POWER MANAGEMENT FOR TELEMETRY ACQUISITION PHYSIOLOGICAL SIGNAL SENSOR

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Abstract— **This paper discusses a severals powers sources wich allow to power wirless acquisition system, it also shows that our sytem need to be sypplyed with RF waves.A limit of wirless standard to transfert this energy depends of maximum power authorized by several organisation such as europeen reglementation.and finally a description of rectenna circuit adopted for our wirless acquisition system.**

I. INTRODUCTION

Our System called T.A.S [1] is module which allows acquisition of the small signals with low frequencies such as the physiological signals (EEG, EMG, ECG), this system is protected with pattern [2]. It is wirless system, which decreases the influence of the interfering signals coming from the electrical supply network on the signals used, however it needs an important electric consumption and oblige us to search a solution to feed it. The need for a strong consumption of energy makes the use of the batteries insufficient for a long duration of transmission (few hour). The solution to seek another source.

II. THE SOURCE OF ENERGIES

Energy is necessary for the electronic system operation, it exists several sources of energy, a most promising sources of energy are the solar sources (use of the solar panels by photovoltaic effect) the electromagnetic sources (the electromagnetic wave) and the sources generated by the human body [**?**] which is illustrated table I:

Let us recall that this energy is spent by a person who practises the activities mentioned in the table. Other sources of energy which one can recover of the human body: Thermal energy: Recovered energy depends on different thermics between the temperature body and, ambient temperature example: the module thermo life which cans provide at a temperature of 5 a voltage of 3V and energy of 30W.In temperature at 10,its provides a voltage of 5,5V with energy of 135W
Energy recovered by breathing: One can obtain until 1mW Energy recovered by the movements: several activities will be able to provide us energy like the movement of the arm up to 1,5 W. Several technics are used for the energy recuperation: thermo-electric, piezoelectric, pressure .....

Energy by magnetic wave: The electromagnetic wave transports energy, in this idea the wirless systems of transmission energy were built.(Example the basin of the meeting). In our case the choice was made on this technic, considering that other systems did not enable us to have the power in reception which respects our specifications (33dBm) [1]. Thus the idea is to use the antennas used in various standards and existing on the market and to verify if it's possible to use them to feed our system and to reload the batteries.

III. VARIOUS STANDARDS OF TELECOMMUNICATION

There are several standards of telecommunication which allow a transmission by magnetic waves, according to requirements' in data rate, distance and installations costs of application.

knowing that the modulations replace the numerical data by symbols, the energy's symbol transmitted is more important than energy binary symbol The table below gives examples of energy of Phase Shift Keying modulation (PSK) [4] and Quadratique Amplitude Modulation (QAM) [5]. It is also clearly that to increase the data rate is necessary to increase the number of symbol transmitted

TABLE I: humain source energy

Activities	energy
sleep World	70
To eat a meal	110
Conversation	110
To drive a car	140
To do the housework	150
To run km/h	350
To swim	500
To climb a mountain	600
To To make a sprint	1400

TABLE II: relation between a transmission energies and modulations

Modulation	Symbol's energy	Binary's energy
PSK-2	A2	A2
PSK-4	A2	A2/2
PSK-8	A2	A2/3
PSK-16	A2	A2/4
QUAM-4	2 A2	A2
QUAM-16	10 A2	5 A2/2
QUAM-64	64 A2	7 A2
QUAM-256	170 A2	85 A2/4

TABLE III: wireless's technologies

Network	Coverage	Data Rates	Mobility	Cost
Satellite	World	144 kb/s	High	High
GSM/GPRS	Aprox 35 km	144 kb/s	High	High
UMTS	20 km	2 Mb/s	High	High
HipeRLAN 2	70 to 300 m	25 Mb/s	Medium	Low
IEEE 802.11a/g	50 to 300 m	54 Mb/s	Medium	Low
IEEE 802.11b	50 to 300 m	11 Mb/s	Medium	Low
Bluetooth	10 m	700 kb/s	Very low	Low

per seconds on the other hand to increase energy see table II.

the table III which summarizes the principal standards using different modulations:

Taking the case of the standard IEEE 802.11a/g [6] to reach the data rate at 54 Mbps, it's must to associate the CCK [7] with the OFDM [8].

IV. Power of transmission and health

The standards mentioned in the table below use the electromagnetic waves to transmit information, this information is sent in the form of power which passes through the environment and which cans endanger human health. Thus a telecommunications standards establish the emission power limit in order to cure this major problem it. There are two ways to evaluate this limit of transmission for the large public one: a evaluation of the specific flow of absorption (DAS): it is a method used to evaluate levels DAS coming from a device by means of measurement techniques physical or data-processing modeling [9]. Evaluation DAS is necessary if the distance from separation between the user and the device is lower or equal to 20 cm. It relates to the quantity of energy RF absorptive by fabric, by unit of mass.

Evaluation of exposure to the RF: Method used to evaluate the levels of exposure to the RF emitted by a device. The evaluation of exposure to the radio frequencies is necessary if the distance from separation between the user and the device is higher than 20 cm. It relates to the measurement of the electric field, a magnetic field or a density of power. See table IV

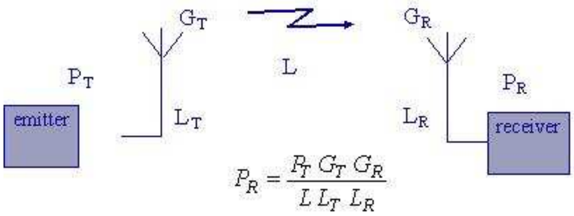

Fig. 1: transmission chanel

V. A COMPARISON BETWEEN STANDARDS AND THE EXPOSURE

The limit of intensity of the fields is expressed by:

$$f = 300Ghz \sum\limits^{=} 3GhzRf \leq 1$$

Where F is the frequency where the density of power is measured: RF = (measured Value of the density of power with F)/(Limit of exposure of the density of power F) [10]. The table which summarizes the limits of exposures to waves RF is as follows:

taking account of the antennas available on the market, the outputs of these antennas are highlighted in the calculation of the power of emission.in figure 1

$$PR = PT * GT * (lambda/4 * p * d) * Gr.(1)$$

where:
PR power reception (dBm)
PT transmission power(dBm)
GT et Gr mission en reception gain (dBi)
lambda/ 4 p d terme qui exprime les pertes en espace libre.(f en MHz et d km)
With in isotrop receptor GR =1.
Equation (1)we extract the relation which expresses the power of emission according to the other term one a:

$$PT = PR/GT * (\lambda/4\pi * d) * Gr(2)$$

$$PTdBm = PRdBm + GdBi - 32,5 - 20 - 20 * LOG10(f).$$

Electric field calculation :

$$E = \sqrt{(30 * PT * GT)/d}$$

TABLE IV: field and power density limitations

Frequancy(Mhz)	Electric field intensity (V/m)	Magnetic field intensity (A/m)	power density (W/m2) (W/m2)	Time (time until the avrage value is calculated) (min)
0.003-1	600	4.9		6
1-10	600/f	4.9/f		6
10-30	60	4.9/f		6
30-300	60 to 300 m	0.163	10*	6
300-1500	3.54f0.5	0.0094f0.5	f/30	6
1500-15000	0.0094f0.5	0.364	50	6
15000-150000	137 m	0.364	50	616000/f0.5
150000-300000	0.354f0.5	9.4x10-4f0.5	3.33x10-4f	616000/f0.5

The table V expresses the power of emission according to standards' of telecommunication at a distance from 100m and a power of reception chosen with 33dBm:

TABLE V: Field and power density limitation

Standard	Emission antenna gain	Emission power
RF-ID 870 MHz	9	88
Systme 1.4 Ghz	15	93,4225607
	17	91,4225607
	18	90,4225607
	19	89,4225607
Systme 2.4 Ghz	9	92,1042248
	18	94,1042248
	21	95,1042248
	19	104,104225
Systme 5 Ghz	6	113,4794
	17	102,4794
	24	95,4794001
	26,5	92,9794001
Systme 2.4 Ghz	9	104,104225
	18	95,1042248
	21	92,1042248
	19	94,1042248

The calculation of the EIRP emitted effective power obtained is not in conformity with the regulation of telecommunications. Taking of account of equation which gives electric field according to a distance from 100m:

$$E2 = (30 * Pe * Ge)/d2$$
$$E = \sqrt{(30 * Pe * Ge)/d2}$$

The values of field are more important than those which are authorized, very large different is on the level of the European or Canadian regulations, beyond frequency 100 MHz the value of the field exceeds both regulations. Thus the frequency chosen in our application does not exceed 100Mhz see table VI. One making calculation reverses and holding you of account the field of 28V/m power received from 33dBm distance from 100m one obtains the maximum values of EIRP = 84,17dBm and a frequency of 86Mhz.

VI. A COMPARISON BETWEEN VARIOUS TYPES OF RECTIFIERS

The TEFS system of recuperation of energy by magnetic wave (rectenna) is composed of the antenna for the reception of the wave magnetic, rectifying, the filter HF to eliminate the harmonics created by the diodes which constitute the rectifier, filter cd [11] .All this blocs are illustreted in figure 2 in reception.

Conversion AC/DC transforms the energy transmitted by the magnetic wave into a continuous tension being able to be used to feed an electronic system or to charge of the battery.

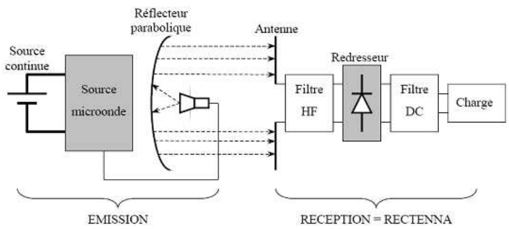

Fig. 2: rectenna

the most important element in the chain is the rectifier. two assemblies are proposed for rectification, a simulation was made to choose the best assembly in term of output efficiency: The both graphs illustrate the simulation of double alternation circuit and voltage multiplier circuit. Our choice was made on voltage multiplier because its represented un best power efficiency,compared with double alternation circuit see figure **??**end figure 4.

TABLE VI: field electric limitation

Standard	Frquence Mhz	rsult	champ lectrique limit par la rglementation europenne V/m	champ lectrique limit limit par la rglementation canadienne V/m
	27	88	28	60
	100	32,6257593	28	60
RF-ID	433	141,269538	39,34	73,66
RF-ID	1400	456,76063	51,44	132,45
Systme 2.4 Ghz	2400	783,018222	61	137
Systme 5 Ghz	5000	1631,28796	61	137

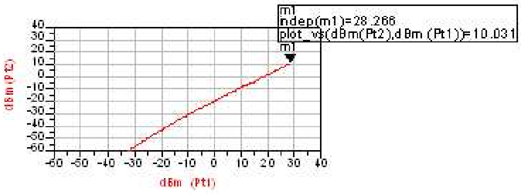

Fig. 3: simulation of power reception with double alternance circuit

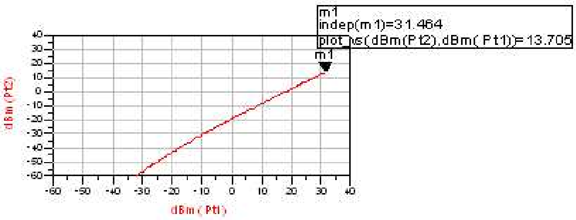

Fig. 4: simulation of power reception with voltage multiplier circuit

VII. Conclusion and prospect

our applications which require a power of 33 dBm, the antennas functioning in the standards of telecommunication known such as the RFID, WiFi required a power (EIRP) which exceeded the regulations established by the organization of telecommunication. And consequently, the resulting magnetic field exceeded that limited by the evaluation of exposure to fields RF. The regulations established in Canada and in Europe differ in term of limitation value of exposure from the electric fields, by taking account of the regulations in Europe, the minimal frequency which enables us to have an electric field beyond the limiting values, does not exceed 86 MHz. One knowing that the length of antenna depends on the frequency of use.

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