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EMF SURVEY USING SRM AND NBM METER

Keyur Sudhir Shirgaonkar
Department Of Electronics & Telecommunications,
Sinhgad Institute Of Technology,Lonavala , SPPU, Pune, India
Mobile No:+919833229419

Abstract: This paper gives an idea about about how emf survey is carried about at different sites. It mainly focuses on the use of SRM and NBM meter used to measure radiation levels released through gsm antenna and the whole process of emf survey is explained in detail which gives the department of telecommunication an idea of radiation within specific area and the summary of which can be used to finalize the radiation limit and analysis of which can be helpful in making people aware of safety limit. We also evaluate and compare RF-measurement methods like field probes measurements or frequency selective methods using antennas. This system is highly efficient, accurate and economical and thus can be effectively used in measuring radiation.

GSM 1800	DCS 1800	1710-1885
GSM 1900	PCS 1900; CDMA 1900 (Code Division Multiple Access)	1850-1990
UMTS	W-CDMA (Wideband Code Division Multiple Access); IMT 2000 (International Mobile Telecommunication)	1885-2200

Keywords—SRM, NBM, Radiation, EMF Survey.

I. INTRODUCTION

EMF is a vast term which includes electric fields generated by charged particles, magnetic fields generated by charged particles in motion, and radiated fields such as TV, radio, and microwaves. The field is a lot stronger near the source and diminishes as you move away from the source. These energies have the ability to influence particles at great distances. An EMF meter can measure AC electromagnetic fields, which are usually emitted from man-made sources such as electrical wiring, while Gauss meters or magnetometers measure DC fields, which occur naturally in the earth's geomagnetic field and are emitted from other sources where direct current is present. The need of mobile communication systems has increased remarkably during the last decade and the market demand still continues to increase. The rapid growth of mobile communication systems has forced to the use of various antennas for base and mobile station applications. Currently, many mobile communication systems use several frequency bands such as GSM 900/1800/1900/2100/2300 bands (890-960 MHz and 1710-1990 MHz), Universal Mobile Telecommunication Systems (UMTS) and UMTS 3G expansion bands (1900-2200 MHz and 2500-2700 MHz). Usage of many antennas is usually limited by the volume and cost constraints of the applications. Therefore, multiband and wideband antennas are essential to provide multifunctional operations for mobile communication [1]. The types and examples of multiband antennas used in mobile communication are as follows:

Wireless Application	Alternate Description(s)	Frequency Band (MHz)
GSM 850	AMPS (Advanced Mobile Phone System)	824-894
GSM 900		890-960
GPS (Global Positioning System)		1565-1585

II. RELATED WORK

The related work for emf survey includes taking emf radiation readings at four corners of the upper roof and four corners at the ground along with its distance from antenna, identifying operator and rf cables used, including the sections, preparing the layout of the site, taking panaromic pictures of the site along with building, rooftop, signage, antennas and sector picture which are required for making standard emf report. SRM or NBM (as per requirement) meter pictures at four corner at the site roof and on the ground are taking along with safety evaluation time completed at each of the corner

III. System Design And Description

The two types of meters used during measurement of radiation are described as below:

1)Narrow Band Meter (NBM):It has Non-directional measurement using isotropic probes for applications in the frequency range 1 Hz to 60 GHz, Automatic storage of position data with GPS interface and plug-in GPS receiver, Memory for up to 5000 measurement results, Probe for spectral measurements and Weighted Peak from 1 Hz to 400 kHz. It makes extremely accurate measurements of non-ionizing radiation. It is equipped with probes for measuring electric and magnetic field strengths, it covers all frequencies from just a few Hz as found in industrial applications through to long wave and on up to microwave radiation. A probe with built-in FFT analysis enables spectral measurements in the low frequency range. These probes are calibrated separately from the field meter, and include a non-volatile memory that contains the probe parameters and calibration data. It is mainly used for used to make precision measurements to establish human safety, particularly in workplace environments where high electric or magnetic field strengths are likely to occur [3].

Fig.1) NBM-550 Meter Fig.2) NBM-520 Meter

2) Selective Radiation Meter(SRM): It is used for Selective Measurement of RF and Microwave Electromagnetic Fields. It has Isotropic and Single Axis Measurement from 9Khz to 16Ghz, Automatic Antenna and Cable Detection, Excellent immunity for Operation in High Field Strengths, Ultrawide Dynamic Range of 50 uV/m to 200 V/m. It also measures strength of single emitters in multiple emitter environments. It determines 5% boundaries for FCC Compliance. It has resolution bandwidths (RBWs) upto 20 Mhz for UMTS. The SRM has the ability to measure fields more accurately than broadband equipment and more importantly is able to give you more information that just the total-like exactly what emitter or emitters are generating most of the power. The meter is an optimized spectrum analyzer covering 9 Khz to 6 Ghz and modified to make accurate field strength reading with the help of the antenna. It is designed for outdoor use: rugged, splash proof ergonomic design and is also equipped with GPS and voice recorder to simplify survey reports. It gives results in V/m, A/m, Power Density, or Percentage of Permissible Limit [4].

Fig.3) SRM-3006 Meter

Fig.4) Test Setup for SRM-3006 Meter

IV. Implementation

The system can be implemented for workplace environments where high electric or magnetic field strengths are likely to occur. Some examples are Measuring field strengths to comply with general safety regulations, Establishing safe zones, Measuring field strengths of cell phone transmitters and satellite communications systems to demonstrate compliance with human safety standard limit values, Measuring field strengths in the industrial environment, such as plastics welding equipment, RF heating, tempering, and drying equipment. It can also be implemented by using “NBM-TS” PC software provides the functions that are - Result transfer to a PC , Result database management , Result evaluations , Device configuration management , Firmware update control , Remote controlled measurements. SRM also has special capabilities when it comes to RF safety measurement, it also has special operational modes (UMTS P-CPICH) for common engineering measurements and it also makes it simple if you want to perform safety measurement only.

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Fig.5) SRM Meter Setup in Work Place

V. RESULTS

The site layout for frequency selective measurement is shown in the figure shown below:

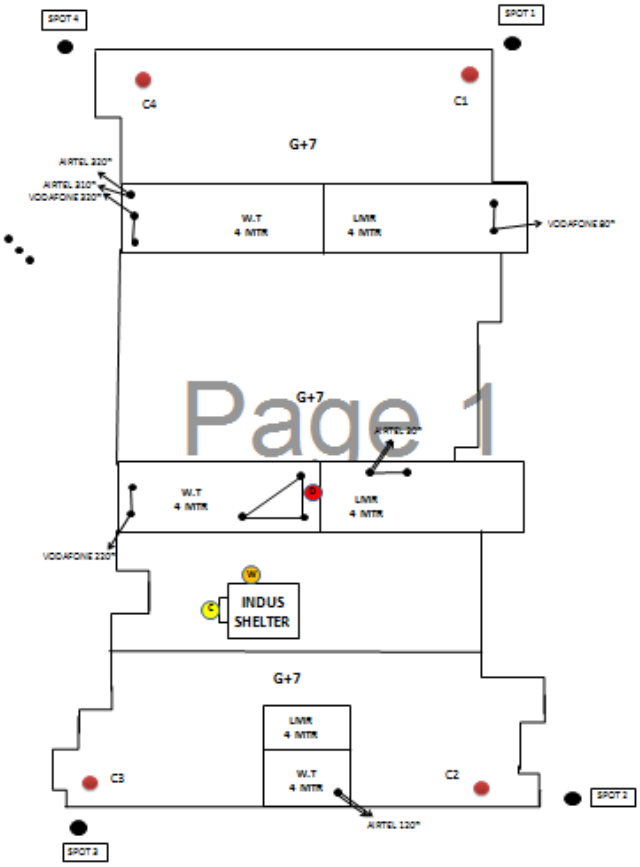

Fig.6) Site layout

The examples of the readings of frequency selective measurements will be seen as follows:-

SITE DATA	Item	Units	Vodafone 2G			Vodafone 3G		
			Sec-1	Sec-2	Sec-3	Sec-1	Sec-2	Sec-3
	Site ID		3302			3302		
	Name		Arjun Niwas			Arjun Niwas		
	Date of Commissioning		30-Aug-08			27-Aug-14		
	Address		Bhatt Lane, Poisar, Kandivali West, Mumbai-400067			Bhatt Lane, Poisar, Kandivali West, Mumbai-400067		
	Lat / Long		19.21441/72.84992			19.21441/72.84992		
	RTT / GBT		RTP	RTP	RTP	RTP	RTP	RTP
	Building Height AGL	(m)	25			25		
	Antenna Height AGL	(m)	31	31	31	31	31	31
	Make and Model of Antenna		Andrew QBXLH 6565 C-VTM	Andrew QBXLH 6565 C-VTM	Andrew QBXLH 6565 C-VTM	Andrew QBXLH 6565 C-VTM	Andrew QBXLH 6565 C-VTM	Andrew QBXLH 6565 C-VTM
	System Type (GSM/CDMA/UMTS)		GSM			UMTS		
	Base Channel Frequency	(MHz)	957.8	936.2	937.2	* 942.6/2161.5	* 942.6/2161.5	* 942.6/2161.5
	Carriers / Sector (Worst)		6	6	6	** 2	** 2	** 2
	Tx Power	(dBm)	43	43	43	43	43	43

Fig.7) Actual Site Report

VI. LIMITATIONS

SRM and NBM meter have certain limitations. They consume high power, which means battery does not last longer. It usually last for maximum of 3hrs. So we must provide an additional battery in device itself in emergency cases and also it should have power saving mode which can be helpful when the device is not in use and saves the power. This can be implemented by same technology which is used in laptops and mobile phones. It is also difficult to take into account time variation of the EMF. In NBM, noise level of shaped probe would distort the result and if significant field components in range of below 10Mhz are present so in case of doubt measurement should be done to determine field components below 10Mhz.For this purpose SRM should be used. Wi-Fi/WLAN (IEEE 802.11 a/h/j), HIPERLAN (High Performance Radio Local Area Network); U-NII (Unlicensed National Information Infrastructure) have very high frequencies (5150-5825Ghz) so they cannot be detected using an H-field/E-field antenna upto 9Khz which makes it hard observe the frequency. For this purpose we use an E-Field antenna of 6Ghz/9Ghz, three axis which makes it easy to detect such frequencies and the purpose is served.

VII. CONCLUSION

EMF radiation levels in area accessible by the people may be controlled very efficiently by measurement. As you can see there are many factors which have an impact on measurement accuracy and the selection of a measurement zone should involve proper selection of adequate tools and measurement techniques. Public concern about potential health effects of human exposure to the electromagnetic fields from modern RF-communication should be taken into consideration. Especially since the number of base stations has grown up considerably within the recent years. The explosive demand for mobile communication and information transfer using personal devices such as mobile phone or notebook computer has caused the need for major advancements of antenna design and adequate measurement equipment. This concludes our report for emf survey using srm and nbm meter.

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