Registration No. DAT-P-207/05

FCC ID: U9A277IWLAN-V200

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

- FCC Part 15.249 -

Test Report No. :	**T33234-03-00AA**	22. June 2009 Date of issue

Type / Model Name : SIMATIC Mobile Panel 277F IWLAN / 277 IWLAN

Product Description : Mobile Human Machine Interface

Applicant **:** Siemens AG, Industry Sector, IIA AS RD ST TT

Address : Werner-von-Siemens-Str. 50

92224 Amberg, Germany

Manufacturer **:** Siemens AG, Industry Sector, IIA AS FA HMI

Address : Gleiwitzer Str. 555

90475 Nürnberg, Germany

Licence holder **:** Siemens AG, Industry Sector, IIA AS RD ST TT

Address : Werner-von-Siemens-Str. 50

92224 Amberg, Germany

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

Deutscher Akkreditierungs Rat

DAT-P-207/05-00

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15 Subpart A - General (October, 2008)

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
Part 15, Subpart A, Section 15.38	Incorporation by reference

FCC Rules and Regulations Part 15 Subpart C - Intentional Radiators (October, 2008)

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 15.207	AC Line conducted emissions
Part 15, Subpart C, Section 15.209	Radiated emissions, general requirements
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

FCC Rules and Regulations Part 15 Subpart B - Unintentional Radiators (October, 2008)

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

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.

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	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C95.1:1992	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 1 WLAN miniPCI module and 1 Effective Range Module (Chirp 2.45 GHz) which measure the distance between Mobile Panel and accompanying Transponder.
The Effective Range Module is connected to an internal dual port patch antenna (gain=2.6 / 2.7 dBic).

The frequency range was scanned from 9 kHz to 25000 MHz. All emissions not reported in this test report are more than 20 dB below the specified limit.

The Mobile Panel 277F IWLAN offers the possibility of having the mobile safety functions of emergency stop and enable available at any point of a machine or plant. The 277 IWLAN doesn't have the safety function. Both are electronically identical however the 277 IWLAN is not equipped with the relevant parts necessary for the safety function.
All tests have been carried out with the full equipped 277F IWLAN Mobile Panel.

This test report describes only the assessment of the Effective Range Module in the 2.4 GHz frequency band.
The EuT has been measured in active transmitting mode. All measurements have been carried out radiated.

The receive mode is too short to be measured.

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 : 19. March 2009

Testing concluded on : 29. April 2009

Checked by:

Klaus Gegenfurtner
Ich bestätige die Richtigkeit und Integrität dieses Dokuments
2009.06.24 14:28:47 +02'00'

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

Tested by:

Anton Altmann
Ich bin der Verfasser dieses Dokuments
2009.06.24 08:45:07 +02'00'

Anton Altmann
Dipl.-Ing.(FH)

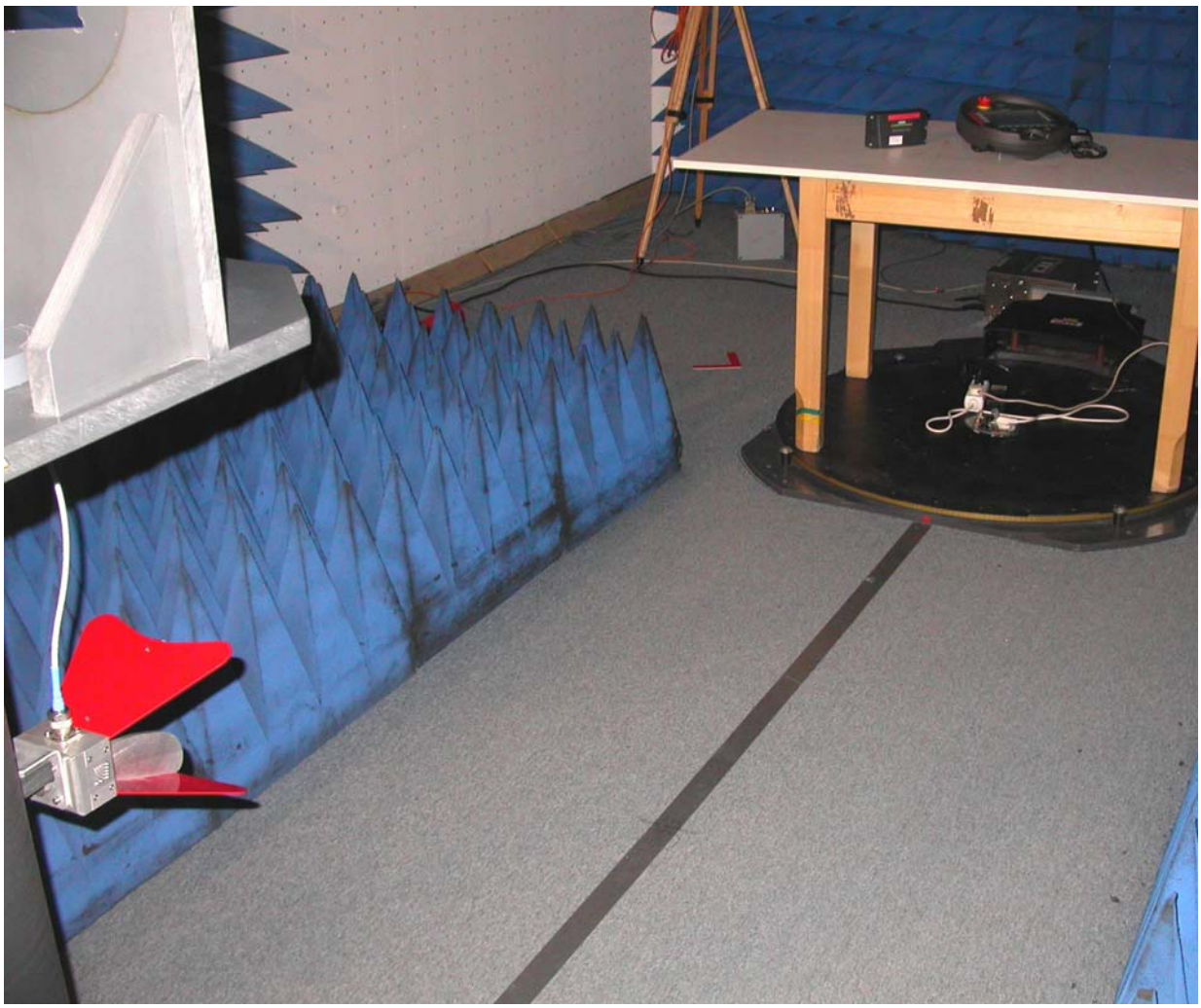
3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT – Please see attachment A

3.2 Power supply system utilised

Power supply voltage	:	7.2 V DC Battery
Power supply voltage (alternative)	:	Input: 110-240 V / 47-63 Hz / 1ϕ Power supply Output: +12 V DC

3.3 Test setup



3.4 Short description of the equipment under test (EUT)

The SIMATIC Mobile Panel 277 IWLAN / 277F IWLAN permits mobile operation at any point in the system. The HMI device communicates with the PLC via WLAN. The HMI device is equipped with a zone recognition function. The simple battery-powered operation and ergonomic design of the HMI device permit safe working with the Mobile Panel 277 IWLAN over extended periods. The operator can operate the system wireless at almost any location on the machine or system.

Number of tested samples: 1
Serial number: Prototype

EuT operation mode:

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

- Continuous transmitting 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:

-	AC/DC power supply	Model :	FAIRWAY Model: VE50-1200
-	Power supply 12 V	Model :	6000A
-		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 processes may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for specific tests. The manufacturer has the sole responsibility of continued compliance of the EUT.

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 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.
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.

4.4.1.2 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

4.4.2.1 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."

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 15, 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 cm above the floor and is positioned 40 cm from the vertical ground plane (wall) of the screen room. The correction factors for cable loss are stored in the memory of the EMI receiver therefore the final level (dBµV) appears directly in the reading of the EMI receiver. 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. The measurement is performed attending the US AC mains 120V/60 Hz.
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 -5.6 dB at 26 MHz

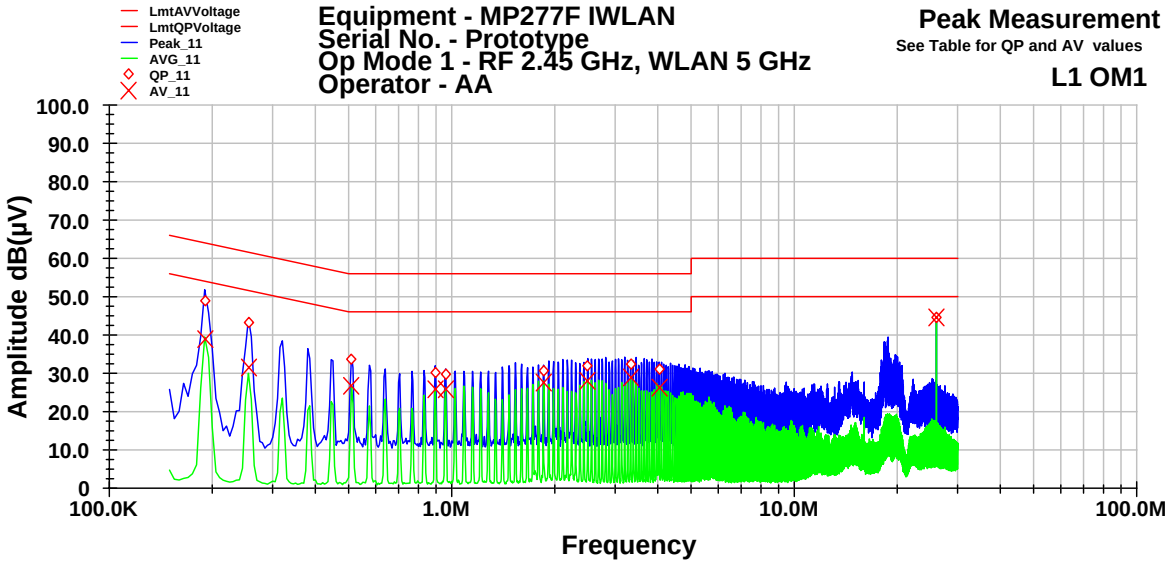
The requirements are **FULFILLED.**

Remarks: The EuT keeps the requirements of EN 55022 class B.

5.1.6 Test protocol

Test point	L1	Result: passed
Operation mode:	Continuous transmitting mode	
Remarks:	Effective range module and WLAN 5 GHz aktiv	
Date:	19.03.2009	
Tested by:	Anton Altmann	

Frequency	QP Level	QP Margin	QP Limit	AV Level	AV Margin	AV Limit
MHz	dB(µV)	dB	dB	dB(µV)	dB	dB
0.19	49.0	-15.0	64.0	38.9	-15.2	54.0
0.255	43.2	-18.4	61.6	31.4	-20.2	51.6
0.51	33.5	-22.5	56.0	26.6	-19.4	46.0
0.895	30.0	-26.0	56.0	25.7	-20.3	46.0
0.96	29.7	-26.3	56.0	25.8	-20.2	46.0
1.855	30.7	-25.3	56.0	27.6	-18.4	46.0
2.495	31.8	-24.2	56.0	28.0	-18.0	46.0
3.325	32.6	-23.4	56.0	28.7	-17.3	46.0
4.03	30.9	-25.1	56.0	26.4	-19.6	46.0
26	44.6	-15.4	60.0	44.4	-5.6	50.0

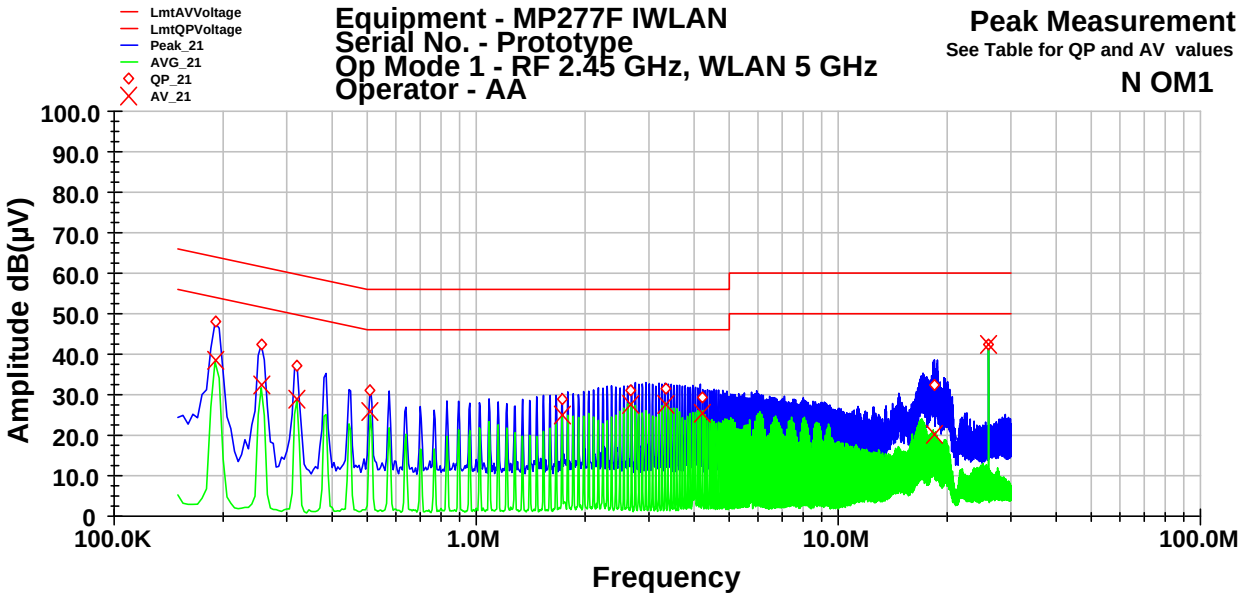


File Number: T33234-00

FCC ID: U9A277IWLAN-V200

Test point:	N	Result: passed
Operation mode:	Continuous transmitting mode	
Remarks:	Effective range module and WLAN 5 GHz aktiv	
Date:	19.03.2009	
Tested by:	Anton Altmann	

Frequency	QP Level	QP Margin	QP Limit	AV Level	AV Margin	AV Limit
MHz	dB(µV)	dB	dB	dB(µV)	dB	dB
0.19	47.8	-16.2	64.0	38.4	-15.6	54.0
0.255	42.2	-19.4	61.6	32.5	-19.1	51.6
0.32	37.2	-22.6	59.7	28.9	-20.8	49.7
0.51	31.0	-25.0	56.0	25.7	-20.3	46.0
1.725	28.9	-27.1	56.0	24.9	-21.1	46.0
2.685	31.2	-24.8	56.0	27.8	-18.2	46.0
3.325	31.4	-24.6	56.0	27.6	-18.4	46.0
4.22	29.5	-26.5	56.0	25.3	-20.7	46.0
18.415	32.2	-27.8	60.0	20.2	-29.8	50.0
26	42.5	-17.5	60.0	42.2	-7.8	50.0



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5.2 Radiated emission of the fundamental frequency

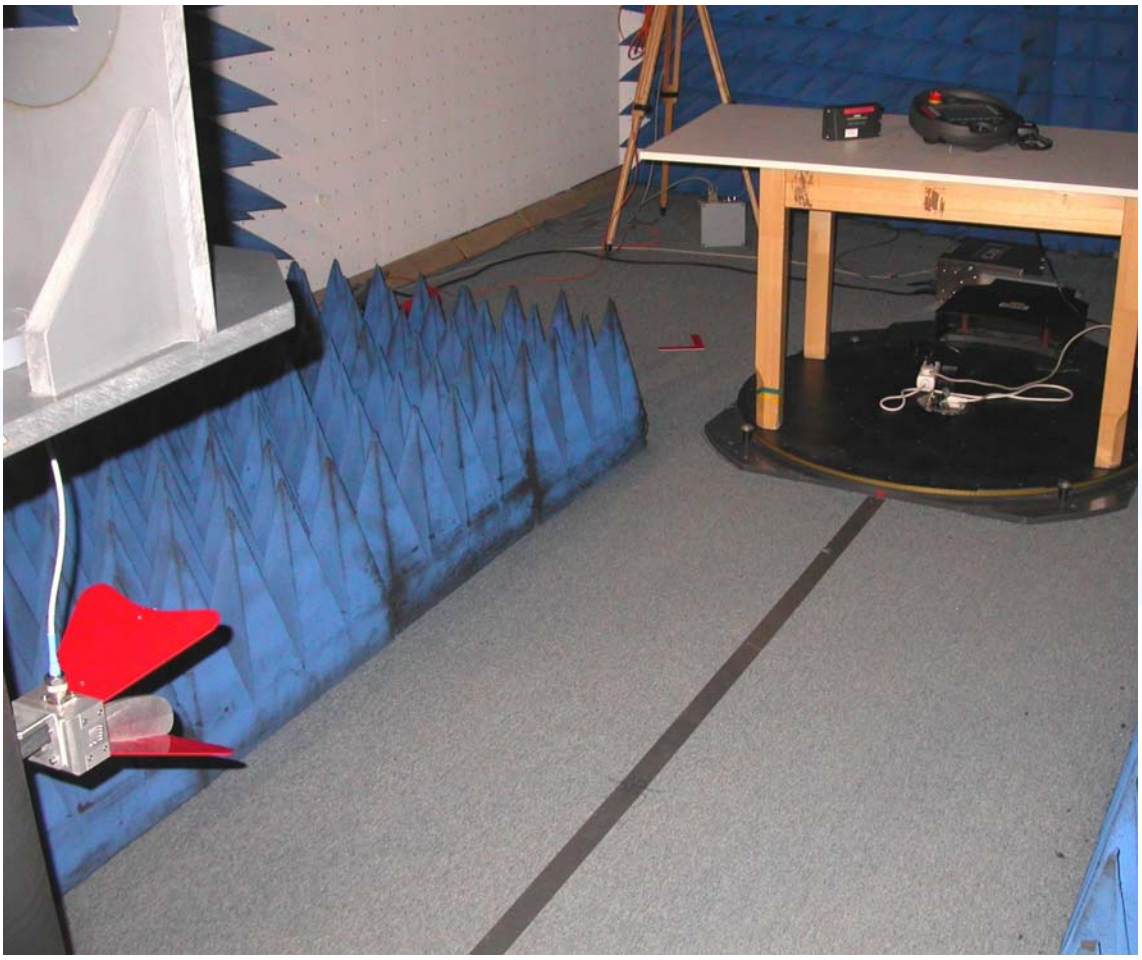
For test instruments and accessories used see section 6 Part **CPR 3**.

5.2.1 Description of the test location

Test location: Anechoic Chamber A2

Test distance: 3 metres

5.2.2 Photo documentation of the test set-up



5.2.1 Applicable standard

According to FCC Part 15C, Section 15.249(a):
The fieldstrength of emissions from intentional radiators within these frequency bands shall comply with the following table:

Fundamental Frequency	Fieldstrength of Fundamental	
(MHz)	(mV/m)	(dBµV/m)
902 - 928	50	94
2400 – 2483.5	**50**	**94**
5725 – 5875	50	94
24.0 – 24.25 GHz	250	108

5.2.2 Description of Measurement

As shown in Section 15.35(b) the emissions above 1000 MHz are based on average limits. However the peak fieldstrength shall not exceed the maximum permitted average limit by more than 20 dB. The set up of the EUT shall be in accordance with ANSI C63.4. The fundamental frequency has been measured radiated using a spectrum analyzer at a distance of 3 m with the following settings:

Peak measurements: RBW=1 MHz, VBW=1 MHz, Peak detector
Average measurements: RBW=1MHz, VBW=10 Hz, Peak detector

5.2.3 Test result

Frequency (MHz)	Reading Level Pk (dBµV)	Reading Level AV (dBµV)	Bandwidth (kHz)	Correction Factor (dB/m)	Corrected Level Pk (dBµV/m)	Corrected Level AV (dBµV/m)	Average Limit (dBµV/m)	Delta (dB)
2449	99.7	---	1000	-9.4	90.3	---	94	-3.7

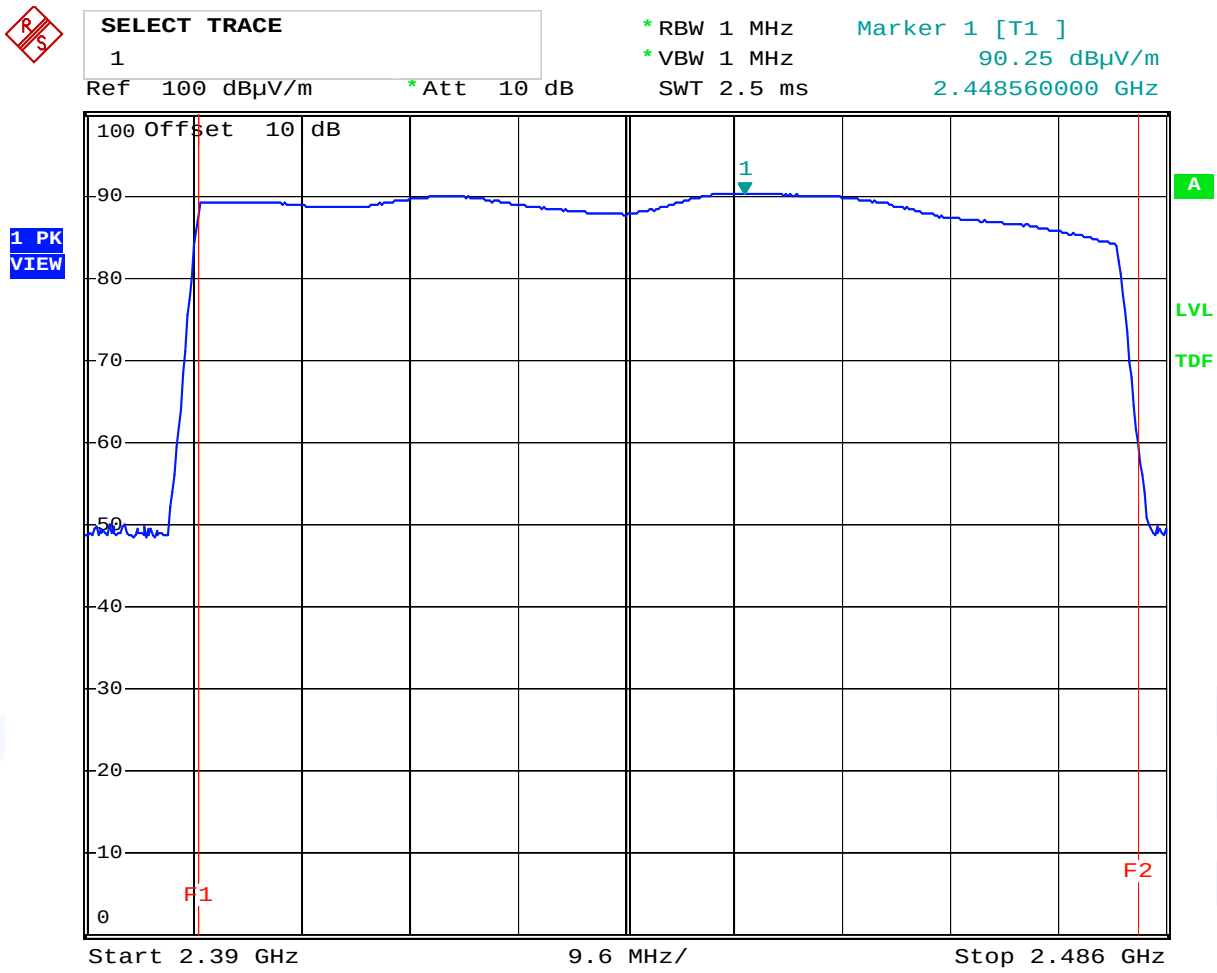
Note: Where correction factor means cable loss, amplifier gain and antenna factor.
The value at 2449 MHz is the highest emission in the frequency band from 2400 to 2483.5 MHz.

The requirements are **FULFILLED.**

Remarks: Because the peak value is below the average limit, no AV-measurement has been performed.

The EuT is transmitting only in the designed band and not in any restricted bands.

For detailed test result refer to following plot.



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5.3 Radiated emissions outside specified frequency bands

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

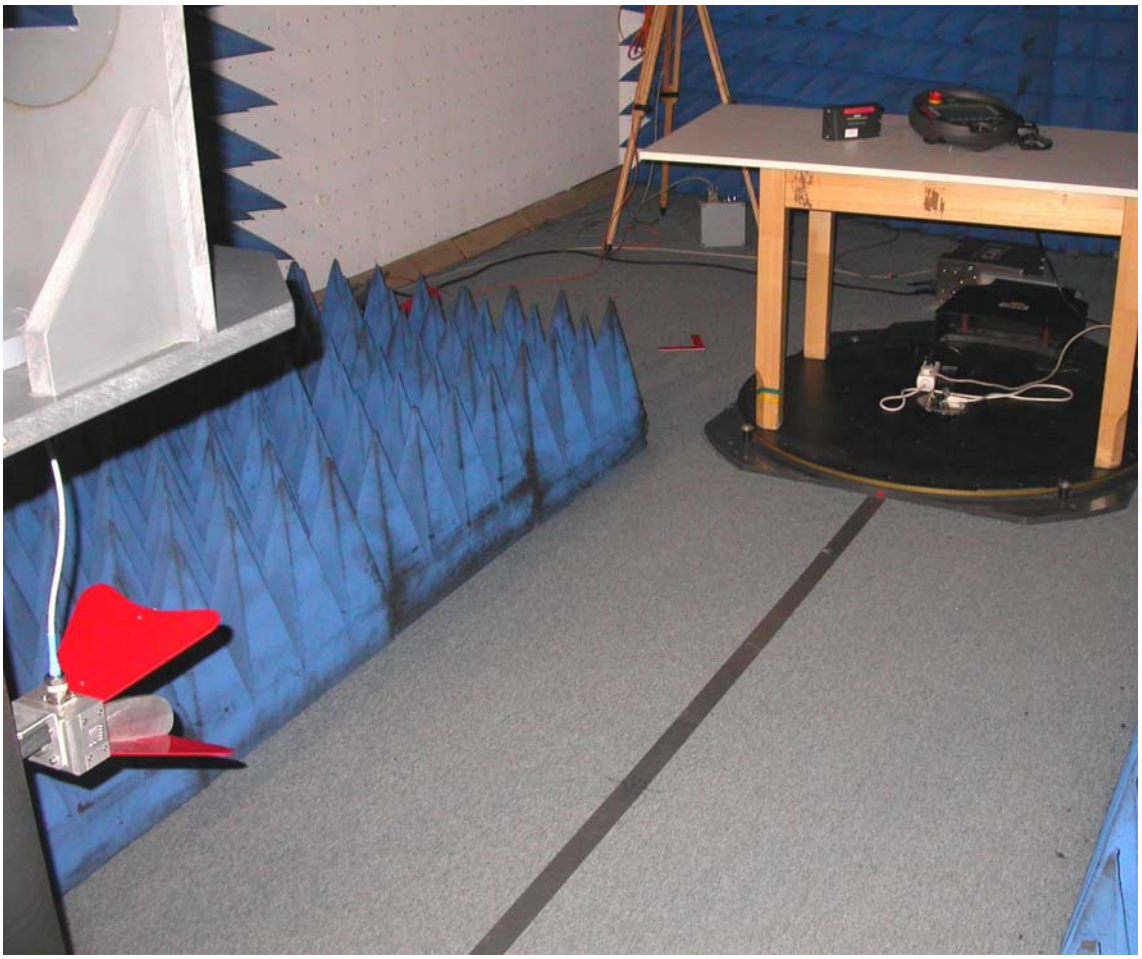
5.3.1 Description of the test location

Test location: OATS1
Test distance: 3 metres

Test location: Anechoic Chamber A2
Test distance: 3 metres

5.3.2 Photo documentation of the test set-up

Anechoic chamber



OATS1 (30-1000 MHz)

OATS1 (9 kHz-30 MHz)

5.3.3 Applicable standard

According to FCC Part 15C, Section 15.249 (d):
Emission radiated outside of the specified frequency bands, except harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated limit in FCC Part 15C, Section 15.209, whichever is the lesser attenuation.

5.3.4 Description of Measurement

The radiated spurious emissions of the EUT are measured in the frequency range from 9 kHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. Measurements between 9 kHz and 1000 MHz are based employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. The set up of the EUT shall be in accordance with ANSI C63.4.
The emissions above 1000 MHz have been measured using a peak detector and RBW=VBW=1 MHz. The peak field strength must comply with the limits specified in Section 15.35 (b). Then the VBW have been set to 10 Hz, while maintaining all of the other instrument settings. The peak level now must comply with the limit specified in Section 15.209. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit.

5.3.5 Test result f < 1 GHz

Frequency (MHz)	Reading Level QP (dBµV)	Reading Level AV (dBµV)	Bandwidth (kHz)	Correction Factor (dB/m)	Corrected Level QP (dBµV/m)	Corrected Level AV (dBµV/m)	Limit (dBµV/m)	Delta (dB)
0.009-0.150	---	---	0.200	---	---	---	---	---
26	23.0	---	9	20.0	43.0	---	69.5	-26.5
52	9.8	---	120	15.2	25.0	---	40.0	-15.0
78	23.1	---	120	12.0	35.1	---	40.0	-4.9
104	17.6	---	120	11.6	29.2	---	43.5	-14.3
130	20.9	---	120	14.0	34.9	---	43.5	-8.6
208	16.2	---	120	14.2	30.4	---	43.5	-13.1
260	11.4	---	120	15.7	27.1	---	46.0	-18.9
286	28.6	---	120	16.6	45.2	---	46.0	-0.8
312	15.2	---	120	17.3	32.5	---	46.0	-13.5
338	25.6	---	120	17.8	43.4	---	46.0	-2.6
364	11.9	---	120	18.4	30.3	---	46.0	-15.7
390	16.3	---	120	18.9	35.2	---	46.0	-10.8
416	12.3	---	120	19.5	31.8	---	46.0	-14.2
442	7.2	---	120	20.1	27.3	---	46.0	-18.7
494	18.7	---	120	21.4	40.1	---	46.0	-5.9
546	18.5	---	120	22.6	41.1	---	46.0	-4.9
598	13.3	---	120	23.9	37.2	---	46.0	-8.8
650	8.8	---	120	24.7	33.5	---	46.0	-12.5
702	6.2	---	120	25.6	31.8	---	46.0	-14.2
858	4.3	---	120	28.1	32.4	---	46.0	-13.6

Remark: According to Section 15.31 (f) (2): The measurement below 30 MHz has been performed at a distance of 3 m. The results have been extrapolated to the specified distance by using the square of an inverse linear distance extrapolation factor of 40 dB/decade.

5.3.6 Test result f > 1 GHz

Frequency (MHz)	Level PK (dBµV)	Duty Cycle Correction (dB)	Level AV (dBµV)	Correction Factor (dB)	Corrected Level PK (dBµV/m)	Corrected Level AV (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Delta (dB)
2399.5	61.2	---	---	-9.6	51.6	---	74	---	-22.4
2483.5	68.7	---	46.9	-9.4	59.3	37.5	74	54	-16.5
4928	56.4	---	---	1.8	58.2	---	74	---	-15.8
7408	47.6	---	---	5.8	53.4	---	74	---	-20.6
9648	44.3	---	---	7.6	51.9	---	74	---	-22.1
18-25 GHz	---	---	---	---	---	---	---	---	---

Note: Where correction factor means cable loss, amplifier gain and antenna factor.

Remark: The limits according to Section 15.209 apply as appropriate limits because they are the lesser attenuation.

Limits according to FCC Part 15C, Section 15.209:

Frequency (MHz)	Field strength (dBµV/m)	Measurement distance (m)
0.009 - -0.490	2400/f(kHz)	300
0.490 – 1.705	24000/f(kHz)	30
1.705 – 30.0	30	30
30 - 88	40	3
88 - 216	43,5	3
216 - 960	46	3
Above 960	54	3

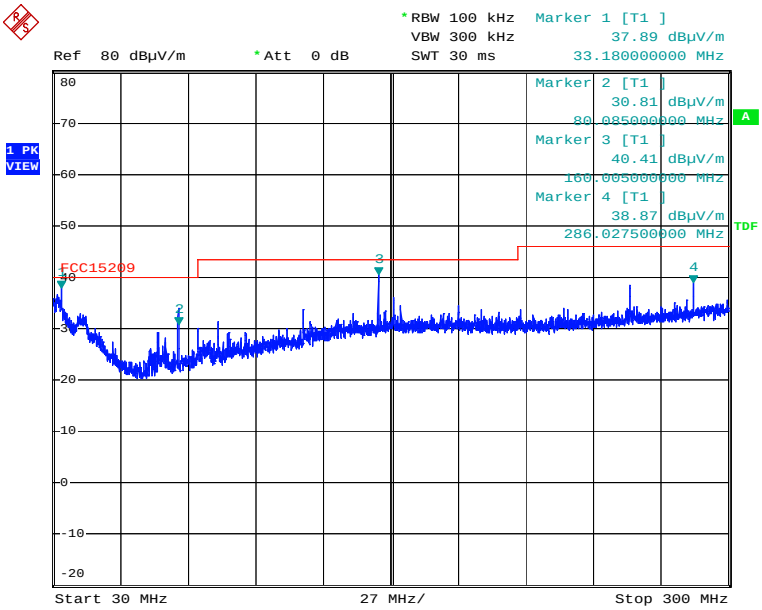
The requirements are **FULFILLED.**

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

For detailed test result please refer to following plots.

FCC ID: U9A277IWLAN-V200

Spurious emissions from 30 to 300 MHz



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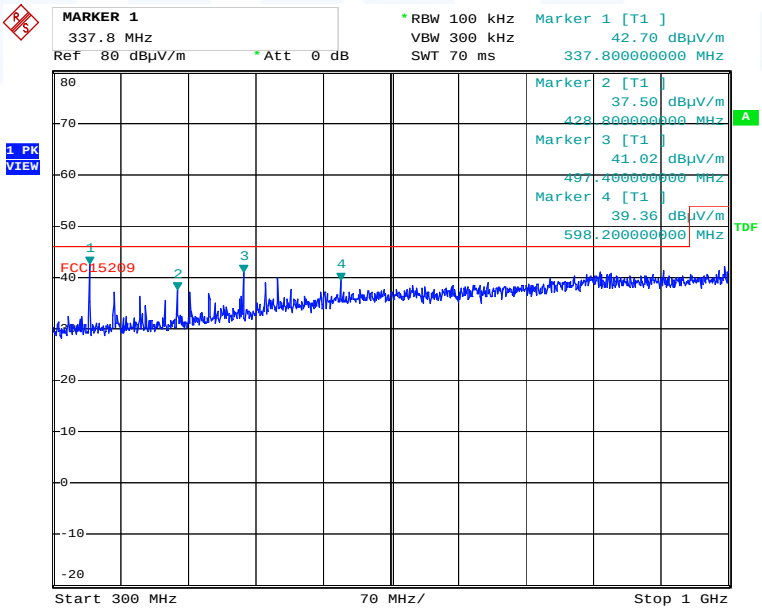
Spurious emissions from 300 to 1000 MHz



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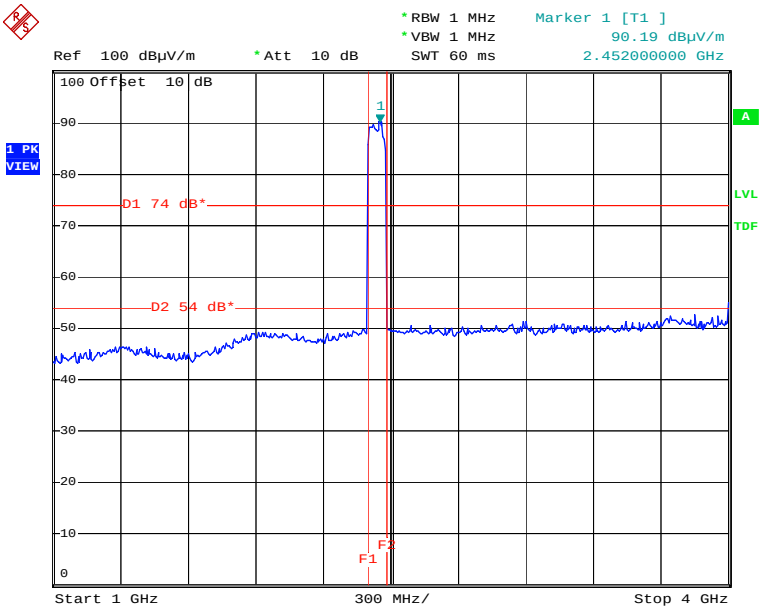
Spurious emissions from 1 to 4 GHz
(incl. Fundamental carrier)



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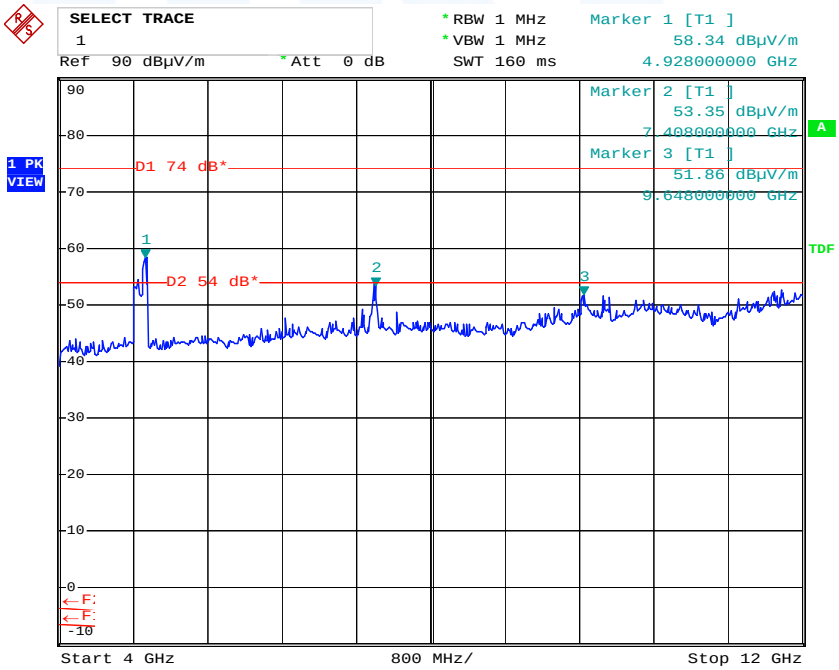
Spurious emissions from 4 to 12 GHz



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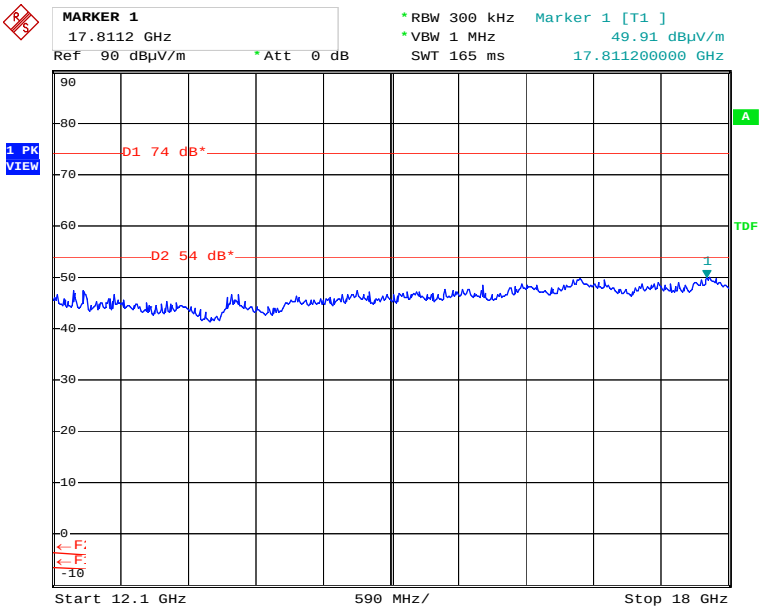
Spurious emissions from 12 to 18 GHz



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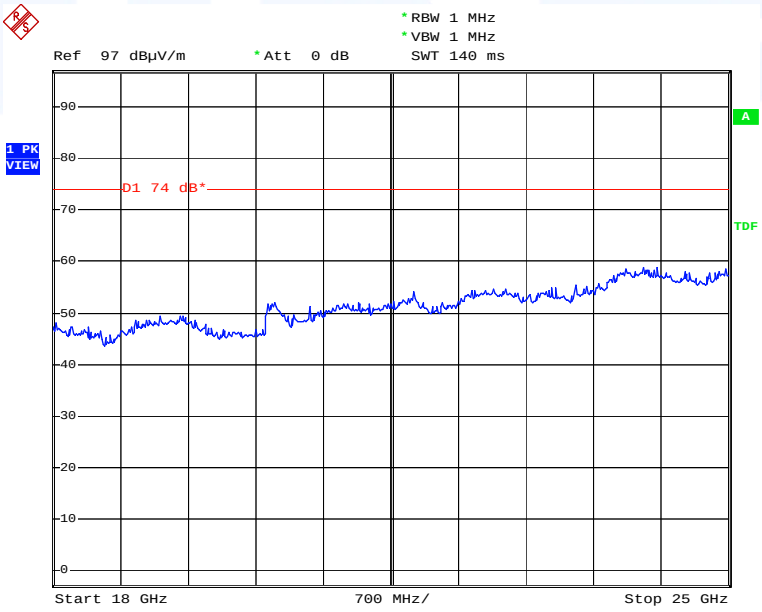
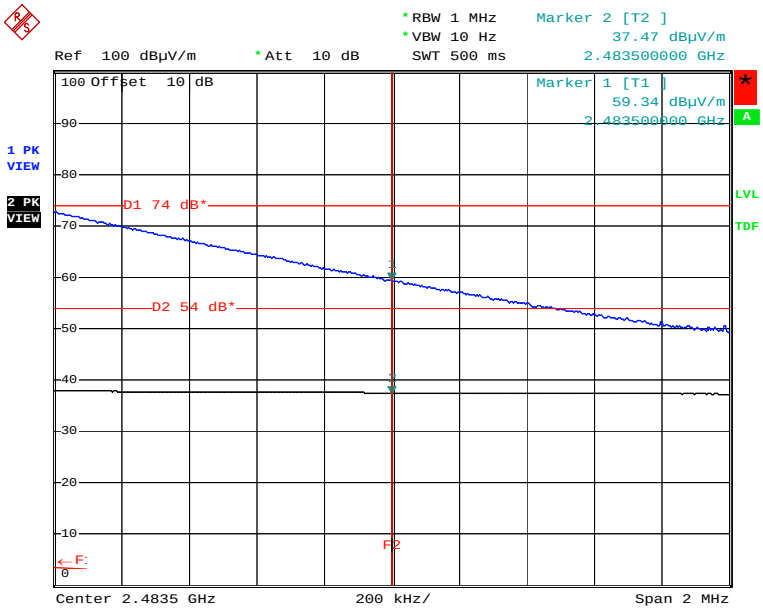
Spurious emissions from 18 to 25 GHz



AV and Pk plot at the upper-out of band



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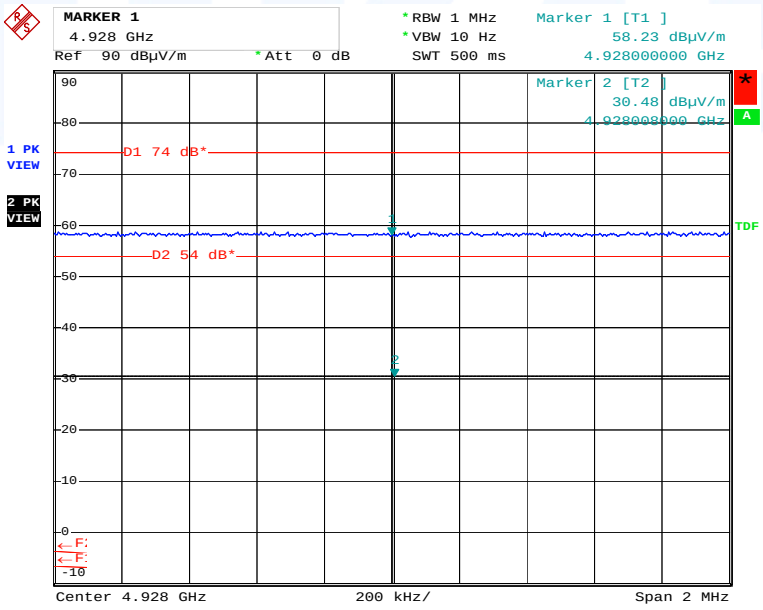
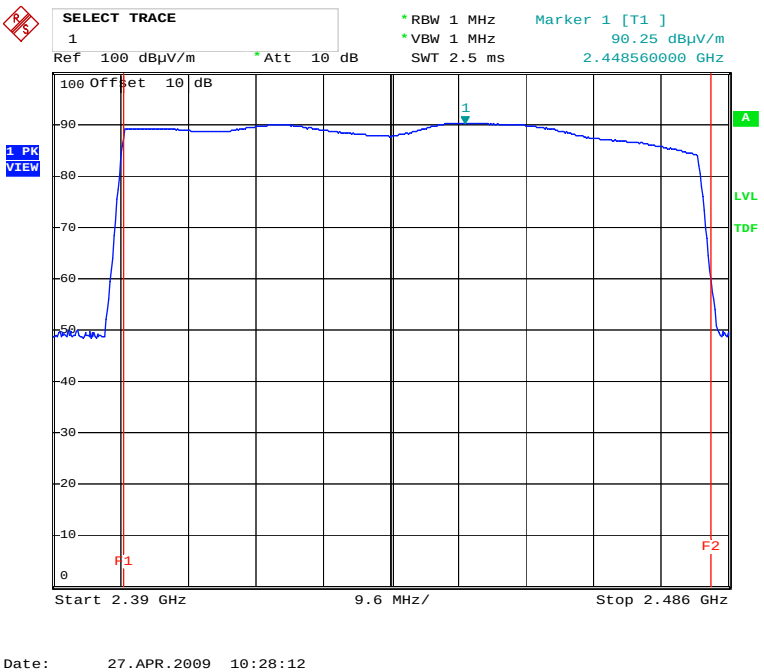
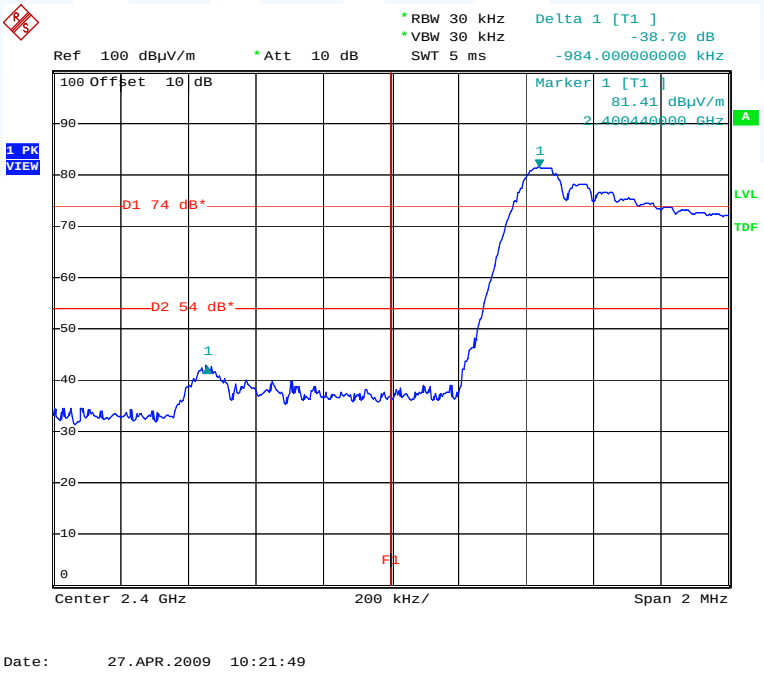


Fundamental reference plot



Marker-Delta Plot at lower out-of band



Calculation of Pk-Value according to the Marker-Delta Method:

1. Pk value of fundamental field strength as reference: 90.3 dBµV/m
2. Amplitude delta between the fundamental and spurious emission: 38.7 dB
3. Calculated attenuation of spurious emission: 90.3-38.7=51.6 dBµV/m
4. No need of AV measurement because the Pk value is below the AV limit.

Remark: The Marker-Delta Method is described in Public Notice DA 00-705 (Released March 30, 2000).

5.4 20 dB Bandwidth

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

5.4.1 Description of the test location

Test location: AREA4 (Climatic chamber)

5.4.2 Photo documentation of the test set-up

5.4.3 Applicable standard

According to FCC Part 15, Section 15.215(c):
Intentional radiators operating under the provisions to the general emission limits, as contained in Section 15.217 through Section 15.257, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from the frequency stability of the transmitter over expected variation in temperature and supply voltage.

5.4.4 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 signal amplitude observed from the transmitter at the fundamental frequency. The measurement has been carried out with normal modulation at normal and extreme test conditions.

Spectrum analyser settings:
RBW = VBW: 100 kHz
Detector: AV
Trace mode: Max hold
Sweep time: 60 s

5.4.5 Test result

Manufacturer declared permitted frequency band:
Lowest frequency: 2400.0 MHz Highest frequency: 2483.5 MHz

Test conditions		Test result	
		Frequency (MHz)	
T_{nom} (20 °C)	V_{nom} (7.2 V)	f_L	2400.250
		f_H	2481.424
T_{max} (0 °C)	V_{min} (5.8 V)	f_L	2400.350
		f_H	2481.280
	V_{max} (8.6 V)	f_L	2400.355
		f_H	2481.280
T_{min} (45 °C)	V_{min} (5.8 V)	f_L	2400.360
		f_H	2481.275
	V_{max} (8.6 V)	f_L	2400.355
		f_H	2481.280
Measurement uncertainty		+/- 500 kHz	

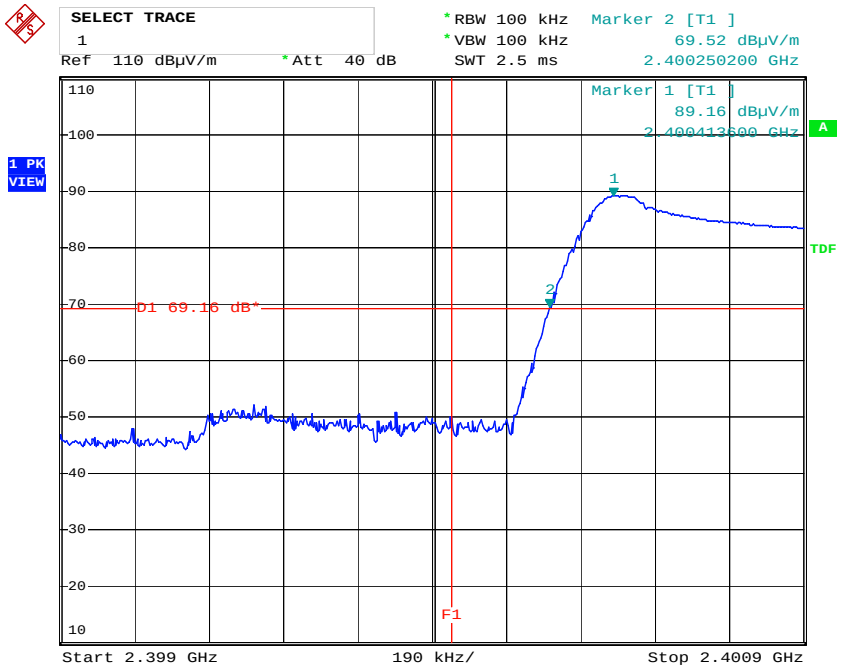
Where f_L Lowest frequency at the appropriate side band level
f_H Highest frequency at the appropriate side band level

Band edge limits: f_{Lm} = Lowest f_L (measured) 2400.250 MHz
and
f_{Hm} = Highest f_H (measured) 2481.424 MHz

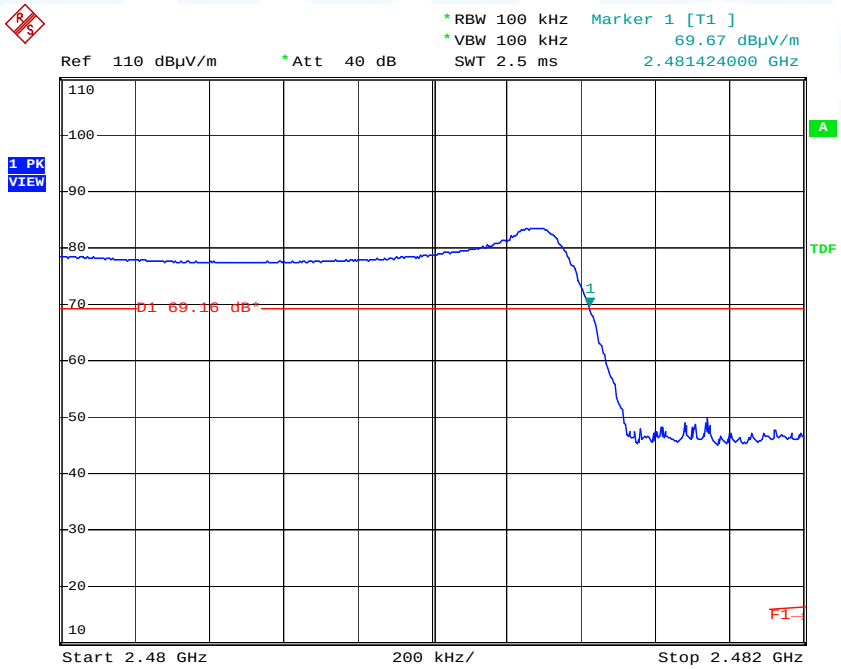
The requirements are **FULFILLED.**

Remarks: For detailed results please refer to following plots.

Bandwidth Plots



Date: 29.APR.2009 10:04:11



Date: 29.APR.2009 10:10:08

5.5 Maximum Permissible Exposure (MPE)

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

5.5.1 Description of the test location

Test location: Anechoic Chamber A2

5.5.2 Applicable standard

According to FCC Part 15 Subpart 15.247 (i): Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commision's guidelines.
The test methods used comply with ANSI/IEEE C95.1-1992, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz".
This test report shows the compliance with the limits for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in FCC 1.1307(b).

5.5.3 Description of Measurement

The maximum total power radiated by the antenna has been calculated using the following far field calculation formula:

$$E = \frac{\sqrt{30 * P_{out} * G}}{R}$$

where

E =E-field strength [V/m]
P_{out} = output power to antenna [W]
G = gain of antenna (linear scale)
R = distance between antenna and observation point [m]

The electrical field strength have been measured radiated as described in clause 5.2 of this document. Through the Friis transmission formula, which is a far field assumption, 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]

5.5.4 Test result

Frequency (MHz)	Max Power Output to Antenna (dBm)	(mW)	Antenna gain (dBi)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
2449	-4.9	0.324	0	0.00006	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)
(A) Limits for Occupational / Controlled Exposure				
0.3 – 3.0	614	1.63	100	6
3.0 – 30	1842/f	4.89/f	900/f^2	6
30 - 300	61.4	0.163	1.0	6
300-1500	---	---	f/300	6
1500-100000	---	---	5.0	6
(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 in MHz

5.5.5 Compliance regarding Co-location and Co-transmission

Applicable standard: ANSI/IEEE C95.1-1999, “IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, Clause 4.1.1. e):

For mixed or broadband fields at a number of frequencies for which there are different values of the MPE, the fraction of the MPE (in terms of E, H, or power density (S)) occurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity (1.0, or 100 % in terms of percentage.

1. MPE of Effective Range Module: P_d = 0.00006 mW/cm^2
   Limit: 1 mW/cm^2
   Fraction of MPE: 0.6 %

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

The requirements are **FULFILLED.**

Remarks: For the test result of WLAN-Module please refer to Test report T33234-03-02AA

(mikes-testingpartners gmbh)

5.6 Antenna application

5.6.1 Applicable standard

According to FCC Part 15C, Section 15.203(a):
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 EUT's antenna meets the requirement of FCC Part 15C, Section 15.203 and 15.204

5.6.2 Result

The requirements are **FULFILLED.**

Remarks: The EuT is equipped with an internal dual port patch antenna (gain=2.6 / 2.7 dBic).

The EuT don't have any external antenna connectors.

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	Kind of Equipment	Manufacturer	Equipment No.
A 4	ESHS 30	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-002
	FSP 30	Spectrum Analyzer	Rohde & Schwarz München	02-02/11-05-001
	ESH 2 - Z 5	LISN	Rohde & Schwarz München	02-02/20-05-004
	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
	ESH 3 - Z 2	Pulse Limiter	Rohde & Schwarz München	02-02/50-05-155
	PE1540	Power Supply	Phillips Fluke GmbH	02-02/50-07-031
CPR 3	FSP 30	Spectrum Analyzer	Rohde & Schwarz München	02-02/11-05-001
	AFS4-01000400-10-10P-4	RF Amplifier 1-4 GHz	PARZICH GMBH	02-02/17-05-003
	BBHA 9120 E 251	Broadband Horn Antenn	Schwarzbeck Mess-Elektron	02-02/24-05-006
	Sucoflex N-2000-SMA	RF Cable	novotronik Signalverarbeit	02-02/50-05-075
	PE1540	Power Supply	Phillips Fluke GmbH	02-02/50-07-031
	Multiflex 141-SMA-N-1500	Coaxicable	novotronik Signalverarbeit	02-02/50-09-016
MB	FSP 30	Spectrum Analyzer	Rohde & Schwarz München	02-02/11-05-001
	WK-340/40	Climatic Chamber	Weiss Umwelttechnik GmbH	02-02/45-05-001
	PE1540	Power Supply	Phillips Fluke GmbH	02-02/50-07-031
SER 1	FMZB 1516	Magnetic Field Antenna	Schwarzbeck Mess-Elektron	01-02/24-01-018
	ESCS 30	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-001
	PE1540	Power Supply	Phillips Fluke GmbH	02-02/50-07-031
SER 2	ESVS 30	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-006
	VULB 9168	Trilog Broad Band Anten	Schwarzbeck Mess-Elektron	02-02/24-05-005
	S10162-B	RF Cable 33 m	Huber + Suhner	02-02/50-05-031
	KK-EF393-21N-16	RF Cable 20 m	Huber + Suhner	02-02/50-05-033
	NW-2000-NB	RF Cable	Huber + Suhner	02-02/50-05-113
	PE1540	Power Supply	Phillips Fluke GmbH	02-02/50-07-031
SER 3	FSP 30	Spectrum Analyzer	Rohde & Schwarz München	02-02/11-05-001
	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	02-02/17-06-002
	3117	Horn Antenna 1-18 GHz	EMCO Elektronik GmbH	02-02/24-05-009
	BBHA 9170, Amplifier, Mixe	Reception System 30-40	mikes-testingpartners gmbh	02-02/30-09-001
	BBHA 9170, Amplifier	Reception System 20-30	mikes-testingpartners gmbh	02-02/30-09-002
	Sucoflex N-1600-SMA	RF Cable	novotronik Signalverarbeit	02-02/50-05-073

Equipment No.	Next Calibration	Last Calibration	Next Verification	Last Verification
02-02/03-05-002	05/06/2010	05/06/2009		
02-02/11-05-001	04/20/2010	04/20/2009		
02-02/20-05-004	03/13/2011	03/13/2008	10/29/2009	04/29/2009
02-02/50-05-138				
02-02/50-05-140				
02-02/50-05-155	10/03/2009	04/03/2009		
02-02/50-07-031				
02-02/11-05-001	04/20/2010	04/20/2009		
02-02/17-05-003				
02-02/24-05-006	11/08/2009	05/08/2009		
02-02/50-05-075				
02-02/50-07-031				
02-02/50-09-016				
02-02/11-05-001	04/20/2010	04/20/2009		
02-02/45-05-001	9/01/2010	09/01/2005	07/12/2009	01/12/2009
02-02/50-07-031				
01-02/24-01-018	02/23/2010	02/23/2009		
02-02/03-05-001	12/10/2009	12/10/2008		
02-02/50-07-031				
02-02/03-05-006	07/30/2009	07/30/2008		
02-02/24-05-005	05/06/2011	05/06/2008	09/02/2009	03/02/2009
02-02/50-05-031				
02-02/50-05-033				
02-02/50-05-113				
02-02/50-07-031				
02-02/11-05-001	04/20/2010	04/20/2009		
02-02/17-05-003				
02-02/17-05-004				
02-02/17-06-002				
02-02/24-05-009	02/04/2010	02/04/2009		
02-02/30-09-001	01/26/2010	01/26/2009		
02-02/30-09-002	01/26/2010	01/26/2009		
02-02/50-05-073				