Understand the Transmit and Receive Levels on Modems

Contents

Introduction

This document describes transmit (Tx) and receive (Rx) levels on modems.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

This document is not restricted to specific software and hardware versions.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Conventions

For more information on document conventions, refer to the Cisco Technical Tips Conventions.

Tx and Rx Levels

The Tx level is the power in decibels per milliwatt (dBm) at which a modem transmits its signal. The Rx level is the power in dBm of the received signal. The server modems normally transmit at -13 dBm by default. Ideally, the Rx level must be in the range of -18 to -25 dBm. If the Rx level is under -25 dBm, the Signal-to-Noise Ratio (SNR) is likely to decrease, which means that the speed also decreases. If the Rx level is too high, you can see signal distortion or the receiver Digital Signal Processor (DSP) overdriven, and erratic connections are possible.

In some modulation standards, such as V.34, a receiver can tell its peer that the signal level is too high and the transmitter then reduces the level at which it transmits. (If this behavior is widespread, try to configure the transmitter to transmit at a lower level). Problems can be observed on modems that use other modulation standards (such as K56 Flex) as some of them do not have the capability to do this.

Therefore, an effective Rx level is a function of the peer initial Tx level, the negotiated dBm reduction (if any), and the attenuation in the voice circuit. The voice circuit attenuation is, in turn, a function of link attenuation and of analog or digital pads, which are telephone company circuitry designed to insert attenuation into the voice circuits.

If you need to reduce or increase your Tx level, this is attainable with these modems and modulation standards:

- Microcom through T51: For details, refer to the AT Command Set and Register Summary for V.34, 56K, and V.90 12-Port Module (Retirement Notice).
- Modem ISDN Channel Aggregation (MICA) through S39 or S59
- NextPort through S39 or S59: For details, refer to the NextPort AT Commands and S Registers Reference (Retirement Notice).

If you need to reduce or increase your Rx level, you need to increase or decrease the padding at the peer transmitter (although this is not feasible if there are thousands of peers) or within the telephone company (more likely).

On a live connection, you can see or infer theses Rx and Tx levels as follows:

- Microcom modems: Initiate a reverse telnet session and issue the AT@E1 command.
- MICA modems: Issue the **show modem operational-status** command.
- NextPort modems: Issue the show port operational-status command.

Some MICA modem examples are:

```
router#show modem operational-status 1/0
Parameter #8 Connected Standard: V.34+
Parameter #20 TX,RX Xmit Level Reduction: 0, 0 dBm
Parameter #22 Receive Level: -22 dBm
```

In this case the Rx level is -22, which is fine. The peer has not requested that the modem attenuate its Tx, so you can infer that it is transmitting at the default output level of -13 dBm. You can also infer that the signal level is not too high for the peer receiver, because the peer has not requested a reduction in signal strength. You must directly interrogate the peer to be certain.

Another example is:

```
router#show modem operational-status 2/14
Parameter #8 Connected Standard: V.34
Parameter #20 TX,RX Xmit Level Reduction: 0, 3 dBm
Parameter #22 Receive Level: -19 dBm
```

In this case there is a good Rx level of -19, but the peer has asked this modem to reduce its Tx level by 3 dBm. Therefore, it starts to transmit at -16 dBm instead. This modem signal arrives with excessive strength at the peer. If this occurrence is widespread, you can cut back on your configured Tx level globally through S39. In this case, the problem appears to be an issue with this particular peer, so there is no need to do so.

For more information on the **show modem operational-status** command and output, please refer to the Cisco IOS Dial Technologies Command Reference.

> **Note**: Only registered Cisco users have access to internal Cisco tools and information.

Padding

Telephone companies can insert a digital or analog pad, which is circuitry designed to add attenuation on a per-channel basis. Padding ensures that end-to-end circuits that take various paths through the Public Switched Telephone Network (PSTN) end up with comparable signal levels. For instance, if a modem transmits at -13 dBm, the receivers see a signal at the right level.

For purely analog carriers (V.34 and earlier standards), pads are useful if they receive the desired levels. If the Rx levels are observed as too high on a widespread basis, then pad insertion can make analog carriers perform better.

However, the effect of pads on a digital (Pulse Code Modulation (PCM)) carrier (K56 Flex and V.90) can be problematic. An analog pad (line pad), which merely attenuates the signal, is not a problem for a PCM carrier. However, a pad in the Network Access Server (NAS) T1 line to trunk, or within the telephone company trunk-to-trunk connection, can have implications for PCM connects.

Digital pads remap the PCM data, which can disrupt communication. The general rule is that zero-dB digital pads are optimal for PCM connects. However, zero-level padding is less than optimal in other cases; for example, K56 Flex modems are less tolerant of Rx levels that are too high.

Different kinds of PCM modems can adapt to different flavors of digital pads. Rockwell K56 Flex modems (as well as Microcom and MICA modems) can handle zero-, three-, or six-dB pads. Lucent modems have a finer granularity of pad handling, and can cope with one-, four-, five-, and seven-dB pads as well. V.90 modems can handle zero to seven dB of padding in one-dB increments. If you see good V.34 connections, but poor or no K56 Flex connections, and if you know that there is no extra A-to-D conversion in the circuit path, then you can have a digital padding issue. In that case you need to contact your telephone company to resolve the problem. In such a case it can be helpful to conduct circuit traces of the suboptimal connections.

Related Information

- **Cisco Technical Support & Downloads**