

DISHPro Installation Accessories

Requirements for use in DISHPro Systems, Retailer Version

By: See Contributors List

Draft Version: 02

September 8, 2005

141014

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III. REVISION HISTORY

Part Number	Rev.	ECO	Date	Description
141014	01	C16432	August 8, 2005	Initial Release to Development
141014	02	C16668	September 1, 2005	<ul style="list-style-type: none"> ▪ Changed upper limit frequency in sections 8, 9, 11, and 12 to 2150MHz from 2200MHz. ▪ Changed section 9.2.1 to separate Off-Air Frequency Range from Sat Frequency Range ▪ Corrected Section 9.2.1 Sat Frequency Range to 1450MHz max. ▪ Section 4.3 - Added separate quantity submission requirements for coax cable samples. ▪ Corrected footer information on all pages ▪ Changed Section 4.1 to better clarify intent.

1 Introduction

1.1 Purpose

This document was created to provide a set of basic requirements for all accessories used in a DishPro or DishPro Plus installation.

1.2 Scope

This document will cover all accessories placed in the signal chain of a Legacy, Dish Pro or DishPro Plus installation. Accessories are being defined as items such as ground block, diplexers, line amps, adapters, etc. This document will provide an overview of the DC, RF, and DiSEqC requirements for all accessories used in these installations.

Requirements for DishPro Plus are the same as for DishPro, unless otherwise noted.

1.3 Reference Documents

- 110869 EchoStar Technologies Corporation Electro-Static Discharge Test Procedure
- 105690 Echostar Technologies Corporation Outdoor Equipment Accelerated Weathering Test Specification
- 123477522-AA Echostar Technologies Corporation Lightning Surge Susceptibility Level and Test Procedures
- 123473765-AA Echostar Technologies Corporation Common Cosmetic Criteria Specification Procedure for all New Product
- Eutelsat DiSEqC 2.0 Bus Functional Specification Version 4.2 released February 25, 1998
- CEA-897 F Connector Color Coding for Home Television Systems
- SCTE 74-2003 Specification for Braided 75-Ohm Flexible RF Coaxial Drop Cable
- SCTE 48-2 2003 Test Procedure for Measuring Relative Shielding Effectiveness
- SCTE 99 2004 Test Method for Axial Pull F Connector/Drop Cable
- SCTE 60 2004 Test Method for Interface Moisture Migration Double Ended
- ASTM B117-97 Standard Practice for Operating Salt Spray (Fog) Apparatus

2 General Electrical Requirements

The following requirements apply to all devices to be used as installation accessories in a DISH Network System.

Section	Item	Specification				Condition
		Min.	Typ	Max	Unit	
2.1	Input Frequency Range	950 to 2150			MHz	Unless otherwise specified. Flatness and gain will be specified for each device.
2.2	Return loss	12			dB	950 – 2150 MHz Unless otherwise specified
	VSWR			1.67:1		
2.3	Nominal RF Impedance		75		Ω	950 – 2150 MHz Unless otherwise specified
2.4	DC Voltage Range	10.5		48	Vdc	
2.4.1	Peak Applied Voltage			50	Vdc	Must survive when applied to any or all ports for \leq 24 hours.
2.5	DC Current Pass Range	0		1650	mA	At 28Vdc.
		0		1000	mA	At 48Vdc.
2.6	DC Resistance			0.25	Ohms	Does not apply to cable
	DC Voltage Drop			0.41	Vdc	Does not apply to cable
2.7	DiSEqC Frequency Range	17.6	22.0	26.4	kHz	Must pass with no degradation or distortions. Reference the Eutelsat DiSEqC 2.0 Spec.
2.7.1	DiSEqC Device Impedance	1000			Ω	The impedance the device presents with respect to ground.
2.7.2	DiSEqC Through Impedance			1	Ω	The impedance the device has in the pass through path.
2.8	ETC Control Words for 13/18 Switching					Must pass with no degradation or distortions. Their presence must not affect RF performance. 13/18 rise fall times must not be affected.

3 Environmental Specifications

3.1 Temperature

Indoor Operating: -0 to +45 degrees C
Storage: -40 to +70 degrees C

Outdoor Operating: -35 to +55 degrees C
External ambient, does not include temperature rise due to solar radiation. To account for this rise, all outdoor rated products will be tested at +65C.

3.2 Humidity

Operating: 95 % RH @ 38° C max., non-condensing
Storage: 95 % RH @ 38° C max., non-condensing

3.3 Solar Radiation

Only for units intended for outdoor mounting.

Equivalent to a sunny day at solar noon in Miami Florida during the spring or fall.

Exposure 1175 Watts/square meter

3.4 UV Exposure

Reference EchoStar document 105690.

3.5 Electrostatic Discharge

Reference: 110869 Electro-Static Discharge Test Procedure for details on testing and requirements.

3.6 Lightning Discharge (Surge)

Reference: 123477522-AA Surge Susceptibility Limits and Test Procedures for details on testing and requirements.

3.7 Corrosion

Only for units intended for outdoor mounting.

Exposure Salt Spray, ASTM B 117-97, 1000
hour exposure- no visible rust, reference
EchoStar document 105690.
Test must be performed with DC voltage and
current present as if in a typical installation.

3.8 Leakage

Only for units intended for outdoor mounting.

Exposure External air pressure of .45 kg/cm², less than
4.5x10⁻² cc/sec leakage to the inside of the unit

4 Quality Assurance Provisions

4.1 Certification

The vendor shall include with each shipment certification that the requirements of this document have been met. Certification shall apply to the specific product production lot and date code shipped. Once product has been approved no changes may be made to product, such as materials, location of manufacture, components used, etc., without first submitting samples and receiving written approval from Echostar to make the change.

4.2 Quality Assurance

In addition to meeting all requirements outlined in this specification, all requirements in the following Echostar Quality Assurance documents and their references must be met or exceeded:

124214 Supplier AQL Requirements
105450 Supplier QA Requirements

4.3 First Article

The vendor shall submit ten (10) first article samples along with an inspection report for at least three (3) samples. This report should detail results of tests performed verifying the component conforms to these specifications over the entire operating range of the unit, including temperature. The report should be performed by an organization approved by ETC. Upon ETC approval of first article submittals, the supplier will then be released for manufacture of the product.

For Coax cable products, first article quantities shall be 2 packages of standard length reels or boxes of each cable type. For example, RG6 single standard packaging is 1000ft. either on a reel or in a pull box. The testing and report details shall be followed as described above.

4.4 Cosmetic Workmanship Standards

The manufacturer shall ensure the product complies with the EchoStar document 123473765-AA Specification, Cosmetic Workmanship Standards.

4.5 Labeling and Packaging Requirements

Where possible all products must have a label that contains vendor/brand name, part number, and lot code, date code, or other production run tracking information. In addition, bulk packaging should also contain vendor/brand name, part number, and the same lot code, date code or other production run tracking information as placed on the product label.

In situations where a label is not practical for a device (such as an F81) some form of vendor marking must be made on the product to aid in identification. Preferably a vendor logo and part number should be visible on the product. The information for the packaging must still contain full vendor/brand name, part number, and lot code, date code, or other production run tracking information.

5 Agency Certification

The unit shall meet all applicable FCC and UL rules and regulations during operation. The vendor is responsible for obtaining these approvals and the vendor shall submit an official compliance report to ETC for review before acceptance of product

6 Lifetime and Warranty

Warranty	Minimum 15 months workmanship and parts
Lifetime	Minimum 7 years

7 In-Line Satellite IF Amplifiers

In-Line Satellite IF amplifiers (or line amps) will be used in installations that exceed 200ft. of cable, or in any situation that requires an amplification of the satellite IF signal. The amplifiers gain shall have cable loss slope compensation. They may also incorporate a level control to adjust gain and slope, either automatically or manually. The amplifier shall be powered by the line, but current draw must be at a minimum. The amplifiers must meet all of Sections 2 through 6, and all of the following specifications. The specifications in this section will prevail in the case of conflicting specifications between this and other sections.

7.1 In-Line IF Amplifier Additional RF Specifications

Section	Item	Specification				Condition
		Min.	Typ	Max	Unit	
7.1.1	Gain	8	12	16	dB	Includes cable slope compensation. 950-2150MHz
7.1.2	Gain Flatness			6	dB	Total allowed slope 950-2150MHz
7.1.3				0.5	dB	Across any 25MHz bandwidth, excluding the region 1450 – 1650MHz
7.1.4	Return Loss	10			dB	950-2150MHz
	VSWR			2:1		
7.1.5	RF power input	-65		-35	dBm	Per Carrier, 32 carriers present
7.1.6	Noise Figure			7	dB	
7.1.7	Isolation	40			dBc	This for units with more than one amp in the same enclosure. Measured at desired port with undesired RF applied to any or all remaining ports.
7.1.8	1dB Compression Point	-13			dBm	Input Power
7.1.9	IM3 Products	40			dBc	Two input tones at –23dBm each.
7.1.10	Second Harmonic Products 1900-2150MHz	35			dBc	One tone at –30dBm from 950 – 1075MHz
7.1.11	IM2 Products	35			dBc	Two input tones at –30dBm each.
7.1.12	Spurious			-80	dBm	54-806MHz
				-90	dBm	950-2150MHz
				-90	dBm	11.7-12.7GHz
						With or without signal present.

7.2 In-Line Amplifiers Additional DC and DiSEqC Specifications

Section	Item	Specification				Condition
		Min.	Typ	Max	Unit	
7.2.1	DC Voltage Range	11.0		21	Vdc	Continuous operating voltage.
7.2.2	Amplifier Current Draw			50	mA	11.0 to 21Vdc
7.2.3	DC Current Pass Range			750	mA	11.0 to 21Vdc
7.2.4	DC Peak Applied Voltage			28	Vdc	Must survive when applied to any or all ports for ≤ 24 hours.
7.2.5	Current Draw Variance			5	mA	During any voltage transition or between any voltage level.
7.2.6	Injected Low Frequency Noise			25	mVpp	Noise addition to LNB voltage when connected. DC – 1MHz
7.2.7	DiSEqC Signal Isolation			30	mVpp	This for units with more than one amp in the same enclosure. Any desired port to all undesired ports with 1Vpp DiSEqC signal present.

7.3 General Mechanical

For a single feed amplifier, it is proposed that connectors be placed opposite ends, in an inline format, to make installation easier. Other formats will be considered by EchoStar Technologies on a case by case basis. No cooling fins are allowed.

For amplifiers with more than one feed, it is proposed that each pair of input and output connectors be in an inline format, on opposite sides of the chassis. Other formats will be considered by EchoStar Technologies on a case by case basis. A minimum of two mounting tabs are required, to be placed on opposite corners. No cooling fins are allowed.

The enclosure will house the PWA and therefore need to be environmentally sealed to survive placement in the outdoors. The unit shall also meet all requirements of Section 3, and shall be made using such materials so as to limit the effects of corrosion. The enclosure, including connectors, shall also be capable of surviving a 3ft drop on concrete and remain intact and operational.

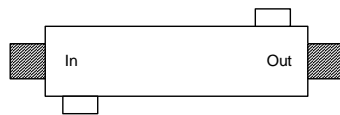


Figure 1
Example Single Feed
Line Amp

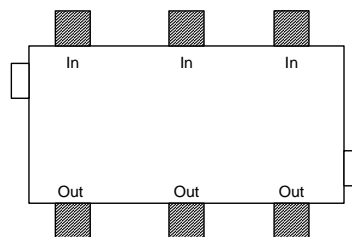


Figure 2
Example Multiple Feed
Line Amp

7.3.1 F Connectors

The connectors must be color coded for satellite signals, in accordance with CEA-897.

The F connector must withstand a minimum of 75 lb-in of applied rotational torque before any mechanical movement and/or degradation to the RF and DC performance is allowed. If the vendor chooses to use cast F connectors in the mechanical design, the dielectric must be able to withstand a 10lb pulling force.

The connectors must accept RG-6 cables. All RF and DC requirements must be met after 100 insertions of cables. Failure of the device to meet RF and DC requirements after insertion of cable will be considered a failure of the product.

All ports will be threaded 3/8-32 UNEF and free of thread damage.

7.4 Cosmetic Appearance

The enclosure may be painted or unpainted metal. A silk screen or label with attachment information will be placed on the housing.

PAINT FINISH:	Paint to meet ASTM B117-97, JIS Z 2371 may be considered equivalent. Color to be approved by EchoStar, semi gloss, light texture, non-metallic in color. Powder coat or dip process preferred. UV stable, slight fade over product life as defined by standard ASTM rating scale. Reference EchoStar specification 105690	
LABEL:	Label Color:	To be approved by Echostar Technologies. Must be UV stable. Reference Echostar spec 105690
	Graphics Color:	To be approved by Echostar Technologies. Must be UV stable. Reference Echostar spec 105690
	Adhesive:	Non-removable

8 Grounding Blocks and F-81s

8.1 Grounding Blocks

Ground Blocks will be used to provide an earth ground point for the system prior to entry into a structure. The units shall meet all of the requirements of Sections 2 through 6 with the exceptions to the items listed in Section 8.3. The units will be required to be UL listed to UL467, Grounding and Bonding Equipment, Communications (Category KDSH) or equivalent.

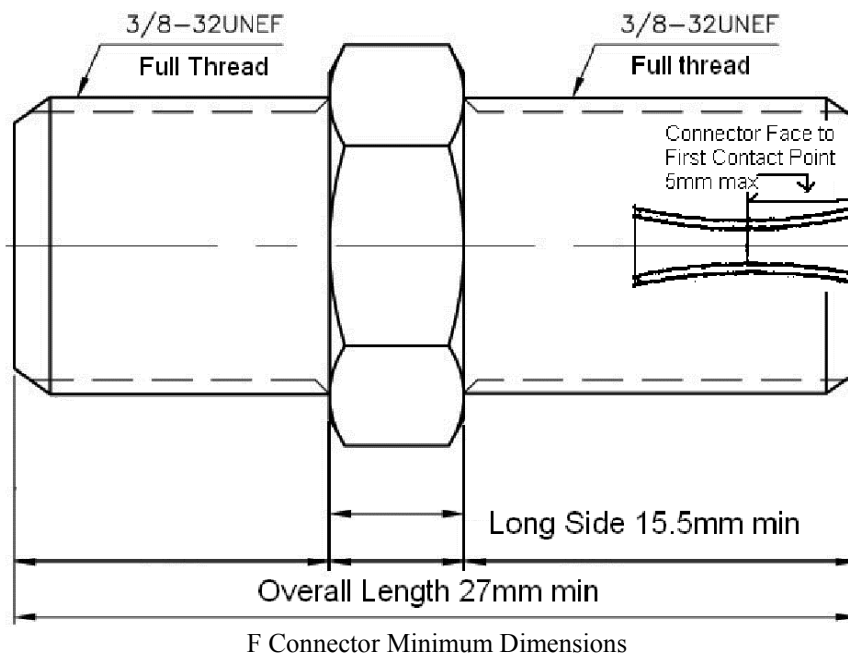
All ports shall be threaded 3/8-32 UNEF and free of thread damage. The ports shall be color coded for satellite signals in accordance with CEA-897 F Connector Color Coding for Home Television Systems. Three grounding points shall be provided on the ground block, with holes to accommodate a wire from 8AWG to 17AWG, and a screw with a combination head to allow for hex, or screwdriver (flat blade or “Phillips” blade) tightening.

8.2 F81 F Female splice

The F-81 is a female F type to female F type splice. They are used to extend cable runs and, used in wall plates to provide a cable connection point for the consumer. These shall meet all of the requirements of Sections 2 through 6 with the exceptions to the items listed in Section 8.3. The F-81 shall be color coded for satellite signals in accordance with CEA-897 F Connector Color Coding for Home Television Systems. The unit shall also meet all requirements of Section 3 for outdoor use, and shall be made using such materials so as to limit the effects of corrosion.

8.2.1 Mechanical Dimensions

To ensure compatibility with existing wall plates and other uses, some basic, minimal dimensional requirements are needed. The F81 shall meet the requirements in the following diagram.



8.3 Ground Block and F81 Electrical Requirements

Since both of these products are intended to connect two pieces of cable together in a seamless fashion, the RF requirements on these are much more stringent. The remainder of the specifications from Section 2 through Section 6 will remain the same

Section	Item	Specification				Condition
		Min.	Typ	Max	Unit	
8.3.1	Frequency Range	5 to 2150			MHz	
8.3.2	Insertion Loss			0.25	dB	5 to 2150MHz
8.3.3	Band Flatness			0.1	dB	5 to 2150MHz
8.3.4	Return Loss	25			dB	5 to 2150MHz
	VSWR			1.12:1		

8.3.5 F Connectors

The connectors must be color coded for satellite signals, in accordance with CEA-897.

The F connector must withstand a minimum of 75 lb-in of applied rotational torque before any mechanical movement and/or degradation to the RF and DC performance is allowed. If the vendor chooses to use cast F connectors in the mechanical design, the dielectric must be able to withstand a 10lb pulling force.

The connectors must accept RG-6 cables. All RF and DC requirements must be met after 100 insertions of cables. Failure of the device to meet RF and DC requirements after insertion of cable will be considered a failure of the product.

All ports will be threaded 3/8-32 UNEF and free of thread damage.

9 Splitters

The splitters are used in a variety of situations that require splitting a signal to more than one destination. There are two types of splitters required for Dish Network installations, one for splitting DishPro signals, and one used for off-air/legacy installations. The different installations have different requirements on the splitter, thus two the two types will have separate specifications.

9.1 DishPro Splitters – Single Port Power Pass

A problem is encountered when splitting the DishPro satellite signal because two DiSEqC masters are now available to a single slave device, with no control over the DiSEqC signal flow. To prevent this problem, only one port of a splitter will be allowed to pass the DiSEqC signals in both directions. The remaining ports must provide at least 30dB of isolation of the DiSEqC signal, with respect to any other port. In addition to these requirements, the units must also meet all of Section 2 through Section 6. The specifications in this section will prevail in the case of conflicting specifications between this and other sections.

Section	Item	Specification				Condition
		Min.	Typ	Max	Unit	
9.1.1	Frequency Range	5 to 2150			MHz	
9.1.2	Insertion Loss		3	5	dB	Two way splitter 5 to 2150MHz
9.1.3			6	9.5	dB	Four way splitter 5 to 2150MHz
9.1.4	RF Flatness			2	dB	5 to 2150MHz
9.1.5	Channel/Transponder Flatness			0.25	dB	Any 6MHz band, 5 to 860MHz Any 25MHz band, 900 to 2150MHz
9.1.6	Return Loss	12			dB	5 to 2150MHz
	VSWR			1.67:1		
9.1.7	DiSEqC Isolation			30	mVpp	Measured on undesired port, with 1Vpp DiSEqC signal present on passing port.

9.2 Off-Air and Legacy Systems – All Port Power Pass

The splitter used for these installations shall be of an all port power pass design. No diode steering is required for this application. There will be four varieties, 2-way, 3-way, 4-way, and 8-way. The units must meet all of these requirements and the requirements of Sections 2 through 6. The specifications in this section will prevail in the case of conflicting specifications between this and other sections.

Section	Item	Specification				Condition	
		Min.	Typ	Max	Unit		
9.2.1	Frequency Range	5 to 860			MHz	Off-Air Frequency Range	
		950 to 1450				Legacy Satellite Frequency Range	
9.2.2	Insertion Loss		3	5	dB	Two way splitter	
9.2.3			6	9	dB	Four way splitter Three way splitter balanced design	
9.2.3.1			6	9	dB	Three way splitter, un- balanced design, two ports	
9.2.3.2			3	5		Three way splitter un- balanced design, one port	
9.2.4				9	14	dB	Eight way splitter
9.2.5	Band Flatness			2	dB		
9.2.6	Channel/Transponder Flatness			0.25	dB	Any 6MHz band, 5 to 860MHz Any 25MHz band, 950 to 1450MHz	
9.2.7	Return Loss	12			dB		
	VSWR			1.67:1			

9.3 General Mechanical

A minimum of two mounting tabs are required, to be placed on opposite corners.

The unit shall meet all requirements of Section 3 for outdoor use, and shall be made using such materials so as to limit the effects of corrosion. The enclosure, including connectors, shall be capable of surviving a 3ft drop on concrete and remain intact and operational.

9.3.1 F Connectors

The connectors must be color coded for satellite signals, in accordance with CEA-897.

The F connector must withstand a minimum of 75 lb-in of applied rotational torque before any mechanical movement and/or degradation to the RF and DC performance is allowed. If the vendor chooses to use cast F connectors in the mechanical design, the dielectric must be able to withstand a 10lb pulling force..

The connectors must accept RG-6 cables. All RF and DC requirements must be met after multiple insertions of cables. Failure of the device to meet RF and DC requirements after insertion of cable will be considered a failure of the product.

All ports will be threaded 3/8-32 UNEF and free of thread damage.

9.4 Cosmetic Appearance

The enclosure may be painted or unpainted metal. A silk screen or label with attachment information will be placed on the housing.

PAINT FINISH:	Paint to meet ASTM B117-97, JIS Z 2371 may be considered equivalent. Color to be approved by EchoStar, semi gloss, light texture, non-metallic in color. Powder coat or dip process preferred. UV stable. Slight fade over product life as defined by standard ASTM rating scales. Reference EchoStar specification 105690	
LABEL:	Label Color:	To be approved by Echostar Technologies. Must be UV stable. Reference EchoStar specification 105690
	Graphics Color:	To be approved by Echostar Technologies. Must be UV stable. Reference EchoStar specification 105690
	Adhesive:	Non-removable

10 Off Air (UHF/VHF) Diplexers

The diplexer is used to combine, and split, an UHF/VHF signal to and from a Satellite signal. This permits running the off-air and satellite signals on one cable. The diplexer may also be built in to an off-air antenna. The diplexer must be able to pass DC and DiSEqC communications on the satellite port and block DC and DiSEqC communications on the UHF/VHF port. In addition to this requirement, the diplexer must meet all of Section 2 through Section 6. Additional electrical requirements are as follows. The specifications in this section will prevail in the case of conflicting specifications between this and other sections.

Section	Item	Specification				Condition
		Min.	Typ	Max	Unit	
10.1.1	UHF/VHF Frequency Response	5 to 806			MHz	
10.1.2	UHF/VHF Insertion Loss			2	dB	From 5 to 806 MHz
10.1.3	UHF/VHF Flatness			1.5	dB	From 5 to 806 MHz
				0.5	dB	Across any 6MHz band. From 5 to 806 MHz
10.1.4	Return loss UHF/VHF port	12			dB	From 5 to 806MHz
	VSWR			1.67:1		
10.1.5	Stop Band Attenuation	35	40		dB	Both Satellite to UHF/VHF and UHF/VHF to Satellite.
10.1.6	L-Band Insertion Loss			2	dB	From 950MHz to 2150MHz
10.1.7	L-Band Flatness			1.5	dB	From 950MHz to 2150MHz
				0.5	dB	Across any 25MHz band From 950MHz to 2150MHz
10.1.8	DC Through Loss			0.4	Vdc	At 1.65A max current draw. Satellite side only.

10.2 General Mechanical

A minimum of two mounting tabs are required, to be placed on opposite corners. No cooling fins are allowed. The unit shall also meet all requirements of Section 3 for outdoor use, and shall be made using such materials so as to limit the affects of corrosion. The enclosure, including connectors, should be capable of surviving a 3ft drop on concrete and remain intact and operational.

10.2.1 F Connectors

The connectors must be color coded in accordance with CEA-897 for the appropriate signals.

The F connector must withstand a minimum of 75 lb-in of applied rotational torque before any mechanical movement and/or degradation to the RF and DC performance is allowed. If the vendor chooses to use cast F connectors in the mechanical design, the dielectric must be able to withstand a 10lb pulling force.

The connectors must accept RG-6 and RG-59 cables. All RF and DC requirements must be met after minimum 100 insertions of RG-6 cable. Failure of the device to meet RF and DC requirements after insertion of cable will be considered a failure of the product.

All ports will be threaded 3/8-32 UNEF and free of thread damage.

10.3 Cosmetic Appearance

The enclosure may be painted or unpainted metal. A silk screen or label with attachment information will be placed on the housing.

PAINT FINISH:	Paint to meet ASTM B117-73, JIS Z 2371 may be considered equivalent. Color to be approved by EchoStar, semi gloss, light texture. Powder coat or dip process preferred. UV stable. Slight fade over product life as defined by standard ASTM rating scales. Reference EchoStar specification 105690	
LABEL:	Label Color:	To be approved by Echostar Technologies. Must be UV stable. Reference EchoStar specification 105690
	Graphics Color:	To be approved by Echostar Technologies. Must be UV stable. Reference EchoStar specification 105690
	Adhesive:	Non-removable

11 Home Plug Compliant AC Power Protection Devices

This section will cover devices such as AC power strips used during installation of a Dish Network receiver with HomePlug capabilities. HomePlug devices allow the transmission of data over the AC power lines, by sending transmitting data in the 4.5MHz to 21MHz range. The items covered will only relate to the portions of the device affecting the HomePlug communications and satellite or off-air/UHF/VHF signals.

Since some devices employ surge or other protection devices, the AC line and satellite, off-air/UHF/VHF signal protection specifications, if any, will be left to the vendor.

11.1 Home Plug Requirements

To ensure that the device does not impact the HomePlug capabilities, the designated port(s) should be able to pass the 4.5-21MHz band used by HomePlug with less than 3dB total loss. The vendor shall reference the HomePlug Alliance and ensure compliance with the latest version of technical requirements. The HomePlug Alliance can be found at www.homeplug.org.

11.2 RF Specifications

The Satellite and Off-Air/Antenna ports on the device shall meet all the specifications below and all specifications from Section 2 through Section 6. The specifications in this section will prevail in the case of conflicting specifications between this and other sections.

Section	Item	Specification				Condition
		Min.	Typ	Max	Unit	
11.2.1	Frequency Range	950 to 2150			MHz	For Satellite Signals
		5 to 860			MHz	For Off-Air/Cable/Antenna Signals
11.2.3	Insertion Loss			1.0	dB	5 to 860MHz 950 to 2150MHz
11.2.4	Band Flatness			0.25	dB	5 to 860MHz 950 to 2150MHz
11.2.5	Return Loss	12			dB	5 to 2150MHz
	VSWR			1.67:1		
11.2.6	HomePlug Insertion Loss			3	dB	4.5 to 21MHz

12 F-type 75ohm Terminations

The F-type 75-ohm terminator is primarily used to terminate unused ports of a splitter or other passive device where not all of the ports are used. The terminators may be configured for DC or non-DC applications, and either version is acceptable. The following specs shall apply to the F-type terminations including Sections 3 through 6.

Section	Item	Specification				Condition
		Min.	Typ	Max	Unit	
12.1.1	Frequency Range	5 to 2150			MHz	
12.1.2	Return Loss	15			dB	5 to 2150MHz
	VSWR			1.43:1		
12.1.3	DC Voltage			28	Vdc	DC Blocking Termination only

13 RJ-11 Phone Jacks

RJ-11 phone jacks are used during installation of Dish Network products for connection of the receiver to the phone line. The phone jacks are usually found as either stand alone units or combined with a wall plate and one or two F81s. In all cases the RJ-11 jacks shall comply with TIA-968-A, and connections shall be made in accordance with T1.TR5-1999 as reference in TIA-968.

14 In Line Attenuators

In line attenuators are occasionally needed during an installation for distribution of UHF/VHF signals from either an agile modulator output or a distribution amplifier. To prevent overdriving the inputs of customer equipment, an attenuator is occasionally needed. The attenuators are restricted to UHF/VHF signal use only. Units shall have a male F connector on one end, and a female F connector on the other end, for an inline connection.

Section	Item	Specification				Condition
		Min.	Typ	Max	Unit	
14.1.1	Frequency Range	5 to 1000			MHz	
14.1.2	Attenuation Deviation			±0.5	dB	From device nominal attenuation. Example 10dB ±0.5dB for 10dB attenuator.
14.1.3	Band/Channel Flatness			0.25	dB	Any 6MHz band and full band max to min. 5 to 1000MHz.
14.1.4	Return Loss	20			dB	5 to 1000MHz
	VSWR			1.22:1		
14.1.5	DC Voltage			28	Vdc	DC passing or DC blocking.

15 Cable

15.1 RG-6 or Series 6 Coaxial Cable

There are many variations on Series 6 or RG-6 coax cable. This section will attempt to outline the basics needed for the DISHPro installations. This section will not try to restrict the construction of the cable, except in the mechanical dimensions, to allow the same connectors to be used on all cable types.

Two basic types of cable will be allowed for use, based on the type of center conductor material used. The first type, and minimum requirements, will be bare, copper covered (clad) steel, center conductor. The second type will be a bare, solid copper, center conductor. The solid copper has better overall performance in terms of DC resistance, which is more critical in a DISHPro installation; however, copper covered steel is still acceptable for use in a DISHPro installation.

Variations on the two basic types of cable are as follows:

- Single RG6
- Dual RG6
- Single RG6 with Messenger/Ground cable.
- Dual RG6 with Messenger/Ground cable.

15.1.1 Basic “RG-6” Cable Requirements

The cable will be a color approved by EchoStar, and shall meet all applicable ETL or UL/NEC ratings for CATV, CM or CMX cable types, including UL1581, Section 1200. All cable shall also meet SCTE 74-2003. All values below are nominal, unless otherwise indicated.

Section	Item	Specification		Condition
		Nom.	Unit	
15.1.1.1	Center Conductor Diameter	18	AWG	
		0.040	inches	
		1.016	mm	
15.1.1.2	Diameter Over Dielectric	0.180	inches	
		4.57	mm	
15.1.1.3	Diameter Over Jacket	0.272	inches	
		6.91	mm	
15.1.1.4	Jacket Thickness	0.030	inches	
		0.762	mm	
15.1.1.5	Shield Type			Foil and 60% coverage braided wire.
15.1.1.6	Messenger/Ground Wire	17	AWG	For cable so equipped. Conductor material shall be copper covered (clad) steel.
		0.045	inches	
		1.143	mm	
15.1.1.7	Operating temperature range	-40	°C	Minimum
		+80	°C	Maximum
15.1.1.8	Return Loss	-15	dB	Maximum. 100% Swept Tested.
15.1.1.9	Impedance	75.0, ±3	Ω	

15.1.2 Copper Covered Steel Center Conductor

Cable using a CCS (Copper Covered Steel) center conductor shall conform to ASTM B869 standards for 21% cladding.

Section	Item	Specification				Condition
		Min	Nom.	Max	Unit	
15.1.2.1	Center Conductor DC Resistance		32		Ω	per 1000ft. at 20°C
15.1.2.2	Shield DC Resistance		10.5		Ω	per 1000ft. at 20°C
		Frequency (MHz)		dB/100ft. Max.		
15.1.2.3	Attenuation	1		0.50		
		10		0.90		
		50		1.60		
		100		2.20		
		200		3.00		
		400		4.30		
		700		5.80		
		900		6.40		
		950		6.60		
		1000		6.70		
		1200		7.50		
		1450		8.30		
		1800		9.30		
		2200		10.00		
2250		10.60				

15.1.3 Solid Copper Center Conductor

Cable using a solid copper center conductor shall conform to SBCA Series 6 Recommended Practices.

Section	Item	Specification				Condition
		Min	Nom.	Max	Unit	
15.1.3.1	Center Conductor DC Resistance		6.5		Ω	per 1000ft. at 20°C
15.1.3.2	Shield DC Resistance		10.5		Ω	per 1000ft. at 20°C
		Frequency (MHz)		dB/100ft. Max.		
15.1.3.3	Attenuation	1		0.50		
		10		0.90		
		50		1.60		
		100		2.20		
		200		3.00		
		400		4.30		
		700		5.80		
		900		6.40		
		950		6.60		
		1000		6.70		
		1200		7.50		
		1450		8.30		
		1800		9.30		
		2200		10.00		
2250		10.60				

15.2 RG-6 or Series 6 Plenum Rated Cable

In some installations it is necessary to use a plenum rated cable. This section will attempt to outline the basics needed for the plenum cable to ensure compatibility with DISHPro installations. This section will not try to restrict the construction of the cable, except in the mechanical dimensions, to allow the same connectors to be used on all cable types.

Two basic types of cable will be allowed for use, based on the type of center conductor material used. The first type, and minimum requirements, will be bare, copper covered (clad) steel, center conductor. The second type will be a bare, solid copper, center conductor. The solid copper has better overall performance in terms of DC resistance, which is more critical in a DISHPro installation; however, copper covered steel is still acceptable for use in a DISHPro installation.

15.2.1 Basic “RG-6” Cable Requirements

The cable will be a color approved by EchoStar, and shall meet all applicable ETL or UL/NEC ratings for CATVP or CMP cable types, including UL1581, Section 1200. All values below are nominal, unless otherwise indicated.

Section	Item	Specification		Condition
		Nom.	Unit	
15.2.1.1	Center Conductor Diameter	18	AWG	
		0.040	inches	
		1.016	mm	
15.2.1.2	Diameter Over Dielectric	0.170	inches	
		4.32	mm	
15.2.1.3	Diameter Over Jacket	0.237	inches	
		6.02	mm	
15.2.1.4	Jacket Thickness	0.017	inches	
		0.432	mm	
15.2.1.5	Shield Type			Foil and 60% coverage braided wire.
15.2.1.6	Messenger/Ground Wire	17	AWG	For cable so equipped. Conductor material shall be copper covered (clad) steel.
		0.045	inches	
		1.143	mm	
15.2.1.7	Operating temperature range	-40	°C	Minimum
		+80	°C	Maximum
15.2.1.8	Return Loss	-15	dB	Maximum. 100% Swept Tested.
15.2.1.9	Impedance	75.0, ±3	Ω	

15.2.2 Copper Covered Steel Center Conductor

Cable using a CCS (Copper Covered Steel) center conductor shall conform to ASTM B869 standards for 21% cladding.

Section	Item	Specification				Condition
		Min	Nom.	Max	Unit	
15.2.2.1	Center Conductor DC Resistance		32		Ω	per 1000ft. at 20°C
15.2.2.2	Shield DC Resistance		10.5		Ω	per 1000ft. at 20°C
		Frequency (MHz)		dB/100ft. Max.		
15.2.2.3	Attenuation	1		0.50		
		10		0.90		
		50		1.60		
		100		2.20		
		200		3.00		
		400		4.50		
		700		6.00		
		900		7.00		
		950		7.30		
		1000		7.50		
		1200		8.10		
		1450		9.30		
		1800		10.50		
2200		11.70				
2250		11.80				

15.2.3 Solid Copper Center Conductor

Cable using a solid copper center conductor shall conform to SBCA Series 6 Recommended Practices.

Section	Item	Specification				Condition
		Min	Nom.	Max	Unit	
15.2.3.1	Center Conductor DC Resistance		6.5		Ω	per 1000ft. at 20°C
15.2.3.2	Shield DC Resistance		10.5		Ω	per 1000ft. at 20°C
		Frequency (MHz)		dB/100ft. Max.		
15.2.3.3	Attenuation	1		0.50		
		10		0.90		
		50		1.60		
		100		2.20		
		200		3.00		
		400		4.50		
		700		6.00		
		900		7.00		
		950		7.30		
		1000		7.50		
		1200		8.10		
		1450		9.30		
		1800		10.50		
2200		11.70				
2250		11.80				

15.3 RG-11 Cable

In some installation, primarily commercial or MDU type of installations, a lower loss cable is required, such as RG-11. This section will attempt to outline the basics needed for the cable to ensure compatibility with DISHPro installations. This section will not try to restrict the construction of the cable, except in the mechanical dimensions, to allow the same connectors to be used on all cable types.

Two basic types of cable will be allowed for use, based on the type of center conductor material used. The first type, and minimum requirements, will be a bare, copper covered (clad) steel, center conductor. The second type, will be a bare, solid copper, center conductor. The solid copper has better overall performance in terms of DC resistance, which is more critical in a DISHPro installation; however, copper covered steel is still acceptable for use in a DISHPro installation.

15.3.1 Basic “RG-11” Cable Requirements

The cable will be a color approved by EchoStar, and shall meet all applicable ETL or UL/NEC ratings for CATV, CM or CMX cable types for non-plenum, and CMP or CATVP for plenum rated cable, including UL1581, Section 1200. All values below are nominal, unless otherwise indicated. Cable shall also meet SCTE 74-2003.

Section	Item	Specification		Condition
		Nom.	Unit	
15.3.1.1	Center Conductor Diameter	14	AWG	
		0.0641	inches	
		1.628	mm	
15.3.1.2	Diameter Over Dielectric	0.280	inches	
		7.11	mm	
15.3.1.3	Diameter Over Jacket	0.405	inches	Standard Non-Plenum Rated
		6.02	mm	
15.3.1.3.1	Diameter Over Jacket, Plenum Rated	0.351	inches	Plenum Rated
		8.915	mm	
15.3.1.4	Non Plenum Jacket Thickness	.045	inches	Standard Non-Plenum Rated
		1.143	mm	
15.3.1.4.1	Plenum Jacket Thickness	0.020	Inches	Plenum Rated
		0.508	mm	
15.3.1.5	Shield Type			Foil and 60% coverage braided wire.
15.3.1.6	Messenger/Ground Wire	17	AWG	For cable so equipped. Conductor material shall be copper covered (clad) steel.
		0.045	inches	
		1.143	mm	
15.3.1.7	Operating temperature range	-40	°C	Minimum
		+80	°C	Maximum
15.3.1.8	Return Loss	-15	dB	Maximum. 100% Swept Tested.
15.3.1.9	Impedance	75.0, ±3	Ω	

15.3.2 Copper Covered Steel Center Conductor

Cable using a CCS (Copper Covered Steel) center conductor shall conform to ASTM B869 standards for 21% cladding.

Section	Item	Specification				Condition
		Min	Nom.	Max	Unit	
15.3.2.1	Center Conductor DC Resistance		11		Ω	per 1000ft. at 20°C
15.3.2.2	Shield DC Resistance		6.9		Ω	per 1000ft. at 20°C
		Frequency (MHz)		dB/100ft. Max. Non-Plenum	dB/100ft. Max. Plenum	
15.3.2.3	Attenuation	1		0.20	0.20	
		10		0.50	0.50	
		50		0.95	1.00	
		100		1.25	1.30	
		200		1.75	1.90	
		400		2.45	2.80	
		700		3.35	4.00	
		900		3.80	4.80	
		1000		4.00	5.10	
		1200		4.40	5.50	
		1450		4.80	6.80	
		1800		5.30	7.80	
2200		5.80	8.60			

15.3.3 Solid Copper Center Conductor

Cable using a solid copper center conductor shall conform to SBCA Series 6 Recommended Practices.

Section	Item	Specification				Condition
		Min	Nom.	Max	Unit	
15.3.3.1	Center Conductor DC Resistance		2.9		Ω	per 1000ft. at 20°C
15.3.3.2	Shield DC Resistance		6.9		Ω	per 1000ft. at 20°C
		Frequency (MHz)		dB/100ft. Max. Non-Plenum	dB/100ft. Max. Plenum	
15.3.3.3	Attenuation	1		0.20	0.20	
		10		0.50	0.50	
		50		0.95	1.00	
		100		1.25	1.30	
		200		1.75	1.90	
		400		2.45	2.80	
		700		3.35	4.00	
		900		3.80	4.80	
		1000		4.00	5.10	
		1200		4.40	5.50	
		1450		4.80	6.80	
		1800		5.30	7.80	
2200		5.80	8.60			

16 Connectors

16.1 Connector Basic Requirements

The connectors for the cable are usually the weakest link in the signal path. If the connector is not of a sound design, and installed properly, the performance of the system suffers greatly. Since there are many different designs for connectors, this document will not dictate the design of the connector, but outline some of the basic needs for the connector to meet. To do this, the following industry standards will be referenced to act as a set of guidelines.

SCTE 48-2-2003	RF Shielding, with modified frequency range to 2200MHz.
SCTE 04-1997	Connector Return Loss, with modified frequency range to 2200MHz
SCTE 99-2004	Axial Pull Load
SCTE 60-2004	Moisture Migration
ASTM B 117-97	Salt Spray (Fog) Test. This test should be performed while the cable and connector are carrying a DC voltage of 48V and a DC current of 2.0A. This better simulates the true environment in which the connector operates. Test time shall be 1000 hours.