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CR638 update

Learnings from IOP tests

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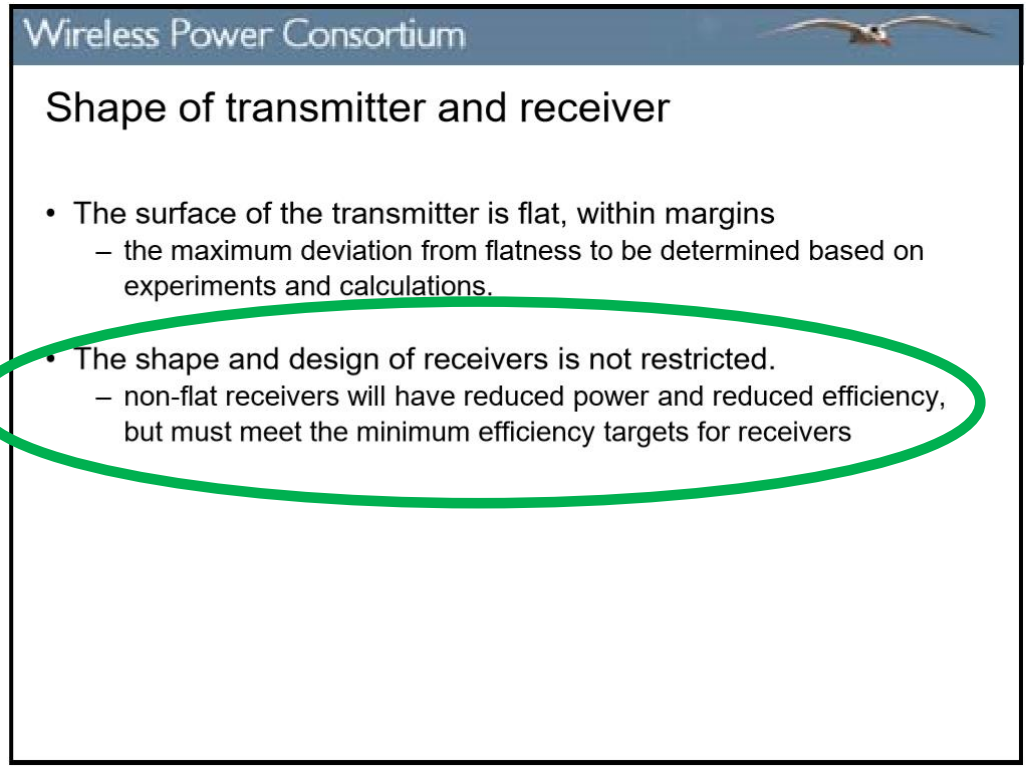
Outline

- Recap WPC1902 Atlanta
- Technology opportunities with relieved dz requirement
- Learnings from pre-IOP tests with S9000P shaver
- Conclusions and next steps

Recap on CR638



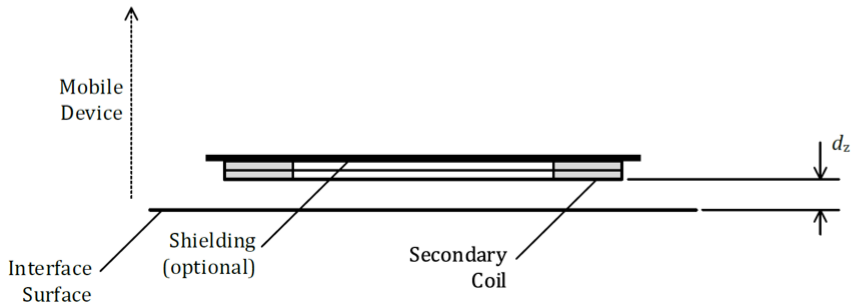
Recap on CR638

Proposed change can be for BPP only.

Proposed change for spec 1.3.1 on PRx mechanical interface

The distance from the Secondary Coil to the Interface Surface of the Mobile Device (see Figure 3) ~~shall~~ should not exceed $dz = 2.5$ mm across the bottom face of the Secondary Coil.

Figure 3. Secondary Coil assembly



Rationale behind proposal:

- It fixes the inconsistency with the WPC commercial requirements
- It enables expansion of the Qi ecosystem with more receiver types
- It is an editorial change that can be integrated in the first update of 1.3 spec
- It does not increase the risk of interoperability problems

Recap on CR638

Proposed improvement direction for spec version 1.4

- Add test cases to increase coverage of the compliance test. For example:
  - Add to specification a TPR coil that covers area between TPR#1D and TPR#1A (see figure 1)
  - Introduce PRx test that checks if coupling factor is not too low. (e.g: ratio between reactive power and output power at TPT should be in acceptable range)
  - Introduce analog ping test for both transmitters and receivers

- Specify an operating window for the most relevant Rx-coil parameters:
  - Coupling factor (see example in figure 1)
  - Quality factor

- Make operating window a function of target power

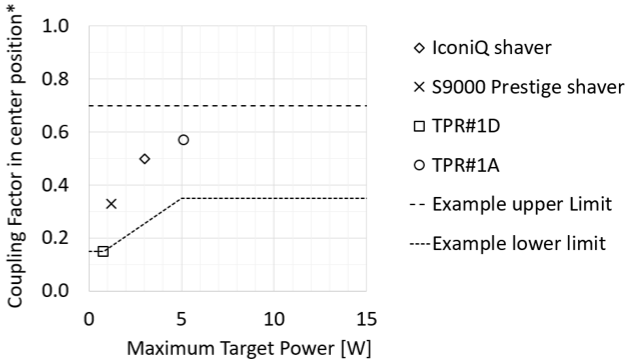


Figure 1: Example of coupling factor operating window

* Measured in the center position of A10 Tx design with defined method

Technology opportunities with relieved dz requirement

- Enable Qi for products with an inner (basic) body and outer body shells. This is used to enable both water tightness and flexibility in outer shell design.

- Enable Qi through curved receiver surface. Enables Qi for Mobile devices in Personal care, Industry, Entertainment.

Fig. 1: Basic body inside outer shells

- Enable Qi through multi-component injection molded plastic surfaces (2K molding).
  - Rubber molded on outer shell for grip
  - Transparent plastic on black plastic for display window in surface
  - These parts often require a thickness > 2.5 mm

Fig. 2: Body groomer with 2K molded rubber grip

Learnings from pre-IOP tests with S9000P shaver

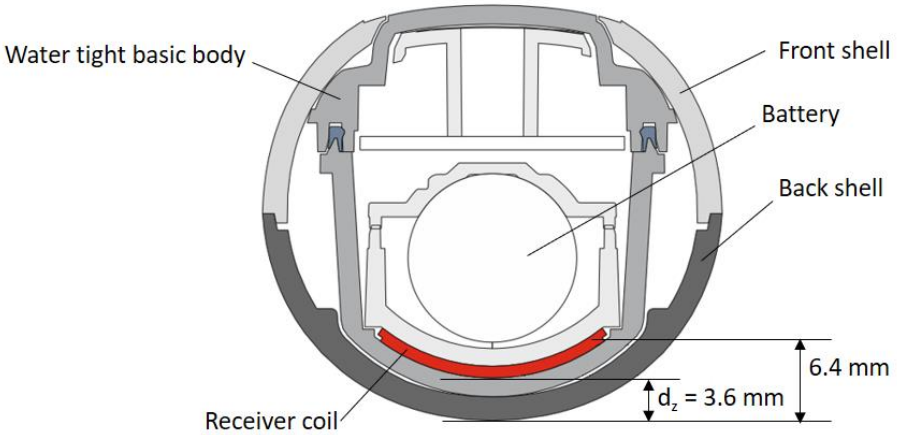


Figure 1: Cross section of S9000P

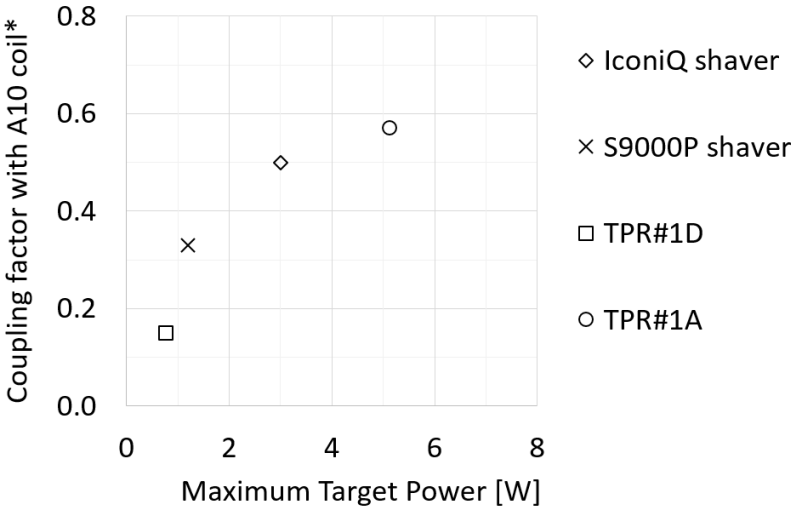


Figure 2: Measured coupling factors with A10 coil

Learnings from pre-IOP tests with S9000P shaver

Power transfer:
No problem as long as the maximum received power target is reduced to compensate for the lower coupling factor.

FOD:
No false positives when tuned to pass compliance test #57

Communication:
Can pass IOP test but needs attention. There was a pass with the compliance test on minimum modulation depth (Test #41). Still there were two PTx samples that had difficulties with demodulating. This could be solved by changing capacitive modulation into resistive modulation.

Analog Ping:
The analog ping function of some PTx samples did not detect presence of the PRx. This leads to a delay between PRx placement and start of power transfer. There were three PTx samples that did not start charging at all because the analog ping did not detect presence of the PRx. This could be solved by allowing the PRx to load its coil when the PTx is in analog ping mode.

Conclusions

- Receivers with low k (dz > 2.5 mm) can pass both compliance and IOP tests when properly designed. This is true for every receiver.
- FOD compliance test seems to cover the low coupling receiver case very well
- Modulation depth compliance test (#41) does not guarantee IOP.
- The analog ping function of some PTx designs is very poor. This is not covered in a compliance test yet. This can be overcome by loading the PRx coil with a resistor.

Next steps

- Gather feedback from WPC members on this topic
- Develop new compliance tests
  - For analog ping (function for PTX, detectability for PRx)
  - Communication without putting additional constraints on PTx design
  - Minimum coupling factor test for PRx.
  - Cover area between TPR1A and TPR1D for PTx.
- Cooperate with Power Interface TF to come with a feasible coupling factor definition for spec v 1.4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