

Measurement of MPE

1. Foreword

In adopt with the Human Exposure IEEE C95.1, and according to the FCC 1.1310. The *Maximum Permissible Exposure (MPE)* is obligated to measure in order to prove the safety of radiation harmfulness to the human body.

The *Gain* of the antenna used is measured in an *Anechoic chamber*. The *maximum total power to the antenna* is to be recorded. By adopting the *Friis Transmission Formula* and the *power gain of the antenna*, we can find the distance right away from the product, where the limit of the MPE is.

2. Description of EUT

Granted FCC ID : MSQA620BT

Product name : Pocket PC

Model name : A620BT

Classification : Portable Device

(i) Under normal use condition, the antenna is at least 2.5cm away from the user;

(ii) Warning statement for keeping 2.5cm separation distance and the prohibition of operating next to the person has been printed in the user' s manual

Frequency Range : 2.402 GHz ~ 2.480GHz

Supported Channel : 79 Channel

Modulation Skill : GFSK

Power Type : (1) Battery-powered by the client' s device

(2) Power adapter

Mfg.: DELTA Electronics Inc.

Model: ADP-10SB REV.BH

I/P: 100-240VAC, 50-60Hz, 400mA ;

O/P: 5VDC, 2A

Power cable:

176cm length, non-shielded, with ferrite core

Data Cable : USB cable of cradle:

100cm length, shielded, no ferrite core

3. Limits for Maximum Permissible Exposure (MPE)

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm ²) | Averaging Time E ² , H ² or S (minutes) |
|--|-------------------------------|-----------------------------------|---|---|
| (A) Limits for Occupational/Controlled Exposure | | | | |
| 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 |

[The EUT is tested in transmit and receive modes and in the first, middle and the last channel separately. The following shows only our observation have the greatest emissions.]

According to OET BULLETIN 56 Fourth Edition/August 1999, Equation for Predicting RF Fields:

$$\text{Friis Transmission Formula: } S = \frac{PG}{4P R^2} = \frac{1.019 \times 1.995}{4P(2.5)^2} = 2.588E^{-2} mW / cm^2$$

$$\text{Estimated safe separation: } R = \sqrt{\frac{PG}{4P}} = \sqrt{\frac{1.019 \times 1.995}{4P}} = 0.402cm$$

Remarks: "The safe estimated separation that the user must maintain from the antenna is at least 0.402 cm."

Where: S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW)

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 (appropriate units, e.g., cm)

The Numeric gain G of antenna with a gain specified in dB is determined by:

$$G = \text{Log}^{-1} (dBi \text{ antenna gain} / 10)$$

$$G = \text{Log}^{-1} (3 / 10) = 1.995$$

AT9520 Series

Multilayer Chip Antenna

Features

- ❖ Monolithic SMD with small, low-profile and light-weight type.
- ❖ Wide bandwidth

Applications

- ❖ 2.4GHz WLAN, Home RF, Bluetooth Modules, etc.



Specifications

| Part Number | Frequency Range (MHz) | Peak Gain (XZ-V) | Average Gain (XZ-V) | VSWR | Impedance |
|-----------------------|-----------------------|------------------|---------------------|--------|-----------|
| AT9520-B2R4HAA | 2400~2500 | 3.0 dBi typ. | 1.0 dBi typ. | 2 max. | 50 Ω |

Q'ty/Reel (pcs) : 1000pcs
 Operating Temperature Range : -40 ~ +85 °C
 Storage Temperature Range : -40 ~ +85 °C
 Power Capacity : 3W max.

Part Number

AT 9520 - B 2R4 HAA □
 ① ② ③ ④ ⑤ ⑥

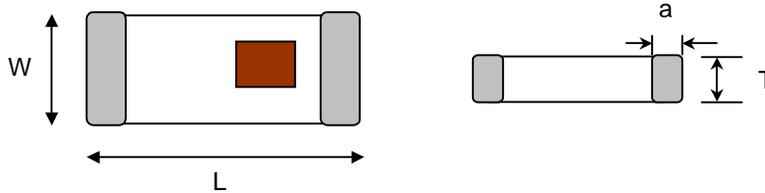
| | | | |
|----------------------|--------------|------------------------|---------------------------|
| ① Type | AT : Antenna | ② Dimensions (L x W) | 9.5x 2.0 mm |
| ③ Material Code | B | ④ Frequency Range | 2R4=2400MHz |
| ⑤ Specification Code | HAA | ⑥ Packaging | T: Tape & Reel B: Bulk |

Terminal Configuration



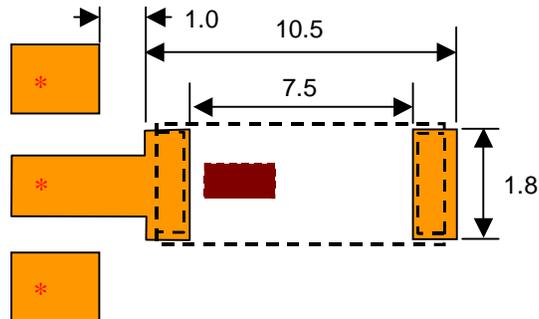
Dimensions and Recommended PC Board Pattern

Unit : mm

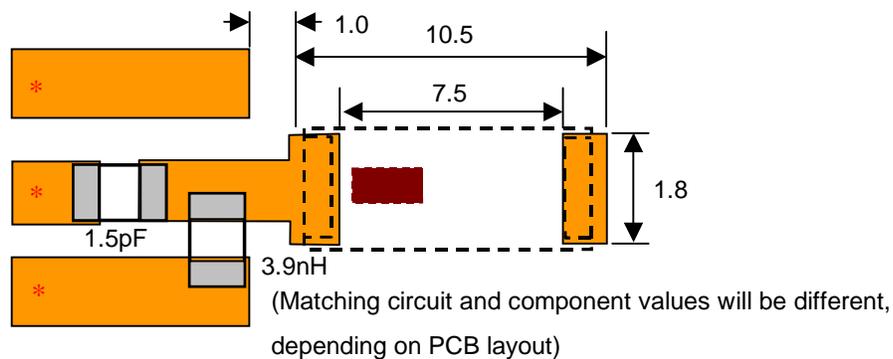


| Mark | L | W | T | a |
|------------|---------|---------|------------------|---------|
| Dimensions | 9.5±0.2 | 2.0±0.2 | 1.2+ 0.1/-0.2 | 0.5±0.3 |

(a) Without Matching Circuits (Moderate Bandwidth)



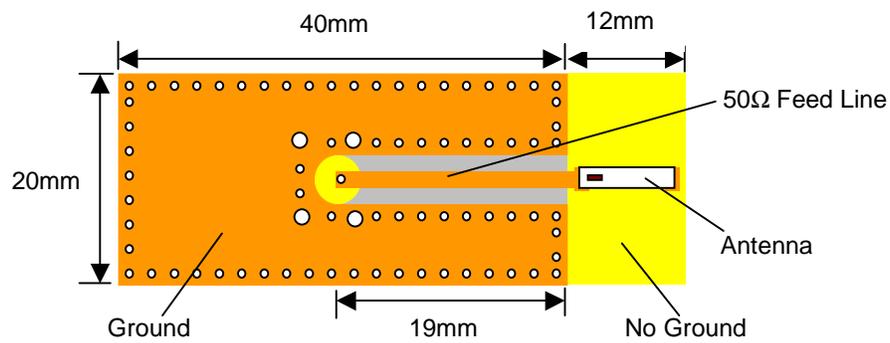
(b) With Matching Circuits (Wide Bandwidth)



*Line width should be designed to match 50Ω characteristic impedance, depending on PCB material and thickness.

Typical Electrical Characteristics (T=25°C)

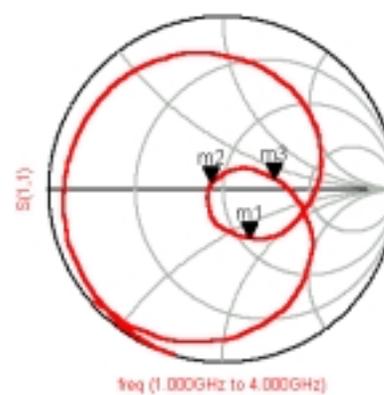
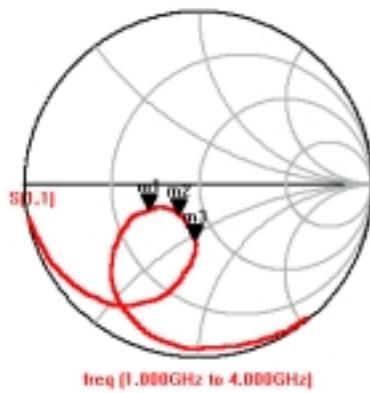
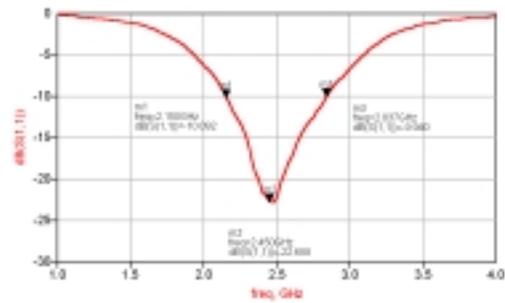
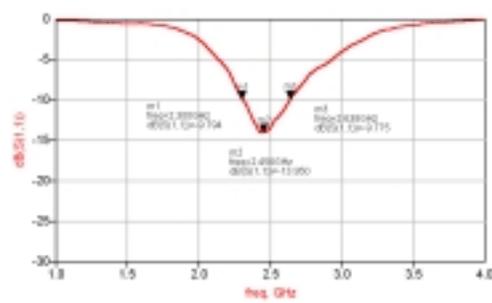
❖ Test Board



❖ Return Loss

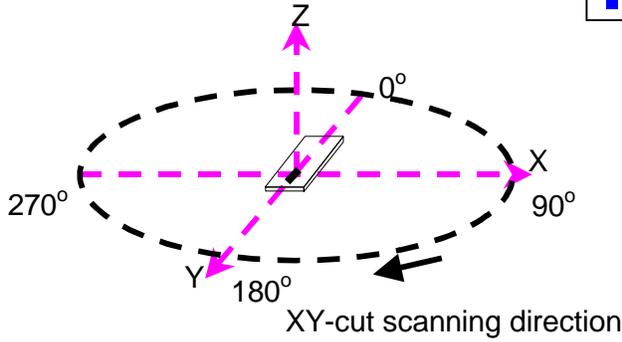
(a) Without Matching Circuits

(b) With Matching Circuits

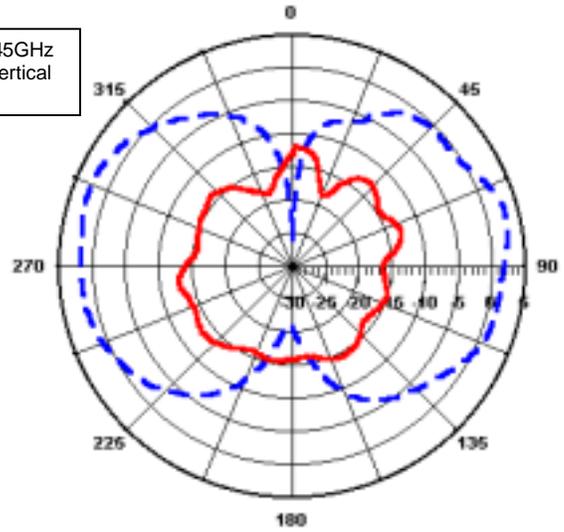


❖ Radiation Patterns

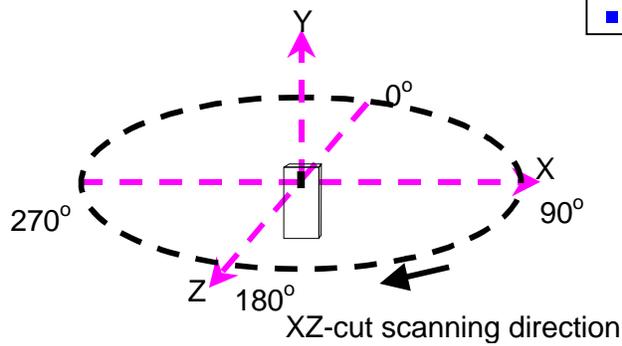
XY-V/XY-H



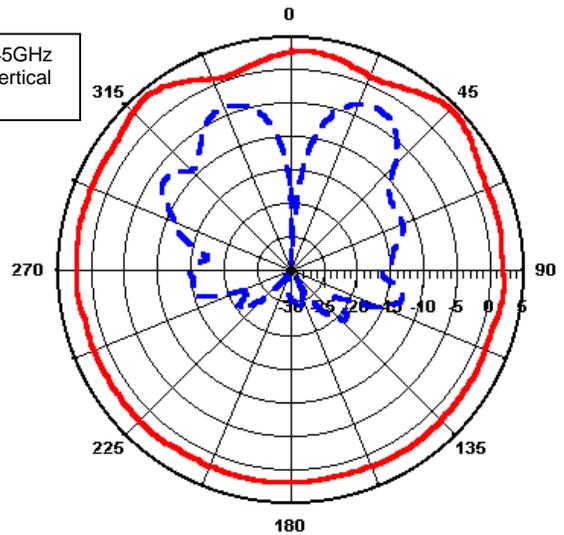
XY cut @2.45GHz
— Vertical
- - - Horizontal



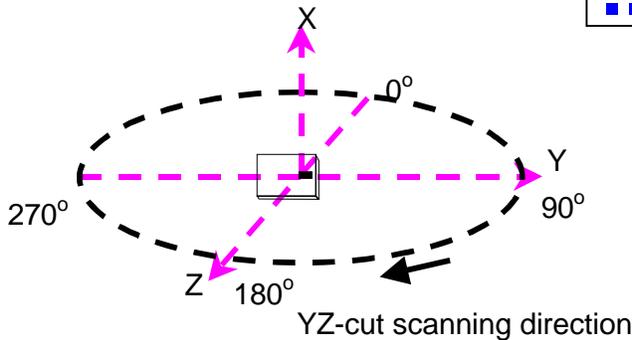
XZ-V/XZ-H



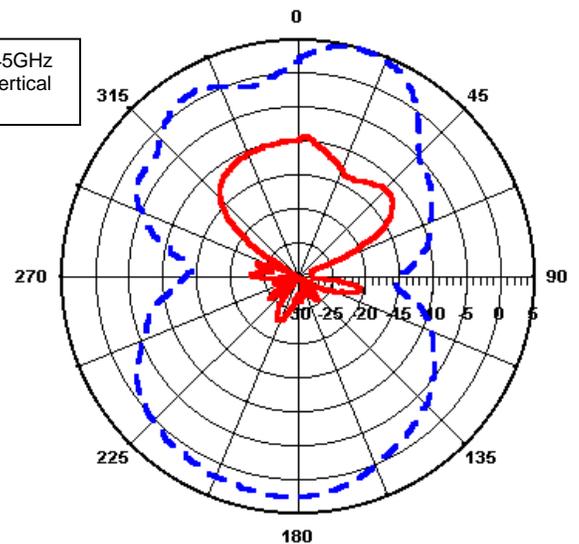
XZ cut @2.45GHz
— Vertical
- - - Horizontal



YZ-V/YZ-H



YZ cut @2.45GHz
— Vertical
- - - Horizontal



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