

G-46/TC6 Spectrum Update
IEEE Electromagnetic Compatibility Symposium
7 August, 2012 Pittsburgh, PA

1.0 Opening and Introductions

The IEEE Electromagnetic Compatibility (EMC) Society's technical committee on Spectrum Management (TC6) and the G-46 EMC Committee sponsored an event with a focus on Spectrum Management during the 2012 EMC Symposium in Pittsburgh. The event was entitled the "G46/TC6 Spectrum Update" and took place on the afternoon of Tuesday, August 7th. Presentations were heard on spectrum topics in the areas of design, analysis/testing compliance and current issues.

The meeting was opened by Bob Davis, Chairman of the G-46, and Karen Dyberg, Chairman of TC6, at about 1:45 pm, after the G-46 meeting concluded. Those present introduced themselves and signed a roster. There were approximately 40 attendees. The event began with a video on the importance of spectrum entitled "Spectrum Use and EMI: The Ugly Truth", followed by presentations and questions from the audience.

Available presentations will be posted with the permission of the presenter at two different locations: <http://www.geia.org/G46---Electromagnetic-Compatibility> and <http://www.emcs.org/committees/tc06/index.html>.

The presentations are summarized below in the order presented.

2.0 Presentations

2.1 Modeling and Mitigation of Wind Turbine Electromagnetic Interference by Carol Kory (QinetiQ)

Carol's presentation explained how wind farms can negatively impact electromagnetic systems (radar, nav aids, comm) and aviation operations. A team was formed and a modeling tool generated to assist with wind farm siting and issues of this sort. High fidelity modeling tools were used to quantify the impact of turbines on these spectrum dependent systems. Various mitigation methods form a 'toolbox' of solutions to reduce the potential impact. These mitigation methods can unlock large areas of land for wind farm development, which can be demonstrated through modeling.

2.2 Transmitter-in-the-Loop Optimization of Physical Radar Emissions - Sarah Seguin (University of Kansas)

Sarah explained that as the spectrum becomes increasingly crowded it is important to design spectrally efficient radars. She described research performed at the University of Kansas that utilized a combination of hardware design and signal processing that result in more spectrally efficient radars, using Continuous Phase Modulation and waveform design. Optimization occurs as physically-realizable radar waveforms are tuned to the transmitter using code to assess the emission spectra. Simulated results were presented followed by measurements of a radar test bed thereby confirming the approach.

2.3 In-Band Test Methodologies for Advanced Radios (ITMAR) - Ken Carrigan (NSWC Dalgren)

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Ken's presentation identified; issues affecting receivers, examples of various military systems, receiver types, and EMI receiver test requirements in MIL-STD-461 and 464. He went on to describe the problem areas with RS103 and CS103-105, and general receiver testing concerns.

Ken then described proposed new requirements, CS107/RS104, to test for the rejection of undesirable signals. This test would be used to verify the ability of the EUT to operate in the presence of inter- or intra- system RF emissions that are out-of-band, adjacent to, and in-band with the EUT receiver input. If the limit cannot be met then testing should identify the threshold level in performance degradation and frequency ranges, similar to distance threshold of RE101. He summarized proposed limits, procedures, and test setups. Ken would like to get a group together to discuss this issue and invites anyone interested to contact him.

2.4 Joint Radar Transmitter Circuit and Waveform Optimization for Detection, Efficiency and Spectral Confinement – Larry Cohen (Naval Research Lab) for Charles Baylis (Baylor University)

Larry Cohen presented for Charles Baylis who was unable to attend. The United States National Broadband Plan mandates the release of 500 MHz of newly available spectrum in the next 10 years. Much of this spectrum will be removed from radar systems, therefore, radars must find a way to operate in a constrained environment and minimize spectral use. Sources of spectral spreading were discussed with respect to the amplifier components. The current research effort was to create a useful design approach for joint optimization of power-amplifier circuitry and waveforms. A test bed was configured at Baylor University to develop intelligent optimization of waveform and load impedance for spectral spreading mitigation and efficiency. A joint load-impedance optimization approach was validated in simulations for linearity and efficiency. Chirp optimization simulations have shown promising results and a chirp optimization has been set up in simulation. Ongoing work involves an ambiguity-function and spectral-mask based waveform search. It is hoped that the techniques developed will ultimately be implementable in future, adaptive radar systems. A 6 month report of this effort is available from Larry Cohen.

2.5 NTIA RSEC Measurement and Analysis Procedures - Frank Sanders (NTIA)

Frank started the presentation with a general description of radars, how they operate and why we need them. He then went on to explain how radars are regulated by the National Telecommunications and Information Administration (NTIA) with regards to spectrum use and electromagnetic compatibility. He provided tips on measurement procedures to verify compliance with requirements (i.e. NTIA Radar Spectrum Engineering Criteria (RSEC)). He went on to discuss RSEC changes and developments. The NTIA is encouraging radar manufacturers and radar output device manufacturers to identify state-of-the-art capabilities as the current RSEC requirements are being reviewed and updated. The NTIA wants the RSEC requirements to be realistic. RSEC changes being considered are:

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- Adding other radars to group A which are exempt from RSEC (but have other emission requirements)
- Review of -20 and -40 dB bandwidth formulas for FM-pulse, coded-pulse, and FM CW.
- Review of emission roll-off from -40 dB bandwidth
- Proposed change to RSEC measurement reference point from antenna input (hardline coupled) to radar antenna output (radiated)
- Provide new and better official guidance related to compliance with RSEC emission masks for multi-mode and frequency-hopping radar systems

Frank concluded by discussing NTIA activities related to the International Telecommunications Union. The presentation contains his contact information and that of Robert Sole.

2.6 Simulating Dynamic Frequency Management, Interference Tolerance and Coexistence in Cognitive Radio Networks – Andy Drozd (ANDRO Computational Solutions)

Andy presented on Dynamic Frequency Management (DFM) for spectrum efficiency and sharing, Dynamic Spectrum Access (DSA) and Cognitive Radio Networks. He stressed that it is really a spectrum planning problem and that it's not just frequency that needs to be considered. There are a broad range of parameters at the signal level and the network operations level that can be used to facilitate sharing of available spectrum among users. Control of these parameters could be based on spectrum sensing and automated adaptation to allow spectrum use under changing conditions. Andy went on to show an example of DFM (demonstration) and concluded that DFM is a potential DSA solution.

2.7 RF Emissions Measurements of an Ultra-wideband Imaging Surveillance Radar - Bob Johnk (Institute for Telecommunications Sciences)

Bob presented on the Shore Line Monitoring System (SLiMs), an all weather radar system (positioned inside strategically placed poles with 10 – 15 meters between poles) used to detect intruders. The system uses Ultra-Wideband (UWB) technology and FCC Part 15 unlicensed devices. Conducted and radiated emissions measurements were performed and the system complies with the FCC limits. The key take-away is that the SLiMS system is a shared spectrum system based on UWB technology. It is a very low power system with very low potential for interference. This demonstrates that UWB as a viable spectrum sharing method.

2.8 Spectrum Attributes of Frequency-Steerable Phased Array Antennas - Sarah Seguin (University of Kansas)

Due to time constraints, Sarah did not present. This topic will be presented on Thursday morning during the Special Session sponsored by TC6 – “Evolving Trends in Spectrum Management and Engineering”.

3.0 Adjournment

The G-46/TC6 Spectrum Update adjourned at about 5:30 pm.

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Karen Dyberg, TC6 Chairman and G-46 Secretary

Robert H. Davis, G-46 Chairman

Clifford Hauser, TC6 and G-46 Vice Chairman

Sarah Seguin, TC6 Secretary