KTL Test Report:	9R02128
Applicant:	Digital Security Controls Ltd. 3301 Langstaff Road Vaughan, Ontario L4K 4L2
Equipment Under Test: (E.U.T.)	WLS906NB433 Smoke Detector
FCC ID:	F5300NB906
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:	22

Table of Contents

Section 1. Summary of Test Results

Manufacturer: Digital Security Controls Ltd.

Model No.: WLS906NB433

Serial No.: None

Date Received In Laboratory: January 17, 2000

KTL Identification No.: Item #1 & 2

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".

It is recommended that the margin of compliance be improved to allow for manufacturing tolerances.

NVLAP LAB CODE: 100351-0

TESTED BY: _____ DATE: _____
Kevin Rose, Test Technician

Summary Of Test Data

Name of Test	Paragraph 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: This equipment is battery operated.

Test Conditions:

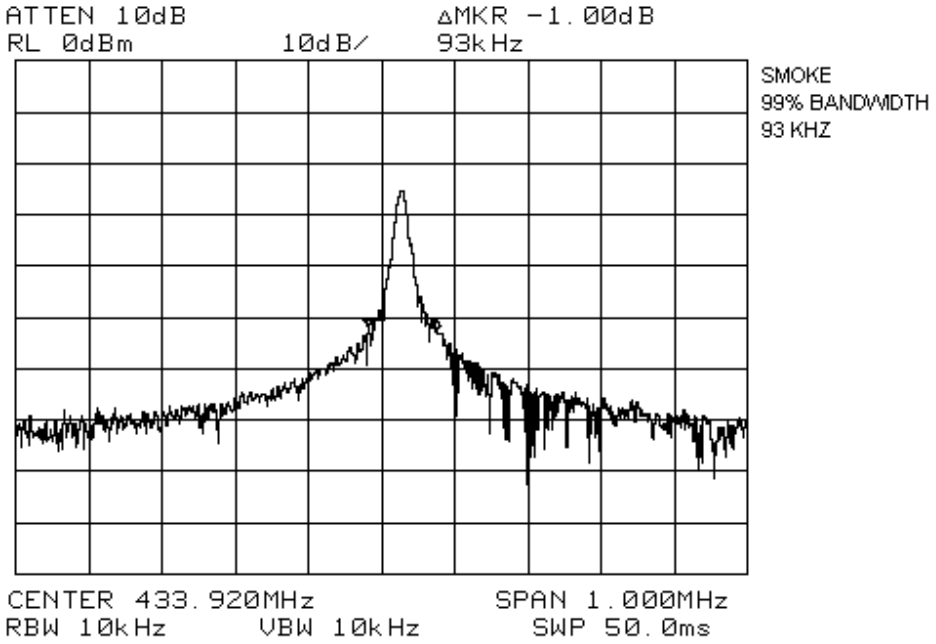
Indoor Temperature: 20 °C
Humidity: 20 %

Outdoor Temperature: 10 °C
Humidity: 20 %

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

General Equipment Information

Frequency Range:	433.92 MHz
Operating Frequency(ies) of Sample:	433.92 MHz
Type of Emission:	Pulse Width Modulation
Emission Designator:	93K0L1D (See attached graph)
Supply Power Requirement:	6 x 1.5 V AA Batteries
Duty Cycle Calculation:	-16.6 dB (See attached duty cycle calculation and –16.6dB Time Domain Graph)


ATTEN 10dB
RL 0dBm
10dB/
ΔMKR -1.00dB
93kHz
SMOKE
99% BANDWIDTH
93 KHZ
CENTER 433.920MHz
SPAN 1.000MHz
RBW 10kHz
VBW 10kHz
SWP 50.0ms

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 µS bit time represents a data logic "0" and 250 µS low then 250 µS high represents a data logic "1".

Figure 1: Bit Timing

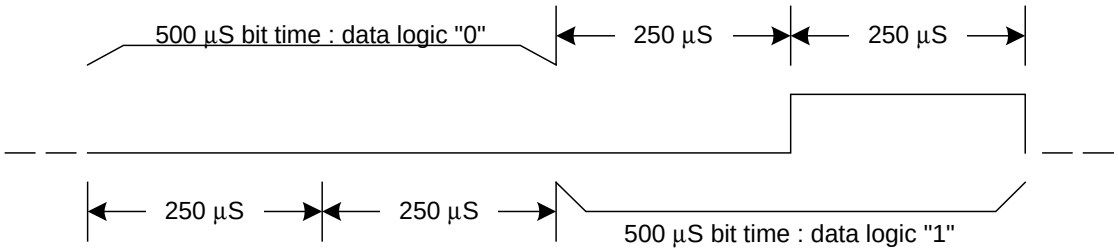
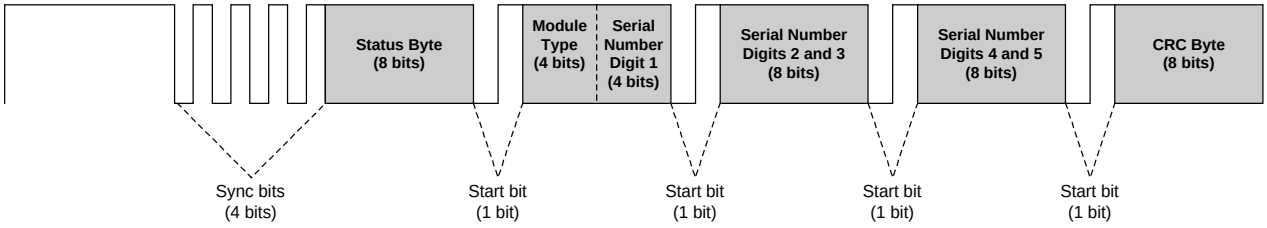


Figure 2 shows the format of the transmitted data packet. Bytes highlighted are bytes that are variable information that would depend on the current status, module type and serial number of the particular device.

Figure 2: Data Packet Format



Minimum ON Time

The packet with the minimum on time would be:

5ms header + 1111 + 1000 0000 + 1 + 0010 0000 + 1 + 0000 0001 + 1 + 0000 0001 +1 + 0011 1001

Thus the minimum ON time would be: 5ms + (16 ON bits * 0.25ms per bit)
5ms + 4ms
9ms

Maximum ON Time

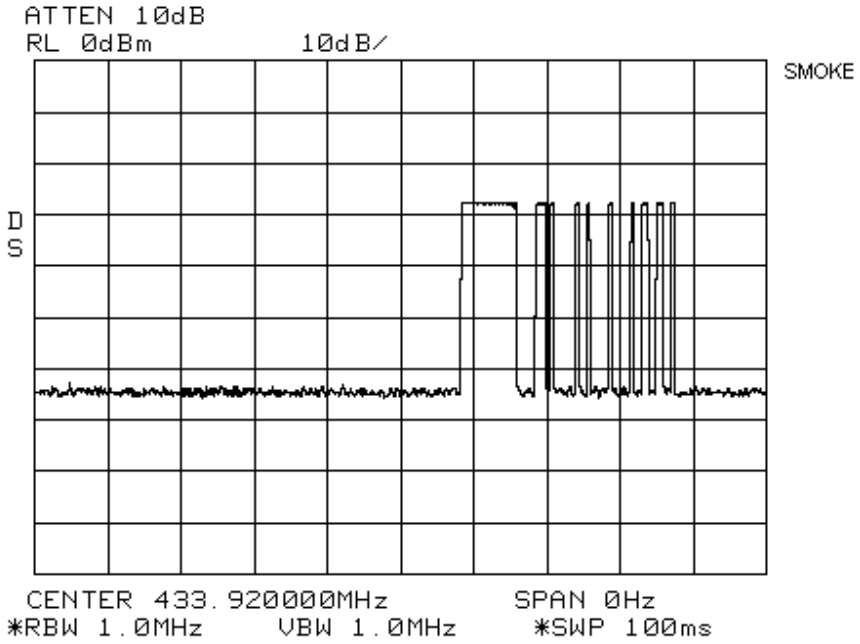
The packet with the maximum on time would be:

5ms header + 1111 + 1111 + 1 + 0110 1111 + 1 + 1111 1110 + 1 + 1111 1110 + 1 + 1001 0001

Thus the maximum ON time would be: 5ms + (39 ON bits * 0.25ms per bit)
5ms + 9.75ms
14.75

Duty Cycle

$$20 \text{ Log} \left(\frac{14.75}{100} \right) = -16.6 \text{ dB}$$


ATTEN 10dB
RL 0dBm
10dB/
SMOKE
D
S
CENTER 433.920000MHz
SPAN 0Hz
*RBW 1.0MHz
VBW 1.0MHz
*SWP 100ms

Section 3. Transmission Requirements

NAME OF TEST: Transmission Requirements	PARA. NO.: 15.231(a)
TESTED BY: Kevin Rose	DATE: January 20, 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.

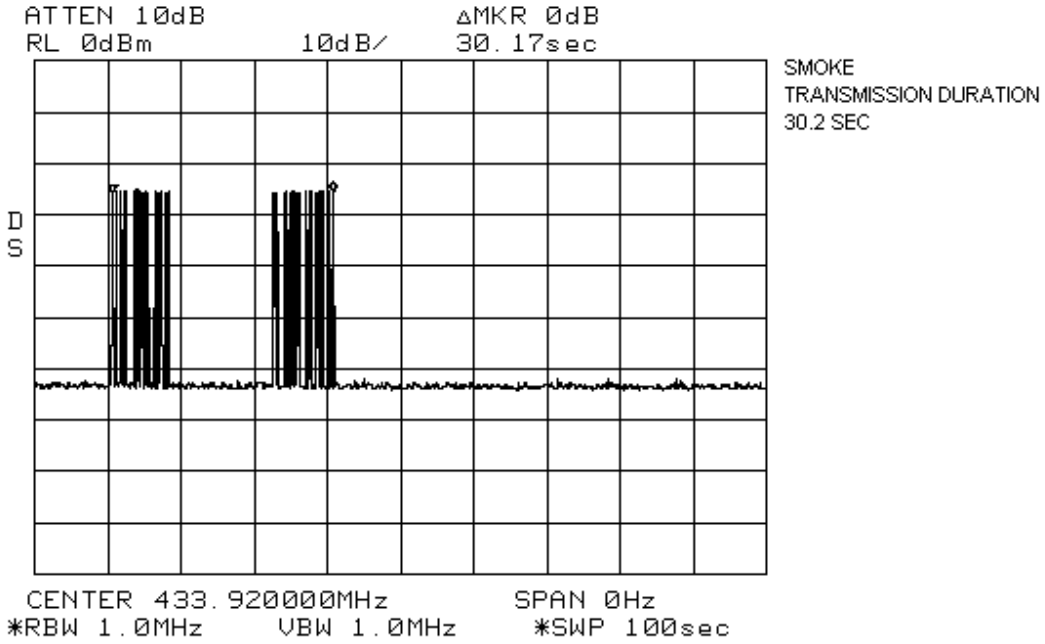
Rationale for Compliance with Transmission Requirements

15.231(a)(1) : Not applicable. This equipment has no provision for manual operation.

15.231(a)(2) : Not applicable as per 15.231(a)(4).

15.231(a)(3) : Not applicable. This equipment has no provision for periodic transmissions.

15.231(a)(4) : This equipment is used for fire, security and safety of life. See attached time domain graph.


ATTEN 10dB
RL 0dBm
10dB/
ΔMKR 0dB
30.17sec
SMOKE
TRANSMISSION DURATION
30.2 SEC
D
S
CENTER 433.920000MHz
SPAN 0Hz
*RBW 1.0MHz
VBW 1.0MHz
*SWP 100sec

Section 4. Radiated Emissions

NAME OF TEST: Radiated Emissions	PARA. NO.: 15.231(b)
TESTED BY: Kevin Rose	DATE: January 20, 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 80.3 dBµV/m @ 3m at 433.92 MHz. This is 0.5 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

Test Distance (meters) : 3		Range: A Tower		Receiver: ESVP		RBW(kHz): 120		Detector: Q-Peak			
Freq. (MHz)	**Ant. ***	**Pol. (V/H)**	**Ant. HGT. (m)**	**Table (deg.)**	**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			68.2	25.9		-16.6	77.5	80.8	3.3
433.92	E/D4	H			71.0	25.9		-16.6	80.3	80.8	0.5
867.84	E/D4	V			9.1	34.4		-16.6	26.9	60.8	33.9
867.84	E/D4	H			11.1	34.4		-16.6	28.9	60.8	31.9
1301.76	Hrn2	V			11.3	28.0		-16.6	22.7	54.0	31.3
1301.76	Hrn2	H			12.8	28.0		-16.6	24.2	54.0	29.8
1735.76	Hrn2	V			57.2	29.6	-46.4	-16.6	23.8	60.8	37.0
1735.76	Hrn2	H			52.8	29.6	-46.4	-16.6	19.4	60.8	41.4
2169.6	Hrn2	V			44.2	31.1	-47.5	-16.6	11.2	60.8	49.6
2169.6	Hrn2	H			48.8	31.1	-47.5	-16.6	15.8	60.8	45.0
2603.5	Hrn2	V			43.8	31.7	-47.8	-16.6	11.1	60.8	49.7
2603.5	Hrn2	H			49.3	31.7	-47.8	-16.6	16.6	60.8	44.2
3037.44	Hrn2	V			45.2	32.9	-47.5	-16.6	14.0	60.8	46.8
3037.44	Hrn2	H			49.2	32.9	-47.5	-16.6	18.0	60.8	42.8
3471.36	Hrn2	V			37.5	35.2	-47.2	-16.6	8.9	60.8	51.9
3471.36	Hrn2	H			39.5	35.2	-47.2	-16.6	10.9	60.8	49.9
3905.28	Hrn2	V			35.2	36.5	-46.6	-16.6	8.5	54.0	45.5
3905.28	Hrn2	H			35.0	36.5	-46.6	-16.6	8.3	54.0	45.7
4339.2	Hrn2	V			40.8	37.1	-45.9	-16.6	15.4	54.0	38.6
4339.2	Hrn2	H			41.3	37.1	-45.9	-16.6	15.9	54.0	38.1
420.36	E/D4	V			19.5	25.7		-16.6	28.6	60.8	32.2
420.36	E/D4	H			22.1	25.7		-16.6	31.2	60.8	29.6
406.8	E/D4	V			16.2	25.5		-16.6	25.1	46.0	20.9
406.8	E/D4	H			19.5	25.5		-16.6	28.4	46.0	17.6

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.

Radiated Photographs (Worst Case Configuration)

FRONT VIEW

REAR VIEW

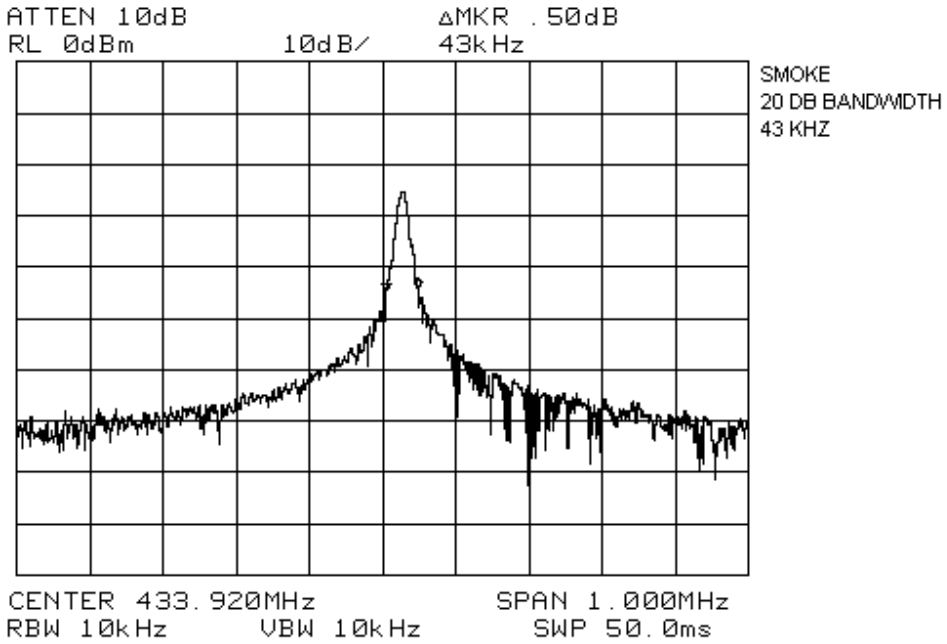
Section 5. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.231(c)
TESTED BY: Kevin Rose	DATE: January 20, 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.

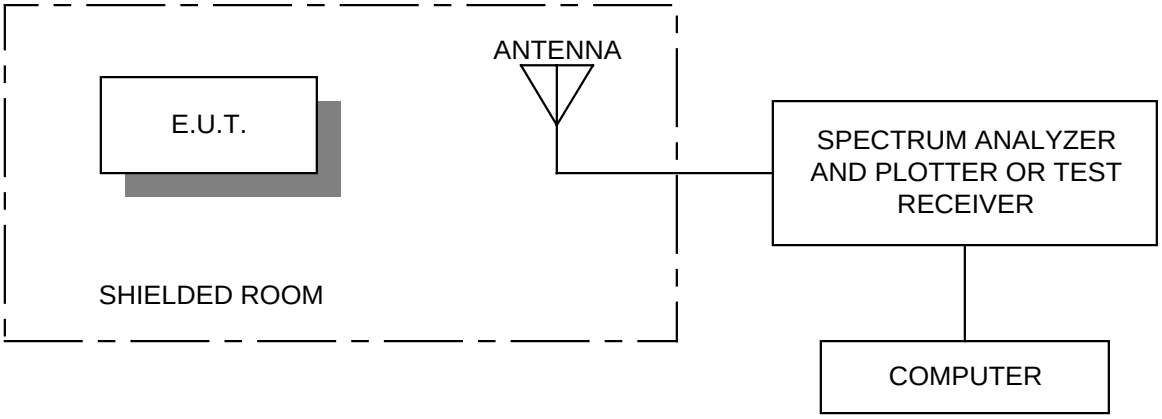
Test Results: Complies. See attached graph.
The 20 dB bandwidth is 43 kHz.

Test Data: See attached graph.

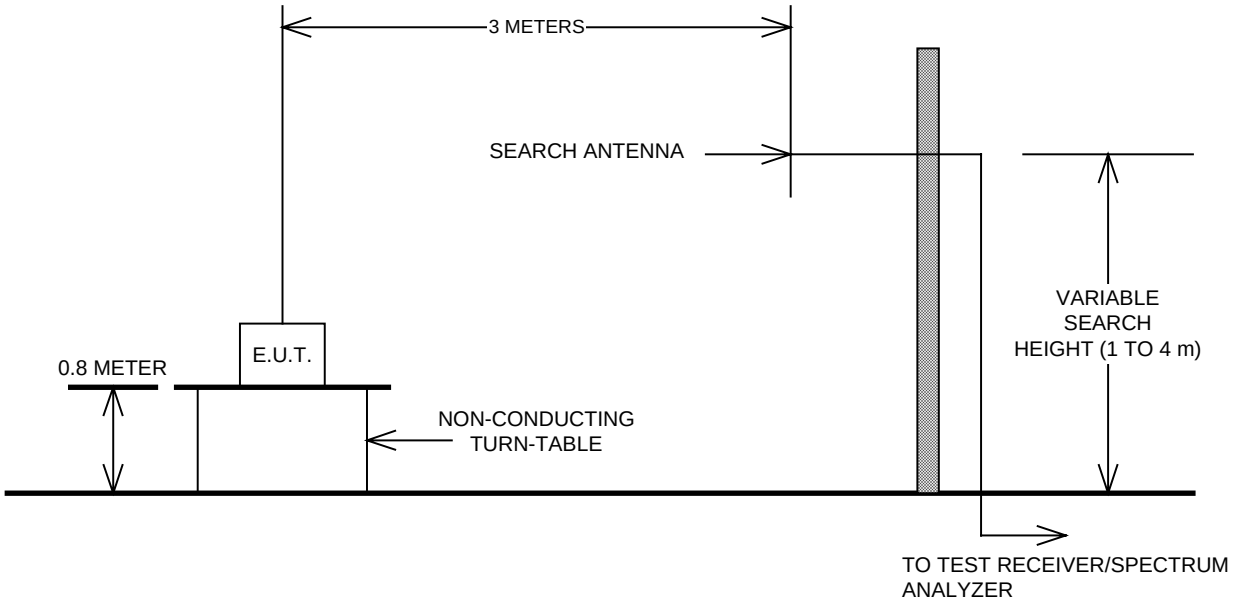

ATTEN 10dB
RL 0dBm
10dB/
ΔMKR .50dB
43kHz
SMOKE
20 DB BANDWIDTH
43 KHZ
CENTER 433.920MHz
SPAN 1.000MHz
RBW 10kHz
VBW 10kHz
SWP 50.0ms

Section 6. Block Diagrams

Radiated Prescan

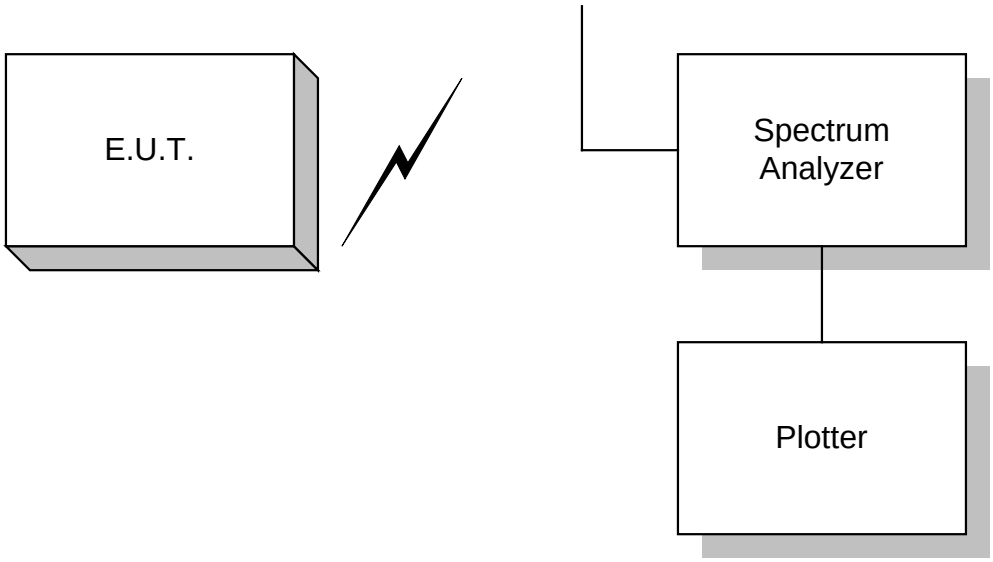


Outdoor Test Site For Radiated Emissions



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	May 31/00
1 Year	Receiver	Rohde & Schwarz	ESVP	892661/014	Mar. 29/99	Mar. 29/00
2 Year	Horn Antenna	EMCO #2	3115	4336	Nov. 11/99	Nov. 11/00
1 Year	Dipole Antenna Set	EMCO #1	3121C	1029	Nov. 18/98	Nov. 18/99

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			