



RF Exposure Evaluation Report

Application No.: SZEM2009009392CR
Applicant: Develco Products
Address of Applicant: Olof Palmes Alle 40, Aarhus N, Denmark, 8240.
Manufacturer: Develco Products A/S
Address of Manufacturer: Tangen 6, 8200 Aarhus N, Denmark
Factory: GPV
Address of Factory: 834 Moo4, Bangpoo industrial Estate Soi 11, 12, Sukhumvit Road, Praksa, Muang Dis. Samutprakam 10280, Thailand.
Product Name: Wireless gateway
Model No.: MGW221-xxxx(such as x=0-1 or A-Z) ♣
 ♣ Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Trade Mark: Squid.link 2X
FCC ID: 2AHNM-MGW221
 47 CFR Part 1.1307
Standards: 47 CFR Part 1.1310
 47 CFR Part 2.1091
Date of Receipt: 2020-09-17
Date of Test: 2020-09-21 to 2020-11-19
Date of Issue: 2020-11-23

Test Result :	PASS*
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* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu
 EMC Laboratory Manager



SGS-CSTC Standards Technical Services Co., Ltd.
 Shenzhen Branch EMC Laboratory

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2 Version

<i>Revision Record</i>				
<i>Version</i>	<i>Chapter</i>	<i>Date</i>	<i>Modifier</i>	<i>Remark</i>
01		2020-11-23		Original

Authorized for issue by:			
			
		Edison Li /Project Engineer	
			
		Eric Fu /Reviewer	





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4 General Information

4.1 General Description of EUT

Power supply:	DC 9V
Internal Operation Frequency:	Above 1GHz
For Bluetooth LE:	
Frequency Range:	2402MHz to 2480MHz
Bluetooth Version:	V4.2
Modulation Type:	GFSK
Number of Channels:	40
Antenna Type:	PCB Antenna
Antenna Gain:	1dBi
For 802.11b/g/n:	
Operation Frequency:	802.11b/g/n(HT20): 2412MHz to 2462MHz
Modulation Type:	802.11b: DSSS(CCK, DQPSK, DBPSK) 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) 802.11n(HT20): OFDM (BPSK, QPSK, 16QAM, 64QAM)
Channel Numbers:	802.11b/g, 802.11n HT20: 11 Channels
Antenna Type:	PCB Antenna
Antenna Gain:	1dBi
For Zigbee:	
Frequency Range:	2405MHz to 2480MHz
Modulation Type:	O-QPSK
Number of Channels:	16
Antenna Type:	PCB Antenna
Antenna Gain:	1dBi
For Z-wave:	
Nominal Frequency:	908.4MHz, 916.0MHz for Z-Wave
Modulation Technique:	DSSS
Number of Channels:	2
Antenna Type:	PCB Antenna
Antenna Gain:	1 dBi



For WCDMA*:			
Frequency Range:	Band 2: 1852.4MHz to 1907.6MHz Band 4: 1712.4MHz-1752.6MHz Band 5: 826.4MHz to 846.6MHz		
Modulation Type:	QPSK		
Antenna Type:	PCB Antenna		
Antenna Gain:	1dBi		
For LTE*:			
Testing frequency band:	LTE Band	Uplink (MHz)	Downlink (MHz)
	2	1850-1910	1930-1990
	4	1710-1755	2110-2115
	5	824-849	869-894
	12	699-716	729-746
	13	777-787	746-756
	14	788-798	758-768
	66	1710-1780	2110-2200
71	663-698	617-652	
Modulation Type:	QPSK, 16QAM		
Antenna Type:	PCB Antenna		
Antenna Gain:	1dBi		

*: The WCDMA/LTE single module approval by TCB(FCC ID:RI7LE910CXNF, date of Grant: 04/02/2020).



4.2 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China 518057

Telephone: +86 (0) 755 2601 2053 Fax: +86 (0) 755 2671 0594

No tests were sub-contracted.

4.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

- **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

- **Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

4.4 Deviation from Standards

None.

4.5 Abnormalities from Standard Conditions

None.

4.6 Other Information Requested by the Customer

None.



5 RF Exposure Evaluation

5.1 RF Exposure Compliance Requirement

5.1.1 Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	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				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30
30–300	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

F= Frequency in MHz

Friis Formula

Friis transmission formula: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

For Uncontrolled Environment, the MPE limit of 300MHz to 1500MHz is f/1500 mW/cm², the MPE limit of 1500MHz to 100000MHz is 1.0 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

5.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.



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5.1.3 EUT RF Exposure Evaluation

1) Test Results

Note: The Bluetooth LE, 2.4G WiFi, Zigbee, Z-Wave and WCDMA/LTE module can synchronous transmission at the same time.

For Bluetooth LE:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant1	1	1.26	1.3	1.35	0.0003	1	0.0003	PASS

Note: Refer to report No. SZEM200900939202 or EUT test Max Conducted Peak Output Power value.

The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For 2.4G WiFi:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant1	1	1.26	22.91	195.43	0.0489	1	0.0489	PASS

Note: Refer to report No. SZEM200900939203 or EUT test Max Conducted Peak Output Power value.

The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.



For Zigbee:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant2	1	1.26	4.21	2.64	0.0007	1	0.0007	PASS

Note: Refer to report No. SZEM200900939204 or EUT test Max Conducted Peak Output Power value.

The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For Z-Wave:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant3	1	1.26	-9.11	0.12	0.00003	0.6056	0.0001	PASS

Note: $EIRP[dBm]=E[dBuV/m]+20*\log D[m]-109.5;$

Refer to report No. SZEM200900939205 or EUT test Max Conducted Peak Output Power value.

The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For WCDMA Band 2:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant4	1	1.26	25	316.23	0.0792	1	0.0792	PASS

Note: Refer to report No. 1980255R-HPUSP17V00-B or EUT test Max Conducted Peak Output Power value.

The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.



For WCDMA Band 4:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant4	1	1.26	25	316.23	0.0792	1	0.0792	PASS

Note: Refer to report No. 1980255R-HPUSP17V00-B or EUT test Max Conducted Peak Output Power value. The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For WCDMA Band 5:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant4	1	1.26	25	316.23	0.0792	0.5509	0.1438	PASS

Note: Refer to report No. 1980255R-HPUSP17V00-B or EUT test Max Conducted Peak Output Power value. The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For LTE Band 2:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant4	1	1.26	25	316.23	0.0792	1	0.0792	PASS

Note: Refer to report No. 1980255R-HPUSP17V00-C or EUT test Max Conducted Peak Output Power value. The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.



For LTE Band 4:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant4	1	1.26	25	316.23	0.0792	1	0.0792	PASS

Note: Refer to report No. 1980255R-HPUSP17V00-C or EUT test Max Conducted Peak Output Power value. The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For LTE Band 5:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant4	1	1.26	25	316.23	0.0792	0.5498	0.1441	PASS

Note: Refer to report No. 1980255R-HPUSP17V00-C or EUT test Max Conducted Peak Output Power value. The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For LTE Band 12:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant4	1	1.26	25	316.23	0.0792	0.4665	0.1698	PASS

Note: Refer to report No. 1980255R-HPUSP17V00-C or EUT test Max Conducted Peak Output Power value. The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.



For LTE Band 13:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant4	1	1.26	25	316.23	0.0792	0.5197	0.1524	PASS

Note: Refer to report No. 1980255R-HPUSP17V00-C or EUT test Max Conducted Peak Output Power value. The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For LTE Band 14:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant4	1	1.26	25	316.23	0.0792	0.5270	0.1503	PASS

Note: Refer to report No. 1980255R-HPUSP17V00-C or EUT test Max Conducted Peak Output Power value. The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For LTE Band 66:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant4	1	1.26	25	316.23	0.0792	1	0.0792	PASS

Note: Refer to report No. 1980255R-HPUSP17V00-C or EUT test Max Conducted Peak Output Power value. The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.



For LTE Band 77:

The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

Antenna	Max Antenna Gain (dBi)	Max Antenna Gain (Numeric)	Max tune-up tolerance power (dBm)	Max tune-up Tolerance power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	MPE Ratios	Result
Ant4	1	1.26	25	316.23	0.0792	0.4437	0.1785	PASS

Note: Refer to report No. 1980255R-HPUSP17V00-C or EUT test Max Conducted Peak Output Power value. The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

The simultaneous transmission result between of Bluetooth LE, 2.4G WiFi, Zigbee, Z-Wave and WCDMA/LTE:

The SAR Exclusion Threshold Level:

$$= \text{CPD1} / \text{LPD1} + \text{CPD2} / \text{LPD2} + \text{CPD3} / \text{LPD3} + \text{CPD4} / \text{LPD4} + \text{CPD5} / \text{LPD5}$$

(CPD = Calculation power density, LPD = Limit of power density)

$$= (0.0003/1) + (0.0489/1) + (0.0007/1) + (0.00003/0.6056) + (0.0792/0.4437) = 0.2284 < 1$$

Since the SAR Exclusion Threshold Level is well below the SAR low threshold level, so the EUT is considered to comply with SAR requirement without testing.

End of Report

