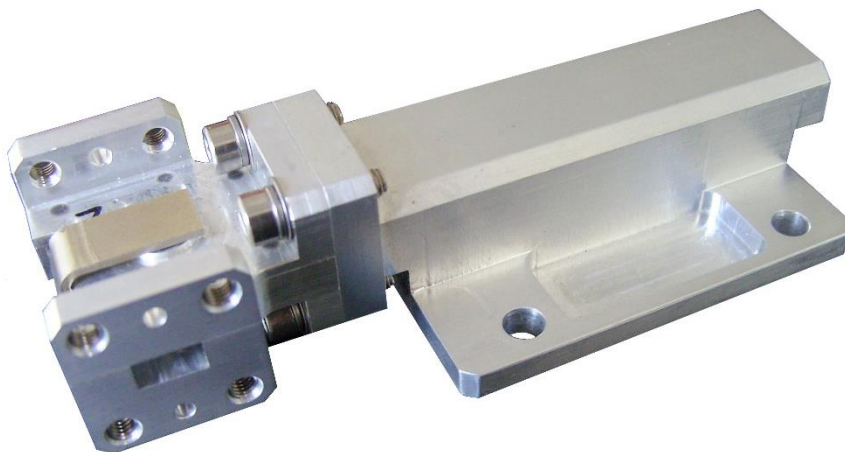


# Waveguide Equipment Qualification Status Review

## Summary & Device Description

### Smiths Interconnect, Dundee

January 2022



This device is a 50W 32GHz junction isolator and was one a suite of parts supplied by SINT for this mission. The device was supplied 12 years ago and was used on the joint ESA/JAXA Bepi-Columbo mission. It is featured on this version's cover to commemorate the first images Bepi-Columbo returned to Earth of the first of its 6 flybys of the planet Mercury.

## Notes:

- The waveguide products described within have been supplied for flight or are in the process of being qualified for spaceflight [*annotated as “qualified” or “in qualification”*]
- Where further information is required e.g. extracts from EIDPs, qualification documents or additional performance data this should be requested and where possible this will be provided in redacted form.
- Heritage overview data is updated annually at the beginning of the calendar year but changes and expands weekly.
- Site specific capability is described in the briefest details at the end of this document.
- The identification of errors and corrections is a feature of a document of this complexity. All opportunities to enhance this document are welcomed.
- The devices listed within are merely a sample of the 2900+ flight model designs have been delivered over the past ~30 years
- Comprehensive heritage data on FMs supplied is available to select recipients.
- The EQSR is now split into 2 documents, this for waveguide and a separate document for non-waveguide and waveguide.

## New in version 13.10:

- Heritage for CY2021 now included
- Corrections to entries & typographic errors
- Updates to qualification status of devices under development and to heritage tables
- Updates to devices under development including E-Band products under development
- Addition of following entries
  - K-band iso-adapter

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## Waveguide Heritage and capability overview

Over the past 30 years Smiths Interconnect (SINT Microwave Limited) has produced and supplied ~192,600 components and equipments for flight use. With >2900 device types supplied this document contains a survey of the performance & qualification of a fraction of the types supplied.

Briefly the Company has provided high and low-power products operating in the following assigned bands. *Heritage* refers to products supplied for space flight while *capability* refers to demonstrable designs that have been supplied but not for space flight, but which could be. *In development* means in the process of being developed for flight applications.

### Waveguide heritage & capability

Function	S	C	X	Ku	K	Ka	Q	V	E
Circulators	Capability	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Capability
Couplers (not test couplers)	Capability	Heritage	Heritage	Capability	Heritage	Heritage	Capability	Capability	-
Hybrids	Capability	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Capability	Capability
Iso-adapters	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	-
Isolators	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Capability
Loads & terminations	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Capability
Test Couplers	Capability	Heritage	Heritage	Capability	Heritage	Heritage	Capability	Capability	-
Transitions	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	-
Integrated assemblies	Capability	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Capability

### Non-waveguide heritage & capability

Function	UHF	L	S	C	X	Ku	K	Ka	Q
<b>Coaxial</b>									
Cable assemblies	-	-	-	-	-	-	Heritage	-	-
Circulators	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	In qualification	-
Combiners/splitters	-	-	Heritage	In Dev't	Qualified	Qualified	Qualified	Capability	-
Iso-adapter	-	Capability	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage
Isolator	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	In qualification	-
Loads & Attenuators	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	-	-
Iso-combiner	-	Capability	Heritage	Capability	Capability	Qualified	In Dev't	-	-
<b>Stripline</b>									
Circulator	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	-	-
Isolators	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	-	-
Loads & Terms.	-	Heritage	-	-	-	-	-	-	-
<b>Microstrip</b>									
Duplexer/Limiters	-	-	-	-	Heritage	-	-	-	-
Isolators	-	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Capability
Circulators	-	Capability	Heritage	Heritage	Heritage	Heritage	Heritage	Heritage	Capability

The following table describes in greater detail the meaning of the bands referred to in the previous table and the core applications into which SINT Dundee products are routinely applied.

Operating frequency band	Common Band	Waveguide band	Applications
0.25 to 1.0 GHz	UHF	-	Satellite Rx & Tx, Over-ride, submarine communications
1.0 to 2.0 GHz	L	-	Satellite Tx & Rx
2.0 to 3.3 GHz	S	WR340	Satellite Tx, data & radar, telemetry links
3.3 to 4.9 GHz	C	WR229	Satellite Rx & Tx, global and regional bands
3.9 to 5.9 GHz	C	WR187	Satellite Rx & Tx, data and radar
4.9 to 7.1 GHz	C	WR159	Satellite Rx & Tx
5.8 to 8.2 GHz	X	WR137	Satellite Rx & Tx
7.0 to 10.0 GHz	X	WR112	Satellite Rx & transmit, TT&C, filtering systems
8.2 to 12.4 GHz	X	WR90	Satellite Rx & Tx, Radar
10.0 to 15.0 GHz	Ku	WR75	Satellite Rx & Tx, communications
12.4 to 18.0 GHz	Ku	WR62	Satellite Rx, frequency conversion/ processing
17.0 to 22.0 GHz	K	WR51	Satellite Tx, frequency conversion/ processing
18.0 to 26.5 GHz	K	WR42	Satellite Tx, inter-satellite links
22.0 to 33.0 GHz	Ka	WR34	Satellite Rx, deep space transmission, deep space data relay
26.5 to 40.0 GHz	Ka	WR28	Satellite Rx, frequency conversion/processing,
33.0 to 50.0 GHz	Q	WR22	Satellite transmit & receive, frequency conversion/ processing
40.0 to 60.0 GHz	V	WR19	Satellite receive, frequency conversion/ processing
60.0 to 90.0 GHz	E	WR12	Satellite transmit and receive, ground station transmit and receive

## Non-Waveguide heritage by end application

Application	S	C	X	Ku	K	Ka	Q	V	Grand Total
RECEIVER/CONVERTER/LNA	88	29	11	1652	589	3693	569	375	7006
FILTER SYSTEM	-	-	11	779	1001	4741	-	-	6532
AIT, GENERIC OR UNCERTAIN	-	71	59	1866	79	761	-	-	2836
TRANSMISSION	-	83	370	126	124	78	-	-	781
COMBINER	-	-	701	24	-	55	-	-	780
TRANSPONDER	-	-	-	-	210	-	-	-	210
RECEIVER	-	-	-	162	-	-	-	-	162
SWITCH MATRIX	-	-	-	-	30	9	-	-	39
ANTENNA	-	19	-	-	14	-	-	-	33
RECEIVER/CONVERTER	-	-	29	-	-	-	-	-	29
TRM/BN	-	-	4	-	-	4	-	-	8
SSPA	-	-	-	5	-	-	-	-	5
<b>Grand Total</b>	<b>202</b>	<b>88</b>	<b>1185</b>	<b>4614</b>	<b>2047</b>	<b>9341</b>	<b>569</b>	<b>375</b>	<b>18421</b>

## Non-Waveguide heritage by function

Row Labels	S	C	X	Ku	K	Ka	Q	V	Grand Total
ISOLATOR	-	130	339	2107	1227	7324	564	259	11950
TRANSITION	-	72	177	491	47	1208	-	112	2107
ISO-ADAPTER	88	-	13	1368	168	2	-	-	1639
CIRCULATOR	-	-	609	346	404	187	-	-	1546
SPLITTER	-	-	6	12	-	546	-	-	564
LOAD/TERMINATION	-	-	39	273	70	63	5	3	453
WG ASSY	-	-	-	-	131	-	-	-	131
COUPLER	-	-	-	17	-	8	-	1	26
TEST COUPLER	-	-	2	-	-	3	-	-	5
<b>Grand Total</b>	<b>88</b>	<b>202</b>	<b>1185</b>	<b>4614</b>	<b>2047</b>	<b>9341</b>	<b>569</b>	<b>375</b>	<b>18421</b>

Heritage is calculated based on FMs delivered up to 31st December 2022.

## Waveguide Isolators & Circulators with flight heritage



The following is a limited summary of coaxial isolators and circulators that have been supplied for spaceflight. Excluded from the tables are the huge number of variations (load position and orientation, circulation etc.). Items highlighted in bold are included in this EQSR.

Waveguide size (full height unless stated)	Operating in the band	Low power <3W	Medium power >20W	High-power >100W	Comments
WR229	3.00-4.80 GHz	-	-	☑	Refer to factory
WR137	5.80-6.40 GHz	☑	-	-	Refer to factory
WR112	7.20-9.00 GHz	☑	☑	☑	Refer to factory
WR90	9.20-9.90 GHz	☑	☑	☑	Refer to factory
WR90	8.90-10.2 GHz	☑	☑	☑	Refer to factory
WR75	10.7-12.8 GHz	☑	☑	☑	Refer to factory
WR75	10.7-14.5 GHz	☑	☑	☑	Refer to factory
WR51	17.3-21.2 GHz	☑	☑	☑	Refer to factory
WR51	17.7-20.3 GHz	☑	☑	☑	Refer to factory
WR62	13.5-15.0 GHz	☑	☑	☑	Refer to factory
WR62	17.0-18.5 GHz	☑	☑	☑	Refer to factory
WR42	18.0-22.0 GHz	☑	☑	-	Refer to factory
WR42	21.0-25.0 GHz	☑	In development	-	Refer to factory
WR34	21.7-22.4 GHz	☑	In development	-	Refer to factory
WR34	22.0-25.0 GHz	☑	☑	-	Refer to factory
WR34	22.0-27.0 GHz	☑	☑	In development	Refer to factory
WR34	25.5-27.0 GHz	☑	☑	☑	Refer to factory
WR34	27.0-33.0 GHz	☑	☑	-	Refer to factory
WR34	30.0-33.0 GHz	☑	☑	☑	Refer to factory
WR28	27.0-33.0 GHz	☑	☑	☑	Refer to factory
WR28	30.0-33.0 GHz	☑	☑	☑	Refer to factory
WR22	37.5-40.5 GHz	☑	-	-	Refer to factory
WR22	42.5-44.5 GHz	☑	-	-	Refer to factory
WR19	47.0-54.0 GHz	☑	-	-	Refer to factory
WR12	73.0 to 78.0 GHz	-	In development	-	Refer to factory

The Non-Waveguide Heritage and capability overview is described at the end of this document



## Waveguide transitions with flight heritage



The following is a limited summary of coaxial to waveguide transitions that have been supplied for spaceflight. Excluded from the tables are the huge number of variations (connector orientation). Items highlighted in bold are included in this EQSR.

Waveguide size (full height unless stated)	Operating band	High-power Orthogonal (TNC, SMA)	Low-power Orthogonal (SMA or SMP)	High-power In line (TNC, SMA)	Low power in line (SMA, 2.9, 2.4, 1.85)
WR340 (1/4 ht)	2.02-2.12 GHz	-	<input checked="" type="checkbox"/>	-	-
WR229 (1/4 ht)	3.40-4.20 GHz	-	<input checked="" type="checkbox"/>	-	-
WR137 (1/4 ht)	5.60-7.20 GHz	-	<input checked="" type="checkbox"/>	-	-
WR112	7.00-9.00 GHz	<input checked="" type="checkbox"/> T	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
WR112	7.10-8.50 GHz	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
WR90	8.00-12.2 GHz	-	<input checked="" type="checkbox"/>	-	<input checked="" type="checkbox"/>
WR90	8.30-12.4 GHz	-	-	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
WR75	10.2-14.8 GHz	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
WR75	10.7-12.8 GHz	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
WR75	12.7-14.5 GHz	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
WR62	13.0-14.5 GHz	-	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> S	<input checked="" type="checkbox"/>
WR51	17.3-22.0 GHz	<input checked="" type="checkbox"/> S	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> S	<input checked="" type="checkbox"/>
WR42	19.2-21.2 GHz	-	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> S	<input checked="" type="checkbox"/>
WR42	18.0-22.0 GHz	-	<input checked="" type="checkbox"/>	-	<input checked="" type="checkbox"/>
WR34	22.0-24.0 GHz	-	<input checked="" type="checkbox"/>	-	<input checked="" type="checkbox"/>
WR34	23.0-25.0 GHz	-	<input checked="" type="checkbox"/>	-	<input checked="" type="checkbox"/>
WR34	25.0-28.0 GHz	-	<input checked="" type="checkbox"/>	-	<input checked="" type="checkbox"/>
WR34	25.5-31.0 GHz	-	<input checked="" type="checkbox"/>	-	<input checked="" type="checkbox"/>
WR28-2.9mm	26.5-31.0 GHz	-	<input checked="" type="checkbox"/>	-	<input checked="" type="checkbox"/>
WR22-2.4mm	36.0-40.5 GHz	-	<input checked="" type="checkbox"/>	-	<input checked="" type="checkbox"/>
WR22-2.9mm	37.5-40.5 GHz	-	<input checked="" type="checkbox"/>	-	<input checked="" type="checkbox"/>
WR22-2.4mm	42.5-44.5 GHz	-	-	-	<input checked="" type="checkbox"/>
WR19-1.85mm	47.5-51.4 GHz	-	-	-	<input checked="" type="checkbox"/>

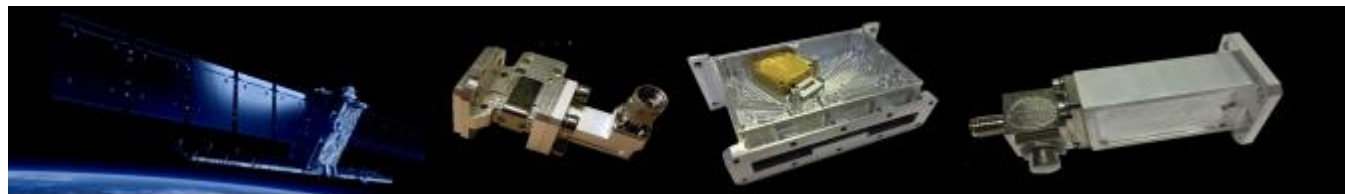
## Waveguide Hybrids & couplers with flight heritage



The following is a limited summary of waveguide hybrid, test and in line couplers that have been supplied for spaceflight. Excluded from the tables are the huge number of variations (load position and orientation, etc.). Items highlighted in bold are included in this EQSR.

Waveguide size (full height unless stated)	Operating band	2 x 2	2,3,4 x 1 (incl. termination)	Test Coupler	Other Couplers
WR112	7.20-8.40 GHz	3dB	-	33dB	-
WR75	10.7-14.5 GHz	3dB	3dB	-	6.5dB
WR62	17.0-18.5 GHz	3dB	3dB	-	-
WR51	17.6-21.2 GHz	3dB	-	-	-
WR34	22.0-25.0 GHz	3dB	-	-	-
WR34	24.5-31.0 GHz	-	-	33dB	-
WR34	25.0-30.0 GHz	-	3dB	-	10dB, 15dB
WR28	26.5-33.0 GHz	3dB	3dB	-	-
WR28	27.0-33.0 GHz	-	4.77dB	-	-
WR28	27.0-33.0 GHz	-	6dB, 4.77dB, 3dB	-	-
WR28	27.0-31.0 GHz	4.77-1.33dB	4.77-1.33dB	-	-
WR22	37.5-40.5 GHz	-	3dB	-	-
WR19	47.4-52.4 GHz	3dB	-	-	-
WR12	80.0 – 88.0 GHz	In development			

## Waveguide Iso-adapters with flight heritage



The following is a limited summary of coaxial to waveguide transitions that have been supplied for spaceflight. Excluded from the tables are the huge number of variations (load position and orientation, circulation etc.). Items highlighted in bold are included in this EQSR.

Waveguide size (full height unless stated)	Operating in the band	Low power <3W	Medium power >10W	High-power >100W	Comments
WR340 QH	2.02-2.12 GHz	☑	-	-	Stripline isolator
WR112	7.20-8.40 GHz	☑	-	-	Coaxial Isolator
WR90	8.9-10.2 GHz	☑	☑	-	Coaxial Isolator
WR75	10.7-12.8 GHz	☑	☑	-	WG isolator
WR75	10.7-12.8 GHz	☑	-	-	Coaxial Isolator
WR75	10.7-15.0 GHz	☑	☑	-	Coaxial Isolator
WR51	18.0-22.0 GHz	☑	☑	-	Coaxial Isolator
WR51	17.3-21.0 GHz	☑	☑	-	WG isolator
WR62	13.5-15.0 GHz	☑	-	-	Coaxial Isolator
WR42	18.0-24.0 GHz	☑	☑	☑	Coaxial Isolator
WR34	21.7-22.4 GHz	☑	☑	-	WG isolator
WR34	24.5-32.0 GHz	☑	☑	-	WG isolator
WR34	27.0-33.0 GHz	☑	☑	-	WG isolator
WR28	27.0-33.0 GHz	☑	☑	-	WG isolator
WR22	37.5-42.5 GHz	☑	-	-	WG isolator
WR19	47.0-54.0 GHz	☑	-	-	WG isolator

## Waveguide Loads & Terminations with flight heritage

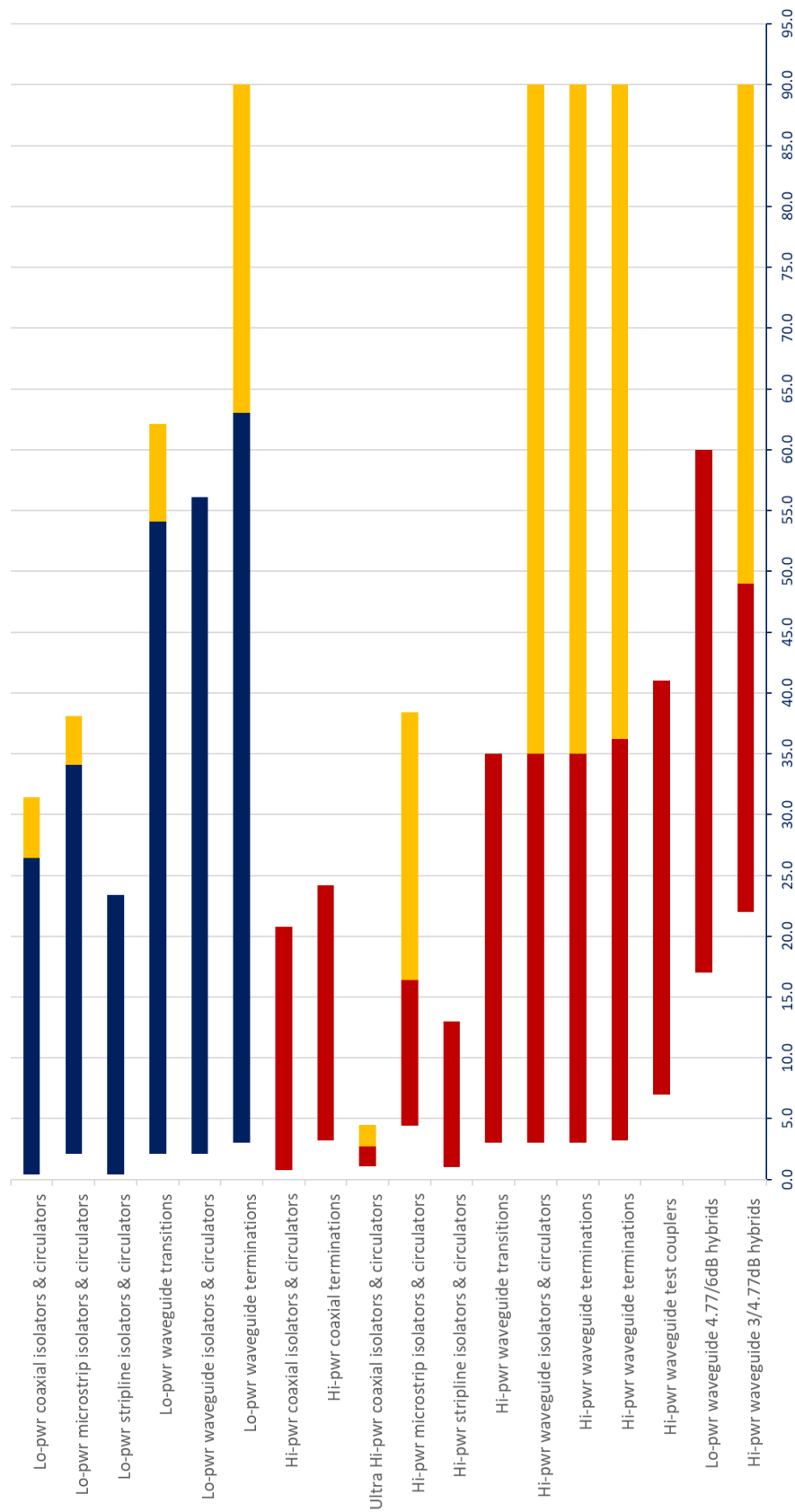


The following is a limited summary of waveguide terminations and loads that have been supplied for spaceflight. Excluded from the tables are the huge number of variations (flange detail etc.). Items highlighted in bold are included in this

Waveguide size (full height unless stated)	Operating in the band	Low power <3W	Medium power >10W	High-power >100W	Comments
WR229	3.20-4.90 GHz	-	-	☑	Refer to factory
WR229	3.40-4.20 GHz	-	-	☑	Refer to factory
WR229	4.20-4.80 GHz	-	-	☑	Refer to factory
WR112	7.00-10.0 GHz	☑	☑	☑	Refer to factory
WR112	7.20-10.2 GHz	☑	☑	☑	Refer to factory
WR90	9.0-10.0 GHz	☑	☑	☑	Refer to factory
WR75	10.0-15.0 GHz	☑	☑	☑	Refer to factory
WR75	10.7-12.8 GHz	☑	☑	☑	Refer to factory
WR62	12.0-18.5 GHz	☑	☑	☑	Refer to factory
WR51	15.0-22.0 GHz	☑	☑	☑	Refer to factory
WR51	17.3-20.3 GHz	☑	☑	☑	Refer to factory
WR51	17.3-22.0 GHz	☑	☑	☑	Refer to factory
WR42	27.0-36.0 GHz	☑	☑	☑	Refer to factory
WR34	18.0-27.0 GHz	☑	☑	☑	Refer to factory
WR34	20.0-31.0 GHz	☑	☑	☑	Refer to factory
WR34	31.0-33.0 GHz	☑	☑	☑	Refer to factory
WR28	26.5-31.0 GHz	☑	☑	☑	Refer to factory
WR34	31.0-33.0 GHz	☑	☑	☑	Refer to factory
WR22	30.0-50.0 GHz	☑	☑	☑	Refer to factory
WR19	40.0-60.0 GHz	☑	☑	-	Refer to factory
WR12	80.0–88.0 GHz	In development	In development		

## Heritage & current product development roadmap by type and frequency

### High & Low power heritage & development



## Heritage by payload (launched)

SINT Dundee products have been launched on 667 payloads covering a wide number of applications and orbits.

Purpose	Elliptical/ Molniya	GEO	LEO	MEO	Total
Communications	3	346	109	20	478
Earth Observation	2	14	112	-	128
Earth Science	-	-	1	-	1
Space Science	8	-	3	-	11
Technology Development	2	-	4	-	6
Communications/ Navigation	-	1	-	-	1
Communications/ Technology Development	-	1	-	-	1
Earth Observation/ Communications	-	1	-	-	1
Earth Observation/ Technology Development	-	-	2	-	2
Navigation/ Global Positioning	2	-	-	24	26
Navigation/ Regional Positioning	-	12	-	-	12
<b>Total</b>	<b>17</b>	<b>375</b>	<b>231</b>	<b>44</b>	<b>667</b>

## List of known payloads in which SINT Dundee products have been used

Including the following programs where the satellites have been launched *[# of payloads in the series]*:

ABS [6]	CRYOSAT	HORIZONS	PALAPA	SPAINSAT I
AEOLUS	CSG	HORYU	PAZ	SPIRALE [2]
AL YAH	CSO	HYLAS [2]	PERUSAT	SPOT [2]
AMAZONAS [4]	DART	HYSIS	PLÉIADES [2]	ST
AMC [9]	DAICHI	IBUKI	PRISMA	STAR [5]
AMOS [3]	DIRECTV [9]	IGS [11]	PROBA	STAR ONE D2
ANIK [5]	DIALOG	INMARSAT [10]	QZS [5]	SUPERBIRD [2]
APSTAR [4]	ECHOSTAR [13]	INSAT [4]	Quantum	SWARM [3]
ARABSAT [3]	EDRS	INTEGRAL	RADARSAT	SYRACUSE [2]
ASIASAT [3]	ELECTRO [3]	INTELSAT [32]	RASCOM	TANDEM
ASIASTAR	ELISA [4]	IRIDIUM NEXT [75]	RCM [3]	TANGO
ASNARO [2]	EOS	IRNSS [8]	RESOURCESAT	TELKOM [2]
ASTRA [15]	ERG	JCSAT [13]	RISAT [4]	TELSTAR [6]
ASTROSAT	EROS B	KAZSAT [2]	RUMBA	TERRASAR
AT&T	ES'HAIL [2]	KOMPSAT [4]	SALSA	TERRASTAR
ATHENA [2]	EUTELSAT [30]	KOREASAT [4]	SAMBA	THAICOM [3]
AZERSPACE [2]	EXACTVIEW [2]	LAOSAT	SAOCOM	THURAYA [2]
BADR [5]	EXPRESS [14]	LEO VANTAGE 1	SAR LUPE [5]	TURKMEN
BANGABANDHU	GALAXY [12]	LUCH [3]	SARAL	TURKSAT [4]
BRAZILSAT	GALILEO [26]	MEASAT [3]	SCATSAT	VIASAT [2]
BRIO	GCOM [2]	MERAH	SCD	VINASAT [2]
BRISAT	GEO [2]	METEOSAT [4]	SDS	WILDBLUE
BSAT [5]	GEOEYE	METOP [3]	SENTINEL [8]	WORLDVIEW [3]
BULGARIASAT	GISAT-1	MTSAT	SES [15]	XMM
CALIPSO	GLOBALSTAR [31]	NIGERIASAT [2]	SGDC	XTAR

**Smiths Interconnect, Dundee**  
**Passive EQSR, Waveguide**

**smiths interconnect**

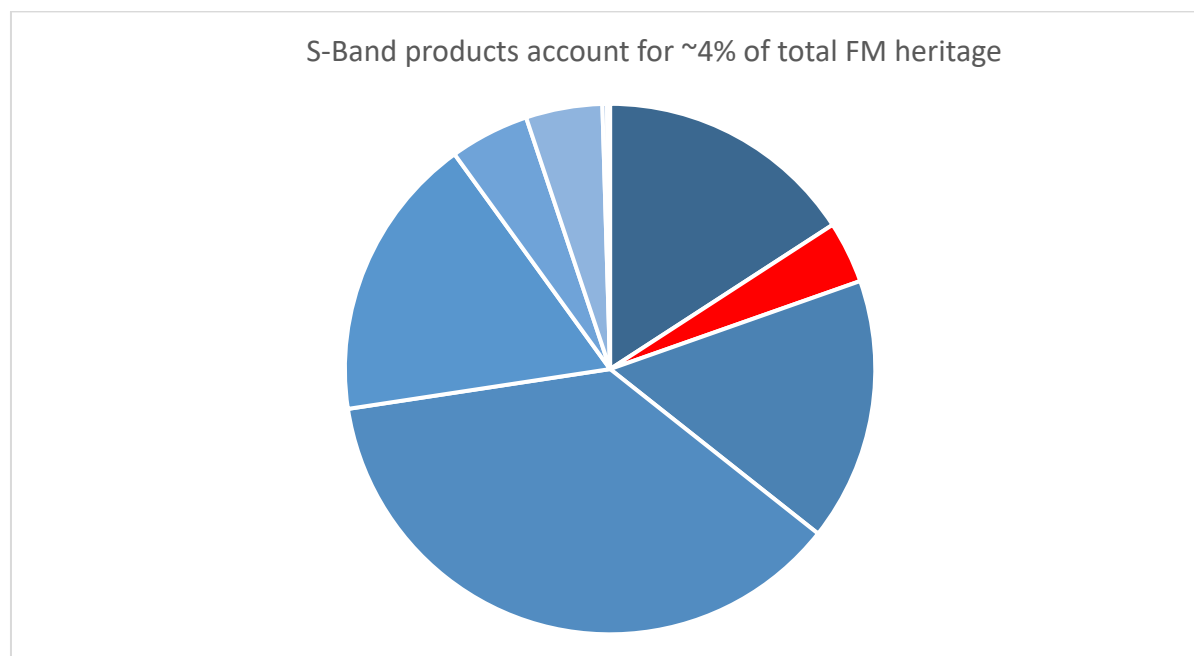
CARTOSAT [9]	GÖKTÜRK	NILESAT	SICRAL [3]	YAHSAT [2]
CBERS [2]	GOSAT	NIMIQ [4]	SIRIUS [10]	YAMAL [4]
CHEOPS	GSAT [16]	NOVASAR	SKY MUSTER [2]	-
CIEL	HELIOS [2]	NSS [7]	SKYBRASIL	-
CMS	HELLASSAT [3]	O3B [20]	SKYNET [5]	-
COMS	HIMAWARI [2]	OFEQ [6]	SKYSAT [8]	-
COMSATBW [2]	HINODE	OPTOS	SMOS	-
COSMO [6]	HISPASAT [4]	OPTUS [5]	SPACEWAY [2]	-

## S-Band Overview

SINT has developed, supplied, and has heritage with many passive devices operating in the 2.0-3.3GHz band designed to operate at either low or high-power. The S-Band range comprises ~116 distinct designs supplied to date. Heritage is dominated by the supplied of high-power isolators used for SSPA applications. In terms of heritage almost all parts have been supplied as EEE components however an increasing number are supplied classed as equipment with the distinction largely a matter of how the parts are specified and procured. The following is an extract from the heritage database which records sales of flight model hardware from 1994 to December 2020.

FMs supplied	COAXIAL	MICPUCK	STRIPLINE (DROP-IN)	WAVEGUIDE	Grand Total
<b>S</b>	<b>4055</b>	<b>106</b>	<b>3409</b>		<b>7570</b>
ISOLATOR	3148	106	3113		6367
CIRCULATOR	148		296		444
SPLITTER	263				263
ISO-COMBINER	247				247
LOAD/TERMINATION	137				137
ATTENUATOR	112				112
<b>S [WR430]</b>				<b>88</b>	<b>88</b>
ISO-ADAPTER				88	88
<b>Grand Total</b>	<b>4055</b>	<b>106</b>	<b>3409</b>	<b>88</b>	<b>7658</b>

Heritage in terms of the numbers and types of products supplied changes daily. Please contact the factory to obtain the most up to date information.



In development/qualification

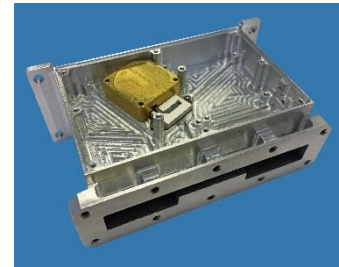
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## S-Band stripline isolator to QH WR340 orthogonal Iso-adapter

The iso-adapter housing includes the structure to accommodate the users LNA and power supply modules.

<b>SINT part number</b>	I2022/H
<b>SINT ICD</b>	D103867
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	ICO



- DC shorted probe iso-adapter
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Passivated Aluminum housing featuring procured connectors.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-50 to +100C
Qualification	-10 to +65C
Acceptance	-5 to +60C
Operating Frequency	2.0 to 2.02 GHz
Insertion Loss (including split)	0.3dB
Isolation	23 dB min
Return Loss	23 dB min
Power Handling	1mW CW
Radiated Emissions	-80dBi
Mass	145g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance (normal)	Acceptance (Parallel)	Qualification
Sine	All 3 axis	5 to 22.6	-	-	6.4 mm
		22.6 to 50	-	-	13.0g
		50 to 100	-	-	5.2g
			-	-	-
Random	All 3 axis	20 to 50	+6dB/oct.	+6dB/oct.	6dB/oct.
		50 to 600	0.2g <sup>2</sup> /Hz	0.08g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>14.9g</b>	<b>9.4g</b>	<b>23.6g</b>

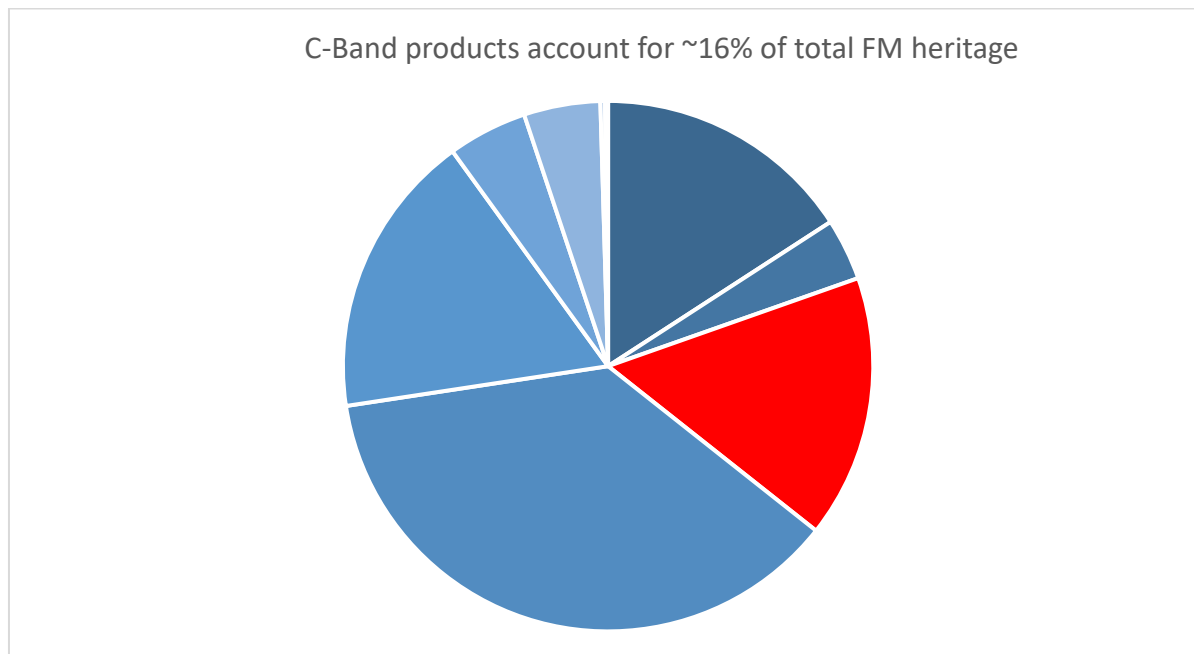
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Not specified	20	52
	4000	4200
	<i>Number of Events</i>	<i>3 per axis</i>

## C-Band Overview

SINT has developed, supplied, and has heritage with many passive devices operating in the 3.2-7.2GHz band designed to operate at either low or high-power. The K-Band range is considered comprehensive with over with ~281 distinct designs supplied to date. In terms of quantities of FMs supplied heritage is dominated by the supplied of miniature microstrip circulators isolators used in space based TRm applications and coaxial isolators used in IMUX and related filter applications. Most parts have been supplied classed as components an increasing number are supplied classed as equipment. This distinction is largely a matter of how the parts are specified and procured. The following is an extract from the heritage database which records sales of flight model hardware from 1994 to December 2020.

FMs supplied	COAXIAL	MICPUCK	MICROSTRIP	STRIPLINE (DROP-IN)	WAVEGUIDE	Grand Total
<b>C</b>	<b>16181</b>	<b>1439</b>	<b>9158</b>	<b>5608</b>		<b>32386</b>
ISOLATOR	11888	1414	1228	5479		20009
CIRCULATOR	3947	25	7930	129		12031
LOAD/TERMINATION	346					346
<b>C [WR137]</b>					<b>83</b>	<b>83</b>
ISOLATOR					47	47
TRANSITION					36	36
<b>C [WR159]</b>					<b>17</b>	<b>17</b>
TRANSITION					17	17
<b>C [WR229]</b>					<b>83</b>	<b>83</b>
ISOLATOR					83	83
TRANSITION					19	
<b>Grand Total</b>	<b>16181</b>	<b>1439</b>	<b>9158</b>	<b>5608</b>	<b>202</b>	<b>32588</b>

Heritage in terms of the numbers and types of products supplied changes daily. Please contact the factory to obtain the most up to date information.



## In development/qualification

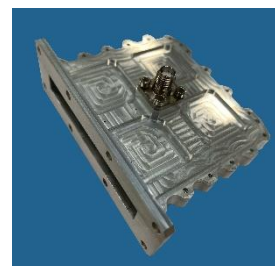
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## C-Band WR229 QH to SMA orthogonal low-power Transition

Used at payload level.

SINT part number	11aTM102
SINT ICD	B35/83762
Application	Space [GEO]
Status	Supplied
Program	-

- QH WR229, in-line dc shorted (<0.5 Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +100C
Acceptance	-35 to +90C
Operating Frequency	3.4 to 4.8GHz
Insertion Loss	0.15dB max
Return Loss	21dB min
Power Handling	2W CW
Radiated Emissions	80dBi min
Mass	64g max

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 26		11 mm
		26 to 50		30.0g
				2 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.67g <sup>2</sup> /Hz	1.50g <sup>2</sup> /Hz
		600 to 2000	-3 dB/oct.	-3 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			33g	50g

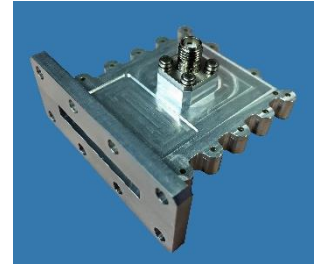
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	40
	1000	1000
	3000	2000
	10000	2000
	Number of Events	3 per axis

## C-Band WR137 QH to SMA orthogonal low-power Transition

This device was used on the output of a waveguide WG mechanical switch.

<b>SINT part number</b>	14TM101
<b>SINT ICD</b>	C107999
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied [PFM & FM]
<b>Program</b>	VARIOUS (multiple programs))

- QH WR137, orthogonal dc shorted (<0.5 Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting, MP, Corona, Thermal.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
PFM & Qualification	-30 to +125C
Acceptance	-25 to +120C
Operating Frequency	5.60 to 7.20GHz
Insertion Loss	0.15dB max
Return Loss	21dB min
Power Handling	12W CW [PFM] 12W CW [FM]
Multipaction	24W pk by test 48W pk by analysis
Radiated Emissions	80dBi min
Mass	42g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

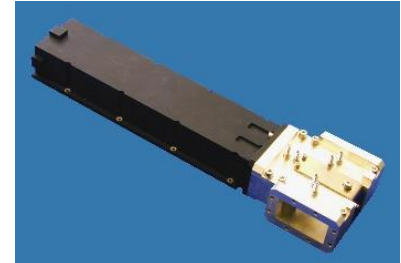
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## C-Band WR229 high-power Isolator

This device is used in conjunction with a high-power remote termination to form an isolator on the output of a TWTA.

<b>SINT part number</b>	11AHD314
<b>SINT ICD</b>	C54741
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [FM]
<b>Program</b>	INSAT

- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on the output of TWTA
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
LAT	-25 to +75C
Acceptance	-20 to +70C
Operating Frequency	3.6 to 4.20GHz
Insertion Loss	0.20dB max
Isolation	21 dB min
Return Loss	21 dB min
Power Handling - tested by customer	567W CW [fwd]
	567W CW [rev]
Multipaction - tested by customer	5000W [peak]
Radiated Emissions	80dBi min
Mass	2000g nom

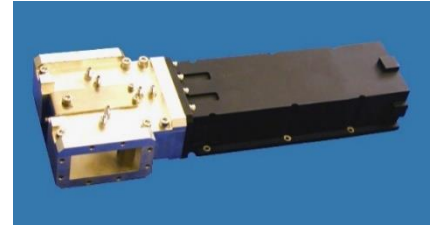
### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g

## C-Band WR229 high-power Isolator

This device is used in conjunction with a high-power remote termination to form an isolator on the output of a TWTA.

<b>SINT part number</b>	11AHD315
<b>SINT ICD</b>	C54742
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [FM]
<b>Program</b>	INSAT



- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on the output of TWTA
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
LAT	-25 to +75C
Acceptance	-20 to +70C
Operating Frequency	3.9 to 4.8GHz
Insertion Loss	0.25dB max
Isolation	21 dB min
Return Loss	21 dB min
Power Handling - tested by customer	150W CW [FWD]
	150W CW [REV]
Multipaction - tested by customer	1500W peak
Radiated Emissions	80dBi min
Mass	1500g nom

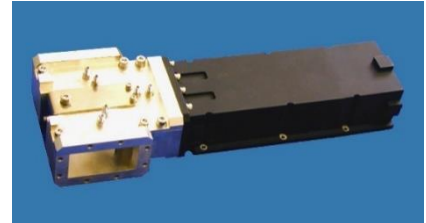
### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>16.7g</b>	<b>23.6g</b>

## C-Band WR229 high-power Isolator

This device is used in conjunction with a high-power remote termination to form an isolator on the output of a TWTA.

<b>SINT part number</b>	11AHD316
<b>SINT ICD</b>	C54744
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [FM]
<b>Program</b>	INSAT



- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on the output of TWTA
- Silver plated junction and black painted thin film load
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
LAT	-25 to +75C
Acceptance	-20 to +70C
Operating Frequency	3.7 to 4.8GHz
Insertion Loss	0.25dB max
Isolation	21 dB min
Return Loss	21 dB min
Power Handling - tested by customer	150W CW [FWD] 150W CW [REV]
Multipaction - tested by customer	1500W peak
Radiated Emissions	80dBi min
Mass	1500g nom

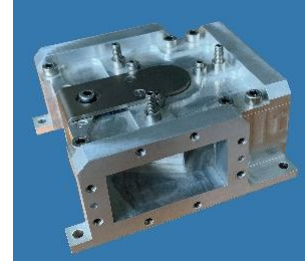
### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g

## C-Band WR229 high-power Circulator

This device is used in conjunction with a high-power remote termination to form an isolator on the output of a TWTA.

<b>SINT part number</b>	11AHD314 junction
<b>SINT ICD</b>	-
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [FM]
<b>Program</b>	INSAT



- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on the output of TWTA
- Passivated Aluminum junction and black painted thin fil load
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
LAT	-25 to +75C
Acceptance	-20 to +70C
Operating Frequency	3.6 to 4.20GHz
Insertion Loss	0.20dB max
Return Loss	21 dB min
Power Handling - tested by customer	567W CW [fwd]
	567W CW [rev]
Multipaction - tested by customer	5000W [peak]
Radiated Emissions	80dBi min
Mass	660g nom

### Environmental

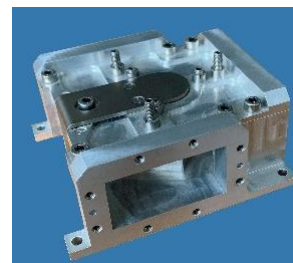
Test	Axis	Frequency (Hz)	Acceptance	Qualification
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g



## C-Band WR229 high-power Circulator

This device is used in conjunction with a high-power remote termination to form an isolator on the output of a TWTA.

<b>SINT part number</b>	11AHD315 junction
<b>SINT ICD</b>	-
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [FM]
<b>Program</b>	INSAT



- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on the output of TWTA
- Passivated Aluminum junction and black painted thin fil load
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
LAT	-25 to +75C
Acceptance	-20 to +70C
Operating Frequency	3.9 to 4.8GHz
Insertion Loss	0.25dB max
Return Loss	21 dB min
Power Handling - tested by customer	150W CW [FWD]
	150W CW [REV]
Multipaction - tested by customer	1500W peak
Radiated Emissions	80dBi min
Mass	660g nom

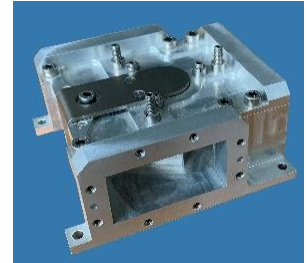
### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g

## C-Band WR229 high-power Circulator

This device is used in conjunction with a high-power remote termination to form an isolator on the output of a TWTA.

<b>SINT part number</b>	11AHD316 junction
<b>SINT ICD</b>	-
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [FM]
<b>Program</b>	INSAT



- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on the output of TWTA
- Passivated Aluminum junction and black painted thin fil load
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
LAT	-25 to +75C
Acceptance	-20 to +70C
Operating Frequency	3.7 to 4.8GHz
Insertion Loss	0.25dB max
Return Loss	21 dB min
Power Handling - tested by customer	150W CW [FWD]
	150W CW [REV]
Multipaction - tested by customer	1500W peak
Radiated Emissions	80dBi min
Mass	660g nom

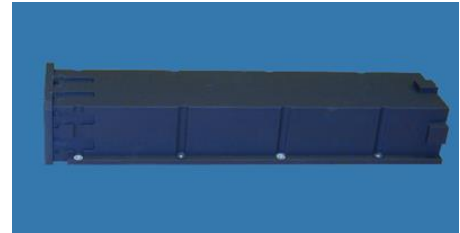
### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g

## C-Band WR229 high-power Load

This device is used in conjunction with a high-power circulator to form an isolator on the output of a TWTA.

<b>SINT part number</b>	11AHD314 termination
<b>SINT ICD</b>	-
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [FM]
<b>Program</b>	INSAT



- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used to load a circulator on the output of a TWTA
- Black painted Aluminum thin film load
- No anomalies, deviations, waivers nor test or issues affecting any models supplied

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
LAT	-25 to +75C
Acceptance	-20 to +70C
Operating Frequency	3.6 to 4.20GHz
Insertion Loss	0.20dB max
Return Loss	21 dB min
Power Handling - tested by customer	567W CW [fwd]
	567W CW [rev]
Multipaction - tested by customer	5000W [peak]
Radiated Emissions	80dBi min
Mass	1400g nom

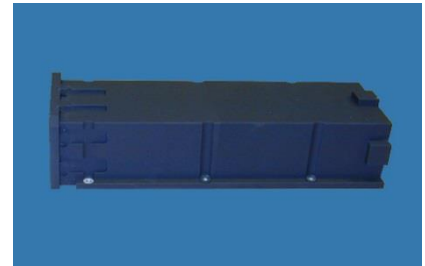
### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g

## C-Band WR229 high-power Load

This device is used in conjunction with a high-power circulator to form an isolator on the output of a TWTA.

<b>SINT part number</b>	11AHD315 termination
<b>SINT ICD</b>	-
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [FM]
<b>Program</b>	INSAT



- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used to load a circulator on the output of a TWTA
- Black painted Aluminum thin film load
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
LAT	-25 to +75C
Acceptance	-20 to +70C
Operating Frequency	3.9 to 4.8GHz
Insertion Loss	0.25dB max
Return Loss	21 dB min
Power Handling - tested by customer	150W CW [FWD] 150W CW [REV]
Multipaction - tested by customer	1500W peak
Radiated Emissions	80dBi min
Mass	1400g nom

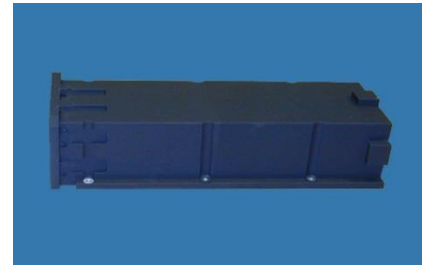
### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g

## C-Band WR229 high-power load

This device is used in conjunction with a high-power circulator to form an isolator on the output of a TWTA.

<b>SINT part number</b>	11AHD316 termination
<b>SINT ICD</b>	-
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [FM]
<b>Program</b>	INSAT



- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used to load a circulator on the output of a TWTA
- Black painted Aluminum thin film load
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
LAT	-25 to +75C
Acceptance	-20 to +70C
Operating Frequency	3.7 to 4.8GHz
Return Loss	25 dB min
Power Handling - tested by customer	150W CW [FWD]
	150W CW [REV]
Multipaction - tested by customer	1500W peak
Radiated Emissions	80dBi min
Mass	1400g nom

### Environmental

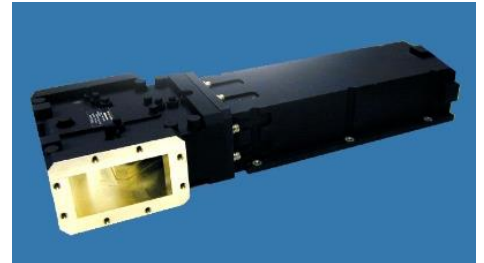
Test	Axis	Frequency (Hz)	Acceptance	Qualification
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g

## C-Band WR229 high-power Isolator

This device is used in conjunction with a high-power remote termination to form an isolator on the output of a compact TWTA.

SINT part number	11AHD319
SINT ICD	C81143
Application	Space [GEO], termination
Status	Qualified & supplied [FM]
Program	-

- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on the output of TWTA
- Black painted Aluminum thin film load and passivated Aluminum junction
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-35 to +90C
Qualification	-35 to +85C
Acceptance	-30 to +80C
Operating Frequency	3.4 to 4.20GHz
Insertion Loss	0.20dB max
Return Loss	21 dB min
Power Handling – tested by customer	500 CW [fwd]
	500W CW [rev]
	1500W [peak fwd]
Radiated Emissions	80dBi min
Mass	1400g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis		-	-
			-	-
			-	-
Random	All 3 axis		MILT-STD-202 method 214 condition I	MILT-STD-202 method 214 condition I
			60 secs/axis	60 secs/axis
			60 secs/axis	60 secs/axis
Overall [rms]			34.02g	34.02g

## X-Band Overview

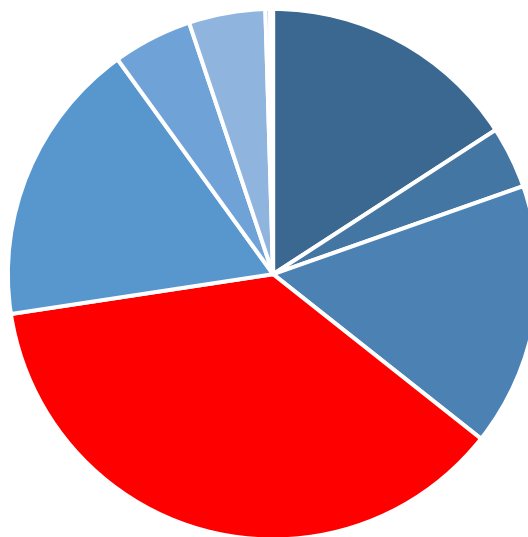
SINT has developed, supplied, and has heritage with many passive devices operating in the 7.2-12GHz band designed to operate at either low or high-power. The X-Band range is considered comprehensive with over with ~226 distinct designs

FMs supplied	COAXIAL	MICPUCK	MICROSTRIP	STRIPLINE (DROP-IN)	WAVEGUIDE	Grand Total
<b>X</b>	<b>3869</b>	<b>4351</b>	<b>60099</b>	<b>5582</b>		<b>73901</b>
DUPLEXOR/ LIMITER			25958			25958
CIRCULATOR	326	90	25324	10		25750
ISOLATOR	3463	4261	8817	5572		22113
LOAD/TERMINATION	65					65
ISO-ADAPTER	15					15
<b>X [WR112]</b>					<b>486</b>	<b>486</b>
ISOLATOR					283	283
TRANSITION					125	125
LOAD/TERMINATION					39	39
CIRCULATOR					18	18
ISO-ADAPTOR					13	13
SPLITTER					6	6
TEST COUPLER					2	2
<b>X [WR90]</b>					<b>682</b>	<b>682</b>
CIRCULATOR					591	591
ISOLATOR					56	56
TRANSITION					35	35
<b>Grand Total</b>	<b>3869</b>	<b>4351</b>	<b>60099</b>	<b>5582</b>	<b>1185</b>	<b>75086</b>

supplied to date. Heritage is dominated by the supplied of miniature microstrip circulators isolators used in space based TRm applications and while most parts supplied are classed as EEE an increasing number are supplied classed as equipments. This distinction is largely a matter of how the parts are specified and procured. The following is an extract from the heritage database which records sales of flight model hardware from 1994 to December 2020.

Heritage in terms of the numbers and types of products supplied changes daily. Please contact the factory to obtain the most up to date information.

X-Band products account for ~37% of total FM heritage



## In development/qualification

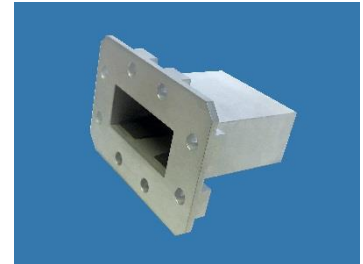
- Low cost WR90 HP circulator

## X-Band WR112 medium-power Termination

Generic application

<b>SINT part number</b>	15TE128
<b>SINT ICD</b>	C35/83387
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied as FM, launched
<b>Program</b>	VARIOUS / -

- Full height WR112 bulk absorbing termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +120C
PFM & Qualification	-35 to +125C
Acceptance	-35 to +120C
Operating Frequency	7.0 to 10.0GHz
Return Loss	23dB min
Power Handling	3W CW [PFM] 2W CW [FM]
Multipaction	blank 12W pk by analysis
Corona (critical pressure)	N/A N/A
Radiated Emissions	80dBi min
Mass	37g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

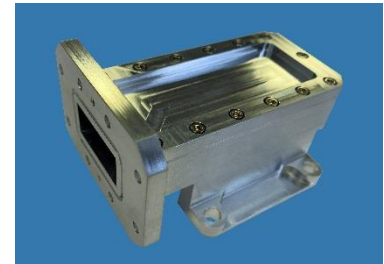
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis



## X-Band WR112 high-power Termination

Generic application

<b>SINT part number</b>	D35/83393
<b>SINT ICD</b>	D35/83393
<b>Application</b>	Deep space probe
<b>Status</b>	Supplied as FM
<b>Program</b>	DART



- Full height WR112 bulk absorbing termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +120C
PFM & Qualification	-35 to +125C
Acceptance	-35 to +120C
Operating Frequency	8.0 to 8.4GHz
Return Loss	30dB min
Power Handling	80W CW [FM]
Radiated Emissions	80dBi min
Mass	275g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## X-Band WR112 high-power Termination

Generic application

<b>SINT part number</b>	C35/83387
<b>SINT ICD</b>	C35/83387
<b>Application</b>	Deep space probe
<b>Status</b>	Supplied as FM
<b>Program</b>	<i>Europa Clipper</i>



- Full height WR112 bulk absorbing termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +120C
PFM & Qualification	-35 to +125C
Acceptance	-35 to +120C
Operating Frequency	7.55 to 9.00GHz
Return Loss	30dB min
Power Handling	70W CW [FM]
Radiated Emissions	80dBi min
Mass	275g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

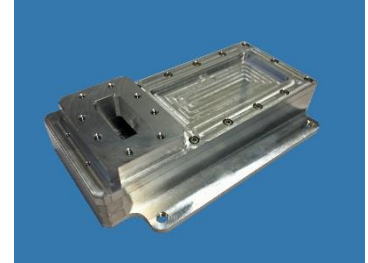
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	<i>Number of Events</i>	<i>3 per axis</i>

## X-Band WR112 high-power Termination

Used on the output of a TWTA application and used in conjunction with a high-power circulator to form an isolator.

<b>SINT part number</b>	15TE127
<b>SINT ICD</b>	C83327
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	STAR One D2

- Full height WR112 Termination with aperture parallel to mounting surface
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +150C
PFM & Qualification	-25 to +135C
Acceptance	-20 to +130C
Operating Frequency	7.00 to 10.00 GHz
Return Loss	21 dB min
Power Handling	340W CW [PFM] 215W CW [FM]
Multipaction	680W pk by test 1354W pk by analysis
Radiated Emissions	80dBi min
Mass	360g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

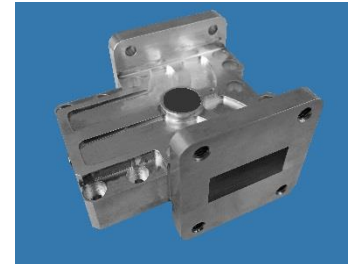
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## X-Band WR112 low-power Isolator

Used in a receiver application.

<b>SINT part number</b>	15HD352
<b>SINT ICD</b>	C35/82091
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied as FM, launched
<b>Customer</b>	Mitsubishi

- Full height WR112 Isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Silver plated Aluminum housing
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-54 to +100C
PFM & Qualification	-40 to +125C
Acceptance	-30 to +80C
Operating Frequency	7.9 to 8.4GHz
Insertion Loss	0.13dB max
Return Loss	23dB min
Isolation	23dB min
Power Handling	1W CW [LAT] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	164g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	5 to 22.6	4.83 mm	-
		22.6 to 50	10.0g	-
		50 to 100	7.7g	-
			2 octaves/min	
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100 to 1000	1.54g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		1000 to 2000	-3 dB/oct.	-3 dB/oct.
			60 secs/axis	60 secs/axis
Overall [rms]			50g	50g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	40
	500	200
	2000	2000
	10000	2000
	Number of Events	3 per axis

## X-Band WR112 low-power Circulator

Used as an antenna duplexer.

<b>SINT part number</b>	15HD357
<b>SINT ICD</b>	C35/82379
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied as FM, launched
<b>Program</b>	VARIOUS

- Full height WR112 Circulator with matching remote load supplied separately
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +105C
LAT	-20 to +85C
Acceptance	-20 to +85C
Operating Frequency	7.25 to 8.4GHz
Insertion Loss	0.10dB max
Return Loss	23dB min
Isolation	23dB min
Power Handling	1W CW [LAT] 1W CW [FM]
Radiated Emissions	75dBi min
Mass	143g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	5 to 22.6	-	-
		22.6 to 50	-	-
		50 to 100	-	-
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100 to 1000	0.67g <sup>2</sup> /Hz	1.54 <sup>2</sup> /Hz
		1000 to 2000	-3 dB/oct.	-3 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			33g	50g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	40
	1000	1000
	4000	2000
	10000	2000
	Number of Events	3 per axis

## X-Band WR112 medium-power isolator

Used in a receiver application.

<b>SINT part number</b>	15HD363
<b>SINT ICD</b>	D35/83380
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied as FM
<b>Program</b>	-

- Full height WR112 Isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Silver plated Aluminum housing
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
PFM & Qualification	-40 to +75C
Acceptance	-35 to +70C
Operating Frequency	7.5 to 8.3GHz
Insertion Loss	0.10dB max
Return Loss	25dB min
Isolation	25dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	196g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM
Sine	All 3 axis	5 to 22.6	4.83mm	6.4mm
		22.6 to 50	Shaker amplitude	13.0g
		50 to 100	10.0g	10.0g
			2 octaves/min	
Random	All 3 axis	20 to 50	+6dB/oct.	+6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.4g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis
Overall [rms]			16.6g	21g

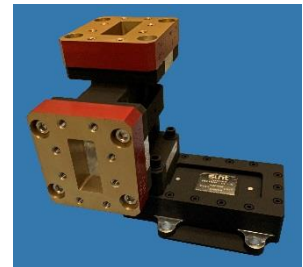
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## X-Band WR112 high-power Isolator

Output of TWTA

<b>SINT part number</b>	15HD364 & 15HD365
<b>SINT ICD</b>	D35/83391 & D35/83391
<b>Application</b>	Deep space probe
<b>Status</b>	Supplied as FM
<b>Program</b>	<i>Europa Clipper</i>

- Full height WR112 circulator combined with bulk absorbing termination
- Mirror image devices supplied
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Black paint or Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Device illustrated features flange savers



### Basic performance criteria

Parameter	Performance
Non-operating	-35 to +120C
Acceptance	-35 to +90C
Operating Frequency	8.35to 8.50GHz
Insertion Loss	0.15dB
Isolation	23dB min
Return Loss	23dB min
Power Handling (limited by load)	70W CW [FM]
Radiated Emissions	80dBi min
Mass	550g nom

### Environmental

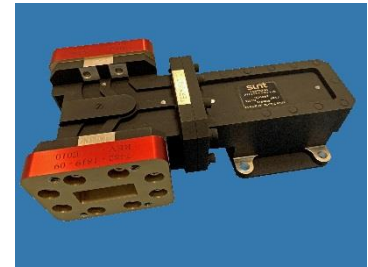
Test	Axis	Frequency (Hz)	Acceptance XY	Acceptance Z
Sine	All axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			<i>2 octaves/min</i>	<i>2 octaves/min</i>
Random	All axis	20	0.20g <sup>2</sup> /Hz	0.20g <sup>2</sup> /Hz
		20 to 50	+4.55dB/oct.	-
		20 to 60		+8.82dB/oct.
		50 to 200	0.50g <sup>2</sup> /Hz	--
		60 to 200	-	0.50g <sup>2</sup> /Hz
		200 to 500	-6.02 dB/oct.	-6.02 dB/oct.
		500 Hz	0.08g <sup>2</sup> /Hz	0.08g <sup>2</sup> /Hz
		500 to 2000	-3.01 dB/oct.	-3.01 dB/oct.
			<i>60 secs/axis</i>	<i>60 secs/axis</i>
<b>Overall [rms]</b>			<b>8.8g</b>	<b>13.9g</b>

## X-Band WR112 high-power Isolator

Output of TWTA

<b>SINT part number</b>	15HD366
<b>SINT ICD</b>	D35/83393
<b>Application</b>	Deep space probe
<b>Status</b>	Supplied as FM
<b>Program</b>	DART

- Full height WR112 circulator combined with bulk absorbing termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Black paint or Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Device illustrated features flange savers



### Basic performance criteria

Parameter	Performance
Non-operating	-35 to +120C
Acceptance	-25 to +55C
Operating Frequency	8.35 to 8.50GHz
Insertion Loss	0.15dB
Isolation	23dB min
Return Loss	23dB min
Power Handling (limited by load)	80W CW [FM]
Radiated Emissions	80dBi min
Mass	550g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance XY	Acceptance Z
Sine	All axis	5	0.63g	.63g
		17	-	7g
		21	-	7g
		25	15g	-
		28	-	1.25g
		29	15g	-
		36	1.25g	-
		100	1.25g	1.25g
			4 octaves/min	4 octaves/min
Random	All axis	20	0.026g <sup>2</sup> /Hz	0.026g <sup>2</sup> /Hz
		50	0.016g <sup>2</sup> /Hz	0.016g <sup>2</sup> /Hz
		800	0.016g <sup>2</sup> /Hz	0.016g <sup>2</sup> /Hz
		2000	0.026g <sup>2</sup> /Hz	0.026g <sup>2</sup> /Hz
			60 secs/axis	60 secs/axis
Overall [rms]			14.1g	13.9g

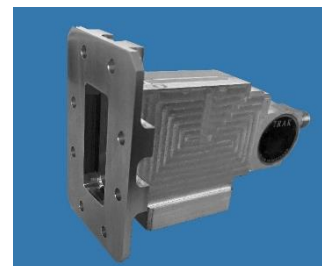


## X-Band WR112 to SMA Iso-adapter

Used on the input to a receiver.

<b>SINT part number</b>	I7984/O
<b>SINT ICD</b>	B105760
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied as FM, launched
<b>Program</b>	Various

- Full height WR112 to 50Ohm bleed path SMA isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +125C
LAT	-30 to +85C
Acceptance	-20 to +85C
Operating Frequency	7.9 to 8.4 GHz
Insertion Loss	0.35dB max
Isolation	23dB min
Return Loss	23dB min
Power Handling	1W CW
Radiated Emissions	75dBi min
Mass	86g nom

### Environmental

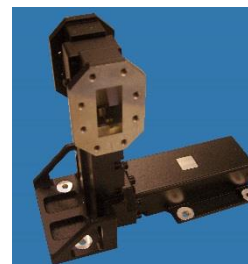
Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	5 to 26	-	11mm (0-pk)
		26 to 100	-	30g
				2 octaves/min
Random	All 3 axis	20 to 100	+6dB/oct.	+6dB/oct.
		100 to 1000	0.25g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			16.7g	50g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	500	300
	4000	4200
	10000	4200
	Number of Events	3 per direction per axis

## X-Band WR112 high-power Isolator

Used on the output of a TWTA.

<b>SINT part number</b>	15HD360
<b>SINT ICD</b>	C35/82970
<b>Application</b>	Space [Deep Space Probe]
<b>Status</b>	Flown
<b>Program</b>	ExoMARS and other missions



- Full height WR112 Isolator with matching remote load supplied separately
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Aluminum housing.
- Several variants available in load powers from 80 to 160W
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	FM	LAT
Non-operating	-50 to +140C	-50 to +140C
Qualification	-35 to +135C	-35 to +105C
Acceptance	-15 to +100C	-35 to +105C
Operating Frequency	8.0 to 8.5GHz	8.0 to 8.5GHz
Insertion Loss	<0.10dB max	<0.10dB max
Return Loss	>26dB min	>26dB min
Isolation	>23dB min	>23dB min
Power Handling	160W CW [FWD], 120W CW [REV]	160W CW [FWD], 120W CW [REV]
Multipaction	Margin >10dB by analysis	Margin >10dB by analysis
Radiated Emissions	80dBi min	80dBi min
Mass	520g nom	520g nom

### Environmental

Environmental

Test	Axis	Frequency (Hz)	Acceptance (Z)	Acceptance (XY)	Qualification (Z)	Qualification (XY)
Sine	All 3 axis	5 to 19.0	-	-	-	11.0 mm
		5 to 28.2	-	-	12.5 mm	-
		19.0 to 100	-	-	-	20g
		28.2 to 100	-	-	40.0g	-
					4 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	+3dB/oct.	+3dB/oct.	+3dB/oct.	+3dB/oct.
		100 to 300	1.25g <sup>2</sup> /Hz	0.563g <sup>2</sup> /Hz	2.0g <sup>2</sup> /Hz	2.0g <sup>2</sup> /Hz
		300 to 650	-	-5.83 dB/oct.	-	-
		300 to 2000	-6 dB/oct.	-		
		650 to 950	-	0.125g <sup>2</sup> /Hz	-	-
		300 to 2000	-	-	-6.0 dB/oct.	-6.0 dB/oct.
		950 to 2000	-	-6 dB/oct.		
			60 secs/axis	60 secs/axis	180 secs/axis	180 secs/axis
Overall [rms]			25.07g	18.23g	31.72g	31.72g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	50
	400	600
	1500	2000
	10000	2500
Number of Events		3 per axis

## X-Band WR112 high-power Circulator

Used on the output of a TWTA application in conjunction with a remote termination to form an isolator.

<b>SINT part number</b>	15CD362
<b>SINT ICD</b>	D35/83333
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied
<b>Program</b>	Star One D2



- Full height WR112 Circulator with matching remote load supplied separately
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-30 to +135C
PFM & Qualification	-25 to +125C
Acceptance	-20 to +120C
Operating Frequency	7.2 to 9.0GHz
Insertion Loss	0.15dB max
Return Loss	20dB min
Isolation	20dB min
Power Handling	340W CW [PFM] 215W CW [FM]
Multipaction	340W pk by test 677W pk by analysis
Radiated Emissions	80dBi min
Mass	224g nom

### Environmental

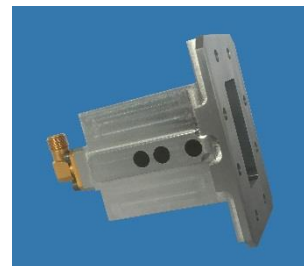
Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	-	-	6.4 mm
		22.6 to 50	-	-	13.0g
		50 to 100	-	-	10.0g
					2 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>16.7g</b>	<b>23.6g</b>	<b>23.6g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## X-Band WR112 to SMA in-line transition

Used to connect an SSPA to an antenna

<b>SINT part number</b>	15TM103
<b>SINT ICD</b>	C182900
<b>Application</b>	Space [deep space probe]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Parker Solar Probe/ JHUAPL



- Full height WR12 orthogonal dc shorted (<0.5 Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-30 to +90C
PFM & Qualification	-
Acceptance	-25 to +85C
Operating Frequency	7.15 to 8.45 GHz
Insertion Loss	0.20dB max
Return Loss	23dB min
Power Handling	2W CW [PFM] 2W CW [FM]
Multipaction	N/A N/A
Corona (critical pressure)	N/A N/A
Radiated Emissions	80dBi min
Mass	53g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	-	-	-
		22.6 to 50	-	-	-
		50 to 100	-	-	-
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.	-
		100 to 600	0.67g <sup>2</sup> /Hz	0.67g <sup>2</sup> /Hz	-
		600 to 2000	-3.0 dB/oct.	-3.0 dB/oct.	-
			60 secs/axis	60 secs/axis	-
Overall [rms]			33.7g	33.0g	

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## X-Band WR112 to SMA orthogonal transition

Used in TT&C equipment

<b>SINT part number</b>	15TM106
<b>SINT ICD</b>	C108511
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various



- Full height WR112 orthogonal dc shorted (<0.5 Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
PFM & Qualification	-45 to +125C
Acceptance	-40 to +120C
Operating Frequency	7.2 to 9.2 GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Power Handling	16W CW [PFM] 12W CW [FM]
Multipaction	N/A N/A
Corona (critical pressure)	N/A N/A
Radiated Emissions	80dBi min
Mass	80g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	-	-	6.4 mm
		22.6 to 50	-	-	13.0g
		50 to 100	-	-	10.0g
					4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.40g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>16.7g</b>	<b>21.0g</b>	<b>23.6g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## X-Band WR112 to orthogonal TNC transition

Used in TT&C equipment

<b>SINT part number</b>	15TM105
<b>SINT ICD</b>	C108269
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various



- Full height WR112 orthogonal dc shorted (<0.5 Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +95C
PFM & Qualification/ LAT	-40 to +95C
Acceptance	-40 to +80C
Operating Frequency	7.1 to 8.5 GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Power Handling	60W CW [PFM] 12W CW [FM]
Multipaction	N/A N/A
Corona (critical pressure)	N/A N/A
Radiated Emissions	85dBi min
Mass	83g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	LAT
Sine	All 3 axis	5 to 22.6	-	-	-
		22.6 to 50	-	-	-
		50 to 100	-	-	-
Random	All 3 axis	20 to 100	6dB/oct.	-	6dB/oct.
		100 to 324	-	-	0.01g <sup>2</sup> /Hz
		100 to 1000	1.54g <sup>2</sup> /Hz	-	0.50g <sup>2</sup> /Hz
		324 to 524	-	-	1.00g <sup>2</sup> /Hz
		524 to 2000	-	-	0.01g <sup>2</sup> /Hz
		1000 to 2000	-3 dB/oct.	-	-
			60 secs/axis		180 secs/axis
Overall [rms]			50.0g		170g

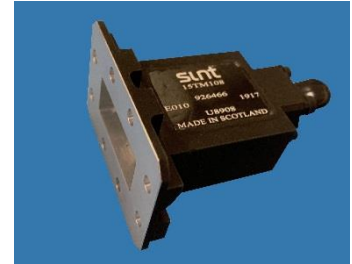
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	50
	740	665
	4000	4200
	10000	4200
	Number of Events	3 per axis

## X-Band WR112 to in-line TNC transition

Used in a transmitter application.

<b>SINT part number</b>	15TM108
<b>SINT ICD</b>	C35/83394
<b>Application</b>	Deep Space probe
<b>Status</b>	Supplied as FM
<b>Program</b>	<i>Europa Clipper</i>

- Full height WR112 to coaxial (TNC(f)) directly coupled transition
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Silver plated Aluminum housing
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-60 to +100C
Acceptance	-40 to +85C
Operating Frequency	7.1 to 8.5GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Power Handling	70W CW [PFM] 70W CW [FM]
Radiated Emissions	80dBi min
Mass	70g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance
Sine	All 3 axis	5 to 22.6	4.83mm
		22.6 to 50	S.A
		50 to 100	10.0g
			2 octaves/min
Random	All 3 axis	20 to 100	+6dB/oct.
		100 to 1000	0.67g <sup>2</sup> /Hz
		600 to 2000	-3.0 dB/oct.
			60 secs/axis
Overall [rms]			33g

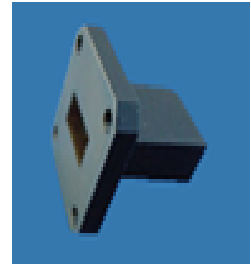
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## X-Band WR90 Termination

Generic application.

<b>SINT part number</b>	16TE43
<b>SINT ICD</b>	B80103
<b>Application</b>	Space [LEO]
<b>Status</b>	Supplied as FM & PFM
<b>Program</b>	-

- Full height WR90 bulk absorbing termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Painted black Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +85C
PFM & Qualification	-35 to +125C
Acceptance	-15 to +65C
Operating Frequency	9.25-10.00GHz
Return Loss	25dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	75dBi min
Mass	10g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5	-	1g
		17-50	-	16g
		50-70	-	10g
		70-95	-	13g
				10g
			4 octaves/min	
Random	All 3 axis	20-100	0.4g <sup>2</sup> /Hz	-
		100-300	2.0g <sup>2</sup> /Hz	-
		300-750	0.7g <sup>2</sup> /Hz	-
		750-1000	0.7g <sup>2</sup> /Hz	-
		1000-2000	0.025g <sup>2</sup> /Hz	-
			60 secs/axis	-
Overall [rms]			30.5g	-

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
		50g in 11ms
	Number of Events	3 per axis



## X-Band WR90 to in-line SMA Transition

Generic applications

<b>SINT part number</b>	16TM104
<b>SINT ICD</b>	C35/82387
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied as FM, launched
<b>Program</b>	<i>Various</i>

- Full height WR90 in line dc shorted (<0.5 Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +125C
LAT	-40 to +125C
Acceptance	-30 to +85C
Operating Frequency	8.3 to 12.4 GHz
Insertion Loss	0.15dB max
Return Loss	25dB min
Power Handling	10W CW [LAT] 10W CW [FM]
Radiated Emissions	75dBi min
Mass	47g nom

### Environmental

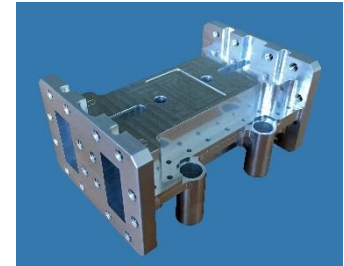
Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	5 to 26	-	11mm (0-pk)
		26 to 100	-	30g
				2 octaves/min
Random	All 3 axis	20 to 100	+6dB/oct.	+6dB/oct.
		100 to 1000	0.25g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			16.7g	50g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	500	300
	4000	4200
	10000	4200
	<i>Number of Events</i>	<i>3 per direction per axis</i>

## X-Band WR112 2 x 2 hybrid coupler

Used in the transmit chain to combine two signals. Used in conjunction with a medium-power load.

<b>SINT part number</b>	15WC401
<b>SINT ICD</b>	D83359
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	STAR One D2



- Full height WR112 broad wall coupled 2 x 2, 3dB hybrid coupler
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-30 to +125C
Acceptance	-25 to +120C
Operating Frequency	7.2-8.4GHz
Insertion Loss	0.10dB max
Return Loss	23dB min
Isolation	23dB min
Coupling	-33.0+/-0.2dB max
Group delay variation	0.12ns max
Amplitude balance	0.2dBp-p max
Power Handling	24W CW [PFM] 12W CW [FM]
Radiated Emissions	80dBi min
Mass	240g nom

### Environmental

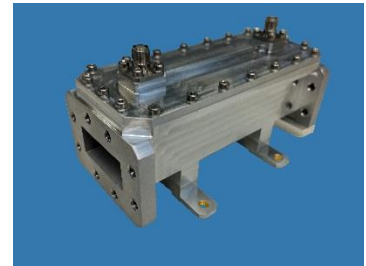
Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## X-Band WR112 SMA test coupler

Used in the transmit chain prior to the antenna.

<b>SINT part number</b>	15TC401
<b>SINT ICD</b>	D83328
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	STAR One D2



- Full height WR112 33dB forward and reverse coupler
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- The waveguide path is made from extrusion; there is no *split line* in the housing
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-40 to +125C
Acceptance	-35 to +120C
Operating Frequency	7.2-9.2GHz
Insertion Loss	0.10dB max
Return Loss	21dB min
Isolation	21dB min
Coupling	-33.0+/-0.5dB max
Directivity	20dB min
Power Handling	556W CW [PFM] 278W CW [FM]
Multipaction	556W CW [PFM] 1112W CW by analysis
Radiated Emissions	80dBi min
Mass	225g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

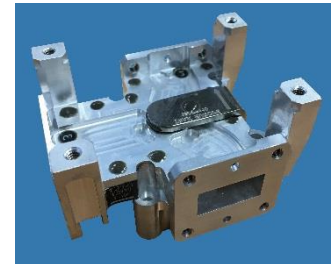
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## X-Band WR90 high-power Circulator

Used in a Butler matrix application.

<b>SINT part number</b>	16CD3110
<b>SINT ICD</b>	D35/80059
<b>Application</b>	Space [HEO]
<b>Status</b>	Supplied as equipment, in orbit
<b>Program</b>	<i>Polaris</i>

- Full height WR90 phase matched Circulator used on the output of a TWTA
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-30 to +100C
PFM & Qualification	-20 to +70C
Acceptance	-15 to +65C
Operating Frequency	9.25 to 9.95GHz
Insertion Loss	<0.10dB
Return Loss	25dB min
Power Handling	2000 W pk, 20% DC [FM] 400W CW [FM]
Multipaction	6kW pk by test 12kW by analysis
Radiated Emissions	80dBi min
Mass	155g nom

### Environmental

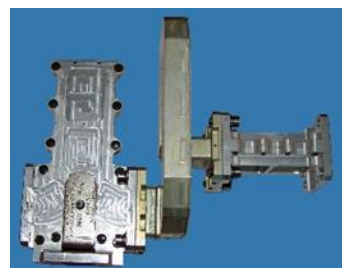
Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 20	-	1.0g
		20 to 50	-	18.0g
		50 to 70	-	10.0g
		70 to 90	-	16.0g
		90 to 200	-	10.0g
				2 octaves/min
Random	All 3 axis	20 to 100	0.36g <sup>2</sup> /Hz	0.36g <sup>2</sup> /Hz
		100 to 300	1.8g <sup>2</sup> /Hz	1.8g <sup>2</sup> /Hz
		300 to 1000	0.1g <sup>2</sup> /Hz	0.1g <sup>2</sup> /Hz
		1000 to 2000	0.025g <sup>2</sup> /Hz	0.025g <sup>2</sup> /Hz
			60 secs/axis	180 secs/axis
Overall [rms]			24.7g	24.7g

## X-Band WR90 high-power Isolator, 90degree twist & Harmonic filter

Used on the output of a TWTA.

<b>SINT part number</b>	16IS001
<b>SINT ICD</b>	D35/80040
<b>Application</b>	Space [HEO]
<b>Status</b>	Supplied as equipment, in orbit
<b>Program</b>	IAI / Polaris

- Full height WR90 filtered isolator used in Butler matrix
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-30 to +100C
PFM & Qualification	-20 to +70C
Acceptance	-15 to +65C
Operating Frequency	9.25 to 9.95GHz
Insertion Loss	<0.15dB
Return Loss	25dB min
Isolation	25dB min
Power Handling	400 W pk, 20% DC [FM] 80W CW [FM]
Multipaction	2kW pk by test 4kW by analysis
Radiated Emissions	80dBi min
Mass	110g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 20	-	1.0g
		20 to 50	-	18.0g
		50 to 70	-	10.0g
		70 to 90	-	16.0g
		90 to 200	-	10.0g
				2 octaves/min
Random	All 3 axis	20 to 100	0.36g <sup>2</sup> /Hz	0.36g <sup>2</sup> /Hz
		100 to 300	1.8g <sup>2</sup> /Hz	1.8g <sup>2</sup> /Hz
		300 to 1000	0.1g <sup>2</sup> /Hz	0.1g <sup>2</sup> /Hz
		1000 to 2000	0.025g <sup>2</sup> /Hz	0.025g <sup>2</sup> /Hz
			60 secs/axis	180 secs/axis
Overall [rms]			24.7g	24.7g

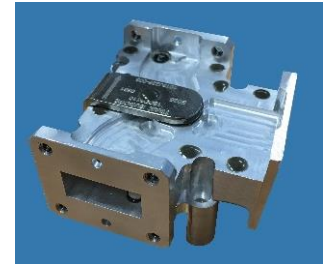
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web		-
		-
		-
		-
	Number of Events	-

## X-Band WR90 power Circulator

Used in a switched receiver system.

<b>SINT part number</b>	16CD3118
<b>SINT ICD</b>	D35/80040
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied as FM, launched?
<b>Program</b>	-

- Full height WR90 circulator used on an antenna switch matrix
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage with Full height WR90 in line dc shorted (<0.5 Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-30 to +135C
LAT	-25 to +125C
Acceptance	-20 to +120C
Operating Frequency	7.2 to 9.0GHz
Insertion Loss	0.15dB max
Return Loss	20dB min
Isolation	20dB min
Power Handling	1W CW [PFM & QM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	60g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	-	-	6.4 mm
		22.6 to 50	-	-	13.0g
		50 to 100	-	-	10.0g
					2 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>16.7g</b>	<b>23.6g</b>	<b>23.6g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ku-Band Overview

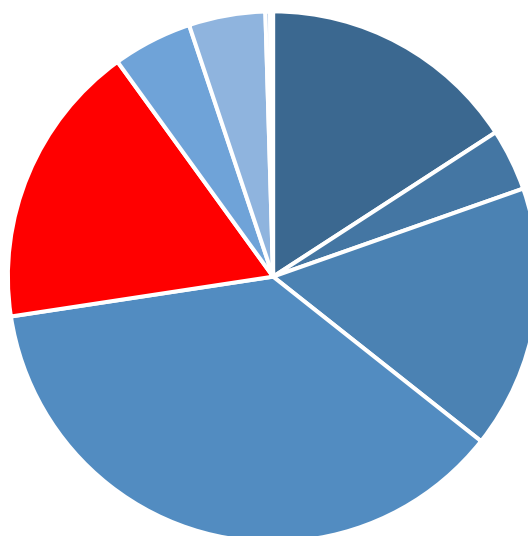
SINT has developed, supplied, and has heritage with many passive devices operating in the 10.7-18GHz band designed to operate at either low or high-power. The K-Band range is considered comprehensive with over with ~449 distinct designs supplied to date. Heritage is dominated by the supply of uniquely compact coaxial isolators used in MUX applications. Many of the parts supplied are classed as components but an increasing number are supplied classed as equipment. This distinction is largely a matter of how the parts are specified and procured. The following is an extract from the heritage

database which records sales of flight model hardware from 1994 to December 2020.

Heritage in terms of the numbers and types of products supplied changes daily. Please contact the factory to obtain the most up to date information.

FMs supplied	COAXIAL	MICPUCK	MICROSTRIP	STRIPLINE (DROP-IN)	WAVEGUIDE	Total
<b>Ku</b>	<b>26647</b>	<b>1991</b>	<b>271</b>	<b>1886</b>	<b>-</b>	<b>30795</b>
ISOLATOR	14292	1991	242	1886	-	10908
CIRCULATOR	11114	-	29	-	-	11143
CONNECTOR ASSY.	918	-	-	-	-	918
LOAD/TERMINATION	312	-	-	-	-	312
ISO-ADAPTOR	11	-	-	-	-	11
<b>Ku [WR62]</b>					<b>857</b>	<b>857</b>
ISOLATOR	-	-	-	-	492	492
ISO-ADAPTER	-	-	-	-	357	357
LOAD/TERMINATION	-	-	-	-	5	5
SPLITTER	-	-	-	-	3	3
<b>Ku [WR75]</b>					<b>3757</b>	<b>3757</b>
ISOLATOR	-	-	-	-	1615	1615
ISO-ADAPTER	-	-	-	-	1011	1011
TRANSITION	-	-	-	-	491	491
CIRCULATOR	-	-	-	-	346	346
LOAD/TERMINATION	-	-	-	-	268	268
COUPLER/SPLITTER	-	-	-	-	26	26
<b>Total</b>	<b>26647</b>	<b>1991</b>	<b>271</b>	<b>1886</b>	<b>4614</b>	<b>35409</b>

Ku-Band products account for ~17% of total FM heritage



## In development/qualification

- -

## Ku-Band WR75 2 x 1 hybrid Coupler

Used in a redundancy network

<b>SINT part number</b>	17WC403
<b>SINT ICD</b>	D82919
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Eutelsat 7c

- Full height WR75 3dB hybrid with low-power termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-30 to +125C
Acceptance	-25 to +120C
Operating Frequency	10.7-14.5GHz
Insertion Loss	0.07dB max
Return Loss	21dB min
Isolation	21dB min
Coupling	-3 +/-0.5dB max
Group delay variation	0.12ns max
Amplitude balance	0.2dBp-p max
Power Handling	8W CW [PFM] 6W CW [FM]
Radiated Emissions	80dBi min
Mass	124g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

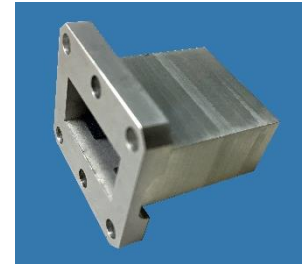


## Ku-Band WR75 low-power Termination

Used within a redundancy network

<b>SINT part number</b>	17TE118
<b>SINT ICD</b>	C82796
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various

- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +120C
PFM & Qualification	-35 to +125C
Acceptance	-35 to +120C
Operating Frequency	10.0 to 15.0GHz
	<i>blank</i>
Return Loss	23dB min
Power Handling	2W CW [PFM]
	2W CW [FM]
Multipaction	4W pk by test
	<i>8W pk by analysis</i>
Corona (critical pressure)	N/A
	N/A
Radiated Emissions	80dBi min
Mass	25g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			<i>2 octaves/min</i>	<i>2 octaves/min</i>	<i>4 octaves/min</i>
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			<i>60 secs/axis</i>	<i>60 secs/axis</i>	<i>180 secs/axis</i>
<b>Overall [rms]</b>			<b>16.7g</b>	<b>23.6g</b>	<b>23.6g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	<i>Number of Events</i>	<i>3 per axis</i>

## Ku-Band WR75 to TNC Transition

Various applications

<b>SINT part number</b>	17TM118
<b>SINT ICD</b>	C82051
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [LAT & FM]
<b>Program</b>	Various

- Full height, in line dc shorted (<0.5 Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
LAT	-45 to +85C
Acceptance	-40 to +80C
Operating Frequency	10.6 to 11.8GHz
Insertion Loss	0.15dB max
Return Loss	25dB min
Power Handling	70W CW [FM] 70W CW [LAT]
Radiated Emissions	80dBi min
Mass	45g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis		-	-
			-	-
			-	-
Random	All 3 axis		2 octaves/min	2 octaves/min
		20 to 100	0.0045g <sup>2</sup> /Hz	0.01g <sup>2</sup> /Hz
		100-500	0.045g <sup>2</sup> /Hz	1.0g <sup>2</sup> /Hz
		500 to 1000	0.0178g <sup>2</sup> /Hz	0.4g <sup>2</sup> /Hz
			60 secs/axis	60 secs/axis
<b>Overall [rms]</b>			<b>18.2g</b>	<b>27.3g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	30
	3000	2000
	10000	2000
	Number of Events	3 per axis

## Ku-Band WR75 to TNC Transition

Various applications

<b>SINT part number</b>	17TM123
<b>SINT ICD</b>	C82754
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Intelsat I39



- Full height, orthogonal dc shorted (<0.5 Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting, MP, Corona, Thermal.

### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
PFM & Qualification	-30 to +125C
Acceptance	-25 to +120C
Operating Frequency	10.2 to 14.75GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Power Handling	40W CW [PFM] 26W CW [FM]
Multipaction	40W pk by test 80W pk by analysis
Corona (critical pressure)	40W CW [PFM] 26W CW [FM]
Radiated Emissions	80dBi min
Mass	55g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ku-Band WR75 to SMA Transition

Various applications

<b>SINT part number</b>	17TM124
<b>SINT ICD</b>	C82755
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	<i>Various</i>

- Full height, orthogonal dc shorted (<0.5 Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
PFM & Qualification	-30 to +125C
Acceptance	-25 to +120C
Operating Frequency	10.2 to 14.75GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Power Handling	40W CW [PFM] 26W CW [FM]
Multipaction	40W pk by test 80W pk by analysis
Corona (critical pressure)	40W CW [PFM] 26W CW [FM]
Radiated Emissions	80dBi min
Mass	55g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ku-Band WR75 low-power Isolator

Various applications

<b>SINT part number</b>	17HD383
<b>SINT ICD</b>	C83038
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	<i>Various</i>

- Full height WR75 isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +85C
PFM & Qualification	-35 to +75C
Acceptance	-30 to +65C
Operating Frequency	12.0 to 15.0 GHz
Insertion Loss	0.13dB max
Isolation	21 dB min
Return Loss	21 dB min
Power Handling (fault)	1 CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	58g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	70
	1400	840
	4000	4200
	10000	4200
	<i>Number of Events</i>	<i>3 per axis</i>

## Ku-Band WR75 low-power Isolator

Used on the input to a multi-channel receiver

<b>SINT part number</b>	17HD351
<b>SINT ICD</b>	B81121
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied & Qualified [FM]
<b>Program</b>	<i>Various</i>

- Full height dual channel WR75 isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
PFM & Qualification	-35 to +75C
Acceptance	-20 to +80C
Operating Frequency	12.7 to 14.5 GHz
Insertion Loss	0.15dB max
Isolation	23 dB min
Return Loss	23 dB min
Power Handling (fault)	1 CW [PFM] 1W CW [FM]
Radiated Emissions	75dBi min
Mass	46g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	-	-
		22.6 to 50	-	-
		50 to 100	-	-
			-	-
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100 to 1000	0.67g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		1000 to 2000	-3.0 dB/oct.	-3.0 dB/oct.
			60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>33.0g</b>	<b>80.0g</b>

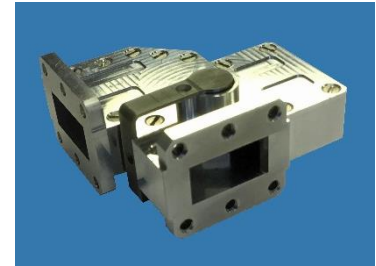
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	40
	1000	1000
	3000	2100
	6000	2100
	6001	2300
	10000	2000
	Number of Events	3 per axis

## Ku-Band WR75 low-power Isolator

Used on the input to a multi-channel receiver

<b>SINT part number</b>	17HD385
<b>SINT ICD</b>	C83084
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied & Qualified [FM]
<b>Program</b>	Various

- Compact full height dual channel WR75 isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
PFM & Qualification	-35 to +75C
Acceptance	-20 to +80C
Operating Frequency	12.75 to 14.5 GHz
Insertion Loss	0.10dB max
Isolation	21 dB min
Return Loss	21 dB min
Power Handling (fault)	1 CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	63g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	-	-
		22.6 to 50	-	-
		50 to 100	-	-
			-	-
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100 to 1000	0.67g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		1000 to 2000	-3.0 dB/oct.	-3.0 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			33.0g	80.0g

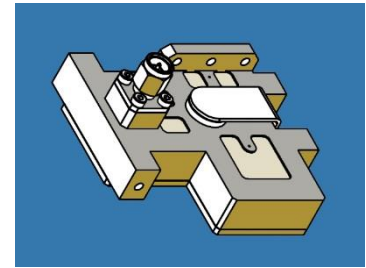
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	40
	1000	1000
	3000	2100
	6000	2100
	6001	2300
	10000	2000
	Number of Events	3 per axis

## Ku-Band WR75 to orthogonal SMA Iso-adapter

Used on the input to a receiver (image not available)

SINT part number	17HD381
SINT ICD	C82727
Application	Space [GEO]
Status	Supplied as FM
Program	-

- Full height WR75 circulator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-30 to +90C
LAT	-25 to +85C
Acceptance	-20 to +80C
Operating Frequency	12.75-14.50 GHz
Isolation	22dB min
Return Loss	22dB min
Insertion Loss	0.30dB max
Power Handling [FM & LAT]	1W CW forward 1W CW reverse
Radiated Emissions	80dBi min
Mass	80g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	10 to 2000	-	30g
				2 octaves/min
Random	All 3 axis	20 to 50	+6dB/oct.	+6dB/oct.
		50 to 1200	0.20g <sup>2</sup> /Hz	0.245g <sup>2</sup> /Hz
		1200 to 2000	-6 dB/oct	-6 dB/oct
			60 secs/axis	240 secs/axis
Overall [rms]			18.2g	27.2g

Location	Frequency (Hz)	Shock response (Q=10), g	Shock response (Q=10), g
		Z	XY
Shear Web		LAT	LAT
	100-600	15dB/Oct	15dB/Oct
	600-5000	700g	400g
	5000-10000	-6dB/Oct	-6dB/Oct
	Number of Events	2 per axis	2 per axis

Note: no image exists of this part. The render is taken from the ICD

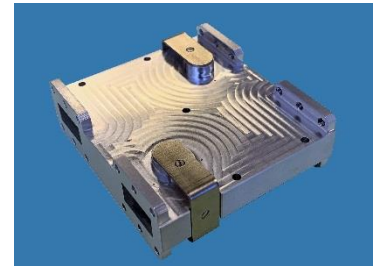


## Ku-Band WR75 dual channel low-power Isolator

Used on the input to a multi-channel receiver

<b>SINT part number</b>	17HD404
<b>SINT ICD</b>	D35/83609
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified [FM]
<b>Program</b>	<i>Various</i>

- Full height dual channel WR75 isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
PFM & Qualification	-35 to +75C
Acceptance	-20 to +80C
Operating Frequency	12.7 to 14.5 GHz
Insertion Loss	0.15dB max
Isolation P1 to P2	21 dB min
Isolation between channels	70 dB min
Return Loss	21 dB min
Power Handling (fault)	1 CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	148g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100 to 1000	1.54g <sup>2</sup> /Hz	3.94g <sup>2</sup> /Hz
		1000 to 2000	-3.0 dB/oct.	-3.0 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			50.0g	80.0g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	40
	1000	1000
	3000	2100
	6000	2100
	6001	2300
	10000	2000
	<i>Number of Events</i>	<i>3 per axis</i>

## Ku-Band WR75 high-power Circulator

Used on the output of a transmission network

<b>SINT part number</b>	17CD384
<b>SINT ICD</b>	C83056
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various



- Full height WR75 Circulator with matching remote load supplied separately
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting, MP, Corona, Thermal.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +135C
PFM & Qualification	-25 to +125C
Acceptance	-20 to +120C
Operating Frequency	10.70 to 12.75 GHz
Insertion Loss	0.11dB max
Return Loss	21 dB min
Power Handling (fault)	340 CW [PFM] 275W CW [FM]
Multipaction	1320W pk by test >2640W pk by analysis
Corona (critical pressure)	100W CW [PFM] 45W CW [FM]
Radiated Emissions	80dBi min
Mass	73g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.40g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	21.0g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ku-Band WR75 high-power Termination

Used on the output of a transmission network

<b>SINT part number</b>	17TE120
<b>SINT ICD</b>	C35/83062
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various



- Full height WR75 Termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting, MP, Corona, Thermal.

### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +150C
PFM & Qualification	-25 to +135C
Acceptance	-20 to +130C
Operating Frequency	10.70 to 12.80 GHz
Return Loss	25 dB min
Power Handling	267W CW [PFM] 267W CW [FM]
Multipaction	1700W pk by test 2675W pk by analysis
Critical Power	70W CW [PFM] 45W CW [FM]
Radiated Emissions	80dBi min
Mass	138g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ku-Band WR75 high-power Circulator

Used on the output of a transmission network

<b>SINT part number</b>	17CD377
<b>SINT ICD</b>	C35/82657
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [FM & LAT]
<b>Program</b>	Various

- Full height WR75 circulator used on the output of a TWT
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +80C
LAT	-20 to +75C
Acceptance	-20 to +70C
Operating Frequency	12.2 to 12.45GHz
Return Loss	21dB min
Insertion Loss	0.12dB max
Power Handling [FM & LAT]	300W CW forward 300W CW reverse
Radiated Emissions	80dBi min
Mass	57g nom

### Environmental

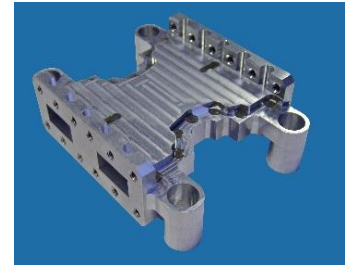
Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	10 to 2000	-	30g
				2 octaves/min
Random	All 3 axis	20 to 50	+6dB/oct.	+6dB/oct.
		50 to 1200	0.20g <sup>2</sup> /Hz	0.245g <sup>2</sup> /Hz
		1200 to 2000	-6 dB/oct	-6 dB/oct
			60 secs/axis	240 secs/axis
Overall [rms]			18.2g	27.2g

Location	Frequency (Hz)	Shock response (Q=10), g	Shock response (Q=10), g
		Z	XY
Shear Web		LAT	LAT
	100-600	15dB/Oct	15dB/Oct
	600-5000	700g	400g
	5000-10000	-6dB/Oct	-6dB/Oct
	Number of Events	2 per axis	2 per axis

## Ku-Band WR62 2 x 2 hybrid Coupler

Used in a redundancy network

<b>SINT part number</b>	18WC402
<b>SINT ICD</b>	D82777
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	BSAT4a



- Full height WR62 3dB hybrid
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-40 to +125C
Acceptance	-30 to +120C
Operating Frequency	17.0-18.5GHz
Insertion Loss	0.10dB max
Return Loss	23dB min
Isolation	23dB min
Coupling	-1.8, -4.8dB+/-0.2dB max
Group delay variation	0.05ns max
Amplitude balance	0.3dBp-p max
Power Handling	3W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	90g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

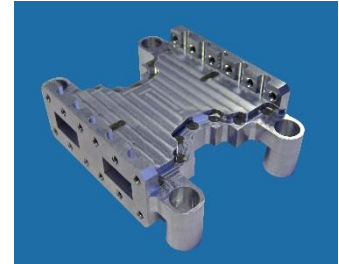
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ku-Band WR62 2 x 1 hybrid Coupler

Used in a redundancy network

<b>SINT part number</b>	18WC403
<b>SINT ICD</b>	D82781
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	BSAT4a

- Full height WR62 3dB hybrid with low-power termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-40 to +125C
Acceptance	-30 to +120C
Operating Frequency	17.0-18.5GHz
Insertion Loss	0.10dB max
Return Loss	23dB min
Isolation	23dB min
Coupling	-1.8, -4.8dB+/-0.2dB max
Group delay variation	0.05ns max
Amplitude balance	0.3dBp-p max
Power Handling	3W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	115g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

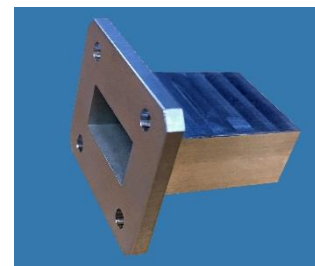
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ku-Band WR62 low-power Termination

Used to terminate a switch network

<b>SINT part number</b>	18TE123
<b>SINT ICD</b>	C82979
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various

- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +120C
PFM & Qualification	-35 to +125C
Acceptance	-35 to +120C
Operating Frequency	12.0 to 18.5GHz
	<i>blank</i>
Return Loss	23dB min
Power Handling	2W CW [PFM]
	2W CW [FM]
Multipaction	4W pk by test
	8W pk by analysis
Corona (critical pressure)	N/A
	N/A
Radiated Emissions	80dBi min
Mass	12g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>16.7g</b>	<b>23.6g</b>	<b>23.6g</b>

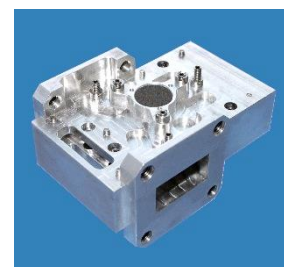
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ku-Band WR62 low-power Isolator

Used on the input to a multi-channel receiver

<b>SINT part number</b>	18HD350
<b>SINT ICD</b>	B81351
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied & Qualified [FM]
<b>Program</b>	Various

- Full height WR62 isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
Qualification	-35 to +75C
Acceptance	-20 to +80C
Operating Frequency	17.3 to 18.45 GHz
Insertion Loss	0.15dB max
Isolation	23 dB min
Return Loss	23 dB min
Power Handling (fault)	1 CW [PFM] 1W CW [FM]
Radiated Emissions	75dBi min
Mass	46g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	-	-
		22.6 to 50	-	-
		50 to 100	-	-
			-	-
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100 to 1000	0.67g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		1000 to 2000	-3.0 dB/oct.	-3.0 dB/oct.
			60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>33.0g</b>	<b>80.0g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	50
	200	300
	400	400
	1000	900
	4000	4200
	10000	2000
	Number of Events	3 per axis



## Ku-Band WR62 low-power Isolator

Used on the input to a multi-channel receiver

<b>SINT part number</b>	18HD358
<b>SINT ICD</b>	B82873
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied & Qualified [FM]
<b>Program</b>	-

- Full height WR62 isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +105C
Qualification	-35 to +85C
Acceptance	-30 to +75C
Operating Frequency	13.5 to 14.50 GHz
Insertion Loss	0.17dB max
Isolation	23 dB min
Return Loss	23 dB min
Power Handling (fault)	1 CW [PFM] 1W CW [FM]
Radiated Emissions	75dBi min
Mass	56g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	-	-
		22.6 to 50	-	-
		50 to 100	-	-
			-	-
Random	All 3 axis	20 to 100	+12dB/oct.	6dB/oct.
		100 to 300	0.67g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		300 to 650	-15.0 dB/oct.	-3.0 dB/oct.
		650 to 850	0.013 g <sup>2</sup> /Hz	
		850 to 2000	-6dB/oct.	
			60 secs/axis	180 secs/axis
Overall [rms]			14.3g	80.0g

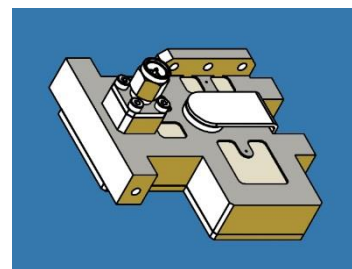
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	50
	200	300
	400	400
	1000	900
	4000	4200
	10000	2000
	Number of Events	3 per axis

## Ku-Band WR62 to orthogonal SMA Iso-adapter

Used on the input to a receiver (image not available)

SINT part number	18HD355
SINT ICD	C82734
Application	Space [GEO]
Status	Supplied as EM
Program	-

- Full height WR75 circulator with orthogonal SMA transition
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-30 to +90C
LAT	-25 to +85C
Acceptance	-20 to +80C
Operating Frequency	17.10-18.40 GHz
Isolation	21dB min
Return Loss	21dB min
Insertion Loss	0.30dB max
Power Handling [FM & LAT]	1W CW forward 1W CW reverse
Radiated Emissions	80dBi min
Mass	69g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	10 to 2000	-	30g
				2 octaves/min
Random	All 3 axis	20 to 50	+6dB/oct.	+6dB/oct.
		50 to 1200	0.20g <sup>2</sup> /Hz	0.245g <sup>2</sup> /Hz
		1200 to 2000	-6 dB/oct	-6 dB/oct
			60 secs/axis	240 secs/axis
Overall [rms]			18.2g	27.2g

Location	Frequency (Hz)	Shock response (Q=10), g	Shock response (Q=10), g
		Z	XY
Shear Web		LAT	LAT
	100-600	15dB/Oct	15dB/Oct
	600-5000	700g	400g
	5000-10000	-6dB/Oct	-6dB/Oct
	Number of Events	2 per axis	2 per axis

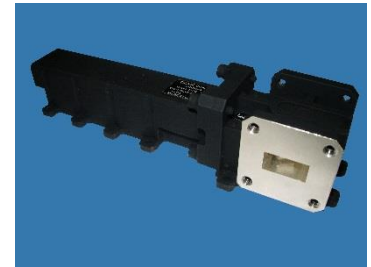
Note: no image exists of this part. The render is taken from the ICD

## Ku-Band WR62 high-power Isolator

Used on the output of a transmission network

<b>SINT part number</b>	18HD348
<b>SINT ICD</b>	B35/81342
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [FM & LAT]
<b>Program</b>	-

- Full height WR62 isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Power testing completed by Program



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +80C
LAT	-20 to +70C
Acceptance	-15 to +65C
Operating Frequency	13.4 to 13.6GHz
Return Loss	26dB min
Insertion Loss	0.11dB max
Isolation	26dB min
Power Handling [FM & LAT]	110W CW forward
	110W CW reverse
Radiated Emissions	80dBi min
Mass	60g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	10 to 2000	-	30g
				2 octaves/min
Random	All 3 axis	20 to 50	+6dB/oct.	+6dB/oct.
		50 to 1200	0.20g <sup>2</sup> /Hz	0.245g <sup>2</sup> /Hz
		1200 to 2000	-6 dB/oct	-6 dB/oct
			60 secs/axis	240 secs/axis
<b>Overall [rms]</b>			<b>18.2g</b>	<b>27.2g</b>

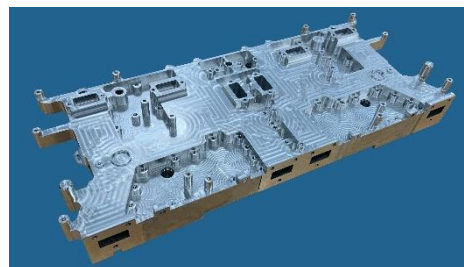
Location	Frequency (Hz)	Shock response (Q=10), g
		LAT
Shear Web	100	300
	1000	1500
	2000	2000
	10000	3000
	Number of Events	3 per axis

## Ku-Band WR62 high-power dual channel front-end assembly

Used on a high-altitude radar

SINT part number	18CDFA601
SINT ICD	-
Application	Very High Altitude
Status	In qualification
Program	-

- Full height WR62 circulator, bandpass filter & high directivity coupler.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum.

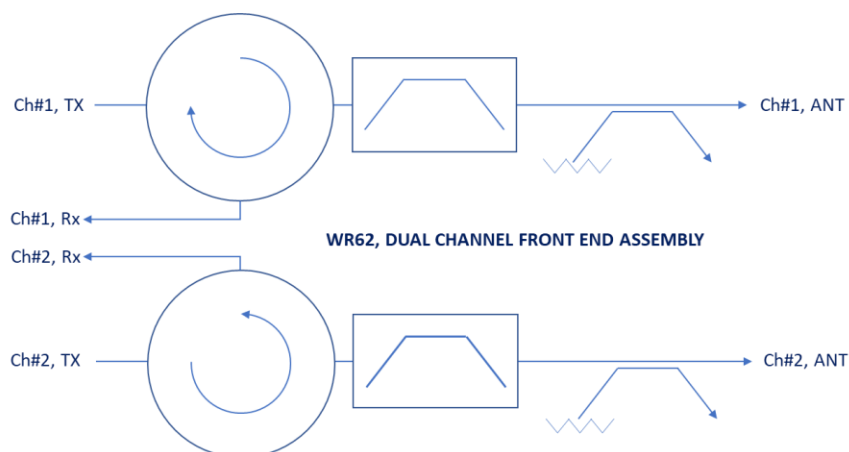


### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +80C
Acceptance	-35 to +75C
Operating Frequency	15.3 to 16.5GHz
Return Loss	23dB min
Insertion Loss	0.15dB max
Directivity	25dB min
Power Handling [FM & LAT]	80W CW forward
	80W CW reverse
Radiated Emissions	80dBi min
Mass	370g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	10 to 2000	-	30g
				2 octaves/min
Random	All 3 axis	20 to 50	+6dB/oct.	+6dB/oct.
		50 to 1200	0.20g <sup>2</sup> /Hz	0.245g <sup>2</sup> /Hz
		1200 to 2000	-6 dB/oct	-6 dB/oct
			60 secs/axis	240 secs/axis
Overall [rms]			18.2g	27.2g



## K-Band Overview

SINT has developed, supplied, and has heritage with many passive devices operating in the 17-26GHz band designed to operate at either low or high-power. The K-Band range is considered comprehensive with over with over ~172 distinct designs supplied to date. Heritage is dominated by the supplied of uniquely compact coaxial isolators used in MUX applications. Most parts supplied have been supplied as components however an increasing number are supplied classed

FMs supplied	COAXIAL	MICPUCK	MICROSTRIP	STRIPLINE (DROP-IN)	WAVEGUIDE	Grand Total
<b>K</b>	<b>5441</b>	<b>495</b>	<b>1321</b>	<b>426</b>		<b>7683</b>
ISOLATOR	4096	495	1321	426		6338
CIRCULATOR	940					940
CABLE/CONN ASSY	366					366
LOAD/TERMINATION	39					39
<b>K [WR42]</b>	<b>119</b>				<b>751</b>	<b>870</b>
ISOLATOR					498	498
ISO-ADAPTER	119				122	241
TRANS/FILT/ISOL					131	131
TRANSITION					7	7
<b>K [WR51]</b>					<b>1069</b>	<b>1069</b>
ISOLATOR					534	534
CIRCULATOR					404	404
ISO-ADAPTER					46	46
LOAD/TERMINATION					45	45
TRANSITION					40	40
<b>Grand Total</b>	<b>5560</b>	<b>495</b>	<b>1321</b>	<b>426</b>	<b>2047</b>	<b>9849</b>

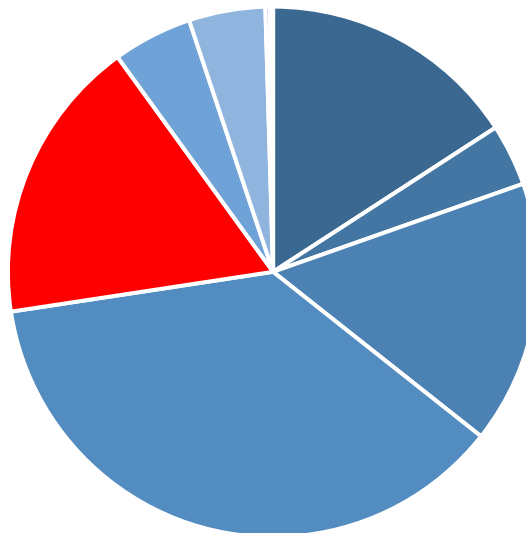
as equipment. This distinction is largely a matter of how the parts are specified and procured.

In terms of heritage the following is an extract from the heritage database which records sales of flight model hardware from 1994 to December 2020.

Heritage in terms of the numbers and types of products supplied changes daily. Please contact the factory to obtain

the most up to date information.

K-Band products account for ~5% of total FM heritage



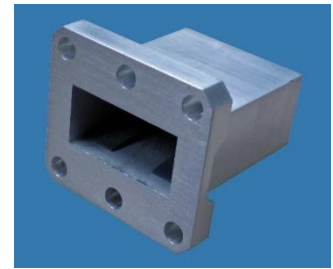
## In development/qualification

- 22.8-27.2GHz low power WR34 isolator
- 22.8-27.2GHz 40W high power WR34 isolator
- 22.8-27.2GHz 80W high power WR34 isolator
- 22.8-27.2GHz low power WR34 3dB hybrid

## K-Band WR51 low-power Termination

Generic applications.

<b>SINT part number</b>	19TE109
<b>SINT ICD</b>	C82797
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & In Orbit [PFM & FM]
<b>Program</b>	TeleVantage 18V and 19V



- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on filter & switch assemblies
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +120C
PFM & Qualification	-35 to +125C
Acceptance	-30 to +120C
Operating Frequency	15.0 to 22.0GHz
Return Loss	23dB min
Power Handling	2W CW [PFM] 2W CW [FM]
Radiated Emissions	80dBi min
Mass	7g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>16.7g</b>	<b>23.6g</b>	<b>23.6g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## K-Band WR51 to 2.92 orthogonal low-power Transition

Generic applications.

<b>SINT part number</b>	19TM101
<b>SINT ICD</b>	C35/81416
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & In Orbit
<b>Program</b>	INSAT series

- Full height, orthogonal launch dc open (>1MΩ resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on filter & switch assemblies
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +85C
LAT	-20 to +70C
Acceptance	-15 to +65C
Operating Frequency	18.5 to 21.5GHz
Insertion Loss	0.20dB max
Return Loss	23dB min
Power Handling	1W CW
Corona (critical pressure)	1W
	N/A
Radiated Emissions	75dBi min
Mass	17g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	10-2000	-	30g peak
			-	--
			-	
			-	2 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 1200	0.20g <sup>2</sup> /Hz	0.45g <sup>2</sup> /Hz
		1200 to 2000	-6.0 dB/oct.	-6.0 dB/oct.
			60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>18.1g</b>	<b>23.6g</b>

## K-Band WR51 to SMA orthogonal medium-power Transition

Used in generic applications.

<b>SINT part number</b>	19TM106
<b>SINT ICD</b>	C82947
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various

- Full height, orthogonal dc shorted (<0.5 Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
PFM & Qualification	-30 to +125C
Acceptance	-25 to +120C
Operating Frequency	17.3 to 22.00GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Power Handling	20W CW [PFM] 13W CW [FM]
Multipaction	40W pk by analysis
Corona (critical pressure)	20W CW [PFM]
Radiated Emissions	80dBi min
Mass	23g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>16.7g</b>	<b>23.6g</b>	<b>23.6g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis



## K-Band WR51 to 2.9mm in-line low-power Transition

Used at payload level.

<b>SINT part number</b>	19TM107
<b>SINT ICD</b>	B35/83757
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied
<b>Program</b>	-

- Full height, in-line dc shorted (<0.5 Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- REACH compliant passivated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-75 to +110C
Acceptance	-65 to +100C
Operating Frequency	17.3 to 21.00GHz
Insertion Loss	0.20dB max
Return Loss	26dB min
Power Handling	2W CW
Radiated Emissions	75dBi min
Mass	14g max

### Environmental

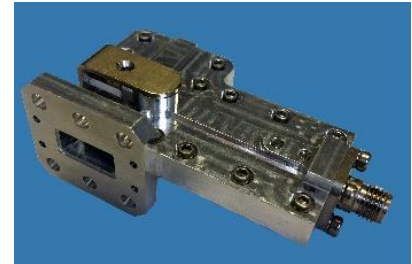
Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 26		11 mm
		26 to 50		30.0g
				2 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.67g <sup>2</sup> /Hz	1.50g <sup>2</sup> /Hz
		600 to 2000	-3 dB/oct.	-3 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			33g	50g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	40
	1000	1000
	3000	2000
	10000	2000
	Number of Events	3 per axis

## K-Band WR51 to SMA in-line iso-adapter

Used in a filter application.

<b>SINT part number</b>	19HD352 (cw) & 19HD353 (ccw)
<b>SINT ICD</b>	C82951 (cw) & C82952 (ccw)
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various



- Full height, orthogonal dc shorted (<0.5 Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting

### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
PFM & Qualification	-30 to +80C
Acceptance	-25 to +75C
Operating Frequency	17.8 to 20.20GHz
Insertion Loss	0.30dB max
Return Loss	23dB min
Isolation	23dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	38g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## K-Band WR51 low-power Circulator

Used in an IMUX application.

<b>SINT part number</b>	19CD328
<b>SINT ICD</b>	C35/82141
<b>Application</b>	Space [GEO]
<b>Status</b>	Flown
<b>Program</b>	Various

- Full height WR51 (custom flange) – 7 mechanical variants available
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: Modal, Venting.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +105C
Qualification	-35 to +80C
Acceptance	-30 to +75C
Operating Frequency	18.00 to 22.00GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	38g nom

### Environmental

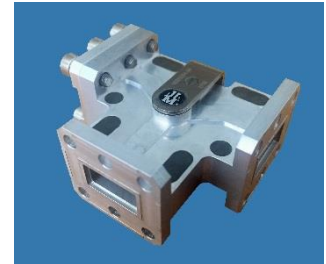
Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	12dB/oct.	6dB/oct.
		100 to 300	0.67g <sup>2</sup> /Hz	-
		100 to 350	-	5.4g <sup>2</sup> /Hz
		300 to 650	-15dB/oct.	
		350 to 1000	-	2.7g <sup>2</sup> /Hz
		650 to 850	0.013g <sup>2</sup> /Hz	-
		850 to 2000	-6 dB/oct.	-
		1000 to 2000	-	-12 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			14.3g	63.9g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## K-Band WR51 low-power Isolator

Used in an IMUX application.

<b>SINT part number</b>	19HD329
<b>SINT ICD</b>	C35/82142
<b>Application</b>	Space [GEO]
<b>Status</b>	Flown
<b>Program</b>	Various



- Full height WR51 (custom flange) – 11 mechanical variants available
- Matched, detachable load (not shown) for maximum flexibility
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: Modal, Venting.

### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +105C
Qualification	-35 to +80C
Acceptance	-30 to +75C
Operating Frequency	18.00 to 22.00GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Isolation	23dB min
Power Handling	1W CW [PFM]
	1W CW [FM]
Radiated Emissions	80dBi min
Mass	38g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	12dB/oct.	6dB/oct.
		100 to 300	0.67g <sup>2</sup> /Hz	-
		100 to 350	-	5.4g <sup>2</sup> /Hz
		300 to 650	-15dB/oct.	
		350 to 1000	-	2.7g <sup>2</sup> /Hz
		650 to 850	0.013g <sup>2</sup> /Hz	-
		850 to 2000	-6 dB/oct.	-
		1000 to 2000	-	-12 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			14.3g	63.9g

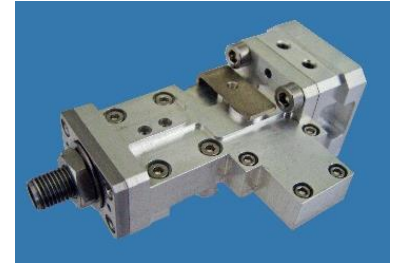
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## K-Band WR51 to SMA medium-power Iso-adapter with waveguide window

Used on the output of a beacon generator.

<b>SINT part number</b>	19HD327
<b>SINT ICD</b>	D35/82017
<b>Application</b>	Space [GEO]
<b>Status</b>	<i>Supplied [QM &amp; FM]</i>
<b>Program</b>	<i>Various</i>

- WR51 iso-adapter with dc shorted in line launch and waveguide window
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
Qualification	-40 to +85C
Acceptance	-20 to +85C
Operating Frequency	18.5 to 20.25GHz
Insertion Loss	0.30dB max
Return Loss	23dB min
Isolation	23dB min
Power Handling	5W CW [QM] 5W CW [FM]
Radiated Emissions	80dBi min
Mass	54g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 20	-	11 mm
		20-100	-	20g
				2 octaves/min
Random	All 3 axis	10 to 100	5.8dB/oct.	5.8dB/oct.
		100 to 300	0.67g <sup>2</sup> /Hz	1.50g <sup>2</sup> /Hz
		300 to 2000	-5.3 dB/oct.	-4.5 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			18.9g	28.3g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	80
	1000	600
	2000	2500
	10000	2500
	<i>Number of Events</i>	<i>3 per axis</i>

## K-Band WR51 high-power Termination

Used as a remote termination on a transmit assembly

<b>SINT part number</b>	19TE111
<b>SINT ICD</b>	C83310
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified
<b>Program</b>	Generic

- Full height WR51 termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- Analysis & reports Venting, Thermal, MP and Corona.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +150C
PFM & Qualification	-25 to +135C
Acceptance	-20 to +130C
Operating Frequency	17.3 to 20.20GHz
Return Loss	25dB min
Power Handling	180W CW
Multipaction	400W pk by test
Critical Power	70W CW
Radiated Emissions	80dBi min
Mass	110g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			<i>2 octaves/min</i>	<i>2 octaves/min</i>	<i>4 octaves/min</i>
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			<i>60 secs/axis</i>	<i>60 secs/axis</i>	<i>180 secs/axis</i>
<b>Overall [rms]</b>			<b>16.7g</b>	<b>23.6g</b>	<b>23.6g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	<i>Number of Events</i>	<i>3 per axis</i>

## K-Band WR51 high-power Termination

Used as a remote termination on a transmit assembly

<b>SINT part number</b>	19TE110
<b>SINT ICD</b>	C83309
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified
<b>Program</b>	Generic

- Full height WR51 termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- Analysis & reports: Venting, Thermal, MP and Corona.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-30 to +125C
Acceptance	-24 to +120C
Operating Frequency	17.3 to 22.0GHz
Return Loss	25dB min
Power Handling	200W CW
Multipaction	500W pk by test
	1600W pk by analysis
Critical Power	70W CW
Radiated Emissions	80dBi min
Mass	120g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>16.7g</b>	<b>23.6g</b>	<b>23.6g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## K-Band SMA to WR51 Isolated filter with Transition

This integrated assembly includes an orthogonal transition, low pass (harmonic) filter and isolator in WR42 with a WR42 to WR51 transition on the output port). This assembly was used on the output of a telemetry transponder.

<b>SINT part number</b>	220HDFW337
<b>SINT ICD</b>	C35/82416
<b>Application</b>	Space [LEO/GEO/MEO]
<b>Status</b>	Supplied
<b>Program</b>	Iridium Next

- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.



### Basic performance criteria

Parameter	Performance
Non-operating	-50 to +125C
Qualification	-20 to +125C
Acceptance	-40 to +80C
Operating Frequency	18.0 to 22.0GHz
Operating Power	4W CW [FWD & REV]
Insertion Loss	0.45 dB
Isolation	23dB min
Return Loss coaxial	19dB min
Return Loss waveguide	23dB min
Attenuation @ 26.5-33.5 GHz	50dB min
Radiated Emissions	65dBi min
Mass	90g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine		-	-	-
		-	-	-
		-	-	-
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100-1000	1.97g <sup>2</sup> /Hz	3.94g <sup>2</sup> /Hz
		600 to 2000	-3.0 dB/oct.	-3.0 dB/oct.
			60 secs/axis	240 secs/axis
Overall [rms]			56.6g	80g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	50
	4000	4200
	10000	4200
	Number of Events	3 per axis



## K-Band WR51 broadband medium-power isolator

Used in payload transmitter applications.

<b>SINT part number</b>	19HD358
<b>SINT ICD</b>	C35/83623
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified, supplied
<b>Program</b>	-



- Full height WR51 circulator with matching load
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Multipaction data available

### Basic performance criteria

Parameter	Performance
Non-operating	-54 to +100C
Acceptance	-30 to +85C
Operating Frequency	17.3-21.2 GHz
Insertion Loss	0.20dB max
Isolation	21 dB min
Return Loss	21 dB min
Power Handling (fault)	20 CW, load rated at 40W
Multipaction tested	80W pk
Radiated Emissions	70dBi min
Mass	166g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	10-28.7		12.7mm pk-pk
		28.7-36		21g
		36-100		28g
				2 oct/min
Random	All 3 axis	20-100	+6.0 dB/oct.	+6.0 dB/oct.
		100-1000	1.54g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		1000-2000	-3.0 dB/oct.	-3.0 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			50.0	50.0

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	40
	500	200
	1000	1000
	2000	2000
	10000	2000
	Number of Events	3 per axis

## K-Band WR51 broadband high-power circulator

Used in payload transmitter applications.

<b>SINT part number</b>	19CD359
<b>SINT ICD</b>	C83732
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified, supplied
<b>Program</b>	-

- Full height WR51 circulator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +135C
Acceptance	-25 to +120C
Operating Frequency	17.7-20.2 GHz
Insertion Loss	0.20dB max
Isolation	20 dB min
Return Loss	20 dB min
Power Handling (nominal)	145 CW [FM], 183W [PFM]
Multipaction tested	580W pk
Radiated Emissions	70dBi min
Mass	62g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM
Sine	All 3 axis	10-28.7		12.7mm pk-pk
		28.7-36		21g
		36-100		28g
				2 oct/min
Random	All 3 axis	20-100	+6.0 dB/oct.	+6.0 dB/oct.
		100-1000	1.54g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		1000-2000	-3.0 dB/oct.	-3.0 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			50.0	50.0

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	40
	500	200
	1000	1000
	2000	2000
	10000	2000
	Number of Events	3 per axis

## K-Band WR42 medium-power isolator

Used in payload transmitter applications.

<b>SINT part number</b>	20HD322
<b>SINT ICD</b>	B43269
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified, supplied, flown
<b>Program</b>	Various

- Full height WR42 isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
Qualification	-35 to +90C
Acceptance	-30 to +90C
Operating Frequency	18.1 to 21.2 GHz
Insertion Loss	0.20dB max
Isolation	21 dB min
Return Loss	21 dB min
Power Handling (fault)	5 CW
Radiated Emissions	70dBi min
Mass	25g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5-25	Test Fc of IEC 68-2-6 swept over 10-2000-10Hz over 10 mins	20mm pk-pk
		25-100		25g
Random	All 3 axis	20-100	-	+6.0 dB/oct.
		100-1000	-	3.94g <sup>2</sup> /Hz
		1000-2000	-	-3.0 dB/oct.
			60 secs/axis	240 secs/axis
Overall [rms]			-	80.0

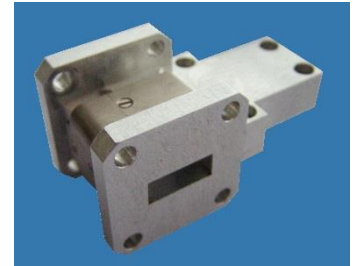
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	50
	4000	4200
	10000	4200
	Number of Events	3 per axis

## K-Band WR42 medium-power isolator

Used in payload transmitter applications.

<b>SINT part number</b>	20HD323
<b>SINT ICD</b>	B81298
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified, supplied, flown
<b>Program</b>	Various

- Full height WR42 isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
Qualification	-35 to +90C
Acceptance	-30 to +90C
Operating Frequency	20.1 to 21.3 GHz
Insertion Loss	0.10dB max
Isolation	25 dB min
Return Loss	25 dB min
Power Handling (fault)	5 CW
Radiated Emissions	70dBi min
Mass	22g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5-25	Test Fc of IEC 68-2-6 swept over 10-2000-10Hz over 10 mins	20mm pk-pk
		25-100		25g
Random	All 3 axis	20-100	-	+6.0 dB/oct.
		100-1000	-	3.94g <sup>2</sup> /Hz
		1000-2000	-	-3.0 dB/oct.
			60 secs/axis	240 secs/axis
Overall [rms]			-	80.0

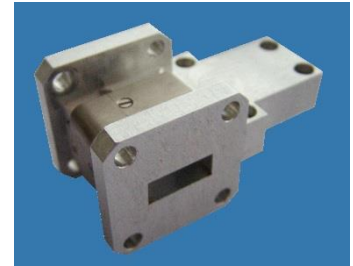
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	50
	4000	4200
	10000	4200
	Number of Events	3 per axis

## K-Band WR42 medium-power isolator

Used in payload transmitter applications.

<b>SINT part number</b>	20HD339
<b>SINT ICD</b>	B82497
<b>Application</b>	Space [GEO]
<b>Status</b>	<i>Qualified, supplied, flown</i>
<b>Program</b>	<i>Various</i>

- Full height WR42 isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
Qualification	-35 to +90C
Acceptance	-30 to +90C
Operating Frequency	19.0 to 22.0 GHz
Insertion Loss	0.20dB max
Isolation	23 dB min
Return Loss	23 dB min
Power Handling (fault)	4 CW
Radiated Emissions	70dBi min
Mass	22g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5-25	Test Fc of IEC 68-2-6 swept over 10-2000-10Hz over 10 mins	20mm pk-pk
		25-100		25g
Random	All 3 axis	20-100	-	+6.0 dB/oct.
		100-1000	-	3.94g <sup>2</sup> /Hz
		1000-2000	-	-3.0 dB/oct.
			60 secs/axis	240 secs/axis
Overall [rms]			-	80.0

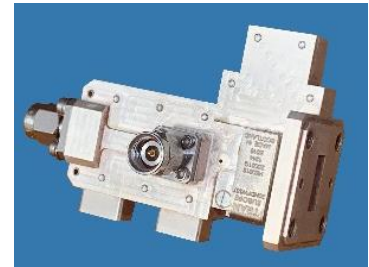
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	50
	4000	4200
	10000	4200
	<i>Number of Events</i>	<i>3 per axis</i>

## K-Band WR42 to 2.9mm low-power Iso-adapter with Power Sense

Used in payload transmitter applications.

<b>SINT part number</b>	20HD340
<b>SINT ICD</b>	D82978
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified, supplied, flown
<b>Program</b>	Various

- Full height WR42 isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-35 to +90C
Qualification	-30 to +80C
Acceptance	-30 to +80C
Operating Frequency	18.4 to 19.0 GHz
Insertion Loss	0.25dB max
Isolation	25 dB min
Return Loss (WR42)	25 dB min
Return Loss (2.9mm)	25 dB min
Coupler (19.5-20.50 GH)	25 dB
Power Handling (fault)	5 CW
Radiated Emissions	70dBi min
Mass	44g nom

### Environmental

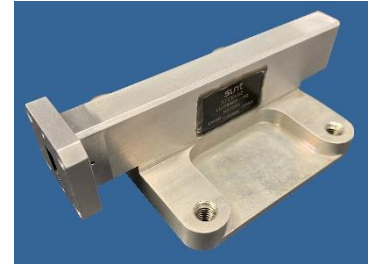
Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5-25	Test Fc of IEC 68-2-6 swept over 10-2000-10Hz over 10 mins	20mm pk-pk
		25-100		25g
Random	All 3 axis	20-100	+6.0 dB/oct.	+6.0 dB/oct.
		100-1000	4.00g <sup>2</sup> /Hz	4.00g <sup>2</sup> /Hz
		1000-2000	-6.0 dB/oct.	-6.0 dB/oct.
			60 secs/axis	240 secs/axis
Overall [rms]			44.2	44.2

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
		½ sine 2000g 0.3ms
	Number of Events	3 per axis

## K-Band WR34 medium-power broadband Termination

Used in a power combiner

<b>SINT part number</b>	21TE102
<b>SINT ICD</b>	B35/83686
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	<i>Deep space missions</i>



- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on filter & switch assemblies
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +155C
PFM & Qualification	-30 to +135C
Acceptance	-25 to +130C
Operating Frequency	18.0 to 27.2GHz
Return Loss	26.0 dB min
Power Handling	70W CW [PFM] 54W CW [FM]
Radiated Emissions	80dBi min
Mass	96g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

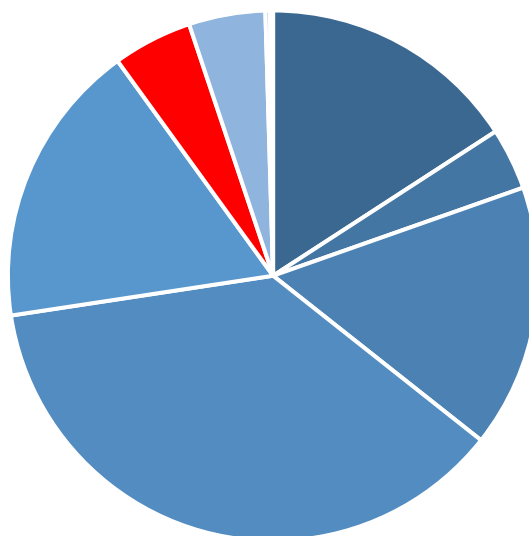
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band Overview

SINT has developed, supplied, and has heritage with many passive devices operating in the 27-37GHz band designed to operate at either low or high-power. The Ka-Band range is considered comprehensive with over with over ~157 distinct designs supplied to date. Heritage is dominated by the supplied of the supply of low loss isolators for LNA and Receiver applications where the focus has been to offer exceptional electrical performance over a broad operating band and in this respect <0.12dB is a routine performance without resort to precious metal plating. Most of the parts supplied are classed as components however an increasing number are supplied classed as equipment. This distinction is largely a matter of how the parts are specified and procured. The following is an extract from the heritage database which records sales of flight model hardware from 1994 to December 2020. Heritage in terms of the numbers and types of products supplied changes daily. Please contact the factory to obtain the most up to date information.

FMs supplied	MICROSTRIP	WAVEGUIDE	Grand Total
<b>Ka</b>	<b>135</b>		<b>135</b>
ISOLATOR	135		135
<b>Ka [WR28]</b>		<b>6932</b>	<b>6931</b>
ISOLATOR		5146	5146
TRANSITION		1037	1037
SPLITTER		495	495
CIRCULATOR		187	187
LOAD/TERMINATION		59	59
COUPLER		5	5
ISO-ADAPTER		2	2
<b>Ka [WR34]</b>		<b>2411</b>	<b>2411</b>
ISOLATOR		2178	2178
TRANSITION		171	171
SPLITTER		51	51
COUPLER		4	4
LOAD/TERMINATION		4	4
TEST COUPLER		3	3
<b>Grand Total</b>	<b>135</b>	<b>9342</b>	<b>9477</b>

Ka-Band products account for ~5% of total FM heritage



In development/qualification

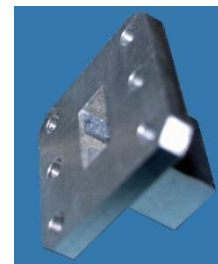
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## Ka-Band WR28 low-power termination

Generic application

<b>SINT part number</b>	22TE116
<b>SINT ICD</b>	B82799
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	<i>Various</i>



- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on filter & switch assemblies
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +120C
PFM & Qualification	-35 to +125C
Acceptance	-35 to +120C
Operating Frequency	26.5 to 31.0GHz
	<i>blank</i>
Return Loss	23dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Multipaction	2W pk by test 4W pk by analysis
Corona (critical pressure)	N/A N/A
Radiated Emissions	80dBi min
Mass	6g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			<i>2 octaves/min</i>	<i>2 octaves/min</i>	<i>4 octaves/min</i>
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			<i>60 secs/axis</i>	<i>60 secs/axis</i>	<i>180 secs/axis</i>
<b>Overall [rms]</b>			<b>16.7g</b>	<b>23.6g</b>	<b>23.6g</b>

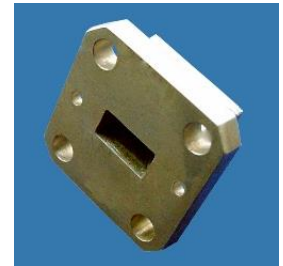
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	<i>Number of Events</i>	<i>3 per axis</i>

## Ka-Band WR34 low-power Termination

Generic applications

<b>SINT part number</b>	21TE101
<b>SINT ICD</b>	B35/82798
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	<i>Various</i>

- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on filter & switch assemblies
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +120C
PFM & Qualification	-35 to +125C
Acceptance	-25 to +120C
Operating Frequency	26.5 to 31.0GHz
Return Loss	26dB min
Power Handling	1W CW [PFM]
	1W CW [FM]
Radiated Emissions	80dBi min
Mass	5g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	<i>Number of Events</i>	<i>3 per axis</i>

## Ka-Band WR34 to 2.9mm orthogonal Transition

Generic application

<b>SINT part number</b>	21TM108
<b>SINT ICD</b>	C107993
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various

- Full height, orthogonal dc open (>1M Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-45 to +125C
Acceptance	-40 to +120C
Operating Frequency	25.5 to 31.00GHz
Insertion Loss	0.15dB max
Return Loss	20dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Multipaction	N/A N/A
Corona (critical pressure)	N/A N/A
Radiated Emissions	80dBi min
Mass	13g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR28 to 2.9mm orthogonal Transition

Generic application

<b>SINT part number</b>	22TM107
<b>SINT ICD</b>	C107989
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied [PFM & FM], launched
<b>Program</b>	<i>Various</i>

- Full height, orthogonal dc open (>1M Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-45 to +125C
Acceptance	-40 to +120C
Operating Frequency	26.5 to 31.00GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Multipaction	N/A N/A
Corona (critical pressure)	N/A N/A
Radiated Emissions	80dBi min
Mass	11g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g²/Hz	0.50g²/Hz	0.50g²/Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
<i>Number of Events</i>		<i>3 per axis</i>

## Ka-Band WR28 to 2.9mm in-line Transition

Used in a DMUX and generic applications

<b>SINT part number</b>	22TM109
<b>SINT ICD</b>	C35/83205
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [FM & LAT]
<b>Program</b>	Various



- Full height, orthogonal dc shorted, (0.5M Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
LAT	-25 to +85C
Acceptance	-20 to +80C
Operating Frequency	27.0 to 31.0GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Multipaction	N/A N/A
Corona (critical pressure)	N/A N/A
Radiated Emissions	75dBi min
Mass	9g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100 to 324	-	0.01g <sup>2</sup> /Hz
		100 to 1000	1.54g <sup>2</sup> /Hz	-
		324 to 524	-	1.0g <sup>2</sup> /Hz
		524 to 2000	-	0.01g <sup>2</sup> /Hz
		1000 to 2000	-3 dB/oct.	-
			60 secs/axis	180 secs/axis
Overall [rms]			50g	170g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	50
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR34 2x2 Hybrid coupler (3.0dB)

Used on a redundancy network

<b>SINT part number</b>	21WC405
<b>SINT ICD</b>	B35/83636
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied [PFM & FM]
<b>Program</b>	-



- Full height WR34 2 x 2 hybrid
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-40 to +125C
Acceptance	-30 to +120C
Operating Frequency	22.0 to 25.0GHz
Insertion Loss	0.25dB max
Return Loss	23dB min
Isolation	23dB min
Coupling	-3.00dB+/-0.3dB max
Group delay variation	0.15ns max
Amplitude balance	0.2dBp-p max
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	57g nom

### Environmental

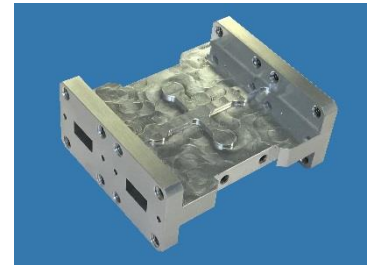
Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>16.7g</b>	<b>23.6g</b>	<b>23.6g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR34 2x2 Hybrid coupler (3dB)

Used on a redundancy network

<b>SINT part number</b>	21WC402
<b>SINT ICD</b>	D83230
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various



- Full height WR34 2 x 2 hybrid (all ports open)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-40 to +125C
Acceptance	-30 to +120C
Operating Frequency	25.0 to 30.0GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Isolation	23dB min
Coupling	-3.0 +/-0.2 dB
Group delay variation	0.15ns max
Amplitude balance	0.2dBp-p max
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	58g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR34 to SMP (male) Iso-adapter

Used on a command receiver

<b>SINT part number</b>	21HD312
<b>SINT ICD</b>	C81815
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied
<b>Program</b>	Various

- Full height WR34 iso-adapter with half détente SMP male connector
- Variations exist with the SMP flange at 90 degree with respect to the unit illustrated
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +125C
Qualification	-20 to +125C
Acceptance	-40 to +85C
Operating Frequency	24.0 to 26.0GHz
Insertion Loss	0.35 dB
Isolation	23dB min
Return Loss coaxial	21dB min
Return Loss waveguide	23dB min
Radiated Emissions	75dBi min
Mass	29g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100-1000	0.67g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		600 to 2000	-3.0 dB/oct.	-3.0 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			33.0g	50g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	50
	200-400	300
	1000	900
	4000	4200
	10000	2000
	Number of Events	3 per axis



## Ka-Band WR34 to 2.92mm low-power Iso-adapter 2.92mm with Power Sense

Used in a GEO meteorological radiometer

<b>SINT part number</b>	22HD3114
<b>SINT ICD</b>	D35/82796
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied
<b>Program</b>	METOP



- Full height WR28 low-power iso-adapter with non-directional power sense
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Silver plated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +85C
Qualification	-35 to +85C
Acceptance	-30 to +80C
Operating Frequency	31.15 to 31.65 GHz
Insertion Loss	0.15dB max
Return Loss (2.9mm coupled port)	~0dB min
Return Loss (2.9mm input port)	21dB min
Return Loss (WG port)	25dB min
Coupling	-20dB +/-0.2dB
Power Handling	1W CW
Radiated Emissions	80dBi min
Mass	56g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	3dB/oct.	6dB/oct.
		100 to 300	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		300 to 2000	-5.0 dB/oct.	-5.0 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			12.0g	16.8g

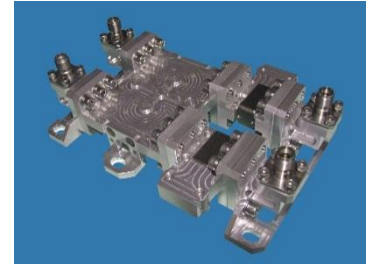
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	20
	2,000 to 10,000	1000
	Number of Events	3 per axis

## Ka-Band WR28 to 2.9mm 2 x 2 isolated Hybrid

Used on a redundancy network as part of the transmit combiner

<b>SINT part number</b>	22WC405
<b>SINT ICD</b>	D82569
<b>Application</b>	Deep Space Probe
<b>Status</b>	Qualified & supplied [FM]
<b>Program</b>	EXOMARS

- Full height isolated 2.9mm INET
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +100C
PFM & Qualification	-35 to +90C
Acceptance	-30 to +75C
Operating Frequency	26.2 to 27.0GHz
Insertion Loss	0.45dB
Return Loss	25dB min
Isolation	25dB min
Coupling	-3.0dB+/-0.15dB max
Group delay variation	0.15ns max
Amplitude balance	0.2dBp-p max
Input power	10W CW
Radiated Emissions	-100dBi min
Mass	176g nom

### Environmental

Test	Axis	Frequency (Hz)	Qualification Z	Qualification XY	Acceptance XYZ
Sine	All 3 axis	5 to 25.0	-	10.0 mm	
		5 to 28.2	12.5 mm	-	
		22.6 to 100	40g	25g	
			4 octaves/min	4 octaves/min	
Random	All 3 axis	20 to 100	+3dB/oct.	+3dB/oct.	+3dB/oct.
		100 to 300	0.69g <sup>2</sup> /Hz	0.284g <sup>2</sup> /Hz	2.0g <sup>2</sup> /Hz
		300 to 2000	-6 dB/oct.	-5.83 dB/oct.	-6 dB/oct.
			180 secs/axis	180 secs/axis	180 secs/axis
Overall [rms]			18.65g	12.07g	33.76g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	50
	400	600
	1500	2000
	10000	2500
	Number of Events	3 per axis

## Ka-Band WR34 15dB Test Coupler

Part of the antenna test network

<b>SINT part number</b>	21WC404
<b>SINT ICD</b>	C83314
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified
<b>Program</b>	STAR One D2



- Full height WR34 Circu15dB test coupler with dismountable terminations
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-40 to +125C
Acceptance	-35 to +120C
Operating Frequency	24.5 to 31.0 GHz
Insertion Loss	0.22dB max
Return Loss	21dB min
Isolation	21dB min
Coupling	15.0+/-0.5dB max
Directivity	20dB min
Power Handling	2W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	75g nom

### Environmental

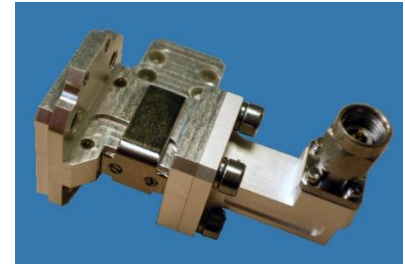
Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
Number of Events		3 per axis

## K-Band WR34 to 2.92mm low-power Iso-adapter

Used in a GEO meteorological radiometer this device features a customized flange

<b>SINT part number</b>	22HD3111
<b>SINT ICD</b>	D35/82794
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied
<b>Program</b>	METOP



- Full height WR34 low-power isolator with matched, non-detachable transition
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Silver plated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +85C
Qualification	-35 to +85C
Acceptance	-30 to +80C
Operating Frequency	23.55 to 24.05GHz
Insertion Loss	0.25dB max
Return Loss	25dB min
Isolation	25dB min
Power Handling	1W CW
Radiated Emissions	80dBi min
Mass	34g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	3dB/oct.	6dB/oct.
		100 to 300	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		300 to 2000	-5.0 dB/oct.	-5.0 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			12.0g	16.8g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	20
	2,000 to 10,000	1000
	Number of Events	3 per axis

## K-Band WR34 low-power Isolator

Used on the input to an LNA

<b>SINT part number</b>	22HD338 [CCW] & 21HD339 [CW]
<b>SINT ICD</b>	B35/83676 [CCW] & B35/83681 [CW]
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied (PFM & FM)
<b>Program</b>	-

- Full height WR34 isolator with integral termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
PFM & Qualification	-30 to +80C
Acceptance	-25 to +75C
Operating Frequency	22.0 to 25.0
Insertion Loss	0.12dB max
Return Loss	24dB min
Isolation	23dB min
Power	1W CW [FM]
Radiated Emissions	80dBi min
Mass	31g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	2 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis
Overall [rms]			16.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	280
	500	1260
	2000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR34 low-power Isolator

Used on the input to an LNA

<b>SINT part number</b>	21HD336[CW] & 21HD337[CCW]
<b>SINT ICD</b>	83640[CW] & 83650 [CCW]
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [FM]
<b>Program</b>	-

- Full height WR34 isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
PFM & Qualification	-30 to +80C
Acceptance	-25 to +75C
Operating Frequency	24.0 to 27.5
Insertion Loss	0.12dB max
Return Loss	23dB min
Isolation	23dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	22g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	2 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis
Overall [rms]			16.6g	23.6g

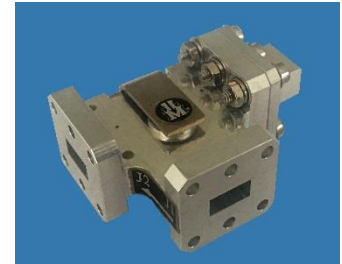
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	280
	500	1260
	2000	4200
	10000	4200
Number of Events		3 per axis

## K-Band WR28 low-power Isolator

Used in a switching matrix

<b>SINT part number</b>	20HD333
<b>SINT ICD</b>	C35/81880
<b>Application</b>	Space [LEO]
<b>Status</b>	Flown
<b>Program</b>	VARIOUS (multiple programs)

- Full height WR28 low-power isolator with matched, non-detachable load
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +85C
Qualification	-30 to +65C
Acceptance	-5 to +60C
Operating Frequency	23.55 to 24.05GHz
Insertion Loss	0.10dB max
Return Loss	25dB min
Isolation	25dB min
Power Handling	1W CW
Radiated Emissions	80dBi min
Mass	30g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	3dB/oct.	6dB/oct.
		100 to 300	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		300 to 2000	-5.0 dB/oct.	-5.0 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			12.0g	16.8g

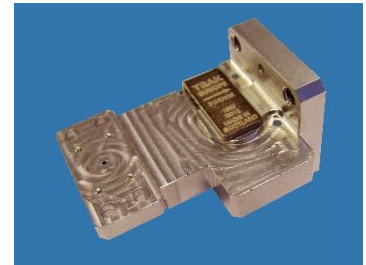
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	20
	2,000 to 10,000	1000
	Number of Events	3 per axis

## Ka-Band WR34 to orthogonal socket Iso-adapter

Used on the input to a command receiver

<b>SINT part number</b>	21HD329
<b>SINT ICD</b>	C82741
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied
<b>Program</b>	Various

- Full height WR34 iso-adapter with socket output port
- The device is used in a command receiver
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +100C
Qualification	-35 to +75C
Acceptance	-25 to +70C
Operating Frequency	27.0 to 31.0 GHz
Insertion Loss	0.55 dB
Isolation	22dB min
Return Loss socket tested using adapter	15dB min
Return Loss waveguide	22dB min
Radiated Emissions	75dBi min
Mass	21g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5-25	Test Fc of IEC 68-2-6 swept over 10-2000-10Hz over 10 mins	20mm pk-pk
		25-100		25g
Random	All 3 axis	20-100	-	+6.0 dB/oct.
		100-1000	-	3.94g <sup>2</sup> /Hz
		1000-2000	-	-3.0 dB/oct.
			60 secs/axis	240 secs/axis
Overall [rms]			-	80.0

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	50
	4000	4200
	10000	4200
	Number of Events	4 per axis

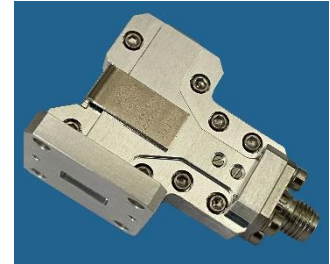


## Ka-Band WR34 to 2.9mm low-power Iso-adapter

Used on the input to an LNA

<b>SINT part number</b>	21HD341 (CW) & 21HD340 (CCW)
<b>SINT ICD</b>	C35/83662 (CW) & C35/83653 (CCW)
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	-

- Full height WR34 isolator with integrated transition to 2.9mm (F)
- Product image not available. Image opposite included to indicate form and function.
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
PFM & Qualification	-30 to +80C
Acceptance	-25 to +75C
Operating Frequency	22.7 to 23.1
Insertion Loss	0.30dB max
Return Loss	21dB min
Isolation	21dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	32g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.6g	23.6g	23.6g

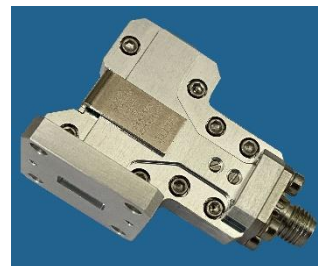
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	280
	500	1260
	2000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR34 to 2.9mm low-power Iso-adapter

Used on the input to an LNA

<b>SINT part number</b>	21HD342 (CW) & 21HD343 (CCW)
<b>SINT ICD</b>	C35/83665(CW) & C35/83671 (CCW)
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	-

- Full height WR34 isolator with integrated transition to 2.9mm (F)
- The device is used following payload pump down.
- Product image not available. Image opposite included to indicate form and function.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
PFM & Qualification	-30 to +80C
Acceptance	-25 to +75C
Operating Frequency	26.5 to 27.7
Insertion Loss	0.30dB max
Return Loss	23dB min
Isolation	23dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	24g nom

### Environmental

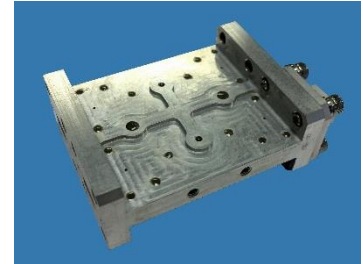
Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.6g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	280
	500	1260
	2000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR34 1x2 Hybrid coupler (3dB)

Used on a redundancy network

<b>SINT part number</b>	21WC403
<b>SINT ICD</b>	D83279
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various



- Full height WR34 1 x 2 hybrid (one port terminated)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-40 to +125C
Acceptance	-30 to +120C
Operating Frequency	25.0 to 30.0GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Isolation	23dB min
Coupling	-3.0 +/-0.2 dB
Group delay variation	0.15ns max
Amplitude balance	0.2dBp-p max
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	58g nom

### Environmental

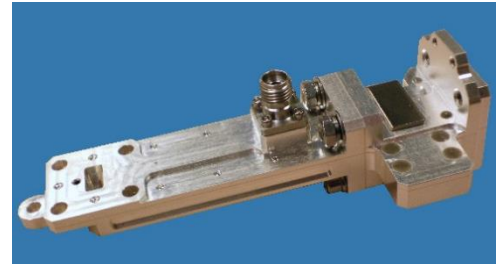
Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR34 low-power Iso-adapter with 2.92mm Power Sense

Used in a GEO meteorological radiometer

<b>SINT part number</b>	22HD3116
<b>SINT ICD</b>	D35/82977
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied
<b>Program</b>	METOP



- Full height WR28 isolator with non-directional power sense & 90-degree bend
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Silver plated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +85C
Qualification	-35 to +85C
Acceptance	-30 to +80C
Operating Frequency	31.15 to 31.65 GHz
Insertion Loss	0.17dB max
Return Loss (2.9mm coupled port)	~0dB min
Return Loss (WG ports)	25dB min
Coupling	-20dB +/-0.2dB
Power Handling	1W CW
Radiated Emissions	80dBi min
Mass	47g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	3dB/oct.	6dB/oct.
		100 to 300	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		300 to 2000	-5.0 dB/oct.	-5.0 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			12.0g	16.8g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	20
	2,000 to 10,000	1000
	<i>Number of Events</i>	<i>3 per axis</i>

## Ka-Band WR34 low-power Isolator

Used on the input to an LNA

<b>SINT part number</b>	21HD333 [CW] & 21HD334 [CCW]
<b>SINT ICD</b>	83270 [CW] & 83271 [CCW]
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	-

- Full height WR34 isolator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
PFM & Qualification	-30 to +80C
Acceptance	-25 to +75C
Operating Frequency	27.0 to 31.0
Insertion Loss	0.12dB max
Return Loss	23dB min
Isolation	23dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	22g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.6g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	280
	500	1260
	2000	4200
	10000	4200
Number of Events		3 per axis

## Ka-Band WR34 33dB Test coupler

On board antenna test

<b>SINT part number</b>	21TC401
<b>SINT ICD</b>	C83047
<b>Application</b>	Space [LEO, GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	-



- Full height WR34 test coupler with 2.9mm forward/reverse coupled ports
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-40 to +125C
Acceptance	-35 to +120C
Operating Frequency	24.5 to 31.00GHz
Insertion Loss	0.10dB max
Return Loss WG, [2.9mm]	23dB [21dB] min
Directivity	20dB min
Coupling	-33 +/-1 dB
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	11g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

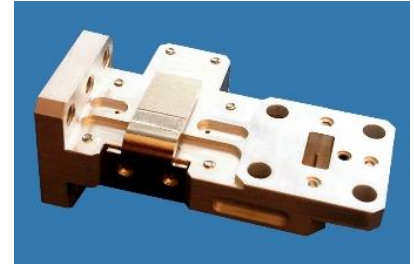
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR34 low-power Isolator with 90-degree bend

Used on the input to an LNA

<b>SINT part number</b>	22HD382
<b>SINT ICD</b>	C35/82338
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied (FM)
<b>Program</b>	Various

- Full height WR28 isolator with integral termination and 90-degree bend
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-50 to +100C
Qualification	-40 to +80C
Acceptance	-20 to +70C
Operating Frequency	28.0 to 30.0
Insertion Loss	0.15dB max
Return Loss	21dB min
Isolation	21dB min
Power Handling	1W CW [PFM]
	1W CW [FM]
Radiated Emissions	70dBi min
Mass	19g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5-25	Test Fc of IEC 68-2-6 swept over 10-2000-10Hz over 10 mins	20mm pk-pk
		25-100		25g
Random	All 3 axis	20-100	-	+6.0 dB/oct.
		100-1000	-	3.94g <sup>2</sup> /Hz
		1000-2000	-	-3.0 dB/oct.
			60 secs/axis	240 secs/axis
Overall [rms]			-	80.0

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	50
	4000	4200
	10000	4200
Number of Events		4 per axis

## Ka-Band WR34 high-power Isolator

Used on the output of the TWTA in conjunction with a remote load

<b>SINT part number</b>	21HD328
<b>SINT ICD</b>	B35/82687
<b>Application</b>	Space [Probe]
<b>Status</b>	Supplied [PFM & FM], launched
<b>Program</b>	<i>Parker Solar Probe</i>

- Full height WR34 circulator supplied with matching dismounted termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Black paint over Chromate conversion coated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting, MP, Corona, Thermal.



### Basic performance criteria

Parameter	Performance
Non-operating	-30 to +70C
LAT	-25 to +65C
Acceptance	-25 to +65C
Operating Frequency	31.8 to 32.3GHz
Return Loss	23dB min
Insertion Loss	0.20dB max
Isolation (measured with matched load)	23dB min
Power Handling [FM & LAT]	40W CW forward
	10W CW reverse
Radiated Emissions	75dBi min
Mass	51g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance Z	Acceptance XY	PFM/Qualification
Sine	All 3 axis	5 to 28	9.65mm DA	12.7mm DA	12.7mm DA
		28 to 60	12g	20g	20g
		65 to 100	1g	1.25g	1.25g
			4 octaves/min	4 octaves/min	2 octaves/min
Random	All 3 axis	20 to 50	0.008g <sup>2</sup> /Hz	0.008g <sup>2</sup> /Hz	0.016g <sup>2</sup> /Hz
		50 to 600	0.05g <sup>2</sup> /Hz	0.05g <sup>2</sup> /Hz	0.1g <sup>2</sup> /Hz
		600 to 2000	0.0045g <sup>2</sup> /Hz	0.0045g <sup>2</sup> /Hz	0.009g <sup>2</sup> /Hz
			120 secs/axis	120 secs/axis	180 secs/axis
Overall [rms]			7g	7g	9.93g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	-
	4000	-
	10000	-
<i>Number of Events</i>		<i>3 per axis</i>



## Ka-Band WR34 high-power load

Used to load the isolated port of an isolator on the output of a TWTA

<b>SINT part number</b>	See 21HD321
<b>SINT ICD</b>	D82606
<b>Application</b>	Space [Probe]
<b>Status</b>	Supplied [FM & LAT], launched
<b>Program</b>	<i>Various</i>

- Full height WR34 isolator with thin film load
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Black paint over Silver plated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
LAT	-40 to +85C
Acceptance	-35 to +85C
—Operating Frequency	20.0 to 30.0GHz
Return Loss	25dB min
Power Handling [FM & LAT],	70W CW
Radiated Emissions	75dBi min
Mass	75g nom

### Environmental

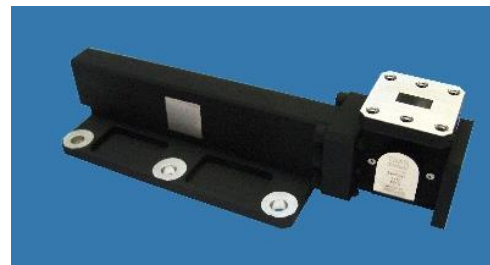
Test	Axis	Frequency (Hz)	Acceptance Z	Acceptance XY	Qualification
Sine	All 3 axis	5 to 22.6	-	-	6.4 mm
		22.6 to 50	-	-	13.0g
		50 to 100	-	-	10.0g
					4 octaves/min
Random	All 3 axis	20 to 100	+3dB/oct.	+3dB/oct.	6dB/oct.
		100 to 324	-	-	0.01g <sup>2</sup> /Hz
		100 to 300	0.69g <sup>2</sup> /Hz	0.284g <sup>2</sup> /Hz	-
		300 to 650	-	-5.83dB/oct.	1.0g <sup>2</sup> /Hz
		524 to 2000	-	-	0.01g <sup>2</sup> /Hz
		300 to 2000	-6 dB/oct.	-	-
			60 secs/axis		180 secs/axis
Overall [rms]			18.65g	12.07g	170g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	50
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR34 high-power Isolator

Used on the output of the TWTA

<b>SINT part number</b>	21HD321
<b>SINT ICD</b>	C35/82594
<b>Application</b>	Space [Probe]
<b>Status</b>	Supplied [FM & LAT], launched
<b>Program</b>	ExoMars



- Full height WR34 isolator with thin film load
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Black paint over Silver plated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting, MP, Corona, Thermal.

### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
LAT	-40 to +85C
Acceptance	-35 to +85C
Operating Frequency	25.5 to 27.0GHz
Return Loss	25dB min
Insertion Loss	0.15dB max
Isolation	25dB min
Power Handling [FM & LAT],	70W CW forward 70W CW reverse
Radiated Emissions	75dBi min
Mass	108g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance Z	Acceptance XY	Qualification
Sine	All 3 axis	5 to 22.6	-	-	6.4 mm
		22.6 to 50	-	-	13.0g
		50 to 100	-	-	10.0g
					4 octaves/min
Random	All 3 axis	20 to 100	+3dB/oct.	+3dB/oct.	6dB/oct.
		100 to 324	-	-	0.01g <sup>2</sup> /Hz
		100 to 300	0.69g <sup>2</sup> /Hz	0.284g <sup>2</sup> /Hz	-
		300 to 650	-	-5.83dB/oct.	1.0g <sup>2</sup> /Hz
		524 to 2000	-	-	0.01g <sup>2</sup> /Hz
		300 to 2000	-6 dB/oct.	-	-
			60 secs/axis		180 secs/axis
<b>Overall [rms]</b>			<b>18.65g</b>	<b>12.07g</b>	<b>170g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	50
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR28 to SMP Iso-adapter

Used on the input to a command receiver

<b>SINT part number</b>	22HD3110
<b>SINT ICD</b>	C82999
<b>Application</b>	Space [GEO], Command Rx
<b>Status</b>	Supplied and In Orbit
<b>Program</b>	<i>Various</i>

- Full height WR34 iso-adapter with limited détente SMP male connector
- The device is used in a command receiver
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +125C
Qualification	-55 to +125C
Acceptance	-30 to +90C
Operating Frequency	27.0 to 31.0 GHz
Insertion Loss	0.55 dB
Isolation	25dB min
Return Loss coaxial	21dB min
Return Loss coaxial	2dB min
Radiated Emissions	75dBi min
Mass	44g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100-1000	0.67g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		600 to 2000	-3.0 dB/oct.	-3.0 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			33.0g	50g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	50
	200-400	300
	1000	900
	4000	4200
	10000	2000
	<i>Number of Events</i>	<i>3 per axis</i>

## Ka-Band WR28 low-power Isolator

Used on the input to an LNA

<b>SINT part number</b>	22HD370
<b>SINT ICD</b>	C35/82406
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied
<b>Program</b>	NBN



- Full height WR22 isolator with integral termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Gold plated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +125C
Qualification	-20 to +125C
Acceptance	-40 to +85C
Operating Frequency	27.0 to 31.0GHz
Insertion Loss	0.60 dB
Isolation	23dB min
Return Loss SMP	21dB min
Return Loss WG	23dB min
Radiated Emissions	75dBi min
Mass	29g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.	6dB/oct.
		100 to 1000	1.54g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		1000 to 2000	-3 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			180 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			50g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	40
	500	200
	2000	2000
	10000	2000
	Number of Events	3 per axis

## Ka-Band WR28 low-power Isolator

Used on the input to an LNA

<b>SINT part number</b>	22HD3117
<b>SINT ICD</b>	C35/82922
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied (PFM & FM)
<b>Program</b>	Various

- Full height WR22 isolator with integral termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
PFM & Qualification	-30 to +80C
Acceptance	-25 to +75C
Operating Frequency	27.0 to 31.0
Insertion Loss	0.120dB max
Return Loss	23dB min
Isolation	23dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	17g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.6g	23.6g	23.6g

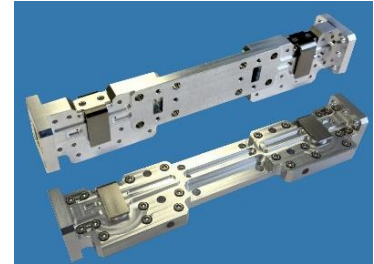
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	280
	500	1260
	2000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR28 dual low-power Isolator assembly

Used on the input and output of an LNA

<b>SINT part number</b>	22HD406
<b>SINT ICD</b>	C82934
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied (FM)
<b>Program</b>	Various

- Full height dual WR28 isolator with integral terminations and WR34 apertures
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-50 to +100C
Qualification	-40 to +80C
Acceptance	-20 to +70C
Operating Frequency	27.0 to 31.0
Insertion Loss	0.15dB max
Return Loss	21dB min
Isolation	21dB min
Power Handling	1W CW [PFM]
Radiated Emissions	75dBi min
Mass	46g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5-25	Test Fc of IEC 68-2-6 swept over 10-2000-10Hz over 10 mins	20mm pk-pk
		25-100		25g
Random	All 3 axis	20-100	-	+6.0 dB/oct.
		100-1000	-	3.94g <sup>2</sup> /Hz
		1000-2000	-	-3.0 dB/oct.
			60 secs/axis	240 secs/axis
Overall [rms]			-	80.0

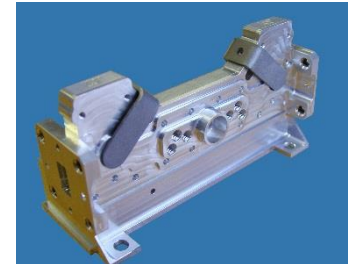
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	50
	4000	4200
	10000	4200
Number of Events		4 per axis

## Ka-Band WR28 dual isolated assembly

Customer introduces their electronics into a SINT passive microwave assembly (in this case an LNA)

<b>SINT part number</b>	-
<b>SINT ICD</b>	-
<b>Application</b>	GEO
<b>Status</b>	Qualified
<b>Program</b>	-

- Full height dual WR28 isolator with integral terminations
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum
- This is a passive assembly into which RF and control circuitry is incorporated.



### Basic performance criteria

Parameter	Performance
Non-operating	-50 to +100C
Qualification	-40 to +80C
Acceptance	-20 to +70C
Operating Frequency	27.0 to 31.0
Insertion Loss	0.15dB max
Return Loss	21dB min
Isolation	21dB min
Power Handling	1W CW [PFM]
Radiated Emissions	75dBi min
Mass	60g nom

### Environmental

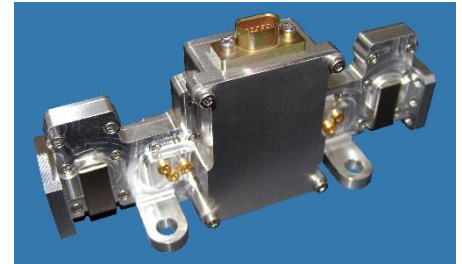
Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	-	-	-
		-	-	-
		-	-	-
Random	All 3 axis	-	-	-
		-	-	-
		-	-	-
			-	-
Overall [rms]			-	-

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	-
	4000	-
	10000	-
	Number of Events	-

## Ka-Band WR28 dual isolated assembly

Customer introduces their electronics into a SINT passive microwave assembly (in this case an LNA)

<b>SINT part number</b>	22HD403
<b>SINT ICD</b>	C82697
<b>Application</b>	GEO
<b>Status</b>	FMs delivered
<b>Program</b>	-



- Full height dual WR28 isolator with integral terminations and WR34 apertures
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum
- No anomalies, deviations, waivers nor test or issues affecting any models supplied
- Image shown with D-connector (not supplied). This is a passive assembly into which RF and control circuitry is incorporated.

### Basic performance criteria

Parameter	Performance
Non-operating	-50 to +100C
Qualification	-40 to +90C
Acceptance	-30 to +80C
Operating Frequency	27.0 to 31.0
Insertion Loss	0.15dB max
Return Loss	21dB min
Isolation	21dB min
Power Handling	1W CW [PFM]
Radiated Emissions	75dBi min
Mass	46g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5-25	Test Fc of IEC 68-2-6 swept over 10-2000-10Hz over 10 mins	20mm pk-pk
		25-100		25g
Random	All 3 axis	20-100	-	+6.0 dB/oct.
		100-1000	-	3.94g <sup>2</sup> /Hz
		1000-2000	-	-3.0 dB/oct.
			60 secs/axis	240 secs/axis
Overall [rms]			-	80.0

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	50
	4000	4200
	10000	4200
	Number of Events	4 per axis

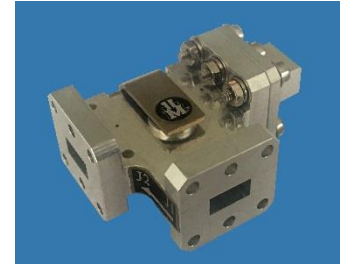


## Ka-Band WR28 low-power isolator

Used on the input to a receiver

<b>SINT part number</b>	22HD357
<b>SINT ICD</b>	C35/81871
<b>Application</b>	Space [GEO]
<b>Status</b>	Flown
<b>Program</b>	Various

- Full height WR28 low-power isolator with matched, non-detachable load
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Image is of a the prototype- FM image not available



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +85C
Qualification	-30 to +65C
Acceptance	-5 to +60C
Operating Frequency	36.25 to 36.75GHz
Insertion Loss	0.10dB max
Return Loss	25dB min
Isolation	25dB min
Power Handling	1W CW
Radiated Emissions	80dBi min
Mass	18g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
Random	All 3 axis		2 octaves/min	4 octaves/min
		20 to 100	3dB/oct.	6dB/oct.
		100 to 300	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		300 to 2000	-5.0 dB/oct.	-5.0 dB/oct.
			60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>12.0g</b>	<b>16.8g</b>

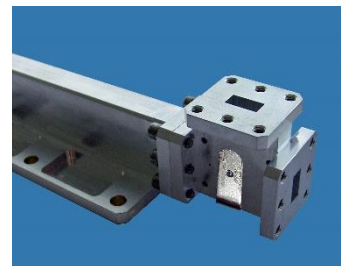
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	280
	500	1260
	2000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR28 high-power isolator

Used on the output of a TWTA

<b>SINT part number</b>	22HD363
<b>SINT ICD</b>	B35/81968
<b>Application</b>	Space [Probe]
<b>Status</b>	In Orbit [FM & LAT]
<b>Program / Program</b>	<i>Bepi Colombo</i>

- Full height WR28 isolator
- The device is used following payload pump down.
- Used on the output of a TWTA
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting, MP, Corona, Thermal.



### Basic performance criteria

Parameter	Performance
Non-operating	-55 to +100C
Qualification	-35 to +70C
Acceptance	-35 to +70C
Operating Frequency	31.8 to 32.3GHz
Return Loss	23dB min
Insertion Loss	0.17dB max
Isolation – with matched load	23dB min
Power Handling [FM & LAT]	50W CW forward 50W CW reverse
Radiated Emissions	75dBi min
Mass	81g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance Z	Acceptance XY	Qualification Z	Qualification XY
Sine	All 3 axis	5 to 19	-	-	-	11.0mm
		5 to 28.2	-	-	12.5mm	-
		19 to 100	-	-	-	166
		28.2 to 100	-	-	40g	-
					4 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	+3dB/oct.	+3dB/oct.	+3dB/oct.	+3dB/oct.
		100 to 300	1.25g <sup>2</sup> /Hz	0.563g <sup>2</sup> /Hz	2.0g <sup>2</sup> /Hz	0.9g <sup>2</sup> /Hz
		300 to 650	-	-5.83dB/oct.	-	-5.83dB/oct.
		650 to 2000	-	-6 dB/oct.	-	0.01g <sup>2</sup> /Hz
		650 to 950	-	-	-	0.2g <sup>2</sup> /Hz
		300 to 2000	-6 dB/oct.	-	-6 dB/oct.	-
		950 to 2000	-	-	-	-6 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis	180 secs/axis
Overall [rms]			25.07g	18.23g	31.72g	23.05g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	300
	1000	1500
	2000	2000
	10000	3000
Number of Events		3 per axis

Note: This image is an image of the unpainted FM parts

## Ka-Band WR28 low-power Circulator

Used on the input to a receiver

<b>SINT part number</b>	22CD3131
<b>SINT ICD</b>	C35/82863
<b>Application</b>	Space [GEO]
<b>Status</b>	Flown
<b>Program</b>	Various

- Full height WR28 low-power circulator
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +100C
Qualification	-30 to +855C
Acceptance	-20 to +80C
Operating Frequency	27.5 to 31.0GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Power Handling	1W CW
Radiated Emissions	75dBi min
Mass	20g nom

### Environmental

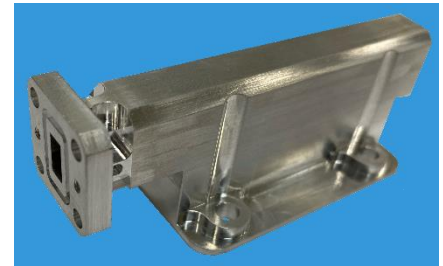
Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	3dB/oct.	6dB/oct.
		100 to 300	0.67g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		300 to 2000	-3.0 dB/oct.	-3.0 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			33.0g	50.0

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	20
	2,000 to 10,000	1000
	Number of Events	3 per axis

## Ka-Band WR28 high-power Termination with 2.9mm Power Sense port

Used on the output of a TWTA

<b>SINT part number</b>	22HD3138
<b>SINT ICD</b>	D35/83389
<b>Application</b>	Space [Probe]
<b>Status</b>	Supplied [FM & LAT], launched
<b>Program</b>	Europa Clipper



- Full height WR28 thin film load
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Black paint over passivated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: Venting, Thermal.

### Basic performance criteria

Parameter	Performance
Non-operating	-35 to +120C
Acceptance	-35 to +90C
Operating Frequency	31.5 to 32.1GHz
Return Loss (waveguide ports)	30dB min
Coupling	-29dB+/-1dB
Coupling port Return Loss	~0dB
Power Handling	50W CW [FM]
Radiated Emissions	80dBi min
Mass (excluding savers)	95g nom

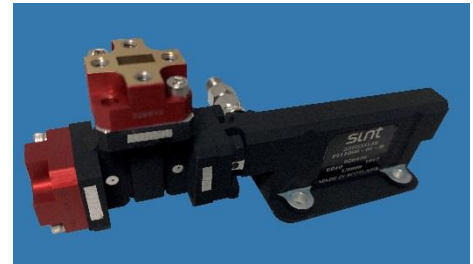
### Environmental

Test	Axis	Frequency (Hz)	Acceptance XY	Acceptance Z
Sine	All axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	2 octaves/min
Random	All axis	20	0.20g <sup>2</sup> /Hz	0.20g <sup>2</sup> /Hz
		20 to 60	+4.55dB/oct.	+8.82dB/oct.
		60 to 200	-	0.50g <sup>2</sup> /Hz
		50 to 200	0.50g <sup>2</sup> /Hz	-
		200 to 500	0.08 dB/oct.	0.08 dB/oct.
		500 to 2000	-4.52 dB/oct.	-3.01 dB/oct.
		2000	0.01g <sup>2</sup> /Hz.	0.02g <sup>2</sup> /Hz.
			60 secs/axis	60 secs/axis
Overall [rms]			8.8g	13.9g

## Ka-Band WR28 high-power Isolator with 2.9mm Power Sense port

Used on the output of a TWTA

<b>SINT part number</b>	N/A refer to 22HD3138
<b>SINT ICD</b>	D35/83389
<b>Application</b>	Space [Probe]
<b>Status</b>	Supplied [FM & LAT], launched
<b>Program</b>	<i>Europa Clipper</i>



- Full height WR28 isolator with thin film load
- Image features WG savers
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Black paint over Silver plated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting, Thermal.

### Basic performance criteria

Parameter	Performance
Non-operating	-35 to +120C
Acceptance	-25 to +90C
Operating Frequency	31.5 to 32.1GHz
Insertion Loss	0.20dB
Isolation	23dB min
Return Loss (waveguide ports)	23dB min
Coupling	-36dB+/-1dB
Coupling port Return Loss	~0dB
Power Handling	50W CW [FM]
Radiated Emissions	80dBi min
Mass (excluding savers)	49g nom

### Environmental

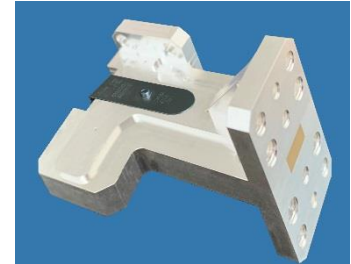
Test	Axis	Frequency (Hz)	Acceptance XY	Acceptance Z
Sine	All axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	2 octaves/min
Random	All axis	20	0.20g <sup>2</sup> /Hz	0.20g <sup>2</sup> /Hz
		20 to 60	+4.55dB/oct.	+8.82dB/oct.
		60 to 200	-	0.50g <sup>2</sup> /Hz
		50 to 200	0.50g <sup>2</sup> /Hz	-
		200 to 500	0.08 dB/oct.	0.08 dB/oct.
		500 to 2000	-4.52 dB/oct.	-3.01 dB/oct.
		2000	0.01g <sup>2</sup> /Hz.	0.02g <sup>2</sup> /Hz.
			60 secs/axis	60 secs/axis
Overall [rms]			8.8g	13.9g

## Ka-Band WR28 medium-power Isolator

Used on the output of a TWTA.

<b>SINT part number</b>	22HD350
<b>SINT ICD</b>	D35/81810
<b>Application</b>	Space [Probe]
<b>Status</b>	Supplied, launched
<b>Program</b>	Juno

- Full height WR284 isolator with integrated termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Silver plated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-50 to +100C
LAT	-20 to +70C
Acceptance	-20 to +70C
Operating Frequency	31.6 to 32.6GHz
Return Loss	21dB min
Insertion Loss	0.17dB max
Isolation	25dB min
Power Handling [FM & LAT]	4W CW forward
Radiated Emissions	75dBi min
Mass	39g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Acceptance XY
Sine	All 3 axis		10-2000Hz test 'Fc' of IEC 68-2-63 cycles per 3 axis 1.5mm from 10Hz to the crossover then 20g to 2KHz	
			90 mins in total	

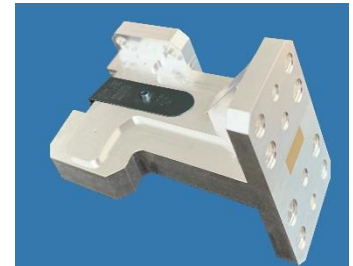
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	½ sine per Test 'Ea' of IEC 68-2-27	50g peak, 11ms
	Number of Events	6 per axis

## Ka-Band WR28 medium-power Isolator

Used on the output of a TWTA.

<b>SINT part number</b>	21HD351
<b>SINT ICD</b>	D35/81809
<b>Application</b>	Space [Probe]
<b>Status</b>	Supplied, launched
<b>Program</b>	Juno

- Full height WR284 isolator with integrated termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Silver plated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-50 to +100C
LAT	-20 to +70C
Acceptance	-20 to +70C
Operating Frequency	31.6 to 32.6GHz
Return Loss	21dB min
Insertion Loss	0.13 dB max
Isolation	25dB min
Power Handling [FM & LAT]	4W CW forward
Radiated Emissions	75dBi min
Mass	33g nom

### Environmental

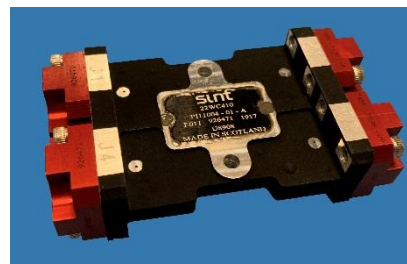
Test	Axis	Frequency (Hz)	Acceptance	Acceptance XY
Sine	All 3 axis		10-2000Hz test 'Fc' of IEC 68-2-63 cycles per 3 axis 1.5mm from 10Hz to the crossover then 20g to 2KHz	
			90 mins in total	

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	½ sine per Test 'Ea' of IEC 68-2-27	50g peak, 11ms
	Number of Events	6 per axis

## Ka-Band WR28 2x2 Hybrid coupler (3dB)

Used on a transmitter redundancy combiner

<b>SINT part number</b>	22WC410
<b>SINT ICD</b>	D35/83534
<b>Application</b>	Space [Deep space probe]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Europa Clipper



- Full height WR28 2 x 2 hybrid
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Unit illustrated with flange savers

### Basic performance criteria

Parameter	Performance
Non-operating	-35 to +90C
Acceptance	-25 to +85C
Operating Frequency	31.5 – 32.1GHz
Insertion Loss	0.25dB max
Return Loss	20dB min
Isolation	20dB min
Coupling	-3.0 +/-0.25 dB
Group delay variation	0.15ns max
Amplitude balance	0.25dBp-p max
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	50g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance (XY)	Acceptance (Z)
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
Random	All 3 axis		2 octaves/min	2 octaves/min
		20	0.02g <sup>2</sup> /Hz	0.02g <sup>2</sup> /Hz
		20 to 50	+4.45dB/oct.	+8.82dB/oct.
		50 to 200	-	0.50g <sup>2</sup> /Hz
		50 to 500	0.08g <sup>2</sup> /Hz	-
		200 to 500	-	-6.02 dB/oct.
		500	-	0.08g <sup>2</sup> /Hz
		500 to 2000	-4.52 dB/oct.	-3.01 dB/oct.
		2000	0.01g <sup>2</sup> /Hz	0.02g <sup>2</sup> /Hz
			60 secs/axis	60 secs/axis
<b>Overall [rms]</b>			<b>8.8g</b>	<b>13.9g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

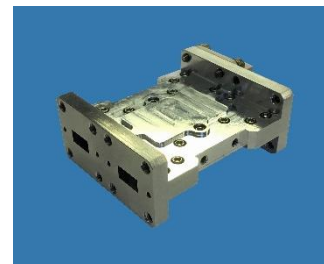


## Ka-Band WR28 1x2 Hybrid coupler (3dB)

Used on a redundancy network

<b>SINT part number</b>	22WC406
<b>SINT ICD</b>	D82953
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various

- Full height WR28 2 x 1 hybrid (all ports open)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-40 to +125C
Acceptance	-30 to +120C
Operating Frequency	27.0 to 31.0GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Isolation	23dB min
Coupling	-3.0dB+/-0.2dB max
Group delay variation	0.15ns max
Amplitude balance	0.2dBp-p max
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	44g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

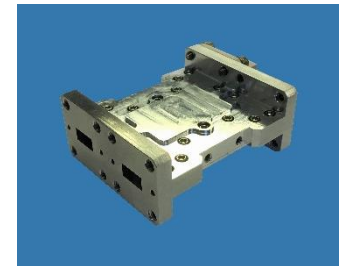
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR28 1x2 Hybrid coupler (1.8/4.77dB)

Used on a redundancy network

<b>SINT part number</b>	22WC408
<b>SINT ICD</b>	D82955
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various

- Full height WR28 2 x 2 hybrid (all ports open)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-40 to +125C
Acceptance	-30 to +120C
Operating Frequency	27.0 to 31.0GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Isolation	23dB min
Coupling	-1.8, -4.8dB+/-0.2dB max
Group delay variation	0.15ns max
Amplitude balance	0.2dBp-p max
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	44g nom



### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR28 1x3 Hybrid coupler (4.77dB)

Used on a redundancy network

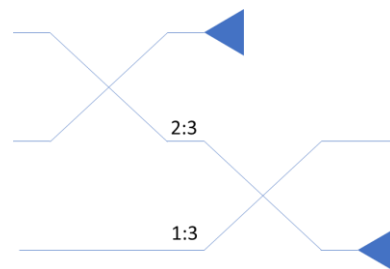
<b>SINT part number</b>	22WC601
<b>SINT ICD</b>	C83716
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied [PFM & FM]
<b>Program</b>	-

- Full height WR28 3x 1 hybrid (internally terminated)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-40 to +125C
Acceptance	-30 to +120C
Operating Frequency	27.0 to 31.0GHz
Insertion Loss	0.25dB max
Return Loss	23dB min
Isolation	23dB min
Coupling	-4.77B+/-0.2dB max
Group delay variation	0.15ns max
Amplitude balance	0.2dBp-p max
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	104g nom



### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

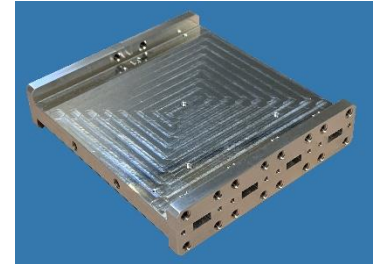
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Ka-Band WR28 1x4 Hybrid coupler (6.0dB)

Used on a redundancy network

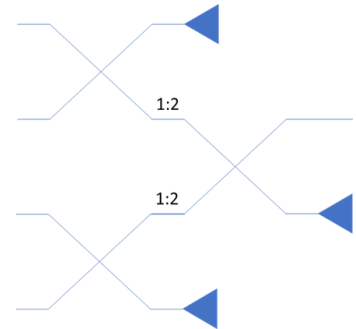
<b>SINT part number</b>	22WC801
<b>SINT ICD</b>	C35/83314
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied [PFM & FM]
<b>Program</b>	-

- Full height WR28 1 x 4 hybrid (internally terminated)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-40 to +125C
Acceptance	-35 to +120C
Operating Frequency	27.0 to 31.0GHz
Insertion Loss (excludes coupling loss)	0.25dB max
Return Loss	23dB min
Isolation	23dB min
Coupling	-6.0+/-0.6dB max
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	150g nom



### Environmental

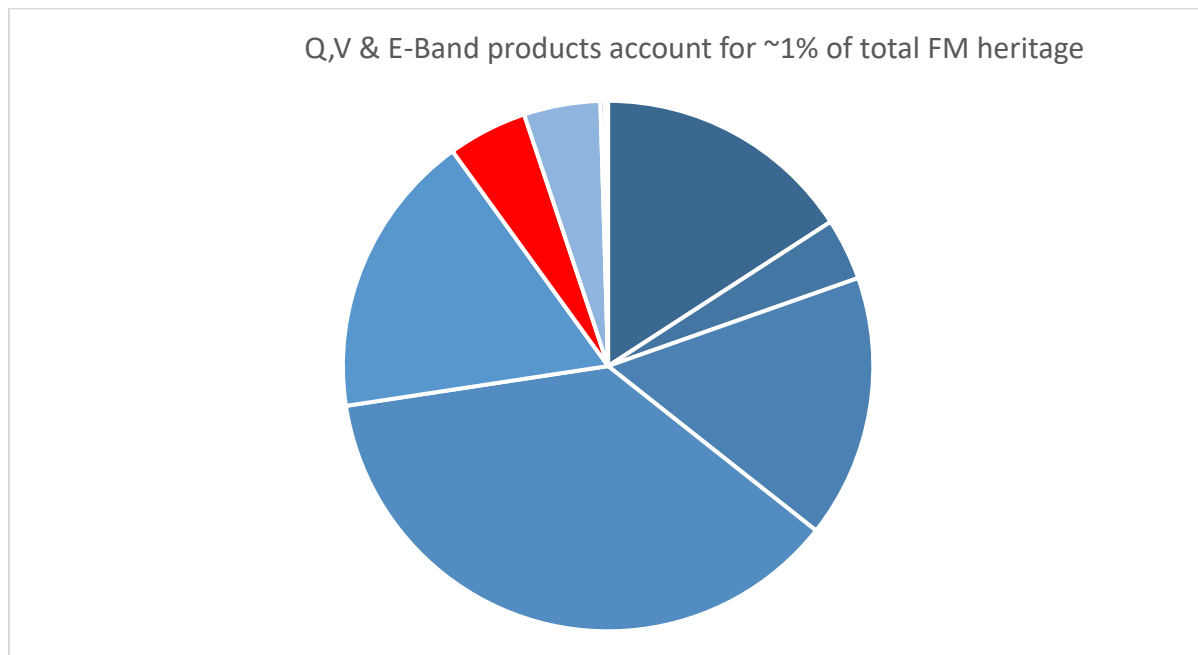
Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g²/Hz	0.50g²/Hz	0.50g²/Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Q, V & E-Bands Overview

SINT has developed, supplied, and has heritage with a limited number of passive devices operating in the 37-47GHz band. The Q-Band range is being expanded with WR22 hybrid couplers (2x1 & 2x2), WR22 to 2.4mm and WR22 to 2.9mm iso-adapters and WR22 to 2.4 & 2.9mm in-line and orthogonal transitions. In terms of heritage most parts supplied are classed as EEE components however an increasing number are supplied classed as equipment. This distinction is largely a matter of how the parts are specified and procured. The following is an extract from the heritage database which records sales of flight model hardware from 1994 to December 2020.

FMs supplied	WAVEGUIDE	Grand Total
<b>Q [WR22]</b>	<b>569</b>	<b>569</b>
ISOLATOR	564	564
LOAD/TERMINATION	5	5
<b>V [WR19]</b>	<b>374</b>	<b>374</b>
ISOLATOR	259	259
TRANSITION	112	112
LOAD/TERMINATION	3	1
<b>Grand Total</b>	<b>944</b>	<b>944</b>



### Currently under active development:

- WR12, 3dB Hybrid, operating circa 80-90GHz
- WR12, 7W load, operating circa 80-90GHz
- WR12, 35W load, operating circa 80-90GHz
- WR12, 35W isolator, operating circa 80-90GHz

## Q-Band WR22 to 2.4mm orthogonal transition

Used in generic applications including filter network.

<b>SINT part number</b>	23TM103
<b>SINT ICD</b>	-
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualification
<b>Program</b>	-

- Full height, orthogonal dc open (>1M Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
Qualification	-40 to +85C
Acceptance	-25 to +80C
Operating Frequency	37.50 to 40.4GHz
Insertion Loss	0.25dB max
Return Loss	21dB min
	1W CW [FM]
Radiated Emissions	80dBi min
Mass	11g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 22.6	-	-
		22.6 to 50	-	-
		50 to 100	-	-
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g

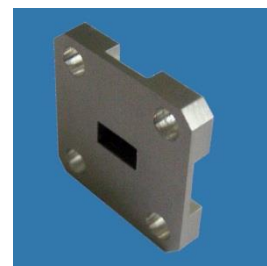
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## Q-Band WR22 low-power termination

Used in generic applications

<b>SINT part number</b>	23TE102
<b>SINT ICD</b>	B82428
<b>Application</b>	Space [GEO], termination
<b>Status</b>	In orbit
<b>Program</b>	-

- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on filter & switch assemblies
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-60 to +120C
Qualification	-60 to +85C
Acceptance	-60 to +85C
Operating Frequency	43.0 to 45.0GHz
Return Loss	26dB min
Power Handling	100mW CW
Radiated Emissions	75dBi min
Mass	3g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	5 to 23	-	11 mm
		23 to 50	-	25.0g
		50 to 100	-	25.0g
				4 octaves/min
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100 to 1000	0.67g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		1000 to 2000	-3.0 dB/oct.	-3.0 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			33.0g	50.0g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	50
	2000	2000
	10000	4200
	Number of Events	3 per axis

## Q-Band WR22 medium-power termination

Used in a power combiner

<b>SINT part number</b>	23TE103
<b>SINT ICD</b>	B83290
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Various

- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on filter & switch assemblies
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +120C
PFM & Qualification	-35 to +125C
Acceptance	-35 to +120C
Operating Frequency	33.0 to 50.0GHz
	<i>blank</i>
Return Loss	23dB min
Power Handling	2W CW [PFM]
	2W CW [FM]
Multipaction	4W pk by test
	8W pk by analysis
Corona (critical pressure)	N/A
	N/A
Radiated Emissions	80dBi min
Mass	6g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
<b>Overall [rms]</b>			<b>16.7g</b>	<b>23.6g</b>	<b>23.6g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis



## Q-Band WR22 to 2.4mm in line transition

Used in generic applications including filter network.

<b>SINT part number</b>	23TM104
<b>SINT ICD</b>	-
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualification
<b>Program</b>	-

- Full height, in line dc shorted Zero Ohm resistance from case to centre contact)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
Acceptance	-25 to +80C
Operating Frequency	36.5 to 40.5GHz
Insertion Loss	0.20 dB max
Return Loss	23dB min
Power handling	1W CW [FM]
Radiated Emissions	80dBi min
Mass	10g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100 to 1000	0.67g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		1000 to 2000	-3 dB/oct.	-3 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			33g	50g

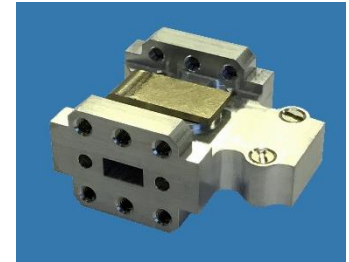
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	40
	1000	1000
	3000	2100
	6000	2100
	6001	2000
	10000	2000
	Number of Events	3 per axis, 18 total

## Q-Band WR22 low-power Isolator

Used on the input to an LNA

<b>SINT part number</b>	23HD304
<b>SINT ICD</b>	C35/82414
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied
<b>Program</b>	Various

- Full height WR22 isolator with integral termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-54 to +100C
PFM & Qualification	-45 to +85C
Acceptance	-45 to +70C
Operating Frequency	42.5 to 44.5 GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Isolation	21dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	70dBi min
Mass	13g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.	6dB/oct.
		100 to 1000	1.54g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		1000 to 2000	-3 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			180 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			50g	23.6g	23.6g

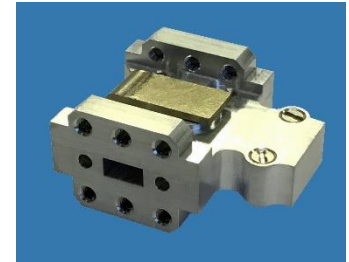
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	40
	500	200
	2000	2000
	10000	2000
	Number of Events	3 per axis

## Q-Band WR22 low-power Isolator

Used on the input to a receiver

<b>SINT part number</b>	23HD307
<b>SINT ICD</b>	C35/83255
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied
<b>Program</b>	Various

- Full height WR22 isolator with integral termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-54 to +100C
PFM & Qualification	-45 to +85C
Acceptance	-45 to +70C
Operating Frequency	37.5 to 42.5 GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Isolation	23dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	70dBi min
Mass	13g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.	6dB/oct.
		100 to 1000	1.54g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		1000 to 2000	-3 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			180 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			50g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	40
	500	200
	2000	2000
	10000	2000
	Number of Events	3 per axis

## Q-Band WR22 low-power 2.4mm coaxial Isolator

Generic application

<b>SINT part number</b>	23HD309
<b>SINT ICD</b>	B35/83542
<b>Application</b>	Space [GEO]
<b>Status</b>	In qualification
<b>Program</b>	-



- WR22 isolator with integral termination and coaxial interfaces (directly coupled)
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.

### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
Acceptance	-25 to +80C
Operating Frequency	37.5 to 40.4 GHz
Insertion Loss	0.70dB max
Return Loss	23dB min
Isolation	21dB min
Power Handling	1W CW
Radiated Emissions	75dBi min
Mass	35g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100 to 1000	0.67g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		1000 to 2000	-3 dB/oct.	-3 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			33g	50g

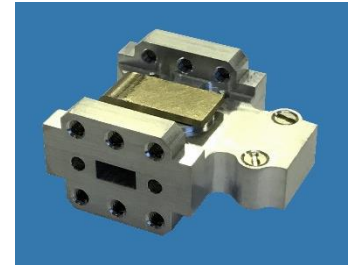
Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	40
	1000	1000
	3000	2100
	6000	2100
	6001	2000
	10000	2000
Number of Events		3 per axis, 18 total

## V-Band WR22 low-power Isolator

Used on the input to a receiver.

<b>SINT part number</b>	23HD302
<b>SINT ICD</b>	C35/82669
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied
<b>Program</b>	VARIOUS

- Full height WR22 isolator with integral termination
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear Chromate conversion coated Aluminum.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
LAT	-45 to +85C
Acceptance	-25 to +80C
Operating Frequency	47.2 to 51.9 GHz
Insertion Loss	0.30dB max
Return Loss	20dB min
Isolation	20dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	75dBi min
Mass	13g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	-	-	-
		-	-	-
		-	-	-
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100 to 1000	0.67g <sup>2</sup> /Hz	4.54g <sup>2</sup> /Hz
		1000 to 2000	-3 dB/oct.	-3 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			33g	50g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	50
	1000	1000
	3000	2100
	6000	2100
	6001	1300
	10000	1300
	Number of Events	3 per axis

## Q-Band WR19 to 2.4mm low-power transition

Used in generic applications

<b>SINT part number</b>	23TM103
<b>SINT ICD</b>	B35/83290
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	-

- Fully vented device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Generic applications
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
Acceptance	-25 to +80C
Operating Frequency	37.5 to 40.4 GHz
Insertion Loss	0.15dB max
Return Loss	23dB min
Power Handling	1W CW
Radiated Emissions	75dBi min
Mass	6g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	LAT
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm
		22.6 to 50	10.0g	13.0g
		50 to 100	7.7g	10.0g
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100 to 1000	0.67g <sup>2</sup> /Hz	1.54g <sup>2</sup> /Hz
		1000 to 2000	-3 dB/oct.	-3 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			7g	50g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	100	40
	1000	1000
	3000	2100
	6000	2100
	6001	2000
	10000	2000
	Number of Events	3 per axis, 18 total

## V-Band WR19 low-power Isolator

Used on the input to a receiver.

<b>SINT part number</b>	23HD305
<b>SINT ICD</b>	C35/82383
<b>Application</b>	Space [GEO]
<b>Status</b>	Qualified & supplied
<b>Program</b>	Jupiter 3

- Full height WR19 isolator with integral termination and extend output port
- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting.



### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +125C
PFM & Qualification	-40 to +85C
Acceptance	-30 to +80C
Operating Frequency	47.0 to 51.6 GHz
Insertion Loss	0.25dB max
Return Loss	21dB min
Isolation	21dB min
Power Handling	1W CW [PFM] 1W CW [FM]
Radiated Emissions	80dBi min
Mass	18g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			2 octaves/min	2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			60 secs/axis	60 secs/axis	180 secs/axis
Overall [rms]			16.7g	23.6g	23.6g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	Number of Events	3 per axis

## V-Band WR19 full band, low-power termination

Used in generic applications

<b>SINT part number</b>	24TE101
<b>SINT ICD</b>	B83295
<b>Application</b>	Space [GEO], termination
<b>Status</b>	Qualified & supplied [PFM & FM]
<b>Program</b>	Jupiter 3



- The device is used following payload pump down.
- Materials and processes have substantial flight heritage.
- Used on filter & switch assemblies
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.
- Analysis & reports: PDR, CDR, MRR, TRR, Venting

### Basic performance criteria

Parameter	Performance
Non-operating	-45 to +120C
PFM & Qualification	-35 to +125C
Acceptance	-35 to +120C
Operating Frequency	40.0 to 60.0GHz
	<i>blank</i>
Return Loss	23dB min
Power Handling	2W CW [PFM]
	2W CW [FM]
Radiated Emissions	80dBi min
Mass	6g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	PFM	Qualification
Sine	All 3 axis	5 to 22.6	4.83 mm	6.4 mm	6.4 mm
		22.6 to 50	10.0g	13.0g	13.0g
		50 to 100	7.7g	10.0g	10.0g
			<i>2 octaves/min</i>	<i>2 octaves/min</i>	<i>4 octaves/min</i>
Random	All 3 axis	20 to 50	6dB/oct.	6dB/oct.	6dB/oct.
		50 to 600	0.25g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz	0.50g <sup>2</sup> /Hz
		600 to 2000	-4.5 dB/oct.	-4.5 dB/oct.	-4.5 dB/oct.
			<i>60 secs/axis</i>	<i>60 secs/axis</i>	<i>180 secs/axis</i>
<b>Overall [rms]</b>			<b>16.7g</b>	<b>23.6g</b>	<b>23.6g</b>

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
Shear Web	200	280
	850	1260
	4000	4200
	10000	4200
	<i>Number of Events</i>	<i>3 per axis</i>

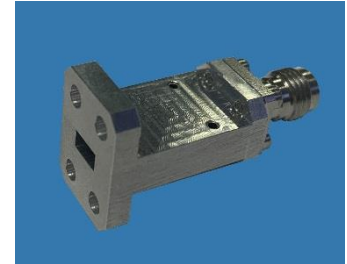


## V-Band WR19 low-power transition to 1.85mm

Used in generic applications

<b>SINT part number</b>	24TM104
<b>SINT ICD</b>	B35/83549
<b>Application</b>	Space [GEO]
<b>Status</b>	Supplied [PFM & FM]
<b>Program</b>	-

- Fully vented design
- Devices used following payload pump down.
- Materials and processes have substantial flight heritage.
- Generic applications
- Clear chromate conversion coated Aluminum housing.
- No anomalies, deviations, waivers nor test or issues affecting any models supplied.



### Basic performance criteria

Parameter	Performance
Non-operating	-40 to +85C
Acceptance	-25 to +80C
Operating Frequency	47.2 to 51.4 GHz
Insertion Loss	0.25dB max
Return Loss	23dB min
Power Handling	1W CW
Radiated Emissions	75dBi min
Mass	8.5g nom

### Environmental

Test	Axis	Frequency (Hz)	Acceptance	Qualification
Sine	All 3 axis	20 to100	-	-
		5 to 26	+/-11 mm	-
		26 to 100	+/-30g	-
		100-1000	-	-
			2 octaves/min	4 octaves/min
Random	All 3 axis	20 to 100	6dB/oct.	6dB/oct.
		100 to 1000	0.67g <sup>2</sup> /Hz	1.5g <sup>2</sup> /Hz
		1000 to 2000	-3 dB/oct.	-3 dB/oct.
			60 secs/axis	180 secs/axis
Overall [rms]			33g	50g

Location	Frequency (Hz)	Shock response (Q=10), g
		Qualification
	100	40
	1000	1000
	3000	2100
	10000	2000
	<i>Number of Events</i>	<i>3 per axis, 18 total</i>

## Coaxial isolator & circulator options with flight heritage



The following is a limited summary of coaxial isolators and circulators that have been supplied for spaceflight. Excluded from the tables are the huge number of variations (connector type & position and orientation, circulation etc.). Items highlighted in bold are included in this EQSR.

Bands	Housing size Excl. conns	Isolator (50 Ohm resistive load)	Circulator		Bands	Housing size Excl. conns	Isolator (50 Ohm resistive load)	Circulator
<b>0.40-0.47 GHz</b>	<b>51.0 mm</b>	☑	☑		6.50-7.20 GHz	12.8 mm	☑	☑
1.00-1.10 GHz	25.4 mm	☑	☑		6.50-10.0 GHz	12.8 mm	☑	☑
1.16-1.26 GHz	25.4 mm	☑	☑		7.00-7.90 GHz	12.8 mm	☑	☑
1.20-1.30 GHz	25.4 mm	☑	☑		7.20-8.40 GHz	12.8 mm	☑	☑
1.20-1.40 GHz	25.4 mm	☑	☑		<b>7.60-11.8 GHz</b>	<b>12.8 mm</b>	☑	☑
1.30-1.60 GHz	25.4 mm	☑	☑		7.90-12.1 GHz	12.8 mm	☑	☑
1.30-1.40 GHz	25.4 mm	☑	☑		8.00-8.50 GHz	12.8 mm	☑	☑
1.50-1.60 GHz	25.4 mm	☑	☑		8.00-10.0 GHz	12.8 mm	☑	☑
1.90-2.30 GHz	25.4 mm	☑	☑		8.00-12.0 GHz	12.8 mm	☑	☑
2.00-2.25 GHz	25.4 mm	☑	☑		8.00-12.2 GHz	12.8 mm	☑	☑
2.00-2.30 GHz	25.4 mm	☑	☑		8.20-10.3 GHz	12.8 mm	☑	☑
2.00-2.40 GHz	25.4 mm	☑	☑		9.00-10.0 GHz	12.8 mm	☑	☑
2.00-4.00 GHz	25.4 mm	☑	-		9.00-11.0 GHz	12.8 mm	☑	☑
2.10-2.70 GHz	25.4 mm	☑	☑		10.0-15.0 GHz	12.8 mm	☑	☑
2.17-2.42 GHz	25.4 mm	☑	☑		10.3-12.4 GHz	12.8 mm	☑	☑
2.20-2.50 GHz	25.4 mm	☑	☑		10.5-13.0 GHz	12.8 mm	☑	☑
<b>2.25-2.55 GHz</b>	<b>25.4 mm</b>	☑	☑		10.7-11.8 GHz	12.8 mm	☑	☑
2.30-2.60 GHz	<b>25.4 mm</b>	☑	☑		10.7-12.8 GHz	12.8 mm	☑	☑
2.40-2.80 GHz	25.4 mm	☑	-		<b>10.7-14.8 GHz</b>	12.8 mm	☑	☑
2.40-2.80 GHz	25.4 mm	☑	☑		11.6-12.8 GHz	12.8 mm	☑	☑
2.55-3.30 GHz	19.05mm	☑	☑		14.0-15.0 GHz	12.8 mm	☑	☑
3.00-5.00 GHz	19.05mm	☑	☑		10.7-14.8 GHz	12.8 mm	☑	☑
<b>3.10-3.30 GHz</b>	<b>19.05mm</b>	☑	☑		<b>12.0-18.0GHz</b>	<b>12.8 mm</b>	☑	☑
3.10-3.50 GHz	19.05mm	☑	☑		12.7-14.5 GHz	12.8 mm	☑	☑
3.20-3.40 GHz	19.05mm	☑	☑		13.0-15.0 GHz	12.8 mm	☑	☑
3.40-3.70 GHz	19.05mm	☑	☑		13.5-14.5 GHz	12.8 mm	☑	☑
<b>3.40-4.30 GHz</b>	<b>19.05mm</b>	☑	☑		<b>13.5-15.0 GHz</b>	<b>12.8 mm</b>	☑	☑
3.70-4.20 GHz	19.05mm	☑	☑		17.0-19.0 GHz	<b>12.8 mm</b>	☑	☑
<b>3.80-6.80 GHz</b>	<b>19.05mm</b>	☑	☑		17.3-19.8 GHz	12.8 mm	☑	☑
<b>4.10-6.60 GHz</b>	<b>19.05mm</b>	☑	☑		<b>17.3-20.3 GHz</b>	<b>12.8 mm</b>	☑	☑
4.20-4.80 GHz	19.05mm	☑	☑		<b>17.3 -22.0 GHz</b>	<b>12.8 mm</b>	☑	☑
4.40-4.80 GHz	19.05mm	☑	☑		17.5-20.5 GHz	12.8 mm	☑	☑
4.60-4.90 GHz	12.8 mm	☑	☑		17.7-20.2 GHz	12.8 mm	☑	☑
5.30-6.00 GHz	12.8 mm	☑	☑		17.7-22.0 GHz	12.8 mm	☑	☑
5.60-6.40 GHz	12.8 mm	☑	☑		18.0-20.5 GHz	12.8 mm	☑	☑
5.70-6.80 GHz	12.8 mm	☑	☑		18.0-21.0 GHz	12.8 mm	☑	☑
5.70-7.10 GHz	12.8 mm	☑	☑		18.0-22.0 GHz	12.8 mm	☑	☑
5.80-6.70 GHz	12.8 mm	☑	☑		19.5-22.0 GHz	12.8 mm	☑	☑
5.90-6.50 GHz	12.8 mm	☑	☑		20.0-22.0 GHz	12.8 mm	☑	☑
<b>6.00-7.00 GHz</b>	<b>19.05mm</b>	☑	☑		22.0-24.0 GHz	12.8 mm	☑	☑
<b>6.20-18.0 GHz</b>	<b>12.8 mm</b>	☑	☑		23.3-23.6 GHz	12.8 mm	☑	-
<b>6.20-10.4 GHz</b>	<b>12.8 mm</b>	☑	☑		23.0-25.0 GHz	12.8 mm	☑	-
6.50-7.20 GHz	12.8 mm	☑	☑					

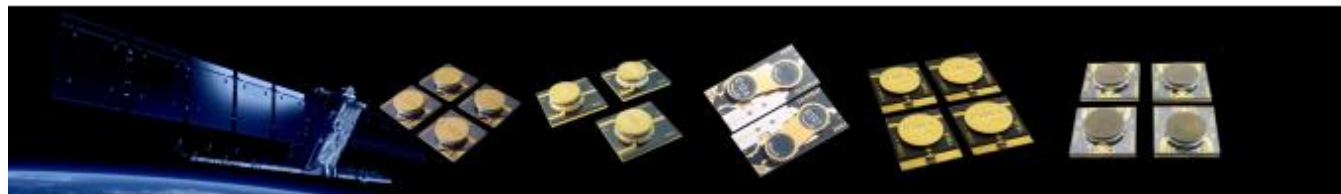
## Stripline (tabbed) isolator & circulator options with flight heritage



The following is a limited summary of stripline (tabbed) isolators and circulators that have been supplied for spaceflight. Excluded from the tables are the huge number of variations (orientation, circulation etc.). Items highlighted in bold are included in this EQSR.

Operating band	Isolator (50 Ohm resistive load)	Circulator		Operating band	Isolator (50 Ohm resistive load)	Circulator
1.10-1.20 GHz	☑	☑		5.95-6.55 GHz	☑	☑
1.20-1.30 GHz	☑	☑		6.10-6.70 GHz	☑	☑
1.34-1.48 GHz	☑	☑		6.35-7.05 GHz	☑	☑
1.50-1.70 GHz	☑	☑		6.60-7.30 GHz	☑	-
<b>1.60-1.70 GHz</b>	☑	☑		6.80-7.60 GHz	☑	-
1.80-2.30 GHz	☑	☑		7.10-7.90 GHz	☑	-
2.00-2.10 GHz	☑	☑		7.20-7.80GHz	☑	-
2.00-2.30 GHz	☑	☑		7.50-7.70 GHz	☑	-
2.10-2.30 GHz	☑	☑		7.60-8.40 GHz	☑	-
2.20-2.30 GHz	☑	☑		7.70-8.60 GHz	☑	-
2.20-2.60 GHz	☑	☑		7.90-8.40 GHz	☑	-
2.30-2.70 GHz	☑	☑		8.00-9.00 GHz	☑	-
2.35-2.65 GHz	☑	☑		8.20-8.40 GHz	☑	-
2.80-2.90 GHz	☑	☑		10.4-11.6 GHz	☑	-
3.10-3.30 GHz	☑	☑		10.5-13.0 GHz	☑	-
3.10-3.50 GHz	☑	☑		10.7-12.8 GHz	☑	-
3.30-3.70 GHz	☑	☑		11.3-12.8 GHz	☑	-
3.40-4.20 GHz	☑	☑		11.8-13.0 GHz	☑	-
3.45-3.95 GHz	☑	☑		11.9-13.2 GHz	☑	-
3.60-4.20 GHz	☑	☑		12.1-12.8 GHz	☑	-
3.80-4.70 GHz	☑	☑		12.1-13.4 GHz	☑	-
3.85-4.30 GHz	☑	☑		12.3-13.6 GHz	☑	-
3.90-4.40 GHz	☑	☑		13.0-14.5 GHz	☑	-
4.40-4.70 GHz	☑	-		13.2-14.6 GHz	☑	-
4.45-4.86 GHz	☑	☑		13.6-14.7 GHz	☑	-
4.95-5.05 GHz	☑	☑		13.7-14.5 GHz	☑	-
5.25-5.45 GHz	☑	☑		14.4-14.6 GHz	☑	-
5.50-6.10 GHz	☑	☑		16.5-17.5 GHz	☑	-
5.85-6.43 GHz	☑	☑		17.2-17.4 GHz	☑	-
5.80-6.50 GHz	☑	☑		17.2-18.5 GHz	☑	-

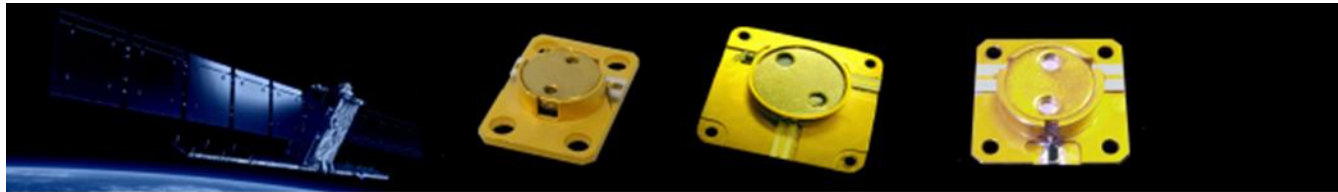
## Microstrip isolator & circulator options with flight heritage



The following is a limited summary of microstrip isolators and circulators with flight heritage or designed for space applications. Items highlighted in bold are included in this EQSR.

Operating band	Isolator (50 Ohm resistive load)	Circulator	Operating band	Isolator (50 Ohm resistive load)	Circulator
2.30-2.50 GHz	☑	-	8.90-10.7 GHz	☑	☑
2.40-2.55 GHz	☑	-	9.00-10.0 GHz	☑	☑
2.70-3.30 GHz	☑	-	9.00-10.2GHz	☑	☑
3.40-4.20 GHz	☑	-	8.90-10.1 GHz	☑	☑
4.20-4.80 GHz	☑	-	8.90-10.7 GHz	☑	☑
5.10-5.60 GHz	☑	☑	9.30-10.3 GHz	☑	☑
5.20-5.60 GHz	☑	☑	9.40-11.8 GHz	☑	☑
5.30-5.55 GHz	☑	☑	10.3-12.4 GHz	☑	☑
5.70-6.80 GHz	☑	☑	10.7-12.8 GHz	☑	☑
6.20-8.21 GHz	☑	☑	12.7-14.8 GHz	☑	☑
6.70-8.86 GHz	☑	☑	17.3-18.6 GHz	☑	☑
7.20-8.10 GHz	☑	☑	17.7-22.0 GHz	☑	-
7.50-8.40 GHz	☑	☑	18.3-20.2 GHz	☑	☑
7.60-9.60 GHz	☑	☑	18.4-18.9 GHz	☑	☑
8.00-8.50 GHz	☑	☑	18.4-20.2 GHz	☑	☑
8.00-12.0 GHz	☑	☑	23.5-24.0 GHz	☑	-
8.00-12.2 GHz	☑	☑	25.5-27.0 GHz	☑	-
8.20-12.4 GHz	☑	☑	27.5-29.1 GHz	☑	☑
8.20-10.3 GHz	☑	☑	27.5-31.0 GHz	☑	-
8.50-10.5 GHz	☑	☑	31.1-31.6 GHz	☑	☑
8.50-11.5 GHz	☑	☑	34.0-36.0 GHz	-	In development
8.80-9.50 GHz	☑	☑	-	-	-

## Stripline (including MIC type) isolator & circulator options with flight heritage



The following is a limited summary of MIC isolators and circulators that have been supplied for spaceflight. Excluded from the tables are the huge number of variations (connector type & position and orientation, circulation etc.). Items highlighted in bold are included in this EQSR.

Operating band	Isolator (50 or 1MOhm load)	Circulator	Operating band	Isolator (50 or 1MOhm load)	Circulator
1.00-1.10 GHz	<input checked="" type="checkbox"/>	Refer to factory	8.00-8.50 GHz	<input checked="" type="checkbox"/>	Refer to factory
1.10-1.20 GHz	<input checked="" type="checkbox"/>	Refer to factory	8.00-8.80 GHz	<input checked="" type="checkbox"/>	Refer to factory
1.20-1.40 GHz	<input checked="" type="checkbox"/>	Refer to factory	8.15-8.25 GHz	<input checked="" type="checkbox"/>	Refer to factory
2.20-2.35 GHz	<input checked="" type="checkbox"/>	Refer to factory	8.45-8.55 GHz	<input checked="" type="checkbox"/>	Refer to factory
1.30-1.70GHz	<input checked="" type="checkbox"/>	Refer to factory	9.25-9.95 GHz	<input checked="" type="checkbox"/>	Refer to factory
2.46-2.73 GHz	<input checked="" type="checkbox"/>	Refer to factory	9.50-9.80 GHz	<input checked="" type="checkbox"/>	Refer to factory
2.95-3.30 GHz	<input checked="" type="checkbox"/>	Refer to factory	10.3-10.7 GHz	<input checked="" type="checkbox"/>	Refer to factory
3.15-3.25 GHz	<input checked="" type="checkbox"/>	Refer to factory	10.6-10.8 GHz	<input checked="" type="checkbox"/>	Refer to factory
3.30-3.50 GHz	<input checked="" type="checkbox"/>	Refer to factory	10.8-11.9 GHz	<input checked="" type="checkbox"/>	Refer to factory
3.40-3.80 GHz	<input checked="" type="checkbox"/>	Refer to factory	10.7-11.8 GHz	<input checked="" type="checkbox"/>	Refer to factory
3.50-3.70 GHz	<input checked="" type="checkbox"/>	Refer to factory	10.7-12.8 GHz	<input checked="" type="checkbox"/>	Refer to factory
3.50-4.00 GHz	<input checked="" type="checkbox"/>	Refer to factory	10.9-11.8 GHz	<input checked="" type="checkbox"/>	Refer to factory
3.60-4.30 GHz	<input checked="" type="checkbox"/>	Refer to factory	10.9-12.8 GHz	<input checked="" type="checkbox"/>	Refer to factory
3.70-4.20 GHz	<input checked="" type="checkbox"/>	Refer to factory	11.1-12.6 GHz	<input checked="" type="checkbox"/>	Refer to factory
4.20-4.80 GHz	<input checked="" type="checkbox"/>	Refer to factory	11.4-12.6 GHz	<input checked="" type="checkbox"/>	Refer to factory
4.30-4.90 GHz	<input checked="" type="checkbox"/>	Refer to factory	11.8-12.8 GHz	<input checked="" type="checkbox"/>	Refer to factory
5.29-5.84 GHz	<input checked="" type="checkbox"/>	Refer to factory	12.8-14.5 GHz	<input checked="" type="checkbox"/>	Refer to factory
5.80-6.50 GHz	<input checked="" type="checkbox"/>	Refer to factory	13.2-14.5 GHz	<input checked="" type="checkbox"/>	Refer to factory
5.90-6.70 GHz	<input checked="" type="checkbox"/>	Refer to factory	13.9-14.6 GHz	<input checked="" type="checkbox"/>	Refer to factory
6.40-6.60 GHz	<input checked="" type="checkbox"/>	Refer to factory	13.9-14.9 GHz	<input checked="" type="checkbox"/>	Refer to factory
6.60-6.80 GHz	<input checked="" type="checkbox"/>	Refer to factory	16.9-17.1 GHz	<input checked="" type="checkbox"/>	Refer to factory
6.60-7.30 GHz	<input checked="" type="checkbox"/>	Refer to factory	17.3-18.5 GHz	<input checked="" type="checkbox"/>	Refer to factory
6.70-7.15 GHz	<input checked="" type="checkbox"/>	Refer to factory	18.5-19.0 GHz	<input checked="" type="checkbox"/>	Refer to factory
6.68-7.52 GHz	<input checked="" type="checkbox"/>	Refer to factory	18.8-20.2 GHz	<input checked="" type="checkbox"/>	Refer to factory
7.08-7.52 GHz	<input checked="" type="checkbox"/>	Refer to factory	19.7-20.3 GHz	<input checked="" type="checkbox"/>	Refer to factory
7.20-7.40 GHz	<input checked="" type="checkbox"/>	Refer to factory	19.5-20.5 GHz	<input checked="" type="checkbox"/>	Refer to factory
7.25-7.75 GHz	<input checked="" type="checkbox"/>	Refer to factory	20.0-20.6 GHz	<input checked="" type="checkbox"/>	Refer to factory
7.60-8.40 GHz	<input checked="" type="checkbox"/>	Refer to factory	20.2-21.2 GHz	<input checked="" type="checkbox"/>	Refer to factory
7.90-8.10 GHz	<input checked="" type="checkbox"/>	Refer to factory	21.0-22.0 GHz	<input checked="" type="checkbox"/>	Refer to factory
7.90-8.50 GHz	<input checked="" type="checkbox"/>	Refer to factory	-	-	-

## Coaxial Loads & Terminations with flight heritage



The following is a limited summary of coaxial terminations and loads that have been supplied for spaceflight. Excluded from the tables are the huge number of variations (mounting detail etc.). Items highlighted in bold are included in this.

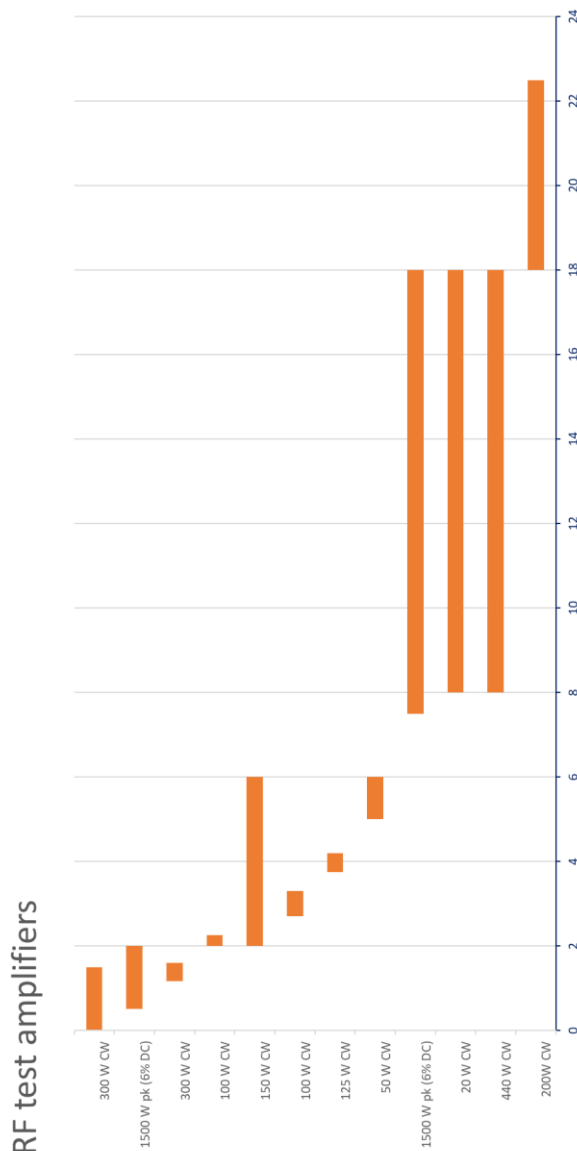
Connector type	Operating in the band	Low power <3W	Medium power >20W	High-power >50W	Comments
TNC	0.20-0.30 GHz	-	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Refer to factory
TNC	0.40-12.7 GHz	-	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Refer to factory
SMA	0.40-8.00 GHz	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-	Refer to factory
SMA	1.50-1.60 GHz	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-	Refer to factory
TNC	1.50-1.80 GHz	-	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Refer to factory
SMA	1.50-3.50 GHz	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-	Refer to factory
TNC	2.00-2.40 GHz	-	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Refer to factory
SMA	2.00-2.50 GHz	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Refer to factory
TNC	3.40-4.20 GHz	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Refer to factory
TNC	3.40-4.80 GHz	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Refer to factory
SMA	7.00-9.00 GHz	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-	Refer to factory
TNC	10.7-14.8 GHz	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-	Refer to factory
SMA	12.7-14.8 GHz	<input checked="" type="checkbox"/>	-	-	Refer to factory
SMA	17.3-17.4 GHz	<input checked="" type="checkbox"/>	-	-	Refer to factory
SMA	17.8-20.2 GHz	<input checked="" type="checkbox"/>	-	-	Refer to factory

## RF test capability at-a-glance

A vital capability in the development, qualification and screening of products is the ability to undertake electrical and mechanical testing in as representative a fashion as practically possible.

Being able to do this using in house capability is a crucial advantage to control costs and support programme schedules.

SINT has invested heavily to be to provide in-house high-power RF and EMC testing capability including multipaction and corona testing (immediately below) and EMC testing using a reverberation test chamber (RE and RS) and will commission a 18-22.5GHz TWTA in Q4 2021 while a new 4-port PNA operating from 70-110GHz was commissioned in late July 2021.



The general capability also includes high level mechanical shock and random/sine vibration s detailed overleaf.

## Dundee Site Capability

The Dundee site views its capability through 6 lenses. This is a capability that is evolving and through routine investment expanding as the demands from the Space changes. For further details please contact the factory.



#### Design & Analysis

- RF modelling and simulation
- Mechanical modelling and drafting
- Magnetic finite element analysis
- Static and dynamic thermal analysis
- Reliability analysis (FMECA, worst case)

#### Climatic & Environmental

- Temperature Cycling, shock & storage
- Humidity Chamber
- Thermal Vacuum - 3 systems
- SRS/ Mechanical shock
- Dry heat/ bake
- Vibration (random & sine) - 3 systems

#### RF & Microwave Test

- Low power RF testing (VNA), 2 & 4 port systems to 110 GHz
- High Power RF testing (TVAC, Corona & Multipaction) in assigned bands.
- EMC Reverberation chamber (0.7 - 40GHz)
- Spectrum Analysis to 50GHz
- Magnet Charging & Magnetic moment measurement
- Continuous S-parameter test and data capture (as a function of temperature), 14 channels to 30 GHz
- RF burn-in

#### DC electrical

- Insulation testing
- Signal measurement
- Dielectric withstanding Voltage measurements
- Continuity testing
- DC burn-in

#### Inspection & Quality Assurance

- Dynamic 3D X-Ray with colour tomography
- XRF
- X-section
- Automated bond pull test (desructive & non-desructive testing)
- Visual inspection to 250x
- RF Connector measurement
- Automated epoxy mixing

#### Operational support

- CNC and ceramic grinding
- Automated co-ordinate measurement
- Laser Etching of labels
- Plasma Cleaning
- 3D wire erosion
- Force guage & die shear testing
- Wire & ribbon bonding
- Cobotic assembly
- PCB Routing
- VHT paint and RF absorber application and high temperature curing
- Prototype circuit photo etching