



FCC ID:SDL-PR3XR01

EMI -- TEST REPORT

- FCC Part 15.249 -

Test Report No. : T33893-01-02HS	03. August 2010 Date of issue
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Type / Model Name : PR35

Product Description : Rotating laser

Applicant : Hilti AG

Address : Feldkirchnerstrasse 100
9494 SCHAAN, LICHTENSTEIN

Manufacturer : HILLOS GmbH

Address : 07745 JENA, GERMANY
Prüssingstrasse 41

Licence holder : Hilti AG

Address : Feldkirchnerstrasse 100
9494 SCHAAN, LICHTENSTEIN

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	11
3.3	Short description of the equipment under test (EUT)	11
4	<u>TEST ENVIRONMENT</u>	12
4.1	Address of the test laboratory	12
4.2	Environmental conditions	12
4.3	Statement of the measurement uncertainty	12
4.4	Measurement protocol for FCC	13
4.5	Determination of worst case measurement conditions	14
5	<u>TEST CONDITIONS AND RESULTS</u>	15
5.1	Conducted emissions	15
5.2	Radiated emission of the fundamental wave	21
5.3	Spurious emissions radiated	24
5.4	20 dB bandwidth	29
5.5	Antenna application	31
5.6	Receiver radiated emissions	32
6	<u>USED TEST EQUIPMENT AND ACCESSORIES</u>	35

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 <input type="checkbox"/> Class A device <input checked="" type="checkbox"/> Class B device
Part 15, Subpart B, Section 15.109	Radiated emissions, general requirements
Part 15, Subpart B, Section 15.111	Antenna power conduction

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

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
Part 15, Subpart C, Section 15.249	Operation within the bands 902 - 929 kHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz

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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ANSI C95.1:1992	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
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CISPR 16-4-2: 2003	Uncertainty in EMC measurement
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CISPR 22: 2005 EN 55022: 2006	Information technology equipment
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2 SUMMARY

GENERAL REMARKS:

The EUT is equipped with a RF transceiver operating within the free 2.4 GHz ISM band that enables the user to control the whole alignment system remote.

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 : 26 June 2010

Testing concluded on : 30 June 2010

Checked by:

Tested by:

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

Hermann Smetana
Dipl.-Ing.(FH)
Radio Expert

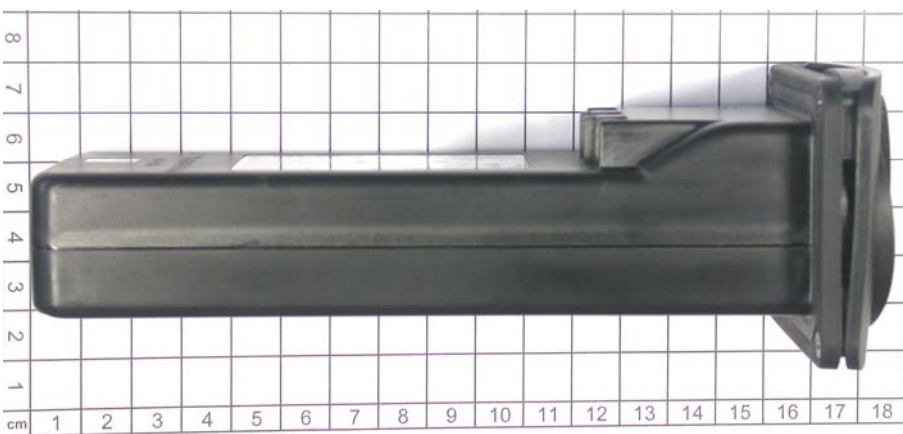
3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT

External view:

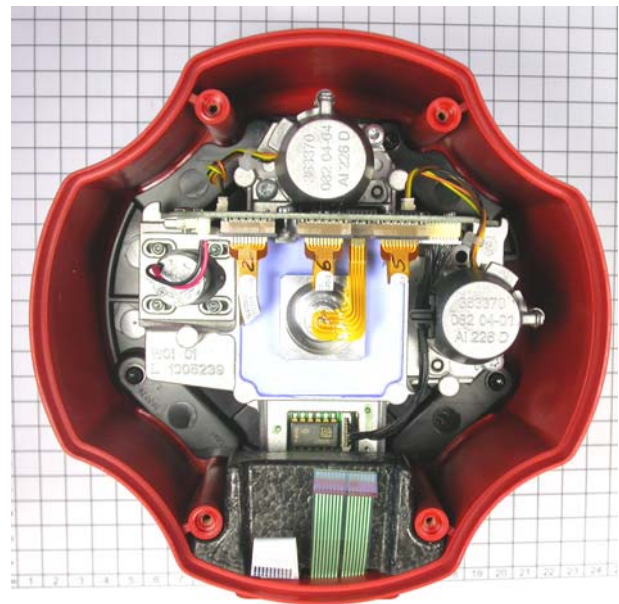


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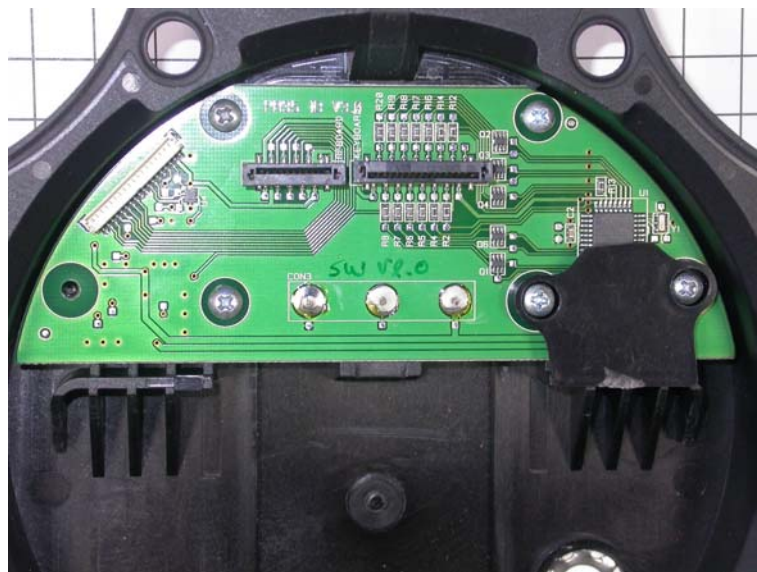
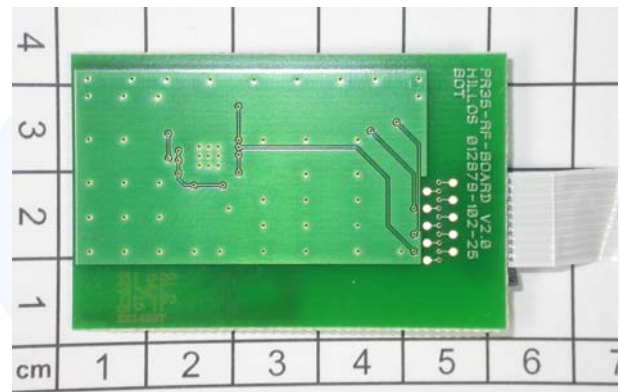
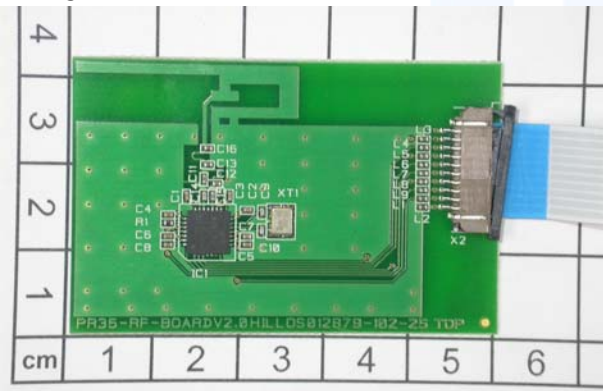


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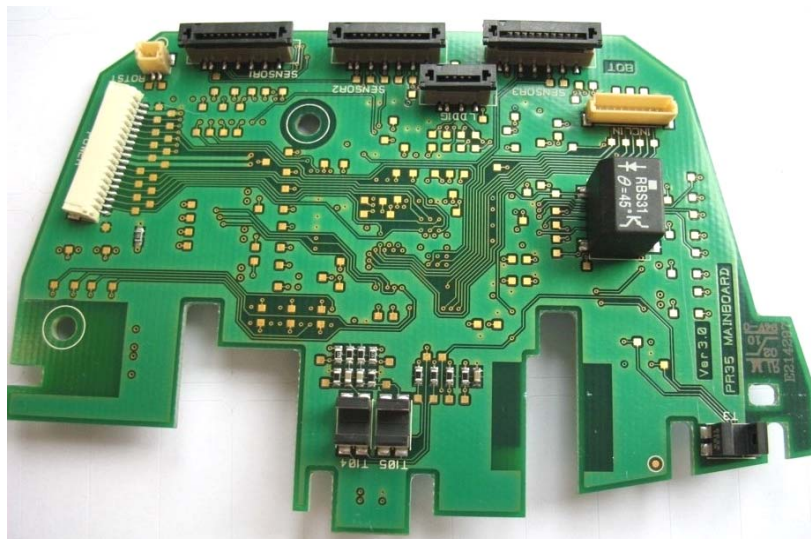
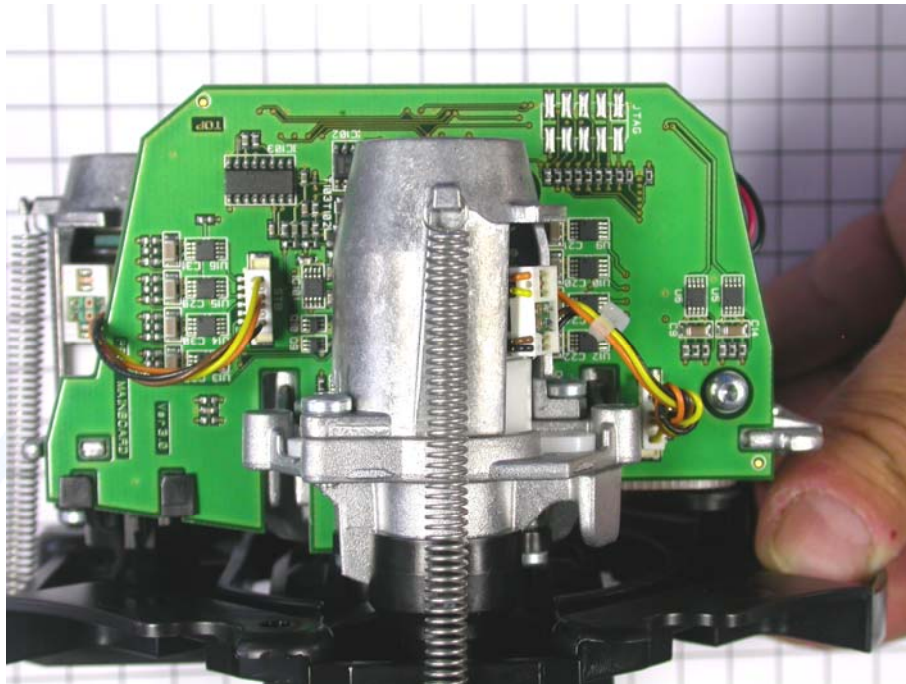
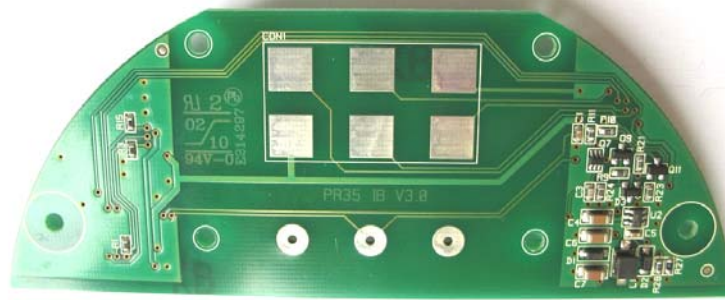
Internal views:



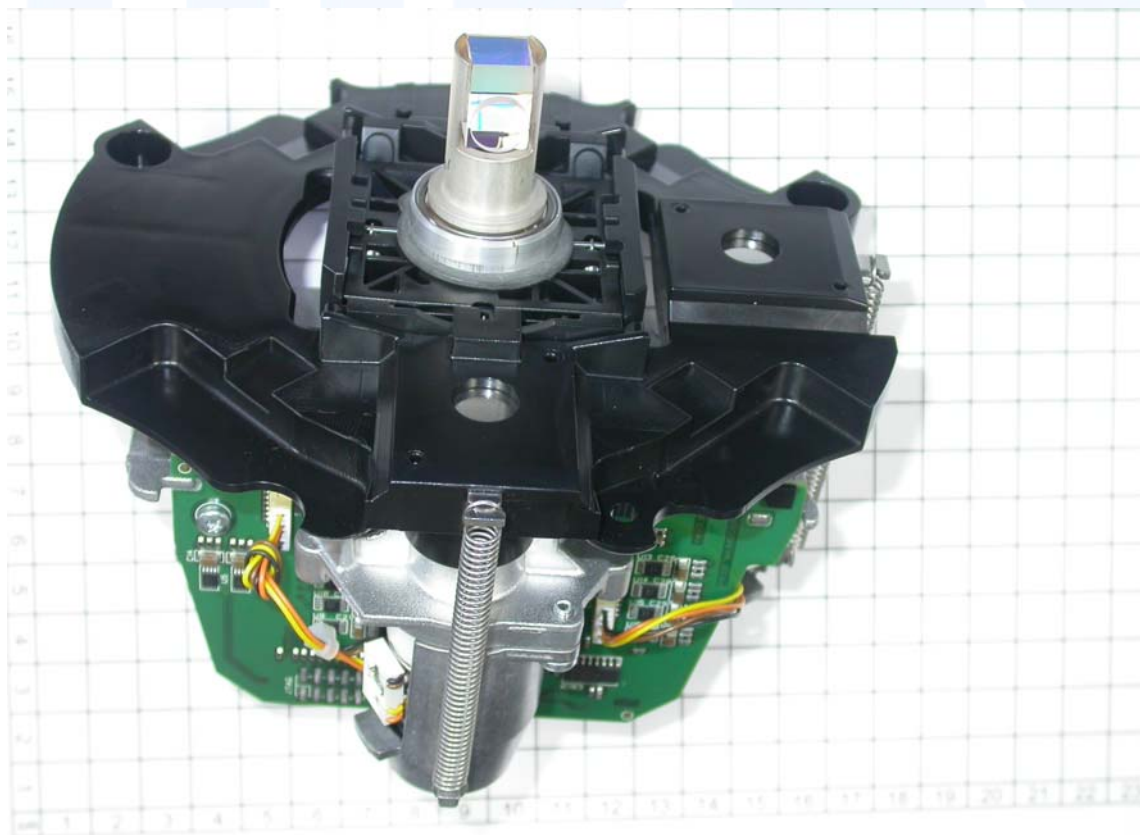
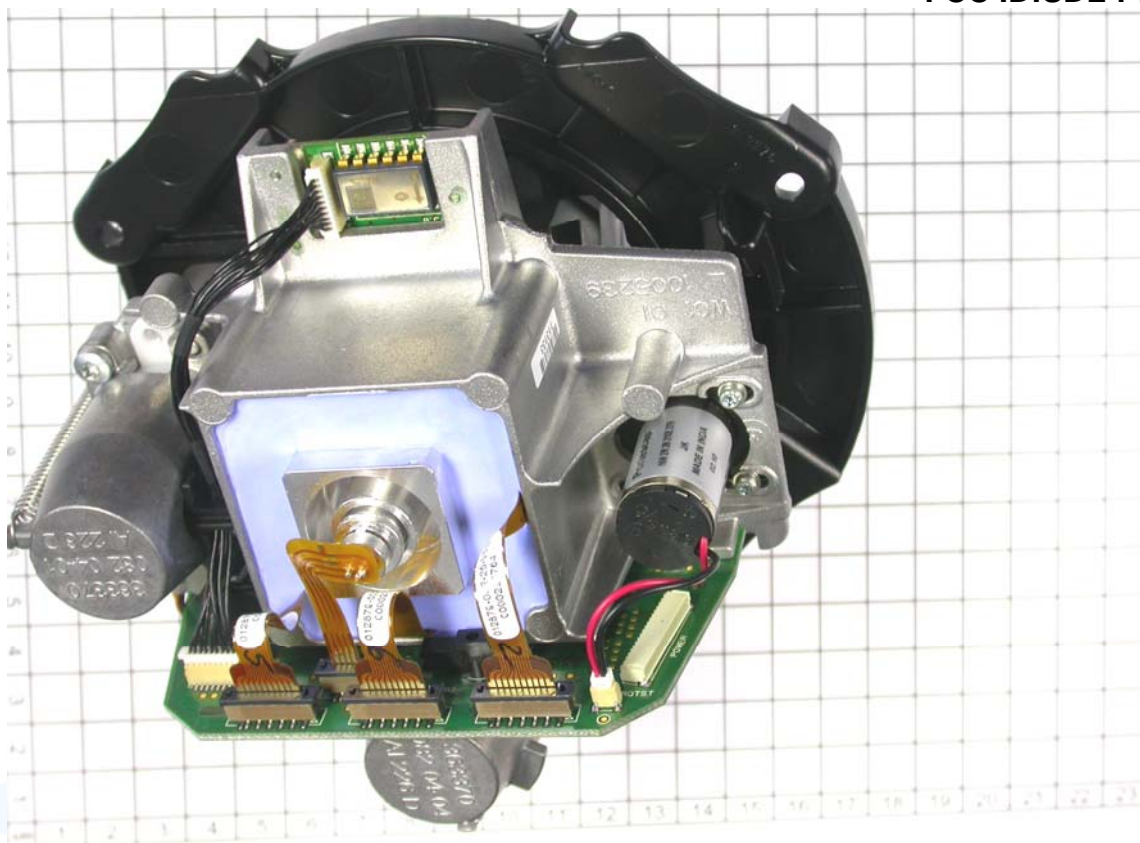
RF PCB



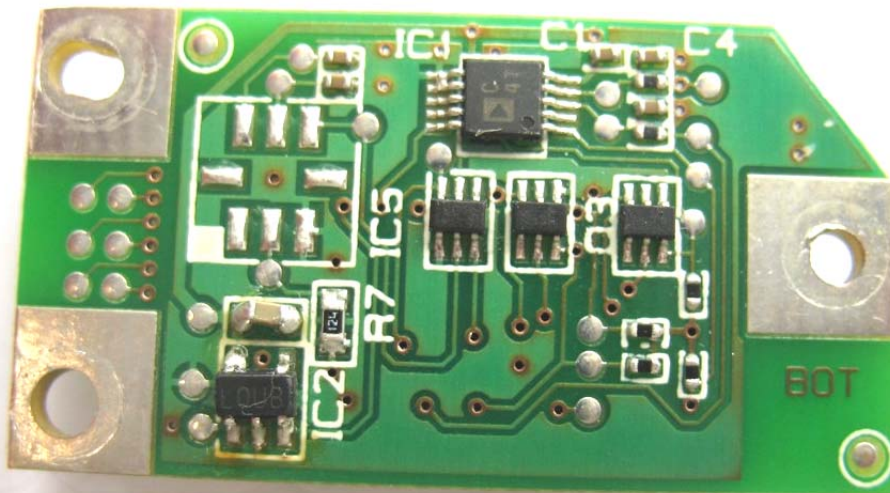
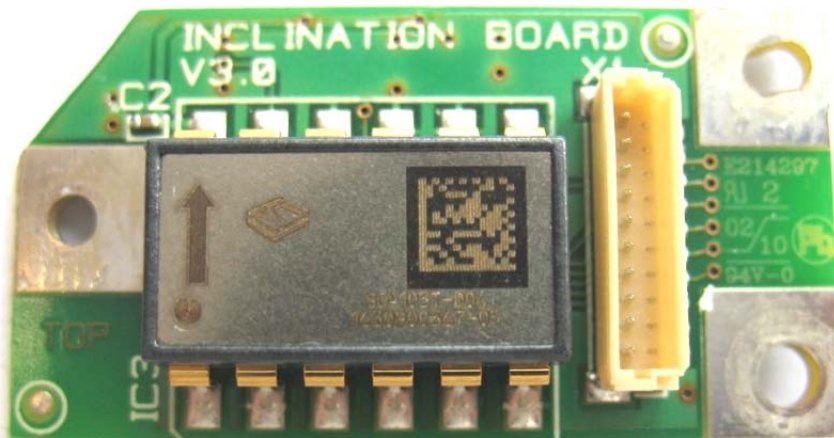
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3.2 Power supply system utilised

Power supply voltage : 100 – 240 VAC, 7.2 VDC Lithium ion battery

3.3 Short description of the equipment under test (EUT)

The EUT is a rotating laser, is a self-levelling tool that can be set up vertically or horizontally. In a simple way can now checked the height on all walls relative to a reference point. The function of the EUT can be controlled by a radio remote controller operating at 2405 MHz.

Number of tested samples: 1 pc for TX continuous, 1 pc for RX and 1 pc with max duty cycle
Serial number: Prototype

EUT operation mode:

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

- TX continuous mode at 2405 MHz

- RX 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:

- Power supply battery 7.2 VDC Model : PRA84
- Power supply 100 – 240 VAC Model : PRA85
- _____ 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

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

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.

To convert between dB μ V and μ V, the following conversions apply:

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \cdot \log(\mu\text{V}); \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)}; \end{aligned}$$

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 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)

Description of measurement

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 to add on the reading from the EMI receiver (dBµV) the antenna and cable loss factor. 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)

Description of measurement

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.

4.5 Determination of worst case measurement conditions

Measurements have been made in all three orthogonal axes and the settings of the EUT were changed to locate at which position and at what setting of the EUT are the maximum of the emissions radiated. For the further measurement the EUT is set in X position. The RF power is not adjustable. The lowest generated frequency is 9 kHz.

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 given limits.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.4 described under item 4.4.3. 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 on the data sheets.

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 17.6 dB at 0.205 MHz

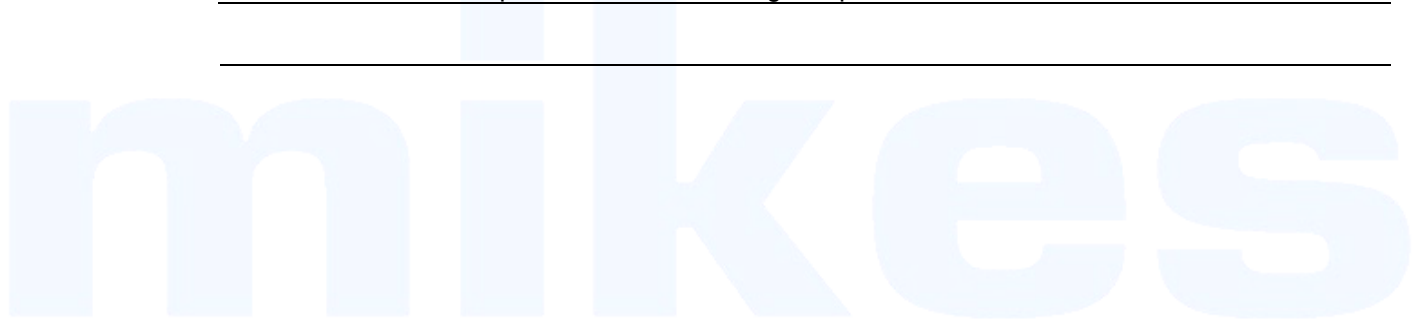
Limit according to FCC Part 15, Section 15.207(a):

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	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

The requirements are **FULFILLED**.

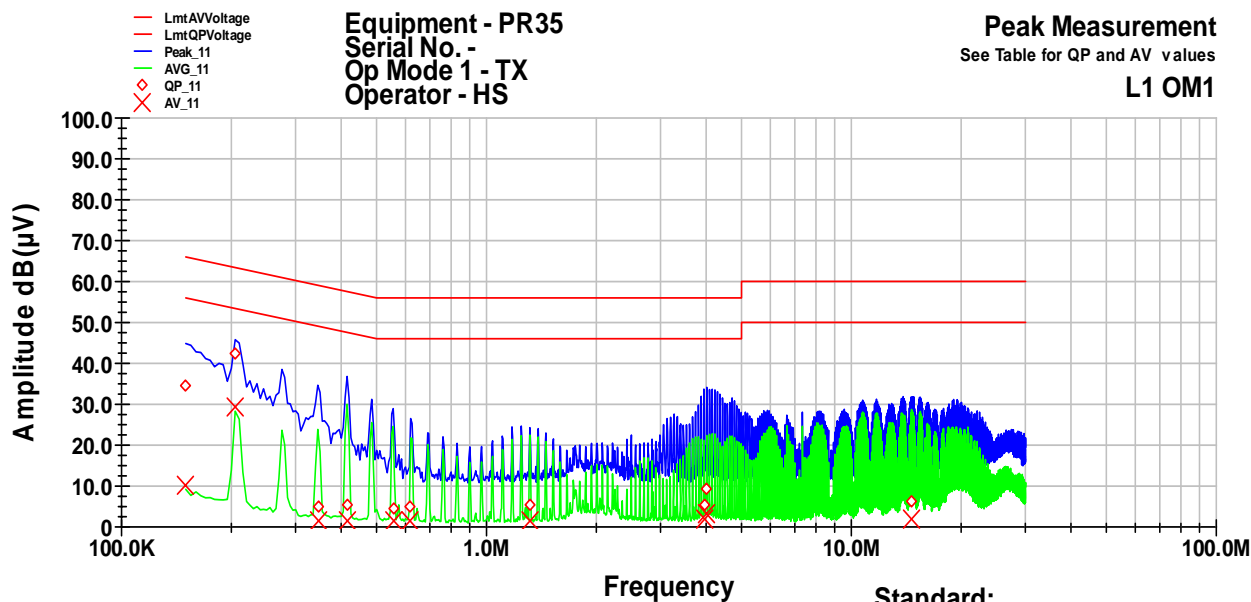
Remarks: For detailed test result please refer to following test protocols.



5.1.6 Test protocol

Test point L1
 Operation mode: TX continuous mode at 2405 MHz
 Remarks:

Result: passed

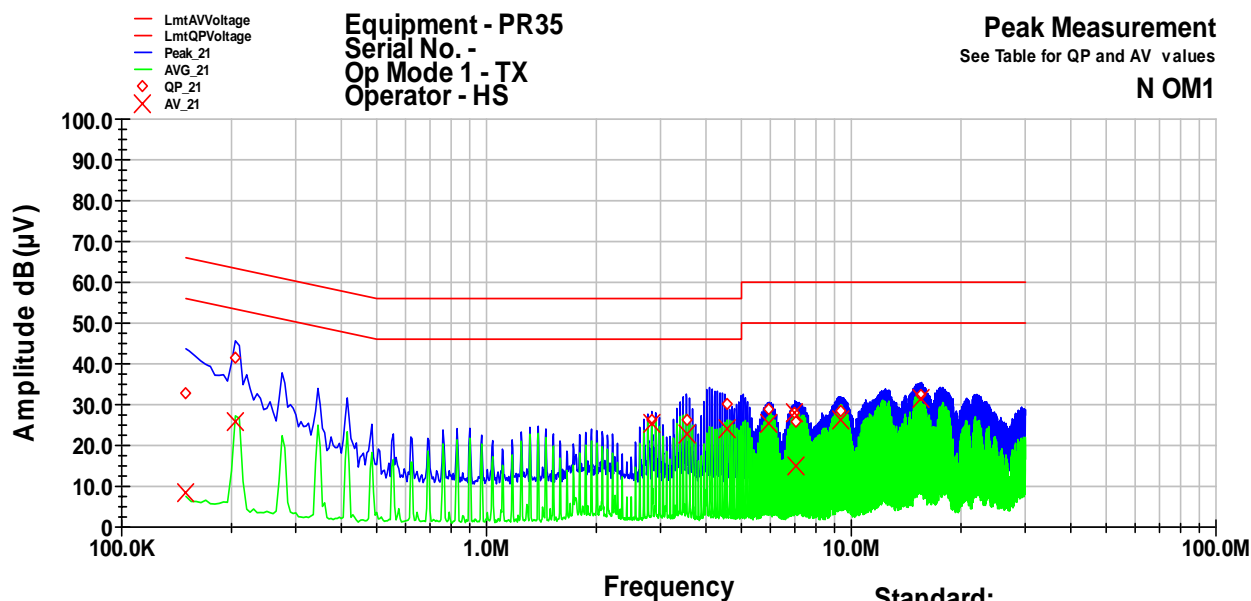


Standard:
File Number: T33893

Frequency MHz	QP Level dB(µV)	QP Delta dB	QP Limit dB	AV Level dB(µV)	AV Delta dB	AV Limit dB
0.15	34.7	-31.3	66.0	10.2	-45.8	56.0
0.205	42.3	-21.1	63.4	29.2	-24.2	53.4
0.345	5.1	-54.0	59.1	1.4	-47.7	49.1
0.415	5.2	-52.3	57.5	1.3	-46.3	47.5
0.555	4.6	-51.4	56.0	1.4	-44.6	46.0
0.62	4.9	-51.1	56.0	1.5	-44.5	46.0
1.315	5.2	-50.8	56.0	1.4	-44.6	46.0
3.945	5.4	-50.6	56.0	1.8	-44.2	46.0
4.015	9.5	-46.5	56.0	3.1	-42.9	46.0
14.615	6.2	-53.8	60.0	2.0	-48.0	50.0

Test point: N
 Operation mode: TX continuous mode at 2405 MHz
 Remarks:

Result: passed



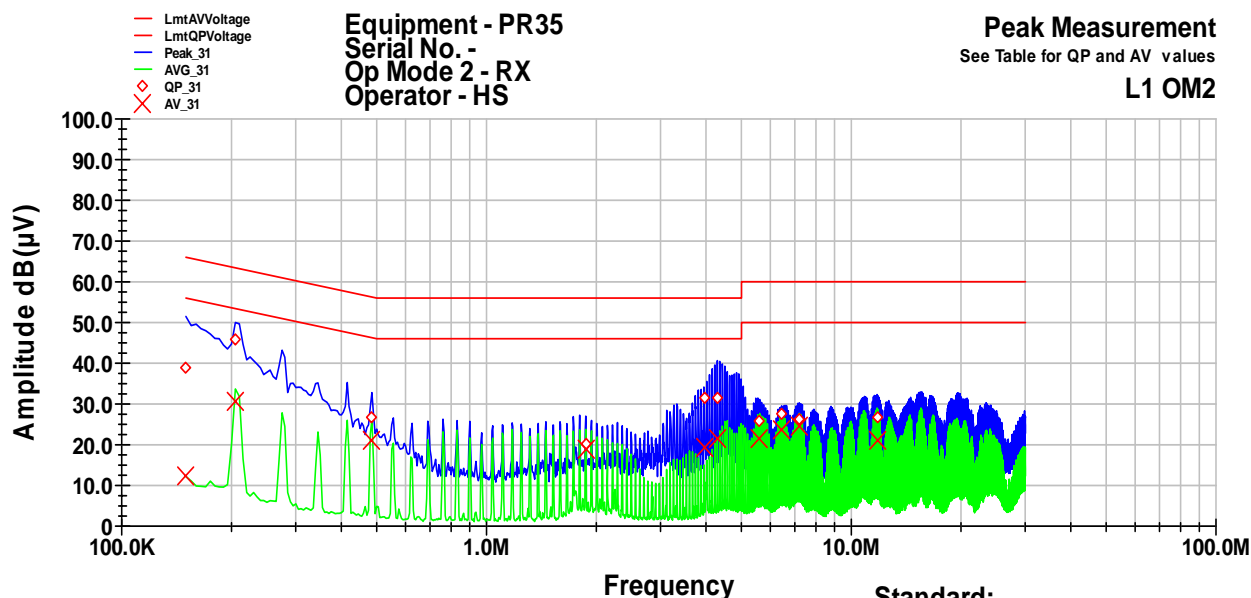
Standard:
 File Number: T33893

Frequency MHz	QP Level dB(µV)	QP Delta dB	QP Limit dB	AV Level dB(µV)	AV Delta dB	AV Limit dB
0.15	33.0	-33.0	66.0	8.4	-47.7	56.0
0.205	41.4	-22.0	63.4	25.8	-27.6	53.4
2.84	26.5	-29.5	56.0	25.6	-20.4	46.0
3.53	26.2	-29.8	56.0	22.8	-23.3	46.0
4.57	30.0	-26.0	56.0	24.2	-21.8	46.0
5.955	28.7	-31.3	60.0	25.5	-24.5	50.0
6.995	27.8	-32.2	60.0	27.8	-22.2	50.0
7.065	25.7	-34.3	60.0	14.9	-35.1	50.0
9.35	28.6	-31.4	60.0	26.2	-23.8	50.0
15.445	32.5	-27.5	60.0	31.7	-18.3	50.0

FCC ID:SDL-PR3XR01

Test point: L1
 Operation mode: RX mode
 Remarks: Limit according to FCC Part 15107

Result: passed



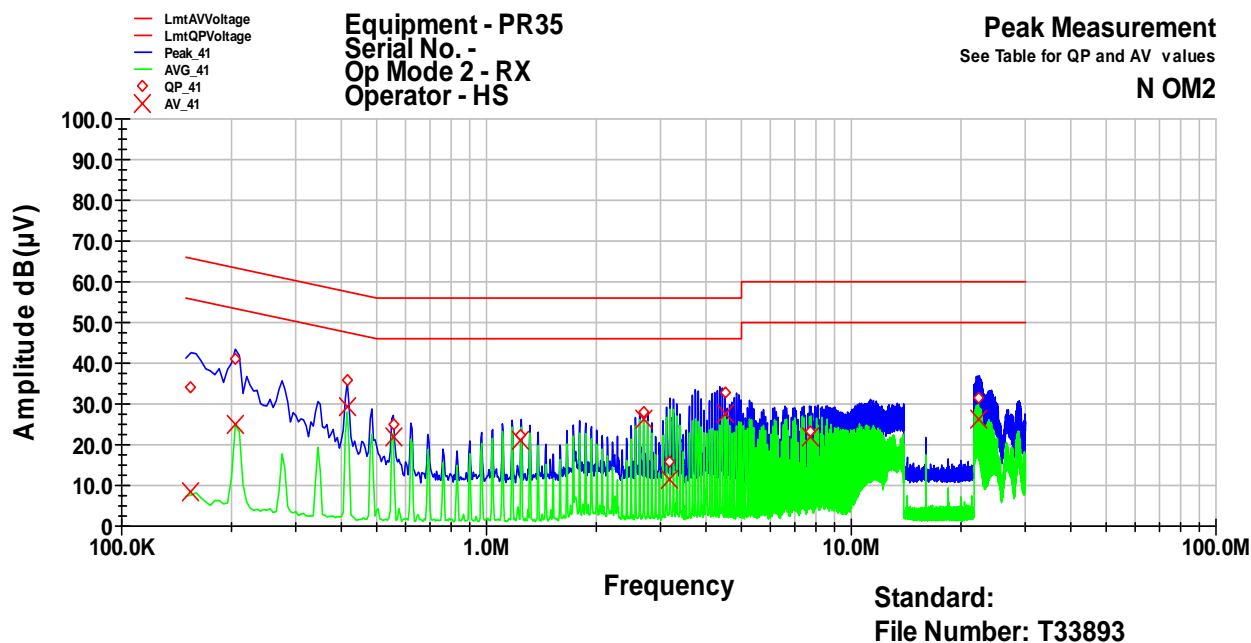
Standard:
 File Number: T33893

Frequency MHz	QP Level dB(µV)	QP Delta dB	QP Limit dB	AV Level dB(µV)	AV Delta dB	AV Limit dB
0.15	39.0	-27.0	66.0	12.1	-43.9	56.0
0.205	45.8	-17.6	63.4	30.5	-22.9	53.4
0.485	26.9	-29.3	56.3	21.1	-25.1	46.3
1.87	20.2	-35.8	56.0	19.0	-27.0	46.0
3.945	31.3	-24.7	56.0	19.3	-26.7	46.0
4.29	31.5	-24.5	56.0	21.6	-24.4	46.0
5.61	26.0	-34.0	60.0	21.3	-28.7	50.0
6.44	27.5	-32.5	60.0	23.8	-26.2	50.0
7.2	26.5	-33.5	60.0	24.4	-25.6	50.0
11.77	26.6	-33.4	60.0	20.9	-29.1	50.0

FCC ID:SDL-PR3XR01

Test point: N
 Operation mode: RX mode
 Remarks: Limit according to FCC Part 15107

Result: passed



Standard:
File Number: T33893

Frequency MHz	QP Level dB(µV)	QP Delta dB	QP Limit dB	AV Level dB(µV)	AV Delta dB	AV Limit dB
0.155	34.0	-31.8	65.7	8.6	-47.2	55.7
0.205	41.1	-22.3	63.4	25.0	-28.4	53.4
0.415	35.8	-21.7	57.5	29.3	-18.3	47.5
0.555	25.1	-30.9	56.0	21.9	-24.1	46.0
1.245	22.3	-33.8	56.0	21.1	-24.9	46.0
2.7	27.9	-28.1	56.0	26.5	-19.5	46.0
3.185	15.9	-40.1	56.0	11.5	-34.5	46.0
4.5	32.7	-23.3	56.0	27.5	-18.5	46.0
7.755	23.2	-36.8	60.0	22.1	-27.9	50.0
22.3	31.5	-28.5	60.0	26.3	-23.7	50.0

5.2 Radiated emission of the fundamental wave

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 field strength of emissions from intentional radiators operated within these frequency bands shall comply with the effective limits.

5.2.2 Description of Measurement

The radiated emission of the fundamental wave from the EUT is measured using a spectrum analyser and appropriate linear polarized antennas.

Analyser settings:

Peak measurement:	RBW: 1 MHz	VBW: 1 MHz	Detector: Max peak
AV measurement:	RBW: 1 MHz	VBW: 10 Hz	Detector: Max peak

5.2.3 Test result

PK value:

Frequency (MHz)	Reading level PK (dB μ V)	Bandwidth (kHz)	Correction factor (dB/m)	Corrected level PK dB(μ V/m)	Corrected level AV dB(μ V/m)	Limit AV dB(μ V/m)	Delta (dB)
2405	111.2	1000	-9.9	101.3		94	7.3

AV value:

Frequency (MHz)	Reading level AV (dB μ V)	Bandwidth (kHz)	Correction factor (dB/m)	Corrected level PK dB(μ V/m)	Corrected level AV dB(μ V/m)	Limit AV dB(μ V/m)	Delta (dB)
2405	53.6	1000	-9.9		43.7	94	-50.3

Average-Limit according to FCC Part 15C, Section 15.249(a):

Frequency (MHz)	Field strength of fundamental	
	(mV/m)	dB(μ V/m)
902 - 928	50	94
2400 - 2483.5	50	94
5725-5875	50	94
24000 - 24250	250	108

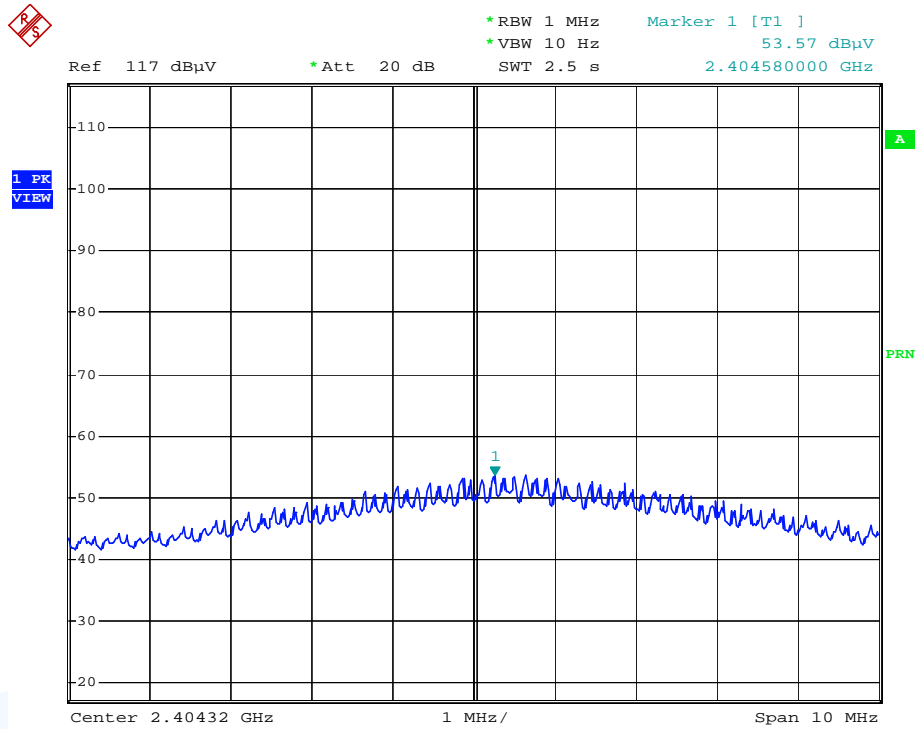
Peak-Limit according to FCC Part 15C, Section 15.249(e):

However the peak field strength shall not exceed the maximum permitted average limit by more than 20 dB.

The requirements are **FULFILLED**.

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

5.2.4 Testprotocol



5.3 Spurious emissions radiated

For test instruments and accessories used see section 6 Part SER1, SER 2, SER 3.

5.3.1 Description of the test location

Test location: OATS 1
Test location: Anechoic Chamber A2
Test distance: 3 metres

5.3.2 Photo documentation of the test set-up

OATS1 (9 kHz - 30 MHz)



OATS1 (30 - 1000 MHz)



Anechoic chamber



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 emissions from the EUT are measured in the frequency range of 9 kHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. The set up of the EUT will be in accordance to ANSI C63.4. In the frequency range above 1 GHz a spectrum analyser is used with appropriate linear polarized antennas. If the emission level in peak mode 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. During the test, the EUT was set into continuous transmitting mode modulated.

Instrument settings:

9 kHz - 150 kHz	RBW:	200 Hz
150 kHz - 30 MHz	RBW:	9 kHz
30 MHz – 1000 MHz:	RBW:	120 kHz
1000 MHz – 25 GHz	RBW:	1 MHz

5.3.5 Test result f < 1 GHz

Channel 1

Frequency (MHz)	Reading level QP (dBµV)	Reading level AV (dBµV)	RBW (kHz)	Correction factor (dB/m)	Corrected level QP dB(µV/m)	Corrected level AV dB(µV/m)	Limit dB(µV/m)	Delta (dB)
111.5	12.2		120	12.3	24.5		43.5	-19.0

Note: The correction factor includes cable loss and antenna factor.

5.3.6 Test result f > 1 GHz

Channel 1

Frequency (MHz)	Level PK (dBµV)	Correct. factor (dB/m)	Corrected level PK dB(µV/m)	Corrected level AV dB(µV/m)	Limit PK dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
2308	59.0	-10.5	48.5			54.0	-5.5
2350	63.8	-10.2	53,6			54.0	-0.4
4800	44.3	3.9	48.2			54.0	-5.8
7219	40.7	7.5	48.2			54.0	-5.8

Limit according to FCC Part 15C, Section 15.209:

Frequency (MHz)	15.209 Limits dB(µV/m)	Measurement distance (m)
0.009 - 0.49	2400/f(kHz)	300
0.49 – 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

Average limit according to FCC Part 15C, Section 15.249(a):

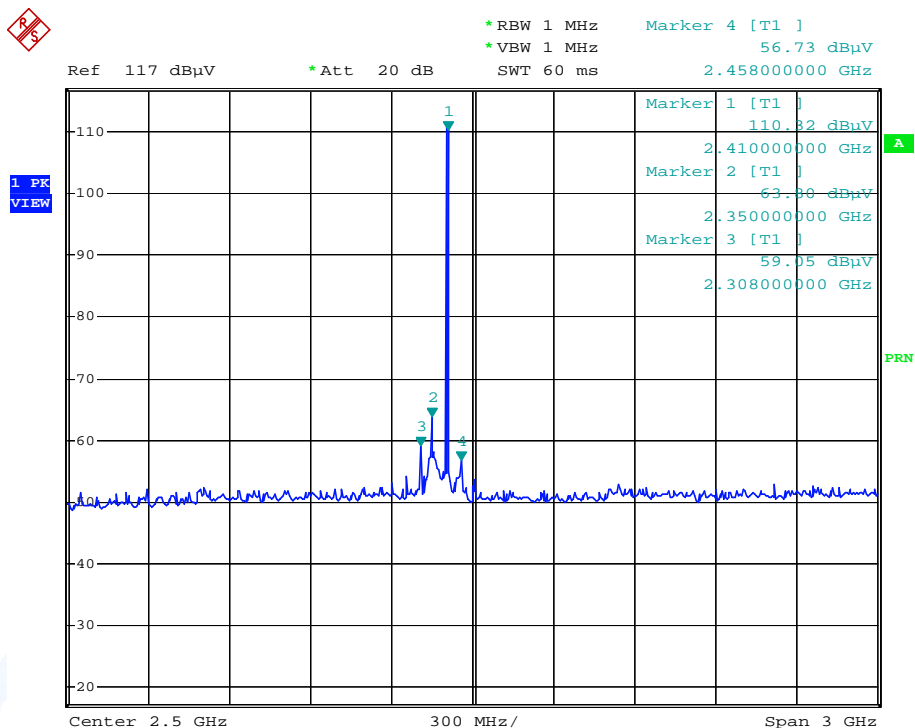
Fundamental frequency (MHz)	Field strength of harmonics	
	(µV/m)	dB(µV/m)
902 - 928	500	54
2400 - 2483.5	500	54
5725 - 5875	500	54
24000 - 24250	2500	68

The requirements are **FULFILLED**.

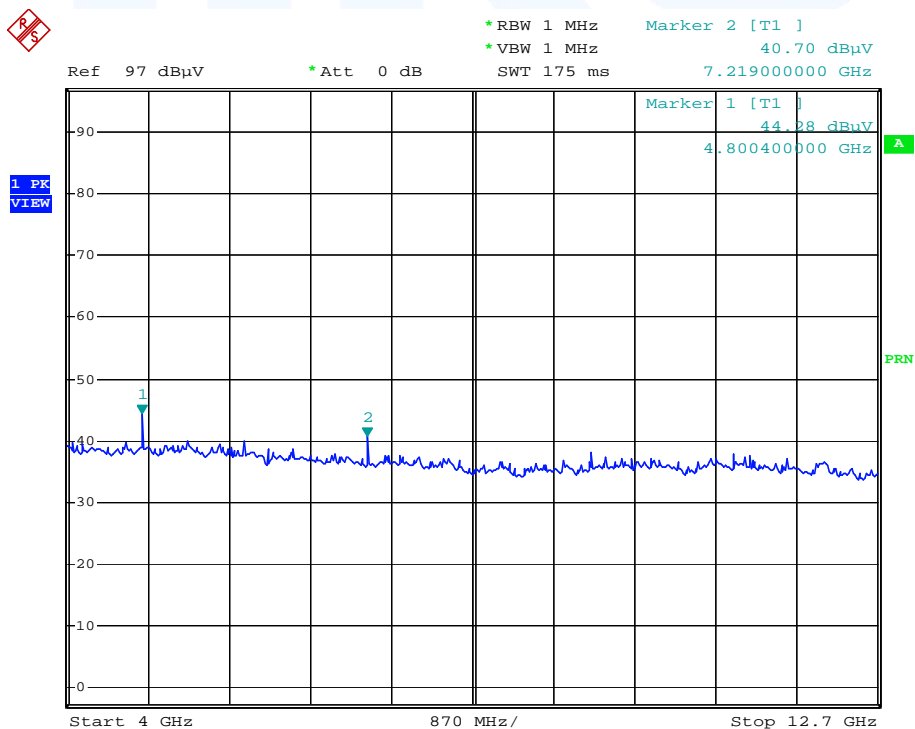
Remarks: The measurement was performed from 9 kHz up to the 10th harmonic (25000 MHz). In the range 9 kHz – 30 MHz, 18 GHz – 25 GHz no emission could be detected. For detailed test result please refer to following test protocols

5.3.7 Test protocols

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



Spurious emissions from 4 to 12 GHz

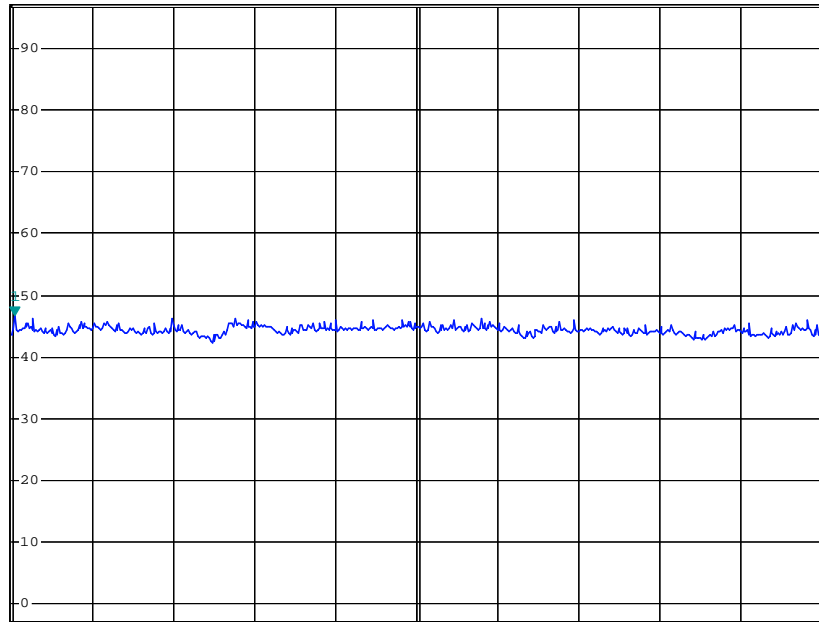


Spurious emissions from 12 to 18 GHz



Ref 97 dB μ V *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz 46.67 dB μ V
SWT 120 ms 12.02400000 GHz

1 PK
MAXH



Start 12 GHz 600 MHz/ Stop 18 GHz



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: Anechoic Chamber A2

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 alternative 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.

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. Alternative is the x-dB-down function of the analyser used. The EBW is than directly shown in the marker display. The measurement is performed with normal modulation and a transfer rate means the worst case.

Spectrum analyser settings:

RBW:	100 kHz	VBW:	300 kHz	Span:	10 MHz
Sweep time:	2.5 ms	Detector:	peak	Trace:	max hold

5.4.5 Test result

Operating frequency band (MHz)	20 dB Bandwidth (MHz)	Limit 80% bandwidth (MHz)
$f_{low} > 2400$	$f_{low} = 2403.408$	> 2401
$f_{high} < 2410$	$f_{high} = 2406.308$	< 2409

80% bandwidth of the permitted band:

2401 MHz – 2409 MHz

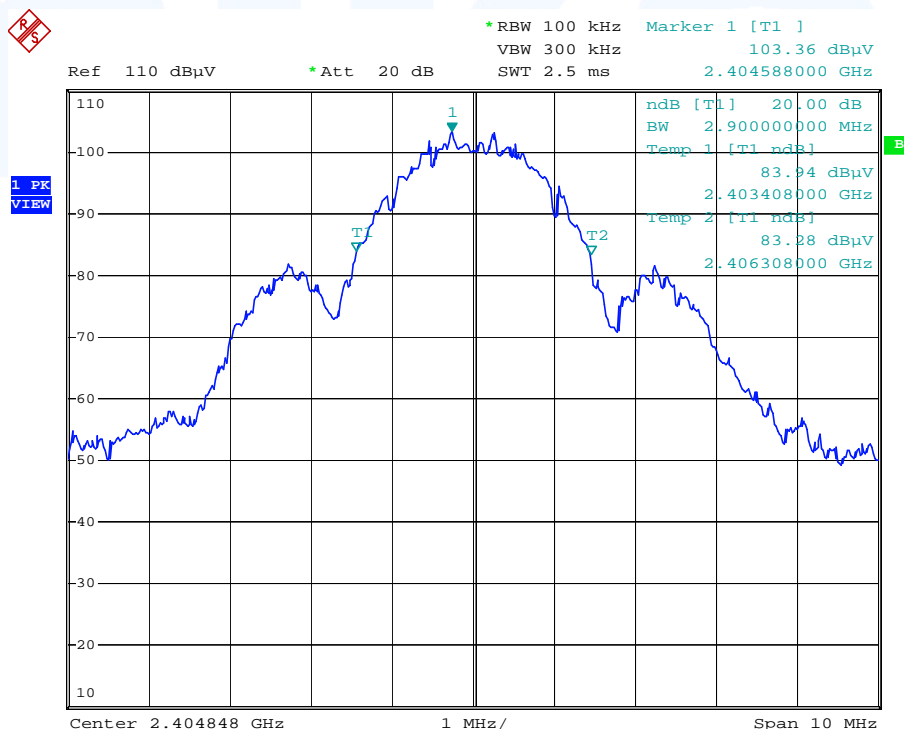
Limit according to FCC Part 15C, Section 15.215(c):

If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

The requirements are **FULFILLED**.

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

5.4.6 Test protocol



Comment: PR35
Date: 25.JUN.2010 13:32:07

5.5 Antenna application

5.5.1 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.

5.5.2 Result

The EUT use an integrated antenna. No other antenna than that furnished by the responsible party or external power amplifier can be applied by a customer.

The EUT's antenna meets the requirement of FCC Part 15C, Section 15.203 and 15.204.

Remarks:

mikes

5.6 Receiver radiated emissions

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

5.6.1 Description of the test location

Test location: OATS 1
Test location: Anechoic Chamber A2
Test distance: 3 metres

5.6.2 Photo documentation of the test set-up

OATS1 (30 - 1000 MHz)



Anechoic chamber



5.6.3 Applicable standard

According to FCC Part 15C, Section 15.109(a):

Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 m shall not exceed the given limit.

5.6.4 Description of Measurement

The radiated 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. In the frequency range above 1 GHz a spectrum analyser is used with appropriate linear polarized antennas. The set up of the EUT will be in accordance to ANSI C63.4. If the emission level in peak mode 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. During the test, the EUT was set into continuous transmitting mode modulated.

Instrument settings:

30 MHz – 1000 MHz: RBW: 120 kHz

1000 MHz – 12.5 GHz RBW = VBW: 1 MHz

5.6.5 Test result f < 1 GHz

Frequency (MHz)	Reading level QP (dBµV)	Bandwidth (kHz)	Correction factor (dB/m)	Corrected level QP dB(µV/m)	Limit dB(µV/m)	Delta (dB)
111.5	20.6	120	12.3	32.9	43.5	-10.6

Note: Correction factor means cable loss and antenna factor.

5.6.6 Test result f > 1 GHz

Frequency (MHz)	Reading level PK (dBµV)	Bandwidth (kHz)	Correction factor (dB/m)	Corrected level PK dB(µV/m)	Limit dB(µV/m)	Delta (dB)
1858	50.6	1000	-10.9	39.5	54.0	-14.5
4805	43.5	1000	3.9	47.4	54.0	-6.6

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

Limit according to FCC Part 15C, Section 15.109:

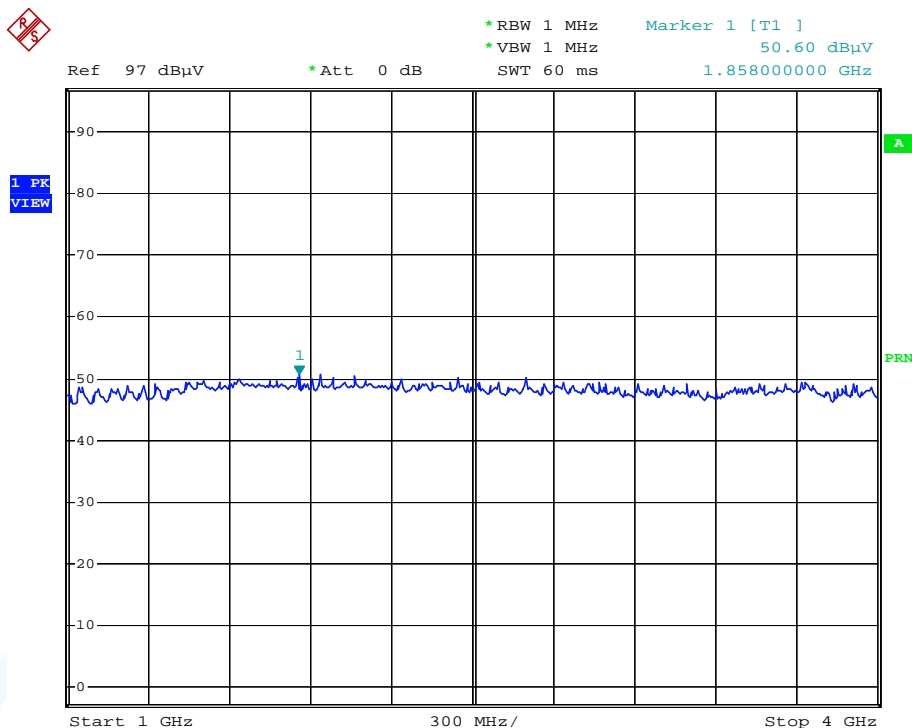
Frequency (MHz)	Limits dB(µV/m)	Measurement distance (m)
30-88	40	3
88-216	43,5	3
216-960	46	3
Above 960	54	3

The requirements are **FULFILLED**.

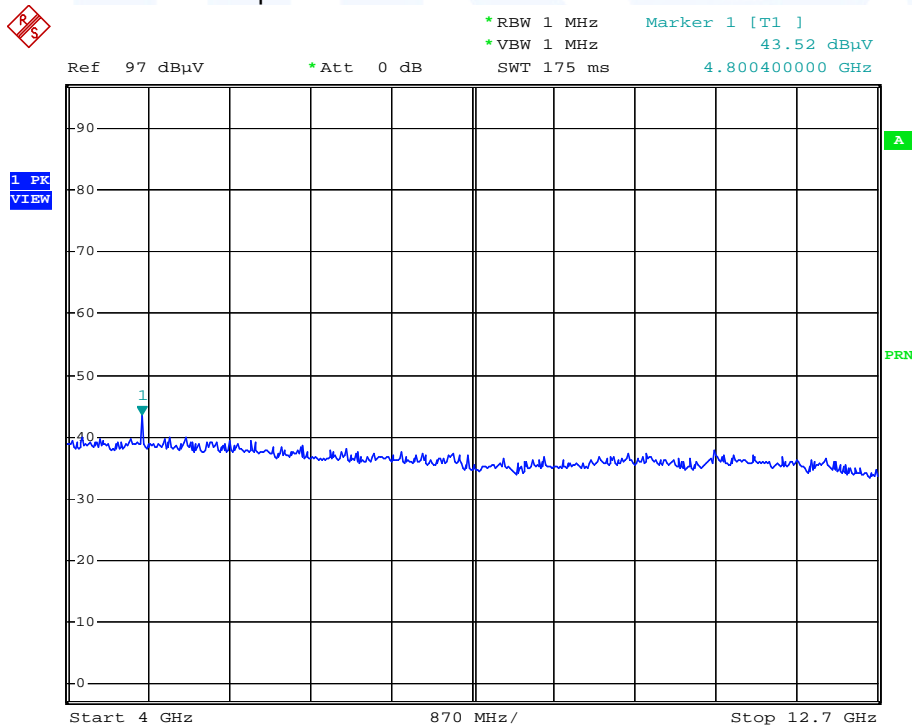
Remarks: The measurement was performed from 30 MHz to the 5th harmonic (12500 MHz). For detailed test result please refer to following test protocols.

5.6.1 Test protocols

Spurious emissions from 1 to 4 GHz



Spurious emissions from 4 to 12 GHz



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.	Next Verif.
A 4	ESHS 30	02-02/03-05-002	18/06/2011	18/06/2010		
	R 3162	02-02/11-05-003	06/10/2011	06/10/2009	06/10/2010	06/10/2009
	ESH 2 - Z 5	02-02/20-05-004	13/03/2011	13/03/2008	11/12/2010	11/06/2010
	RF Antenna	02-02/24-05-032				
	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			07/10/2010	07/04/2010
CPR 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				
	3117	02-02/24-05-009	10/02/2011	10/02/2010		
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
MB	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
	AFS4-01000400-10-10P-4	02-02/17-05-003				
	3117	02-02/24-05-009	10/02/2011	10/02/2010		
SER 1	FMZB 1516	01-02/24-01-018			15/02/2011	15/02/2010
	ESCI	02-02/03-05-005	10/11/2010	10/11/2009		
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 2	ESVS 30	02-02/03-05-006	11/06/2011	11/06/2010		
	VULB 9168	02-02/24-05-005	06/05/2011	06/05/2008	01/10/2010	01/04/2010
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
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				
	3117	02-02/24-05-009	10/02/2011	10/02/2010		
	R1	02-02/30-09-002			17/02/2011	17/02/2010
	Sucoflex N-1000-SMA	02-02/50-05-072				
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	C12-K1K1-157	02-02/50-06-001				