August 19, 1999

Mr. Frank Coperich
FCC Application Processing Branch

Re: Questions from the FCC

FCC ID:	**JOYKC-SSSD-66K**
Correspondence Reference Number:	**8953**
731 Confirmation Number:	**EA94173**

Dear Mr. Coperich,

Pursuant to your E-Mail of Correspondence Reference Number "8953" sent us July 28, 1999, I would like to forward to you our responses.
The relevant portions of your E-Mail follow with our responses inserted in the appropriate place.

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> To:          Nobuyuki Hayashida, Kyocera Corporation
> From:        Frank Coperich
>              fcoperic@fcc.gov
>              FCC Application Processing Branch
>
> Re:          FCC ID JOYKC-SSSD-66K
> Applicant:                                Kyocera Corporation
> Correspondence Reference Number:          8953
> 731 Confirmation Number:                  EA94173
> Date of Original E-Mail:                  07/28/1999
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> 1. The issue on external antenna has not been addressed. RF exposure compliance
> for external antenna is dependent on the installation/operating conditions and
> the antenna gain.
>
> Please clarify with respect to 2.1091 or 2.1093 (if applicable) and determine
> if categorical exclusion applies or if MPE evaluation is needed.
>

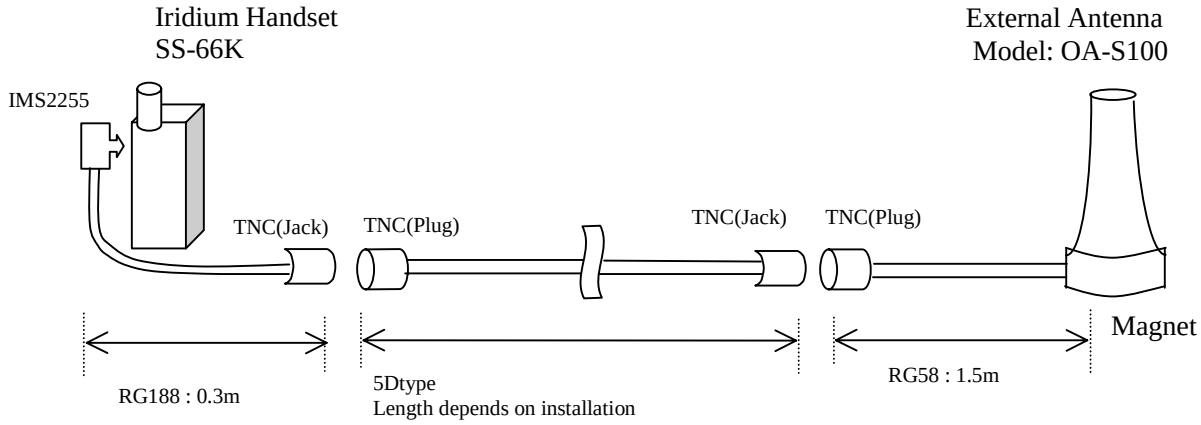
We are planning to deliver the following two passive type external antennas as the option of our Single Mode Iridium Handset SS-66K.
It is intended for use in vehicle operation (cars and boats)

Antenna Model	MA-S100	OA-S100
Antenna Type	Helix	Helix
Antenna Polarization	RHCP	RHCP
Antenna Gain (Max.)	0 dBi (3 dBic)	0 dBi (3 dBic)
Length	224 mm	142 mm
Diameter (Max.)	49 mm	59.5 mm

Could you please refer Figure 1.1 and Figure 1.2 for connection of the external antenna?

These external antennas are generally mounted on the roof of a vehicle. In addition, we will give user a warning not to operate the Iridium mobile telephone when a person is within 8 inches (20 centimeters) of the externally-mounted antenna.
Since the separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure and the body of the user, the Single Mode Iridium Handset with an external antenna falls into the category of Mobile Devices according to 2.1091(b).
As each external antenna gain is the same as the internal antenna built in the Single Mode Iridium Handset, which uses TDMA technology for transmission, the Effective Radiated Power is 0.644 W.
Because the Single Mode Iridium Handset with an external antenna operates at frequency above 1.5 GHz and the ERP is less than 3 W, it is not subject to routine environmental evaluation for RF exposure according to 2.1091(c).

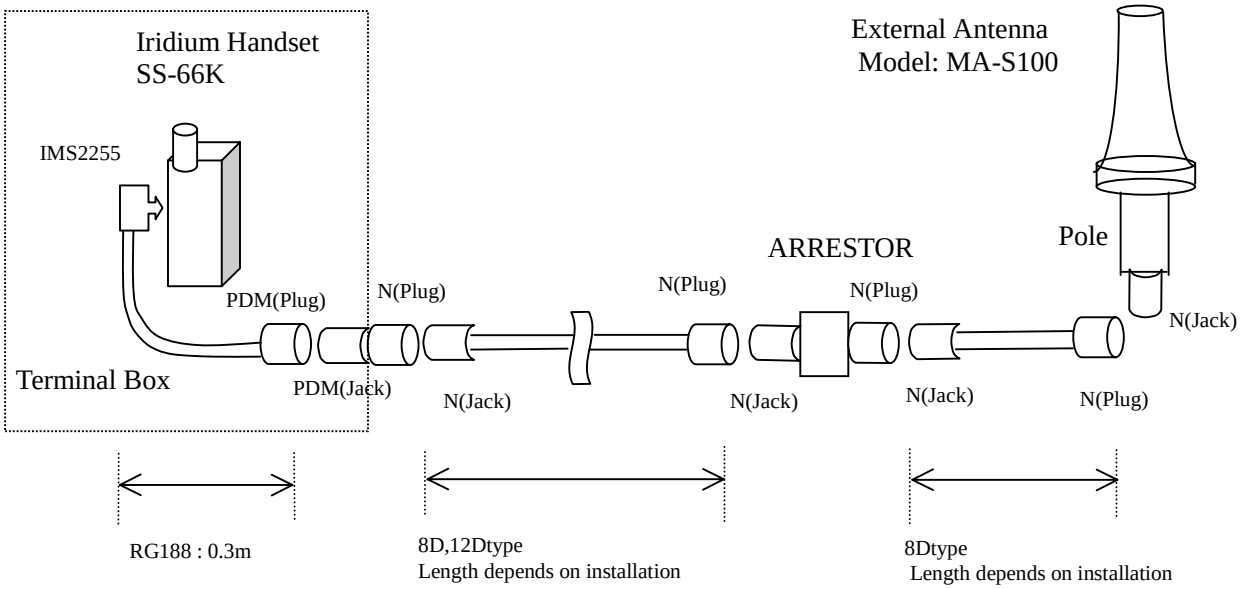
Figure 1.1. Cable connection of the external antenna (model: OA-S100)



Cable loss

Cable Type	Loss (dB/m)
5Dtype	0.37
RG188	1.20

Figure 1.2. Cable connection of the external Antenna (model: MA-S100)



Cable Loss

Cable Type	Loss (dB/m)
8Dtype	0.17
12Dtype	0.11
RG188	1.20

> 2. The antenna is offset to the left side of the handset which results in a
> total of 6 extended antenna positions on either side of a head model. SAR
> measurements near the top of a head model for antennas extending above the head
> typically require special E-field probe positioning procedures and/or phantom
> orientation (rotation). The antenna may protrude differently above the head
> with varying separation distances when the phone is placed on the opposite side
> of the head from those indicated in figures 5-7, and with respect to those
> indicated in figures 2-4 for the Uni-Head or figure 8 of latest response.
> Please identify the peak SAR location(s) obtained using the Uni-Head phantom
> and relate it to the worst case exposure conditions for the 6 extended antenna
> head exposure configurations. Information on worst case peak SAR location and
> separation distances are needed to determine if and how the SAR obtained using
> the Uni-Head phantom can be applied to support worst case SAR at the top and/or
> side of the head for the 6 extended antenna positions.
>
>

The antenna is built with one hinge which allows the antenna to be tilted in the plane of the phone. The antenna can be retracted but cannot be rotated.

The following drawings show the closest distance of the “active antenna” element to the head simulation boundary. The positioning of the handset with respect to the phantom and the location of the antenna’s feedpoint relative to the phantom when the antenna is extended are also shown.
Figure 1 shows the case when the antenna is straight out, while Figure 2 shows the case when the antenna is tilted left or right. Notice that since the feedpoint is within 10mm of the hinge that the location of the feedpoint with respect to the phantom is constant (to a first approximation). The normal distance from the feedpoint to the phantom is thus 90mm plus or minus a few millimeters for all 6 extended antenna positions.

The connection between the output amplifier and the antenna is implemented with a coaxial connection and it was found from measurement that there is no current on the outer skin of the shielded cable and therefore there was no energy absorbed in the head below the pivoting point of the antenna.

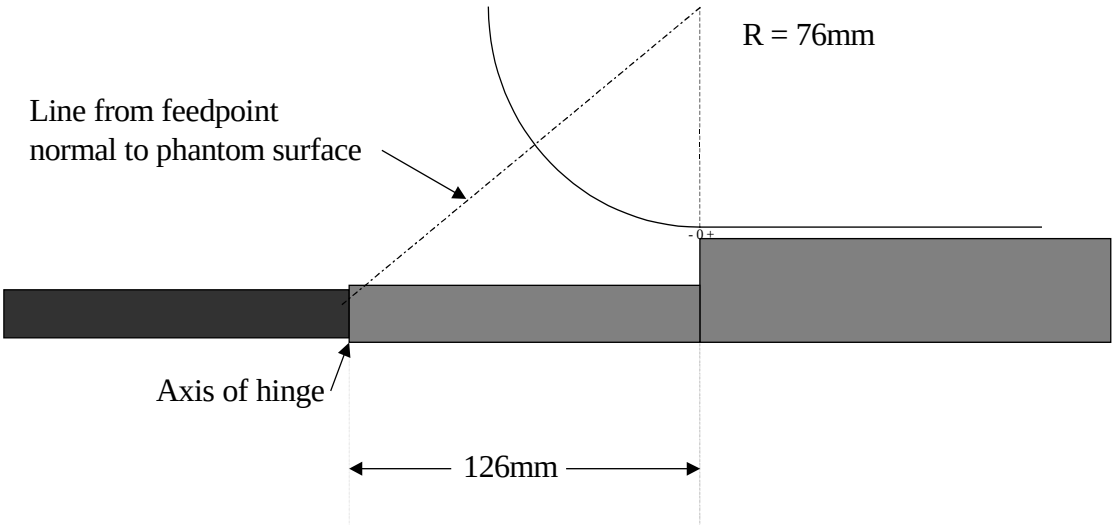


Figure 1. Sideview of Phantom and Iridium Handset with Antenna Extended Straight Out

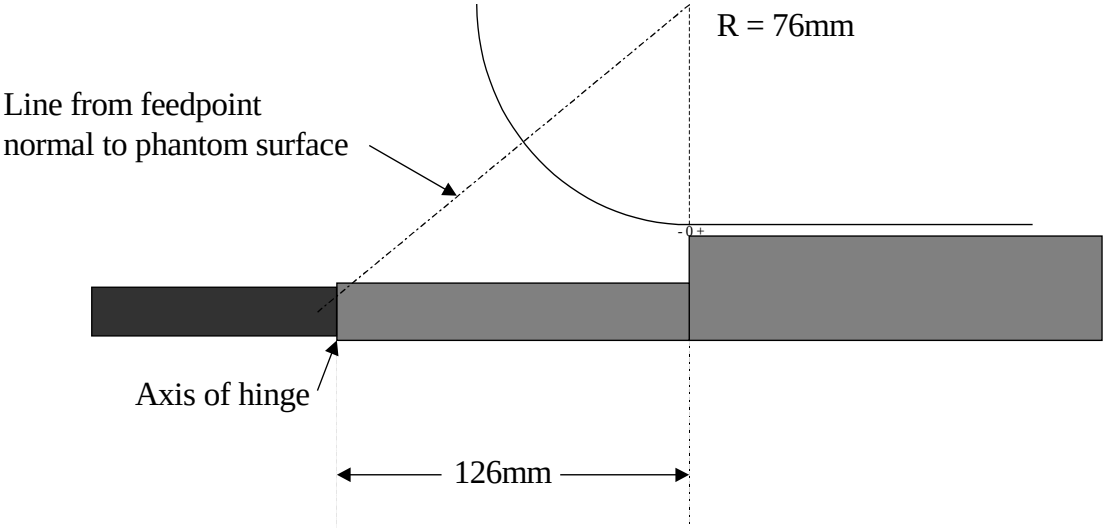


Figure 2. Sideview of Phantom and Iridium Handset with Antenna Extended and Tilted Either Left or Right.

The SAR hotspot will be located somewhere along the antenna between the feedpoint and the tip. The tip of the antenna is 124mm from the hinge so the normal distance from the tip of the antenna to the phantom will be 196mm.

Since the radiating structure does not change when the antenna is retracted we can approximate the SAR to be expected in the extended position by the inverse square law. If the hotspot is located at the feedpoint then we would expect a maximum 1g SAR of about 0.03 W/kg, while if the hotspot is near the tip we would expect a value around 0.007 W/kg.

The following table shows the peak local SAR measured for each of the 6 extended antenna positions on the low channel:

Side of the Head	Highest SAR (W/kg)			
	Antenna			
	In	Out	Tilt Right	Tilt Left
Left	0.285	0.017	0.029	0.012
Right	0.285	0.017	0.029	0.012

The following surface charts display these area scans. Note that the axis on the charts is the opposite of that show in the figures above, i.e. the "-" x values lie along the curved portion of the phantom head are to the left in the figures above while they are on the right in the charts below.

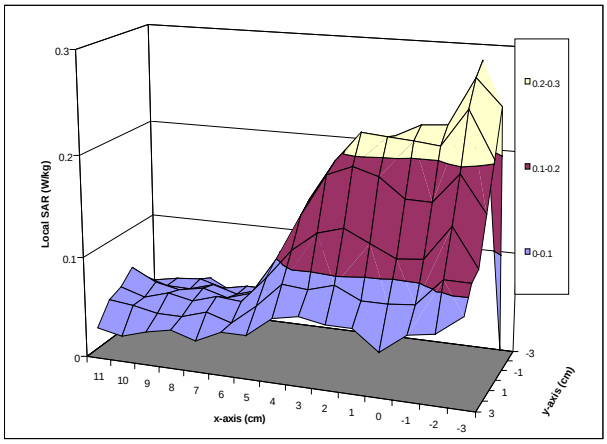


Figure 3. Antenna In

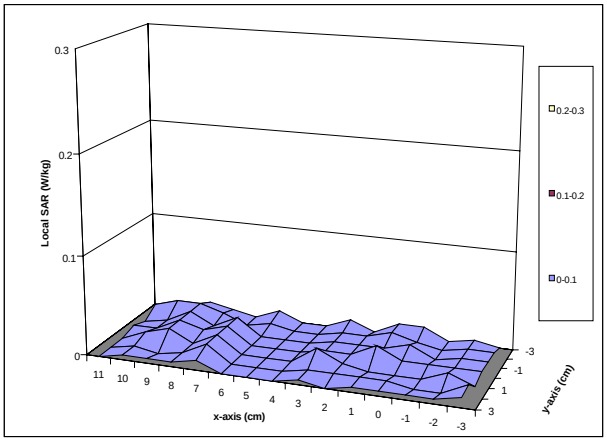


Figure 4. Antenna Out

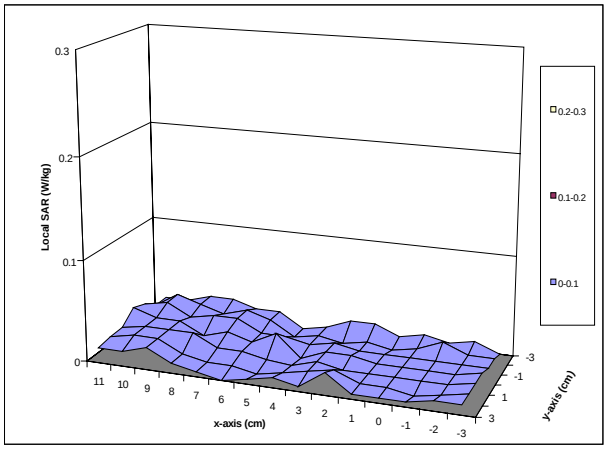


Figure 5. Antenna Out-Tilted Right

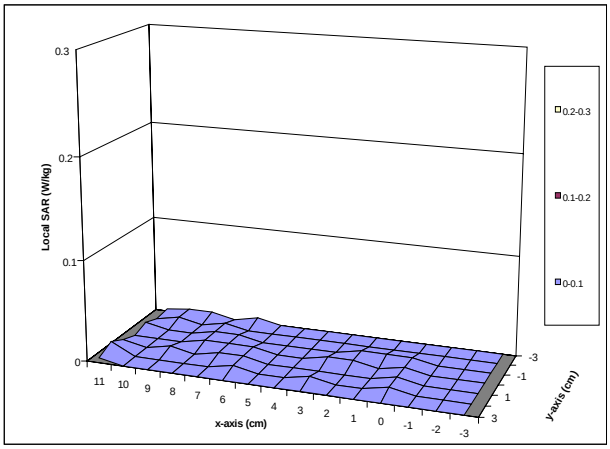


Figure 6. Antenna Out-Tilted Left

Notice that there is no clearly identifiable peak when the antenna is stretched out and use in any of its 6 extended positions (note that 2 of these positions are in contravention of the manufacturer's instruction for using the phone. Specifically, the handset should be used with the antenna extended straight out or with the antenna tilted in the appropriate direction (depending on which side of the head it is used) so that it is pointing towards the sky.

> 3. Issue addressed.
>
>
> 4. The pictures of antenna assembly in Appendix B are different than that shown
> on the cover page of the SAR report which has only the upper hinge with lower
> hinge replaced by a collar. The wording in the original correspondence, "two
> hinged sections" instead of "sections held together by two hinges", had resulted
> in some confusion (sorry about that).
>
> Please clarify discrepancies on 2 hinges or single hinge, as described in latest
> responses, because device test positions may be affected by the hinge(s).
>

The handset on a picture of antenna assembly in Appendix A is just the same as the handset shown on the cover page of the SAR report. Because each selection of photographic angle is different, I think you may have been given different impression between them.
The handset on the picture in Appendix A was laid on a desk so that its front side could face upper direction. And the picture was taken from the above position at slightly left oblique angle. Then, a collar at the bottom of the antenna came out clearly well in the picture.
But on the other hand, the handset on a picture of the cover page was stood straight on a table. And the picture was taken from the front position at slightly low angle. Then, a collar at the bottom of the antenna hid behind the top surface.
The antenna has only one hinge. The hinge mechanism is effective only when the antenna is fully extended straight.

> 5 & 6. We are not asking for the actual measurement uncertain analysis. The
> concern is about the left most section of the plot on page 20 of the SAR report,
> which was further revised in figure 9 of latest response. At less than 1.0 W,
> the slopes for voltage and temperature are quite different than that predicted
> by the regression lines. The differences in slopes between the regression lines
> and data points below 1.0 W could result in uncertainties larger than those
> specified in the SAR report. The tissue enhancement factor and final SAR results
> could be affected if determined according to the regression lines for the average
> output level of 600 mW produced by this phone.
>
> The SAR determined in #2 above should be adjusted/corrected accordingly with
> calibration factors applicable to less than 1.0 W output (table 2 of response)
> for determining SAR compliance. Please also indicate the peak and average power
> used at 9.2% duty factor for results shown in figure 11 of the latest response.
>

The corrected maximum 1g SAR reported in the 09 July 1999 correspondence was 0.224 W/kg. This was associated with a tissue conversion factor of 5.6. The tissue conversion factor determined with only the data less than 1.1W (this includes the 3 lowest data points and allows the uncertainty to be estimated) is 4.3 with a 2 sigma uncertainty of 25.6%. The adjusted/corrected maximum 1g SAR would then be 0.292 with an overall uncertainty of 33.1%.

The peak power used at the 9.2% duty factor for the results shown in Figure 11 (09 July, 1999 correspondence) was 3.3 W with an average power of 300mW.