



VTX COMPATIBILITY WITH TELEPHONE NETWORKS

AN APPLICATION NOTE

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October 17, 2003
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INTRODUCTION

The VTX Wideband protocol, as used in the SoundStation VTX1000 audioconferencing system, employs a robust set of algorithms to maximize the quality of the conference connection on a given telephone line. In spite of this, however, it will sometimes occur that a connection cannot be established in VTX Wideband mode, or once established may revert to narrowband in the course of the call. This paper will discuss the reasons for this, and the options available in response.

VTX OPERATIONAL MODES AND PERFORMANCE

VTX-compatible instruments such as the SoundStation VTX1000 Audioconferencing system select an operating mode from the following repertoire.

- a. *Conventional Narrowband Telephony.* When communicating with a conventional telephone, or with another VTX-capable instrument in narrowband mode, VTX systems operate as fully compatible telephone endpoints. When operating in this mode, they are compatible with any standard telephone or telephone network, bridging system, or analog PBX, and fully support multipoint operation features of a connected bridge or PBX, Call Waiting, and Caller ID in selected countries.
- b. *VTX Wideband Telephony.* When communicating with a VTX Wideband-capable bridge or endpoint, VTX systems can communicate in VTX Wideband modes. These modes adapt to the performance of the telephone connection available, and can provide enhanced audio performance, including bandwidth up to 14kHz.
- c. *VTX Software Download.* When connected to a VTX Download server (such as a SoundStation VTX1000 operating in Download Server mode), the telephone connection is used to carry a conventional modem data signal.

VTX Audio Performance Strategy

Business conferencing requires consistent, reliable, and continuous audio operation so that the local and remote participants can interact normally. The VTX audio performance strategy is to maintain clear two-way audio performance independent of the voice bandwidth delivered.

The intelligent VTX algorithms provide continuous monitoring of line quality and automatically compensate for impairments where possible. When line quality is impaired beyond these compensation limits, the VTX will preserve the conference continuity by reverting to narrowband for more consistent audio performance; in other words, the VTX 1000 will select a reliable narrowband connection in preference to a less reliable wideband connection. However, whether narrowband or wideband, the exceptional

transparency, microphone pickup, and other features such as gain control and noise reduction in the SoundStation VTX 1000 provide major advantages over previous generations of audio systems.

ANOMALOUS LINE BEHAVIORS

In the same way that a great automobile performs its best on smooth roads but is safe under all road conditions, the VTX will achieve wideband on over 90% of lines in North America, but occasionally will have to default to narrowband mode on poor lines. Once the VTX mode is established between two ends, the connection will continue unless it experiences a degradation of the connection. If this occurs, the VTX Wideband connection will respond by switching to conventional narrowband.

These are the most common network behaviors that will cause a VTX Wideband connection to drop to narrowband.

1. *Poor or varying line quality.* The initial VTX Wideband connection is made to the highest performance level that the telephone line can reliably support, but lines will sometimes degrade with time. When this happens, the connection may experience excessive connection errors, and the VTX system will automatically downshift to narrowband operation to preserve the integrity of the call.
2. *Additional call bridged in by non-VTX Compatible telephone bridge.* Because the VTX connection is by necessity point-to-point, multipoint connections must be made using a VTX-capable multipoint bridge or PBX. Conventional (non-VTX capable) bridges or PBX's create multiway connections by, in effect, tying multiple phone lines together, and this corrupts the VTX connection fatally. When this occurs, the VTX system senses the loss of connection integrity, and switches to conventional narrowband operation. This happens automatically, however, so the user only experiences a sudden loss of audio fidelity as the connection drops to the performance of conventional telephony; the connection continues running without being otherwise disrupted.
3. *Call Waiting.* "Call waiting" systems operate by interrupting the signals on the telephone line to inject their own. This is sufficient to disrupt the VTX Wideband connection, and this will cause a switch to narrowband operation.
4. *Caller ID Type 2.* Type 2 Caller ID signals differ from the more common Type 1 Caller ID signals in that Type 2 signals interrupt the call after it is already in progress to announce the identity of a second, incoming call (Type 1 carries this information before the call is established, during the ringing sequence, which is not a problem for VTX Wideband). Because they interrupt the connection after it is established, Type 2 Caller ID signals force VTX Wideband connections to drop to conventional narrowband.
5. *Bridged telephone taken offhook.* If another telephone is connected to the same wires as a VTX-connected system, it is ideally positioned to disrupt a VTX

Wideband connection if taken offhook during such a call. This would be similar to adding another connection with a non-VTX Compatible bridge, as above, and will cause the VTX connection to drop to narrowband.

6. *Analog calls through digital networks.* There is a wide variety of digital and IP networks today. While most of these behave very well with VTX Wideband connections, the degree of signal integrity they provide can vary drastically. Some IP converters, in particular, have been found to inject significant distortions, jitter, and data dropouts. These can be tolerable in a conventional narrowband connection, but will cause a VTX Wideband connection to quickly veer onto the shoulder, and drop to narrowband in order to preserve the connection.
7. *High-Efficiency Speech codecs.* Occasionally, one will encounter a connection in which a high-efficiency speech compressor is operating. Such compressors, such as G.723, G.729, or ADPCM, are incompatible with VTX Wideband because of the high degree of distortion they introduce. These codecs are sometimes found in proprietary networks, and occasionally in long-distance connections to maximize the usage of undersea lines, although less commonly these days. G.711, not being a high-efficiency compressor, is compatible with VTX Wideband operation.

As mentioned above, if there is an interruption or significant degradation in the connection while in VTX Wideband mode, the protocol will automatically switch to conventional narrowband mode. When necessary, this is done in preference to interruption of the conference. The listener will experience an abrupt muffling of the tone quality, but no more, as the additional fidelity of VTX Wideband is lost.

MAXIMIZING VTX PERFORMANCE

The strategies for getting the best performance from a VTX connection are again analogous to those for getting the best performance from a racing car.

Keep the Road Free of Obstructions

We have identified a number of specific interruptions that, if thrown onto a phone line, will cause a VTX Wideband connection to drop to narrowband. Simply stated: avoid them.

- a. Caller ID and Call Waiting can be disabled on most phone calls by programming the PBX, or by entering prefixes while establishing the call, or both.
- b. Multipoint calls should only be attempted with a VTX-capable bridge or PBX. If not available, the call can still be established, it will just be in narrowband.
- c. Be careful to not have another telephone attached to the same wires as a VTX-capable system.
- d. Beware when on transcontinental calls, which may have unexpected processing.

- e. Avoid convoluted paths for connecting to the network, such as through adapters onto internal IP networks and thence back on to the public switched network. The more such conversions, the greater the likelihood of corruption that will make VTX Wideband operation less resilient.

Downshift and Stay on the Shoulder

When a VTX Wideband connection has been established but then has switched itself to narrowband for unexplained reasons, it may be most expedient to just complete the call in this mode. All the remaining features of the conferencing system are still available, so an instrument such as the SoundStation VTX1000 will still provide excellent performance, it will just provide this in narrowband.

Drive Back Onto the Road

If the reason for dropping out of VTX Wideband operation is understood and is believed to be avoidable for the remainder of the call, the SoundStation VTX1000 can be directed to re-establish a VTX Wideband connection. This is done through the “MODE” button under the display during an ongoing call; this button can actually cause the connection to switch back and forth, as desired (very useful for demonstrations). As in the beginning of the call, re-establishing VTX Wideband will take 6 – 12 seconds.

CONCLUSION

In this paper, we have examined what a VTX Wideband connection requires of a telephone line in order to operate reliably. We have observed that when the line introduces noise, distortion, or interruptions, the connection drops cleanly to narrowband operation, and that it can be set back into VTX Wideband mode if it is determined that the line problem was a one-time aberration such as a Call Waiting signal.

It is hoped that this information will provide some useful guidance to those looking to achieve the best performance from VTX Wideband-capable instruments.

