

RF Exposure Evaluation Report

Application No.: SZEM2010010202CR
Applicant: Mavenir Systems, Inc.
Address of Applicant: 1700 International Parkway, Ste 200, Richardson, Texas 75081 USA
Manufacturer: Mavenir Systems, Inc.
Address of Manufacturer: 1700 International Parkway, Ste 200, Richardson, Texas 75081 USA
Factory: Sunwave Communications Co., Ltd.
Address of Factory: 581 Huoju Avenue, Binjiang District, Hangzhou, P.R.China Zip: 310053
Product Name: Remote Unit
Product Description: The RU conducts digital-analog conversion and power amplification of the input signals.
Model No.(EUT): DRRU-R304024
FCC ID: 2AWAS-910-00021
Standards: 47 CFR Part 1.1307
47 CFR Part 1.1310
Date of Receipt: 2020-09-21
Date of Test: 2020-09-21 to 2020-11-21
Date of Issue: 2020-11-22

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

Keny Xu
EMC Laboratory Manager



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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		2020-11-22		Original

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



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4 General Information

4.1 General Description of EUT

Product Name:	Remote Unit
Model No.:	DRRU-R304024
Trade Mark:	MAVENIR
Sample Type:	Fixed production
Antenna Gain:	4dBi
Power Supply:	DC48V
Optical Fiber:	200cm (unshielded)
DC Cable:	200cm (unshielded)
RF Cable:	200cm (shielded)
Type of Modulation	TDD
Frequency Band:	Downlink 3550MHz to 3700MHz
Modulation Type:	QPSK, 16QAM, 64QAM, 256QAM
System Gain:	20dB
MIMO:	2x2MIMO 4x4MIMO The antenna is uncorrelated.
Power Control Method:	ALC
Contains BT/WIFI function	
Conatins FCC ID:	BT: S78-I482E WIFI: NDD9578111008
Frequency range:	BT: 2402-2480MHz WIFI: 2412-2462MHz for IEEE 802.11b/g/n(HT20), 2422-2452MHz for IEEE 802.11n(HT40)
Antenna Type:	Integral
Antenna Gain:	BT: -1.0 dBi WIFI: 3.0 dBi



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

R = distance between observation point and center of the radiator in 20cm

P_d is the limit of MPE. 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.



5.1.3 EUT RF Exposure Evaluation

1) exposure conditions for standalone operations

Output Power Into Antenna & RF Exposure Evaluation Antenna Gain:

Operating frequency range: 3550~3700MHz							
Tune-up Output Power (dBm)	Output Power (mW)	Minimum Distance to Human body (cm)	Maximun Antenna Gain (Numeric)	Maximun Antenna Gain (dBi)	Power density (mW/cm ²)	Power density limit (mW/cm ²)	MPE Ratio
28.02	501.19	20	2.51	4	0.3168	1.0	0.3168

Remark:

1). This product support 4*4 MIMO, Tune-up Output Power is the MIMO output power.

2) exposure conditions for standalone operations for Bluetooth

Antenna Gain: -1.0 dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 0.80 in linear scale.

MPE Evaluation and MPE Ratio result:

Bluetooth							
Peak Output Power (dBm)	Peak Output Power (mW)	Minimum Distance to Human body (cm)	Maximun Antenna Gain (Numeric)	Maximun Antenna Gain (dBi)	Power density (mW/cm ²)	Power density limit (mW/cm ²)	MPE Ratio
8.84	7.66	20	0.80	-1.0	0.0012	1.0	0.0012

3) exposure conditions for standalone operations for WIFI

Antenna Gain: 3.0 dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 0.80 in linear scale.

MPE Evaluation and MPE Ratio result:

WIFI							
Peak Output Power (dBm)	Peak Output Power (mW)	Minimum Distance to Human body (cm)	Maximun Antenna Gain (Numeric)	Maximun Antenna Gain (dBi)	Power density (mW/cm ²)	Power density limit (mW/cm ²)	MPE Ratio
24.22	264	20	2.00	3.0	0.1049	1.0	0.1049



4) Exposure conditions for simultaneous transmission operation:

Simultaneous transmission MPE ratio: $0.3168+0.0012+0.1049=0.4299$

The simultaneous transmission MPE ratio is less than 1.0 and the EUT satisfied with RF exposure, no additional RF exposure test or evaluating is needed.

Conclusion:

The EUT comply with the RF exposure requirement and exclusion from RF exposure test.

- End of the Report -

