

HRFA5000 Hybrid Raman/Er-doped Fiber Amplifier



Description

1. Erbium-doped Fiber Amplifier, due to multiple cascades and the accumulation of noise caused by spontaneous emission, will reduce the system CNR greatly and thus it will limit the transmission capacity and distance of the system. Raman Fiber Amplifier (RFA) is a newly designed fiber amplifier based on Stimulated Raman Scattering (SRS) effect. It is considered as the core technology of new generation DWDM fiber over-long communication. Compared with Erbium-Doped Fiber Amplifier, Raman amplifier has the advantage of low Noise Figure (NF), wider gain bandwidth, flexible gain spectral region and stable temperature. It is the only device that can operate in 1300~1600nm.

2. The gain medium of EDFA is Erbium-doped Fiber (EDF). It is a separated amplifier and its signal light can only be amplified after putting into EDFA. The gain medium of Distributed Raman Amplifier is Single Mode Fiber (SMF) which is for signal light transmission. Its gain area is distributed at long transmitting fiber that is 25km from the output end. That is to say, the signal light is amplified 25km before it reaches the output end of the transmitting fiber.

3. Low noise figure marks the super advantages as following:

4. ① During Single Mode Fiber(G.652) transmission, adopting Distributed Raman Amplifier, it can reduce the loss for 5.5dB (Typical value) at effective cross-distance. Compared with EDFA, it equals that the effective distance is reduced for 25km, (fiber loss is calculated as 0.22dB/km). Therefore, the input power to the fiber is reduced and the damage of fiber non-linearity effect (SBS) is weakened.

5. ② In OSNR calculation, the Equivalent Noise Figure of distributed backward pump Raman Amplifier is 0dB, typical value 0 ~ -2dB, which has remarkable help for improvement of cross-band length, increase system

OSNR and transmission distance.

5. But Raman amplifier also has its disadvantages. Its gain is very low, not exceed 16 dB in actual application. Although the noise figure of EDFA is incomparable with Raman amplifier, its small signal gain can be higher than 30dBm. So the Raman amplifier is always combined with EDFA in system application. Hybrid Raman Amplifier combined both the two amplifiers is an ideal solution.

6. When a backward EDFA (If GP=10dBm, NF=5.5Db) combines with one pre-distributed Raman Amplifier (if GP=10dB, NF=-0.5dB), the gain of hybrid Raman amplifier (Raman + EDFA) will reach to GP=200Db and NF=0.96dB.

7. 5. Huatai HRFA5000 is a combination of RFA and EDFA to get flat Gain spectrum and high Optical Signal Noise Ratio (OSNR). The un-relayed distance can be extended up to 30~50km and CNR can be improved for 4.5~6dB.

Feature

Perfect laser APC, AGC, ATC closed-looped circuit ensuring long life and stable operation of the pump laser.

Low noise figure and flat gain.

Adopts famous Fitel Raman pump laser.

Different Raman gain and EDFA output power optional, suitable for different networks.

Optimized structure, easy to use.

Application

Fiber CATV system, extra-long trunk that is inconvenient for building relay station.

Relay distance > 60Km.

Single span distance > 80Km.

DWDM, CATV extra-long trunk optical transmission system.

Submarine optical transmission system

Specification

Performance		Min	Typ	Max	Supplement	
Optic feature	Work wavelength	(nm)	1528		1563	HRFA5000 C-Band
	Pump optic transmission power	(mW)	400			
	Raman switch gain	(dB)	5.5	6	7	HRFA5206
			7	8	9	HRFA5208
			9	10	11	HRFA5210
			11	12	13	HRFA5212
			13	14	15	HRFA5214
			15	16	16.5	HRFA5216
	EDFA gain	(dB)	10			
	EDFA output power	(dB)	13			
	Gain flatness	(dB)		1.0		HRFA5200 (With GFF)
				2.0		HRFA5200 (Without GFF)
	Noise ratio	(dB)			4.5	
	Polarize mode dispersion	(ps)			0.2	
Polarize related gain	(dB)			0.4		
Polarize related loss	(dB)		0.1			
General	Work voltage	(V)	90		250	-48VDC optional

feature	Power Consume	(W)		30	
	Work temp	(°C)	0		60
	Work humidity	(%)	5		95
	Storage temp	(°C)	-40		+85
	Size 1U (W)×(D)×(H)		19×14.5×1.75 (")		
			483×368×44 (mm)		
Size 2U (W)×(D)×(H)		19×14.5×3.5 (")			
		483×368×89 (mm)			

Notes: work wavelength and pumping optical power can be tailored according to the customer's request

Product series

Model	Work wavelength (nm)	Gain flatness (dB)	Raman Switch gain (dB)	EDFA output power (dBm)
HRFA5206-13	1528~1563	<±2	6 (-0.5~+1)	>13dBm
HRFA5208-13	1528~1563	<±2	8±1.0	>13dBm
HRFA5210-13	1528~1563	<±2	10±1.0	>13dBm
HRFA5212-13	1528~1563	<±2	12±1.0	>13dBm
HRFA5214-13	1528~1563	<±2	14±1.0	>13dBm
HRFA5216-13	1528~1563	<±2	16 (-1~+0.5)	>13dBm
HRFA5206-13/F	1528~1563	<±1.0	6 (-0.5~+1)	>13dBm
HRFA5208-13/F	1528~1563	<±1.0	8±1.0	>13dBm

HRFA5210-13/F	1528~1563	<±1.0	10±1.0	>13dBm
HRFA5212-13/F	1528~1563	<±1.0	12±1.0	>13dBm
HRFA5214-13/F	1528~1563	<±1.0	14±1.0	>13dBm
HRFA5216-13/F	1528~1563	<±1.0	16 (-1~+0.5)	>13dBm

Notes: 1. Optical raman amplifier with opposite phase PUMP (phasing back PUMP).

2. F model, built-in gain flatness filter GFF.

3. F model, built-in gain flatness filter GFF.

4. F model, built-in gain flatness filter GFF.

Ordering information

HRFA 5 2 □□ - □□ / □

Raman Optical Amplifier		Wavelength		Number of pump wavelength		Raman Switch Gain		EDFA output power		Gain flatness	
HRFA	Hybrid Raman/Er-doped optical amplifier	5	C-Band	2	Dual-wavelength	08	7~8.5dB	13	13dBm	0	Without GFF <±2.0
		6	L-Band	3	Three-wavelength	10	9~10.5dB	14	14dBm		
RFA	Separate Raman optical amplifier			4	Four-wavelength	12	11~12.5dB	15	15dBm	F	With GFF <±1.0
DRA	Separate dispersion compensation Raman optical amplifier					14	13~14.5dB	16	16dBm		
								17	17dBm		