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# TEST REPORT

**Test Report Reference: F082373E01**

**Equipment under Test: SePem01 Logger**

**FCC ID: WSPSF01L7021**

**IC: 7994A-SF01L7021**

**Applicant: Hermann Sewerin GmbH**

**Manufacturer: Hermann Sewerin GmbH**

**Test Laboratory  
(CAB)**

**accredited by DATech in der TGA GmbH  
in compliance with DIN EN ISO/IEC 17025  
under the Reg. No. DAT-P-105/99-21,**

**recognized by Bundesnetzagentur  
under the Reg.-No. BNetzA-CAB-02/21-104/1,**

**CAB Designation Number DE0004,**

**listed by**

**FCC 31040/SIT1300F2**

**FCC Test site registration number 90877  
Industry Canada Test site registration IC3469A-1**

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## 1 IDENTIFICATION

### 1.1 APPLICANT

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	33334 Gütersloh
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### 1.2 MANUFACTURER

Name:	Hermann Sewerin GmbH
Address:	Robert-Bosch-Strasse 3
	33334 Gütersloh
Country:	Germany
Name for contact purposes:	Mr. Christian KREIENBRINK
Tel:	+ 49 52 41 934-319
Fax:	+49 52 41 934-444
e-mail address:	christian.kreienbrinck@sewerin.com

### 1.3 DATES

Date of receipt of test sample:	29 September 2008
Start of test:	29 September 2008
End of test:	08 October 2008

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## 1.4 TEST LABORATORY

The tests were carried out at:

**PHOENIX TESTLAB GmbH**  
Königswinkel 10  
D-32825 Blomberg  
Germany

Phone: +49 (0) 52 35 / 95 00-0  
Fax: +49 (0) 52 35 / 95 00-10

Test engineer: Thomas KÜHN  
Name



Signature

09 October 2008  
Date

Test report checked: Bernd STEINER  
Name



Signature

09 October 2008  
Date

**PHOENIX TESTLAB GmbH**  
Königswinkel 10  
32825 Blomberg  
Tel. 0 52 35 / 95 00-0  
Fax 0 52 35 / 95 00-10

Stamp

## 1.5 RESERVATION

This test report is only valid in its original form.

Any reproduction of its contents 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 generalisations 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 REFERENCE.

## 1.6 NORMATIVE REFERENCES

- [1] **ANSI C63.4:2003** 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 47 CFR Part 2** Frequency allocations and radio treaty matters, General Rules and Regulations
- [3] **FCC 47 CFR Part 90** Privat land mobile radio services
- [4] **RSS-119 Issue 9 June 2007** Land Mobile and Fixed Radio Transmitters and Receivers Operating in the Frequency Range 27.41-960 MHz
- [5] **RSS-Gen Issue 2 June 2007** General Requirements and Information for the Certification of Radiocommunication Equipment

## 1.7 TEST RESULTS

The requirements of this test document are fulfilled by the equipment under test. The complete test results are presented in the following.

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## 2 TECHNICAL DATA OF EQUIPMENT

### 2.1 DEVICE UNDER TEST

Type of equipment: *	Noise Logger
Type designation: *	SePem 01 Logger
FCC ID: *	WSPSF01L7021
IC: *	7994A-SF01L7021
Antenna type: *	External antenna ANT-433-CW-QW from ANTENNAFACTOR
Antenna gain: *	No antenna gain available
Antenna connector: *	SMA
Power supply: *	3.6 V DC by internal lithium battery
Type of modulation: *	GFSK
Operating frequency range: *	461.0375 MHz to 464.5625 MHz (transmit) 466.0375 MHz to 469.5625 MHz (receive)
Channel spacing: *	12.5 kHz
Number of channels: *	282
Temperature range: *	-20 °C to 70 °C
Lowest internal Frequency: *	32 kHz

\*: declared by the applicant

#### The following external I/O cables were used:

No cables were connectable to the EUT.

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## 2.2 PERIPHERY DEVICES

**The following equipment was used as control unit and ancillary equipment:**

- A SePem01 Master with special configuration software was used to set the SePem 01 Data Logger in the requested operation mode.

## 3 OPERATIONAL STATES AND PHYSICAL BOUNDARIES

The test was carried out with an unmodified test sample operating in test mode. The test mode was implemented by the applicant. To enter the test mode, the EUT has to be activated with the help of a permanent magnet, presented on the housing of the EUT. So the operational state of the SePem 01 Logger could be chosen with the help of a SePem Master.

During the spurious emission and radiation measurement the test sample was powered by the internal 3.6 V battery.

For measurements under extreme conditions, an external power supply was connected to the battery contacts of the EUTs transmitter.

As declared by the applicant, the EUT is intended to be used in the frequency range –20 °C to + 70 °C. Due to this fact the measurements under extreme conditions were carried out, using this temperature range.

The EUT is equipped with a permanent external antenna connector, but is intended to be used with the antenna type ANT-433-CW-QW from ANTENNAFACTOR only (dedicated antenna).

During the tests, the EUT was not labelled.

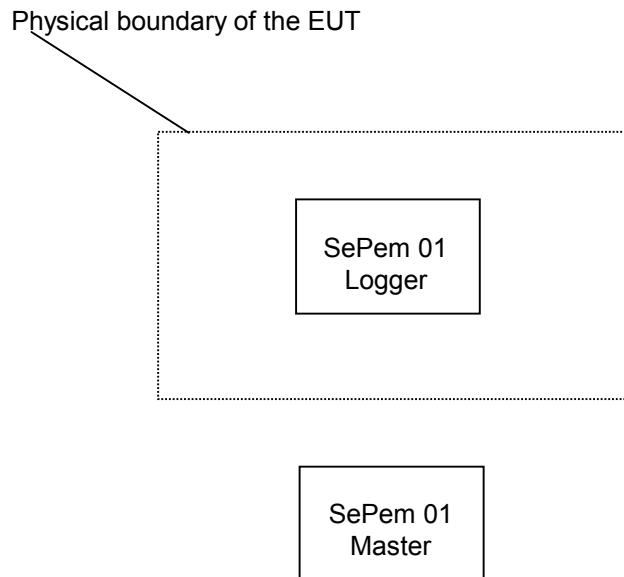
The following operation modes were used during the tests:

Operation mode	Description of the operation mode
1	Continuous transmitting on 461.0375 MHz with and without modulation *
2	Continuous transmitting on 462.8625 MHz with and without modulation *
3	Continuous transmitting on 464.5625 MHz with and without modulation *
4	Continuous receiving on 466.0375 MHz
5	Continuous receiving on 467.8625 MHz
6	Continuous receiving on 469.5625 MHz

\*: The following options were selectable:

- Unmodulated carrier
- Modulated signal with continuous 01 bit sequence
- Modulated signal with data telegrams (burst operation)

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## 4 APPLICATION OVERVIEW

Application	Frequency range [MHz]	FCC 47 CFR section	RSS 119, Issue 9 [4] or RSS-Gen, Issue 2 [5]	Status	Refer page
RF Output Power	General	2.1046 (a)	5.4 [4]	Passed	8 et seq.
Spectrum Mask	General	90.217 (b)	5.10 [4]	Passed	10 et seq.
Radiated emissions (transmitter)	0.009 - 5,000	2.1053	5.8.3 [4]	Passed	16 et seq.
Frequency Stability	General	90.213	5.3 [5]	Passed	33 et seq.
Radiated emissions (receiver)	0.009 - 2,500	15.109 (a)	5.11 [4], 6 [4]	Passed	1 et seq. of F082373E01 Annex D
99 % Bandwidth	General	-	4.6.1 [5]	-	5 et seq. of F082373E01 Annex D

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## 5 TEST RESULTS

### 5.1 OUTPUT POWER

#### 5.1.1 METHOD OF MEASUREMENT (OUTPUT POWER)

The calibration of the power meter has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the power meter via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on.

The following power meter settings shall be used:

- Filter No. auto.
- Measuring time 0.136 s to 26 s.
- Used peak sensor NRV -Z51.

The measurement will be performed at the upper and lower end and the middle of the assigned frequency band.

Test set-up:



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### 5.1.2 TEST RESULTS (OUTPUT POWER)

Ambient temperature	20 °C	Relative humidity	53 %
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TEST CONDITION	MEASURED OUTPUT POWER (dBm)		
$T_{\text{nom}}$ (20 °C)	461.0375 MHz	462.8625 MHz	464.5625 MHz
$U_{\text{nom}}$ (3.6 V DC)	10.0	10.1	10.2
$U_{\text{min}}$ (3.1 V DC)	9.4	9.5	9.6
$U_{\text{max}}$ (3.7 V DC)	10.2	10.2	10.3
Measurement uncertainty	$\pm 0.2$ dB		

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

54, 65, 66

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## 5.2 SPECTRUM MASK

### 5.2.1 METHOD OF MEASUREMENT (SPECTRUM MASK)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed.

The following spectrum analyser settings shall be used:

- Span: 100 kHz, centred on the actual channel.
- Resolution bandwidth: 100 Hz.
- Video bandwidth: 100 kHz.
- Sweep: 50 s.
- Detector function: peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set to the peak of the unmodulated carrier. This value has to set to the Reference Level. The measurement has to be repeated with all kinds of modulation to find the worst case.

Test set-up:



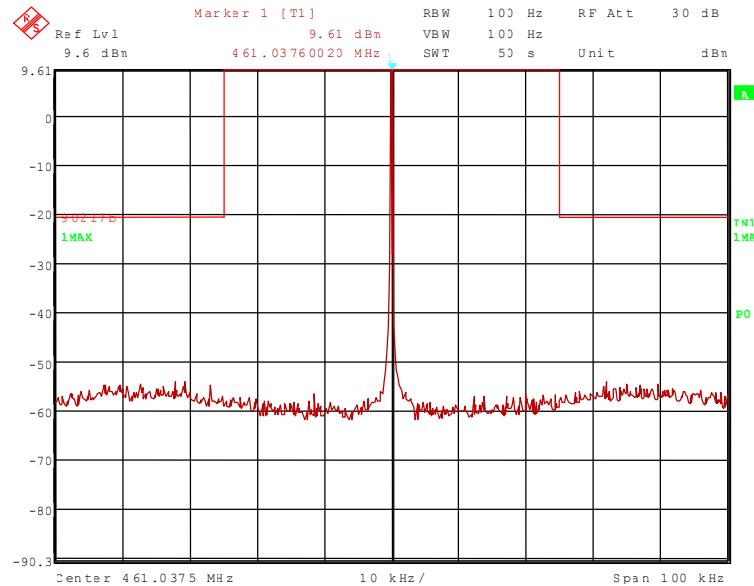
TEST REPORT REFERENCE: F082373E01

### 5.2.2 TEST RESULTS (SPECTRUM MASK)

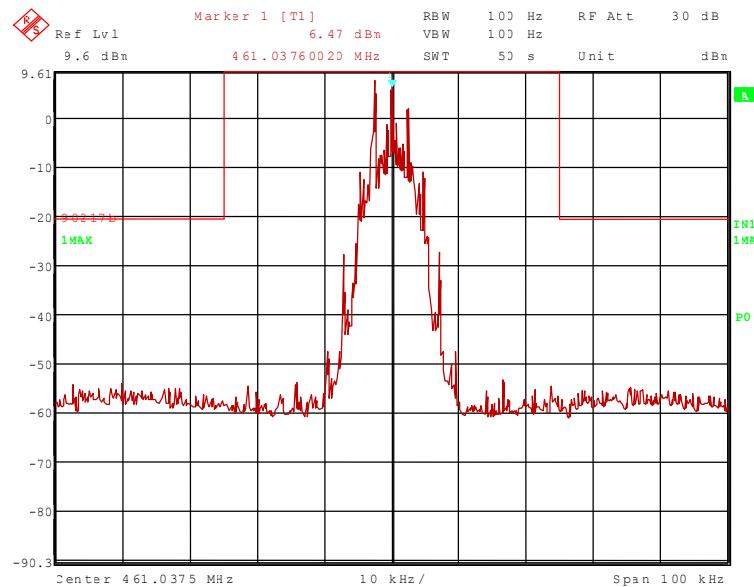
Ambient temperature	20 °C	Relative humidity	53 %
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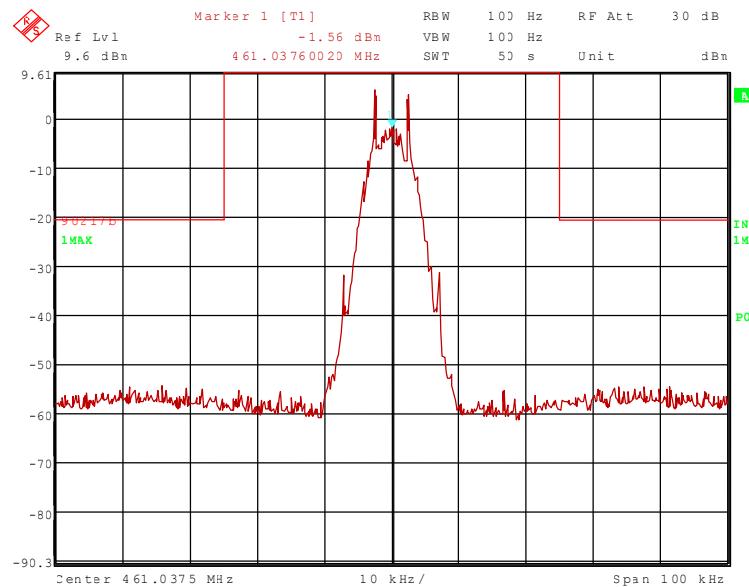
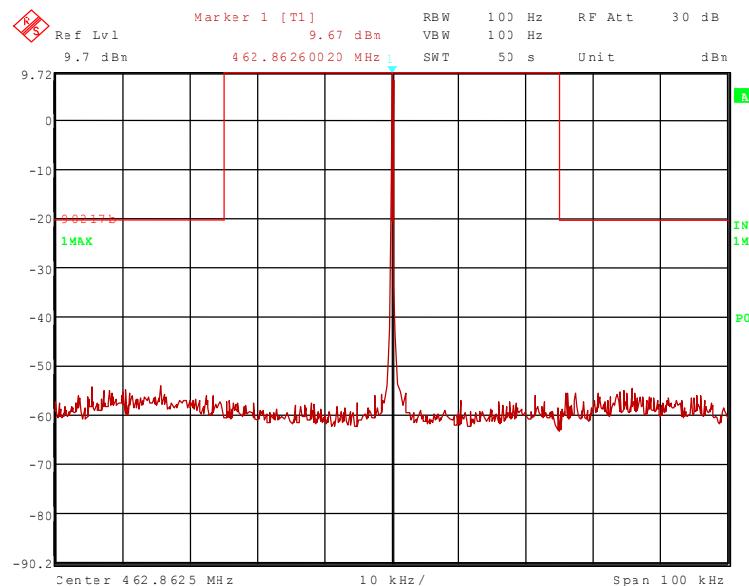
Transmitter operates on 461.0375 MHz:

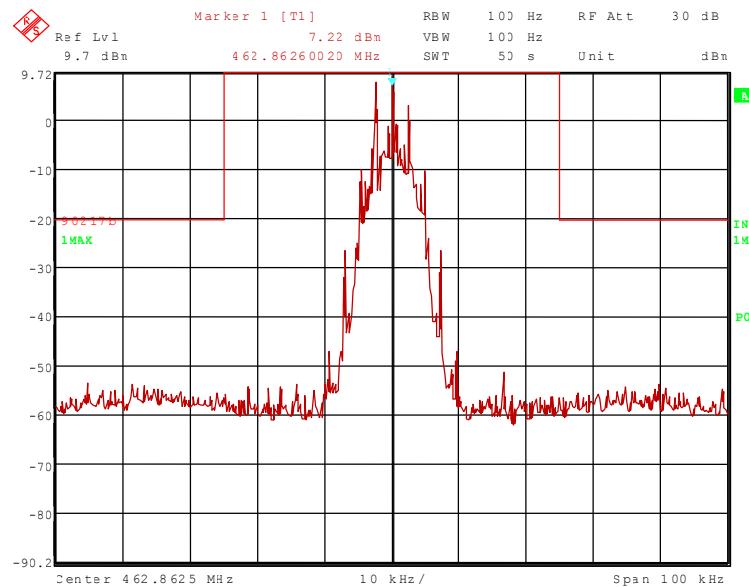
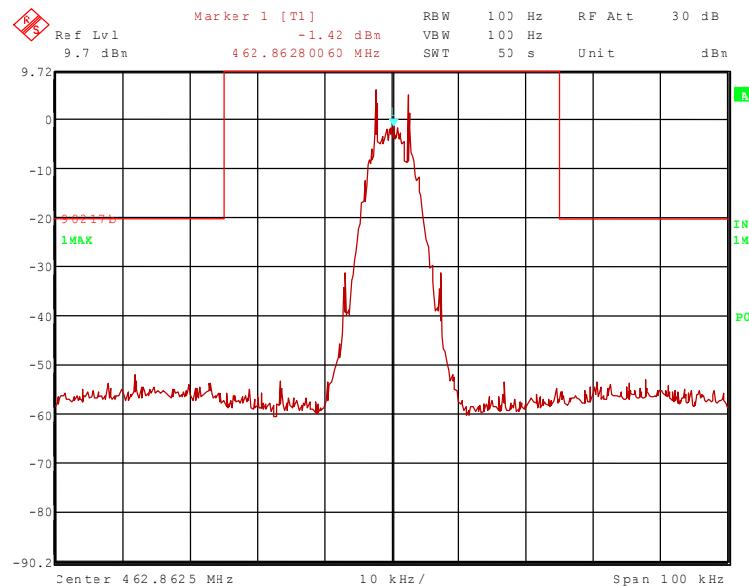
82373\_23.wmf: Spectrum mask, transmitter operates without modulation on 461.0375 MHz:



82373\_24.wmf: Spectrum mask, transmitter operates continuous modulation on 461.0375 MHz:



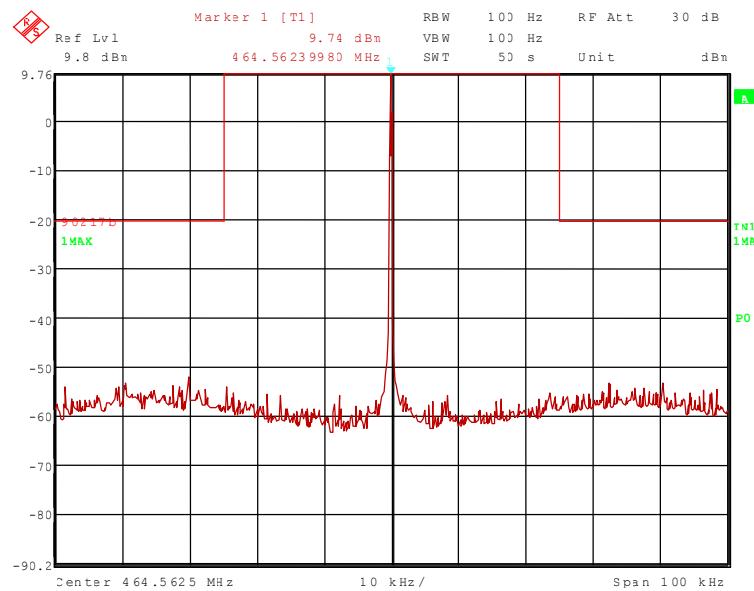
**TEST REPORT REFERENCE: F082373E01**
82373\_25.wmf: Spectrum mask, transmitter operates with burst modulation on 461.0375 MHz:

Transmitter operates on 462.8625 MHz:
82373\_20.wmf: Spectrum mask, transmitter operates without modulation on 462.8625 MHz:


**TEST REPORT REFERENCE: F082373E01**
82373\_21.wmf: Spectrum mask, transmitter operates continuous modulation on 462.8625 MHz:

82373\_22.wmf: Spectrum mask, transmitter operates with burst modulation on 462.8625 MHz:


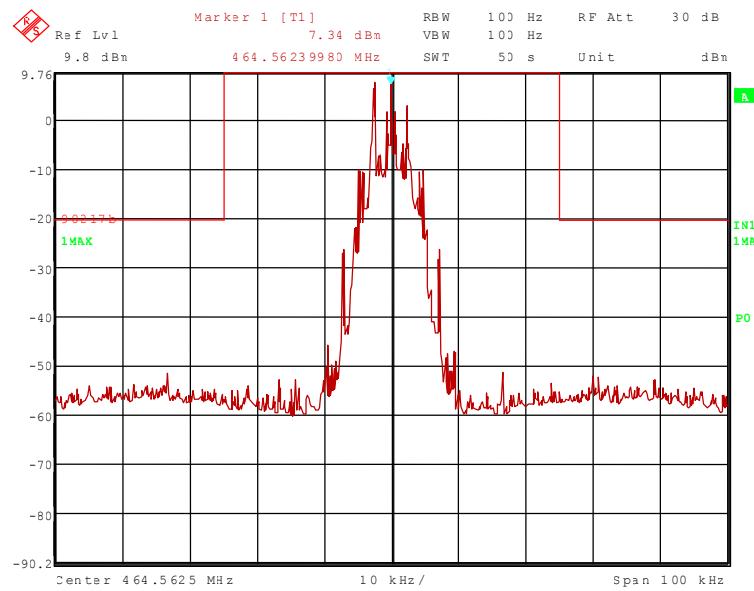
**TEST REPORT REFERENCE: F082373E01**

Transmitter operates on 464.5625 MHz:

82373\_26.wmf: Spectrum mask, transmitter operates without modulation on 464.5625 MHz:

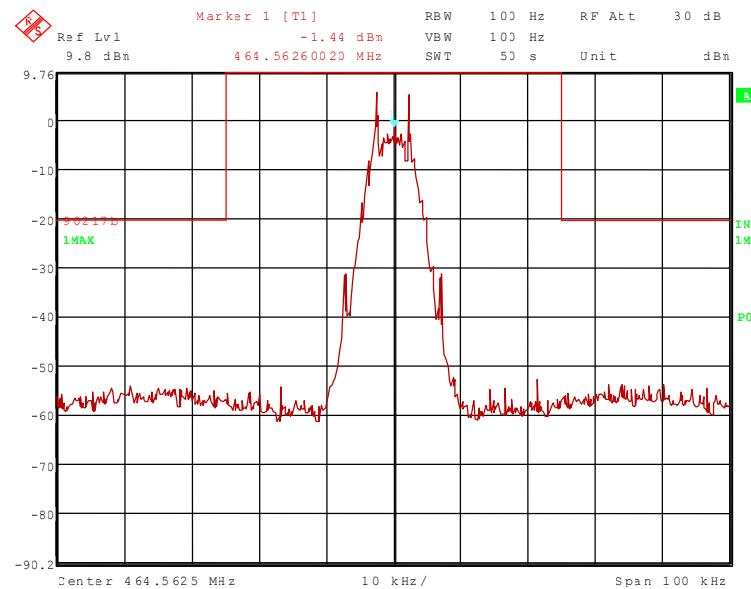


82373\_27.wmf: Spectrum mask, transmitter operates continuous modulation on 464.5625 MHz:



TEST REPORT REFERENCE: F082373E01

82373\_28.wmf: Spectrum mask, transmitter operates with burst modulation on 464.5625 MHz:



Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

31

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## 5.3 RADIATED EMISSIONS

### 5.3.1 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 height 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 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 25 GHz.

All measurements will be carried out with the EUT working on the middle and upper and lower edge of the assigned frequency band. For this reason the hopping function of the EUT has to be disabled.

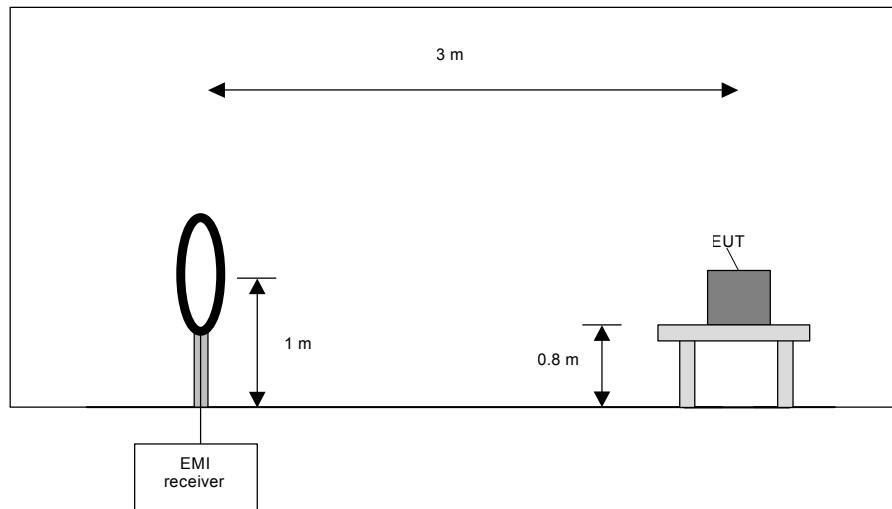
#### Preliminary measurement (9 kHz to 30 MHz):

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 C63.4-2003 [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



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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).

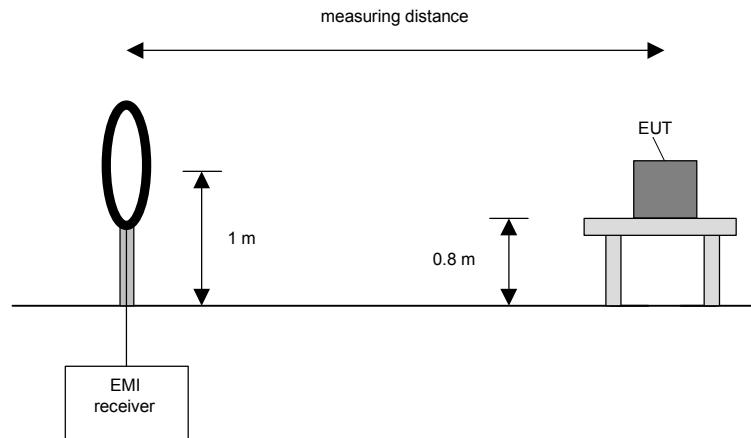
Final measurement (9 kHz to 30 MHz):

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane in a measuring distances of 3 m, 10 m and 30 m. In the case where larger measuring distances are 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



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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).

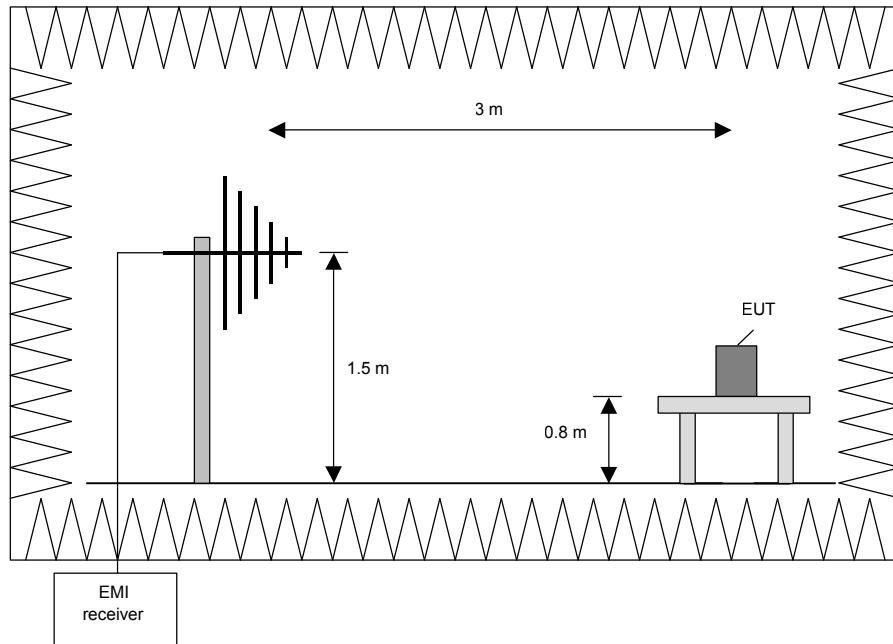
**Preliminary measurement (30 MHz to 1 GHz)**

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 C63.4-2003 [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



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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:

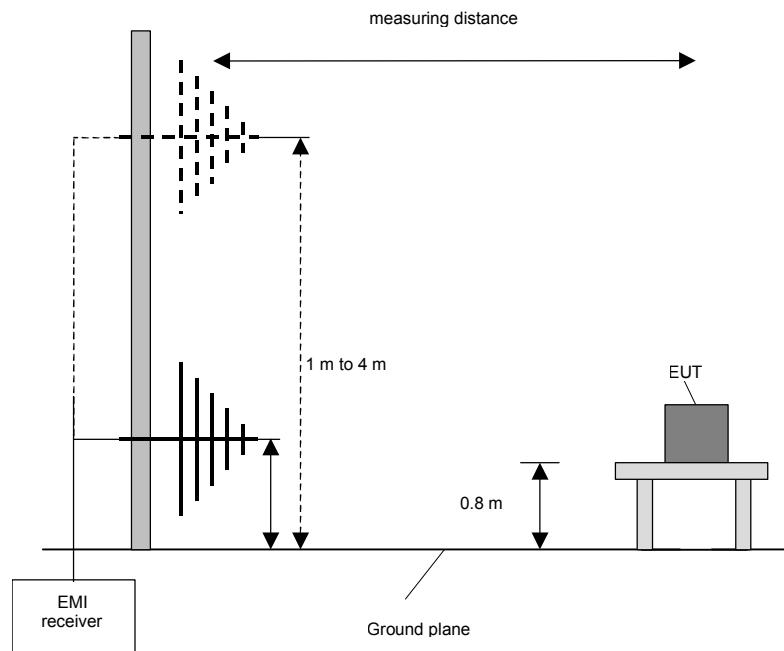
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the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



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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 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).
- 13) Replace the EUT by a suitable substitution antenna and connect this antenna to a signal generator.
- 14) Set the turntable to the azimuth and the antenna to the position where the maximum value is found
- 15) Variate the output power for each frequency, until the level of the EUTs emission is found.
- 16) Note the output power of the signal generator.

Preliminary and final measurement (1 GHz to 25 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 C63.4-2003 [1].

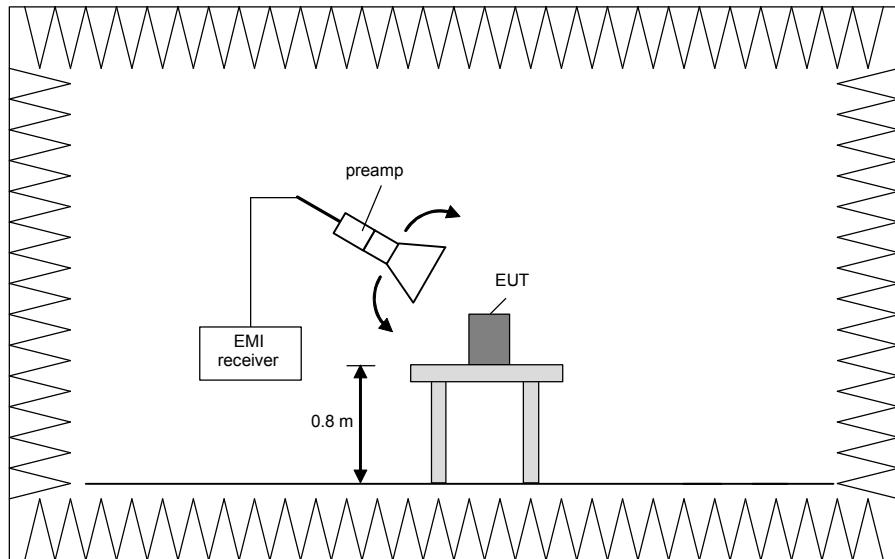
Preliminary measurement (1 GHz to 25 GHz)

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 GHz	100 kHz

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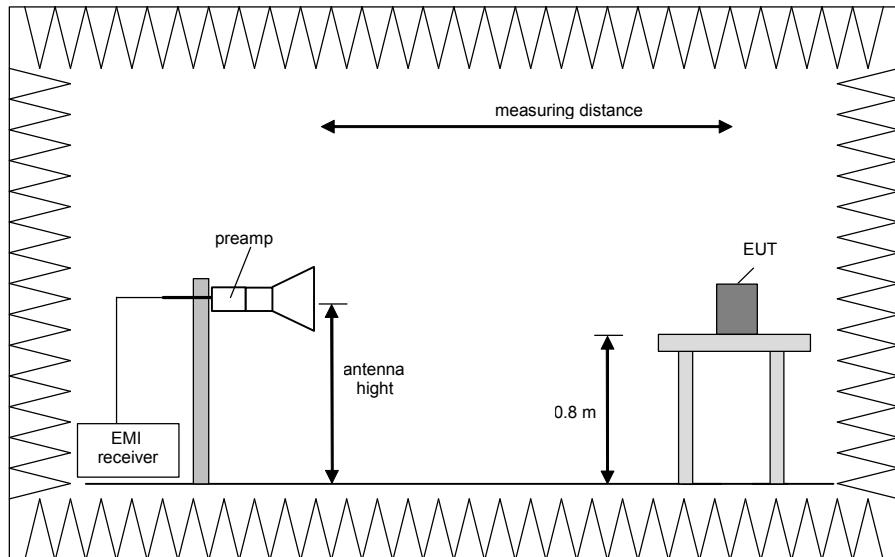


### Final measurement (1 GHz to 25 GHz)

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 GHz	1 MHz



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Procedure of measurement:

The measurements were performed in the frequency range 1 GHz to 4 GHz, 4 GHz to 12 GHz, 12 GHz to 18 GHz and 18 GHz to 25 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.
- 9) Replace the EUT by a suitable substitution antenna and connect this antenna to a signal generator.
- 10) Set the turntable to the azimuth to the position where the maximum value is found
- 11) Variate the output power for each frequency, until the level of the EUTs emission is found.
- 12) Note the output power of the signal generator.

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

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### 5.3.2 TEST RESULTS (RADIATED EMISSIONS)

#### 5.3.2.1 PRELIMINARY MEASUREMENT (9 kHz to 5 GHz)

Ambient temperature	20 °C	Relative humidity	46 %
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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. For further information of the set up refer to the pictures in annex A of this test report.

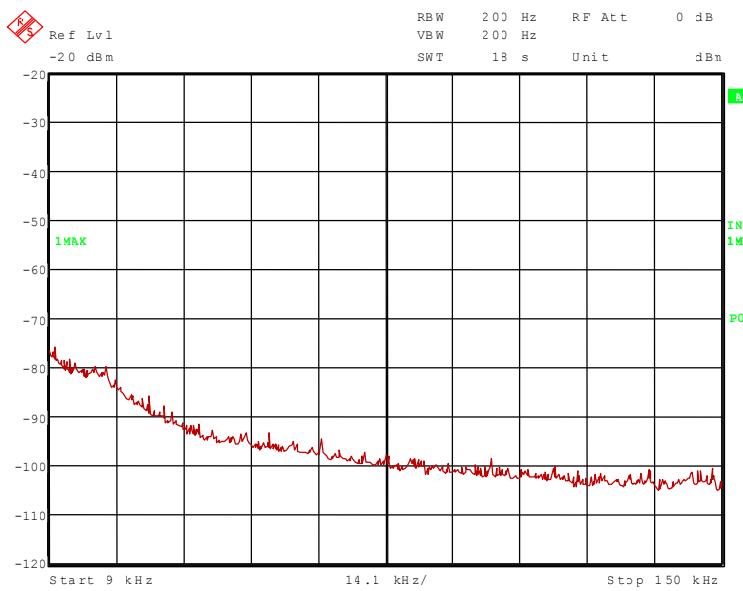
Cable guide: No cables were connectable to the EUT.

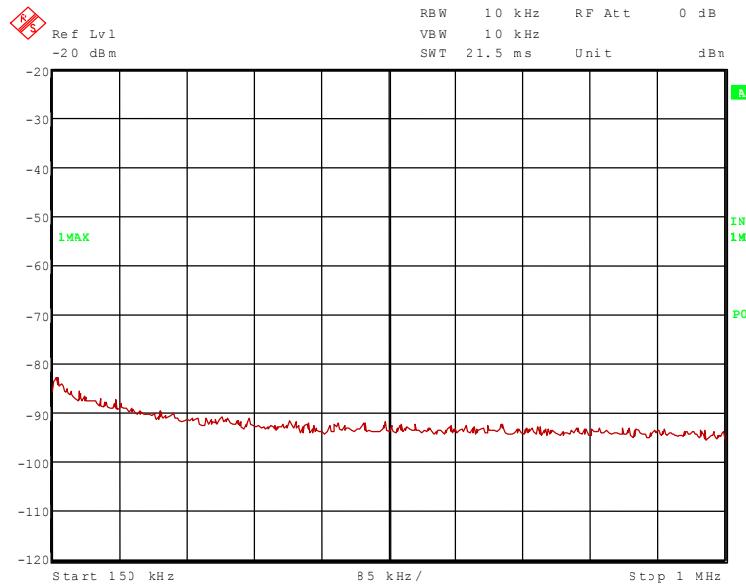
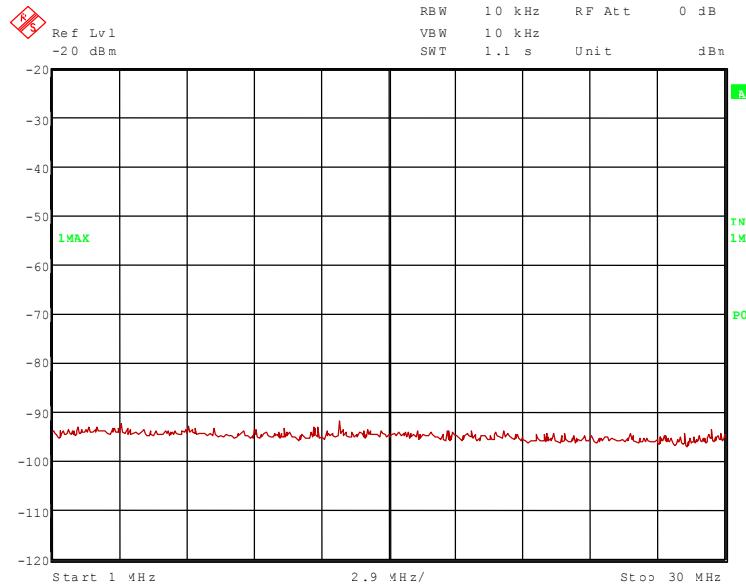
Test record: Where not otherwise stated the test was carried out in test mode 2 of the EUT, because there was no difference to the other test modes. All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 3.6 V DC via the internal battery.

Remark: As pre-tests have shown, the emissions in the frequency range 9 kHz to 30 MHz are not depending on selected channel.

#### 82373\_10.wmf: Spurious emissions from 9 kHz to 150 kHz (operation mode 2):



**TEST REPORT REFERENCE: F082373E01**
82373\_11.wmf: Spurious emissions from 150 kHz to 1 MHz (operation mode 2):

82373\_12.wmf: Spurious emissions from 1 MHz to 30 MHz (operation mode 2):


No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the outdoor test site.

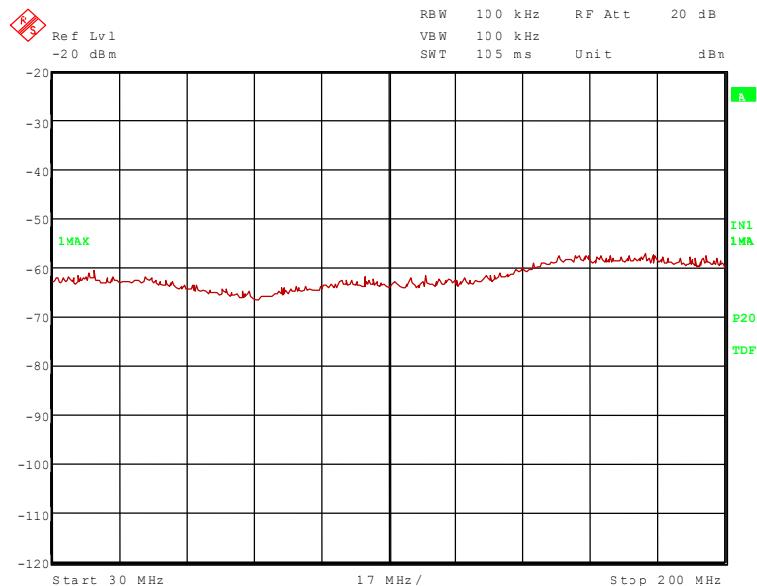
**TEST EQUIPMENT USED FOR THE TEST:**

29, 31 – 36, 43, 44, 49, 58
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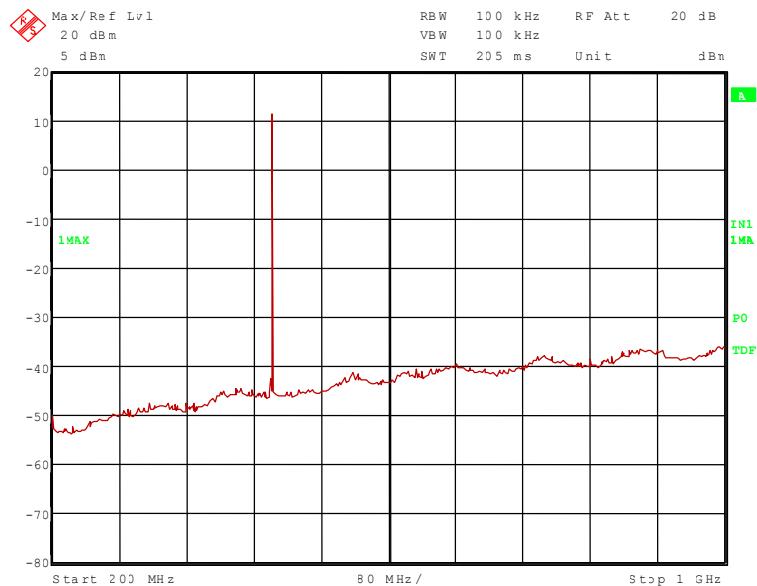
TEST REPORT REFERENCE: F082373E01

**Transmitter operates at the lower end of the assigned frequency band (operation mode 1)**

82373\_6.wmf: Spurious emissions from 30 MHz to 200 MHz (operation mode 1):



82373\_1.wmf: Spurious emissions from 200 MHz to 1 GHz (operation mode 1):



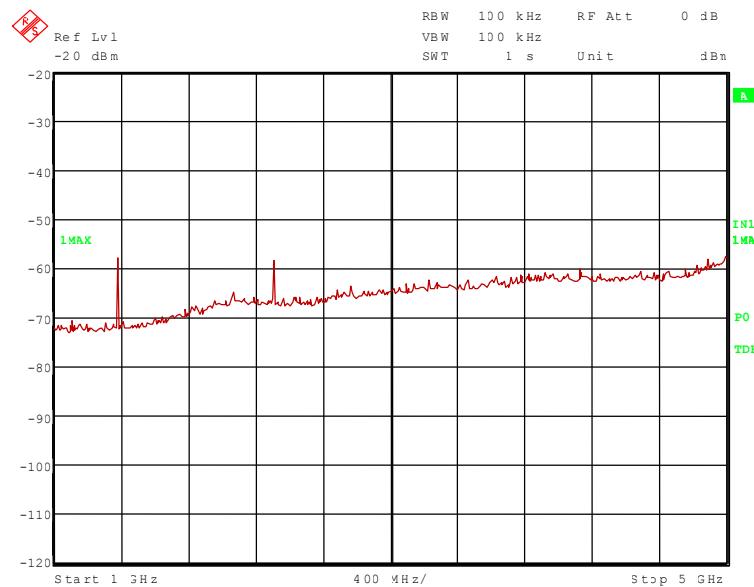
The following frequency was found during the preliminary radiated emission test:

- 461.0375 MHz.

This frequency has to be measured on the open area test site. The results were presented in the following

TEST REPORT REFERENCE: F082373E01

82373\_17.wmf: Spurious emissions from 1 GHz to 5 GHz (operating at 461.0375 MHz):



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

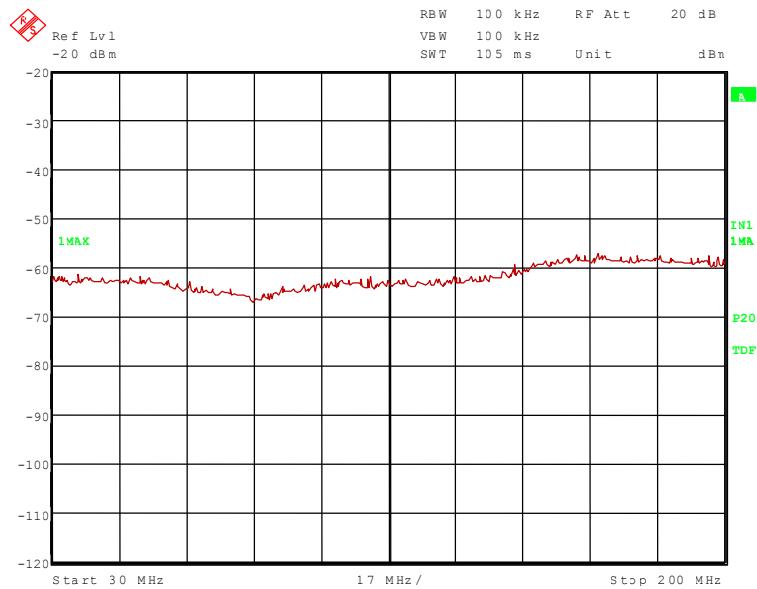
- 1383.1125 MHz and 2305.1875 MHz.

These frequencies have to be measured on in a final measurement.

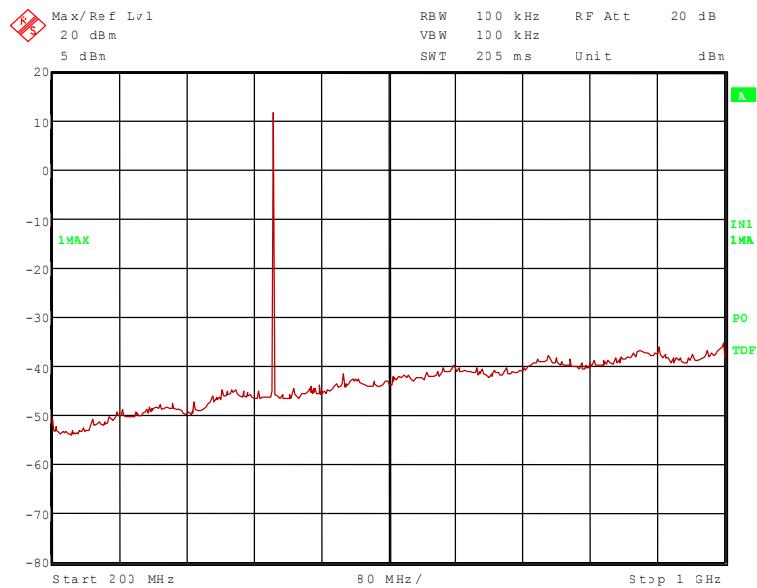
TEST REPORT REFERENCE: F082373E01

**Transmitter operates at the middle of the assigned frequency band (operation mode 2)**

82373\_5.wmf: Spurious emissions from 30 MHz to 200 MHz (operating at 462.8625 MHz):



82373\_2.wmf: Spurious emissions from 200 MHz to 1 GHz (operating at 462.8625 MHz):



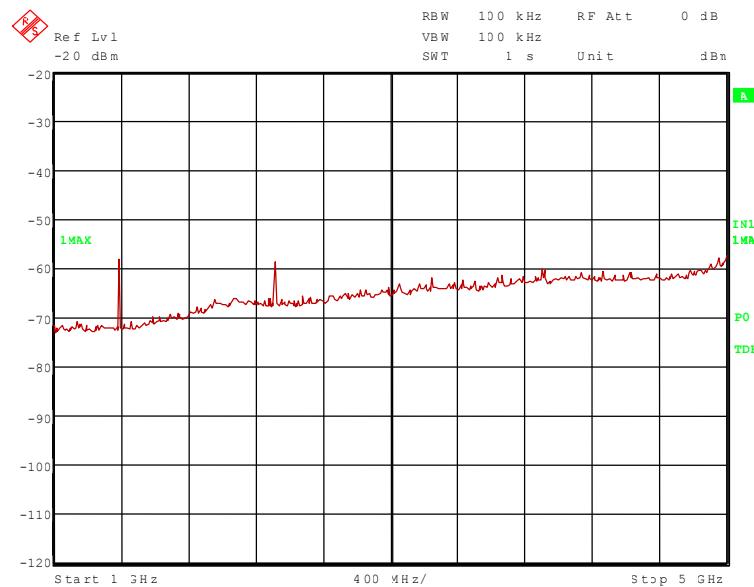
The following frequency was found during the preliminary radiated emission test:

- 462.8625 MHz.

This frequency has to be measured on the open area test site. The results were presented in the following

TEST REPORT REFERENCE: F082373E01

82373\_16.wmf: Spurious emissions from 1 GHz to 5 GHz (operating at 462.8625 MHz):



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

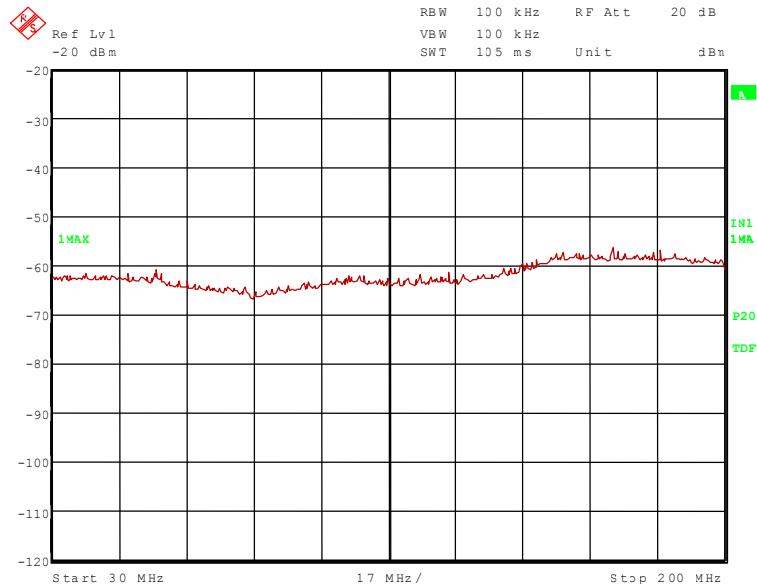
- 1388.5875 MHz and 2314.3125 MHz.

These frequencies have to be measured on in a final measurement.

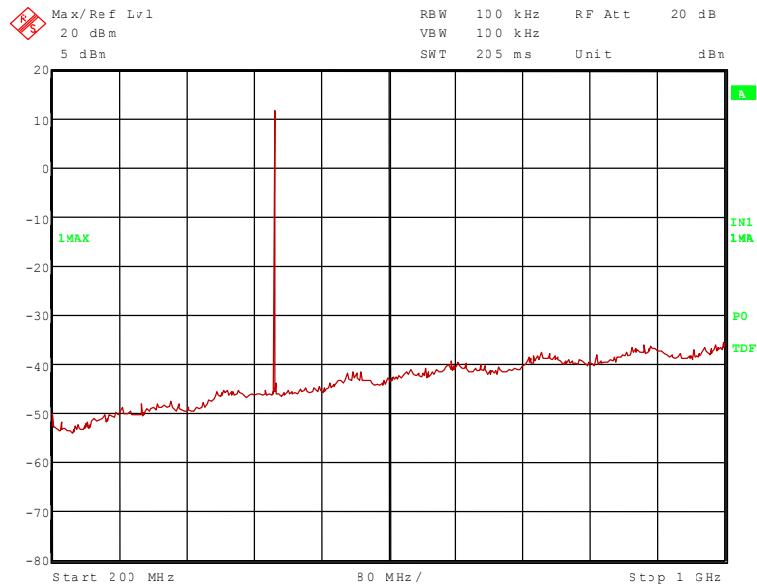
TEST REPORT REFERENCE: F082373E01

**Transmitter operates at the upper end of the assigned frequency band (operation mode 3)**

82373\_4.wmf: Spurious emissions from 30 MHz to 200 MHz (operating at 464.5625 MHz):



82373\_3.wmf: Spurious emissions from 200 MHz to 1 GHz (operating at 464.5625 MHz):



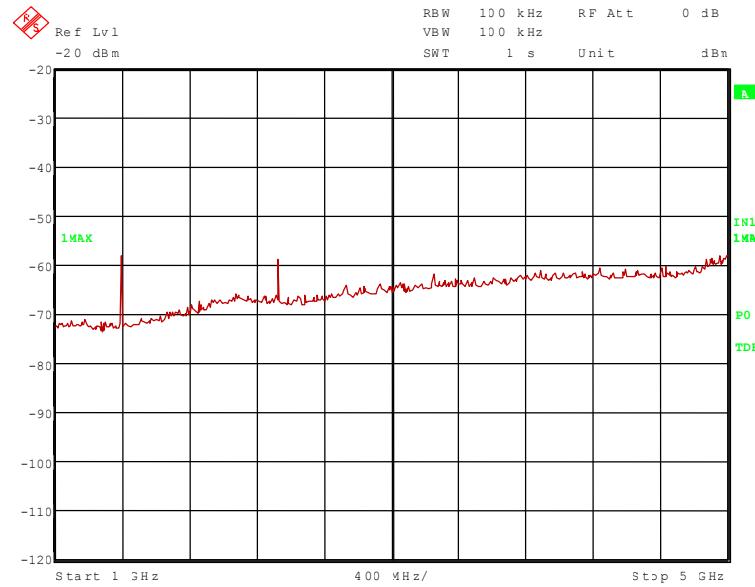
The following frequency was found during the preliminary radiated emission test:

- 464.5625 MHz.

This frequency has to be measured on the open area test site. The results were presented in the following

TEST REPORT REFERENCE: F082373E01

82373\_18.wmf: Spurious emissions from 1 GHz to 5 GHz (operating at 464.5625 MHz):



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

- 1393.6875 MHz and 2322.8125 MHz.

These frequencies have to be measured on in a final measurement

TEST REPORT REFERENCE: F082373E01

### 5.3.2.2 FINAL MEASUREMENT (30 MHz to 1 GHz)

Ambient temperature	19 °C	Relative humidity	56 %
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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. For further information of the set up refer to the pictures in annex A of this test report.

Cable guide: No cables were connectable to the EUT.

Supply voltage: During all measurements the EUT was supplied with 3.6 V DC via the internal battery.

Resolution bandwidth: For all measurements a resolution bandwidth of 120 kHz was used.

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.

#### Result measured with the quasipeak detector:

(These values are marked in the above diagram by x)

Spurious emissions							
Transmitter operation mode	Frequency MHz	Result mW	Limit mW	Margin dB	Height cm	Azimuth deg	Pol.
Operation mode 1	461.0375	70.8	120	2.3	100	246.0	Vertical
Operation mode 2	462.8625	77.6	120	1.9	100	153.0	Vertical
Operation mode 3	464.5625	74.1	120	2.1	100	358.0	Vertical
Measurement uncertainty			+2.2 dB / -3.6 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

14 – 20, 60, 61, 63

TEST REPORT REFERENCE: F082373E01

### 5.3.2.3 FINAL MEASUREMENT (1 GHz to 5 GHz)

Ambient temperature	20 °C	Relative humidity	46 %
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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. For further information of the set up refer to the pictures in annex A of this test report.

Supply voltage: During all measurements the EUT was supplied with 3.6 V DC via the internal battery.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

#### Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

##### Result measured with the average detector:

Frequency MHz	Corr. value dBm	Limit dBm	Margin dB	Preamp	Height cm	Polarisation
1383.1125	-51.3	-11.5	39.8	Yes	150	Vertical
2305.1875	-53.2	-11.5	41.7	Yes	150	Vertical
Measurement uncertainty				+2.2 dB / -3.6 dB		

#### Transmitter operates at the middle of the assigned frequency band (operation mode 2)

##### Result measured with the average detector:

Frequency MHz	Corr. value dBm	Limit dBm	Margin dB	Preamp	Height cm	Polarisation
1388.5875	-51.4	-11.1	40.3	Yes	150	Vertical
2314.3125	-53.3	-11.1	42.4	Yes	150	Vertical
Measurement uncertainty				+2.2 dB / -3.6 dB		

#### Transmitter operates at the upper end of the assigned frequency band (operation mode 3)

##### Result measured with the average detector:

Frequency MHz	Corr. value dBm	Limit dBm	Margin dB	Preamp	Height cm	Polarisation
1393.6875	-51.5	-11.3	40.2	Yes	150	Vertical
2322.8125	-53.2	-11.3	41.9	Yes	150	Vertical
Measurement uncertainty				+2.2 dB / -3.6 dB		

Test: Passed

#### TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 34, 36, 43, 44, 49, 58, 60, 62, 63

TEST REPORT REFERENCE: F082373E01

## 5.4 FREQUENCY STABILITY

### 5.4.1 METHOD OF MEASUREMENT (FREQUENCY STABILITY)

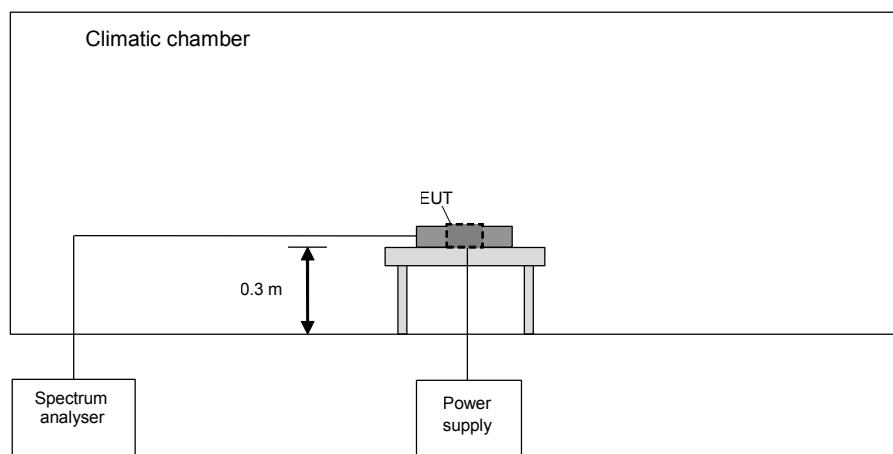
The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a test fixture shall be used.

The following procedure will be used:

- 1) Place the EUT in the climatic chamber.
- 2) Switch on the EUT and check the correct function and the settings of the spectrum analyser.
- 3) Switch off the EUT and tune the climatic chamber to a temperature of 50 °C. Wait until the thermal balance is obtained.
- 4) Switch the EUT on and record the frequencies at start-up and 2, 5 and 10 minutes after powering on.
- 5) Repeat 4) with the minimum and the maximum of the supply voltage.
- 6) Switch off the EUT and tune the climatic chamber to a temperature range of 50 °C to –20 °C to in ten-degree steps. Wait until the thermal balance is obtained for every step.
- 7) Switch the EUT on and record the frequencies at start-up and 2, 5 and 10 minutes after powering on.
- 8) Repeat 7) with the minimum and the maximum of the supply voltage at 20 °C.
- 9) Repeat 6) with the next temperature step until –20 °C were reached.

The measurement will be performed at the upper and lower end and the middle of the assigned frequency band.

Test set-up:



TEST REPORT REFERENCE: F082373E01

### 5.4.2 TEST RESULTS (FREQUENCY STABILITY)

Ambient temperature	20 °C	Relative humidity	53 %
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Test set-up: For this test the EUT was fixed on a wooden table inside the climatic chamber.

Cable guide: For further information of the cable guide refer to the pictures in annex A of this test report.

Remark: The table below shows the worst case frequency error with regard to the power-on time.

#### Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

Temperature	Supply voltage	Minutes after switch on	Frequency [MHz]	Allowed tolerance	Measured tolerance	Result
70 °C	3.6 V DC	10	461.037689	±1.153 kHz	+189 Hz	Passed
60 °C	3.6 V DC	10	461.037488	±1.153 kHz	-12 Hz	Passed
50 °C	3.6 V DC	10	461.037311	±1.153 kHz	-189 Hz	Passed
40 °C	3.6 V DC	10	461.037254	±1.153 kHz	-246 Hz	Passed
30 °C	3.6 V DC	10	461.037334	±1.153 kHz	-166 Hz	Passed
20 °C	3.1 V DC (U <sub>min</sub> )	10	461.037521	±1.153 kHz	+21 Hz	Passed
	3.6 V DC (U <sub>nom</sub> )		461.037521	±1.153 kHz	+21 Hz	Passed
	3.7 V DC (U <sub>max</sub> )		461.037521	±1.153 kHz	+21 Hz	Passed
10 °C	3.6 V DC	10	461.037716	±1.153 kHz	+216 Hz	Passed
0 °C	3.6 V DC	10	461.037698	±1.153 kHz	-198 Hz	Passed
-10 °C	3.6 V DC	10	461.037534	±1.153 kHz	+34 Hz	Passed
-20 °C	3.6 V DC	10	461.037471	±1.153 kHz	-29 Hz	Passed
Measurement uncertainty				< ± 1*10 <sup>-7</sup>		

#### Transmitter operates at the middle of the assigned frequency band (operation mode 2)

Temperature	Supply voltage	Minutes after switch on	Frequency [MHz]	Allowed tolerance	Measured tolerance	Result
70 °C	3.6 V DC	10	462.862875	±1.157 kHz	+375 Hz	Passed
60 °C	3.6 V DC	10	462.862624	±1.157 kHz	+124 Hz	Passed
50 °C	3.6 V DC	10	462.862452	±1.157 kHz	-48 Hz	Passed
40 °C	3.6 V DC	10	462.862391	±1.157 kHz	-109 Hz	Passed
30 °C	3.6 V DC	10	462.862471	±1.157 kHz	-29 Hz	Passed
20 °C	3.1 V DC (U <sub>min</sub> )	10	462.862648	±1.157 kHz	+148 Hz	Passed
	3.6 V DC (U <sub>nom</sub> )		462.862654	±1.157 kHz	+154 Hz	Passed
	3.7 V DC (U <sub>max</sub> )		462.862654	±1.157 kHz	+154 Hz	Passed
10 °C	3.6 V DC	10	462.862858	±1.157 kHz	+358 Hz	Passed
0 °C	3.6 V DC	10	462.862840	±1.157 kHz	+340 Hz	Passed
-10 °C	3.6 V DC	10	462.862678	±1.157 kHz	+378 Hz	Passed
-20 °C	3.6 V DC	10	462.862608	±1.157 kHz	+108 Hz	Passed
Measurement uncertainty				< ± 1*10 <sup>-7</sup>		

TEST REPORT REFERENCE: F082373E01

**Transmitter operates at the upper end of the assigned frequency band (operation mode 3)**

Temperature	Supply voltage	Minutes after switch on	Frequency [MHz]	Allowed tolerance	Measured tolerance	Result
70 °C	3.6 V DC	10	464.562533	±1.161 kHz	+33 Hz	Passed
60 °C	3.6 V DC	10	464.562390	±1.161 kHz	-110 Hz	Passed
50 °C	3.6 V DC	10	464.562227	±1.161 kHz	-273 Hz	Passed
40 °C	3.6 V DC	10	464.562158	±1.161 kHz	-342 Hz	Passed
30 °C	3.6 V DC	10	464.562238	±1.161 kHz	-262 Hz	Passed
20 °C	3.1 V DC ( $U_{\min}$ )	10	464.562423	±1.161 kHz	-77 Hz	Passed
	3.6 V DC ( $U_{\text{nom}}$ )		464.562423	±1.161 kHz	-77 Hz	Passed
	3.7 V DC ( $U_{\max}$ )		464.562423	±1.161 kHz	-77 Hz	Passed
10 °C	3.6 V DC	10	464.562624	±1.161 kHz	+124 Hz	Passed
0 °C	3.6 V DC	10	464.562608	±1.161 kHz	+108 Hz	Passed
-10 °C	3.6 V DC	10	464.562437	±1.161 kHz	-63 Hz	Passed
-20 °C	3.6 V DC	10	464.562376	±1.161 kHz	-124 Hz	Passed
Measurement uncertainty				< ± 1*10 <sup>-7</sup>		

Test result: Passed

TEST EQUIPMENT USED FOR THE TEST:

31, 54, 64

TEST REPORT REFERENCE: F082373E01

## 6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	Measuring receiver	ESCS30	Rohde & Schwarz	828985/014	480270	02/27/2008	02/2010
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.)	
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	02/25/2008	02/2010
32	Controller	HD100	Deisel	100/670	480326	-	
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	
34	Antenna support	AS615P	Deisel	615/310	480187	-	
35	Antenna	CBL6112 B	Chase	2688	480328	10/11/2005	10/2010
36	Antenna	3115 B	EMCO	9609-4918	480184	09/11/2008	09/2013
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.)	
49	Preamplifier	JS3-00101200-23-5A	Miteq	681851	480337	Six month verification (system cal.)	
54	Power supply	TOE 8852	Toellner	51712	480233	11/27/2006	11/2008
58	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	02/19/2008	02/2013
60	Signal generator	83650L	Agilent	3844A00554	480333	02/26/2008	02/2010
61	Precision Dipole	HZ 13	Rohde & Schwarz	831782/02	480062	Six month verification (system cal.)	
62	Horn Antenna	3115 A	EMCO	9609-4922	480183	Six month verification (system cal.)	
63	RF-cable No. 1	RTK 081	Rosenberger	-	410093	Weekly verification (system cal.)	
64	Climatic chamber	MK 240	BINDER	05-79022	480462	01/22/2008	07/2009
65	Power Meter	NRVD	Rohde & Schwarz	828110/026	480267	02/26/2008	02/2010
66	Thermal Power Sensor	NRV-Z51	Rohde & Schwarz	825489/004	480247	02/22/2008	02/2010

TEST REPORT REFERENCE: F082373E01

## 7 LIST OF ANNEXES

<b>ANNEX A</b>	<b>PHOTOGRAPHS OF THE TEST SET-UPS:</b>	<b>4 pages</b>
	SePem 01 Logger, test setup fully anechoic chamber	82373_1.jpg
	SePem 01 Logger, test setup fully anechoic chamber	82373_2.jpg
	SePem 01 Logger, test setup open area test site	82373_4.jpg
	SePem 01 Logger, test setup climatic chamber	82373_3.jpg
<b>ANNEX B</b>	<b>EXTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:</b>	<b>3 pages</b>
	SePem 01 Logger, 3-D-view 1	82373_b.jpg
	SePem 01 Logger, 3-D view 2	82373_c.jpg
	SePem 01 Logger, detail view to antenna connector	82373_d.jpg
<b>ANNEX C</b>	<b>INTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:</b>	<b>4 pages</b>
	SePem 01 Logger, internal view	82373_e.jpg
	SePem 01 Logger, PCB, top view	82373_f.jpg
	SePem 01 Logger, PCB, top view, battery removed	82373_a.jpg
	SePem 01 Logger, PCB, bottom view	82373_g.jpg
<b>ANNEX D</b>	<b>ADDITIONAL RESULTS FOR INDUSTRY CANADA:</b>	<b>4 pages</b>