

INTERTEK TESTING SERVICES

MEASUREMENT/TECHNICAL REPORT

Application: RadioShack, A Division of Tandy Corporation
Trade Name: RadioShack
Model No.: 21-1810
Date: April 27, 1998

This report concerns (check one:) Original Grant Class II Change

Equipment Type: Family Radio Service, FRS

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes No

If yes, defer until: _____
date

Company Name agrees to notify the Commission by: _____
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

C. K. Lam
Intertek Testing Services.
2/F., Garment Centre,
576 Castle Peak Road,
Kowloon, Hong Kong.
Phone: 852-2746-8211
Fax: 852-2785-5487

INTERTEK TESTING SERVICES

Table of Contents

1.0 <u>General Description</u>	2
1.1 Product Description.....	2
1.2 Related Submittal(s) Grants.....	3
1.3 Test Methodology.....	3
1.4 Test Facility.....	3
2.0 <u>System Test Configuration</u>	5
2.1 Justification.....	5
2.2 EUT Exercising Software.....	6
2.3 Special Accessories.....	6
2.4 Equipment Modification.....	6
3.0 <u>RF Output Power (Section 95.639(d))</u>	8
4.0 <u>Modulation Characteristics (Section 95.637(a))</u>	12
4.1 Modulation Frequency Response.....	14
4.2 Modulation Limiting Characteristic.....	16
5.0 <u>Occupied Bandwidth (Section 95.633(c))</u>	21
6.0 <u>Spurious Emission (Section 95.635(b))</u>	20
6.1 Field Strength of Spurious Radiation.....	27
7.0 <u>Frequency Stability (Section 95.627)</u>	34
7.1 Frequency Tolerance.....	35
7.2 Voltage Extreme Condition.....	38
7.3 Temperature Extreme Condition.....	42
8.0 <u>Technical Specifications</u>	45
8.1 Block Diagram.....	46
8.2 Schematic Diagram.....	47

INTERTEK TESTING SERVICES

Table of Contents (Cont'd.)

9.0 Product Labelling	49
9.1 Label Artwork.....	50
9.2 Label Location.....	51
10.0 Equipment Photographs	53
11.0 Instruction Manual	55

INTERTEK TESTING SERVICES

Table of Contents (Cont'd..)

Figure 4.1 Modulation Frequency Response Graph	14
Figure 4.2 Modulation Limiting Characteristic Graph	16
Figure 5.0 Bandwidth Plot.....	21
Figure 6.1 Spurious Emission Plot	24
Figure 8.1 Block Diagram	46
Figure 8.2 Schematic Diagram.....	47

INTERTEK TESTING SERVICES

EXHIBIT 1

GENERAL DESCRIPTION

INTERTEK TESTING SERVICES

1.0 General Description

1.1 Product Description

The 21-1810 is a 14 Channel Family Radio Service (FRS) transceiver. The unit is powered from 4.5V Vdc, (3 x "AA" batteries).

Transmitter portion:

- i) Type of emission: F3E
- ii) Frequency Range: 462.5625 MHz to 462.7125 MHz
467.5625 MHz to 467.7125 MHz
- iii) Maximum Power Rating: 0.5 Watt

Receiver Portion:

- i) Type of Receiver: Superheterodyne receiver
- ii) Tuning Frequency: 462.5625 MHz to 462.7125 MHz
462.5625 MHz to 467.7125 MHz
- iii) Local oscillator: 415 MHz to 425 MHz
- iv) IF: 45 MHz, 10.695 MHz, 0.455 MHz

The device transmits CTCSS subaudible tone (50 Hz to 300 Hz) which is used to identify user group to avoid unwanted signal interference continuously only while the user is talking, And an audible ringer tone (more than 300 Hz) will be transmitted less than 5 second for the paging function in the group.

The brief circuit description is listed in the following page.

CIRCUIT DESCRIPTION

General

The 21-1810 FRS is a 14 channel, crystal controlled handy transceiver which consists of a RF board and a Digital board. Power is supplied by 4.5V DC (1.5V "AA" alkaline battery × 3 pcs. or rechargeable battery × 3 pcs). Refer to the Block Diagram and the Schematic Diagram as you read the following descriptions.

RF Board

PLL synthesizer section:

The FRS 21-1810 uses a Phase-Locked-Loop circuit (PLL) to synthesize the local-oscillator frequencies for receiver and transmitter.

It employs one IC (TB31202FN) and only one crystal (12.8MHz TCXO). The IC is a Bi-CMOS integrated circuit containing a reference oscillator, a reference divider(1/8190), two phase comparators, two programmable counters.

The programmable divider directly divides the output of the VCO (voltage controlled oscillator) down to 12.8MHz. Crystal Y3 provides a reliable frequency standard which controls the local-oscillator frequencies. The reference-frequency divider inside U1 counts down the oscillator signal to 12.8MHz and passes it on to the phase comparator, where it is compared with the 12.8MHz signal from the external TCXO. An error voltage is generated by the phase detector, which is proportional to the phase difference between the two 12.8MHz signals.

Upon receiving, the error voltage appears at pin 14 of U1 and passes through the loop filter, where the error voltage is integrated and harmonics and noise are filtered out. The resulting DC voltage is applied to the varactor diodes D6 and D7. On the other hand, when the unit is transmitting, the error voltage appears at pin 3 of U1 and passes through another loop filter. The resulting DC voltage is applied to varactor diodes D3 and D4. Their capacitances vary with the applied DC voltage. Because of these capacitances change, the output frequency of the VCO is corrected. With proper circuit design and precise adjustments, the VCO frequency is accurate and precise when the system is "lock".

This means that the phase comparator senses no phase differences between the two 12.8MHz signals, and the VCO generates a frequency that is as accurate and stable as the reference crystal oscillator. The transmitter VCO circuit consists of Q7, D3, D4 and D5 while the receiver VCO consists of Q3, D6 and D7.

Both circuits are connected in the form of Colpitts oscillators. The transmitter VCO circuit generates a signal ranging from 460MHz to 470MHz. The receiver VCO circuit generates a signal ranging from 415MHz to 425MHz.

Transmitter Circuit

Modulation

The mic input is fed to pin 14 of U205 (TB31224F-NL) which is a limiting amplifier and the audio signal is amplified via the mic amp and pass through an internal active filter which is inside the U205. The output from pin 9 of U205 is then fed to the high pass filter which is in pin 22 of U206 (MX-465). The high pass filter helping to avoid talk-off due to intermodulation of speech frequencies with the transmitted CTCSS tone. The output of the high pass filter from pin 20 is applied to modulator diode D5 via the potential divider network formed by R297, R315 and R314. The modulation level of speech can be adjusted by tuning the variable resistor R315.

RF Amplification

The VCO output from Q7 is fed via buffer amplifier Q12 to two stages of class A RF pre-amplifiers formed by Q13 and Q14. The output from Q14 is then fed to class AB driving amplifier Q9. The output from Q9 drive the class C RF power amplifier Q8 and then radiated by antenna. Switching diodes D1 and D2 are conducted while transmitting to protect the receiver front end amplifier.

Receiver Circuit

The receiver is a triple conversion superheterodyne with first IF at 45MHz, the second IF at 10.695MHz and the third IF at 455KHz. The received RF signal through the antenna passes on the low pass filter formed by L1, L9, C22 and C24 and then is applied to low noise amplifier Q2. The amplified signal output from Q2 passes through the band pass filter formed by C1-C8, L1-L3, C11, C12, C15 and L6. The filter only allows the required signal to get into the first mixer Q1. The synthesizer supplies the first local oscillator 45MHz below the received frequency to the base of Q1 and mixed with input signal. The 45MHz IF output from the mixer passes through two crystal filters and buffer amplifier Q10 and then is applied to Digital board.

Digital Board

IF Demodulation

The 45MHz IF signal is applied to combo chip U205 which consists of an programmable RX VCO, 10.24MHz crystal oscillator, two mixers, quadrature detector, active filter, noise filter, voice compressor and voice expander. The 1st IF is down converted to 10.695MHz by mixing RF signal with RX-VCO signal. The second IF is transformed to

third IF in 2nd mixer by mixing the local oscillator signal which also provides PLL reference frequency. Quadrature detection with external tuning coil L201 demodulates audio signal from pin 27 (AF OUT).

Audio amplifier

The audio signal is applied to both pin 24 and pin 23 of U208 which consists 300Hz high pass filter for both TX and RX, 50-300Hz band pass filter for CTCSS tone and a CTCSS tone generator. The RX audio output from the filter at pin 19 of U208 is then applied to pre-amp at pin 15 of U205. The amplified signal is internally routed to expander of U205 to get better S/N. The output from expander at pin 19 of U205 is fed to audio amplifier IC U207 via the digital volume control circuit formed by Q202-Q205. The audio is amplified by U207 and then is applied to speaker. The supply voltage of U207 is controlled by Q210 and Q208.

Battery detector

U206 is a voltage comparator which compares the divided battery voltage with reference voltage (set at 1V). Q201 is turned on first when unit is turned on. The voltage at pin 3 of U206 is divided by R254 and R260. The voltage level at pin 3 of U206 drops as the battery voltage drops. Once the battery voltage drops to the pre-set value, Q211 is turned on and Q201 is turned off. The voltage level at pin 3 of U206 is now divided by R254 and R259. Finally, when Q214 is turned on, the voltage level at pin 3 of U206 is then divided by R254 and R258.

Voltage regulator

The unit operates with 3 × AA batteries (4.5V). The batteries supply power to the regulators U210 and U212. U210 is always enabled while U212 is controlled by Q219. U210 regulates a 3V which is supplied to U209 (MCU) as long as the unit is on. U212 regulates a 3V supply to all circuits connected to V+. For power saving, V+ is turning on and off while the unit is not active.

INTERTEK TESTING SERVICES

EXHIBIT 2

SYSTEM TEST CONFIGURATION

INTERTEK TESTING SERVICES

1.2 Related Submittal(s) Grants

This is an Application for Certification of the transmitter portion of a FRS Transceiver. The receiver section of the FRS Transceiver is subject to verification process.

1.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.4 (1992). All measurement were performed in Open Area Test Sites. Preliminary scans were performed in the Open Area Test Sites only to determine worst case modes. For each scan, the procedure of maximizing emissions in Appendices D and E were followed. All Radiated tests were performed at an antenna the EUT distance of 3 meters, unless stated otherwise in the **“Justification Section”** of this Application.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the emission data is located at Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong. The test facility and site measurement data have been fully placed on file with the FCC.

INTERTEK TESTING SERVICES

2.0 System Test Configuration

2.1 Justification

The device was configured for testing in a typical fashion (as a customer would normally use it). The device was mounted to a cardboard box, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes. When the radiated emissions are measured.

The device was powered by three fully charged 1.5V "AA" batteries (4.5Vdc).

The frequency range from 30 MHz to 10th harmonics was searched for spurious emissions from the device. Only those emissions reported were detected. All other emissions were at least 20 dB below the applicable limits.

INTERTEK TESTING SERVICES

2.2 EUT Exercising Software

There was no special software to exercise the device. Once the unit is powered on, a signal is transmitted.

2.3 Special Accessories

A special headset is provided by client for compliance of this device.

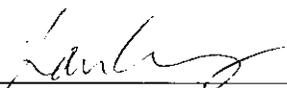
2.4 Equipment Modification

Any modification installed previous to testing by Radio Shack, A Division of Tandy Corporation will be incorporated in each production model sold/leased in the United States.

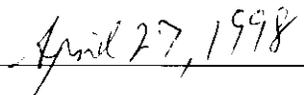
No modification were installed by Intertek Testing Services.

Confirmed by:

C. K. Lam
Assistant Manager
Intertek Testing Services
Agent for Radio Shack, A Division of Tandy Corporation



Signature



Date

INTERTEK TESTING SERVICES

EXHIBIT 3

RF POWER OUTPUT

INTERTEK TESTING SERVICES

3.0 RF Power Output (Section 2.985(a))

A. Equipment Used

Equipment	Brand Name	Model No.
Biconical Antenna	CDI	B300
Test receiver	Rohde & Schwarz	ESVS30
RF Filter	Tailithic	3VF
Tuned Dipole Antenna	CDI	Robert Antenna 4
Signal Generator	Maconi	2024

B. Testing Procedure

1. On a test site, the EUT shall be placed at 1.5m height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarisation located 3m from EUT to correspond to the frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the quasi-peak detector is used for the measurement.
4. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.

INTERTEK TESTING SERVICES

6. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a tuned dipole (substitution antenna).
10. The substitution antenna shall be orientated for vertical polarisation and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarisation.
17. The measure of the effective radiated power is the larger of the two levels recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.

INTERTEK TESTING SERVICES

Table 1

**RadioShack, A Division of Tandy Corporation
RadioShack 21-1810**

Transmission Power

Channel	Frequency (MHz)	Effectived Radiated Power (W)	Limit (W)	Margin (W)
1	462.5625	0.363	0.5	-0.137
2	462.5875	0.372	0.5	-0.128
3	462.6125	0.380	0.5	-0.120
4	462.6375	0.389	0.5	-0.111
5	462.6675	0.389	0.5	-0.111
6	462.6875	0.380	0.5	-0.120
7	462.7125	0.380	0.5	-0.120
8	467.5625	0.295	0.5	-0.205
9	467.5875	0.302	0.5	-0.198
10	467.6125	0.302	0.5	-0.198
11	467.6375	0.302	0.5	-0.198
12	467.6675	0.309	0.5	-0.191
13	467.6875	0.302	0.5	-0.198
14	47.7125	0.331	0.5	-0.169

Notes: Negative sign in the margin column shows the value below limits.

Test Engineer: Wilson S. K. Loke

Date of Test: April 14, 1998

INTERTEK TESTING SERVICES

EXHIBIT 4

MODULATION CHARACTERISTICS

INTERTEK TESTING SERVICES

4.0 Modulation Characteristics

In order to satisfy the 95.637(a) requirement, Modulation Frequency Response, Modulation Limit Characteristics and Over Modulation Transient Response, are attached in Exhibit 4.1 & 4.2.

Plots for each tests are included in the following sections.

INTERTEK TESTING SERVICES

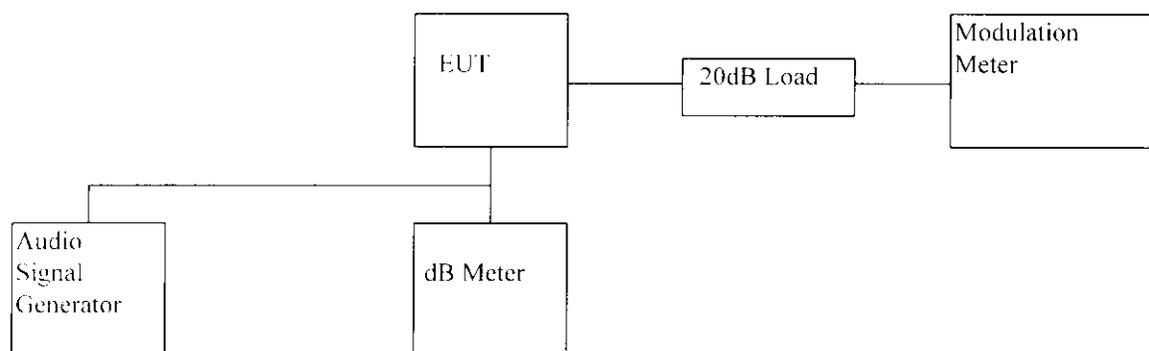
4.1 Modulation Frequency Response

A. Test Equipment

Equipment	Brand Name	Model No.
Audio Signal Generator	Leader	LFG-1300S
dB meter	Leader	LMV-182A
20 dB RF Load	Bird	8304-200-N
Modulation Meter	Marconi Instrument	2945

B. Testing Procedure

- 1) Set-up the test equipment in the following configuration:



- 2) Set the audio signal generator frequency to the sound pressure level 97.0dB SPL at the microphone of the EUT.
- 3) The frequency of the audio signal generator is changed from 300Hz to 4kHz.
- 4) Record the frequency deviation.

INTERTEK TESTING SERVICES

C. Test Result

Table 2

**RadioShack, A Division of Tandy Corporation
RadioShack 21-1810**

Modulation Frequency Response

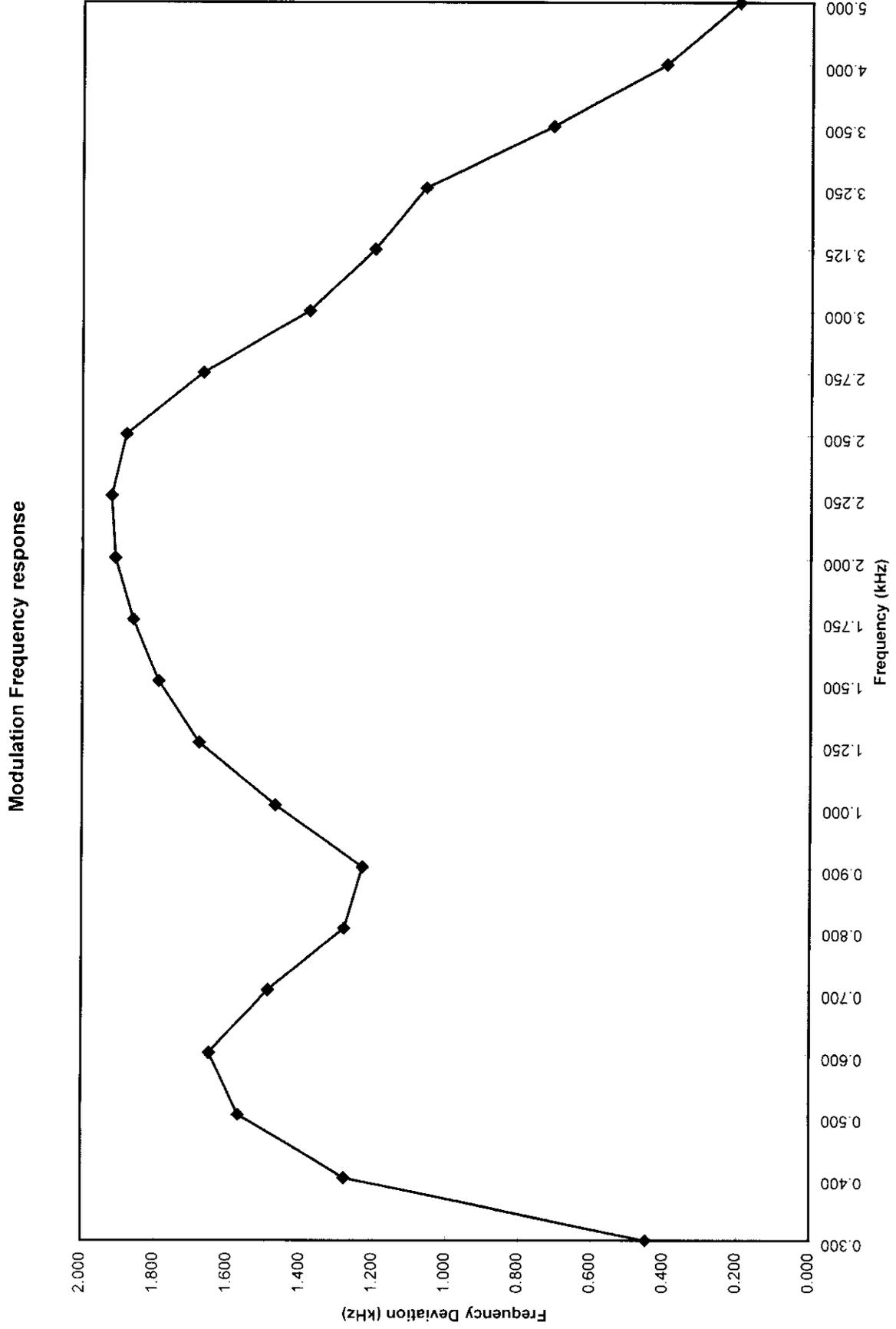
Test Channel : 4

Input level = 97.0dB SPL

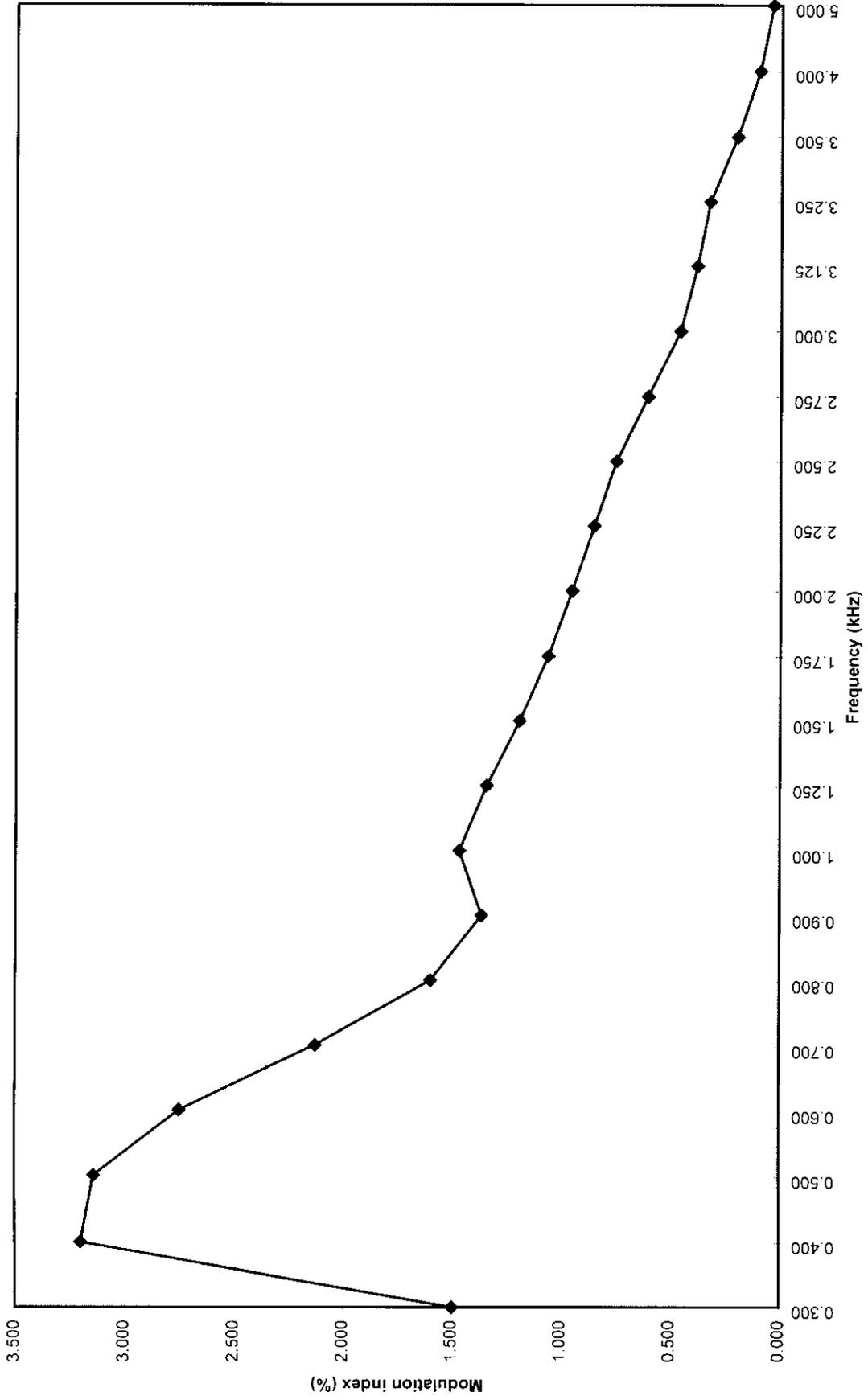
Modulation Frequency (Hz)	Frequency deviation (kHz)	Modulation index (%)
300	0.36	1.2
400	1.00	2.5
500	1.40	2.8
600	1.36	2.3
700	1.39	2.0
800	1.20	1.5
900	1.16	1.3
1000	1.31	1.3
1250	1.79	1.4
1500	1.90	1.3
1750	1.95	1.1
2000	2.00	1.0
2250	2.01	0.9
2500	1.92	0.8
2750	1.74	0.6
3000	1.40	0.5
3125	1.25	0.4
3250	1.08	0.3
3500	0.8	0.2
4000	0.45	0.1
5000	0.25	0.1

Test Engineer: Wilson S. K. Loke

Date of Test: April 14, 1998



Modulation Frequency Response



INTERTEK TESTING SERVICES

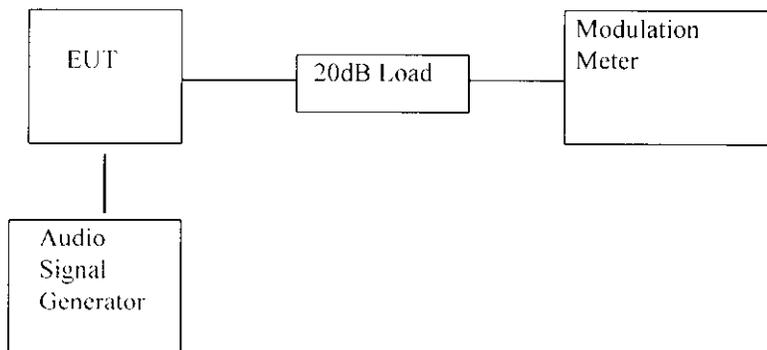
4.2 Modulation Limiting Characteristics (Section 2.987(b))

A. Test Equipment

Equipment	Brand Name	Model No.
Audio Signal Generator	Leader	LFG-1300S
20 dB RF Load	Bird	8304-200-N
Modulation Meter	Marconi	2950

B. Testing Procedure

- 1) Set-up the test equipment in the following configuration:



- 2) Set the frequency of the audio signal generator to 500Hz and adjust the level from 47dBSPL to 117dBSPL.
- 3) Record the maximum value of plus or minus peak frequency deviation.
- 4) Repeat the above procedure with frequency 1000Hz, 2500Hz & 3125Hz.

INTERTEK TESTING SERVICES

C. Test Result

Table 3

**RadioShack, A Division of Tandy Corporation
RadioShack 21-1810**

Modulation Limiting Characteristics

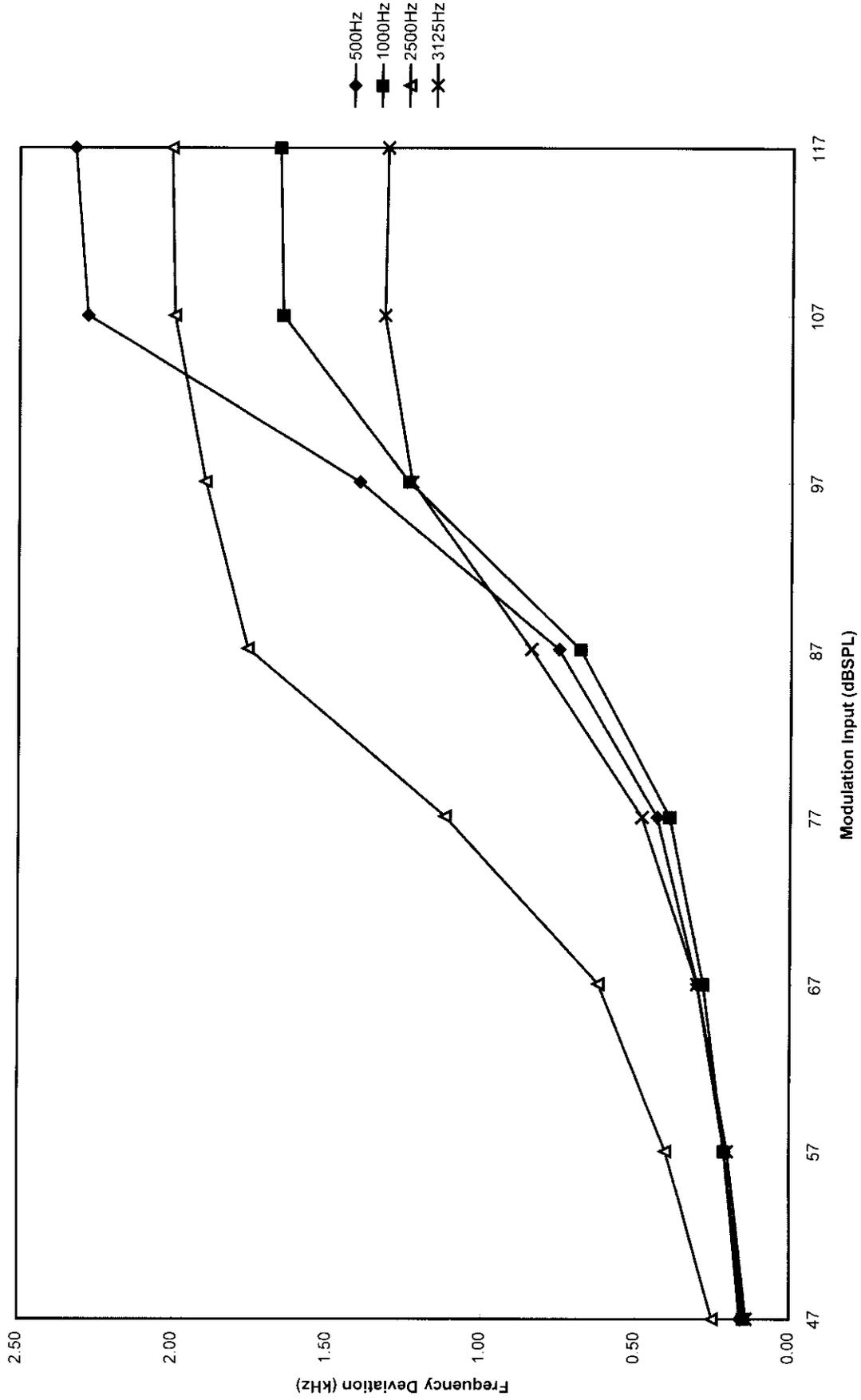
Test Channel : 4

Modulation Input (dB SPL)	Peak Frequency deviation (kHz) at 500Hz	Peak Frequency deviation (kHz) at 1000Hz	Peak Frequency deviation (kHz) at 2500Hz	Peak Frequency deviation (kHz) at 3125Hz
47	0.16	0.15	0.25	0.14
57	0.21	0.21	0.40	0.20
67	0.30	0.28	0.62	0.30
77	0.43	0.39	1.12	0.48
87	0.75	0.68	1.76	0.84
97	1.40	1.24	1.90	1.23
107	2.30	1.65	2.00	1.32
117	2.31	1.68	2.08	1.38

Test Engineer: Wilson S. K. Loke

Date of Test: April 14, 1998

Modulation Limiting Characteristic



INTERTEK TESTING SERVICES

EXHIBIT 5

OCCUPIED BANDWIDTH

INTERTEK TESTING SERVICES

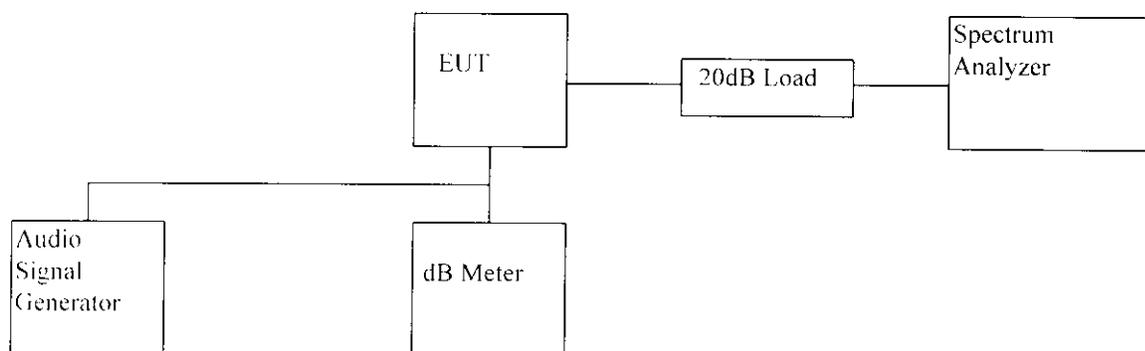
5.0 Occupied Bandwidth (Section 95.633(c))

A. Test Equipment

Equipment	Brand Name	Model No.
Audio Signal Generator	Leader	LFG-1300S
dB meter	Leader	LMV-182A
20 dB RF Load	Bird	8304-200-N
Spectrum Analyzer	Hewlett Packard	8951EM

B. Testing Procedure

- 1) Set-up the test equipment in the following configuration:



- 2) Set the level of audio signal generator to obtain 16 dB greater than required for 50% modulation.
- 3) The occupied bandwidth is measured with the spectrum analyzer set at 5kHz/div scan and 10dB/div.

C. Test Result

The occupied Bandwidth is measured to be 10.5 kHz.

Test Engineer: Wilson S. K. Loke

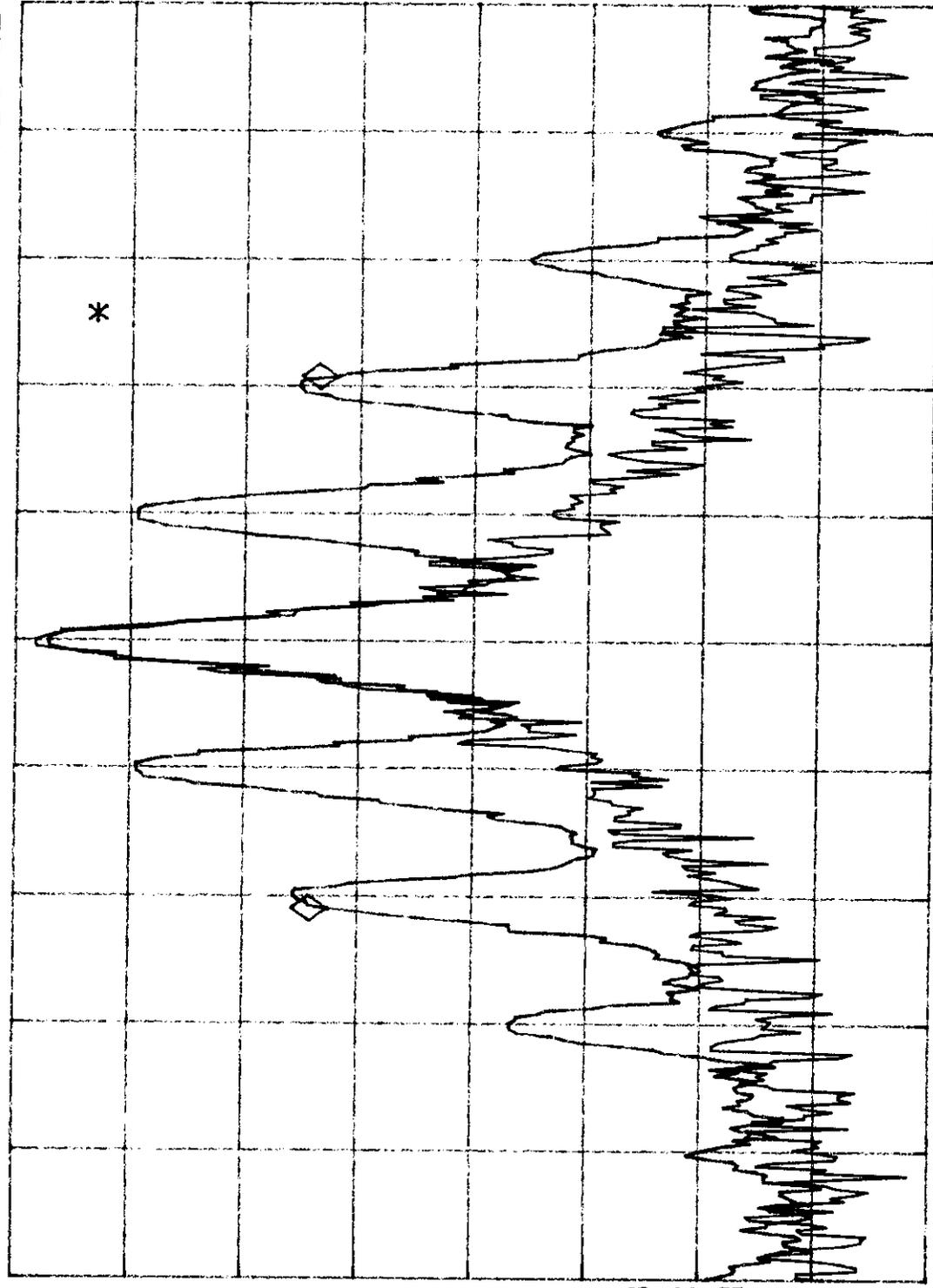
Date of Test: April 14, 1998

7/2

MKR 10.44 KHZ
- .61 dB

REF 117.0 dBμV AT 20 dB

PEAK
LOG
10
dB/



VA VB
SC FC
CORR

CENTER 462.63750 MHZ
RES BW 300 HZ
#VBW 3 MHZ
SPAN 25.00 KHZ
SWP 1.00 sec

hp

MKR 10.50 KHZ
.42 dB

AT 10 dB

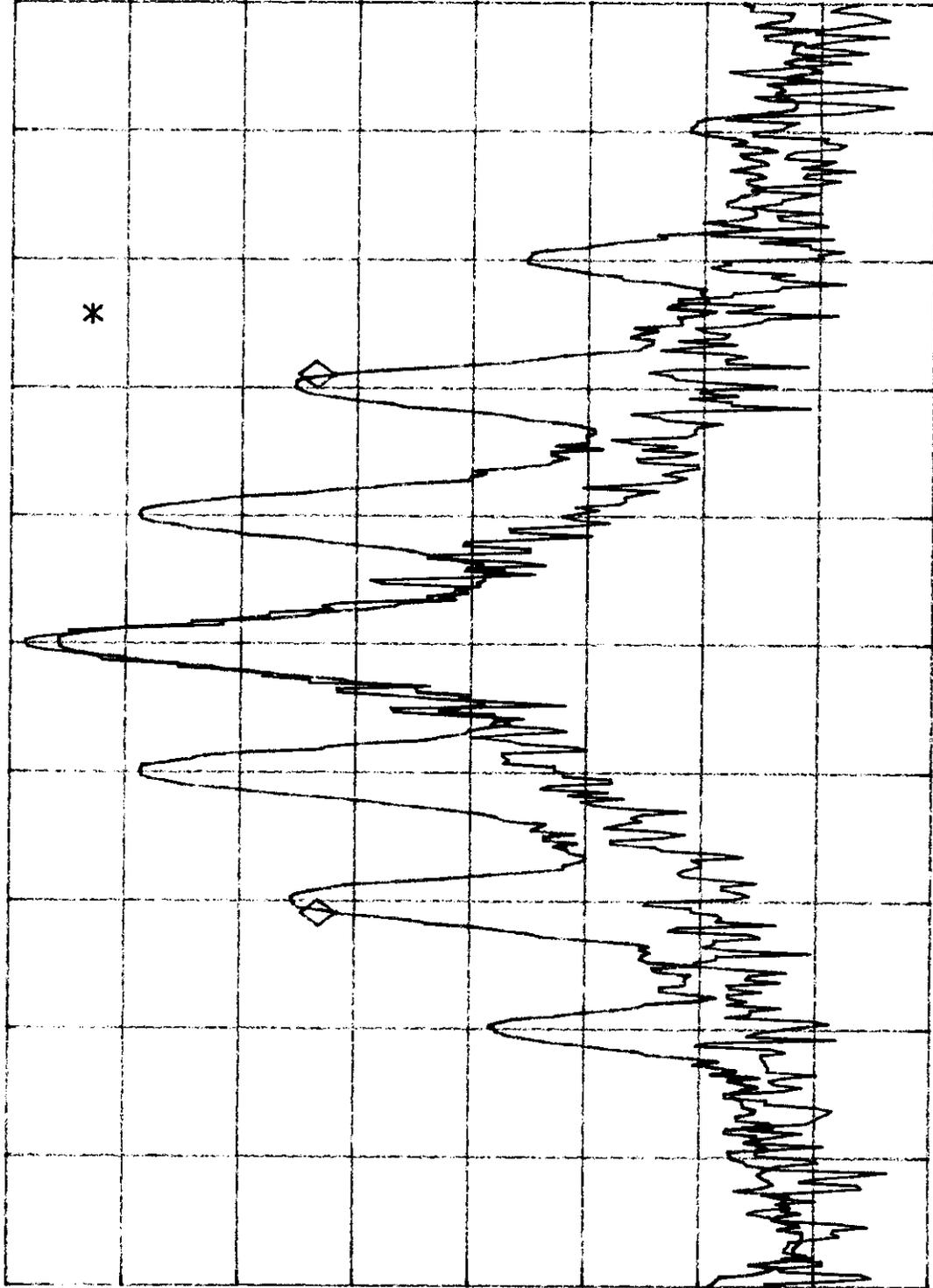
REF 95.0 dBμV

PEAK

LOG

10

dB/



VA VB
SC FC
CORR

CENTER 467.63750 MHz

RES BW 300 HZ

#VBW 3 MHz

SPAN 25.00 KHZ

SWP 1.00 sec

INTERTEK TESTING SERVICES

EXHIBIT 6

SPURIOUS EMISSION

INTERTEK TESTING SERVICES

6.0 Spurious Emission (Section 95.635)

In order to satisfy the 95.635 requirement, the spurious emission from the EUT are measured and shown in the Exhibit 6.1.

INTERTEK TESTING SERVICES

6.2 Field Strength of Spurious Radiation (Section 95.635)

A. Test Equipment

Equipment	Brand Name	Model No.
Antenna	CDI	B100,B200,B300, Horn
Test receiver	Rohde & Schwarz	ESVS30
RF Filter	Tailithic	3VF

B. Testing Procedure

Radiated emission measurements were performed according to the procedures in ANSI C63.4(1992). All measurements were performed in Open Area Test Sites located at Roof Top of Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong.

INTERTEK TESTING SERVICES

C. Test Result

RadioShack, A Division of Tandy Corporation RadioShack 21-1810

Table 4(a)

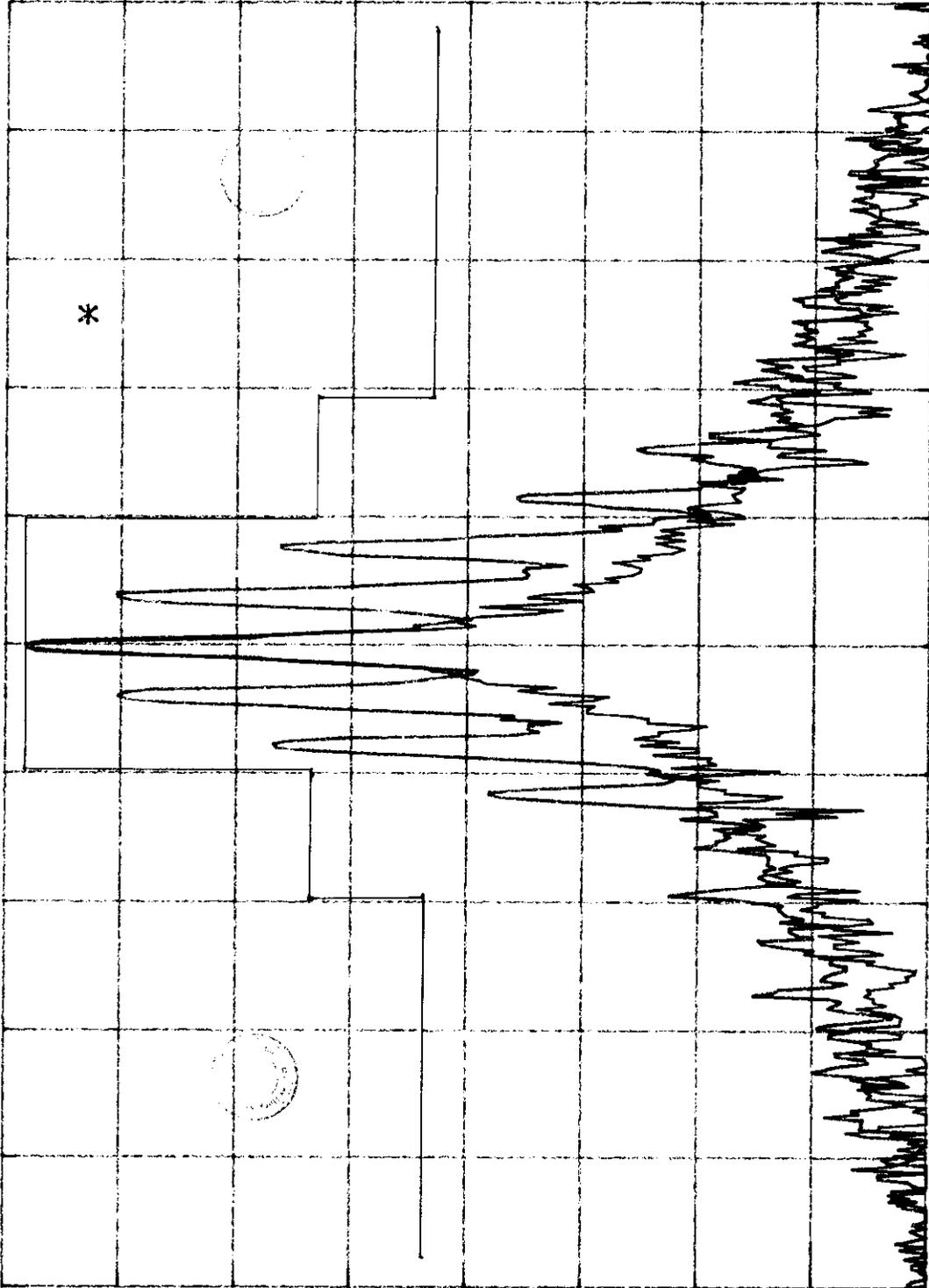
1. Unwanted emission from CARRIER $\pm 6.25\text{kHz}$ to Carrier $\pm 31.25\text{kHz}$ (Refer to the plots)

Region	Unwanted emission	
	Channel 4	Channel 11
CARRIER $\pm 6.25\text{kHz}$ to $\pm 12.5\text{kHz}$	$< 25\text{dB}$	$< 25\text{dB}$
CARRIER $\pm 12.5\text{kHz}$ to $\pm 31.25\text{kHz}$	$< 35\text{dB}$	$< 35\text{dB}$

hp

REF 117.0 dB μ V AT 20 dB

PEAK
LOG
10
dB/



VA VB
SC FC
CORR

CENTER 462.63750 MHz
#RES BW 300 Hz

SPAN 65.00 KHz
SWP 2.17 sec

hp

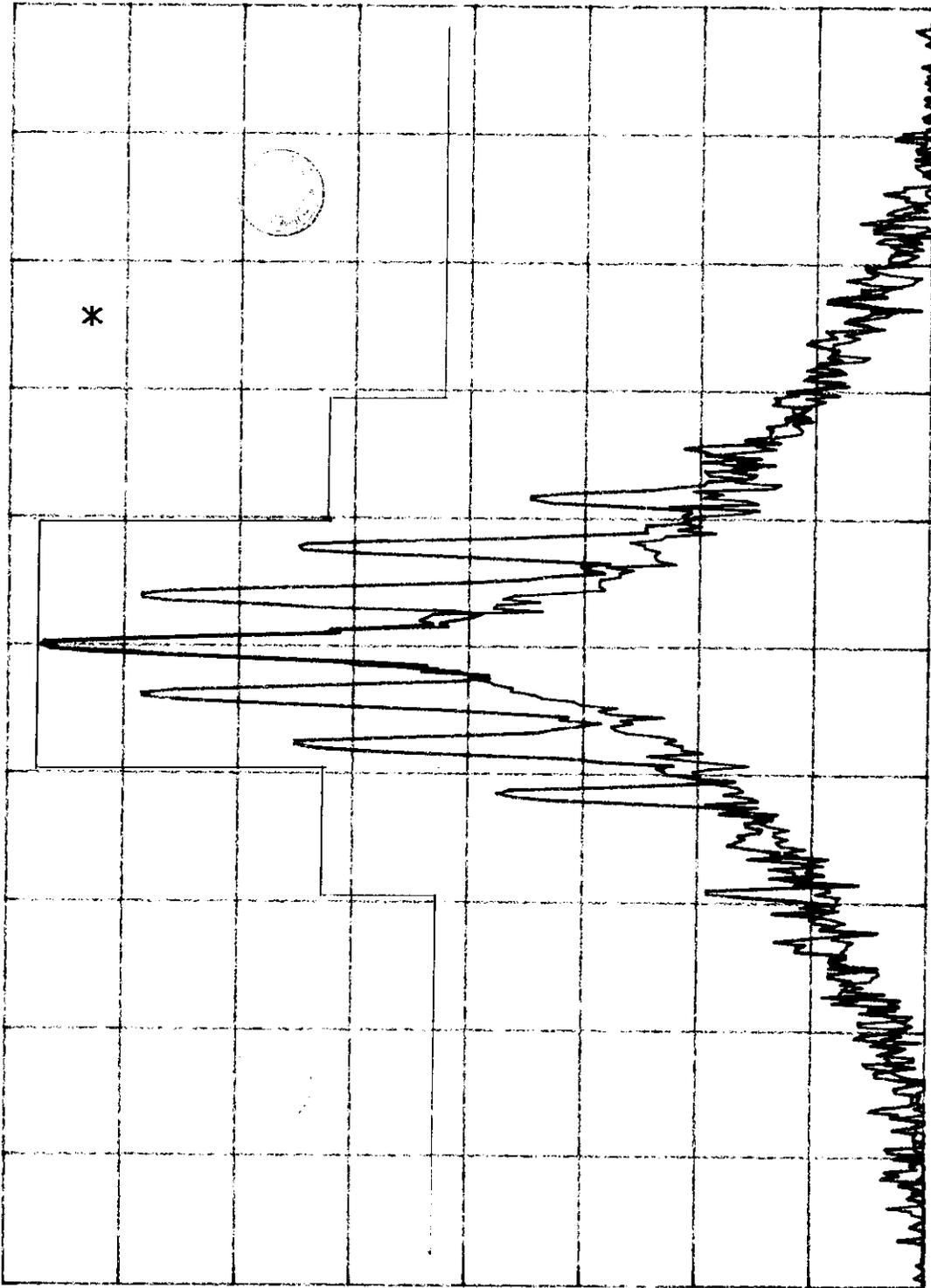
REF 95.0 dB μ V AT 10 dB

PEAK

LOG

10

dB/



VA VB
SC FC
CORR

CENTER 467.63750 MHz

#RES BW 300 Hz

#VBW 3 MHz

SPAN 65.00 KHz

SWP 2.17 sec

INTERTEK TESTING SERVICES

Table 4(b): Channel 4

Orientation	Frequency (MHz)	Reading (dB μ V)	Pre-Amp (dB)	Antenna Factor (dB)	Calculated Net at 3m (dB μ V/m)	Calculated Limit at 3m * (dB μ V/m)	Margin (dB)
H	925.275	49.1	16	33.0	66.1	82.2	-16.1
H	1387.913	84.7	34	25.5	76.2	82.2	-6.0
H	1850.551	70.0	34	26.5	62.5	82.2	-19.7
H	2313.188	68.7	34	29.1	63.8	82.2	-18.4
H	3238.463	70.9	34	31.4	68.3	82.2	-13.9
V	3701.101	61.0	34	32.8	59.8	82.2	-22.4
V	4163.739	63.7	34	34.2	63.9	82.2	-18.3
H	4626.376	72.3	34	34.0	72.3	82.2	-9.9
V	5089.014	73.7	34	35.2	74.9	82.2	-7.3

- Remark:
1. Quasi-peak data for emission below 1000MHz.
 2. '-' sign in margin column shows the value below the limits.
 3. Any emissions and any other harmonics which are attenuated more than 20dB below the permissible value need not be recorded.
 4. Horn Antenna and average detector is used for emission over 1000MHz.

$$\begin{aligned}
 * \text{ Calculated limit} &= 10 \log_{10} (\text{TP(W)}) - 43 - 10 \log_{10} (\text{TP}) \\
 &= -43\text{dBW} \\
 &= 82.2\text{dB}\mu\text{V/m at 3m}
 \end{aligned}$$

Test Engineer: Wilson S. K. Loke

Date of Test: April 14, 1998

INTERTEK TESTING SERVICES

Table 4(c): Channel 11

Orientation	Frequency (MHz)	Reading (dB μ V)	Pre-Amp (dB)	Antenna Factor (dB)	Calculated Net at 3m (dB μ V/m)	Calculated Limit at 3m (dB μ V/m)	Margin (dB)
H	935.256	84.4	16	33.0	67.4	82.2	-14.8
H	1402.884	57.9	34	25.5	66.4	82.2	-15.8
H	1870.512	57.3	34	26.5	64.8	82.2	-17.4
H	2338.141	50.5	34	29.1	55.4	82.2	-26.8
V	2805.768	46.9	34	29.1	51.8	82.2	-30.4
V	3273.396	62.8	34	31.4	65.4	82.2	-16.8
H	3741.024	63.3	34	32.8	64.5	82.2	-17.7
V	4208.653	59.7	34	34.0	59.7	82.2	-22.5
V	4676.281	64.3	34	34.0	64.3	82.2	-17.9
V	5143.909	55.2	34	35.2	54.0	82.2	-28.2
V	5611.537	57.5	34	35.2	56.3	82.2	-25.9
H	6079.166	63.2	34	36.5	60.7	82.2	-21.5

- Remark: 1. Quasi-peak data for emission below 1000MHz.
2. '-' sign in margin column shows the value below the limits.
3. Any emissions and any other harmonics which are attenuated more than 20dB below the permissible value need not be recorded.
4. Horn Antenna and average detector is used for emission over 1000MHz.

$$\begin{aligned}
 * \text{ Calculated limit} &= 10 \log_{10} (\text{TP(W)}) - 43 - 10 \log_{10} (\text{TP}) \\
 &= -43\text{dBW} \\
 &= 82.2\text{dB}\mu\text{V/m at 3m}
 \end{aligned}$$

Test Engineer: Wilson S. K. Loke

Date of Test: April 14, 1998

INTERTEK TESTING SERVICES

EXHIBIT 7

FREQUENCY STABILITY

INTERTEK TESTING SERVICES

7.0 Frequency Stability

The frequency tolerance was tested in normal condition & over extreme ambient conditions with respect to voltage and temperature variation.

INTERTEK TESTING SERVICES

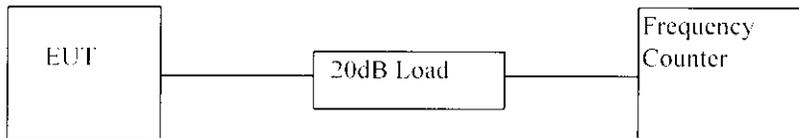
7.1 Frequency Tolerance (Section 95.625)

A. Test Equipment

Equipment	Brand Name	Model No.
Regulated Power Supply	PAD	30-35L
20 dB RF Load	Bird	8304-200-N
Frequency Counter	Phillips	PM6668

B. Testing Procedure

- 1) Set-up the test equipment in the following configuration:



- 2) Measure all transmit channel frequencies in MHz.

INTERTEK TESTING SERVICES

C. Test Result

Table 5

**RadioShack, A Division of Tandy Corporation
RadioShack 21-1810
Frequency Tolerance**

Channel	Frequency (MHz)	Measured Frequency (MHz)	Tolerance (%)
1	462.5625	462.5622	-0.00006
2	462.5875	462.5872	-0.00006
3	462.6125	462.6122	-0.00006
4	462.6375	462.6372	-0.00006
5	462.6625	462.6622	-0.00006
6	462.6875	462.6872	-0.00006
7	462.7125	462.7122	-0.00006
8	467.5625	467.5624	-0.00002
9	467.5875	467.5874	-0.00002
10	467.6125	467.6123	-0.00004
11	467.6375	467.6374	-0.00002
12	467.6625	467.6623	-0.00004
13	467.6875	467.6873	-0.00004
14	467.7125	467.7123	-0.00004

INTERTEK TESTING SERVICES

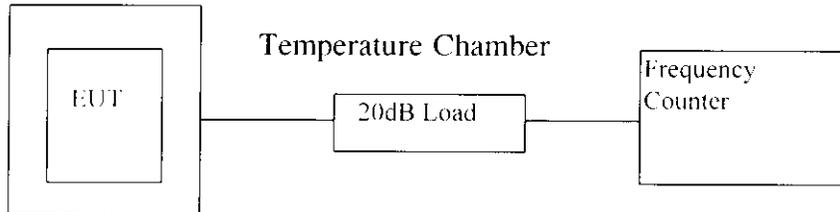
7.2 Frequency Stability - Temperature (Section 2.995)

A. Test Equipment

Equipment	Brand Name	Model No.
20 dB RF Load	Bird	8304-200-N
Frequency Counter	Phillips	PM6668

B. Testing Procedure

- 1) Set-up the test equipment in the following configuration:



- 2) Set the Temperature Chamber to -20°C and stabilize the EUT temperature for one hour. Set transmitter ON for two minutes.
- 3) Measure the channel frequency of channel 4, 11 in MHz.
- 4) Turn the EUT OFF
- 5) Repeat the above procedure with -20°C , 25°C , 50°C

INTERTEK TESTING SERVICES

C. Test Result

Table 6(a)

**RadioShack, A Division of Tandy Corporation
RadioShack 21-1810**

Frequency Deviation with Temperature Variation

Channel : 4

Temperature (°C)	Assigned Frequency (MHz)	Measured Frequency (MHz)	% Deviation
-20	462.6375	462.6372	-0.00006
25	462.6375	462.6372	-0.00006
50	462.6375	462.6370	-0.00011

Test Engineer: Wilson S. K. Loke

Date of Test: April 14, 1998

INTERTEK TESTING SERVICES

C. Test Result

Table 6(b)

**RadioShack, A Division of Tandy Corporation
RadioShack 21-1810**

Frequency Deviation with Temperature Variation

Channel : 11

Temperature (°C)	Assigned Frequency (MHz)	Measured Frequency (MHz)	% Deviation
-20	467.6375	467.6372	-0.00004
25	467.6375	467.6374	-0.00002
50	467.6375	467.6370	-0.00011

Test Engineer: Wilson S. K. Loke

Date of Test: April 14, 1998

INTERTEK TESTING SERVICES

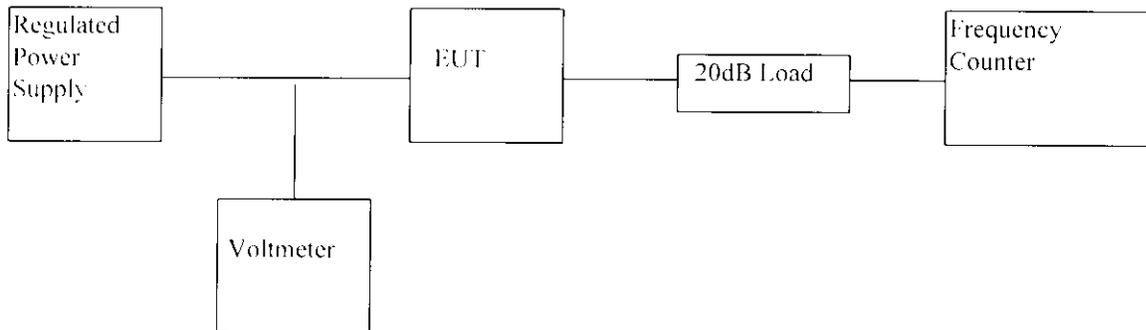
7.3 Frequency Stability - Voltage (Section 2.995)

A. Test Equipment

Equipment	Brand Name	Model No.
Regulated Power Supply	PAD	30-35L
20 dB RF Load	Bird	8304-200-N
Voltage meter	Fluke	87
Frequency Counter	Phillips	PM6668

B. Testing Procedure

- 1) Set-up the test equipment in the following configuration:



- 2) Vary the level of regulated power supply to the manufacturer specified battery end point of the EUT.
- 3) Measure the channel frequency of channel 4 & 11 in MHz.

INTERTEK TESTING SERVICES

C. Test Result

Table 7

**RadioShack, A Division of Tandy Corporation
RadioShack 21-1810**

Frequency Deviation with Voltage Variation

The manufacturer specified battery end point 3.0V

Channel : 4

Voltage (V)	Assigned Frequency (MHz)	Measured Frequency (MHz)	% Deviation
3.0	462.6375	462.6372	-0.00006

Channel : 11

Voltage (V)	Assigned Frequency (MHz)	Measured Frequency (MHz)	% Deviation
3.0	467.6375	467.6374	-0.00002

INTERTEK TESTING SERVICES

EXHIBIT 8

TECHNICAL SPECIFICATIONS