



DATE: 1 September 2020

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

FCC Radio Test Report

for

Juganu Ltd.

Equipment under test:

RF Module

JNET1

Tested by:

M. Zohar

Approved by:

D. Shidlow

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Measurement/Technical Report for Juganu Ltd.

RF Module

JNET1

FCC ID: 2ATPH-JNET1-915MHZ

This report concerns:

Original Grant:

Class I Change:

Class II Change: X

Equipment type:

FCC: (DTS) Digital Transmission System

Limits used:

47CFR15 Section 15.247

Measurement procedure used is KDB 558074 D01 v05r03, ANSI C63.10:2013

Application for Certification

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1. General Information

1.1 Administrative Information

Manufacturer:	Juganu Ltd.
Manufacturer's Address:	1 Yehadut Canada St. Or-Yehuda, Israel, 6037501 Tel: +972-3-531-0030
Manufacturer's Representative:	David Davidov
Equipment Under Test (E.U.T):	RF Module
Equipment PMN:	JNET1
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	August 02, 2020
Start of Test:	August 02, 2020
End of Test:	August 13, 2020
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C



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. Department of Innovation, Science and Economic Development (ISED) Canada, CAB identifier: IL1002

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 E.U.T. is an RF module used in street & road lighting applications with full-embedded FOAM capabilities.

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v05r03, 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

Conducted Emission

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)

0.15 – 30 MHz:

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

± 3.44 dB

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

1. On 06/23/2020, the EUT received single modular FCC certification under FCC ID: 2ATPH-JNET1-915MHZ.
2. The manufacturer would like to use this 915MHz module in device Phoenix 1, which is street light, together with two other RF modules, the Compex FCC certified 2.4 GHz Wi-Fi module FCC ID: TK4WLE1216V220 and the Compex FCC certified 5.0GHz Wi-Fi module FCC ID: TK4WLE1216V520.
3. Juganu Ltd. requests a C2PC to allow their module to be co-located in their device, the Phoenix 1, together with the two other certified modules and to allow simultaneous transmission.
4. The evaluation was performed with the E.U.T. located in the Phoenix 1 with all three RF modules transmitting simultaneously as follow:
FCC ID: 2ATPH-JNET1-915MHZ transmitting at 926MHz.
FCC ID: TK4WLE1216V220 transmitting at 2437MHz.
FCC ID: TK4WLE1216V520 transmitting at both 5180MHz & 5826 MHz.
5. The following test was performed: Radiated Emission.
6. The EUT meets the requirements of the C2PC.

2.2 EUT Exercise Software

No special exercise software was used.

2.3 Special Accessories

No special accessories were used.

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, 30-200MHz



Figure 3. Radiated Emission Test, 200-1000MHz



Figure 4. Radiated Emission Test, 1.0-18.0GHz



Figure 5. Radiated Emission Test, 18-26.5GHz



Figure 6. Radiated Emission Test, 26.5-40.0GHz

4. Radiated Spurious Emissions

4.1 Test Specification

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

4.2 Test Procedure

(Temperature (23°C)/ Humidity (65%RH))

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

For measurements between 30-1000MHz:

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 30MHz -1000MHz was scanned and the list of the highest emissions was verified and updated accordingly.

For measurements between 1GHz-40GHz:

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 1GHz -40GHz was scanned.

The highest radiations are described in Figure 8.

4.3 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

Figure 7 Table of Limits

*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.

4.4 Test Results

JUDGEMENT: Passed by -0.4 dB

For the frequency of 1,250.0 MHz, the margin between the emission level and the specification limit is in the worst case -0.4 dB at the frequency of 1250.0 MHz, vertical polarization.

For the frequency of 6,251.5 MHz, the margin between the emission level and the specification limit is in the worst case -3.6 dB at the frequency of 6251.5.0 MHz, vertical polarization.

For the frequency of 9,748.0 MHz, the margin between the emission level and the specification limit is in the worst case -22.0 dB at the frequency of 9,748.0 MHz, vertical polarization.

For the frequency of 11,000.0 MHz, the margin between the emission level and the specification limit is in the worst case -20.7 dB at the frequency of 11,000.0 MHz, vertical polarization.

For the frequency of 20,688.0 MHz, the margin between the emission level and the specification limit is in the worst case -23.7 dB at the frequency of 20,688.0 MHz, vertical polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C Sections 15.209, 15.205, 15.247(d) specifications.

The details of the highest emissions are given in *Figure 8*

Radiated Emission

E.U.T Description RF Module
Type JNET1
Serial Number: Not designated

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

Antenna Polarization: Horizontal/Vertical Frequency Range: 9kHz to 40.0 GHz
Detector: Peak, Average

Freq.	Pol	Peak Reading	Peak Limit	Peak Margin	Average Reading	Average Limit	Average Margin
(MHz)	(H/V)	(dBμV/m)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1,250.0	V	60.7	74.0	-13.3	53.6	54.0	-0.4
	H	57.1	74.0	-16.9	52.2	54.0	-1.8
6,251.5	V	58.7	74.0	-15.3	50.4	54.0	-3.6
	H	57.4	74.0	-16.6	49.8	54.0	-4.2
9,748.0	V	51.8	74.0	-22.2	-	54.0	-
	H	52.0	74.0	-22.0	-	54.0	-
11,000.0	V	53.1	74.0	-20.9	-	54.0	-
	H	53.3	74.0	-20.7	-	54.0	-
20,688.0	V	49.5	74.0	-24.5	-	54.0	-
	H	50.1	74.0	-23.9	-	54.0	-

Figure 8. 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

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

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	March 09 2020	March 31, 2021
EMI Receiver	HP	8542E	3906A00276	March 11 2020	March 31, 2021
RF Filter Section	HP	85420E	3705A00248	March 11 2020	March 31, 2021
Spectrum Analyzer	HP	8593EM	3826A00265	March 09, 2020	March 31, 2021
Active Loop Antenna	EMCO	6502	9506-2950	February 5, 2019	February 29, 2021
Biconical Antenna	EMCO	3110B	9912-3337	May 21, 2019	October 31, 2020
Log Periodic Antenna	EMCO	3146	9505-4081	May 31, 2018	May 31, 2021
Horn Antenna	ETS	3115	29845	May 31, 2018	May 31, 2021
Horn Antenna	ARA	SWH-28	1007	December 13, 2017	December 31, 2020
MicroWave System Amplifier	HP	83006A	3104A00589	December 24, 2018	December 31, 2020
Low Noise Amplifier 1GHz-18GHz	Miteq	AFSX4-02001800-50-8P	-	December 24, 2018	December 31, 2020
RF Cable Chamber	Commscope ORS	0623 WBC-400	G020132	December 24, 2018	December 31, 2020
RF Cable Oats	EIM	RG214-11N(X2)		May 26, 2019	May 31, 2021
Band Pass Filter 4-20 GHz	Meuro	MFL040120H50	902252	December 24, 2018	December 31, 2020
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 9 Test Equipment Used

5. APPENDIX A - CORRECTION FACTORS

5.1 *Correction factors for ITL #1911 (oats RF cable)*

Frequency (MHz)	Cable Loss (dB)	Frequency (MHz)	Cable Loss (dB)
1.0	0.5	450.00	5.83
10.00	1.0	500.00	6.33
20.00	1.34	550.00	6.67
30.00	1.5	600.00	6.83
50.00	1.83	650.00	7.17
100.00	2.67	700.00	7.66
150.00	3.17	750.00	7.83
200.00	3.83	800.00	8.16
250.00	4.17	850.00	8.5
300.00	4.5	900.00	8.83
350.00	5.17	950.00	8.84
400.00	5.5	1000.00	9.0

5.2 **Correction factors for ITL #1840 (anechoic chamber RF cable)**

Frequency (MHz)	Cable Loss (dB)	Frequency (MHz)	Cable Loss (dB)
1000.0	-1.4	10000.0	-6.0
1500.0	-1.7	10500.0	-6.2
2000.0	-2.0	11000.0	-6.2
2500.0	-2.3	11500.0	-6.0
3000.0	-2.6	12000.0	-6.0
3500.0	-2.8	12500.0	-6.1
4000.0	-3.1	13000.0	-6.3
4500.0	-3.3	13500.0	-6.5
5000.0	-3.6	14000.0	-6.7
5500.0	-3.7	14500.0	-7.0
6000.0	-4.0	15000.0	-7.3
6500.0	-4.4	15500.0	-7.5
7000.0	-4.7	16000.0	-7.6
7500.0	-4.8	16500.0	-8.0
8000.0	-5.0	17000.0	-8.0
8500.0	-5.1	17500.0	-8.1
9000.0	-5.6	18000.0	-8.2
9500.0	-5.8		

5.3 ***Correction factors for ITL #1356(Biconical antenna)***

Frequency	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



5.4 Correction factors for ITL # 1349(log periodic antenna)

Frequency	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

5.5 Correction factors for ITL # 1352(1-18GHz Horn antenna)

FREQUENCY (GHz)	AF (dB/m)	FREQUENCY (GHz)	AF (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

5.6 Correction factors for ITL # 1353(18-26.5GHz Horn antenna)

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 dB μ V to obtain field strength in dB μ V/m.

5.7 Correction factors for ITL # 1777(26.5-40GHz Horn antenna)

