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Test Report

Report Number: F135012E1

Applicant:

SICK AG

Manufacturer:

SICK AG

Equipment under Test (EUT):

RFU630

DAkkS
Deutsche
Akkreditierungsstelle
D-PL-17186-01-01
D-PL-17186-01-02
D-PL-17186-01-03

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

REFERENCES

[1] **ANSI C63.4-2009** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

[2] **FCC CFR 47 Part 15 (August 2013)** Radio Frequency Devices

[3] **FCC Public Notice DA 00-705 (March 2000)**

[4] **RSS-210 Issue 8 (December 2010)** Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

[5] **RSS-Gen Issue 3 (December 2010)** General Requirements and Information for the Certification of Radiocommunication Equipment

TEST RESULT

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test.
The complete test results are presented in the following.

Test engineer:	Thomas KÜHN		04 November 2013
	Name	Signature	Date
Authorized reviewer:	Bernd STEINER		04 November 2013
	Name	Signature	Date

RESERVATION

This test report is only valid in its original form.

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 NUMBER.

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1 Identification

1.1 Applicant

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Applicant represented during the test by the following person:	Mr. Michael REHSE

1.2 Manufacturer

Name:	SICK AG
Address:	Merkurring 20 22143 Hamburg
Country:	Germany
Name for contact purposes:	Mr. Michael REHSE
Phone:	+ 49 40 61 16 80 - 248
Fax:	+ 49 40 61 16 80 - 201
eMail Address:	michael.rehse@sick.de
Manufacturer represented during the test by the following person:	Mr. Michael REHSE

1.3 Test laboratory

The tests were carried out at:

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Germany

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

1.4 EUT (Equipment Under Test)

Test object: *	UHF RFID reader
Model name: *	RFU630
FCC ID: *	**WRMRFU630**
IC: *	**10066A-RFU630**
Serial number: *	1342 0016
PCB identifier: *	EK-Frontend 2071803 / EK-Digital 2059896 / EK-Koppler 2060866
Hardware version: *	Zero series
Software version: *	V1.40

1.5 Technical data of equipment

Channel 0	RX:	902.75 MHz	TX:	902.75 MHz
Channel 24	RX:	914.75 MHz	TX:	914.75 MHz
Channel 49	RX:	927.25 MHz	TX:	927.25 MHz

Rated RF output power: *	Max. 30 dBm (conducted)					
Antenna type: *	Internal or external (refer table below)					
Antenna gain: *	6 dBi (internal), up to 11.0 dBi (for external patch antenna)					
Antenna connector: *	Reverse TNC					
Adaptive frequency agility: *	Yes					
Modulation: *	PR-ASK / DSB-ASK					
Supply Voltage: *	U_{nom}=	24.0 V DC	U_{min}=	12.0 V DC	U_{max}=	30.0 V DC
Temperature range: *	-30 °C to +60 °C					
Ancillary used for test:	A switchbox typ CDB620-001 was used to connect the EUT to the power supply, AC / DC adaptor type MINI-PS-100-240AC/24DC/1 (conducted emissions on AC mains only).					

* declared by the applicant.

The following external I/O cables were used:

Identification	Connector		Length
	EUT	Ancillary	
External antenna port	RP-BNC	RP-BNC	1.0 m
Ethernet	4-pin M12-connector	-	2.0 m
Power / RS422 and external Sensor	17-pin M12-connector	SubD 15pin (CDB620-001)	1.5 m

*: Length during the test if no other specified.

The following patch antennas are intended to be used in combination with the EUT

No.	Manufacturer	Model name	max. Gain
1	SICK AG	RFA630-001	6.0 dBi
2	Poynting	PATCH-A0025	7.0 dBi
3	Huber+Suhner	Sencity Antenna	8.0 dBi
4	Kathrein	UHF RFID Wide Range Antenna	7.5 dBi
5	Times7	SlimLine FCC	11.0 dBi
6	Huber+Suhner	Sencity SPOT-L RFID Antenna	5.0 dBi
7	Huber+Suhner	Sencity SPOT-L RFID Antenna	6.0 dBi
8	Huber+Suhner	Sencity SPOT-L RFID Under-Belt Antenna	5.0 dBi

1.6 Dates

Date of receipt of test sample:	17 October 2013
Start of test:	28 October 2013
End of test:	31 October 2013

2 Operational states

All tests were carried out with an unmodified sample with integral antenna and three external antenna ports.

During the all tests the RFU320 was powered by an external 24.0 V DC power supply. During the emission measurement on the AC supply line the EUT was powered by an AC / DC adaptor type MINI-PS-100-240AC/24DC/1.

The operation mode could be chosen with the help of a laptop computer with a test-software, communicates with the EUT via the Ethernet line.

As declared by the applicant the output of the EUTs power amplifier is switched to a multiplexer that switched the power amplifier to one of the ports at the same time. Therefore no combiner was necessary for measurements on the antenna ports. All conducted measurements were carried out on antenna port 3, because there was no measurable difference to the other ports.

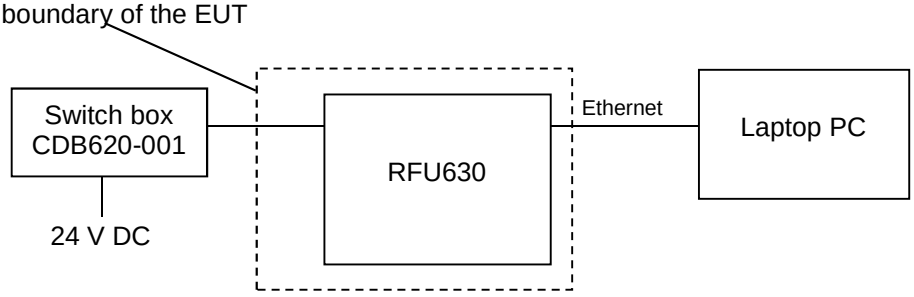
The EUT is intended to be used in combination with several patch antennas with different antenna gains. For installation the professional installer has to type in the gain of the used antenna and the cable attenuation. The output power of the EUT will be reduced automatically by the firmware in case of antenna gain of more than 6 dBi. All measurements were carried out with the output power of the EUT was set to 30 dBm (maximum value) and using the internal patch antenna because this combination represents the maximum allowed output power and the maximum allowed antenna gain with the lowest possible cable attenuation. Except the peak output power measurement all measurement were carried out with the maximum output power (30 dBm). For measuring the peak output power all possible power steps assuming 0 dB cable attenuation were measured and documented.

The following test modes were adjusted during the tests:

Test items	Operation mode	Used modulation *
20 dB bandwidth	1, 2, 3	DSB-ASK (Link_Profile 3) and PR-ASK (Robust/Industrial)
Carrier frequency separation	1, 2, 3	DSB-ASK (Link_Profile 3)
Number of hopping channels	4	PR-ASK (Robust/Industrial)
Dwell time	1, 2, 3	PR-ASK (Robust/Industrial)
Maximum peak output power	1, 2, 3	PR-ASK (Robust/Industrial)
Radiated emissions (transmitter)	1, 2, 3	PR-ASK (Robust/Industrial)
Conducted emissions on supply line	4	PR-ASK (Robust/Industrial)

*: As pre-tests have shown the used modulation type represents the worst case modulation for the tested item.

Physical boundary of the EUT



3 Additional information

As declared by the applicant the EUT is available in different variants. For these variants the model name is extended as described below:

RFU630-13101 1 x internal antenna, 3 x external antennas
RFU630-10101 1 x internal antenna, no external antenna
RFU630-04101 No internal antenna, 4 x external antennas

The tests documented in this test report were carried out with an RFU630-13101.

As declared by the applicant the combination of antenna gain and cable loss will not exceed 6.0 dBi.

During the tests the EUT was not labelled as required by FCC / IC.

4 Overview

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS 210, Issue 8 [4] or RSS-Gen, Issue 3 [5]	Status	Refer page
20 dB bandwidth	General	15.247 (a) (1) (i)	A8.1 (c) [4]	Passed	9 et seq.
Carrier frequency separation	General	15.247 (a) (1) (i)	-	Passed	12 et seq.
Number of hopping channels	902.0 – 928.0	15.247 (a) (1) (i)	A8.1 (c) [4]	Passed	15 et seq.
Dwell time	902.0 – 928.0	15.247 (a) (1) (i)	A8.1 (c) [4]	Passed	17 et seq.
Maximum peak output power	902.0 – 928.0	15.247 (b) (2)	A8.4 (1) [4]	Passed	19 et seq.
Radiated emissions (transmitter)	0.009 - 10,000	15.247 (d) 15.205 (a) 15.209 (a)	A8.5 [4] 2.5 [4] 7.2.2 [5]	Passed	23 et seq.
Conducted emissions on supply line	0.15 - 30	15.207 (a)	7.2.4 [5]	Passed	45 et seq.
Radiated emissions (receiver)	30 – 5,000	15.109 (a)	6.1 [5]	Not carried out *	-

*: No measurement of the receiver spurious emissions was carried out, because of a continuously operating co-located transmitter.

5 Test results

5.1 20 dB bandwidth

5.1.1 Method of measurement (20 dB bandwidth)

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 EUT has to be switched on and the hopping function has to be disenabled, the transmitter shall work with its maximum data rate.

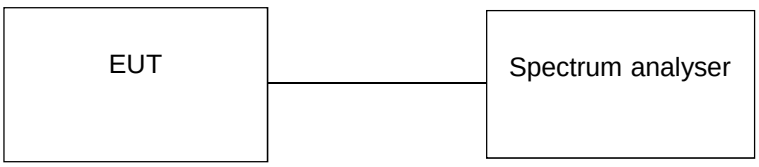
The following spectrum analyser settings shall be used:

- Span: App. 2 to 3 times the 20 dB bandwidth, centred on the actual hopping channel.
- Resolution bandwidth: ≥ 1 % of the 20 dB bandwidth.
- Video bandwidth: ≥ 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.

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

Test set-up:

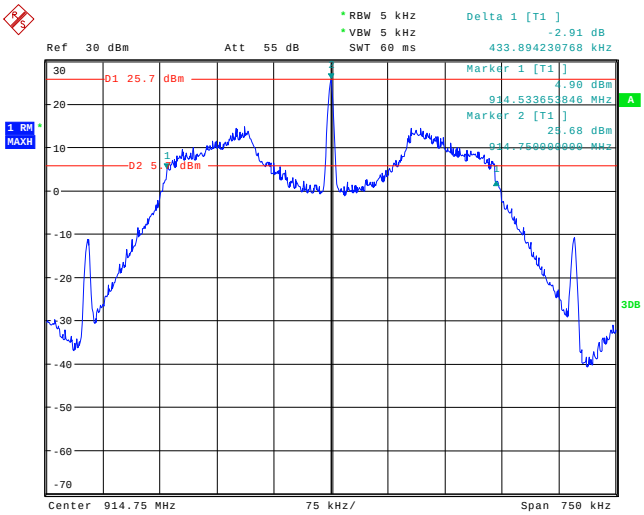


5.1.2 Test results (20 dB bandwidth)

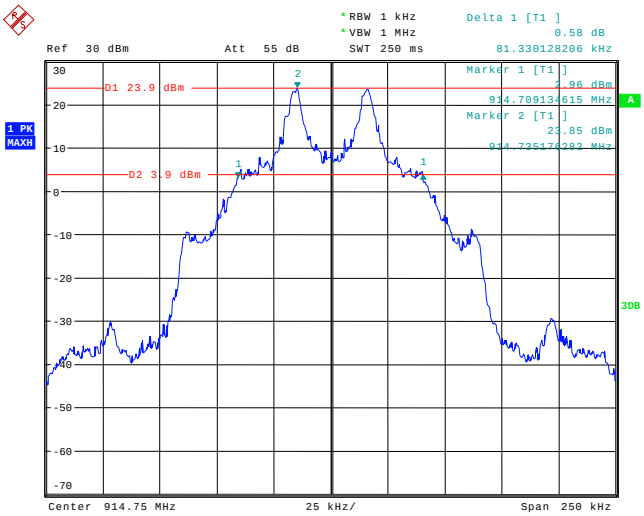
Ambient temperature	21 °C

Relative humidity	45 %

135012_70.wmf: 20 dB bandwidth at the middle of the assigned frequency band (Link_Profile_3):



135012_89.wmf: 20 dB bandwidth at the middle of the assigned frequency band (Robust/Industrial):



Channel number	Channel frequency [MHz]	20 dB bandwidth [kHz]
Maximum 20 dB bandwidth		
0	902.750	427.885
24	914.750	433.894
49	927.250	431.490
Minimum 20 dB bandwidth		
0	902.750	82.131
24	914.750	81.330
49	927.250	81.330
Measurement uncertainty		+0.66 dB / -0.72 dB

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
30

5.2 Carrier frequency separation

5.2.1 Method of measurement (carrier frequency separation)

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 EUT has to be switched on and the hopping function has to be enabled.

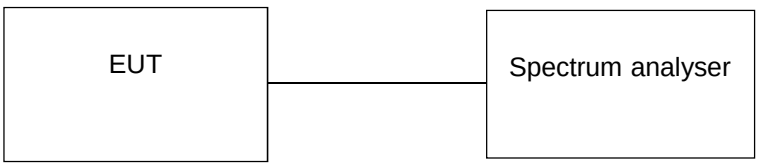
The following spectrum analyser settings shall be used:

- Span: Wide enough to capture the peaks of two adjacent channels.
- Resolution bandwidth: ≥ 1 % of the span.
- Video bandwidth: ≥ the resolution bandwidth.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.

After trace stabilisation the marker and the delta marker function will be used to determine the separation between the peaks of two adjacent channel signals.

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

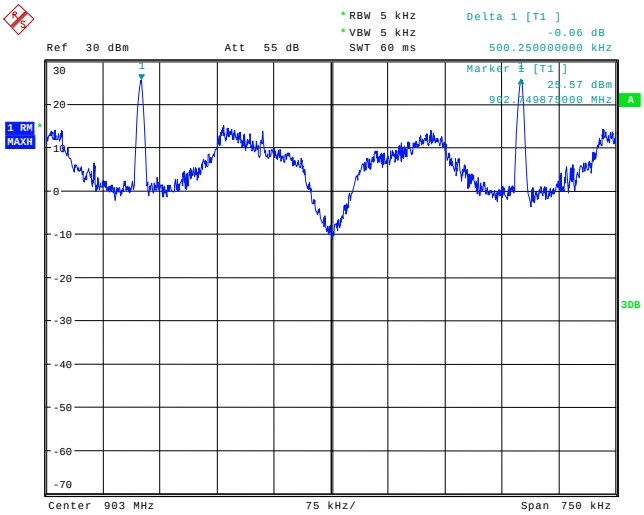
Test set-up:



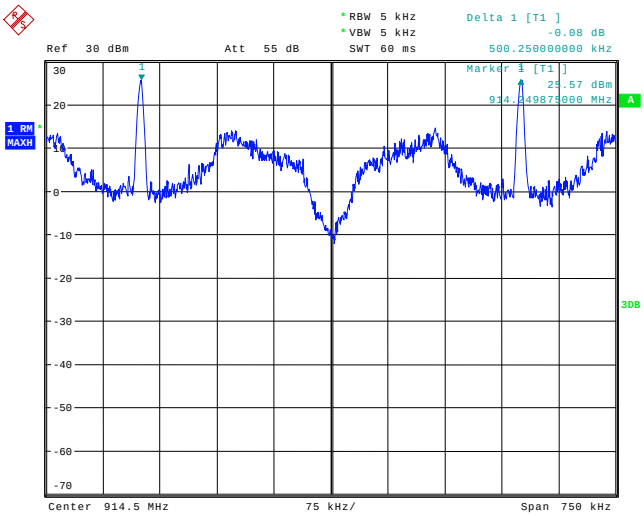
5.2.2 Test results (carrier frequency separation)

Ambient temperature	21 °C		Relative humidity	45 %

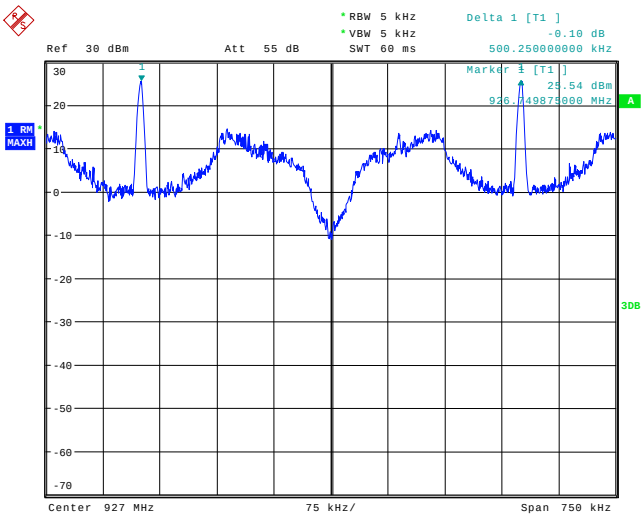
135012_72.wmf: Channel separation at the lower end of the assigned frequency band:



135012_73.wmf: Channel separation at the middle of the assigned frequency band:



135012_74.wmf: Channel separation at the upper end of the assigned frequency band:



Channel number	Channel frequency [MHz]	Channel separation [kHz]	Minimum limit [kHz]
0	902.750	500.250	427.885 (the 20 dB bandwidth)
24	914.750	500.250	433.894 (the 20 dB bandwidth)
49	927.250	500.250	431.490 (the 20 dB bandwidth)
Measurement uncertainty			$<10^{-7}$

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
30

5.3 Number of hopping frequencies

5.3.1 Method of measurement (number of hopping frequencies)

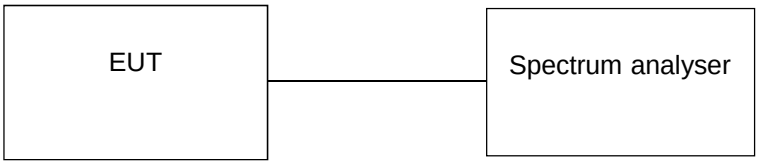
The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT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

The following spectrum analyser settings shall be used:

- Span: Equal to the assigned frequency band.
- Resolution bandwidth: ≥ 1 % of the span.
- Video bandwidth: ≥ the resolution bandwidth.
- Sweep: Auto.
- Detector function: Peak.
- Trace mode: Max hold.

After trace stabilisation the number of hopping channels could be counted. It might be possible to divide the span into some sub ranges in order to clearly show all hopping frequencies.

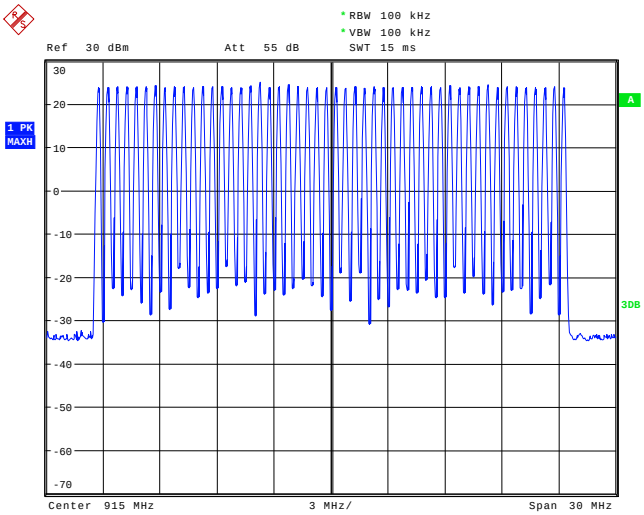
Test set-up:



5.3.2 Test results (number of hopping frequencies)

Ambient temperature	21 °C	Relative humidity	45 %

135012_68.wmf: Number of hopping channels:



Number of hopping channels	Limit
Operation mode 4	
50	At least 50

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
30

5.4 Dwell time

5.4.1 Method of measurement (dwell time)

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 EUT has to be switched on and the hopping function has to be enabled.

The following spectrum analyser settings shall be used:

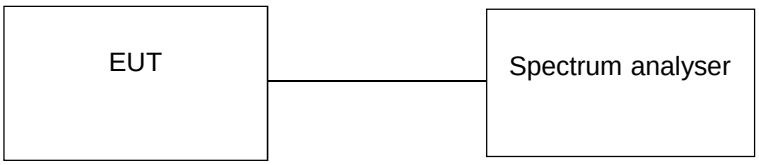
- Span: Zero, centred on a hopping channel.
- Resolution bandwidth: 1 MHz.
- Video bandwidth: ≥ the resolution bandwidth.
- Sweep: As necessary to capture the entire dwell time per hopping channel.
- Detector function: peak.
- Trace mode: Max hold.

The marker and delta marker function of the spectrum analyser will be used to determine the dwell time.

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

If the EUT is possible to operate with different mode of operation (data rates, modulation formats etc.) the test will be repeated with every different operation mode of the EUT.

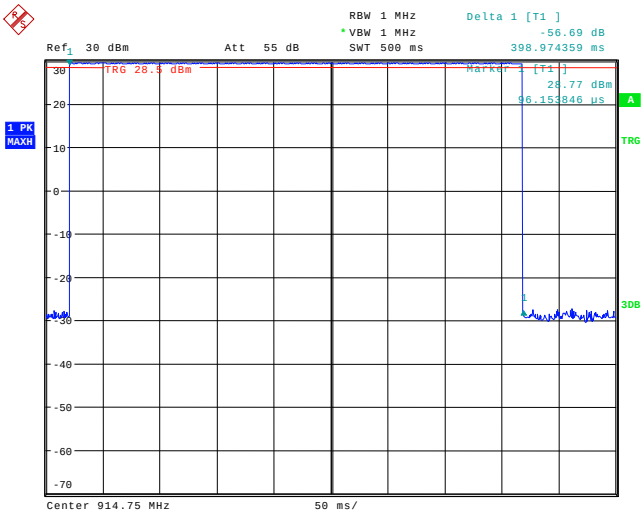
Test set-up:



5.4.2 Test results (dwell time)

Ambient temperature	21 °C	Relative humidity	45 %

135012_87.wmf: Dwell time at the middle of the assigned frequency band:



The dwell time is calculated with the following formula:

Dwell time = t_{pulse} x n_{hops} / number of hopping channels x 20 s

Where:

t_{pulse} is the measured pulse time (pls. refer the plots of the spectrum analyser above) [s],
n_{hops} is the number of hops per second in the actual operating mode of the transmitter [1/s].

The hopping rate of the system is 2.5 hops per second and the system uses 50 channels.

Channel number	Channel frequency [MHz]	t_{pulse} [ms]	Dwell time [ms]	Limit [ms]
25	914.750	398.974	398.974	400
Measurement uncertainty			$<10^{-7}$	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
30

5.5 Maximum peak output power

5.5.1 Method of measurement (maximum peak output power)

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 EUT has to be switched on and the hopping function has to be disenabled.

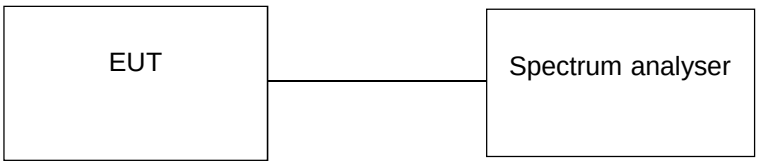
The following spectrum analyser settings shall be used:

- Span: Approx. 5 times the 20 dB bandwidth, centred on a hopping channel.
- Resolution bandwidth: > the 20 dB bandwidth of the emission being measured.
- Video bandwidth: ≥ 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 indicated level is the peak output power, which has to be corrected with the value of the cable loss and an external attenuation (if necessary).

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

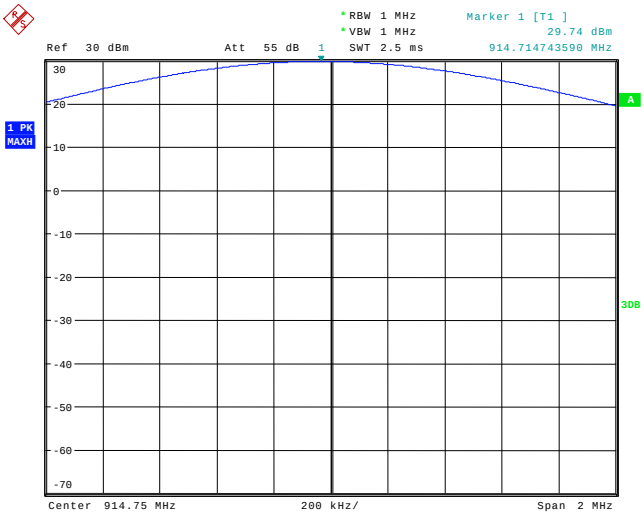
Test set-up:



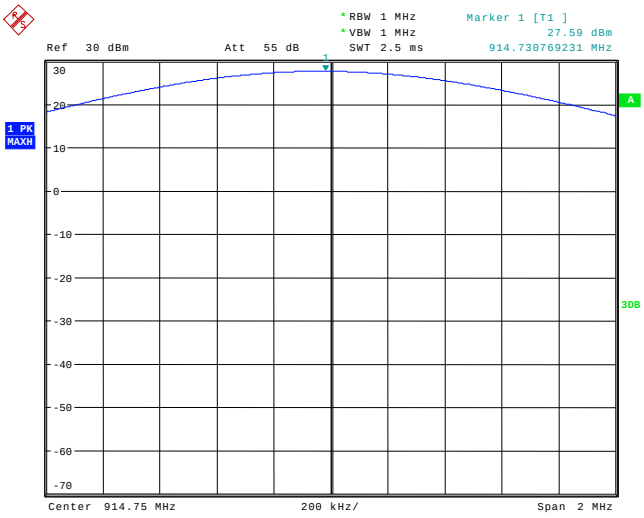
5.5.2 Test results (maximum peak output power)

Ambient temperature	21 °C	Relative humidity	45 %

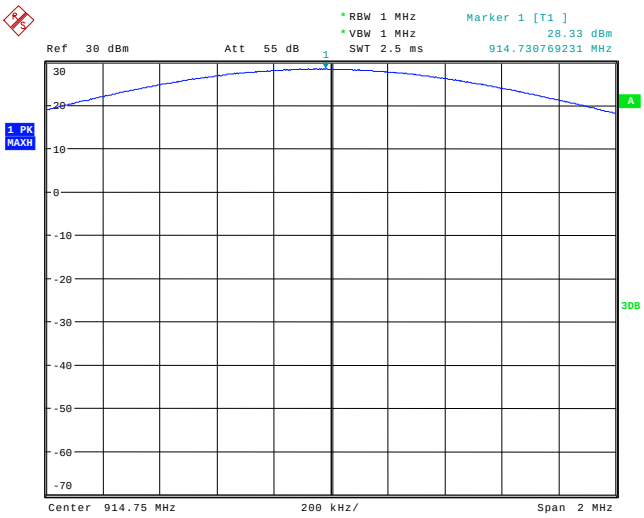
135012_76.wmf: Maximum peak output power at the middle of the assigned frequency band (power setting 30 dBm):



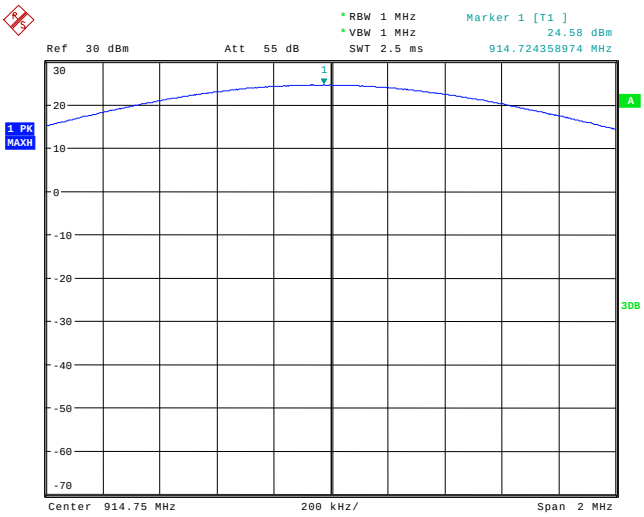
135012_79.wmf: Maximum peak output power at the middle of the assigned frequency band (power setting 28 dBm):



135012_82.wmf: Maximum peak output power at the middle of the assigned frequency band (power setting 28.5 dBm):



135012_85.wmf: Maximum peak output power at the middle of the assigned frequency band (power setting 25 dBm):



Operation mode	Channel number	Channel frequency [MHz]	Maximum peak output power [dBm]	Antenna gain [dBi]	Peak power limit [dBm]
Power setting 30 dBm					
1	0	902.750	29.9	6.0	30.0
2	24	914.750	29.7	6.0	30.0
3	49	927.250	29.8	6.0	30.0
Power setting 28 dBm					
1	0	902.750	27.8	8.0	28.0
2	24	914.750	27.6	8.0	28.0
3	49	927.250	27.6	8.0	28.0
Power setting 28.5 dBm					
1	0	902.750	28.4	7.5	28.5
2	24	914.750	28.3	7.5	28.5
3	49	927.250	28.3	7.5	28.5
Power setting 25 dBm					
1	0	902.750	24.7	11.0	25.0
2	24	914.750	24.6	11.0	25.0
3	49	927.250	24.6	11.0	25.0
Measurement uncertainty				+0.66 dB / -0.72 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
30

5.6 Radiated emissions

5.6.1 Method of measurement (Radiated emissions)

The radiated emission measurement is subdivided into four stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 9 kHz to 110 GHz.
- A final measurement carried out on an outdoor test side without reflecting ground plane and a fixed antenna height in the frequency range 9 kHz to 30 MHz.
- A final measurement carried out on an open area test side with reflecting ground plane and various antenna heights in the frequency range 30 MHz to 1 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 110 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 disenabled.

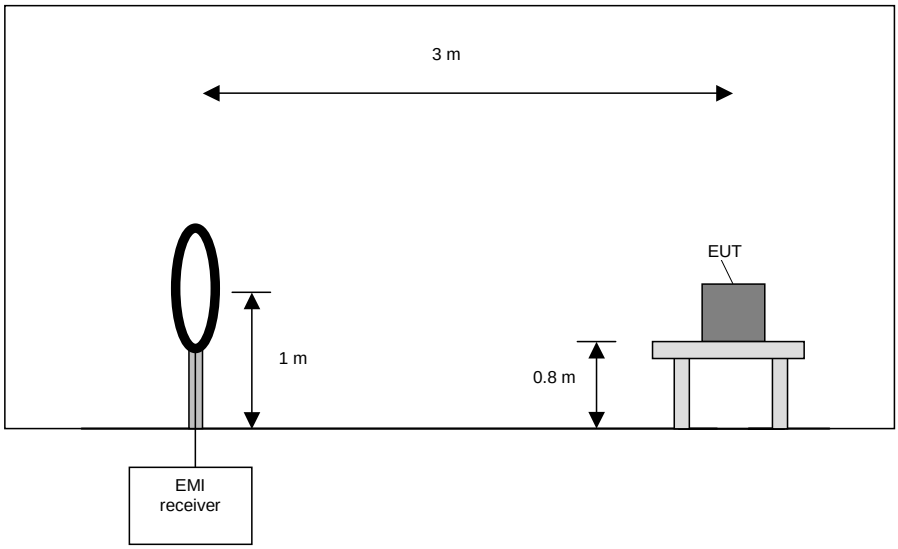
Preliminary measurement (9 kHz to 30 MHz):

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

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

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

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



Preliminary measurement procedure:

Prescans were performed in the frequency range 9 kHz to 150 kHz, 150 kHz to 1 MHz and 1 MHz 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).

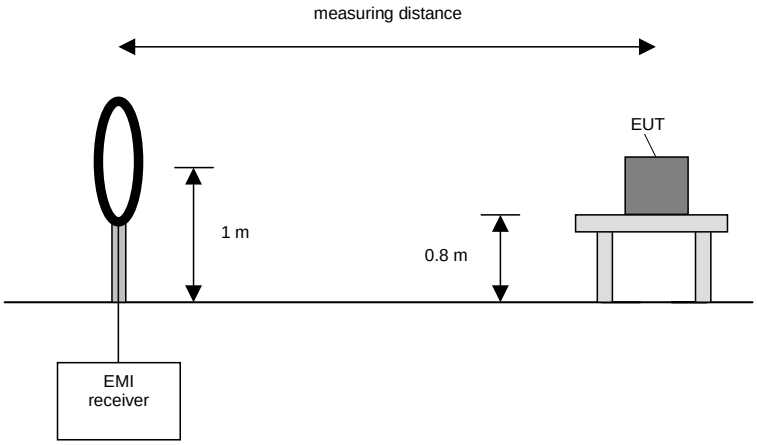
Final measurement (9 kHz to 30 MHz):

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane with 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	10 kHz



Final measurement procedure:

The following procedure will be used:

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

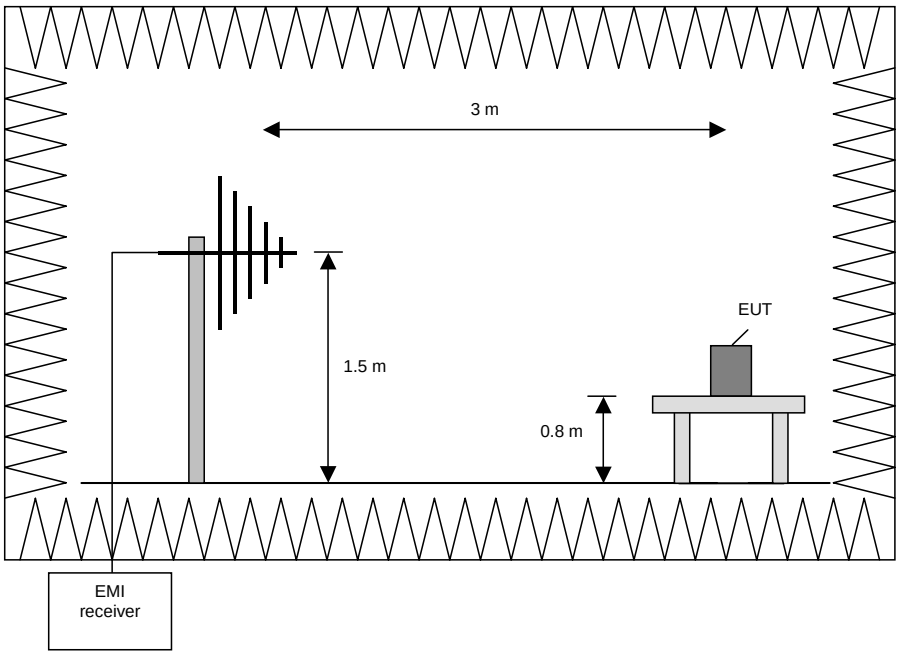
Preliminary measurement (30 MHz to 1 GHz)

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

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

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

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



Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.
The following procedure will be used:

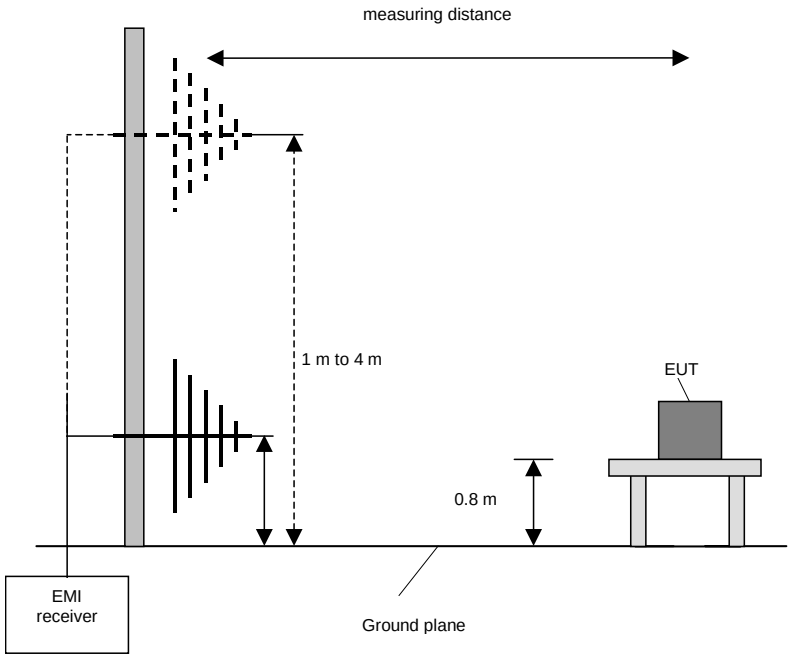
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the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

Final measurement (30 MHz to 1 GHz)

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

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

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure final measurement:

The following procedure will be used:

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

Preliminary and final measurement (1 GHz to 110 GHz)

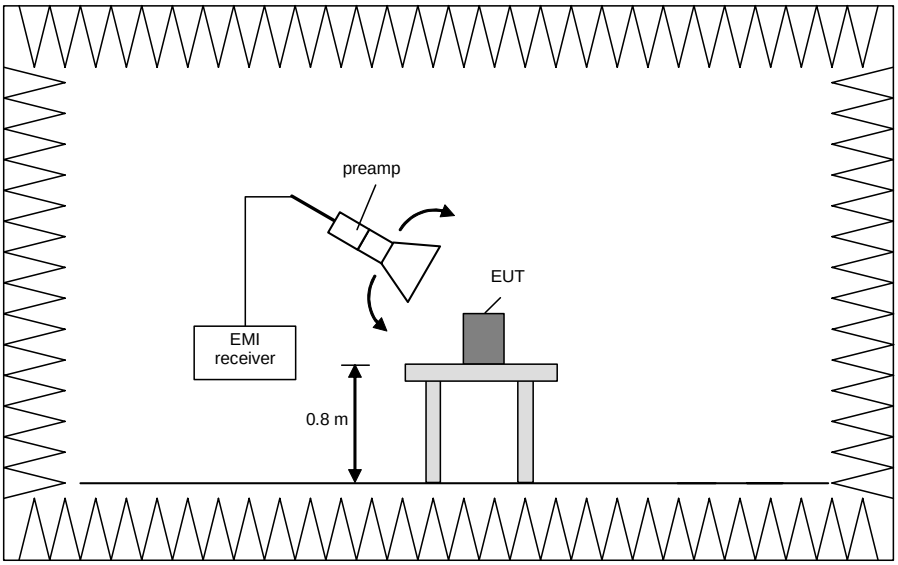
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set-up of the Equipment under test will be in accordance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

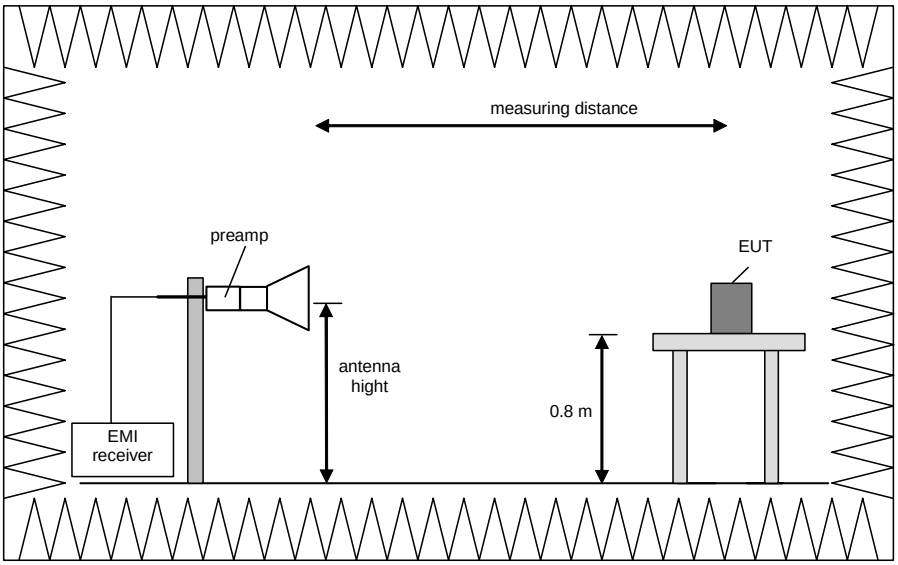


Final measurement (1 GHz to 110 GHz)

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



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 beam width.

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

5.6.2 Test results (radiated emissions)

5.6.2.1 Preliminary radiated emission measurement

Ambient temperature	21 °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.

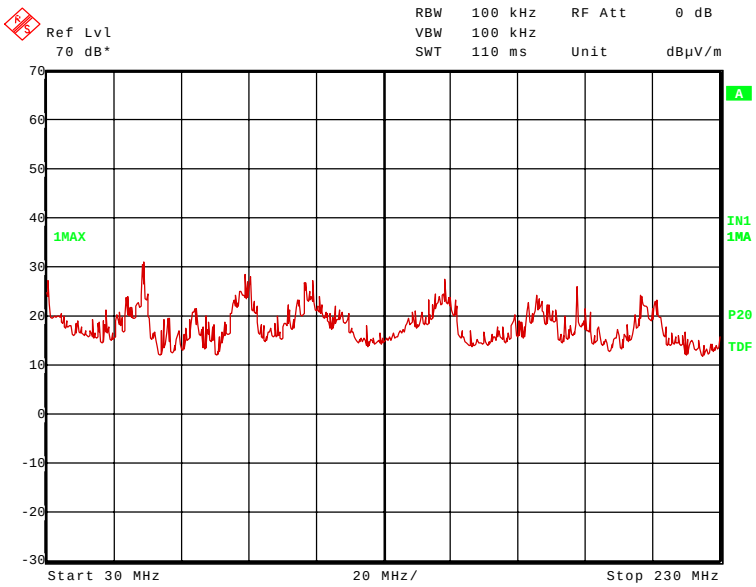
Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 24 V DC by an external power supply.

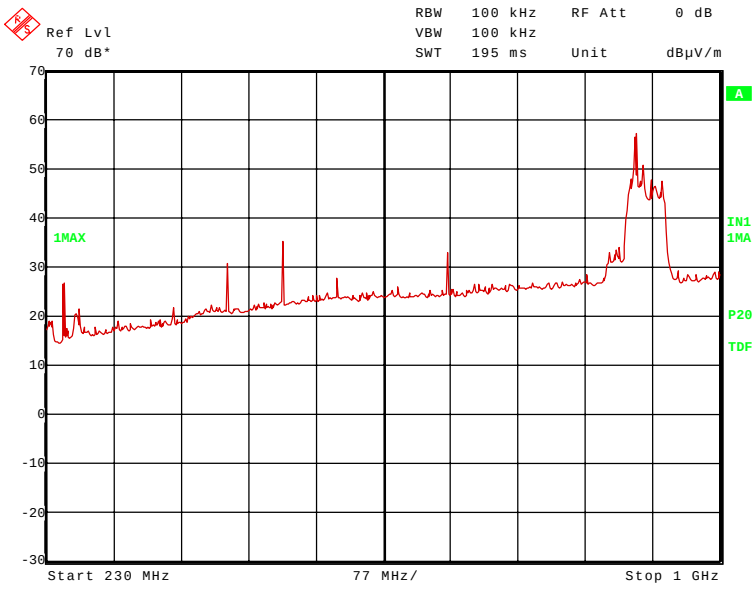
Remark: As pre-tests have shown, the emissions in the frequency range 1 MHz to 30 MHz are not depending on the transmitter operation mode. Therefore the emissions in this frequency range were measured only with the transmitter operates in operation mode 2.

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

135012_56.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 1):



135012_55.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 1, carrier notched):



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

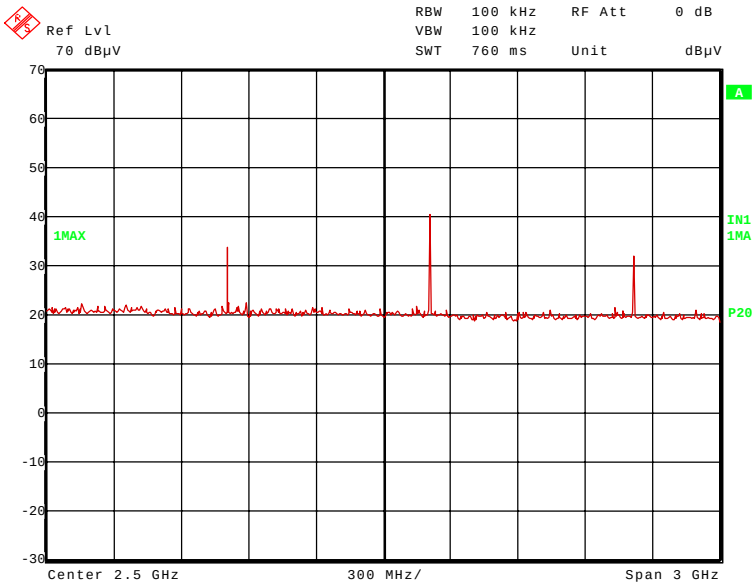
- 30.640 MHz, 58.788 MHz, 88.861 MHz, 148.122 MHz, 437.500 MHz, 500.000 MHz, 687.494 MHz and 902.750 MHz.

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

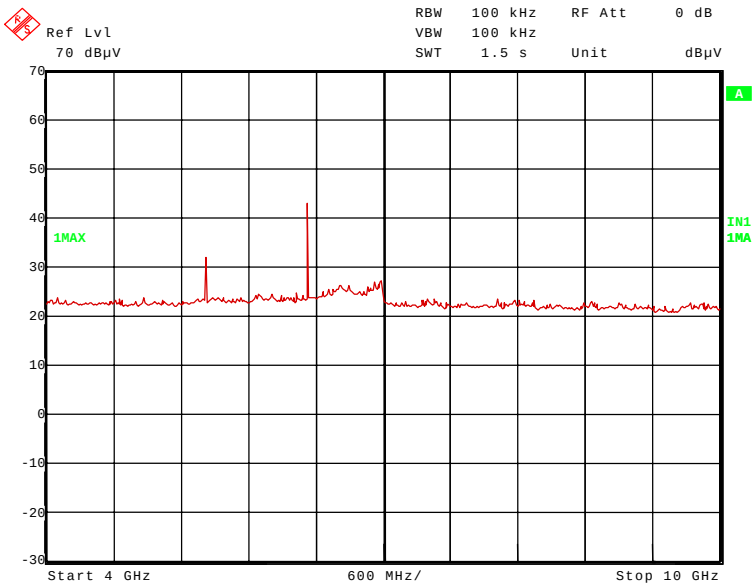
- 109.378 MHz and 250.000 MHz.

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

135012_63.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 1):



135012_64.wmf: Spurious emissions from 4 GHz to 10 GHz (operation mode 1):



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

- 2.70825 GHz, 3.611 GHz and 5.4165 GHz.

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

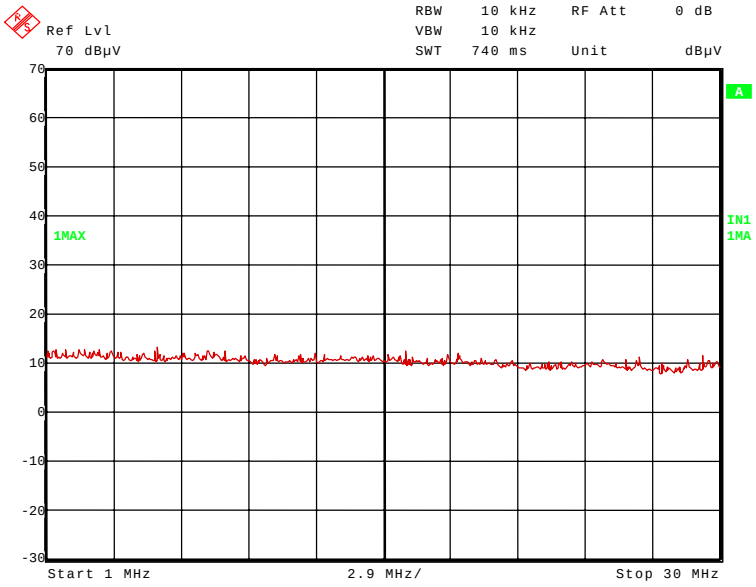
- 1.8055 GHz and 6.31925 GHz.

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

TEST EQUIPMENT USED FOR THE TEST:
29, 31 - 36, 43, 44, 49, 55, 73, 75

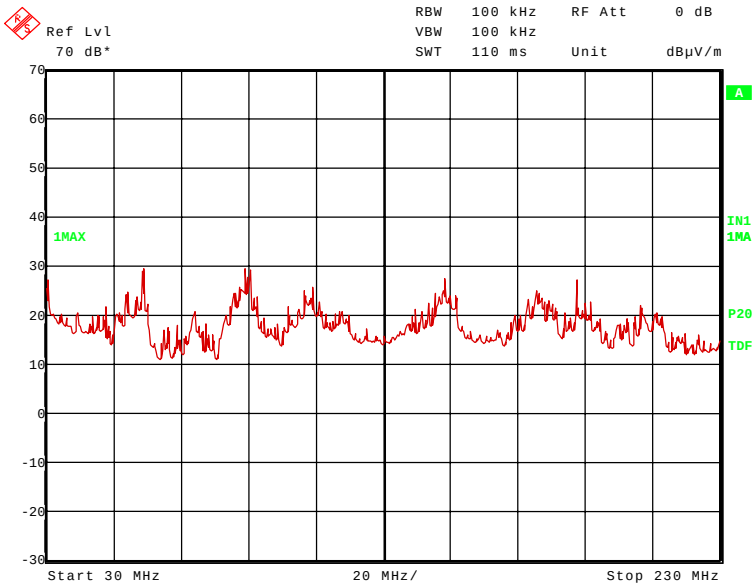
Transmitter operates on the middle of the assigned frequency band (operation mode 2)

135012_67.wmf: Spurious emissions from 1 MHz to 30 MHz (operation mode 2):

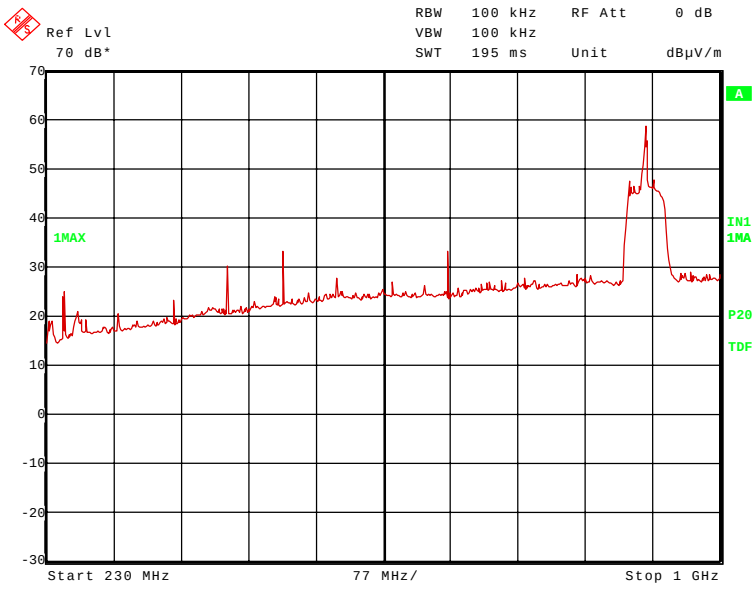


No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the outdoor test site.

135012_57.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 2):



135012_58.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 2, carrier notched):



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

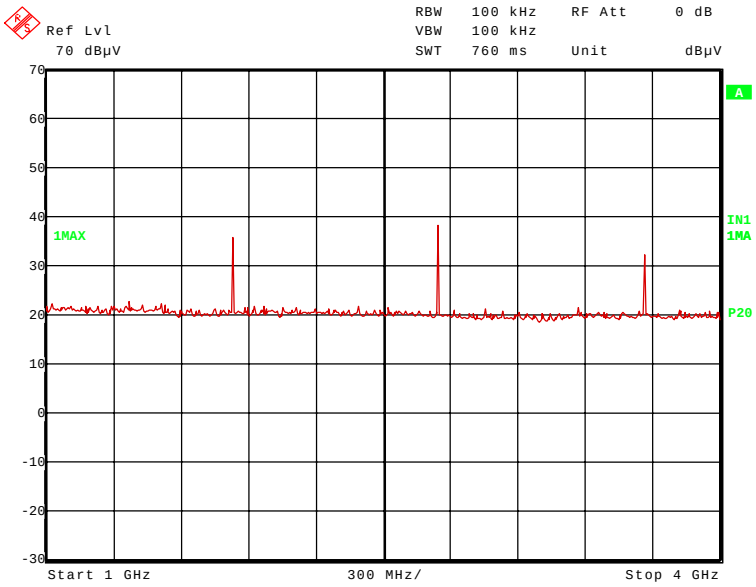
- 30.640 MHz, 58.788 MHz, 88.861 MHz, 148.122 MHz, 187.503 MHz, 437.500 MHz, 500.000 MHz, 687.494 MHz and 914.750 MHz.

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

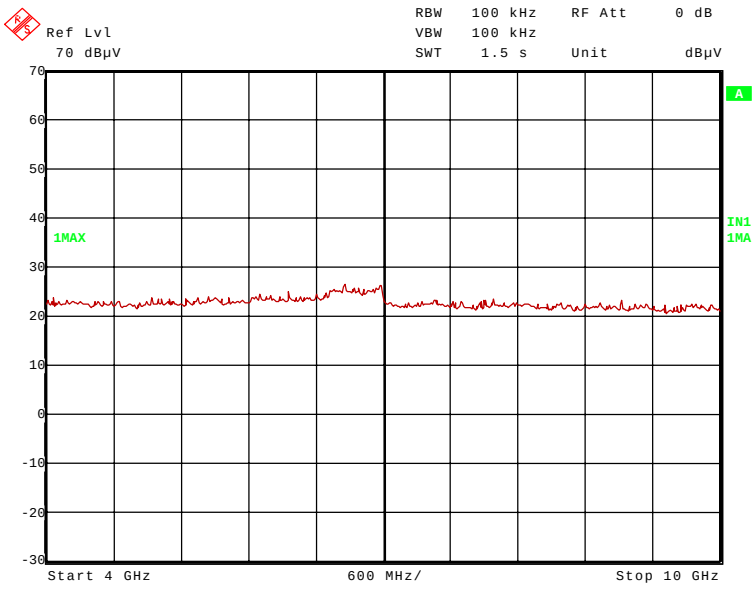
- 108.795 MHz and 250.000 MHz.

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

135012_62.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 2):



135012_.wmf: Spurious emissions from 4 GHz to 10 GHz (operation mode 2):



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

- 2.74425 GHz and 3.659 GHz.

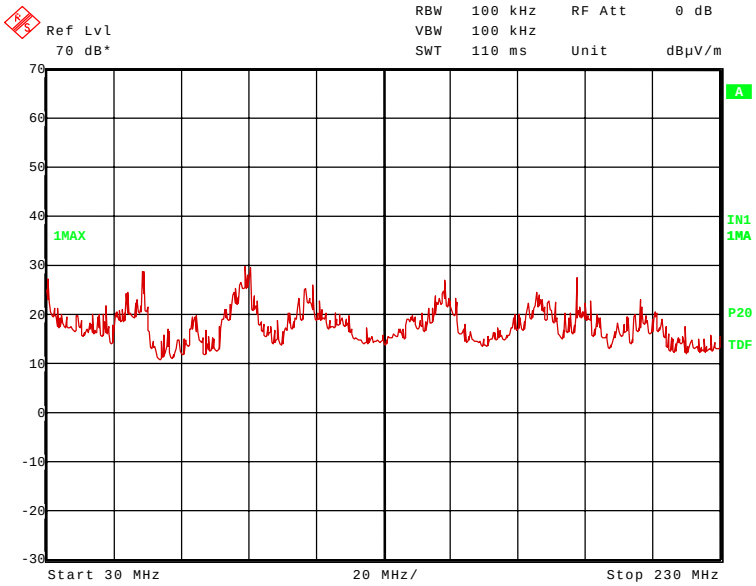
The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 1.8295 GHz, 5.4885 GHz and 6.40325 GHz.

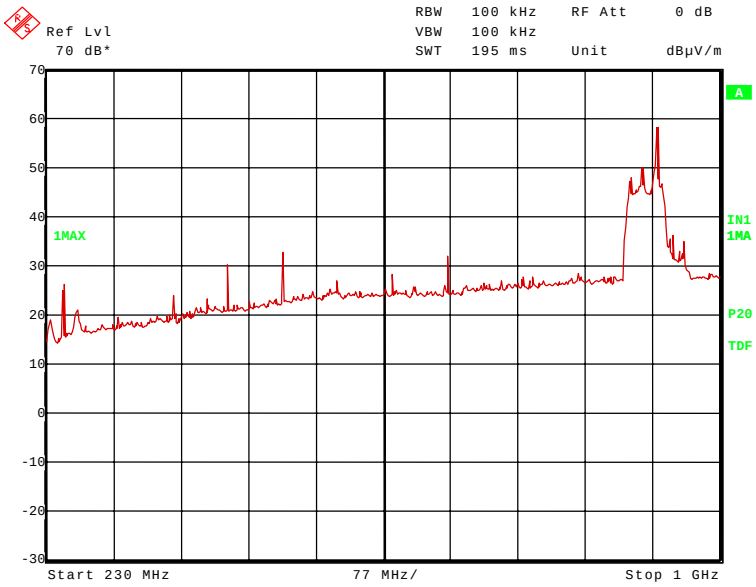
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates on the upper end of the assigned frequency (operation mode 3)

135012_59.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 3):



135012_60.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 3, carrier notched):



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

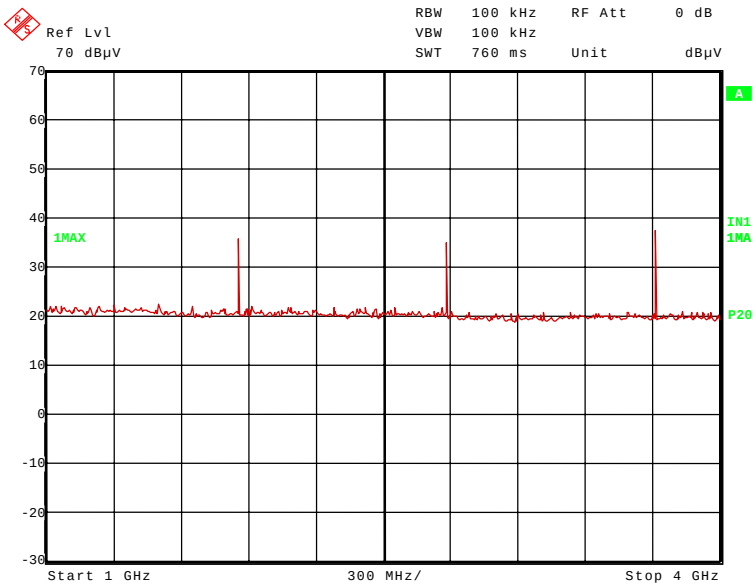
- 30.640 MHz, 58.788 MHz, 88.861 MHz, 148.122 MHz, 187.503 MHz, 437.500 MHz, 500.000 MHz, 687.494 MHz, 927.250 MHz and 944.760 MHz.

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

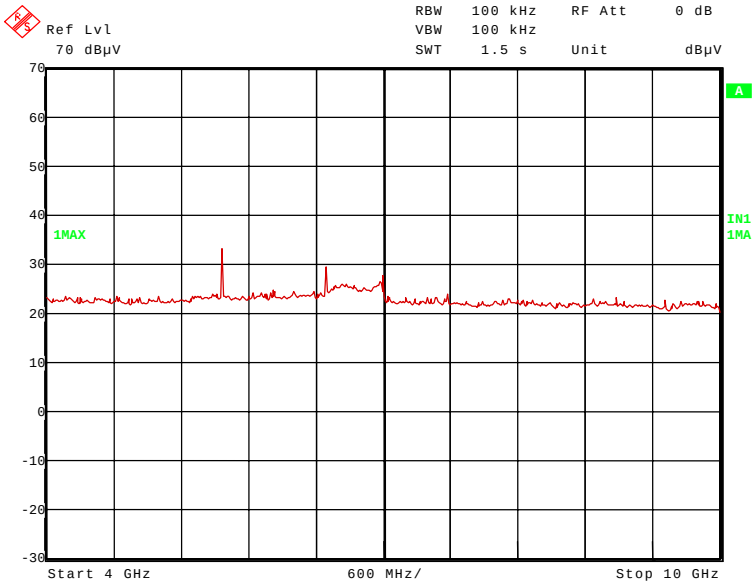
- 108.503 MHz and 250.000 MHz.

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

135012_61.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 3):



135012_66.wmf: Spurious emissions from 4 GHz to 10 GHz (operation mode 3):



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

- 2.78175 GHz and 3.709 GHz.

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

- 1.8545 GHz, 5.5635 GHz and 6.49075 GHz.

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

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

Ambient temperature	20 °C	Relative humidity	44 %

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: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 24 V DC by an external power supply.

Test results: The test results were calculated with the following formula:

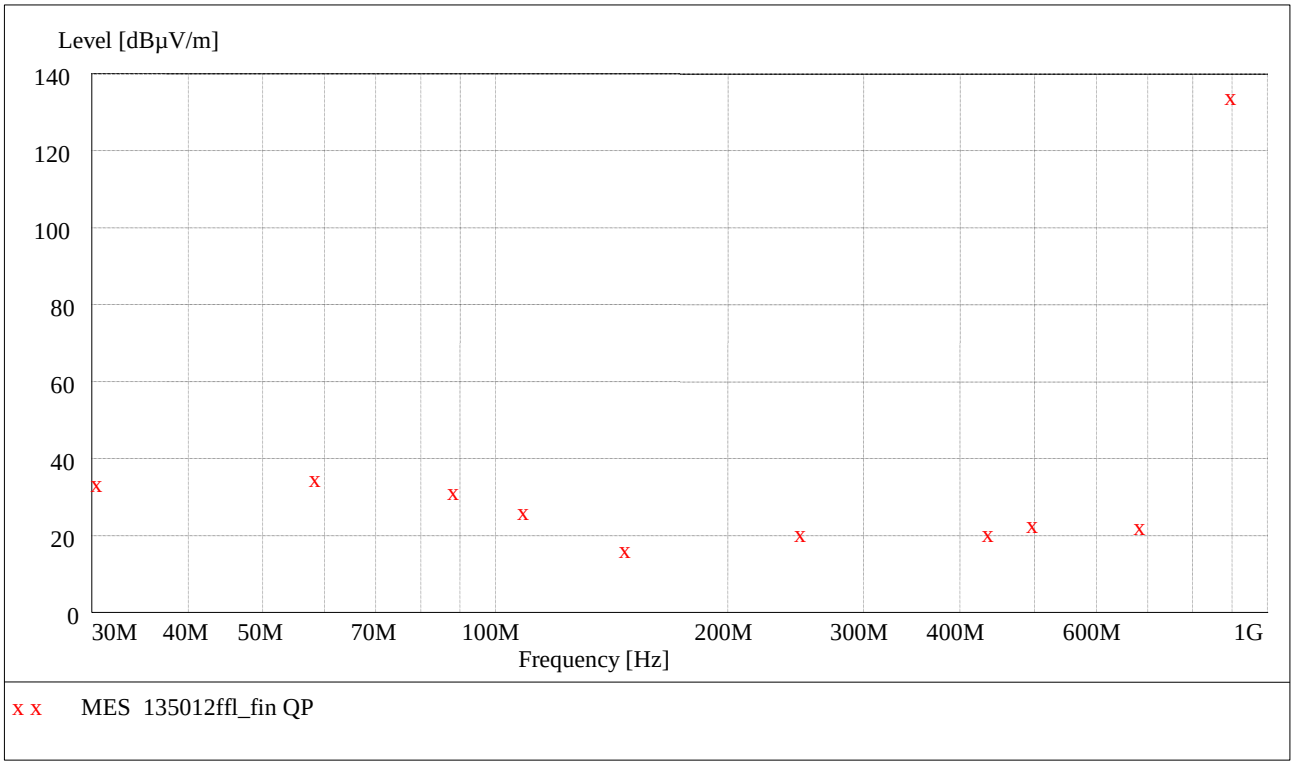
Result [dBµV/m] = reading [dBµV] + cable loss [dB] + antenna factor [dB/m]

The measured points and the limit line in the following diagrams 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 final measurement on the open area test site.

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.

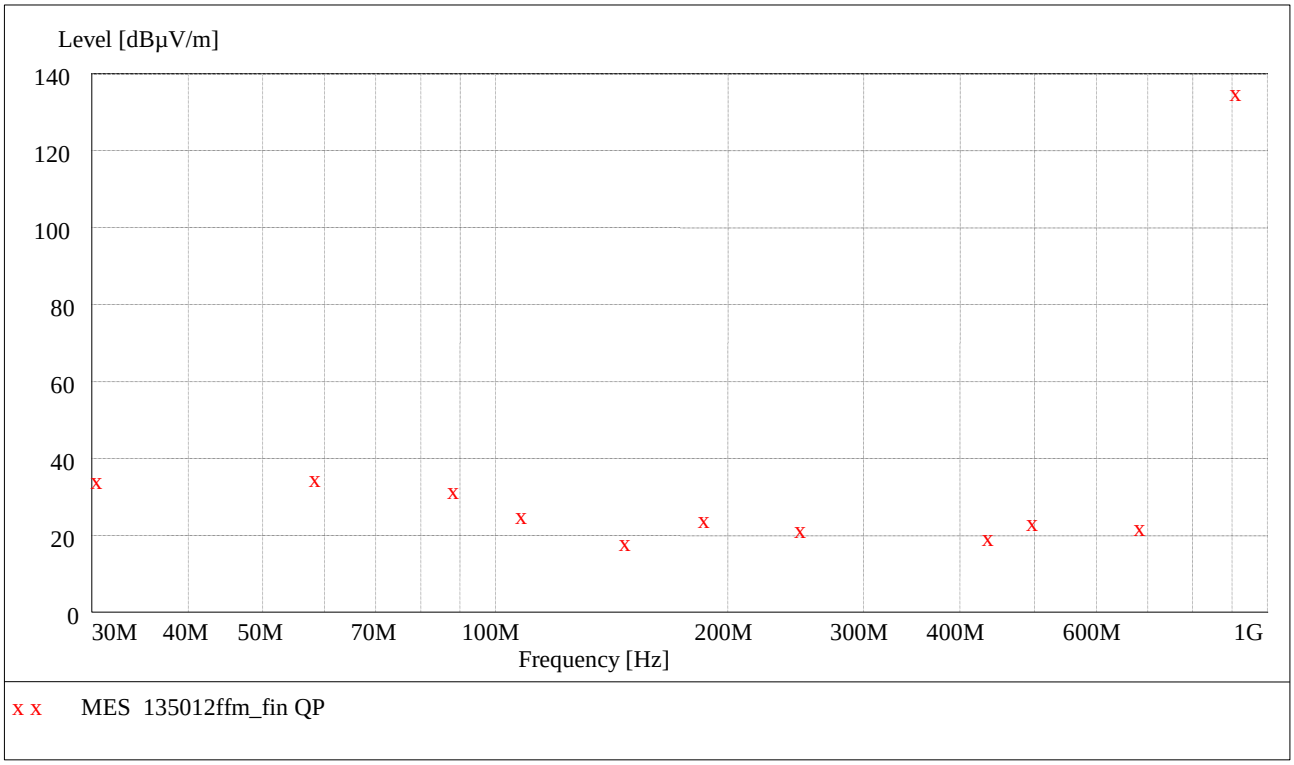
The measurement time with the quasi-peak measuring detector is 1 second.

Transmitter operates on the lower end of the assigned frequency (operation mode 1)



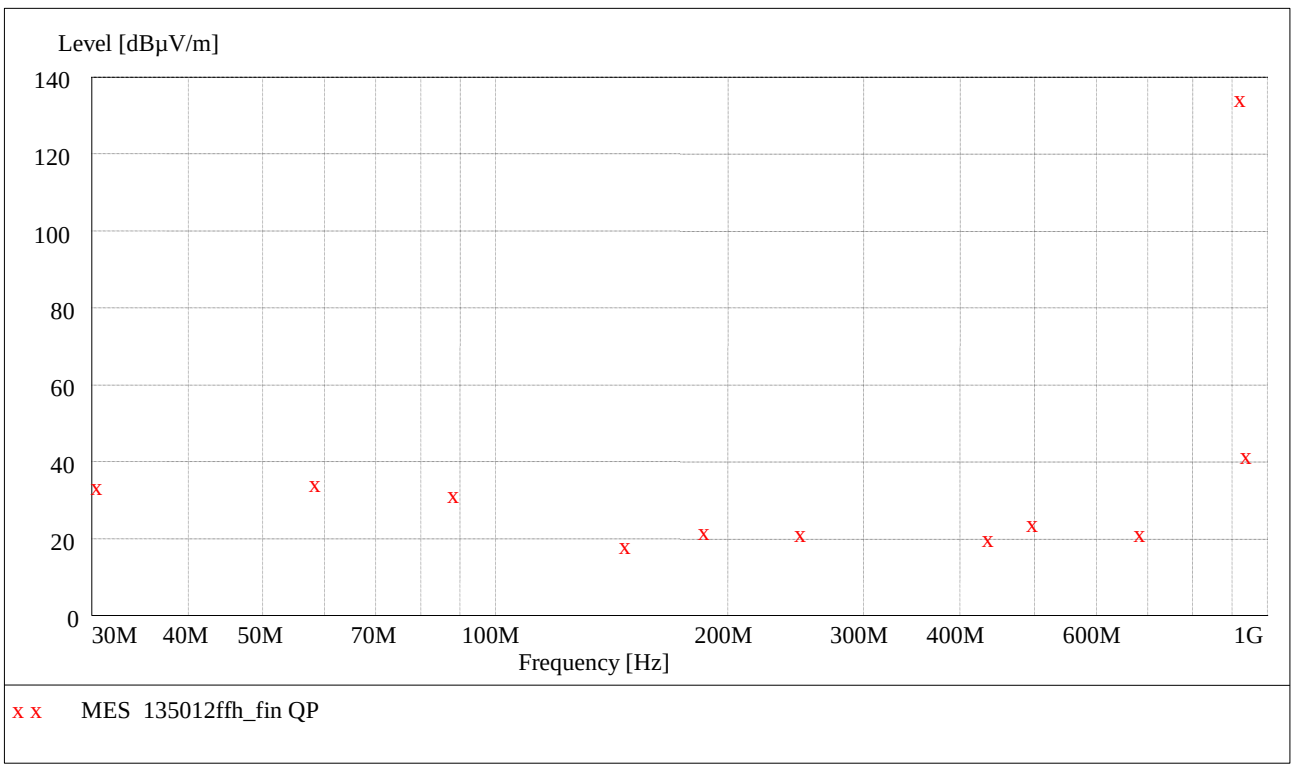
Data record name: 135012ffl

Transmitter operates on the middle of the assigned frequency (operation mode 2)



Data record name: 135012ffm

Transmitter operates on the upper end of the assigned frequency (operation mode 3)



Data record name: 135012ffh

Result measured with the quasi-peak detector:

(These values were marked in the diagrams by an x)

Transmitter operates on the lower end of the assigned frequency band (operation mode 1)									
Spurious emissions outside restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dBµV/m	dBµV/m	dB	dBµV	dB/m	dB	cm	deg	
30.640	34.4	114.8	80.4	14.5	19.3	0.6	300.0	113.0	Vert.
58.788	35.6	114.8	79.2	28.5	6.3	0.8	250.0	68.0	Vert.
88.861	32.1	114.8	82.7	21.4	9.6	1.1	150.0	68.0	Vert.
148.122	17.1	114.8	97.7	4.1	11.7	1.3	100.0	23.0	Vert.
250.000	21.1	114.8	93.7	7.2	12.1	1.8	100.0	23.0	Vert.
437.500	21.2	114.8	93.6	2.4	16.4	2.4	100.0	158.0	Vert.
500.000	23.5	114.8	91.3	3.6	17.4	2.5	100.0	203.0	Vert.
687.494	23.0	114.8	91.8	0.1	19.9	3.0	150.0	247.0	Hor.
902.750	134.8	Carrier	-	108.9	22.5	3.4	100.0	23.0	Vert.
Spurious emissions inside restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dBµV/m	dBµV/m	dB	dBµV	dB/m	dB	cm	deg	
109.378	27	43.5	16.5	14.2	11.7	1.1	300.0	247.0	Hor.
250.000	21.1	46.0	24.9	7.2	12.1	1.8	100.0	23.0	Vert.
Transmitter operates on the middle of the assigned frequency band (operation mode 2)									
Spurious emissions outside restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dBµV/m	dBµV/m	dB	dBµV	dB/m	dB	cm	deg	
30.640	35	115.8	80.8	15.1	19.3	0.6	300.0	113.0	Vert.
58.788	35.4	115.8	80.4	28.3	6.3	0.8	250.0	68.0	Vert.
88.861	32.5	115.8	83.3	21.8	9.6	1.1	150.0	112.0	Vert.
148.122	18.8	115.8	97.0	5.8	11.7	1.3	100.0	23.0	Vert.
187.503	24.8	115.8	91.0	14.3	9.0	1.5	100.0	157.0	Hor.
437.500	20.1	115.8	95.7	1.3	16.4	2.4	100.0	158.0	Vert.
500.000	24.2	115.8	91.6	4.3	17.4	2.5	150.0	203.0	Vert.
687.494	22.7	115.8	93.1	-0.2	19.9	3.0	100.0	247.0	Hor.
914.750	135.8	Carrier	-	109.6	22.8	3.4	100.0	23.0	Vert.
Spurious emissions inside restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dBµV/m	dBµV/m	dB	dBµV	dB/m	dB	cm	deg	
108.795	25.9	43.5	17.6	13.2	11.6	1.1	100.0	112.0	Hor.
250.000	22.3	46.0	23.7	8.4	12.1	1.8	100.0	248.0	Vert.

Transmitter operates on the upper end of the assigned frequency band (operation mode 3)									
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.
30.640	34.4	115.3	80.9	14.5	19.3	0.6	300.0	113.0	Vert.
58.788	35.1	115.3	80.2	28.0	6.3	0.8	250.0	68.0	Vert.
88.861	32.3	115.3	83.0	21.6	9.6	1.1	150.0	112.0	Vert.
148.122	18.9	115.3	96.4	5.9	11.7	1.3	100.0	68.0	Vert.
437.500	20.6	115.3	94.7	1.8	16.4	2.4	100.0	203.0	Vert.
500.000	24.6	115.3	90.7	4.7	17.4	2.5	100.0	248.0	Vert.
687.494	22.2	115.3	93.1	-0.7	19.9	3.0	300.0	247.0	Hor.
927.250	135.3	Carrier	-	108.5	23.4	3.4	100.0	23.0	Vert.
944.760	42.5	115.3	72.8	15.3	23.8	3.4	250.0	112.0	Hor.
Spurious emissions inside 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.
187.503	22.6	43.5	20.9	12.1	9.0	1.5	100.0	203.0	Vert.
250.000	22.0	46.0	24.0	8.1	12.1	1.8	100.0	23.0	Vert.
Measurement uncertainty				+2.2 dB / -3.6 dB					

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
14 – 20

5.6.2.3 Final radiated emission measurement (1 GHz to 10 GHz)

Ambient temperature	21 °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.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 24 V DC by an external power supply.

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 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
1.80550	40.7	114.8	74.1	37.1	26.5	25.9	3.0	150	Vert.	No
2.70825	49.4	74.0	24.6	42.8	28.7	26.1	4.0	150	Vert.	Yes
3.61100	46.6	74.0	27.4	36.6	31.3	25.9	4.6	150	Vert.	Yes
5.41650	50.8	74.0	23.2	35.6	33.8	24.4	5.8	150	Hor.	Yes
6.31925	60.9	114.8	53.9	44.6	34.4	24.2	6.1	150	Hor.	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
1.80550	33.6	114.8	81.2	30.0	26.5	25.9	3.0	150	Vert.	No
2.70825	41.4	54.0	12.6	34.8	28.7	26.1	4.0	150	Vert.	Yes
3.61100	37.7	54.0	16.3	27.7	31.3	25.9	4.6	150	Vert.	Yes
5.41650	42.4	54.0	11.6	27.2	33.8	24.4	5.8	150	Hor.	Yes
6.31925	52.1	114.8	62.7	35.8	34.4	24.2	6.1	150	Hor.	No
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 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
1.82950	42.2	115.8	73.6	38.3	26.7	26.1	3.3	150	Vert.	No
2.74425	48.2	74.0	25.8	40.8	28.9	25.6	4.1	150	Vert.	Yes
3.65900	46.8	74.0	27.2	36.2	31.5	25.4	4.5	150	Vert.	Yes
5.48850	53.7	115.8	62.1	38.5	34.0	24.6	5.8	150	Hor.	No
6.40325	48.9	115.8	66.9	32.9	34.3	24.6	6.3	150	Hor.	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
1.82950	34.4	115.8	81.4	30.5	26.7	26.1	3.3	150	Vert.	No
2.74425	39.4	54.0	14.6	32.0	28.9	25.6	4.1	150	Vert.	Yes
3.65900	37.2	54.0	16.8	26.6	31.5	25.4	4.5	150	Vert.	Yes
5.48850	46.4	115.8	69.4	31.2	34.0	24.6	5.8	150	Hor.	No
6.40325	38.8	115.8	77.0	22.8	34.3	24.6	6.3	150	Hor.	No
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 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
1.85450	43.2	115.3	72.1	38.3	27.0	25.7	3.6	150	Vert.	No
2.78175	45.6	74.0	28.4	38.6	29.0	26.1	4.1	150	Vert.	Yes
3.70900	50.8	74.0	23.2	40.1	31.8	25.7	4.6	150	Vert.	Yes
5.56350	51.9	115.3	63.4	36.6	34.0	24.7	6.0	150	Hor.	No
6.49075	50.4	115.3	64.9	34.3	34.2	24.4	6.3	150	Hor.	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
1.85450	34.9	115.3	80.4	30.0	27.0	25.7	3.6	150	Vert.	No
2.78175	36.1	54.0	17.9	29.1	29.0	26.1	4.1	150	Vert.	Yes
3.70900	41.9	54.0	12.1	31.2	31.8	25.7	4.6	150	Vert.	Yes
5.56350	44.3	115.3	71.0	29.0	34.0	24.7	6.0	150	Hor.	No
6.49075	40.7	115.3	74.6	24.6	34.2	24.4	6.3	150	Hor.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

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

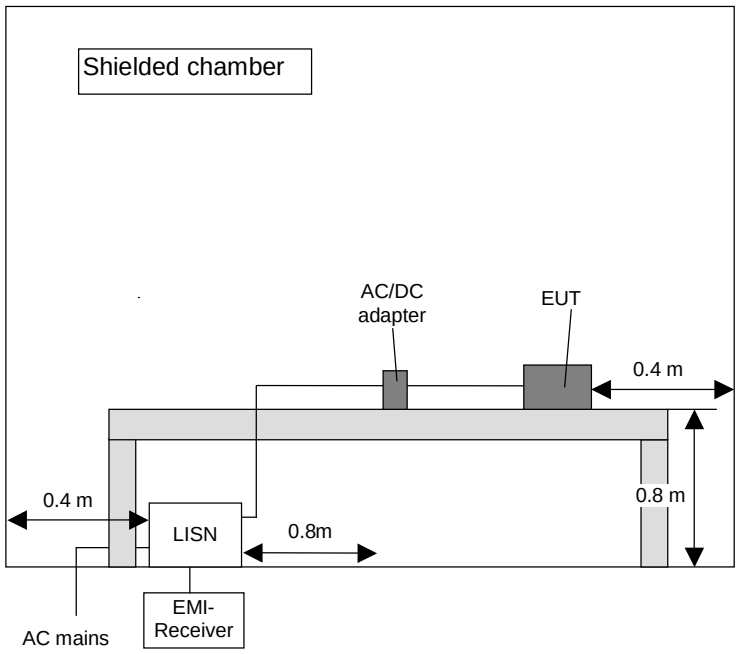
5.7 Conducted emissions on power supply lines (150 kHz to 30 MHz)

5.7.1 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 C63.4-2009 [1].

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

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz



5.7.2 Test results (conducted emissions on power supply lines)

Ambient temperature	21 °C	Relative humidity	40 %

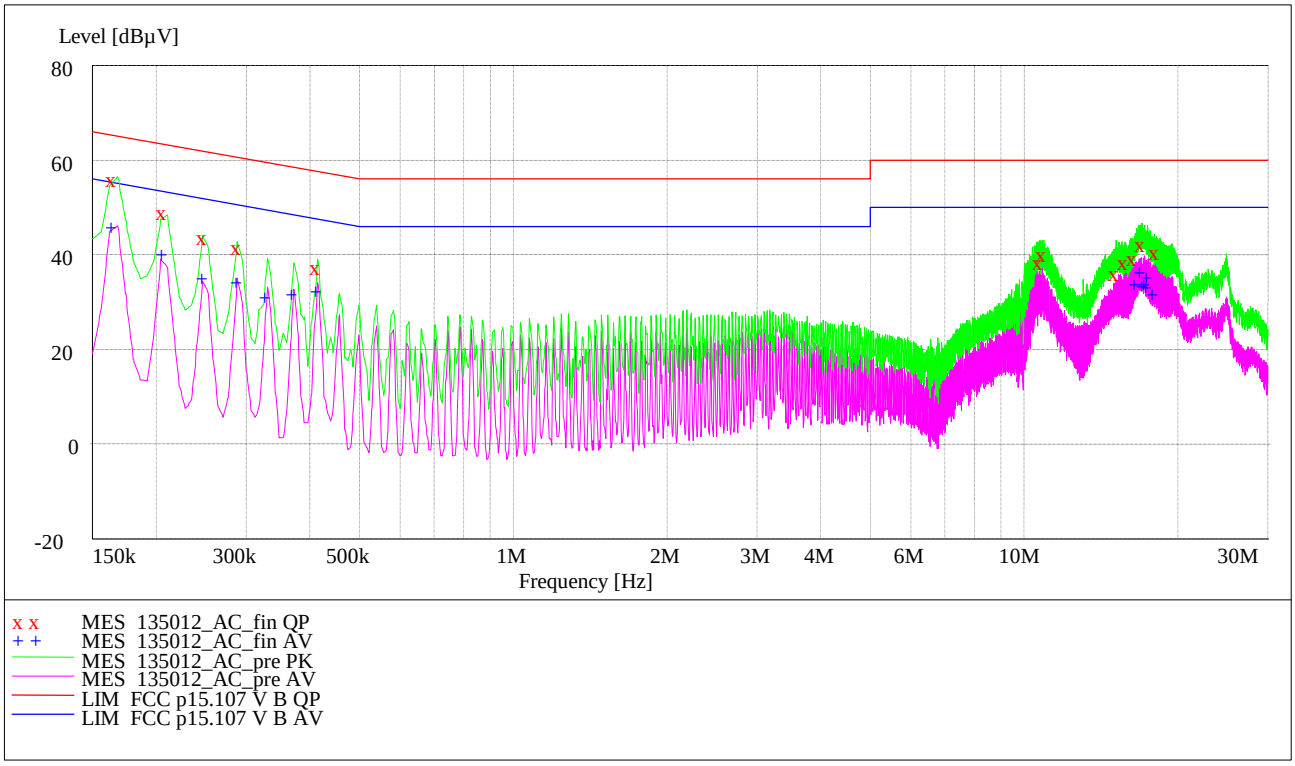
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

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

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 24.0 V DC by an AC / DC adaptor type MINI-PS-100-240AC/24DC/1, which was supplied by 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.



Data record name: 135012_AC

Result measured with the quasi-peak detector (marked in the diagram by an x):

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.1653	56.5	1.3	65.2	8.6	N	GND
0.2067	49.5	1.0	63.3	13.8	L1	GND
0.2481	44.3	0.9	61.8	17.5	N	FLO
0.2895	42.3	0.9	60.5	18.3	N	GND
0.4137	37.8	0.9	57.6	19.8	N	FLO
10.7520	39.0	1.4	60.0	21.0	N	FLO
10.9131	40.8	1.4	60.0	19.2	N	GND
15.1161	36.7	1.8	60.0	23.3	N	GND
15.7749	38.9	1.9	60.0	21.1	N	FLO
16.3932	39.8	2.0	60.0	20.2	N	FLO
17.0502	42.8	2.0	60.0	17.2	N	FLO
18.1608	41.1	2.1	60.0	18.9	N	FLO

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

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.1653	46.4	1.3	55.2	8.8	L1	FLO
0.2067	40.6	1.0	53.3	12.7	L1	FLO
0.2481	35.6	0.9	51.8	16.3	L1	GND
0.2895	34.7	0.9	50.5	15.8	N	GND
0.3300	31.7	0.9	49.5	17.7	N	GND
0.3723	32.2	0.9	48.4	16.2	L1	GND
0.4146	32.8	0.9	47.6	14.7	L1	GND
16.5984	34.3	2.0	50.0	15.7	N	FLO
17.0088	36.8	2.0	50.0	13.2	N	FLO
17.1771	34.0	2.0	50.0	16.0	N	FLO
17.3391	34.4	2.1	50.0	15.6	N	GND
17.5047	33.8	2.1	50.0	16.2	N	FLO
17.5434	35.9	2.1	50.0	14.1	N	FLO
17.9988	32.3	2.1	50.0	17.7	N	FLO

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
1 - 4, 20

6 Test equipment and ancillaries used for tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
1	Shielded chamber M47	-	Albatross Projects	B83117-C6439-T262 -	480662	Weekly verification (system cal.)	
2	EMI Receiver	ESIB 26	Rohde & Schwarz	1088.7490	481182	03/09/2012	03/2014
3	LISN	NSLK8128	Schwarzbeck	8128161	480138	12/20/2012	12/2013
4	High pass filter	HR 0.13-5ENN	FSY Microwave Inc.	DC 0109 SN 002	480340	Weekly verification (system cal.)	
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	Measuring receiver	ESIB7	Rohde & Schwarz	100304	480521	02/15/2012	02/2014
16	Controller	HD100	Deisel	100/670	480139	-	-
17	Turntable	DS420HE	Deisel	420/620/80	480087	-	-
18	Antenna support	AS615P	Deisel	615/310	480086	-	-
19	Antenna	CBL6111 D	Chase	25761	480894	09/28/2011	09/2014
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
30	Spectrum analyser	FSU	Rohde & Schwarz	200125	480956	07/15/2013	07/2015
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	02/13/2012	02/2014
32	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
34	Antenna support	AS615P	Deisel	615/310	480187	-	-
35	Antenna	CBL6112 B	Chase	2688	480328	04/21/2011	04/2014
36	Antenna	3115 B	EMCO	9609-4922	480184	09/28/2011	09/2014
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	02/16/2012	02/2014
73	High Pass Filter	WHJS1000C 11/60EF	Wainwright Instruments GmbH	1	480413	Weekly verification (system cal.)	
75	High Pass Filter	WHKX4.0/18 G-8SS	Wainwright Instruments GmbH	1	480587	Weekly verification (system cal.)	

7 Report history

Report Number	Date	Comment
F135012E1	04 November 2013	Document created

8 List of annexes

Annex A Test set-up photographs 6 pages

135012_a.JPG: RFU630, test set-up fully anechoic chamber
135012_b.JPG: RFU630, test set-up fully anechoic chamber
135012_c.JPG: RFU630, test set-up fully anechoic chamber
135012_d.JPG: RFU630, test set-up fully anechoic chamber
135012_e.JPG: RFU630, test set-up open area test site
135012_j.JPG: RFU630, test set-up shielded chamber

Annex B External photographs 4 pages

135012_1.JPG: RFU630, 3-D-view 1
135012_2.JPG: RFU630, 3-D.view 2
135012_3.JPG: RFU630, connector view
135012_4.JPG: RFU630, type plate

Annex C Internal photographs 9 pages

135012_5.JPG: RFU630, internal view 1
135012_13.JPG: RFU630, internal view 2
135012_14.JPG: RFU630, internal view 3 (antenna removed)
135012_7.JPG: RFU630 PCB 1, top view
135012_8.JPG: RFU630, PCB 1 bottom view
135012_11.JPG: RFU630 PCB 2, top view
135012_10.JPG: RFU630, PCB 2 bottom view
135012_15.JPG: RFU630 PCB 3, top view
135012_12.JPG: RFU630, PCB 3, bottom view