ATTN: Joe Dichoso

Re:	FCC ID L2C0023TR
Applicant:	Delphi Delco Electronics Systems
Correspondence Reference Number:	28332
731 Confirmation Number:	EA384397

Dear Joe,

We have some concerns about measurement procedures with regard to demonstration of EIRP emission limit compliance at mm-wave frequencies.

Please consider the following example.

Example: Measurement of a UWB emission measurement at 100 GHz

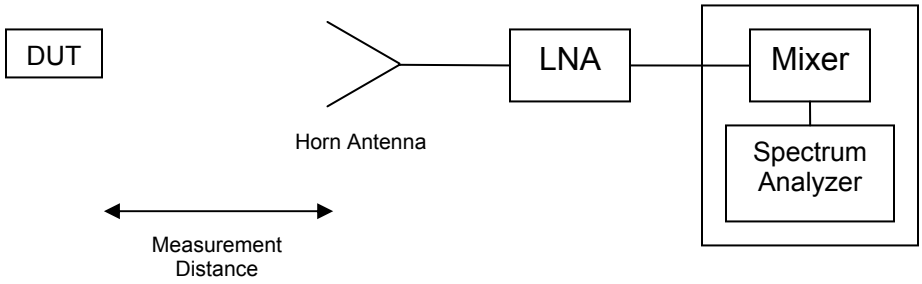

Figure 1. Measurement Setup and Test Receiver Chain

FCC EIRP limit: -61.3 dBm

1) Formulate power measured at the test receiver due to a source with EIRP = -61.3 dBm

(a) $P_{rec}(dBm) = EIRP(dBm) + G + 20 \log_{10}(\lambda/(4 \pi R_{meas}))$

where P_{rec} is the power received by the test receiver, G is the receiver antenna gain, λ is the receiver, and R_{meas} is the measurement distance.

At a distance of 3 meters, using a standard gain horn antenna of G = 25 dBi, frequency of 100 GHz, and no LNA,

(b) $P_{rec}(dBm) = -118.3$ (at 3 meters)

2) Next, we consider the noise floor of the receiver (without LNA). For an Agilent 8563E Spectrum Analyzer with 11970W harmonic mixer, in a 1 kHz bandwidth, Agilent datasheets give the noise floor as:

(c) $Pr_{(noise)}$ ~ -85 dBm / 1kHz

For a 1 MHz BW, this equates to -55 dBm / 1 MHz. We measure -50.1 dBm / 1 MHz for our particular mixer and spectrum analyzer.

Thus, the signal-to-noise ratio (SNR) at a distance of 3 m from a device, using our particular receiver and spectrum analyzer is (b) – (c) = (d)

(d) SNR(3m) = -118 - -50.1 = -67.9 dB

At 40 dB/decade field decay (per FCC mm-Wave Measurement Procedures), the range at which this receiver can achieve a SNR > 0 dB occurs at a distance reduced by more than 1.5 decades, a distance of ~6 cm from the DUT.

However, from the FCC specified 20 dB/decade for UWB devices, the measurement distance is reduced by more than 3 decades, becoming less than 1.2 mm.

3) While measurements may be made at this range, we must consider whether measurements at these ranges would be acceptable to the FCC. If it is deemed that measurements must be made at a greater distance, then a low noise amplifier may be required. After an extensive search we have found a small handful of companies that can provide top of the line W-band LNAs. Of these LNAs, the best amplifier commercially available, with 18 dB of gain and a noise figure of 4.5 dB, has a lead time of 10 weeks for custom construction and costs between $6000 and $8000.

However, please note that such an amplifier, even with an ideal noise figure, would only improve the SNR of our receiver by 18 dB, still requiring measurements at a range of 9 mm from the DUT (assuming a 20 dB/decade field decay). Finally, while we have outlined the situation for a 100 GHz (W-band) example, a similar situation exists for the frequency range between 50 and 75 GHz (V-band), where measurement ranges are only slightly increased.

Therefore, our question is: At what measurement range would the FCC consider the measurement results sufficient for demonstration of EIRP compliance?