

EXPERIMENTAL STUDY OF MM-RANGE RADIATION FROM CERTAIN OBJECTS

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Abstract: The measurement and experimental results of mm-range radiation from some objects are described. Amplitude-frequency characteristics are given for radiation of three objects within frequency range of 53–64 GHz as well as characteristics of response of water and a human body to low-intensity radiation signal. There were registered "resonance absorptions" at certain mm-range frequencies which exhibit themselves by 10–30 times increase of absorbing ability of a human skin.

Key words: radiometric system, radiation, irradiation, "resonance absorptions".

The development of technical basis of the microwave resonance therapy (MRT) is directly connected with constant decreasing of the therapeutic level of radiation of the medical equipment that is now of the order of $10^{-18} - 10^{-20} \text{ W/Hz} \cdot \text{cm}^2$. Such magnitudes are typical for the devices "Porig-3", "Porig-3M", "Harmoniya", "ARIA-SC" and others.

The efficiency of just low levels of action is confirmed by experiments with the simplest biological objects, results of treatment of many human diseases and experimental studies in the physics of the alive field.

Even in 1994, by the perspectives of development of the MRT and quantum medicine it was anticipated to reduce therapeutic levels of the spectral density during courses of treatment up to $10^{-20} \text{ W/Hz} \cdot \text{cm}^2$ [1]. Utilization of such class of medical equipment required developing of the highly sensitive metrological measuring systems of the radiometric type [2, 3] and formed a basis for their further improvement. Developing of individual unit of the radiometric system with usage of a new elementary basis and microminiaturization provided possibility for increasing the system sensitivity by approximately two orders. The expansion of scientific studies within the quantum medicine field and utilization of the developed systems provided the direct instrumental registration of the human radiation in the mm-range [4] and the study radiation levels and parameters of absorption and reflection by the biological and physical objects-liquids, heated solids and other sources of the low and high temperature radiothermal radiation.

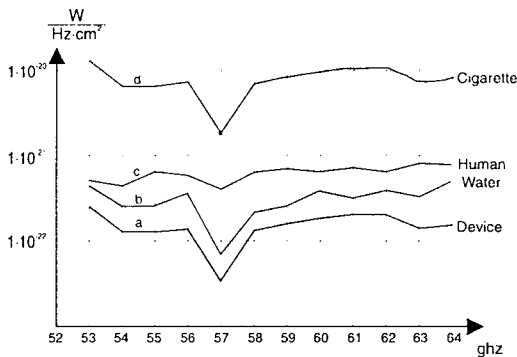


Fig.1 Amplitude-frequency properties of different objects

Registration of the human radiation was carried out with the help of the radiometry device with a limiting fluctuation sensitivity $\approx 0.5 \cdot 10^{-22}$ W/Hz. The level of human eigen radiation is within $10^{-21} - 10^{-22}$ W/Hz \cdot cm². An error of determination of the radiation level depends on the metrological possibility of a radiometry system and equals approximately $\pm 25\%$ [3]. Depending on a human individual state and a point of measurement, the radiation level can differ up to 3 times. The experimental checking of frequency properties of the human radiation confirmed its existence within the wide band of mm-range frequencies from 37 to 78 GHz. At the same time, the radiation level changes slightly depending on the radiation frequency.

Figure 1 shows the results of measurements of amplitude-frequency properties of some objects obtained with the help the developed device.

Figure 1a depicts the gauge characteristics of the measuring device at 53–64 GHz. The radiation level of water heated up to 36–37 °C is shown in figure 1b. This radiation possesses a uniform distribution. The amplitude-frequency characteristic (AFC) repeats basically AFC of the device gauge characteristic. The water radiation level lies within the range of $(10^{-22} \div 10^{-21})$ W/Hz \cdot cm².

Figure 1c corresponds to the human radiation (patient M.) in a frequency range 53–64 GHz. In fact, this distribution is not uniform taking account of the device gauge characteristics and a bit higher than the water radiation level. In our case the studied object radiation level is within the range of $(1.0 \div 0.6) \cdot 10^{-21}$ W/Hz \cdot cm².

The graph of distribution of radiation of the wormwood cigarette radiation that is used in the oriental medicine for heating of acupuncture points is located somewhat upper (figure 1d). The wormwood cigarette AFC shape completely repeats the gauge characteristic of the measuring device and possesses a uniform distribution within the range under investigation. The radiation level of the wormwood cigarette, as one can see from Fig. 1d, is approximately $1 \cdot 10^{-20}$ W/Hz \cdot cm² that considerably exceeds the level of a biological object, i.e. human being.

The study of the amplitude-frequency characteristic of a typical cigarette shows the complete coincidence in shape and level with the corresponding characteristics of the wormwood cigarette.

The absorptance and reflection ability of the objects were studied with the help of the measuring diagram presented in Fig.2.

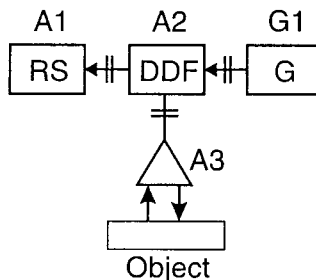


Fig.2 Measuring of absorptance and reflection ability of objects

- G1 is the generator of irradiating signal;
- A1 is the radiometric measuring system;
- A2 is the distribution device of electromagnetics flows;
- A3 is the receiving-transmitting antenna;
- O is the object under investigation.

The natural radiation of object is coming to the receiving antenna A3 and is directed to the radiometric system A1 through the distribution device of electromagnetic flows A2. The indicator RS records a magnitude of the object's proper radiation. When generator G1 is switched on, a signal (noise or monochromatic) is given to the object through the distribution device and antenna. If the object absorbs a radiating signal of the generator, the indicator reading does not change. Increasing in the generator irradiation level results in increasing of a power magnitude of the indicator which records the sum of proper and reflected radiation. With the help of the RS and the attenuator included in the channel of irradiating signal the level of absorption and reflection is measured.

Figure 3 illustrates the result of study of the water reaction (at a temperature 36°C) and a human palm on irradiation by a noise and monochromatic signal.

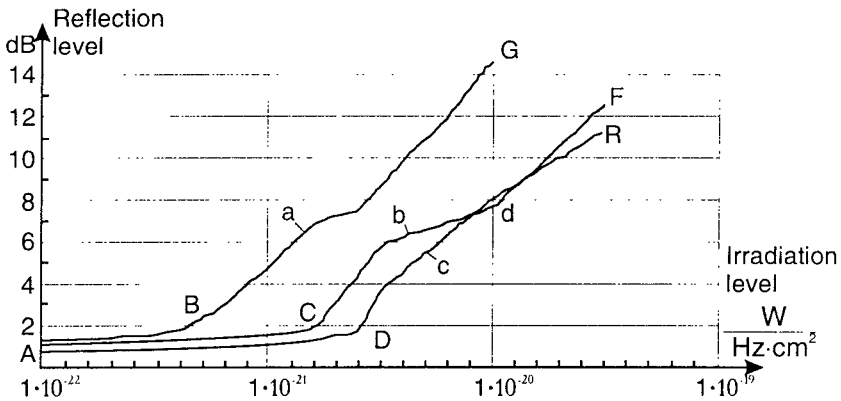


Fig.3 Reaction of water and human palm

Basically the graph shows the absorption and reflection properties of these objects. Epure 3a and 3b illustrate the water reaction when irradiated by noise and monochromatic signals and epure 3c is a reaction of a human palm to irradiation by monochromatic signals.

Analysis of graphs shows that on increasing the level of irradiation signal the process of signal energy absorption takes place first (sections AB, AC and AD). And here, from graph 3c it is seen that a human skin possesses a considerable absorptance revealing in the fact that even with ten-fold increase of irradiation signal the skin absorbs well, than follows a reflection phase stage (sections BG, CF and DR). The latter testifies to the existence of protective reactions of biological objects to the irradiation level higher than their eigen radiation.

Probably, at the considerable levels of irradiation an organism loses the ability to reflect the external irradiation that results, in many cases, in heating of biological objects and further destructive changes (oppression of a bioobject,

violation of thermoregulation, affection of cells). We note that namely the UHF-heating is used in the conventional medical practice by the ultrahigh frequency therapy [5] with application of devices in a frequency range of 27–300 MHz with power up to 300W and short-term irradiation of biological objects.

Our study of the absorption and reflection properties of human skin in a range of millimeter waves shows that the considerable absorptance (with the dynamic range of an irradiating signal up to 10–14 dB) takes place only at particular, the so called, resonance absorption frequencies. At other frequencies the absorptance of the skin is insignificant (the segment AD is narrowed) or absent completely. In other words, at these frequencies we observe sharp increasing of the reflection properties of human skin.

The results of experimental study obtained when measuring of the absorption and reflection ability of human skin and a level of the human proper radiation expand possibilities of standardization of the medical regimes of the MRT methods of treatment and form the basis for development of a new medical and diagnostic equipment in a millimeter range.

ЕКСПЕРИМЕНТАЛЬНЕ ДОСЛІДЖЕННЯ ВИПРОМІНЮВАННЯ ДЕЯКИХ ОБ'ЄКТІВ В ММ-ДІАПАЗОНІ

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В статті подаються результати вимірювання та дослідження випромінювання деяких об'єктів у міліметровому діапазоні. Наведені амплітудно-частотні характеристики випромінювання трьох об'єктів у діапазоні частот від 53 до 64 ГГц, а також характеристики реакції води та людини на низькоінтенсивний опромінюючий сигнал. На певних частотах мм-діапазону зафіксовані "резонанси поглинання", які виявляються у 10–30-кратному збільшенні поглинальної здатності шкіри людини.

ЭКСПЕРИМЕНТАЛЬНОЕ ИССЛЕДОВАНИЕ ИЗЛУЧЕНИЯ НЕКОТОРЫХ ОБЪЕКТОВ В ММ-ДИАПАЗОНЕ

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В статье представлены результаты измерения и исследования излучения некоторых объектов в миллиметровом диапазоне. Приведены амплитудно-частотные характеристики излучения трех объектов в диапазоне частот от 53 до 64 ГГц, а также характеристики реакции воды и человека на низкоинтенсивный излучающий сигнал. На некоторых частотах мм-диапазона зафиксированы "резонансы поглощения", которые проявляются в 10–30-кратном увеличении поглощающей способности кожи человека.

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