Increased LITELINK™ III Transmit Power

Application Note AN-157

1. Introduction

Some applications, such as voice computer telephony, require higher power transmission from the host equipment to the telephone network. This application note describes changes to the standard LITELINK III application circuits to provide the transmit gain needed for a particular application.

Note: The recommended maximum drive level into the line from LITELINK III is 6 mA peak, which is equivalent to about +10 dBm into a 600 Ω load. Datasheet specifications for maximum line-side current draw (I_{DDL}) do not apply with higher-than-specified output power. Minimum line operating current is defined as follows:

$$I_{MIN} = \frac{0.625V}{R_{ZTX} \| R_{ZNT}} + 5.5mA$$

Where R_{ZNT} is the resistive component of Z_{ZNT}.

Higher transmit signal levels may require a higher dc bias level on the loop to meet peak voltage requirements and avoid signal compression. The value of R_{DCS2} may be reduced to increase the dc loop bias level if necessary. See **AN-158, LITELINK III Application Circuit Calculations** for more information.

2. Transmit Gain Design Procedure

1. Determine the peak transmit level needed for the application.
2. If necessary, convert the required peak transmit power into a voltage level. For example, 0 dBm into 600 Ω = 1.1 V_P.
3. Calculate the required linear voltage gain A_V by dividing the peak transmit voltage level from step 2 by 1.1.
4. Modify the following application circuit component values:

$$Z_{ZNT} \leftarrow Z_{ZNT}/A_V$$

$$R_{NTF} \leftarrow \frac{R_{NTF}}{A_V}$$

5. Use the values from step 4 in the following formulas to solve for the new R_{NTX} and R_{HTX} values:

$$R_{NTX} = \left(1 + \frac{R_{ZNT}}{2R_{ZTX}}\right) \cdot \frac{R_{NTF}}{2}$$

$$R_{HTX} = \left(1 + \frac{R_{ZNT}}{R_{ZTX}}\right) \cdot 200k\Omega$$

These calculations result in a transmit (4-wire to 2-wire) gain of A_V, and a receive gain (2-wire to 4-wire) of $1/A_V$. If necessary, the receive loss can be compensated with either the programmable input gain of a CODEC or with a discrete op-amp gain stage between the LITELINK RX output and the host system.

3. Examples

3.1 PBX Example

To meet +3.18 dBm into 900 Ω, use the following calculations:

+3.18 dBm into 900 Ω = 1.935 V_P.
1.935 V/1.1 V = 1.76.
The calculations work out as follows:

$$R_{ZNT} = 453/1.76 = 256.9$$

$$R_{NTF} = 499k\Omega/1.76 = 282938$$

The closest standard resistor values are 255 Ω for R_{ZNT} and 280 kΩ for R_{NTF}. Use these values to find for R_{NTX} and R_{HTX} as follows:

$$R_{NTX} = \left(1 + \frac{255}{6640}\right) \cdot 140000 = 145.38k\Omega$$

$$R_{HTX} = \left(1 + \frac{255}{3320}\right) \cdot 200000 = 215.36k\Omega$$

The closest standard resistor values are 147 kΩ for R_{NTX}, and 215 kΩ for R_{HTX}.

3.2 +3 dBm into 600 Ohm Transmit Power Example

The following application circuit uses component values determined by the design procedure above for +3 dBm transmit power into 600 Ω.

Peak transmit power of +3 dBm into 600 Ω = 1.55 V_P. 1.55/1.1 = 1.4. The calculations work out as follows:

$$R_{ZNT} = 301/1.4 = 215$$

$$R_{NTF} = 499k\Omega/1.4 = 356429$$

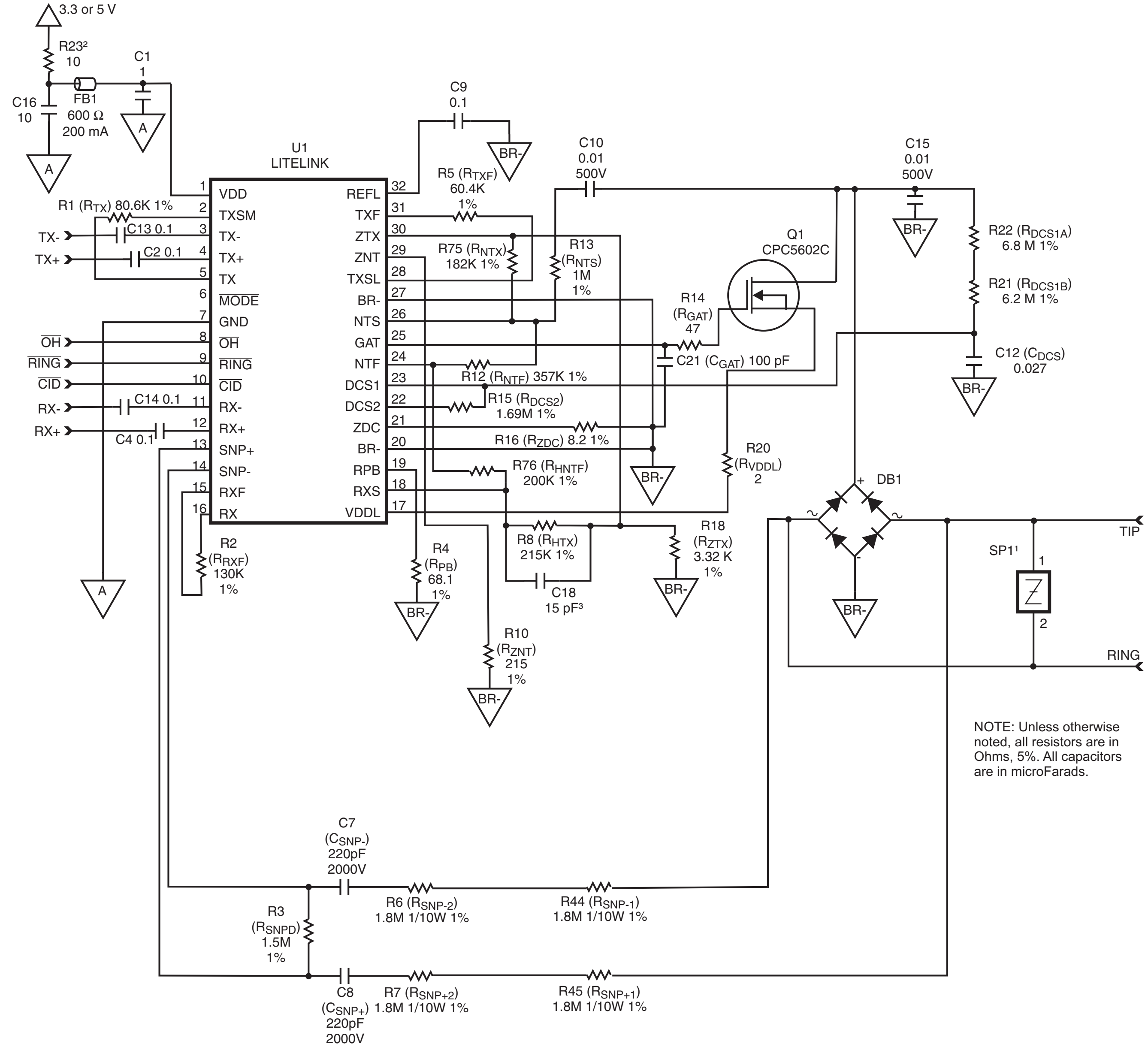
The closest standard resistor values are 215 Ω for R_{ZNT} and 357 kΩ for R_{NTF}. Use these values to find for R_{NTX} and R_{HTX} as follows:

$$R_{NTX} = \left(1 + \frac{215}{6640}\right) \cdot 178500 = 184.28k\Omega$$

$$R_{HTX} = \left(1 + \frac{215}{3320}\right) \cdot 200000 = 212.95k\Omega$$

Standard resistor values have been substituted in the circuit in Figure 1.

Figure 1. +3 dBm Application Circuit



4. Receive Gain

This application note addresses LITELINK III transmit gain. It must be noted, however, that increasing LITELINK III transmit gain decreases receive gain by a corresponding amount. For instance, increasing transmit power to +3 dBm results in receive gain of -3 dB. This difference can be accounted for by adding a 6 dB gain block between the RX+/RX- pins and the host circuitry, but can be adjusted using CODEC gain (for CODEC applications).

5. LITELINK Design Resources

5.1 Clare, Inc. Design Resources

The Clare, Inc. web site has a wealth of information useful for designing with LITELINK, including application notes and reference designs that already meet all applicable regulatory requirements. LITELINK data sheets also contains additional application and design information. See the following links:

LITELINK datasheets and reference designs

Application note AN-117 **Customize Caller-ID Gain and Ring Detect Voltage Threshold**

Application note AN-141, **Enhanced Pulse Dialing with LITELINK**

Application note AN-146, **Guidelines for Effective LITELINK Designs**

Application note AN-152 **LITELINK II to LITELINK III Design Conversion**

Application note AN-155 **Understanding LITELINK Display Feature Signal Routing and Applications**

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