REPORT OF MEASUREMENTS
GENERAL

Applicant: **Bosch Security Systems**

Device: **10.525 GHz Field Disturbance Sensor**

Model: **OD850**

Serial Number: **N/A**

FCC ID: **ESV850**

Input Power Requirements: **10 to 15 VDC, 22 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 C63.4:2000.**
15.31 ©)	**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 40 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

Drive pulses are applied to Q99 via Q1 and are twenty microsecond (20 μSec) on time and four hundred and eighty microseconds (480 μSec) off time. This yields a duty cycle of 4%, 20 μSec divided by 500 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:

Pulse Desensitization (δ) = 20 log (Pulsewidth * bandwidth * 1.5)

Setting the above equal to zero and utilizing the 20.0 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 Report Number R-10051
FCC ID: ESV850

TEST SAMPLE: 10.525 GHz Field Disturbance Sensor
FCC ID: ESV850
APPLICANT: Bosch Security Systems
TEST METHOD: Radiated Emissions, Fundamental
SPECIFICATION: FCC Part 15, Section 15.245 (b)
PERFORMED BY: C. Weber
DATE: September 12, 2003

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
10.530	H-1.4	X	56.4	30.0	86.4		20.9	2,500
	V-1.1	X	67.4	30.0	97.4		74.1	2,500
	H-1.0	Y	68.2	30.0	98.2		81.3	2,500
	V-1.4	Y	53.9	30.0	83.9		15.7	2,500
	H-1.3	Z	58.9	30.0	88.9		27.9	2,500
	V-1.3	Z	50.0	30.0	80.0		10.0	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: ESV850
APPLICANT: Bosch Security Systems
TEST METHOD: Radiated Emissions, Fundamental, Input Voltage Variation
SPECIFICATION: FCC Part 15, Section 15.245 (b), 15.31(e)
PERFORMED BY: C. Weber
DATE: September 12, 2003

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
10.530	85% (Vmin)	8.5	68.2	30.0	98.2		81.3	2,500
	85% (Vnom)	10.2	68.2	30.0	98.2		81.3	2,500
	100% (Vnom)	12.0	68.2	30.0	98.2		81.3	2,500
	115% (Vnom)	13.8	68.2	30.0	98.2		81.3	2,500
	115% (Vmax)	17.25	68.2	30.0	98.2		81.3	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 Report Number R-10051
FCC ID: ESV850

TEST SAMPLE: 10.525 GHz Field Disturbance Sensor
FCC ID: ESV850
APPLICANT: Bosch Security Systems
TEST METHOD: Radiated Emissions, Harmonics
SPECIFICATION: FCC Part 15, Section 15.245 (b)(1)
PERFORMED BY: C. Weber
DATE: September 12, 2003

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	39.6	20.7	-3.5	56.8	691.8*	250000.0
	V - 1.0	X	39.6	20.7	-3.5	56.8	691.8*	|
	H - 1.0	Y	39.6	20.7	-3.5	56.8	691.8*	|
	V - 1.0	Y	39.6	20.7	-3.5	56.8	691.8*	|
	H - 1.0	Z	39.6	20.7	-3.5	56.8	691.8*	|
	V - 1.0	Z	39.6	20.7	-3.5	56.8	691.8*	|
31.6	H - 1.0	X	43.7	35.8	-9.5	70.0	3162.2	|
	V - 1.0	X	39.6	35.8	-9.5	65.9	1972.4*	|
	H - 1.0	Y	39.6	35.8	-9.5	65.9	1972.4*	|
	V - 1.0	Y	44.5	35.8	-9.5	70.8	3467.3	|
	H - 1.0	Z	39.6	35.8	-9.5	65.9	1972.4*	|
	V - 1.1	Z	39.6	35.8	-9.5	65.9	1972.4*	|

42.1	H - 1.0	X	36.1	39.9	-9.5	66.5	2113.4*	|
	V - 1.0	X	36.1	39.9	-9.5	66.5	2113.4*	|
	H - 1.0	Y	36.1	39.9	-9.5	66.5	2113.4*	250000.0
	V - 1.0	Y	36.1	39.9	-9.5	66.5	2113.4*	250000.0
	H - 1.0	Z	36.1	39.9	-9.5	66.5	2113.4*	|
	V - 1.0	Z	36.1	39.9	-9.5	66.5	2113.4*	|
52.6	H - 1.0	X	36.0	41.1	-9.5	67.6	2398.9*	|
	V - 1.0	X	36.0	41.1	-9.5	67.6	2398.9*	|
	H - 1.0	Y	36.0	41.1	-9.5	67.6	2398.9*	|
	V -1.0	Y	36.0	41.1	-9.5	67.6	2398.9*	|
	H - 1.0	Z	36.0	41.1	-9.5	67.6	2398.9*	|
	V - 1.0	Z	36.0	41.1	-9.5	67.6	2398.9*	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 - 1.0	X	691.8	4.0		27.7*	25,000
	V - 1.0	X	691.8	4.0		27.7*	|
	H - 1.0	Y	691.8	4.0		27.7*	|
	V - 1.0	Y	691.8	4.0		27.7*	|
	H - 1.0	Z	691.8	4.0		27.7*	|

	V - 1.0	Z	691.8	4.0		27.7*	|
31.575	H - 1.0	X	3162.2	4.0		126.5	|
	V - 1.0	X	1972.4	4.0		78.9*	|
	H - 1.0	Y	1972.4	4.0		78.9*	|
	V - 1.0	Y	3467.3	4.0		138.7	25,000
	H - 1.0	Z	1972.4	4.0		78.9*	25,000
	V - 1.1	Z	1972.4	4.0		78.9*	|
42.100	H - 1.0	X	2113.4	4.0		84.5*	|
	V - 1.0	X	2113.4	4.0		84.5*	|
	H - 1.0	Y	2113.4	4.0		84.5*	|
	V - 1.0	Y	2113.4	4.0		84.5*	|
	H - 1.0	Z	2113.4	4.0		84.5*	|
	V - 1.0	Z	2113.4	4.0		84.5*	|
52.625	H - 1.0	X	2398.4	4.0		95.9*	|
	V - 1.0	X	2398.4	4.0		95.9*	|
	H - 1.0	Y	2398.4	4.0		95.9*	|
	V -1.0	Y	2398.4	4.0		95.9*	|
	H - 1.0	Z	2398.4	4.0		95.9*	|
	V - 1.0	Z	2398.4	4.0		95.9*	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: ESV850
APPLICANT: Bosch Security Systems
TEST METHOD: Radiated Emissions, Band Edges
SPECIFICATION: FCC Part 15, Section 15.245 (b)(3)
PERFORMED BY: C. Weber
DATE: September 15, 2003

The emission at the Lower (10.5GHz) and Upper (10.55GHz) Band edge were attenuated by 50dB. See attached plot.

TEST DATA

OCCUPIED BANDWIDTH

15.245 (b)

Test Report Number R-10051
FCC ID: ESV850

TEST DATA

RADIATED EMISSIONS, SPURIOUS

15.245 (b)(3)

Test Report Number R-10051
FCC ID: ESV850

TEST SAMPLE: 10.525 GHz Field Disturbance Sensor
FCC ID: ESV850
APPLICANT: Bosch Security Systems
TEST METHOD: Spurious Emissions, 30 MHZ to 52.625 GHz
SPECIFICATION: FCC Part 15, Section 15.245 (b)(3)
PERFORMED BY: C. Weber
DATE: September 15, 2003

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
No Emissions Observed								
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**

TEST SETUP PHOTOGRAPH