EMC-ECL-EMC Test Report No.: 10-016

Equipment under test:	**Security device (Alarm) for Suitcases and bags called "KEVIN" – Base module**
FCC ID	**YPL-KEVIN-BASE**
Type of test:	**FCC 47 CFR Part 15 Subpart C**
Measurement Procedures:	**ANSI C63.4 (2003)**
Test result:	**Passed**

Date of issue:	02.09.2010			Signature:
Issue-No.:	03	Author:	**M. Lehmann** Head of EMC	Digital unterschrieben von Mario Lehmann DN: cn=Mario Lehmann, o=TEMPTON Service Plus GmbH, ou=ECL, email=mario.lehmann@tempton.de, c=DE Datum: 2010.10.28 15:30:09 +02'00'
Date of delivery:	13.01.2010	Checked:	**T. Vogel** Deputy Head of EMC	Digital unterschrieben von Thomas Vogel DN: cn=Thomas Vogel, o=Tempton Service Plus GmbH, ou=ECL, email=thomas.vogel@tempton.de, c=DE Datum: 2010.10.28 15:45:13 +02'00'
Test dates:	15.01. – 29.01.2010.			
Pages:	30			

Manufacturer:	CCS Schweiz AG Mr. Schmitt Werkstrasse 36 3250 Lyss Swiss

Test Location:	TEMPTON Service Plus GmbH European Compliance Laboratory (ECL) Thurn-und-Taxis Strasse 18 D-90411 Nürnberg Tel.: +49 0911 59835 0 Fax: +49 0911 59835 90

General:
The purpose of this report is to show compliance to the FCC regulations for unlicensed devices operating under section 15.249 of the Code of Federal Regulations title 47.
This report informs about the results of the EMC tests, it only refers to the equipment under test. No part of this report may be reproduced in any form, without written permission.

Table of contents

1 Test Results Summery

Summary of Test Results
KEVIN Suitcase alarm – Base module

Requirement	CFR Section	Report Section	Test Result
Antenna requirement	15.203	4	pass
Radiated Spurious Emissions (Transmitter)	15.109, 15.209, 15.249	5	Pass
Conducted emissions (Transmitter)	15.207		n.a.*
Field Strength Limits (Fundamental and Harmonics) Band edges measurement	15.249	6	Pass
20dB Occupied Bandwidth	15.215 (c)	8	Pass

* Not required, the EUT is battery powered and there is no provision for connection to the mains.

The client has made the determination that EUT Condition, Characterization, and Mode of Operation are representative of production units, and meet the requirements of the specifications referenced herein.

Consistent with industry practice, measurement and test equipment not directly involved in obtaining measurement results but having an impact on measurements (such as cable loss, antenna factors, etc.) are factored into the “Correction Factor” documented in certain test results. Instrumentation employed for testing meets tolerances consistent with known Industry Standards and Regulations.

The measurements contained in this report were made in accordance with the procedure ANSI C63.4-2003 and all applicable Public Notices received prior to the date of testing. All emissions from the device were found to be within the limits outlined in this report.
The test results in this report apply only to the particular Equipment Under Test (EUT) as declared in this report.

2 Equipment under test

2.1 EUT designation

Security device (Alarm) for Suitcases and bags called "KEVIN" – Base module
FCC ID: KEVINBASE

2.2 Description

KEVIN is a wireless **Security device (Alarm) for Suitcases and bags** operated in the 2,4 - 2,4835 GHz band, communicating with the "KEVIN" Tag Module (see detailed in the external operation manual and test report ECL-EMC-TR-10-017-V01.00).

The used 3 Frequencies are:

- f_{low} = 2.4100 GHz
- f_{middle} = 2.4400 GHz
- f_{high} = 2.4725 GHz

Each transmission frequency keeps activated for 10s and will than be changed to the next higher frequency.

2.3 Configuration

Fig. 2.3.1: EUT: Base Module Front Cover

Fig. 2.3.2: EUT: Base Module Rear Cover

2.4 Technical Data Overview

Frequency Range :	2410 – 2472.5 MHz
Tunable Bands :	1
Number of Channels:	3 in use
Operating Mode:	TX & RX
Type of Modulation:	GFSK
Emissions Designator:	G1D
User Frequency Adjustment :	None, Software controlled*
Rated Output Power	1 dBm
Type of Power Supply :	Battery
Antenna Connector:	Integral antenna only
Antenna Diversity Supported :	None

*Flow=2,41 GHz
Fmid=2,44 GHz
Fhigh=2,4725 GHz
Dwell time = 10s for each frequency

3 Description of the EMC test centre

3.1 Registrations

Registration No. (DATech): DAT-P-231/92-04

Registration No. (Kraftfahrt-Bundesamt): KBA-P 00053-03

Registration No.: 96997

Registration No.
for radiated emission: IC 3475

Registration No.
for conducted emission on power supply lines: C-2169
for conducted emission on telecommunication ports: T-140
for radiated emission: R-2016

Registered within Verizons ITL program.

3.2 Measurement Uncertainty

The table below shows the measurement uncertainties for each measurement method. The expanded uncertainty was calculated with worst case values over the complete frequency area.

Measurement method	Frequency area impulse duration time	Description	expanded Uncertainty (95% or k=2)
Radiated emission (EN 55022; ANSI C63.4 etc.)	30 MHz - 1 GHz	Semi anechoic chamber	± 4,7 dB
	1 GHz - 18 GHz	Fully anechoic chamber	± 3,9 dB
Conducted emission (EN 55022; ANSI C63.4 etc.)	9 kHz - 150 kHz	EMI	± 4,0 dB
	150 kHz - 30 MHz		± 3,6 dB

4 Antenna Requirement

Test requirement: FCC CFR47, Part 15C

4.1 Regulation

15.203 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. The use of a permanently attached antenna or of antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

4.2 Result

EUT: **KEVIN Base Module**

Antenna is directly soldered on the PCB.
The EUT meets the requirements of this section.

5 Radiated Emissions Test

Test requirement: FCC CFR47, Part 15C §15.249
Test procedure: ANSI C63.4: 2003

5.1 Regulation

15.249(a) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (milli volts/meter)	Field strength of harmonics (micro volts/meter)
902 – 928 MHz	50	500
2400 – 2483.5 MHz	50	500
5725 – 5875 MHz	50	500
24.0 – 24.25 GHz	250	2500

(b) Field strength limits are specified at a distance of 3 meters.

(c) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or the general radiated emission limits in §15.209, whichever is the lesser attenuations.

(d) As shown in §15.35(b), for frequencies above 1000 MHz, the above field strength limits are based on average limits. However, 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.

Section 15.33 Frequency range of radiated measurements:
(a) Unless otherwise noted in the specific rule section under which the equipment operates for an intentional radiator the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:
(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

5.2 Radiated Emissions Test, 30 MHz to 26 GHz

5.2.1 Test equipment used:

Designation	Equipment	Manufacturer	Frequency range	used
EMI test receiver	ESVS30	Rohde & Schwarz	20 MHz – 1 GHz	
EMI test receiver	ESAI	Rohde & Schwarz	20 Hz – 1,8 GHz	
EMI test receiver	ESI40	Rohde & Schwarz	20 Hz – 40 GHz	X
Amplifier	AFS4-00102000	Miteq	1 GHz – 18 GHz	X
Amplifier	JS43-18004000-30-5A	Miteq	18 GHz – 26 GHz	X
Amplifier	AM-1431-N	Miteq	10 KHz – 1 GHz	X
Antenna	HFH2-Z2	Rohde & Schwarz	9 KHz – 30 MHz	X
Antenna	CBL 6111	Chase	30 MHz – 1 GHz	X
Antenna	3141	EMCO	26 MHz – 2 GHz	
Antenna	HL025	Rohde & Schwarz	1 GHz – 18 GHz	X
Antenna	MWH-1826/B	ARA Inc.	18 GHz – 26 GHz	X

5.2.2 Test Procedures

For tabletop equipment, the EUT is placed on a 0.8 meter high nonconductive table that sits on a flush mounted metal turntable. Floor standing equipment is placed directly on the flush mounted metal turntable. The EUT is connected to its associated peripherals with any excess I/O cabling bundled to approximately 1 meter.
Preview tests are performed. Emissions from the unit are maximized by adjusting the polarization and height of the receive antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions. All tests performed with the antenna placed in two polarizations: horizontal and vertical.

Radiated Emissions Test Characteristics	
Frequency range	9 kHz – 26 GHz
Test distance	3 m *
Test instrumentation resolution bandwidth	9 kHz (9 kHz – 30 MHz) 120 kHz (30 MHz – 1 GHz) 1 MHz (1 GHz – 26 GHz)
Receive antenna scan height	1 m – 4 m
Receive antenna polarization	Vertical/Horizontal

* According to Section 15.31 (f)(1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. (...) When performing measurements at a distance other than specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

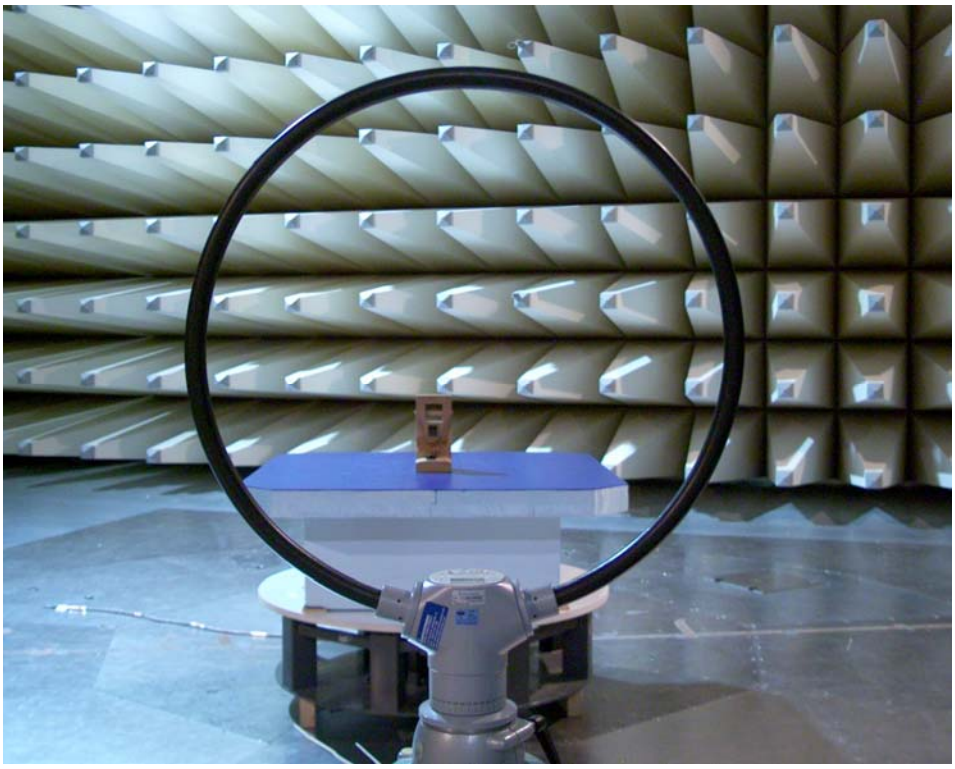


Fig. 5.2.1: Basic set-up for radiated emission; 9 kHz – 30 MHz @ 3m

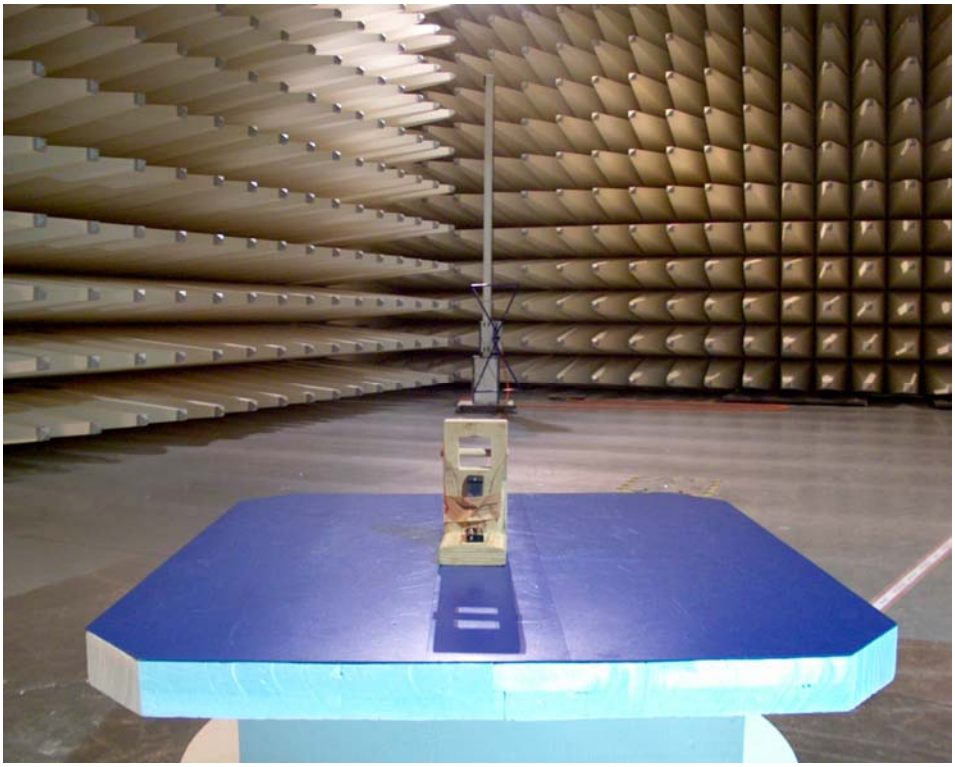


Fig. 5.2.2: Basic set-up for radiated emission; 30 MHz - 1 GHz @ 10m

Fig. 5.2.3: Basic set-up for radiated emission 1 GHz – 18 GHz @ 3m

Fig. 5.2.4: Basic set-up for radiated emission test above 18 GHz @ 3m

5.2.3 Calculation of Field Strength Limits

Fundamental field strength limit for the band 902 to 928 MHz:
50 mV/m at 3 meters; 50 mV/m corresponds with 94.0 dB(µV/m).

Harmonics field strength limit for the band 902 to 928 MHz:
500 µV/m at 3 meters; 500 µV/m corresponds with 54.0 dB(µV/m).

The above field strength limits are based on average limits. However, 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.

Emissions radiated outside the frequency band 902 to 928 MHz, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Calculation: microvolts/meter to dB(µV/m)

Frequency	Field Strength Limits according to §15.209		Measurement distance
[MHz]	[µV/m]	[dB(µV/m)]	[m]
0,009 - 0,490	26667 – 4898	88,5 – 73,8	3
0,490 - 1,705	4898 – 140,8	73,8 – 44,97	3
1,705 - 30	300	50	3
30 - 88	100	40.0	3
88 - 216	150	43.5	3
216 - 960	200	46.0	3
Above 960	500	54.0	3

The emission limits shown in the above table are based on measurements employing a CISPR quasipeak detector except for frequencies above 1000 MHz. Radiated emission limits above 1000 MHz are based on measurements employing an average detector.

5.2.4 Calculation of Average Correction Factor

The average correction factor is computed by analyzing the “worst case” on time in any 100 ms time period and using the formula:

Correction Factor (dB) = 20*log (worst case on time/100 ms)

The peak to average ratio has been measured by using the right detectors of the ESI40. Therefore the correction factor was zero.

5.2.5 Field Strength Calculation

The field Strength is calculated by adding the Antenna Factor and the Cable Factor. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF
where
FS = Field Strength in dB((µV/m)
RA = Receiver Amplitude in dB(µV)
AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB

Assume a receiver reading of 23.5 dB(µV) is obtained. The Antenna Factor of 7.4 dB(1/m) and a Cable Factor of 1.1 dB are added, giving a field strength of 32 dB(µV/m). The 32 dB(µV/m) value can be mathematically converted to its corresponding level in µV/m.

FS = 23.5 dB(µV) + 7.4 dB (1/m) + 1.1 dB = 32 dB(µ/m)

FS = $10^{(32/20)}$µV/m = 39.8 µV/m

For test distances other than what is specified, but fulfilling the requirements of Section 15.31 (f)(1) the field strength is calculated by adding an additional extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements). The basic equation with a sample calculation is as follows:

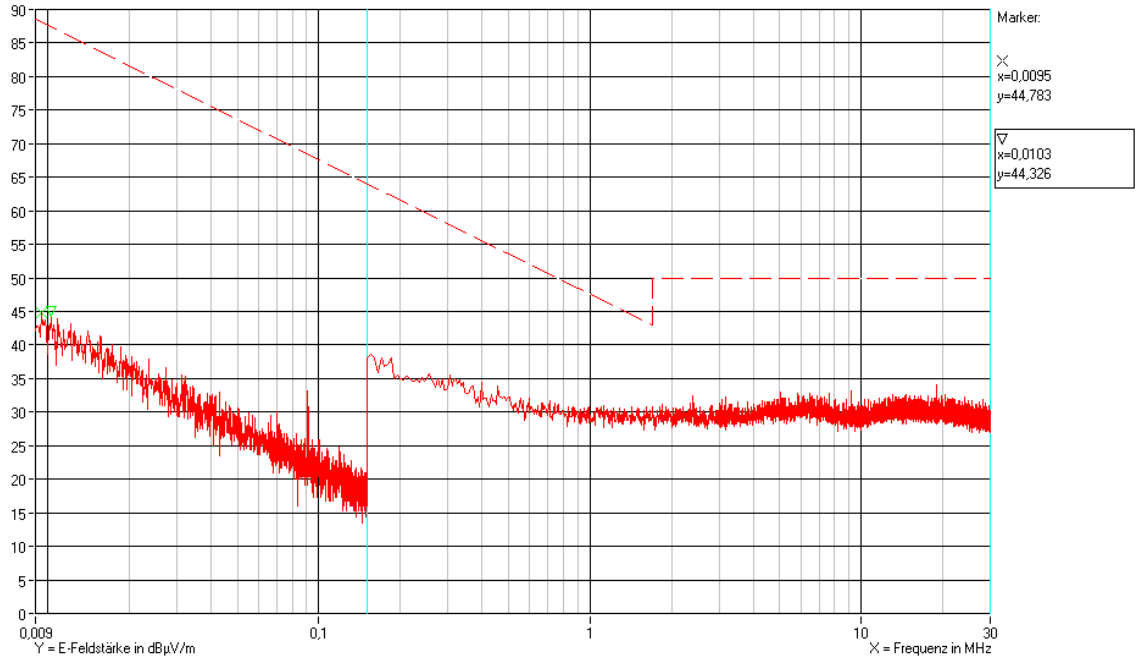
FS = RA + AF + CF + DF
where
FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude in dB(µV)
AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB
DF = Distance Extrapolation Factor in dB
where DF = 20log(D_{test}/D_{spec}) where D_{test} = test distance and D_{spec} = specified distance

Assume the test performed at a reduced test distance of 1.5 m instead of the specified distance of 3 m giving a Distance Extrapolation of DF = 20log(1.5m/3m) = - 6 dB.
Assuming a receiver reading of 23.5 dB(µV) is obtained. The Antenna Factor of 7.4 dB(1/m), the Cable Factor of 1.1 dB and the Distance Factor of –6 dB are added, giving a field strength of 26 dB(µV/m). The 26 dB(µV/m) value can be mathematically converted to its corresponding level in µV/m.

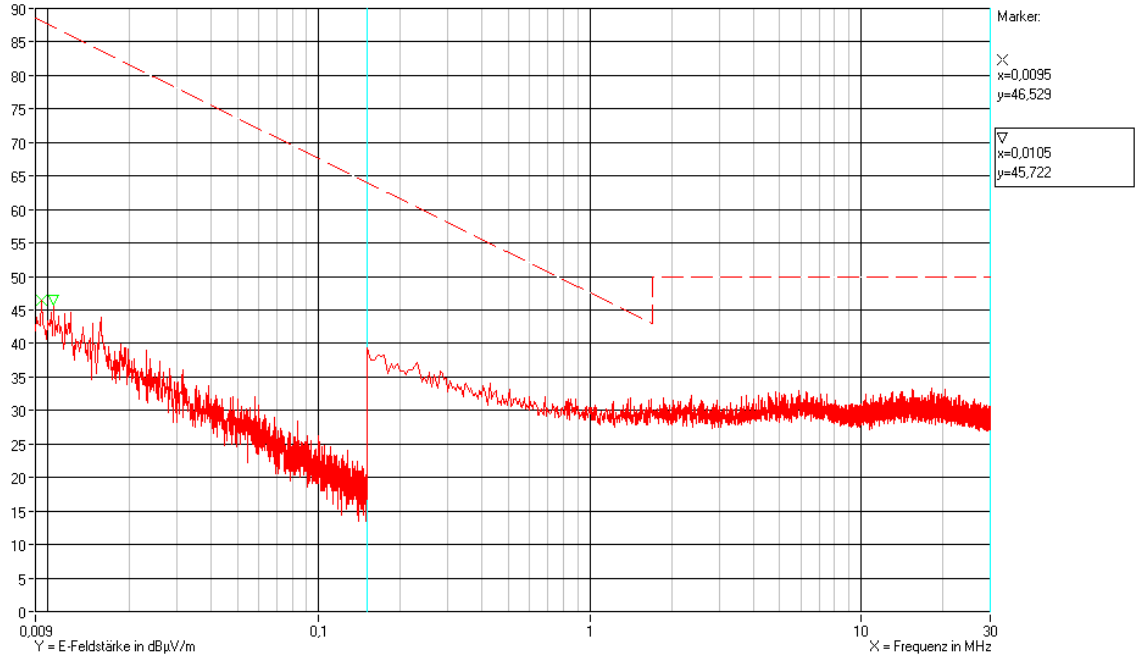
FS = 23.5 dB(µV) + 7.4 dB(1/m) + 1.1 dB – 6 dB = 26 dB(µV/m)

FS = $10^{(26/20)}$µV/m = 20.0 µV/m

5.3 Test Results spurious emission 9 kHz to 30 MHz

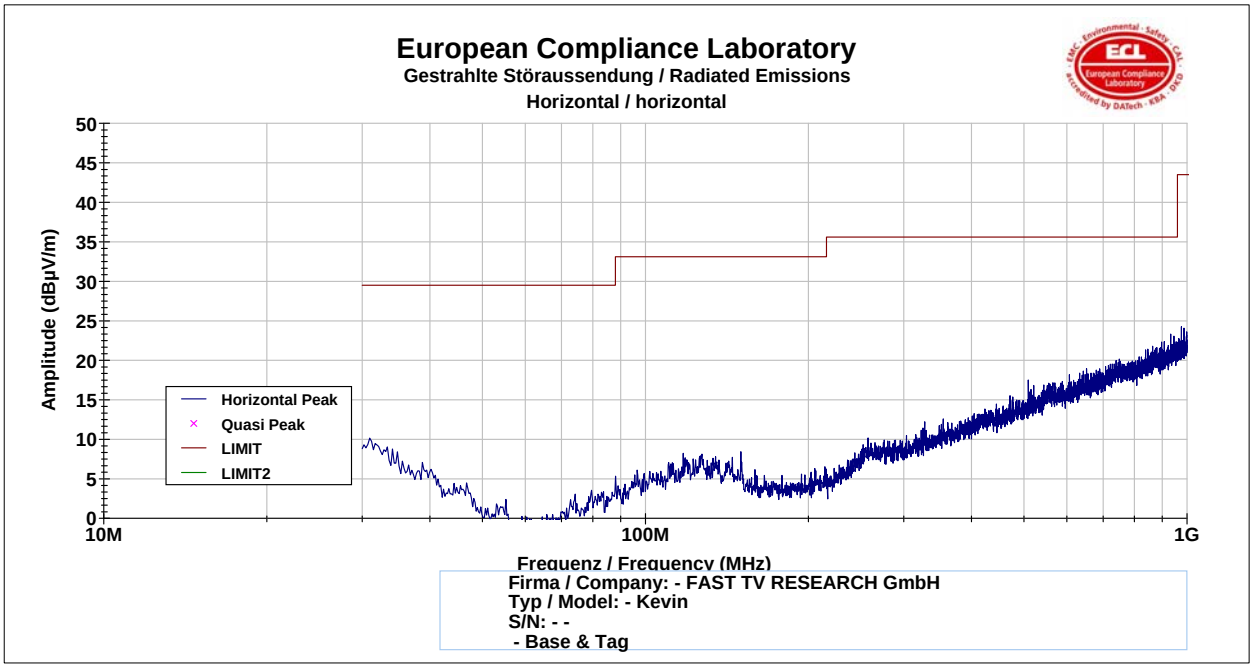


Measurement report 1: Parallel loop
9 MHz – 30 MHz

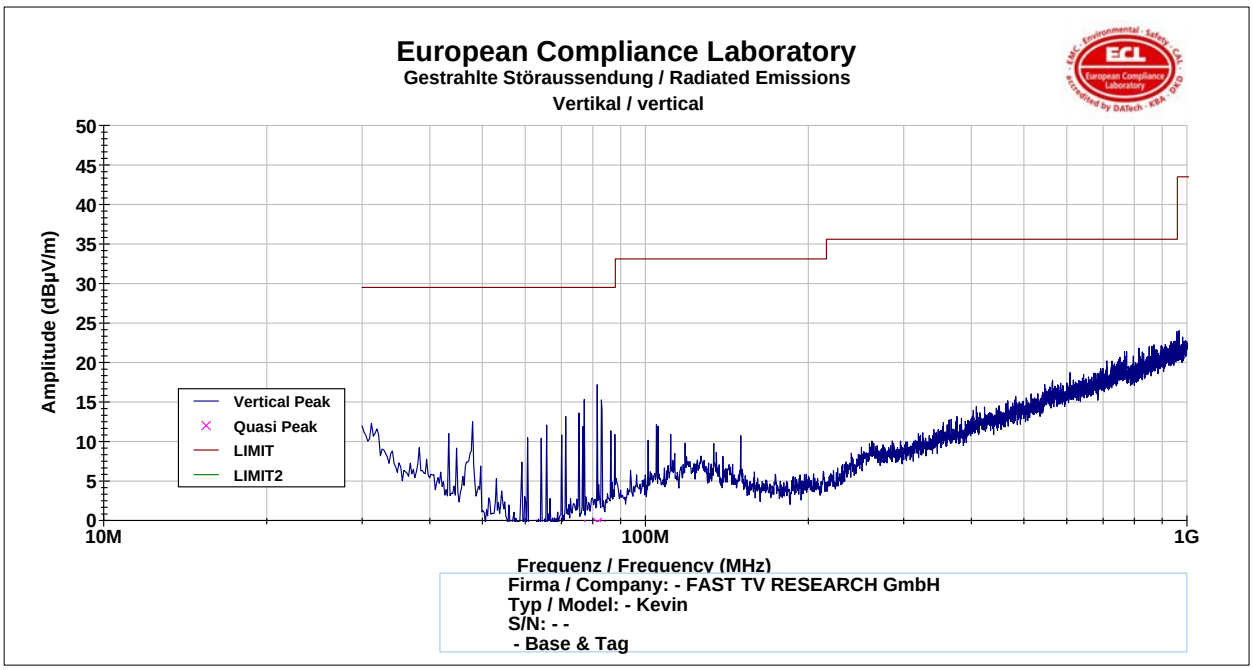


Measurement report 2: Perpendicular loop
9 MHz – 30 MHz

5.4 Test Results spurious emission 30 MHz to 1 GHz



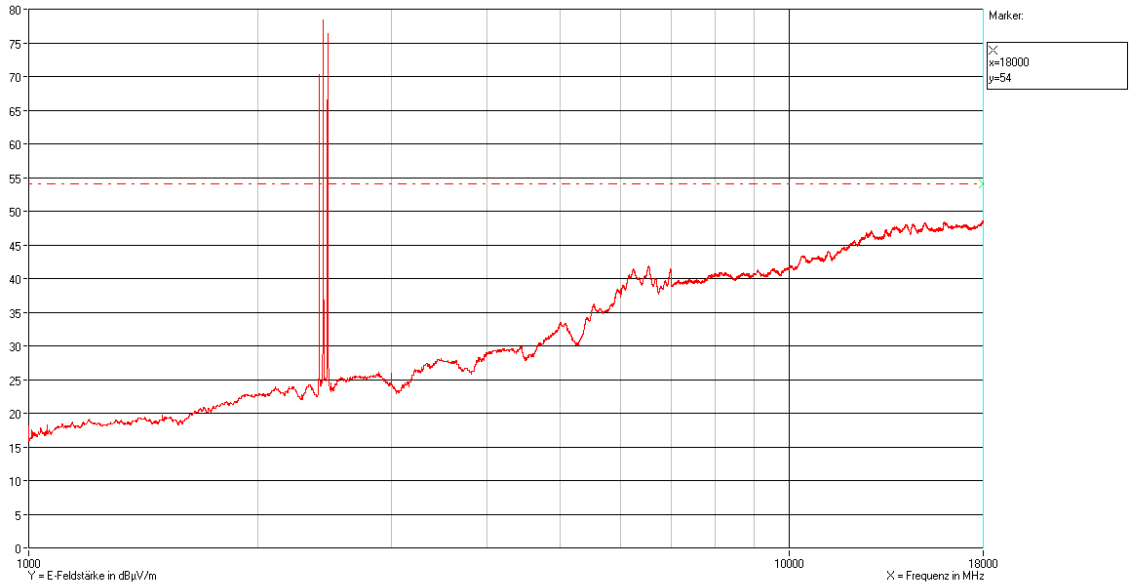
Measurement report 3: horizontal
30 MHz – 1 GHz



Frequency	Polarisation	Height	TT-Position	Cable Loss	Antenna Factor	Reading	Field Intensity	Limit	Margin
[MHz]	H/V	[cm]	[°]	[dB]	[db/m]	[dBµV]	[dBµV/m]	[dBµV/m]	[dB]
77.2593	V	128	-128	36.562	7.439	27.460	-1.663	29.500	31.163
81.573	V	360	-82	36.527	8.086	28.185	-0.256	29.500	29.756
82.7309	V	127	-174	36.520	8.260	27.576	-0.685	29.500	30.185

Measurement report 4: vertical
30 MHz – 1 GHz

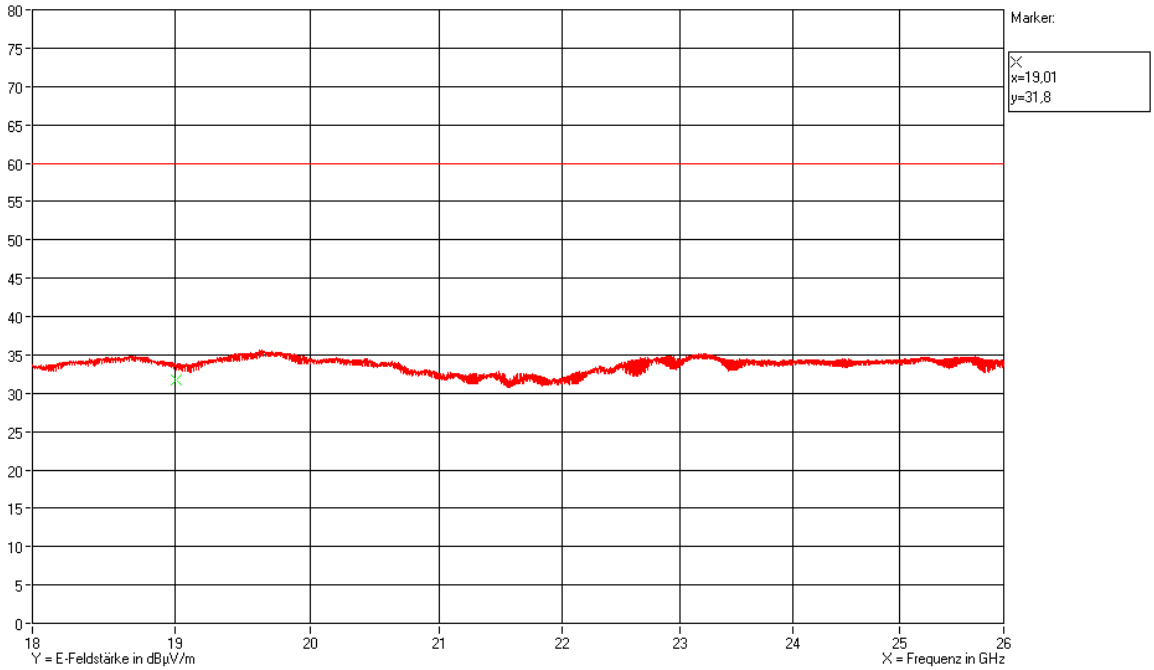
5.5 Test Results spurious emission 1 GHz to 18 GHz



Measurement report 5: max. hold, all positions and polarisations with average detector
1 GHz – 18 GHz

The peaks at 2.41/2.44/2.4725 GHz are the fundamental frequencies.
There were detected no harmonics.

5.6 Test Results spurious emission 18 GHz to 26 GHz



Measurement report 7: max. hold, all positions and polarisations with average detector
18 GHz – 26 GHz

EUT: **KEVIN Base Module**

The EUT meets the requirements of this section.

6 Field strength limits (Fundamental + Harmonics)

FCC Part 15.249 “Digital Transmission System”

6.1 Regulation

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902 - 928 MHz	50	500
2400 - 2483.5 MHz	50	500
5725 - 5875 MHz	50	500
24.0 - 24.25 GHz	250	2500

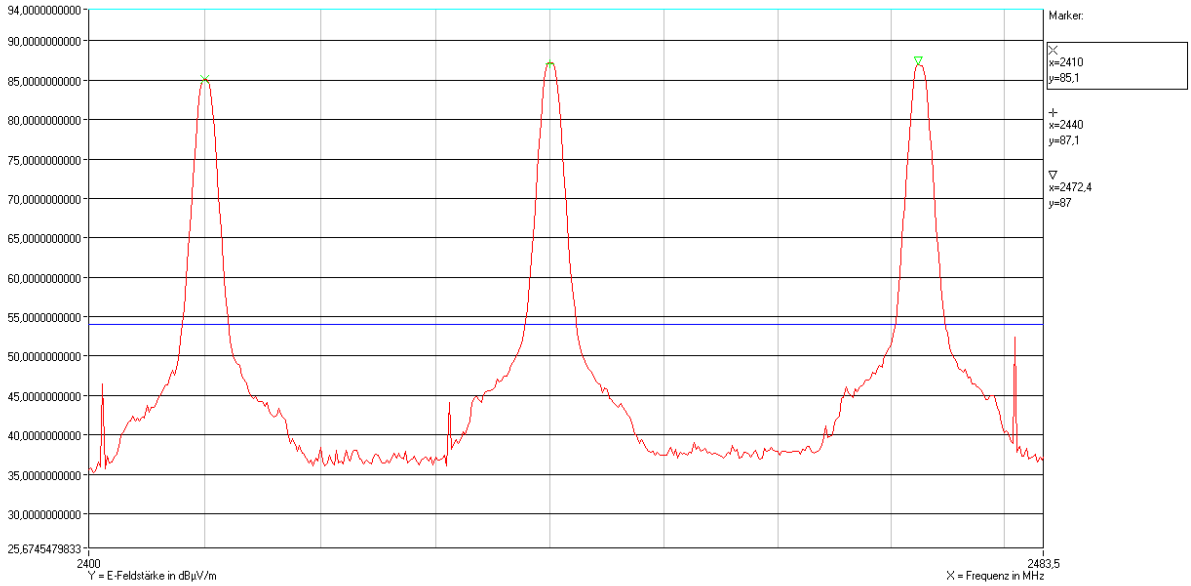
(c) Field strength limits are specified at a distance of 3 meters.

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

(e) As shown in Section 15.35(b), for frequencies above 1000 MHz, the above field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, 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. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

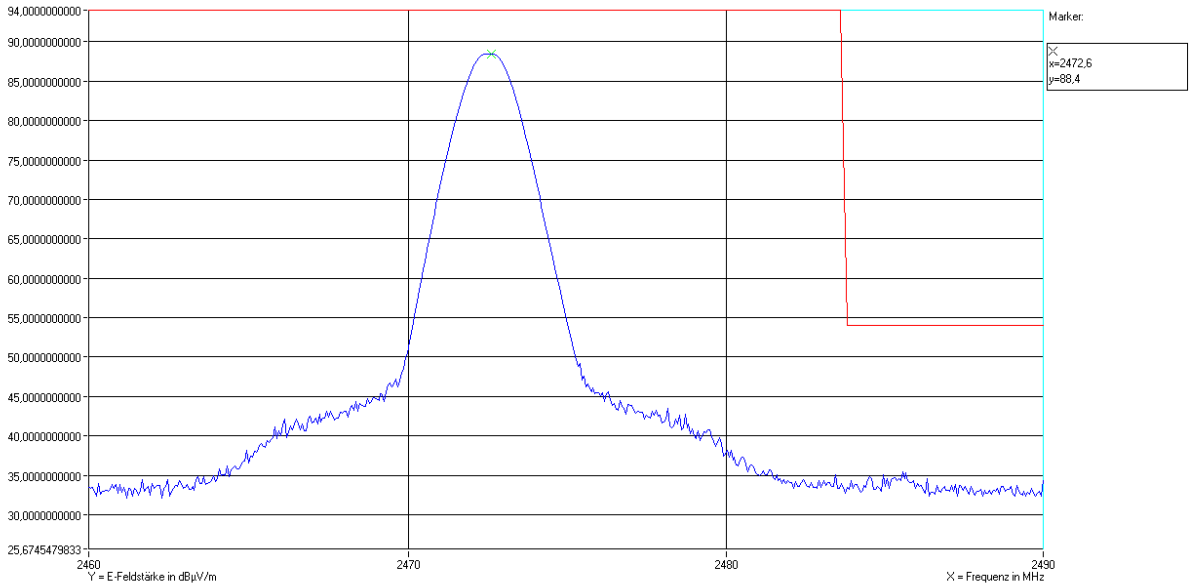
6.2 Maximum Field Strength of the fundamental

ResBW: 1MHz
Steps: 60kHz
Peak detector with max. hold function

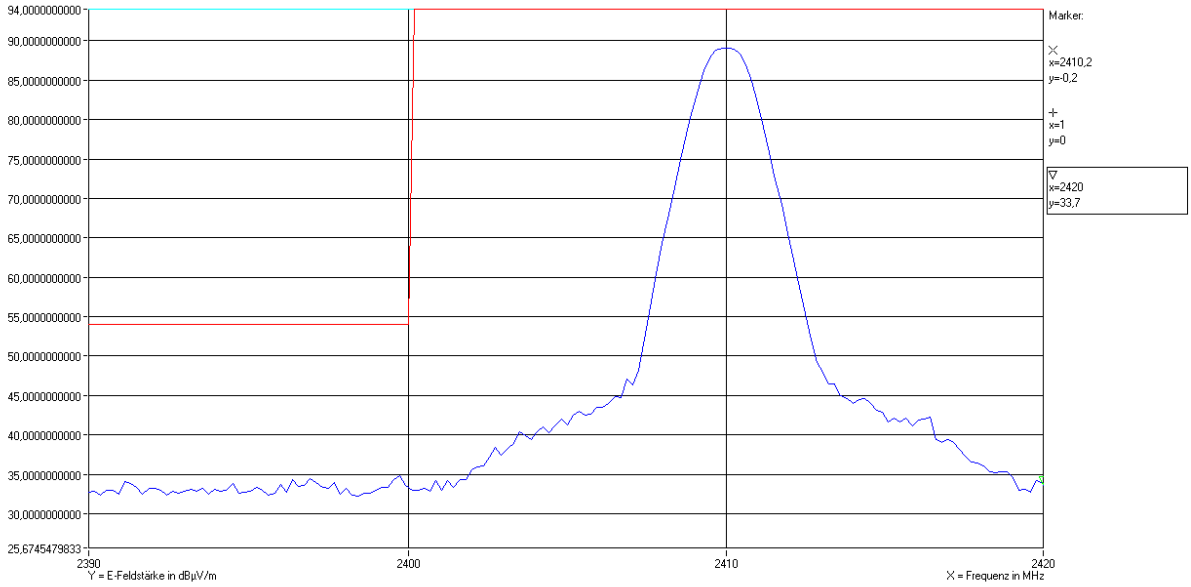


6.3 Band edge emissions

ResBW: 1MHz
Steps: 60kHz
Peak detector with max. hold function



Upper channel @ 2,4725 GHz



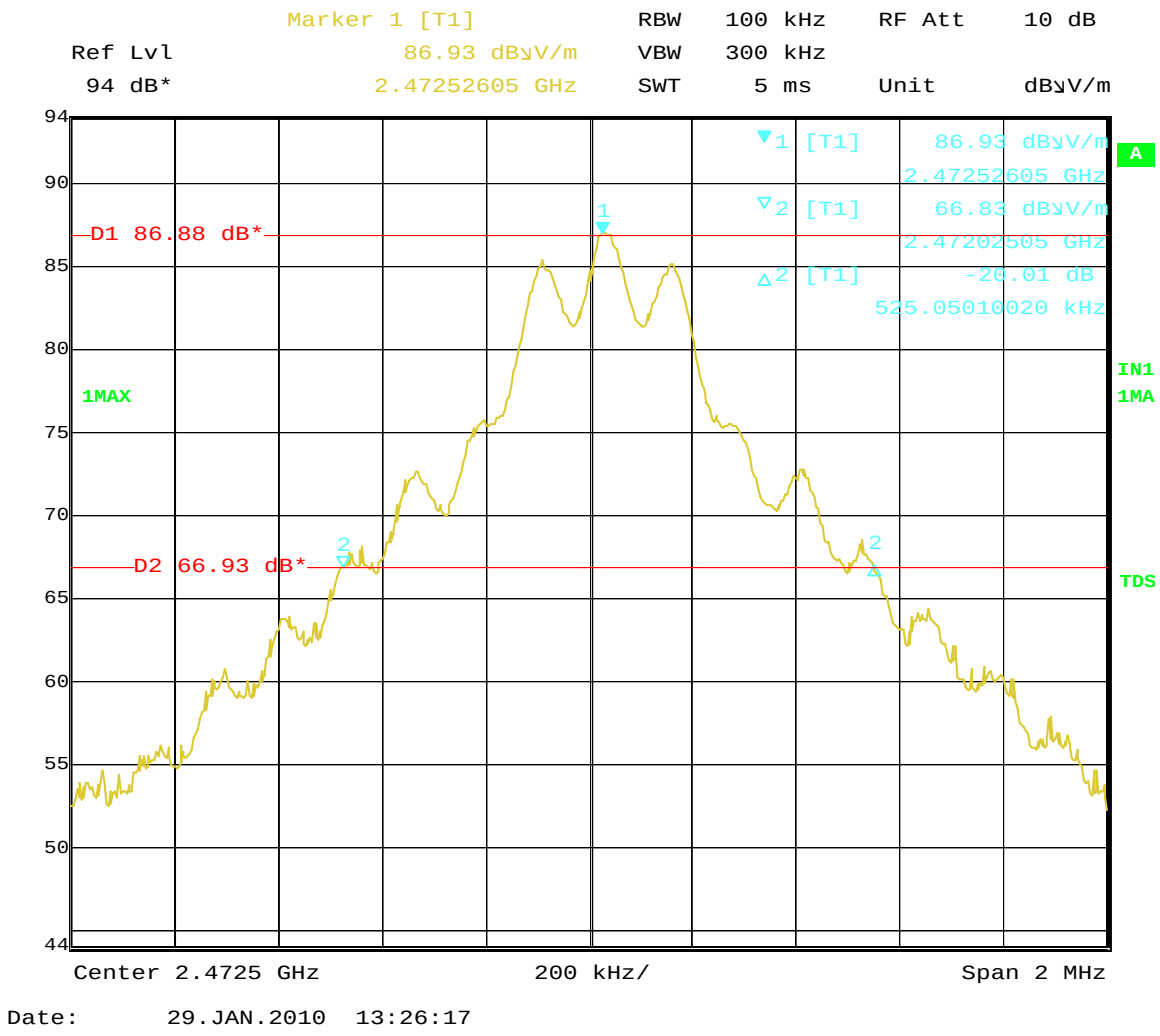
Lower channel @ 2,41 GHz

7 20 dB Bandwidth §15.215 (c)

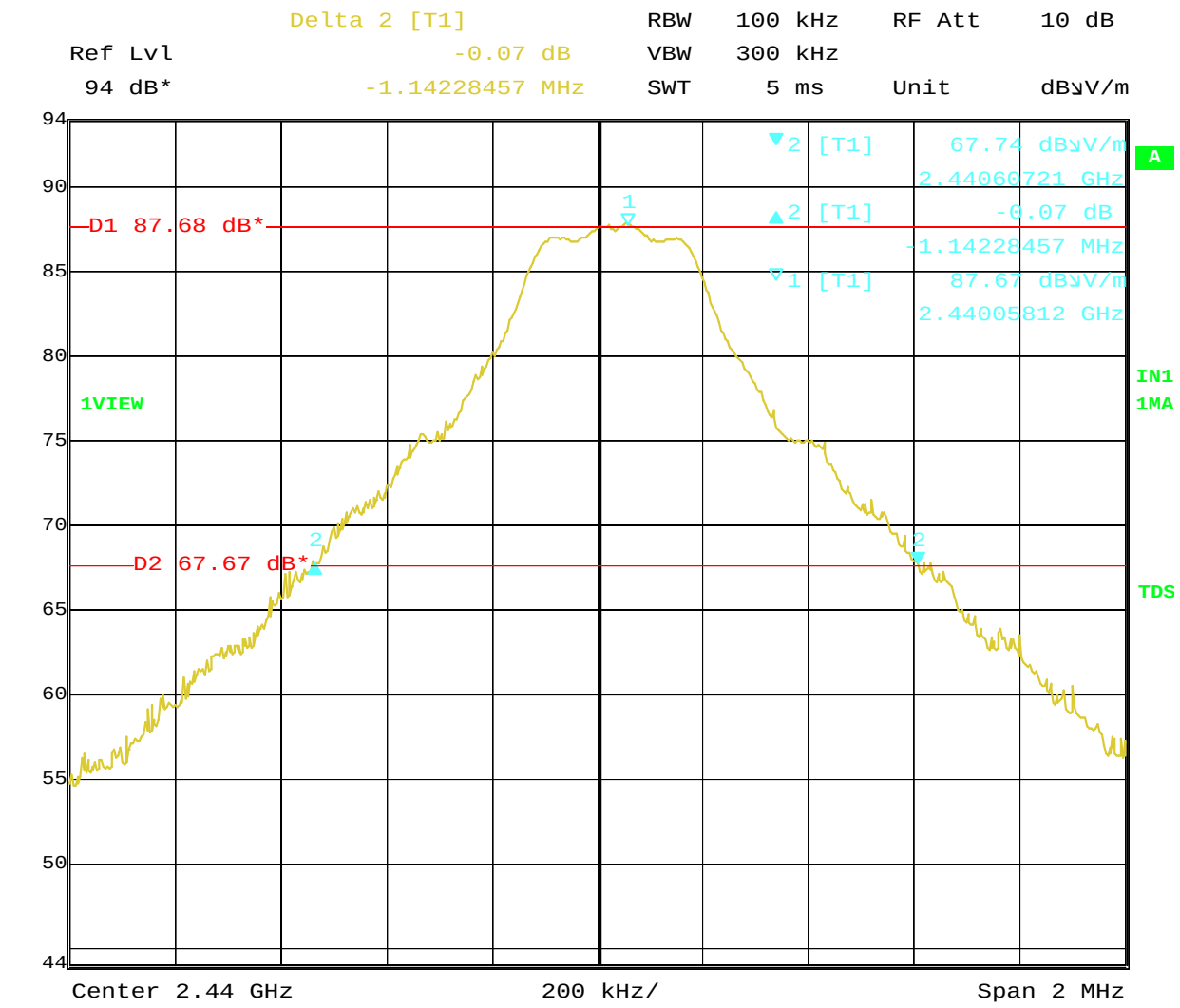
7.1 Rule

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

7.2 Measurements

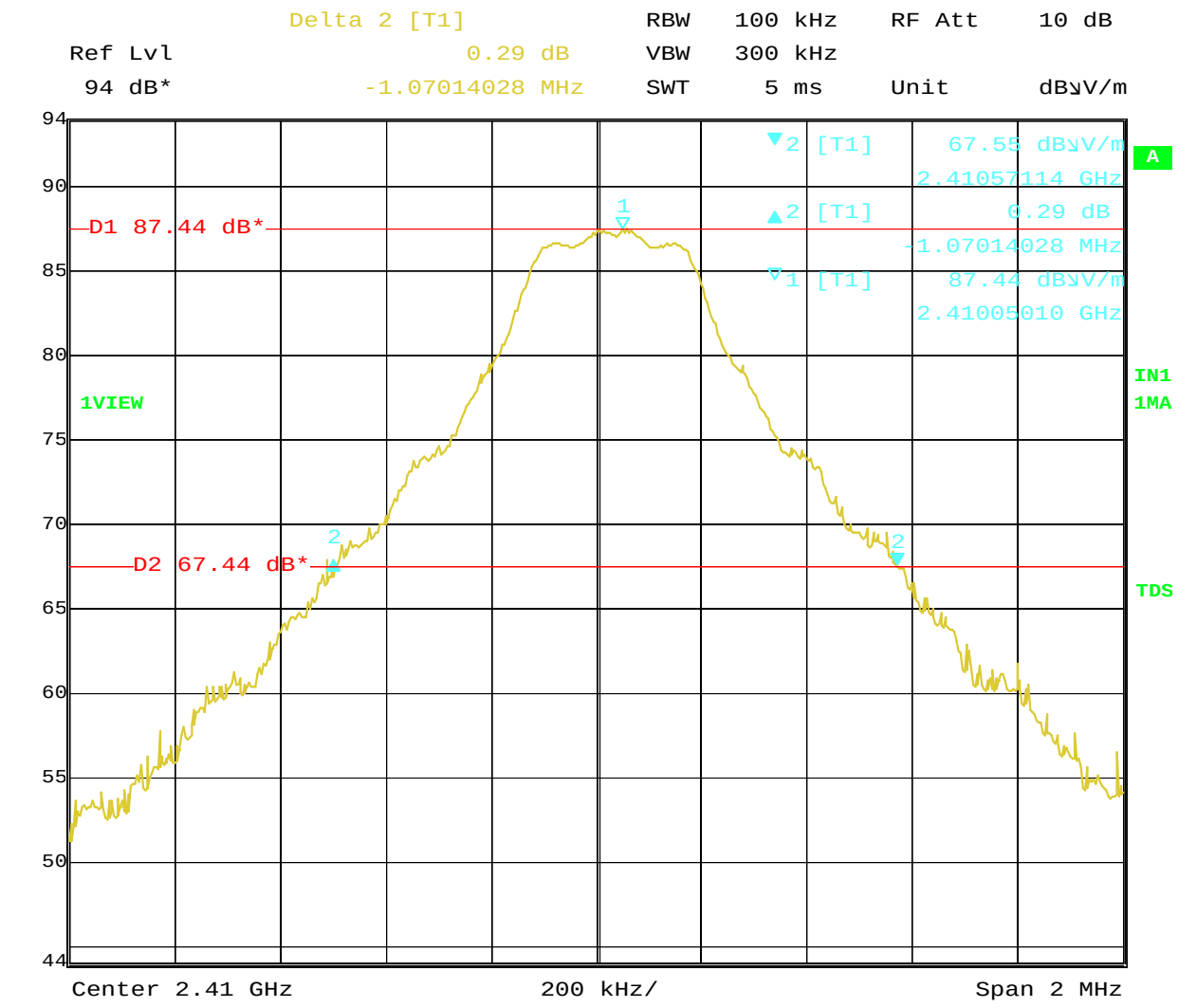


BW=1,05 MHz



Date: 29.JAN.2010 13:44:28

BW=1,14 MHz



Date: 29.JAN.2010 13:47:02

BW=1,07 MHz

8 Accreditation certificate

DATech Deutsche Akkreditierungsstelle Technik GmbH
Unterzeichner der Multilateralen Abkommen von EA und ILAC zur gegenseitigen Anerkennung

vertreten im

Deutschen AkkreditierungsRat

Akkreditierung

Die **DATech Deutsche Akkreditierungsstelle Technik GmbH** bestätigt hiermit, dass das Prüflaboratorium

HERBERG
Service Plus GmbH
European Compliance Laboratory (ECL)
Nordostpark 51

D-90411 Nürnberg

die Kompetenz nach DIN EN ISO/IEC 17025 besitzt, Prüfungen in den Bereichen

Elektromagnetische Verträglichkeit und Mobilfunk,
Sicherheit elektrischer Betriebsmittel, Umweltsimulation,
Telekommunikationsschnittstelle

nach den in der Anlage aufgeführten Normen und Spezifikationen auszuführen.

Die Akkreditierung ist gültig bis: **07.02.2012**

Die Anlage ist Bestandteil der Urkunde und besteht aus **18** Seiten.

DAR-Registriernummer: **DAT-P-231/92-04**

Frankfurt/Main, 08.02.2007

i.V. Dipl.-Ing.(FH) R. Egner
Leiter der Akkreditierungsstelle

Mitglied in EA, ILAC, IAF

Siehe Hinweise auf der Rückseite

End of Testreport