

Test Report

Report Number: F131297E1

Applicant:

Bernstein AG

Manufacturer:

Bernstein AG

Equipment under Test (EUT):

Contactless Safety Monitoring Switch

CSMS-M-RRS-H-KA (6075985048) + CSMS-S-H (6075980052)

Laboratory (CAB) accredited by
Deutsche Akkreditierungsstelle GmbH (DAkkS)
in compliance with DIN EN ISO/IEC 17025
under the Reg. No. D-PL-17186-01-02,
FCC Test site registration number 90877 and
Industry Canada Test site registration IC3469A-1

REFERENCES

- [1] **ANSI C63.4-2009** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC CFR 47 Part 15 (July 2013)** Radio Frequency Devices
- [3] **RSS-210 Issue 8 (December 2010)** Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment
- [4] **RSS-Gen Issue 3 (December 2010)** General Requirements and Information for the Certification of Radiocommunication Equipment

TEST RESULT

The complete test results are presented in the following.

Test engineer:	Raimund BLASK		4 October 2013
	Name	Signature	Date
Authorized reviewer:	Michael DINTER		7 October 2013
	Name	Signature	Date

RESERVATION

This test report is only valid in its original form.

Any reproduction of its contents in extracts without written permission of the accredited test laboratory PHOENIX TESTLAB GmbH is prohibited.

The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalizations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

Contents:	Page
1 IDENTIFICATION.....	4
1.1 Applicant.....	4
1.2 Manufacturer	4
1.3 Test laboratory.....	4
1.4 EUT (Equipment Under Test).....	5
1.5 Technical data of equipment.....	5
1.6 Dates	6
2 OPERATIONAL STATES.....	6
3 ADDITIONAL INFORMATION.....	7
4 OVERVIEW	7
5 TEST RESULTS	8
5.1 CONDUCTED EMISSIONS ON POWER SUPPLY LINES.....	8
5.1.1 TESTMETHOD	8
5.1.2 RESULTS CONDUCTED EMISSION MEASUREMENT ON AC MAINS	9
5.2 Radiated emissions	11
5.2.1 Method of measurement (radiated emissions).....	11
5.2.2 TEST RESULTS (RADIATED EMISSIONS)	18
5.2.2.1 PRELIMINARY RADIATED EMISSION MEASUREMENT (9 kHz to 30 MHz).....	18
5.2.2.2 FINAL RADIATED EMISSION MEASUREMENT (9 kHz to 30 MHz)	20
5.2.2.3 Preliminary emission measurement (30 MHz to 2 GHz)	21
5.2.2.4 Final radiated emission measurement (30 MHz to 1 GHz).....	23
6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS.....	25
7 REPORT HISTORY	25
8 LIST OF ANNEXES	26

1 IDENTIFICATION

1.1 Applicant

Name:	Bernstein AG
Address:	Tieloser Weg 6 32457 Porta Westfalica
Country:	Germany
Name for contact purposes:	Mr. Viktor Keller
Phone:	+49-(0)-571-793-504
Fax:	+49-(0)-571-793-555
eMail Address:	v.keller@de.bernstein.eu
Applicant represented during the test by the following person:	Mr. Viktor Keller

1.2 Manufacturer

Name:	Bernstein AG
Address:	Tieloser Weg 6 32457 Porta Westfalica
Country:	Germany
Name for contact purposes:	Mr. Viktor Keller
Phone:	+49-(0)-571-793-504
Fax:	+49-(0)-571-793-555
eMail Address:	v.keller@de.bernstein.eu
Applicant represented during the test by the following person:	Mr. Viktor Keller

1.3 Test laboratory

The tests were carried out at: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

accredited by Deutsche Gesellschaft Akkreditierungsgesellschaft GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025 under Reg. No. D-PL-17186-01-02, FCC Test site registration number 90877 and Industry Canada Test site registration IC3469A-1.

1.4 EUT (Equipment Under Test)

Test object	Contactless Safety Monitoring Switch
Type	CSMS-M-RRS-H-KA (6075985048) + CSMS-S-H (6075980052)
Order number	-
Serial number	-
FCC ID:	2ABA6CSMSR
IC:	11535A-CSMSR
PCB identifier	5901240036_05 + 5901240037_03
Hardware version	V05 + V03
Software version	CSMS-M-RRS-H-KA: µC1: 17.05.2013, µC2: 17.05.2013 CSMC-S-H: Rev432

1.5 Technical data of equipment

Power supply: *	External 24 V DC-Power-Supply				
Supply voltage: *	$U_{\text{nom}} =$	24.0 V _{DC}	$U_{\text{min}} =$	20.5 V _{DC}	$U_{\text{max}} =$
Type of modulation: *	AM				
Frequency deviation: *	-				
Operating frequency range: *	6.78 MHz				
Number of channels: *	1				
Antenna type: *	Internal antenna				
Duty cycle: *	100 %				
Rated RF power: *	-				
Data rate: *	62.5 kBit/s				
Lowest internal frequency: *	75 kHz				
Highest internal frequency: *	13.56 MHz				
Temperature range: *	-25°C to +70°C				

* declared by the applicant.

The following external I/O cables were used:

Identification	Connector		Length
	EUT	Ancillary	
Data-/ Power-Line	fixed	customized	3m
-	-	-	-
-	-	-	-

*: Length during the test if no other specified.

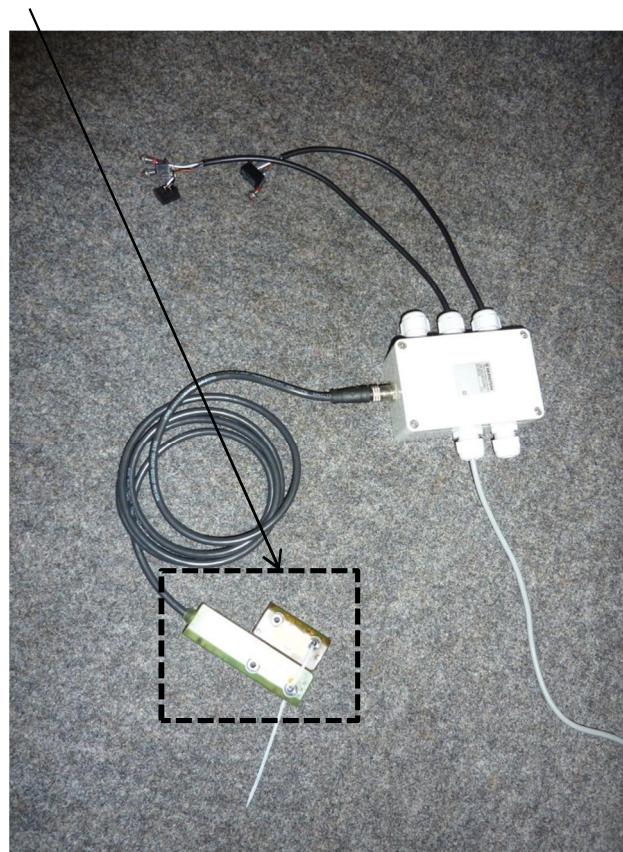
1.6 Dates

Date of receipt of test sample:	13 June 2013
Start of test:	4 July 2013
End of test:	4 July 2013

2 OPERATIONAL STATES

The EUT is a “Contactless Safety Monitoring Switch” operating in the frequency range 6.780 MHz. The tests were carried out with an unmodified Test-Sample in normal operation mode (transmit-mode). No receive- or standby-mode was available (declared by the applicant).

Physical boundaries of the EUT:



3 ADDITIONAL INFORMATION

Ancillary (necessary for testing):

- 24V DC-Power Supply; type Phoenix Contact, MINI-PS-130-240AC/24DC/1

Special EMC measures:

- none

4 OVERVIEW

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS 210, Issue 8 [3] or RSS-Gen, Issue 2 [4]	Status	Refer page
Conducted emissions on supply line	0.15 - 30	15.207 (a)	7.2.4 [4]	Passed	9 et seq.
Radiated emissions	0.009 - 2,000	15.205 (a) 15.209 (a)	2.5 [3]	Passed	11 et seq.
99 % bandwidth	6.78 MHz	-	4.6.1 [4]	Passed	Annex D

5 TEST RESULTS

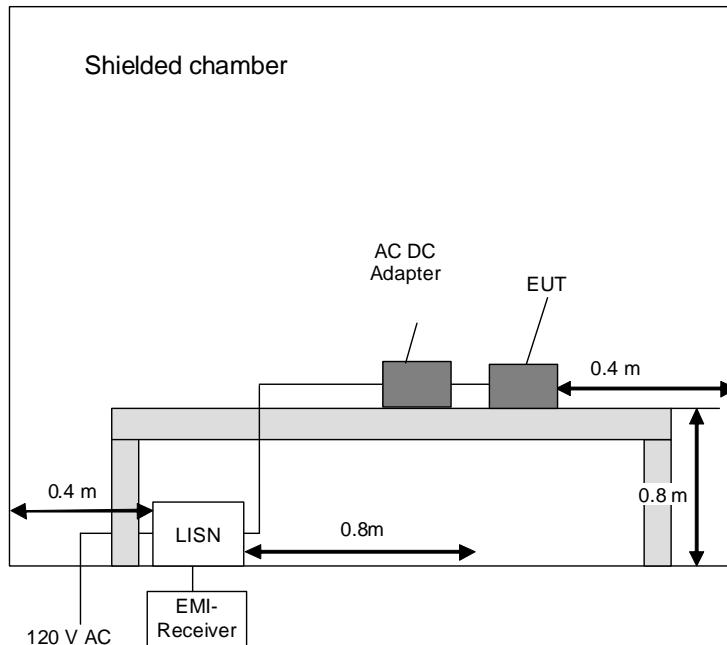
5.1 CONDUCTED EMISSIONS ON POWER SUPPLY LINES

5.1.1 TESTMETHOD

This test will be carried out in a shielded chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm above the ground plane. Floor-standing devices will be placed directly on the ground plane. The setup of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

The frequency range 150 kHz to 30 MHz will be measured with an EMI Receiver set to MAX Hold mode with peak and average detector and a resolution bandwidth of 9 kHz. A scan will be carried out on the phase (or plus pole in case of DC powered devices) of the AC mains network. If levels detected 10 dB below the appropiable limit, this emission will be measured with the average and quasi-peak detector on all lines.

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz

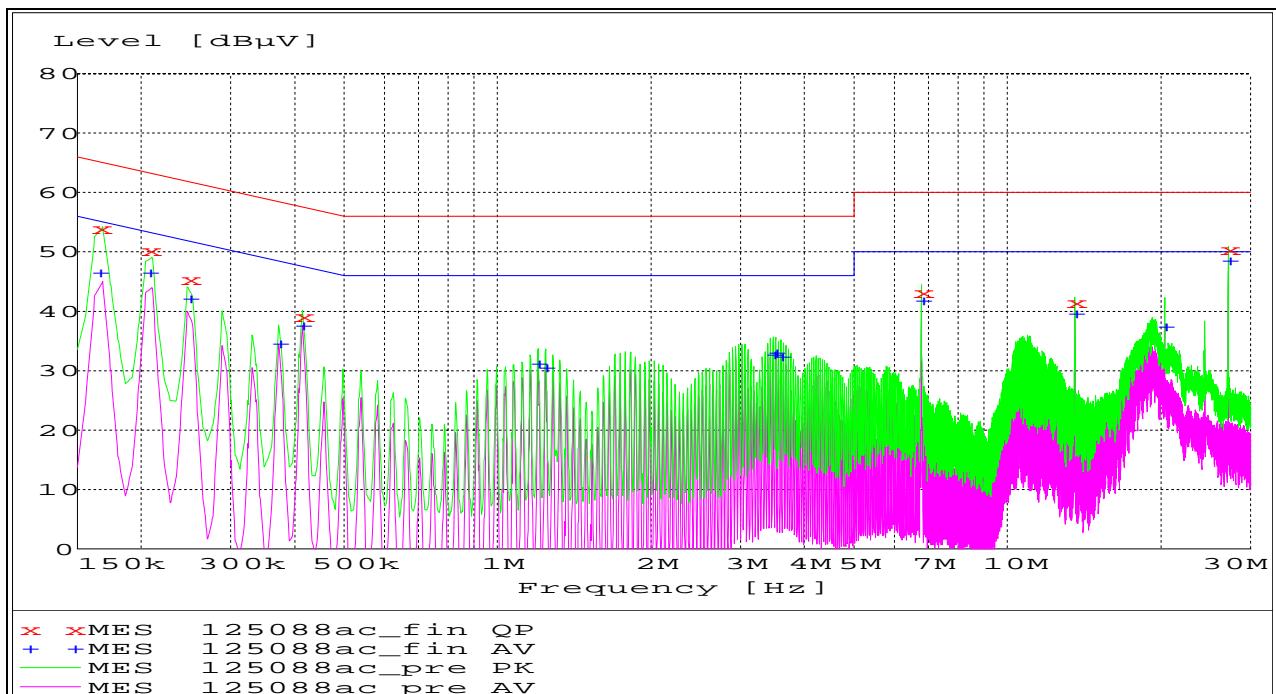


5.1.2 RESULTS CONDUCTED EMISSION MEASUREMENT ON AC MAINS

Ambient temperature:	20 °C	Relative humidity:	35 %
----------------------	-------	--------------------	------

Position of EUT: The EUT was set-up on a wooden table of a height of 0.8 m.
 Cable guide: The cables of the EUT were fixed on the wooden table. For further information of the cable guide refer to the pictures in annex A of this test report.
 Power supply: During the measurement the EUT was supplied with 120 V_{AC} 60 Hz via a AC adapter.
 Operation states: As described in chapter 2.
 Title: Mains terminal disturbance voltage measurement with protective ground conductor simulation
 Test Specification: 120 V / 60 Hz

The curves in the diagram only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by "x" and the average measured points by "+".



Result measured with the quasipeak detector (marked by x):

Frequency MHz	Level dB μ V	Transducer dB	Limit dB μ V	Margin dB	Line	PE
0.166200	53.90	1.3	65.1	11.3	L1	GND
0.207600	50.30	1.0	63.3	13.0	L1	GND
0.248100	45.40	0.9	61.8	16.5	L1	GND
0.414600	39.20	0.9	57.6	18.4	L1	GND
6.780300	43.30	1.1	60.0	16.7	L1	FLO
13.560000	41.60	1.8	60.0	18.4	L1	GND
27.120300	50.40	3.0	60.0	9.6	L1	FLO

Result measured with the average detector (marked by +):

Frequency MHz	Level dB μ V	Transducer dB	Limit dB μ V	Margin dB	Line	PE
0.165300	46.60	1.3	55.2	8.6	L1	GND
0.206700	46.70	1.0	53.3	6.6	L1	FLO
0.248100	42.20	0.9	51.8	9.6	L1	FLO
0.372300	34.60	0.9	48.4	13.8	L1	FLO
0.413700	37.70	0.9	47.6	9.8	L1	GND
1.200300	31.20	0.7	46.0	14.8	L1	FLO
1.241700	30.60	0.7	46.0	15.4	L1	GND
3.468300	32.80	0.9	46.0	13.2	L1	GND
3.509700	33.00	0.8	46.0	13.0	L1	GND
3.592500	32.50	0.7	46.0	13.5	L1	FLO
6.780300	41.90	1.1	50.0	8.1	L1	FLO
13.560000	39.70	1.8	50.0	10.3	L1	GND
20.339700	37.40	2.3	50.0	12.6	L1	FLO
27.120300	48.60	3.0	50.0	1.4	L1	GND

Test: Passed

TEST EQUIPMENT USED:

1-3, 5, 6

5.2 Radiated emissions

5.2.1 Method of measurement (radiated emissions)

The radiated emission measurement is subdivided into five stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 9 kHz to 1 GHz.
- A final measurement carried out on an outdoor test side without reflecting ground plane and a fixed antenna height in the frequency range 9 kHz to 30 MHz.
- A final measurement carried out on an open area test side with reflecting ground plane and various antenna heights in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a variable antenna distance and height in the frequency range 1 GHz to 25 / 40 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 25 / 40 GHz.

Preliminary measurement (9 kHz to 30 MHz):

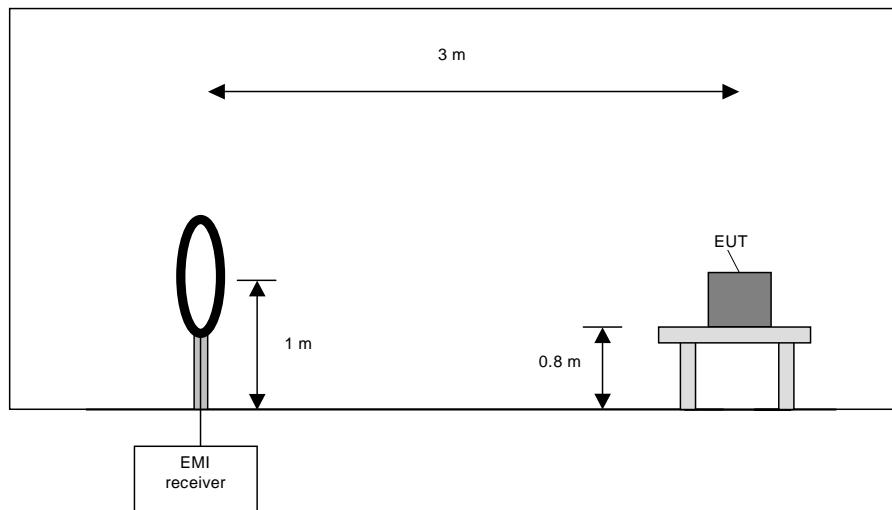
In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of

3 meters. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

The frequency range 9 kHz to 30 MHz will be monitored with a spectrum analyser while the system and its cables will be manipulated to find out the configuration with the maximum emission levels if applicable. The EMI Receiver will be set to MAX Hold mode. The EUT and the measuring antenna will be rotated around their vertical axis to found the maximum emissions.

The resolution bandwidth of the spectrum analyser will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	10 kHz



Preliminary measurement procedure:

Prescans were performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0°.
- 2) Manipulate the system cables within the range to produce the maximum level of emission.
- 3) Rotate the EUT by 360° to maximize the detected signals.
- 4) Make a hardcopy of the spectrum.
- 5) Measure the frequencies of highest detected emission with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 6) Repeat steps 1) to 5) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).
- 7) Rotate the measuring antenna and repeat steps 1) to 5).

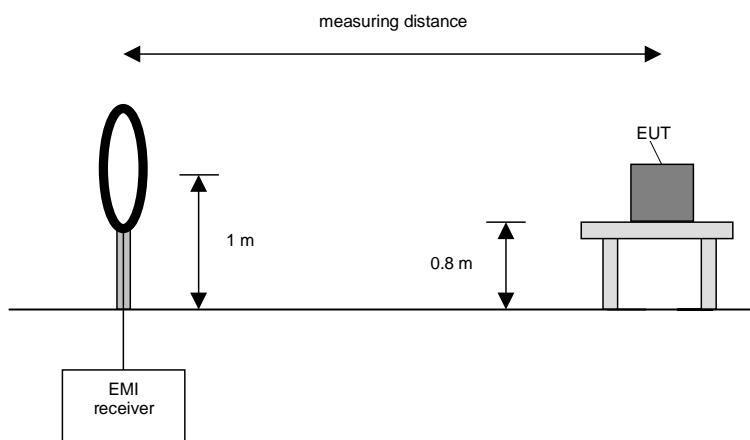
Final measurement (9 kHz to 30 MHz):

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane in measuring distances of 3 m, 10 m and 30 m. In the case where larger measuring distances is required the results will be extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with a EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 kHz to 490 kHz where an average detector will be used according Section 15.209 (d) [2].

On the during the preliminary measurement detected frequencies the final measurement will be performed while rotating the EUT and the measuring antenna in the range of 0 ° to 360 ° around their vertical axis until the maximum value is found.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz



Final measurement procedure:

The following procedure will be used:

- 1) Monitor the frequency range with the measuring antenna at vertical orientation parallel to the EUT at an azimuth of 0 °.
- 2) Rotate the EUT by 360 ° to maximize the detected signals and note the azimuth and orientation.
- 3) Rotate the measuring antenna to find the maximum and note the value.
- 4) Rotate the measuring antenna and repeat steps 1) to 3) until the maximum value is found.
- 5) Repeat steps 1) to 4) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).

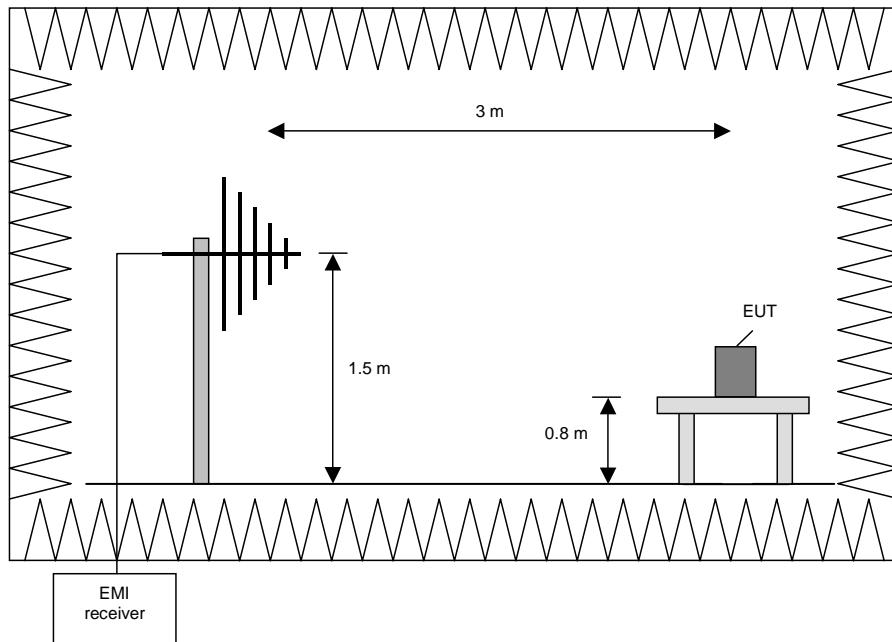
Preliminary measurement (30 MHz to 1 GHz)

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 230 MHz	100 kHz
230 MHz to 1 GHz	100 kHz



Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.

The following procedure will be used:

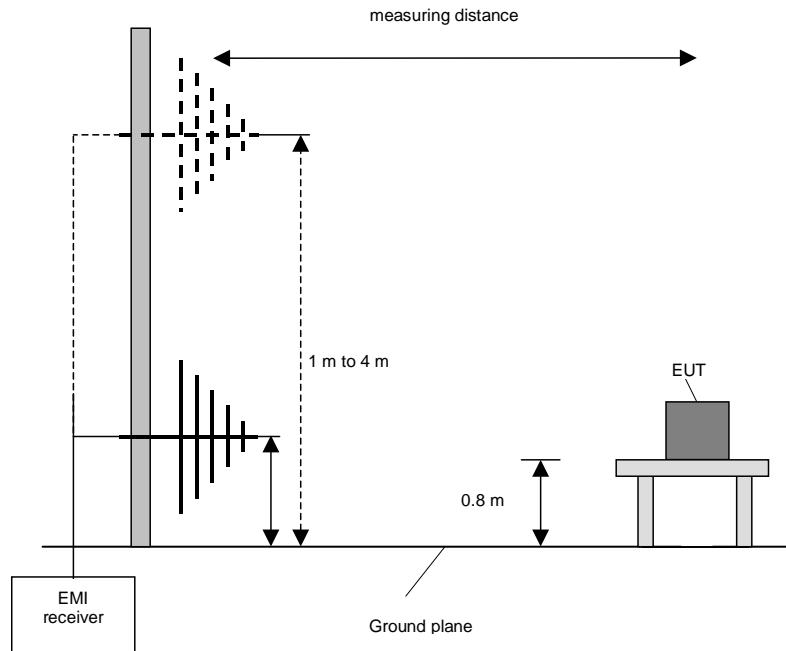
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6. Repeat 1) to 4) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).
7. Repeat 1) to 5) with the vertical polarisation of the measuring antenna.

Final measurement (30 MHz to 1 GHz)

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure final measurement:

The following procedure will be used:

- 1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.
- 2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
- 3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.
- 4) Repeat 1) to 3) for the other orthogonal antenna polarization.
- 5) Move the antenna and the turntable to the position where the maximum value is detected.
- 6) Measure while moving the antenna slowly +/- 1 m.
- 7) Set the antenna to the position where the maximum value is found.
- 8) Measure while moving the turntable +/- 45 °.
- 9) Set the turntable to the azimuth where the maximum value is found.
- 10) Measure with Final detector (QP and AV) and note the value.
- 11) Repeat 5) to 10) for each frequency.
- 12) Repeat 1) to 11) for each orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).

Preliminary and final measurement (1 GHz to 40 GHz)

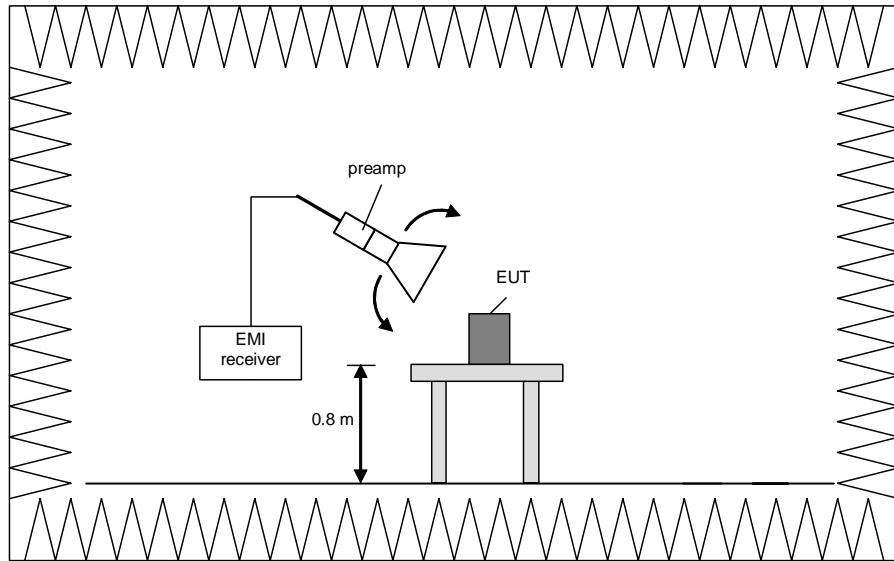
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The setup of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

Preliminary measurement (1 GHz to 40 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyser set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna, the antenna close to the EUT and while moving the antenna over all sides of the EUT. With the spectrum analyser in CLEAR / WRITE mode the cone of the emission should be found and then the measuring distance will be set to 3 m with the receiving antenna moving in this cone of emission. At this position the final measurement will be carried out.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	100 kHz
4 GHz to 12 GHz	100 kHz
12 GHz to 18 GHz	100 kHz
18 GHz to 25 / 26.5 GHz	100 kHz
26.5 GHz to 40 GHz	100 kHz

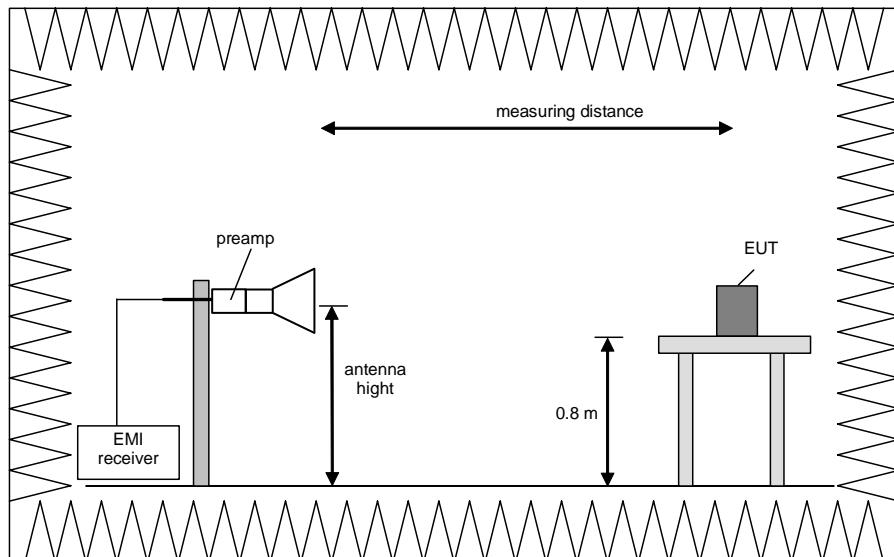


Final measurement (1 GHz to 40 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 ° in order to have the antenna inside the cone of radiation.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 25 / 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz



Procedure of measurement:

The measurements were performed in the frequency ranges 1 GHz to 4 GHz, 4 GHz to 12 GHz, 12 GHz to 18 GHz, 18 GHz to 25 /26.5 GHz and 26.5 GHz to 40 GHz.

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and move the antenna over all sides of the EUT (if necessary move the EUT to another orthogonal axis).
- 2) Change the antenna polarisation and repeat 1) with vertical polarisation.
- 3) Make a hardcopy of the spectrum.
- 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 5) Change the analyser mode to Clear / Write and found the cone of emission.
- 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3 m and the antenna will be still inside the cone of emission.
- 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarisation and azimuth and the peak and average detector, which causes the maximum emission.
- 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beam width.

Step 1) to 6) are defined as preliminary measurement.

5.2.2 TEST RESULTS (RADIATED EMISSIONS)

5.2.2.1 PRELIMINARY RADIATED EMISSION MEASUREMENT (9 kHz to 30 MHz)

Ambient temperature	20 °C	Relative humidity	45 %
---------------------	-------	-------------------	------

Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

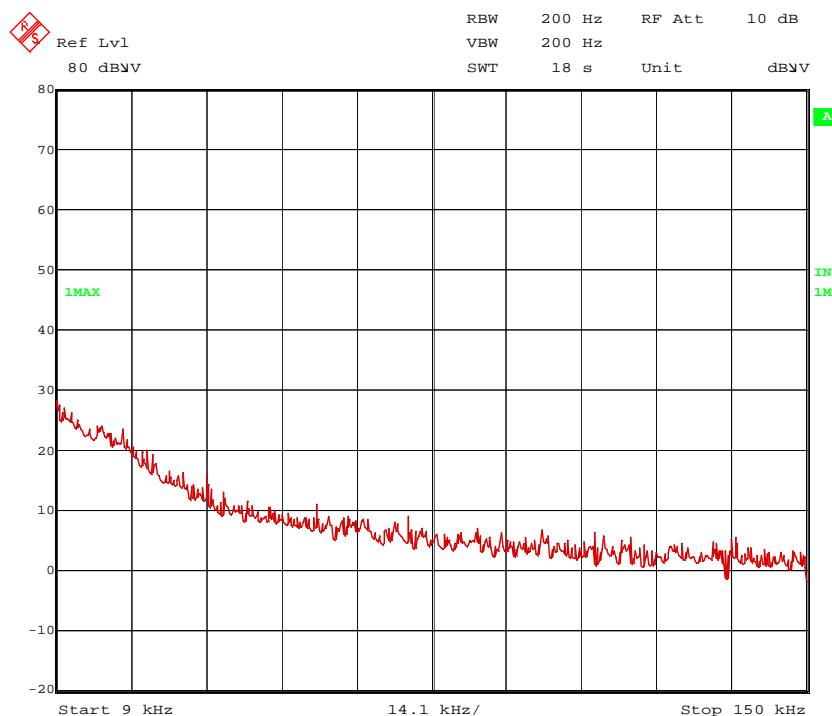
The distance between EUT and antenna was 3 m.

Cable guide: The cable was connected to the EUT and running vertically to the false floor.

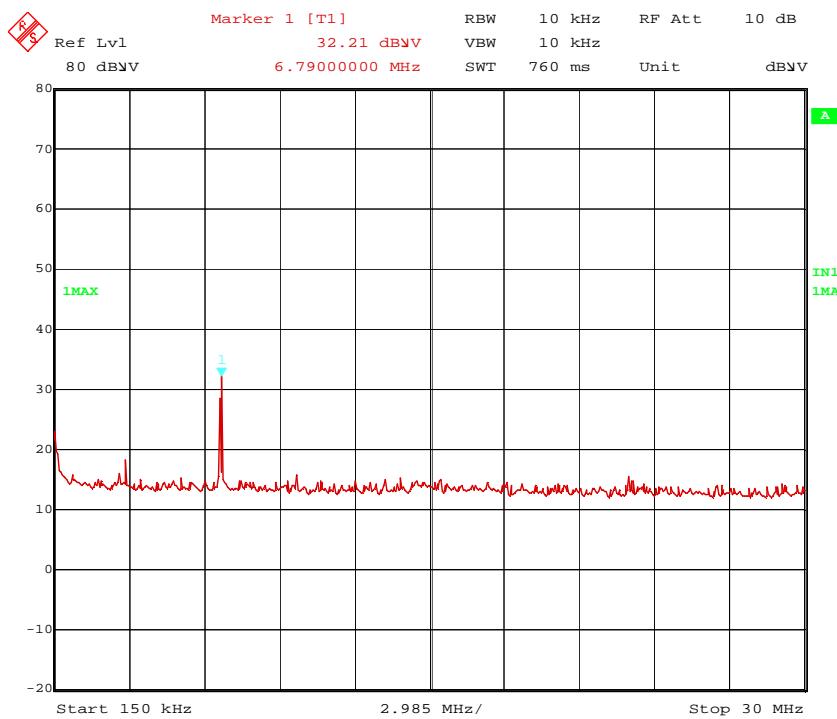
For detail information of test set-up and the cable guide refer to the photographs in annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 24.0 V DC via an external power supply.



131297tx1.wmf: 9 kHz to 150 kHz



131297tx2.wmf: 150 kHz to 30 MHz

The wanted frequency 6.790 MHz was detected during the measurement. No other significant spurious frequencies above the noise floor of the system were found during the preliminary radiated emission test, so only this frequency was measured on the outdoor test site.

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 33, 133

5.2.2.2 FINAL RADIATED EMISSION MEASUREMENT (9 kHz to 30 MHz)

Ambient temperature	20 °C	Relative humidity	65 %
---------------------	-------	-------------------	------

Position of EUT:	The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
Cable guide:	The cable was connected to the EUT and running vertically to the false floor. For detail information of test set-up and the cable guide refer to the photographs in annex A of this test report.
Test record:	All results are shown in the following.
Supply voltage:	During all measurements the EUT was supplied with 24.0 V DC via an external power supply.
Test results:	The test results were calculated with the following formula: Result [dB μ V/m] = reading [dB μ V] + antenna factor [dB/m]

Results with measuring distance of 10 m (fundamental):						
Frequency	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector	Readings dB μ V	Antenna factor * ² dB/m
6.790 MHz	47.0	69.5 * ¹	22.5	QP	27.0	20.0
Measurement uncertainty		+2.2 dB / -3.6 dB				

*¹: Limit corrected with 40 dB / decade

*²: Cable loss included

Results with measuring distance of 3 m (harmonics):						
Frequency	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector	Readings dB μ V	Antenna factor * ² dB/m
-						-
-	No significant emissions found.					
-						-
-						-
Measurement uncertainty		+2.2 dB / -3.6 dB				

*¹: Limit corrected with 40 dB / decade

*²: Cable loss included

TEST EQUIPMENT USED FOR THE TEST:
14, 15, 133

5.2.2.3 Preliminary emission measurement (30 MHz to 2 GHz)

Ambient temperature	20 °C	Relative humidity	50 %
---------------------	-------	-------------------	------

Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cable was connected to the EUT and running vertically to the false floor. For detail information of test set-up and the cable guide refer to the photographs in annex A of this test report.

Test record: All results are shown in the following.

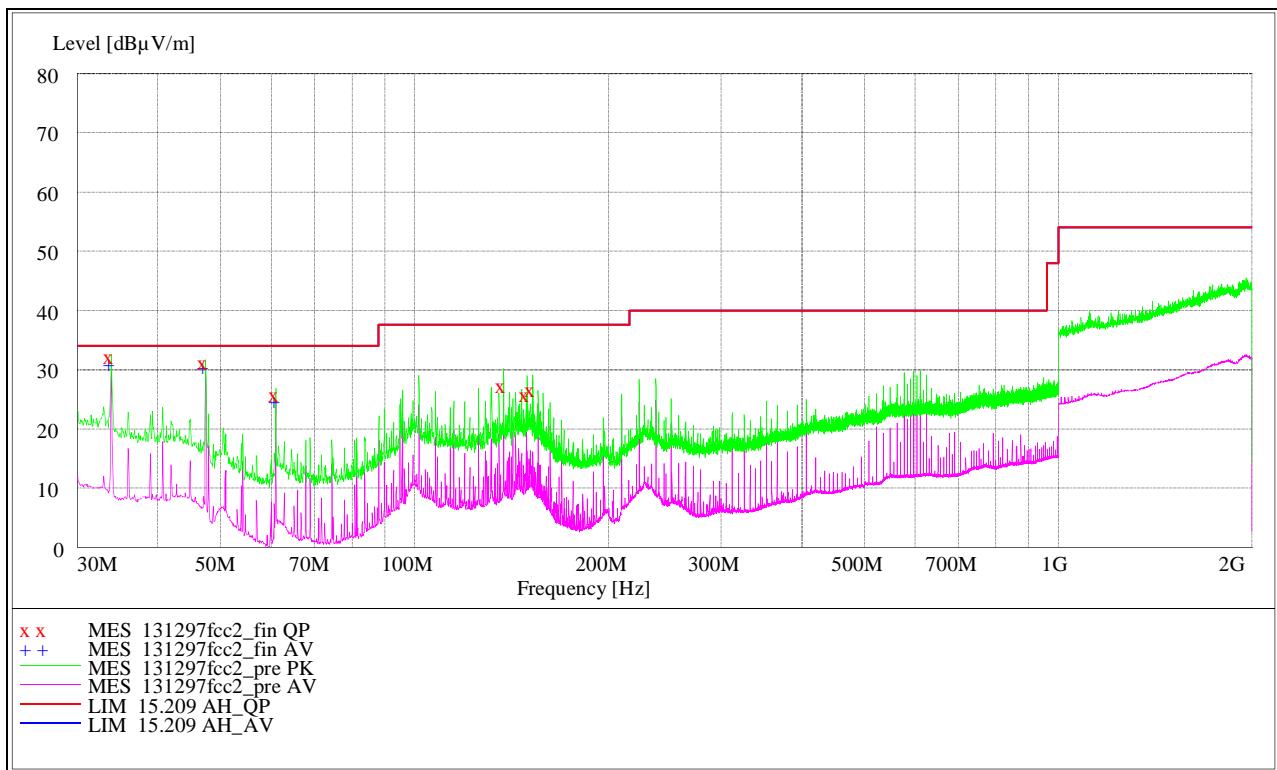
Supply voltage: During all measurements the EUT was supplied with 24.0 V DC via an external power supply.

The limit line and measurement curve shown in the diagram below refer to the preliminary measurements. Here, it must be noted that because of the reduced measuring distance and because of the floor absorbers, the measured values do not comply with the values of the above mentioned standard; they only serve as orientation in determining which frequencies must be measured on the open area test site.

The limit line is achieved with the applied standard by converting to a 3 m measurement distance (+ 10 dB) and the correction for the free space in which in the "worst case" the reflected floor wave is missing entirely (- 6 dB). Therefore 4 dB is added to the limit line of the standard concerned.

The curves in the diagram only represent the maximum measured value for each frequency point of all preliminary measurements, which were carried out with the EUT in various positions.

The top measured curve represents the peak measurement. The measured points marked with "x" are frequency points for which later measurements with a quasi-peak detector were carried out. These values are indicated in the following table. The bottom measured curve represents average values (marked with "+"), which are only required for control purposes.



Data record name: 131297fcc2

Result measured with the quasipeak detector (marked by an x):

Frequency MHz	Level dB μ V/m	Transducer dB	Limit dB μ V/m	Margin dB	Height cm	Azimuth deg	Polarisation
33.900000	32.50	18.3	34.0	1.5	150.0	302.00	VERTICAL
47.460000	31.60	10.7	34.0	2.4	150.0	1.00	VERTICAL
61.020000	26.00	7.7	34.0	8.0	150.0	45.00	VERTICAL
137.748000	27.60	13.0	37.5	9.9	150.0	98.00	HORIZONTAL
149.736000	26.00	12.2	37.5	11.5	150.0	90.00	HORIZONTAL
152.736000	27.00	12.0	37.5	10.5	150.0	90.00	HORIZONTAL

Result measured with the average detector (marked by a +):

Frequency MHz	Level dB μ V/m	Transducer dB	Limit dB μ V/m	Margin dB	Height cm	Azimuth deg	Polarisation
33.900000	31.20	18.3	34.0	2.8	150.0	271.00	VERTICAL
47.460000	30.90	10.7	34.0	3.1	150.0	1.00	VERTICAL
61.020000	25.20	7.7	34.0	8.8	150.0	24.00	VERTICAL

In this case it was necessary to carry out subsequent measurements because at some frequency points a value was above the Qualify limit curve during the preliminary measurements. The results from the standard subsequent measurements on the open area test site are presented in the following.

The following frequencies were found during the preliminary radiated emission test:

33.900 MHz; 47.460 MHz; 61.020 MHz, 137.748 MHz; 149.736 MHz; 152.736 MHz

These frequencies have to be measured in a final measurement. The results were presented in the following.

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 35, 142

5.2.2.4 Final radiated emission measurement (30 MHz to 1 GHz)

Ambient temperature	20 °C	Relative humidity	53 %
---------------------	-------	-------------------	------

Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

The distance between EUT and antenna was 3 m.

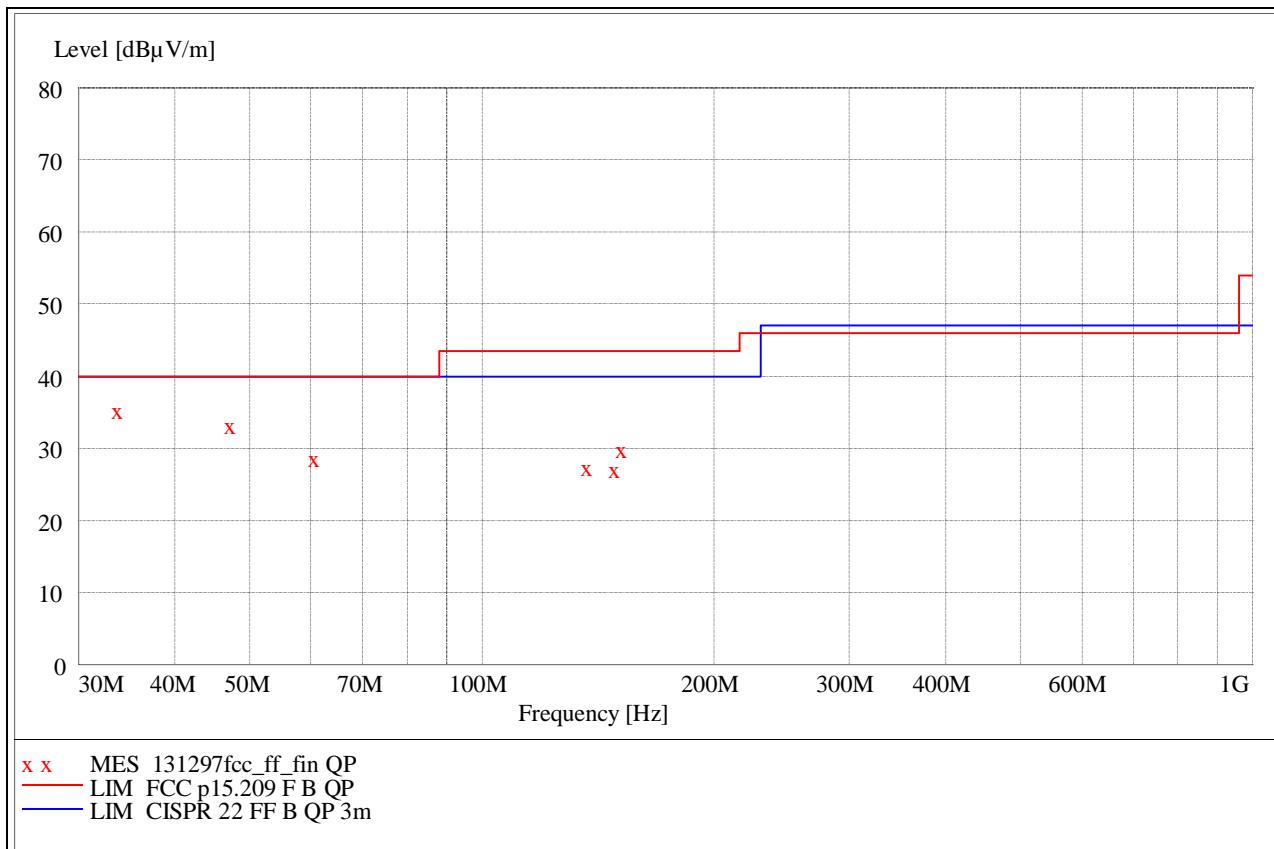
Cable guide: The cable was connected to the EUT and running vertically to the false floor.

For detail information of test set-up and the cable guide refer to the photographs in annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 24.0 V DC via an external power supply.

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above mentioned standard. The measured points marked with "x" are the measured results of the standard subsequent measurement on the open area test site.



Data record name: 131297fcc_ff

The results of the standard subsequent measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

Radiated emission results according to FCC 47 CFR Part 15 section 15.209 (b) [3]

Result measured with the quasipeak detector (marked by an x):

Frequency MHz	Level dB μ V/m	Transducer dB	Limit dB μ V/m	Margin dB	Height cm	Azimuth deg	Polarisation
33.900000	35.40	18.0	40.0	4.6	154.0	61.00	VERTICAL
47.460000	33.30	10.9	40.0	6.7	100.0	136.00	VERTICAL
61.020000	28.80	7.5	40.0	11.2	211.0	225.00	VERTICAL
137.748000	27.60	13.9	43.5	15.9	225.0	180.00	VERTICAL
149.736000	27.30	13.7	43.5	16.2	262.0	2.00	VERTICAL
152.736000	30.10	13.5	43.5	13.4	100.0	2.00	VERTICAL

Radiated emission results according to ICES-003 Issue 5 section 7.1 [4]

Result measured with the quasipeak detector (marked by an x):

Frequency MHz	Level dB μ V/m	Transducer dB	Limit dB μ V/m	Margin dB	Height cm	Azimuth deg	Polarisation
33.900000	35.40	18.0	40.0	4.6	154.0	61.00	VERTICAL
47.460000	33.30	10.9	40.0	6.7	100.0	136.00	VERTICAL
61.020000	28.80	7.5	40.0	11.2	211.0	225.00	VERTICAL
137.748000	27.60	13.9	40.0	12.4	225.0	180.00	VERTICAL
149.736000	27.30	13.7	40.0	12.7	262.0	2.00	VERTICAL
152.736000	30.10	13.5	40.0	10.1	100.0	2.00	VERTICAL

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

14 - 20

6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
1	Shielded chamber M4	-	Siemens AG	B83117-S1-X158	480088	Weekly verification (system cal.)	
2	EMI Receiver	ESIB 26	Rohde & Schwarz	1088.7490	481182	02/2012	02/2014
3	LISN	NSLK8128	Schwarzbeck	8128161	480138	02/2012	02/2014
4	High pass filter	HR 0.13-5ENN	FSY Microwave Inc.	DC 0109 SN 002	480340	Weekly verification (system cal.)	
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	Measuring receiver	ESIB7	Rohde & Schwarz	100304	480521	02/2012	02/2014
16	Controller	HD100	Deisel	100/670	480139	-	-
17	Turntable	DS420HE	Deisel	420/620/80	480087	-	-
18	Antenna support	AS615P	Deisel	615/310	480086	-	-
19	Antenna	CBL6111 D	Chase	25761	480894	02/2012	02/2014
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	02/2012	02/2014
32	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
34	Antenna support	AS615P	Deisel	615/310	480187	-	-
35	Antenna	CBL6112 B	Chase	2917	480447	02/2012	02/2014
142	RF-cable No. 36	Sucoflex 106B	Huber + Suhner	-	480865	Weekly verification (system cal.)	
143	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	08/2014	

7 REPORT HISTORY

Report Number	Date	Comment
F131297E1	4 October 2013	Document created
-	-	-
-	-	-

8 LIST OF ANNEXES

ANNEX A	TEST SETUP PHOTOS	4 pages
	131297emi1.jpg: Test setup preliminary measurement (E-field) 131297emi2.jpg: Test setup preliminary measurement (H-field) 131297emi3.jpg: Test setup final measurement (E-field) 131297emi4.jpg: Test setup final measurement (H-field)	
ANNEX B	EXTERNAL PHOTOS OF THE EUT	5 pages
	131297eut1.jpg: EUT with periphery-device (connection-box) 131297eut2.jpg: Transceiver, front view 131297eut3.jpg: Transceiver, rear view 131297eut4.jpg: Transponder, front view 131297eut5.jpg: Transponder, rear view	
ANNEX C	INTERNAL PHOTOS OF THE EUT	4 pages
	131297eut6.jpg: Transmitter, front view 131297eut7.jpg: Transmitter, rear view 131297eut8.jpg: Transponder, front view 131297eut9.jpg: Transponder, rear view	
ANNEX D	MEASUREMENT RESULT 99%-Bandwidth	2 pages