

**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

**Test Report Number R-10051**  
**FCC ID: ESV850**

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.

<b>Frequency GHz</b>	<b>Minimum Test Distance Meters</b>	<b>Actual Test Distance Meters</b>
<b>10.525</b>	<b>2.7</b>	<b>3</b>
<b>21.050</b>	<b>1.5</b>	<b>2</b>
<b>31.575</b>	<b>1.0</b>	<b>1</b>
<b>42.100</b>	<b>0.5</b>	<b>1</b>

52.625	0.7	1
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### **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 20.0 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 Orientatio n 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 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, 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 Report Number R-10051**  
**FCC ID: ESV850**

**TEST DATA**  
**RADIATED EMISSIONS, HARMONICS**  
**15.245 (b)(1)**



**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 Orientatio n 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*	

**Test Report Number R-10051**

**FCC ID: ESV850**

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 Orientatio n 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*	

**Test Report Number R-10051**  
**FCC ID: ESV850**

	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

**Test Report Number R-10051**  
**FCC ID: ESV850**

**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 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
<b>No Emissions Observed</b>								
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 Report Number R-10051**  
**FCC ID: ESV850**



**TEST SETUP PHOTOGRAPH**

**Test Report Number R-10051**  
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