

RF Exposure Measurement

1. Introduction

The maximum Gain measured in Fully Anechoic Chamber is 12 dBi or 15.85 (numeric).

Because this device is transmitting the high power signal, it is regarded specially as a dangerous band for its heating harmfulness to the human body. The manufacturer whose product is working in this frequency band is obligatory to prove the harmfulness of his product. 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), and 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.

2. Classification

MODE: CDMA & WCDMA & GSM & LTE

The antenna of the product, under normal use condition, is at least 76 cm away from the body of the user. Warning statement for keeping 76 cm separation distance and the prohibition of operating next to a person has been printed on the user's manual.

3. 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)

(A) Limits for Occupational/Controlled Exposures

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Average Time (minutes)
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

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Average Time (minutes)
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 * = Plane-wave equivalent power density

4. Friis Formula

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

The maximum Gain measured in Fully Anechoic Chamber is 12dBi or 15.85 (numeric).

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

$\pi = 3.1416$

MODE: CDMA & WCDMA & GSM & LTE

P_d is the limit of MPE, $1\text{mW}/\text{cm}^2$. 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.

The software provided by Manufacturer enabled the EUT to transmit with max power at lowest, middle and highest channel individually.

5. Test Results

FCC ID:STE-APEX1933

5.1 Antenna Gain

The maximum Gain measured in Fully Anechoic Chamber is 12dBi or 15.85 (numeric).

5.2 Output Power into Antenna & RF Exposure value at distance 76 cm:

MODE: CDMA(Down link)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
Low	1931.25	2177.710	0.475575	1.0
Middle	1960.00	2387.811	0.521457	1.0
High	1993.75	1592.209	0.347711	1.0

MODE: WCDMA(Down link)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
Low	1932.50	2306.747	0.503754	1.0
Middle	1962.50	2285.599	0.499136	1.0
High	1992.50	1555.966	0.339796	1.0

MODE: GSM(Down link)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
Low	1930.20	2009.093	0.438752	1.0
Middle	1960.00	2371.374	0.517868	1.0
High	1989.80	1636.817	0.357453	1.0

MODE: LTE(Down link)-5M

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
Low	1933.00	2317.395	0.506080	1.0
Middle	1960.00	2333.458	0.509588	1.0
High	1992.00	1432.188	0.312766	1.0

MODE: LTE(Down link)-10 M

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
Low	1935.00	2208.005	0.482191	1.0
Middle	1962.50	2254.239	0.492288	1.0
High	1990.00	1452.112	0.317117	1.0

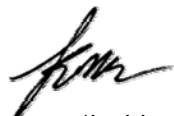
MODE: LTE(Down link)-15 M

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
Low	1937.50	2243.882	0.490026	1.0
Middle	1962.50	2264.644	0.494560	1.0
High	1987.50	1527.566	0.333594	1.0

MODE: LTE(Down link)-20 M

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
Low	1940.00	2213.095	0.483302	1.0
Middle	1962.50	2051.162	0.447939	1.0
High	1985.00	1655.770	0.361592	1.0

Sign :



Reviewer : Jin Mo Yang / Technical engineer