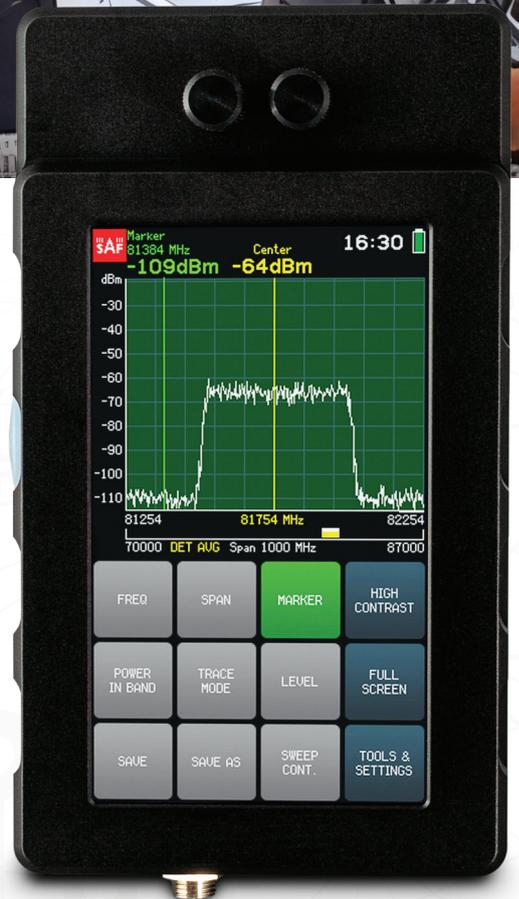




# E-Band Troubleshooting

WINDTRE  
Case Study 2023



## INTRODUCTION

WINDTRE, a prominent nationwide Italian mobile operator and internet service provider, has established itself as a leader in the industry over two decades. Their extensive network, featuring fiber and microwave technologies, is renowned for its reliability and top-notch customer service.

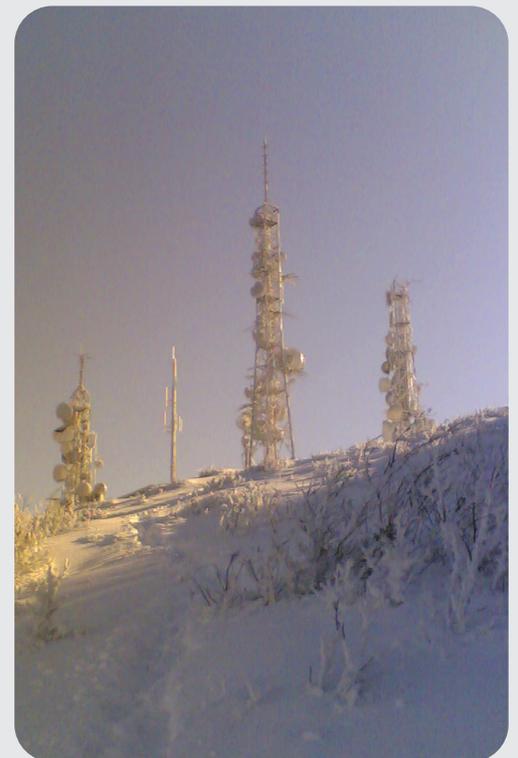
## THE CHALLENGE

Despite the serene coastal climate in Liguria, Italy, where the Italian Riviera graces the sea level, WINDTRE faces unique challenges. Many of their radio sites are perched high in the Ligurian mountains, subject to severe weather conditions including temperature fluctuations, heavy rain, and ice formation on antennas. The most formidable adversary is the relentless multi-directional winds, often surpassing 120 km/h, which place significant stress on the antenna systems.



Recently, WINDTRE experienced a path failure of an 80 GHz radio link (M. Leco – Campomorone) used to offload the capacity of backhaul connections to a series of radio centers in Liguria mountains. This disruption would strongly impact a number of sites leading to network downtime and potential SLA penalties. Quick troubleshooting to identify and solve the problem was given the highest priority.

In such scenarios, the standard RF loop tests, conducted through the link supervision system GUI, are invaluable for checking modem and radio components. However, they fall short in identifying antenna system problems. In this instance, the RF loop test yielded no clues, necessitating a field inspection to pinpoint a potential antenna failure.



Troubleshooting a critical backhaul microwave link in such a harsh environment is not a joke. Crews tend to seek out the quickest fix to limit the time exposed to the elements. Without utilizing field-ready portable RF testing equipment crews can end up in a guessing game. Sometimes they guess wrong - making an attempt at realigning/repositioning the good side and misaligning the entire link instead of fixing it.

Another common problem is related to the use of a multimeter as an indicator of proper antenna alignment: in high power RF sites (broadcasting FM radio, TV, ...), the tester becomes unreliable due to oversaturation. On the other hand, using GUI-based received signal level readings is not recommended because they lack real-time accuracy.



## THE SOLUTION

To tackle these challenges, WINDTRE turned to a spectrum analyzer for field use. This device offered a straightforward way to determine whether the failed antenna resided at the local or remote site, aiding technicians in climbing the correct tower. In situations where E-band links are short, providing a clear line-of-sight (LOS) from the local site's tower base to the remote terminal, verification could be performed without traveling to the remote site.

Additionally, mounting the spectrum analyzer directly on the antenna ensured rapid and precise alignment, eliminating the risk of RF interference on the multimeter and minimizing time-consuming errors associated with GUI signal level readings.

WINDTRE adopted the Spectrum Compact E-band by SAF Tehnika, a 70-87 GHz handheld spectrum analyzer kit (P/N: J0GSAP8001), which facilitated ground-level analyses and direct antenna alignment. The kit comes with a small horn antenna suitable for radio and antenna system verification at ground level. Using the Spectrum Compact E-band, WINDTRE swiftly identified that the antenna problem was at the M.Leco site, not Campomorone, based on readings from the M.Leco tower base.

Antenna replacement and alignment in M.Leco was carried out the next day in less than 12 minutes due to the skill of the RF technician and the precision alignment capability achieved by connecting the Spectrum Compact E-band directly to the replacement antenna.

***"The E-band spectrum analyzer was very effective and would be a significant time-saver resolving similar issues. The settings are simple and very intuitive - even our junior technicians can use it with minimal training. The instrument is indispensable in fault detection and provides very effective support during installation." – Paolo Caminata – WINDTRE***

## E-BAND LINK TROUBLESHOOTING – THE PROCESS

Here is the summary of the process used by WINDTRE for troubleshooting E-band links, specifically in the case of a complete outage on an 80 GHz link. WINDTRE utilized SAF Tehnika's Spectrum Compact E-Band ultra-portable spectrum analyzer. The unit has a compact, robust, and user-friendly design with a touchscreen for operation even while wearing gloves.



### STEP 1.

To conduct ground-level measurements outside the antenna radiating system, it is necessary to use a sturdy support mechanism such as a camera tripod to ensure accurate verification of beam diffractions.

### STEP 2.

Configure the center frequency, reference level, and select "power in band" option. The SAF Spectrum Compact E-band 3 hr battery life provides ample time for most field tests (bringing along a USB power bank extends usage time if needed).

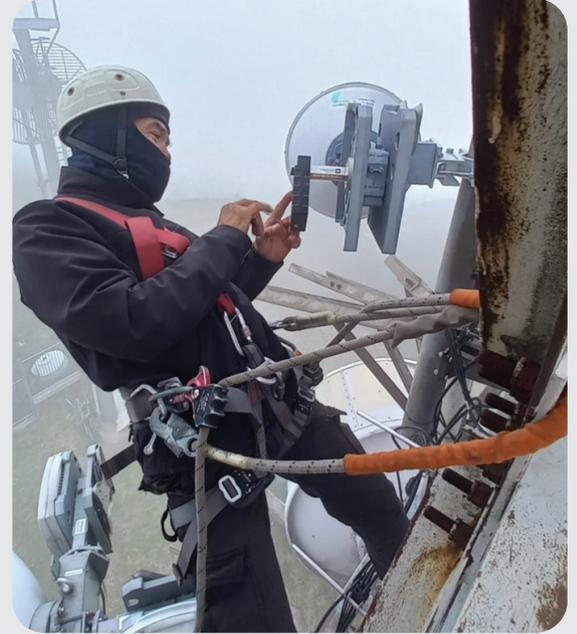
### STEP 3.

Test RF levels of local terminal and of any linked remote terminal (whether in line-of-sight) for benchmarking expected signal levels and determine the failed antenna.



## STEP 4.

Climb tower, rooftop or mounting structure to access the antenna to be replaced. Using the WR12 rigid flange guide - mount the Spectrum Compact E-band unit to the antenna (care needs to be taken to protect the flange guide from moisture in adverse conditions).



## STEP 5.

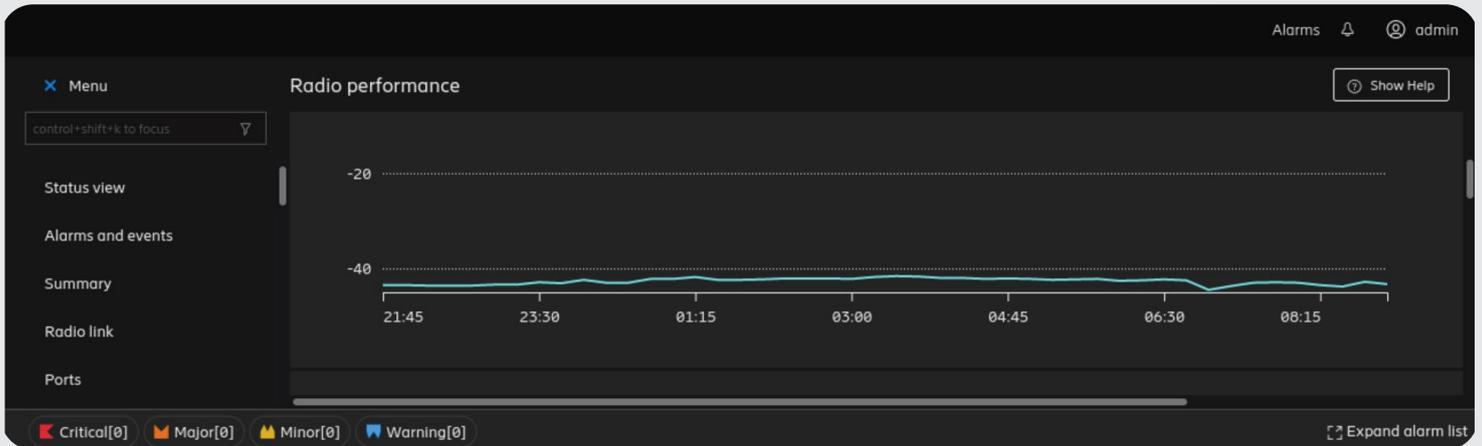
Fine-tune antenna alignment to precision accuracy with the visual "power in band" reading and the audible signal via the 3.5 mm audio output. Then tighten down the antenna mount to the manufacturer's specification.

In cases where it is difficult to work with the mounted spectrum analyzer (due to the antenna placement at the site) a micro-USB cable can be utilized to connect to a ruggedized pc or tablet for viewing the live spectrum scans in the Spectrum Manager application.



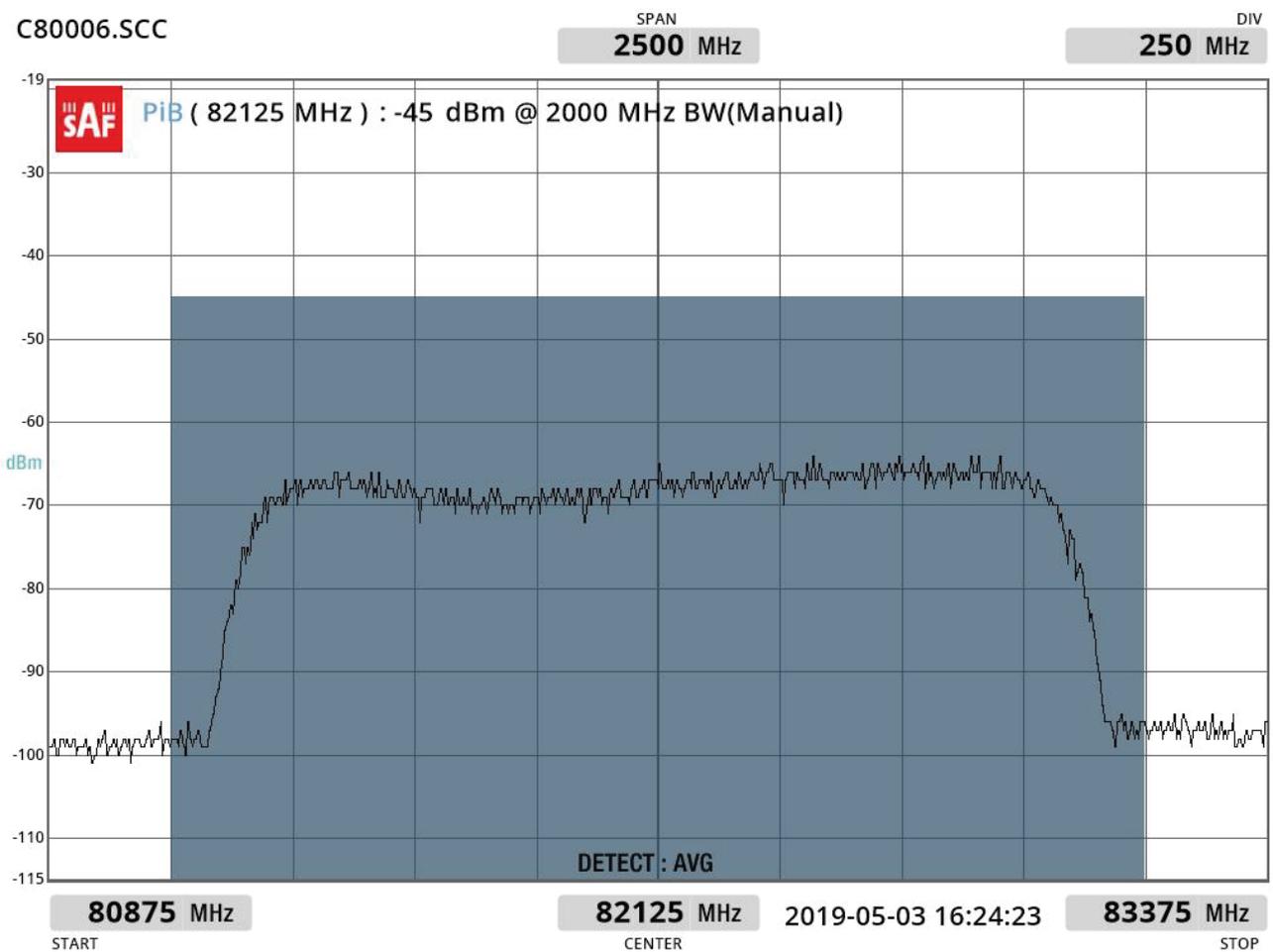
## STEP 6.

Re-mount radio and cables. Power up and verify radio parameters.



## STEP 7.

Take spectrum scan for signal verification and save it to the internal memory of the device to review it on the SAF Spectrum Manager PC software and create reports.



## CONCLUSIONS

Having field-optimized handheld spectrum analyzers should be included as essential equipment for installation and troubleshooting of microwave radios. Utilizing the E-band spectrum analyzer was instrumental in quickly identifying and solving WINDTRE's link outage problem.

The compact form factor, intuitive graphic user interface, and 3 hr long battery life in a handheld Spectrum Compact E-band spectrum analyzer saved considerable guesswork while troubleshooting. WINDTRE was able to conduct a ground level survey of both ends of the E-band link from the same location using the handheld analyzer – saving manpower and time while quickly identifying the problematic side of the hop. Swapping out a damaged antenna was accomplished in record time. In-the-field RF spectrum scans confirming optimal signal levels were saved for reference using the Spectrum Manager PC software.

SAF's Spectrum Compact banded solution of swept-tuned spectrum analyzers provides flexibility for operators, allowing them to choose the devices of specific frequencies tailored to their network needs. For operators deploying licensed backhaul and E-band links, the 6-20 GHz, 16-26.5 GHz, 24-43 GHz, 56-71 GHz and 70-87 GHz units are uniquely suited for most of their RF analysis requirements.



**SAF Tehnika** is one of the most specialized microwave data transmission technology manufacturers in Europe with long-term competence in the development and production of microwave radios, compact handheld touchscreen spectrum analyzers **Spectrum Compact** and radio signal generators, and IoT wireless monitoring ecosystem **Aranet**.



For more detailed information visit [saftehnika.com](https://saftehnika.com)

or contact your SAF Tehnika representative [info@saftehnika.com](mailto:info@saftehnika.com)

Product features may vary between different models and configurations.

They are subject to change without prior notice. **SAF Tehnika © 2023**

