



Today's technology for a sustainable future

TUTORIAL 10 EM

TITLE: Propagation of EM Waves through Seawater

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ABSTRACT

The tutorial is concerned with the propagation of electromagnetic (EM) waves through seawater. The use of EM waves has several advantages over acoustic waves, which are the main technique presently used for data transmission through seawater. These advantages are faster velocity, longer wavelength and higher operating frequency. It has been shown theoretically and by experiments that EM waves within a frequency range 1 to 10 MHz will be able to propagate distances up to 100's/m for transmission powers of the order of 100W. These properties of the EM waves allows data to be propagated with high bit rates up to 1 Mbits/sec which allows video images to be propagated at standard camera frame rates (25 Hz). A complete system has been designed and constructed. A series of EM wave propagation trials have been undertaken within both laboratory tank and open water dock trials to quantify EM wave propagation through seawater.

The tutorial will include the following topics.

Theory using Maxwell's Equations for the propagation through conductive medium

Antenna design and modeling in conductive medium using FEKO and HFSS Packages

Antenna testing in seawater

Marinised battery operated, stand alone power electronic systems

Laboratory test tank trials

Open water marina Trials

Communication electronic design and testing

Multiphase Monitoring of oil, gas and water within a pipeline

Applications

BIOGRAPHY



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Professor Jim Lucas (left) is a Professor of Electronics in the department of Electrical Engineering and Electronics the University of Liverpool. He was born in Wigan, UK on the 21st November 1936. He obtained his degrees at Imperial College University of London. During the past forty years he has worked on gases electronics. Currently he is actively researching microwave-generated plasma for material processing, spraying and food technology.

Dr. Ahmed I. Al-Shamma'a (right) is a Senior Lecturer within the Department of Electrical Engineering and Electronics. He received the Electrical Engineering and Electronics BSc degree from the University of Baghdad in 1987 and his MSc and PhD degrees from the University of Liverpool, UK, in 1990 and 1993 respectively. Since 1994 he has been working on microwave plasmas for industrial applications. His principal areas of interest are THz free electron laser, microwave plasma applications, underwater communications, spot welding and Internet and multimedia technologies