Radio Exposure Evaluation Report

Contains FCC ID	**:**	**RI7ME910G1WW**
FCC ID	**:**	**2BAH4SBG-2**
Equipment	**:**	**Silvanet Border Gateway, Silvanet Mesh Gateway**
Brand Name	**:**	**DRYAD Dryad DRYAD**
Model Name	**:**	**SBG-2, SMG-2**
Applicant	**:**	**Dryad Networks GmbH Eisenbahnstr. 37, 16225 Eberswalde, Germany**
Manufacturer	**:**	**Dryad Networks GmbH Eisenbahnstr. 37, 16225 Eberswalde, Germany**
Standard	**:**	**47 CFR FCC Part 2 Subpart J, section 2.1091**

The product was received on Mar. 19, 2024, and testing was started from Apr. 19, 2024 and completed on Apr. 23, 2024. We, SPORTON INTERNATIONAL INC. Hsinhua Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR FCC Part 2 Subpart J, section 2.1091 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. Hsinhua Laboratory, the test report shall not be reproduced except in full.

Approved by: Jackson Tsai

SPORTON INTERNATIONAL INC. Hsinhua Laboratory
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History of this test report

Report No.	Version	Description	Issued Date
FA431322	01	Initial issue of report	Jun. 18, 2024
FA431322	02	Photographs of EUT was updated. (This report is the latest version replacing for the report issued on Jun. 18, 2024.)	Jun. 21, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
None

Reviewed by: Terry Chang

Report Producer: Michelle Tsai

1 General Description

1.1 Information

1.1.1 EUT General Information

RF General Information		
Evaluation Mode	**Frequency Range (MHz)**	**Modulation Type**
LoRa	902-928	LoRa (125kHz/500kHz)
GPRS 850	824–849	GMSK / 8PSK
EDGE 1900	1850–1910	GMSK / 8PSK
Cat-M1 Band 2	1850–1910	QPSK/16QAM
Cat-M1 Band 4	1710–1755	QPSK/16QAM
Cat-M1 Band 5	824–849	QPSK/16QAM
Cat-M1 Band 12	699–716	QPSK/16QAM
Cat-M1 Band 13	777–787	QPSK/16QAM
Cat-M1 Band 25	1850–1915	QPSK/16QAM
Cat-M1 Band 26	814–849	QPSK/16QAM
Cat-M1 Band 66	1710–1780	QPSK/16QAM
Cat-M1 Band 85	698–716	QPSK/16QAM
NB-IoT Band 2	1850–1910	QPSK/16QAM
NB-IoT Band 4	1710–1755	QPSK/16QAM
NB-IoT Band 5	824–849	QPSK/16QAM
NB-IoT Band 12	699–716	QPSK/16QAM
NB-IoT Band 13	777–787	QPSK/16QAM
NB-IoT Band 25	1850–1915	QPSK/16QAM
NB-IoT Band 26	814–849	QPSK/16QAM
NB-IoT Band 66	1710–1780	QPSK/16QAM
NB-IoT Band 71	663–698	QPSK/16QAM
NB-IoT Band 85	698–716	QPSK/16QAM

1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	ALFA	AOA-868-5ACM	Dipole	N male	5

For LoRa function:

Ant. 1 could transmit/receive.

Ant.	Brand	Model Name	Antenna Type	Connector
1	Delock	Nr. 88980	Dipole	N male

Ant.	WWAN 2G/4G Gain (dBi)						
	P-GSM900	DCS 1800	LTE Band 1	LTE Band 3	LTE Band 8	LTE Band 20	LTE Band 28
1	-0.03	2.45	1.38	2.45	-0.03	-0.4	-0.25

For WWAN function (1TX/1RX):

Ant. 1 could transmit/receive.

1.1.3 Table for Multiple Listing

Equipment Name	Model Name	PoE Layout component	Cellular (WWAN) Chip	Satellite Communications Chip
Silvanet Border Gateway	SBG-2	With	With	With
Silvanet Mesh Gateway	SMG-2	Without	Without	Without

Note: The model SBG-2 was measured during the test.

1.2 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR FCC Part 2 Subpart J, section 2.1091
- KDB 447498 D04 Interim General RF Exposure Guidance v01

The following reference test guidance is not within the scope of accreditation of TAF.

- 47 CFR Part 1.1307
- 47 CFR Part 1.1310

1.3 Testing Location

Test Lab.：Sporton International Inc. Hsinhua Laboratory			
☒	Hsinhua	**ADD:** No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)	
	(TAF: 3785**)**	**TEL:** 886-3-327-3456	**FAX:** 886-3-327-0973
		Test site Designation No. TW3785 with FCC.	
☐	Wen 33rd.St.	**ADD:** No.14-1, Ln. 19, Wen 33rd St., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)	
	(TAF: 3785**)**	**TEL:** 886-3-318-0787	**FAX:** 886-3-318-0287
		Test site Designation No. TW0008 with FCC.	

2 Maximum Permissible Exposure

2.1 Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time |E|²,|H|² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f²)*	6
30-300	61.4	0.163	1.0	6
300-1500	-	-	F/300	6
1500-100,000	-	-	5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time |E|²,|H|² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f²)*	30
30-300	27.5	0.073	0.2	30
300-1500	-	-	F/1500	30
1500-100,000	-	-	1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

Multiple Transmitters Condition
Co-location as simultaneously transmitting (co-transmitting) and the evaluation shall be consider that simultaneous transmissions from co-located devices the individual transmitters are evaluated separately. After sum of the individual value (basic restriction / reference level) are measured/calculated also have to under basic restriction / reference level.
Co-transmitting mode: 1. WWAN Cat-M1 + LoRa 2. WWAN NB-IoT + LoRa 3. 2G + LoRa

2.2 RF Exposure Exempt Measurement

Option	Refer Std.	Exemption Exposure Thresholds (TL)
A	§1.1307(b)(3)(i)(A)	Available maximum time-averaged power is no more than 1 mW
B	§1.1307(b)(3)(i)(B)	$\mathrm{P}th(mW)=\begin{cases} ERP_{20cm}(d/20cm)^{x} \rightarrow d \le 20cm \\ ERP_{20cm} \rightarrow 20cm < d \le 40cm \end{cases}$ $x=-\log_{10}\left(\frac{60}{ERP_{20cm}\sqrt{f}}\right)$ and f is in GHz $\begin{cases} ERP_{20cm}: 0.3GHz \le f < 1.5GHz \rightarrow 2040f(mW) \\ ERP_{20cm}: 1.5GHz \le f \le 6GHz \rightarrow 3060(mW) \end{cases}$
C	§1.1307(b)(3)(i)(C)	$\begin{cases} 0.3 \sim 1.34MHz \rightarrow ERP(\mathrm{W}) = 1920R^2 \\ 1.34 \sim 30MHz \rightarrow ERP(\mathrm{W}) = 3450R^2 / f^2 \\ 30 \sim 300MHz \rightarrow ERP(\mathrm{W}) = 3.83R^2 \\ 300 \sim 1500MHz \rightarrow ERP(\mathrm{W}) = 0.0128R^2 f \\ 1500 \sim 100000MHz \rightarrow ERP(\mathrm{W}) = 19.2R^2 \end{cases}$ f is in MHz; R is in m; $\mathrm{R} > \lambda/2\pi$

2.3 Multiple RF Sources Exposure

Refer Std.	Exemption Exposure Thresholds (TL)
§1.1307(b)(3)(ii)(A)	The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required)
§1.1307(b)(3)(ii)(B)	$\sum_{i=1}^{a}\frac{P_i}{P_{th,i}}+\sum_{j=1}^{b}\frac{ERP_j}{ERP_{th,j}}+\sum_{k=1}^{c}\frac{Evaluated_k}{ExposureLimit_k}\le 1$ a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(B) of this section for P , including existing exempt transmitters and those being added. b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added. c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters. P_i = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive). $P_{th,i}$ = the exemption threshold power (P_{th}) according to paragraph §1.1307(b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i. ERP_j = the ERP of fixed, mobile, or portable RF source j. $ERP_{th,j}$ = exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least λ/2π according to the applicable formula of paragraph §1.1307 (b)(3)(i)(C) of this section. $Evaluated_k$ = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure. $Evaluated\ Limit_k$ = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k, as applicable from § 1.1310 of this chapter.

2.4 MPE Calculation Method

The MPE was calculated at 23 cm to show compliance with the power density limit.
The following formula was used to calculate the Power Density:

E (V/m) = $\frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

E = Electric field (V/m)

P = RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

Pd = $\frac{30 \times P \times G}{377 \times d^2}$

2.5 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

LoRa

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm²)	S Limit (mW/cm²)	Option	TL ERP (mW)	TL Ratio
0.9G;LoRa-500	5.00	11.39	16.39	0.50	29.79	23.00	0.00735	0.60947	B	1864.968	0.0160
0.9G-1;LoRa-500	5.00	11.66	16.66	0.50	31.70	23.00	0.00782	0.61553	B	1883.532	0.0168
0.9G;LoRa-125	5.00	9.27	14.27	0.50	18.29	23.00	0.00451	0.60580	B	1853.748	0.0099

WWAN Cat-M1

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm²)	S Limit (mW/cm²)	Option	TL ERP (mW)	TL Ratio
2;G7D	1.79	23.63	25.42	0.50	238.29	20.00	0.07776	1.00000	B	3060.000	0.0779
2;W7D	1.79	23.69	25.48	0.50	241.61	20.00	0.07884	1.00000	B	3060.000	0.0790
4;G7D	1.96	23.86	25.82	0.50	261.28	20.00	0.08526	1.00000	B	3060.000	0.0854
4;W7D	1.96	23.59	25.55	0.50	245.53	20.00	0.08012	1.00000	B	3060.000	0.0802
5;G7D	-0.37	23.50	23.13	0.50	140.64	20.00	0.04589	0.55033	B	1684.020	0.0835
5;W7D	-0.37	23.51	23.14	0.50	140.96	20.00	0.04600	0.56433	B	1726.860	0.0816
12;G7D	-0.17	23.46	23.29	0.50	145.92	20.00	0.04761	0.46933	B	1436.160	0.1016
12;W7D	-0.17	22.98	22.81	0.50	130.65	20.00	0.04263	0.47167	B	1443.300	0.0905
13;G7D	-0.56	23.04	22.48	0.50	121.09	20.00	0.03951	0.52300	B	1600.380	0.0757
13;W7D	-0.56	22.94	22.38	0.50	118.33	20.00	0.03861	0.52133	B	1595.280	0.0742
25;G7D	1.79	23.57	25.36	0.50	235.02	20.00	0.07669	1.00000	B	3060.000	0.0768
25;W7D	1.79	23.75	25.54	0.50	244.97	20.00	0.07993	1.00000	B	3060.000	0.0801
26;G7D	-0.95	23.61	22.66	0.50	126.21	20.00	0.04118	0.55100	B	1686.060	0.0749
26;W7D	-0.95	23.87	22.92	0.50	134.00	20.00	0.04373	0.55433	B	1696.260	0.0790
26;G7D	-0.95	23.38	22.43	0.50	119.70	20.00	0.03906	0.54600	B	1670.760	0.0716
26;W7D	-0.95	23.22	22.27	0.50	115.37	20.00	0.03765	0.54600	B	1670.760	0.0691
66;G7D	1.96	23.81	25.77	0.50	258.29	20.00	0.08428	1.00000	B	3060.000	0.0844
66;W7D	1.96	23.62	25.58	0.50	247.24	20.00	0.08067	1.00000	B	3060.000	0.0808
85;G7D	-0.17	23.20	23.03	0.50	137.44	20.00	0.04485	0.46700	B	1429.020	0.0962
85;W7D	-0.17	23.24	23.07	0.50	138.71	20.00	0.04526	0.46867	B	1434.120	0.0967

WWAN NB-IoT

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm²)	S Limit (mW/cm²)	Option	TL ERP (mW)	TL Ratio
2;G7D	1.79	23.86	25.65	0.50	251.25	23.00	0.06199	1.00000	B	3060.000	0.0821
4;G7D	1.96	23.62	25.58	0.50	247.24	23.00	0.06100	1.00000	B	3060.000	0.0808
5;G7D	-0.37	23.24	22.87	0.50	132.47	23.00	0.03268	0.55767	B	1706.460	0.0776
12;G7D	-0.17	23.56	23.39	0.50	149.32	23.00	0.03684	0.47167	B	1443.300	0.1035
13;G7D	-0.56	23.68	23.12	0.50	140.32	23.00	0.03462	0.52133	B	1595.280	0.0880
25;G7D	1.79	23.70	25.49	0.50	242.16	23.00	0.05975	1.00000	B	3060.000	0.0791
26;G7D	-0.95	23.86	22.91	0.50	133.69	23.00	0.03299	0.54940	B	1681.368	0.0795
66;G7D	1.96	23.81	25.77	0.50	258.29	23.00	0.06373	1.00000	B	3060.000	0.0844
71;G7D	-0.17	21.89	21.72	0.50	101.65	23.00	0.02508	0.45367	B	1388.220	0.0732
85;G7D	-0.17	23.63	23.46	0.50	151.74	23.00	0.03744	0.47727	B	1442.280	0.1039

2G

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm²)	S Limit (mW/cm²)	Option	TL ERP (mW)	TL Ratio
900 GXW	-0.03	35.00	34.97	0.50	2148.37	23.00	0.53007	0.60000	B	1836.000	1.1701
1800 GXW	2.45	35.00	37.45	0.50	2421.64	23.00	0.93828	1.00000	B	3060.000	0.7914

Note 1: Option A, B and C refer as clause 2.2
Note 2: For option B, Pth(mW) convert to TL ERP(mW); For option C, ERP(W) convert to TL ERP(mW)
Note 3: TL Ratio=Tune-up ERP(mW)/TL ERP(mW)

Simultaneous Transmission Analysis Mode: WLAN 2.4GHz+WLAN 5GHz

MPE Co-TX WWAN Cat M1 + Lora

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm²)	S Limit (mW/cm²)	Option	TL ERP (mW)	TL Ratio
4;G7D	1.96	23.86	25.82	0.50	261.28	23.00	0.06447	1.00000	B	3060.000	0.0854
0.9G-1;LoRa-500	5.00	11.66	16.66	0.50	31.70	23.00	0.00782	0.61553	B	1883.532	0.0168
										Sum Ratio	0.1022
										Ratio Limit	1

MPE Co-TX WWAN NB-IoT + Lora

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm²)	S Limit (mW/cm²)	Option	TL ERP (mW)	TL Ratio
66;G7D	1.96	23.81	25.77	0.50	258.29	23.00	0.06373	1.00000	B	3060.000	0.0844
0.9G-1;LoRa-500	5.00	11.66	16.66	0.50	31.70	23.00	0.00782	0.61553	B	1883.532	0.0168
										Sum Ratio	0.1012
										Ratio Limit	1

MPE Co-TX WWAN 2G + Lora

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm²)	S Limit (mW/cm²)	Option	TL ERP (mW)	TL Ratio
1800 GXW	2.45	35.00	37.45	0.50	2421.64	23.00	0.93828	1.00000	B	3060.000	0.7914
0.9G-1;LoRa-500	5.00	11.66	16.66	0.50	31.70	23.00	0.00782	0.61553	B	1883.532	0.0168
										Sum Ratio	0.8082
										Ratio Limit	1

Note 1: Option A, B and C refer as clause 2.2
Note 2: For option B, Pth(mW) convert to TL ERP(mW); For option C, ERP(W) convert to TL ERP(mW)
Note 3: TL Ratio=Tune-up ERP(mW)/TL ERP(mW)
Note 4: Refer as clause 2.3 Multiple RF Sources Exposure. Please follow below option and sum TL ration table.

Option	Sum TL Ratio_B	Option	Sum TL Ratio_C	Option	Sum TL Ratio_E
B	$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}}$	C	$\sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}}$	E	$\sum_{k=1}^{c} \frac{Evaluated_k}{ExposureLimit_k}$

Note: The above antenna gain was declared by manufacturer.

————THE END————