Exhibit 11: RF Exposure/Environmental Evaluation

Vectran Corporation
Div. of Canac International Inc.

Memo

To: Fred Horst
From: Bob O'Farrell
CC: C.Bellware,J.McCann,C.Loeffler,D.Masse,T.Mueller,H.Warren
Date: 07/15/99
Re: **SAR Compliance, FCC Certification**

Dear Fred;

Follow up to our telephone conversation relative to the need to perform routine environmental evaluation for RF exposure on your **one watt 450mhz Transmitter**, prior to equipment authorization or use.

I spoke to various FCC offices in tracking down a definitive answer to the above question.

FCC Gettysburg , PA (Mike) ;

FCC national call center, (1-888-225-5322);

FCC Office of Engineering and Technology; Columbia, MD (1-301-362-3010);

At the Office of Engineering and Technology I spoke to Joe Dichoso (1-301-362-3024) their "Low Power" specialist, who directed me to Kwok Chan (1-301-362-3055), their specialist on SAR Testing.

I spoke to Kwok Chan on two occasions. On both occasions Mr. Chan said that that the transmitter in question must be in compliance with FCC Rules Part 2, Paragraph 2.1091 & 2.1093 but That The 450mhz to 470mhz Frequency range meant that it was "categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use". The reason Mr. Chan gave for this exclusion was that the requirement for SAR Testing applied to SMR devices which are higher frequency devices.

In my discussions with Kwok Chan, I pointed out that the Transmitter now being submitted for equipment authorization is a modified version of a transmitter that was previously submitted for equipment authorization. @ 800mhz to 860mhz, and was tested for SAR Compliance at that time. I also mentioned the low duty cycle, and that the emission levels were more than 50 times below allowable limits. Mr. Chan suggested that the submission be made without the additional SAR Testing, but the previous test results could be provided as added supporting information.

CANAC

29 June 1999

Communication Certification Laboratories
1940 Alexander Street
Salt Lake City, Utah
USA
84119-20

ATTN: Mr Joseph Jackson

SUBJECT: SAR Testing of the CANAC Remote Controller

Dear Mr. Jackson,

Attached you will find a copy of the SAR Testing report prepared by Dr. Om P. Ghandi of the University of Utah. The conclusions of this report indicate that the radiated emissions of both units tested are over a factor of 50 times lower that the ANSI/IEEE C95.1-1992 SAR limit of 1.6 W/kg for any gram of tissue anywhere in the body.

The transmitters currently being evaluated by your laboratories will be used in a configuration that is functionally and dimensionally similar to the Vectran Model VM1000018 model tested by Dr. Ghandi. The peak output power is equivalent and the duty cycle is less than 7%.

Please advise if you require any further information.

Sincerely,

Fred Horst – P. Eng
Director – Product Design
CANAC Inc.

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SAR TESTING OF THE CN LOCOMOTIVE CONTROL SYSTEMS

VECTRAN MODEL VM1000018 AND THEIMEG MODEL EE021-00061

FINAL TECHNICAL REPORT

October 15, 1997

Submitted to:

Ms. Kathy Smolynec
Industrial Hygienist
Safety & Regulatory Affairs
Canadian National
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Submitted by:

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SAR TESTING OF THE CN LOCOMOTIVE CONTROL SYSTEMS VECTRAN MODEL VM1000018 AND THEIMEG MODEL BE021-00061

I. Introduction

We have conducted the SAR testing of two CN Locomotive Control Systems (LCS) Vectran Model VM1000018 and Theimeg Model BE021-00061. Both the experimental and computational test procedures that have been widely accepted by the bioelectromagnetics scientific community were used to assess the rates of electromagnetic energy absorption (specific absorption rates or SARs) in terms of peak one-gram SARs that should not exceed certain prescribed limits for safe operation of radiofrequency (RF) radiating devices. Several of the safety guidelines for highest allowable one-gram SARs are given in Table 1 [1-5]. In the Canadian Recommendations on Radiofrequency Exposure Protection [1], the local SAR averaged over any one gram of tissue for any six minute (0.1 hour) period should not exceed 8 W/kg for occupational exposures and one-half of this value or 4.0 W/kg for exposure of the general population. Fairly similar peak one-gram SARs have also been proposed in the RF radiation Safety Standard ANSI/IEEE C95.1-1992 [2] where the peak one-gram SAR for Controlled Environments should not exceed 8.0 W/kg and for Uncontrolled Environments should not exceed 1.6 W/kg. Limits on the peak one-gram SAR proposed in the other safety guidelines [3-5] are fairly similar and are summarized in Table 1.

II. Methods for Determining SAR Distributions

Experimental and computational methods for determining SAR distributions have been developed over the last 25 years and are described in a number of original and review articles, some of which are referenced here [6-8]. For experimental measurements, a human-shaped model (see Fig. 1) filled with tissue-equivalent material simulating the electromagnetic properties (dielectric constant ϵ_r and electrical conductivity σ corresponding to the average properties of the torso may be used. For experimental SAR measurements at the LCS frequencies of 806-866 MHz, we have developed a gel type phantom composed of 71% by weight water, 20.55% polyethylene powder, 0.5% salt (NaCℓ) and 7.95% gelling agent TX151 available from Oil Center Research, PO Box 51871, Lafayette, Louisiana.

For this composition, the dielectric properties were measured for the desired frequency band using Hewlett Packard (HP) Model 85070B Dielectric Probe in conjunction with the HP Model 8720C Network Analyzer (50 MHz - 20 GHz). The measured properties are as follows: Dielectric constant $\varepsilon_r = 43.8$; electrical conductivity $\sigma = 0.90$ S/m. These values correspond to the average for the tissues in the torso region of the body [9, 10].

For numerical computations of SAR distributions, the most successful and widely accepted method is the finite-difference time-domain (FDTD) method [7, 11, 12]. This method allows use of realistic, anatomically-based models of the human body and has been used extensively for calculations of SAR distributions [7, 11, 12]. For the present calculations, we have used a 1.974 × 1.974 × 3.0 mm resolution model of the human body which was developed from the magnetic resonance imaging (MRI) scans of a male human volunteer. This model has been segmented to identify 31 tissue types whose electrical properties can then be prescribed at 812.5 MHz which is the irradiation frequency of the Locomotive Control Systems.

III. Determination of SAR Distributions

It has been our experience that the RF radiating systems such as cellular telephones and other portable communication devices may couple significantly to the human body when the antennas are within 1-5 cm of the body [12, 13]. For the CN Locomotive Control Systems such as Vectran Model VM1000018 and Theimeg Model BE021-00061, the radiating antennas are 10-12 cm removed from the body and, from electromagnetic field theory, are, therefore, expected to couple much less power to the human body. It was, therefore, decided to measure, as well as calculate, the SAR distributions when the two

LCS models are mounted, as for normal use, with antennas further away from the body, and for abnormal situations when the units are turned around so that the antenna is close to the body, as for Vectran LCS, or directed toward the body, as for the Theimeg LCS. Regions of the highest-internal energy deposition were located both experimentally and numerically. The SAR distributions thus determined were used to determine peak one-gram SAR by using a volume of 1 × 1 × 1 cm with a weight of one gram of tissue. The peak one-gram SARs determined for both of the Locomotive Control Systems are given in Table 2.

From Table 2, it is interesting to note a fairly good agreement (within 25%) between SARs that were measured or calculated using the anatomically-based model of the human body. It is also interesting to note that the SARs are fairly low when the LCS units are placed, as for normal use, so that the antennas are approximately 10-12 cm away from the body. For this case, the SARs obtained for Vectran and Theimeg models are both fairly small and approximately 0.025 and 0.031 W/kg, respectively (these are the highest values obtained in each case by using experimental or numerical procedure). Even for the abnormal placement of the LCS units, when the units are turned around such that the radiating antennas are next to the body, the SARs, though considerably higher, are still fairly low as compared to the peak one-gram SARs of 1.6 - 4.0 W/kg suggested in the various safety guidelines [see Table 1]. In Table 2, it is interesting to see that the peak 1-g SAR measured for Theimeg Model BE021-00061 for abnormal placement of this unit (worst case exposure condition) is less than that measured for the Vectran LCS. This is due to the fact that Theimeg LCS uses an internal slot antenna which spreads the radiated power over a wider area reducing thereby the maximum coupling to any 1 × 1 × 1 cm of tissue in the body. When the antennas are further away from the body, as for normal use, the fields spread out for both of the LCS units, and larger areas of the body are thus exposed albeit with considerably lower SARs.

IV. Comparison of the Data With Safety Guidelines

All of the safety standards proposed in western countries on both sides of the Atlantic [1-5] are set in terms of SARs that must not exceed certain prescribed limits for any 1- or 10-g of tissue anywhere in the body. The most stringent limit is that prescribed by ANSI/IEEE C95.1-1992 [2] where for any one gram of tissue anywhere in the body, the maximum allowable SAR is 8.0 W/kg for workers/controlled environments and one-fifth as much or 1.6 W/kg for general population/uncontrolled environments. As seen in Table 2, the maximum measured or calculated one-gram SARs for both the Vectran and Theimeg LCS units for normal-operating conditions are 0.025 and 0.031 W/kg, respectively. Both of these values are over a factor of 50 times lower than the ANSI/IEEE C95.1-1992 SAR limit of 1.6 W/kg for any one gram of tissue anywhere in the body. Even for the abnormal operational condition where the LCS units are turned around such that the antennas are facing and next to the body, rather than 10-12 cm away, the peak one-gram SARs are still considerably less than the safety limit of 1.6 W/kg suggested in ANSI/IEEE C95.1-1992 exposure standard [2].

We may compare the SARs determined for the two CN Locomotive Control Systems with those measured or calculated for various cellular telephones that are being increasingly used by the public. This comparison is also instructive since the transmission frequencies used for cellular telephones in North America are on the order 820-850 MHz and thus very similar to those being used for the LCS units. Besides, the maximum time-averaged powers being used for cellular telephones are very similar, and if anything, somewhat higher with values as high as 200-250 mW instead of 73 and 104 mW being used for LCS Vectran and Theimeg models, respectively. There is, however, a major distinction between the antennas being used for cellular telephones and LCS units, respectively. Whereas the antennas used for cellular telephones are located much closer at a distance of 1-2 cm from the body in normal use, the antennas for the LCS units are considerably further and typically 10-12 cm from the body. As expected, because of stronger fields that would result at closer distances for the cellular telephone antennas, considerably higher SARs on the order of 0.6-1.3 W/kg have generally been measured or calculated for cellular telephone antennas [12, 14-16], depending on the nature of the antenna and its location vis à vis the body.

REFERENCES

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3. European Prestandard ENV 50166-2, "Human Exposure to Electromagnetic Fields: High Frequencies (10 kHz to 300 GHz)," CENELEC European Committee for Electrotechnical Standardization, Central Secretariat: Rue de Stassart 35, B-1050, Brussels, Belgium.

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Table 1. Safety Guidelines for Maximum Allowable Specific Absorption Rates (SARs) in Human Tissues

	Frequency	Maximum Allowable: Local SAR (W/kg) Occupational/Controlled Environments	Maximum Allowable: Local SAR (W/kg) General Population/ Uncontrolled Environments
Canadian Standard [1]	10 kHz - 300 GHz	8.0 (any 1-g of tissue) 25.0 (any 1-g of tissue in the limbs)	4.0 (any 1-g of tissue) 12.0 (any 1-g of tissue in the limbs)
ANSI/IEEE C95.1-1992 [2]	3 kHz - 300 GHz	8.0 (any 1-g of tissue) 20.0 (any 10-g of tissue in the limbs)	1.6 (any 1-g of tissue) 4.0 (any 10-g of tissue in the limbs)
CENELEC (ENV50166)[3]	10 kHz - 300 GHz	10.0 (any 10-g of tissue) 20.0 (any 10-g of tissue in the limbs)	2.0 (any 10-g of tissue) 4.0 (any 10-g of tissue in the limbs)
ACGIH TLV* [4]	10 MHz - 300 GHz	8.0 (any 1-g of tissue) 20.0 (any 10-g of tissue in the limbs)	1.6 (any 1-g of tissue) 4.0 (any 10-g of tissue in the limbs)
NRPB** [5]	10 MHz - 10 GHz	10.0 (any 10-g of tissue) 20.0 (any 100-g of tissue in the limbs	

* American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV).

** National Radiological Protection Board (NRPB), United Kingdom.

Table 2. Measured and calculated Peak One-Gram Specific Absorption Rates (SARs) for the Human Model for Two CN Locomotive Control Systems

LCS Model	Peak Radiated Power W	Duty Cycle	Time-Averaged Radiated Power mW	Location of Antenna	Peak 1-g SAR	
					Experimental Measurements W/kg	Numerical Computations W/kg
Vectran Model VM 1000018	1.0	0.07	70	Normal use	0.022	0.025
				Abnormal (Unit turned around; antenna next to the body)	0.32	0.40
Theimeg Model BE 021-00061	2.0	0.052	104	Normal use	0.031	0.028
				Abnormal (Unit turned around; antenna facing and next to the body)	0.075	0.082

Om P. Gandhi is Professor and Chairman, Department of Electrical Engineering at the University of Utah, Salt Lake City. He is the author or co-author of several book chapters, and journal articles on electromagnetic dosimetry, microwave tubes and solid-state devices. He also edited the book, *Biological Effects and Medical Applications of Electromagnetic Energy* (Prentice-Hall, 1990), and coedited the book, *Electromagnetic Biointeraction* (Plenum Press, 1989).

Dr. Gandhi was elected a Fellow of the IEEE in 1979 and received the Distinguished Research Award from the University of Utah for 1979-1980. He has been President of the Bioelectromagnetics Society (1992-93), Cochairman of IEEE SCC 28.IV Subcommittee on the RF Safety Standards (1988- 97), and Chairman of the IEEE Committee on Man and Radiation (COMAR). In 1995, he received the d'Arsonval Medal of the Bioelectromagnetics Society for pioneering contributions to the field of bioelectromagnetics.