

RF Exposure TEST REPORT



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Laboratory Accreditations (per ISO/IEC 17025:2017)



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Manufacturer: JSF Technologies Inc.

Address: 6582 Bryn Rd.
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Equipment Tested: WP6 – Wireless Platform 6

Model Number(s): WP6
FCC ID: SFIWP6
ISED ID: 5301A-WP6



REVISION HISTORY

Date	Report Number	Details	Author's Initials
October 16, 2023	E11168-2301_JSF_Technologies_WP6_RFExp_FCC-ISED_Rev0.0	Initial draft	AH
November 1, 2023	E11168-2301_JSF_Technologies_WP6_RFExp_FCC-ISED_Rev0.1	Draft	AH
November 9, 2023	E11168-2301_JSF_Technologies_WP6_RFExp_FCC-ISED_Rev1.0	Final	AH

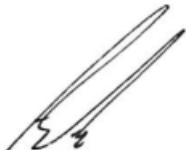
All previous versions of this report have been superseded by the latest dated revision as listed in the above table.
Please dispose of all previous electronic and paper printed revisions accordingly.

REPORT AUTHORIZATION

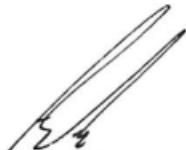
The data documented in this report is for the test equipment provided by the manufacturer. The tests were conducted on the sample equipment as requested by the manufacturer for the purpose of demonstrating compliance with the standards outlined in Section I of this report as agreed upon by the Manufacturer under the quote 23TW08161.

The Manufacturer is responsible for the tested product configurations, continued product compliance, and for the appropriate auditing of subsequent products as required.

This report may comprise a partial list of tests that are required for FCC and ISED Declaration of Conformity can only be produced by the manufacturer. This is to certify that the following report is true and correct to the best of our knowledge.



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QAI EMC ACCREDITATION

QAI EMC is your one-stop regulatory compliance partner for electromagnetic compatibility (EMC) and electromagnetic interference (EMI). Products are tested to the latest and applicable EMC/EMI requirements for domestic and international markets. QAI EMC goes above and beyond being a testing facility—we are your regulatory compliance partner. QAI EMC has the capability to perform RF Emissions and Immunity for all types of electronics manufacturing including Industrial, Scientific, Medical, Information Technology, Telecom, Wireless, Automotive, Marine and Avionics.

EMC Laboratory Location	FCC Designation (3m SAC)	IC Registration (3m SAC)	A2LA Certificate
Burnaby, BC, Canada	CA9543	9543A	3657.02

EMC Facility Burnaby BC, Canada



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1 EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this report is to demonstrate and document the compliance of WP6 – Wireless Platform 6 as per Sections 1.2 and 1.3.

1.2 Scope

The information documented in this report is based on the test methods and levels as per Quote 23TW08161R1:

- **FCC OET Bulletin 65 Ed. 97-01** – Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
- **FCC KDB 447498 D04: v01** – General RF Exposure Guidance
- **RSS-102 Issue 5** – Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

1.3 Summary of Results

The following testing was performed pursuant to FCC Title 47 Part 15 and Industry Canada ICES-003 to demonstrate the testimony to “FCC, IC, & CE” mark Electromagnetic Compatibility testing for the product.

No.	Test	Applicable Standard	Test Method	Result
1	RF Exposure Evaluation	FCC 47 CFR 2.1091 FCC 47 CFR 1.1310 RSS-102 Issue 2	KDB 447498 D04 RSS-102	Complies

Table 1: Applicable test standards and descriptions

Note: The gain of the antenna(s) is provided by the client to measure or calculate test results and is not independently measured by QAI.

2 GENERAL INFORMATION

2.1 Product Description

The information provided in this section is for the Equipment Under Test (EUT) and the corresponding Auxiliary Equipment needed to perform the tests as a complete system.

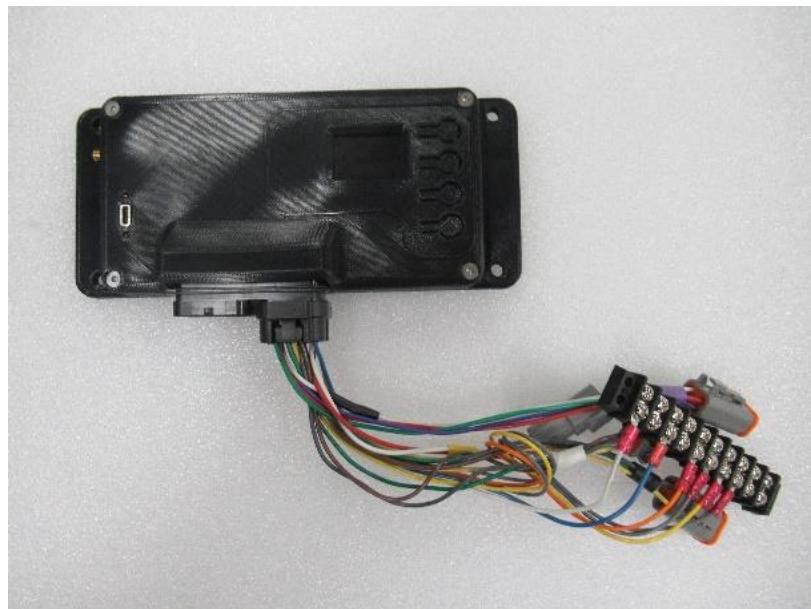


Figure 1: EUT

Equipment Under Test (EUT)

Equipment	WP6 - Wireless Platform 6
Description	The WP6 is a radio or push button activated solar powered LED assembly
Manufacturer	JSF Technologies Inc.
Model No.	WP6
Serial No.	Sample 1
Clock frequencies tuned upon within the EUT:	32 kHz, 32MHz
Highest frequency generated within the EUT:	928MHz

Equipment Under Test (EUT) – RF Information

RF device type	Digital Transmission System (DTS)
Model No. (HVIN)	WP6
Operating frequency	902 – 928 MHz
Number of available channels/Transmitter	LoRa: 16 Channels FSK: 16 Channels
Channel bandwidth	LoRa: 500 kHz FSK: 50 kHz
Output Power/Transmitter	LoRa: 18.5 dBm conducted FSK: 94 dBuV/m at 3m
Modulation type	LoRa, FSK
Test Channels (L, M, H)	LoRa: 902.5, 915.25, 925.75 MHz FSK: 902.5, 914.5, 927 MHz
Data Rate	LoRa SF7: 21875 bps LoRa SF12: 1171.88 bps FSK: 4800 bps
Adaptive	No
Geo-location-capable	No
Number of antennas	2
Antenna type & gain	1/4 Wave, Chrome, Mobile Ant, 0 dBi, LM Hole Mount Larson Q cone, 3.5" – Hinged-whip antenna, 2.5 dBi

Notes: Device is only able to transmit one modulation type at a time.

Equipment Under Test (EUT) – General Information

Tested as	Table-top
Dimensions	WP6 Module case: 22 x 9.6 x 4 cm, Solar Enclosure: 78.4 x 33.7 x 11.5 cm
Declared operating temperature range:	-40C to +60C
Input power	20V Solar Input, 12-15V SLA Battery Input, 4A Battery load output maximum.
Grounded	No
Device use	Fixed Location – Physically secured and not easily moved.

Notes: None.

Test Modes

Test	Transmitter State	Power
1	On, Continuous Tx, LoRa SF7	12V, battery supplied
2	On, Continuous Tx, LoRa SF12	12V, battery supplied
3	On, Continuous Tx, FSK	12V, battery supplied
4	Off, Rx Mode, LoRa	12V, battery supplied
5	Off, Rx Mode, FSK	12V, battery supplied

Auxiliary Manufacturer Supplied Equipment

Equipment	Manufacturer	Product Description	Model No.
Aux 1	Interstate Batteries	12V Battery	HSL1125

2.2 Environmental Conditions

The equipment under test was operated and tested under the following environmental conditions:

Parameter	Conditions
Location	QAI Burnaby – Indoors
Temperature	25 °C
Relative Humidity	53% RH

2.3 Measurement Uncertainty

Parameter	Uncertainty
Radiated Emissions, 30MHz-1GHz	± 2.40 dB
Radiated Emissions, 1GHz-40GHz	± 2.48 dB
Radio Frequency	±1.5 x 10-5 MHz
Total RF Power Conducted	±1.36 dB
Spurious Emissions, Conducted	±1.36 dB
RF Power Density, Conducted	±1.36 dB
Temperature	±1°C
Humidity	±5 %
DC and low frequency voltages	±3 %

3 DATA & TEST RESULTS

3.1 RF Exposure Evaluation

Date Performed: October 16, 2023

Test Standard: FCC 47 CFR 2.1093
FCC 47 CFR 1.1310
RSS-102 Issue 2

Test Method: FCC OET Bulletin 65 Ed 97-01
FCC KDB 477498 D04: v01
RSS-102 Issue 5

Modifications: None

Final Result: Complies

FCC – KDB 447498

2.1.2: 1-mW Test Exemption

Per § 1.1307(b)(3)(i)(A), a single RF source is exempt RF device (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions.

2.1.4: MPE-Based Exemption

An alternative to the SAR-based exemption is provided in § 1.1307(b)(3)(i)(C), for a much wider frequency range, from 300 kHz to 100 GHz, applicable for separation distances greater or equal to $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. The MPE-based test exemption condition is in terms of ERP, defined as the product of the maximum antenna gain and the delivered maximum time-averaged power.¹⁰ For this case, a RF source is an RF exempt device if its ERP (watts) is no more than a frequency-dependent value, as detailed tabular form in Appendix B. These limits have been derived based on the basic specifications on Maximum Permissible Exposure (MPE) considered for the FCC rules in § 1.1310(e)(1).

Appendix B.3 MPE-based Exemption

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in the following table [Table 1 of § 1.1307(b)(3)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

RF Source Frequency Range (MHz)	Minimum Distance	Threshold ERP (W)
0.3 – 1.34	159 m – 35.6 m	$1,920 R^2$
1.34 – 30	35.6 m – 1.6 m	$3,450 R^2/f^2$
30 – 300	1.6 m – 159 mm	$3.83 R^3$
300 – 1,500	159 mm – 31.8 mm	$0.0128 R^2 f$
1,500 – 100,000	31.8 mm – 0.5 mm	$19.2 R^2$

The table applies to any RF source (i.e., single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least $\lambda/2\pi$. The thresholds are based on the general population MPE limits with a single perfect reflection, outside of the reactive near-field, and in the main beam of the radiator.

Section 2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation:

RF Exposure evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is greater than 20 cm, except when the device operates as follows:

- Below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- At or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- At or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- At or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance);

3.1.1 Measurement Data and Plots (FCC):

Data Collected:

Modulation	Antenna	Frequency (MHz)	RF Peak Output Power (Conducted) dBm	Peak Antenna Gain ¹ dBi	EIRP		Exemption Limit ² (mW)	Result
					dBm	mW		
SF7	1	902.5	13.49	1.2	14.69	29.4	462	Exempt
SF7	2	902.5	13.49	2.0	15.49	35.4	462	Exempt
SF12	1	902.5	13.52	1.2	14.72	29.6	462	Exempt
SF12	2	902.5	13.52	2.0	15.52	35.6	462	Exempt

¹ Antenna gain provided by manufacturer

² Exemption limit calculated for 20 cm separation

Table 2: LoRa Modulation RF Exposure (FCC)

Note: FSK modulation is categorically exempt from RF Exposure evaluation due to < 1mW transmit power.

3.1.2 Measurement Data and Plots (ISED):

Data Collected:

Modulation	Antenna	Frequency (MHz)	RF Peak Output Conducted Power (dBm)	Peak Antenna Gain ¹ (dBi)	EIRP		Exemption Limit ² (mW)	Result
					dBm	mW		
SF7	1	902.5	13.49	1.2	14.69	29.4	1368	Exempt
SF7	2	902.5	13.49	2.0	15.49	35.4	1368	Exempt
SF12	1	902.5	13.52	1.2	14.72	29.6	1368	Exempt
SF12	2	902.5	13.52	2.0	15.52	35.6	1368	Exempt

¹ Antenna gain provided by manufacturer

² Exemption limit calculated at 900 MHz

Table 3: LoRa Modulation RF Exposure (ISED)

Modulation	Antenna	Frequency (MHz)	RF Peak Output Power at 3 m (dB μ V/m)	EIRP		Exemption Limit ² (mW)	Result
				dBm	mW		
FSK	1	902	90.67	-6.71	0.213	1368	Exempt
FSK	2	902	93.54	-3.84	0.413	1368	Exempt

² Exemption limit calculated at 900 MHz

Table 4: FSK Modulation RF Exposure (ISED)

Appendix A: ABBREVIATIONS

Abbreviation	Definition
AC	Alternating Current
AM	Amplitude Modulation
CE	European Conformity
CISPR	Comité International Spécial des Perturbations Radioélectriques (International Special Committee on Radio Interference)
DC	Direct Current
EFT	Electrical Fast Transient
EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Interference
ESD	Electrostatic Discharge
EUT	Equipment Under Test
FCC	Federal Communications Commission
FVIN	Firmware Version Identification Number FVIN
IC	Industry Canada
ICES	Interference Causing Equipment Standard
IEC	International Electrotechnical Commission
LISN	Line Impedance Stabilizing Network
OATS	Open Area Test Site
RF	Radio Frequency
RMS	Root-Mean-Square
SAC	Semi-Anechoic Chamber

END OF REPORT