

R&S®EMC32 / R&S®AMS32 V8.70

Release Note

Products:

- | R&S®AMS32

This document gives an overview of the additional features and improvements that are implemented with version 8.70.0

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1 Scope

This document gives an overview of the additional features and improvements that are implemented with version 8.70.0:

- R&S® AMS32 (OTA Measurement Software)

Subject to change.

2 Installation/Update

Download and expand the “Update_EM32_8V70_0.zip” file (requires password for unzip and is encrypted with WinZip 2.0 method) into a temporary folder on your hard drive.

Run the “Setup.exe” program in order to update your EMC32/AMS32 installation to V8.70.0.

For further information please follow the update instructions in the installation guide.

3 Introduction of MIMO OTA Testing (Option AMS32-K31)

With the release of V8.70, a new option AMS32-K31, implementing OTA MIMO 2x2 testing, is available.

In this first release the following features are supported by this option:

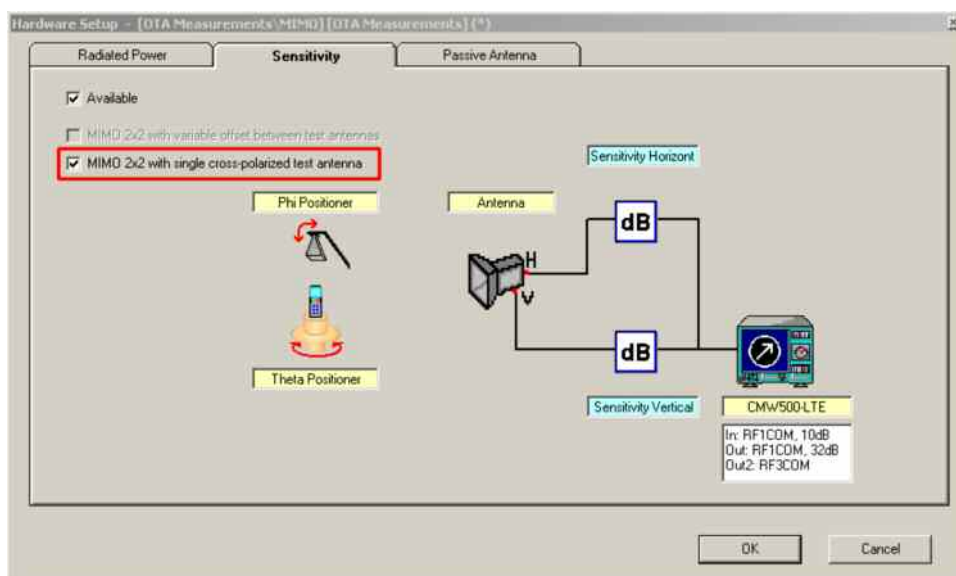
- Sensitivity tests with MIMO 2x2 in the downlink
- Radio technologies: LTE-FDD and TD-LTE, both with R&S CMW500. Minimum required firmware versions: For LTE-FDD, V2.0.20 for both “CMW BASE” and “CMW LTE Signaling” firmware. For TD-LTE, see section 4.1.1.
- Simple system setup with a single cross-polarized measurement antenna. The two downlink streams are fed to the two orthogonal polarizations of the antenna. (e.g. with R&S R-Line Compact Test Chamber)
- Evaluation according to the corresponding section (“Noise-Limited Performance in Diversity Mode”) of the MIMO OTA test plan presented by Rohde & Schwarz to the COST IC1004 meeting in Lund, Sweden, in June 2011.

Extended features, like additional radio technologies, and more complex system setups, will be implemented in the future, being automatically added to the option AMS32-K31 with later AMS32 releases. For additional details and background please refer to Application Note 1SP12 **Two-Channel Method for OTA Performance Measurements of MIMO-enabled Devices**, which can be downloaded from the Rohde & Schwarz homepage.

3.1 Configuring a MIMO Setup

3.1.2 Hardware Setup

The starting point for configuring a MIMO test is checking the new box **MIMO 2x2 with single cross-polarized test antenna** in the **Sensitivity** tab of an OTA Hardware Setup:

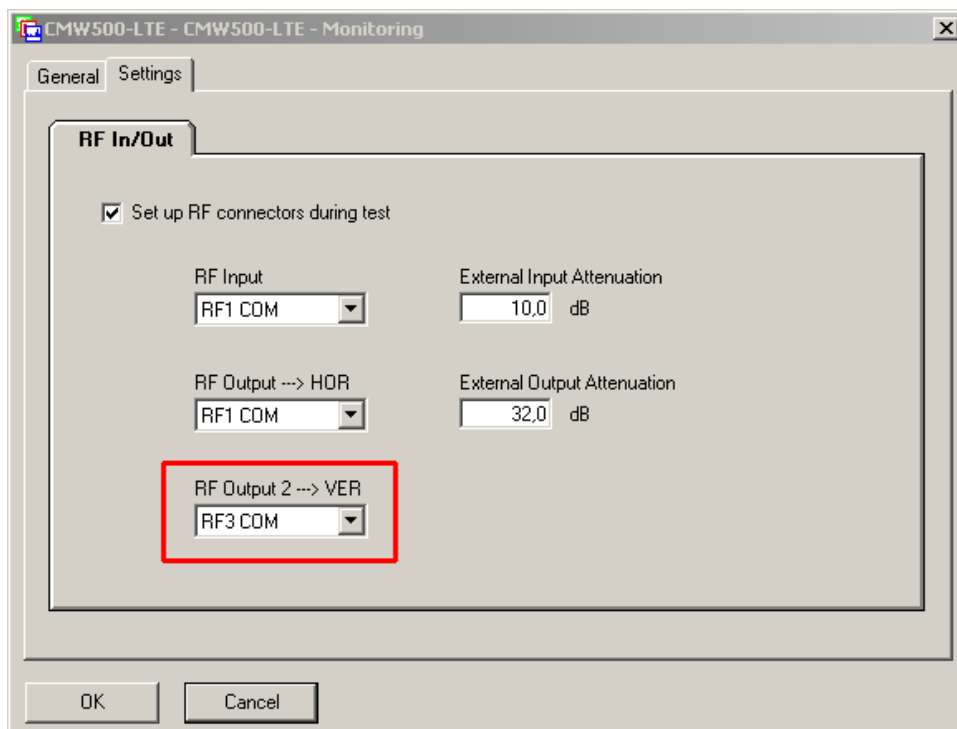


This new check box will only be visible if option AMS32-K31 is active.

On checking this box, only those Communication Tester instrument drivers will be available for selection which support MIMO setups. For AMS32 V8.70, the CMW500-LTE driver is the only one.

As can be seen in the above screenshot as well, it is not mandatory that the Signal Paths selected in the Hardware Setup contain switching information, because the setup will be fixed, without polarizations being switched, as both polarizations of the test antenna are fed simultaneously with the two downlink streams.

On the other hand, the RF configuration of the communication tester will be extended for selecting a second output RF connector:



The *External Output Attenuation* associated to the *RF Output 2* is not available for configuration; it will be configured automatically by the software as explained below.

3.1.2 OTA Test Template

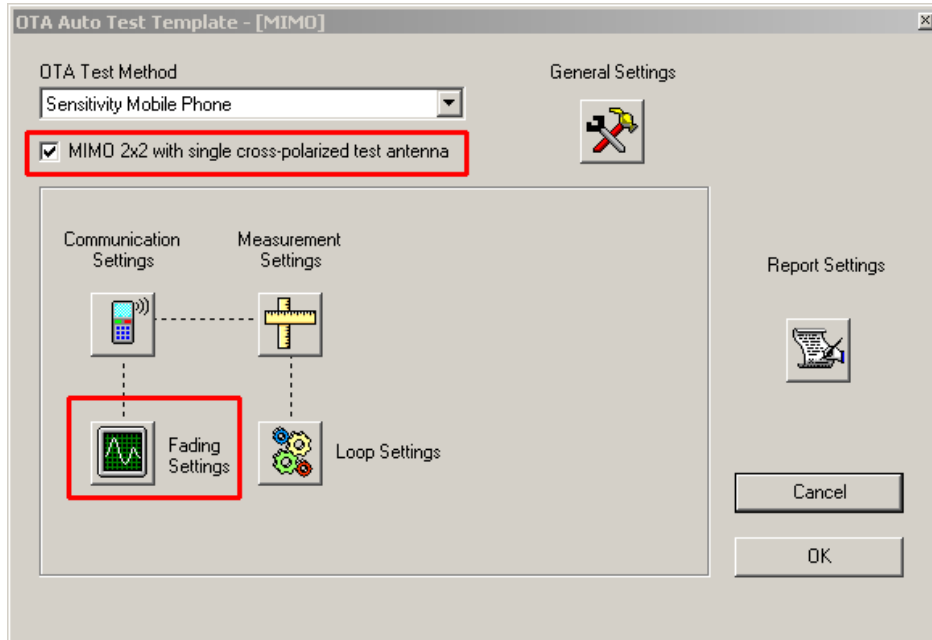
Once a Hardware Setup for MIMO has been saved, the next step is configuring a test template.

3.1.2.1 Main Dialog

If a Hardware Setup configured for MIMO is selected in the **General Settings** dialog, two new elements will appear in the main dialog of the OTA test template editor:

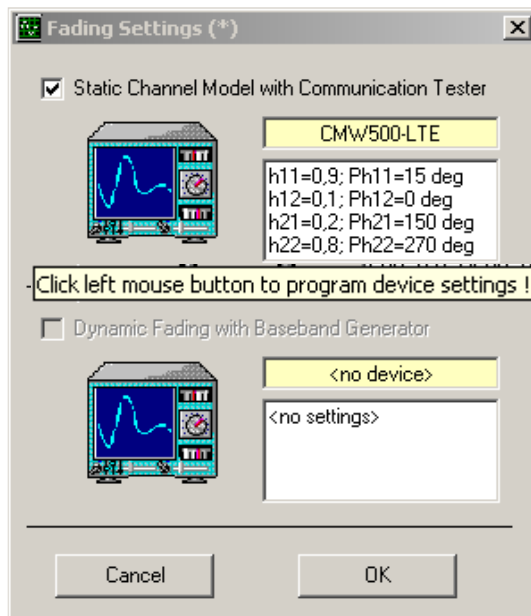
- A check box **MIMO 2x2 with single cross-polarized test antenna**. This box will always be checked, and is there for reminding the user that the test template he is working on is a MIMO setup. For removing this box, select another non-MIMO Hardware Setup in the **General Settings** dialog.

- A new button labeled **Fading Settings**. As the other buttons in the dialog, clicking on this one will open an additional sub-dialog for configuring fading or channel models to be applied during the test. More details are given in chapter 3,1.2.2.



3.1.2.2 Fading Settings Sub-Dialog

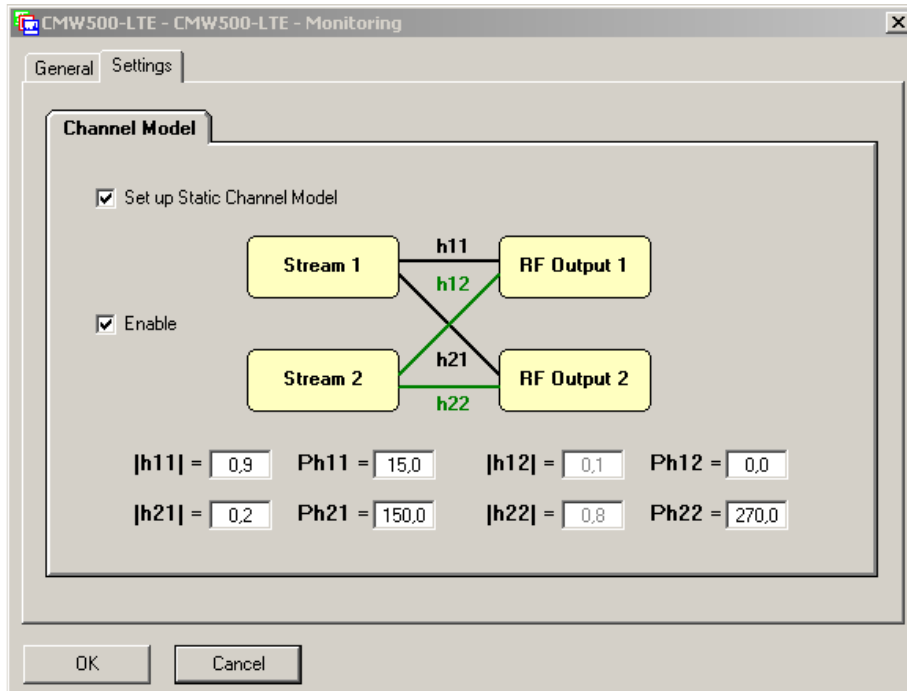
The new **Fading Settings** sub-dialog includes two areas for configuration:



Checking the box **Static Channel Model with Communication Tester** will automatically select the Communication Tester instrument driver configured in the Hardware Setup. If the box is not checked, no instrument can be selected, and no channel model can be configured.

An additional section allowing to configure dynamic fading with a baseband generator is available for future extensions and disabled in V8.70. A R&S AMU200A will be supported for applying a fading model to the baseband I/Q signal of the communication tester, and feed it back to the CMW500.

To configure the static channel model on the CMW500, please click with the left mouse button on the icon symbolizing the instrument. The following dialog will appear:



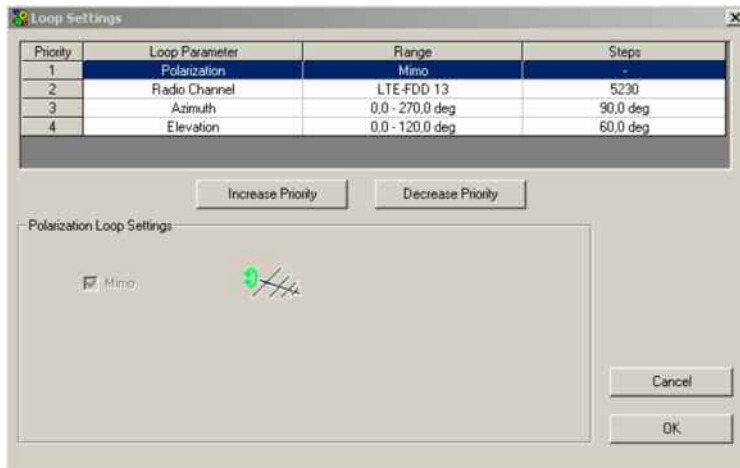
Four components of the 2x2 channel matrix can be defined, where the relative phases of all four can be defined independently of each other to be multiples of 15 degree, whereas only the two magnitudes h_{11} and h_{21} are configurable to the user (resolution 0.1). h_{12} and h_{22} are automatically set by the expressions $h_{12} = 1 - h_{11}$ and $h_{22} = 1 - h_{21}$.

It is also possible to disable the static channel model, making sure both downlink data stream are generated without cross-correlations.

Please note that fading the MIMO signal is not required according to the Rohde & Schwarz OTA Test Plan. The possibility to fade the signal has only been added in order to support R&D investigations.

3.1.2.3 Loop Settings Sub-Dialog

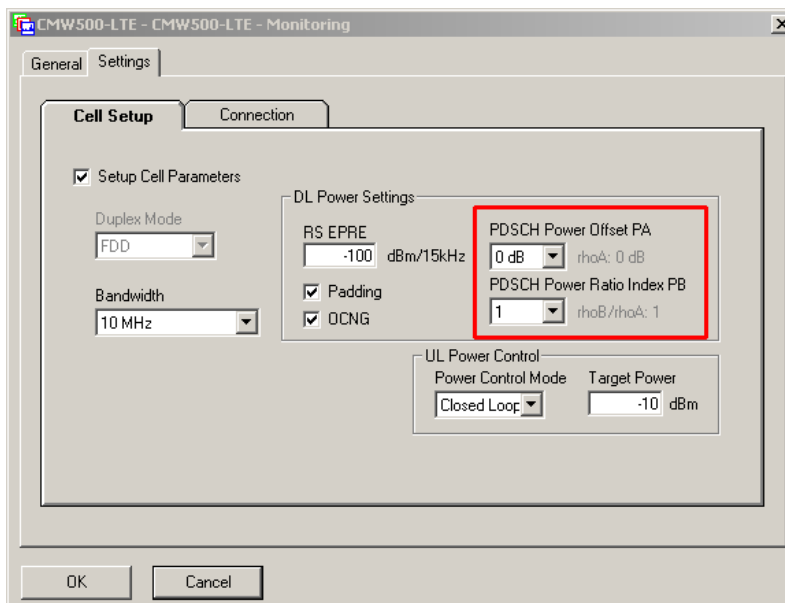
In the **Loop Settings** sub-dialog, only one test antenna (cross-polarized) is visible. As discussed above, the system setup will be fixed, without switching between polarizations.



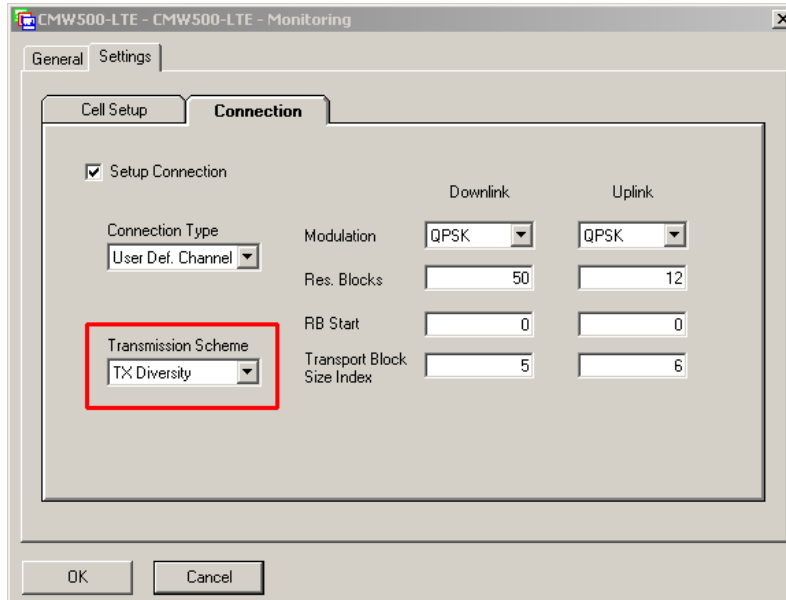
3.1.2.4 Communication Settings Sub-Dialog

Finally, the **Communication Settings** sub-dialog has been extended. The settings have been divided into two tabs **Cell Setup** and **Connection**, and additional parameters have been added for allowing the user to configure them.

Especially for MIMO, the relevant new parameters are **PDSCH Power Offset PA** and **PDSCH Power Ratio Index PB**, which together will define the power levels of LTE PDSCH for both data streams, relative to the RS EPRE value. Please refer to the CMW500 manual for more details.



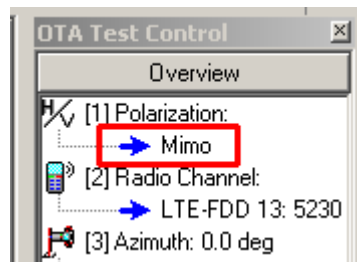
In the **Connection** tab, a list box allows the configuration of the **Transmission Scheme**. Available selections are TX Diversity, Open Loop Spatial Multiplexing (OLSM) and Closed Loop Spatial Multiplexing (CLSM):



3.2 MIMO Test and Results

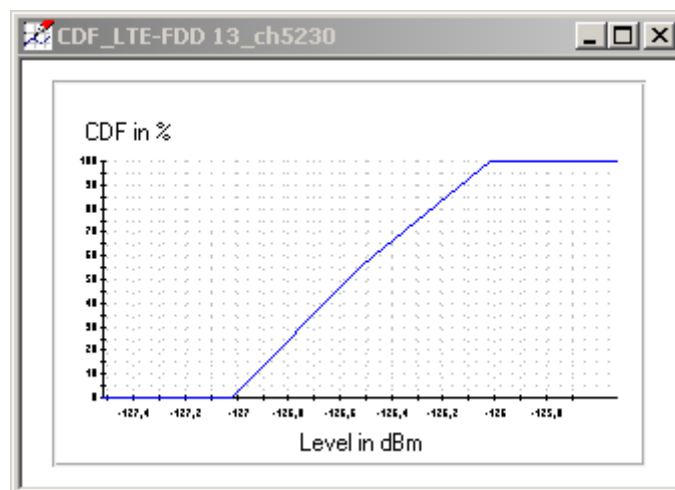
During a test run with a MIMO system configuration, the following changes will become visible:

- There is no polarization switching, but each of the downlink data streams is routed always to the same antenna connector, as configured in the Hardware Setup. The polarization display in the OTA Test Control pane will be set to **Mimo**.



Also, as there is only one polarization configuration to be considered, one single polar graph will be displayed during the test and one single result table will be generated. Both will be named ending in “_hor”.

- At the end of the test, a 3D graph will be generated as usual. However, this will show no TIS value. In fact, the standard evaluation for calculating the figures of merit (TIS, NHPIS, etc.) for SISO testing is completely skipped, because these figures of merit are not significant for MIMO.
- Instead, the CDF (Cumulative Distribution Function) of the sensitivity threshold values for all positions will be calculated as a function of the downlink level, as described in the R&S MIMO OTA Test Plan. This function will be saved to a table and displayed in a Cartesian graph, both of them named with “CDF_” at the beginning.



- The standard CTIA report will be generated, including the screenshots of the 3D graph, but without the **OTA Evaluation Results** section. Additionally, a second report including the CDF graph will be generated.

Two additional points are important for understanding the MIMO test procedure:

- The external attenuation for the second RF output connector can not be configured by the user (see section 3.1.1). Instead, this value will be automatically set by the software as follows: external attenuation of RF output 2 equals the external attenuation of RF output 1 matched by the difference of the attenuation values defined in the signal paths attenuation tables associated to both connectors. The antenna connector for the horizontal plane is linked to RF output 1, the vertical one to RF output 2.

If the downlink attenuation values for both paths have been correctly calibrated, compensating the path attenuation difference by the same difference in external attenuations will generate equal power density for both downlink streams at the DUT location.

- In addition to the sensitivity threshold values measured at each point, which are saved to the result table of the test, AMS32 logs the BLER and throughput values measured at every downlink level during the test. The data are logged to a file "LteMimoData.csv" in the test's \System sub-folder. The layout of this csv file is the following:

	A	B	C	D	E	F	G	H	I	J	K	L
	Azimuth	Elev. 1	Elev. 2	Polarization	LevelDL	BLER	NACK	Throughput abs	Throughput rel	DTX abs		
1												
2												
3	0	0	0	hor-ver	-100	0	0	4392	100	0	15.49.06	30.06.2011
4	0	0	0	hor-ver	-100	0	0	4392	100	0	15.49.07	30.06.2011
5	0	0	0	hor-ver	-102	0	0	4392	100	0	15.49.08	30.06.2011
6	0	0	0	hor-ver	-104	0	0	4392	100	0	15.49.09	30.06.2011
7	0	0	0	hor-ver	-106	0	0	4392	100	0	15.49.10	30.06.2011
8	0	0	0	hor-ver	-108	0	0	4392	100	0	15.49.11	30.06.2011
9	0	0	0	hor-ver	-110	0	0	4392	100	0	15.49.12	30.06.2011
10	0	0	0	hor-ver	-112	0	0	4392	100	0	15.49.13	30.06.2011
11	0	0	0	hor-ver	-114	0	0	4392	100	0	15.49.15	30.06.2011
12	0	0	0	hor-ver	-116	0	0	4392	100	0	15.49.16	30.06.2011
13	0	0	0	hor-ver	-118	0	0	4392	100	0	15.49.17	30.06.2011
14	0	0	0	hor-ver	-120	0	0	4392	100	0	15.49.18	30.06.2011
15	0	0	0	hor-ver	-122	0	0	4392	100	0	15.49.19	30.06.2011
16	0	0	0	hor-ver	-124	0	0	4392	100	0	15.49.20	30.06.2011
17	0	0	0	hor-ver	-126	0.17	0	4384.68	99.83	1	15.49.21	30.06.2011
18	0	0	0	hor-ver	-128	98.17	95.5	80.52	1.83	16	15.49.22	30.06.2011
19	0	0	0	hor-ver	-126	0.6	0.17	4365.65	99.4	13	15.49.26	30.06.2011
20	0	0	0	hor-ver	-126.5	4.17	3.3	4209	95.83	26	15.49.30	30.06.2011
21	0	0	0	hor-ver	-127	31.5	29.6	3008.52	68.5	57	15.49.34	30.06.2011
22	0	60	60	hor-ver	-116.5	0	0	4392	100	0	15.49.49	30.06.2011
23	0	60	60	hor-ver	-116.5	0	0	4392	100	0	15.49.50	30.06.2011
24	0	60	60	hor-ver	-118.5	0	0	4392	100	0	15.49.51	30.06.2011
25	0	60	60	hor-ver	-120.5	0	0	4392	100	0	15.49.52	30.06.2011
26	0	60	60	hor-ver	-122.5	0	0	4392	100	0	15.49.53	30.06.2011
27	0	60	60	hor-ver	-124.5	0.17	0	4384.68	99.83	1	15.49.54	30.06.2011
28	0	60	60	hor-ver	-126.5	0.83	0	4355.4	99.17	5	15.49.55	30.06.2011
29	0	60	60	hor-ver	-128.5	98.83	97	51.24	1.17	11	15.49.56	30.06.2011

4 Changes to AMS32

4.1 Extensions

4.1.1 Support for TD-LTE

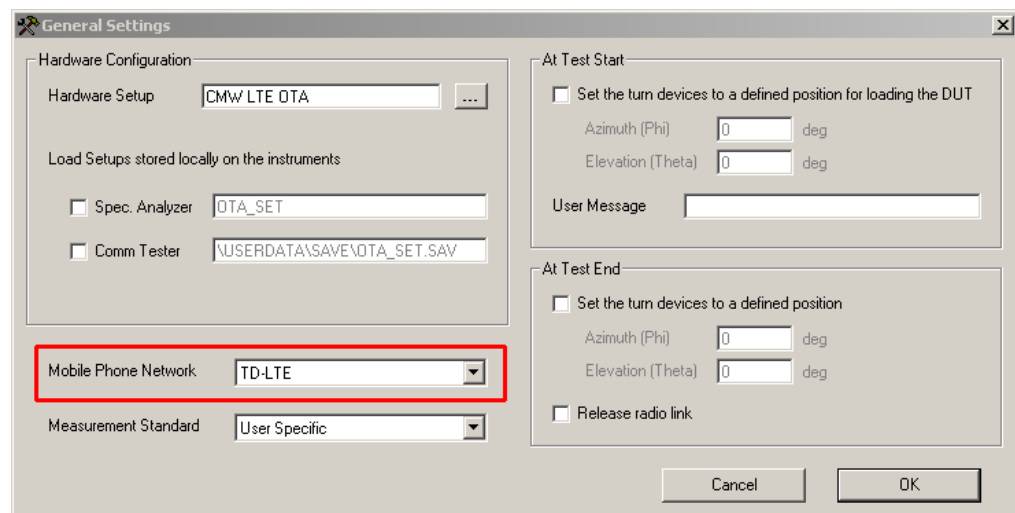
TD-LTE (or LTE-TDD) has been added as radio technology being supported for OTA measurements. It requires the same software options as for LTE-FDD: AMS32-K29 and/or AMS32-K30.

TD-LTE tests require the R&S CMW500 Wideband Radio Communication Tester with option CMW-KS550. The minimum firmware version required is 2.1.10 for the “CMW BASE” firmware and 2.1.21 for the “CMW LTE Signaling” firmware.

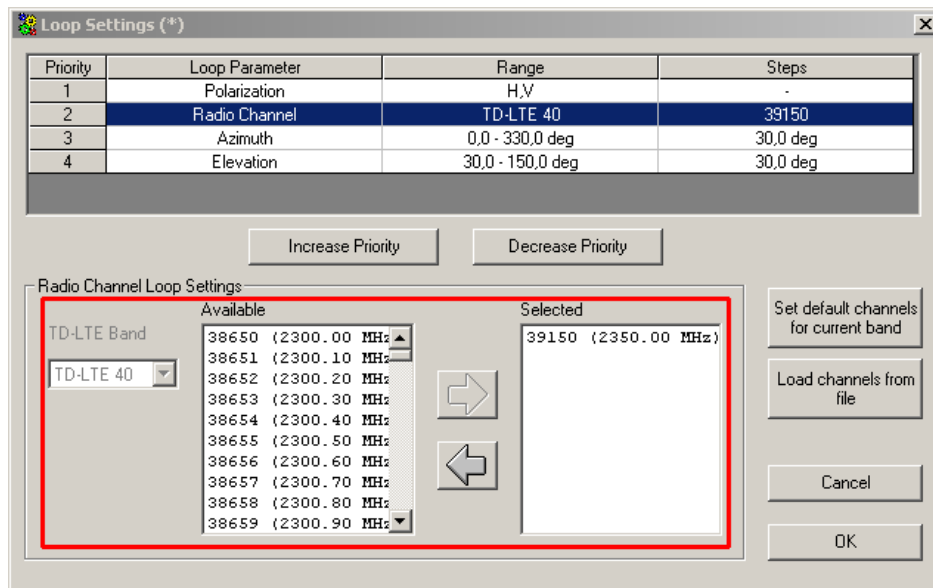
All TD-LTE bands currently defined in the standards, that is bands 33 to 43, can be configured. The CMW500 does not yet support all of them, but for the not supported bands there are no UEs available.

For performing an OTA test in TD-LTE, the following settings need to be configured in the OTA test template:

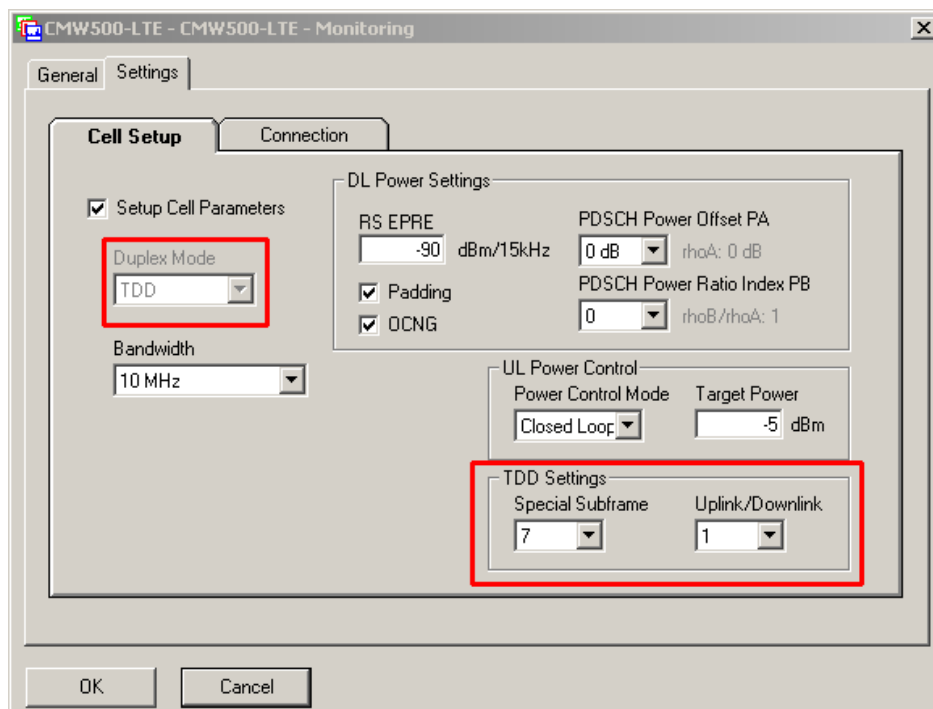
- **General Settings:** Select TD-LTE as Mobile Phone Network.



- **Loop Settings:** Select the TD-LTE band and channel to be tested.



- **Communication Settings:** Configure the CMW500 as needed. For TD-LTE, two additional configuration items have been added. The LTE signaling firmware version 2.1.21 of the CMW500 is currently restricted to the default settings shown below. Other settings are made available in next firmware versions.



Please note that the Duplex Mode is fixed by the selection in the **General Settings** section of the test template, and is displayed here for information only.

The AMS32 measurement operation for LTE-TDD, as well as evaluation and reporting are identical to LTE-FDD.

4.1.2 Support of Compact OTA Test Chambers with one Test Antenna

Small-sized OTA test chambers such as R&S DST200 RF Diagnostic Chamber or R&S R-Line Compact Test Chamber are usually equipped with a single cross-polarized test antenna. The radio communications testers CMU200 and CMW500 include RF front ends with multiple RF connectors. As a result external RF switch units are not required. It is possible to connect the antenna ports directly to the communication tester.

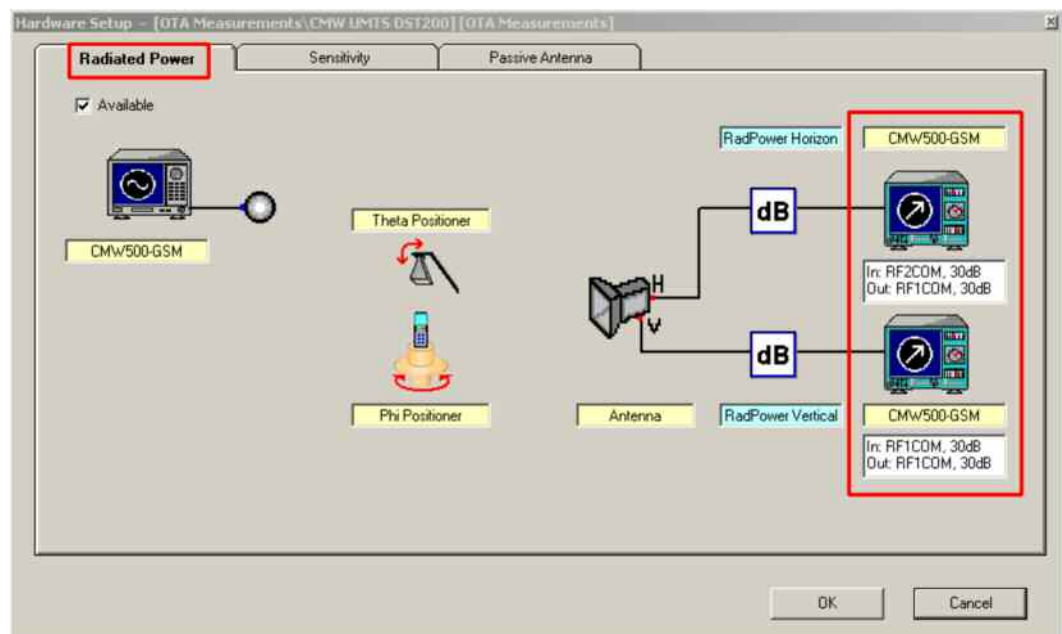
For example, consider a setup with CMW500 port RF1COM connected to the horizontal antenna polarization and RF2COM to the vertical.

TRP tests can be performed by switching the RF input between both antenna ports and measuring the uplink power with the CMW500. The downlink signal (maintaining the communication link) would remain routed fixed through one of the two, e.g. RF1COM.

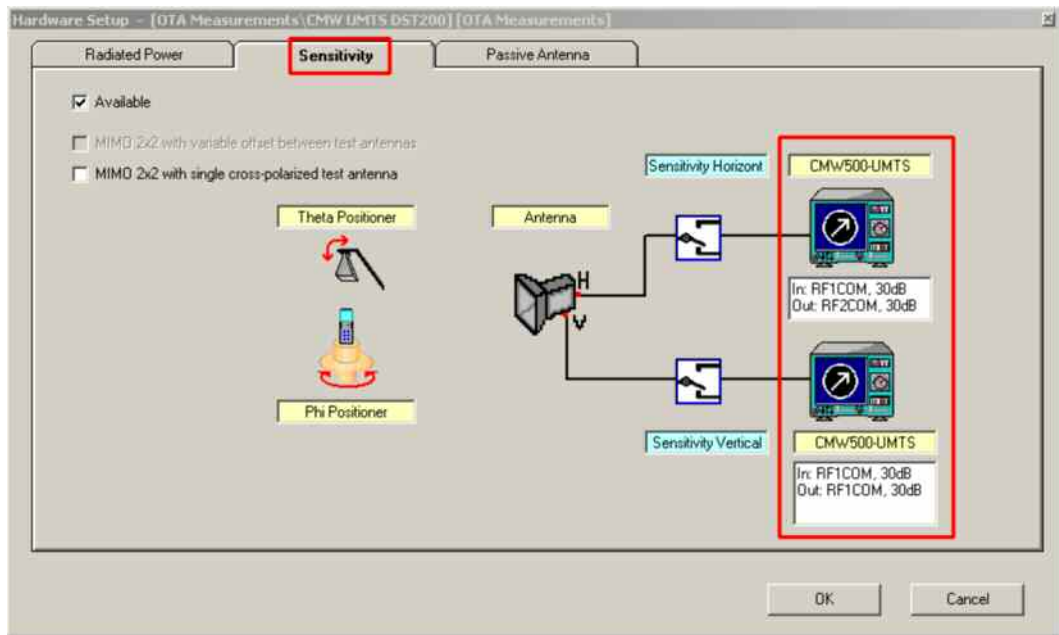
TIS tests would be done routing the downlink alternatively through both ports, while the uplink signal would be routed through a fixed input port, e.g. RF1COM.

The following screenshots show how to configure such a straightforward test setup in the AMS32 **Hardware Setup**. It is possible, with V8.70, to associate the same communication tester instrument to both antenna polarization with different RF connector selections, using signal paths that do not contain any reference to a switch unit.

For TRP:



For TIS:



A test template using such a straightforward system Hardware Setup will show no changes as compared to any other test template.

During the test run, the RF ports of the communication tester will be toggled when the measurement polarization changes, instead of routing different paths with an RF switch unit.

Both the R&S CMW500 and the R&S CMU200 support this straightforward test setup.

Cellular Technology	R&S CMU200	R&S CMW500
GSM	X	X
CDMA200	X	X
W-CDMA	X	X
LTE-FDD	-	X
LTE-TDD	-	X
WiMAX	-	X

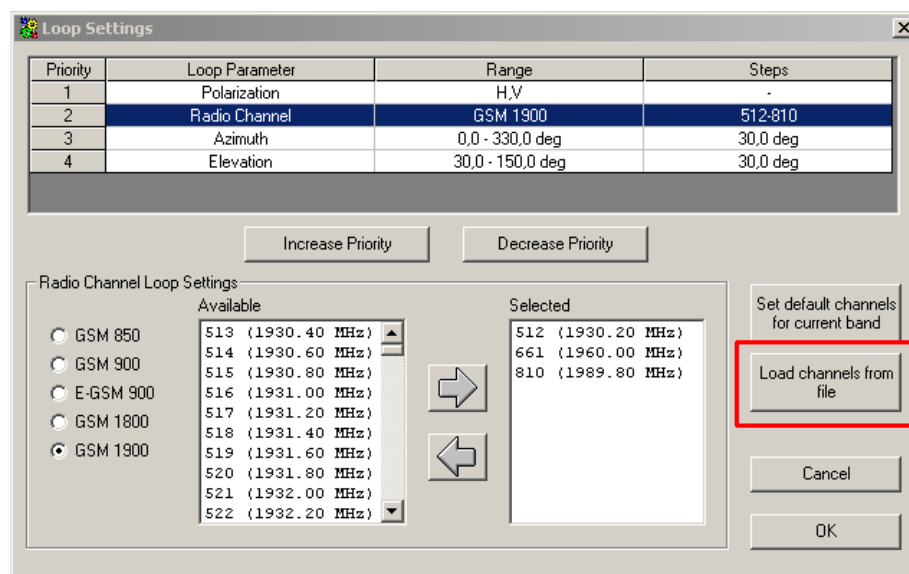
Please be aware that for passive antenna tests or TRP measurements (with a power meter or spectrum analyzer) an RF switch unit is mandatory.

4.1.3 Other Extensions

- **OTA Test Template editor, Loop Settings, Radio Channel Loop:**

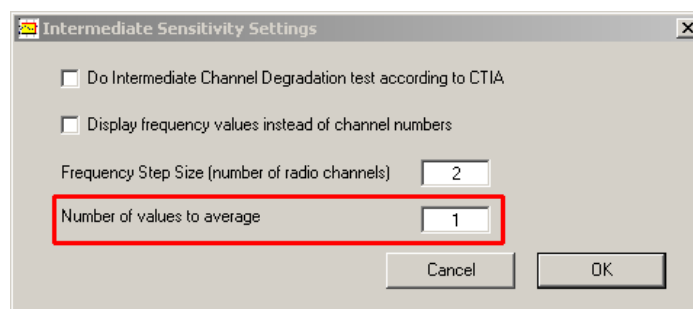
A new button **Load channels from file** has been added to the dialog. When clicking on this button, the standard file selection dialog will appear for selecting a table from the **SystemTables** folder. If this table contains valid channel numbers for the selected radio band, these channels are entered into the **Selected** channel list.

This allows configuring a selection of channels different from the default min/mid/max scheme. A typical application example is performing a Sensitivity Sweep on a list of channels at which self-interference effects are expected. The list of channels to test in this case can be somewhat arbitrary, not evenly distributed through the band. Instead of having to find the channels in the **Available** list, it is much easier and faster to enter them with just a click into the **Selected** list.



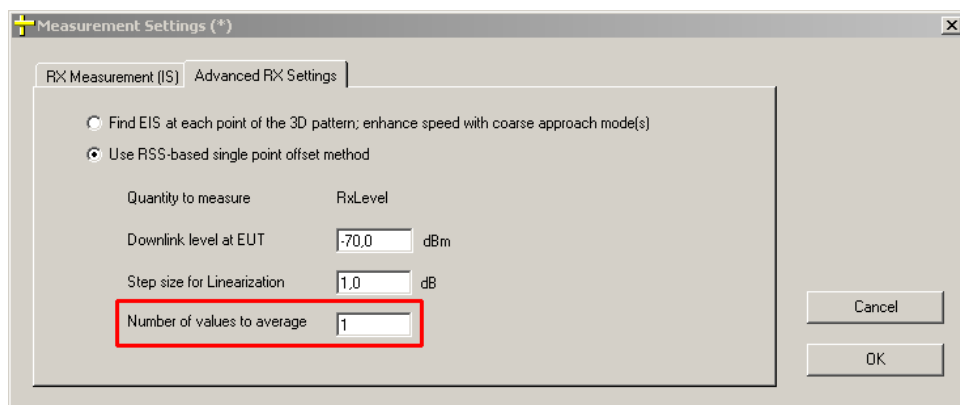
- **OTA Test Template editor, Intermediate Sensitivity Settings for A-GPS Measurements:**

A new field **Number of values to average** has been added to this dialog. This allows configuring several of measurements at each intermediate channel. The test results are linearly averaged. Up to V8.60, the number of values to average was taken to be that configured for the level linearization in the **Measurement Settings** sub-dialog.



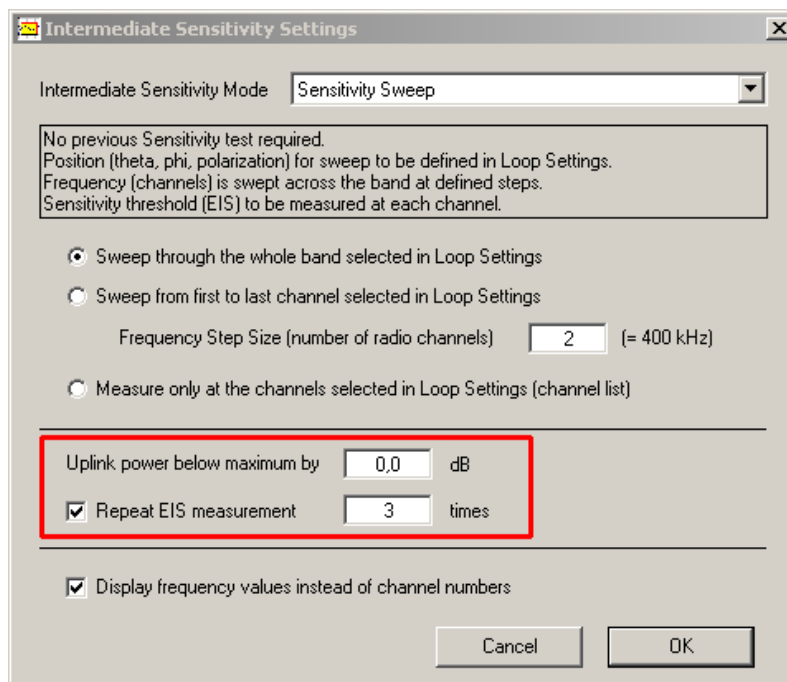
- **OTA Test Template editor, Measurement Settings for Sensitivity (TIS) tests with RSS-based method:**

A new **Number of values to average** has been added to this dialog. This allows configuring a number of measurements to average at each position during 3D pattern acquisition and for each step during level linearization. Up to V8.60, only one measurement was taken at each level except for A-GPS, where this field was already available.



- **OTA Test Template editor, Intermediate Sensitivity Settings:**

Two new fields have been added to this dialog. Both of them are for R&D purpose only, they should not be used for tests conforming to standard.

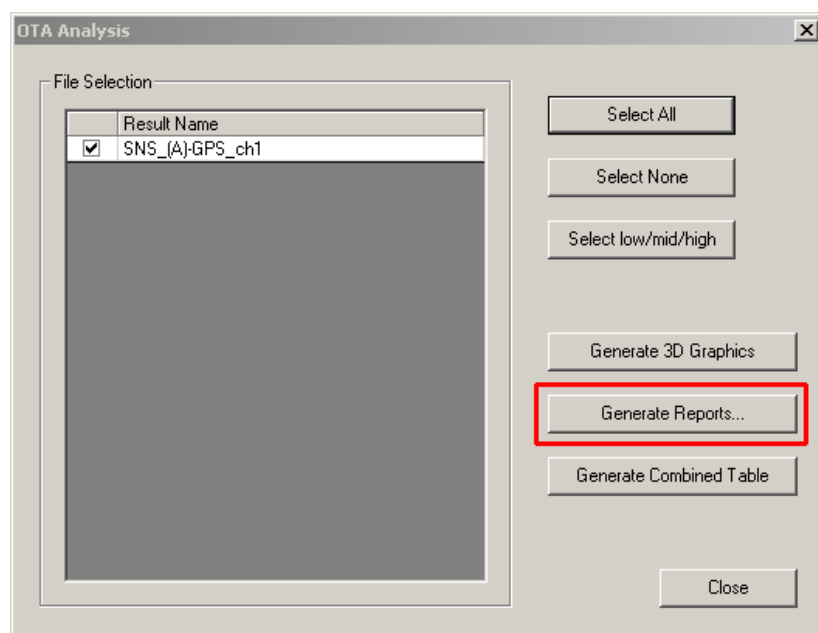


Uplink power below maximum by adds the possibility of conducting the Intermediate Sensitivity test at a DUT output power level less than the rated maximum, in order to save battery lifetime. This field is available for all Intermediate Sensitivity Modes (according to CTIA, Sensitivity Sweep and Sweep with constant power).

Repeat EIS measurement adds the possibility of making the EIS measurement (sensitivity threshold evaluation) several times at each radio channel during the sweep. This field is available only if mode **Sensitivity Sweep** has been selected, as only in this mode the EIS is measured. Whenever repeated EIS is activated, an additional result file ending in “_AllReps” (for “all repetitions”) will be generated, holding the results of all repetitions. The purpose of this new feature is to be able to estimate the stability of the EIS value and hence of the DUT’s sensitivity with time.

- **Reporting:**

When re-generating the standard CTIA reports from the **OTA Analysis** dialog, any report for intermediate channel tests will also be newly generated. Click the **Generate Reports** in the OTA Analysis dialog:



- **Reporting for A-GPS:**

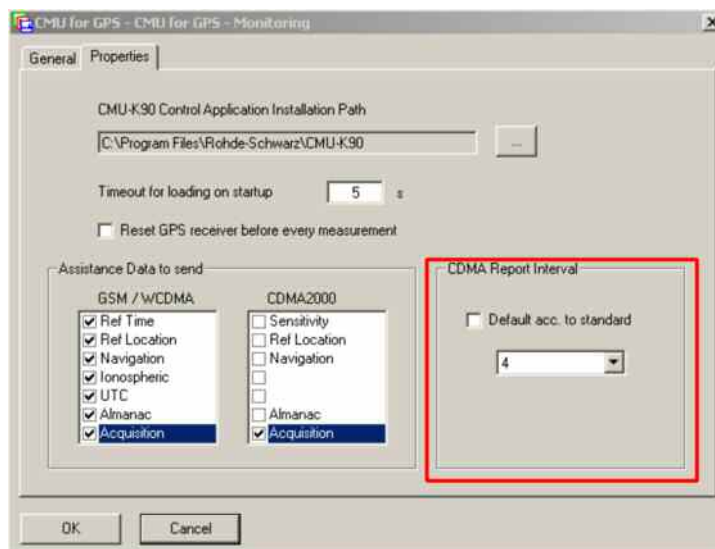
In the report for A-GPS ICD (Intermediate Channel Degradation), a new line has been added displaying the overall GPS ICD value (maximum of all measured values):

Test Information:

Test Method:	Sensitivity Mobile Phone
Test Condition:	FS: Free Space
CMU for GPS Connectors:	In: RF2 (30.0 dB), Out: RF2 (30.0 dB)
GPS ICD Value:	0.83 dB

- **A-GPS driver:**

A new configuration entry **CDMA Report Interval** has been introduced in the driver’s **Properties** dialog. The standard requires 16 seconds report interval, which was used by default until now. However, some EUTs will not work with such long report intervals, so it is possible to configure shorter intervals down to 2 seconds..



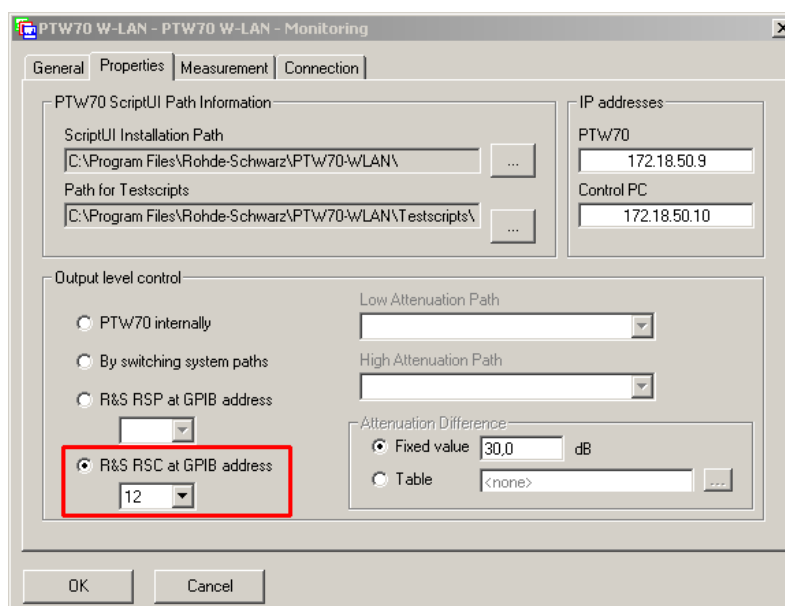
Checking the box **Default acc. to standard** will fix the report interval to 16 seconds.

- **A-GPS driver:**

Call setup after loss of call is now more efficient, the driver will try immediately to restart the call without reprogramming the test instruments (R&S CMU200 and R&S SMU200A). Only if the call recovery fails, the system is re-initialized.

- **PTW70 driver:**

The programmable Step Attenuator R&S RSC has been added as an option for controlling the external attenuation of the downlink path. If needed, please select it in the driver's **Properties**:



Selecting this new option works exactly in the same way as for the already selectable R&S RSP RF Step Attenuator. Only a different instrument is controlled.

4.2 Improvements

For each item, the AMS32 version when the corrected problem first appeared is stated at the end of the description in brackets.

OTA Test Loop Measurement Control

- Relative Sensitivity test according to CTIA would abort before starting with an error message “4009: Index out of range”. This has been corrected. (V8.60)
- For Complex RSSI testing (option AMS32-K30), linearization was done only once at the overall best position. Now it is done twice, once for each polarization, at the position where the highest RSSI value was detected for this polarization. (V8.50)
- Intermediate Channel Degradation for A-GPS would continue without stopping if the radio link was lost. This has been corrected. (V8.30)

Reporting

- The vertical bar indicating the color scale of the 3D graph was not included when printing the six default views of the 3D graph to a report. Printout of the color bars has been recovered. (V8.40)

Device Drivers

- CMW270 driver would try to control a UE's uplink power, even if not used during the test, as long as it was entered to the **Device List**. This could lead to a troublesome message box popping up during call setup. This has been corrected. (V8.60)
- NRP driver: NRP-Z81 does not work for measuring GSM bursts with the same settings as other insertion units. The trigger level has been adapted to -20 dBm. Anyway, it is recommended to use another insertion unit (NRP-Z11).
- Signal Path driver: Path calibration with a network analyzer in LIN or LOG mode was done with a fixed number of points of 401 on the instrument, instead of using the number of points configured in the driver's settings. This has been corrected, the configured number of points is used. (V8.40)

About Rohde & Schwarz

Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Environmental commitment

- Energy-efficient products
- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system



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