

TEST REPORT

Test Report Reference: F101794E1

Equipment under Test:

Global A Flap Key

Part Number: 5WK50079

FCC ID: KR55WK50079

IC: 7812D-5WK50079

Applicant: Continental Automotive GmbH

Manufacturer: Continental Automotive GmbH

**Test Laboratory
(CAB)**

**accredited by Deutsche Gesellschaft für Akkreditierung mbH (DGA)
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**

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1 IDENTIFICATION

1.1 APPLICANT

Name:	Continental Automotive GmbH
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Country:	Germany
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Fax:	+49 941 790-996699
e-mail address:	dagmar.kolar@continental-corporation.com

1.2 MANUFACTURER

Name:	Continental Automotive GmbH
Address:	Osterhofener Str. 14 93055 Regensburg
Country:	Germany
Name for contact purposes:	Mrs. Dagmar KOLAR
Tel:	+49 941 790-6699
Fax:	+49 941 790-996699
e-mail address:	dagmar.kolar@continental-corporation.com

1.3 DATES

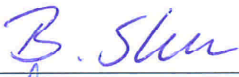
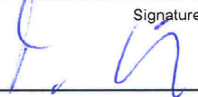
Date of receipt of test sample:	15 June 2010
Start of test:	6 July 2010
Finish of test:	22 July 2010

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1.4 TEST LABORATORY

The tests were carried out at: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg Phone: **+49 (0) 52 35 / 95 00-0**
Germany Fax: **+49 (0) 52 35 / 95 00-10**

accredited by Deutsche Gesellschaft für Akkreditierung mbH (DGA) 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

Test engineer:	<u>Bernd STEINER</u> Name	<u></u> Signature	<u>26 July 2010</u> Date
Test report checked:	<u>Thomas KÜHN</u> Name	<u></u> Signature	<u>26 July 2010</u> 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 C63.4-2009** 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 (October 2009)** 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

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

Channel 1	RX:	-	TX:	433.92 MHz
Channel 2	RX:	-	TX:	-
Channel 3	RX:	-	TX:	-

Type: *	Global A Flap Key				
Type of equipment: *	Transmitter for a RF-remote control system of a Body Computer Module (BCM) for an automotive carline.				
Part number	5WK50079				
FCC ID:	KR55WK50079				
IC:	7812D-5WK50079				
Duty cycle class: *	Manual triggered device				
Rated RF Output Power: *	- 11.4 dBm				
Channel spacing: *	None (one wideband channel operation only)				
Antenna type: *	Internal loop antenna with -15 dBi (typ.)				
Alignment range: *	Single wideband channel operation 433.92 MHz				
Switching range: *	Single wideband channel operation 433.92 MHz				
Modulation: *	ASK				
Bit rate of transmitter: *	4.2 kBit/s				
Supply Voltage: *	U _{Nom} =	3.0 V DC	U _{Min} =	2.2 V DC	U _{Max} = 3.5 V DC
Power Supply:	3 V DC by one Lithium cell (CR2032)				
Temperature range: *	Not declared				
Printed circuit designation: *	A2C53360923-05				
Hardware version: *	Not available				
Software version *	Not available				
Ancillaries to be tested with: *	none				

*: Declared by the applicant.

Ports/Connectors

Identification	Connector		Length
	EUT	Ancillary	
-	No cables were connectable to the EUT		-
-	-	-	-

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3 OPERATIONAL STATES AND PHYSICAL BOUNDARIES

During all tests the EUT was supplied via a new internal battery. All measurements, except the transmitter release time, duty cycle and occupied bandwidth, were carried out with a sample which operates with a test-software. This software set the EUT in continuous transmission mode (without modulation). The measurements of transmitter release time, duty cycle and occupied bandwidth were carried out with an unmodified test sample in application mode.

There are 2 variants of the device. As declared by the applicant the only difference between both devices is a different matching capacitor C032_1 with a value of 5.6 pF for matching N and a value of 3.9 pF for matching O.

Due to this fact the emission measurement of both variants was performed.

The 3 orthogonal axes were defined as Pos.1 EUT lying flat, Pos.2 EUT standing vertical on the key side and Pos 3 EUT standing vertical on the ear.

For the whole frequency range a preliminary measurement in a fully anechoic chamber with a measuring distance of 3 m was carried out to determine the frequencies, which were radiated by the EUT.

The final measurements on the detected frequencies were carried out on an open area test site with ground plane (for the frequency range 30 MHz to 1 GHz) and a fully anechoic chamber (for the frequency range 1 GHz to 5 GHz)

During the tests, the EUT was sealed but not labelled.

The physical boundaries of the Equipment Under Test are shown below.



Global A Flap Key

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4 LIST OF TEST MODULES

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 – 5000	15.231 (b) 15.205 (a) 15.209 (a)	2.6 [3]	Passed	8 et seq.
Occupied bandwidth	433.92	15.231 (c)	4.6.1 [4]	Passed	35 et seq. and Annex D
Transmitter release time	433.92	15.231 (a) (1)	A1.1 [3]	Passed	37 et seq.

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5 TEST RESULTS

5.1 RADIATED EMISSIONS

5.1.1 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 110 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 110 GHz.

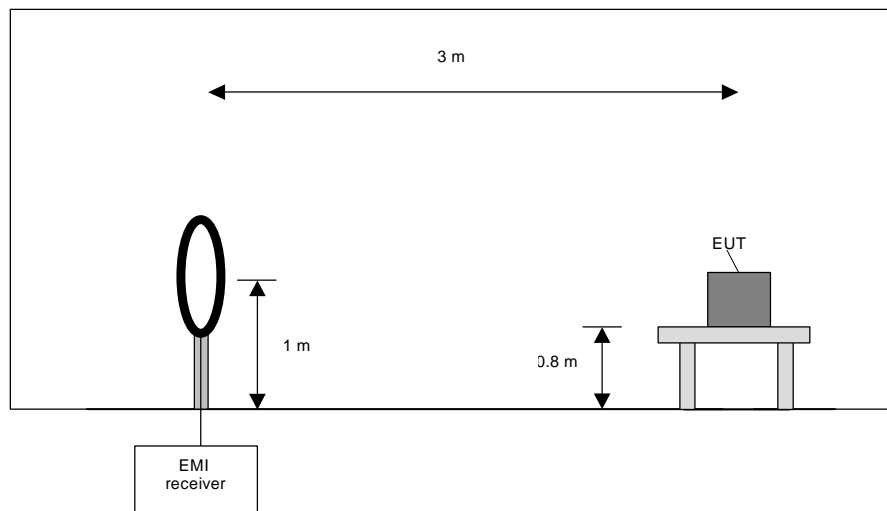
Preliminary measurement (9 kHz to 30 MHz):

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 analyzer 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 analyzer 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:

Pre-scans 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).

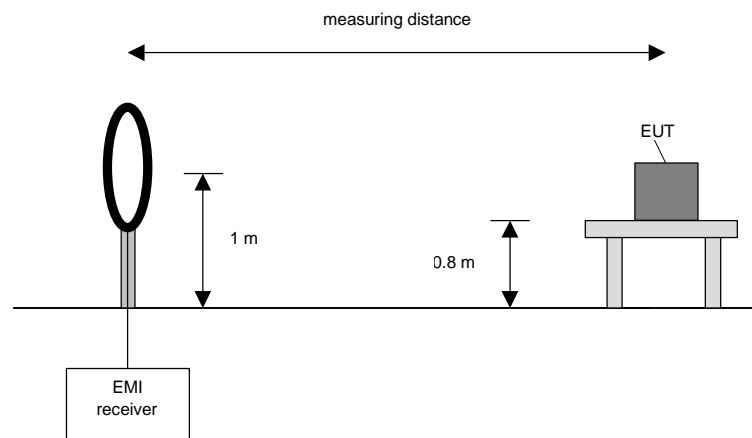
Final measurement (9 kHz to 30 MHz):

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 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).

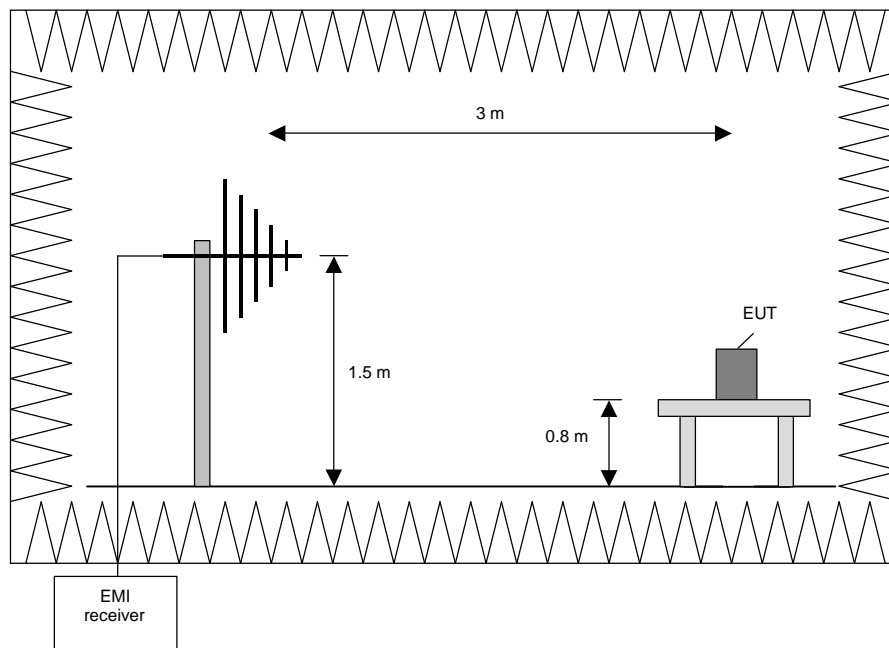
Preliminary measurement (30 MHz to 1 GHz)

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 C63.4-2009 [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



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Procedure preliminary measurement:

Pre-scans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.

The following procedure will be used:

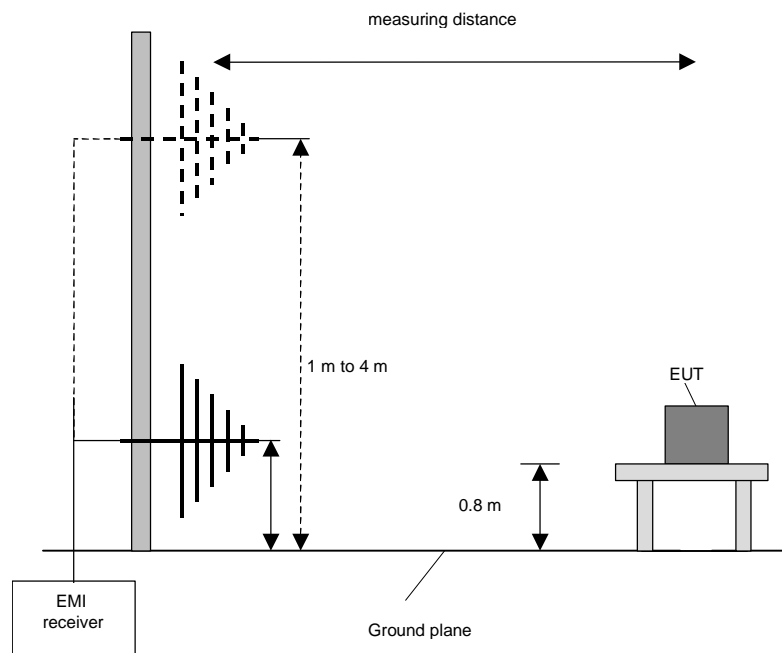
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the 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 (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 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 C63.4-2009 [1].

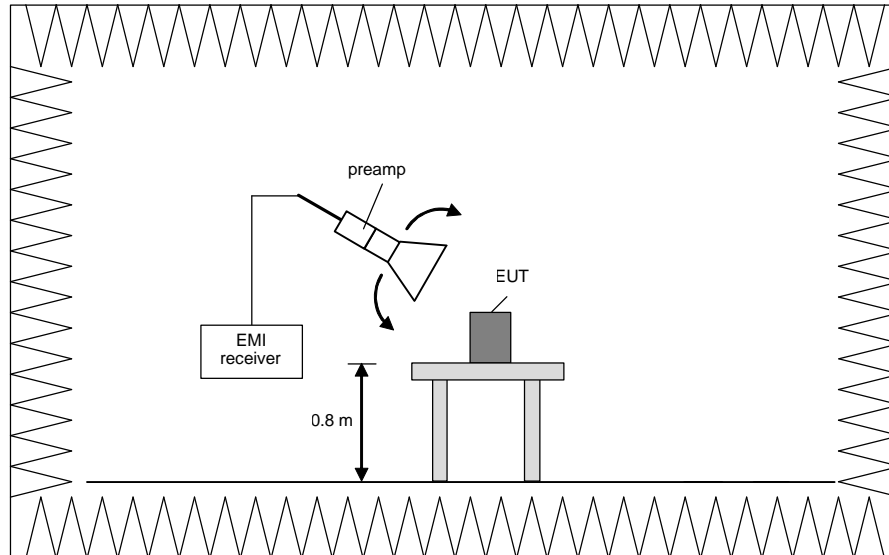
Preliminary measurement (1 GHz to 110 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyzer 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 analyzer 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

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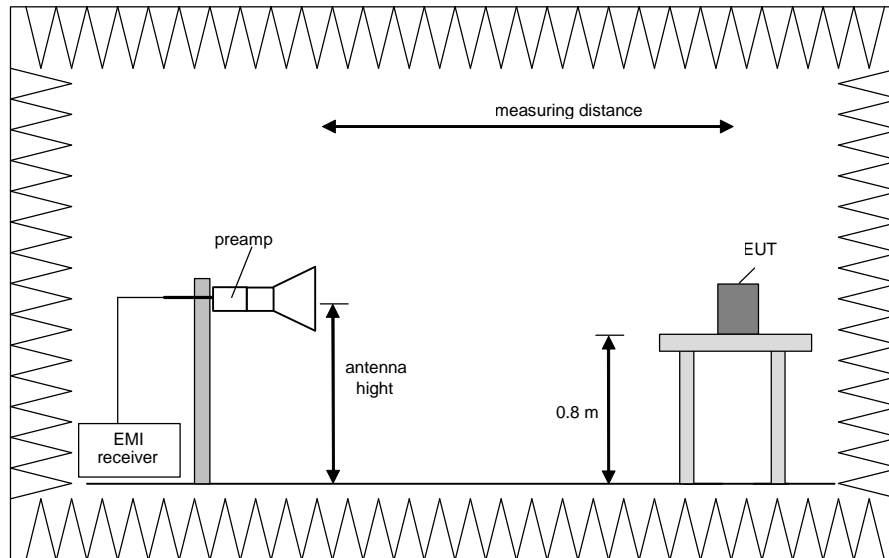
Final measurement (1 GHz to 110 GHz)

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

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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, 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 analyzer 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) is defined as preliminary measurement.

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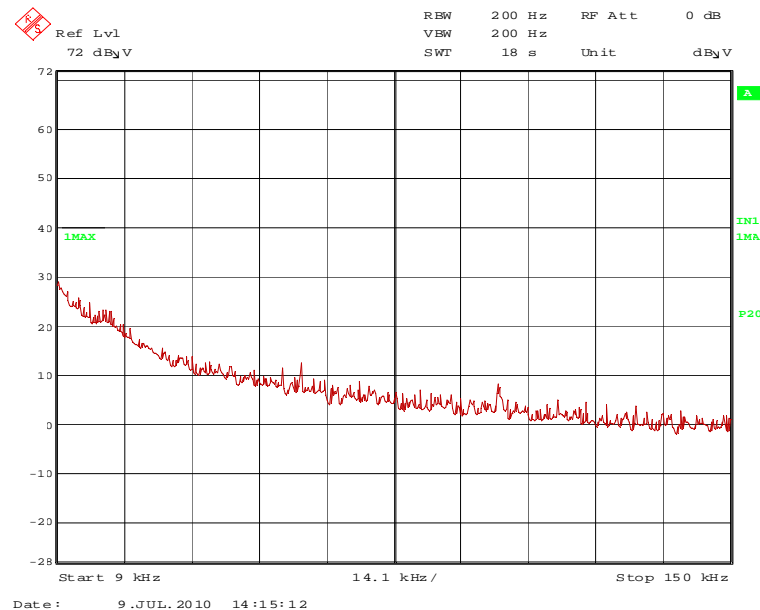
5.1.2 PRELIMINARY RADIATED EMISSION TEST

Ambient temperature:	19 °C	Relative humidity:	34 %
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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.
- Cable guide: No cables were connectable to the EUT. For further information of the EUT set-up refer to the pictures in annex A of this test report.
- Test record: During the test, the EUT transmits continuously without modulation. All results are shown in the following. The EUT was tested in three orthogonal directions; the documented results were the worst case emissions.
- Supply voltage: The EUT was supplied by new batteries.

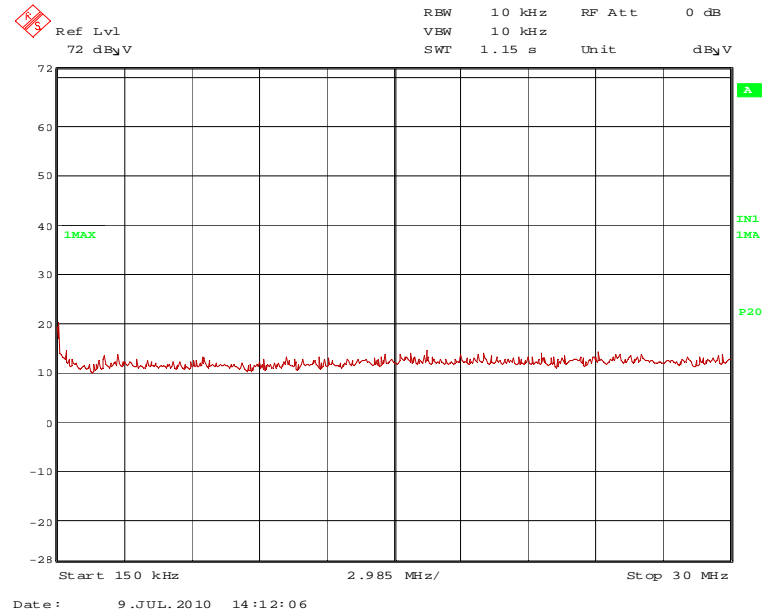
5.1.2.1 RESULTS MATCHING N

101794 7: Spurious emissions from 9 kHz to 150 kHz:



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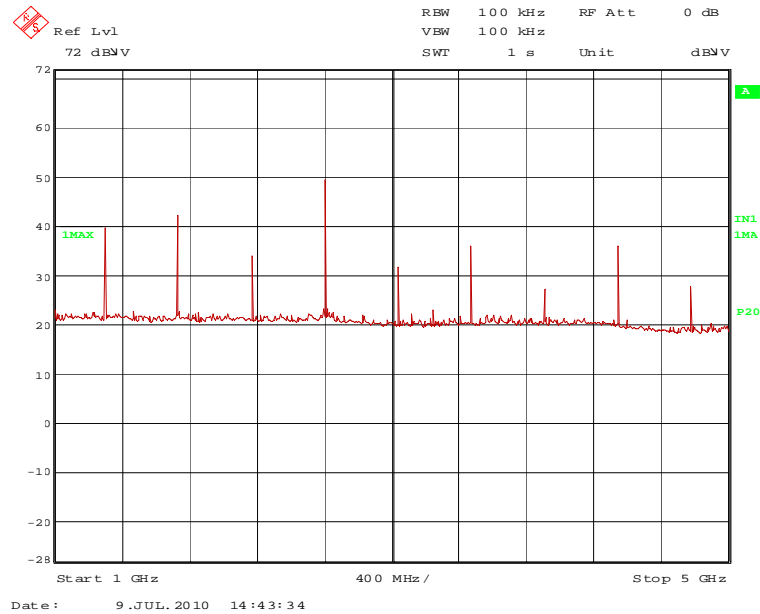
101794_8: Spurious emissions from 150 kHz to 30 MHz:



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.

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101794 9: Spurious emissions from 1 GHz to 5 GHz:



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

- 1301.760 MHz, 3905.280 MHz, 4339.200 MHz, 4773.12 MHz

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

- 1735.680 MHz, 2169.600 MHz, 2603.520 MHz, 3037.440 MHz, 3471.360 MHz, 3905.280 MHz

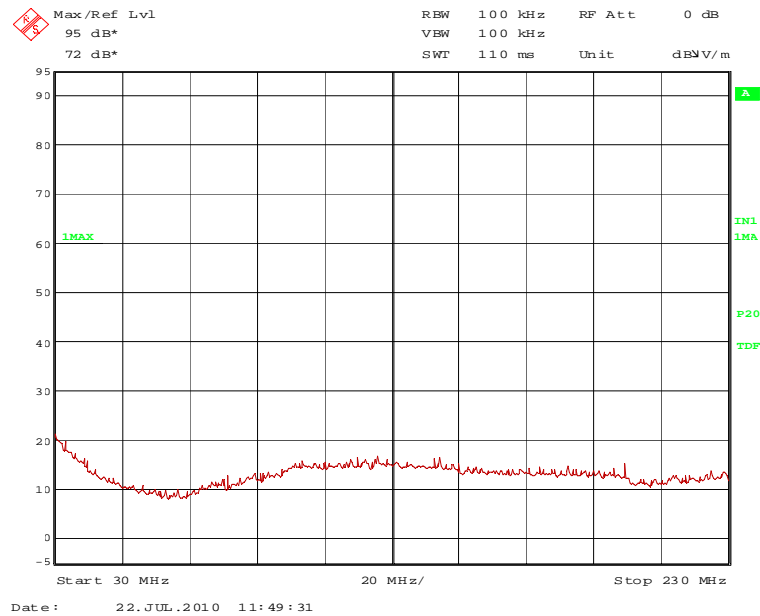
At these frequencies has to be performed a final measurement. The result is presented in the following.

TEST EQUIPMENT USED THE TEST:

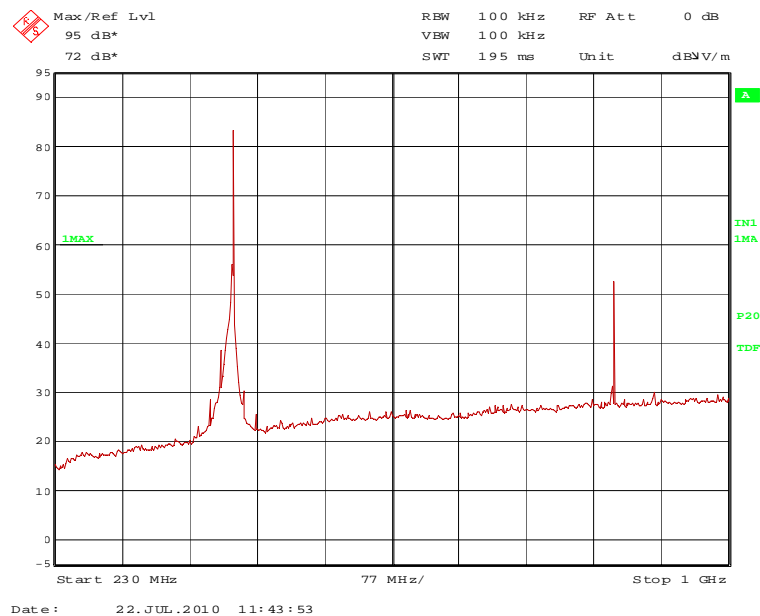
29, 31 – 35, 43, 56, 60 - 63

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101794 11: Spurious emissions from 30 MHz to 230 MHz



101794 12: Spurious emissions from 230 MHz to 1 GHz



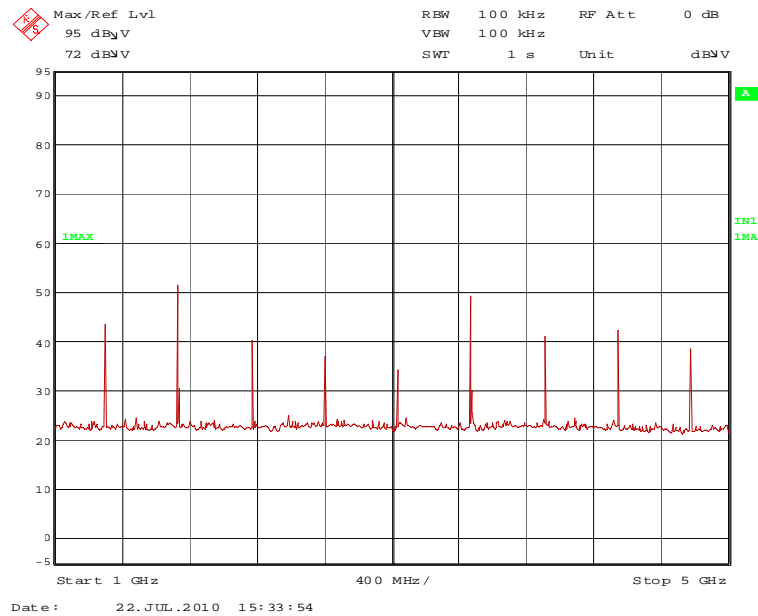
The following frequencies were found during the preliminary radiated emission test:

433.9215 MHz and 887.8425 MHz

These frequencies have to be measured on the open area test site. The results were presented in the following

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101794 14: Spurious emissions from 1 GHz to 5 GHz:



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

- 1301.760 MHz, 3905.280 MHz, 4339.200 MHz, 4773.12 MHz

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

- 1735.680 MHz, 2169.600 MHz, 2603.520 MHz, 3037.440 MHz, 3471.360 MHz, 3905.280 MHz

At these frequencies has to be performed a final measurement. The result is presented in the following.

TEST EQUIPMENT USED THE TEST:

29, 31 – 35, 43, 56, 60 - 63

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5.1.3 FINAL RADIATED EMISSION MEASUREMENT

5.1.3.1 RESULTS 30 MHz to 1 GHz MATCHING N

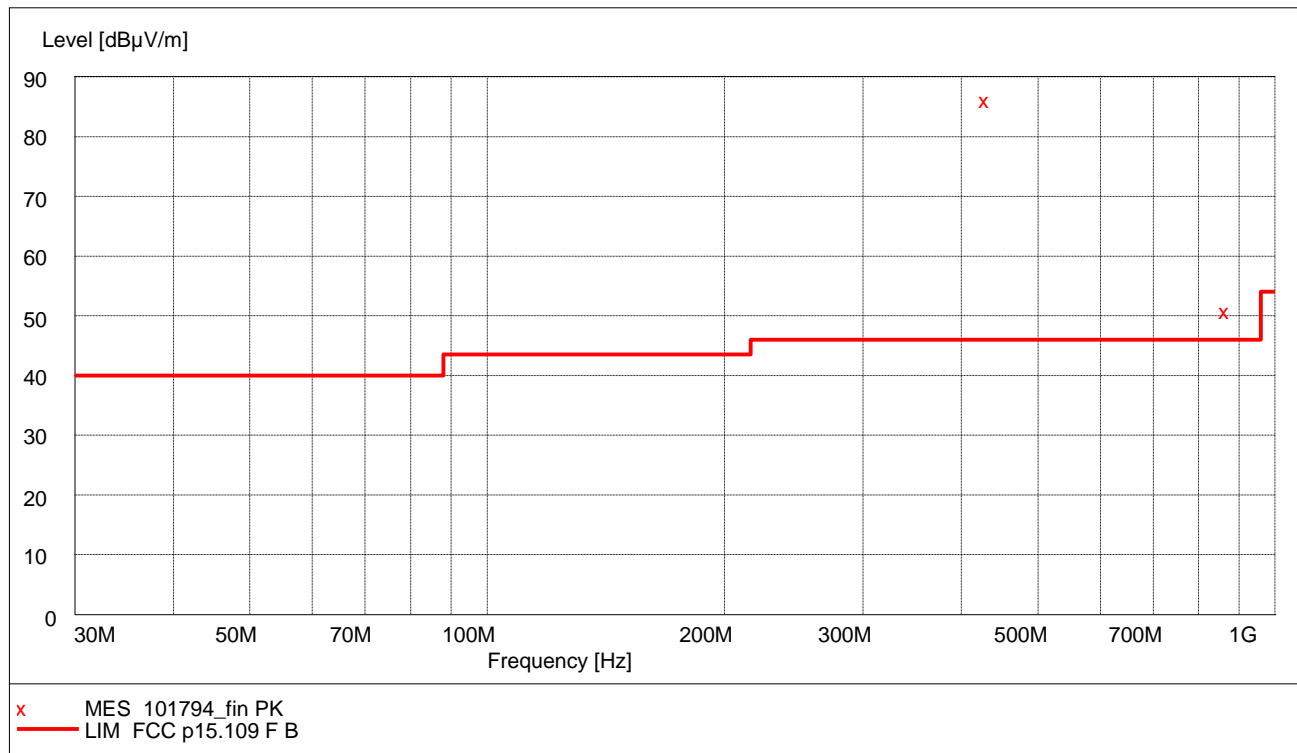
Ambient temperature	19 °C	Relative humidity	34 %
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- Position of EUT:** The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide:** No cables were connectable to the EUT. For further information of the EUT set-up refer to the pictures in annex A of this test report.
- Test record:** During the test, the EUT transmits continuously without modulation. All results are shown in the following. The EUT was tested in three orthogonal directions.
- Supply voltage:** The EUT was supplied by a new internal battery.
- Test results:** The test results were calculated with the following formula:

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

The duty cycle correction factor was determined in clause 5.2 of this report

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with x are the measured results with a peak detector with transducer included of the standard final measurement on the open area test site.



Data record name: 101794

of 21.07.2010

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The results of the standard final 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 peak measuring detector is 1 second.

Result measured with the peak detector and corrected with duty cycle correction factor:

Spurious emissions outside restricted bands											
Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Duty cycle correction dB	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.	Pos.
433.920	73.2	80.8	7.6	66.6	-13.4	16.2	3.8	200	35	Hor.	1
867.840	37.9	60.8	22.9	23.2	-13.4	22.1	6.0	100	305	Hor.	1
-	-	-	-	-	-	-	-	-	-	-	-
Spurious emissions in restricted bands											
Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Duty cycle correction dB	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.	Pos.
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
Measurement uncertainty				+2.2 dB / -3.6 dB							

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

14 – 20

TEST REPORT REFERENCE: F101794E1

5.1.3.2 RESULTS 30 MHz to 1 GHz MATCHING O

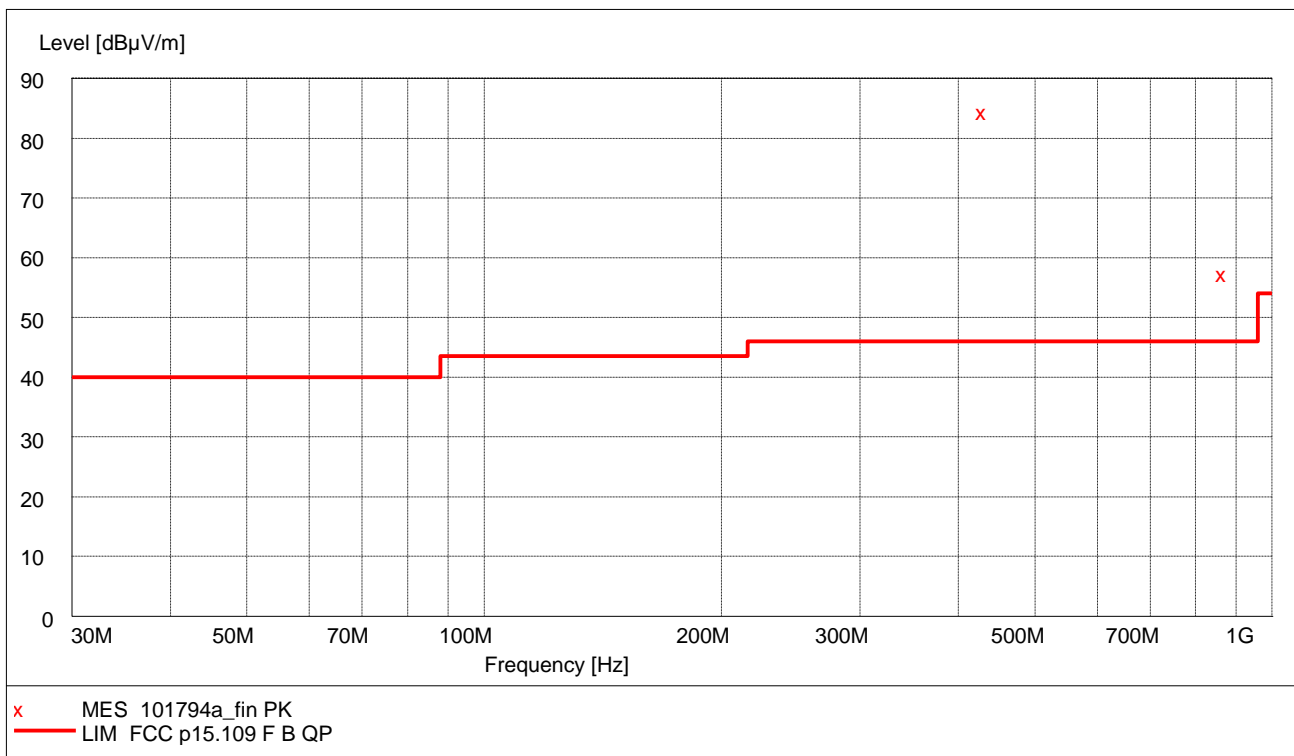
Ambient temperature	20 °C	Relative humidity	35 %
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- Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide: No cables were connectable to the EUT. For further information of the EUT set-up refer to the pictures in annex A of this test report.
- Test record: During the test, the EUT transmits continuously without modulation. All results are shown in the following. The EUT was tested in three orthogonal directions.
- Supply voltage: The EUT was supplied by a new internal battery.
- Test results: The test results were calculated with the following formula:

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

The duty cycle correction factor was determined in clause 5.2 of this report

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with x are the measured results with a peak detector with transducer included of the standard final measurement on the open area test site.



Data record name: 101794a of 22.07.2010

TEST REPORT REFERENCE: F101794E1

The results of the standard final 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 peak measuring detector is 1 second.

Result measured with the peak detector and corrected with duty cycle correction factor:

Spurious emissions outside restricted bands											
Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Duty cycle correction dB	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.	Pos.
433.920	71.5	80.8	9.3	64.9	-13.4	16.2	3.8	200	35	Hor.	1
867.840	43.9	60.8	16.9	29.2	-13.4	22.1	6.0	100	305	Hor.	1
-	-	-	-	-	-	-	-	-	-	-	-
Spurious emissions in restricted bands											
Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Duty cycle correction dB	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.	Pos.
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
Measurement uncertainty				+2.2 dB / -3.6 dB							

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

14 – 20

TEST REPORT REFERENCE: F101794E1

5.1.3.3 RESULTS 1 GHz to 5 GHz MATCHING N

Ambient temperature	20 °C	Relative humidity	35 %
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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.

Cable guide: No cables were connectable to the EUT. For further information of the EUT set-up refer to the pictures in annex A of this test report.

Test record: During the test, the EUT transmits continuously without modulation. All results are shown in the following. The EUT was tested in three orthogonal directions, the documented results were the worst case emissions.

Supply voltage: The EUT was supplied by a new internal battery.

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

Result measured with the peak detector and corrected with duty cycle correction factor:

Frequency MHz	Field- strength dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Duty Cycle correction dB	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
1301.760	29.8	54.0	24.2	42.0	-13.4	25.0	26.5	2.7	150	Hor.	Yes	1
1735.680	33.3	60.8	27.5	43.5	-13.4	26.6	26.5	3.1	150	Hor.	No	1
2169.600	33.9	60.8	26.9	39.1	-13.4	28.2	26.5	3.5	150	Hor.	No	1
2603.520	43.7	60.8	17.1	50.2	-13.4	29.4	26.4	3.9	150	Hor.	No	1
3037.440	32.8	60.8	28.0	37.4	-13.4	30.9	26.4	4.3	150	Vert.	No	1
3471.360	36.2	60.8	24.6	39.6	-13.4	31.9	26.3	4.4	150	Hor.	No	1
3905.280	33.6	54.0	20.4	35.3	-13.4	33.1	26.1	4.7	150	Hor.	Yes	1
4339.200	38.4	54.0	15.6	39.6	-13.4	33.1	25.9	5.0	150	Hor.	Yes	1
4773.120	34.9	54.0	19.1	35.1	-13.4	33.6	25.7	5.3	150	Hor.	Yes	1
Measurement uncertainty						+2.2 dB / -3.6 dB						

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 34, 60 – 63

TEST REPORT REFERENCE: F101794E1

5.1.3.4 RESULTS 1 GHz to 5 GHz MATCHING O

Ambient temperature	20 °C	Relative humidity	35 %
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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.
- Cable guide: No cables were connectable to the EUT. For further information of the EUT set-up refer to the pictures in annex A of this test report.
- Test record: During the test, the EUT transmits continuously without modulation. All results are shown in the following. The EUT was tested in three orthogonal directions, the documented results were the worst case emissions.
- Supply voltage: The EUT was supplied by a new internal battery.
- Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

Result measured with the peak detector and corrected with duty cycle correction factor:

Frequency MHz	Field- strength dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Duty Cycle correction dB	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
1301.760	33.2	54.0	20.8	45.4	-13.4	25.0	26.5	2.7	150	Hor.	Yes	1
1735.680	43.8	60.8	17.0	54.0	-13.4	26.6	26.5	3.1	150	Hor.	No	1
2169.600	37.1	60.8	23.7	45.3	-13.4	28.2	26.5	3.5	150	Hor.	No	1
2603.520	36.1	60.8	24.7	42.6	-13.4	29.4	26.4	3.9	150	Hor.	No	1
3037.440	36.6	60.8	24.2	41.2	-13.4	30.9	26.4	4.3	150	Vert.	No	1
3471.360	47.5	60.8	13.3	50.9	-13.4	31.9	26.3	4.4	150	Hor.	No	1
3905.280	44.3	54.0	9.7	46.0	-13.4	33.1	26.1	4.7	150	Hor.	Yes	1
4339.200	43.6	54.0	10.4	44.8	-13.4	33.1	25.9	5.0	150	Hor.	Yes	1
4773.120	40.5	54.0	13.5	40.7	-13.4	33.6	25.7	5.3	150	Hor.	Yes	1
Measurement uncertainty						+2.2 dB / -3.6 dB						

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 34, 60 – 63

TEST REPORT REFERENCE: F101794E1

5.2 DUTY CYCLE

5.2.1 METHOD OF MEASUREMENT

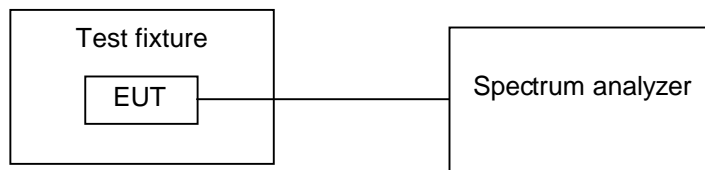
The calibration of the spectrum analyzer has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyzer via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed or a test fixture has to be used. The unmodified EUT has to be switched on, the transmitter shall work with its maximum data rate.

The following spectrum analyzer settings shall be used:

- Span: = 0 Hz.
- Resolution bandwidth: 100 kHz.
- Video bandwidth: \geq the resolution bandwidth.
- Sweep: Single sweep with 120 milliseconds.
- Detector function: peak.
- Trace mode: Max hold.

The time of each pulse as to be determine and added to a total tx on time in 100 ms.

Test set-up:



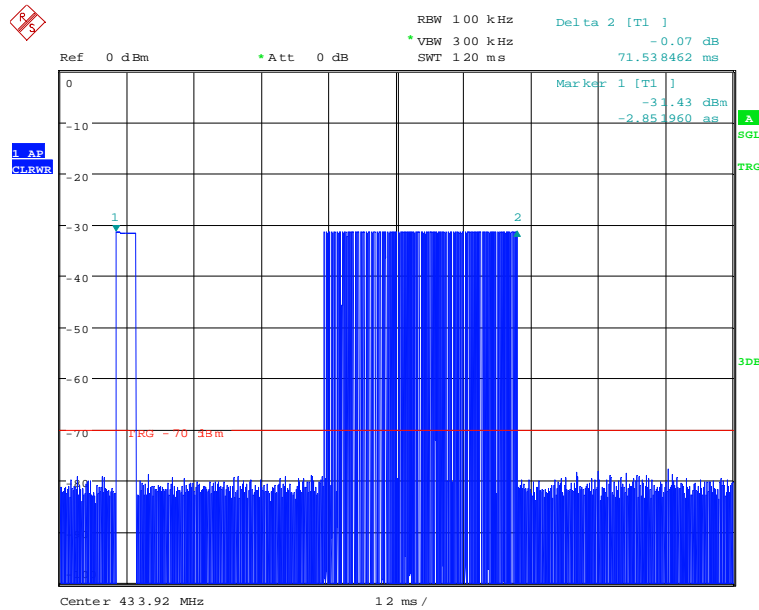
TEST REPORT REFERENCE: F101794E1

5.2.2 TEST RESULTS (DUTY CYCLE)

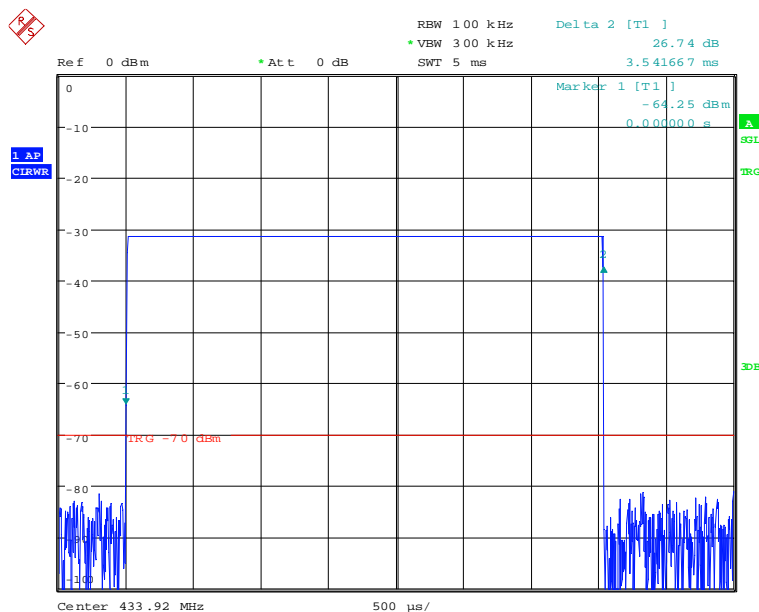
Ambient temperature	20 °C	Relative humidity	45 %
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The measurement was performed with a matching N device in application mode while button panic pressed.

101794_17.wmf: total pulse train:

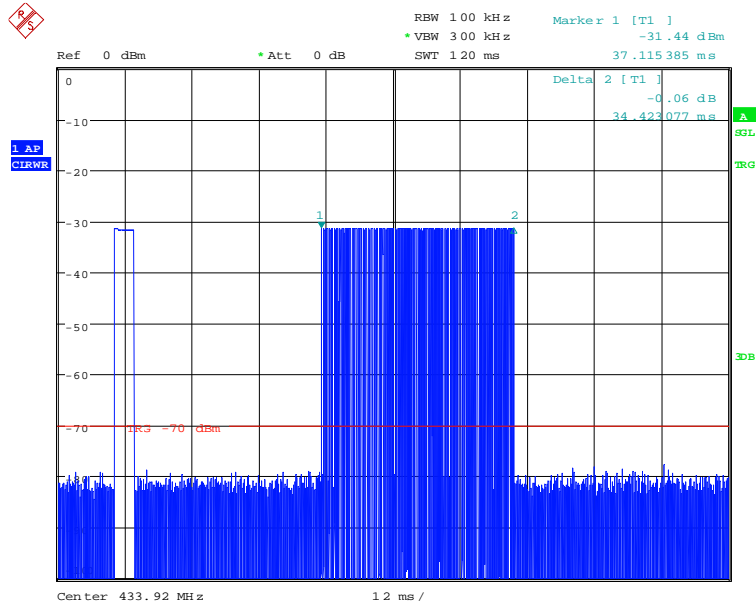


101794_18.wmf: detail view first pulse:

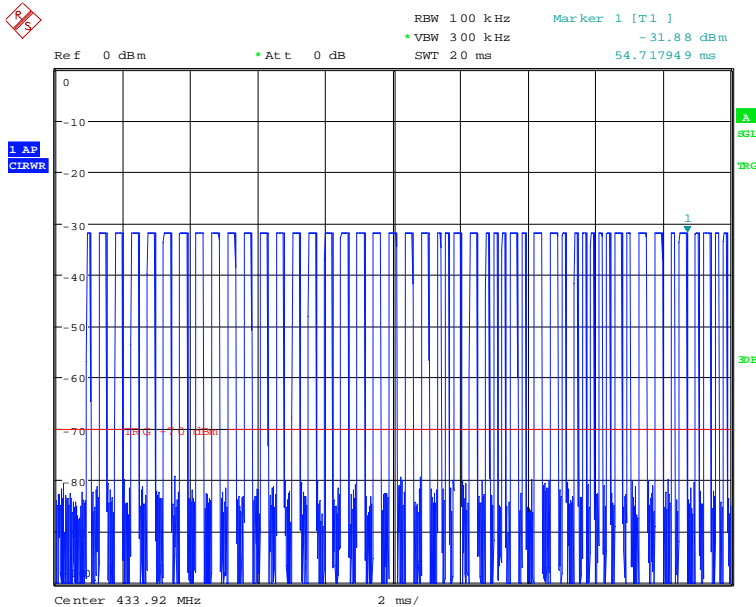


TEST REPORT REFERENCE: F101794E1

101794_17B.wmf: detail view second pulse train:

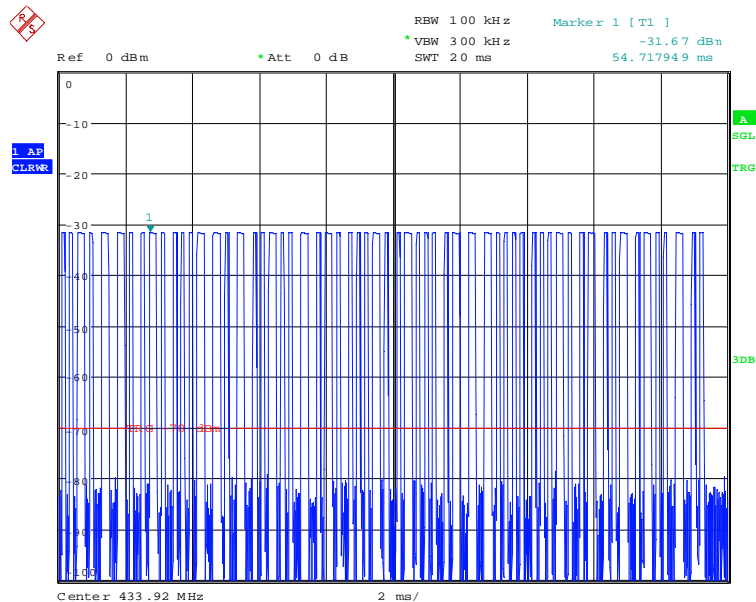


101794_19.wmf: detail view second pulsetrain part 1:



TEST REPORT REFERENCE: F101794E1

101794_20.wmf: detail view second pulsetrain part 2:



Length of first pulse: 3.542 ms
 Length of short pulse: 125 µs
 Length of long pulse: 250 µs

A total pulse train consists of 1 start pulse, 51 short pulses and 46 long pulses

Therefore the total on time is. $3.542 \text{ ms} + 51 \times 0.125 \text{ ms} + 46 \times 0.25 \text{ ms} = 21.417 \text{ ms}$

The duty cycle correction factor is calculated by

$20 \log (21.417 \text{ ms} / 100 \text{ ms}) = -13.4 \text{ dB}$

TEST EQUIPMENT USED FOR THE TEST:

58, 59, 64

TEST REPORT REFERENCE: F101794E1

5.3 BAND-EDGE COMPLIANCE

5.3.1 METHOD OF MEASUREMENT (BAND-EDGE COMPLIANCE (RADIATED))

The same test set-up as used for the final radiated emission measurement shall be used (refer also subclause 5.1.1 of this test report).

The following spectrum analyzer settings shall be used:

- Span: Wide enough to capture the peak level of the emission on the channel closest to the band-edge, as well as any modulation products, which fall outside the assigned frequency band.
- Resolution bandwidth: 100 kHz.
- Video bandwidth: \geq the resolution bandwidth.
- Sweep: Auto.
- Detector function: Peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 20 dB below the first line (or the peak marker). The frequency line shall be set on the edge of the assigned frequency band. Set the second marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is higher than that at the band-edge. This frequency shall be measured with the EMI receiver as described in subclause 5.1.1 of this test report, but 100 kHz resolution bandwidth shall be used.

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

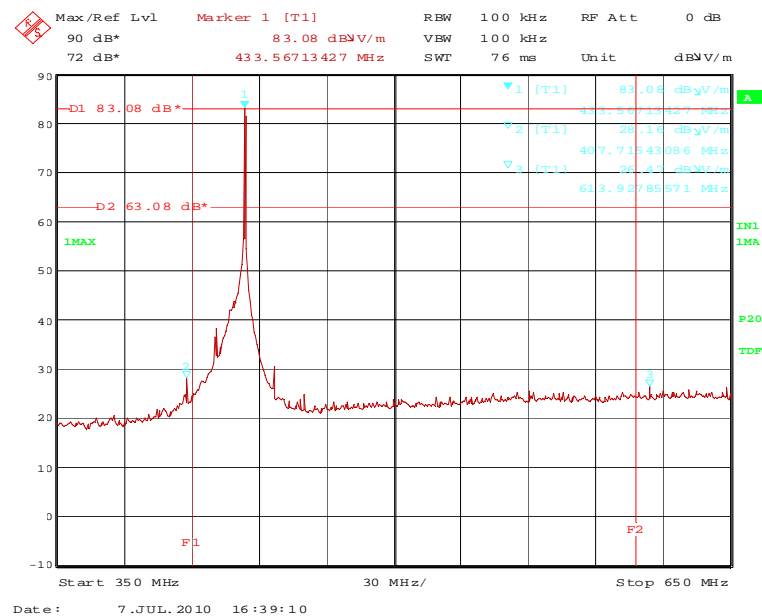
TEST REPORT REFERENCE: F101794E1

5.3.2 TEST RESULT (BAND-EDGE COMPLIANCE (RADIATED))

Ambient temperature	20 °C	Relative humidity	45 %
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The measurement was performed with a matching N device with continuous modulation Button Unlock pressed.

101794_3.wmf: Band edge compliance (radiated):



TEST REPORT REFERENCE: F101794E1

The plot on the page before shows the radiated band-edge compliance for the upper and lower band edge. The display line 1 (D1) in the plot represents the highest level within the assigned frequency band. The display line 2 (D2) represents the 20 dB offset to this highest level and shows the compliance with FCC 47 CFR Part 15.231 (b). The frequency lines 1 (F1) and 2 (F2) are showing the edges of the assigned or restricted frequency bands.

Band edge compliance (lower band edge)										
Result measured with the peak detector and corrected with duty cycle correction factor:										
Frequency MHz	Field- strength dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Duty cycle correction factor	Antenna factor 1/m	Cable loss dB	Height cm	Pol.	Restr. Band
433.920	73.2	80.8	7.6	66.6	-13.4	16.2	3.8	200.0	Hor	No
407.715	18.3	46.0	27.7	12.3	-13.4	15.7	3.7	200.0	Hor	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Band edge compliance (upper band edge)										
Result measured with the peak detector and corrected with duty cycle correction factor:										
Frequency MHz	Field- strength dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Duty cycle correction factor	Antenna factor 1/m	Cable loss dB	Height cm	Pol.	Restr. Band
433.920	73.2	80.8	7.6	66.6	-13.4	16.2	3.8	200.0	Hor	No
613.928	16.6	46.0	29.4	6.3	-13.4	19.2	4.5	200.0	Hor	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 35, 43

TEST REPORT REFERENCE: F101794E1

5.4 20 dB BANDWIDTH

5.4.1 METHOD OF MEASUREMENT (20 dB BANDWIDTH)

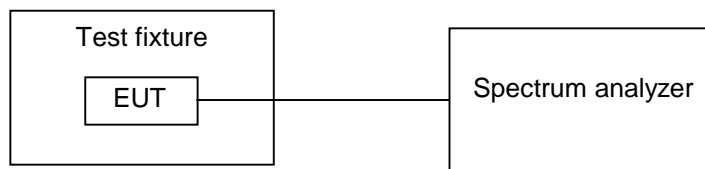
The calibration of the spectrum analyzer has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyzer via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed or a test fixture has to be used. The EUT has to be switched on, the transmitter shall work with its maximum data rate.

The following spectrum analyzer settings shall be used:

- Span: App. 2 to 3 times the 20 dB bandwidth, centred on the actual channel.
- Resolution bandwidth: $\geq 1\%$ of the 20 dB bandwidth.
- Video bandwidth: \geq the resolution bandwidth.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 20 dB below the first line (or the peak marker). The frequency lines shall be set on the intersection points between the second display line and the measured curve.

Test set-up:



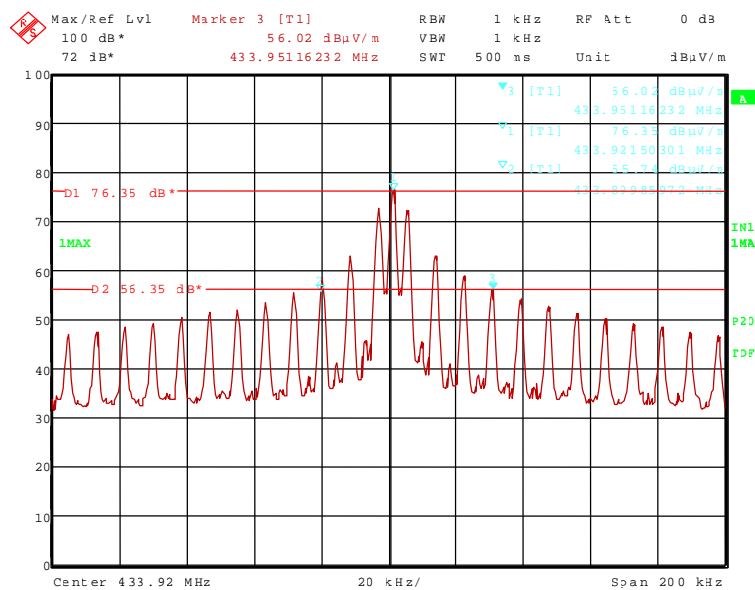
TEST REPORT REFERENCE: F101794E1

5.4.2 TEST RESULTS (20 dB BANDWIDTH)

Ambient temperature	20 °C	Relative humidity	30 %
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The measurement was performed with a matching N device with continuous modulation Button Unlock pressed.

101794_6.wmf: 20 dB Bandwidth:



Lower frequency	Upper frequency	20 dB bandwidth	LIMIT (0.25 % of the center frequency)
433.89985972 MHz	433.95116232 MHz	51.3026 kHz	1083.5 kHz
Measurement uncertainty		+0.66 dB / -0.72 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 34

TEST REPORT REFERENCE: F101794E1

5.5 TRANSMITTER RELEASE TIME

5.5.1 METHOD OF MEASUREMENT (TRANSMITTER RELEASE TIME)

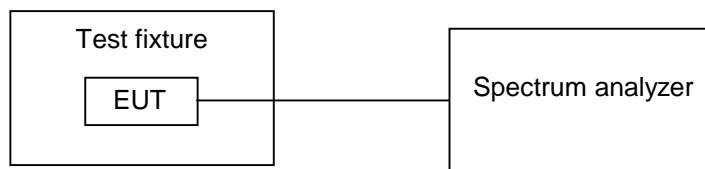
The calibration of the spectrum analyzer has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyzer via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed or a test fixture has to be used. The EUT has to be switched on, the transmitter shall work with its maximum data rate.

The following spectrum analyzer settings shall be used:

- Span: = 0 Hz.
- Resolution bandwidth: 1 MHz.
- Video bandwidth: \geq the resolution bandwidth.
- Sweep: Single sweep with 15 seconds.
- Detector function: peak.
- Trace mode: Max hold.

The frequency line shall be set a point, were the transmitter will be released. The sweep shall start, when the transmitter started to operate, The transmitter shall released when the trace crosses the frequency line. One marker shall be set to the point of the frequency line, a delta marker to the time, were the transmitter stopped transmission.

Test set-up:



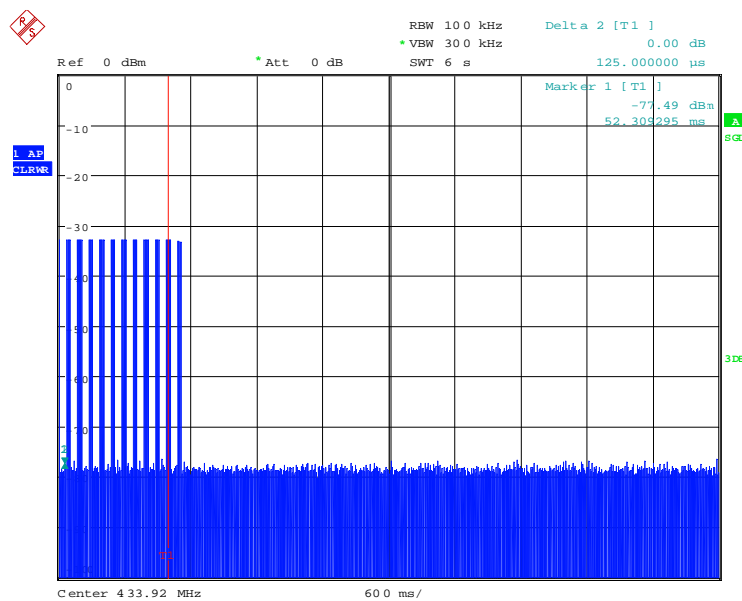
TEST REPORT REFERENCE: F101794E1

5.5.2 TEST RESULTS (TRANSMITTER RELEASE TIME)

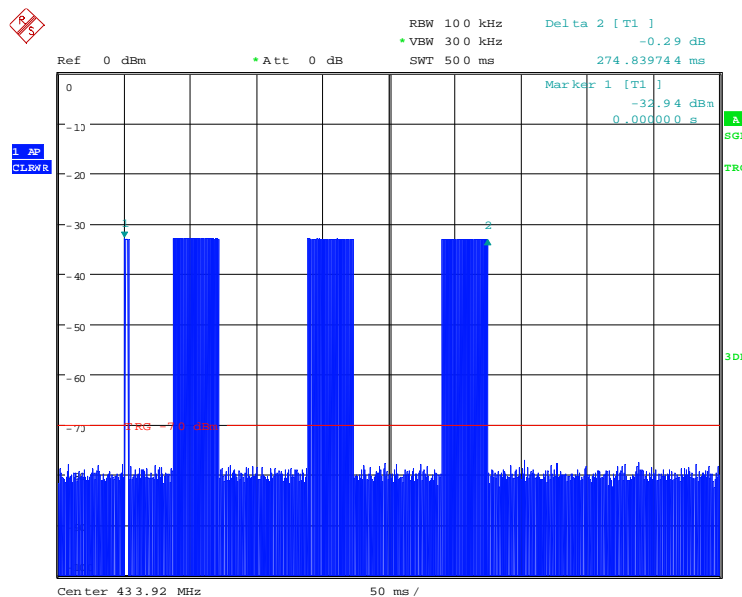
Ambient temperature	20 °C	Relative humidity	30 %
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The measurement was performed with a matching N device in application mode while button panic pressed.

101794_24.wmf: Transmitter release time total view:



101794_26.wmf: Transmitter release time detail view of one trigger :



TEST REPORT REFERENCE: F101794E1

Transmitter release time	LIMIT
274 ms	5 s
Measurement uncertainty	$<10^{-7}$

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

58, 59, 64

TEST REPORT REFERENCE: F101794E1

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	Measuring receiver	ESIB 26	Rohde & Schwarz	100292	481182	02/08/2010	02/2012
3	LISN	NSLK8128	Schwarzbeck	8128155	480058	08/07/2009	08/2010
5	AC-filter	B84299-D87-E3	Siemens	930262292	480097	-	-
6	EMI-Software	ES-K1	Rohde & Schwarz	-	480111	-	-
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	Measuring receiver	ESIB 7	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	CBL6111D	Chase	25761	480894	09/18/2008	09/2013
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	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	10/11/2005	10/2010
43	RF-cable No. 30	RTK 081	Rosenberger	-	410141	Weekly verification (system cal.)	
54	Power supply	66332A	Hewlett Packard	US37471069	480718	12/08/2009	12/2011
56	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	03/10/2010	03/2012
57	EMI test receiver	ESPC	Rohde & Schwarz	843756/006	480150	02/28/2008	02/2010
58	Test fixture	-	Phoenix Test-Lab	-	410160	-	-
59	RF-cable No. 10	RG223	Phoenix-Test-Lab	-	410102	-	-
60	Horn Antenna	3115 A	EMCO	9609-4918	480183	11/07/2008	11/2011
61	High Pass Filter	WHJS1000C 11/60EF	Wainwright Instruments GmbH	1	480413	08/26/2009	08/2010
62	Preamplifier	JS3-00101200-23-5A	Miteq	681851	480337	04/24/2010	04/2011
63	RF-cable No. 31	RTK 081	Rosenberger	-	410142	-	-
64	Spectrum analyzer	FSU 46	Rohde & Schwarz	200125	480956	04/15/2010	04/2012

