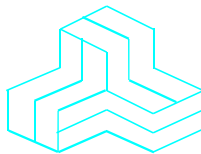


ENGINEERING TEST REPORT



Headset Transceiver, 49 MHz
Model No.: Peltor LiteCom

FCC ID: NUVMT53H749

Applicant:

Aearo Company
5457 W. 79th Street
Indianapolis, INDIANA
USA, IN 46268

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.235
Intentional Radiators in the Band 49.82 – 49.90 MHz

UltraTech's File No.: TLT-006FCC15C235

This Test report is Issued under the Authority of
Tri M. Luu, Professional Engineer,
Vice President of Engineering
UltraTech Group of Labs



Date: June 23, 2004

Report Prepared by: Anca Dobre

Tested by: Hung Trinh, RFI Technician

Issued Date: June 23, 2004

Test Dates: April 18 – May 13, 2004

- The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.
- This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.

UltraTech

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31040/SIT



C-1376



46390-2049



200093-0



SL2-IN-E-1119R



00-034



TABLE OF CONTENTS

EXHIBIT 1.	SUBMITTAL CHECK LIST	1
EXHIBIT 2.	INTRODUCTION	2
2.1.	SCOPE	2
2.2.	RELATED SUBMITTAL(S)/GRANT(S)	2
2.3.	NORMATIVE REFERENCES	2
EXHIBIT 3.	PERFORMANCE ASSESSMENT	3
3.1.	CLIENT INFORMATION	3
3.2.	EQUIPMENT UNDER TEST (EUT) INFORMATION	3
3.3.	EUT'S TECHNICAL SPECIFICATIONS.....	4
3.4.	LIST OF EUT'S PORTS	5
3.5.	ANCILLARY EQUIPMENT	5
3.6.	BLOCK DIAGRAM OF TEST SETUP.....	5
EXHIBIT 4.	EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS	6
4.1.	CLIMATE TEST CONDITIONS	6
4.2.	OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS.....	6
EXHIBIT 5.	SUMMARY OF TEST RESULTS.....	7
5.1.	LOCATION OF TESTS.....	7
5.2.	APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS.....	7
5.3.	MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES.....	7
EXHIBIT 6.	MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS	9
6.1.	TEST PROCEDURES.....	9
6.2.	MEASUREMENT UNCERTAINTIES	9
6.3.	MEASUREMENT EQUIPMENT USED	9
6.4.	METHOD OF MEASUREMENTS.....	9
6.5.	ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER.....	9
6.6.	ANTENNA REQUIREMENTS [§15.203]	9
6.7.	26 dB BANDWIDTH [§ 2.1049].....	10
6.8.	TRANSMITTER RADIATED EMISSIONS @ 3 METERS [§§ 15.235(a), (b), 15.209 & 15.205].....	12
EXHIBIT 7.	MEASUREMENT UNCERTAINTY	20
7.1.	RADIATED EMISSION MEASUREMENT UNCERTAINTY	20

EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
--	Test Report	- Exhibit 1: Submittal check lists - Exhibit 2: Introduction - Exhibit 3: Performance Assessment - Exhibit 4: EUT Operation and Configuration during Tests - Exhibit 5: Summary of test Results - Exhibit 6: Measurement Data - Exhibit 7: Measurement Uncertainty - Exhibit 8: Measurement Methods	OK
1	Test Setup Photos	Radiated Emissions Setup Photos	OK
2	External EUT Photos	External EUT Photos	OK
3	Internal EUT Photos	Internal EUT Photos	OK
4	Cover Letters	Cover Letter	OK
5	Attestation Statements	- Letter from the Applicant to appoint Ultratech to act as an agent - Letter from the Applicant to request for Confidentiality Filing - Letter from the Applicant to attest that the modifications required for compliance will be incorporated in the final manufactured units.	OK
6	ID Label/Location Info	- ID Label - Location of ID Label	OK
7	Block Diagrams	Block diagram	OK
8	Schematic Diagrams	Schematics	OK
9	Parts List/Tune Up Info	Parts List	OK
10	Operational Description	Operational Description	OK
12	Users Manual	User Manual	OK

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File #: TLT-006FCC15C235

June 21, 2004

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EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.235
Title:	Code of Federal Regulations (CFR), Title 47 - Telecommunication, Part 15
Purpose of Test:	To obtain FCC Certification Authorization for an Intentional Radiator operating in the frequency band 49.82 – 49.90 MHz.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 – American National Standard for Methods of Measurement of Radio – Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	Commercial, industrial or business.

2.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

2.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19	2003	Code of Federal Regulations, Title 47 – Telecommunication
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CISPR 22 & EN 55022	2003 2003	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1	2003	Specification for Radio Disturbance and Immunity measuring apparatus and methods

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File #: TLT-006FCC15C235
June 21, 2004

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EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	Aearo Company
Address:	5457 W. 79 th Street Indianapolis, Indiana USA, IN 46268
Contact Person:	Mr. Mike Cimino Phone #: 705-733-3403 ext.106 Fax #: 705-733-3565 Email Address: mike_cimino@aearo.com

MANUFACTURER	
Name:	Peltor AB
Address:	Malmstensgatan 19 Varnamo Sweden, SE-331 02
Contact Person:	Mr. Lars Carlborg Phone #: 46 370 65 65 35 Fax #: 46 370 69 42 80 Email Address: lars.carlborg@peltor.se

3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	LiteCom (49 MHz)
Product Name:	Headset Transceiver, 49 MHz
Model Name or Number:	Peltor LiteCom
Serial Number:	2742272
Type of Equipment:	Low Power Transceiver
Input Power Supply Type:	Internal battery
Primary User Functions of EUT:	Provide safe communication in noisy environment

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3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Portable
Intended Operating Environment:	Commercial, industrial or business
Power Supply Requirement:	3 V Battery
RF Output Power Rating:	79.65 dB μ V/m
Operating Frequency Range:	49.82 – 49.90 MHz
RF Output Impedance	50 Ohms
Channel Spacing	N/A
Duty Cycle	N/A
26 dB Bandwidth	18.4 kHz
Modulation type	FM Modulation with 1 kHz sine wave signal 300mVrms
Oscillator Frequencies	49.830 MHz; 49.845 MHz; 49.860 MHz; 49.875 MHz; 49.890 MHz
Antenna Connector Type	Integral, permanently attached
Antenna Description	Manufacturer: Chief Tek Electronics Co.Ltd. Type: Helix Model: Ant 18 Frequency Range: 49 – 50 MHz In/Out Impedance: 50 Ohms Gain: -3 dB

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File #: TLT-006FCC15C235

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3.4. LIST OF EUT'S PORTS

None

3.5. ANCILLARY EQUIPMENT

None

3.6. BLOCK DIAGRAM OF TEST SETUP

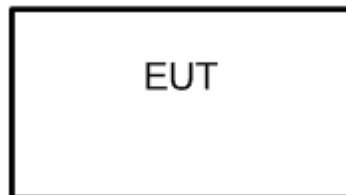


EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power Input Source:	3 V Battery

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	The EUT was operated continuously and had the following settings during the tests: • Surround 3 • Volume 3 • Vox 3 • Squelch 1 • Subchannel Off
Special Test Software:	Special software was provided by Aearo Company to operate the EUT continuously.
Special Hardware Used:	None
Transmitter Test Antenna:	The EUT was tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment.

Transmitter Test Signals:	
Frequency Band(s):	49.82 – 49.90 MHz
Frequency(ies) Tested:	49.86 MHz (Channel 3)

EXHIBIT 5. SUMMARY OF TEST RESULTS

5.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 24'(L) x 16'(W) x 8'(H).
- Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: February 17, 2004.

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section (s)	Test Requirements	Compliance (Yes/No)
15.203	The transmitter shall use a transmitting antenna that is an integral part of the device.	Yes
2.1049	26 dB Bandwidth	Yes
15.235(a) & (b)	Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious	Yes
15.107	AC Power Conducted Emissions	Not applicable for battery operated device.
15.109(a)	Radiated Emissions from Digital Devices and Radio Receiver	Yes (See Note)

Note: The digital circuits portion and Radio Receiver of the EUT have been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices. The engineering test report can be provided upon requests.

5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

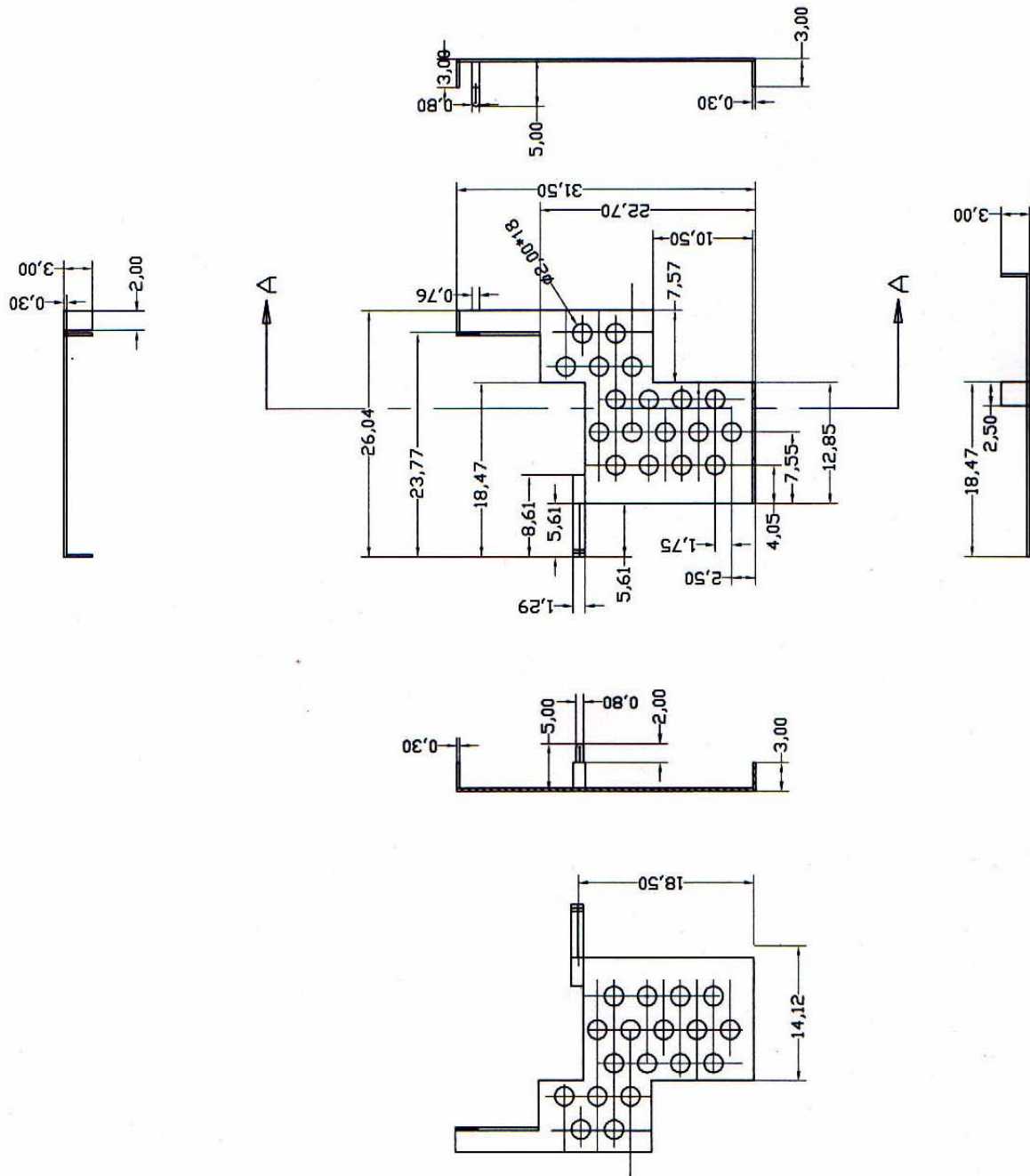
The only change was the addition of a shield part on the PCB. See the following drawing for details.

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June 21, 2004

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EXHIBIT 6. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

6.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in Exhibit 8 of this report.

6.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

6.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63-4: 2003, FCC 15.235 and CISPR 16-1.

6.4. METHOD OF MEASUREMENTS

The measurements were performed in accordance with Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4: 2003.

6.5. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER

The essential function of the EUT is to enable safe communication to and from radios over RF link.

6.6. ANTENNA REQUIREMENTS [§15.203]

6.6.1. Limits

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Note: This requirement does not apply to carrier current devices operated under the provisions of §§ 15.211, 15.213, 15.217, 17.219 or 15.221.

6.6.2. Engineering Analysis

Antenna is an integral component mounted on the printed circuit board.

6.7. 26 dB BANDWIDTH [§ 2.1049]

6.7.1. Limits

No limit is required by FCC. However, the 26dB bandwidth shall be small enough so that the carrier signal will not spread outside the permitted band 49.82 – 49.90 MHz.

6.7.2. Test Arrangement



6.7.3. Test Equipment List

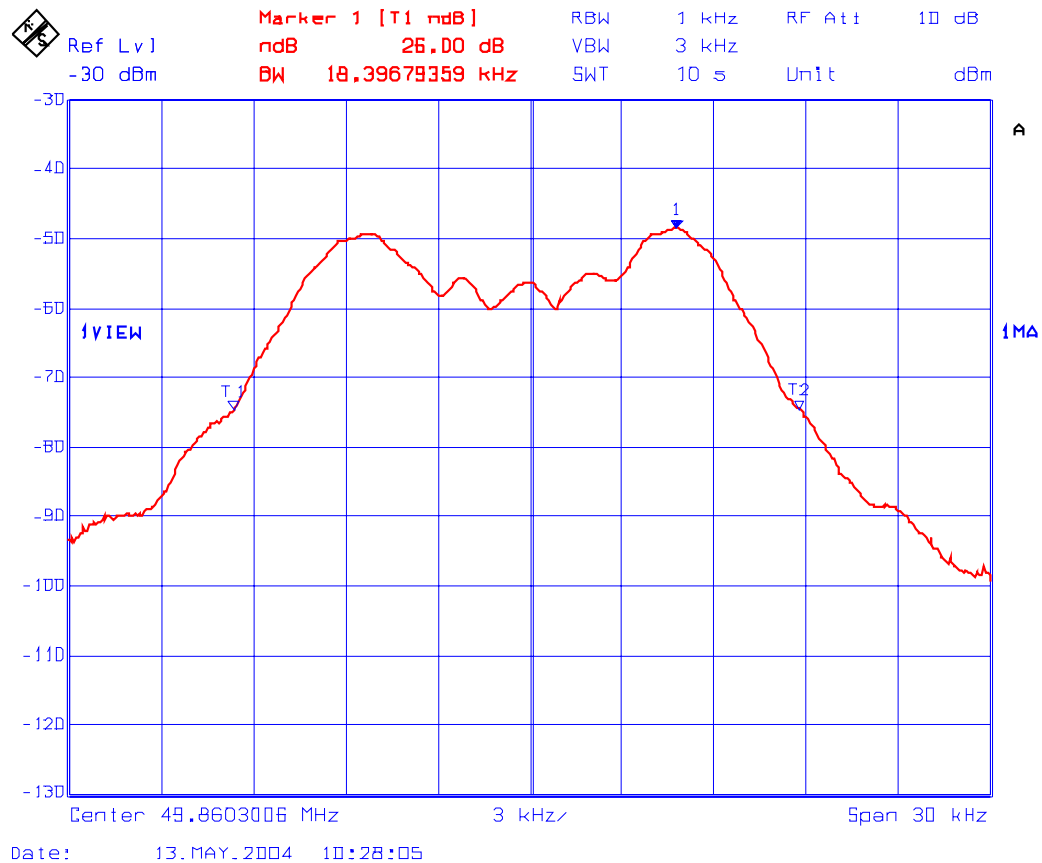
Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Rohde & Schwarz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz

6.7.4. Test Data

Frequency (MHz)	26 dB Bandwidth (kHz)
49.86	18.4

*See Plot # 1 for details of measurement.

Plot # 1:
26 dB Bandwidth
Test Frequency: 49.86 MHz
Modulation: FM with 1 kHz sine wave signal 300 m Vrms



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File #: TLT-006FCC15C235

June 21, 2004

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6.8. TRANSMITTER RADIATED EMISSIONS @ 3 METERS [§§ 15.235(a), (b), 15.209 & 15.205]

6.8.1. Limits

§15.235 (a) (b) The RF radiated emissions measured at 3 meters distance within this band shall not exceed the field strength below:

Fundamental Frequency (MHz)	Field Strength Limits (dB μ V/m) @3m (using Average Detector, RBM = 100 kHz, VBW = 10 Hz)	
	Fundamental	Harmonic/Spurious
49.82 – 49.90	80.0	26 dBc or FCC 15.209 (All signals exceeding 26 dB μ V/m @ 3m shall be recorded)

§15.205 (a) The field strength of any emissions appearing outside of this band shall not exceed the general radiated emission limits shown in § 15.209 (a).

Section 15.205(a) – Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	162.0125 - 167.17	2310 - 2390	9.3 - 9.5
0.49 - 0.51	167.72 - 173.2	2483.5 - 2500	10.6 - 12.7
2.1735 - 2.1905	240 - 285	2655 - 2900	13.25 - 13.4
8.362 - 8.366	322 - 335.4	3260 - 3267	14.47 - 14.5
13.36 - 13.41	399.9 - 410	3332 - 3339	14.35 - 16.2
25.5 - 25.67	608 - 614	3345.8 - 3358	17.7 - 21.4
37.5 - 38.25	960 - 1240	3600 - 4400	22.01 - 23.12
73 - 75.4	1300 - 1427	4500 - 5250	23.6 - 24.0
108 - 121.94	1435 - 1626.5	5350 - 5460	31.2 - 31.8
123 - 138	1660 - 1710	7250 - 7750	36.43 - 36.5
149.9 - 150.05	1718.8 - 1722.2	8025 - 8500	Above 38.6
156.7 - 156.9	2200 - 2300	9000 - 9200	

Section 15.209(a) – Field Strength Limits within Restricted Frequency Bands

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76– 88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.		

6.8.2. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Rohde & Schwarz	FSEK20/B4/B21	834157/005	9 KHz – 40 GHz
Spectrum Analyzer	Hewlett Packard	8946A	3325A00141	9 kHz – 6.5 GHz
Function Generator	Stanford Research Systems	DS345	34591	1 µHz – 30.2 MHz
Amplifier	Hewlett Packard	83051A	3611A01947	40 MHz – 50 GHz
Log Periodic/Bow-Tie Antenna	EMCO	3143	1029	20 - 1000 MHz

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File #: TLT-006FCC15C235
June 21, 2004

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6.8.3. Test Data

6.8.3.1. Field Strength within the 49.82- 49.90 MHz

Frequency (MHz)	Peak E-Field @3m (dB μ V/m)	Average E-Field @ 3m (dB μ V/m)	Antenna Plane (H/V)	² Limit 15.235(a) @3m (dB μ V/m)	Margin (dB)	Pass/Fail
49.86	79.95	79.65	H	80	-0.35	Pass
49.86	79.68	79.56	V	80	-0.44	Pass

Notes:

1. Portable transmitter was placed in three different orthogonal positions for searching maximum field strength level.
2. The limit is based on measurement instrument employing an average detector.

6.8.3.2. Field Strength Emissions appearing outside of 49.82- 49.90 MHz

6.8.3.2.1. Field Strength Emissions appearing between the Band-Edges and up to 10 kHz above and below the Band-Edges

Conform. See Plots # 2 to 5 for details of measurements.

Plot # 2:
Lower Band-Edge Radiated Emissions @ 3 meters, Horizontal Polarization
Channel 1, 49.83 MHz
FM Modulation with 1 kHz sine wave signal 300m Vrms



MARKER
49.83525 MHz
77.25 dB μ V/m

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 49.83525 MHz
77.25 dB μ V/m

Last Hrd
Key Menu

SPAN

Aux Conn
Contro

LOG REF 90.0 dB μ V/m

PREAMP ON

10
dB/
ATN
20 dB

VA SB
SC FC
ACORR

CENTER 49.83000 MHz

#IF BW 1.0 kHz

#AVG BW 3 kHz

SPAN 50.00 kHz

SWP 300 msec

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June 21, 2004

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Plot #3:
Lower Band-Edge Radiated Emissions, Vertical Polarization
Channel 1, 49.83 MHz
FM Modulation with 1 kHz sine wave signal 300m Vrms



MARKER
49.83513 MHz
76.07 dB μ V/m

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 49.83513 MHz
76.07 dB μ V/m

Last Hrd
Key Menu

SPAN

LOG REF 90.0 dB μ V/m

PREAMP ON

Aux Conn
Contro

10
dB/
ATN
20 dB

VA SB
SC FC
ACORR

CENTER 49.83000 MHz

#IF BW 1.0 kHz

#AVG BW 3 kHz

SPAN 50.00 kHz

SWP 300 msec

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File #: TLT-006FCC15C235

June 21, 2004

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Plot #4
Upper Band-Edge Radiated Emissions @ 3 meters, Horizontal Polarization
Channel 5, 49.89 MHz
FM Modulation with 1 kHz sine wave signal 300m Vrms



SPAN
50.00 kHz

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 49.89513 MHz
77.07 dB μ V/m

Last Hrd
Key Menu

SPAN

LOG REF 90.0 dB μ V/m

PREAMP ON

Aux Conn
Contro

10
dB/
ATN
20 dB

VA SB
SC FC
ACORR

CENTER 49.89000 MHz

#IF BW 1.0 kHz

#AVG BW 3 kHz

SPAN 50.00 kHz

SWP 300 msec

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June 21, 2004

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Plot #5:
Upper Band-Edge Radiated Emissions @ 3 meters, Vertical Polarization
Channel 5, 49.89 MHz
FM Modulation with 1 kHz sine wave signal 300m Vrms



SPAN
50.00 kHz

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 49.89525 MHz
75.98 dB μ V/m

Last Hrd
Key Menu

SPAN

LOG REF 90.0 dB μ V/m

PREAMP ON

Aux Conn
Contro

10
dB/
ATN
20 dB

VA SB
SC FC
ACORR

CENTER 49.89000 MHz

#IF BW 1.0 kHz

#AVG BW 3 kHz

SPAN 50.00 kHz

SWP 300 msec

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File #: TLT-006FCC15C235

June 21, 2004

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6.8.3.2.2. Field Strength Emissions appearing outside the Band-Edges

The emissions were scanned from 20 MHz to 1 GHz; no relevant spurious/harmonic emissions were detected.

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File #: TLT-006FCC15C235
June 21, 2004

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EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (+ dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	± 1.0	± 1.0
Cable Loss Calibration	Normal (k=2)	± 0.3	± 0.5
EMI Receiver specification	Rectangular	± 1.5	± 1.5
Antenna Directivit	Rectangular	± 0.5	± 0.5
Antenna factor variation with height	Rectangular	± 2.0	± 0.5
Antenna phase center variation	Rectangular	0.0	± 0.2
Antenna factor frequency interpolation	Rectangular	± 0.25	± 0.25
Measurement distance variation	Rectangular	± 0.6	± 0.4
Site imperfections	Rectangular	± 2.0	± 2.0
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67(\text{Bi}) 0.3 (\text{Lp})$ Uncertainty limits $20\text{Log}(1 \pm \Gamma_1 \Gamma_R)$	U-Shaped	± 1.1 -1.25	± 0.5
System repeatability	Std. Deviation	± 0.5	± 0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k = 2 is used:

$$U = 2u_c(y) = 2 \times (+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2 \times (-2.21) = -4.42 \text{ dB}$$

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All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)