

FCC ID:SRDRTR5W

EMI -- TEST REPORT

Test Report No. :	T30654-00-04HU	10. April 2006 Date of issue
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Type / Model Name : RTR-5W

Product Description : Data Collector

Applicant : T&D CORPORATION

Address : 5652-169 Sasaga Matsumoto City NAGANO
399-0033 Japan

Manufacturer : T&D CORPORATION

Address : 5652-169 Sasaga Matsumoto City NAGANO
399-0033 Japan

Licence holder : T&D CORPORATION

Address : 5652-169 Sasaga Matsumoto City NAGANO
399-0033 Japan

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
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The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

Contents

1	<u>TEST STANDARDS</u>	3
2	<u>SUMMARY</u>	4
3	<u>EQUIPMENT UNDER TEST</u>	5
3.1	PHOTO DOCUMENTATION OF THE EUT	5
3.2	POWER SUPPLY SYSTEM UTILISED	19
3.3	SHORT DESCRIPTION OF THE EQUIPMENT UNDER TEST (EUT)	19
4	<u>TEST ENVIRONMENT</u>	20
4.1	ADDRESS OF THE TEST LABORATORY	20
4.2	ENVIRONMENTAL CONDITIONS	20
4.3	STATEMENT OF THE MEASUREMENT UNCERTAINTY	20
4.4	MEASUREMENT PROTOCOL FOR FCC, VCCI AND AUSTEL	20
5	<u>TEST CONDITIONS AND RESULTS</u>	22
5.1	CONDUCTED EMISSIONS	22
5.2	RADIATED POWER OF THE FUNDAMENTAL WAVE	26
5.3	SPURIOUS EMISSIONS (MAGNETIC FIELD) 9 KHz – 30 MHz	29
5.4	RADIATED EMISSIONS (ELECTRIC FIELD) 30 MHz – 40 GHz	31
5.5	EMISSION BANDWIDTH	38
5.6	BAND EDGE TEST	43
5.7	ANTENNA APPLICATION	47
5.8	RECEIVER CONDUCTED DISTURBANCES 0.15 - 30 MHz	48
5.9	RECEIVER SPURIOUS EMISSIONS (MAGNETIC FIELD) 9 KHz – 30 MHz	52
5.10	RECEIVER RADIATED EMISSIONS (ELECTRIC FIELD) 30 MHz - 40 GHz	54
6	<u>USED TEST EQUIPMENT AND ACCESSORIES</u>	57

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 15.249	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz
Part 15, Subpart C, Section 15.35(c)	Correction for Pulse Operation (Duty Cycle)
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 15.209(a)	Radiated emissions, general requirements
ANSI C63.4-2003, Section 13.1.7	Occupied bandwidth measurements

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

2 SUMMARY

GENERAL REMARKS:

The frequency range was scanned from 9 kHz to 9500 MHz.
All emissions not reported in this test report were more than 10 dB below the specified limit.

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 : 08. March 2006

Testing concluded on : 10. March 2006

Checked by:

Tested by:

Klaus Gegenfurtner
Dipl.-Ing.(FH)
Manager: Radio Group

Huber Markus

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EuT

RTR-5W

External Photo
Front view



FCC ID:SRDRTR5W

RTR-5W

External Photo
Rear view



FCC ID:SRDRTR5W

RTR-5W

External Photo
Side view left



FCC ID:SRDRTR5W

RTR-5W

External Photo
Side view right



FCC ID:SRDRTR5W

RTR-5W

External Photo
Top view



FCC ID:SRDRTR5W

RTR-5W

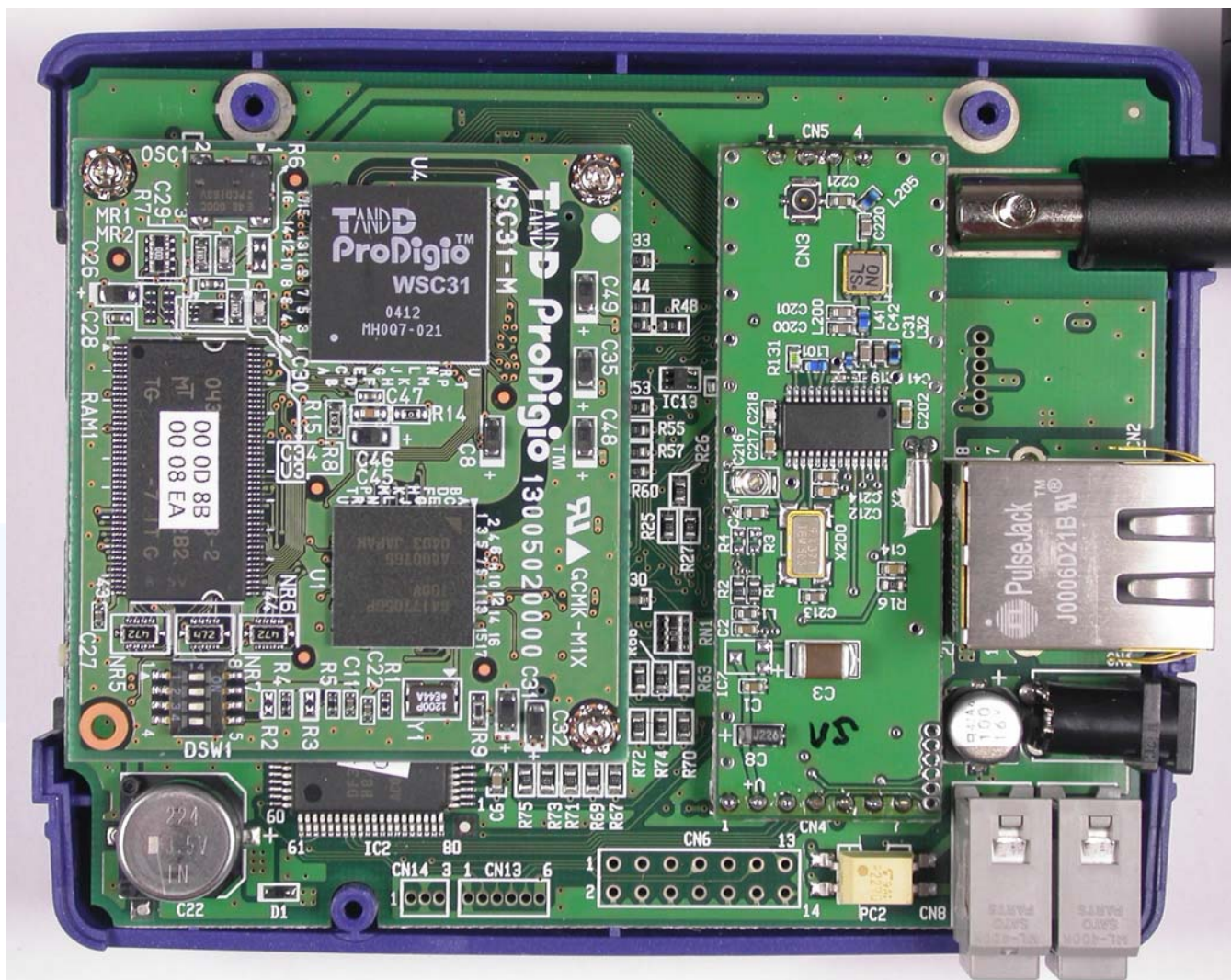
External Photo
Bottom view



FCC ID:SRDRTR5W

RTR-5W

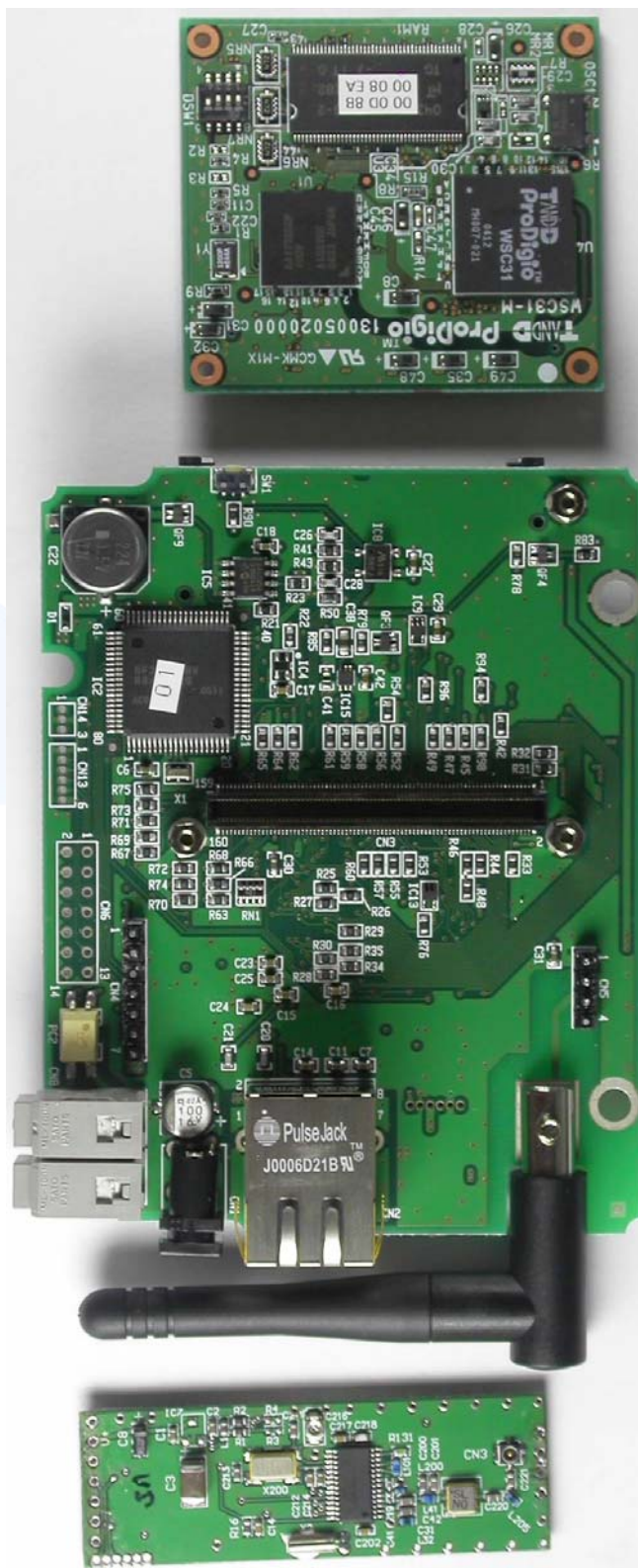
Internal Photo
Rear view of open cover



FCC ID:SRDRTR5W

RTR-5W

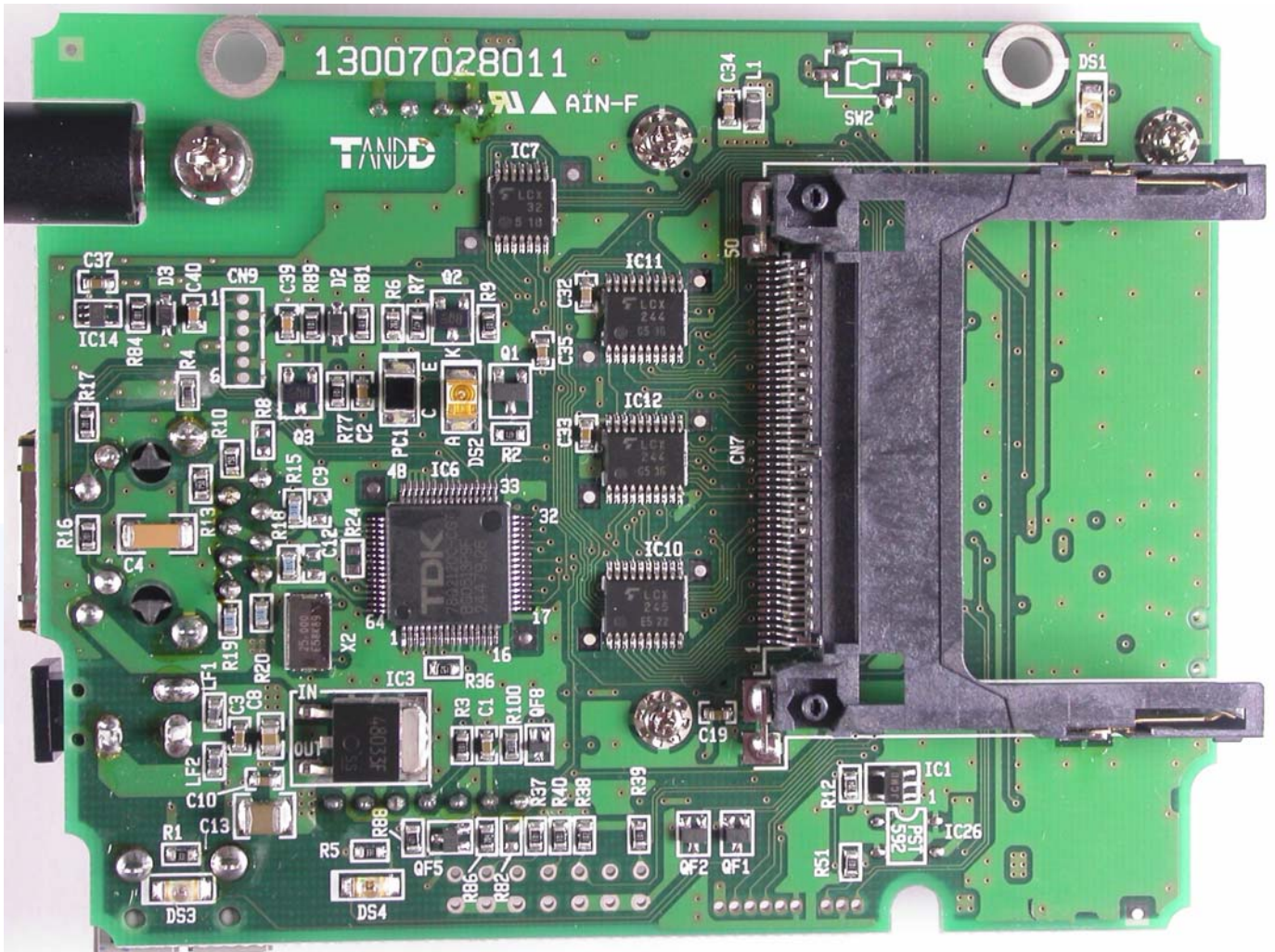
Internal Photo
Front view PCB



FCC ID:SRDRTR5W

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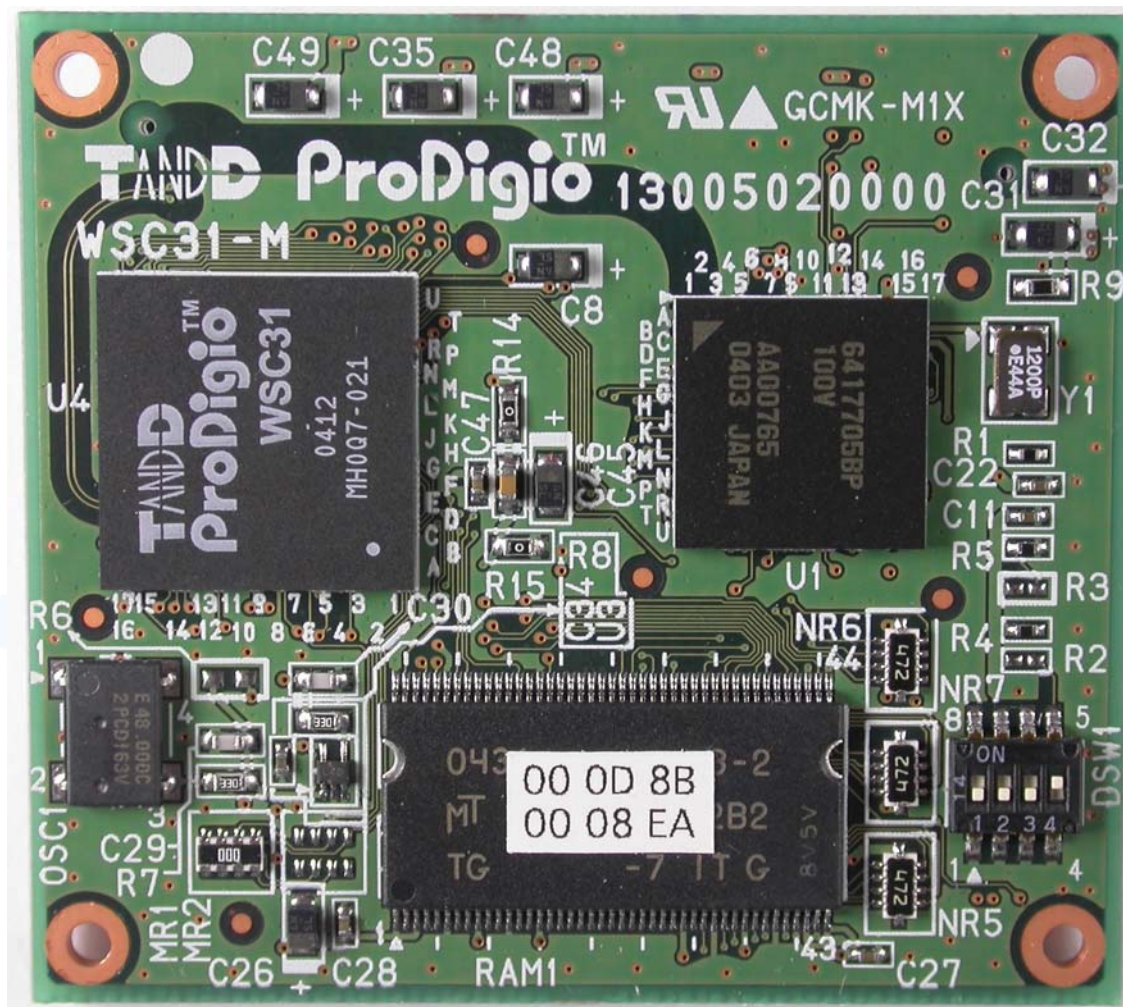
Internal Photo
Rear view PCB



FCC ID:SRDRTR5W

RTR-5W

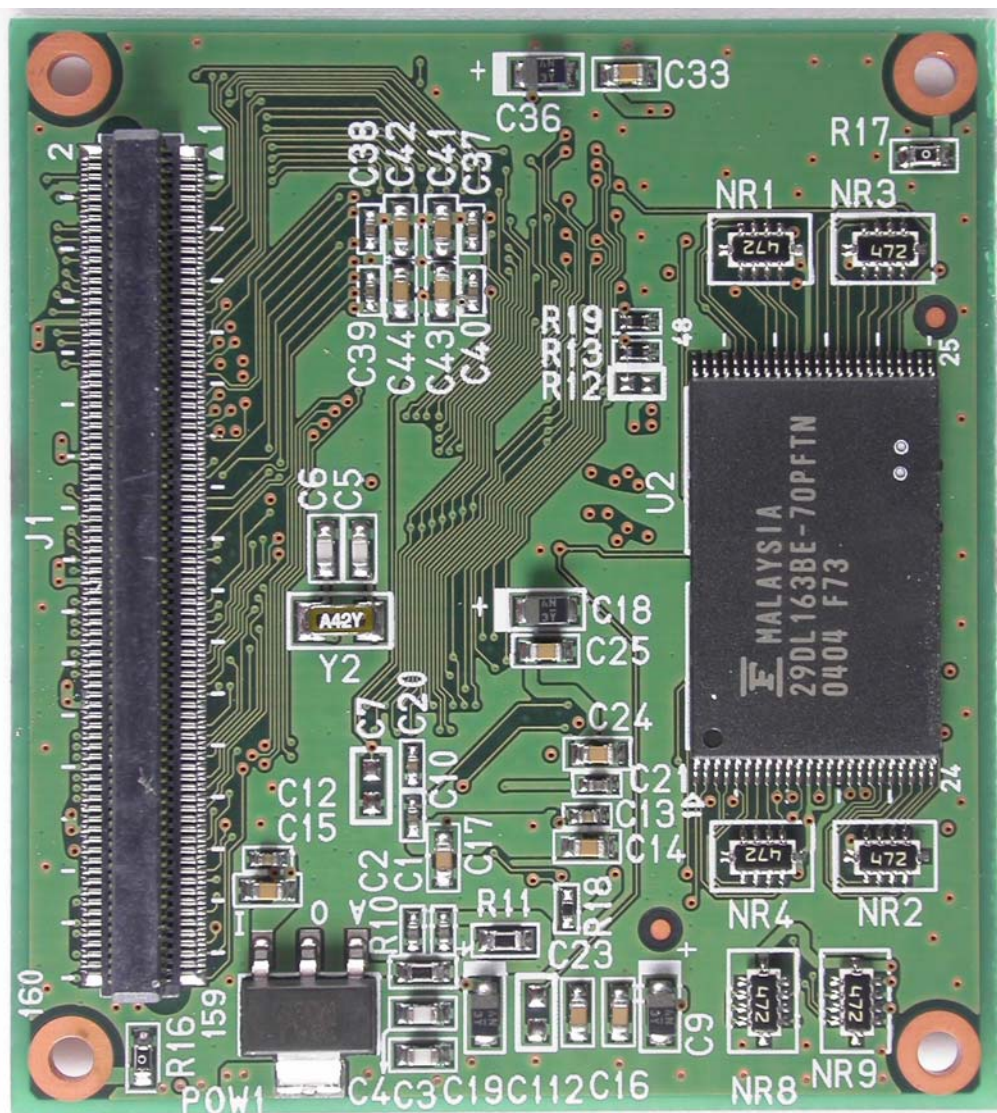
Internal Photo
Front view PCB



FCC ID:SRDRTR5W

RTR-5W

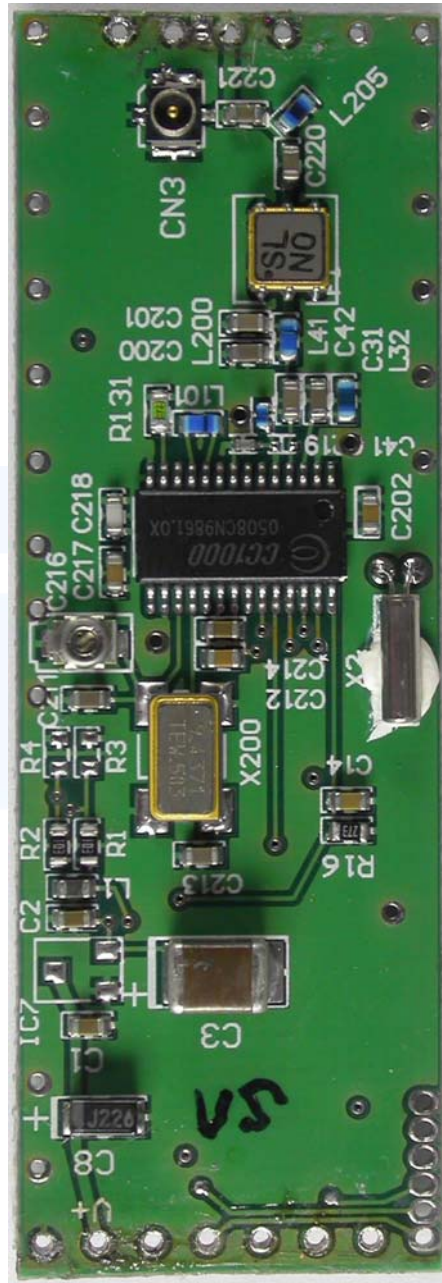
Internal Photo
Rear view PCB



FCC ID:SRDRTR5W

RTR-5W

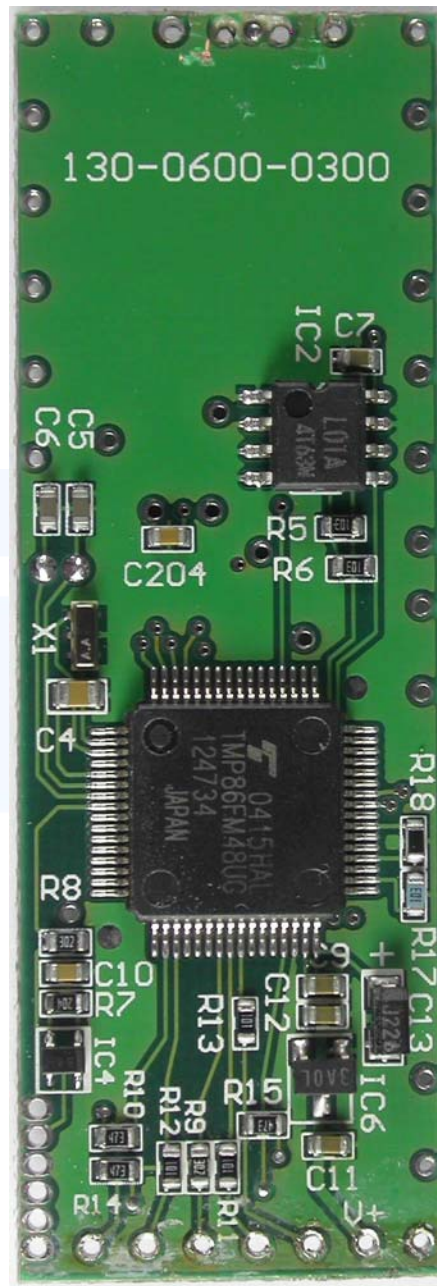
Internal Photo
Front view PCB



FCC ID:SRDRTR5W

RTR-5W

Internal Photo
Rear view PCB



FCC ID:SRDRTR5W

Power Supply Unit

External Photo



3.2 Power supply system utilised

Power supply voltage : 5,0 V / DC

3.3 Short description of the Equipment under Test (EuT)

The data collector RTR-5W collect recorded temperature data from the RTR-51/RTR-52/RTR-53 and RVR-52 units via short-wave wireless technology. To make use of this data logger you must connect it to a network via LAN cable.

Number of tested samples: 1

Serial number: Prototype

EuT operation mode:

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

- Tx Mode at Channel 1: 902,28MHz, Channel 12: 915,25MHz and Channel 22:927,05MHz

- Receiving mode at Channel 1: 902,28MHz, Channel 12: 915,25MHz and Channel 22: 927,05MHz

- Standby

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:

- Test Software Model : Fa. T & D
- Lap Top Model : Fa. Mikes Intern 02-01/01-05-012
- Hub Model : Fa. Mikes Intern
- Model :
- Model :
- Model :
- customer specific cables
- unscreened power cables

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."

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5 TEST CONDITIONS AND RESULTS

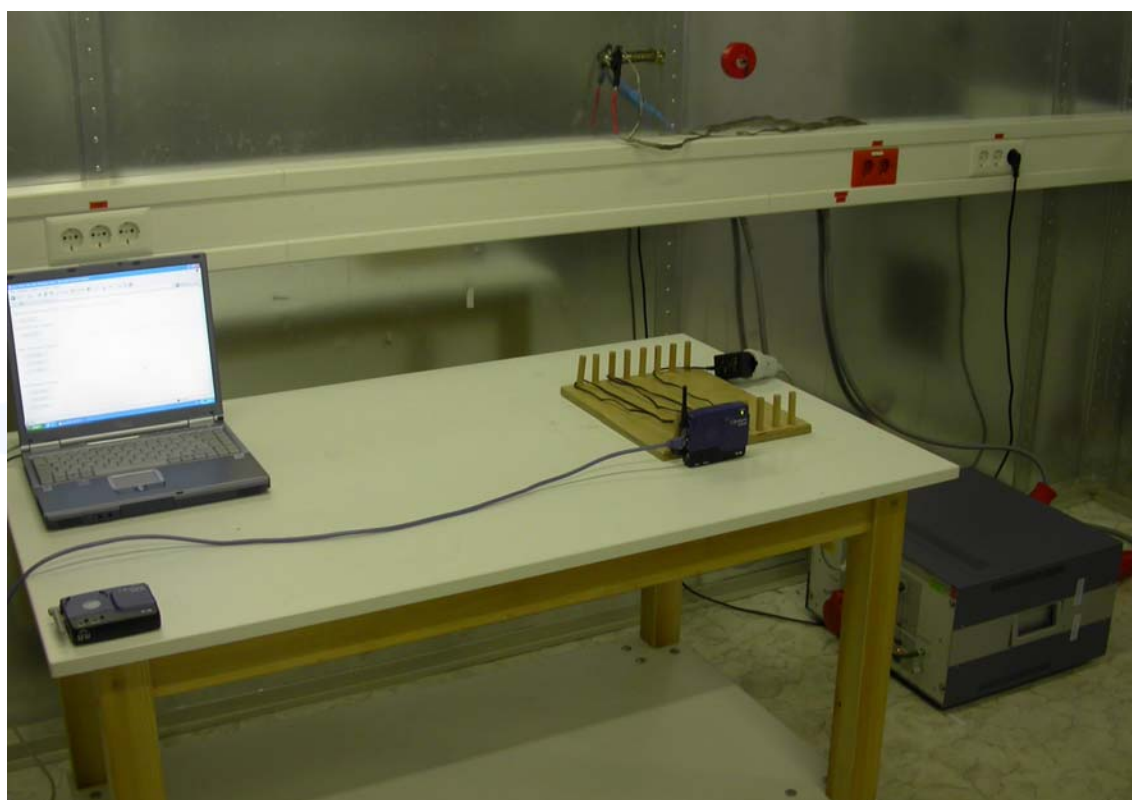
5.1 Conducted emissions

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 dB μ V, 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 dB μ V and μ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

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 50 Ω /50 μ H (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.

FCC ID:SRDRTR5W

5.1.4 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 0,3dB at 1,04 MHz

The requirements are **FULFILLED**.

Remarks:

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FCC ID:SRDRTR5W

5.1.5 Test protocol

Test point: L1
Operation mode: Tx mode at 915,25MHz
Remarks:
Date:
Tested by: Huber Markus

Result: passed

Freq kHz	QP- L dB[μV]	D -Limit QP [dB]	Freq kHz	AV-L dB[μV]	D -Limit AV [dB]
150	45,3	20,7	260	48,3	3,1
190	36,7	28,3	520	45,1	0,9
260	50,3	11,1	780	44,6	1,4
520	50,5	5,5	1045	44,6	1,4
615	30,2	25,8	1305	43,3	2,7
785	50,2	5,8	1570	41,6	4,4
875	31,4	24,6	2355	38,7	7,3
1040	49,6	6,4	2615	35,5	10,5
1310	51,2	4,8	3405	35,5	10,5
1570	49,3	6,7	3925	33,3	12,7
2330	50,3	5,7	4715	29,7	16,3
2360	46	10,0	6540	30,1	19,9
3110	44,3	11,7	8125	30,5	19,5
4140	44	12,0	9675	23,8	26,2
4460	42,1	13,9	10485	25	25,0

Freq kHz	QP- L dB[μV]	D -Limit QP [dB]	Freq kHz	AV-L dB[μV]	D -Limit AV [dB]
6530	43	17,0	14145	25,6	24,4
7735	45,2	14,8			
9170	36,5	23,5			
11805	38,5	21,5			
13615	39,3	20,7			
15910	32,2	27,8			

FCC ID:SRDRTR5W

Test point: N
Operation mode: Tx mode at 915,25MHz
Remarks:
Date:
Tested by: Huber Markus

Result: passed

Freq kHz	QP- L dB[μV]	D -Limit QP [dB]	Freq kHz	AV-L dB[μV]	D -Limit AV [dB]
155	44,2	21,5	185	34,5	19,8
190	37,7	29,3	260	50,8	0,6
260	56,5	9,9	520	45,2	0,8
420	25	34,4	780	44,8	1,2
520	52,7	3,3	1045	45,7	0,3
620	32,1	23,9	1305	41,3	4,7
785	52,3	3,7	1570	40,5	5,5
885	33,4	22,6	2355	35,5	10,5
1045	50,3	5,7	2885	34,7	11,3
1310	49,4	6,6	3140	31	15,0
1570	48,6	7,4	3930	30,6	15,4
2350	49	7,0	4720	26,8	19,2
2595	46,9	9,1	5750	25,8	24,2
3105	41,7	14,3	7865	28,9	21,1
4140	43,4	12,6	9175	26,7	23,3

Freq kHz	QP- L dB[μV]	D -Limit QP [dB]	Freq kHz	AV-L dB[μV]	D -Limit AV [dB]
4455	42,2	13,8	11240	26,1	23,9
6005	41,5	18,5	15455	22,7	27,3
7745	42	18,0			
9380	38,5	21,5			
11495	38,7	21,3			
14045	37,6	22,4			
15955	35	25,0			
20665	28,7	31,3			

5.2 Radiated power of the fundamental wave

For test instruments and accessories used see section 6 Part CPR 2.

5.2.1 Description of the test location

Test location: OATS1

Test distance: 3 metres

5.2.2 Photo documentation of the test set-up



5.2.3 Description of Measurement

The radiated power of the fundamental wave from the EUT is measured in the frequency range of 30 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 dB μ V/m, is arrived by taking the reading from the EMI receiver (Level dB μ V) 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 power of the fundamental wave from the EUT is measured in the frequency range 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. The antenna was positioned 3 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 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.

The resolution bandwidth during the measurement is as follows:

30 MHz – 1000 MHz:	ResBW: 120 kHz
1000 MHz – 40 GHz	ResBW: 1 MHz

5.2.4 Test result

Channel1:

Frequency [MHz]	L: QP [dBµV]	L: AV [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBµV/m]	L: AV [dBµV/m]	Limit [dBµV/m]	Delta [dB]
902,28	52,3		120	27,4	79,7		94,0	14,3

Channel 12:

Frequency [MHz]	L: QP [dBµV]	L: AV [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBµV/m]	L: AV [dBµV/m]	Limit [dBµV/m]	Delta [dB]
915,25	53,3		120	27,6	80,9		94,0	13,1

Channel 22:

Frequency [MHz]	L: QP [dBµV]	L: AV [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBµV/m]	L: AV [dBµV/m]	Limit [dBµV/m]	Delta [dB]
927,05	50,3		120	27,7	78,0		94,0	16,0

Quasipeak-Limit according to FCC Subpart 15.249(a) for fundamental and harmonics

Frequency (MHz)	Fieldstrength of fundamental		Fieldstrength of harmonics	
	(mV/m)	dB (µV/m)	(µV/m)	dB (µV/m)
902-928	50	94	500	54
2400-2483.5	50	94	500	54
5725-5875	50	94	500	54

The requirements are **FULFILLED**.

Remarks:

5.3 Spurious emissions (Magnetic field) 9 kHz – 30 MHz

For test instruments and accessories used see section 6 Part SER 1.

5.3.1 Description of the test location

Test location: OATS1

Test distance: 3 metres

5.3.2 Photo documentation of the test set-up



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 dB μ V/m, is arrived at by taking the reading from the EMI receiver (Level dB μ V) 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

Example:

Frequency (MHz)	Level (dB μ V)	+	Factor (dB)	=	Level (dB μ V/m)	Limit (dB μ V/m)	=	Delta (dB)
1.705	5	+	20	=	25	30	=	5

5.3.4 Test result

Frequency [MHz]	L: PK [dB μ V]	L: AV [dB μ V]	L: QP [dB μ V]	Correct. [dB]	L: PK [dB μ V/m]	L: AV [dB μ V/m]	L: QP [dB μ V/m]	Limit [dB μ V/m]	Delta [dB]
0,009 – 0,15							< 30		
0,15 – 30,0							< 30		

Limit according to FCC Part 15 Subpart 15.209(a)

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (meters)
	(μ V/m)	dB (μ V/m)	
0.009-0.490	2400/F (kHz)	--	300
0.490-1.705	24000/F (kHz)	--	30
1.705-30.0	30	29.5	30

The requirements are **FULFILLED**.

Remarks:

5.4 Radiated emissions (electric field) 30 MHz – 40 GHz

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

5.4.1 Description of the test location

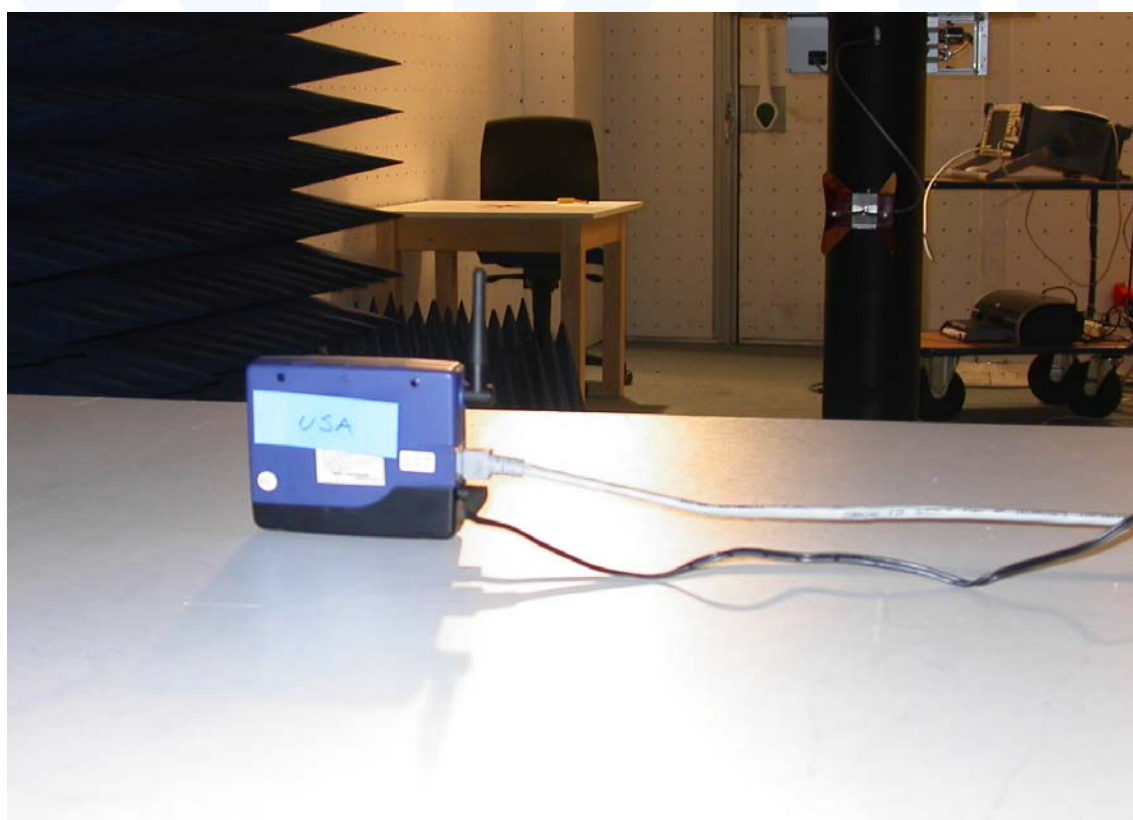
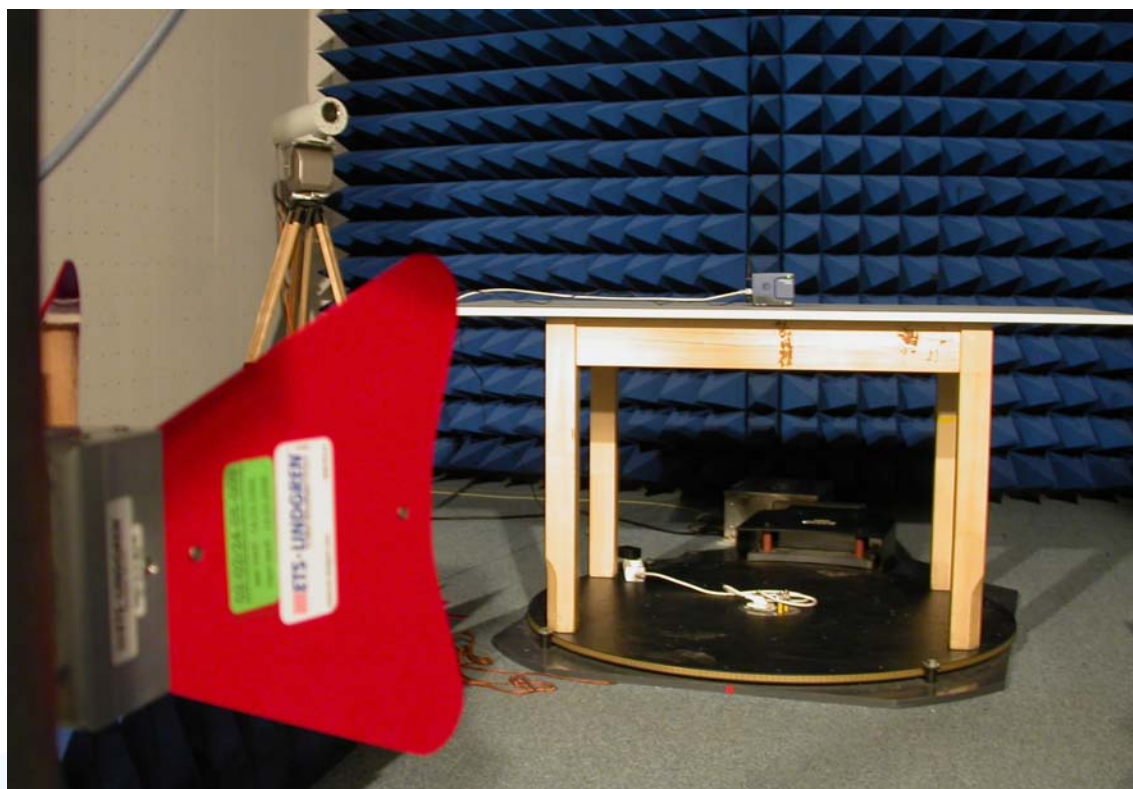
Test location: OATS1
Test location: Anechoic Chamber A2

Test distance: 3 metres

5.4.2 Photo documentation of the test set-up



FCC ID:SRDRTR5W



5.4.3 Description of Measurement

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 dB μ V/m, is arrived by taking the reading from the EMI receiver (Level dB μ V) 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 3 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 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.

The resolution bandwidth during the measurement is as follows:

30 MHz – 1000 MHz:	ResBW: 120 kHz
1000 MHz – 40000 MHz	ResBW: 1 MHz

5.4.4 Test result

Testresult in detail: (<1GHz)

Channel1: Center frequency: 902,28 MHz

Frequency [MHz]	L: QP [dBμV]	L: AV [dBμV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBμV/m]	L: AV [dBμV/m]	Limit [dBμV/m]	Delta [dB]
30-1000			120		<30			>20

Channel 12: Center frequency: 915,25 MHz

Frequency [MHz]	L: QP [dBμV]	L: AV [dBμV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBμV/m]	L: AV [dBμV/m]	Limit [dBμV/m]	Delta [dB]
30-1000			120		<30			>20

Channel 22: Center frequency: 927,05 MHz

Frequency [MHz]	L: QP [dBμV]	L: AV [dBμV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBμV/m]	L: AV [dBμV/m]	Limit [dBμV/m]	Delta [dB]
30-1000			120		<30			>20

Testresult in detail:(>1GHz)

Corrected field strength of fundamental wave as reference for radiated emissions: 79,7 dBμV/m

Channel 1									
Frequency [MHz]	Reading Level PK [dBμV]	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]
1804,0	52,98	40,53	1000	-12,8	40,2	27,7	74,0	54,0	26,3
2710,0	54,09	42,90	1000	-9,3	44,8	33,6	74,0	54,0	20,4
3616,0	50,59	38,44	1000	-8,5	42,1	29,9	74,0	54,0	24,1

Corrected field strength of fundamental wave as reference for radiated emissions: 80,9dBμV/m

Channel 12									
Frequency [MHz]	Reading Level PK [dBμV]	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]
1830,5	51,35	39,84	1000	-12,6	38,8	27,2	74,0	54,0	26,8
2745,7	52,48	40,26	1000	-9,3	43,2	30,9	74,0	54,0	23,1
3661,0	48,72	45,19	1000	-8,4	40,3	36,8	74,0	54,0	17,2

FCC ID:SRDRTR5W

Corrected field strength of fundamental wave as reference for radiated emissions:

78,0dB μ V/m

Channel 22									
Frequency [MHz]	Reading Level PK [dB μ V]	Level AV [dB μ V]	Band-width [kHz]	Correct. Factor [dB]	Corrected Level PK [dB μ V/m]	Corrected Level AV [dB μ V/m]	Limit PK [dB μ V/m]	Limit AV [dB μ V/m]	Delta [dB]
1854,1	51,24	41,68	1000	-12,4	38,8	29,3	74,0	54,0	24,7
2781,1	50,57	40,58	1000	-9,2	41,4	31,4	74,0	54,0	22,6
3708,2	47,98	44,31	1000	-8,4	39,6	35,9	74,0	54,0	18,1

mikes

Average-Limit according to FCC Subpart 15.249(a)

Frequency (MHz)	Fieldstrength of harmonics	
	($\mu\text{V/m}$)	dB ($\mu\text{V/m}$)
902-928	500	54
2400-2483.5	500	54
5725-5875	500	54

Peak-Limit according to FCC Subpart 15.249(a), Subpart 15.249(e)

Frequency (MHz)	Fieldstrength of harmonics	
	($\mu\text{V/m}$)	dB ($\mu\text{V/m}$)
902-928	5000	74
2400-2483.5	5000	74
5725-5875	5000	74

Average-Limit according to FCC Subpart 15.249(d) for spurious emissions outside of the specified frequency band:

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 in paragraph 15.209, whichever is the lesser attenuation.

Channel 1:

Frequency [MHz]	50dB below of the fundamental [dB $\mu\text{V/m}$]	15.209 Limits [dB $\mu\text{V/m}$]	General Radiated Limits [dB $\mu\text{V/m}$]
30-88	44	40	44
88-216	44	43,5	44
216-960	44	46	46
Above 960	44	54	54

Channel 12:

Frequency [MHz]	50dB below of the fundamental [dB $\mu\text{V/m}$]	15.209 Limits [dB $\mu\text{V/m}$]	General Radiated Limits [dB $\mu\text{V/m}$]
30-88	44	40	44
88-216	44	43,5	44
216-960	44	46	46
Above 960	44	54	54

Channel 22:

Frequency [MHz]	50dB below of the fundamental [dB $\mu\text{V/m}$]	15.209 Limits [dB $\mu\text{V/m}$]	General Radiated Limits [dB $\mu\text{V/m}$]
30-88	44	40	44
88-216	44	43,5	44
216-960	44	46	46
Above 960	44	54	54

FCC ID:SRDRTR5W

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 continuous transmitting mode.

The measurement was performed up to the 10th harmonic of channel 3 (9270,50 MHz).

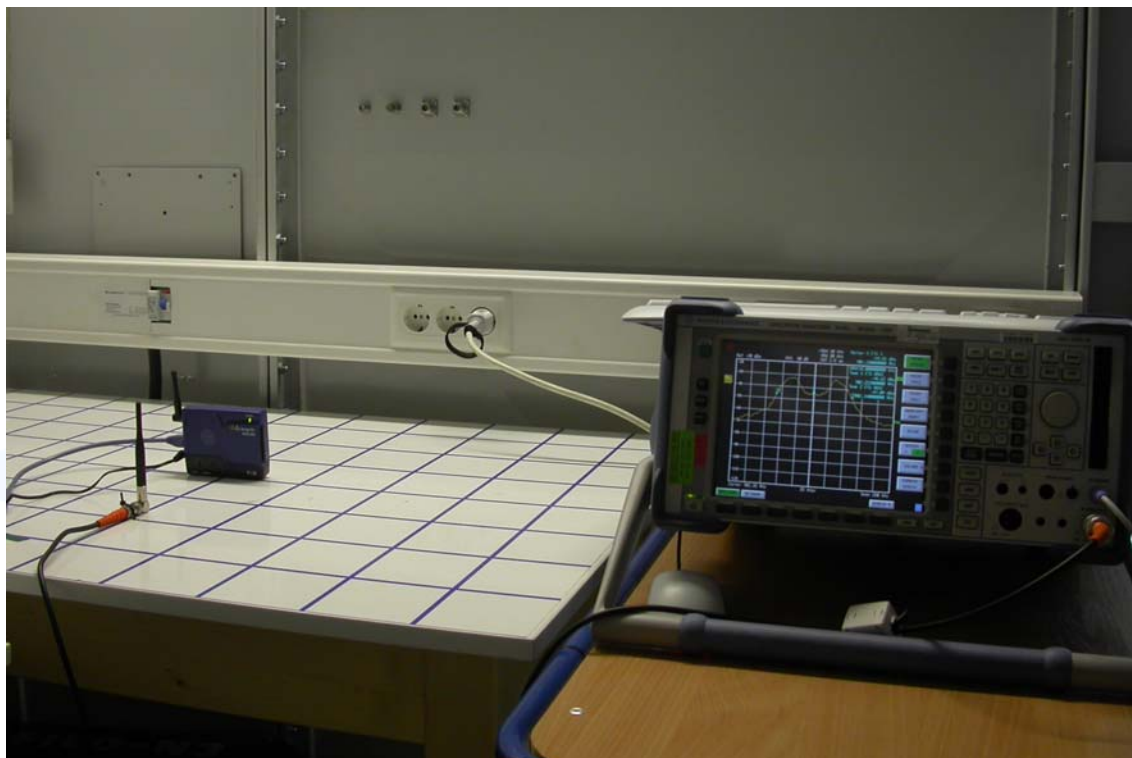
5.5 Emission Bandwidth

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

5.5.1 Description of the test location

Test location: Shielded Room S4

5.5.2 Photo documentation of the test set-up



5.5.3 Description of Measurement

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio of -20 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 following 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

5.5.4 Test result

Channel 1 Frequency [MHz]	20 dB Bandwidth [kHz]
902,28	131,0

Channel 12 Frequency [MHz]	20 dB Bandwidth [kHz]
915,25	137,0

Channel 22 Frequency [MHz]	20 dB Bandwidth [kHz]
927,05	131,0

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

FCC ID:SRDRTR5W

Channel 1: Center frequency:902,28 MHz

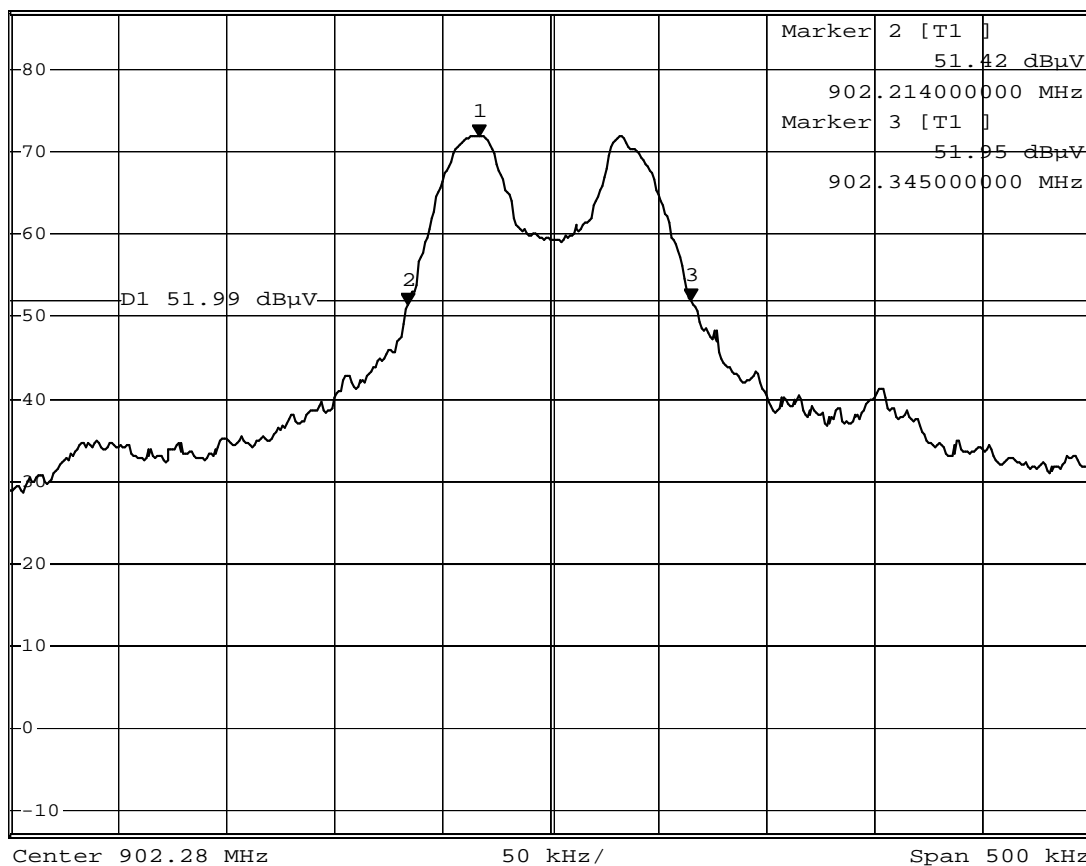


*RBW 10 kHz Marker 1 [T1]
VBW 30 kHz 71.99 dBμV
SWT 5 ms 902.247000000 MHz

Ref 87 dBμV

Att 10 dB

1 PK
VIEW



Center 902.28 MHz

50 kHz/

Span 500 kHz

Date: 9.MAR.2006 11:34:05

FCC ID:SRDRTR5W

Channel 12: Center frequency:915,25 MHz



*RBW 10 kHz Marker 1 [T1]
VBW 30 kHz 73.66 dBμV
SWT 5 ms 915.223000000 MHz

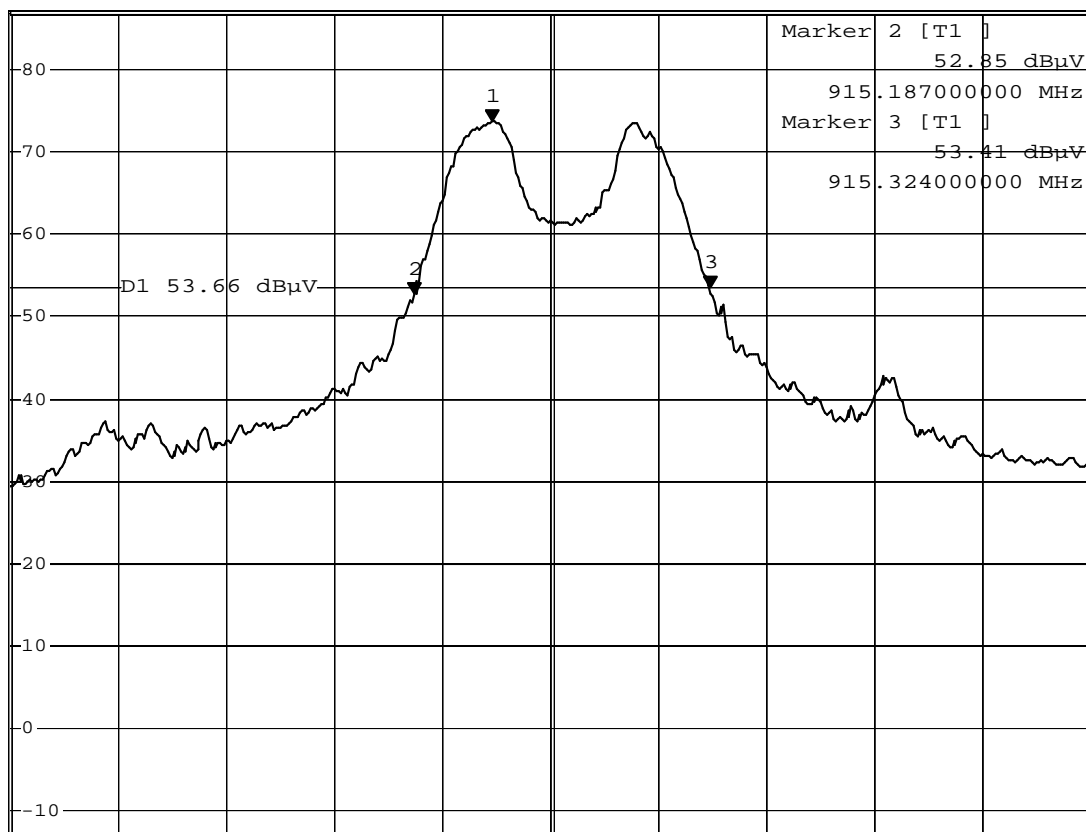
Ref 87 dBμV

Att 10 dB

SWT 5 ms

915.223000000 MHz

1 PK
VIEW



Center 915.25 MHz

50 kHz/

Span 500 kHz

Date: 9.MAR.2006 11:30:37

FCC ID:SRDRTR5W

Channel 22: Center frequency:927,05 MHz



*RBW 10 kHz Marker 1 [T1]
VBW 30 kHz 70.86 dBμV
SWT 5 ms 927.085000000 MHz

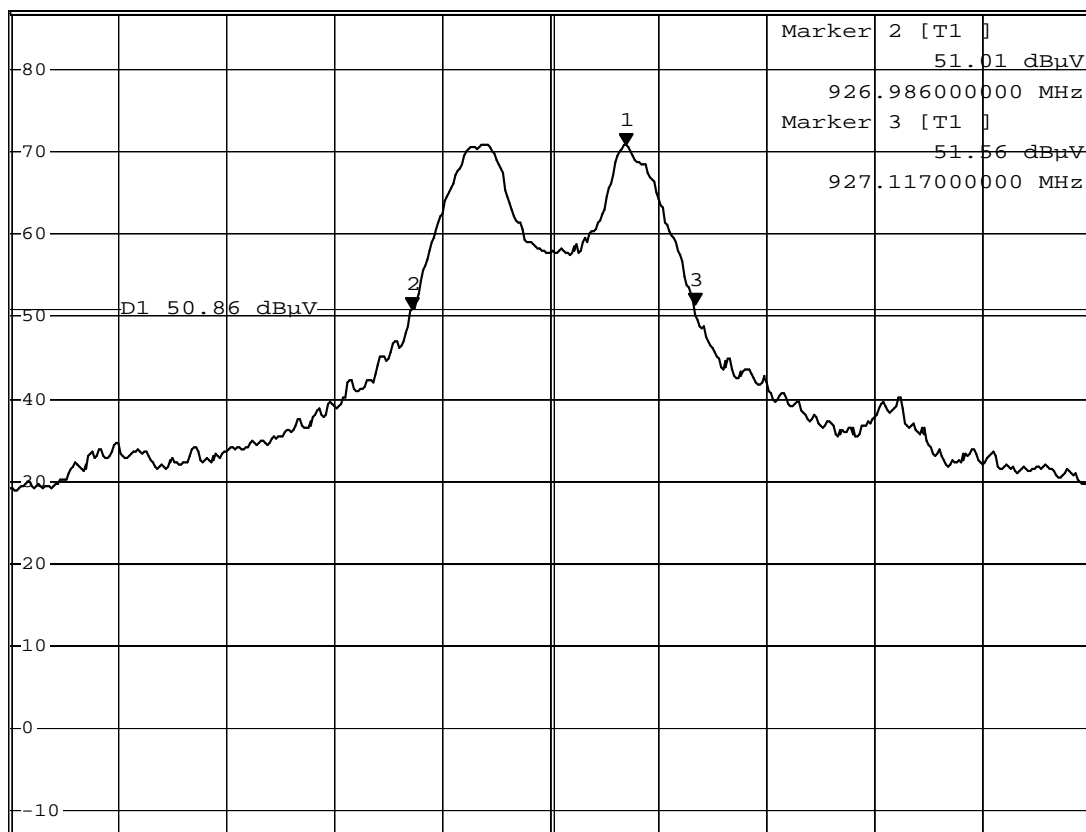
Ref 87 dBμV

Att 10 dB

SWT 5 ms

927.085000000 MHz

1 PK
VIEW



Center 927.05 MHz

50 kHz/

Span 500 kHz

Date: 9.MAR.2006 11:26:46

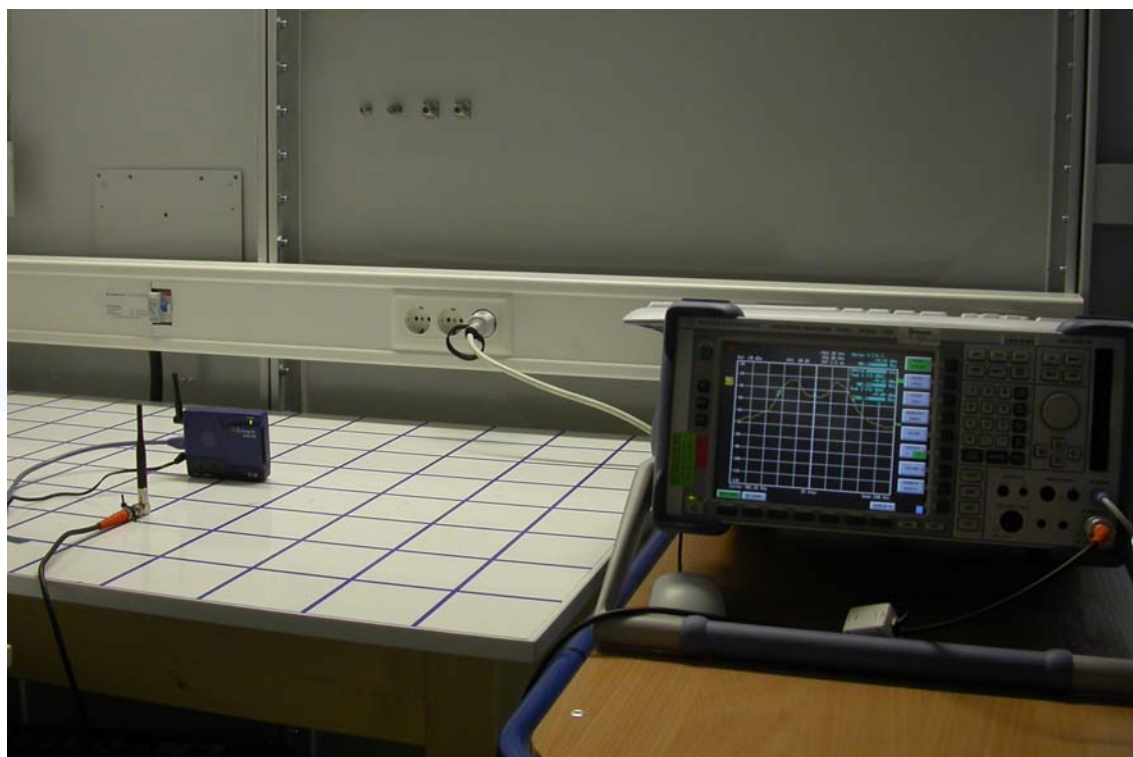
5.6 Band edge test

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

5.6.1 Description of the test location

Test location: Shielded Room S4

5.6.2 Photo documentation of the test set-up



5.6.3 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 spectral 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:	$\geq 1\%$ of the span
VBW:	\geq RBW
Sweep:	Auto
Detector function:	Peak

5.6.4 Test result

Frequency [MHz]	Peak Power Output [dBμV]	Spurious emission read value [dBμV]	Result of Band edge [dBc]	Band edge LIMIT [dBc]
< 902,0	70,56	18,73	51,83	>50
> 928,0	71,83	14,04	57,79	>50

Peak-Limit according to FCC Subpart 15.249(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 §15.209, whichever is the lesser attenuation.

The requirements are **FULFILLED**.

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

FCC ID:SRDRTR5W

5.6.5 Test protocol

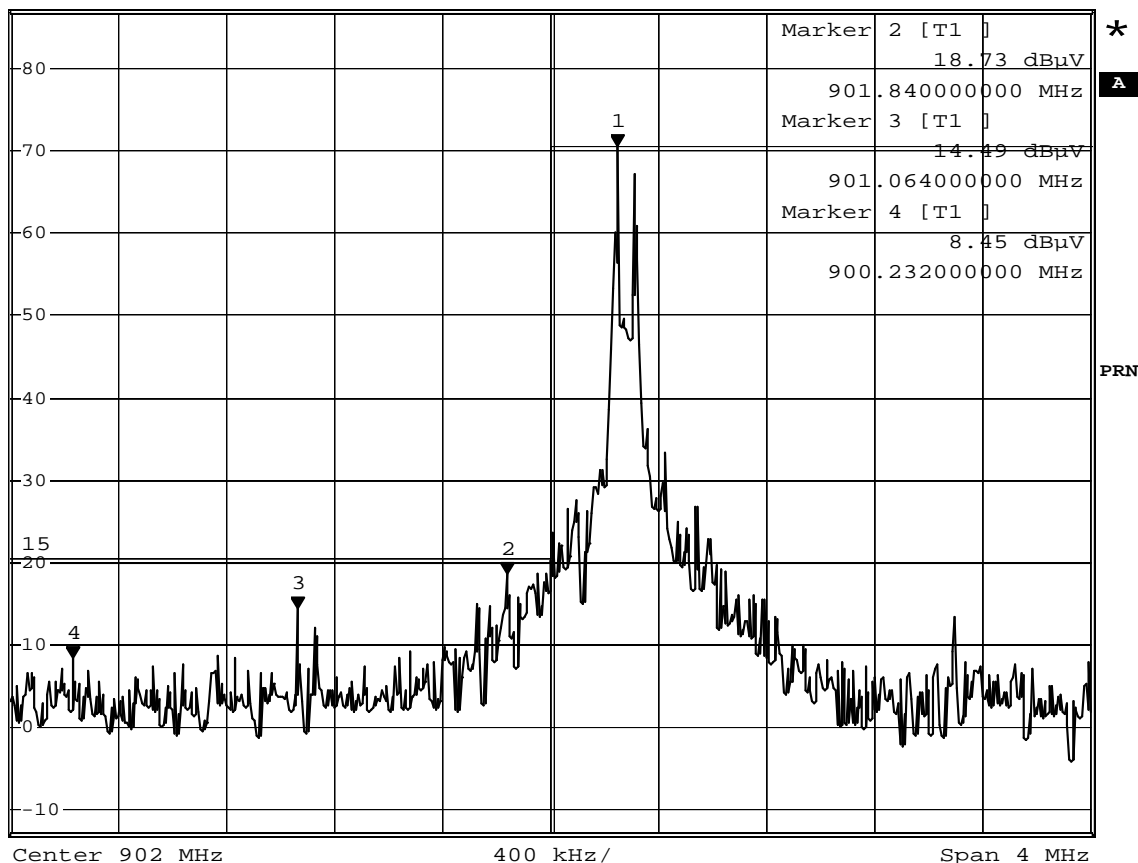


*RBW 3 kHz Marker 1 [T1]
VBW 10 kHz 70.56 dBμV
SWT 450 ms 902.248000000 MHz

Ref 87 dBμV

Att 10 dB

1 PK
VIEW



Date: 9.MAR.2006 11:15:21

FCC ID:SRDRTR5W

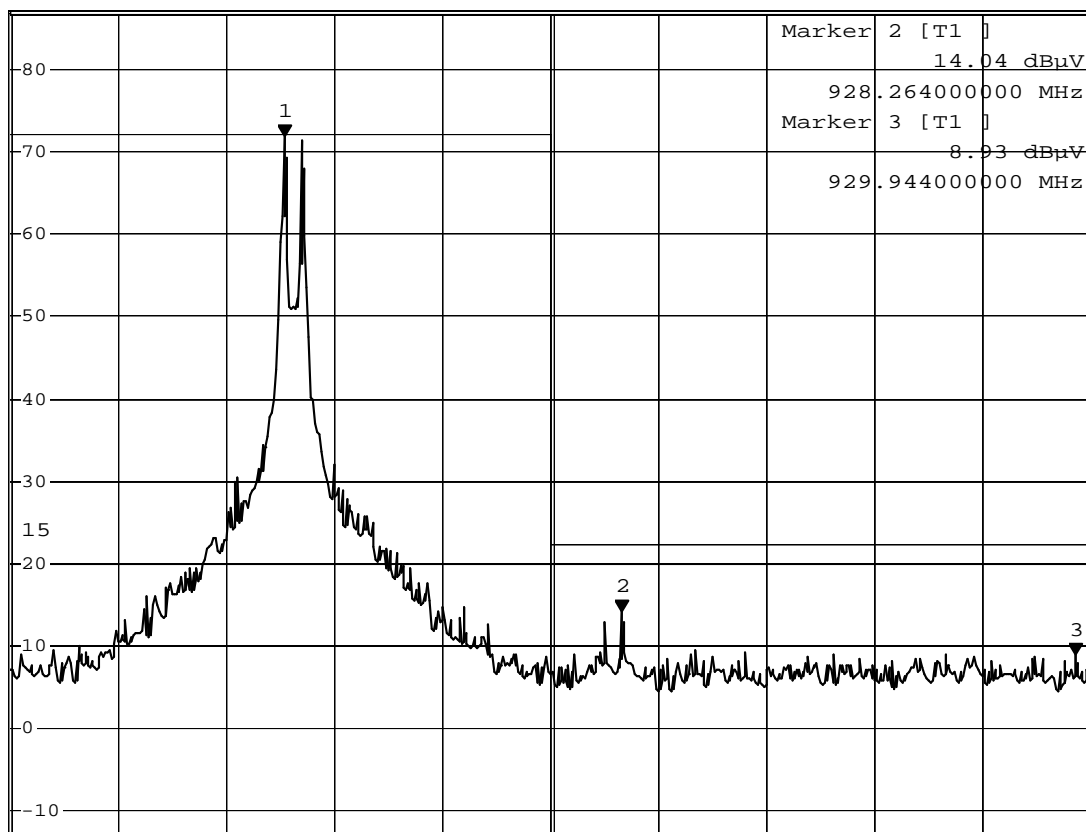


*RBW 3 kHz Marker 1 [T1]
VBW 10 kHz 71.83 dBμV
SWT 450 ms 927.016000000 MHz

Ref 87 dBμV

Att 10 dB

1 PK
VIEW



Center 928 MHz

400 kHz/

Span 4 MHz

Date: 9.MAR.2006 11:18:20

5.7 Antenna application

5.7.1 Antenna requirements

The EUT's antenna is met the requirement of FCC Part 15 C section 15.203 and 15.204

5.7.2 Result

The EUT used a dedicated antenna and is screwed on the PCB. The gain of antenna is < 2,14 dB and no other antenna than that furnished by the responsible party are be used with the device.

mikes

FCC ID:SRDRTR5W

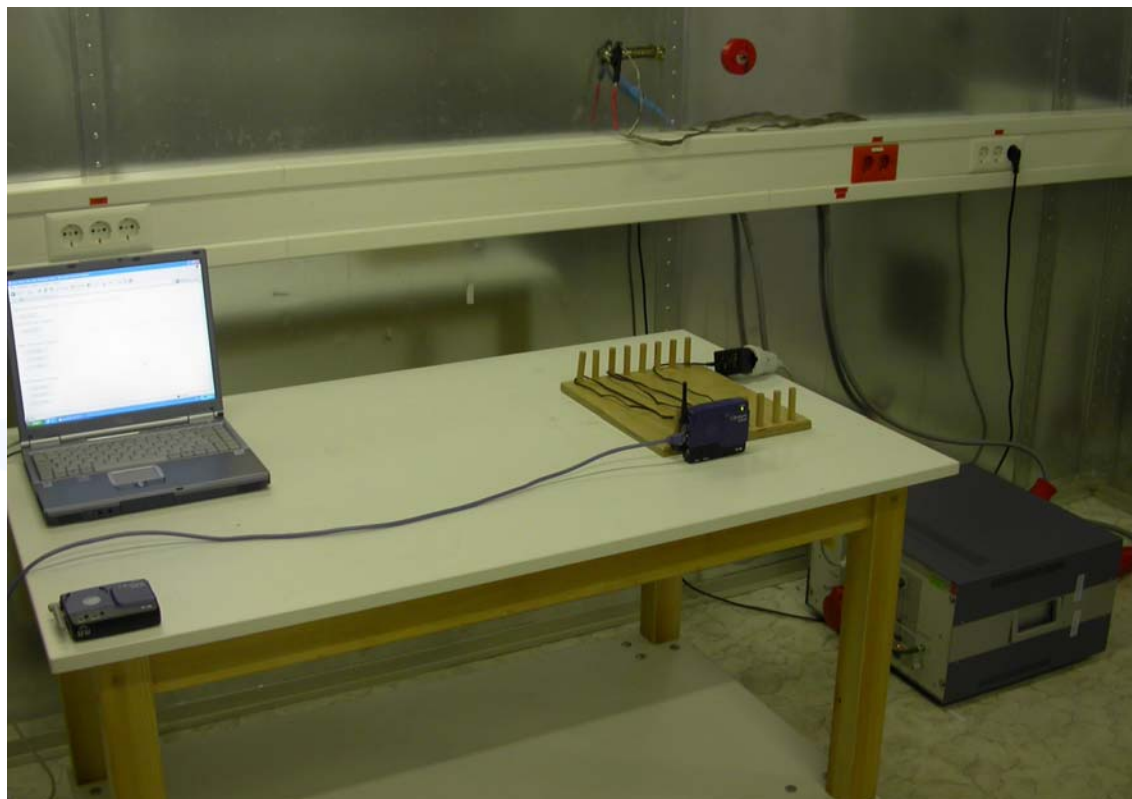
5.8 Receiver conducted disturbances 0.15 - 30 MHz

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

5.8.1 Description of the test location

Test location: Shielded Room S2

5.8.2 Photo documentation of the test set-up



5.8.3 Description of Measurement

The final level, expressed in dB μ V, 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 dB μ V and μ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

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 50 Ω /50 μ H (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.

5.8.4 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 0,5dB at 520,0 kHz

The requirements are **FULFILLED**.

Remarks:

FCC ID:SRDRTR5W

Test point: L1
Operation mode: Rx mode at 915,25MHz
Remarks:
Date:
Tested by: Huber Markus

Result: passed

Freq kHz	QP- L dB[μV]	D -Limit QP [dB]	Freq kHz	AV-L dB[μV]	D -Limit AV [dB]
150	45,3	20,7	260	48,3	3,1
190	36,7	28,3	520	45,1	0,9
260	50,3	11,1	780	44,6	1,4
520	50,5	5,5	1045	44,6	1,4
615	30,2	25,8	1305	43,3	2,7
785	50,2	5,8	1570	41,6	4,4
875	31,4	24,6	2355	38,7	7,3
1040	49,6	6,4	2615	35,5	10,5
1310	51,2	4,8	3405	35,5	10,5
1570	49,3	6,7	3925	33,3	12,7
2330	50,3	5,7	4715	29,7	16,3
2360	46	10,0	6540	30,1	19,9
3110	44,3	11,7	8125	30,5	19,5
4140	44	12,0	9675	23,8	26,2
4460	42,1	13,9	10485	25	25,0

Freq kHz	QP- L dB[μV]	D -Limit QP [dB]	Freq kHz	AV-L dB[μV]	D -Limit AV [dB]
6530	43	17,0	14145	25,6	24,4
7735	45,2	14,8			
9170	36,5	23,5			
11805	38,5	21,5			
13615	39,3	20,7			
15910	32,2	27,8			

FCC ID:SRDRTR5W

Test point: N
Operation mode: Rx mode at 915,25MHz
Remarks:
Date:
Tested by: Huber Markus

Result: passed

Freq kHz	QP- L dB[μV]	D -Limit QP [dB]	Freq kHz	AV-L dB[μV]	D -Limit AV [dB]
150	45,8	20,2	185	34,3	20,0
190	37,5	29,5	260	50,4	1,0
260	56,3	8,5	520	45,5	0,5
520	52,3	5,7	785	45,1	0,9
535	39,6	16,4	1045	44	2,0
785	52	4,0	1305	39,5	6,5
885	30,1	25,9	1570	37,1	8,9
1050	49,9	6,1	2355	30,7	15,3
1290	47,7	8,3	2630	28,7	17,3
1575	48	8,0	3145	29,5	16,5
2350	47,2	8,8	3925	28,3	17,7
2600	46,8	9,2	4470	22,7	23,3
3100	42,2	13,8	7845	25,2	24,8
4135	42,2	13,8	9665	26,2	23,8
4470	42,2	13,8			

Freq kHz	QP- L dB[μV]	D -Limit QP [dB]	Freq kHz	AV-L dB[μV]	D -Limit AV [dB]
6030	39,5	20,5			
7790	42,2	17,8			
9405	40,3	19,7			
11345	37	23,0			
13635	39,9	20,1			
15950	32,9	27,1			
20810	28,8	31,2			

FCC ID:SRDRTR5W

5.9 Receiver spurious emissions (Magnetic field) 9 kHz – 30 MHz

For test instruments and accessories used see section 6 Part SER 1.

5.9.1 Description of the test location

Test location: OATS1

Test distance: 3 metres

5.9.2 Photo documentation of the test set-up



5.9.3 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 be 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 dB μ V/m, is arrived at by taking the reading from the EMI receiver (Level dB μ V) 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

Example:

Frequency (MHz)	Level (dB μ V)	+	Factor (dB)	=	Level (dB μ V/m)	Limit (dB μ V/m)	=	Delta (dB)
1.705	5	+	20	=	25	30	=	5

5.9.4 Test result

Channel 1, Channel 12 and Channel 22:

Frequency [MHz]	L: PK [dB μ V]	L: AV [dB μ V]	L: QP [dB μ V]	Correct. [dB]	L: PK [dB μ V/m]	L: AV [dB μ V/m]	L: QP [dB μ V/m]	Limit [dB μ V/m]	Delta [dB]
0,009 – 0,15							< 30		
0,15 – 30,0							< 30		

Limit according to FCC Part 15 Subpart 15.209(a)

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (meters)
	(μ V/m)	dB (μ V/m)	
0.009-0.490	2400/F (kHz)	--	300
0.490-1.705	24000/F (kHz)	--	30
1.705-30.0	30	29.5	30

The requirements are **FULFILLED**.

Remarks:

FCC ID:SRDRTR5W

5.10 Receiver radiated emissions (electric field) 30 MHz - 40 GHz

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

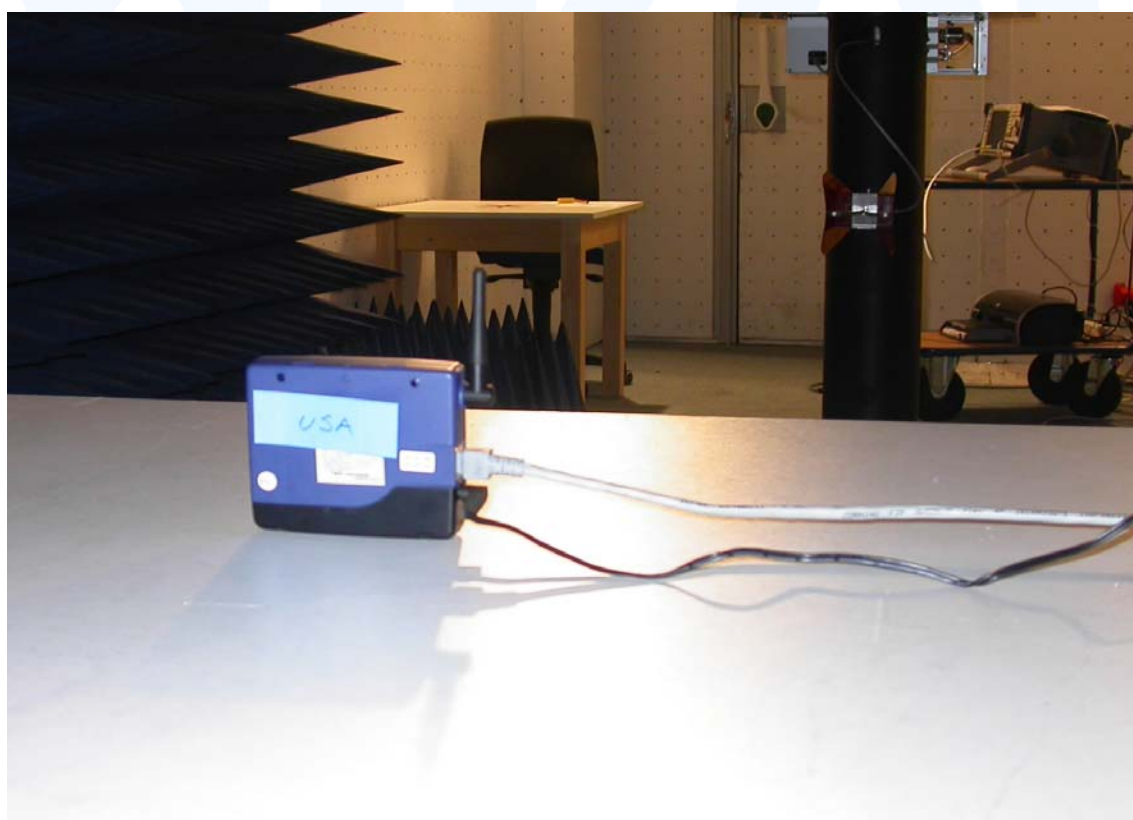
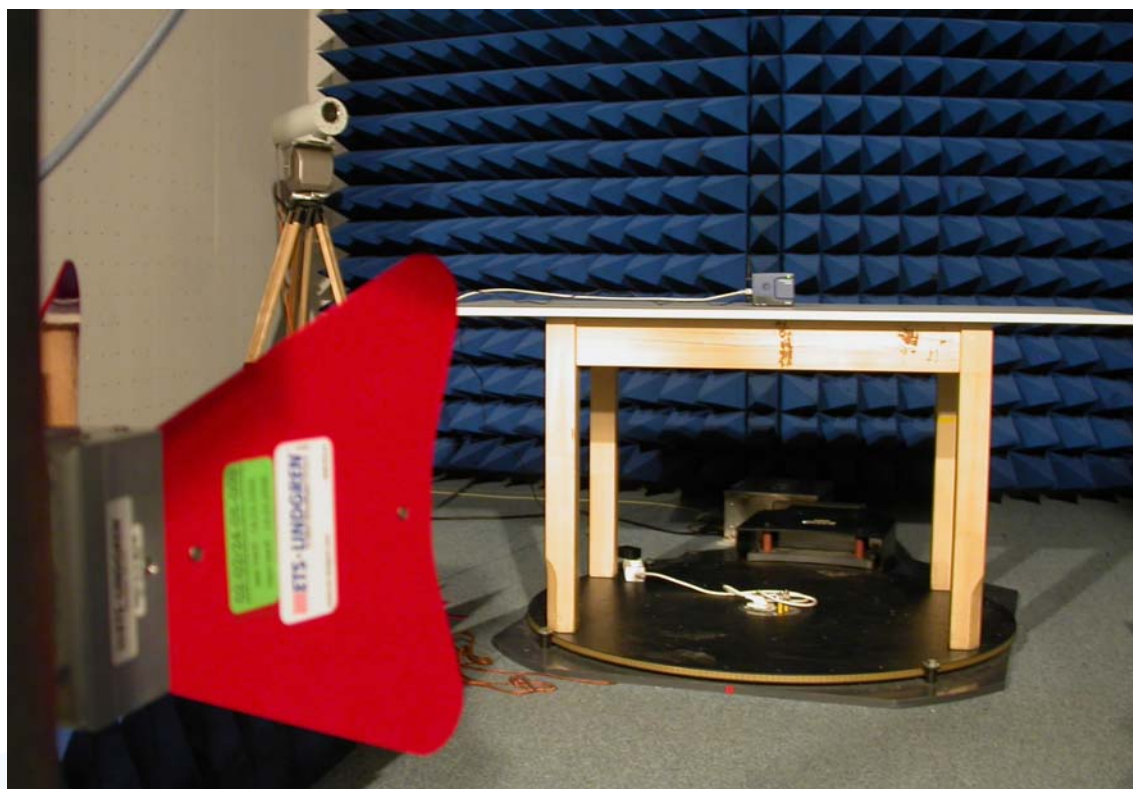
5.10.1 Description of the test location

Test location: OATS1
Test location: Anechoic Chamber A2

Test distance: 3 metres

5.10.2 Photo documentation of the test set-up

FCC ID:SRDRTR5W



5.10.3 Test result

Testresult in detail: (<1GHz)

Channel 1, Channel 12 and Channel 22:

Frequency [MHz]	L: QP [dBµV]	L: AV [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBµV/m]	L: AV [dBµV/m]	Limit [dBµV/m]	Delta [dB]
30-1000			120		<30			

Test result >1GHz

Channel 1, Channel 12 and Channel 22						
Frequency [GHz]	Reading Level PK [dBµV]	Bandwidth [kHz]	Correct. factor [dB]	Corrected Level PK [dBµV/m]	Limit [dBµV/m]	Delta [dB]
1-10		1000		<50		

Limit according to FCC Subpart 15.109(a)

Frequency of emission [MHz]	Field strength Limits [µV/m]	Field strength Limits [dBµV/m]
30-88	100	40
88-216	150	44
216-960	200	46
Above 960	500	54

The requirements are **FULFILLED**.

Remarks: The Limits are met.

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

The measurement was performed up to the 10th harmonic (9270,5 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.

Beginning of Testing: 08 März 2006
End of Testing: 10 März 2006

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
	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
CPR 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
MB	FSP 30	Spectrum Analyzer	Rohde & Schwarz München	02-02/11-05-001
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
	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 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 1-4GHz	PARZICH GMBH	02-02/17-05-003
	AMF-4F-04001200-15-10P	RF Amplifier 4-12GHz	PARZICH GMBH	02-02/17-05-004
	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