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Test Report: TADEMC_FCC.13856.doc
Date: January, 2000

ELECTROMAGNETIC EMISSIONS TEST REPORT
ACCORDING TO FCC CFR 47 PART 15 SUBPART B, PART 90 SUBPART I
for
Tadiran Telematics
EQUIPMENT UNDER TEST:
**Vehicle location unit,
model TULIP-US**

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Description of equipment under test

Test items	Vehicle location unit
Manufacturer	Tadiran Telematics
Types (Models)	TULIP-US
Receipt date	December 29, 1999

Applicant information

Applicant's representative	Mr. Genik Anatoly
Applicant's responsible person	Mr. Hanan Raviv, project manager
Company	Tadiran Telematics
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P.O.Box	267
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Country	Israel
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Test performance

Project Number:	13856
Location	Hermon Laboratories
Test started	December 29, 1999
Test completed	January 3, 2000
Purpose of test	Apparatus verification in accordance with emissions requirements
Test specification(s)	FCC part 15 subpart B class A, part 90 subpart I



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1 Summary and signatures

The EUT, vehicle location unit TULIP-US, was tested according to FCC part 15 subpart B class A and part 90 subpart I and found to comply with the standard requirements.

Test performed by:

Mrs. Eleonora Pitt, test engineer




Test report prepared by:

Mrs. Valeria Mednikov, certification engineer



Test report approved by:

Mr. Alex Usoskin, QA manager



The A2LA logo endorsement applies only to the test methods and the standards that are listed in the scope of Hermon Laboratories accreditation by A2LA.
Through this report a point is used as the decimal separator, while thousands are counted with a comma.
This report is in conformity with EN 45001 and ISO GUIDE 25.
The test results relate only to the items tested.
This test report must not be reproduced in any form except in full with the approval of Hermon Laboratories Ltd.



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2 General information

2.1 Abbreviations and acronyms

The following abbreviations and acronyms are applicable to this test report:

AC	alternating current
cm	centimeter
CE	conducted emissions
dB	decibel
dBm	decibel referred to one milliwatt
dB(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
DC	direct current
EMC	electromagnetic compatibility
EUT	equipment under test
GHz	gigahertz
H	height
Hz	hertz
kHz	kilohertz
kV	kilovolt
L	length
LISN	line impedance stabilization network
m	meter
MHz	megahertz
NA	not applicable
NARTE	National Association of Radio and Telecommunications Engineers, Inc.
PC	personal computer
QP	quasi-peak (detector)
RE	radiated emission
RMS	root-mean-square
sec	second
V	volt
W	width

2.2 Specification references

CFR 47 part 15 subpart B: 10/1998	Radio Frequency Devices, Subpart B.
CFR 47 part 90 subpart I: 10/1998	Private land mobile radio services, Subpart I
ANSI C63.2:06/1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4:1992	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.



2.3 EUT description

The EUT is an alarm transmitter for vehicle location system, which operates at frequency 907.997333 MHz.

The EUT is energized from 12.6 V vehicle battery.

The transmitter is equipped with connector for external antenna.

Modes of operation:

- 1) normal operation – Tx – active,
- 2) stand-by.

The EUT operating frequencies are given in Table 2.3.1

Table 2.3.1 EUT operating frequencies

Frequency, MHz	Card
907.997333	radio
11.947333	digital part
903.42921	LO1
23.894666	LO2

2.4 EUT test configuration

The EUT ports and lines description is given in Table 2.4.1, the support/test equipment description - in Table 2.4.2.

Test configuration is given in Figure 2.4.1.

**Table 2.4.1
EUT ports and lines**

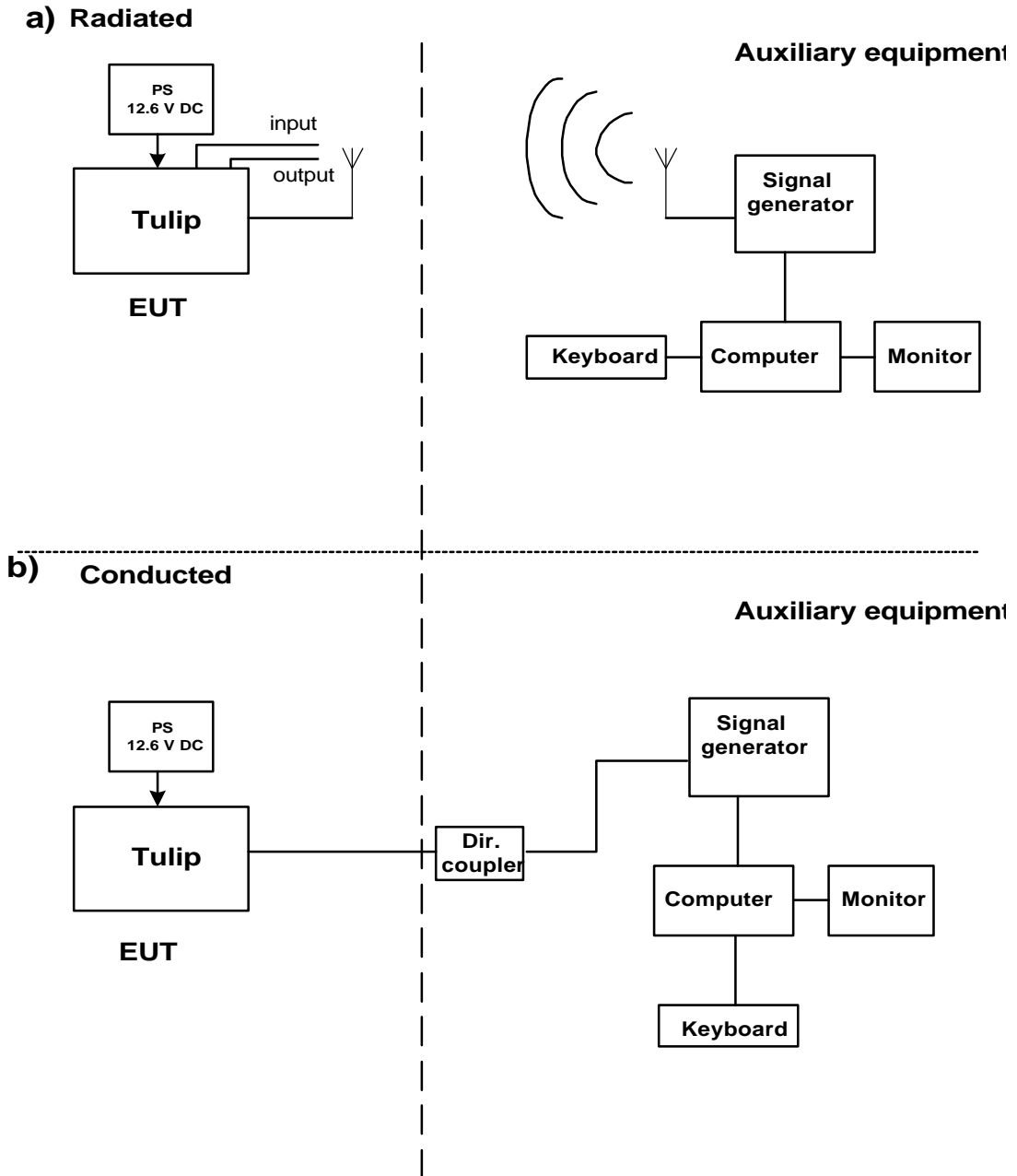
Port type	Port description	Connector type	Quantity of wires	Cable type description	Cable length, m	Connected to
Power/ signal	DC	D type 37 pin	1 pair	unshielded	1.5	12.6 V DC
	input		1 pair	unshielded	1	open
	output		1 pair	unshielded	1	open
Antenna	input	TNC	1	NA	NA	Antenna

**Table 2.4.2
EUT support/test equipment**

Description	Manufacturer	Model number	Serial number	FCC-ID number	Notes
Personal Computer	Unitel	No markings			
Monitor	Philips	Brilliance 1409	7CM3209/60T	No mark	
Keyboard	Quantum	MCK-701W	7113336	KJXMCK-701W	
Bidirectional coupler	Narda	3020A	01519		Cal. 3.12.99
Attenuator	Narda	769-30	02155		Cal. 1.12.99
Signal generator	HP	8657B	3133V02205		
Termination	Narda	374BNM	8305		



Figure 2.4.1
EUT test configuration





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2.5 EUT verification. Labeling requirements (CFR 47, FCC part 15, sections 15.19, 15.109)

A device subject to verification shall bear the following label in a conspicuous location on the device:

**This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:**
(1) **This device may not cause harmful interference, and**
(2) **this device must accept any interference received, including interference that may cause undesired operation.**

For a Class A digital device the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

For a Class A and Class B digital device the instructions furnished the user shall include the following caution:

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.



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3 Test facility description

3.1 General

Tests were performed at Hermon Laboratories, which is a fully independent, private EMC, Safety and Telecommunication testing facility. Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47) and by Industry Canada for radiated measurements (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-809 for anechoic chamber, C-845 for conducted emissions site), assessed by NMI Certin B.V. (Netherlands) for a number of EMC, Telecommunications, Safety standards, and assessed by AMTAC (UK) for safety of Medical Devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO GUIDE 25/EN 45001 for EMC, Telecommunications and Product Safety Information Technology Equipment (Certificate No. 839.01).

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Telephone: +972 6628 8001
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Person for contact: Mr. Alex Usoskin, testing and QA manager.

3.2 Equipment calibration

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error. The standards and instruments used in the calibration system conform to the present requirements of MIL-STD-45662A. The laboratory standards are calibrated by the third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements.

3.2.1 Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements


Radiated emissions in the open field test site at 10 m measuring distance	Biconilog antenna: ± 3.2 dB Log periodic antenna: ± 3 dB Biconical antenna: ± 4 dB Double ridged guide antenna: ± 2.36 dB
Radiated emissions in the anechoic chamber at 3 m measuring distance	Biconilog antenna: ± 3.2 dB



3.3 Statement of qualification


The test measurement data supplied in this test measurement report having been received by me, is hereby duly certified. The following is a statement of my qualifications:
I am an engineer, graduated from university in 1974 with an MScEE degree, have obtained 26 years experience in EMC measurements and have been with Hermon Laboratories since 1991.

Name: Mrs. Eleonora Pitt
Position: test engineer

Signature: 
Date: March 14, 2000

I hereby certify that this test measurement report was prepared by me and is hereby duly certified. The following is a statement of my qualifications.
I have a university degree and more than 10 years experience in document processing.
I have been with Hermon Laboratories since May 1999.

Name: Mrs. Valeria Mednikov
Position: technical writer

Signature: 
Date: March 14, 2000



4 Emissions measurements

4.1 Radiated emission measurements according to FCC part 15 subpart B

4.1.1 General

Radiated emission measurements specification limits are given in Table 4.1.1 below:

Table 4.1.1
Limits for electric field strength, quasi-peak detector

Frequency MHz	Class A equipment dB(mV/m) @3 meter distance
30 - 88	49.5
88 - 216	54
216 - 960	57
960 - 5000	60

The limit for 3 m distance was calculated using the inverse linear distance extrapolation factor as follows:

$$\text{Lim}_{3\text{m}} = \text{Lim}_{10\text{m}} + 20 \log (S_1/S_2), \text{ where } S_1 = 10 \text{ m, } S_2 = 3 \text{ m.}$$

4.1.2 Test procedure

The highest frequency used in the EUT for unintentional radiators is 903.429 MHz hence the frequency range from 30 MHz to 5 GHz was investigated (FCC, 15.33, b). The EUT was tested in stand-by and Tx modes.

The EUT was set up on the wooden table in the anechoic chamber, as shown in Figure 4.1.1, Photographs 4.1.1 to 4.1.4. For full test configuration refer to Figure 2.4.1a.

Frequency range from 30 MHz to 1 GHz was investigated with biconilog antenna and from 1 GHz to 5 GHz with double ridge guide antenna installed at 3 meter distance.

To find maximum radiation the turntable was rotated 360°, the measuring antenna height varied from 1 to 4 m and the antennas polarization was changed from vertical to horizontal.

The test results are recorded in Table 4.1.2 and shown in Plots 4.1.1 to 4.1.5.

Reference numbers of test equipment used

HL 0041	HL 0465	HL 0521	HL 0589	HL 0604
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Full description is in Appendix A.

**Table 4.1.2 Radiated emission measurements test results,
electric field, frequency range 30 MHz - 5 GHz**

TEST SPECIFICATION: FCC part 15, subpart B, Class A
 DATE: December 29, 1999
 RELATIVE HUMIDITY: 57%
 AMBIENT TEMPERATURE: 24°C

MEASUREMENTS PERFORMED AT 3-METER DISTANCE

Frequency, MHz	Ant. type	Ant. pol.	Radiated emission, dB(μ V/m)	Limit, dB(μ V/m)	Margin, dB	Pass/ Fail
203.1050	BL	H	39.22	54	14.78	Pass
334.5257	BL	H	47.41	57	9.59	Pass
903.4397	BL	V	55.55	57	1.45	Pass
1806.88	DR	V	55.0	60	5	Pass

Test results listed in the Table were obtained throughout testing with antennas at 1 m height.

Test parameters:

Detector type = QP (quasi peak).

Resolution bandwidth = 120 kHz (in the range 30 MHz to 1 GHz) and 1 MHz (1 GHz to 5 GHz).

Table calculations and abbreviations:

Radiated emission dB (μ V/m) = measured results dB(μ V) + correction factor dB(1/m).

Correction factor = antenna factor + cable loss (for antenna factor and cable loss refer to Appendix B).

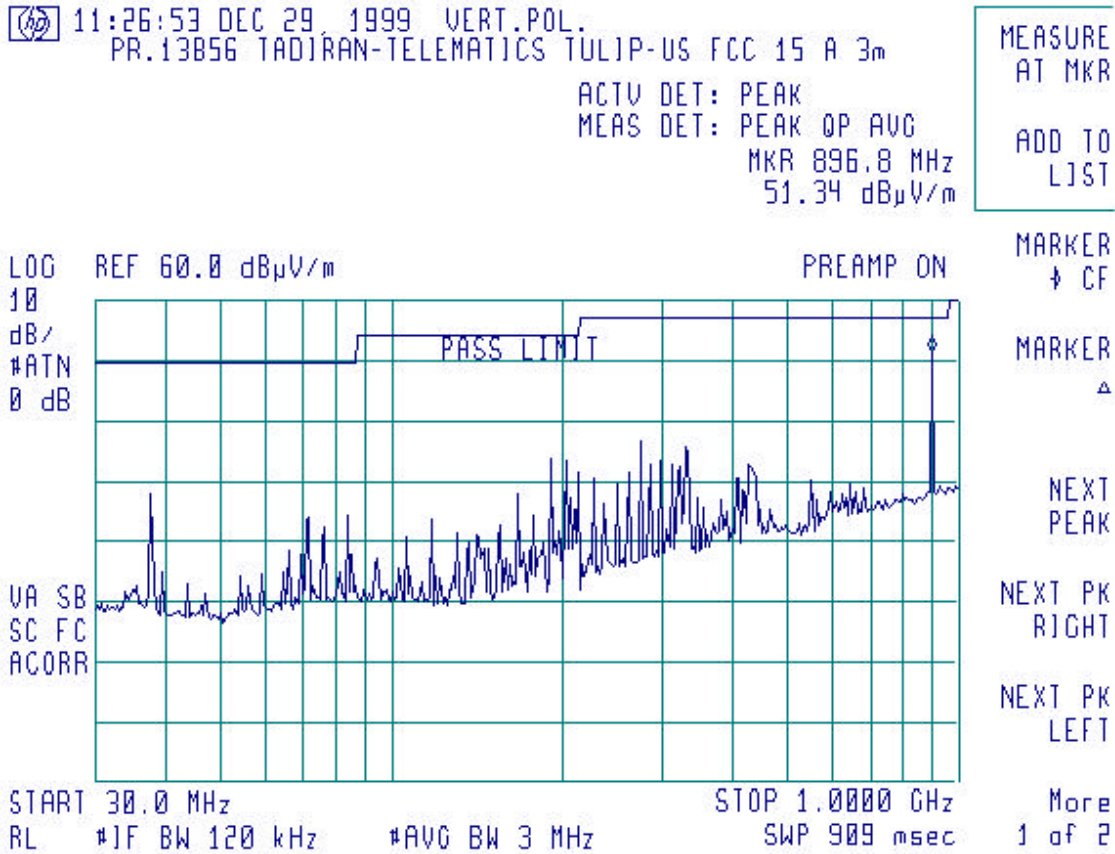
Ant. type = antenna type (BL – biconilog, DR – double ridged guide).

Ant. pol. = antenna polarization (V-vertical, H-horizontal).

Margin = dB below (negative if above) limit.



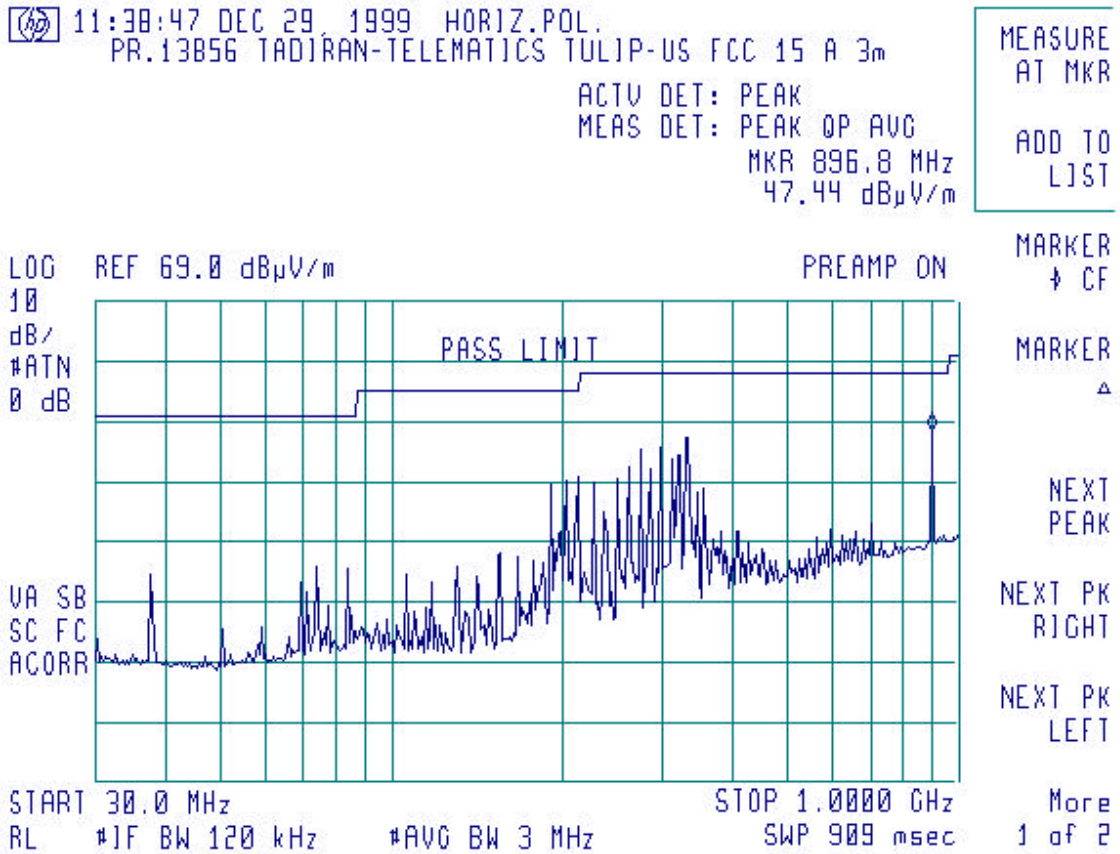
**Plot 4.1.1 Radiated emission measurements test results,
electric field, frequency range 30 MHz - 1 GHz
Stand-by and Tx mode, vertical polarization**





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**Plot 4.1.2 Radiated emission measurements test results,
electric field, frequency range 30 MHz - 1 GHz
Stand-by and Tx mode, horizontal polarization**

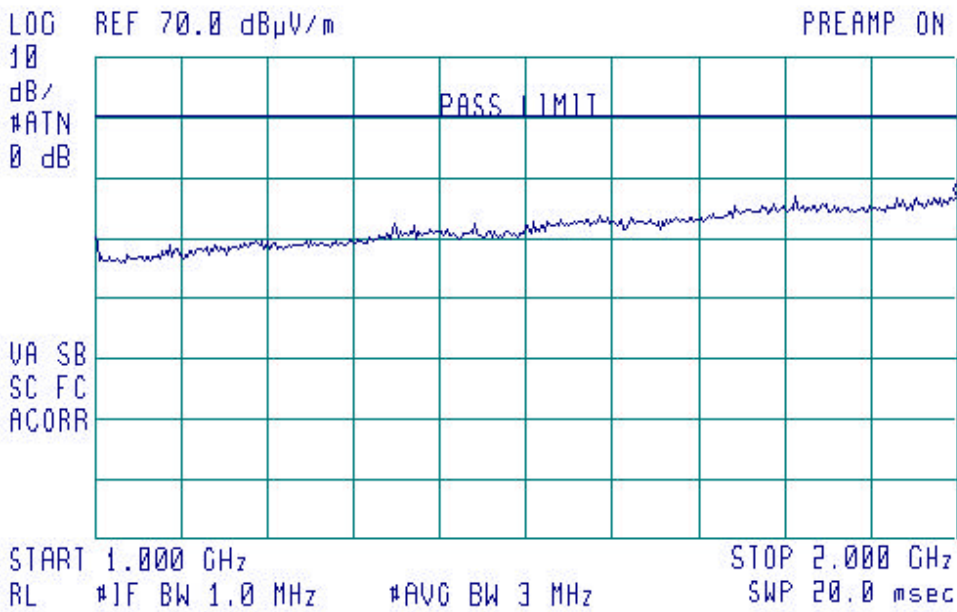




**Plot 4.1.3 Radiated emission measurements test results,
electric field, frequency range 1 GHz – 2 GHz
Stand-by mode, vertical and horizontal polarization**

11:58:39 DEC 29, 1999 VERT.+HORIZ.POL.
PR.13856 TADJIRAN-TELEMATICS TULIP-US FCC 15 A 3m
ACTV DET: PEAK
MEAS DET: PEAK OP
MKR 2.000 GHz
46.81 dB μ V/m

MEASURE
AT MKR
ADD TO
LIST



CLEAR
WRITE A
MAX
HOLD A
VIEW A
BLANK A
Trace
A B C
More
1 of 3