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Base Station Power Requirement Analysis For Maximized Performance Level For Wcdma Based 3g Services

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Abstract: *In recent years many Radiation Measurement at various places have been carried out at various types with different traffic rate and sizes. The new topology analysis an output power level distributions of radio base stations (RBSs) and user devices connected to a WCDMA based 3G mobile communication network and relate the results to realistic human exposure to radio frequency (RF) electromagnetic field (EMF) emitted by the corresponding RBSs and the devices. The output power level distributions have been obtained through network-based measurements. This impact on different source signal in which power level will be analysed and proved. In order to analysis the impact of discontinuous transmission (DTX) is taken into consideration with distance metric based energy consumption. And noted that on high traffic rate video based transmission leads the measured radiated power is very high and also stable even at high normalized power with an ideal WCDMA modulation type.*

I. INTRODUCTION

Human exposure to radio frequency (RF) electromagnetic fields (EMF) is directly proportional to the output power of the radio transmitters. Before radio base station (RBS) equipment and user devices are placed on the market they are tested by the manufacturers to make sure that the RF EMF exposure is in compliance with internationally recognized exposure limits, such as the ones specified by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Also network operators conduct EMF compliance assessment of RBS installations before they are put into service. According to most RF EMF compliance assessment standards developed by the International Electrotechnical Commission (IEC) and the European Committee for Electrotechnical Standardization (CENELEC), continuous transmission at the maximum available power shall be assumed during the assessments of radio products.

In practice, however, the actual power levels depend on different factors, such as fast and advanced power control mechanisms, soft handover, traffic variations, and discontinuous transmission (DTX). This implies that the standardized RF exposure assessment procedures provide a conservative estimate of the actual exposure, which is further emphasized by the fact that the ICNIRP exposure limits for mobile communication frequencies are intended to be taken as an average over 6 min. For realistic exposure assessments of interest (e.g. epidemiological investigations), it is of fundamental importance to have knowledge on the actual output power levels in real usage scenarios for RBS equipment and user devices. A possible method for quantifying the actual power levels used by RBSs in downlink is to conduct network based measurements. Network-based measurements of downlink and uplink output power levels have been conducted in a 3G Wideband Code Division Multiple Access (WCDMA) network.

In WCDMA systems, information is spread over a relatively wide bandwidth, which increases robustness of the system to interference and thus leads to a reduced average output power for terminals compared with systems like GSM that do not make use of this spreading . A fast closed loop power control mechanism is implemented in both uplink and downlink at the rate of 1500 Hz to keep interference at a minimum level. Furthermore, an open loop power control algorithm is implemented in uplink, to estimate an appropriate power level when a connection is initialized. Another feature of WCDMA is so called "soft" and "softer" handover, which allows the output power in uplink to remain low as the device moves from one cell to another.

II. METHODS AND MATERIALS

In-situ measurement and test terminal measurement are used for downlink and uplink. Both In-situ measurement and test terminal measurement are quit time consuming and allow the limited of samples. A new measurement technique name network based measurement is employed for network management. Each cell corresponds to a geographical area in which 3G user devices have access to the radio signals emitted by a RBS transmitter in a specific UMTS channel. The cells are sorted into one of the categories depending on the environment in which they are located.

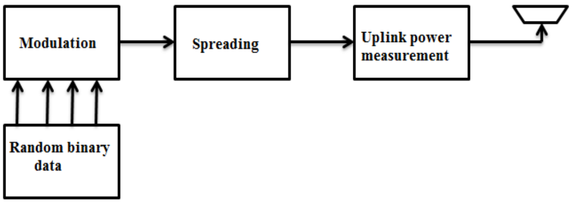
A. Design of WCDMA signals

The UMTS has been assigned frequencies in the 2.2 GHz band, 5 MHz for uplink and 5 MHz for downlink transmission and therefore in the following we assume a sample frequency of 5 MHz A proper design of a radio interface based on WCDMA depends on the characteristics of the radio environment in these bands. For the evaluation of the UMTS, ETSI has developed a set of channel models that describe the environment for different transmission situations (indoor, pedestrian, vehicular) The system should typically use in all these environments and therefore design on the worst values for the Doppler frequencies and channel delay spreads.

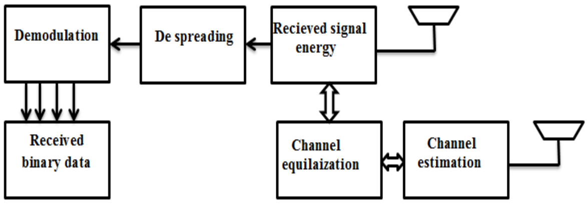
Since the effects on the system performance of violating either the left or right hand requirement are different, it is not obvious how to choose N. One possible design could be, for instance, the geometric mean of the boundary values: A typical UMTS radio interface thus could use 1024 subcarriers implemented with a 1024-point FFT.

The length of the cyclic prefix must be larger than the channel impulse response. A possible design example of a 64-sample cyclic prefix (12.8 micro sec) leads to a reduction of the data rate and transmission power of 6%. If we modulate each subcarrier with a QPSK symbol, we have b=2 bits per subcarrier giving us an overall raw data rate of 9.4 Mbits/sec. Similarly, an extension to 16-QAM symbols would give 18.8 Mbits/sec raw data rate.

B. Block diagram



3.1Transmitter side



3.2 Receiver side

B. Downlink Measurement

An RBS counter, which provides the transmitted carrier power at the antenna reference point as a percentage of the maximum allocated power to the antenna, was used for the downlink measurements. The sampling time of the counter is 100 ms, and every sample constitutes an average during the sampling period. Each sample was sorted into one out of 50 possible bins (ranges) and the range counter for the corresponding bin was incremented accordingly. The statistical data was fetched by the OSS-RC from the RBS every 15 min corresponding to the smallest possible result output period (ROP).

MATLAB was used to post-process the data acquired by the OSS-RC. The number of samples in each bin was multiplied by the mid-value of the corresponding counter range, and the resulting numbers were summed.

C. Uplink measurement

In the uplink, the post-processing of the collected samples was done in MATLAB. The number of samples from all the cells was summed for each range counter, in order to get the probability density function (PDF) for all terminals. The cumulative distribution function (CDF) was determined conservatively from the PDF by setting the power level of all samples to the upper limit of the corresponding counter. Continuous CDF curves were determined from discrete CDF values, using the Walsh- Hadamard code in MATLAB.

III. RESULT AND DISCUSSION

A. MS location over coverage area

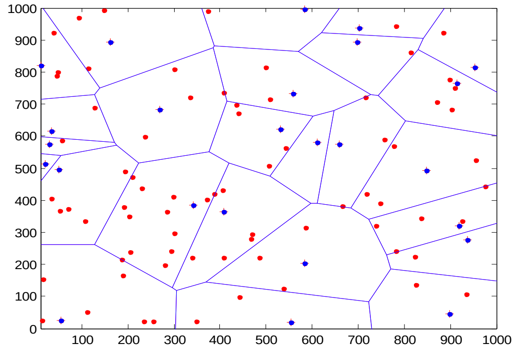


Figure 4.1: MS placement over different BS locations

In order to influence of Traffic Variations on RF exposure to Wireless Signals in Realistic Environments number of MS in each area is changed randomly as like real environment. Here real exposure of RF from each BS is compared to the maximum assessment imposed by all MS in that coverage area to characterize the ratio between maximum theoretical values over MS traffic rate.

B. RF maximum power point

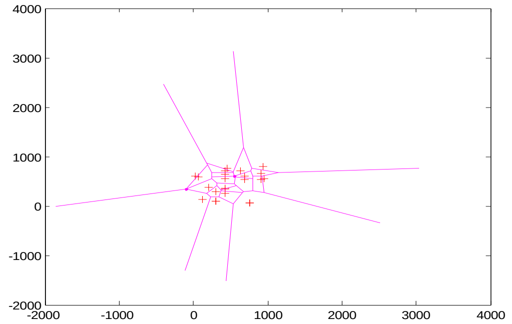


Figure 4.2: RF maximum power point

Figure 4.2 has analyzed proved that RF field strength for WCCDMA based 3G MS emissions remain relatively constant over the average and uniform traffic rate. Here for analysis of the real transmitted and received powers for WCDMA services in different configurations MS traffic over all areas. A worst case RF exposure will be occurred with maximized correlated factors of various MS traffic signals but the occurrence probability of this is very less.

C.Packet arrival rate to RF base station

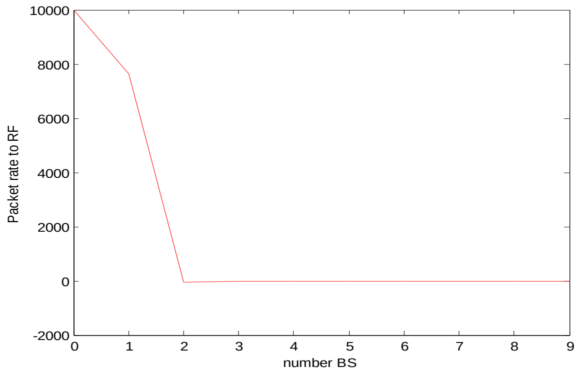


Figure 4.3: Packet arrival rate to RF base station

Figure 4.3 perform a power controls both the BS and the MS can be act as uplink and downlink. It uses BS as a downlink and signal transmission is done with MS. When number of BS increased the traffic rate over each BS from MS will gone down that will decrease average packet rate reduction when transmitting to the BS and finally the value of emitted radiation will also lower.

D. CDF level reduction over MS rate

Figure 4.4 has analysed the power level in the BS by considering the MS as a uplink module where transmitter used WCDMA method for signal transmission. Increase in MS rate when transmitting RF modulated signal to the BS will lead considerable power fluctuations in RF level and finally the value of emitted radiation will nonlinear with MS rate.

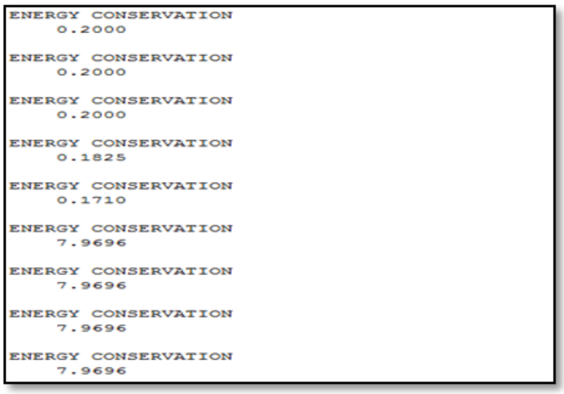

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Figure 4.4: CDF level reduction over MS rate

E. Impact of source signal over rf exposure level

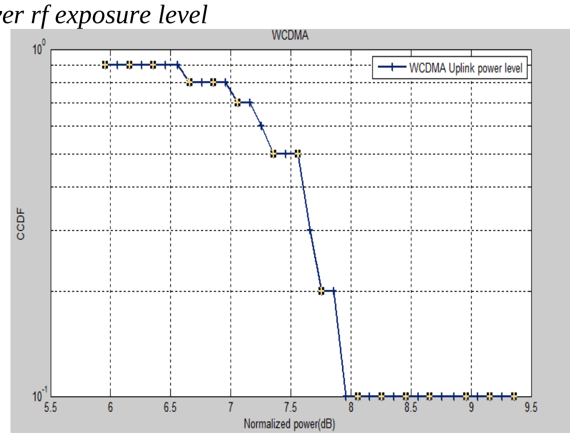

Figure 4.5: RF exposure over user source of video

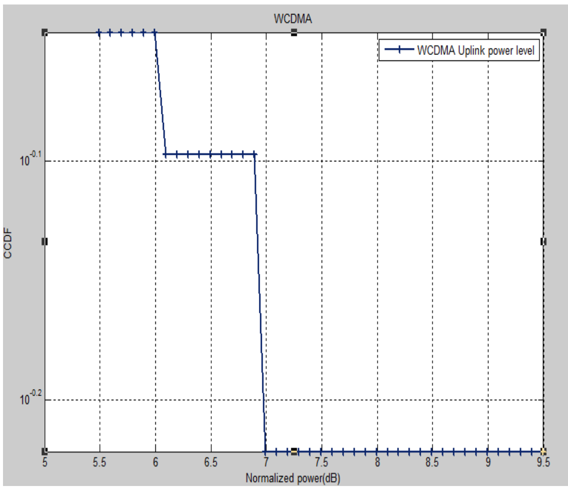

Figure 4.6: RF exposure over user source of audio

Figure 4.6 analysed the performance of WCDMA in terms of RF exposure with different type of input signal characteristics which is proved that if source signal has continues signal flow like video stream leads some noticeable differences in power level. But with linear gabs in input signal will give constant power level over period of time.

IV. CONCLUSION

Output power measurements for radio base stations and mobile station in WCDMA-based 3G network is analyzed. Source signal leads some noticeable differences at power levels for different data types, a larger amount of collected data and a larger number of MS users implying a larger proportion of data traffic. The high traffic video and audio transmission rates have found to be consistent. The future work includes, the analyses for 4G networks to implements power control mechanism to reduce user device output power consumption. The power control rate in WCDMA is slower than in MC-CDMA. 4G network will be analysed using MC-CDMA based methodology.

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