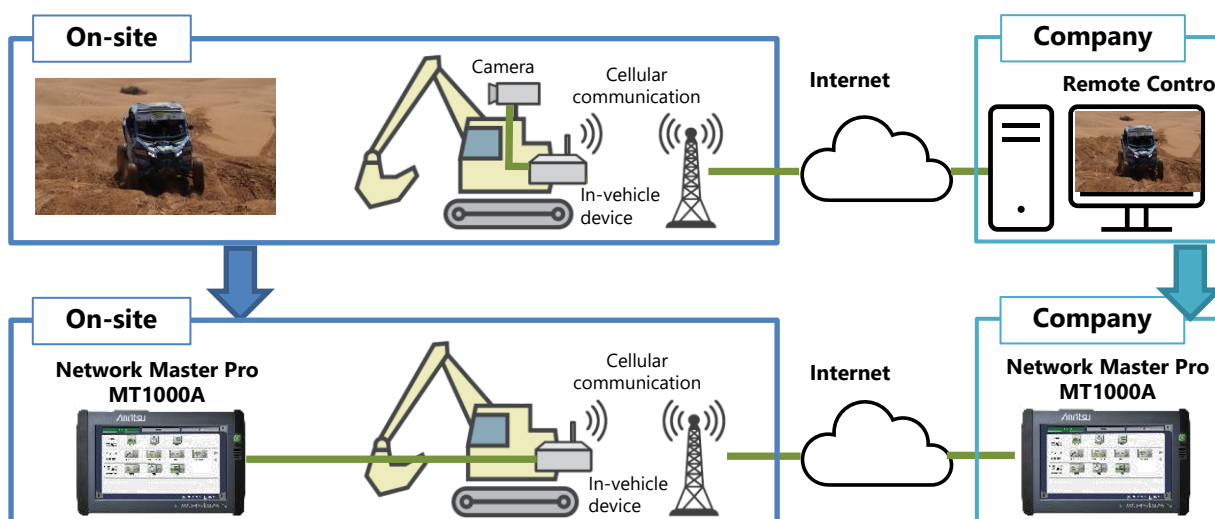


Remote Control of Agricultural/Construction Machinery – Communications Quality Test Solution

Anritsu Network Master Pro MT1000A
 Anritsu Base Station Simulator MD8475B/MT8000A
 Apposite Network Emulator Linktropy

With the spread of sensing and cellular communications technologies, agricultural and construction businesses are increasingly using Information Communications Technology (ICT) due to expectations for better safety, productivity, and quality. In these circumstances, testing and assuring communications quality are critical to guaranteeing precise remote control of agricultural/construction machinery even when video quality is degraded by communications latency and data loss. This leaflet introduces on-site communications quality evaluation and Service Level Agreement (SLA) benchtop testing.

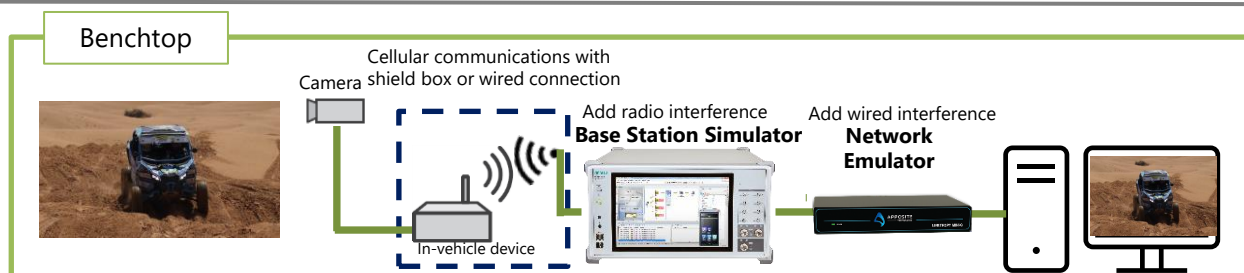
1. On-site Communications Quality Evaluation (explained on next page)



The Network Master Pro supports:

1. Quantitative evaluation of impact from time-variable network load by other communications using fixed-period monitoring
 2. Assured reproducibility of interference using hardware-based fixed-data-rate transmissions
- The software-based iPerf application may be overloaded by burst data exceeding presumed levels.

2. Service Level Agreement (SLA) Benchtop Testing (explained on next page)



Secure minimum service level quality by adding wireless and wired interference to conclude SLA with Mobile Network Operator (MNO).
 Perform regular on-site quality evaluation if SLA not concluded.

1. On-site Communications Quality Testing

Although the PC ping command and the iPerf software application are simple tools for evaluating communications quality on-site, the measured results depend upon PC performance. Additionally, iPerf may not measure quality correctly due to high-rate burst data overloading the presumed network capacity. Consequently, these methods are not ideal for industrial applications such as remote control of valuable agricultural and construction machinery with severe safety risks for people.

The following evaluations can be performed with assurance using the Network Master Pro, MT1000A, with hardware-based data transmissions.

- Securely reproduce communication conditions by transmitting data at high but stable rates
- Assess impacts from other communications using simple, daily, weekly, and monthly long-term monitoring
- Discover bottlenecks by measuring downlink and uplink separately
- Determine change in worst value with time by monitoring minimum, average, and maximum values

2. Service Level Agreement (SLA)

The impact of communications quality on actual remote control can be assessed from the video for remote control. Current communications condition can be confirmed on-site. However, the minimum required level cannot be reproduced stably. The level is reproduced by configuring a benchtop communications evaluation model in a lab. Combining Anritsu's Base Station Simulator, MD8475B (or MT8000A for 5G), with the Apposite Linktropy network emulator reproduces both radio and wired communications interference accurately. It can define the communications service level assuring the minimum required video quality. After the level is defined, the SLA is concluded with the MNO to guarantee the service level.

Without a defined SLA, communications quality varies from time to time and data rates can fall constantly as transferred data sizes increase. In this case, quality must be confirmed by repeated on-site communications quality tests.

Ordering Information

Model	Name	Function
MT1000A	Network Master Pro ^{*1}	Network monitoring and data capture
MD8475B	Signalling Tester ^{*1}	2G/3G/4G base station simulation
MT8000A	Radio Communication Test Station ^{*1}	5G base station simulation
	Network Emulator ^{*2}	Interference addition by network emulation

*1: Contact Anritsu sales representative for configuration details.

*2: Product of Apposite Technologies;; contact Apposite for details.