The Effect of MRET Polymer Compound on SAR Values of RF Phones

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This article is related to the proposed hypothesis and experimental data regarding the ability of defined polar polymer compound (MRET polymer) applied to RF phones to increase the dielectric permittivity of water based solutions and to reduce the SAR (Specific Absorption Rate) values inside the "phantom head" filled with the jelly simulating muscle and brain tissues. Due to the high organizational state of fractal structures of MRET polymer compounds and the phenomenon of piezoelectricity, this polymer generates specific subtle, low frequency, non-coherent electromagnetic oscillations (optimal random field) that can affect the hydrogen lattice of the molecular structure of water and subsequently modify the electrodynamic properties of water. The increase of dielectric permittivity of water finally leads to the reduction of the absorption rate of the electromagnetic field by living tissue. The reduction of SAR values is confirmed by the research conducted in June – July of 2006 at RF Exposure Laboratory in Escondido, California. This test also confirmed that the application of MRET polymer to RF phones does not significantly affect the air measurements of RF phone signals, and subsequently does not lead to any significant distortion of transmitted RF signals.

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INTRODUCTION

The epoxy polar polymer material is a good example that presents all qualities of volumetric fractal matrix. The epoxy polymer samples were studied with the help of small-angle X-ray scattering (SAXS). The analysis of the entire scattering curve of an epoxy compound suggests a fractal behavior of the internal surface on a scale between 100 nm and 10 nm, and in the tail end of the SAXS curves reveals maxima corresponding to those of two regular spheres with radii of the order of 7 nm and 14 nm. The analysis of the beginning of the curves yields one or two correlation lengths close to 100 nm and 20 nm. These results are consistent with the general model of IPN (interpenetrating polymer network) structures as revealed by other physico-chemical techniques [Sobry *et al.*, 1991].

While many polar polymers are highly flexible and form an amorphous solid upon the process of polymerization, a large number of polymers, such as epoxy, actually form partially crystalline structures. Epoxy is formed by mixing Bisphenol A with low-molecular weight liquid resin that contains epoxy groups. The principal reaction of epoxy groups with phenolic hydroxyl functions leads to linear

Keywords: *SAR value, MRET polymer, piezoelectric effect, fractal matrix, optimal random field, superposition, dielectric permittivity, electrical conductivity, water molecules, cell water.*

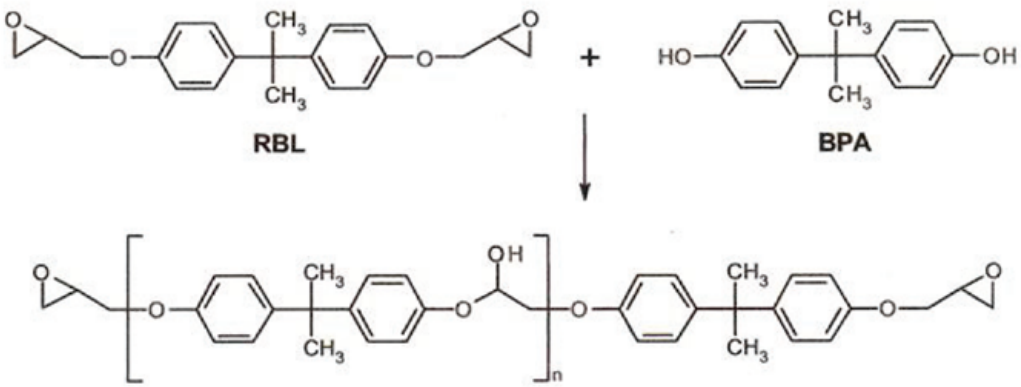

Figure 1. *Epoxy polymer typically contains highly polar hydroxyls and amines. Once all the amines sites have reacted with the epoxy sites a three dimensional network is achieved.*

polymer chains formation (nM ---- Mn, where n > 38) (Figure 1).

A number of studies show that the external electromagnetic field can affect local orientations and phase transitions in polymer crystalline systems of longitudinal chains. The longitudinal polymer crystalline system is a macromolecule of consecutively copolymerized liquid crystals and flexible polymer sequences. Polar polymers possess comparatively low values of relative dielectric permittivity (3-15), which means that macromolecules in the molecular structure of these polymers can be easily displaced by external electromagnetic force. Subsequently the external electromagnetic field can seriously modify the local orientation order of the system and affect phase transition parameters and dielectric properties of the polymer compound. A simple molecular mechanism exists since the polar parts of the molecule in epoxy are rigidly attached to the chain backbone. The orientation of the polar groups in the electromagnetic field affects the backbone orientation and determines the resulting anisotropy of crystalline structure of epoxy polymer introduced to the electromagnetic field.

The external electromagnetic field generates an excitation in crystalline structures of the polymer compound. The existence of orientations and phase transitions in crystalline systems of epoxy polymer introduced to external electromagnetic field leads to the origination of subsequent relaxation and strain phases in macromolecular structures that induce the phenomenon of piezoelectricity. Piezoelectricity is the electrical response of a material to the change of pressure in molecular structures of polymer compound. It can only be observed in materials having a non centre-symmetrical structure and elastic properties. Both properties can be found in polar polymer compounds. Several investigations conducted on polymers with cholesteric elastomer structures including epoxy indicated that uniaxial compression parallel to the helicoidal axis of the cholesteric structure leads to a compression of the helix. Simultaneously an electric charge at the surface of the elastomer is observed. A linear correlation exists between deformation of the sample and the electric voltage that resembles piezoelectricity. According to the theory of Brand, the following equation (1) gives the expansion of the free energy of a cholesteric elastomer. Only terms dealing with deformations and electric field effects are written down explicitly, all other contributions are summarized in F_o:

$$F = F_o + 1/2Ce^2 + \varepsilon E^2 + q_0 \xi Ee \qquad (1)$$

where C is Young's modulus, e – the deformation, ε– the dielectric permittivity, E – the electrical

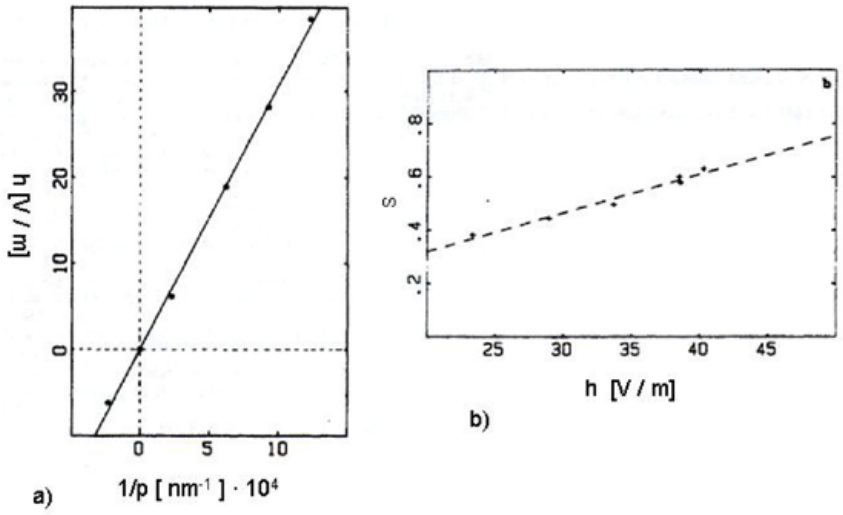

Figure 2. *(a) Piezoelectric coefficient (h) versus the reciprocal pitch (1/p)of the elastomer; (b) - Order parameter (S) of the cholesteric phase versus piezoelectric coefficient (h) [Meier and Finkelmann, 1993].*

field strength, $q_0 = 2\prod/p$ – the cholesteric reciprocal pitch, and ξ – the coupling coefficient between E and e. Minimizing the free energy with respect to the electric field yields a relation between deformation and the electric field:

$$dF / dE = 2\varepsilon E + q_0 \zeta e = 0 \qquad (2)$$

or

$$E = -(q_0 \xi / 2\varepsilon)e \qquad (3)$$

where the term $q_0 \xi / 2\varepsilon$ defines the piezoelectric coefficient *h*. Here it has to be noted that *h* is inversely related to the pitch of cholesteric elastomer. According to equation (3) the piezoelectric coefficient is directly proportional to the reciprocal pitch of the cholesteric phase. There is an excellent linear relation with respect to the pitch dependence of the piezoelectric effect (Figure 2) [Meier and Finkelmann, 1993].

The correlation between the piezoelectric coefficient and the order parameter reflects a coupling, and shows that the piezoelectric effect of polymer compounds directly depends on the order state of the liquid crystalline phase structures. It means there is direct correlation between the topology of polymer molecular structures and the intensity of piezoelectric phenomenon. The topology of polymer molecular structure is scientifically based on the principles of formation of fractal systems [Serov, 2003].

The first principle of fractalization is realized through the iterative algorithm of formation of complex structural systems based on the existence of the initial prototype matrix which governs the formation of the object. In this case, the final system's iterative formation consists of the successive reflection of the initial prototype matrix on the final structure of the whole system. As a result, the final multilevel fractal structure has long distance correlations in the arrangement of particles. Any small fragment of the fractal system reproduces the structure of the whole system under the increasing scale. This principle clearly describes the hierarchal organization of fractal system. This principle can be seen in the formation of crystalline lattice of mono crystals, development and growth of biological systems where genetic prototype is developed through the certain algorithm of replication from single cell into the organism, where all cells have a unique basic matrix in the

form of DNA structure.

Another principle that governs formation of the fractal system is the principle of complementarity. The main criterion of the integrity of fractal system is minimization of tendencies leading to spontaneous formation of "inside" conflicts and contradictions in the system. It states that in order to achieve stability of any complex system the level of inside "contradictions" of this system should be directed to null. This statement is correct for any three dimensional system as well as any volumetric system that has the infinite number of different kinds of structural vectors. The basis of formation of stable complex system should be the structural module which has precise, balanced matrix structure and can clone self projections in the surrounded environment. The fractal cloning of structures considers the formation of self-similar replications of the initial basic module with the specific coefficient of similarity. The object which is formed as a result of the fractal cloning process has dimensions that are proportional to the dimensions of the initial basic module.

The next basic principle that governs the formation of the fractal system in nature provides the idea of existence of the lattice of "barrier" membranes. Any fractal system is separated by barrier membranes relative to the central zone of the system, and those membranes play roles of transformers and converters of the previously existing algorithm or signal into another algorithm or signal which is more adequate for the present level. In this case, the transmission of the signal from the central zone of the fractal system to the peripheral zone of the same system and vise a verse is related with its step by step adaptation. This principle can be interpreted as a process of quantum transformations of the entropy of the object. In this case each barrier membrane of the system is considerate to be some kind of a fractal "space – wave" filter which modifies the previously existing algorithm or signal into the new form of algorithm or signal. This concept provides some evidence that the encounter of fractal matrix with the electromagnetic field has the ability to affect this field in a way obviously characterized by the matrix's structure. In the case of epoxy polymer, the kinetics to a large extent determine the final crystalline structure of the polymer.

The introduction of foreign agents (substances) into the parent lattice of epoxy polymer leads to the effect of superimposed periodicity and, as a result, develops modulated crystalline structures with specific fractal microstructure, phase transition, network topology and polarity [Smirnov and Peerayot, 2006]. It is a basic concept of MRET polymer compound covered by US Patent No: 6369399, April 2002. Due to the fractal structures of MRET polymer compound and the phenomenon of piezoelectricity, this polymer generates subtle, low frequency, non-coherent electromagnetic field (random field) that can affect the hydrogen lattice of the molecular structure of water, and subsequently modify the electrodynamic properties of water. Such resonance interaction, including both a spatial resonance and a resonance of the oscillating frequency of microscopic orbital currents of protons in water-molecular hexagons, leads to the process of deviation from the stochiometric composition of water and to the reorganization of water clathrate structures with minimum input of energy. The modification of water's molecular structure can lead to the modification of the electrodynamic characteristics of water such as dielectric permittivity and electrical conductivity.

Taking into consideration the scientific fact that living tissue such as muscle and brain tissue are composed of 70 – 90% of water, it is possible to admit that the application of MRET polymer compound to RF phones may compensate for the possible biological effect related to the absorption of electromagnetic radiation by human body tissues [Smirnov, 2006]. It is a well known scientific fact that microwave

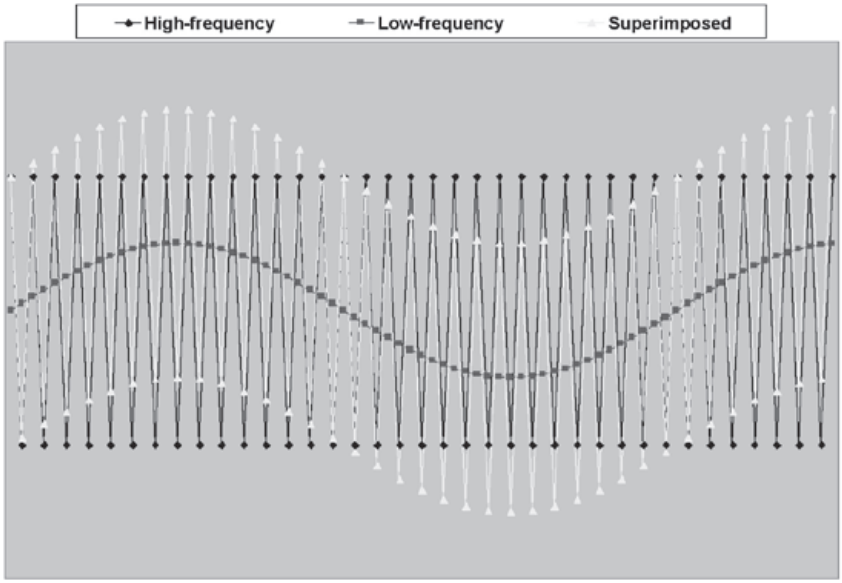

Figure 3. *The principle of superposition of electromagnetic waves.*

radiation can penetrate into the living tissues at the depth of 0.3 mm – 300 mm depending on the power and intensity of the radiation. The high frequency microwave oscillations of RF phones are a perfect carrier for the low frequency signals generated by MRET polymer material. It is found empirically that as long as the amplitudes of waves in most media are small, two waves in the same physical location don't interact with each other. Thus, for example, two waves moving in the opposite direction simply pass through each other without their shapes or amplitudes being changed. When collocated, the total wave displacement is just the algebraic sum of the displacements of the individual waves. This is called the superposition principle.

Thus, specific low frequency patterns generated by the defined polar polymer compound superimposed on high frequency signal can interact with hydrogen lattice of water molecules in biological systems. The mechanism of such processes was confirmed by a number of studies. For example, ELF signal (extremely low frequency, 5-12 Hz) carried by microwave frequency can induce the generation of Alpha or Theta waves in animal (including human) brains [Wilson *et al.*, 1990]. The interaction of such composed electromagnetic fields with the molecular structure of cell water may lead to the modification of dielectric permittivity and electrical conductivity of cell water, and finally to the reduction of the absorption rate of the electromagnetic field by living tissue.

Below is presented the theoretical concept of electrodynamic processes which lead to the reduction of the absorption rate of EMF composed of microwave radiation and specific oscillations of very low frequencies and amplitudes in cell water. Under the influence of applied EMF, polar molecules tend to align themselves with the field. Although water has polar molecules, its hydrogen bonding network tends to oppose this alignment. The level to which a substance does this is called its dielectric permittivity. Dependent on the frequency of applied EMF the dipole may move in time to the field, lag behind it or remain apparently unaffected. The ease of the movement depends on the viscosity and the mobility of the electron clouds. In the wide range of EMF frequencies lower than GHz frequency level (corresponding to microwave thermal effect), the water dipoles

move in time to the field. In the range of extremely low frequency of 0.1 – 1000 Hz (corresponding to the extremely low velocity of movement) the dynamic viscosity of water and the resistance of water dipoles to the alignment (dielectric permittivity) are extremely high (up to 10^8 at 0.1 Hz) due to hydrogen bonding between molecules (molecular coupling). In this extremely low frequency range of applied EMF the water dipoles are able to move in time with low frequency electromagnetic field and, as a result, can form multilayer molecular formations which oscillate in accordance with applied low frequency EMF. In the higher frequency range of kHz to GHz generated by RF phones the reorientation process may be modeled using a "wait and switch" process where the water molecule has to wait until favorable orientation of neighboring molecules occurs and then the hydrogen bonds switch to new molecules. This range of frequencies of RF phones is related to the ease with which water dipoles move, resulting in chaotic Brownian movement of water molecules. In the process of Brownian movement water molecules located in close proximity to each other develop the "friction effect" that results in the increase of the level of absorption of EMF energy emitted by RF phone and in the generation of heat (called "dielectric loss") [Chaplin, 2005].

The subtle low frequency oscillations generated by MRET-Shield compound (superimposed on the carrying frequency of RF phone) support the tendency of water dipoles to align and to move in time with low frequency field keeping their normal structures of hydrogen bonding and water molecular formations. Thus, MRET-Shield supports the existing proper molecular structuring in water and counteracts the tendency of RF to break hydrogen bonding between water molecules and to ease their chaotic movement.

The fundamental biophysical theories reveal the scientific paradigm regarding polarized-oriented multilayer structuring of the cell water in biological systems [Ling, 2003]. One of the main functions of cell water is to support the transduction mechanism in cellular structures. Using the mechanism of alignment of polarized-oriented multilayer structures of cell water, living cells provide continuous long-range transduction mechanisms in order to support normal homeostasis of the body. Even slight distortion or destruction of hydrogen bonding in multilayer structures of cell water leads to the distortion (possible high level of distortion) of the transduction mechanism on cellular and organism levels of the body, and to consequent harmful biological effects.

The processes of distortion and destruction of cell water polarized-oriented multilayer structuring are directly correlated with the rate of absorption of the energy of applied EMF emitted by RF phone. Even a slight increase in absorption rate can lead to the distortion of proper molecular structures, and the subsequent distortion of the transduction mechanism of the body. This can result in a number of health problems. A number of the comparative biological tests were conducted regarding the effect of MRET polymer compound. The results provide evidence of the beneficial health effect for the human body when MRET polymer compound is installed on the source of non-ionizing radiation. The Human Blood Morphology test was conducted in vitro on human blood samples at Cedar-Sinai Medical Center, Los Angeles, EEG testing on human subjects conducted at SA Biomedical Instrumentation Co., San Diego, Magnetic Resonance Angiography test was conducted on human subjects at Tex Chu Technology Co., Taiwan, Thermography test was conducted on human subjects at SAMEER Centre for Electromagnetic, a division of the Research and Design Institution of the Ministry of Communications and Information Technology, Department of Information for the Government of India, in Chennai. However these findings are out of the scope of SAR investigation and cannot be discussed in this article. The typical

SAR reduction of the order of few percent when MRET polymer is installed on the source of radiation is very significant for the exposed biological systems. According to the existing physical models, the cells are considered detectors of very weak periodic magnetic fields with the intensity of the minimum field to which the membrane macromolecules could be sensitive estimated at around 10^{-3} volts/cm. However, if the model parameters take in to account the so-called frequency "windows", i.e. the possibility that certain cellular responses occur only within a restricted frequency band, then the theoretical intensity proves to be several orders of magnitude lower (10^{-6} volts/cm), thus closely approaching the data from various experiments in cells and animals. There is also evidence that cell proliferation activity is influenced by electromagnetic fields of very low intensity (0.2-20 mT, 0.02-1.0 mV/cm) [Sonnier and Marino, 2001]. Considering this fact, it is possible to admit that the reduction of the electrical field's intensity even by the order of a few percent can significantly minimize the cell membrane stress response to EMR.

Unfortunately, it is impossible to verify the absorption rate of cell water and a SAR (Specific Absorption Rate) test was developed on the basis of water based jelly (the simulated living tissue in the "phantom head"). Consequently, it is necessary to consider the fact that polarized-oriented multilayer molecular structuring of cell water (essential for the process of transduction mechanism in the body) cannot be reproduced in such jelly compound. Consequently, even a slight increase of SAR values obtained by testing based on this jelly can lead to a substantial level of distortion of multilayer structures in cell water and to harmful biological effects. On the other hand, even a slight decrease of SAR values obtained by such testing in the case of MRET-Shield material application to RF phone is correlated with the process of alignment of multilayer structures of water molecules and substantial reduction of chaotic water molecular movement which distorts the transduction mechanism in the body. It is reasonable to admit that the application of MRET-Shield material to RF phones and other electronic appliances will produce a beneficial biological effect [Smirnov and Peerayot, 2006; Smirnov, 2006].

The mathematical concept and calculations are presented below. Specific Absorption Rate is defined as the time derivation (rate) of the incremental energy (dW) absorbed by an incremental mass (dm) contained in a volume element (dv) of a given density (p):

$$SAR = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{pdv}\right) \qquad (4)$$

There is a direct correlation between the absorption of non-ionizing electromagnetic radiation by the exposed tissue and the magnitude of the electric component of the field applied to the tissue. Specific Absorption Rate can be related to the electric field at a point by:

$$SAR = \frac{\sigma |E|^2}{p} \qquad (5)$$

where σ – conductivity of the tissue (S/m); p – mass density of the tissue (kg/m^3); E – electrical field strength (V/m) [IndeXsar Company].

The equation for the electrical field strength at the point in space which is distant from the source of electromagnetic radiation is:

$$E(r) = q/4\pi\varepsilon r^2 \qquad (6)$$

where q – electrical charge (V); ε – dielectric permittivity (F/m); r – distance from the source of electromagnetic radiation (m).

According to the standard methodology for SAR measurements for the "phantom head" [IEEE Standard, 2003], the electrical conductivity (σ) of simulated brain tissue (hydroxethylcellullose jelling agent) and mass

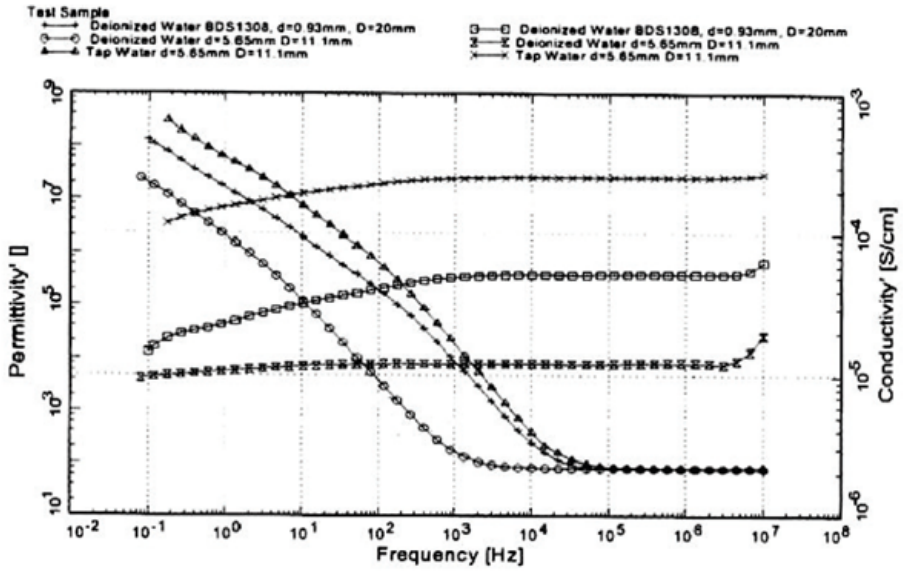

Figure 4. *The relative dielectric permittivity of water significantly increases from 80 up to 10^8 and electrical conductivity of water samples decreases up to 10 times in the frequency range of 0.1 – 1000 Hz. Measurements were conducted on the samples of deionized and tap water in measurement units with different size (length and diameter) at 20°C.*

density of the simulated tissue (p) are considered to be a constant. Considering this fact, it is possible to conclude that any modifications of the measured SAR values have a direct correlation with the modifications of the measured electric field strength magnitudes. It is a scientifically proven fact that a low frequency electromagnetic field can dramatically affect the dielectric permittivity and electrical conductivity of water and water based solutions. Particularly, the scientists of Novocontrol Technologies GmbH & Co. KG provide the following results for measurements of electrodynamic characteristics of water when the body of water is exposed to the wide range of electromagnetic oscillations (Figure 4) [Novocontrol Technologies].

Electrodynamic Characteristics of Water

In the range of low frequencies of 0.1 – 1000 Hz the relative dielectric permittivity of water increases from its regular value of 80 up to 10^8, and electrical conductivity decreases up to 10 times. These facts confirm that water as a subject to applied EMF of extremely low frequency range undergoes molecular structural modifications. It is reasonable also to admit that these structural changes can affect the electrodynamic characteristics of water in the range of RF frequencies as well. Taking into consideration that MRET polymer compound generates low frequency oscillations, it is reasonable to admit that these specific signals can affect the electrodynamic characteristics of the water based jelly in the "phantom head" by slightly increasing the dielectric permittivity (ε) and decreasing the conductivity (σ) of the hydroxethylcellullose jelling agent. Subsequently the increase of dielectric permittivity (ε) leads to the decrease of the electric field's strength (E) inside the "phantom head" following the equation (6), and to the decrease of SAR values following the equation (5).

According to equation (5), the decrease of electrical conductivity (σ) of the simulating tissue jelly should lead to the additional decrease of SAR values, but it is not reflected in these test results due to the standard methodology of

SAR test [IEEE Standard, 2003]. According to the standard methodology, only the electric field magnitudes are measured by the probe and the value of conductivity of the water based jelly is measured before each test and considered to be a constant during the computerized calculation of SAR values.

The research "R&D Testing SAR Evaluation" was conducted at the RF Exposure Laboratory, Escondido, California by the analyst Jay Moulton in June – July of 2006 [Moulton, 2006]. It showed the reduction of SAR values in 90% of experimental points inside the "phantom head" for three different models of RF phones functioning at 835 MHz and 1900 MHz respectfully (242 points were measured for each RF phone with and without application of MRET polymer compound) and, thus, confirmed the beneficial effect of the application of MRET polymer compound (MRET-Shield) to RF phones.

METHODS

The SAR values were calculated using the equation (5) based on the measurements of the E-field. The series of measurements in 242 points were accomplished for RF phones without MRET polymer material and with MRET polymer material applied to RF phones for the Uni-Phantom head filled with head tissue simulating liquid of the following electrical parameters measured before the test at 835 MHz:

Relative Dielectricity	40.88	±5%
Conductivity	0.88 mho/m	±5%

and at 1900 MHz:

Relative Dielectricity	39.24	±5%
Conductivity	1.43 mho/m	±5%

The brain and muscle mixtures consist of a viscous gel using hydroxethylcellulose (HEC)

Figure 5. *Measurement of head tissue depth.*

Figure 6. *ALSAS system configuration.*

Figure 7. *Mobile phone with applied MRET polymeric material (180 mg).*

Table 1. SAR Data Summary – 835 MHz Head

Measurement Results Frequency 836.52 MHz, Channel 384, Modulation CDMA, Battery Standard						
Phone Used	1 gram SAR value (W/kg)		Decrease (Increase) of SAR	10 gram SAR value (W/kg)		Decrease (Increase) of SAR
	NO Polymer	MRET Polymer 180 mg		NO Polymer	MRET Polymer 180 mg	
Kyocera Wireless	0.647	0.612	5.4%	0.427	0.387	9.4%
LG	1.087	1.082	0.5%	0.685	0.676	1.3%

Phone Used	Area Scan Peak SAR (W/kg)		Decrease (Increase) of SAR	Zoom Scan Peak SAR (W/kg)		Decrease (Increase) of SAR
	NO Polymer	MRET Polymer 180 mg		NO Polymer	MRET Polymer 180 mg	
Kyocera Wireless	0.798	0.730	8.5%	0.870	0.840	3.4%
LG	1.275	1.222	4.2%	1.641	1.651	(0.6%)

SAR standard for Muscle Tissue
1.6 W/kg (mW/g) averaged over 1 gram
SAR standard for Muscle Tissue
2.0 W/kg (mW/g) averaged over 10 gram

gelling agent and saline solution. Preservation with a bactericide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired simulated tissue.

The APREL Laboratories ALSAS system with a dosimetric E-field probe E-020 was used for the measurements. The dipole was mounted so that the dipole feed point was positioned below the center marking of the flat phantom and dipole was oriented parallel to the body axis (the long side of the phantom).

The standard measuring distance was in the range of 10mm from the dipole center to the solution surface. The coarse grid with a grid spacing of 10mm was aligned with dipole. The 5x5x8 fine cube was chosen for the cube integration. The dipole input power (forward power) was 250 mW ± 3%. The results are normalized to 1W input power. The laboratory environment conditions were as follows during the calibration sequence:

Ambient Temperature of the laboratory: 22 °C ± 1.0 °C
Temperature of the Tissue: 20 °C ± 1.0 °C
Relative Humidity: 41%

The investigation was conducted on cellular phones: Sanyo Model PM-8200(S) S/N 2D29555E, Kyocera Wireless Model 2325 S/N 457E8CE6, and LG Model VX6000 S/N 12KS030845; TX frequency range: 824.70 - 848.31 MHz and 1851.25 – 1908.75 MHz; Maximum RF output: 23 dBm conducted; Signal modulation: CDMA; Antenna type (length): Standard with each model; Weight of MRET polymer compound applied to each RF phone:

Table 2. SAR Date Summary – 1900 MHz Head.

Measurement Results Frequency 1880 MHz, Channel 600, Modulation CDMA, Battery Standard						
Phone Used	1 gram SAR value (W/kg)		Decrease (Increase) of SAR	10 gram SAR value (W/kg)		Decrease (Increase) of SAR
	NO Polymer	MRET Polymer 180 mg		NO Polymer	MRET Polymer 180 mg	
Kyocera Wireless	1.039	1.033	0.6%	0.588	0.586	0.3%
Sanyo	1.545	1.454	5.9%	0.959	0.841	12.3%
LG	0.875	0.635	27.4%	0.540	0.391	27.6%

Phone Used	Area Scan Peak SAR (W/kg)		Decrease (Increase) of SAR	Zoom Scan Peak SAR (W/kg)		Decrease (Increase) of SAR
	NO Polymer	MRET Polymer 180 mg		NO Polymer	MRET Polymer 180 mg	
Kyocera Wireless	1.126	1.120	0.5%	1.801	1.741	3.3%
Sanyo	1.751	1.652	5.7%	2.542	2.372	6.7%
LG	0.922	0.907	1.6%	1.451	1.030	29.0%

SAR standard for Muscle Tissue
1.6 W/kg (mW/g) averaged over 1 gram
SAR standard for Muscle Tissue
2.0 W/kg (mW/g) averaged over 10 gram

180 mg.

The wireless mobile phones have been evaluated in this experiment for localized specific absorption rate (SAR) for controlled environment/occupational exposure limits [ANSI/EEE, 1999; ANSI/EEE, 2002] and had been tested in accordance with the measurement procedures specified in IEEE 1528-2003 and OET Bulletin 65 [Federal Communications Commission, 2001]. The RF phone was placed into simulated transmit mode using the manufacturer's test codes. Such test signals offer a consistent means for SAR and are recommended for evaluating of SAR data. Each SAR measurement was taken with a fully charged battery. In order to verify that each phone was tested at full power, conducted output power measurements were performed before and after each SAR test to confirm the output power. SAR measurement results were obtained, analyzed and compared to provide the scientific conclusion of the experiment.

EXPERIMENTAL RESULTS

This investigation provides the following results of SAR measurements: "Hot Spot" Area Scan Diagrams, NO MRET polymer material and Applied MRET polymer material.

The analysis of "Hot Spot" Area Scan data provides evidence that the incorporation of 180 mg of MRET polymeric material in the RF phones in this experiment does not change location of "Hot Spot". The "Hot Spots" remain in the same location as without the MRET polymer and their amplitudes decrease in 90% of data points. Results were calculated and analyzed by using the FCC proprietary software

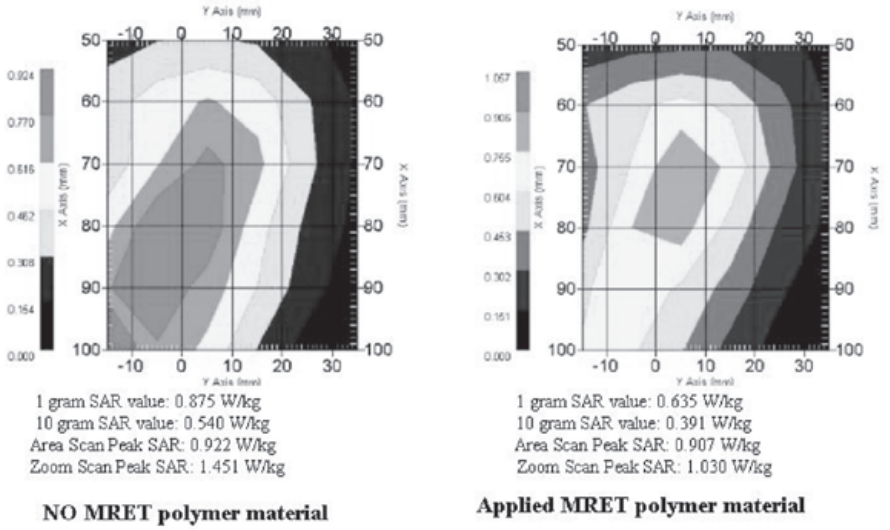

Figure 8. *Phone Model: LG VX6000; Frequency: 1900.00 MHz; Max. Transmitted Power: 0.256 W; Phantom data: APREL-SAM Left Ear; Probe Sensitivity: 1.20 1.20 1.20 μV/ (V/m)².*

program which prevents any possible manual modification of the results. Figure 8 provides evidence that 1 gram SAR value with MRET polymer is lower by 27.4% compare to control, and 10 gram SAR value with MRET polymer is lower by 27.6% compare to control result.

The Standard Uncertainty for the Area Scan and Zoom Scan Peak SAR values is 18.6%. The level of Uncertainty for the mean values of SAR for 1 gram of tissue is 6.6% and for 10 gram of tissue is 2.8%, [Moulton, 2006].

CONCLUSIONS

The measurements in this investigation are taken to simulate the RF exposure effects under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The tested RF phone complies with the requirements in respect to all parameters subject to the test.

The application of MRET polymer to RF phones does not significantly affect the air measurements of RF phone signals and subsequently does not lead to any significant distortion of transmitted RF signals. In each experiment SAR values were measured in 242 points of "phantom head." The incorporation of 180 mg of MRET polymer material in the RF phones showed that "Hot Spots" remained in the same location as without the MRET polymer and their amplitudes decreased in 90% of data points. In 70% of data points was observed the significant decrease of SAR values in the range of 10% to 60%. The incorporation of MRET polymeric material in the RF phones leads to the reduction of the majority of SAR values: 19 SAR values out of 20 meaningful SAR values in this experiment were reduced in the range of 0.3% – 29.0%, and only 1 SAR value increased by 0.6%.

The reduction of SAR values calculated on the basis of E-field probe measurements inside the "phantom head" confirms that the subtle low frequency oscillations generated by MRET polymer material actually increase the value of dielectric permittivity of the simulating brain tissue jelly resulting in the reduction of SAR values in the "phantom head."

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