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FCC Part 15, Certification Application

Scorebrite, Inc.

Tennis Scoreboard Model TNSB1001

May 7, 2004

Report Number: 03-0076
Customer: Scorebrite, Inc.
Model: Tennis Scoreboard Model TNSB1001

MEASUREMENT/TECHNICAL REPORT

This report concerns (check one): Original grant_X_
Class II change_____

Equipment type: **Low Power Transmitter**

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes_____ No_X_

If yes, defer until:_____
date

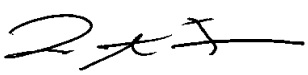
__N.A.__ agrees to notify the Commission by__N.A.___
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

United States Technologies, Inc.
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

Report reviewed by:



Louis A. Feudi
Operations Manager

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Customer: Scorebrite, Inc.
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SECTION 1

GENERAL INFORMATION

GENERAL INFORMATION

Product Description

The Equipment Under Test (EUT) is the Scorebrite, Inc. Tennis Scoreboard, Model TNSB1001. The product is intended to be a score-keeping device for use on a tennis court. The product consists of a receiver that displays the score in 8-segment format using LEDs, and a transmitter (EUT) that hangs on the tennis net.

Related Submittal(s)/Grant(s)

The EUT will be used with a DoC Approved receiver.

SECTION 2

TESTS AND MEASUREMENTS

TESTS AND MEASUREMENTS

Configuration of Tested System

The sample was tested per ANSI C63.4, Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (1992). Conducted and radiated emissions data were taken with the test receiver or spectrum analyzer's resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and fundamental emissions are shown in Figure 2.

Since the EUT is a hand held device, it was placed into a continuous mode of transmit and rotated about all 3 axis to obtain worse case results. Fresh batteries, with sufficient voltage were used during test.

Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. Conducted and digital device testing was performed at US Tech's measurement facility. This site has been fully described and registered by the FCC under Registration Number 91037. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number IC2982.

Modifications

No modifications were necessary to bring the EUT into compliance with Part 15, Class B FCC Rules and Regulations:

Test Equipment

Table 2 describes test equipment used to evaluate this product.

FIGURE 1

TEST CONFIGURATION

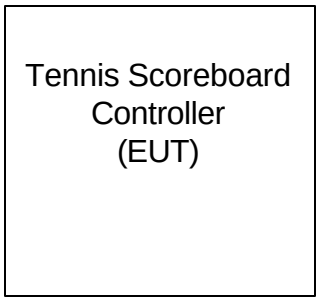

FIGURE 2a

Photograph(s) for Spurious and Fundamental Emissions

FIGURE 2b

Photograph(s) for Spurious and Fundamental Emissions

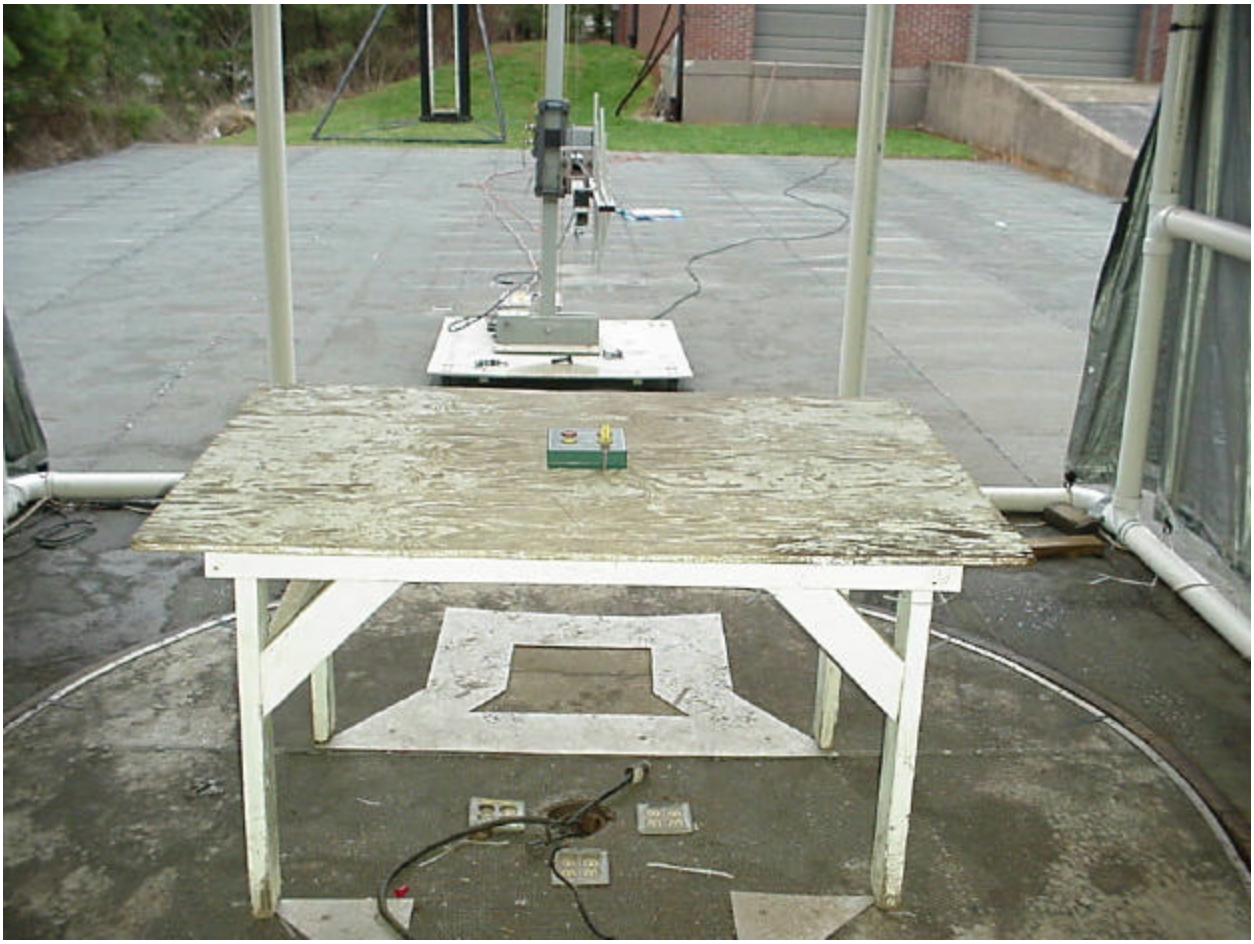

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FIGURE 2c

Photograph(s) for Spurious and Fundamental Emissions

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FIGURE 2d

Photograph(s) for Spurious and Fundamental Emissions

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FIGURE 2e

Photograph(s) for Spurious and Fundamental Emissions

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FIGURE 2f

Photograph(s) for Spurious and Fundamental Emissions

TABLE 1

EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Controller Scorebright (EUT)	Tennis Scoreboard Model TNSB1001	100	RZ8-083170DJA (Pending)	None

TABLE 2

TEST INSTRUMENTS

EQUIPMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8558B	HEWLETT-PACKARD	2332A10055	2/19/04
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	2/9/04
SIGNAL GENERATOR	8648B	HEWLETT-PACKARD	3642U01679	10/13/03
RF PREAMP	8447D	HEWLETT-PACKARD	2944A07436	6/19/03
RF PREAMP	8449B	HEWLETT-PACKARD	3008A00480	7/11/03
HORN ANTENNA	3115	EMCO	9107-3723	1/20/04
BICONICAL ANTENNA	3110	EMCO	9307-1431	1/20/04
LOG PERIODIC ANTENNA	3146	EMCO	3236	7/21/03
LISN (x 2) 8028-50-TS24-BNC	8028	SOLAR ELE.	910494 & 910495	1/10/04
CALCULATION PROGRAM	N/A	N/A	Ver. 6.0	N/A

Note: The calibration interval of the above test instruments is 12 months and all calibrations are traceable to NIST/USA.

Periodic Operation (47 CFR 15.231(a1))

A transmitter manually activated must automatically deactivate within not more than 5 seconds of being released. The transmitter is a 4 button transmitter. The EUT continues to transmit while each button is being pressed. The EUT ceases transmission almost immediately upon being released and appears to finish the current packet being transmitted. Therefore the longest period of time the transmitter should take to deactivate is a packet length, or 15.3 msec as shown in Figure 3.

FIGURE 3a

Periodic Operation 15.231(a)(c1)

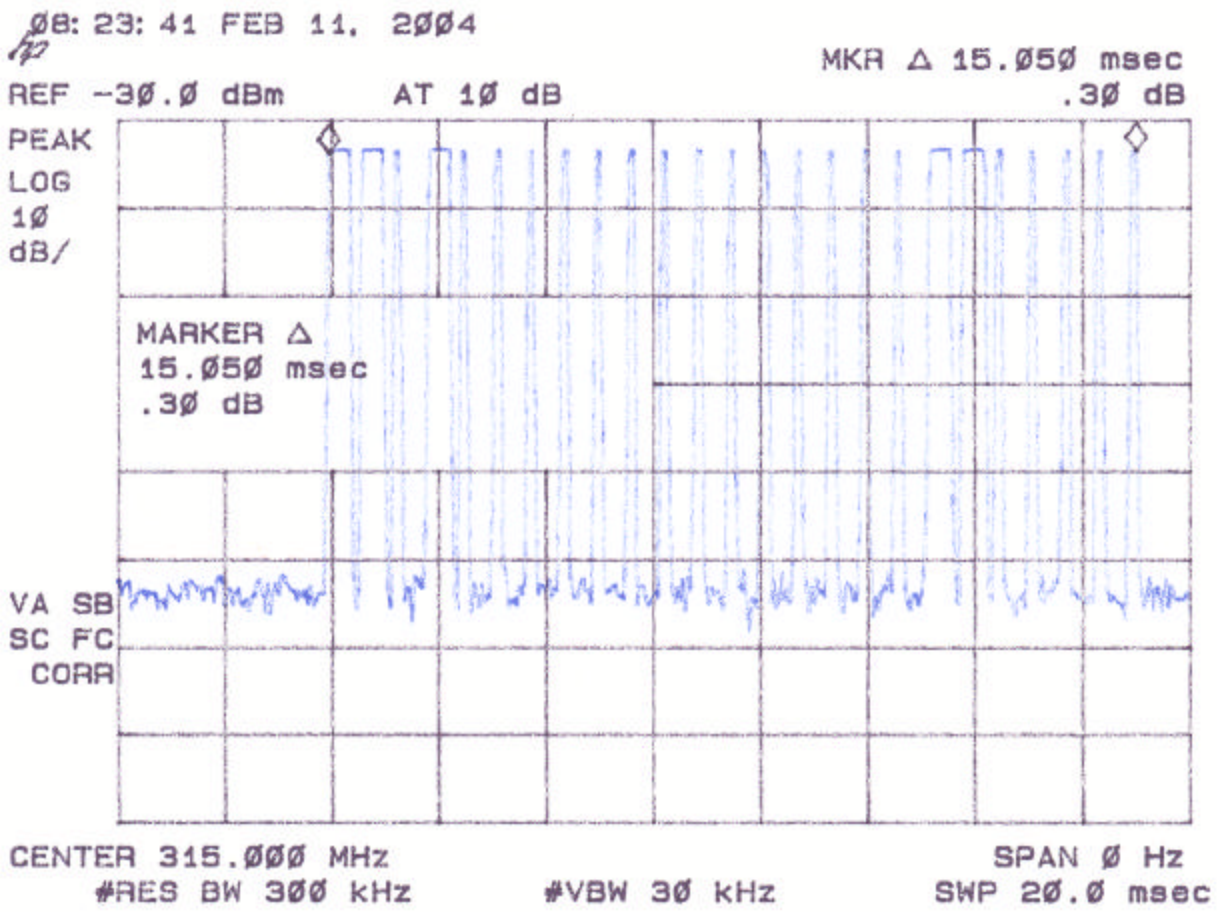
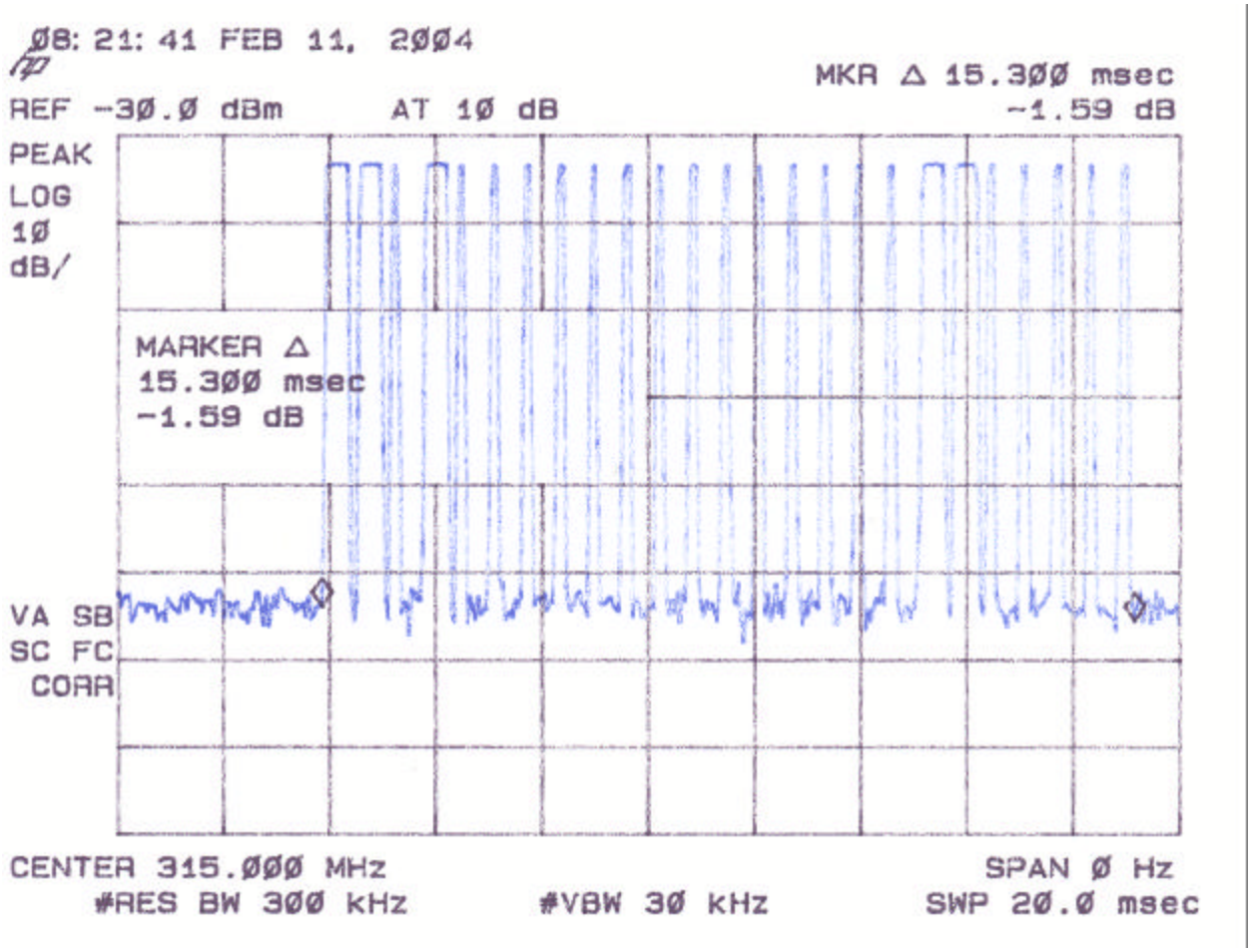


FIGURE 3b

Periodic Operation 15.231(a)(c1)



Field Strength of Fundamental Emission (47 CFR 15.231b)

Measurements were made using a peak detector. Field strength of the peak fundamental emission is shown in Table 3 and Figure 4.

Field strength of the average fundamental emission is shown in Table 4.

Duty Cycle Correction During 100 msec:

Each function key sends a different series of characters, but each packet period (20.25 msec) never exceeds a series of 25 long (350.0 µs) and short (50.0 µs) pulses. The transmit duty cycle would be considered 20 x 50.0 usec + 5 x 30 usec per 20.25 msec = 13.69% duty cycle. Figures 5a through 5c show the characteristics of the pulse train for one of these functions.

Duty Cycle Correction = 20 log (0.136) = -17.3 dB

Duty Cycle Characteristics are shown in Figures 5a, 5b, and 5c.

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TABLE 3a

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Peak Measurement

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	FCC LIMITS (uV/m) @ 3m	MARGIN BELOW FCC LIMITS (dB)
314.93	-34.6	18.5	35063.9	60417.0	4.72

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m Antilog [(-34.6 + 18.5 + 107)/20] = 35063.9
CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: February 11, 2004

Tested by
Signature:  **Name: David Blethen**

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TABLE 3b

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Average Measurement

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	FCC LIMITS (uV/m) @ 3m	MARGIN BELOW FCC LIMITS (dB)
314.93	-51.9	18.5	4784.8	6041.7	2.02

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m Antilog [(-51.9 + 18.5 + 107)/20] = 4784.8
CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: February 11, 2004

Tested by
Signature:  **Name: David Blethen**

FIGURE 4

FIELD STRENGTH OF FUNDAMENTAL EMISSION 15.231(b)

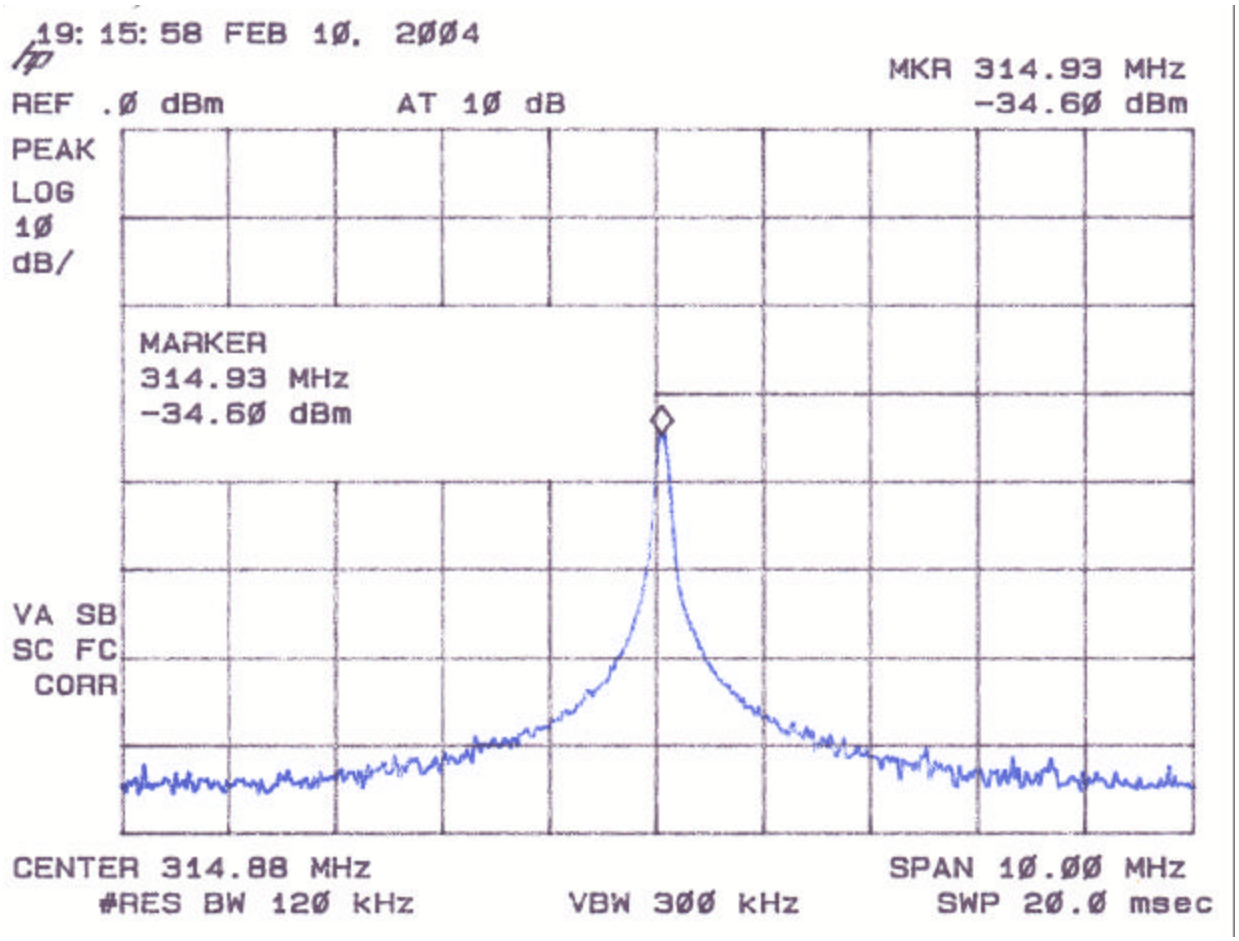


FIGURE 5a

DUTY CYCLE CHARACTERISTICS

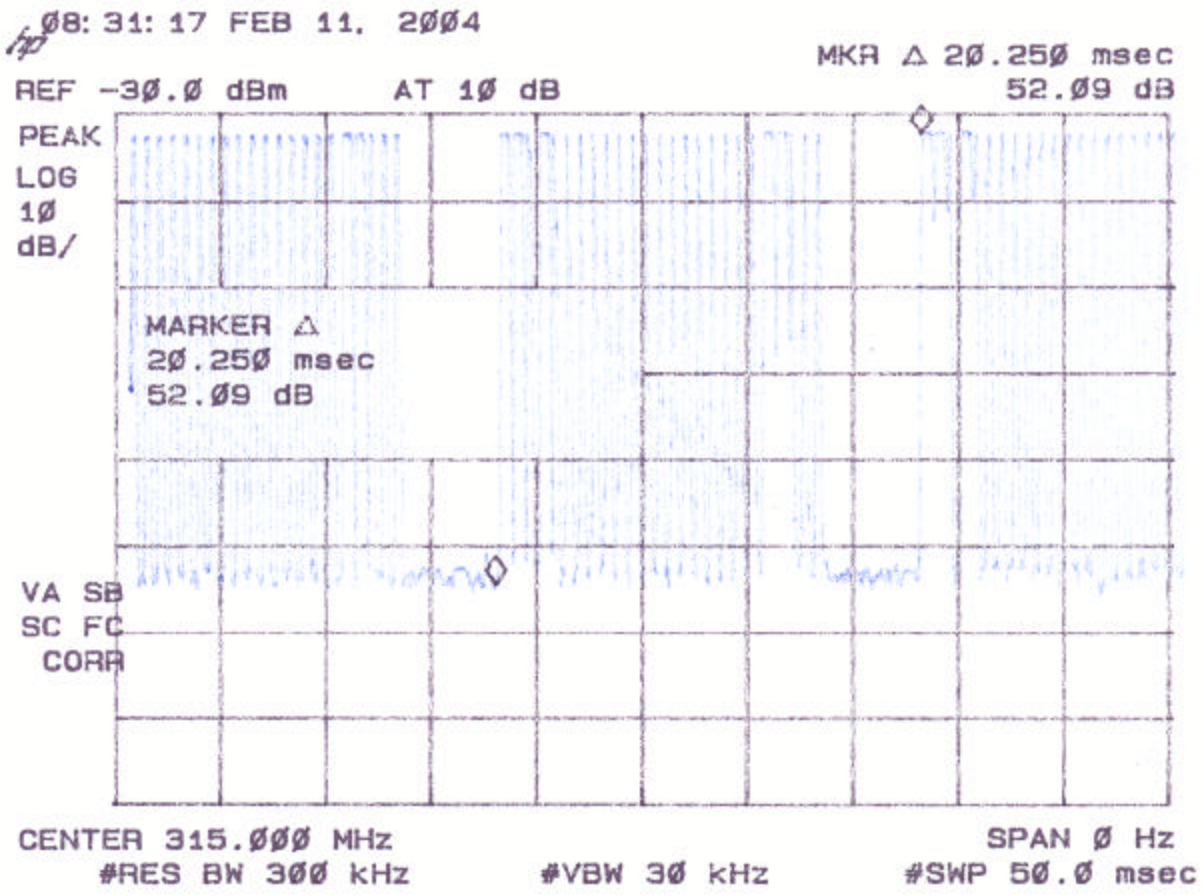


FIGURE 5b

DUTY CYCLE CHARACTERISTICS

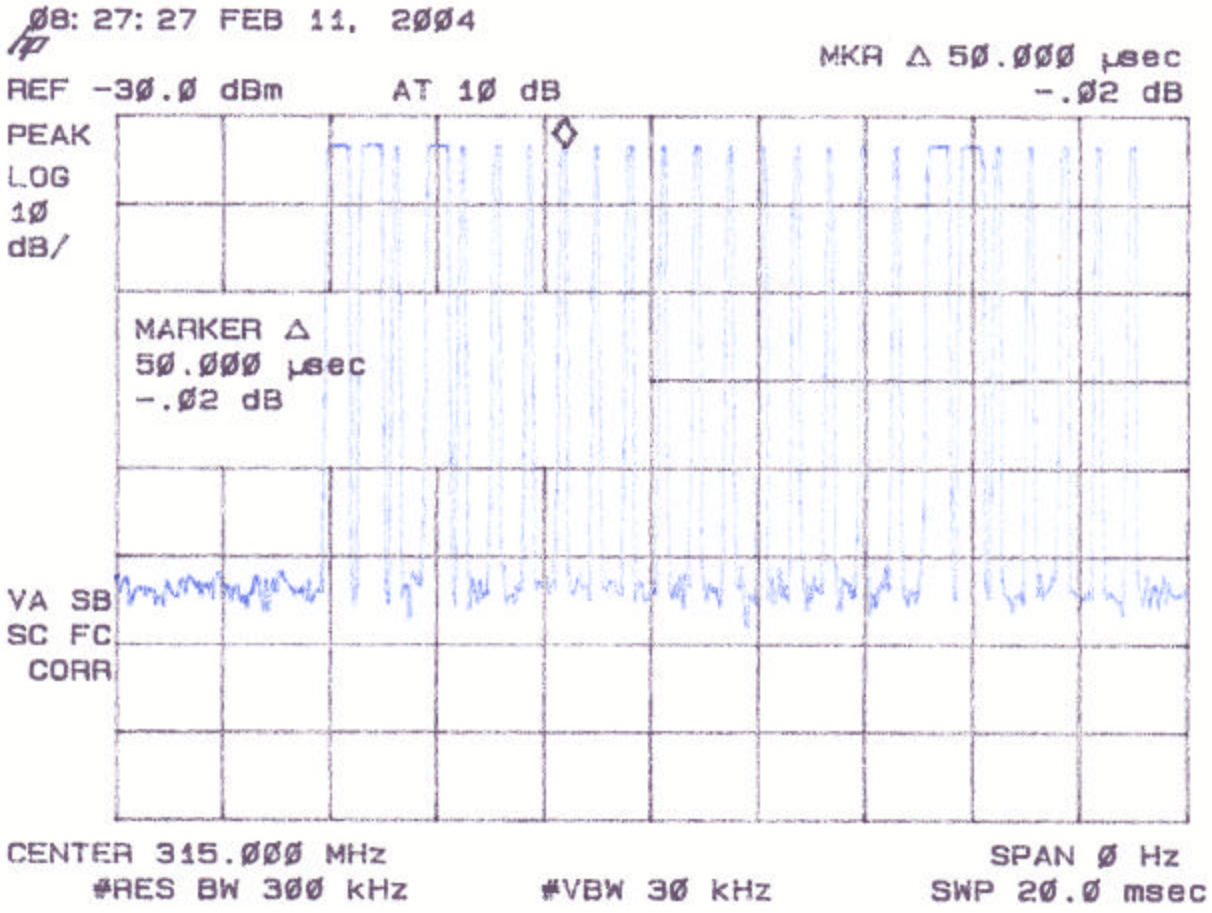
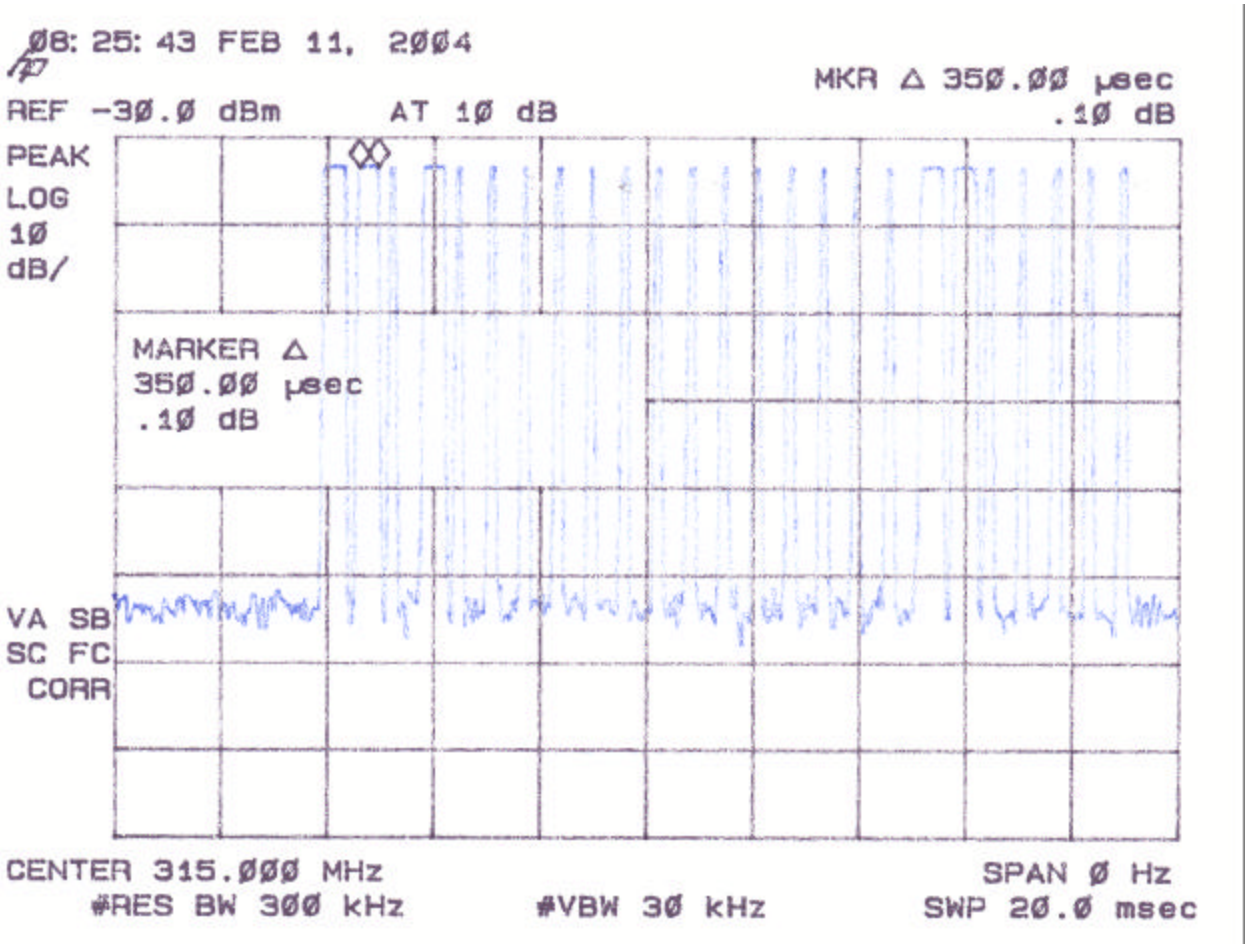


FIGURE 5c

DUTY CYCLE CHARACTERISTICS



Field Strength Of Spurious Emissions (47 CFR 15.231b)

Measurements were made using a peak detector. Field strength of Spurious Emissions are shown in Tables 5 and Figure 6. For comparison to the average limits, duty cycle corrections were made as given in the previous section. Any emission less than 1000 MHz and falling within the restricted bands of 15.205 were not adjusted for averaging and the limits of 15.209 were applied.

TABLE 5a

FIELD STRENGTH OF SPURIOUS EMISSIONS

Peak Measurements > 1 GHz

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	FCC LIMITS (uV/m) @ 3m	MARGIN BELOW FCC LIMITS (dB)
NO EMISSIONS WERE DETECTED WITHIN 20 dB OF FCC LIMITS					

Test Date: February 10, 2004

Tested by Signature:  **Name: David Blethen**

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TABLE 5b

FIELD STRENGTH OF SPURIOUS EMISSIONS

Average Measurement > 1 GHz

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	FCC LIMITS (uV/m) @ 3m	MARGIN BELOW FCC LIMITS (dB)
NO EMISSIONS WERE DETECTED WITHIN 20 dB OF FCC LIMITS					

Test Date: February 10, 2004

Tested by
Signature: _____ **Name: David Blethen**

FIGURE 6

FIELD STRENGTH OF SPURIOUS EMISSIONS (15.231B)

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	FCC LIMITS (uV/m) @ 3m	MARGIN BELOW FCC LIMITS (dB)
NO EMISSIONS WERE DETECTED WITHIN 20 dB OF FCC LIMITS					

Test Date: February 10, 2004

Tested by Signature:  **Name: David Blethen**

20 dB Bandwidth of Fundamental Emission (47 CFR 15.231c)

The peak 20 dB bandwidth measurement of the fundamental emission is shown in Table 6 and Figure 7.

TABLE 6

20 dB BANDWIDTH OF FUNDAMENTAL EMISSION

FREQUENCY (MHz)	20 dB BANDWIDTH (kHz)	FCC LIMITS (kHz)
314.93	325	787

FCC Limit = (0.25%) (Center Frequency) = (0.0025)(314.93) = 787 kHz

Test Date: July 2, 2003

Tested by
Signature: David B. Blethen **Name: David Blethen**

Report Number: 03-0076
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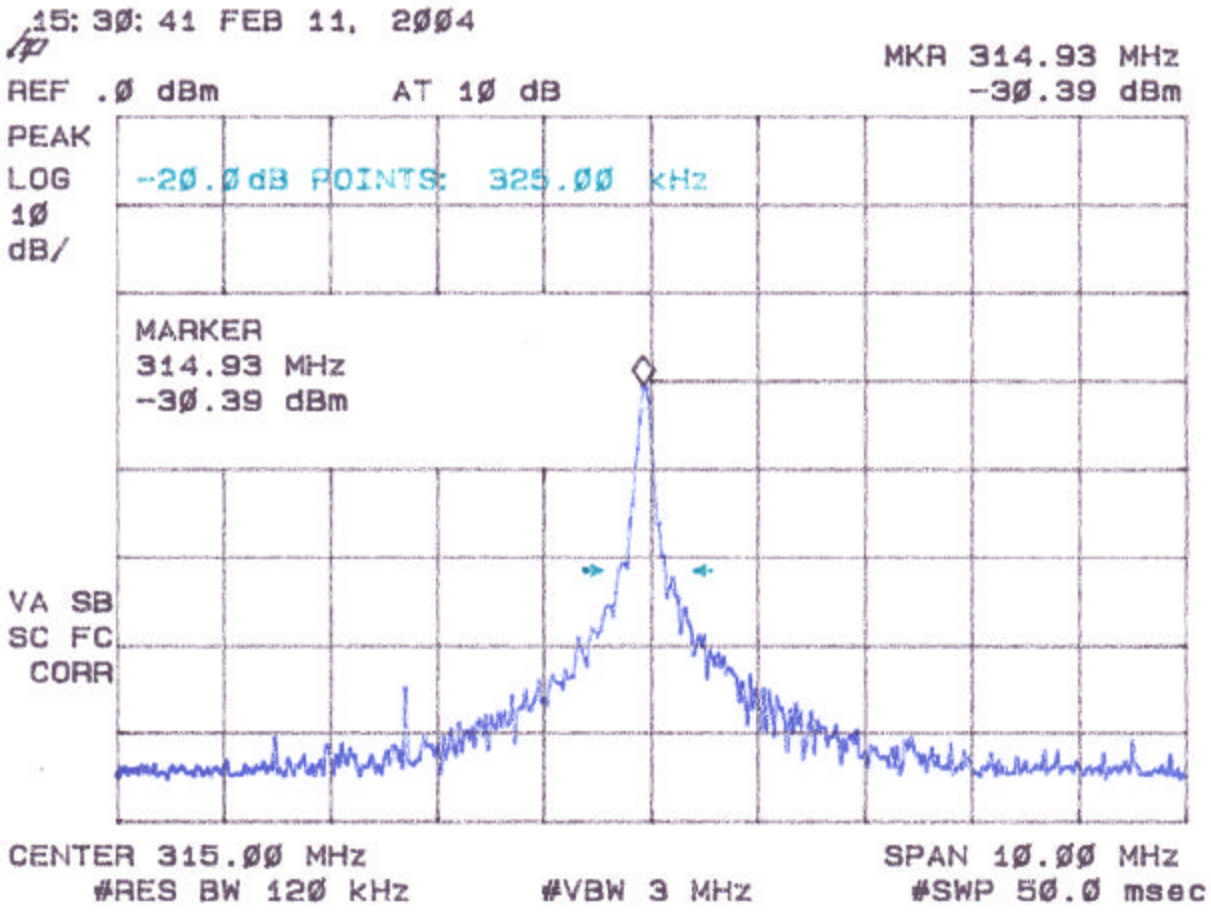
FIGURE 7

20 dB BANDWIDTH OF FUNDAMENTAL EMISSION 15.231(c)



Frequency Tolerance of Carrier Signal (47 CFR 15.231d)

The EUT does not operate in the 40.66 - 40.70 MHz band, therefore frequency tolerance measurements were deemed unnecessary.

Radiated Digital Device Emissions (47 CFR 15.109a)

Radiated emissions were evaluated from 30 to 1000 MHz. Measurements were made with the analyzer's bandwidth set to 120 kHz. Emissions are shown in Table 7.

TABLE 7

CLASS B
RADIATED EMISSIONS

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	FCC LIMITS (uV/m) @ 3m
NO EMISSIONS DETECTED WITHIN 20 dB OF FCC LIMITS				

Test Date: February 10, 2004

Tested by Signature:  **Name: David Blethen**

Power Line Conducted Emissions (47 CFR 15.107a)

The EUT is operated by internal battery power only, therefore power line conducted emissions was deemed unnecessary.

SECTION 5
PHOTOGRAPHS

PHOTOS OF THE TESTED EUT

The following photos are attached:

Photo 1. EUT, Front View

Photo 2. EUT, Rear View

Photo 3. Transmitter Board, Component Side

Photo 4. Transmitter Board, Solder Side

SECTION 6

USER'S MANUAL

User's Manual

Please follow these instructions once the scoreboard is assembled and mounted properly.

Step 1 – Select Power Source

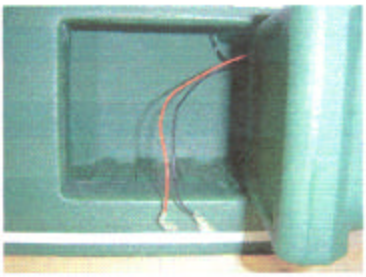
Each scoreboard is equipped with two (2) different power supplies. Use the best power supply option based on the court layout. If a power outlet is not available, then select the battery option. If a power outlet is nearby, then select the power cord option.

Battery

Power Cord

Step 2 – Install Battery or Attach Power Cord

If the battery option is selected, then locate the red and black battery connector wires found behind the small door at the bottom of the scoreboard. Attach the red and black connector wires to the top of the battery using the color-coded ends. Once attached, place the battery behind the small door and close.



Important Note: Battery is 12V and rechargeable.

If the power cord option is selected, then locate the small receptacle located at the bottom of the scoreboard. Attach the power cord (i.e. transformer) to the small receptacle. Plug the other end into a nearby power outlet or extension cord.

Important Note: The transformer converts the normal current of 115V AC to 12V DC. Once attached, place as much of the cord outside the fence.

Step 3 – Select Control Panel Settings

Behind the other small door at the bottom of the scoreboard is the control panel. The control panel allows the user to turn the scoreboard on and off, set the power source, change the game and set scores and control the brightness of the scoreboard.

If the battery option is selected, then place the Power Source switch in the DC position. If the power cord option is selected, then place the Power Source switch in the AC position.

Step 4 – Turn Scoreboard On

On the control panel, place the Power switch in the ON position. The large, red game scores will light up and default to zero. Anytime the power is turned off and then back on, the scores will default back to zero.

Important Note: Always turn the scoreboard off when not in use.

Step 5 – Adjust Brightness

On the control panel, turn the Brightness knob to the right to increase the brightness (usually during the day) and back to the left to decrease the brightness (usually at night). More battery power is used when the brightness is increased.

Step 6 – Test Scoreboard

Once the scoreboard is turned on, press each red Score button on the control panel to verify that the game score changes from 0, 1, 2, 3…9. Once the score reaches 9, the game score returns to 0. Press each yellow Set button on the control panel to verify that the set light updates 1, 2 and back to 0. Once testing is complete, close the small door.

Step 7 – Setup Remote Control

Each scoreboard comes with a remote control. Turn the remote control over to reveal the battery compartment. Please remove the battery compartment door using a Philips head screwdriver. Attach the supplied 9V battery in the remote control and replace the battery compartment door.

Important Note: Each remote control has a unique frequency code. The frequency code allows the remote control to control just one scoreboard and not interfere with any other remote controls in the area. Match the frequency code label found on the back of the remote control with the corresponding frequency code label on the bottom of each scoreboard.

Step 8 – Test Remote Control

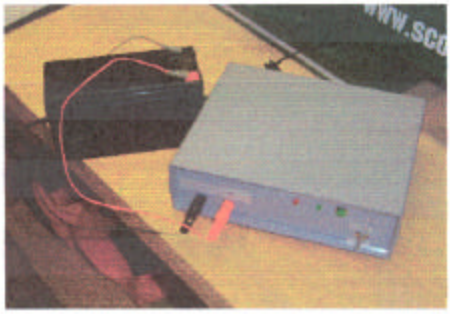
Like Step 6, press the red and yellow buttons on the remote control to update the game and set scores on the scoreboard. The remote control is stored in the drawer attached to the net post. Setup is complete.

Other Important Items:

Recharging the Batteries

The 12V batteries provided will last several weeks (or up to several months) based on the amount of use. Please follow these steps when recharging a battery:

1. Verify that the scoreboard is turned off
2. Remove the battery from the scoreboard
3. Attach the battery to the battery charger using the red and black connectors
4. Attach a power cord to the back of the battery charger
5. Turn the battery charger on by flipping the switch – the red Stop Charge light will come on
6. Push the Charge button – the green Charging button will come on
7. After 2 hours, the battery is fully recharged
8. Turn the battery charger off and re-attach to scoreboard



Applying Court Numbers

Each scoreboard comes with a sheet of vinyl numbers 0 through 9. Depending on the court layout, remove the desired vinyl court number(s) and place on the scoreboard next to the COURT display.