HEWLETT PACKARD

Application Note (SUPPLEMENT)

Quasi-Peak Measurements Using a Spectrum Analyzer

SPECTRUM ANALYZER SERIES
AN 63E-1

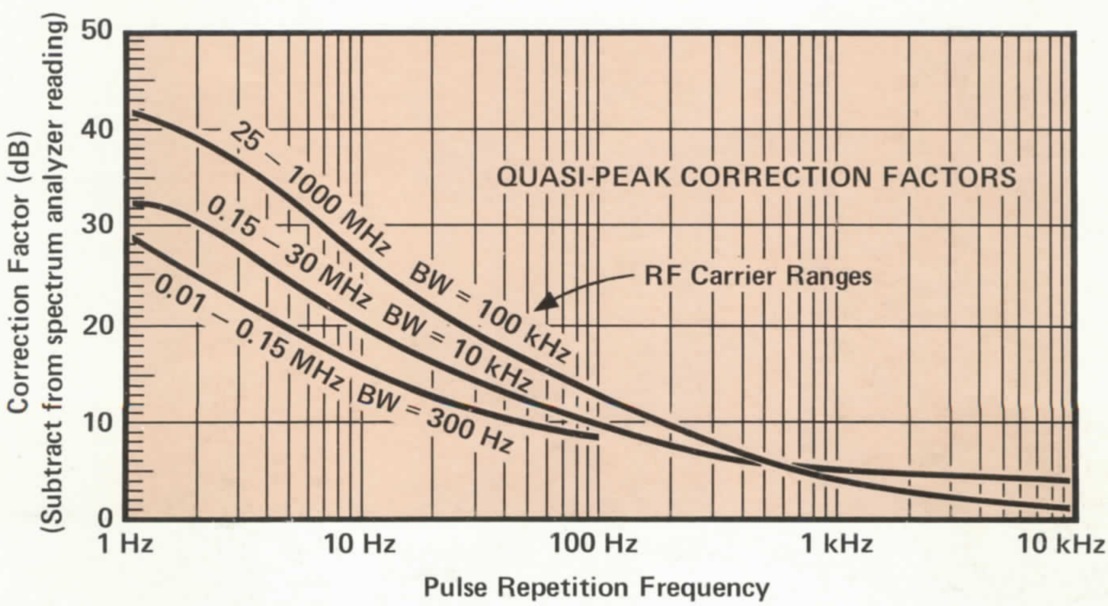
INTRODUCTION

With the rapid increase in electrical and electronic equipment and communications systems come more and more problems of Electromagnetic Compatibility (EMC) and Electromagnetic Interference (EMI, RFI). This interference is due primarily to broadband noise resulting from repeated impulses. Early work of C.I.S.P.R. (Comite International Special des Perturbations Radioelectriques = International Special Committee on Radio Interference) led to the conclusion that the best measure of the effect of this type of interference would be by using a quasi-peak type of voltmeter. This type of voltmeter gives a weighted value depending on PRF (pulse repetition frequency) such that a lower PRF (pulses occurring less frequently) results in a lower reading. Subsequent experience has shown that a true peak or r.m.s. voltmeter might be more accurate, but the quasi-peak measurement has been retained because 1.) peak and quasi-peak indications are nearly the same for relatively high PRF's; 2.) there is extensive experience with quasi-peak readings which reflect the "nuisance value" of broadband noise; 3.) a large number of test sets using quasi-peak type voltmeters are already in existence.

HOW TO GET QUASI-PEAK VALUE

HP Spectrum Analyzers can be used to make quasi-peak measurements if the PRF is known or measured from the Spectrum Analyzer display. The quasi-peak value is found by subtracting the factors in the graph below from the indicated peak value on the Spectrum Analyzer in the bandwidths indicated on the curves. If another bandwidth is chosen, subtract 10 dB *more* for *each step wider* in bandwidth (with 1, 3, 10 sequence). For example, if the level on the analyzer is +44 dBμV (-63 dBm) at 20 MHz in the 30 kHz bandwidth and the PRF is 10 Hz; then the quasi-peak value is +44 dBμV -20 dB (correction factor) -10 dB (bandwidth correction) or +14 dBμV.

These curves are valid for C.I.S.P.R., V.D.E., British Standards, Australian Standards, and others based on C.I.S.P.R. For CW signals, quasi-peak and true peak voltmeters give similar readings.



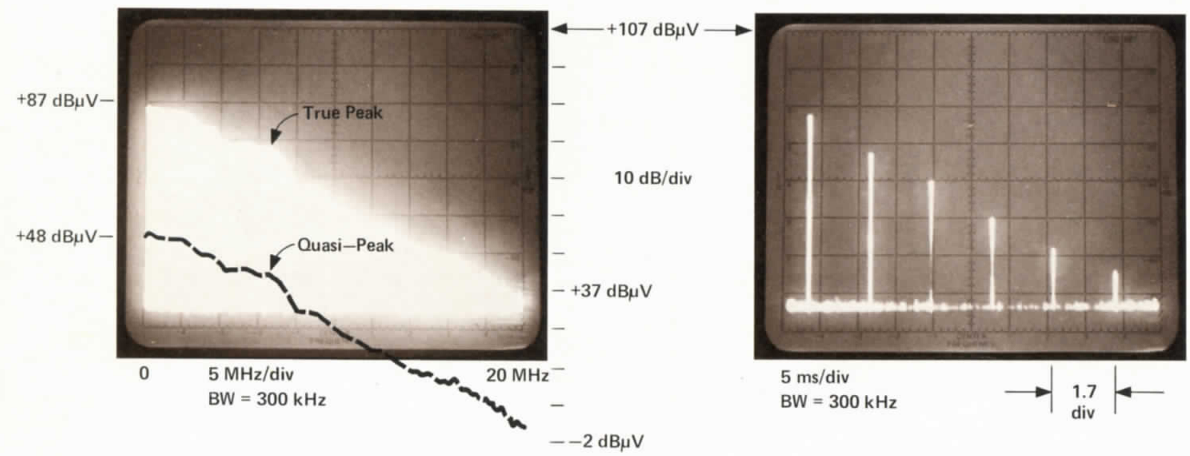
In the 30 - 1000 MHz range, quasi-peak = r.m.s. if PRF >10 kHz.

In the 0.01 - 30 MHz range, quasi-peak is undefined for PRF's >10 kHz because the spectral lines are resolved.

HOW TO DETERMINE PRF

The way we determine PRF depends on whether the pulses are periodic or random burst. For example, if the pulses repeat at a regular interval i.e., periodic, then with a wide bandwidth we will see a "pulse" spectrum rather than a "line" spectrum*, as shown in figure 1a. Then we can video trigger on the pulses and vary the scan time of the analyzer to determine the PRF from the scan time per division setting (see figure 1b). Now that the PRF is known, the quasi-peak level can be determined for any frequency in the "pulse" spectrum using the appropriate correction factor from the graph.

Pulses may sometimes occur at random intervals rather than periodic. The maximum level for a quasi-peak meter in the "pulse" spectrum is a result of the pulses spaced closest together. This pulse spacing can be determined by single scanning the Spectrum Analyzer several times and using the greatest PRF displayed to determine the quasi-peak level.



(a) (b)

FIGURE 1. (a) This is the true peak of conducted EMI from an SCR light dimmer, and the quasi-peak level found from the graph. (b) The PRF is determined by video triggering and using the calibrated scan time to determine the time between pulses.

In the example above, the PRF $= \frac{1}{1.7 \text{ DIV} \times 5 \text{ ms/DIV}} \cong$ 120 Hz. From the graph, the quasi-peak correction factor is 9 dB in the 0.15 -30 MHz range. The 300 kHz bandwidth used in this measurement is 3 steps (300 kHz, 100 kHz, 30 kHz, 10 kHz) *wider* than the 10 kHz bandwidth designated in the graph. Hence, the bandwidth correction factor is 30 dB. Therefore, the quasi-peak level is 39 dB down from the level indicated on the Spectrum Analyzer.

* Refer to HP Application Note 150-2 (Lit. No. 5952-1039) for detailed discussion of pulsed RF spectra.

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