Sweep Testing Tips & Tricks

Preparations

1- Make sure to get a copy of your customer's sweep testing procedures sufficiently ahead of time, if possible. Do not rely upon the customer's project manager's assumptions or knowledge base. Different carriers have widely varying requirements

2- Try to find out exactly what connectors your customer is using and which ones you will need to be able to connect your analyzer at the bottom and your short/load at the top. In most cases, customers prefer to have all necessary adapters connected and calibrated. The notion here is, this could require you to carry four or more different types of short/open/load setups to be able to not only calibrate but then to use on the tower so as not to use any adapters. If you use precision adapters, you can usually get away with using one particular adapter that you are not able to calibrate through. Just be aware that more and more carriers and/or turn-key contractors are requiring this while it can be very expensive to have all of the proper RF cords, adapters and short/open/load setups. In short; find out their requirements ahead of time.

3- Before connecting your tester to the point under test, be conscious to the overall cell site configuration and connections to avoid high reflected RF power that might burn the RF front-end of your analyzer

4- Question the quality and performance of any of your accessories that will be used during the test. Connectors' quality is critical for a precision measurement. RF connectors for such purposes are manufactured to ultra-precise tolerances (close to VSWR of 1.05) and must be used and maintained with enough care to protect the measurement accuracy and consistency. Taking proper care of cables and connectors will protect your tester's ability to make accurate measurements. Inaccurate measurements often result of improper connections, dirty, or damaged connectors. Worn, damaged, out of tolerance, or dirty connectors degrade the accuracy and repeatability of RF measurements.

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5- It's highly recommended to coverage map the design location using a CW test transmitter and receiver. This is done through transmitting a CW test signal through the antenna while the receiver measures the received power level. This allows for verification of the coverage from an antenna location before the permanent installation works. Consultix family of CW test transmitters and CW receivers provides broad capabilities in this regards

Setup

6- Avoid or minimize the bending of test cables. One single sharp bend can destruct an RF cable.

7- Reduce repeated connection and disconnection of any RF cable connections.

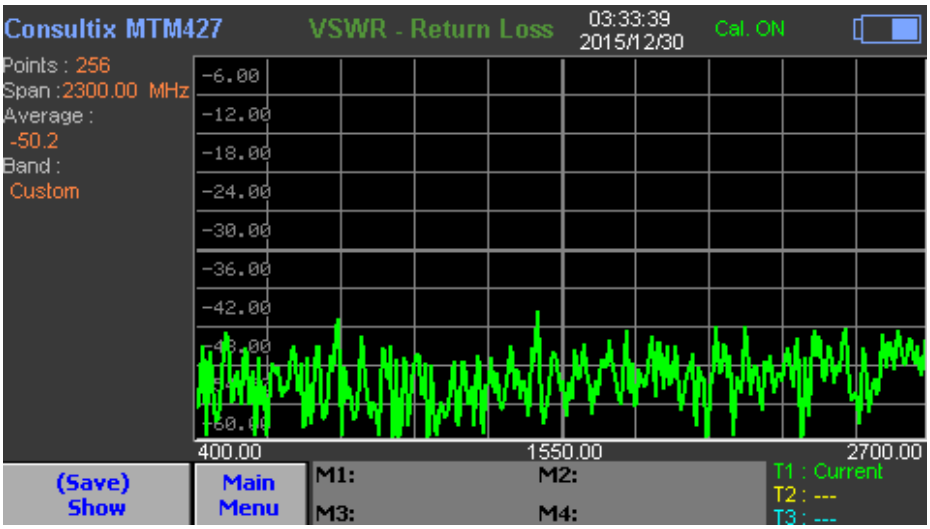
8- Don't bend cables at or close to the RF connectors. This may affect the RF accuracy.

9- Examine all connectors for dirt, nicks, and other signs of damage or wear before connection. And keep in mind; a bad connector can ruin a good connector instantly.

10- Clean dirty connectors. Dirt and foreign matter can cause poor electrical connections, affect RF measurements, and may permanently damage the connectors.

Calibration

11- To verify that calibration was conducted properly, a curve similar to the following return loss should be observed when connecting the matched load. Values below 42 dB indicates excellent setup.



12- Using some quick calibration or instant calibration methods can be acceptable in some cell site troubleshooting to detect imperfection points, however a real calibration should take place to validate or qualify the installations

Measurements

Distance to Fault

13- For best results, in your tester settings, the cable should be specified 20% to 50% longer than the actual cable length. Optimum is 25%

14- The frequency range for DTF sweeps should stay within the employed load's bandwidth. If an antenna is used as the load, any portion of the DTF sweep that goes outside the pass band is mostly reflected, reducing the accuracy of the vertical axis Return Loss or VSWR measurements.

A wider frequency range improves distance resolution and lowers the maximum measureable distance. Usually keep in mind if an antenna is in place at the other end of the cable, the DTF frequency range should be restricted to the antenna's pass band.

14- Propagation velocity (PV or Vp) directly affects distance accuracy and must be set either manually or by entering a cable type.

VSWR & Return Loss

15- Adjusting the amplitude scale can improve the clarity and view ability of the amplitude of a trace. Refer to the MTM-427 user manual for more details and capabilities in this regards.

16- Using pre-set signal standards will reduce testing time and prevent mistakes. Check your country frequency bands in your analyzer's band list

17- Cable loss also needs to be set precisely. False cable loss values can mask return loss or VSWR problems, making your job more difficult.

18- When measuring cables with high insertion loss, the displayed measurement trace may exhibit a high level of noise. In this case, the relative signal-to-noise and associated measurement accuracy can be improved by choosing an analyzer with high power output.

For Troubleshooting

19- Most Sweep testers have capability to recall previously saved or stored sweeps enabling you to compare present readings to previously stored readings to determine if anything has changed. Always make sure to have results saved and named in a meaningful and structured format

20- Any changes, no matter how small, indicate a potential problem with the cable and antenna system.

Antenna Measurements

21- Testing the antenna by itself in a return loss sweep mode is the only truly accurate method of determining antenna return loss performance.

22- When interfacing the antenna to the analyzer, high-quality adapters can be used to improve measurement accuracy and repeatability. In any case, the adapter and test cables' characteristics may be removed from the measured results using the analyzer's calibration procedures. The analyzer should also be attached as close to the antenna as possible so the insertion loss of the cable does not mask the antenna's true return loss.

23- The antenna under test should be pointed skyward or with as minimum obstructions as possible when testing. Nearby objects can cause reflections back into the antenna that will give flawed readings

24- The antenna must be removed from any enclosure unless the enclosure was considered in the manufacturer's process.

25- The antenna should be tested in an RF clean environment. In-band signals radiated from adjacent sectors or sites will cause spikes that could be interpreted as failures. These signals must be shielded or turned off prior to testing.

26- Ensure that the antenna connector is clean and dry before the measurements.

27- Antennas can be tested while installed on top of the tower in case the above criteria are obeyed. In many cases, it is easier to bring a handheld analyzer to the antenna than to remove and reinstall the antenna.

Reporting

28- Reporting time could consume significant time of site engineers. Invest adequate time to learn the features and capabilities of your reporting software, and make sure to choose the analyzer with a professional tool that enables comprehensive reporting while saving your time and showing excellent impression.
The ***Site Auditor*** from Consultix is a good example in this regards

And finally keep in mind

..**Sometimes even the most qualified antenna crews may not connect components appropriately, not perfectly mount connectors or never recognize if a factory jumper, TMA, antenna or other element is defective. Such failures can cause network performance troubles and equipment defections.**

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Annex
Useful info

Typical causes of improper performance

- Bad connectors
- Bent (impedance affecting) cable
- Bad Lightning protectors
- Moisture in Coax
- Bad antennas
- Bad jumpers
- Subtle changes at connections that are not found otherwise
- Improperly installed antennas (too close to the tower)
- Antennas spacing too close to other antennas
- Improperly installed Ground Kits on transmission lines

Typical system specifications

If a system is properly constructed, different components will meet different return loss specification levels. The following table lists some of the parameters that you will encounter in actual systems:

Lightning Protectors:	30 dB
Coaxial Cable:	35 dB
Antennas:	14 dB
Jumpers	30 dB
Connectors	25 dB
Ground Kits	35 dB