FCC ID: S5H-WRC

EMI -- T E S T R E P O R T

Test Report No. :	**T30411-00-02XF**	February 13, 2006 Date of issue

Type / Model Name : Wireless User Interface, P/N: 7263791

Product Description : Wireless hand control for remote-control of Medical xray-systems

Applicant : Siemens AG, Medical Solutions

Address : Allee am Röthelheimpark 2

D – 91052 Erlangen

Manufacturer : Siemens AG, Medical Solutions

Address : Allee am Röthelheimpark 2

D – 91052 Erlangen

Licence holder : Siemens AG, Medical Solutions

Address : Allee am Röthelheimpark 2

D – 91052 Erlangen

Test Result according to the standards listed in clause 1 test standards:	**Positive**

Deutscher Akkreditierungs Rat
DAR
DAT-P-207/05-00

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15 Subpart C - Intentional Radiators (October 01, 2004)

Part 15, Subpart C, Section 15.35(c)	Correction for Pulse Operation (Duty Cycle)
Part 15, Subpart C, Section 15.207(a)	AC Line conducted emissions
Part 15, Subpart C, Section 15.209(a)	Radiated emissions, general requirements
Part 15, Subpart C, Section 15.247(c)	Radiated emissions, outside the used frequency band
Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.247(1)(iii)	Bandwidth requirement
Part 15, Subpart C, Section 15.247(b)(1)	Maximum Peak output Power of intentional radiator

FCC Rules and Regulations Part 15 Subpart B - Unintentional Radiators (October 01, 2004)

Part 15, Subpart B, Section 15.107(a)	AC Line conducted emissions
Part 15, Subpart B, Section 15.109(a)	Radiated emissions, general requirements

2 SUMMARY

GENERAL REMARKS:

The frequency range was scanned from 9 kHz to 25000 MHz. All emissions not reported in this test report were more than 10 dB below the specified limit.

All the tests in this test report have been tested at the handheld sample WRC. The same radio module is also built in the Fixed Unit which receives the signals from WRC and controls the radiological System.

FINAL ASSESSMENT:

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : December 07, 2005

Testing concluded on : February 09, 2006

Checked by:

Thomas Weise
Ich bestätige die Richtigkeit und Integrität dieses Dokuments
2006.02.13 15:25:21 +01'00'

Thomas Weise
Dipl.-Ing.(FH)
Laboratory Manager

Tested by:

Xaver Fischer
Ich bin der Verfasser dieses Dokuments
2006.02.13 15:15:31 +01'00'

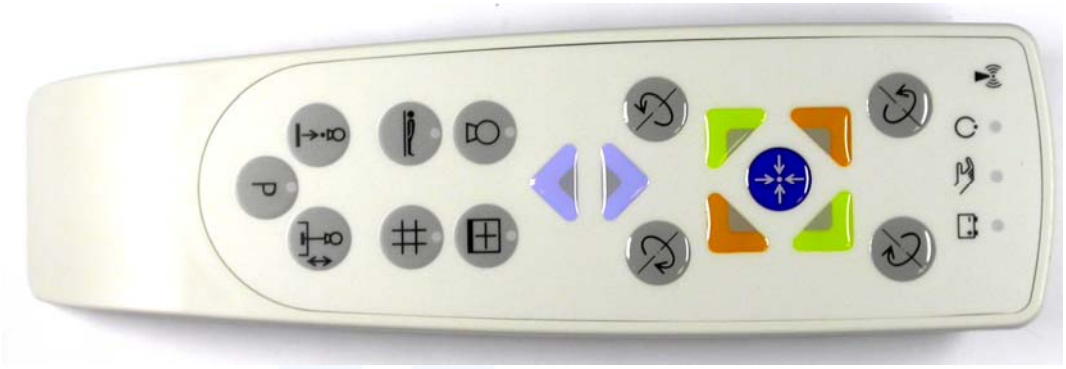
Fischer Xaver

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EuT

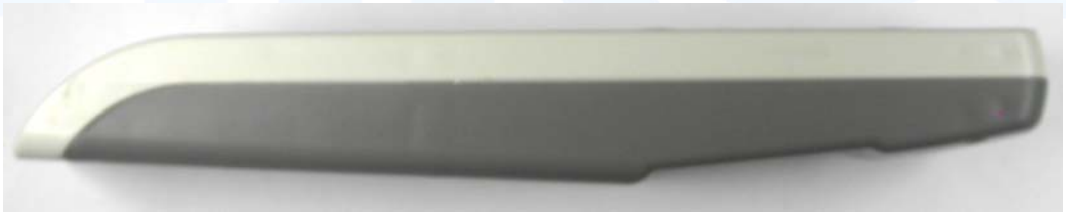
WRC (Wireless remote Control)
T30411-00-02XF

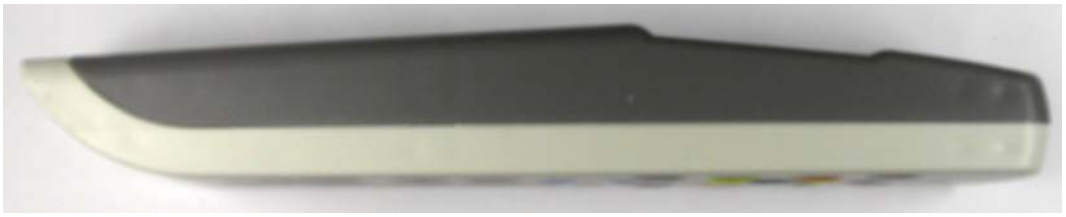
External Photo
Front view



WRC (Wireless remote Control)
T30411-00-02XF

External Photo
Side view





WRC (Wireless remote Control)
T30411-00-02XF

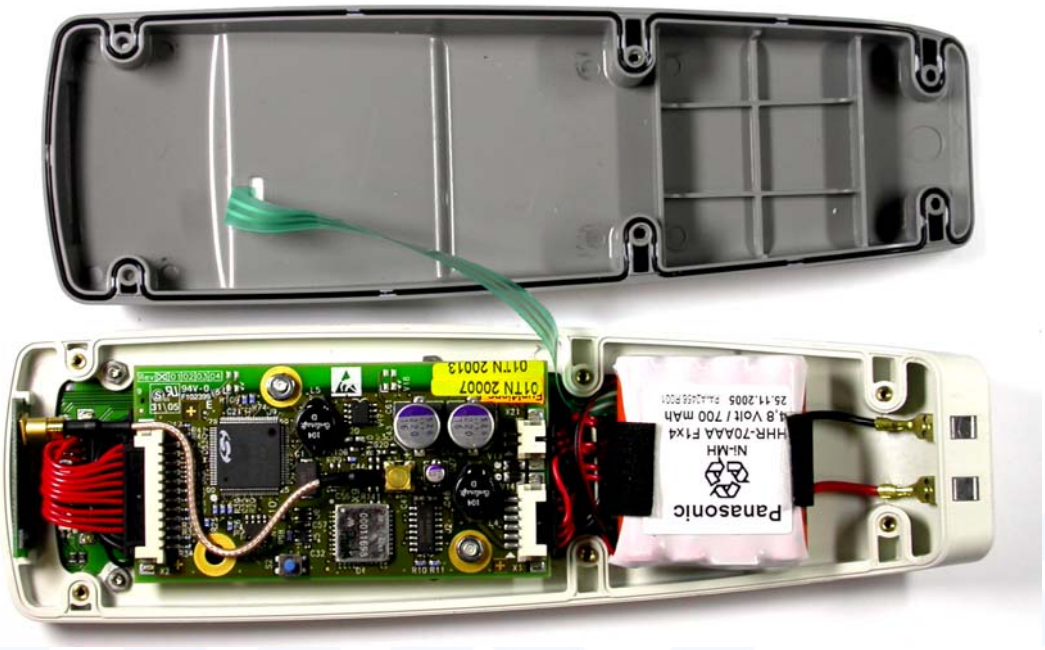
External Photo
Rear view

WRC (Wireless remote Control)
T30411-00-02XF

External Photo
Label view

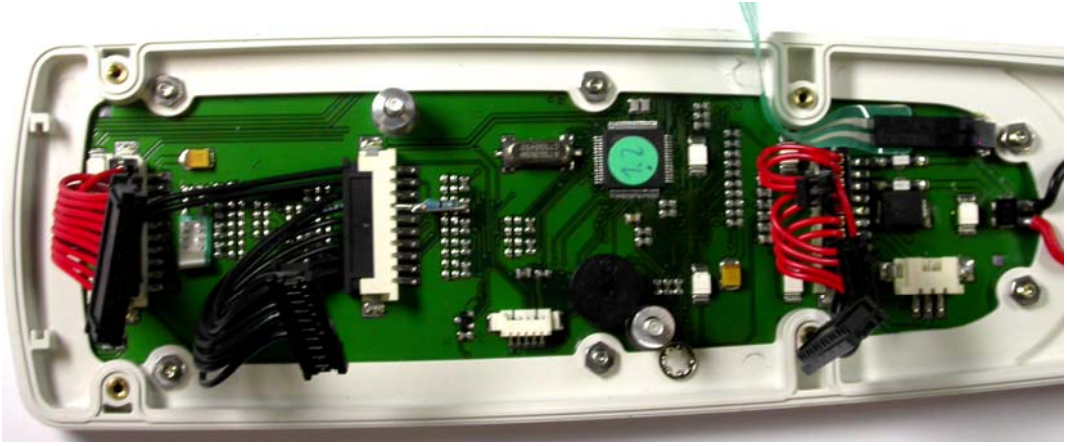
WRC (Wireless remote Control)
T30411-00-02XF

Internal Photo
Open view



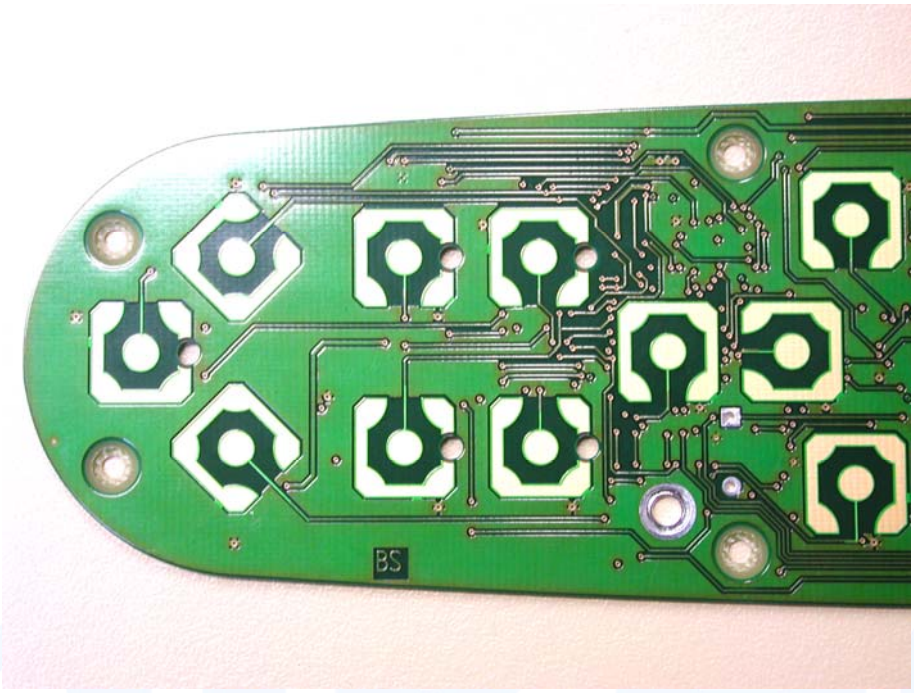
WRC (Wireless remote Control)
T30411-00-02XF

Inernal Photo
Rear view of keyboard



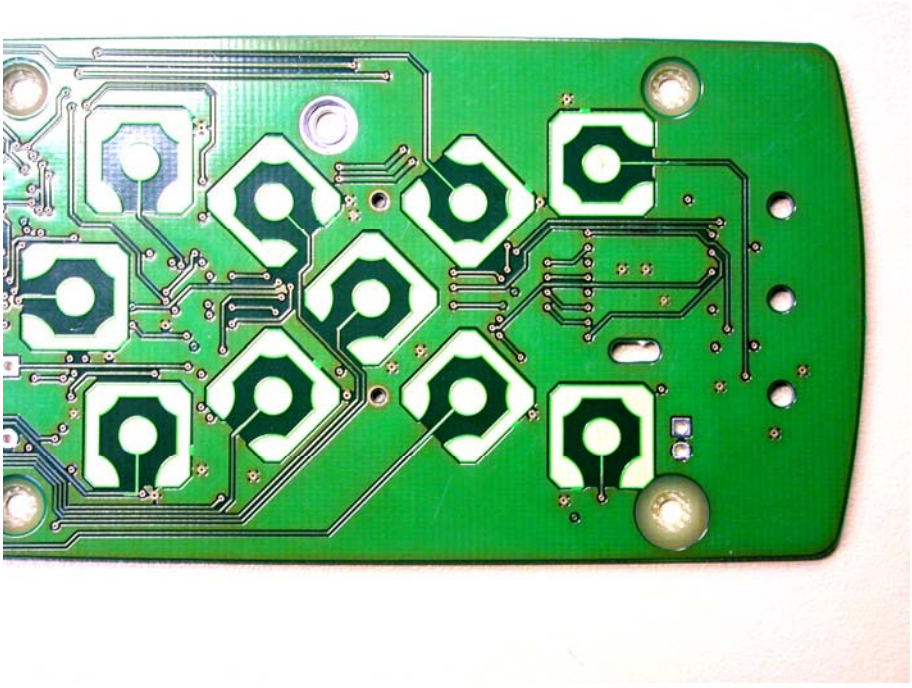
WRC (Wireless remote Control)
T30411-00-02XF

Internal Photo
Front part view of keyboard



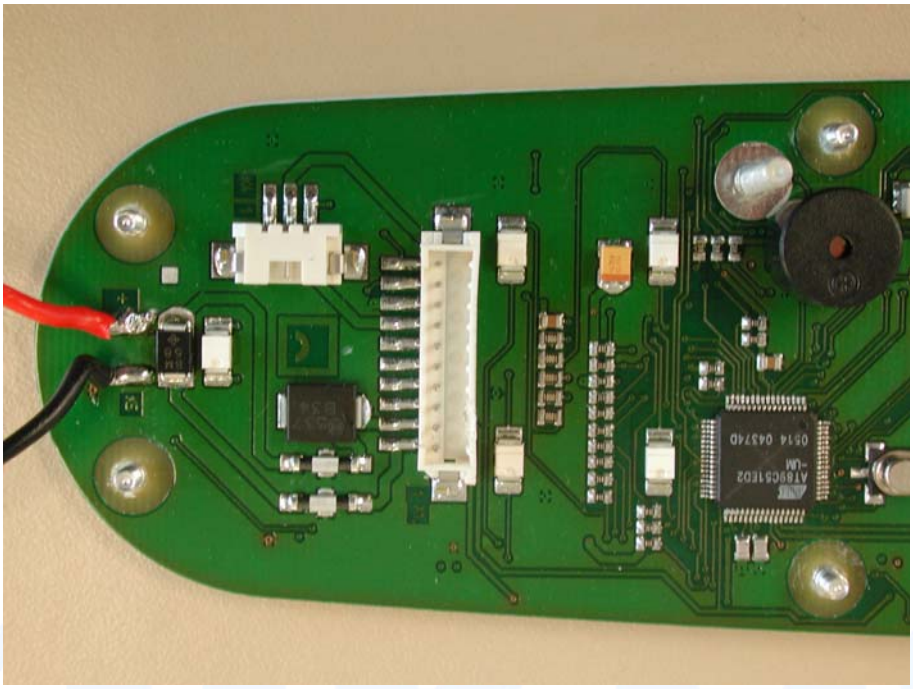
WRC (Wireless remote Control)
T30411-00-02XF

Internal Photo
Front part view of keyboard



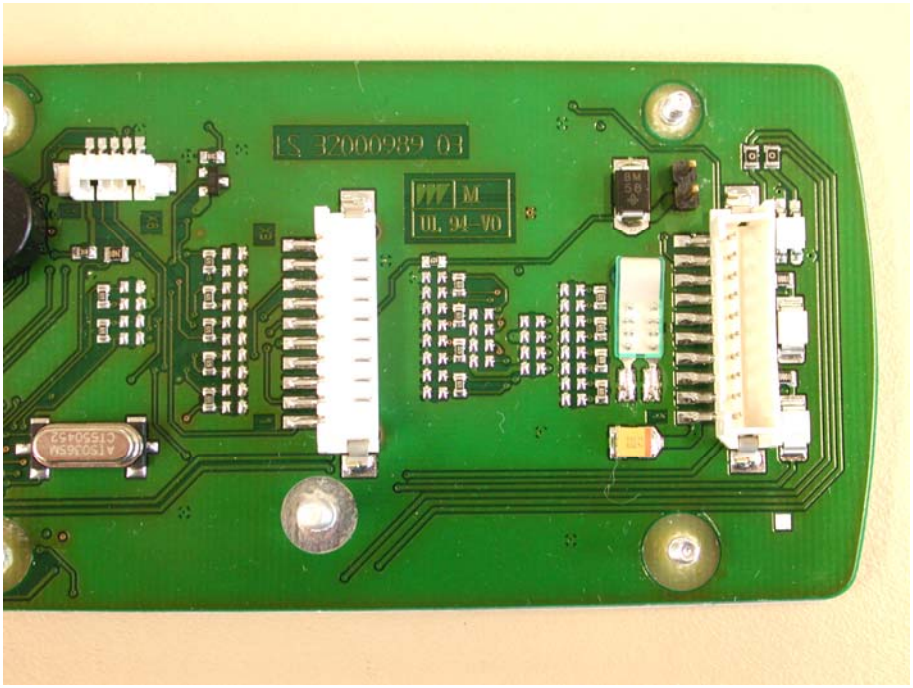
WRC (Wireless remote Control)
T30411-00-02XF

Internal Photo
Rear part view of keyboard



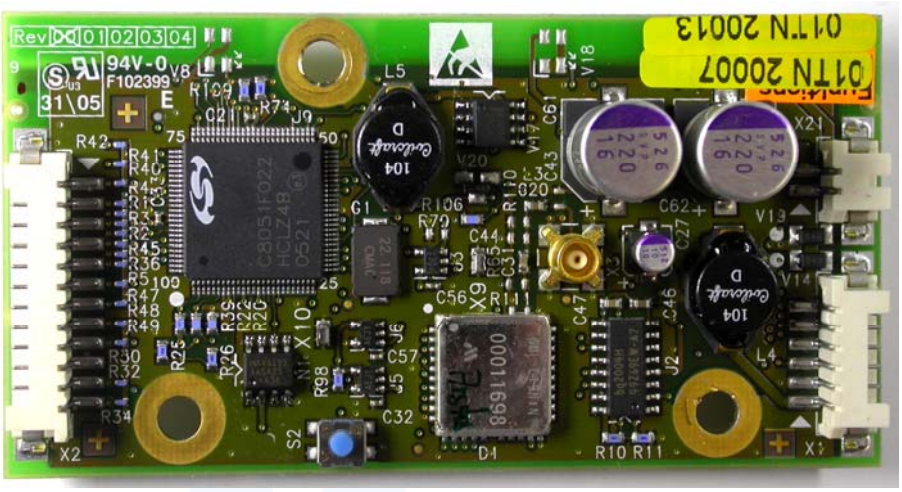
WRC (Wireless remote Control)
T30411-00-02XF

Internal Photo
Rear part view of keyboard



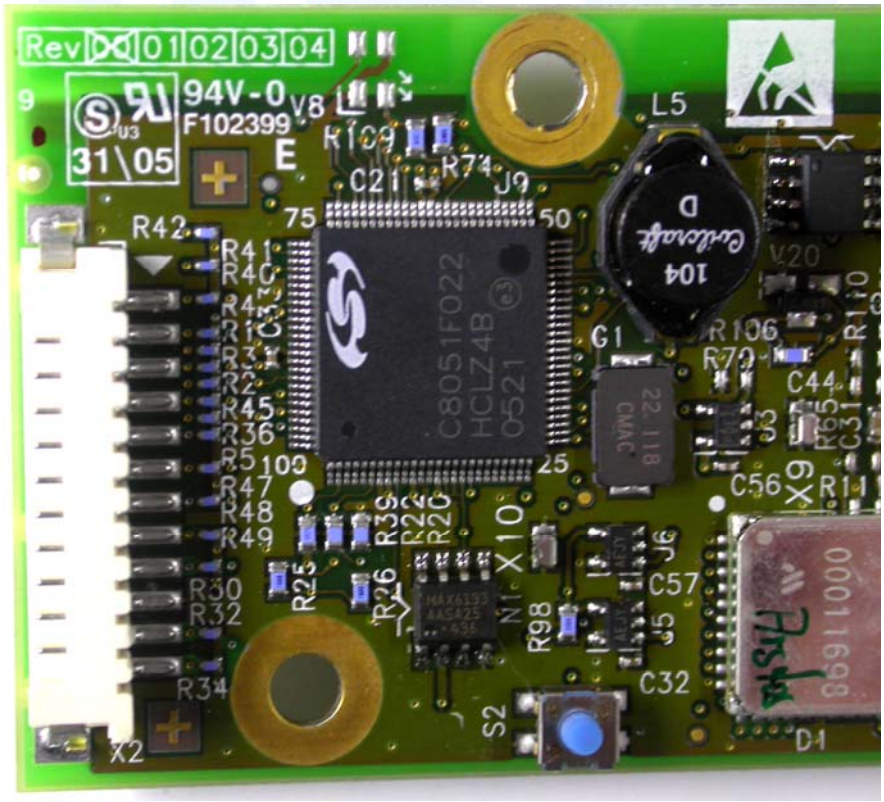
WRC (Wireless remote Control)
T30411-00-02XF

Internal Photo
Top view

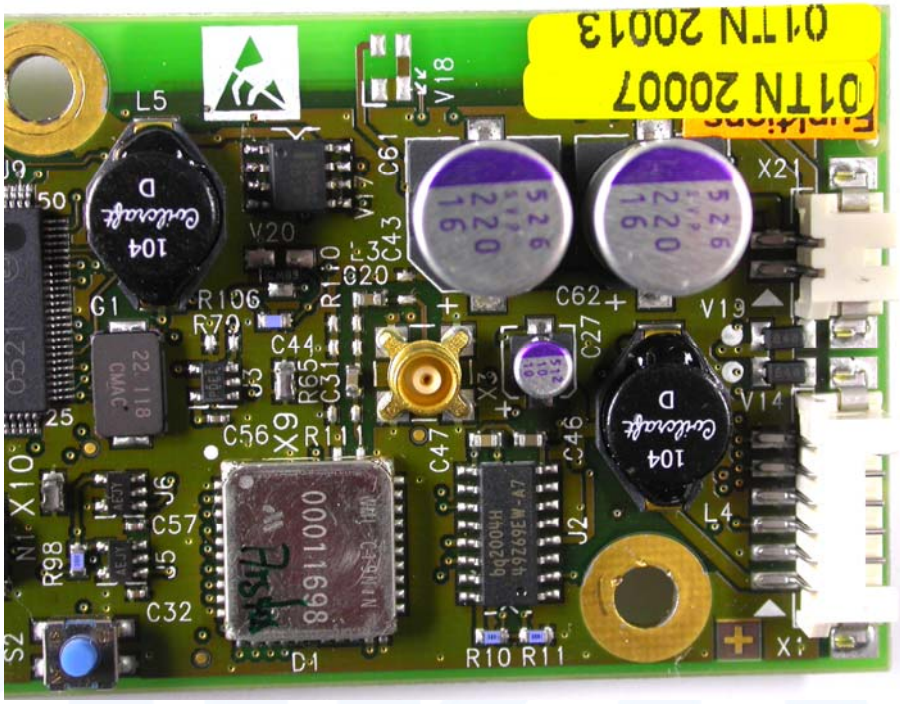


WRC (Wireless remote Control)
T30411-00-02XF

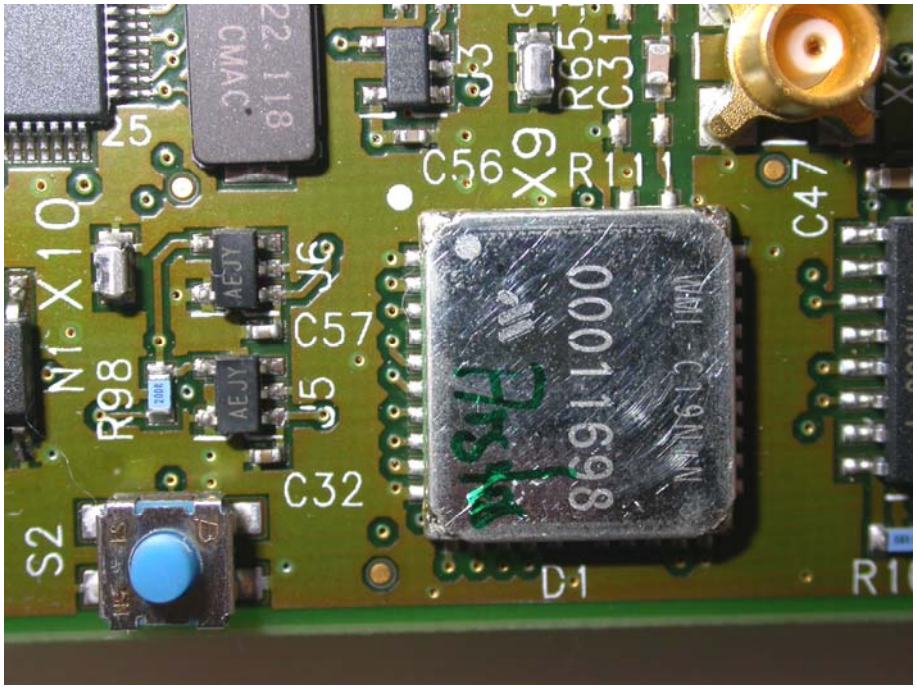
Internal Photo
Part of top view



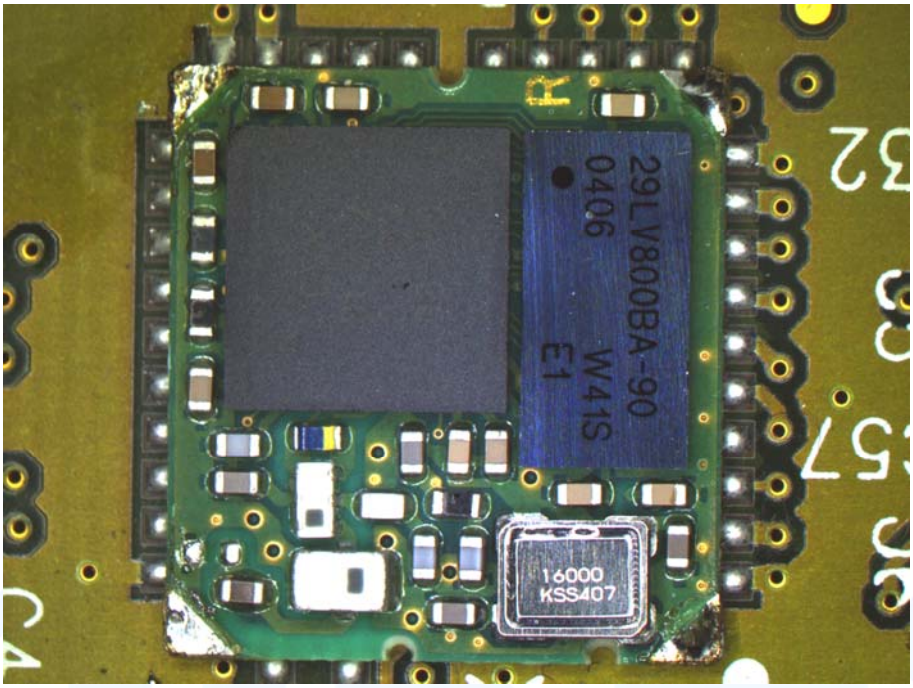
WRC (Wireless remote Control)
T30411-00-02XF
Internal Photo
Part of top view



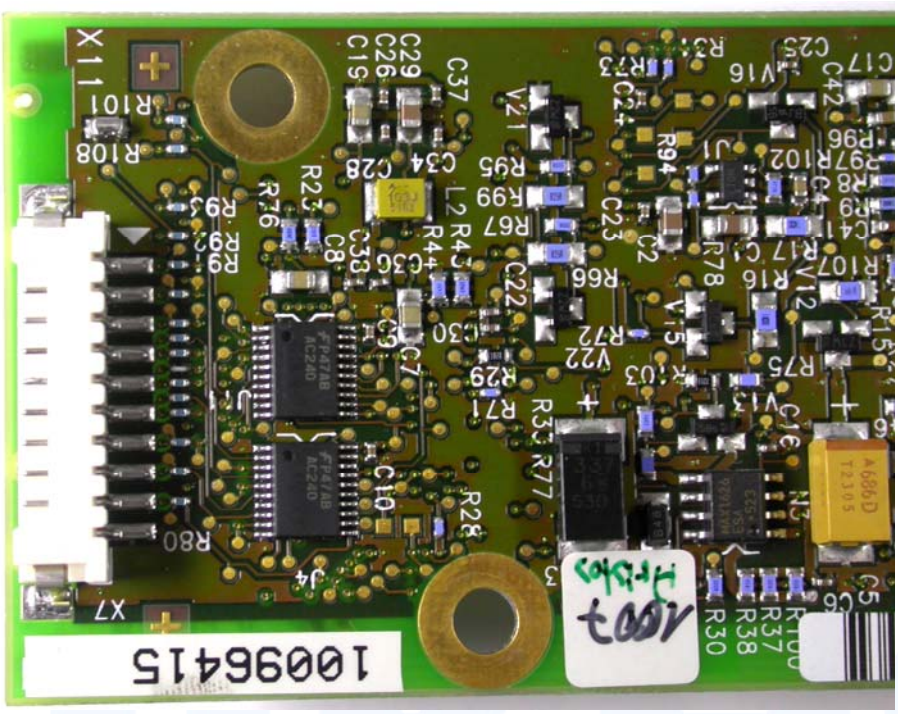
WRC (Wireless remote Control)
T30411-00-02XF
Internal Photo
Bluetooth module



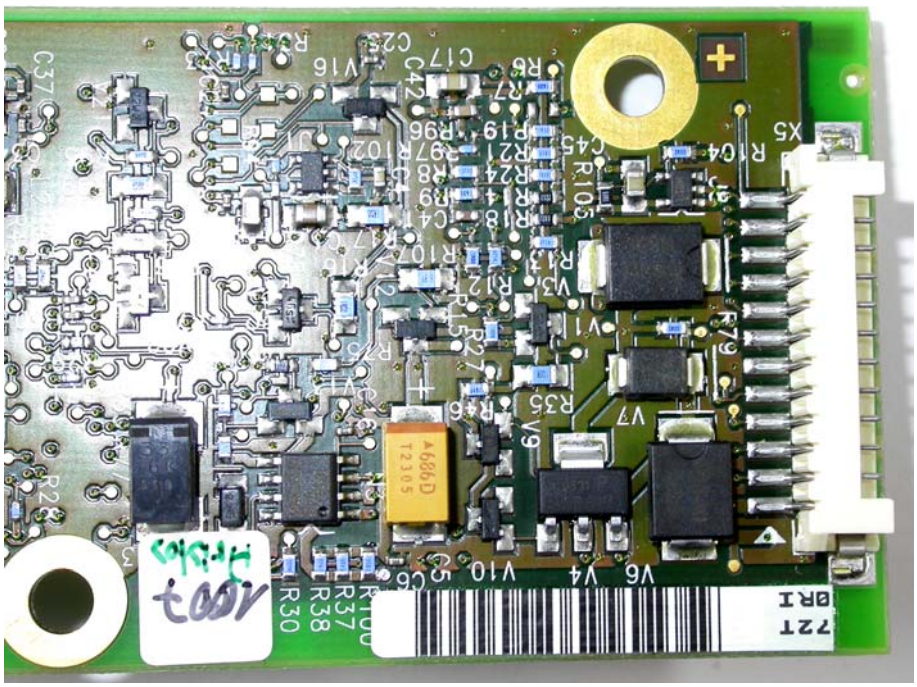
WRC (Wireless remote Control)
T30411-00-02XF
Internal Photo
Bluetooth module without shielding



WRC (Wireless remote Control)
T30411-00-02XF
Internal Photo
Part of rear view



WRC (Wireless remote Control)
T30411-00-02XF
Internal Photo
Part of rear view



WRC (Wireless remote Control)
T30411-00-02XF
External Photo
PCB of Antenna with RF-cable

WRC (Wireless remote Control)
T30411-00-02XF
Internal Photo
PCB of antenna

WRC (Wireless remote Control)
T30411-00-02XF
Internal Photo
Antenna

Power supply and charging unit for WRC
T30411-00-02XF

External Photo
Top view

Power supply and charging unit for WRC
T30411-00-02XF

External Photo
Top view of charging unit

Power supply and charging unit for WRC
T30411-00-02XF

External Photo
Side view of charging unit

Power supply and charging unit for WRC
T30411-00-02XF

External Photo
Bottom view of charging unit

Power supply and charging unit for WRC
T30411-00-02XF

External Photo
Label view of charging unit

Power supply and charging unit for WRC
T30411-00-02XF

External Photo
Front view of power supply with label

Power supply system utilised

Power supply voltage	:	Internal: 4,8 V / DC External: 100-240 V / 50-60 Hz / 1ϕ

3.4 Short description of the Equipment under Test (EuT)

The “Wireless User Interfaces” which are intended to be used as a remote control in current radiological systems. The present handheld device shall be replacing an existed wired solution.
This component “Wireless Remote Control” uses the Bluetooth-RF-technology in order to establish a safe short range radio communication link between the hand-held as mobile unit and the radiological system. Additional hardware and own protocol layers beside the built in Bluetooth module provide a safety oriented signal transmission.
The component “Wireless User Interfaces” consist of:

- Wireless Remote Control (handheld)
  (Mobile unit; collects signal information and transmits to the fixed unit)
- Fixed Unit
  (Built in the radiological System, receives the signal information and controls the upper device)
- Medical grade power supply
  (Power supply and charging unit for the handheld built in battery)

A safe assignment between the wireless hand-held and the fixed unit must be established, before the mobile unit can be used for signal transmission. This assignment is done by a comparison procedure, where a unique and proprietary identification code is exchanged and stored between both devices. When the check procedure is successfully done, the user is able to control the radiological system remotely and wireless by using the “wireless handheld”.
Top mounted LED’s signals the user the current state of the handheld:

- green
  (Green mains active radio link, handheld is ready to use)
- yellow
  (An active signal is transmitting)
- yellow/ green
  (Flashing yellow, the battery becomes low, static yellow the recharging process is ongoing, green, the recharging process is complete)

The whole design considers possible randomly failures in hardware, software or transmission. If any possible failure occurs, a safe state will be reached. Due to this design, no unexpected or unintentional system reaction will occur.

Number of tested samples:	1
Serial number:	Prototype
Protection class:	IPX4

EuT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- TX - mode

- RX - mode

- Standby mode

EuT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

The following peripheral devices and interface cables were connected during the measurements:

- _____ Model : _____
- _____ Model : _____
- _____ Model : _____
- _____ Model : _____
- _____ Model : _____
- _____ Model : _____

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

mikes-testingpartners gmbh
Ohmstrasse 2-4
94342 Strasskirchen
Germany

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 /11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.4 Measurement Protocol for FCC, VCCI and AUSTEL

4.4.1 GENERAL INFORMATION

4.4.1.1 Test Methodology

Conducted and radiated disturbance testing is performed according to the procedures in International Special Committee on Radio Interference (CISPR) Publication 22 (1997), European Standard EN 55022 and Australian Standard AS 3548 (which are based on CISPR 22).

The Japanese standard, "Voluntary Control Council for Interference (VCCI) by Data Processing Equipment and Electronic Office Machines, Technical Requirements" is technically equivalent to CISPR 22 (1997). For official compliance, a conformance report must be sent to and accepted by the VCCI.

In compliance with FCC Docket 92-152, "Harmonization of Rules for Digital Devices Incorporate International Standards", testing for FCC compliance may be done following the ANSI C63.4-2003 procedures and using the CISPR 22 Limits.

4.4.1.2 Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into it's characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum disturbances from the unit.

4.4.2 DETAILS OF TEST PROCEDURES

4.4.2.1 General Standard Information

The test methods used comply with CISPR Publication 22 (1997), EN 55022 (2001) and AS 3548 (1992) - "Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment" and with ANSI C63.4-2003 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

TEST CONDITIONS AND RESULTS

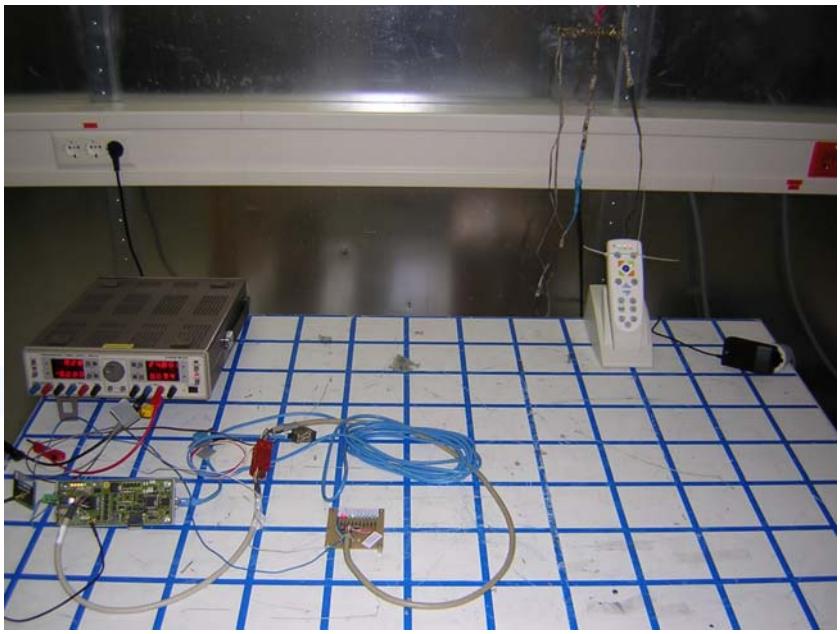
5.1 Conducted emissions

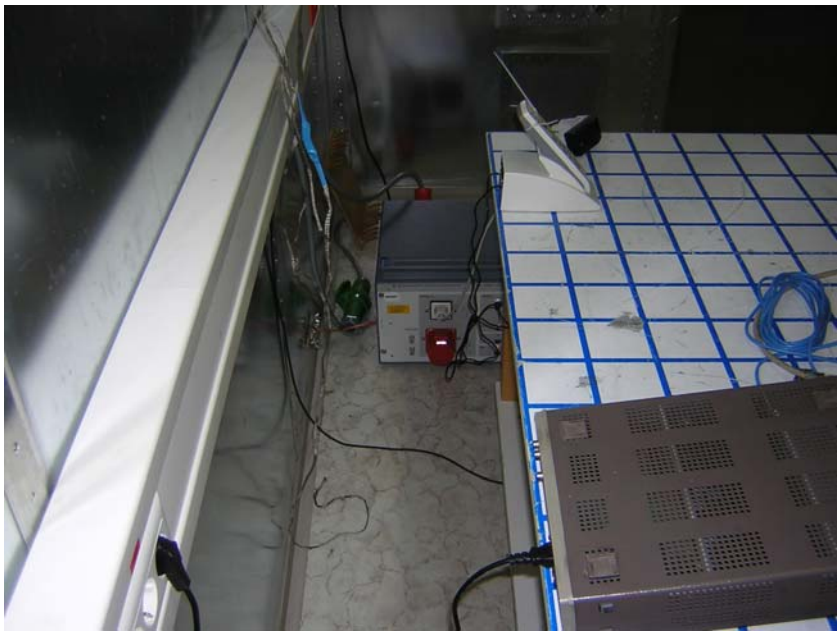
For test instruments and accessories used see section 6 Part **A 4**.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up





5.1.3 Description of Measurement

The final level, expressed in dBμV, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC Limit or to the CISPR limit, which is equivalent to the Australian AS 3548 limit.

To convert between dBμV and μV, the following conversions apply:

dBμV = 20(log μV)

μV = Inverse log(dBμV/20)

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EuT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50Ω/50 μH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeter's above the floor and is positioned 40 centimeter's from the vertical ground plane (wall) of the screen room. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

5.1.4 Test result

Frequency range:	0,15 MHz - 30 MHz
Min. limit margin	19,8 dB at 0,69 MHz

The requirements are **FULFILLED.**

Remarks: _____

_____

_____

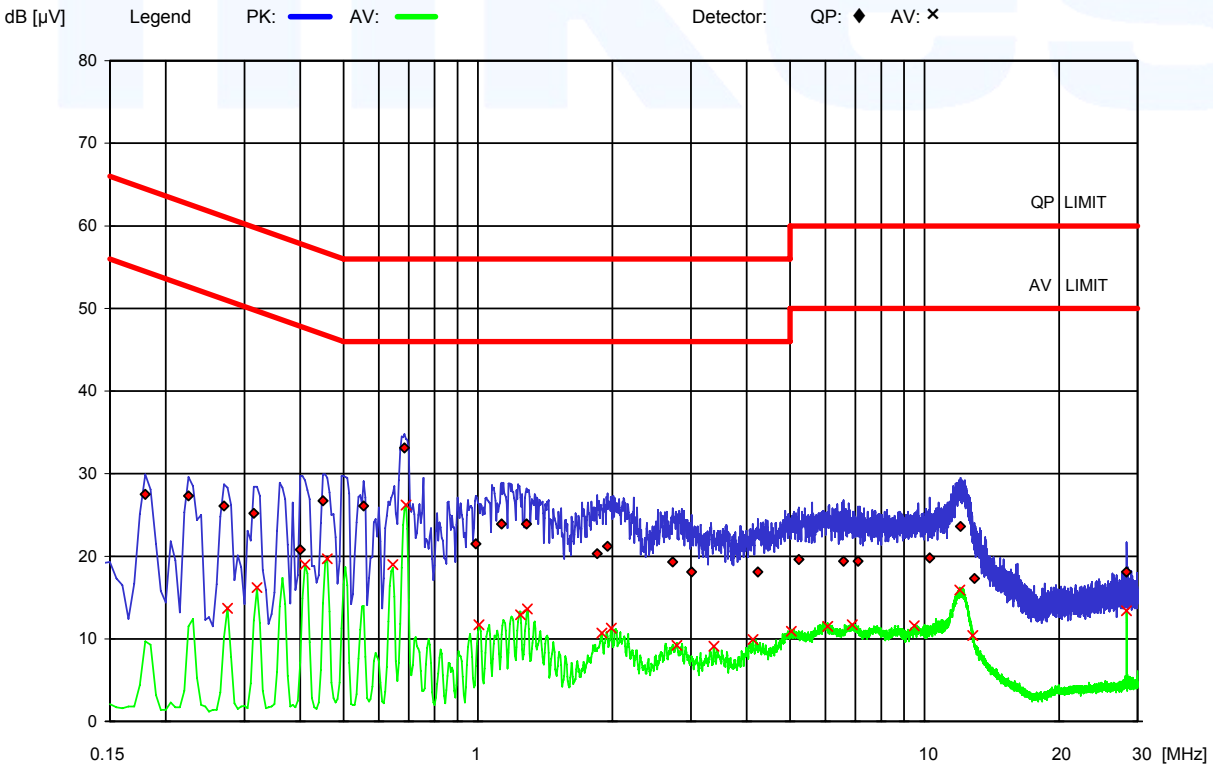
_____

5.1.5 Test protocol

Test point	L1	Result: passed
Operation mode:	Charging – and transmit mode	
Remarks:	Power Voltage 115V / 60Hz	
Date:	December 15, 2005	
Tested by:	Fischer Xaver	

Freq	QP- L	D -Limit	Freq	AV-L	D -Limit
kHz	dB[µV]	QP [dB]	kHz	dB[µV]	AV [dB]
180	27,5	37,0	275	13,7	37,3
225	27,3	35,3	320	16,2	33,5
270	26,1	35,0	410	19	28,6
315	25,2	34,6	460	19,7	27,0
400	20,8	37,1	645	19	27,0
450	26,7	30,2	690	26,2	19,8
555	26,1	29,9	1005	11,7	34,3
685	33,1	22,9	1245	12,9	33,1
990	21,5	34,5	1290	13,6	32,4
1130	23,9	32,1	1895	10,7	35,3
1285	23,9	32,1	1990	11,3	34,7
1850	20,3	35,7	2790	9,2	36,8
1950	21,2	34,8	3375	9,1	36,9
2730	19,3	36,7	4130	9,9	36,1
3010	18,1	37,9	5030	10,9	39,1

Freq	QP- L	D -Limit	Freq	AV-L	D -Limit
kHz	dB[µV]	QP [dB]	kHz	dB[µV]	AV [dB]
4235	18,1	37,9	6070	11,5	38,5
5235	19,6	40,4	6890	11,7	38,3
6590	19,4	40,6	9490	11,6	38,4
7095	19,4	40,6	11995	15,9	34,1
10270	19,8	40,2	12815	10,4	39,6
12035	23,6	36,4	28335	13,4	36,6
12935	17,3	42,7			
28335	18,1	41,9			

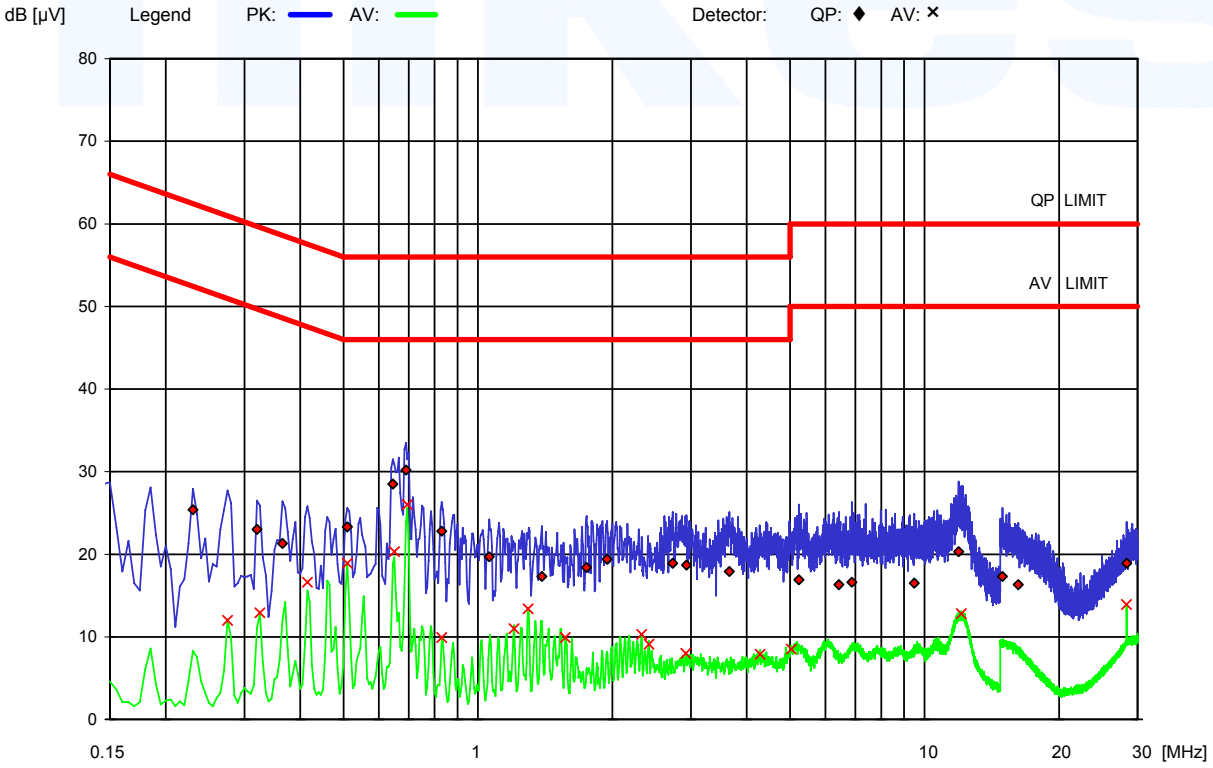


FCC ID: S5H-WRC

Test point	N	Result: passed
Operation mode:	Charging – and transmit mode	
Remarks:	Power Voltage 115V / 60Hz	
Date:	December 15, 2005	
Tested by:	Fischer Xaver	

Freq	QP- L	D -Limit	Freq	AV-L	D -Limit
kHz	dB[µV]	QP [dB]	kHz	dB[µV]	AV [dB]
230	25,4	37,0	275	12	39,0
320	23	36,7	325	12,9	36,7
365	21,3	37,3	415	16,6	30,9
510	23,3	32,7	510	18,9	27,1
645	28,5	27,5	650	20,3	25,7
690	30,2	25,8	695	26	20,0
830	22,8	33,2	830	9,9	36,1
1060	19,7	36,3	1205	11	35,0
1390	17,3	38,7	1295	13,4	32,6
1750	18,4	37,6	1570	9,9	36,1
1945	19,4	36,6	2325	10,3	35,7
2730	18,9	37,1	2415	9,1	36,9
2930	18,7	37,3	2920	8	38,0
3655	17,9	38,1	4285	7,9	38,1
5235	16,9	43,1	5035	8,5	41,5

Freq	QP- L	D -Limit	Freq	AV-L	D -Limit
kHz	dB[µV]	QP [dB]	kHz	dB[µV]	AV [dB]
6430	16,3	43,7	12095	12,8	37,2
6875	16,6	43,4	28335	13,9	36,1
9480	16,5	43,5			
11920	20,3	39,7			
14945	17,3	42,7			
16205	16,3	43,7			
28340	18,9	41,1			



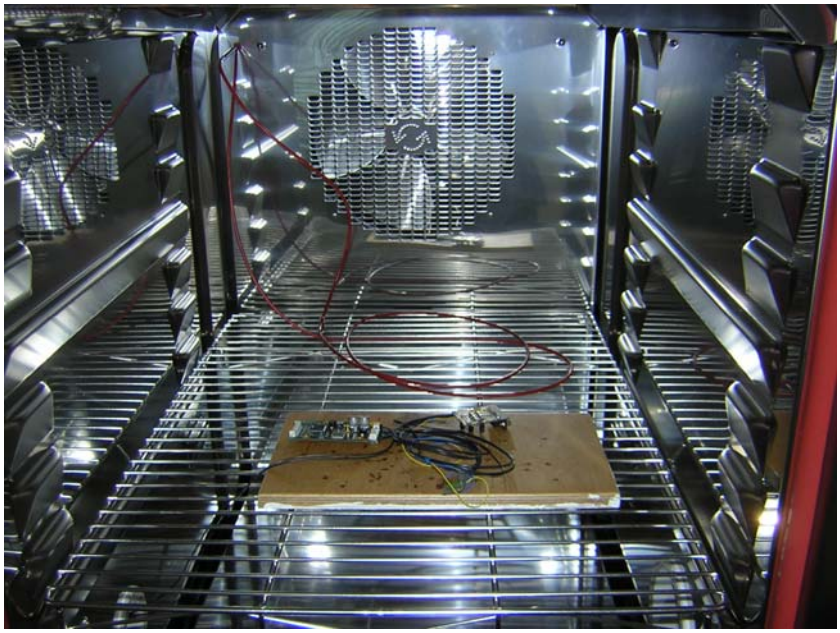
5.2 Maximum Peak Output Power

For test instruments and accessories used see section 6 Part **CPC 3**.

5.2.1 Description of the test location

Test location: AREA4

5.2.2 Photo documentation of the test set-up



5.2.3 Description of Measurement

Conducted test procedure:

Conducted maximum peak output power:

A spectrum analyzer / EMI test receiver is connected to the ouput of the transmitter via a suitable attenuator while EuT was operating in transmit mode using the assigned frequency.
Analyzer Settings:

- Detector: Max hold
- RBW: greater than 20 dB Bandwidth
- VBW: ≥ RBW
- Sweep Time: Coupled

Alternative test procedure:
If antenna conducted tests cannot be performed on the EuT, radiated tests to show compliance with the various conducted requirements of Section 15.247 are performed. A pre-amp have been used in making the following requirements.

Radiated maximum peak output power:

Radiated maximum peak output power from the EuT is measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003.
The Interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarization`s and the EuT are rotated 360 degrees.

The final level, expressed in dBµV/m, is arrived by taking the reading from the EMI receiver (Level dBµV) and adding the correction factors and cable loss factor (Factor dB) to it. This is done automatically in the EMI receiver, where the correction factors are stored. This result then has the FCC or CISPR limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets at page.

Radiated maximum peak output power from the EuT is measured above 1 GHz, using a tuned receiver (Spectrum Analyser) and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003.
The Interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area.

Measurement are made in both the horizontal and vertical planes of polarization in a fully anechoic room using a spectrum analyzer with the detector function set to peak and resolution as well as video bandwith set to 1 MHz.
All tests are performed at a test-distance of 3 meters. Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration procedure the highest emission relative the limit and therefore shall be used for final testing. During the tests the EUT is rotated all around to find the maximum levels of emissions. The cables and equipment were placed and moved within the range of position likely to find their maximum emissions. When the EuT is larger than the beamwidth of the measuring antenna, the measurement

antenna will be moved over the surfaces for the four sides or the test distance will be reduced to demonstrate that emissions were at maximum at the limit distance.
Analyzer Settings:

- Detector: Max hold
- RBW: greater than 20 dB Bandwidth
- VBW: ≥ RBW
- Sweep Time: Coupled

5.2.4 Test result

Channel	Frequency [MHz]	Peak Power Output (dBm)	Correct. [dB]	Corr. Peak Power Output (dBm)	Peak Power Limit (dBm)	Delta [dB]
0	2402	--	--	1,55	30	-28,45
39	2441	--	--	1,69	30	-28,31
78	2480	--	--	1,48	30	-28,45

Peak Power Limit according to FCC Subpart 15.247(b)(3)

Frequency (MHz)	Peak Power Limit	
	(dBm)	(Watt)
902-928	30	1,0
2400-2483.5	**30**	**1,0**
5725-5850	30	1,0

The requirements are **FULFILLED.**

Remarks: It was used the “conducted test procedure“.

Bluetooth Specifications: Packet type: DH1

Packet size: max

Antenne gain: 4,1 dBi

5.3 Radiated emissions 9 kHz – 40 GHz

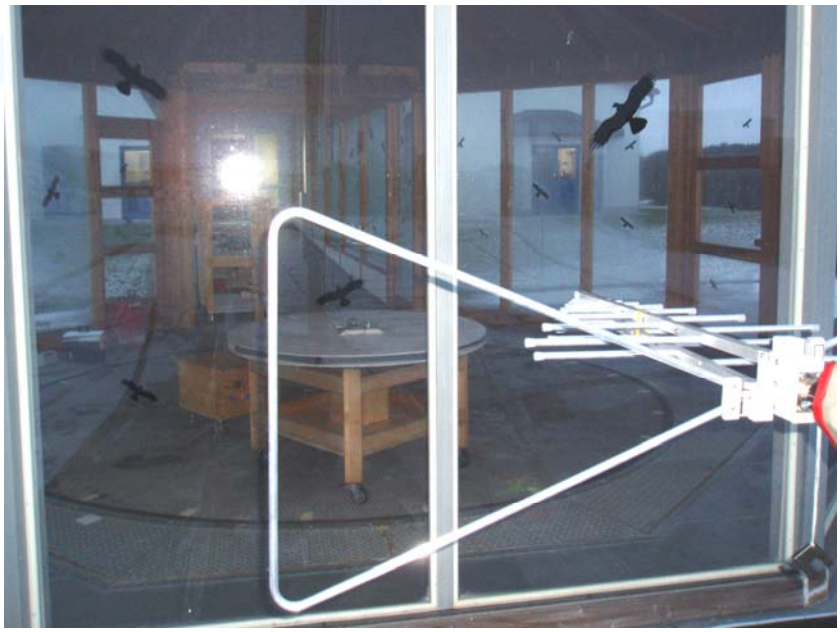
For test instruments and accessories used see section 6 Part **SER 1, SER 2 and SER 3**.

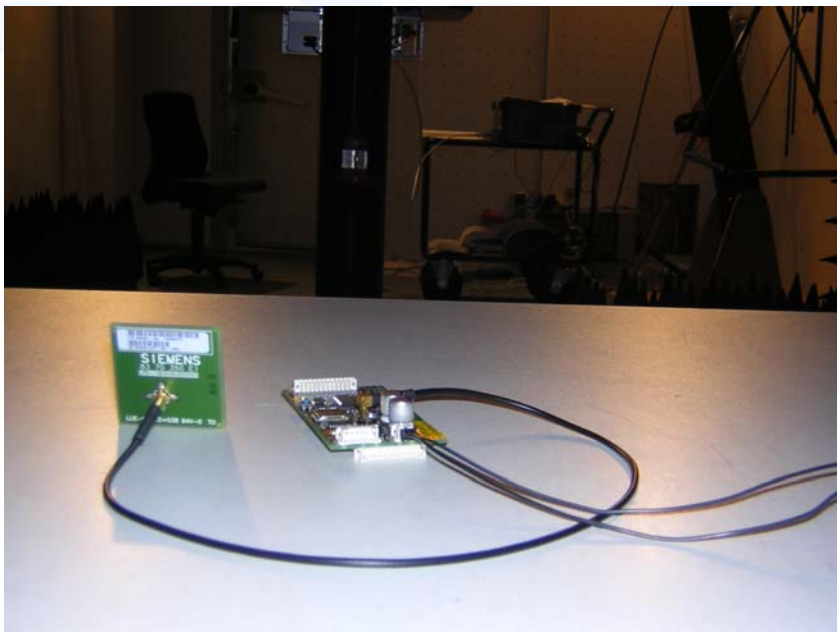
5.3.1 Description of the test location

Test location: OATS1
Anechoic Chamber A2

Test distance: 3 metres

5.3.2 Photo documentation of the test set-up




SIEMENS

5.3.3 Description of Measurement

The spurious emissions from the EuT will be measured on an open area test site in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions. In the case where larger measuring distances are required the results will extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with an EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used according to Section 15.209 (d) [2].

The final level, expressed in dBµV/m, is arrived at by taking the reading from the EMI receiver (Level dBµV) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has to be compared with the relevant FCC limit.
The resolution bandwidth during the measurement is as follows:
9 kHz – 150 kHz: ResBW: 200 Hz
150 kHz – 30 MHz: ResBW: 9 kHz

Radiated spurious emissions from the EuT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003. The Interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarization`s and the EuT are rotated 360 degrees.

The final level, expressed in dBµV/m, is arrived by taking the reading from the EMI receiver (Level dBµV) and adding the correction factors and cable loss factor (Factor dB) to it. This is done automatically in the EMI receiver, where the correction factors are stored. This result then has the FCC or CISPR limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets at page.

The radiated emissions from the EuT are measured in the frequency range of 1 GHz to maximum frequency as specified in section 15.33, using a tuned receiver (Spectrum Analyser) and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003.
The Interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna was positioned 3m horizontally from the EuT.

Measurement are made in both the horizontal and vertical planes of polarization in a fully anechoic room using a spectrum analyzer with the detector function set to peak and resolution as well as video bandwidth set to 100 kHz and for any spurious emission or modulation product that falls in Restricted Band, as defined in Section 15.205, set the resolution and video bandwidth to 1 MHz.
All tests are performed at a test-distance of 3 meters. Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration procedure the highest emission relative the limit and therefore shall be used for final testing. During the tests the EUT is rotated all around to find the maximum levels of emissions. The cables and equipment were placed and moved within the range of position likely to find their maximum emissions. When the EuT is larger than the beamwidth of the measuring antenna, the measurement antenna will be moved over the surfaces for the four sides or the test distance will be reduced to demonstrate that emissions were at maximum at the limit distance.

Analyzer Settings (EMI receiver) for spurious emissions which fall not in Restricted Band:

- Detector: Max hold
- RBW: 100 kHz for f ≥ 1GHz, 120 kHz for f ≤ 1GHz
- VBW: ≥ RBW
- Sweep Time: Coupled
- Detecter function: Peak

Analyzer Settings (EMI receiver) for spurious emissions which fall in Restricted Band:

- Detector: Max hold
- RBW: 1 MHz for f ≥ 1GHz, 120 kHz for f ≤ 1GHz
- VBW: ≥ RBW
- Sweep Time: Coupled
- Detecter function: Peak for f ≥ 1GHz, Quasi Peak for f ≤ 1GHz

5.3.4 Test result

Testresult in detail: (<1GHz)

Corrected field strength of fundamental wave as reference for radiated emissions: 102,5 dBµV/m

Channel 0												
Frequency [MHz]	Restricted Band	Reading Level QP [dBµV]	Reading Level AV [dBµV]	Reading Level PK [dBµV]	Bandwidth [kHz]	Correct. factor [dB]	Corrected Level QP [dBµV/m]	Corrected Level AV [dBµV/m]	Corrected Level PK [dBµV/m]	Limit [dBµV/m] PK	Limit [dBµV/m] QP	Delta [dB]
0,009-0,15					0,2		< 30					
0,15-30					9		< 30					
663,56				14,5	120	24,0			38,5	82,5		> -44,0
30-88	■				120		< 30				40	> -10,0
88-216	■				120		< 30				43,5	> -13,5
216-960	■				120		< 30				46	> -16,0
960-1000	■				120		< 30				54	> -24,0

Corrected field strength of fundamental wave as reference for radiated emissions: 104,2 dBµV/m

Channel 39												
Frequency [MHz]	Restricted Band	Reading Level QP [dBµV]	Reading Level AV [dBµV]	Reading Level PK [dBµV]	Bandwidth [kHz]	Correct. factor [dB]	Corrected Level QP [dBµV/m]	Corrected Level AV [dBµV/m]	Corrected Level PK [dBµV/m]	Limit [dBµV/m] PK	Limit [dBµV/m] QP	Delta [dB]
0,009-0,15					0,2		< 30					
0,15-30					9		< 30					
663,56				14,2	120	24,0			38,2	84,2		> -46,0
30-88	■				120		< 30				40	> -10,0
88-216	■				120		< 30				43,5	> -13,5
216-960	■				120		< 30				46	> -16,0
960-1000	■				120		< 30				54	> -24,0

Corrected field strength of fundamental wave as reference for radiated emissions: 104,0 dBµV/m

Channel 78												
Frequency [MHz]	Restricted Band	Reading Level QP [dBµV]	Reading Level AV [dBµV]	Reading Level PK [dBµV]	Bandwidth [kHz]	Correct. factor [dB]	Corrected Level QP [dBµV/m]	Corrected Level AV [dBµV/m]	Corrected Level PK [dBµV/m]	Limit [dBµV/m] PK	Limit [dBµV/m] QP	Delta [dB]
0,009-0,15					0,2		< 30					
0,15-30					9		< 30					
663,56				14,3	120	24,0			38,3	84,0		> -45,7
30-88	■				120		< 30				40	> -10,0
88-216	■				120		< 30				43,5	> -13,5
216-960	■				120		< 30				46	> -16,0
960-1000	■				120		< 30				54	> -24,0

Testresult in detail:(>1GHz)

Corrected field strength of fundamental wave as reference for radiated emissions: 102,5 dBµV/m

Channel 0												
Frequency [MHz]	Restricted Band	Reading Level PK [dBµV]	Corr. Duty Cycle [dB]	Level AV [dBµV] *)	Band-width [kHz]	Correct. Factor [dB]	Corrected Level PK [dBµV/m]	Corrected Level AV [dBµV/m]	Limit PK [dBµV/m]	Limit AV [dBµV/m]	Delta PK [dB]	Delta AV [dB]
4804	■	65,4		44,3	1000	0,6	66,0	44,92	74,0	54,0	-8,0	-9,1
7206		53,0			100	7,2	60,3		82,5		-22,2	
9608		32,8			100	6,4	39,2		82,5		-43,3	

Corrected field strength of fundamental wave as reference for radiated emissions: 104,2 dBµV/m

Channel 39												
Frequency [MHz]	Restricted Band	Reading Level PK [dBµV]	Corr. Duty Cycle [dB]	Level AV [dBµV] *)	Band-width [kHz]	Correct. Factor [dB]	Corrected Level PK [dBµV/m]	Corrected Level AV [dBµV/m]	Limit PK [dBµV/m]	Limit AV [dBµV/m]	Delta PK [dB]	Delta AV [dB]
4882	■	69,7		43,5	1000	0,8	70,5	44,3	74,0	54,0	-3,5	-9,7
7323	■	57,7		29,8	1000	7,5	65,2	37,3	74,0	54,0	-8,8	-16,7
9764		38,3			1000	6,5	44,8		84,2		-39,4	

Corrected field strength of fundamental wave as reference for radiated emissions: 104,0 dBµV/m

Channel 39												
Frequency [MHz]	Restricted Band	Reading Level PK [dBµV]	Corr. Duty Cycle [dB]	Level AV [dBµV] *)	Band-width [kHz]	Correct. Factor [dB]	Corrected Level PK [dBµV/m]	Corrected Level AV [dBµV/m]	Limit PK [dBµV/m]	Limit AV [dBµV/m]	Delta PK [dB]	Delta AV [dB]
4960	■	67,8		41,1	1000	1,0	68,8	42,1	74,0	54,0	-5,2	-11,9
7440	■	56,0		26,8	1000	7,9	63,9	34,7	74,0	54,0	-10,1	-19,3
9920		36,1			100	6,5	42,5		84,0		-41,5	

*) Average values were measured with spectrum analyzer by taking the following Settings
RBW: 1 MHz
VBW: 10 Hz
Sweep: Auto

Peak-Limit according to FCC Subpart 15.247(c)

In any 100 kHz bandwidth outside the frequency band 2400 – 2483.50 MHz, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required.
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limit specified in §15.209(a) (see §15.205(c)).

Final radiated limits for spurious emissions which fall not in restricted band:

Frequency [MHz]	**Limits acc. 15.209 [dBµV/m]**	**Measure-ment dis-tance (meters)**	**Limits acc. 15.247(c) [dBµV/m]**			**Final Radiated Limits [dBµV/m]**		
	Limit		Ch 0	Ch 39	Ch 78	Ch 0	Ch 39	Ch 78
0,009-0,490	2400/F(kHz)	300	**82,5**	**84,2**	**84,0**	**82,5**	**84,2**	**84,0**
0,490-1,705	24000/F(kHz)	30	**82,5**	**84,2**	**84,0**	**82,5**	**84,2**	**84,0**
1,705-30	30	30	**82,5**	**84,2**	**84,0**	**82,5**	**84,2**	**84,0**
30-88	40	3	**82,5**	**84,2**	**84,0**	**82,5**	**84,2**	**84,0**
88-216	43,5	3	**82,5**	**84,2**	**84,0**	**82,5**	**84,2**	**84,0**
216-960	46	3	**82,5**	**84,2**	**84,0**	**82,5**	**84,2**	**84,0**
Above 960	54	3	**82,5**	**84,2**	**84,0**	**82,5**	**84,2**	**84,0**

Radiated limits according to FCC Part 15 Subpart 15.209(a) for spurious emissions which fall in restricted band:

Frequency (MHz)	**Field strength of spurious emissions**		**Measurement distance (meters)**
	(µV/m)	**dB (µV/m)**	
0,009-0,490	2400/F(kHz)		300
0,490-1,705	24000/F(kHz)		30
1,705-30	30	29,5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209

MHz	MHz	GHz
25.5 – 25.67	960 – 1240	4.5 – 5.15
37.5 – 38.25	1300 – 1427	5.35 – 5.46
73 – 74.6	1435 – 1626.5	7.25 – 7.75
74.8 – 75.2	1645.5 – 1646.5	8.025 – 8.5
108 – 121.94	1660 – 1710	9.0 – 9.2
123 – 138	1718.8 – 1722.2	9.3 – 9.5
149.9 – 150.05	2200 – 2300	10.6 – 12.7
156.52475 – 156.52525	2310 – 2390	13.25 – 13.4
156.7 – 156.9	2483.5 – 2500	14.47 – 14.5
162.0125 – 167.17	2655 – 2900	15.35 – 16.2
167.72 – 173.2	3260 – 3267	17.7 – 21.4
240 – 285	3332 – 3339	22.01 – 23.12
322 – 335.4	3345.8 – 3358	23.6 – 24.0
399.9 – 410	3600 – 4400	31.2 – 31.8
608 – 614		36.43 – 36.5

The requirements are **FULFILLED.**

Remarks: During the test, the Eut was set into normal modulation mode as intented for use.

The measurement was performed up to the 10th harmonic (25000MHz).

Bluetooth Specifications: Packet type: DH1

Packet size: max

Antenne gain: 4,1 dBi

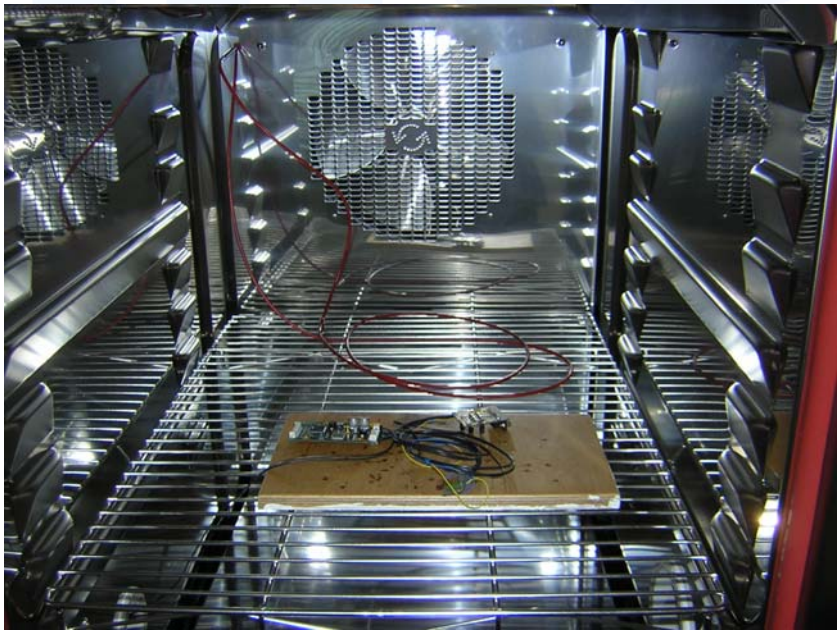
5.4 Spurious RF Conducted Emission

For test instruments and accessories used see section 6 Part **SEC1, SEC2 and SEC3**.

5.4.1 Description of the test location

Test location: AREA4

5.4.2 Photo documentation of the test set-up



5.4.3 Description of Measurement

A Spectrum analyzer / EMI test receiver is connected to the ouput of the transmitter via a suitable attenuator while EuT was operating in transmit mode using the assigned frequency.
Analyzer Settings:

- Detector: Max Hold
- RBW: 100 kHz
- VBW: ≥ RBW
- Sweep Time: Coupled
- Detecter function: Peak

5.4.4 Test result

Corrected field strength of fundamental wave as reference for conducted emissions: 108,54 dBµV

Channel 0											
Frequency [MHz]	Restricted Band	Reading Level PK [dBµV]	Corr. Duty Cycle [dB]	Level AV [dBµV] *)	Band-width [kHz]	Correct. Factor [dB]	Corrected Level PK [dBµV/m]	Corrected Level AV [dBµV/m]	Limit PK [dBµV/m]	Limit AV [dBµV/m]	Delta [dB]
0,009-0,15					0,2		< 30				
0,15-30					9		< 30				
664,38					100		49,47		88,54		-39,07
7210,00					100		42,73		88,54		-45,81

Corrected field strength of fundamental wave as reference for conducted emissions: 108,67 dBµV

Channel 39											
Frequency [MHz]	Restricted Band	Reading Level PK [dBµV]	Corr. Duty Cycle [dB]	Level AV [dBµV] *)	Band-width [kHz]	Correct. Factor [dB]	Corrected Level PK [dBµV/m]	Corrected Level AV [dBµV/m]	Limit PK [dBµV/m]	Limit AV [dBµV/m]	Delta [dB]
0,009-0,15					0,2		< 30				
0,15-30					9		< 30				
703,18					100		49,36		88,67		-39,31

Corrected field strength of fundamental wave as reference for conducted emissions: 108,47 dBµV

Channel 78											
Frequency [MHz]	Restricted Band	Reading Level PK [dBµV]	Corr. Duty Cycle [dB]	Level AV [dBµV] *)	Band-width [kHz]	Correct. Factor [dB]	Corrected Level PK [dBµV/m]	Corrected Level AV [dBµV/m]	Limit PK [dBµV/m]	Limit AV [dBµV/m]	Delta [dB]
0,009-0,15					0,2		< 30				
0,15-30					9		< 30				
743,92					100		47,06		88,47		-41,41

Peak-Limit according to FCC Subpart 15.247(c)

In any 100 kHz bandwidth outside the frequency band 2400 – 2483.50 MHz, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required.
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limit specified in §15.209(a) (see §15.205(c)).

Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209

MHz	MHz	GHz
25.5 – 25.67	960 – 1240	4.5 – 5.15
37.5 – 38.25	1300 – 1427	5.35 – 5.46
73 – 74.6	1435 – 1626.5	7.25 – 7.75
74.8 – 75.2	1645.5 – 1646.5	8.025 – 8.5
108 – 121.94	1660 – 1710	9.0 – 9.2
123 – 138	1718.8 – 1722.2	9.3 – 9.5
149.9 – 150.05	2200 – 2300	10.6 – 12.7
156.52475 – 156.52525	2310 – 2390	13.25 – 13.4
156.7 – 156.9	2483.5 – 2500	14.47 – 14.5
162.0125 – 167.17	2655 – 2900	15.35 – 16.2
167.72 – 173.2	3260 – 3267	17.7 – 21.4
240 – 285	3332 – 3339	22.01 – 23.12
322 – 335.4	3345.8 – 3358	23.6 – 24.0
399.9 – 410	3600 – 4400	31.2 – 31.8
608 – 614		36.43 – 36.5

The requirements are **FULFILLED.**

Remarks: Only spurious emission which fall not in restricted bands has been measured contucted.

Spurious emissions which fall in restricted band have been measured radiated. Please refer to „Radiated emissions 9 kHz – 40 GHz“ on page 30 – 37.

The measurement was performed up to the 10th harmonic (25000MHz).

Bluetooth Specifications: Packet type: DH1

Packet size: max

5.5 Hopping Sequence

Requirement according to FCC Subpart 15.247(a)

The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies.

Remarks: The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF-channels. For details refer to Bluetooth standard.

5.6 Equal Hopping Frequency Use

Requirement according to FCC Subpart 15.247(a)

Each of the transmitter's hopping channels is used equally on average.

Remarks: The EUT complies with the Bluetooth RF specifications. For details refer to the Bluetooth Standard.

5.7 Receiver Input Bandwidth

Requirement according to FCC Subpart 15.247(a)

The associated receiver(s) complies with the requirement that its input bandwidth matches the bandwidth of the transmitted signal.

Remarks: The receiver bandwidth is equal to the receiver bandwidth in the 79 hopping channel mode, which is 1 MHz.

The receiver bandwidth was verified during Bluetooth RF conformance testing.

5.8 Receiver Hopping Capability

Requirement according to FCC Subpart 15.247(a)

The associated receiver has the ability to shift frequencies in synchronisation with the transmitted signals.

Remarks: The EUT complies with the Bluetooth RF specifications. For details refer to the Bluetooth standard.

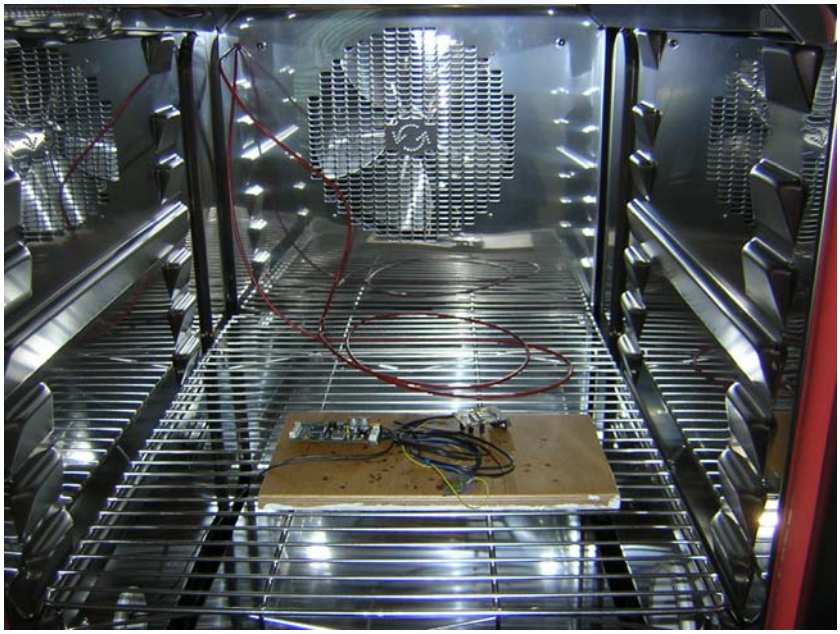
5.9 20dB Bandwidth

For test instruments and accessories used see section 6 Part **MB**.

5.9.1 Description of the test location

Test location: AREA4

5.9.2 Photo documentation of the test set-up



5.9.3 Description of Measurement

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio of -26 dB. The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or the first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.
The resolution bandwidth of measuring instrument was set to a value as shown in the folloing table below according to ANSI C63.4-2003.

Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1kHz
30 to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

5.9.4 Test result

Channel Frequency [MHz]	20 dB Bandwidth [kHz]
2402	834
2441	834
2480	834

Requirement according to FCC Subpart 15.247(a)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

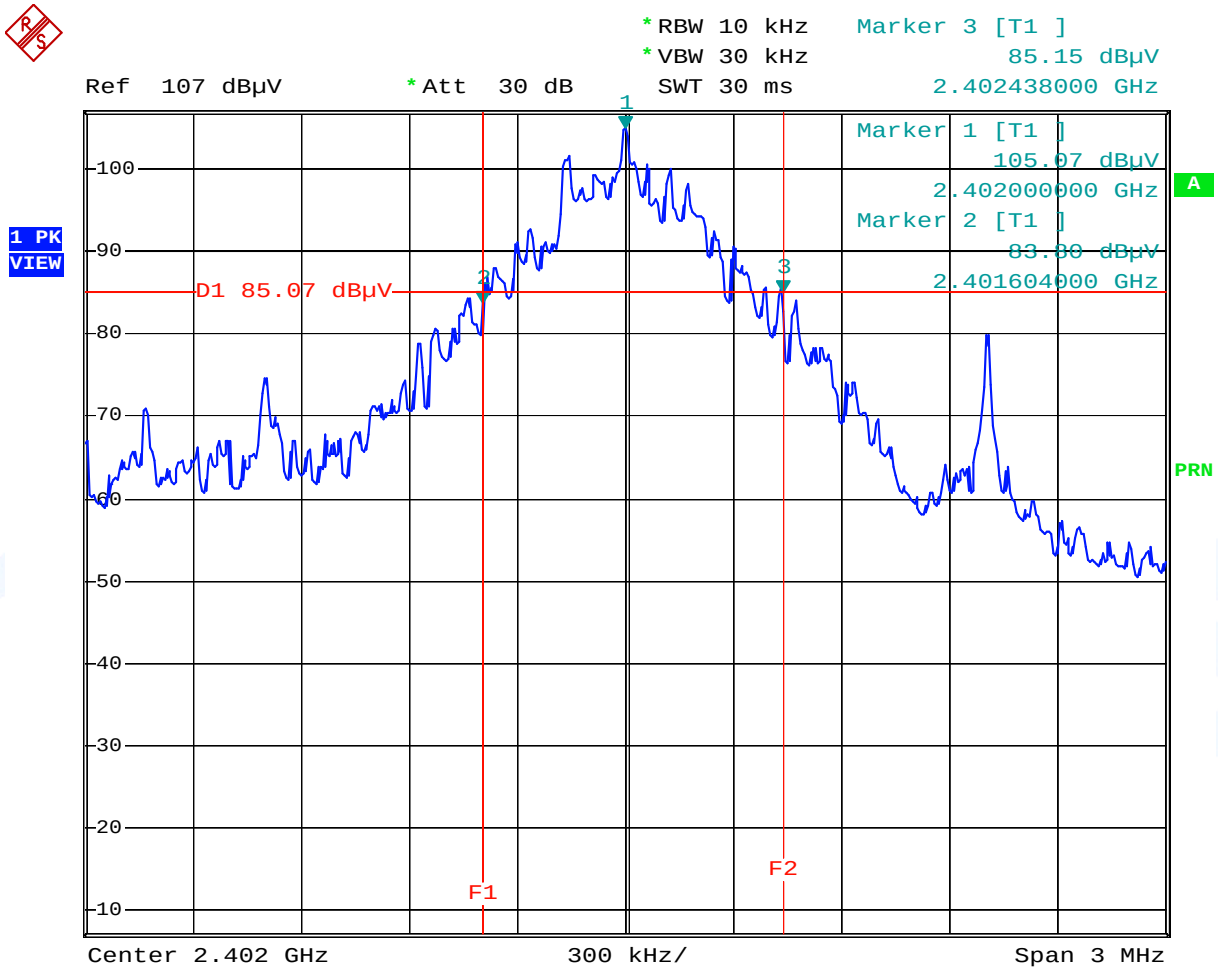
Remarks: For detailed test result please refer to following test protocol.

Bluetooth Specifications: Packet type: DH1

Packet size: max

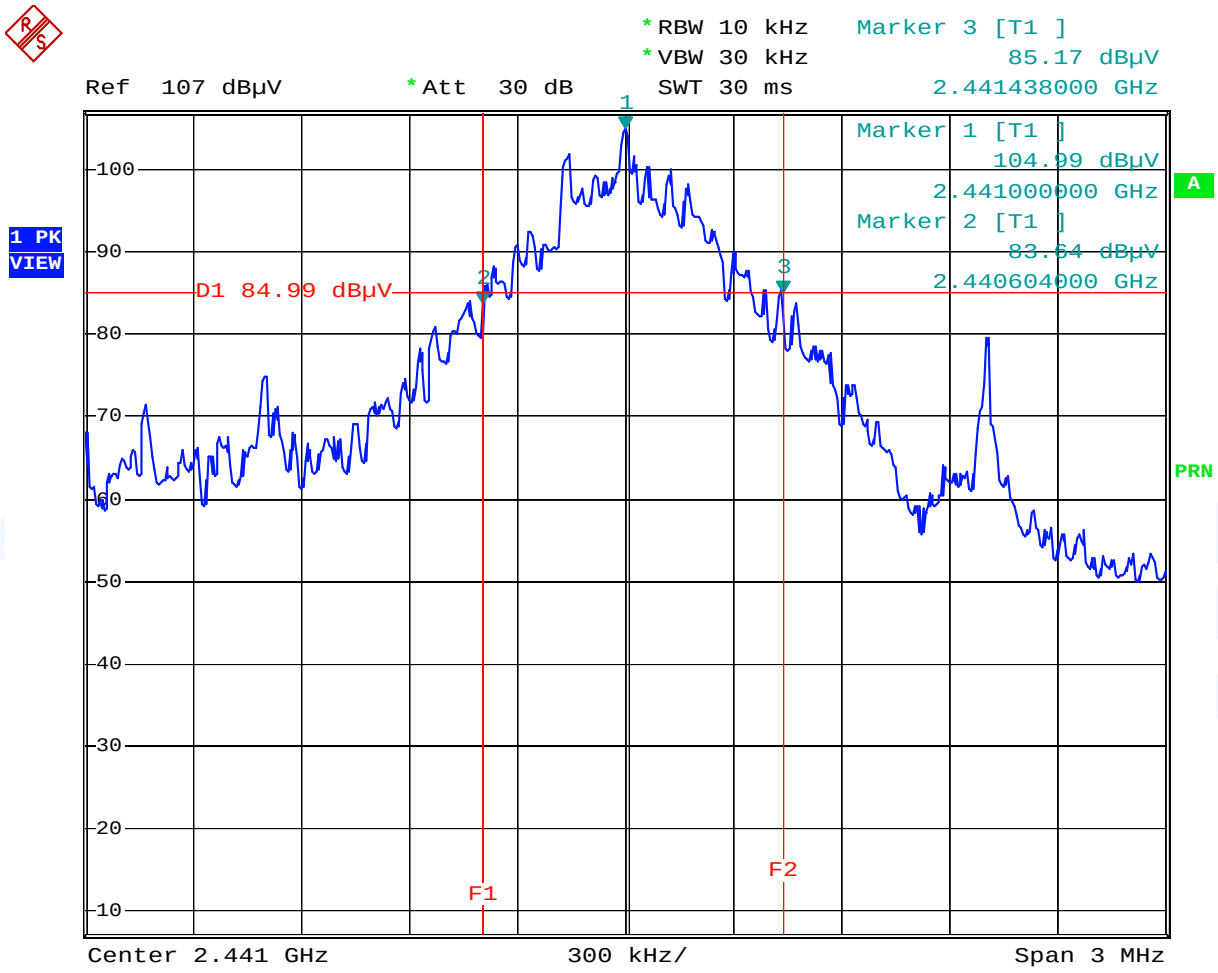
5.9.5 Test protocol

Channel 0
2402 MHz



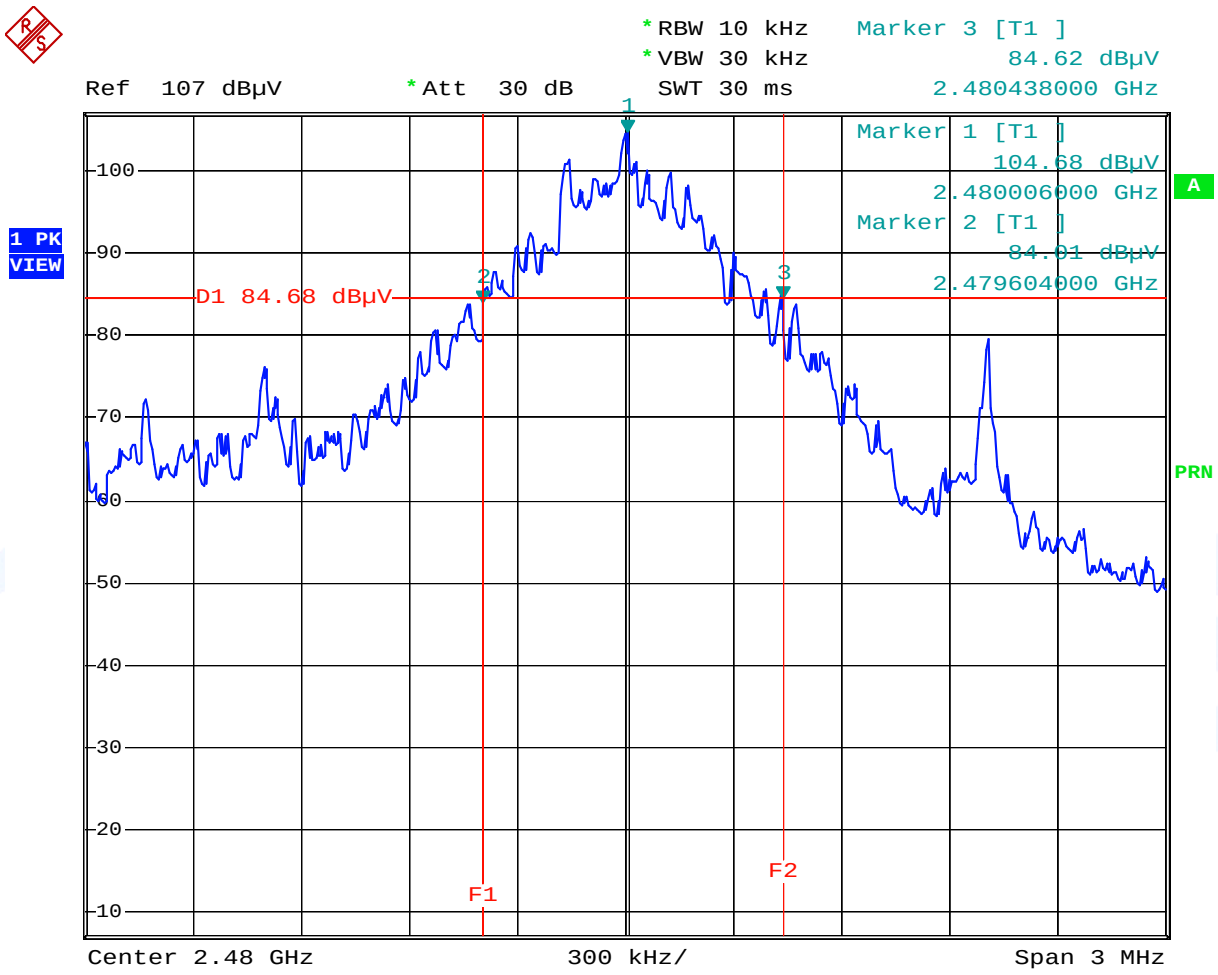
Date: 8.DEC.2005 09:32:52

Channel 39
2441 MHz



Date: 8.DEC.2005 09:38:19

Channel 78
2480 MHz



Date: 8.DEC.2005 09:41:36

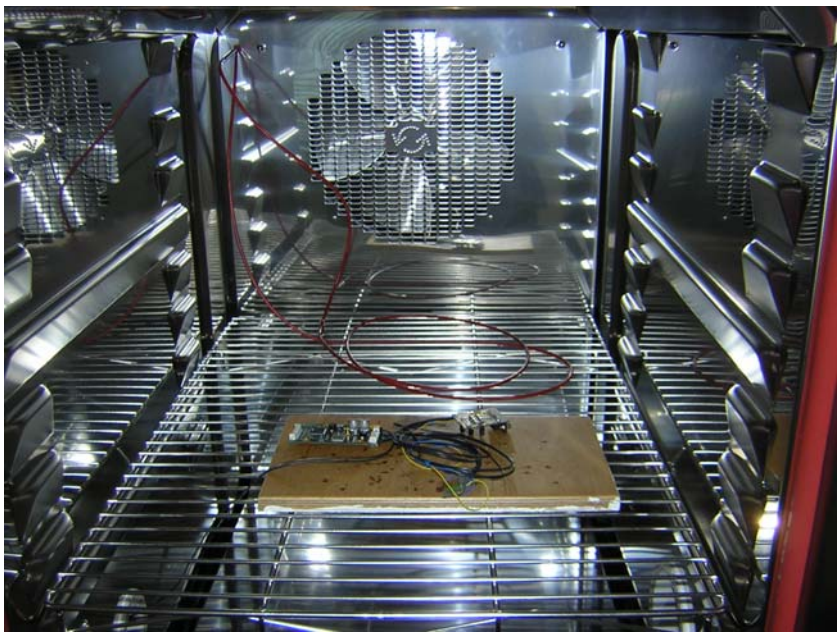
5.10 Band edge test

For test instruments and accessories used see section 6 Part **MB**.

5.10.1 Description of the test location

Test location: AREA4

5.10.2 Photo documentation of the test set-up



5.10.3 Description of Measurement

The EuT was connected to the spectrum analyzer with a suitable attenuator. The span of the spectrum analyzer was set wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation. The highest amplitude appearing on sprectal display was measured and it was set as the reference level for the emission mask.
It was allowed the trace to stabilize and after then it was set the emission mask on the reference level to show the compliance with the bandedge requirements.
Further settings on the spectrum analyzer:

RBW:	≥ 1% of the span
VBW:	≥ RBW
Sweep:	Auto
Detecter function:	Peak

5.10.4 Test result

Frequency [MHz]	Peak Output read value [dBµV]	Spurious emission read value [dBµV]	Result of Band edge [dBc]	Band edge LIMIT [dBc]
< 2400	108,51	66,74	41,77	≥ 20
> 2483,5	107,55	59,84	47,71	≥ 20

Peak-Limit according to FCC Subpart 15.247(c)

In any 100 kHz bandwidth outside the frequency band 2400 – 2483.50 MHz, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required.
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limit specified in §15.209(a) (see §15.205(c)).

The requirements are **FULFILLED.**

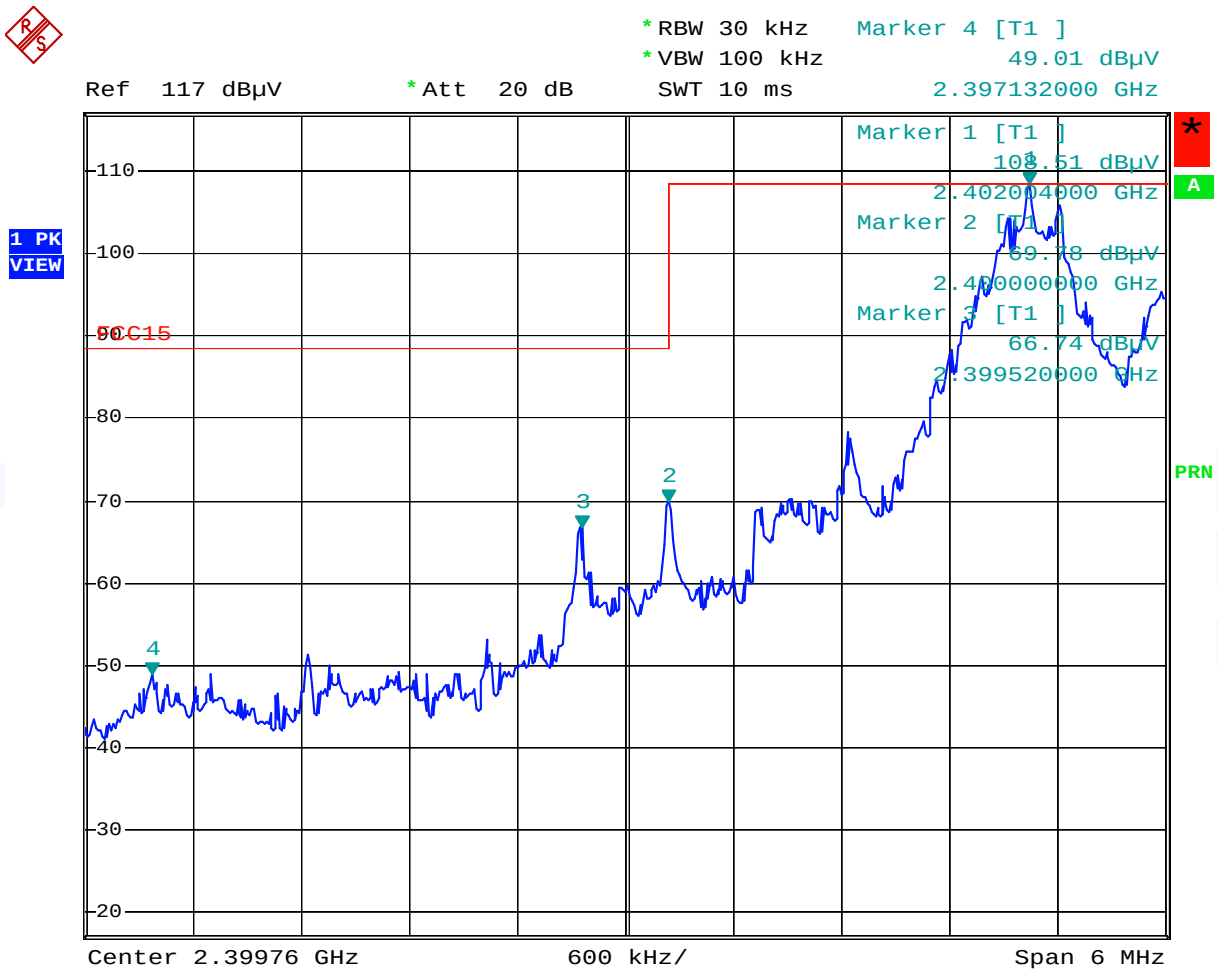
Remarks: For detailed test result please refer to following test protocol.

Bluetooth Specifications: Packet type: DH1

Packet size: max

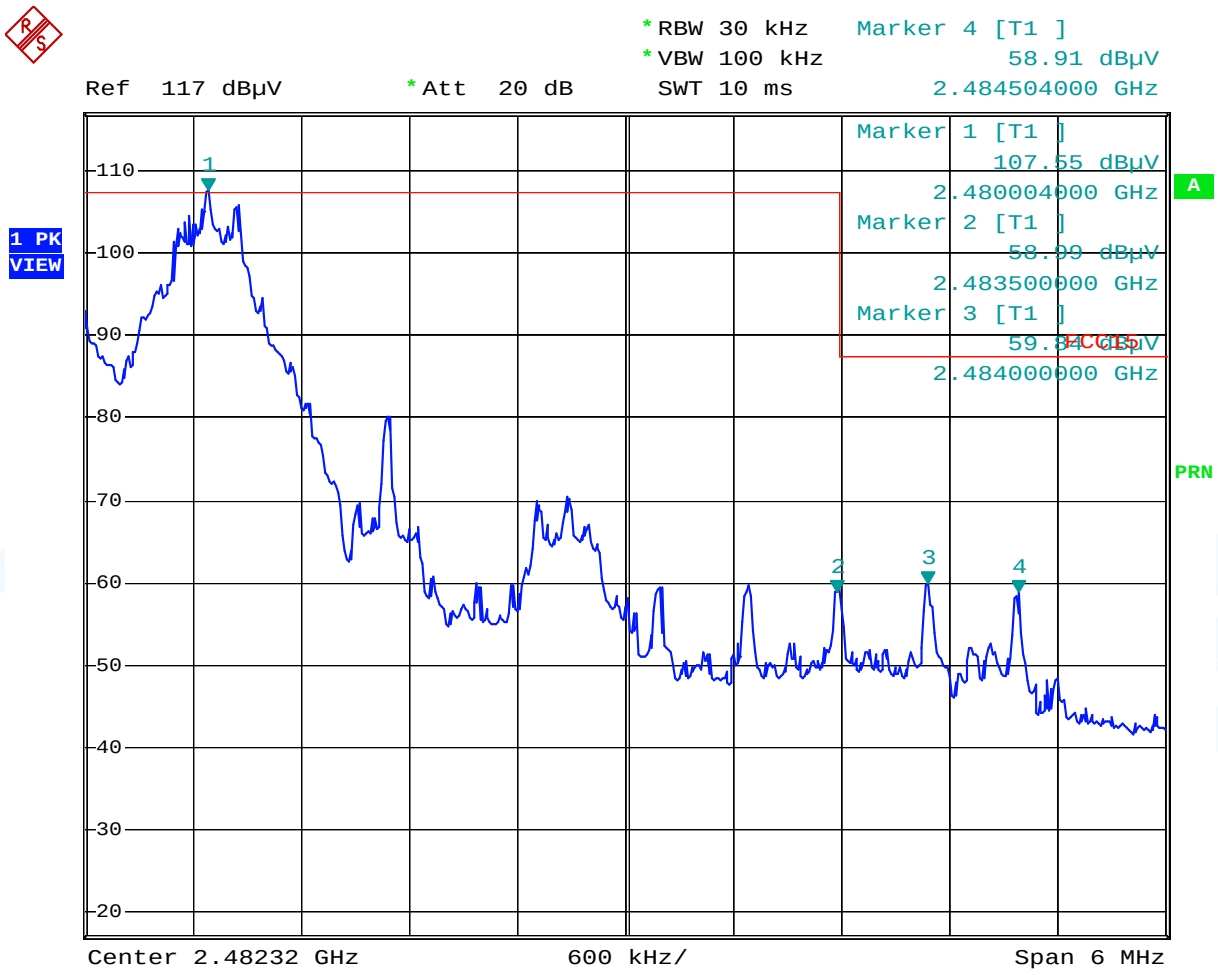
5.10.5 Test protocol

Lower Channel
2402 MHz



Date: 8.DEC.2005 11:49:34

Higher Channel
2480 MHz



Date: 8.DEC.2005 11:56:09

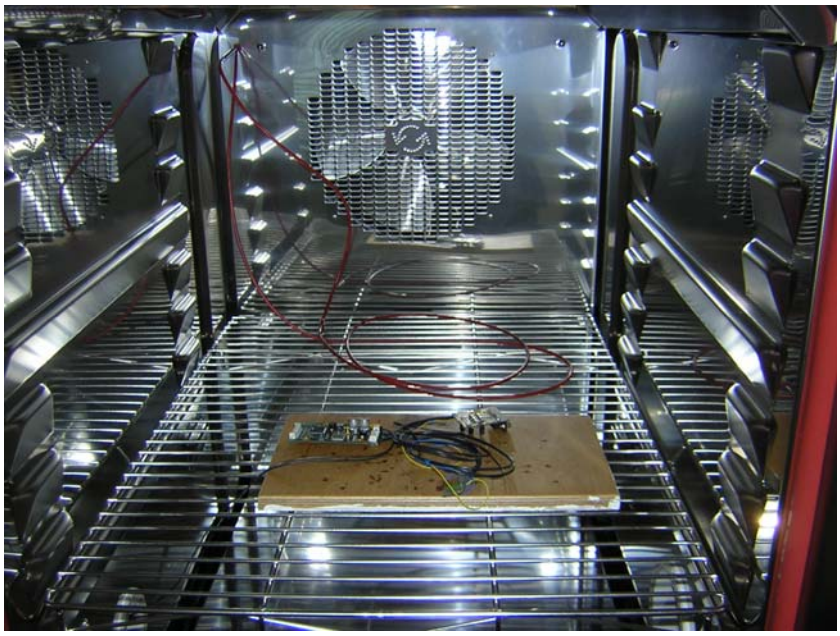
Time of occupancy (Dwell Time)

For test instruments and accessories used see section 6 Part **DC**.

5.12.1 Description of the test location

Test location: AREA4

5.12.2 Photo documentation of the test set-up



5.12.3 Test result

Channel frequency [MHz]	Pulse Time [µs]	Bursts (in 1 second)	Time of occupancy (Dwell time) [ms]	Avarage time of Occupancy LIMIT [ms]
2441	450	11	156,42	400

Limit according to FCC Subpart 15.247 (1)(iii)

Frequency hopping systems shall be used at least 15 non-overlapping channels. The average time of occupancy on any channel shall no be greater than 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems which use fewer than 75 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum or 15 non-overlapping channels are used.

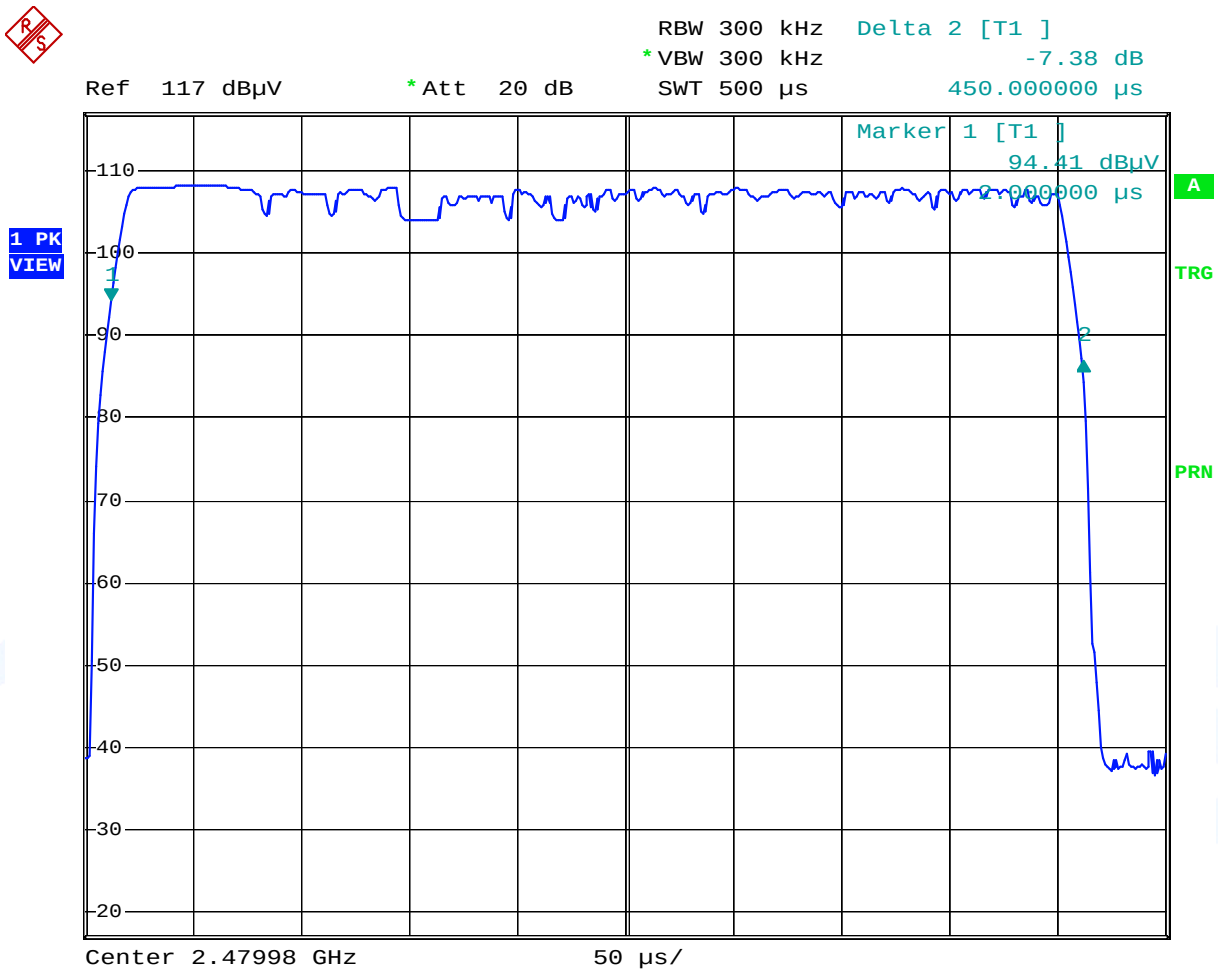
The requirements are **FULFILLED.**

Remarks: For detailed test result please refer to following test protocol.

Bluetooth Specifications: Packet type: DH1

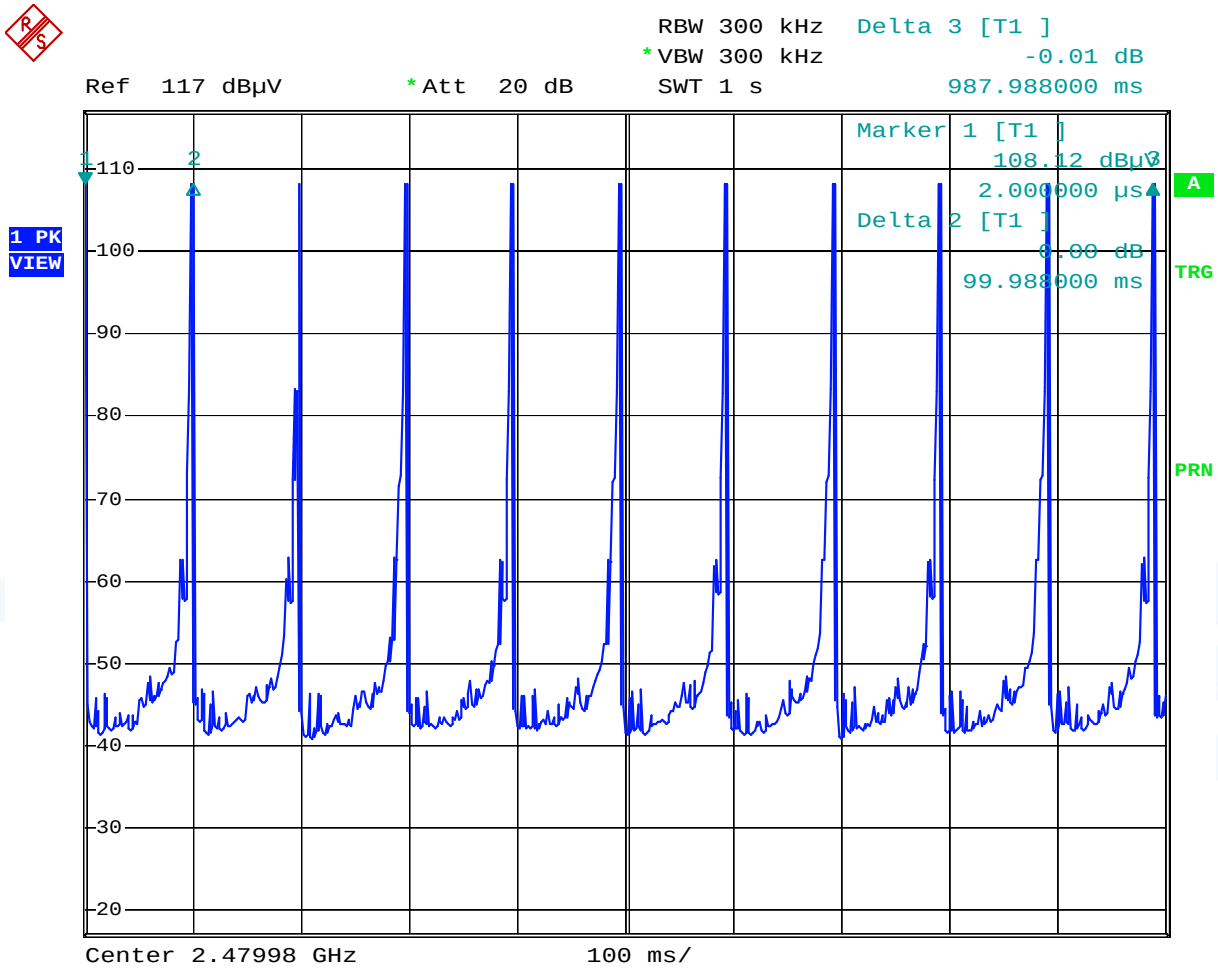
Packet size: max

Time of occupancy (Dwell time)
FCC Part 15 Subpart 15.247 (1)(iii)



Date: 8.DEC.2005 11:29:48

Time of occupancy (Dwell time)
FCC Part 15 Subpart 15.247 (1)(iii)



Date: 8.DEC.2005 11:11:11

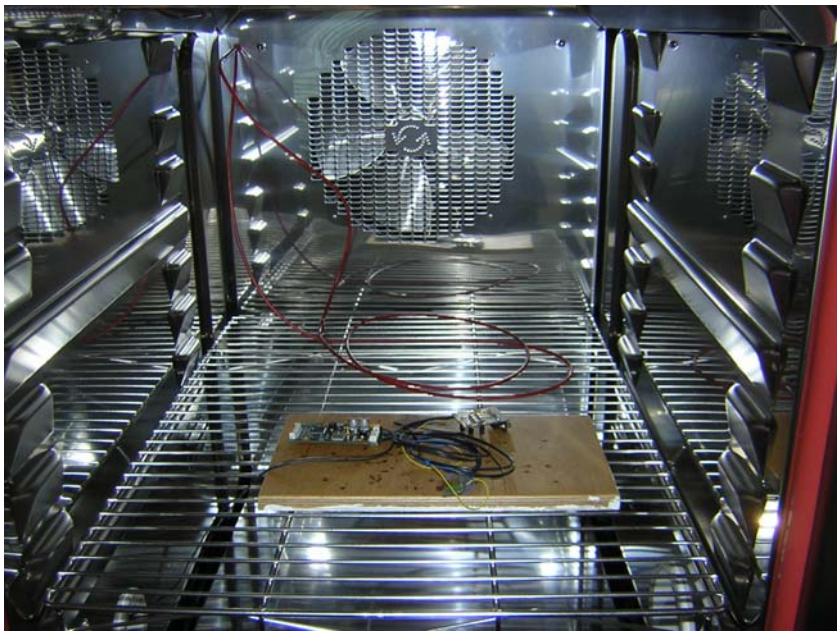
5.13 Channel separation test

For test instruments and accessories used see section 6 Part **MB**.

5.13.1 Description of the test location

Test location: AREA4

5.13.2 Photo documentation of the test set-up



5.13.3 Test result

Channel 0 [MHz]	Channel 1 [MHz]	Separation Value [kHz]	Separation LIMIT [kHz]
2402	2403	1000	≥ 834

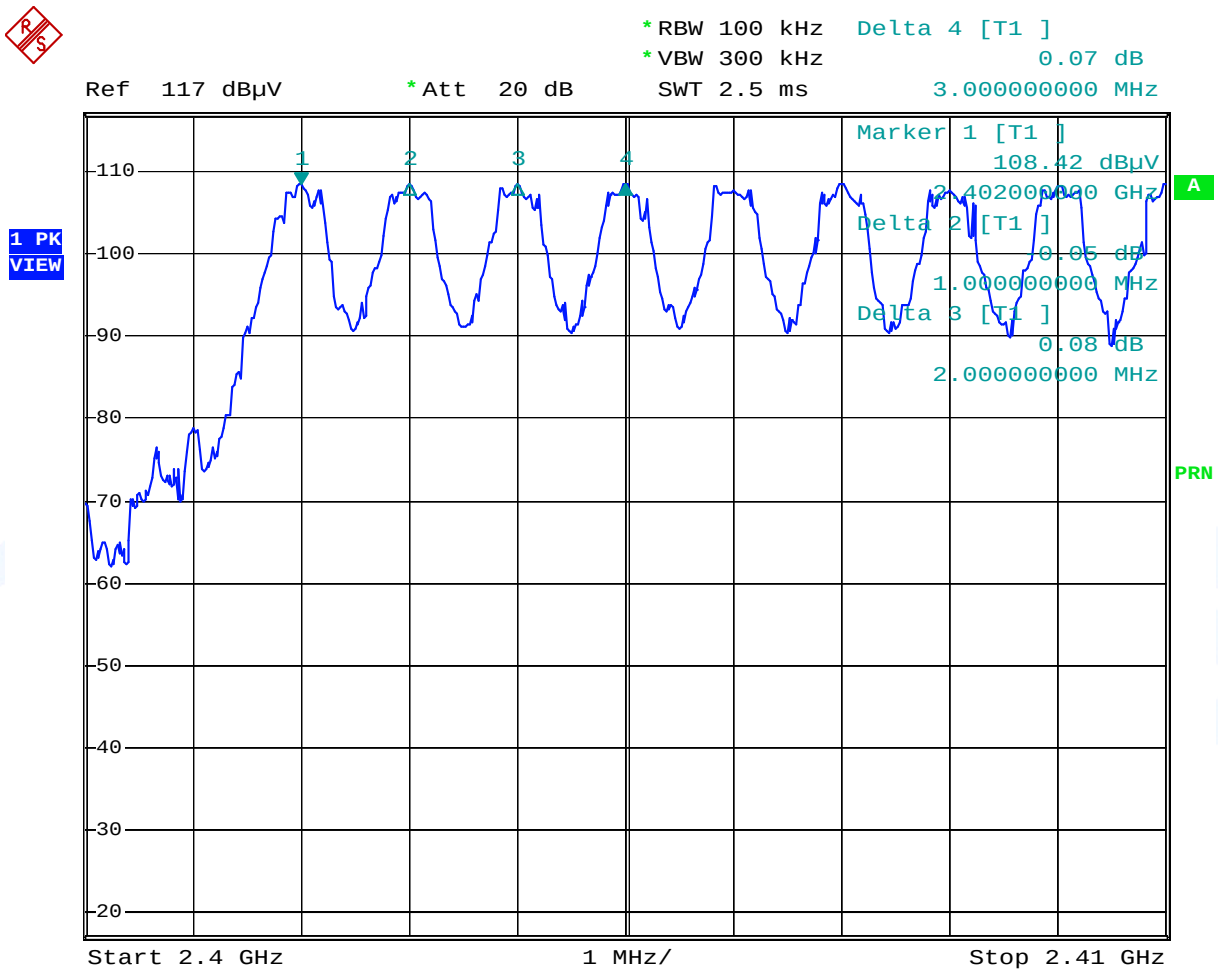
Limit according to FCC Subpart 15.247 (1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

The requirements are **FULFILLED.**

Remarks: For detailed test result please refer to following test protocol.

Channel separation test
FCC Subpart 15.247 (1)



Date: 8.DEC.2005 09:51:40

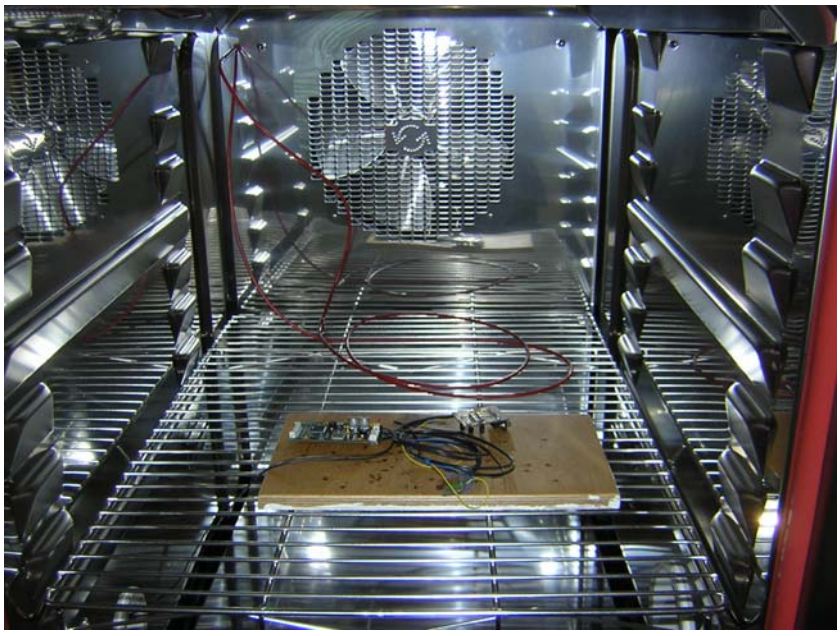
5.14 Quantity of Hopping Channel test

For test instruments and accessories used see section 6 Part **MB**.

5.14.1 Description of the test location

Test location: AREA4

5.14.2 Photo documentation of the test set-up



5.14.3 Test result

Hopping Channel Frequency range	Quantitiy of hopping Channel value	Quantitiy of hopping Channel MINIMUM LIMIT
2402-2480	79	15

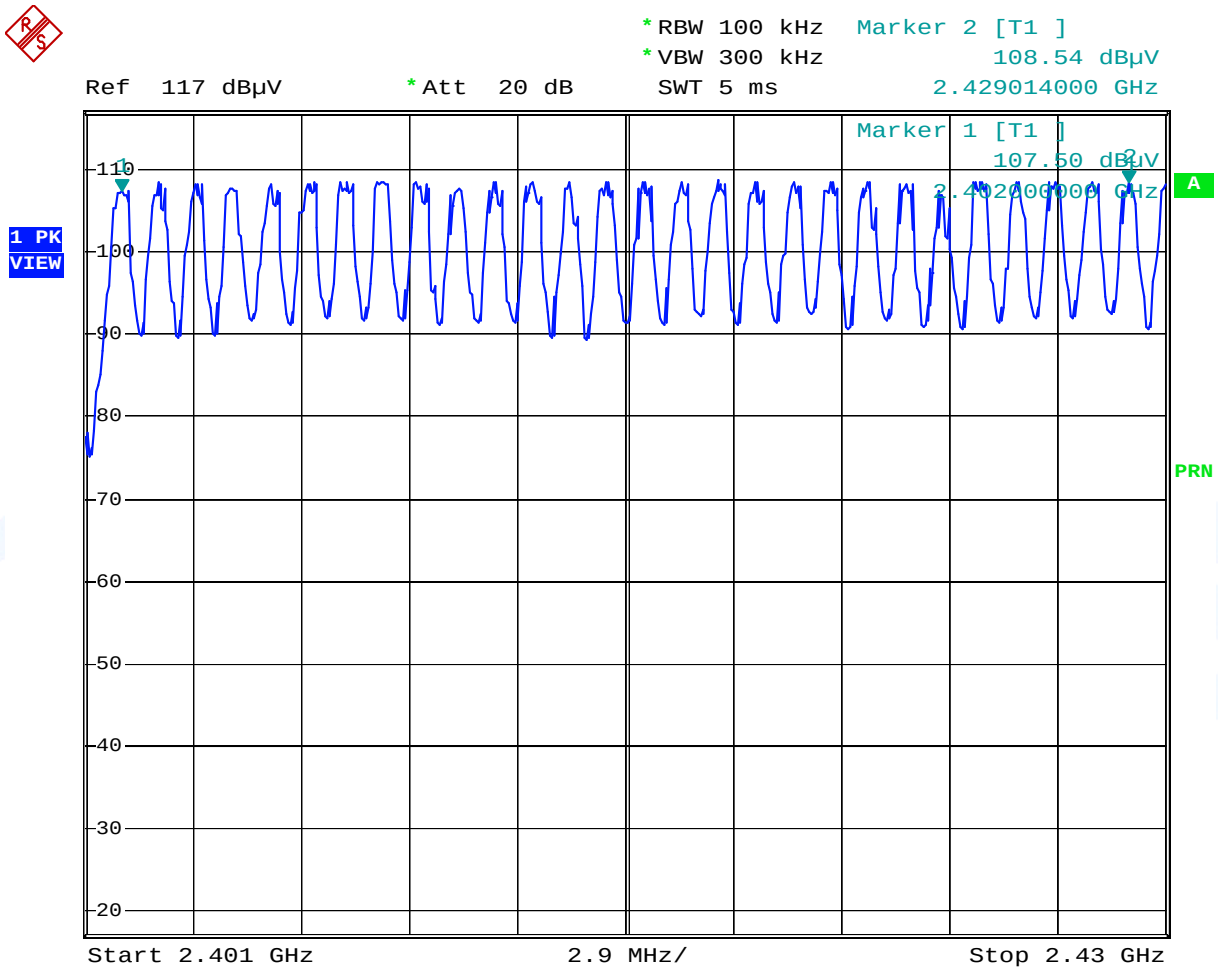
Limit according to FCC Subpart 15.247 (1)(iii)

Frequency range [MHz]	LIMIT (Quantity of Hopping Channel)			
	20dB Bandwidth < 250kHz	20dB Bandwidth > 250kHz	20dB Bandwidth < 1 MHz	20dB Bandwidth > 1MHz
902 - 928	50	25	n.A	n.A
2400 – 2483,5	**15**	**15**	**15**	**15**
5725 - 5850	n.A	n.A	75	n.A

The requirements are **FULFILLED.**

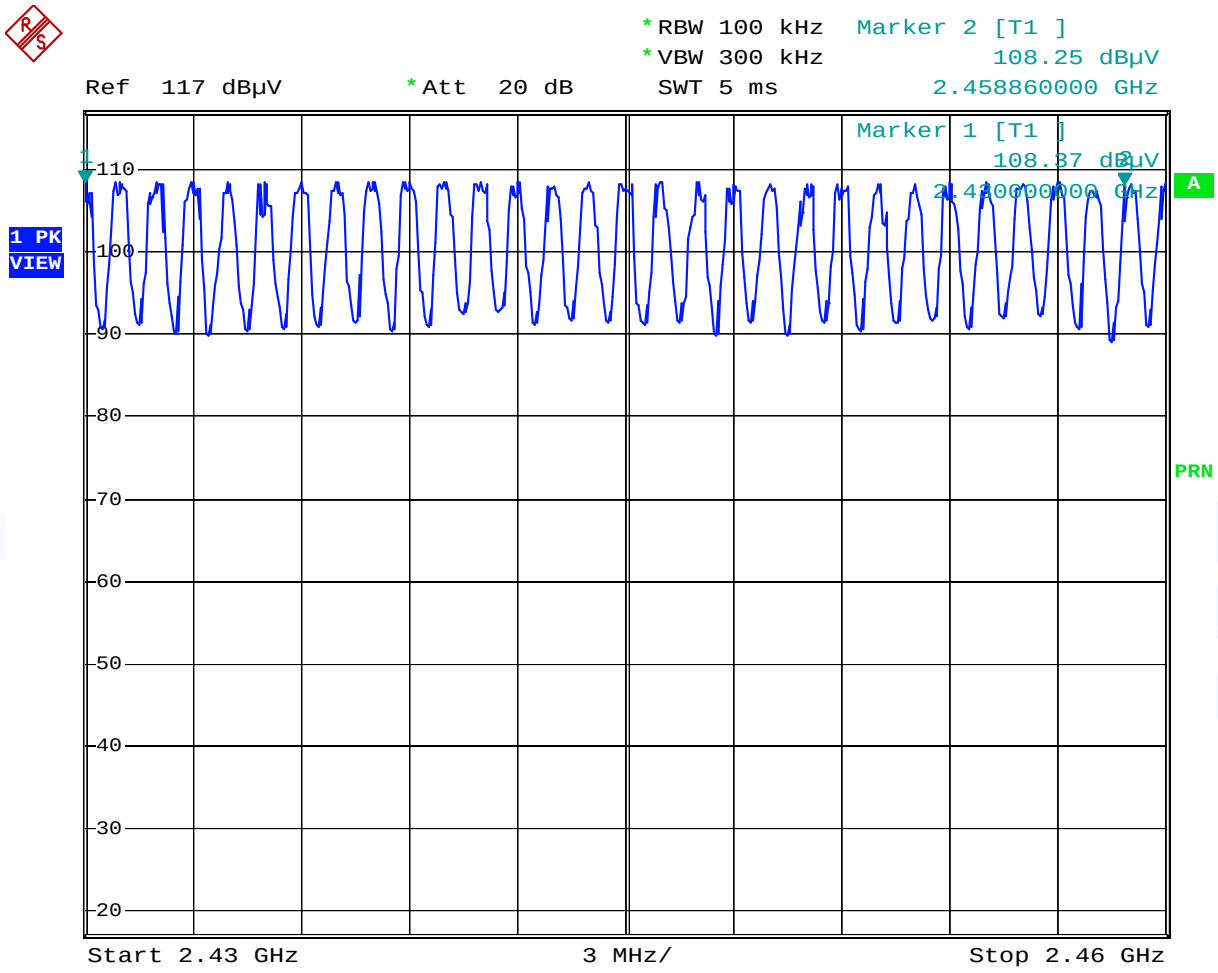
Remarks: For detailed test result please refer to following test protocol.

Quantity of hopping channel
FCC Subpart 15.247 (1)(iii)
Channel 0 - 28



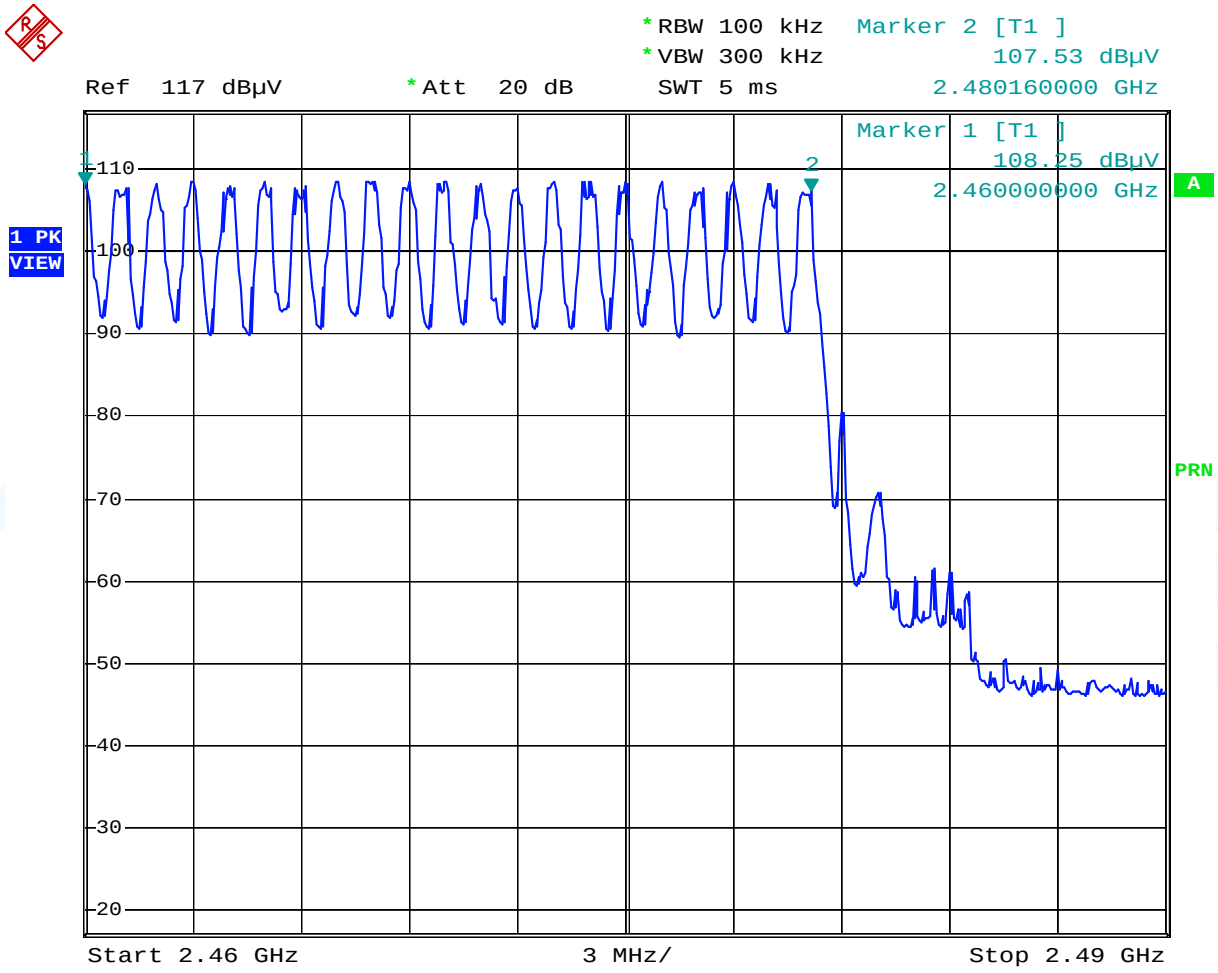
Date: 8.DEC.2005 10:28:16

Quantity of hopping channel
FCC Subpart 15.247 (1)(iii)
Channel 29 - 58



Date: 8.DEC.2005 10:37:31

Quantity of hopping channel
FCC Subpart 15.247 (1)(iii)
Channel 59 - 78



Date: 8.DEC.2005 10:40:00

5.15 Antenna application

5.15.1 Antenna requirements

The EuT's antenna is met the requirement of FCC part 15C section 15.203 and 15.204.

FCC part 15C section 15.247 requirement:
Systems operating in the 2400-2483,5 MHz band that are used exclusively for fixed, point to point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dbi.

5.15.2 Result

The EuT's antenna used a patch antenna and integrated on an own PCB. The antenna's gain is 4,1 dBi and therefore the requirement are met.

Receiver radiated emissions 9 kHz - 40 GHz

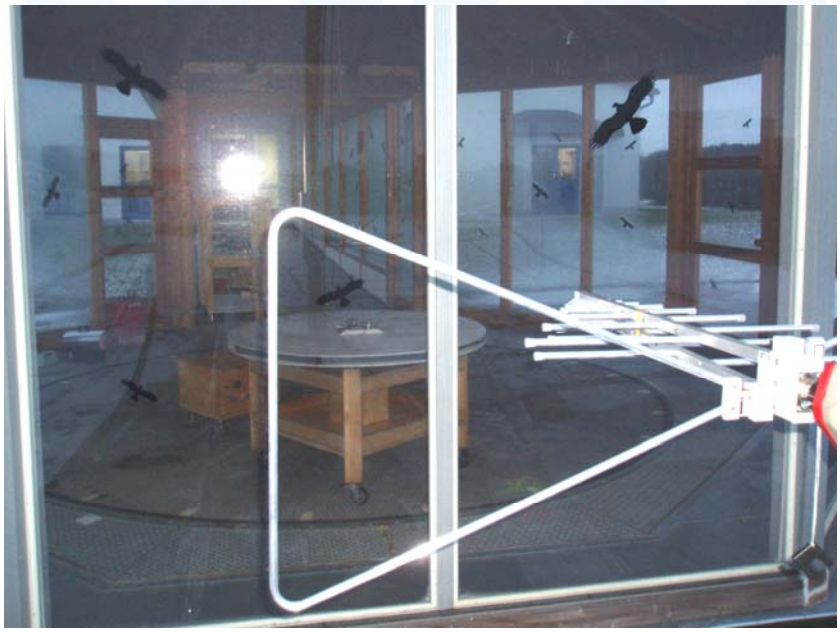
For test instruments and accessories used see section 6 Part **SER1, SER2** and **SER3**.

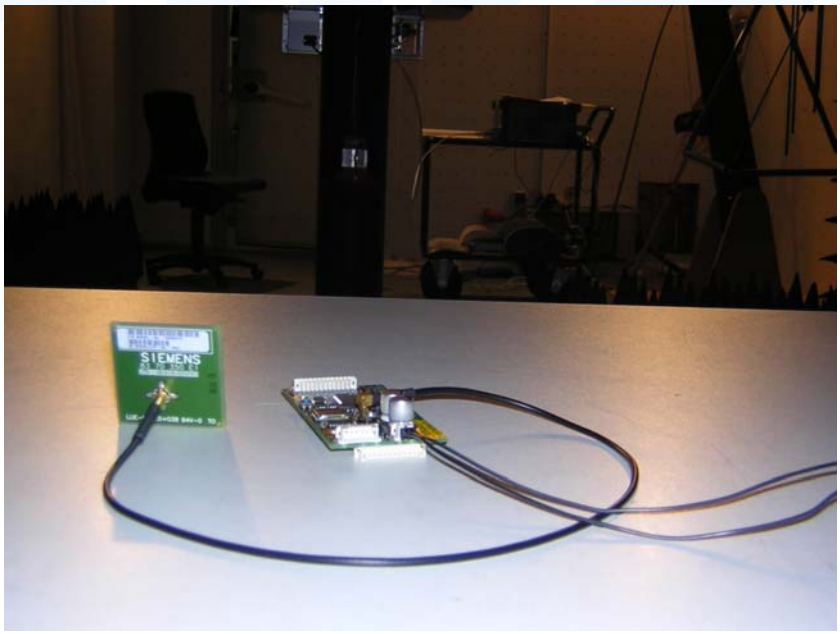
5.17.1 Description of the test location

Test location: OATS1
Anechoic Chamber A2

Test distance: 3 metres

5.17.2 Photo documentation of the test set-up




SIEMENS

5.17.3 Description of Measurement

The spurious emissions from the EuT will be measured on an open area test site in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions. In the case where larger measuring distances are required the results will extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with an EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used according to Section 15.209 (d) [2].

The final level, expressed in dBµV/m, is arrived at by taking the reading from the EMI receiver (Level dBµV) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has to be compared with the relevant FCC limit.
The resolution bandwidth during the measurement is as follows:
9 kHz – 150 kHz: ResBW: 200 Hz
150 kHz – 30 MHz: ResBW: 9 kHz

Radiated spurious emissions from the EuT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003. The Interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarization`s and the EuT are rotated 360 degrees.

The final level, expressed in dBµV/m, is arrived by taking the reading from the EMI receiver (Level dBµV) and adding the correction factors and cable loss factor (Factor dB) to it. This is done automatically in the EMI receiver, where the correction factors are stored. This result then has the FCC or CISPR limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets at page.

The radiated emissions from the EuT are measured in the frequency range of 1 GHz to maximum frequency as specified in section 15.33, using a tuned receiver (Spectrum Analyser) and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003.
The Interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna was positioned 3m horizontally from the EuT.

Measurement are made in both the horizontal and vertical planes of polarization in a fully anechoic room using a spectrum analyzer with the detector function set to peak and resolution as well as video bandwidth set to 100 kHz and for any spurious emission or modulation product that falls in Restricted Band, as defined in Section 15.205, set the resolution and video bandwidth to 1 MHz.
All tests are performed at a test-distance of 3 meters. Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration procedure the highest emission relative the limit and therefore shall be used for final testing. During the tests the EUT is rotated all around to find the maximum levels of emissions. The cables and equipment were placed and moved within the range of position likely to find their maximum emissions. When the EuT is larger than the beamwidth of the measuring antenna, the measurement antenna will be moved over the surfaces for the four sides or the test distance will be reduced to demonstrate that emissions were at maximum at the limit distance.

Analyzer Settings (EMI receiver) for spurious emissions which fall not in Restricted Band:

- Detector: Max hold
- RBW: 100 kHz for f ≥ 1GHz, 120 kHz for f ≤ 1GHz
- VBW: ≥ RBW
- Sweep Time: Coupled
- Detecter function: Peak

Analyzer Settings (EMI receiver) for spurious emissions which fall in Restricted Band:

- Detector: Max hold
- RBW: 1 MHz for f ≥ 1GHz, 120 kHz for f ≤ 1GHz
- VBW: ≥ RBW
- Sweep Time: Coupled
- Detecter function: Peak for f ≥ 1GHz, Quasi Peak for f ≤ 1GHz

5.17.4 Test result

Testresult in detail: (<1GHz)

Channel 0												
Frequency [MHz]	Reading Level QP [dBµV]	Reading Level AV [dBµV]	Reading Level PK [dBµV]	Bandwidth [kHz]	Correct. factor [dB]	Corrected Level QP [dBµV/m]	Corrected Level AV [dBµV/m]	[Corrected Level PK [dBµV/m]	Limit [dBµV/m]			Delta [dB]
									QP	AV	PK	
0,009-0,15				0,2		< 30						
0,15-30				9		< 30						
30-1000				120		< 30						

Channel 39												
Frequency [MHz]	Reading Level QP [dBµV]	Reading Level AV [dBµV]	Reading Level PK [dBµV]	Bandwidth [kHz]	Correct. factor [dB]	Corrected Level QP [dBµV/m]	Corrected Level AV [dBµV/m]	[Corrected Level PK [dBµV/m]	Limit [dBµV/m]			Delta [dB]
									QP	AV	PK	
0,009-0,15				0,2		< 30						
0,15-30				9		< 30						
30-1000				120		< 30						

Channel 78												
Frequency [MHz]	Reading Level QP [dBµV]	Reading Level AV [dBµV]	Reading Level PK [dBµV]	Bandwidth [kHz]	Correct. factor [dB]	Corrected Level QP [dBµV/m]	Corrected Level AV [dBµV/m]	[Corrected Level PK [dBµV/m]	Limit [dBµV/m]			Delta [dB]
									QP	AV	PK	
0,009-0,15				0,2		< 30						
0,15-30				9		< 30						
30-1000				120		< 30						

Test result >1GHz

Channel 0									
Frequency [MHz]	Reading Level PK [dBµV]	Reading Level AV [dBµV] *)	Band-width [kHz]	Correct. Factor [dB]	Corrected Level PK [dBµV/m]	Corrected Level AV [dBµV/m]	Limit PK [dBµV/m]	Limit AV [dBµV/m]	Delta [dB]
1000-13000			1000		< 50				

Channel 39									
Frequency [MHz]	Reading Level PK [dBµV]	Reading Level AV [dBµV] *)	Band-width [kHz]	Correct. Factor [dB]	Corrected Level PK [dBµV/m]	Corrected Level AV [dBµV/m]	Limit PK [dBµV/m]	Limit AV [dBµV/m]	Delta [dB]
1000-13000			1000		< 50				

Channel 78									
Frequency [MHz]	Reading Level PK [dBµV]	Reading Level AV [dBµV] *)	Band-width [kHz]	Correct. Factor [dB]	Corrected Level PK [dBµV/m]	Corrected Level AV [dBµV/m]	Limit PK [dBµV/m]	Limit AV [dBµV/m]	Delta [dB]
1000-13000			1000		< 50				

Limit according to FCC Subpart 15.109(a)

Frequency of emission [MHz]	Field strength Limits [µV/m]	Field strength Limits [dBµV/m]
0,009-0,490	2400/F(kHz)	
0,490-1,705	24000/F(kHz)	
1,705-30	30	
30-88	100	40
88-216	150	44
216-960	200	46
Above 960	500	54

The requirements are**.**

Remarks: During the test, the Eut was set into continuous receiving mode.

The measurement was performed up to the 5th harmonic (13000 MHz).

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used, in addition to the test accessories, are calibrated and verified regularly.

The calibration intervals and the calibration history will be given out on request.

Test ID	Model / Type	Kind of Equipment	Manufacturer	Equipment No.
A 4	ESHS 30	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-002
	NNLK 8129	LISN	Schwarzbeck Mess-Elektronik	02-02/20-05-001
	ESH 2 - Z 5	LISN	Rohde & Schwarz München	02-02/20-05-004
	ESH 3 - Z 2	Pulse Limiter	Rohde & Schwarz München	02-02/50-05-001
	HM-8142	Power Supply	A.H.-Systems Inc.	02-02/50-05-047
	N-4000-BNC	RF Cable	mikes-testingpartners gmbh	02-02/50-05-138
	N-1500-N	RF Cable	mikes-testingpartners gmbh	02-02/50-05-140
CPC 3	FSP 30	Spectrum Analyzer	Rohde & Schwarz München	02-02/11-05-001
	THS730A	Handheld Scope	Tektronix GmbH	02-02/13-05-001
	HM-8142	Power Supply	A.H.-Systems Inc.	02-02/50-05-047
DC	FSP 30	Spectrum Analyzer	Rohde & Schwarz München	02-02/11-05-001
	THS730A	Handheld Scope	Tektronix GmbH	02-02/13-05-001
	HM-8142	Power Supply	A.H.-Systems Inc.	02-02/50-05-047
MB	FSP 30	Spectrum Analyzer	Rohde & Schwarz München	02-02/11-05-001
	THS730A	Handheld Scope	Tektronix GmbH	02-02/13-05-001
	HM-8142	Power Supply	A.H.-Systems Inc.	02-02/50-05-047
SEC 1-3	FSP 30	Spectrum Analyzer	Rohde & Schwarz München	02-02/11-05-001
	THS730A	Handheld Scope	Tektronix GmbH	02-02/13-05-001
	HM-8142	Power Supply	A.H.-Systems Inc.	02-02/50-05-047
	WHK3.0/18G-10EF	High Pass Filter	Wainwright Instruments GmbH	02-02/50-05-180
SER 1	FMZB 1516	Antenna 9kHz - 30 MHz	Schwarzbeck Mess-Elektronik	01-02/24-01-018
	ESHS 30	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-002
SER 2	ESVS 30	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-006
	VULB 9168	Trilog-Broadband Antenna	Schwarzbeck Mess-Elektronik	02-02/24-05-005
	S10162-B / +11N-50-10-5 / +	RF Cable 33m	Huber + Suhner	02-02/50-05-031
	KK-EF393-21N-16	RF Cable 20m	Huber + Suhner	02-02/50-05-033
	NW-2000-NB	RF Cable	Huber + Suhner	02-02/50-05-113
SER 3	AFS4-01000400-10-10P-4	RF Amplifier 1-4 GHz	PARZICH GMBH	02-02/17-05-003
	AMF-4F-04001200-15-10P	RF Amplifier 4-12 GHz	PARZICH GMBH	02-02/17-05-004
	AFS5-12001800-18-10P-6	RF Amplifier 12-18 GHz	PARZICH GMBH	02-02/17-05-005
	3117	Horn Antenna 1-18 GHz	EMCO Elektronik GmbH	02-02/24-05-009
	Sucoflex N-1600-SMA	RF Cable	novotronik Signalverarbeitung	02-02/50-05-073
	Sucoflex N-2000-SMA	RF Cable	novotronik Signalverarbeitung	02-02/50-05-075