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DATE: 2 April 2018

I.T.L. (PRODUCT TESTING) LTD.

FCC Radio Test Report

for

Extronics Ltd

Equipment under test:

Personnel & Asset Tracking Tag

iTAG100-1-CB*

See customer declaration on page 5

Tested by: _____
M. Zohar

Approved by: _____
D. Shidlowsky

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Measurement/Technical Report for

Extronics Ltd

Personnel & Asset Tracking Tag

iTAG100-1-CB

FCC ID: 2AIZEEXTRFID00002

This report concerns:	Original Grant: Class I Change: Class II Change: X
Equipment type:	Digital Transmission System
Limits used:	47CFR15 Section 15.247

Measurement procedure used is KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63. 10-2013.

Application for Certification
prepared by:
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Applicant for this device:
(different from "prepared by")
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1. General Information

1.1 *Administrative Information*

Manufacturer:	Extronics Ltd
Manufacturer's Address:	1 Dalton Way Middlewich, CW10 0HU United Kingdom Tel: +441606738446 Fax: +441606738446
Manufacturer's Representative:	Andrew Martell
Equipment Under Test (E.U.T):	Personnel & Asset Tracking Tag
Equipment Model No.:	iTAG100-1-CB* (See customer declaration on following page)
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	November 19, 2017
Start of Test:	November 19, 2017
End of Test:	November 22, 2017
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C

MODELS DECLARATION

Date: March 27, 2018

Subject: Permissive Change Class II for Extronics Ltd, iTAG100, FCC ID: 2AIZEEXTRFID00002.

I HEREBY DECLARE THE FOLLOWING:

1. The iTAG-100-1-CB which was tested for the C2PC differs from the below models by the differences appearing in the below chart.

2. Please relate to them, from a radio point of view, as the same product.

Models	DESCRIPTION	ENCAPSULATED	SOLDERED BATTERY	DROP IN BATTERY	Optional 4.7K Ohm Resistor in call button circuit
iTAG 100-1	Zone 1 Group IIC Tag	X	X	X	
iTAG 100-1-CB	Zone 1 Group IIC Tag with call button	X	X		X
iTAG 100-3	Mining Group I Tag	X	X	X	
iTAG 100-3-CB	Mining Group I Tag with call button	X	X	X	X
iTAG 100-6	Zone 0 Group IIB Tag	X	X	X	
iTAG 100-6-CB	Zone 0 Group IIB Tag with call button	X	X	X	X
iTAG100-MSHA	North American certified mining tag	X	X	X	
iTAG100-MSHA-CB	North American certified mining tag with call button	X	X	X	X
iTAG100-5	US certified for Class I,II and III Groups A-G tag	X	X	X	
iTAG100-5-CB	US certified for Class I,II and III Groups A-G tag with call button	X	X	X	X

Andrew Martell

Technical Manager

X120372(1)

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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*

The iTAG100 is an intrinsically safe version of the market's leading Wi-Fi Tag, the T2. The iTAG100 is a small, long-life Wi-Fi based Active RFID device that can be placed on any person or asset, allowing the Extronics system to locate personnel and assets that are not Wi-Fi enabled.

Extronics Advance delivers real-time location, auto-identification, wireless sensing and telemetry technologies to automate business processes and deliver context-aware applications. Our Real-Time Visibility solutions go beyond standalone RFID applications, RTLS and sensor solutions by unifying all enterprise visibility data on a single Wi-Fi-based platform. This can be based on your existing Wi-Fi infrastructure, adding ROI and functionality to your current set-up. The iTAG100 has proven usability, dependability, and scalability, as well as flexibility to enable a wide variety of valuable applications for many industries to streamline business processes and improve operational efficiency.

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v03r05 and 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*

On 3/26/2018, a FCC ID change application was approved for the E.U.T. under FCC ID: 2AIZEEXTRFID00002.

The following C2PC changes were made to the E.U.T.

1. The PCB was encapsulated;

2. On some models, the battery has soldered wire connections;

3. On some versions, a 4.7 Ohm resistor is fitted in the call button circuit.

See customer declaration on page 5.

Maximum transmitted peak power output, spurious radiated emissions and bandwidth were tested to see if the EUT meets the requirements for a C2PC.

The unit was evaluated while transmitting at the low channel (2412MHz), the mid channel (2437MHz) and the high channel (2462MHz) in IEEE 802.11/n (20MHz BW) standard technology (WI-FI).

Exploratory emission testing was performed in 3 orthogonal polarities to determine the “worst case” emissions.

According to the below results, the worst case was the Y axis.

Orientation	**Frequency**	**Field Strength**	**2rd Harmonic**	**3th Harmonic**
	(MHz)	(dBuV/m)	(dBuV/m)	(dBuV/m)
X axis	2412.0	105.7	56.2	57.7
	2437.0	105.5	56.5	58.0
	2462.0	104.5	56.0	58.2
Y axis	2412.0	**106.3**	56.2	58.1
	2437.0	**106.5**	56.9	58.0
	2462.0	**105.8**	56.5	58.0
Z axis	2412.0	103.8	56.0	58.0
	2437.0	103.5	56.5	57.9
	2462.0	102.8	56.3	58.0

Figure 1. Screening Results

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*

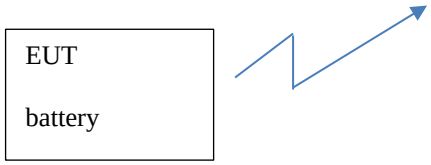

Figure 2. Configuration of Tested System

3. Radiated Measurement Test Set-Up Photos

Figure 3. Radiated Emission Test

4. Maximum Transmitted Peak Power Output

4.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(b)(3)

4.2 *Test Procedure*

(Temperature (23°C)/ Humidity (63%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground and 3 meter from testing antenna.

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \text{ [W]}$$

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

4.3 *Test Limit*

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz bands: 1 Watt.

4.4 *Test Results*

JUDGEMENT: PASSED

For additional information see *Figure 4.*

Unit	Operation Frequency	Polarization	Field Strength	Power	Power	Limit
(Old/new)	(MHz)	(V/H)	(dBuV/m)	(dBm)	(W)	(W)
Old	2412.0	V	104.6	9.4	0.009	1.0
Old	2412.0	H	106.6	11.4	0.014	1.0
New	***2412.0***	***V***	***103.4***	***8.2***	***0.007***	***1.0***
New	***2412.0***	***H***	***99.5***	***4.3***	***0.003***	***1.0***
Old	2437.0	V	104.6	9.4	0.009	1.0
Old	2437.0	H	106.0	10.8	0.012	1.0
New	***2437.0***	***V***	***101.6***	***6.4***	***0.004***	***1.0***
New	***2437.0***	***H***	***98.1***	***2.9***	***0.002***	***1.0***
Old	2462.0	V	105.5	10.3	0.011	1.0
Old	2462.0	H	103.6	8.4	0.007	1.0
New	***2462.0***	***V***	***96.5***	***1.3***	***0.001***	***1.0***
New	***2462.0***	***H***	***91.1***	***-4.1***	***0.0004***	***1.0***

Figure 4 Maximum Peak Power Output

4.5 *Test Equipment Used; Maximum Peak Power Output*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Date
EMI Receiver	R&S	ESCI7	100724	February 28, 2017	February 28, 2018
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

Figure 5 Test Equipment Used

5. Radiated Emissions

5.1 *Test Specification*

FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)

5.2 *Test Procedure*

(Temperature (23°C)/ Humidity (63%RH))

For measurements between 0.009MHz-30MHz:

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

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 frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

For measurements between 1.0GHz-25.0GHz:

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 1.0GHz -25.0GHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

The E.U.T. was operated at the low (2412MHz), mid (2437MHz) and high channels (2462 MHz) and only for CCK modulation like the original testing.

5.3 *Test Limit*

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	Field strength* (dBµV/m)	Field strength* (dBµV/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.

Figure 6 Table of Limits

5.4 *Test Results*

JUDGEMENT: Passed

The details of the highest emissions are given in *Figure 7*.

Radiated Emission

E.U.T Description Personnel & Asset Tracking Tag
Type iTAG100-1-CB
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 0.009MHz to 25.0 GHz
Test Distance: 3 meters Detector: Peak

Operation Frequency	Unit	Freq.	Polarity	Peak Reading	Limit
(MHz)	(Old/New)	(MHz)	(H/V)	(dBµV/m)	(dBµV/m)
2412.0	Old	4824.0	H	66.6	74.0
	Old	4824.0	V	71.8	74.0
	New	***4824.0***	***H***	***63.5***	***74.0***
	New	***4824.0***	***V***	***65.3***	***74.0***
2437.0	Old	4874.0	H	68.3	74.0
	Old	4874.0	V	68.6	74.0
	New	***4874.0***	***H***	***71.0***	***74.0***
	New	***4874.0***	***V***	***68.9***	***74.0***
2462.0	Old	4924.0	H	61.7	74.0
	Old	4924.0	V	69.5	74.0
	New	***4924.0***	***H***	***64.1***	***74.0***
	New	***4924.0***	***V***	***72.1***	***74.0***

Figure 7. Radiated Emission Results

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.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

5.5 *Test Instrumentation Used; Emissions in Restricted Frequency Bands*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Date
EMI Receiver	R&S	ESCI7	100724	February 28, 2017	February 28, 2018
Spectrum Analyzer	HP	8592L	3826A01204	March 1, 2017	March 1, 2018
EMI Receiver	HP	8542E	3906A00276	March 1, 2017	March 1, 2018
RF Filter Section	HP	85420E	3705A00248	March 1, 2017	March 1, 2018
Spectrum Analyzer	HP	8564E	3442A00275	March 19, 2017	March 19, 2018
Biconical Antenna	EMCO	3110B	9912-3337	May 15, 2017	May 15, 2019
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2017	October 19, 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
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	December 31, 2017
Low Noise Amplifier	Narda	DBS-0411N313	13	October 1, 2017	October 1, 2018
Low Noise Amplifier	Sophia Wireless	LNA28-B	232	October 1, 2017	October 1, 2018
Spectrum Analyzer	HP	8593EM	3536A00120ADI	February 28, 2017	February 28, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

Figure 8 Test Equipment Used

6. Occupied Bandwidth

6.1 *Test Specification*

FCC, Part 2, Sub part J, Section 2.1049

6.2 *Test Procedure*

(Temperature (22°C)/ Humidity (56%RH))

The E.U.T. operation mode and test set-up are as described in Section 2 of this report. The E.U.T. was placed in the chamber on a non-conductive table, 0.8 meters above the ground.

The distance between the E.U.T. and test antenna was 3 meters.
The transmitter unit was operated with normal modulation. The RBW set to the range of 1% to 5% of the OBW. The span was set to ~ 3 times the OBW.
The 99% occupied bandwidth function was set on.

6.3 *Test Limit*

N/A

6.4 *Test Results*

FREQUENCY (MHz)	**READING** (MHz)
2412.0	19.4
2437.0	19.6
2562.0	19.5

Figure 9. Bandwidth Test Results

6.5 *Test Equipment Used; Occupied Bandwidth*

Instrument	**Manufacturer**	**Model**	**Serial No.**	**Last Calibration Date**	**Next Calibration Due**
EMI Receiver	R&S	ESCI7	100724	February 28, 2017	February 28, 2018
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

Figure 10 Test Equipment Used

7. APPENDIX A - CORRECTION FACTORS

7.1 *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

7.2 *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*

7.3 *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

7.4 Correction factors for biconical antenna – ITL # 1356

Model: EMCO 3110B

Serial No.:9912-3337

Frequency	**ITL 1356 AF**
[MHz]	**[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

7.5 *Correction factors for log periodic antenna – ITL # 1349*

Model: EMCO 3146

Serial No.:9505-4081

Frequency [MHz]	**ITL 1349 AF [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

7.6 *Correction factors for Double –Ridged Waveguide Horn ANTENNA*

Model: 3115
Serial number:29845
3 meter range; ITL # 1352

FREQUENCY (GHz)	AFE (dB/m)	FREQUENCY (GHz)	AFE (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

7.7 *Correction factors for* *Horn Antenna*

Model: SWH-28
at 3 meter range.
ITL #:1353

CALIBRATION DATA

3 m distance

Frequency, MHz	Measured antenna factor, dB/m [1]
18000	32.4
18500	32.0
19000	32.3
19500	32.4
20000	32.3
20500	32.8
21000	32.8
21500	32.7
22000	33.1
22500	33.0
23000	33.1
23500	33.8
24000	33.5
24500	33.5
25000	33.8
25500	33.9
26000	34.2
26500	34.7

[1] The antenna factor shall be added to receiver reading in dBµV to obtain field strength in dBµV/m.