

100W Ku-Band 1:2 Phase Combined SSPA System with FPRC-1200 Controller



125W Ku-Band 1:1 Phase Combined SSPB System with FPRC-1100 Controller and RCP2-1100 Controller for L-Band redundancy



1 kW C-Band, 1:1 Phase Combined High Power Outdoor SSPA System

DESCRIPTION

Paradise Datacom's family of outdoor packaged, phase combined solid state power amplifier (SSPA) systems provide the highest degree of redundancy and system reliability. Phase Combined amplifier systems can be configured using Paradise Datacom's High Power Outdoor amplifiers.

1:1 Phase Combined Systems are an economical solution to providing high output power capability with 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.

Both 1:1 and 1:2 Phase Combined Systems utilize a signal box through which all RF and L-band input signals are distributed. This ensures that any reference signal is modulated to each amplifier at the same frequency, and that the phase adjustment is optimized.

FEATURES

- Extremely High Power Density:
 - 1.2 kW C-Band;
 - 1.2 kW S-Band;
 - 600 W X-Band;
 - 500 W Ku-Band
- Universal Power Factor Corrected Power Supply
- System Output Power Monitor

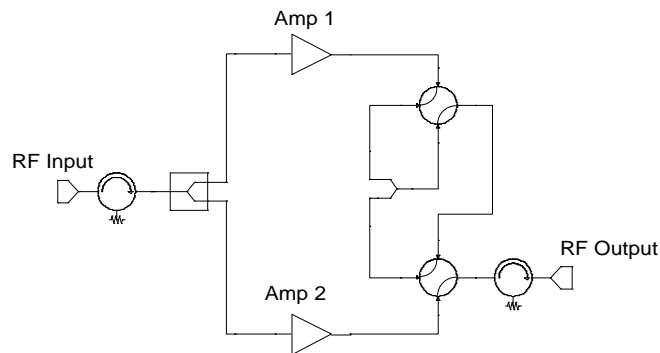
OPTIONS

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



1:1 Phase Combined / Redundant System

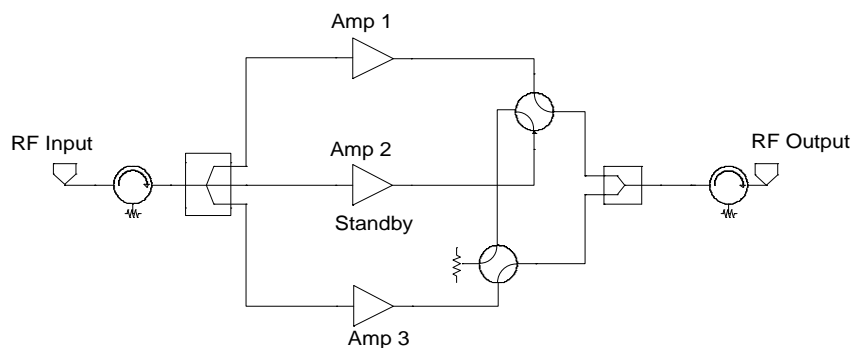
The 1:1 Fixed Phase Combined Redundant System is a popular system architecture that enables two Solid State Power Amplifiers to operate as a normal 1:1 redundant system or a phase combined system. The basic system topology is very similar to a 1:1 redundant system and is shown in the block diagram. An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



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**.



1:2 Phase Combined System Simplified Block Diagram



Outdoor Systems are configured with Paradise Datacom's popular High Power Outdoor or Compact Outdoor SSPA packages



High Power Outdoor Enclosure
Output Power Levels

S-Band: 400W - 600W
C-Band: 400W - 600W
X-Band: 350W - 500W
Ku-Band: 200W - 250W



Compact Outdoor
Output Power Levels

S-Band: 50W - 300W
C-Band: 30W - 300W
X-Band: 60W - 250W
Ku-Band: 10W - 125W

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 3dB 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:

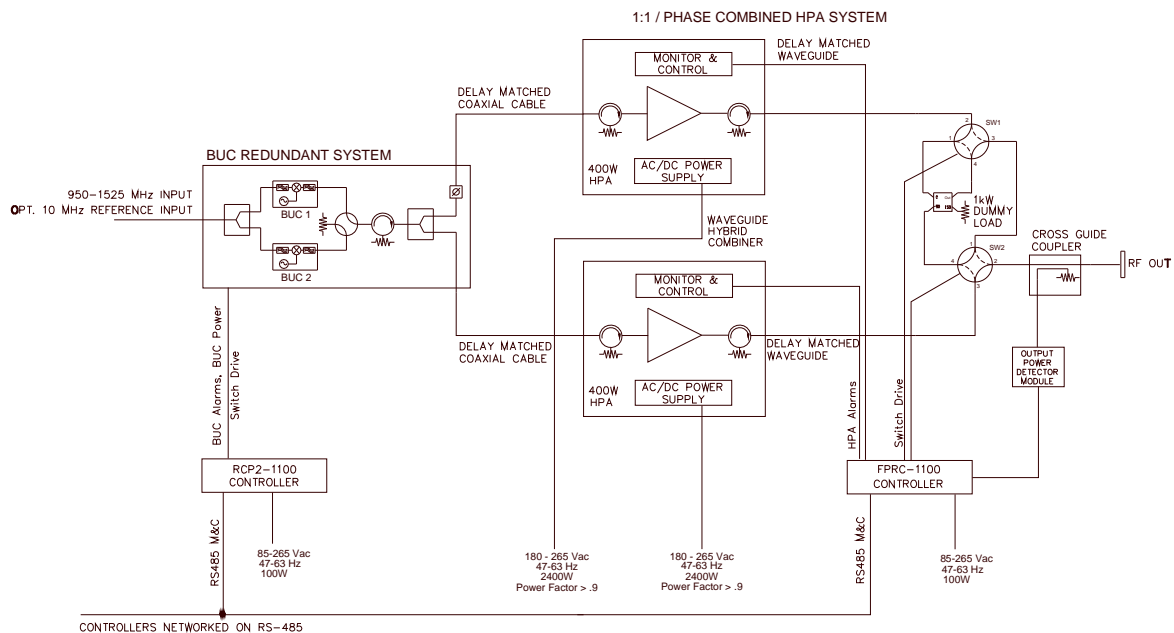
Single HPA: $P_{1dB} = 50.0$ dBm; $P_{sat} = 51.0$ dBm

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



L-Band Operation

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.

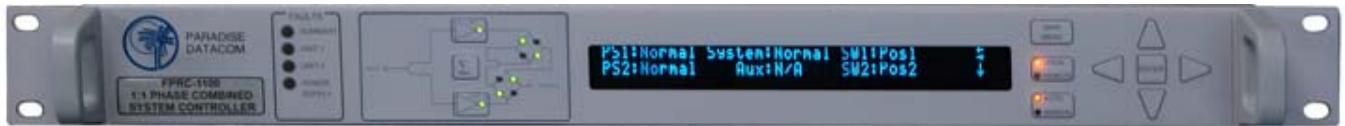


The Block Up Converter system is housed in a weather-proof enclosure (shown below) and controlled by an indoor RCP2-1100 Redundant Controller. The Up Converters can be configured with internal reference oscillators or external reference oscillators. The Paradise Datacom ZBUC architecture allows a converter that is fitted with an internal reference oscillator to automatically detect and switch to an externally applied 10 MHz reference signal.

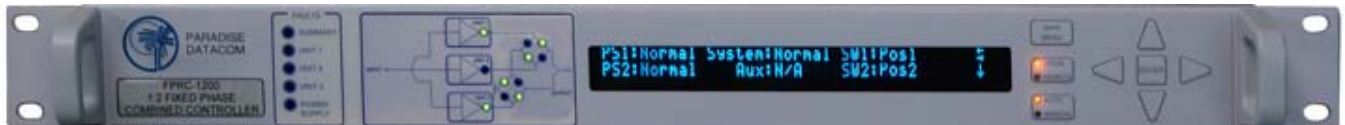




System Controllers



FPRC-1100 1:1 Phase Combined System Controller



FPRC-1200 1:2 Phase Combined System Controller

The FPRC-1X00 is the heart of the Redundant 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 lights are provided for easy indication of system status.

All FPRC-1X00 monitor and control is available locally at the front panel LCD 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 FPRC-1X00.

The FPRC-1X00 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 FPRC-1X00 is a 1RU indoor control unit that contains its own internal redundant components including fully redundant power supplies.

Note: Systems can be configured without the use of a system controller. Consult the factory for operation of phase combined systems without a system controller.



General System Specifications

PARAMETER	NOTES	LIMITS	UNITS
Gain	minimum	75	dB
Gain Flatness	full band (all except Extended C-Band)	±1.0	dB
	Extended C-Band units	±1.5	dB
Gain Slope	per 40 MHz	±0.3	dB/40 MHz
Gain Variation vs. Temperature	-40 to +60°C	±1.0	dB
Gain Adjustment	0.1 dB resolution adjustable by either serial or analog voltage input: 0.5 to 2.5 VDC	20	dB
Intermodulation Distortion	3dB back off relative to P _{1dB}	-25	dBc
AM/PM Conversion	(@ rated P _{1dB})	3.5	°/dB
	(@ P _{1dB} -3dB)	1.0	°/dB
Spurious	(@ rated P _{1dB})	-60	dBc
Harmonics	(@ rated P _{1dB} -3dB) (C-,X-,Ku-bands)	-50	dBc
	(@ rated P _{1dB} -3dB) (S-band)	-30	dBc
Input/Output VSWR	All units except Extended C-Band Extended C-Band units	1.30:1 1.50:1	
Noise Figure	at maximum gain (C-,X-,Ku-bands)	10	dB
	at maximum gain (S-band)	8	dB
Group Delay (per 40 MHz segment)	Linear	0.01	ns/MHz
	Parabolic	0.003	ns/MHz ²
	Ripple	1.0	ns p-p
Transmit Band Noise Output Power Density	TX Band	-75	dBW/4 KHz
	RX Band (C- or Ku-bands)	-150	dBW/4 KHz
	RX Band (X-Band)	-100	dBW/4 KHz
	RX Band (S-Band)	See options	
Receive Band Noise Output Power Density	S-Band, with optional filter	-155	dBW/4 KHz
	S-Band, without optional filter	-95	dBW/4 KHz
Residual AM Noise	0 - 10 KHz	-45	dBc
	10 KHz - 500 KHz	-20 (1.25 + log F)	dBc
	500 KHz - 1 MHz	-80	dBc
Phase Noise	Offset frequency from carrier		
	10 Hz	-90	dBc/Hz
	100 Hz	-100	dBc/Hz
	1 KHz	-110	dBc/Hz
	10 KHz	-120	dBc/Hz
	100 KHz	-125	dBc/Hz
	1 MHz	-130	dBc/Hz

Environmental

Operating Temperature	Ambient	-40 to +60	°C
Relative Humidity	condensing	100	%
Cooling System	integrated	Forced air	

Mechanical

Size, High Power Outdoor	width X length X height	21.0 X 27.95 X 13.5 533 X 710 X 343	inches mm
Size, Compact Outdoor	width X length X height	10.0 X 19.5 X 6.50 254 X 495 X 165	inches mm
Weight, High Power Outdoor		125 (57)	lbs.(kg)
Weight, Compact Outdoor	S-/C-/X-Band to 200W / Ku-Band to 70W 250W C,X-Band / 100, 125 W Ku-Band	36 (16.4) 44 (20.0)	lbs.(kg) lbs.(kg)
Finish		Paint	White; powder coat

Specifications are subject to change.



Part Number Configuration, High Power Outdoor System

HPA 2 W

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

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

Frequency Sub Band
S-Band
A - 2.020 - 2.120 GHz
B - 2.200 - 2.300 GHz
C-Band
A* - 5.85 - 6.425 GHz
B* - 5.85 - 6.725 GHz
C - 5.75 - 6.670 GHz
E* - 6.425 - 6.725 GHz (Palapa)
F* - 6.725 - 7.025 GHz (Insat)
G* - 5.750 - 6.475 GHz
X-Band
A* - 7.90 - 8.40 GHz
B - 7.50 - 8.50 GHz
D - 7.70 - 8.40 GHz
E - 7.75 - 8.50 GHz
Ku-Band
A* - 14.00 - 14.50 GHz
B* - 13.75 - 14.50 GHz

* Available with optional ZBUC

Configuration Modifier
XXX = Standard
SXX = Input Sample
XVX = Reflected Power Monitor
XXR* = Receive Band Reject Filter

* S-Band only, 400W max.

System Configuration
E = 1:2, Input Splitter, FPRC-1200*
G = 1:1, Input Splitter, FPRC-1100*
J = 1:2, Input Splitter, Internal control
S = System (Custom)

* Standard Cable Length of 100 ft. (30m) with FPRC

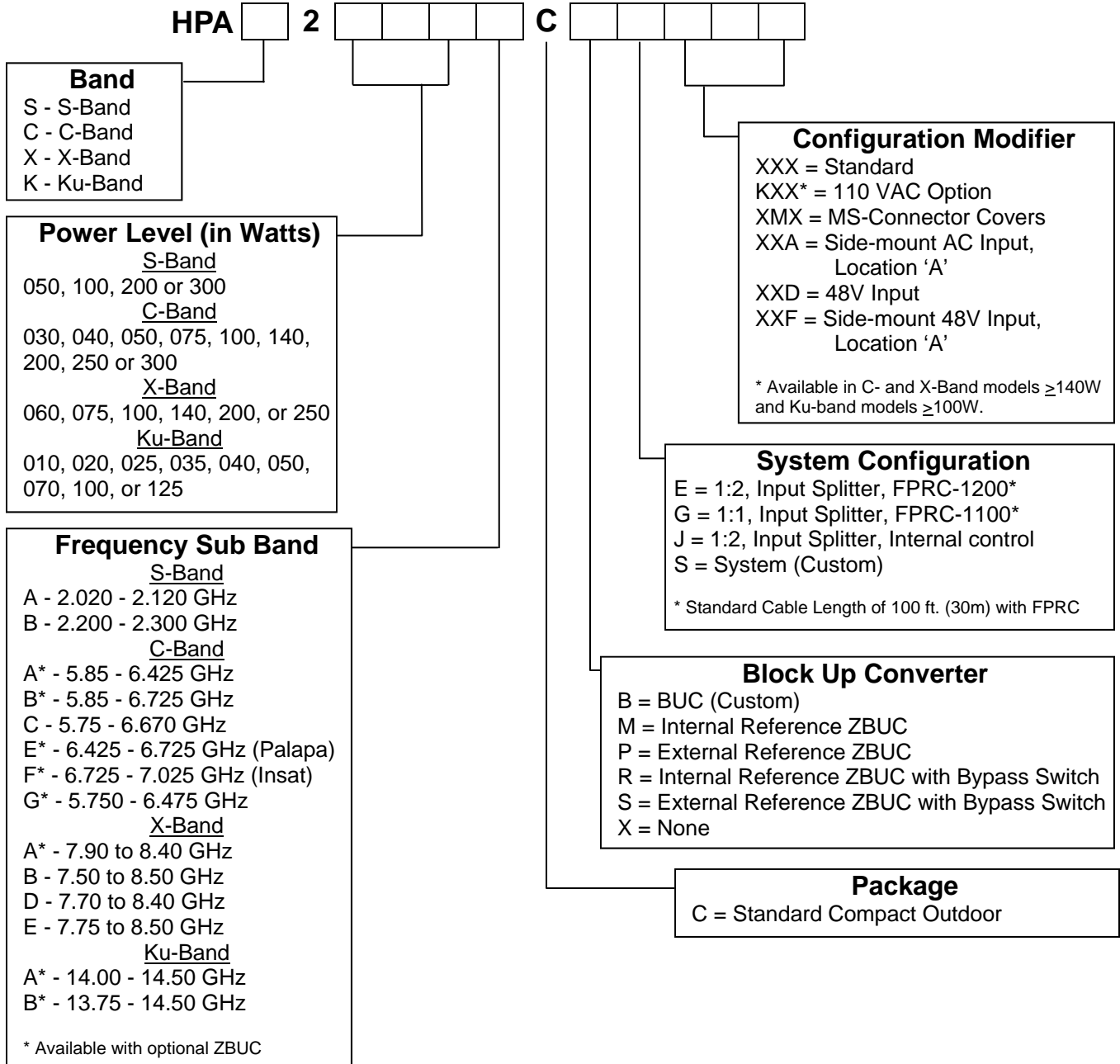
Block Up Converter
B = BUC (Custom)
M = Internal Reference ZBUC (FSK)
P = External Reference ZBUC (FSK)
X = None

Package
W = Weather proof (NEMA)

Example - A 400W S-Band 1:2 Fixed Phase Combined High Power Outdoor SSPA System with a FPRC-1200 controller and no block up converter is part number: **HPAS2400AWXEXXX**.



Part Number Configuration, Compact Outdoor Systems



Example - A 1:1 standard frequency 70W Ku-Band Compact Outdoor SSPA system with input splitter and internal control with an external reference BUC is part number: **HPAK2070ACBPXXX**.