



RF EXPOSURE REPORT

REPORT NO.: SA980506L09

MODEL NO.: ESR7750, TEW-671BR,
WL-328 v1 001, RNX-N4-Dual

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

APPLICANT: Senao Networks Inc.

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ISSUED BY: Bureau Veritas Consumer Products Services
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RF EXPOSURE MEASUREMENT (MOBILE DEVICE)

1. INTRODUCTION

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this product is measured in a Fully Anechoic Chamber (FAC) calibrated for antenna measurement in ADT, and also the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

2. RF EXPOSURE LIMIT

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

FREQUENCY RANGE (MHz)	ELECTRIC FIELD STRENGTH (V/m)	MAGNETIC FIELD STRENGTH (A/m)	POWER DENSITY (mW/cm ²)	AVERAGE TIME (minutes)
(A)LIMITS FOR OCCUPATIONAL / CONTROL EXPOSURES				
300-1500	F/300	6
1500-100,000	5	6
(B)LIMITS FOR GENERAL POPULATION / UNCONTROLLED EXPOSURE				
300-1500	F/1500	30
1500-100,000	1.0	30

F = Frequency in MHz



3. FRIIS FORMULA

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

where

P_d = power density in mW/cm^2

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

$\pi = 3.1416$

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

If we know the maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the MPE value at distance r .

Ref.: David K. Cheng, *Field and Wave Electromagnetics*, Second Edition,
Page 640, Eq. (11-133).

4. EUT OPERATING CONDITION

The software provided by Manufacturer enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

5. CLASSIFICATION

The antenna of this product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in users manual. So, this device is classified as **Mobile Device**.

6. TEST RESULTS

6.1 ANTENNA GAIN

The maximum Gain measured in Fully Anechoic Chamber are 4.5dBi or 2.818(numeric) (for 2.4GHz); 5.0dBi or 3.162(numeric) (for 5.0GHz).

6.2 OUTPUT POWER INTO ANTENNA & RF EXPOSURE VALUE AT DISTANCE 20cm:

For 2.412 ~ 2.462GHz band:

802.11b DSSS MODULATION:

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM ²)	LIMIT OF POWER DENSITY (mW/CM ²)
		CHAIN 0	CHAIN 1				
1	2412	16.54	15.52	80.727	19.07	0.045	1.000
6	2437	16.55	16.03	85.272	19.31	0.048	1.000
11	2462	16.01	16.57	85.297	19.31	0.048	1.000

802.11g OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM ²)	LIMIT OF POWER DENSITY (mW/CM ²)
		CHAIN 0	CHAIN 1				
1	2412	22.03	22.06	320.282	25.06	0.180	1.000
6	2437	22.05	22.54	339.798	25.31	0.191	1.000
11	2462	22.06	22.01	319.549	25.05	0.179	1.000

DRAFT 802.11n (20MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM ²)	LIMIT OF POWER DENSITY (mW/CM ²)
		CHAIN 0	CHAIN 1				
1	2412	22.06	22.02	319.915	25.05	0.179	1.000
6	2437	22.03	22.54	339.061	25.30	0.190	1.000
11	2462	22.01	21.53	301.088	24.79	0.169	1.000

DRAFT 802.11n (40MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM ²)	LIMIT OF POWER DENSITY (mW/CM ²)
		CHAIN 0	CHAIN 1				
1	2422	18.04	18.55	135.294	21.31	0.076	1.000
4	2437	18.06	18.53	135.259	21.31	0.076	1.000
7	2452	18.05	18.57	135.771	21.33	0.076	1.000



For 5.180 ~ 5.320GHz band:

802.11a OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM ²)	LIMIT OF POWER DENSITY (mW/CM ²)
		CHAIN 0	CHAIN 1				
36	5180	10.02	12.03	26.005	14.15	0.016	1.000
40	5200	9.53	11.53	23.230	13.66	0.015	1.000
48	5240	9.05	11.56	22.357	13.49	0.014	1.000

DRAFT 802.11n (20MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM ²)	LIMIT OF POWER DENSITY (mW/CM ²)
		CHAIN 0	CHAIN 1				
36	5180	10.03	12.02	25.991	14.15	0.016	1.000
40	5200	9.54	11.56	23.317	13.68	0.015	1.000
48	5240	9.05	11.51	22.193	13.46	0.014	1.000

DRAFT 802.11n (40MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM ²)	LIMIT OF POWER DENSITY (mW/CM ²)
		CHAIN 0	CHAIN 1				
38	5190	9.03	11.52	22.189	13.46	0.014	1.000
46	5230	10.51	13.04	31.383	14.97	0.020	1.000

For 5.745 ~ 5.825GHz band:

802.11a OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM ²)	LIMIT OF POWER DENSITY (mW/CM ²)
		CHAIN 0	CHAIN 1				
149	5745	18.04	18.52	134.801	21.30	0.085	1.000
157	5785	18.55	18.57	143.559	21.57	0.090	1.000
165	5825	19.56	19.55	180.522	22.57	0.114	1.000

DRAFT 802.11n (20MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM ²)	LIMIT OF POWER DENSITY (mW/CM ²)
		CHAIN 0	CHAIN 1				
149	5745	17.53	18.07	120.745	20.82	0.076	1.000
157	5785	17.54	17.51	113.118	20.54	0.071	1.000
165	5825	19.56	19.53	180.108	22.56	0.113	1.000

DRAFT 802.11n (40MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM ²)	LIMIT OF POWER DENSITY (mW/CM ²)
		CHAIN 0	CHAIN 1				
151	5755	20.53	20.55	226.481	23.55	0.142	1.000
159	5795	20.55	20.57	227.526	23.57	0.143	1.000

CONCLUSION:

Both of the WLAN 2.4G & 5.0G can transmit simultaneously, the formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

$$1. \text{ WLAN 2.4G} + \text{WLAN 5.0G} = 0.334$$

Therefore, the maximum calculation of this situation is 0.334, which is less than the "1" limit.