

# Flex Max<sup>®</sup> RF Amplifiers

## FM901e-T/B

### 1 GHz Trunk and Bridger 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 analog or QAM ALC
- Facilitate underground installation with optional 90° access ports



## PRODUCT OVERVIEW

For cable operators looking to ensure maximum backwards compatibility and scalability and protect network investments, ARRIS offers solutions that deliver new services with minimal CAPEX, enhance network efficiency and increase subscriber satisfaction.

The Flex Max<sup>®</sup> FM901e-T/B 1 GHz Trunk and Bridger Amplifiers enable cable operators to increase forward capacity for high definition television (HDTV) channels, typically allowing a 40% increase over current program offerings.



ARRIS FM901e-T/B Trunk and Bridger Amplifiers are designed to easily and cost effectively increase bandwidth from 750/870 MHz to 1 GHz in legacy C-COR networks. The FM901e-T/B comes in high forward gain and output configurations, which allow operators to overcome the higher insertion losses that result from coaxial cable and passives and support cost-effective new designs.

Featuring 1 GHz GaAs technology, the FM901e-T/B is available as a complete unit for greenfield deployments or as a drop-in RF module for economical 1 GHz upgrades of legacy C-COR 750 MHz and 870 MHz FlexNet trunk and bridger amplifiers. In addition, they can be used as spares in existing 750 MHz and 870 MHz systems. Operating specifications, such as gain and tilt, are maintained at 750 MHz and 870 MHz, with extended gain and tilt out to 1002 MHz. These unique design considerations enable operators to reuse their legacy amplifier housings and existing spacing, which in turn eliminates the cost of resplicing.

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.

**COMPATIBILITY**

| Platform                 | FlexNet 700 | FlexNet800 | FlexNet 900 | Flex Max 900 | Flex Max 901 |
|--------------------------|-------------|------------|-------------|--------------|--------------|
| Upgrade to Flex Max 901e | Yes         | Yes        | Yes         | Yes          | Yes          |

**RELATED PRODUCTS**

|                       |                        |
|-----------------------|------------------------|
| FM601e-T/B            | FM321e                 |
| FM331                 | STARLINE RF Amplifiers |
| Installation Services |                        |

## BRIDGER SPECIFICATIONS – GaAs (ALC)

| Specifications <sup>15</sup>                         | Units       | Forward  | Return                           |
|--|-------------|--|----------------------------------|
| Frequency Split                                      | MHz         | 54 – 1002<br>85 – 1002<br>105 – 1002 <sup>14</sup> | 5 – 42<br>5 – 65<br>5 – 85       |
| Flatness   | dB          | ± 1.0  | ± 0.5                            |
| Full Gain (without EQ and ALC)                       | dB          | 48   | 19                               |
| Operation Gain (-0,+1.0 dB) <sup>1,2</sup>           | dB          | 43   | 18                               |
| ALC Control Range                                    | dB          | +4/-5  | NA                               |
| Noise Figure (without EQ) <sup>3</sup>               | dB          | 8/8/7/9  | 12                               |
| Output Reference Frequency                           | MHz         | 1002/870/550/54                                    | F <sub>MAXRTN</sub> /5           |
| Reference Output Level <sup>5,6</sup>                | dBmV        | 52/49.5/44/35                                      | 35/35                            |
| Operating Cable Loss                                 | dB          | 23   | NA                               |
| Carrier to Interference Ratio                        |             |  |                                  |
| Channels, Number of NTSC <sup>4</sup>                |             | 79   | 6                                |
| Composite Triple Beat (CTB)                          | -dBc        | 75   | 80                               |
| Cross Modulation (XM)                                | -dB         | 67   | 74                               |
| Composite Second Order (CSO)                         | -dBc        | 73   | 82                               |
| Carrier to Intermodulation Noise (CIN) <sup>8</sup>  | dB          | 63   | —                                |
| Channels, Number of 256 QAM <sup>9</sup>             |             | 154  | —                                |
| Carrier to Intermodulation Noise (CIN) <sup>10</sup> | dB          | 63   | —                                |
| Test Point Accuracy (-20 dB)                         | dB          |  |                                  |
| Input Test Point                                     |             | ± 1.0 (54 – 1002)                                  | ± 0.5 (5 – F <sub>MAXRTN</sub> ) |
| Output Test Point                                    |             | ± 0.5 (54 – 550), ± 1.0 (551 – 1002)               | ± 0.5 (5 – F <sub>MAXRTN</sub> ) |
| Return Loss <sup>11</sup>                            | 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/Typical                               | mA          |  | 1650/1475                        |
| Power Consumption Max/Typical                        | W           |  | 45.5/41                          |
| Input Voltage Range                                  | VAC         |  |                                  |
| 90 VAC HFC   |             |  | 45 – 90                          |
| HFC AC Current Draw Max/Typical <sup>13</sup>        | A           |  |                                  |
| @ 90 VAC   |             |  | 0.67/0.63                        |
| @ 60 VAC   |             |  | 0.82/0.74                        |
| AC Bypass Current                                    | A           |  |                                  |
| Ports 1,3,4,6  |             |  | 15                               |
| Ports 2,5  |             |  | 13                               |
| 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  |             | —  | 19                               |

## BRIDGER SPECIFICATIONS – GaN (ALC)

| Specifications <sup>15</sup>                         | Units       | Forward  | Return                           |
|--|-------------|--|----------------------------------|
| Frequency Split                                      | MHz         | 54 – 1002<br>85 – 1002<br>105 – 1002 <sup>14</sup> | 5 – 42<br>5 – 65<br>5 – 85       |
| Flatness   | dB          | ± 1.0  | ± 0.5                            |
| Full Gain (without EQ and ALC)                       | dB          | 48   | 19                               |
| Operation Gain (-0,+1.0 dB) <sup>1,2</sup>           | dB          | 43   | 18                               |
| ALC Control Range                                    | dB          | +4/-5  | NA                               |
| Noise Figure (without EQ) <sup>3</sup>               | dB          | 8/8/7/9  | 12                               |
| Output Reference Frequency                           | MHz         | 1002/870/550/54                                    | F <sub>MAXRTN</sub> /5           |
| Reference Output Level <sup>5,6</sup>                | dBmV        | 56/53.5/48/39                                      | 35/35                            |
| Operating Cable Loss                                 | dB          | 23   | NA                               |
| Carrier to Interference Ratio                        |             |  |                                  |
| Channels, Number of NTSC <sup>4</sup>                |             | 79   | 6                                |
| Composite Triple Beat (CTB)                          | -dBc        | 71   | 80                               |
| Cross Modulation (XM)                                | -dB         | 60   | 74                               |
| Composite Second Order (CSO)                         | -dBc        | 70   | 82                               |
| Carrier to Intermodulation Noise (CIN) <sup>8</sup>  | dB          | 60   | —                                |
| Channels, Number of 256 QAM <sup>9</sup>             |             | 154  | —                                |
| Carrier to Intermodulation Noise (CIN) <sup>10</sup> | dB          | 59   | —                                |
| Test Point Accuracy (-20 dB)                         | dB          |  |                                  |
| Input Test Point                                     |             | ± 1.0 (54 – 1002)                                  | ± 0.5 (5 – F <sub>MAXRTN</sub> ) |
| Output Test Point                                    |             | ± 0.5 (54 – 550), ± 1.0 (551 – 1002)               | ± 0.5 (5 – F <sub>MAXRTN</sub> ) |
| Return Loss <sup>11</sup>                            | 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/Typical                               | mA          |  | 1650/1475                        |
| Power Consumption Max/Typical                        | W           |  | 45.5/41                          |
| Input Voltage Range                                  | VAC         |  |                                  |
| 90 VAC HFC   |             |  | 45 – 90                          |
| HFC AC Current Draw Max/Typical <sup>13</sup>        | A           |  |                                  |
| @ 90 VAC   |             |  | 0.67/0.63                        |
| @ 60 VAC   |             |  | 0.82/0.74                        |
| AC Bypass Current                                    | A           |  |                                  |
| Ports 1,3,4,6  |             |  | 15                               |
| Ports 2,5  |             |  | 13                               |
| 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  |             | —  | 19                               |

## TRUNK SPECIFICATIONS – GaAs (ALC)

| Specifications <sup>15</sup>  | Units       | Forward                              |  | Return                           |
|---|-------------|--------------------------------------|--|----------------------------------|
|   |             | Trunk                                | Bridger  |                                  |
| Frequency Split   | MHz         |                                      | 54 – 1002<br>85 – 1002<br>105 – 1002 <sup>14</sup> | 5 – 42<br>5 – 65<br>5 – 85       |
| Flatness  | dB          | ± 0.75                               | ± 1.5  | ± 0.5                            |
| Full Gain (without EQ and ALC)  | dB          | 38                                   | 48   | 19                               |
| Operation Gain (-0,+1.0 dB) <sup>1,2</sup>                            | dB          | 33                                   | 43   | 18                               |
| ALC Control Range   | dB          | +4/-5                                |  | NA                               |
| Noise Figure (without EQ) <sup>3</sup>                                | dB          | 8/7/8/10                             |  | 14                               |
| Output Reference Frequency  | MHz         | 1002/870/550/54                      |  | F <sub>MAXRTN</sub> /5           |
| Output Reference Level <sup>5,6</sup>                                 | dBmV        | 42/40.5/37/32                        | 52/49.5/44/35                                      | 35/35                            |
| Operating Cable Loss  | dB          | 13                                   |  | NA                               |
| Carrier to Interference Ratio   |             |                                      |  |                                  |
| Channels, Number of NTSC <sup>4</sup>                                 |             | 79                                   | 79   | 6                                |
| Composite Triple Beat (CTB)   | -dBc        | 84                                   | 75   | 80                               |
| Cross Modulation (XM)   | -dB         | 76                                   | 67   | 74                               |
| Composite Second Order (CSO)  | -dBc        | 79                                   | 73   | 82                               |
| Carrier to Intermodulation Noise (CIN) <sup>8</sup>                   | dB          | 80                                   | 63   | —                                |
| Channels, Number of 256 QAM <sup>9</sup>                              |             | 154                                  | 154  | —                                |
| Carrier to Intermodulation Noise (CIN) <sup>10</sup>                  | dB          | 76                                   | 63   | —                                |
| Test Point Accuracy (-20 dB)  | dB          |                                      |  |                                  |
| Input Test Point  |             | ± 1.0 (54 – 1002)                    |  | ± 0.5 (5 – F <sub>MAXRTN</sub> ) |
| Output Test Point   |             | ± 0.5 (54 – 550), ± 1.0 (551 – 1002) |  | ± 0.5 (5 – F <sub>MAXRTN</sub> ) |
| Return Loss <sup>11</sup>   | 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/Typical  | mA          | 1955/1775                            |  |                                  |
| Power Consumption Max/Typical   | W           | 53.5/49                              |  |                                  |
| Input Voltage Range<br>90 VAC HFC                                     | VAC         | 45 – 90                              |  |                                  |
| HFC AC Current Draw Max/Typical <sup>13</sup><br>@ 90 VAC<br>@ 60 VAC | A           | 0.735/0.70<br>0.97/0.88              |  |                                  |
| AC Bypass Current<br>Ports 1,3,4,6<br>Ports 2,5                       | A           | 15<br>13                             |  |                                  |
| 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   |             | —                                    |  | 19                               |

## TRUNK SPECIFICATIONS – GaN (ALC)

| Specifications <sup>15</sup>  | Units       | Forward                              |  | Return                           |
|---|-------------|--------------------------------------|--|----------------------------------|
|   |             | Trunk                                | Bridger  |                                  |
| Frequency Split   | MHz         |                                      | 54 – 1002<br>85 – 1002<br>105 – 1002 <sup>14</sup> | 5 – 42<br>5 – 65<br>5 – 85       |
| Flatness  | dB          | ± 0.75                               | ± 1.5  | ± 0.5                            |
| Full Gain (without EQ and ALC)  | dB          | 38                                   | 48   | 19                               |
| Operation Gain (-0,+1.0 dB) <sup>1,2</sup>                            | dB          | 33                                   | 43   | 18                               |
| ALC Control Range   | dB          | +4/-5                                |  | NA                               |
| Noise Figure (without EQ) <sup>3</sup>                                | dB          | 8/7/8/10                             |  | 12                               |
| Output Reference Frequency  | MHz         | 1002/870/550/54                      |  | F <sub>MAXRTN</sub> /5           |
| Output Reference Level <sup>5,6</sup>                                 | dBmV        | 46/44.5/41/36                        | 56/53.5/48/39                                      | 35/35                            |
| Operating Cable Loss  | dB          | 13                                   |  | NA                               |
| Carrier to Interference Ratio   |             |                                      |  |                                  |
| Channels, Number of NTSC <sup>4</sup>                                 |             | 79                                   | 79   | 6                                |
| Composite Triple Beat (CTB)   | -dBc        | 78                                   | 71   | 80                               |
| Cross Modulation (XM)   | -dB         | 70                                   | 60   | 74                               |
| Composite Second Order (CSO)  | -dBc        | 76                                   | 70   | 82                               |
| Carrier to Intermodulation Noise (CIN) <sup>8</sup>                   | dB          | 72                                   | 60   | —                                |
| Channels, Number of 256 QAM <sup>9</sup>                              |             | 154                                  | 154  | —                                |
| Carrier to Intermodulation Noise (CIN) <sup>10</sup>                  | dB          | 69                                   | 59   | —                                |
| Test Point Accuracy (-20 dB)  | dB          |                                      |  |                                  |
| Input Test Point  |             | ± 1.0 (54 – 1002)                    |  | ± 0.5 (5 – F <sub>MAXRTN</sub> ) |
| Output Test Point   |             | ± 0.5 (54 – 550), ± 1.0 (551 – 1002) |  | ± 0.5 (5 – F <sub>MAXRTN</sub> ) |
| Return Loss <sup>11</sup>   | 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/Typical  | mA          | 1955/1775                            |  |                                  |
| Power Consumption Max/Typical   | W           | 53.5/49                              |  |                                  |
| Input Voltage Range<br>90 VAC HFC                                     | VAC         | 45 – 90                              |  |                                  |
| HFC AC Current Draw Max/Typical <sup>13</sup><br>@ 90 VAC<br>@ 60 VAC | A           | 0.735/0.70<br>0.97/0.88              |  |                                  |
| AC Bypass Current   | A           |                                      |  |                                  |
| Ports 1,3,4,6   |             | 15                                   |  |                                  |
| Ports 2,5   |             | 13                                   |  |                                  |
| 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   |             | —                                    |  | 19                               |

## SPECIFICATIONS – MECHANICAL

| Specifications <sup>15</sup>  | Units        | Forward | Return  |
|-------------------------------|--------------|---------|---|
| Operating Temperature Range   | °C<br>°F     |         | -40 to +60<br>-40 to +140                         |
| Housing Dimensions, L x W x D | inches<br>mm |         | 16.0 L x 10.7 W x 5.35 D<br>406 L x 272 W x 136 D |
| Weight                        | lb<br>kg     |         | 10.14<br>4.6                                      |

## 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 FM901e Equipment Manual, document number 1502154.

## REQUIRED ACCESSORIES

| Part Number                         | Description   |
|-------------------------------------|---|
| SEQ-1G-00<br>SEQ-1G-xx<br>SCS-1G-xx | 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) |
| 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<br>NPB-750                 | Plug-in attenuator/pad (values 0 to 26 dB in 1 dB steps)<br>Plug-in terminator (75 ohm)   |

## OPTIONAL ACCESSORIES

| Part Number | Description  |
|-------------|--|
| 173720-01   | Cable adapter from 12 pin connector (PS) to 9 pin connector (FNT/FNB700 RF Module) |
| 173720-02   | Cable adapter from 9 pin connector (old PS) to 12 pin connector (RF Module)        |

**Note:** Specifications are subject to change without notice.

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