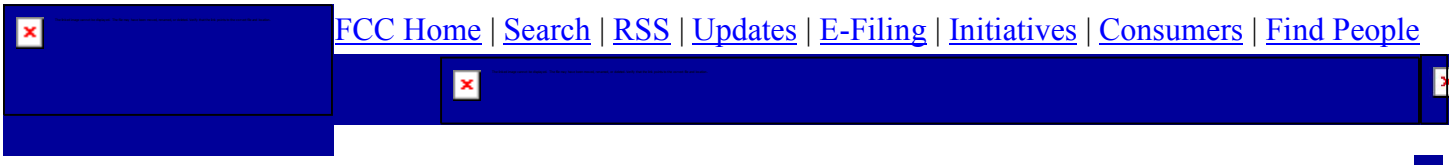
Briggs, Mark

From: oetech@fccsun27w.fcc.gov
Sent: Friday, October 2, 2015 9:47 AM
To: Briggs, Mark
Subject: Response to Inquiry to FCC (Tracking Number 386456)



Office of Engineering and Technology

Inquiry on 07/23/2015 :

Inquiry:

Dear OET staff,

This inquiry is being submitted for a wireless charging coil
following the A4WP wireless charging standard.
The inquiry will be for a nominal 5W charging device with a rectangular,
multi-turn coil measuring approximately 9cm x 14cm.

The A4WP standard uses a charging frequency of
6.78 MHz that is loosely inductively coupled (resonant charging. Load\power management and control is performed via a Bluetooth Low Energy link with Bluetooth transceivers located
on both the transmit unit and the receive (client) unit. Specific device details are included in an attachment to this KDB.

As the measured electric and magnetic fields exceed the reference levels in FCC Part 2 we will need to perform evaluation of rf exposure using computational modelling as was done for FCC ID 2AB8ZND3. Included in the attachment are proposed rf exposure evaluation distances for the assessment and we would appreciate confirmation that these are appropriate prior to us submitting the data (anticipated time-frame would be week ending August 8).

It is anticipated that this coil will be used by different manufacturers in their versions of the same charging pad. Where possible we would like to use approval of the rf exposure evaluation via this KDB inquiry for these other devices to enable our customers that use the exact same coil architecture and design at the same (or lower) maximum current used in our modelling. To do this we would provide very specific information to restrict re-use of the KDB approval to only those designs that use the exact same coil design and operation at the same or lower current for desktop charging applications.
Are there any other aspects we should address to allow the KDB to cover this coil design versus a specific charging mat?

If a phone call would be useful to clarify any aspect of this enquiry please do not hesitate to call.

FCC response on 08/06/2015

Before consideration of test data being applied across different transmitter implementations (a policy which is currently most akin to modular approvals), assessment procedures for the EUT should be reviewed. Although KDB Publication 680106 D01 indicates that WPT type devices used for typical desktop applications should have their exposure analysis conducted at 10cm, if an EUT can be shown to be designed for use at farther distances (or such a distances can be assured via appropriate marking), testing at such a distance may be authorized (consistent with 47 CFR 2.1091). Other items which will be taken into consideration are size, form factor, output power, and/or associated receivers.

Please clarify if it is desirable to show compliance at a distance consistent with mobile applications (i.e. 20cm) and, if so, please provide documentation demonstrating that this EUT would be designed for such conditions. Incorporation of user instructions, labeling, and a compliance information statement (consistent with 2.1077(c)) may also be used to justify such testing.

---Reply from Customer on 08/17/2015---

OET Staff,

Thank you forthe response. You asked: Please clarify if it is desirable to showcompliance at a distance consistent with mobile applications (i.e. 20cm) and,if so, please provide documentation demonstrating that this EUT would bedesigned for such conditions. Incorporation of user instructions, labeling, anda compliance information statement (consistent with 2.1077(c)) may also be usedto justify such testing.

The intendeduse for chargers using this coil design will be for table-top use, consistentwith mobile applications supporting a minimum separation distance of 20cm. The5W charging capability is for handset charging and not for charging largerdevices, such as tablets or laptops. As such we have prepared a guidancedocument, submitted as an attachment to this KDB enquiry, to be provided toODMs and OEMs who intend to use this specific coil design in their endproducts. This document contains the restrictions on leveraging any

OETapproval through this KDB enquiry, includes the language that needs to beprovided to end users and installers related to minimum separation distances,and describes the approval procedures related to rf exposure. Note thatthe coil (aka resonator) has been certified with A4WP and leverage of the A4WPcertification to support final device certification is also limited to use ofthis specific coil design at the same maximum coil current we are describing inthis KDB.

As the finaldevice will require certification for the Bluetooth transmitter (possibly forPart 18 if the manufacturer decides not to follow these DoC procedures) the TCBshould ask for an rf exposure exhibit that addresses compliance of the completeproduct (not just the Bluetooth transmitter). The applicant will need toprovide this KDB enquiry information, including the associated test report andthe Intel installation guide, so that the TCB can confirm compliance with therequirements for product intended use. We hope the guidance in thisenquiry and associated attachments are sufficiently clear that the TCB would beallowed to issue the certification grants without additional FCC oversight. If,however, the TCB does not consider that the device meets the implementationrequirements described in this, or any other related enquiry, then they shouldbe following the PAG procedures.

A test reportcontaining the RF field values at 20cm, measured from the sides of the coil andalso at 20cm from the front face of the coil (to allow for charging mats thatcan be inclined as described in our original entry for this enquiry) will becompleted and submitted around August 21st on the assumption thatthe proposal described above is acceptable.

FCC response on 08/27/2015

Please confirm –

It is understood that the above proposal is to take RF exposure measurements of a single EUT and apply those results to all other EUTs using the same coil configuration, even if the mechanical housing, form factor, manufacturer, and supporting equipment are different. Is that correct?

It is understood that this proposal also would allow TCBs to decide which devices may and may not leverage test data generated by a “master” device. Is that also correct?

Further, no test data has been uploaded as mentioned in the prior inquiry response.

---Reply from Customer on 09/01/2015---

Responses to your three questions:

It is understood that the above proposalis to take RF exposure measurements of a single EUT and apply those results toall other EUTs using the same coil configuration, even if the mechanicalhousing, form factor, manufacturer, and supporting equipment are different. Isthat correct?

The proposal is to take those measurementsfrom this specific EUT and apply to them to all other EUTs that use the samecoil configuration at the same or lower maximum coil current AND will be usedin a manner consistent with desktop use to allow for a 20cm separation distancefrom persons. The OEM/ODM guidance document we submitted alsostated that the device would be designed for charging handsets and othersimilar portable devices.

While not explicitly stated in the ODMguidance we provided, the mechanical housing would need to be a plastic orother non-conductive material for the charger to operate. The proposal isbased on the dominant

source of fields being the coil and the device enclosurewould need to be designed to have minimum impact on those fields to ensureconsistent and effective operation – use of metal or other conductive materialswithin the enclosure would prevent charging.

If there are additions or revisions to therequirements that FCC would like to see please advise. For example,require a minimum distance of 5cm from the coil to any conductive metal partsin the host device beyond the charging circuitry and associated shielding(refer to the internal photographs attached to this response).

It is understood that this proposal alsowould allow TCBs to decide which devices may and may not leverage test datagenerated by a "master" device. Is that also correct?

Not quite – the rf exposure is related to thePart 18 approvals and, as such, would typically follow DoC procedures. Wewould expect that the TCB used to certify the Bluetooth transmitter in thecharging mat would expect to see some sort of confirmation that the applicanthad followed current KDB guidance (KDB 680106 D01) and submitted an rfexposure evaluation to FCC.

We are proposing that the application couldleverage this Pre-Approval Guidance for their rf exposure evaluation andprovide the PAG guidance to the TCB. As part of leveraging the guidance theproduct design would need to follow the requirements within the OEM Guidancedocument (6 bullet items on page 2). One would expect the TCB to confirmthat the design does meet these requirements before allowing the applicant toleverage this PAG.

Further,no test data has been uploaded as mentioned in the prior inquiry response.

The report took a little longer than expectedto complete its review process and was completed earlier this week. Itwill be attached to this response. Note that the field levels were belowthe reference levels (62.2% of the H-field limit and 9% of the E-field limit).

As always, if it would help to set up aconference call to discuss any aspects of this please let us know.

Mark Briggs (503) 702 5892

FCC response on 09/01/2015

1. It is unclear what the maximum PTU coil current is for a Class 2 A4WP device. The most recent standard submitted to the FCC (A4WP-S-0001 v1.2.1) states that a Class 2 device has a 10W PT_IN_MAX, but that I_TX_MAX is TBD per Table 7.1.1-1. Further research from another A4WP partner shows that PTU current may be 1000mA for a Class 2 device – see link below.

http://www.samsungsem.com/global/product/module/power-transfer-wpt/index.jsp

Because of this, assuming a standard scalar (in this case, scaling to 680mA) for MPE calculations across products would not appear to be consistent (in this case, that would scale to 92% of the MPE limit if IT_MAX = 1000mA).

2. It is unclear if the EUT presented in this inquiry is indeed operating at maximum coil current due to the unloaded nature of the receiver. Typically, a dummy load is required for such testing. Please discuss how the current approach compares to such a proposal.

3. The ability to show compliance for mobile based use conditions is a function of the device form factor and intended usage. Modifications to the form factor presented in this inquiry may impact distances at which such devices will need to be tested at (i.e. 10cm – 20cm). Attempting to apply test results of one transmitter to transmitters of other form factors (upright – as shown in this inquiry, tabletop, etc.) may prove difficult due to the likelihood of such devices to fail exposure testing at distances closer than 20cm (which may be required due to the aforementioned deviations in form factor and/or usage). Further, due to the very limited margin provided for by the Maximum Permissible Exposure levels specified in 47 CFR 1.1310 at the A4WP frequency range, failure to comply due to test distance may require an alternative demonstration of meeting the basic restriction (SAR) levels. Such an alternative would likely be through numerical modeling which, again, would depend upon form factor and usage relative to the user.

4. With regard to allowing TCBs to decide which devices are allowed to leverage test data against other devices, such discretion is not explicitly granted under 47 CFR 2.960. Further, pursuant to 2.964, as long as WPT device are found on the Pre-Approval Guidance list, any disparate device would require FCC review regardless of similar devices produced by other manufacturers.

Our office would be happy to discuss this topic via a teleconference if the inquirer would like. Please submit three or four meeting times and a call in number which will work for your team.

---Reply from Customer on 09/09/2015---

1. It is unclear what the maximum PTU coil current is for a Class 2 A4WPdevice. The most recent standard submitted to the FCC (A4WP-S-0001 v1.2.1)states that a Class 2 device has a 10W PT_IN_MAX, but that I_TX_MAX is TBD per Table7.1.1-1. Further research from another A4WP partner shows that PTU current maybe 1000mA for a Class 2 device – see link below.

http://www.samsungsem.com/global/product/module/power-transfer-wpt/index.jsp

Because of this, assuming a standard scalar (in this case, scaling to680mA) for MPE calculations across products would not appear to be consistent(in this case, that would scale to 92% of the MPE limit if IT_MAX = 1000mA).

Response: PTUs are classified based onthe power level they are able to support, not the drive current to the coil.The current is based on the coil design and coupling performance as determinedduring A4WP certification so two different A4WP Class 2 transmitters may havethe same power rating but require different coil current to achieve that samerating.

The maximum current in the coil used in thedesign being submitted for approval is 680mA to achieve the Class 2 rating.

2. It is unclear if the EUT presented in this inquiry is indeed operatingat maximum coil current due to the unloaded nature of the receiver. Typically,a dummy load is required for such testing. Please discuss how the currentapproach compares to such a proposal.

Response: The EUT was loaded by the Power Receiver Unit (PRU)which was placed on the transmitter. The PRU was not connected to a load butdid provides a constant load to the device, at a coil current of 500mA (the PRUis drawing power to run the Bluetooth transceiver and the voltage regulationcircuits). Our testing scaled

themeasured values based on the difference between the constant current mode(500mA) and maximum current of 680mA.

3. The ability to show compliance for mobile based use conditions is afunction of the device form factor and intended usage. Modifications to theform factor presented in this inquiry may impact distances at which suchdevices will need to be tested at (i.e. 10cm – 20cm). Attempting to apply testresults of one transmitter to transmitters of other form factors (upright – asshown in this inquiry, tabletop, etc.) may prove difficult due to thelikelihood of such devices to fail exposure testing at distances closer than20cm (which may be required due to the aforementioned deviations in form factorand/or usage). Further, due to the very limited margin provided for by theMaximum Permissible Exposure levels specified in 47 CFR 1.1310 at the A4WPfrequency range, failure to comply due to test distance may require analternative demonstration of meeting the basic restriction (SAR) levels. Suchan alternative would likely be through numerical modeling which, again, wouldddepend upon form factor and usage relative to the user.

Response: Our initial enquiry showed the upright position and askedthe question about evaluation distance for both flat and upright positions. OET's previous response appeared to recommendthat we consider a 20cm distance and so we proceeded with the 20cm measurementsand analysis attached to this KDB. Inthis response OET seems to suggest that 20cm is not conservative enough. If a smallerdistance (e.g. 10cm) would allow for more flexibility for re-use of thisguidance then we would like to discuss. We will set up a call (see item 4 below) todetermine the most appropriate distance that would allow most flexibility.

We can provide modeling data for SAR at 10cm and/or20cm separation distances to show good margins relative to the 1.6 W/Kglimit.

4. With regard to allowing TCBs to decide which devices are allowed toleverage test data against other devices, such discretion is not explicitlygranted under 47 CFR 2.960. Further, pursuant to 2.964, as long as WPT deviceare found on the Pre-Approval Guidance list, any disparate device would requireFCC review regardless of similar devices produced by other manufacturers.

Response: Under section IV. SPECIAL CIRCUMSTANCES, paragraphs C and Dof KDB 388624 v11 appear to allow for cases where prior KDB guidance canbe used. The expectation is that the rationale for re-use of priorguidance is clearly communicated and consistent with the application. We wouldlike to use the ODM/OEM guidance document to clearly document the scenariosunder which this guidance could be re-used for the benefit of the OEMs, ODMS,TCB and OET. Any suggestions for improving that guidance to make it easier foran ODM to know whether or not they need to initiate the KDB guidance processfor their specific device versus leveraging this guidance would be appreciated.

Our office would be happy to discuss this topic via a teleconference ifthe inquirer would like. Please submit three or four meeting times and a callin number which will work for your team.

Response: We would appreciate the opportunity to review this projectwith you, primarily to resolve the following:

- Can we approve at 20cm now for this specificdesign, which includes the angled stand, based on the report we submitted?
    - If not, what distance would the OET like to seeevaluated?

        - As it will be less than 20cm we will need to usecomputational modeling to demonstrate compliance with SAR limits versus thereference levels. We will need to know what model validation is needed tosupport the evaluation.
    - If yes, can we add flexibility through continueddialog in this KDB to show compliance at 10cm (or closer) based on SAR modeling?The goal would be to allow all table-top designs to leverage the approval, orat least minimize FCC review time, for other devices that use the same coil /maximum drive current.

In addition, as we will be submitting several similar enquiries for higherpower A4WP projects in the near future we would like to understand whatinformation we can provide you to determine the evaluation distance for bodyand/or extremity exposure conditions?

These are some times we have available (all times PST):

- Friday Sept 11: 12 pm – 1:00 pm
- Monday Sept 14: 10:00am – 2:00 pm
- Tuesday Sept 15: 9:00am– 2:00 pm

FCC response on 09/10/2015

Testing at 20 cm is authorized for this devices based upon size and form factor.

The lab is very much in favor of continued dialog and would be happy to discuss other alternatives which may be authorized within the bounds of current regulations. We are available to discuss this topic any time after 9:00 AM (EST) on Wednesday the 16th. Please provide a call-in number for the teleconference.

---Reply from Customer on 09/10/2015---

Thanks for the reply. To confirm - the comment about testing at 20cm, the test report we submitted and the information in the ODM/OEM guidance document we submitted is sufficient to cover the rf exposure for the device we tested and similar designs (i.e. minor changes in enclosure). The KDB can be included with the application for Certification of the associated Bluetooth transceiver for TCB to submit for the PAG review.

We appreciate the opportunity to continue the discussion. Here are the details for the call (I can send an email invitation if you can provide an email address to mark.briggs@intel.com):

Wednesday September 16, 2pm EST - 3pm EST (11 - 12 PST)

Link for call: https://meet.intel.com/mark.briggs/966D6MJT

Phone number if above link does not work:

+1(916) 356-2663 (or your local bridge access #) Choosebridge 5, Conference ID: 904589396

FCC response on 09/11/2015

The 20 cm test distance is approved only for the device shown in this inquiry (i.e. the device shown in the "description of device and test plan" attachment).

Our team has schedule a teleconference for 2pm EST for Wednesday 16 November and will call into the number provided. We will update this inquiry should any scheduling conflicts arise.

---Reply from Customer on 09/15/2015---

Just wanted to double check - in your reply you say 2pm EST Wednesday 16th November but hopefully the November was a typo and we are still meeting tomorrow, Wednesday 16th September at 2pm EST.

FCC response on 09/15/2015

That is correct. Wednesday 16th September at 2pm EST.

---Reply from Customer on 09/17/2015---

Opened by FCC.

FCC response on 09/17/2015

As discussed in the teleconference held on 16 September between the FCC laboratory and Intel, the specific device discussed in this inquiry may perform MPE testing at a distance of 20cm.

When the EUT is at a 45 degree incline position, measurements should be made horizontally from the center of the front and back surfaces. Measurements should be conducted for different charging conditions, including 0% receive battery charged, 50% receive battery charged, and near complete receive battery charge. Please also be sure to include all pertinent specifications, calibration information, and operating requirements of the field probes. It is also recommend that a real phone instead of a cradle as a client device be used for the field measurements.

---Reply from Customer on 09/28/2015---

Thanks for the teleconference and follow up.

We have performed measurements with a cradle and phone combination as requested at 20cm from the edges of the device and across the plane 20cm from the front and back surfaces as measured from the center of the device in the inclined position. Measurements were made for three conditions: phone < 10% charged; phone ~ 50% charged and phone ~ 90% charged. We left the original data for the measurements around the edges with the cradle only, scaled to the maximum coil current, to show that these scaled values gave a conservative estimate of the fields for the worst-case phone charging condition (i.e. phone battery at less than 10% charged).

The report has been updated and also includes the specifications for both electric and magnetic field probes and calibration data for the magnetic field probe to support isotropy claims. The calibration data is embedded in the pdf report document.

Further to our conference call we have also updated the ODM guidance document to modify the language to the end user and changed the word "install" to "use". It also clarifies that the KDB guidance and associated test report only applies to this specific form factor.

FCC response on 09/30/2015

The exposure analysis provided is consistent with the guidance supplied in this inquiry.

However, with regards to the statement within the "OEM Guidance" document, please be advised that the above guidance was not solely based upon the charging coil and associated electronics for "similar" charging mats, but was rather based upon this specific device's characteristics and form factor and is only applicable to identical devices as defined in 47 CFR 2.908.

Please update the "OEM Guidance" to reflect this nuance.

---Reply from Customer on 09/30/2015---

OEM Guidance has been revised - and to clarify the scope I also added the mechanical outline drawings from the rf exposure report. Document is attached (rev 1).

FCC response on 10/02/2015

The OEM guidance document is consistent with the direction provided in this inquiry.

Attachment Details:

ODM Guidance version 1.0

Do not reply to this message. Please select the Reply to an Inquiry Response link from the OET Inquiry System to add any additional information pertaining to this inquiry.