

RSAXxx(N) EMI Mode – Getting Started

Introduction:

In this description you will find first steps of operation how to work with EMI Mode in RIGOL's RSA Series¹ and how to adjust different settings. The target should be, to understand the principle of this mode for pre-compliance analysis and perform easily adequate settings from the beginning.

The principle of EMI mode is, to make a pre-compliance analysis (conducted or radiated emission) and save test time for that evaluation. In case a whole trace would be recorded with a valued detector (like quasi peak) the test time would be quite long. This EMI mode can do a fast scan of the trace with e.g. **[Average]** or **[Peak]** detector and search all peaks. With that peaks, the measurement of valued detectors (QP and/or CISPR AV) can be done and the result is available within minutes.

But saving test time is only one part. Failure debugging and design improvement is a second step. With the integrated measurement meter, customer can do a live debugging and can do an immediate improvement of each unwanted single peak. Last but not least, the mode allows you to generate a test report for your documentation. This mode contains a lot of features, for correction, pass / fail testing, and much more.

Default Window, EMI – Mode:

Activate the EMI Mode and see the window of *figure 1*.

The default mode is set to CISPR filter (6 dB filter). In case that for some evaluation 3 dB filter are required, please change this here: Please select **[Mode Setup]** → **[EMC Standard]**: "None".

¹ RSA Series: RSA5032N, RSA5065N, RSA5032(-TG), RSA5065(-TG), RSA3015N, RSA3030N, RSA3045N, RSA3030(-TG), RSA3045(-TG), RSA3015E(-TG), RSA3030E(-TG)

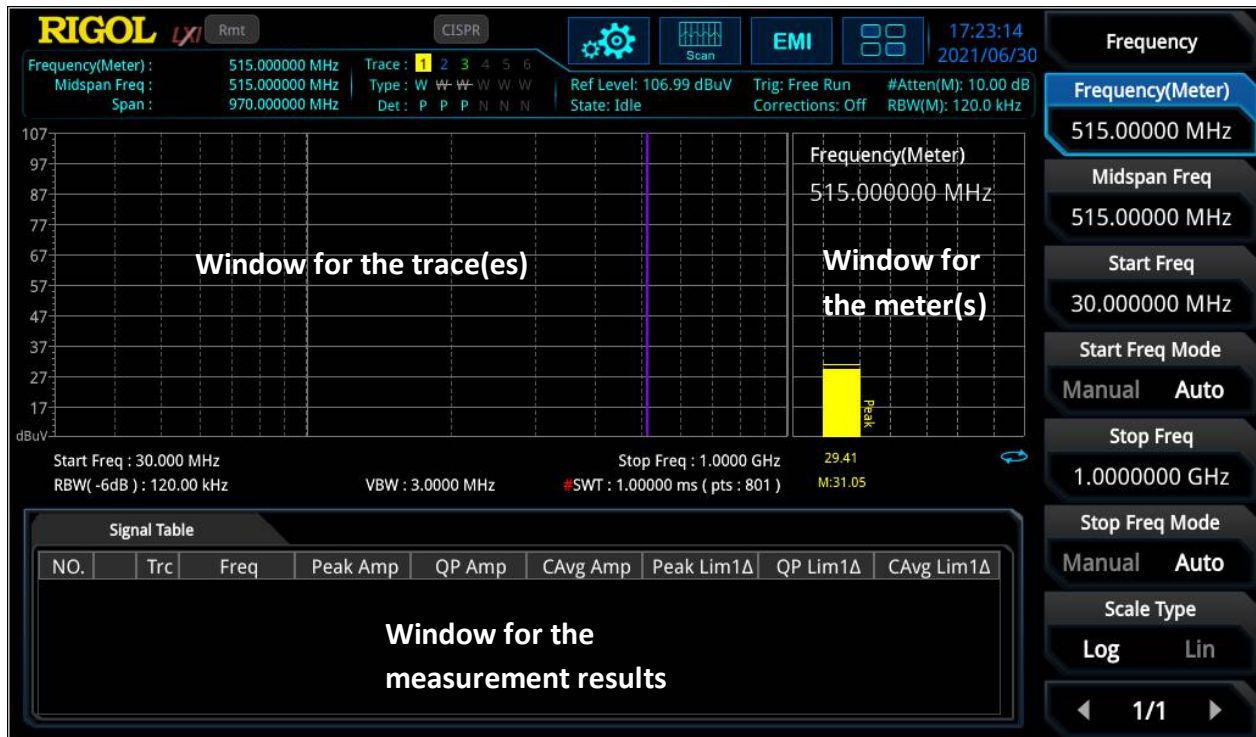


Figure 1: Default Window of EMI Mode

Trace Settings:

For adjustment of different parameter, please select the button **[Meas Setup]**. A new side window is now opening with different menus (*see figure 2*).



Figure 2: [Meas Setup] Window on right hand side

In this menu, the main settings of test setup can be realized. The first setting will be focus to the adjustment of frequency range according to the measured standard. This will be realized in [Scan Table] (see figure 3).

Here you can select the required frequency range.

- Up to 10 ranges are displayed. Each range will use max. 10.000 test points. If more measurement points are required (e.g. to reach a frequency resolution of $RBW/2$) then ranges can be combined together with selecting several ranges. The default points are calculated to reach $RBW/2$ resolution.
- The RBW is adjusted by default according to CISPR norm (e.g. from 150 kHz to 30 MHz: $RBW = 9\text{ kHz}$),
- Scan time is the optimum for the test. But can be modified according to your need.
- For each range, the dynamic range can be modified. Eg. If you expect more small signals slightly above the noise floor, then you should use pre-amplifier and set the attenuator to 0 dB. If you are expecting high peaks, then pre-amp is "OFF" and the attenuator is set to a higher level according to your needs (e.g. 50 dB).
- In case you would need different dynamic range settings for different frequency ranges, then you can use several ranges according to your need and set for each single range the dynamic range you need. For example: range 1: attenuator: 0 dB and pre-amp: "ON" (in case you expect smaller signals here), range 2: attenuator: 30 dB and pre-amp: "OFF" (in case you expect higher signal values here) etc.



Figure 3: Menu [Scan Table] for basic adjustment of measurement scan

Note 1: Please be carefully with dynamic range settings. Please set attenuator to the maximum value and turn off pre-amp in case you don't know the signal level to avoid to destroy the spectrum analyzer. If you are unsure about the interference level, please use additionally an external attenuator for the first test. This one can be removed for further tests when you are sure that the maximum interference level of your DUT are not higher than the reference level of your spectrum analyzer.

Note 2: Please be carefully with measurement with a LISN and use always a **transient limiter** for such tests to protect the spectrum analyzer.

Note 3: The dynamic range settings in [Scan Table] is only for the trace and not for the measurement meter. They need to be adjusted via [Ampt] button (see description "Dynamic Range for Measurement Meter")

For the **trace detector selection**, please select [Trace] → [Trace Det] (e.g. Average). Here you can also activate a second or more traces with different detectors or adjustments

Scan Sequence Settings:

For the next adjustment please select again [Meas Setup] and select [Scan Sequence]

- In this menu, you can decide the sequence of your test.
- In case you want to record only the trace without any further measurements, you should select [Scan Only]
- In case you measured already a trace and you want to search for the peaks, please select [Search Only]



Figure 4: Scan Sequence adjustment with "Scan-Search-Measure"

- In case trace was measured and the peaks were already listed in the **[Signal Table]**, and you want to start the final scan with measuring the valued detectors at these peaks only, please select **[(Re)measure]**.
- You can combine all of them. For example: if you want to do all together, please select **[Scan-Srch-Ms]** (see figure 4)

Measurement Procedure of [Signal Table]:

- In **[Meas Setup]** → **[(Re)measure]** you can decide if all peaks or specific peaks will be measured.
 - if you want to select one specific peak in the **[Signal Table]** and you want to measure only this one, please select **[Curr Signal]**
 - If you want to measure all listed peaks in the **[Signal Table]**, please select **[All Signal]**
 - In case you select several signals which should be measured, please select **[Marked Sigs]**

Detector Configuration for Final Scan:

- After search all peaks of the trace, they will be listed in the **[Scan Table]**.
- Now you can start the final scan. Here the detectors, you selected will be measured. (e.g. the valued detectors like Quasi Peak) at the peaks, visible in the **[Signal Table]**.
- You can select the different traces for **Final Scan** as follow: please select **[Meas Setup]** → **[Detectors]** and select the type of detector and the limit line which shall be used as reference for the pass / fail test. For example, “detector 1” refers to “limit 1”, “detector 2” refers to “limit 2” etc....

Limit Lines for Pass / Fail Analysis:

- The EMI mode contents many pre-installed limit lines which can be recalled as follow:
 - Please select **[Recall]** → **[Limit]** → (decide which limit you want to load, e.g. to “limit 1” which is selected in “Detectors” above) → **[File Explorer]** → select **[Preloadlimit]** → and select a folder of your reference (e.g. “EN”).
 - **Note 1:** You can select a folder and select **[browse]** and it will open
 - Now select the standard of your need (example “EN” → “55022”)
 - In this window, please select **[File Type]** → **[All Files (*.*)]** and you can see all the integrated limits for this standard and you can select yours of your need (e.g. “Conducted Emission, Class B, Average”)
 - In case you want to load a second (or more) limits (e.g. for QP) please select **[Recall]** → **[Limit]** and “limit 2” (or higher).
- After you selected your limits from pre-integrated storage, please select **[Meas Setup]** → **[Limit]** and select **[Test Limit]: “ON”** and **[Limit State]: “ON”** for all your loaded limit lines.

- In **[Edit Limit]** you can create your own limit line or you can modify the pre-loaded one according to your need (e.g. use a margin for pass / fail test) (*see figure 5*)

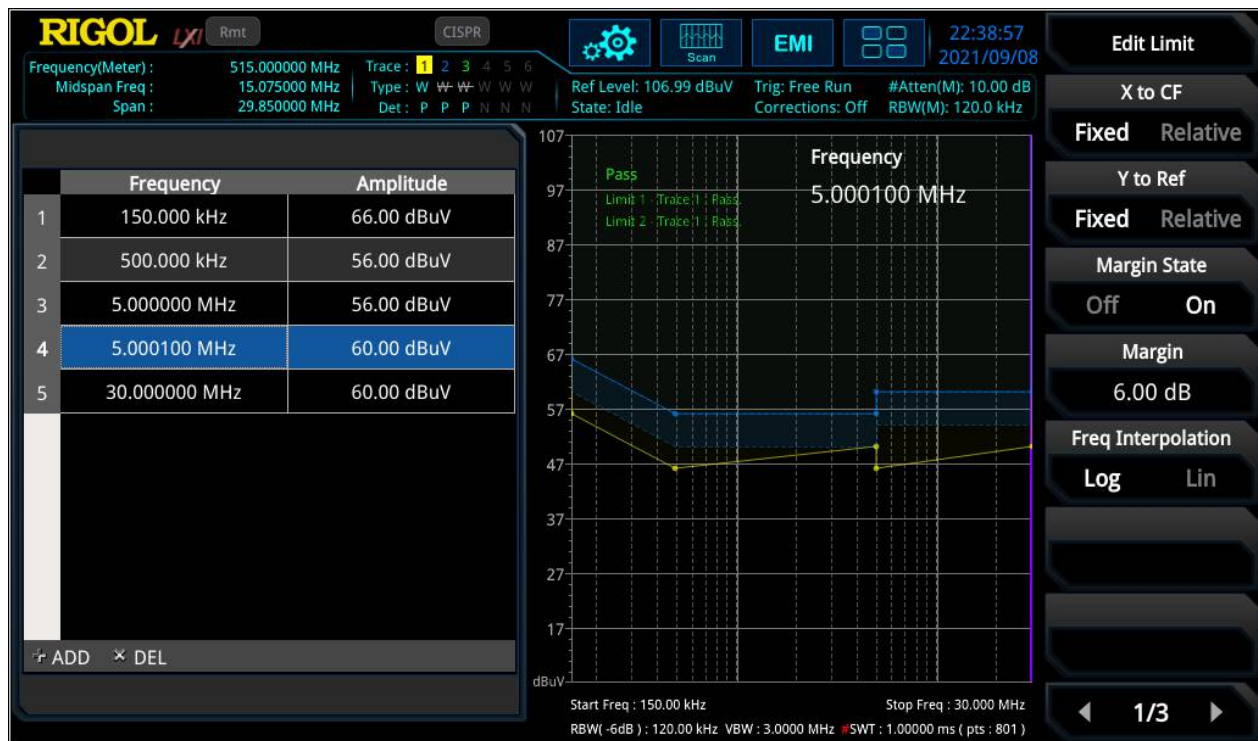


Figure 5: **[Edit limit]** for creation or modification of own limit line or add margin for pass / fail test

Activation of Measurement Meter:

The measurement meter is a very good tool for debugging peaks with different detectors. Max three meter can be activated in parallel. It can be connected with selection of peaks. In case one peak is selected and the engineer try a design improvement, the result of this peak will be immediate visible in the meter and a case by case improvement of engineers DUT is possible.

- To activate more than one meter with different detectors, please select **[Mode Setup] → [Meters Control] → [Meters]**:
 - Here you can activate meter (max three meter in parallel)
 - You can decide which detector is used at each meter
 - You can add a limit line with pass fail result for the meter
- Furthermore you can decide to couple the meter to a signal. In case you select a peak in the **[Signal Table]** the meter will jump to this peak and you can measure it.
- See figure 6* with three activated meter with different detectors (here: peak, QP, CISPR AV) including pass fail limit and **[Coupled to a Signal]** is selected.
- The pink line in trace screen show the position of measurement meter.



Figure 6: Adjustment of measurement meter with different detectors and coupled to signal

Dynamic Range of Measurement Meter:

- As mentioned before, the dynamic range of measurement meter can't be adjusted in [Scan Sequence] settings because different ranges could be used with different dynamic range settings



Figure 7: Set dynamic range of measurement meter and the reference level of the test in [AMPT]

- Therefore you must select separately the dynamic range of the measurement meter as follow: Please select **[AMPT]** and adjust attenuator and pre-amplifier / reference level according to your need (see figure 7).

Correction:

In case you using external components like attenuators, amplifiers, cable, LISN, etc. you can add a correction which will be take into account into the result of trace, measurement meter and signal table.

- To insert correction, please select **[Input Output]** and **[Corrections]**

Start The Measurement:

After you finalized all the setup of your need, you can start the test.

- Please select **[Sweep]** → **[Start]**

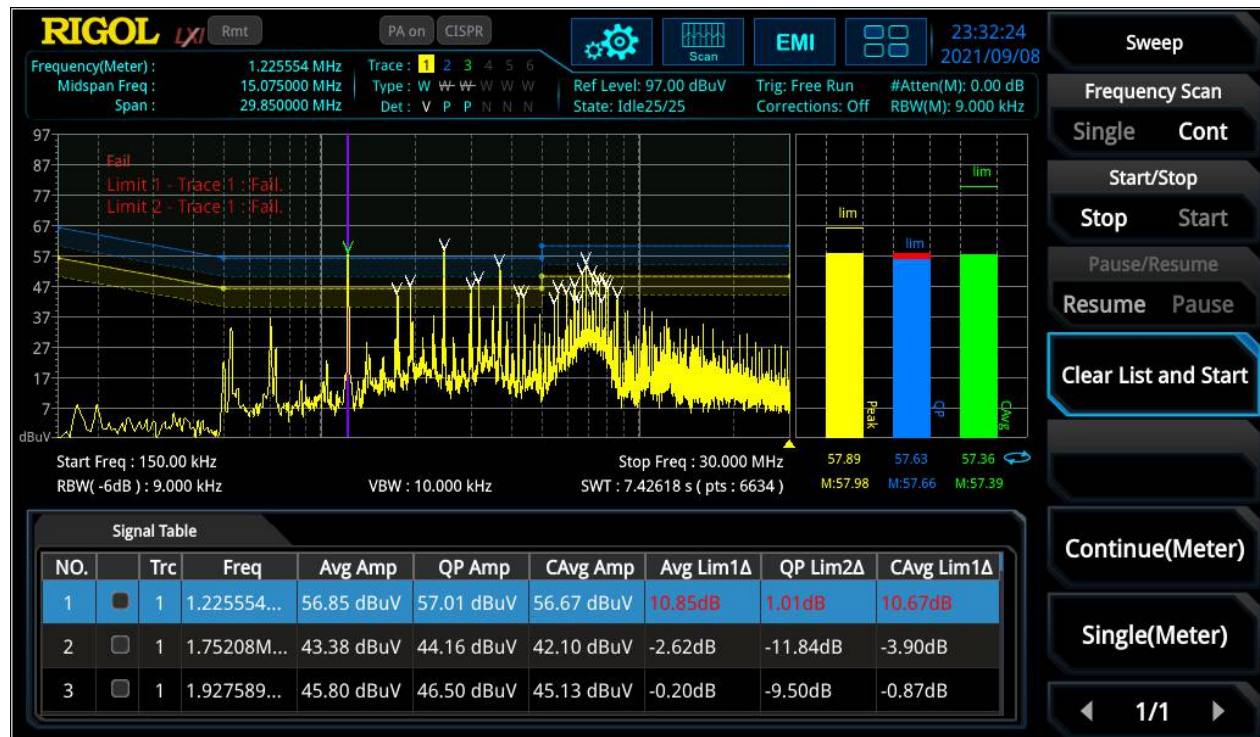


Figure 8: Result of measurement after finalization of test with the settings described above

Signal Table Settings:

- Signal table displays all the peaks which are detected in the trace according to your adjusted search criteria.
- The numbers of detected peaks can be adjusted in the signal table as follow: Select **[Meas Setup]** → **[Signal Table]** and insert the settings for search criteria and sort of signals according to your need.
- You can also select one peak and **[Zoom In]** for deeper analysis.

- You can also select the number of peak you want to mark
- In case the measurement meter are coupled to the signal, then the meter jump to the selected peak and measure it (*see figure 8*).

Generate a Test Report for Documentation:

- The EMI Mode has the possibility to store the *.csv file of the trace or generate a test report as follow:
 - Please select [Save] → [Meas Data] → [Data Type] ([Trace] = csv, [Meas Result] = test report)
 - In menu [Meas Data] → [Meas Results] you can make adjustments like print as pdf or HTML, use inverted screen (save print color) and decide what all should be in the report. You can also fill in the header (e.g. temperature, name of DUT, test place, etc., *see figure 9*).

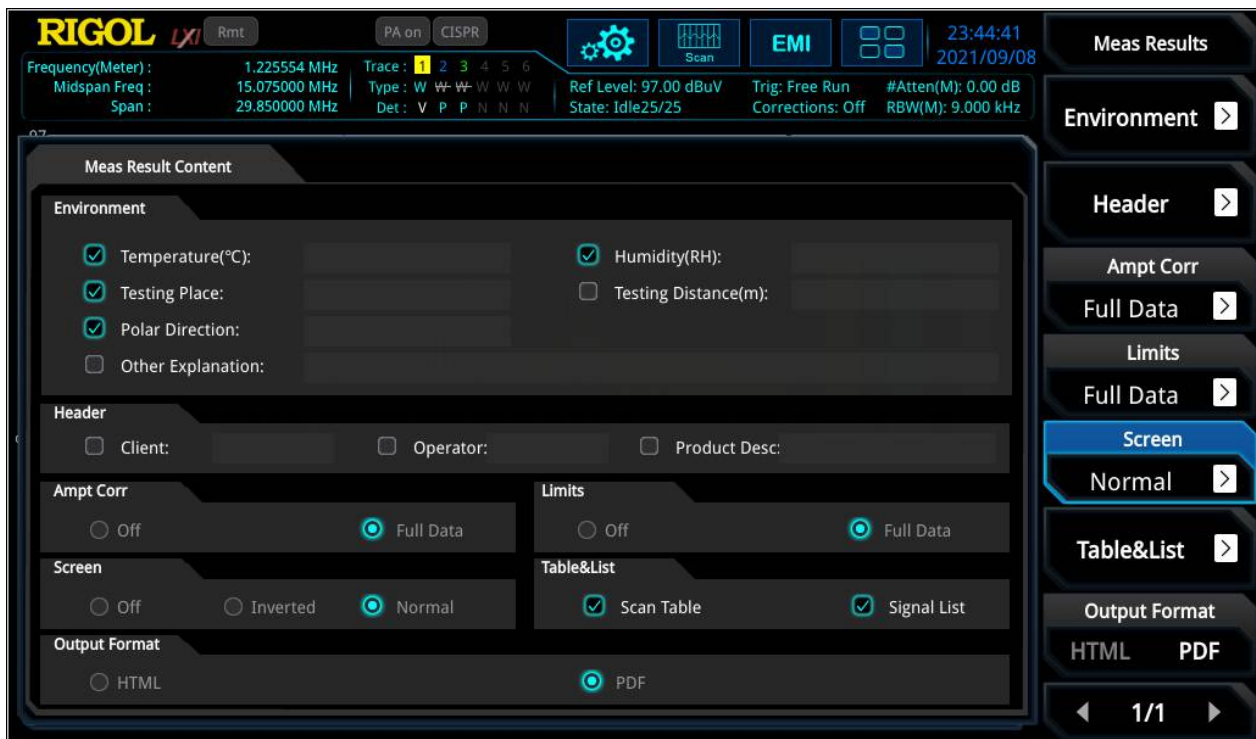


Figure 9: Template to generate a test report for documentation

Storage of Settings:

- You can store the limit lines and the settings in [Save].

Note: Limit lines and correction needs to be stored separately. The main adjustments (e.g. activation of limit line) is stored in [State] but not the limit line itself.

Window Adjustments:

- For some tests its important to see the whole trace without meter on the screen. You can realize this with selecting [System] → [Display] → [Meters Display]: Off (*see figure 10*).
- In case you need to display the measurement in horizontal linear axis instead of logarithmic view, then you can change this here: [Freq] → [Scalar Type]: “Lin”

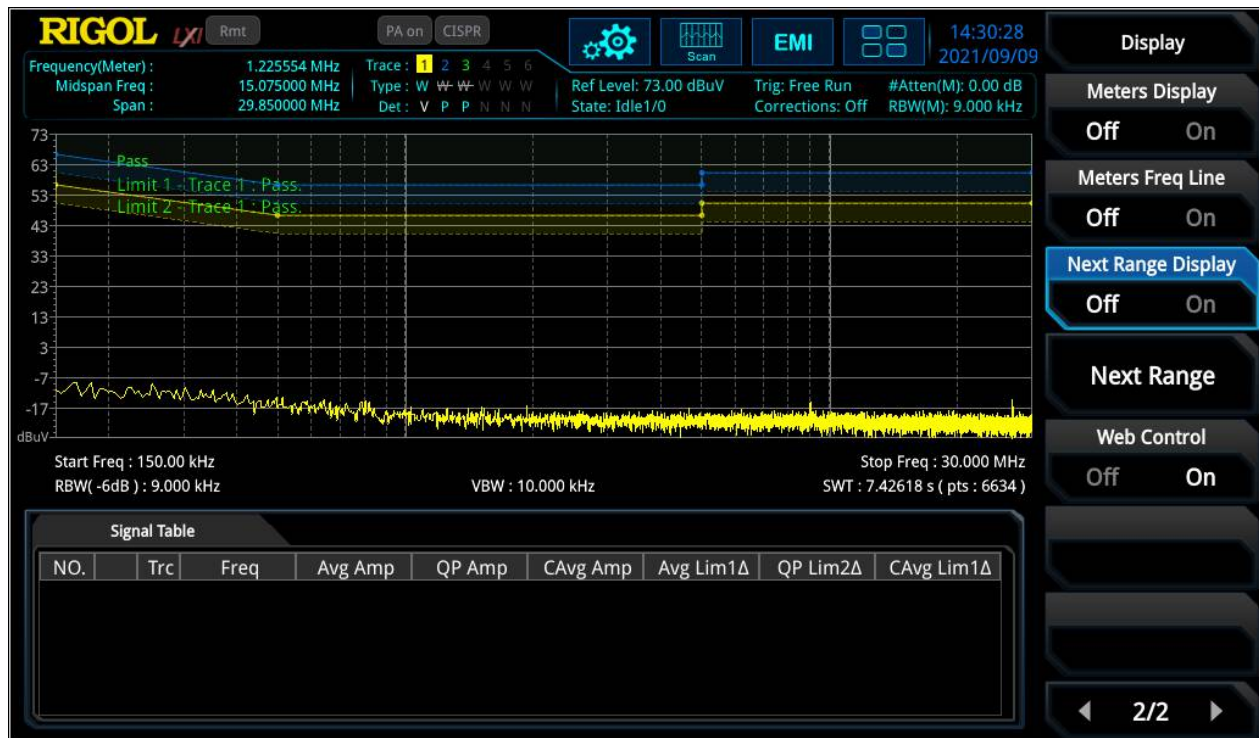


Figure 10: Display modification for bigger trace visibility

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