# *FCC Part 74 Subpart H*

# *EMI TEST REPORT*

*of*

E.U.T. : Wireless Microphone TX

FCC ID. : NTMEJ-880T

MODEL : EJ-880T

Working Frequency : 744MHz-806MHz

*for*

APPLICANT : E-J ELECTRONICS CO., LTD.
ADDRESS : 4F, No.11, Lane 125, Sec 1, Kuo Kwang Road
Ta Li City, Taichung Hsien Taiwan R.O.C.

Test Performed by

**ELECTRONICS TESTING CENTER, TAIWAN**
NO. 34, LIN 5, DING FU TSUN, LINKOU HSIANG
TAIPEI HSIEN, TAIWAN, R.O.C.

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Report Number : ET92R-06-058-04

# *TEST REPORT CIRTIFICATION*

Applicant : E-J ELECTRONICS CO., LTD.
4F, No.11, Lane 125, Sec 1, Kuo Kwang Road Ta Li City,
Taichung Hsien Taiwan R.O.C.

Manufacturer : E-J ELECTRONICS CO., LTD..
4F, No.11, Lane 125, Sec 1, Kuo Kwang Road Ta Li City, Taichung Hsien Taiwan R.O.C.

Description of EUT :

| | |
|---|---|
| a) Type of EUT | : Wireless Microphone TX |
| b) Trade Name | : OKAYO |
| c) Model No. | : EJ-880T |
| d) FCC ID | : NTMEJ-880T |
| e) Working Frequency | : 744MHz-806MHz |
| f) Power Supply | : Input：AC 100~240V；50/60Hz 250mA<br>Output：DC 11V；800mA |

Regulation Applied : FCC Rules and Regulations Part 74 Subpart H (2002)

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 : Aug. 25, 2003

Test Engineer : kevin Lee
( Kevin Lee )

Approve & Authorized Signer : Will Yauo
Will Yauo, Manager
EMC Dept. II of ELECTRONICS
TESTING CENTER, TAIWAN

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# 1. GENERAL INFORMATION

## 1.1 Product Description

| | |
|---|---|
| a) Type of EUT | : Wireless Microphone TX |
| b) Trade Name | : OKAYO |
| c) Model No. | : EJ-880T |
| d) FCC ID | : NTMEJ-880T |
| e) Working Frequency | : 744MHz-806MHz |
| f) Power Supply | : Input：AC 100~240V~；50/60Hz 250mA<br>Output：DC 11V；800mA |

## 1.2 Characteristics of Device:

The EUT is A frequency modulation Wireless Microphone with following feature:Operation Frequency Range:740-806MHz. Type of Modulation:FM, 172KF3E. This Wireless Microphone operates within UHF band with PLL synthesized. There are 16 channel available and channel used can be selected from a DIP switch.

## 1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in chapter 13 of ANSI C63.4. and section 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, and 2.1055 of Part 2 of CFR 47

## 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, Lin 5, Ding Fu Tsun, Linkou Hsiang, Taipei Hsien, 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. 74.802 of Part 74, the following frequencies are available for low power auxiliary station :

Frequencies (MHz)

| | |
|---|---|
| 26.100-26.480 | 455.000-456.000 |
| 54.000-72.000 | 470.000-488.000 |
| 76.000-88.000 | 488.000-494.000 |
| 161.625-161.775 | 614.000-806.000 |
| 174.000-216.000 | 450.000-451.000 |
| 944.000-952.000 | |

## 2.3 Requirements for Radio Equipment on Certification

### (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

For radiotelephone transmitter, other than single sideband or indenpent sideband transmitter, when modulateed by a 2.5kHz 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）.

# 3. OUTPUT POWER MEASUREMENT

## 3.1 Provision Applicable

According to § 74.861(e)(1)(ii), the output power shall not exceed 250 milliwatts.

## 3.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 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 1MHz 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◦ to 360 ◦ , 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 2 : Frequencies measured below 1 GHz configuration

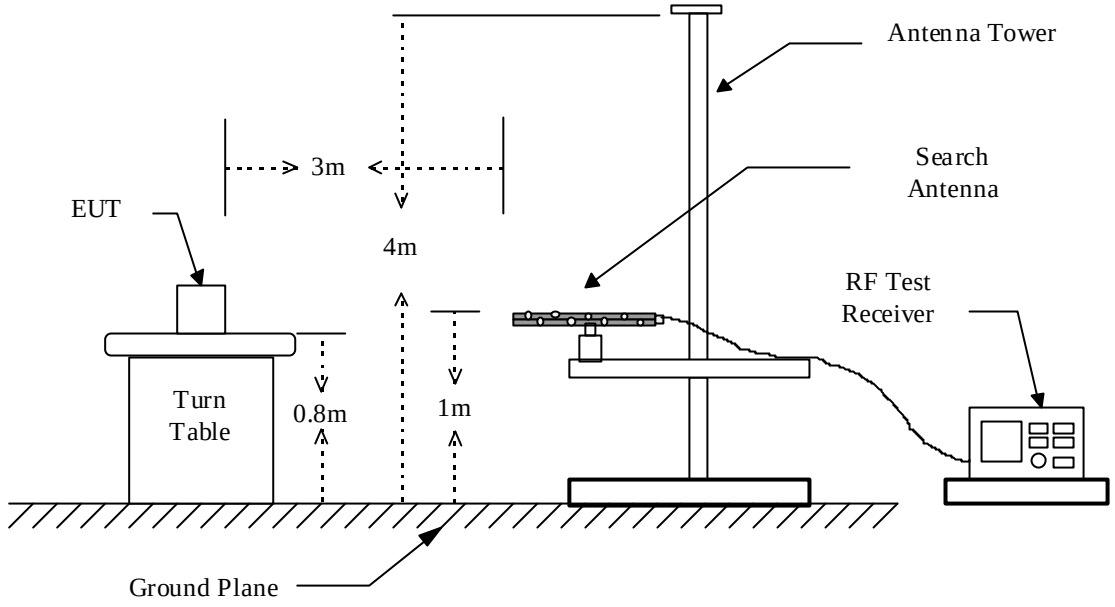
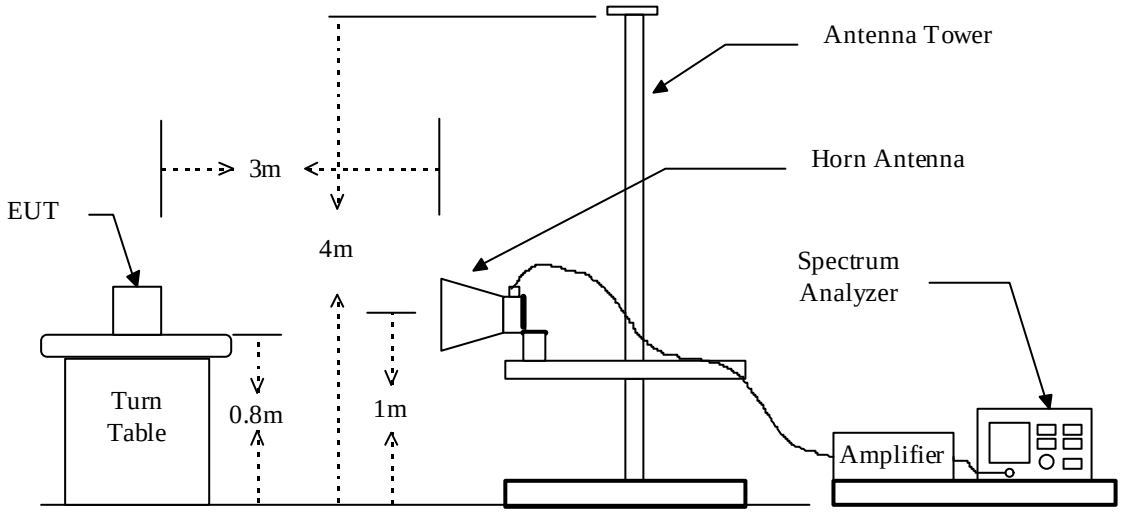



Figure 1 : Frequencies measured above 1 GHz configuration



## 3.3 Test Data

### A. Channel Low (ERP)

Operated mode : TX Test Date : Jul. 05, 2003
Temperature : 24 ℃ Humidity : 57 %

| Frequency (MHz) | Meter Reading (dB μV/m) | SG Reading (dBm) | Cable Loss (dB) | Antenna Gain | Result (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|---|---|
| 744.210 | 74.9 | 5.0 | 2.5 | --- | 2.5 | 1.78 | 250 |

### B. Channel Mid (ERP)

Operated mode : TX Test Date : Jul. 05, 2003
Temperature : 24 ℃ Humidity : 57 %

| Frequency (MHz) | Meter Reading (dB μV/m) | SG Reading (dBm) | Cable Loss (dB) | Antenna Gain | Result (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|---|---|
| 794.810 | 74.7 | 4.9 | 2.6 | --- | 3.9 | 2.45 | 250 |

### C. Channel High (ERP)

Operated mode : TX Test Date : Jul. 05, 2003
Temperature : 24 ℃ Humidity : 57 %

| Frequency (MHz) | Meter Reading (dB μV/m) | SG Reading (dBm) | Cable Loss (dB) | Antenna Gain | Result (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|---|---|
| 805.310 | 73.1 | 3.3 | 2.6 | --- | 2.2 | 1.65 | 250 |

**Note: For measured frequency below 1GHz, a tuned dipole antenna is used.**

## 3.4 Result Calculation

Result calculation is as following :

Result = SG Reading + Cable Loss + Antenna Gain Corrected

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

$$mW = \log^{-1}[\frac{Result(dBm)}{10}]$$

## 3.5 Test Equipment

| Equipment | Manufacturer | Model No. | Next Cal. Date |
|---|---|---|---|
| EMI Test Receiver | R&S | ESBI | 05/24/2004 |
| Plotter | HP | 7440A | N/A |

# 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.

## 4.2 Measurement Method

A) Frequency response of audio circuits

1. Position the EUT as shown in figure 3.

2. Vary the modulating frequency from 100 Hz to 5000 Hz with varying the input voltage from 0V to maximum permitted input voltage, and observe the change in output.

B) Modulation Limit

1. Position the EUT as shown in figure 3, adjust the audio input frequency to 100 Hz and the input level from 0V to maximum permitted input voltage with recording each carrier frequency deviation responding to respective input level.

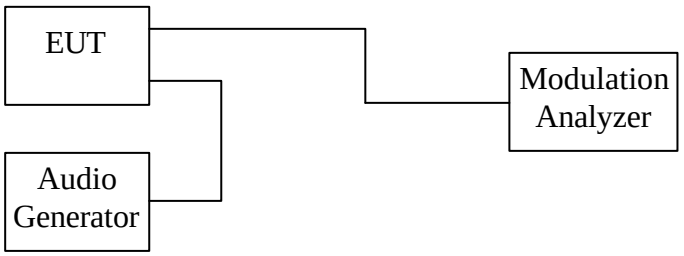
2. Repeat step 1 with changing the input frequency for 200, 500, 1000, 3000, and 5000 Hz in sequence.

C) Frequency response of all circuits

1. Position the EUT as shown in figure 3.

2. Vary the modulating frequency from 100 Hz to 15000 Hz with constant input voltage (derived from 5.4(a) of this test report), and observe the change in output.

Figure 3 : Modulation characteristic measurement configuration

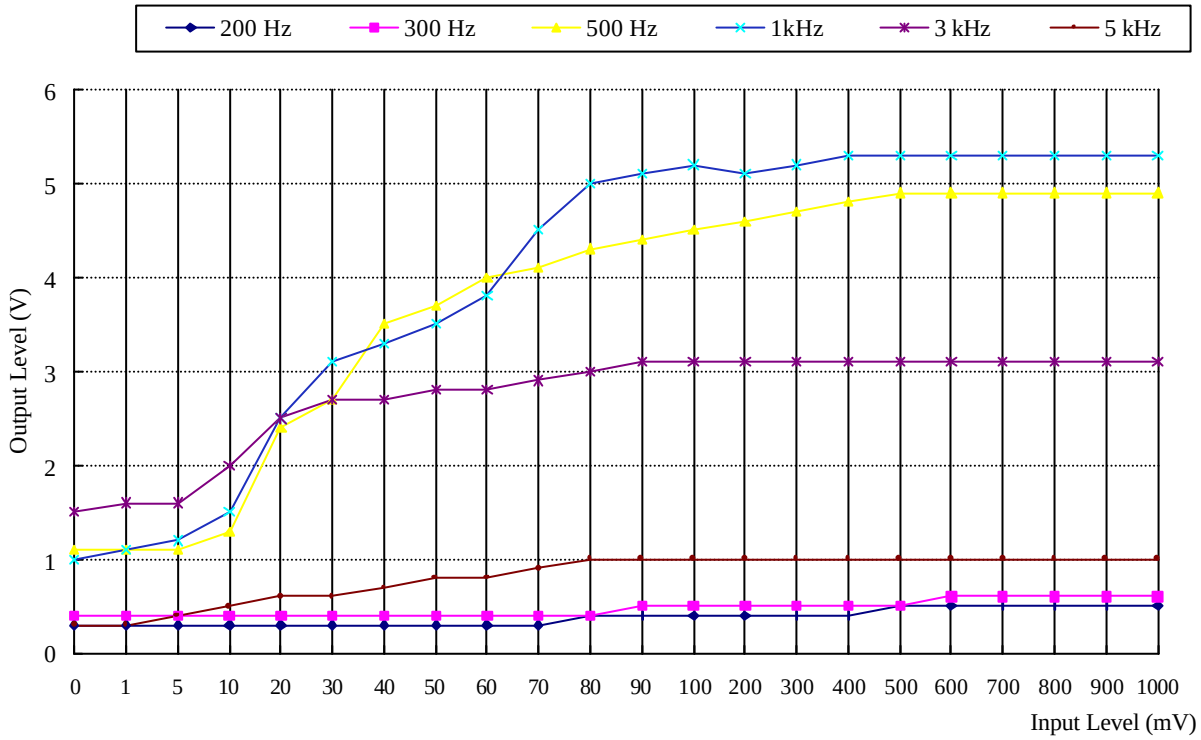


## 4.3 Measurement Instrument

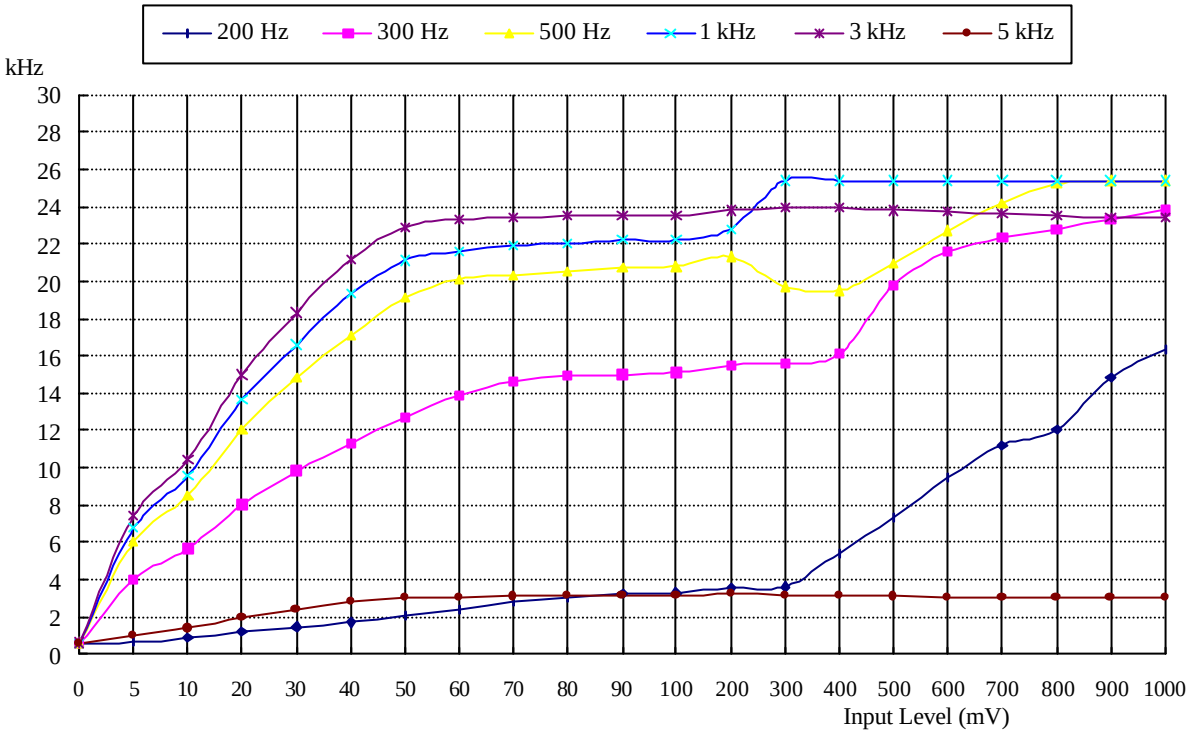
| Equipment | Manufacturer | Model No. | Next Cal. Date |
|---|---|---|---|
| Modulation Analyzer | Hewlett-Packard | 8901A | 12/01/2003 |
| Multifunction Synthesizer | Hewlett-Packard | 8904A | 12/07/2003 |
| Oscillscope | Lecroy | 9350A | 05/25/2004 |

## 4.4 Measurement Result

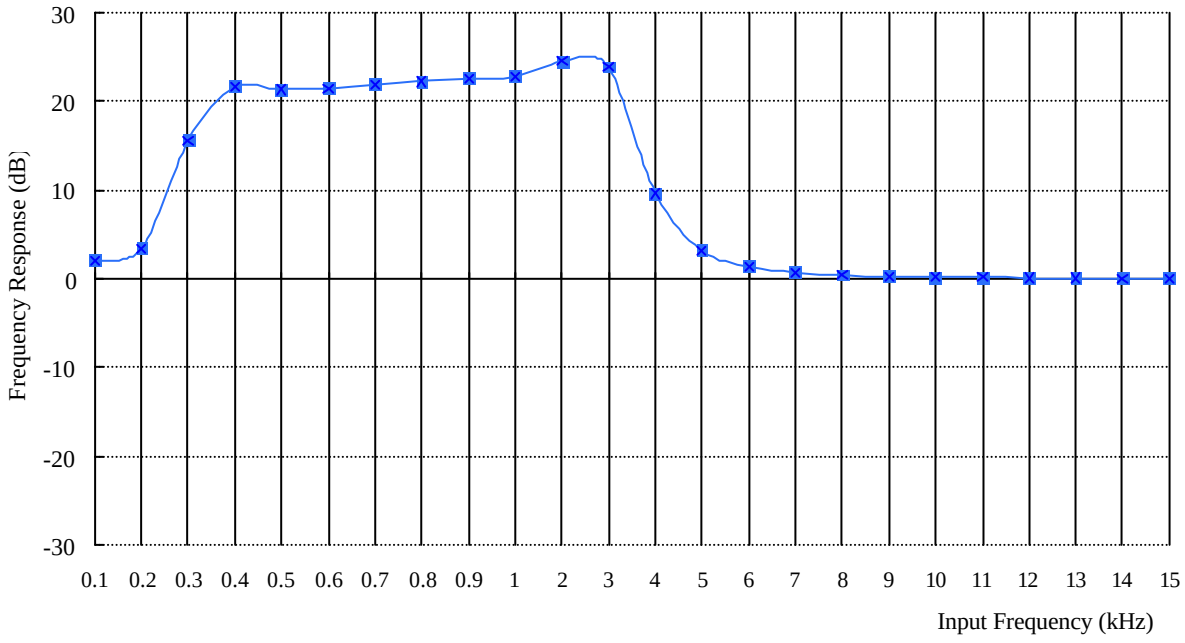
A). Frequency response



B). Modulation Limit




C). Frequency response of all circuits



# 5. OCCUPIED BANDWIDTH OF EMISSION

## 5.1 Provisions Applicable

According to § 2.1049 (c)(1), For radiotelephone transmitter, other than single sideband or indenpent sideband transmitter, when modulateed by a 2.5kHz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.
According to § 74.861( e)(5), the frequency emission bandwidth shall not exceed 200 kHz.

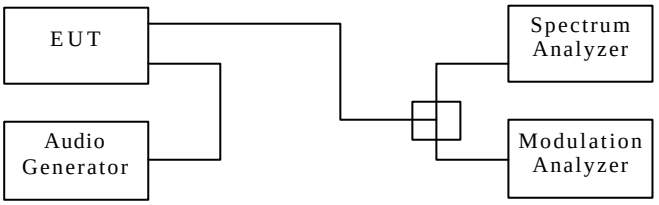
## 5.2 Measurement Method

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 4, and Install new batteries in the EUT. Turn on the EUT ant 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 4 : Occupied bandwidth measurement configuration



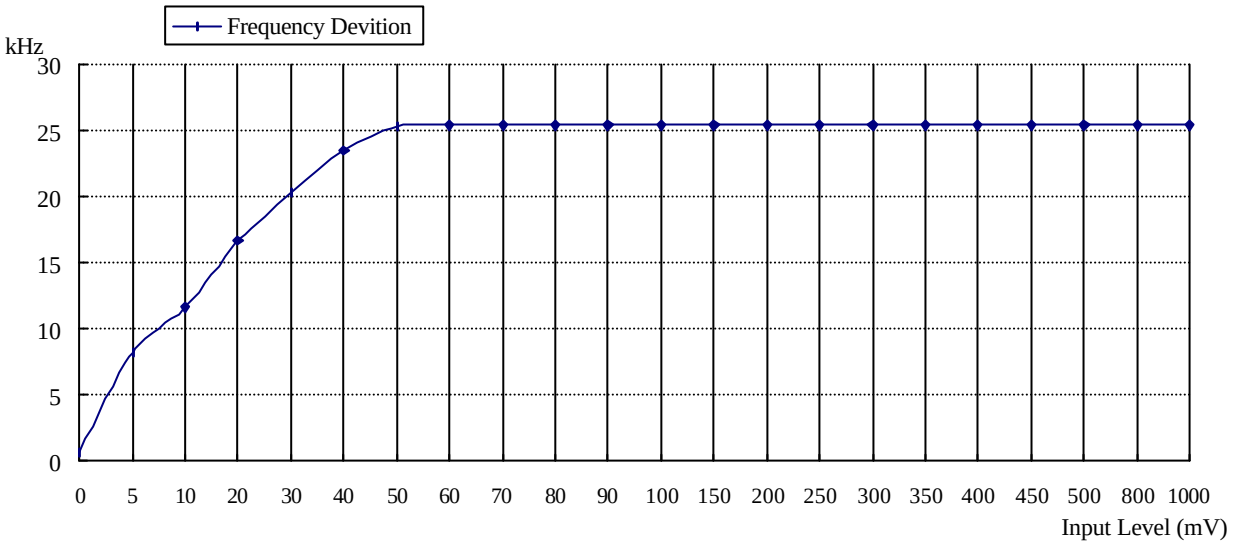

## 5.3 Occupied Bandwidth Test Equipment

| Equipment | Manufacturer | Model No. | Next Cal. Date |
|---|---|---|---|
| Spectrum Analyzer | R&S | ESBI | 05/24/2004 |
| Modulation Analyzer | Hewlett-Packard | 8901A | 12/01/2003 |
| Multifunction Synthesizer | Hewlett-Packard | 8904A | 12/07/2003 |
| Plotter | Hewlett-Packard | 7440A | N/A |

## 5.4 Bandwidth Measured

### 5.4.1 Input Level Derived

Input Audio Frequency : 2.5 kHz, Sine Wave




The Level input to produce 50 % modulation is 20 mV, therefore the magnitude 16 dB greater than it is 126 mV.

### 5.4.2 Occupied Bandwidth Plotted

The Channel Low 26 dB Bandwidth is 100.5KHz.
The Channel Mid 26 dB Bandwidth is 103.3KHz.
The Channel High 26 dB Bandwidth is 111.1KHz.

**Please see appendix 1 for plotted data.**

# 6. FIELD STRENGTH OF EMISSION

## 6.1 Provisions Applicable

According to § 2.1053, 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 § 74.861(e)(6), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the follwing sceedule:

(i) on any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB.

(ii) on any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB.

(iii) on any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth shall be attenuated below the unmodulated carrier by at least 43 plus 10 Log(output power in watts) dB.

## 6.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 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 1MHz 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◦ to 360 ◦ , 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.

## 6.3 Measuring Instrument

| Equipment | Manufacturer | Model No. | Next Cal. Date |
|---|---|---|---|
| Spectrum Analyzer | Hewlett-Packard | 8568B | 01/09/2004 |
| Quasi Peak Detector | Hewlett-Packard | 85650A | 01/09/2004 |
| Pre-selector | Hewlett-Packard | 85685A | 01/09/2004 |
| Spectrum Analyzer | Hewlett-Packard | 8564E | 05/16/2004 |
| Horn Antenna | EMCO | 3115 | 05/14/2004 |
| Log periodic Antenna | EMCO | 3146 | 11/05/2003 |
| Biconical Antenna | EMCO | 3110B | 11/05/2003 |
| Preamplifier | Hewlett-Packard | 8449B | 05/10/2004 |
| Preamplifier | Hewlett-Packard | 8447D | 09/29/2003 |
| EMC Analyzer | Agilent | E7405A | 07/01/2004 |

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 |

## 6.4 Measuring Data

### A. Channel Low

Operated mode : TX Test Date : Jul. 05, 2003
Temperature : 25℃ Humidity : 65%

Unmodulated carrier output power is –2.5 dBm , or 1.78 mW (ERP).

The limit of spurious or harmonics is calculated as following :

-2.5-[43+10log(carrier output power in W)], or -13dBm

| Frequency (MHz) | Meter Reading (dBuV) H | V | SG Reading (dBm) H | V | Antenna Gain | Cable Loss (dB) | Result (dBm) H | V | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1240.504 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 1860.756 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 2481.008 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 3101.260 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 3721.512 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 4341.764 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 4962.016 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 5582.268 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 6202.520 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |

Note :

1. Remark "---" means that the emission level is too weak to be detected.
2. For measured frequency below 1GHz, a tuned dipole antenna is used.
3. Result calculation is as following :

   Result = SG Reading + Cable Loss + Antenna Gain Corrected

   Antenna Gain Corrected : is used for antenna other than dipole to convert radiated power to ERP.
4. Spurious or harmonics above 1 GHz is too low to be detected or attenuated more than 60 dB from limit value.

**B. Channel Mid**

Operated mode : TX Test Date : Jul. 05, 2003
Temperature : 25℃ Humidity : 65%

Unmodulated carrier output power is 3.9 dBm , or 2.45 mW (ERP).

The limit of spurious or harmonics is calculated as following :

3.9-[43+10log(carrier output power in W)], or -13dBm

| Frequency (MHz) | Meter Reading (dBuV) H | V | SG Reading (dBm) H | V | Antenna Gain | Cable Loss (dB) | Result (dBm) H | V | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1480.500 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 2220.753 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 2961.004 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 3701.255 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 4441.506 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 5181.757 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 5922.008 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 6662.259 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 7402.510 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |

Note :

1. Remark "---" means that the emission level is too weak to be detected.
2. For measured frequency below 1GHz, a tuned dipole antenna is used.
3. Result calculation is as following :

   Result = SG Reading + Cable Loss + Antenna Gain Corrected

   Antenna Gain Corrected : is used for antenna other than dipole to convert radiated power to ERP.
4. Spurious or harmonics above 1 GHz is too low to be detected or attenuated more than 60 dB from limit value.

**C. Channel High**

Operated mode : TX Test Date : Jul. 05, 2003
Temperature : 25℃ Humidity : 65%

Unmodulated carrier output power is 2.2 dBm , or 1.65 mW (ERP).

The limit of spurious or harmonics is calculated as following :

2.2-[43+10log(carrier output power in W)], or -13dBm

| Frequency (MHz) | Meter Reading (dBuV) H | V | SG Reading (dBm) H | V | Antenna Gain | Cable Loss (dB) | Result (dBm) H | V | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1604.004 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 2406.006 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 3208.008 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 4010.010 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 4812.012 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 5614.014 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 6416.016 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 7218.018 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |
| 8020.020 | --- | --- | --- | --- | --- | --- | --- | --- | -13.0 | --- |

Note :

1. Remark "---" means that the emission level is too weak to be detected.
2. For measured frequency below 1GHz, a tuned dipole antenna is used.
3. Result calculation is as following :

   Result = SG Reading + Cable Loss + Antenna Gain Corrected

   Antenna Gain Corrected : is used for antenna other than dipole to convert radiated power to ERP.
4. Spurious or harmonics above 1 GHz is too low to be detected or attenuated more than 60 dB from limit value.

**D. Emission mask plots**

Please see appendix 2 for plotted data.

## 6.5 Radiated Measurement Photos

**Please See Exhibit_F Test Setup Photos**

# 7. FREQUENCY STABILITY MEASUREMENT

## 7.1 Provisions Applicable

According to §2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30°C to +50°C centigrade, and according to §2.1055 (d)(1), the frequency stability shall be measured with varying primary supply voltage from 85 to 115 percent of the nominal valve for other than hand carried battery equipmwnt.

According to §74.861(e)(4), the frequency tolerance of the transmitter shall be 0.005 percent.

## 7.2 Measurement Procedure

A) Frequency stability versus environmental temperature

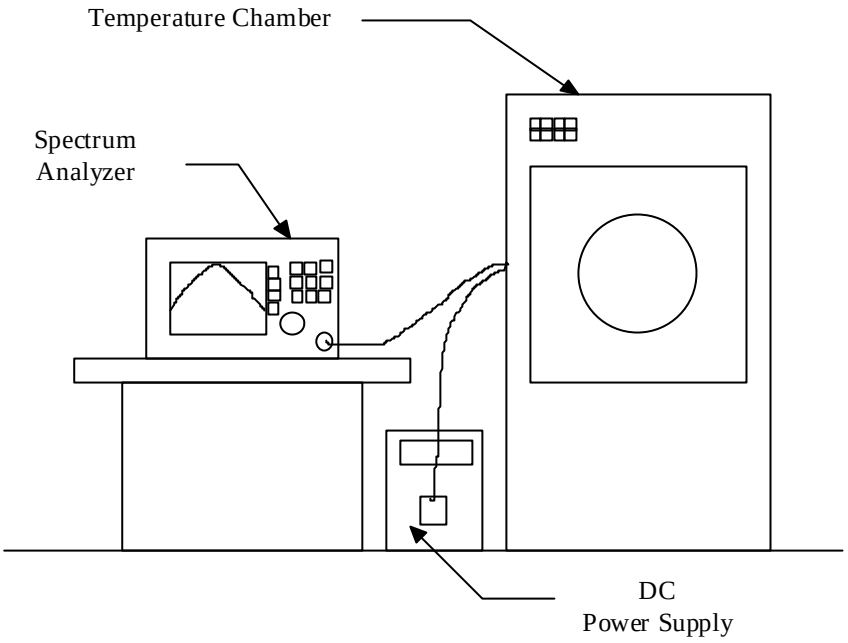
1. Setup the configuration per figure 5 for frequencies measured at ambient temperature if it is within 15°C to 25°C. Otherwise, an environmental chamber set for a temperature of 20°C shall be used. Install new batteries in the EUT.

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°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°C decreased per stage until the lowest temperature -30°C is measured, record all measurement frequencies.

Figure 5 : Frequency stability measurement configuration




## 7.3 Measurement Instrument

| Equipment | Manufacturer | Model No. | Next Cal. Date |
|---|---|---|---|
| Spectrum Analyzer | HP | 8564E | 04/13/2004 |
| Temperature Chamber | Mallier | MCT-2X-M | 10/08/2003 |

## 7.4 Measurement Data

A1. Frequency stability versus enviroment tempture

| Reference Frequency : 744.21 MHz | | Limit：0.005% | | | | | |
|---|---|---|---|---|---|---|---|
| Enviroment Tempture (℃) | Power Supplied (Vac) | Frequency measured with time elapsed | | | | | |
| | | 2 minute | | 5 minute | | 10 minute | |
| | | (MHz) | (%) | (MHz) | (%) | (MHz) | (%) |
| 50 | 102.00 | 744.1851 | -0.00335 | 744.2278 | 0.00240 | 744.2041 | -0.00080 |
| | 120.00 | 744.2335 | 0.00316 | 744.1927 | -0.00233 | 744.2338 | 0.00320 |
| | 138.00 | 744.2091 | -0.00012 | 744.1896 | -0.00274 | 744.1851 | -0.00335 |
| 40 | 102.00 | 744.2260 | 0.00215 | 744.2063 | -0.00049 | 744.2195 | 0.00128 |
| | 120.00 | 744.2038 | -0.00083 | 744.1858 | -0.00325 | 744.1848 | -0.00339 |
| | 138.00 | 744.1969 | -0.00176 | 744.2206 | 0.00142 | 744.1887 | -0.00287 |
| 30 | 102.00 | 744.2146 | 0.00062 | 744.2100 | 0.00000 | 744.2005 | -0.00128 |
| | 120.00 | 744.2163 | 0.00085 | 744.2372 | 0.00365 | 744.2155 | 0.00074 |
| | 138.00 | 744.2069 | -0.00042 | 744.2316 | 0.00290 | 744.2022 | -0.00105 |
| 20 | 102.00 | 744.2372 | 0.00365 | 744.2077 | -0.00030 | 744.2189 | 0.00120 |
| | 120.00 | 744.1849 | -0.00338 | 744.2362 | 0.00352 | 744.1891 | -0.00280 |
| | 138.00 | 744.2045 | -0.00074 | 744.2257 | 0.00211 | 744.1927 | -0.00233 |
| 10 | 102.00 | 744.1869 | -0.00310 | 744.2212 | 0.00151 | 744.2184 | 0.00114 |
| | 120.00 | 744.1816 | -0.00381 | 744.2058 | -0.00056 | 744.1964 | -0.00183 |
| | 138.00 | 744.1992 | -0.00145 | 744.2017 | -0.00112 | 744.1902 | -0.00267 |
| 0 | 102.00 | 744.2202 | 0.00138 | 744.1996 | -0.00140 | 744.1877 | -0.00300 |
| | 120.00 | 744.1908 | -0.00258 | 744.2209 | 0.00146 | 744.1818 | -0.00379 |
| | 138.00 | 744.2127 | 0.00036 | 744.1851 | -0.00335 | 744.1956 | -0.00194 |
| -10 | 102.00 | 744.2099 | -0.00001 | 744.2215 | 0.00155 | 744.1936 | -0.00221 |
| | 120.00 | 744.2030 | -0.00094 | 744.1841 | -0.00348 | 744.1896 | -0.00274 |
| | 138.00 | 744.2066 | -0.00046 | 744.2043 | -0.00077 | 744.1990 | -0.00147 |
| -20 | 102.00 | 744.2238 | 0.00185 | 744.2084 | -0.00021 | 744.1814 | -0.00384 |
| | 120.00 | 744.2071 | -0.00039 | 744.2128 | 0.00037 | 744.1952 | -0.00198 |
| | 138.00 | 744.1897 | -0.00272 | 744.2110 | 0.00013 | 744.2206 | 0.00142 |
| -30 | 102.00 | 744.2344 | 0.00328 | 744.1974 | -0.00170 | 744.2191 | 0.00123 |
| | 120.00 | 744.2109 | 0.00012 | 744.2274 | 0.00234 | 744.2279 | 0.00240 |
| | 138.00 | 744.1880 | -0.00296 | 744.2333 | 0.00313 | 744.2150 | 0.00068 |

## B1. Frequency stability versus enviroment tempture

| Reference Frequency : 794.81 MHz | | Limit：0.005% | | | | | |
|---|---|---|---|---|---|---|---|
| Enviroment Tempture (℃) | Power Supplied (Vac) | Frequency measured with time elapsed | | | | | |
| | | 2 minute | | 5 minute | | 10 minute | |
| | | (MHz) | (%) | (MHz) | (%) | (MHz) | (%) |
| 50 | 102.00 | 794.8200 | 0.00125 | 794.7846 | -0.00320 | 794.8020 | -0.00100 |
| | 120.00 | 794.8157 | 0.00071 | 794.7955 | -0.00183 | 794.8237 | 0.00172 |
| | 138.00 | 794.8378 | 0.00349 | 794.7848 | -0.00317 | 794.7812 | -0.00362 |
| 40 | 102.00 | 794.8024 | -0.00096 | 794.7845 | -0.00320 | 794.7826 | -0.00344 |
| | 120.00 | 794.8146 | 0.00057 | 794.8395 | 0.00371 | 794.8108 | 0.00010 |
| | 138.00 | 794.8198 | 0.00124 | 794.7989 | -0.00139 | 794.8271 | 0.00216 |
| 30 | 102.00 | 794.7874 | -0.00284 | 794.8011 | -0.00112 | 794.8216 | 0.00146 |
| | 120.00 | 794.7876 | -0.00281 | 794.8162 | 0.00077 | 794.8108 | 0.00010 |
| | 138.00 | 794.7867 | -0.00294 | 794.7900 | -0.00252 | 794.7839 | -0.00328 |
| 20 | 102.00 | 794.8111 | 0.00014 | 794.7985 | -0.00145 | 794.8200 | 0.00126 |
| | 120.00 | 794.7829 | -0.00341 | 794.8124 | 0.00030 | 794.8318 | 0.00274 |
| | 138.00 | 794.8047 | -0.00067 | 794.7840 | -0.00327 | 794.7964 | -0.00171 |
| 10 | 102.00 | 794.8245 | 0.00183 | 794.8374 | 0.00344 | 794.8397 | 0.00373 |
| | 120.00 | 794.8201 | 0.00127 | 794.8146 | 0.00057 | 794.8211 | 0.00140 |
| | 138.00 | 794.8258 | 0.00199 | 794.7925 | -0.00220 | 794.8325 | 0.00283 |
| 0 | 102.00 | 794.8080 | -0.00025 | 794.8349 | 0.00314 | 794.8337 | 0.00298 |
| | 120.00 | 794.8144 | 0.00055 | 794.7807 | -0.00369 | 794.7927 | -0.00217 |
| | 138.00 | 794.8272 | 0.00216 | 794.8295 | 0.00245 | 794.8027 | -0.00091 |
| -10 | 102.00 | 794.8062 | -0.00048 | 794.8139 | 0.00049 | 794.8380 | 0.00352 |
| | 120.00 | 794.8020 | -0.00100 | 794.8155 | 0.00069 | 794.8352 | 0.00317 |
| | 138.00 | 794.7936 | -0.00206 | 794.8391 | 0.00366 | 794.7800 | -0.00378 |
| -20 | 102.00 | 794.7879 | -0.00278 | 794.7985 | -0.00145 | 794.8155 | 0.00069 |
| | 120.00 | 794.8307 | 0.00261 | 794.8299 | 0.00250 | 794.8022 | -0.00099 |
| | 138.00 | 794.7949 | -0.00190 | 794.8175 | 0.00094 | 794.8240 | 0.00176 |
| -30 | 102.00 | 794.7843 | -0.00323 | 794.8076 | -0.00030 | 794.8009 | -0.00115 |
| | 120.00 | 794.7960 | -0.00177 | 794.8237 | 0.00172 | 794.8135 | 0.00044 |
| | 138.00 | 794.8302 | 0.00254 | 794.8087 | -0.00016 | 794.7843 | -0.00323 |

## C1. Frequency stability versus enviroment tempture

| Reference Frequency : 805.31 MHz | | Limit：0.005% | | | | | |
|---|---|---|---|---|---|---|---|
| Enviroment Tempture (℃) | Power Supplied (Vac) | Frequency measured with time elapsed | | | | | |
| | | 2 minute | | 5 minute | | 10 minute | |
| | | (MHz) | (%) | (MHz) | (%) | (MHz) | (%) |
| 50 | 102.00 | 805.3209 | 0.00135 | 805.2795 | -0.00379 | 805.2903 | -0.00245 |
| | 120.00 | 805.2837 | -0.00327 | 805.3277 | 0.00219 | 805.2993 | -0.00133 |
| | 138.00 | 805.2852 | -0.00308 | 805.2910 | -0.00236 | 805.3003 | -0.00121 |
| 40 | 102.00 | 805.3303 | 0.00252 | 805.2897 | -0.00252 | 805.3265 | 0.00205 |
| | 120.00 | 805.3246 | 0.00181 | 805.2802 | -0.00370 | 805.2899 | -0.00250 |
| | 138.00 | 805.2992 | -0.00134 | 805.2906 | -0.00241 | 805.3006 | -0.00117 |
| 30 | 102.00 | 805.3330 | 0.00286 | 805.2813 | -0.00356 | 805.2916 | -0.00228 |
| | 120.00 | 805.3012 | -0.00110 | 805.3322 | 0.00276 | 805.3226 | 0.00156 |
| | 138.00 | 805.3056 | -0.00054 | 805.3048 | -0.00064 | 805.3276 | 0.00218 |
| 20 | 102.00 | 805.3272 | 0.00214 | 805.2890 | -0.00261 | 805.3299 | 0.00247 |
| | 120.00 | 805.3030 | -0.00087 | 805.2814 | -0.00355 | 805.3077 | -0.00028 |
| | 138.00 | 805.3384 | 0.00353 | 805.3299 | 0.00247 | 805.3031 | -0.00086 |
| 10 | 102.00 | 805.3395 | 0.00367 | 805.3398 | 0.00370 | 805.3302 | 0.00251 |
| | 120.00 | 805.3321 | 0.00275 | 805.3318 | 0.00271 | 805.3005 | -0.00118 |
| | 138.00 | 805.2895 | -0.00255 | 805.3316 | 0.00268 | 805.3237 | 0.00170 |
| 0 | 102.00 | 805.3134 | 0.00042 | 805.3365 | 0.00329 | 805.3398 | 0.00369 |
| | 120.00 | 805.2795 | -0.00378 | 805.3342 | 0.00301 | 805.2952 | -0.00184 |
| | 138.00 | 805.2861 | -0.00296 | 805.3234 | 0.00166 | 805.2977 | -0.00153 |
| -10 | 102.00 | 805.2802 | -0.00370 | 805.3211 | 0.00137 | 805.3188 | 0.00109 |
| | 120.00 | 805.3206 | 0.00131 | 805.3040 | -0.00075 | 805.3037 | -0.00078 |
| | 138.00 | 805.3374 | 0.00340 | 805.3376 | 0.00342 | 805.3170 | 0.00087 |
| -20 | 102.00 | 805.2849 | -0.00312 | 805.3391 | 0.00361 | 805.3163 | 0.00079 |
| | 120.00 | 805.3346 | 0.00306 | 805.2792 | -0.00383 | 805.3331 | 0.00287 |
| | 138.00 | 805.2803 | -0.00369 | 805.2834 | -0.00330 | 805.3304 | 0.00253 |
| -30 | 102.00 | 805.2988 | -0.00139 | 805.3300 | 0.00248 | 805.3261 | 0.00200 |
| | 120.00 | 805.2926 | -0.00216 | 805.3209 | 0.00135 | 805.3215 | 0.00142 |
| | 138.00 | 805.3231 | 0.00162 | 805.3371 | 0.00336 | 805.2804 | -0.00367 |

# 8 CONDUCTED EMISSION MEASUREMENT

## 8.1 Standard Applicable

For unintentional and intentional device, Line Conducted Emission Limits are in accordance to § 15.107(a) and § 15.207(a) respectively. Both Limits are identical specification.

## 8.2 Measurement Procedure

1. Setup the configuration per figure 3.

2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.

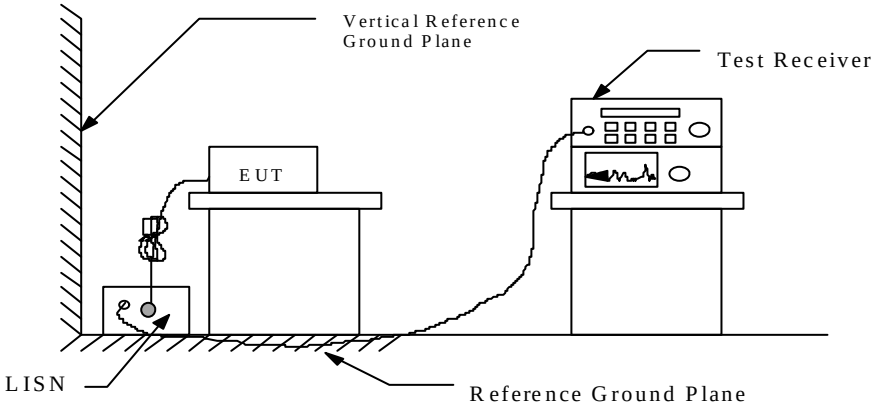
3. Record the 6 or 8 highest emissions relative to the limit.

4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then record the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.

5. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.

6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 3 : Conducted emissions measurement configuration



## 8.3 Conducted Emission Data

a) 744.21MHz

Operation Mode : Working
Test Date : Jul. 05, 2003 Temperature : 24 ℃ Humidity: 57 %

| Freq. | Meter Reading (dBì V) | | | | Factor | Limit (dBì V) | | Result (dBì V) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q.P Value | | AVG. Value | | | Q.P | AVG. | Q.P Value | | AVG. Value | |
| (MHz) | N | L1 | N | L1 | (dB) | Value | Value | N | L1 | N | L1 |
| 0.189 | 37.6 | 37.2 | ---- | ---- | 0.2 | 64.1 | 54.1 | 37.8 | 37.4 | ---- | ---- |
| 0.334 | 33.4 | 33.4 | ---- | ---- | 0.3 | 59.4 | 49.4 | 33.7 | 33.7 | ---- | ---- |
| 0.405 | 29.1 | 30.5 | ---- | ---- | 0.3 | 57.8 | 47.8 | 29.4 | 30.8 | ---- | ---- |
| 0.490 | 19.7 | 25.3 | ---- | ---- | 0.3 | 56.2 | 46.2 | 20.0 | 25.6 | ---- | ---- |
| 0.750 | 21.3 | 12.9 | ---- | ---- | 0.3 | 56.0 | 46.0 | 21.6 | 13.2 | ---- | ---- |
| 1.074 | 10.6 | 15.4 | ---- | ---- | 0.3 | 56.0 | 46.0 | 10.9 | 15.7 | ---- | ---- |

b) 794.81MHz

Operation Mode : Working
Test Date : Jul. 05, 2003 Temperature : 24 ℃ Humidity: 57 %

| Freq. | Meter Reading (dBì V) | | | | Factor | Limit (dBì V) | | Result (dBì V) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q.P Value | | AVG. Value | | | Q.P | AVG. | Q.P Value | | AVG. Value | |
| (MHz) | N | L1 | N | L1 | (dB) | Value | Value | N | L1 | N | L1 |
| 0.228 | 36.6 | 36.4 | ---- | ---- | 0.2 | 62.5 | 52.5 | 36.8 | 36.6 | ---- | ---- |
| 0.267 | 35.4 | 34.9 | ---- | ---- | 0.2 | 61.2 | 51.2 | 35.6 | 35.1 | ---- | ---- |
| 0.310 | 34.3 | 34.1 | ---- | ---- | 0.3 | 60.0 | 50.0 | 34.6 | 34.4 | ---- | ---- |
| 0.809 | 22.6 | 19.3 | ---- | ---- | 0.3 | 56.0 | 46.0 | 22.9 | 19.6 | ---- | ---- |
| 0.922 | 18.7 | 19.3 | ---- | ---- | 0.3 | 56.0 | 46.0 | 19.0 | 19.6 | ---- | ---- |
| 2.340 | 8.8 | 5.3 | ---- | ---- | 0.5 | 56.0 | 46.0 | 9.3 | 5.8 | ---- | ---- |

*Note : 1. Please see appendix 1 for Plotted Data*
*2. The expanded uncertainty of the conducted emission tests is 2.45 dB.*

c) 805.31MHz

Operation Mode : Working
Test Date : Jul. 05, 2003 Temperature : 24 ℃ Humidity: 57 %

| Freq. | Meter Reading (dBì V) | | | | Factor | Limit (dBì V) | | Result (dBì V) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q.P Value | | AVG. Value | | | Q.P | AVG. | Q.P Value | | AVG. Value | |
| (MHz) | N | L1 | N | L1 | (dB) | Value | Value | N | L1 | N | L1 |
| 0.170 | 38.1 | 38.0 | ---- | ---- | 0.2 | 65.0 | 55.0 | 38.3 | 38.2 | ---- | ---- |
| 0.333 | 33.5 | 33.6 | ---- | ---- | 0.3 | 59.4 | 49.4 | 33.8 | 33.9 | ---- | ---- |
| 0.423 | 27.3 | 29.3 | ---- | ---- | 0.3 | 57.4 | 47.4 | 27.6 | 29.6 | ---- | ---- |
| 0.463 | 23.1 | 27.1 | ---- | ---- | 0.3 | 56.6 | 46.6 | 23.4 | 27.4 | ---- | ---- |
| 1.105 | 13.3 | 13.7 | ---- | ---- | 0.3 | 56.0 | 46.0 | 13.6 | 14.0 | ---- | ---- |
| 2.422 | 5.6 | 4.1 | ---- | ---- | 0.5 | 56.0 | 46.0 | 6.1 | 4.6 | ---- | ---- |

*Note : 1. Please see appendix 3 for Plotted Data*
*2. The expanded uncertainty of the conducted emission tests is 2.45 dB.*

## 8.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

***RESULT = READING + LISN FACTOR***

Assume a receiver reading of 22.5 dBμV is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dBμV.

RESULT = 22.5 + 0.1 = 22.6 dBμV
Level in μV = Common Antilogarithm[(22.6 dBμV)/20]
= 13.48 μV

## 8.5 Conducted Measurement Equipment

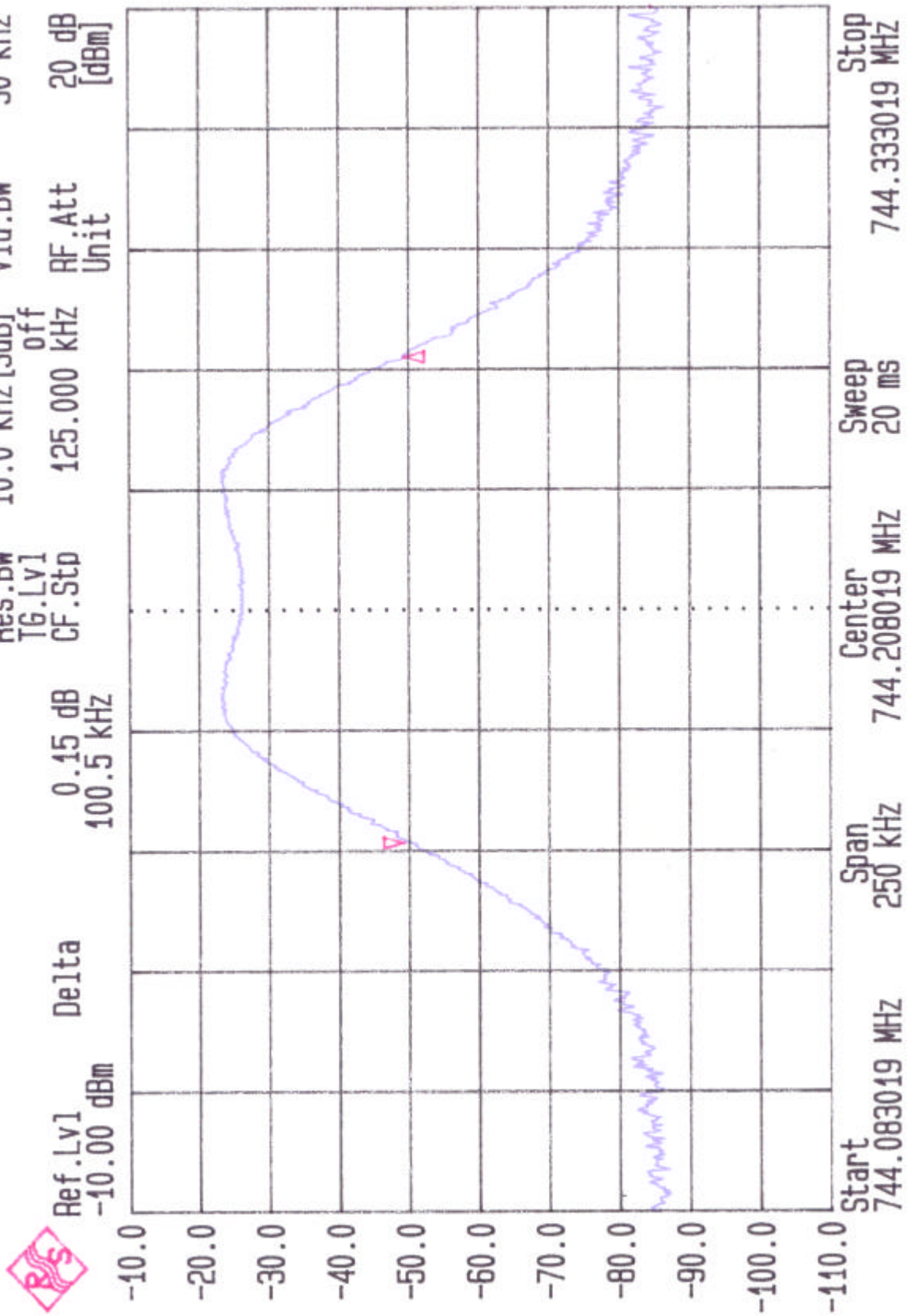
The following test equipment are used during the conducted test .

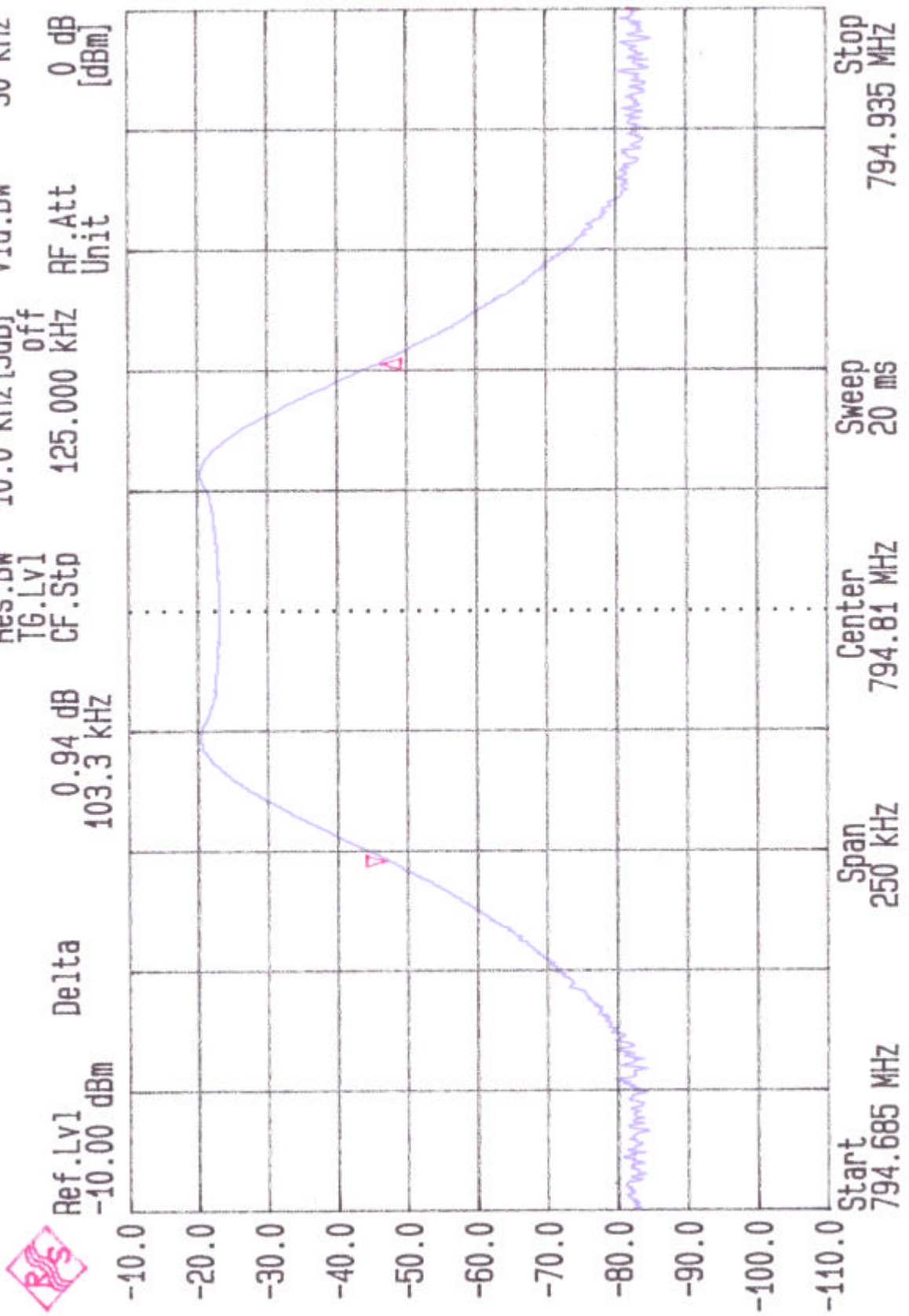
| Equipment | Manufacturer | Model No. | Next Cal. Due |
|---|---|---|---|
| EMI Test Receiver | Rohde and Schwarz | ESCS 30 | 11/27/2003 |
| Line Impedance Stabilization network | Rohde and Schwarz | ESH2-Z5 | 09/03/2003 |
| Monitor | IBM | E54 | N.C.R. |
| Printer | HP | LaserJet 1000 | N.C.R. |
| Shielded Room | Riken | | N.C.R. |
| Computer | Acer | Veriton | N.C.R. |
| EMI Test Receiver | Rohde and Schwarz | ESCS 30 | 11/27/2003 |

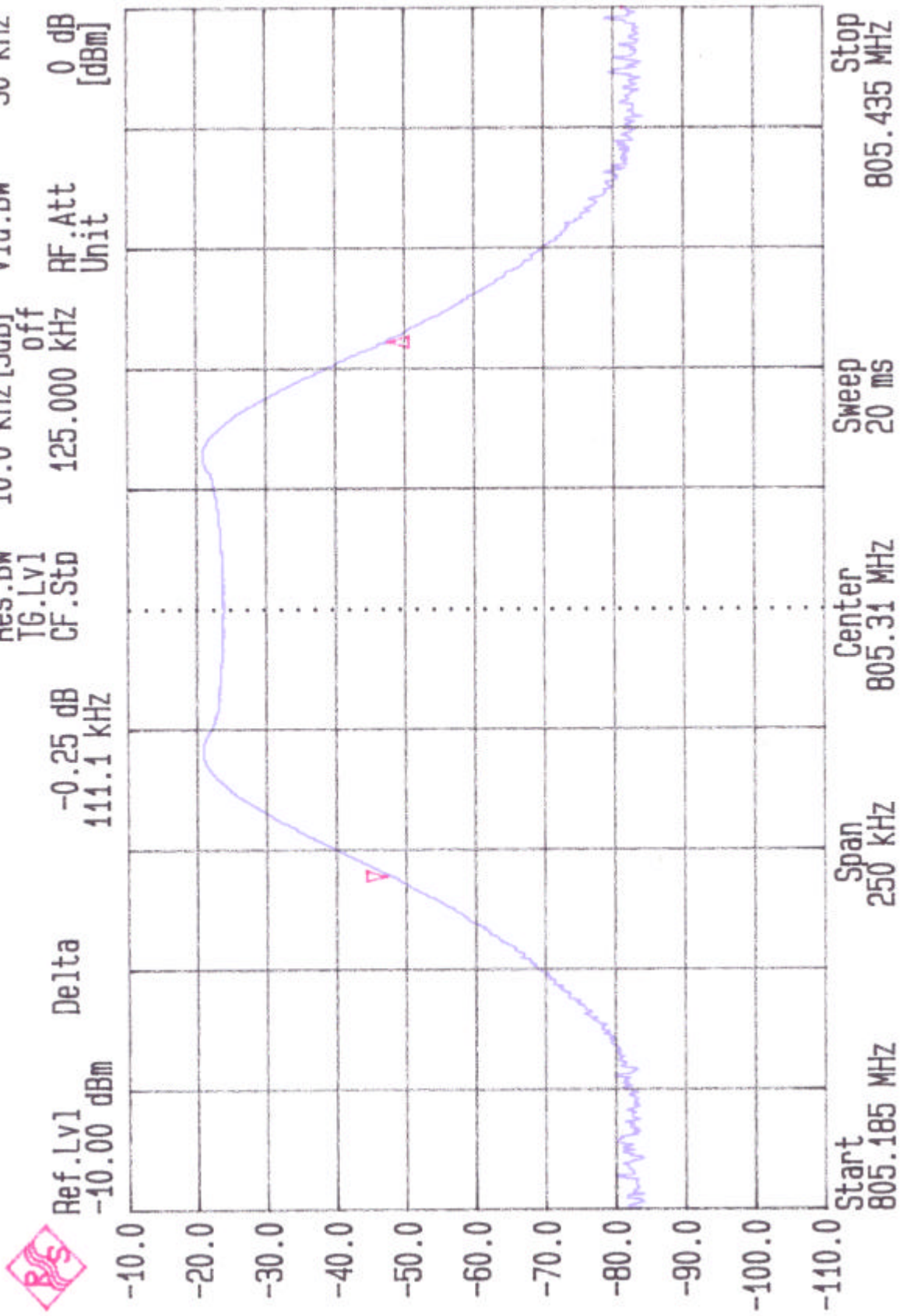
## 8.6 Photos of Conduction Measuring Setup

**Please Exhibit_F Test Setup Photos**

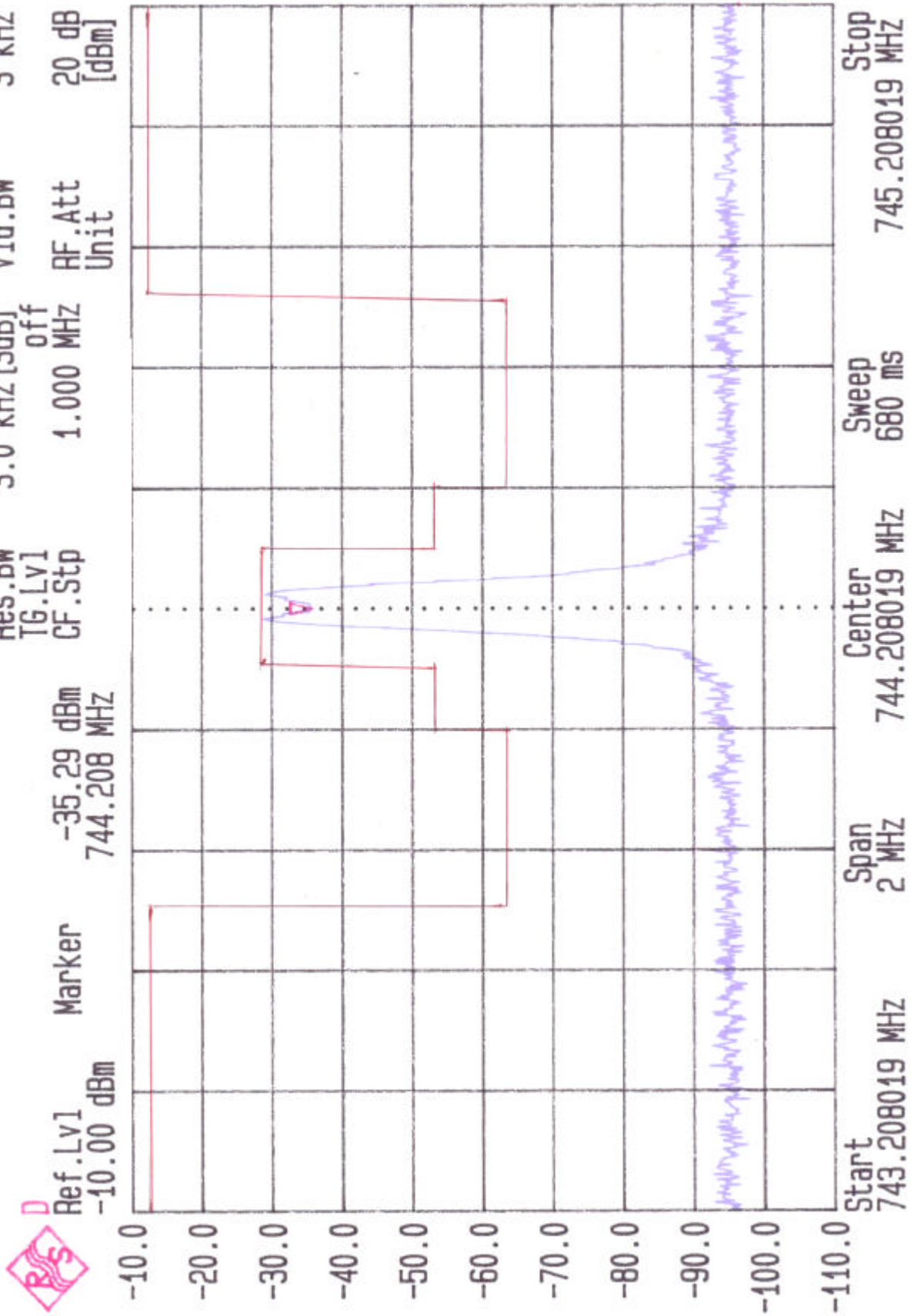
# Appendix 1 : Occupied Emission Bandwidth Plotted Data

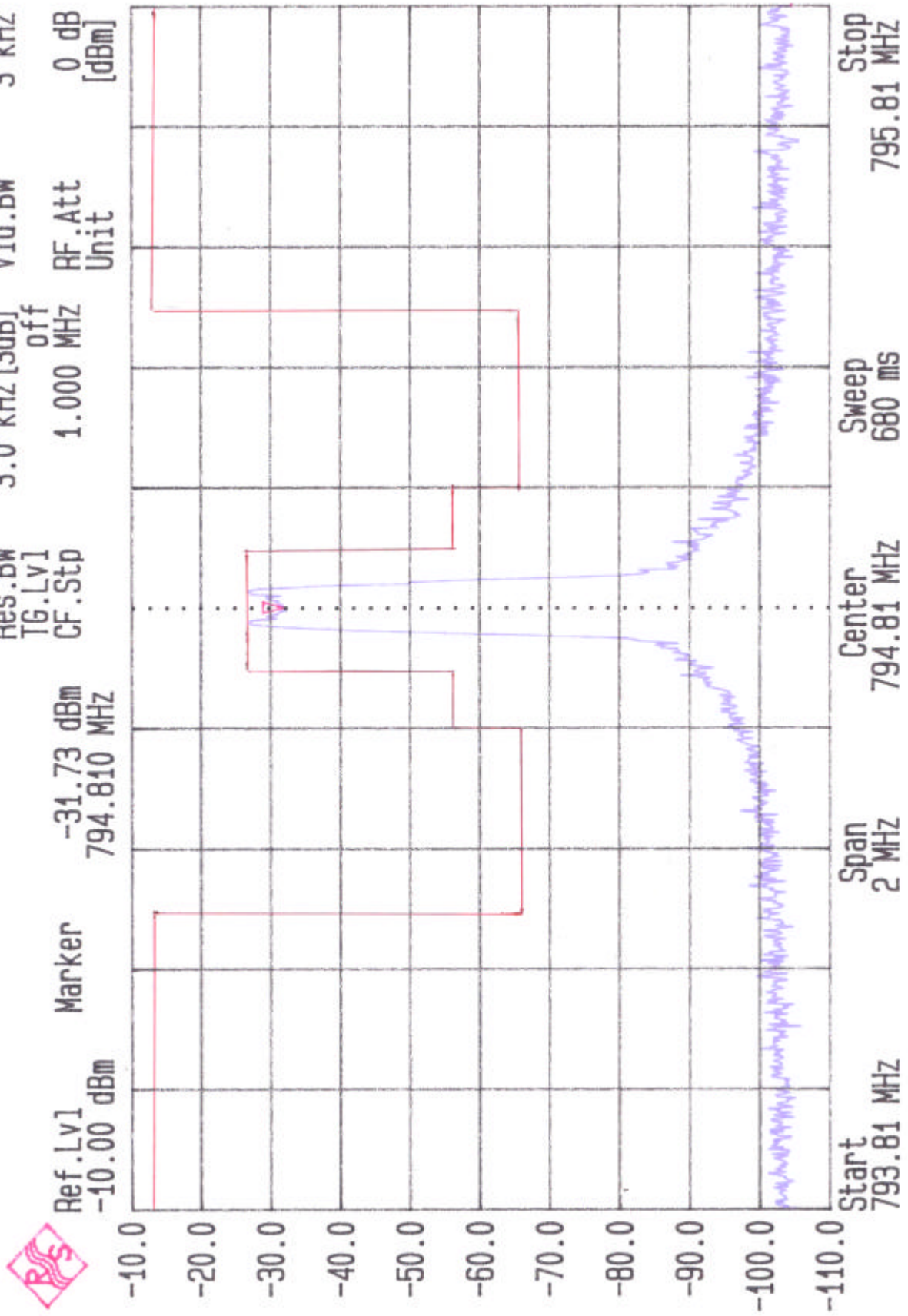

Ref.Lvl
-10.00 dBm
Delta
0.15 dB
100.5 kHz
Res.Bw
10.0 kHz [3dB]
TG.Lvl
off
CF.Stp
125.000 kHz
Vid.Bw
30 kHz
RF.Att
20 dB
Unit
[dBm]
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0
Start
744.083019 MHz
Span
250 kHz
Center
744.208019 MHz
Sweep
20 ms
Stop
744.333019 MHz

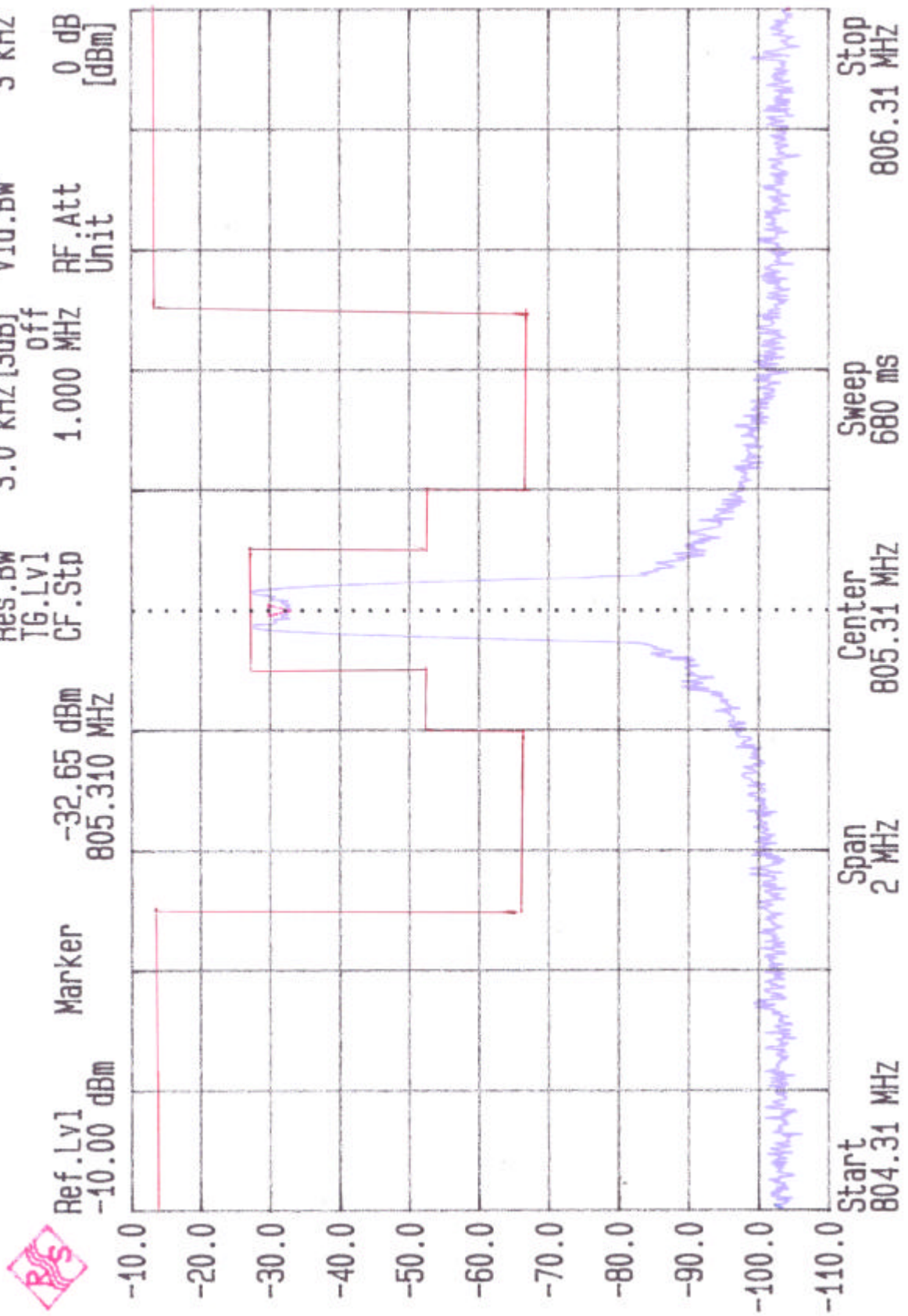

Ref.Lvl
-10.00 dBm
Delta
0.94 dB
103.3 kHz
Res.Bw
TG.Lvl
CF.Stp
10.0 kHz [3dB]
off
125.000 kHz
Vid.Bw
RF.Att
Unit
30 kHz
0 dB
[dBm]
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0
Start
794.685 MHz
Span
250 kHz
Center
794.81 MHz
Sweep
20 ms
Stop
794.935 MHz


Ref.Lvl
-10.00 dBm
Delta
-0.25 dB
111.1 kHz
Res.Bw
TG.Lvl
CF.Stp
10.0 kHz [3dB]
off
125.000 kHz
Vid.Bw
RF.Att
Unit
30 kHz
0 dB
[dBm]
Start
805.185 MHz
Span
250 kHz
Center
805.31 MHz
Sweep
20 ms
Stop
805.435 MHz
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0

# Appendix 2 : Emission Mask Plotted Data


Ref.Lvl
-10.00 dBm
Marker
-35.29 dBm
744.208 MHz
Res.Bw
3.0 kHz [3dB]
TG.Lvl
off
CF.Stp
1.000 MHz
Vid.Bw
3 kHz
RF.Att
20 dB
Unit
[dBm]
Start
743.208019 MHz
Span
2 MHz
Center
744.208019 MHz
Sweep
680 ms
Stop
745.208019 MHz
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0


Ref.Lvl
-10.00 dBm
Marker
-31.73 dBm
794.810 MHz
Res.Bw
3.0 kHz [3dB]
TG.Lvl
off
CF.Stp
1.000 MHz
Vid.Bw
3 kHz
RF.Att
0 dB
Unit
[dBm]
Start
793.81 MHz
Span
2 MHz
Center
794.81 MHz
Sweep
680 ms
Stop
795.81 MHz
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0


Ref.Lvl
-10.00 dBm
Marker
-32.65 dBm
805.310 MHz
Res.Bw
3.0 kHz [3dB]
TG.Lvl
off
CF.Stp
1.000 MHz
Vid.Bw
3 kHz
RF.Att
0 dB
Unit
[dBm]
Start
804.31 MHz
Span
2 MHz
Center
805.31 MHz
Sweep
680 ms
Stop
806.31 MHz
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0

# Appendix 3 : Plotted Data of Conducted Emissions

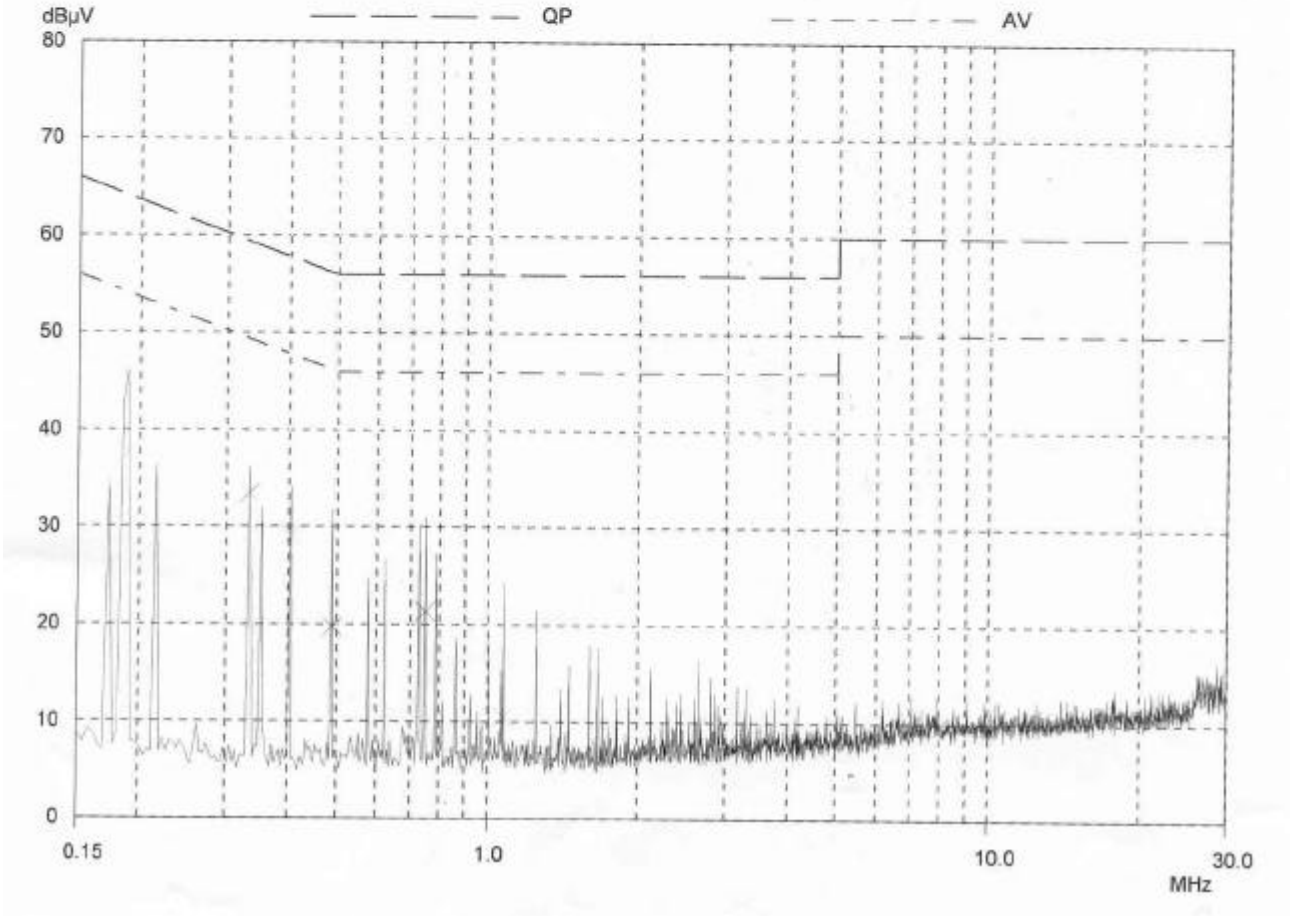
# CONDUCTION EMISSION TEST

## Peak Value

EUT:
Manuf:
Op Cond: 744.21MHz
Operator:
Test Spec:
Comment:
N

Final Measurement:

| | |
|---|---|
| Detector: | X QP |
| Meas Time: | 1sec |
| Peaks: | 8 |
| Acc Margin: | 25 dB |



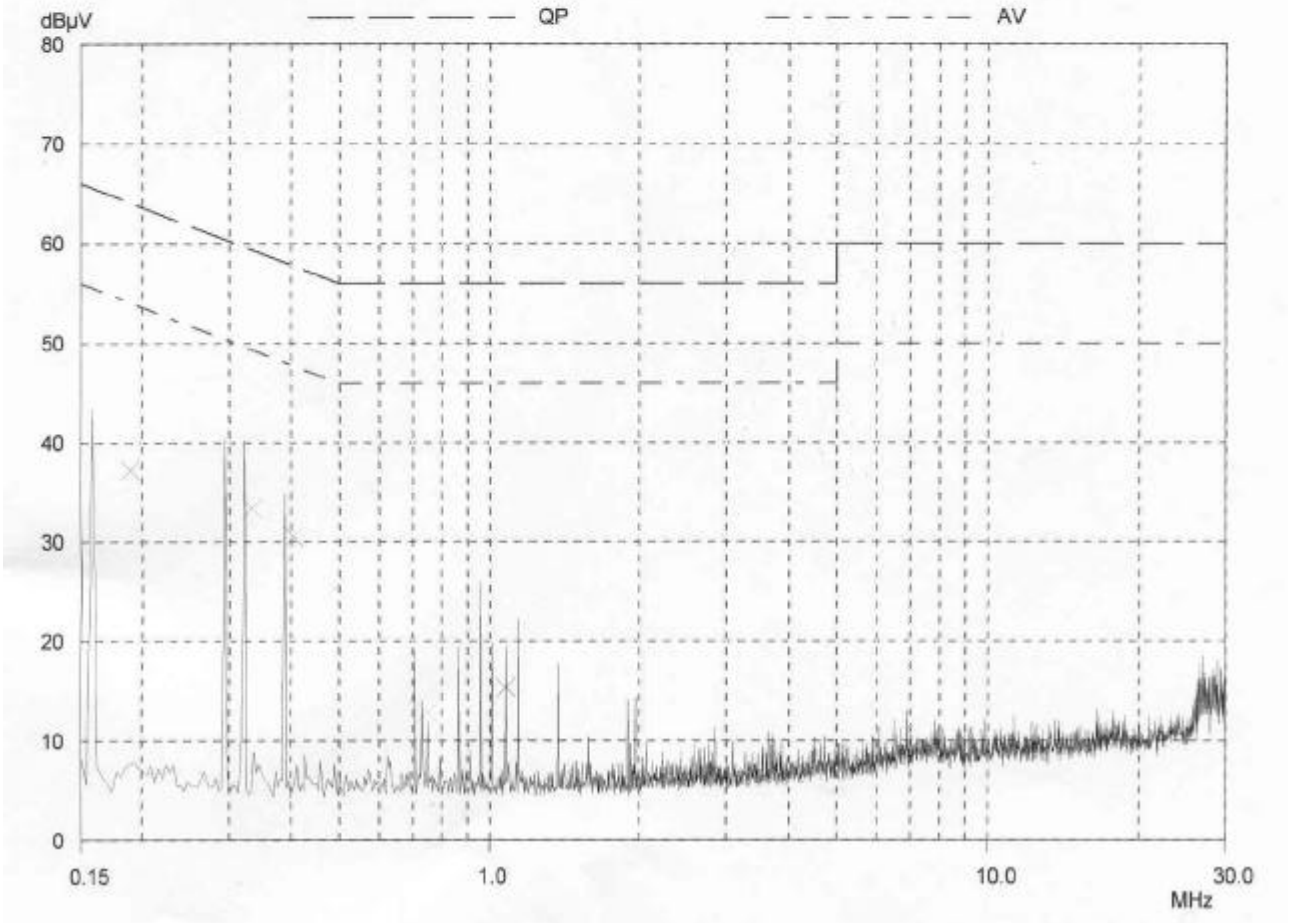
## CONDUCTION EMISSION TEST

### Peak Value

EUT:
Manuf:
Op Cond: 744.21MHz
Operator:
Test Spec:
Comment:
L1

Final Measurement:

| | |
|---|---|
| Detector: | X QP |
| Meas Time: | 1sec |
| Peaks: | 8 |
| Acc Margin: | 25 dB |

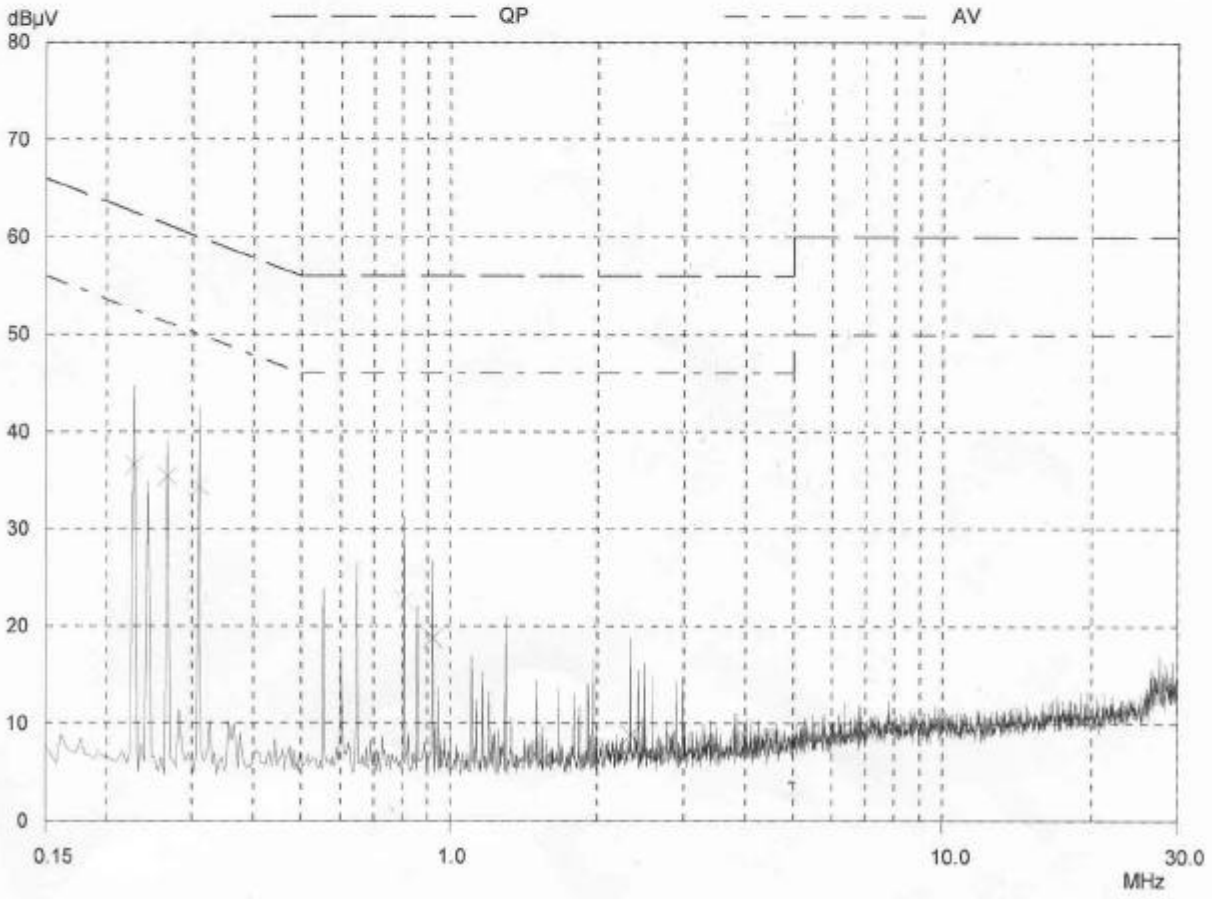


## CONDUCTION EMISSION TEST

### Peak Value

EUT:
Manuf:
Op Cond: 794.81MHz
Operator:
Test Spec:
Comment:
N

Final Measurement: Detector: X QP
Meas Time: 1sec
Peaks: 8
Acc Margin: 25 dB

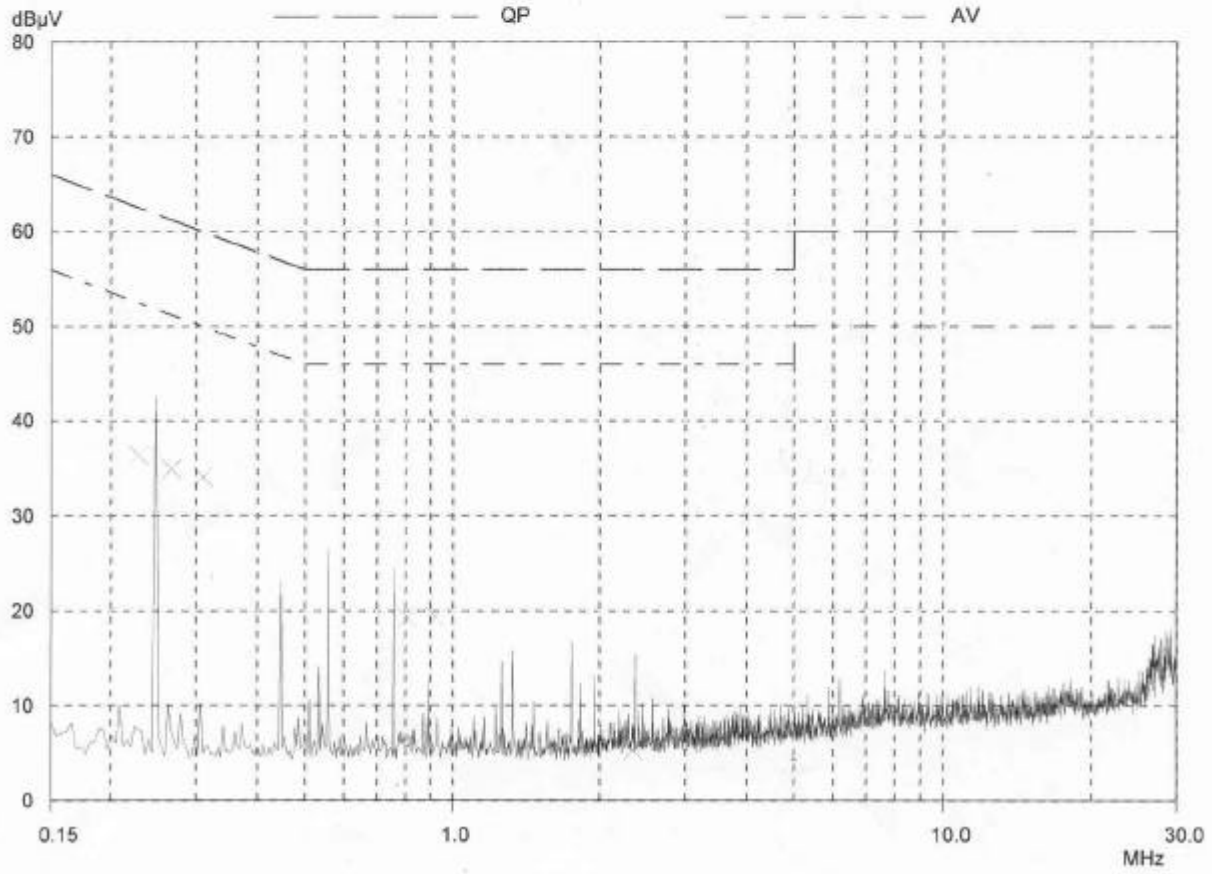


## CONDUCTION EMISSION TEST

### Peak Value

EUT:
Manuf:
Op Cond: 794.81MHz
Operator:
Test Spec:
Comment:
L1

Final Measurement: Detector: X QP
Meas Time: 1sec
Peaks: 8
Acc Margin: 25 dB



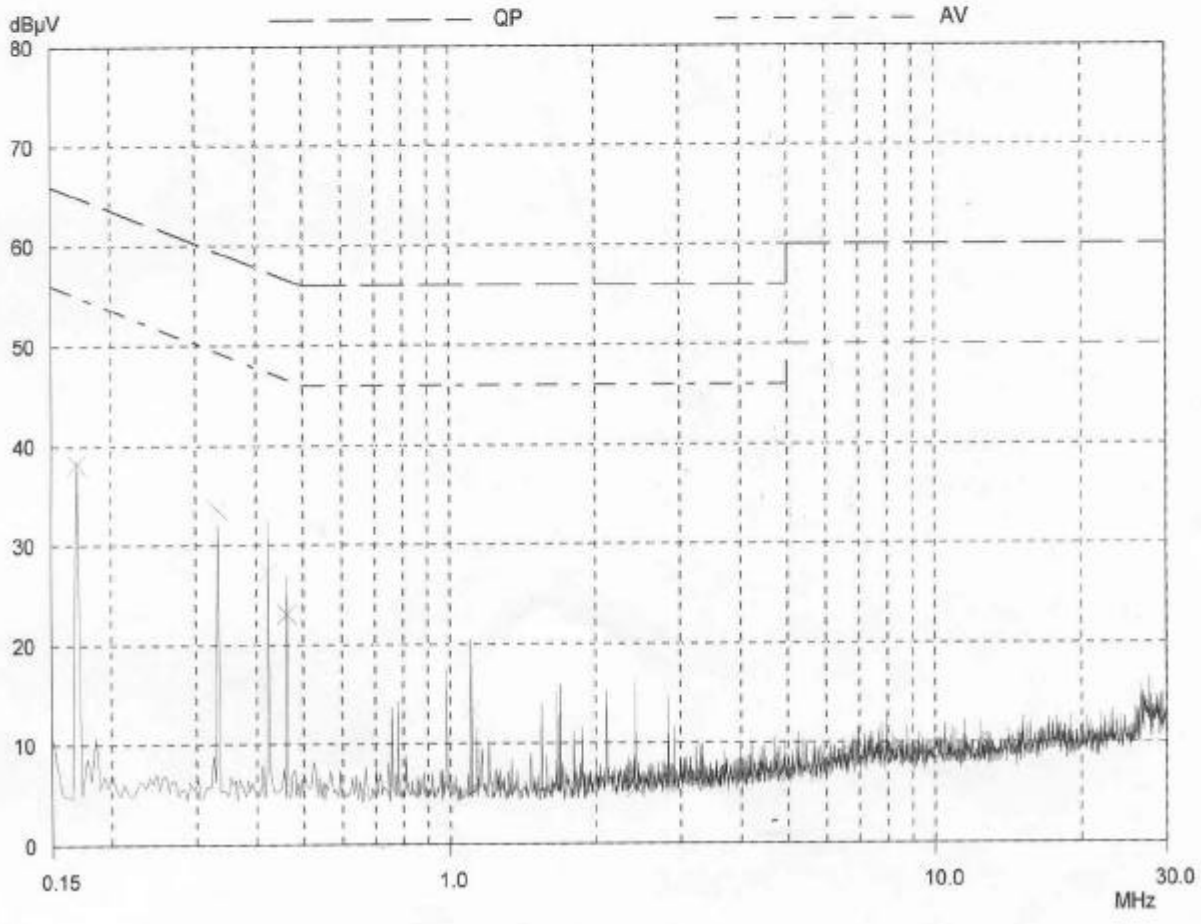
## CONDUCTION EMISSION TEST

### Peak Value

EUT:
Manuf:
Op Cond: 805.31MHz
Operator:
Test Spec:
Comment:
N

Final Measurement:

| | |
|---|---|
| Detector: | X QP |
| Meas Time: | 1sec |
| Peaks: | 8 |
| Acc Margin: | 25 dB |



## CONDUCTION EMISSION TEST

### Peak Value

EUT:
Manuf:
Op Cond: 805.31MHz
Operator:
Test Spec:
Comment:
L1

Final Measurement: Detector: X QP
Meas Time: 1sec
Peaks: 8
Acc Margin: 25 dB