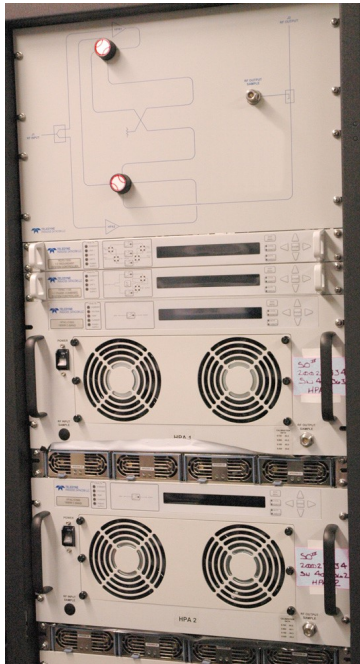


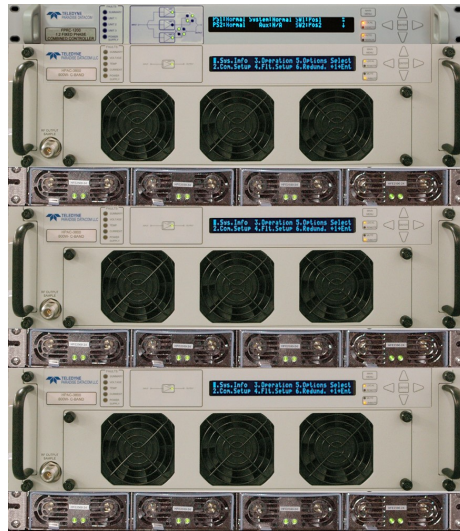
Phase Combined Systems

Indoor Packaged GaAs SSPAs

3RU, 5RU, 6RU & 7RU



**600 W C-Band, 1:1 5RU
Phase Combined System
with FPRC-1100 Controller**



**300W C-Band,
1:2 3RU Phase Combined System
with FPRC-1200 Controller**

DESCRIPTION

Teledyne Paradise Datacom's family of indoor packaged, phase combined solid state power amplifier (SSPA) systems provide the highest degree of redundancy and system reliability. Phase Combined systems can be configured using any combination of Teledyne Paradise Datacom's Indoor Packaged amplifiers.

1:1 Phase Combined Systems are an economical solution to providing high output power capability with the addition of soft-fail redundancy.

1:2 Phase Combined Systems can provide full output power redundancy to mission critical applications which cannot tolerate any decrease in output power capability.

All phase combined systems include a 1RU system controller with a full color touchscreen display and user-friendly menu structure for monitor and control of the system.

FEATURES

- Extremely High Power Density:
To 1.1 kW C-Band
To 1.0 kW X-Band
To 500 W Ku-Band
- True Redundant Chassis Architecture
- Universal Power Factor Corrected Power Supply
- System Output Power Monitor
- SSPA with Touchscreen
- 1RU System Controller with Touchscreen

OPTIONS

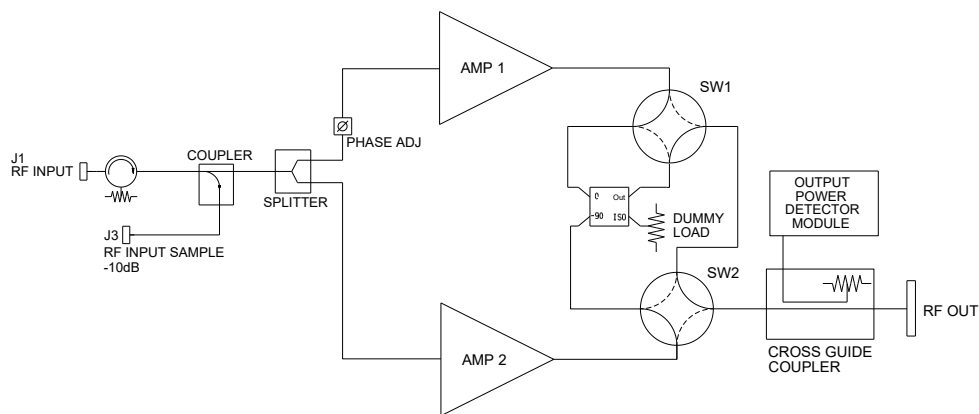
- Reflected Power Monitor
- L-Band Input operation
- SSPA and Controller Remote Panels
- Auxiliary / Maintenance Output Switch
- Cold Standby Amplifier Operation for Prime Power Savings
- External Exhaust Air Ducting Kit
- Custom Configurations

SPECIFICATIONS

- 3 RU SSPA Chassis:
19.0 X 5.22 X 25.25
85 lbs (38.5 kg)
- 5 RU SSPA Chassis:
19.0 X 8.75 X 30.25
150 lbs (68 kg)
- 6 RU SSPA Chassis:
19.0 X 10.47 X 30.25
180 lbs (82 kg)
- 7 RU SSPA Chassis:
19.0 X 12.22 X 30.0
160 lbs (72.5 kg)
- 1 RU System Controller:
19.0 X 1.75 X 13.3
5 lbs (2.3 kg)

1:1 Phase Combined / Redundant System

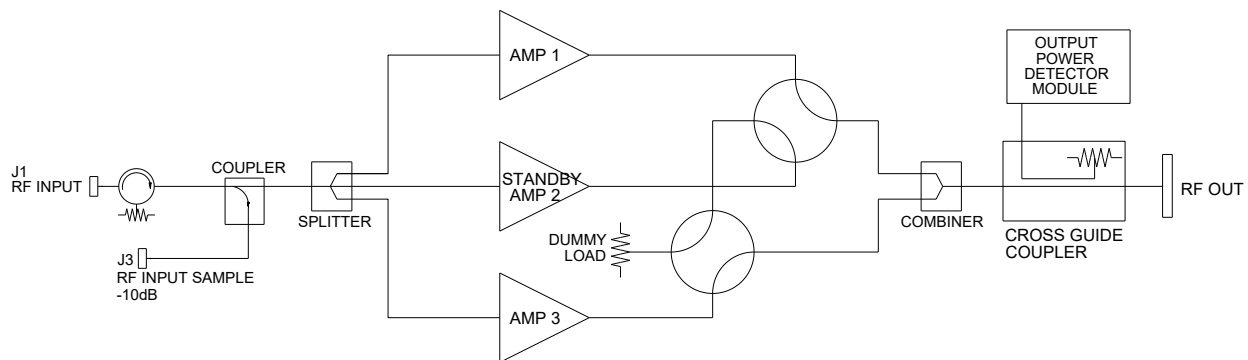
The 1:1 Fixed Phase Combined Redundant System is a popular system architecture that enables two Solid State Power Amplifiers to operate as a normal 1:1 redundant system or a phase combined system. The basic system topology is very similar to a 1:1 redundant system and is shown in the block diagram. An additional switch is included which allows either amplifier to be individually connected to the antenna or connect both amplifiers to a waveguide combiner. The system includes an integrated input sample port along with system level output power detection.



1:1 Phase Combined System Simplified Block Diagram

1:2 Phase Combined / Redundant System

The 1:2 Phase Combined Redundant System is a system architecture that enables Solid State Power Amplifiers to achieve higher output power levels while building in a level of redundancy. The basic system topology is similar to a 1:2 redundant system shown in the block diagram below. Amplifiers #1 and #3 are normally online. The outputs of #1 and #3 are directed by the waveguide switches into a low loss power combiner. In the event of a failure of either on line amplifier, the standby amplifier, #2, can be switched in place of either #1 or #3 and the system maintains **full output power**. The system includes an integrated input sample port along with system level output power detection.



1:2 Phase Combined System Simplified Block Diagram

Phase Combined Systems

Indoor Packaged GaAs SSPAs

3RU, 5RU, 6RU & 7RU



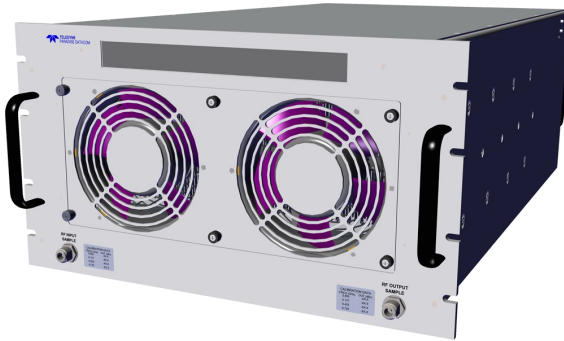
**Single 3RU Chassis
Output Power Levels**

C Band: 75W - 300W
X Band: 200W
Ku Band: 100W - 125W



**Single 5RU Chassis
Output Power Levels**

C Band: 400W - 600W
X Band: 250W - 350W
Ku Band: 200W - 250W



**Single 6RU Chassis
Output Power Levels**

C Band: 800W - 1.1 kW



**Single 7RU Chassis
Output Power Levels**

C Band: 800W - 1.1 kW
X Band: 700W - 1.0 kW
Ku Band: 250W - 500W

System Output Power Capacity

Due to the output waveguide and switches, there is always some residual loss in the output of phase combined HPA systems. This results in slightly less than the ideal 3 dB power addition to the output power of a single HPA unit.

On 1:1 phase combined systems, the typical additive output power is 2.70 dB above the output power of a single HPA. On 1:2 phase combined systems, the typical additive output power is 2.50 dB above the output power of a single HPA.

For example, a 125W Ku-Band Compact Outdoor SSPA in a 1:1 phase combined system would have the following output power:

Single HPA: $P_{1dB} = 50.0 \text{ dBm}$; $P_{sat} = 51.0 \text{ dBm}$

1:1 phase combined system: $P_{1dB} = 52.7 \text{ dBm}$; $P_{sat} = 53.7 \text{ dBm}$

General System Specifications

PARAMETER	NOTES	LIMITS	UNITS
Gain	minimum minimum (units with L-Band input)	70 67	dB dB
Gain Flatness	full band (All except Extended C-Band) Extended C-Band units	± 1.0 ± 1.5	dB dB
Gain Slope	per 40 MHz	± 0.3	dB/40 MHz
Gain Variation vs. Temperature	0°C to +50°C	± 1.0	dB
Gain Stability	at constant temperature	± 0.25	dB/24 hours
Gain Adjustment	0.1 dB resolution	20	dB
Intermodulation Distortion	3dB back off relative to P_{1dB}	-25	dBc
AM/PM Conversion	(@ rated P_{1dB}) (@ $P_{1dB} - 3dB$)	3.5 0.5	°/dB °/dB
Spurious Harmonics	(@ rated P_{1dB}) (@ rated $P_{1dB} - 3dB$)	-65 -50	dBc dBc
Input/Output VSWR		1.50:1	
Noise Figure	at maximum gain	12	dB
Group Delay (per 40 MHz segment)	Linear Parabolic Ripple	0.01 0.003 1.0	ns/MHz ns/MHz ² ns p-p
Noise Output	TX Band RX Band (C-, Ku-Bands) RX Band (X-Band)	-75 - 150 - 100	dBW/4 KHz dBW/4 KHz dBW/4 KHz
Residual AM Noise	0 - 10 KHz 10 KHz - 500 KHz 500 KHz - 1 MHz	-45 -20 (1.25 + log F) -80	dBc dBc dBc
Phase Noise		IESS -308/309 - 10 dB	

Mechanical

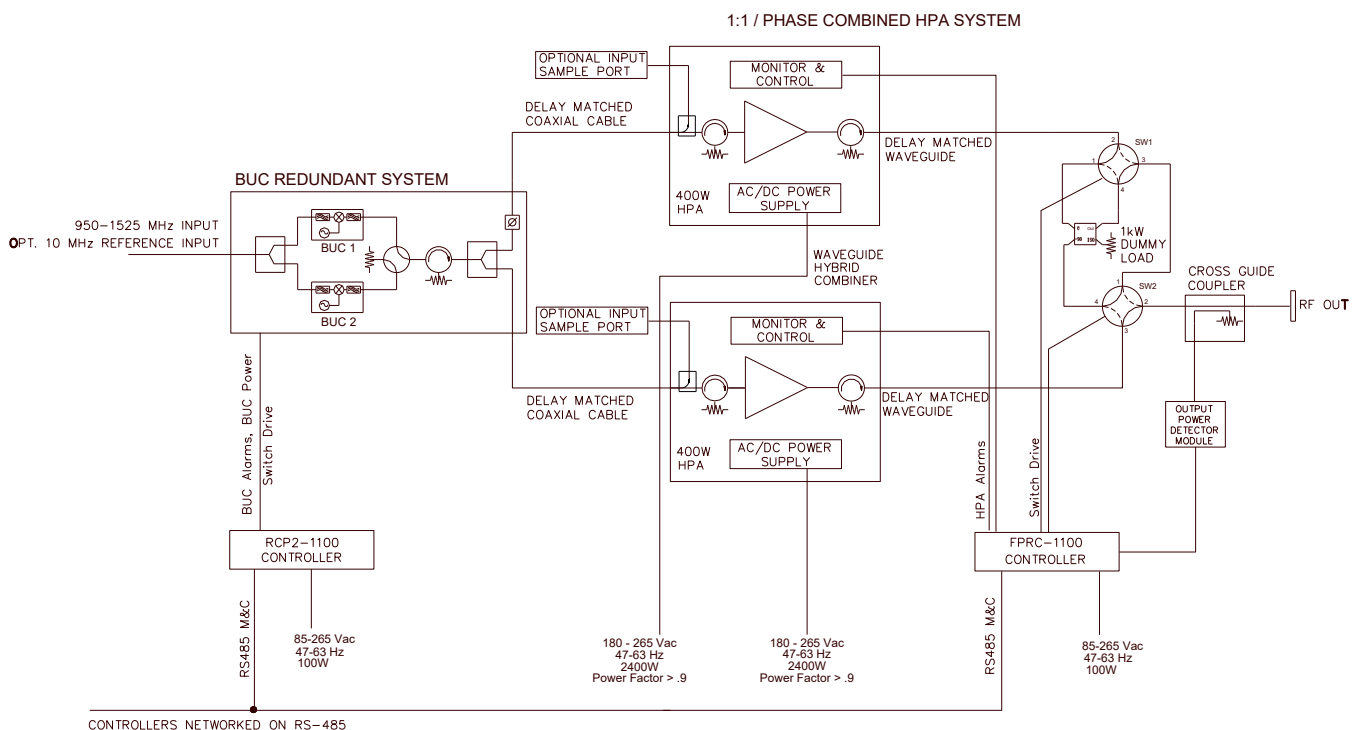
Size		width x height x depth 19.0 x 5.22 x 25.25 (483 x 133 x 641) 19.0 x 8.75 x 30.25 (483 x 222 x 768) 19.0 x 10.47 x 30.25 (483 x 266 x 768) 19.0 x 12.22 x 30.0 (483 x 310 x 762) 19.0 x 1.75 x 16.1 (483 x 44 x 409)	inches (mm) inches (mm) inches (mm) inches (mm) inches (mm)
Weight		85 (38.5) 150 (68) 180 (82) 160 (72.5) 29 (13)	lbs. (kg) lbs. (kg) lbs. (kg) lbs. (kg) lbs. (kg)
Finish		powder coat	Gray

Environmental

Operating Temperature	Ambient	0 to +50	°C
Relative Humidity	Condensing	95	%
Cooling System	Integrated	Forced air	

L-Band Operation

Teledyne Paradise Datacom Phase Combined HPA Systems can be configured for L-Band Input operation. For optimum RF phase combining over the entire bandwidth of a communication amplifier, the frequency translation part of the system must be separated from the phase combining loop. Therefore, systems with L-Band input are configured with a separate 1:1 system of L-Band Block Up Converters that feed the 1:1 or 1:2 Phase Combined HPA system. If L-Band redundancy is not required, the system can be configured with a single thread L-Band Block Up Converter.



The Block Up Converter system is housed in a 1RU rack-mountable enclosure and controlled by a RCP2-1100 Redundant Controller. The Up Converters can be configured with internal reference oscillators or external reference oscillators. The Teledyne Paradise Datacom zBUC® architecture allows a converter that is fitted with an internal reference oscillator to automatically detect and switch to an externally applied 10 MHz reference signal.

Optional input sample ports on each SSPA chassis are available on L-Band Input Phase Combined Systems to allow the user to monitor the output of the block up converter.

L-Band Operation

Teledyne Paradise Datacom amplifiers are available with an integrated L-Band Block Up Converter. L-Band units utilize Teledyne Paradise Datacom's proprietary zBUC technology. The addition of a zBUC® converter to the SSPA typically increases the gain by 2-4 dB. The advantages of zBUC technology include:

- zBUC converter can detect and switch to an externally supplied reference.
- Optional internal high stability (10MHz) reference.
- zBUC converter can lock to an externally supplied reference of 10 or 50 MHz.
- zBUC converter can accept a wide range of external reference power (-10 to +5 dBm).

Available Frequency Plans

Band	Model Number	IF Input	LO Frequency	RF Output
C	Sub-Band "A"	950 - 1525 MHz	4.900 GHz	5.850 - 6.425 GHz
C	Sub-Band "B"	950 - 1825 MHz	4.900 GHz	5.850 - 6.725 GHz
C	Sub-Band "C"	950 - 1870 MHz	4.800 GHz	5.750 - 6.670 GHz
C	Sub-Band "E"	950 - 1250 MHz	5.475 GHz	6.425 - 6.725 GHz
C	Sub-Band "F"	950 - 1250 MHz	5.775 GHz	6.725 - 7.025 GHz
C	Sub-Band "G"	950 - 1675 MHz	4.800 GHz	5.750 - 6.475 GHz
X	Sub-Band "A"	950 - 1450 MHz	6.950 GHz	7.900 - 8.400 GHz
Ku	Sub-Band "A"	950 - 1450 MHz	13.050 GHz	14.00 - 14.50 GHz
Ku	Sub-Band "B"	950 - 1700 MHz	12.800 GHz	13.75 - 14.50 GHz

Electrical Specifications for RM SSPA Systems with ZBUC converter

PARAMETER	NOTES	LIMITS				UNITS
Gain	Nominal setting	75				dB
Gain Flatness	full band (C-,X-,Ku-bands)	± 2.0				dB
Gain Slope	per 40 MHz (C-,X-,Ku-bands)	± 0.5				dB/40 MHz
Gain Adjusted Range	Typical C-Band Adj. Range	20				dB
	Typical Ku-Band Adj. Range	60 - 80				dB
Gain Stability	-40 to +60 °C	57 - 77				dB
		± 1.5				dB
Phase Noise	Offset frequency from carrier	<u>Absolute max.</u>	<u>C-band (typ.)</u>	<u>X-band (typ.)</u>	<u>Ku-band (typ.)</u>	
	10 Hz	-30	-60	-58	-56	dBc/Hz
	100 Hz	-60	-74	-70	-67	dBc/Hz
	1 KHz	-70	-84	-80	-78	dBc/Hz
	10 KHz	-80	-100	-94	-91	dBc/Hz
	100 KHz	-90	-105	-97	-94	dBc/Hz
	1 MHz	-90	-125	-122	-120	dBc/Hz
Spurious	In-Band Signal Related (C-/Ku-Band)	-50				dBc
	(Extended C-Band)	-40				dBc
	Close to Carrier Spurious (≤ 20 MHz)	-50				dBc
	Local Oscillator	-30				dBm
Noise Figure	At Maximum gain	20				dB
Transmit Band Noise Output Power Density	Tx Band at Maximum gain	-65				dBW/4kHz
Input VSWR	L-Band	1.5 : 1				
Internal Reference Option	Reference Accuracy (initial)	± 1 • 10 ⁻⁸				
	Aging per day (after 30 days)	± 1 • 10 ⁻⁹				
	Aging per year (after 30 days)	± 6 • 10 ⁻⁸				
	Reference Stability over Temperature (-40 to +40 °C, ambient)	± 1 • 10 ⁻⁸				

System Controller



System Controller Configured for 1:1 Phase Combined Mode



System Controller Configured for 1:2 Phase Combined Mode

The 1RU system controller with touchscreen display is the heart of the Phase Combined SSPA System. It provides an extremely user friendly interface for complete monitor and control of the high power amplifiers. The front panel mimic display shows the on-line amplifiers and the switch positions. Fault indicators are provided for easy indication of system status.

All controller monitor and control is available locally at the front panel touchscreen display, as well as remotely by the RS232, RS485, or Ethernet interface ports. Audible alarms and a full compliment of parallel I/O signal are available at the rear panel of the controller.

The system controller allows the Phase Combined System of amplifiers to be controlled as if it were a single SSPA. The FPRC is the single point of interface for either local, front panel, or remote control. System monitor and control capability include gain adjustment, output power monitoring (dBm or Watts), and alarms.

The controller contains its own internal redundant components including fully redundant power supplies.

Phase Combined Systems

Indoor Packaged GaAs SSPAs

3RU, 5RU, 6RU & 7RU

Part Number Configuration, 2nd Generation 3 RU GaAs SSPA

HPA **C** **3** **3** **0** **0** **A** **S** **M** **G** **S** **X** **P** **2** — 2nd Generation

Band	
C-Band	C
X-Band	X
Ku-Band	K

Rack Height	
3RU	3

Power Level (Watts)	
C-Band	075, 100, 140, 200, 250, 300
X-Band	200
Ku-Band	100, 125

Frequency Sub Band	
C-Band	
A ¹	5.850 to 6.425 GHz
B ¹	5.850 to 6.725 GHz
C ¹	5.750 to 6.670 GHz
E ¹	6.425 to 6.725 GHz
F ¹	6.725 to 7.025 GHz
G ¹	5.750 to 6.475 GHz
X-Band	
A ¹	7.90 to 8.40 GHz
F	7.10 to 7.40 GHz
Ku-Band	
A ¹	14.00 to 14.50 GHz
B ¹	13.75 to 14.50 GHz

¹ Available with optional BUC

Package	
S	Rack Mount, Top Mounted Waveguide Switching, with cabinet
T	Rack Mount, Top Mounted Waveguide Switching, without cabinet
Y	Rack Mount, Rear Mounted Waveguide Switching, with cabinet
Z	Rack Mount, Rear Mounted Waveguide Switching, without cabinet

Configuration Modifier 3	
P	1RU N+1 Power Supply
L ¹	1RU N+1 Power Supply & Rear Exhaust Adapters

¹ Not available with Package options 'Y' or 'Z'

Configuration Modifier 2	
X	Standard
P	Front Panel Power Switch
R ¹	Receive Band Reject Filter
V	Reflected Power Monitor
A ¹	P + R (see above)
B	P + V (see above)
C ¹	V + R (see above)
D ¹	P + R + V (see above)

¹ X-Band only

Configuration Modifier 1	
X	Standard
K	110 VAC Input
S	Input Sample Port
C	K + S (see above)

System Configuration	
E	1:2 Fixed Phase Combined System, Input Splitter, FPRC-1200*
G	1:1 Fixed Phase Combined System, Input Splitter, FPRC-1100*

¹ Standard location for RCP is directly above HPA1

Block Up Converter	
M	Internal Reference BUC
P	External Reference BUC
X	No BUC

COMMENTS:

Phase Combined Systems

Indoor Packaged GaAs SSPAs

3RU, 5RU, 6RU & 7RU

Part Number Configuration, 5 RU GaAs SSPA

HPA **C** **5** **5** **0** **0** **A** **S** **M** **B** **S** **X** **P**

Band	
C-Band	C
X-Band	X
Ku-Band	K

Rack Height	
5RU	5

Power Level (Watts)	
C-Band	400, 500, 600
X-Band	250, 350
Ku-Band	200, 250

Frequency Sub Band	
C-Band	
A ¹	5.850 to 6.425 GHz
B ¹	5.850 to 6.725 GHz
C ¹	5.750 to 6.670 GHz
E ¹	6.425 to 6.725 GHz
F ¹	6.725 to 7.025 GHz
H	5.715 to 5.790 GHz
L ¹	4.400 to 5.000 GHz
X-Band	
A ¹	7.90 to 8.40 GHz
F	7.10 to 7.40 GHz
Ku-Band	
A ¹	14.00 to 14.50 GHz
B ¹	13.75 to 14.50 GHz

¹ Available with optional BUC

Package	
S	Rack Mount, Top Mounted Waveguide Switching, with cabinet
T	Rack Mount, Top Mounted Waveguide Switching, without cabinet
Y	Rack Mount, Rear Mounted Waveguide Switching, with cabinet
Z	Rack Mount, Rear Mounted Waveguide Switching, without cabinet

Configuration Modifier 3	
P	1RU N+1 Power Supply
L ¹	1RU N+1 Power Supply & Rear Exhaust Adapters

¹ Not available with Package options 'Y' or 'Z'

Configuration Modifier 2	
X	Standard
R ¹	Receive Band Reject Filter
V	Reflected Power Monitor
C ¹	V + R (see above)

¹ X-Band only

Configuration Modifier 1	
X	Standard
S	Input Sample Port

System Configuration	
E	1:2 Fixed Phase Combined System, Input Splitter, FPRC-1200*
G	1:1 Fixed Phase Combined System, Input Splitter, FPRC-1100*

¹ Standard location for RCP is directly above HPA1

Block Up Converter	
M	Internal Reference BUC
P	External Reference BUC
X	No BUC

COMMENTS:

Phase Combined Systems

Indoor Packaged GaAs SSPAs

3RU, 5RU, 6RU & 7RU

Part Number Configuration, 6 RU GaAs SSPA

HPA **C** **6** **8** **0** **0** **A** **S** **M** **G** **S** **X** **P**

Band	
C-Band	C

Rack Height	
6RU	6

Power Level (Watts)	
C-Band	800, 900, 1100 (11K)

Frequency Sub Band	
C-Band	
A ¹	5.850 to 6.425 GHz
B ¹	5.850 to 6.725 GHz
C ¹	5.750 to 6.670 GHz
E ¹	6.425 to 6.725 GHz
F ¹	6.725 to 7.025 GHz
G	5.750 to 6.475 GHz

¹ Available with optional BUC

Package	
S	Rack Mount, Top Mounted Waveguide Switching, with cabinet
T	Rack Mount, Top Mounted Waveguide Switching, without cabinet
Y	Rack Mount, Rear Mounted Waveguide Switching, with cabinet
Z	Rack Mount, Rear Mounted Waveguide Switching, without cabinet

Configuration Modifier 3	
P	1RU N+1 Power Supply
L ¹	1RU N+1 Power Supply & Rear Exhaust Adapters

¹ Not available with Package options 'Y' or 'Z'

Configuration Modifier 2	
X	Standard
V	Reflected Power Monitor

Configuration Modifier 1	
X	Standard
S	Input Sample Port

System Configuration	
E	1:2 Fixed Phase Combined System, Input Splitter, FPRC-1200*
G	1:1 Fixed Phase Combined System, Input Splitter, FPRC-1100*

¹ Standard location for RCP is directly above HPA1

Block Up Converter	
M	Internal Reference BUC
P	External Reference BUC
X	No BUC

COMMENTS:

Phase Combined Systems

Indoor Packaged GaAs SSPAs

3RU, 5RU, 6RU & 7RU

Part Number Configuration, 2nd Generation 7 RU GaAs SSPA

HPA **C** **7** **1** **1** **K** **A** **S** **M** **B** **S** **X** **P** **2** — 2nd Generation

Band	
C-Band	C
X-Band	X
Ku-Band	K

Rack Height	
7RU	7

Power Level (Watts)	
C-Band	800, 900, 1100 (11K)
X-Band	700, 1000 (10K)
Ku-Band	250, 400, 500

Frequency Sub Band	
C-Band	
A ¹	5.850 to 6.425 GHz
B ¹	5.850 to 6.725 GHz
C ¹	5.750 to 6.670 GHz
E ¹	6.425 to 6.725 GHz
F ¹	6.725 to 7.025 GHz
G ¹	5.750 to 6.475 GHz
X-Band	
A ¹	7.90 to 8.40 GHz
B	7.50 to 8.50 GHz
C	9.50 to 10.50 GHz
D	7.70 to 8.40 GHz
Ku-Band	
A ¹	14.00 to 14.50 GHz
B ¹	13.75 to 14.50 GHz

¹ Available with optional BUC

Package	
S	Rack Mount, Top Mounted Waveguide Switching, with cabinet
T	Rack Mount, Top Mounted Waveguide Switching, without cabinet
Y	Rack Mount, Rear Mounted Waveguide Switching, with cabinet
Z	Rack Mount, Rear Mounted Waveguide Switching, without cabinet

Configuration Modifier 3	
P	1RU N+1 Power Supply
L ¹	1RU N+1 Power Supply & Rear Exhaust Adapters

¹ Not available with Package options 'Y' or 'Z'

Configuration Modifier 2	
X	Standard
R ¹	Receive Band Reject Filter
V	Reflected Power Monitor
C ¹	V + R (see above)

¹ X-Band only

Configuration Modifier 1	
X	Standard
S	Input Sample Port

System Configuration	
E	1:2 Fixed Phase Combined System, Input Splitter, FPRC-1200*
G	1:1 Fixed Phase Combined System, Input Splitter, FPRC-1100*

¹ Standard location for RCP is directly above HPA1

Block Up Converter	
M	Internal Reference BUC
P	External Reference BUC
X	No BUC

COMMENTS:

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Specifications are subject to change without notice.