# FCC Certification Test Report of *450MHz to 470MHz Transceiver*

| | | |
|---|---|---|
| **Applicant** | : | Gold Apollo Co., Ltd.<br>Rm 1, 3rd F1., No. 77, Sec. 1, Hsin Tai Wu Rd.,<br>His-Chih, Taipei Hsien, Taiwan, R.O.C. |
| **Model No.** | : | TX-125 & TX-125EN |
| **EUT** | : | 5W transceiver |
| **FCC ID** | : | NDATX500XU |
| **Report No.** | : | G1590050048 |

**Tested by :**

***Training Research Co., Ltd.***

**TEL : 886-2-26461146** **FAX : 886-2-26461778**

No. 15, Lane 530, Pa-Lian RD., Sec. 1, Hsichih City, Taipei Hsien, Taiwan, R.O.C.

# CERTIFICATION

**We here by verify that:**

The test data, data evaluation, test procedures and equipment configurations shown in this report were made mainly in accordance with the procedures given in ANSI C63.4 (2003) as a reference and ANSI/TIA/EIA-603. All test were conducted by ***Training Research Co., Ltd.***, No. 15, Lane 530, Pa-Lian RD., Sec. 1, Hsichih City, Taipei Hsien, Taiwan, R.O.C.. Also, we attest to the accuracy of each.

We further submit that the energy emitted by the sample EUT tested as described in the report is **in compliance with** the technical requirements set forth in the FCC Rules Part 90.

**Prepared by:**_____**Project Engineer**
(Jason Yeh)

**Authorized by:**_____**V. General Manager**
(Jacob Lin)

Test date: April 06, 2005
Issue date: June 08, 2005

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# Ⅰ. GENERAL

## 1.1 Introduction

The following measurement report is submitted on behalf of applicant in support that the certification in accordance with Part 2 Subpart J and Part 90 of the Commission's Rules and Regulations.

During the testing, the EUT has three kinds of modulations, as below:

- AN；Analogy, with 12.5KHz channel spacing.
- NB；Digital, with 12.5KHz channel spacing.
- WB；Digital, with 25KHz channel spacing.

## 1.2 Description of EUT

The EUT is a POCSAG transmitter, specifications as below:

1. Frequency Rang : UHF = 440MHz ~ 470MHz
2. Channel Spacings : 12.5KHz, 25KHz
3. RF Output Power : 5W, 2W
4. Modulation Type : F1D
5. Intermediate Frequency : 45MHz & 450KHz
6. Number of Channels : 16
7. Frequency Source : Synthesizer
8. Power Supply : DC 10V ~ 14V
9. Temperature Range : -30°C ~ 50°C
10. Current Consumption

| | |
|---|---|
| Standby | : 100mA, |
| TX(5W) | : < 2A, |
| TX(1W) | : < 1A, |

Transmitter:

1. Carrier Power

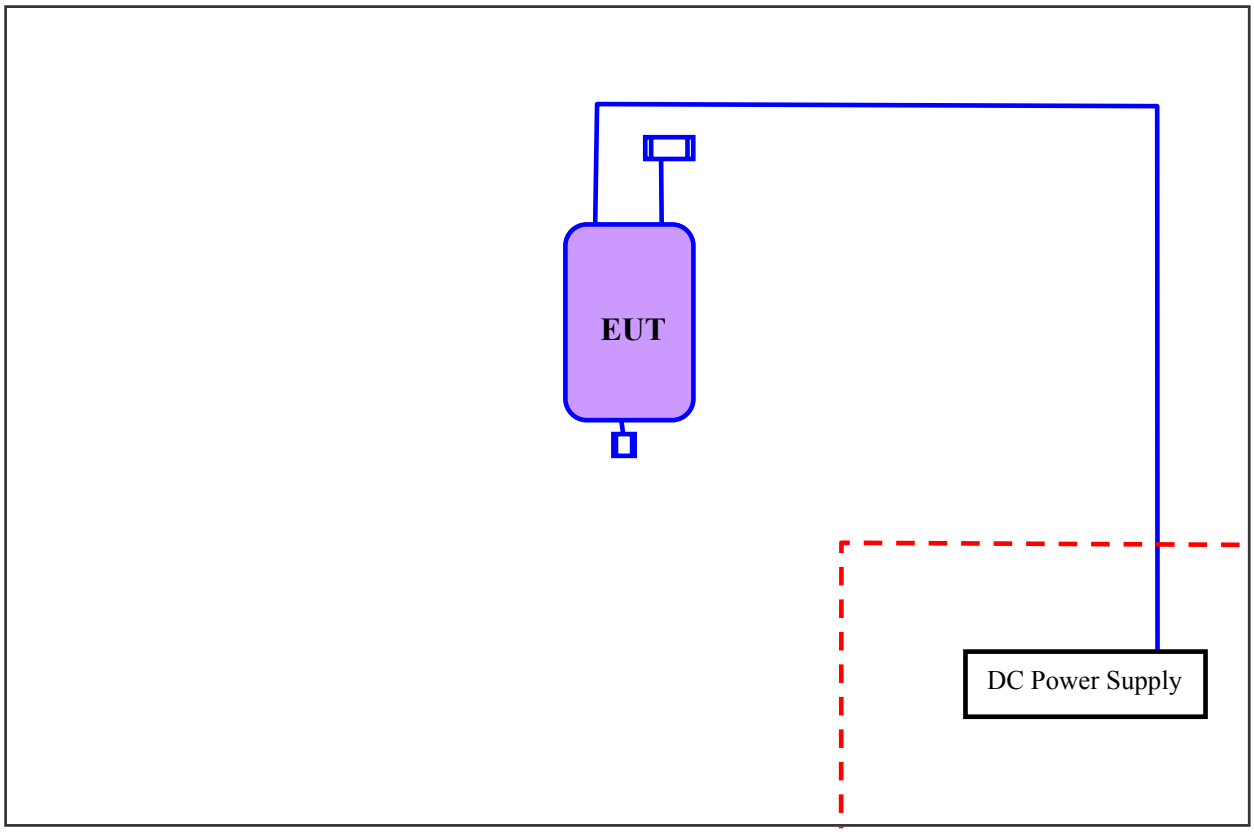
| | |
|---|---|
| Hi | : 5W + / -1 dB, |
| Low | : 2W + / -1 dB, |

2. Frequency Error : + / -2.5ppm
3. Frequency Deviation

| | |
|---|---|
| 25KHz Channel Spacing | : 5KHz ~ 3.8KHz (Peak) |
| 12.5KHz Channel Spacing | : 2.5KHz ~ 1.8KHz (Peak) |

4. Audio Frequency response : 300Hz ~ 2.5KHz – 6dB
5. Adjacent Channel Power : < 70dBc
6. Conducted Spurious Emission : - 57dBc

### 1.3 Configuration of System Under Test




***Connections of EUT:***

*DC Power jack --- via 10 m power cable connected to the DC power supply that located remotely.

*RS-232 port --- via 1.4 m data cable that terminated.

*Antenna port --- with a 50ohm terminated.

## *List of support equipment*

| | | |
|---|---|---|
| **DC Power Supply** | **:** | **GW** |
| Model No. | : | GPC-3030D |
| Serial No. | : | 8050549 |
| FCC ID | : | N/A |
| Power type | : | AC 100 –127 4.0A, 200-240 2.0A, 50 ~ 60Hz |
| Data cable | : | Non-shielded, 1.8 m long, Plastic, No ferrite core |

## 1.4 Location of the Test Site

The radiated emissions measurements (above 1GHz) required by the rules were performed on the **three-meter**, **Anechoic Chamber (Registration Number: 93906)** maintained by *Training Research Co., Ltd.* 1F, No. 255 Nanyang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C. Complete description and measurement data have been placed on file with the commission. The conducted power line emissions tests and radiated emissions measurements below 1 GHz were performed in an OATS located at Pa-Lian His-chih Training Research Co., Ltd.

No. 15, Lane 530, Pa-Lian RD., Sec. 1, Hsichih City, Taipei Hsien, Taiwan, R.O.C. (Registration No.: 91035) *Training Research Co., Ltd.* is listed by the FCC as a facility available to do measurement work for others on a contract basis.

## 1.5 General Test Condition

The conditions under which the EUT operates were varied to determine their effect on the equipment's emission characteristics. The final configuration of the test system and the mode of operation used during these tests were chosen as that which produced the highest emission levels. However, only those conditions, which the EUT was considered likely to encounter in normal use were investigated.

**Normal Temperature and Humidity**

Temperature : 20°C ± 4°C maintained.

Relative Humidity : 60% ± 10% observed.

**Normal Test Power Source**

Test Voltage : 12 Vdc.

**Extreme Temperature**

High Temperature : + 50°C maintained.

Low Temperature : - 30°C maintained.

**Extreme Voltage**

High Voltage : 15.6 Vdc

Low Voltage : 10.2 Vdc

**While testing, device was set in high power and continuously transmitting mode.**

## II. Emissions Designator (Part 2.201)

The necessary authorized bandwidth is taken to be the necessary bandwidth.

Using the formulas contained in Par 2.202 the necessary bandwidth calculation for the 25 kHz channel step emission is:

Bn = 2 x D + 2 x M
Where D = maximum deviation: 5.0 kHz
Where M = maximum modulation frequency: 2.5 kHz
Bn = 15 kHz

This is confirmed in the emission designation, 15K0F1D, declared by the client.

Using the formulas contained in Part 2.202 the necessary bandwidth calculation for the 12.5 kHz channel step emission is:

Bn = 2 x D + 2 x M
Where D = maximum deviation: 2.5 kHz
Where M = maximum modulation frequency: 2.5 kHz
Bn = 10 kHz

This is confirmed in the emission designation, 10K0F1D, declared by the client.

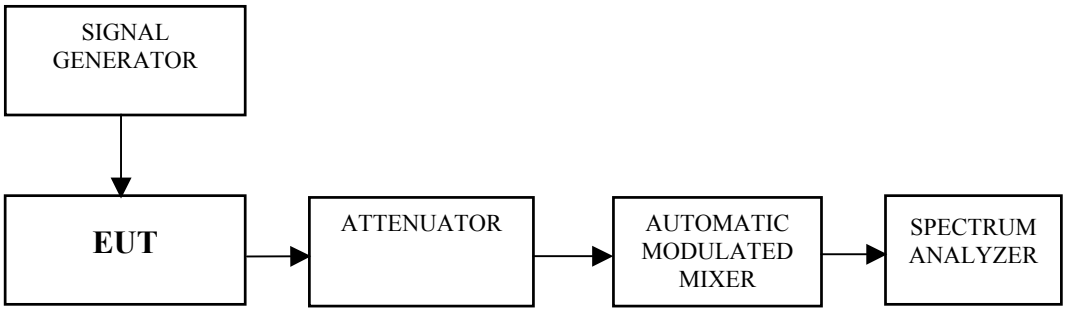
# III. Modulation Characteristics: (Part 2.1047)

## 3.1 Audio Low Pass Filter Test procedure:

**Definition**

The audio low pass filter response is the frequency response of the post limiter low pass filter circuit above 3000 Hz

**Method of measurement**

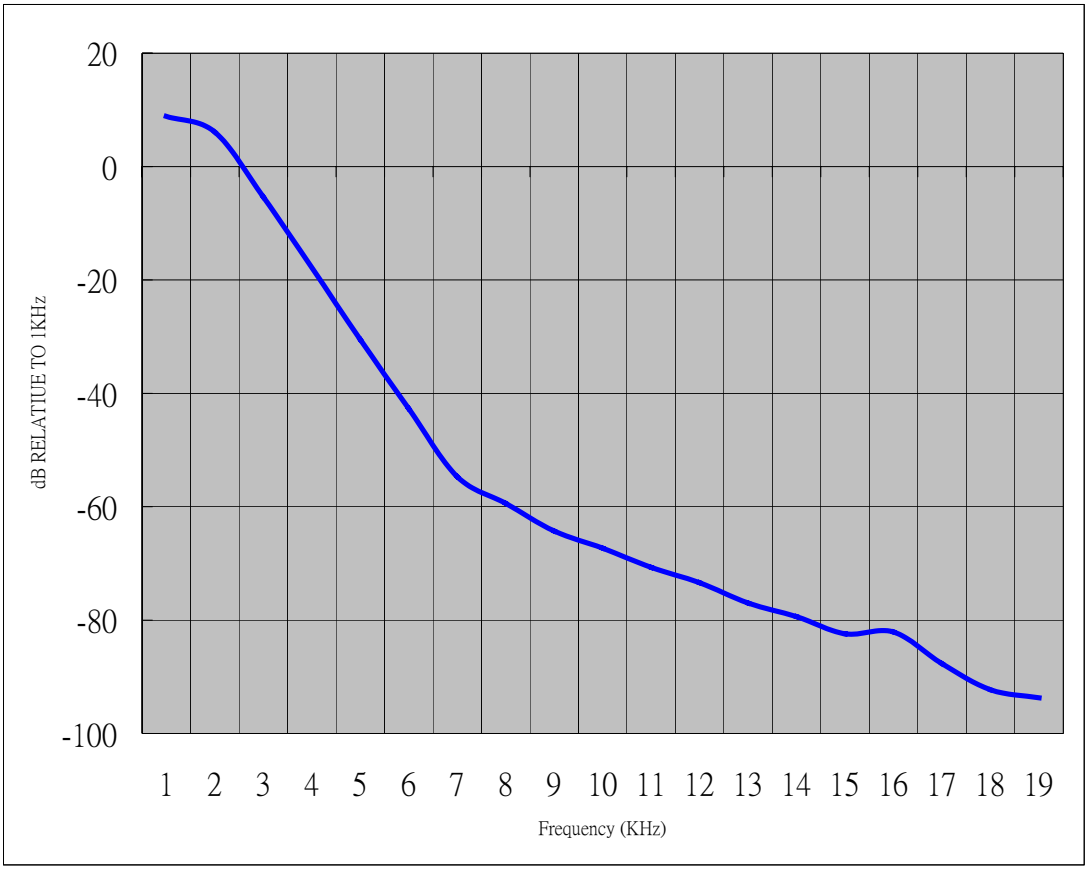



(1) Connect the equipment as illustrated.
(2) The signal generator was transmitting modulation signal to the EUT.
(3) From 1kHz to 20kHz modulation signals have tested.
(4) During the testing, adjust the amplitude of the signal generator.
(5) Observe and recorded the test results.
(6) Describe the test results to a figure.

**NOTE:**

Pretest was found the 5W power output is the worst mode than 2W power output, so the test was only the worst mode and recorded the test results

**Measurement Result:**

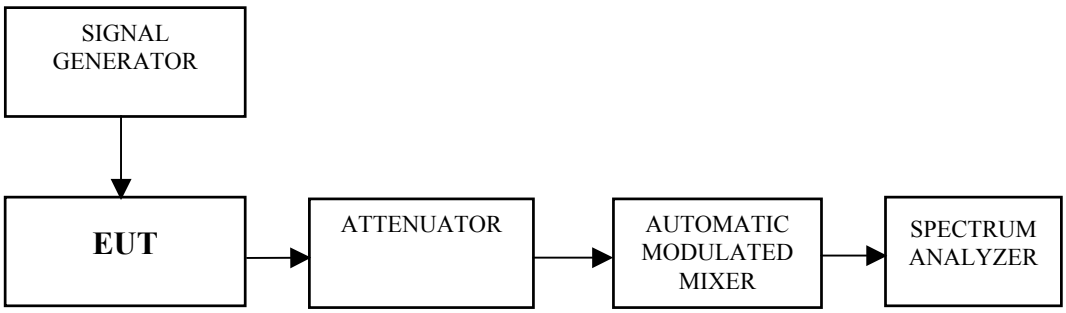


## 3.2 Audio Frequency Response Test procedure:

**Definition**

The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic.

**Method of measurement**

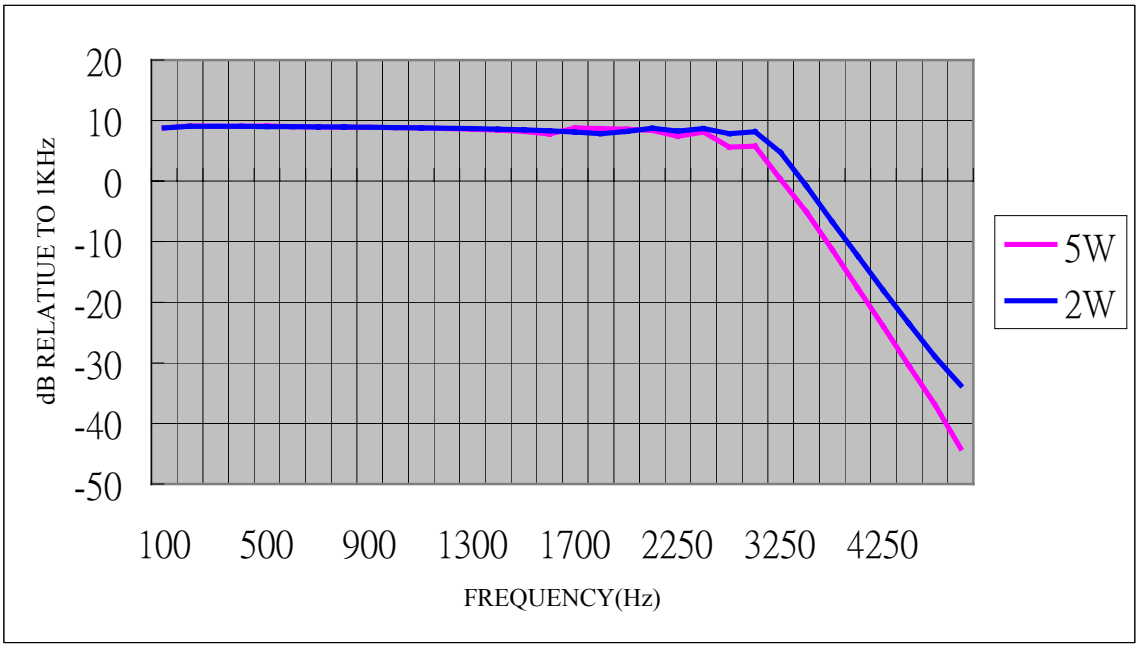



(1) Connect the equipment as illustrated.
(2) The signal generator was transmitting modulation signal to the EUT.
(3) From 100Hz to 5kHz modulation signals have tested.
(4) Two kinds power have tested.
(5) During the testing, adjust the amplitude of the signal generator.
(6) Observe and recorded the test results.
(7) Describe the test results to a figure.

**NOTE:**

Pretest was found the 5W power output is the worst mode than 2W power output, so the test was only the worst mode and recorded the test results

**Measurement Result:**

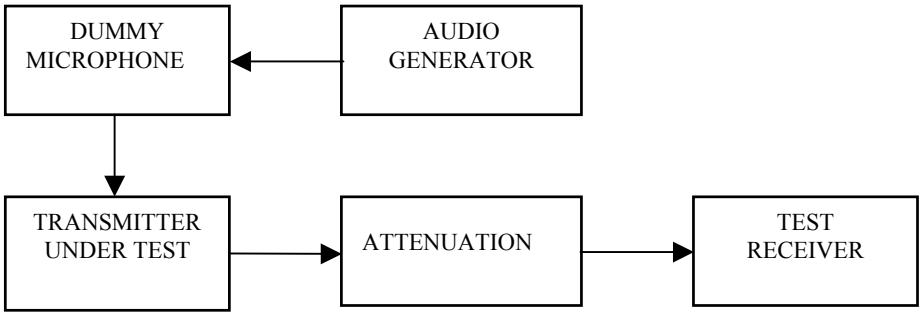


### 3.3 Modulation Limiting Test procedure:

**Definition**

Modulation limiting is the transmitter circuit's ability to limit the transmitter from producing deviations in excess of a rated system deviation.

**Method of measurement**



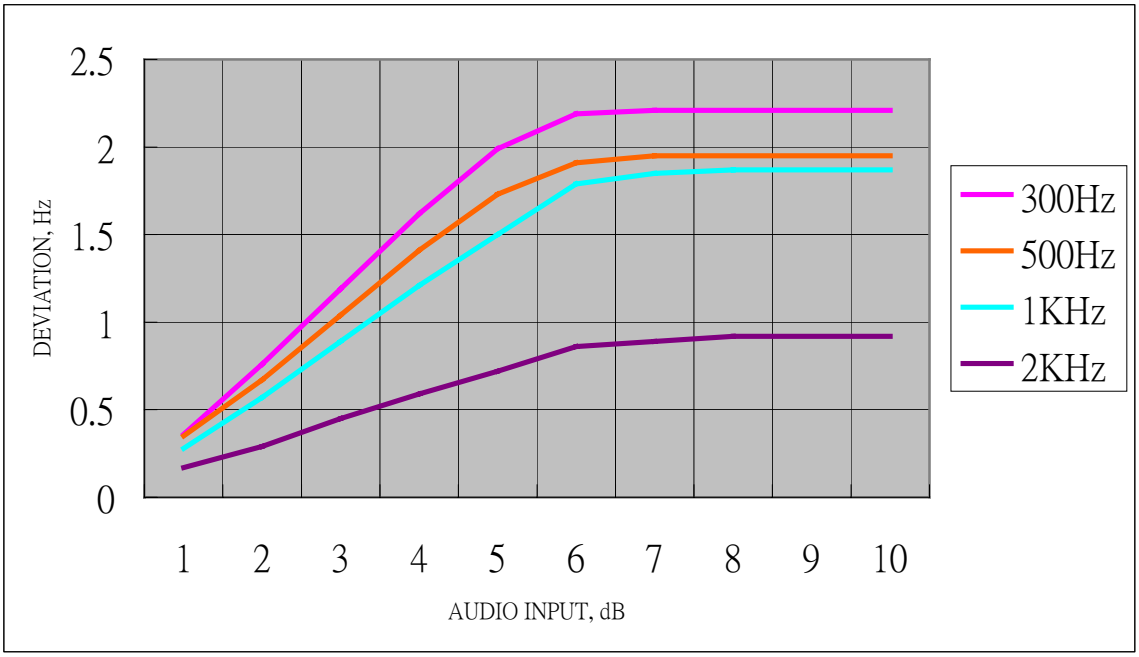

(1) Connect the equipment as illustrated.
(2) The signal generator was transmitting modulation signal to the EUT.
(3) Four modulation signals have tested, they are 300Hz, 500Hz, 1kHz and 2kHz.
(4) During the testing, adjust the amplitude of the signal generator.
(5) Measurements were performed for both negative and positive modulation and the respective results were recorded.
(6) Observe and recorded the test results.
(7) Describe the test results to a figure.

**NOTE:**

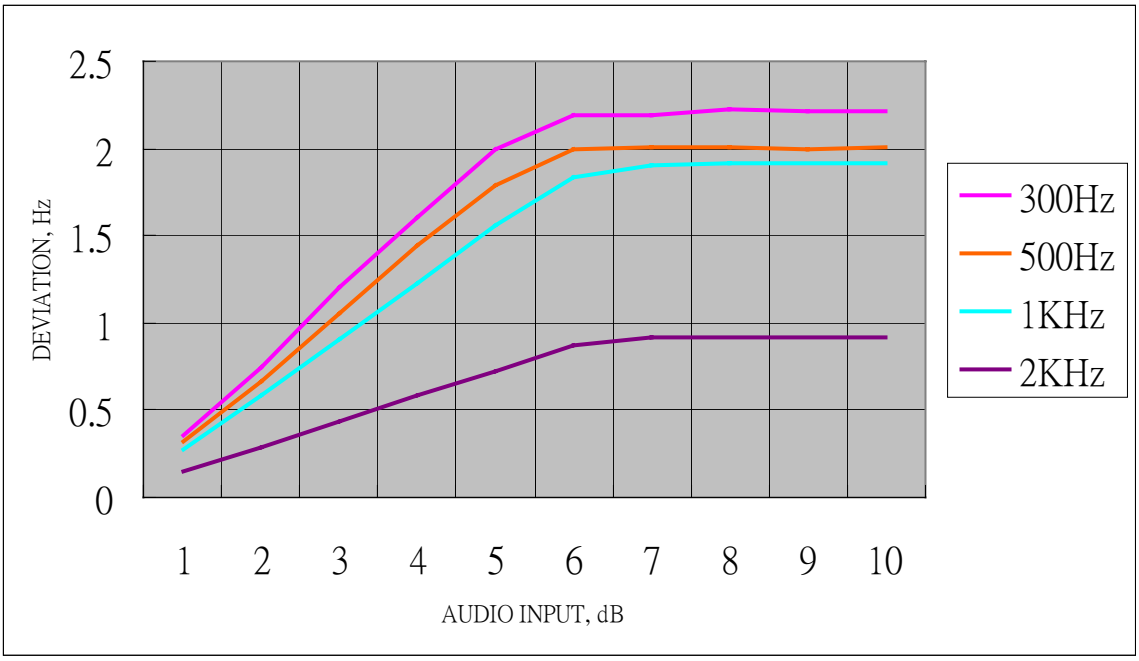
Pretest was found the 5W power output is the worst mode than 2W power output, so the test was only the worst mode and recorded the test results

**Measurement Result:**

**Positive Peaks:**




**Negative Peaks:**



# IV. RF Power Output (Part 2.1046, 90.205)

## 4.1 Test procedure:

(1) Antenna was replaced with a short connector which was connected with a 40 dB attenuator.

(2) Set the spectrum., RBW = 100Hz, VBW = 100Hz, SPAN = 1KHz, ATT = 30dB

## 4.2 Test Result:

| | Modulation | Channel Spacing (KHz) | Frequency (MHz) | Output power (dBm) | Power (W) |
|---|---|---|---|---|---|
| 5W | AN | 12.5 | 440 | 36.91 | 4.909 |
| 5W | NB | 12.5 | 440 | 37.00 | 5.011 |
| 5W | WB | 25 | 440 | 36.92 | 4.920 |
| 5W | AN | 12.5 | 455 | 37.26 | 5.322 |
| 5W | NB | 12.5 | 455 | 37.29 | 5.358 |
| 5W | WB | 25 | 455 | 37.29 | 5.358 |
| 5W | AN | 12.5 | 470 | 37.51 | 5.636 |
| 5W | NB | 12.5 | 470 | 37.53 | *5.662 |
| 5W | WB | 25 | 470 | 37.52 | 5.649 |
| 2W | AN | 12.5 | 440 | 32.14 | 1.637 |
| 2W | NB | 12.5 | 440 | 32.63 | 1.832 |
| 2W | WB | 25 | 440 | 32.32 | 1.706 |
| 2W | AN | 12.5 | 455 | 32.65 | 1.840 |
| 2W | NB | 12.5 | 455 | 33.21 | *2.094 |
| 2W | WB | 25 | 455 | 32.95 | 1.972 |
| 2W | AN | 12.5 | 470 | 32.32 | 1.706 |
| 2W | NB | 12.5 | 470 | 32.80 | 1.905 |
| 2W | WB | 25 | 470 | 32.78 | 1.897 |

"*", means the worst case.

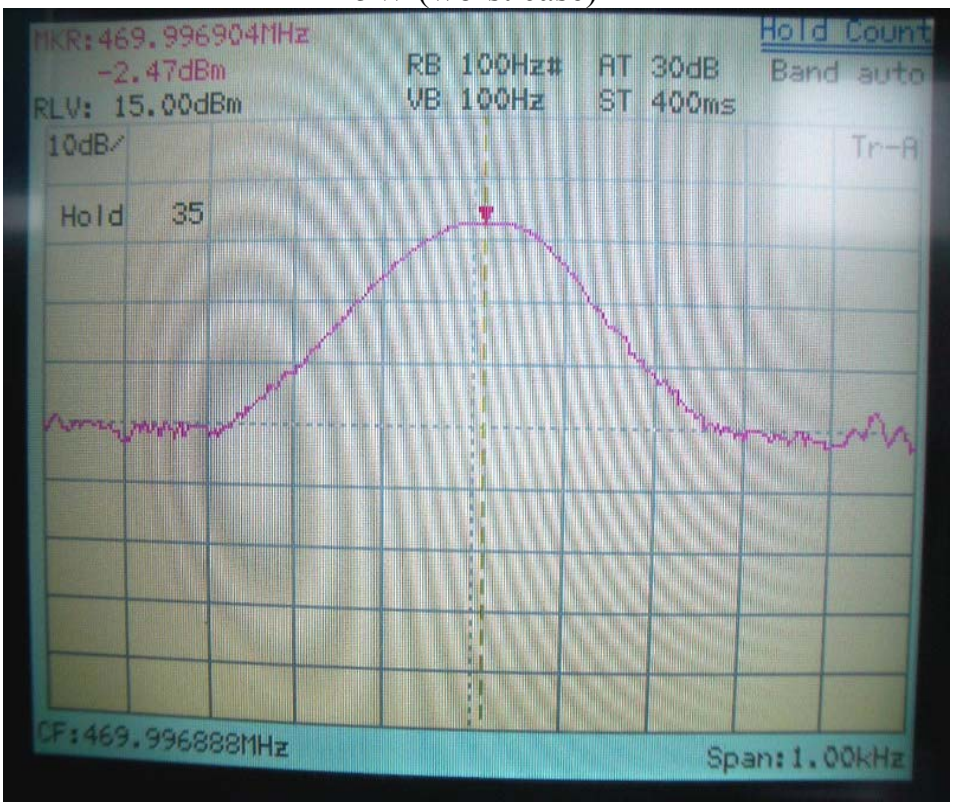
## 4.3 Test Equipment:

| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
|---|---|---|---|---|---|
| Spectrum | MS2665C | Anritsu | 6200175476 | 03/21/05 | 03/20/06 |

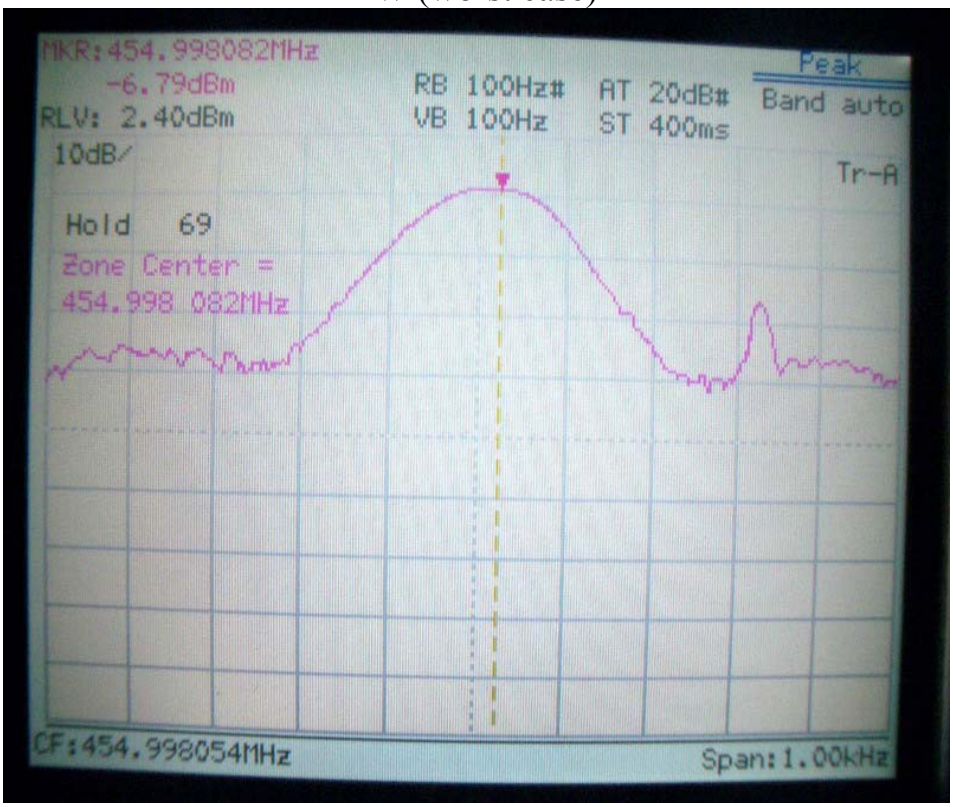
The level of confidence of 95% , the uncertainty of measurement of conducted emission is ± 1.55 dB .

Measurement Result:

5W (worst case)

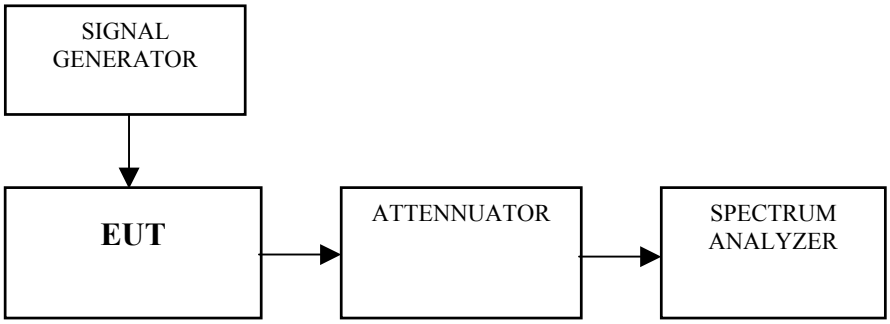



2W (worst case)



# V. Occupied Bandwidth: (Part 2.1049, 90.209)

## 5.1 Test procedure:




(1) Connect the equipment as illustrated.
(2) The signal generator was transmitting modulation signal to the EUT.
(3) Four kinds of modulation signals have tested, they are none, AN, NB and WB.
(4) During the testing, adjust different modulations.
(5) Observe and recorded the test results.

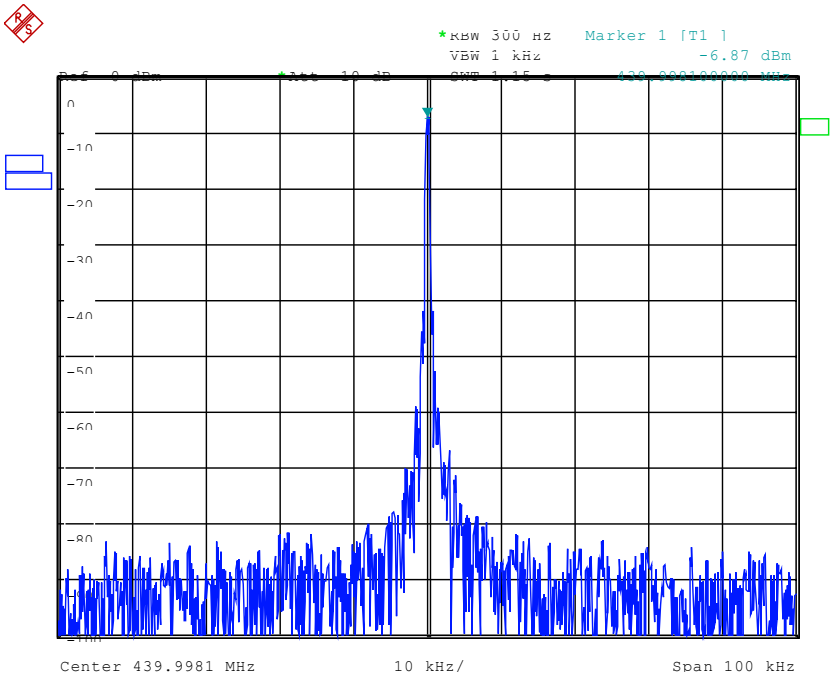
## 5.2 Test Equipment:

| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
|---|---|---|---|---|---|
| Spectrum | MS2665C | Anritsu | 6200175476 | 03/21/05 | 03/20/06 |

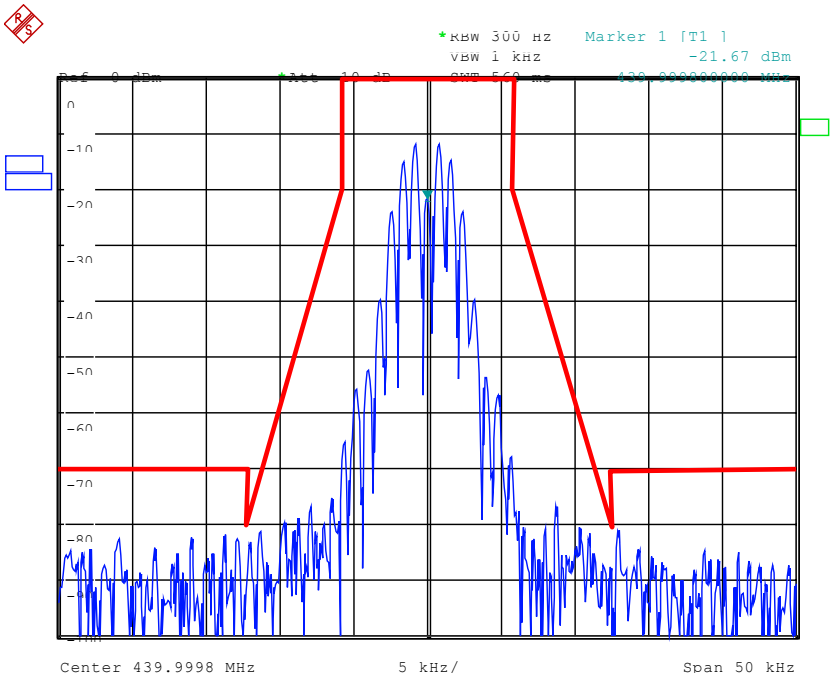
The level of confidence of 95% , the uncertainty of measurement is ± 12 Hz .

### 5.3 Test Result:

Measurement Result:

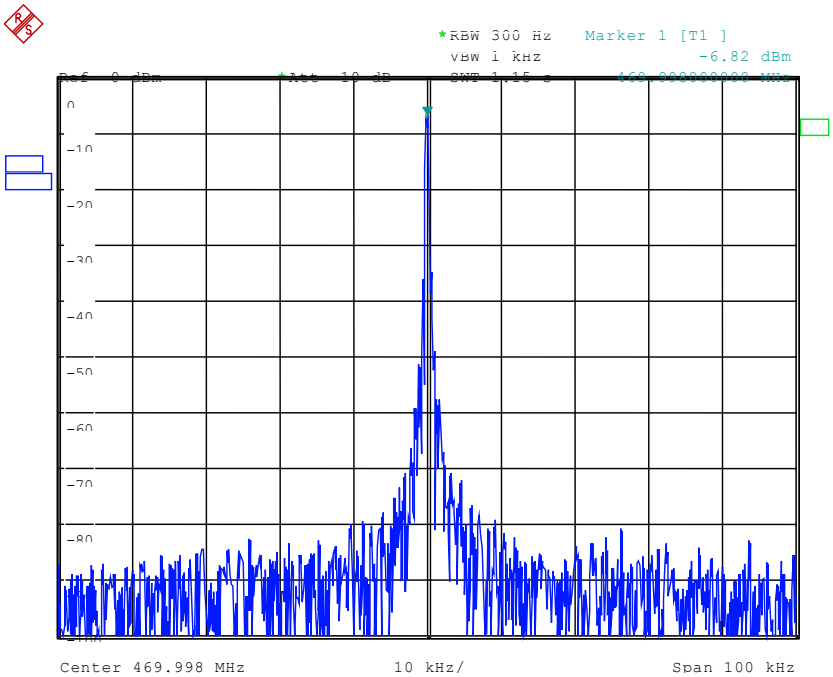



**Power : 2W**
**Frequency : 440MHz**
**Modulation : NONE**

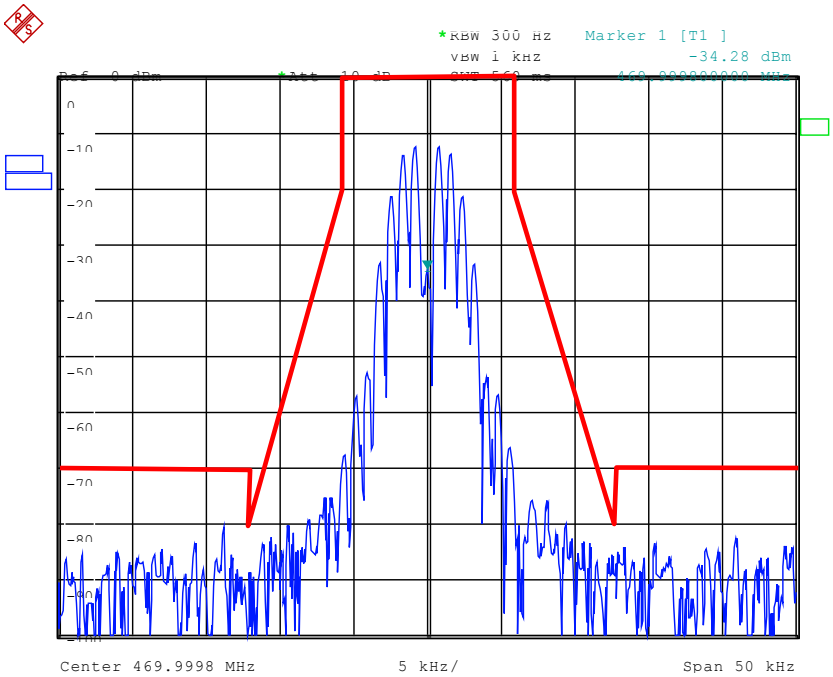



**Power : 2W**
**Frequency : 440MHz**
**Modulation : Mask: D, NB**

Measurement Result:

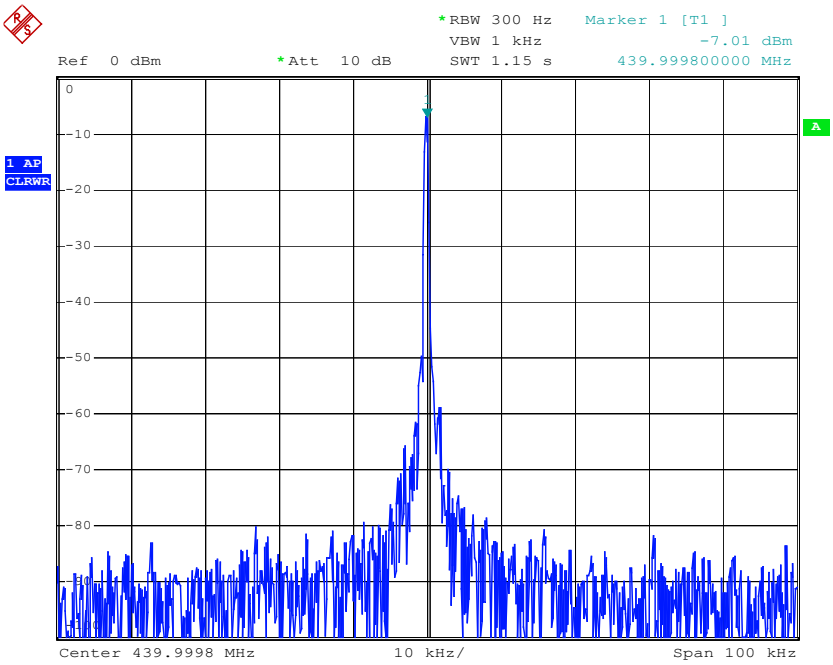



**Power : 2W**
**Frequency : 470MHz**
**Modulation : NONE**



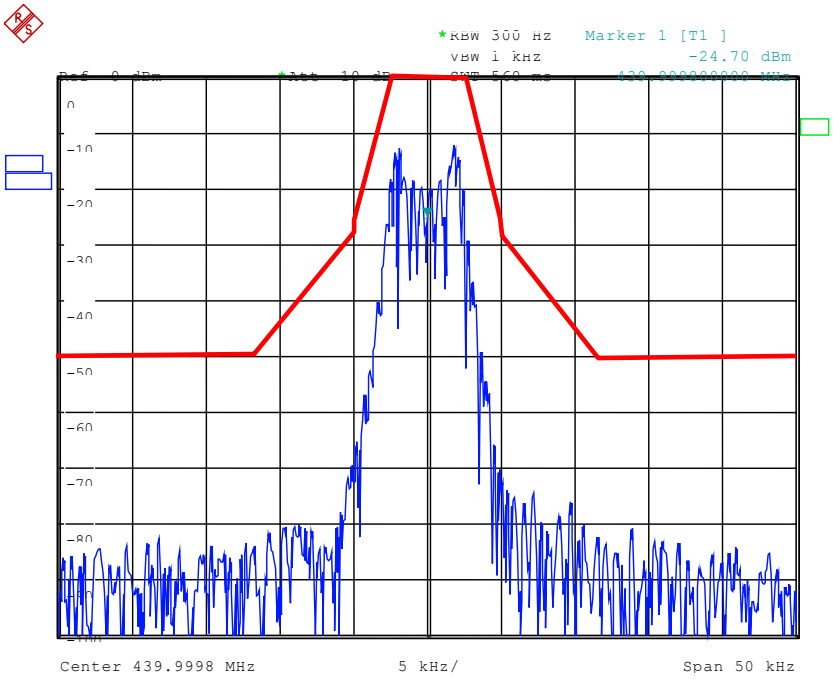

**Power : 2W**
**Frequency : 470MHz**
**Modulation : Mask: D, NB**

Measurement Result:



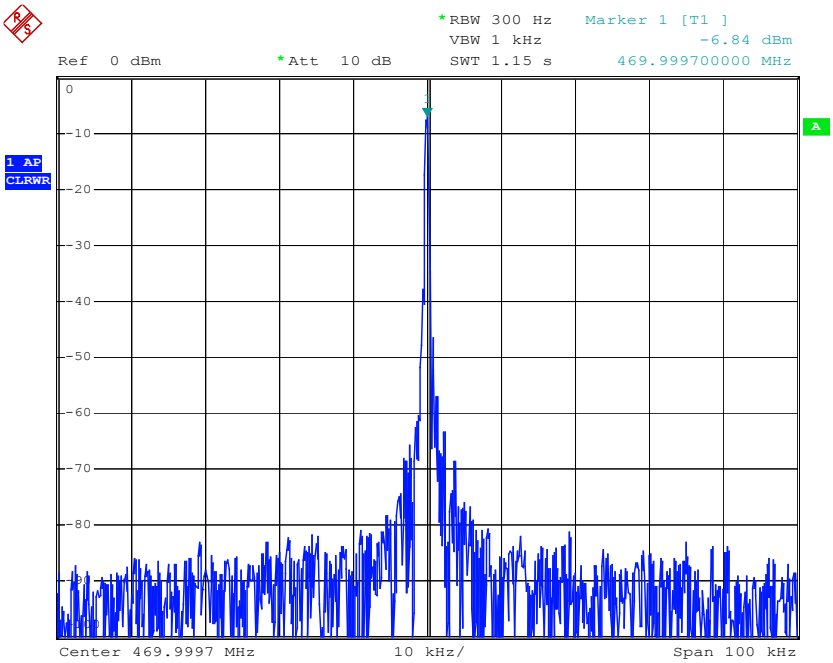

Date: 4.APR.2005 09:00:42

**Power : 2W**
**Frequency : 440MHz**
**Modulation : NONE**



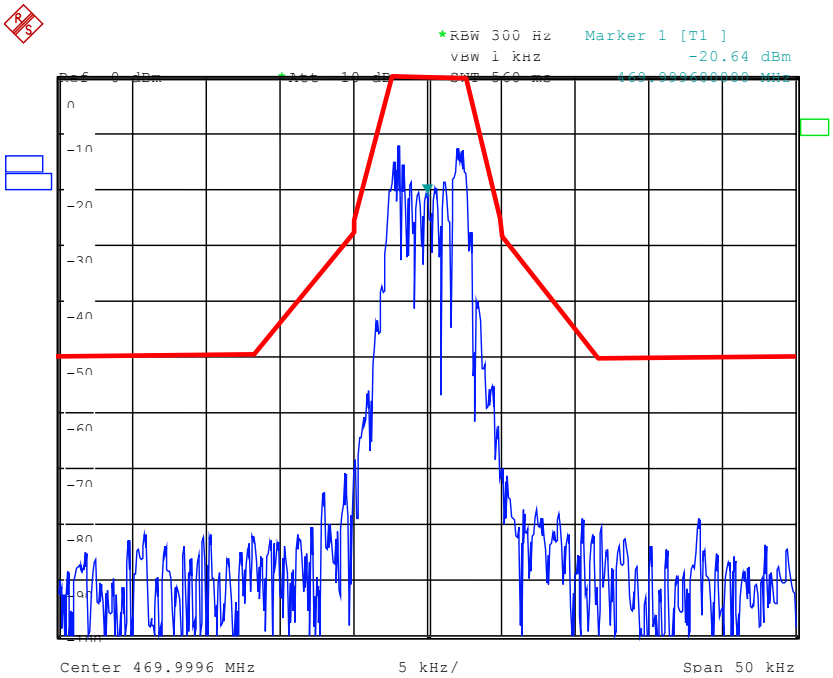

**Power : 2W**
**Frequency : 440MHz**
**Modulation : Mask: C, AN**

Measurement Result:



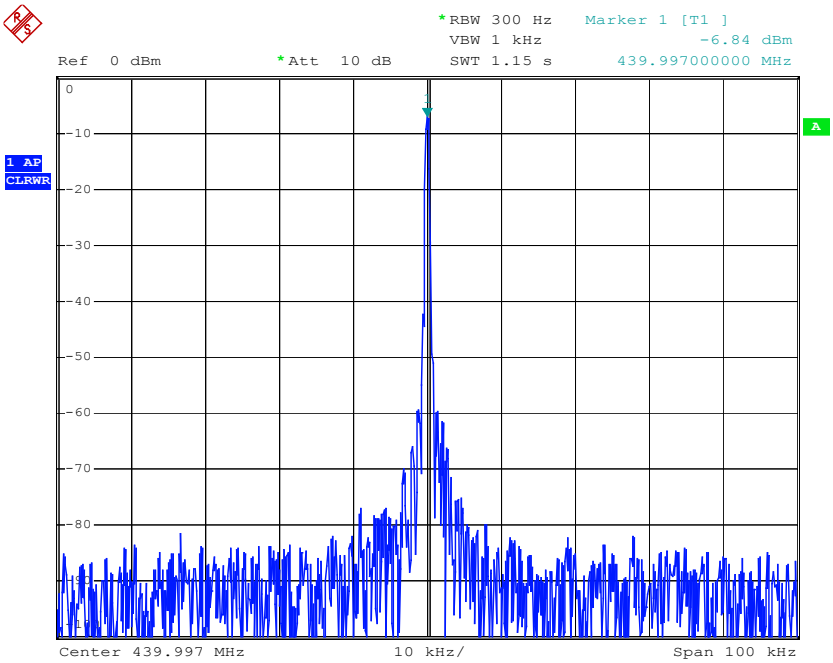

Date: 4.APR.2005 09:13:26

**Power : 2W**
**Frequency : 470MHz**
**Modulation : NONE**



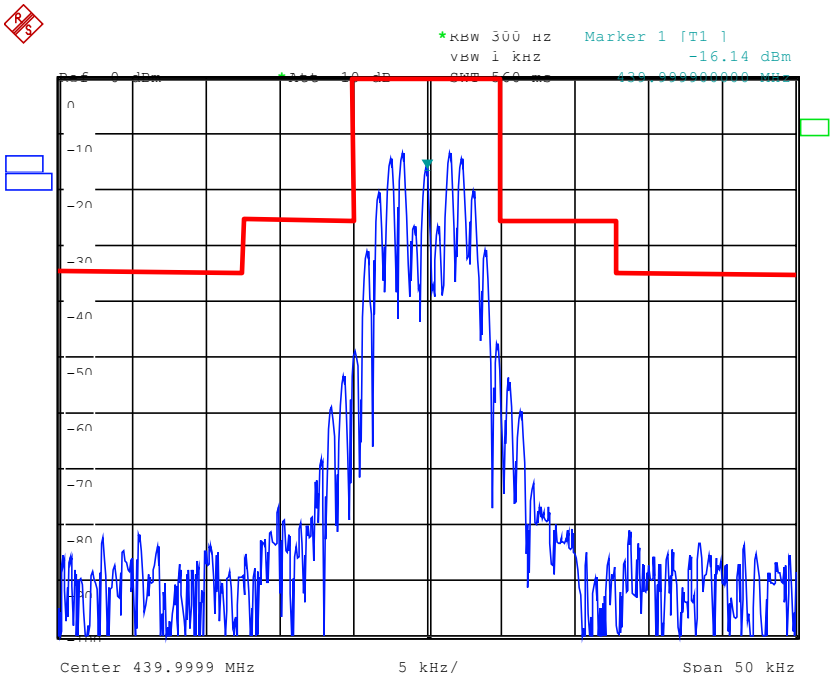

**Power : 2W**
**Frequency : 470MHz**
**Modulation : Mask: C, AN**

Measurement Result:



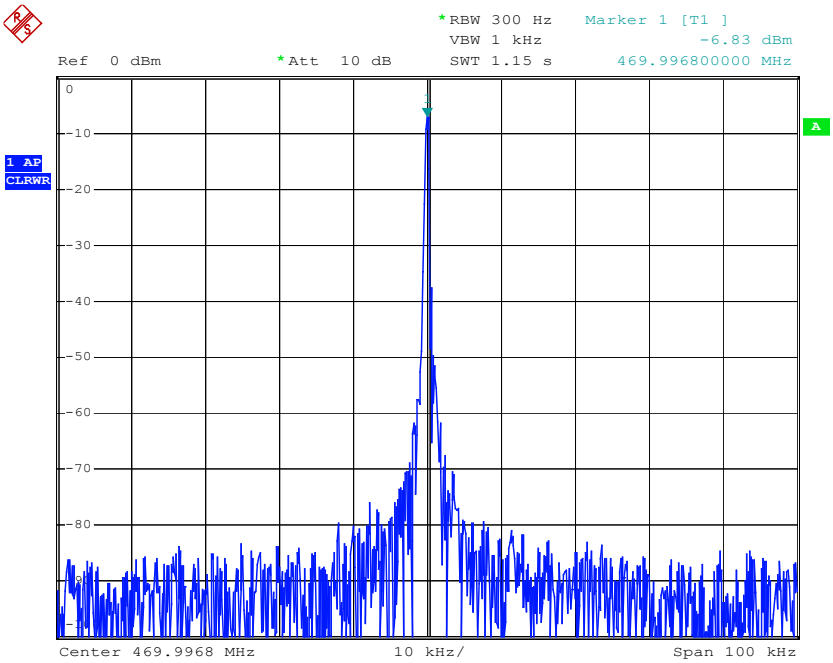

Date: 4.APR.2005 08:55:47

**Power : 2W**
**Frequency : 440MHz**
**Modulation : NONE**



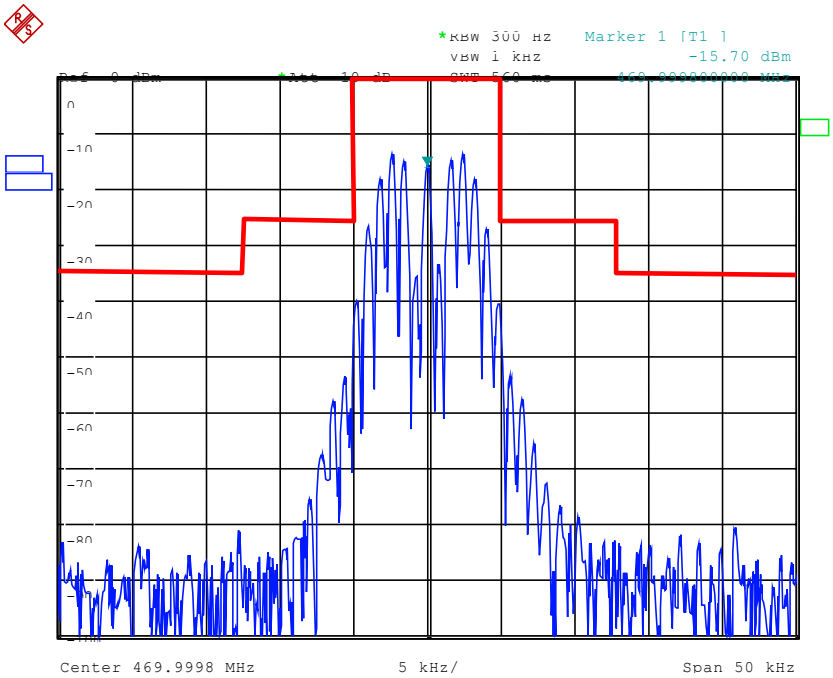

**Power : 2W**
**Frequency : 440MHz**
**Modulation : Mask: B, BW**

Measurement Result:



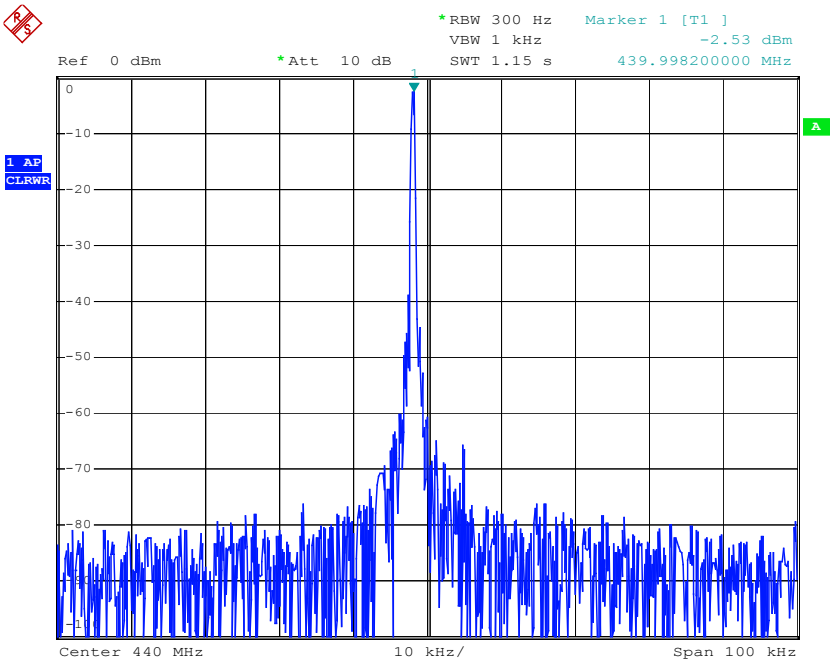

Date: 4.APR.2005 08:52:31

**Power : 2W**
**Frequency : 470MHz**
**Modulation : NONE**



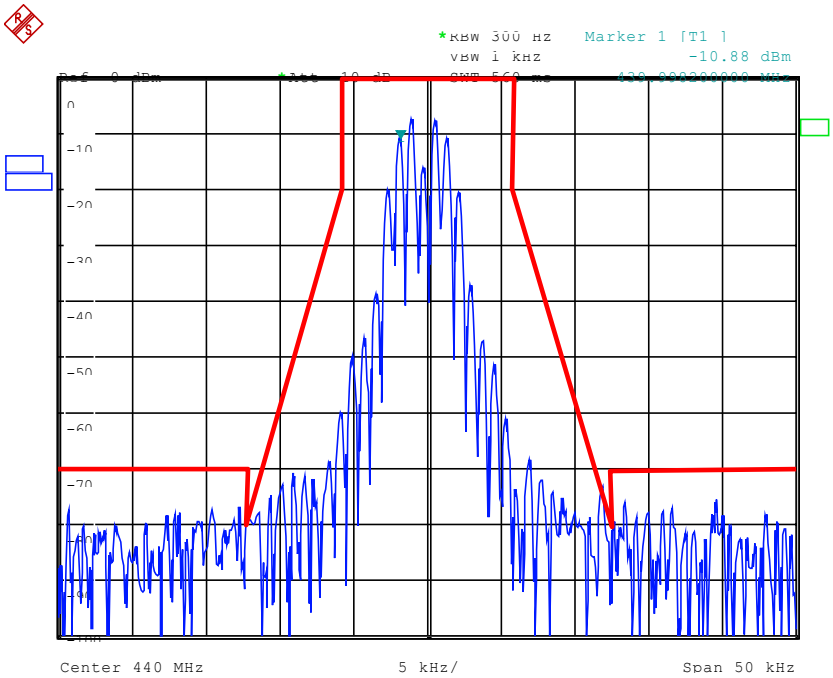

**Power : 2W**
**Frequency : 470MHz**
**Modulation : Mask: B, BW**

Measurement Result:



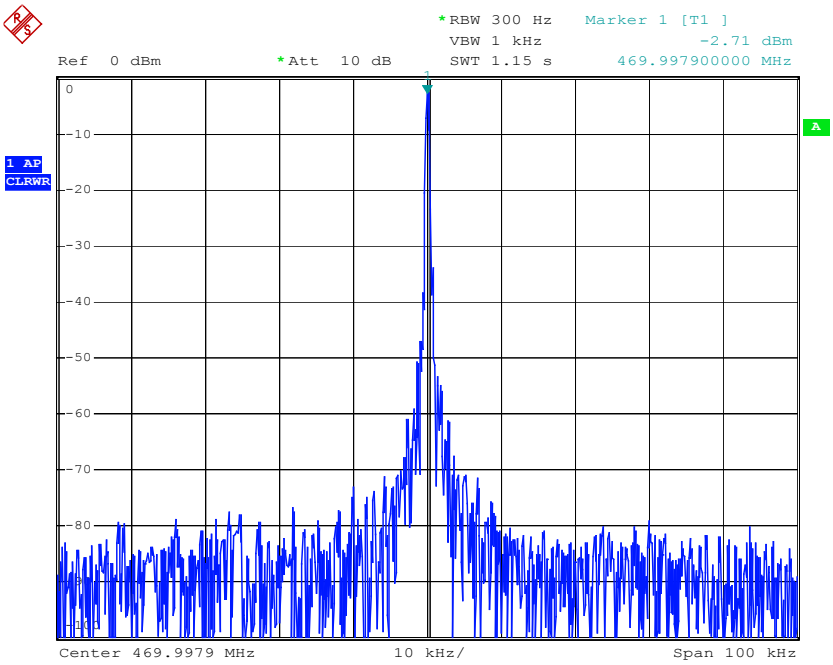

Date: 4.APR.2005 07:49:53

**Power : 5W**
**Frequency : 440MHz**
**Modulation : NONE**



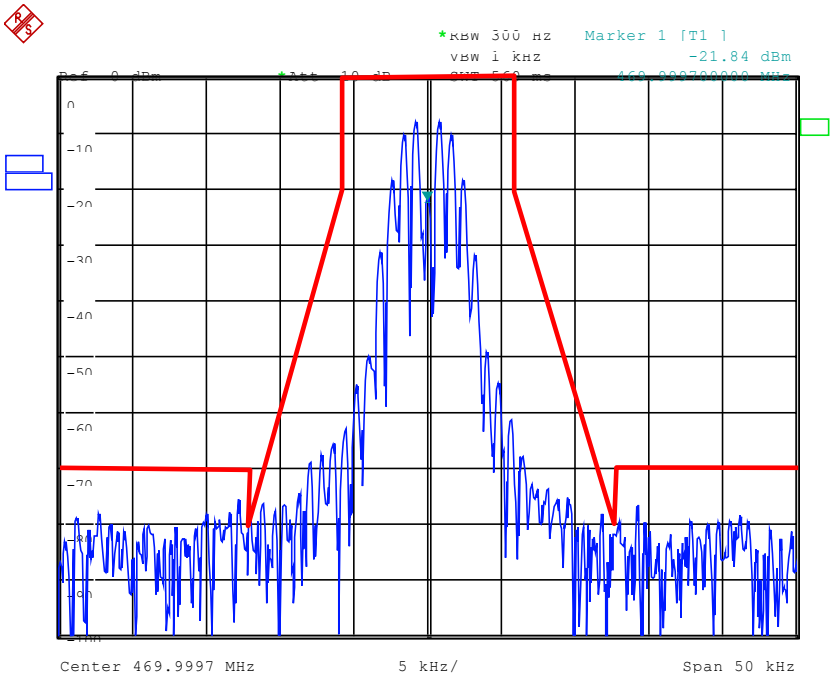

**Power : 5W**
**Frequency : 440MHz**
**Modulation : Mask: D, NB**

Measurement Result:



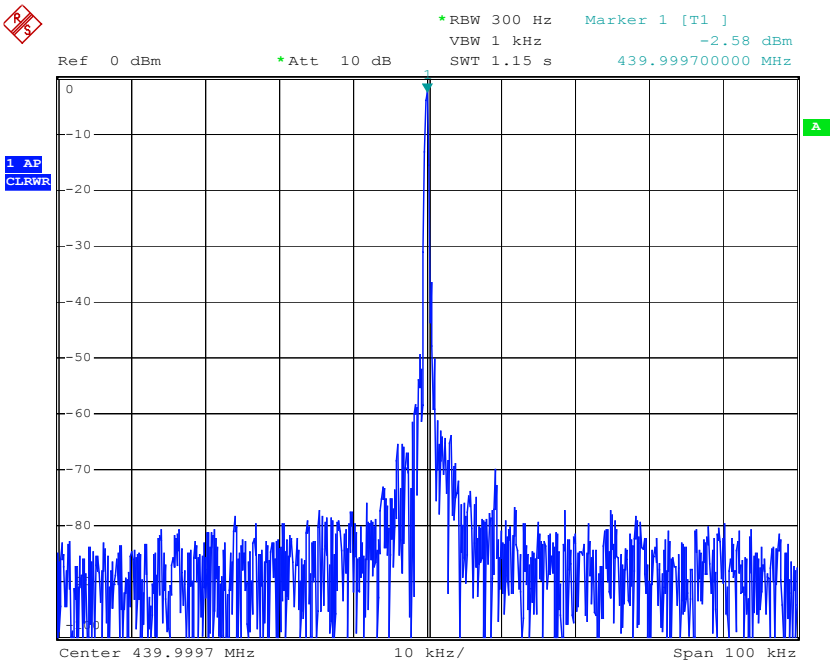

Date: 4.APR.2005 08:24:12

**Power : 5W**
**Frequency : 470MHz**
**Modulation : NONE**



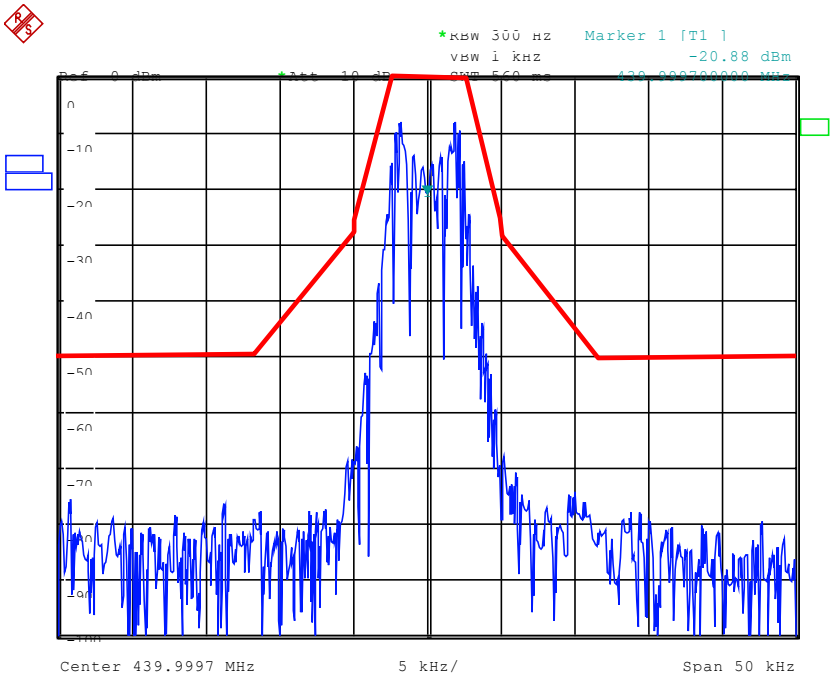

**Power : 5W**
**Frequency : 470MHz**
**Modulation : Mask: D, NB**

Measurement Result:



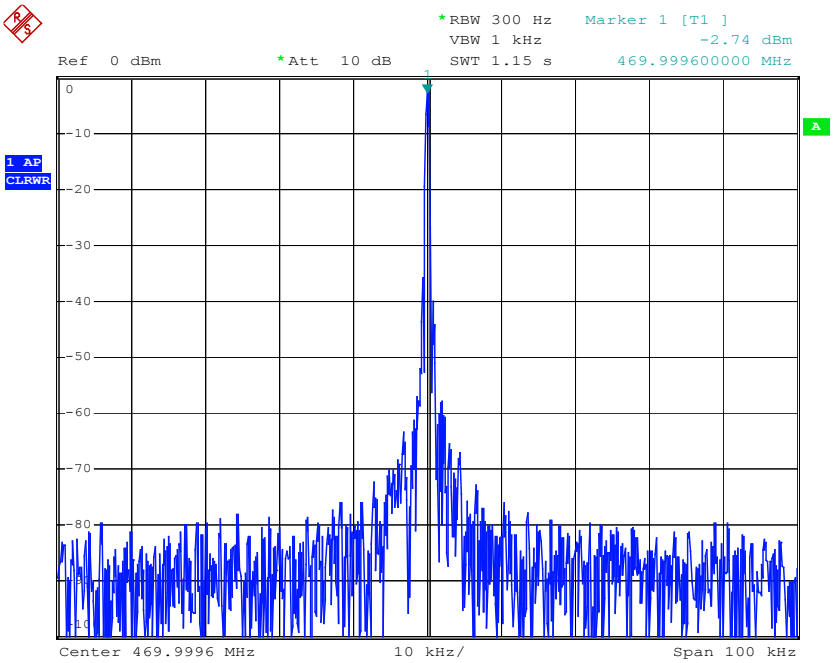

Date: 4.APR.2005 09:04:41

**Power : 5W**
**Frequency : 440MHz**
**Modulation : NONE**



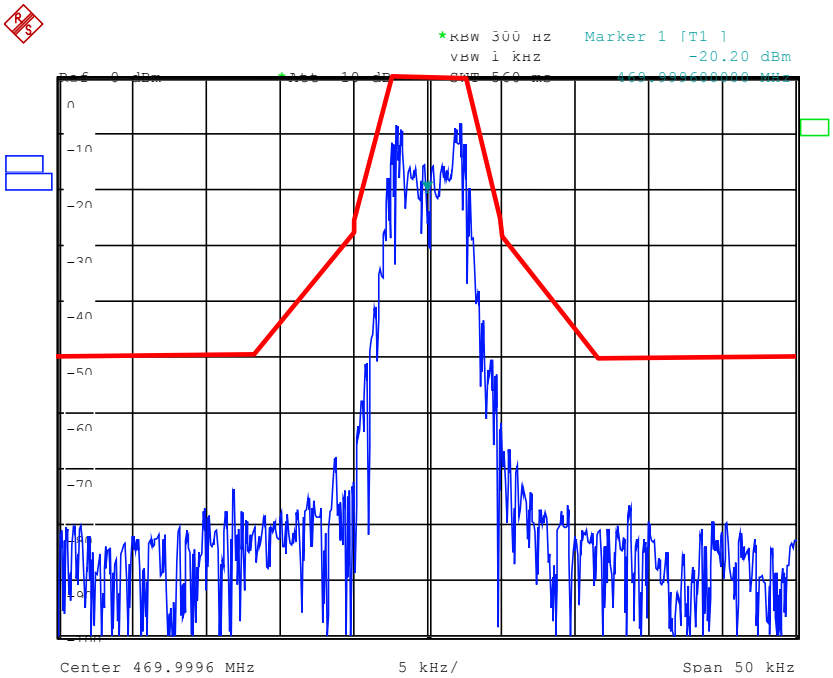

**Power : 5W**
**Frequency : 440MHz**
**Modulation : Mask: C, AN**

Measurement Result:



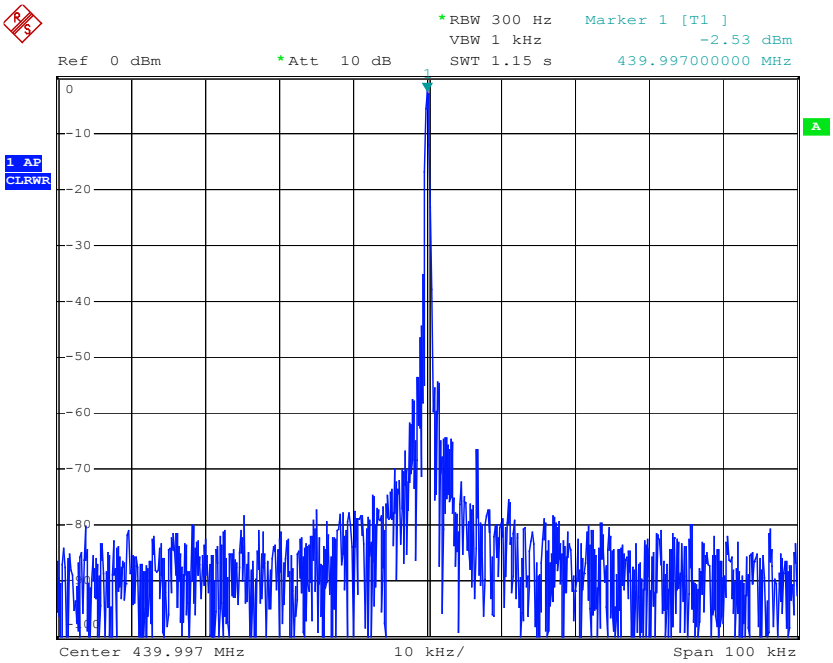

Date: 4.APR.2005 09:07:24

**Power : 5W**
**Frequency : 470MHz**
**Modulation : NONE**



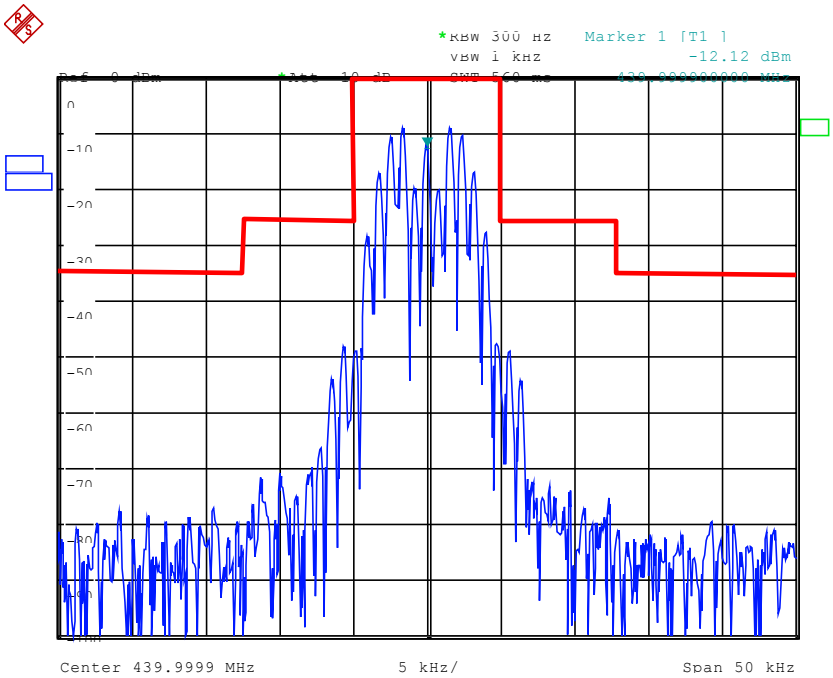

**Power : 5W**
**Frequency : 470MHz**
**Modulation : Mask: C, AN**

Measurement Result:



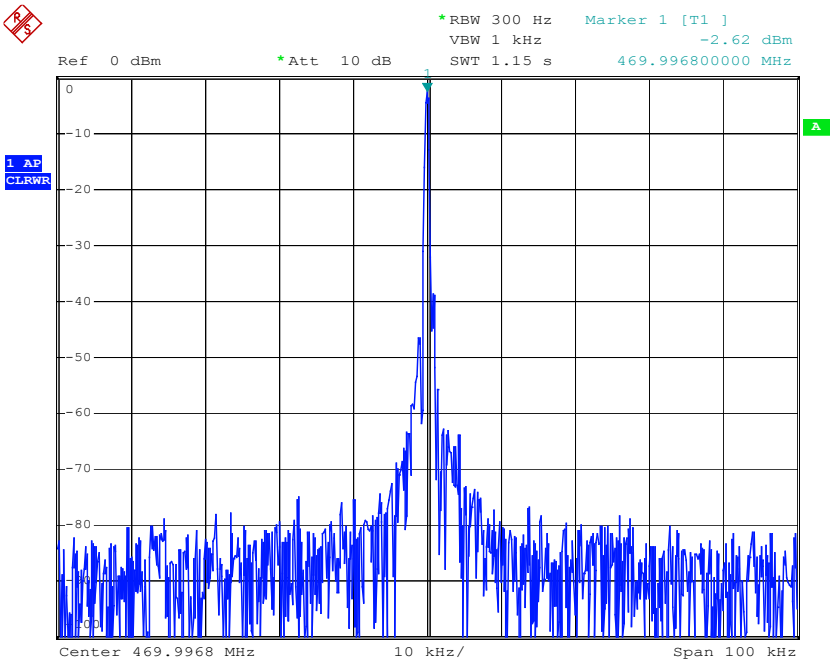

Date: 4.APR.2005 08:09:02

**Power : 5W**
**Frequency : 440MHz**
**Modulation : NONE**



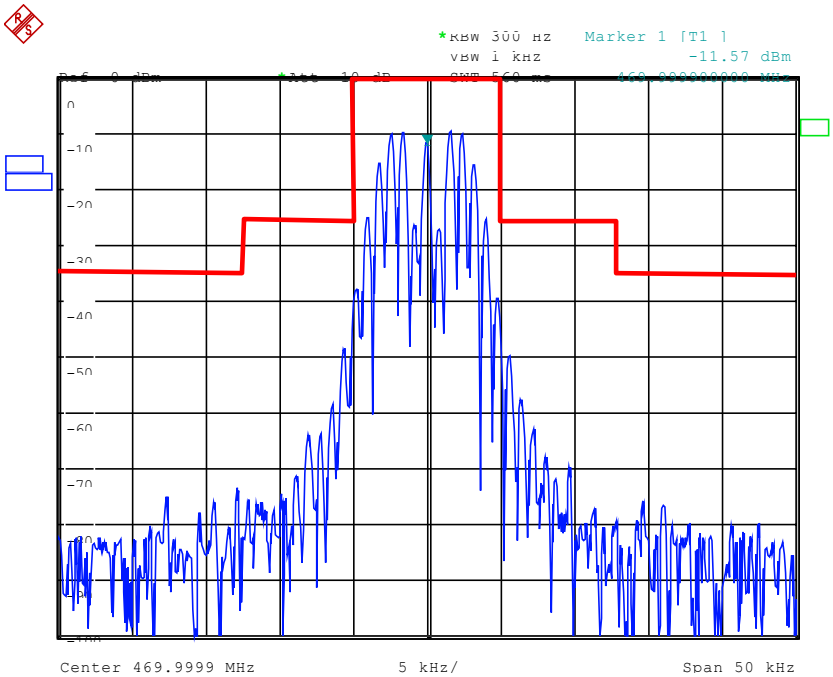

**Power : 5W**
**Frequency : 440MHz**
**Modulation : Mask: B, BW**

Measurement Result:




Date: 4.APR.2005 08:17:51

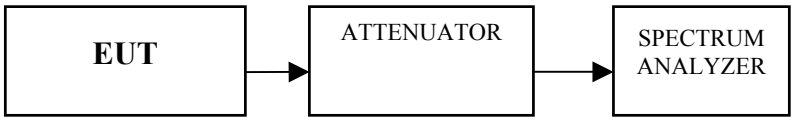
**Power : 5W**
**Frequency : 470MHz**
**Modulation : NONE**




**Power : 5W**
**Frequency : 470MHz**
**Modulation : Mask: B, BW**

# VI. Spurious Emissions at Antenna Terminals (Part 2.1051, 90.210)

## 6.1 Test procedure:




(1) Set the ref level to the RF power output.
(2) The EUT was connected with attenuator and spectrum analyzer.
(3) The spectrum offset was adjusted to compensate the attenuator and losses caused by the connection.
(4) Connect the EUT as step (2) (3)
(5) For deviation 2.5KHz, set spectrum Frequency start from 30MHz to 1GHz, RBW = 10KHz, VBW = 10KHz.
(6) Then set Frequency from 480MHz to 1GHz, 1GHz to 3.0GHz, 3.0GHz to 5.0GHz. RBW = 10KHz, VBW = 10KHz.
(7) Then set Frequency from 3.0GHz to 5.0GHz. RBW = 10KHz, VBW = 10KHz.
(8) For deviation 2.5kHz, repeat step (5) to (7).

## 6.2 Test Result:

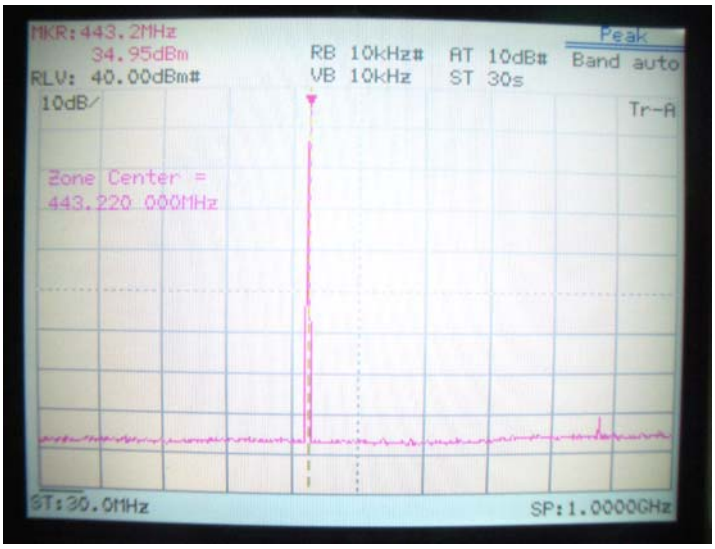
| Spurious (dBm) | Limit (dBm) |
|---|---|
| Under limit | -20 |

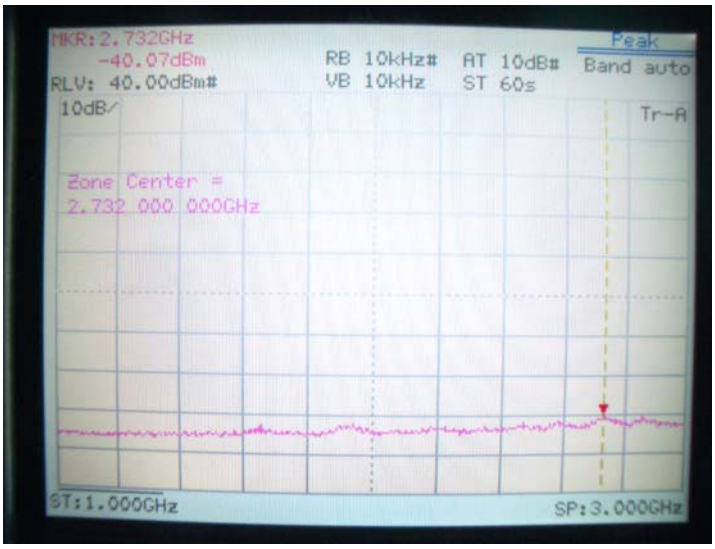
## 6.3 Test Equipment:

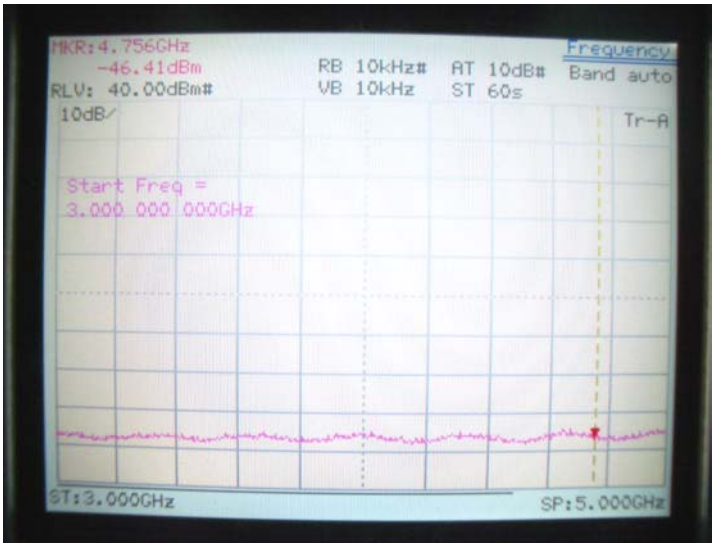
| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
|---|---|---|---|---|---|
| Spectrum | MS2665C | Anritsu | 6200175476 | 03/21/05 | 03/20/06 |

The level of confidence of 95% , the uncertainty of measurement of conducted emission is ± 2.02 dB .

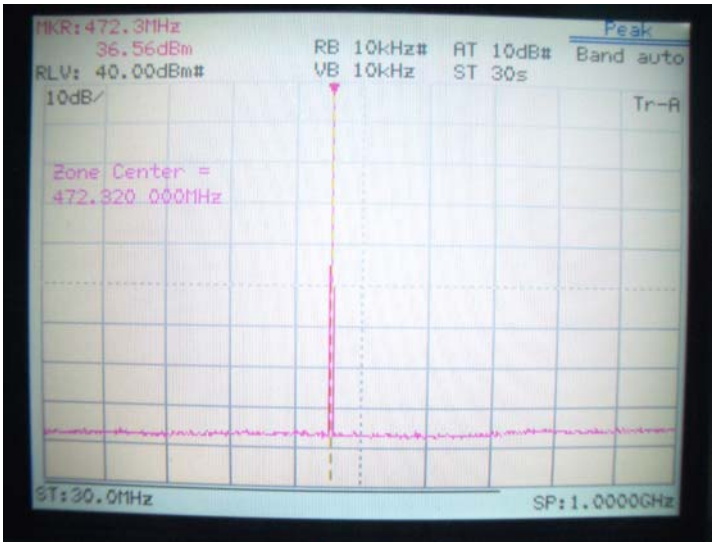
Measurement Result:
5W, 440MHz, AN

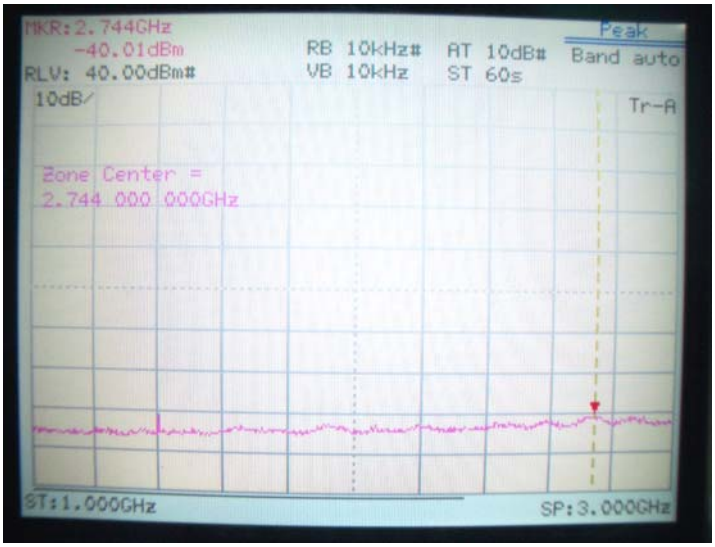


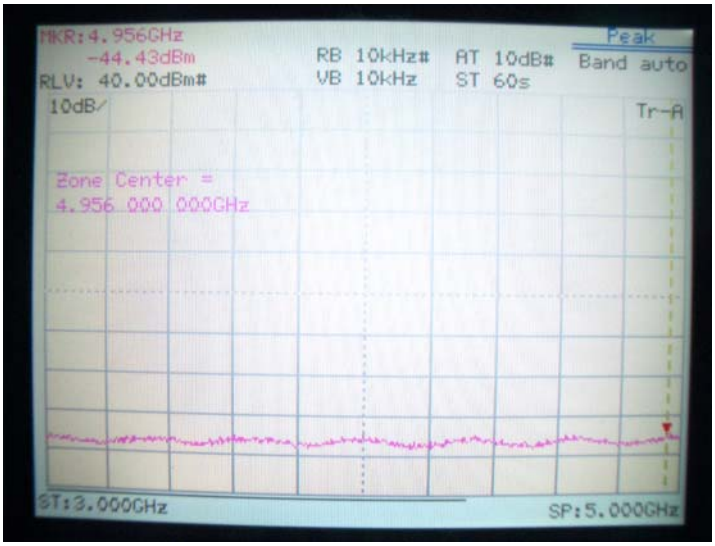



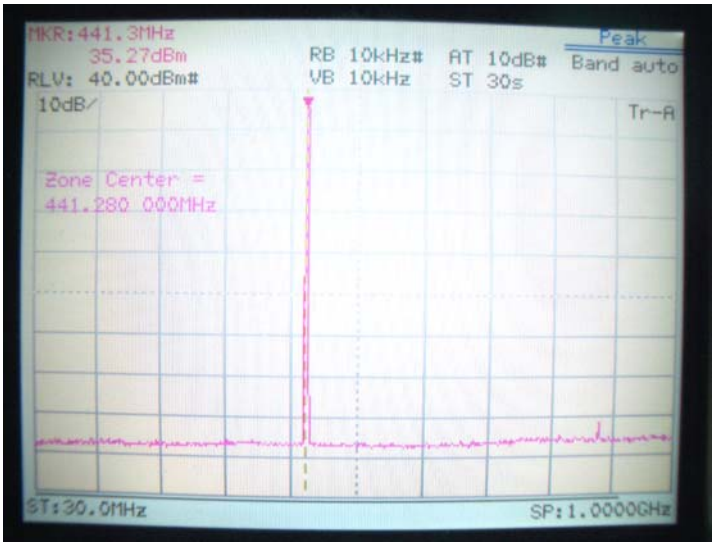
Measurement Result:
5W, 470MHz, AN

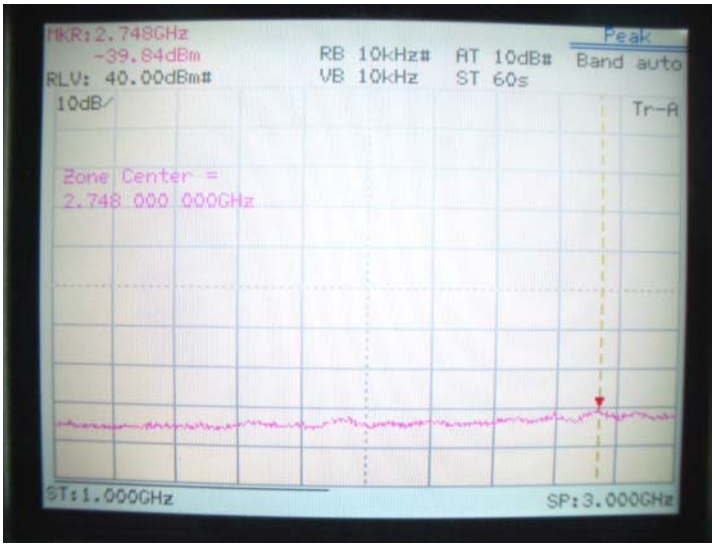


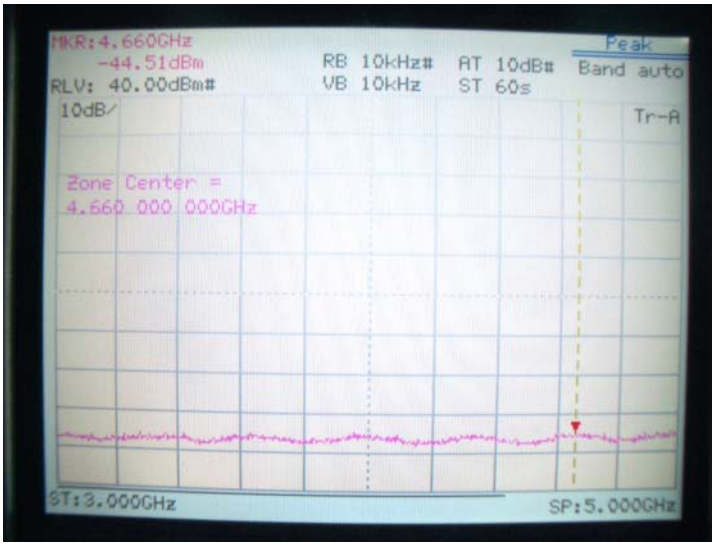



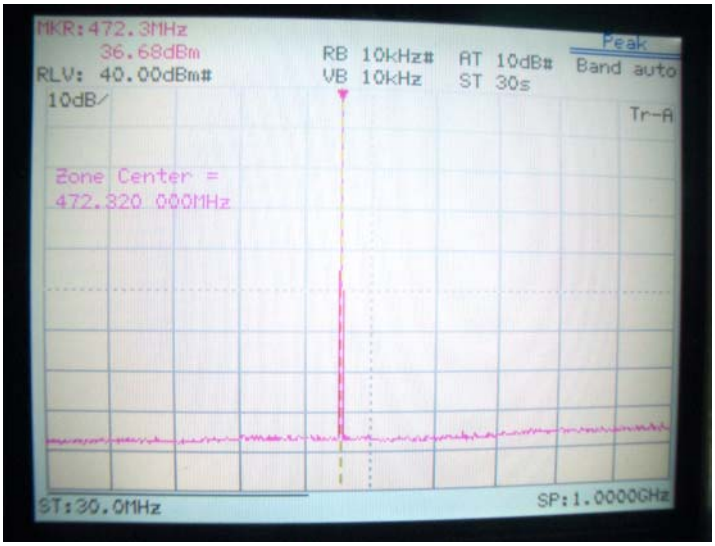
Measurement Result:
5W, 440MHz, NB

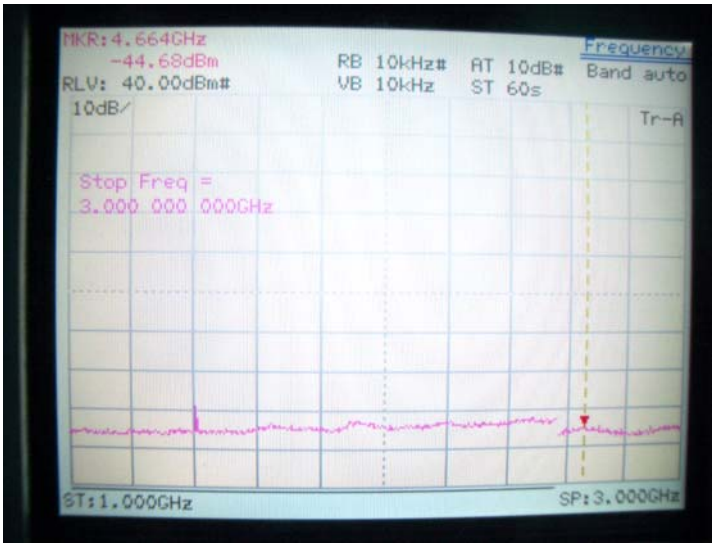


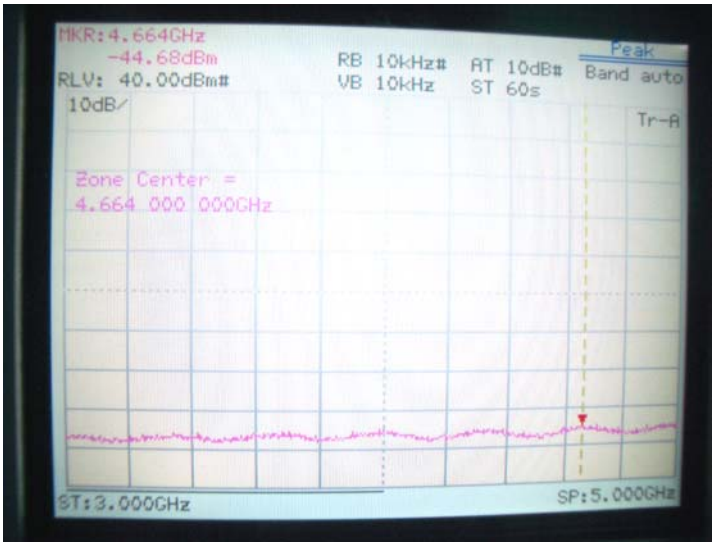



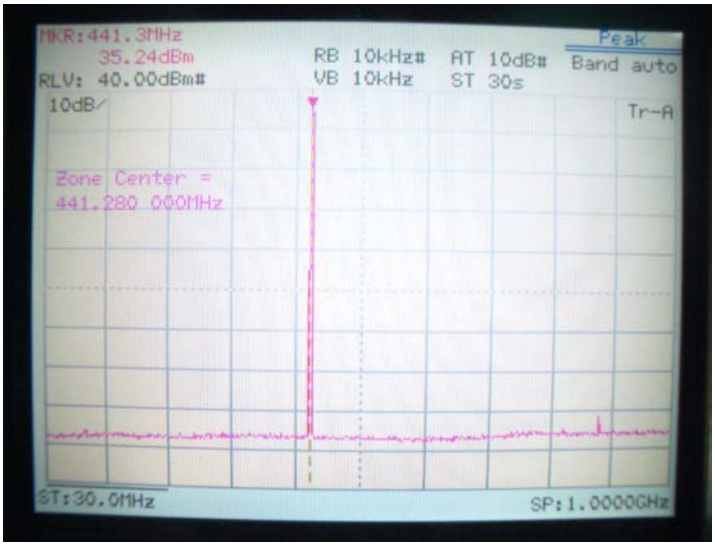
Measurement Result:
5W, 470MHz, NB

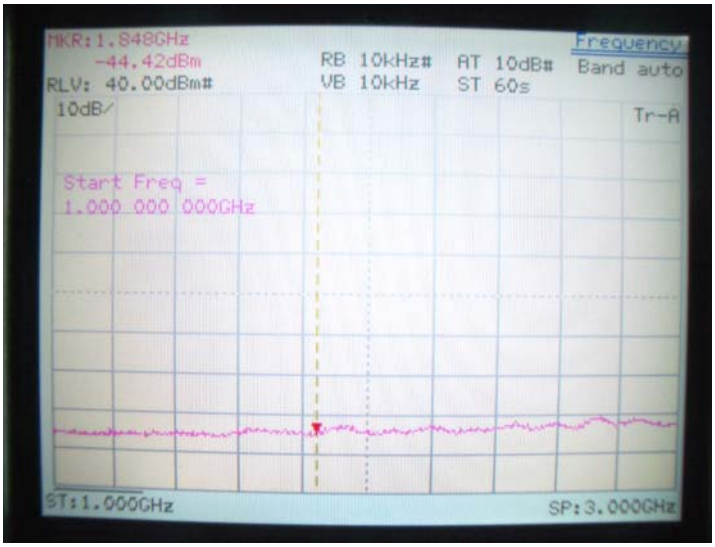


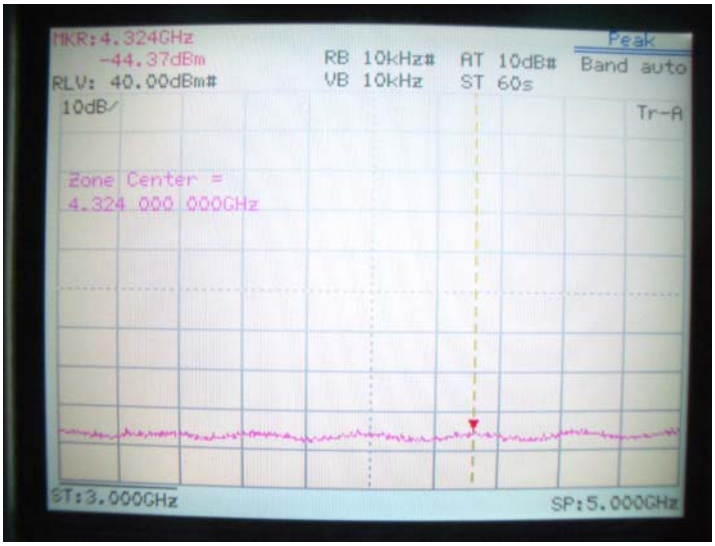



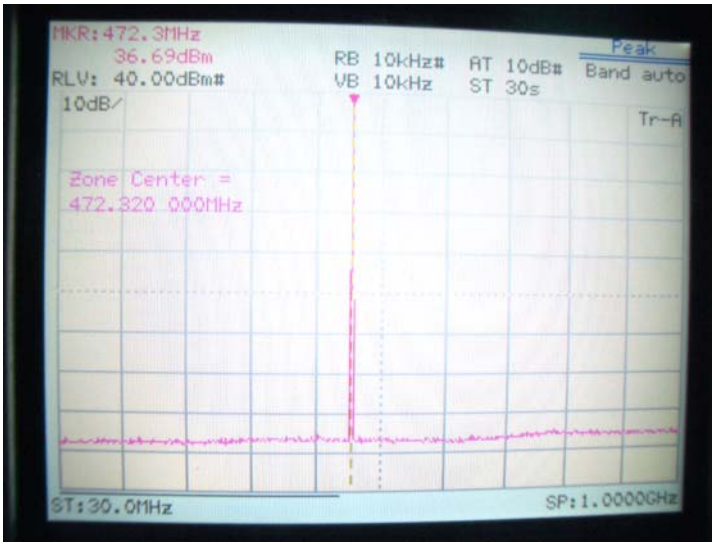
Measurement Result:
5W, 440MHz, WB

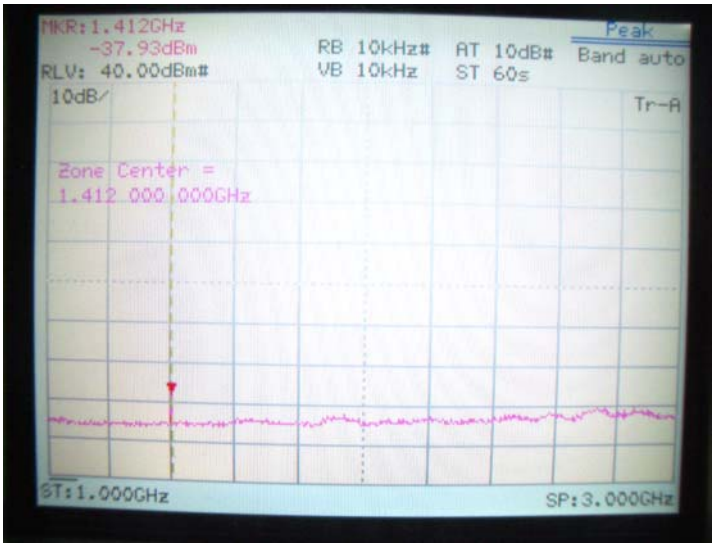


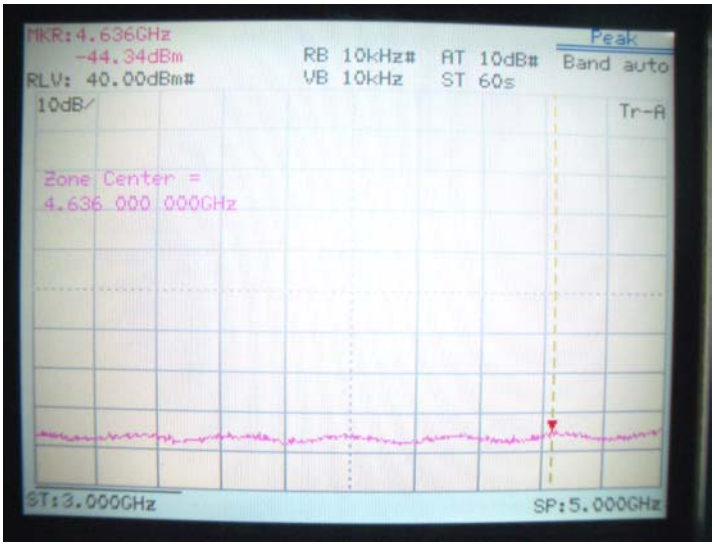



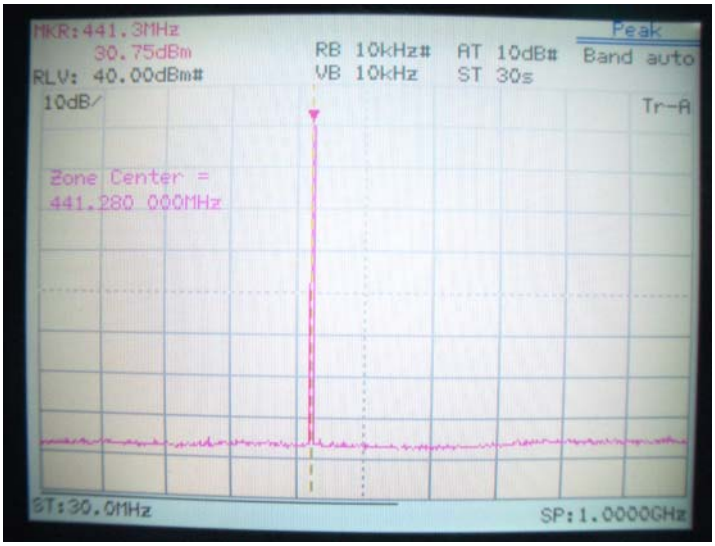
Measurement Result:
5W, 470MHz, WB

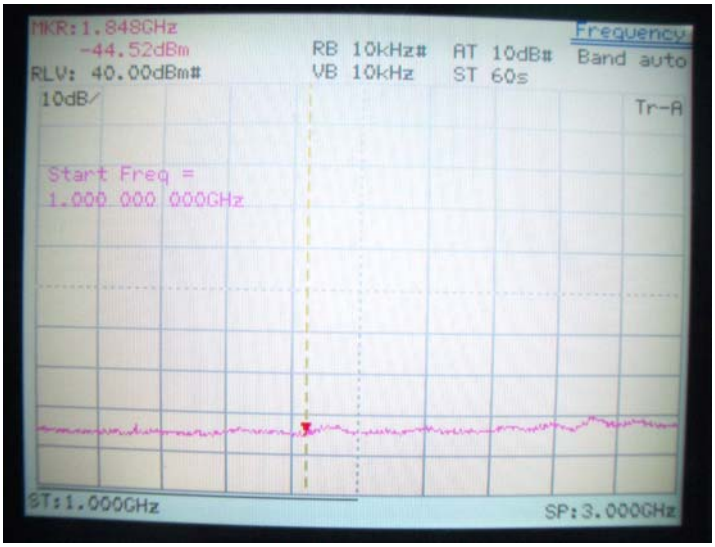


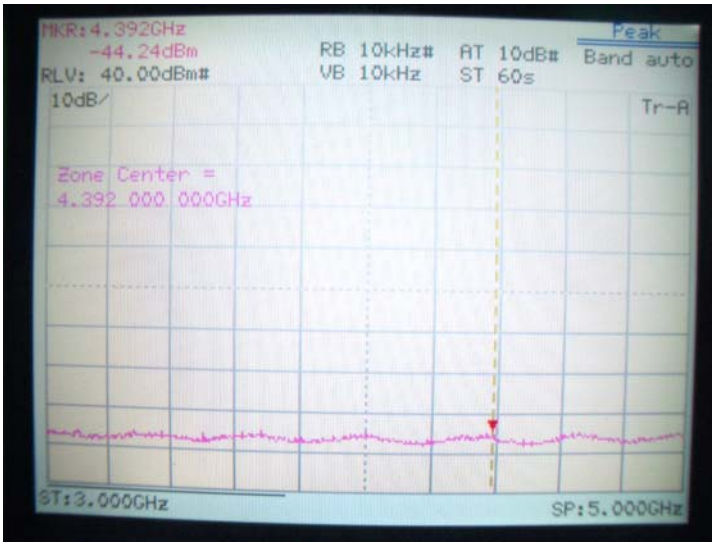



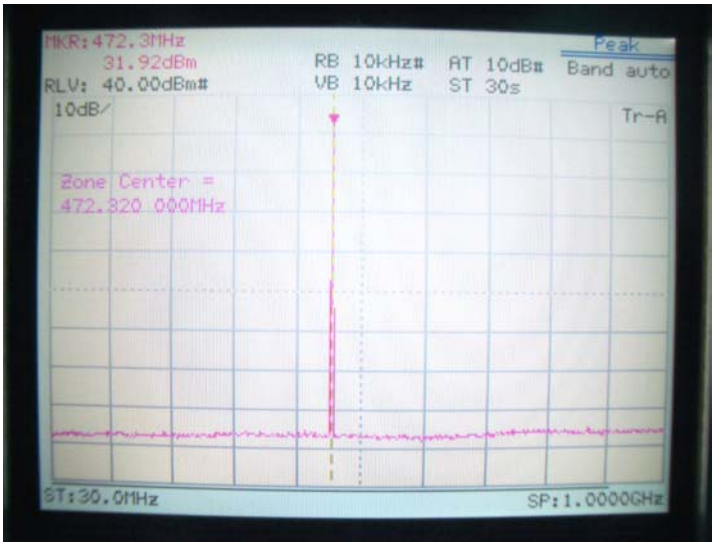
Measurement Result:
2W, 440MHz, AN

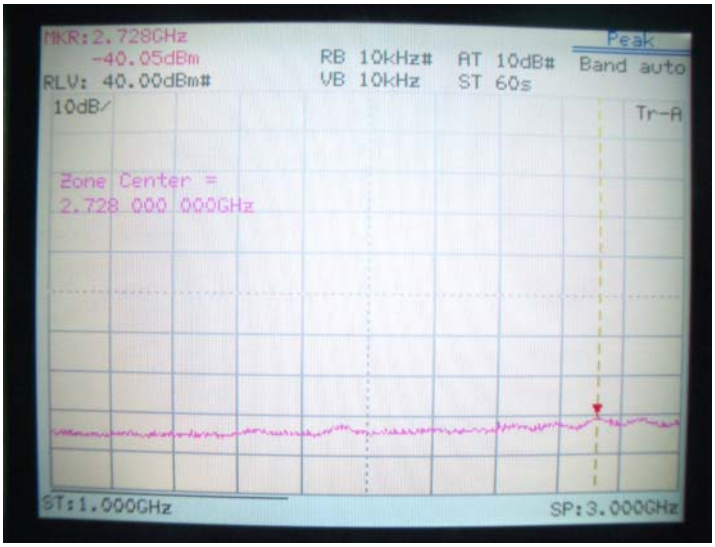


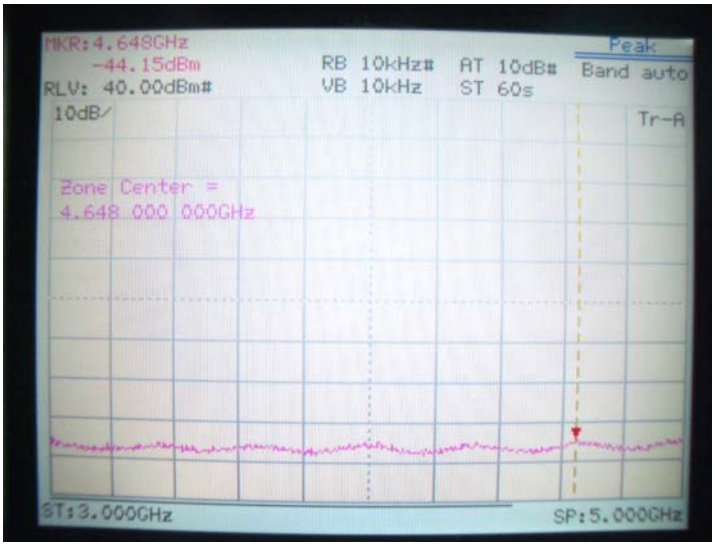



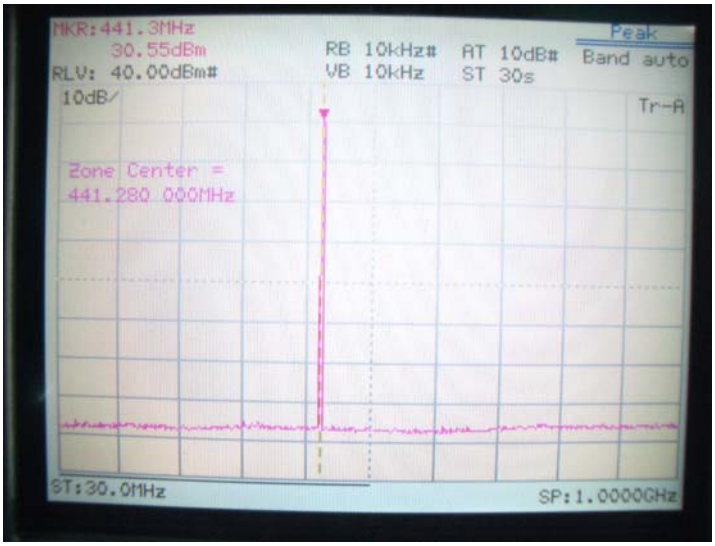
Measurement Result:
2W, 470MHz, AN

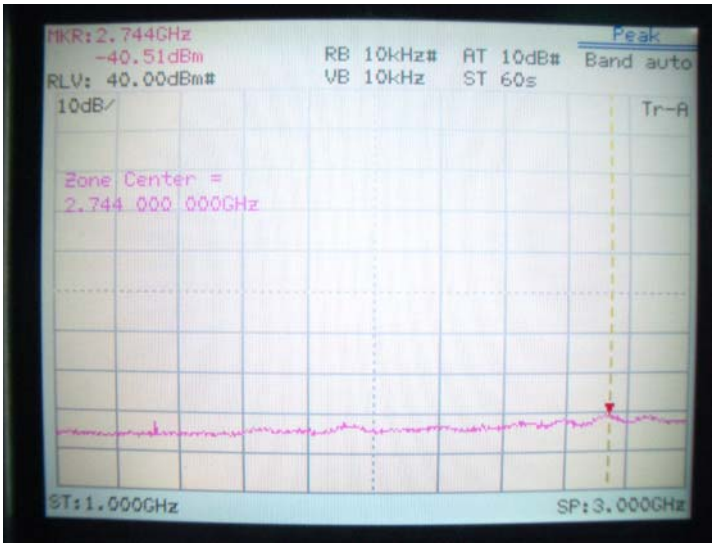


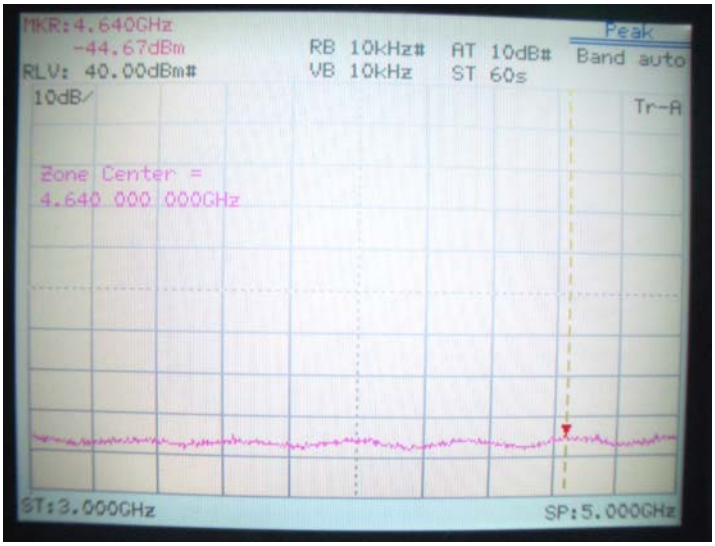



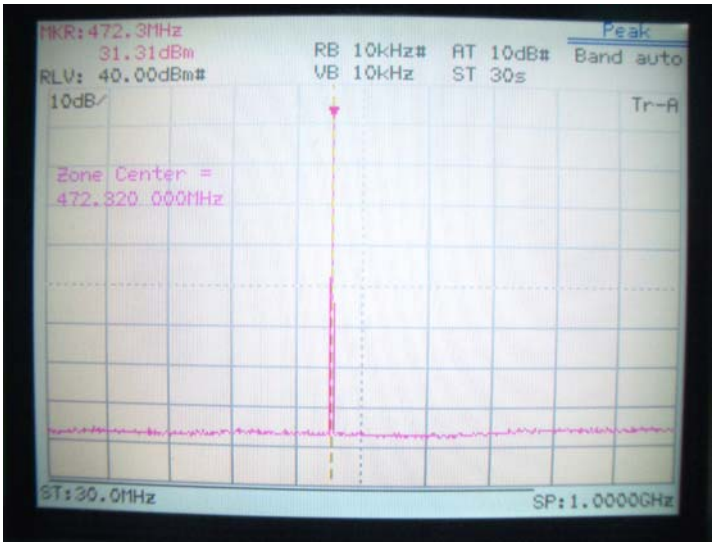
Measurement Result:
2W, 440MHz, NB

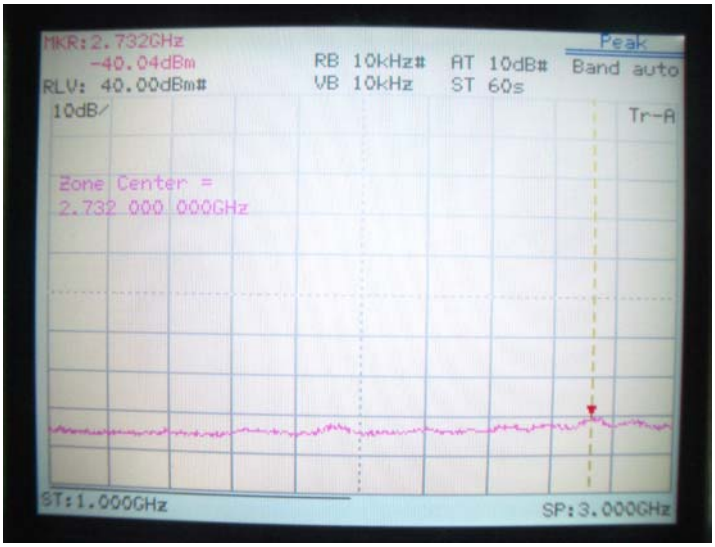


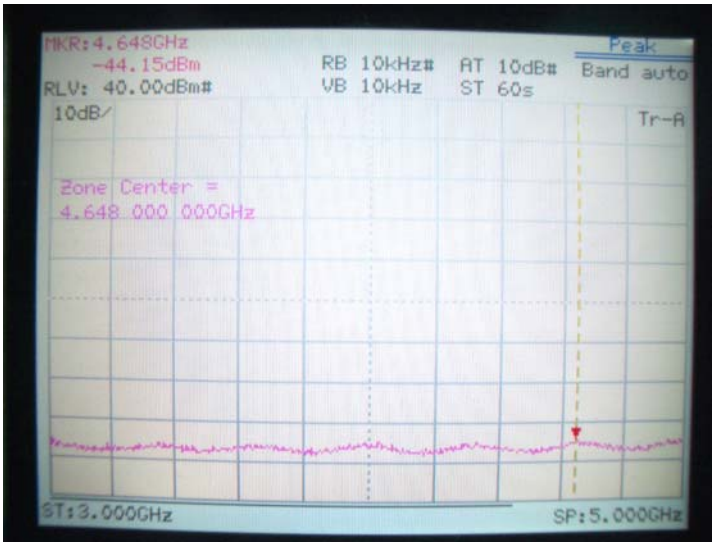



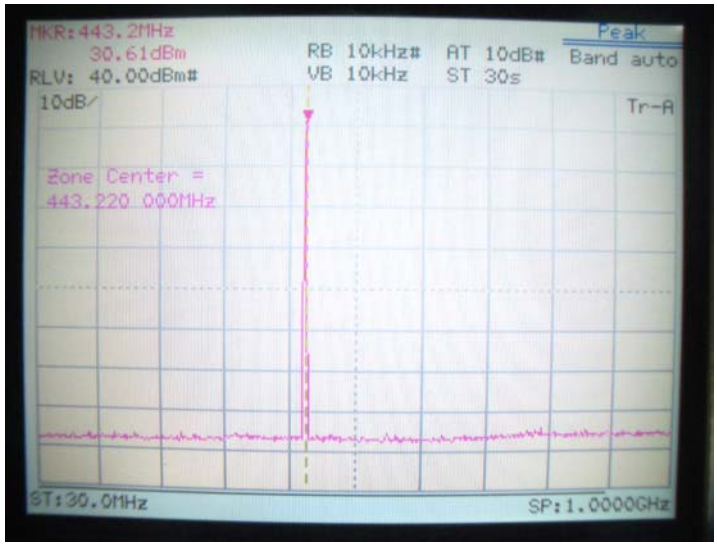
Measurement Result:
2W, 470MHz, NB

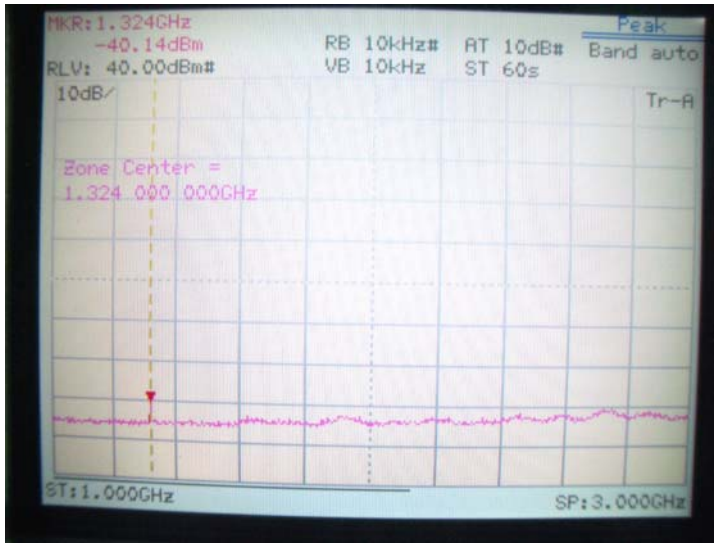


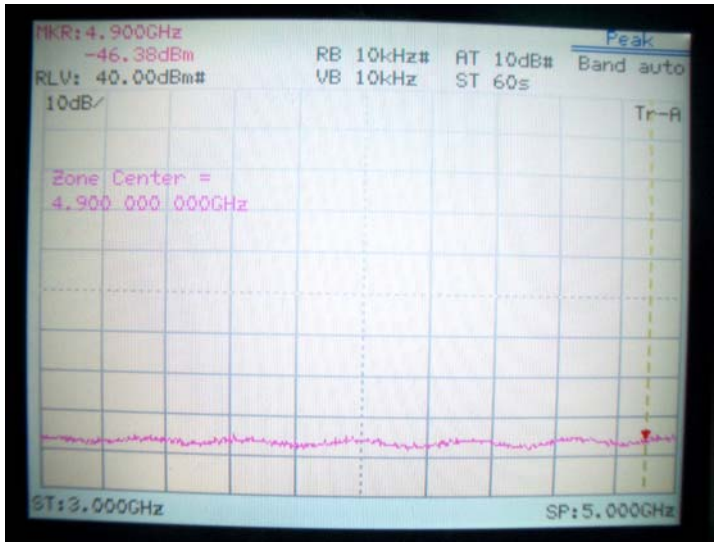



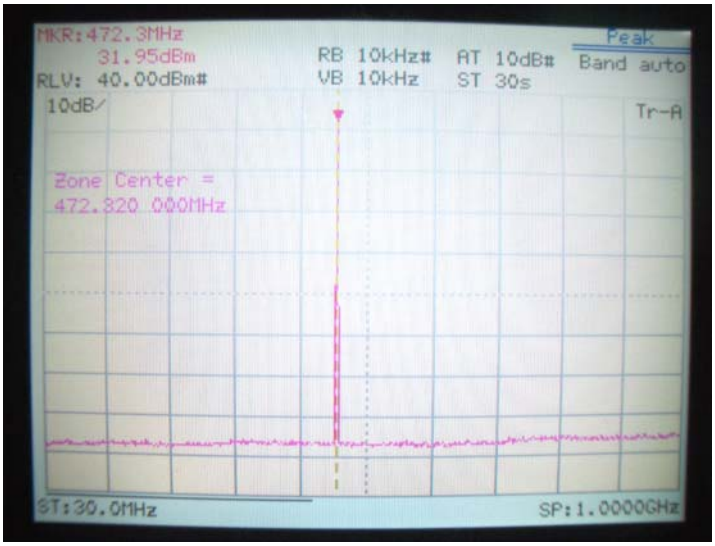
Measurement Result:
2W, 440MHz, WB

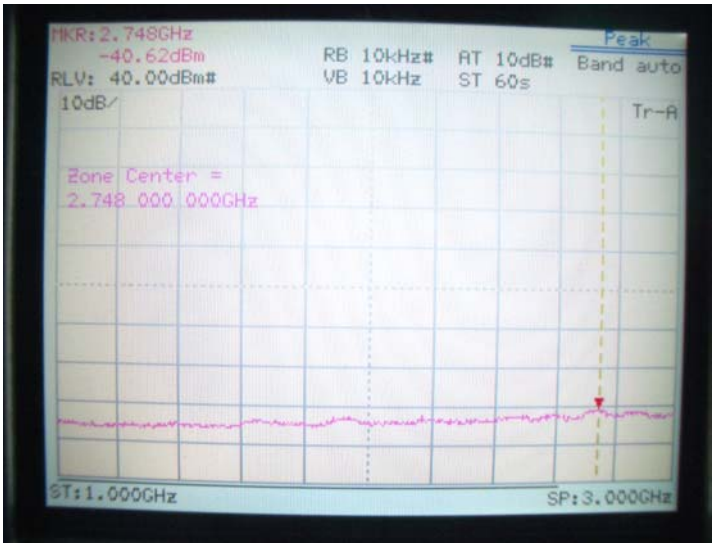


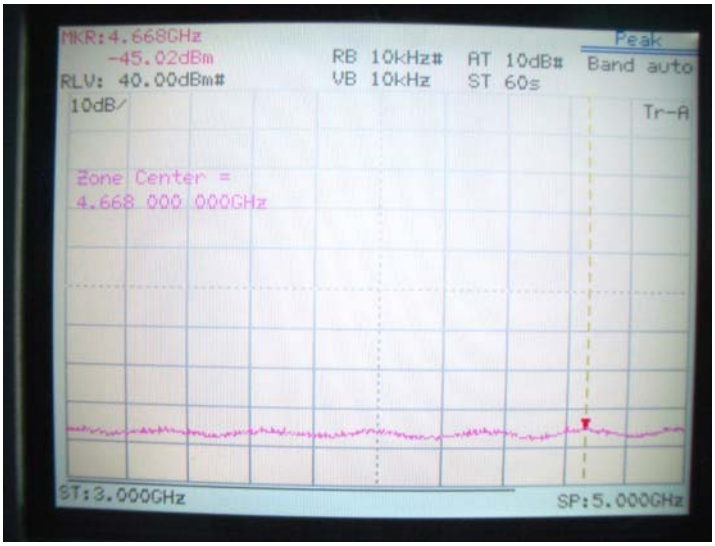



Measurement Result:
2W, 470MHz, WB



# VII. Field Strength of Spurious Radiation (Part 90.210)

## 7.1 Test procedure:

(1) Set-up followed by TIA/EIA-603 2.2.12 (Substitution Method)

(2) Pd (dBm) ＝ Pg (dBm) － Cable loss (dB) ＋ antenna gain (dB)

(where, Pd is the equivalent power and Pg is the generator output into the substitution antenna)

## 7.2 Test Equipment:

| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
|---|---|---|---|---|---|
| Receiver | SCR3102 | SCHAFFNER | 012 | 03/29/05 | 03/28/06 |
| Antenna | CBL6141A | SCHAFFNER | 4188 | 11/29/04 | 11/29/05 |
| Open test side (Antenna, Amplify, cable calibrated together) | | | | 05/16/04 | 05/15/05 |
| Spectrum Analyzer | 8564E | HP | US36433002 | 11/03/04 | 11/03/05 |
| Microwave Preamplifier | 83051A | HP | 3232A00347 | 08/01/04 | 08/01/05 |
| Horn Antenna | 3115 | EMCO | 9704 - 5178 | 12/27/04 | 12/27/05 |
| Signal Generator | 8648D | HP | 3613A00117 | 05/24/04 | 05/23/05 |
| Dipole Antenna | 3121C | EMCO | 9707-1311 | 12/26/04 | 12/25/05 |

The level of confidence of 95% , the uncertainty of measurement of radiated emission is ± 3.44dB .

### 7.3 Test Result:

Antenna Polarity: Vertical Bandwidth: 25K

| Frequency [MHz] | Signal Gen Level [dBm] | Cable Loss [dBm] | Tx Antenna Gain | Emission Level [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|
| 880.57 | -74.58 | 0.96 | 6.7 | -68.84 | -20 | -48.84 |
| 1410.05 | -48.079 | 4.159 | 10.3 | -41.938 | -20 | -21.938 |
| 1878.33 | -53.595 | 4.713 | 11.9 | -46.408 | -20 | -26.408 |
| 2345.83 | -50.798 | 5.150 | 13.5 | -42.448 | -20 | -22.448 |
| 2813.33 | -54.757 | 5.541 | 14.8 | -45.498 | -20 | -25.498 |
| 3287.92 | -59.516 | 5.852 | 16.2 | -49.168 | -20 | -29.168 |

Antenna Polarity: Horizontal Bandwidth: 25K

| Frequency [MHz] | Signal Gen Level [dBm] | Cable Loss [dBm] | Tx Antenna Gain | Emission Level [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|
| 880.57 | -77.66 | 0.96 | 6.7 | -71.92 | -20 | -51.92 |
| 1409.99 | -49.769 | 4.159 | 10.3 | -43.628 | -20 | -23.628 |
| 1878.33 | -52.265 | 4.713 | 11.9 | -45.078 | -20 | -25.078 |
| 2345.83 | -50.968 | 5.150 | 13.5 | -42.618 | -20 | -22.618 |
| 2813.33 | -54.757 | 5.541 | 14.8 | -45.498 | -20 | -25.498 |

# VIII. Frequency Stability (Part 2.1055, 90.213)

## 8.1 Test procedure:(Temperature)

(1) Frequency shift vs. temperature:

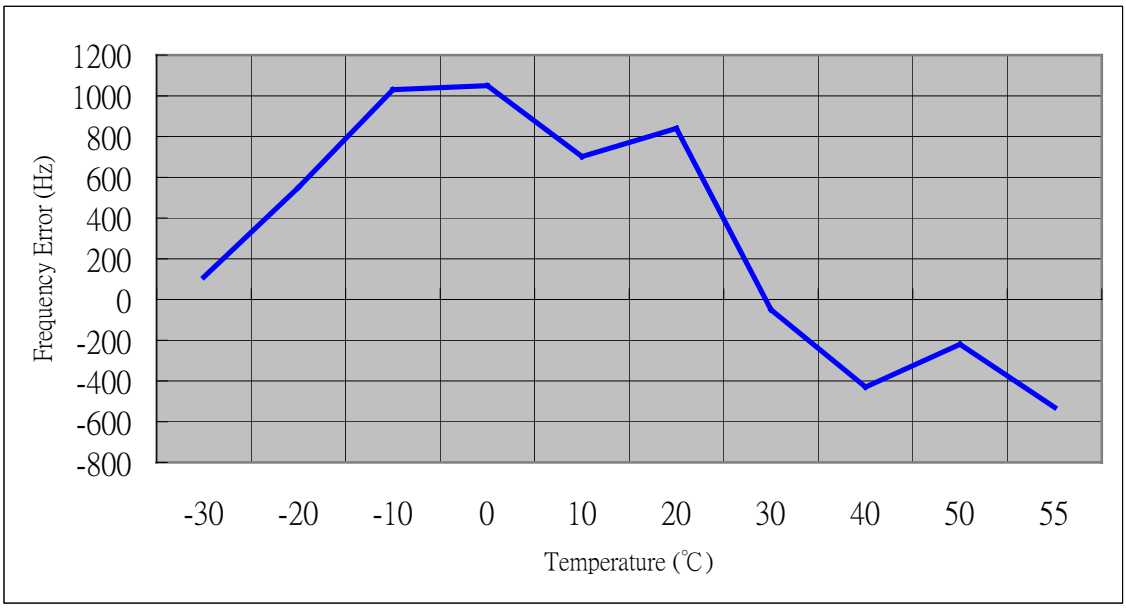
The nominal room temperature 20℃, and the reference frequency is 455.0000MHz.

(2) The EUT was put in an environmental chamber and set up the temperature of this chamber from -30℃ to +50℃ and recorded the frequency has been shift.

## 8.2 Test Result:

Nominal Frequency: 454.997200MHz Bandwidth: 12.5K

| Temperature [℃] | Frequency [MHz] | Frequency Error [Hz] | Limit (2.5PPM) | Error in PPM |
|---|---|---|---|---|
| -30℃ | 454.997310 | 110 | 1147 | 0.24 |
| -20℃ | 454.997750 | 550 | 1147 | 1.20 |
| -10℃ | 454.998230 | 1030 | 1147 | 2.26 |
| 0.0℃ | 454.998250 | 1050 | 1147 | 2.31 |
| 10℃ | 454.997902 | 702 | 1147 | 1.54 |
| 20℃ | 454.998040 | 840 | 1147 | 1.85 |
| 30℃ | 454.997150 | -50 | 1147 | -0.11 |
| 40℃ | 454.996770 | -430 | 1147 | -0.95 |
| 50℃ | 454.996980 | -220 | 1147 | -0.48 |



### 8.3 Test Equipment:

| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
|---|---|---|---|---|---|
| Spectrum | 8594EM | HP | 3619A00198 | 03/21/05 | 03/20/06 |
| DC Power Supply | GPC-3030D | LABORATORY | | 02/03/05 | 02/02/06 |
| Temperature & Humidity Chamber | THS-ML1 | King Son | 240 | 09/15/04 | 09/14/05 |

The level of confidence of 95% , the uncertainty of measurement is ± 12Hz .

### 8.4 Test procedure:(voltage)

(1) Frequency shift vs. voltage:

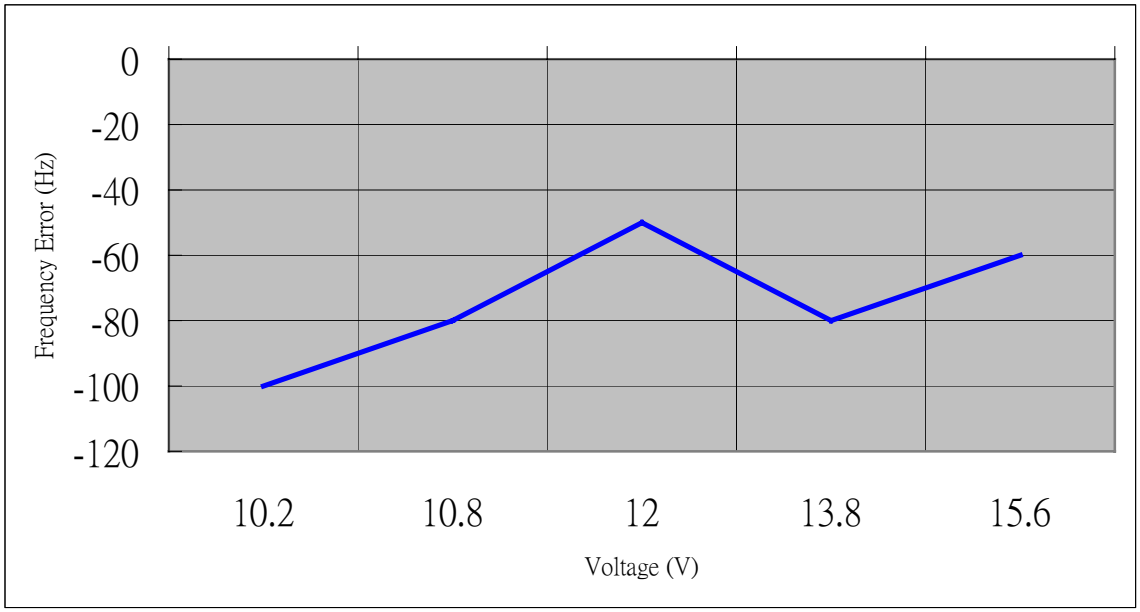
Nominal power is 12 Vdc and the reference Frequency is 455.0000MHz

(2) The EUT was powered at 85% and 115% of nominal.

### 8.5 Test Result:

Nominal Frequency: 454.997200MHz Nominal Voltage: 12V Bandwidth: 12.5K

| Voltage [V] | Frequency [MHz] | Frequency Error [Hz] | Limit (2.5PPM) | Error (PPM) | Pass/Fail |
|---|---|---|---|---|---|
| 10.2 | 454.997100 | -100 | 1147 | -0.22 | PASS |
| 10.8 | 454.997120 | -80 | 1147 | -0.18 | PASS |
| 13.8 | 454.997120 | -80 | 1147 | -0.18 | PASS |
| 15.6 | 454.997240 | -60 | 1147 | -0.13 | PASS |



## IX. Conducted Emission Test (ANSI C63.4)

### 9.1 Test procedure:

All the equipment is placed and setup according to the ANSI C63.4.

The EUT is assembled on a wooden table which is 80 cm high, is placed 40 cm from the back-wall which is a vertical conducting plane. One LISN is for EUT, the other LISN is for support equipment. They are all placed on the conductive ground. The EUT's LISN connect a line switch box for selecting L1 or L2, then connect to a preamplifier and spectrum.

The spectrum measured from 150KHz to 30MHz. Conducted emission levels are detected at max. peak mode. But if the max. peak mode failed or over average limit, it will be measured by QP and average detection mode using the Receiver.

While testing, there is the worst-emission plot printed at peak detection mode, and there are more than 6 highest emissions relative to limit recorded. The plot is kept as the original data, not included in test report.

### 9.2 Test Equipment:

| | | | | ***Calibration Date*** | |
|---|---|---|---|---|---|
| **Instrument Name** | **Model No.** | **Brand** | **Serial No.** | **Last time** | **Next time** |
| *Receiver* | SCR3102 | SCHAFFNER | 012 | 05/13/04 | 05/12/05 |
| LISN (EUT) | 3825/2 | *EMCO* | 9411-2284 | 07/21/04 | 07/20/05 |
| LISN (Support E.) | 3825/2 | EMCO | 9210-2007 | 09/03/04 | 09/02/05 |
| Line switch box | CB-01 | TRC | 98-04 | 05/29/04 | 05/28/05 |
| 1dB Attenuator | CAT-1 | mini-circuits | - - - - - - - - - | 05/29/04 | 05/28/05 |
| FTB-1-6 Attenuator | 15542 | mini-circuits | 9620 03 | 05/29/04 | 05/28/05 |
| 20dB Attenuator | CAT-20 | mini-circuits | 9620 13 | 05/29/04 | 05/28/05 |
| Coaxial Cable | BNC3200B-0058 | Jyebao | CL-05 | 05/29/04 | 05/28/05 |
| Coaxial Cable | BNC31VB-0316 | Jyebao | IF-01ca0069-036 | 05/29/04 | 05/28/05 |
| 50ohm terminator | 370BNM | NARDA | PWR5W | 07/21/04 | 07/20/05 |
| 50ohm terminator | 370BNM | NARDA | PWR5W | 07/21/04 | 07/20/05 |
| 50ohm terminator | 370BNM | NARDA | PWR5W | 09/03/04 | 09/02/05 |
| 50ohm terminator | 370BNM | NARDA | PWR5W | 09/03/04 | 09/02/05 |

**The level of confidence of 95% , the uncertainty of measurement of conducted emission is +3.1/-4.84 dB .**

***Test Result : N/A***

# X. Transient Frequency Behavior (Part 90.214)

## 10.1 Test procedure:

(1) Set-up followed by TIA/EIA 603. Section 1.2.19

(2) Turn on the EUT and Record the plot.

(3) Turn off the EUT and Record the plot.

(4) Let the EUT modulated and repeat step (3) (4).

(5) Use the EUT 2 with BW 12.5KHz, repeat step (3) ~ (5).

## 10.2 Test Result:

| Deviation / Time Intervals | | 2.5KHz | |
|---|---|---|---|
| | | Max Frequency Difference | Result |
| t1 | 10ms | ± 12.5KHz | Pass |
| t2 | 25ms | ± 6.25KHz | Pass |
| t3 | 10ms | ± 12.5KHz | Pass |

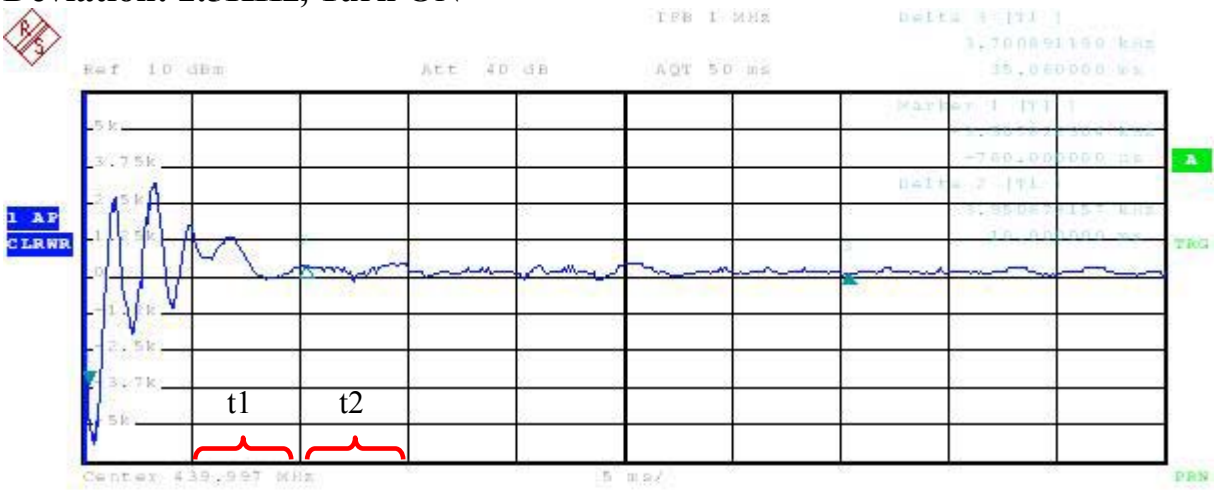
* See Figures 8－11

## 10.3 Test Equipment:

| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
|---|---|---|---|---|---|
| Signal Generator | 2030 | MARCONI | 119665/027 | 07/12/04 | 07/11/05 |
| Oscilloscope | FSP13 | ROHD&SCHWARZ | 100126 | 05/25/04 | 05/24/05 |

The level of confidence of 95% , the uncertainty of measurement is ± 0.5KHz .

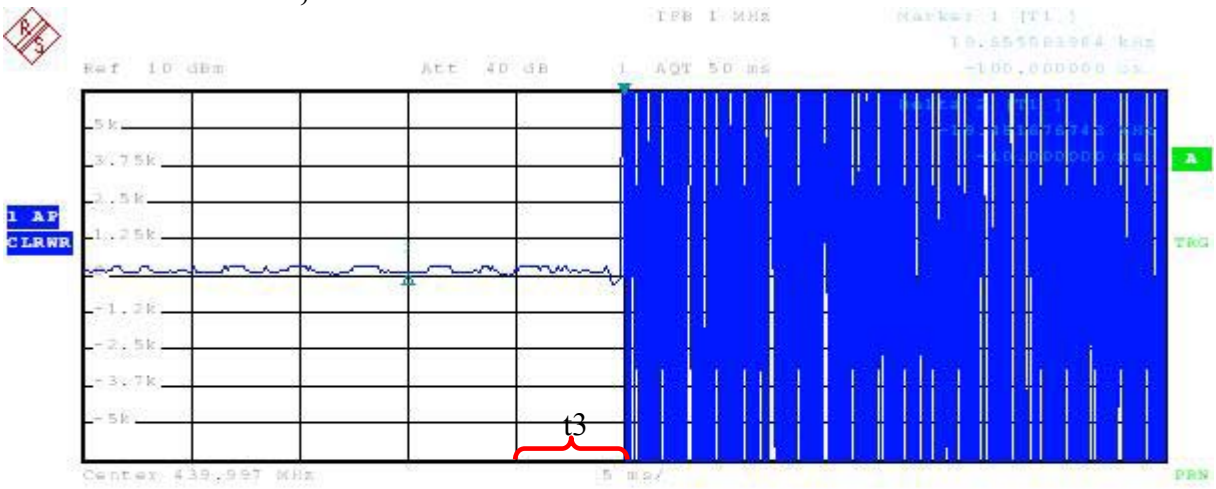
**Measurement Result:**
**Frequency: 440MHz**
**Deviation: 2.5KHz, Turn ON**




**Frequency Modulation Summary**

| | | | | |
|---|---|---|---|---|
| Coupling | DC | | Carrier Offset | 248.73 Hz |
| Deviation | +peak | 47.77 kHz | Carrier Power | -3.28 dBm |
| | -peak | -18.19 kHz | Modulation Frequency | 19.316 kHz |
| | ⇕peak/2 | 32.98 kHz | Sampling Rate | 62.5 kHz |
| | RMS | 1.367 kHz | Record Length | 3126 |
| | | | Demod Bandwidth | 50 kHz |

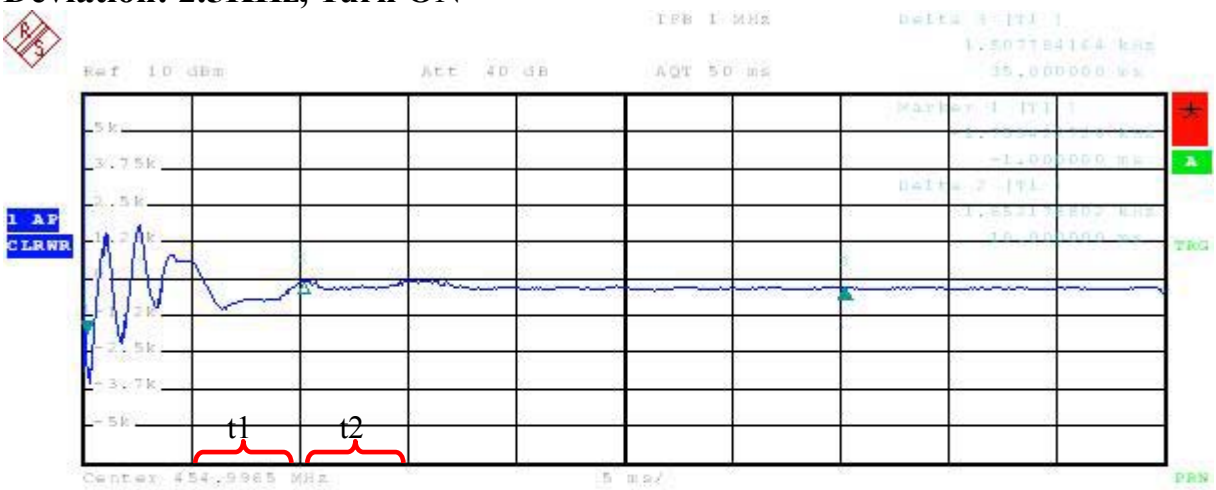
**Deviation: 2.5KHz, Turn OFF**




**Frequency Modulation Summary**

| | | | | |
|---|---|---|---|---|
| Coupling | DC | | Carrier Offset | 312.78 Hz |
| Deviation | +peak | 54.11 kHz | Carrier Power | -6.32 dBm |
| | -peak | -53.61 kHz | Modulation Frequency | --- Hz |
| | ⇕peak/2 | 53.86 kHz | Sampling Rate | 62.5 kHz |
| | RMS | 13.76 kHz | Record Length | 3126 |
| | | | Demod Bandwidth | 50 kHz |

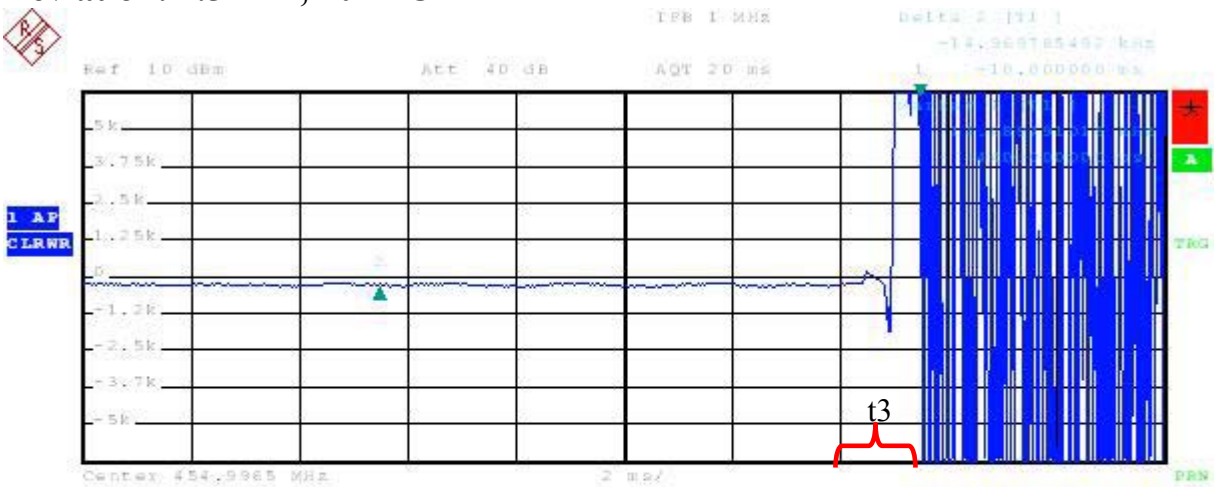
**Frequency: 455MHz**
**Deviation: 2.5KHz, Turn ON**




**Frequency Modulation Summary**

| | | | | |
|---|---|---|---|---|
| Coupling | DC | | Carrier Offset | -282.84 Hz |
| Deviation | +peak | 9.887 kHz | Carrier Power | -3.21 dBm |
| | -peak | -3.502 kHz | Modulation Frequency | --- Hz |
| | ⇕peak/2 | 6.694 kHz | Sampling Rate | 62.5 kHz |
| | RMS | 571.5 Hz | Record Length | 3126 |
| | | | Demod Bandwidth | 50 kHz |

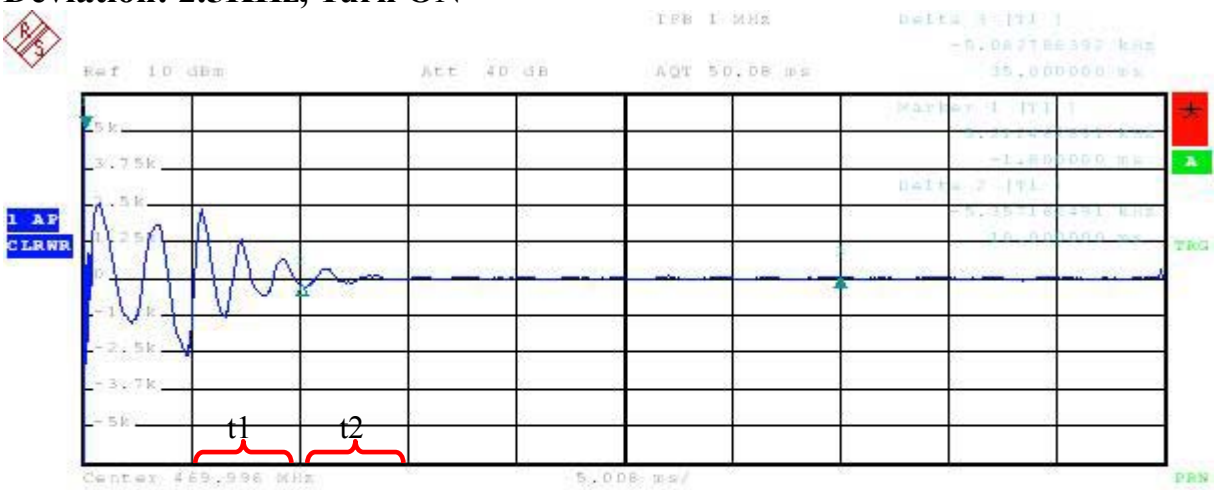
**Deviation: 2.5KHz, Turn OFF**




**Frequency Modulation Summary**

| | | | | |
|---|---|---|---|---|
| Coupling | DC | | Carrier Offset | 11.342 Hz |
| Deviation | +peak | 45.21 kHz | Carrier Power | -3.59 dBm |
| | -peak | -48.50 kHz | Modulation Frequency | --- Hz |
| | ⇕peak/2 | 46.86 kHz | Sampling Rate | 62.5 kHz |
| | RMS | 9.576 kHz | Record Length | 1251 |
| | | | Demod Bandwidth | 50 kHz |

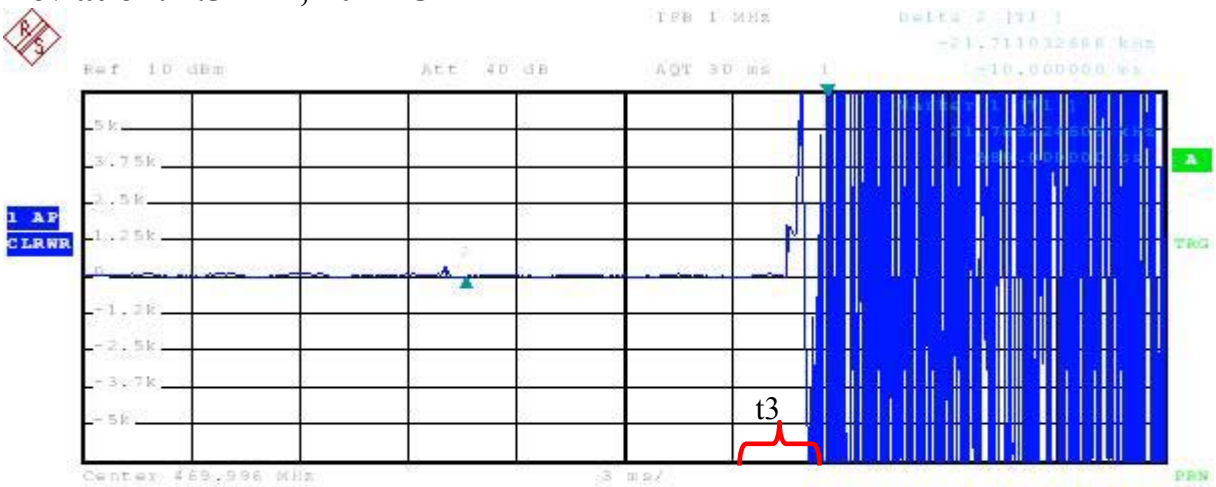
**Frequency: 470MHz**
**Deviation: 2.5KHz, Turn ON**




**Frequency Modulation Summary**

| | | | | |
|---|---|---|---|---|
| Coupling | DC | | Carrier Offset | 67.379 Hz |
| Deviation | +peak | 5.212 kHz | Carrier Power | -3.32 dBm |
| | -peak | -7.359 kHz | Modulation Frequency | --- Hz |
| | ⇕peak/2 | 6.285 kHz | Sampling Rate | 62.5 kHz |
| | RMS | 591.2 Hz | Record Length | 3131 |
| | | | Demod Bandwidth | 50 kHz |

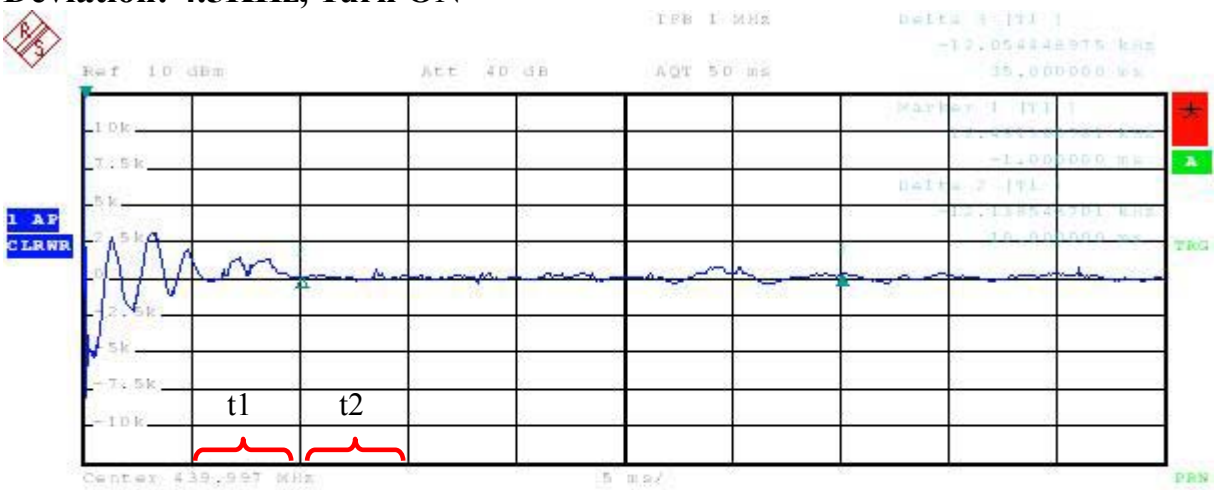
**Deviation: 2.5KHz, Turn OFF**




**Frequency Modulation Summary**

| | | | | |
|---|---|---|---|---|
| Coupling | DC | | Carrier Offset | -66.184 Hz |
| Deviation | +peak | 52.38 kHz | Carrier Power | -4.13 dBm |
| | -peak | -47.77 kHz | Modulation Frequency | --- Hz |
| | ⇕peak/2 | 50.07 kHz | Sampling Rate | 62.5 kHz |
| | RMS | 10.70 kHz | Record Length | 1876 |
| | | | Demod Bandwidth | 50 kHz |

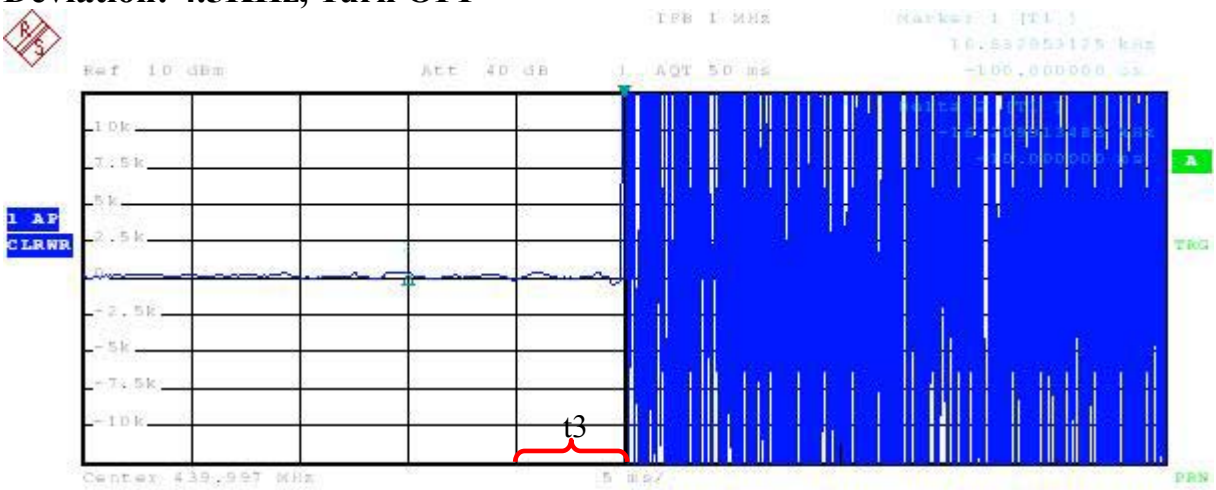
**Frequency: 440MHz**
**Deviation: 4.5KHz, Turn ON**




**Frequency Modulation Summary**

| | | | | |
|---|---|---|---|---|
| Coupling | DC | | Carrier Offset | 215.35 Hz |
| Deviation | +peak | 12.49 kHz | Carrier Power | -3.26 dBm |
| | -peak | -8.035 kHz | Modulation Frequency | 14.018 kHz |
| | ⇕peak/2 | 10.26 kHz | Sampling Rate | 62.5 kHz |
| | RMS | 856.1 Hz | Record Length | 3126 |
| | | | Demod Bandwidth | 50 kHz |

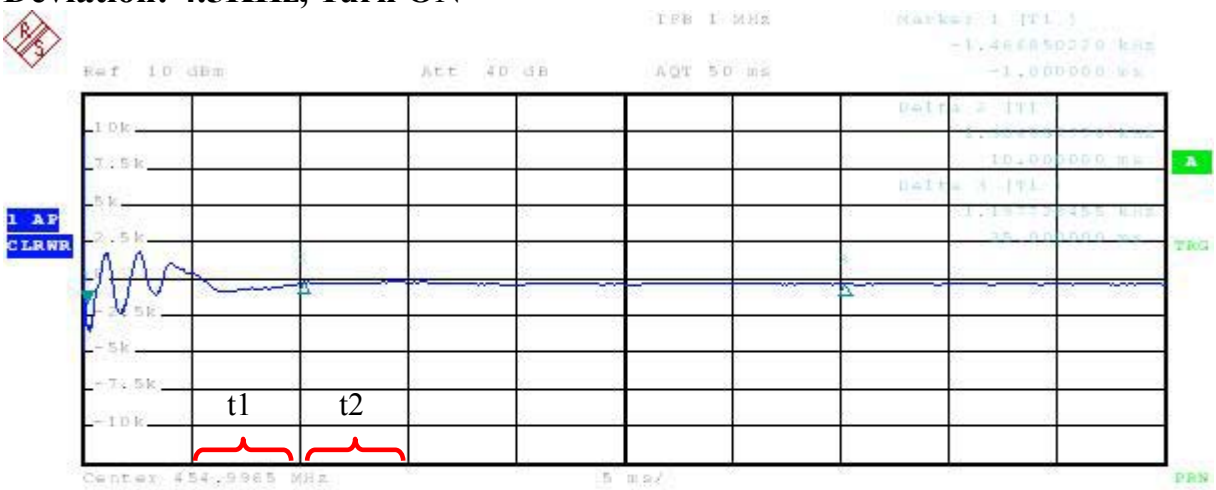
**Deviation: 4.5KHz, Turn OFF**




**Frequency Modulation Summary**

| | | | | |
|---|---|---|---|---|
| Coupling | DC | | Carrier Offset | 312.78 Hz |
| Deviation | +peak | 54.11 kHz | Carrier Power | -6.32 dBm |
| | -peak | -53.61 kHz | Modulation Frequency | --- Hz |
| | ⇕peak/2 | 53.86 kHz | Sampling Rate | 62.5 kHz |
| | RMS | 13.76 kHz | Record Length | 3126 |
| | | | Demod Bandwidth | 50 kHz |

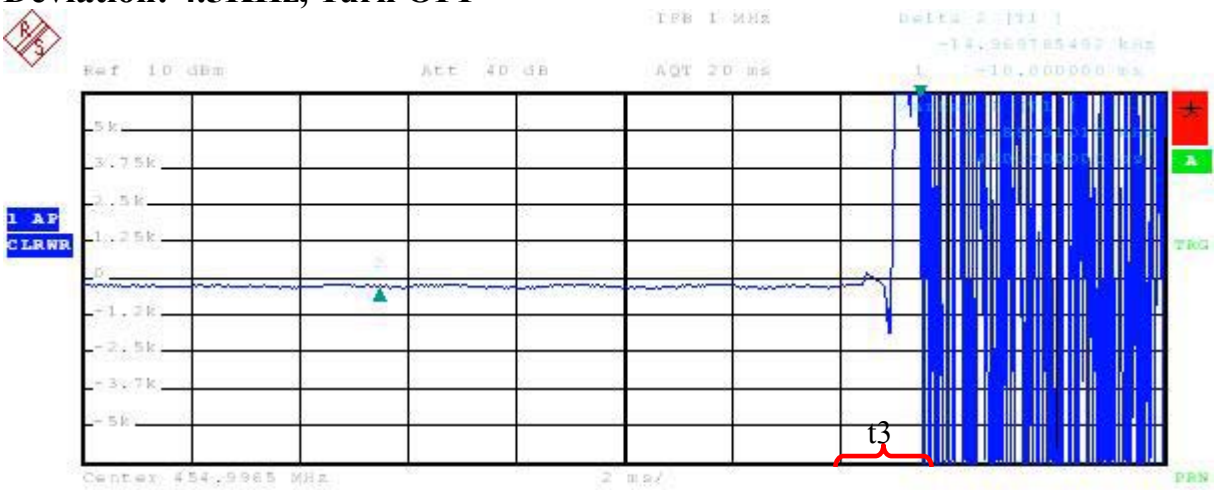
**Frequency: 455MHz**
**Deviation: 4.5KHz, Turn ON**




**Frequency Modulation Summary**

| | | | | |
|---|---|---|---|---|
| Coupling | DC | | Carrier Offset | -288.07 Hz |
| Deviation | +peak | 9.580 kHz | Carrier Power | -3.21 dBm |
| | -peak | -4.964 kHz | Modulation Frequency | --- Hz |
| | ⇕peak/2 | 7.272 kHz | Sampling Rate | 62.5 kHz |
| | RMS | 583.4 Hz | Record Length | 3126 |
| | | | Demod Bandwidth | 50 kHz |

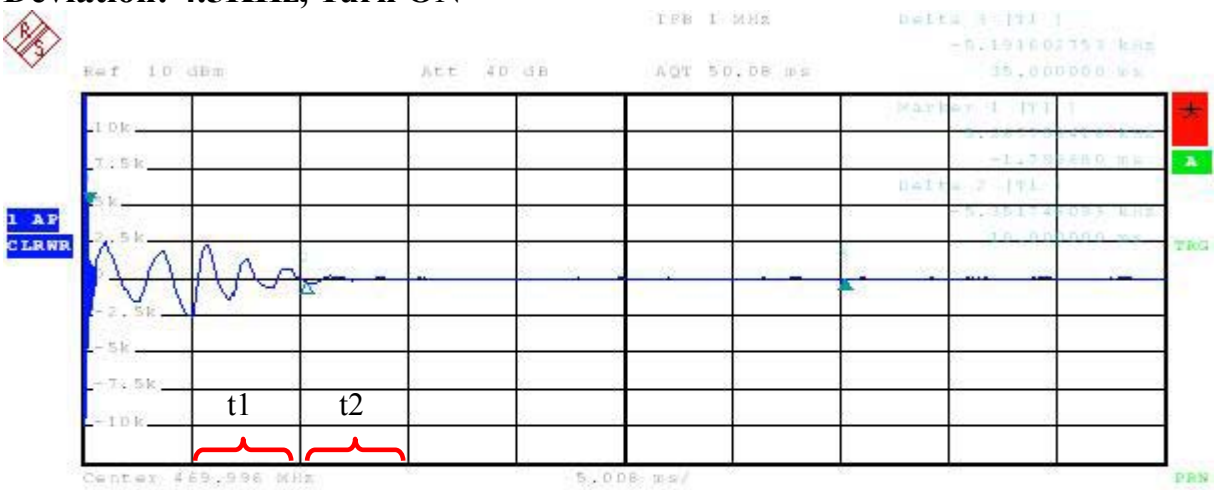
**Deviation: 4.5KHz, Turn OFF**




**Frequency Modulation Summary**

| | | | | |
|---|---|---|---|---|
| Coupling | DC | | Carrier Offset | 11.342 Hz |
| Deviation | +peak | 45.21 kHz | Carrier Power | -3.59 dBm |
| | -peak | -48.50 kHz | Modulation Frequency | --- Hz |
| | ⇕peak/2 | 46.86 kHz | Sampling Rate | 62.5 kHz |
| | RMS | 9.576 kHz | Record Length | 1251 |
| | | | Demod Bandwidth | 50 kHz |

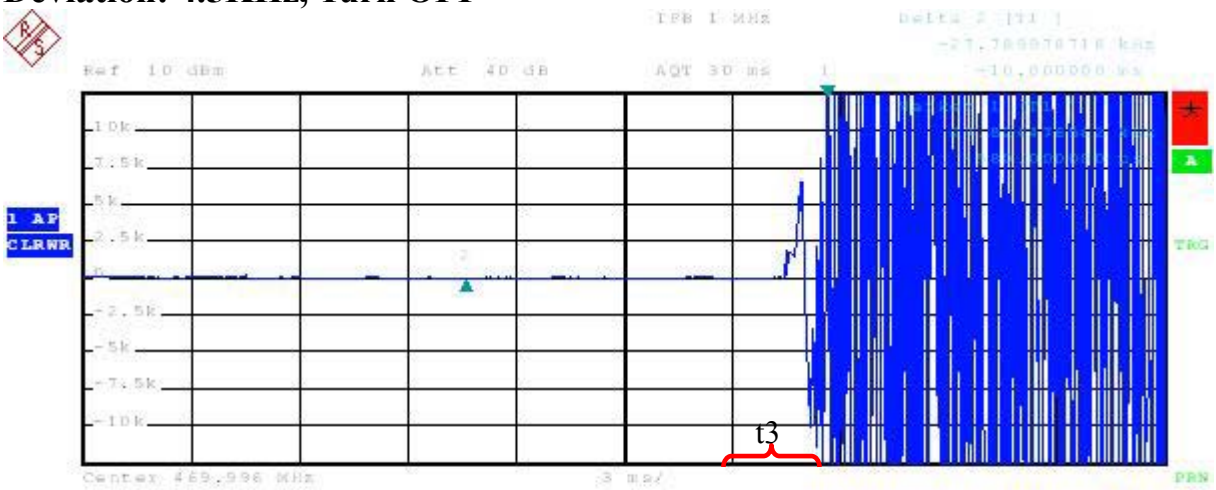
**Frequency: 470MHz**
**Deviation: 4.5KHz, Turn ON**




**Frequency Modulation Summary**

| | | | | |
|---|---|---|---|---|
| Coupling | DC | | Carrier Offset | 67.295 Hz |
| Deviation | +peak | 32.22 kHz | Carrier Power | -3.33 dBm |
| | -peak | -10.00 kHz | Modulation Frequency | --- Hz |
| | ⇕peak/2 | 21.11 kHz | Sampling Rate | 62.5 kHz |
| | RMS | 1.099 kHz | Record Length | 3131 |
| | | | Demod Bandwidth | 50 kHz |

**Deviation: 4.5KHz, Turn OFF**




**Frequency Modulation Summary**

| | | | | |
|---|---|---|---|---|
| Coupling | DC | | Carrier Offset | -9.6731 Hz |
| Deviation | +peak | 47.18 kHz | Carrier Power | -4.13 dBm |
| | -peak | -47.26 kHz | Modulation Frequency | --- Hz |
| | ⇕peak/2 | 47.22 kHz | Sampling Rate | 62.5 kHz |
| | RMS | 10.83 kHz | Record Length | 1876 |
| | | | Demod Bandwidth | 50 kHz |

# XI. Maximum Permissible Exposure

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

S(W/m2) = PG/4 $\pi$ $R^2$;

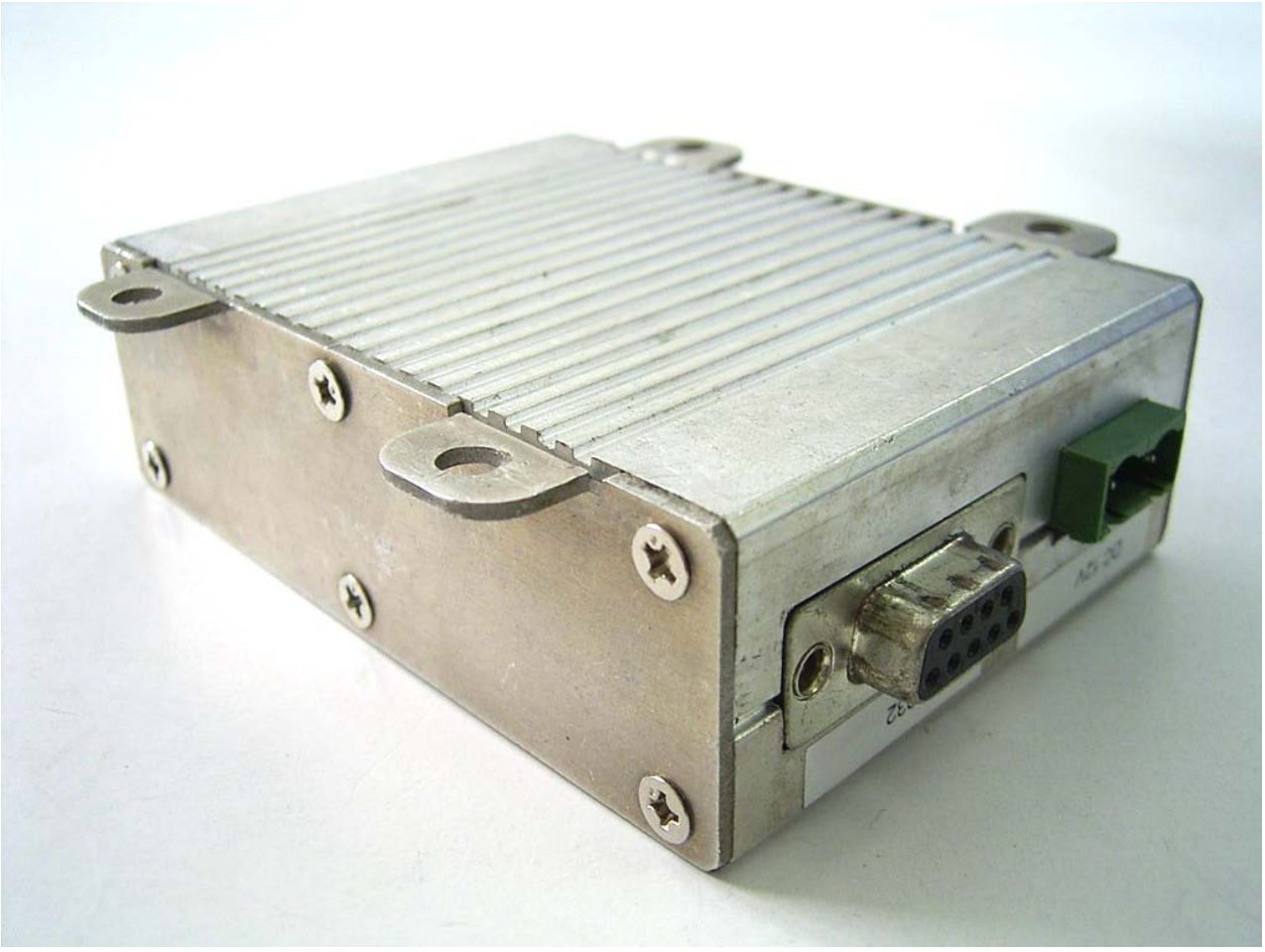
$$R = \sqrt{\frac{PG}{4\pi S}} \qquad r = \sqrt{\frac{5662 \times 10}{4\pi (470/300)}} = \mathbf{53.63cm}$$

Where: S = power density (in appropriate units, e.g. $mW/cm^2$)
P = power input to the antenna (in appropriate units, e.g., mW)
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

The Numeric gain G of antenna with a gain specified in dB is determined by:
$G = \text{Log}^{-1}$ (dBi antenna gain/10)
$G = \text{Log}^{-1}$ (2/10) = 1.58

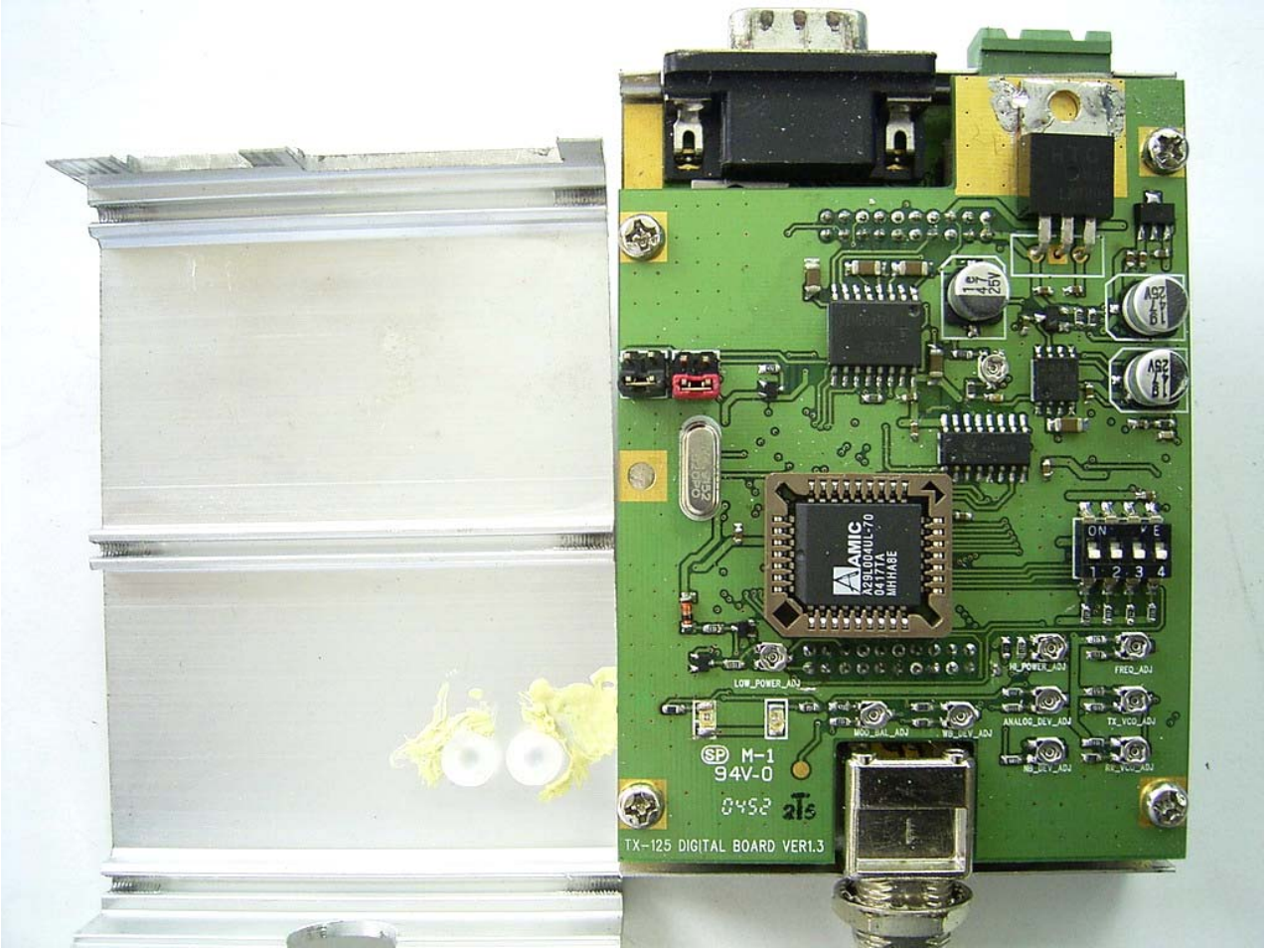
## Limits for Maximum Permissible Exposure (MPE)

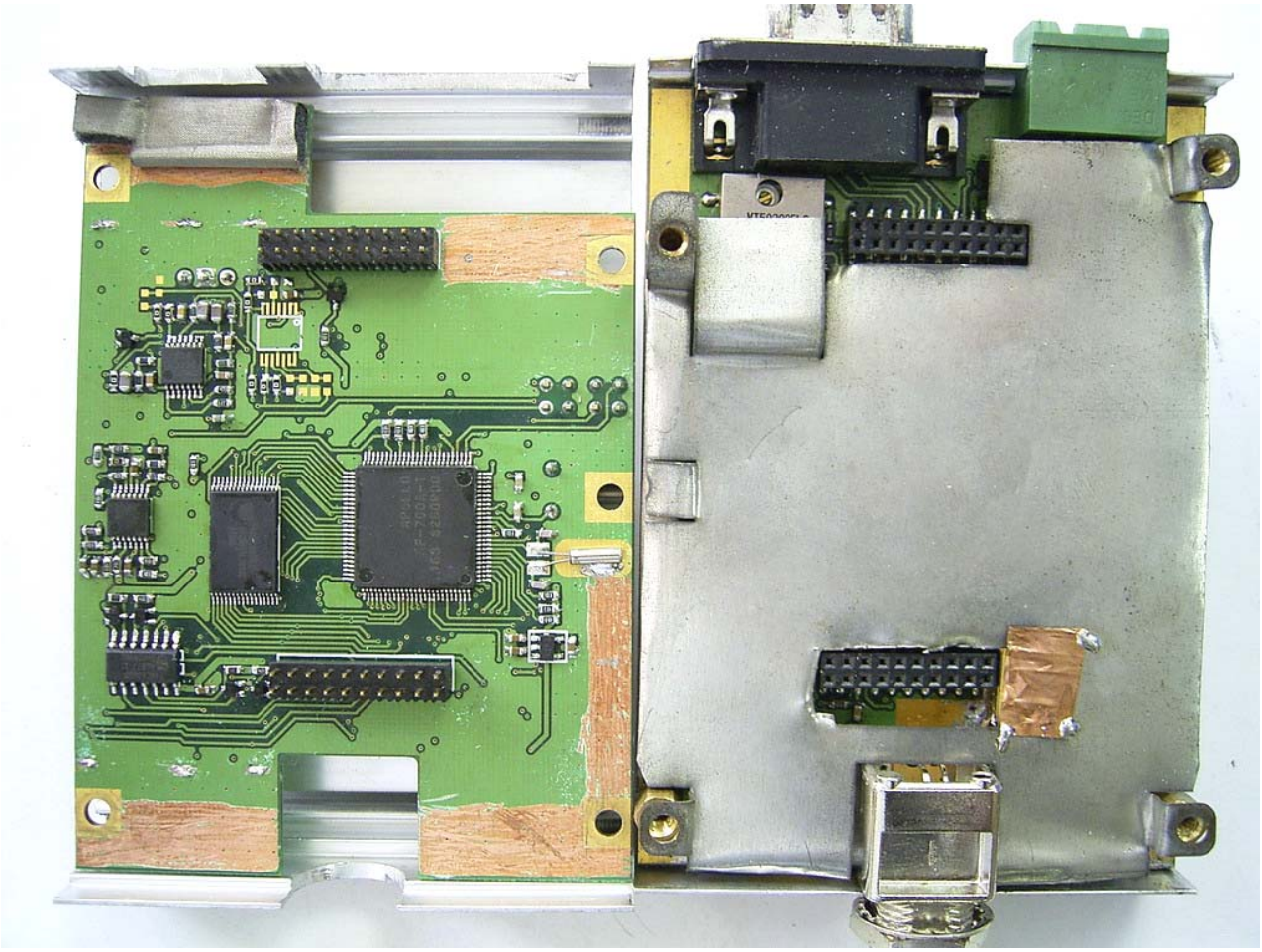
| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Filed Strength (H) (A/m) | Power Density (S) ($mW/cm^2$) | Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes) |
|---|---|---|---|---|
| **(A) Limits for Occupational/Controlled Exposure** | | | | |
| 0.3-3.0 | 614 | 1.63 | 100 | 6 |
| 3.0-30 | 1842/f | 4.89/f | $900/f^2$ | 6 |
| 30-300 | 61.4 | 0.163 | 1.0 | 6 |
| 300-1500 | -- | -- | f/300 | 6 |
| 1500-100,000 | -- | -- | 5 | 6 |
| **(B) Limits for General Population/Uncontrolled Exposure** | | | | |
| 0.3-1.34 | 614 | 1.63 | 100 | 30 |
| 1.34-30 | 824/f | 2.19/f | $180/f^2$ | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | -- | -- | f/1500 | 30 |
| 1500-100,000 | -- | -- | 1.0 | 30 |

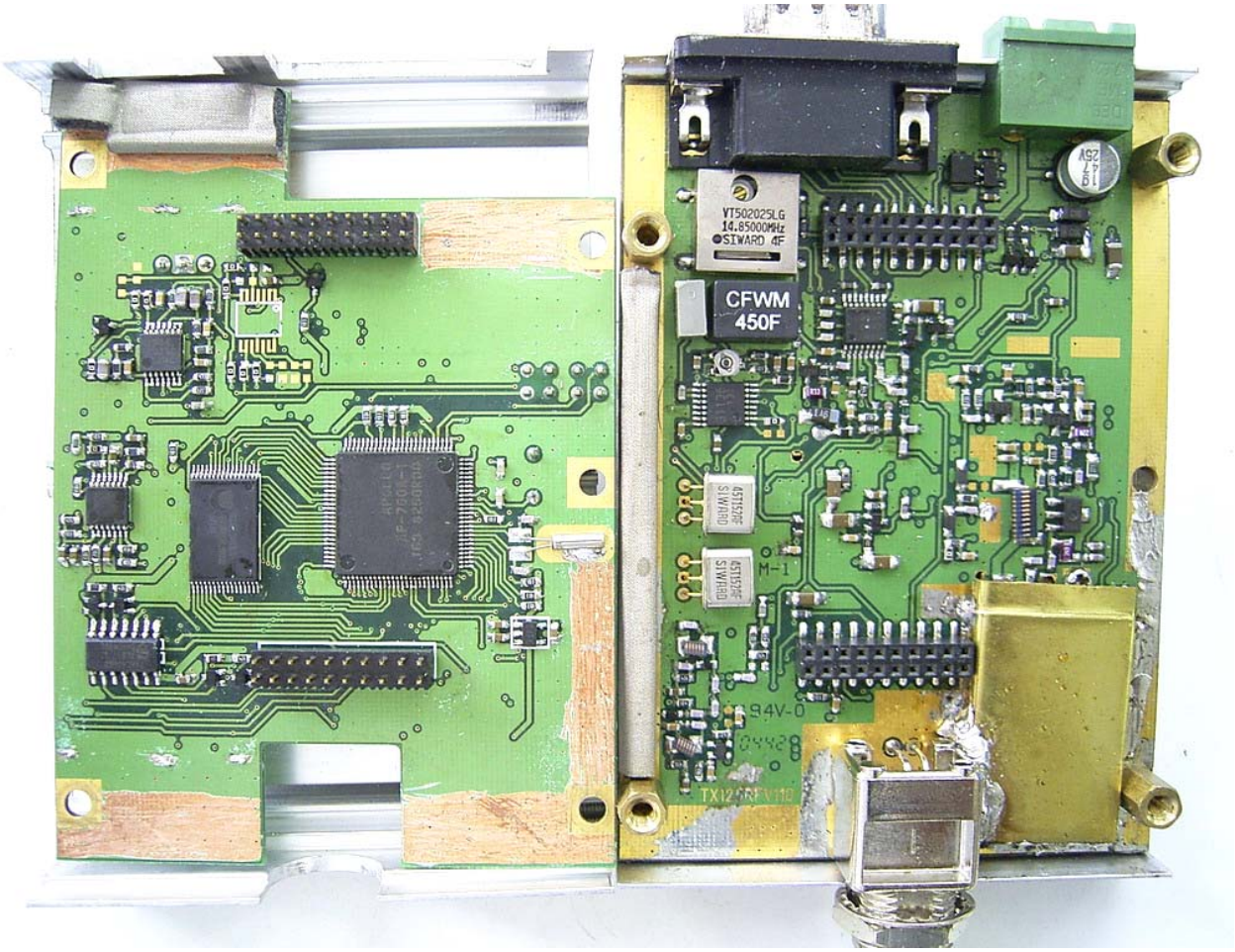


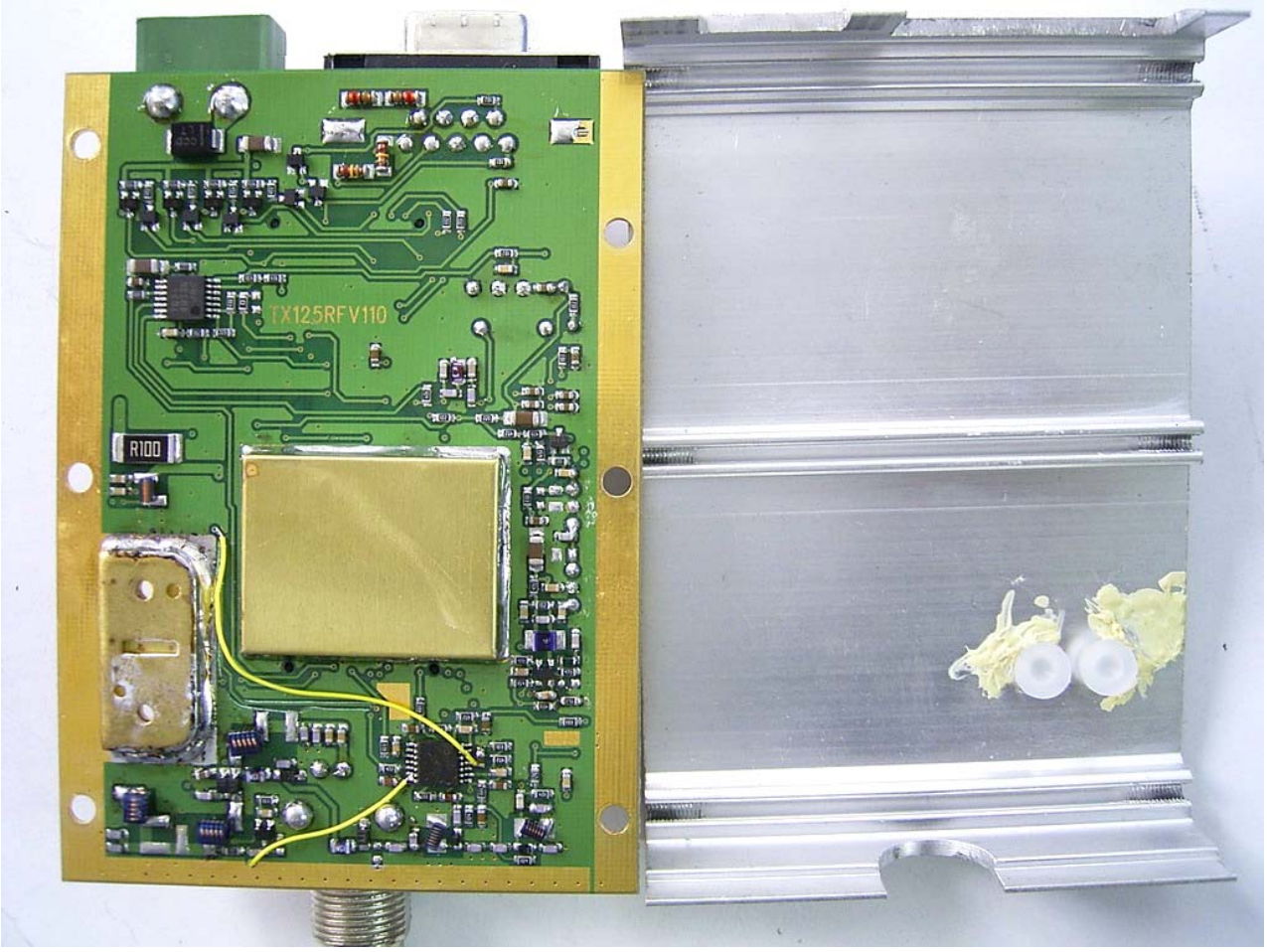
PWR TX

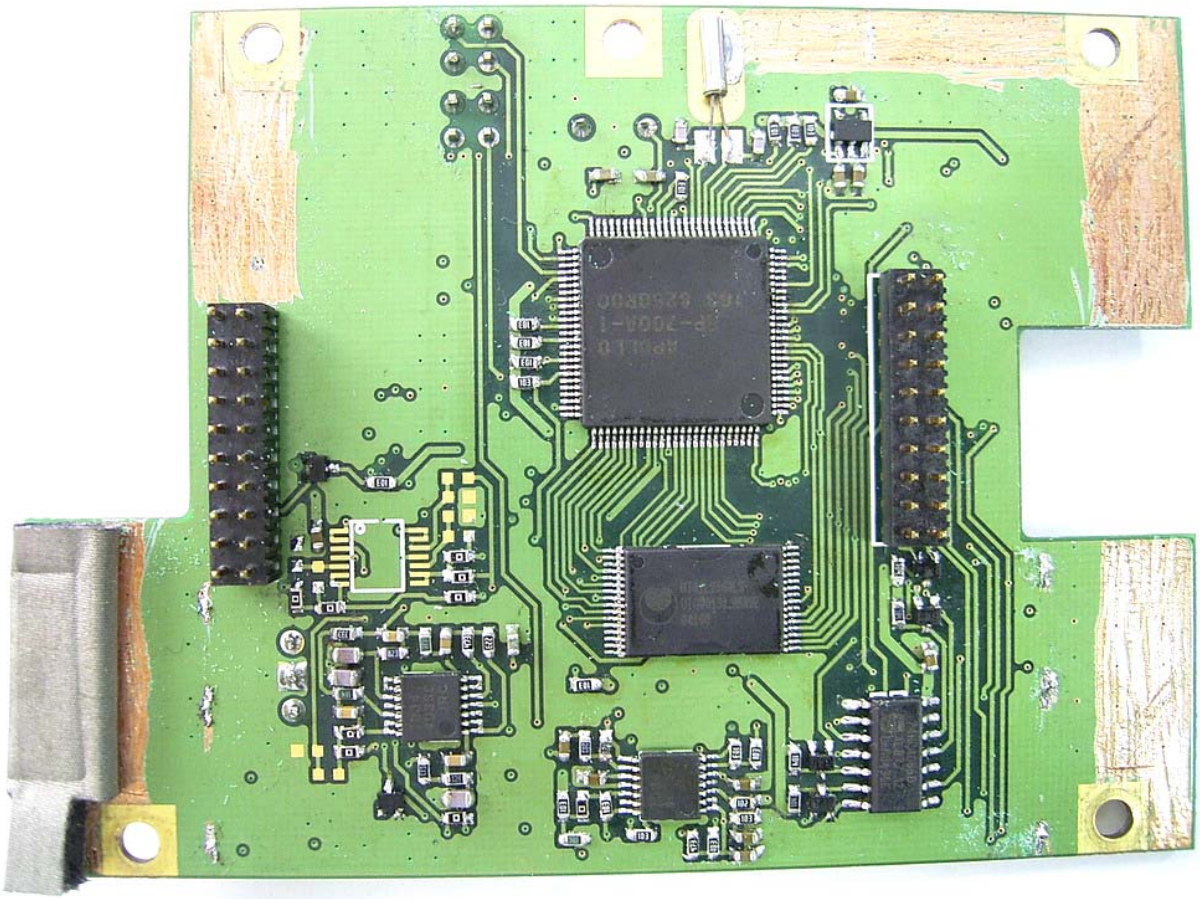
DC 12V
RS-232

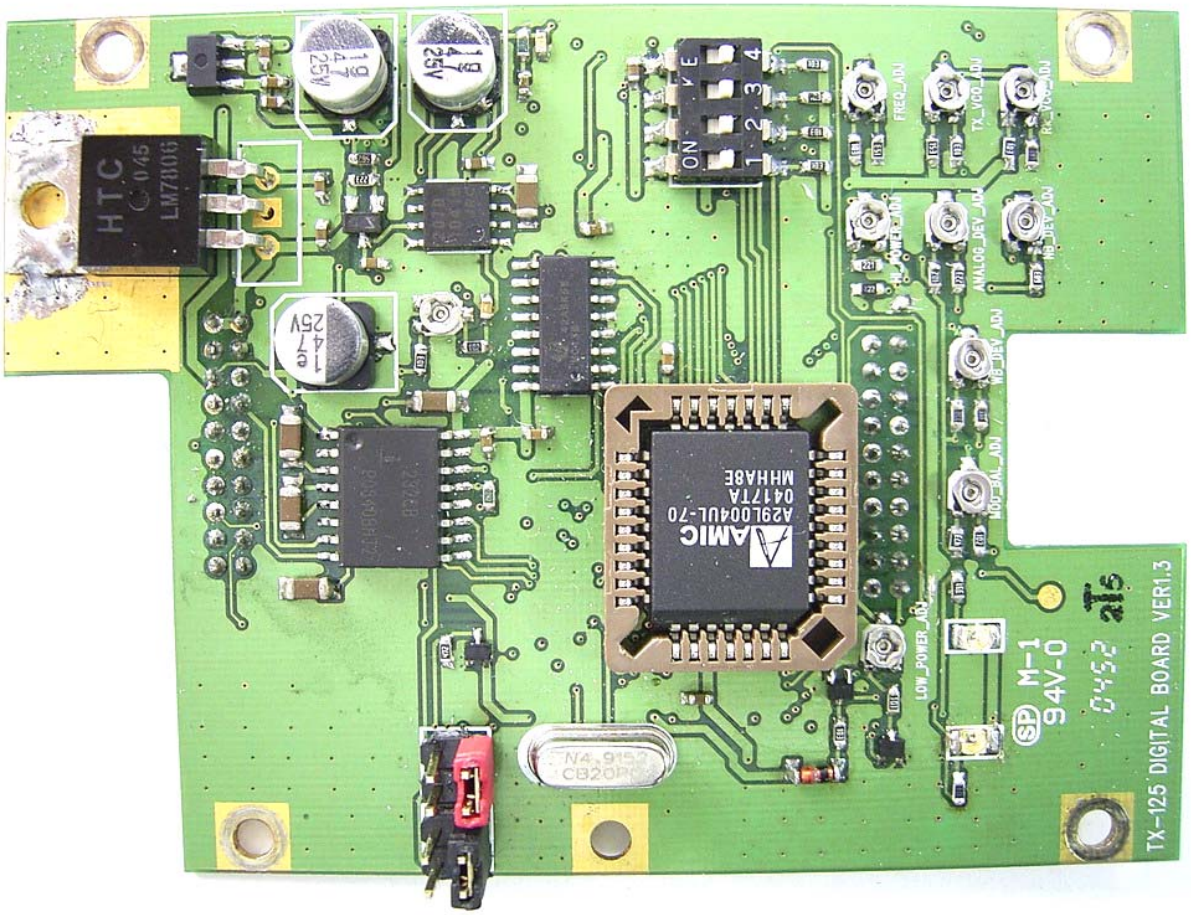

AMIC
ON
1 2 3 4
LOW_POWER_ADJ
HI_POWER_ADJ
FREQ_ADJ
ANALOG_DEV_ADJ
TX_VCO_ADJ
MOD_BAL_ADJ
WB_DEV_ADJ
NB_DEV_ADJ
M-1
94V-0
TX-125 DIGITAL BOARD VER1.3

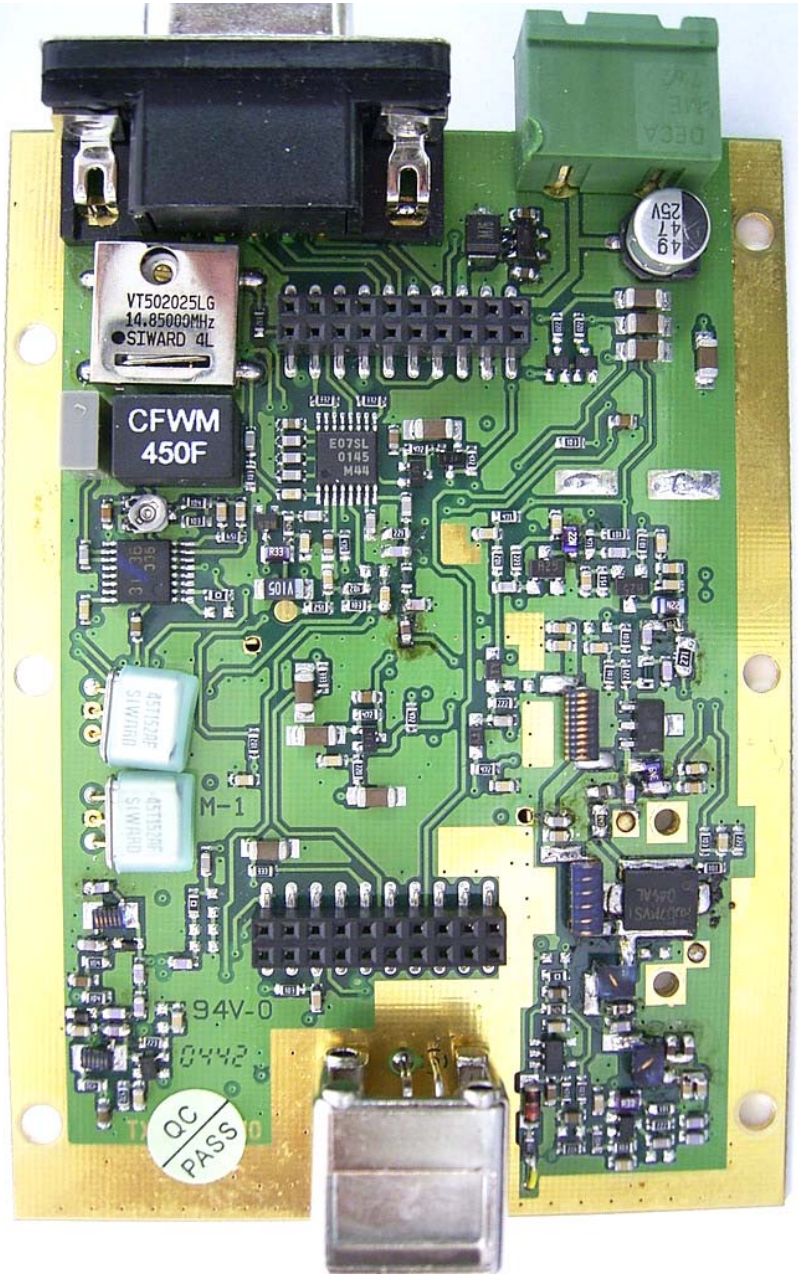


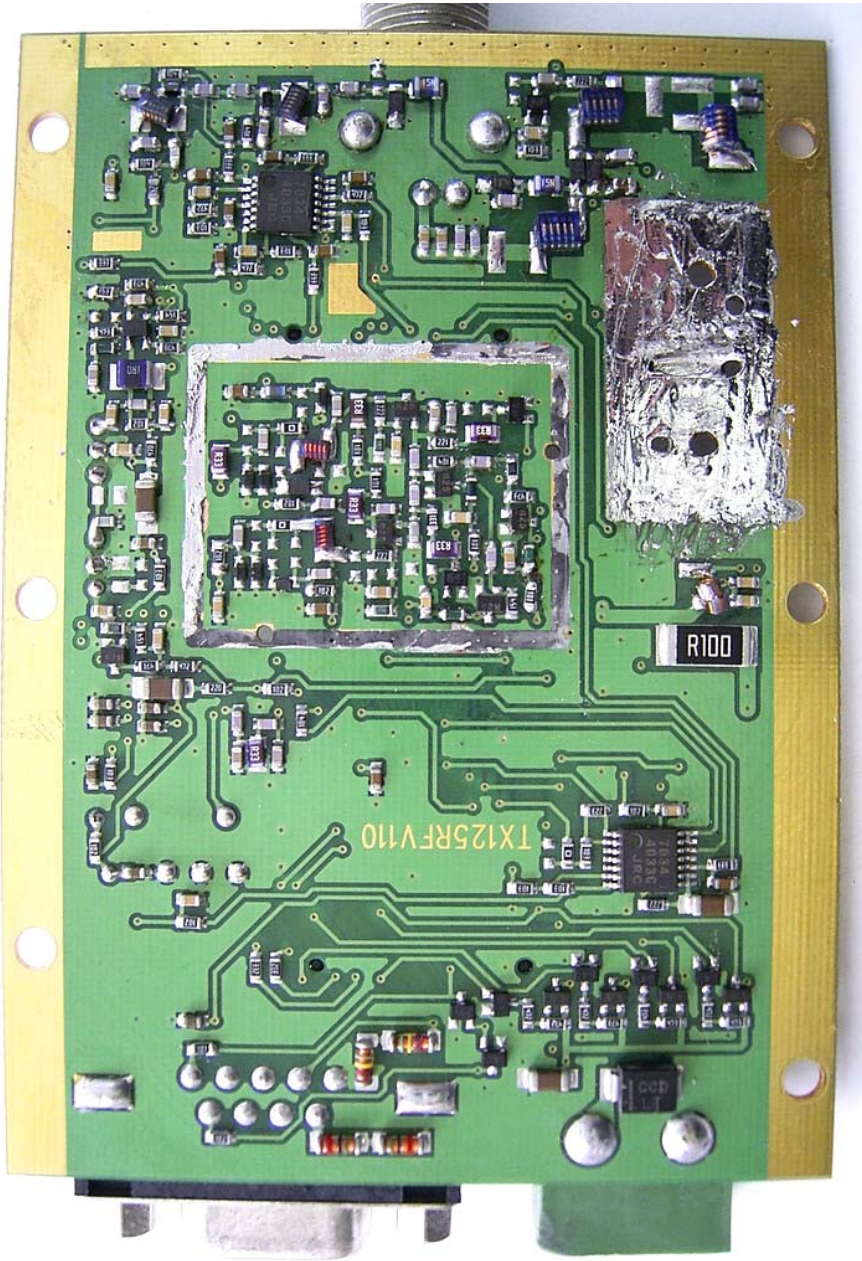

VT502025LG
14.85000MHz
SIWARD 4F
CFWM
450F
M-1
94V-0
TX125RFV110


TX125RFV110
R100

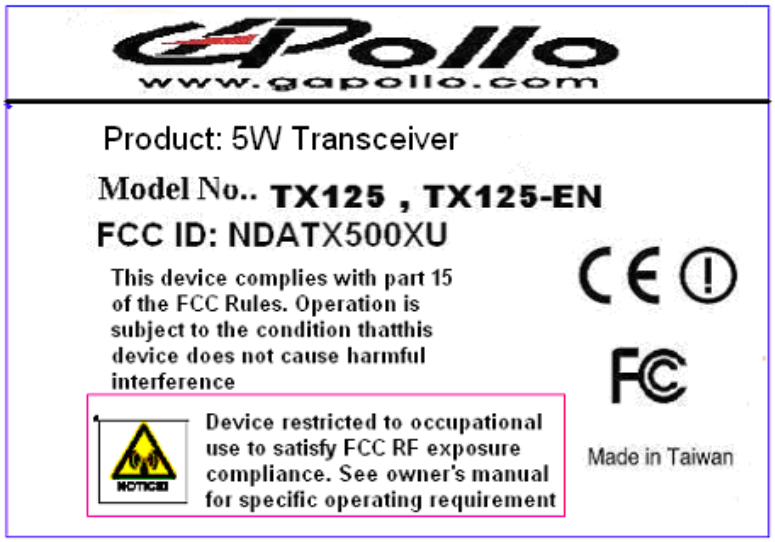



HTC
LM7806
AMIC
A29L004UL-70
0417TA
MHHA8E
FREQ_ADJ
TX_VCO_ADJ
RX_VCO_ADJ
ANALOG_DEV_ADJ
HB_DEV_ADJ
LOW_POWER_ADJ
M-1
94V-0
TX-125 DIGITAL BOARD VER1.3


VT502025LG
14.85000MHz
SIWARD 4L
CFWM
450F
E07SL
0145
M44
V105
M-1
94V-0
0442
QC
PASS


R100
TX125RFV110

LABEL Format:




LABEL Size: 60x 42 mm

LABEL Position: