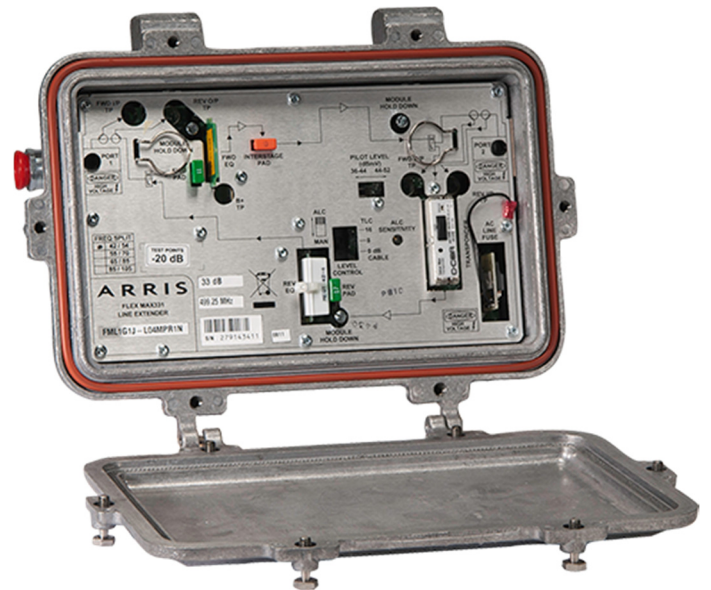


Flex Max[®] RF Amplifiers

FM331-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

Drop-in RF modules are a cost-effective way for operators to upgrade networks with existing legacy C-COR 2-port housings—such as the FlexNet 700 series, Flex Max[®] FM340 series, and Flex Max[®] FM330 series line extenders—with minimal network disruption. The FM331-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. By integrating the FM331-LE into their design systems, operators can more cost-effectively upgrade 750/870 MHz system bandwidths.



The FM331-LE maintains operating specifications, such as gain and tilt, at 750 MHz and 870 MHz, with extended gain and tilt out to 1 GHz. These unique design considerations eliminate the additional cost of resplicing by enabling operators to reuse legacy line extender housings and existing spacing, making the FM331-LE line extender drop-in RF module an ideal choice for 1 GHz system upgrades.

The FM331-LE also provides excellent forward and return path performance. The unit features 1 GHz GaAs technology that improves distortion performance and minimizes system performance issues relative to Composite Second Order (CSO) and Composite Triple Beat (CTB). Optional GaN technology provides higher output capacity for extended reach or fiber deep applications.

FM331-LE line extenders are available with three level control options: automatic level control (ALC), thermal level control (TLC), and no level control (NLC). The ALC models offer a variety of common analog and QAM/digital pilot frequencies. In addition, ARRIS offers an ALC pilot frequency option with a gain hold feature, which enables the amplifier to adjust output levels to the mid-range automatically if its pilot frequency level drops by 10 dB or more. The gain hold option also allows operators to choose between 609 MHz and 711 MHz pilot frequencies.

ARRIS also offers several frequency split options for the FM331-LE, including the 85/105 MHz frequency split for expanding broadband networks. The unit’s plug-in filter design allows for bench upgradability to any offered frequency split for maximum flexibility.

PLATFORM COMPATIBILITY				
Platform	FlexNet E5	FlexNet E7	Flex Max 340	Flex Max 330
Upgrade to FM331	Yes*	Yes	Yes**	Yes

* Requires Baseplate Upgrade Kit part number 1500855-001
 ** Requires Adapter Plate Kit part number 1504044-001

RELATED PRODUCTS	
FM901e-T/B	STARLINE RF Amplifiers
FM601e-T/B	FM321e
Installation Services	

SPECIFICATIONS – GaAs (ALC)

Specifications ¹⁴	Units	Forward	Return
Frequency Split	MHz	54 – 1002 85 – 1002 105 – 1002 ¹³	5 – 42 5 – 65 5 – 85
Flatness	dB	± 0.5	± 0.5
Operation Gain (-0,+1.5 dB) ^{1,2}	dB	35	18
Slope Control Range	dB	+3.5/-4.5	NA
Noise Figure (without EQ) ³	dB	7/7/7/9	5.5
Standard Slope Reference Frequency	MHz	1002/870/550/54	F _{MAXRTN} /5
Reference Output Level ^{5,6}	dBmV	52/49.5/44/35	35/35
Operating Cable Loss	dB	13 ± 1.0	NA
Carrier to Interference Ratio			
Channels, Number of NTSC ⁴		79	6
Composite Triple Beat (CTB)	-dBc	77	84
Cross Modulation (XM)	-dB	72	74
Composite Second Order (CSO)	-dBc	75	80
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 or -25 dB)	dB		
Accuracy		± 0.5 (54 – 550 MHz) ± 1.0 (550 – 1002 MHz)	± 0.5 (5 – F _{MAXRTN})
Return Loss	dB	16	16
Hum Modulation @ 15A	-dBc		
5 – 10 MHz		—	55
11 – 750 MHz		60	60
751 – 1002 MHz		55	—
DC Voltage	VDC		24 ± 0.5
Current DC Max.	mA		870
Power Consumption Max.	W		25
Input Voltage Range	VAC		
90 VAC HFC			45 – 90
HFC AC Current Draw Max. ¹²	A		
@ 90 VAC			0.340
@ 60 VAC			0.535
AC Bypass Current (all ports)	A		15
Chrominance/Luminance Delay	ns/3.58 MHz		
Channel 2		35	—
Channel 3		14	—
Channel 4		7	—
Channel 5		3.6	—
Return Group Delay	ns		
5.5 – 7 MHz		—	52
10 – 11.5 MHz		—	6
35 – 36.5 MHz		—	10
38.5 – 40 MHz		—	23

SPECIFICATIONS – GaN (ALC)

Specifications ¹⁴	Units	Forward	Return
Frequency Split	MHz	54 – 1002 85 – 1002 105 – 1002 ¹³	5 – 42 5 – 65 5 – 85
Flatness	dB	± 0.5	± 0.5
Operation Gain ^{1,2}	dB	35	18
Full Gain	dB	39.5	19
Slope Control Range	dB	+3.5/-4.5	NA
Noise Figure (without EQ) ³	dB	7/7/7/9	5.5
Standard Slope Reference Frequency	MHz	1002/870/550/54	F _{MAXRTN} /5
Reference Output Level ^{5,7}	dBmV	56/53.5/48/39	35/35
Operating Cable Loss	dB	13 ± 1.0	NA
Standard Slope Performance			
Channels, Number of NTSC ⁴		79	6
Composite Triple Beat (CTB)	-dBc	72	84
Cross Modulation (XM)	-dB	65	74
Composite Second Order (CSO)	-dBc	70	80
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 or -25 dB) Accuracy	dB	± 0.5 (54 – 550 MHz) ± 1.0 (550 – 1002 MHz)	± 0.5 (5-F _{MAXRTN})
Return Loss	dB	16	16
Hum Modulation @ 15A 5 – 10 MHz 11 – 750 MHz 751 – 1002 MHz	-dBc	— 60 55	55 60 —
DC Voltage	VDC		24 ± 0.5
Current DC Max.	mA		870
Power Consumption Max.	W		25
Input Voltage Range 90 VAC HFC	VAC		45 – 90
HFC AC Current Draw Max. ¹² @ 90 VAC @ 60 VAC	A		0.340 0.535
AC Bypass Current (all ports)	A		15
Chrominance/Luminance Delay Channel 2 Channel 3 Channel 4 Channel 5	ns/3.58 MHz	35 14 7 3.6	— — — —
Return Group Delay 5.5 – 7 MHz 10 – 11.5 MHz 35 – 36.5 MHz 38.5 – 40 MHz	ns	— — — —	52 6 10 23

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		12.3 L x 9.6 W x 3.5 D 312 L x 244 W x 89 D
Weight	lb kg		8.6 3.9

NOTES:

- Forward spacing at highest frequency with SEQ-1G-xx equalizer installed.
- Reverse spacing includes losses due to housing, diplex filters, and MEQ-xx-x.
- The noise figure specification is "Typical" within specified passband.
- Analog channels occupying the 54 to 550 MHz frequency range with 256-QAM channels to 1002 MHz at -6 dBc below equivalent video channels.
- Recommended maximum return output level includes loss due to equalizer.
- At specified operational tilt, maximum equivalent analog output level for 1 GHz loading is 56.5 dBmV @ HF for GaAs.
- At specified operational tilt, maximum equivalent analog output level for 1 GHz loading is 59 dBmV @ HF for GaN.
- 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.
- 256-QAM channels occupy 54 to 1002 MHz with 3 channels replaced by analog channels for CCNR measurement.
- 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.
- Output return loss may derate to 15 dB above 600 MHz.
- Test point tolerance is with input attenuator position terminated into 75 Ω.
- 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.
- 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
- Full list of specifications available in FM331 Equipment Manual, document number 1500338.

REQUIRED ACCESSORIES

Part Number	Description
SEQ-1G-00	One of the following per FM331 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 15 dB in 1 dB steps)
SEQ-1G-xx	
SCS-1G-xx	
MEQ-xx-x	Return equalizer, 5-42 MHz, 5-65 MHz, 5-85 MHz, values 2 to 7 dB in 1 dB steps
NPB-xxxx	Plug-in attenuator/pad (values 0 to 26 dB in 1 dB steps)
NPB-750	Plug-in terminator (75 ohm)

Note: Specifications are subject to change without notice.

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