

TEST REPORT

Test Report Reference: F091199E1

Equipment under Test / model name: MF1-USA / 7060

FCC ID: W8J7060

IC: 8529A-7060

Serial Number: None

Applicant: STEINEL GmbH

Manufacturer: STEINEL 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,
Industry Canada Test site registration IC3469A-1
and
FCC Test site registration number 90877**

TEST REPORT REFERENCE: F091199E1

Contents:	Page
1 IDENTIFICATION	3
1.1 APPLICANT	3
1.2 MANUFACTURER	3
1.3 DATES	3
1.4 TEST LABORATORY	4
1.5 RESERVATION	4
1.6 NORMATIVE REFERENCES	4
1.7 TEST RESULTS	4
2 TECHNICAL DATA OF EQUIPMENT	5
2.1 PERIPHERY DEVICES	5
3 OPERATIONAL STATES AND PHYSICAL BOUNDARIES	6
4 LIST OF MEASUREMENTS	7
5 TEST RESULTS	8
5.1 OCCUPIED BANDWIDTH	8
5.1.1 METHOD OF MEASUREMENT (OCCUPIED BANDWIDTH)	8
5.1.2 TEST RESULTS (OCCUPIED BANDWIDTH)	9
5.2 RADIATED EMISSIONS	10
5.2.1 METHOD OF MEASUREMENT (RADIATED EMISSIONS)	10
5.2.2 TEST RESULTS (RADIATED EMISSIONS)	17
5.2.2.1 PRELIMINARY MEASUREMENT (1 MHz to 10 GHz)	17
5.2.2.2 FINAL MEASUREMENT (30 MHz to 1 GHz)	20
5.2.2.3 FINAL MEASUREMENT (1 GHz to 10 GHz)	22
5.3 BAND-EDGE COMPLIANCE	23
5.3.1 METHOD OF MEASUREMENT (BAND-EDGE COMPLIANCE)	23
5.3.2 TEST RESULT (BAND-EDGE COMPLIANCE)	24
5.4 CONDUCTED EMISSIONS ON POWER SUPPLY LINES (150 kHz to 30 MHz)	25
5.4.1 METHOD OF MEASUREMENT	25
5.4.2 TEST RESULTS (CONDUCTED EMISSIONS ON POWER SUPPLY LINES)	26
6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS	28
7 LIST OF ANNEXES	30

TEST REPORT REFERENCE: F091199E1

1 IDENTIFICATION

1.1 APPLICANT

Name:	STEINEL GmbH
Address:	Dieselstraße 80 - 84
	33442 Herzebrock-Clarholz
Country:	Germany
Name for contact purposes:	Mr. Markus WOLFF
Tel:	+ 49 52 45 448 - 220
Fax:	+ 49 52 45 448 - 208
e-mail address:	wolff.markus@steinel.de

1.2 MANUFACTURER

Name:	STEINEL GmbH
Address:	Dieselstraße 80 - 84
	33442 Herzebrock-Clarholz
Country:	Germany
Name for contact purposes:	Mr. Markus WOLFF
Tel:	+ 49 52 45 448 - 220
Fax:	+ 49 52 45 448 - 208
e-mail address:	wolff.markus@steinel.de

1.3 DATES

Date of receipt of test sample:	29 June 2009
Start of test:	13 July 2009
End of test:	28 July 2009

TEST REPORT REFERENCE: F091199E1

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

accredited by DATech in der TGA GmbH in compliance with DIN EN ISO/IEC 17025 under Reg. No. DAT-P-105/99, Industry Canada Test site registration IC3469A-1 and FCC Test site registration number 90877.

Test engineer: Thomas KÜHN
Name


Signature

31 July 2009
Date

Test report checked: Bernd STEINER
Name


Signature

31 July 2009
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 CFR 47 Part 15** Radio Frequency Devices
- [3] **RSS-210 Issue 7 (June 2007)** Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment
- [4] **RSS-Gen Issue 2 (June 2007)** General Requirements and Information for the Certification of Radiocommunication Equipment
- [5] **FCC Public Notice 913591 (March 2007)** Measurement of radiated emissions at the edge of the band of a Part 15 RF device

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.

TEST REPORT REFERENCE: F091199E1

2 TECHNICAL DATA OF EQUIPMENT

Type of equipment: *	Transceiver module for light switching applications					
Type designation / model name: *	MF1-USA / 7060					
Hardware / software version: *	104675100 / 104533900					
FCC ID: *	W8J7060					
IC: *	8529A-7060					
Antenna type: *	Integral					
Power supply: *	U _{nom} =	5.0 V DC	U _{min} =	4.75 V DC	U _{max} =	5.25 V DC
Type of modulation: *	FSK					
Operating frequency range: *	915 MHz (one channel application)					
Lowest internal frequency: *	7.15 MHz					
Number of channels: *	1					
Temperature range: *	0 °C to 50 °C					

*: declared by the applicant

The following external I/O cables were used:

Identification	Connector		Lenght
	EUT	Ancillary	
DC input	Five pole connector	-	1.2 m *
-	-	-	-
-	-	-	-

*: Length during the test

2.1 PERIPHERY DEVICES

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

- For the conducted emission measurement on AC mains a lamp type RS PRO 1000 Slave (7495) was used to supply the EUT with 5.0 V DC.

TEST REPORT REFERENCE: F091199E1

3 OPERATIONAL STATES AND PHYSICAL BOUNDARIES

The EUT is intended to be used in lightning plants in combination with movement detectors. All tests were carried out with a sample with a test-software, which allows to operate the transmitter either continuously or with its normal duty cycle. The test mode could be chosen with the help of the integrated DIP-switches. The receiver tests were carried out with a second unmodified sample.

During all tests the EUT was powered with 5.0 V DC. During the conducted emission measurement on supply lines the EUT was mounted inside a lamp type RS PRO 1000 Slave (7495), which was supplied with 120 V AC / 60 Hz. Because the module is intended to build in fixed applications, all measurements were carried out in normal position of the EUT as declared by the manufacturer.

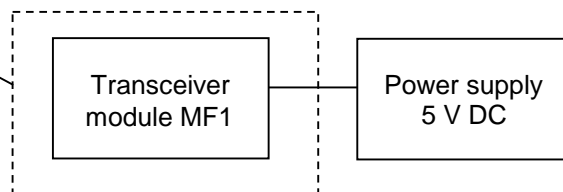
Radiated emission measurements were carried out in the frequency range 1 MHz to 10 GHz.

During the tests, the EUT was not labelled with an FCC/IC-label.

The following operation modes were used during the tests:

Operation mode	Description of the operation mode
1	Continuous transmitting on 915 MHz
2	Continuous transmitting with normal duty cycle on 915 MHz
3	Continuous receiving on 915 MHz

Physical boundary of the EUT



TEST REPORT REFERENCE: F091199E1

4 LIST OF MEASUREMENTS

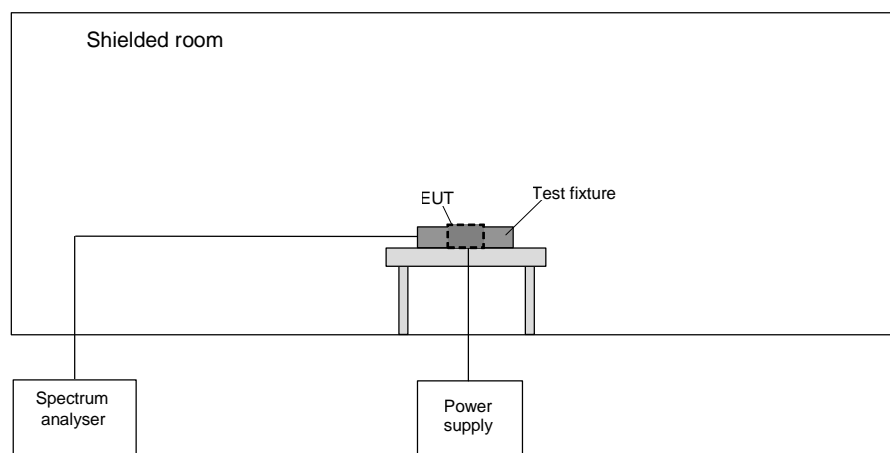
Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS 210, Issue 7 [4] or RSS-Gen, Issue 2 [5]	Status	Refer page
20 dB bandwidth	General	15.215 (a) (1)	-	Passed	8 et seq.
Radiated emissions (transmitter)	1.00 - 10,000	15.249 (d) 15.205 (a) 15.209 (a)	A2.9 (a) [4] A2.9 (b) [4]	Passed	10 et seq.
Band edge compliance	902 – 928	15.249 (d)	A2.9 (a) [4] A2.9 (b) [4]	Passed	23 et seq.
Conducted emissions on supply line	0.15 - 30	15.207 (a)	7.2.2 [5]	Passed	25 et seq.
99 % bandwidth	General	-	7.2.2 [5]	Passed	Annex D
Radiated emissions (receiver)	1.00 - 5,000	15.109 (a)	6 [5] 2.6 [4]	Passed	Annex D

TEST REPORT REFERENCE: F091199E1

5 TEST RESULTS

5.1 OCCUPIED BANDWIDTH

5.1.1 METHOD OF MEASUREMENT (OCCUPIED BANDWIDTH)



The following procedure will be used for the occupied bandwidth measurement:

- 1) Place the EUT in the test fixture and switch it on.
- 2) Use the following spectrum analyser settings: $RWB = VBW = 1\%$ of the selected Span, Span = wide enough to capture app. 1.5 times the 20 dB bandwidth, Trace mode = MaxHold.
- 3) After trace stabilisation, set the first marker and the first display line to the signal peak. Set the second display line 20 dB below the first display line. The second marker and its delta marker shall be set to cross points of the spectrum line and the second display line and note these frequencies.
- 4) Alternatively the 20 dB down function of the analyser could be used, if this function will be applicable to the displayed spectrum.

TEST REPORT REFERENCE: F091199E1

5.1.2 TEST RESULTS (OCCUPIED BANDWIDTH)

Ambient temperature:

21 °C

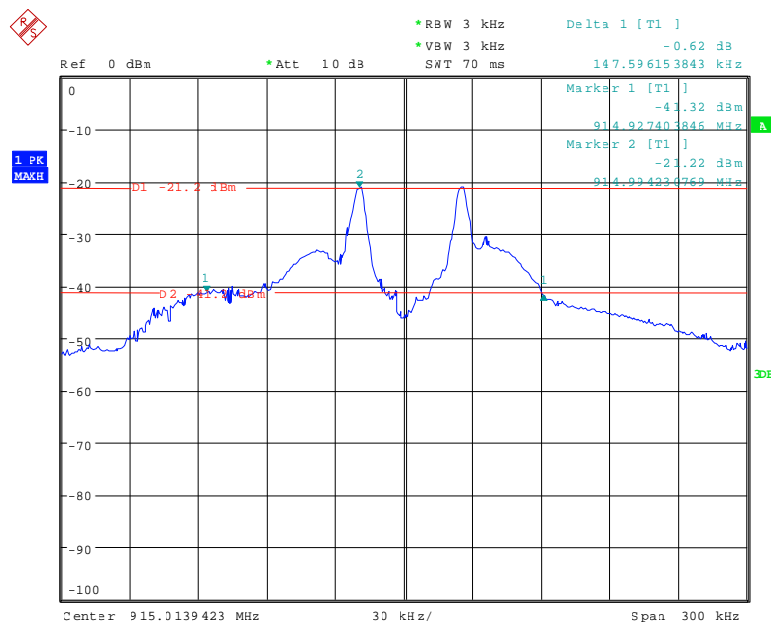
Relative humidity:

55 %

Supply voltage: The EUT was supplied with 5.0 V DC.

Test record: The measurement was carried out in operation mode 1 of the EUT.

91567_31.wmf: Occupied bandwidth at 915 MHz:



F_L	F_U	BW ($F_U - F_L$)
914.927404 MHz	915.07500 MHz	147.596 kHz
Measurement uncertainty		$< \pm 1 \cdot 10^{-7}$

TEST EQUIPMENT USED THE TEST:

75, 78, 108

TEST REPORT REFERENCE: F091199E1

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 site 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 site 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.

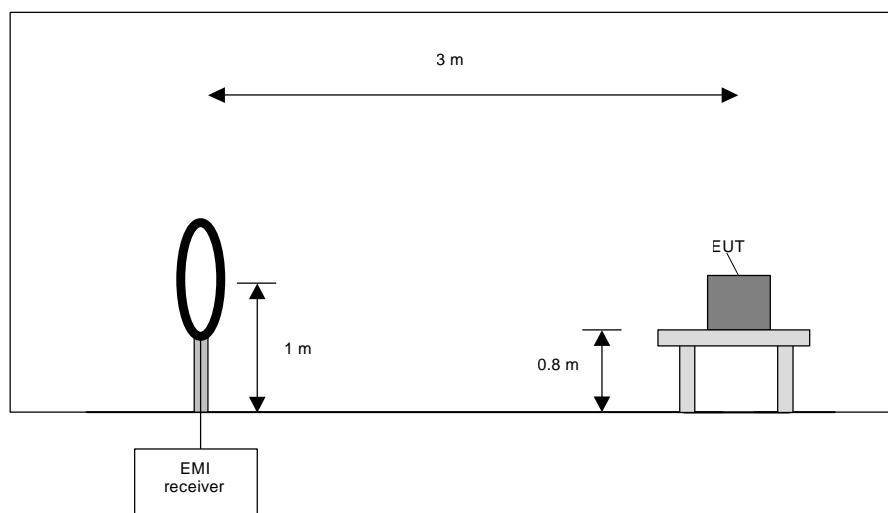
Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. Tabletop devices will be 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 find 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



TEST REPORT REFERENCE: F091199E1

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 (in case of handheld equipment).
- 7) Rotate the measuring antenna and repeat steps 1) to 5).

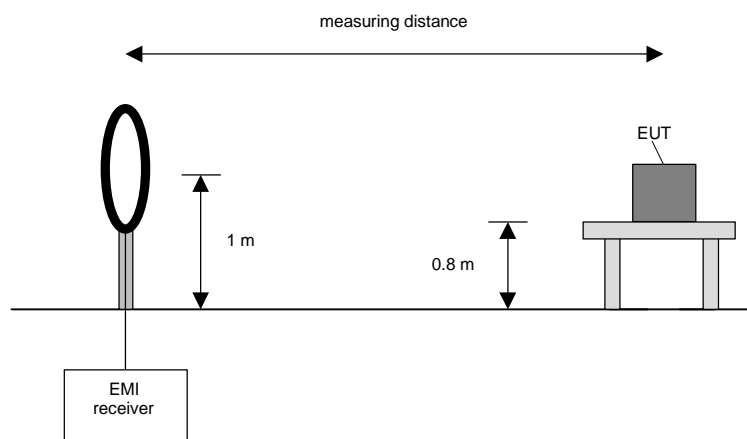
Final measurement (9 kHz to 30 MHz):

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



TEST REPORT REFERENCE: F091199E1

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 (in case of handheld equipment).

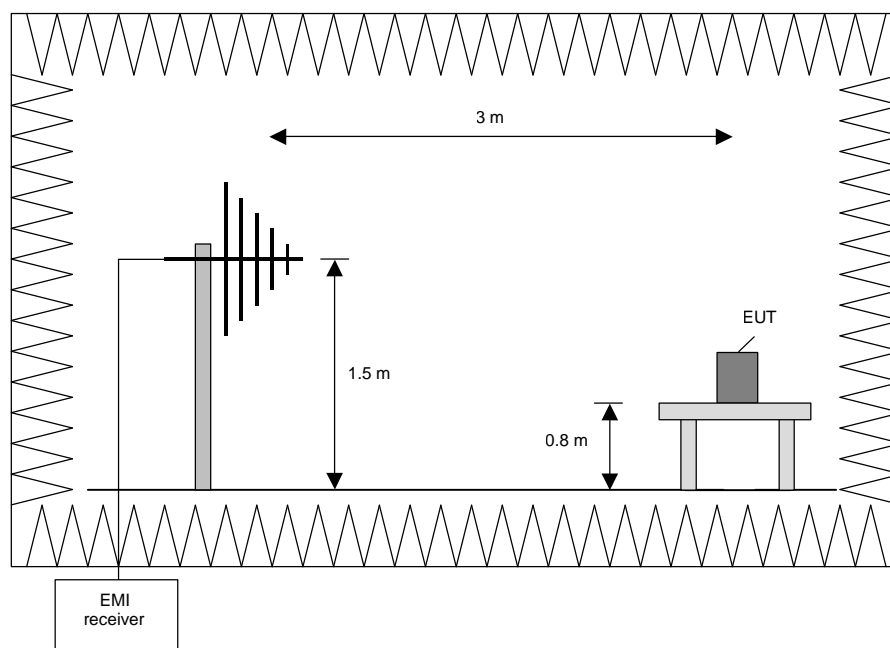
Preliminary measurement (30 MHz to 1 GHz)

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



TEST REPORT REFERENCE: F091199E1

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:

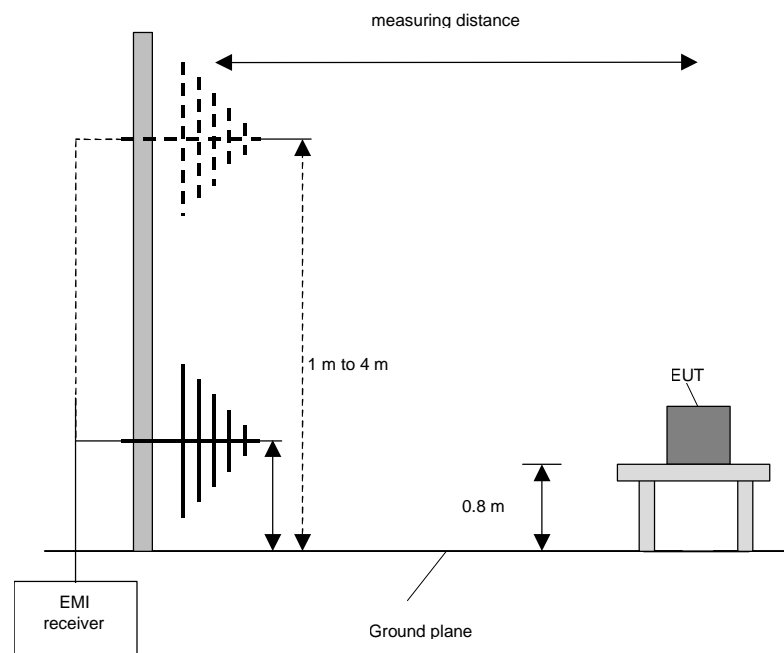
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the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



TEST REPORT REFERENCE: F091199E1

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 (in case of handheld equipment).

Preliminary and final measurement (1 GHz to 110 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].

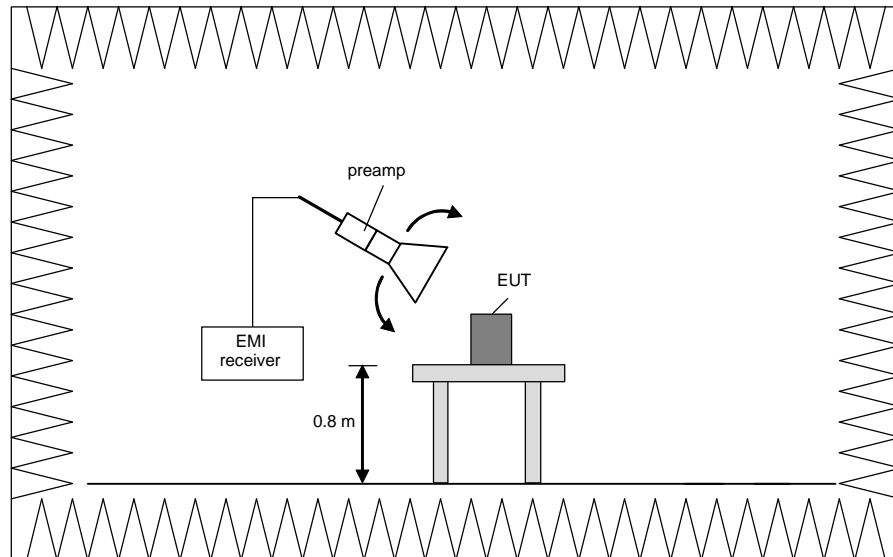
Preliminary measurement (1 GHz to 110 GHz)

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 26.5 GHz	100 kHz
26.5 GHz to 40 GHz	100 kHz
40 GHz to 60 GHz	100 kHz
50 GHz to 75 GHz	100 kHz
75 GHz to 110 GHz	100 kHz

TEST REPORT REFERENCE: F091199E1



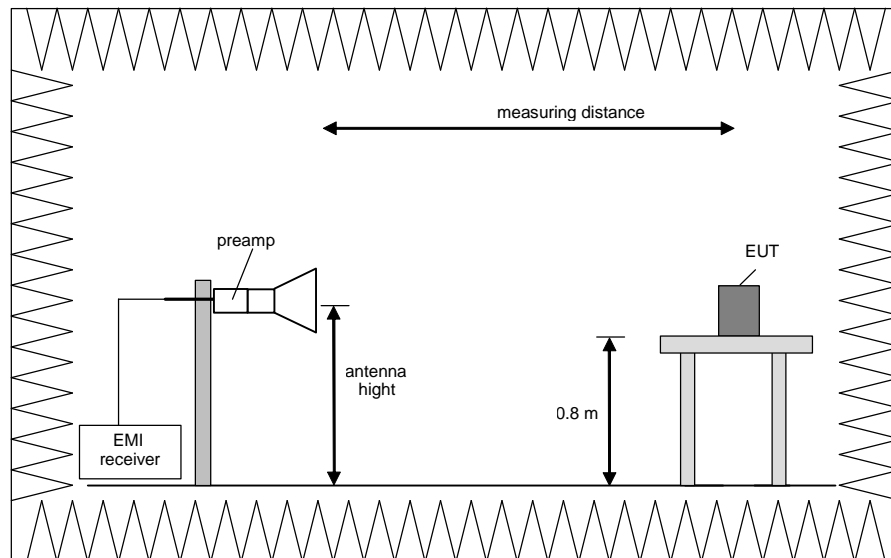
Final measurement (1 GHz to 110 GHz)

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 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz
40 GHz to 60 GHz	1 MHz
50 GHz to 75 GHz	1 MHz
75 GHz to 110 GHz	1 MHz

TEST REPORT REFERENCE: F091199E1



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, 18 GHz to 26.5 GHz, 26.5 GHz to 40 GHz, 40 GHz to 60 GHz, 60 GHz to 75 GHz and 75 GHz to 110 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.

TEST REPORT REFERENCE: F091199E1

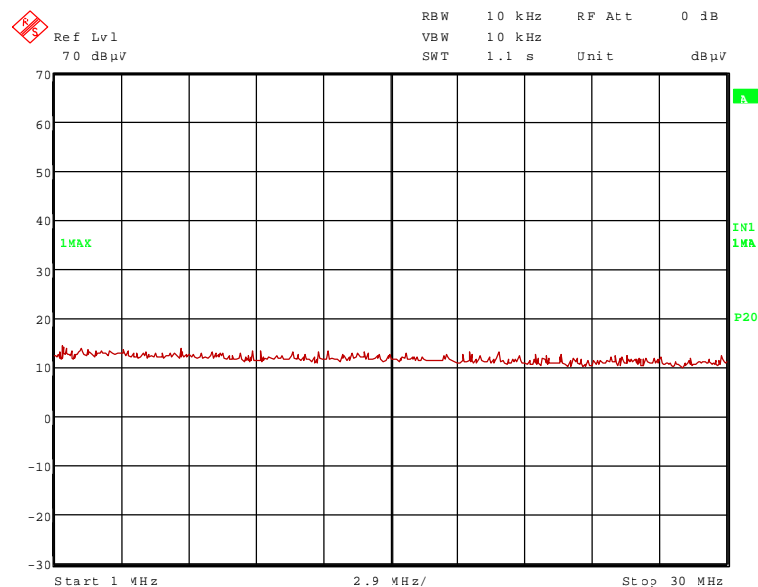
5.2.2 TEST RESULTS (RADIATED EMISSIONS)

5.2.2.1 PRELIMINARY MEASUREMENT (1 MHz to 10 GHz)

Ambient temperature	21 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

- 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: For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.
- Test record: The measurement was carried out in operation mode 1 of the EUT. All results are shown in the following.
- Supply voltage: During all measurements the EUT was supplied with 5.0 V DC.

91199_15.wmf: Spurious emissions from 1 MHz to 30 MHz:

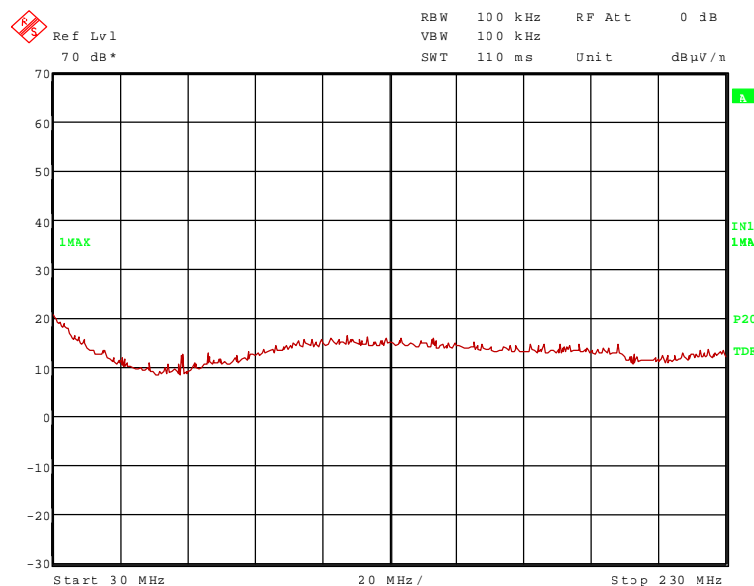


No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test inside this frequency range, so no measurements were carried out on the outdoor test site.

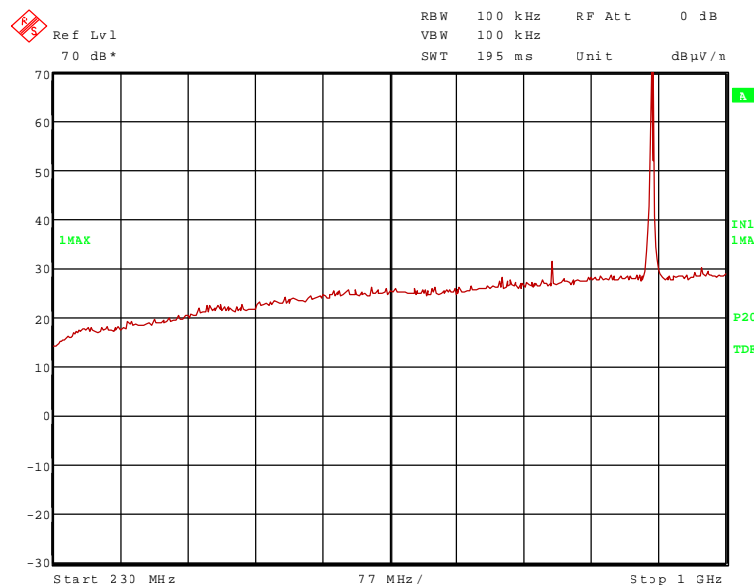
TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 36, 43, 44, 49, 55, 72, 73

TEST REPORT REFERENCE: F091199E1

91199 13.wmf: Spurious emissions from 30 MHz to 230 MHz:



91199 12.wmf: Spurious emissions from 230 MHz to 1 GHz (carrier notched):



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

- None.

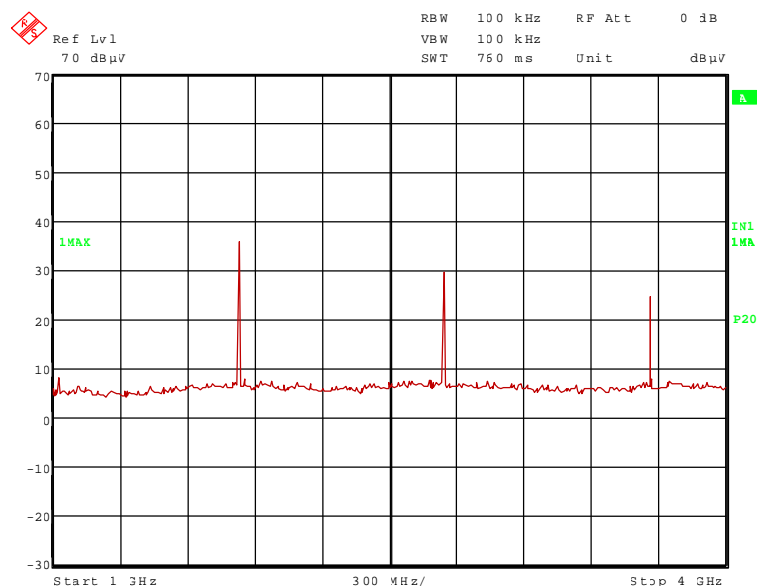
The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 68.268 MHz, 76.290 MHz, 800.632 MHz and 915.041 MHz.

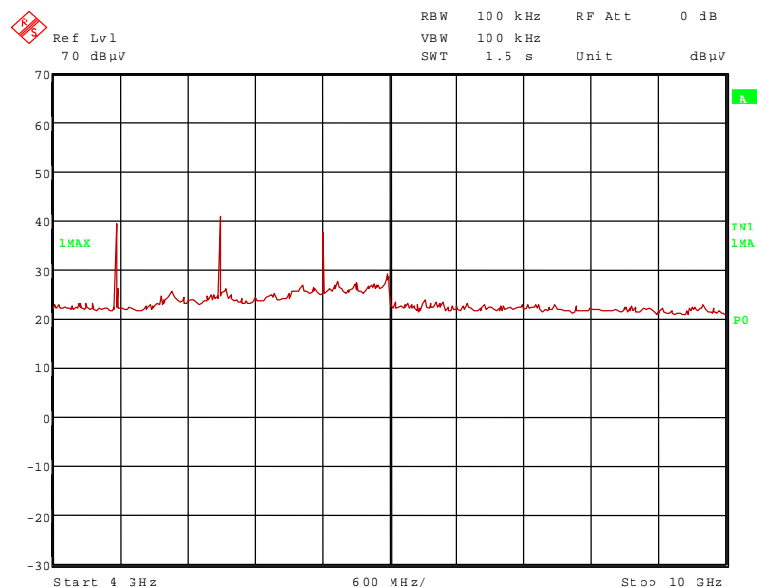
These frequencies have to be measured in a final measurement on an open area test-site. The results were presented in the following.

TEST REPORT REFERENCE: F091199E1

91199 10.wmf: Spurious emissions from 1 GHz to 4 GHz:



91199 11.wmf: Spurious emissions from 4 GHz to 10 GHz:



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

- 2.745 GHz, 3.660 GHz and 4.575 GHz.

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

- 1.830 GHz, 5.490 GHz and 6.405 GHz.

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

TEST REPORT REFERENCE: F091199E1

5.2.2.2 FINAL MEASUREMENT (30 MHz to 1 GHz)

Ambient temperature	20 °C	Relative humidity	55 %
---------------------	-------	-------------------	------

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

Supply voltage: During all measurements the EUT was supplied with 5.0 DC.

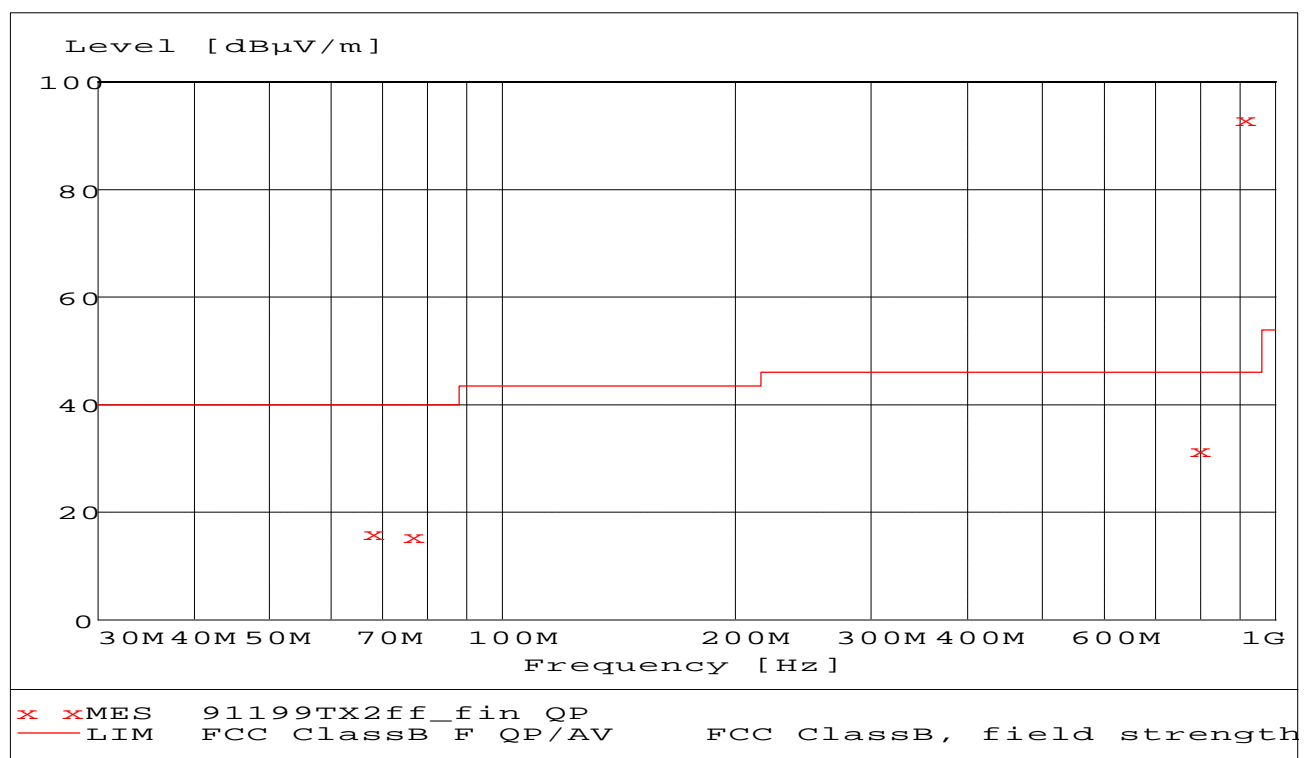
Resolution bandwidth: For all measurements a resolution bandwidth of 120 kHz was used.

Test record: The measurement was carried out in operation mode 2 of the EUT.

The test results were calculated with the following formula:

$$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]}$$

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 an x are the measured results of the standard subsequent measurement on the open area test site.



Data record name: 91199TX2ff

TEST REPORT REFERENCE: F091199E1

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.

The measurement time with the quasi-peak measuring detector is 1 second.

Result measured with the quasipeak detector:

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

Spurious emissions outside restricted bands									
Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
68.268	16.4	40.0	23.6	9.2	6.3	0.9	100.0	46.0	Vert.
76.290	15.6	40.0	24.4	7.2	7.5	0.9	279.0	226.0	Vert.
800.632	31.4	46.0	14.6	6.9	21.3	3.2	100.0	149.0	Hor.
915.041	93.2	94.0	0.8	66.9	22.9	3.4	100.0	152.0	Hor.
Spurious emissions in restricted bands									
Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
-	-	-	-	-	-	-	-	-	-
Measurement uncertainty				+2.2 dB / -3.6 dB					

The test results were calculated with the following formula:

$$\text{Result [dBμV/m]} = \text{reading [dBμV]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]}$$

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
14 – 20

TEST REPORT REFERENCE: F091199E1

5.2.2.3 FINAL MEASUREMENT (1 GHz to 10 GHz)

Ambient temperature	21 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

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

Test record: The measurement was carried out in operation mode 2 of the EUT. All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC.

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

Result measured with the peak detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1.830	67.1	74.0	6.9	36.8	27.0	0.0	3.3	150	Vert.	No
2.745	64.9	74.0	9.1	30.9	29.9	0.0	4.1	150	Vert.	Yes
3.660	65.0	74.0	9.0	28.1	32.4	0.0	4.5	150	Hor.	Yes
4.575	55.3	74.0	18.7	42.7	33.2	25.8	5.2	150	Hor.	Yes
5.490	59.8	74.0	14.2	44.6	34.8	25.4	5.8	150	Hor.	No
6.405	54.1	74.0	19.9	37.5	35.3	25.0	6.3	150	Vert.	No
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1.830	41.8	54.0	12.2	11.5	27.0	0.0	3.3	150	Vert.	No
2.745	39.7	54.0	14.3	5.7	29.9	0.0	4.1	150	Vert.	Yes
3.660	43.1	54.0	10.9	6.2	32.4	0.0	4.5	150	Hor.	Yes
4.575	31.8	54.0	22.2	19.2	33.2	25.8	5.2	150	Hor.	Yes
5.490	34.4	54.0	19.6	19.2	34.8	25.4	5.8	150	Hor.	No
6.405	33.7	54.0	20.3	17.1	35.3	25.0	6.3	150	Vert.	No
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 34, 36, 44, 49, 72, 73

TEST REPORT REFERENCE: F091199E1

5.3 BAND-EDGE COMPLIANCE

5.3.1 METHOD OF MEASUREMENT (BAND-EDGE COMPLIANCE)

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 antenna, which causes the highest field strength on the wanted frequency.

The following method of measurement shall be used:

- STEP 1: Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function for the frequency being measured, as required by C63.4 and FCC Rules (refer also subclause 5.2.1 of this test report). For example, for a device operating in the 902-928 MHz band under Section 15.249, use a 120 kHz RBW with a CISPR Quasi-Peak detector. A peak detector with 100 kHz RBW may also be used. For transmitters operating above 1 GHz, use a 1 MHz RBW, a 1 MHz VBW, and a peak detector (as required by Section 15.35). Repeat the measurement with an average detector (i.e., 1 MHz RBW with 10 Hz VBW).
- STEP 2: Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band edge emission under investigation. Set the analyzer RBW to 1 % of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band edge emission. This is not a field strength measurement, it is only a relative measurement to determine the amount by which the emission drops at the band edge relative to the highest fundamental emission level.
- STEP 3: Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band edge compliance as required by Section 15.205.
- STEP 4: The above delta measurement technique may be used for measuring emissions that are up to two standard bandwidths away from the band edge, where a standard bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the delta technique for measuring emissions up to 2 MHz removed from the band edge. Radiated emissions that are removed by more than two standard bandwidths must be measured in the conventional manner.

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

TEST REPORT REFERENCE: F091199E1

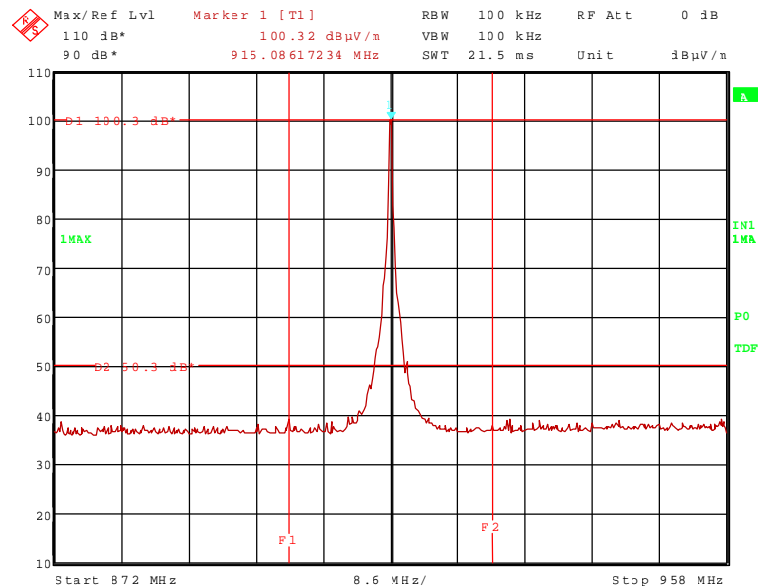
5.3.2 TEST RESULT (BAND-EDGE COMPLIANCE)

Ambient temperature	21 °C	Relative humidity	60 %
---------------------	-------	-------------------	------

Test record: The measurement was carried out in operation mode 2 of the EUT. All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC.

91199_14.wmf (radiated band-edge compliance, upper band edge, operation mode 1):



Remark: No emissions caused by the EUT at least 10 dB below the 50 dBc limit. Therefore it can be assumed that the emissions at the edge of the assigned frequency band will also meet the 46 dBμV/m requirement and no separate delta measurement was carried out.

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 35, 43

TEST REPORT REFERENCE: F091199E1

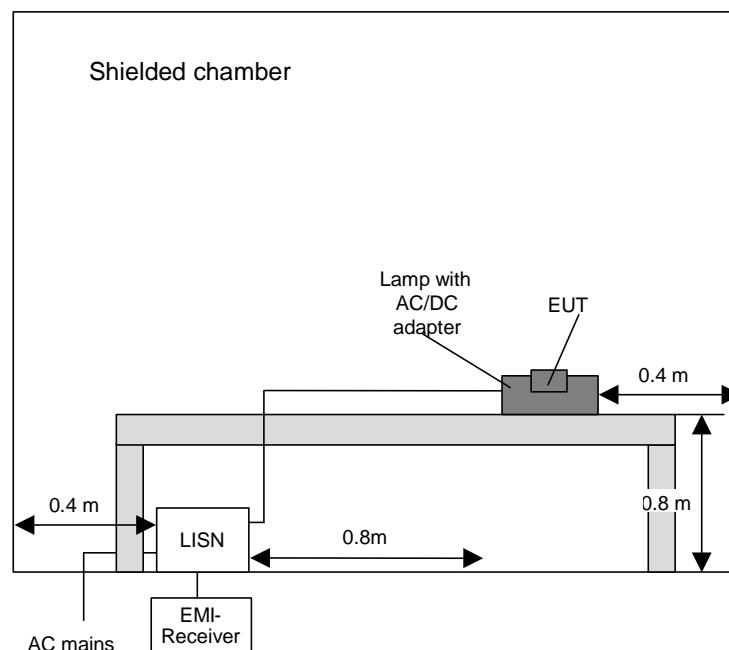
5.4 CONDUCTED EMISSIONS ON POWER SUPPLY LINES (150 kHz to 30 MHz)

5.4.1 METHOD OF MEASUREMENT

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 set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [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 appropriate 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



TEST REPORT REFERENCE: F091199E1

5.4.2 TEST RESULTS (CONDUCTED EMISSIONS ON POWER SUPPLY LINES)

Ambient temperature	20 °C	Relative humidity	52 %
---------------------	-------	-------------------	------

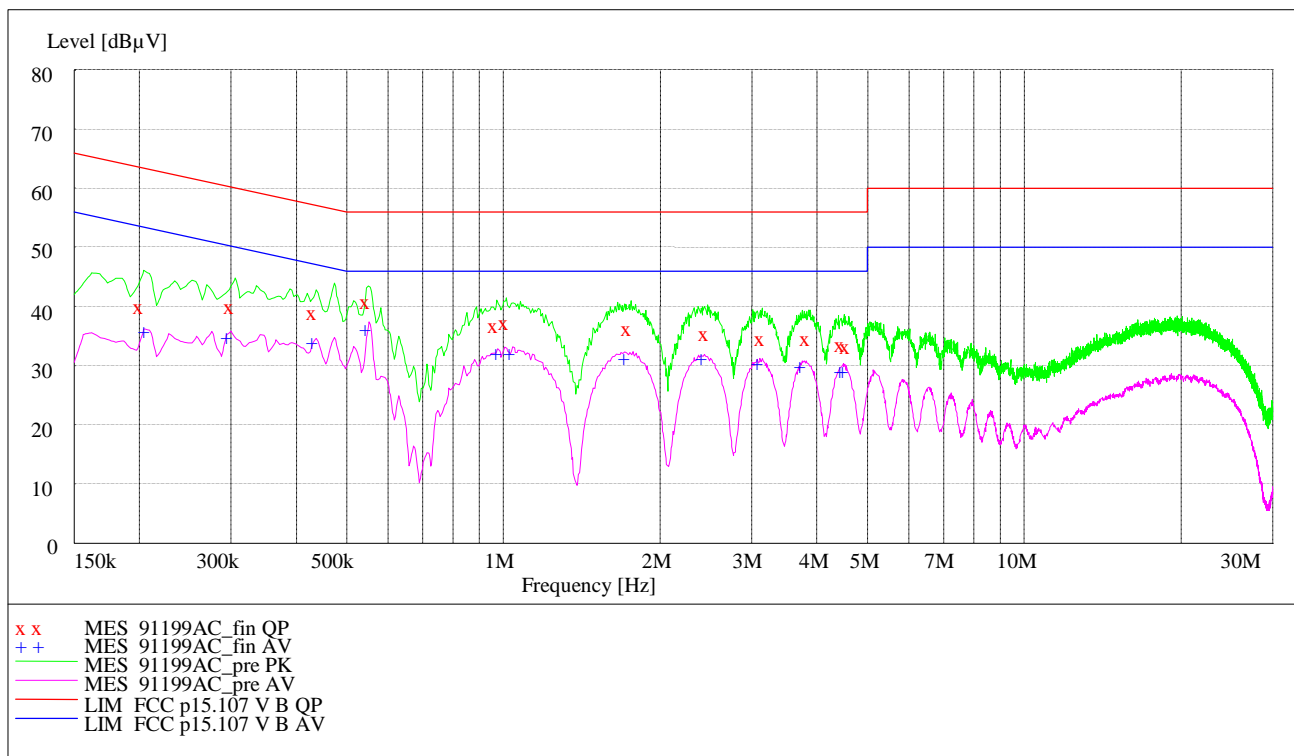
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

Cable guide: The cable of the EUT was 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: The measurement was carried out in operation mode 2 of the EUT. All results are shown in the following.

Supply voltage: During the measurement the EUT was supplied with 5.0 V DC by lamp type RS PRO 1000 Slave (7495), which was powered with 120 V AC / 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 an x and the average measured points by an +.



Data record name: 91199AC

TEST REPORT REFERENCE: F091199E1

Result measured with the quasipeak detector:

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

Frequency MHz	Level dBμV	Transducer dB	Limit dBμV	Margin dB	Line	PE
0.201480	40.8	1.0	63.5	22.8	L1	FLO
0.304080	40.6	0.9	60.1	19.5	L1	FLO
0.437280	39.8	0.9	57.1	17.3	L1	FLO
0.551670	41.7	0.9	56.0	14.3	L1	FLO
0.972870	37.5	0.8	56.0	18.5	L1	FLO
1.015350	37.8	0.7	56.0	18.2	L1	FLO
1.757490	37.0	0.7	56.0	19.0	L1	FLO
2.475420	36.1	0.8	56.0	19.9	N	FLO
3.146190	35.5	0.7	56.0	20.5	N	FLO
3.857730	35.0	0.7	56.0	21.0	N	FLO
4.509060	34.4	0.9	56.0	21.6	N	FLO
4.616070	33.9	0.9	56.0	22.1	N	FLO
Measurement uncertainty			+3.6 dB / -4.4 dB			

Data record name: 91199AC_fin QP

Result measured with the average detector:

(These values are marked in the diagram by an +)

Frequency MHz	Level dBμV	Transducer dB	Limit dBμV	Margin dB	Line	PE
0.207510	36.8	1.0	53.3	16.5	L1	FLO
0.299130	35.9	0.9	50.3	14.4	L1	FLO
0.434940	34.9	0.9	47.2	12.2	L1	FLO
0.553920	37.0	0.9	46.0	9.0	L1	FLO
0.978810	33.0	0.7	46.0	13.0	N	FLO
1.047390	33.1	0.8	46.0	12.9	L1	FLO
1.735530	32.1	0.7	46.0	13.9	N	FLO
2.431770	31.9	0.7	46.0	14.1	N	FLO
3.112620	31.1	0.7	46.0	15.0	N	FLO
3.788700	30.8	0.7	46.0	15.3	N	FLO
4.503210	30.0	0.8	46.0	16.0	N	FLO
4.533990	29.8	0.9	46.0	16.2	N	FLO
Measurement uncertainty			+3.6 dB / -4.4 dB			

Data record name: 91199AC_fin AV

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

1 – 3, 5, 6

TEST REPORT REFERENCE: F091199E1

6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

TEST REPORT REFERENCE: F091199E1

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	Measuring receiver	ESAI	Rohde & Schwarz	831953/001 833181/018	480025 480026	06/16/2009	06/2011
3	LISN	NSLK8128	Schwarzbeck	8128155	480058	01/15/2009	01/2011
5	AC-filter	B84299-D87-E3	Siemens	930262292	480097	Weekly verification (system cal.)	
6	EMI-Software	ES-K1	Rohde & Schwarz	-	480111	Not applicable	
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	Measuring receiver	ESIB7	Rohde & Schwarz	100304	480521	02/26/2008	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	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	10/11/2005	10/2010
36	Antenna	3115 A	EMCO	9609-4918	480183	11/04/2008	11/2013
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.)	
55	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	02/19/2008	02/2013
72	4 GHz High Pass Filter	WHKX4.0/18 G-8SS	Wainwright Instruments	1	480587	Weekly verification (system cal.)	
73	High Pass Filter	WHJS1000C 11/60EF	Wainwright Instruments GmbH	1	480413	Weekly verification (system cal.)	
75	Test fixture	-	Phoenix Test-Lab	-	410160	Weekly verification (system cal.)	
78	RF-cable No. 10	RG223	Phoenix-Test-Lab	-	410102	Weekly verification (system cal.)	
108	Spectrum analyser	FSU 46	Rohde & Schwarz	200125	480956	02/04/2009	02/2011

TEST REPORT REFERENCE: F091199E1

7 LIST OF ANNEXES

ANNEX A	PHOTOGRAPHS OF THE TEST SET-UPS:	6 pages
	MF1-USA, test set-up shielded chamber	91199_12.jpg
	MF1-USA, test set-up fully anechoic chamber	91199_6.jpg
	MF1-USA, test set-up fully anechoic chamber	91199_7.jpg
	MF1-USA, test set-up fully anechoic chamber	91199_8.jpg
	MF1-USA, test set-up fully anechoic chamber	91199_9.jpg
	MF1-USA, test set-up open area test site	91199_11.jpg
ANNEX B	INTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:	2 pages
	MF1-USA, PCB, top view	91199_d.jpg
	MF1-USA, PCB, bottom view	91199_e.jpg
ANNEX C	INTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:	2 pages
	MF1-USA, 3-D-view 1	91199_a.jpg
	MF1-USA, 3-D-view 2	91199_c.jpg
ANNEX D	ADDITIONAL RESULTS FOR INDUSTRY CANADA:	10 pages