PMM EMI Smart Detector

A method for dramatically reduced test time during pre-certification and debugging

Detectors

The most advanced EMC analyzers integrate several detectors specified by the relevant standards.

The best performing receivers allow measurements using more than one detector at a time. The latest-generation PMM receivers can read up to six detectors simultaneously.

The six detectors are as follows: Peak, Quasi-peak, RMS, Average, RMS-AVG, and C-AVG.

When a measurement is performed, a certain hold time must be observed for each of the frequencies tuned. The hold time can be adjusted in the scan settings, and its duration, which technically depends on the repetition frequency of the pulse disturbances that are going to be measured, is specified in the generic and product standards.

In brief, the lower the repetition frequency of the pulses under analysis, the longer the hold time. The minimum hold time is generally 2 seconds for the most common detectors, such as Quasi-peak, RMS-AVG, and C-AVG. This is indispensable for achieving the necessary settling time.

How it works

To perform a measurement across an entire band, a traditional (stepped) receiver would take the set hold time times the number of tuning steps. For example, the C+D bands of the CISPR 16-1-1 standard, which range from 30 to 1000 MHz and require 60 kHz steps, would take (1000-30) / 0.06 = 16,167 steps, each lasting 2 seconds, for a total test time of 32,334 s or about 9 hours.

To shorten the process during non-full-compliant phases (preliminary, debugging and pre-certification), it is customary to run quick scans with detectors that allow short hold times (peak detector) and then repeat the slower compliant measurement only for frequencies at which the pre-scan found relatively higher levels. This is usually handled by software. In other words, first a rapid peak scan is performed, and once the list of frequencies for further investigation is obtained, a second scan on limited sub-bands is carried out with the required detectors and hold times.

The problem is that the compliant measurement is accomplished later, even hours after the preliminary scan has found the frequencies of interest. This means that the compliant measurement might take place during a phase of EUT functioning when the disturbance is no longer present.

For the first time in the history of electromagnetic compatibility, PMM has dramatically mitigated this problem by adding Smart Detector to its firmware, which quickly and efficiently performs the compliant measurement immediately after detecting a signal with the peak detector.

Smart Detector, which can be selected in Sweep mode, shortens the measurement process while maintaining strong reliability, and therefore makes the test lab more productive. It involves a rapid peak scan with short hold times which, frequency by frequency, compares the level with a user-selected limit lower than the one set for the given CISPR detector. If the limit is exceeded, the scan immediately stops and a compliant measurement is taken around that frequency, at which point the scan resumes.

The user can set Smart Detector to catch not just the signals exceeding the limit but also those that are close to it as potential disturbances. This provides an additional safety margin, as the preliminary measurement takes place in non-compliant mode. The resulting analysis is much faster than one carried out on all frequencies without distinction, while remaining highly accurate.

In recent years, measurement instruments have been developed using FFT (Fast Fourier Transform) techniques that can reduce test times by observing an entire frequency band at once. This means that several tuning steps can be covered in one shot. The technology is limited, however, by the range of the frequency bands that can be processed in

compliance with the standards, which are still relatively narrow in relation to the broad bands of radiated emission measurements. Here, too, Smart Detector can shorten measurement times

PMM has therefore updated the Smart Detector feature for new FFT receivers, such as the ER8000 and ER9000. Working by frequency bands, the receiver can now run the preliminary scan with Peak detector even faster than before, and Smart Detector can significantly shorten test times.

For the reasons described above, on the frequency bands of conducted emissions for which few hold times are sufficient, this feature provides no benefits.

Practical example

Figure 1 shows the PMM Emission Suite pane where users can set the detector parameters for a scan in Sweep mode.

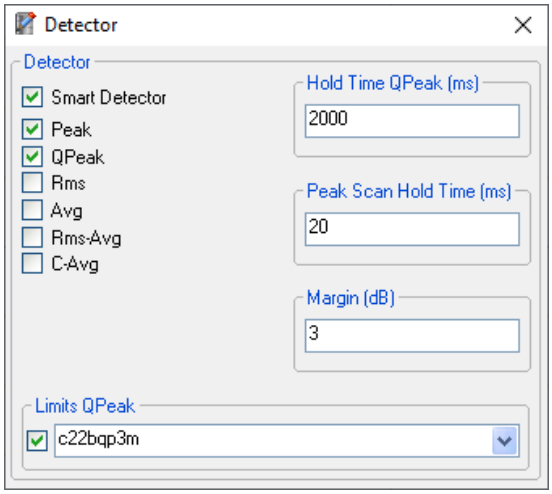

Fig. 1 – PMM Emission Suite, detector settings

The settings for the measurement set-up in Figs. 1 and 2 are as follows:

- Smart Detector on:
- Quasi-peak limit c22bqp3m (40 dBµV up to 230 MHz and 47 dBµV beyond)
- pre-scan with Peak detector and 20 ms hold time
- 3 dB margin on the selected limit
- measurement with Quasi-Peak detector and hold time of 2 s (2000 ms) only on frequencies where peak levels are detected that exceed the limit minus the margin (i.e., in this example, 37 dBµV up to 230 MHz and 44 dBµV beyond)
- band of analysis from 30 to 1000 MHz, with automatic frequency step
- standard 120 kHz RBW, with CISPR 16-1-1 compliant shape
- minimum attenuation 10 dB, preamp off, preselector on

Figure 2 shows the screen with the measurement result.

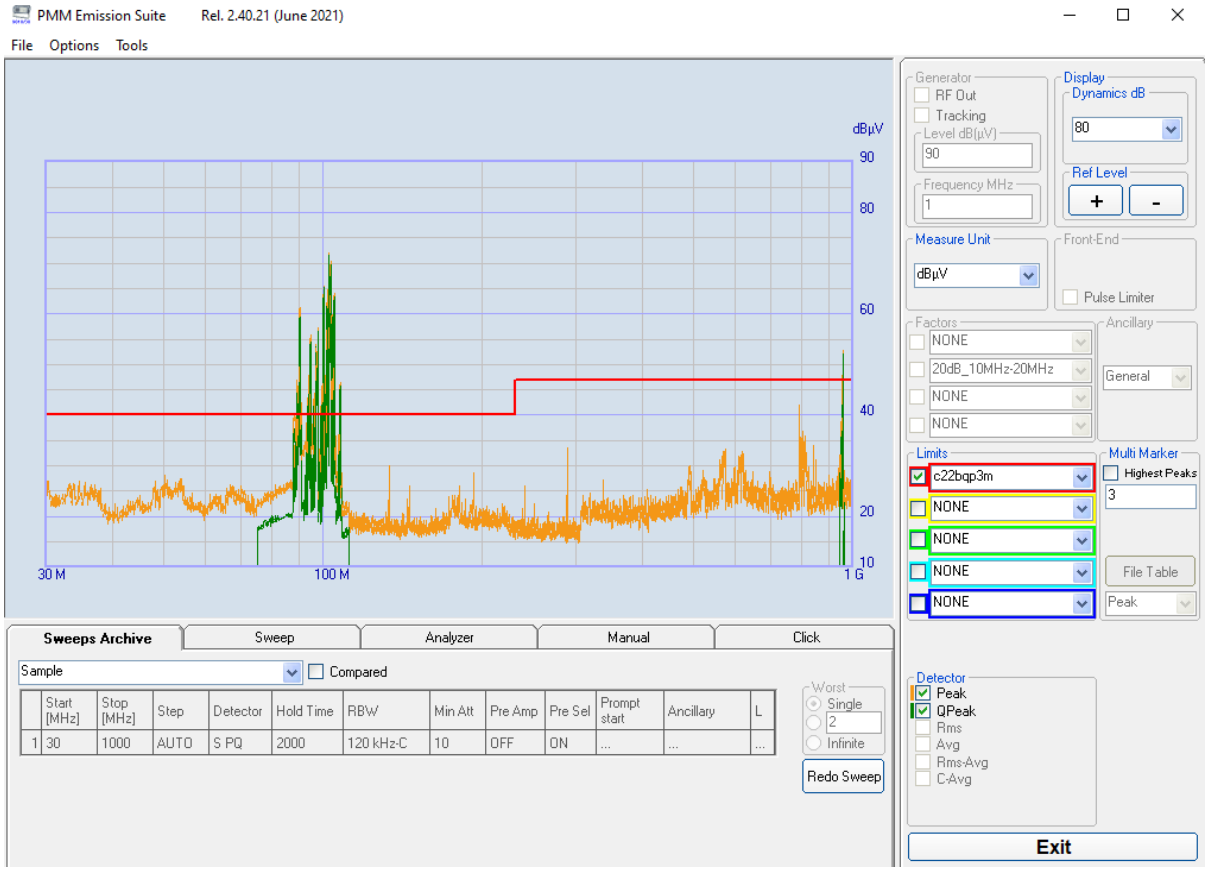

Fig. 2 – PMM Emission Suite, measurement result

The tables below report some sweep times of typical cases for stepped and FFT receivers. Durations are theoretical, net of switching times.

Tab. 1 – Stepped receiver

Full scan	Smart Detector no point above limit	Smart Detector 10 points above limit	Smart Detector 30 points above limit
9 h	323 s	343 s	383 s

Tab. 2 – ER series, FFT

Full scan	Smart Detector no point above limit	Smart Detector 10 points above limit	Smart Detector 30 points above limit
130 s	1.3 s	From 2.3 s to 21.3 s	From 2.3 s to 61.3 s

For FFT receivers, time ranges are indicated considering the chance that the frequencies with measurements above the limit will fall in a single slice (frequency bands analyzed simultaneously) or across all of the slices making up the scan.

Conclusion

Smart Detector is a new and improved feature of PMM receivers, designed to reduce test time and increase lab productivity. It involves a preliminary rapid scan to measure signals with the Peak detector using very short hold times; the compliant measurement takes place during the rapid scan with standard hold times, immediately after a signal of interest is detected. The resulting test time is much faster than a measurement carried out on all frequencies without distinction, without any loss of accuracy.

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