PHOENIX TESTLAB
Königswinkel 10
32825 Blomberg
Germany
Phone: +49 (0) 52 35 95 00-0
Fax: +49 (0) 52 35 95 00-10

Test Report

Report Number: F113539E1

Applicant:

PIEPS GmbH

Manufacturer:

PIEPS GmbH

Equipment under Test (EUT):

Avalanche Beacon

“VECTOR”

Laboratory (CAB) accredited by
Deutsche Gesellschaft für Akkreditierung mbH
in compliance with DIN EN ISO/IEC 17025
under the Reg. No. DGA-PL-105/99-22,
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 (August 2011)** 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.

	Name	Signature	Date
Test engineer:	Raimund BLASK		15 December 2011
Authorized reviewer:	Bernd STEINER		16 December 2011

RESERVATION

This test report is only valid in its original form.

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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

1.1 APPLICANT

Name:	PIEPS GmbH
Address:	Parkring 4 8403 Lebring
Country:	Austria
Name for contact purposes:	Mr. DI Wolfgang Platzer
Tel:	+43-3182-52556-12
Fax:	+43-3182-52556-19
e-mail address:	platzer.wolfgang@pieps.com

1.2 MANUFACTURER

Name:	PIEPS GmbH
Address:	Parkring 4 8403 Lebring
Country:	Austria
Name for contact purposes:	Mr. Rudolf Sackl
Tel:	+43-3182-52556-12
Fax:	+43-3182-52556-19
e-mail address:	platzer.wolfgang@pieps.com

1.3 TEST LABORATORY

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

accredited by DGA Deutsche Gesellschaft für Akkreditierung mbH in compliance with DIN EN ISO/IEC 17025 under Reg. No. DGA-PL-105/99-22, FCC Test site registration number 90877 and Industry Canada Test site registration IC3469A-1.

1.4 EUT (EQUIPMENT UNDER TEST)

Test object: *	Avalanche Beacon
Type: *	Vector
Antenna type: *	Integral H-Field-Antenna
Hardware version: *	Rev. 6
Software version: *	Version 1.0

1.5 TECHNICAL DATA OF EQUIPMENT

Duty cycle class: *	Up to 100%					
Rated transmitter field strength: *	7 dBµA/m @ 10 m distance (declared by the applicant)					
Channel spacing: *	-					
ITU classification: *	1K50A1A					
Alignment range: *	457 kHz					
Switching range: *	457 kHz					
Modulation: *	A1A Double Sideband Amplitude Modulation					
Bit rate of transmitter: *	No Data transfer					
Supply Voltage: *	U_{Nom} =	3.7 V	U_{Min}=	2.9 V	U_{Max}=	4.2 V
Power Supply: *	3.7 V Lithium-Ion-Battery (1350mAh)					
Temperature range: *	-20°C to 55°C					

*: Declared by the applicant.

The following external I/O cables were used:

Identification	Connector		Length*
	EUT	Ancillary	
-	-	-	-

*: Length during the test.

1.6 DATES

Date of receipt of test sample:	19 October 2011
Start of test:	19 October 2011
End of test:	28 October 2011

2 OPERATIONAL STATES

The tests were carried out with an unmodified test sample.
The EUT is an Avalanche Beacon (Transceiver) which can be used as Transmitter or Receiver at 457 kHz.
During the Tests the EUT was powered with the integrated battery.

The physical boundaries are shown below:

3 ADDITIONAL INFORMATION:

none

4 OVERVIEW

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS 210, Issue 7 [3] or RSS-Gen, Issue 2 [4]	Status	Refer page
Radiated emissions	0.009 - 1,000	15.205 (a) 15.209 (a)	2.5 [3]	Passed	15 et seq.
Conducted emissions on supply line	0.15 - 30	15.207 (a)	7.2.4 [4]	Not applicable*	-
99 % bandwidth	457 kHz	-	4.6.1 [4]	Passed	Annex D

* EUT is battery-powered, no lines available.

5 METHODS OF MEASUREMENT

5.1 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.

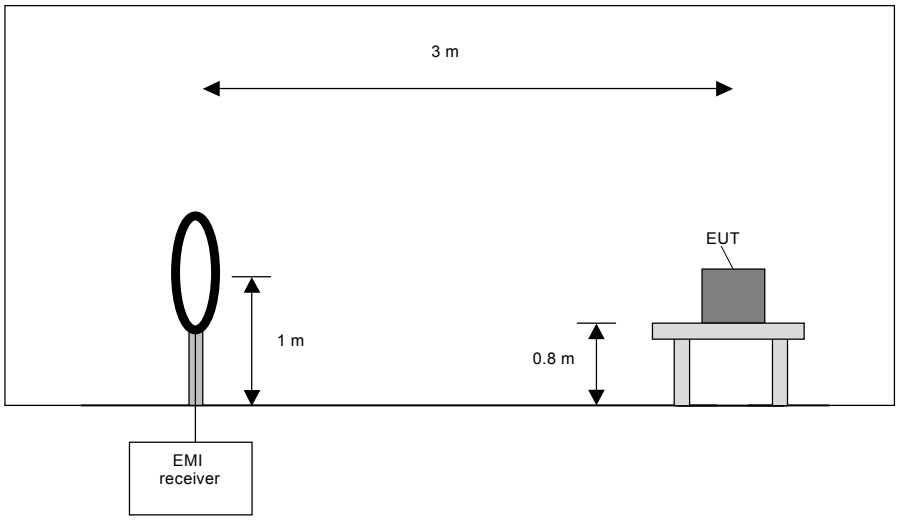
Preliminary measurement (9 kHz to 30 MHz):

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).

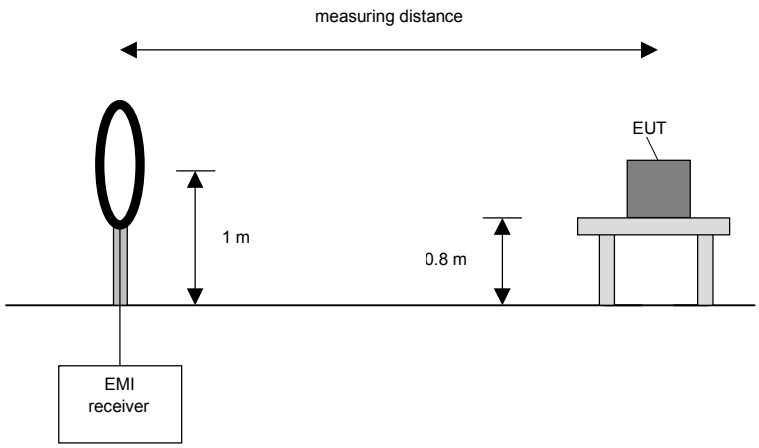
Final measurement (9 kHz to 30 MHz):

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).

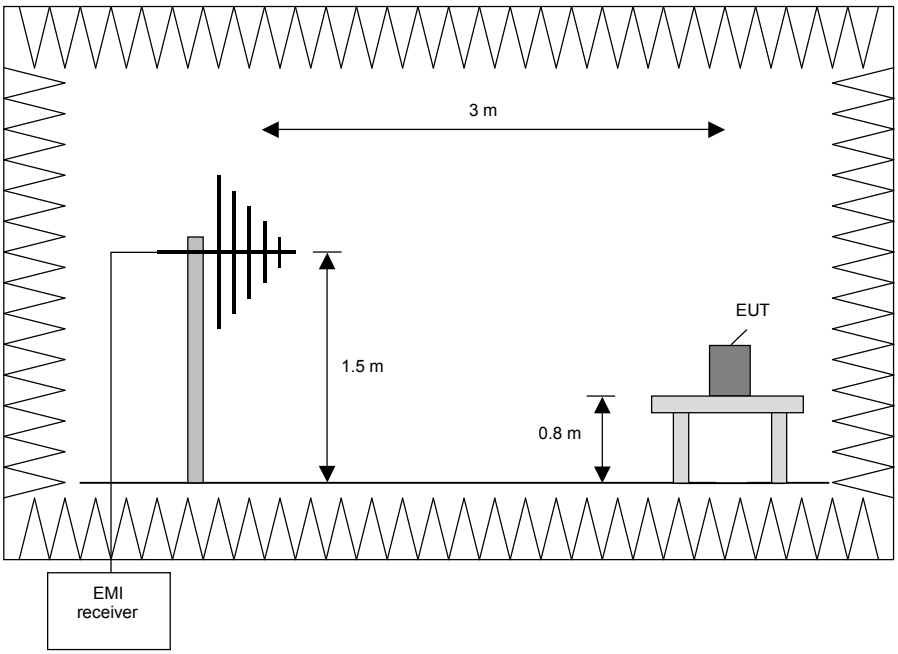
Preliminary measurement (30 MHz to 1 GHz)

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:

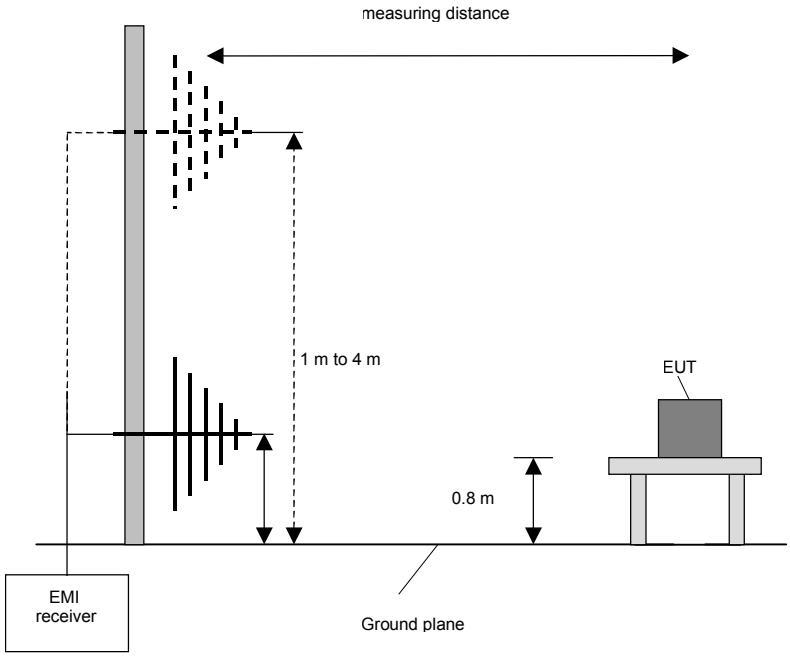
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the 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)

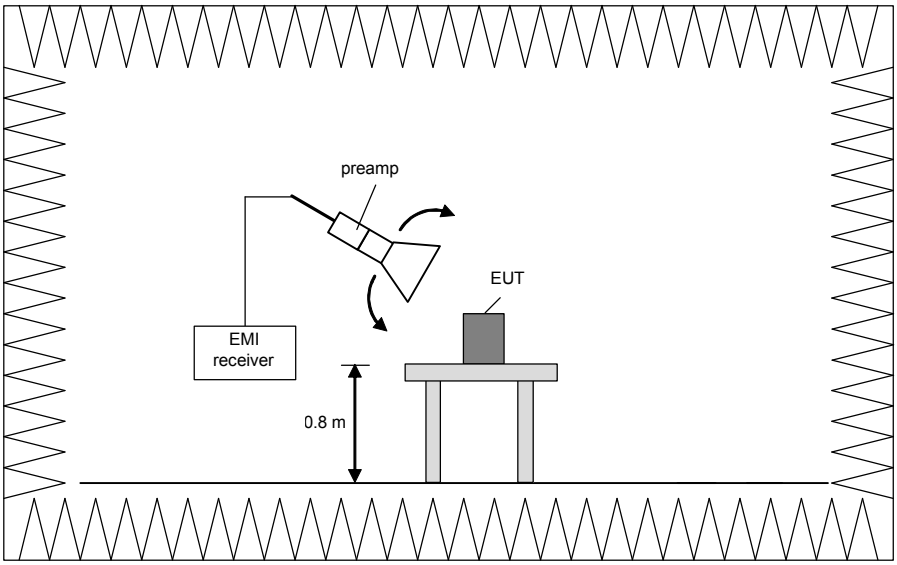
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance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

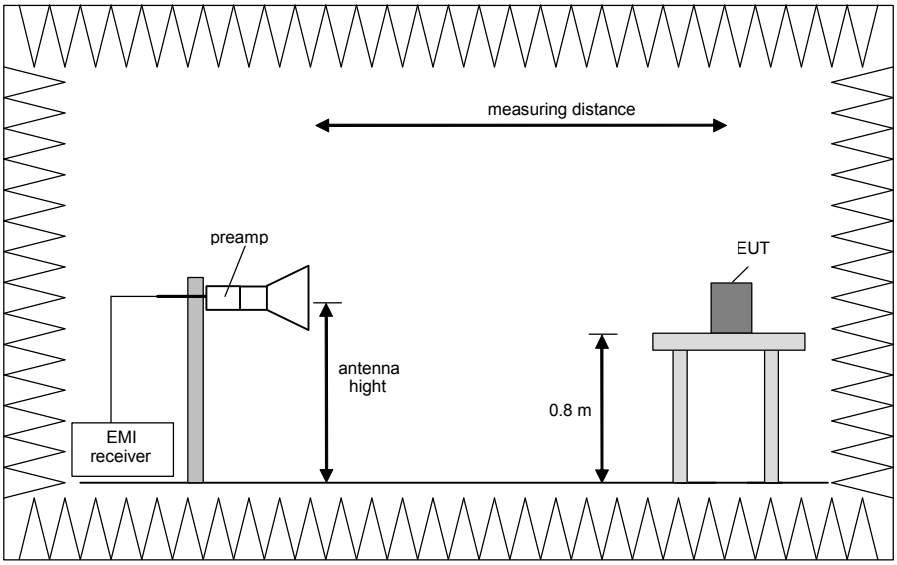


Final measurement (1 GHz to 40 GHz)

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 beamwidth.

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

5.2 RADIATED EMISSIONS

5.2.1 TEST RESULTS (RADIATED EMISSIONS)

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

Ambient temperature	20 °C	Relative humidity	45 %

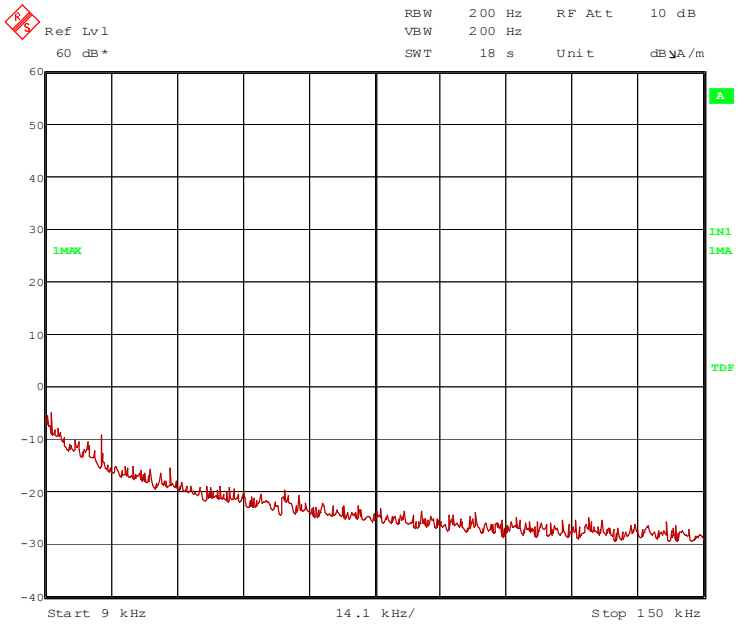
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

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

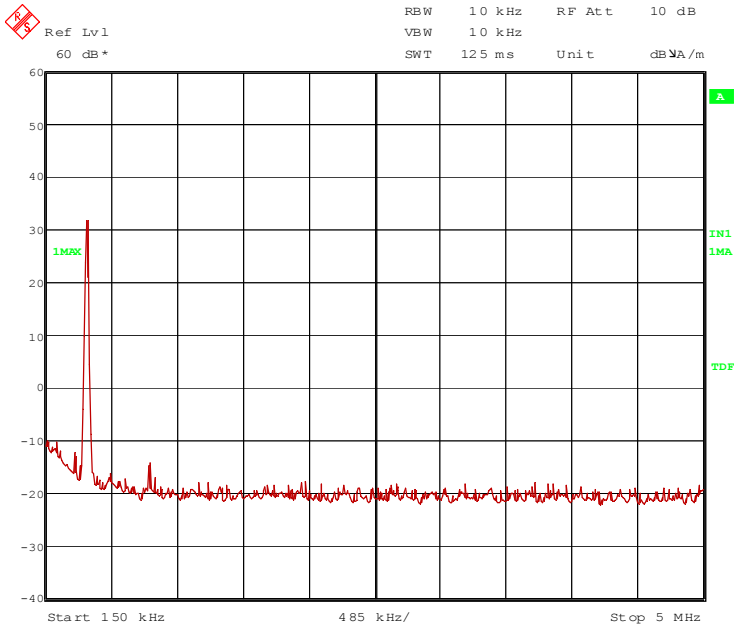
Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT`s were supplied with the internal 3.7 V-Battery.

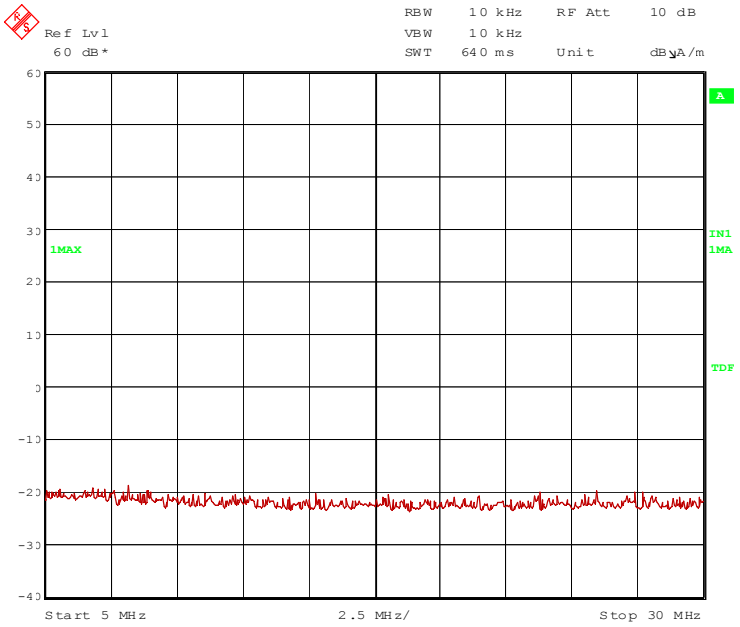
113169FCC1.wmf: Spurious emissions from 9 kHz to 150 kHz:



113169FCC2.wmf: Spurious emissions from 150 kHz to 5 MHz:



113169FCC3.wmf: Spurious emissions from 5 MHz to 30 MHz:



Only the wanted frequency 457 kHz 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 the wanted frequency-measurement was carried out on the outdoor test site.

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 33, 133

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

Ambient temperature	10 °C	Relative humidity	35 %

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 of the EUT is running vertically to the false floor. For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT`s were supplied with 3.7 V with the internal battery.

Test results: The test results were calculated with the following formula:
Result [dBµV/m] = reading [dBµV] + antenna factor [dB/m]

Results with measuring distance of 10 m						
Frequency	Result dBµV/m	Limit dBµV/m	Margin dB	Detector	Readings dBµV	Antenna factor *2 dB/m
457 kHz	54.5	74.4 *1	19.9	AV	34.5	20.0
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

5.2.1.3 PRELIMINARY MEASUREMENT (30 MHz to 1 GHz)

Ambient temperature	20 °C	Relative humidity	40 %

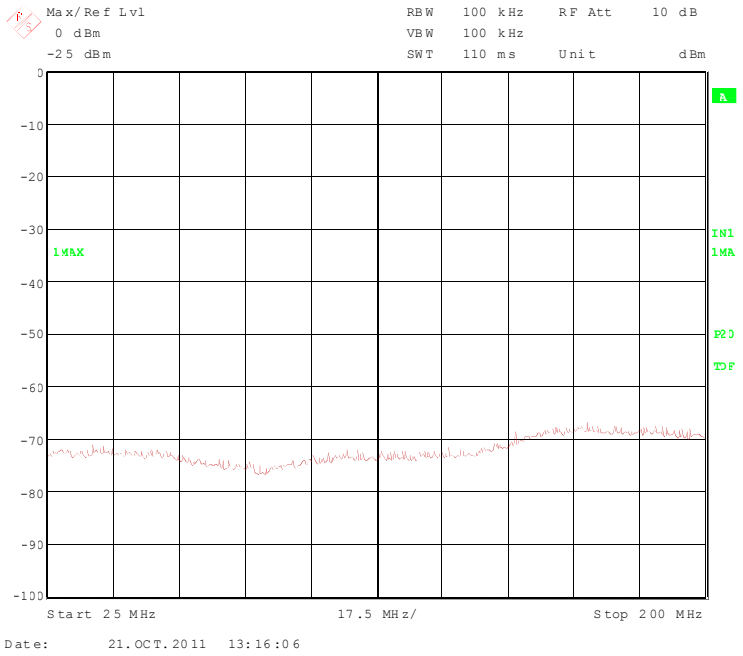
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

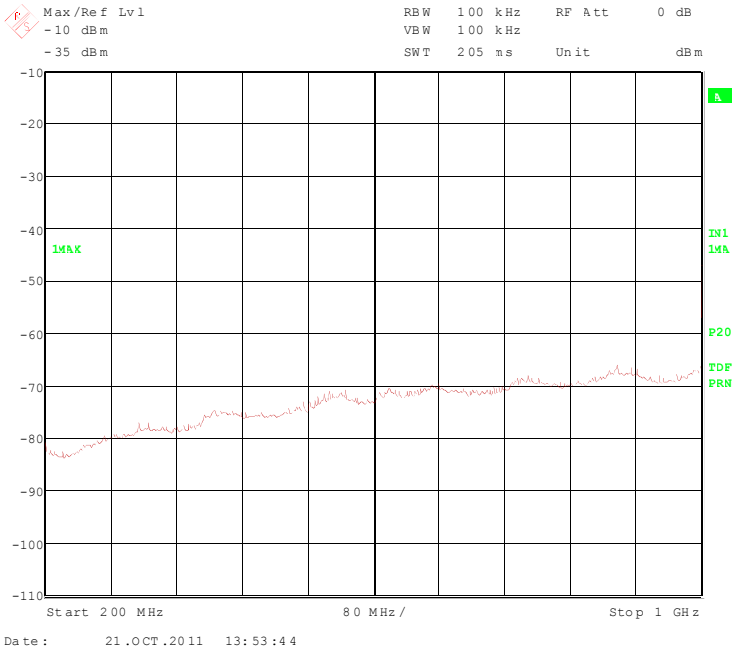
Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 3.7 V.

113169FCC4.wmf: Spurious emissions from 30 MHz to 200 MHz:



113169FCC5.wmf: Spurious emissions from 200 MHz to 1000 MHz:



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

-

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

-

Therefore no frequencies were measured in a final measurement on an open area test-site.

Additional information:

The integrated GPS-Receiver was active during the radiated measurement (but exempted according to the FCC-/IC-Standard). Therefore no measurement above 1 GHz was carried out.

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 35, 43

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	B83117S1-X158	480088	Weekly verification (system cal.)	
2	EMI Receiver	ESIB 26	Rohde & Schwarz	1088.7490	481182	02/08/2010	02/2012
3	LISN	NSLK8128	Schwarzbeck	8128161	480138	05/07/2010	05/2012
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	03/15/2010	03/2012
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 A	Chase	1643	480147	08/01/2007	08/2012
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
30	Spectrum analyser	FSU	Rohde & Schwarz	200125	480956	04/15/2010	04/2012
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	03/17/2010	03/2012
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	2688	480328	04/2011	04/2014
36	Antenna	3115 A	EMCO	9609-4918	480183	04/11/2008	11/2011
37	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	483	480294	Six month verification (system cal.)	
39	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	411	480297	Six month verification (system cal.)	
41	Standard Gain Horn 26.4 GHz – 40.1 GHz	22240-20	Flann Microwave	469	480299	Six month verification (system cal.)	
43	RF-cable No. 30	RTK 081	Rosenberger	-	410141	Weekly verification (system cal.)	
44	RF-cable No. 31	RTK 081	Rosenberger	-	410142	Weekly verification (system cal.)	
46	RF-cable 1 m	KPS-1533-400-KPS	Insulated Wire	-	480301	Six month verification (system cal.)	
49	Preamplifier	JS3-00101200-23-5A	Miteq	681851	480337	Six month verification (system cal.)	
50	Preamplifier	JS3-12001800-16-5A	Miteq	571667	480343	Six month verification (system cal.)	
51	Preamplifier	JS3-18002600-20-5A	Miteq	658697	480342	Six month verification (system cal.)	

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	
52	Preamplifier	JS3-26004000-25-5A	Miteq	563593	480344	Six month verification (system cal.)	
72	4 GHz High Pass Filter	WHKX4.0/18 G-8SS	Wainwright Instruments	1	480587	Weekly verification (system cal.)	
73	8 GHz High Pass Filter	WHKX8.0/18 G-8SS	Wainwright Instruments	4	480586	Weekly verification (system cal.)	
132	Power Meter	NRVD	Rohde & Schwarz	828110/026	480267	03/2010	03/2012
132	Thermal Power Sensor	NRV-Z51	Rohde & Schwarz	825489/004	480247	03/2010	03/2012
133	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	08/2010	08/2012

7 REPORT HISTORY

Report Number	Date	Comment
F113539E3	30 November 2011	Document created
-	-	-
-	-	-

8 LIST OF ANNEXES

ANNEX A	TEST SETUP PHOTOS	3 pages
	113539emi1.jpg: Test set-up preliminary radiated emission (H-Field) 113539emi2.jpg: Test set-up radiated emission (E-Field) 113539emi1.jpg: Test set-up final radiated emission (H-Field)	
ANNEX B	EXTERNAL PHOTOGRAPHS	2 pages
	113539eut1.jpg: EUT, front-view 113539eut2.jpg: EUT, rear-view	
ANNEX C	EXTERNAL PHOTOGRAPHS	2 pages
	113539eut3.jpg: EUT, PCB front-view 113539eut4.jpg: EUT, PCB rear-view	
ANNEX D	ADDITIONAL RESULTS FOR INDUSTRY CANADA	2 Pages