Appendix

ENGINEERING COMMENTS RELATED TO FCC ET DOCKET NO. 00-90 NOTICE OF INQUIRY

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Prepared by

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BACKGROUND

In response to the recently enacted Satellite Home Viewer Improvement Act of 1999 (SHVIA), the FCC has released a Notice of Inquiry (NOI) in ET Docket No. 00-90 to obtain information for evaluating whether the signal intensity standard used to determine the eligibility of satellite television subscribers to receive retransmitted distant signals of network stations should be modified or replaced. The existing standard uses the Grade B signal intensity values that have long been used within the television broadcast service. The FCC is seeking information and comment in the NOI on all technical parameters that could be considered to affect the quality of over-the-air reception of television programming. The FCC is also seeking information and comment on an appropriate eligibility standard for digital signals. Based on the record that will be developed, the FCC will submit findings on this issue to Congress.

APPROACH

IITRI obtained and reviewed the FCC NOI, comments and materials submitted to the FCC in previous FCC dockets, and published test analysis results provided by NTIA and the ITU. Based on the cited materials and our engineering experience and judgement, IITRI provides the following comments on the Grade B planning factors, viewer expectations, and multipath and "ghosting."

Grade B Planning Factors

The Grade B signal intensity standard is a Commission-defined measure of the strength of a given television station's over-the-air signal. This standard was developed as a component of the Commission's channel allotment process. Specifically, Grade B signal intensity represents

an electric field strength level that is enough to provide a television picture that the median observer would classify as "acceptable" at least 90% of the time in the absence of man-made noise or interference from other stations using a receiving antenna, receiver, and transmission line typical of outlying or near-fringe areas.

A Grade B signal contour represents the result of a calculation to establish the area within which a television station's over-the-air signal meets or exceeds the Grade B signal intensity standard. This signal contour is used to define a television station's geographical Grade B service area. By definition, Grade B service areas include rural areas and presuppose the use of larger, directional receiving antenna installations.

Since the Grade B signal intensity standard is the result of a calculation, values for the various environmental and technological parameters required as inputs to this calculation were established along with the signal intensity standard itself. These inputs, including the signal levels established for the standard itself, are referred to as planning factors. The current Grade B planning factors include thermal noise, environmental noise, receiver noise figure, receiving antenna gain, dipole factor, transmission line loss, and propagation factors. A listing of all of the factors and their currently assigned values for the low VHF, high VHF, and UHF bands are listed in Table 1.

These planning factors have been addressed in various previous FCC proceedings and in published broadcast television performance materials, standards, and test results. The core of the issue being addressed here is whether or not these planning factors and the values chosen for them are still appropriate for calculating the Grade B signal intensity values that are used to determine whether a household is "unserved" for purposes of SHVIA. In other words, do the current Grade B values adequately represent whether the median observer would classify a picture as "acceptable" at least 90% of the time, in the absence of man-made noise or interference from other stations, using a receiving antenna, receiver, and transmission line typical of outlying or near-fringe areas? In short, the answer is "yes." In the rest of this section, several of these planning factors will be reviewed with this question in mind.

TABLE 1 GRADE B PLANNING FACTORS			
Factor	Low VHF Channels 2-6	High VHF Channels 7-13	UHF Channels 14-69
Thermal Noise @ 300 ohms, dB/1uV	7	7	7
Receiver Noise Figure, dB	12	12	15
Signal-to-Noise, dB	30	30	30
Transmission Line Loss, dB	1	2	5
Receiving Antenna Gain, dB	(6)	(6)	(13)
Dipole Factor, dB	(3)	6	16
Local Field, dB	41	51	60
Terrain Factor (50%), dB	0	0	0
Time Fading Factor (90%), dB	6	5	4
Median Field F(50,50), dB/1uV/m	47	56	64
Urban Noise, dB	0	0	0
Required Median Field, dB/1uv/m	**47**	**56**	**64**

Urban Noise: Urban noise is generated by various man-made sources such as electrical power distribution, electric motors, industrial operations, automobile ignition systems, and consumer wireless devices. The urban noise level for *urban areas* is currently assumed to be 14 dB for low VHF, 7 dB for high VHF, and 0 dB for UHF, and this urban noise level is a factor in the Grade A signal intensity standard. However, in the outlying and near-fringe areas of concern for Grade B purposes, urban noise is considered to be 0 dB.

While, in some areas, there has been further urban development since the original noise levels were determined, there is no current measured data to show that the levels have in fact increased and, even if so, by how much. In addition, the Commission has examined the issue of urban

noise and determined that the effects are significant only for low VHF frequencies.[1] Although it could be assumed that noise levels have increased based on the extent of urban development, there has also been an increased awareness of electrical and radio noise and its impact on consumer electronic devices and, with this awareness, a concomitant increase in attempts to shield noise generators.

The FCC Technical Advisory Committee is currently engaged in examining man-made noise and its potential impact on wireless devices. This effort is currently on-going and no results are available yet. Until measured results of a study on urban noise are available, it cannot be assumed that the urban noise factor should be changed in the Grade B planning factors.

Time Fading Factor (90%), dB: The time fading factor represents the offset necessary to assure that an acceptable picture will be available at least 90% of the time at 50% of the households. This adjustment is the difference between the median value and that expected 90% of the time. Time fading is due to the changing nature of the atmosphere and is typically a long-term phenomenon. Time fading follows a log-normal distribution with the variation being symmetrical about the median.

It should be noted that increasing the time fading factor beyond the 90% value results in Grade B intensity adjustments that are no longer "log normal" in nature and result in unreliable values. In addition, it seems that availability comparisons with subscription services or expectations of better than 90% time availability may not be reasonable for a free, analog, over-the-air signal.

Terrain Factor (50%), dB: This planning factor represents the variability of the signal with location. Since the Grade B service is defined as the median with respect to location (a signal level 50% of the locations exceed and 50% do not meet), the terrain factor of 0 dB is fixed by definition.

[1] Report and Order, FCC 75-636, Television and FM Field Strength Curves.

Dipole Factor: The dipole factor provides the voltage across the terminals of a half wavelength dipole antenna in the presence of a field intensity at a given frequency. In the NOI, the FCC states that the current dipole factors are based on the geometric mean frequency of each of the three television frequency bands. This is correct, and the range of variability is approximately +/- 2.3 dB from the bottom of the UHF band to the top of the UHF band. There is little variability in the low VHF and high VHF bands. If the Commission would like to more accurately define the dipole factor to account for the variability due to frequency, the following adjustments could be made for UHF channels:

Channel	Adjustment
14-23	-2 dB
24-33	-1 dB
34-46	no change
47-59	+1 dB
60-69	+2 dB

Receiving Antenna Gain: The antenna gain serves to enhance the signal level. Thus, larger gains than those used in the current planning factors will work to increase Grade B intensity signal reception. The current planning factors have receiving antenna gains based on 1952 television receiving antenna technology. In the intervening years things have improved. The standard practice now recommended by the Commission is to use separate UHF and VHF antennas since that provides better performance than a combined UHF/VHF antenna. A 1980 study determined that the average gain for an eight-bay bowtie-with-screen antenna, considered to be the conventional UHF antenna for fringe rural areas, was 13.4 dB. This exceeds the 13 dB UHF receiving antenna gain planning factor. Even higher gain antennas are available, such as the Channel Master Model No. 4251 with an average gain of 15.6 dB.

Similar results apply to the low and high VHF bands. For instance, Channel Master's Crossfire Model No. 3617 has an average gain of 5.9 dB in the low VHF and 11.9 dB in the high VHF band. This gain for high VHF is nearly double the assumed receiving antenna gain in the planning factors.

Transmission Line Loss: The transmission line loss degrades the signal prior to the receiver front end. The loss figures used for the current planning factors represent older technology utilizing twinlead cable. Twinlead cable is susceptible to degradation due to water, proximity to metal structures such as downspouts, and poor terminations. Currently available RG-6 coaxial cable is shielded and much less susceptible to attenuation changes due to wetness and metal proximity, and the connectors used with it provide more consistent terminations.

Current specifications for RG-6 attenuation for 50 feet of cable are as follows:

Low VHF	0.8 to .94 dB
High VHF	1.3 to 1.4 dB
UHF	2.2 to 2.9 dB

From this it can be seen that the line losses occurring in 50 feet of RG-6 cable are less than 1 dB, 1.5 dB, and 3 dB for low VHF, high VHF, and UHF, respectively. When all of these factors are taken into account the loss attributable to coaxial transmission line is the same or slightly better than that found with twinlead.

Signal-to-Noise (S/N): In the 1951 Third Notice, the Commission determined that a signal-to-noise ratio of 30 dB would be necessary to provide an acceptable picture to the median observer.[2] Subsequently, the Television Allocations Study Organization (TASO) determined that the median observer found a picture with a S/N of 27.5 dB to be of acceptable quality. A picture with a S/N of 30 dB was found acceptable by 70% of viewers.

More recently, a report on further analysis of TASO data prepared by Mr. Harry Fine indicated that 50% of viewers rated a picture as acceptable with a S/N of 28 dB. This agrees very well with the results of the original TASO study in 1959.

Based on this data, it appears that the Commission's determination of S/N is actually 2 dB too much for an adequate picture. Since the Commission's intention was to provide for an acceptable picture for the median observer, the 30 dB S/N value actually provides an extra margin.

Receiver Noise Figure, dB: The noise figure is a measure of the internal noise a receiver adds to a signal. The lower the noise figure, the smaller this added noise is. The noise figures of modern receivers are several dB less than the receiver noise figures used for the current planning factors. In 1977, the Commission's Office of Chief Engineer determined that the average noise figure for low VHF was 6 dB and for high VHF was 7 dB. Another study several years later found an average UHF noise figure of about 9 dB. Using the more modern noise factors would make the Grade B signal intensity values for each band less than they are now.

Thermal Noise @ 300 ohms, dB/1uV: This is random noise generated within the system components. It is based upon the laws of physics and has not changed.

Required Median Field: When improvements in the receiver noise figure, receiving antenna gain, and transmission line loss are considered together with the extra margin in the S/N ratio, it is seen that the current Grade B planning factors offer a very conservative view of whether, at any given household in outlying or near-fringe areas, the median observer can receive an "acceptable" picture at least 90% of the time.

Based on the state of knowledge today and the transition to DTV, it is our considered engineering opinion that there is no need to change the Grade B planning factors for the

[2] Third Notice of Further Proposed Rulemaking, FCC 51-244, Television Broadcast Service, April 1951.

narrow purposes of determining the eligibility of satellite television subscribers to receive retransmitted distant signals of network stations. If anything, the various improvements noted above would permit a slight reduction in the Grade B signal intensity standard for each frequency band. However, the current Grade B standard is well-established and has served the television broadcast industry and consumers well for nearly half a century.

Consumer Expectations

Some may argue that consumer expectations are higher today than 50 years ago. Today, many commonly available and premium services provide television programming. Analog cable, digital cable, digital direct broadcast satellite television (DBS), and analog (C-band) satellite services are available. Of these, a case can be made that the service provided by analog cable and analog satellite are actually inferior to broadcast television in many cases due to implementation, weather, service outage, and installation issues. Digital cable and DBS services do provide improved picture quality; however, they are premium services and carry the higher costs of acquiring the suitable equipment, proper installation, and monthly and pay-per-view service fees. Certainly consumer expectations should be higher for these higher priced and widely glorified and advertised services than for free over-the-air broadcast television. For these reasons, any comparison of digital DBS service to analog broadcast television is not appropriate and does not serve the consumer in an honest fashion. Arguing for an increase in the Grade B signal intensity standard due to heightened viewer expectations assumes that increasing expectations from premium services will ratchet up the expectations from broadcast service. This is illogical or, at best, not proven.

The Consideration of "Ghosting" and Multipath

Ghosting resulting from multipath interference is a highly localized and individual location specific effect, and it has no direct relation with the whether an individual household can or cannot receive a signal of Grade B intensity.

While it is possible to measure multipath signal levels and time delays and relate them to a ghosting image on a television receiver, to model and predict them in a dynamic environment of individual receivers will be difficult, if not impossible. Multipath propagation to a specific location is highly individual in its sensitivity to small changes in numerous variables, many of which are additive. These variables include terrain, weather (rain, snow), receiving antenna height, antenna location, antenna discrimination (pointing angle), local obstacle location, size, geometry, reflection coefficient of potential reflectors, time of year for areas with deciduous trees, wind, and even moving vehicles and aircraft. In addition, even movement of the transmitting antenna in the wind will affect the phase of the desired and interfering signals. To keep track of even a subset of these variables for every target residence and consider the unlimited number of potential multipath reflectors and the reflection coefficients associated with them accurately seems an insurmountable task. If a potential multipath reflector could be located anywhere within the coincident beamwidths of the transmitter and receiving antennas, it would be impossible to accurately predict the likelihood of a ghosting problem at any particular location or residence with any confidence. In addition, viewers can also take personal action to minimize or eliminate multipath effects such as moving the receiving antenna vertically or horizontally or rotating it away from the source of the interference as well as utilizing a more directive (higher gain) antenna to better discriminate against the interfering multipath signal.

Lastly, technical solutions already exist to eliminate the impact of "ghosting" and multipath.[3] Ghost cancelling integrated circuits are available from at least one manufacturer that can be used to eliminate the impact of "ghosting" on picture quality.[4] These ghost cancellers utilize adaptive equalizers to eliminate the effects of time-shifted signals. The fact that this technology is not currently used in the industry may be that consumers do not view ghosting as a large problem or have successfully solved the problem, hence receiver manufacturers have not offered it (even as an option) due to lack of need. If "ghosting" were a major problem, the implementation of existing technical solutions would minimize the impact, and television receiver manufacturers would offer it to consumers.

Any methodology required to incorporate the prediction of "ghosting" will not produce meaningful results and will unnecessarily complicate the determination of SHVIA eligibility. "Ghosting" has nothing to do with predicting whether a residence receives a signal of Grade B intensity, and it has no place in the determination of Grade B signal strength.

Summary

The state of technology for consumer television receivers and installation practice has improved markedly in the last 40 years. The receiver noise floor of current technology receivers is at least 6 dB better that that found in tube receivers of the 1950s (and probably substantially better than even 6 dB), antenna gain has improved for each band, and transmission lines are less susceptible to weather and installation problems. The impact of these factors on television receivers has had the effect of actually increasing the effective signal-to-noise (S/N) at a receiver, providing for a better picture. In effect, the Grade B

[3] In Response to Notice Of Proposed Rulemaking Comments of Richard L. Biby, PE., In the Matter of Establishment of an Improved Model Predicting the Broadcast Television Field Strength Received at Individual Locations, ET Docket No. 00-11, February 22, 2000, pp 15.

[4] Oren Semiconductor, 2620 Augustine Drive, Suite 238, Santa Clara, CA 95054. (www.oren.com).

standard has increased over the years. A technical argument can be made that the standard could actually be lowered to account for these system improvements or that the picture quality associated with Grade B is better.

Indeed, the Grade B criteria have been reviewed by the Commission several times since the standard was instituted, and the criteria have withstood the test of time and technology. Reviews conducted by the Commission in 1975[5] and by the Office of Chief Engineer in 1977[6] concluded that there were data to support a reduction in the Grade B standard, although the Commission did not act to do so in either case. And recently, as part of the DTV proceedings, the Commission gave the Grade B standard a substantial vote of confidence by deciding to premise DTV service areas on a replication of existing NTSC Grade B service areas.[7] This reaffirmation demonstrated that the Grade B service criteria are adequate, and no change is deemed necessary by the Commission. Of course, just last year the FCC re-examined these planning factors specifically for SHVA purposes in CS Docket No. 98-201 and concluded that no change was warranted.

It is arguable whether consumer expectations for free over-the-air television are higher today than they were 40 or 50 years ago. Certainly consumer expectations are higher for heavily promoted subscription services, as well they should be. However, any comparison of digital DBS service with analog broadcast television is not appropriate and does not serve the consumer in an honest manner. Arguing for an increase in the Grade B signal intensity standard due to heightened viewer expectations assumes that increasing expectations from premium services will ratchet up the expectations from broadcast service. This is illogical or, at best, not proven.

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[5] Report and Order, FCC 75-636, Television and FM Field Strength Curves.

[6] Gary S. Kalagian, A Review of the Technical Planning Factors for VHF Television Service, FCC/OCE Bulletin RS 77-01.

Ghosting resulting from multipath interference is a highly localized and individual location specific effect, and it has no direct relation with whether an individual household can or cannot receive a signal of Grade B intensity. Modeling or predicting ghosting, and consideration of it as part of the Grade B planning factors, would be impossible at best and suspect in any case due to the potentially unlimited number of difficult-to-quantify variables needed to model it. The good news is that the consumer has several methods available to utilize the characteristics of his receiving antenna to discriminate against ghosting. In addition, technical solutions in the form of adaptive equalizers or "ghost cancellers" are available to mitigate the impact of ghosting. The fact that this technology is not currently used in the industry is evidence that consumers do not view ghosting as a large problem or have successfully solved the problem themselves, hence receiver manufacturers have not offered it (even as an option) due to lack of need. If "ghosting" were a major problem, the implementation of existing technical solutions would minimize the impact, and television receiver manufacturers would offer it to consumers.

[7] Sixth Report and Order, FCC 97-115, Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service.

Declaration of Ross R. Sorci

I, Ross R. Sorci, hereby declare as follows:

1. I am Ross R. Sorci, Assistant Vice President, IIT Research Institute Center for Electromagnetic Science.

2. IITRI is a not-for-profit contract research organization serving both government and industry in a wide range of planning and engineering tasks related to the use of the electromagnetic spectrum. Since 1961, IITRI has been providing spectrum-related support to US Government agencies and the Department of Defense in the areas of spectrum planning and management, communications-electronics systems engineering, RF interference, electromagnetic compatibility, and the development and maintenance of supporting radio propagation and analysis computer models and databases. The Center for Electromagnetic Science (CEMS) was established in 1994 to leverage IITRI's experience and extensive range of computer models related to radio system engineering, and is now providing design, planning and engineering support to the commercial wireless community, as well as local and municipal governments.

I have over 20 years of telecommunications and RF systems engineering experience as a Division Manager and Project Manager. Specific areas of expertise include planning, conducting, and managing electromagnetic compatibility (EMC) and electromagnetic interference (EMI) analyses, radio system design, radio system performance evaluation, spectrum management, microwave link analysis, and computer modeling of communications and radar/ATC systems. I have also developed analysis techniques and design methodologies for high-capacity digital point-to-point systems, conducted radio communications site surveys, and generated test plans. My resume is attached.

3 I prepared the accompanying Engineering Statement at the request of the ABC Television Affiliates Association, CBS Television Network Affiliates Association, Fox Television Affiliates Association, and NBC Television Affiliates Association (the "Network Affiliates") for use by the Network Affiliates in response to the *Notice of Inquiry*, ET Docket No. 00-90, released May 26, 2000, in the matter of Technical Standards For Determining Eligibility For Satellite-Delivered Network Signals Pursuant To The Satellite Home Viewer Improvement Act.

4. I was assisted in the preparation of the Engineering Statement by James H. Cook. Dr. Cook is currently an IITRI Senior Science Adviser with over 25 years of experience performing analyses and performance modeling of communications systems. In addition, he has expertise in the analysis, design, and development of software systems. Dr. Cook's resume is attached.

5. The accompanying Engineering Statement is true and correct to the best of my information, knowledge, and belief.

This the 26th day of June, 2000

Ross R. Sorci
Assistant Vice President
IITRI Center for Electromagnetic Science

IIT Research Institute

RELEVANT EXPERIENCE

Program Manager	EMC/ EMI Analysis	Radio Communications	Radio Propagation
Computer Modeling	Radio Coverage	Radio System Design	Spectrum Management

NAME: ROSS R. SORCI

SKILL CLASSIFICATIONS: PRIMARY: TELECOMMUNICATIONS SYSTEM ANALYSIS, SECONDARY: SPECTRUM MANAGEMENT

SUMMARY OF EXPERIENCE: Over 20 years of telecommunications and RF systems engineering experience. Specific expertise in planning, conducting, and managing electromagnetic compatibility (EMC) and electromagnetic interference (EMI) analyses, radio system performance and design efforts, spectrum management, microwave link analysis, and computer modeling of RF communications systems and radar/ATC systems. Developed analysis techniques and design methodologies for high-capacity digital point-to-point systems, conducted radio communications site surveys, and generated test plans.

CHRONOLOGICAL EXPERIENCE:

1999 to Present -- Assistant Vice President, Division Manager, IIT Research Institute – Center for Electromagnetic Science

Division Manager of CEMS EM Engineering Division. Project responsibility includes, Extremely Low Frequency (ELF) Communications System Environmental Compatibility Assurance Program, HQDA Spectrum Management Engineering Support, Electromagnetic Environmental Effects (E3) Protection Program Engineering Technical Services for FEMA Facilities, ILC Data Device Corporation DC Motor Torque Controller Hardening Evaluation, UDLP Crusader Hardening Evaluation, UDLP Grizzly Nuclear Survivability, and M1 Tank Hardening projects.

Program Manager of an effort to provide spectrum certification and spectrum management engineering and information analysis support to the DoD Office of Spectrum Management and Analysis (OSAM). This effort has successfully defined DoD spectrum certification process improvements and practices to enhance DoD spectrum access and technology insertion. Specific accomplishments include identifying and aiding in the resolution of spectrum certification and management issues facing the DoD Joint Tactical Radio System, review and evaluation of emerging and future communications technologies such as software defined radios (SDR), and the assimilation of this knowledge to define a framework for a revised, unified DoD spectrum certification process that effectively supports technology insertion.

Provided spectrum management related analysis capabilities and engineering support to the US Army Spectrum Manager. Tasks included information analysis, development of software and databases, and electromagnetic compatibility/electromagnetic interference (EMC/EMI) studies required in support of the evaluation of spectrum reallocation impacts, frequency management, and international/host country frequency coordination issues.

Managed the successful marketing, packaging and sale of a commercialized version of an IITRI developed terrain dependent radiowave propagation computer model. This computer software has applications to radio antenna siting studies, interference analysis efforts, and radio coverage studies for mobile radio and broadcast radio and television station operators. Also oversaw the development of a state-of-the-art time division multiple access (TDMA) computer simulation model. This model was developed for use in evaluating radio spectral emission constraints, spectral efficiency studies, and system transition considerations.

1994 to 1999 -- Manager Of Research, IIT Research Institute, Center For Electromagnetic Science

Designed and specified a Police and Fire Department mobile radio communications system for the Borough of Bogota, NJ. Effort consisted of defining the limitations of the current system, establishing requirements, and designing a new radio system consisting of fixed and mobile radios and repeaters to provide the desired radio coverage. Also assisted in producing specifications to be used for the competitive bidding process, and evaluating bids for construction of the specified system.

Successfully represented the Borough of Bogota, NJ at a public hearing concerning mobile radio antenna siting and safety, and also provided testimony concerning siting of cellular antenna facility at a public zoning hearing.

Program Manager for a digital wireless cable television system design project for CAI Wireless Systems, Inc. Responsible for planning, development, and implementation of the system design methodology, producing system designs for 13 markets in the mid-Atlantic and Northeast regions, and identifying and solving technical issues associated with the design effort. Worked closely with CAI Wireless and its partners to successfully define design analysis criteria, develop and present solutions to issues associated with implementation of new digital wireless technology, and present results of the design process.

Chairman of the Intelligent Transportation Society of America (ITS-A) Telecommunications Committee 1995-1996. Responsible for developing positions and recommendations pertaining to wireline and wireless telecommunications, integration, and identifying spectrum requirements. Also proactively engaged in spectrum management activities with the Federal Communications Commission (FCC), National Telecommunications and Information Administration (NTIA) and International Telecommunications Union (ITU) as the ITS-A focal point for telecommunications issues.

Project Manager for an effort to define terrain dependent NTSC and Digital Television (DTV) signal coverage for Fox Television affiliates in Pittsburgh, PA. The signal coverage data was used to determine the number of households covered within a defined market area. In addition to the coverage and demographic analyses, customer supplied coverage modeling assumptions and propagation data inputs were examined and evaluated. Also conducted a Grade B signal coverage analysis for 31 Los Angeles and Detroit TV stations for Fox Television. This study produced terrain dependent signal coverage maps and data where the impact of potential cochannel, adjacent channel, intermodulation, and receiver spurious response interference interactions were considered.

Lead Engineer for an analysis to rank the top 12 Rand McNally BTA's for Local Multipoint Distribution Service (LMDS) use as input for an FCC spectrum auction. The ranking was based on a comparison of terrain and ground cover features, climate factors affecting 28 GHz radio propagation applicable to LMDS service, and relative demographics of the BTAis of interest.

Provided wireless communications system consulting support to local government zoning board and community development officials in Cedar Grove, NJ. Consulting support consisted of evaluating radio coverage needs and predictions, assessing antenna and tower siting criteria, performing site surveys, and providing technical guidance.

Extensive experience in utilizing wireless communication coverage and performance computer models developed by Comsearch, MSI and EDX Engineering, as well as IITRI developed radiowave propagation models such as TIREM and Millimeter Wave. This includes selection of appropriate model inputs such as terrain elevation and ground cover data, system performance and interference criteria, equipment and antenna technical characteristics, and demographic data. Also developed signal coverage test plans, conducted measurements, and developed methodology and conducted statistical analyses to validate and verify radio coverage predictions produced by computer models.

1988 to 1994 -- Manager Of Research, IIT Research Institute, Joint Spectrum Center / Electromagnetic Compatibility Analysis Center Support Services

Supervised staff assigned to US Air Force sponsored airborne and ground based radar, VHF/UHF communications, RADHAZ, cosite/intersite EMC, HF communications reliability, and air traffic control simulation and modeling efforts. Provided spectrum management and engineering analysis support to telecommunication development and in support of spectrum regulation on various projects.

Responsible for successful completion of a DoD frequency supportability evaluation, and vulnerability and cosite interference analyses of airborne radars. Developed computer models and automated performance evaluation tools of radar and air traffic control systems, and identified existing electromagnetic signal environments and appropriate system performance measures to assess impact of systems on the RF spectrum.

Performed site surveys of numerous communications and radar sites in Egypt, developed an automated frequency management system specification, and managed the development and successful delivery of the specified frequency management system to the Egyptian Air Force (EAF). Also performed an evaluation of cosite interference performance of a proposed VHF/UHF air-ground-air tactical communications system for the EAF.

1982 to 1988 -- Research Engineer/Project Manager, IIT Research Institute, Electromagnetic Compatibility Analysis Center

Provided Analysis, Computer Simulation, Testing and Frequency Allocation support for a proposed next generation jam resistant, and secure military Identification Friend-or-Foe (IFF) system. Evaluated compatibility of new IFF systems with existing air traffic control (ATC) environment and military navigation and communication systems, supervised performance of, and reviewed and documented simulation results of IFF/ATC system performance, interfaced with US Air Force, Federal Aviation Administration (FAA), National Telecommunications and Information Administration (NTIA), and NATO member countries on frequency allocation and spectrum supportability issues. Planned and supervised laboratory bench testing of performance impacts to selected ATC transponders, interrogators, and beacons from military IFF signals.

Acted as an electromagnetic compatibility (EMC) and frequency management consultant to the US Air Force air-to-air and air-to-ground training ranges in Nevada. This highly successful effort included performing communications and microwave site surveys and cosite interference analyses, evaluating radar simulator interference, performing radar siting and coverage evaluations, and conducting backbone and point-to-point digital and analog microwave system siting and link analyses. Other tasks included investigating and recommending solutions to interference cases caused by training activities such as radar jamming, and developing a database of equipment technical characteristics necessary for training range spectrum management and EMC analyses.

1979 to 1982 -- Assistant/Associate Engineer, IIT Research Institute, Electromagnetic Compatibility Analysis Center Support Services

Provided timely and accurate technical support to a succession of spectrum engineering projects. Efforts successfully supported ranged from HAVE QUICK UHF frequency hopping spread spectrum communications systems EMC, AWACS UHF air-ground-air frequency planning, EMC of AMRAAM missile testing telemetry systems, compatibility of intrusion detectors utilizing pseudonoise spread spectrum modulation, system performance of air-to-air data links, and analog and digital microwave system link analyses and frequency plans.

ACTIVE SECURITY CLEARANCES:

Secret, DoD, August 1979

EDUCATION:

B.S., Electrical and Computer Engineering, June 1979

Clarkson College of Technology

Potsdam, NY 13676

OTHER COURSES:

National Defense University, Armed Forces Staff College, Norfolk, VA, Electronic Warfare Staff Officers Course, December 1990.

AWARDS/AFFILIATIONS

IITRI Commitment to Excellence Award, July, 1986

Letters of Appreciation: USAF Director, Combat Identification SPO, 16 April, 1986,

Director, ECAC, 28 April, 1986

USAF Director, Combat Identification SPO, December, 1986

Director, ECAC, January, 1987

Assistant Secretary of Defense, 7 November, 1989

Director, ECAC, 14 December, 1989

USAF Deputy for Air Force Projects, ECAC, 15 May, 1991

Asst. Director for Air Force Projects, ECAC, 17 January, 1992

Selected Publications for Ross R. Sorci

Cedar Peak Antenna Siting Analysis, ECAC-CR-81-164, February 1981, DoD ECAC, Annapolis, MD.

EMC Analysis of the Mobile Individual Resource Protection Sensor (MIRPS), ECAC-CR-80-104, March 1981, DoD ECAC, Annapolis, MD.

EMC Analysis of HAVE QUICK Operations Aboard the E-3A Aircraft, ECAC-CR-80-034, May 1981, DoD ECAC, Annapolis, MD.

EMC Analysis of the Mobile Individual Resource Protection Sensor (MIRPS) in the 1215-1400 MHz Band, ECAC-CR-81-045, August 1981, DoD ECAC, Annapolis, MD.

EMC Analysis of the Digital Microwave Communication System at Nellis AFB, NV, ECAC-CR-83-125, January 1983, DoD ECAC, Annapolis, MD.

An EMC Analysis of the Short-Haul Microwave System at Nellis AFB, NV, ECAC-CR-83-107, January 1983, DoD ECAC, Annapolis, MD.

A Cosite EMC Analysis of the VHF and UHF Tactical Nets at Angels Peak, NV, ECAC-CR-83-095, August 1983, DoD ECAC, Annapolis, MD.

A Cosite EMC Analysis of the VHF and UHF Tactical Nets at Highland Peak, NV, ECAC-CR-83-179, December 1983, DoD ECAC, Annapolis, MD.

An EMC Analysis of the CDLJ at Nellis AFB, NV, ECAC-CR-83-201, March 1984, DoD ECAC, Annapolis, MD.

Analysis of the Radio Coverage on the Alamo, Elgin, and Coyote Training Ranges, ECAC-CR-85-016, March 1985, DoD ECAC, Annapolis, MD.

PLSS IDL and DME Frequency Recommendations for Use in the FRG, ECAC-CR-85-038, May 1985, DoD ECAC, Annapolis, MD.

VHF/UHF Band Study for Nellis AFB Training Ranges, ECAC-CR-85-050, June 1985, DoD ECAC, Annapolis, MD

EMC of the MILSTAR Air Force Terminals, ECAC-CR-84-132, February 1987, DoD ECAC, Annapolis, MD.

An Empirical Antenna-to-Antenna Propagation Path Loss Model Applicable to Low Observable Aircraft, Title 876, November 1991, IIT Research Institute, Annapolis, MD.

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Preliminary EMC Analysis of MILSTAR Air Force Terminals, ECAC-CR-86-095, February 1987, DoD ECAC, Annapolis, MD.

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Technical Reports and White Papers for Ross R. Sorci

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High Power and Adjacent Signal Radar Interference, IIT Research Institute, Center For Electromagnetic Science, 4409 Forbes Blvd, Lanham, MD 20706, 5 August 1995, (Prepared for CAI Wireless Systems, 12 Corporate Woods Blvd, Albany, NY 12211)

Comparison Of Near-In Blockage Due To Foliage And Buildings, IIT Research Institute, Center For Electromagnetic Science, 4409 Forbes Blvd, Lanham, MD 20706, 12 December 1995, (Prepared for CAI Wireless Systems, 12 Corporate Woods Blvd, Albany, NY 12211)

Calculation Of The Average Number Of Households Covered For Systems Containing Large Numbers Of Transmitters, IIT Research Institute, Center For Electromagnetic Science, 4409 Forbes Blvd, Lanham, MD 20706, 4 January 1996 (Prepared for CAI Wireless Systems, 12 Corporate Woods Blvd, Albany, NY 12211)

Digital Multichannel Multipoint Distribution Service (MMDS) RF Site Engineering Program Plan, IIT Research Institute, Center For Electromagnetic Science, 4409 Forbes Blvd, Lanham, MD 20706, 15 January 1996, (Prepared for CAI Wireless Systems, 12 Corporate Woods Blvd, Albany, NY 12211)

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Survey Of Commercially Available Point-To-Point Microwave Link And Interference Analysis Computer Models, IIT Research Institute, Center For Electromagnetic Science, 4409 Forbes Blvd, Lanham, MD 20706, 1 March 1996, (Prepared for Video/Phone Systems, Inc. Suite 3050 Atrium, 2701 Summer St, Stamford, CT 06905)

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Evaluation of Potential Digital MMDS Interference To The FAA ASR-9 Radar in Boston, IIT Research Institute, Center For Electromagnetic Science, 4409 Forbes Blvd, Lanham, MD 20706, 22 July 1996. (Prepared for CAI Wireless Systems, 12 Corporate Woods Blvd, Albany, NY 12211)

Methodology For Determining The Feasibility Of Sharing Between High-Density Fixed Service And Fixed Satellite Service Operations In Frequency Bands Above 30 GHz, IIT Research Institute, Center For Electromagnetic Science, 4409 Forbes Blvd, Lanham, MD 20706, November 1996, (Prepared for Biztel)

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Modification of Near-In Blockage Observation Data Due To The Application Of The -71 DBM Burnthrough Criteria, IIT Research Institute, Center For Electromagnetic Science, 4409 Forbes Blvd, Lanham, MD 20706, 7 December 1996, (Prepared for CAI Wireless Systems, 12 Corporate Woods Blvd, Albany, NY 12211)

Grade B Coverage Test Case Analysis For Los Angeles and Detroit, IIT Research Institute, Center For Electromagnetic Science, 4409 Forbes Blvd, Lanham, MD 20706, June 1997. (Prepared for News Corporation, 10201 West Pico Blvd, Los Angeles, CA 90035)

NTSC And DTV Signal Coverage And Demographic Analysis For KDKA And WPGH In Pittsburgh, PA, IIT Research Institute, Center For Electromagnetic Science, 4409 Forbes Blvd, Lanham, MD 20706, October 1997, (Prepared for News Corporation, 10201 West Pico Blvd, Los Angeles, CA 90035)

Ranking Of The Top 12 Basic Trading Areas For LMDS Use According To Demographics, Terrain, Ground Cover, and Climate Factors, IIT Research Institute, Center For Electromagnetic Science, 4409 Forbes Blvd, Lanham, MD 20706, 7 November 1997. (Prepared for RDL-CTC, 5800 Uplander Way, Culver City, CA 90230)

Application Of Digital Adaptive Equalization To Support Spectrum Re-Use At A Wireless Point-To-Point Relay Facility, IIT Research Institute, Center For Electromagnetic Science, 4409 Forbes Blvd, Lanham, MD 20706, November 1997. (Prepared for Headquarters Of The Army (HQDA) Spectrum Management, Pentagon, Washington, D.C.)

IIT Research Institute

RELEVANT EXPERIENCE

Systems Analysis	Software Development	Requirements Analysis
System Optimization	Procurement Support	

NAME: JAMES, H, COOK

SKILL CLASSIFICATIONS: SYSTEM ANALYSIS, SOFTWARE DEVELOPMENT

SUMMARY OF EXPERIENCE:

Dr. Cook has over 20 years experience addressing the analysis, design, and development of software systems. He has provided significant project contributions for both government and industrial clients. Dr. Cook is experienced addressing tasks requiring the application of both qualitative and quantitative analysis of IT systems. His experience includes the major tools/concepts defining the current technology such as UNIX, Client/Server architecture, TCP/IP protocols, and relational databases.

Dr. Cook has recent experience in software training, testing, design, and coding. This has involved a variety of tools and languages, such as C, C++, HTML, Make, MATLAB, MS Access, PERL, SQL Server, UML, Unix Shells, Visual Basic, and XML. Some of this has been hands-on code work, but much has also involved work at the requirements and design level, focusing on the customer interface. Other projects have required a focus on quantitative analysis and design, such as solving an optimization problem via a numerical implementation of Lagrangian Multipliers or developing the trigonometric equations via vector analysis to represent the location of an image of a moving plane on a PC screen.

Dr. Cook is a member of the adjunct faculty in the School of Computing and Technical Studies at Anne Arundel Community College; teaching C programming.

CHRONOLOGICAL EXPERIENCE:

IITRI, ATG;
Senior Science Advisor, July 1985 – Present

Responsibilities include providing technical guidance and support to division personnel, leading the introduction of new technologies, and assisting with marketing activities.

During this period Dr. Cook's accomplishments included the following:

Dr. Cook is currently leading an internal process improvement initiative addressing CMM compliance for various departments in the ATG Center for Information Technology Operation.

Dr. Cook served as a senior technical advisor for several tasks at the National Institutes of Health. This work primarily involved re-engineering legacy client server and mainframe applications to thin client Web based architectures. Additional efforts involved planning for the introduction of XML technology.

Dr Cook participated in the development of an Enterprise Information Technology (IT) Architecture for the Bureau of the Census. Work, functional, and informational views of the Bureau's business processes are being obtained from planning documents and personnel interviews. These are then being mapped to the current and planned technical infrastructure to provide the overall IT architecture. This work resulted in a Conference Presentation (See Publications list below.)

Another effort involved writing a white paper for the Defense Information Systems Agency addressing the reengineering of the DoD JOPES suite of software applications to bring them into compliance with the Defense Information Infrastructure's Common Operating Environment (DII COE). Dr. Cook was the project lead on this effort.

He provided testing support for the DISA DII COE Kernel Platform Certification Program. This required working with the source distribution from three separate contractors in a UNIX workstation environment. Dr Cook performed and documented builds, which required sorting out problems with make files and shell scripts. In addition, he developed a PERL script for accumulating the total line count for the delivered files by type.

He was the primary analyst on an effort to provide hotline support for the Defense Information Infrastructure's Common Operating Environment (DII COE) at the Defense Information Systems Agency (DISA). The work required developing thorough understanding of the DII COE concepts and on-line Web based documentation. Considerable e-mail and phone support was required in addition to participation in training classes to answer customers' questions. During this project, Dr. Cook also moderated a ListServ covering COE issues and maintained a COE FAQ file on the Web.

He provided procurement support to the National Institutes of Health (NIH), writing statements of work and supporting the evaluation process for two large IDIQ procurements (Image World and CIOSP). He also assisted in writing an ordering guide for the NIH Electronic Computer Store. These efforts required hosting documents on the Web and coordinating with teams from more than 15 contractors interested in bidding the effort.

He prototyped a dynamic audit filters proof-of-concept experiment, including a real-time data interfaces, for the Internal Revenue Service. This was written in Visual Basic. Dr. Cook worked closely with a data-mining analyst on this effort.

He developed a graphical ADP system for processing timesheet data. This involved a Visual Basic interface to facilitate the process of entering timesheet data and formatting it for transmission to a Prime computer. This application was in continuous use within IITRI for several years.

He provided extensive on-site customer training for an Automated Vehicle Location Radio Dispatch system for the Los Angeles Metropolitan Transportation Authority. The system was hosted on DEC workstations using VMS. Dr. Cook familiarized himself with the course and system in two weeks and conducted classes at the customer's site alone for four 6-day weeks. Each day involved 7 hours of class lecture and demonstration.

He managed and provided the lead analysis of a Defense Logistics project to develop a concept for addressing the data aggregation problem in multilevel secure databases. The data aggregation problem is a topic on research in computer database security. The purpose of this study was to develop a conceptual design for a real-time monitoring tool to address compromise by aggregation. A model of the aggregation process was developed through an analogy to the process of assembling a jigsaw puzzle. The results of the modeling process were used to develop various concepts, which could be included in the design of the real-time tool.

He provided the project management and designed the display algorithms for a prototype Covert Aircraft Retrieval and Tracking System (CARTS), involving a real-time Landing Signal Officer (LSO) aircraft position display, for the Naval Air Engineering Center. The CARTS was conceived as a system to enable planes to be landed on a carrier during times when radar emissions were undesired. This working prototype was developed in about 10 weeks and tested for several days by LSOs handling actual planes at an airfield in Virginia. The display algorithms provided the on-screen coordinates of the glide path with respect to the image of the landing aircraft, using laser ranging data and the pointing coordinates of the infrared camera. The LSOs felt the system worked perfectly.

He provided procurement support to Niagara Mohawk Power Corporation in the development and evaluation of a several competitive solicitations. Two involved the development of expert systems, one to help customers react properly to an hourly incentive pricing program and the other addressed alarm processing. The third involved a map board display system study. Continued to serve in a consultant capacity during the performance of the expert system projects.

He managed and provided major technical contributions to a project to assess the impact of separating client and servers in X-Window applications. The customer was the Defense Information Systems Agency (DISA). The work was performed at the Pentagon on a testbed for the Crisis Management Action System, a network of workstations used for various information gathering, processing and presentation systems. A test scenario was developed to measure the network impact of running typical applications in a distributed mode. Tests were then run and the results analyzed. The analysis of the test

results had indicated that the system was processor limited, and this was emphasized in the final report. After project completion it was learned that the primary motivation for the effort had been that the customer had wanted to confirm his view that the system was processor limited.

Dr. Cook designed and developed a hydroelectric power plant dispatch decision support system involving real-time graphical data displays for the Niagara Mohawk Power Corporation. This first involved modeling the plant operation based upon the analysis of real-time performance data. Then an approach was conceived whereby optimum plant settings could be generated in response to changing environmental and load conditions in real time. The system was prototyped and tested against experienced plant operators at Niagara Mohawk's School Street plant in Cohoes, New York. The system out-performed the operators. The customer ordered a full system as a result, and one was designed and installed based on the prototype. A paper on this system was awarded second place in the Waterpower Conference at Denver, Colorado in 1992. (See the Publications list below).

He provided technical contributions to a winning proposal and then acted as program manager for a $9M task order contract with RADC's Intelligence Reconnaissance Directorate. This included administrative coordination of the work of 13 subcontractors in intelligence related efforts such as upgrading Intelligence Data Handling Systems (IDHS), developing speech processing workstations, and camouflage concealment and deception studies. As part of this effort, he also performed an engineering analysis assessing the operational utility of exploiting near field electromagnetic disturbances as a passive aircraft discrimination technique for Rome Air Development Center.

Assembled a team and managed a winning proposal responding to an RFP from the Niagara Mohawk Power Corporation to develop a corporate wide survey of potential AI opportunities. He managed the project to a successful completion, including a conference presentation of the results (See the Publications list below). As a direct result of this effort, a sole source task was awarded to extend the survey to the corporate members of the Empire State Electric Energy Research Corp.(ESEERCO).

He performed an assessment of AI applications in manufacturing for the DoD's Manufacturing Technology Information Analysis Center. This was a one-month effort to produce a "State-of-the-Art" survey (MTIAC TA-85-01). It involved performing a quick literature search, summarizing the results in a report, and developing a position regarding the status of the technology. The results were then confirmed with various experts in the field through phone interviews. This work was published as a conference paper and later incorporated as a chapter in the Manufacturing High Technology Handbook. (See the Publications list below).

Division Director; July 1982 – July 1985

Managed the operation of the Chicago Electronics Division.

During this time period Dr. Cook directed IITRI's Electronics Department in Chicago, which included management responsibility for IITRI's cancer protocol database work for the National Institute of Health (NIH). He introduced an automated budgeting process into the division and initiated consideration of AI technologies within the division's projects.

Research Engineer to Assistant Division Director; August 1974 – July 1982

Provided technical and management support on various Electromagnetic Compatibility Analysis projects.

During this period Dr. Cook managed various analysis capability development groups at the Electromagnetic Compatibility Analysis Center (ECAC). This involved development of engineering models for determining the performance of communications systems.

The Cleveland State University, Electrical Engineering Department;
Assistant Professor; September 1990 – July 1974

Taught undergraduate and graduate electrical engineering courses. Guided M.Sc. students.

Dr. Cook taught Electrical Engineering courses in Electromagnetics, Communications, Electronics, and Electrical Machinery. Received a NASA summer faculty fellowship to participate in the Cyclops project in conjunction with Stanford University and NASA's operations at Moffett field, California. Performed research in electronic machinery, addressing a novel two frequency approach for synthetically loading an induction machine for testing. (See Publications list below.)

PROFESSIONAL REGISTRATION:

HARDWARE:

IBM mainframes, 1794 – 360, Utilized for graduate research

Sun Workstations, Spark, Utilized for project analysis activities

IBM PCs and compatibles, Various manufacturers, Utilized for project activities and delivery platforms

SOFTWARE:

Microsoft, Windows OS, 3.1 – 9x and NT, Utilized for project activities and as delivery platforms

Microsoft, Office, 7, Utilized for project activities

Fortran, Utilized for graduate research

QuickC for Windows, Utilized for project activities

C++, Borland Turbo 4.5, Utilized for project activities

Visual Basic, 3.0 – 4.0, Utilized for project activities

Perl, various versions, utilized for project activities

Unix shells, various versions, utilized for project activities

HTML, various versions, utilized for project activities

XML, 1.0, utilized for research

ACTIVE SECURITY CLEARANCES:

TS, issuing agency, date issued

INACTIVE SECURITY CLEARANCES:

N/A

EDUCATION:

Ohio State University, 1970, Ph.D., Electrical Engineering

Ohio State University, 1967, M.S., Electrical Engineering

Ohio State University, 1965, B.S., Electrical Engineering

OTHER COURSES:

Anne Arundel Community College, various programming courses (C++, Unix, TCP/IP) , mid 90's

PUBLICATIONS/PRESENTATIONS:

"XML Sets Stage for Efficient Knowledge Manaagement," IT Professional, Published by the IEEE Computer Society, May/June 2000.

"Integrating Multiple Enterprise Information Technology Architecture Views," Proceedings of the Eleventh Annual Software Technology Confference, Salt Lake City, Utah, 2-6 May 1999. With F. Armour and S. Carlson.

"Improving Performance with a Hydro Control System," Proceedings of Waterpower '93, August 10-13, 1993. With J.Walsh and J. Veitch.

"Performance Monitoring and Artificial Intelligence for Hydro Plant Efficiency Improvement," Proceedings of the 1992 Joint Power Generation Conference sponsored by the American Society of Mechanical Engineers, Atlanta, Georgia, August 1992. With J.Walsh and F.Lowell.

"A Hydroelectric Plant Operator's Assistant," Proceedings of Waterpower '91, July 25, 1991. With C. Hosmer, C. Ritchie, and J. Walsh.

"CALS Database Usage and Analysis Tool Study," Technical Report for The Defense Logistics Agency, October, 1991. With E. Szwedo.

"Artificial Intelligence Applications in a Large Electric Power Utility," American Power Conference, Chicago, Illinois, April, 1987. With N. Martin, R. Senn, S. Lipton, and C. Saylor.

"Artificial Intelligence in Manufacturing," Chapter 27 in Manufacturing High Technology Handbook, McKee and Tijunelis, editors, Marcel Dekker, New York, 1986. With M. Emerich.

"AI in Manufacturing: An Assessment," Proceedings of the Artificial Intelligence and Advanced Computer Technology Conference, Long Beach, California, May 1986.

"Quasi-Peak to RMS Voltage Conversion," IEEE Transactions on EMC, Vol. EMC-21, no. 1, pp. 9-12, February 1979.

"Synthetic Load Testing of Induction Machines," IEEE Transactions on Power Apparatus and Systems, Vol. PAS-96, no. 4 pp. 1101-1105, July/August 1977. With H.E. Jordan and R.L. Smith.

"The EMC of a Proposed Power Plant and the HF Communications Facility at Westover AFB," ESD TR-75-006, May 1975.

"Sampling Theory for Control Engineers," IEEE Transactions on Industrial Electronics and Control Instrumentation," Vol. IECI-21, no. 3, pp. 145-152, August 1974. With S. Hu.

AWARDS/AFFILIATIONS:

Association of Computing Machinery (ACM)

Institute of Electrical and Electronic Engineers

Sigma Xi

Tau Beta Pi