February 23, 2000

RESPONSE TO SAR QUESTIONS

(Correspondence Reference Number: 11961)

Federal Communications Commission
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, Maryland 21046

Re: Application for Cellular/PCS Transceiver Certification (EA95728)

Kwok Chan & Errol Chang:

Purpose:

This document responds a request for additional rf exposure information on EA95728 (IHDT5ZX1).

Description:

To facilitate responses to SAR questions, the following includes the original text and the highlighted answer.

From: Errol Chang
echang@fcc.gov
FCC Application Processing Branch

Re: FCC ID IHDT5ZX1
Applicant: Motorola Inc
Correspondence Reference Number: 11961
731 Confirmation Number: EA95728
Date of Original E-Mail: 02/08/2000

1. RF exposure responses indicated the antenna installation for this device has line losses of 6.8-9.1 dB, typically using 1.5 dBi gain quarterwave antennas. The device has 3.1 W (34.9 dBm) maximum conducted output (requesting 3.0 W). The device was tested for SAR using a specific antenna for the "Carry-Phone" configuration and no MPE data has been submitted for other antenna configurations for the "Mobile-Phone" configuration. The antennas used for Mobile-Phone operations must satisfy the 1.5 W ERP (2.46 W EIRP) categorical exclusion requirements of 2.1091. This implies cable loss and antenna gain must not exceed -1.0 dB (34.9 dBm-1.0 dB = 33.9 dBm = 2.46 W EIRP). The proposed minimum separation distance plot for external antenna installation requirements includes data for much higher output which do not apply to this transmitter and could cause confusion to the installer. Please confirm that if the external antennas used for Mobile-Phone configurations are to be installed by the typical unskilled users or trained professionals. The proposed installation instructions and requirements for Mobile-Phone operations should be revised accordingly for the installers to satisfy MPE requirements.

RESPONSE: Motorola agrees that the least confusing approach is to evaluate the rf exposure and provide clear and concise instructions to the installer to maintain the categorical exclusion requirements of 2.1091. Refer to the attached Installation Manual page 33 for details.

2. Please see recent filing, EA 95622, on how to revise the proposed graph on separation distances and antenna/cable configurations. If external antennas are to be installed by the users, the installation

instructions should be understandable by the typical unskilled users for meeting categorical exclusion requirements of 2.1091 for mobile transmitting devices.

RESPONSE: Mobile installations are performed by a trained OEM technician. The supplied instructions specify the minimum antenna separation distance and necessary loss to satisfy the categorical exclusion requirements. Refer to the attached Installation Manual page 33 (same as in response 1) for details.

3. SAR tests were performed for the Carry-Phone configuration using a specific whip antenna. The SAR plots indicated head equivalent tissue parameters were used instead of muscle equivalent parameters. The tests determined a minimum separation distance of 7 cm would be needed to satisfy SAR limit and Motorola is proposing 10 cm. Please verify that the head tissue parameters used for the SAR tests, instead of more conductive muscle parameters, will allow sufficient SAR margins for the proposed 10 cm separation distance for satisfying SAR limit, or provide new SAR data using muscle equivalent parameters. (Also see below for mobile and portable issues)

RESPONSE: The tissue simulant used for the Carry Phone was head tissue, having a relative dielectric constant of 43.4 and a conductivity of 0.89 S/m. FCC's OET Bulletin 65 Supplement C recommends muscle tissue simulant with a relative dielectric constant of 56.1 +/-5%, and a conductivity of 0.95 +/-5%. Thus the simulant actually used for the SAR tests was 23% low on relative dielectric constant, and 6.4% low on conductivity. The IEEE Standards Coordinating Committee 34 Subcommittee 2 draft document dated January 24, 2000 section 4.4 titled "Phantom Uncertainty", gives a description of the effect of a change in dielectric parameters on measured SAR. Specifically, "An increase in dielectric constant by 5% gives a decrease in the 1 g spatial peak SAR of <3.2% at 835 MHz to 900 MHz and <2.6% at 1800 MHz to 1900 MHz", and "An increase in conductivity by 5% gives an increase in the 1 g spatial peak SAR of <3.2% at 835 MHz to 900 MHz and <2.2% at 1800 MHz to 1900 MHz."

By using these guidelines, and applying them to an increase in relative dielectric constant of 23%, and an increase in conductivity of 6.4%, one would find that the measured SAR values would decrease by 10.6% (-14.7% + 4.1%) when measured in muscle tissue simulant. Thus the conservative statement that "At 10 cm the SAR values will be lower than the SAR values measured at 7cm" from the Motorola SAR report dated December 27, 1999 is still valid.

4. Please upload dipole validation data etc.

RESPONSE: Refer to attached dipole validation plot for details.

5. Body-worn operating configurations do not apply to this device. An RF exposure statement has been included for body-worn operating conditions for this device. Please revise accordingly to avoid misinterpretations by users.

RESPONSE: The users manual has been revised. Refer to attached Users Manual page 7 for details.

6. The RF exposure statement indicated in the users manual is different than that proposed in the SAR report. In revising this statement, please also confirm if Motorola is requesting for the Carry-Phone configuration to be considered as a mobile or a portable operating configuration. The submitted SAR data only supports operations that allow 7-10 cm (with tissue parameter clarification) separation between the antenna and persons. As a portable device (2.1093), at closer than 7-10 cm, the Carry-Phone does not comply with SAR limits. Effective means must be available to eliminate any non-compliance conditions

that may exist, which may require warning statements, labels, specific operating instructions and other procedures to ensure the Carry-Phone operation complies with SAR limit for portable devices. If the Carry-Phone operates as a mobile transmitting device with respect to 2.1091, a minimum separation distance of 20 cm is needed between the antenna and persons to satisfy MPE requirements, using the submitted SAR data. Appropriate operating instructions and requirements must be provided to users to satisfy the 20 cm operating requirement for mobile devices. Please submit appropriate info and revise manuals accordingly with respect to mobile or portable operating requirements for users to satisfy RF exposure compliance.

Note: we will need to get staff at headquarters to determine if the Carry-Phone may be considered as a portable device; if compliance for portable operating configuration is desired for the Carry-Phone, please confirm ASAP to avoid possible delays.

COMMENT: Confirmation of the request for portable device classification was provided via e-mail to on February 9, 2000. Motorola can provide representatives to answer inquires at your staff meeting. Please contact me with details.

(a) Suggested statement for mobile device - IMPORTANT: To comply with FCC RF exposure requirements for mobile transmitting devices, a minimum separation distance of 20 cm should be maintained between the antenna and all persons for the Carry-Phone operating configurations. This device has been tested with respect to SAR limit at a minimum separation distance of xx cm (to be adjust for tissue parameters) for demonstrating compliance as a mobile transmitter. This minimum separation distance must be maintained during all Carry-Phone operations to ensure RF exposure limits are not exceeded

(b) Suggested statement for portable device - CAUTION/WARNING: To comply with FCC RF exposure requirements for portable transmitting devices, the antenna must be positioned with a minimum separation distance of 10 cm from all persons while operating in the Carry-Phone configuration. Operations that do not meet this minimum separation distance requirement have very high potential for exceeding the SAR limit for RF exposure compliance and must be avoided. The unit and its antenna are neither designed nor needed to be within 10 cm of persons for operating in the Carry-Phone configuration. (NOTE: whether portable configuration is acceptable, CAUTION or WARNING is applicable, exact wording and other applicable requirements will need involvement of staff at headquarters.)

(c) Please revise all other RF exposure statements, operating instructions and requirements proposed in the manuals to match the mobile or portable operating configurations/requirements described above.

Note: Mobile-Phone should have a different RF statement (similar to that used in EA 95622) to ensure compliance with respect to MPE categorical exclusion requirements.

RESPONSE: The users manual has been revised. Refer to attached users manual page 7 for details.

NOTE:

Classifying the portable carry phone application as a mobile device may confuse the user. For example, a minimum separation distance of 20 cm is required to comply with the RF exposure requirements, yet 10 cm of separation is required to be below the tested RF exposure limit. Most likely the user will not understand why the portable carry phone is classified as a "mobile device", and which "proper" distance to maintain.

To prevent possible user confusion, during carry phone operation, Motorola recommends that the user simply be informed to maintain 20 cm of separation during mobile operation, and 10 cm of separation during portable operation.

7. Step 9 of the installation instructions on page 17 of the installation manual indicates there is provision for an external antenna for the Carry-Phone configuration, please clarify and revise installation procedures to reference applicable vehicle-mount Mobile-Phone operating configurations for satisfying categorical exclusion requirements, as proposed in other parts of this filing.

RESPONSE: The Installation Manual has been revised. Refer to attached Installation Manual page 17 for details.

Note: Output is 3.0 W at the antenna terminal of the device.

Proposed Grant Conditions: This transmitter may operate with external vehicle-mounted antennas in the "Mobile-Phone" configuration or with a specific whip antenna in the "Carry-Phone" configuration. For Mobile-Phone operations, the antenna installation must provide a minimum separation distance of 20 cm from users and nearby persons to satisfy RF exposure requirements. The combined cable loss and antenna gain must not exceed -1.0 dB (attenuation of 1.0 dB) and total system output must not exceed 1.5 W ERP (2.46 W EIRP) to qualify for categorical exclusion requirements of 2.1091. Grantee must provide appropriate installation requirements for installers and end users to satisfy RF exposure compliance. Carry-Phone operations were evaluated using a whip antenna with respect to SAR limit for satisfying mobile/portable requirements of 2.109x. A minimum separation distance of xx cm must be maintained between the antenna and all persons for Carry-Phone operations to satisfy RF exposure requirements. Grantee must provide end-users with appropriate operating instructions to ensure Carry-Phone operations comply with mobile/portable exposure requirements of 2.109x. (may combine Carry/Mobile Phone conditions if both are mobile with respect to 2.1091)

Contact Information:

Thank you for this special consideration. Please contact me by telephone at (847) 523-6167, by facsimile at (847) 523-2350, or by e-mail (A.Bachler@motorola.com), if there are questions or additional information needed concerning this filing.

Regards,

Andrew J. Bachler
FCC Liaison
Cellular Subscriber Sector
600 N. U.S. Highway 45
Libertyville, IL 60048-5343

Antenna Installation

IMPORTANT: To comply with the FCC RF exposure limits and satisfy the categorical exclusion requirements for mobile transmitters, all of the following requirements must be met:

1. The transmit antenna is mounted externally on the vehicle.
2. A minimum separation distance of 20 cm is maintained between the antenna and the users and nearby persons.
3. The transmitter conducted power (3.1 Watts or 34.9 dBm) is reduced to a maximum of 1.5 Watts ERP (2.46 Watts or 33.9 dBm EIRP). This requires the combination of antenna gain and feed line loss to attenuate the transmit signal by a minimum of 1.0 dB.

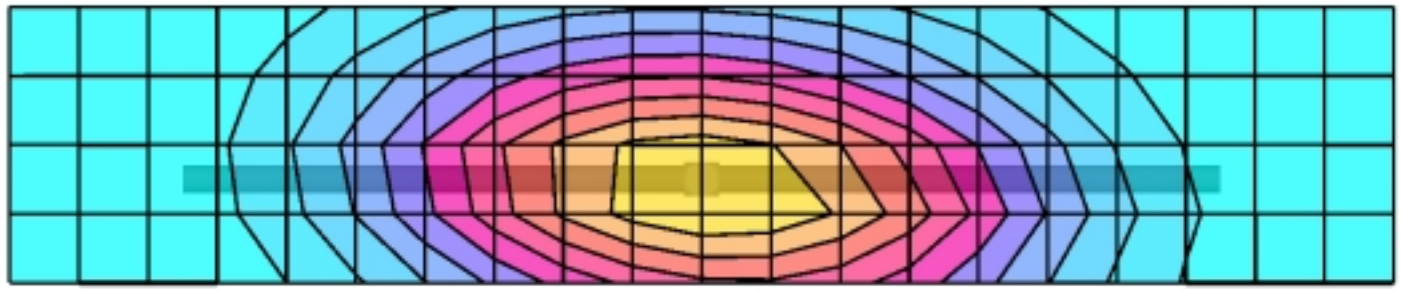
Hands-Free Microphone Installation

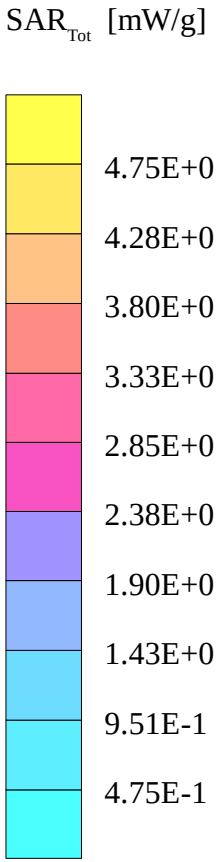
The mounting position of the Digital HF hands-free microphone within the vehicle has a definite influence on the performance of the Vehicular Speaker Phone (V.S.P.) hands-free operation. The microphone should be mounted either on the sun visor (directly above the driver) or on the headliner (above the driver). The microphone should never be mounted near the window or in a location where the road and ambient background noise would be substantially high (above 85 dB SPL).

The visor clip mounting bracket provides the simplest and most effective mounting of the hands-free microphone. See Figure 25. The clip slides into channels on the microphone housing, and then clips on to the sun visor. The cable may then be

Dipole 900 MHz

Input Power = 503mW / 900MHz Dipole Serial Number 036
System Accuracy Reference SAR 9.56mW/g normalized to 1W
900dip; 900MHzdip
Probe: ET3DV6R - SN1418; ConvF(5.71,5.71,5.71); Crest factor: 1.0; Brain 900 MHz: σ = 0.89 mho/m ε_r = 40.6 ρ = 1.00 g/cm^3
Cubes (2): Peak: 7.28 mW/g ± 0.01 dB, SAR (1g): 4.74 mW/g ± 0.02 dB, SAR (10g): 3.11 mW/g ± 0.02 dB, (Worst-case extrapolation)
Penetration depth: 13.1 (11.8, 14.7) [mm]
Powerdrift: 0.00 dB





reviewed the available body of research to develop the updated ANSI standard.

The design of your phone complies with these standards when used as described under "Phone Operation."

Antenna Care

Use only the supplied or an approved replacement antenna. Unauthorized antennas, modifications, or attachments could damage the phone and may violate local agency regulations.

Carry Phone Operation

IMPORTANT: Do not operate your carry phone when a person is within 4 inches (10 centimeters) of the antenna. A person or object within 4 inches (10 centimeters) of the antenna could impair call quality and may cause the phone to operate at a higher power level than necessary and expose that person to RF energy in excess of that established by the FCC RF Exposure Guidelines.

Mobile Phone Operation

IMPORTANT: Do not operate your mobile telephone when any person is within 8 inches (20 centimeters) of its vehicle-installed antenna.

Step 8 Zip the battery compartment closed. See Figure 18.

Figure 18

Step 9 The battery should now be charged for at least 10 hours or overnight using the AC charger before attempting to use the cellular telephone.

Please note that there is an opening in the lower left corner of the bag to allow for connection of an external antenna. The transceiver unit can positioned in either direction when placed in the bag. See Figures 19a and 19b.

NOTE *To comply with the FCC RF exposure limits, the vehicle antenna must be installed in accordance with the guidelines in the ANTENNA INSTALLATION section.*

Figure 19a