Flex Max® RF Amplifiers

FM321e-LE

1 GHz Line Extender Amplifiers

FEATURES

- Simplify plant upgrades with modular RF design
- Improve amplifier reach with optional GaN technology and increased station tilt
- Maintain current amplifier spacing with high output GaAs technology
- Expand return path bandwidth with plug-in diplex filter support to 85 MHz
- Minimize RF drift over temperature with optional analog or QAM ALC

PRODUCT OVERVIEW

The Flex Max® FM321e-LE 1 GHz line extender amplifier is designed to extend existing systems or build out new networks, providing operators with the ability to quickly add high-output capacity with minimal disruption. The FM321e-LE features a host of drop-in module options that operators can use to cost-effectively upgrade legacy 9-LH series housings for integration into 1 GHz architectures, while FM321e-LE units with 110 or 230 VAC powering options are excellent solutions for deployments in high-rise buildings and medium-to-large MDUs.

The FM321e-LE provides operators with superior forward and return path performance. The unit features 1 GHz GaAs technology that mitigates distortion and minimizes performance issues relative to Composite Second Order (CSO) and Composite Triple Beat (CTB), while optional GaN technology provides higher output capacity for extended reach or fiber deep applications. The unit's return path circuitry, installed on the PC board, uses a hybrid amplifier with an improved compression point and bit error rate (BER) for digitally loaded traffic. Directional coupler forward output and return input test points isolate their respective input signals from the effects of reflections in the cable. The FM321e-LE's design also provides slope and gain control flexibility in the forward path, which minimizes amplifier respacing during upgrades. On the return output, an attenuator and an equalizer circuit controlled by a plug-in attenuator allow for accurate return path alignment.

ARRIS also offers a QAM Channel Automatic Level Control (ALC) Pilot Frequency option, which is available with or without a gain hold feature, for Flex Max Amplifiers. An option with the gain hold feature enables an amplifier to adjust output levels to the mid-range automatically if its pilot level drops by 10 dB or more. The ALC Pilot Frequency option allows operators to choose between 609 MHz or 711 MHz pilot frequencies.

PLATFORM COMPATIBILITY

Platform	Philips LE9x	Philips MMLE	Flex Max 320	Flex Max 321
Upgrade to FM321e	Yes	Yes	Yes	Yes

HOUSING COMPATIBILITY

Platform	7-LH Housing	9-LH Housing
Upgrade to FM321e	Yes*	Yes
* Requires input and output baseplate upgrade kit part number: 1505595-001		

RELATED PRODUCTS

FM601e-T/B	STARLINE RF Amplifiers
FM901e-T/B	FM331
Installation Services	

SPECIFICATIONS – GaAs (ALC)

Specifications [15]	Units	Forward	Return
Frequency Split	MHz	54 – 1002 85 –1002 105 –1002[14]	5 – 42 5 – 65 5 – 85
Flatness	dB	± 0.8	± 0.9
Full Gain (without EQ and ALC)	dB	41	20
Operation Gain (-0,+1.5 dB) [1,2]	dB	33	20
ALC Control Range	dB	± 3	NA
Noise Figure (without EQ) [3]	dB	10/9.5/9/10	6.5
Standard Slope Reference Frequency	MHz	1002/870/550/54	$F_{MAXRTN}/5$
Reference Output Level [5,6]	dBmV	52/49.5/44/35	37/37
Operating Tilt	dB	17	NA
Carrier to Interference Ratio			
Channels, Number of NTSC [4]		79	6
Composite Triple Beat (CTB)	–dBc	75	80
Cross Modulation (XM)	–dB	67	70
Composite Second Order (CSO)	–dBc	73	78
Carrier to Intermodulation Noise (CIN) [8]	dB	63	—
Channels, Number of 256 QAM [9]		154	—
Carrier to Intermodulation Noise (CIN) [10]	dB	63	—
Test Point Accuracy (-20 dB)	dB		
Input Test Point		± 1.25 (54 – 1002)	± 0.5 (5 – F_{MAXRTN})
Output Test Point		± 0.5 (54 – 550), ± 1.0 (550 – 1002)	± 1.5 (5 – F_{MAXRTN})
Return Loss	dB	16	16
Hum Modulation @ 15A	-dBc		
5 – 10 MHz		—	55
11 – F_{MAXRTN} MHz		—	60
F_{MINFWD} – 1002 MHz		60	—
DC Voltage	VDC	24 ± 0.5	
Current DC Max./Typical	mA	865/800	
Power Consumption Max./Typical	W	27/23	
Input Voltage Range	VAC		
90 VAC HFC		45 – 90	
110 VAC Mains		90 – 130	
230 VAC Mains		205 – 253	
HFC AC Current Draw Max./Typical [13]	A		
@ 90 VAC		0.375/0.32	
@ 60 VAC		0.61/0.52	
AC Bypass Current (all ports)	A	15	
Chrominance/Luminance Delay	ns/3.58 MHz		
Channel 2		28	—
Channel 3		12	—
Channel 4		7	—
Channel 5		4	—
Return Group Delay	ns		
5.5 – 7 MHz		—	52
10 – 11.5 MHz		—	13
35 – 36.5 MHz		—	10
38.5 – 40 MHz		—	28

SPECIFICATIONS – GaN (ALC)

Specifications [15]	Units	Forward	Return
Frequency Split	MHz	54 – 1002 85 –1002 105 –1002[14]	5 – 42 5 – 65 5 – 85
Flatness	dB	± 0.8	± 0.9
Full Gain (without EQ and ALC)	dB	41	20
Operation Gain (-0,+1.5 dB) [1,2]	dB	33	20
ALC Control Range	dB	± 3	NA
Noise Figure (without EQ) [3]	dB	10/9.5/9/10	6.5
Standard Slope Reference Frequency	MHz	1002/870/550/54	$F_{MAXRTN}/5$
Reference Output Level [5,7]	dBmV	56/53.5/48/39	37/37
Operating Tilt	dB	17	NA
Carrier to Interference Ratio			
Channels, Number of NTSC [4]		79	6
Composite Triple Beat (CTB)	–dBc	70	80
Cross Modulation (XM)	–dB	65	70
Composite Second Order (CSO)	–dBc	73	78
Carrier to Intermodulation Noise (CIN) [8]	dB	60	—
Channels, Number of 256 QAM [9]		154	—
Carrier to Intermodulation Noise (CIN) [10]	dB	59	—
Test Point Accuracy (-20 dB)	dB		
Input Test Point		± 1.25 (54 – 1002)	± 0.5 (5 – F_{MAXRTN})
Output Test Point		± 0.5 (54 – 550), ± 1.0 (550 – 1002)	± 1.5 (5 – F_{MAXRTN})
Return Loss [11]	dB	16	16
Hum Modulation @ 15A	-dBc		
5 – 10 MHz		—	55
11 – F_{MAXRTN} MHz		—	60
F_{MINFWD} – 1002 MHz		60	—
DC Voltage	VDC	24 ± 0.5	
Current DC Max./Typical	mA	865/800	
Power Consumption Max./Typical	W	27/23	
Input Voltage Range	VAC		
90 VAC HFC		45 – 90	
110 VAC Mains		90 – 130	
230 VAC Mains		205 – 253	
HFC AC Current Draw Max./Typical [13]	A		
@ 90 VAC		0.375/0.32	
@ 60 VAC		0.61/0.52	
AC Bypass Current (all ports)	A	15	
Chrominance/Luminance Delay	ns/3.58 MHz		
Channel 2		28	—
Channel 3		12	—
Channel 4		7	—
Channel 5		4	—
Return Group Delay	ns		
5.5 – 7 MHz		—	52
10 – 11.5 MHz		—	13
35 – 36.5 MHz		—	10
38.5 – 40 MHz		—	28

SPECIFICATIONS – MECHANICAL

Specifications	Units	Forward	Return
Operating Temperature Range	°C °F	–40 to +60 –40 to +140	
Housing Dimensions, L x W x D	inches mm	8.9 L x 7.5 W x 5.5 D 226 L x 191 W x 140 D	
Weight	lb kg	7.4 3.35	

NOTES:

1. Forward spacing at highest frequency with PEQ-1G-xx equalizer installed.
2. Return spacing is with a 0 dB attenuator installed in the return EQ location. Return EQ circuitry is built into main PCB. As the attenuator value increases, the return equalization insertion loss at F_{MAXRTN} MHz also increases.
3. The noise figure specification is "Typical" within specified passband.
4. Analog channels occupying the 54 to 550 MHz frequency range with 256-QAM channels to 1002 MHz at –6 dBc below equivalent video channels.
5. Recommended maximum return output level includes loss due to equalizer.
6. At specified operational tilt, maximum equivalent analog output level for 1 GHz loading is 56.5 dBmV @ HF for GaAs.
7. At specified operational tilt, maximum equivalent analog output level for 1 GHz loading is 59 dBmV @ HF for GaN.
8. Systems operating with digitally compressed channels or equivalent broadband noise from 550 to 1002 MHz at levels 6 dB below equivalent video channels will experience a composite intermodulation distortion (CIN) appearing as noise in the 54 to 550 MHz frequency spectrum.
9. 256-QAM channels occupy 54 to 1002 MHz with 3 channels replaced by analog channels for CCNR measurement.
10. Systems operating with digitally compressed channels from 54 to 1002 MHz at levels 6 dB below equivalent video channels will experience a composite intermodulation distortion (CIN) appearing as noise relative to any remaining analog channels.
11. Output return loss may derate to 15 dB above 600 MHz.
12. Test point tolerance is with input attenuator position terminated into 75 Ω.
13. The power supply is internal to the RF module. Refer to drawing #333995-32.
    For 60 VAC powering: AC power consumption in watts divided by a factor of 43 = Amps required.
    For 90 VAC powering: 67 VAC, 1.03 x (AC power consumption in watts divided by voltage) = Amps required.
    For 67 to 90 VAC, AC power consumption in watts divided by 65 = Amps required.
14. For frequency split 85/105 MHz roll-off from 105 MHz to 102 MHz < 1.0 dB. Group delay from 103.25 MHz to 105.25 MHz is < 22 ns
15. Full list of specifications available in FM321e Equipment Manual, document number 1505332.

REQUIRED ACCESSORIES

Part Number	Description
PEQ-1G-00 PEQ-1G-XX PCS-1G-XX	One of the following per FM321e Forward 1002 MHz equalizer (0 dB) -or- Forward 1002 MHz equalizer (values 2 to 20 dB in 1 dB steps) -or- Cable simulator (values 2 to 12 dB in 1 dB steps)
10-Axx.0-WC	Plug-in pad/attenuator (values 0 to 26 dB in 1 dB steps) Also used for Return Equalization

Customer Care

Contact Customer Care for product information and sales:

- United States: 866-36-ARRIS
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Note: Specifications are subject to change without notice.

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