Report No.	G1515243
Specifications Test Method	FCC Part 95, Subpart B – Certification. ANSI C63.4 1992
Applicant address	Rm 1, 3th Fl., No. 77, Sec. 1, Hsin Tai Wu Rd., Hsi-chih, Taipei Hsien, Taiwan, R.O.C.
Applicant Items tested Model No.	Gold Apollo Co., Ltd. General Mobile Radio Service GMRS-220 (Sample # G15243)
Results Date	**Compliance** (As detailed within this report) 08/22/2001 (month / day / year) (Sample received) 03/27/2002 (month / day / year) (Test)
Prepared by	Project Engineer
Authorized by	General Manager (Frank Tsai)
Issue date	March *28, 2001* (month / day / year)
Modifications	**None**
Tested by	Training Research Co., Ltd.
Office at	2, Lane 194, Huan-Ho Street, Hsichih, Taipei Hsien 221, Taiwan
Anechoic Chamber at	2, Lane 194, Huan-Ho Street, Hsichih, Taipei Hsien 221, 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 : NDAGMRS-220***

Contents

Chapter 0 Application for Certification

2.1033 (c)(1)(2)	**Gold Apollo Co., Ltd. — Applicant and Manufacturer**
	TRANSCEIVER in quantity, for use under FCC RULES PART 95.
2.1033 (c)	TECHNICAL DESCRIPTION
2.1033(c)(3)	Instruction book. A draft copy of the instruction manual is included as Exhibit.
2.1033 (c)(4)	Type of Emission: 15K3F3E
95.629	Bn = 2M + 2DK
	M = 3K
	D = 4.685K
	Bn = 2(3.0) + 2 (4.685) = 15.3KHz
	Authorized Bandwidth 20.0KHz
2.1033 (c) (5)	Frequency Range: 462.5500 – 462.7250 MHz
95.627	
2.10311(c) (6)(7)	The Maximum Output Power Rating: 4.073Watts
2.1033 (c) (8)	DC Voltage and Current into Final Amplifier:
	(6.0Vdc)(1.0A) = 6.0 Watts
2.1033 (c) (9)	Tune-up procedure the turn-procedure is included as Exhibit
2.1033 (c) (10)	Completed Circuit Diagrams: The circuit Diagrams is included as Exhibit. The Block Diagrams are included as Exhibit.
2.1033 (c) (11)	A Photograph or a drawing of equipment identification label is included as Exhibit.
2.1033 (c) (12)	Photographs of the equipment of sufficient clarity to reveal equipment construction and layout, including meters, labels for controls, including any view under shields. See Exhibit
2.1033 (c) (13)	Digital modulation is not allowed.
2.1033 (d) (14)	The data required by 2.1046 through 2.1057 is submitted below.
95.639	Power Output shall not exceed 50.0Watts effective radiated power.
95.649	There can be no provisions for increasing the power or varying the power.
	RF power output.

Chapter 1 General

Introduction

The following data are submitted in connection with this request for type acceptance of the GMRS-220 transceiver in accordance with part 2, Subpart J of the FCC Rules.

The GMRS-220 is a hand-held, battery operated, frequency modulation, 4.0W transceiver in the 462.5500 – 462.7250 MHz band under part 95 in the GMRS service.

Description of EUT

EUT	:	General Mobile Radio Service
Model No.	:	GMRS-220
Carrier Frequency Range	:	462.5500 ~ 462.7250 MHz
RF Power Output	:	4.073 Watts
Supply Voltage	:	6.0V (1.5V x 4 Batteries)
Supply Current	:	1000 mA
Frequency Stability	:	5 ppm
Operating Temperature	:	-30 to +50 degree centigrade

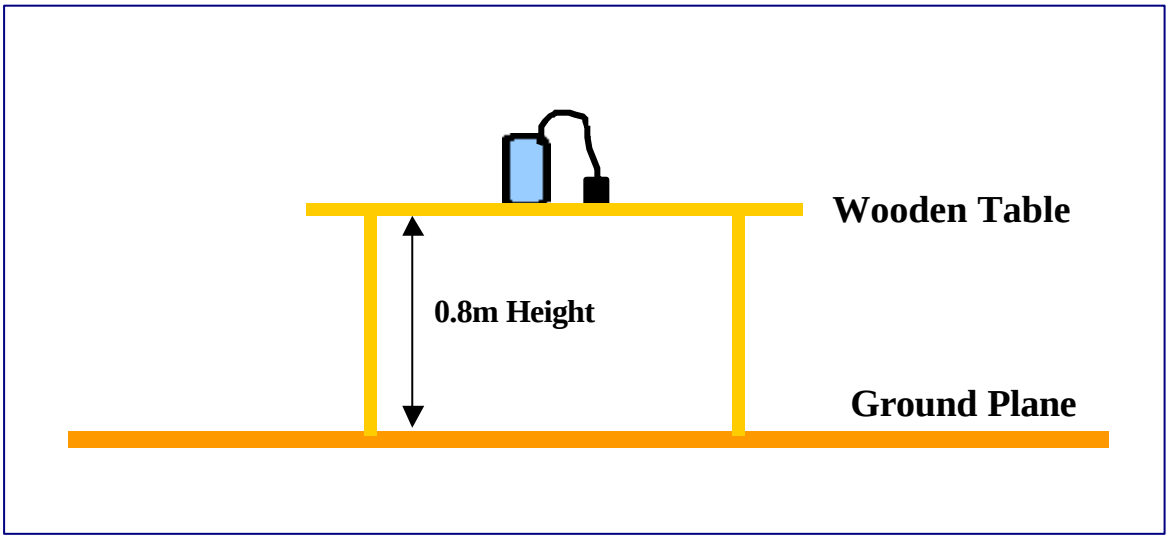
Description of Support Equipment

N/A

Verify the Frequency and Channel

Channel	*Frequency (MHz)*	*Channel*	*Frequency (MHz)*	*Channel*	*Frequency (MHz)*
1	462.5625	8	462.5750	15	462.7250
2	462.5875	9	462.6250		
3	462.6125	10	462.6750		
4	462.6375	11	462.5500		
5	462.6625	12	462.6000		
6	462.6875	13	462.6500		
7	462.7125	14	462.7000		

Configuration of test setup



Location of the Measurement Site

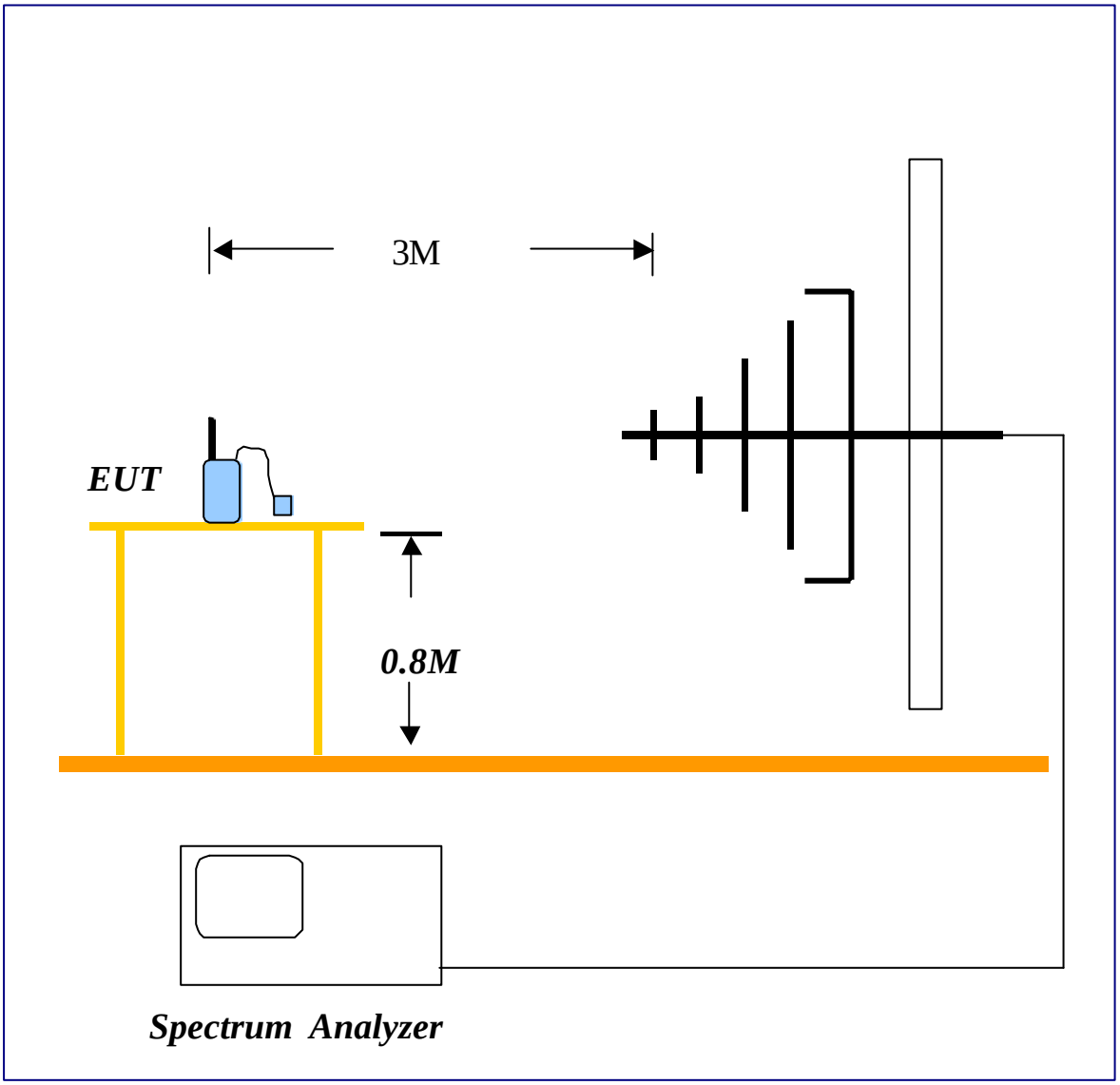
The radiated emissions measurements required by the rules were performed on the **three-meter**, **Anechoic Chamber (Registration Number: 93906)** maintained by *Training Research Co., Ltd.* 1F., No. 2, Lane 194, Huan-Ho Street, Hsi-chih, Taipei Hsien 221, Taiwan, R.O.C. Complete description and measurement data have been placed on file with the commission. The conducted power line emissions tests and other test items were performed in an anechoic chamber also located at Training Research Co., Ltd. 1F, No. 2, Lane 194, Huan-Ho Street, Hsichih, Taipei Hsien 221, Taiwan, R.O.C. *Training Research Co., Ltd.* is listed by the FCC as a facility available to do measurement work for others on a contract basis.

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 that the EUT was considered likely to encounter in normal use were investigated.

Chapter 2
2.1046(a) Maximum Transmitter Power Output Measurement

Test Setup (ERP)



Test Procedure (ERP)

1. Measurement was made on Anechoic Chamber 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 SCHAFFNER 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 Bi - Log antenna.
3. Because the EUT out power is too strong, the signal generator doesn' t supply. To choose the other method is finding the related value. As below. Spectrum Analyzer reading value from EUT = Spectrum Analyzer reading value from dipole antenna (how much signal generator input) + 30dB.

List of test Instrument (ERP)

				Calibration Date	
Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
EMI Receiver	8546A	H P	3520A00242	06/29/01	06/29/02
RF Filter Section	85460A	H P	3448A00217	06/29/01	06/29/02
Bi-log Antenna	CBL6141A	Schaffner	4206	03/12/02	03/12/03
Switch/Control Unit (> 30MHz)	3488A	HP	N/A	11/20/00	11/20/01
Auto Switch Box (> 30MHz)	ASB-01	TRC	9904-01	11/20/00	11/20/01
Spectrum Analyzer	8564E	HP	US36433002	08/01/01	08/01/02
Microwave Preamplifier	83051A	HP	3232A00347	08/01/01	08/01/02
Horn Antenna	3115	EMCO	9704 – 5178	08/01/01	08/01/02
Signal Generator	8648D	HP	3613A00117		
Anechoic Chamber (cable calibrated together)				05/20/01	05/20/02

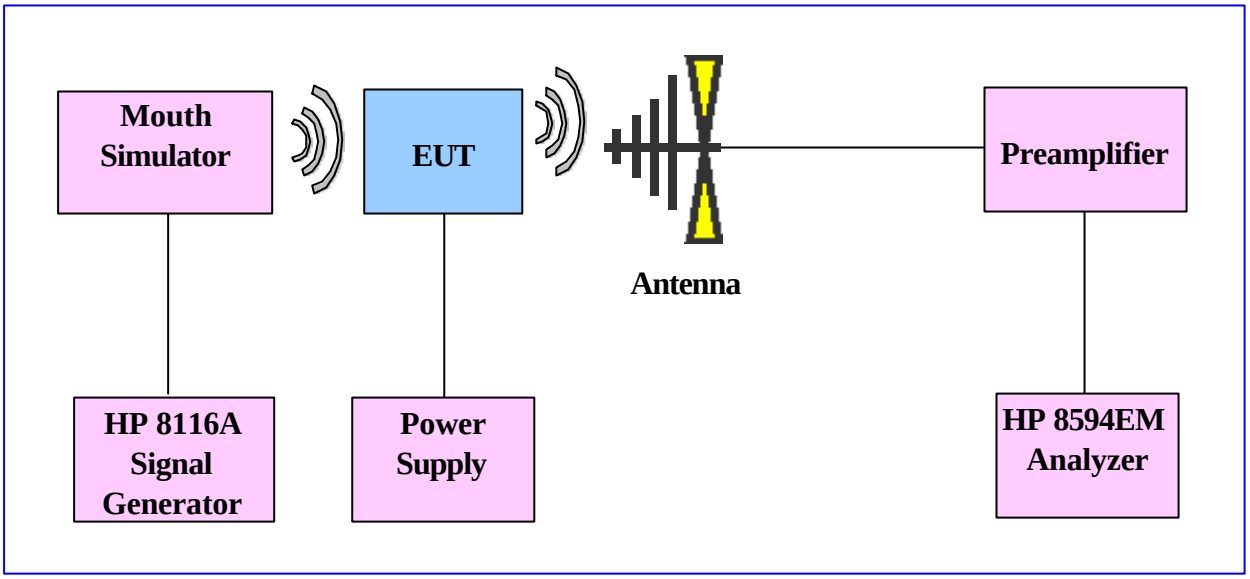
Measurement Result (ERP)

Channel / Frequency	AP	E.R.P	
CH8 / 462.5750 MHz	Vertical	23.713 dBm	235.125 mW

Vertical > Horizontal

Chapter 3 2.1047(a)(b) Modulation Characteristics Measurement

Test Setup



List of test instrument

Manufacturer	Device	Model No.	Input Impedance
HP	Dynamic Signal Analyzer	HP35660A	50
HP	Signal Generator 50 MHz	HP8116A	50
SCHAFFNER	Bi-log Antenna	CBL6141A	50
Farnell	Modulation Meter	AMM2000	50
TRC	Preamplifier	TRC001	50

2.1047(a)(b) Audio Frequency Response

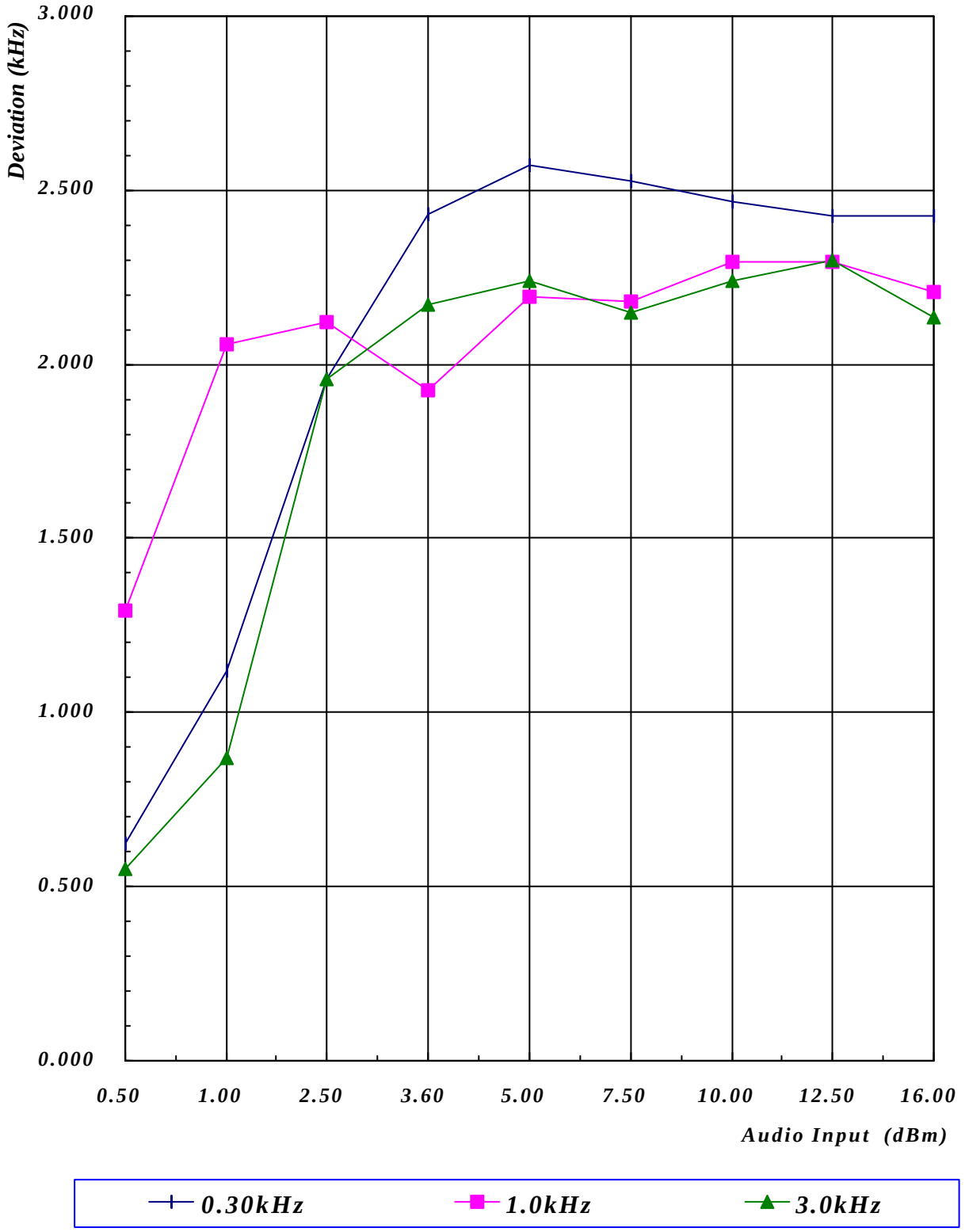
The audio frequency response was measured in accordance with TIA / EIA Specification 603. The audio frequency response curve is shown on the next page. The audio signal was fed into a dummy microphone circuit and into the microphone connector. The input required to produce 30 percent modulation level was measured. Test result in following.

Modulation Frequency Response

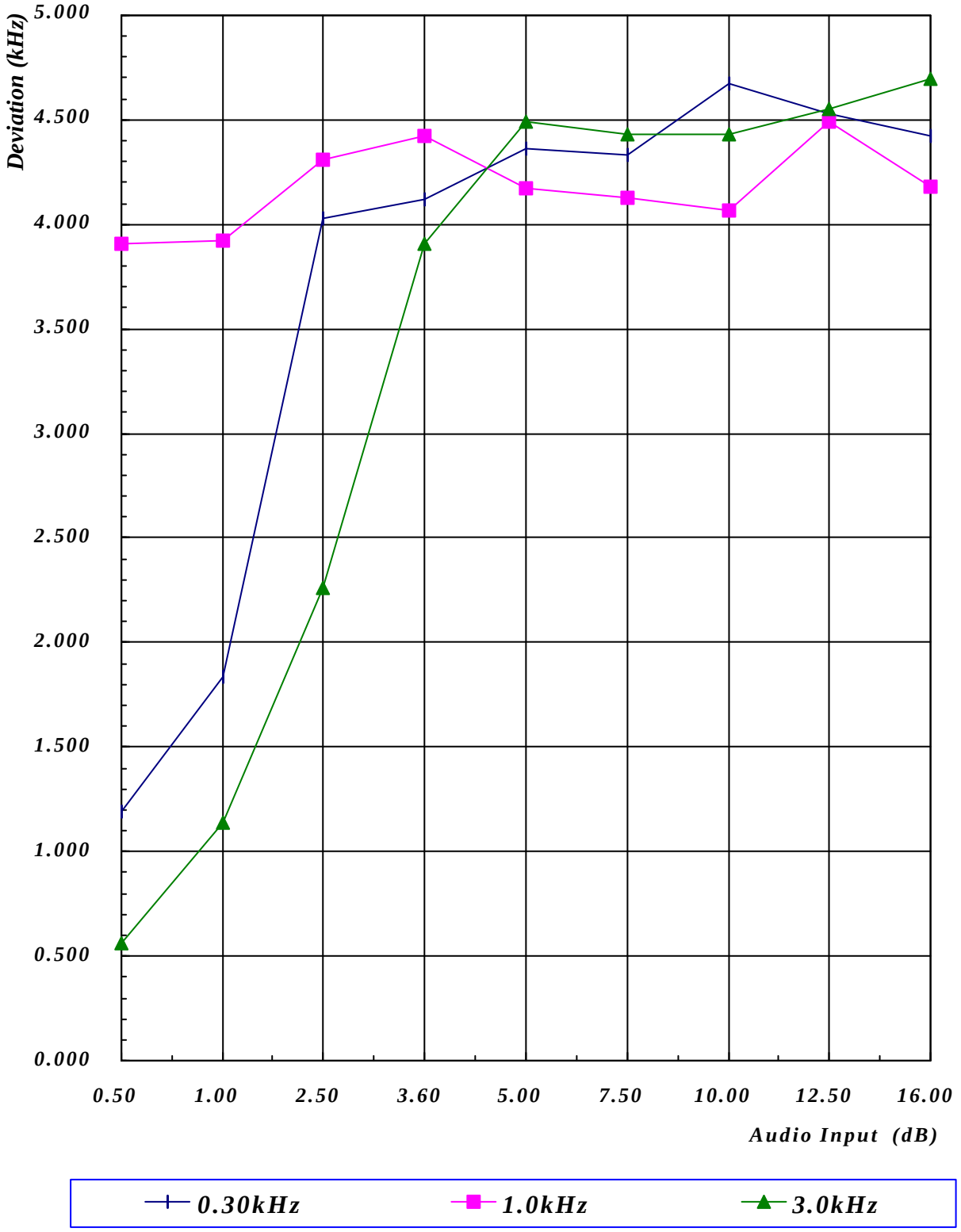
2.1047(b) Audio input versus modulation

The audio input level needed for a particular per percentage of modulation was measured in accordance with TIA/EIA Specification 603. The audio input curves versus modulation are on the following page. Curves are provided for audio input frequencies of 300, 1000 and 3000 Hz. Test result in following

Modulation Limiting Measurement Channel-8 Positive



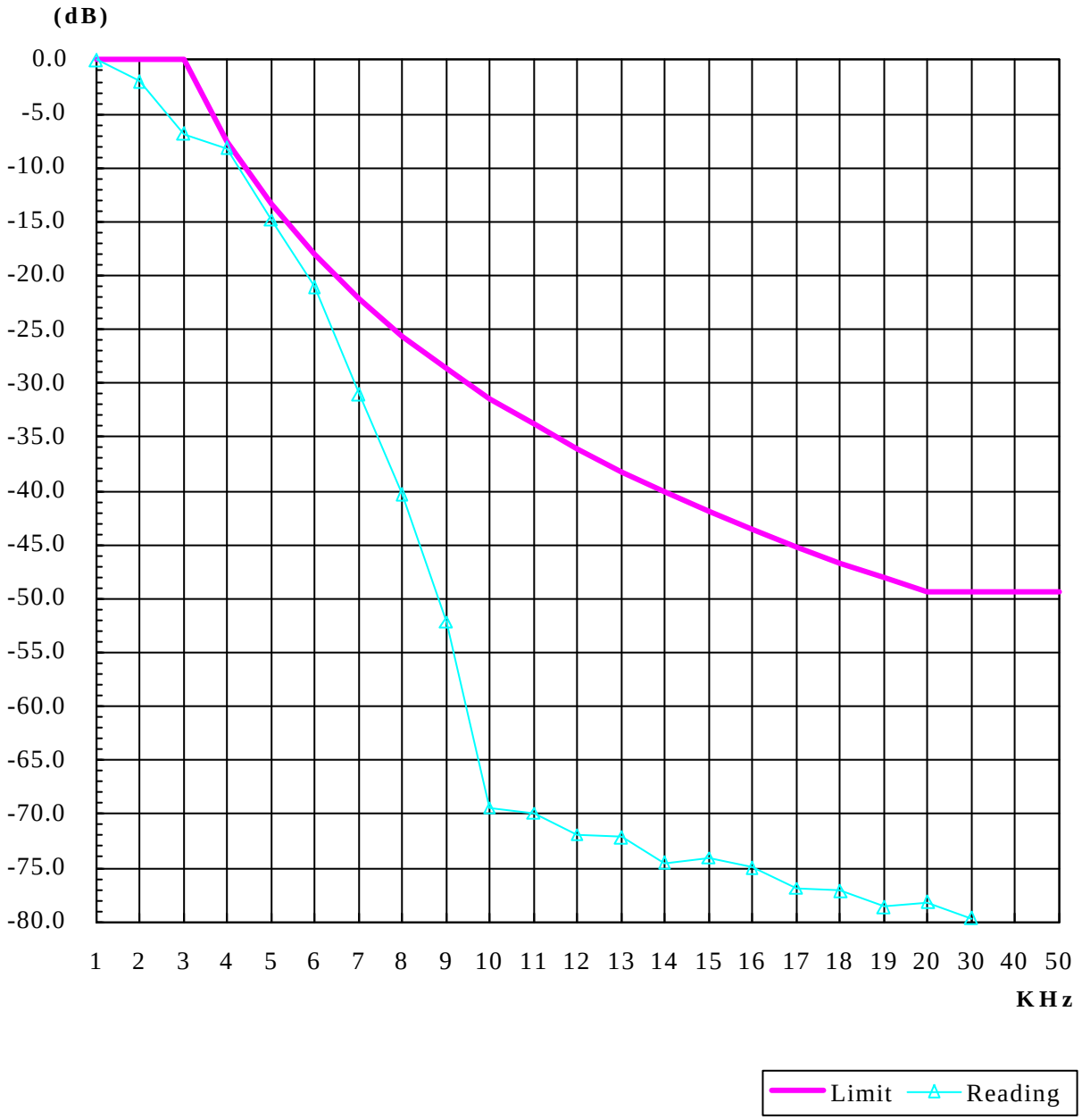
Modulation Limiting Measurement Channel-8 Negative



95.637 Modulation Limiting

Post Limited Filter Each GMRS transmitter, except a mobile station transmitter with a power of 2.5 Watts or less, must be equipped with an audio low pass filter. At any frequency between 3kHz and 20kHz the filter must have an attenuation of 60 log (f / 3) greater than the attenuation at 1kHz. Test result in following.

Audio Low Pass Filter Response

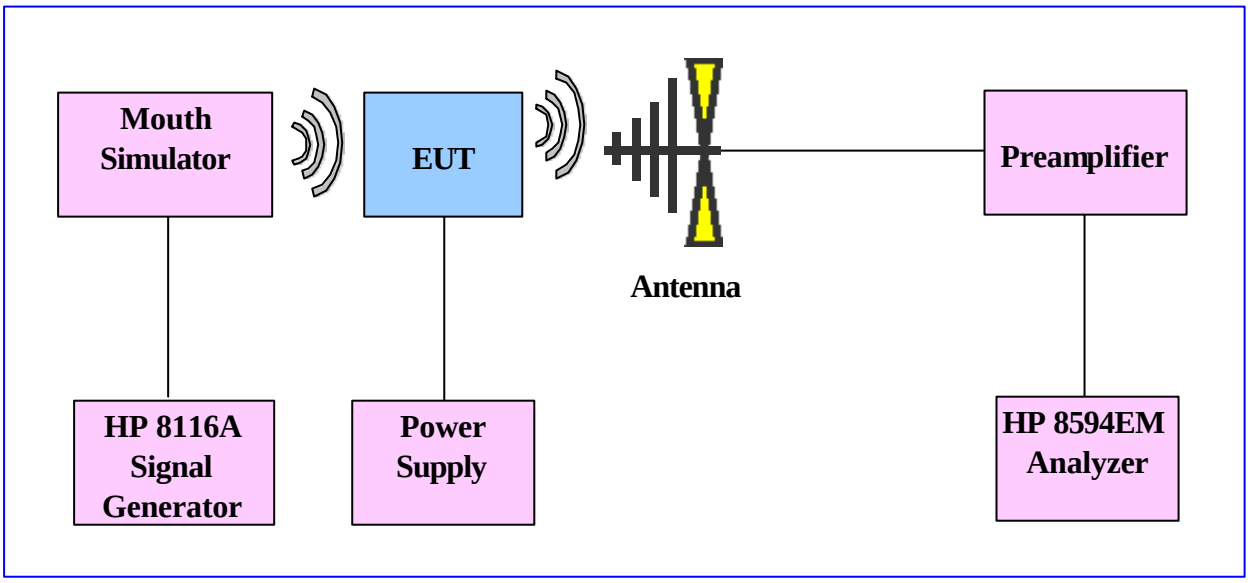


Chapter 4 2.1049 Occupied Bandwidth Measurement

Rules and Specification Limits

95.635 (b)(1)(3)(7) At least 25dB on any frequency removed from the center of the authorized BW by more than 50% up to and including 100% of the authorized BW. At least 35 dB on any frequency removed from the center of the authorized BW by more than 100% up to and including 250% of the authorized BW. At least 43 + 10 Log10(T) on any frequency removed from the center of the authorized BW by more than 250%.

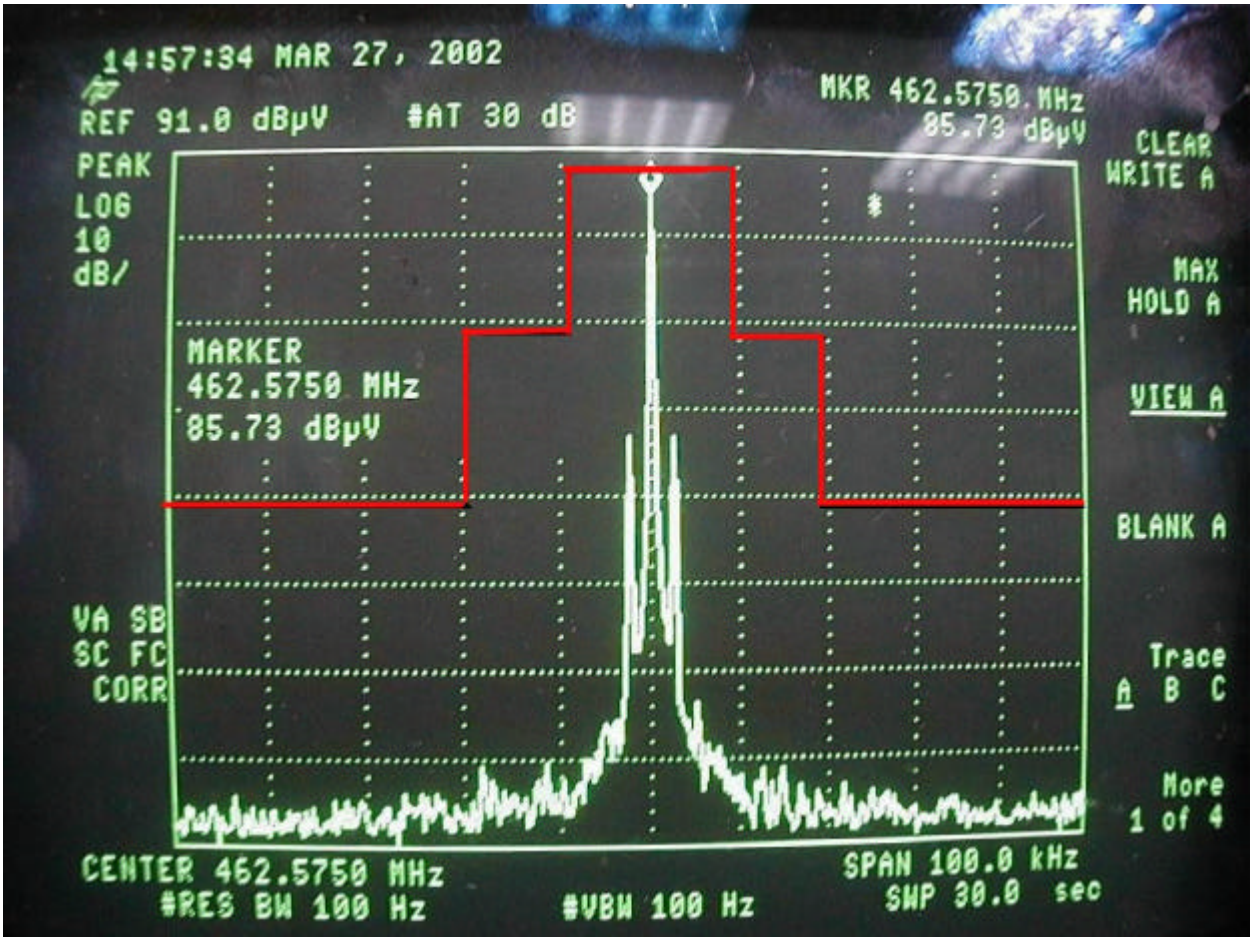
Test Setup



List of test Instrument

Instrument Name	Model No.	Brand	Input Impedance
Spectrum analyzer (9K~1.8GHz)	8594EM	HP	50
Preamplifier (30MHz~1GHz)	TRC001	TRC	50
Signal Generator 50 MHz	HP8116A	HP	50
Bi-log Antenna	CBL6141A	SCHAFFNER	50

Test Result


14:57:34 MAR 27, 2002
REF 91.0 dBµV
#AT 30 dB
MKR 462.5750 MHz
85.73 dBµV
PEAK
LOG
10
dB/
MARKER
462.5750 MHz
85.73 dBµV
CLEAR
WRITE A
MAX
HOLD A
VIEW A
BLANK A
VA SB
SC FC
CORR
Trace
A B C
More
1 of 4
CENTER 462.5750 MHz
#RES BW 100 Hz
#VBW 100 Hz
SPAN 100.0 kHz
SWP 30.0 sec

Chapter 5
2.1051 Spurious Emission at Antenna Terminals (Conducted)

Test Setup

Test Procedure

The test procedure used was TIA/EIA 603 S2.2.13 with the exception that the emission were recorded in dBc. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental.

List of Measurement Instruments

				Calibration Date	
Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
EMI Receiver	8546A	H P	3520A00242	06/29/01	06/29/02
Mini-Circuits			331BA04732		

Measurement Result

Test Conditions:

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

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

Table 1 30MHz to 5GHz [Channel 8]

Frequency	Spectrum Reading	Attn.	Cable Loss	Actual Value	Limit	Margin
MHz	dBm	dB	DB	dBm	dBm	dBc
231.250	-60.85	30.0	0.20	-30.65	15.593	46.243
693.305	-59.21	30.0	0.30	-28.91	15.593	44.503
924.380	-49.47	30.0	0.30	-19.17	15.593	34.763
1386.78	-66.19	30.0	0.30	-35.89	15.593	51.483
1849.00	-53.46	30.0	0.30	-23.16	15.593	38.753
2311.38	-52.92	30.0	0.30	-22.62	15.593	38.213
3237.80	-64.20	30.0	0.30	-33.90	15.593	49.493

Note:

1. Margin = Amplitude - limit
2. Attenuation required = 43 + 10 log (4.017W) = 8.12
   Limit = 121.09 – 8.12 = 112.97

Chapter 6
2.1053 Unwanted Radiation Measurement 95.635(b)(7)

Test procedure

The test procedure used was TIA/EIA 603 S2.2.12, the substitution method. The spectrum was scanned from 30 to at least the 10 harmonic of the fundamental.

List of Measurement Instruments

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
EMI Receiver	8546A	H P	3520A00242	06/29/01	06/29/02
RF Filter Section	85460A	H P	3448A00217	06/29/01	06/29/02
Bi-log Antenna	CBL6141A	Schaffner	4206	03/12/02	03/12/03
Switch/Control Unit (> 30MHz)	3488A	HP	N/A	11/20/01	11/20/02
Auto Switch Box (> 30MHz)	ASB-01	TRC	9904-01	11/20/01	11/20/02
Spectrum Analyzer	8564E	HP	US36433002	08/01/01	08/01/02
Microwave Preamplifier	83051A	HP	3232A00347	08/01/01	08/01/02
Horn Antenna	3115	EMCO	9704 – 5178	08/01/01	08/01/02
Anechoic Chamber (cable calibrated together)				05/20/01	05/20/02

Test Result

Table 3 Radiated Emissions for 30MHz to 1GHz [Horizontal, Channel 8]

Radiated Emission				Correction Factors	Corrected Amplitude	FCC Class B (3 M)	
Frequency (MHz)	Amplitude (dBμV/m)	Ant. H. (cm)	Table (°)	(dB)	(dBμV/m)	Limit (dBμV/m)	Margin (dB)
925.15	41.19	2.5	81	-30.35	71.54	112.97	-41.43

Table 4 Radiated Emissions for 30MHz to 1GHz [Vertical, Channel 8]

Radiated Emission				Correction Factors	Corrected Amplitude	FCC Class B (3 M)	
Frequency (MHz)	Amplitude (dBμV/m)	Ant. H. (cm)	Table (°)	(dB)	(dBμV/m)	Limit (dBμV/m)	Margin (dB)
925.15	46.85	2.50	35	-30.35	77.20	112.97	-35.77

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)

Table 5 Radiated Emissions for 1GHz to 18GHz [Horizontal, Channel 8]

Radiated Emission				Correction Factors	Corrected Amplitude		FCC Class B (3 M)	
Frequency (GHz)	Amplitude (dBμV/m)	Ant. H. (cm)	Table (°)	(dB)	***Peak*** (dBμV/m)	***Average*** (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1157.46	43.75	1.00	354	5.35	49.10	---	112.97	-63.87
1388.81	58.36	1.00	115	6.95	65.31	---	112.97	-47.66
1619.14	44.45	1.00	24	8.54	52.99	---	112.97	-59.98
1851.70	63.32	1.00	129	10.15	73.47	---	112.97	-39.50
2082.03	45.79	1.00	118	11.59	57.38	---	112.97	-55.59
2314.59	56.75	1.00	86	12.80	69.55	---	112.97	-43.42
2543.70	38.88	1.00	29	13.75	52.63	---	112.97	-60.34
2777.47	51.50	1.00	41	13.75	65.25	---	112.97	-47.72

Table 6 Radiated Emissions For 1GHz to 18GHz [Vertical, Channel 8]

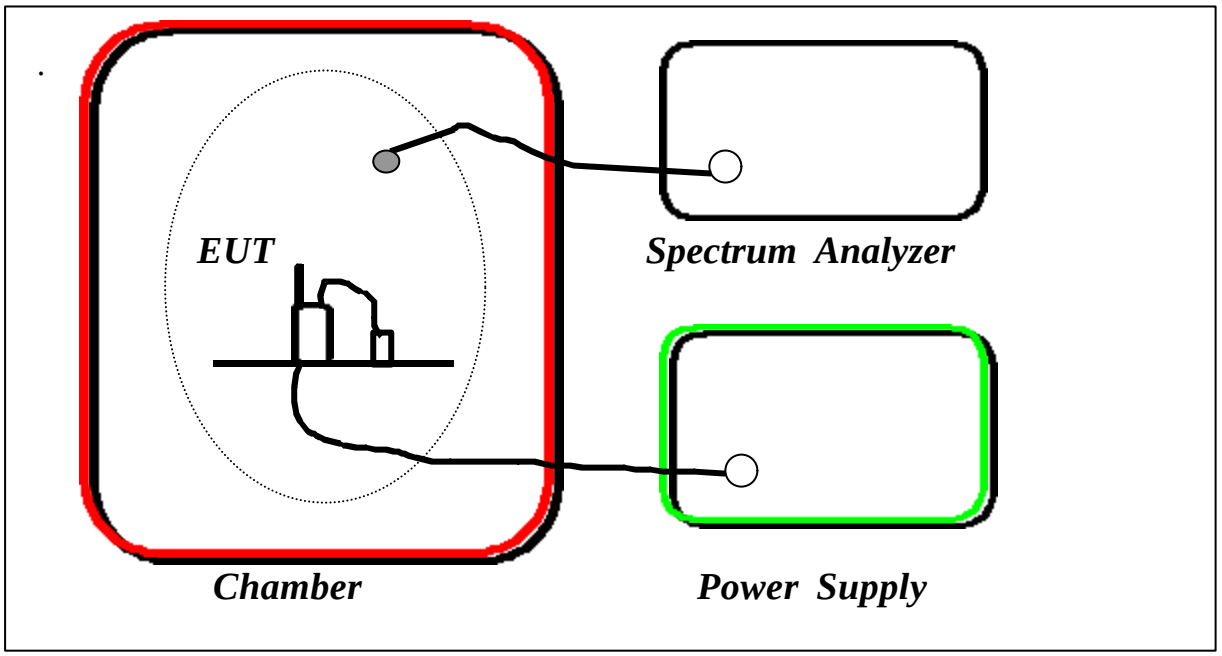
Radiated Emission				Correction Factors	Corrected Amplitude		FCC Class B (3 M)	
Frequency (GHz)	Amplitude (dBμV/m)	Ant. H. (cm)	Table (°)	(dB)	***Peak*** (dBμV/m)	***Average*** (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1156.25	44.75	1.00	193	5.34	50.09	---	112.97	-62.88
1388.81	52.59	1.00	128	6.95	59.54	---	112.97	-53.43
1619.14	41.45	1.00	16	8.54	49.99	---	112.97	-62.98
1851.70	57.08	1.00	89	10.15	67.23	---	112.97	-45.74
2082.03	38.37	1.00	321	11.59	49.96	---	112.97	-63.01
2314.59	54.34	1.00	191	12.80	67.14	---	112.97	-45.83
2544.91	40.64	1.00	64	13.75	54.39	---	112.97	-58.58
2777.47	44.01	1.00	8	13.75	57.76	---	112.97	-55.21

Note: 1. Margin = Corrected – Limit.

2. Peak Amplitude + Correction Factor = Corrected

Chapter 7
2.1055 Frequency Stability Tolerance Measurement 95.621(b)

Test Setup



Test Procedure

95.621(b) Temperature and Voltage tests were performed to verify that the frequency remains within the 0.0005%, 5ppm specification limit. The test was conducted as follows: The transmitter was placed in the temperature chamber as 25 degrees C and allowed to stabilize for one hour. The transmitter was keyed ON for one minute during which four frequency readings were recorded at 15 second intervals. The worse case number was taken for temperature plotting. The assigned channel frequency was then reduced to –30 degrees C after which the transmitter was again allowed to stability for one hour. The transmitter was keyed ON for one minute, and again frequency reading were noted at 15 second intervals. The worse case number was recorded for temperature plotting. This procedure was repeated in 10 degree increments up to + 50 degrees C.

Readings were also taken at plus and minus 15% of the battery voltage of 6 VDC.

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.	

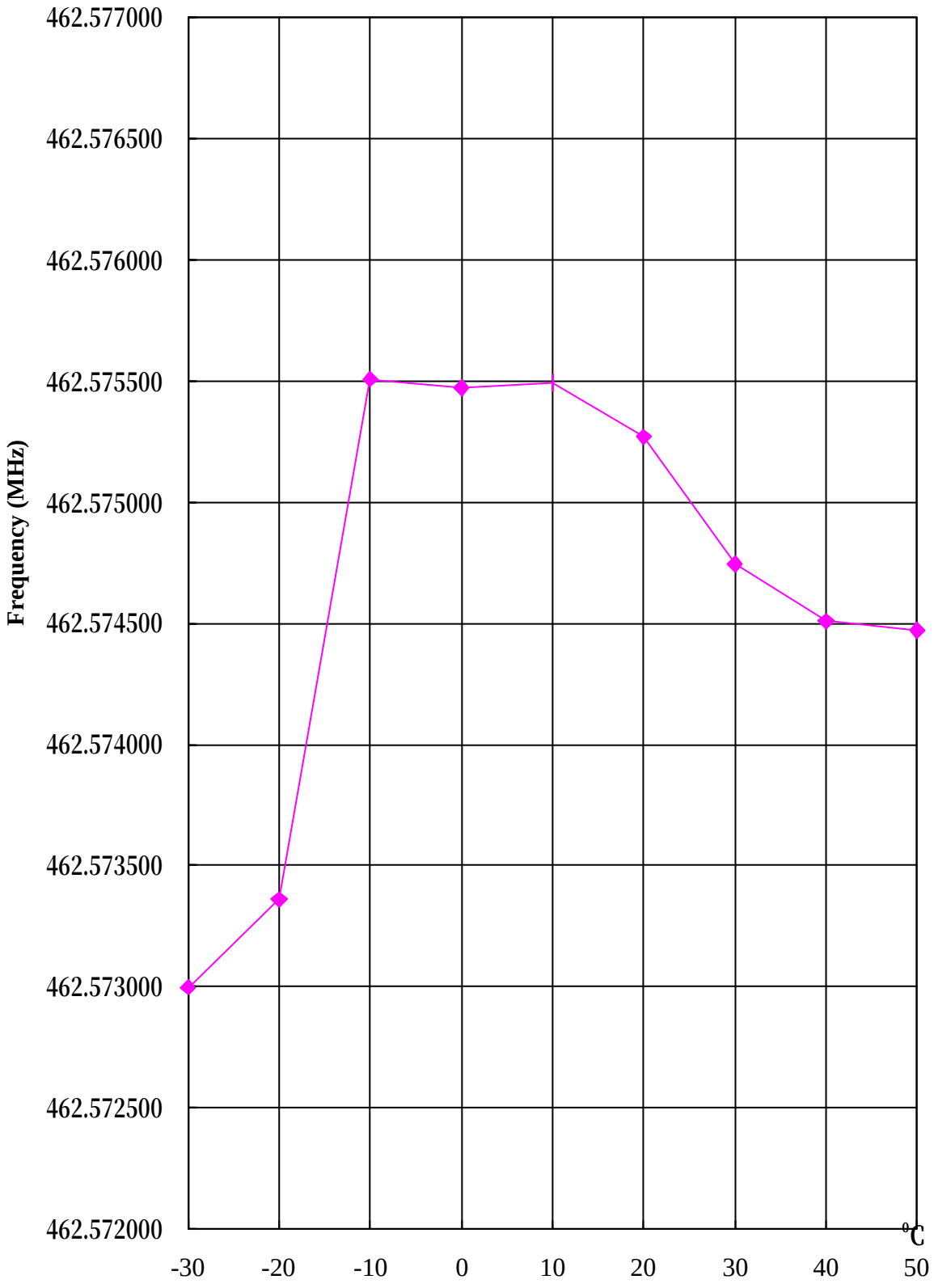
Measurement Result

A plot and table is presented which illustrates compliance with the rule where the center frequency are CH8– 462.5750 MHz

Temperature Variation Table

Temperature (Centigrade)	***Frequency (MHz)***	***Tolerance (MHz)***	***Limit (ppm)***
-30	462.5729962	462.5726871 ~ 462.5773129	5
-20	462.5733614		
-10	462.5755091		
0	462.5754737		
10	462.5754932		
20	462.5752710		
30	462.5747456		
40	462.5745100		
50	462.5744710		

Temperatuer Variation Vs. Frequency Chart



Voltage Variation

Supply Voltage (Volt)	*Frequency (MHz)*	*Tolerance (MHz)*
5.1 (85%)	462.5751710	462.5726871 ~ 462.5773129
6 (100%)	462.5752860	
6.9 (115%)	462.5751430	
Endpoint-Voltage: 2.50V	462.5742750	

Voltage Variation Vs. Frequency Chart