



DATE: 27 November 2017

I.T.L. (PRODUCT TESTING) LTD.
FCC Radio Test Report
For

ArrowSpot Systems LTD

Equipment under test:
ArrowTrack Door Sensor G1

FL-ARS-RL0009

Tested by:


M. Zohar

Approved by:


D. Shidlowsky

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This report relates only to items tested.



Measurement/Technical Report for ArrowSpot Systems LTD

ArrowTrack Door Sensor G1

FL-ARS-RL0009

FCC ID: 2ANZWARSRL0009

This report concerns:	Original Grant: X
	Class I Change:
	Class II Change:
Equipment type:	DSR: Part 15 Security/Remote Control Transceiver
Limits used:	47CFR15 Section 15.231 (a-d)

Measurement procedure used is ANSI C63.10-2013.

Application for Certification
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1. General Information

1.1 Administrative Information

Manufacturer:	ArrowSpot Systems LTD
Manufacturer's Address:	3 Hakerem St Kfar Hess, 4069200, Israel Tel: +972-72-250-2230 Fax: +972-72-250-2231
Manufacturer's Representative:	Ran Grinshtain
Equipment Under Test (E.U.T):	ArrowTrack Door Sensor G1
Equipment Model No.:	FL-ARS-RL0009
Equipment Serial No.:	GDC20500AG3
Date of Receipt of E.U.T:	October 17, 2017
Start of Test:	October 17, 2017 November 27, 2017*
End of Test:	October 24, 2017 November 27, 2017*
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C, Section 231(a-d)

*Periodic Operation was re-tested on November 27, 2017.



1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. Industry Canada (Canada), IC File No.: 46405-4025; Site Nos. IC 4025A-1, IC 4025A-2.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 **Product Description**

ArrowTrack Door Sensor is a dedicated sensor, which easily connects to a reefer's sea container door. The sensor is sending in real time information to the ArrowTrack 3G-433 device which includes: Light, Temperature, Humidity, Battery voltage number and THE Door sensor S/N.

Model Name	FL-ARS-RL0009
Working Voltage	3.6VDC battery operated
Mode of Operation	Transceiver
Modulation	GFSK
Assigned Frequency Range	Above 70MHz
Operating Frequency Range	432.7-433.7MHz
Transmit power	~10mW
Antenna Gain	+0.5dB
Modulation BW	250.0kHz

1.4 **Test Methodology**

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 **Test Facility**

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

1.6 **Measurement Uncertainty**

Radiated Emission

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)
for open site:

30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):
± 4.96 dB

1 GHz to 6 GHz

Expanded Uncertainty (95% Confidence, K=2):
±5.19 dB

>6 GHz

Expanded Uncertainty (95% Confidence, K=2):
±5.51 dB

2. System Test Configuration

2.1 Justification

The E.U.T contains a 433.2MHz transceiver.

The testing was performed with the EUT in installation position.

2.2 EUT Exercise Software

No special exercise software was used.

2.3 Special Accessories

No special accessories were needed to achieve compliance.

2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

2.5 Configuration of Tested System

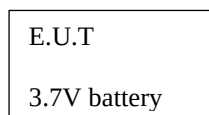


Figure 1. Configuration of Tested System

3. Radiated Measurement Test Set-Up Photos

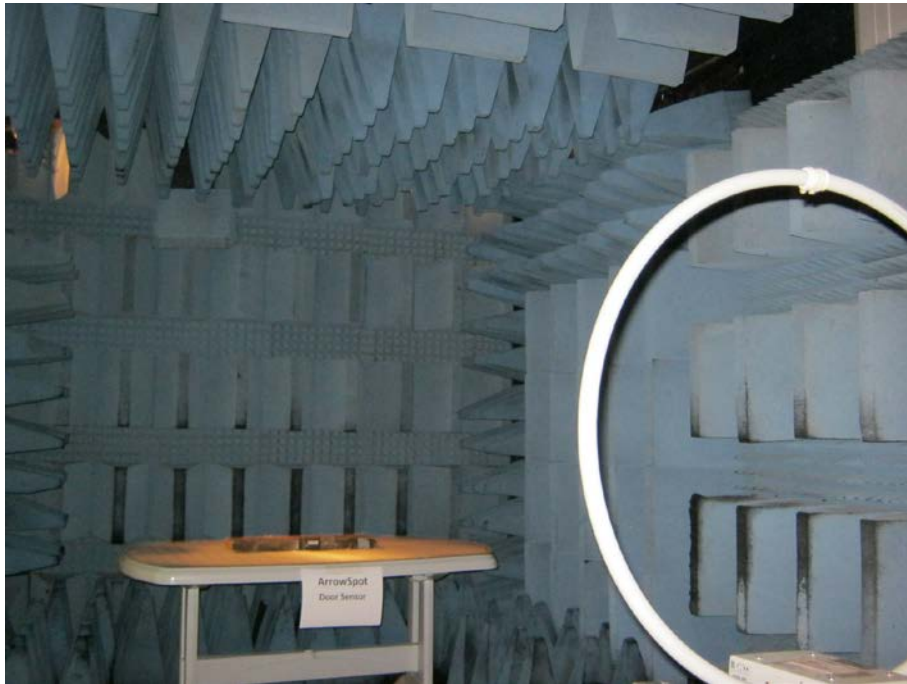


Figure 2. Radiated Emission Test 0.009-30.0MHz

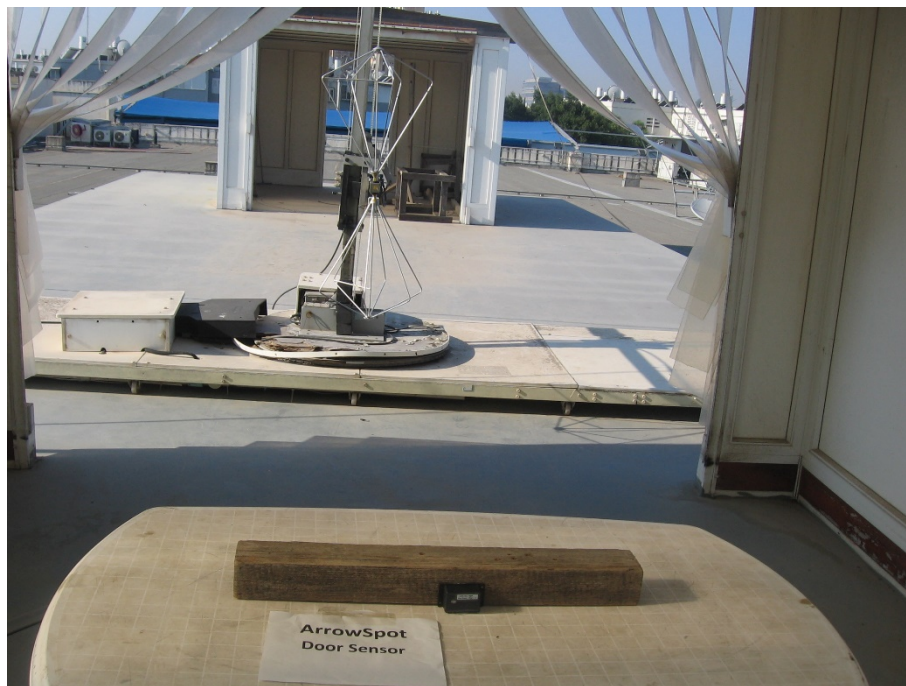


Figure 3. Radiated Emission Test 30.0-200MHz

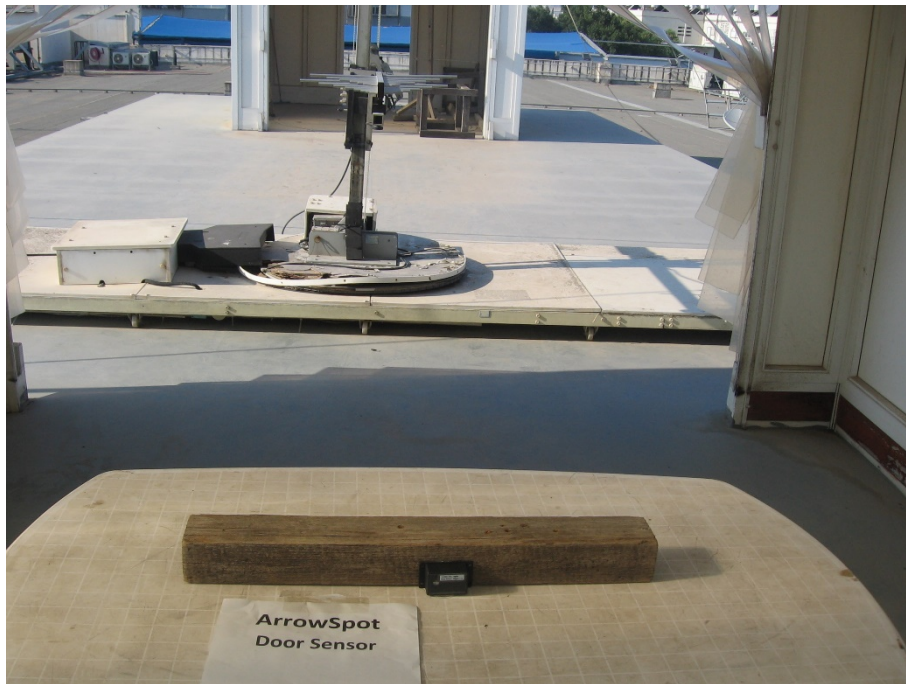


Figure 4. Radiated Emission Test 200-1000.0MHz

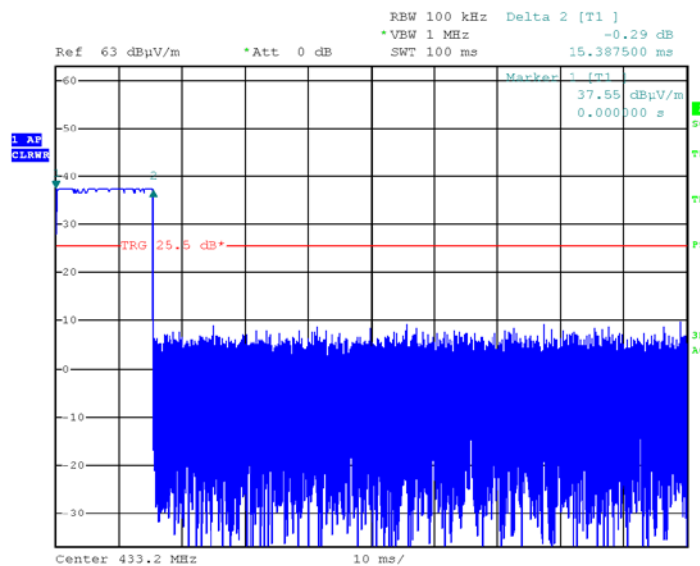


Figure 5. Radiated Emission Test 1.0-5.0GHz

4. Average Factor Calculation

1. Transmission pulse duration = N/A
2. Transmission pulse period = N/A
3. Burst duration in 100msec = 15.38msec
4. Average Factor = $20 \log \left[\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{burst duration}}{100\text{msec}} \times \text{Num of burst within 100msec} \right]$

$$\text{Average Factor} = 20 \log \left[1 \times \frac{15.38}{100} \times 1 \right] = -16.2\text{dB}$$



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Figure 6. Burst duration = 15.38msec

4.1 Test Instrumentation Used; Average Factor Calculation

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	March 2, 2017	March 2, 2018
Log Periodic Antenna	EMCO	3146	9505-4081	May 15, 2107	May 15, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

Figure 7 Test Equipment Used

5. Periodic Operation

5.1 Specification

F.C.C., Part 15, Subpart C, Section 15.231(a)

5.2 Test Procedure

(Temperature (22°C)/ Humidity (58%RH))

The E.U.T operation mode and test setup are described in Section 2 of this report.

5.3 Test Requirements and Verdicts

Requirement	Rationale	Verdict
1. A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.	N/A	Complies
2. An automatically operated transmitter shall cease operation within 5 seconds after activation.	See Figure 8	Complies
3. Periodic transmissions at regular predetermined intervals are not permitted.	N/A	Complies
4. Polling or supervised transmissions to determine system integrity of transmitter used in security or safety applications shall not exceed more than 2 seconds per hour.	See Figure 9 & Figure 10	Complies
5. 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 condition	N/A	Complies
6. Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.	N/A	Complies

5.4 Results

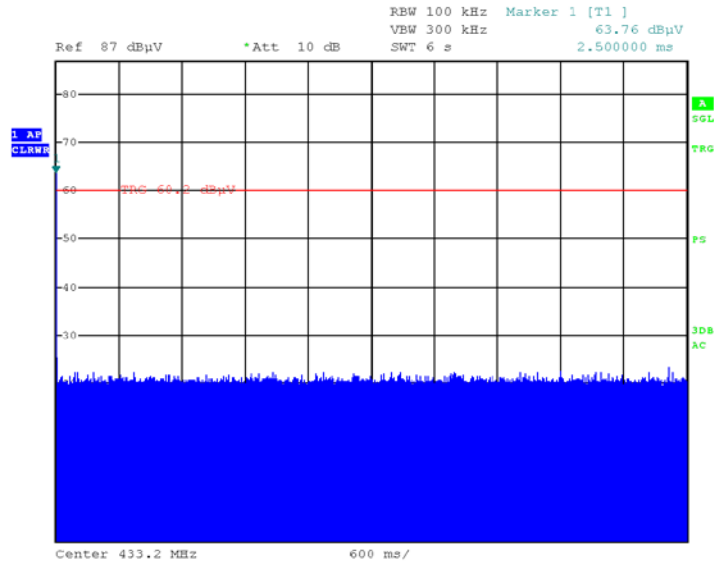
JUDGEMENT: Passed

The EUT met the FCC Part 15, Subpart C, Section 15.231(a) specification requirements.

For additional information see Figure 8 to Figure 10.

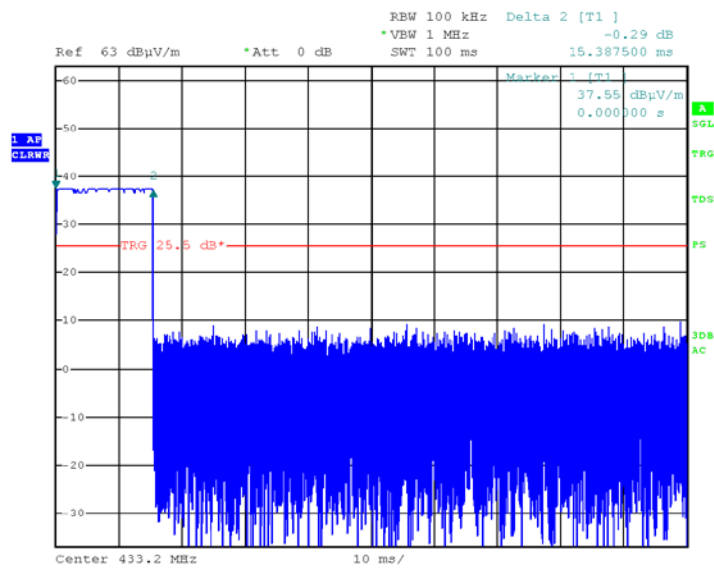
Periodic Operation

E.U.T Description ArrowTrack Door Sensor G1
Type FL-ARS-RL0009
Serial Number: GDC20500AG3



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Figure 8. Automatic Transmission

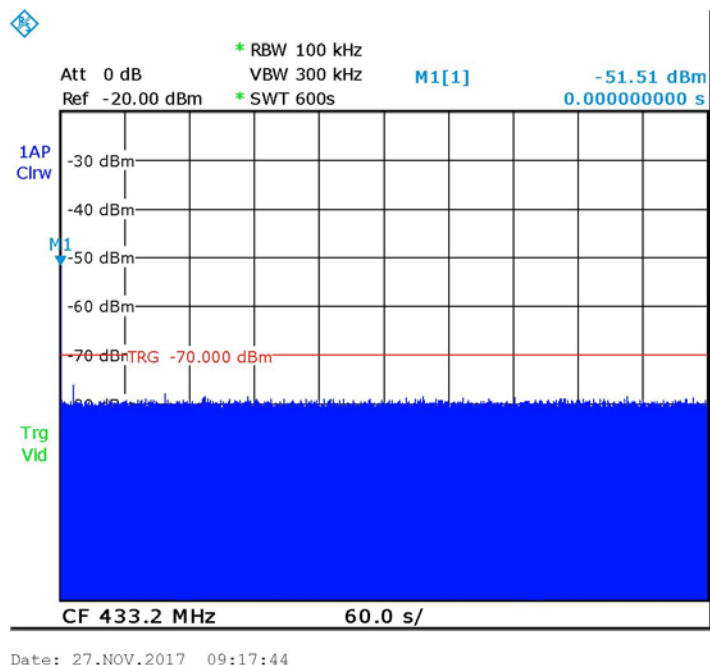


Date: 17.OCT.2017 15:37:37

Figure 9. Burst Duration=15.3msec

Periodic Operation

E.U.T Description ArrowTrack Door Sensor G1
Type FL-ARS-RL0009
Serial Number: GDC20500AG3



**Figure 10. “Worst Case” Number of Bursts in 10min=1
Total Burst Duration in 1hour=6*15.3m=91.8msec<2sec**

5.5 Test Instrumentation Used; Periodic Operation

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	March 2, 2017	March 2, 2018
Log Periodic Antenna	EMCO	3146	9505-4081	May 15, 2107	May 15, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

Figure 11 Test Equipment Used

6. Field Strength of Fundamental

6.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.231(b)

6.2 Test Procedure

(Temperature (21°C)/ Humidity (57%RH))

The E.U.T was tested in the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

6.3 Test Limit

The field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental@3m (μV/m)	Field strength of fundamental@3m (dBμV/m)
40.66-40.70	2,250	67.0
70-130	1,250	61.9
130-174	¹ 1,250 to 3,750	¹ 61.9 to 71.5
174-260	3,750	71.5
260-470	¹ 3,750 to 12,500	¹ 71.5 to 81.9
Above 470	12,500	81.9

¹ Linear interpolations

* The limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions.

** If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply.

6.4 Test Results

JUDGEMENT: Passed by 17.9 dB

The EUT met the FCC Part 15, Subpart C, Section 15.231(b) specification requirements.

The details of the highest emissions are given in *Figure 12* to *Figure 14*.

Field Strength of Fundamental

E.U.T Description ArrowTrack Door Sensor G1
Type FL-ARS-RL0009
Serial Number: GDC20500AG3

Specification: F.C.C., Part 15, Subpart C, 15.231(b)

Antenna Polarization: Horizontal/Vertical

Test Distance: 3 meters Detector: Peak

Freq.	Pol.	Peak Reading	Average Factor	Average Result	Peak Limit	Average Limit	Peak Margin	Average Margin
(MHz)	(V/H)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV/m)	(dBμV/m)	(dB)	(dB)
433.2	H	78.2	-16.2	62.0	100.8	80.8	-22.6	-18.8
433.2	V	79.1	-16.2	62.9	100.8	80.8	-21.7	-17.9

Figure 12. Field Strength of Fundamental - Average/Peak Results

Notes:

1. Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.
2. "Peak Reading." (dBμV/m) includes the "Correction Factors".
3. "Correction Factors" (dB) = Test Antenna Correction Factor (dB) + Cable Loss.
4. "Average Result" (dBμV/m) = Peak Reading (dBμV/m) + Average Factor (dB)

Field Strength of Fundamental

E.U.T Description ArrowTrack Door Sensor G1
Type FL-ARS-RL0009
Serial Number: GDC20500AG3

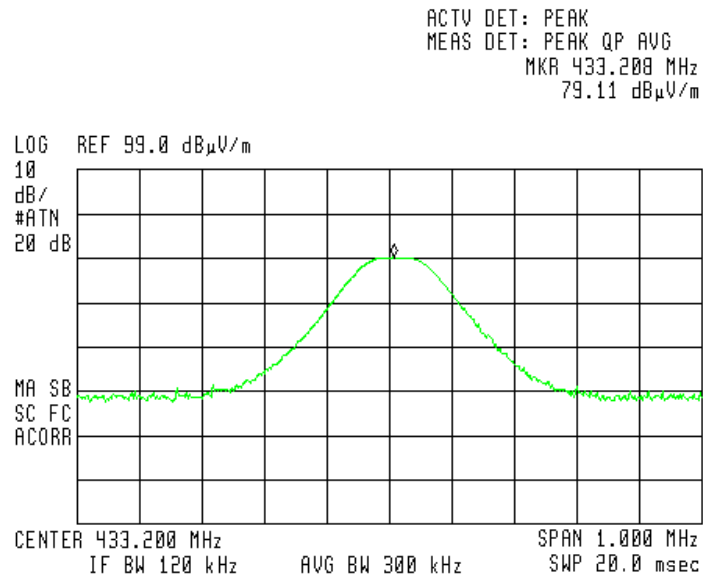


Figure 13. Field Strength of Fundamental - Vertical

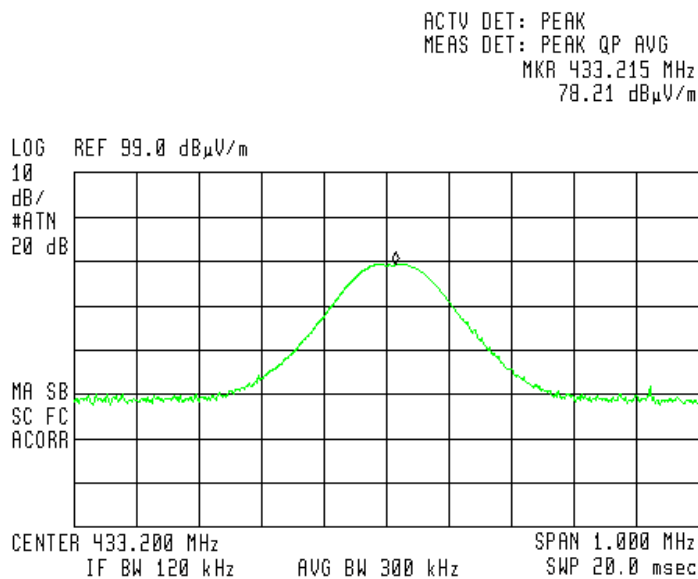


Figure 14. Field Strength of Fundamental -Horizontal

6.5 *Test Instrumentation Used; Field Strength of Fundamental*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	HP	8542E	3906A00276	March 1, 2017	March 1, 2018
RF Filter Section	HP	85420E	3705A00248	March 1, 2017	March 1, 2018
Log Periodic Antenna	EMCO	3146	9505-4081	May 15, 2017	May 15, 2018

Figure 15 Test Equipment Used

7. Field Strength of Spurious Emissions

7.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.231(b)

7.2 Test Procedure

(Temperature (21°C)/ Humidity (59%RH))

For measurements between 0.009MHz-30MHz:

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 0.8 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The frequency range 0.009MHz-30MHz was scanned.

For measurements between 30.0MHz-1.0GHz:

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. The frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.

For measurements between 1.0GHz-5.0GHz:

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 1.5 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The frequency range 1.0GHz -5.0GHz was scanned.

7.3 Test Limit

Spurious emissions shall be attenuated to the average limits shown in next table or to the general limits shown in §15.209, whichever limit permits a higher field strength:

Fundamental frequency (MHz)	Field strength of spurious emissions@3m (µV/m)	Field strength of spurious emissions@3m (dBµV/m)
40.66-40.70	225	47.0
70-130	125	41.9
130-174	¹ 125 to 375	¹ 41.9 to 51.5
174-260	375	51.5
260-470	¹ 375 to 1,250	¹ 51.5 to 61.9
Above 470	1,250	61.9

¹ Linear interpolations

* The limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions.

** If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	Field strength (dB μ V/m)	Field strength* (dB μ V/m)@3m
0.009-0.490	2400/F(kHz)	300	48.5-13.8	128.5-73.8
0.490-1.705	24000/F(kHz)	30	33.8-23.0	73.8-63.0
1.705-30.0	30	30	29.5	69.5
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

7.4 Test Results

JUDGEMENT: Passed by 8.1 dB

The EUT met the requirements of the F.C.C. Part 15, Subpart C specification.

The margin between the emission level and the specification limit was 8.1 dB in the worst case at the frequency of 4332.0 MHz, vertical polarization.

For additional information see *Figure 16*.



Radiated Emission

E.U.T Description ArrowTrack Door Sensor G1
Type FL-ARS-RL0009
Serial Number: GDC20500AG3

Specification: FCC Part 15, Subpart C

Antenna Polarization: Vertical/Horizontal Frequency range: 0.009MHz to 5GHz
Antenna: 3 meters distance Detector: Peak

Freq. (MHz)	Pol. (V/H)	Peak Reading (dBμV/m)	Average Factor (dB)	Average Result (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Peak Margin (dB)	Average Margin (dB)
866.4	H	43.5	-16.2	27.3	74.0	54.0	-30.5	-26.7
866.4	V	44.0	-16.2	27.8	74.0	54.0	-30.0	-26.2
1299.6	H	49.2	-16.2	33.0	74.0	54.0	-24.8	-21.0
1299.6	V	49.0	-16.2	32.8	74.0	54.0	-25.0	-21.2
3465.6	H	60.5	-16.2	44.3	74.0	54.0	-13.5	-9.7
3465.6	V	60.8	-16.2	44.6	74.0	54.0	-13.2	-9.4
4332.0	H	62.0	-16.2	45.8	74.0	54.0	-12.0	-8.2
4332.0	V	62.1	-16.2	45.9	74.0	54.0	-11.9	-8.1

Figure 16. Spurious Radiated Emission Results

Notes:

1. Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.
2. "Peak Reading." (dBμV/m) included the "Correction Factors".
3. "Correction Factors" (dB) = Test Antenna Correction Factor (dB) + Cable Loss.
4. "Average Result" (dBμV/m)=Peak Reading (dBμV/m)+ Average Factor (dB)

7.5 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 28, 2017	February 28, 2018
EMI Receiver	HP	8542E	3906A00276	March 1, 2017	March 1, 2018
RF Filter Section	HP	85420E	3705A00248	March 1, 2017	March 1, 2018
Biconical Antenna	EMCO	3110B	9912-3337	May 15, 2017	May 15, 2018
Log Periodic Antenna	EMCO	3146	9505-4081	May 15, 2017	May 15, 2018
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Active Loop Antenna	EMCO	6502	9506-2950	October 15, 2017	October 15, 2018
Spectrum Analyzer	HP	8593EM	3536A00120 ADI	February 28, 2017	February 28, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR
Antenna Mast	ETS	2070-2	9608-1497	NCR	NCR
Turntable	ETS	2087	-	NCR	NCR
Mast & Table Controller	ETS/EMCO	2090	9608-1456	NCR	NCR

Figure 17 Test Equipment Used

8. 20dB Bandwidth

8.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.231(c)

8.2 Test Procedure

(Temperature (21°C)/ Humidity (50%RH))

The transmitter unit operated with normal modulation. The spectrum analyzer was set to 30 kHz resolution BW and center frequency of the transmitter fundamental. The spectrum bandwidth of the transmitter unit was measured and recorded. The BW was measured at 20 dBc points.

8.3 Test Limit

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.

8.4 Test Results

The EUT met the requirements of F.C.C. Part 15, Subpart C, section 15.231(c) specification.

Bandwidth Reading (kHz)	Specification (kHz)	Margin (kHz)
132.0	<1082	950

Figure 18 20dB Bandwidth Test Results

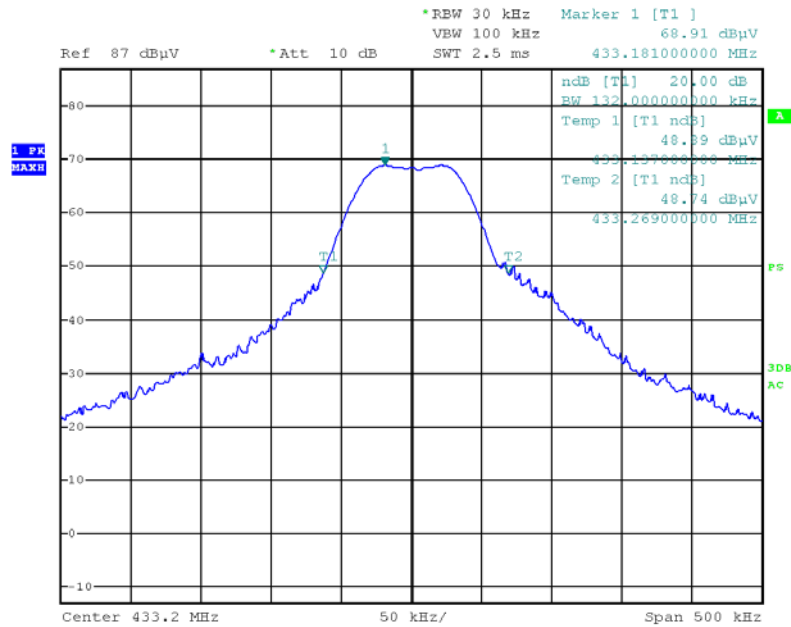
JUDGEMENT: Passed by 950 kHz

For additional information see *Figure 19*.



20dB Bandwidth

E.U.T Description ArrowTrack Door Sensor G1
Type FL-ARS-RL0009
Serial Number: GDC20500AG3



Date: 18.OCT.2017 09:47:03

Figure 19 20dB Bandwidth Results

8.5 Test Equipment Used; 20dB Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	HP	8542E	3906A00276	March 1, 2017	March 1, 2018
RF Filter Section	HP	85420E	3705A00248	March 1, 2017	March 1, 2018
Log Periodic Antenna	EMCO	3146	9505-4081	May 15, 2017	May 15, 2018

Figure 20 Test Equipment Used

9. Antenna Information

Antenna Gain – 0.5dBi



AN1603-433

**Multilayer Chip Antenna for
433MHz Wireless Communication**

10. APPENDIX A - CORRECTION FACTORS

10.1 Correction factors for RF OATS Cable 35m ITL #1879

Frequency (MHz)	Cable loss (dB)
30.0	1.1
50.0	1.1
100.0	1.7
150.0	2.1
200.0	2.5
250.0	2.7
300.0	2.9
350.0	3.1
400.0	3.5
450.0	3.7
500.0	3.9
550.0	4.0
600.0	4.2
650.0	4.4
700.0	4.9
750.0	5.0
800.0	5.0
850.0	4.9
900.0	5.0
950.0	5.1
1000.0	5.4



10.2 Correction factors for Biconical Antenna – ITL # 1356

Model: EMCO 3110B

Serial No.:9912-3337

Frequency [MHz]	ITL 1356 AF [dB/m]
30	13.00
35	10.89
40	10.59
45	10.63
50	10.12
60	9.26
70	7.74
80	6.63
90	8.23
100	11.12
120	13.16
140	13.07
160	14.80
180	16.95
200	17.17



10.3 Correction factors for LogPeriodic Antenna
ITL # 1349
Model: EMCO 3146
Serial No.:9505-4081

Frequency	ITL 1349 AF
[MHz]	[dB/m]
200	11.58
250	12.04
300	14.76
400	15.55
500	17.85
600	18.66
700	20.87
800	21.15
900	22.32
1000	24.22



10.4 Correction factors for Active Loop Antenna
Model 6502 S/N 9506-2950
ITL # 1075

f(MHz)	MAF(dBs/m)	AF(dB/m)
0.01	-33.1	18.4
0.02	-37.2	14.3
0.03	-38.2	13.3
0.05	-39.8	11.7
0.1	-40.1	11.4
0.2	-40.3	11.2
0.3	-40.3	11.2
0.5	-40.3	11.2
0.7	-40.3	11.2
1	-40.1	11.4
2	-40	11.5
3	-40	11.5
4	-40.1	11.4
5	-40.2	11.3
6	-40.4	11.1
7	-40.4	11.1
8	-40.4	11.1
9	-40.5	11
10	-40.5	11
20	-41.5	10
30	-43.5	8



**10.5 Correction factors for
Horn ANTENNA**

Double –Ridged Waveguide

Model: 3115

Serial number:29845

3 meter range; ITL # 1352

FREQUENCY	AFE	FREQUENCY	AFE
(GHz)	(dB/m)	(GHz)	(dB/m)
0.75	25	9.5	38
1.0	23.5	10.0	38.5
1.5	26.0	10.5	38.5
2.0	29.0	11.0	38.5
2.5	27.5	11.5	38.5
3.0	30.0	12.0	38.0
3.5	31.5	12.5	38.5
4.0	32.5	13.0	40.0
4.5	32.5	13.5	41.0
5.0	33.0	14.0	40.0
5.5	35.0	14.5	39.0
6.0	36.5	15.0	38.0
6.5	36.5	15.5	37.5
7.0	37.5	16.0	37.5
7.5	37.5	16.5	39.0
8.0	37.5	17.0	40.0
8.5	38.0	17.5	42.0
9.0	37.5	18.0	42.5

10.6 Correction factor for RF CABLE for Semi Anechoic Chamber

ITL # 1841

FREQ (MHz)	LOSS (dB)
1000.0	1.5
2000.0	2.1
3000.0	2.7
4000.0	3.1
5000.0	3.5
6000.0	4.1
7000.0	4.6
8000.0	4.9
9000.0	5.7
10000.0	5.7
11000.0	6.1
12000.0	6.1
13000.0	6.2
14000.0	6.7
15000.0	7.4
16000.0	7.5
17000.0	7.9
18000.0	8.1
19000.0	8.8
20000.0	9.1

NOTES:

1. The cable is manufactured by Commscope
2. The cable type is 0623 WBC-400, serial # G020132 and 10m long