

# ***FCC Part 95 Subpart B EMI TEST REPORT***

*of*

E.U.T. : FRS Transceiver

FCC ID. : LIPTL00001

MODEL : FRS-500

*for*

APPLICANT : Tron Link enterprises Co., Ltd.

ADDRESS : No. 184, Hwa Kang Street, Pa-Teh City, Taoyuan  
Hsien, Taiwan, R.O.C.

Test Performed by

**ELECTRONICS TESTING CENTER, TAIWAN**  
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Report Number : ET89R-05-125-01

**TEST REPORT CIRTIFICATION**

Applicant : Tron Link enterprises Co., Ltd.  
No. 184, Hwa Kang Street, Pa-Teh City, Taoyuan Hsien, Taiwan,  
R.O.C.

Manufacturer : Tron Link enterprises Co., Ltd.  
No. 184, Hwa Kang Street, Pa-Teh City, Taoyuan Hsien, Taiwan,  
R.O.C.

Description of EUT :

- a) Type of EUT : FRS Transceiver
- b) Trade Name : N/A
- c) Model No. : FRS-500
- d) FCC ID : LIPTL00001
- e) Working Frequency : 14 Channels covers frequency band of 462.5625 to  
462.7125 MHz and 467.5625 to 467.7125 MHz
- f) Power Supply : DC 6V

Regulation Applied : FCC Rules and Regulations Part 95 Subpart B (1998)

I HEREBY CERTIFY THAT: The data shown in this report were made in accordance with the procedures given in ANSI C63.4 and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Issued Date : Jul. 27, 2000

Test Engineer : Tien Lu Liao  
( Tien Lu Liao )

Approve & Authorized Signer : Will Yauo  
Will Yauo, Supervisor  
EMI Test Site of ELECTRONICS  
TESTING CENTER, TAIWAN

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## 1. GENERAL INFORMATION

### 1.1 Product Description

- a) Type of EUT : FRS Transceiver  
 b) Trade Name : N/A  
 c) Model No. : FRS-500  
 d) FCC ID : LIPTL00001  
 e) Working Frequency : 14 Channels covers frequency band of 462.5625 to 462.7125 MHz and 467.5625 to 467.7125 MHz  
 f) Power Supply : DC 6V

### 1.2 Characteristics of Device:

\* 14 channels for selection

|       |          |       |          |
|-------|----------|-------|----------|
| CH 01 | 462.5625 | CH 08 | 467.5625 |
| CH 02 | 462.5875 | CH 09 | 467.5875 |
| CH 03 | 462.6125 | CH 10 | 467.6125 |
| CH 04 | 462.6375 | CH 11 | 467.6375 |
| CH 05 | 462.6625 | CH 12 | 467.6625 |
| CH 06 | 462.6875 | CH 13 | 467.6875 |
| CH 07 | 462.7125 | CH 14 | 467.7125 |

\* effective distance 2 miles range, has a full 250mW output power.

### 1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in chapter 13 of ANSI C63.4, and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057.

### 1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the roof top of Building at No.34, 5 Lirn, Din Fu Tsun, Lin Kou, Taipei, Taiwan, R.O.C.

This site has been fully described in a report submitted to your office, and accepted in a letter dated Feb. 10 , 2000.

## 2. REQUIREMENTS OF PROVISIONS

### 2.1 Definition

Intentional radiator:

A device that intentionally generates and emits radio frequency energy by radiation or induction.

### 2.2 Frequencies Available

According to sec. 95.627 of Part 95, the following frequencies are available for wireless microphone operations :

|       |          |       |          |
|-------|----------|-------|----------|
| CH 01 | 462.5625 | CH 08 | 467.5625 |
| CH 02 | 462.5875 | CH 09 | 467.5875 |
| CH 03 | 462.6125 | CH 10 | 467.6125 |
| CH 04 | 462.6375 | CH 11 | 467.6375 |
| CH 05 | 462.6625 | CH 12 | 467.6625 |
| CH 06 | 462.6875 | CH 13 | 467.6875 |
| CH 07 | 462.7125 | CH 14 | 467.7125 |

### 2.3 Requirements For Measurement

#### (1) RF Output Power

For transmitters, the power output shall be measured at the RF output terminals.

#### (2) Modulation Characteristics

For Voice Modulated Communication Equipment, a curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted.

#### (3) Occupied Bandwidth

Other than single sideband or independent sideband Transmitter when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.

#### (4) Spurious Emissions at Antenna Terminals

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminal when properly loaded with a suitable artificial antenna.

**(5) Field Strength of Spurious Emissions**

Measurements shall be made to detect spurious emission that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal condition of installation and operation.

**(6) Frequencies Tolerance**

- a) The frequency stability shall be measured with variation of ambient temperature.
- b) The frequency stability shall be measured with variation of primary supply voltage.

**2.4 Labeling Requirement**

Each equipment for which a type acceptance application is filed on or after May 1,1981, shall bear an identification plate or label pursuant to § 2.925 ( Identification of equipment ) and § 2.926 ( FCC identifier ) .

**2.5 User Information**

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### 3. OUTPUT POWER MEASUREMENT

#### 3.1 Provision Applicable

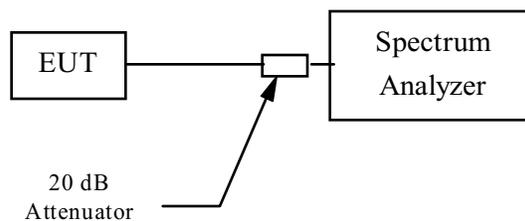
According to § 95.639 (d), the output power shall not exceed 500 milliwatts (ERP).

#### 3.2 Measurement Procedure

##### A. Conducted measured

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 1 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set spectrum analyzer RBW to 1M kHz and VBW to 1 MHz., and adjust spectrum analyzer center frequency at the highest amplitude appearing on spectral display. Then set spectrum analyzer frequency span to 5M Hz.
4. Measure the highest amplitude appearing on spectral display and record the level as result data.
5. Repeat above procedures until all frequencies measured were complete.

Figure 1 : Output power measurement configuration



## B. ERP

1. Setup the configuration per figure 3 and 4 for frequencies measured below and above 1 GHz respectively, adjusting the input voltage to produce the maximum power as measured in above conducted output power measurement.
2. Adjust the analyzer for each frequency measured in chapter 6 on a 1 MHz frequency span and 100 kHz resolution bandwidth.
3. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from  $0^{\circ}$  to  $360^{\circ}$ , and record the highest value indicated on spectrum analyzer as reference value.
4. Repeat step 3 until all frequencies need to be measured were complete.
5. Repeat step 4 with search antenna in vertical polarized orientations.
6. Replace the EUT with a tuned dipole antenna (horn antenna for above 1 GHz) relative to each frequency in horizontally polarized orientation and as the same polarized orientation with search antenna. Connect the tuned dipole antenna to a standard signal generator (SG) via a low loss cable. Power on the SG and tune the right frequency in measuring as well as set SG at a appreciated output level. Rise and lower the search antenna to get the highest value on spectrum analyzer, and then hold this position. Adjust the SG output to get a value as close as that derived from step 3 on spectrum analyzer. Record this value for result calculated.
7. Repeat step 6 until all frequencies need to be measured were complete.
8. Repeat step 7 with both dipole antenna (horn antenna for above 1 GHz) and search antenna in vertical polarized orientations.

Figure 3 : Frequencies measured below 1 GHz configuration

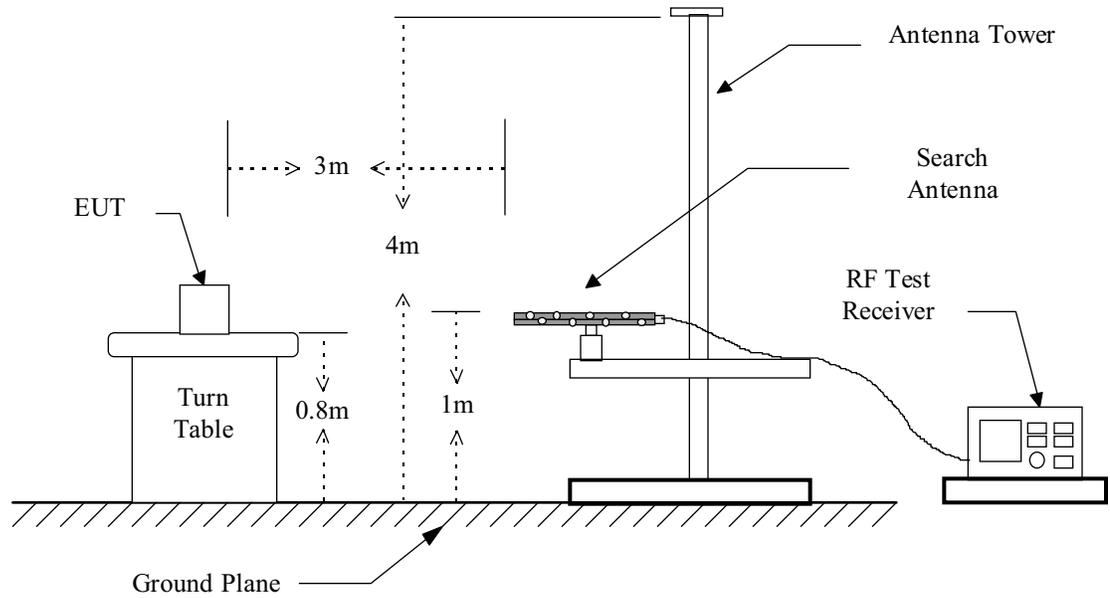
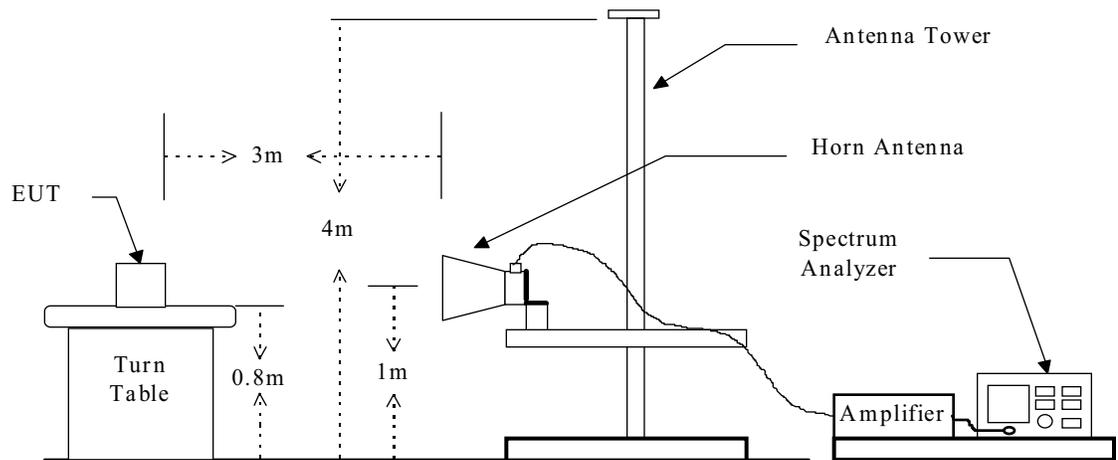


Figure 4 : Frequencies measured above 1 GHz configuration



### 3.3 Test Data

#### A. Conducted measured

Operated mode : Transmitting                      Test Date : Jun. 02, 2000  
 Temperature : 28 °C                                      Humidity : 58 %

| CH | Frequency (MHz) | SA Reading (dBm) | Cable Loss (dB) | Attenuator (dB) | Result (dBm) | Output Power (W) | Limit (W) |
|----|-----------------|------------------|-----------------|-----------------|--------------|------------------|-----------|
| 1  | 462.5625        | 3.33             | 0.5             | 20              | 23.83        | 0.242            | 0.5       |
| 14 | 467.7125        | 2.67             | 0.5             | 20              | 23.17        | 0.207            | 0.5       |

Note: Result = SA Reading + Cable Loss + Attenuator

*Pease find Appendix 1 for plotted graphs.*

#### B. ERP

Operated mode : Transmitting                      Test Date : Jun. 01, 2000  
 Temperature : 24 °C                                      Humidity : 61 %

SG @ 20 dBm

| Frequency (MHz) | SA Reading (dBuV) | SG Reading (dBuV) | Cable Loss (dB) | Result (dBm) | ERP (W) | Limit (W) |
|-----------------|-------------------|-------------------|-----------------|--------------|---------|-----------|
| 462.554         | 95.5              | 95.0              | -1.9            | 18.6         | 0.072   | 0.5       |
| 467.701         | 97.3              | 94.9              | -1.9            | 20.5         | 0.112   | 0.5       |

### 3.3 Result Calculation

The conducted result is calculated as following equation :

a. For conducted output power measurement:

$$\text{Result} = \text{Reading} + \text{Cable Loss} + \text{Attenuation of Attenuator (if any)}$$

b. For ERP measurement:

$$\text{Result} = \text{SA Reading} - \text{SG Reading} + 20 + \text{Cable Loss}$$

c.  $W = \log^{-1} \left[ \frac{\text{Result(dBm)}}{10} \right] / 1000$

### 3.4 Output Power Test Equipment

| Equipment            | Manufacturer    | Model No. | Next Cal. Date |
|----------------------|-----------------|-----------|----------------|
| Spectrum Analyzer    | Hewlett-Packard | 8568B     | JAN. 03, 2001  |
| Pre-selector         | Hewlett-Packard | 85685A    | JAN. 10, 2001  |
| Quasi Peak Detector  | Hewlett-Packard | 85650A    | JAN. 10, 2001  |
| Log periodic Antenna | EMCO            | 3146      | NOV. 03, 2000  |
| Dipole Antenna       | EMCO            | 3121C     | SEP. 22, 2000  |

## 4. MODULATION CHARACTERISTICS

### 4.1 Provisions Applicable

According to § 2.1047 (a), for Voice Modulated Communication Equipment, the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be measured.

According to § 95.637 (a), a FRS unit that transmits emission type F3E must not exceed, a peak frequency deviation of  $\pm 2.5$  KHz, and the audio frequency response must not exceed 3.125 KHz.

### 4.2 Measurement Method

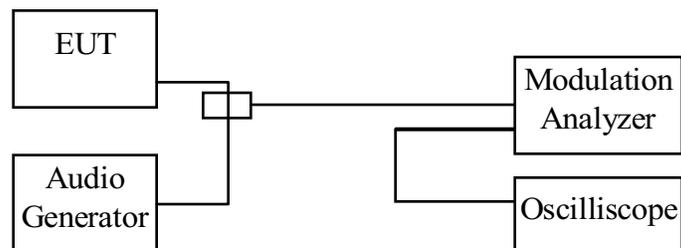
#### A) Modulation Limit

1. Position the EUT as shown in figure 2, adjust the audio input frequency to 100 Hz and vary the input level from 0V to proper level rated by manufacturer with recording each carrier frequency deviation responding to respective input level.
2. Repeat step 1 with changing the input frequency for 200, 500, 1000, 3000, and 5000 Hz in sequence.

#### B) Audio frequency response

1. Position the EUT as shown in figure 2.
2. Vary the modulating frequency from 100 Hz to 5000 Hz with fixing the input voltage at proper level derived from chapter 5, and observe the change in output.

Figure 2 : Modulation characteristic measurement configuration



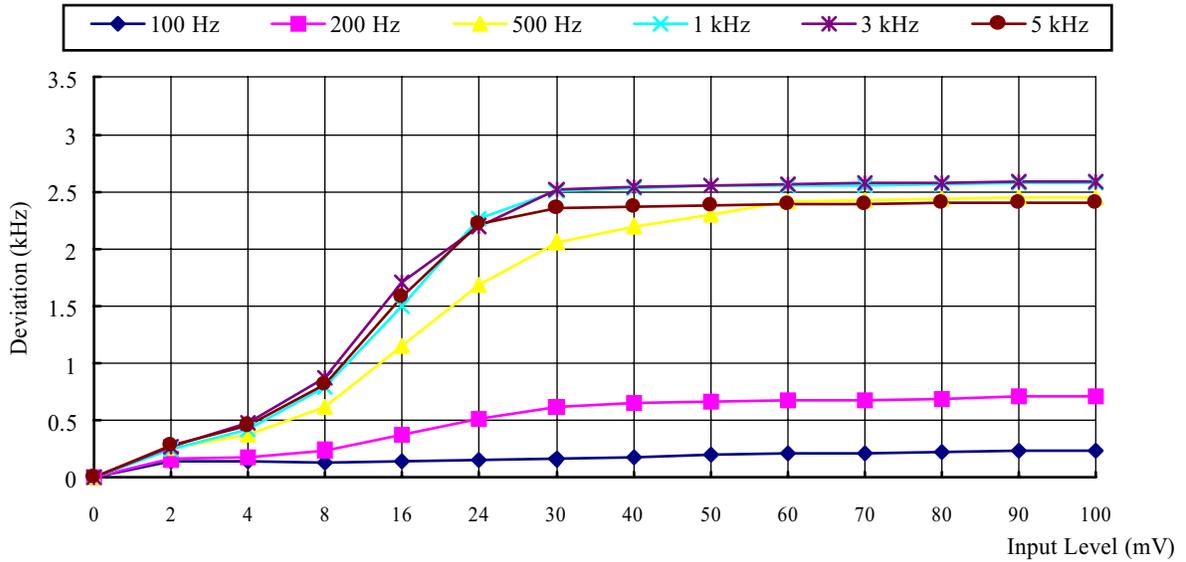
### 4.3 Measurement Instrument

| Equipment                 | Manufacturer    | Model No. | Next Cal. Date |
|---------------------------|-----------------|-----------|----------------|
| Modulation Analyzer       | Hewlett-Packard | 8901A     | Dec. 01, 2001  |
| Multifunction Synthesizer | Hewlett-Packard | 8904A     | Dec. 01, 2001  |

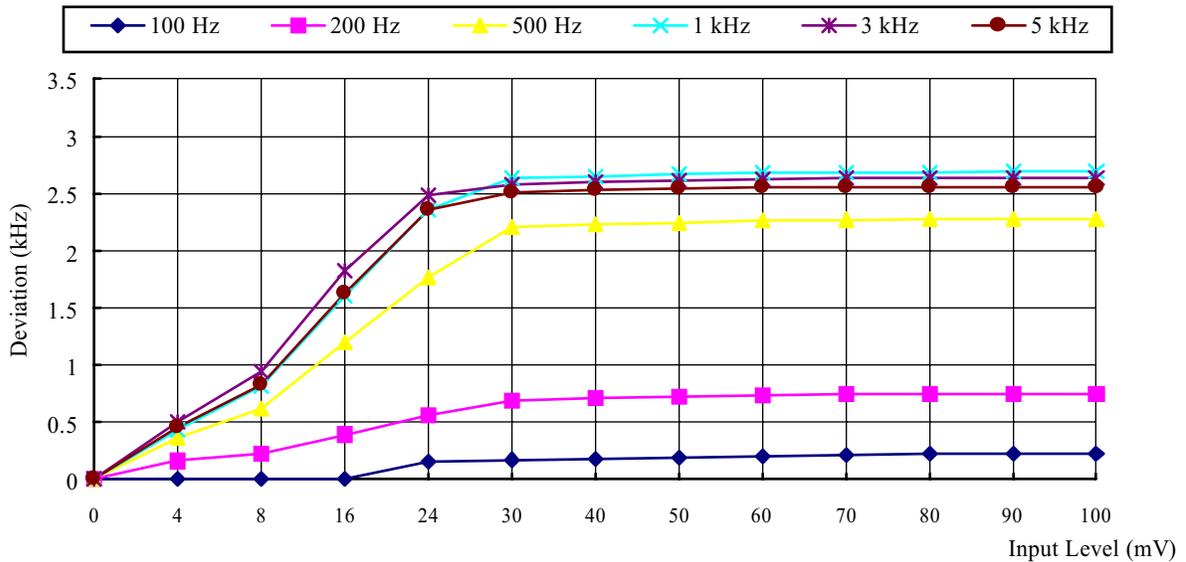
### 4.4 Measurement Result

#### A). Modulation Limit

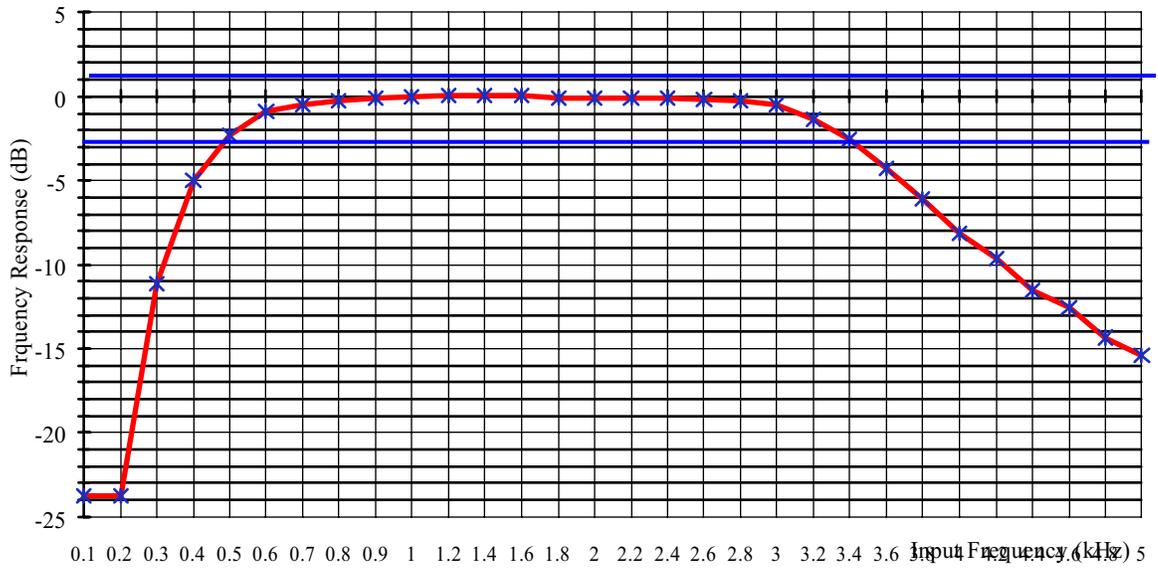
Channel 1 : 462.5625 MHz



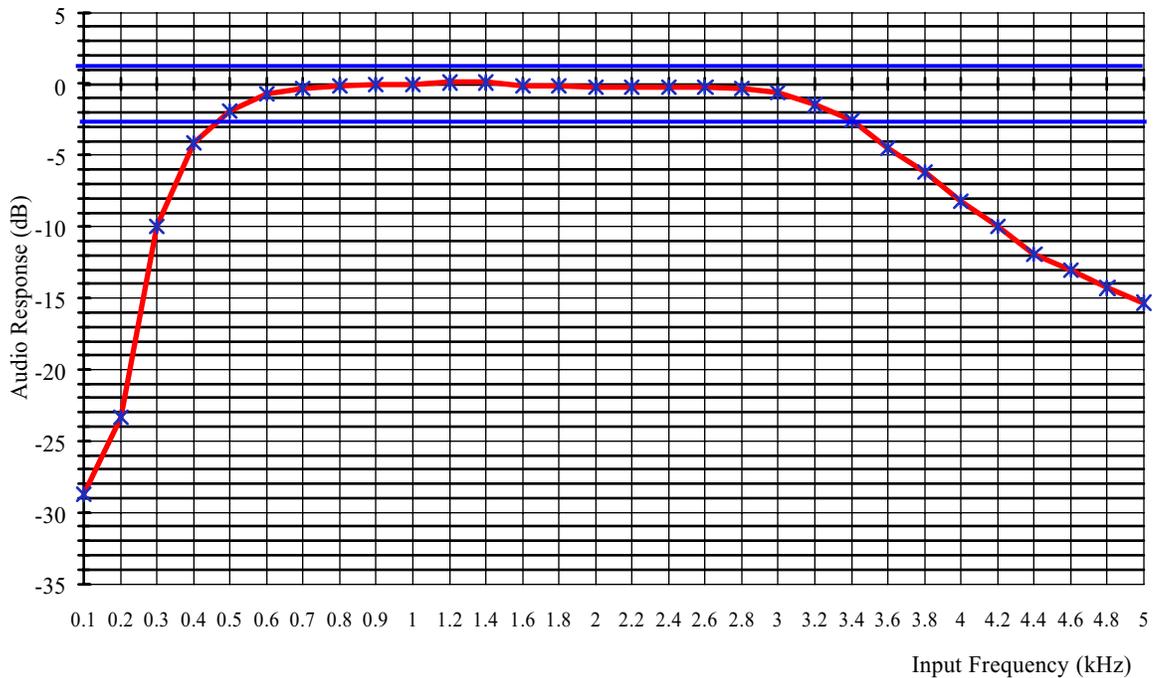
Channel 14 : 467.7125 MHz



B). Frequency response of all circuits  
CH A: 462.5625 MHz



CH C: 467.7125 MHz



## 5. EMISSION BANDWIDTH

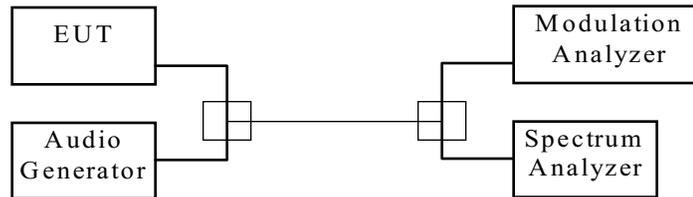
### 5.1 Provisions Applicable

According to § 95.633 (3), the authorized bandwidth for emission type F3E transmitted by a FRS unit is 12.5 KHz.

### 5.2 Measurement Method

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 3, and Install new batteries in the EUT. Turn on the EUT and set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Apply a 2.5 kHz modulation signal to EUT and measure the frequencies of the modulated signal from the EUT where it is the specified number of dB below the reference level set in step 2. This is the occupied bandwidth specified.

Figure 3 : Occupied bandwidth measurement configuration



### 5.3 Occupied Bandwidth Test Equipment

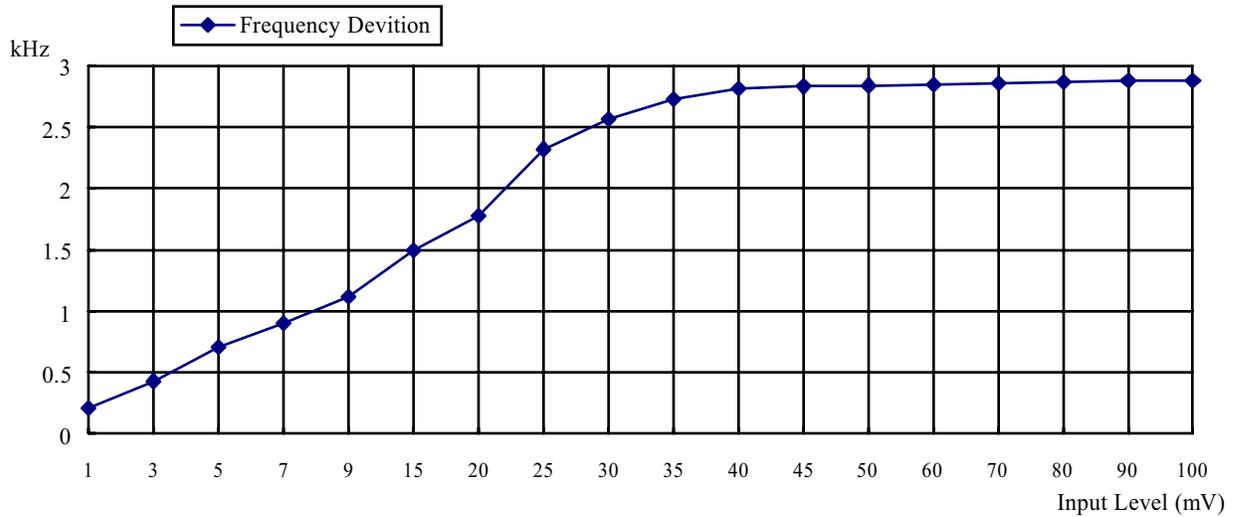
| Equipment                 | Manufacturer    | Model No. | Next Cal. Date |
|---------------------------|-----------------|-----------|----------------|
| Spectrum Analyzer         | Adventest       | R3361A    | Mar. 22, 2001  |
| Modulation Analyzer       | Hewlett-Packard | 8901A     | Dec. 01, 2000  |
| Multifunction Synthesizer | Hewlett-Packard | 8904A     | Dec. 01, 2000  |
| Plotter                   | Hewlett-Packard | 7440A     | N/A            |

### 5.4 Bandwidth Measured

a.) Input Level Derived

1) Channel A : 462.5625 MHz

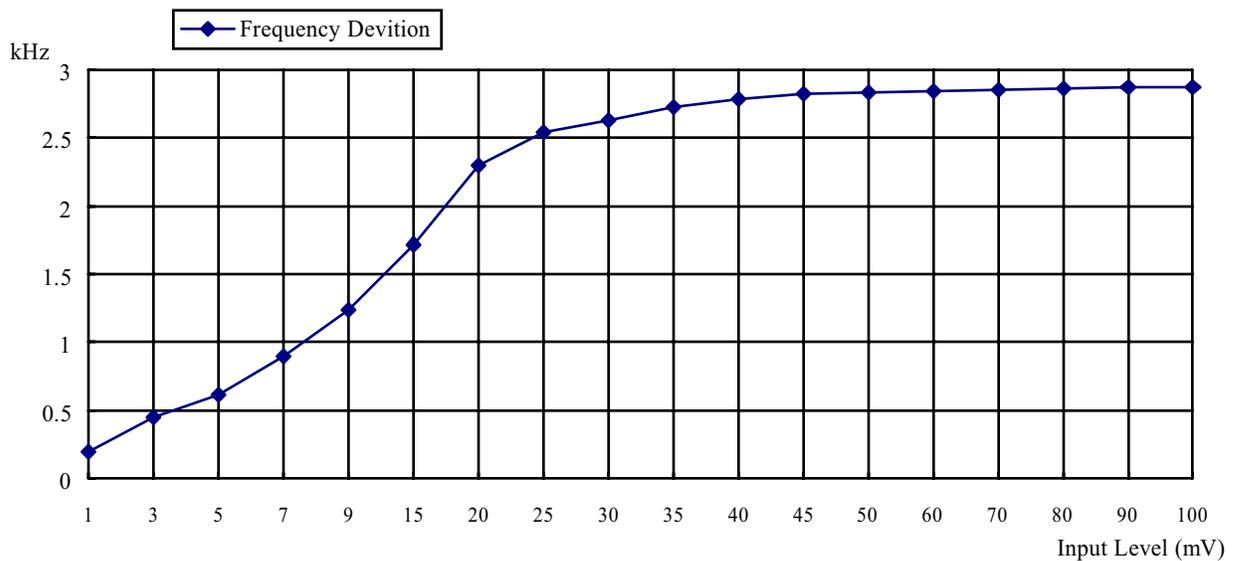
Input Audio Frequency : 2.5 kHz, Sine Wave



The Level input to produce 85% modulation is 34 mV.

2) Channel C : 467.6625 MHz

Input Audio Frequency : 2.5 kHz, Sine Wave



The Level input to produce 85% modulation is 34 mV

b) Occupied Bandwidth Plotted

*Please find Appendix 2 for plotted data.*

## 6. SPURIOUS EMISSIONS AT ANTENNA TERMINALS

### 6.1 Provisions Applicable

According to § 2.1051, the radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminal when properly loaded with a suitable artificial antenna.

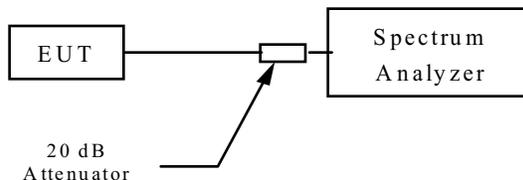
According to § 95.635 (b), the power of each unwanted emission shall be less than TP as specified as follows:

- (1) At least 25 dB on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth
- (2) At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.
- (3) At least  $43 + 10 \log_{10}(TP)$  dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

### 6.2 Measurement Procedure

1. Setup the configure per figure 4, adjusting the input voltage to produce the maximum power as measured in chapter 3.
2. Adjust the analyzer frequency span from 30 MHz to 1 GHz, record any frequency attenuated less than 20 dB relative to the permitted emission and then adjust the analyzer frequency span from 1 GHz to 2 GHz and record emissions frequency should be measured.
3. Adjust the analyzer for each frequency measured above on a 2 MHz frequency span and 1MHz resolution bandwidth. Record the highest value on spectrum analyzer.

Figure 4 : Conducted spurious emission measurement configuration



### 6.3 Measurement Equipment

| Equipment           | Manufacturer    | Model No. | Next Cal. Date |
|---------------------|-----------------|-----------|----------------|
| Spectrum Analyzer   | Hewlett-Packard | 8568B     | Jan. 03, 2001  |
| Pre-selector        | Hewlett-Packard | 85685A    | Jan. 10, 2001  |
| Quasi Peak Detector | Hewlett-Packard | 85650A    | Jan. 10, 2001  |

### 6.3 Measurement Data

a) Channel 1: 462.5625 MHz

Operated mode : Transmitting

Test Date : Jun. 02, 2000

Temperature : 28 °C

Humidity : 58 %

Unmodulated carrier power is 23.83 dBm , or 0.242 W (Conducted).

The limit of spurious or harmonics is 23.83-[43+10log(output power in W)], or -13dBm

| Frequency<br>( MHz) | SA Reading<br>(dBm) | Cable Loss<br>(dB) | Attenuator<br>(dB) | Result | Limit<br>(dBm) | Margin<br>( dB ) |
|---------------------|---------------------|--------------------|--------------------|--------|----------------|------------------|
| 925.1158            | -53.72              | 1.0                | 20                 | -32.7  | -13.0          | -19.7            |
| 1387.6737           | -50.38              | 1.5                | 20                 | -28.9  | -13.0          | -15.9            |
| 1850.2316           | -50.59              | 1.8                | 20                 | -28.8  | -13.0          | -15.8            |
| 2312.7895           | -58.25              | 2.1                | 20                 | -36.2  | -13.0          | -23.2            |
| 2775.3474           | -58.60              | 2.4                | 20                 | -36.2  | -13.0          | -23.2            |
| 3237.9053           | -47.53              | 2.5                | 20                 | -25.0  | -13.0          | -12.0            |
| 3700.4632           | -57.84              | 2.7                | 20                 | -35.1  | -13.0          | -22.1            |
| 4163.0211           | -57.75              | 2.8                | 20                 | -35.0  | -13.0          | -22.0            |
| 4625.5790           | -57.25              | 3.0                | 20                 | -34.3  | -13.0          | -21.3            |

## b) Channel 14: 467.7125 MHz

Operated mode : Transmitting  
 Temperature : 28 °C

Test Date :Jun. 02, 2000  
 Humidity : 58 %

Unmodulated carrier power is 23.17 dBm , or 0.208 W (Conducted).

The limit of spurious or harmonics is  $23.17-[43+10\log(\text{output power in W})]$ , or -13dBm

| Frequency<br>( MHz) | SA Reading<br>(dBm) | Cable Loss<br>(dB) | Attenuator<br>(dB) | Result | Limit<br>(dBm) | Margin<br>( dB ) |
|---------------------|---------------------|--------------------|--------------------|--------|----------------|------------------|
| 935.4238            | -53.63              | 1.0                | 20                 | -32.6  | -13.0          | -19.6            |
| 1403.1357           | -54.66              | 1.5                | 20                 | -33.2  | -13.0          | -20.2            |
| 1870.8476           | -45.34              | 1.8                | 20                 | -23.5  | -13.0          | -10.5            |
| 2338.5595           | -57.72              | 2.1                | 20                 | -35.6  | -13.0          | -22.6            |
| 2806.2714           | -58.53              | 2.4                | 20                 | -36.1  | -13.0          | -23.1            |
| 3273.9833           | -45.94              | 2.5                | 20                 | -23.4  | -13.0          | -10.4            |
| 3741.6952           | -56.94              | 2.7                | 20                 | -34.2  | -13.0          | -21.2            |
| 4209.4071           | -55.72              | 2.8                | 20                 | -32.9  | -13.0          | -19.9            |
| 4677.1190           | -57.72              | 3.0                | 20                 | -34.7  | -13.0          | -21.7            |

## 7. FIELD STRENGTH OF EMISSION

### 7.1 Provisions Applicable

According to § 2.1053 (a), Measurements shall be made to detect spurious emission that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal condition of installation and operation. Information submitted shall include the relative radiated power of spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from a halfwave dipole antenna.

According to § 95.635 (b), the power of each unwanted emission shall be less than TP as specified as follows:

- (1) At least 25 dB on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth
- (2) At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.
- (3) At least  $43 + 10 \log_{10}(TP)$  dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

### 7.2 Measurement Procedure

1. Setup the configuration per figure 5 and 6 for frequencies measured below and above 1 GHz respectively, adjusting the input voltage to produce the maximum power as measured in chapter 3.
2. Adjust the analyzer for each frequency measured in chapter 6 on a 1 MHz frequency span and 100 kHz resolution bandwidth.
3. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from  $0^\circ$  to  $360^\circ$ , and record the highest value indicated on spectrum analyzer as reference value.
4. Repeat step 3 until all frequencies need to be measured were complete.
5. Repeat step 4 with search antenna in vertical polarized orientations.

6. Replace the EUT with a tuned dipole antenna (horn antenna for above 1 GHz) relative to each frequency in horizontally polarized orientation and as the same polarized orientation with search antenna. Connect the tuned dipole antenna to a standard signal generator (SG) via a low loss cable. Power on the SG and tune the right frequency in measuring as well as set SG at a appreciated output level. Rise and lower the search antenna to get the highest value on spectrum analyzer, and then hold this position. Adjust the SG output to get a identical value derived from step 3 on spectrum analyzer. Record this value for result calculated.
7. Repeat step 6 until all frequencies need to be measured were complete.
8. Repeat step 7 with both dipole antenna (horn antenna for above 1 GHz) and search antenna in vertical polarized orientations.

Figure 5 : Frequencies measured below 1 GHz configuration

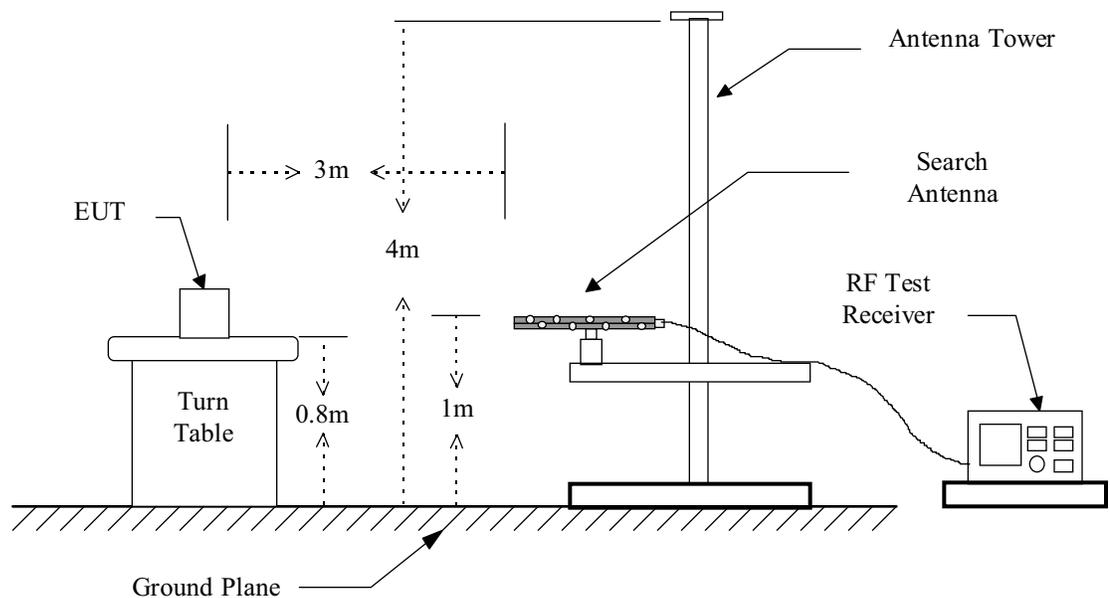
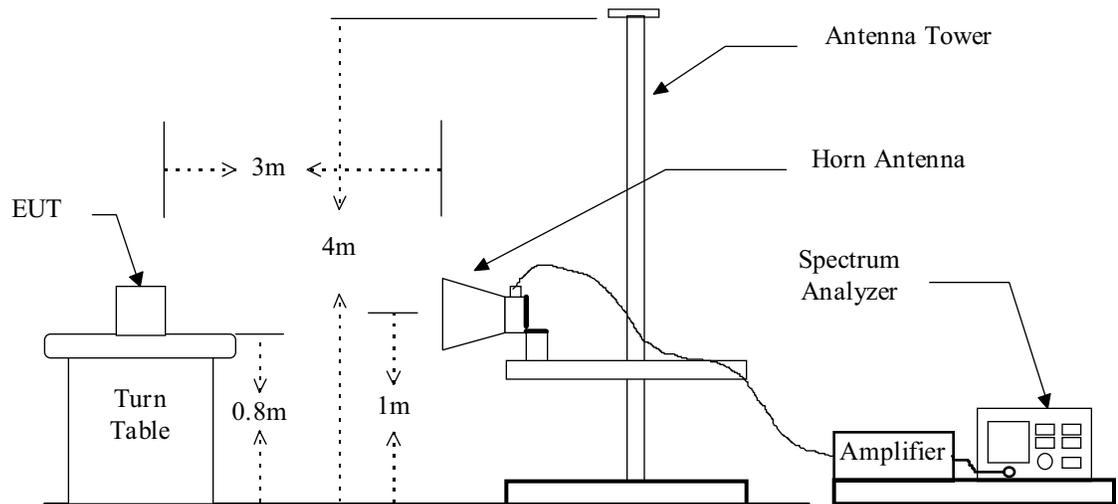


Figure 6 : Frequencies measured above 1 GHz configuration



### 7.3 Measuring Instrument

| Equipment            | Manufacturer    | Model No. | Next Cal. Date |
|----------------------|-----------------|-----------|----------------|
| Spectrum Analyzer    | Hewlett-Packard | 8568B     | Jan. 03, 2001  |
| Pre-selector         | Hewlett-Packard | 85685A    | Jan. 10, 2001  |
| Quasi Peak Detector  | Hewlett-Packard | 85650A    | Jan. 10, 2001  |
| Spectrum Analyzer    | Hewlett-Packard | 8564E     | Apr. 18, 2001  |
| Horn Antenna         | EMCO            | 3115      | May 11, 2001   |
| Log periodic Antenna | EMCO            | 3146      | Nov. 03, 2000  |
| Biconical Antenna    | EMCO            | 3110      | Nov. 03, 2000  |
| Preamplifier         | Hewlett-Packard | 8449B     | May. 09, 2001  |
| Preamplifier         | Hewlett-Packard | 8447D     | Sep. 19, 2000  |

Measuring instrument setup in frequency band measured is as following :

| Frequency Band (MHz) | Instrument        | Function | Resolution bandwidth | Video Bandwidth |
|----------------------|-------------------|----------|----------------------|-----------------|
| 30 to 1000           | Spectrum Analyzer | Peak     | 100 kHz              | 100 kHz         |
| Above 1000           | Spectrum Analyzer | Peak     | 1 MHz                | 1 MHz           |

## 7.4 Measurement Data

### a) Channel 1

Operated mode : Transmitting                      Test Date : Jun. 01, 2000  
 Temperature : 24 °C                                  Humidity : 61 %  
 Fundamental Frequency: 462.5625 MHz

Unmodulated carrier output power is 18.56 dBm , or 0.072 W (ERP).

The limit of spurious or harmonics is calculated as following :

$$18.56-[43+10\log(\text{carrier output power in W})], \text{ or } -13\text{dBm}$$

| Frequency<br>(MHz) | Meter<br>Reading<br>(dBuV) | SG Reading<br>(dBm) | Cable<br>Loss<br>(dB) | Antenna<br>Gain<br>Corrected | Result<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------|----------------------------|---------------------|-----------------------|------------------------------|-----------------|----------------|----------------|
| 925.108            | 45.6                       | -11.3               | -2.8                  | 0                            | -14.1           | -13            | -1.1           |
| 1387.662           | 82.0                       | -23.37              | -1.3                  | 6.2                          | -18.5           | -13            | -5.5           |
| 1850.216           | 65.2                       | -24.30              | -1.7                  | 7.4                          | -18.6           | -13            | -5.6           |
| 2312.770           | 72.3                       | -27.27              | -1.7                  | 7.3                          | -21.7           | -13            | -8.7           |
| 2775.324           | 74.5                       | -29.10              | -1.7                  | 7.5                          | -23.3           | -13            | -10.3          |
| 3237.878           | 69.5                       | -21.77              | -1.7                  | 7.7                          | -15.8           | -13            | -2.8           |
| 3700.432           | 74.5                       | -22.28              | -2.1                  | 7.6                          | -16.8           | -13            | -3.8           |
| 4162.986           | 67.5                       | -31.53              | -2.1                  | 8.1                          | -25.5           | -13            | -12.5          |
| 4625.540           | 66.3                       | -29.70              | -2.1                  | 8.9                          | -22.9           | -13            | -9.9           |

Note :

1. Result calculation is as following :

$$\text{Result} = \text{SG Reading} + \text{Cable Loss} + \text{Antenna Gain Corrected}$$

Antenna Gain Corrected : is used for antenna other than dipole to convert radiated power to ERP.

Operation Mode : Receiving

Fundamental Frequency : 483.970 MHz (Rx)

Test Date : Jun. 01, 2000

Temperature : 24 °C

Humidity : 61%

| Frequency<br>(MHz) | Reading (dBuV) @3m |     |           | Factor<br>(dB)<br>Corr. | Result @3m<br>(dBuV/m) |      | Limit @3m<br>(dBuV/m) |         | Margin<br>(dB) | Table<br>Deg.<br>(Deg.) | Ant.<br>High<br>(m) |     |
|--------------------|--------------------|-----|-----------|-------------------------|------------------------|------|-----------------------|---------|----------------|-------------------------|---------------------|-----|
|                    | H<br>Peak          | Ave | V<br>Peak |                         | Peak                   | Ave  | Peak                  | Ave./OP |                |                         |                     |     |
| 483.962            | 40.5               | --- | 47.2      | ---                     | -4.5                   | 42.7 | ---                   | N/A     | 46.0           | -3.3                    | 0                   | 1.5 |
| 967.924            | 32.1               | --- | 34.9      | ---                     | 3.3                    | 38.2 | ---                   | 74.0    | 54.0           | -15.8                   | 0                   | 2.3 |
| 1451.886           | ---                | --- | ---       | ---                     | -7.7                   | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | --- |
| 1935.848           | ---                | --- | ---       | ---                     | -5.0                   | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | --- |
| 2419.810           | ---                | --- | ---       | ---                     | -3.0                   | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | --- |
| 2903.772           | ---                | --- | ---       | ---                     | -1.5                   | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | --- |
| 3387.734           | ---                | --- | ---       | ---                     | -0.3                   | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | --- |
| 3871.696           | ---                | --- | ---       | ---                     | 1.5                    | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | --- |
| 4355.658           | ---                | --- | ---       | ---                     | 2.0                    | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | --- |
| 4839.620           | ---                | --- | ---       | ---                     | 2.6                    | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | --- |

Note :

1. Remark “---” means that the emission level is too low to be measured (a pre-amplifier of about 35 dB is used).
2. Margins are derived from Peak or Average whichever is lower. If there is only peak value in Result field, the Margin is also referred to average limits.

## b) Channel C

Operated mode : Transmitting                      Test Date : Jun. 02, 2000  
 Temperature : 28 °C                                      Humidity : 57 %  
 Fundamental Frequency: 467.7125 MHz

Unmodulated carrier output power is 20.46 dBm , or 0.111W (ERP).

The limit of spurious or harmonics is calculated as following :

$$20.46-[43+10\log(\text{carrier output power in W})], \text{ or } -13\text{dBm}$$

| Frequency<br>(MHz) | Meter<br>Reading<br>(dBuV) | SG Reading<br>(dBm) | Cable<br>Loss<br>(dB) | Antenna<br>Gain<br>Corrected | Result<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------|----------------------------|---------------------|-----------------------|------------------------------|-----------------|----------------|----------------|
| 935.402            | 49.9                       | -11.86              | -2.8                  | 0                            | -14.7           | -13            | -1.7           |
| 1403.103           | 45.9                       | -21.17              | -1.3                  | 7.2                          | -15.3           | -13            | -2.3           |
| 1870.804           | 51.5                       | -21.5               | -1.7                  | 7.4                          | -15.8           | -13            | -2.8           |
| 2338.505           | 45.3                       | -27.87              | -1.7                  | 7.3                          | -22.3           | -13            | -9.3           |
| 2806.206           | 48.6                       | -25.40              | -1.7                  | 7.5                          | -19.6           | -13            | -6.6           |
| 3273.907           | 49.7                       | -22.13              | -1.7                  | 7.7                          | -16.1           | -13            | -3.1           |
| 3741.608           | 44.9                       | -21.60              | -2.1                  | 7.6                          | -16.1           | -13            | -3.1           |
| 4209.309           | 37.1                       | -30.23              | -2.1                  | 8.1                          | -24.2           | -13            | -11.2          |
| 4677.010           | 38.5                       | -29.67              | -2.1                  | 8.9                          | -22.9           | -13            | -9.9           |

Note :

1. Result calculation is as following :

$$\text{Result} = \text{SG Reading} + \text{Cable Loss} + \text{Antenna Gain Corrected}$$

Antenna Gain Corrected : is used for antenna other than dipole to convert radiated power to ERP.

Operation Mode : Receiving

Fundamental Frequency : 488.970 MHz (Rx)

Test Date : Jun. 01, 2000

Temperature : 24 °C

Humidity : 61%

| Frequency<br>(MHz) | Reading (dBuV) @3m |     |           | Factor<br>(dB)<br>Corr. | Result @3m<br>(dBuV/m) |      | Limit @3m<br>(dBuV/m) |         | Margin<br>(dB) | Table<br>Deg.<br>(Deg.) | Ant.<br>High<br>(m) |      |
|--------------------|--------------------|-----|-----------|-------------------------|------------------------|------|-----------------------|---------|----------------|-------------------------|---------------------|------|
|                    | H<br>Peak          | Ave | V<br>Peak |                         | Peak                   | Ave  | Peak                  | Ave./QP |                |                         |                     |      |
| 489.114            | 39.9               | --- | 47.4      | ---                     | -4.4                   | 43.0 | ---                   | N/A     | 46.0           | -3.0                    | 0                   | 1.40 |
| 978.228            | 34.7               | --- | 37.1      | ---                     | 3.4                    | 40.5 | ---                   | 74.0    | 54.0           | -13.5                   | 45                  | 1.40 |
| 1467.342           | ---                | --- | ---       | ---                     | -7.6                   | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | ---  |
| 1956.456           | ---                | --- | ---       | ---                     | -4.9                   | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | ---  |
| 2445.570           | ---                | --- | ---       | ---                     | -2.9                   | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | ---  |
| 2934.684           | ---                | --- | ---       | ---                     | -1.4                   | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | ---  |
| 3423.798           | ---                | --- | ---       | ---                     | -0.2                   | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | ---  |
| 3912.912           | ---                | --- | ---       | ---                     | 1.6                    | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | ---  |
| 4402.026           | ---                | --- | ---       | ---                     | 2.0                    | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | ---  |
| 4891.140           | ---                | --- | ---       | ---                     | 2.7                    | ---  | ---                   | 74.0    | 54.0           | ---                     | ---                 | ---  |

Note :

1. Remark “---” means that the emission level is too low to be measured (a pre-amplifier of about 35 dB is used).
2. Margins are derived from Peak or Average whichever is lower. If there is only peak value in Result field, the Margin is also referred to average limits.

## 8. FREQUENCY STABILITY MEASUREMENT

### 8.1 Provisions Applicable

According to § 2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  centigrade.

According to § 2.1055 (d)(2), for hand carried, battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point which is specified by the manufacturer.

According to § 95.627 (b), the FRS unit must be maintained within a frequency tolerance of 0.00025%.

### 8.2 Measurement Procedure

#### A) Frequency stability versus environmental temperature

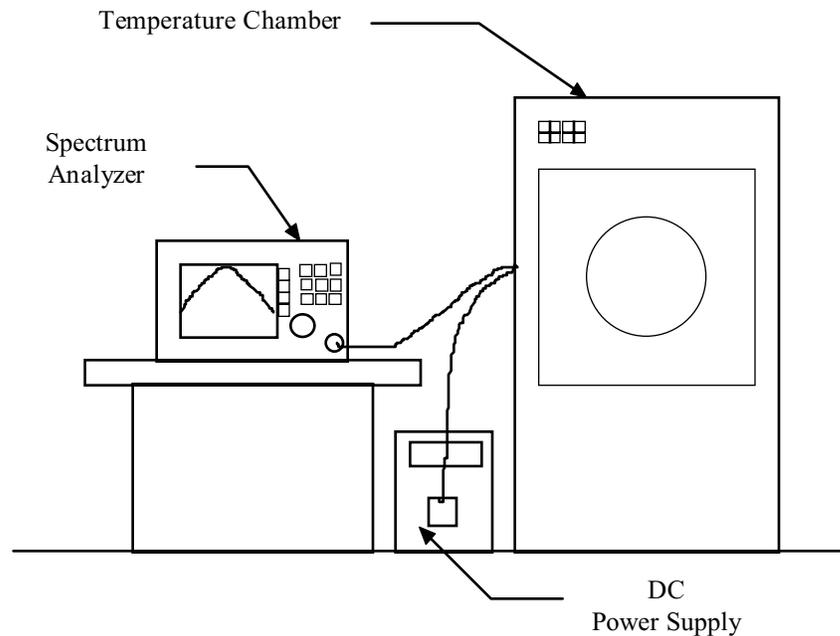
1. Setup the configuration per figure 7 for frequencies measured at ambient temperature if it is within  $15^{\circ}\text{C}$  to  $25^{\circ}\text{C}$ . Otherwise, an environmental chamber set for a temperature of  $20^{\circ}\text{C}$  shall be used. Install new batteries in the EUT.
2. Turn on EUT and set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. Set the temperature of chamber to  $50^{\circ}\text{C}$ . Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a  $10^{\circ}\text{C}$  decreased per stage until the lowest temperature  $-30^{\circ}\text{C}$  is measured, record all measurement frequencies.

#### B) Frequency stability versus input voltage

1. Setup the configuration per figure 7 for frequencies measured at ambient temperature if it is within  $15^{\circ}\text{C}$  to  $25^{\circ}\text{C}$ . Otherwise, an environmental chamber set for a temperature of  $20^{\circ}\text{C}$  shall be used. Install new batteries in the EUT.

2. Set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. For battery operated only device, supply the EUT primary voltage at the battery operating end point which is specified by the manufacturer and record the frequency.

Figure 7 : Frequency stability measurement configuration



### 8.3 Measurement Instrument

| Equipment                 | Manufacturer    | Model No. | Next Cal. Date |
|---------------------------|-----------------|-----------|----------------|
| Spectrum Analyzer         | Adventest       | R3361A    | Mar. 22, 2001  |
| Temperature Chamber       | ACS             | EOS 200T  | Jan. 10, 2001  |
| Modulation Analyzer       | Hewlett-Packard | 8901A     | Dec. 01, 2000  |
| Multifunction Synthesizer | Hewlett-Packard | 8904A     | Dec. 01, 2000  |

## 8.4 Measurement Data

### A) Frequency stability versus environmental temperature

| Environment     |                            | Reference Frequency: 462.5624 (MHz) Limit: 0.00025 (%) |          |          |          |           |          |
|-----------------|----------------------------|--|----------|----------|----------|-----------|----------|
| Tempure<br>(°C) | Power<br>Supplied<br>(Vdc) | Frequency deviation measured with time elapse          |          |          |          |           |          |
|                 |                            | 2 minute   |          | 5 minute |          | 10 minute |          |
|                 |                            | (MHz)  | (%)      | (MHz)    | (%)      | (MHz)     | (%)      |
| 50              | New Batt                   | 462.5621   | -0.00006 | 462.5624 | 0.00000  | 462.5622  | -0.00004 |
| 40              | New Batt                   | 462.5624   | 0.00000  | 462.5616 | -0.00017 | 462.5626  | 0.00004  |
| 30              | New Batt                   | 462.5623   | -0.00002 | 462.5622 | -0.00004 | 462.5622  | -0.00004 |
| 20              | New Batt                   | 462.5621   | -0.00006 | 462.5633 | 0.00019  | 462.5630  | 0.00013  |
| 10              | New Batt                   | 462.5620   | -0.00009 | 462.5618 | -0.00013 | 462.5621  | -0.00006 |
| 0               | New Batt                   | 462.5629   | 0.00011  | 462.5623 | -0.00002 | 462.5625  | 0.00002  |
| -10             | New Batt                   | 462.5617   | -0.00015 | 462.5628 | 0.00009  | 462.5620  | -0.00009 |
| -20             | New Batt                   | 462.5629   | 0.00011  | 462.5618 | -0.00013 | 462.5622  | -0.00004 |
| -30             | New Batt                   | 462.5628   | 0.00009  | 462.5618 | -0.00013 | 462.5619  | -0.00011 |

| Environment     |                            | Reference Frequency: 467.7127 (MHz) Limit: 0.00025 (%) |          |          |          |           |          |
|-----------------|----------------------------|--|----------|----------|----------|-----------|----------|
| Tempure<br>(°C) | Power<br>Supplied<br>(Vdc) | Frequency deviation measured with time elapse          |          |          |          |           |          |
|                 |                            | 2 minute   |          | 5 minute |          | 10 minute |          |
|                 |                            | (MHz)  | (%)      | (MHz)    | (%)      | (MHz)     | (%)      |
| 50              | New Batt                   | 467.7129   | 0.00004  | 467.7118 | -0.00019 | 467.7135  | 0.00017  |
| 40              | New Batt                   | 467.7132   | 0.00011  | 467.7131 | 0.00009  | 467.7126  | -0.00002 |
| 30              | New Batt                   | 467.7119   | -0.00017 | 467.7132 | 0.00011  | 467.7134  | 0.00015  |
| 20              | New Batt                   | 467.7130   | 0.00006  | 467.7122 | -0.00011 | 467.7124  | -0.00006 |
| 10              | New Batt                   | 467.7123   | -0.00009 | 467.7118 | -0.00019 | 467.7136  | 0.00019  |
| 0               | New Batt                   | 467.7136   | 0.00019  | 467.7122 | -0.00011 | 467.7132  | 0.00011  |
| -10             | New Batt                   | 467.7128   | 0.00002  | 467.7119 | -0.00017 | 467.7119  | -0.00017 |
| -20             | New Batt                   | 467.7130   | 0.00006  | 467.7128 | 0.00002  | 467.7119  | -0.00017 |
| -30             | New Batt                   | 467.7121   | -0.00013 | 467.7124 | -0.00006 | 467.7130  | 0.00006  |

## B) Frequency stability versus input voltage (battery operating end point voltage is 4.5V dc)

| Channel | Reference Frequency ( MHz ) | Frequency measured at end point supply voltage (MHz) | Frequency Deviation ( % ) | Limit (%) |
|---------|-----------------------------|--|---------------------------|-----------|
| 1       | 462.5624                    | 462.5616   | -0.00017                  | 0.00025   |
| 14      | 467.7127                    | 467.7134   | 0.00015                   | 0.00025   |