SAR & HAC
MEASUREMENT SYSTEMS

PRODUCT OVERVIEW

mvg
Microwave Vision Group

The multiplication of consumer mobile telecommunication equipment (MTE) has raised concerns about potential adverse health effects due to electromagnetic field exposure. For radio frequency safety purposes, international regulatory bodies and committees have elaborated standards to which MTE should comply. MVG offers a range of Specific Absorption Rate (SAR) and Hearing Aid Compatibility (HAC) measurement systems for the test and certification of MTE.

Why do we measure SAR values?

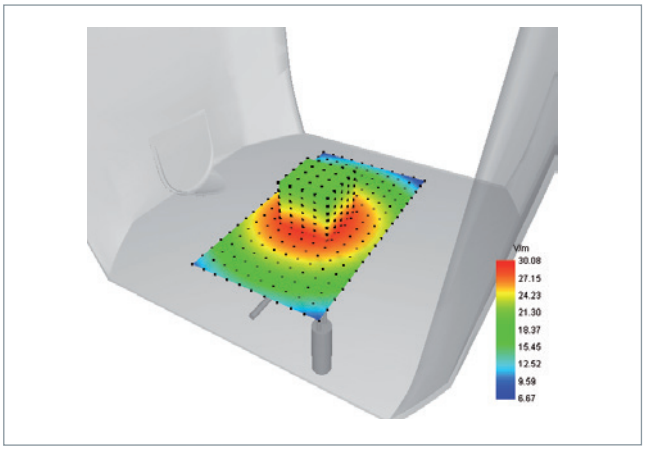
The radio frequency (RF) energy radiated by MTE is absorbed in the body and produces heat, which is carried away by the body's thermoregulatory processes. The rate at which RF electromagnetic energy is imparted to an element or mass of a biological body is called Specific Absorption Rate (SAR). The SAR value is expressed as energy flow (power) per unit of mass in units of W/kg.

What are the main SAR standards?

In 1998, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) elaborated guidelines to limit exposure to electric, magnetic and electromagnetic fields. It exists today two other major standards: the IEEE 1528 and the IEC 62209.
The IEC 62209-2 is expanding the scope of the standard IEC 62209-1 to the frequency range of 30 MHz to 6 GHz. It will also address a broader category of devices, such as laptops or PDAs.

For base station testing, the European EN 50383 standard concerns the calculation and measurement of electromagnetic field strength and SAR related to human exposure from radio base stations and fixed terminal stations for wireless communication (110 MHz to 40 GHz).

IEC 62232 define the guidelines for the Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure.



Most countries (such as the USA, European Members, Australia, Japan or Canada) have adopted regulations that require MTE to be tested in order to ensure their compliancy to basic SAR restrictions. All these regulations are consistent with each other in the sense that they all follow almost the same methodology although the values themselves can differ.

How do we measure SAR values?

The SAR values are complex to measure as the penetration of energy within human tissues depends on many factors, such as the type of the phone, the shape of the user's head or the frequency. For this reason, SAR measurements are performed in laboratory using specific instrumentation defined in the standards: head phantom, liquid, E-field probe…

The measurement process consists in using a scanning system to measure the internal E-field distribution in a phantom model filled with liquid. The shape of the head and the liquids simulate the human head and tissue. The device under test emits at maximum power and is positioned according to the procedure of the standards. The E-field value is measured with a miniature E-field probe.

Indeed, E-field probes are the most appropriate sensor to measure the SAR, due to their sensitivity and fast time response. The E-field is calculated using the following formula:

$$SAR\ (W/Kg) = \sigma E\ (V/m)^2/\rho$$

Sigma (σ) being conductivity of the liquid and rho (r) the density of the liquid.

Finally, from the measured E-field values, the SAR distribution, the 1 g and 10 g mass averaged SAR values are calculated.

What are HAC measurements?

The use of mobile phones together with hearing aid devices can cause interferences. For this reason, the Federal Communications Commission (FCC) has required that mobile phone compatibility with hearing aid devices be measured. This compatibility must be measured in the two modes commonly used by the hearing aid: microphone mode and telecoil mode. The FCC has set ratings in order to calculate the risks of interference:

- M Ratings concern the microphone mode.
- T Ratings concern the telecoil mode.

The American National Standards Institute adopted the ANSI C63.19 standard in 2001. According to the FCC, a large percentage of mobile phones marketed by each manufacturer should be HAC compatible (M3-4 and T3-4 rating).

How do we define HAC rating?

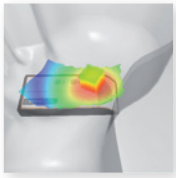
The HAC rating is measured in two steps:

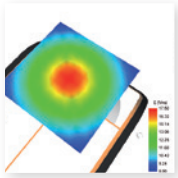
- RF test (HA microphone mode): measure the near-field electric and magnetic fields emitted by the phone using an E-field and H-field miniature probe.
- Audio test (HA telecoil mode): measure the magnetic fields emitted by the phone using a T-coil probe.

A 6-axis robot is necessary to reach the measurement uncertainty limit stipulated in the standards.

https://mvg.link/sar

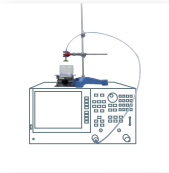
Quick Guide of MVG's SAR & HAC measurement Solutions



Product Name	ComoSAR V5	OpenSAR V5	ComoHAC	OpenHAC	CaliProbe	Probes
Product Category	• SAR measurement bench	• Software	• HAC measurement bench	• Software	• Probe calibration	• Field probe
Function	• SAR Measurement Enhanced HAC Testing capabilities available with additional ComoHAC kit	• Controls ComoSAR test bench instrumentation for both certification and fast R&D measurements • Liquid measurement	• Allows measure-ments to be performed in compliance with the ANSI C63.19 standard and related KDB • Enables the M (RF test) and T (audio test) rating of the DUT to be defined	• Controls ComoHAC test bench instrumentation for HAC evaluation	• Calibrates EM field probes used for SAR measurements	• Measures field in SAR and HAC benches
Frequency bands	• 150 MHz to 7.5 GHz	-	-	-	-	• 150 MHz to 7.5 GHz
User Profile	• Certification bodies • Regulatory bodies • R&D and test laboratories • Terminal manufacturers • Antenna manufacturers	• SAR bench users	• Certification bodies, • Regulatory bodies, • R&D and test laboratories • Terminal manufacturers • Antenna manufacturers	• ComoHAC bench users	• Certification and regulatory bodies	• SAR and HAC bench user
Related Standard	• IEEE 1528 • FCC OET Bulletin 65 (Ed. 97-01) supplement C • IEC 62209-1/ IEC 62209-2 • EN 50361:2001 • EN 50383	• ComoSAR V5 related standards	• ANSI C63-19	• ComoHAC V5 related standards	• IEEE 1528 • FCC OET Bulletin 65 (Ed. 97-01) supplement C • IEC 62209-1/ IEC 62209-2 • EN 50361:2001 • EN 50383	• IEEE 1528 • FCC OET Bulletin 65 (Ed. 97-01) supplement C • IEC 62209-1/ IEC 62209-2 • EN 50361:2001 • EN 50383 • ANSI 63.19






Product Name	SAM phantoms	Liquids	LimeSAR	Positioning systems	Validation Dipoles	TMFS
Product Category	• Phantom	• Liquids 10, 20, 25, 30 liters	• Dielectric parameter measurement	• Device positioning system for SAR and HAC measurements Laptop, Mobile, Tab and others	• Validation antenna	• Telephone Magnetic Field Simulator
Function	• Contains liquids that simulate human tissues (head and body) for SAR measurements	• Simulates the human head and body tissues	• Assess the dielectric properties of SAR and CTIA liquids	• Positions handset, larger telecommunication terminals and BSA for SAR and HAC measurements	• Validates the overall set up of the system	• T-coil probe assessment
Frequency bands	-	-	• 150 MHz to 7.5 GHz	-	• 150 MHz to 7.5 GHz	-
User Profile	• SAR bench user	• SAR bench user	• SAR bench user academic Lab R&D lab	• SAR bench user academic Lab R&D lab	• SAR and HAC bench user	• HAC bench user
Related Standard	• Ear Reference Point (ERP) within a tolerance of less than ± 0.2 mm.	• IEEE 1528 • FCC OET Bulletin 65 (Ed. 97-01) supplement C • IEC 62209-1/ IEC 62209-2 • EN 50361:2001 • CTIA 2.2 appendix C.3 for 835 and 1900 MHz	• IEEE 1528 • FCC OET Bulletin 65 (Ed. 97-01) supplement C • IEC 62209-1/ • IEC 62209-2 • EN 50361:2001 • EN 50383	-	• IEEE 1528 • FCC OET Bulletin 65 (Ed. 97-01) supplement C • IEC 62209-1/ IEC 62209-2 • EN 50361:2001 • ANSI C63.19	• ANSI C63-19

MVG - Testing Connectivity for a Wireless World

The Microwave Vision Group offers cutting-edge technologies for the visualization of electromagnetic waves. Enhancing the speed and accuracy of wireless connectivity testing, as well as the performance and reliability of anechoic and EMC technologies, our systems are integral to meeting the testing challenges of a fully connected world.

WORLDWIDE GROUP, LOCAL SUPPORT

Our teams, in offices around the world, guide and support you from purchase, through design, to delivery and installation. Because we are local, we can assure speed and attention in project follow through. This includes customer support and maintenance once the system is in place.
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