

**MIL-STD-2113**  
23 JULY 1980

# **MILITARY STANDARD**

## **RADIO FREQUENCY CIRCULATORS AND ISOLATORS**

### **SELECTION OF**



**FSC 5985**

MIL-STD-2113  
23 July 1980

DEPARTMENT OF DEFENSE  
Washington, D.C. 20301

Radio Frequency Circulators and Isolators, Selection of.

MIL-STD-2113.

1. This Military Standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Naval Electronic Systems Command, ATTN: ELEX 5043, Department of the Navy, Washington, DC 20360, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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## 1. SCOPE

1.1 Scope. This standard provides a list of standard circulators and isolators for use in military applications.

1.2 Purpose. The purpose of this standard is to:

- a. Provide the equipment designer with a list of circulators and isolators considered standard for use in military applications.
- b. Restrict the number of circulators and isolators for use in military applications in order to provide effective logistic support of equipment.
- c. Establish criteria pertinent to choice and application of circulators and isolators for use in military equipment.

## 2. REFERENCED DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on the date of invitation for bids or request for proposal, form a part of this standard to the extent specified herein.

## SPECIFICATIONS

## MILITARY

- MIL-C-28790 - Circulators, Radio Frequency, General Specification for.
- MIL-I-28791 - Isolators, Radio Frequency, General Specification for.

(Copies of specifications, standards, drawings and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

## 3. DEFINITIONS

3.1 The terms used in this standard are those commonly encountered in circulator and isolator engineering practices.

## 4. GENERAL REQUIREMENTS

4.1 Selection of circulators and isolators. Circulators to be used in military applications shall be selected from those listed in tables I through III. Isolators to be used in military applications shall be selected from those listed in tables IV and V.

4.2 Criteria for selections. The criteria for the selection of circulators and isolators for inclusion in this standard are:

- a. The circulators and isolators shall be considered by representatives of the military departments the best available type for current applications.
- b. Availability of the circulators and isolators shall be reasonably certain.
- c. The circulators and isolators shall have an approved military specification.

4.3 Application and use. Circulators and isolators used in military applications shall be representative of manufactured lots possessing acceptable material and physical and electrical characteristics and shall in no manner degrade the operational characteristics of the equipment in which used.

## 5. DETAILED REQUIREMENTS.

The detailed requirements for circulators and isolators listed in this standard are covered by the applicable MIL-C-28790 and MIL-I-28791 specification sheets.

6. NOTES. Not applicable.

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TABLE I. Circulators (3 ports) with series SMA connectors.

Part number	Frequency range	Isolation	Insertion loss	VSWR	Operating temperature range	Power rating (AVG)
	<u>GHz</u>	<u>dB (min)</u>	<u>dB (min)</u>	<u>Max</u>		<u>Watt min</u>
M28790/1-001	9.50 - 10.0	20	0.3	1.25:1	-54° to +95°C ↓	10
M28790/1-002	12.5 - 13.5	20	0.3	1.25:1		10
M28790/1-003	7.0 - 11.0	20	0.5	1.30:1	-54° to +85°C ↓	50
M28790/1-004	11.0 - 18.0	20	0.5	1.30:1		1
M28790/1-005	0.95 - 1.225	20	0.5	1.25:1	-29° to +70°C ↓	10
M28790/1-006	9.0 - 9.2	20	0.3	1.25:1		2
M28790/2-01	.15 - .18	10	2.0	2.20:1	-54° to +65°C ↓	2
M28790/4-01	4.4 - 5.0	21	0.2	1.20:1		2
M28790/4-02	7.125 - 8.4	21	0.2	1.20:1	-54° to +65°C	2

TABLE II. Circulators (4 ports) with series SMA connectors.

Part number	Frequency range	Isolation	Insertion loss	VSWR	Operating temperature range	Power rating (AVG)
	<u>GHz</u>	<u>dB (min)</u>	<u>dB (max)</u>	<u>Max</u>		<u>Watt min</u>
M28790/3-01	.60 - .80	18	0.5	1.30:1	-50° to +100°C	20

TABLE III. Circulators (3 ports) waveguide.

Part number	Frequency range	Isolation	Insertion loss	VSWR	Operating temperature range	Power rating (AVG)
	<u>GHz</u>	<u>dB (min)</u>	<u>dB (max)</u>	<u>Max</u>		<u>Watt min</u>
M28790/5-01	7.125 - 8.4	21	0.2	1.20:1	-54° to +65°C	2
M28790/6-01	10.8 - 18.0	10	1.0	2.00:1	0° to +75°C	100
M28790/6-03	9.5 - 10.6	20	0.3	1.20:1	-55° to +125°C	225

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TABLE IV. Isolators with series SMA connectors.

Part number	Frequency range	Isolation	Insertion loss	VSWR	Operating temperature range	Input power rating AVG.
	GHz				dB (min)	
M28791/1-001	9.50 - 10.0	20	0.3	1.25:1	-55°C to +95°C	10
M28791/1-002	12.5 - 13.5	20	0.3	1.25:1	-55°C to +95°C	10
M28791/1-003	7.0 - 11.0	20	0.5	1.30:1	-55°C to +95°C	10
M28791/1-004	11.0 - 18.0	20	0.5	1.30:1	-55°C to +95°C	10
M28791/1-005	0.95 - 1.225	20	0.5	1.25:1	-54°C to +85°C	2
M28791/1-006	0.95 - 1.225	22	0.4	1.25:1	0°C to +71°C	2
M28791/1-007	0.96 - 1.215	18	0.5	1.25:1		75
M28791/1-008	1 - 2	18	0.5	1.30:1	0°C to +71°C	2
M28791/1-009	1.255 - 1.41	20	0.4	1.25:1	-28°C to +65°C	5
M28791/1-010	1.26 - 1.666	20	0.5	1.25:1	-40°C to +65°C	0.03
M28791/1-011	1.495 - 1.65	20	0.3	1.25:1	-28°C to +65°C	5
M28791/1-012	1.53 - 1.87	20	0.5	1.25:1	-20°C to +70°C	2
M28791/1-013	1.8 - 4.2	20	0.8	1.50:1	-40°C to +75°C	2
M28791/1-014	2 - 4	20	0.4	1.25:1	-55°C to +125°C	1
M28791/1-015	2 - 4	20	0.4	1.25:1	-54°C to +71°C	2
M28791/1-016	2.16 - 4.16	18	0.5	1.35:1	-55°C to +85°C	2
M28791/1-017	2.2 - 4.2	18	0.5	1.35:1	-55°C to +85°C	2
M28791/1-018	2.7 - 2.9	20	0.4	1.25:1	-41°C to +53°C	2
M28791/1-019	3.6 - 8.4	20	0.5	1.50:1	-40°C to +75°C	2
M28791/1-020	4.0 - 8.0	20	0.5	1.30:1	-55°C to +125°C	1
M28791/1-021	4.0 - 8.0	20	0.4	1.25:1	-54°C to +70°C	2
M28791/1-022	4.16 - 8.16	18	0.5	1.35:1	-55°C to +85°C	2
M28791/1-023	4.2 - 8.2	18	0.5	1.35:1	-55°C to +85°C	2
M28791/1-024	4.35 - 4.85	25	0.5	1.18:1	-40°C to +71°C	2
M28791/1-025	7 - 11	30	0.4	1.10:1	-54°C to +105°C	10
M28791/1-026	7.55 - 12.85	25	1.2	1.35:1	-40°C to +75°C	2
M28791/1-027	8 - 12	20	0.4	1.25:1	-54°C to +70°C	1
M28791/1-028	8 - 12	20	0.4	1.25:1	-54°C to +71°C	2
M28791/1-029	8 - 12	40	0.8	1.25:1	0°C to +65°C	2
M28791/1-030	8.16 - 12.56	18	0.5	1.35:1	-55°C to +85°C	2
M28791/1-031	8 - 16	17	0.7	1.35:1	-45°C to +85°C	2
M28791/1-032	12 - 18.5	30	1.2	1.35:1	-40°C to +75°C	2
M28791/1-033	12 - 18	18	0.6	1.30:1	-54°C to +71°C	2
M28791/1-034	12.4 - 18	40	0.8	1.25:1	0°C to +65°C	2
M28791/1-035	12.56 - 18.16	17	1.0	1.45:1	-55°C to +85°C	2
M28791/2-01	4.4 - 5.0	18	0.7	1.30:1	-40°C to +70°C	0.02
	7.125 - 8.4					
M28791/3-01 1/	4.4 - 5.0	20	0.3	1.25:1	-40°C to +65°C	0.03
M28791/4-01	.85 - 1.05	20	0.5	1.25:1	-45°C to +71°C	2

1/ This part has a SMA connector on port 1 and a stripline connection on port 2.

TABLE V. Isolators with stripline connections.

Part number	Frequency range	Isolation	Insertion loss	VSWR	Operating temperature range	Input power rating AVG.
	GHz				dB (min)	
M28791/5-01	0.95 - 1.215	20	0.3	1.20:1	-54°C to +71°C	50
M28791/5-02	0.96 - 1.215	20	0.6	1.25:1	-10°C to +71°C	10

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Custodians:

Army - ER  
Navy - EC  
Air Force - 11

Review activities:

Army - AR, MI  
Navy - OS, SH  
Air Force - 17, 85, 99  
DLA - ES

User activities:

Army - AV  
Navy - AS, CG, MC  
Air Force - 19

Preparing activity:  
Navy - EC

Agent:  
DLA - ES

(Project 5985-0938)

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