TLV2322 EMI Immunity Performance

1 EMI Rejection Ratio (EMIRR)

The electromagnetic interference (EMI) rejection ratio, or EMIRR, describes the EMI immunity of operational amplifiers. An adverse effect that is common to many op amps is a change in the offset voltage as a result of RF signal rectification. An op amp that is more efficient at rejecting this change in offset as a result of EMI has a higher EMIRR and is quantified by a decibel value.

Measuring EMIRR can be performed in many ways, but this report provides the EMIRR IN+, which specifically describes the EMIRR performance when the RF signal is applied to the noninverting input pin of the op amp. In general, only the noninverting input is tested for EMIRR for the following three reasons:

1. Op amp input pins are known to be the most sensitive to EMI, and typically rectify RF signals better than the supply or output pins.
2. The noninverting and inverting op amp inputs have symmetrical physical layouts and exhibit nearly matching EMIRR performance.
3. EMIRR is easier to measure on noninverting pins than on other pins because the noninverting input terminal can be isolated on a printed circuit board (PCB). This isolation allows the RF signal to be applied directly to the noninverting input terminal with no complex interactions from other components or connecting PCB traces.

A more formal discussion of the EMIRR IN+ definition and test method is provided in application report SBOA128, *EMI Rejection Ratio of Operational Amplifiers*, available for download at www.ti.com.

The EMIRR IN+ of the TLV2322 is plotted versus frequency as shown in Figure 1. If available, any dual and quad op amp device versions have nearly similar EMIRR IN+ performance. The TLV2322 unity-gain bandwidth is 27 MHz. EMIRR performance below this frequency denotes interfering signals that fall within the op amp bandwidth.

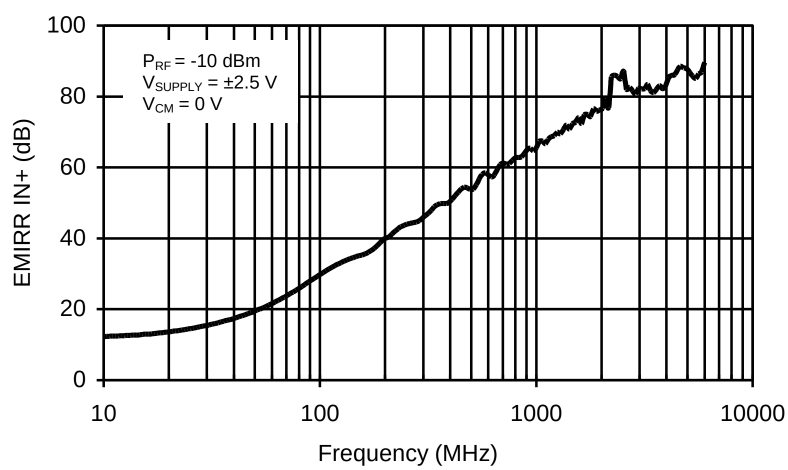

Figure 1. TLV2322 EMIRR IN+ vs Frequency

Bluetooth is a registered trademark of Bluetooth SIG, Inc. All other trademarks are property of their respective owners.

Table 1 shows the EMIRR IN+ values for the TLV2322 at particular frequencies commonly encountered in real-world applications. Applications listed in Table 1 may be centered on or operated near the particular frequency shown. This information may be of special interest to designers working with these types of applications, or working in other fields likely to encounter RF interference from broad sources, such as the industrial, scientific, and medical (ISM) radio band.

Table 1. TLV2322 EMIRR IN+ for Frequencies of Interest

FREQUENCY	APPLICATION/ALLOCATION	EMIRR IN+
400 MHz	Mobile radio, mobile satellite/space operation, weather, radar, UHF	50.2 dB
900 MHz	GSM, radio com/nav./GPS (to 1.6 GHz), ISM, aeronautical mobile, UHF	65.2 dB
1.8 GHz	GSM, mobile personal comm. broadband, satellite, L-band	74.4 dB
2.4 GHz	802.11b/g/n, Bluetooth™, mobile personal comm., ISM, amateur radio/satellite, S-band	85.6 dB
3.6 GHz	Radiolocation, aero comm./nav., satellite, mobile, S-band	82.0 dB
5.0 GHz	802.11a/n, aero comm./nav., mobile comm., space/satellite operation, C-band	87.9 dB

2 EMIRR IN+ Test Configuration

Figure 2 shows the circuit configuration for testing the EMIRR IN+. An RF source is connected to the op amp noninverting input terminal using a transmission line. The op amp is configured in a unity gain buffer topology with the output connected to a low-pass filter (LPF) and a digital multimeter (DMM). Note that a large impedance mismatch at the op amp input causes a voltage reflection; however, this effect is characterized and accounted for when determining the EMIRR IN+. The resulting dc offset voltage is sampled and measured by the multimeter. The LPF isolates the multimeter from residual RF signals that may interfere with multimeter accuracy. Refer to SBOA128 for more details.

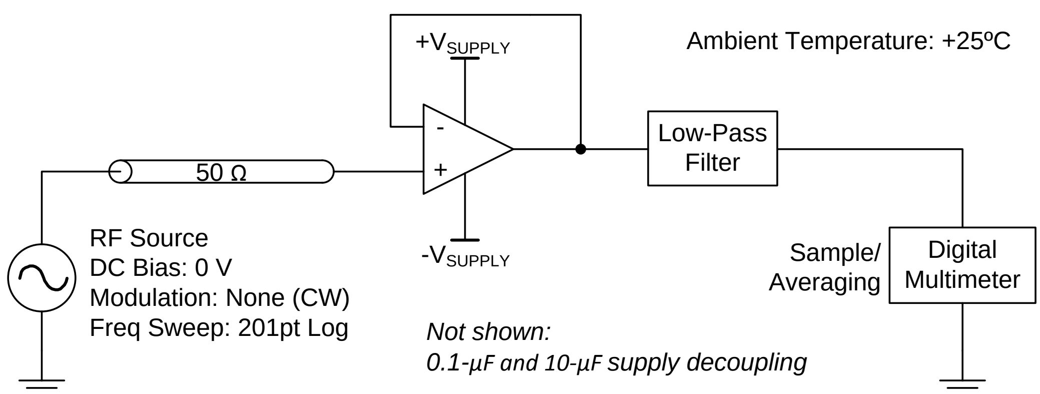

Figure 2. EMIRR IN+ Test Configuration Schematic

References

1. Chris Hall and Thomas Kuehl, "EMI Rejection Ratio of Operational Amplifiers," application report SBOA128, Texas Instruments, August 2011.
2. Gerrit de Wagt and Arie van Staveren, "A Specification for EMI Hardened Operational Amplifiers," application report SNOA497A, Texas Instruments, January 2010.