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Black dot redefinition proposal for universal and limited case

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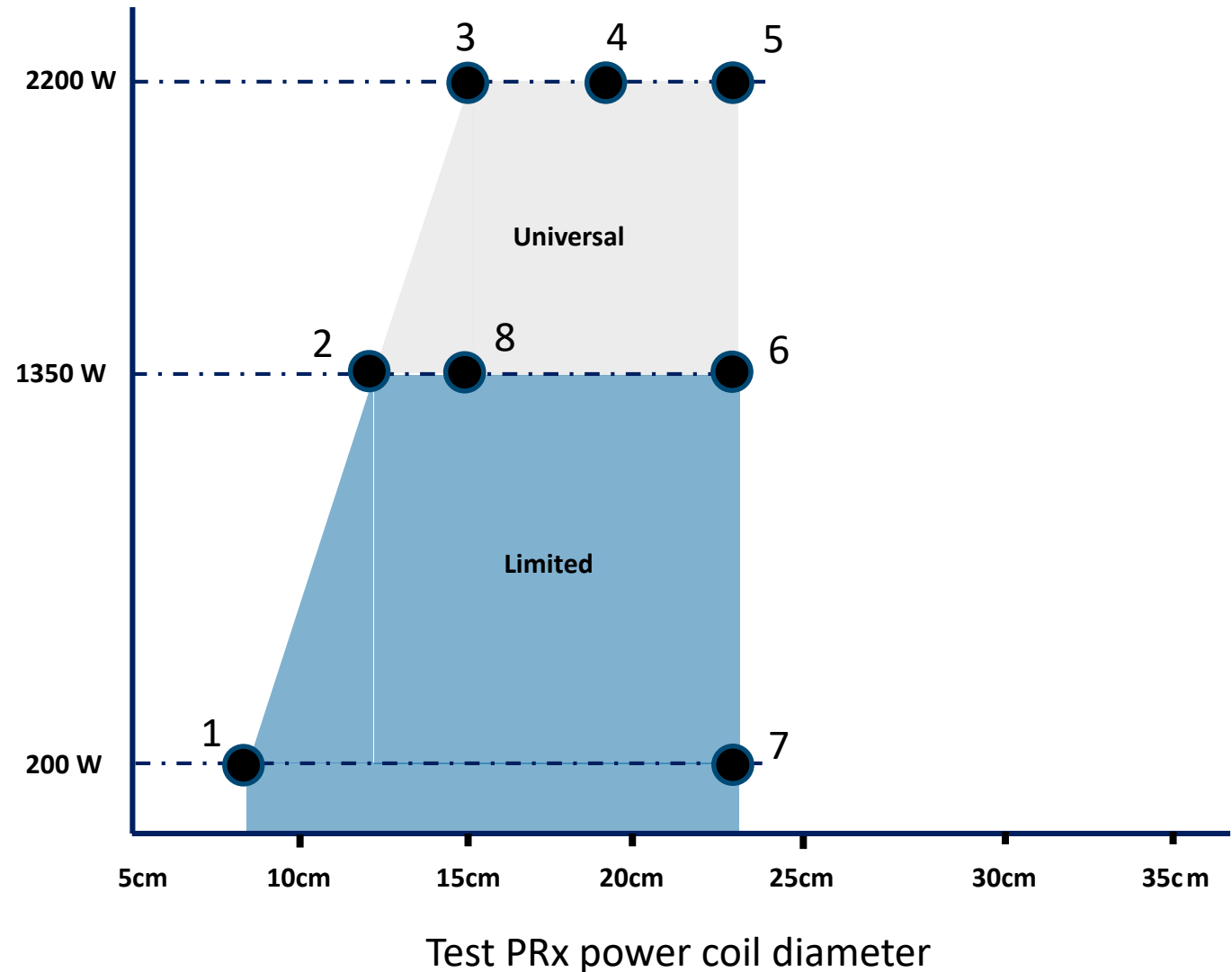
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Current Power Interface Description

Agreed @WPC1805

Test PTx parameters

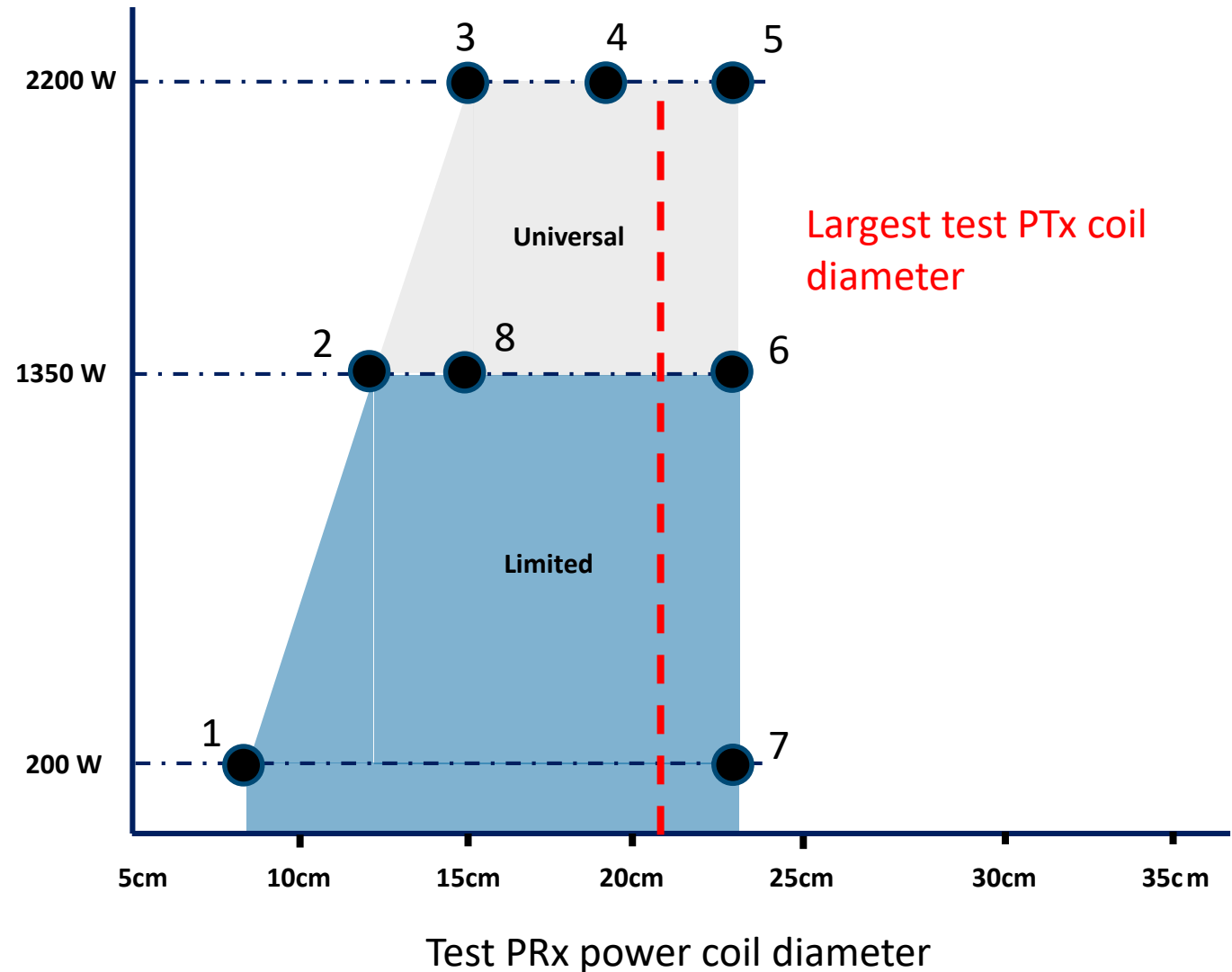
PTx Case	Guaranteed Power [kW]	Tx coil diameter [cm]
Universal Tx hob	2.20	18
Universal Tx hidden	2.20	21
Limited* Tx hob	1.35	15
Limited* Tx hidden	1.35	18



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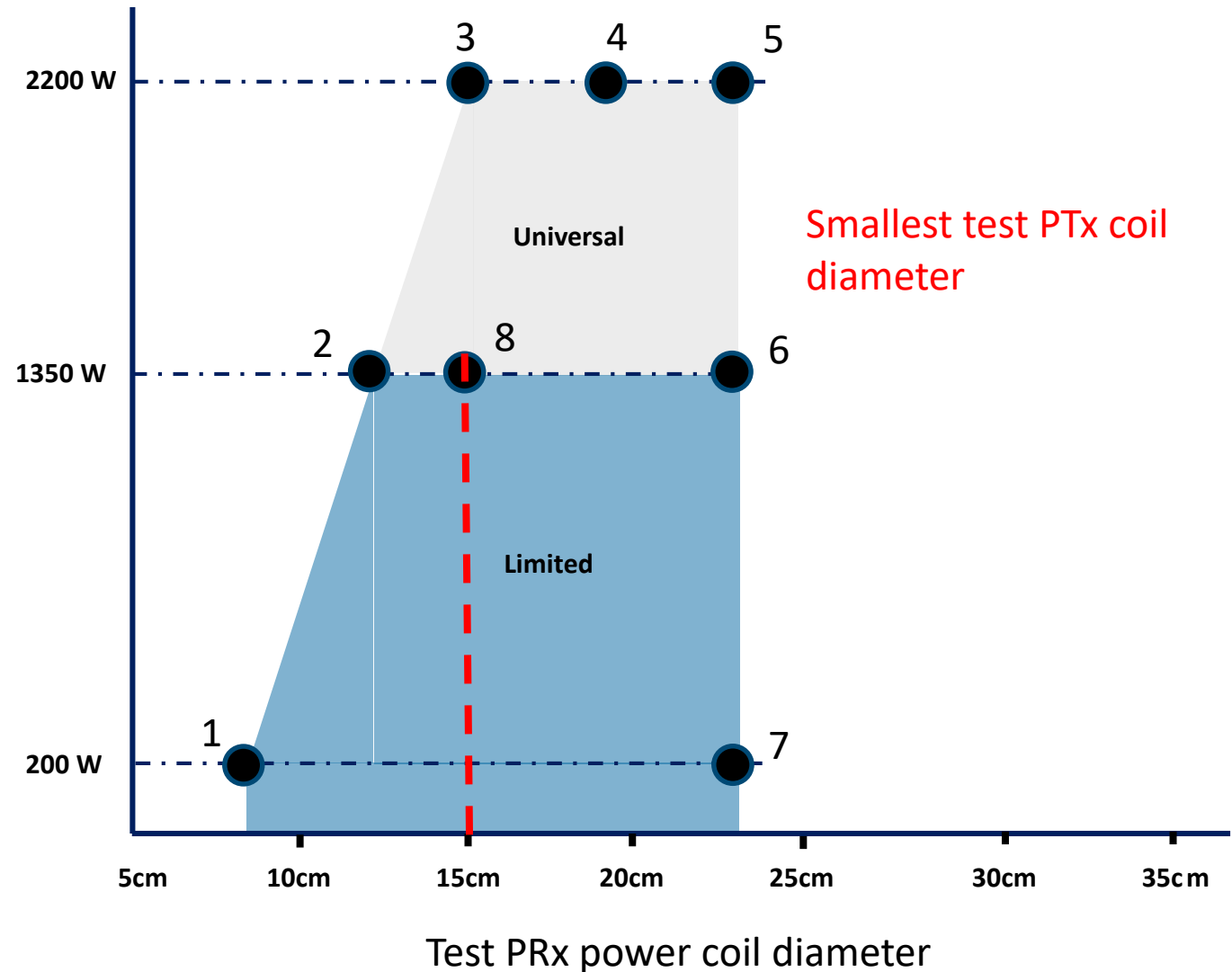
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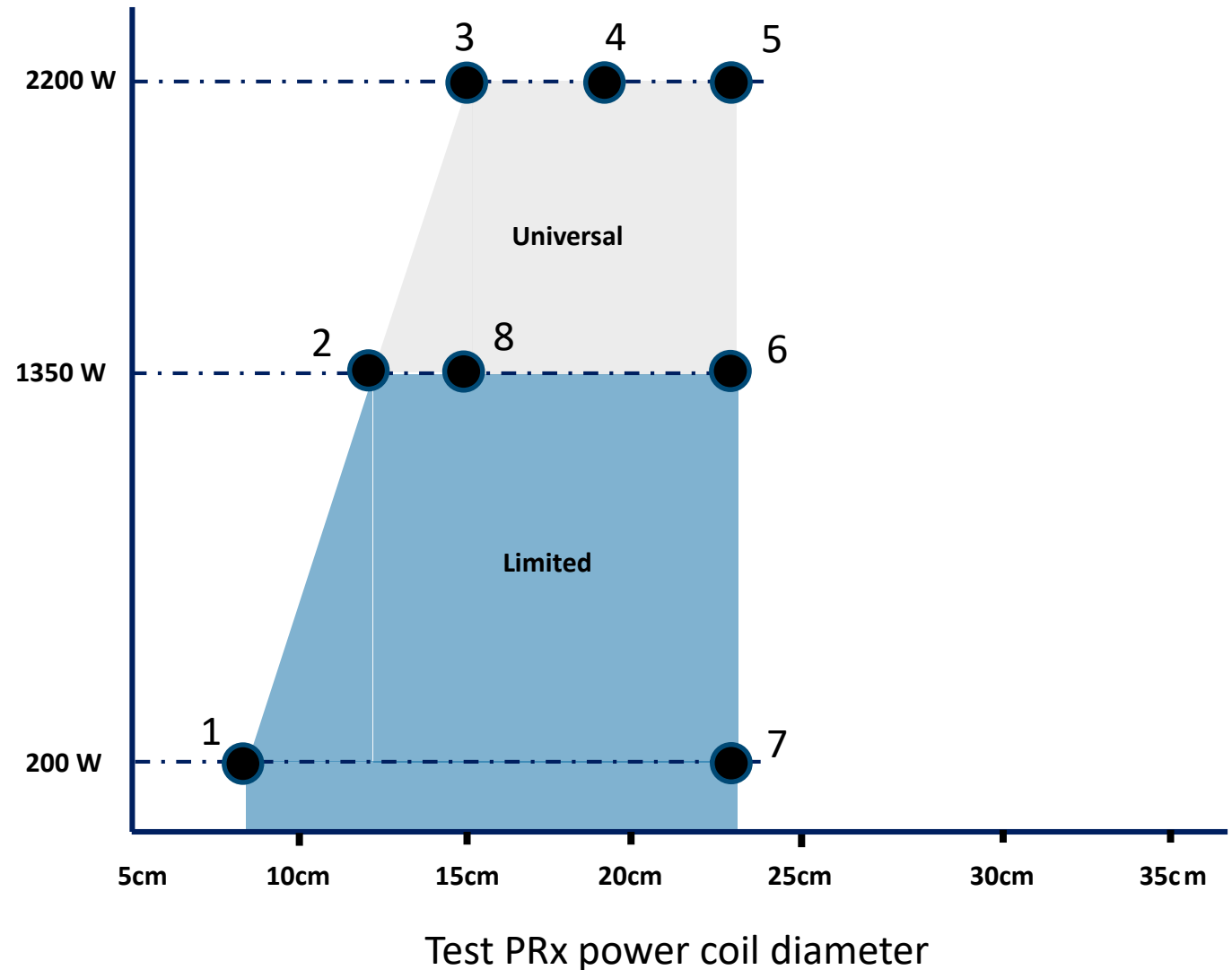
Test PRx Antenna Design

Agreed @WPC1805

The default implementation in the PRx is a single winding antenna where the diameter is 2 cm larger than the PRx power coil diameter

- This reduces the effect of the proximity of the power coil, without using a ferrite sheet on the PRx side

The PRx antenna diameters will therefore range from 10-25 cm

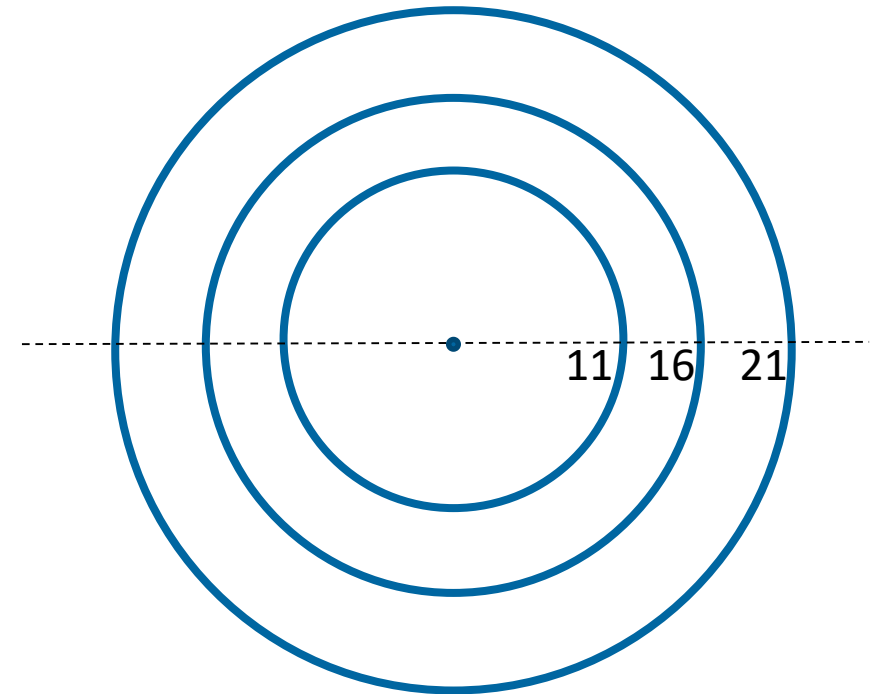


Universal Test PTx Reference Antenna Design

Agreed @WPC1805

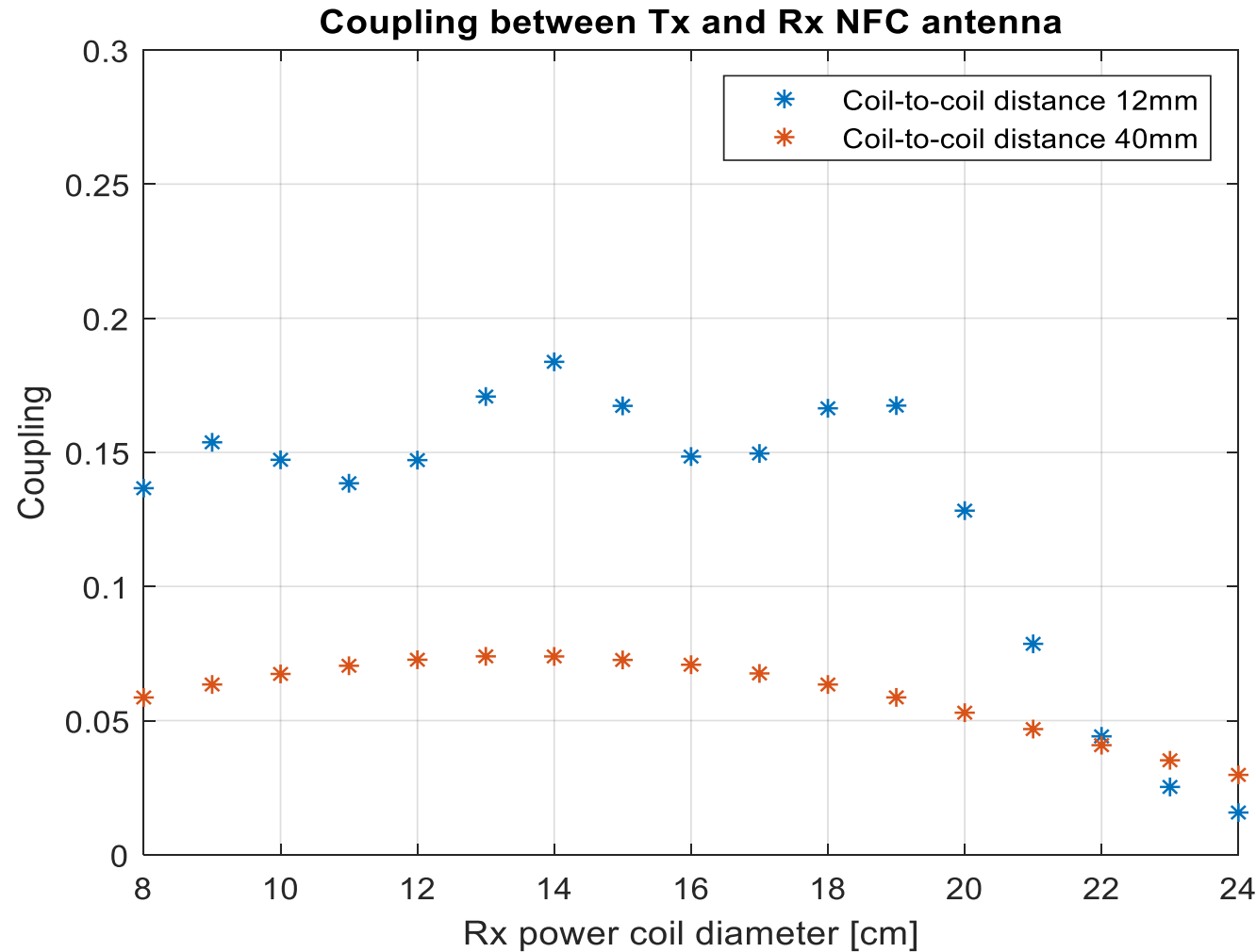
The PTx antenna consists of multiple windings with diameters between 11 and 21cm

- This design has a sufficient coupling with the complete PRx antenna range [10-25 cm]
- A ferrite sheet is placed between PTx antenna and power coil to increase the antenna performance.
- This design combined with a thin ferrite sheet was agreed at WPC1805 for the reference universal hidden transmitter.



Reference antenna for universal hidden transmitter

Universal Test PTx Reference Antenna Design



Sufficient coupling over the complete PRx diameter range

Limited Transmitters

Mechanical constraints

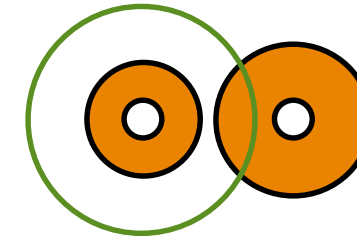
Compact transmitter designs should be possible

The proposed PTx antenna is too large compared to the PTx power coil diameter of 15 cm:

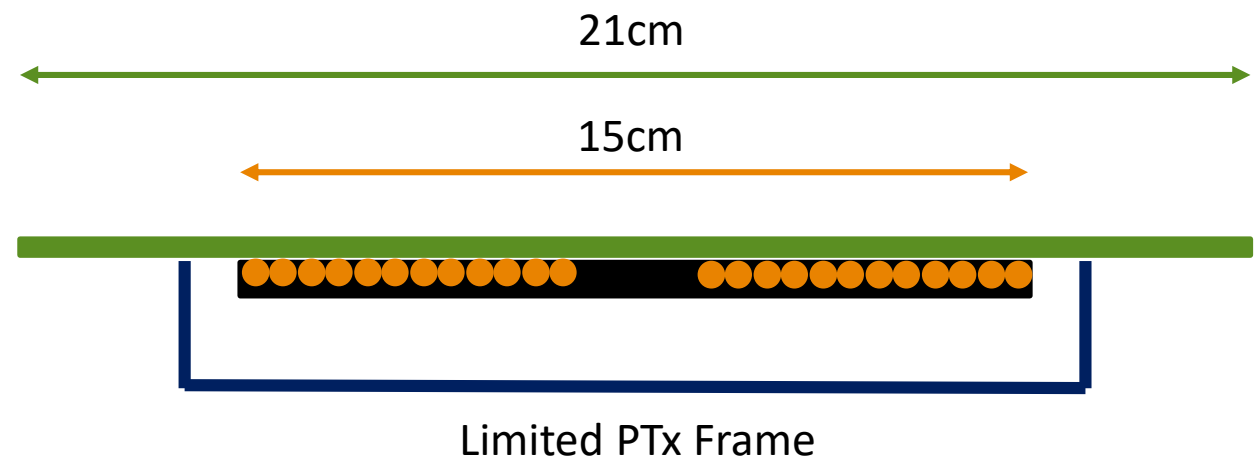
- The antenna could overlap with other power coils
- Limited cabinet, frame or placement space

To enable compact transmitters, the PTx antenna should be smaller.

- **The coupling with antennas of large footprint appliances may become too low for proper NFC communication and harvesting.**



Potential overlap with other power coils

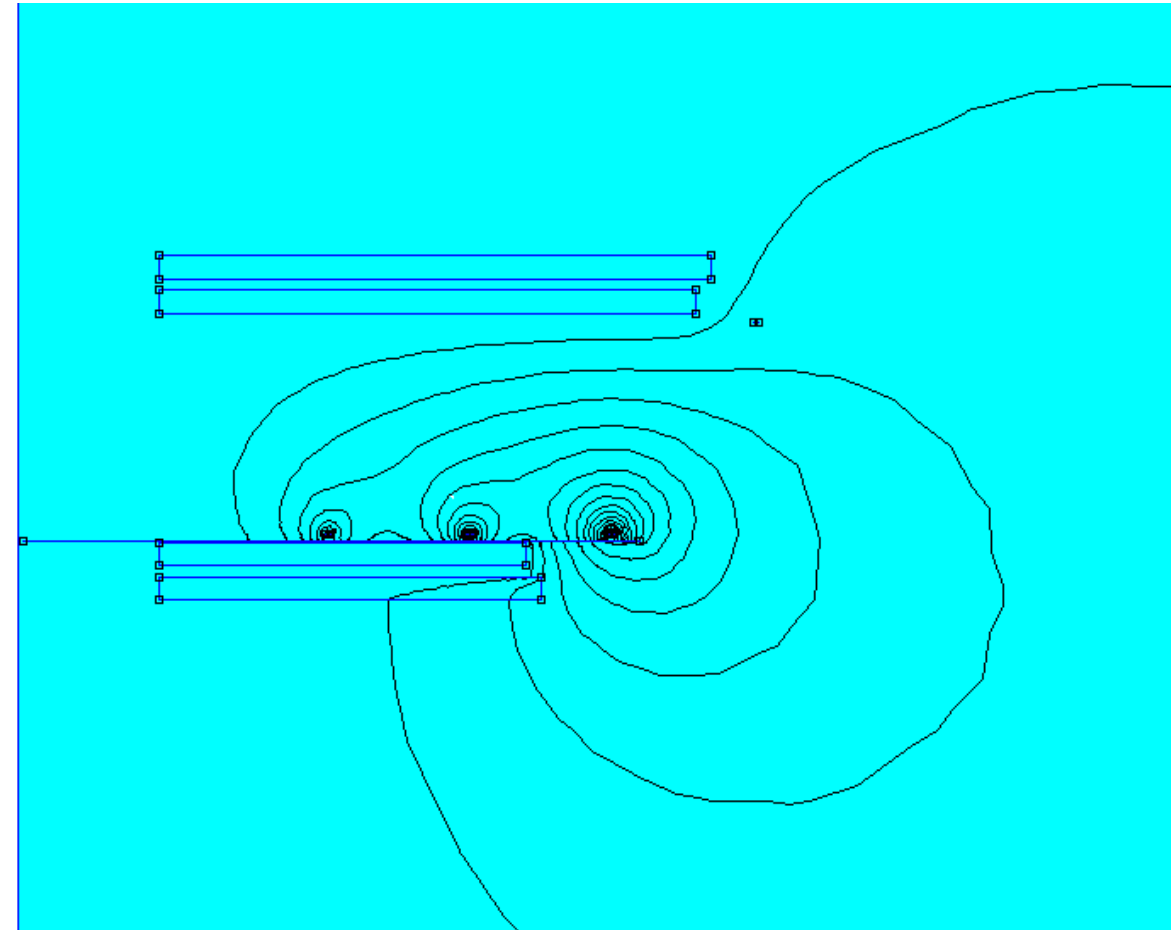


Possible options for PRx antenna size reduction

The PRx antenna experiences negative effects from the power coil proximity

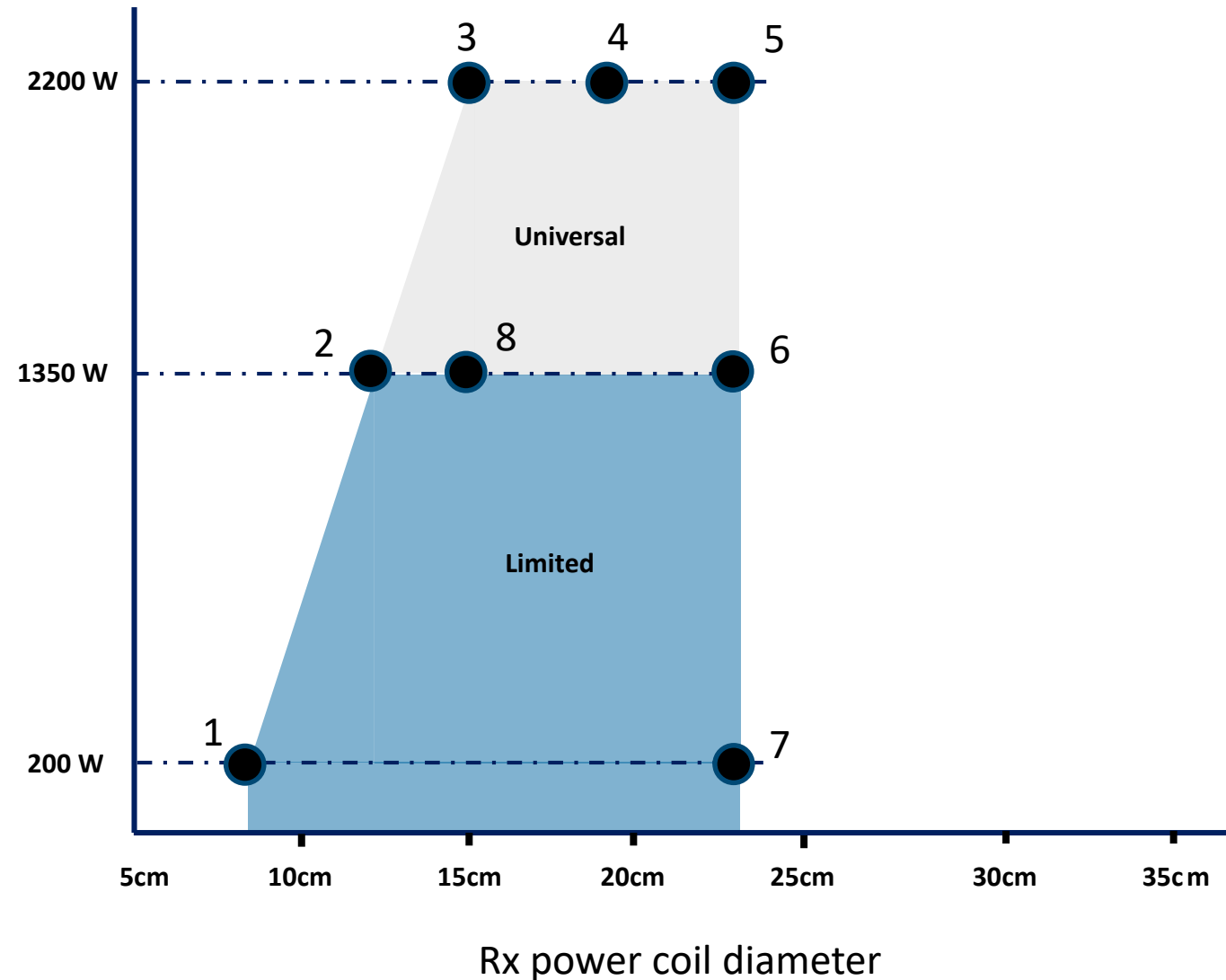
There are two solutions to allow a smaller Rx antenna diameter range:

- 1. Place a thin ferrite sheet between the PRx antenna and power coil**
 - The ferrite sheet shields the antenna from the coil
- 2. Reduce the PRx power coil size**
 - Keep the 1cm separation between the antenna and power coil



Current Power Interface Description

- PRx antenna ranges from 8-25cm
- PTx antenna needs to be 21cm to enable communication and power harvesting with black dot 5,6 and 7
- **This PTx antenna might not fit in a limited transmitter**



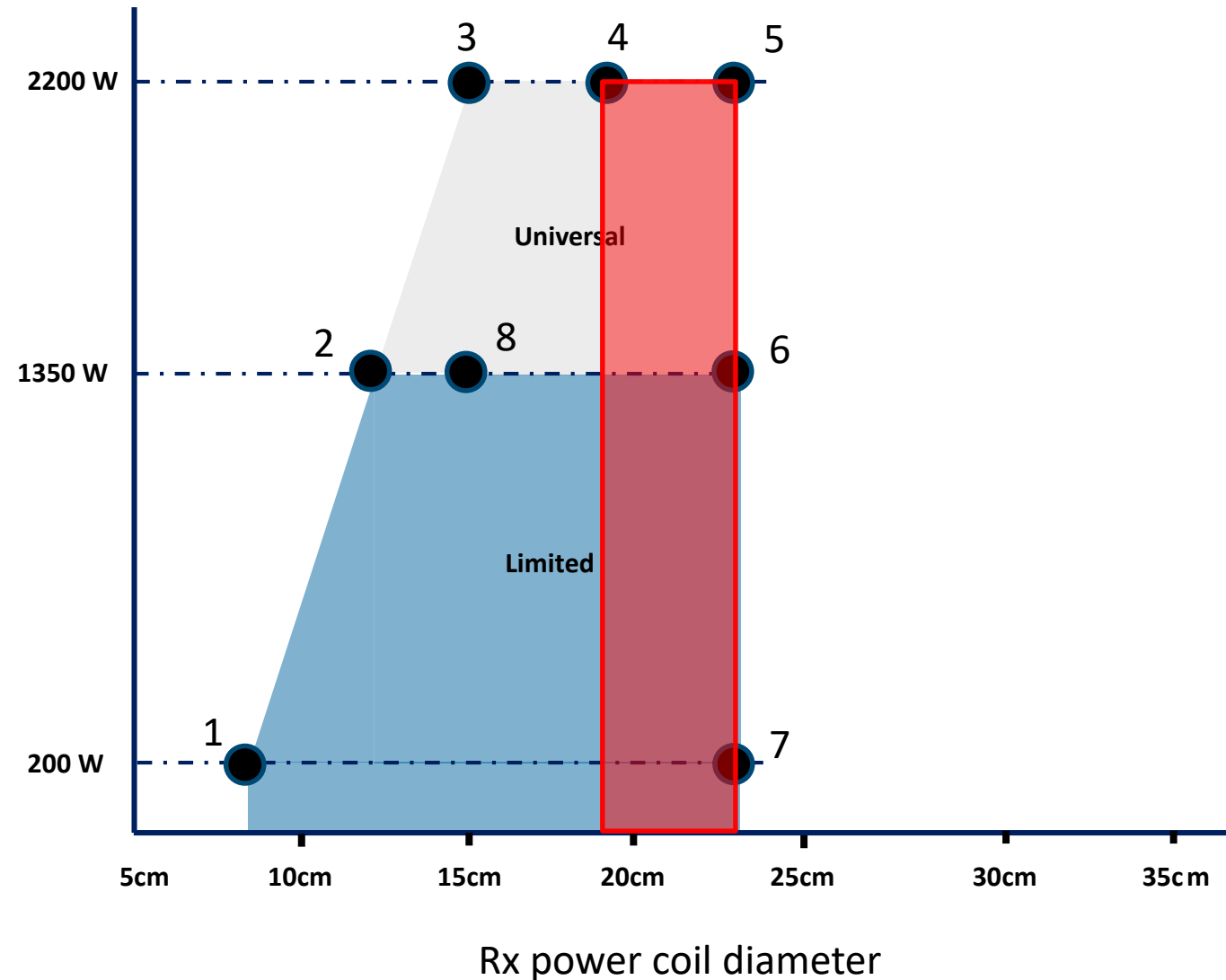
Possible options for PRx antenna size reduction

Option 1

Power interface is unchanged

A thin ferrite sheet used on the PRx side

- The maximum PRx antenna diameter is reduced (e.g. from 25 to 19 cm)
- A ferrite sheet might be required in the red area to shield the antenna from the power coil

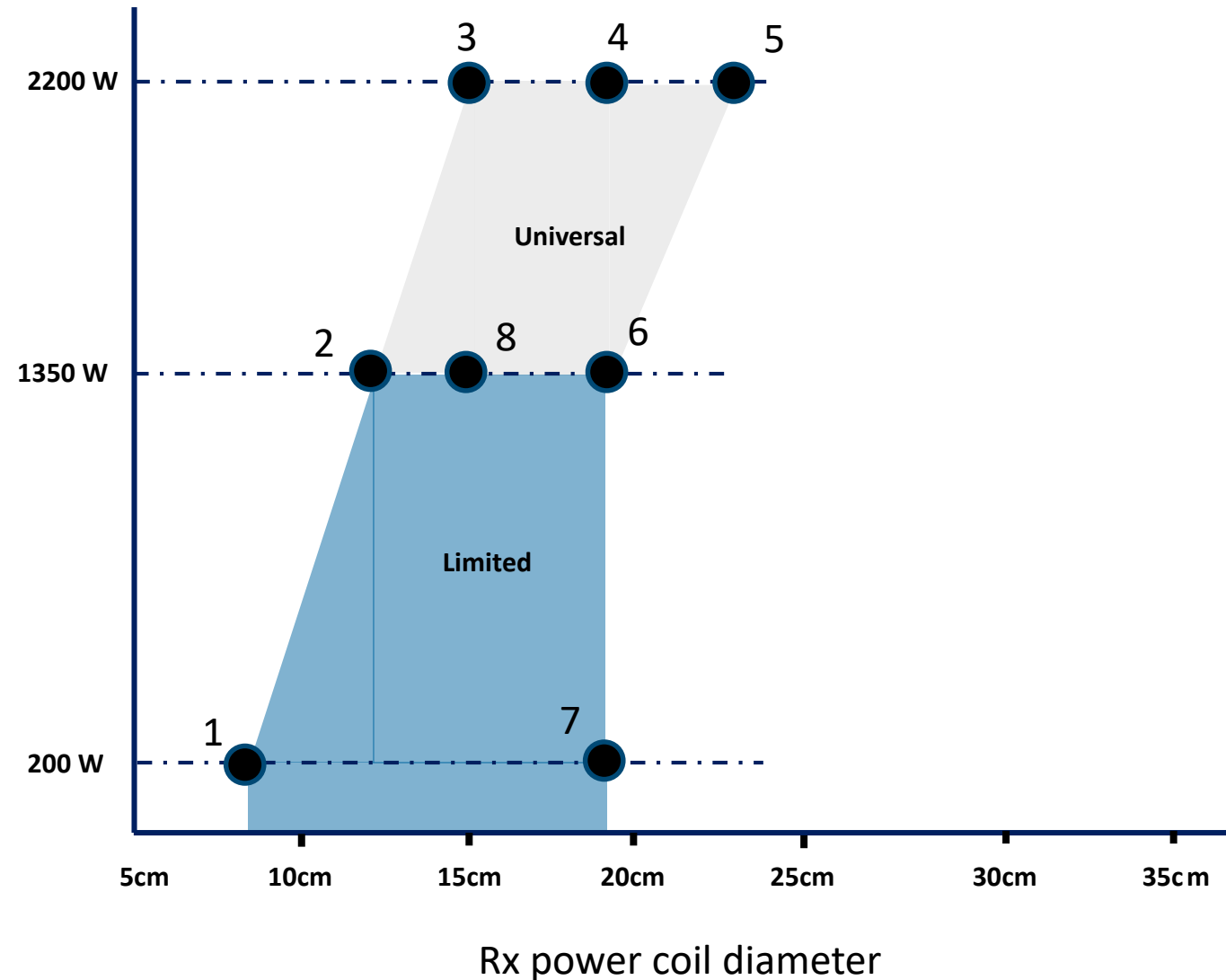


Possible options for PRx antenna size reduction

Option 2

Reduce the maximum PRx power coil diameter for low power appliances (dot 6 and 7)

- Black dot 5 and a limited transmitter cannot communicate anymore
 - **This is not preferred because the (black dot 5) appliance will not be able to show an error message to the user**

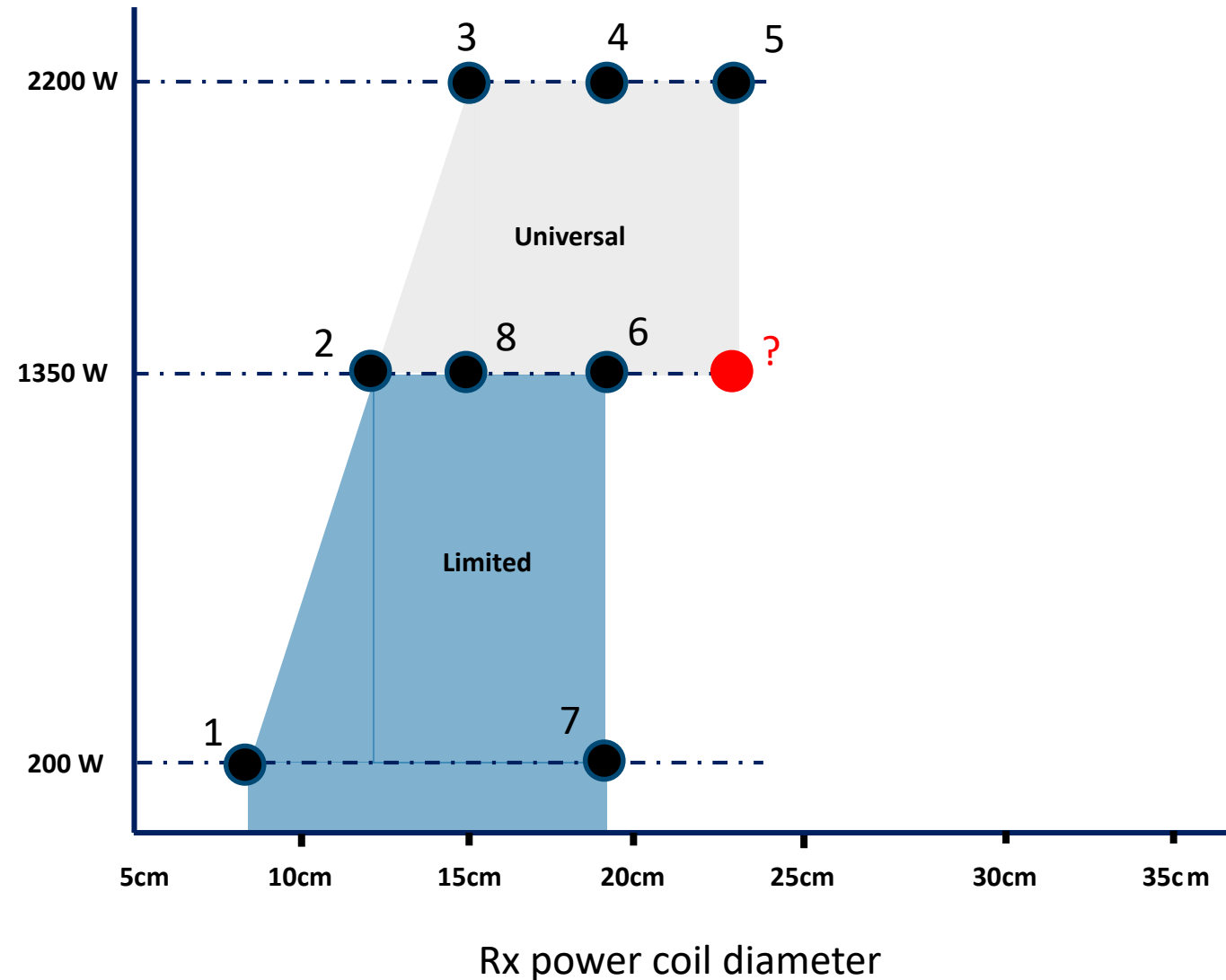


Possible options for PRx antenna size reduction

Option 2

Reduce the maximum PRx power coil diameter for low power appliances (dot 6 and 7)

- Black dot 5 and a limited transmitter cannot communicate anymore
 - This is not preferred because the (black dot 5) appliance will not be able to show an error message to the user
 - Do we need an extra dot?



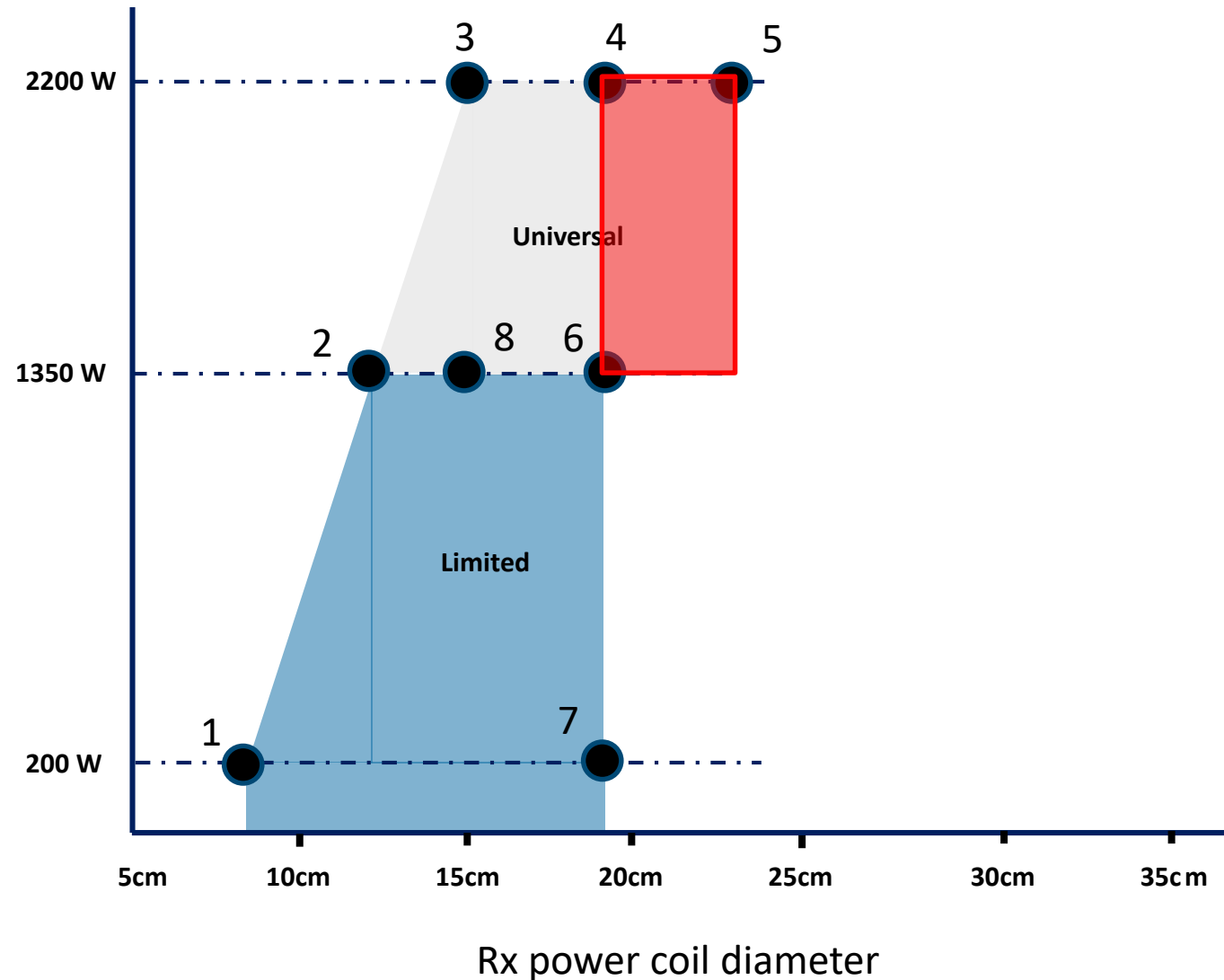
Possible options for PRx antenna size reduction

Option 3

Reduce the maximum power coil diameter for low power appliances (dot 6 and 7)

Appliance maker in the red area can choose to communicate with a limited PTx

- A thin ferrite sheet and a smaller PRx antenna might be required
- Or use a large diameter PRx, and only communicate with a universal PTx



Discussion

As a result of mechanical constraints in Limited Transmitters, the design space for PRx antennas is limited.

Three options make PRx antenna diameter reduction possible

1. Use a ferrite sheet in large footprint appliances
2. Limit the power coil size for low power appliances
3. A combination of the two, with option of black dot 5 communication compatibility with limited PTx

Philips proposes option #3

Question to PTx makers:

What maximum PTx antenna diameter is still acceptable for a limited transmitter design?

- 17 cm
- 18 cm
- Other?

Recommendation to the KWG

Discuss / define how large footprint/high power appliances are managed on a limited transmitter

