Proposal for Test of Sony SWR50 / RD-0090

FCC ID PY7-RD0090

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BACKGROUND

The RD-00090 is a 'SmartWatch' product, designed to be worn on the wrist and supporting Bluetooth and WLAN 802.11 communication in the 2.4GHz range.

The purpose of this document is to detail a proposal for performing SAR testing on this device.

This proposal involves no deviation from the normal requirements for selection of the wireless configurations (channels, modes etc.). Normal limits for exposure would be applied for a device used at the extremities.

Due to the shape of the device, it is not possible to perform SAR testing for extremities using the flat part of a SAR phantom. This proposal details a method to place the device against another area of a SAR phantom to give a sufficiently conservative SAR measurement.

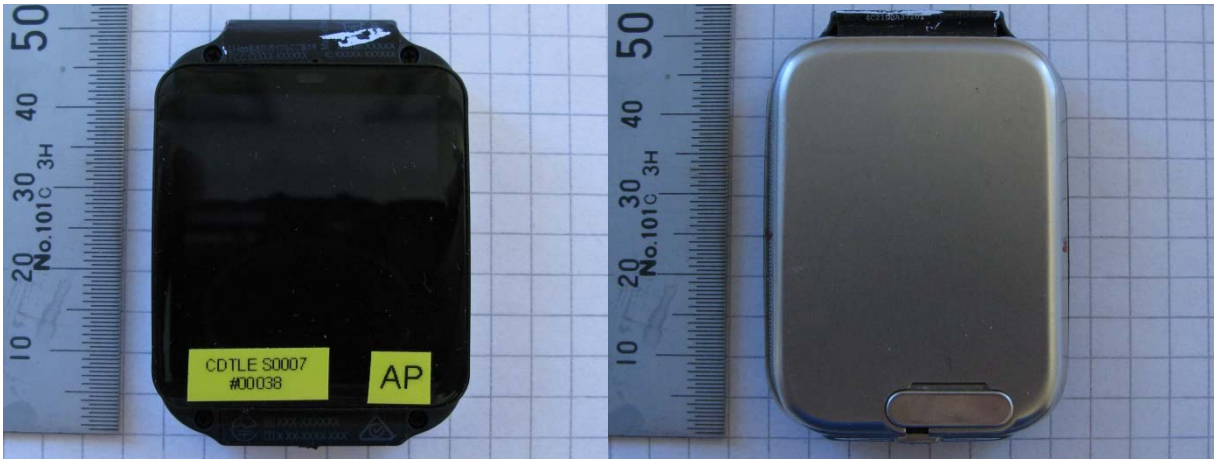
The proposal involves a test position where the rear of the device (i.e. the part that is in contact with the body of a person wearing it) is in contact with a SAR phantom. No other test positions (edges, front of device etc.) have been included.

DEVICE FORMAT

The device is in the form of a wristwatch. The electronics and active parts are contained within a module which fits into a special strap/carrier. There will be more than one type of strap/carrier available and these are intended to be interchangeable. Three types of strap/carrier have been considered.

Below are some pictures to illustrate the device. For full details, please refer to the manufacturer's technical description

All proposed testing involves the complete wristwatch device (module and strap/carrier assembled as one part). The clasp will be disconnected from one side of the strap to allow the strap to be opened, but will remain attached to the device. In this way, all the parts of the device will be in place during testing.



Front and rear views of the module (covered USB connector visible on rear of device to right)

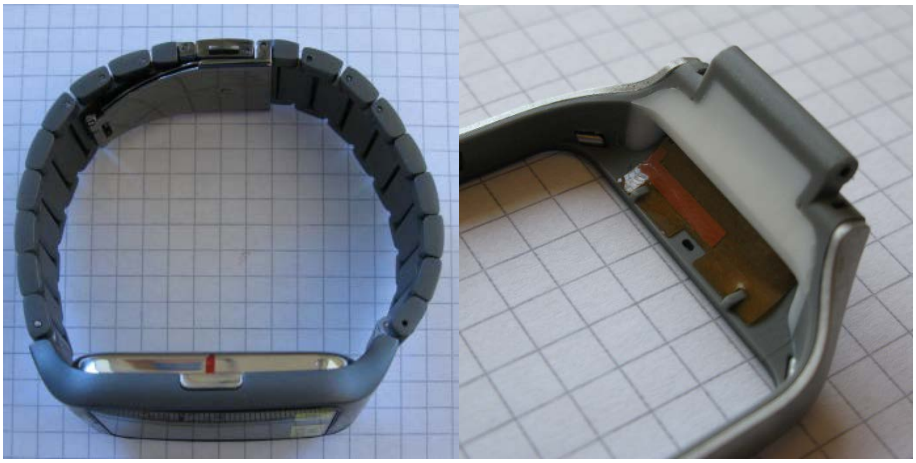
Illustration of the location of the WLAN/BT antenna (exposed on right)

Type 1: "Metal" strap (Sony part 1289-1695)

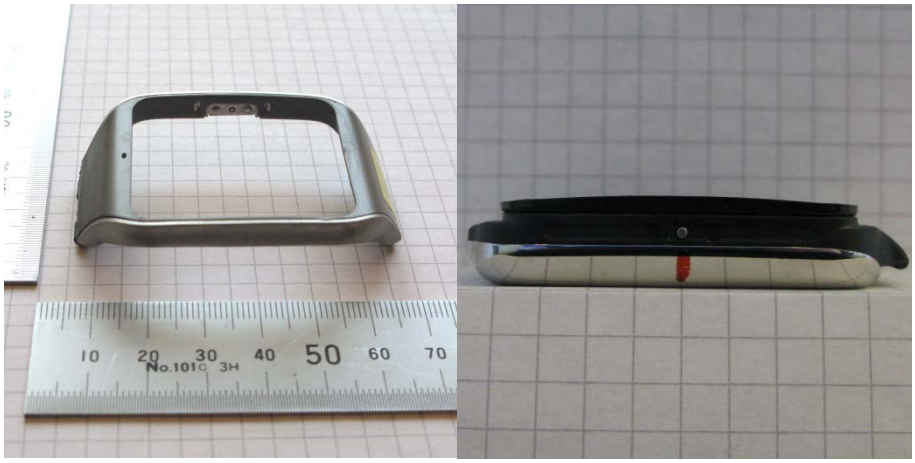
For this type, the centre part of the strap/carrier is moulded in plastic with some metal parts enclosed by the plastic (not visible), and some metal parts forming the outside edges of the carrier. The carrier also includes the outer part of the on/off button to operate the device (other controls are via the touch-screen). This button is in contact with the small button on the edge of the module

The carrier part for the metal strap also contains a small Flexible Printed Circuit (FPC) film which is placed so it is adjacent to the antenna when the module is placed in the carrier.

The strap is in the form of metal links, with a metal clasp to allow the strap to be expanded when the user is placing it on their wrist. The metal straps can be separated from the rest of the carrier using watchmaker's tools. According to the manufacturer's description, there is no galvanic contact between the metal straps and any part of the module.



'Metal' type strap/carrier with module (left) and detail of the FPC film (right)



Detail of the on/off button outer part (left) and location of the button on the module (right)

Types 2 & 3: “Classic” and “Sport” straps (Sony parts 1289-1690 & 1289-1693)

For these types, the strap/carrier is moulded as single piece of plastic, so the straps cannot be separated from the rest of the carrier. A metal frame is moulded inside the plastic (not visible) where the module fits. As with the “Metal” type, the carrier also includes the on/off button outer part and a metal clasp is attached to the straps.

There is no FPC film included in these plastic types.

These two types are identical in design except for the plastic part of the strap. The “Sport” strap has some cut-outs in the strap whereas the “Classic” has a solid strap.

’Classic’ type strap/carrier with module (left) and without module (right)

No photograph of the “Sport” type is included here; please refer to the manufacturer’s technical description for further details.

REASON FOR NOT USING A FLAT PHANTOM

The shape of the device prevents it from being placed against a flat phantom with the rear of the device in contact with the phantom, even if the clasp is detached to allow the strap to open.

In the case of the 'metal' strap/carrier type, the strap itself is not sufficiently flexible to allow this placement. There is no way to deform the strap sufficiently without completely distorting the strap and the carrier part that holds the module.

'Metal' type opened as far as possible (clasp disconnected at one end)

In the case of the 'plastic' strap/carrier types, the strap itself is flexible, but the shape of the carrier part prevents the rear of the device from being placed against the flat part of the phantom. In particular, the carrier would be deformed in close proximity to the antenna inside the module: the module 'pops out' of the carrier

'Classic' type showing distortion to carrier if the strap is bent too far.

Instead, it is proposed that a curved part of a SAR phantom, specifically the neck region of a Specific Anthropomorphic Mannequin (SAM) is used for testing all varieties.

MODIFICATIONS TO THE DEVICE

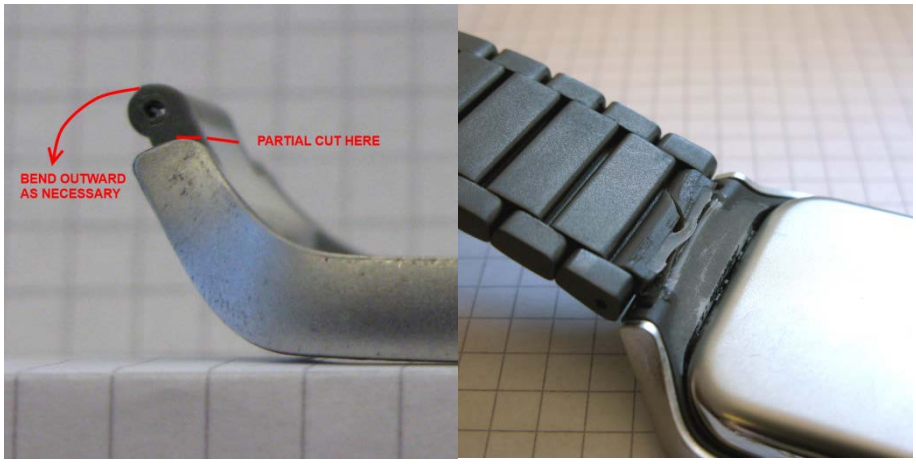
In order to place the device against the neck region of the SAM phantom, some small modifications to the device are necessary:

In the case of the two plastic strap/carrier types, it is necessary to apply some pressure to the sides of the carrier part to prevent it from deforming too much as the radius of the curve of the phantom is somewhat larger than the radius of a typical human arm. This can be achieved by using plastic cable ties around the device. As these contain no metal, the effect on SAR measurements should not be significant.

Cable Ties used to prevent distortion of the carrier for 'Classic' type

Note that even with this solution, it is not possible to place the device so the rear is in contact with a flat SAR phantom, so the curved neck region must be used.

In the case of the 'Metal' strap/carrier type, the strap is still not quite flexible enough to allow placement against the phantom even in the neck region. To provide some extra flexibility, the plastic of the carrier where each of the metal straps join is cut part way through. This allows the straps to be opened further and the device to be placed in contact with the phantom without removing any of the material of the device.



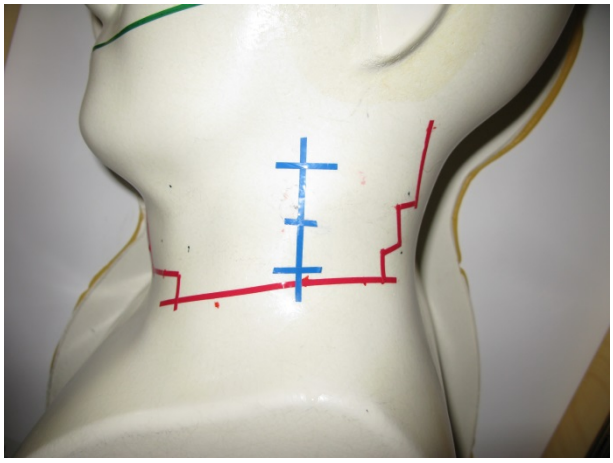
Modification made to 'Metal' type to allow the strap to open further

PLACEMENT AT THE NECK REGION OF A SAM PHANTOM

After some discussion with the manufacturer of the SAM phantoms, Schmidt & Partners Engineering AG (SPEAG), it was determined that it might be possible to use part of the neck region for SAR testing of a wristwatch device.

Using the software supplied with the test system, it was possible to map out an area where the E-Field probe had access to the surface. A new point was defined on the surface of the phantom, and this was used as a reference for the position of Area Scans and Zoom Scans. The reference point was physically marked on the phantom, together with other markings to allow repeatable positioning of the device.

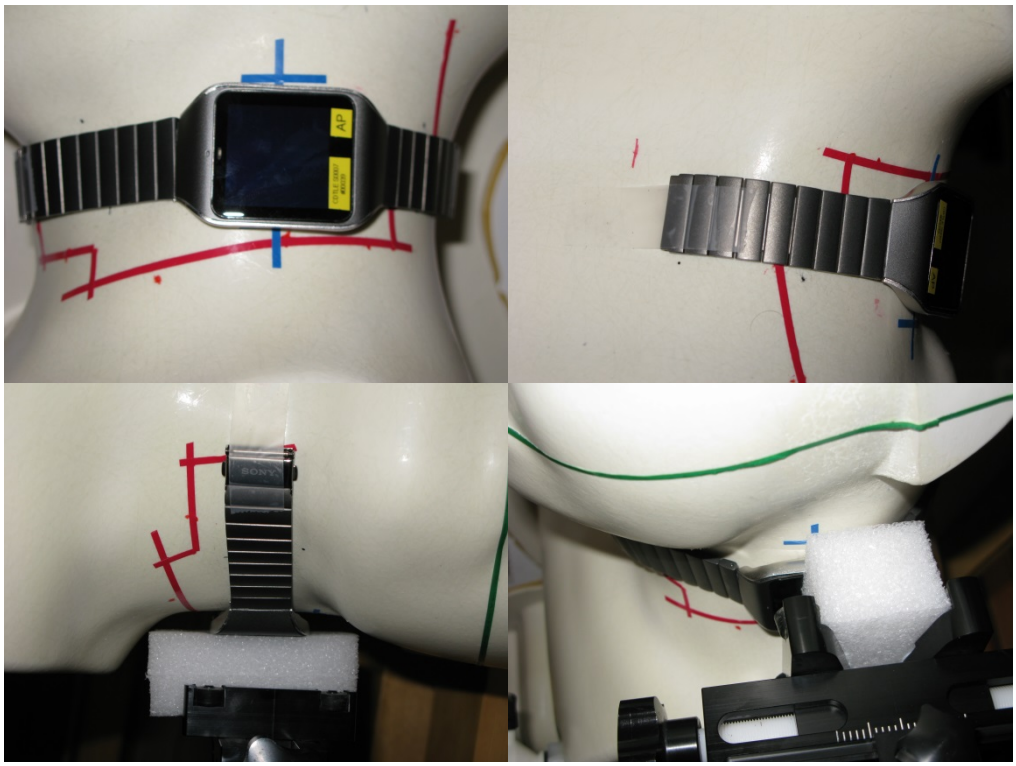
As can be seen from the photographs below, the whole of the carrier and module are covered by SAR Area Scans, and a significant part of the straps also. It was not possible to find a location where the whole length of the straps could be covered by an Area Scan



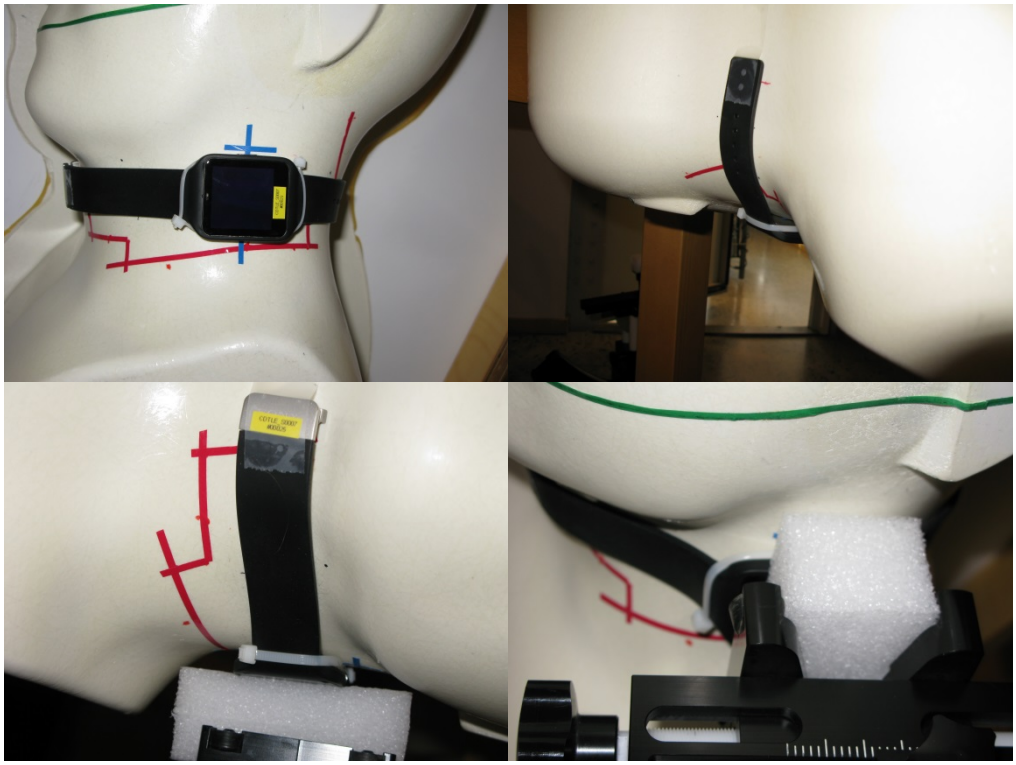
Proposed region of SAM phantom to use for testing
Red markings show the approximate limits of the area the probe can access
Blue markings are to allow for alignment of the DUT (see below),

The device is placed so that the antenna is close to the centre of the measureable area.

During testing, the DUT holder supplied with the test system can be used with a piece of low-loss foam to hold the device firmly against the phantom. The ends of the straps can be attached to the phantom using non-metallic adhesive tape to ensure a close fit to the contours of the phantom.



Proposed test position for 'metal' type. Note that the DUT holder is omitted in the top two photos for clarity, but would be used to hold the device during testing.



Proposed test position for plastic types. Note that the DUT holder is omitted in the top two photos for clarity, but would be used to hold the device during testing.

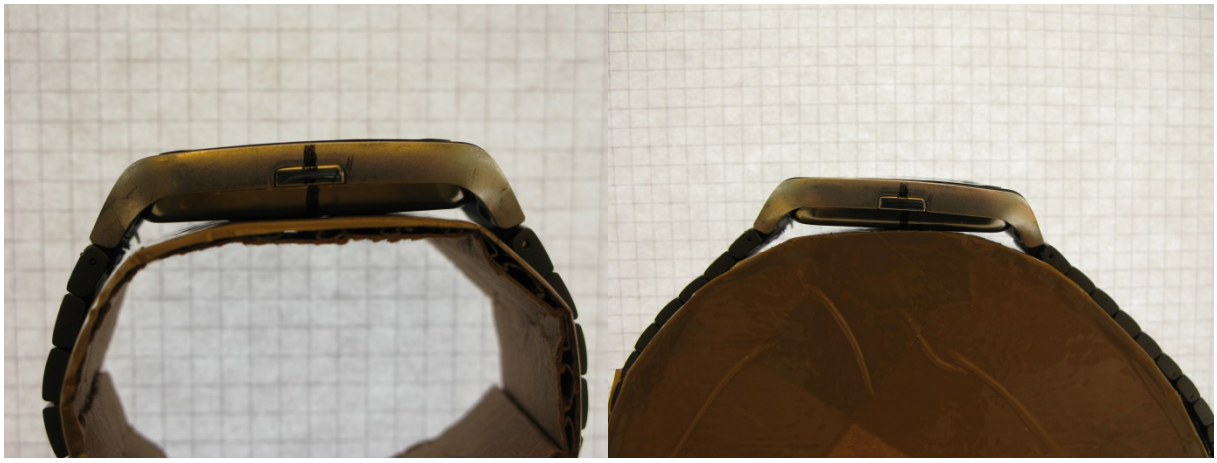
TEST SEPARATION

The chosen location on the neck area of the SAM phantom allows for placement with the centre of the rear of the device to be in direct contact with the phantom. Due to the curvature of the phantom, there is a slight gap present for some parts of the device.

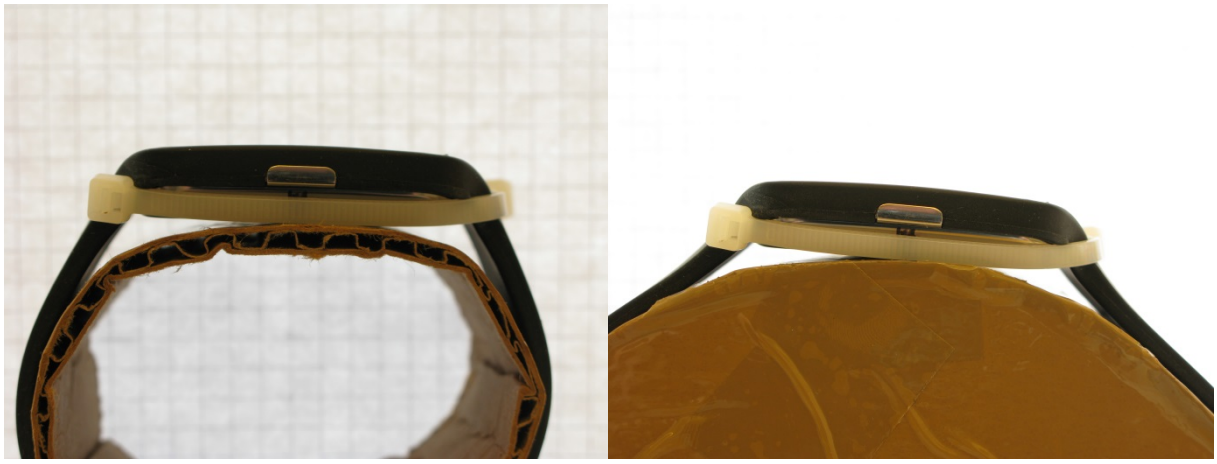
The largest gap is where the strap joins the body of the carrier. As can be seen from the images below, this gap is similar to the gap that exists when the device is worn on the wrist: in a real-life usage situation, gaps will be present regardless of the size of the users arm.

The majority of the rest of the device is either in contact with the phantom, or very close to it (<2mm separation). The metal clasp has been placed as it would be when the strap is closed around the arm, which means that the clasp itself is in contact with the phantom.

To compare the gaps, a cardboard tube with the approximate shape of an arm, and a cardboard cross section of the phantom (at the proposed test position) were made. The dimensions of the phantom cross section are not exact, but a close approximation



Comparison of gaps for 'Metal' type for arm (left) and phantom neck region (right)



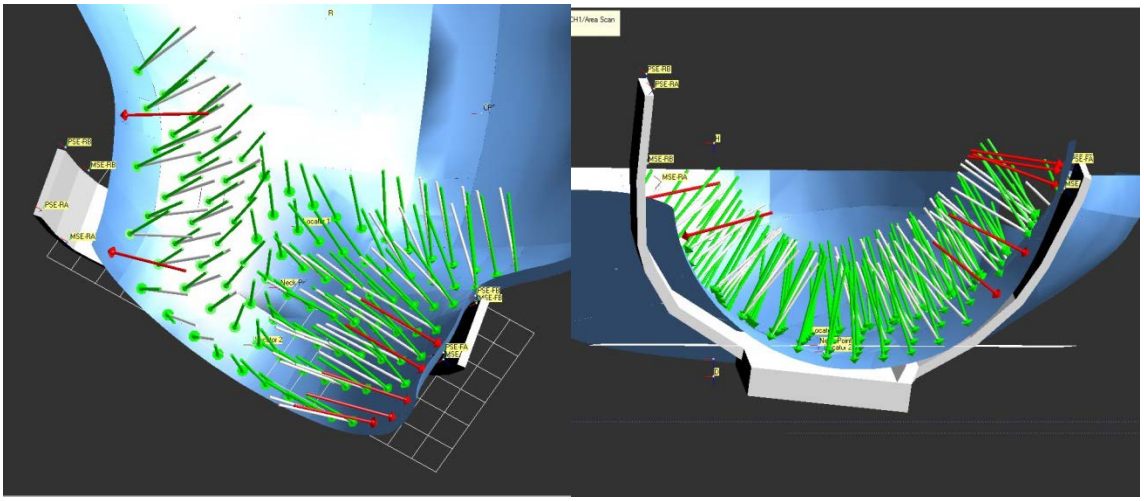
Comparison of gaps for 'Classic' type for arm (left) and phantom neck region (right)

SAR TEST SYSTEM AND FLUID SET-UP

The SPEAG DASY system will be used for SAR testing. After discussion with SPEAG, a parameter was set to allow the E-Field probe to measure with an angle of up to 30° from the normal to the phantom surface, in order to give access to a sufficient area of the phantom. This should be within the range allowed for measurements up to 3GHz.

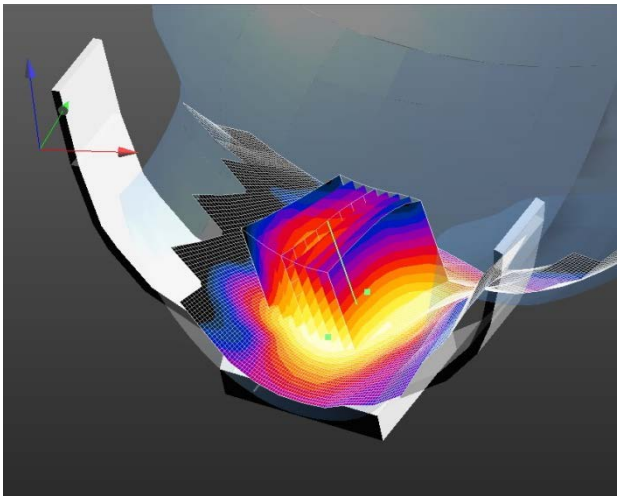
Other settings used are standard. The usual Area Scans, Zoom Scans and power reference/power drift measurements will be made. The Area Scan will be set to cover as much as possible of the device. See examples below.

Testing will be performed using a SAR tissue simulating liquid that fulfils the requirements for a “body” fluid.



Examples of SAR Area Scan placement

Note that the 3D model in the picture is not accurate and is only intended to give an approximation of the positioning of the device.



Example of expected SAR distribution (based on preliminary tests)

PROPOSAL TO COVER DIFFERENT STRAP/CARRIER TYPES

Based on previous discussion with the FCC, the following tests are proposed:

1) Testing the 'Metal' type with the rear of the device placed in contact with the phantom as described above. All applicable wireless link configurations to be tested.

2) Testing the 'Classic' type with the rear of the device placed in contact with the phantom as described above. All applicable wireless link configurations to be tested.

3) Testing the "Sport" type with the rear of the device placed in contact with the phantom as described above. Only the worst case from (2) will be tested.

For (1), (2) and (3) the same module will be used, in order to allow for direct comparison of the results.

Based on initial testing, the Bluetooth power level will be below the threshold where SAR testing is required. WLAN testing is expected to be performed with 802.11b 1Mbps at the required channels. Full details of the justifications would be included in the final report, as usual.