CERTIFICATE OF COMPLIANCE
SAR EVALUATION

Test Lab:	Applicant Information:
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FCC Rule Part(s):	**2.1093; ET Docket 96-326**
FCC ID:	**ALH32263120**
Model(s):	**TK-3140-2**
EUT Type:	**Portable UHF PTT Radio Transceiver**
Modulation:	**FM (UHF Band)**
Tx Frequency Range:	**470 - 512 MHz**
Rated RF Conducted Power:	**4.0 Watts (High Power)**
Antenna Type(s):	**Fixed Stubby**
Battery Type(s):	**7.2VDC 1200mAh Ni-Cd**
	7.2VDC 2000mAh Ni-MH
Body-Worn Accessories:	**Belt-Clip & Speaker-Microphone**

Celltech Research Inc. declares under its sole responsibility that this device was found to be in compliance with the Specific Absorption Rate (SAR) RF exposure requirements specified in OET Bulletin 65, Supplement C, Edition 01-01 (Occupational/Controlled Exposure), and was tested in accordance with the appropriate measurement standards, guidelines, and recommended practices specified in American National Standards Institute C95.1-1992.

I attest to the accuracy of data. All measurements were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

This test report shall not be reproduced partially, or in full, without the prior written approval of Celltech Research Inc. The results and statements contained in this report pertain only to the device(s) evaluated.

Shawn McMillen
General Manager
Celltech Research Inc.

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1.0 INTRODUCTION

This measurement report shows that the KENWOOD COMMUNICATIONS CORP. Model: TK-3140-2 Portable UHF PTT Radio Transceiver FCC ID: ALH32263120 complies with FCC Part 2.1093, ET Docket 96-326 Rules for mobile and portable devices (controlled exposure). The test procedures, as described in American National Standards Institute C95.1-1992 (see reference [1]), and FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [2]) were employed. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

Rule Part(s)	FCC 2.1093; ET Docket 96.326	**Modulation**	FM (UHF Band)
EUT Type	Portable UHF PTT Radio Transceiver	**Tx Frequency Range**	470 - 512 MHz
Body-Worn Accessories	1. Belt-Clip 2. Speaker-Microphone	**Rated RF Conducted Output Power**	4.0 Watts (High Power)
FCC ID	ALH32263120	**Antenna Type**	Fixed Stubby
Model No.(s)	TK-3140-2	**Antenna Length**	83 mm
Serial No.	Pre-production	**Battery Type(s)**	7.2VDC 1200mAh Ni-Cd 7.2VDC 2000mAh Ni-MH


EUT with Speaker-Mic


Front of EUT


Back of EUT & Belt-Clip


Left Side of EUT

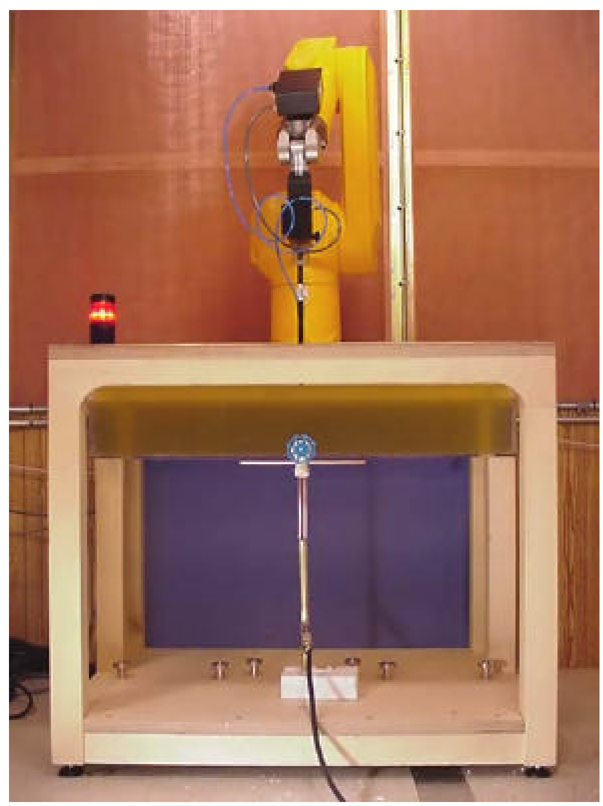

Left Side of EUT

Ni-Cd & Ni-MH Batteries

3.0 SAR MEASUREMENT SYSTEM

Celltech Research SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY system is comprised of the robot controller, computer, near-field probe, probe alignment sensor, specific anthropomorphic mannequin (SAM) phantom, and various planar phantoms for brain or body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card. The DAE3 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

DASY3 SAR Measurement System with SAM phantom



DASY3 SAR Measurement System with large planar phantom

4.0 MEASUREMENT SUMMARY

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the EUT are reported in Appendix A.

Face-Held SAR Measurement Results

Freq. (MHz)	Channel	Mode	Conducted Power Before (W)	Conducted Power After (W)	Battery Type	Separation Distance (cm)	SAR (w/kg)	
							100% Duty Cycle	50% Duty Cycle
470.05	Low	CW	4.3	4.2	2000mAh Ni-MH	2.5	3.68	1.84
490.05	Mid	CW	4.2	4.1	2000mAh Ni-MH	2.5	7.48	3.74
511.95	High	CW	4.1	4.0	2000mAh Ni-MH	2.5	4.21	2.11
490.05	Mid	CW	4.2	4.0	1200mAh Ni-Cd	2.5	7.27	3.64
Mixture Type: Brain Dielectric Constant: 43.7 Conductivity: 0.87 (Measured)				**ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak: Controlled Exposure / Occupational BRAIN: 8.0 W/kg (averaged over 1 gram)**				

Notes:

1. The SAR values found were below the maximum limit of 8.0 w/kg (controlled exposure).
2. The highest face-held SAR value found was 7.48 w/kg (100% duty cycle, 2000mAh Ni-MH battery).
3. The EUT was tested for face-held SAR with a 2.5cm separation distance between the front of the EUT and the outer surface of the SAM planar phantom.
4. Ambient TEMPERATURE: 23.3 °C
   Relative HUMIDITY: 38.7 %
   Atmospheric PRESSURE: 101.1 kPa
5. Fluid Temperature ≈ 23.0 °C
6. During the entire test the conducted power was maintained to within 5% of the initial conducted power.

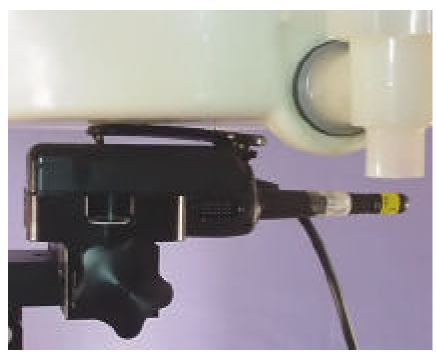
Face-held SAR Test Setup
2.5cm Separation Distance

Body-Worn SAR Measurement Results

Freq. (MHz)	Channel	Mode	Conducted Power Before (W)	Conducted Power After (W)	Battery Type	Belt-Clip Separation Distance (cm)	SAR (w/kg)	
							100% Duty Cycle	50% Duty Cycle
470.05	Low	CW	4.3	4.2	2000mAh Ni-MH	1.0	7.19	3.6
490.05	Mid	CW	4.2	4.1	2000mAh Ni-MH	1.0	10.2	5.1
511.95	High	CW	4.1	3.9	2000mAh Ni-MH	1.0	7.14	3.57
490.05	Mid	CW	4.2	4.1	1200mAh Ni-Cd	1.0	9.85	4.93
Mixture Type: Body Dielectric Constant: 56.9 Conductivity: 0.94 (Measured)				ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Controlled Exposure / Occupational BRAIN: 8.0 W/kg (averaged over 1 gram)				

Notes:

1. The highest SAR value found was below the maximum limit of 8.0 w/kg (controlled exposure, 50% duty cycle).
2. The highest body-worn SAR value found was 5.1 w/kg (50% duty cycle, 2000mAh Ni-MH battery).
3. The EUT was tested for body-worn SAR with speaker-microphone accessory, and the attached belt-clip providing a 1.0cm separation distance between the back of the EUT and the outer surface of the SAM planar phantom.
4. Ambient TEMPERATURE: 23.3 °C
Relative HUMIDITY: 38.7 %
Atmospheric PRESSURE: 101.1 kPa
5. Fluid Temperature ≈ 23.0 °C
6. During the entire test the conducted power was maintained to within 5% of the initial conducted power.



Body-worn SAR Test Setup
with Belt-Clip & Speaker-Mic
(Belt-Clip providing a 1.0cm Separation)

5.0 DETAILS OF SAR EVALUATION

The KENWOOD COMMUNICATIONS CORP. Model: TK-3140-2 Portable UHF PTT Radio Transceiver FCC ID: ALH32263120 was found to be compliant for localized Specific Absorption Rate (controlled exposure) based on the following test provisions and conditions:

1. The EUT was tested in a face-held configuration with the front of the device placed parallel to the outer surface of the SAM planar phantom at a 2.5cm separation distance.
2. The EUT was tested in a body-worn configuration with speaker-microphone accessory, and the attached belt-clip touching the outer surface of the planar phantom. The belt-clip provided a 1.0cm separation distance between the back of the EUT and the outer surface of the SAM planar phantom.
3. The EUT was evaluated for SAR at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimize drift. The conducted power levels were checked before and after each test. If the conducted power level deviated more than 5% of the initial power level, then the EUT was retested. Any unusual anomalies over the course of the test also warranted a re-evaluation.
4. The conducted power was measured according to the procedures described in FCC Part 2.1046.
5. The EUT was tested with the transmitter in continuous operation (100% duty cycle) throughout the SAR evaluation. As this is a push-to-talk device the 50% duty cycle compensation reported assumes a transmit/receive cycle of equal time base.
6. The location of the maximum spatial SAR distribution (Hot Spot) was determined relative to the device and its antenna.
7. The EUT was tested with a fully charged battery (2000mAh and 1200mAh battery options).

Face SAR Test Setup with SAM Planar Phantom

Body SAR Test Setup with SAM Planar Phantom

6.0 EVALUATION PROCEDURES

The Specific Absorption Rate (SAR) evaluation was performed in the following manner:

a. (i) The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For devices held to the ear during normal operation both the left and right ear positions were evaluated at the low, middle, and high frequencies of the band at maximum power, and with the device antenna in both the extended and extracted positions as applicable. The positioning of the ear-held device relative to the phantom was performed in accordance with FCC OET Bulletin 65, Supplement C (Edition 01-01) using the SAM phantom.

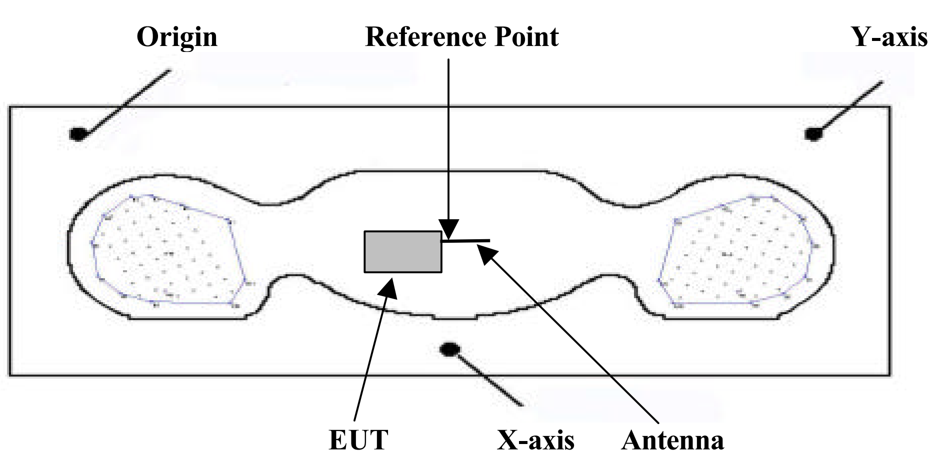
(ii) For face-held and body-worn devices a planar phantom was used. Depending on the phantom used for the evaluation, all other phantoms were drained of fluid.

b. The SAR was determined by a pre-defined procedure within the DASY3 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface using a uniform grid spacing.

c. A 5x5x7 matrix was performed around the greatest spatial SAR distribution found during the area scan of the applicable exposed region. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.

d. The depth of the simulating tissue in the phantom used for the SAR evaluation was no less than 15cm.

e. The target tissue parameters for 450MHz were used in the SAR evaluation software. If there was any appreciable variation in the measured tissue parameters from the target values specified then the SAR was adjusted using the sensitivities to SAR (see “Appendix D - SAR Sensitivities”).



Device Positioning & Reference Point

7.0 SYSTEM VALIDATION

Prior to the assessment, the system was verified in a planar phantom with a 450MHz dipole. A forward power of 250mW was applied to the dipole and the system was verified to a tolerance of ±10%. The applicable verifications are as follows (see Appendix B for dipole validation test plots and Appendix C for dipole calibration information):

Dipole Validation Kit	Target SAR 1g (w/kg)	Measured SAR 1g (w/kg)	Fluid Temperature	Validation Date
450MHz	1.47	1.46	≈23.0 °C	11/29/01

8.0 TISSUE PARAMETERS

The dielectric parameters of the fluids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer. The dielectric parameters of the fluid are as follows:

BRAIN TISSUE PARAMETERS - DIPOLE VALIDATION AND EUT EVALUATION			
Equivalent Tissue	**Dielectric Constant e_r**	**Conductivity s (mho/m)**	**r (Kg/m^3)**
450MHz Brain (Target)	43.5 ± 5%	0.87 ± 5%	1000
450MHz Brain (Measured: 11/29/01)	43.7	0.87	1000

BODY TISSUE PARAMETERS - EUT EVALUATION			
Equivalent Tissue	**Dielectric Constant e_r**	**Conductivity s (mho/m)**	**r (Kg/m^3)**
450MHz Body (Target)	56.7 ±5%	0.94 ±5%	1000
450MHz Body (Measured: 11/29/01)	56.9	0.94	1000

9.0 SIMULATED TISSUES

The brain and body mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution. Preservation with a bactericide is added and visual inspection is made to ensure air bubbles are not trapped during the mixing process. The fluid was prepared according to standardized procedures, and measured for dielectric parameters (permitivity and conductivity).

TISSUE MIXTURES FOR DIPOLE VALIDATION & EUT EVALUATION		
INGREDIENT	**450MHz Brain Mixture (Validation & EUT Evaluation) %**	**450MHz Body Mixture (EUT Evaluation) %**
Water	38.56	52.00
Sugar	56.32	45.65
Salt	3.95	1.75
HEC	0.98	0.10
Bactericide	0.19	0.10

10.0 SAR SAFETY LIMITS

EXPOSURE LIMITS	**SAR (W/Kg)**	
	(General Population / Uncontrolled Exposure Environment)	**(Occupational / Controlled Exposure Environment)**
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10g)	4.0	20.0

Notes:

1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

11.0 ROBOT SYSTEM SPECIFICATIONS

Specifications

POSITIONER:	Stäubli Unimation Corp. Robot Model: RX60L
Repeatability:	0.02 mm
No. of axis:	6

Data Acquisition Electronic (DAE) System

Cell Controller	
Processor:	Pentium III
Clock Speed:	450 MHz
Operating System:	Windows NT
Data Card:	DASY3 PC-Board
Data Converter	
Features:	Signal Amplifier, multiplexer, A/D converter, and control logic
Software:	DASY3 software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock

PC Interface Card

Function:	24 bit (64 MHz) DSP for real time processing Link to DAE3 16-bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot

E-Field Probe

Model:	ET3DV6
Serial No.:	1590
Construction:	Triangular core fiber optic detection system
Frequency:	10 MHz to 6 GHz
Linearity:	± 0.2 dB (30 MHz to 3 GHz)

Evaluation Phantom

Type:	SAM V4.0C
Configuration:	Left Head, Right Head, Planar Section
Shell Material:	Fiberglass
Thickness:	2.0 ±0.1 mm
Volume:	Approx. 20 liters

Validation Phantom (£ 450MHz)

Type:	Large Planar Phantom
Shell Material:	Plexiglas
Bottom Thickness:	6.2 mm ± 0.1mm
Dimensions:	86.0cm (L) x 39.5cm (W) x 21.8cm (H)

12.0 SAM PHANTOM V4.0C

The SAM phantom V4.0C is a fiberglass shell phantom with a 2.0 mm shell thickness for left and right head and flat planar area integrated in a wooden table. The shape of the fiberglass shell corresponds to the phantom defined by SCC34-SC2. The device holder positions are adjusted to the standard measurement positions in the three sections.

SAM Phantom V4.0C

13.0 LARGE PLANAR PHANTOM

The large planar phantom is constructed of Plexiglas material with a 6.0 mm shell thickness for SAR validations at and below 450MHz. The large planar phantom is mounted in the DASY3 compact system in place of the SAM phantom.

Large Planar Phantom

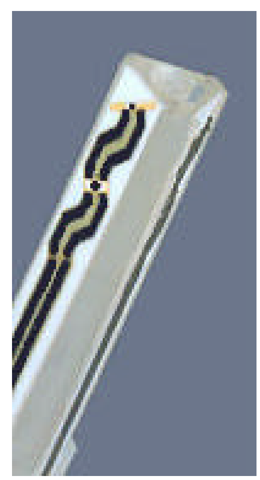
14.0 DEVICE HOLDER

The DASY3 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.

Device Holder

15.0 PROBE SPECIFICATION (ET3DV6)

Construction:	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g. glycol)
Calibration:	In air from 10 MHz to 2.5 GHz In brain simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy ± 8%)
Frequency:	10 MHz to >6 GHz; Linearity: ±0.2 dB (30 MHz to 3 GHz)
Directivity:	±0.2 dB in brain tissue (rotation around probe axis) ±0.4 dB in brain tissue (rotation normal to probe axis)
Dynam. Rnge:	5 µW/g to >100 mW/g; Linearity: ±0.2 dB
Srfce. Detect.	±0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Dimensions:	Overall length: 330 mm Tip length: 16 mm Body diameter: 12 mm Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 3 GHz Compliance tests of mobile phone



ET3DV6 E-Field Probe

16.0 TEST EQUIPMENT LIST

SAR MEASUREMENT SYSTEM		
EQUIPMENT	***SERIAL NO.***	***DATE CALIBRATED***
DASY3 System -Robot -ET3DV6 E-Field Probe -300MHz Validation Dipole -450MHz Validation Dipole -900MHz Validation Dipole -1800MHz Validation Dipole -SAM Phantom V4.0C	 599396-01 1590 135 136 054 247 N/A	 N/A Mar 2001 Oct 2001 Oct 2001 June 2001 June 2001 N/A
85070C Dielectric Probe Kit	N/A	N/A
Gigatronics 8652A Power Meter -Power Sensor 80701A -Power Sensor 80701A	1835272 1833535 1833542	Oct 2001 Jan 2001 Feb 2001
E4408B Spectrum Analyzer	US39240170	Nov 2001
8594E Spectrum Analyzer	3543A02721	Mar 2001
8753E Network Analyzer	US38433013	Nov 2001
8648D Signal Generator	3847A00611	Aug 2001
5S1G4 Amplifier Research Power Amplifier	26235	N/A

17.0 MEASUREMENT UNCERTAINTIES

Uncertainty Description	Error	Distribution	Weight	Standard Deviation	Offset
Probe Uncertainty					
Axial isotropy	±0.2 dB	U-Shaped	0.5	±2.4 %	
Spherical isotropy	±0.4 dB	U-Shaped	0.5	±4.8 %	
Isotropy from gradient	±0.5 dB	U-Shaped	0	±	
Spatial resolution	±0.5 %	Normal	1	±0.5 %	
Linearity error	±0.2 dB	Rectangle	1	±2.7 %	
Calibration error	±3.3 %	Normal	1	±3.3 %	
SAR Evaluation Uncertainty					
Data acquisition error	±1 %	Rectangle	1	±0.6 %	
ELF and RF disturbances	±0.25 %	Normal	1	±0.25 %	
Conductivity assessment	±5 %	Rectangle	1	±5.8 %	
Spatial Peak SAR Evaluation Uncertainty					
Extrapolated boundary effect	±3 %	Normal	1	±3 %	±5 %
Probe positioning error	±0.1 mm	Normal	1	±1 %	
Integrated and cube orientation	±3 %	Normal	1	±3 %	
Cube Shape inaccuracies	±2 %	Rectangle	1	±1.2 %	
Device positioning	±6 %	Normal	1	±6 %	
Combined Uncertainties				±11.7 %	±5 %

Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environmental.

According to ANSI/IEEE C95.3, the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy's of ± 1 to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least ± 2dB can be expected.

According to CENELEC, typical worst-case uncertainty of field measurements is ± 5 dB.
For well-defined modulation characteristics the uncertainty can be reduced to ± 3 dB.

18.0 REFERENCES

(1) ANSI, *ANSI/IEEE C95.1: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 Ghz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY: 1992.*

(2) Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65, Supplement C, Edition 01-01, FCC, Washington, D.C. 20554: June 2001.

(3) Thomas Schmid, Oliver Egger, and Niels Kuster, "Automated E-field scanning system for dosimetric assessments", IEEE *Transaction on Microwave Theory and Techniques,* Vol. 44, pp. 105 – 113: January 1996.

(4) Niels Kuster, Ralph Kastle, and Thomas Schmid, "Dosimetric evaluation of mobile communications equipment with know precision", IEICE Transactions of Communications, vol. E80-B, no. 5, pp. 645 – 652: May 1997.