



FCC CFR47 PART 90 REQUIREMENT
CERTIFICATION REPORT
FOR
PORTABLE HANDHELD TRANSCEIVER

MODEL: SR21A-01A

FCC ID: OQBSR21A-01

REPORT NUMBER: 02I1218-1

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Prepared for
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1. VERIFICATION OF COMPLIANCE

Inspection Institution: COMPLIANCE CERTIFICATION SERVICES
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Applicant: TEMCO JAPAN CO., LTD.
Manufacturer: TEMCO JAPAN CO., LTD.
Brand Name: V.A.D.E.R.
Model No/Name: SR21A-01A Serial No: N/A

ITEM	TESTING ITEM	APPLIED SPECIFICATION	TESTING RESULTS	TESTING EQUIPMENT	REMARK
1	Type acceptance required	Section 90.203	Complied	Note 1	
2	Power and Antenna Height Limits	Section 90.205	Complied	Note 1	
3	Types of Emissions	Section 90.207	Complied	Note 1	
4	Emission Bandwidth	Section 90.209	Complied	Note 1	
5	Unwanted Emission	Section 90.210	Complied	Note 1	
6	Modulation Characteristic	Section 2.1047	Complied	Note 1	
7	Frequency Stability	Section 90.213	Complied	Note 1	
8	Transient Frequency Behavior	Section 90.214	Complied	Note 1	

Note 1: Please refer to each test section for detailed instrument list.

The above equipment was tested by Compliance Certification Services for compliance with the requirements set forth in the FCC PART 90. The results of testing in this report apply to the product/system, which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties. **Warning** : This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification will constitute fraud and shall nullify the document.

Approved & Released For CCS By:

Tested By:



STEVE CHENG
MANAGER OF EMC DEPARTMENT
COMPLIANCE CERTIFICATION SERVICES



THU CHAN
SENIOR EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

- a). Type of EUT: Portable Handheld Transceiver
- b). Brand Name: V.A.D.E.R.
- c). Model No: SR21A-01A
- d). FCC ID: OQBSR21A-01
- e). Working Frequency: 15 Channels within frequency band from 150 ~ 174 MHz.
- f). Power Supply: 9V dc (6xAAA)
- g). Antenna Gain: -1.5dBi

2.2. METHODOLOGY

Both conducted and radiated testing were performed according to the procedures documented in chapter 13 of ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057.

2.3. TEST FACILITY

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

2.4. ACCREDITATION AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code:200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT(1300F2))

2.5. MEASURING INSTRUMENT CALIBRATION

The measuring equipment which was utilized in performing the tests documented herein has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment which is traceable to recognized national standards.

3. REQUIREMENTS OF PROVISION

3.1. GENERAL TECHNICAL REQUIREMENTS

- a). Section 90.205 – Maximum ERP $\leq 1W$
- b). Section 90.207 – Emission Type shall be F3E
- c). Section 90.209 – Emission Bandwidth shall less than 20 KHz
- d). Section 90.210 – Unwanted Radiation
According to CFR 47 section 90.210(b), the power of each unwanted emission shall be less than Transmitted Power as specified below:
 - 1). At least 25 dB on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.
 - 2). At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.
 - 3). At least $43+10 \log_{10}(TP)$ dB on any frequency removed from the center of the authorized bandwidth by more than 250%.
- e). Section 90.213(a) – Frequency Tolerance less than 0.0005%
- f). Section 2.1047 – Modulation Characteristic

3.2. LABELING REQUIREMENT

Each equipment for which a type acceptance application is filed on or after May 1, 1981 shall bear an identification plate or label pursuant to section 2.925 (Identification of equipment) and section 2.926 (FCC Identifier).

3.3. USER INFORMATION

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for the compliance could void the user's authority to operate the equipment.

4. OUTPUT POWER MEASUREMENT

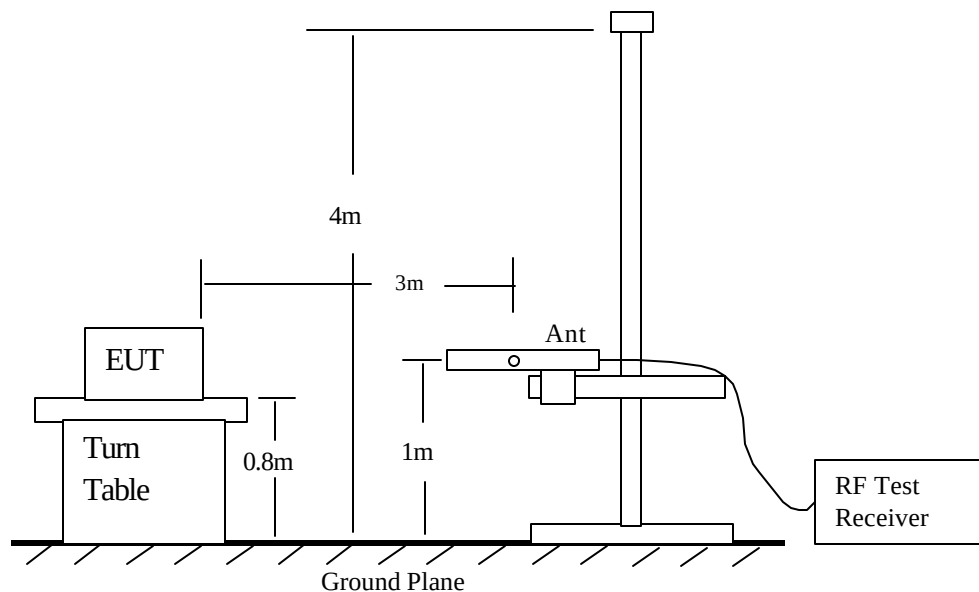
4.1. PROVISION APPLICABLE

According to section 90.205, Table 1 – the output power shall not exceed 1 W ERP @ 3 km service area radius.

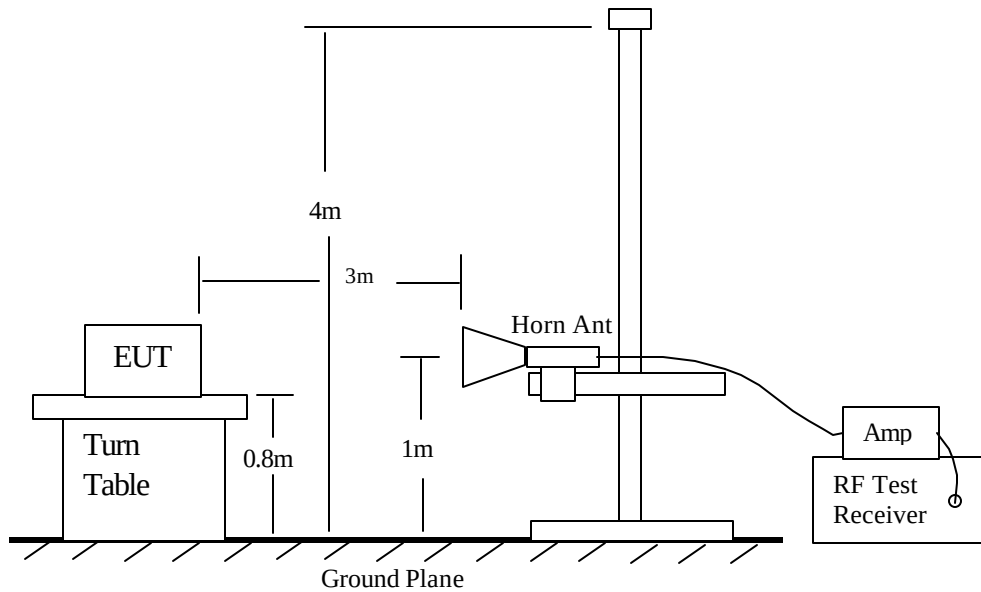
MEASUREMENT PROCEDURE

- 1). On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
- 2). The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the frequency of the transmitter.
- 3). The output of the test antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- 4). The transmitter shall be switched on, if possible, without the modulation and the measurement 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.
- 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 oriented for vertical polarization 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 the height to ensure that the maximum signal is received.

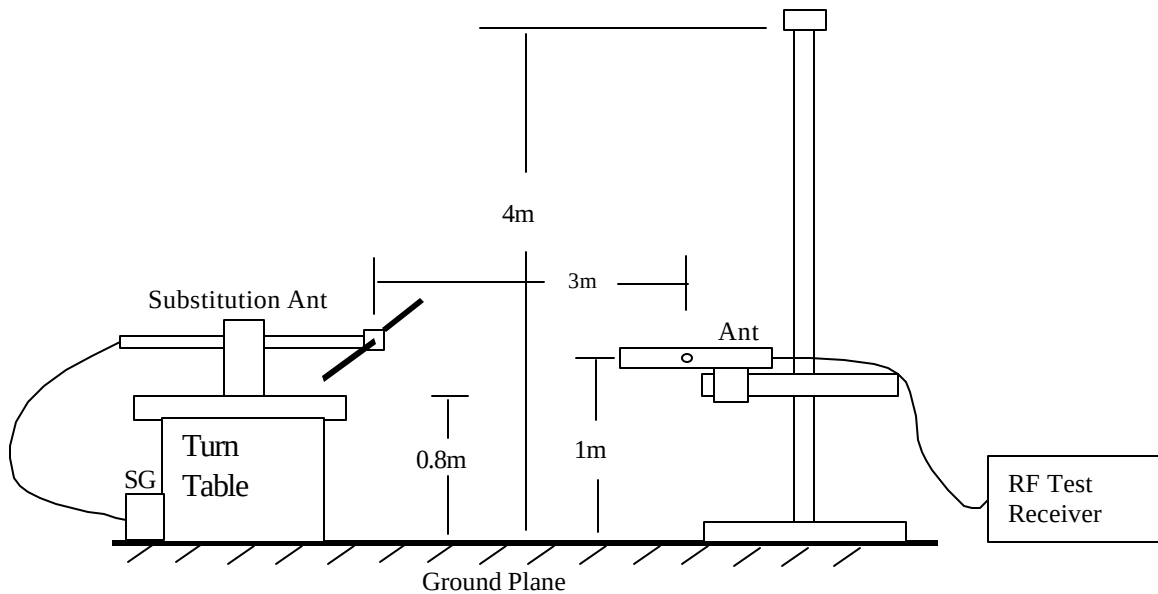
- 14). The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
- 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 oriented for horizontal polarization.
- 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 the gain of the substitution antenna if necessary.



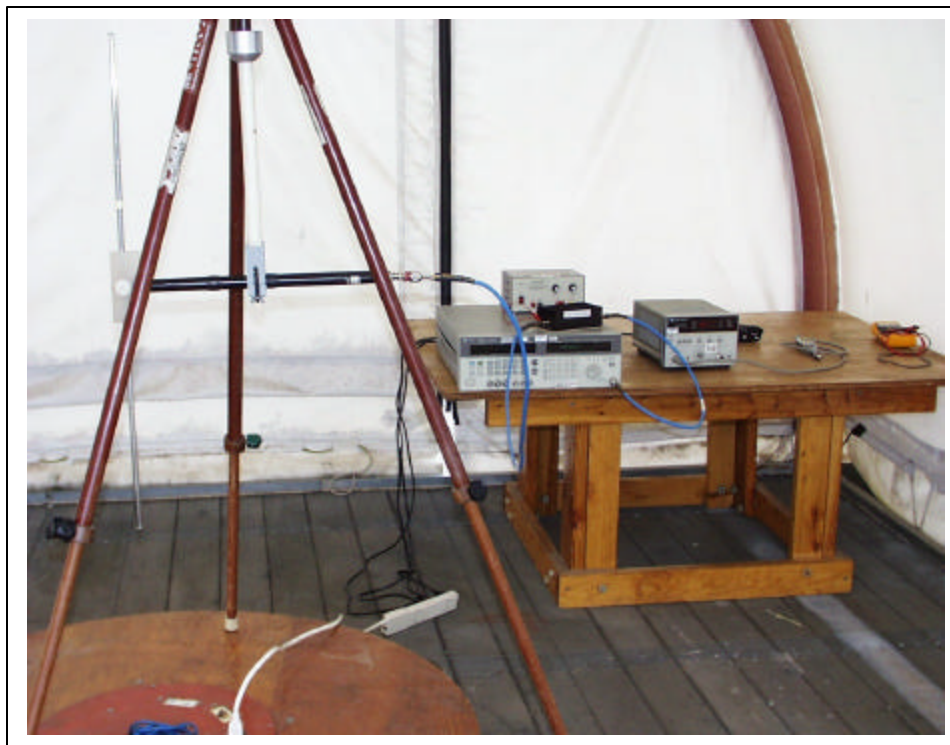
Radiated Emission Measurement 30 to 1000 MHz



Radiated Emission Above 1000 MHz



Radiated Emission – Substitution Method setup



4.2. OUTPUT POWER TEST EQUIPMENT

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	6/11/03
LP Antenna	EMCO	3146	8/2/02
Dipole Antenna	COMPLIANCE DESIGN	ROBERTS	5/5/03
Modulation Analyzer	HP	8901B	6/12/03
Audio Signal Generator	HP	3325A	9/26/02
Amplifier	MITEQ	NSP2600-44	4/26/03

4.3. MEASUREMENT RESULT

Freq. (MHz)	SA Reading (dBuV)	SG Setting (dBm)	Ant Gain (dBi)	Dipole Gain (dBd)	Cable Loss (dB)	ERP Result (dBm)	Pol (H/V)
Transmitting Mode:							
Fundamental measurement:							
Hi Power, Low Channel:							
150.02	99.50	23.90	0.00	0.00	0.30	23.60	3mV
150.02	88.00	5.20	0.00	0.00	0.30	4.90	3mH
Low Power, Low Channel:							
150.02	88.50	13.80	0.00	0.00	0.30	13.50	3mV
150.02	78.00	-4.80	0.00	0.00	0.30	-5.10	3mH
Hi Power Mid Channel:							
162.02	99.40	23.80	0.00	0.00	0.30	23.50	3mV
162.02	88.00	5.30	0.00	0.00	0.30	5.00	3mH
Low Power, Mid Channel:							
162.02	88.50	13.80	0.00	0.00	0.30	13.50	3mV
162.02	78.00	-4.70	0.00	0.00	0.30	-5.00	3mH
Hi Power, Hi Channel:							
173.98	101.50	25.30	0.00	0.00	0.30	25.00	3mV
173.98	94.00	9.80	0.00	0.00	0.30	9.50	3mH
Low Power, Hi Channel:							
173.98	91.70	15.30	0.00	0.00	0.30	15.00	3mV
173.98	84.00	-0.20	0.00	0.00	0.30	-0.50	3mH

Hi Power, Maximum Output Power (ERP): 25.00 dBm = 0.3162 W

Low Power, Maximum Output Power (ERP): 15.00 dBm = 0.0316 W

5. MODULATION CHARACTERISTICS

5.1. PROVISIONS APPLICABLE

According to CFR 47 section 2.1047 (a), for Voice Modulated Communication Equipment, the frequency response of the audio modulation circuit over a range of 100 to 5000 Hz shall be measured.

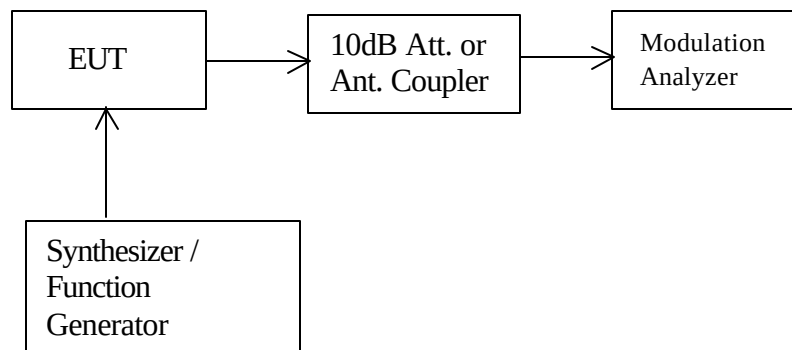
5.2. MEASUREMENT METHOD

5.2.1. Modulation Limit

- 1). Configure the EUT as shown below, adjust the audio input for 60% of rated system deviation at 1 KHz using this level as a reference (0 dB) and vary the input level from -20 to +20 dB. Record the frequency deviation obtained as a function of the input level.
- 2). Repeat step 1 with input frequency changing to 300, 1004, and 2500 Hz in sequence.

5.2.2. Audio Frequency Response

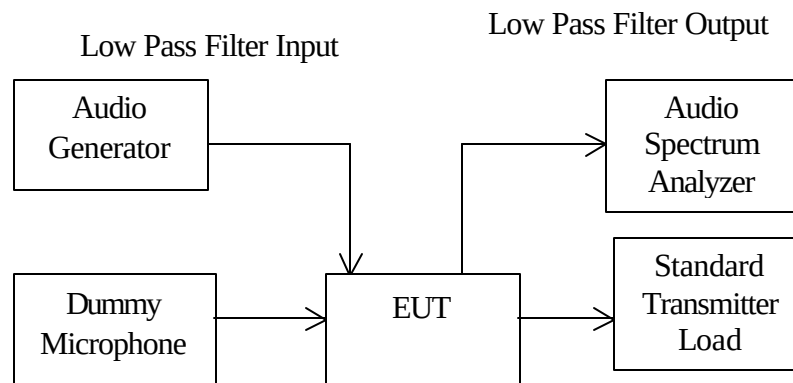
- 1). Configure the EUT as shown below.
- 2). Adjust the audio input for 20% of rated system deviation at 1 KHz using this level as a reference (0 dB).
- 3). Vary the Audio frequency from 100 Hz to 10 KHz and record the frequency deviation.
- 4). Audio Frequency Response = $20 \log_{10} (\text{Deviation of test frequency} / \text{Deviation of 1KHz reference})$.



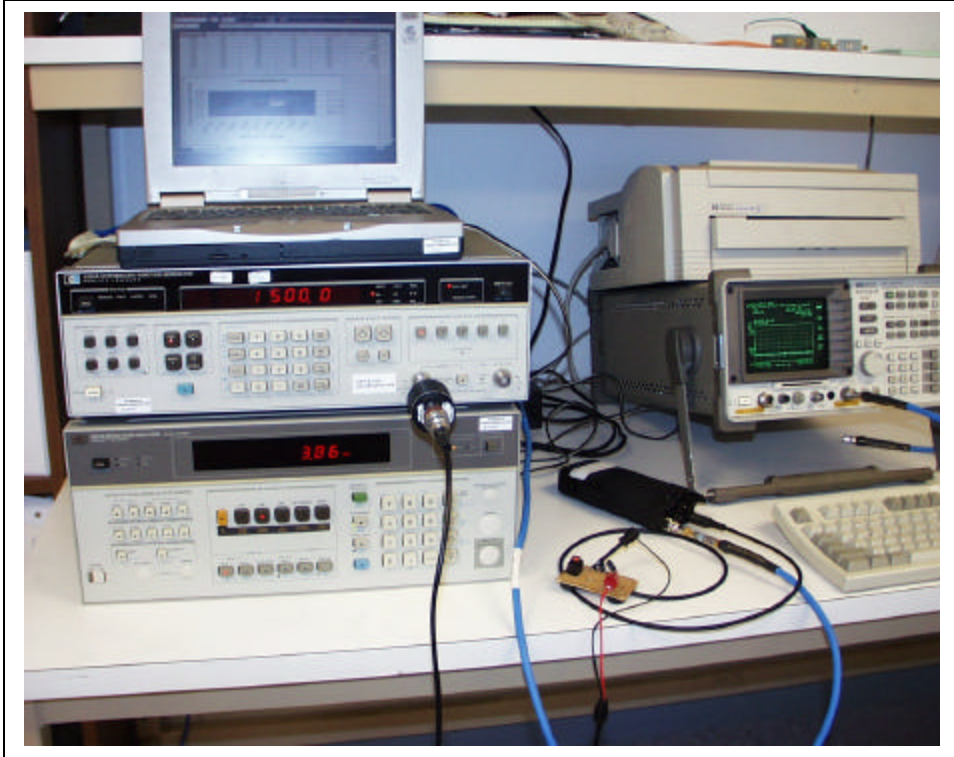
Modulation characteristic measurement configuration

5.2.3. Audio Low Pass Filter Response

- 1). Configure the EUT as shown below.
- 2). Connect the audio frequency generator as close as possible the input of the post limiter low pass filter within the transmitter under test.
- 3). Connect the audio spectrum analyzer to the output of the post limiter low pass filter within the transmitter under test.
- 4). Apply 1000 Hz tone from the audio frequency generator and adjust the level per manufacturer's specifications.
- 5). Record the dB level of the 1000 Hz spectral line on the audio spectrum analyzer as LEV_{REF} .
- 6). Set the audio frequency generator to the desired test frequency between 3000 Hz and the upper low pass filter limit.
- 7). Record audio spectrum analyzer levels, at the frequency in step 6).
- 8). Record the dB level on the audio spectrum analyzer as LEV_{FREQ} .
- 9). Calculate the audio frequency response at the test frequency as:
$$\text{low pass filter response} = LEV_{FREQ} - LEV_{REF}$$
- 10). Repeat the 6) through 9) for all the desired test frequencies.



Audio low pass filter response measurement configuration

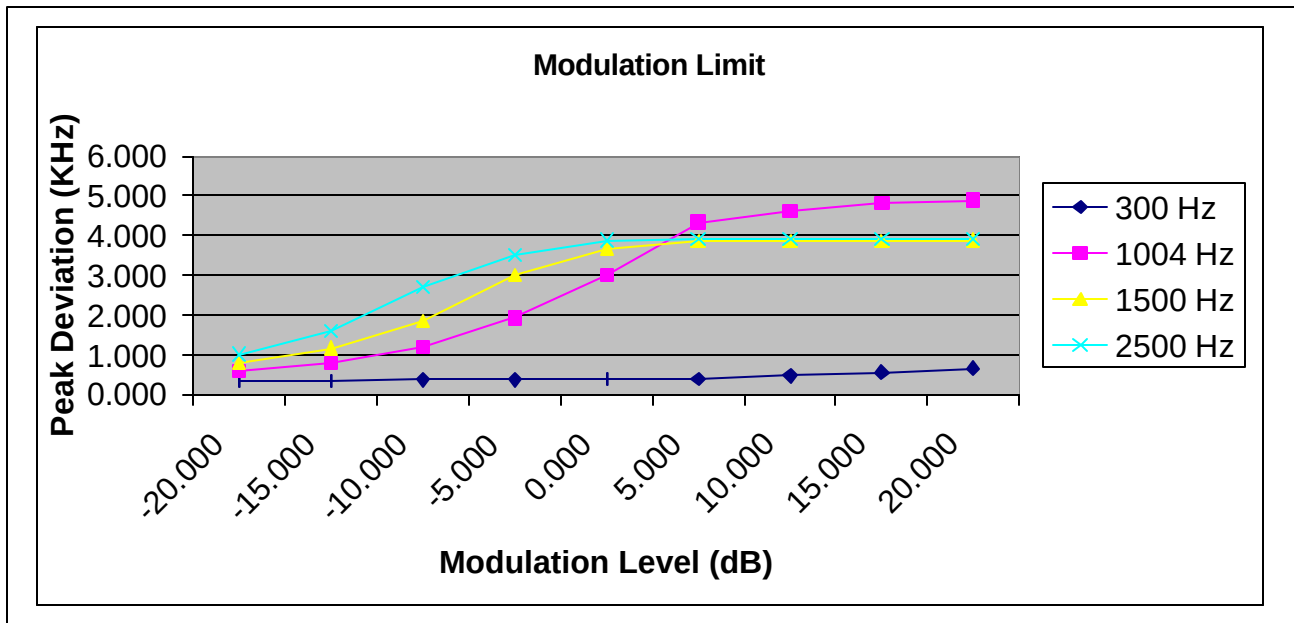


5.3. MEASUREMENT INSTRUMENT

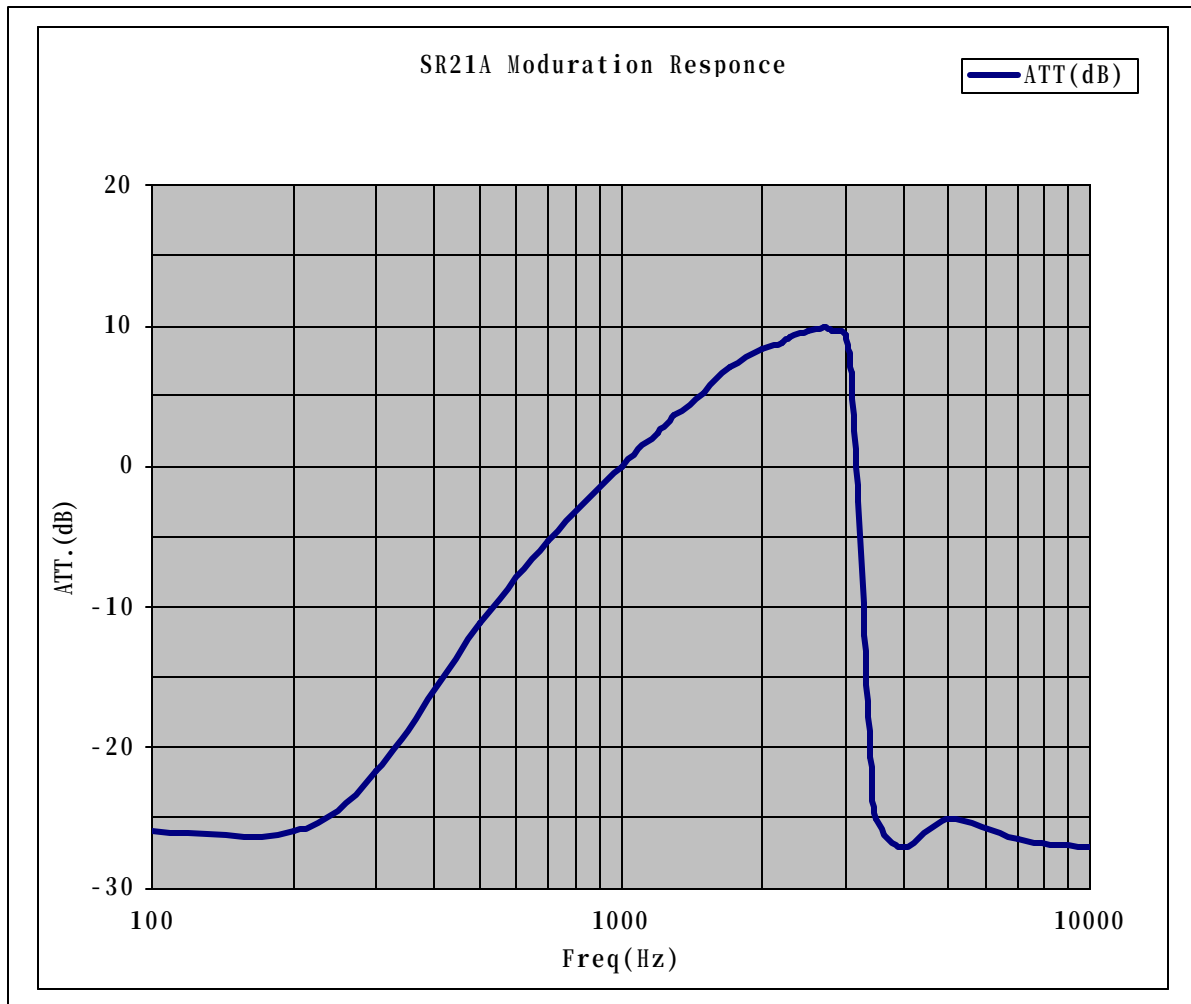
EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Modulation Analyzer	HP	8901b	5/30/02
Attenuator	MINI CIRCUITS	MCL BW-S10W2	N/A
Audio Signal Generator	HP	3325A	9/26/02

5.4. MEASUREMENT RESULT

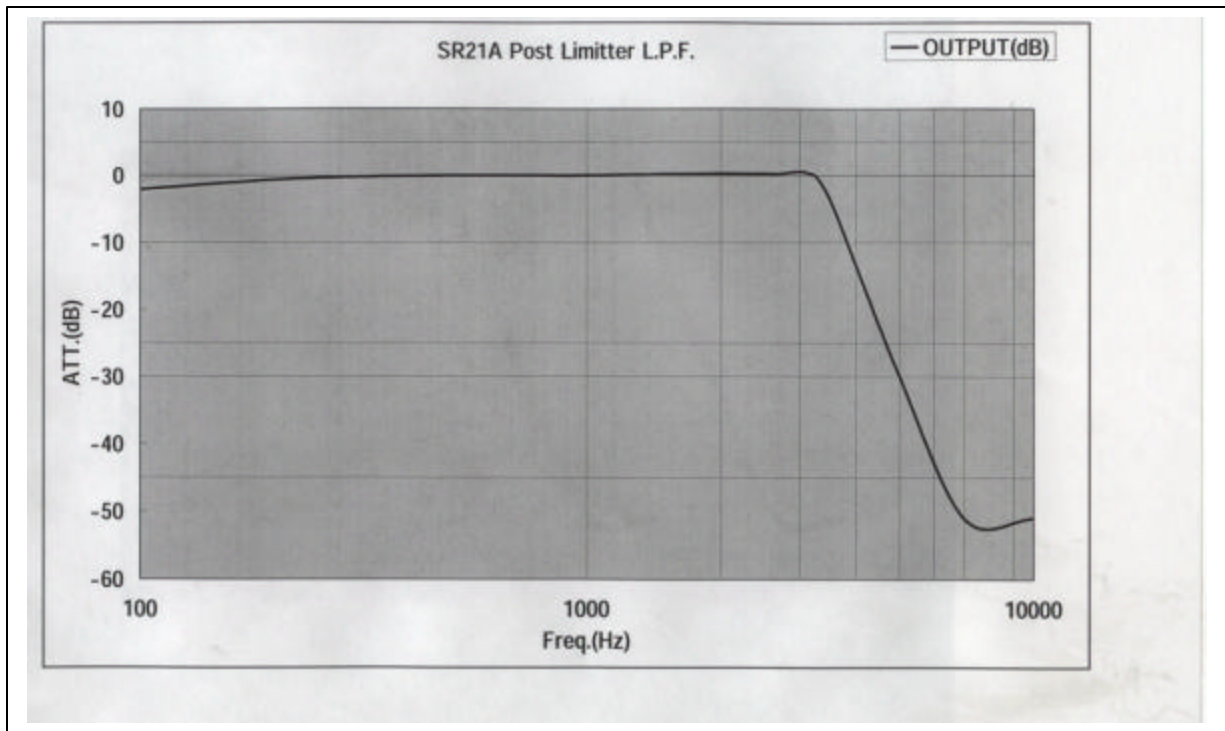
a). Modulation Limit:



b). Audio Frequency Response:



c). Audio low pass filter response:



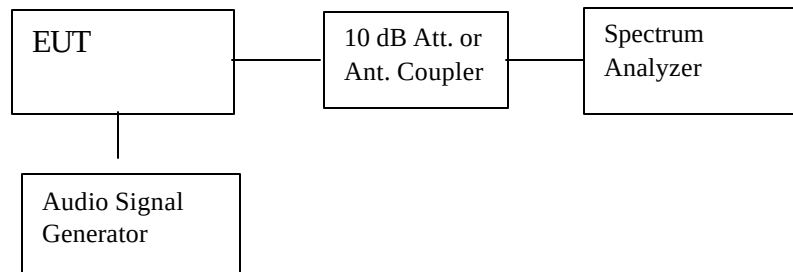
6. EMISSION BANDWIDTH

6.1. PROVISIONS APPLICABLE

According to CFR 47 section 90.209, the authorized bandwidth for emission type of F3E unit is 20 KHz.

6.2. MEASUREMENT METHOD

- a). Check the calibration of the measurement instrument using either an internal calibrator or a known signal from an external generator.
- b). Set-up the test equipments as shown below.



Emission Bandwidth measurement configuration

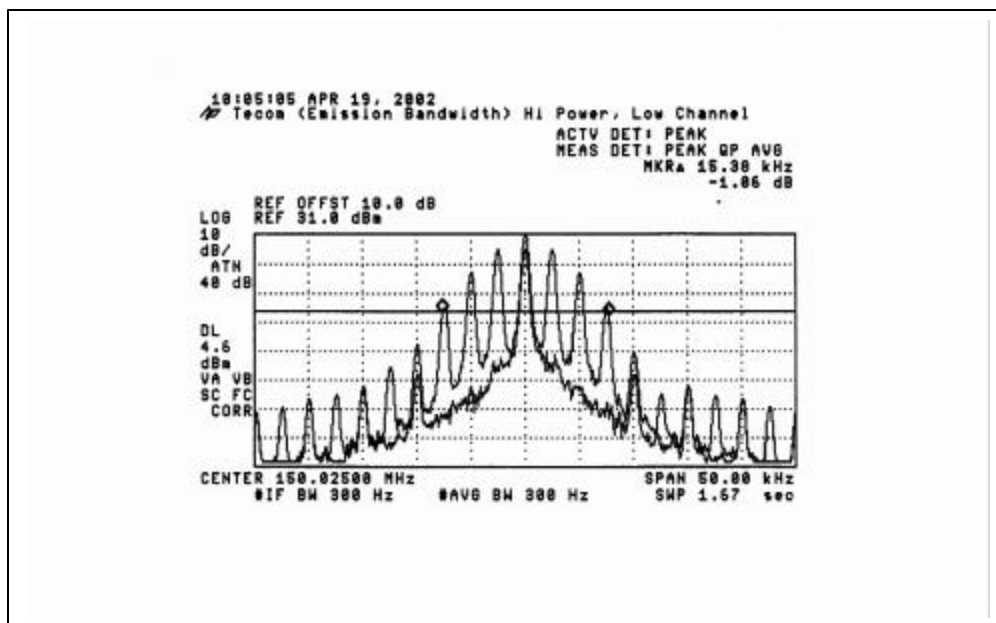
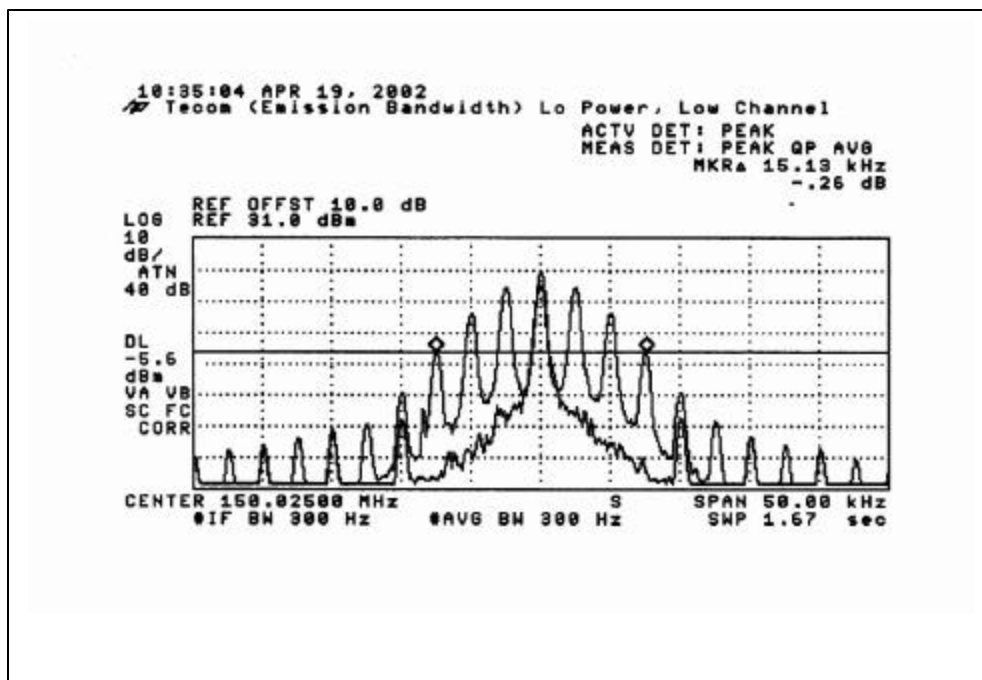
- c). Set the level of audio signal generator to obtain 16 dB greater than required for the rated 50% modulation.
- d). The occupied bandwidth is measured with the spectrum analyzer set at 5 KHz/div scan and 10 dB/div.

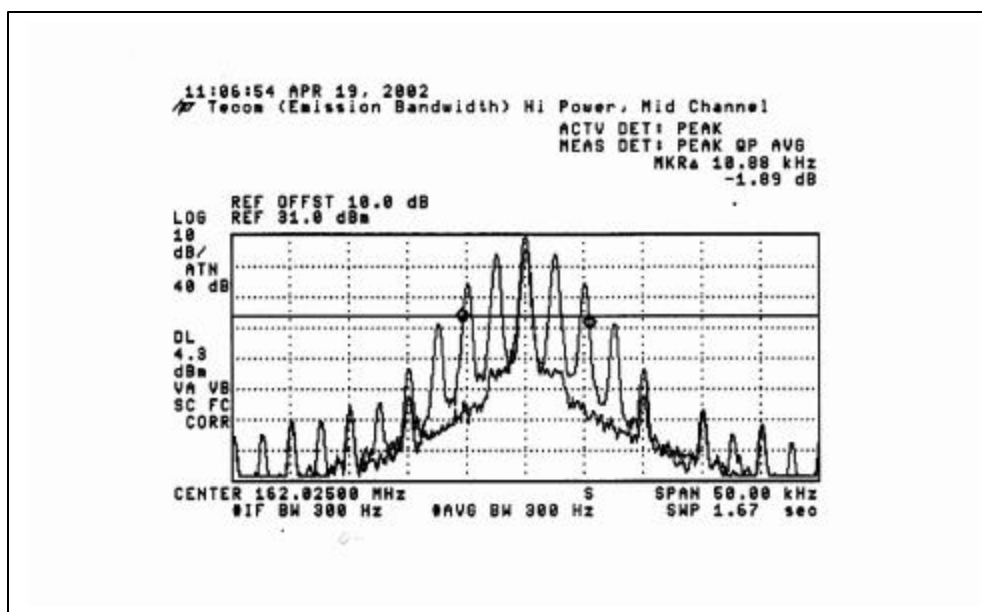
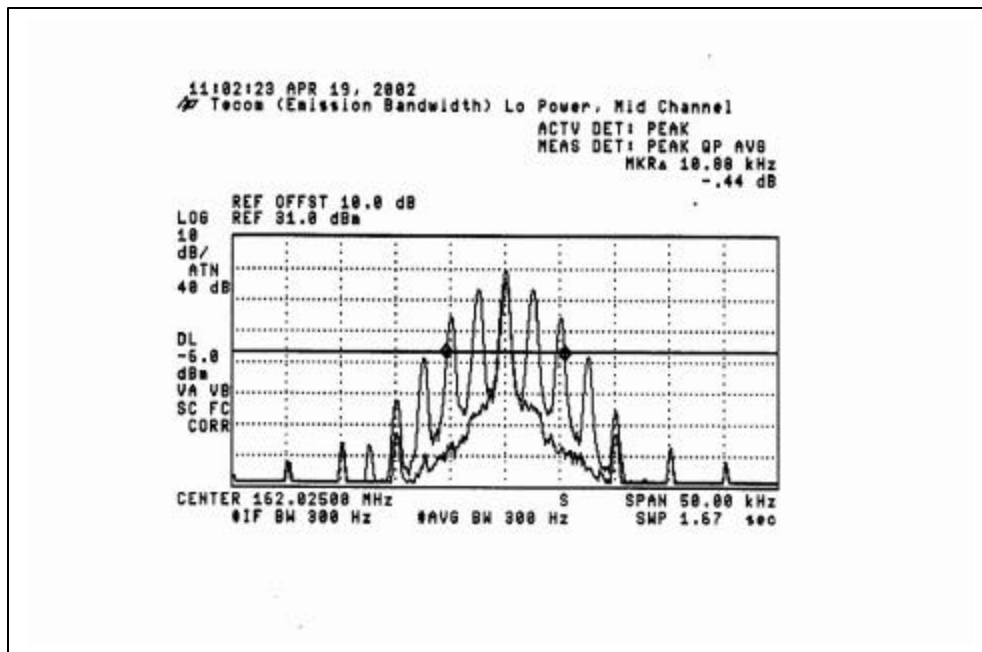
6.3. MEASUREMENT INSTRUMENT

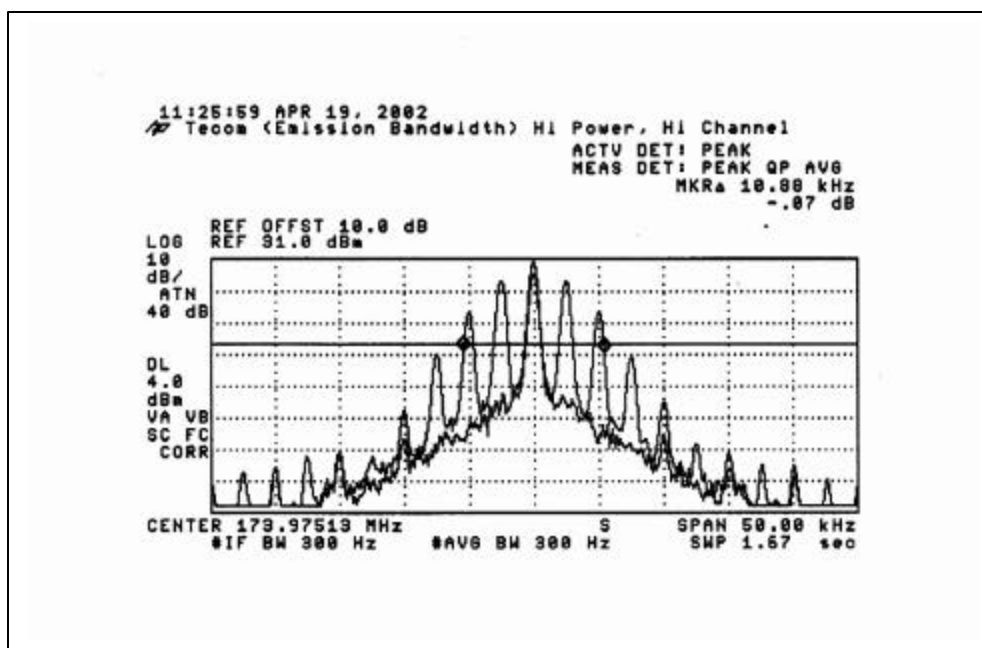
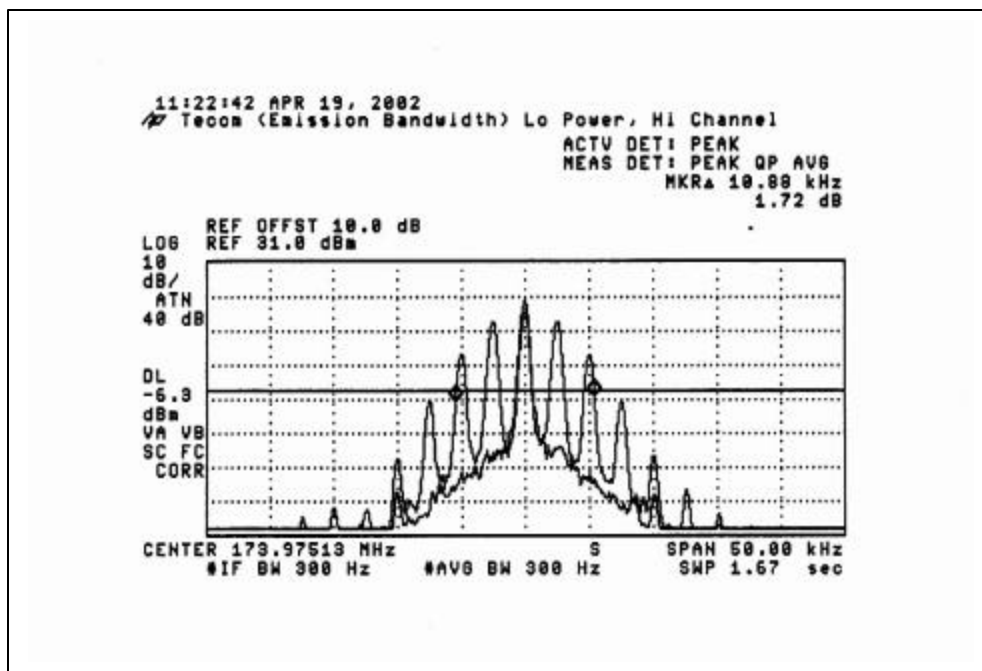
EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	6/11/03
Attenuator	MINI CIRCUITS	MCL BW-S10W2	N/A
Modulation Analyzer	HP	8901B	6/12/03
Audio Signal Generator	HP	3325A	9/26/02

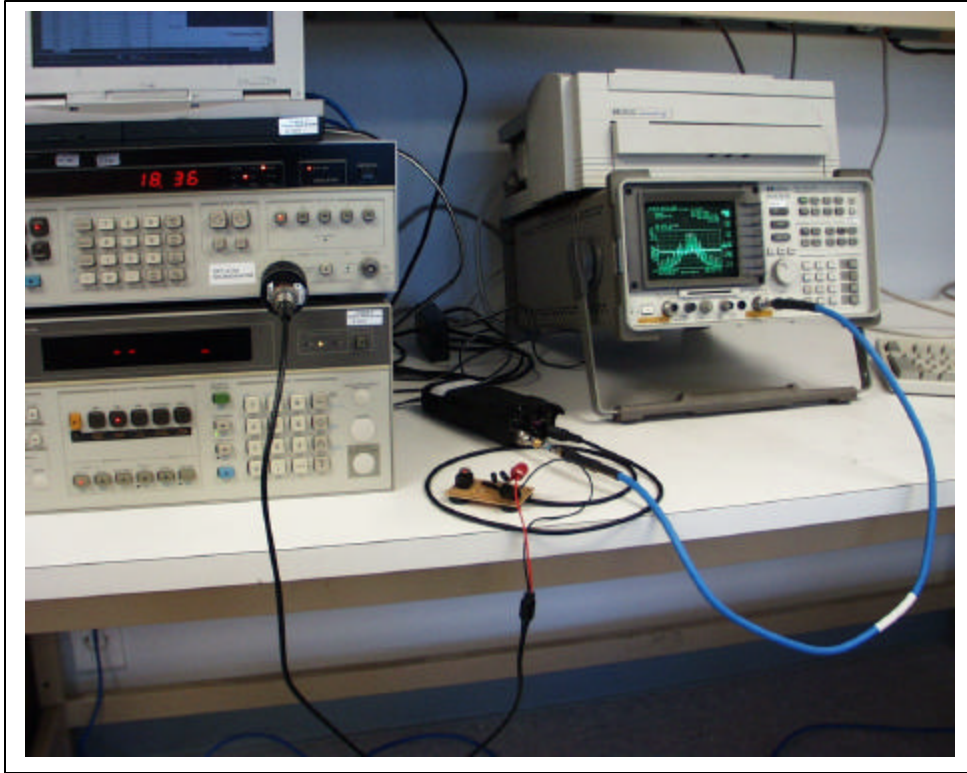
6.4. MEASUREMENT RESULT

The Occupied Bandwidth is measured 15.38 KHz.









7. FIELD STRENGTH OF SPURIOUS EMISSION

7.1. PROVISIONS APPLICABLE

According to CFR47 section 2.1053(a), Measurement shall be made to detect spurious emission that may be radiated directly from the cabinet, control circuits, power leads or intermediate circuit element 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,

According to CFR 47 section 90.210(b), the power of each unwanted emission shall be less than Transmitted Power as specified below:

- 1). At least 25 dB on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.
- 2). At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.
- 3). At least $43 + 10 \log_{10}(TP)$ dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

7.2. MEASUREMENT PROCEDURE

--- For Frequency Range From 30 to 1000 MHz ---

- 1). On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
- 2). The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the frequency of the transmitter.
- 3). The output of the test antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- 4). The transmitter shall be switched on, if possible, without the modulation and the measurement 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.
- 6). The transmitter shall than 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 measurement shall be repeated with the test antenna set to horizontal polarization.

--- For Frequency Above 1000 MHz ---

10). Repeat procedures 1 to 9 with a proper Antenna (i.e. Horn antenna for 1 to 26 GHz)

11). After down with step 10. Replace the transmitter with a proper Antenna (substitution antenna).

12). The substitution antenna shall be oriented for vertical polarization and, if necessary, the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.

13). The substitution antenna shall be connected to a calibrated signal generator.

14). If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.

15). The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.

16). 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 in step 10, corrected for the change of input attenuation setting of the measuring receiver.

17). 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.

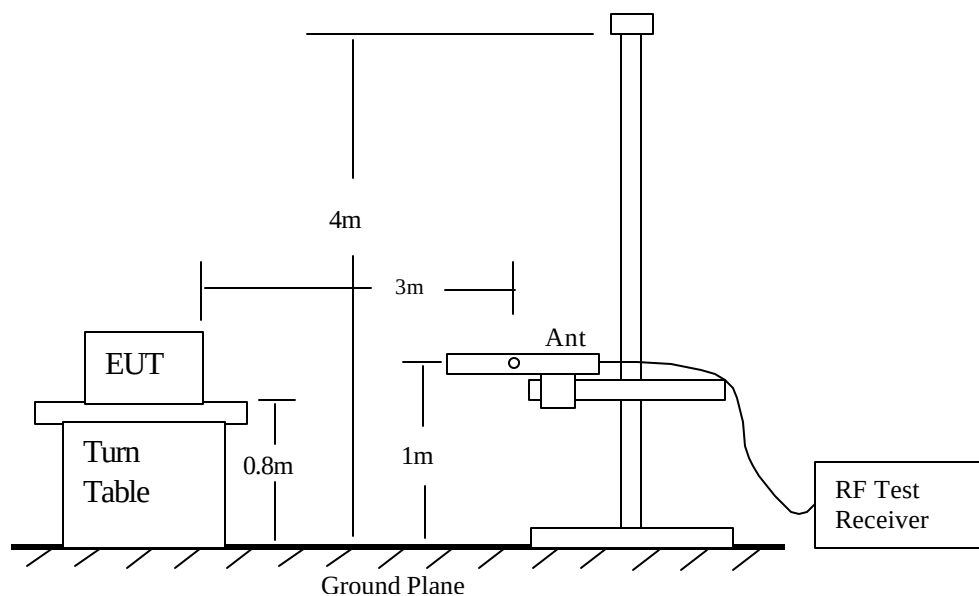
18). The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

7.3. MEASUREMENT INSTRUMENT

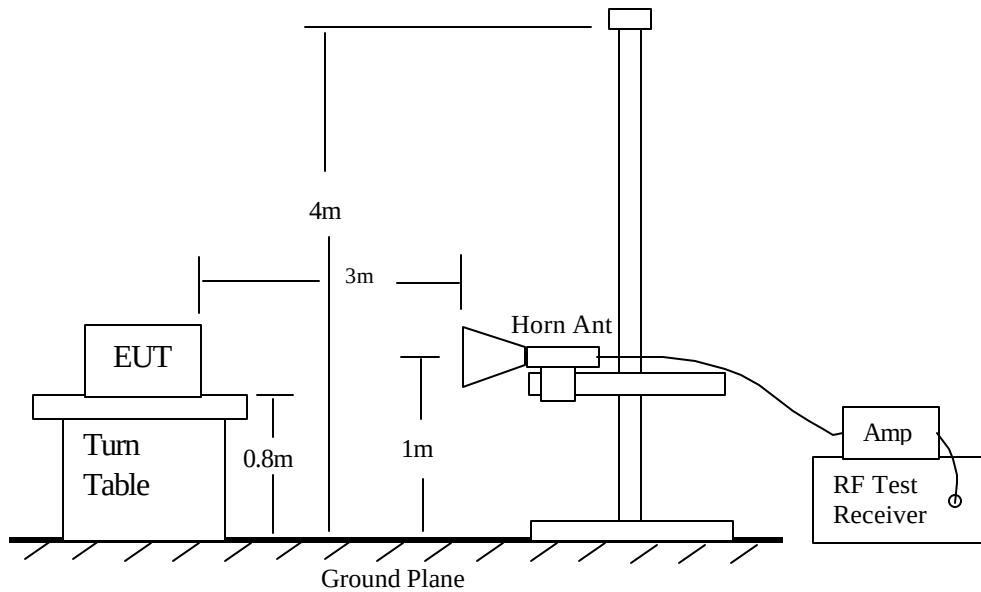
EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	6/20/02
RF Synthesizer	HP	83732B	3/29/03
Amplifier	MITEQ	NSP2600-44	4/26/03
LP Antenna	EMCO	3146	8/2/02
Horn Antenna	EMCO	3115 SN: 2238	6/20/02
Horn Antenna	EMCO	3115 SN: 3245	6/20/02
Dipole Antenna	COMPLIANCE DESIGN	ROBERTS	5/5/03

Detector Function Setting of Test Receiver

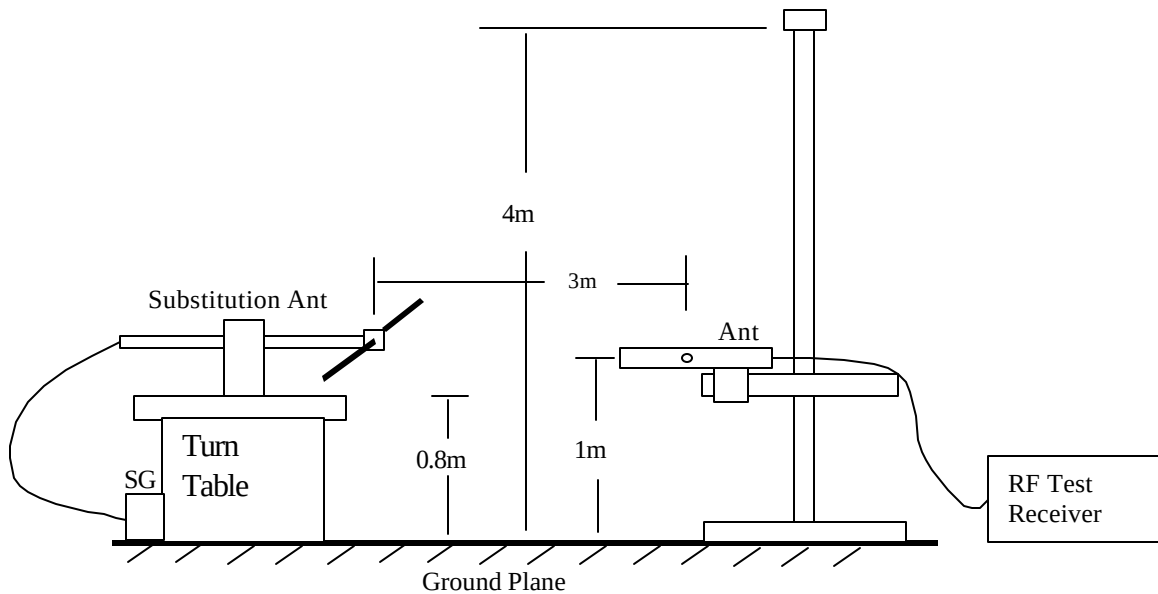
Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	Quasi Peak/Peak	120 KHz/100 KHz	120 KHz/100 KHz
Above 1000	Average/ Peak	1 MHz	1 MHz



Radiated Emission Measurement 30 to 1000 MHz

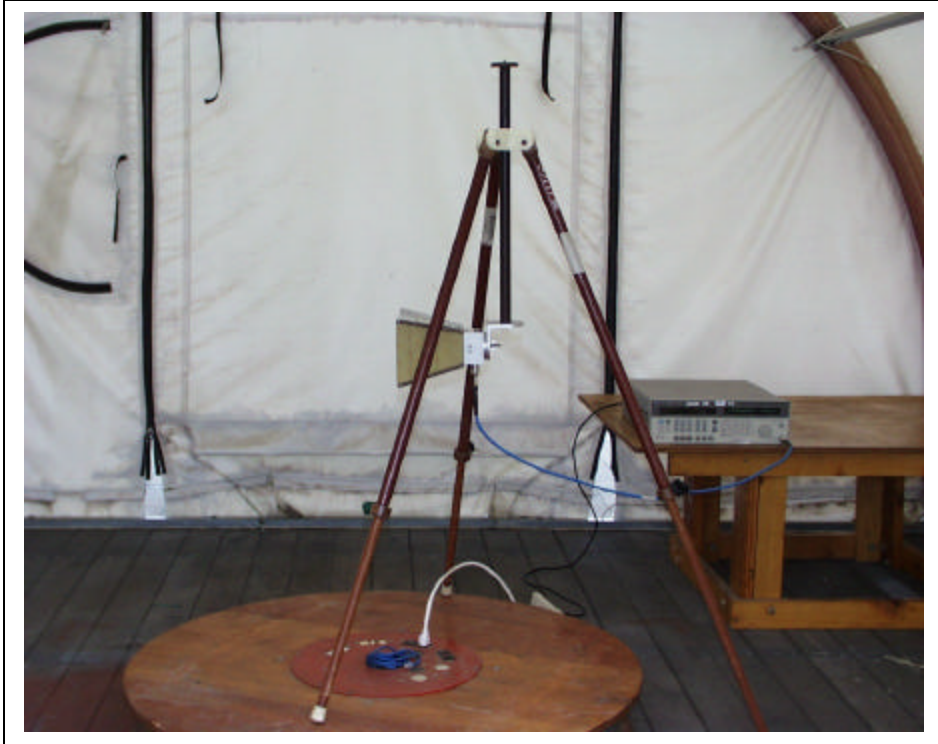


Radiated Emission Above 1000 MHz



Radiated Emission – Substitution Method setup





7.4. MEASUREMENT RESULT

