To: Kwok Chan, Federal Communications Commission cc: John Kalenowsky
From: Paul Moller
Date: July 8, 1998
Subject: FCC ID IHDT6ND1

Kwok,

This memo is in further response to the request for "measurement data showing compliance with the SAR requirement" for Motorola FCC ID IHDT6ND1 reference ID number 1670 requesting additional data dated July 1, 1998.

1) Figure 3 shows the orientation of the subject phone with respect to the scan area as shown in the SAR contour plots. In summary, the 0,0 location on the plots is always chosen to be the center of the ear of the phantom. The center of the ear piece of the phone is also located at this position. The phone thus extends in the –X direction, with the center line of the phone aligned with a line connecting the center of the ear and the center of the mouth. I am also including an excerpt from the Motorola internal document "Motorola Cellular Electromagnetics Lab SAR Measurement Procedure" titled Phone Positioning and Scan Area for further reading.

2) The phone is placed as close to the phantom head as possible and also consistent with the intended use position as identified in the Motorola users manual for the subject phone. I have measured the distance from the test phantom to three locations on the subject phone. They are as follows. As a point of reference, the phantom's ear is 5 mm thick at the top of the ear, which is intended to simulate the ear of an actual user of a cellular phone. Figures 1 and 2 show the phone positioned on the phantom for the antenna in the retracted and extended positions respectively. See the figures on the next page. The following are some distances measured from the phantom to the phone as positioned in figures 1 and 2.

    a) Phantom to center of earpiece of phone: 13 mm
    b) Phantom to body of phone at the top of the phone: 24 mm
    c) Phantom to retracted antenna: 52 mm
    d) Phantom to extended antenna: 57 mm

Figure 1

Figure 2

3) The subject phone was tested only in the left side talk position and held in a position as described in the Motorola users manual. The unit is equipped with a telescoping quadrifilar helix antenna that serves as both a receive and transmit antenna. The operation of the Iridium™ system is such that the subscriber unit must be in communication with satellites in low earth orbit. This means that the subscriber units antenna must have a clear view of the sky above the users head at all times. Thus the antenna is designed so as to have three positions. The first position is the "stowed" position where the antenna is rotated behind the subscriber unit. In this position the user would not be able to place or receive a phone call. This position is available for convenience of storage. The second position is the "retracted" position where the antenna is pointed towards the zenith, but is kept in its shortened telescoping dimension. The third position is were the antenna is also pointed towards the zenith, but is in its long telescoping dimension referred to as the "extended position". Furthermore, the antenna can rotate to either of two detented positions which are roughly 30 degrees to the left and roughly 30 degrees to the right. These are intended to keep the antenna pointed to the zenith in both the left and right handed talk positions. Figures 3 and 4 show the unit configured for left handed talk position, in the extended and retracted positions respectively.

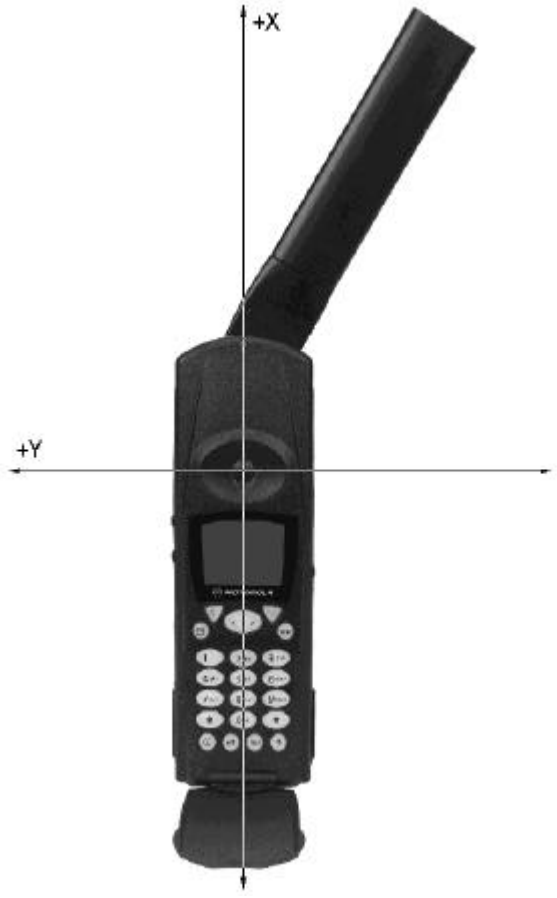

Figure 3

Figure 4

Due to the design of the antenna, the RF currents that contribute most to the SAR measurement are the currents at the base of the antenna. Due to the construction of phone and antenna mast, the base of the antenna is always at least several centimeters away from the users head. Also, since the antenna is mounted at the center of the phone, the location level of highest SAR is essentially the same for both the left and right side talk positions. Any differences between left and right side that show up are within measurement error, and are more controlled by phone positioning than by any real left / right difference.

4) The tissue simulant used is a sugar, water, salt solution. It has a relative dielectric constant of 40 and a conductivity of 1.58 S/m at 1621 MHz. This is accomplished by using the following percentages of materials by weight:

   a) water: 47.3%
   b) sugar: 51.6%
   c) salt 0%
   d) HEC (a gelling agent): 1.0%
   e) Dowicil 75 (anti-bacterial compound): 0.1%

5) I am including a copy of the draft titled “Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, dated December 1997 written by Dr. Q. Balzano of the Motorola Florida Corporate Electromagnetics Research Laboratory, dated December 1995. This document will explain in detail the test methodology, SAR formulas, and tissue materials that were used for the SAR testing of the subject phone.

6) I have an estimate of the possible errors that we have in the measurement system. The breakdown of the individual errors is as follows:

	Error (%)
a) Measurement of the conductivity of the tissue simulant	±3%
b) Temperature rise calibration of probe	±5%
c) Measurement of thermal capacity of tissue simulant	±5%
d) Accuracy of a repeatable phone position	±1%
e) Probe isotropic response	±12%

   Since it is statistically unlikely that any of the errors are correlated, it is reasonable to use a Root-Sum-Squared calculation to estimate the total error. Using this method I calculate a likely error of ±14.3%, or about ±15%.

If you have any further questions please give me a call at 847-523-5210.

Paul Moller