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TECHNICAL BULLETIN # 11

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To: All RFxpert End-Users

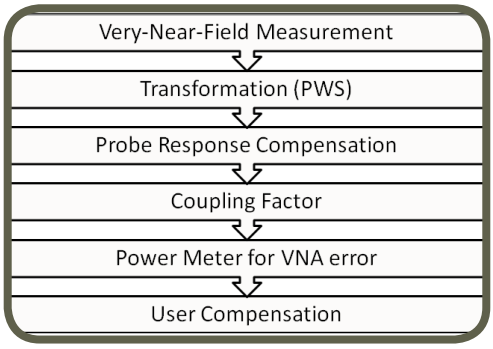
Re: Understanding RFxpert Accuracy Claims

There will always be some difference between RFxpert results and chamber results based on device model and frequency though these differences can often be accounted for. EMSCAN commits to a ± 1.5 dB absolute accuracy compared to a chamber for gain and TRP. With some antenna structures, some of our customers have however noticed larger variations of 3 dB or more. Until now, we have always successfully resolved this large difference to everybody's satisfaction.

This technical bulletin explains how the RFxpert predicts far-field from the very-near-field measurements. Once every party understand this process, it becomes apparent that our "error" can be split in two parts, a fixed offset that can be corrected and a variable error that cannot be accounted for and is the main component of the 1.5 dB accuracy.

Kindly keep in mind that chamber results will also have some error or variability associated with them. A comparison with the RFxpert results must also take into consideration this factor as detailed further down in this bulletin.

The RFxpert results come from a multi-stage process, as shown below. The measurement, the transformation to far-field (PWS) and the probe response stages are straightforward and predictable. The coupling factor correction stage is what makes the RFxpert unique and is what allows us to measure within the reactive region. This stage will adjust the radiated power and all associated readings to remove the effect that the scanner has on the AUT.



ABSOLUTE ACCURACY

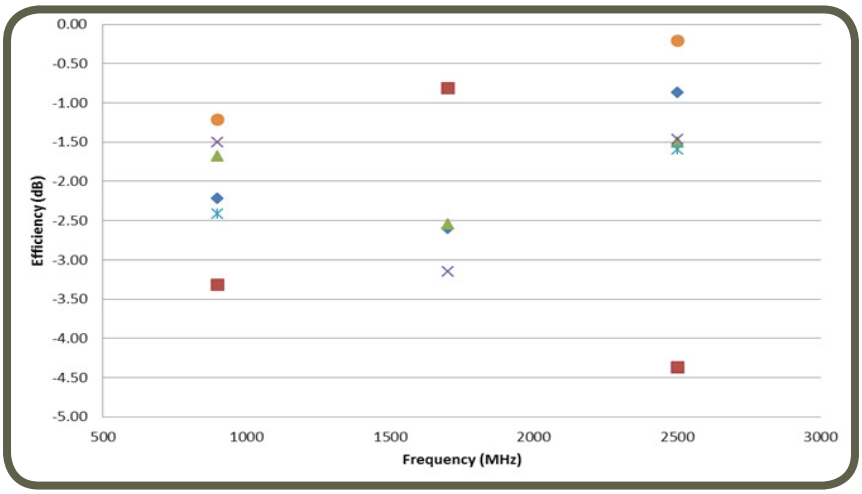
The coupling factor correction is based on extensive testing and modeling that is aimed to be representative of the average coupling effect for most antenna structures. This average or expected effect is corrected by the default coupling factor. The actual coupling effect will depend on the specific structure of the device being tested. The coupling effect is frequency dependent so there can also be a variation in the same device across different frequencies.

There may also be a further change in the coupling effect if the AUT is separated from the surface of the scanner as this effectively changes the overall structure. The difference between the default coupling factor and the actual coupling effect creates an error in a given device's measurement that the software cannot account for. This is the most significant source of error in our predicted results and is what limits the accuracy to ±1.5dB for typical devices.

This difference will vary based on the device structure but for a given structure at a given frequency there is a constant actual coupling effect and therefore a constant error. If the error is known for a given device then it can be reliably compensated for by applying a user defined offset.

The absolute measurement given by the RFxpert is naturally compared to that of a chamber. Yet taken individually, far-field chambers of different makes and near-field chambers of different makes show significant differences in their absolute measurements and patterns. Similarly, tests in the same chamber by different people at different time will yield different results; positioning of the DUT and of a bad feed cable will have a large impact on chamber results, much less so with the RFxpert.

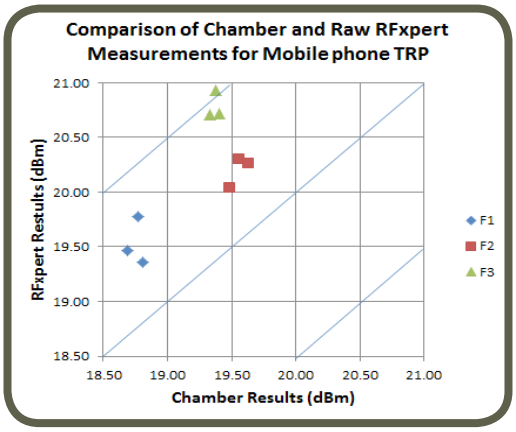
A near-field chamber may commit to +/- 1.0 dB; a commercial far-field chamber should achieve +/-0.5 dB accuracy. But our analysis has shown a variation in the 3 to 4 dB range as per the report below.



RELATIVE ACCURACY

For the evaluation of many similar devices, though not necessarily identical, the RFxpert is an effective tool to judge the variation with a much better than ±1.5dB absolute accuracy. An example of this is shown below.

This data has been shared with us by a major phone manufacturer. They were testing batches of phones in the hundreds to evaluate the production variation. The plot below shows chamber data versus RFxpert data for 3 samples of a phone model at low (F1), mid (F2) and high (F3) frequencies with default correction applied. These were reasonable results but it does show a repeatable error for a given frequency for this model.



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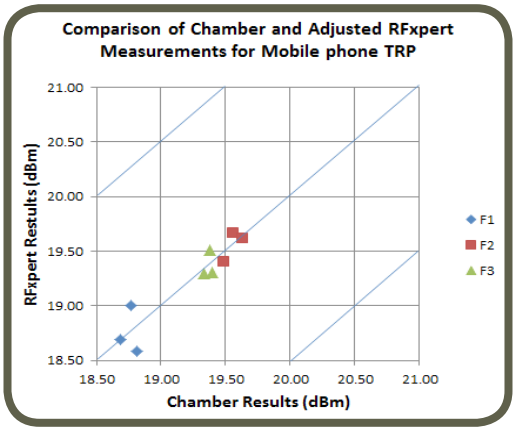
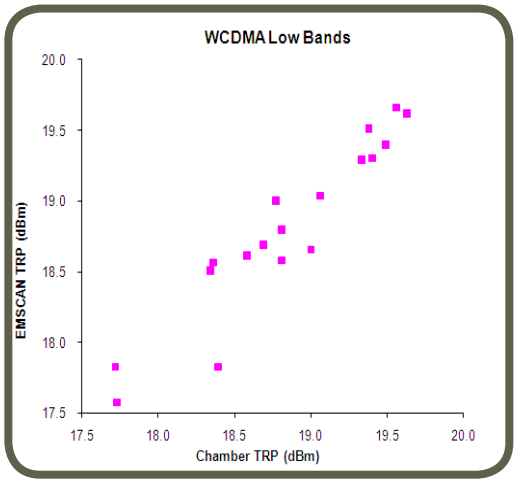
After analyzing the data the customer applied an offset based on the average deviation.

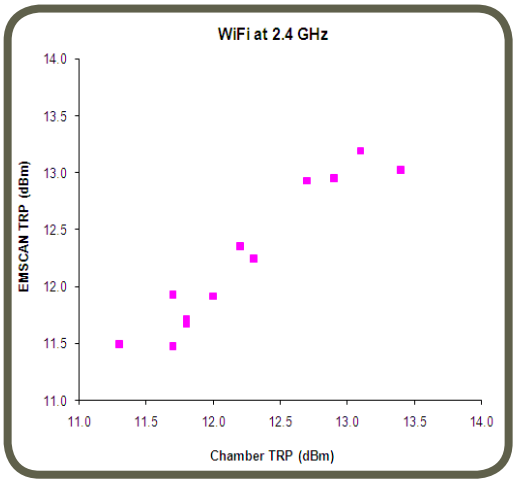
	Band 5				
Freq 1	Chamber	RFxpert	Error	Applied Error	Adjusted
1	18.81	19.36	-0.55	-0.78	18.58
1	18.77	19.78	-1.01	-0.78	19.00
1	18.69	19.47	-0.78	-0.78	18.69
2	19.49	20.04	-0.55	-0.64	19.40
2	19.56	20.30	-0.74	-0.64	19.66
2	19.63	20.26	-0.63	-0.64	19.62
3	19.33	20.71	-1.38	-1.42	19.29
3	19.40	20.72	-1.32	-1.42	19.30
3	19.38	20.93	-1.55	-1.42	19.51

The accuracy of the RFxpert measurement was then increased to a level which rivaled the chamber data.



This was just the data from three samples of one model in one band but they have repeated this for various models across all the operational bands and repeatedly found very good correlation with a chamber after applying the user compensated offset. In fact, this customer is now using the RFxpert to screen hundreds of samples that they previously screened in a chamber, saving them weeks of measurement time. Some of this data is in the tables below.





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Setting these offsets is available in the RFxpert application menu as follows.