PRE-COMPLIANCE EMISSIONS TESTING: ACCOUNTING FOR AMBIENT NOISE

The key advantage of pre-compliance testing is rapid fix and repeat cycles. This technical note outlines the main steps taken in measuring EUT emissions during those fix and repeat cycles. Although concentrating on outdoor test set-ups, most of this note still applies to indoor pre-compliance set-ups.

The Basic Approach

Unlike when testing in an anechoic chamber, surrounding RF signals (ambient noise) will be present when attempts are made to capture emissions from the equipment under test (EUT). However, there are three main approaches that can be brought into play to reduce the effect of the surrounding ambient noise.

Narrowing the Test Frequency Span

The first method is to severely narrow the frequency range of the test such that a particular EUT emission stands out from a close by ambient noise signal.

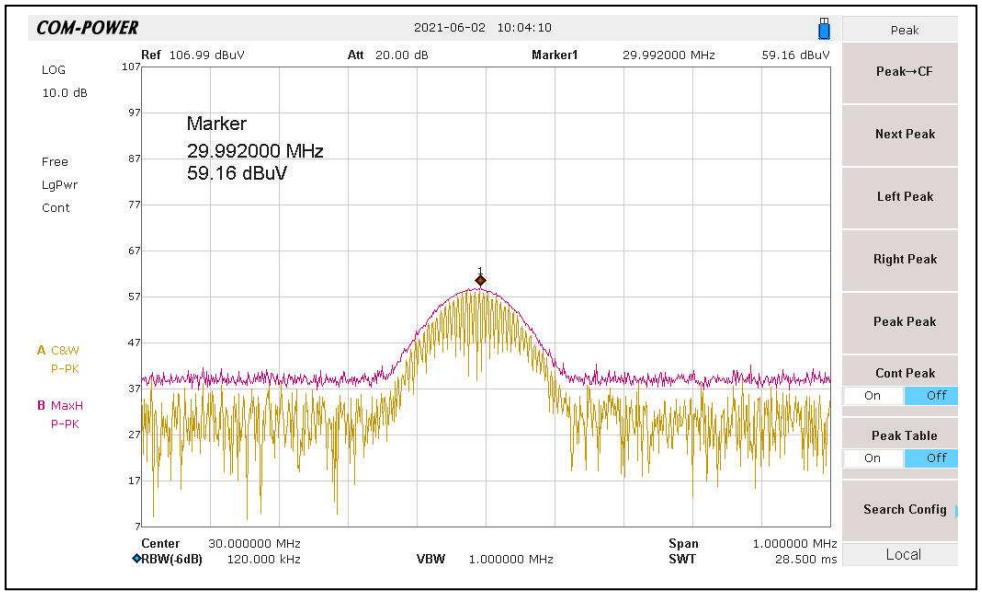

Figure 1

Figure 1 shows an EUT emission masked by an ambient noise signal. Note that the Resolution Bandwidth (stated as RBW and marked with a blue diamond at the bottom left of the screen) is set at 120kHz.

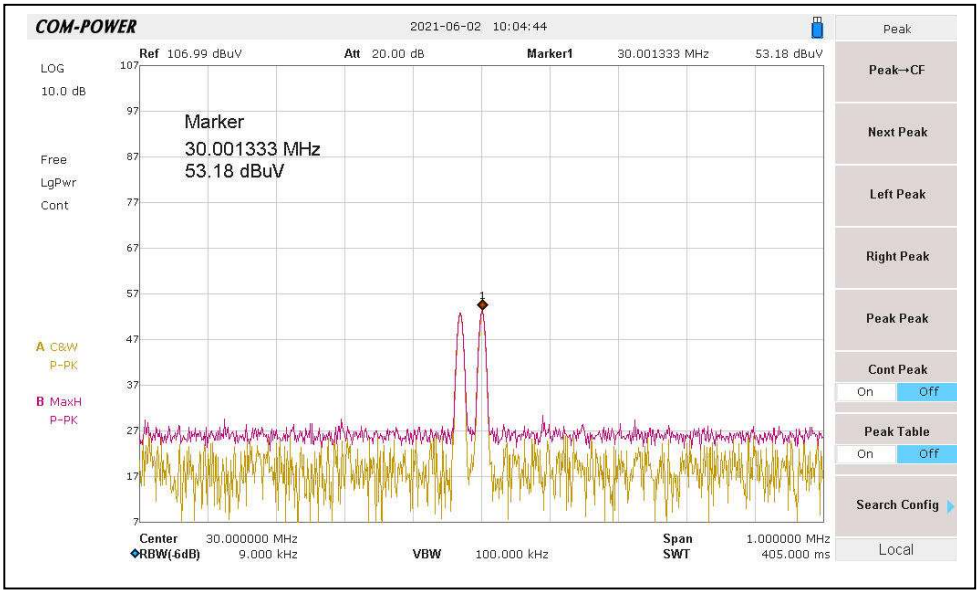

Figure 2

Figure 2 shows the same measurement, but with the RBW reduced to 9kHz. As can be seen, the EUT emission and the ambient noise signal now are easily distinguished from each other.

Note, there is a trade off between RBW and the time taken for the spectrum analyzer to complete a sweep across the screen. A narrow RBW results in a very long sweep time, which explains why it is normal to first collect data with a wide RBW to collect all emissions quickly. Only afterwards is a particular part of the frequency spectrum 'homed in upon'.

Changing the Test Antenna Polarization

For maximum pick up of a signal, the receive antenna must be in the same 'polarization' as the received radio wave. That is, if an ambient noise transmitting station radiates a vertically polarized signal (E-Field pointing up and down), ideally the intended receive antenna is perfectly aligned with the transmitted signal, i.e. the antenna rods are also pointing up and down.

Conversely, minimum pick up occurs for the same radio wave when the rods are horizontal to the wave.

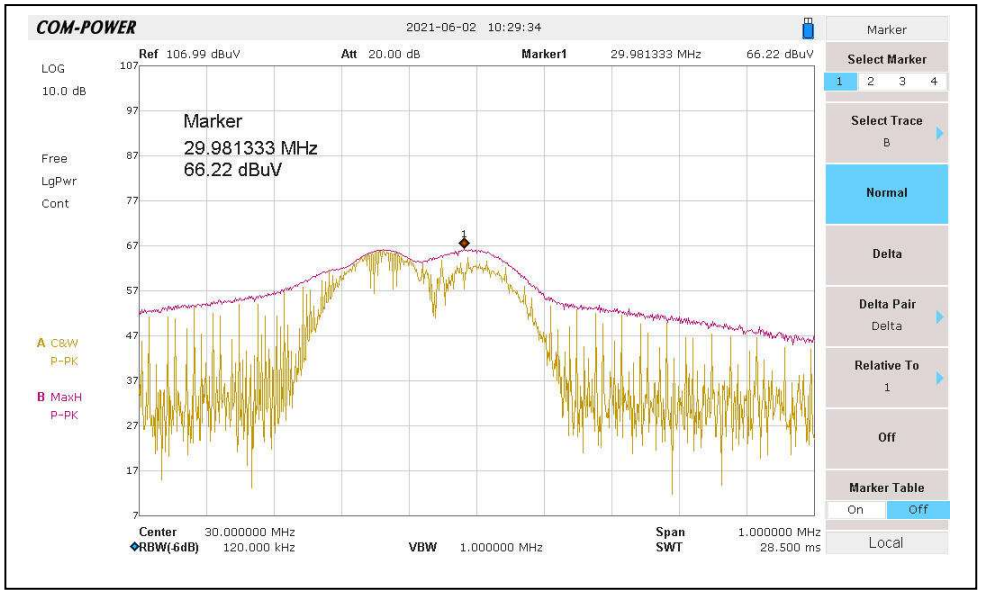

Figure 3

Figure 3 shows an EUT emission obscured by an ambient noise signal.

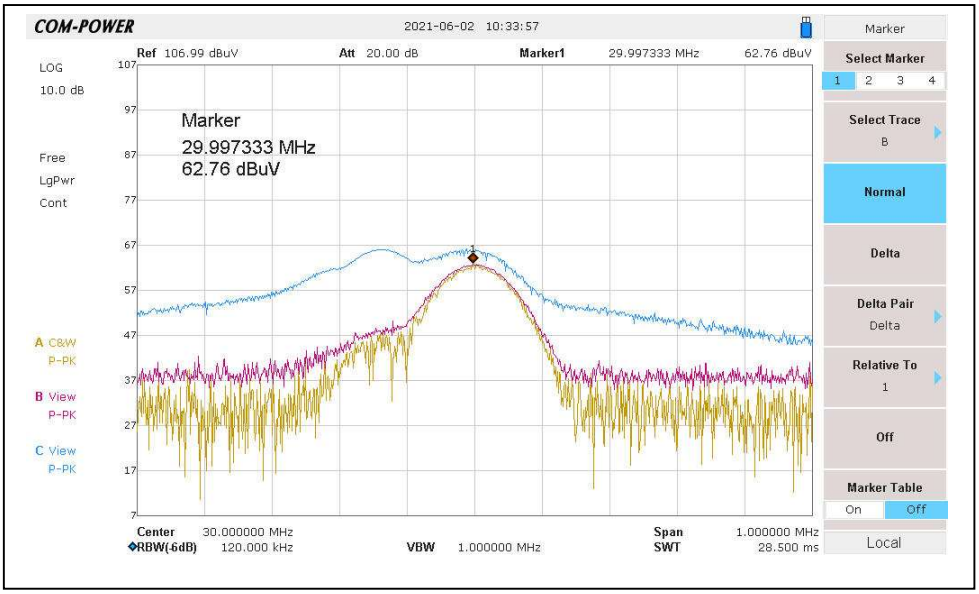

Figure 4

Figure 4 shows the same measurement with the antenna and EUT rotated 90 degrees. The EUT signal (blue trace) now emerges from the obscuring ambient noise.

Reducing the Measurement Distance

The test distance can be changed with relative ease, where the nearer the antenna is to the EUT, the larger the measured EUT noise signal is. Meantime, due to the great distance from the source, measured ambient noise signals stay constant.

Figure 5 shows a measurement at a test distance of 10 meters. The two markers show the signal is 3.49 dB above the noise floor.

Figure 6 shows the same measurement at a test distance of 3 meters. The two markers show the improvement in the signal above the noise floor at 12.24dB.

Finally, Figure 6 shows the same measurement at 1 meter test distance. The EUT emission is now 20.39 dB above the noise floor.

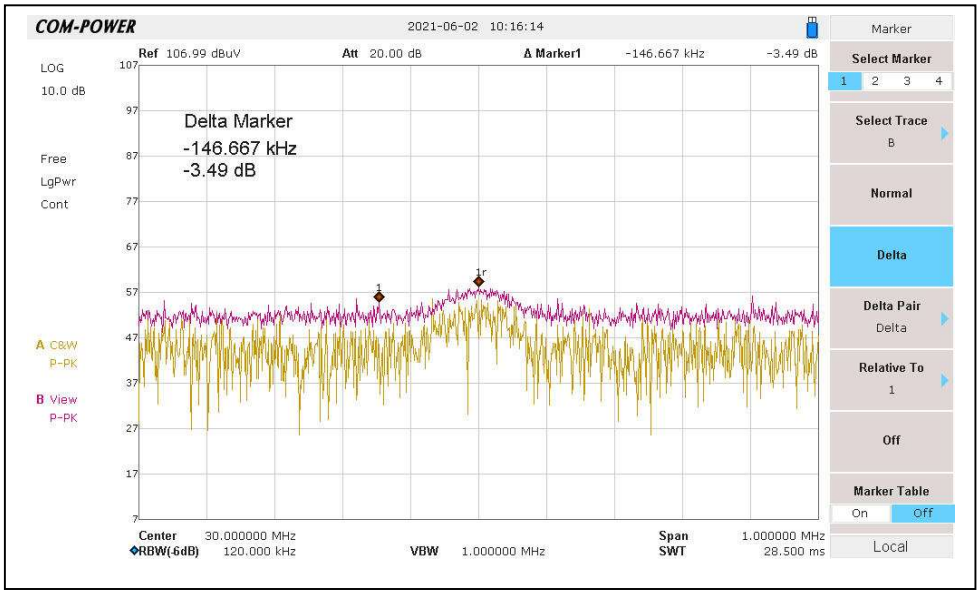

Figure 5

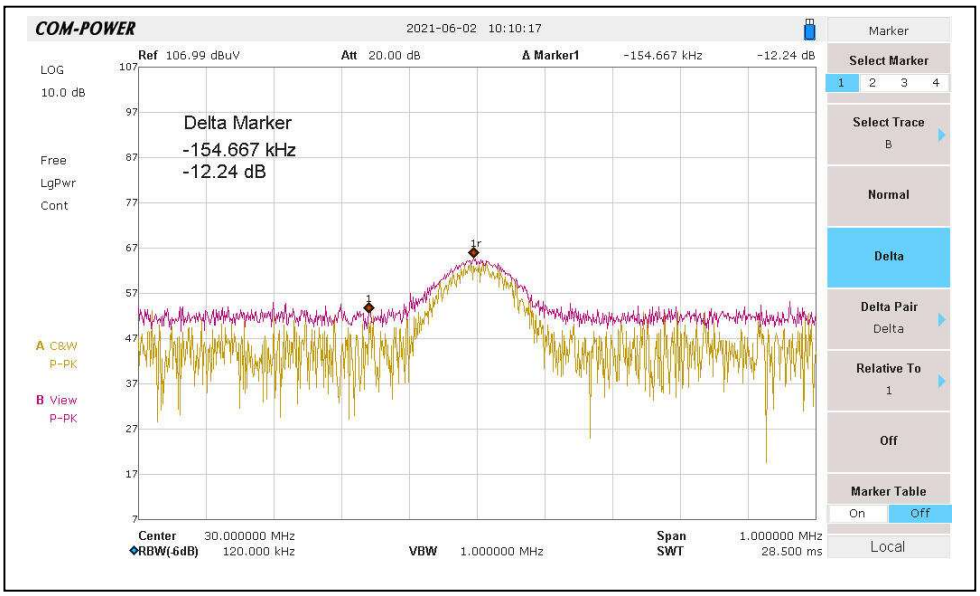

Figure 6

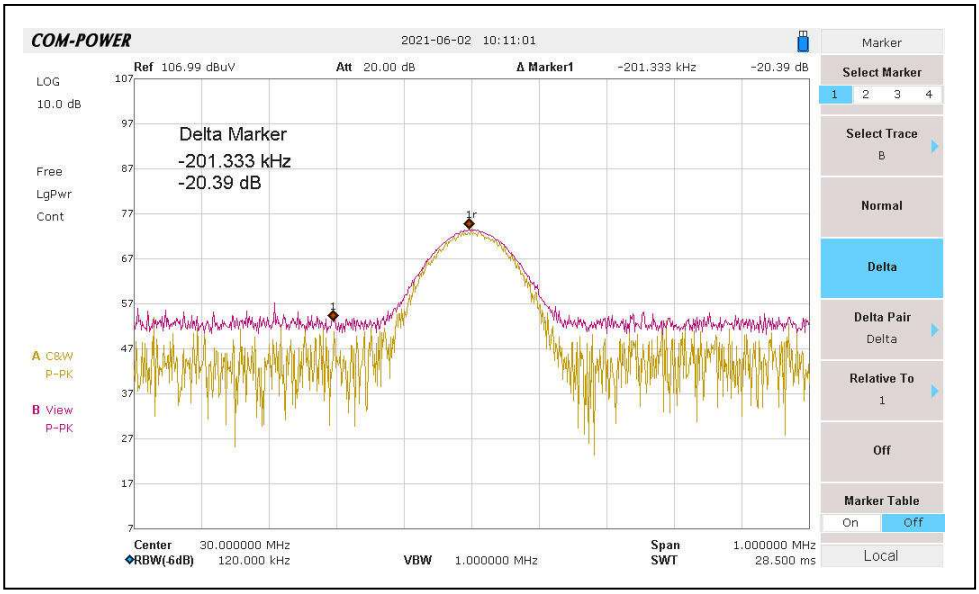
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Figure 7