FCC ID ： FU5FE004

# EUT System: Charging Mode for FE004

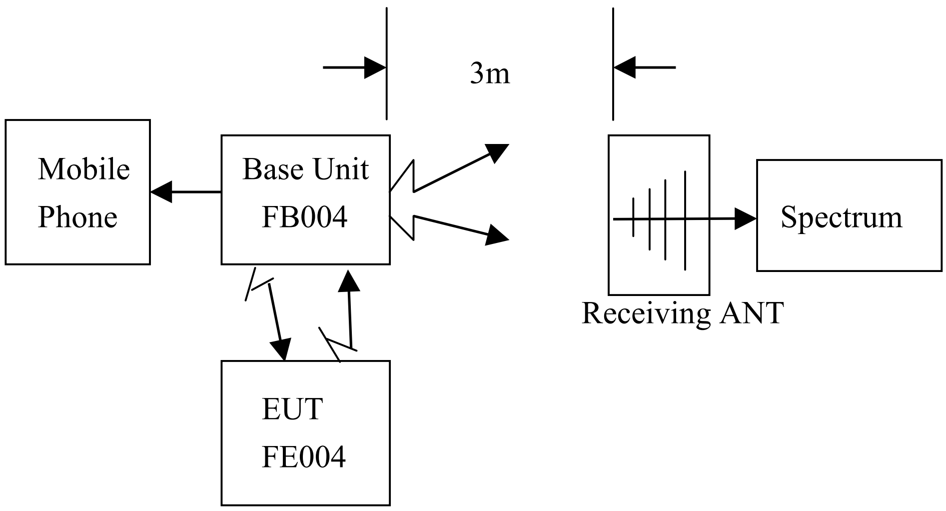
**< FRONT VIEW >**

**< REAR VIEW >**

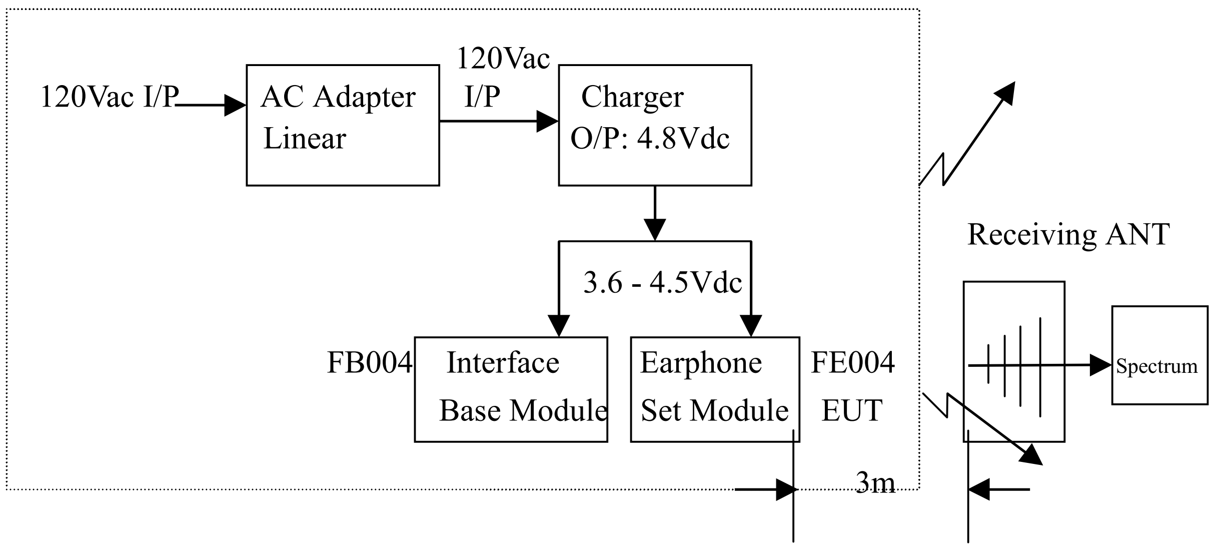
FCC ID : FU5FE004

**EUT Model No. FE004**

Transmitting / Receiving Mode




Charging Mode



# § 15.247(c) : Carrier Frequency

FCC ID ： FU5FE004

**EUT Model No. FE004**

In any 100KHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating，the radio frequency power that is produced by the intentional radiator shall be at least 20dB

below that in the 100KHz bandwidth within the band that contains the highest level of the desired power，based on either an RF conducted or a radiated measurement.

Test result : top channel – 902 MHz = △31.01 dB > 20dB

bottom channel – 928MHz = △35.14 dB > 20dB

Spectrum plot on next page .

FCC ID ： FU5FE004

# Spectrum Plot

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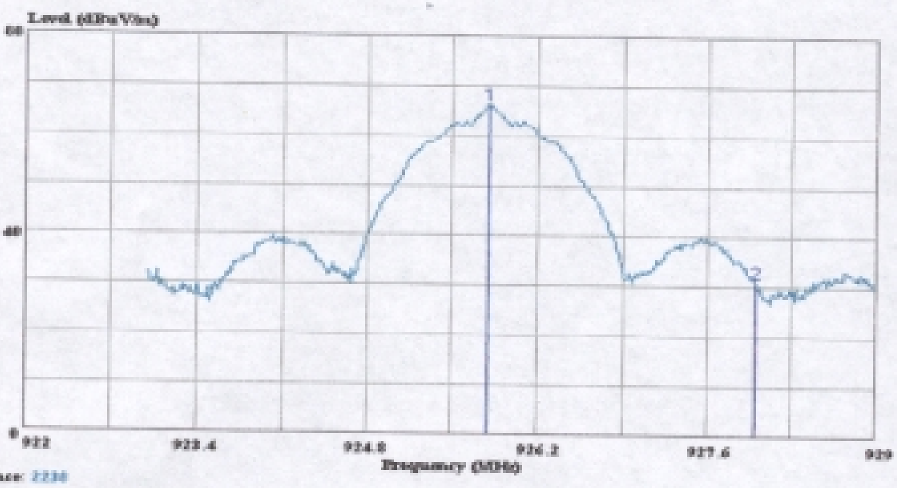
Data#: 2239 File#: E2000.emi Date: 2001-05-28 Time: 15:21:57




Trace: 2238

Site : Chamber No.3(Jason Gong)-Linko Site
Condition: 3m ANT.3M(H) HORIZONTAL
eut : F004U
power : AC 115V / 50Hz
memo : Peak Value
: Channel 1: 925.8MHz
: Part No. FE004
: Outside Band Frequency

Page: 1

| | Freq | Level | Over Limit | Limit Line | Read Level | Probe Factor | Cable Loss | Preamp Factor |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB | dB | dB |
| 1 | 925.800 | 66.13 | ------ | ------ | 58.97 | 24.39 | 2.77 | 20.00 |
| 2 | 928.000 | 31.09 | ------ | ------ | 23.83 | 24.49 | 2.77 | 20.00 |

Read Level = 58.97 – 23.83 = 35.14 dB
35.14 ≧ 20dB pass

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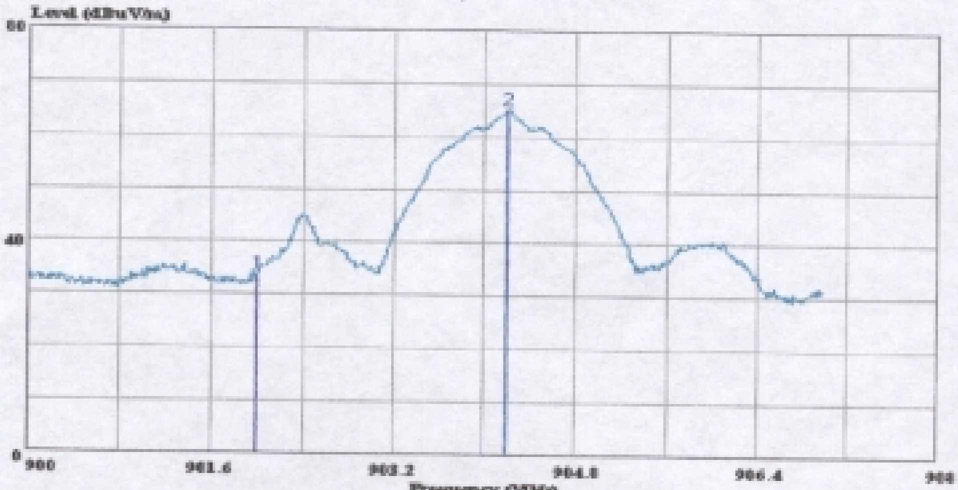
Data#: 2237 File#: E2000.emi Date: 2001-05-28 Time: 15:13:19




Trace: 2236

Site : Chamber No.3(Jason Gong)-Linko Site
Condition: 3m ANT.3M(H) HORIZONTAL
eut : F004U
power : AC 115V / 50Hz
memo : Peak Value
: Channel 1: 902.4MHz
: Part No. FE004
: Outside Band Frequency

Page: 1

| | Freq | Level | Over Limit | Limit Line | Read Level | Probe Factor | Cable Loss | Preamp Factor |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB | dB | dB |
| 1 | 902.000 | 33.88 | ------ | ------ | 27.64 | 23.44 | 2.80 | 20.00 |
| 2 | 904.200 | 64.98 | ------ | ------ | 58.65 | 23.54 | 2.79 | 20.00 |

Read Level = 58.65 – 27.64 = 31.01 dB

31.01 ≧ 20dB pass

# § 15.247(d) : Power Spectral Density

FCC ID ： FU5FE004

The summary below is the highest power spectral density of the EUT Model No. FE004

RBW = 3KHz VBW = 10KHz SWP = 100 sec.

| Channel | Frequency (MHz) | S.P. read (dBuV/m) | C.F. (dB) | Level (dBm) | Limit (dBm) | Margin (dBm) |
|---|---|---|---|---|---|---|
| Top | 904.287 | 47.86 | 6.33 | 54.19 | 8 | -41.2 |
| Middle | 914.312 | 49.38 | 6.71 | 56.09 | 8 | -39.2 |
| Bottom | 925.877 | 46.33 | 7.16 | 53.49 | 8 | -41.2 |

Note:

1. "S.P. read" means spectrum analyzer read power density .
2. "C.F." means correct factor = antenna factor + cable loss – Preamplifier Gain .
3. "Level" means power spectral density .

   E.R.P. = $(E\ d)^2 / 30G$

   where E (V) = S.P. read + C.F.

   d (m) = measurement distance = 3m

   G = 1 ( the gain of the transmitting antenna over isotropic antenna )

   Example :

   If Level = 120 dBuV/m

   $10^{(120/20)} \times 10^{-6} = 1$ V

   E.R.P. = $(1 \times 3)^2 / 30$ = 300 mW = 10 Log (300mW/1mW)

   = 24.77dBm

# Spectrum of Power Spectral Density

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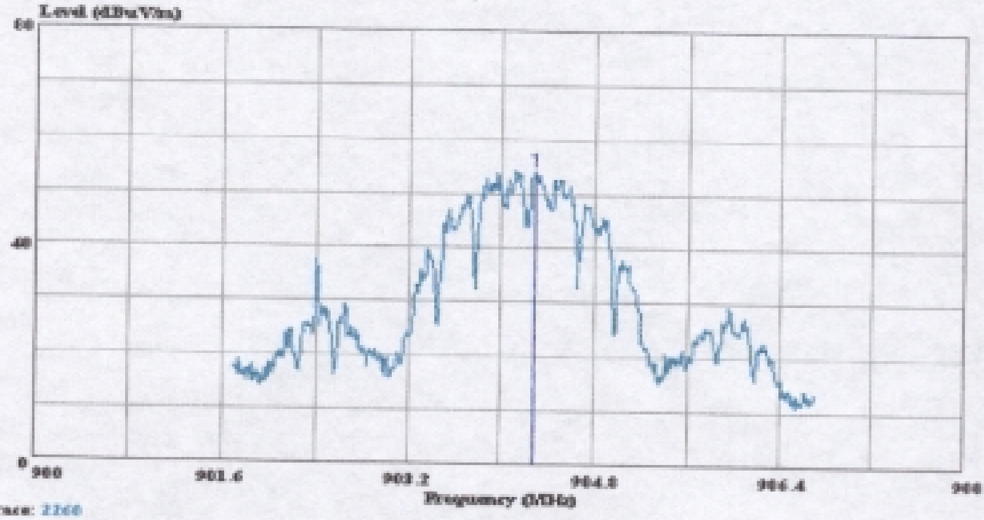
Data#: 2261 File#: E2000.emi Date: 2001-05-28 Time: 18:06:52




Trace: 2260

Site : Chamber No.3(Jason Gong)-Linko Site
Condition: 3m ANT.3M(H) HORIZONTAL
eut : F004U
power : AC 115V / 60Hz
memo : Peak Value
: Channel 1: 904.2MHz
: Part No. FE004
: Test : The Peak Power Density
: RBW:3KHz;VBW:10KHz;Span:5MHz
: Swp:60ms

Page: 1

| | Freq | Level | Over Limit | Limit Line | Read Level | Probe Factor | Cable Loss | Preamp Factor |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB | dB | dB |
| 1 | 904.287 | 54.19 | ------ | ------ | 47.86 | 23.54 | 2.79 | 20.00 |

E (dBmv) = 54.19

E (v/m) = $10^{[54.19/20]} \times 10^{-6} = 10^{2.7} \times 10^{-6} = 0.0005$

E.R.P = $[\,0.0005 \times 3\,]^2 / 30 = 0.000075$mw

dBm = $10 \log \left( \dfrac{0.000075\text{mw}}{1\text{mw}} \right) = -41.2$

$\because$ -41 < + 8 故 pass

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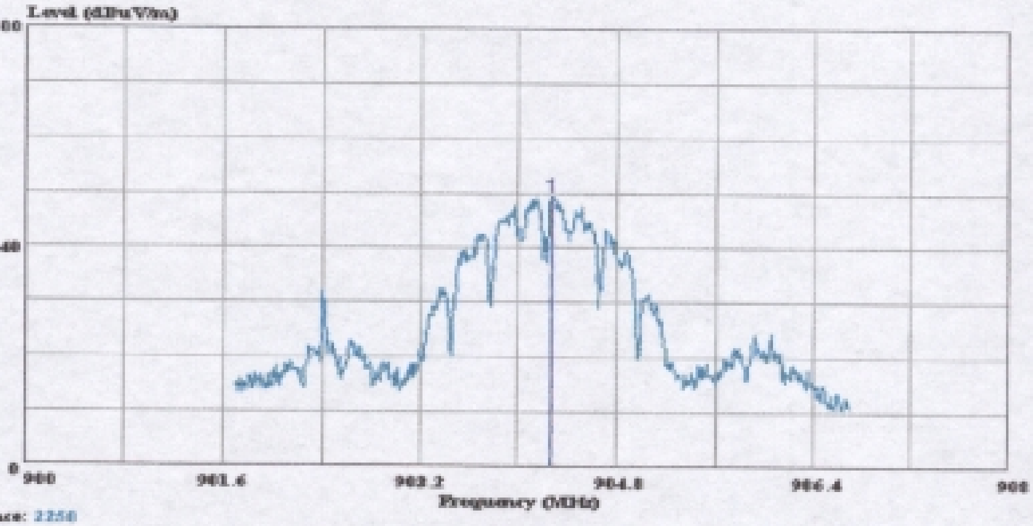
Data#: 2259 File#: E2000.emi Date: 2001-05-28 Time: 17:54:39




Trace: 2258

Site : Chamber No.3(Jason Gong)-Linko Site
Condition: 3m ANT.3M(V) VERTICAL
eut : F004U
power : AC 115V / 60Hz
memo : Peak Value
: Channel 1: 904.2MHz
: Part No. FE004
: Test : The Peak Power Density
: RBW:3KHz;VBW:10KHz;Span:5MHz
: Swp:60ms

Page: 1

| | Freq | Level | Over Limit | Limit Line | Read Level | Probe Factor | Cable Loss | Preamp Factor |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB | dB | dB |
| 1 | 904.267 | 49.31 | ------ | ------ | 42.98 | 23.54 | 2.79 | 20.00 |

E (dBmv) = 54.19

E (v/m) = $10^{[49.31/20]} \times 10^{-6} = 10^{2.5} \times 10^{-6} = 0.00032$

E.R.P = $[\,0.00032 \times 3\,]^2 / 30 = 0.000031$mw

dBm = $10 \log \left( \frac{0.000031\text{mw}}{1\text{mw}} \right) = -45.1$

∵ -45.1 < + 8 故 pass

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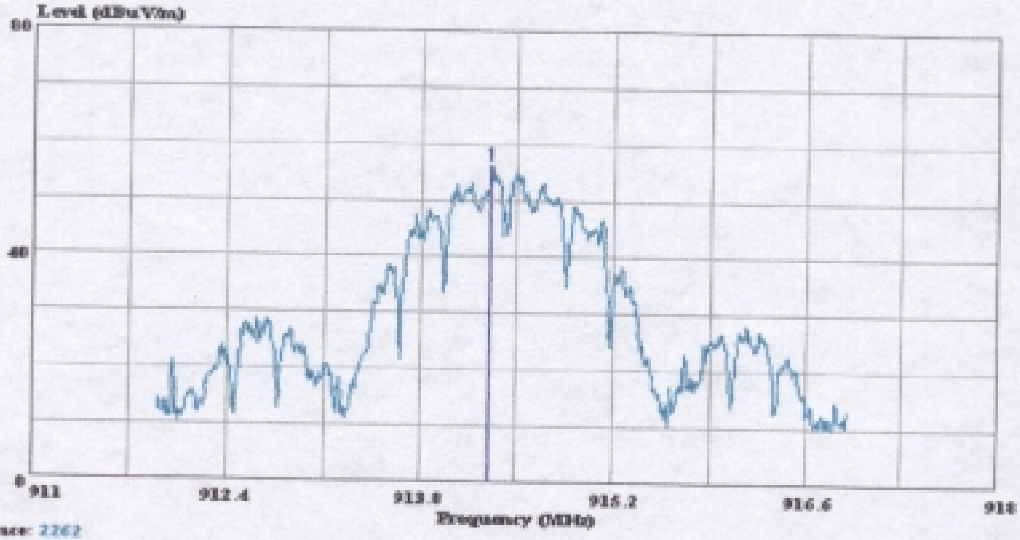
Data#: 2263 File#: E2000.emi Date: 2001-05-28 Time: 18:15:49




Trace: 2262

Site : Chamber No.3(Jason Gong)-Linko Site
Condition: 3m ANT.3M(H) HORIZONTAL
eut : F004U
power : AC 115V / 60Hz
memo : Peak Value
: Channel 1: 914.4MHz
: Part No. FE004
: Test : The Peak Power Density
: RBW:3KHz;VBW:10KHz;Span:5MHz
: Swp:60ms

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| | Freq | Level | Over Limit | Limit Line | Read Level | Probe Factor | Cable Loss | Preamp Factor |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB | dB | dB |
| 1 | 914.312 | 56.09 | ------ | ------ | 49.38 | 23.93 | 2.78 | 20.00 |

E (dBmv) = 56.09

E (v/m) = $10^{[56.09/20]} \times 10^{-6} = 10^{2.8} \times 10^{-6} = 0.00063$

E.R.P = $[\,0.00063 \times 3\,]^2 / 30 = 0.00012$mw

dBm = $10 \log \left( \frac{0.00012\text{mw}}{1\text{mw}} \right) = -39.2$

∵ $-39.2 < +8$ 故 pass

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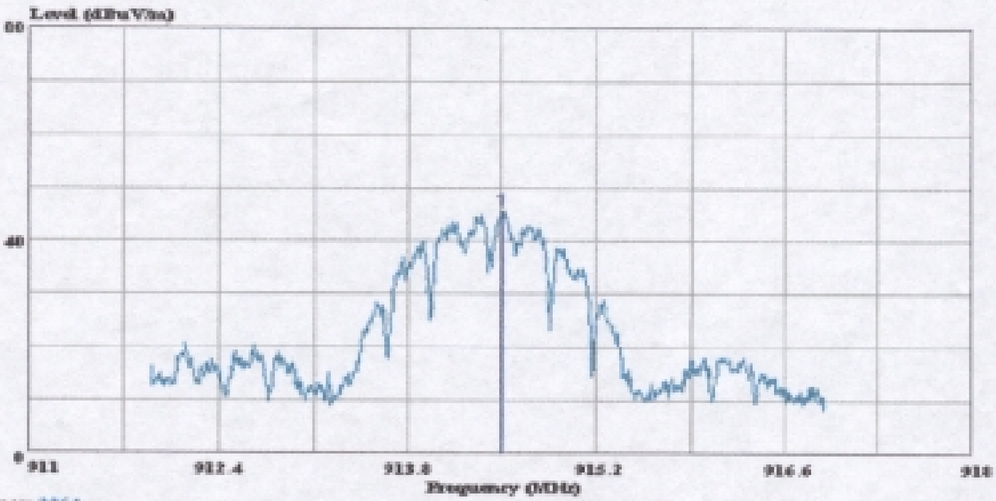
PEP Testing Laboratory

Data#: 2265 File#: E2000.emi Date: 2001-05-28 Time: 18:22:22




Trace: 2264

Site : Chamber No.3(Jason Gong)-Linko Site
Condition: 3m ANT.3M(V) VERTICAL
eut : F004U
power : AC 115V / 60Hz
memo : Peak Value
: Channel 1: 914.4MHz
: Part No. FE004
: Test : The Peak Power Density
: RBW:3KHz;VBW:10KHz;Span:5MHz
: Swp:60ms

Page: 1

| | Freq | Level | Over Limit | Limit Line | Read Level | Probe Factor | Cable Loss | Preamp Factor |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB | dB | dB |
| 1 | 914.512 | 45.58 | ------ | ------ | 38.86 | 23.94 | 2.78 | 20.00 |

E (dBmv) = 45.58

E (v/m) = $10^{[45.58/20]} \times 10^{-6} = 10^{2.3} \times 10^{-6} = 0.0002$

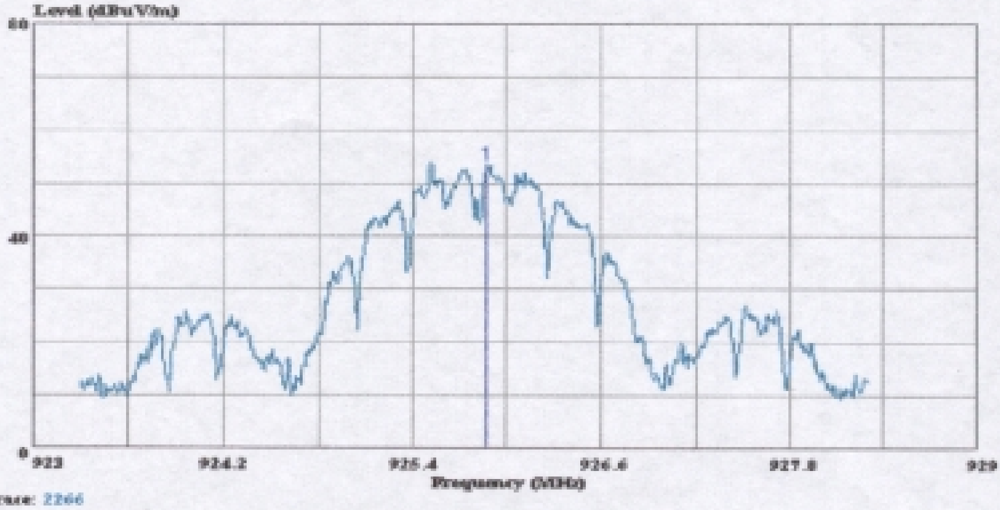
E.R.P = $[\,0.0002 \times 3\,]^2 / 30 = 0.000012$mw

dBm = $10 \log \left( \frac{0.000012\text{mw}}{1\text{mw}} \right) = -49.2$

$\because$ $-49.2 < +8$ 故 pass

瞕鑫科技有限公司
PEP Testing Laboratory

Data#: 2267   File#: E2000.emi   Date: 2001-05-28   Time: 18:37:13




Trace: 2266

```
Site      : Chamber No.3(Jason Gong)-Linko Site
Condition: 3m ANT.3M(H) HORIZONTAL
eut       : F004U
power     : AC 115V / 60Hz
memo      : Peak Value
          : Channel 20: 925.8MHz
          : Part No. FE004
          : Test  : The Peak Power Density
          : RBW:3KHz;VBW:10KHz;Span:5MHz
          : Swp:60ms
```

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| | Freq | Level | Over Limit | Limit Line | Read Level | Probe Factor | Cable Loss | Preamp Factor |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB | dB | dB |
| 1 | 925.877 | 53.49 | ------ | ------ | 46.33 | 24.39 | 2.77 | 20.00 |

E (dBmv) = 53.49

E (v/m) = $10^{[53.49/20]} \times 10^{-6} = 10^{2.7} \times 10^{-6} = 0.0005$

E.R.P = $[\,0.0005 \times 3\,]^2 / 30 = 0.000075$mw

dBm = $10 \log \left( \dfrac{0.000075\text{mw}}{1\text{mw}} \right) = -41.2$

$\because$ $-41.2 < +8$   故 pass

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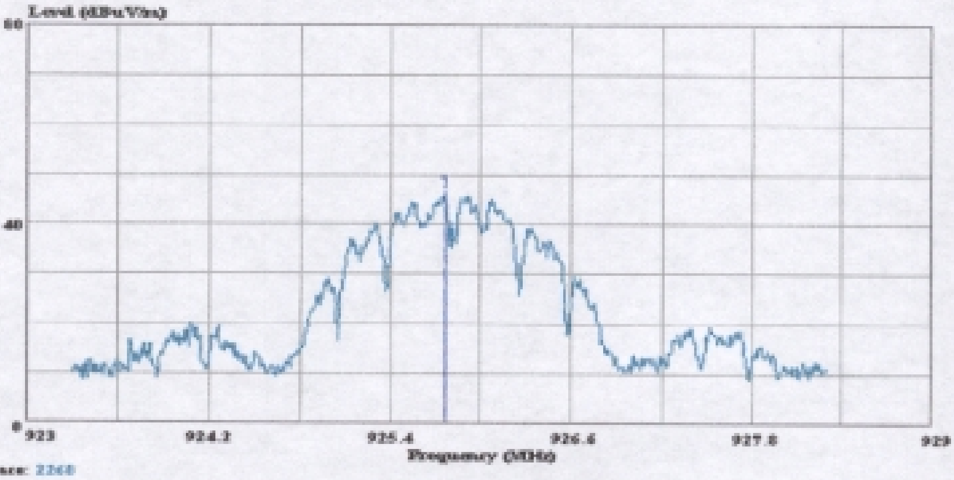
PEP Testing Laboratory

Data#: 2269  File#: E2000.emi  Date: 2001-05-28  Time: 18:44:51




Trace: 2269

Site : Chamber No.3(Jason Gong)-Linko Site
Condition: 3m ANT.3M(V) VERTICAL
eut : F004U
power : AC 115V / 60Hz
memo : Peak Value
: Channel 1: 925.8MHz
: Part No. FE004
: Test : The Peak Power Density
: RBW:3KHz;VBW:10KHz;Span:5MHz
: Swp:60ms

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| | Freq | Level | Over Limit | Limit Line | Read Level | Probe Factor | Cable Loss | Preamp Factor |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB | dB | dB |
| 1 | 925.767 | 46.45 | ------ | ------ | 39.30 | 24.38 | 2.77 | 20.00 |

E (dBmv) = 46.45

$E\ (v/m) = 10^{[46.45/20]} \times 10^{-6} = 10^{2.3} \times 10^{-6} = 0.0002$

$E.R.P = [\ 0.0002 \times 3\ ]^2 / 30 = 0.000012mw$

$dBm = 10 \log \left( \frac{0.000012mw}{1mw} \right) = -49.2$

$\because\ -49.2 < +8$ 故 pass

# § 15.247(e) :Processing Gain

## 7.1 Test Condition & Setup

### A, Bit Error Rate (Pe)

The subject RF device Earphone set model FE004 is digital modulation by Differential Phase Shift Keying (OPS K), the DPSK can use it's previous waveform as the phase reference for demodulation and thus requires no coherent detection, which greatly simplifies the receiver structure but with some Bit Error Rate (BER) degradation because of noisy phase reference. There is tradeoff between system complexity and system performance. In order to driver the DPSK error probability, we observe that DPSK using differential coding , we observable that DPSK using different coding is essentially an orthogonal signal scheme. A binary I is transmitted a sequence of two pulse (P,P) or (-P,-P) (-P, P) To seconds (no transition). Similarly, a binary 0 is transmitted by a sequence of two plus (1',-?) or (-P, P) over 2 TO seconds (transition). Either of the pulse sequences used for binary I is orthogonal to either of the pulse sequences used for binary 0. Because no local carrier is generated for demodulation, the detection is noncoherent , with an effective pulse energy equal to 2 Ep (twice the energy of pulse P ). The actual energy transmitted per digit only Ep, however, the same as in noncoherent FSK, Consequently, the performance of DPSK is 3 dB superior to that of noncoherent FSK, We can write Pe for DPSK as:

The major component inside the subjective device are supplied by Rock well , Included RF block transmitter (RF105), Receiver (RF 100), and Base band block ASIC (c8502-13), CODEC (10497-14), above 4 IC chips are affected the processing gain as following:

*JIS* = (WIRE)) I (ED/NO) [without CODING]

Where: W= Spread Chip Rate = Required Transmitted Base band Bandwidth.
Rb = Information Data Rate
Eb/No = Require Energy per Bit over noise Spectral Density for a Specific Bit Error Probability.

The subjective Device Information Data Rate are 80k and the Spread Chip Rate are 960k So the processing gain (10 log w/Rb) at least 10.79dB (without Coding).

The ASIC (c8502-13) and CODEC (10497-14) these two chip included the coding function, So, it is great improve the processing gain and also improve the J/S ratio.

The Engineer work for Rock well System in Taiwan had pass us the information about the probability of error rate (Pe) must be lower than 0.001 That the system performance will satisfy for communication between Handset and Base station.

Why we need the F' lower than 0.001, the Rockwell Semiconductor System is not explained, Since it relative with ASIC and Codec, it is confidential area that Rockwell is not allow to disdouse to the public. When Pe = 0.001 and then Signal to Noise Ratio (S/N) = 6.2194 = 7.9dB.

**B. Jamming Margin Method**

The Rockwell semiconductor System give us a software operated in the personal computer. And use the computer series port COMI and COM2 connect headset and interlace module than we can measure the Bit Error Rate.

Using this software we can perform Jamming Margin method testing, The test consists of stepping

a signal generator in 50KHz increments across the pass band of the system (up to 960KHz away in RI's DCT ). At each point, the generator level required to produce the recommend Bit ERROR Rate (BER = 10e – 3) is recorded. This level is the jamming level. The maximum implementation loss a system can claim in calculating processing gain is 2 dB. The equation to calculate the processing gain (Gp) is the following :

Gp = (S/N) + Mj + Lsys

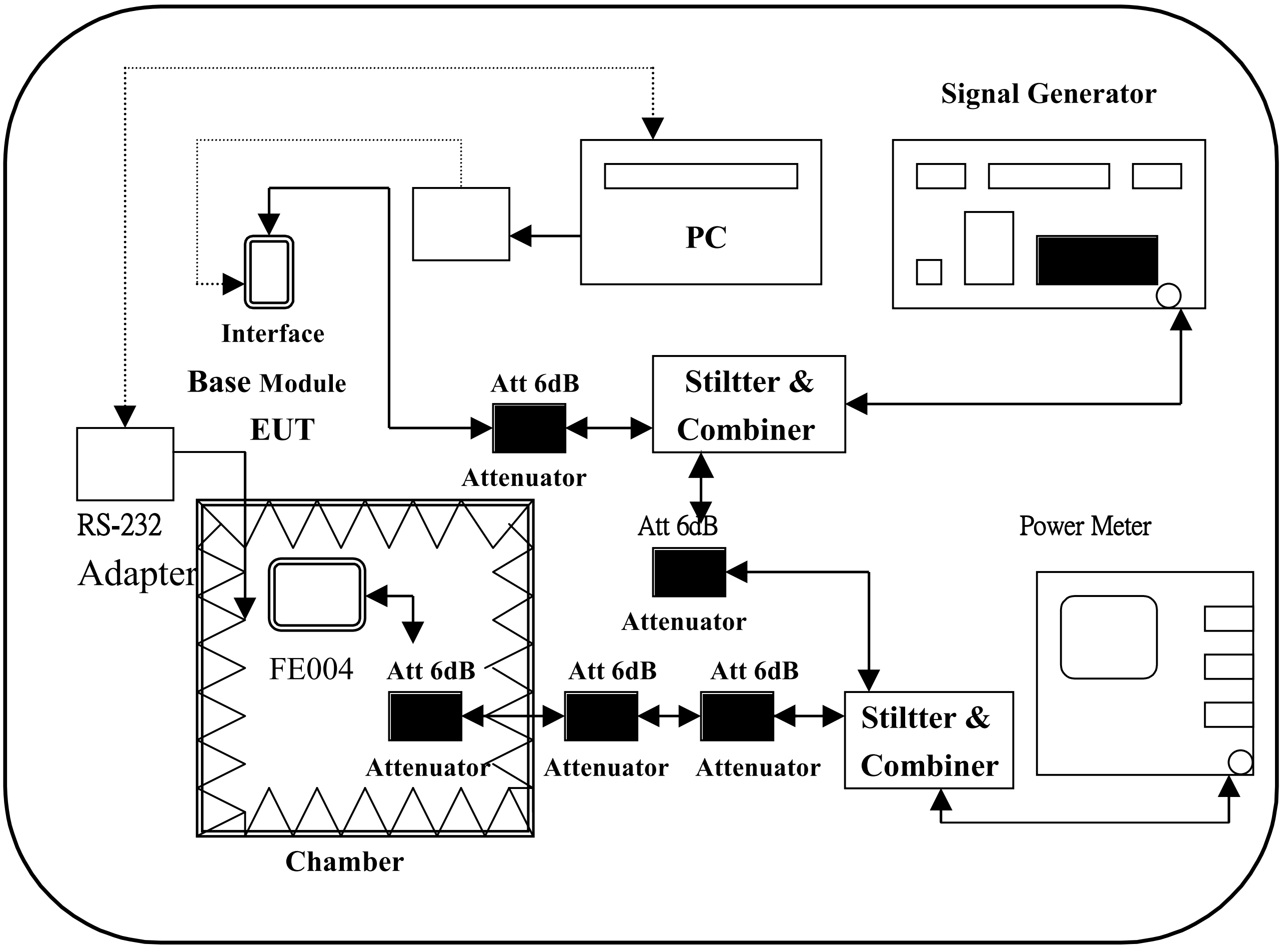
Gp = 8 dB + Mj +2 dB

FCC regulation section 15.247(e) rewire the processing gain of a direct sequence system shall be at least 10dB, when Gp must be greater than 10dB, then the Jammer must be greater than 0d.

The processing gain may be measured using the CW jamming margin method. The Jammer to Signal (J/S) ratio is then calculated Discard the worst 20% of the J/S data points.

1. For avoid the headset and interface module station are situation, so, the BUT were in low power mode.
2. The signal generator was selected in interference band, using this software we can perform Jamming Margin method testing, the test consists of stepping a signal generator is 50KHz increments across the pass band of the System (up to 960 KM' away in RI's EUT) So, the BER will keep in 0.1%.

## 7.2 Test Instruments Configuration




P.S: A serial port from computer to control the EUT at power output and channel number.

Test Configuration of processing gain for Earphone set

## 7.3 Test Procedure

Measure the high power output of the channel 11 of the headset while the headset is in “Transmit-Only-Test” and the whole circuit is as same as attachment. What we measure in this step is “S”.
Change to the “BER Test“ program. Increase the RF output of the signal generator till the BER is close to the 0.1%but under 0.1%.
Stop the program and turn off the interface module, headset then record the highest point of the spectrum. What we measure in this step is ”J” .
Star the Program again and test the next point.

## 7.4 Test Result of Processing Gain

[ Processing Gain for Channel 11 : 914.600 to 915.950 MHz ]

| Jammer Frequency (MHz) | S (dBm) | J (dBm) | Mj (J/S) | Process Gain (dB) |
|---|---|---|---|---|
| 914.600 | -52.80 | -45.88 | 6.92 | 16.82 |
| 914.650 | -52.80 | -49.85 | 2.95 | 12.85 |
| 914.700 | -52.80 | -50.15 | 2.65 | 12.55 |
| 914.750 | -52.80 | -49.74 | 3.06 | 12.96 |
| 914.800 | -52.80 | -49.48 | 3.32 | 13.22 |
| 914.850 | -52.80 | -51.30 | 1.50 | 11.40 |
| 914.900 | -52.80 | -51.18 | 1.62 | 11.52 |
| 914.950 | -52.80 | -44.00 | 8.80 | 18.70 |
| 915.000 | -52.80 | -50.63 | 2.17 | 12.07 |
| 915.050 | -52.80 | -45.60 | 7.20 | 17.10 |
| 915.100 | -52.80 | -49.72 | 3.08 | 12.98 |
| 915.150 | -52.80 | -49.70 | 3.10 | 13.00 |
| 915.200 | -52.80 | -46.07 | 6.73 | 16.63 |
| 915.250 | -52.80 | -45.05 | 7.75 | 17.65 |
| 915.300 | -52.80 | -45.06 | 7.74 | 17.64 |
| 915.350 | -52.80 | -43.00 | 9.80 | 19.70 |
| 915.400 | -52.80 | -41.00 | 11.80 | 21.70 |
| 915.450 | -52.80 | -49.85 | 2.95 | 12.85 |
| 915.500 | -52.80 | -49.85 | 2.95 | 12.85 |
| 915.550 | -52.80 | -47.52 | 5.28 | 15.18 |
| 915.600 | -52.80 | -42.55 | 10.25 | 20.15 |
| 915.650 | -52.80 | -45.21 | 7.59 | 17.49 |
| 915.700 | -52.80 | -45.20 | 7.60 | 17.50 |
| 915.750 | -52.80 | -46.20 | 6.60 | 16.50 |
| 915.800 | -52.80 | -42.85 | 9.95 | 19.85 |
| 915.850 | -52.80 | -44.28 | 8.52 | 18.42 |
| 915.900 | -52.80 | -44.19 | 8.61 | 18.51 |
| 915.950 | -52.80 | -41.88 | 10.92 | 20.82 |

[ Processing Gain for Channel 11 : 916.000 to 916.600 MHz ]

| Jammer Frequency (MHz) | S (dBm) | J (dBm) | Mj (J/S) | Process Gain (dB) |
|---|---|---|---|---|
| 916.000 | -52.80 | -41.88 | 10.92 | 20.82 |
| 916.050 | -52.80 | -41.75 | 11.05 | 20.95 |
| 916.100 | -52.80 | -41.88 | 10.92 | 20.82 |
| 916.150 | -52.80 | -34.84 | 17.96 | 27.86 |
| 916.200 | -52.80 | -39.85 | 12.95 | 22.85 |
| 916.250 | -52.80 | -34.85 | 17.95 | 27.85 |
| 916.300 | -52.80 | -36.26 | 16.54 | 26.44 |
| 916.350 | -52.80 | -37.47 | 15.33 | 25.23 |
| 916.400 | -52.80 | -32.64 | 20.16 | 30.06 |
| 916.450 | -52.80 | -32.74 | 20.06 | 29.96 |
| 916.500 | -52.80 | -30.35 | 22.45 | 32.35 |
| 916.550 | -52.80 | -30.40 | 22.40 | 32.30 |
| 916.600 | -52.80 | -30.00 | 22.80 | 32.70 |

Test Result : Processing Gain = 12.98dB

Note : 1.GP = (S/No) + Mj + Lsys
= 7.9dB + Mj + 2dB
2. S = Signal Level
3. J = Signal Generator RF Output

# Ⅷ. List of Test Instruments

| Emission | Instrument | Model No. | Serial No. | Next Cal. Date | Cal. Interval |
|---|---|---|---|---|---|
| Conduction (No.2) | HP Spectrum | 8591A | 3225A03039 | May 19, 2002 | 1Year |
| | R & S LISN | ESH2-Z5 | 831886/00A | Jan. 30, 2002 | 1Year |
| | Kyoritsu LISN | KNW-242 | 8-837-7 | N/A | N/A |
| | RF Cable | No.4 | N/A | Feb. 20, 2002 | 1Year |
| Radiation (OP No.2) | R & S Receiver | ESVS10 | 826148/012 | Apr. 17, 2001 | 1Year |
| | Advantest Spectrum | R3261C | 81720343 | N/A | N/A |
| | Schaffner Pre-Amp. | CPA-9232 | 1012 | Feb. 25, 2002 | 1Year |
| | R & S Pre-Amp. | ESMI-Z7 | 612278/011 | Jun. 01, 2001 | 1Year |
| | EMCO Antenna | 3142B | 9909-1420 | Jun. 01, 2001 | 1Year |
| | COM-Power Horn Ant. | AH-118 | 10056 | Aug. 24, 2001 | 1Year |
| | RF Cable | No.1 | N/A | Feb. 20, 2002 | 1Year |
| | SCHWARZBECK Precision Dipole Ant. | VHAP | 970+971 953+954 | Jun. 27, 2003 | 3Year |
| | R &S Signal Generator | SMY02 | 839846/038 | Jan. 30, 2002 | 1Year |