**Suggested responses to ATCB questions**

There are many benefits in terms of usability and reduced uncertainty in using upright phantoms compared to horizontal bath phantoms. Since the angle to the source direction can be greater than 30 degrees, the uncertainty allowances for SARA2 systems include allowance for the whole spherical isotropy range of the probes rather than just an allowance for rotational isotropy about the probe axis. The additional uncertainty allowance can be more than offset by the uncertainty reductions with an upright geometry. These include:

1. Lower phone positioning uncertainty
2. Reduced effects from liquid evaporation
3. Reduced influence of stratification of liquid properties at measurement depth

In response to FCC requests, Indexsar have performed specific tests to demonstrate that tests at the side of the phantom give equivalent results to tests at the bottom of a bath (probe angled or end-on). These have been reported in several Reports submitted to FCC:

1. IXS0209 (April 2002) Error assessment for probe/interface proximity effects for an upright phantom
2. IXS0214 (September 2002) Error assessment for probe/interface proximity effects for an upright phantom geometry at 1800MHz
3. ISX0215 (October 2002) SARA2 validation testing with CDMA-modulated signals at bottom and side of phantom at 1900MHz

These reports showed that probe sensitivity is the same when the field gradient direction is either normal to or parallel to the probe axis.

Since then, Indexsar have advanced a more general theory setting out how SAR probe response varies with probe presentation angle over all possible configurations. Such studies supplied to FCC are:

1. IXS0223 (May 2003) Compensating for the finites size of SAR probes used in electric-field gradients (Virtual Probe Miniaturization VPM).
2. IXS0224( September 2003) Isotropy variations of SAR probes presented within +/- 30 degrees to the local field gradient directions

These Reports show that probe presentation angle has a minor effect on SAR results at frequencies within the IEEE1528 range but that the effects become more marked with bigger probes and at higher frequencies. Indexsar have implemented a correction scheme based on the VPM theory and this will be included in subsequent software upgrades.

Implications of this approach are that the +/- 30 degrees to the surface normal criterion does not obviate variations in probe sensitivity with probe presentation angle because the relevance angle is to the local field-gradient direction and not the surface normal. Effects are small at IEEE1528 frequencies and can be assessed or corrected using VPM dependent on frequency of testing.

So, the uncertainties have been analysed (including boundary effect uncertainties) and it is argued that uncertainties are small at 2450MHz and below.

Boundary effect compensation is a new opportunity that can be corrected for if appropriate measurements have been made during the waveguide probe calibrations. Indexsar have responded to this opportunity by modifying the waveguide measurements for probes calibrated now and by building a correction scheme into the software.

However, the correct ways of handling boundary effect corrections are still being discussed by committees formulating new standards modifications. The current way of limiting the uncertainties are by allowing adequate spacing between the probe tip and the phantom surface. For the area scan, the probe sensors are maintained at 8mm from the phantom. With a sensor-tip or sensor-side dimension of approx. 2.7mm, it is clear that the boundary effect is minimised by keeping the probe tip more than half a probe tip diameter away from the surface.

For the situation of an area scan, there is a potential conflict between the requirement that the probe tip should be kept more than half a diameter from the surface and the requirement that 2 measurement points should be taken within 10mm of the surface (i.e. Question 10). Recommended zoom scans have a suggested inter-planar spacing of 5mm. This means one measurement taken at 10mm and another taken at 5mm, at which point, the probe tip is only, say, 2mm from the phantom surface or less than half a diameter. With an 8mm diameter probe, these two conditions would not be reconcilable. The Indexar approach is to use scan points (by default) spaced only 3.5mm apart in the depth direction, so that 2 points are collected within 10mm and the probe is kept at greater than half a diameter from the surface.