

MPE Report

Applicant : PISMO LABS TECHNOLOGY LIMITED
Product Type : PEPWAVE / peplink Wireless Product
Trade Name : PEPWAVE / peplink
Model Number : Balance 20X, B20X, Surf SOHO, Surf SOHO LTE,
Surf SOHO LTEA, Balance 20X LTE,
Balance 20X LTEA, PismoAC8E, BPL-021X-LTE-US-T,
BPL-021X-LTEA-W-T, EXM-MINI-1LTEA-W, EXM-MINI-1LTEA-P,
PismoAC8P, PismoAC8
FCC ID : U8G-P1AC8E
Test Specification : ANSI / IEEE Std.C95.1-1992 / IEEE Std. 1528-2013
47 CFR § 2.1091
47 CFR § 1.1310
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Issue by

Approved By : Jet Lu (Jet Lu) Tested By : Kris Pan (Kris Pan)

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Taiwan Accreditation Foundation accreditation number: 1330
Test Firm MRA designation number: TW0010

Note:

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Revision History

Rev.	Issue Date	Revisions	Revised By
00	Aug. 27, 2019	Initial Issue	Jennifer Liu



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1. Reference Testing Standards

Standard	Description	Version
ANSI/IEEE C95.1	American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300 KHz to 100 GHz, New York.	2005

2. Description of Equipment under Test (EUT)

Applicant	PISMO LABS TECHNOLOGY LIMITED A8, 5/F, HK Spinners Industrial Building, Phase 6, 481 Castle Peak Road, Cheung Sha Wan, Hong Kong	
Manufacturer	PISMO LABS TECHNOLOGY LIMITED A8, 5/F, HK Spinners Industrial Building, Phase 6, 481 Castle Peak Road, Cheung Sha Wan, Hong Kong	
Product Type	PEPWAVE / peplink Wireless Product	
Trade Name	PEPWAVE / peplink	
Model Number	Balance 20X, B20X, Surf SOHO, Surf SOHO LTE, Surf SOHO LTEA, Balance 20X LTE, Balance 20X LTEA, PismoAC8E, BPL-021X-LTE-US-T, BPL-021X-LTEA-W-T, EXM-MINI-1LTEA-W, EXM-MINI-1LTEA-P, PismoAC8P, PismoAC8	
Product Type /Trade Name / Model Number Different Description	These product Type & trade names & model numbers differ from each other in selling region.	
FCC ID	U8G-P1AC8E	
IMEI No.	LE910C4-NF: 354328092001740 MC7455: 359072064700480	
Frequency Range	Operate Band	Frequency Range (MHz)
	Module: Telit, LE910C4-NF	
	WCDMA(RMC12.2K)/HSDPA/HSUPA Band II	1852.4-1907.6
	WCDMA(RMC12.2K)/HSDPA/HSUPA Band IV	1712.4-1752.6
	WCDMA(RMC12.2K)/HSDPA/HSUPA Band V	826.4-846.6
	LTE Band 2 (BW 1.4, 3, 5, 10, 15, 20 MHz)	1850-1910
	LTE Band 4 (BW 1.4, 3, 5, 10, 15, 20 MHz)	1710-1755
	LTE Band 5 (BW 1.4, 3, 5, 10 MHz)	824-849
	LTE Band 12 (BW 1.4, 3, 5, 10 MHz)	699-716
	LTE Band 13 (BW 5, 10 MHz)	777-787
	LTE Band 14 (BW 5, 10 MHz)	788-798
	LTE Band 66 (BW 1.4, 3, 5, 10, 15, 20 MHz)	1710-1780
	LTE Band 71 (BW 5, 10, 15, 20 MHz)	663-698



Module: Sierra, MC7455		
Frequency Range	WCDMA(RMC12.2K)/HSDPA/HSUPA Band II	1852.4-1907.6
	WCDMA(RMC12.2K)/HSDPA/HSUPA Band IV	1712.4-1752.6
	WCDMA(RMC12.2K)/HSDPA/HSUPA Band V	826.4-846.6
	LTE Band 2 (BW 1.4, 3, 5, 10, 15, 20 MHz)	1850-1910
	LTE Band 4 (BW 1.4, 3, 5, 10, 15, 20 MHz)	1710-1755
	LTE Band 5 (BW 1.4, 3, 5, 10 MHz)	824-849
	LTE Band 7 (BW 5, 10, 15, 20 MHz)	2500-2570
	LTE Band 12 (BW 1.4, 3, 5, 10 MHz)	699-716
	LTE Band 13 (BW 5, 10 MHz)	777-787
	LTE Band 25 (BW 1.4, 3, 5, 10, 15, 20 MHz)	1850-1915
	LTE Band 26 (BW 1.4, 3, 5, 10, 15 MHz)	814-849
	LTE Band 30 (BW 5, 10 MHz)	2305-2315
	LTE Band 41 (BW 5, 10, 15, 20 MHz)	2496-2690
	WLAN	
	IEEE 802.11b / 802.11g / 802.11n 2.4 GHz 20 MHz (256QAM)	2412-2462
	IEEE 802.11n 2.4 GHz 40 MHz (256QAM)	2422-2452
	IEEE 802.11a U-NII Band I	5180-5240
	IEEE 802.11a U-NII Band III	5745-5825
	IEEE 802.11n 5 GHz / 802.11ac 20 MHz U-NII Band I	5180-5240
	IEEE 802.11n 5 GHz / 802.11ac 20 MHz U-NII Band III	5745-5825
	IEEE 802.11n 5 GHz / 802.11ac 40 MHz U-NII Band I	5190-5230
IEEE 802.11n 5 GHz / 802.11ac 40 MHz U-NII Band III	5755-5795	
IEEE 802.11ac 80 MHz U-NII Band I	5210	
IEEE 802.11ac 80 MHz U-NII Band III	5775	



Antenna Information	ANT	Model	Type	Frequency (MHz)	Max. Gain (dBi)	
	Module: Telit, LE910C4-NF					
	Main	98619ZSAX053	Replacement Antenna	WCDMA Band II	2.14	
				WCDMA Band IV	2.56	
				WCDMA Band V	1.80	
				LTE Band 2	2.14	
				LTE Band 4	2.56	
				LTE Band 5	1.80	
				LTE Band 12	1.71	
				LTE Band 13	1.87	
LTE Band 14				1.66		
LTE Band 66				2.56		
LTE Band 71	1.50					
Module: Sierra, MC7455						
Main	98619ZSAX025	Replacement Antenna	WCDMA Band II	3.77		
			WCDMA Band IV	3.74		
			WCDMA Band V	1.69		
			LTE Band 2	3.77		
			LTE Band 4	3.74		
			LTE Band 5	1.69		
			LTE Band 7	2.77		
			LTE Band 12	1.93		
			LTE Band 13	1.93		
			LTE Band 25	3.77		
			LTE Band 26	1.69		
			LTE Band 30	2.64		
LTE Band 41	2.80					
WLAN						
ANT-0 / ANT-1	98614PRSX000	Replacement antenna (RP SMA)	2412-2462	2.44		
			5150-5250	4.10		
			5725-5850	4.73		
G _{ANT}			2412-2462	2.44		
			5150-5250	4.10		
			5725-5850	4.73		
Directional Gain			2412-2462	5.45		
			5150-5250	7.11		
			5725-5850	7.74		



Antenna Delivery	IEEE 802.11b: 1TX (Diversity) IEEE 802.11g: 2TX (CDD) IEEE 802.11n 2.4 GHz 20 MHz / 40 MHz: 2TX (MIMO) IEEE 802.11a: 2TX (CDD) IEEE 802.11ac 20 MHz / 40 MHz / 80 MHz: 2TX (MIMO)
RF Evaluation	0.445 mW/cm ²
Operate Temp. Range	-10 ~ 45°C

The above equipment was tested by A Test Lab Techno Corp. For compliance with the requirements set forth in 47 CFR § 2.1091 / 47 CFR § 1.1310. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties



3. *Human Exposure Assessment*

Due to the design and installation of this product, it is not possible to conduct SAR evaluation. This is because client either manufactures or supplies the antenna(s) that will be used in the installation of this product. Therefore, this product will be evaluated as a mobile device per 47 CFR § 1.1310 titled "Radiofrequency radiation exposure limits", generally referred to as MPE limits.

In 47 CFR § 2.1091, paragraph (b) defines a mobile device as "a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 cm is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons." This product is intended to be installed into a vehicle such that the unit is physically secured at one location. In the installation guide supplied with the product,

Client has made the following statement: "IMPORTANT: To meet the FCC's RF Exposure Guidelines, the antenna should be installed so there is at least 20 cm of separation between the body of the user and nearby persons and the antenna". Based on the installation of the transceiver and the antenna, the transmitters radiating structure is more than 20 cm from the user. Thus, this product is a "mobile device" as defined in section § 2.1091 paragraph (b).

Exposure evaluation

$$S = \frac{PG}{4\pi R^2}$$

Where

S: power density

P: power input to the antenna

G: power gain of the antenna in the direction of interest relative to an isotropic radiator.

R: distance to the center of radiation of the antenna.



4. RF Output Power

Note: The WWAN power results are refer to Sierra MC7455 & LE910C4-NF Module report.

Band	Data Rate (Mbps)	Frequency (MHz)	Average Conducted power (dBm)		
			ANT-0	ANT-1	ANT-0+1
IEEE 802.11b	1	2412.0	20.08	20.46	23.28
		2437.0	22.62	22.46	25.55
		2462.0	20.92	20.95	23.95
IEEE 802.11g	6	2412.0	16.46	16.42	19.45
		2437.0	23.72	23.44	26.59
		2462.0	16.79	16.61	19.71
IEEE 802.11n 2.4 GHz 20 MHz	13	2412.0	16.41	16.42	19.43
		2437.0	22.31	21.94	25.14
		2462.0	15.31	14.95	18.14
IEEE 802.11n 2.4 GHz 40 MHz	27	2422.0	13.13	13.11	16.13
		2437.0	16.91	16.82	19.88
		2452.0	12.62	12.42	15.53

Note: The relevant measured result has the offset with cable loss already.



Band	Data Rate (Mbps)	Frequency (MHz)	Average Conducted power (dBm)		
			ANT-0	ANT-1	ANT-0+1
IEEE 802.11a	6	5180.0	16.31	16.03	19.18
		5200.0	18.22	18.02	21.13
		5220.0	18.25	18.12	21.20
		5240.0	18.31	18.25	21.29
		5745.0	17.25	16.64	19.97
		5765.0	17.15	16.63	19.91
		5785.0	17.07	16.57	19.84
		5805.0	16.93	16.53	19.74
		5825.0	16.96	16.61	19.80
IEEE 802.11ac 20 MHz	13	5180.0	16.35	16.18	19.28
		5200.0	18.25	18.07	21.17
		5220.0	18.31	18.22	21.28
		5240.0	18.41	18.35	21.39
		5745.0	17.25	16.35	19.83
		5765.0	17.16	16.31	19.77
		5785.0	16.98	16.25	19.64
		5805.0	16.81	16.35	19.60
		5825.0	16.84	16.55	19.71
IEEE 802.11ac 40 MHz	27	5190.0	13.42	13.12	16.28
		5230.0	18.35	18.31	21.34
		5755.0	17.86	17.02	20.47
		5795.0	17.64	17.01	20.35
IEEE 802.11ac 80 MHz	58.6	5210.0	10.37	10.05	13.22
		5775.0	15.35	14.55	17.98

Note: The relevant measured result has the offset with cable loss already.



5. Test Result

Antenna	Band	Frequency (MHz)	Limit (mw)/cm ²	Distance [R] (cm)	Tune-up Power [P] (dBm)	ANT Gain (dBi)	Numeric Gain [G]	Duty Cycle	Power with Duty cycle [TP] (mW)	Power Density [S] (mw)/cm ²
WWAN Antenna (Telit, LE910C4-NF)	WCDMA Band II	1852.4-1907.6	1.000	20	25.00	2.14	1.64	1	518.61	0.103
	WCDMA Band IV	1712.4-1752.6	1.000	20	25.50	2.56	1.80	1	638.66	0.127
	WCDMA Band V	826.4-846.6	0.564	20	25.50	1.80	1.51	1	535.77	0.107
	LTE Band 2	1850-1910	1.000	20	25.00	2.14	1.64	1	518.61	0.103
	LTE Band 4	1710-1755	1.000	20	25.50	2.56	1.80	1	638.66	0.127
	LTE Band 5	824-849	0.566	20	25.50	1.80	1.51	1	535.77	0.107
	LTE Band 12	699-716	0.477	20	25.00	1.71	1.48	1	468.02	0.093
	LTE Band 13	777-787	0.525	20	25.00	1.87	1.54	1	486.99	0.097
	LTE Band 14	788-798	0.532	20	25.00	1.66	1.47	1	464.85	0.092
WWAN Antenna (Sierra, MC7455)	LTE Band 66	1710-1780	1.000	20	25.00	2.56	1.80	1	569.21	0.113
	LTE Band 71	663-698	0.465	20	25.00	1.50	1.41	1	445.88	0.089
	WCDMA Band II	1852.4-1907.6	1.000	20	24.00	3.77	2.38	1	597.83	0.119
	WCDMA Band IV	1712.4-1752.6	1.000	20	24.00	3.74	2.37	1	595.32	0.118
	WCDMA Band V	826.4-846.6	0.564	20	24.00	1.69	1.48	1	371.76	0.074
	LTE Band 2	1850-1910	1.000	20	24.00	3.77	2.38	1	597.83	0.119
	LTE Band 4	1710-1755	1.000	20	24.00	3.74	2.37	1	595.32	0.118
	LTE Band 5	824-849	0.566	20	24.00	1.69	1.48	1	371.76	0.074
	LTE Band 7	2500-2570	1.000	20	23.00	2.77	1.89	1	377.10	0.075
	LTE Band 12	699-716	0.477	20	24.00	1.93	1.56	1	391.85	0.078
	LTE Band 13	777-787	0.525	20	24.00	1.93	1.56	1	391.85	0.078
	LTE Band 25	1850-1915	1.000	20	24.00	3.77	2.38	1	597.83	0.119
Wi-Fi Antenna	2.4 GHz	2412-2462	1.000	20	27.00	2.44	1.75	1	877.08	0.174
	5 GHz	5150-5250	1.000	20	21.50	7.11	5.14	1	726.04	0.144
		5725-5850	1.000	20	20.50	7.74	5.94	1	666.48	0.133

Note:

1. Mobile or fixed location transmitters, minimum separation distance is 20 cm, even if calculations indicate MPE distance is less.
2. We used the maximum power and gain to provide MPE results.
3. The Numeric Gain calculated by $10^{(\text{ant. Gain(dBi)} / 10)}$.
4. The MPE results are evaluated by lowest data rate for WLAN.

Simultaneous Transmitting :

$$\text{Total MPE} = \text{WWAN} + 2.4\text{GHz MPE} + 5\text{GHz MPE} = 0.127 + 0.174 + 0.144 = 0.445 \text{ (mw)/cm}^2 < 1 \text{ (mw)/cm}^2$$

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