FCC TEST REPORT

for

FCC Part 74 Subpart H

Equipment	:	TX : UHF Wireless Microphone
Model No.	:	UH-76
FCC ID	:	LL4UH76
Filing Type	:	Certification
Applicant	:	**ECEN ELECTRONICS CO., LTD.** No. 32-1, Lane 38, Li-dar St., Taiping 411, Taichung, Taiwan

SPORTON International Inc.

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

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History of this test report

Original Report Issue Date: Mar. 20, 2002

■ No additional attachment.

☐ Additional attachment were issued as following record:

Attachment No.	Issue Date	Description

Certificate No. : F310802

CERTIFICATE OF COMPLIANCE

for

FCC Part 74 Subpart H

Equipment : TX : UHF Wireless Microphone

Model No. : UH-76

FCC ID : LL4UH76

Applicant : **ECEN ELECTRONICS CO., LTD.**
No. 32-1, Lane 38, Li-dar St.,
Taiping 411, Taichung, Taiwan

I **HEREBY** CERTIFY THAT :

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 - 1992** and the equipment under test was ***passed*** all test items required in FCC Part 74 Subpart H, relative to the equipment under test. Testing was carried out on Mar. 17, 2003 at **SPORTON International Inc.** LAB.

Mar. 26, 2003

K. J. Lin
Manager

SPORTON International Inc.

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

1. General Description of Equipment under Test

1.1. Applicant

ECEN ELECTRONICS CO., LTD.
No. 32-1, Lane 38, Li-dar St.,
Taiping 411, Taichung, Taiwan

1.2. Manufacturer

Same as 1.1.

1.3. Basic Description of Equipment under Test

Equipment	: TX : UHF Wireless Microphone
Model No.	: UH-76
Trade Name	: SENRUN
Power Supply Type	: From battery 9V
AC Power Cord	: N/A

1.4. Feature of Equipment under Test

- Operational Frequency Range : 622 ~ 806MHz
- Tone Frequency : 32.768KHz
- Emission Power : 10mW
- Frequency Response : 50Hz ~ 20KHz
- Modulation Rate : ±40KHz
- Voltage: DC 12V

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
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 indepent sideband transmitter, when modulated by a 15kHz 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.

3. General Information of Test

3.1. Test Facility

This test was carried out by SPORTON International Inc.

Test Site Location : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park,
Kwei-Shan Hsiag, Tao Yuan Hsien, Taiwan, R.O.C.
TEL : 886-3-327-3456
FAX : 886-3-318-0055

3.2. Standard for Methods of Measurement

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

3.3. Test in Compliance with

FCC Part 74, Subpart H

3.4. Frequency Range Investigated

- Radiation : from 30 MHz to 9GHz

3.5. Test Distance

The test distance of radiated emission from antenna to EUT is 3 M.

3.6. Test Modes

The EUT is the portable device. So the EUT was tested on three different axes. The EUT uses the frequency range that are more than 10MHz, so that was tested on low, middle, and high three different frequencies.

4. Report of Measurements and Examinations

4.1. OUTPUT POWER MEASUREMENT

4.1.1. Provision Applicable

According to §74.861(e)(1)(i), the output power shall not exceed 50 milliwatts.

4.1.2. Measurement Procedure

The maximum peak output power was measured with a spectrum analyzer connected to the antenna terminal (conducted measurement) while EUT was operating in normal situation. Set RBW of spectrum analyzer to 100kHz and VBW to 100kHz.

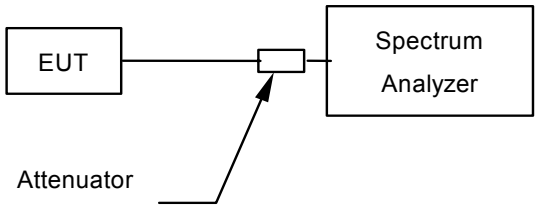


Figure 1 : Output power measurement configuration

4.1.3. Test Data

Signal Type : Carrier Only Test Date: Mar. 17, 2003
Temperature: 21 ℃ Humidity : 50 %

Frequency (MHz)	Result (dBm)	Output Power (mW)	Limit (mW)
622.510	9.40	9.731	50
702.244	9.49	9.773	50
806.790	9.66	9.850	50

4.2. MODULATION CHARACTERISTICS

4.2.1. 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.

4.2.2. Measurement Method

A) Modulation Limit

1. Position the EUT as shown in figure 2, 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 300, 500, 1000, 3000, and 5000 Hz in sequence.

B) Frequency response of all circuits

1. Position the EUT as shown in figure 2.
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

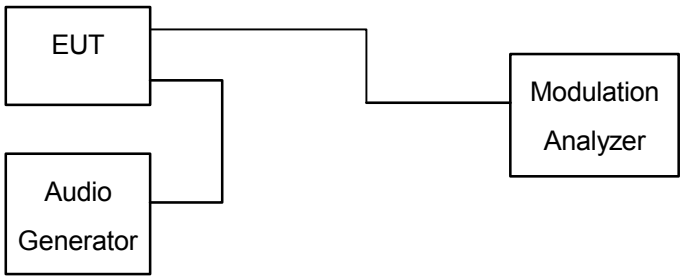
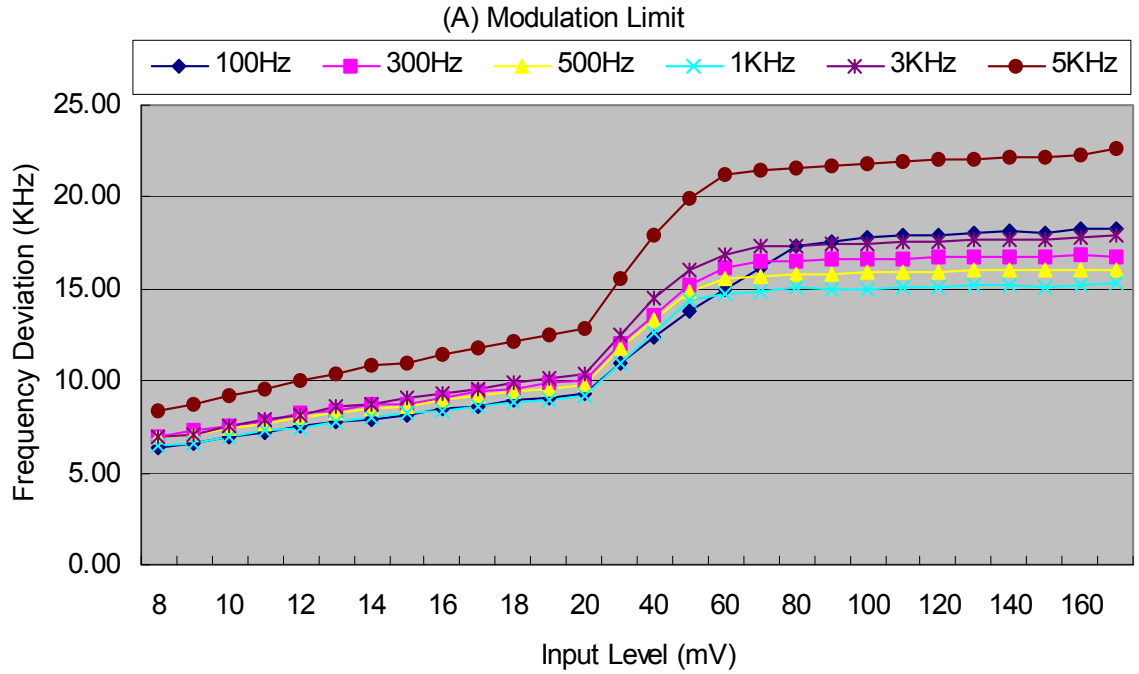


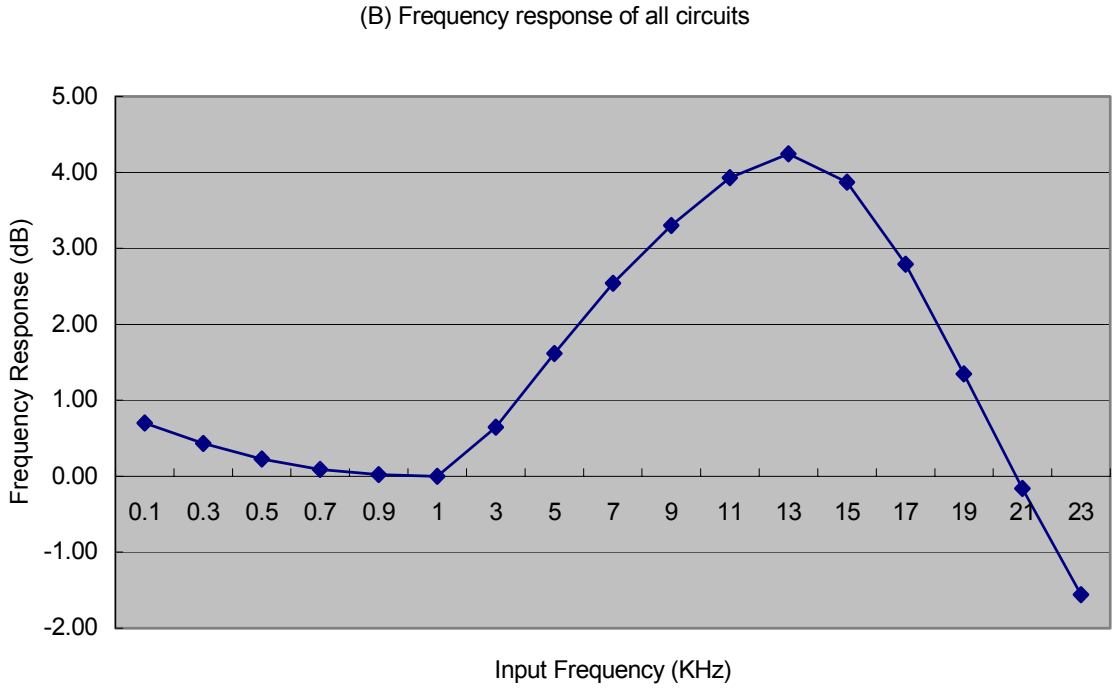
Figure 2 : Modulation characteristic measurement configuration

4.2.3. Measurement Result

Operation Mode : 622.50 MHz
Test Date : Mar. 17, 2002 Temperature : 21 ℃ Humidity: 50%
A). Modulation Limit

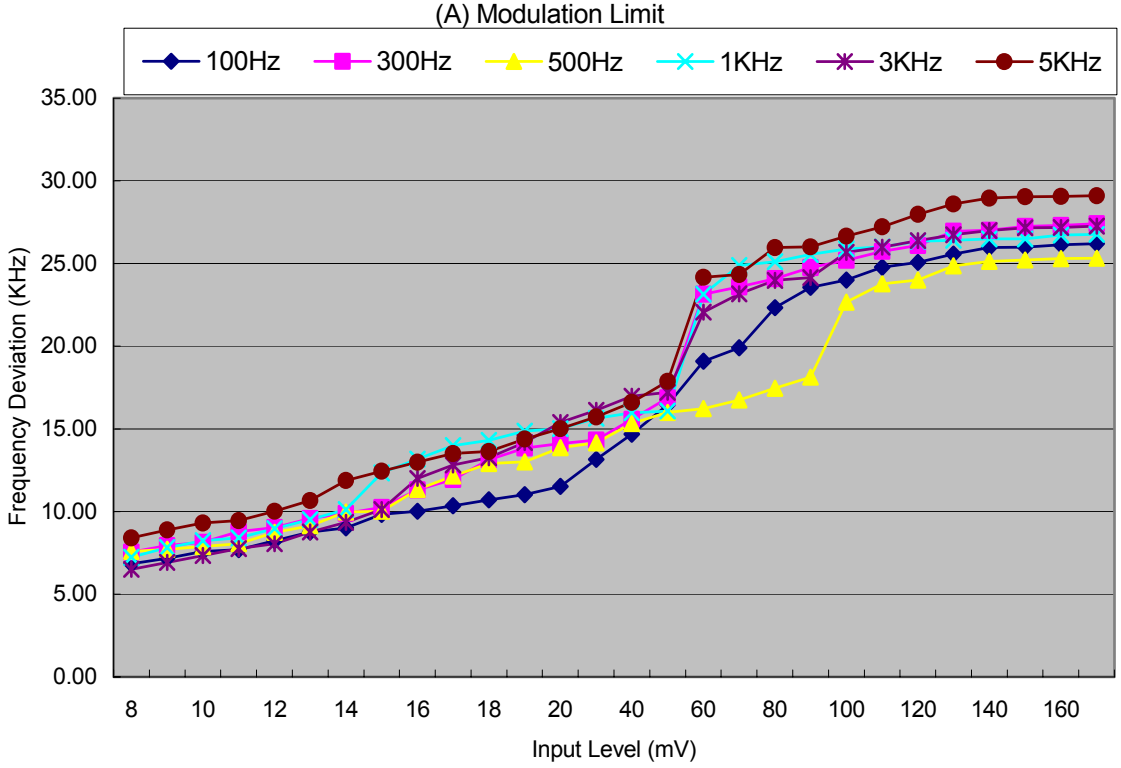


B). Frequency response of all circuits



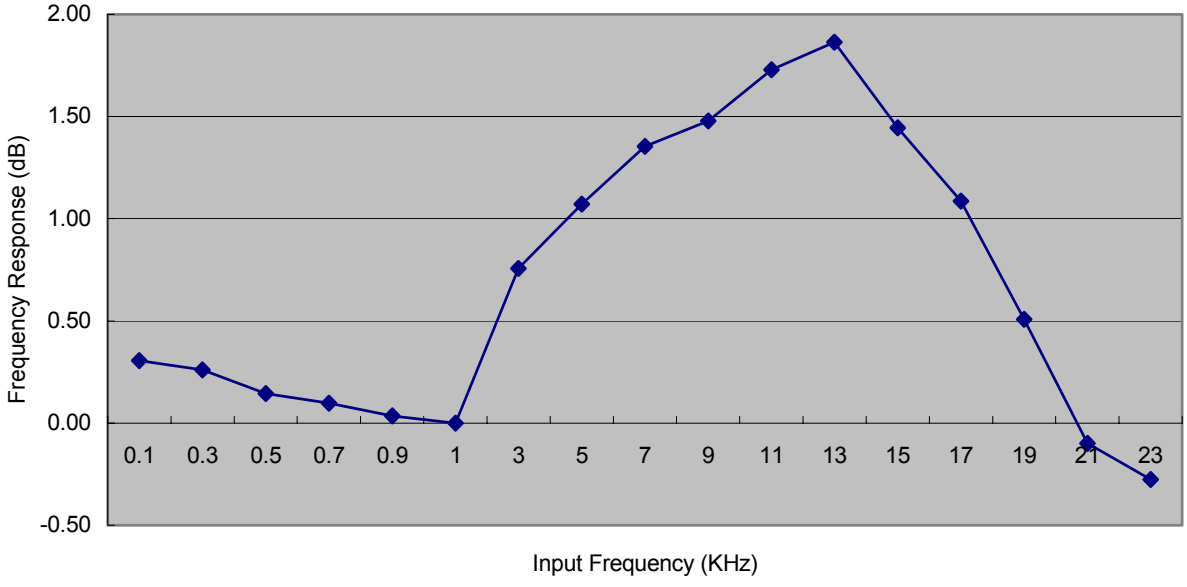
Operation Mode : 702.25 MHz
Test Date : Mar. 17, 2002 Temperature : 21 ℃ Humidity: 50%
A). Modulation Limit

(A) Modulation Limit

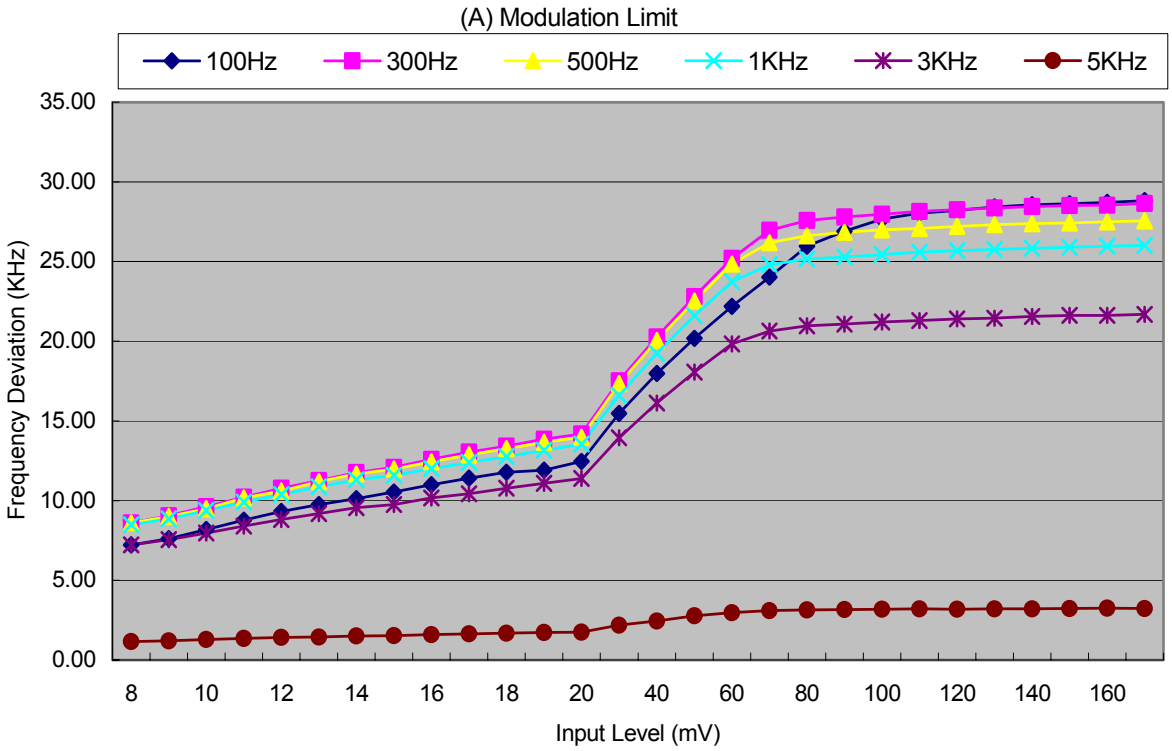


B). Frequency response of all circuits

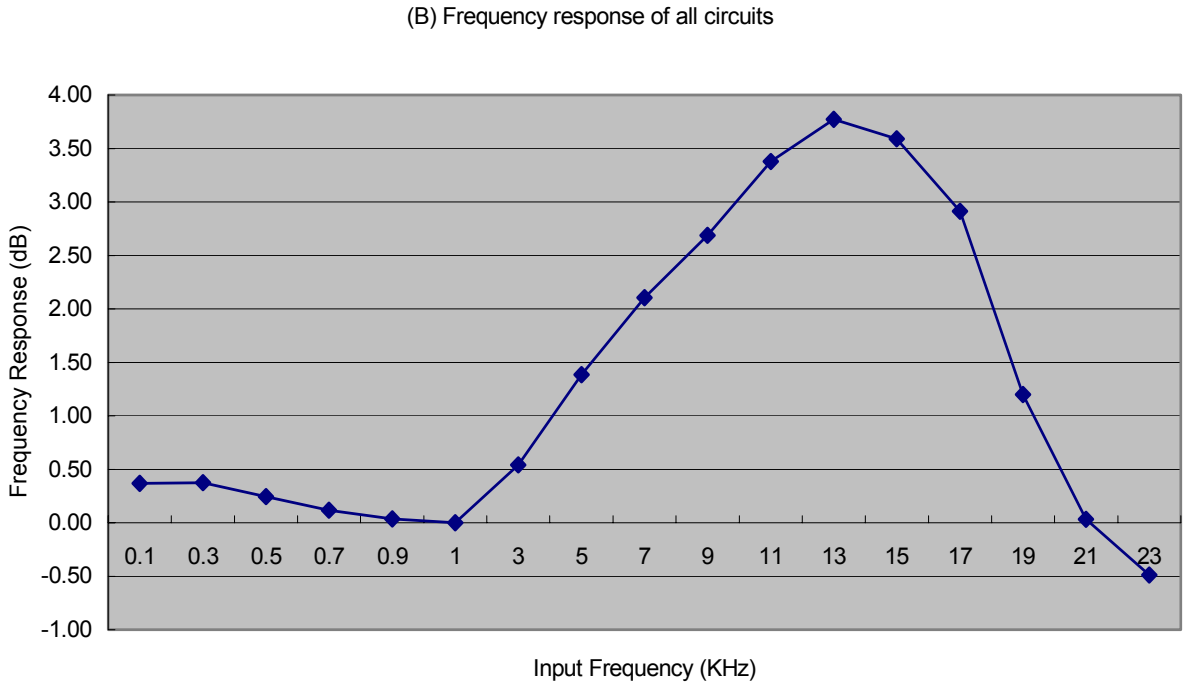
(B) Frequency response of all circuits



Operation Mode : 806.80 MHz
Test Date : Mar. 17, 2002 Temperature : 21 ℃ Humidity: 50%
A). Modulation Limit



B). Frequency response of all circuits



4.3. OCCUPIED BANDWIDTH OF EMISSION

4.3.1. Provisions Applicable

According to §2.1049 (c)(1), For radiotelephone transmitter, other than single sideband or indepent sideband transmitter, when modulated by a 15kHz 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.

4.3.2. Measurement Method

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 3, and Install new batteries in the EUT. Turn on the EUT 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 15 kHz modulation signal to EUT and measure the frequencies of the modulated signal from the EUT where it is the specified number of dB below the reference level set in step 2. This is the occupied bandwidth specified.

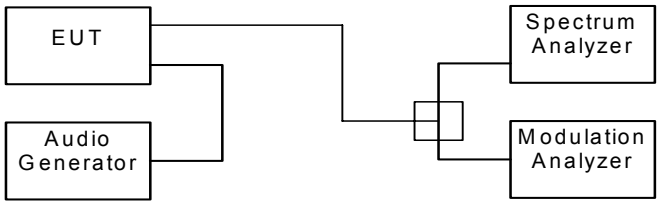
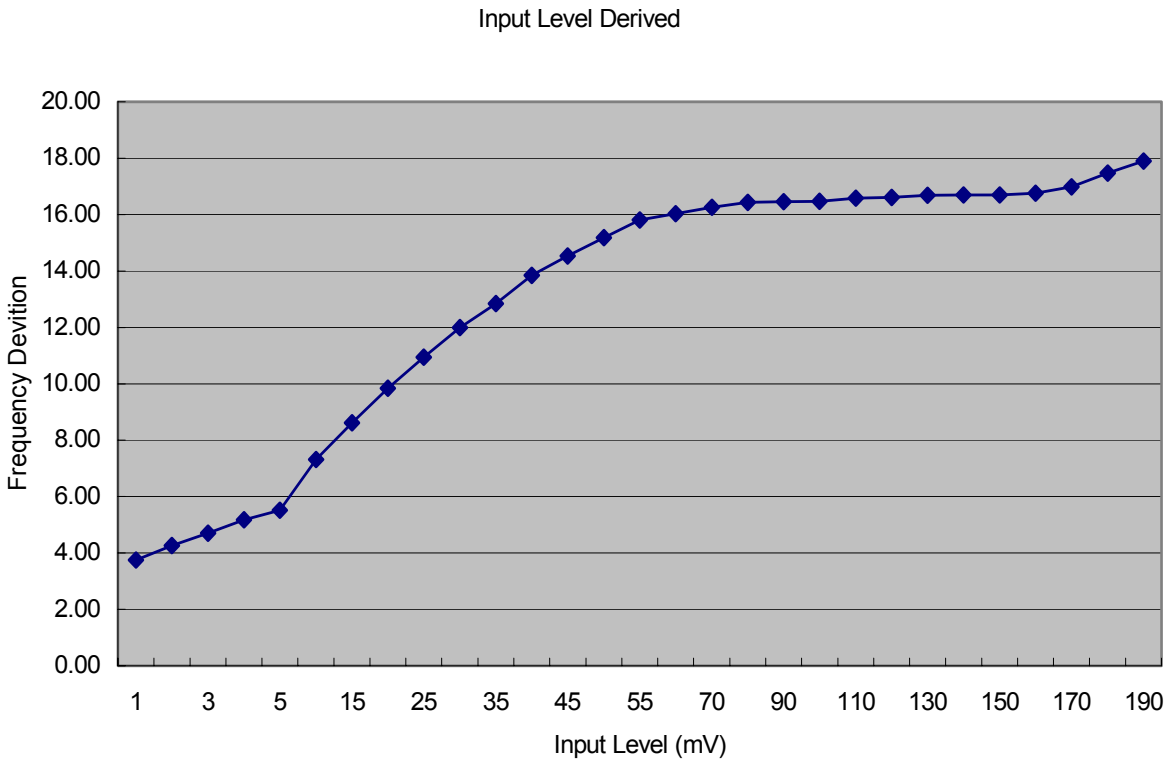


Figure 3 : Occupied bandwidth measurement configuration

4.3.3. Bandwidth Measured

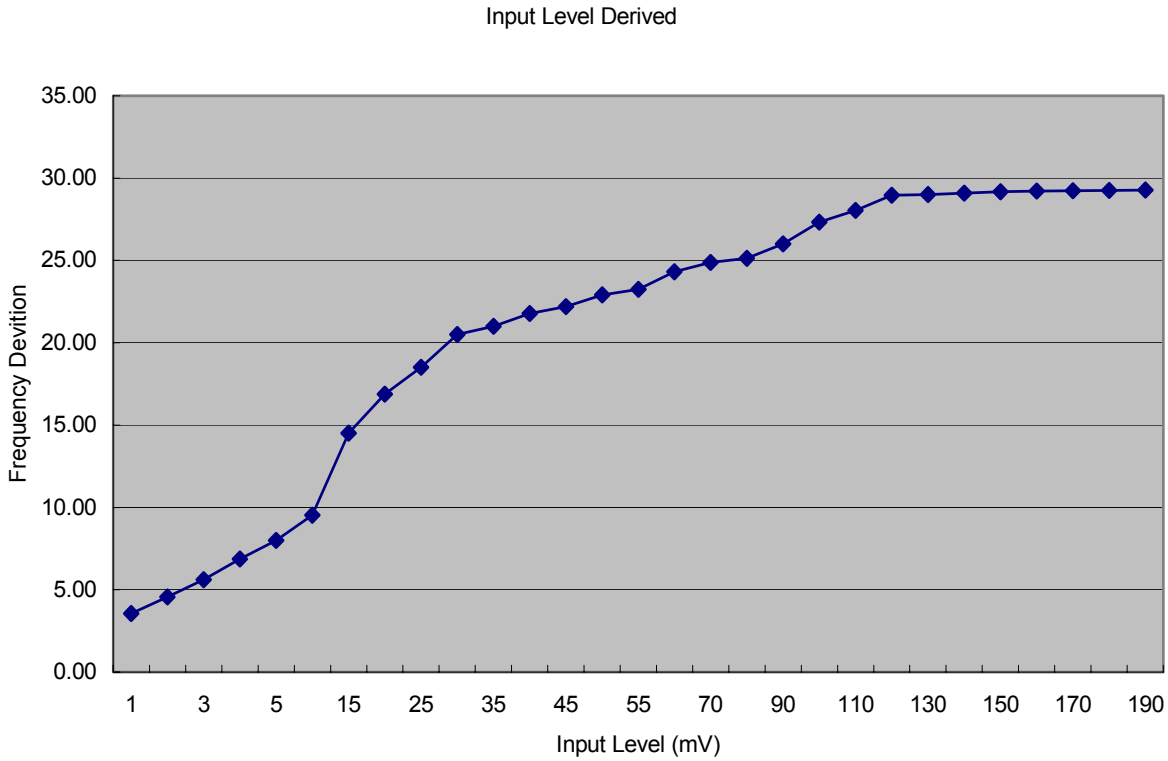
4.3.3.1. Input Level Derived

Operation Mode : 622.50MHz
Test Date : Mar. 17, 2002 Temperature : 21 ℃ Humidity: 50%
Input Audio Frequency : 15kHz, Sine Wave



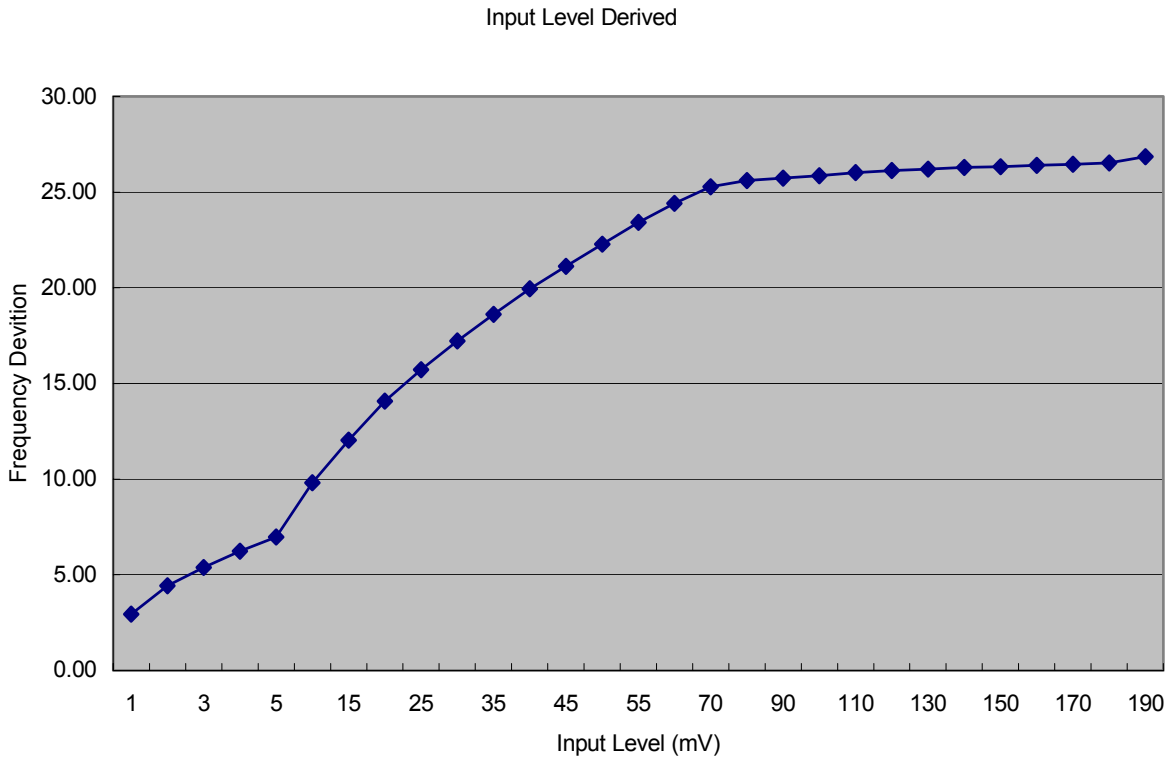
The Level input to produce 50% modulation is 14 mV, therefore the magnitude 16 dB greater than it is 89mV.

Operation Mode : 702.25MHz
Test Date : Mar. 17, 2002 Temperature : 21 ℃ Humidity: 50%
Input Audio Frequency : 15 kHz, Sine Wave



The Level input to produce 50% modulation is 15 mV, therefore the magnitude 16 dB greater than it is 94.5mV.

Operation Mode : 806.50MHz
Test Date : Mar. 17, 2002 Temperature : 21 ℃ Humidity: 50%
Input Audio Frequency : 15 kHz, Sine Wave

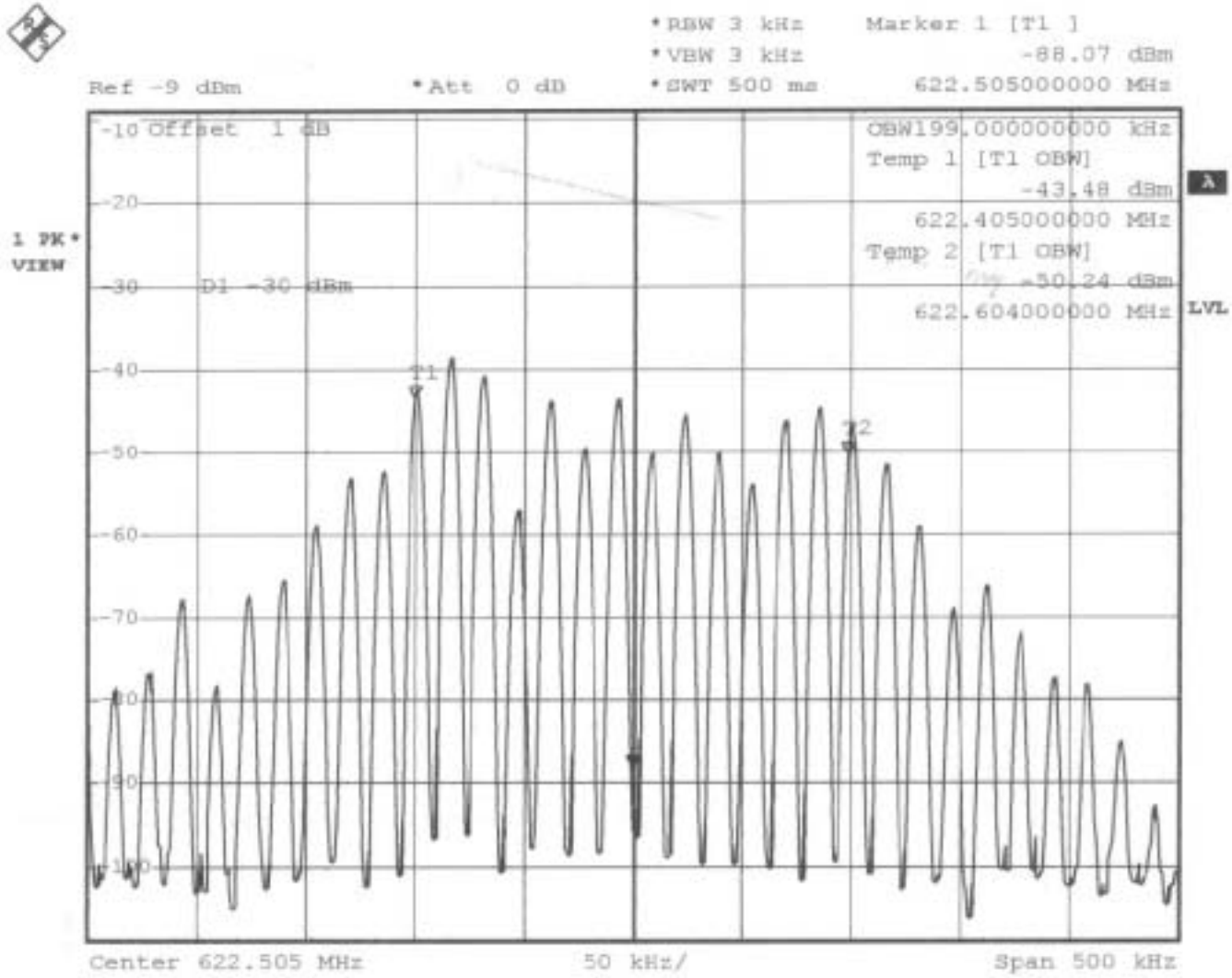


The Level input to produce 50% modulation is 17.5 mV, therefore the magnitude 16 dB greater than it is 106mV.

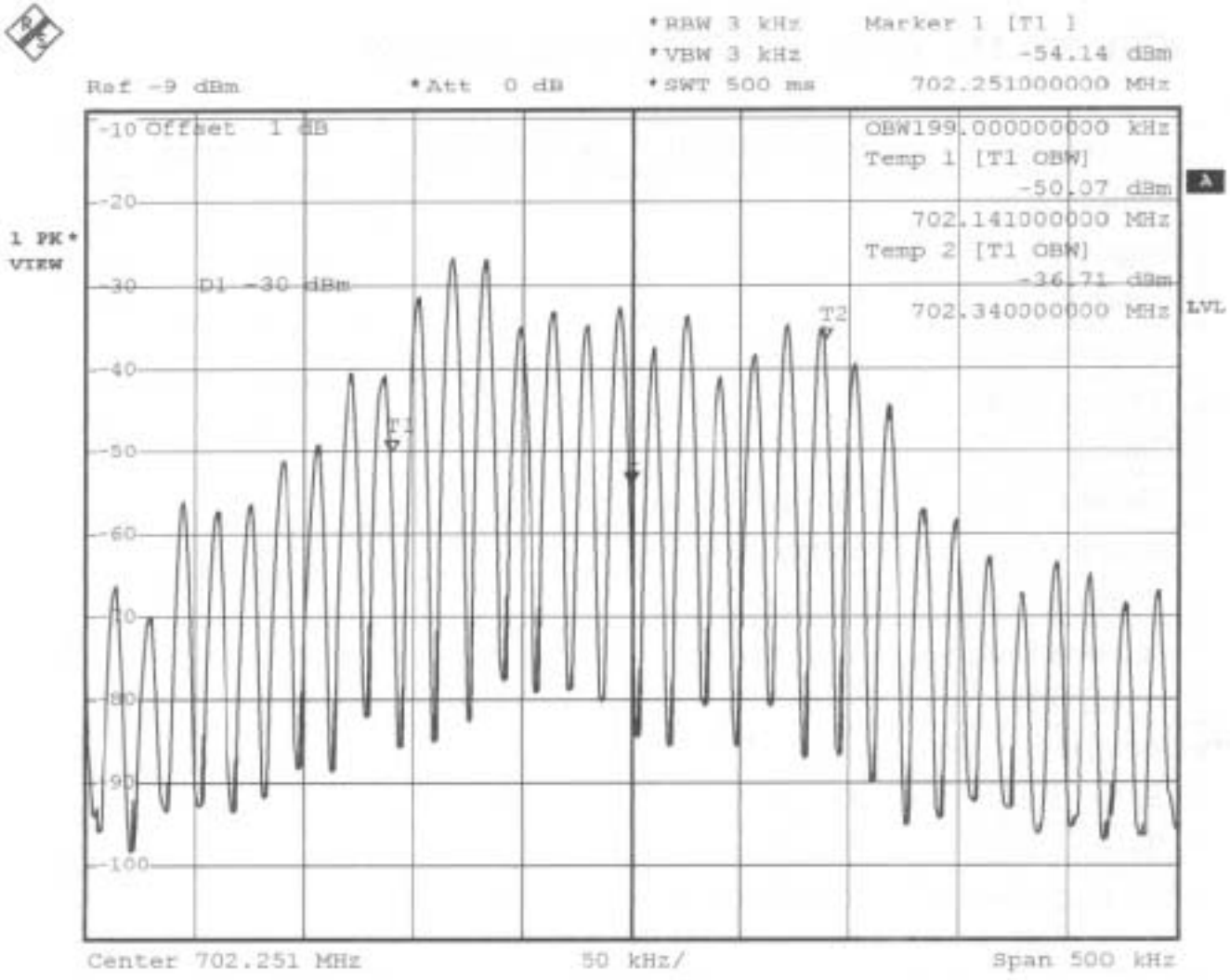
4.3.3.2 Occupied Bandwidth Plotted

Frequency (MHz)	Occupied Bandwidth (kHz)	Plot
622.50	199.00	Plot 1
702.25	199.00	Plot 2
806.80	199.00	Plot 3

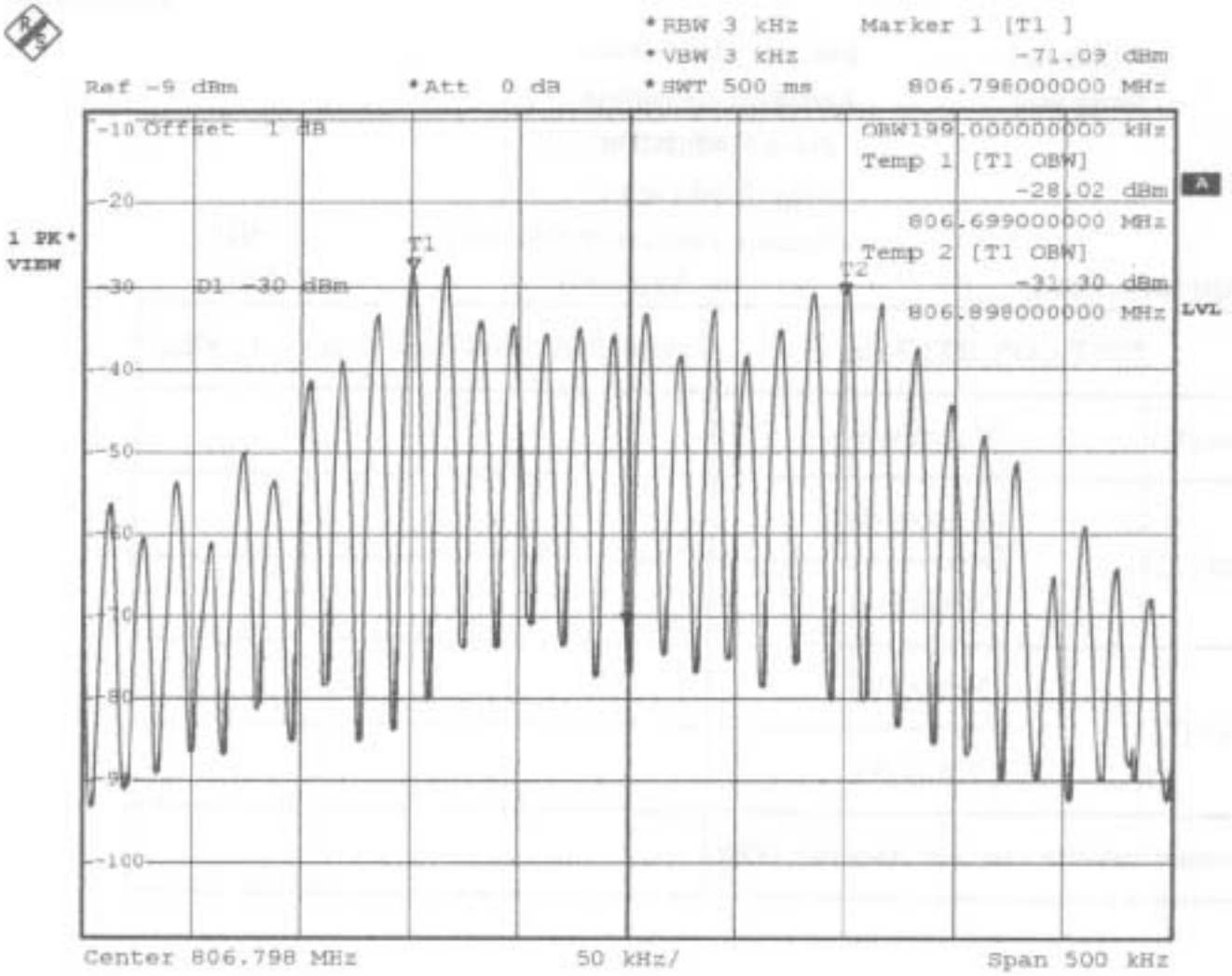
Plot 1


*RBW 3 kHz
*VBW 3 kHz
*SWT 500 ms
Marker 1 [T1]
-88.07 dBm
622.505000000 MHz
Ref -9 dBm
*Att 0 dB
Offset 1 dB
OBW199.000000000 kHz
Temp 1 [T1 OBW]
-43.48 dBm
622.405000000 MHz
Temp 2 [T1 OBW]
-50.24 dBm
622.604000000 MHz
1 PK*
VIEW
D1 -30 dBm
LVL
Center 622.505 MHz
50 kHz/
Span 500 kHz

Plot 2


*RBW 3 kHz
*VBW 3 kHz
*SWT 500 ms
Marker 1 [T1]
-54.14 dBm
702.251000000 MHz
Ref -9 dBm
*Att 0 dB
-10 Offset 1 dB
OBW199.000000000 kHz
Temp 1 [T1 OBW]
-50.07 dBm
702.141000000 MHz
Temp 2 [T1 OBW]
-36.71 dBm
702.340000000 MHz
1 PK*
VIEW
D1 -30 dBm
T1
T2
LVL
Center 702.251 MHz
50 kHz/
Span 500 kHz

Plot 3


*RBW 3 kHz
*VBW 3 kHz
*SWT 500 ms
Marker 1 [T1]
-71.09 dBm
806.796000000 MHz
Ref -9 dBm
*Att 0 dB
-10 Offset 1 dB
OBW199.000000000 kHz
Temp 1 [T1 OBW]
-28.02 dBm
806.699000000 MHz
Temp 2 [T1 OBW]
-31.30 dBm
806.898000000 MHz
A
LVL
1 PK*
VIEW
T1
T2
D1 -30 dBm
-20
-30
-40
-50
-60
-70
-80
-90
-100
Center 806.798 MHz
50 kHz/
Span 500 kHz

4.4. SPURIOUS EMISSIONS AT ANTENNA TERMINALS

4.4.1. Provisions Applicable

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

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

(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.

4.4.2. Measurement Procedure

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

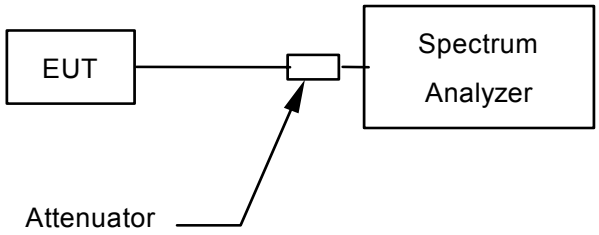


Figure 4 : Conducted spurious emission measurement configuration

4.4.3. Measurement Data

Operated mode : Normal Test Date : Mar. 17, 2003
Temperature : 21 ℃, Humidity : 50 %

A. 622.50MHz:
Unmodulated carrier power is 9.40 dBm.
The limit of spurious or harmonics is 9.40-[43+10log(output power in W)], or -13dBm

Frequency (MHz)	Result (dBm)	Limit (dBm)	Margin (dB)	Plot
622.3024	-55.25	-18	-37.25	1
622.4036	-49.93	-8	-41.93	
622.5038	9.38	17	-7.62	
622.6012	-54.57	-8	-46.57	2
622.7048	-56.51	-18	-38.51	

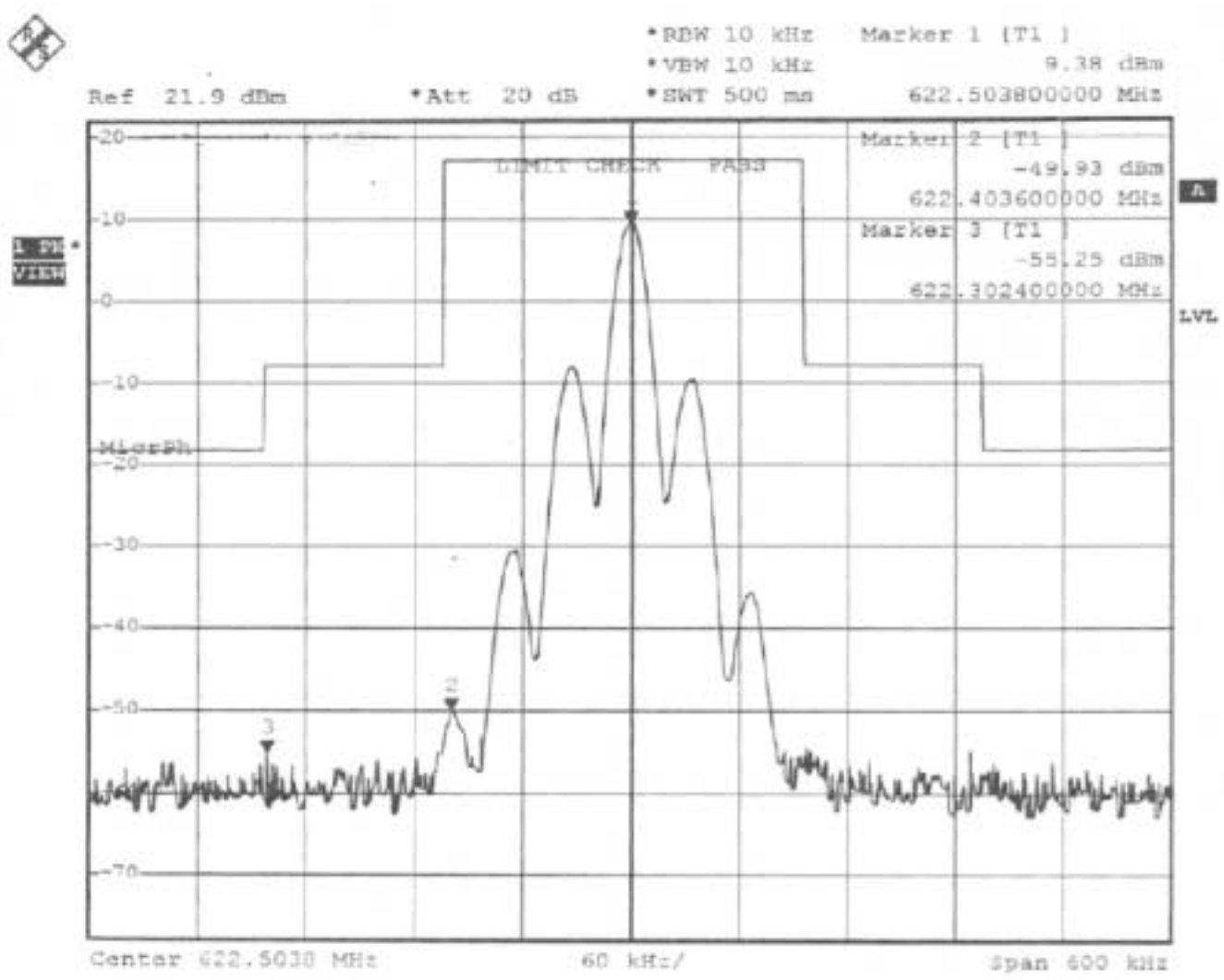
B. 702.25MHz:
Unmodulated carrier power is 9.49 dBm.
The limit of spurious or harmonics is 9.49-[43+10log(output power in W)], or -13dBm

Frequency (MHz)	Result (dBm)	Limit (dBm)	Margin (dB)	Plot
702.0272	-56.42	-18	-38.42	3
702.1512	-51.73	-8	-43.73	
702.2512	9.19	17	-7.81	
702.3440	-53.12	-8	-45.12	4
702.4572	-55.47	-18	-37.47	

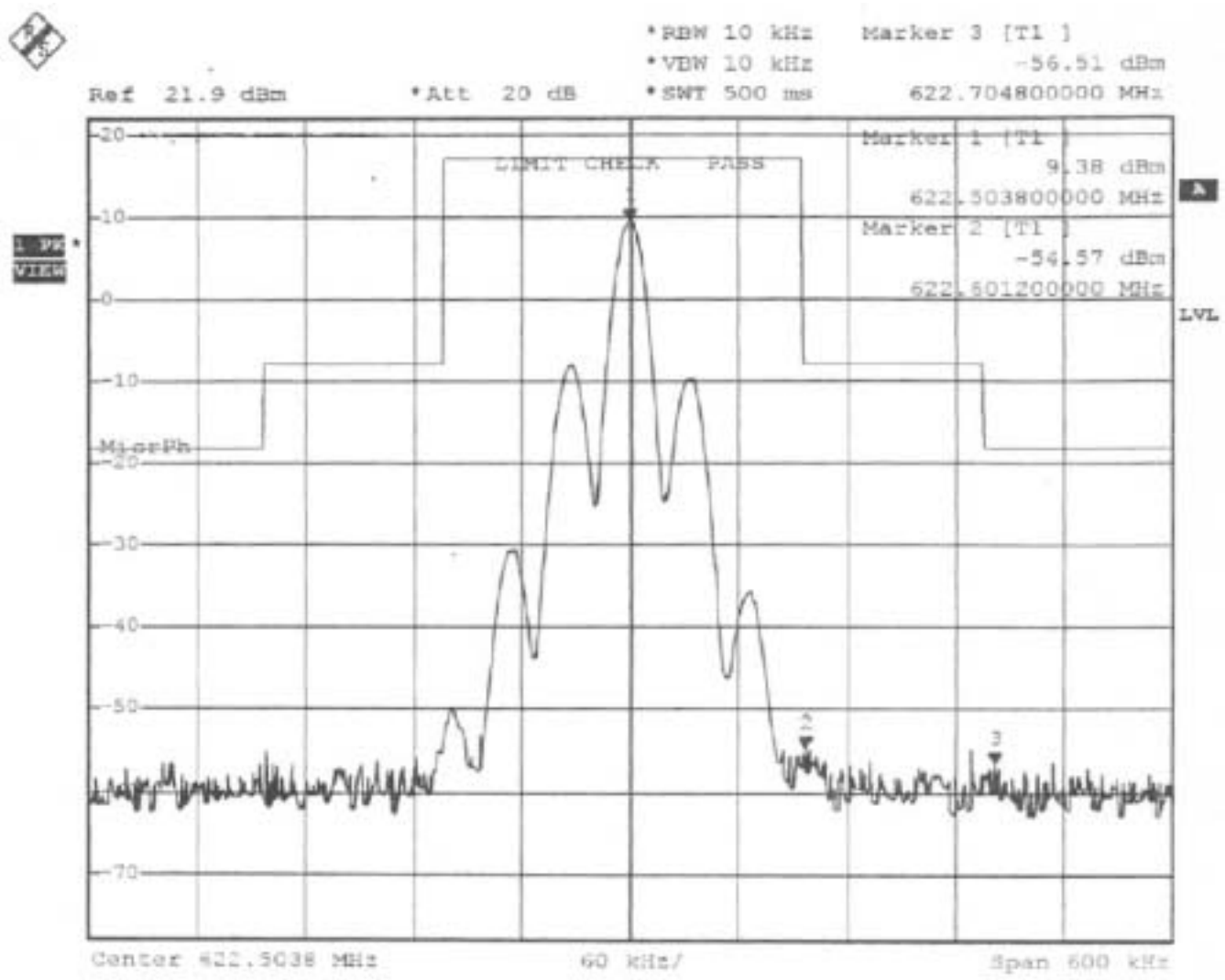
C. 806.80MHz:
Unmodulated carrier power is 9.66 dBm.
The limit of spurious or harmonics is 9.66-[43+10log(output power in W)], or -13dBm

Frequency (MHz)	Result (dBm)	Limit (dBm)	Margin (dB)	Plot
806.5604	-54.66	-18	-36.66	5
806.7000	-50.47	-8	-42.47	
806.7976	9.11	17	-7.89	
806.8976	-47.48	-8	-39.48	6
807.0336	-53.26	-18	-35.26	

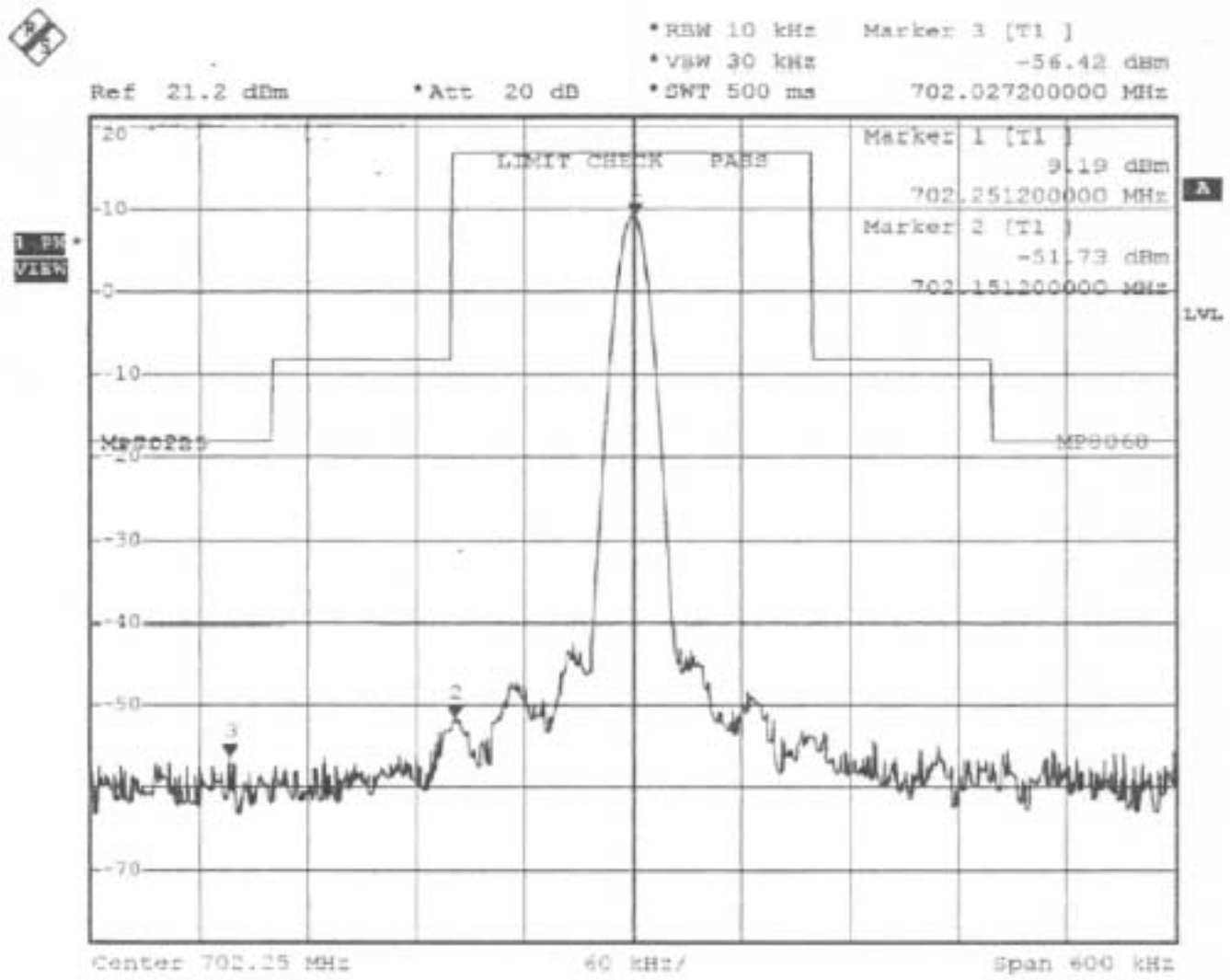
Plot 1


*RBW 10 kHz
*VBW 10 kHz
*SWT 500 ms
Marker 1 [T1]
9.38 dBm
622.503800000 MHz
Ref 21.9 dBm
*Att 20 dB
Marker 2 [T1]
-49.93 dBm
622.403600000 MHz
Marker 3 [T1]
-55.25 dBm
622.302400000 MHz
LIMIT CHECK PASS
1 PK VIEW
A
LVL
MkrdBh
Center 622.5038 MHz
60 kHz/
Span 600 kHz

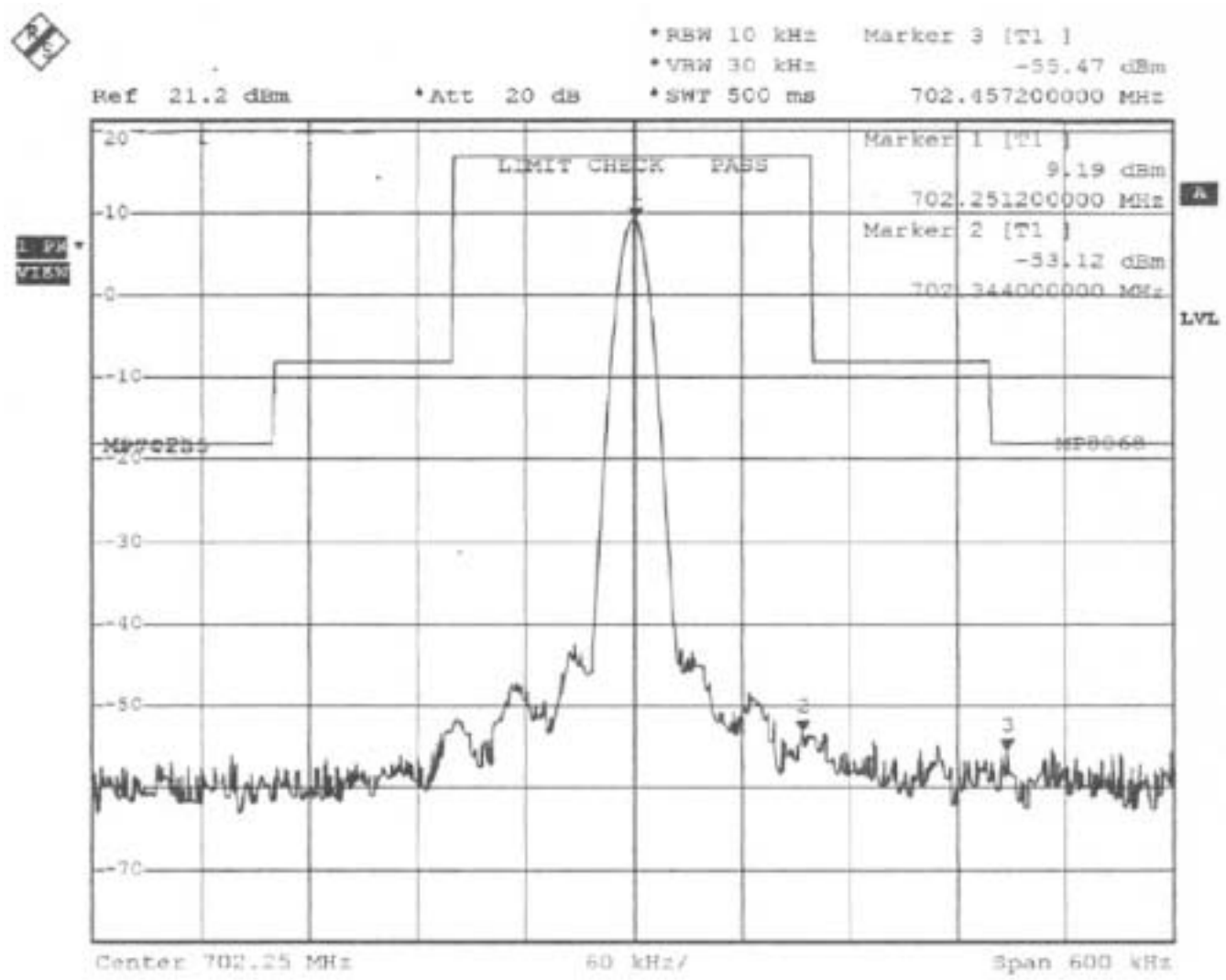
Plot 2


*RBW 10 kHz
*VBW 10 kHz
*SWT 500 ms
Marker 3 [T1]
-56.51 dBm
622.704800000 MHz
Ref 21.9 dBm
*Att 20 dB
LIMIT CHECK PASS
Marker 1 [T1]
9.38 dBm
622.503800000 MHz
Marker 2 [T1]
-54.57 dBm
622.501200000 MHz
1 PK VIEW
A
LVL
20
10
0
-10
MkrPk
-20
-30
-40
-50
-70
Center 622.5038 MHz
60 kHz/
Span 600 kHz

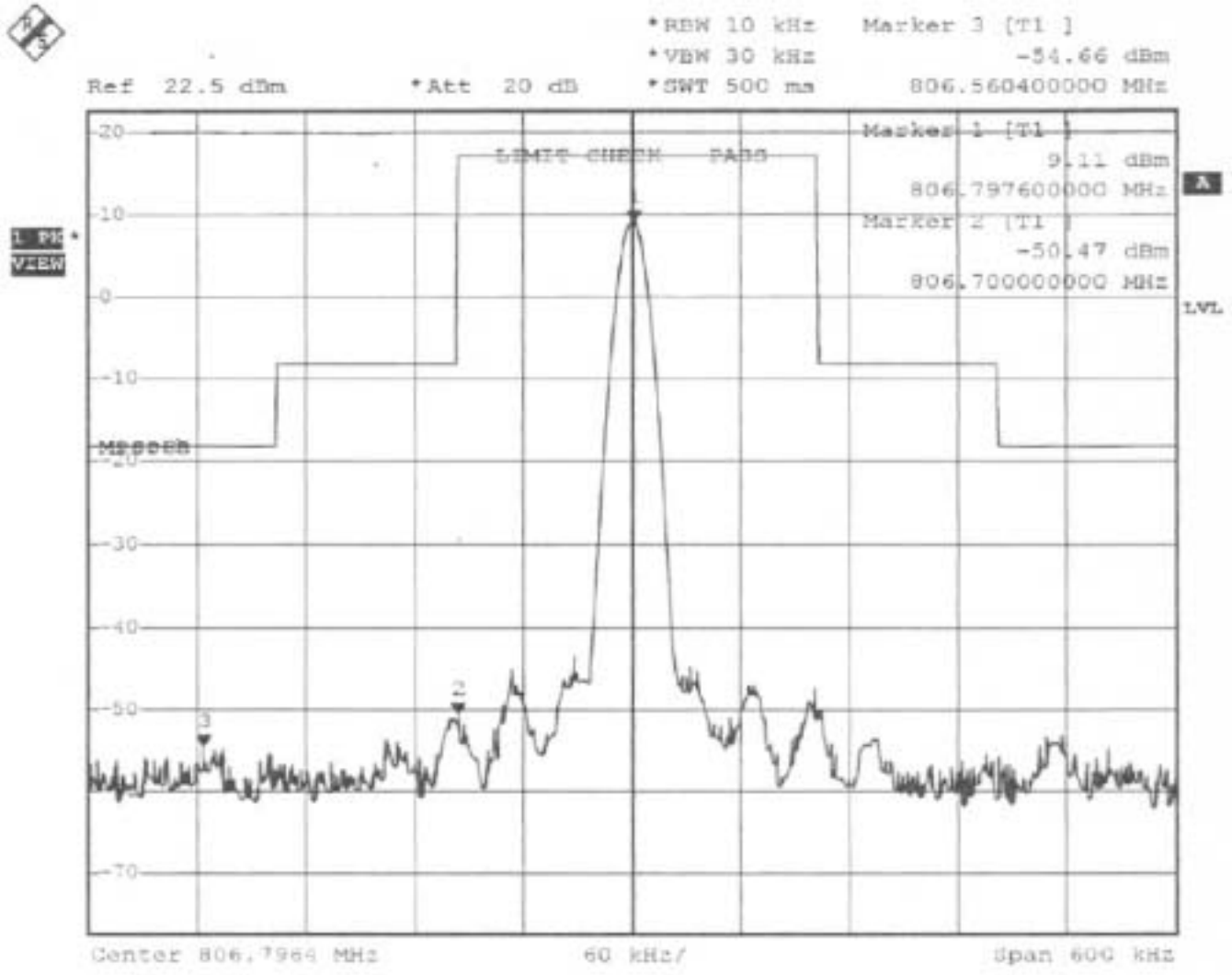
Plot 3


*RBW 10 kHz
*VBW 30 kHz
*SWT 500 ms
Marker 3 [T1]
-56.42 dBm
702.027200000 MHz
Ref 21.2 dBm
*Att 20 dB
LIMIT CHECK PASS
Marker 1 [T1]
9.19 dBm
702.251200000 MHz
Marker 2 [T1]
-51.73 dBm
702.151200000 MHz
1 PK
VIEW
A
LVL
20
10
0
-10
-20
-30
-40
-50
-70
Center 702.25 MHz
60 kHz/
Span 600 kHz

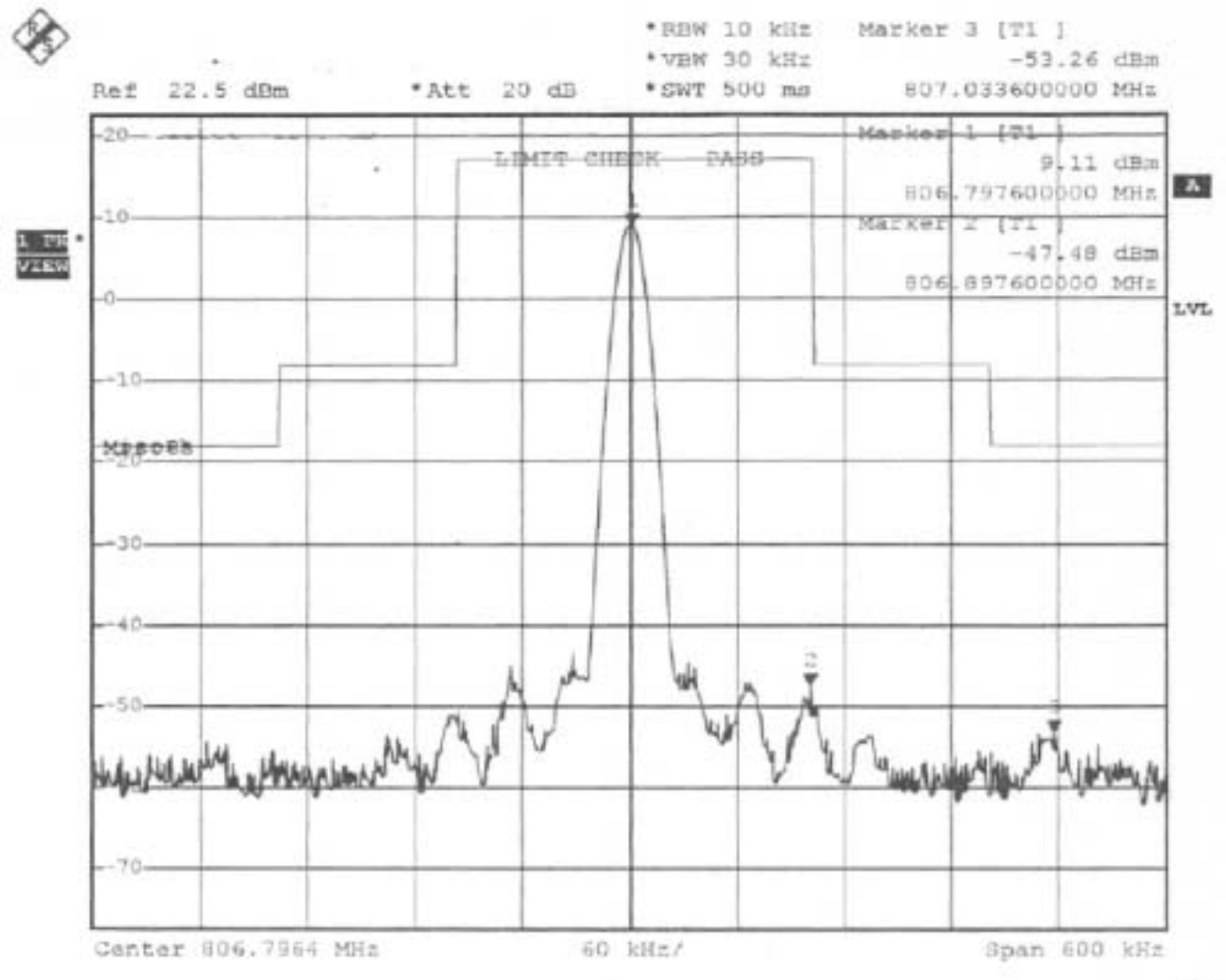
Plot 4


*RBW 10 kHz
*VBW 30 kHz
*SWT 500 ms
Marker 3 [T1]
-55.47 dBm
702.457200000 MHz
Ref 21.2 dBm
*Att 20 dB
LIMIT CHECK PASS
Marker 1 [T1]
9.19 dBm
702.251200000 MHz
Marker 2 [T1]
-53.12 dBm
LVL
Center 702.25 MHz
60 kHz/
Span 600 kHz

Plot 5


*RBW 10 kHz
*VBW 30 kHz
*SWT 500 ms
Marker 3 [T1]
-54.66 dBm
806.560400000 MHz
Ref 22.5 dBm
*Att 20 dB
LIMIT CHECK PASS
Marker 1 [T1]
9.11 dBm
806.797600000 MHz
Marker 2 [T1]
-50.47 dBm
806.700000000 MHz
1 PK
VIEW
A
LVL
20
10
0
-10
-20
-30
-40
-50
-70
Center 806.7964 MHz
60 kHz/
Span 600 kHz

Plot 6



4.5. FIELD STRENGTH OF EMISSION

4.5.1. 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 following schedule:

(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.

4.5.2. Measurement Procedure

1. Setup the configuration per figure 5 and 6 for frequencies measured below and above 1 GHz respectively, adjusting the input voltage to produce the maximum power as measured in chapter 3.
2. Adjust the analyzer for each frequency measured in chapter 6 on a 1 MHz frequency span and 100 kHz resolution bandwidth.
3. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° 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.

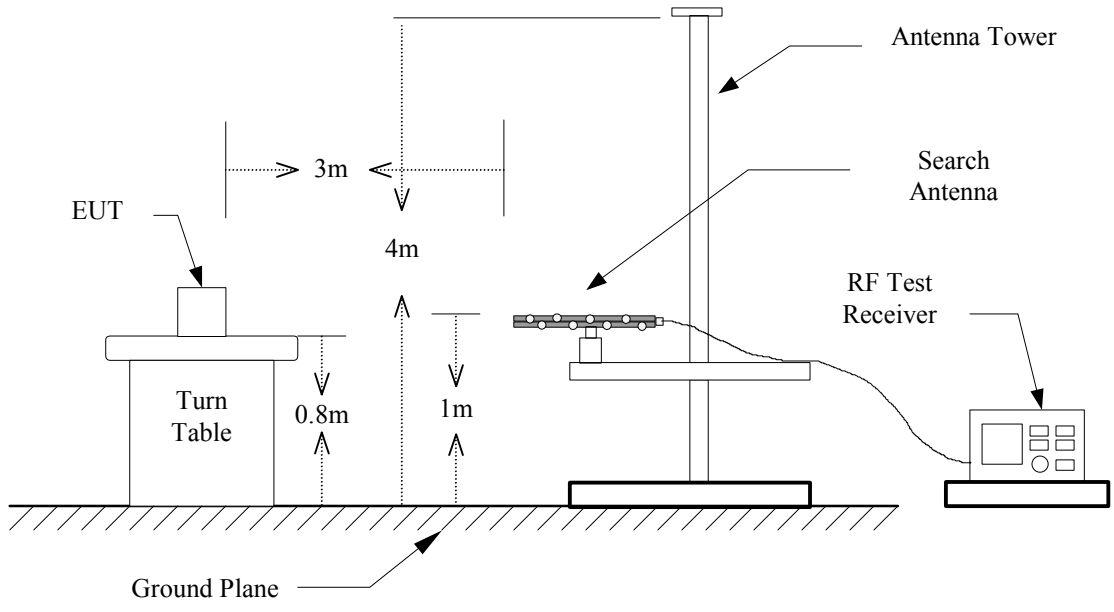


Figure 5 : Frequencies measured below 1 GHz configuration

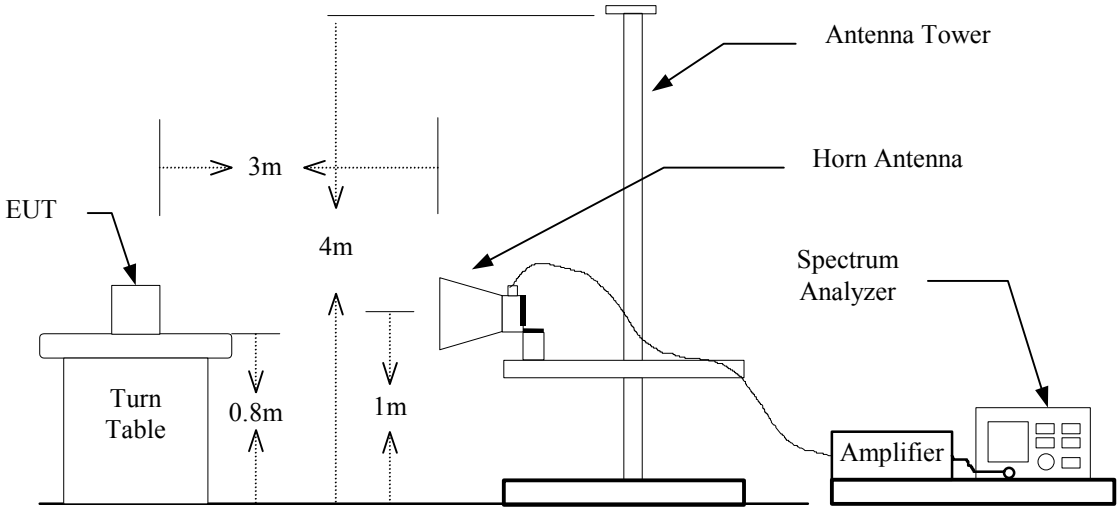


Figure 6 : Frequencies measured above 1 GHz configuration

4.5.3. 4.5.3. Measuring Data

4.5.3.1 Operated mode: 622.50MHz

Orthogonal axes: X Test Date : Jan. 22, 2003

Temperature : 21 ℃ Humidity : 50 %

The limit of spurious or harmonics is calculated as following :

Fundamental ERP-[43+10log(carrier ERP in W)]

■ Field strength of harmonics

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
1244.000	H	-63.1	-13.0	-50.1
1244.000	V	-63.6	-13.0	-50.6
1867.500	H/V	-	-13	-
2490.000	H/V	-	-13	-
3112.500	H/V	-	-13	-
3735.000	H/V	-	-13	-
4357.500	H/V	-	-13	-
4980.000	H/V	-	-13	-
5602.500	H/V	-	-13	-
6225.000	H/V	-	-13	-

Remark "---" means that the emission level is too weak to be detected.

■ Spurious Emission

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
207.660	H	-63.6	-13.0	-50.6
276.780	H	-60.5	-13.0	-47.5
310.500	H	-40.2	-13.0	-27.2
517.700	H	-37.5	-13.0	-24.5
587.700	H	-43.2	-13.0	-30.2
634.600	H	-39.6	-13.0	-26.6
1452.000	H	-64.1	-13.0	-51.1
1556.000	H	-62.0	-13.0	-49.0
2686.000	H	-59.2	-13.0	-46.2
2860.000	H	-58.3	-13.0	-45.3
310.500	V	-47.5	-13.0	-34.5
517.700	V	-46.0	-13.0	-33.0
634.600	V	-46.6	-13.0	-33.6
657.000	V	-48.1	-13.0	-35.1
727.000	V	-47.4	-13.0	-34.4
1660.000	V	-62.8	-13.0	-49.8
2180.000	V	-53.2	-13.0	-40.2
2284.000	V	-59.2	-13.0	-46.2
5412.000	V	-58.1	-13.0	-45.1
8110.000	V	-45.5	-13.0	-32.5

Orthogonal axes: Y Test Date : Jan. 22, 2003

Temperature : 21 ℃ Humidity : 50 %

The limit of spurious or harmonics is calculated as following :

Fundamental ERP-[43+10log(carrier ERP in W)]

■ Field strength of harmonics

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
1244.000	H/V	-	-13	-
1867.500	H/V	-	-13	-
2490.000	H/V	-	-13	-
3112.500	H/V	-	-13	-
3735.000	H/V	-	-13	-
4357.500	H/V	-	-13	-
4980.000	H/V	-	-13	-
5602.500	H/V	-	-13	-
6225.000	H/V	-	-13	-

Remark "---" means that the emission level is too weak to be detected.

■ Spurious Emission

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
207.660	H	-61.2	-13.0	-48.2
276.780	H	-58.3	-13.0	-45.3
310.500	H	-39.9	-13.0	-26.9
517.700	H	-37.4	-13.0	-24.4
587.700	H	-41.6	-13.0	-28.6
610.100	H	-42.0	-13.0	-29.0
634.600	H	-37.9	-13.0	-24.9
7534.000	H	-46.6	-13.0	-33.6
310.500	V	-47.9	-13.0	-34.9
517.700	V	-46.2	-13.0	-33.2
634.600	V	-45.9	-13.0	-32.9
657.000	V	-48.3	-13.0	-35.3
4598.000	V	-59.5	-13.0	-46.5

Orthogonal axes: Z Test Date : Jan. 22, 2003

Temperature : 21 ℃ Humidity : 50 %

The limit of spurious or harmonics is calculated as following :

Fundamental ERP-[43+10log(carrier ERP in W)]

■ Field strength of harmonics

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
1244.000	H/V	-	-13	-
1867.500	H/V	-	-13	-
2490.000	H/V	-	-13	-
3112.500	H/V	-	-13	-
3735.000	H/V	-	-13	-
4357.500	H/V	-	-13	-
4980.000	H/V	-	-13	-
5602.500	H/V	-	-13	-
6225.000	H/V	-	-13	-

Remark "---" means that the emission level is too weak to be detected.

■ Spurious Emission

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
207.660	H	-63.6	-13.0	-50.6
276.780	H	-59.4	-13.0	-46.4
310.500	H	-53.2	-13.0	-40.2
587.700	H	-54.0	-13.0	-41.0
610.100	H	-54.4	-13.0	-41.4
634.600	H	-54.6	-13.0	-41.6
727.000	H	-54.4	-13.0	-41.4
3806.000	H	-60.9	-13.0	-47.9
8454.000	H	-45.3	-13.0	-32.3
207.660	V	-59.5	-13.0	-46.5
238.170	V	-51.5	-13.0	-38.5
276.789	V	-58.4	-13.0	-45.4
310.500	V	-40.3	-13.0	-27.3
517.700	V	-37.6	-13.0	-24.6
587.700	V	-42.4	-13.0	-29.4
634.600	V	-37.5	-13.0	-24.5
6142.000	V	-59.1	-13.0	-46.1

4.5.3.2 Operated mode: 702.25MHz

Orthogonal axes: X Test Date : Jan. 22, 2003

Temperature : 21 ℃ Humidity : 50 %

The limit of spurious or harmonics is calculated as following :

Fundamental ERP-[43+10log(carrier ERP in W)]

■ Field strength of harmonics

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
1404.500	H/V	-	-13	-
2106.750	H/V	-	-13	-
2809.000	H/V	-	-13	-
3511.250	H/V	-	-13	-
4213.500	H/V	-	-13	-
4915.750	H/V	-	-13	-
5618.000	H/V	-	-13	-
6320.250	H/V	-	-13	-
7022.500	H/V	-	-13	-

Remark "---" means that the emission level is too weak to be detected.

■ Spurious Emission

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
55.380	H	-52.5	-13.0	-39.5
349.700	H	-42.1	-13.0	-29.1
715.800	H	-46.8	-13.0	-33.8
741.000	H	-44.5	-13.0	-31.5
819.400	H	-44.2	-13.0	-31.2
7582.000	H	-46.5	-13.0	-33.5
47.820	V	-51.5	-13.0	-38.5
74.820	V	-60.8	-13.0	-47.8
349.700	V	-49.2	-13.0	-36.2
741.000	V	-48.0	-13.0	-35.0
819.400	V	-46.3	-13.0	-33.3
2356.000	V	-61.3	-13.0	-48.3
5078.000	V	-56.6	-13.0	-43.6
6692.000	V	-55.1	-13.0	-42.1
7614.000	V	-46.4	-13.0	-33.4

Orthogonal axes: Y Test Date : Jan. 22, 2003

Temperature : 21 ℃ Humidity : 50 %

The limit of spurious or harmonics is calculated as following :

Fundamental ERP-[43+10log(carrier ERP in W)]

■ Field strength of harmonics

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
1404.500	H/V	-	-13	-
2106.750	H/V	-	-13	-
2809.000	H/V	-	-13	-
3511.250	H/V	-	-13	-
4213.500	H/V	-	-13	-
4915.750	H/V	-	-13	-
5618.000	H/V	-	-13	-
6320.250	H/V	-	-13	-
7022.500	H/V	-	-13	-

Remark "---" means that the emission level is too weak to be detected.

■ Spurious Emission

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
349.700	H	-40.7	-13.0	-27.7
715.800	H	-45.1	-13.0	-32.1
741.000	H	-42.5	-13.0	-29.5
780.200	H	-42.6	-13.0	-29.6
819.400	H	-40.1	-13.0	-27.1
4292.000	H	-58.7	-13.0	-45.7
4524.000	H	-58.0	-13.0	-45.0
5428.000	H	-56.7	-13.0	-43.7
8164.000	H	-45.4	-13.0	-32.4
47.820	V	-49.8	-13.0	-36.8
349.700	V	-48.9	-13.0	-35.9
741.000	V	-47.7	-13.0	-34.7
819.400	V	-46.9	-13.0	-33.9
2372.000	V	-61.4	-13.0	-48.4
8206.000	V	-45.7	-13.0	-32.7

Orthogonal axes: Z Test Date : Jan. 22, 2003

Temperature : 21 ℃ Humidity : 50 ％

The limit of spurious or harmonics is calculated as following :

Fundamental ERP-[43+10log(carrier ERP in W)]

■ Field strength of harmonics

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
1404.500	H/V	-	-13	-
2106.750	H/V	-	-13	-
2809.000	H/V	-	-13	-
3511.250	H/V	-	-13	-
4213.500	H/V	-	-13	-
4915.750	H/V	-	-13	-
5618.000	H/V	-	-13	-
6320.250	H/V	-	-13	-
7022.500	H/V	-	-13	-

Remark "---" means that the emission level is too weak to be detected.

■ Spurious Emission

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
349.700	H	-53.0	-13.0	-40.0
741.000	H	-53.8	-13.0	-40.8
819.400	H	-51.1	-13.0	-38.1
2060.000	H	-49.4	-13.0	-36.4
349.700	V	-40.4	-13.0	-27.4
663.300	V	-46.6	-13.0	-33.6
715.800	V	-42.9	-13.0	-29.9
741.000	V	-40.6	-13.0	-27.6
780.200	V	-41.6	-13.0	-28.6
819.400	V	-40.2	-13.0	-27.2
2900.000	V	-64.6	-13.0	-51.6

4.5.3.3 Operated mode: 806.80MHz

Orthogonal axes: X Test Date : Jan. 22, 2003

Temperature : 21 ℃ Humidity : 50 %

The limit of spurious or harmonics is calculated as following :

Fundamental ERP-[43+10log(carrier ERP in W)]

■ Field strength of harmonics

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
1613.600	H/V	-	-13	-
2420.400	H/V	-	-13	-
3227.200	H/V	-	-13	-
4034.000	H/V	-	-13	-
4840.800	H/V	-	-13	-
5647.600	H/V	-	-13	-
6454.400	H/V	-	-13	-
7261.200	H/V	-	-13	-
8068.000	H/V	-	-13	-

Remark "---" means that the emission level is too weak to be detected.

■ Spurious Emission

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
134.220	H	-64.7	-13.0	-51.7
402.900	H	-33.1	-13.0	-20.1
799.800	H	-38.7	-13.0	-25.7
813.800	H	-40.3	-13.0	-27.3
850.900	H	-41.6	-13.0	-28.6
957.300	H	-37.5	-13.0	-24.5
134.220	V	-60.7	-13.0	-47.7
150.420	V	-54.9	-13.0	-41.9
402.900	V	-39.8	-13.0	-26.8
761.300	V	-47.8	-13.0	-34.8
850.900	V	-44.2	-13.0	-31.2
940.500	V	-44.9	-13.0	-31.9
957.300	V	-38.3	-13.0	-25.3
3252.000	V	-60.6	-13.0	-47.6

Orthogonal axes: Y Test Date : Jan. 22, 2003

Temperature : 21 ℃ Humidity : 50 %

The limit of spurious or harmonics is calculated as following :

Fundamental ERP-[43+10log(carrier ERP in W)]

■ Field strength of harmonics

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
1613.600	H/V	-	-13	-
2420.400	H/V	-	-13	-
3227.200	H/V	-	-13	-
4034.000	H/V	-	-13	-
4840.800	H/V	-	-13	-
5647.600	H/V	-	-13	-
6454.400	H/V	-	-13	-
7261.200	H/V	-	-13	-
8068.000	H/V	-	-13	-

Remark "---" means that the emission level is too weak to be detected.

■ Spurious Emission

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
134.220	H	-64.3	-13.0	-51.3
402.900	H	-33.6	-13.0	-20.6
761.300	H	-36.4	-13.0	-23.4
792.100	H	-40.3	-13.0	-27.3
850.900	H	-35.7	-13.0	-22.7
940.500	H	-35.0	-13.0	-22.0
4358.000	H	-59.0	-13.0	-46.0
5812.000	H	-57.5	-13.0	-44.5
402.900	V	-40.3	-13.0	-27.3
671.700	V	-49.5	-13.0	-36.5
761.300	V	-43.0	-13.0	-30.0
850.900	V	-44.0	-13.0	-31.0
940.500	V	-45.0	-13.0	-32.0
957.300	V	-39.3	-13.0	-26.3
2684.000	V	-61.3	-13.0	-48.3
4084.000	V	-62.2	-13.0	-49.2
5758.000	V	-58.7	-13.0	-45.7
6726.000	V	-54.6	-13.0	-41.6
7388.000	V	-47.5	-13.0	-34.5
7484.000	V	-46.7	-13.0	-33.7
8510.000	V	-46.8	-13.0	-33.8

Orthogonal axes: Z Test Date : Jan. 22, 2003

Temperature : 21 ℃ Humidity : 50 %

The limit of spurious or harmonics is calculated as following :

Fundamental ERP-[43+10log(carrier ERP in W)]

■ Field strength of harmonics

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
1613.600	H/V	-	-13	-
2420.400	H/V	-	-13	-
3227.200	H/V	-	-13	-
4034.000	H/V	-	-13	-
4840.800	H/V	-	-13	-
5647.600	H/V	-	-13	-
6454.400	H/V	-	-13	-
7261.200	H/V	-	-13	-
8068.000	H/V	-	-13	-

Remark "---" means that the emission level is too weak to be detected.

■ Spurious Emission

Frequency (MHz)	Polarity	Result (dBm)	Limit (dBm)	Margin (dB)
209.820	H	-58.4	-13.0	-45.4
402.900	H	-47.7	-13.0	-34.7
671.700	H	-54.3	-13.0	-41.3
761.300	H	-49.8	-13.0	-36.8
850.900	H	-48.3	-13.0	-35.3
940.500	H	-48.9	-13.0	-35.9
1654.000	H	-65.1	-13.0	-52.1
1742.000	H	-64.7	-13.0	-51.7
4980.000	H	-54.7	-13.0	-41.7
96.420	V	-33.2	-13.0	-20.2
402.900	V	-33.9	-13.0	-20.9
761.300	V	-35.4	-13.0	-22.4
792.100	V	-40.4	-13.0	-27.4
850.900	V	-36.4	-13.0	-23.4
940.500	V	-36.5	-13.0	-23.5
4004.000	V	-62.0	-13.0	-49.0

4.6. FREQUENCY STABILITY MEASUREMENT

4.6.1. Provisions Applicable

According to §2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -20℃ to +50℃ centigrade, and according to §2.1055 (d)(2), the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point which is specified by the manufacturer.
According to §74.861(e)(4), the frequency tolerance of the transmitter shall be less than 0.005 percent.

4.6.2. Measurement Procedure

A) Frequency stability versus environmental temperature

1. Setup the configuration per figure 7 for frequencies measured at ambient temperature if it is within 15 ℃ to 25℃. Otherwise, an environmental chamber set for a temperature of 20℃ 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℃. 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℃ per stage until the lowest temperature -30℃ is measured, record all measurement frequencies.

B) Frequency stability versus input voltage

1. Setup the configuration per figure 7 for frequencies measured at ambient temperature if it is within 15 ℃ to 25℃. Otherwise, an environmental chamber set for a temperature of 20℃ shall be used. Install new batteries in the EUT.
2. Set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. For battery operated only device, supply the EUT primary voltage at the battery operating end point which is specified by the manufacturer and record the frequency.

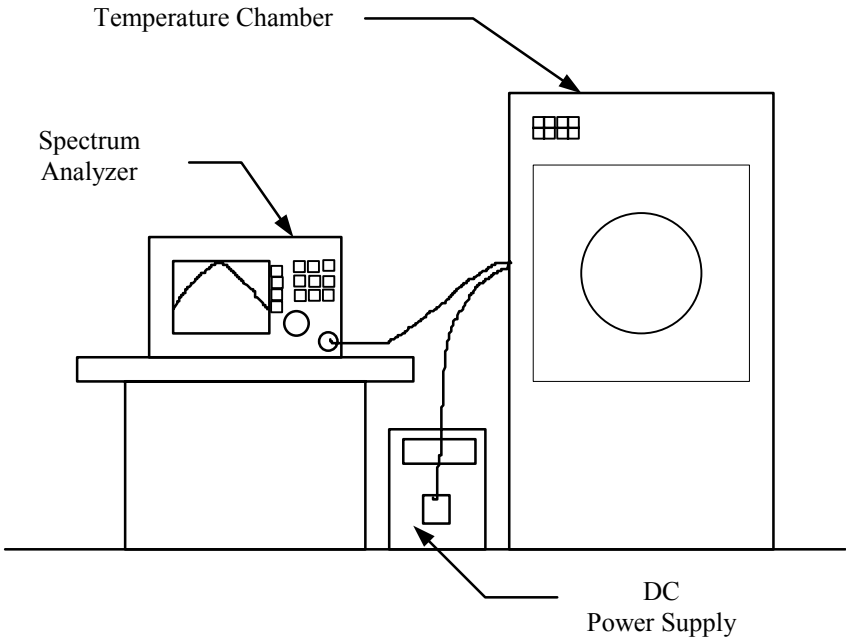


Figure 7 : Frequency stability measurement configuration

4.6.3. Measurement Data

4.6.3.1. Operated mode: 622.50MHz

Signal Type: Carrier Only

Test Date : Mar. 17, 2003

Reference Frequency : 622.510MHz

A) Frequency stability versus environmental temperature

Enviroment Tempture (℃)	Frequency measured with time elapsed					
	2 minute		5 minute		10 minute	
	(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
50	622.5020	-0.00129	622.5026	-0.00119	622.5036	-0.00103
40	622.5022	-0.00125	622.5040	-0.00096	622.5042	-0.00093
30	622.5014	-0.00138	622.5012	-0.00141	622.5020	-0.00129
20	622.5026	-0.00119	622.5014	-0.00138	622.5016	-0.00135
10	622.5012	-0.00141	622.5020	-0.00129	622.5012	-0.00141
0	622.5016	-0.00135	622.5008	-0.00148	622.4990	-0.00177
-10	622.4926	-0.00280	622.4962	-0.00222	622.4942	-0.00254
-20	622.4860	-0.00386	622.4900	-0.00321	622.4916	-0.00296

B) Frequency stability versus input voltage

Power Supplied (Vdc)	Frequency measured with time elapsed					
	2 minute		5 minute		10 minute	
	(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
102.00	622.5020	-0.00129	622.5000	-0.00161	622.5020	-0.00129
120.00	622.5000	-0.00161	622.5000	-0.00161	622.5000	-0.00161

4.6.3.2. Operated mode: 702.25MHz

Signal Type: Carrier Only

Test Date : Mar. 17, 2003

Reference Frequency : 702.244MHz

A) Frequency stability versus environmental temperature

Enviroment Tempture (℃)	Frequency measured with time elapsed					
	2 minute		5 minute		10 minute	
	(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
50	702.2322	-0.00168	702.2324	-0.00165	702.2326	-0.00162
40	702.2372	-0.00097	702.2398	-0.00060	702.2362	-0.00111
30	702.2418	-0.00031	702.2406	-0.00048	702.2420	-0.00028
20	702.2464	0.00034	702.2458	0.00026	702.2480	0.00057
10	702.2482	0.00060	702.2504	0.00091	702.2510	0.00100
0	702.2520	0.00114	702.2532	0.00131	702.2522	0.00117
-10	702.2536	0.00137	702.2578	0.00197	702.2572	0.00188
-20	702.2542	0.00145	702.2585	0.00206	702.2586	0.00208

B) Frequency stability versus input voltage

Power Supplied (Vdc)	Frequency measured with time elapsed					
	2 minute		5 minute		10 minute	
	(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
102.00	702.2420	-0.00028	702.2440	0.00000	702.2420	-0.00028
120.00	702.2420	-0.00028	702.2400	-0.00057	702.2440	0.00000

4.6.3.3. Operated mode: 806.80MHz

Signal Type: Carrier Only

Test Date : Mar. 17, 2003

Reference Frequency : 806.790MHz

A) Frequency stability versus environmental temperature

Enviroment Tempture (℃)	Frequency measured with time elapsed					
	2 minute		5 minute		10 minute	
	(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
50	806.7902	0.00002	806.7922	0.00027	806.7904	0.00005
40	806.7920	0.00025	806.7924	0.00030	806.7946	0.00057
30	806.8090	0.00236	806.7978	0.00097	806.7990	0.00112
20	806.8068	0.00208	806.8084	0.00228	806.8074	0.00216
10	806.8062	0.00201	806.8046	0.00181	806.8060	0.00198
0	806.8056	0.00193	806.8054	0.00191	806.8064	0.00203
-10	806.8060	0.00198	806.8064	0.00203	806.8044	0.00178
-20	806.7998	0.00121	806.8042	0.00176	806.8046	0.00181

B) Frequency stability versus input voltage

Power Supplied (Vdc)	Frequency measured with time elapsed					
	2 minute		5 minute		10 minute	
	(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
102.00	806.7940	0.00050	806.7940	0.00050	806.7940	0.00050
120.00	806.7940	0.00050	806.7920	0.00025	806.7940	0.00050

5. EMI Suppression Component List

⇒No EMI suppression components.

6. Antenna Factor & Cable Loss

Frequency (Mhz)	Antenna Factor (dB)	Cable Loss (dB)
30	15.35	1.00
35	13.63	1.08
40	11.11	1.18
45	10.59	1.24
50	6.47	1.30
55	5.83	1.38
60	5.18	1.44
65	4.81	1.52
70	4.43	1.59
75	5.10	1.68
80	5.91	1.75
85	7.33	1.77
90	8.74	1.83
95	9.05	1.85
100	9.36	1.90
110	9.65	2.01
120	9.97	2.06
130	10.51	2.16
140	10.32	2.24
150	9.42	2.34
160	8.09	2.42
170	7.43	2.56
180	7.60	2.62
190	7.43	2.67
200	7.26	2.76
220	9.11	2.92
240	10.88	3.09
260	11.75	3.23
280	11.55	3.38
300	11.36	3.51
320	12.03	3.63
340	12.69	3.73
360	13.33	4.03
380	14.00	4.00
400	14.63	4.09
450	15.33	4.31
500	16.03	4.64
550	16.65	5.09
600	17.29	5.49
650	17.64	5.82
700	18.00	5.94
750	18.39	6.16
800	18.79	6.58
850	19.10	6.72
900	19.42	6.81
950	19.58	7.10
1000	19.75	7.41

7. List of Measuring Equipments Used

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date
Spectrum analyzer	R&S	FSP40	100004/040	9KHZ~40GHz	Aug. 07, 2002
Amplifier	HP	8447D	2944A09072	100KHz~1.3GHz 15±6% Vdc @80mA	Oct. 21, 2002
Amplifier	MITEQ	AFS44	879981	100MHz~26.5G	Aug. 12, 2002
Bilog Antenna	SCHAFFNER	CBL6112B	2687	30MHz –2GHz	Dec. 21, 2002
Horn Antenna	COM-POWER	AH-118	10094	1GHz – 18GHz	Apr. 09, 2002
Turn Table	HD	DS 420	420/650/00	0 ~ 360 degree	N/A
Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A
Half-wave dipole antenna	R&S	HZ12	83924403	30MHz - 1GHz	Sep. 23, 2002
Horn Antenna	EMCO	3115	6821	1GHz – 18GHz	May. 28, 2002
Signal Generator	R&S	SMR40	1104.0002.40	10MHz-40GHz	Nov. 09, 2002
RF Commanications Test Set	HP	8920 A	3235A02106	0.4MHz~1GHz	May. 11, 2002

※ Calibration Interval of instruments listed above is one year.

8. Uncertainty of Test Site

Uncertainty of Radiated Emission Measurement

Contribution	Probability Distribution	3m
Antenna factor calibration	normal(k=2)	±1
cable loss calibration	normal(k=2)	±0.3
RCV/SPA specification	rectangular	±2
Antenna Directivity	rectangular	±3
Antenna Factor V.S. Height	rectangular	±2
Antenna Factor Interpolation for Frequency	rectangular	±0.25
site imperfection	rectangular	±2
Mismatch Receiver VSWR Γ1=0.09 Antenna VSWR Γ2=0.67 Uncertainty=20log(1-Γ1*Γ2)	U-shaped	±0.54
combined standard uncertainty Ue(y)	normal	±2.7
Measuring uncertainty for a level of confidence of 95% U=2Ue(y)	normal (k=2)	±5.4

$U=\sqrt{\{(1/2)^2+(0.3/2)^2+(2^2+0.5^2+2^2+0.25^2+2^2)/3+(0.54)^2/2\}}=2.2$ for 10m test distance

$U=\sqrt{\{(1/2)^2+(0.3/2)^2+(2^2+3^2+2^2+0.25^2+2^2)/3+(0.54)^2/2\}}=2.7$ for 3m test distance

Uncertainty of Conducted Emission Measurement

Contribution	Probability Distribution	150KHz – 30MHz
Cable and I/P attenuator calibration	normal(k=2)	±0.3
RCV/SPA specification	rectangular	±2
LISN coupling specification	rectangular	±1.5
Transducer factor frequency interpolation	rectangular	±0.2
Mismatch Receiver VSWR Γ1=0.09 LISN VSWR Γ2=0.33 Uncertainty=20log(1-Γ1*Γ2)	U-shaped	0.2
combined standard uncertainty Ue(y)	normal	±1.66
Measuring uncertainty for a level of confidence of 95% U=2Ue(y)	normal (k=2)	±3.32

$U=\sqrt{\{(0.3/2)^2+(2^2+1.5^2+0.2^2)/3+(0.2)^2/2\}}=1.66$