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Test Report

Report Number:

F190760E2

Equipment under Test (EUT):

ZONESCAN 820 Alpha V2

Applicant:

Gutermann Technology

Manufacturer:

Gutermann Technology

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

References

[1] **ANSI C63.4-2014** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

[2] **FCC 47 CFR Part 2** General Rules and Regulations

[3] **FCC 47 CFR Part 15** Radio Frequency Devices (Subpart B)

[4] **ICES-003 Issue 6** Published: January 2016 Updated: April 2017, Information Technology Equipment (Including Digital Apparatus) — Limits and Methods of Measurement

Test result

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

Test engineer:	Thomas KÜHN		02.09.2019
	Name	Signature	Date
Authorized reviewer:	Michael DINTER		02.09.2019
	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 generalizations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

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1 Identification

1.1 Applicant

Name:	Gutermann Technology GmbH
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Name for contact purposes:	Mr. Hermann WAIBEL
Phone:	+49 751 35 90 16 - 83
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eMail Address:	hermann.waibel@gutermann-water.com
Applicant represented during the test by the following person:	Mr. Hermann WAIBEL, Mr. Stefan LANG

1.2 Manufacturer

Name:	Gutermann Technology GmbH
Address:	Gottlieb Daimler Straße 10 88214 Ravensburg
Country:	Germany
Name for contact purposes:	Mr. Hermann WAIBEL
Phone:	+49 751 35 90 16 - 83
Fax:	+49 751 35 90 16 - 99
eMail Address:	hermann.waibel@gutermann-water.com
Manufacturer represented during the test by the following person:	Mr. Hermann WAIBEL, Mr. Stefan LANG

1.3 Test Laboratory

The tests were carried out at:

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Germany

Accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025 under Reg. No. D-PL-17186-01-02 and D-PL-17186-01-05, FCC Test Firm Designation Number DE0004, FCC Test Firm Registration Number 469623, CAB Identifier DE0003 and ISED# 3469A.

The tests were performed at:

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Germany

1.4 EUT (Equipment Under Test)

Test object: *	Wireless transceiver for data collection
(PMN): *	ZONESCAN 820 Alpha V2
Modelname / HVIN: *	S-ALPHA-5-0-B3
FCC ID:*	ZSSZS820915AL3
IC: *	9789A-ZS820915AL3
Serial number: *	50274
PCB identifier: *	ZS820-40B, ZS820-41B and ZS-43A
Hardware version: *	B3
Software version: *	2.08

* declared by the applicant.

Ancillary equipment

- External power supply type enercell CAT: NO. 273-316 for emission measurement on power supply lines (provided by the laboratory).

1.5 Technical data of equipment

Power supply:	U_{nom} = 3.3 V_{DC} by internal battery
Highest internal frequency[1]:	2 GHz

Remark [1]: Highest internal frequency as declared by the applicant.

The following GSM/UMTS module is built in the EUT:

GSM/UMTS module:	Cinterion PLS62-W (FCC ID: QIPPLS62-W; IC: 7830A-PLS62W)

1.6 Dates

Date of receipt of test sample:	02.07.2019
Start of test:	03.07.2019
End of test:	04.07.2019

2 Operational states and test setup

Description of function of the EUT:

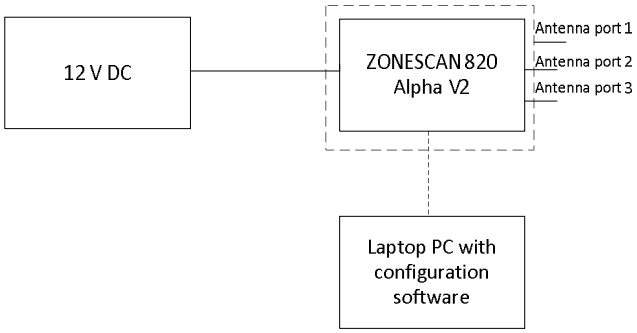
The ZONESCAN 820 Alpha V2 is intended to be used to collect date from voice loggers. The data collection will be initiated via GSM/UMTS/LTE and the will take place via the 915 MHz frequency hopper. After receiving the data from a voice logger on 915 MHz, they were furnished with a time stamp (received from the GNSS module) and stored inside the device. When data collection is finished, the stored data will be transferred via GSM/UMTS/LTE. The EUT is intended to be installed outdoor at increased positions on lamp poles or similar meanings. It is possible to charge the internal battery via a solar panel or another external power supply, the charge control of the internal battery will be handled by the EUT.

The following states were defined as the operating conditions and were adjusted before testing with the help of a laptop PC by the applicant:

- GSM/UMTS module activated,
- GPS module activated,
- frequency hopper receives on 911.2 MHz,
- no external antenna for the frequency hopper was connected.

Definition of the functions:

- During all tests the internal battery was buffered by either an external power supply or an AC/DC adaptor. Unused antenna ports were terminated with 50 W.



3 Additional information

During the tests the EUT was not labelled as required by FCC / IC.
The EUT contains also a GSM/UMTS/LTE transceiver and a GNSS receiver. Measurement results of these parts of the EUT are documented in separate test reports.

4 Overview

Conducted emissions FCC 47 CFR Part 15 section 15.107 (b) [3] / ICES-003 section 6.1 [4]					
Application	Frequency range	Limits	Reference standard	Remark	Status
AC supply line	0.15 to 0.5 MHz 0.5 to 5 MHz 5 to 30 MHz	66 to 56 dBµV (QP)* 56 to 46 dBµV (AV)* 56 dBµV (QP) 46 dBµV (AV) 60 dBµV (QP) 50 dBµV (AV)	ANSI C63.4 (2014)	Class B	Passed
*: Decreases with the logarithm of the frequency					
Radiated emissions FCC 47 CFR Part 15 section 15.109 (b) [3] / ICES-003 section 6.2 [4]					
Application	Frequency range	Limits	Reference standard	Remark	Status
Radiated Emission	30 to 88 MHz 88 to 216 MHz 216 to 960 MHz 960 to 1000 MHz above 1000 MHz	40.0 dBµV/m QP at 3 m 43.5 dBµV/m QP at 3 m 46.0 dBµV/m QP at 3 m 54.0 dBµV/m QP at 3 m 54.0 dBµV/m AV at 3 m	ANSI C63.4 (2014);	Class B	Passed

5 Results

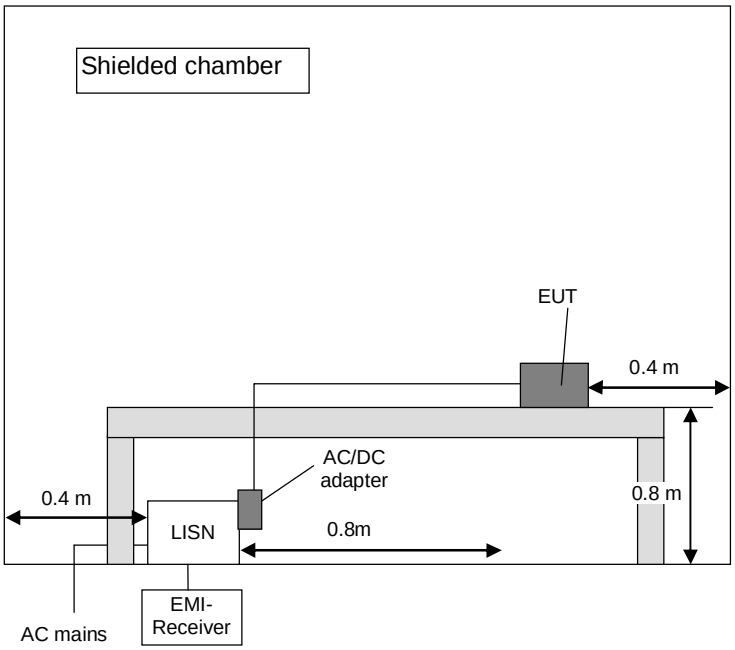
5.1 Conducted emissions on power supply lines

5.1.1 Test method

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 setup of the Equipment under test will be in accordance to [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

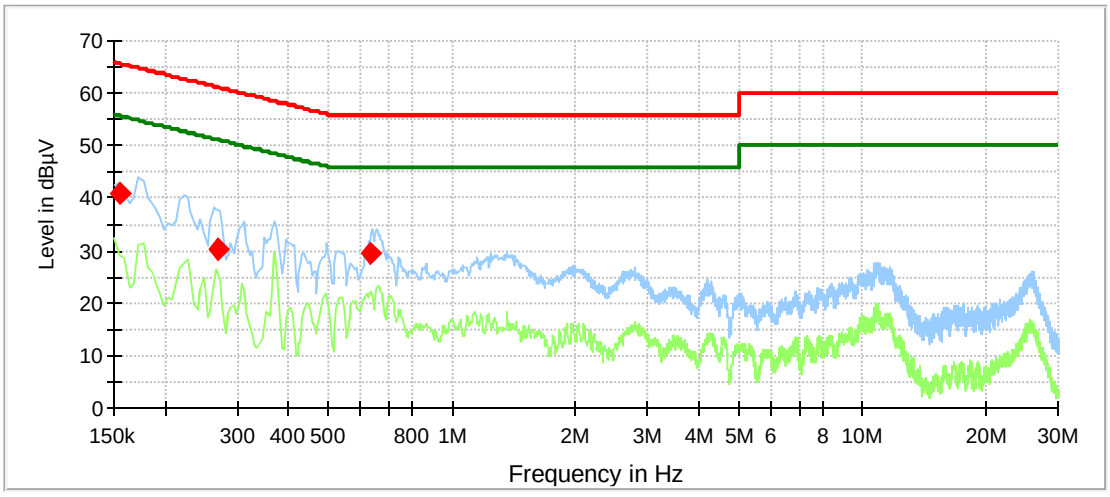


5.1.2 Results conducted emission measurement on AC mains

Ambient temperature:	°C	Relative humidity:	%

Test description:	Conducted emission measurement
EUT:	ZONESCAN 820 Alpha V2
Manufacturer:	Gutermann Technology GmbH
Operating conditions:	Receive on 911.2 MHz, GSM/UMTS modem and GPS switched on
Test site:	Phoenix TESTLAB GmbH, shielded room M4
Operator:	Th. KÜHN
Comment:	EUT powered with supplied 3.6 V_{DC} by the internal battery, which was buffered with 12 V_{DC} by an external power supply type enercell CAT: NO. 273-316 (provided by the laboratory), supplied with 120 V_{AC} / 60 Hz.

The curves in the diagram only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by ◆ and the average measured points by ▼.



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.155400	40.9	---	65.7	24.9	5000	9.000	L1	FLO	9.8
0.267900	30.2	---	61.2	31.0	5000	9.000	N	FLO	9.9
0.634200	29.4	---	56.0	26.6	5000	9.000	N	FLO	9.9
Measurement uncertainty				±2.8 dB					

Test: Passed

Test equipment used (see chapter 6):

1 - 5

5.2 Radiated emissions

5.2.1 Test method

5.2.2 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 30MHz to 1 GHz.
- A final measurement carried out on an open area test side with reflecting ground plane and various antenna heights in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a variable antenna distance and height in the frequency range 1 GHz to 40 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 40 GHz.

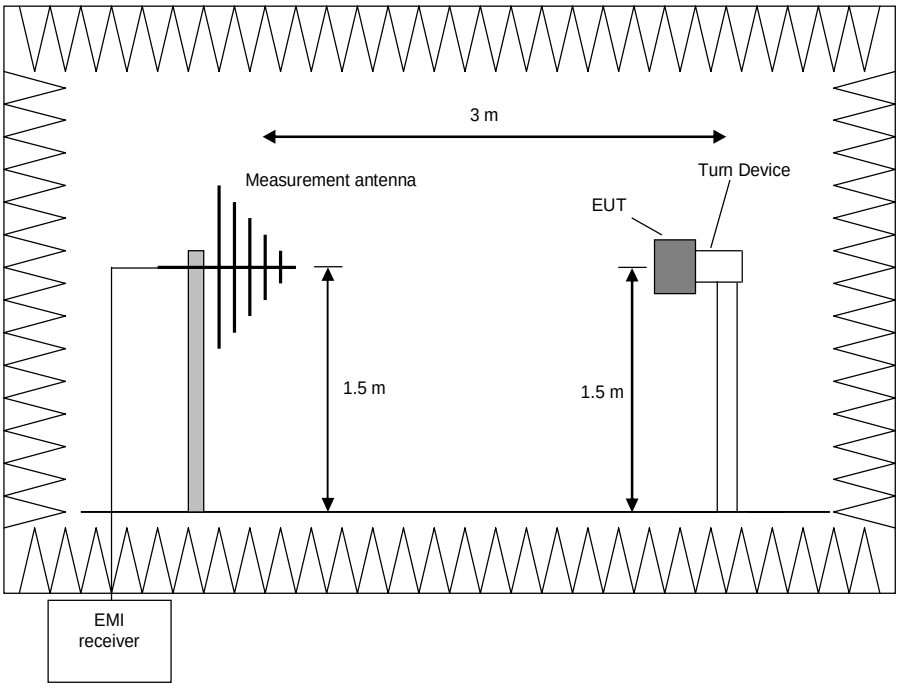
Preliminary measurement (30 MHz to 1 GHz)

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Table top devices will set up on a non-conducting turn device on the height of 1.5 m. 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 [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 °. This measurement is repeated after raising the EUT in 30 ° steps according 6.6.5.4 in [1].

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:

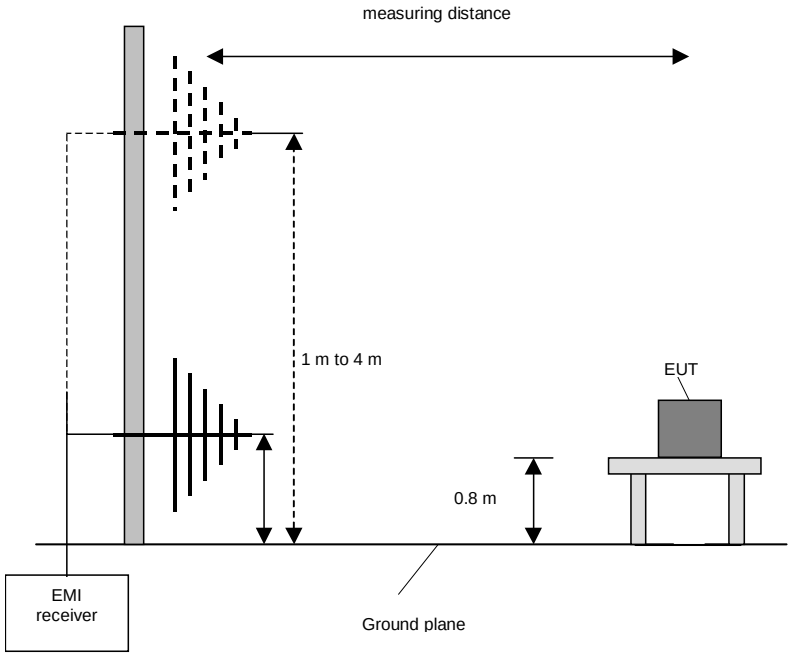
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Repeat 1) to 3) with the vertical polarisation of the measuring antenna.
5. Make a hardcopy of the spectrum.
6. Repeat 1) to 5) with the EUT raised by an angle of 30 ° (60 °, 90 °, 120 ° and 150 °) according to 6.6.5.4 in [1].
7. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.

Final measurement (30 MHz to 1 GHz)

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

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

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure final measurement:

The following procedure will be used:

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

Preliminary and final measurement (1 GHz to 40 GHz)

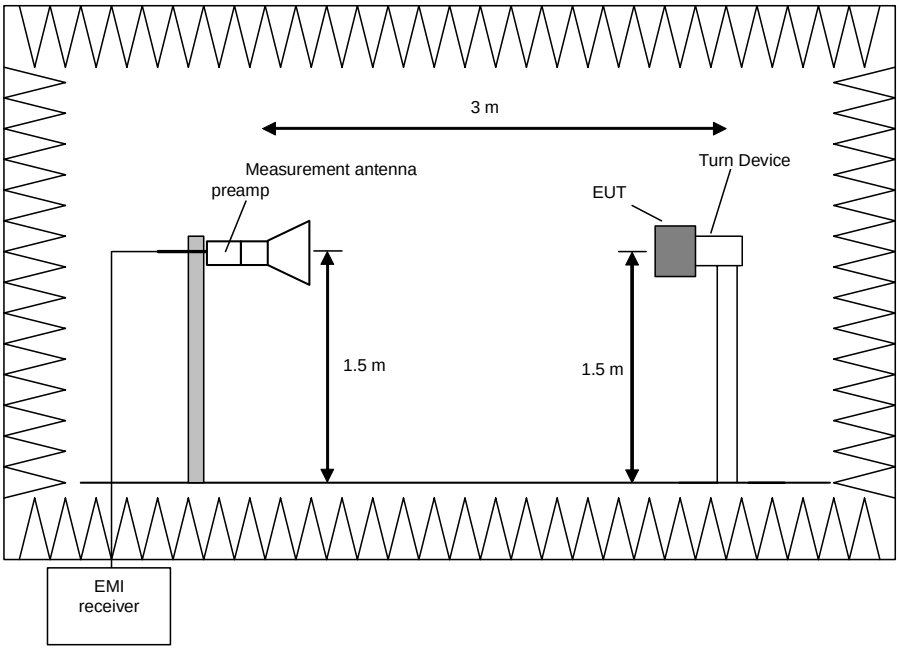
This measurement will be performed in a fully anechoic chamber. Table top devices will set up on a non-conducting turn device on the height of 1.5 m. The set-up of the Equipment under test will be in accordance to [1].

Preliminary measurement (1 GHz to 40 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyser set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °. This measurement is repeated after raising the EUT in 30 ° steps according 6.6.5.4 in [1].

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

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	100 kHz
4 GHz to 12 GHz	100 kHz
12 GHz to 18 GHz	100 kHz
18 GHz to 25 / 26.5 GHz	100 kHz
26.5 GHz to 40 GHz	100 kHz



Procedure preliminary measurement:

Prescans were performed in the frequency range 1 to 40 GHz.
The following procedure will be used:

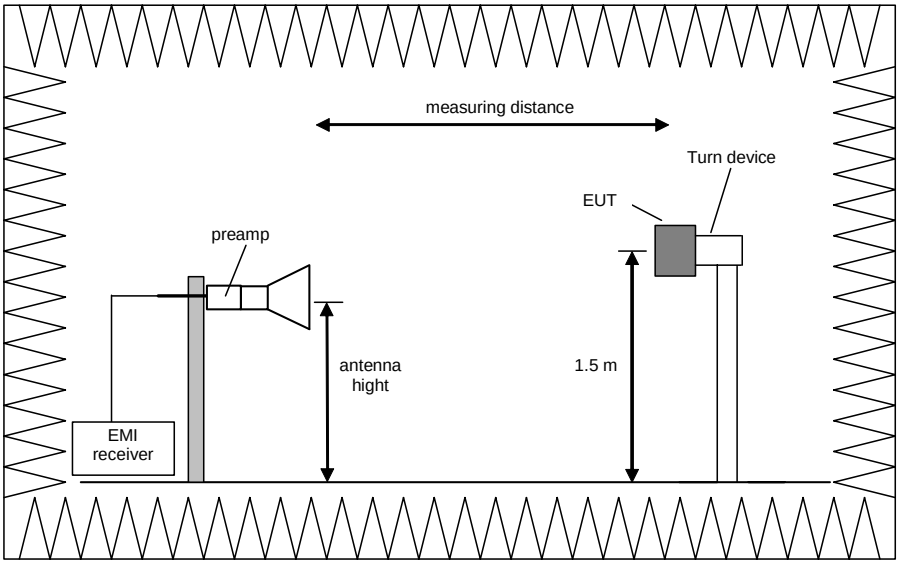
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Rotate the EUT by 360° to maximize the detected signals.
3. Repeat 1) to 2) with the vertical polarisation of the measuring antenna.
4. Make a hardcopy of the spectrum.
5. Repeat 1) to 4) with the EUT raised by an angle of 30° (60°, 90°, 120° and 150°) according to 6.6.5.4 in [1].
6. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
7. The measurement antenna polarisation, with the according EUT position (Turntable and Turn device) which produces the highest emission for each frequency will be used for the final measurement. The six closest values to the applicable limit will be used for the final measurement.

Final measurement (1 GHz to 40 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed by rotating the turntable through 0 to 360° in the worst-case EUT orientation which was obtained during the preliminary measurements.

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

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 25 / 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz



Procedure of measurement:

The measurements were performed in the frequency ranges 1 GHz to 4 GHz, 4 GHz to 12 GHz, 12 GHz to 18 GHz, 18 GHz to 25 /26.5 GHz and 26.5 GHz to 40 GHz.
The following procedure will be used:

1) Set the turntable and the turn device to obtain the worst-case emission for the first frequency identified in the preliminary measurements.
2) Set the measurement antenna polarisation to the orientation with the highest emission for the first frequency identified in the preliminary measurements.
3) Set the spectrum analyser to EMI mode with peak and average detector activated.
4) Rotate the turntable from 0° to 360° to find the EUT angle that produces the highest emissions.
5) Note the highest displayed peak and average values
6) Repeat the steps 1) to 5) for each frequency detected during the preliminary measurements.

5.2.3 Results preliminary measurement 30 MHz to 14 GHz

Ambient temperature	22 °C	Relative humidity	44 %

Position of EUT: The EUT was set-up on the positioner at a height of 1.5 m. The distance between EUT and antenna was 3 m.

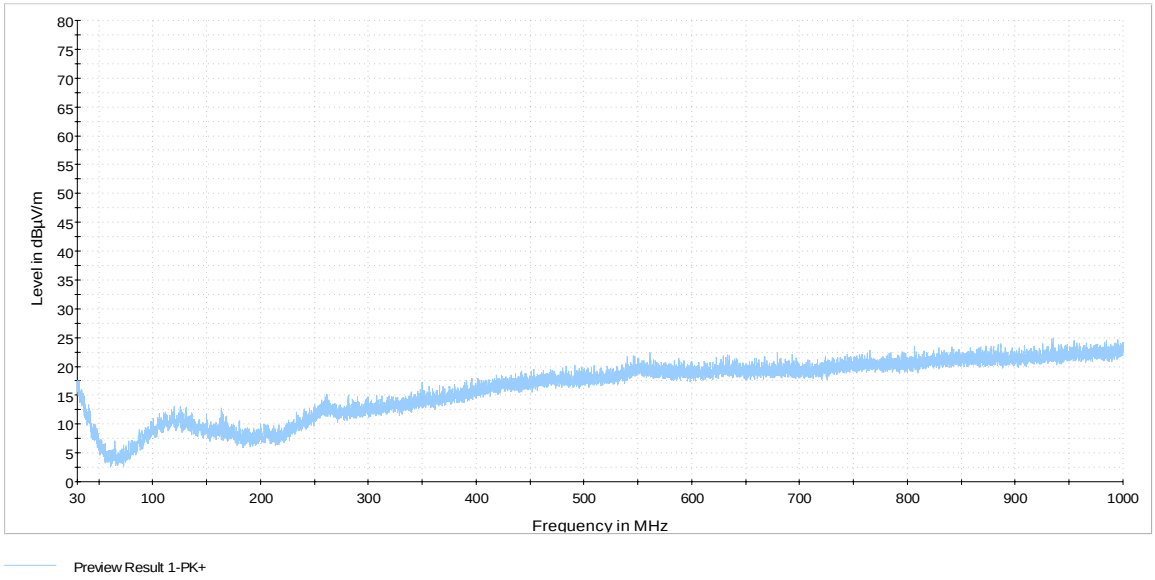
Cable guide: For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied 3.3 V DC by the internal battery, which was buffered by an external power supply.

Frequency range: The preliminary measurement was carried out in the frequency range 30 MHz to 14 GHz according to [2].

190760_30M_1G_15B: Preliminary emission measurement from 30 MHz to 1 GHz:

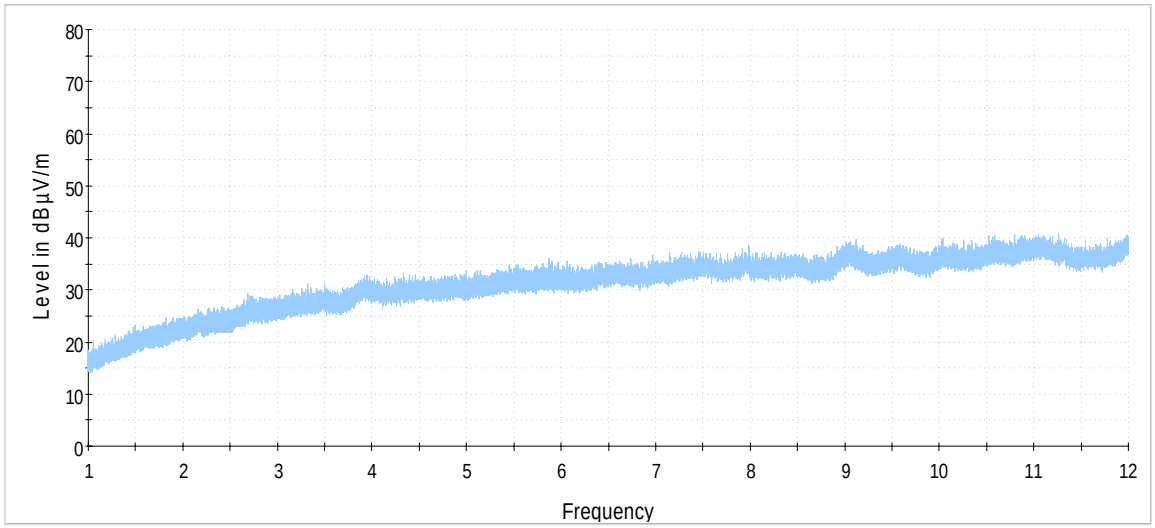


Test equipment used (see chapter 6):

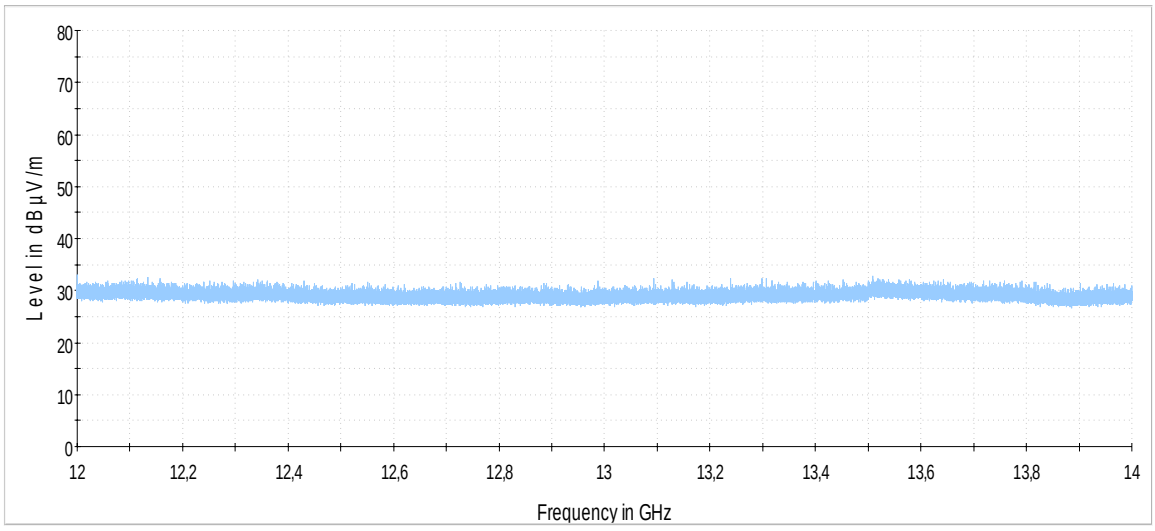
6 - 19

No significant frequencies above the noise floor of the system (max 25 dBµV/m (measured with peak detector) at 3 m distance) were found during the preliminary radiated emission test, so no measurements were carried out on the open area test site.

190760_1G_12G_15B: Preliminary emission measurement from 1 GHz to 12 GHz:



190760_12G_14G_15B: Preliminary emission measurement from 12 GHz to 14 GHz:



No significant frequencies above the noise floor of the system (max 40.9 dBµV/m (measured with peak detector) at 3 m distance) were found during the preliminary radiated emission test, so no final measurements were carried out.

5.2.4 Result final measurement from 30 MHz to 1 GHz

No significant frequencies above the noise floor of the system (max 25 dBµV/m (measured with peak detector) at 3 m distance) were found during the preliminary radiated emission test, so no measurements were carried out on the open area test site.

5.2.5 Result final measurement from 1 GHz to 14 GHz

No significant frequencies above the noise floor of the system (max 40.9 dBµV/m (measured with peak detector) at 3 m distance) were found during the preliminary radiated emission test, so no final measurements were carried out.

6 Test equipment

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
1	Shielded chamber M4	-	Siemens	B83117S1-X158	480088	Calibration not necessary	
2	Measuring receiver	ESIB 26	Rohde & Schwarz	100292	481182	28.02.2018	02.2020
3	LISN	NSLK8128	Schwarzbeck	8128155	480058	14.03.2018	30.2020
4	Transient Filter Limiter	CFL 9206A	Teseq GmbH	38268	481982	Calibration not necessary	
5	EMI-Software	ES-K1	Rohde & Schwarz	-	480111	Calibration not necessary	
6	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Calibration not necessary	
7	Measuring receiver	ESW44	Rohde & Schwarz	101635	482467	29.03.2018	03.2020
8	Controller	MCU	Maturo	MCU/043/971107	480832	Calibration not necessary	
9	Turntable	DS420HE	Deisel	420/620/80	480315	Calibration not necessary	
10	Antenna support	AS615P	Deisel	615/310	480187	Calibration not necessary	
11	Antenna	CBL6112 B	Chase	2688	480328	19.07.2017	06.2020
12	Antenna	HL50	Rohde & Schwarz	100438	481170	09.10.2017	10.2020
13	Standard gain horn antenna	18240-20	Flann Microwave	483	480294	Calibration not necessary	
14	Turn device	TDF 1.5- 10Kg	Maturo	15920215	482034	Calibration not necessary	
15	Preamplifier 100 MHz – 16 GHz	AFS6-00101600-23-10P-6-R	MITEQ	2011215	482333	10.07.2018	07.2020
16	Preamplifier 12 GHz - 18 GHz	JS3-12001800-16-5A	MITEQ	571667	480343	10.07.2018	07.2020
17	RF-cable No. 3	Sucoflex 106B	Suhner	0563/6B	480670	Calibration not necessary	
18	RF-cable No. 36	Sucoflex 106B	Suhner	0522/6B	480571	Calibration not necessary	
19	RF-cable No. 40	Sucoflex 106B	Suhner	0708/6B	481330	Calibration not necessary	

7 Test site validation

Test equipment	PM. No.	Frequency range	Type of validation	According to	Val. Date	Val Due
Fully anechoic chamber M20	480303	30 – 1000 MHz	NSA	ANSI C63.4-2014	13.02.2018	12.02.2020
Fully anechoic chamber M20	480303	1 -18 GHz	SVSWR	CISPR 16-1-4 Amd. 1	13.07.2018	12.07.2020
Shielded chamber M4	480088	9 kHz – 30 MHz	GND-Plane	ANSI C63.4-2014	06.11.2018	05.11.2020

8 Report history

Report Number	Date	Comment
F190760E2	30.08.2019	Document created
-	-	-
-	-	-

9 List of annexes

Annex A Test set-up photos 4 pages