REPORT OF MEASUREMENTS

GENERAL

Applicant:	Detection Systems, Inc.
Device:	10.525 GHz Field Disturbance Sensor
Model:	DS 720i
Serial Number:	N/A
FCC ID:	ESVDS720I
Input Power Requirements:	9 to 15 VDC, 60 mA (12 VDC Nominal)
Rule Section:	Part 15, Subpart C, Section 15.245

TEST METHODS PERFORMED

15.245 (b) Radiated Emissions, Fundamental

15.245 (b)(1) Radiated Emissions, Harmonics

15.245 (b)(3) Radiated Emissions, Band Edges

15.245 (b)(3) Radiated Emissions, Spurious Emissions, 30 MHz to 52.625 GHz

TEST RESULTS

15.245 (a)	The device is an intentional radiator used as a field disturbance sensor.
15.245 (b)	The device operates within the 10.500 to 10.550 GHz frequency band. The field strength of the fundamental emission did not exceed 2500 millivolts per meter, average.
15.245 (b)(1)	The device does not produce harmonic emissions below 17.7 GHz.
15.245 (b)(1)(i)	The device is intended to be used only within buildings and the field strength of harmonic emissions did not exceed 25.0 millivolts per meter.
15.245 (b)(2)	All radiated emissions measurements were extrapolated to the specified 3 meter test distance.
15.245 (b)(3)	The emissions radiated outside of the specified frequency band of 10.500 to 10.550 GHz did not exceed the general radiated emission limits of 15.209.

15.245 (b)(4)	The requirements of 15.35 for averaging pulsed emissions and limiting peak emissions were met.

NOTES

15.31 (a)(b)	All measurements were made in accordance with ANSI C63.4:1992.
15.31 (c)	The device does not use swept frequency techniques.
15.31 (d)	All testing was performed on Retlif Testing Laboratories Ronkonkoma, NY test site which has been listed with the FCC.
15.31 (e)	Variation of the radiated signal level of the fundamental frequency component was performed with the supply voltage varied between 85 and 115% of nominal (12 VDC). This was also performed at 85% of the minimum and 115% of the maximum rated input voltage range.
15.31 (f)(1)	Where testing was performed at distances other than the specified test distance, the obtained readings were extrapolated to the specified test distance using an inverse linear-distance extrapolation factor (20dB / decade) for measurements between 30 MHz and 52.625 GHz.
15.31 (f)(5)	The device was rotated 360° in order to maximize the radiated emissions. The maximum field strength observed has been reported.
15.31 (g)	All consumer accessible controls were adjusted in order to maximize emissions (MW Range Control). A one meter length of unshielded twisted pair wire was connected to each of the relay and tamper outputs.
15.31 (m)	The device operates at a single frequency of 10.525 GHz.
15.31 (o)	All emissions within 20 dB of the specified limits have been reported unless otherwise stated.
15.33 (a)(2)	The device operates above 10 and below 30 GHz at a frequency of 10.525 GHz. Therefore radiated emissions measurements were made from 30 MHZ to 52.625 GHz, the fifth harmonic.

DUTY CYCLE

Twenty microsecond (20 μSec) pulses are applied to the gunn diode at a repetition rate of 1kHz. This yields a duty cycle of 2%, 20 μSec divided by 1000 μSec. This duty cycle was applied to the obtained peak readings in order to determine the average value of the emissions.

TEST DISTANCES

In order to obtain adequate system sensitivity at the harmonic frequencies of interest, it was necessary to perform certain measurements at a distance less than 3 meters. Care was taken to ensure that all measurements were taken in the far field region. The antenna was determined to be in the far field IFF:

$$d \geq 2 D^2 / \lambda$$

Where: d = Test Distance

D = Largest Antenna Length

λ = Wavelength at the Frequency of Interest

Solving for d yields the minimum test distances shown in the table below. Also shown is the actual test distance utilized.

Frequency GHz	Minimum Test Distance Meters	Actual Test Distance Meters
10.525	2.7	3
21.050	1.5	2
31.575	1.0	1
42.100	0.5	1
52.625	0.7	1

SPECTRUM ANALYZER DESENSITIZATION CONSIDERATIONS

Due to the nature of the emissions being measured, care was taken to ensure that the resolution bandwidth of the spectrum analyzer was adequate to provide accurate peak field strength measurements. The following formula was utilized:

$$\text{Pulse Desensitization } (\delta) = 20 \log (\text{Pulsewidth} * \text{bandwidth} * 1.5)$$

Setting the above equal to zero and utilizing the 20 microsecond pulsewidth yields a minimum required bandwidth of 33.3 kHz. The 1 MHz bandwidth specified in ANSI C63.4 was utilized for all fundamental and harmonic measurements.

TEST DATA

RADIATED EMISSIONS, FUNDAMENTAL

15.245 (b)

TEST SAMPLE: 10.525 GHz Field Disturbance Sensor
FCC ID: ESVDS720I
APPLICANT: Detection Systems, Inc.
TEST METHOD: Radiated Emissions, Fundamental
SPECIFICATION: FCC Part 15, Section 15.245 (b)
PERFORMED BY: P.Lananna
DATE: 11/01/00

Field Strength of Fundamental

Frequency GHz	Antenna Position H / V	EUT Orientation X / Y/ Z	Meter Reading dBuV	Antenna Factor +dB	Corrected Reading dBuV/m		Converted Reading mV/m	Limit at 3 Meters mV/m
10.525	H-1.0	X	69.1	30.0	99.1		90.2	2,500
	V-1.0	X	87.3	30.0	117.3		732.8	2,500
	H-1.3	Y	85.8	30.0	115.8		616.6	2,500
	V-1.3	Y	65.3	30.0	95.3		58.2	2,500
	H-1.0	Z	66.2	30.0	96.2		64.6	2,500
	V-1.0	Z	67.9	30.0	97.9		78.5	2,500

Detector Function: Peak
Test Distance: 3 Meters
Resolution Bandwidth: 1 MHz
Video Bandwidth: 3 MHz

TEST SAMPLE: 10.525 GHz Field Disturbance Sensor
FCC ID:ESVDS720I
APPLICANT: Detection Systems, Inc.
TEST METHOD: Radiated Emissions, Fundamental, Input Voltage Variation
SPECIFICATION: FCC Part 15, Section 15.245 (b), 15.31(e)
PERFORMED BY: P.Lananna
DATE: 11/01/00

Input Voltage Variation

Frequency GHz	Test Voltage % Nominal	Test Voltage VDC	Meter Reading dBuV	Antenna Factor +dB	Corrected Reading dBuV/m		Converted Reading mV/m	Limit at 3 Meters mV/m
10.525	85% (Vmin)	7.65	87.3	30.0	117.3		732.8	2,500
	85% (Vnom)	10.2	87.3	30.0	117.3		732.8	2,500
	100% (Vnom)	12.0	87.3	30.0	117.3		732.8	2,500
	115% (Vnom)	13.8	87.3	30.0	117.3		732.8	2,500
	115% (Vmax)	17.25	87.3	30.0	117.3		732.8	2,500

Detector Function: Peak
Test Distance: 3 Meters
Resolution Bandwidth: 1 MHz
Video Bandwidth: 3 MHz

TEST DATA

RADIATED EMISSIONS, HARMONICS

15.245 (b)(1)

TEST SAMPLE: 10.525 GHz Field Disturbance Sensor
FCC ID:ESVDS720I
APPLICANT: Detection Systems, Inc.
TEST METHOD: Radiated Emissions, Harmonics
SPECIFICATION: FCC Part 15, Section 15.245 (b)(1)
PERFORMED BY: P.Lananna
DATE: 11/01/00

Field Strength of Harmonics - Peak

Frequency GHz	Antenna Position & Distance H / V	EUT Orientation X / Y/ Z	Meter Reading dBuV	Antenna Factor dB	Test Distance Correction dB	Corrected Reading dBuV/m	Converted Reading uV/m	Peak Limit at 3 Meters uV/m
21.1	H - 1.0	X	50.3	20.7	-3.5	67.5	2371.4	250000.0
	V - 1.0	X	50.2	20.7	-3.5	67.4	2344.2	|
	H - 1.0	Y	51.2	20.7	-3.5	68.4	2630.3	|
	V - 1.0	Y	45.2	20.7	-3.5	62.4	1318.3	|
	H - 1.0	Z	39.0	20.7	-3.5	56.2	645.7	|
	V - 1.0	Z	45.4	20.7	-3.5	62.6	1349.0	|
31.6	H - 1.0	X	52.5	35.8	-9.5	78.8	8709.6	|
	V - 1.0	X	51.8	35.8	-9.5	78.1	8035.3	|
	H - 1.0	Y	51.5	35.8	-9.5	77.8	7762.5	|
	V - 1.0	Y	45.0	35.8	-9.5	71.3	3672.8	|
	H - 1.0	Z	48.0	35.8	-9.5	74.3	5188.0	|
	V - 1.0	Z	50.4	35.8	-9.5	76.7	6839.1	|
42.1	H - 1.0	X	40.0	39.9	-9.5	70.4	3311.3*	|
	V - 1.0	X	40.0	39.9	-9.5	70.4	3311.3*	|
	H - 1.0	Y	40.0	39.9	-9.5	70.4	3311.3*	250000.0

	V - 1.0	Y	40.0	39.9	-9.5	70.4	3311.3*	250000.0
	H - 1.0	Z	40.0	39.9	-9.5	70.4	3311.3*	|
	V - 1.0	Z	40.0	39.9	-9.5	70.4	3311.3*	|
52.6	H -1.0	X	40.0	41.1	-9.5	71.6	3801.9*	|
	V - 1.0	X	40.0	41.1	-9.5	71.6	3801.9*	|
	H - 1.0	Y	40.0	41.1	-9.5	71.6	3801.9*	|
	V -1.0	Y	40.0	41.1	-9.5	71.6	3801.9*	|
	H - 1.0	Z	40.0	41.1	-9.5	71.6	3801.9*	|
	V - 1.0	Z	40.0	41.1	-9.5	71.6	3801.9*	250000.0

* Denotes Minimum Sensitivity of Measurement System.

Field Strength of Harmonics - Average

Frequency GHz	Antenna Position H / V	EUT Orientation X / Y/ Z	Peak Reading uV/m	Duty Cycle %		Average Reading uV/m	Limit at 3 Meters uV/m
21.050	H -	X	2371.4	2.0		47.4	25,000
	V -	X	2344.2	2.0		46.9	|
	H -	Y	2630.3	2.0		52.6	|
	V -	Y	1318.3	2.0		26.4	|
	H -	Z	645.7	2.0		12.9	|
	V -	Z	1349.0	2.0		27.0	|
31.575	H -	X	8709.6	2.0		174.2	|
	V -	X	8035.3	2.0		160.7	|
	H -	Y	7762.5	2.0		155.2	25,000

	V -	Y	3672.8	2.0		73.5	25,000
	H -	Z	5188.0	2.0		103.8	|
	V -	Z	6839.1	2.0		136.8	|
42.100	H -	X	3311.3	2.0		66.2*	|
	V -	X	3311.3	2.0		66.2*	|
	H -	Y	3311.3	2.0		66.2*	|
	V -	Y	3311.3	2.0		66.2*	|
	H -	Z	3311.3	2.0		66.2	|
	V -	Z	3311.3	2.0		66.2*	|
52.625	H -	X	3801.9	2.0		76.0*	|
	V -	X	3801.9	2.0		76.0*	|
	H -	Y	3801.9	2.0		76.0*	|
	V -	Y	3801.9	2.0		76.0*	|
	H -	Z	3801.9	2.0		76.0*	|
	V -	Z	3801.9	2.0		76.0*	25,000

Detector Function: Peak / Duty Cycle Applied to Obtain Average Levels
Test Distance: As Specified for each frequency
Resolution Bandwidth: 1 MHz
Video Bandwidth: 3 MHz

TEST DATA

RADIATED EMISSIONS, BAND EDGES

15.245 (b)(3)

TEST SAMPLE: 10.525 GHz Field Disturbance Sensor
FCC ID:ESVDS720I
APPLICANT: Detection Systems, Inc.
TEST METHOD: Radiated Emissions, Band Edges
SPECIFICATION: FCC Part 15, Section 15.245 (b)(3)
PERFORMED BY: P.Lananna
DATE: 11/01/00

The emissions at the upper and lower band edge,10.5 and 10.550 GHz, was attenuated 50 dB below the level of the fundamental. See attached plot.

TEST DATA

OCCUPIED BANDWIDTH

15.245 (b)

Customer:	Detection Systems, Inc.
Test Sample:	10.525GHz Field Disturbance Sensor
Model No.:	DS7229
Test Method:	FCC15.245(b)(3) Occupied Bandwidth, 10.5-10.55GHz
Notes:	Emissions radiated at the band edge are greater than 50dB down from the modulated carrier.
Date:	November 21, 2000
Tech:	Peter Lonzo
Sheet	1 of 1

Retlif Testing Laboratories

Report No. R-8767

TEST DATA

RADIATED EMISSIONS, SPURIOUS

15.245 (b)(3)

TEST SAMPLE: 10.525 GHz Field Disturbance Sensor
FCC ID: ESVDS720I
APPLICANT: Detection Systems, Inc.
TEST METHOD: Spurious Emissions, 30 MHZ to 52.625 GHz
SPECIFICATION: FCC Part 15, Section 15.245 (b)(3)
PERFORMED BY: P.Lananna
DATE: 11/01/00

Frequency GHz	Antenna Distance Meters		Meter Reading dBuV	Antenna Factor +dB	Test Distance Correction -dB	Corrected Reading dBuV/m	Converted Reading uV/m	Limit at 3 Meters uV/m
0.030	3		-					100 QP
0.088	3		-					100 / 150
0.216	3		-					150 / 200
0.960	3		-					200 / 500
1.0	3		-					500
1.0	1		-					5000 Pk 500 Ave
52.625	1		-					5000 Pk 500 Ave

The frequency range was scanned from 30 MHZ to 52.625 GHz. No spurious emissions were observed within 20 dB of the specified limit in the 30 MHZ to 40 GHz range. No spurious emissions were observed within 10 dB of the specified limit above 40 GHz.

	For F < 1 GHz	For F > 1 GHz
Resolution Bandwidth:	100 kHz	1 MHz
Video Bandwidth:	300 kHz	3 MHz
Detector:	Quasi-Peak	Peak / Average

EQUIPMENT LIST

FCC15.245(b) Radiated Emissions 30MHz to 52.5GHz

EN	Type	Manufacturer	Description.	Model No.	Cal Date	Due Date
066	High Gain Horn Antenna	Microlab/FXR	8.2 GHz - 12.4 GHz	X638A	01/26/2000	01/26/2001
067	Open Area Test Site	Retlif	3 Meter	RNY	10/15/1997	10/15/2000
128C	Double Ridge Guide	Eaton Corporation	1 GHz - 18 GHz	96001	09/16/1999	09/16/2000
129F	High Gain Horn Antenna	Microlab/FXR	18 GHz - 26.5 GHz	K638A	09/16/1999	09/16/2000
129H	High Gain Horn Antenna	Microlab/FXR	26.5 GHz - 40 GHz	U638A	09/16/1999	09/16/2000
133	Broadband Pre-Amplifier	Electro-Metrics	10 kHz - 1 GHz, 26dB	BPA-1000	06/22/1999	06/22/2000
141	Spectrum Analyzer	Hewlett Packard	100 Hz - 40 GHz	8566B	03/20/2000	09/20/2000
141A	Graphics Plotter	Hewlett Packard	N/A	7470A	03/08/2000	03/08/2001
141B	Quasi-Peak Adaptor	Hewlett Packard	100 Hz - 1 GHz	85650A	03/20/2000	09/20/2000
206B	6.0 dB Attenuator	Texscan	0 - 1.0 GHz	FP-50 - 6 dB	06/22/1999	06/22/2000
420	Amplifier	Hewlett Packard	2.0 GHz - 18 GHz	11975A	03/09/2000	03/09/2001
421	Harmonic Mixer	Hewlett Packard	18 GHz - 26.5 GHz	11970K	03/09/2000	03/09/2001
421A	Harmonic Mixer	Hewlett Packard	26.5 GHz - 40 GHz	11970A	03/09/2000	03/09/2001
421B	Harmonic Mixer	Hewlett Packard	40 GHz - 60 GHz	11970U	03/09/2000	03/09/2001
543	Preamplifier	Hewlett Packard	1.0 GHz - 26.5 GHz	8449B	06/16/1999	06/16/2001
696	DC Power Supply	BK Precision	30V/3A	1730	08/20/1999	08/20/2000