

## Universal Transmission Chassis



### Products:

- DEV 4101** - Universal Transmission Chassis 1 RU for two 5 HP Modules
- DEV 4111** - Universal Transmission Chassis 1 RU for two 4 HP Modules

### Features:

- /// Chassis providing 2 Slots at the Front Side which can be equipped with RF Amplifier Modules or Optical Modules
- /// Cabling Options with 50 Ohm or 75 Ohm Impedance
- /// Distribution Options with 50 Ohm or 75 Ohm Impedance
- /// Matrix Switch Option with 75 Ohm Impedance
- /// 1+1 Redundancy Switching for Optical Modules and Redundant Amplifier Options, both with 50 Ohm or 75 Ohm Impedance can be integrated
- /// Redundant Power Supplies
- /// Optional Remote Control and Surveillance

### Application Areas:

- /// Cable Head End Stations with distant Dish Farms
- /// Redundant distributed Dish Farms
- /// Satellite Ground Stations

**Table of Contents**

**Technical Data ----- 3**

**DEV 4101 / DEV 4111 - Universal Transmission Chassis 1 RU ----- 3**

**Option 59 - CPU for DEV 4101 / DEV 4111 ----- 3**

**Cabling Options ----- 4**

**Distribution Options ----- 5**

**Matrix Switch Option ----- 6**

**1+1 Redundancy Options ----- 7**

**Redundant Amplifier Options ----- 8**

**DEV 15-0011 - Redundant Amplifier Module Extended L-Band (for DEV 4101) ----- 9**

**DEV 11-0055, DEV 11-0059 - Amplifier Modules (Extended) L-Band (for DEV 4111) ----- 10**

**Order Information ----- 11**

**Remarks ----- 13**



*Front DEV 4111*



*Rear DEV 4111*

**The Situation**

In cable head ends or satellite ground stations, it is sometimes required to process a smaller number of RF signals. Either these signals need to be amplified and/or distributed or the signals are required to be optically converted. Also, there may be the necessity for the redundant transmission of a single signal.

**DEV worked out a Solution**

DEV Systemtechnik provides two universal transmission chassis which can be tailored to the requirement of the specific application.

**The Technical Concept**

DEV Systemtechnik offers various modules for processing RF signals, e.g. RF amplifier modules and optical modules for the conversion of RF signals. These modules are intended to be integrated in 3 RU or 4 RU chassis which are capable to manage a larger number of signal channels.

The 1 RU chassis DEV 4101 and DEV 4111 were developed as a single or dual channel solution by installing one or two of these modules at the front side of the chassis. The DEV 4101 is designed for the application of modules with a width of 5 HP (~25 mm); the DEV 4111 is designed for the application of modules with a width of 4 HP (~20 mm).

Both chassis can be either equipped with cabling options, for the direct access to the RF ports (inputs/outputs) of the modules. Alternatively, the chassis can be configured with distribution options, providing up to 16 outputs per chassis, i.e. one channel with 16 equal outputs or up to two channels with 8 outputs. As a third alternative, the chassis can be equipped with a 1+1 redundancy option for the redundant optical transmission of a single RF signal or with a redundant amplifier option to realize RF amplifier module redundancy. All three alternatives are available in 50 Ohm with SMA connectors or in 75 Ohm with precision F connectors. Different frequency ranges are offered for the cabling options and for the 1+1 redundancy options. As a fourth alternative, the chassis can be configured as an (optical receiver) chassis with matrix switch outputs. For matrix switches with 4 inputs the DEV 4111 has to be equipped with 2 twin link optical receiver modules, and for matrix switches with 2 inputs the chassis has to be equipped with 2 single link optical receiver modules or with 2 RF amplifier modules. Finally, if the chassis is equipped with the CPU option, this enables the monitoring and control of the instrument via Web Interface or via SNMP.

## Technical Data

### DEV 4101 / DEV 4111 - Universal Transmission Chassis 1 RU

#### Capacity

Front side	DEV 4101: 2 * 5 HP slots for RF/optical modules (DEV 15-0001, DEV 721x, DEV 7221, DEV 731x, DEV 7321)
	DEV 4111: 2 * 4 HP slots for RF/optical modules (DEV 11-0055, DEV 11-0059, DEV 723x, DEV 7241, DEV 733x, DEV 7341)

#### Redundant Power Supply

Number of power supplies	2
Bias capability	15+3/-0 V, max. 0,5 A per RF amplifier or optical transmitter module
Power line redundancy	100...240 V AC supplied by two different lines
Power consumption	<80 VA

#### Potential Free Contacts

Alarm connector	Sub-D-9 (m)
Contact load	60 V; 0,3 A
Summary Alarm	Via remote communication <sup>1</sup> and via potential free contacts

Two Stage Alarm Signalization for Power Line Failure:

B-Alarm	One power supply unit does not deliver any secondary power.
A-Alarm	All power supply units do not deliver any secondary power.

#### General Specifications

Housing	19" (483 mm), 1 RU (45 mm), ~360 mm depth + max. 80 mm (connectors)
Weight	~5 kg (empty chassis)
Environmental conditions	ETS 300019 Part 1-3 Class 3.1

### Option 59 - CPU for DEV 4101 / DEV 4111

The CPU option enables the control and surveillance of the instrument via SNMP and via Web Interface; Option 59 includes one Web Interface license.

#### Remote Communication

Interfaces (connectors)	<ul style="list-style-type: none"> <li>• Ethernet (RJ-45);</li> <li>• serial interface RS 232 (Sub-D-9 (f)).</li> </ul>
Remote control & surveillance (interface)	<ul style="list-style-type: none"> <li>• via Web Interface (Ethernet);</li> <li>• via SNMP (Ethernet).</li> </ul>

#### Note:

- Option 59 is mandatory if the instrument is equipped with a 1+1 Rx redundancy option or with a redundant amplifier option.
- Option 59 is also required, if the bias functionality of a basic (twin) optical transmitter module DEV 7231 or DEV 7241 is to be operated.
- Option 59 is not available for a DEV 4101 equipped with amplifier module(s) DEV 15-0011.

## Technical Data

### Cabling Options

Cabling options are required for the direct access to the RF ports of the installed modules. Cabling options for the RF inputs (Option 4y/I) can be installed once per optical transmitter module (path) and per RF amplifier module. Cabling options for the RF outputs (Option 4y/O) can be installed once or twice per optical receiver module and per RF amplifier module.

DEV Systemtechnik offers the following cabling options for DEV 41x1:

- Option 40/I: Input Cabling 50 Ohm, SMA connector for one RF port
- Option 40/O: Output Cabling 50 Ohm, SMA connector for one RF port
- Option 41/I: Input Cabling CATV-Band, 75 Ohm, precision F connector for one RF port
- Option 41/O: Output Cabling CATV-Band, 75 Ohm, precision F connector for one RF port
- Option 42/I: Input Cabling L-Band, 75 Ohm, precision F connector for one RF port
- Option 42/O: Output Cabling L-Band, 75 Ohm, precision F connector for one RF port

The “d” in the following table is used as a placeholder which can be “I” (Input) or “O” (Output).

### Specifications

Number of ports	1 per cabling option	
Frequency range, impedance, connectors	Option 40/d:	DC...2300 MHz, 50 Ohm, SMA (f)
	Option 41/d:	DC, 5...862 MHz, 75 Ohm, precision F (f)
	Option 42/d:	DC, 700...2300 MHz, 75 Ohm, precision F (f)

### General Specifications

Weight	Option 40/d:	~0,1 kg
	Option 41/d,	
	Option 42/d:	~0,2 kg
Environmental conditions	ETS 300019 Part 1-3 Class 3.1	

### Note:

- One cabling option for the RF input (Option 4y/I):
  - a. is required per RF amplifier module in combination with cabling option(s) for the output(s) of the module, and in combination with a distribution option or a matrix switch option.  
A cabling option for the RF input can not be applied in combination with a redundant amplifier option.
  - b. is required per optical transmitter module (path) if not in combination with a 1+1 redundancy option.
- One or two cabling options for the RF output(s) (Option 4y/O):
  - a. can be applied per RF amplifier module for direct external access to the output port(s) of the module.  
A cabling option for the RF output(s) can not be applied in combination with a distribution option, with a matrix switch option, or with a redundant amplifier option.  
Two cabling options can be applied for the RF amplifier modules DEV 15-0011 & DEV 11-0055, only.
  - b. can be applied per optical receiver module (path) for direct external access to the output port(s) of the module.  
A cabling option for the RF output(s) can not be applied in combination with a distribution option, with a matrix switch option, or with a 1+1 redundancy option.  
Two cabling options can only be applied for optical receiver modules with Option 43 (!), i.e. DEV 7311, DEV 7312 and DEV 7313 and for the twin optical receiver module DEV 7341.

## Technical Data

### Distribution Options

With the application of a distribution option, the output(s) of an RF amplifier module or of an optical receiver module feed(s) the input(s) of a 1:8 or 1:16 Extended L-Band splitter.

The following distribution options are available for DEV 41x1:

- Option 8/50: 1:8, Outputs: 50 Ohm, SMA connectors
- Option 8/75: 1:8, Outputs: 75 Ohm, precision F connectors
- Option 16/50: 1:16, Outputs: 50 Ohm, SMA connectors
- Option 16/75: 1:16, Outputs: 75 Ohm, precision F connectors

The “Y” in Y/50 or Y/75 in the following table is used as a placeholder which can be 8 or 16.

### RF Specifications

Number of outputs	8 or 16 per distribution option	
Frequency range	700...2300 MHz	
Impedance, connectors	Option Y/50:	50 Ohm, SMA (f)
	Option Y/75:	75 Ohm, precision F (f)
Return loss	Option Y/50:	>16 dB
	Option Y/75:	>14 dB
Frequency response	±1,0 dB	(full band)
	±0,3 dB	(in any 36 MHz interval)
Isolation between output ports	>25 dB	
Intermodulation distortion	<-40 dBc	(2 tones, -13 dBm each)

### General Specifications

Weight	Option 8/50:	~0,3 kg
	Option 8/75:	~0,4 kg
	Option 16/50:	~0,4 kg
	Option 16/75:	~0,5 kg
Environmental conditions	ETS 300019 Part 1-3 Class 3.1	

### Note:

- Distribution options with 8 outputs can be installed once or twice per chassis, a distribution option with 16 outputs can be installed once per chassis, serving only one module of the instrument.
- When combining an RF amplifier module with a distribution option, the input of the module needs to be supplied via a cabling option for the RF input.
- Apart from this exception, it is not possible to combine distribution options with cabling options, with a matrix switch option, with a 1+1 redundancy option or with a redundant amplifier option.
- Distribution options with 16 outputs require an RF amplifier module or an optical receiver module with two RF outputs. I.e. if the DEV 4101 is to be equipped with an optical receiver module, this module is to be ordered with Option 43; and if the DEV 4111 is to be equipped with an RF amplifier module, the DEV 11-0055 is to be selected.
- To achieve the optimal performance when applying distribution options, the usage of optical receiver modules with variable gain functionality is highly recommended.  
For the DEV 4111, the usage of optical receiver modules with variable gain functionality (DEV 7332, DEV 7333) is mandatory.

## Technical Data

### Matrix Switch Option

With the application of a matrix switch option, the output of two RF amplifier modules or of two optical receiver modules feed the two inputs of an L-Band matrix switch with eight outputs.

If two basic twin optical receiver modules are installed in a DEV 4111, a matrix switch option with four inputs and eight outputs is possible.

The following matrix switch option is offered for DEV 41x1:

- Option mx8/75: 2 or 4 Inputs and 8 Outputs: 75 Ohm, precision F connectors

### RF Specifications

Number of inputs	2 or 4
Number of outputs	8
Frequency range	950...2150 MHz
Impedance, connectors	75 Ohm, precision F (f)
Tilt	4 dB over entire band
Return loss	>14 dB
Frequency response	950...1100 MHz: ±0,6 dB
(in any 36 MHz interval)	1100...2150 MHz: ±0,3 dB
Isolation between input ports	>25 dB
Intermodulation distortion	<-35 dBc @ 85 dBμV
IMA <sub>3</sub> output level	<89 dBμV
IMA <sub>2</sub> output level	<87 dBμV

### Input Selection

Switch control	14 V, 18 V and 0 Hz, 22 kHz at each output
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### General Specifications

Weight	~1,2 kg
Environmental conditions	ETS 300019 Part 1-3 Class 3.1

### Note:

- The matrix switch option can be installed once per chassis.
- A matrix switch option with two inputs is to be ordered in combination with two single link optical receiver modules or two RF amplifier modules.
- A matrix switch option with four inputs is possible for a DEV 4111 only and is to be ordered in combination with two optical twin link receiver modules DEV 7341.
- When combining RF amplifier modules with a matrix switch option, the input of the modules needs to be supplied via cabling options for the RF input.
- Apart from this exception, it is not possible to combine a matrix switch option with cabling options, with distribution options, with a 1+1 redundancy option or with a redundant amplifier option.
- To achieve the optimal performance when applying a matrix switch option, the usage of optical receiver modules with variable gain functionality is recommended.

## Technical Data

### 1+1 Redundancy Options

1+1 redundancy options are offered to realize the redundant transmission of an optically converted RF signal.

The following 1+1 redundancy options are possible for DEV 41x1, distinctions are made regarding the frequency range, impedance/connector, and whether the option is to be applied on the receiver side (Rx) or the transmission side (Tx) of an optical 1+1 redundancy:

- Option 44/75/Rx: Redundancy 1+1 Rx, CATV-Band, 75 Ohm, precision F connectors
- Option 44/75/Tx: Redundancy 1+1 Tx, CATV-Band, 75 Ohm, precision F connectors
- Option 45/50/Rx: Redundancy 1+1 Rx, L-Band, 50 Ohm, SMA connectors
- Option 45/50/Tx: Redundancy 1+1 Tx, L-Band, 50 Ohm, SMA connectors
- Option 45/75/Rx: Redundancy 1+1 Rx, L-Band, 75 Ohm, precision F connectors
- Option 45/75/Tx: Redundancy 1+1 Tx, L-Band, 75 Ohm, precision F connectors

In the following table “4y” stands either for 44 or 45; “zz” stands either for 50 Ohm or 75 Ohm; and “Xx” is used either for Rx (receive side) or Tx (transmit side) of an optical 1+1 redundancy.

### RF Specifications

Frequency range	Option 44/zz/Xx:	47...862 MHz
	Option 45/zz/Xx:	950...2150 MHz
Impedance, connectors	Option 45/50/Xx:	50 Ohm, SMA (f)
	Option 4y/75/Xx:	75 Ohm, precision F (f)
Additional frequency response tolerance		±0,5 dB
Switching cycles	Rx options:	>10E6 (no DC)

### General Specifications

Weight	~0,3 kg
Environmental conditions	ETS 300019 Part 1-3 Class 3.1

### Note:

- 1+1 redundancy options can be installed once per chassis in combination with two single link optical modules.
- 1+1 redundancy options for the DEV 4111 are not available in combination with basic (twin) optical modules.
- The CPU option (Option 59) is required when ordering the chassis with an Rx redundancy option.
- It is not possible to combine a 1+1 redundancy option with cabling options, with distribution options, or with a matrix switch option.

## Technical Data

### Redundant Amplifier Options

Redundant L-Band amplifier options are offered for the DEV 4111 to provide failsafe operation of an RF amplifier application.

The following redundant amplifier options are available, differentiations are made regarding impedance and connector:

- Option 24/50: L-Band Amplifier Redundancy, 50 Ohm, SMA connectors
- Option 24/75: L-Band Amplifier Redundancy, 75 Ohm, precision F connectors

In the following table “zz” stands either for 50 Ohm or 75 Ohm.

### RF Specifications

Number of inputs	1	
Frequency range	950...2150 MHz	
Impedance, connectors	Option 24/50:	50 Ohm, SMA (f)
	Option 24/75:	75 Ohm, precision F (f)
Additional frequency response tolerance	±0,5 dB	
Switching cycles	>10E6 (no DC)	

### General Specifications

Weight	~0,3 kg
Environmental conditions	ETS 300019 Part 1-3 Class 3.1

### Note:

- The redundant amplifier options are not available for the DEV 4101.
- A redundant amplifier option can be installed once per DEV 4111.
- The redundant amplifier option is to be ordered in combination with two RF amplifier modules DEV 11-0059.
- Option 59 is required when ordering the DEV 4111 with a redundant amplifier option.
- It is not possible to combine the redundant amplifier option with cabling options, with distribution options, or with a matrix switch option.

## Technical Data

### RF Amplifier Modules

(Please note, that the technical data for the optical modules is stated in the corresponding Optribution® data sheet!)

#### DEV 15-0011 - Redundant Amplifier Module Extended L-Band (for DEV 4101)

##### RF Specifications

Number of outputs	2
Frequency range	700...2300 MHz
Damage level	+10 dBm
Nominal input level	-10 dBm
Return loss	>16 dB
Group delay	<5 ns
Noise figure	<8 dB

##### Monitoring Port

Impedance, connector	50 Ohm, SMA (f)
Return loss	>18 dB typ.
Frequency response	= input level $\pm 1,0$ dB

##### Bias & Bias Current Alarm

Bias	15+3/-0 V; max. 0,5 A
DEV factory settings:	
• Upper alarm level	350 mA
• Lower alarm level	150 mA (other values are possible)
Alarm indication	Via LED on the front panel

##### General Specifications

Power consumption	16 V; 0,5 A (without bias)
Housing	3 RU (133 mm), 5 HP (25 mm), 160 mm depth
Weight	~0,4 kg
Environmental conditions	ETS 300019 Part 1-3 Class 3.1

##### Note:

- Option 59 is not available for a DEV 4101 equipped with amplifier module(s) DEV 15-0011.

## Technical Data

### DEV 11-0055, DEV 11-0059 - Amplifier Modules (Extended) L-Band (for DEV 4111)

#### RF Specifications

Number of outputs	DEV 11-0059:	1
	DEV 11-0055:	2
Frequency range	(standard):	950...2150 MHz
	Option 25:	700...2300 MHz
Damage level	+10 dBm	
Nominal input level	-10 dBm	
Return loss	>14 dB	
Amplifier gain variation	-5...+20 dB	(with Option 59 only)
Variable tilt	0...9 dB	(with Option 25 and Option 59 only)
Group delay	<5 ns	
Noise figure	<10 dB	

#### Monitoring Port

Impedance, connector	50 Ohm, SMA (f)
Return loss	>18 dB

#### Bias & Bias Current Alarm

Bias	15+3/-0 V; max. 0,5 A	
Adjustable level setting:		
• Upper alarm level	max. 500 mA	(DEV factory setting: 350 mA)
• Lower alarm level	min. 0 mA	(DEV factory setting: 100 mA)
Alarm indication	Via remote communication <sup>1</sup> & via LED on the front panel	

#### RF Sensing

Adjustable threshold level	-20 dBm > threshold level > -60 dBm (DEV factory setting: -40 dBm)
Alarm indication	Via remote communication <sup>1</sup> & via LED on the front panel

#### General Specifications

Power consumption	16 V; 0,4 A (without bias)
Housing	3 RU (133 mm), 4 HP (20 mm), 100 mm depth
Weight	~0,2 kg
Environmental conditions	ETS 300019 Part 1-3 Class 3.1

## Order Information

### Universal Transmission Chassis

DEV 4101	Universal Transmission Chassis 1 RU for 5 HP modules
DEV 4111	Universal Transmission Chassis 1 RU for 4 HP modules
Option 59	CPU for DEV 4101 / DEV 4111 (including 1 Web Interface License) <sup>2</sup>
Option 79	Additional Web Interface License
Option 81	Blanking Plate (to cover an empty slot at the front side)

### Cabling Options <sup>2</sup>

Option 40/I	Input Cabling 50 Ohm, SMA connector for one RF port
Option 40/O	Output Cabling 50 Ohm, SMA connector for one RF port
Option 41/I	Input Cabling CATV-Band, 75 Ohm, prec. F connector for one RF port
Option 41/O	Output Cabling CATV-Band, 75 Ohm, prec. F connector for one RF port
Option 42/I	Input Cabling L-Band, 75 Ohm, precision F connector for one RF port
Option 42/O	Output Cabling L-Band, 75 Ohm, precision F connector for one RF port

### Distribution Options <sup>2</sup>

Option 8/50	1:8, Outputs: 50 Ohm, SMA connectors
Option 8/75	1:8, Outputs: 75 Ohm, precision F connectors
Option 16/50	1:16, Outputs: 50 Ohm, SMA connectors
Option 16/75	1:16, Outputs: 75 Ohm, precision F connectors

### Matrix Switch Option <sup>2</sup>

Option mx8/75	2 or 4 Inputs and 8 Outputs: 75 Ohm, precision F connectors
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### 1+1 Redundancy Options <sup>2</sup>

Option 44/75/Rx	Redundancy 1+1 Rx, CATV-Band, 75 Ohm, precision F connectors <sup>1</sup>
Option 44/75/Tx	Redundancy 1+1 Tx, CATV-Band, 75 Ohm, precision F connectors
Option 45/50/Rx	Redundancy 1+1 Rx, L-Band, 50 Ohm, SMA connectors <sup>1</sup>
Option 45/50/Tx	Redundancy 1+1 Tx, L-Band, 50 Ohm, SMA connectors
Option 45/75/Rx	Redundancy 1+1 Rx, L-Band, 75 Ohm, precision F connectors <sup>1</sup>
Option 45/75/Tx	Redundancy 1+1 Tx, L-Band, 75 Ohm, precision F connectors

### Redundant Amplifier Options <sup>1 2</sup>

Option 24/50	L-Band Amplifier Redundancy, 50 Ohm, SMA connectors
Option 24/75	L-Band Amplifier Redundancy, 75 Ohm, precision F connectors

## DEV 4101 / DEV 4111

## Order Information (cont.)

**Optical Transmitter Modules for DEV 4101**<sup>3</sup>

DEV 7211	Optical Transmitter Module L-Band
DEV 7212	Optical Transmitter Module Extended L-Band
DEV 7221	Optical Transmitter Module CATV-Band

## Connector Options:

Option 08	Optical Connector E2000 HRL
Option 09	Optical Connector SC/APC

**Optical Receiver Modules for DEV 4101**<sup>3</sup>

DEV 7311	Optical Receiver Module L-Band
DEV 7312	Optical Receiver Module Extended L-Band, MGC
DEV 7313	Optical Receiver Module Extended L-Band, MGC/AGC
DEV 7321	Optical Receiver Module CATV-Band

## Connector Options:

Option 08	Optical Connector E2000 HRL
Option 09	Optical Connector SC/APC
Option 37	Short distance option for optical links (less than 10 km) (DEV 7312, DEV 7313 only)
Option 43	Second RF Output (DEV 7311, DEV 7312, and DEV 7313, only) <sup>4</sup>

**RF Amplifier Module for DEV 4101**

DEV 15-0011	Redundant Amplifier Module Extended L-Band
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**Optical Transmitter Modules for DEV 4111**<sup>3</sup>

DEV 7231	Basic Optical Transmitter Module L-Band
DEV 7232	Advanced Optical Transmitter Module L-Band
DEV 7233	Top Performance Optical Transmitter Module Ext. L-Band
DEV 7237	TV Direct Optical Transmitter Module CATV-Band
DEV 7241	Basic Twin Optical Transmitter Module L-Band

## Connector Options:

Option 07	Optical Connector FC/APC
Option 08	Optical Connector E2000 HRL (for DEV 7232 and DEV 7233 only)
Option 09	Optical Connector SC/APC

## Wavelength Options:

Option Lambda 0	$\lambda_0$ : 1310 nm (for DEV 7233 and DEV 7232 only)
Option Lambda 1	$\lambda_1$ : 1470 nm (for DEV 7233 only)
Option Lambda 2	$\lambda_2$ : 1490 nm (for DEV 7233 only)
Option Lambda 3	$\lambda_3$ : 1510 nm (for DEV 7233 only)
Option Lambda 4	$\lambda_4$ : 1530 nm (for DEV 7233 only)
Option Lambda 5	$\lambda_5$ : 1550 nm (for DEV 7233 and DEV 7232 only)
Option Lambda 6	$\lambda_6$ : 1570 nm (for DEV 7233 only)
Option Lambda 7	$\lambda_7$ : 1590 nm (for DEV 7233 only)
Option Lambda 8	$\lambda_8$ : 1610 nm (for DEV 7233 only)

## Order Information (cont.)

### Optical Receiver Modules for DEV 4111 <sup>3</sup>

DEV 7331	Basic Optical Receiver Module L-Band
DEV 7332	Advanced Optical Receiver Module L-Band
DEV 7333	Top Performance Optical Receiver Module Ext. L-Band
DEV 7337	TV Direct Optical Receiver Module CATV-Band
DEV 7341	Basic Twin Optical Receiver Module L-Band
Connector Options:	
Option 07	Optical Connector FC/APC
Option 08	Optical Connector E2000 HRL (for DEV 7332 and DEV 7333 only)
Option 09	Optical Connector SC/APC

### RF Amplifier Modules for DEV 4111

DEV 11-0055	Amplifier Module L-Band, 2 Outputs
DEV 11-0059	Amplifier Module L-Band, 1 Output
Option 25	Extended L-Band Frequency Range plus Tilt Control

## Remarks

- <sup>1</sup> Only with Option 59.
- <sup>2</sup> For conditions and restrictions to apply these options please refer to the corresponding technical data section.
- <sup>3</sup> For information on technical data please refer to the corresponding Optribution<sup>®</sup> data sheet.
- <sup>4</sup> Option 43 is to be ordered for an optical receiver module installed in the DEV 4101, if two cabling options for the RF outputs or a distribution option with 16 outputs are/is to be applied for the chassis.

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