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APPLICATION NOTE 4259

# MAX2165 Single-Loop AGC Control Solution for the Chinese Terrestrial TV Standard GB20600

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*Abstract: This application note presents a single-loop AGC control solution for the MAX2165 zero-IF tuner. The solution is tested for the Chinese terrestrial TV standard GB20600. Maximum signal performance is nominally 0dBm. Sensitivity is -81dBm for 64QAM, 0.8 code rate (CR).*

## Introduction

This single-loop AGC control solution uses the [MAX2165](#) zero-IF tuner and involves both hardware and software. Using only a few discrete resistors and capacitors, a signal demodulator PWM output controls both the BBAGC and RFAGC on the MAX2165. A LNA switching algorithm for incorporation in the demodulator software is presented.

This solution is tested for the Chinese terrestrial TV standard GB20600. Maximum signal performance is nominally 0dBm. Sensitivity is -81dBm for 64QAM, 0.8 code rate (CR).



[Click here for an overview of the wireless components used in a typical radio transceiver.](#)

## Single-Loop AGC Control Schematic

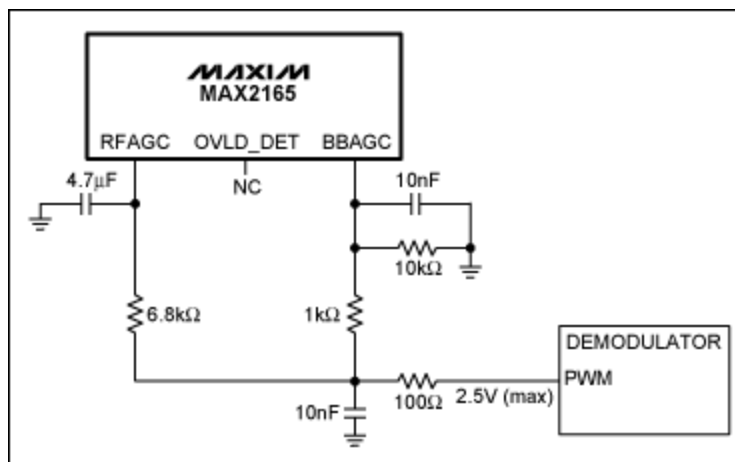


Figure 1. Single-loop AGC control schematic.

**Figure 1** shows a closed-loop method for controlling both the RFAGC and the BBAGC with a single PWM output. A filtered version of the PWM output controls the RFAGC. Similarly, a voltage-divided and filtered version of the same PWM output controls the BBAGC. The RC filters set a 5Hz filter bandwidth for RFAGC and a 16kHz bandwidth for BBAGC. A 160kHz filter at the PWM output reduces high-frequency edge content from the PWM.

Pin 11 (OVLN\_DET) can be left open circuit; it can also be connected to another node, as long as the OVLN\_DET is powered off.

## LNA Switching Software Algorithm

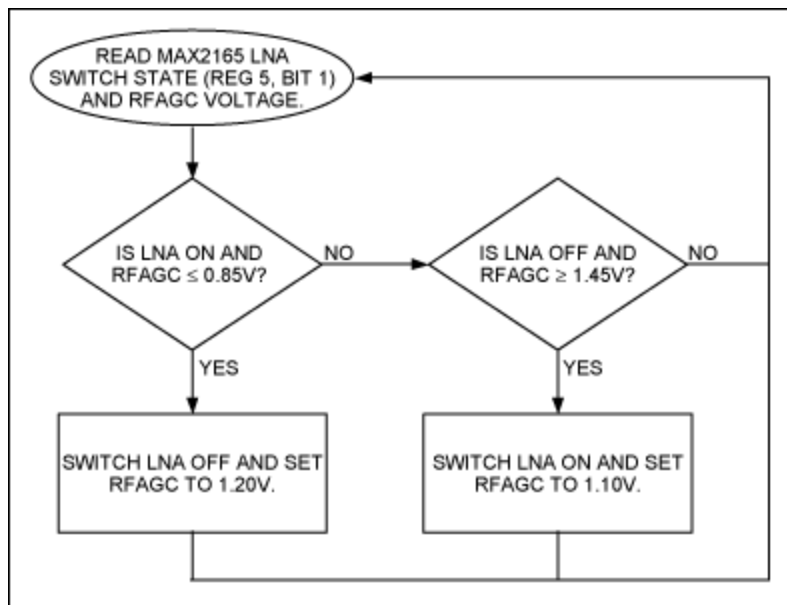


Figure 2. LNA switching software algorithm.

**Figure 2** shows the recommended LNA switching algorithm. **Figure 3** shows the corresponding RFAGC curve. Note that the software actually uses PWM codes corresponding to the RFAGC voltages referenced above.

Additionally, the MAX2165 OVLN\_DET must be powered off. To do this, set register 0x08 bit 1 to 1.

Depending on the demodulator used, the software algorithm can reside in the decoder CPU IC, USB CPU controller IC, or demodulator IC.

A MAX2165 C-code driver is available. To request the driver, please contact your local Maxim Field Applications Engineer or Account Manager.

## Carrier-to-Noise Ratio (CNR) and RFAGC Response

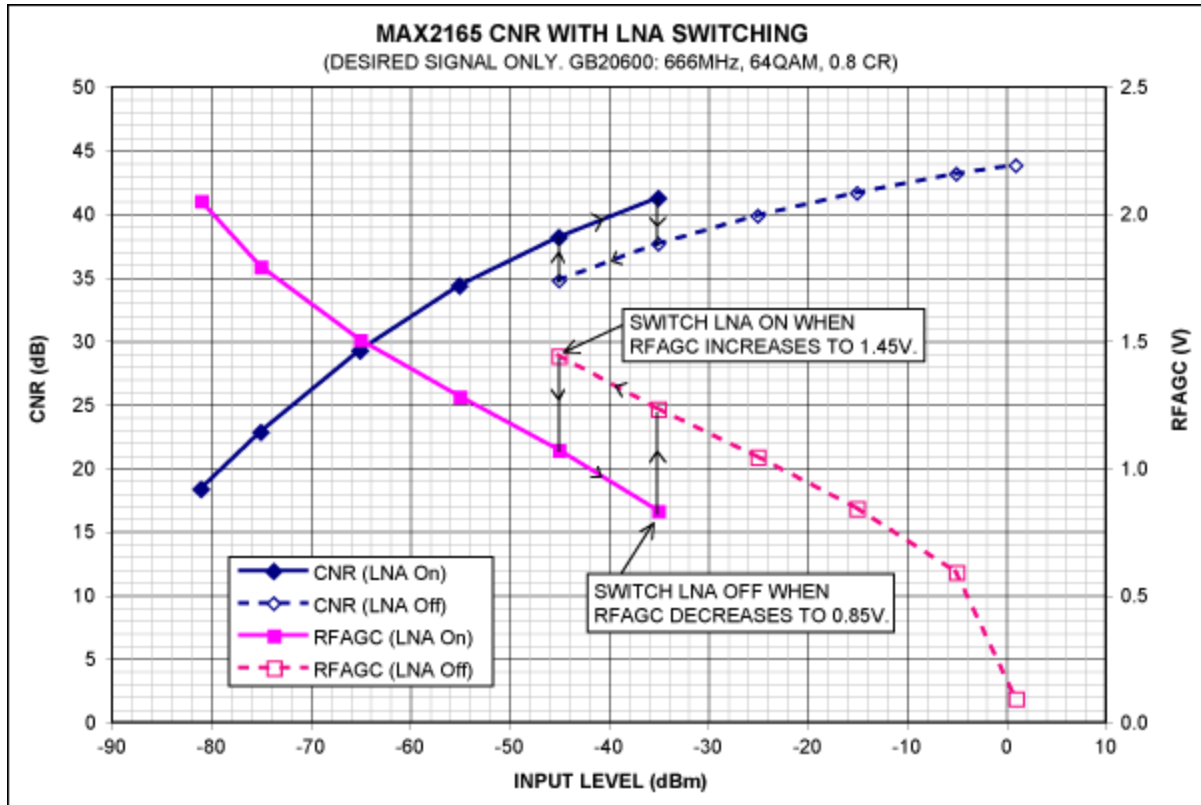


Figure 3. CNR and RFAGC response with LNA switching hysteresis.

Figure 3 shows that the CNR increases from 18.3dB at sensitivity to 44dB at maximum signal. LNA switching occurs in the -40dBm input-level range with 10dB of hysteresis. For input levels increasing from sensitivity, the LNA is switched off when RFAGC decreases to 0.85V. Conversely, for input levels decreasing from maximum signal, the LNA is switched on when RFAGC increases to 1.45V.

For simplicity, BBAGC is not included in Figure 3 since a voltage-divider sets it to 91% of RFAGC. This setting typically results in values 0.08V to 0.17V lower than RFAGC.

## Performance for Chinese Terrestrial (GB20600)

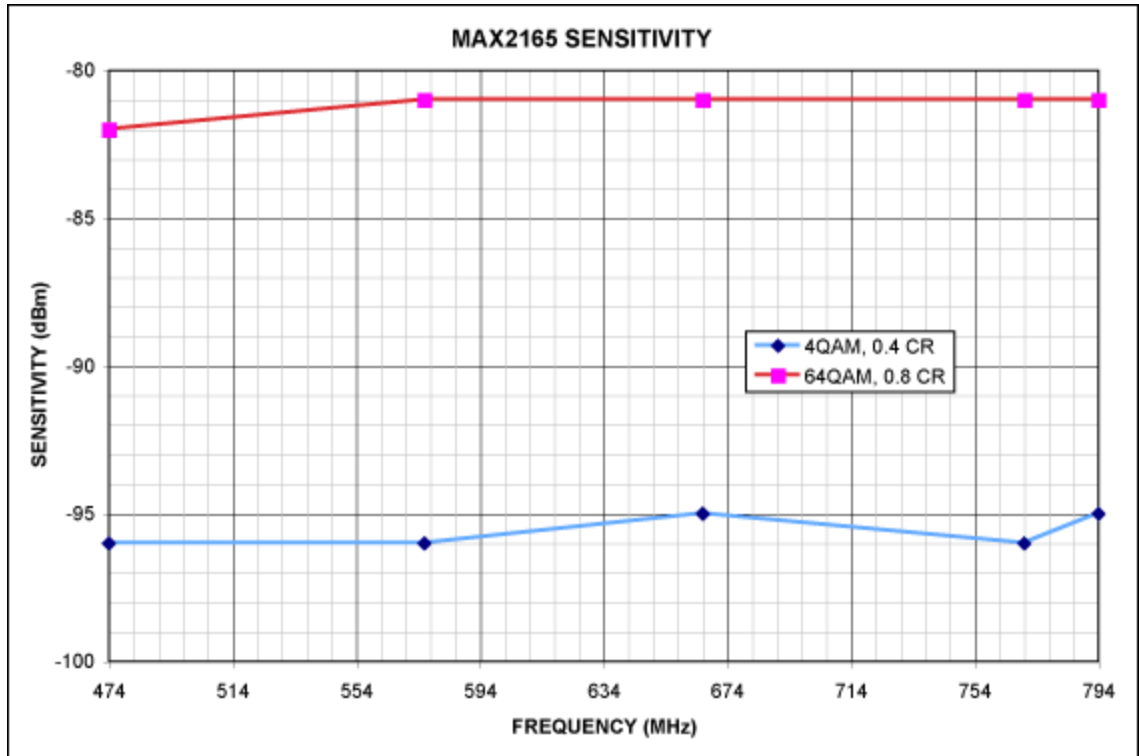


Figure 4. MAX2165 sensitivity for 4QAM and 64QAM.

Figure 4 shows that the sensitivity is at least -95dBm for 4QAM with 0.4 CR, and at least -81dBm for 64QAM with 0.8 CR.

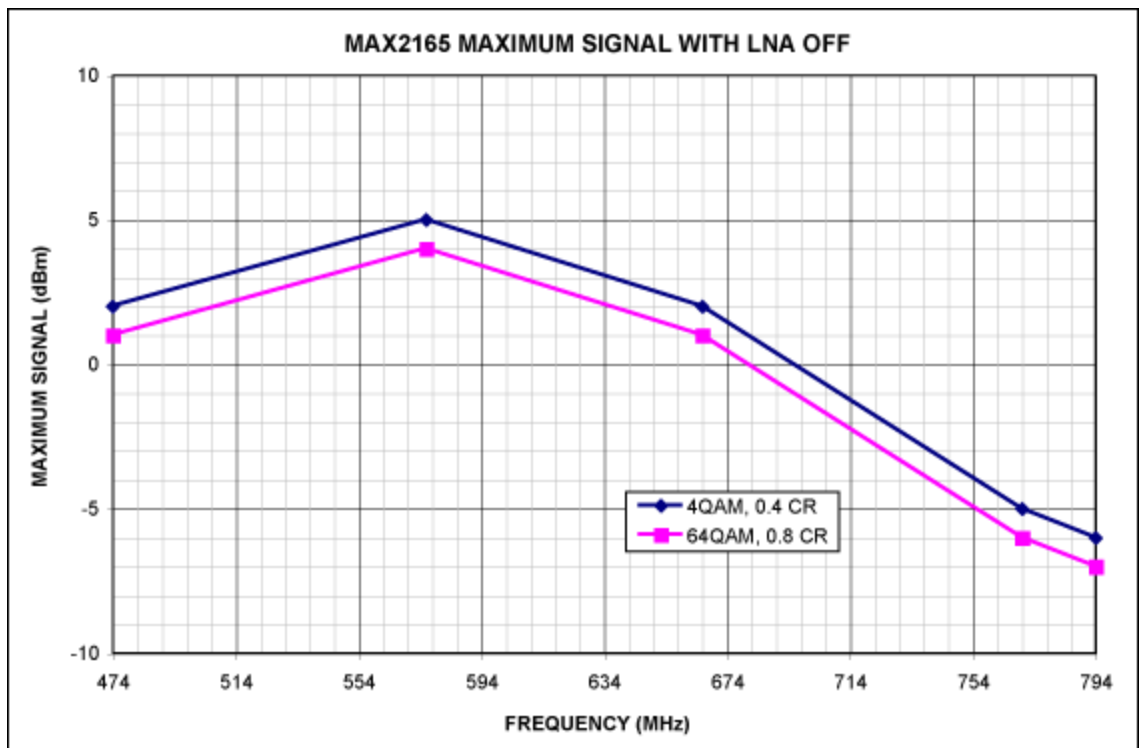


Figure 5. MAX2165 maximum signal with LNA off for 4QAM and 64QAM.

Figure 5 shows the maximum signal performance with the LNA off (i.e., LNA switching is incorporated). It is at least -6dBm for 4QAM with 0.4 CR, and at least -7dBm for 64QAM with 0.8 CR.

If 0dBm maximum signal performance is desired across the band, please contact your local Maxim Field Applications Engineer or Account Manager.

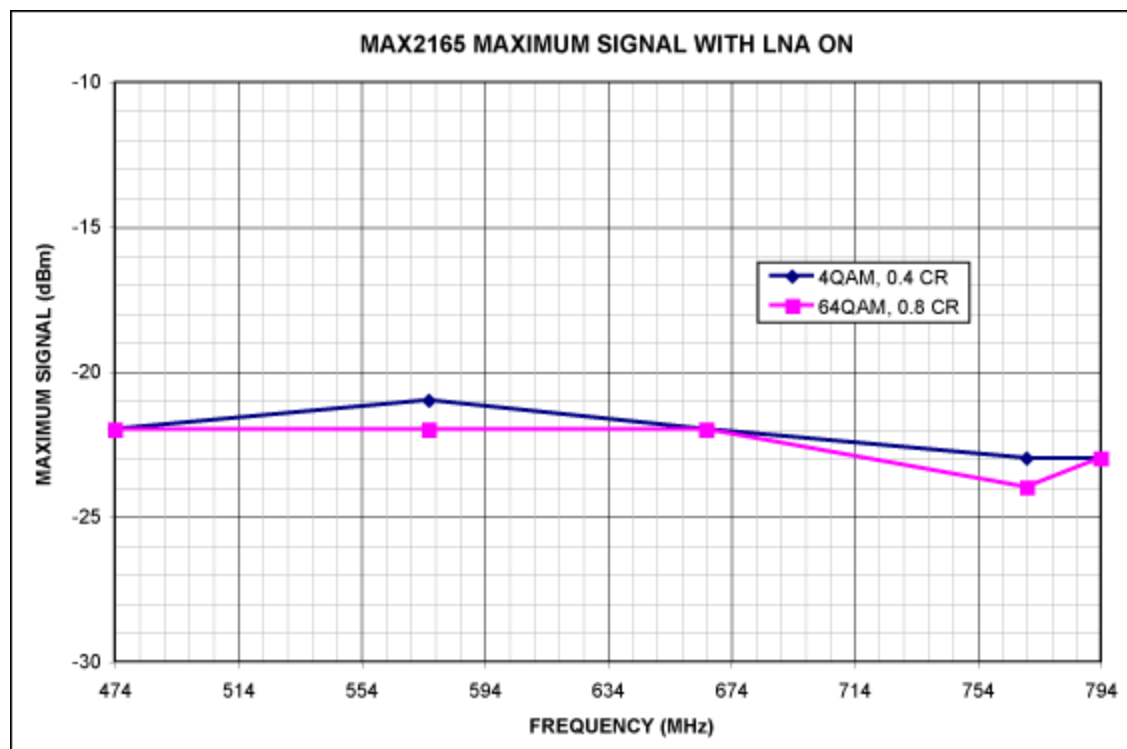


Figure 6. MAX2165 maximum signal with LNA on.

Figure 6 shows the maximum signal performance with the LNA on (i.e., LNA switching is not incorporated). It is at least -23dBm for 4QAM with 0.4 CR, and at least -24dBm for 64QAM with 0.8 CR.

## Conclusion

A single-loop AGC control method is presented for the MAX2165. Characterization data is shown for the GB20600 terrestrial TV standard in China.

### Related Parts

[MAX2165](#)

Single-Conversion DVB-H Tuner

[Free Samples](#)

### More Information

For Technical Support: <http://www.maximintegrated.com/support>

For Samples: <http://www.maximintegrated.com/samples>  
Other Questions and Comments: <http://www.maximintegrated.com/contact>

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