

Number: MS-0032213 Revision: 8 Effective date: 07/26/2019

**Report No.:** 

32062580.002

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# Electromagnetic Compatibility Test Report

# **Description:** RADION Inertia

# Model: RF3405E

Bosch Security Systems, Inc. 130 Perinton Pkwy Fairport, NY, 14450

**Prepared by:** 

# **TUV Rheinland of North America, Inc.**

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA.



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Client:	Bosch Security Systems, Inc. 130 Perinton Pkwy Fairport, NY, 14450		Contact: Tel: Fax: e-mail:	Pete 585- 585- peter	r Namisnak 223-4060 223-9180 namisnak@us.bosch.com		
Identification:	RADION Inertia	Serial No.:					
Test item:	RF3405E	Dat	e Test Comple	ted:	09/18/2020		
Testing location:	TUV Rheinland of North Amer 710 Resende Road, Building 19 Webster, NY 14580 U.S.A.	ica 99	Tel: (585 Fax: -	) 645-	-0125		
Test specification:	cification: Emissions: FCC Part 15 Subpart C: Sections 205, 209, and 231; RSS-210; RSS-Gen						
Test Result and/or Conclusion:	The above product was found to	be Com	<b>bliant</b> to the ab	pove to	est standard(s)		
Report written/updated l	y: Alexander Sowinski	<i>reviewed by:</i> Rachana Khanduri					
24 September 2020 Date	Signature	24 September 2020 Date Signature					
F©		VCI			Industry Canada ISED		
5253	3331.08	1097 (A-0329)			482B-1		



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# Revisions

Date mm/dd/yy	Name	Page Number of Change	Describe Change
7/22/2020	Rev.0	N/A	Original Document
9/24/2020	Rev.1	11,17,22,31	Updated Duty Cycle, removed EUT Photos.



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## **1** General Information

#### 1.1 Scope

This report is intended to document the status of conformance based on the results of testing performed on the RADION Inertia, Model Number: RF3405E, manufactured by Bosch Security Systems, Inc.. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components.

#### 1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.



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1.3	Summ	ary d	of Test Results						
Applicant:	Bosch 130 Pe	ch Security Systems, Inc. Perinton Pkwy		Tel:	585-223-4060		Contact:	Peter Namisna	k
	Fairpo	rt, NY	NY, 14450		585-223-9180		e-mail:	peter.namisnal	k@us.bosch.com
Descr	iption:	RAI	DION Inertia	Model Number: RF3405E					
Serial Nu	umber:	0001		Test V	Voltage/Freq.:	3	VDC		
Test Date Com	e Completed: 09/18/2020		8/2020	J	<b>Test Engineer:</b>	A	lexander Sowi	nski	
Standar	rds		Description		Severity Level	l or	Limit	Measured	Test Result
FCC Part 15 Subpart C; FCC Part 15.231; RSS-210; RSS- Gen		CC 8-	Radiated Emission Requirements: Intentional Radiators. Periodic Operation in the band 40.66-40.70 MHz and above 70 MHz		See Subparts	See Below	Complies		
FCC Part 15.231(a A.1.1	a); RSS-2	210	Deactivation of Transmitter	Within 5 seconds of activation			< 2 sec.	Complies	
FCC Part 15.231(a A.1.1	a); RSS-2	210	Duty Cycle	No more than 2 seconds per hour (0.056%)			0.017%	Complies	
FCC Part 15.231(b); RSS-210 A.1.2		Field strength of fundamental and spurious emissions	Peak Li Peak Li	mit of Fundament mit of Spurious: 6	79.6 dBµV/m 40.6 dBµV/m	Complies			
FCC Part 15.231(c); RSS-210 A.1.3		210	20 dB Bandwidth	Bandw	ridth < 1.083 MF	247.80 kHz	Complies		
RSS-Gen 6.7			99% Bandwidth	Bandw	ridth < 1.083 MF	Ηz		210.76 kHz	Complies
RSS-Gen 6.11 & 8	3.11		Frequency Stability	Within central 80% of Frequency band				Within	Complies



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## **2** Laboratory Information

## 2.1 Accreditations & Endorsements

#### 2.1.1 US Federal Communications Commission

TUV Rheinland of North America located at, 710 Resende Road Webster, NY 14580 is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 5253). The laboratory scope of accreditation includes: Title 47 CFR Part 15, and 18. The accreditation is updated every 3 years.

## 2.1.2 ILAC/A2LA

This is a program which is administered under the auspices of A2LA. The laboratory has been assessed and accredited in accordance with ISO Standard 17025:2017 (Certificate Number: 3331.08). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

## 2.1.3 VCCI

VCCI Accredited test lab. Registration numbers A-0329.

## 2.1.4 Industry Canada

(Registration No.: 482B-1) The 10 meter Semi-Anechoic chamber has been accepted by Industry Canada to perform testing to 3 and to 10m, based on the test procedures described in ANSI C63.4-2014.

## 2.1.5 BSMI

Registration No.: SL2-IN-E-1159R. The BSMI accreditation was obtained by NIST MRA with the BSMI.

#### 2.1.6 Korea

(Designation No.: US0192). Recognized by National Radio Research Agency (RRA) as an accredited Conformity Assessment Body (CAB) under the terms for Korea Phase I of the APEC TEL.



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#### 2.2 Test Software

1) CIGUI 32 Version 1.4 for California Instruments AC power source

- 2) HP software E7415A Version A.01.45
- 3) National Instruments 'Measurement & Automation Employer' Version 4.6.2f1
- 4) TILE version 3.4.K.28
- 5) Voltech PM 6000 Firmware 1.22.07RC6, Software IEC61000-3 for PM6000 Release 1.24.12
- 6) California Instruments AC power source MXHCL
- 7) Rohde & Schwarz EMI Measurement software EMC32 version 8.50.0
- 8) TILE version 4.0.B
- 9) Keytek CEWare 2.10

#### 2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1<sup>st</sup> Edition, 1995.

*The Combined Standard Uncertainty* is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or co-variances of these other quantities weighted according to how the measurement result varies with changes in these quantities. The term standard uncertainty is the result of a measurement expressed as a standard deviation.

*The Expanded Uncertainty* defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand. The fraction may be viewed as the coverage probability or level of confidence of the interval.

#### 2.3.1 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength  $(dB\mu V/m) = RAW - AMP + CBL + ACF$ 

Where: RAW = Measured level before correction  $(dB\mu V)$ 

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

 $\mu V/m = 10^{\frac{dB\mu V/m}{20}}$ 



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Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor-Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB - 20 dB + 1.0 dB = 23.5 dBuV/m

# 2.3.2 Measurement Uncertainty Emissions

Per CISPR 16-4-2	Ulab	Ucispr							
Radiated Disturbance @ 1	0m								
30 MHz – 1,000 MHz	4.57 dB	5.2 dB							
Radiated Disturbance @ 3m									
1.0 GHz – 6.0 GHz	5.18 dB	5.2 dB							
6.0 GHz – 18.0 GHz	5.48 dB	5.5 dB							
18.0 GHz – 26.5 GHz	5.21 dB								
26.5 GHz – 40.0 GHz	4.99 dB								
Conducted Disturbance @	Mains Terminals								
150 kHz – 30 MHz	2.62 dB	3.6 dB							
Disturbance Power									
30 MHz – 300 MHz	3.88 dB	4.5 dB							

#### **Measurement Uncertainty Emissions**

The estimated combined standard uncertainty for radiated emissions measurements is $\pm 4.57 \text{ dB}$	Per CISPR16-4-2 Method
The estimated combined standard uncertainty for radiated emissions measurements from 1 GHz to 6 GHz is $\pm$ 5.18dB	Per CISPR16-4-2 Method
The estimated combined standard uncertainty for radiated emissions measurements from 6 GHz to 18 GHz is $\pm$ 5.48dB	Per CISPR16-4-2 Method
The estimated combined standard uncertainty for conducted emissions measurements is $\pm 2.62$ dB.	Per CISPR16-4-2 Method

Expanded measurement uncertainty numbers are shown in the tables above. Compliance criteria are not based on measurement uncertainty.



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# 2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard ISO IEC 17025:2017. Equipment calibration records are kept on file at the test facility.

# 2.5 Measurement Equipment Identification

Equipment	Manufacturer	Model #	Ref.	Serial #	Last Cal dd/mm/yy	Next Cal dd/mm/yy	Test				
		Radiated Er	nission	s							
Receiver (2Hz-44GHz)	Rohde & Schwarz	ESW44		101880	15-Oct-19	15-Oct-20	RE				
Receiver (Radio)	Rohde & Schwarz	ESU		100274	29-Jul-19	29-Sept-20	RE				
BiLog	Sunol	JB3		A102115	27-Jun-18	27-Sept-20	RE				
Horn(1-18 GHz)	ETS-Lindgren	3117		109306	20-Aug-18	20-Sept-20	RE				
Loop Antenna	EMCO	6502		0004-3336	26-Feb-20	26-Feb-22	RE				
Amplifier (30-1000)	Hewlett-Packard	8447D		0001	30-Jul-19	30-Sept-20	RE				
Notch Filter (433 MHz)	Eagle	240NFNM			No Cal	No Cal	RE				
Temperature Chamber	Cincinnati Sub-Zero	ZPHE-16-2-H/AC		ROC031	2-Sep-19	2-Oct-20	RE				
	General Laboratory Equipment										
Multimeter	Fluke	87		59890224	1-Aug-19	1-Aug-20					
Pressure/Temperature/RH	Control Company	68000-49		181704893	31-Oct-18	31-Oct-20					

Note: RE=Radiated Emissions



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# **3 Product Information**

#### 3.1 Test Plan

The EUT product information, test configuration, mode of operation, test types, test procedures, test levels, pass/failure criteria, in this report were carried out per the product test plan located in Appendix A of this report.

#### 3.2 EUT Photos

Per the confidentiality agreement with the client, all setup photos have been removed from this report. All photos have been moved to the document "32062580.001 Test Setup Exhibit".

Figure 1 – External Photo of EUT

Figure 2 – External Photo of EUT

Figure 3 – Internal Photo of EUT

Figure 4 – Internal Photo of EUT

Figure 5 – Internal Photo of EUT



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## 4 **Emissions**

#### 4.1 Deactivation of Transmitter

4.1.1 Over View of Test

This test confirms that the periodic transmission deactivates within 5 seconds of activation

Results	Complies (as test	ted per th	is report	)			Date	e 0	9/18/2020	
Standard	FCC Part 15.231(a);	CC Part 15.231(a); RSS-210 A.1.1								
Product Model	RF3405E				Seria	l#	0001			
Configuration	See test plan for d	See test plan for details								
Test Set-up	Tested in a shield	Tested in a shielded room, EUT placed on workbench								
EUT Powered By	3 VDC	Temp	22° C	Hum	idity	54%	6 ]	Pressure	997 mbar	
Frequency	433.42 MHz Tran	smitter								
Perf. Criteria	TX off within 5 se	ec.	Perf. Verification			1	Measurement Under Limit			
Mod. to EUT	None		Test	Test Performed By    Alexander Sowinski					winski	

## 4.1.2 Test Procedure

Per FCC 15.231(a)(2) "A transmitter activated automatically shall cease transmission within 5 seconds after activation."

The EUT was placed on a workbench and a zero-span transmission was recorded. The supervisory message was observed to end **within 1 second** of the start of transmission. The alarm message was observed to end **within 2 seconds** of the start of a transmission.

#### 4.1.3 Final Test

The transmitter shut-off time was observed to be in compliance with the limit specified.



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#### 4.1.4 Test Data



22:55:31 17.09.2020





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MultiView 8	Spectrum								
Ref Level 108 Att Input	3.50 dBµV Off 10 dB ● SW 2 DC PS	set 1.5 dB ● RE T 6 s ● VE On No	3W 100 kHz 3W 300 kHz otch Off				Frequ	ency <b>433.40</b>	90000 MHz
1 Zero Span									o1Pk View
								D2[	11 -18.66 dB
								PEL	5 00206 c
100 dBuV-	a								5.00290 5
200 0001								MIL	1] 43.10 dBµV
									389.04 ms
oo Jowy									
ао пвру-	s (	-					( ) (		
00 10 11									
80 авhл-			-						
1.400000000000000000									
70 dBµV	(			8		\$\$			1
60 dBµ∨		5							
50 dBµV						0 <u></u>			3
MI									
7									
40 dBuV									
чо авру									
00 10 11		(1 N 1	6						
зи авру-									
unplusion Marine	In we wand filler to a	Windown would be	unhumbered with	and manufactures and	Manual Marth & day		marine marine marine	montheasthand	Charles and have been all
20 dBµV			S	8		3 (S			8
10 dBµV						3		22	
CF 433.409 MH	iz			1001	pts				600.0 ms/
	1				Measuring		<b>466</b> 17.09.2	020 Att	RBW
L							23:12	2:33	

23:12:34 17.09.2020

Figure 7 – Alarm Message TX deactivation



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#### 4.2 Duty Cycle

This test measures the ratio of the transmit on-time to the transmit off-time.

#### 4.2.1 Over View of Test

Results	Complies (as test	omplies (as tested per this report)						09/	18/2020	
Standard	FCC Part 15.231(a);	<sup>2</sup> CC Part 15.231(a); RSS-210 A.1.1								
Product Model	RF3405E				Seria	l#	0001			
Configuration	See test plan for d	See test plan for details								
Test Set-up	Tested in a shielded room, EUT placed on workbench									
EUT Powered By	3 VDC	Temp	22° C	Hum	idity	54%	6 Pressu	re	997 mbar	
Frequency	433.42 MHz Tran	smitter								
Perf. Criteria	Duty cycle < 0.056% <b>Perf. Verification</b>			ı	Measurement Under Limit					
Mod. to EUT	None <b>Test Performed By</b> Alexander Sowinski						inski			

## 4.2.2 Test Procedure

The limit for duty cycle is described in FCC 15.231(a) as follows:

"Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour."

A total on-time of 2 seconds over the period of 1 hour equates to a duty cycle of (2/3600)\*100 = 0.056%

The EUT transmits supervisory messages every 13 minutes. In the default state, each message consists of six 16 ms packets spread over a minimum of 696 ms. In the event an alarm event occurs, a message consisting of eight 16 ms packets spread over 2 seconds is sent immediately, with the next supervisory message being sent 13 minutes after the alarm. Taking an alarm event as worst-case, at most over the course of an hour there could be 1 alarm message interrupting a sequence of 5 supervisory messages at 13 minute increments. This yields a maximum possible on-time over a period of 1 hour of:

[(6\*16)\*5 + (8\*16)] = 608 ms

Thus the long-term duty cycle of the EUT can be expressed as:

#### [736/3600000]\*100 = **0.017%**

The short-term duty cycle of the EUT when considering an individual message is [(8\*16)/(2\*3600)]\*100 = 1.78% for alarm messages or [(6\*16)/696]\*100 = 13.79% for supervisory messages.

## 4.2.3 Final Test

The duty cycle of the periodic transmitter is within the specified limit.



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## 4.2.4 Test Data

MultiView 8	Spectrum	n 🔺							
Ref Level 108 Att Input	.50 dBµV 0 10 dB ● S' 2 DC P:	ffset 1.5 dB ● P WT 1800 s ● V S On N	<b>BW</b> 100 kHz <b>BW</b> 300 kHz lotch Off				Frec	quency 433.4090	0000 MHz
1 Zero Span	200 1		oton on						o1Pk View
								M1[1]	44.15 dBµV
100 dBuV									651.60 s
100 0001								D4[1]	-2.37 dB
									750.60 s
90 авhA									
80 dBµV		5			-				
70 dBµV				2	2	2			
60 dBµV		-							
12				Alarm Trig	ered				
FO dBuVe				M3				Supervisory Messa	age 2
30 dbpv			M1	X				D4	
	5	Supervisory Mo	ssage 1					· •	
40 dBµV									
30 dBµV	YA.	57	Parana a la la	51 mil 1		Contract of the	a la carres su	D2	
and a second second and a second s	and the second second	and and and an advantage of the	an batter when the she	work burning was shown	mahannanded	the second hardward and the second	northweather	Rougenergenergen	Additional data
20 dBµV			1						
20						13	min.		
10 dBuV-				-					
CF 433.409 MH	z	10		100	1 pts			10 (1)	180.0 s/
2 Marker Table									
Type   Ref	Trc	X-Value		Y-Value		Function		Function Resu	lt
M1	1	651.6 s		44.15 dBµV					
D2 M1	1	780.0 s		-18.26 dB					
	1	750.6 5		-2.37 dB					
	T	7 9 9 9			1		10.00	1 2020 Att	( PDW
	Л				Measu	ring 📲	<b>96</b> 18.09	:05:28	<b>NBW</b>

00:05:28 18.09.2020

Figure 8 – Alarm event during normal operation



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#### MultiView Receiver Spectrum (23) $\bigtriangledown$ $\square$ Ref Level 100.00 dBµV Offset 1.4 dB RBW 100 kHz Att 10 dB SWT 1 s VBW 300 kHz Input 2 DC PS On Notch Off 1 Zero Span Off 1 Zero Span Off Off 1 Zero Span Frequency 433.4030000 MHz ●1Pk View 0.18 d 16.000 m 43.62 dBµV M1E1 90 dBµV 425.000 m 80 dBuV 70 dBµV 60 dBµV 50 dBµV M1 D2 40 dBµ√ 30 dBµV Muchalip 20 dBµV 10 dBµV-CF 433.403 MHz 1001 pts 100.0 ms/ 16.09.2020 02:34:24 Measuring... Att RBW

02:34:25 16.09.2020





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#### X X MultiView Receiver Spectrum $\bigtriangledown$ Ref Level 100.00 dBµV Offset 1.4 dB RBW 100 kHz Att 10 dB SWT 2 s VBW 300 kHz Input 2 DC PS On Notch Off 1 Zero Span V State 10 dB SWT 2 s VBW 300 kHz Frequency 433.4040000 MHz ●1Pk View D2[1 -0.08 c 16.00 m MIE 61.12 dBµV 90 dBµV-216.00 m 80 dBµV 70 dBµV D2 60 dBµ∨-50 dBµV-40 dBµV-30 dBµ∨-20 dep 10 dBµV-CF 433.404 MHz 1001 pts 200.0 ms/ 16.09.2020 01:59:31 Measuring... RBW Att 01:59:32 16.09.2020





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#### 4.3 Field Strength of Fundamental and Spurious Emissions

This test measures the electromagnetic levels of the fundamental transmission frequency and its associated harmonics.

#### 4.3.1 Over View of Test

Results	Complies (as tes	Complies (as tested per this report)							2020	
Standard	FCC Part 15.231(b);	FCC Part 15.231(b); RSS-210 A.1.2								
Product Model	RF3405E				Serial# 0			001		
Configuration	See test plan for d	See test plan for details.								
Test Set-up	Tested at 3 meters plans for details.	Tested at 3 meters in a semi-anechoic chamber, EUT placed on turntable. See test plans for details.								
EUT Powered By	3 VDC <b>Temp</b> 22° C <b>Humidity</b> 57 <sup>4</sup>				57%	)	Pressure	995 mbar		
Frequency Range	Fundamental @ 4 Harmonics measu	33.42MH red to 10	Iz <sup>th</sup> @ 4.33	842 C	Hz					
Perf. Criteria	Fundamental < 80.8 dBµV/m @ 3m Spurious < 60.8 dBµV/m @ 3m (Below Limit )			n I	Perf. Verification			Readings Under Limit		
Mod. to EUT	None			] I	Test Performed By			Alexander Sowinski		

## 4.3.2 Test Procedure

The EUT was placed on the turntable at 80 cm from the reference ground place and 3 meters form the measurement antenna. All three orthogonal orientations were investigated for the highest field strength and spurious emissions. The fundamental frequency of the EUT is given to be 433.42MHz, so in addition to the requirements set by FCC 15.205 and FCC 15.209, the requirements of FCC 15.231(b) were also considered:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	<sup>1</sup> 1,250 to 3,750	<sup>1</sup> 125 to 375
174-260	3,750	375
260-470	<sup>1</sup> 3,750 to 12,500	<sup>1</sup> 375 to 1,250
Above 470	12,500	1,250

## 4.3.3 Deviations

Given the low (<60%) Duty Cycle of the unit, a Duty Cycle correction factor is applied to the fundamental and harmonic measurements. The correction factor is  $\delta = 20 \log(\Delta)$ , thus  $\delta = 20 \log(0.1379) = -17.21 \text{ dB}$ 

## 4.3.4 Final Test

All final radiated emissions measurements were below (in compliance) the limits.



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## 4.3.5 Final Graphs

NOTES: Fundamental Zero-Span, CW mode

## Radiated Emissions Worst Case: EUT X-axis, Antenna Horz.

Ref Level 100	0.00 dBµV Off	set 1.4 dB •	RBW 100 kHz			Frequenc	v 433 36	60000 MH2
Input	2 DC PS	On	Notch Off			Hequene	y 433.30	
Zero Span								●1Pk Max
							M1[1	] 73.86 dBµV 26.1300 ms
) dвµ∨	8							
) dBuV								
1 0000							M1	
) dBµV								
0 dвµV	2							
) dBµV								
0 dBµV								
) dBµV						 		
) dвµV								
і dBµV								
F 433.366 MH	łz			10	001 pts			3.0 ms/
	Tr.				Measurir	16.09.2020	Att	RBW

Corrected Receiver Voltage: 73.86 dBµV Electric Field Conversion: 73.86 + 20log(433.366) - 29.8 = **96.797 dBµV/m** 



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NOTES: Max Power 30 - 1000 MHz







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NOTES: Max Power 1 – 6 GHz







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Signal	Frequency (MHz)	Peak Measured (dBµV/m)	Duty Cycle Correction (dB)	Result (dBµV/m)	Limit* (dBµV/m)	Margin (dB)
Fundamental	433.366	96.797	-17.21	79.59	80.8	-1.21
2 <sup>nd</sup> Harmonic	866.72	54.3	-17.21	37.1	60.8	-23.7
3 <sup>rd</sup> Harmonic	1300.10	48.7	-17.21	31.5	54.0	-22.5
4 <sup>th</sup> Harmonic	1733.40	47.5	-17.21	30.3	60.8	-30.5
5 <sup>th</sup> Harmonic	2166.80	57.8	-17.21	40.6	60.8	-20.2
6 <sup>th</sup> Harmonic	2600.20	45.3	-17.21	28.1	60.8	-32.7
7 <sup>th</sup> Harmonic	3033.50	46.7	-17.21	29.5	60.8	-31.3
8 <sup>th</sup> Harmonic	3466.90	43.2	-17.21	26.0	60.8	-34.8
9 <sup>th</sup> Harmonic	3900.20	43.4	-17.21	26.2	54.0	-27.8
10 <sup>th</sup> Harmonic	4333.68	42.1	-17.21	24.9	54.0	-29.1

#### 4.3.6 Final Tabulated Data

Note: The duty cycle correction factor is based off the worst-case short-term duty cycle of 13.79%

\* Emissions falling into restricted bands must comply with the limits of FCC §15.209 / RSS-Gen



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#### 4.4 20 dB Bandwidth

This test measures the bandwidth of the fundamental transmission frequency of the device under test. This test utilizes the n-dB down method specified in ANSI C63.10 section 6.9.2

#### 4.4.1 Test Over View

Results	<b>Complies</b> (as tested per this report)					Date	06/30/202	.0	
Standard	FCC Part 15.231(c)	FCC Part 15.231(c); RSS-210 A.1.3							
Product Model	RF3405E				Seria	<b>l</b> #	0001		
Configuration	See test plan for d	letails.							
Test Set-up	Tested at 3m, sem details	Tested at 3m, semi-anechoic chamber, EUT placed on turntable. See test plan for details							
EUT Powered By	3 VDC	Temp	22° C	Hum	idity	58%	Pressure	1001 mbar	
Perf. Criteria	OBW < 1.083 MHz (Within Limit)		Perf.	Perf. Verification		Rea	Readings within Limit		
Mod to EUT	None		Test Performed By			Ale	Alexander Sowinski		

#### 4.4.2 Test Procedure

Occupied Bandwidth measurements were taken at 3 meters in the semi-anechoic chamber. RBW and VBW were adjusted according to the procedures outlined in ANSI C63.10, and a peak/max-hold trace was captured as a result.

Per FCC Part 15.231(c) and RSS-210 A.1.3, the maximum bandwidth allowed is defined as follows: "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."

Given that the measured center frequency of the fundamental transmission is 433.368 MHz, The maximum allowed bandwidth of the EUT is 1.083 MHz

## 4.4.3 Deviations

There were no deviations from the test methodology listed in the test plan for the 20 dB bandwidth test.

#### 4.4.4 Final Result

The 20 dB bandwidth is measured to be 247.80 kHz



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4.4.5 Final Plot



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Figure 11 – 20 dB Bandwidth of transmitter



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#### 4.5 99% Bandwidth

This test measures the bandwidth of the fundamental transmission frequency of the device under test. This test utilizes the 99% method specified in ANSI C63.10 section 6.9.3.

## 4.5.1 Test Over View

Results	<b>Complies</b> (as tested per this report) <b>Date</b>							06/30/2020		
Standard	RSS-Gen 6.7	RSS-Gen 6.7								
Product Model	RF3405E	RF3405E Serial#					0001			
Configuration	See test plan for	See test plan for details.								
Test Set-up	Tested in shielde	d room, E	UT plac	ed on t	table. S	ee test	pla	n for detail	ls	
EUT Powered By	3 VDC	Temp	22° C	Hun	nidity	58%	I	Pressure	1001 mbar	
Perf. Criteria	OBW < 1.083 MHz (Within Limit) Perf. Ver			erf. Verification			Readings within Limit			
Mod to EUT	None	Test Performed By			y	Alexander Sowinski				

#### 4.5.2 Test Procedure

Occupied Bandwidth measurements were taken at 3 meters in the semi-anechoic chamber. RBW and VBW were adjusted according to the procedures outlined in ANSI C63.10, and a peak/max-hold trace was captured as a result.

Per FCC Part 15.231(c) and RSS-210 A.1.3, the maximum bandwidth allowed is defined as follows: "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."

Given that the measured center frequency of the fundamental transmission is 433.368 MHz, The maximum allowed bandwidth of the EUT is 1.083 MHz

## 4.5.3 Deviations

There were no deviations from the test methodology listed in the test plan for the 99% bandwidth test.

## 4.5.4 Final Result

The 99% bandwidth is measured to be 210.76 kHz.



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#### 4.5.5 Final Plot



02:14:08 30.06.2020

Figure 12 – 99% Bandwidth of transmitter



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#### 4.6 Frequency Stability

This test is to confirm that the fundamental transmission frequency does not change significantly across different operating voltages and temperatures.

#### 4.6.1 Test Over View

Results	<b>Complies</b> (as tested per this report) <b>Date</b>					e 06/30/2020			
Standard	RSS-Gen 6.11 &	RSS-Gen 6.11 & 8.11							
Product Model	RF3405E			Serial	#	0001			
Configuration	See test plan for	details.							
Test Set-up	Tested in temper	Tested in temperature chamber, EUT placed inside. See test plan for details							
EUT Powered By	2.55, 3.00, 3.45 VDC	Temp	-20, 20, 50 ° C	Hun	nidity	58 %	Pressure	1001 mbar	
Perf. Criteria	390.078 < F < 46 [MHz]	67.762	Perf. Veri	rification		Readings within Limits			
Mod to EUT	None		Test Perfo	ormed l	By	Alexander Sowinski			

#### 4.6.2 Test Procedure

Temperature testing was performed inside the temperature chamber. EUT was allowed to soak at each measurement point for 20 minutes before peak/max-hold data was acquired. Voltage testing was performed in the semi-anechoic chamber using a variable DC voltage supply.

Per RSS-Gen 8.11: "If the frequency stability of the license-exempt radio apparatus is not specified in the applicable RSS, the fundamental emissions of the radio apparatus should be kept within at least the central 80% of its permitted operating frequency band in order to minimize the possibility of out-of-band operation."

Given that the EUT operates on a single channel within the 433.42 MHz band, the "central 80%" is defined to be 390.078 MHz to 467.762 MHz.

## 4.6.3 Deviations

There were no deviations from the test methodology listed in the test plan for the frequency stability test.

#### 4.6.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.



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#### 4.6.5 Final Plots



Date: 30.JUN.2020 06:52:37

Figure 13 – Sample Stability (-20°C)



Date: 1.JUL.2020 00:23:11

Figure 14 – Sample Stability (2.55 VDC)



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## 4.6.6 Final Data

Table 4: Frequency stability across temperature

Temp:	Freq: Lower Limit		Upper Limit	Result
°C	MHz	MHz	MHz	
-20	433.347564	390.078	476.762	Pass
20	433.360384	390.078	476.762	Pass
50	433.366794	390.078	476.762	Pass

Table 5: Frequency stability across voltage

Volt:	Freq:	Lower Limit	Upper Limit	Result
VDC	MHz	MHz	MHz	
2.55	433.370000	390.078	476.762	Pass
3.00	433.360384	390.078	476.762	Pass
3.45	433.366794	390.078	476.762	Pass



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# **Appendix A**

# 5 Test Plan

This test report is intended to follow the test plan outlined herein unless otherwise stated. The test plan provides product information, reference standards, and testing details. The product information below came via client, product manual, product itself and or the internet. Test procedure information will reference standards or internal TUV Rheinland NA procedures.

## 5.1 General Information

Client	Bosch Security Systems, Inc.
Address 1	130 Perinton Pkwy
Address 2	Fairport, NY, 14450
Contact Person	Peter Namisnak
Telephone	585-223-4060
Fax	585-223-9180
e-mail	peter.namisnak@us.bosch.com

## 5.2 Model(s) Name

RF3405E

## 5.3 Type of Product

**RADION** Inertia

## 5.4 Equipment Under Test (EUT) Description

The RF3405E is a wireless transmitter with an inertia sensor, reed switch, and supervised external contact input. It is used for monitoring doors, windows, or other dry contact devices.



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## 5.5 Wireless



Antenna Type	Pigtail
Max. Antenna Gain	0 dBi
Modulation Type	OOK
Max. rated E-Field	10,000 µV/m

# 5.6 General Product Information

Size	Н	2.7 cm	W	2.4 cm	L	16.9 cm
Weight	kg	Fork-Lift Needed		Lift Needed	No	
<b>Notes</b> (1.1 in. x 0.9 in. x	6.7 ir	ı.)				

## 5.7 Modifications

None.

# 5.8 EUT Electrical Power Information

# 5.8.1 Electrical Power Type

# 5.8.2 Electrical Power Information

	Name	Туре	Voltage		Frequency	Current	Notes
			min	max			
3 VDC	Lithium Battery	See Below	N/A	3.0	DC	N/A	See Below
<b>Notes</b> The following battery types are recommended for correct operation of your transmitter: Duracell® DL123A, Energizer® EL123AP, Panasonic®® CR123A							



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## 5.9 EUT Modes of Operation during Testing

Full Transmit once 3VDC battery is installed.

## 5.10 EUT Clock/Oscillator Frequencies

Please specify the maximum clock frequency used in the product – \_\_\_\_433.42 MHz\_\_

In the table below, please specify other clock frequencies and sensitive operating frequencies in the product.

Clock Frequencies & Sensitive Frequencies				
13.54 MHz				
433.42 MHz				

## 5.11 Electrical Support Equipment

Туре	Manufacturer	Model	<b>Connected To</b>
None			

## 5.12 Non - Electrical Support Equipment

Item	Notes			
Gas	None			
Water	None			
Air	None			

# 5.13 EUT Equipment/Cabling Information

	Connected To	Location	Cable Type		
EUT Port			Length	Shielded	Bead
None					



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# 5.14 EUT Configuration

	Configuration	Description	
	1	EUT powered by 3VDC battery	
Notes	All configurations are the same except as noted above		

# 5.15 Block Diagram





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#### **END OF REPORT**