FCC ID: VEB-NKRDCMA82

EMI – TEST REPORT

- FCC Part 15.407 -

Deutsche Akkreditierungsstelle D-PL-12030-01-01

Test Report No. : T34715-00-03AA	11. April 2011 Date of issue

Type / Model Name : 1 796 616 7 WLAN-Karte #MPCI-DCMA-82-MMCX

Product Description : Option REC5 IP5K Basis prog.

Applicant : SEW-Eurodrive GmbH & Co KG

Address : Ernst-Blickle-Str. 42

76646 Bruchsal

Manufacturer : SEW-Eurodrive GmbH & Co KG

Address : Ernst-Blickle-Str. 42

76646 Bruchsal

Licence holder : SEW-Eurodrive GmbH & Co KG

Address : Ernst-Blickle-Str. 42

76646 Bruchsal

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

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.

mikes-testingpartners gmbh
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Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (October, 2009)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart B - Unintentional Radiators (October, 2009)

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

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (October, 2009)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.202	Certified operating frequency range
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements

FCC Rules and Regulations Part 15, Subpart E – Unlicensed National Information Infrastructure Devices (October, 2009)

Part 15, Subpart E, Section 15.407	Operation within the bands 5.15 - 5.25 GHz, 5.25 - 5.35 GHz, 5.47 - 5.725 GHz and 5.725 - 5.825 GHz

FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: portable device

OET Bulletin 65, 65A, 65B, 65C Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

ANSI C63.4: 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C95.1:2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
CISPR 16-4-2: 2003	Uncertainty in EMC measurement
CISPR 22: 2005 EN 55022: 2006	Information technology equipment

2 SUMMARY

GENERAL REMARKS:

The EuT consists of 2 identical WLAN Modules mounted on a dedicated Host PCB.

Available Features:

The WLAN client module is compatible with 802.11a/h, 802.11b and 802.11g technology. It is able to operate in the 2.4 GHz and 5 GHz frequency band.

- 802.11a Mode 5.15 GHz – 5.25 GHz and 5.725 GHz – 5.850 GHz
- 802.11b/g Mode 2400 – 2483.5 MHz
- 802.11h Mode 5.25 GHz – 5.35 GHz and 5.47 GHz – 5.725 GHz

The module uses DSSS or OFDM modulation and is capable to provide following data rates:

- 802.11b Mode 11, 5.5, 2, 1 Mbps, auto-fallback
- 802.11g Mode 54, 48, 36, 24, 18, 12, 9, 6 Mbps, auto-fallback
- 802.11a/h 54, 48, 36, 24, 18, 12, 9, 6 Mbps, auto-fallback

The tests have been carried out in the following frequency band:
5150 to 5250 MHz

Pre-scan has been performed to determine the worst-case mode from all possible combinations between available modulations and data rates. The maximum output power depends on used data rate.

As worst case the following data rates are used:

- **802.11a: 6Mbps**

The EuT has been adjusted to transmit data during the tests with a duty cycle (X) of about X=1.

Following antennas are supported:

Number	Part number	Certification name	Connection	Frequency	Gain
1	13003356	Nahfeldkoppler	R-SMA	2.4 GHz	2.7
2	18231942	Nahfeldkoppler	R-SMA	5 GHz	3.7
3	18235840	Koppler	R-SMA	5 GHz	0.0
4	---	TW-145	RP-TNC	2.4 / 5 GHz	2.0 / 2.0

Note: The US version will be firmware limited to operate only in the 5150-5250 MHz band.

2.1 Certified operating frequency range

4 channels are provided to this EuT in 802.11a mode:

802.11a mode:

Channel	Frequency
36	5180
40	5200
44	5220
48	5240

Following channels were selected for the final test as listed below:

Technology	Available Channel	Tested Channel	Modulation	Modulation Type	Data Rate (Mbps)
802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6

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 : 25 October 2010

Testing concluded on : 16 November 2010

Checked by:

Klaus Gegenfurtner
I confirm the correctness and integrity of this document
2011.04.14 09:48:16 +02'00'

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

Tested by:

Anton Altmann
I`m the author of this document
2011.04.11 10:59:32 +02'00'

Anton Altmann
Dipl. Ing.(FH)

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EuT – Detailed photos see attachment A

3.2 Power supply system utilised

Power supply voltage Host PCB : 24 VDC
Power supply voltage WLAN Module : 3.3 VDC

3.3 Short description of the equipment under test (EuT)

The EuT is an Ethernet converter. It connects the WLAN to the Ethernet.

Number of tested samples: 2
Serial number: Prototype

EuT operation mode:

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

- Continuous transmitting (99 % Duty Cycle)

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:

- 24 VDC Power supply Model : UWU 52A
- 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 may notice that tolerances within the calibration of the equipment and facilities may cause additional uncertainty. The measurement uncertainty is calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurement“ and documented in the mikes-testingpartners gmbh quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners gmbh, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component diversity and modifications in production process of devices may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for the specific test. The manufacturer has the sole responsibility of continued compliance of the EuT.

4.4 Measurement protocol for FCC

4.4.1 GENERAL INFORMATION

4.4.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

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 using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.2 DETAILS OF TEST PROCEDURES

General Standard information

The test methods used comply with CISPR Publication 22, EN 55022 - " Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.3 Conducted emission

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

dBμV = 20*log(μV);
μV = 10^(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 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin of a peak mode measurement appears to be less than 20 dB, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

4.4.4 Radiated emission (electrical field 30 MHz - 1 GHz)

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 polarised 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 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance with ANSI C63.4.The interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so that 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 screened room located outside the test area. The antenna is positioned 3, 10 or 30 meters horizontally from the EuT and is repeated vertically. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters and the EuT is rotated 360 degrees.
The final level in dBµV/m is calculated by add the antenna correction factor and cable loss factor on the reading from the EMI receiver. The FCC or CISPR limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

The resolution bandwidth setting:
30 MHz – 1000 MHz: RBW: 120 kHz

Example:

Frequency (MHz)	Level (dBµV)	+	Factor (dB/m)	=	Level (dBµV/m)	-	CISPR Limit (dBµV/m)	=	Delta (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

4.4.5 Radiated emission (electrical field 1 GHz - 40 GHz)

Radiated emissions from the EuT are measured in the frequency range 1 GHz up to the maximum frequency as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is following set out in ANSI C63.4. 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 screened room located outside the test area. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to max peak detector function and a resolution 1 MHz and video bandwidth 3 MHz for peak and 10 Hz for average measurement. The conditions determined as worst case will then be used for the final measurements. When the EuT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty and are calculated at the specified test distance.

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 Applicable standard

According to FCC Part 15C, Section 15.207(a):
Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

5.1.4 Description of Measurement

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 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit 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.

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

dBµV = 20 log µV

µV = 10^(dBµV/20)

5.1.5 Test result

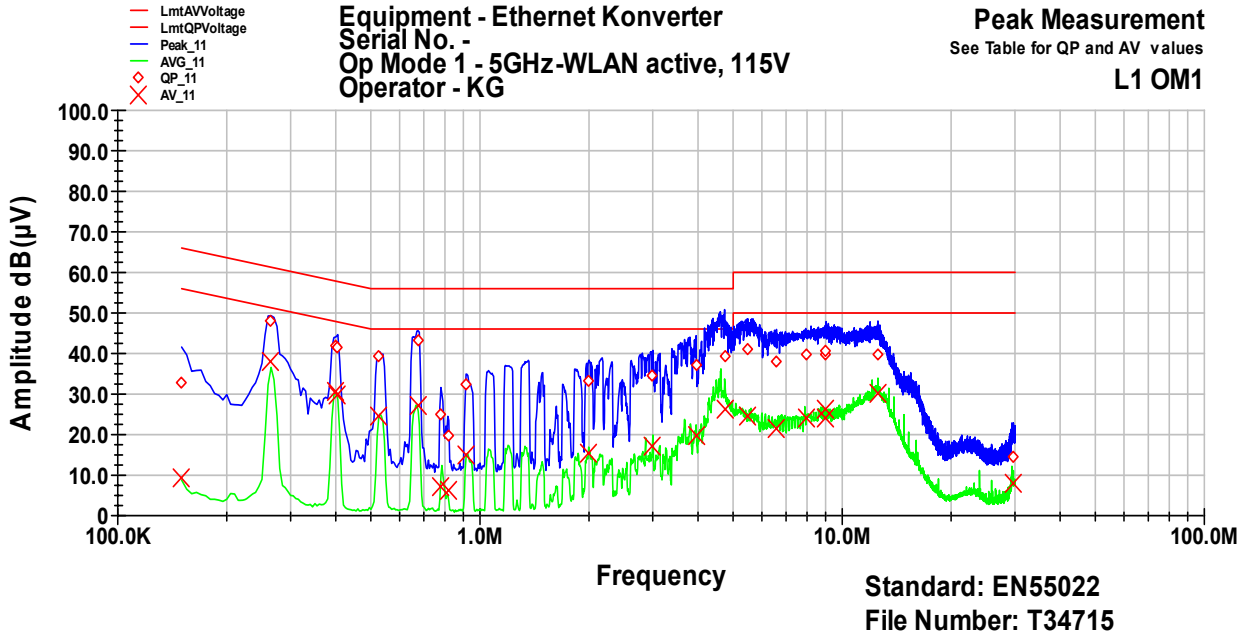
Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 12.9 dB at 0.675 MHz

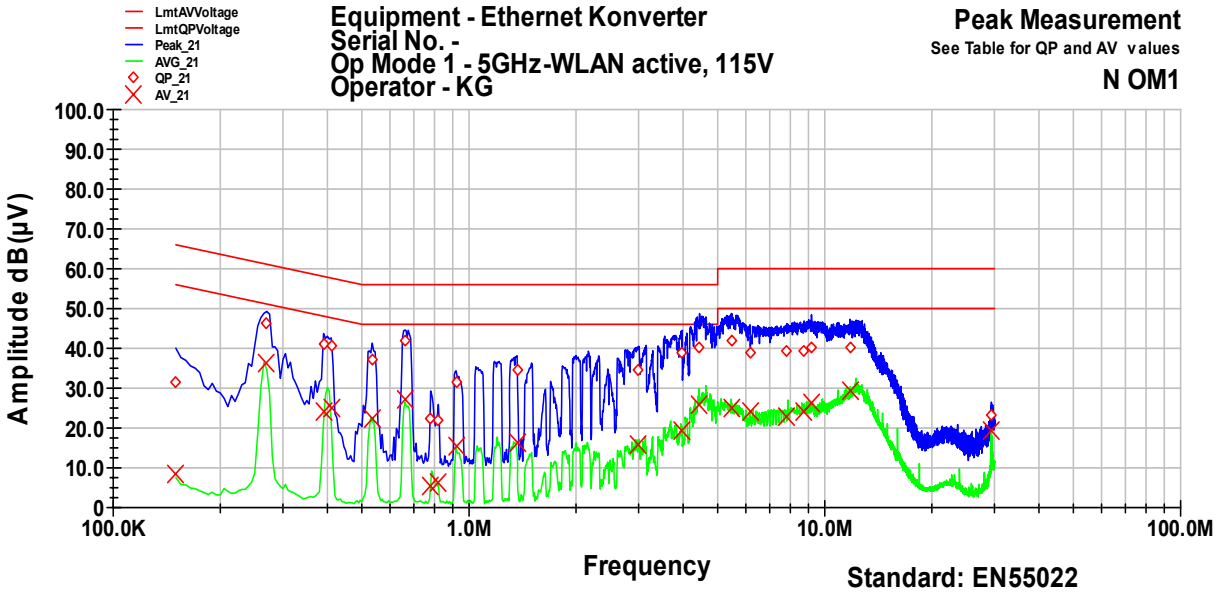
The requirements are **FULFILLED.**

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

5.1.6 Test protocol



Frequency	QP Level	QP Margin	QP Limit	AV Level	AV Margin	AV Limit
MHz	dB(µV)	dB	dB	dB(µV)	dB	dB
0.15	33.0	-33.0	66.0	9.3	-46.7	56.0
0.265	48.1	-13.2	61.3	38.2	-13.1	51.3
0.4	42.0	-15.8	57.9	30.5	-17.4	47.9
0.405	41.7	-16.1	57.8	29.6	-18.1	47.8
0.525	39.1	-16.9	56.0	24.4	-21.6	46.0
0.675	43.1	-12.9	56.0	27.2	-18.8	46.0
0.78	24.9	-31.1	56.0	7.2	-38.8	46.0
0.815	19.8	-36.2	56.0	6.2	-39.8	46.0
0.915	32.4	-23.6	56.0	15.0	-31.0	46.0
2	33.2	-22.8	56.0	15.2	-30.8	46.0
3	34.6	-21.4	56.0	17.3	-28.7	46.0
3.95	37.0	-19.0	56.0	19.7	-26.3	46.0
4.735	39.3	-16.8	56.0	26.4	-19.6	46.0
5.495	40.9	-19.1	60.0	24.6	-25.4	50.0
6.58	38.3	-21.8	60.0	21.7	-28.3	50.0
7.925	39.7	-20.3	60.0	24.2	-25.8	50.0
8.97	39.7	-20.3	60.0	24.2	-25.8	50.0
9.02	40.5	-19.5	60.0	26.4	-23.6	50.0
12.54	39.8	-20.2	60.0	30.1	-19.9	50.0
29.665	14.7	-45.3	60.0	8.1	-41.9	50.0



Frequency	QP Level	QP Margin	QP Limit	AV Level	AV Margin	AV Limit
MHz	dB(µV)	dB	dB	dB(µV)	dB	dB
0.15	31.6	-34.4	66.0	8.4	-47.5	56.0
0.27	46.2	-14.9	61.1	36.2	-14.9	51.1
0.39	41.0	-17.0	58.1	24.2	-23.9	48.1
0.41	40.7	-17.0	57.6	24.9	-22.8	47.6
0.535	37.2	-18.8	56.0	22.2	-23.8	46.0
0.66	42.2	-13.8	56.0	27.0	-19.0	46.0
0.78	22.2	-33.8	56.0	5.5	-40.5	46.0
0.82	21.9	-34.1	56.0	6.4	-39.6	46.0
0.92	31.4	-24.6	56.0	15.4	-30.6	46.0
1.365	34.7	-21.3	56.0	16.3	-29.7	46.0
2.995	34.5	-21.5	56.0	15.7	-30.3	46.0
3.97	38.7	-17.3	56.0	19.5	-26.5	46.0
4.445	40.3	-15.7	56.0	25.8	-20.2	46.0
5.475	42.1	-17.9	60.0	25.1	-24.9	50.0
6.16	39.0	-21.0	60.0	23.9	-26.1	50.0
7.83	39.2	-20.8	60.0	22.8	-27.2	50.0
8.74	39.3	-20.7	60.0	24.2	-25.8	50.0
9.175	40.3	-19.7	60.0	26.2	-23.8	50.0
11.78	40.3	-19.7	60.0	29.2	-20.8	50.0
29.395	23.1	-36.9	60.0	19.4	-30.6	50.0

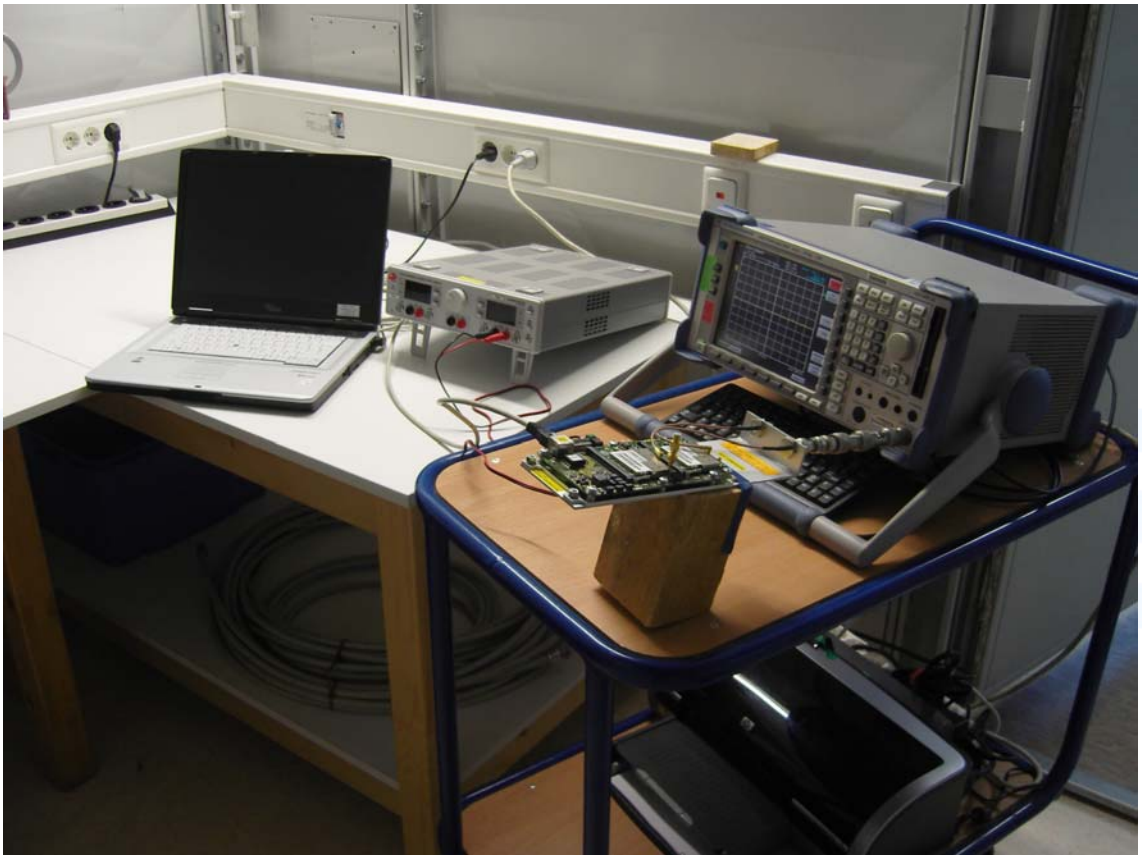
5.2 26 dB emission bandwidth

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

5.2.1 Description of the test location

Test location: AREA4

5.2.2 Photo documentation of the test set-up



5.2.3 Applicable standard

According to FCC Part 15E, Section 15.407(a), (1):
The emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum of the modulated carrier.

5.2.4 Description of Measurement

The bandwidth was 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 of the signal observed from the transmitter frequency.

Spectrum analyzer settings:
RBW: 300 kHz
VBW: 1 MHz
Detector: Peak

5.2.5 Test result

Channel number	Center frequency (MHz)	26 dB bandwidth (MHz)
36	5180	25.0
40	5200	23.9
48	5240	23.8

The requirements are **FULFILLED.**

Remarks: The EBW of the EuT was measured and compared to the original filing.

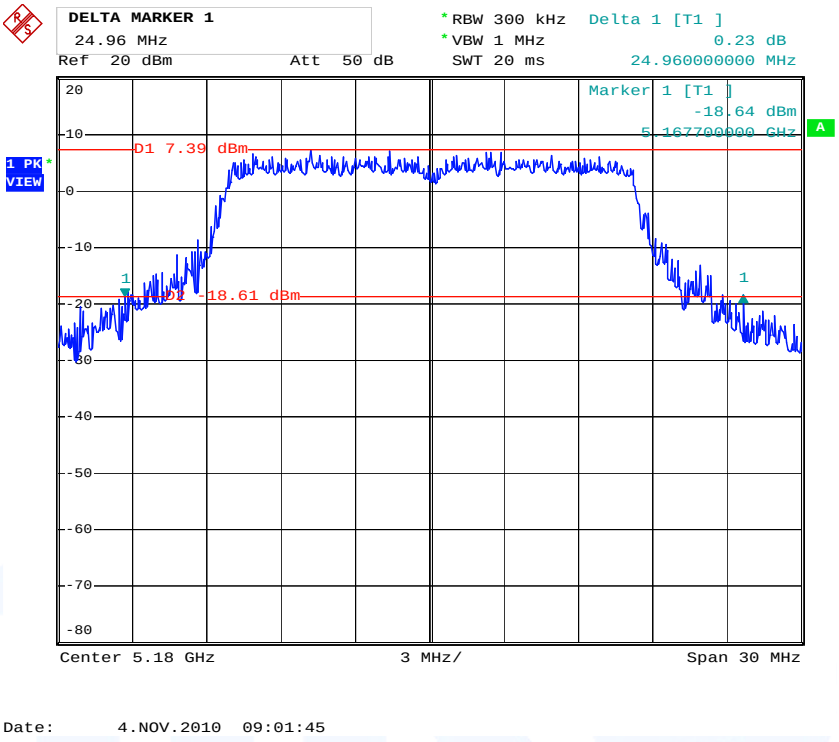
Addition of new antennas would not change previous results.

For detailed test results please refer to following test protocols.

5.2.6 Test protocol

26dB Bandwidth Measurement plots

Channel 36 (5180 MHz)



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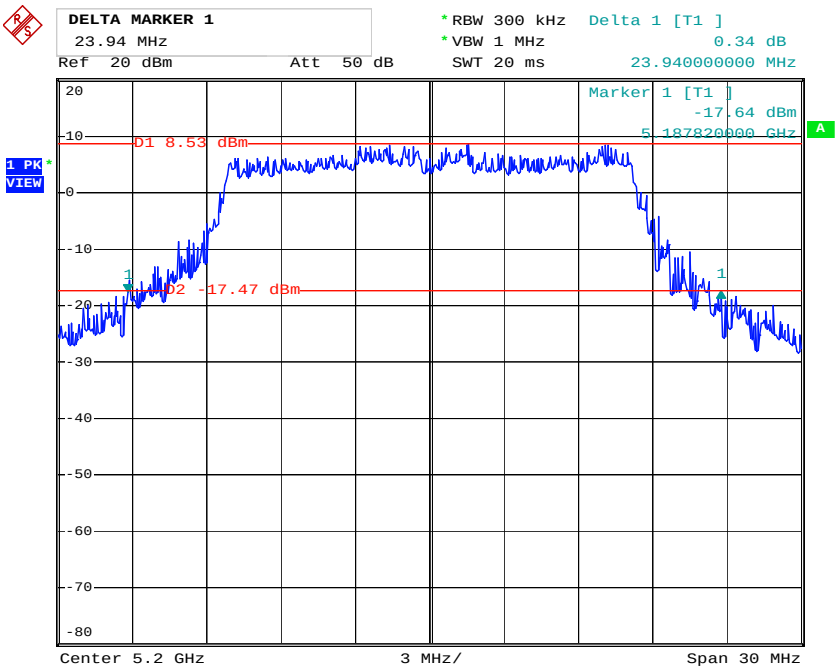
Channel 40 (5200 MHz)



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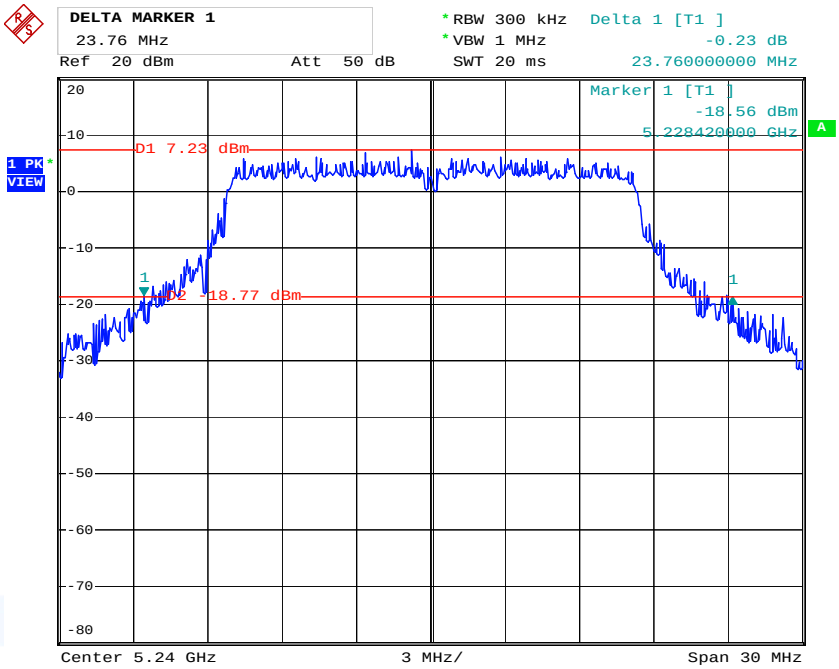
Channel 48 (5240 MHz)



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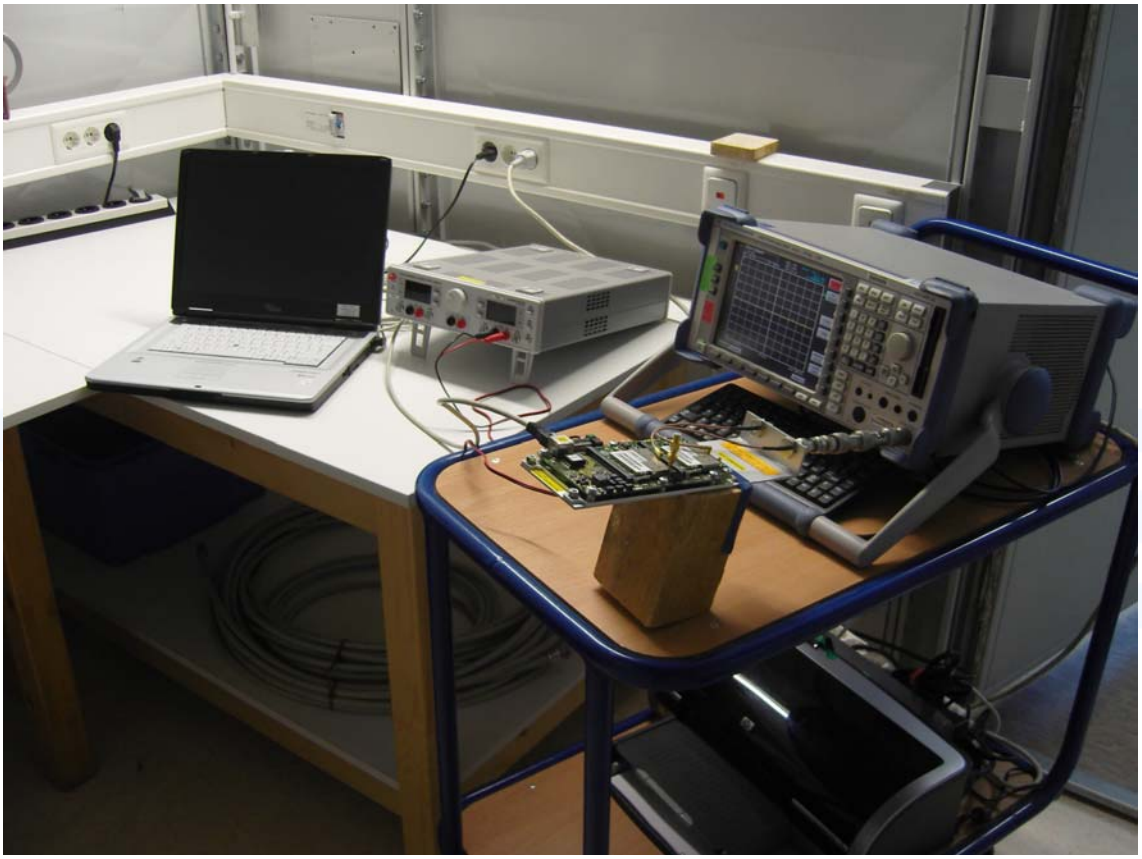
5.3 Maximum conducted output power

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

5.3.1 Description of the test location

Test location: AREA4

5.3.2 Photo documentation of the test set-up



5.3.3 Applicable standard

According to FCC Part 15E, Section 15.407(a):
The maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm+10 log B, where B is the 26 dB emission bandwith in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.3.4 Description of Measurement

The transmitter output was connected to the spectrum analyzer. The center frequency of the spectrum analyzer is set to the carrier center frequency. The span of the spectrum analyser should be larger than the power envelope of the emission bandwidth (EBW). To get the total power of the occupied bandwidth the function “Channel Power Measurement” of the analyzer has been used. The channel bandwidth has been set to EBW. With AV detector and Power Mode Max Hold the result is the average output power inside the EBW.

Spectrum analyzer settings:
RBW: 1 MHz
VBW: 300 kHz
Detector: AV
Power mode: Max. hold

5.3.5 Test result

CH	Frequency (MHz)	Power settings (dBm)	Measured power (dBm)	Correction (dB)	Antenna gain (dBi)	EIRP (dBm)	EIRP limit (dBm)	Delta (dB)
36	5180	18	16.2	---	0.0	16.2	23	-6.8
		18	16.2	---	2.0	18.2	23	-4.8
		18	16.2	---	3.7	19.9	23	-3.1
40	5200	18	16.3	---	0.0	16.3	23	-6.7
		18	16.3	---	2.0	18.3	23	-4.7
		18	16.3	---	3.7	20.0	23	-3.0
48	5240	18	16.8	---	0.0	16.8	23	-6.2
		18	16.8	---	2.0	18.8	23	-4.2
		18	16.8	---	3.7	20.5	23	-2.5

Note: No Correction necessary. EuT is direct connected to measurement equipment.

Supplied antennas:

- Nahfeldkoppler: 3.7 dBi
- TW-145: 2.0 dBi
- Koppler: 0 dBi

Peak power limit according to FCC Part 15E, Section 15.407(a):

Frequency	Conducted power limit		EIRP limit
(GHz)	(dBm)	(mW)	(dBm)
5.150 - 5.250	17	50	23
	or 4 + 10 log *EBW*		

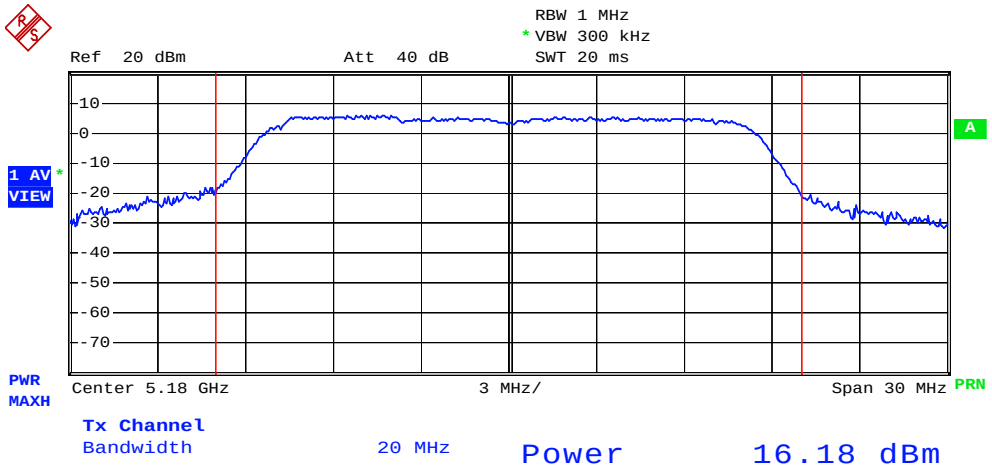
The requirements are **FULFILLED.**

Remarks: The output power of the EuT was measured and compared to the original filing.

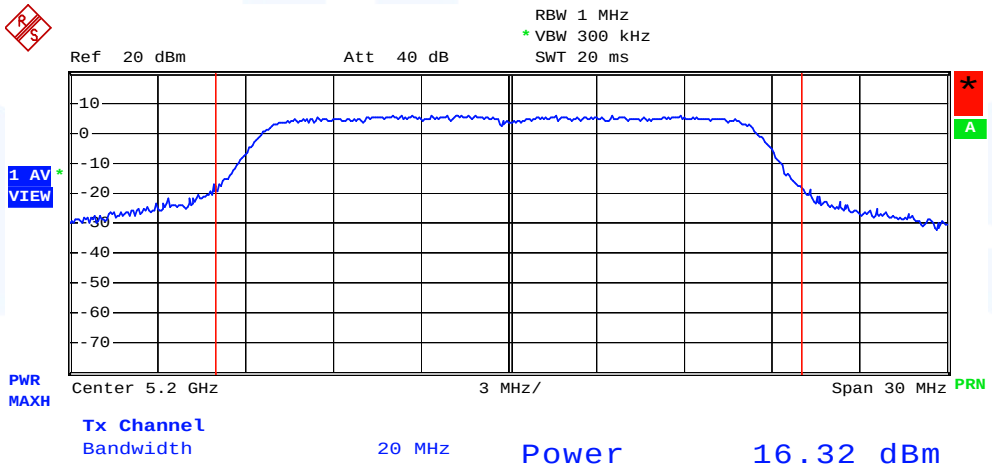
Addition of new antennas would not change previous results.

Plots of output power

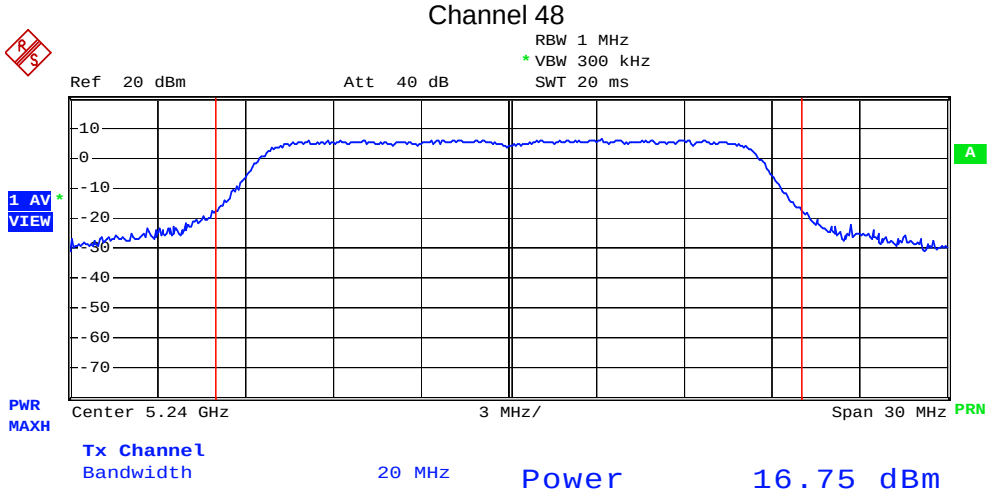
Channel 36



Channel 40



Channel 48



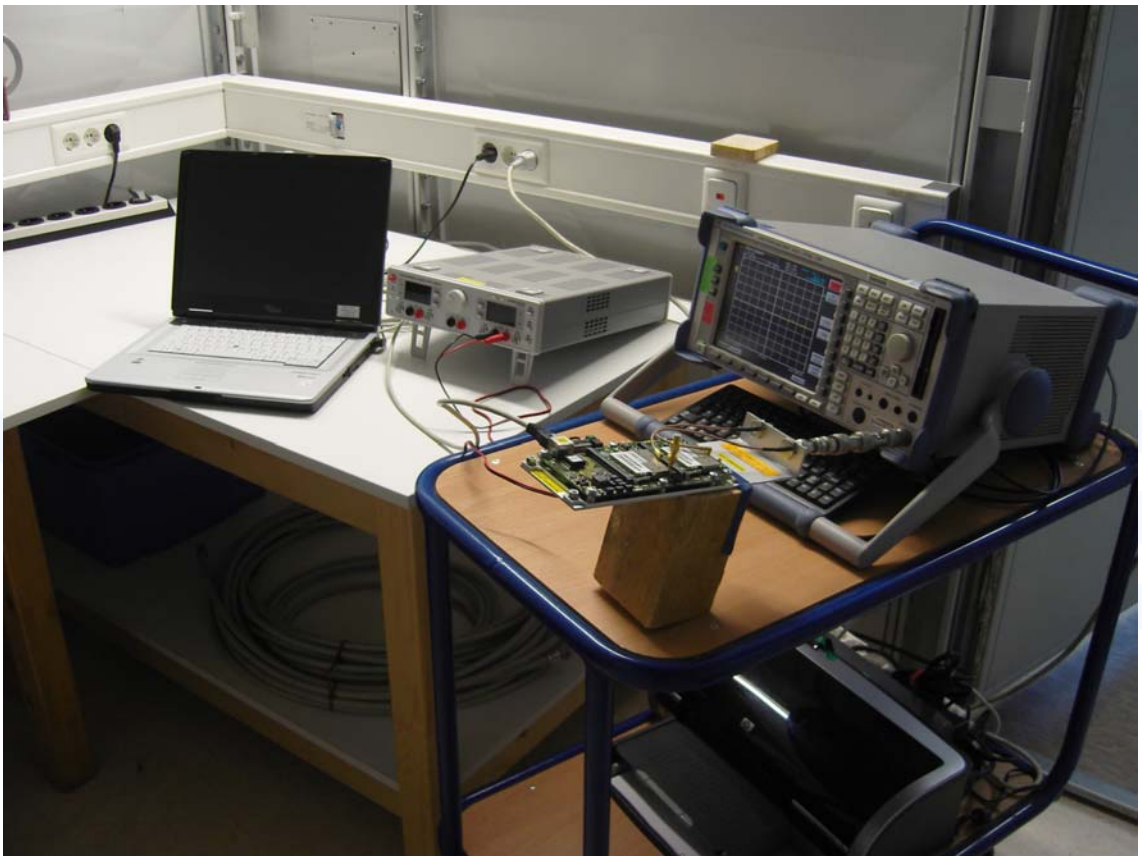
5.4 Peak power spectral density

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

5.4.1 Description of the test location

Test location: AREA 4

5.4.2 Photo documentation of the test set-up



5.4.3 Applicable standard

According to FCC Part 15E, Section 15.407(a):
For the defined operating bands the peak power spectral density conducted from the intentional radiator to the antenna shall not exceed 4 dBm in any 1 MHz band during any time interval of continuous transmission. If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.4.4 Description of Measurement

The EuT was connected to the spectrum analyzer trough a suitable attenuator. The peak power spectral density was measured using the analyser function of measuring the power of the emission band (dBm/Hz) and the same settings like the power measuring. The result is calculated by adding a bandwidth correction factor of 60 dB (10 log 1 MHz/Hz) to the analyser reading.

Spectrum analyser settings:
RBW: 1 MHz,
VBW: 3 MHz,
Detector function: AV

5.4.5 Test result

Channel	Center frequency (MHz)	Reading (dBm/Hz)	1 MHz Correction (dB Hz/MHz)	PPSD (dBm/MHz)	Limit (dBm/MHz)
36	5180	-57.5	60	2.5	4
40	5200	-56.1	60	3.9	4
48	5240	-58.1	60	1.9	4

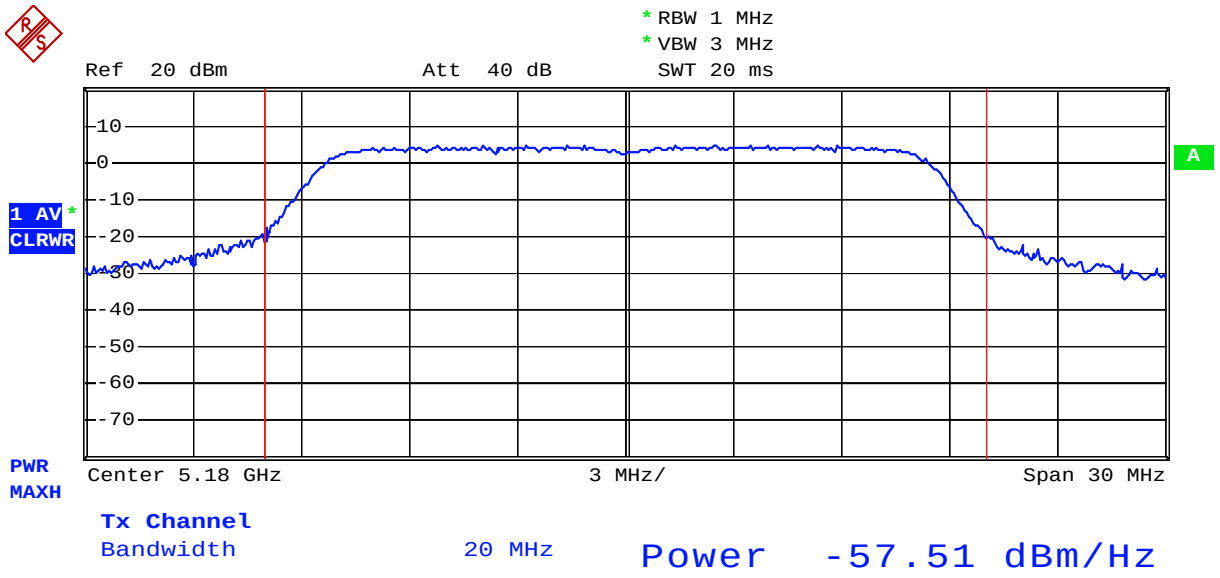
The requirements are **FULFILLED.**

Remarks: The PPSD of the EuT was measured and compared to the original filing.

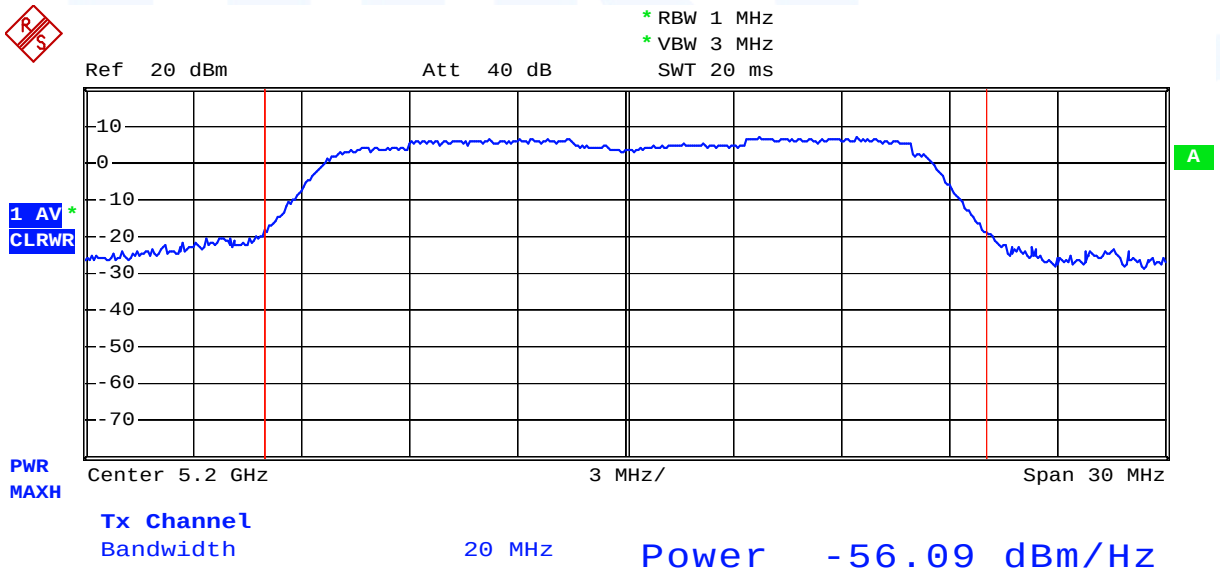
Addition of new antennas would not change previous results.

5.4.5.1 Peak Power spectral density plots

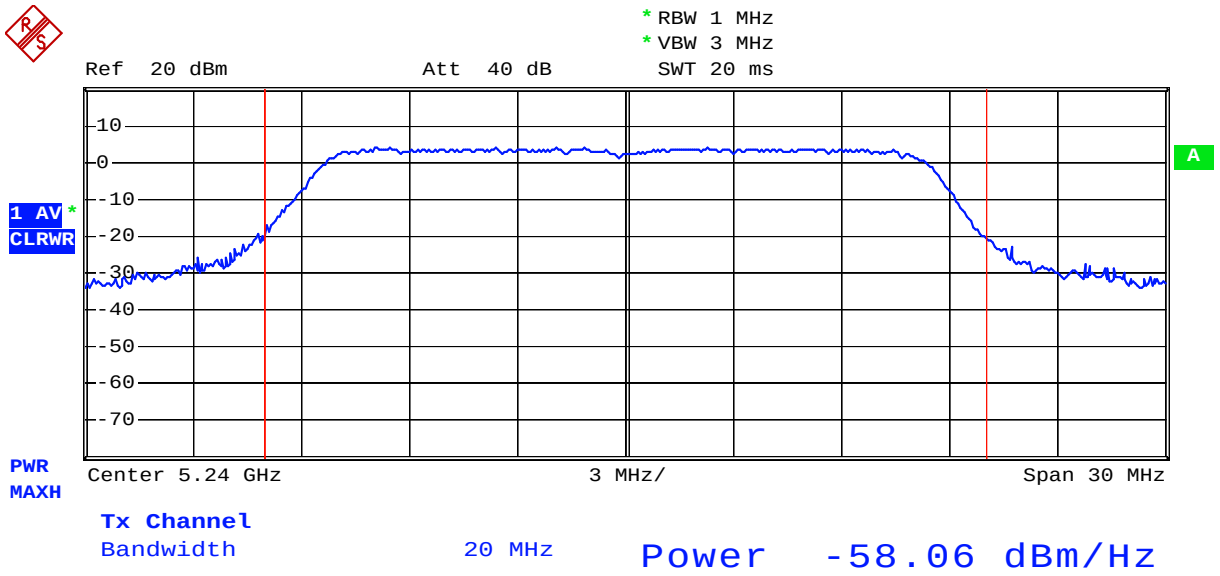
Channel 36 (5180 MHz)



Channel 40 (5200 MHz)



Channel 48 (5240 MHz)



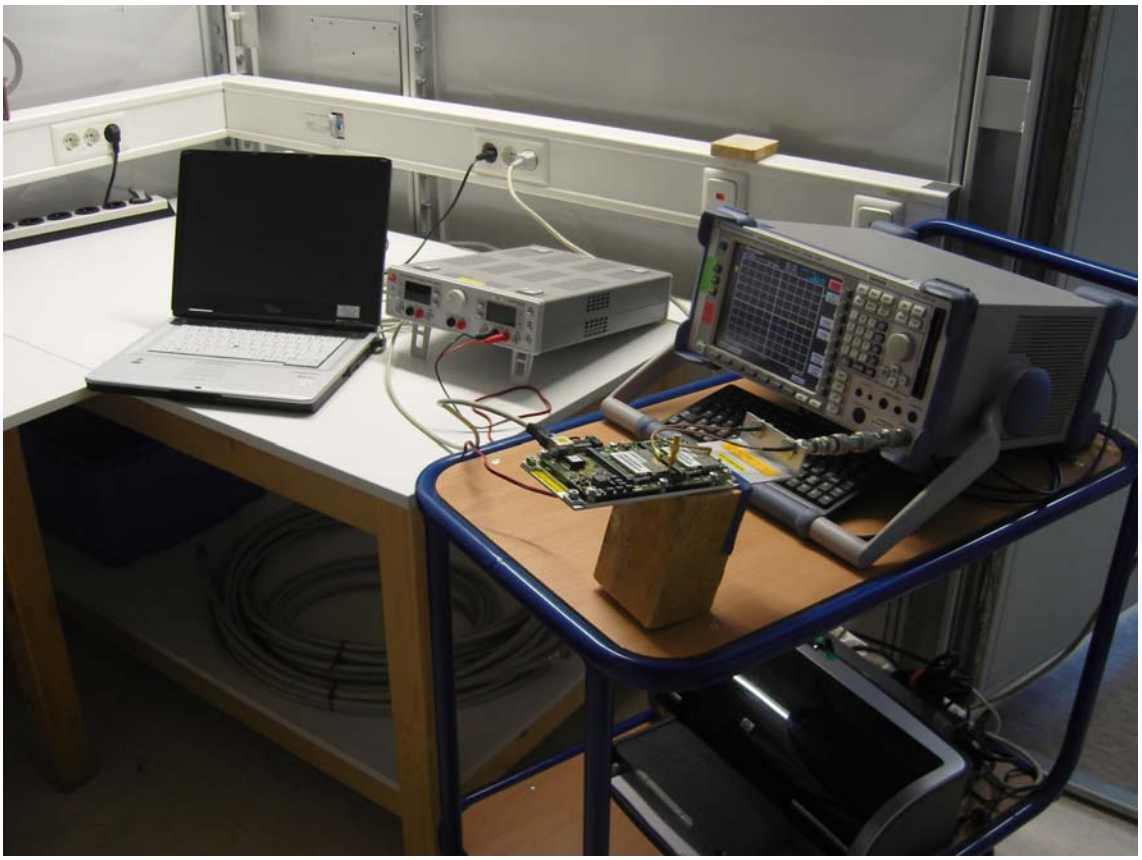
5.5 Peak excursion

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

5.5.1 Description of the test location

Test location: AREA 4

5.5.2 Photo documentation of the test set-up



5.5.3 Applicable standard

According to FCC Part 15E, Section 15.407(a)(6):
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

5.5.4 Description of Measurement

The transmitter output was connected to the spectrum analyzer. Using peak detector and “MAX HOLD” function for Trace 1 with 1 MHz RBW and 3 MHz VBW and Trace 2 with 1 MHz RBW and 300 kHz VBW both traces were recorded. The largest difference between Trace 1 and Trace 2 in any 1 MHz band was noted as maximum *Peak Excursion* value.

5.5.5 Test result

Channel	Frequency	Peak Power Excursion	Peak to Average Excursion Limit	Delta
	(MHz)	(dBm)	(dBm)	(dB)
36	5180	9.4	13	-3.6
40	5200	10.1	13	-2.9
48	5240	10.2	13	-2.8

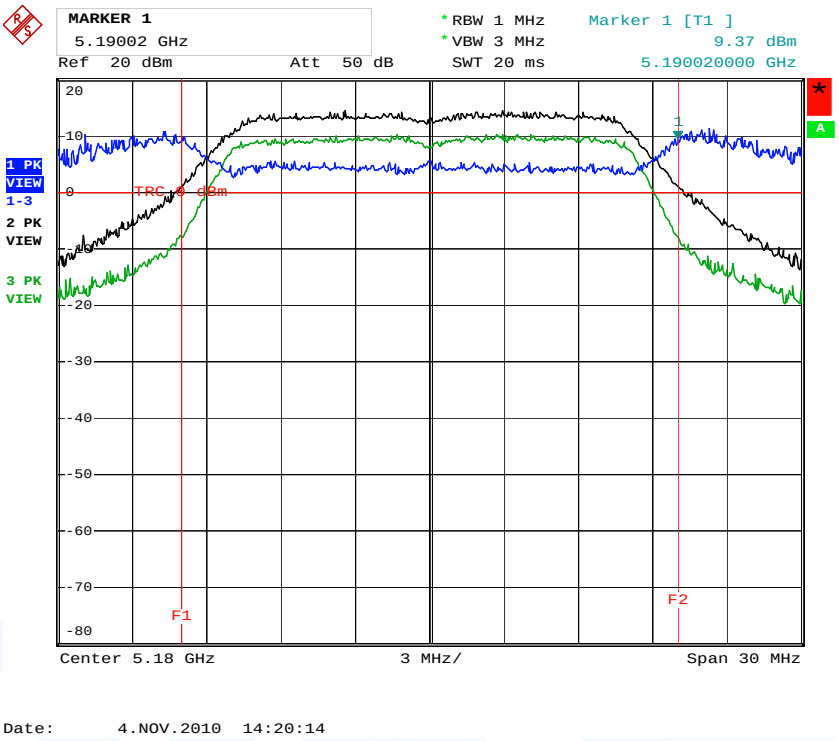
The requirements are **FULFILLED.**

Remarks: The Peak excursion of the EuT was measured and compared to the original filing.

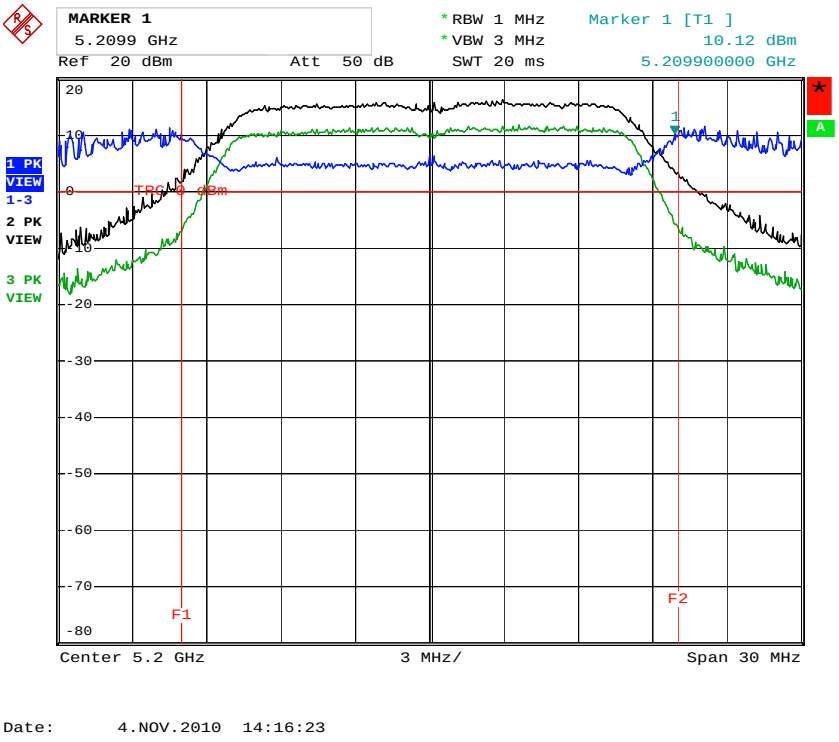
Addition of new antennas would not change previous results.

5.5.5.1 Peak excursion plots

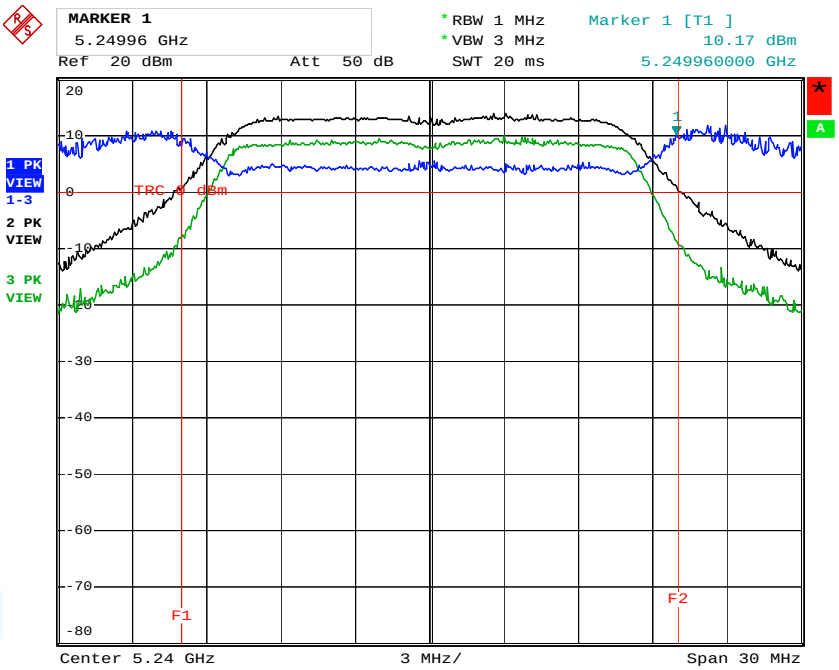
Channel 36 (5180 MHz)



Channel 40 (5200 MHz)



Channel 48 (5240 MHz)



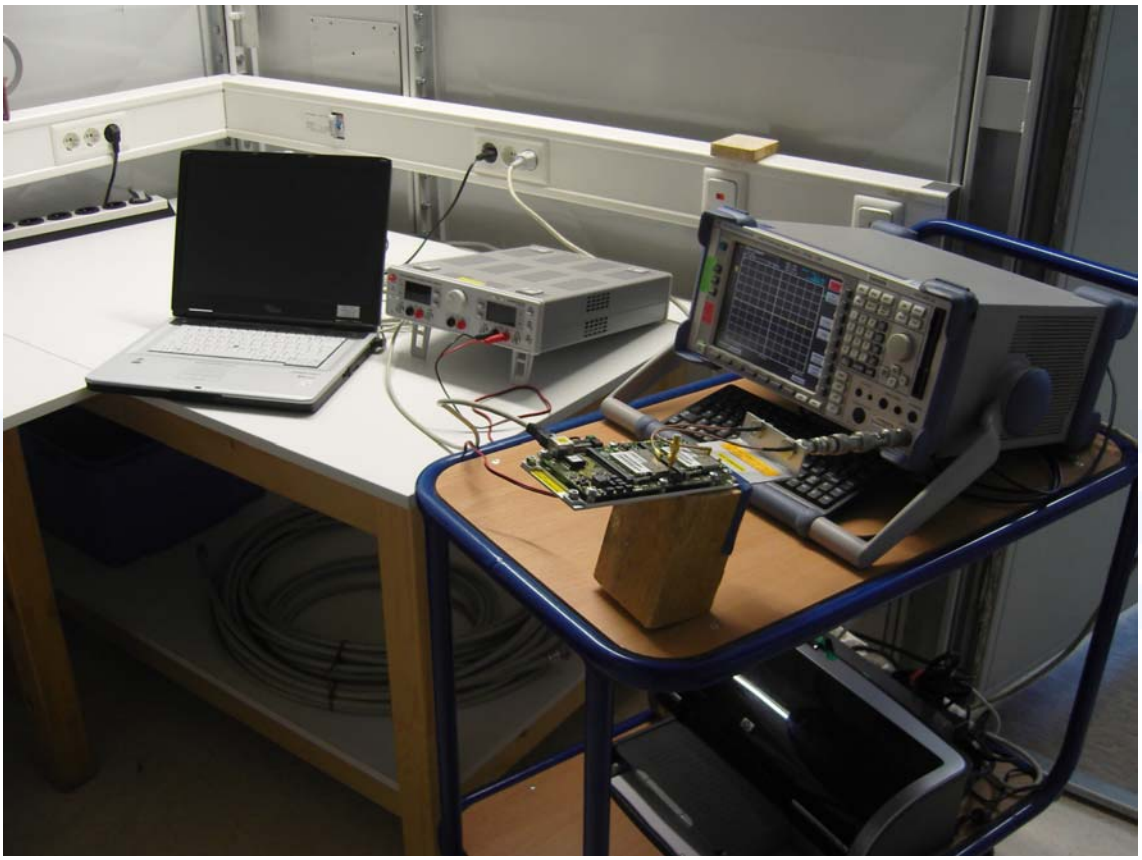
5.6 Maximum permissible exposure (MPE)

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

5.6.1 Description of the test location

Test location: AREA 4

5.6.2 Photo documentation of the test set-up



5.6.3 Applicable standard

According to FCC Part 15, Section 15.407(f):
U-NII devices are subject to the radio frequency radiation exposure requirements specified in Section 1.1307(b), 2.1091 and 2.1093 of this chapter, as appropriate. All equipment shall considered to operate in a “general population/uncontrolled” environment. The test methods used comply with ANSI/IEEE C95.1-2005, “IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”.

5.6.4 Description of Measurement

The maximum total power input to the antenna has been measured conducted as described in clause 5.3 of this document. Through the Friis transmission formula, which is a far field assumption and the known maximum gain of the antenna, the maximum MPE at a defined distance away from the product, can be calculated.

Friis transmission formula: $$P_d = \frac{P_{out} * G}{4 * \Pi * r^2}$$

where

P_d =power density in mW/cm^2
P_{out} = output power to antenna in mW
G = gain of antenna (linear scale)
r = distance between antenna and observation point (cm)

5.6.5 Test result

Worst case: Antenna Nahfeldkoppler with an antenna gain of 3.7 dBi, Power setting: 18 dBm

Channel No.	Frequency	Max power output to antenna		Antenna gain	Power density	Limit of power density
	(MHz)	(dBm)	(mW)	(dBi)	(mW/cm^2)	(mW/cm^2)
36	5180	16.2	41.7	3.7	0.019	1.0
40	5200	16.3	42.7	3.7	0.020	1.0
48	5240	16.8	47.9	3.7	0.022	1.0

Limits for maximum permissible exposure (MPE)

Frequency range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
(B) Limits for General Population / Uncontrolled Exposure				
0.3 – 3.0	614	1.63	100	30
3.0 – 30	824/f	2.19/f	180/ f^2	30
30 - 300	27.5	0.073	0.2	30
300-1500	---	---	f/1500	30
1500-100000	**---**	**---**	**1.0**	**30**

f = Frequency (MHz)

The requirements are **FULFILLED.**

Remarks: Addition of new antennas would not change previous results.

5.7 Co-location and Co-transmission

Applicable standard:
OET Bulletin 65, Edition 97-01, Section 2: Multiple-transmitter sites and complex environments

The MPE limits of FCC vary with frequency. Therefore, in mixed or broadband RF fields where several sources and frequencies are involved, the fraction of the recommended limit (in terms of power density or square of the electric or magnetic field strength) incurred within each frequency interval should be determined, and the sum of all fractional contributions should not exceed 1.0, or 100 % in terms of percentage.

1. WLAN Module 1 (2.4 GHz): P_d = 0.054 mW/cm^2
Limit: 1 mW/cm^2
Fraction of MPE: 5.4 %

2. WLAN Module 2 (5 GHz): P_d = 0.022 mW/cm^2
Limit: 1 mW/cm^2
Fraction of MPE: 2 %

The requirements are **FULFILLED.**

Remarks: Addition of new antennas would not change previous results.

For the results of the 2.4 GHz Module please refer to test report T34715-00-02AA.

5.8 Undesirable emissions

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

5.8.1 Description of the test location

Test location: Anechoic Chamber A2

Test distance: 3 metres

5.8.2 Photo documentation of the test set-up

Anechoic chamber

5.8.3 Applicable standard

According to FCC Part 15E, Section 15.407(b):
For transmitters operating in the defined bands shall not exceed the appropriate emission limit outside of the operating bands.
In addition, radiated emissions which fall in the restricted bands, as defined in Section15.205(a), must also comply with the radiated emission limit specified in Section15.209(a) (see Section15.205(c)).

5.8.4 Description of Measurement

Spurious emissions radiated by the EuT are measured with Spectrum Analyzer in Peak mode. If the peak level complies with the average limit, then testing will be stopped and peak values of the EuT will be reported, otherwise, the emission will be measured in average mode again and reported.

Spectrum analyzer settings for peak values:
RBW: 1 MHz,
VBW: 1 MHz,
Spectrum analyzer settings for average values:
RBW: 1 MHz,
VBW: 10 Hz,

5.8.5 Test result

5.8.5.1 Antenna: Nahfeldkoppler

Channel 36 (5180 MHz)

Frequency (MHz)	Detector	Analyzer reading hor dB(µV)	Analyzer reading vert dB(µV)	Correction (dB/m)	Result hor dB(µV/m)	Result vert dB(µV/m)	Limit dB(µV/m)	Delta (dB)
5149	Pk	<50	67.4	3.4	---	70.8	74	-3.2
	AV	<30	45.1	3.4	---	48.5	54	-5.5
5394	Pk	<50	49.4	4.0	---	53.4	74	-20.6
	AV	<30	<30	---	---	---	54	---
5441	Pk	<50	47.7	4.0	---	51.7	74	-22.3
	AV	<30	<30	---	---	---	54	---

Channel 48 (5240 MHz)

Frequency (MHz)	Detector	Analyzer reading hor dB(µV)	Analyzer reading vert dB(µV)	Correction (dB/m)	Result hor dB(µV/m)	Result vert dB(µV/m)	Limit dB(µV/m)	Delta (dB)
5120	Pk	<50	46.0	3.4	---	49.4	74	-24.6
	AV	<30	<30	---	---	---	54	---
5441	Pk	<50	48.1	4.0	---	52.1	74	-31.9
	AV	<30	<30	---	---	---	54	---

5.8.5.2 Antenna: TW-145

Channel 36 (5180 MHz)

Frequency (MHz)	Detector	Analyzer reading hor dB(µV)	Analyzer reading vert dB(µV)	Correction (dB/m)	Result hor dB(µV/m)	Result vert dB(µV/m)	Limit dB(µV/m)	Delta (dB)
5149	Pk	<50	64.6	3.4	---	68.0	74	-6.0
	AV	<30	44.3	3.4	---	47.7	54	-6.3
5400	Pk	<50	52.2	4.0	---	56.2	74	-17.8
	AV	<30	39.6	4.0	---	43.6	54	-10.4

Channel 48 (5240 MHz)

Frequency (MHz)	Detector	Analyzer reading hor dB(µV)	Analyzer reading vert dB(µV)	Correction (dB/m)	Result hor dB(µV/m)	Result vert dB(µV/m)	Limit dB(µV/m)	Delta (dB)
5143	Pk	<50	49.1	3.4	---	52.5	74	-21.5
	AV	<30	<30	---	---	---	54	---
5440	Pk	<50	52.0	4.0	---	56.0	74	-18.0
	AV	<30	39.8	4.0	---	43.8	54	-10.2

5.8.5.3 Antenna: <u>Koppler</u>

Channel 36 (5180 MHz)

Frequency (MHz)	Detector	Analyzer reading hor dB(µV)	Analyzer reading vert dB(µV)	Correction (dB/m)	Result hor dB(µV/m)	Result vert dB(µV/m)	Limit dB(µV/m)	Delta (dB)
5149	Pk	<50	65.1	3.4	---	68.5	74	-5.5
	AV	<30	44.9	3.4	---	46.3	54	-7.7
5388	Pk	<50	46.5	4.0	---	50.5	74	-23.5
	AV	<30	<30	---	---	---	54	---

Channel 48 (5240 MHz)

Frequency (MHz)	Detector	Analyzer reading hor dB(µV)	Analyzer reading vert dB(µV)	Correction (dB/m)	Result hor dB(µV/m)	Result vert dB(µV/m)	Limit dB(µV/m)	Delta (dB)
5120	Pk	<50	46.5	3.4	---	49.9	74	-24.6
	AV	<30	33.9	3.4	---	37.3	54	-16.7
5440	Pk	<50	43.9	4.0	---	47.9	74	-26.1
	AV	<30	36.1	4.0	---	40.1	54	-13.9

Limits for emissions from an intentional radiator according to FCC Part 15C, Section 15.209(a):

Frequency	Field strength of spurious emissions		Measurement distance
(MHz)	(µV/m)	dB(µV/m)	(metres)
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:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	Above 38.6

The requirements are **FULFILLED.**

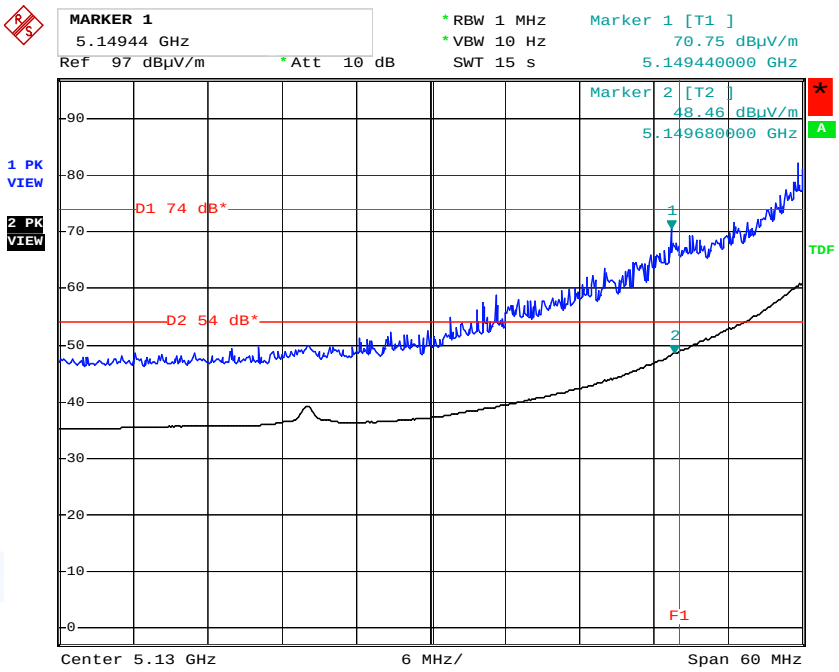
Remarks: The measurement was performed up to the 10th harmonic.

Conducted spurious emissions are not included in this permissive change.

5.8.6 Plots of radiated emissions in restricted bands and harmonics.

5.8.6.1 Antenna: Nahfeldkoppler

Channel 36 (5180 MHz)



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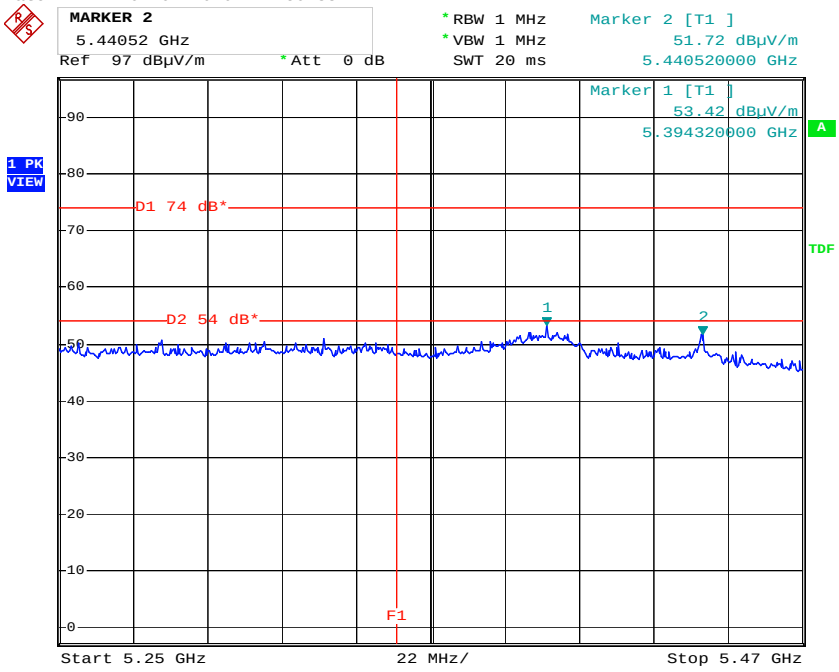

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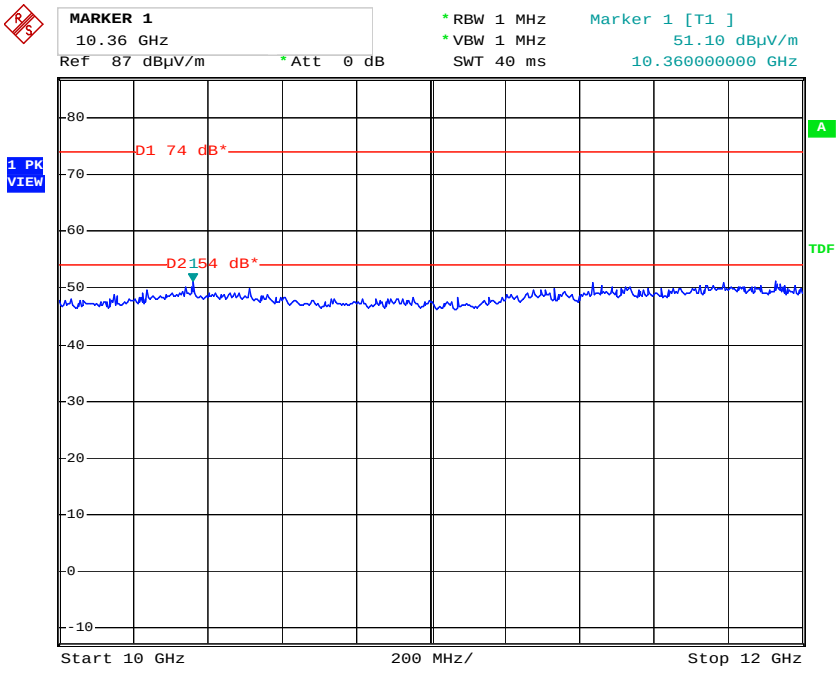

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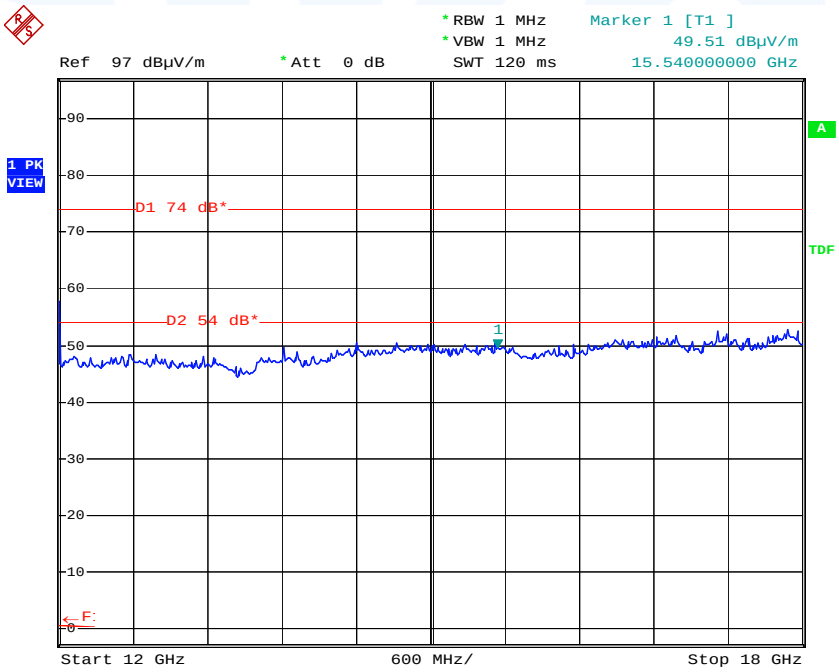
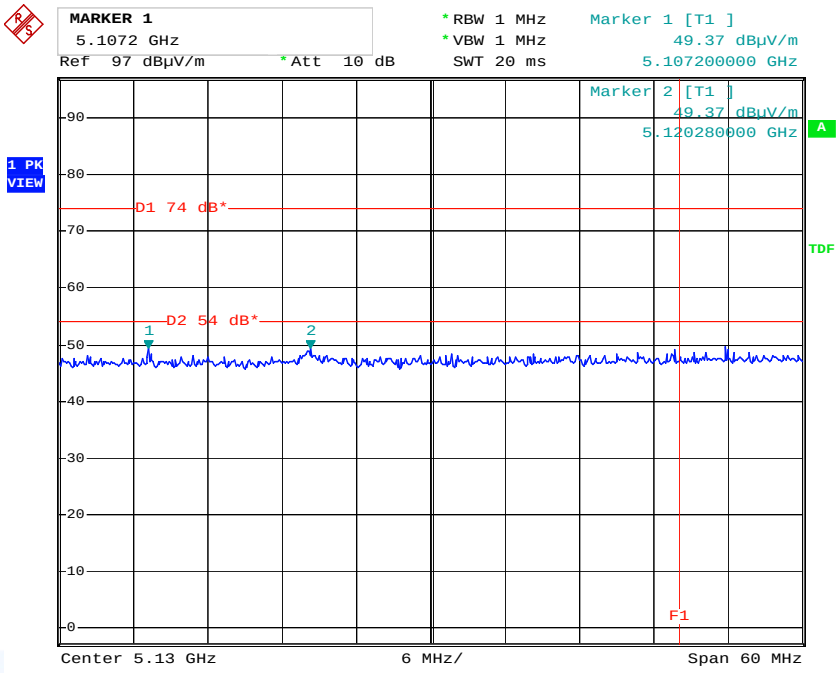


Date: 16.NOV.2010 14:37:07

Channel 48 (5240 MHz)



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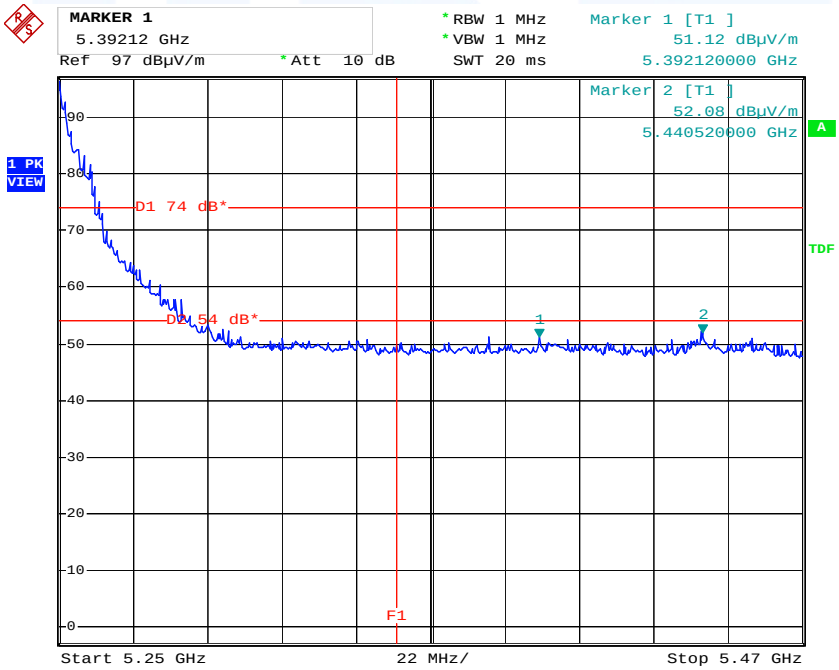

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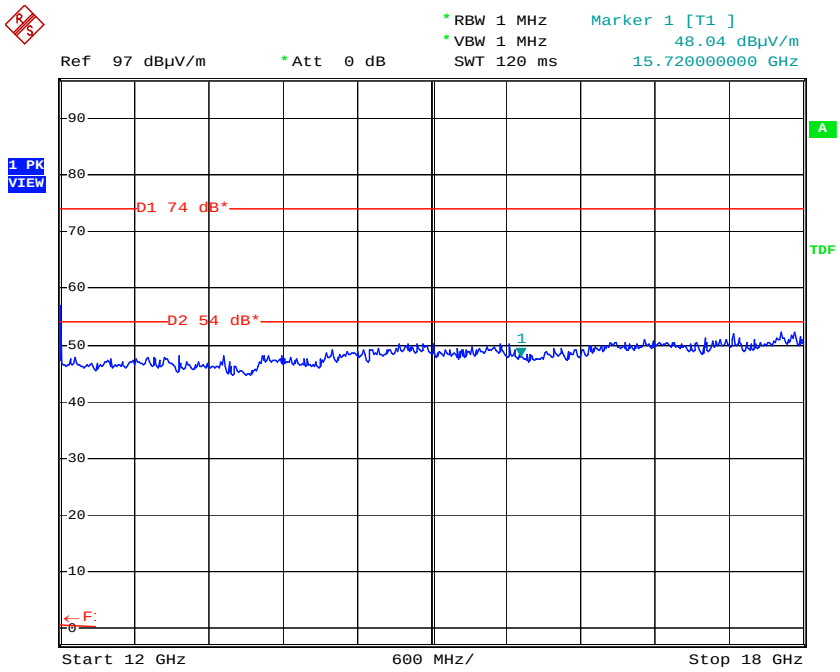
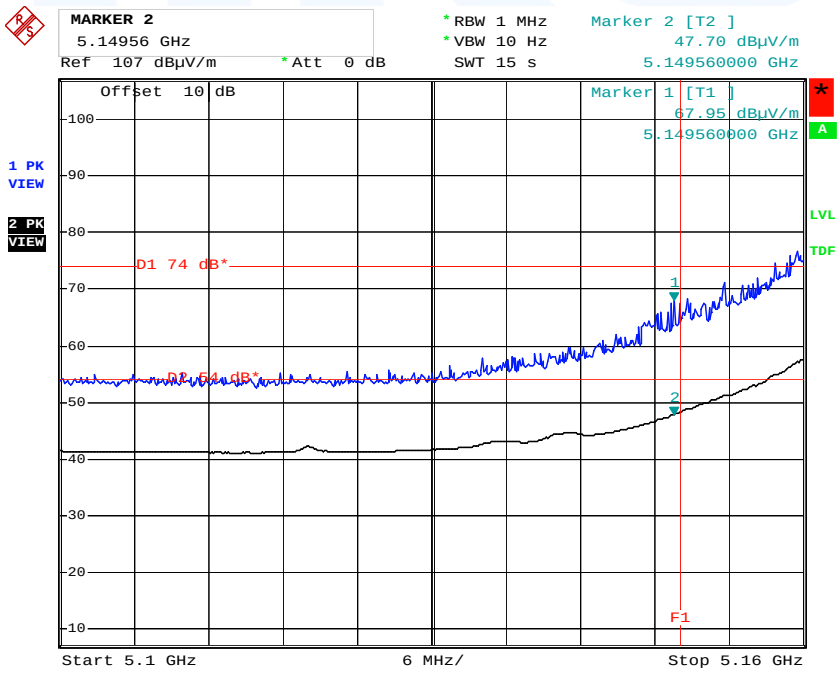


Date: 16.NOV.2010 14:35:45

5.8.6.2 Antenna: TW-145

Channel 36 (5180 MHz)



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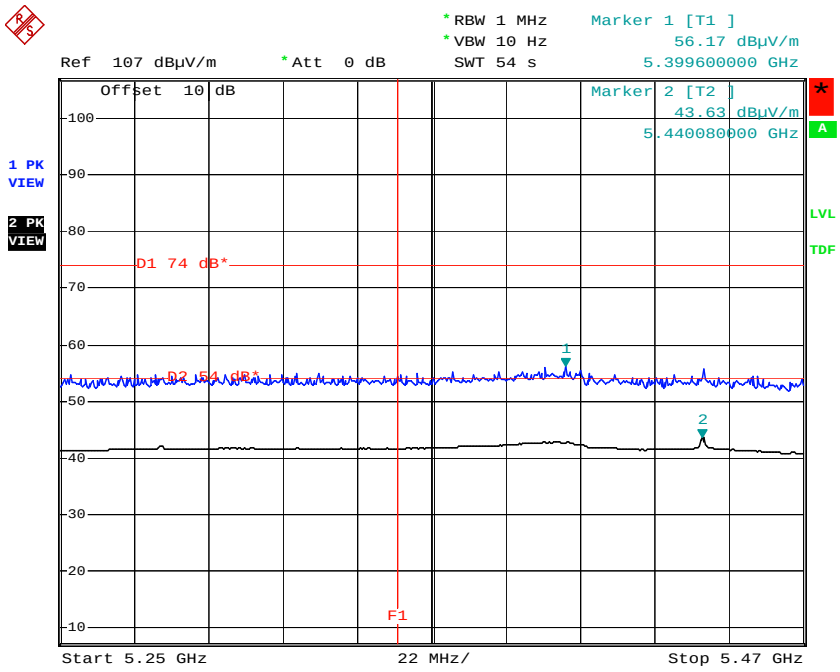

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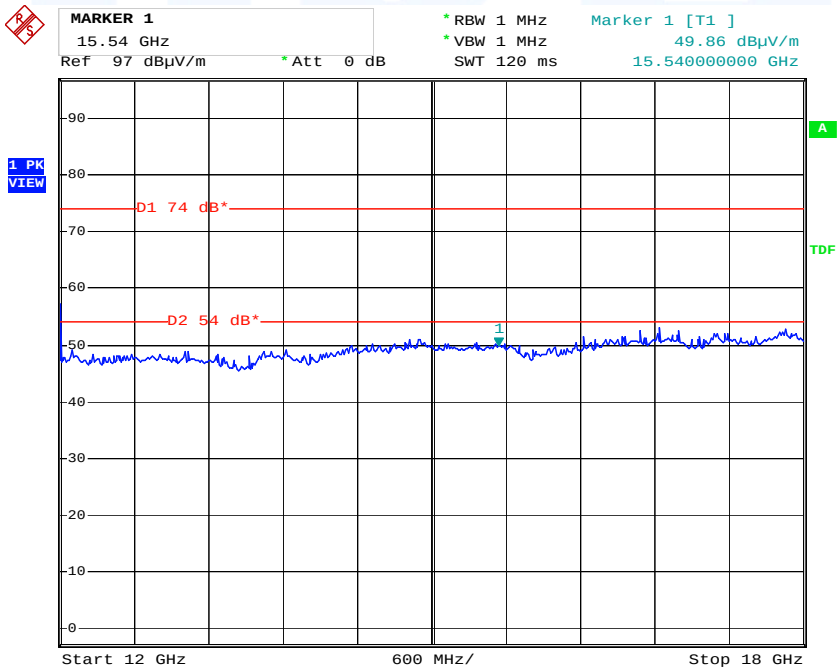
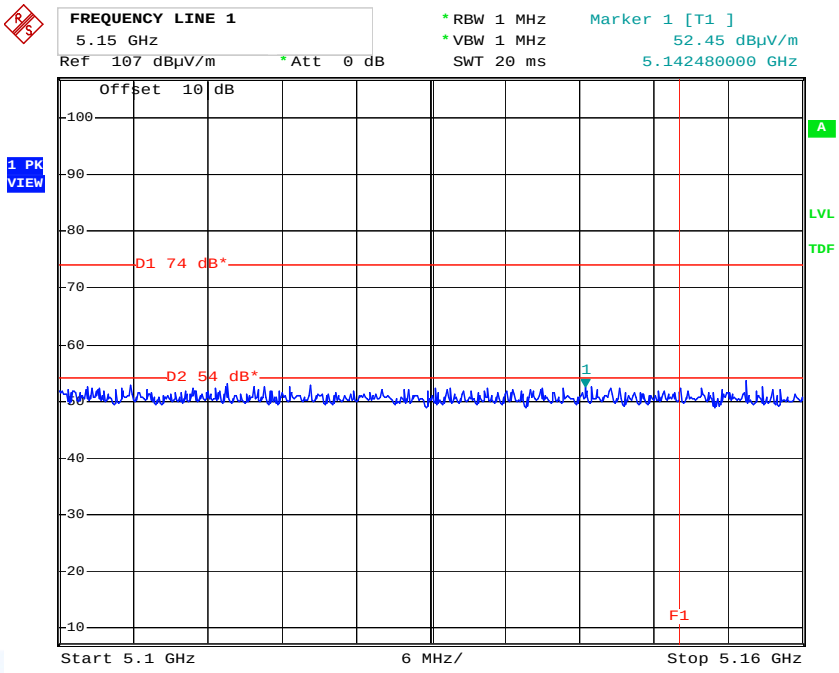


Date: 16.NOV.2010 16:27:35

FCC ID: VEB-NKRDCMA82

Channel 48 (5240 MHz)



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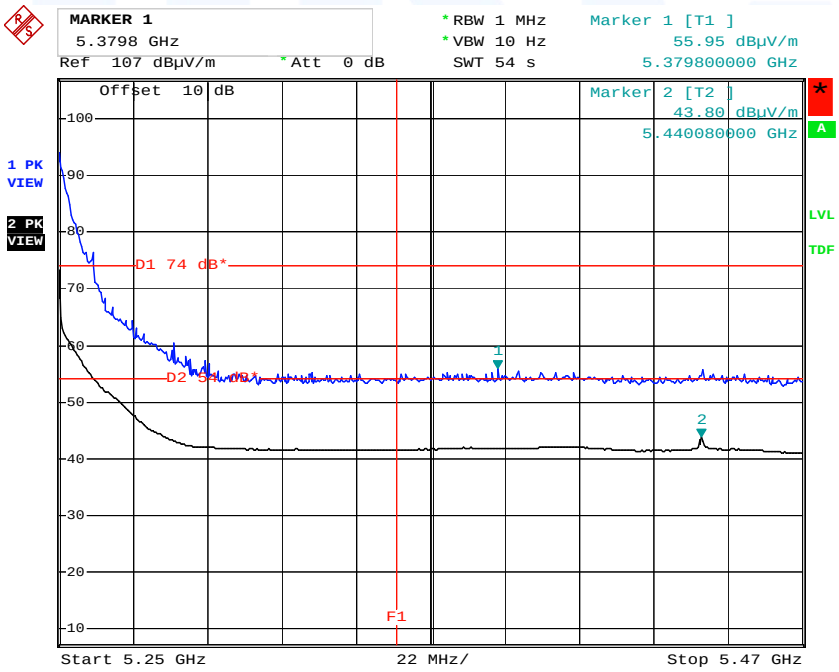

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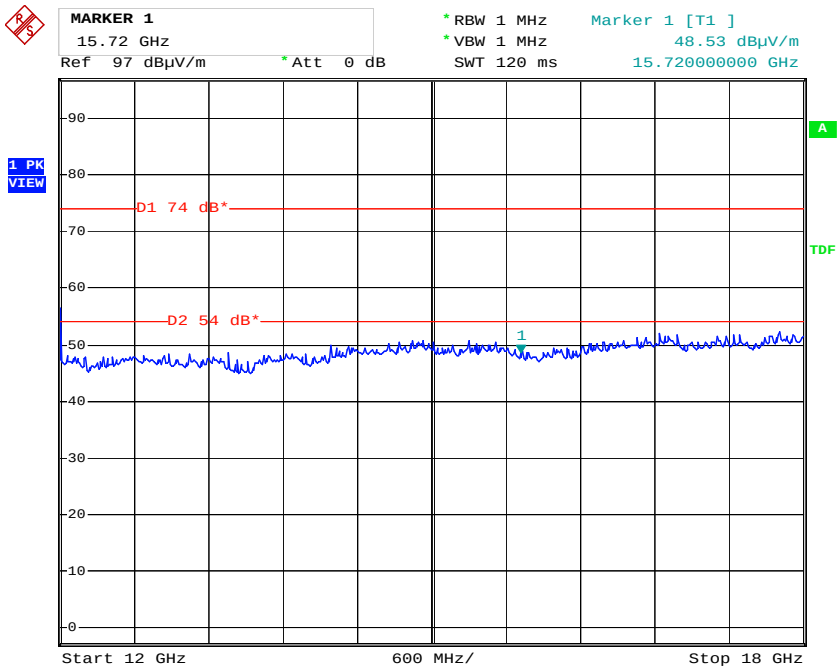

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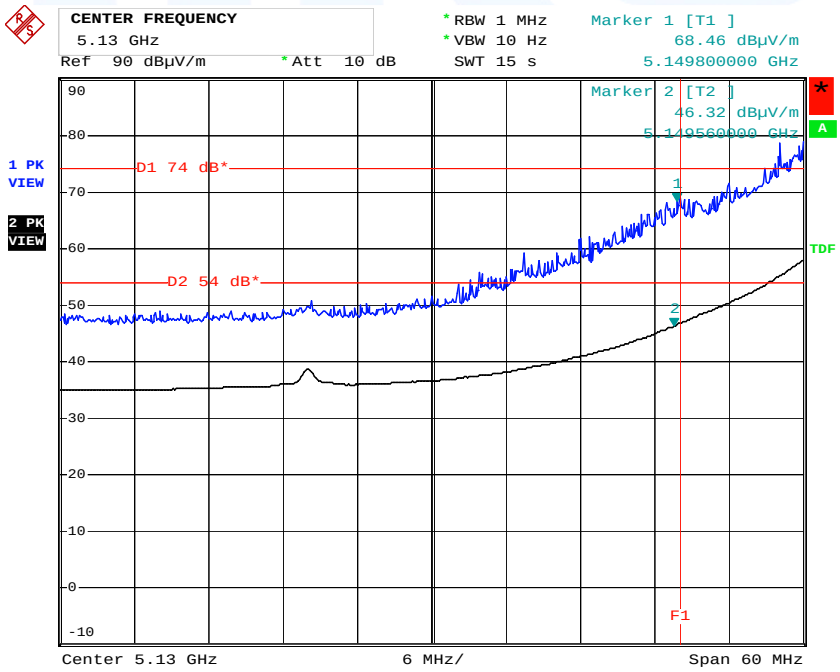
5.8.6.3 Antenna: Koppler

Channel 36 (5180 MHz)



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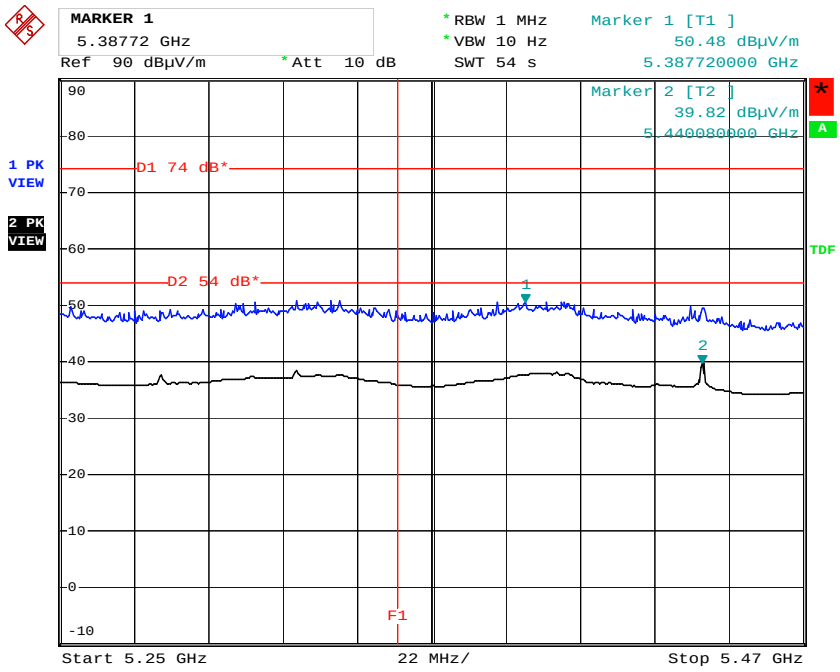

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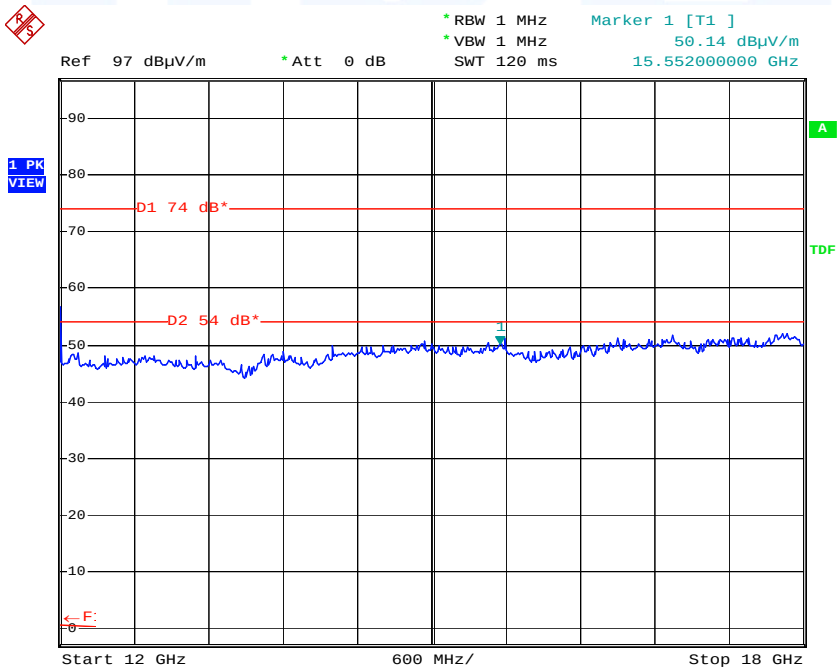
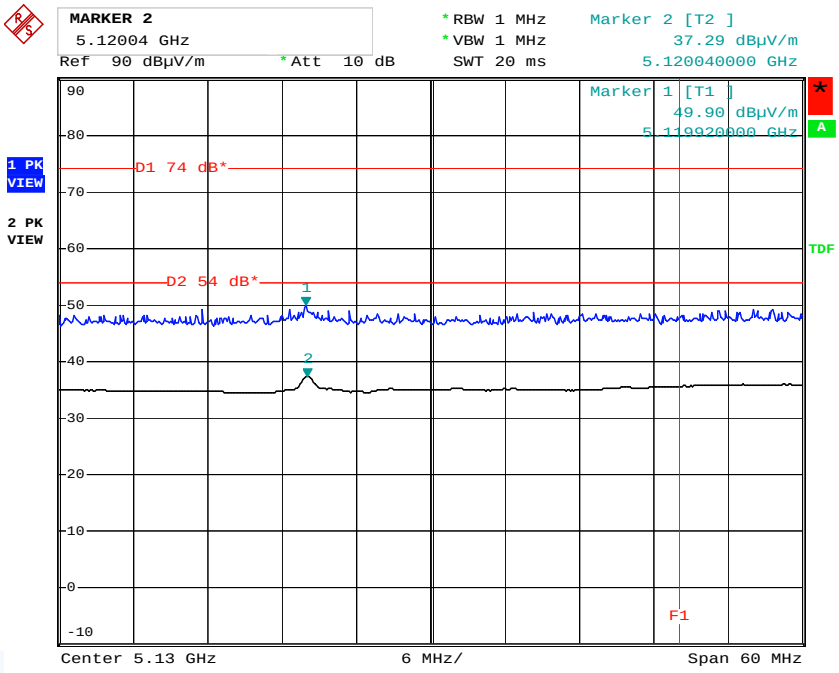


Date: 16.NOV.2010 14:31:30

FCC ID: VEB-NKRDCMA82

Channel 48 (5240 MHz)



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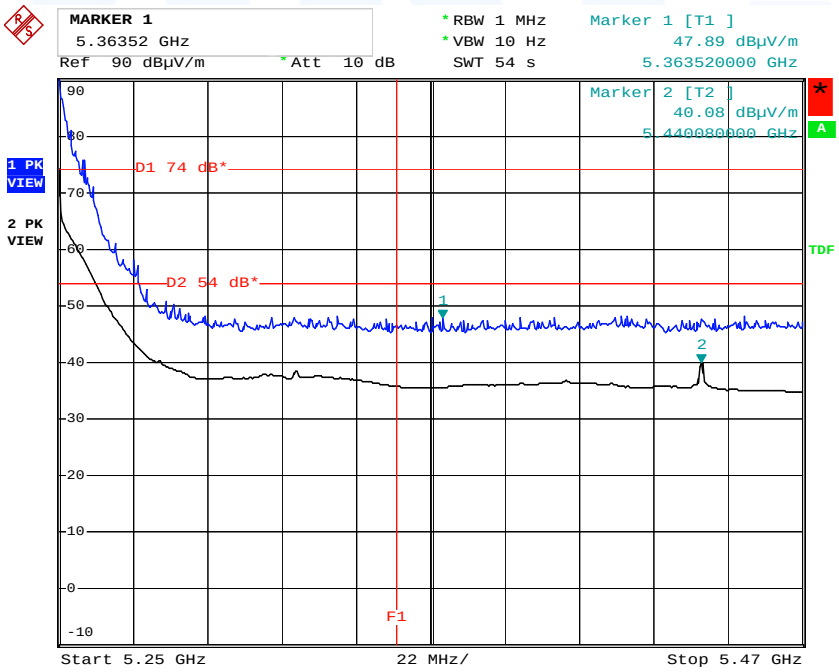
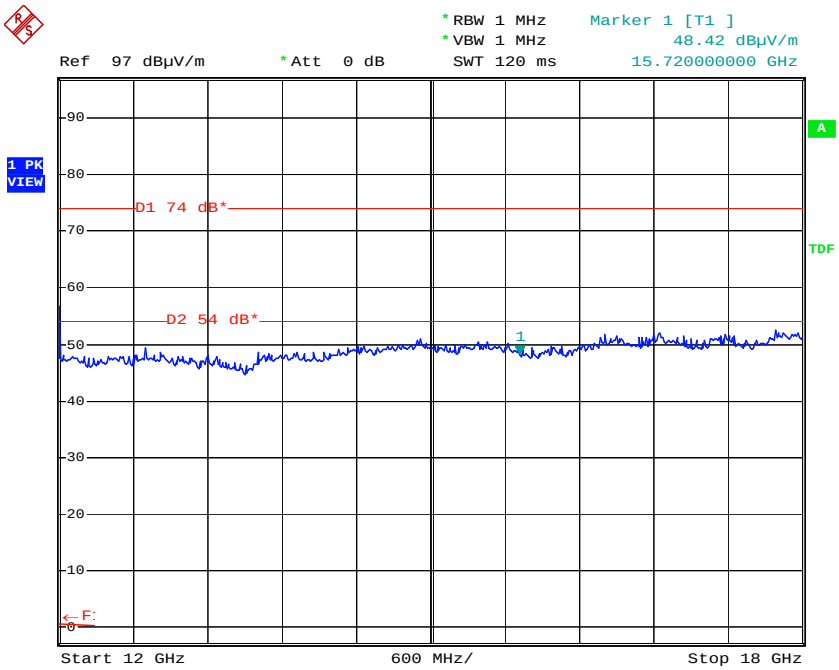


Date: 16.NOV.2010 14:17:41



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5.9 Antenna application - Detailed photos see attachment B

5.9.1 Applicable standard

According to FCC Part 15C, Section 15.203:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The antennas are equipped with R-SMA connectors.
All supplied antennas meet the requirements of part 15.203 and 15.204.

5.9.2 Antenna requirements

According to FCC Part 15E, Section 15.407(a):
The conducted output power limit specified in paragraph (a) of 15.407 is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from intentional radiator shall be reduced below the stated values in paragraph (a)(1), (a)(2) and (a)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds the effective value.

5.9.3 Evaluation

The necessary reduction of the output power depends on the gain of the applied antenna. The reduction of the output power is implemented in the firmware of the EuT and will be automatically set by selecting the applied antenna type.

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	ESHS 30	02-02/03-05-002	18/06/2011	18/06/2010		
	ESH 2 - Z 5	02-02/20-05-004	13/03/2011	13/03/2008	22/06/2011	22/12/2010
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2	02-02/50-05-155			07/04/2011	07/10/2010
CPC 3	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
	HM8143	02-02/50-10-016				
MB	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
	HM8143	02-02/50-10-016				
SER 3	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
	AFS4-01000400-10-10P-4	02-02/17-05-003				
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	BBHA 9120 E 251	02-02/24-05-006			13/06/2011	13/12/2010
	WBH2-18HN	02-02/24-05-007				
	WLJS 3500-3EF	02-02/50-05-042				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	WHKX 7.5/18G-8SS	02-02/50-07-010				
	Multiflex 141-SMA-N-1500	02-02/50-09-015				
	Multiflex 141-SMA-N-1500	02-02/50-09-016				