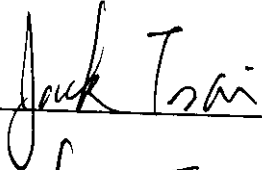
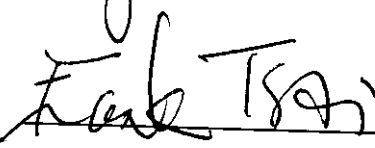


EXHIBIT B

Test Report

Report No.	W1115984
Specifications Test Method	FCC Part 95, Subpart B -- Certification. ANSI C63.4 1992
Applicant Address	No. 7, Ming Lee St., Chung Ho City, Taipei Hsien, Taiwan
Applicant Items tested Model No.	Wintecronics Ltd. Family Radio Face Held Transmitter FRS-268 (Sample # W11984)
Results Sample received date	Compliance (As detailed within this report) 03/09/1999 (month / day / year)
Prepared by	 project engineer
Authorized by	 General Manager (Frank Tsai) Apr. 20, 1999 (month / day / year)
Modifications	None
Tested by	Training Research Co., Ltd.
Office at	2, Lane 194, Huan-Ho Street, Hsichih, Taipei Hsien 221, Taiwan
Open site at	No. 5-3, Lane 21, Yen Chiu Yuan Rd., Sec.4, Taipei Taiwan

Conditions of issue:

- (1) **This test report shall not be reproduced except in full, without written approval of TRC. And the test result contained within this report only relate to the sample submitted for testing.**
- (2) **This report must not be used by the client to claim product endorsement by NVLAP or nay agency of U.S. Government.**

★ FCC ID : NJQFRS-268

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Chapter 0 Application for Certification

- 2.983 (a) : Wintecronics Ltd. — applicant and manufacturer
- 2.983 (b) : The equipment is a FRS
Model No. : FRS-268
- 2.983 (c) : Quantity production is planned
- 2.983 (d) (1) : Type of emission — F3E-FM Modulation
- 2.983 (d) (2) : 100 Hz ~ 2.5 KHz
- 2.983 (d) (3) : 39.55 mW
- 2.983 (d) (4) : No recommendations as to standardized output power levels are made.
- 2.983 (d) (5) : Final RF amplifier stage current : 400mA, 1.5V*3 Batteries
- 2.983 (d) (6) : Description in the Block Diagram
- 2.983 (d) (7) : Complete circuit diagrams are included. No modification was made.
- 2.983 (d) (8) : Instruction sheet to user included.
- 2.983 (d) (9) : Tune up procedure follows
- 2.983 (d) (11) : Description in the Block Diagram
- 2.983 (d) (12) : Description in the Block Diagram

Chapter 1 General

1.1 Introduction :

The following measurement report is submitted on behalf of *Wintecronics Ltd.* in support of a wireless microphone certification in accordance with FCC Rules. 2.981 through 2.999 and Part 95, Subpart B.

Description of EUT :

EUT	:	Family Radio Face Held Transmitter
Model No.	:	FRS-268
Carrier Frequency Range	:	462.5625 ~ 467.7125 MHz
RF Power Output	:	39.55 mW
Supply Voltage	:	4.5V (1.5V x 3 Batteries)
Supply Current	:	400 mA
Frequency Response	:	100 Hz ~ 2.5 KHz
Frequency Stability	:	0.00025%
Operating Temperature	:	-30 to +50 degree centigrade

Wireless microphone is a transmitter which operates in the frequency range of 1462.5625 ~ 467.7125 MHz. (462.5625MHz and 467.7125 MHz tested) It has CTCSS mode and frequency of tone is 67.0 Hz ~ 250.3 Hz that shown in the page 8. This FRS device is worn by a performer and provide traveler assistance , make a voice page, or to conduct a brief test and so on.

1.2 Description of Support Equipment :

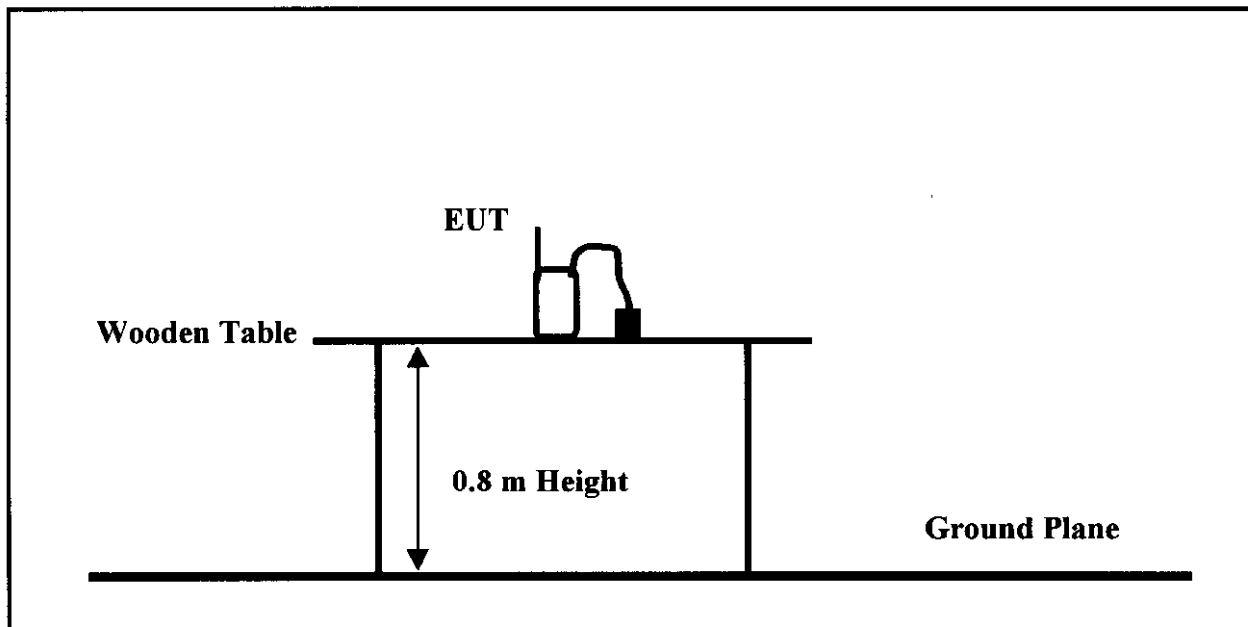
Clip of style for Microphone and Speaker: MODEM (Brand name)

Model No.	:	MS-201
Serial No.	:	N/A
Power type	:	By EUT
Power cord	:	Non-shielded, 230cm long, metal plug, no ferrite core

Verify the Frequency and Channel

<i>Channel</i>	<i>Frequency (MHz)</i>	<i>Channel</i>	<i>Frequency (MHz)</i>
1	462.5625	8	467.5625
2	462.5875	9	467.5875
3	462.6125	10	467.6125
4	462.6375	11	467.6375
5	462.6625	12	467.6625
6	462.6875	13	467.6875
7	462.7125	14	467.7125

1.3 Configuration of test setup



1.4 Location of the Measurement Site :

The radiated emissions measurements required by the Rules were performed on the Three-meter, open-field test site maintained by *Training Research CO., Ltd.*, No. 5-3, Lane 21, Yen-Chiu-Yuan Rd., Sec. 4, Taipei, Taiwan, R.O.C. Complete description and measurement data have been placed on file with the Commission. The conducted power line Emissions tests were performed in a shielded enclosure also located at the above facility.

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 was 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.

1.6 Type of Communication

95.193(b) The FRS unit may transmit tones to make contact or to continue communications with a particular FRS unit. If the tone is audible (more than 300 Herz), it must last no longer than 15 seconds at one time. If the tone is subaudible (300 Herz or less), it may be transmitted continuously only while your are talking.

CTCSS Privacy Codes VS Frequency Hz

<i>No.</i>	<i>Frequency (Hz)</i>	<i>Level (dBVrms)</i>	<i>No.</i>	<i>Frequency (Hz)</i>	<i>Level (dBVrms)</i>
01	67.0	-78.816	21	136.5	-62.601
02	71.9	-77.280	22	141.3	-61.913
03	74.4	-76.816	23	146.2	-60.547
04	77.0	-75.234	24	151.4	-59.929
05	79.7	-74.562	25	156.7	-59.328
06	82.5	-74.196	26	162.2	-58.321
07	85.4	-73.942	27	167.9	-57.890
08	88.5	-73.194	28	173.8	-57.156
09	91.5	-72.471	29	179.9	-56.491
10	94.8	-71.977	30	186.2	-56.130
11	97.4	-71.033	31	192.8	-55.814
12	100.0	-70.129	32	203.5	-55.344
13	103.5	-69.232	33	210.7	-54.939
14	107.2	-68.213	34	218.1	-53.318
15	110.9	-67.482	35	225.7	-53.001
16	114.8	-66.221	36	233.6	-52.370
17	118.8	-65.432	37	241.8	-51.930
18	123.0	-64.563	38	250.3	-51.178
19	127.3	-63.901			
20	131.8	-64.514			

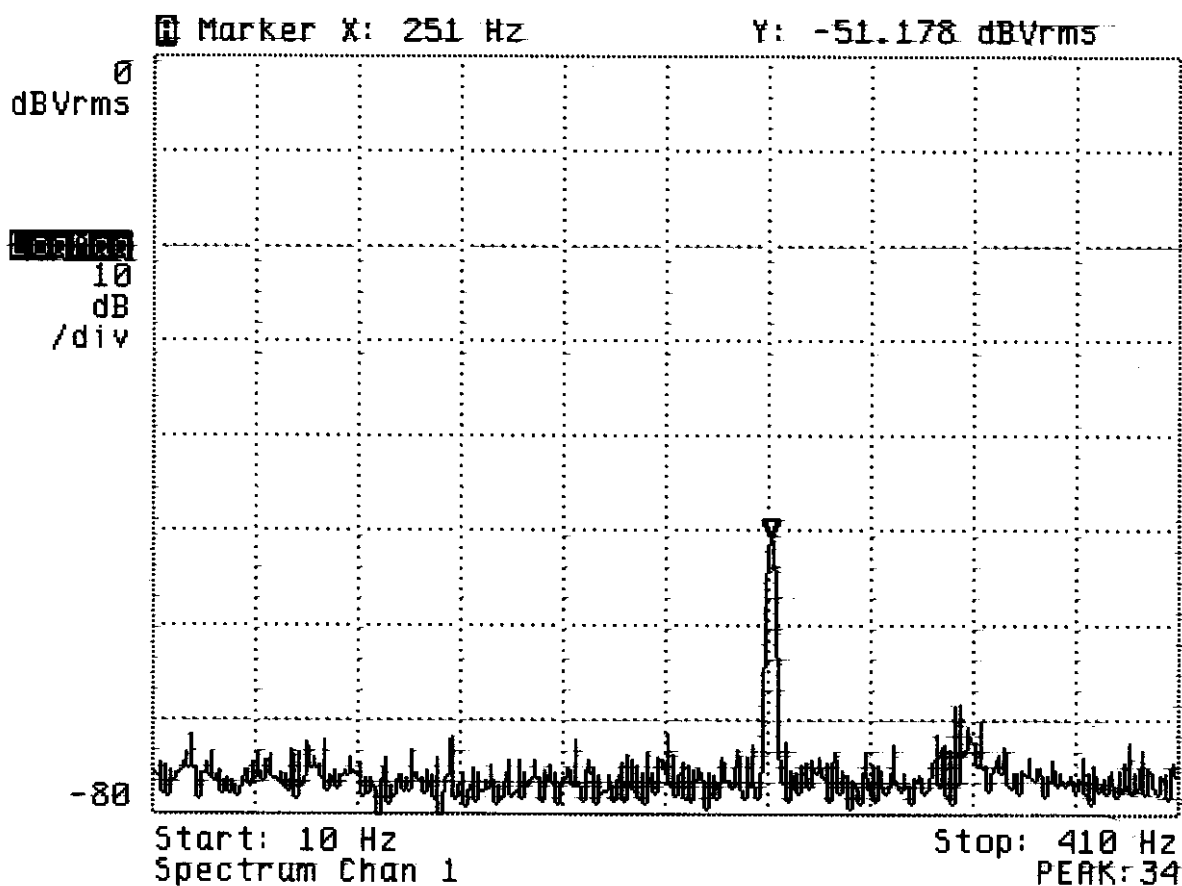
Offset: OFF

X Ref: 51.2 kHz

Y Ref: -40 dBVrms

REAL-TIME AVG IN PROGRESS

Meas



It is transmitted continuously only while user are talking.

Chapter 2 Maximum Transmitter Power Output Measurement

2.1 Rules and Specification Limits

95.639 (d) No FRS unit, under any condition of modulation, shall exceed 0.500W effective radiated power (ERP).

2.2 Test condition and setup :

1. Measurement was made on open-field test site. The EUT system was placed on non-conductive turntable which is 0.8 meters height, top surface 1.0 X 1.5 meter. The EUT was placed in three direction of the space in order to obtain maximum emission.
2. A EMCO whole range antenna with horizontal and vertical polarization was raised from 1 – 4 meter as well as the turntable was rotate from 0 to 360 degree to search for the maximum Field Strength Spectrum where the spectrum analyzer was operated in the quasi-peak detection mode. Recorded all the values which measured under horizontal and vertical position for the biconical antenna.
3. The following procedures were used to convert the emission levels measured in decibels referenced to 1 microvolt (dBuV) into field intensity in Watt.
 - (1) The actual field intensity in decibels referenced to 1 micro volt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB), and cable loss (dB) at the appropriate frequency.

$$FI_a(\text{dBuV/m}) = FI_r(\text{dBuV}) + \text{Corrected (dB)}$$

$$\text{Corrected (dB)} = AF(\text{dB}) + CL(\text{dB})$$

FI_a : Actual Field Intensity

FI_r : Reading of the Field Intensity

AF : Antenna Factor

CL : Cable Loss

- (2) The field intensity in Volt can then be determined by the following equation:

$$FI(\text{Volt}) = 10^{FI(\text{dBuV/m}) / 20} \times 10^{-6}$$

The field intensity in Watt can then be determined by the following equation :

$$P(\text{watt}) = FI^2(\text{Volt}) \times d^2(\text{meter}) / 30G$$

$$G=1$$

P : Power in Watt

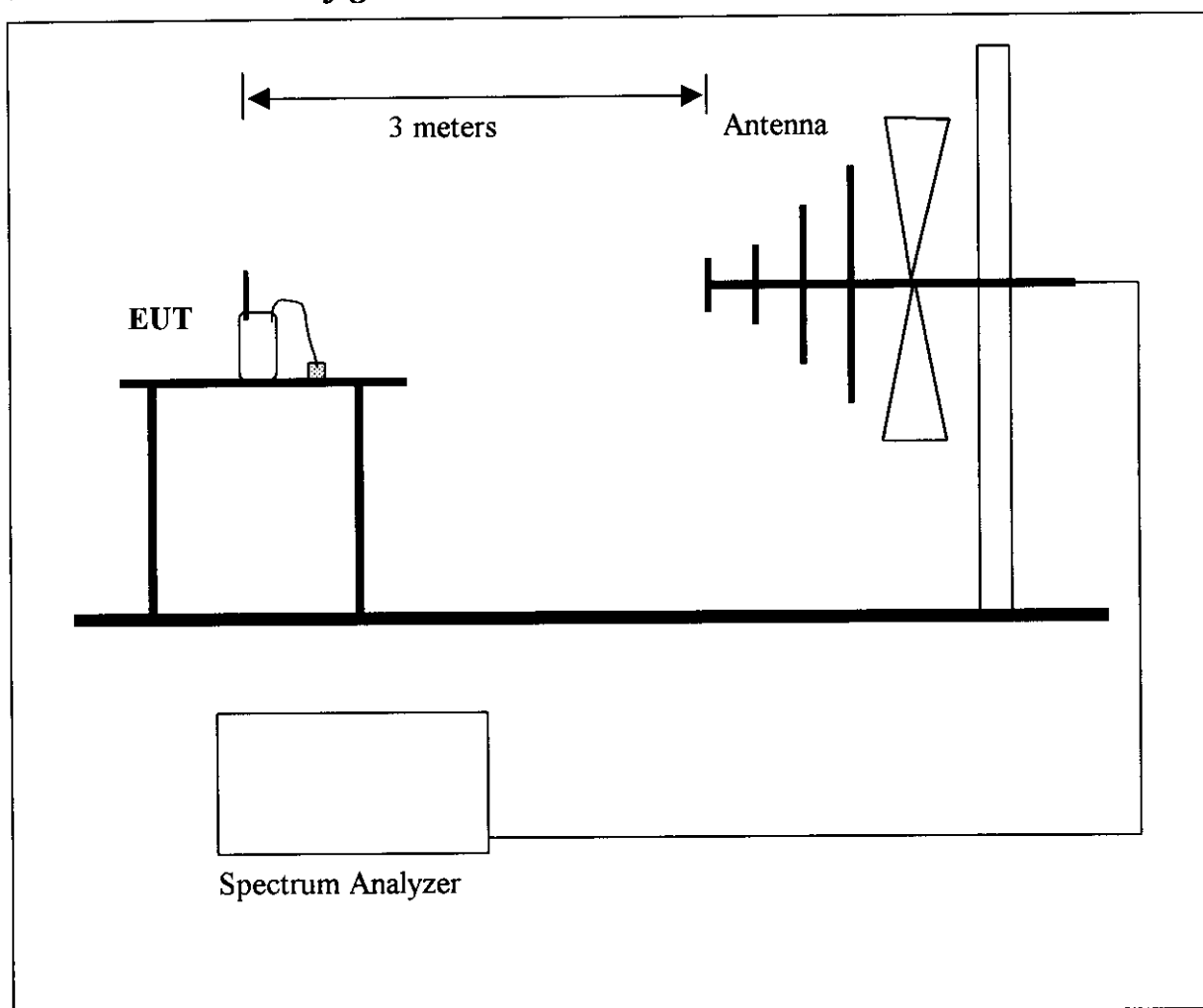
D : Measurement Distance (3 M)

2.3 List of test Instrument :

Instrument Name	Model No.	Brand	Serial No.	Calibration Date	
				Last	Next
Spectrum analyzer	8568B	H P	3004A18617	05/15/98	05/15/99
Quasi-peak Adapter	85650A	H P	2521A00984	05/15/98	05/15/99
RF Pre-selector	85685A	H P	2947A01011	05/15/98	05/15/99
Spectrum analyzer	8591EM	H P	3710A01203	01/29/99	01/29/00
Antenna (30M-2G Hz)	3142	EMCO	1296	06/10/98	06/10/99
Open test side (Antenna, Amplify, cable calibrated together)				05/15/98	05/15/99

The level of confidence of 95%, the uncertainty of measurement of radiated emission is ± 4.96 dB.

2.4 Measurement Configuration



2.5 Measurement Result

<i>Channel</i>	<i>Frequency (MHz)</i>	<i>A. P. (H/V)</i>	<i>Amplitude (dBuV/m)</i>	<i>E.R.P. (mW)</i>
01	462.5625	H	96.80	1.44
		V	111.20	39.53
14	467.7125	H	100.05	3.03
		V	109.45	26.43

The maximum field measured is 111.20 dBuV/m

$$FI \text{ (Volt)} = 10^{111.20/20} \times 10^{-6} = 0.36308 \text{ V}$$

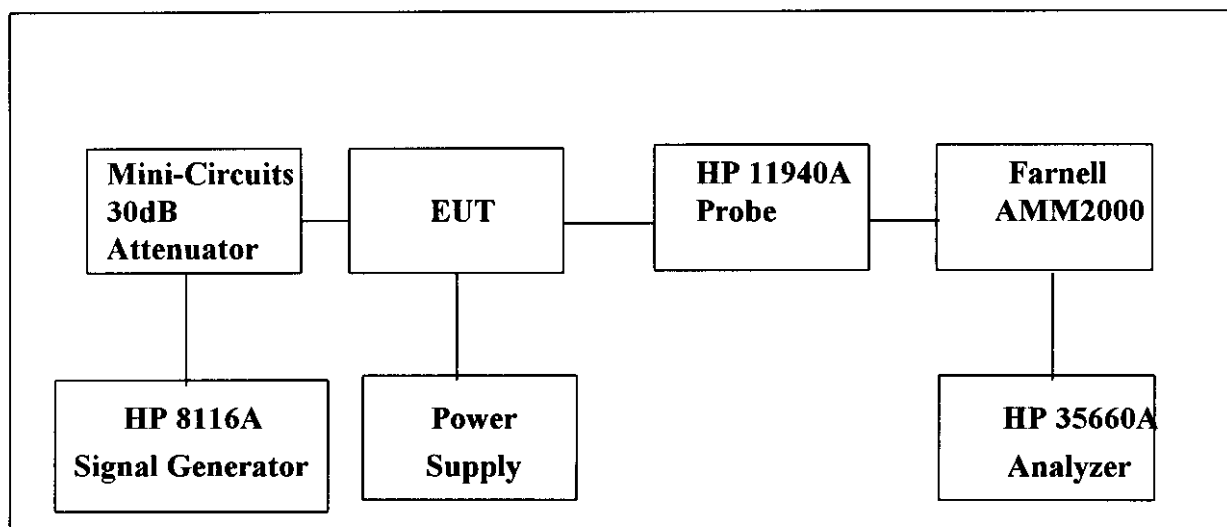
$$FI \text{ (mW)} = (0.36308 \times 3)^2 / 30 = 39.55 \text{ mW}$$

Chapter 3 Modulation Characteristics Measurement

3.1 Rules and Specification Limits

- 2. 987 (a) Voice modulated communication equipment
- 2. 987 (b) Equipment which employs modulation limiting
- 95.637 (a) A FRS unit that transmits emission type F3E must not exceed a peak frequency deviation of plus or minus 2.5KHz, and the audio frequency response must not exceed 3.125KHz.

3.2 Test Configuration & List of Test Instruments



List of test instrument :

Manufacturer	Device	Model No.	Input Impedance
HP	Dynamic Signal Analyzer	HP35660A	50
HP	Signal Generator 50 MHz	HP8116A	50
Farnell	Modulation Meter	AMM2000	---
HP	Close-Field Probe 30M~1GHz	11940A	---

3.3 Frequency Response of Audio Modulation Circuit Measurement Condition & Setup

2.987 (a)

1. The EUT and test equipment were set up as shown on the Section 3.2 .
2. The Plus/Function generator was connected to the audio input circuit/microphone of the EUT.
3. The audio signal input was adjusted to obtain 50% modulation at 1 KHz.
4. With input levels held constant and below limiting at all frequencies, the generator was varied from 100 Hz to 51.3 kHz.
5. The response in dBVrms relative to 1kHz was then measured, using the HP 35660A Dynamic Signal Analyzer as follow page that have no page number.

Offset: OFF

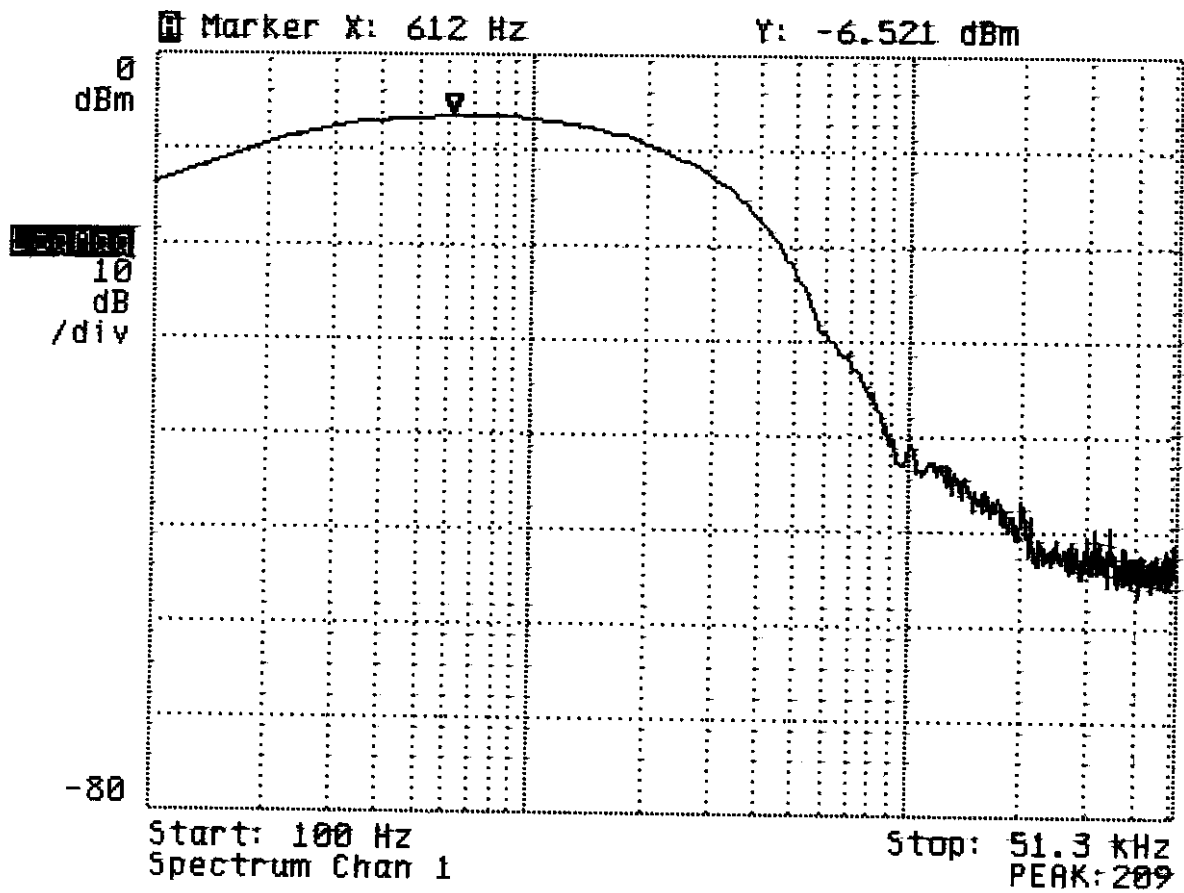
X Ref: 51.2 kHz

Y Ref: -26.99 dBm

AVERAGE IN PROGRESS

Meas

CH1



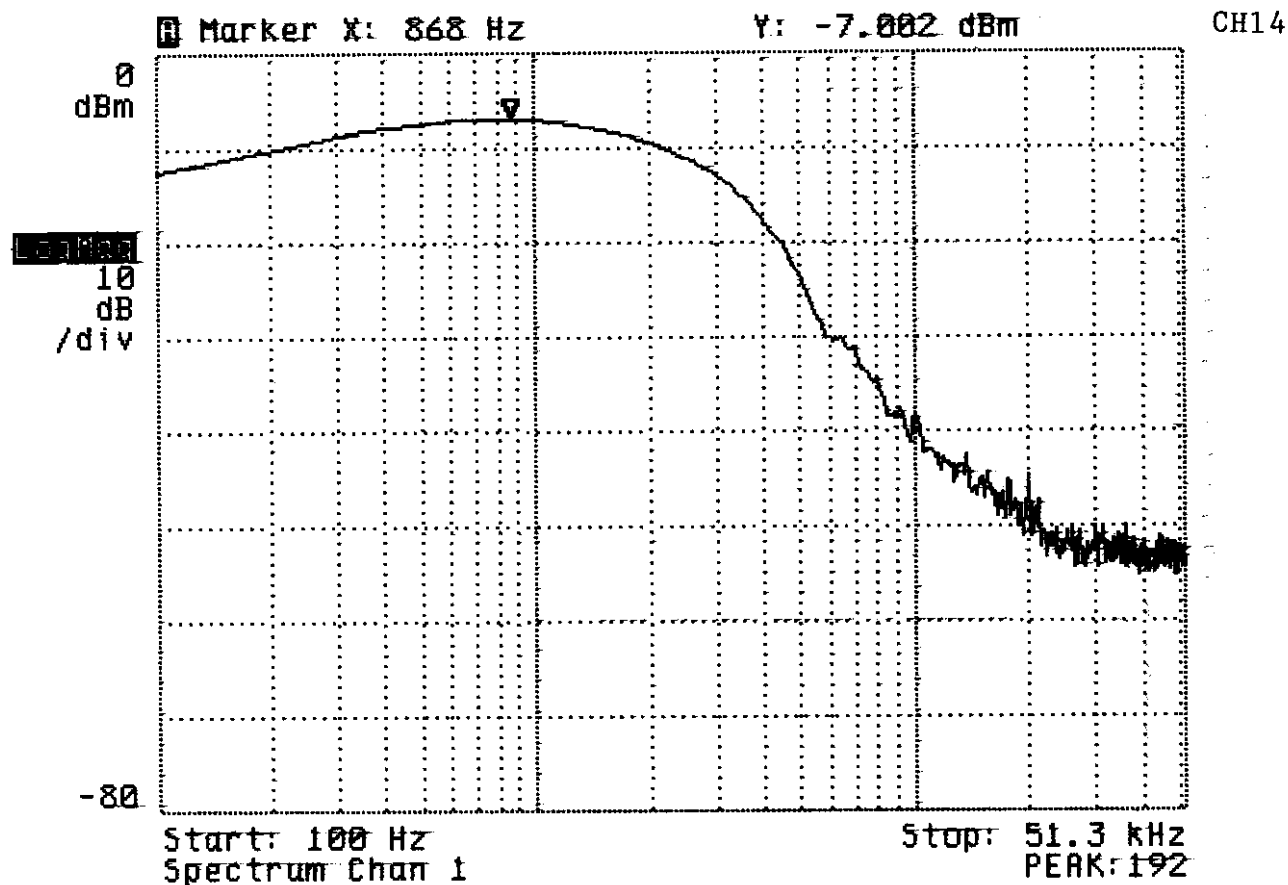
frequency response of Audio Modulation Circuit Measurement.

Offset: OFF
X Ref: 51.2 kHz

Y Ref: -26.99 dBm

Meas

AVERAGE IN PADDERS



Frequency Response of Audio Modulation Circuit Measurement

3.4 Frequency Response of Audio Low Pass Filter Measurement Condition & Setup

1. The measurement condition and setup as Section 3.3 .
2. With input levels held constant and below limiting at all frequencies , the generator was varied from 1KHz to 103.4kHz .
3. The response in dBVrms relative to 1kHz was then measured, using the HP 35660A Dynamic Signal Analyzer as follow page that have no page number.

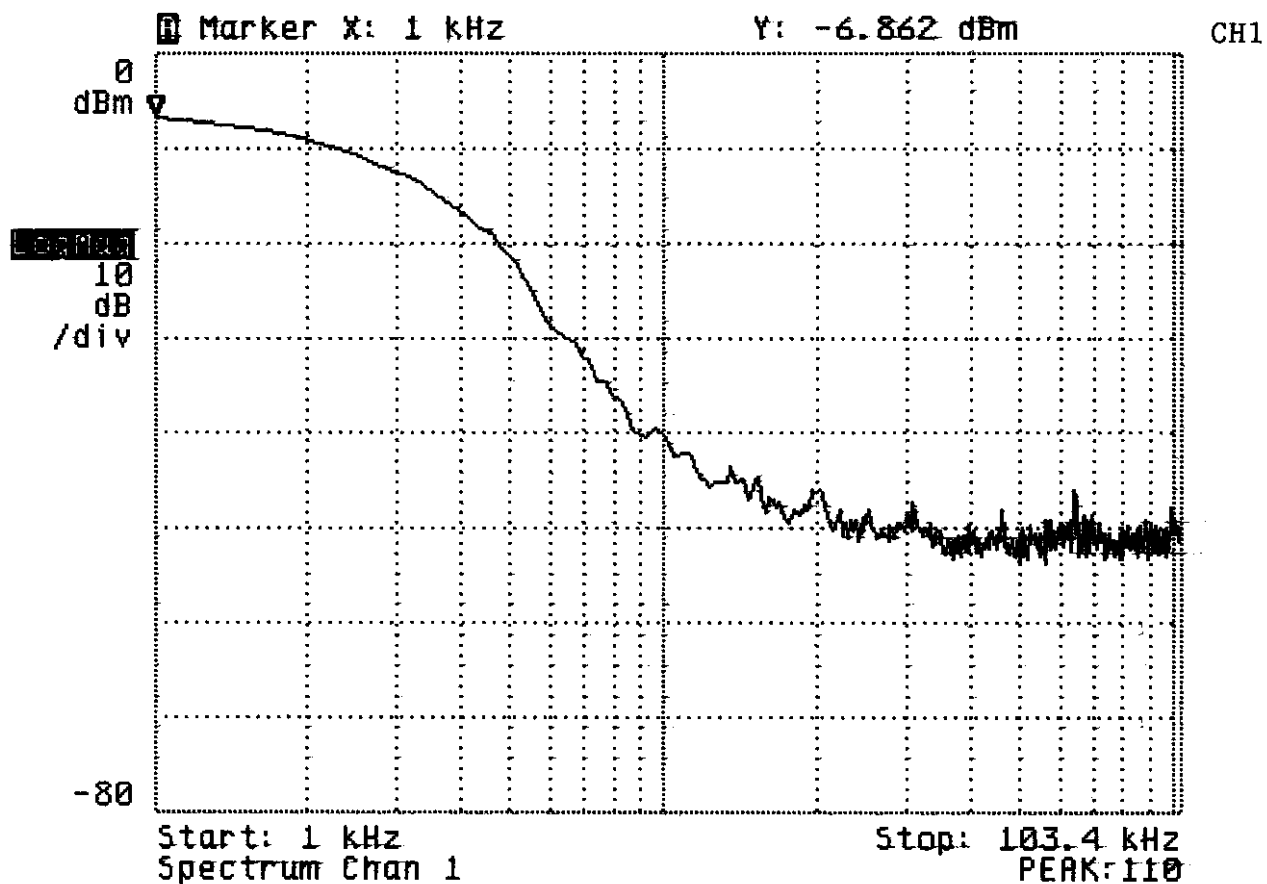
3.5 Modulation Limiting Measurement Condition & Setup

1. The signal generator was connected to the input of the EUT as for “Frequency Response of the Modulating Circuit”.
2. The modulation response was measured for each of five frequencies : CH1 — 100Hz, 612Hz, 1KHz, 2.02KHz, 2.5KHz and CH14 — 100Hz, 868Hz, 996Hz, 1256Hz, 2.5KHz.
3. The input level was varied from 30% modulation to at least 20 dB higher than the saturation point.
4. Measurements were performed for both negative and positive modulation and the respective results were recorded.
5. Measurement results as Chart 3.1 to 3.4

Offset: OFF
X Ref: 51.2 kHz

Y Ref: -26.99 dBm

Meas

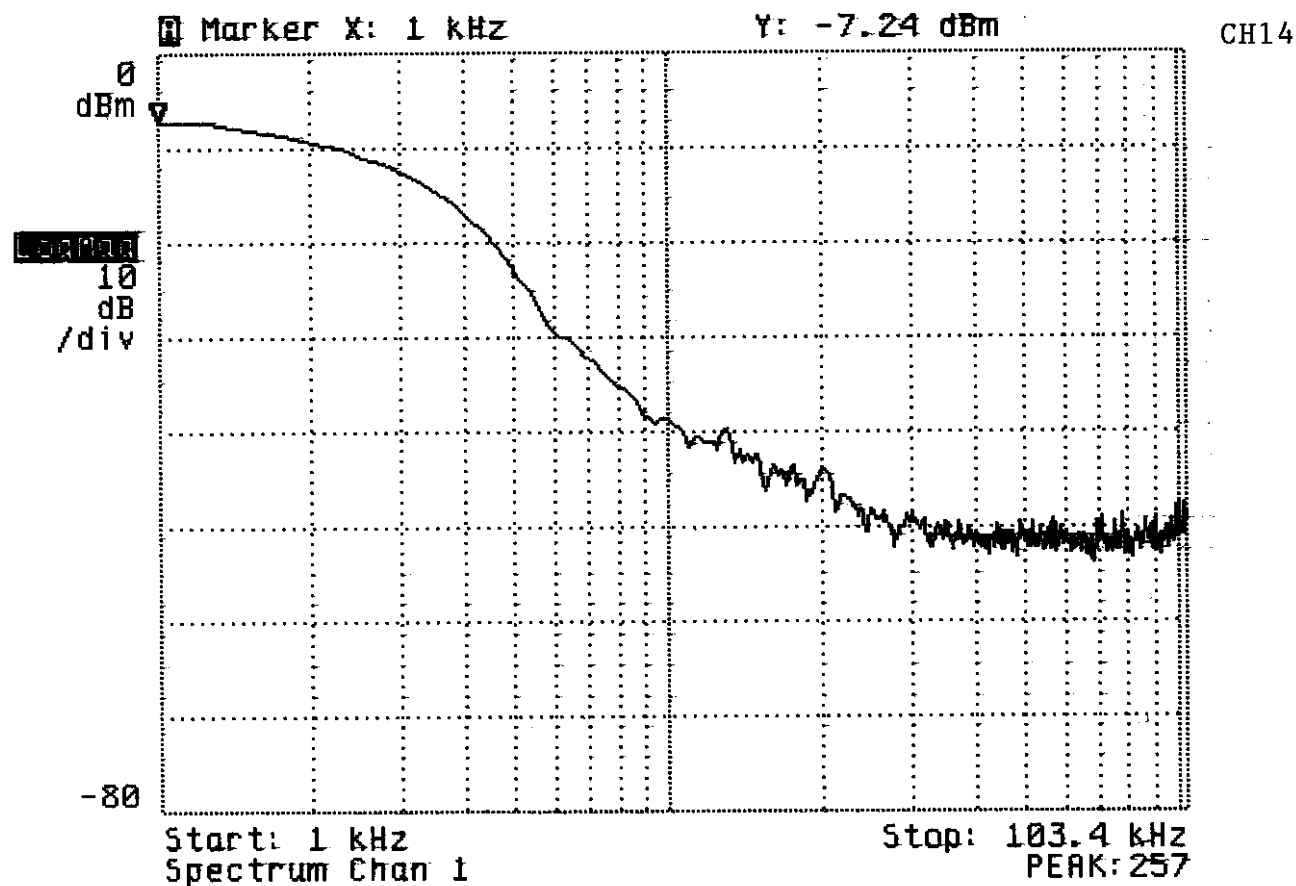


Frequency Resposne of Audio Modulation Circuit Mearsurement.

Offset: OFF
X Ref: 51.2 kHz

Y Ref: -26.99 dBm

Meas



Frequency Response of Audio Modulation Circuit Measurement..

Chart 3.1 Modulation Limiting Measurement CH 01 Negative

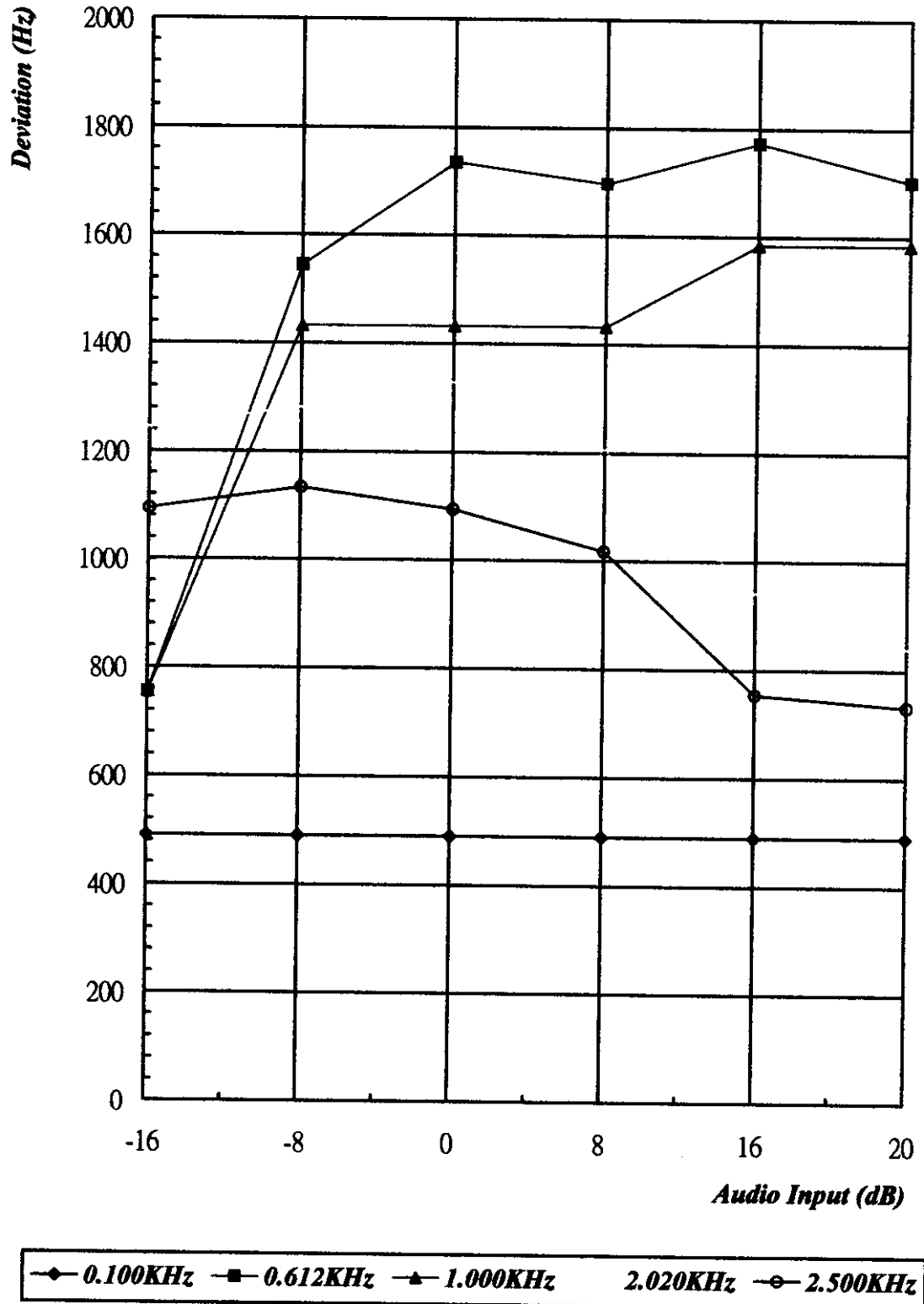


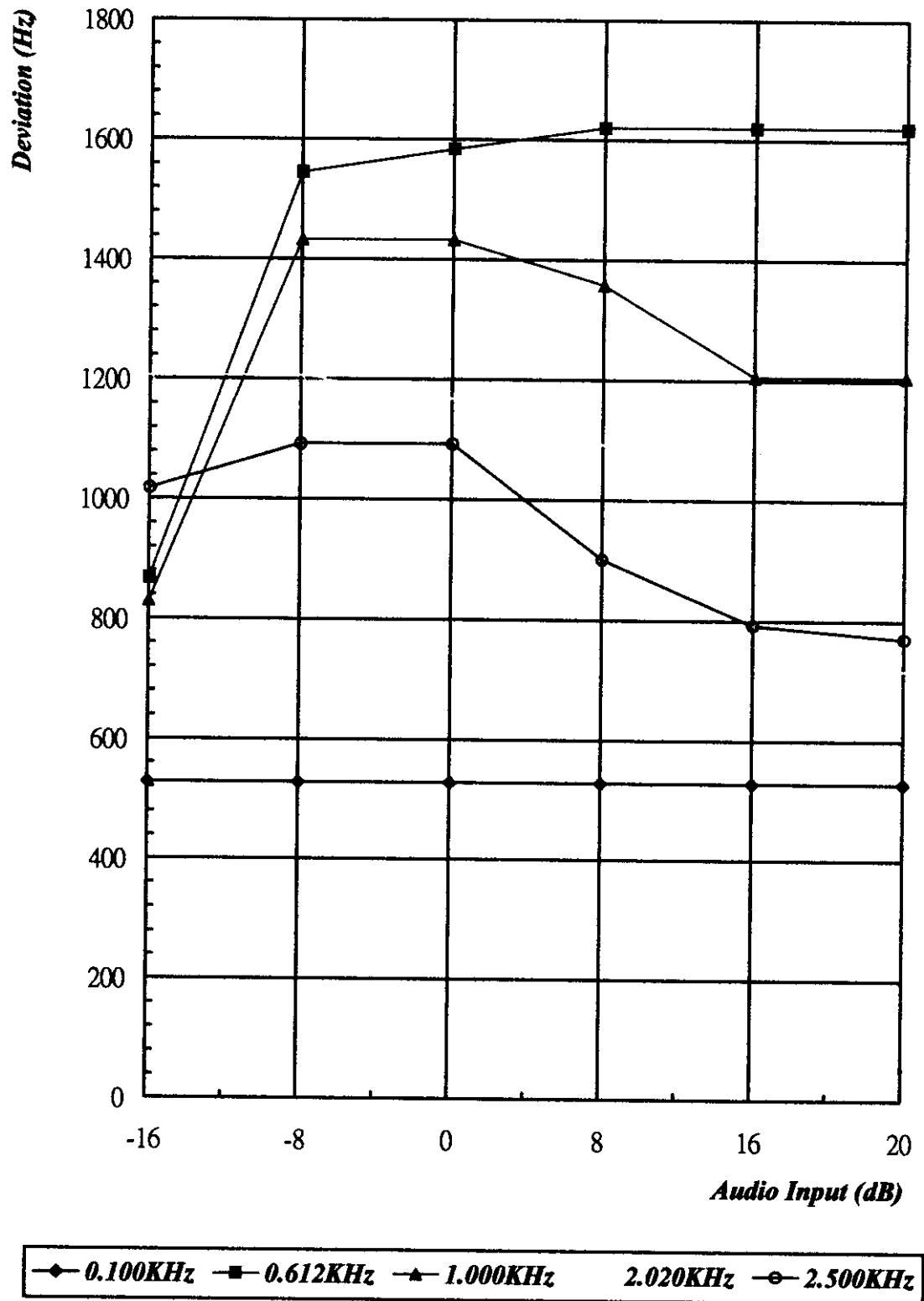
Chart 3.2 Modulation Limiting Measurement CH 01 Positive

Chart 3.3 Modulation Limiting Measurement CH14 Negative

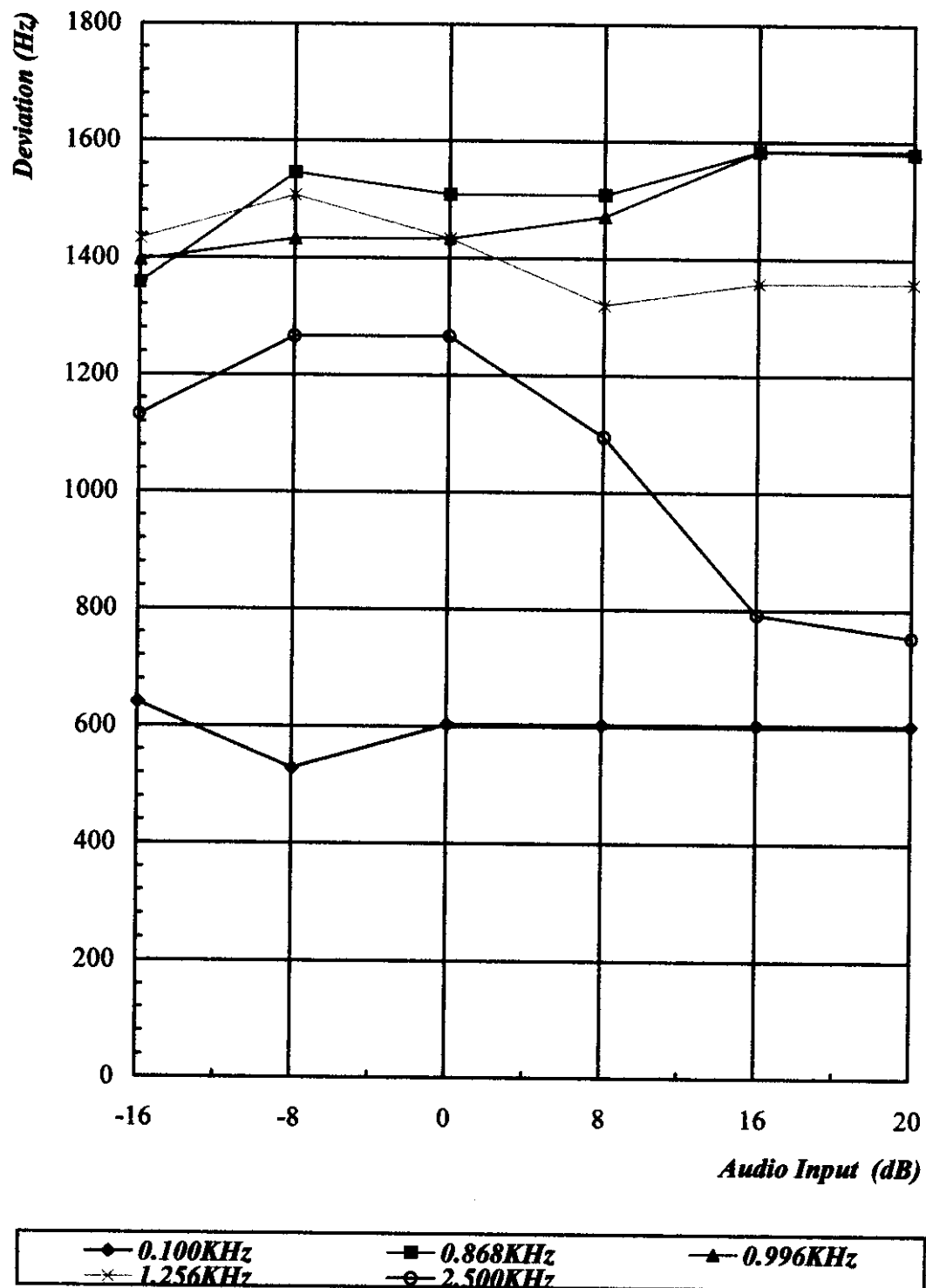


Chart 3.4 Modulation Limiting Measurement CH14 Positive

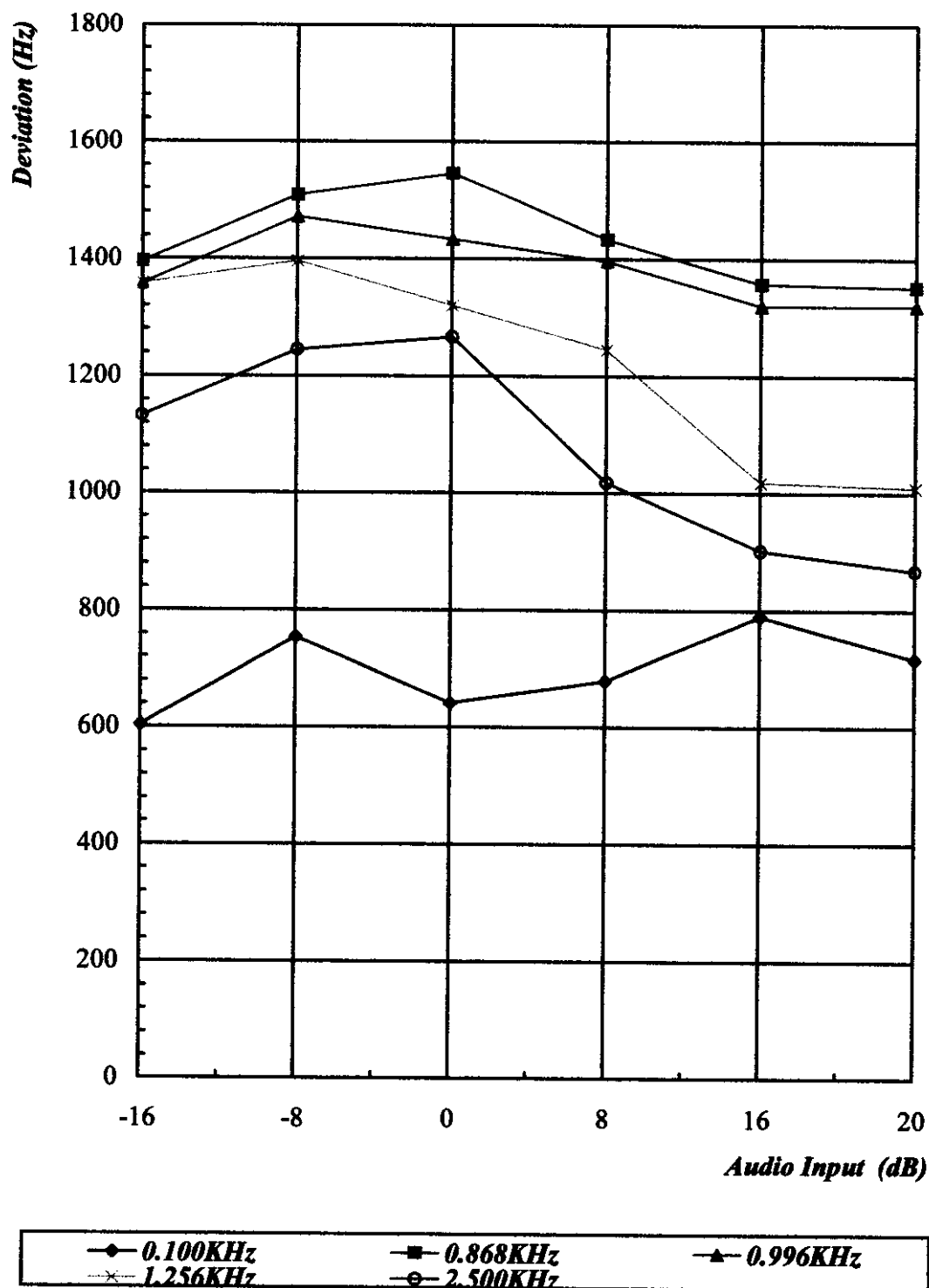


Chart 4 Occupied and Emission Bandwidth Measurement

4.1 Rules and Specification Limits

95.633(c): The authorized bandwidth for emission type F3E transmitted by a FRS unit is 12.5 KHz.

90.210(d): Emission Mask D — 12.5 KHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 KHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

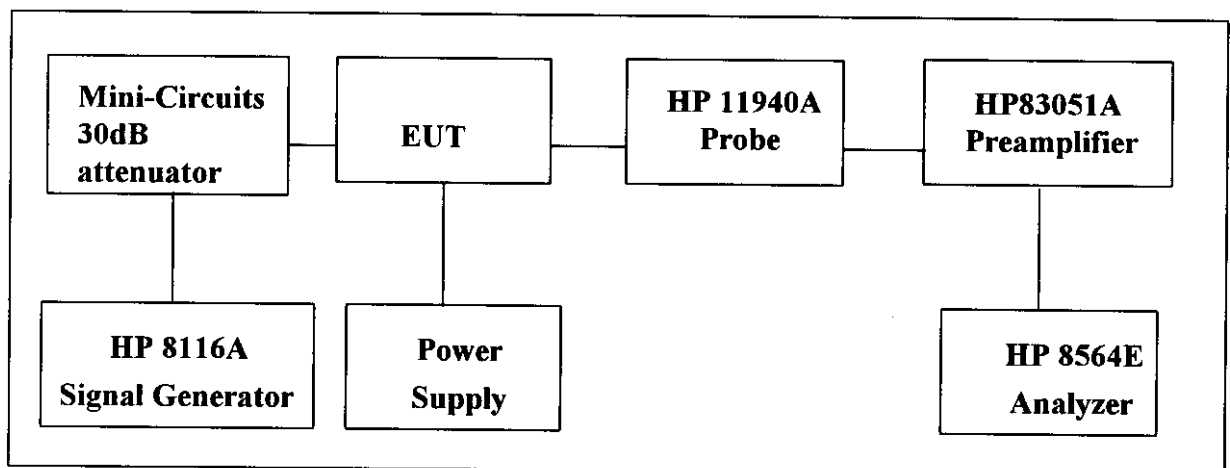
90.210(d)(1): On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 : Zero dB.

90.210(d)(2): On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625kHz but no more than 12.5 kHz : At least $7.27(f_d - 2.88 \text{ kHz})$ dB.

90.210(d)(3): On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz : At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation .

2.989: Occupied bandwidth

4.2 Test Configuration & List of Test Instruments



List of test Instrument :

<u>Instrument Name</u>	<u>Model No.</u>	<u>Brand</u>	<u>Serial No.</u>
Spectrum analyzer (9K~40GHz)	8564E	HP	
Preamplifier (45M~50GHz)	83051A	HP	VS36433002
Close-Field Probe 30M~1GHz	11940A	HP	---

4.3 Measurement Procedure

1. For EUT's supporting audio modulation, the audio signal generator was adjusted to the frequency of maximum response and with output level set for ± 2.5 KHz (or 50% modulation). With level constant , the signal level was increased 16 dB.
2. For EUT's supporting digital modulation, the digital modulation mode was operated to its maximum extent .
3. The occupied Bandwidth was measured as follow four pages with no page number.

4.4 Calculation of Necessary Bandwidth (Bn)

The occupied bandwidth's plot is presented on following pager which illustrates compliance with the rules.

Calculation of Necessary Bandwidth (Bn)

$$B_n = 2M + 2D$$

$$M = \text{Max. Modulation Frequency} = 2.500 \text{ KHz}$$

$$D = \text{Peak Frequency Deviation} = 1.773 \text{ KHz} \quad (\text{Chart 3-1})$$

$$K = 1$$

$$B_n = 8.546 \text{ KHz}$$

ATTEN 30dB

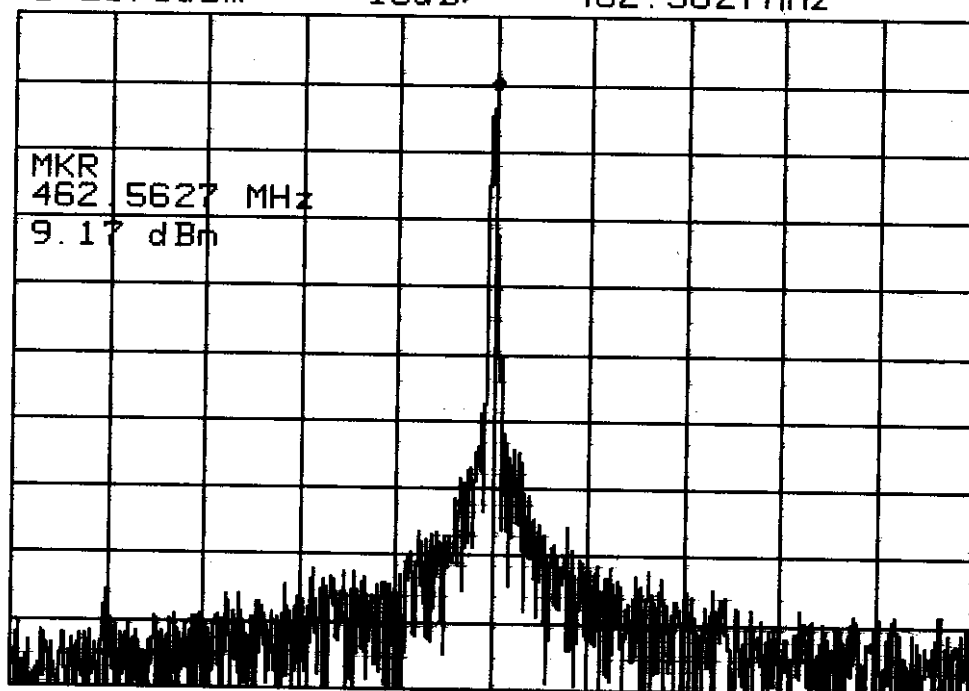
RL 20.0dBm

10dB/

MKR 9.17dBm

462.5627MHz

CH01



CENTER 462.5625MHz

SPAN 120.0kHz

*RBW 100Hz

*VBW 100Hz

SWP 9.60sec

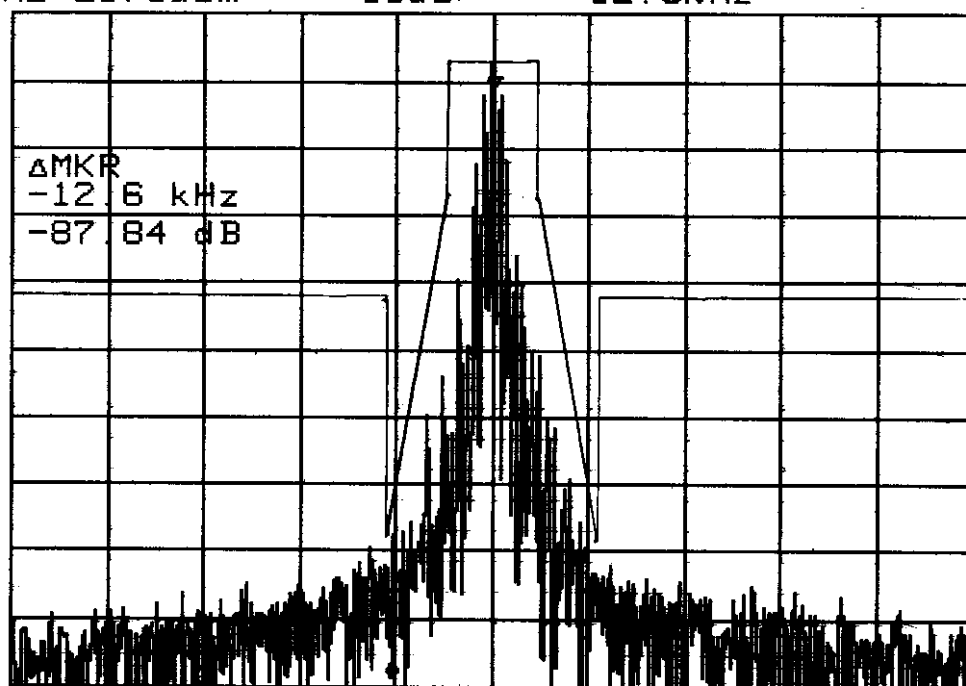
ATTEN 30dB

RL 20.0dBm

10dB/

 Δ MKR -87.84dB

-12.6kHz

1KHz
Modulation

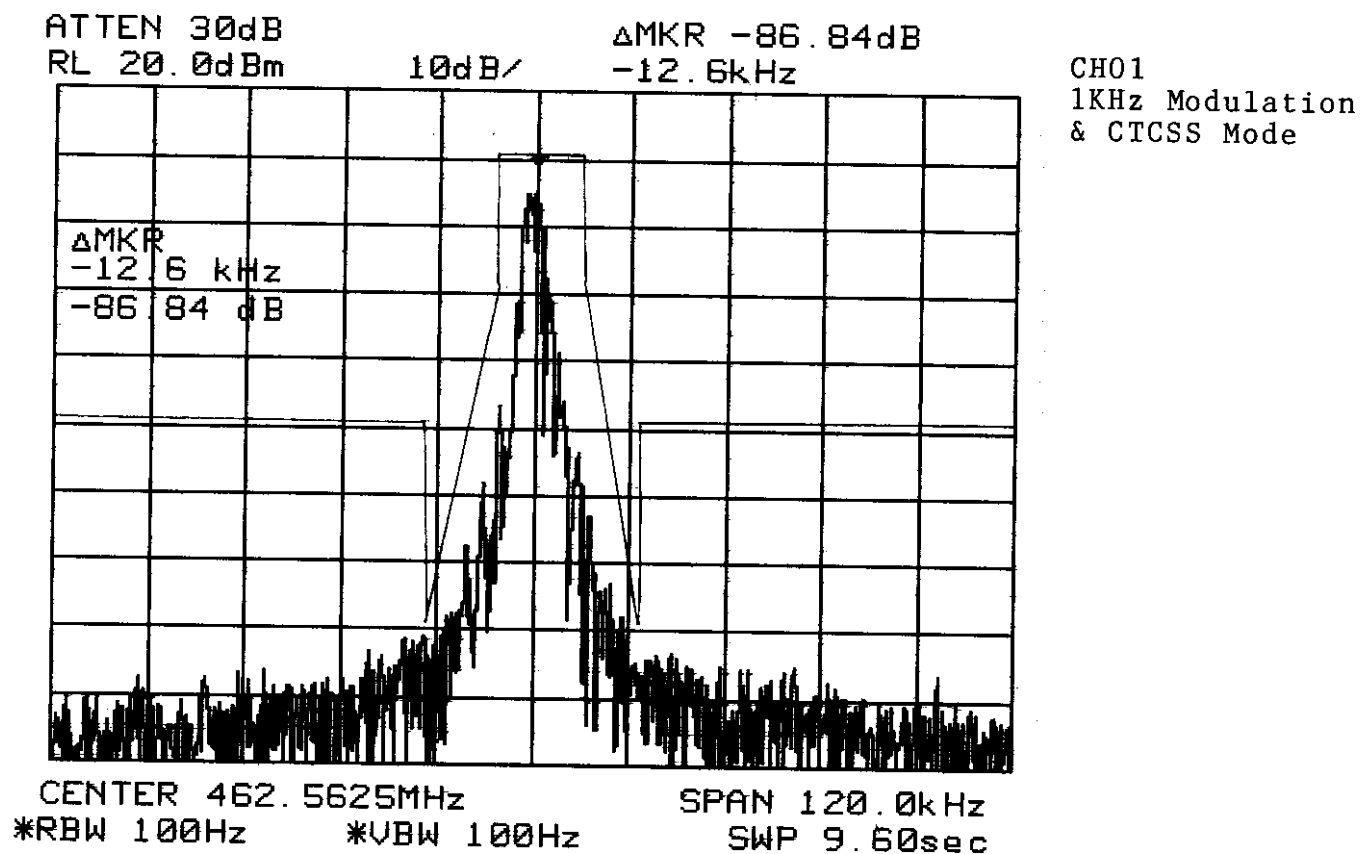
CENTER 462.5625MHz

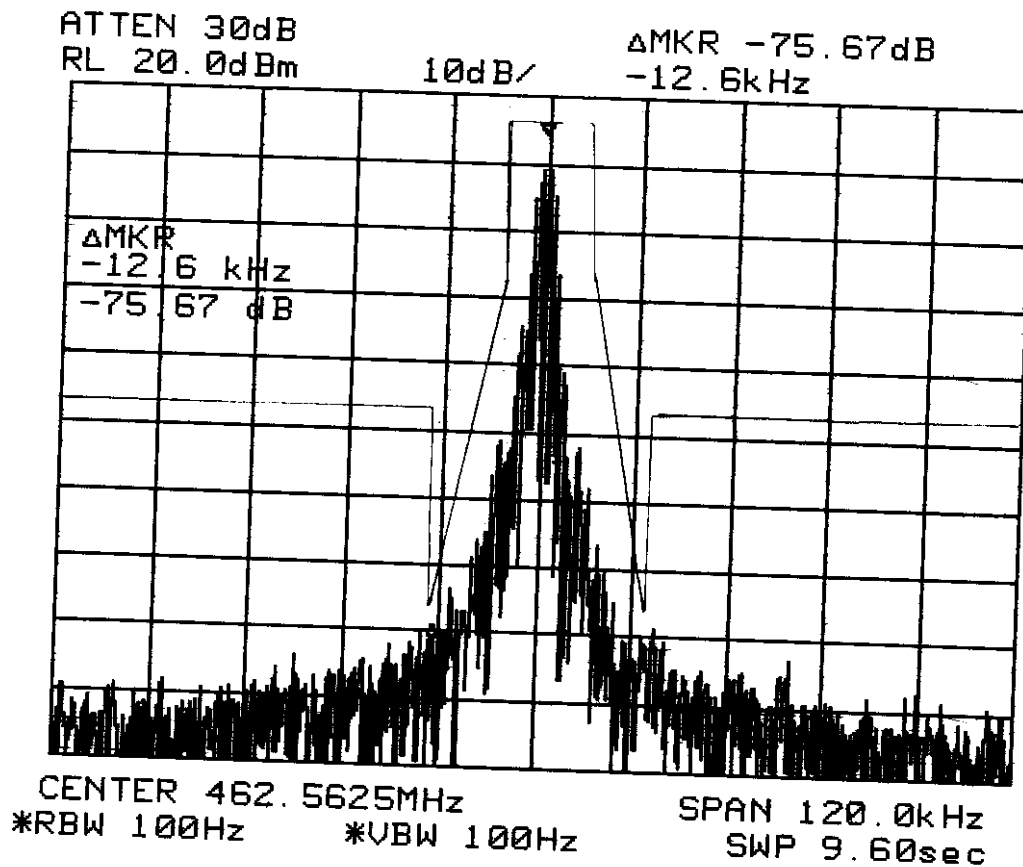
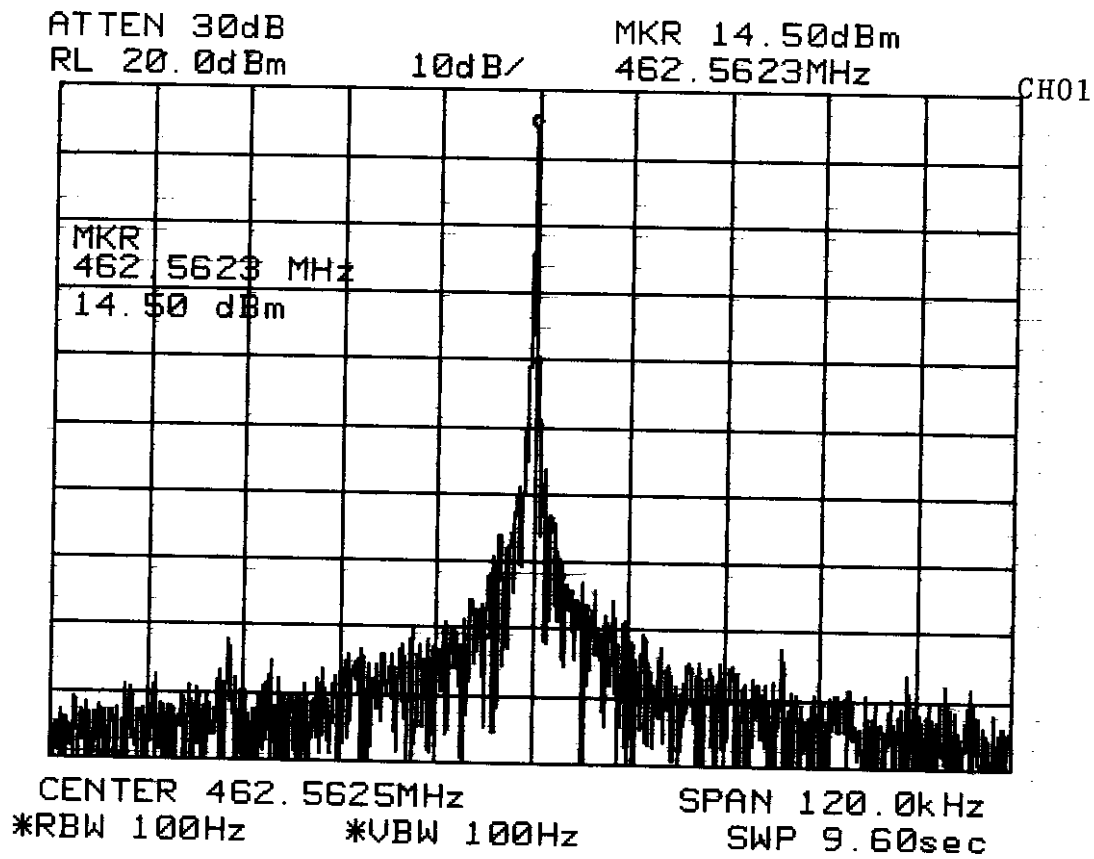
SPAN 120.0kHz

*RBW 100Hz

*VBW 100Hz

SWP 9.60sec





612Hz
Modulation

ATTEN 30dB

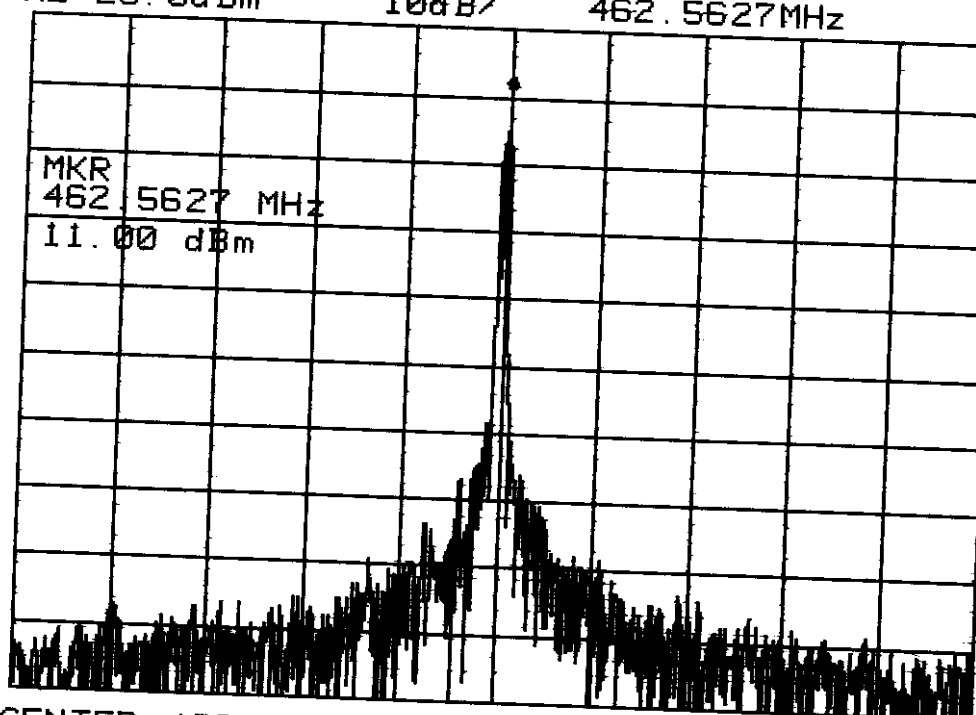
RL 20.0dBm

10dB/

MKR 11.00dBm

462.5627MHz

CH01



CENTER 462.5625MHz

*RBW 100Hz

*VBW 100Hz

SPAN 120.0kHz

SWP 9.60sec

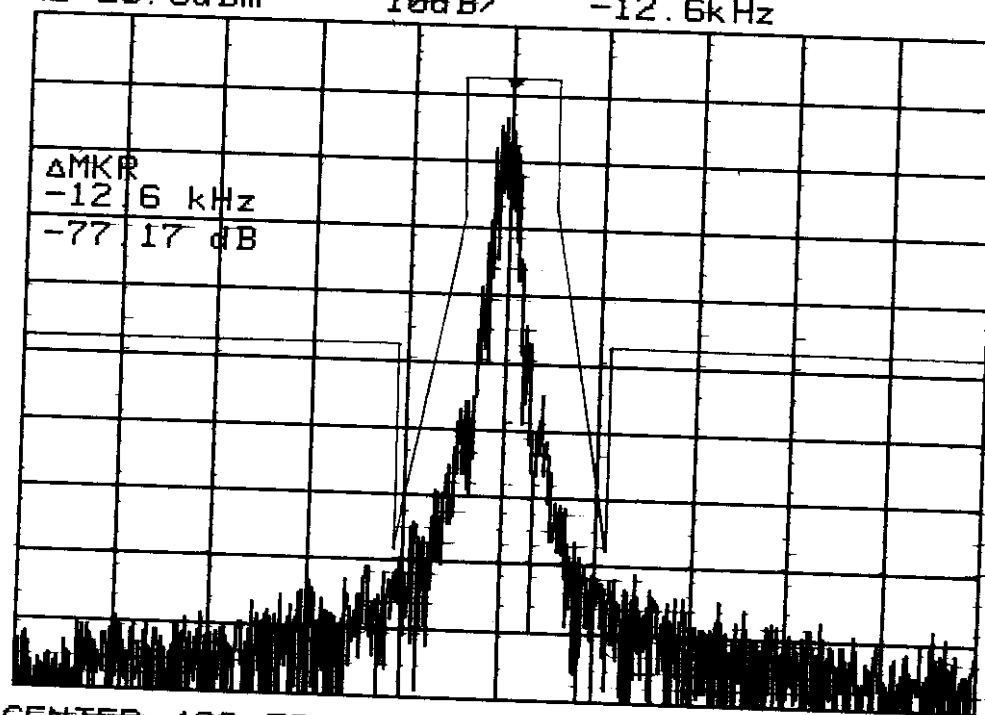
ATTEN 30dB

RL 20.0dBm

10dB/

 Δ MKR -77.17dB

-12.6kHz

612Hz Modulation
& CTCSS Mode

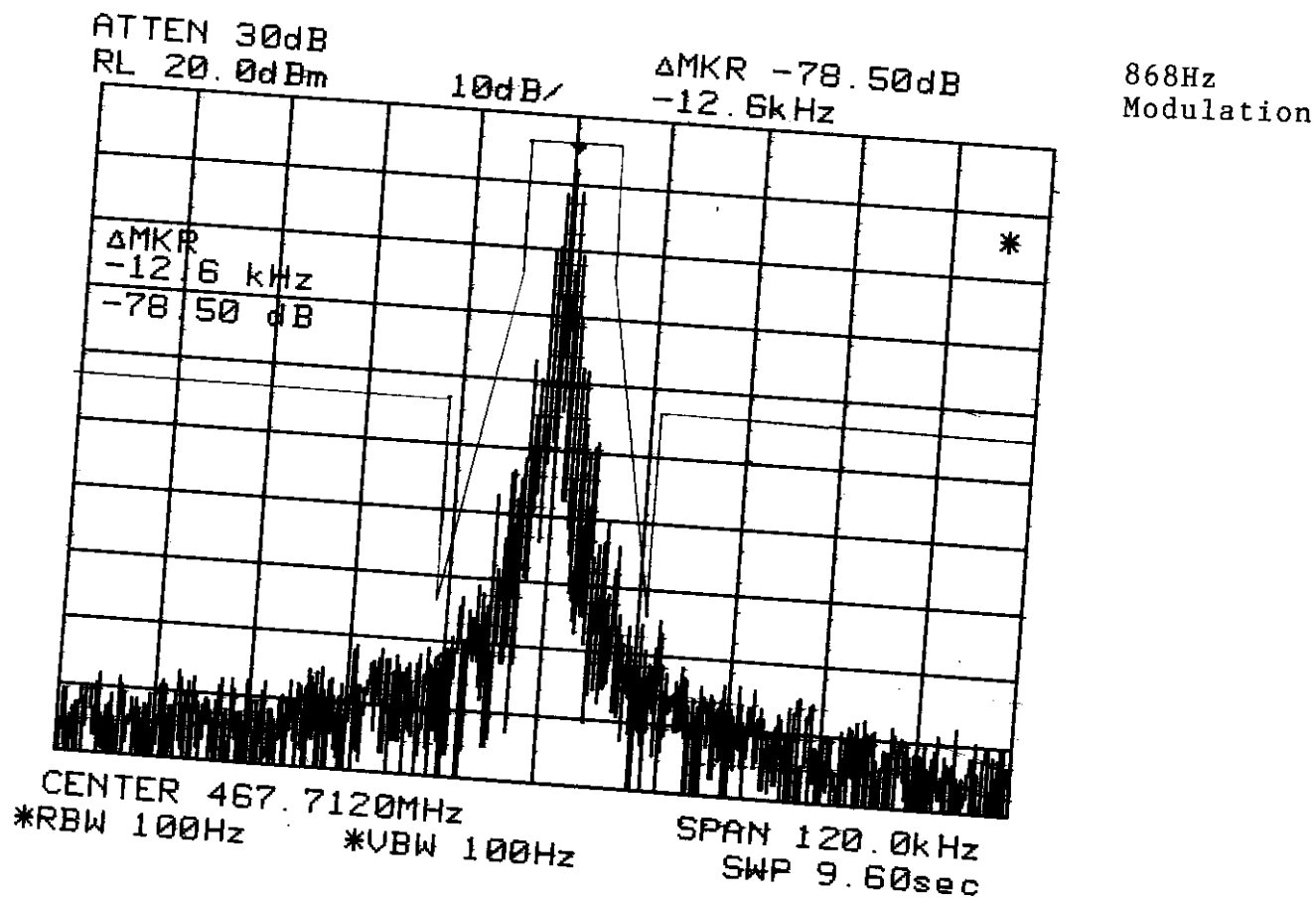
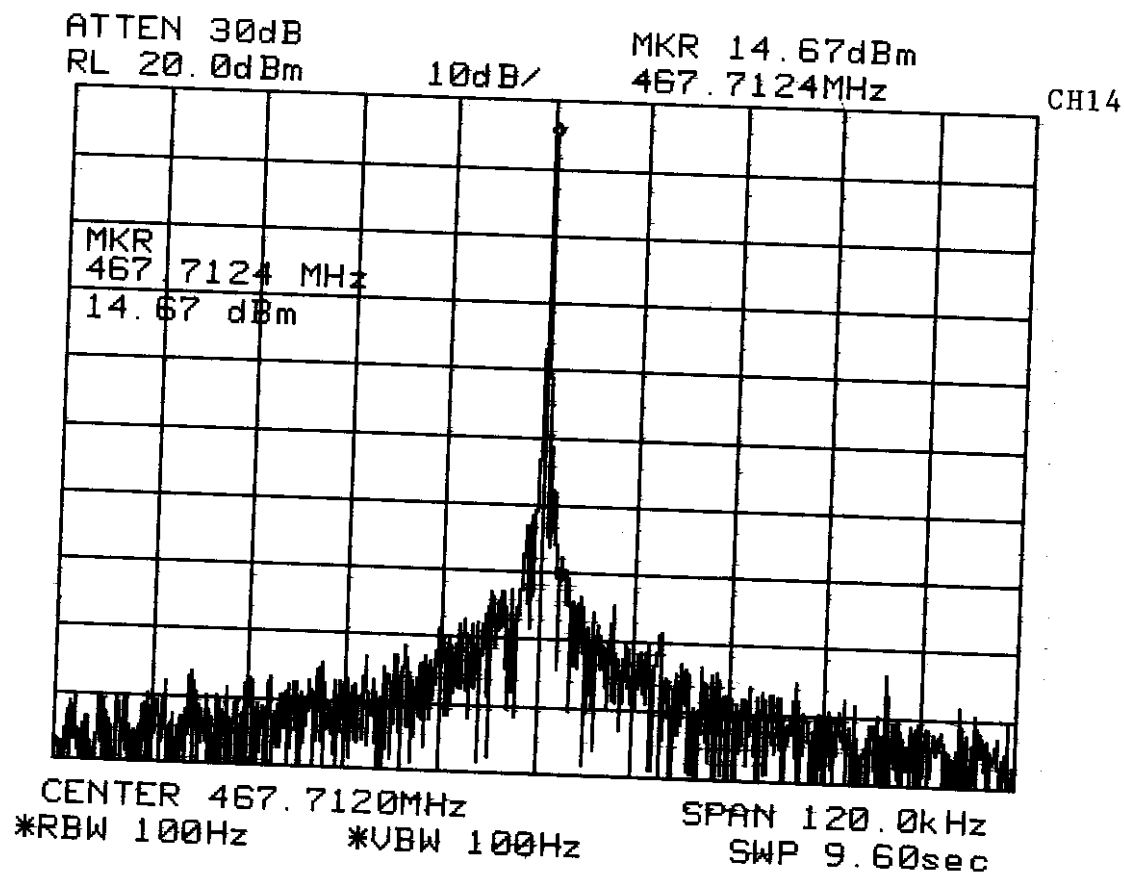
CENTER 462.5625MHz

*RBW 100Hz

*VBW 100Hz

SPAN 120.0kHz

SWP 9.60sec



ATTEN 30dB

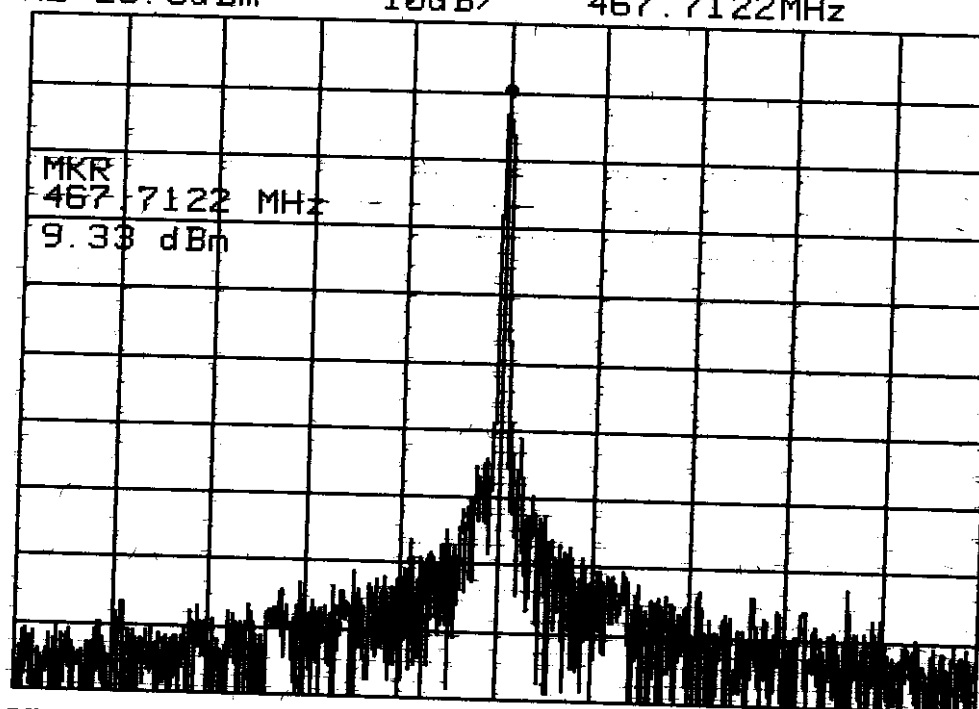
RL 20.0dBm

10dB/

MKR 9.33dBm

467.7122MHz

CH14



CENTER 467.7120MHz

*RBW 100Hz

*VBW 100Hz

SPAN 120.0kHz

SWP 9.60sec

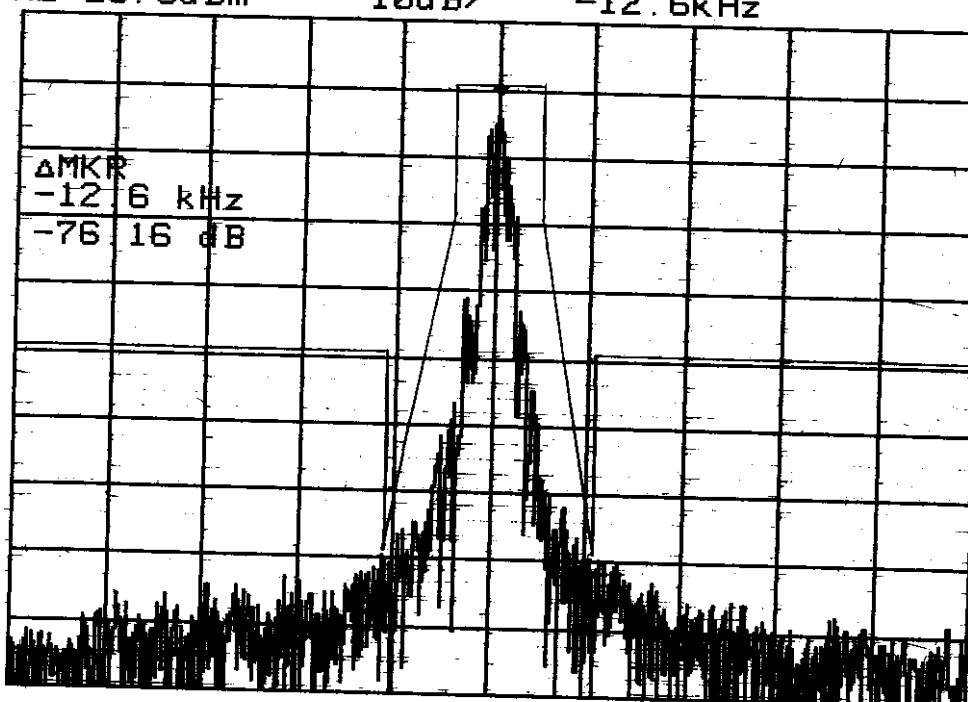
ATTEN 30dB

RL 20.0dBm

10dB/

 Δ MKR -76.16dB

-12.6kHz

868Hz Modulation
& CTCSS Mode

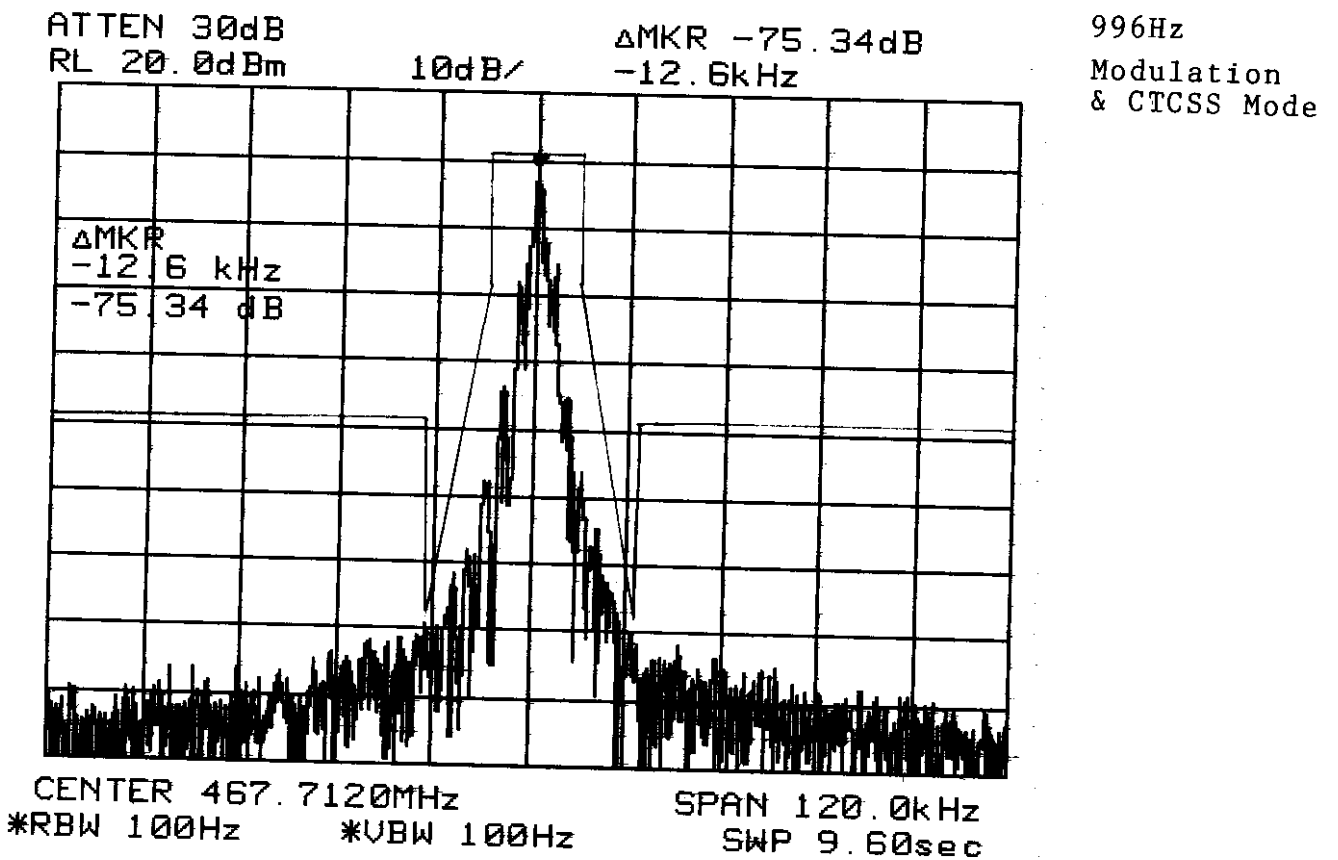
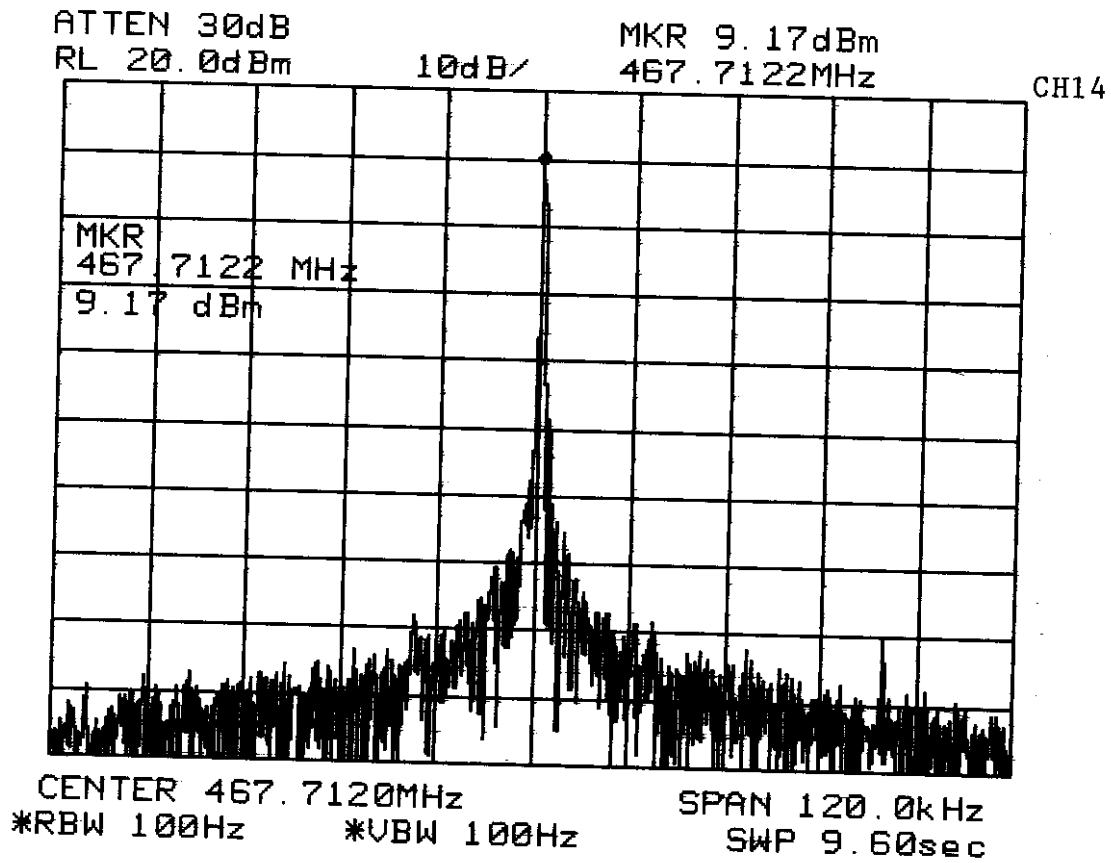
CENTER 467.7120MHz

*RBW 100Hz

*VBW 100Hz

SPAN 120.0kHz

SWP 9.60sec



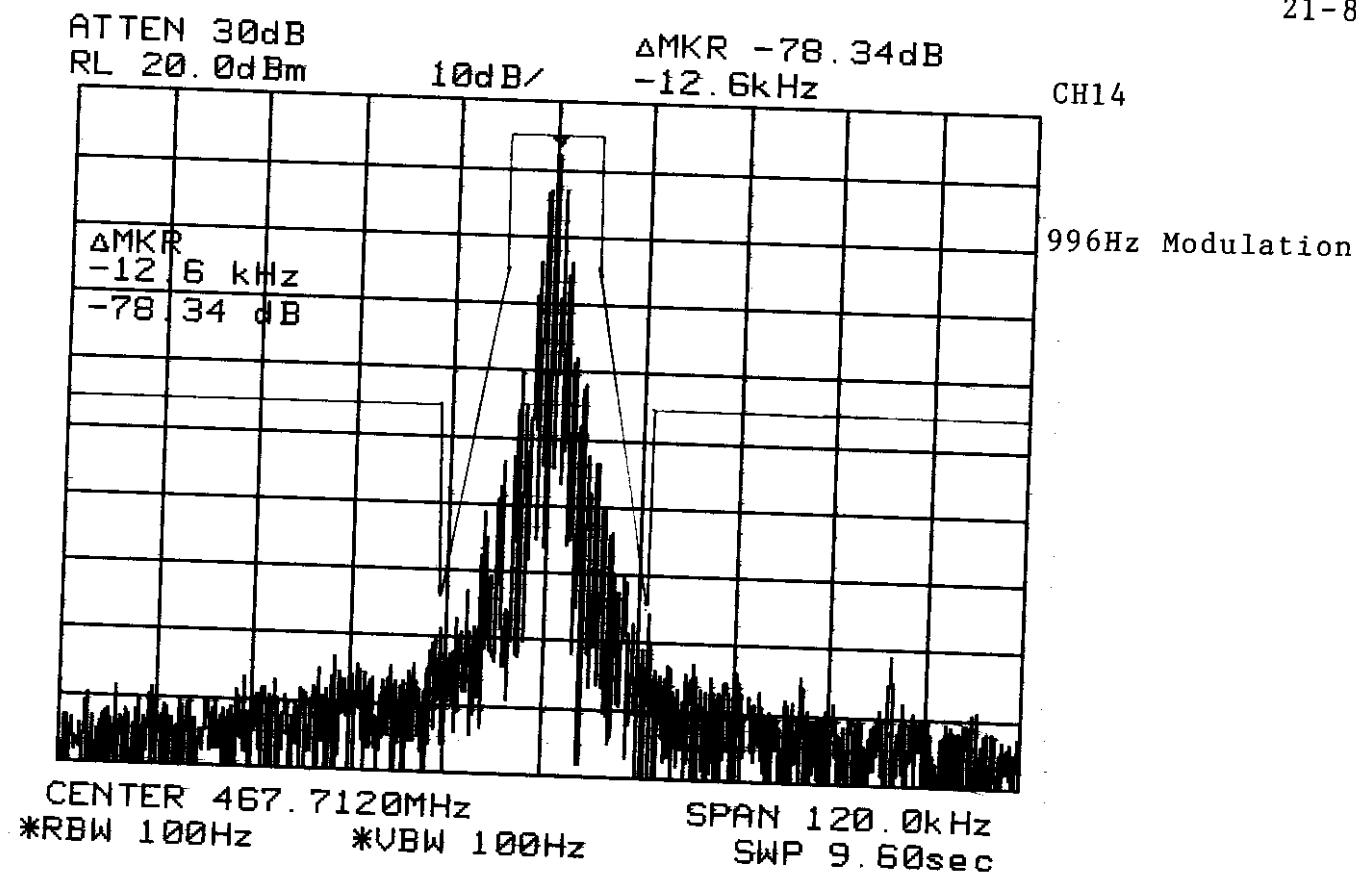


Chart 5 Field Strength of Spurious Radiation Measurement

5.1 Rules and Specification Limits

2.993(a): Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, Power leads, or intermediate circuit elements under normal conditions of installation and operation.

90.210(d)(3): On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz : At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation .

2.997: In all measurements set forth , the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency.

5.2 Measurement Condition & Setup

Pretest : Prior to the final test (OATS test) ,the EUT is placed in a shielded enclosure ,GTEM, and scan from 30MHz to 1GHz.This is done to ensure the radiation exactly emits form the EUT.

Final test : Final radiation measurements is made on a **3 - meter**, open-field test site. The EUT is placed on a nonconductive table which is 0.8 m height, the top surface is 1.0 x 1.5 meter. All the placement is according to ANSI C63.4 - 1992.

The spectrum is examined from 30 MHz to 18 GHz measured by HP spectrum.

The EMCO whole range Antenna is used to measure frequency from 30 MHz to 18 GHz. The final test is used the spectrum HP 8591A & HP 8564E.

Measure more than six top marked frequencies generated form pretest by computer step by step at each frequency. The EUT is rotated 360 degrees, and antenna is raised and lowered from 1 to 4 meter to find the maximum emission levels. The antenna is used with both horizontal and vertical polarization.

Appropriated preamplifier which is made by TRC is used for improving sensitivity and precautions is taken to avoid overloading. The spectrum analyzer's 6dB bandwidth is set to 120 K Hz , and the EUT is measured at quasi-peak mode.

The actual field intensity in decibels referenced to 1 microvolt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB) and cable loss (dB) at the appropriate frequency .

$$FI_a \text{ (dBuV/m)} = FI_r \text{ (dBuV)} + AF \text{ (dB)} + CL \text{ (dB)}$$

FI_a : Actual Field Intensity

FI_r : Reading of the Field Intensity

AF : Antenna Factor

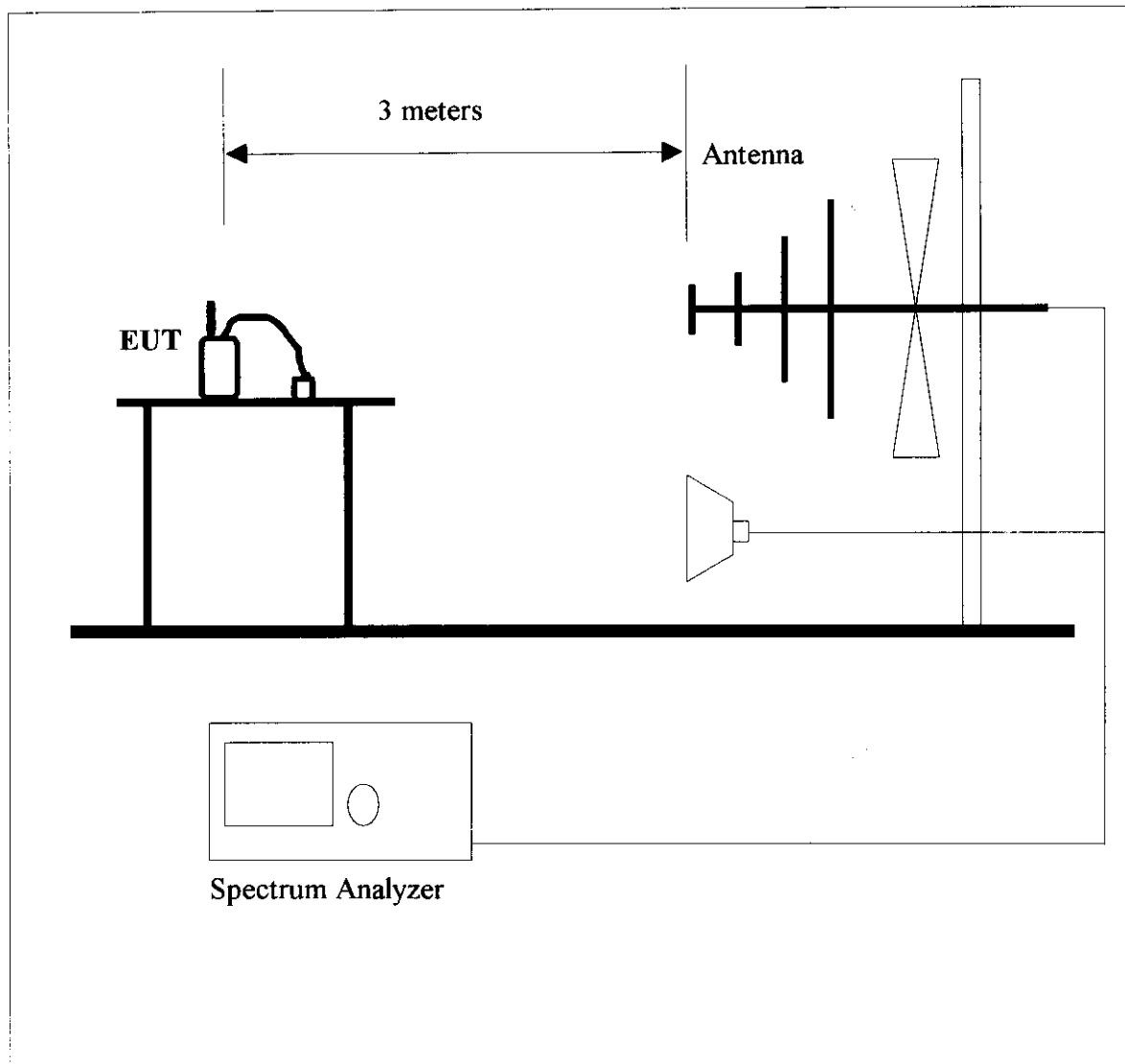
CL : Cable Loss

5.3 List of Measurement Instruments

Instrument Name	Model No.	Brand	Serial No.	<u>Calibration Date</u>	
				Last	Next
Spectrum analyzer	8568B	H P	3004A18617	05/15/98	05/15/99
Quasi-peak Adapter	85650A	H P	2521A00984	05/15/98	05/15/99
RF Pre-selector	85685A	H P	2947A01011	05/15/98	05/15/99
Spectrum analyzer	8591EM	H P	3710A01203	01/29/99	01/29/00
Spectrum analyzer	8564E	H P	US36433002	08/09/98	08/09/99
Antenna (30M-2G Hz)	3142	EMCO	1296	06/10/98	06/10/99
Antenna (1G-18G Hz)	3142	EMCO	5178	08/09/98	08/09/99
Open test side (Antenna, Amplify, cable calibrated together)				05/15/98	05/15/99

The level of confidence of 95% , the uncertainty of measurement of radiated emission is ± 4.96 dB.

5.4 Measurement Configuration



5.5 Measurement Result (CH01 Tx) : (Horizontal for 30 MHz ~ 1 GHz)

Test Conditions:

Testing room : Temperature : 22 °C Humidity : 69 % RH

Testing site : Temperature : 19 °C Humidity : 80 % RH

<i>Frequency</i>	<i>Reading Amplitude</i>	<i>Ant. Height</i>	<i>Table</i>	<i>Correction Factors</i>	<i>Corrected Amplitude</i>	<i>Limit</i>	<i>Margin</i>
<i>MHz</i>	<i>dBuV</i>	<i>m</i>	<i>degree</i>	<i>dB/m</i>	<i>dBuV/m</i>	<i>dBuV/m</i>	<i>dB</i>
925.120	50.80	1.00	87	7.85	58.65	75.23	-16.58

Note:

1. Margin = Amplitude - limit, *if margin is minus means under limit.*
2. Corrected Amplitude = Reading Amplitude - Correction Factors
3. Correction factor = Antenna factor + (Cable Loss - Amplitude gain)
(For example : 30MHz correction factor = 15.5 + (-15.26) = 0.24 dB/m)
4. Attenuation required = $50 + 10 \log (3.955 \times 10^{-2} \text{ W}) = 35.97$
Limit = 111.20 – 35.97 = 75.23

Measurement Result (CH01 Tx) : (Horizontal for 1 GHz ~ 18 GHz)

Radiated Emission				Correction Factors	Corrected Amplitude	FCC Class B (3 M)	
Frequency (GHz)	Amplitude (dBuV/m)	Ant.H. (cm)	Table (°)	(dB)	(dBuV/m)	Limit (dBuV/m)	Margin (dB)
1.388	45.30	100.00	81	-8.67	36.63	54	-17.37
1.850	44.80	100.00	110	-8.67	36.13	54	-17.87
2.313	45.96	100.00	32	-8.67	37.29	54	-16.71
2.775	47.80	100.00	159	-6.84	40.96	54	-13.04
3.238	42.47	100.00	299	-6.84	35.63	54	-18.37
3.701	41.43	100.00	15	-5.64	35.79	54	-18.21
4.163	41.60	100.00	235	-5.64	35.96	54	-18.04
4.626	32.55	100.00	381	3.91	36.46	54	-17.54
5.088	29.72	100.00	355	3.91	33.63	54	-20.37

Note:

1. Margin = Corrected - Limit.
2. Peak Amplitude + Correction Factor = Corrected

Measurement Result (CH01 Tx) : (Vertical for 30 MHz ~ 1 GHz)

<i>Frequency</i>	<i>Reading Amplitude</i>	<i>Ant. Height</i>	<i>Table</i>	<i>Correction Factors</i>	<i>Corrected Amplitude</i>	<i>Limit</i>	<i>Margin</i>
<i>MHz</i>	<i>dBuV</i>	<i>m</i>	<i>degree</i>	<i>dB/m</i>	<i>dBuV/m</i>	<i>dBuV/m</i>	<i>dB</i>
925.122	53.80	1.00	195	7.85	61.65	75.23	-13.58

Measurement Result (CH01 Tx) : (Vertical for 1 GHz ~ 18 GHz)

Radiated Emission				Correction Factors	Corrected Amplitude (dBuV/m)	FCC Class B (3 M)	
Frequency (GHz)	Amplitude (dBuV/m)	Ant.H. (cm)	Table (°)	(dB)		Limit (dBuV/m)	Margin (dB)
1.388	48.13	100.00	281	-8.67	39.46	54	-14.54
1.850	47.46	100.00	11	-8.67	38.79	54	-15.21
2.313	46.80	100.00	311	-8.67	38.13	54	-15.87
2.775	51.63	100.00	158	-6.84	44.79	54	-9.21
3.238	40.63	100.00	294	-6.84	33.79	54	-20.21
3.701	42.10	100.00	151	-5.64	36.46	54	-17.54
4.163	41.93	100.00	28	-5.64	36.29	54	-17.71
4.626	30.72	100.00	271	3.91	34.63	54	-19.37
5.088	30.05	100.00	305	3.91	33.96	54	-20.04

Measurement Result (CH14 Tx) : (Horizontal for 30 MHz ~ 1 GHz)

<i>Frequency</i>	<i>Reading Amplitude</i>	<i>Ant. Height</i>	<i>Table</i>	<i>Correction Factors</i>	<i>Corrected Amplitude</i>	<i>Limit</i>	<i>Margin</i>
<i>MHz</i>	<i>dBuV</i>	<i>m</i>	<i>degree</i>	<i>dB/m</i>	<i>dBuV/m</i>	<i>dBuV/m</i>	<i>dB</i>
935.420	50.60	1.00	5	7.80	58.40	75.23	-16.83

Measurement Result (CH14 Tx) : (Horizontal for 1 GHz ~ 18 GHz)

Radiated Emission				Correction Factors	Corrected Amplitude (dBuV/m)	FCC Class B (3 M)	
Frequency (GHz)	Amplitude (dBuV/m)	Ant.H. (cm)	Table (°)	(dB)		Limit (dBuV/m)	Margin (dB)
1.403	43.96	100.00	17	-8.67	35.29	54	-18.71
1.871	36.30	100.00	232	-8.67	27.63	54	-26.37
2.234	36.80	100.00	325	-8.67	28.13	54	-25.87
2.806	49.47	100.00	188	-6.84	42.63	54	-11.37
3.274	38.63	100.00	341	-6.84	31.79	54	-22.21
3.742	39.93	100.00	79	-5.64	34.29	54	-19.71
4.209	33.72	100.00	148	3.91	37.63	54	-16.37
4.677	31.88	100.00	56	3.91	35.79	54	-18.21

Measurement Result (CH14 Tx) : (Vertical for 30 MHz ~ 1 GHz)

<i>Frequency</i>	<i>Reading Amplitude</i>	<i>Ant. Height</i>	<i>Table</i>	<i>Correction Factors</i>	<i>Corrected Amplitude</i>	<i>Limit</i>	<i>Margin</i>
<i>MHz</i>	<i>dBuV</i>	<i>m</i>	<i>degree</i>	<i>dB/m</i>	<i>dBuV/m</i>	<i>dBuV/m</i>	<i>dB</i>
935.420	52.60	1.00	280	7.80	60.40	75.23	-14.83

Measurement Result (CH14 Tx) : (Vertical for 1 GHz ~ 18 GHz)

Radiated Emission				Correction Factors	Corrected Amplitude (dBuV/m)	FCC Class B (3 M)	
Frequency (GHz)	Amplitude (dBuV/m)	Ant.H. (cm)	Table (°)	(dB)		Limit (dBuV/m)	Margin (dB)
1.403	47.13	100.00	107	-8.67	38.46	54	-15.54
1.871	35.46	100.00	132	-8.67	26.79	54	-27.21
2.234	37.13	100.00	226	-8.67	28.46	54	-25.54
2.806	51.80	100.00	154	-6.84	44.96	54	-9.04
3.274	36.30	100.00	314	-6.84	29.46	54	-24.54
3.742	38.60	100.00	86	-5.64	32.96	54	-21.04
4.209	29.55	100.00	141	3.91	33.46	54	-20.54
4.677	32.38	100.00	259	3.91	36.29	54	-17.71

Measurement Result (CH01 Rx) : (Horizontal for 30 MHz ~ 1 GHz)

[illegible]

Measurement Result (CH01 Rx) : (Horizontal for 1 GHz ~ 18 GHz)

Radiated Emission				Correction Factors	Corrected Amplitude (dBuV/m)	FCC Class B (3 M)	
Frequency (GHz)	Amplitude (dBuV/m)	Ant.H. (cm)	Table (°)	(dB)		Limit (dBuV/m)	Margin (dB)
1.323	46.80	100.00	111	-8.67	38.13	54	-15.87
1.764	43.63	100.00	10	-8.67	34.96	54	-19.04
2.205	47.80	100.00	321	-8.67	39.13	54	-14.87
2.647	51.13	100.00	179	-6.84	44.29	54	-9.71
3.088	45.97	100.00	199	-6.84	39.13	54	-14.87
3.529	38.77	100.00	185	-5.64	33.13	54	-20.87
3.970	42.10	100.00	25	-5.64	36.46	54	-17.54
4.412	33.05	100.00	331	3.91	36.96	54	-17.04
4.853	28.88	100.00	345	3.91	32.79	54	-21.21
5.294	24.91	100.00	165	9.72	34.63	54	-19.37

Measurement Result (CH01 Rx) : (Vertical for 30 MHz ~ 1 GHz)

<i>Frequency</i>	<i>Reading Amplitude</i>	<i>Ant. Height</i>	<i>Table</i>	<i>Correction Factors</i>	<i>Corrected Amplitude</i>	<i>Limit</i>	<i>Margin</i>
<i>MHz</i>	<i>dBuV</i>	<i>m</i>	<i>degree</i>	<i>dB/m</i>	<i>dBuV/m</i>	<i>dBuV/m</i>	<i>dB</i>
441.162	44.50	1.00	127	-3.28	41.22	46.00	-4.78
882.326	26.20	1.00	149	7.76	33.96	46.00	-12.04

Measurement Result (CH01 Rx) : (Vertical for 1 GHz ~ 18 GHz)

Radiated Emission				Correction Factors (dB)	Corrected Amplitude (dBuV/m)	FCC Class B (3 M)	
Frequency (GHz)	Amplitude (dBuV/m)	Ant.H. (cm)	Table (°)			Limit (dBuV/m)	Margin (dB)
1.323	56.63	100.00	211	-8.67	47.96	54	-6.04
1.764	49.63	100.00	106	-8.67	40.96	54	-13.04
2.205	49.74	100.00	231	-8.67	41.07	54	-12.93
2.647	57.63	100.00	79	-6.84	50.79	54	-3.21
3.088	48.47	100.00	119	-6.84	41.63	54	-12.37
3.529	39.10	100.00	181	-5.64	33.46	54	-20.54
3.970	43.10	100.00	264	-5.64	37.46	54	-16.54
4.412	32.22	100.00	33	3.91	36.13	54	-17.87
4.853	28.55	100.00	331	3.91	32.46	54	-21.54
5.294	24.41	100.00	65	9.72	34.13	54	-19.87

Measurement Result (CH14 Rx) : (Horizontal for 30 MHz ~ 1 GHz)

<i>Frequency</i>	<i>Reading Amplitude</i>	<i>Ant. Height</i>	<i>Table</i>	<i>Correction Factors</i>	<i>Corrected Amplitude</i>	<i>Limit</i>	<i>Margin</i>
<i>MHz</i>	<i>dBuV</i>	<i>m</i>	<i>degree</i>	<i>dB/m</i>	<i>dBuV/m</i>	<i>dBuV/m</i>	<i>dB</i>
446.313	33.00	1.00	231	-3.17	29.83	46.00	-16.17
892.625	20.10	1.00	210	8.09	28.19	46.00	-17.81

Measurement Result (CH14 Rx) : (Horizontal for 1 GHz ~ 18 GHz)

Radiated Emission				Correction Factors	Corrected Amplitude (dBuV/m)	FCC Class B (3 M)	
Frequency (GHz)	Amplitude (dBuV/m)	Ant.H. (cm)	Table (°)	(dB)		Limit (dBuV/m)	Margin (dB)
1.339	51.36	100.00	20	-8.67	42.69	54	-11.31
1.785	48.63	100.00	281	-8.67	39.96	54	-14.04
2.232	51.13	100.00	1	-8.67	42.46	54	-11.54
2.678	51.97	100.00	315	-6.84	45.13	54	-8.87
3.124	51.80	100.00	222	-6.84	44.96	54	-9.04
3.510	37.77	100.00	19	-5.64	32.13	54	-21.87
4.017	44.60	100.00	58	-5.64	38.96	54	-15.04
4.463	34.22	100.00	291	3.91	38.13	54	-15.87
4.909	31.55	100.00	301	3.91	35.46	54	-18.54
5.356	25.74	100.00	67	9.72	35.46	54	-18.54

Measurement Result (CH14 Rx) : (Vertical for 30 MHz ~ 1 GHz)

<i>Frequency</i>	<i>Reading Amplitude</i>	<i>Ant. Height</i>	<i>Table</i>	<i>Correction Factors</i>	<i>Corrected Amplitude</i>	<i>Limit</i>	<i>Margin</i>
<i>MHz</i>	<i>dBuV</i>	<i>m</i>	<i>degree</i>	<i>dB/m</i>	<i>dBuV/m</i>	<i>dBuV/m</i>	<i>dB</i>
446.313	46.10	1.00	140	-3.17	42.93	46.00	-3.07
892.625	25.00	1.00	141	8.09	33.09	46.00	-12.91

Measurement Result (CH14 Rx) : (Vertical for 1 GHz ~ 18 GHz)

Radiated Emission				Correction Factors	Corrected Amplitude (dBuV/m)	FCC Class B (3 M)	
Frequency (GHz)	Amplitude (dBuV/m)	Ant.H. (cm)	Table (°)	(dB)		Limit (dBuV/m)	Margin (dB)
1.339	59.74	100.00	205	-8.67	51.07	54	-2.93
1.785	53.63	100.00	28	-8.67	44.96	54	-9.04
2.232	51.46	100.00	116	-8.67	42.79	54	-11.21
2.678	58.13	100.00	317	-6.84	51.29	54	-2.71
3.124	52.47	100.00	281	-6.84	45.63	54	-8.37
3.510	37.71	100.00	191	-5.64	32.07	54	-21.93
4.017	41.60	100.00	5	-5.64	35.96	54	-18.04
4.463	35.55	100.00	297	3.91	39.46	54	-14.54
4.909	32.72	100.00	307	3.91	36.63	54	-17.37
5.356	23.74	100.00	88	9.72	33.46	54	-20.54

Chart 6 Frequency Stability Tolerance Measurement

6.1 Rules and Specification Limits

2.995: Measurements required – Frequency stability

95.627 (b): Each FRS unit must be maintained within a frequency tolerance of 0.00025%.

6.2 Measurement Condition & Setup with Temperature Variation

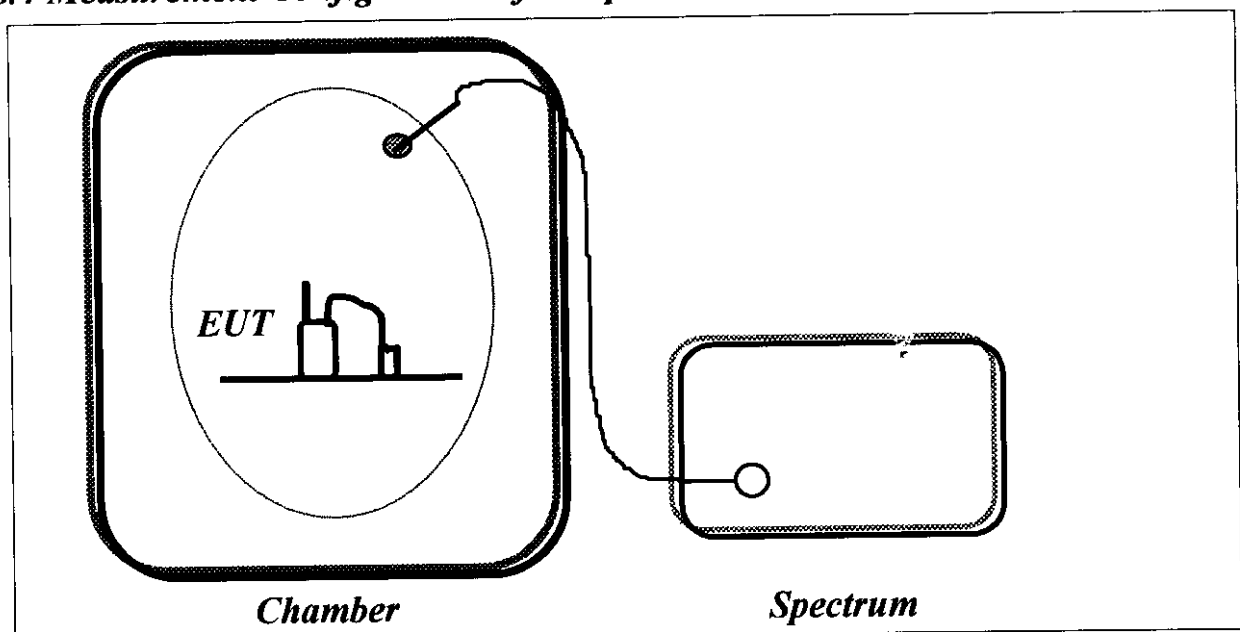
1. Place the EUT in the chamber, powered in its normal operation and select channel 1 or 14.
2. Set the temperature of the chamber -30 degree Centigrade. Allow the equipment to stabilize at that temperature.
3. Measured the carrier frequency using preamplifier and frequency counter.
4. Repeated procedures 1 to 3 from -20 to 50 degree Centigrade at intervals of 10 degree.

6.3 List of Measurement Instruments with Temperature Variation

List of test Instrument :

Instrument Name	Model No.	Brand	Remark
Spectrum Analyzer	8591A	H P	1.8GHz
Temperature Chamber	THS-MV2	King Son	
Near field Probe	7405-901	EMCO	
Power Supply	GPR-6030	Good Will	
Auto Transformer	Powerstat	Supprior Elec. Co.	

6.4 Measurement Configuration of Temperature variation test :



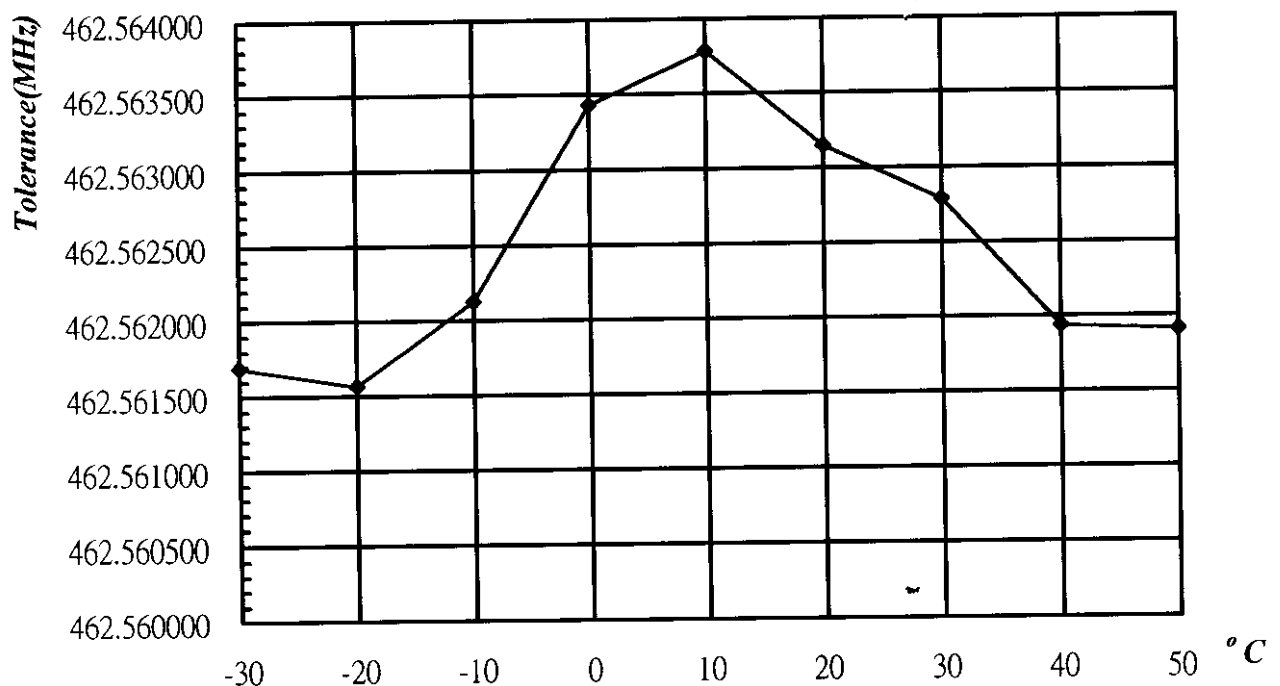
6.5 Measurement Result with Temperature Variation

A plot and table is presented which illustrates compliance with the rule where the center frequency are CH1- 462.5625 MHz and CH14 - 467.7125 MHz.

Temperature Variation Table (CH01)

<i>Temperature (Centigrade)</i>	<i>Frequency (MHz)</i>	<i>Tolerance (MHz)</i>
-30	462.561688	462.5613361 ~ 462.5636639
-20	462.561563	462.5613361 ~ 462.5636639
-10	462.562124	462.5613361 ~ 462.5636639
0	462.563427	462.5613361 ~ 462.5636639
10	462.563782	462.5613361 ~ 462.5636639
20	462.563147	462.5613361 ~ 462.5636639
30	462.562785	462.5613361 ~ 462.5636639
40	462.561937	462.5613361 ~ 462.5636639
50	462.562912	462.5613361 ~ 462.5636639

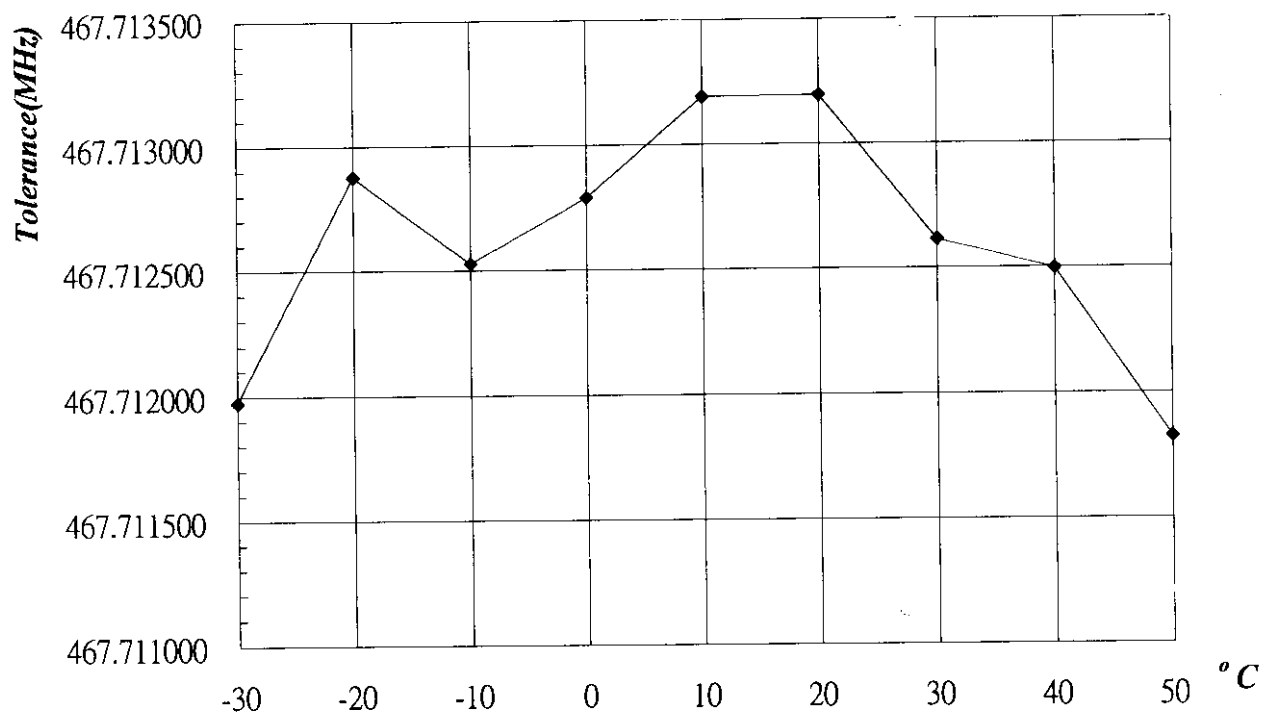
Temperatuer Variation VS. Frequency Chart



Temperature Variation Table (CH14)

Temperature (Centigrade)	Frequency (MHz)	Tolerance (MHz)
-30	467.711973	467.711330 ~ 467.713669
-20	467.712875	467.711330 ~ 467.713669
-10	467.712527	467.711330 ~ 467.713669
0	467.712789	467.711330 ~ 467.713669
10	467.713189	467.711330 ~ 467.713669
20	467.713194	467.711330 ~ 467.713669
30	467.712615	467.711330 ~ 467.713669
40	467.712497	467.711330 ~ 467.713669
50	467.711823	467.711330 ~ 467.713669

Temperatuer Variation VS. Frequency Chart



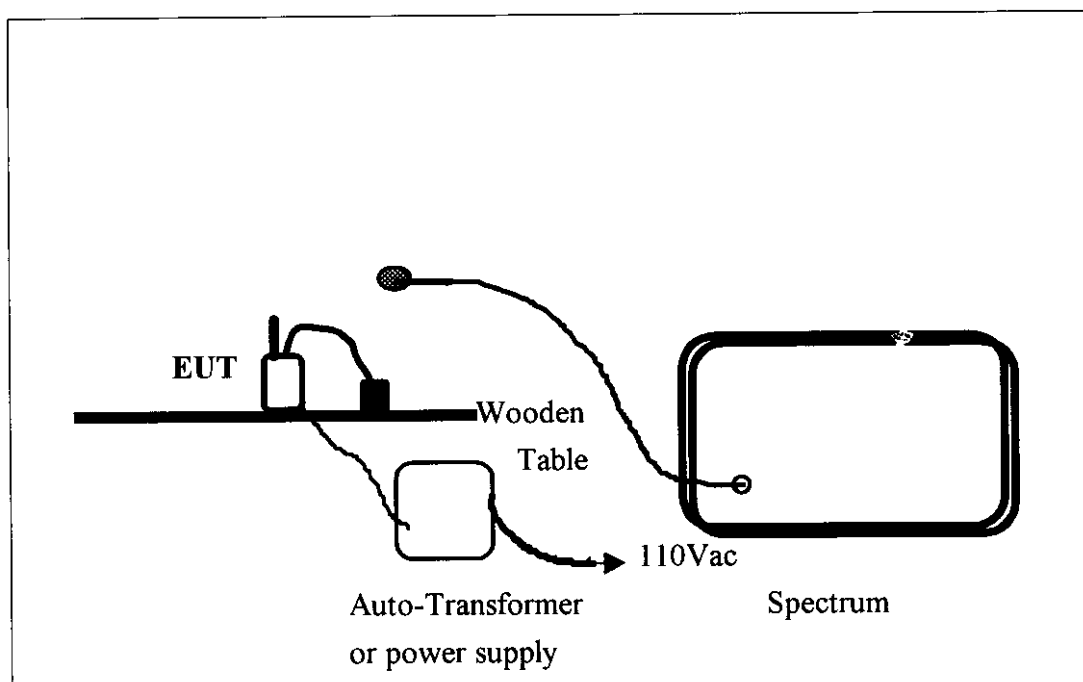
6.6 Measurement Condition & Setup with Voltage Variation

1. Attached the power line of the power supply to the battery position of the EUT.
2. Tuned the output power level to battery end point , 85 % , 100%, 115% of the normal operation power of EUT.
3. Recorded the frequency with a frequency counter.

6.7 List of test Instrument :

Instrument Name	Model No.	Brand	Remark
Spectrum Analyzer	8591A	H P	1.8GHz
Temperature Chamber	THS-MV2	King Son	
Near field Probe	7405-901	EMCO	
Power Supply	GPR-6030	Good Will	
Auto Transformer	Powerstat	Supprior Elec. Co.	

6.8 Configuration of Voltage variation test :

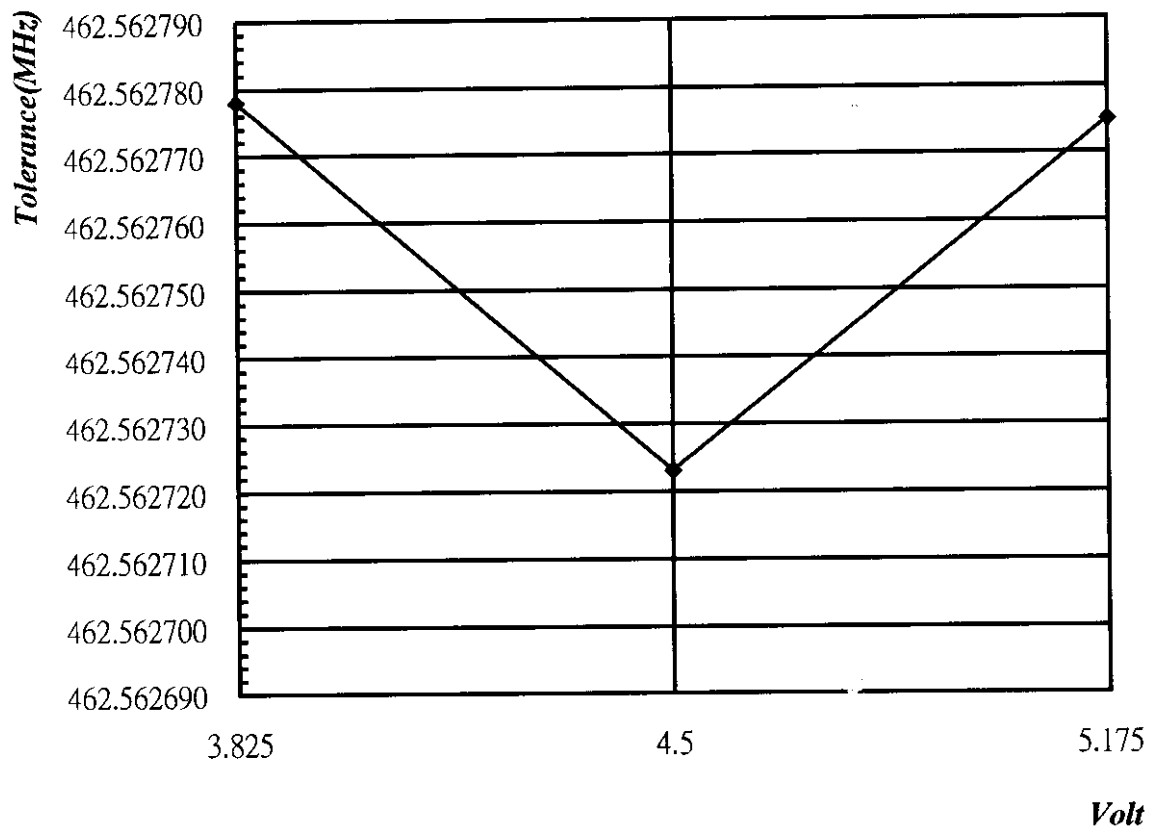


6.9 Measurement Result with Voltage Variation

Frequency Stability of Voltage Variation Measurement Table (CH01)

<i>Supply Voltage (Volt)</i>	<i>Frequency (MHz)</i>	<i>Tolerance (MHz)</i>
3.825 (85%)	462.562778	462.5613361 ~ 462.5636639
4.500 (100%)	462.562723	462.5613361 ~ 462.5636639
5.175 (115%)	462.562775	462.5613361 ~ 462.5636639
Endpoint-Voltage : 2.78V		

Voltage Variation VS. Frequency Chart



Frequency Stability of Voltage Variation Measurement Table (CH14)

<i>Supply Voltage (Volt)</i>	<i>Frequency (MHz)</i>	<i>Tolerance (MHz)</i>
3.825 (85%)	467.712789	467.711330 ~ 467.713669
4.500 (100%)	467.712921	467.711330 ~ 467.713669
5.175 (115%)	467.712982	467.711330 ~ 467.713669
Endpoint-Voltage : 2.78V		

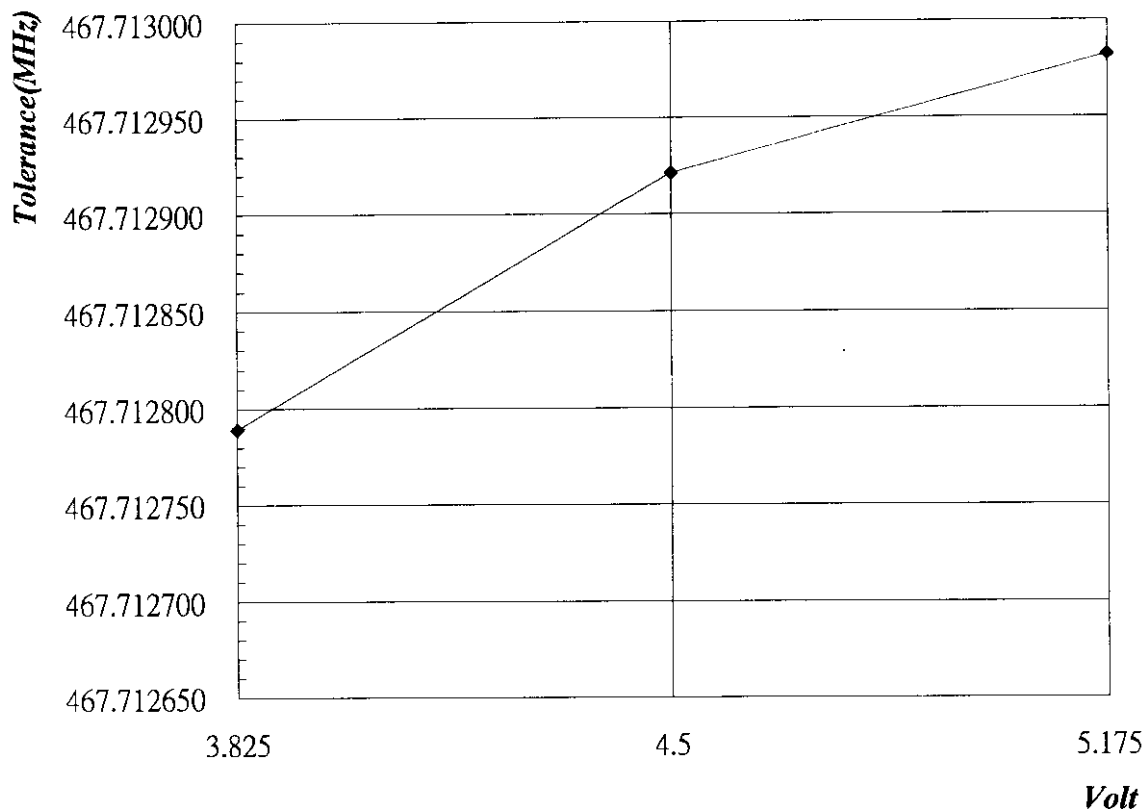
Voltage Variation VS. Frequency Chart

Chart 7 Antenna of Requirements

95.647: FRS unit and R/C transmitter antennas. – The antenna of each FRS unit, and the antenna of each R/C station transmitting in the 72-76 MHz band, must be an integral part of the transmitter. The antenna must have no gain (as compared to a half-wave dipole) and must be vertically polarized.

Normal-mode helical antennas of EUT

The subject device its antenna polarization is vertically polarized and define by its physical dimension.

When the dimensions of the helix are small compared with wavelength, the maximum radiation is in a direction normal to the helix axis. Kraus has shown that the radiation from a short-axial-length helix can be calculated by assuming that the helix is composed of small loops of diameter D and short dipoles of length S . The far field of a short dipole has only an E_θ component,

$$E_\theta = \frac{jBe^{-jkr}}{r} \left[\frac{S}{\lambda} \right] \sin \theta$$

and the far field of a small loop has only an E_ϕ component,

$$E_\phi = \frac{Be^{-jkr}}{2r} \left[\frac{\pi D}{\lambda} \right]^2 \sin \theta$$

where r is the distance and B is a constant. The E_θ and E_ϕ components are 90° out of phase, and the far field of a small helix is, in general, elliptically polarized. The axial ratio is given by

$$AR = \frac{|E_\theta|}{|E_\phi|} = \left[\frac{2S}{\lambda} \right] / \left[\frac{\pi D}{\lambda} \right]^2$$

In our case:

$$\lambda \text{ (Meter)} = 300 / f \text{ (MHz)} \implies \lambda = 300 / 462 \text{ MHz} = 0.649 \text{ Meter}$$

$D = 4.9 \text{ mm}$, $S = 68.5 \text{ mm}$, See Page 47-3

$$\implies AR = \left[\frac{2 \times 68.5}{649} \right] / \left[\frac{3.1416 \times 4.9}{649} \right]^2$$

$$\implies AR = 375.2115002$$

$$AR \rightarrow \infty \text{ when } \pi D \ll \sqrt{2S\lambda}$$

$$\implies 3.1416 \times 4.9 \ll \sqrt{2 \times 68.5 \times 649} \implies 15.393 \ll 298.180$$

$$\implies \text{So, } AR \rightarrow \infty, \text{ because } \pi D \gg \sqrt{2S\lambda}$$

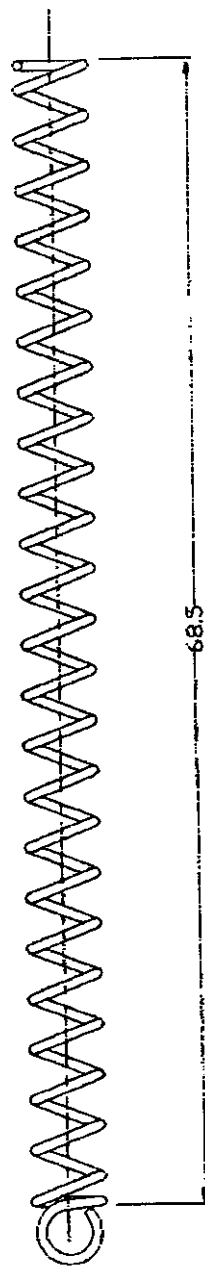
So, antenna is vertically polarize.

The length of the antenna of EUT is 0.1λ of the operated frequency of EUT.

The antenna gain of EUT is -1.6 dB . (See attached page 47-4 for Antenna Radiation Pattern)

Diameter : $\phi 4.9$ mm

Length : 68.5 mm



Antenna Radiation Pattern

FCC ID: N1QFRS-268
Gain: -1.6dB

