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4RF Application Note

Aprisa XE Performance and Monitoring Data

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1 Overview

The Aprisa XE provides a range of performance and monitoring data, available remotely through the web-based SuperVisor management tool. The parameters are extremely useful for both monitoring a link's performance during normal operation and, perhaps more importantly, to diagnose performance issues. Effective analysis of the performance data can allow the user to identify the likely cause for many issues before 'leaving the office'. This is critical in quick and efficient recovery of link issues minimising impact to network operations.

2 Performance data and analysis

2.1 Overview

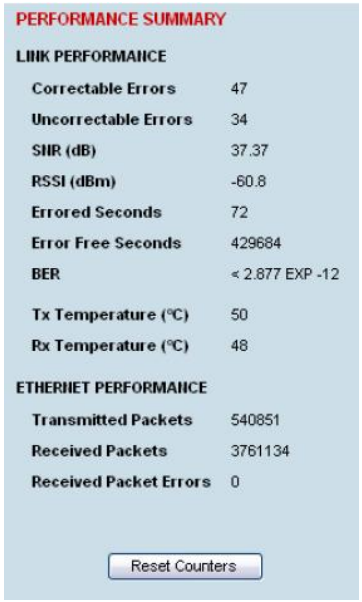
There is a range of performance data available. Some of the key items are:

- Forward Error Correction (FEC) counters, including correctable and uncorrectable errors
- Receive Signal Strength Indicator (RSSI), often called RSL
- Signal to Noise Ratio (SNR)
- Bit Error Rate (BER)
- Transmitter and receiver temperatures
- Constellation analyser
- Alarm table
- Alarm history

2.2 Performance summary page

The performance summary page provides the user access to the main parameters.

It is most useful to compare the parameters on both sides of the link against each other, focusing on the key indicators such as SNR, RSSI, and error counters.



2.3 Analysing issues from parameter comparison

Directly comparing the parameters on both sides of the link can help to determine in which path or direction the issue is as well as, when combined with the constellation analyser and radio loopback functions (described later), the most likely cause for issues such as equipment, installation, or path.

Irrespective of the absolute values of SNR and RSSI there should be little variation across the link, typically <2 dB in either parameter.

Variation in excess of 3-4 dB across the link indicates a potential issue even though the link may be running error free. The issue may be minor however should be investigated.

While actual SNRs and RSSIs are dependent on each specific path's characteristics and radio settings, some typical guidelines for assessing link performance are listed below. The guidelines are useful when comparing parameters across the link and when analysing theoretical or previously monitored performance:

SNRs > 32 dB, RSSI > -60 dBm and <2 dB variation across the link in each parameter

- Good operational link
- RSSI may be lower, but expected to be +/- 4 dB of theoretical path engineering
- SNRs may be lower if link designed to work close to receiver threshold – within 15 dB

Low SNR, low RSSI on both ends of link and <2 dB of variation across the link

- Faulty feeder system, antenna alignment
- Excessive path obstruction or distance (check planning for expected results)

Low SNR and high RSSI on one radio with other across the link

- Constructive interference on a link (from an inband transmission)
- If the interference is impacting both ends of the link the comparison may be close. Both will have low SNR but higher than expected RSSI, i.e. SNRs = 25 dB, RSSI > 55 dBm

Low RSSI on one radio, SNR good on both

- Low power from one end or faulty amplifier in transmitter or receiver
- SNR may also be reduced if the low RSSI is within approximately 15 dB of the receive threshold

Low RSSI on both ends with low SNR on one end

- Crack in feeder conductor, connector pin or poor connection
- Experience has been the 'break' is often at the transmit end, so opposite end of the link from the displayed low SNR

3 Constellation analyser

3.1 Overview

Typically only available in expensive external equipment, the SuperVisor constellation analyser provides a graphical indication of received signal distortion and link performance. The dots in the constellation diagram are a graphical representation of the demodulated signal with each of the groups of dots representing one of the possible symbol states for the level of modulation (i.e. in 16 QAM there are 16 groups of dots). The analyser is very useful in determining causes of signal quality degradation (typically only seen as low SNR or high error counts). Often the radio loopback function is used to further isolate the cause to the radio hardware or the installation and path:

Typical displays showing distortion are below:

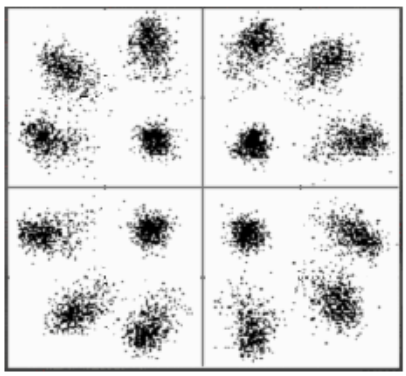


Figure 1: Amplitude distortion

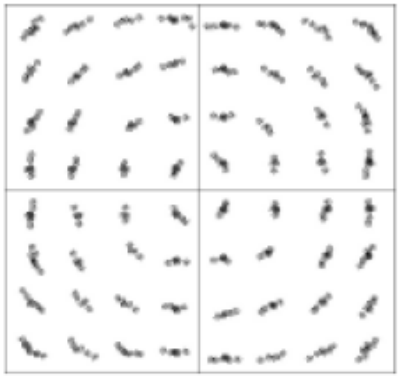


Figure 2: Phase distortion

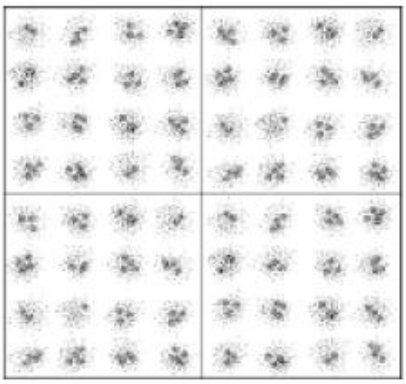


Figure 3: high noise level

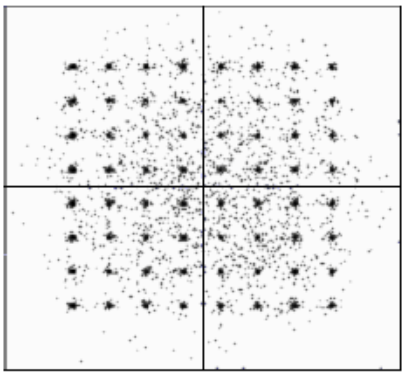


Figure 4: Burst interference

3.2 Types of distortion and potential causes

The main types of distortion and likely causes are described below

Amplitude distortion (Figure 1)

- Indicates a faulty amplifier in the radio or distortion in the radio path

Phase distortion (Figure 2)

- Typically a faulty synthesiser in the radio
- Phase distortion does occur from interference such as multipath however this is corrected in the radio modem and typically does not result in a change to the display

High noise level (Figure 3)

- Large groups of dots without the previous types of distortion suggest low overall signal level
- If in both paths a feeder / antenna system issue, excessive path obstruction or distance (check planning)
- If in one direction only then typically low output power at one end – could still be a feeder system issue however more likely to be output power related, potentially software setting or a faulty amplifier

Burst interference (Figure 4)

- Often considered to be the result of other transmissions in the region such as pager systems however experience has shown typically the result of installation issues such as loose connectors, wet feeders, antenna mounting and vibration or tower earthing
- Sweep the antenna system as an initial step

3.3 Isolating distortion cause

Isolating the cause of the distortion typically takes the following steps:

- Compare local and remote radios to determine if the distortion is affecting both TX-RX paths, which helps to determine where the distortion is coming from
- Using the radio loopback function to check if the distortion is being generated in the equipment or externally. If a radio is put in local loopback and the constellation becomes 'clean' then the cause is the other radio, installation or path. Repeating the process at both ends of the link can further isolate the cause

4 Additional performance and monitoring data

4.1 Performance history

The Aprisa XE allows the user to extract a performance history file which includes SNR, RSSI, BER, uncorrectable errors and transmitter temperature values which are captured in two different time intervals:

- Previous week (data captured every 24 hours)
- Previous hour (data captured every minute)

This feature is useful for monitoring a links performance and is also useful for diagnostics and fault finding purposes.

4.2 Alarm table

The Alarm Table page allows the user to view active alarms on the Aprisa XE. These alarms indicate:

- Source of alarm (transmitter, receiver, interface card etc.)
- Type of alarm (transmitter temperature, modem synch etc.)
- Severity of alarm (minor/major)
- Time at which the alarm became active

4.3 Alarm history

The Alarm History page allows the user to view up to 50 current and past alarms. The SuperVisor software allows the user to extract an alarm history file which records up to 600 alarm events. This is complimented by a file which can be downloaded to a PC containing up to 13,000 alarm events.

4.4 Loopback functionality

The Aprisa XE provides a radio loopback function:

- Switches the receiver from the antenna to an internal loopback from the transmitter – inside the RF brick
- Isolates the radio from being the cause of poor performance indicators
- Small risk that the issue may be in the duplexer which is between the loopback switch and antenna connection

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