

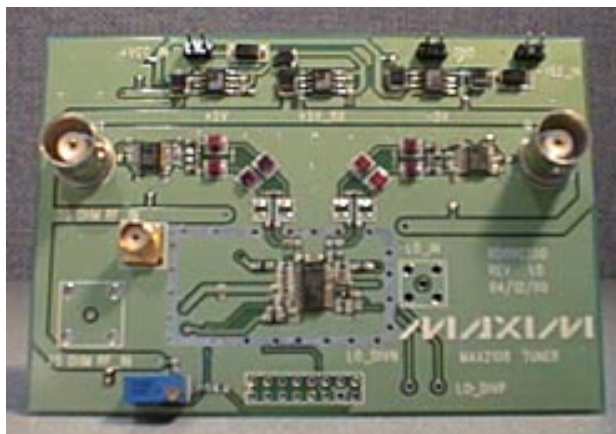
APPLICATION NOTE 1986

## REP026: Direct-Conversion Tuner Optimized for Operation from 950MHz to 1750MHz

*This application note presents the schematic and bill of materials to optimize the MAX2108 satellite tuner for 950MHz to 1750MHz operation.*

Rapid engineering prototypes are real circuits that Maxim application engineers have built and measured in our labs. They can provide a starting point for new RF designs. They are not available as evaluation kits.

Additional Information: [Wireless Product Line Page](#)  
[Quick View Data Sheet for the MAX2108](#)  
[Applications Technical Support](#)



*Objective: To optimize the MAX2108 direct-conversion tuner for operation from 950MHz to 1750MHz.*

A reference evaluation board has been developed and tested for the MAX2108 satellite, digital video broadcasting (DVB) tuner IC. Important board design features include a transmission-line input match, a pair of 0.1dB ripple differential Tchebychev lowpass I and Q filters at 35MHz cutoff, and DC voltage regulators. A pair of MAX4145 video op amps acts as baluns to terminate the lowpass filters and drive the 50-ohm output test ports. The board was laid out for easy testing and modification using FR4 material for low cost. To provide for the op-amp baluns,  $\pm 8\text{VDC}$  is required at the board input.

The result of the design was that all data sheet targets were met, including greater than 50dB gain range, IIP3 and IIP2 of +8dBm and +14dBm over the band, and NF of 10dB to 13dB over the band. An excellent reverse isolation was

obtained of -87dBm LO power measured at the RF input port, which was achieved through the use of an LO balun and carefully planned layout.

The MAX2108 is a low-cost direct-conversion tuner IC designed for use in digital, direct-broadcast satellite (DBS) television set-top box units and microwave links. Its direct-conversion architecture reduces system cost, compared to devices with IF-based architectures. The MAX2108 directly tunes L-band signals to baseband using a broadband I/Q downconverter offering typically +8dBm IIP3. The operating frequency range spans from 950MHz to 2150MHz. The MAX2108 includes a low-noise amplifier with gain control, two downconverter mixers with output buffers, a 90-degree quadrature generator, and a divide-by-32/33 prescaler.

### Specifications for Optimized Operation at 950MHz to 1750MHz

Item	Requirements	Qualifications	Lab Results
PCB Material	FR-4, four layers	Two-layer FR-4 eval PCB	FR-4
Circuit Area	N/R	See test eval PCB	-
Shielding	N/R	-	-
Connectors	F-type for tuner input, SMA for LO	F-type for tuner input, SMA for LO	-
Vcc	+5.0V DC for tuner	+8.0V, and -8.0V DC for linear regulators	+8.0V DC, -8.0V DC (Note 1)
Icc	TBD	TBD	128mA @ +8.0V, 22mA @ -8.0V
Frequency	950MHz to 1750MHz	-	950MHz to 1750MHz
RF Power In	-20dBm to -70dBm	-	-20dBm to -70dBm
Gain-Control Range	50dB	-	>50dB
IIP3	+8dBm	-	+6dBm (Note 2)
IIP2	+14dBm	-	+25dBm (Note 3)
Noise Figure	10dB	-	11dB @ 950MHz, 10dB @ 1300MHz, 13.4dB @ 1750MHz (Note 4)
Input-Return Loss	-10dB	-7.5dB min from 950MHz to 1750MHz	-7.5dB min from 950MHz to 1750MHz
LO Drive Level	-10dBm	-10dBm	-10dBm
LO Leakage at RFIN Port	-100dBm	-	-87dBm @ 950MHz, -87dBm @ 1300MHz, -76dBm @ 1750MHz (Note 4)
Baseband Filter fc	Not required	0.1dB Chebyshev fc = 35MHz	0.1dB Chebyshev fc = 35MHz

#### Notes:

1. Linear regulators are on-board. MAX2108 DC operating voltage is +5.0V. MAX4145 diff. line-receiver DC operating voltages are  $\pm 5.0V$ .
2. Prf in = -20dBm per tone, GC set to +3.4V, f1rf in = 1749MHz, f2rf in = 1751MHz, fLO = 1740MHz.
3. Prf in = -20dBm per tone, GC set to +3.4V, f1rf in = 1200MHz, f2rf in = 2150MHz, fLO = 951MHz, f baseband = 1MHz.
4. GC set to +3.6V.

[Schematic](#) (PDF, 89k)  
[Bill of Materials](#)

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### More Information

MAX2108: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)