



RF EXPOSURE REPORT

REPORT NO.: SA970825L11

MODEL NO.: Goldcrest

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

APPLICANT: Gemtek Technology Co., Ltd.

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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 : $P_d = (P_{out} * G) / (4 * \pi * r^2)$

where

P_d = power density in mW/cm^2

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 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 1.65dBi or 1.4621 and 1.26dBi or 1.3365(numeric)(2.4GHz) & 1.58dBi or 1.4387 and 4.33dBi or 2.7101(numeric)(5.0GHz).

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

802.11b DSSS MODULATION:

FOR DIPOLE ANTENNA 1.26dBi GAIN

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	POWER DENSITY (mW/cm ²)	LIMIT OF POWER DENSITY (mW/cm ²)
1	2412	100.925	20.04	0.027	1.0
6	2437	112.720	20.52	0.030	1.0
11	2462	127.644	21.06	0.034	1.0

FOR PIFA ANTENNA 1.65dBi GAIN

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	POWER DENSITY (mW/cm ²)	LIMIT OF POWER DENSITY (mW/cm ²)
1	2412	100.925	20.04	0.029	1.0
6	2437	112.720	20.52	0.033	1.0
11	2462	127.644	21.06	0.037	1.0

802.11g OFDM MODULATION:

FOR DIPOLE ANTENNA 1.26dBi GAIN

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	POWER DENSITY (mW/cm ²)	LIMIT OF POWER DENSITY (mW/cm ²)
1	2412	254.683	24.06	0.068	1.0
6	2437	317.687	25.02	0.084	1.0
11	2462	318.420	25.03	0.085	1.0

FOR PIFA ANTENNA 1.65dBi GAIN

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	POWER DENSITY (mW/cm ²)	LIMIT OF POWER DENSITY (mW/cm ²)
1	2412	254.683	24.06	0.074	1.0
6	2437	317.687	25.02	0.092	1.0
11	2462	318.420	25.03	0.093	1.0

**DRAFT 802.11n (20MHz) OFDM MODULATION:****FOR DIPOLE ANTENNA 1.26dBi GAIN**

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	22.07	21.04	288.122	24.60	0.077	1.000
6	2437	23.04	22.07	362.437	25.59	0.096	1.000
11	2462	22.10	21.01	288.364	24.60	0.077	1.000

FOR PIFA ANTENNA 1.65dBi GAIN

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	22.07	21.04	288.122	24.60	0.084	1.000
6	2437	23.04	22.07	362.437	25.59	0.105	1.000
11	2462	22.10	21.01	288.364	24.60	0.084	1.000

DRAFT 802.11n (40MHz) OFDM MODULATION:**FOR DIPOLE ANTENNA 1.26dBi GAIN**

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	21.04	20.56	240.820	23.82	0.064	1.000
4	2437	21.06	21.04	254.701	24.06	0.068	1.000
7	2452	21.07	20.53	240.918	23.82	0.064	1.000

FOR PIFA ANTENNA 1.65dBi GAIN

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	21.04	20.56	240.820	23.82	0.070	1.000
4	2437	21.06	21.04	254.701	24.06	0.074	1.000
7	2452	21.07	20.53	240.918	23.82	0.070	1.000



802.11a OFDM MODULATION:

FOR DIPOLE ANTENNA 1.58dBi GAIN

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	POWER DENSITY (mW/cm ²)	LIMIT OF POWER DENSITY (mW/cm ²)
36	5180	28.576	14.56	0.008	1.0
40	5200	25.527	14.07	0.007	1.0
48	5240	25.351	14.04	0.007	1.0
52	5260	25.763	14.11	0.007	1.0
60	5300	25.468	14.06	0.007	1.0
64	5320	25.645	14.09	0.007	1.0
100	5500	25.410	14.05	0.007	1.0
120	5600	25.645	14.09	0.007	1.0
140	5700	17.906	12.53	0.005	1.0
149	5745	252.930	24.03	0.072	1.0
157	5785	255.859	24.08	0.073	1.0
165	5825	254.683	24.06	0.073	1.0

FOR PIFA ANTENNA 4.33dBi GAIN

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	POWER DENSITY (mW/cm ²)	LIMIT OF POWER DENSITY (mW/cm ²)
36	5180	28.576	14.56	0.015	1.0
40	5200	25.527	14.07	0.014	1.0
48	5240	25.351	14.04	0.014	1.0
52	5260	25.763	14.11	0.014	1.0
60	5300	25.468	14.06	0.014	1.0
64	5320	25.645	14.09	0.014	1.0
100	5500	25.410	14.05	0.014	1.0
120	5600	25.645	14.09	0.014	1.0
140	5700	17.906	12.53	0.010	1.0
149	5745	252.930	24.03	0.136	1.0
157	5785	255.859	24.08	0.138	1.0
165	5825	254.683	24.06	0.137	1.0



DRAFT 802.11n (20MHz) OFDM MODULATION:

FOR DIPOLE ANTENNA 1.58dBi GAIN

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	12.06	12.04	32.065	15.06	0.009	1.000
40	5200	12.03	12.08	32.102	15.07	0.009	1.000
48	5240	12.07	12.03	32.065	15.06	0.009	1.000
52	5260	12.11	12.05	32.288	15.09	0.009	1.000
60	5300	12.08	12.09	32.324	15.10	0.009	1.000
64	5320	12.05	12.02	31.955	15.05	0.009	1.000
100	5500	12.09	12.06	32.250	15.09	0.009	1.000
120	5600	12.13	12.08	32.474	15.12	0.009	1.000
140	5700	10.52	10.54	22.596	13.54	0.006	1.000
149	5745	23.06	22.54	381.775	25.82	0.109	1.000
157	5785	23.04	22.58	382.506	25.83	0.109	1.000
165	5825	23.09	23.07	406.472	26.09	0.116	1.000

FOR PIFA ANTENNA 4.33dBi GAIN

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	12.06	12.04	32.065	15.06	0.017	1.000
40	5200	12.03	12.08	32.102	15.07	0.017	1.000
48	5240	12.07	12.03	32.065	15.06	0.017	1.000
52	5260	12.11	12.05	32.288	15.09	0.017	1.000
60	5300	12.08	12.09	32.324	15.10	0.017	1.000
64	5320	12.05	12.02	31.955	15.05	0.017	1.000
100	5500	12.09	12.06	32.250	15.09	0.017	1.000
120	5600	12.13	12.08	32.474	15.12	0.018	1.000
140	5700	10.52	10.54	22.596	13.54	0.012	1.000
149	5745	23.06	22.54	381.775	25.82	0.206	1.000
157	5785	23.04	22.58	382.506	25.83	0.206	1.000
165	5825	23.09	23.07	406.472	26.09	0.219	1.000



DRAFT 802.11N (40MHZ) OFDM MODULATION:

FOR DIPOLE ANTENNA 1.58dBi GAIN

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM ²)
		CHAIN 0	CHAIN 1				
38	5190	12.07	12.04	32.102	15.07	0.009	1.000
46	5230	12.54	11.08	30.771	14.88	0.009	1.000
54	5270	12.05	12.06	32.102	15.07	0.009	1.000
62	5310	12.09	11.55	30.470	14.84	0.009	1.000
102	5510	11.06	10.56	24.141	13.83	0.007	1.000
118	5590	12.52	12.53	35.771	15.54	0.010	1.000
134	5670	11.57	11.08	27.178	14.34	0.008	1.000
151	5755	20.53	20.09	215.074	23.33	0.062	1.000
159	5795	20.07	20.13	204.663	23.11	0.059	1.000

FOR PIFA ANTENNA 4.33dBi GAIN

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM ²)
		CHAIN 0	CHAIN 1				
38	5190	12.07	12.04	32.102	15.07	0.017	1.000
46	5230	12.54	11.08	30.771	14.88	0.017	1.000
54	5270	12.05	12.06	32.102	15.07	0.017	1.000
62	5310	12.09	11.55	30.470	14.84	0.016	1.000
102	5510	11.06	10.56	24.141	13.83	0.013	1.000
118	5590	12.52	12.53	35.771	15.54	0.019	1.000
134	5670	11.57	11.08	27.178	14.34	0.015	1.000
151	5755	20.53	20.09	215.074	23.33	0.116	1.000
159	5795	20.07	20.13	204.663	23.11	0.110	1.000