

EMI - TEST REPORT

- FCC Part 15.249 -

Test Report No. :	T38406-00-06JP	27. October 2014 Date of issue
--------------------------	----------------	-----------------------------------

Type / Model Name : BSB000900

Product Description : Local Positioning Radar

Applicant : SYMEO GmbH

Address : Professor-Messerschmitt-Str. 3

85579 Neubiberg / Munich

GERMANY

Manufacturer : SYMEO GmbH

Address : Professor-Messerschmitt-Str. 3

85579 Neubiberg / Munich

GERMANY

Licence holder : SYMEO GmbH

Address : Professor-Messerschmitt-Str. 3

85579 Neubiberg / Munich

GERMANY

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



The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test results
without the written permission of the test laboratory.

Contents

1	<u>TEST STANDARDS</u>	3
2	<u>SUMMARY</u>	4
2.1	GENERAL REMARKS:	4
2.2	Test result summary	4
2.3	FINAL ASSESSMENT:	4
3	<u>EQUIPMENT UNDER TEST</u>	5
3.1	Power supply system utilised	5
3.2	Short description of the equipment under test (EUT)	5
4	<u>TEST ENVIRONMENT</u>	7
4.1	Address of the test laboratory	7
4.2	Environmental conditions	7
4.3	Statement of the measurement uncertainty	7
4.4	Measurement protocol for FCC and IC	8
5	<u>TEST CONDITIONS AND RESULTS</u>	9
5.1	AC power line conducted emissions	9
5.2	Field strength of fundamental	12
5.3	Out-of-band emission, radiated	14
5.4	20dB bandwidth	19
5.5	Correction for pulse operation (duty cycle) FSK	23
5.6	Correction for pulse operation (duty cycle) FMCW	25
6	<u>USED TEST EQUIPMENT AND ACCESSORIES</u>	27

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September, 2013)

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September, 2013)

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 20dB bandwidth

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

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.

2 SUMMARY

2.1 GENERAL REMARKS:

The EUT has a TX mode and a RX mode but RX is not possible without TX beacons therefore the measurements were performed in TX mode only. The frequency range was scanned from 9 kHz to 40 GHz.

2.2 Test result summery

FCC Rule Part	Description	Result
15.207	AC power line conducted emissions	passed
15.209 / 15.249	Radiated emission limits	passed
15.215	20dB Bandwidth	passed
15.249	Field strength of fundamental	passed

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 : 01 July 2014

Testing concluded on : 21 July 2014

Checked by:

Tested by:

Thomas Weise

Jürgen Pessinger

3 EQUIPMENT UNDER TEST

3.1 Power supply system utilised

Power supply voltage : 10 – 36V DC (12V DC applied during test)

3.2 Short description of the equipment under test (EUT)

The EuT is a wireless system for contactless, real time determination of distances and positions.

Number of tested samples: 1
Serial number: BV00P00103

Radio equipment characteristics

FSK Channel

Frequency band(s): 5725MHz – 5875MHz
Operating frequency: 5737MHz – 5863MHz
Channel spacing: 1MHz
Number of RF-channels: 38 channels (CH08 – CH46)
Comments: None

FMCW band

Frequency band(s): 5725MHz – 5875MHz
Operating frequency: 5761MHz – 5842MHz
Number of RF-channels: 1 distance measurement band
Comments: None

EUT operation mode:

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

- Testsoftware active, FSK CH08 (5863MHz) adjusted

- Testsoftware active, FSK CH27 (5755MHz) adjusted

- Testsoftware active, FSK CH46 (5737MHz) adjusted

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 | Model : D-LP, Deutronic Elektronik GmbH |
| - Laptop | Model : Tecra A2, Toshiba |

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

**CSA Group Bayern GmbH
Ohmstrasse 1-4
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. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor $k = 2$. The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern 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 and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.4 Measurement protocol for FCC and IC

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.

The Open Area test site is a listed Open Site 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 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.

4.4.1.3 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 and applying the CISPR 22 limits.

5 TEST CONDITIONS AND RESULTS

5.1 AC power line 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 Applicable standard

According to FCC Part 15, Section 15.207

5.1.3 Description of Measurement

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

5.1.4 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 3.87 dB at 3.8715 MHz

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

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

The requirements are **FULFILLED**.

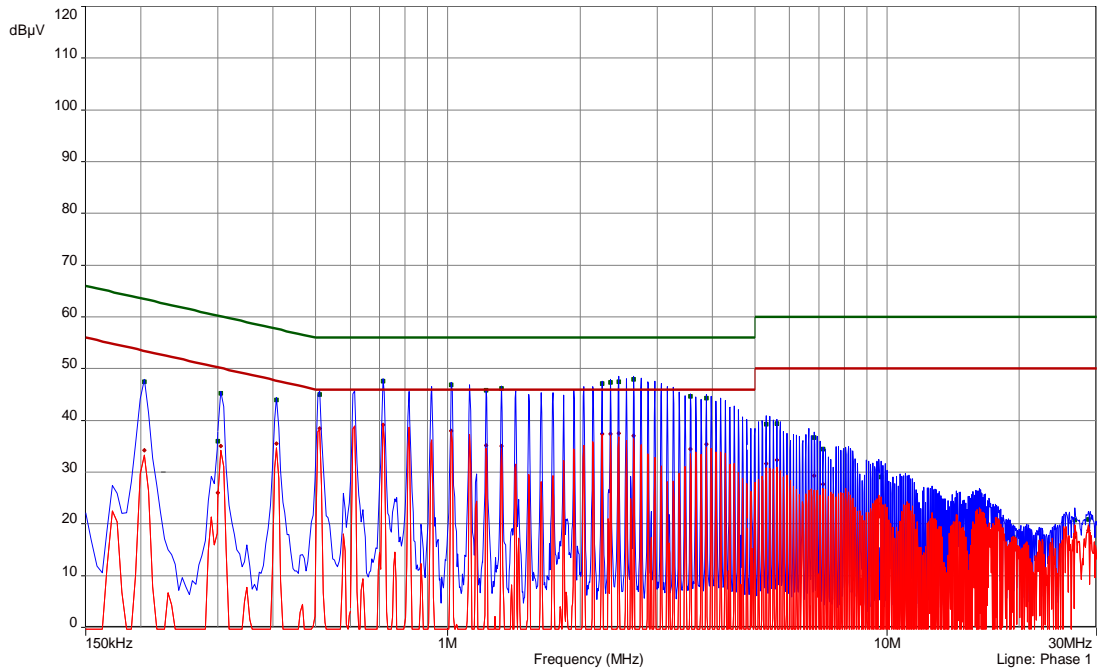
Remarks: The measurement was performed at the AC input of the dedicated power supply D-LP.

A prescan whows no influence of the adjusted TX Channel, therefore the measurement was
made on CH27 (middle Channel).

5.1.5 Test protocol

Test point L1
Operation mode: Testsoftware active, FSK CH27 (5755MHz) adjusted
Remarks: none

Result: PASS

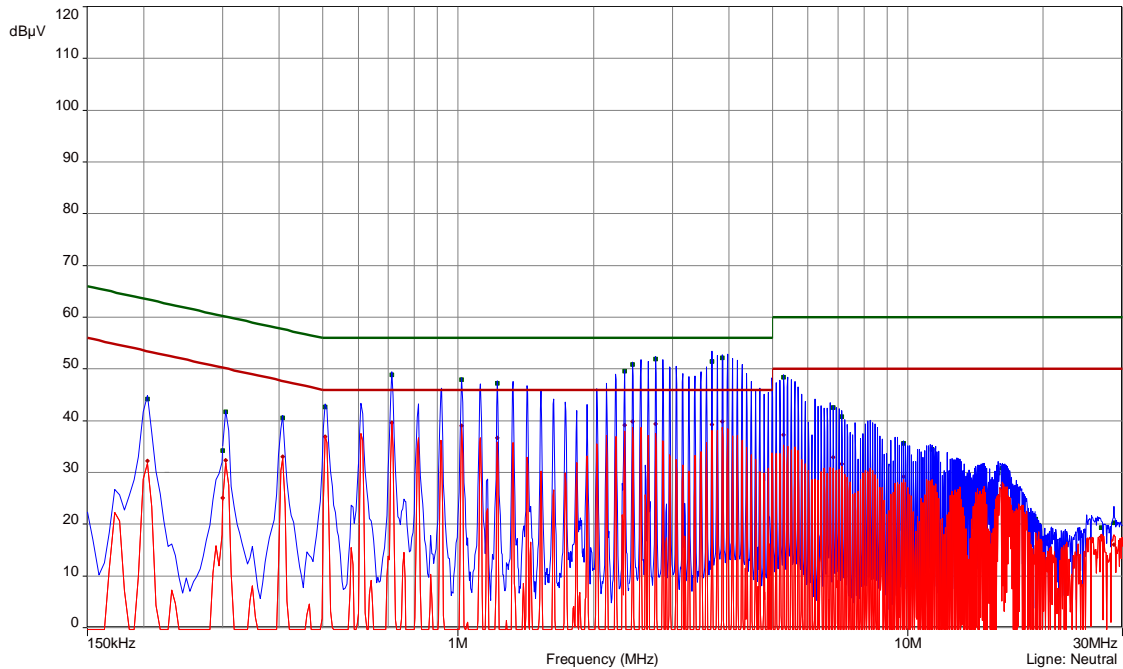


freq MHz	QP dB(μV)	margin dB	limit dB	AV dB(μV)	margin dB	limit dB	line
0.204	47.42	16.02	63.45	34.23	19.21	53.45	Phase 1
0.3	36.02	24.22	60.24	26.07	24.17	50.24	Phase 1
0.3045	45.26	14.86	60.12	34.99	15.13	50.12	Phase 1
0.408	43.91	13.78	57.69	35.55	12.14	47.69	Phase 1
0.5115	45.01	10.99	56	38.47	7.53	46	Phase 1
0.7125	47.56	8.44	56	39.2	6.8	46	Phase 1
1.0185	46.92	9.08	56	38.03	7.97	46	Phase 1
1.2225	45.78	10.22	56	35.13	10.87	46	Phase 1
1.326	46.23	9.77	56	35.03	10.97	46	Phase 1
2.244	47.14	8.86	56	37.44	8.56	46	Phase 1
2.3475	47.32	8.68	56	37.38	8.62	46	Phase 1
2.4495	47.42	8.58	56	37.46	8.54	46	Phase 1
2.652	47.9	8.1	56	37.01	8.99	46	Phase 1
3.57	44.63	11.37	56	34.42	11.58	46	Phase 1
3.876	44.29	11.71	56	35.38	10.62	46	Phase 1
5.304	39.32	20.68	60	31.66	18.34	50	Phase 1
5.61	39.43	20.57	60	32.32	17.68	50	Phase 1
6.834	36.64	23.36	60	29.29	20.71	50	Phase 1
7.14	34.42	25.58	60	27.72	22.28	50	Phase 1
9.69	29.12	30.88	60	23.88	26.12	50	Phase 1
16.215	25.7	34.3	60	22.88	27.12	50	Phase 1
19.3755	17.48	42.52	60	15.39	34.61	50	Phase 1
20.802	17.19	42.81	60	15.18	34.82	50	Phase 1
26.715	20.77	39.23	60	17.44	32.56	50	Phase 1
28.7535	20.83	39.17	60	18.73	31.27	50	Phase 1

FCC ID: W5IBSB000900

Test point: N
Operation mode: Testsoftware active, FSK CH27 (5755MHz) adjusted
Remarks: none

Result: PASS



freq MHz	QP dB(μV)	margin dB	limit dB	AV dB(μV)	margin dB	limit dB	line
0.204	44.21	19.23	63.45	32.22	21.22	53.45	Neutral
0.3	34.23	26.01	60.24	25.11	25.13	50.24	Neutral
0.3045	41.74	18.38	60.12	32.39	17.73	50.12	Neutral
0.408	40.5	17.19	57.69	33.05	14.64	47.69	Neutral
0.507	42.71	13.29	56	36.93	9.07	46	Neutral
0.7125	48.88	7.12	56	39.63	6.37	46	Neutral
1.0185	48	8	56	39.06	6.94	46	Neutral
1.2225	47.25	8.75	56	36.73	9.27	46	Neutral
2.343	49.52	6.48	56	39.16	6.84	46	Neutral
2.445	50.82	5.18	56	39.83	6.17	46	Neutral
2.751	51.92	4.08	56	39.4	6.6	46	Neutral
3.669	51.47	4.53	56	39.26	6.74	46	Neutral
3.8715	52.13	3.87	56	39.9	6.1	46	Neutral
5.2995	48.35	11.65	60	37.33	12.67	50	Neutral
6.8295	42.59	17.41	60	32.89	17.11	50	Neutral
7.1355	40.82	19.18	60	31.61	18.39	50	Neutral
9.7845	35.62	24.38	60	29.21	20.79	50	Neutral
11.3145	34.49	25.51	60	28.59	21.41	50	Neutral
15.9	29.88	30.12	60	25.45	24.55	50	Neutral
16.206	30.8	29.2	60	27.54	22.46	50	Neutral
19.263	20.98	39.02	60	19.12	30.88	50	Neutral
19.569	19.81	40.19	60	18.43	31.57	50	Neutral
26.9085	19.4	40.6	60	17.61	32.39	50	Neutral
28.7445	20.29	39.71	60	16.06	33.94	50	Neutral

5.2 Field strength of fundamental

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

5.2.1 Description of the test location

Test location: Anechoic chamber 1
Test distance: 3 m

5.2.1 Applicable standard

According to FCC Part 15C, Section 15.249

5.2.2 Description of Measurement

The set up of the EUT and the measurement procedure is in accordance to ANSI C63.4, Item 8.3.

Analyser settings:

Peak measurement: RBW: 1 MHz

VBW: 1 MHz

Detector: Max peak

5.2.3 Test result
FSK Signal

Channel Number ¹	Frequency [MHz]	Reading level PK [dBμV]	Correction Factor ² [dB]	Corrected level PK [dBμV/m]	Limit PK [dBμV/m]	Duty Cycle correction Factor ³ [dB]	Corrected level AV [dBμV/m]	Limit AV [dBμV/m]
08	5863.0	93.8	4.4	98.2	114	-27.3	70.9	94
27	5755.0	98.2	4.3	102.5	114	-27.3	75.2	94
45	5737.0	96.8	4.2	101.0	114	-27.3	73.7	94

¹Adjusted FSK Channel

²The correction factor includes cable loss and antenna factor.

³Please refer to sub clause 5.5 of this report.

FMCW Signal

Channel	Frequency [MHz]	Reading level PK [dBμV]	Correction Factor ¹ [dB]	Corrected level PK [dBμV/m]	Limit PK [dBμV/m]	Duty Cycle correction Factor ² [dB]	Corrected level AV [dBμV/m]	Limit AV [dBμV/m]
Low	5761	98.4	4.4	102.8	114	-53.9	48.9	94
Mid	5800	97.3	4.6	101.9	114	-53.9	48.0	94
High	5842	98.4	4.4	102.8	114	-53.9	48.9	94

¹The correction factor includes cable loss and antenna factor.

²Please refer to sub clause 5.6 of this report.

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

Frequency (MHz)	Field strength of fundamental	
	(mV/m)	dB(μV/m)
5725-5875	50	94

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

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

The requirements are **FULFILLED**.

Remarks: Measurement was performed in vertical polarization. Pretests show the highest field strength
occur in vertical polarization.

5.3 Out-of-band emission, 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 1

Test distance: 3 m

5.3.2 Applicable standard

According to FCC Part 15C, Section 15.249(d) and Section 15.209(a)

5.3.3 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 setup of the EUT and the measurement procedure is in accordance to ANSI C63.4, Item 8.3. 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 testing is stopped and peak values will be reported, otherwise, the emission is measured in average mode again and reported. The EUT is measured in TX continuous mode unmodulated under normal conditions.

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 – 40 GHz	RBW:	1 MHz

5.3.1 Test result $f < 30$ MHz

Note: In the frequency range 9 kHz to 30 MHz no emission could be detected. The frequencies mention the noise level. The measurement results from distance 3 m are extrapolated (D factor) to the specified distance.

Frequency (MHz)	Reading PK dB(μ V)	D factor dB(μ V/m)	Level PK dB(μ V/m)	Limit AV dB(μ V/m)	Delta (dB)
0.047	52.0	-80.0	-28.0	34.2	-62.2
1.5	51.0	-40.0	11.0	24.1	-13.1
18.2	39.0	-40.0	-1.0	29.5	-30.5

5.3.2 Test result 30 MHz < f < 1 GHz
FSK Channel 08

Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
37.75	9.1	5.9	13.6	12.5	22.7	18.4	40.0	-17.3
42.10	6.0	1.3	14.4	13.3	20.4	14.6	40.0	-19.6
49.37	13.2	9.2	15.0	14.0	28.2	23.2	40.0	-11.8
52.27	11.4	6.4	14.9	13.9	26.3	20.3	40.0	-13.7
112.39	6.5	6.1	10.6	11.5	17.1	17.6	43.5	-25.9
149.86	7.7	6.3	13.3	14.2	21.0	20.5	43.5	-22.5
299.71	18.9	28.4	16.5	15.9	35.4	44.3	46.0	-1.7
449.57	12.3	12.7	20.3	20.0	32.6	32.7	46.0	-13.3

FSK Channel 27

Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
37.75	9.0	6.2	13.6	12.5	22.6	18.7	40.0	-17.4
42.10	6.3	1.5	14.4	13.3	20.7	14.8	40.0	-19.3
49.37	13.3	9.2	15.0	14.0	28.3	23.2	40.0	-11.7
52.27	11.5	6.3	14.9	13.9	26.4	20.2	40.0	-13.6
112.39	6.6	6.1	10.6	11.5	17.2	17.6	43.5	-25.9
149.86	7.7	6.4	13.3	14.2	21.0	20.6	43.5	-22.5
299.71	18.9	29.0	16.5	15.9	35.4	44.9	46.0	-1.1
449.57	12.5	12.7	20.3	20.0	32.8	32.7	46.0	-13.2

FSK Channel 46

Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
37.75	8.9	6.1	13.6	12.5	22.5	18.6	40.0	-17.5
42.10	6.2	2.0	14.4	13.3	20.6	15.3	40.0	-19.4
49.37	13.3	9.3	15.0	14.0	28.3	23.3	40.0	-11.7
52.27	11.4	6.4	14.9	13.9	26.3	20.3	40.0	-13.7
112.39	6.6	6.2	10.6	11.5	17.2	17.7	43.5	-25.8
149.86	7.7	6.4	13.3	14.2	21.0	20.6	43.5	-22.5
299.71	18.9	28.4	16.5	15.9	35.4	44.3	46.0	-1.7
449.57	12.6	12.7	20.3	20.0	32.9	32.7	46.0	-13.1

5.3.3 Test result f > 1 GHz

FSK Channel 08

Harmonics of FSK fundamental

Frequency [MHz]	Level PK [dBμV]	Correction factor [dB]	Corrected level PK [dBμV/m]	Limit PK [dBμV/m]	Duty Cycle Correction ¹ [dB]	Corrected level AV dB(μV/m)	Limit AV [dBμV/m]	Delta [dB]
11726.00	47.1	10.9	58.0	74	-27.3	30.7	54	-16.0
17589.00	59.0	6.8	65.8	74	-27.3	38.5	54	-8.2

Harmonics of FMCW band

Frequency [MHz]	Level PK [dBμV]	Correction factor [dB]	Corrected level PK [dBμV/m]	Limit PK [dBμV/m]	Duty Cycle Correction ¹ [dB]	Corrected level AV dB(μV/m)	Limit AV [dBμV/m]	Delta [dB]
11552.00	50.3	10.5	60.8	74	-53.9	6.9	54	-13.2
11616.00	45.9	10.4	56.3	74	-53.9	2.4	54	-17.7
17304.00	59.1	5.3	64.5	74	-53.9	10.6	54	-9.5
17436.00	61.9	6.5	68.4	74	-53.9	14.5	54	-5.6

Other disturbances

Frequency [MHz]	Reading level PK [dBμV]	Reading level AV ² [dBμV]	Correction Factor ³ [dB]	Corrected level PK [dBμV/m]	Corrected level AV [dBμV/m]	Limit PK [dBμV/m]	Limit AV [dBμV/m]	Delta [dB]
1330.00	57.3	--	-19.1	38.2	--	74	54	-35.8
1990.00	63.7	--	-15.5	48.2	--	74	54	-25.8
11760.00	45.8	19.2	11.2	57	30.4	74	54	-17.0
15660.00	48.0	--	5.2	53.2	--	74	54	-20.8

¹Please refer to sub clauses 5.5 and 5.6 of this report.

²RMS detector function in combination with maxhold used

³The correction factor includes cable loss and antenna factor.

NOTE: For frequencies where the PK value is below the average limit no average measurement was performed

FSK Channel 27

Harmonics of FSK fundamental

Frequency [MHz]	Level PK [dBμV]	Correction factor [dB]	Corrected level PK [dBμV/m]	Limit PK [dBμV/m]	Duty Cycle Correction ¹ [dB]	Corrected level AV dB(μV/m)	Limit AV [dBμV/m]	Delta [dB]
11510.00	54.1	10.6	64.7	74	-27.3	37.4	54	-9.3
17265.00	54.5	5.6	60.2	74	-27.3	32.9	54	-13.8

Harmonics of FMCW band

Frequency [MHz]	Level PK [dBμV]	Correction factor [dB]	Corrected level PK [dBμV/m]	Limit PK [dBμV/m]	Duty Cycle Correction ¹ [dB]	Corrected level AV dB(μV/m)	Limit AV [dBμV/m]	Delta [dB]
11616.00	45.0	10.4	55.4	74	-53.9	1.5	54	-18.6
11680.00	48.9	10.6	59.5	74	-53.9	5.6	54	-14.5

Other disturbances

Frequency [MHz]	Reading level PK [dBμV]	Reading level AV ² [dBμV]	Correction Factor ³ [dB]	Corrected level PK [dBμV/m]	Corrected level AV [dBμV/m]	Limit PK [dBμV/m]	Limit AV [dBμV/m]	Delta [dB]
1018.00	56.6	--	-20.1	36.5	--	74	54	-37.5
1438.00	59.3	--	-20.0	39.3	--	74	54	-34.7
11488.00	43.6	18.9	10.5	54.1	29.4	74	54	-19.9

¹Please refer to sub clauses 5.5 and 5.6 of this report.

²RMS detector function in combination with maxhold used

³The correction factor includes cable loss and antenna factor.

NOTE: For frequencies where the PK value is below the average limit no average measurement was performed

FSK Channel 45
Harmonics of FSK fundamental

Frequency [MHz]	Level PK [dBμV]	Correction factor [dB]	Corrected level PK [dBμV/m]	Limit PK [dBμV/m]	Duty Cycle Correction ¹ [dB]	Corrected level AV [dB(μV/m)]	Limit AV [dBμV/m]	Delta [dB]
11474.00	49.0	10.5	59.5	74	-27.3	32.2	54	-14.5
17211.00	54.5	5.6	60.2	74	-27.3	32.9	54	-13.8

Harmonics of FMCW band

Frequency [MHz]	Level PK [dBμV]	Correction factor [dB]	Corrected level PK [dBμV/m]	Limit PK [dBμV/m]	Duty Cycle Correction ¹ [dB]	Corrected level AV [dB(μV/m)]	Limit AV [dBμV/m]	Delta [dB]
11616.00	44.8	10.4	55.2	74	-53.9	1.3	54	-18.8
11680.00	48.5	10.6	59.1	74	-53.9	5.2	54	-14.9

Other disturbances

Frequency [MHz]	Reading level PK [dBμV]	Reading level AV ² [dBμV]	Correction Factor ³ [dB]	Corrected level PK [dBμV/m]	Corrected level AV [dBμV/m]	Limit PK [dBμV/m]	Limit AV [dBμV/m]	Delta [dB]
1018.00	61.1	--	-20.1	41.0	--	74	54	-33.0
1078.00	57.8	--	-20.6	37.2	--	74	54	-36.8
11456.00	41.5	--	10.3	51.8	--	74	54	-22.2

¹Please refer to sub clauses 5.5 and 5.6 of this report.

²RMS detector function in combination with maxhold used

³The correction factor includes cable loss and antenna factor.

NOTE: For frequencies where the PK value is below the average limit no average measurement was performed

FCC ID: W5IBSB000900

Limit according to FCC Part 15C, Section 15.209:

Frequency (MHz)	15.209 Limits ($\mu\text{V/m}$)	Measurement distance (m)
0.009 - -0.49	$2400/f(\text{kHz})$	300
0.49 – 1.705	$24000/f(\text{kHz})$	30
1.705 – 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

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

Fundamental frequency (MHz)	Field strength of harmonics	
	($\mu\text{V/m}$)	$\text{dB}(\mu\text{V/m})$
5725 - 5875	500	54

The requirements are **FULFILLED**.

Remarks: The measurement was performed in the frequency range up to 40 GHz.

5.4 20dB bandwidth

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

5.4.1 Description of the test location

Test location: Anechoic chamber 1

5.4.2 Applicable standard

According to FCC Part 15, Section 15.215

5.4.3 Description of Measurement

The bandwidth is measured at an amplitude level reduced from the reference level by 20dB.

Spectrum analyser settings:

RBW: 100 kHz, VBW: 300 kHz, Span: 150 MHz, Trace mode: max. hold, Detector: max. peak;

5.4.4 Test result

Operating FSK Channel	20dB Bandwidth FSK (MHz)	20dB Bandwidth FMCW (MHz)
08	0.440	80.40
27	0.450	81.30
45	0.450	80.85

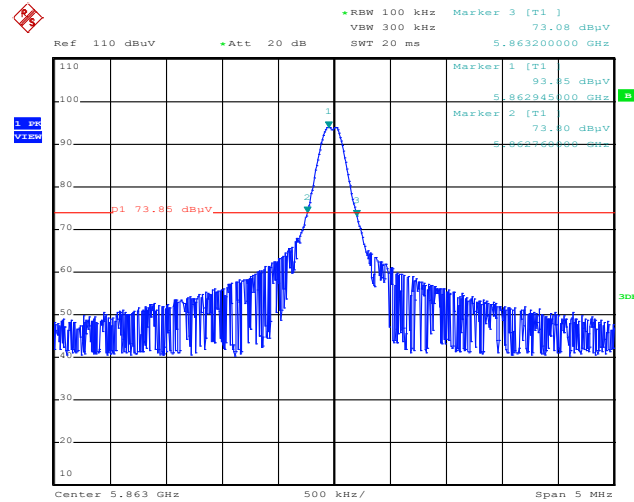
The requirements are **FULFILLED**.

Remarks: Measurement was performed in vertical polarization. Pretests show the highest field strength
occur in vertical polarization.

5.4.5 Test protocols

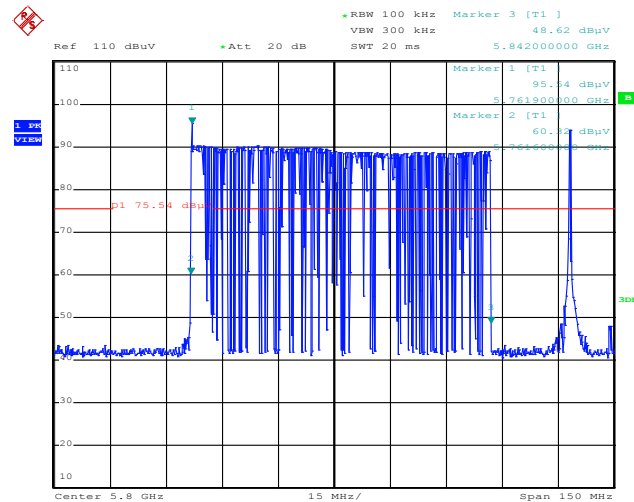
20 dB bandwidth

CH08 FSK



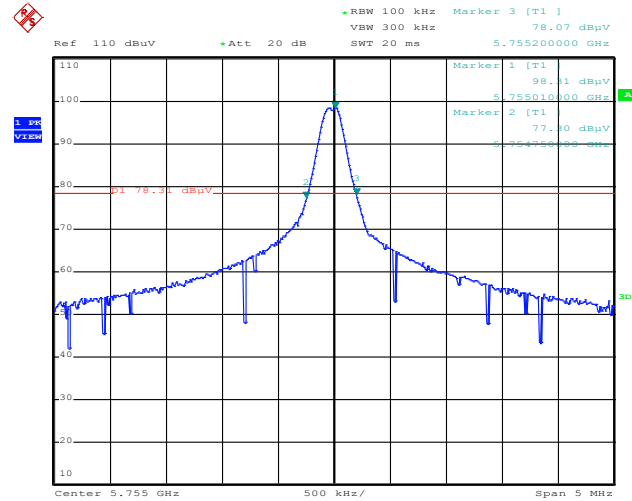
Date: 14.JUL.2014 16:11:43

CH08 FMCW



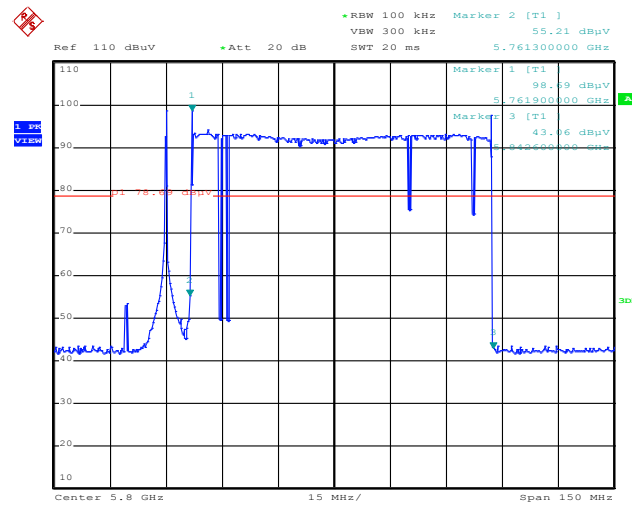
Date: 14.JUL.2014 16:08:28

CH27 FSK



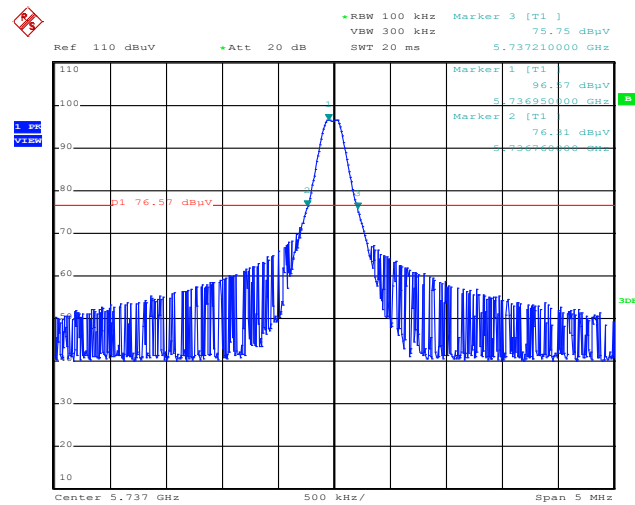
Date: 21.JUL.2014 09:25:11

CH27 FMCW



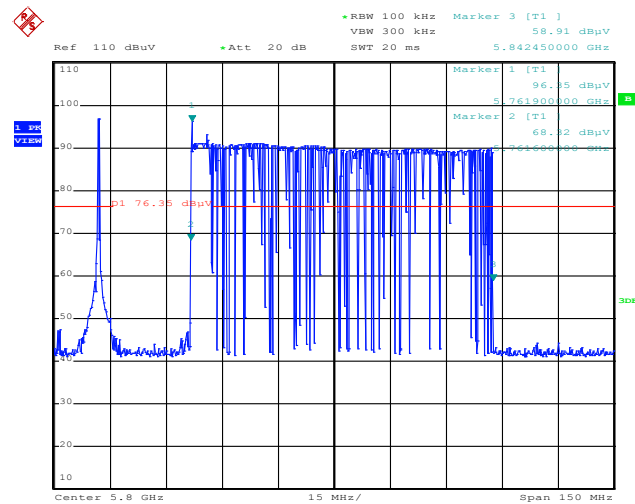
Date: 21.JUL.2014 09:21:37

CH46 FSK



Date: 14.JUL.2014 13:55:26

CH46 FMCW



Date: 14.JUL.2014 13:53:31

5.5 Correction for pulse operation (duty cycle) FSK

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

5.5.1 Description of the test location

Test location: Anechoic chamber 1

5.5.2 Applicable standard

According to FCC Part 15A, Section 15.35(c)

5.5.3 Description of Measurement

The duty cycle correction factor (dB) is calculated applying the following formula:

$$\delta(\text{dB}) = 20 \log ((t_1 + t_2 + \dots + t_n) / T)$$

$\delta(\text{dB})$ duty cycle correction factor expressed in dB

t_1 duration of pulse 1 in the defined time period T

t_2 duration of pulse 2 in the defined time period T

t_n duration of pulse n in the defined time period T

T period of one complete puls train or 100ms if the complete puls train is longer 100ms

5.5.4 Test result

t_1 [ms]	t_2 [ms]	t_3 [ms]	t_4 [ms]	T [ms]
2.16	2.16	0	0	100

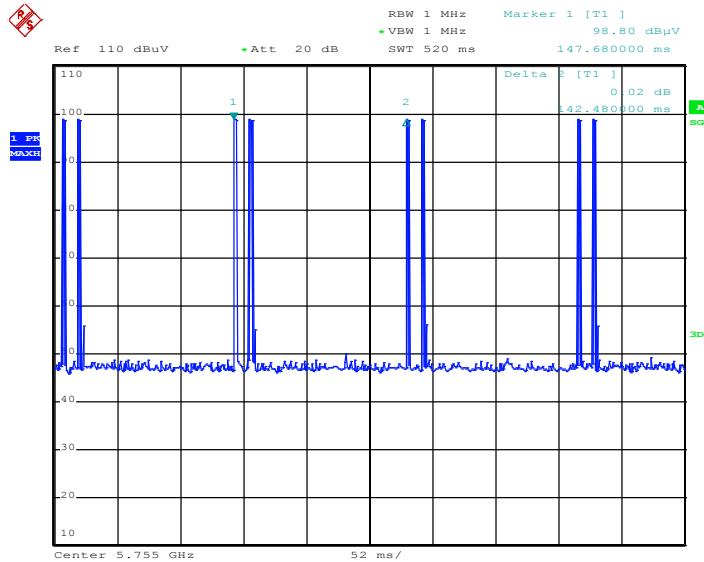
RESULT $\delta(\text{dB}) = -27.3$

Remarks: Maximum duty cycle used for calculation.

The duty cycle was calculated for the FSK channel.

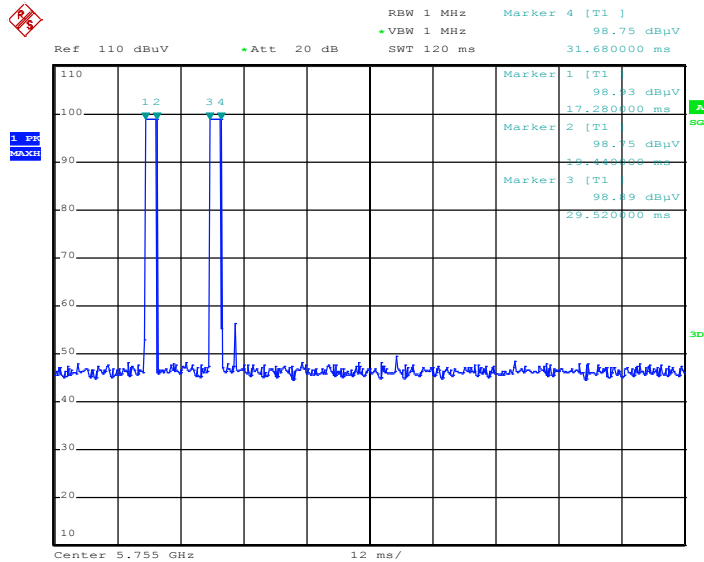
5.5.5 Test protocol

Determination of $T = 142.48\text{ms}$ where allowed maximum is 100ms



Date: 21.JUL.2014 09:05:27

Determination of $t_1 = 2.16\text{ms}$
Determination of $t_2 = 2.16\text{ms}$



Date: 21.JUL.2014 09:06:58

5.6 Correction for pulse operation (duty cycle) FMCW

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

5.6.1 Description of the test location

Test location: Anechoic chamber 1

5.6.2 Applicable standard

According to FCC Part 15A, Section 15.35(c)

5.6.3 Description of Measurement

The duty cycle correction factor (dB) is calculated applying the following formula:

$$\delta(\text{dB}) = 20 \log ((t_1 + t_2 + \dots + t_n) / T)$$

$\delta(\text{dB})$ duty cycle correction factor expressed in dB

t_1 duration of pulse 1 in the defined time period T

t_2 duration of pulse 2 in the defined time period T

t_n duration of pulse n in the defined time period T

T period of one complete puls train or 100ms if the complete puls train is longer 100ms

5.6.4 Test result

t_1 [ms]	t_2 [ms]	t_3 [ms]	t_4 [ms]	T [ms]
0.1	0.1	0	0	100

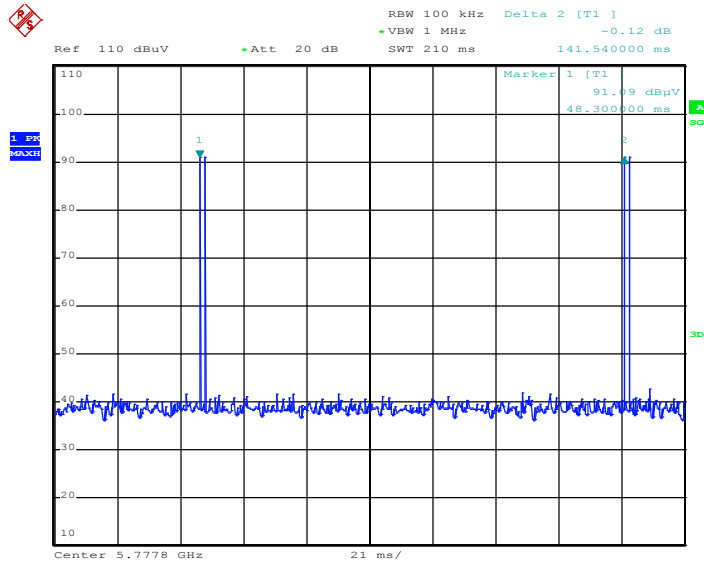
RESULT $\delta(\text{dB}) = -53.9$

Remarks: Maximum duty cycle used for calculation.

The duty cycle was calculated for the FMCW Signal.

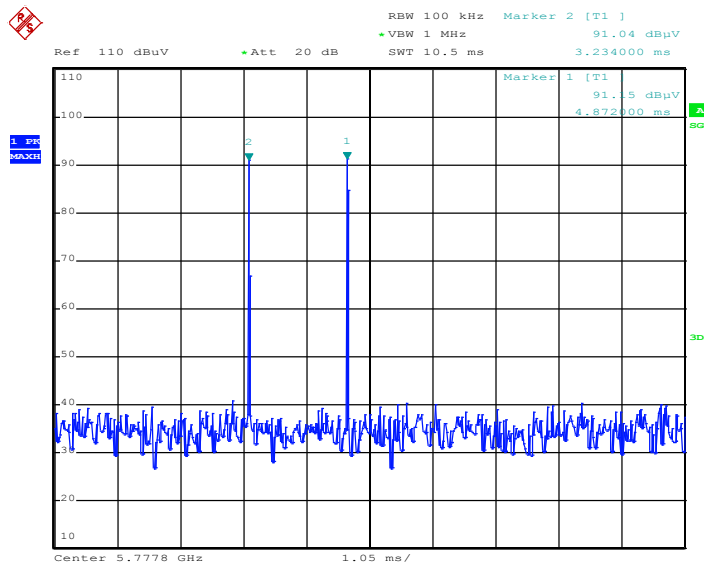
5.6.5 Test protocol

Determination of $T = 141.54\text{ms}$ where allowed maximum is 100ms



Date: 14.JUL.2014 14:16:26

Determination of $t_1 = 0.1\text{ms}$
Determination of $t_2 = 0.1\text{ms}$



Date: 14.JUL.2014 14:18:10

NOTE: The pulse duration of t_1 and t_2 are much shorter than 0.1ms , for calculation we used 0.1ms to show compliance.

6 USED TEST EQUIPMENT AND ACCESSORIES

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

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	ESHS 30	02-02/03-05-002	17/07/2015	17/07/2014		
	ESH 2 - Z 5	02-02/20-05-004	18/10/2015	18/10/2013	28/08/2014	28/02/2014
	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			10/10/2014	10/04/2014
CPR 3	FSP 40	02-02/11-11-001	30/09/2014	30/09/2013		
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	3117	02-02/24-05-009	07/05/2015	07/05/2014		
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	SF104/11N/11N/1500MM	02-02/50-13-015				
DC	FSP 40	02-02/11-11-001	30/09/2014	30/09/2013		
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	3117	02-02/24-05-009	07/05/2015	07/05/2014		
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	SF104/11N/11N/1500MM	02-02/50-13-015				
MB	FSP 40	02-02/11-11-001	30/09/2014	30/09/2013		
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	3117	02-02/24-05-009	07/05/2015	07/05/2014		
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	SF104/11N/11N/1500MM	02-02/50-13-015				
SER 1	FMZB 1516	01-02/24-01-018			13/02/2015	13/02/2014
	ESCI	02-02/03-05-005	12/12/2014	12/12/2013		
	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	03/07/2015	03/07/2014		
	VULB 9168	02-02/24-05-005	08/04/2015	08/04/2014	08/10/2014	08/04/2014
	S10162-B	02-02/50-05-031				
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
SER 3	FSP 40	02-02/11-11-001	30/09/2014	30/09/2013		
	JS4-18004000-30-5A	02-02/17-05-017				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	AFS4-01000400-10-10P-4	02-02/17-13-002				
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	3117	02-02/24-05-009	07/05/2015	07/05/2014		
	BBHA 9170	02-02/24-05-014				
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	KMS102-0.2 m	02-02/50-11-020				
	SF104/11N/11N/1500MM	02-02/50-13-015				