



FCC CFR47 PART 95 REQUIREMENT

CERTIFICATION REPORT

FOR

FRS TRANCEIVER

MODEL: TC-102, TC-102A

FCC ID: OL4APT102210101

REPORT NUMBER: 00C0583-1

ISSUE DATE: MAY 02, 2001

Prepared for

ARTPROTECH CO., LTD.

**UNIT 8, 10F, TOWER 2, HARBOUR CENTER
8 HOK CHEUNG ST., HUNG HOM, KOWLOON
HONG KONG**

Prepared by

COMPLIANCE ENGINEERING SERVICES, INC.

**561F MONTEREY ROAD,
MORGAN HILL, CA 95037, USA
TEL: (408) 463-0885**



LAB CODE:200065-0

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1. VERIFICATION OF COMPLIANCE

Inspection Institution: COMPLIANCE ENGINEERING SERVICES INC.
561F MONTEREY ROAD,
MORGAN HILL, CA 95037, USA
TEL: (408) 463-0885 FAX: (604) 463-0888



Applicant: ARTPROTECH CO., LTD.
Manufacturer: ARTPROTECH CO., LTD
Brand Name: ARTPROTECH
Model No/Name: TC-102, TC-102A

Serial No: N/A



ITEM	TESTING ITEM	APPLIED SPECIFICATION	TESTING RESULTS	TESTING EQUIPMENT	REMARK
1	Channel Frequency	Section 95.627(a)	Complied	Note 1	
2	Type of Communication	Section 95.193	Complied	Note 1	
3	Frequency Toleration	Section 95.627(b)	Complied	Note 1	
4	Emission Type	Section 95.631	Complied	Note 1	
5	Emission Bandwidth	Section 95.633	Complied	Note 1	
6	Unwanted Emission	Section 95.635	Complied	Note 1	
7	Modulation Standards	Section 95.637	Complied	Note 1	
8	Maximum Transmitter Power	Section 95.639	Complied	Note 1	
9	Transmitter Antenna	Section 95.647	Complied	Note 1	
10	Power Capability	Section 95.649	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 95 Subpart B FRS. 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

JESSE SALDIVAR
ASSOCIATE EMC ENGINEER

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

- a). Type of EUT: FRS Transceiver
- b). Trade Name: N/A
- c). Model No: TC-102, TC-102A
- d). FCC ID: OL4APT102210101
- e). Working Frequency: 14 Channels within frequency band from 462.5625 ~ 467.7125 MHz.
- f). Power Supply: 4.5 Vdc

2.2. MEASURED CHARACTERISTICS OF EUT

- a). Communication Type: Voice/Tone only
- b). Frequency Tolerance: 0.00022% (limit < 0.00025%)
- c). Emission Type: F3E
- d). Emission Bandwidth: 9.95 KHz (limit <12.5 KHz)
- e). Unwanted Radiation:
 - 1). At least: 38dB (limit 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: 55dB (limit 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: 60dB (limit $43+10 \log_{10}(TP)$ dB) on any frequency removed from the center of the authorized bandwidth by more than 250%.
- f). Peak Frequency Deviation: 1.91 KHz at 0dB reference (limit < ± 2.5 KHz)
- g). Audio Frequency Response: 2.8KHz (limit < 3.125 KHz)
- h). Maximum Transmitter Power: 0.083 W (limit < 0.5W)
- i). Antenna Type: Fixed wipe antenna solder to the EUT
- j). Output power Modification: Fixed can't be change
- k). Operating Frequency Range and Channels
Frequency Range: 462.5625 ~ 467.7125 MHz
Total 14 channels

CH 01----	462.5625 MHz	CH08----	467.5625 MHz
CH 02----	462.5875 MHz	CH09----	467.5875 MHz
CH 03----	462.6125 MHz	CH10----	467.6125 MHz
CH 04----	462.6375 MHz	CH11----	467.6375 MHz
CH 05----	462.6625 MHz	CH12----	467.6625 MHz
CH 06----	462.6875 MHz	CH13----	467.6875 MHz
CH 07----	462.7125 MHz	CH14----	467.7125 MHz
- l). Effective distance: Nominal 2 miles, with 250mW power output.
- m). Battery Endpoint: 3.9 Vdc

2.3. TEST 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.

2.4. 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.

2.5. 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))

2.6. 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 95.193 – Communication Type shall be Voice/Tone only
- b). Section 95.627(b) – Frequency Tolerance less than 0.00025%
- c). Section 95.631 – Emission Type shall be F3E
- d). Section 95.633 – Emission Bandwidth shall less than 12.5 KHz
- e). Section 95.635 – Unwanted Radiation
According to CFR 47 section 95.635(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%.
- f). Section 95.637 – Peak Frequency Deviation less than ± 2.5 KHz, and Audio Frequency Response less than 3.125 KHz
- g). Section 95.639 – Maximum Transmitter Power less than 0.5W
- h). Section 95.647 – Antenna shall be a dedicate type
- i). Section 95.649 – Output power can't be change

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 95.639(d), the output power shall not exceed 500 milliwatts (ERP).

4.2. 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 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 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.

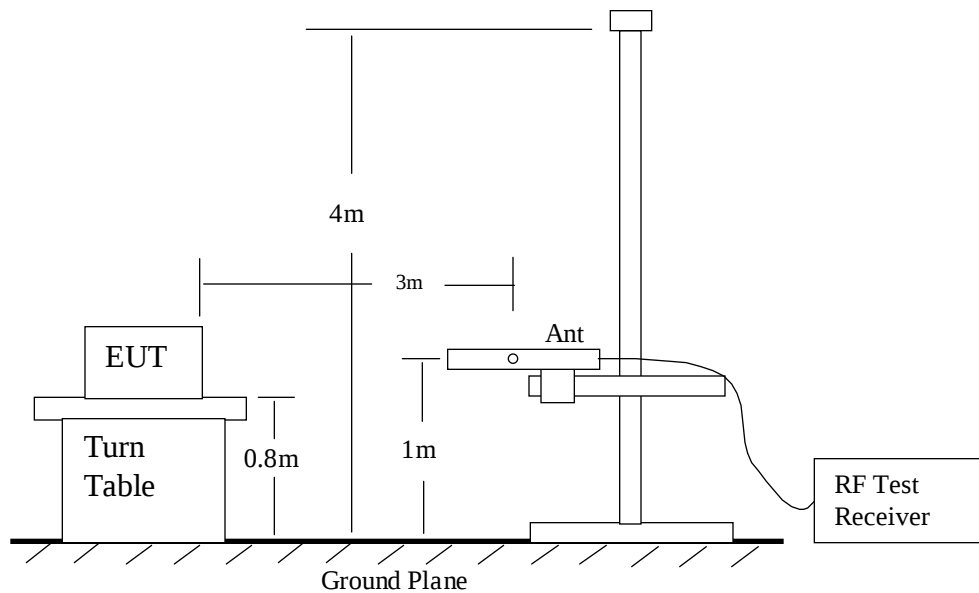


Fig 1: Radiated Emission Measurement 30 to 1000 MHz

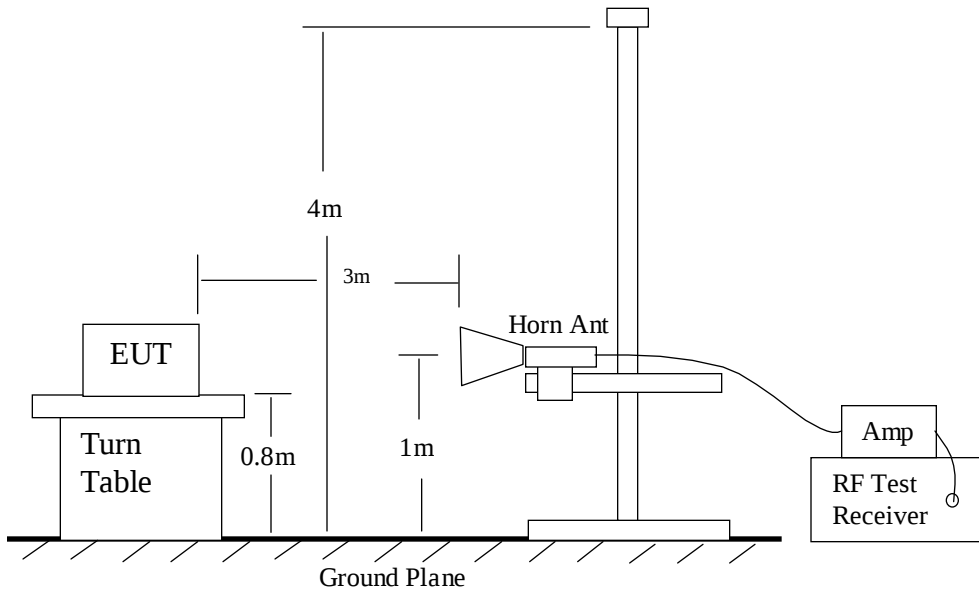


Fig 2: Radiated Emission Above 1000 MHz

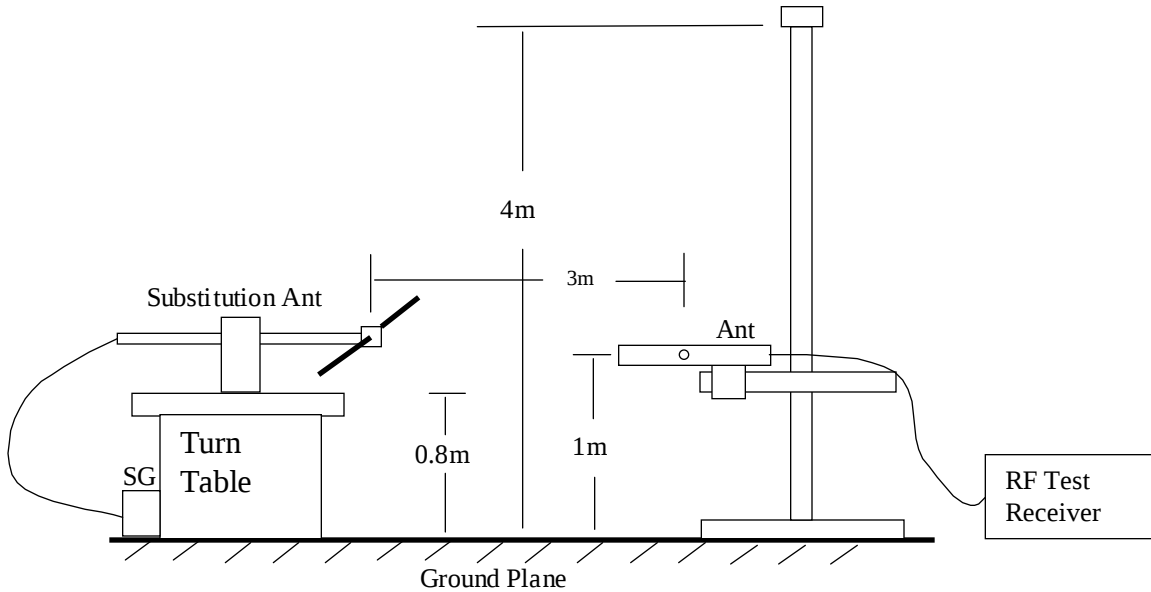


Fig 3: Radiated Emission – Substitution Method setup

4.3. OUTPUT POWER TEST EQUIPMENT

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	05/25/01
Bilog Antenna	CHASE EMC LTD	CBL6112	11/23/00
Dipole Antenna	COMPLIANCE DESIGN	ROBERTS	5/5/01
RF Synthesizer	HP	83732B	2/11/02
Amplifier	HP	8449B	4/12/01

4.4. MEASUREMENT RESULT

Channel	Frequency (MHz)	SA Reading (dBuV)	SG Reading (dBm)	Cable Loss (dB)	Gain (dBd)	Result (dBm)	Limit (dBm)	Margin dB
1	462.5625	97.1	19.66	.45	0	19.21	27	-7.79
2	462.5875	97.1	19.66	.45	0	19.21	27	-7.79
3	462.6125	97.1	19.66	.45	0	19.21	27	-7.79
4	462.6375	97.1	19.66	.45	0	19.21	27	-7.79
5	462.6625	97.1	19.66	.45	0	19.21	27	-7.79
6	462.6875	97.1	19.66	.45	0	19.21	27	-7.79
7	462.7125	97.1	19.66	.45	0	19.21	27	-7.79
8	467.5625	97.1	19.66	.45	0	19.21	27	-7.79
9	467.5875	97.1	19.66	.45	0	19.21	27	-7.79
10	467.6125	97.1	19.66	.45	0	19.21	27	-7.79
11	467.6375	97.1	19.66	.45	0	19.21	27	-7.79
12	467.6625	97.1	19.66	.45	0	19.21	27	-7.79
13	467.6875	97.1	19.66	.45	0	19.21	27	-7.79
14	467.7125	97.1	19.66	.45	0	19.21	27	-7.79

Maximum Output Power (ERP): 19.21dBm = 0.083 W

Date Tested:

Temperature:

Humidity:

Test Engineer:_____

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.

According to CFR 47 section 95.637 (a), a FRS unit that transmits emission type F3E must not exceed a peak frequency deviation of $\pm 2.5\text{KHz}$, and the audio frequency response shall not exceed 3.125 KHz.

5.2. MEASUREMENT METHOD

5.2.1. Modulation Limit

- 1). Configure the EUT as shown in figure 4, 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 in figure 4.
- 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 = $20 \log_{10} (\text{Deviation of test frequency} / \text{Deviation of 1KHz reference})$.

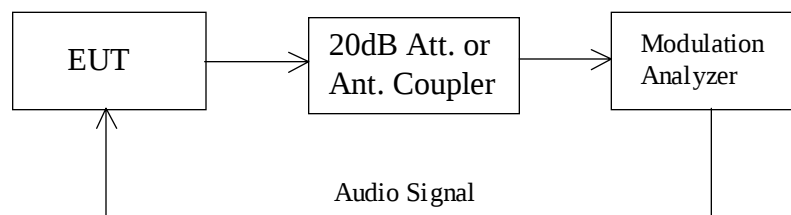


Figure 4: Modulation characteristic measurement configuration

5.3. MEASUREMENT INSTRUMENT

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Modulation Analyzer	HP	8920A	11 Dec. 02
Attenuator	MINI CIRCUITS	MCL BW-S20W2	NA

5.4. MEASUREMENT RESULT

a). Modulation Limit: Channel #1 – 462.5625 MHz

Modulation Level (dB)	Peak Freq. Deviation At 300 Hz (KHz)	Peak Freq. Deviation At 1004 Hz (KHz)	Peak Freq. Deviation At 1500 Hz (KHz)	Peak Freq. Deviation At 2500 Hz (KHz)
-20	0.23	0.31	0.34	0.38
-15	0.26	0.41	0.45	0.55
-10	0.31	0.58	0.74	0.87
-5	0.44	0.93	1.15	1.40
0	0.63	1.51	1.91	1.86
+5	1.03	2.00	1.98	1.87
+10	1.73	2.05	2.00	1.90
+15	2.32	2.05	2.01	1.93
+20	2.43	2.05	2.01	1.95

b). Modulation Limit: Channel #14 – 467.7125 MHz

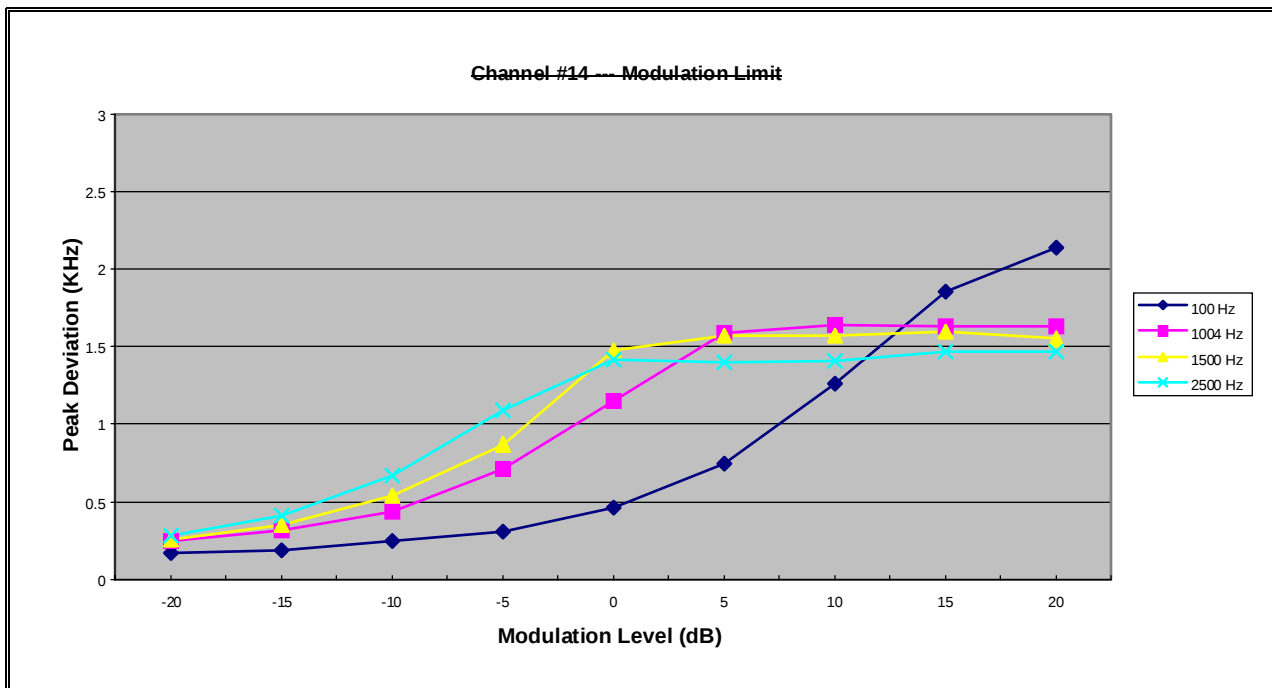
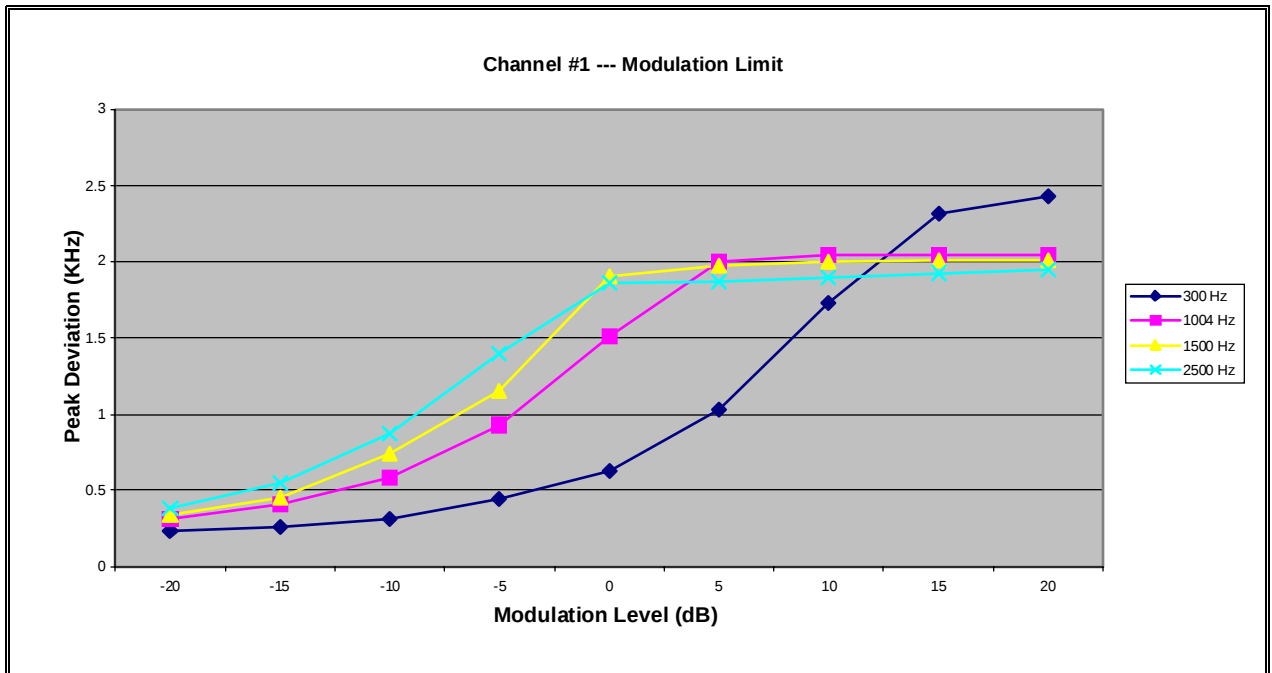
Modulation Level (dB)	Peak Freq. Deviation At 300 Hz (KHz)	Peak Freq. Deviation At 1004 Hz (KHz)	Peak Freq. Deviation At 1500 Hz (KHz)	Peak Freq. Deviation At 2500 Hz (KHz)
-20	0.17	0.25	0.26	0.28
-15	0.19	0.32	0.35	0.41
-10	0.25	0.44	0.54	0.67
-5	0.31	0.71	0.87	1.09
0	0.46	1.15	1.48	1.42
+5	0.75	1.59	1.57	1.40
+10	1.26	1.64	1.57	1.41
+15	1.85	1.63	1.60	1.47
+20	2.14	1.63	1.55	1.47

Date Tested:

Temperature:

Humidity:

Test Engineer:_____



c). Audio Frequency Response: Channel #1 – 462.5625 MHz

Frequency (Hz)	Deviation (KHz)
100	0.22
200	0.27
300	0.31
400	0.34
500	0.38
600	0.42
700	0.44
800	0.46
900	0.5
1000	0.5
1200	0.57
1400	0.63
1600	0.70
1800	0.71
2000	0.72
2200	0.74
2400	0.81
2600	0.82
2800	0.74
3000	0.70
3200	0.60
3400	0.53
3600	0.47
3800	0.42
4000	0.40
4200	0.34
4400	0.32
4600	0.27
4800	0.25
5000	0.24
5500	0.21
6000	0.19
6500	0.18
7000	0.18
8500	0.18
10000	0.17

d). Audio Frequency Response: Channel #14 – 467.7125 MHz

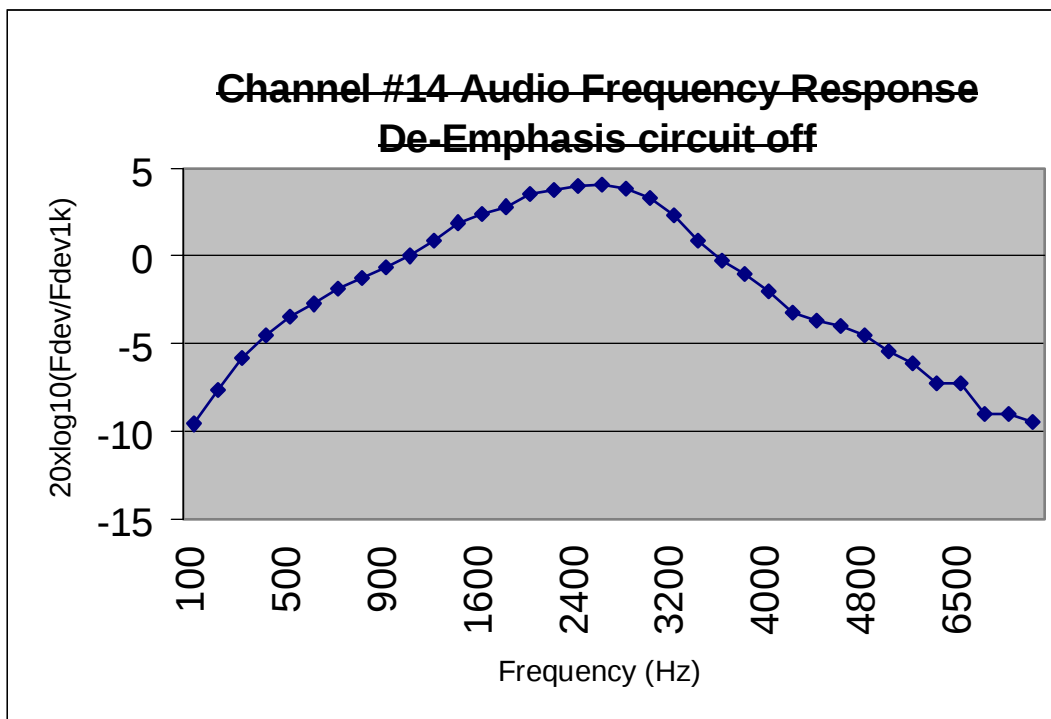
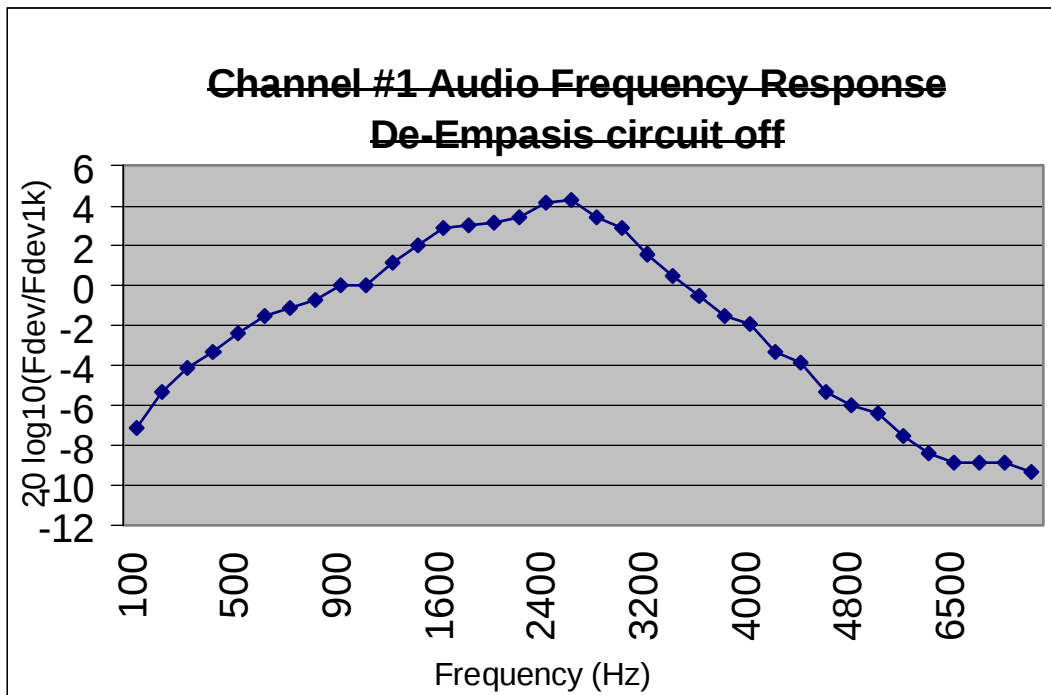
Frequency (Hz)	Deviation (KHz)
100	0.168
200	0.21
300	0.26
400	0.30
500	0.34
600	0.37
700	0.41
800	0.44
900	0.47
1000	0.507
1200	0.56
1400	0.63
1600	0.67
1800	0.70
2000	0.76
2200	0.78
2400	0.80
2600	0.81
2800	0.79
3000	0.74
3200	0.66
3400	0.56
3600	0.49
3800	0.45
4000	0.40
4200	0.35
4400	0.33
4600	0.32
4800	0.30
5000	0.27
5500	0.25
6000	0.22
6500	0.22
7000	0.18
8500	0.18
10000	0.17

Date Tested:

Temperature:

Humidity:

Test Engineer:_____



6. EMISSION BANDWIDTH

6.1. PROVISIONS APPLICABLE

According to CFR 47 section 95.633(3), the authorized bandwidth for emission type FRS unit is 12.5 KHz.

6.2. MEASUREMENT METHOD

- Check the calibration of the measurement instrument using either an internal calibrator or a known signal from an external generator.
- Set-up the test equipments as shown in the following Figure (5).

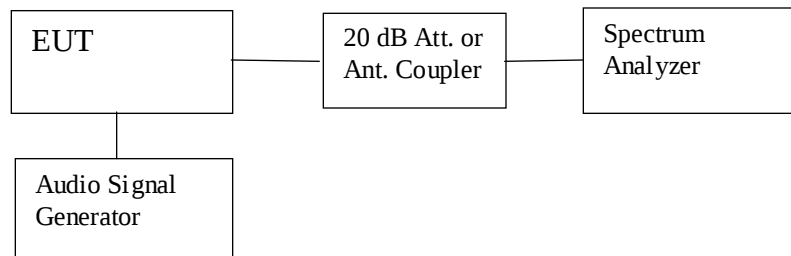


Figure 5: Emission Bandwidth measurement configuration

- Set the level of audio signal generator to obtain 16 dB greater than required for the rated 50% modulation.
- 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	8566B	6/12/01
Attenuator	MINI CIRCUITS	MCL BW-S20W2	NA
Audio Signal Generator	HP	3325A	NA

6.4. MEASUREMENT RESULT

The Occupied Bandwidth is measured to be 9.95 KHz.

Date Tested:

Temperature:

Humidity:

Test Engineer:_____

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 95.635(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	05/25/01
RF Synthesizer	HP	83732B	2/11/02
Amplifier	HP	8449B	4/12/01
Bilog Antenna	CHASE EMC LTD	CBL6112	11/23/01
Horn Antenna	EMCO	3115 SN: 2238	5/1/01
Horn Antenna	EMCO	3115 SN: 3245	5/1/01
Dipole Antenna	COMPLIANCE DESIGN	ROBERTS	5/5/98

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

7.4. MEASUREMENT RESULT

a). Channel-1: 462.5625 MHz

Frequency (MHz)	Receiver Reading (dBuV)	SG setting (dBm)	Cable Loss	Ant Gain (dB)	Result ERP (dBm)	Limit (dBm)	Margin (dBm)
925.12	97.12	-19.2	2.7	4.5	-17.4	-13	-4.4
1388	76.95	-37.7	3	6.1	-34.6	-13	-21.6
1850	73.68	-38.5	3.75	6.9	-35.35	-13	-22.35
2313	63.98	-45.7	4.35	6.7	-43.35	-13	-30.35
2775	60.4	-43.4	4.95	6.8	-41.55	-13	-28.55
3238	51.18	-55.3	5.4	6.2	-54.5	-13	-41.5
3700	60.08	-46.9	5.7	6.8	-45.8	-13	-32.8
4163	55.67	-49.4	6	8	-47.4	-13	-34.4
4626	53.78	-49.1	6.3	8.5	-46.9	-13	-33.9

b). Channel-14: 467.7125 MHz

Frequency (MHz)	Receiver Reading (dBuV)	SG setting (dBm)	Cable Loss	Ant Gain (dB)	Result ERP (dBm)	Limit (dBm)	Margin (dBm)
935.425	96.53	-19.9	2.7	4.5	-18.1	-13	-5.1
1403	79.46	-35.31	3	6.1	-32.21	-13	-19.21
1870	75.28	-37.09	3.75	6.9	-33.94	-13	-20.94
2338	62.71	-46.99	4.35	6.7	-44.64	-13	-31.64
2806	60.1	-46.39	4.95	6.8	-44.54	-13	-31.54
3274	55.1	-49.89	5.4	6.2	-49.09	-13	-36.09
3741	61.09	-43.89	5.7	6.8	-42.79	-13	-29.79
4209	59.21	-47.49	6	8	-45.49	-13	-32.49
4677	51.9	-54.2	6.3	8.5	-52	-13	-39

Date Tested:

Temperature:

Humidity:

Test Engineer:_____

8. FREQUENCY STABILITY MEASUREMENT

8.1. PROVISIONS APPLICABLE

- a). According to CFR 47 section 1055(a)(1), the frequency stability shall be measured with variation of ambient temperature from -30°C to $+50^{\circ}\text{C}$ centigrade.
- b). According to CFR 47 section 1055(d)(2), for hand carried battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacture.
- c). According to CFR 47 section 95.267(b), the FRS unit must be maintained within a frequency tolerance of 0.00025%.

8.2. MEASUREMENT METHOD

8.2.1. Frequency stability versus environmental temperature

- 1). Setup the configuration per figure 6 for frequencies measurement inside an environmental chamber. Install new battery in the EUT.
- 2). Turn on EUT and set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 10 KHz and Video Resolution Bandwidth to 100 KHz and Frequency Span to 100 KHz. Record this frequency as reference frequency.
- 3). Set the temperature of chamber to 50°C . Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
- 4). Repeat step 2 with a 10°C decreased per stage until the lowest temperature -30°C is measured, record all measured frequencies on each temperature step.

8.2.2. Frequency stability versus input voltage

- 1). Setup the configuration per figure 6 for frequencies measured at temperature if it is within 15°C to 25°C . Otherwise, an environmental chamber set for a temperature of 20°C shall be used. Install new battery in the EUT.
- 2). Set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 10 KHz and Video Resolution Bandwidth to 100 KHz and Frequency Span to 100 KHz. Record this frequency as reference frequency.
- 3). For battery operated only device, supply the EUT primary voltage at the operating end point which is specified by manufacturer and record the frequency.

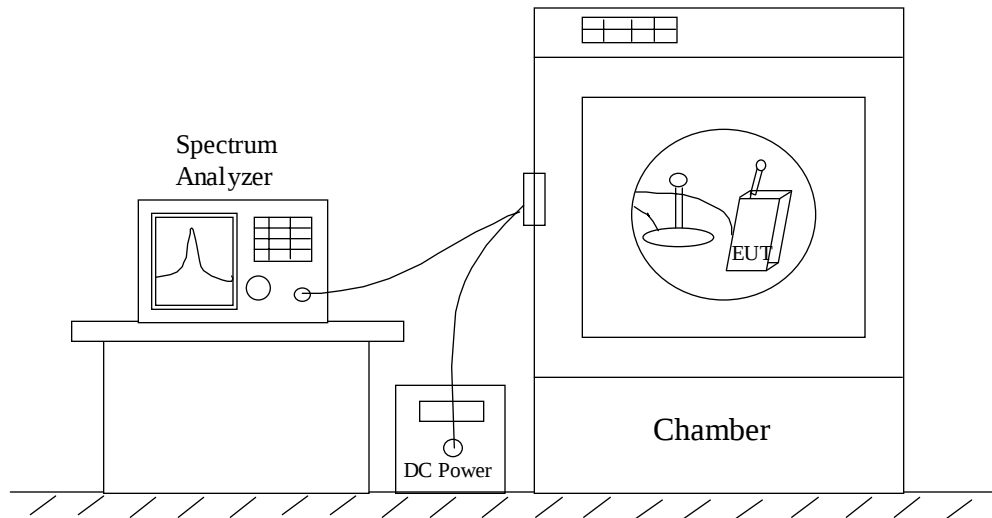


Figure 6: Frequency stability measurement configuration

8.3. MEASUREMENT INSTRUMENT

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	05/25/01
Attenuator	MINI CIRCUITS	MCL BW-S20W2	NA
Environmental Chamber	TENNY	TEN	5/12/01

8.4. MEASUREMENT RESULT

Reference Frequency: 462.56192 MHz		Limit: 0.00025 (%)					
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency deviation measured with time elapse					
		2 minutes		5 minutes		10 minutes	
		MHz	%	MHz	%	MHz	%
50	New Batt	462.56271	0.00017	462.56260	0.00015	462.56263	0.00015
40	New Batt	462.56254	0.00013	462.56241	0.00011	462.56230	0.00008
30	New Batt	462.56228	0.00008	462.56225	0.00007	462.56200	0.00002
20	New Batt	462.56192	0.00000	462.56194	0.00001	462.56180	0.00003
10	New Batt	462.56192	0.00000	462.56195	0.00001	462.56263	0.00015
0	New Batt	462.56260	0.00015	462.56263	0.00015	462.56250	0.00013
-10	New Batt	462.56246	0.00012	462.56236	0.00010	462.56200	0.00002
-20	New Batt	462.56203	0.00002	462.56208	0.00003	462.56200	0.00002
-30	New Batt	462.56211	0.00004	462.56216	0.00005	462.56238	0.00010

Reference Frequency: 467.71239 MHz				Limit: 0.00025 (%)			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency deviation measured with time elapse					
		2 minutes		5 minutes		10 minutes	
		MHz	%	MHz	%	MHz	%
50	New Batt	467.71320	0.00017	467.71335	0.00021	467.71340	0.00022
40	New Batt	467.71338	0.00021	467.71336	0.00021	467.71330	0.00019
30	New Batt	467.71317	0.00017	467.71287	0.00010	467.71240	0.00001
20	New Batt	467.71239	0.00000	467.71230	0.00002	467.71225	0.00003
10	New Batt	467.71224	0.00003	467.71223	0.00003	467.71225	0.00003
0	New Batt	467.71235	0.00001	467.71243	0.00001	467.71255	0.00003
-10	New Batt	467.71261	0.00005	467.71265	0.00006	467.71270	0.00007
-20	New Batt	467.71266	0.00006	467.71253	0.00003	467.71245	0.00001
-30	New Batt	467.71248	0.00002	467.71250	0.00002	467.71255	0.00003

b). Frequency stability versus input voltage (battery operation end point voltage is 3.8 Vdc)

Channel	Reference Frequency (MHz)	Frequency measured at end point voltage	Frequency Deviation (%)	Limit (%)
1	462.56257	462.56256	0.000002	0.00025
14	467.712535	467.712545	0.000002	0.00025

Date Tested:

Temperature:

Humidity:

Test Engineer:_____

9. APPENDIX

EXHIBIT 1:	User Manual
EXHIBIT 2:	EUT External Photos
EXHIBIT 3:	EUT Internal Photos
EXHIBIT 4:	Schematic
EXHIBIT 5:	Block Diagram
EXHIBIT 6:	Operational Description
EXHIBIT 7:	Report of Measurements
EXHIBIT 8:	Setup photo
EXHIBIT 9:	Labeling