KTL Test Report:	0R02861
Applicant:	Digital Security Controls Ltd. 3301 Langstaff Road Vaughn, Ontario L4K 4L2
Equipment Under Test: (E.U.T.)	WLS 929 – 433UA233, Rev. 01
In Accordance With:	**FCC Part 15, Subpart C** For Low Power Transmitters Operating Periodically In The Band 40.66 - 40.77 MHz And Above 70 MHz
Tested By:	KTL Ottawa Inc. 3325 River Road, R.R. 5 Ottawa, Ontario K1V 1H2
Authorized By:	
	R. Grant, Wireless Group Manager
Date:	
Total Number of Pages:	24

Table of Contents

Section 1. Summary of Test Results

General

All measurements are traceable to national standards.

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.231. All tests were conducted using measurement procedure ANSI C63.4-1992. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

☒ New Submission ☒ Production Unit

☐ Class II Permissive Change ☐ Pre-Production Unit

D	S	C

Equipment Code

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.
See " Summary of Test Data".

NVLAP LAB CODE: 100351-0

TESTED BY: _____ DATE: _____
Kevin Carr, Technologist

Summary Of Test Data

Name of Test	Para. Number	Results
Transmission Requirements	15.231(a)	Complies
Radiated Emissions	15.231(b)	Complies
Occupied Bandwidth	15.231(c)	Complies
Frequency Tolerance	15.231(d)	Not Applicable
Periodic Alternate Field Strength Requirements	15.231(e)	Not Applicable
Powerline Conducted Emissions	15.207	Not Applicable

Footnotes For N/A's:

15.231(d) – The E.U.T. does not transmit in the band specified under this sub-section.

15.213 (e) – The applicant is not seeking approval under this sub-section.

15.207 – The E.U.T. is battery powered.

Test Conditions:

Indoor Temperature: 25 °C
Humidity: 64 %

Outdoor Temperature: 30 °C
Humidity: 84 %

Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

Manufacturer:	Digital Security Controls Ltd.
Model No.:	WLS 929-433UA233, Rev. 01
Serial No.:	None
Date Received In Laboratory:	August 15, 2000
KTL Identification No.:	Items 1 & 2
Frequency Range:	433.92 MHz (Fixed)
Operating Frequency(ies) of Sample:	433.92 MHz
Type of Emission:	ASK
Emission Designator:	552KL1D
Supply Power Requirement:	4.5 VDC, 3 x A76BP2 (1.5V) Batteries
Duty Cycle Calculation:	$20 \text{ Log } \frac{12.25}{100} = -18.2 \text{ dB}$

Section 3. Transmission Requirements

Para. No.: 15.231(a)

Test Performed By: Kevin Carr	**Date of Test:** August 15, 2000

Minimum Standard:

15.231(a) Continuous transmissions such as voice, video or data transmissions are not permitted.

15.231(a)(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds after being released.

15.231(a)(2) A transmitter activated automatically shall cease transmission within 5 seconds of activation.

15.231(a)(3) Periodic transmissions at regular pre-determined intervals are not permitted. However polling or supervisory transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.

15.231(a)(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm.

Test Results: Complies.

Test Data: Compliance was determined by verification of technical specifications and a functional test on the equipment.

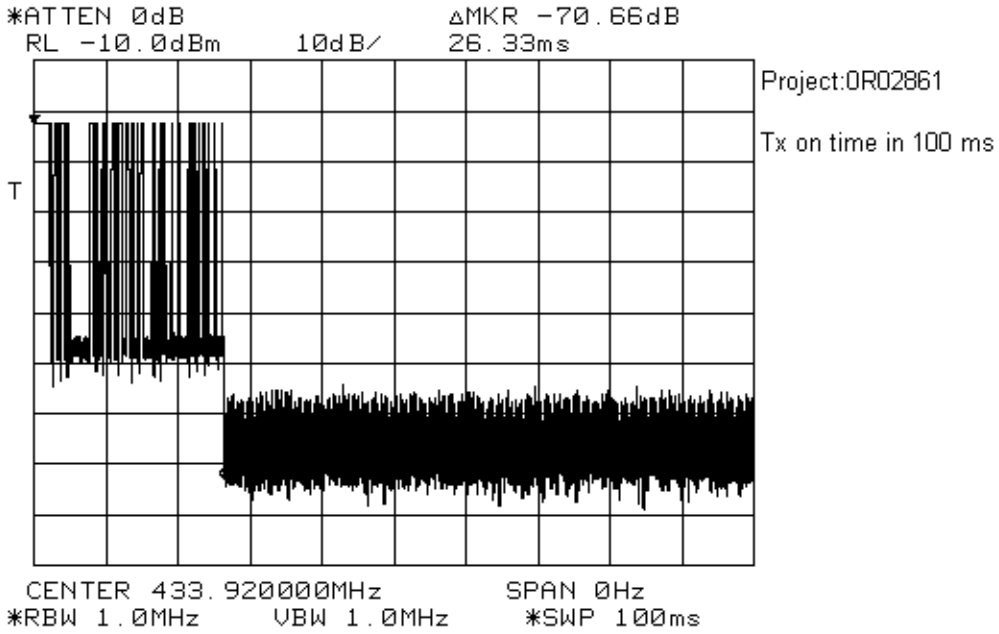
Rationale for Compliance with Transmission Requirements

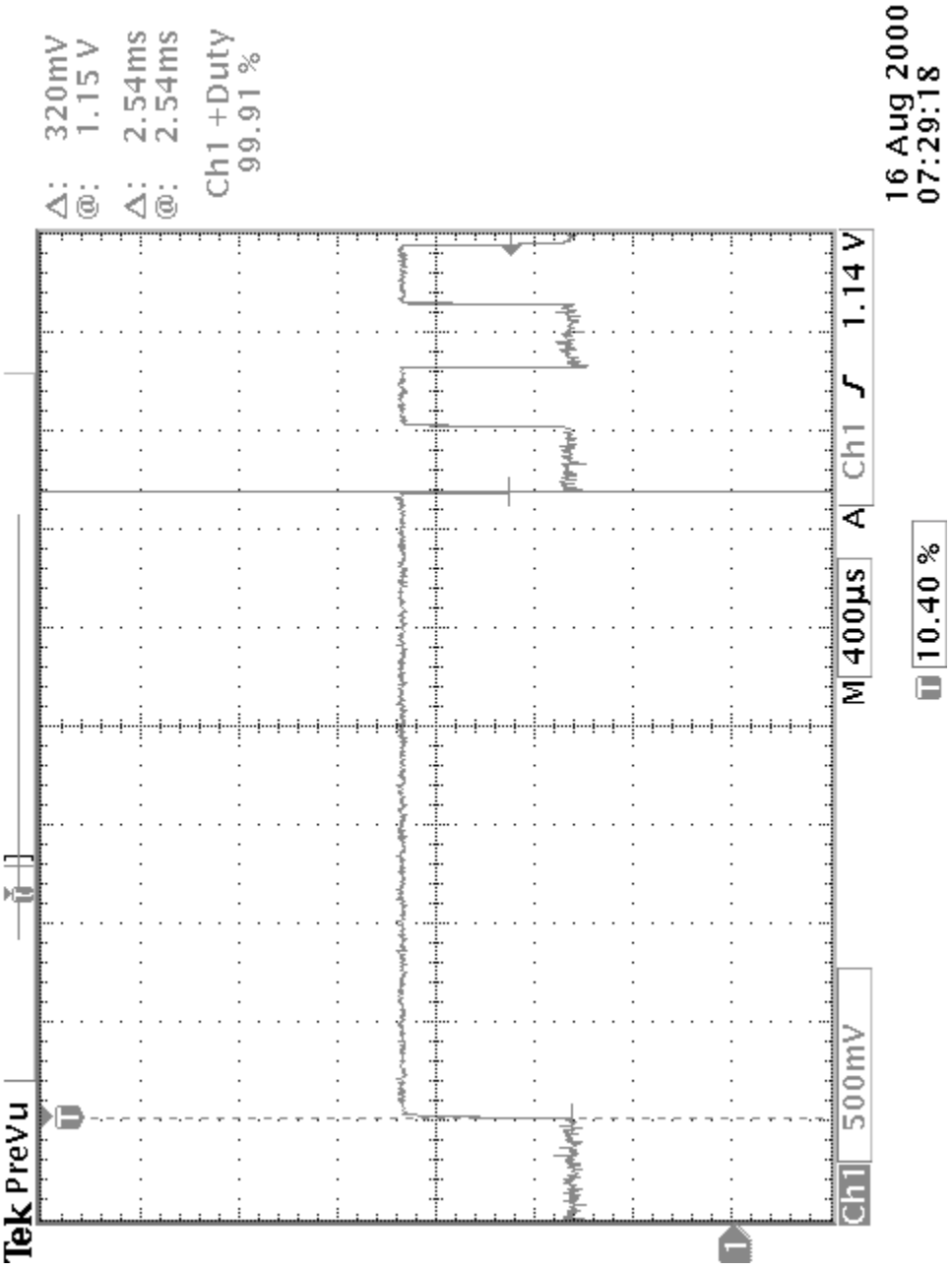
15.231(a)(1) : The E.U.T. does not continuously transmit and automatically shuts off.

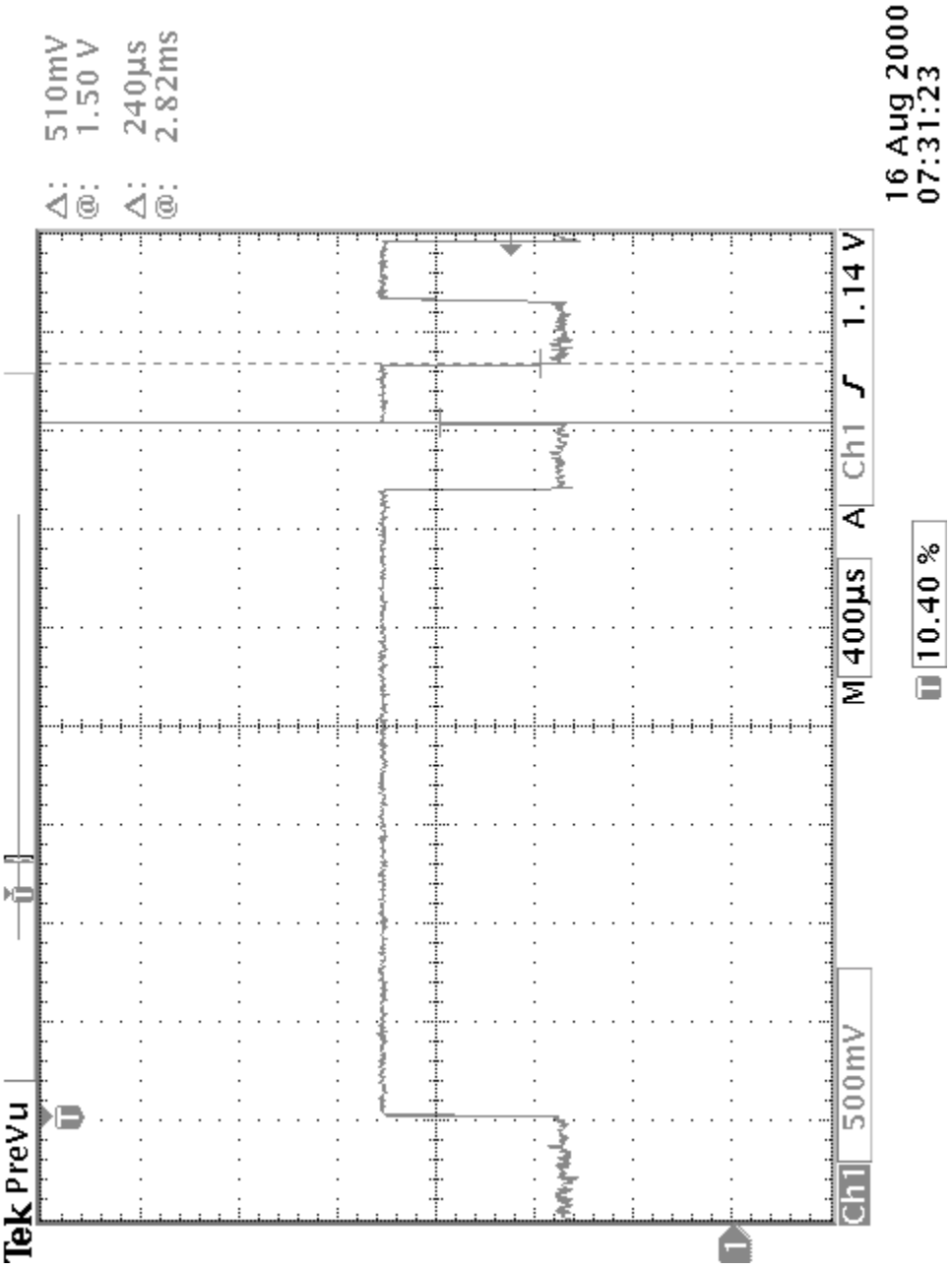
15.231(a)(2) : The E.U.T. is manually activated.

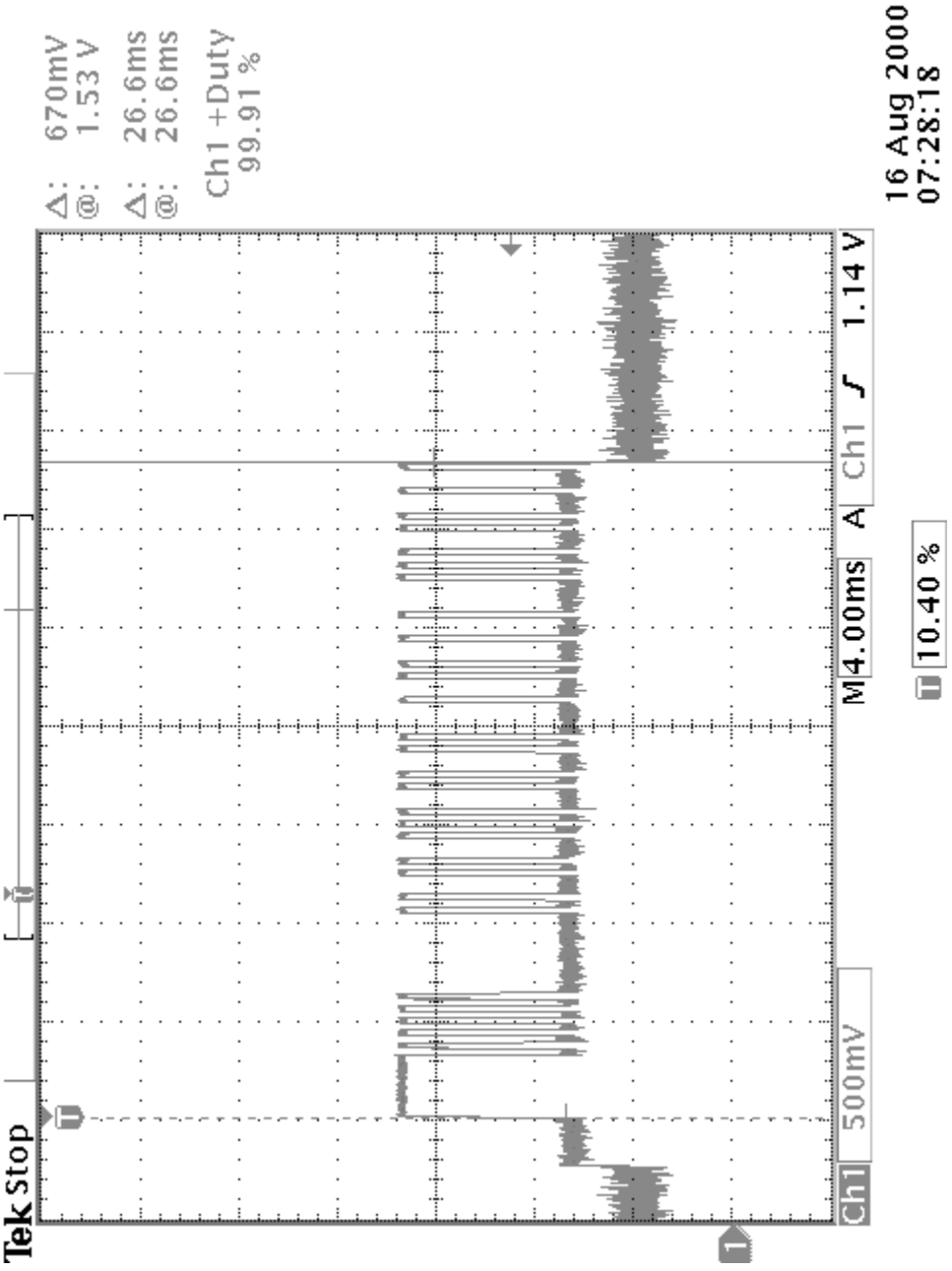
15.231(a)(3) : The E.U.T. does not periodically transmit.

15.231(a)(4) : The E.U.T. does not remain active.


*ATTEN 0dB
ΔMKR -70.66dB
RL -10.0dBm
10dB/
26.33ms
Project:0R02861
Tx on time in 100 ms
T
CENTER 433.920000MHz
SPAN 0Hz
*RBW 1.0MHz
VBW 1.0MHz
*SWP 100ms


Tek PreVu
Ch1 500mV
M 400µs A Ch1 1.14 V
10.40 %
16 Aug 2000
07:29:18
Δ: 320mV
@: 1.15 V
Δ: 2.54ms
@: 2.54ms
Ch1 +Duty
99.91 %


Tek PreVu
Ch1 500mV
M 400µs A Ch1 1.14 V
10.40 %
16 Aug 2000
07:31:23
Δ: 510mV
@: 1.50 V
Δ: 240µs
@: 2.82ms


Tek Stop
Ch1 500mV
M4.00ms A Ch1 1.14 V
10.40 %
Δ: 670mV
@: 1.53 V
Δ: 26.6ms
@: 26.6ms
Ch1 +Duty
99.91 %
16 Aug 2000
07:28:18

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Security Products

Narrow Band 2K baud
Data Transmission Format

CONFIDENTIAL

Data Transmission Format

The transmitted data packet is a fixed length, amplitude modulated packet. The packet contains all of the necessary information to indicate which sensor generated the packet, the type of sensor and the status of the sensor's inputs. The data is sent at a rate of 500 µS per bit or 2 Kbits per Second.
Figure 1 shows the bit timing used for all bits in the packet. Where a low logic present for the 500 us bit time represents a data logic "0", and 250 us low then 250 us high represents a data logic "1".

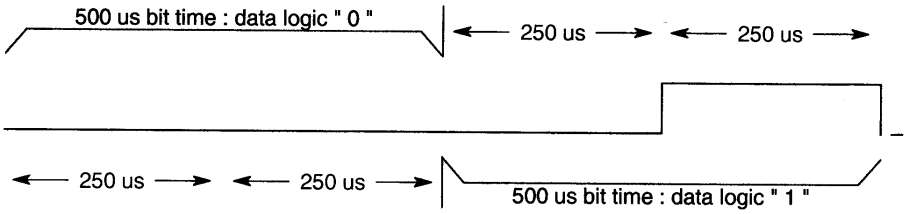

Figure 1 – Bit Timing

Figure 2 shows the format of the transmitted data packet. Bytes highlighted in green are bytes that are variable information that would depend on the current status, module type, and serial number of the particular device.

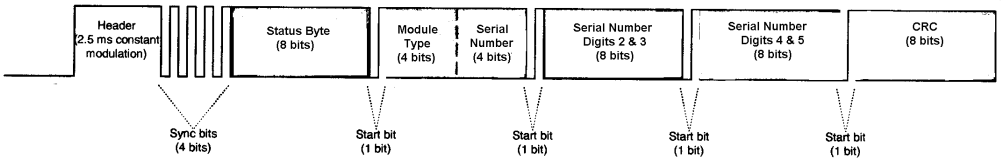

Figure 2 – Data Packet format

Because these bytes are variable there is a best and worst case packet when considering ON time.

Minimum ON time
The packet with the minimum on time would be:

2.5ms header + 1111 + 1000 0000 + 1 + 0010 0000 + 1 + 0000 0001 + 1 + 0000 0001 + 1 + 0011 1001

Thus the minimum ON time would be: 2.5 ms + (16 ON bits * 0.25 ms per bit)
2.5 ms + 4 ms
6.5 ms

Maximum ON time
The packet with the maximum on time would be:

2.5ms header + 1111 + 1111 1111 + 1 + 0110 1111 + 1 + 1111 1110 + 1 + 1111 1110 + 1 + 1001 0001

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Narrow Band 2K baud
Data Transmission Format

CONFIDENTIAL

Thus the maximum ON time would be: 2.5 ms + (39 ON bits * 0.25 ms per bit)
2.5 ms + 9.75 ms
12.25

The components of the data packet are broken down in Table 1 showing the maximum and minimum ON times for the packet. These maximum and minimum ON times are based on best and worst case possible information that is transmitted by the devices.

Packet Component	Description	# of Bits	Max. ON Time	Min. ON Time	Total Time
Header	2.5 ms of carrier frequency to indicate start of packet.	-	2.5 ms	2.5 ms	2.5 ms
Sync Bits	4 logic '1' bits for synchronization	4	1 ms	1 ms	2 ms
Status	Status information:				4 ms
	minimum valid value = 80 hex (1000 0000 binary)	1	-	0.25 ms	
	maximum valid value = FF hex (1111 1111 binary)	8	2 ms	-	
Start Bit	1 logic '1' bit for synchronization	1	0.25 ms	0.25 ms	0.5 ms
Module Type	Valid module types currently used are: 2 hex (0010 binary), 3 hex (0011 binary), 4 hex (0100 binary), 5 hex (0101 binary), 6 hex (0110 binary), and 9 hex (1001 binary).				2 ms
	minimum valid value = 2 or 4 hex	1	-	0.25 ms	
	maximum valid value = 3, 5, 6, or 9 hex	2	0.5 ms	-	
Serial # Digit 1	minimum valid value = 0 hex (0000 binary)	0	-	0 ms	2 ms
	maximum valid value = F hex (1111 binary)	4	1 ms	-	
Start Bit	1 logic '1' bit for synchronization	1	0.25 ms	0.25 ms	0.5 ms
Serial # Digit 2 and 3	minimum valid value = 01 hex (0000 0001 binary)	1	-	0.25 ms	4 ms
	maximum valid value = F0 hex (1111 1110 binary)	7	1.75 ms	-	
Start Bit	1 logic '1' bit for synchronization	1	0.25 ms	0.25 ms	0.5 ms
Serial # Digit 4 and 5	minimum valid value = 01 hex (0000 0001 binary)	0	-	0.25 ms	4 ms
	maximum valid value = F0 hex (1111 1110 binary)	7	1.75 ms	-	
Start Bit	1 logic '1' bit for synchronization	1	0.25 ms	0.25 ms	0.5 ms
CRC	Cyclic Redundancy Check value				4 ms
	CRC byte calculated from above minimum values = 39 hex (0011 1001 binary)	4	-	1 ms	
	CRC byte calculated from above maximum values = 91 hex (1001 0001 binary)	3	0.75 ms	-	
Total Maximum ON time based on valid packet information:			***12.25 ms***		
Total Minimum ON time based on valid packet information:				***6.50 ms***	
Total packet time:					***26.5 ms***

Diagram 1 – Maximum / Minimum packet ON times

Section 4. Radiated Emissions

Para. No.: 15.231(b)

Test Performed By: Kevin Carr	**Date of Test:** August 15, 2000

Minimum Standard:

Permissible Field Strength Limits (Momentarily Operated Devices

Fundamental Frequency (MHz)	Field Strength of Fundamental Microvolts/Meter at 3 meters; (watts)	Field Strength of Unwanted Emissions Microvolts/Meter at 3 meters; (watts)
40.66 - 40.70	2,250	225
70-130	1, 250	125
130-174	1,250 to 3,750*	125 to 375
174-260 (note 1)	3,750	375
260-470 (note 1)	3,750 to 12,500*	375 to 1,250
Above 470	12,500	1,250

Notes:

# Use quasi-peak or averaging meter.	*For 130 - 174 MHz: FS (microvolts/m) = (56.82 x F) - 6136*
** Linear interpolation with frequency F in MHz*	*For 260 - 470 MHz: FS (microvolts/m) = (41.67 x F) - 7083*

Any emissions that fall within the restricted bands of 15.205 shall not exceed the following limits:

Frequency (MHz)	Field Strength (µV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

Test Results: Complies. The worst-case emission level is 53.0 dBµV/m @ 3m at 2169.6 MHz. This is 7.8 dB below the specification limit.

Test Data: See attached table.

Above 1 GHz a spectrum analyzer and low noise amplifier are used to measure emission levels. The spectrum analyzer resolution bandwidth was set to 1 MHz and video bandwidth was 3 MHz.

In the case of handheld equipment, the E.U.T. is rotated in three planes to obtain worst-case results.

Test Data - Radiated Emissions - Average

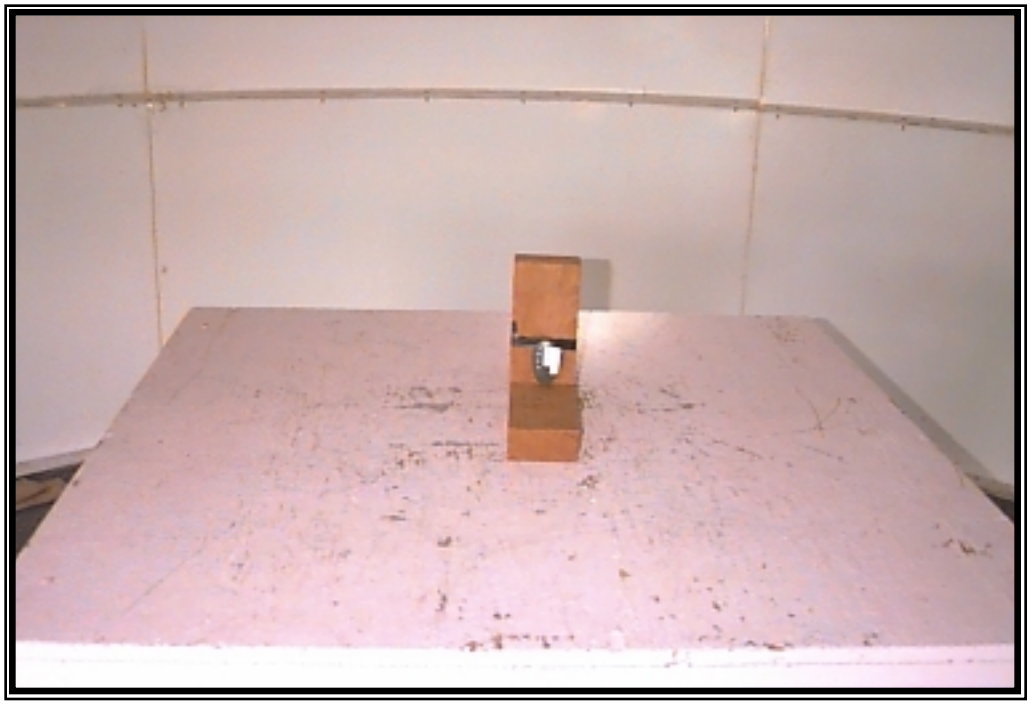
Test Distance (meters) : 3		Range: A Tower		Receiver: ESVP, HP8564E		RBW(kHz): 120, 1000		Detector: CISPR, Q-Peak, Peak	
Freq. (MHz)	Ant. *	Pol. (V/H)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
433.92	E/D4	V	64.9	25.9		-18.2	72.6	80.8	8.2
433.92	E/D4	H	63.7	25.9		-18.2	71.4	80.8	9.4
867.83	E/D4	V	18.7	33.7		-18.2	34.2	60.8	26.6
867.83	E/D4	H	19.3	33.7		-18.2	34.8	60.8	26.0
1301.7	Hrn2	V	73.9	30.4	-48.0	-18.2	38.1	54.0	15.9
1301.7	Hrn2	H	67.2	30.4	-48.0	-18.2	31.4	54.0	22.6
1735.7	Hrn2	V	76.5	32.5	-48.0	-18.2	42.8	60.8	18.0
1735.7	Hrn2	H	66.4	32.5	-48.0	-18.2	32.7	60.8	28.1
2169.6	Hrn2	V	35.8	35.4		-18.2	53.0	60.8	7.8
2169.6	Hrn2	H	29.5	35.4		-18.2	46.7	60.8	14.1
2603.5	Hrn2	V	26.3	37.7		-18.2	45.8	60.8	15.0
2603.5	Hrn2	H	26.9	37.7		-18.2	46.4	60.8	14.4
3037.0	Hrn2	V	73.4	39.0	-59.4	-18.2	44.8	60.8	16.0
3037.4	Hrn2	H	89.1	39.0	-59.4	-18.2	50.5	60.8	10.3
3471.4	Hrn2	V	79.5	40.7	-57.3	-18.2	44.7	60.8	16.1
3471.4	Hrn2	H	81.3	40.7	-57.3	-18.2	46.5	60.8	14.3
3905.2	Hrn2	V	74.1	42.5	-57.8	-18.2	40.6	54.0	13.4
3905.3	Hrn2	H	75.1	42.5	-57.8	-18.2	41.6	54.0	12.4
4339.1	Hrn2	V	64.2	43.3	-54.9	-18.2	34.4	54.0	19.6
4339.1	Hrn2	H	67.8	43.3	-54.9	-18.2	38.0	54.0	16.0

Notes:

B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole
* Re-measured using dipole antenna.
** Includes cable loss when amplifier is not used.
*** Includes cable loss.
( ) Denotes failing emission level.
N.D. = Not Detected

Radiated Photographs (Worst Case Configuration)

Front View



Section 5. Occupied Bandwidth

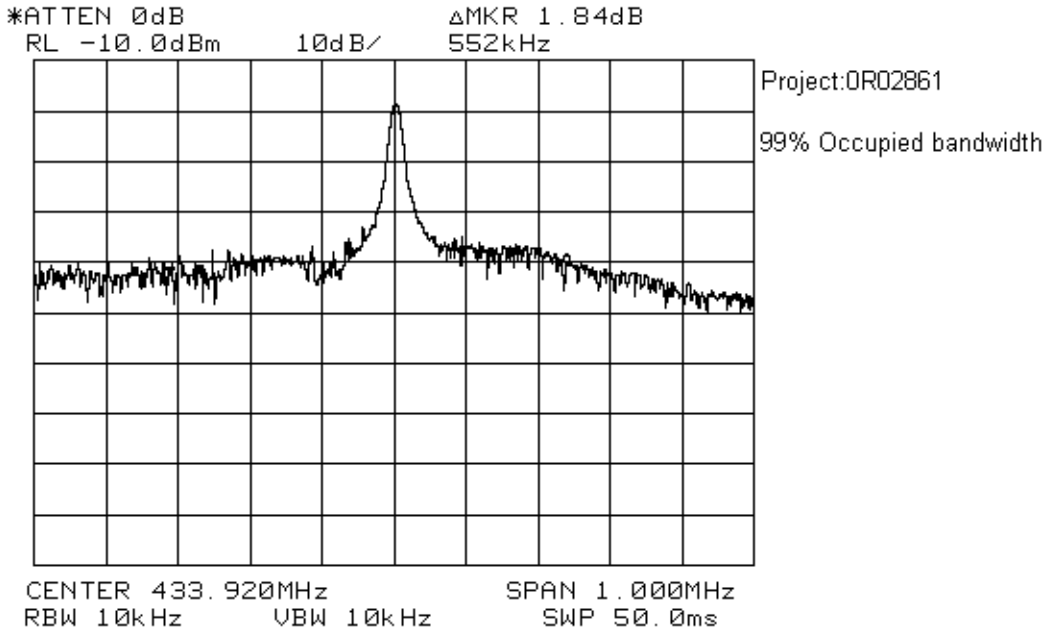
Para. No.: 15.231(c)

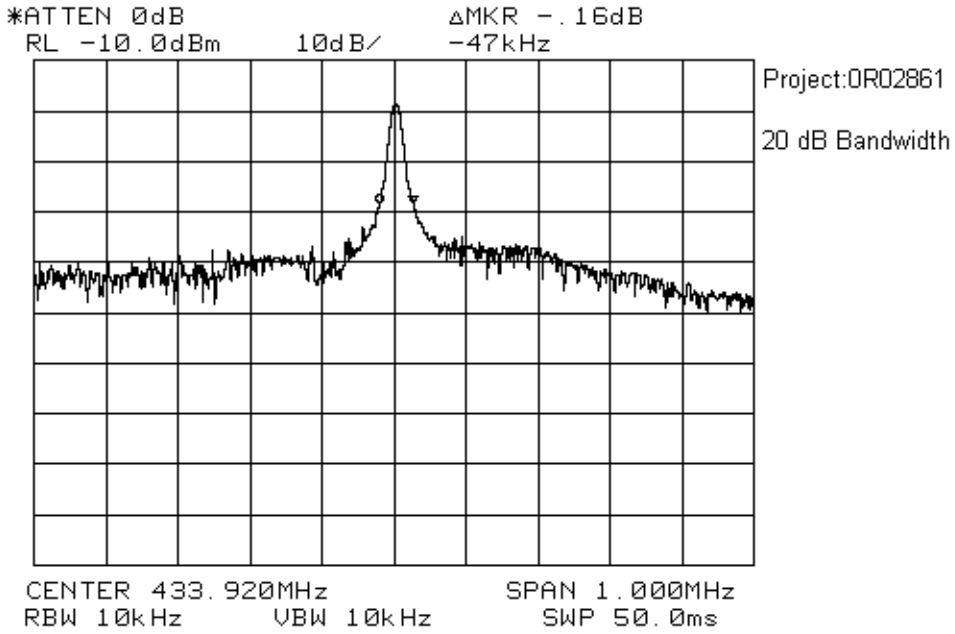
Test Performed By: Kevin Carr	**Date of Test:** August 16, 2000

Minimum Standard: 15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Results: Complies. See attached graph.

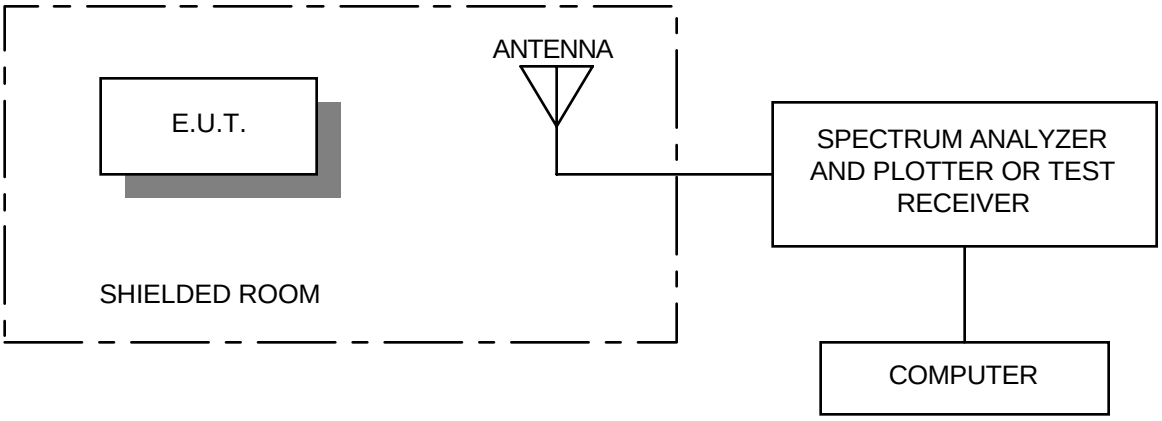
Test Data: See attached graph.


*ATTEN 0dB
RL -10.0dBm
10dB/
ΔMKR 1.84dB
552kHz
Project:0R02861
99% Occupied bandwidth
CENTER 433.920MHz
SPAN 1.000MHz
RBW 10kHz
VBW 10kHz
SWP 50.0ms

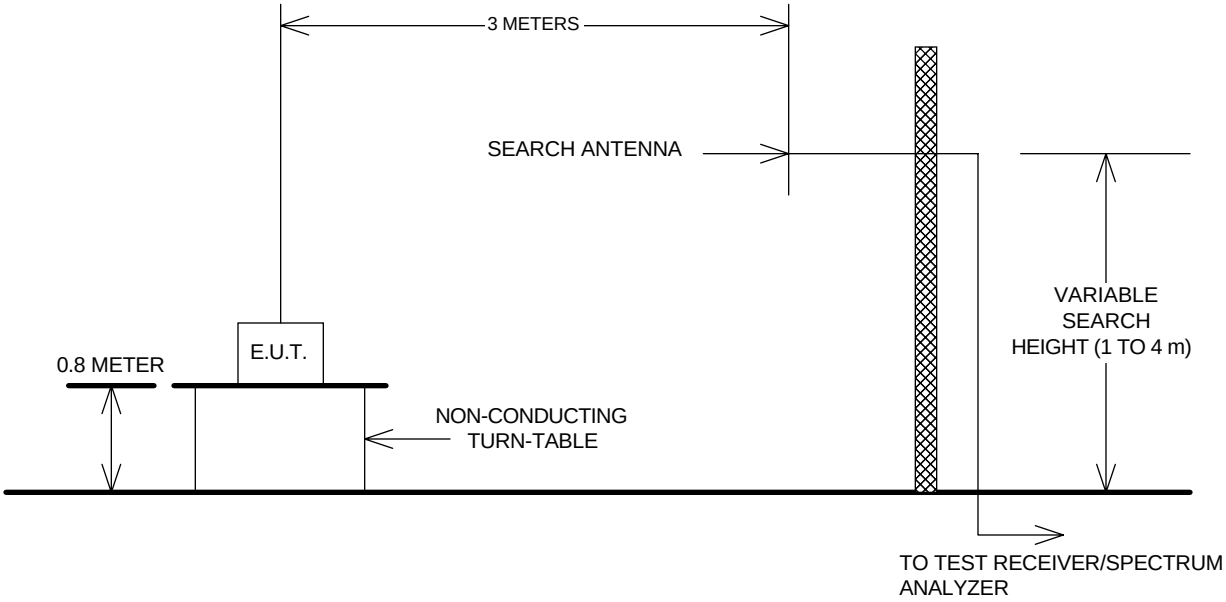

*ATTEN 0dB
RL -10.0dBm
10dB/
ΔMKR -.16dB
-47kHz
Project:0R02861
20 dB Bandwidth
CENTER 433.920MHz
SPAN 1.000MHz
RBW 10kHz
VBW 10kHz
SWP 50.0ms

Section 6. Block Diagrams

Radiated Prescan

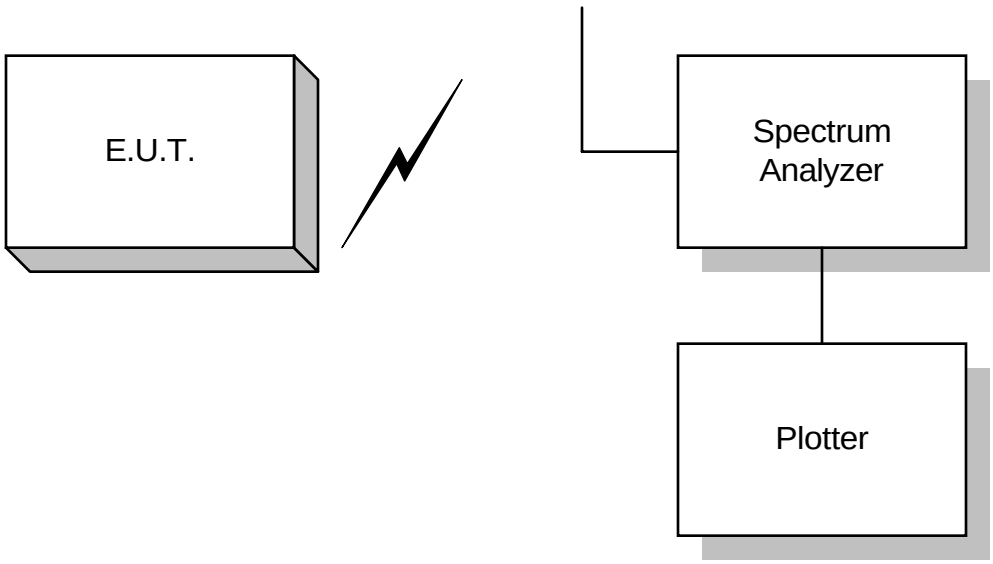


Outdoor Test Site For Radiated Emissions



The spectrum was searched up to the 10th harmonic of the fundamental frequency of operation.

Occupied Bandwidth



Section 7. Test Equipment List

CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.
1 Year	Spectrum Analyzer	Hewlett Packard	8564E	3846A01407	May 31/99	Nov. 30/00
	Power Supply	Astron	VS-50M	8405071	NCR	NCR
1 Year	Receiver	Rohde & Schwarz	ESVP	892661/014	April 5/00	April 5/01
1 Year	Horn Antenna	EMCO #2	3115	4336	Nov. 11/99	Nov. 11/00
1 Year	Dipole Antenna Set	EMCO #2	3121C	FA001349	June 27/00	June 27/01
1 Year	RF AMP	JCA	2-4 GHz	FA001496	May 31/00	May 31/01
1 Year	RF AMP	JCA	1-2 GHz	FA001498	May 31/00	May 31/01
1 Year	RF AMP	JCA	4-8 GHz	FA001497	May 31/00	May 31/01
1 Year	Oscilloscope	Tektronix	TDS 3012	FA001560	Jan. 31/00	Jan. 31/01

NA: Not Applicable
NCR: No Cal Required
COU: CAL On Use

Annex A

Restricted Bands

Section A Restricted Bands of Operation

(a) Except as shown in paragraph (d) of this section , only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
0.49 - 0.51	16.69475-16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425-16.80475	960-1240	7.25-7.75
3.020 - 3.026	25.5-25.67	1300-1427	8.025-8.5
4.125 - 4.128	37.5-38.25	1435-1626.6	9.0-9.2
4.17725 - 4.17775	73-74.6	1645.5-1646.5	9.3-9.5
4.20725 - 4.20775	74.8-75.2	1660-1710	10.6-12.7
6.215 - 6.218	108-121.94	1718.8-1722.2	13.25-13.4
6.31175 - 6.31225	123-138	2220-2300	14.47-14.5
8.291 - 8.294	149.9-150.05	2310-2390	15.35-16.2
8.362 - 8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625 - 8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425 - 8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29 - 12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975 - 12.52025	240-285	3345.8-3358	36.43-36.5
12.57675 - 12.57725	322-335.4	3600-4400	Above 38.6
13.36 - 13.41			