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REGISTRATION
NUMBER: 905266

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NUMBER IC 4621

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TEST REPORT

Report No.: 22442RET.101

TEST NAME: FCC PART 15.249 RF TESTING FOR EQUIPMENT OPERATING IN THE
2400 – 2483.5 MHz FREQUENCY BAND

Product : LOGITECH CORDLESS MOUSE
Trade Mark : LOGITECH
Model/type Ref. : M-RAY105
Manufacturer : SUZHOU LOGITECH ELECTRONIC Co., LTD
Requested by : LOGITECH INC.
Other identification of the product : FCC ID: DZL201940
 IC: 1807B-201940
 P/N: 852374-0000
Standard(s) : USA FCC Part 15.249, 15.205, 15.209, 15.109
 CANADA RSS-210

This test report includes 2 annexes and therefore the total number of pages is 35

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Date: 2005-07-21	Test operator	Revised by:	Approved by:	Page: 1 of 7 AGY 735880-0000.A0
	A. Llamas 	Date: 25-07-05 J. C. Soler Consultant	Date: 25-07-05 A. Rojas Technical Director	

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ANNEXES

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1. COMPETENCE AND GUARANTEES

Centro de Tecnología de las Comunicaciones (CETECOM), S.A. is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 905266.

Centro de Tecnología de las Comunicaciones (CETECOM), S.A. is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: IC 4621.

In order to assure the traceability to other national and international laboratories, CETECOM has a calibration and maintenance programme for its measuring equipment.

CETECOM guarantees the reliability of the data presented in this report, which is the result of measurements and tests performed to the item under test on the date and under the conditions stated on the report and is based on the knowledge and technical facilities available at CETECOM at the time of execution of the test.

CETECOM is liable to the client for the maintenance by its personnel of the confidentiality of all information related to the item under test and the results of the test.

2. GENERAL CONDITIONS

1. This report only refers to the item that has undergone the test.
2. This report does not constitute or imply by its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without written approval of CETECOM.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of CETECOM and the Accreditation Bodies.

3. CHARACTERISTICS OF THE TEST

3.1 TEST REQUESTED

RF measurements for equipment operating in the 2400 MHz -2483.5 MHz band, according to FCC Part 15.249.

3.2 REQUIREMENTS AND METHOD

The test has been carried out according to FCC parts 15.33, 15.35, 15.109, 15.205, 15.209 and 15.249. The testing was performed according to the procedure in ANSI C63.4. Radiated testing was performed in Cetecom's semi-anechoic chamber. This site has been fully described in a report submitted to the FCC and was accepted in a letter dated July 25, 2002.

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The instrumentation used to perform the testing is listed below:

1. Semianechoic Absorber Lined Chamber IR 11. BS.
2. Control Chamber IR 12.BC.
3. Antenna mast EM 1072 NMT.
4. Rotating table EM 1084-4. ON.
5. Multi device controller ETS 2090.
6. Bilog antenna CHASE CBL6111.
7. Antenna tripod EMCO 11968C.
8. Double-ridge Guide Horn antenna 1-18 GHz HP 11966E.
9. Double-ridge Guide Horn antenna 18-40 GHz Agilent 119665J.
10. RF pre-amplifier Miteq AFS5-04001300-15-10P-6.
11. RF pre-amplifier Miteq JS4-12002600-30-5A.
12. RF pr-eamplifierr Schaffner CPA 9231.
13. Spectrum analyzer R&S ESIB 26.
14. Spectrum analyzer R&S FSM.

4. IDENTIFICATION DATA SUPPLIED BY THE APPLICANT

Identification data in this section has been supplied by the client.

4.1 APPLICANT

Name or Company: LOGITECH INC.

V.A.T.: -----

Address: 6505 kaiser Drive

City: Fremont (California)

Postal code: CA94555

Country: USA

Telephone: +1 510 7958500

Fax: +1 510 7928901

4.2 REPRESENTATIVE

Name: Bharat Shah

4.3 TEST SAMPLES SUPPLIER

Name or Company: LOGITECH EUROPE, S.A.

V.A.T.: -----

Address: ZI Moulin du Choc

City: Romanel Sur Morges

Postal code: 1122

Country: Switzerland

Telephone: +41 (0)21 863 50 67

Fax: +41 (0)21 863 53 11

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Samples undergoing test have been selected by: **the client.**

4.4 IDENTIFICATION OF ITEM/ITEMS TESTED

Product: LOGITECH CORDLESS MOUSE

Trade mark: LOGITECH **Model:** M-RAY105

Manufacturer: Suzhou Logitech Electronic Co., LTD

Country of manufacture: P.R.C.

Manufacture site: No. 168, Bin He Rd, Standard Plant, 215011, Suzhou City

Description: Cordless mouse using the 2.4 GHz technology for PC or laptop

5. USAGE OF SAMPLES, PERIOD OF TESTING AND ENVIRONMENTAL CONDITIONS

5.1 USAGE OF SAMPLES

Sample M/01 is formed by the following elements:

<u>Control No.</u>	<u>Description</u>	<u>Model</u>	<u>Serial No.</u>	<u>Date of reception</u>
22442/01	Cordless mouse with integral antenna	M-RAY105	---	27/06/05

1. Sample M/01 has undergone following test(s).
All tests indicated in annex A.

5.2 PERIOD OF TESTING

The performed test started on 2005-06-28 and finished on the same day.

The tests as detailed in this report have been performed at CETECOM.

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5.3 ENVIROMENTAL CONDITIONS

In the control chamber the following limits were not exceeded during the test:

Temperature	Min. = 25 °C Max. = 26 °C
Relative humidity	Min. = 48 % Max. = 48 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

In the semianechoic chamber (21 meters x 11 meters x 8 meters) the following limits were no exceeded during the test.

Temperature	Min. = 25.0 °C Max. = 25.0 °C
Relative humidity	Min. = 52 % Max. = 52 %
Air pressure	Min. = 1020 mbar Max. = 1020 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

6. TEST RESULTS

Abbreviations used in the VERDICT column of the following tables are:

- P** Pass
- F** Fail
- NA** not applicable
- NM** not measured

FCC PART 15 PARAGRAPH	VERDICT			
	NA	P	F	NM
15.249 Subclause (a). Field strength of fundamental emission		P		
15.249 Subclause (a) and (d). Emission limitations radiated for harmonics and outside of the specified frequency bands		P		
15.109. Radiated emission limits for receiver		P		

7. REMARKS AND COMMENTS

None.

8. SUMMARY

Based on the results of the performed test, stated in annex A the item under test is **IN COMPLIANCE** with the specifications listed in section 3.1 “TEST REQUESTED”.

NOTE: The results presented in this Test Report apply only to the particular item under test declared in section 4.4 “IDENTIFICATION OF ITEM/ITEMS TESTED” of this document, as presented for test on the date(s) declared in section 5, “USAGE OF SAMPLES, PERIOD OF TESTING AND ENVIRONMENTAL CONDITIONS”.

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ANNEX A TEST RESULTS

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TEST CONDITIONS

Power supply (V):

$$V_{\text{nominal}} = 1.5 \text{ Vdc}$$

Type of power supply = 2 x type AA LR06 batteries, in parallel.

Type of antenna = Integral antenna

TEST FREQUENCIES:

Lowest channel: 2402 MHz

Middle channel: 2448 MHz

Highest channel: 2479 MHz

The test set-up and procedure was made in accordance to the general provisions of ANSI C63.4-1992.

RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-25 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive (wooden) platform one meter above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

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Section 15.249 Subclause (a). Field strength of fundamental emission

SPECIFICATION

The field strength of emissions from intentional radiators operated within the 902-928 MHz, 2400-2483.5, 5725-5875 MHz and 24.0-24.25 GHz shall comply the following:

Fundamental frequency	Field strength of fundamental (mV/m)	Field strength of fundamental (dB μ V/m)
902-928 MHz	50	93.98
2400-2483.5 MHz	50	93.98
5725-5875 MHz	50	93.98
24.0-24.25 GHz	250	107.96

For frequencies above 1000 MHz the above field strength limits are based on average limits. The peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS

Field strength level of fundamental See next plots.

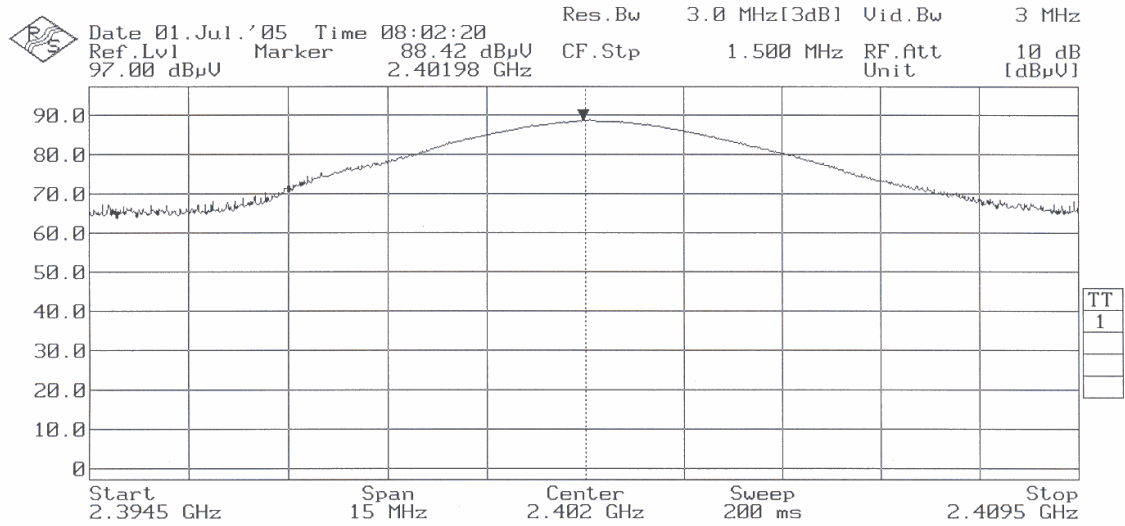
	Lowest frequency 2402 MHz	Middle frequency 2448 MHz	Highest frequency 2479 MHz
Peak level (dB μ V/m)	88.42	87.96	89.87
Average level (dB μ V/m)	52.67	52.74	52.82
Measurement uncertainty (dB)	± 1.5		

Verdict: PASS

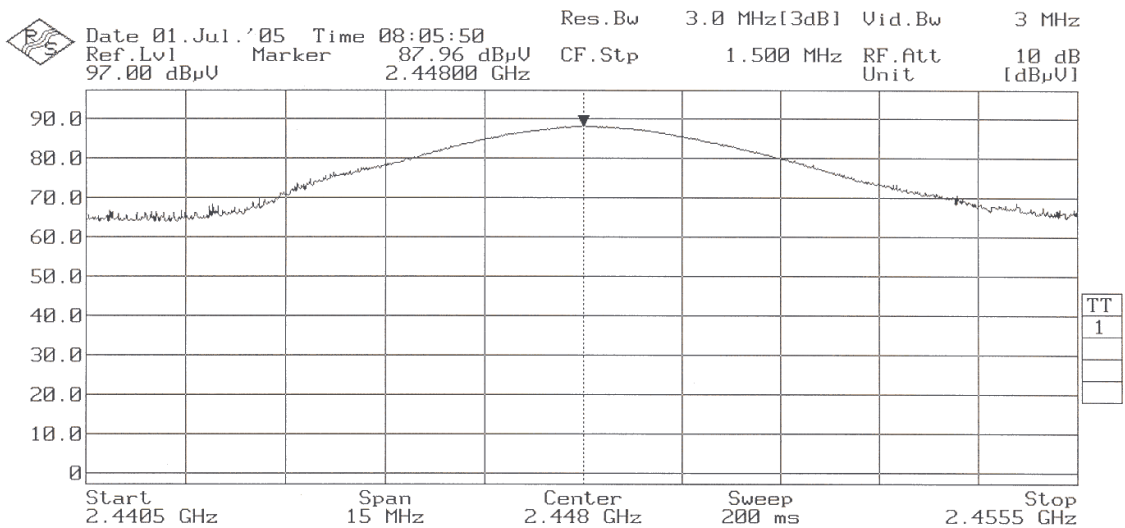
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Maximum peak field strength level of fundamental (Radiated).

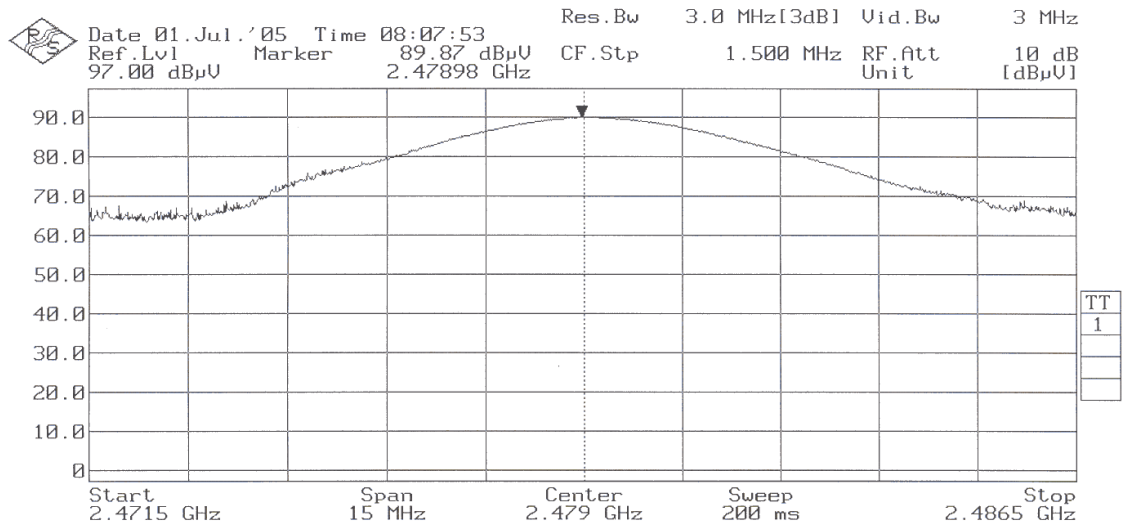
Lowest Channel: 2402 MHz.



Middle Channel: 2448 MHz.



Highest Channel: 2479 MHz.



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Section 15.249 Subclause (a) and (d). Emission limitations radiated for harmonics and outside of the specified frequency bandsSPECIFICATION

The field strength of harmonics emissions from intentional radiators operated within the 902-928 MHz, 2400-2483.5, 5725-5875 MHz and 24.0-24.25 GHz shall comply the following:

Fundamental frequency	Field strength of Harmonics ($\mu\text{V/m}$)	Field strength of Harmonics ($\text{dB}\mu\text{V/m}$)
902-928 MHz	500	53.98
2400-2483.5 MHz	500	53.98
5725-5875 MHz	500	53.98
24.0-24.25 GHz	2500	67.96

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits shown in Section 15.209, whichever is the lesser attenuation.

For frequencies above 1000 MHz the above field strength limits are based on average limits. The peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-25 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyser. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

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1. CHANNEL: LOWEST (2402 MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

Frequency range 1 GHz-25 GHz.

Only harmonic emissions were detected.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement uncertainty (dB):
4803.8199	V	Peak	47.53	± 4.0
4803.8199	V	Average	26.58	± 4.0

Additionally, no spurious signals were found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz.

2. CHANNEL: MIDDLE (2448 MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

Frequency range 1 GHz-25 GHz.

Only harmonic emissions were detected.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement uncertainty (dB):
4895.9088	V	Peak	45.85	± 4.0
4895.9088	V	Average	26.17	± 4.0

Additionally, no spurious signals were found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz.

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3. CHANNEL: HIGHEST (2479 MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

Frequency range 1 GHz-25 GHz.

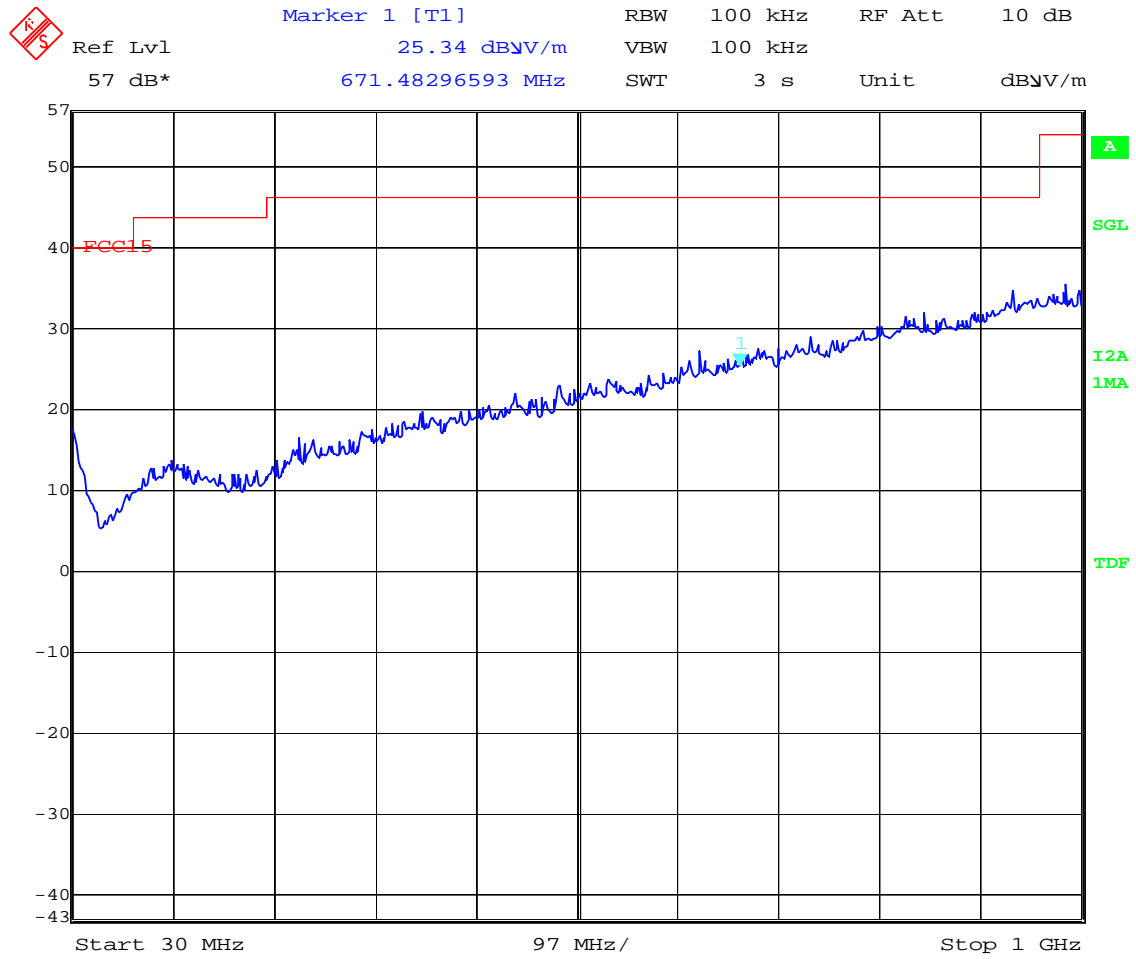
Only harmonic emissions were detected.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement uncertainty (dB):
4958.3061	V	Peak	44.89	± 4.0
4958.3061	V	Average	25.33	± 4.0

Additionally, no spurious signals were found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz.

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.



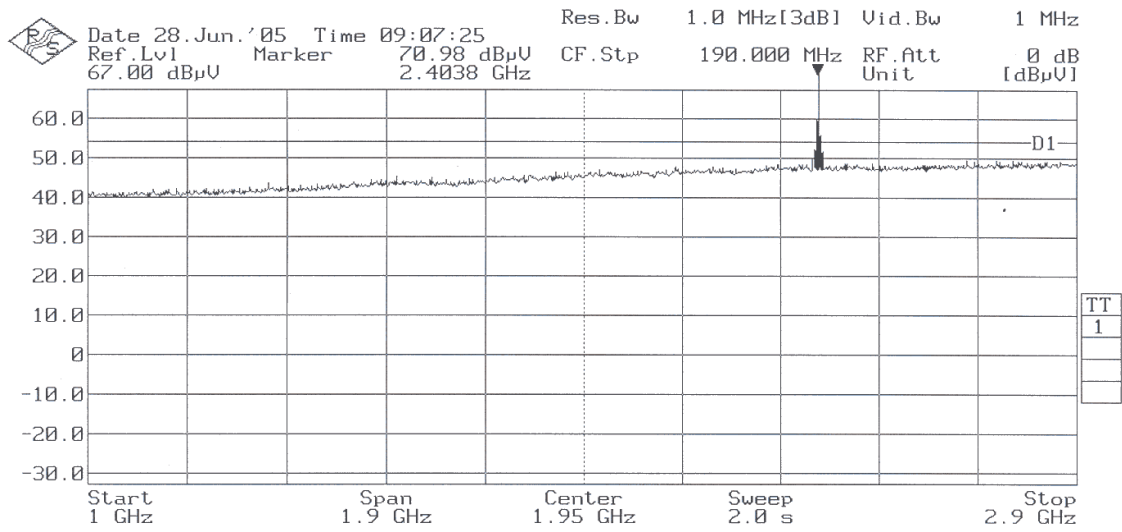
Date: 28.JUN.2005 09:18:56

(This plot is valid for all three channels).

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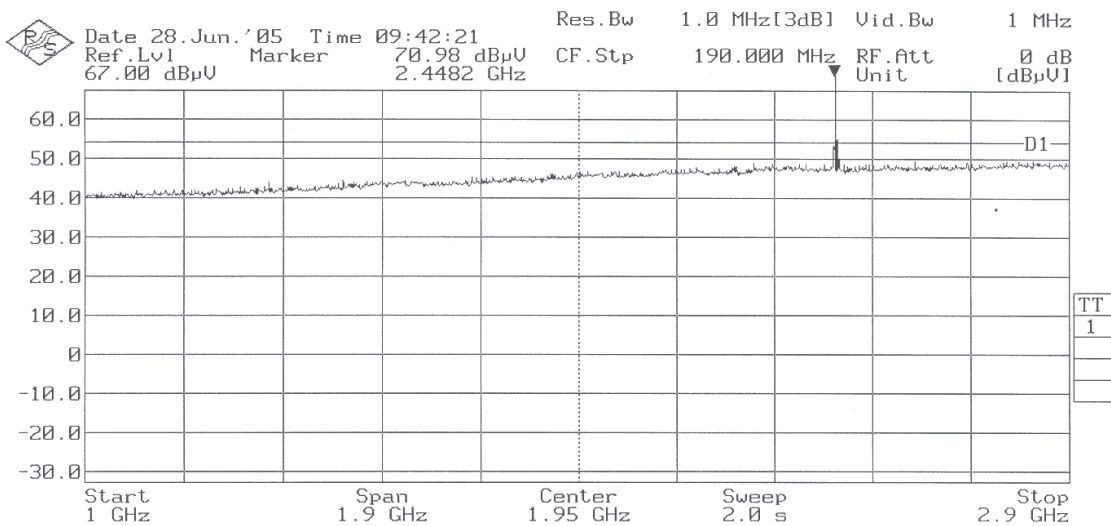
FREQUENCY RANGE 1 GHz to 2.9 GHz.

CHANNEL: Lowest (2402 MHz).



Note: The peak above the limit is the carrier frequency.

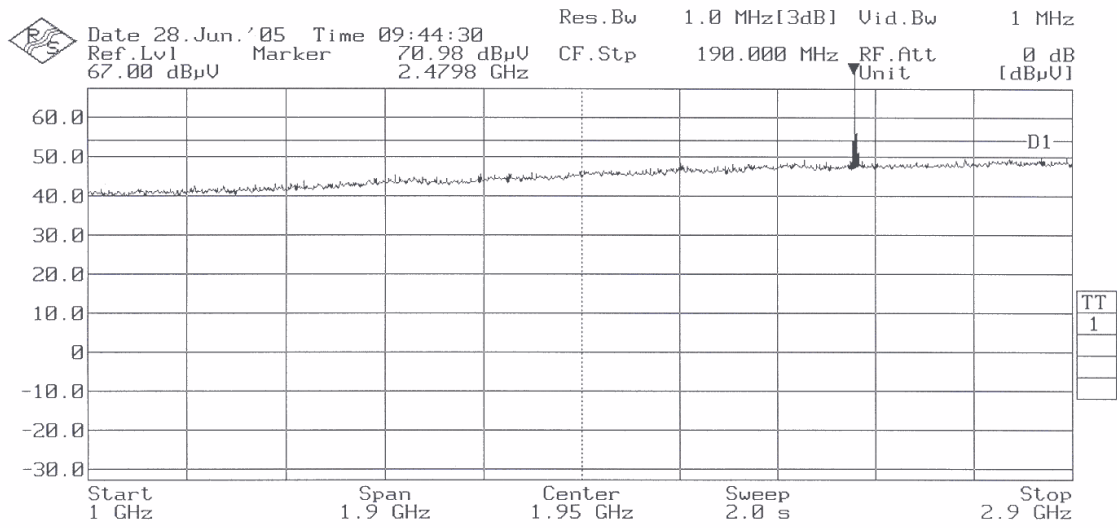
CHANNEL: Middle (2448 MHz).



Note: The peak above the limit is the carrier frequency.

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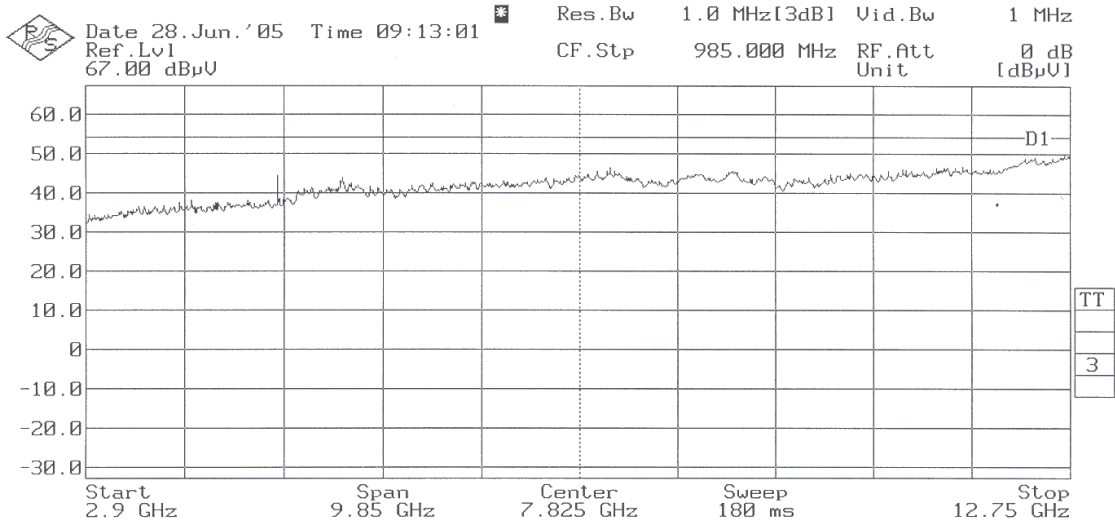
CHANNEL: Highest (2479 MHz).



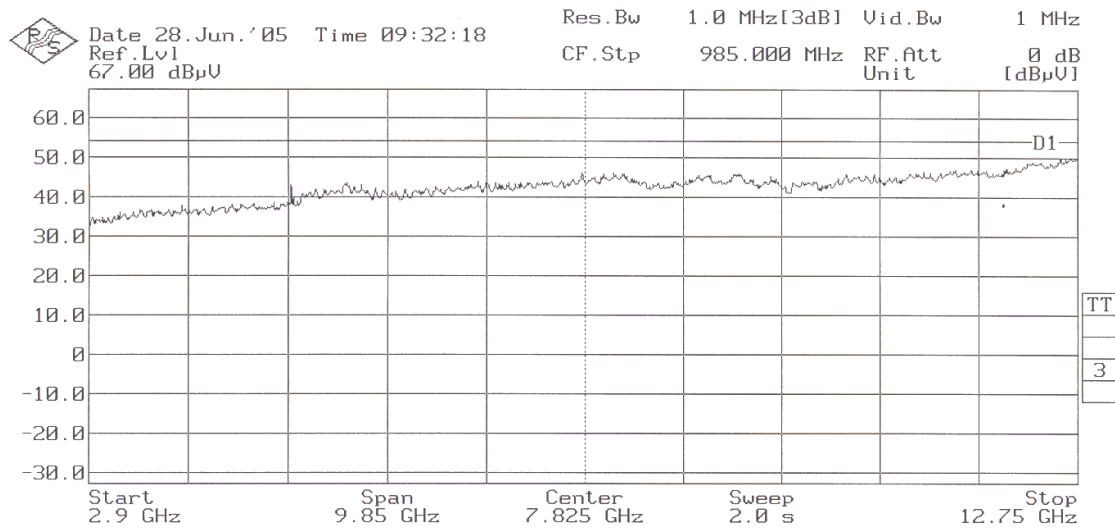
Note: The peak above the limit is the carrier frequency.

FREQUENCY RANGE 2.9 GHz to 12.75 GHz.

CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2448 MHz).



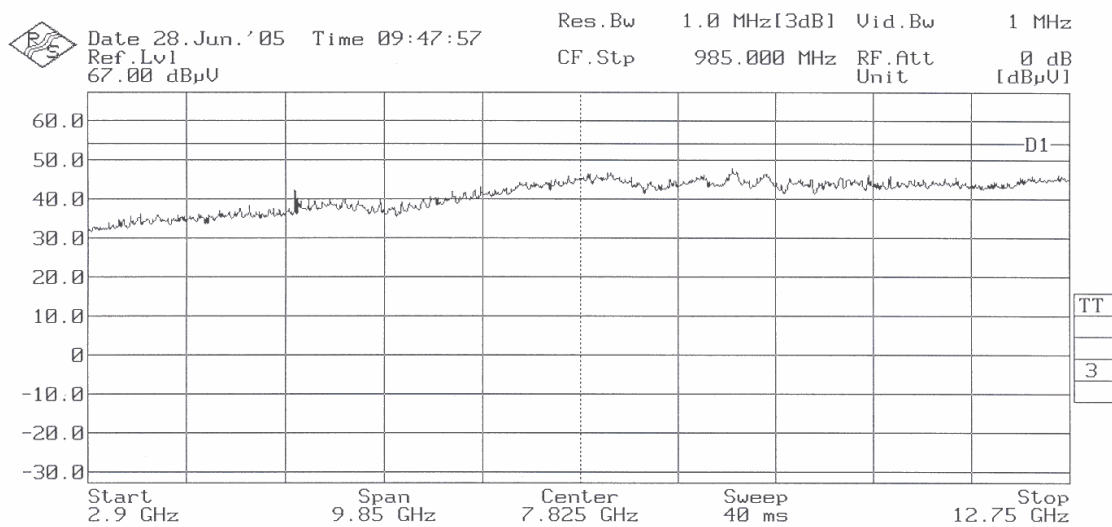
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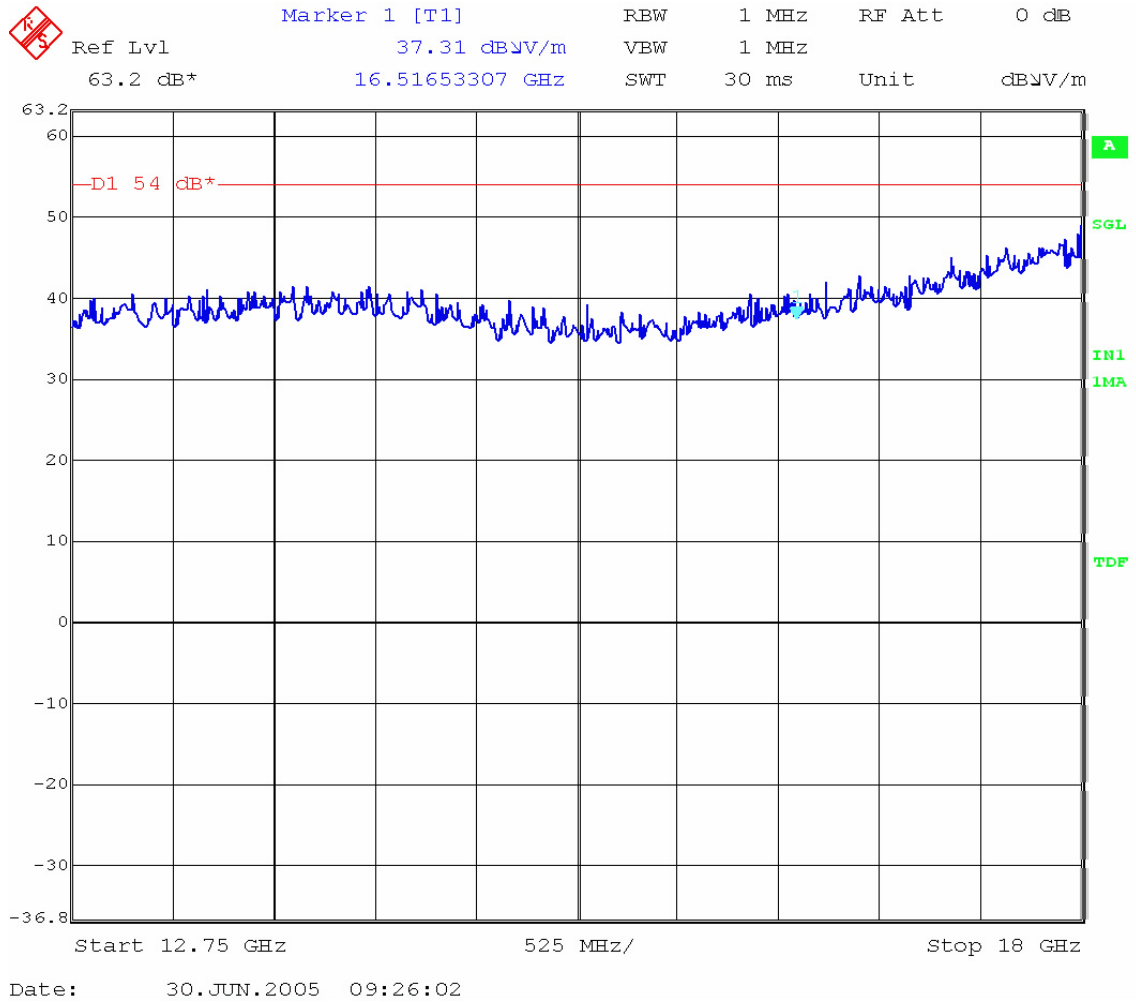
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CHANNEL: Highest (2479 MHz).



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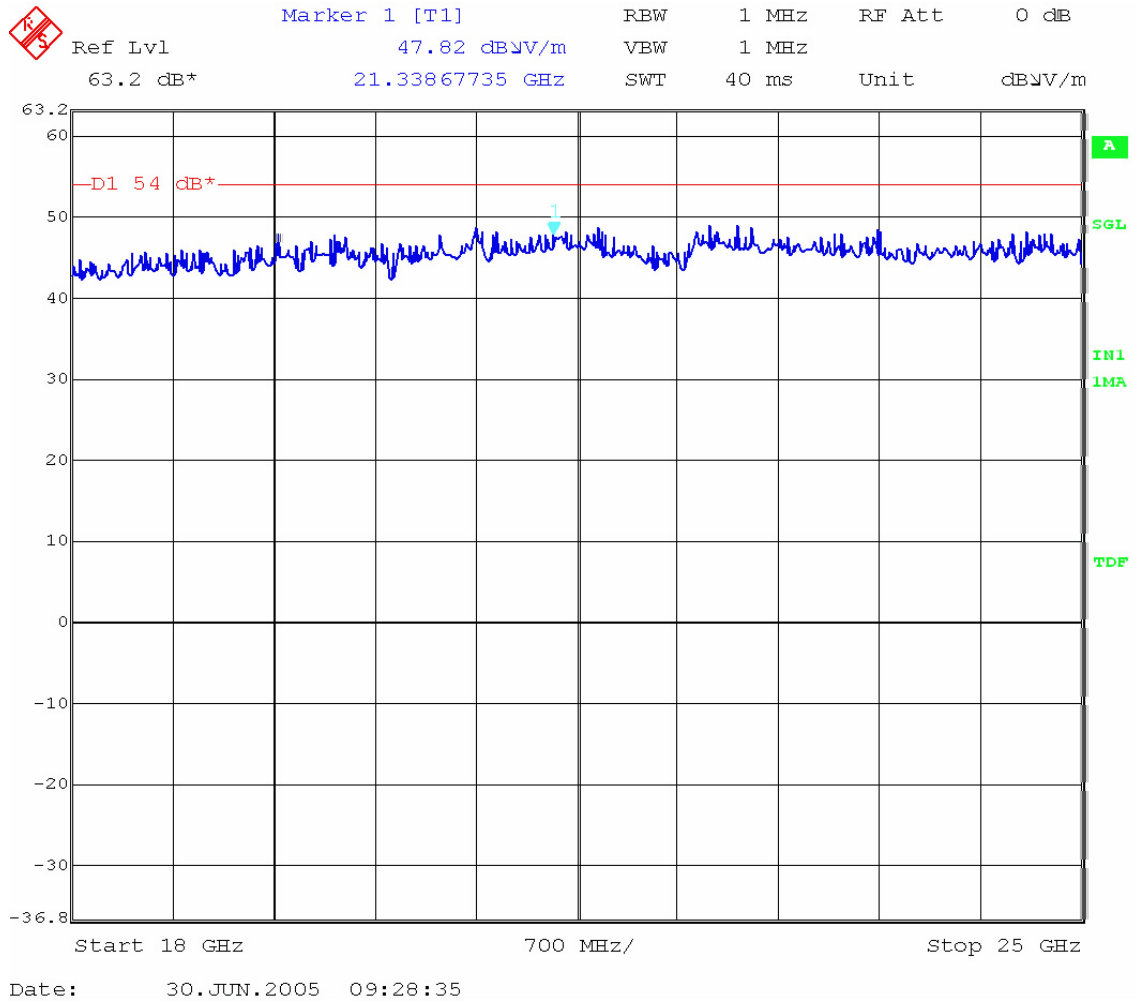
FREQUENCY RANGE 12.75 GHz to 18 GHz.



(This plot is valid for all three channels).

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FREQUENCY RANGE 18 GHz to 25 GHz.



(This plot is valid for all three channels).

Section 15.109. Receiver spurious radiationSPECIFICATION

The field strength shall not exceed the following values:

Frequency Range (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-25 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyser. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

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1. CHANNEL: LOWEST (2402 MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

Frequency range 1 GHz-25 GHz.

No spurious signals were found in all the range.

Additionally, no spurious signals were found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz.

2. CHANNEL: MIDDLE (2441 MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

Frequency range 1 GHz-25 GHz.

No spurious signals were found in all the range.

Additionally, no spurious signals were found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz.

3. CHANNEL: HIGHEST (2480 MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

Frequency range 1 GHz-25 GHz.

No spurious signals were found in all the range.

Additionally, no spurious signals were found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz.

Verdict: PASS.

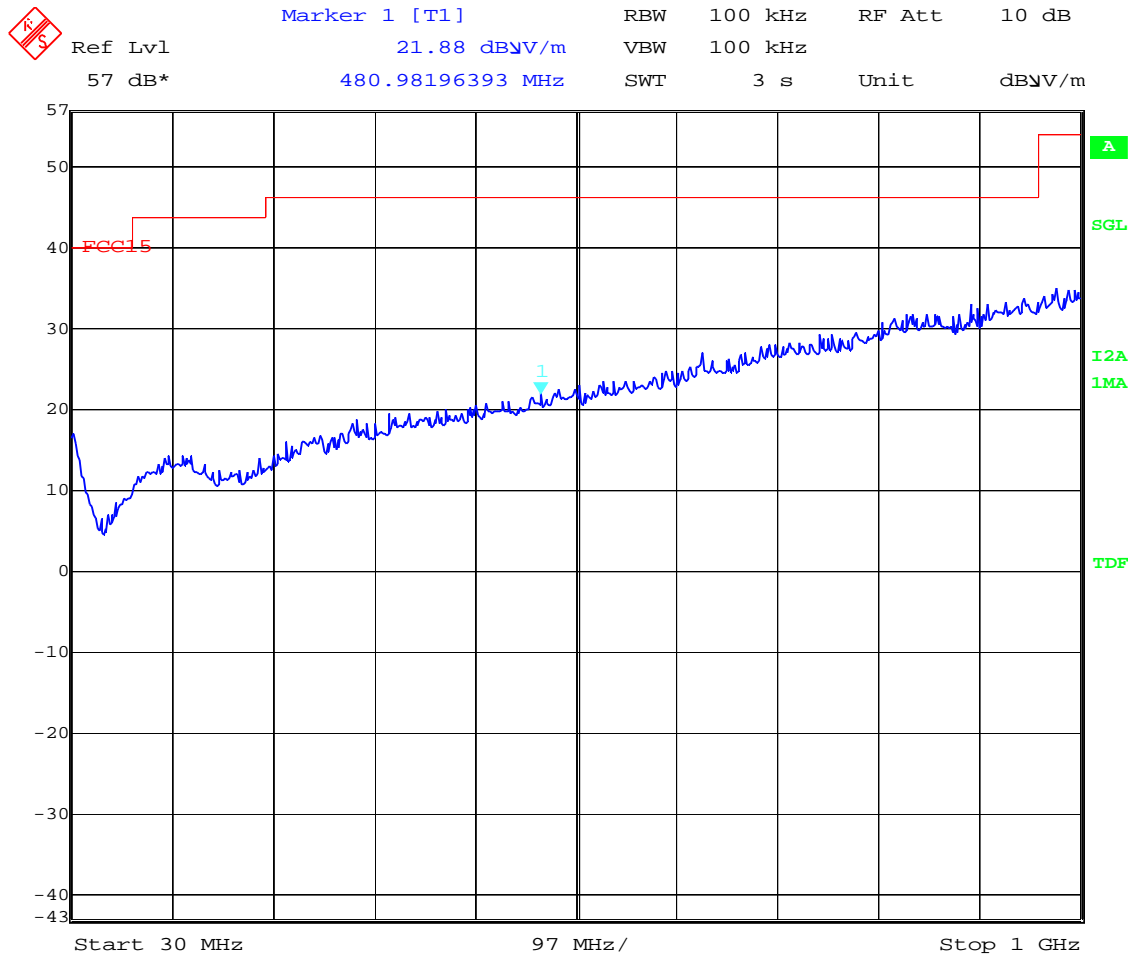
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FREQUENCY RANGE 30 MHz-1000 MHz.

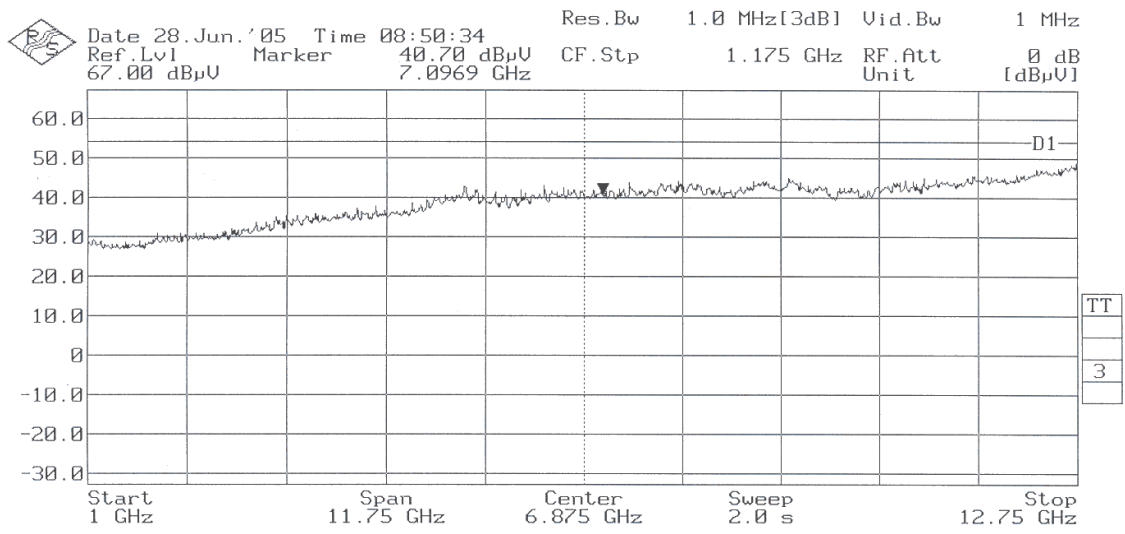


Date: 28.JUN.2005 09:02:49

(This plot is valid for all three channels).

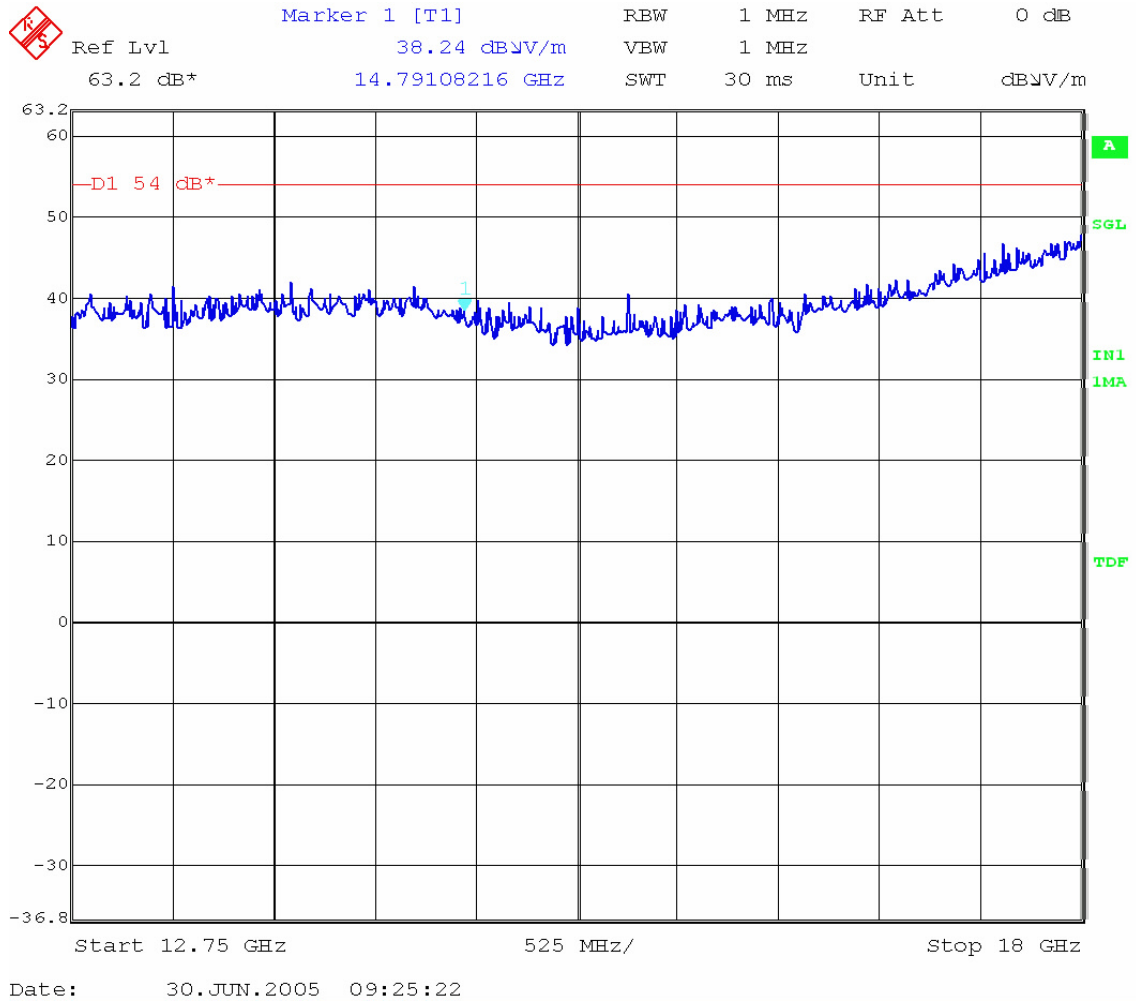
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FREQUENCY RANGE 1 GHz-12.75 GHz.



(This plot is valid for all three channels).

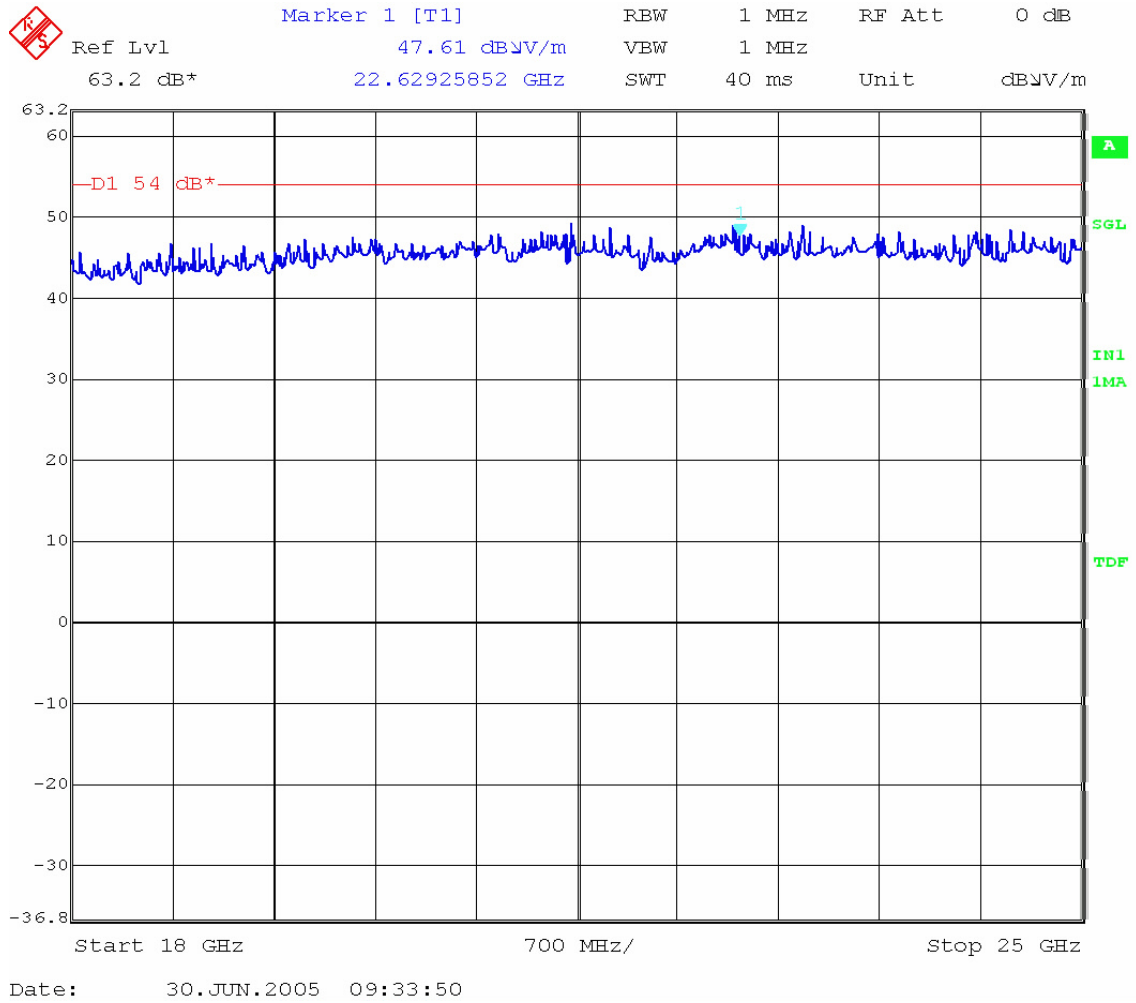
FREQUENCY RANGE 12.75 GHz-18 GHz.



(This plot is valid for all three channels).

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FREQUENCY RANGE 18 GHz-25 GHz.



(This plot is valid for all three channels).

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ANNEX B

PHOTOGRAPHS **(Number of photographs: 5)**

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1. Equipment under test (front view).



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2. Equipment under test (back view).



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3. General test set-up for radiated measurements.



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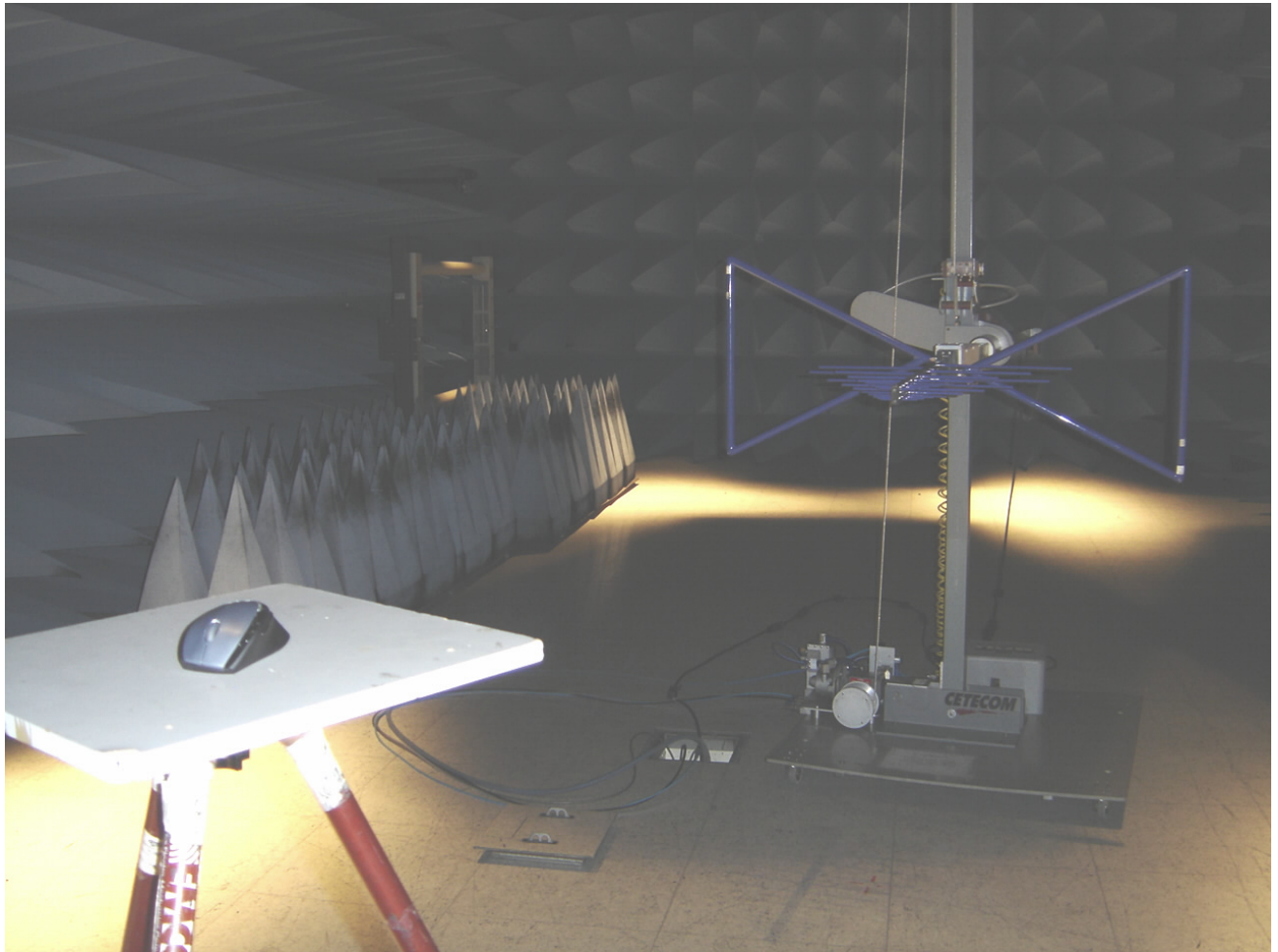
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4. Test set-up for radiated measurements below 1 GHz.



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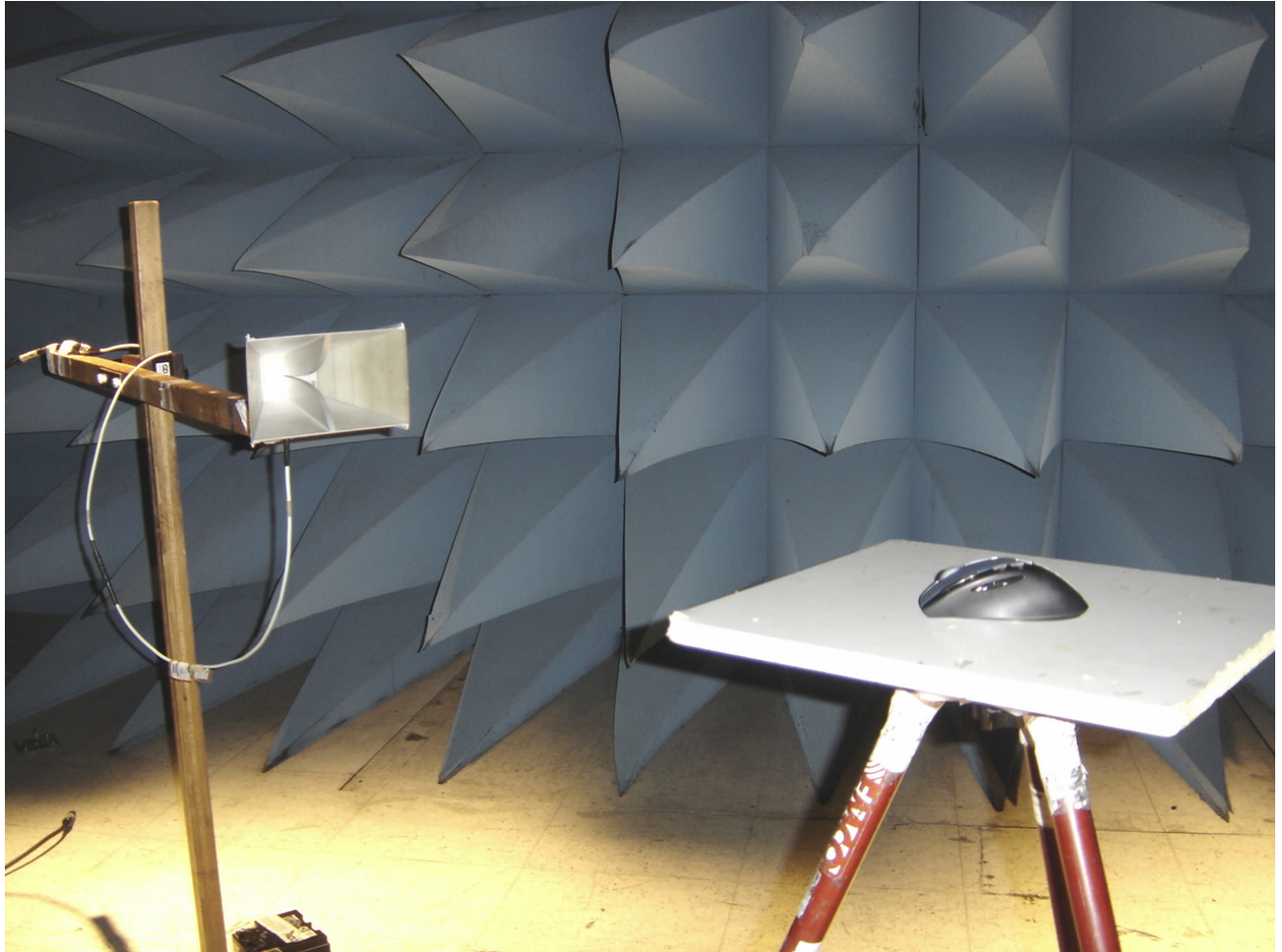
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5. Test set-up for radiated measurements above 1 GHz.



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