FCC ID: LTQ31121678

EMI – TEST REPORT

- FCC Part 15.231 -

Deutsche Akkreditierungsstelle D-PL-12030-01-01

Test Report No. : T36036-00-05HS	13. September 2012 Date of issue

Type / Model Name : 3K FZV

Product Description : Keyless entry system

Applicant : Delphi Deutschland GmbH

Address : TecCenter

31162 BAD SALZDETFURTH, GERMANY

Manufacturer : Delphi Deutschland GmbH

Address : TecCenter

31162 BAD SALZDETFURTH, GERMANY

Licence holder : Delphi Deutschland GmbH

Address : Delphiplatz 1

42119 WUPPERTAL, GERMANY

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

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September, 2011)

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 C - Intentional Radiators (September, 2011)

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 15.205	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 15.215	Additional provisions to the general radiated emission limitations
Part 15, Subpart C, Section 15.231	Periodic operation in the band 40.66-40.70 MHz and above 70 MHz

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: 2009	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
CISPR 16-4-2: 2003	Uncertainty in EMC measurement
CISPR 22: 2005 EN 55022: 2006	Information technology equipment

2 SUMMARY

2.1 Test result summary

SRD device using digital modulation and operates in the 315 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS Gen, 7.2.4.	Conducted limits	not applicable
15.231(b)	RSS210, A1.1.2	Field strength of the fundamental wave	passed
15.231(b)	RSS210, A1.1.2	Spurious emissions radiated (electric field)	passed
15.231(c)	-	Emission bandwidth	passed
15.215(c)	RSS-Gen, 7.2.6	Frequency tolerance	passed
15.231(a1)	RSS210, A1.1.1	Signal deactivation	passed
-	RSS210, A1.1.3	OBW 99%	passed

The mentioned RSS Rule Parts in the above table are related to:
RSS Gen, Issue 3, December 2010
RSS 210, Issue 8, December 2010

2.2 GENERAL REMARKS:

This EUT is a transceiver for keyless entry systems for vehicular use.

Operation frequency and channel plan

Channel	Frequency
1	314.00 MHz
2	314.90 MHz
3	314.45 MHz

Power setting

The output power setting in the firmware is “P=0x20 in a hex range from 4h to 40h. The user has no access on the output power setting of the device.

Antenna

The EUT has a dedicated antenna (A207) as a special structure in the window of a car.

Transmit operating modes

- Normal TX mode (when the car will be locked or unlocked)
- Comfort TX mode (when the key is requested to open or close a window)

2.3 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 : 13 June 2012

Testing concluded on : 17 June 2012

Checked by:

Thomas Weise
I confirm the correctness and integrity of this document
2012.09.13 15:23:05 +02'00'

Thomas Weise
Dipl. Ing.(FH)
Laboratory Manager

Tested by:

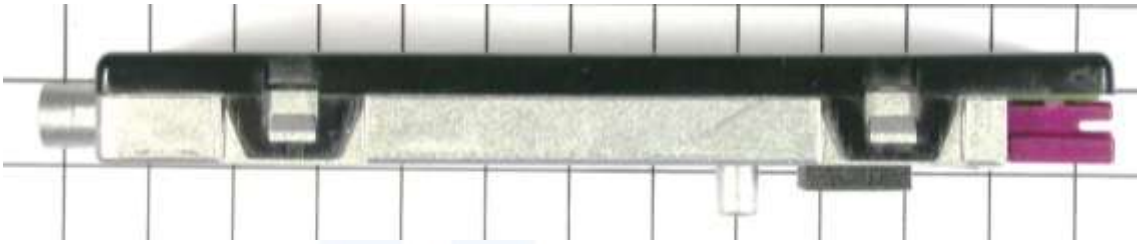
Hermann Smetana
2012.09.13 14:59:38 +02'00'

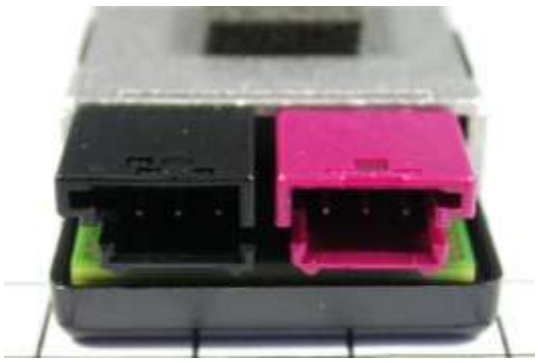
Hermann Smetana
Dipl.-Ing.(FH)
Radio Expert

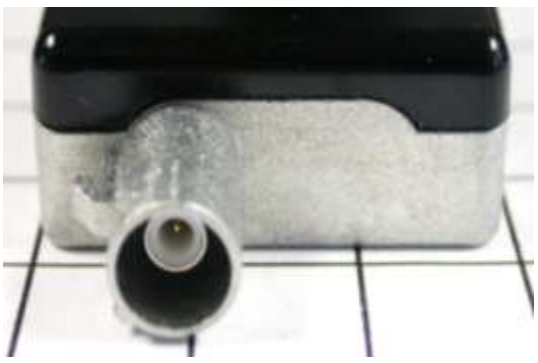
3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT

External view:







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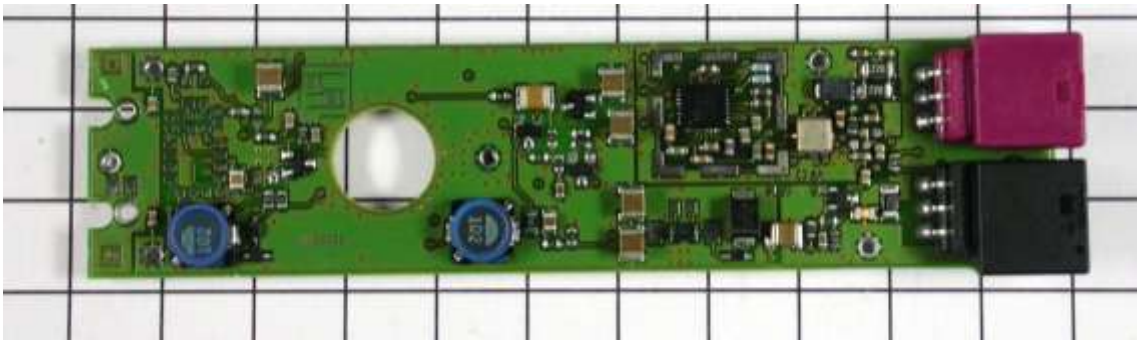
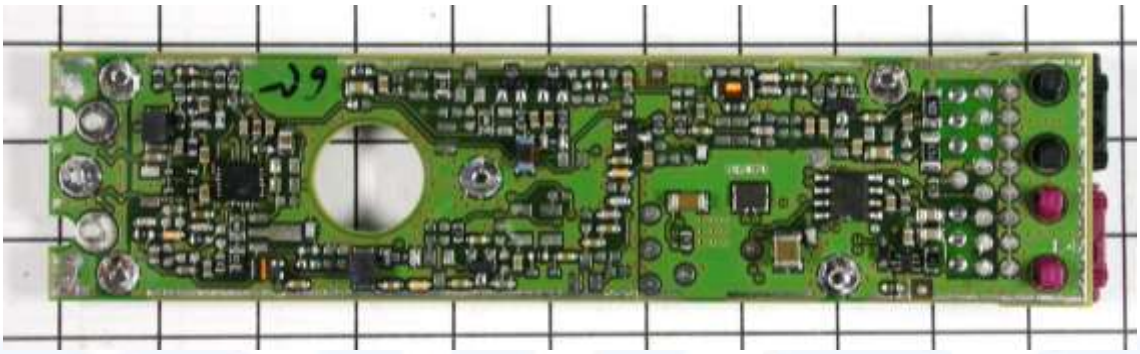
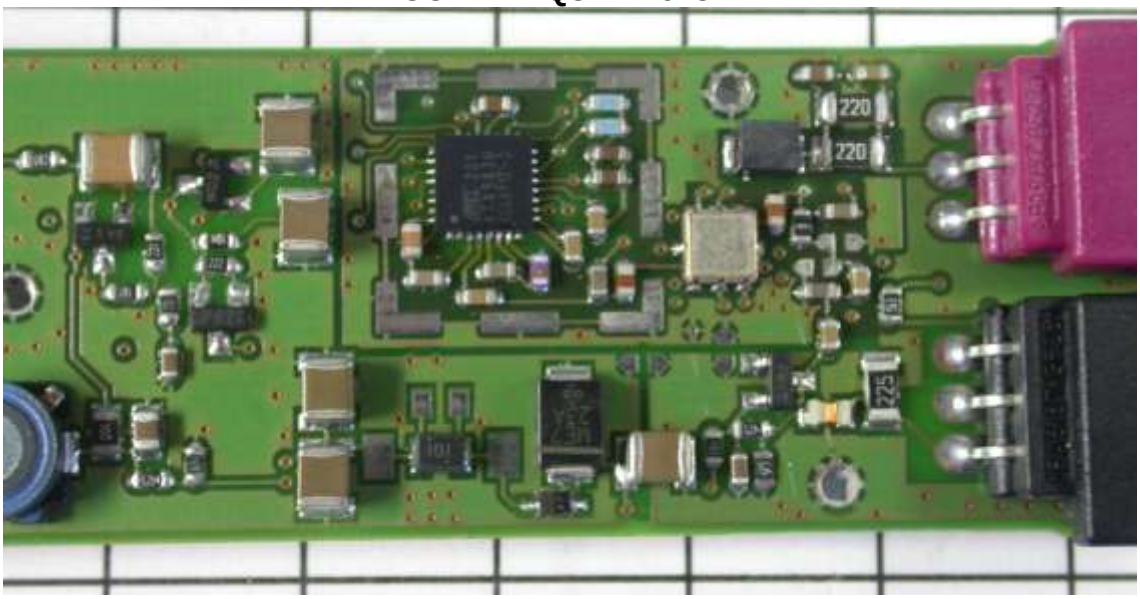
Internal view:



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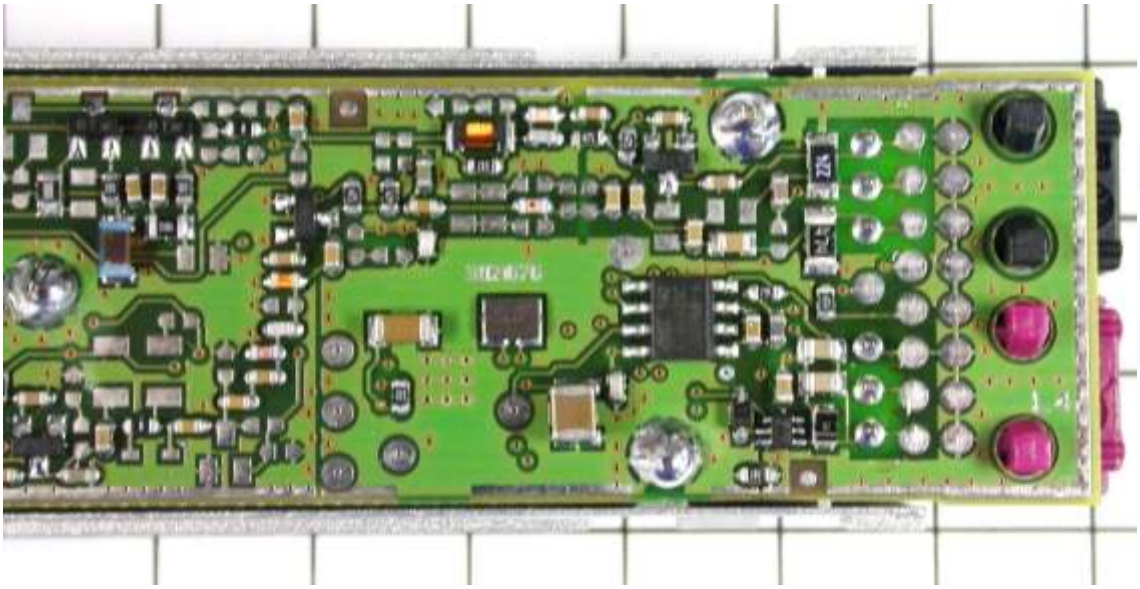

EUT connected to the dedicated window antenna in the original integration of a car.

3.2 Power supply system utilised

Power supply voltage: : 12 VDC (car application)

3.3 Short description of the Equipment under Test (EUT)

The EUT is a transceiver for car entry systems. The EUT has additionally an antenna preamplifier for AM/FM radio. The EUT is a multi-channel system using 3 RF channels and is controlled via LIN-Bus.

Number of tested samples: 1
Serial number: 21110002

EUT operation mode:

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

- TX continuous mode

- Polling 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:

- Adapter board for remote control Model : self-made
- 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.

4.1 Measurement protocol for FCC and IC

4.1.1 GENERAL INFORMATION

4.1.1.1 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 open area test site is a listed under the Canadian Test-Sites File-No:

IC 3009A-1

In compliance with RSS 210 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.4, ANSI C63.10 and applying the CISPR 22 limits.

4.1.1.2 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 without termination. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.1.1.3 Details of test procedures

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, ANSI C63.10 and applying the CISPR 22 limits.

4.1.2 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.

4.1.3 Conducted emission

Description of measurement

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

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.

4.1.4 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. Floor standing equipment is placed directly on the turnable ground plane. The setup of the equipment under test is established in accordance with ANSI C63.4. The antenna is positioned 3 metres 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 taking the reading from the EMI receiver (Level dBµV) and adding the correction factors and cable loss factor (dB). 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)	=	Level (dBµV/m)	-	CISPR Limit (dBµV/m)	=	Margin (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

4.1.5 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. Floor standing equipment is placed directly on the turnable ground plane. The setup of the equipment under test is following set out in ANSI C63.4. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyzer 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.

4.2 Determination of worst case measurement conditions

Measurements have been made in the original application.

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: NONE

Remarks: Not applicable the EUT has no AC mains connection.

5.2 Field strength of the fundamental wave

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

5.2.1 Description of the test location

Test location: OATS 1

Test distance: 10 m

5.2.2 Photo documentation of the test set-up

5.2.1 Applicable standard

According to FCC Part 15C, Section 15.231(b):
The field strength of emissions from intentional radiators shall not exceed the effective field strength limits.

5.2.2 Description of measurement

The radiated field strength of the fundamental wave from the EUT is measured in the frequency range of 30 to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. The setup of the EUT will be in accordance to ANSI C63.4. The EUT is measured in TX continuous mode unmodulated under normal conditions. The measurement is done at distance 10 m because of the large dimension of the car. The measurement value is calculated to a distance of 3 m.
EMI test receiver settings:
30 MHz – 1000 MHz: RBW: 120 kHz, Detector: Pk,

5.2.3 Test result

Frequency	Level Pk	Bandwidth	Duty cycle factor	Level AV	Limit 315 MHz	Margin
(MHz)	(dBµV/m)	(kHz)	(dB)	dB(µV/m)	dB(µV/m)	(dB)
314.00	84.6	120	-13.8	70.8	75.6	-4.8
314.90	85.8	120	-13.8	72.0	75.6	-3.6
314.45	89.2	120	-13.8	75.4	75.6	-0.2

Limit according to FCC Section 15.231(b):

Frequency (MHz)	Field strength of fundamental @ 3m		Effective limit for 315 MHz	
	(µV/m)	dB(µV/m)	(µV/m)	dB(µV/m)
40.66 – 40.70	2250	67		
70 - 130	1250	62		
130 - 174	1250 to 3750*	62 to 71.4*		
174 - 260	3750	71.4		
260 - 470	**3750 to 12500***	**71.4 to 81.9***	**6042**	**75.6**
Above 470	12500	81.9		

*Linear interpolation

The requirements are **FULFILLED.**

Remarks: _____

_____

5.3 Spurious emissions radiated (electric field)

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

5.3.1 Description of the test location

Test location: OATS 1
Test distance: 10 m

Test location: Anechoic chamber 2
Test distance: 3 m

5.3.2 Photo documentation of the test set-up

5.3.3 Applicable standard

According to FCC Part 15C, Section 15.231(b), Section 15.209(a) and Section 15.205(a):
The emissions from intentional radiators shall not exceed the effective field strength limits.

5.3.4 Description of measurement

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI C63.4. If the emission level of the EUT in peak mode complies with the average limit is 20 dB lower, 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.

Instrument settings:
30 MHz – 1000 MHz: RBW: 120 kHz
1000 MHz – 4000 MHz RBW: 1 MHz

5.3.5 Test result f < 1 GHz

The measurement is done at distance 10 m because of the large dimension of the car. The measurement value is calculated to a distance of 3 m.
No emissions could be detected within 20 dB to the limit at a test distance of 3 metres. Emissions 20 dB below the limit needs not to be reported.

5.3.6 Test result f > 1 GHz

CH1:

Frequency	Bandwidth	Level PK	Level AV	Limit PK	Limit AV	Delta
(MHz)	(kHz)	dB(µV/m)	dB(µV/m)	dB(µV/m)	dB(µV/m)	(dB)
1054	1000	42.0	-	75.6	55.6	-33.6
1330	1000	36.9	-	75.6	55.6	-38.7
1618	1000	37.3	-	75.6	55.6	-38.3
1858	1000	46.1	-	75.6	55.6	-29.5

Note: The measured peak level is lower the AV limit. No further measurement is needed.

CH2:

Frequency	Bandwidth	Level PK	Level AV	Limit PK	Limit AV	Delta
(MHz)	(kHz)	dB(µV/m)	dB(µV/m)	dB(µV/m)	dB(µV/m)	(dB)
1054	1000	42.0	-	75.6	55.6	-33.6
1330	1000	36.9	-	75.6	55.6	-38.7
1618	1000	37.3	-	75.6	55.6	-38.3
1858	1000	46.1	-	75.6	55.6	-29.5

Note: The measured peak level is lower the AV limit. No further measurement is needed.

CH3:

Frequency	Bandwidth	Level PK	Level AV	Limit PK	Limit AV	Delta
(MHz)	(kHz)	dB(µV/m)	dB(µV/m)	dB(µV/m)	dB(µV/m)	(dB)
1054	1000	40.6	-	75.6	55.6	-35.0
1330	1000	39.5	-	75.6	55.6	-36.1
1654	1000	36.1	-	75.6	55.6	-39.5
1936	1000	44.3	-	75.6	55.6	-31.3

Note: The measured peak level is lower the AV limit. No further measurement is needed.

Limit according to FCC Section 15.231(b), Section 15.209(a) and Section 15.205(a):

Fundamental frequency	Field strength of spurious emissions @ 3m		**Limit for 315 MHz fundamental**	
(MHz)	(µV/m)	dB(µV/m)	(µV/m)	dB(µV/m)
40.66 – 40.70	225	47		
70 - 130	125	42		
130 - 174	125 to 375*	42 to 51.4*		
174 - 260	375	51,4		
260 - 470	**375 to 1250***	**51.4 to 61.9***	604	**55.6**
Above 470	1250	61.9		

*Linear interpolation

Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in the table above or to the general limits shown in the table below according to § 15.209, whichever limit permits a higher field strength.

Frequency (MHz)	15.209 Limits (µV/m)	15.209 Limits dB(µV/m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

Additionally there is a limit according to §15.35(b) on the radio frequency emissions, as measured with a peak detector, corresponding to 20 dB above the maximum permitted average limits.

Restricted bands of operation according to FCC Part 15C, Section 15.205(a):
The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209

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. For detailed test results please see the following test protocols. Only the worst cases of the plots are listed.

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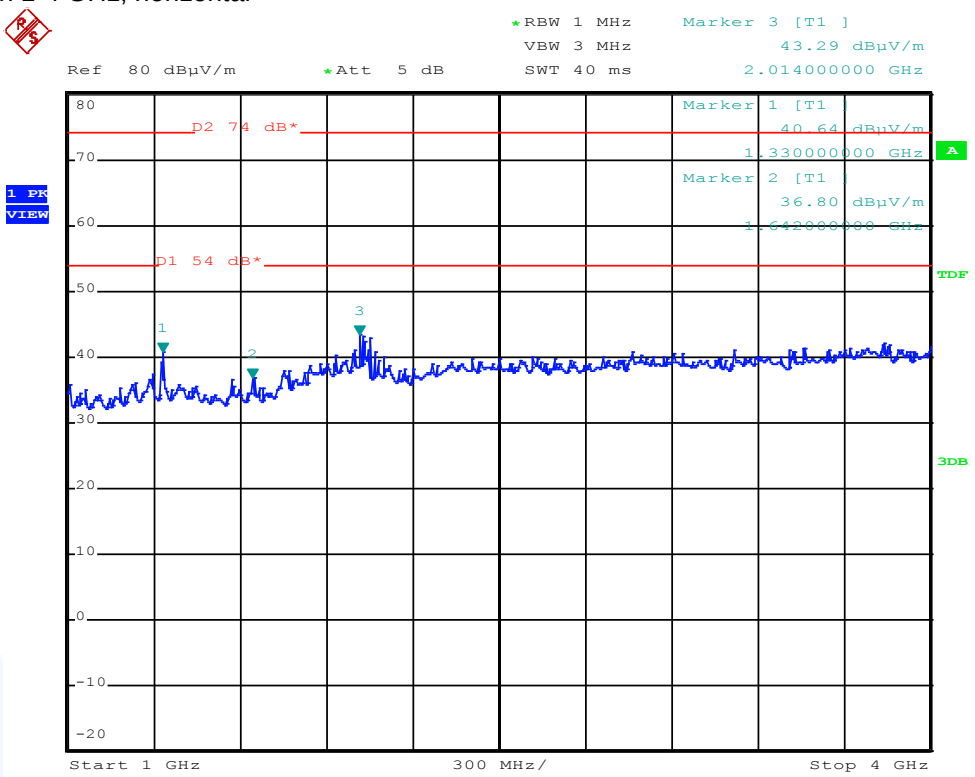
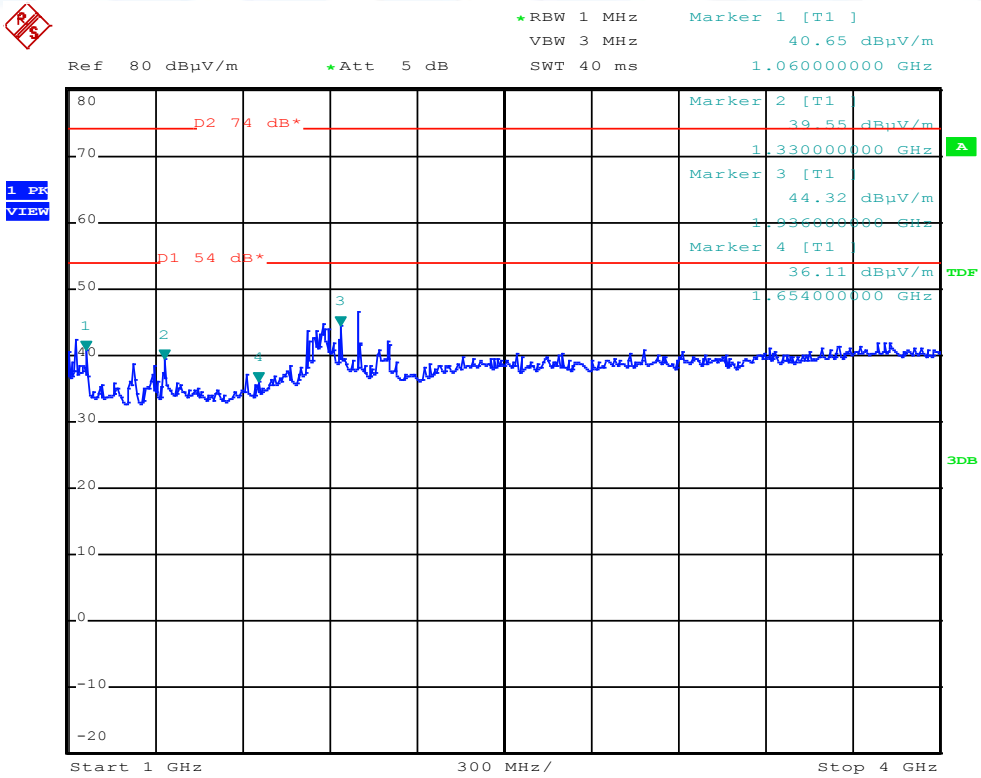
5.3.1 Test protocol spurious emissions

Emission 1-4 GHz, horizontal



Emission 1-4 GHz, vertical



5.4 Correction for pulse operation (duty cycle)

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

5.4.1 Description of the test location

Test location: NONE

5.4.2 Applicable standard

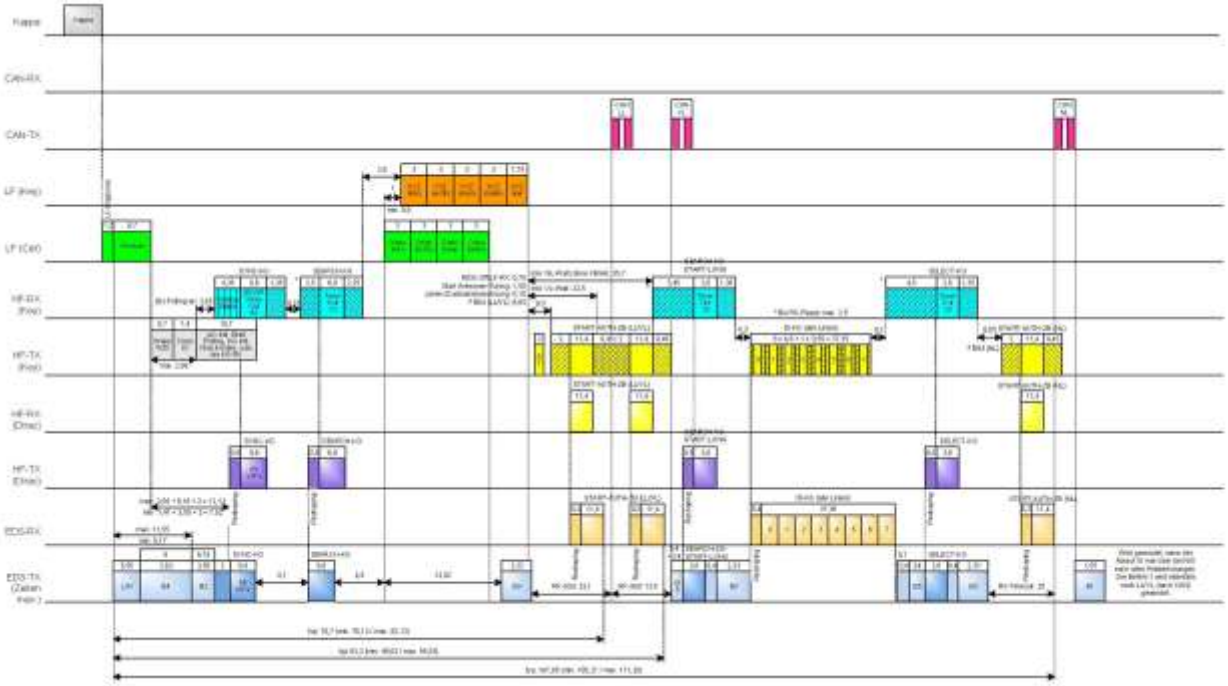
According to FCC Part 15C, Section 15.35(c):
The emissions from intentional radiators shall not exceed the effective field strength limits.

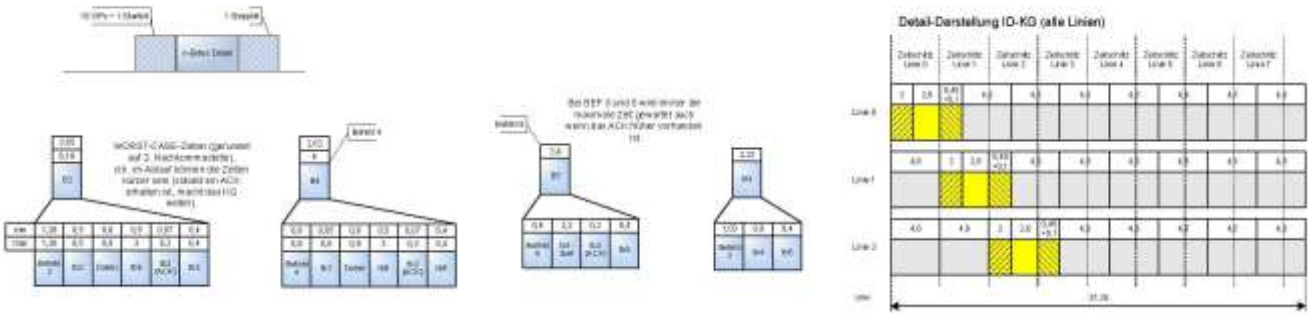
5.4.3 Description of measurement

The duty cycle timing is declared by the manufacturer with the following timing schedules

5.4.4 Test result

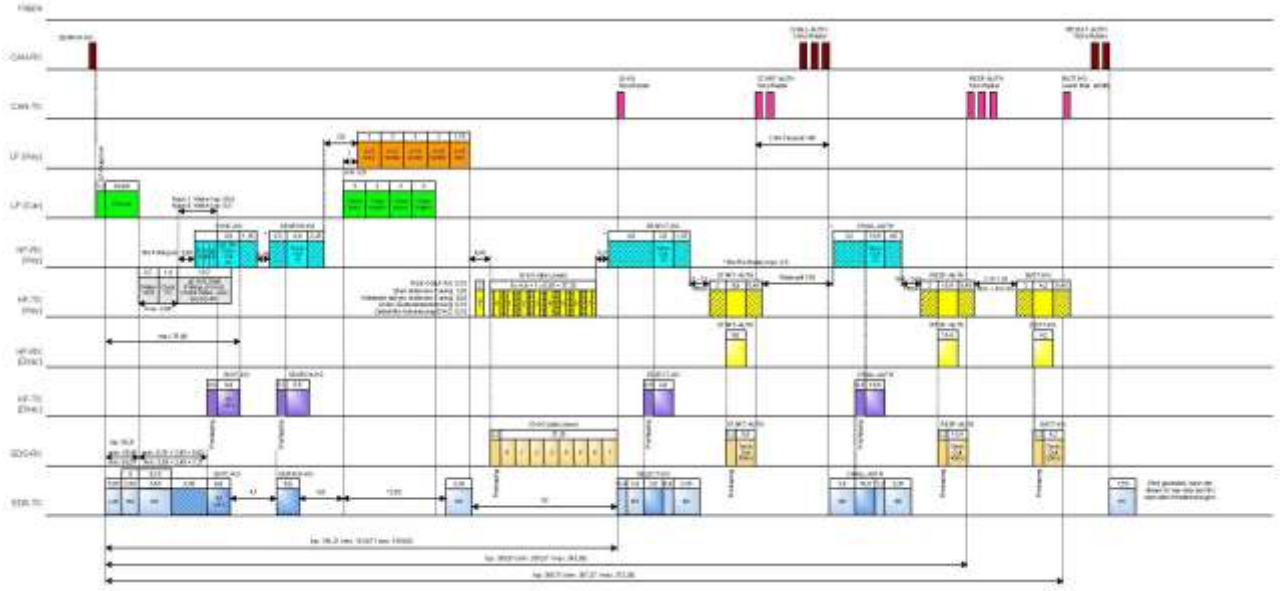
ZB timing





RF on time (pulstrain longer than 100 ms) 10.3 ms+7.1 ms + 3.1 ms = 20.5 ms

FB timing



The worst case of all kinds of pulses are pulstrains with more than 2 pulses as described in the timing schedule before.

RF on time (pulstrain longer than 100 ms) 10.3 ms+7.1 ms + 3.1 ms = 20.5 ms

Duty cycle correction factor: 20log(RF on time/0.1 ms) =-13.8 dB

Remarks: The pulse train (*Tw*) exceeds 100 ms, therefore the duty cycle have been calculated by averaging the sum of the pulse widths over the 100 ms width with the highest average value.

5.5 Emission bandwidth

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

5.5.1 Description of the test location

Test location: AREA4

5.5.2 Photo documentation of the test set-up

5.5.3 Applicable standard

According to FCC Part 15C, Section 15.231(c):
The bandwidth of the emission shall not exceed the effective limits.

5.5.4 Description of measurement

The measurement was performed conducted with intentional modulation using a spectrum analyser. The analyser span was set wide enough to capture the most of the power envelope of the signal. The function “20-dB-down” is used to determine the BW. For an overview on the adjacent restricted bands the span was set as wide as needed to show that the restricted bands are not affected.

Spectrum analyser settings:
RBW = 10 kHz, VBW = 30 kHz, Span: 200 kHz

5.5.5 Test result

Centre *f*	20dB bandwidth	20dB bandwidth	Measured EBW	Limit
(MHz)	f_1	f_2	(MHz)	(*f**0.0025)(MHz)
314.002405	313.970405	314.034405	0.064000	0.785006
314.899205	314.871205	314.927205	0.056000	0.787248
314.452828	314.425605	314.480050	0.054445	0.786132

Centre *f*	99% bandwidth	99% bandwidth	Measured OBW	Limit
(MHz)	f_1	f_2	(MHz)	(*f**0.0025)(MHz)
314.006805	313.970805	314.042805	0.072000	0.785017
314.887805	314.830405	314.945205	0.114800	0.787220
314.458205	314.406005	314.510405	0.104400	0.786146

Limit according to FCC Part 15C Section 15.231(c):

Frequency (MHz)	20 dB BW limit dependent of the carrier (%)
70 – 900	0.25
above 900	0.50

The bandwidth of the emission shall be no wider than 0.25% of the centre frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

The requirements are **FULFILLED.**

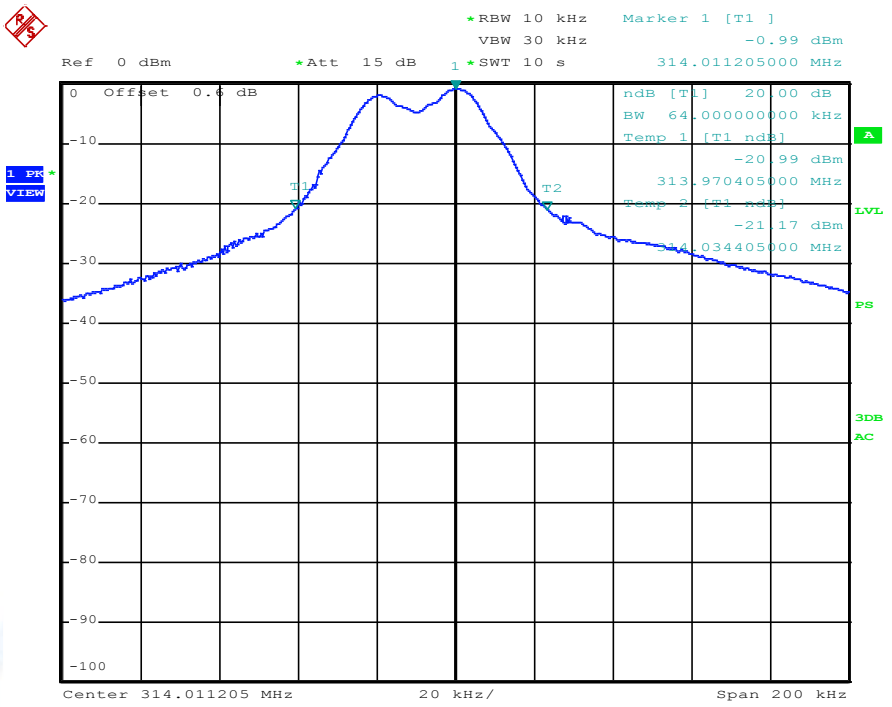
Remarks: For detailed results, please see the test protocol below.

5.5.6 Test protocol

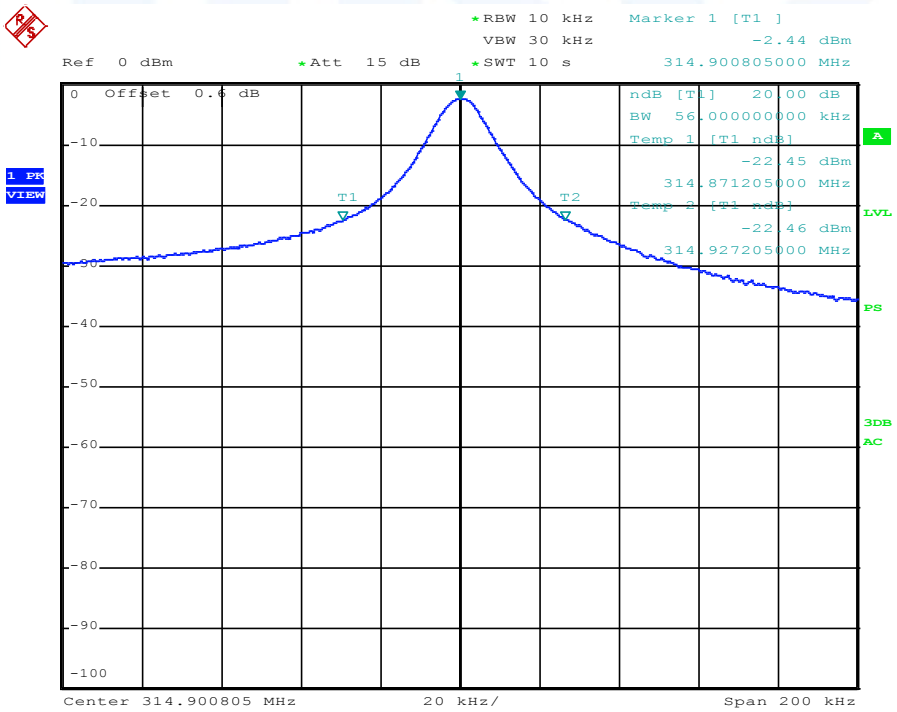
Emission bandwidth -20 dB

FCC Part 15C, Section 15.231(c)

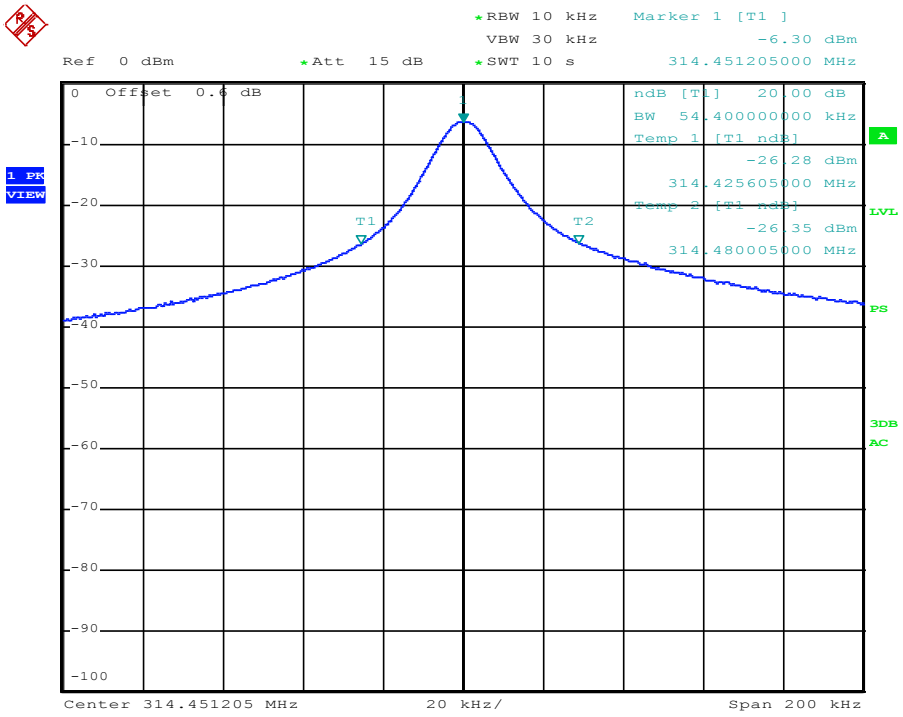
CH1:



CH2:

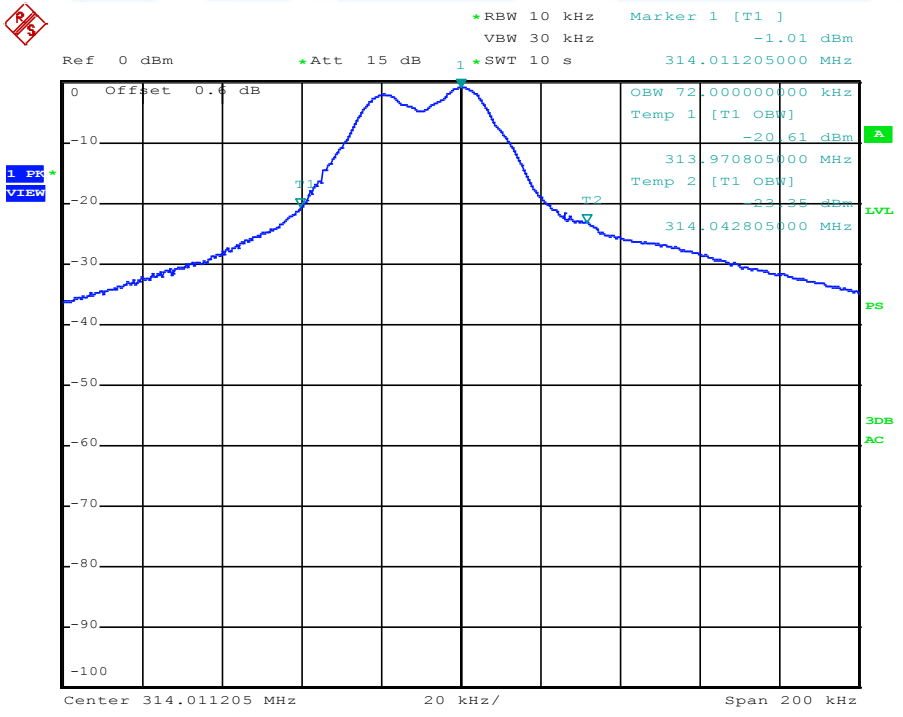


CH3:

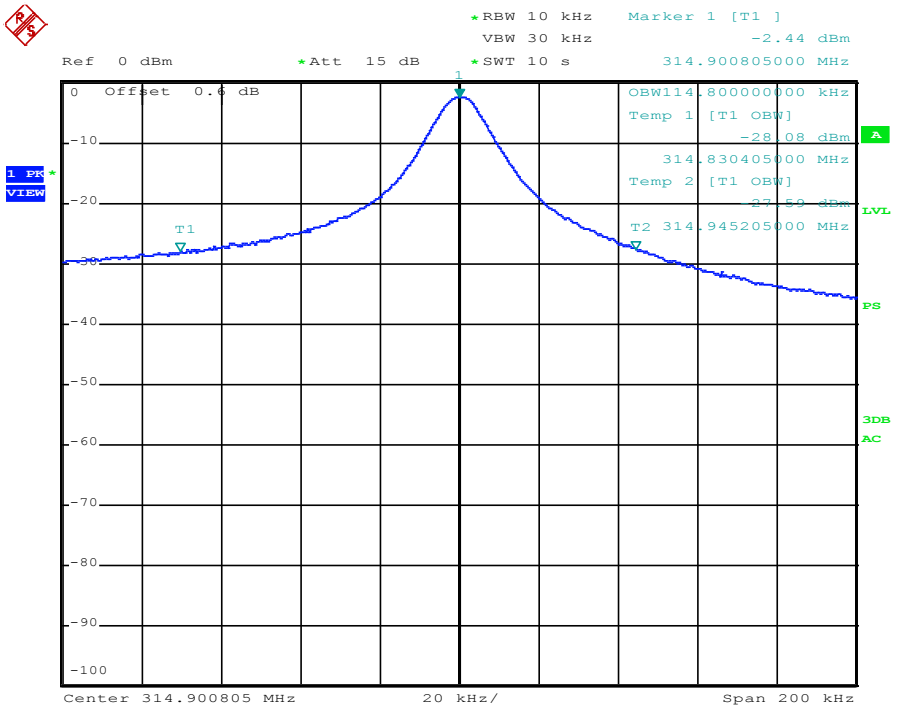


Emission bandwidth 99%

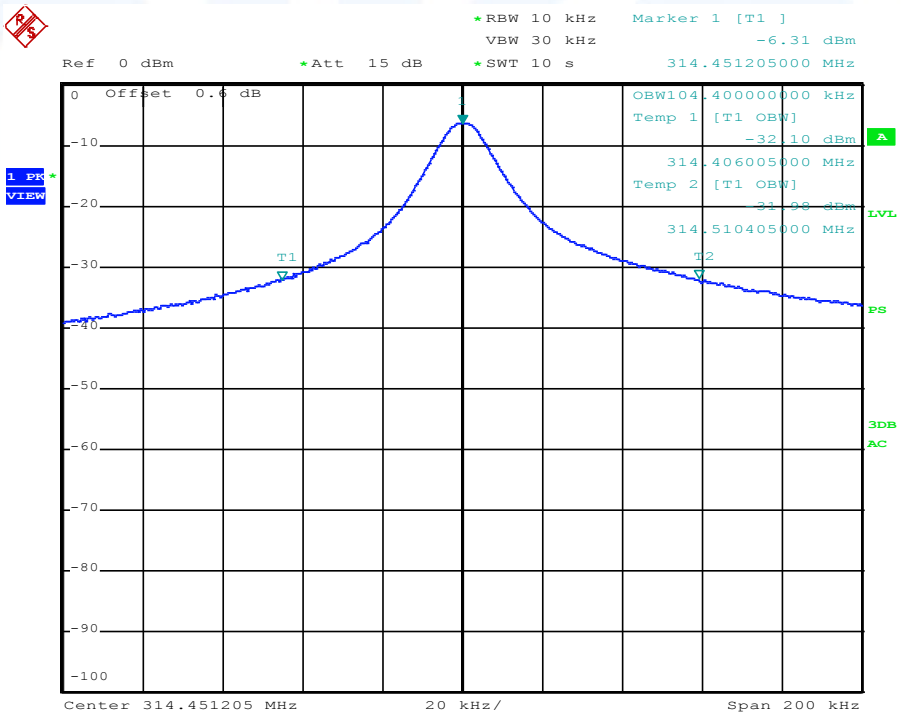
CH1:



CH2:


RBW 10 kHz
VBW 30 kHz
SWT 10 s
Marker 1 [T1]
-2.44 dBm
314.900805000 MHz
Ref 0 dBm
Att 15 dB
0 Offset 0.6 dB
OBW114.800000000 kHz
Temp 1 [T1 OBW]
-28.08 dBm
314.830405000 MHz
Temp 2 [T1 OBW]
-27.59 dBm
T2 314.945205000 MHz
T1
1 PK VIEW
A
LVL
PS
3DB AC
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Center 314.900805 MHz
20 kHz/
Span 200 kHz

CH3:


RBW 10 kHz
VBW 30 kHz
SWT 10 s
Marker 1 [T1]
-6.31 dBm
314.451205000 MHz
Ref 0 dBm
Att 15 dB
0 Offset 0.6 dB
OBW104.400000000 kHz
Temp 1 [T1 OBW]
-32.10 dBm
314.406005000 MHz
Temp 2 [T1 OBW]
-31.98 dBm
314.510405000 MHz
T1
T2
1 PK VIEW
A
LVL
PS
3DB AC
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Center 314.451205 MHz
20 kHz/
Span 200 kHz

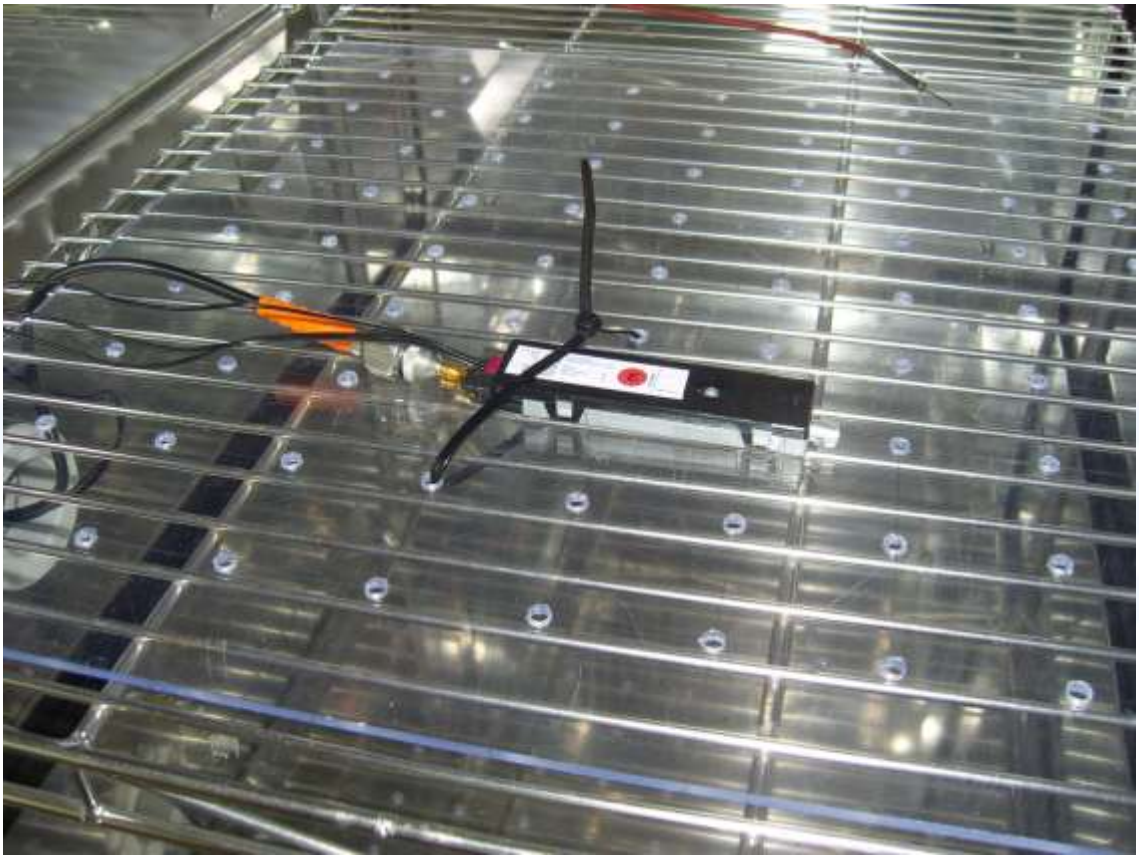
5.6 Frequency tolerance

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

5.6.1 Description of the test location

Test location: AREA4

5.6.2 Photo documentation of the test set-up



5.6.3 Applicable standard

According to FCC Part 15C, Section 15.231(d):
The frequency tolerance of the carrier signal shall be maintained within a limit of the operating frequency over extreme conditions for devices operating in the frequency range of 40.66 MHz – 40.70 MHz.

5.6.4 Description of Measurement

The frequency tolerance is measured with the spectrum analyzer. The sweep points were set to maximum for higher the frequency resolution or the function “frequency counter” is used. The signal is unmodulated; the marker of the analyzer is set to maximum amplitude at normal temperature, the frequency was recorded. Than the maximum supply voltage is set and the marker of the analyzer is set to maximum amplitude. This procedure is done again for the minimum supply voltage. The EUT was now driven at normal supply voltage but in the climatic chamber to range the temperature from -20 °C to +50 °C in steps of 10 degrees. The drifting carrier is measured by setting the marker at the analyzer.

5.6.5 Test result

Test conditions		Test result
		Frequency (MHz)
T_{min} (-20)°C	V_{nom}	314.451383
T (-10)°C	V_{nom}	314.451847
T (0)°C	V_{nom}	314.451166
T (10)°C	V_{nom}	314.449928
T_{nom} (20)°C	V_{min} (10.2 V)	314.446921
T_{nom} (20)°C	V_{nom} (12 V)	314.446943
T_{nom} (20)°C	V_{max} (13.8 V)	314.446914
T (30)°C	V_{nom}	314.446971
T (40)°C	V_{nom}	314.444241
T_{max} (50)°C	V_{nom}	314.443292

Carrier frequency f_c	314.446943 MHz
Max tolerance	no limit
Highest frequency f_h	314.451847 MHz
Lowest frequency f_l	314.443292 MHz
Negative tolerance f_l - f_c	-3.651 kHz
Positive tolerance f_h - f_c	4.904 kHz

Limit according to FCC Part 15C, Section 15.231(d):

For devices operating in the frequency range of 40.66 MHz – 40.70 MHz the frequency tolerance of t he carrier signal shall be maintained within ±0.01 % of the operating frequency over a temperature range of -20 °C to +50 °C at normal supply voltage and for a variation in the primary supply voltage from 85 % to 115 % of the rated supply voltage at a temperature of 20 °C. For battery operated equipment, the equipment shall be performed using a new battery.

The requirements are **FULFILLED.**

Remarks: No limit for 315 MHz devices.

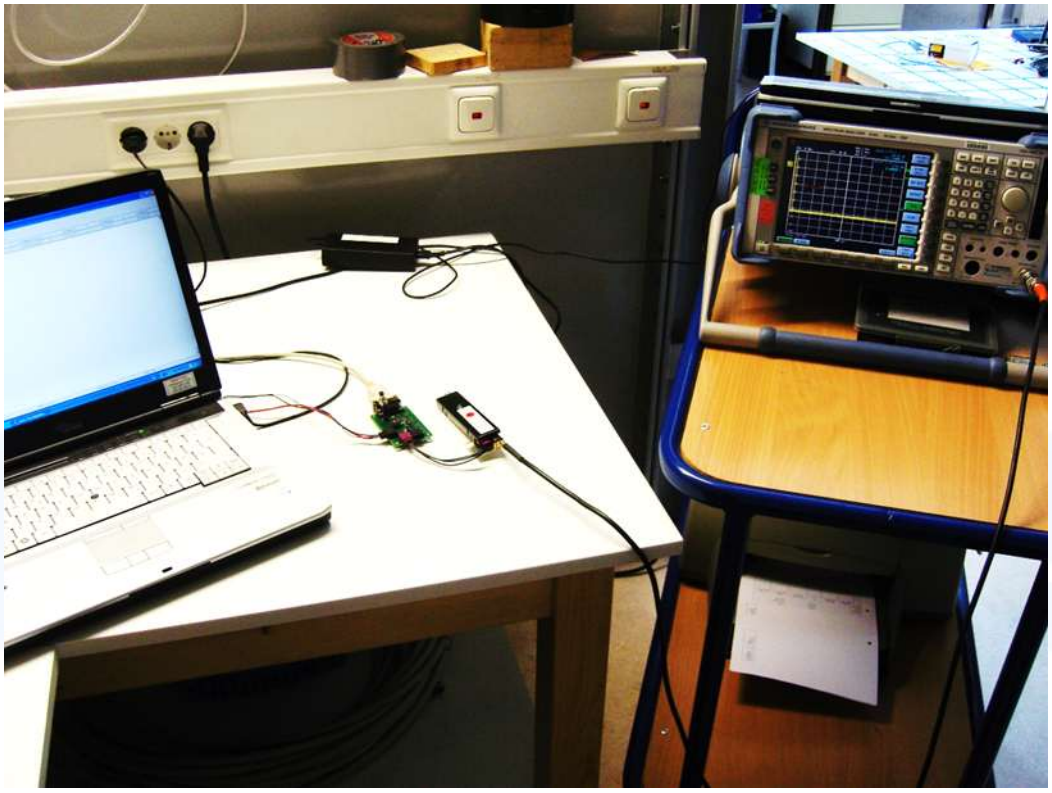
5.7 Signal deactivation

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

5.7.1 Description of the test location

Test location: AREA4

5.7.2 Photo documentation of the test set-up



5.7.3 Applicable standard

According to FCC Part 15C, Section 15.231(a)(1):
A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter not exceeding the defined on time limit.

5.7.4 Description of measurement

The duration of transmission is measured with the spectrum analyzer. The sweep points were set to maximum for higher the time resolution. The signal is modulated; the analyser is set to zero span, single sweep and triggered on the button, the marker was set to the edges in order to measure the duration time and than recorded.

5.7.5 Test result

Duration of transmission (ms)	Duration after releasing the button (ms)
20.5	126.4

Limit according to FCC Part 15C, Section 15.231(a):
A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released and a transmitter activated automatically shall cease transmission within 5 seconds after activation.

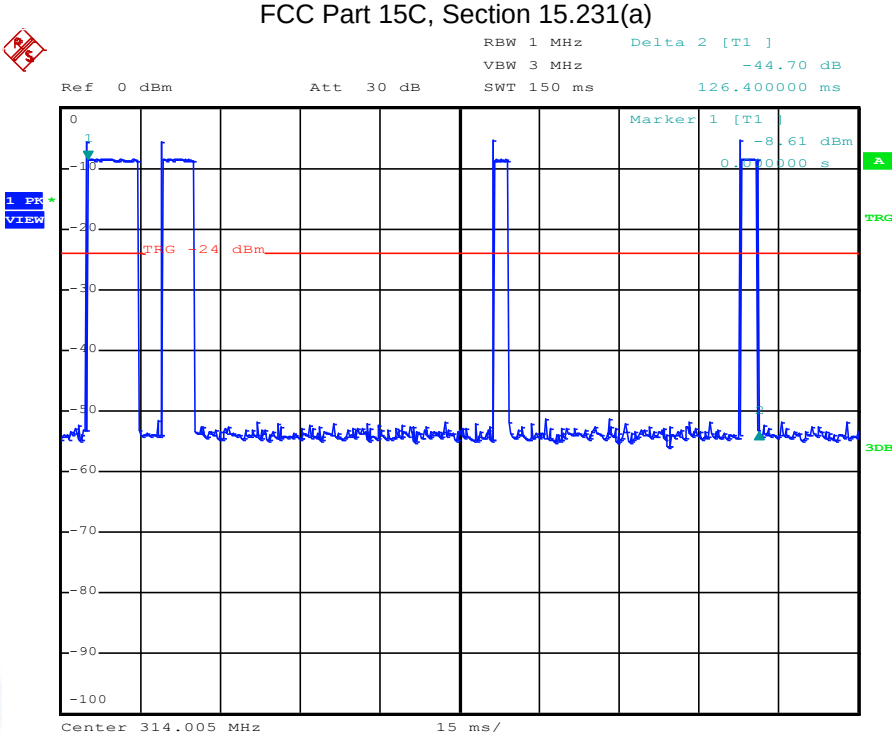
The requirements are **FULFILLED.**

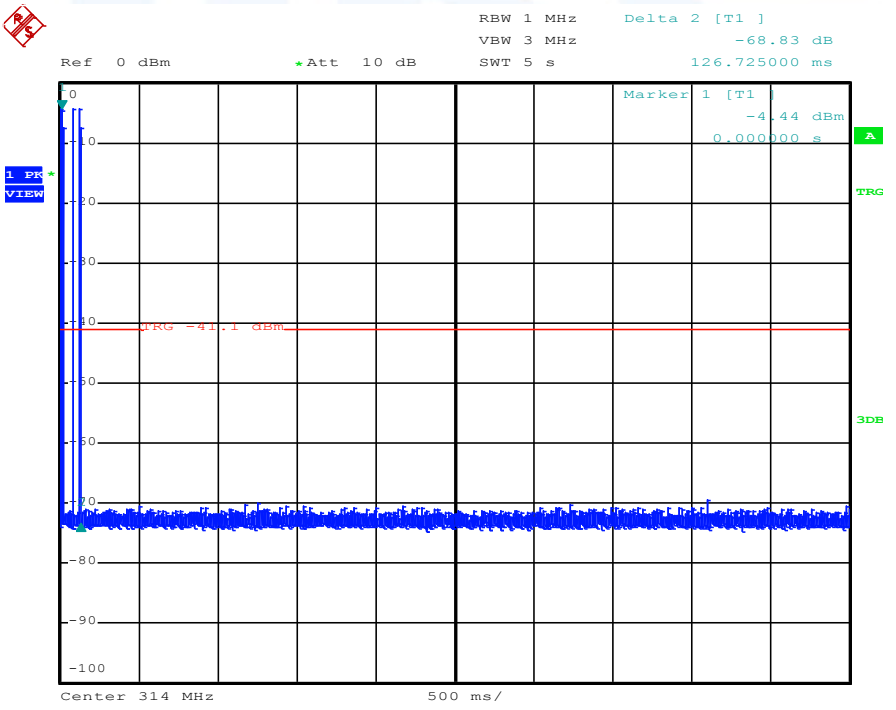
Remarks: For detailed test results, please see the test protocol below.

5.7.6 Test protocol

Signal deactivation

FCC Part 15C, Section 15.231(a)





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.
CPR 2	ESVS 30	02-02/03-05-006	20/06/2012	20/06/2011		
	VULB 9168	02-02/24-05-005	16/03/2013	16/03/2012	16/09/2012	16/03/2012
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
FE	ESCI	02-02/03-05-004	01/03/2013	01/03/2012		
	WK-340/40	02-02/45-05-001	31/05/2013	31/05/2012	22/06/2012	22/12/2011
	6543A	02-02/50-05-157				
MB	ESCI	02-02/03-05-004	01/03/2013	01/03/2012		
	WK-340/40	02-02/45-05-001	31/05/2013	31/05/2012	22/06/2012	22/12/2011
	6543A	02-02/50-05-157				
SER 1	FMZB 1516	01-02/24-01-018	16/02/2013	16/02/2012		
	ESCI	02-02/03-05-005	21/11/2012	21/11/2011		
	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	20/06/2012	20/06/2011		
	VULB 9168	02-02/24-05-005	16/03/2013	16/03/2012	16/09/2012	16/03/2012
	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	05/10/2012	05/10/2011		
	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	16/02/2013	16/02/2012		
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				