

FCC ID: NDX-GES3S

EMI - TEST REPORT

- FCC Part 15.209 -

Test Report No. : T34600-01-00HU	19. September 2013 Date of issue
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Type / Model Name : GES3S

Product Description : RFID handheld reader for livestock application

Applicant : Datamars S.A.

Address : Via ai Prati

CH – 6930 BEDANO

Manufacturer : Datamars S.A.

Address : Via ai Prati

CH – 6930 BEDANO

Licence holder : Datamars S.A.

Address : Via ai Prati

CH – 6930 BEDANO

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
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The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test results
without the written permission of the test laboratory.

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (October, 2012)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (October, 2012)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements

ANSI C63.4: 2003	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
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ANSI C95.1:1992	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
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CISPR 16-4-2: 2003	Uncertainty in EMC measurement
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Mobile and portable devices RF exposure procedures and equipment authorisation policies	447498 D01 General RF exposure Guidance v05r01, 5/28/2013
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2 SUMMARY

GENERAL REMARKS:

The EUT consists of a RFID reader and a Bluetooth module, which is co-located to the RFID reader. The Bluetooth module is fully tested and approved under the FCC ID: PVH0925, connectBlue AB. The carrier frequency of the reader is 134.2 kHz.

Declaration of the manufacturer:

During battery charging mode it is not able to set the RFID handheld reader in tag reading mode.

FINAL ASSESSMENT:

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 08. August 2013

Testing concluded on : 14. August 2013

Checked by:

Tested by:

Klaus Gegenfurtner
Dipl.-Ing.(FH)
Manager: Radio Group

Huber Markus

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3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT – Detailed photos see Attachment A

3.2 Power supply system utilised

Power supply voltage: : AC: 115 V / 60 Hz
DC: 3.7 V / DC

3.3 Short description of the Equipment under Test (EUT)

The EUT is a RFID handheld reader for livestock application.

Number of tested samples: 1
Serial number: 02N2504699

EUT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- Tx mode at 134.2 kHz

- Accu charging mode

- Bluetooth active (open connection)

EUT configuration:

The following peripheral devices and interface cables were connected during the measurements:

- | | |
|---|--|
| - <u>USB 2.0 Cable, male type A to mini USB</u> | Model : <u>Supplied by manufacturer</u> |
| - <u>Power supply, AK II Technology</u> | Model No.: A05T3-05MU,
Model : <u>Serial No.: A 112604330</u> |
| - _____ | Model : _____ |
| - _____ | Model : _____ |
| - _____ | Model : _____ |
| - _____ | Model : _____ |
| - customer specific cables | |

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

mikes-testingpartners gmbh
Ohmstrasse 2-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader may notice that tolerances within the calibration of the equipment and facilities may cause additional uncertainty. The measurement uncertainty is calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurement“ and documented in the mikes-testingpartners gmbh quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners gmbh, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component diversity and modifications in production process of devices may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for the specific test. The manufacturer has the sole responsibility of continued compliance of the EUT.

4.4 Measurement Protocol for FCC

4.4.1 GENERAL INFORMATION

4.4.1.1 Test Methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.1.2 Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

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5 TEST CONDITIONS AND RESULTS

5.1 Conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up



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5.1.3 Applicable standard

According to FCC Part 15, Section 15.207(a):

Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

5.1.4 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin: 13.4 dB at 12.075 MHz

The requirements are **FULFILLED**.

Remarks: For detailed results, please see the following page(s).

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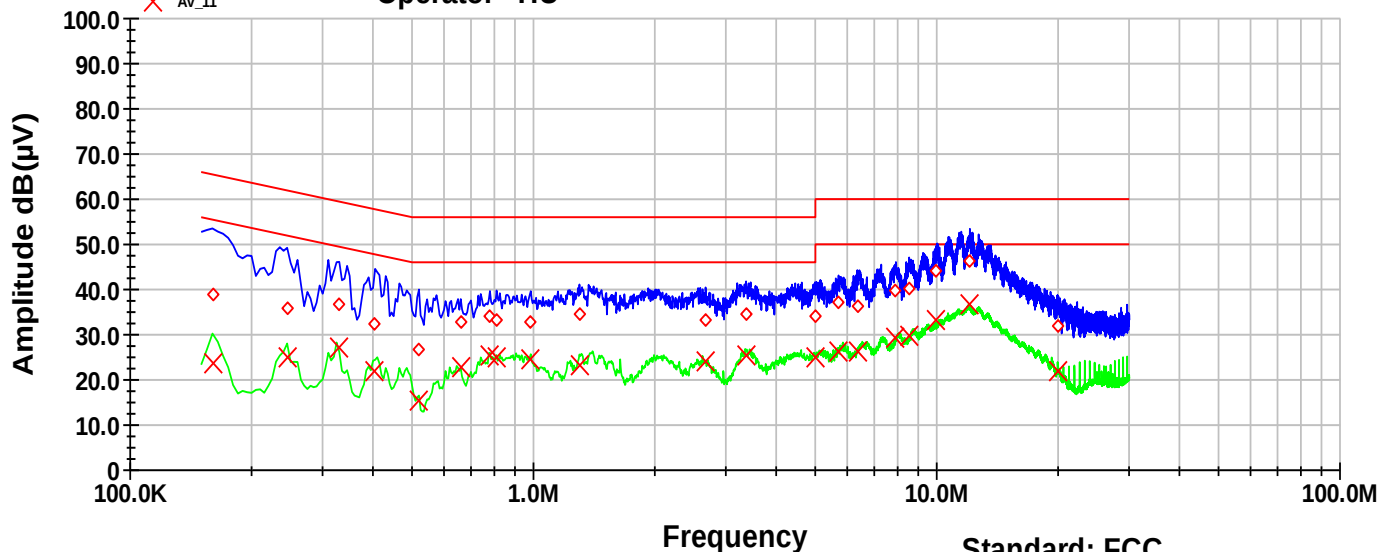
Test point: L1
Operation mode: Accu charging mode
Remarks:
Date: 08.008.2013
Tested by: Huber Markus

Result: passed

— LmtAVVoltage
— LmtQPVoltage
— Peak_11
— AVG_11
◇ QP_11
× AV_11

Equipment - T3GES3S
Serial No. - 02N2504699
Op Mode 1 - Battery charging
Operator - HU

Peak Measurement
See Table for QP and AV values
L1 OM1



Standard: FCC
File Number: T34600-01HU

Frequency MHz	QP Level dB(μV)	QP Margin dB	QP Limit dB	AV Level dB(μV)	AV Margin dB	AV Limit dB
0.16	38.7	-26.8	65.5	23.7	-31.8	55.5
0.245	36.0	-26.0	61.9	24.9	-27.1	51.9
0.33	36.5	-22.9	59.5	26.9	-22.5	49.5
0.405	32.3	-25.4	57.8	22.0	-25.8	47.8
0.52	26.5	-29.5	56.0	15.5	-30.5	46.0
0.66	32.7	-23.3	56.0	22.7	-23.3	46.0
0.78	34.0	-22.0	56.0	25.3	-20.7	46.0
0.81	33.2	-22.8	56.0	25.1	-20.9	46.0
0.985	32.8	-23.3	56.0	24.3	-21.7	46.0
1.3	34.8	-21.2	56.0	23.1	-22.9	46.0
2.67	33.0	-23.0	56.0	24.0	-22.0	46.0
3.365	34.5	-21.5	56.0	25.3	-20.7	46.0
4.985	34.0	-22.0	56.0	25.0	-21.0	46.0
5.705	37.3	-22.7	60.0	26.4	-23.6	50.0
6.35	36.2	-23.8	60.0	26.3	-23.7	50.0
7.915	39.8	-20.2	60.0	29.3	-20.7	50.0
8.54	40.4	-19.6	60.0	29.8	-20.3	50.0
9.975	44.0	-16.0	60.0	33.2	-16.8	50.0
12.075	46.5	-13.5	60.0	36.6	-13.4	50.0
20.005	31.9	-28.1	60.0	22.1	-27.9	50.0

FCC ID: NDX-GES3S

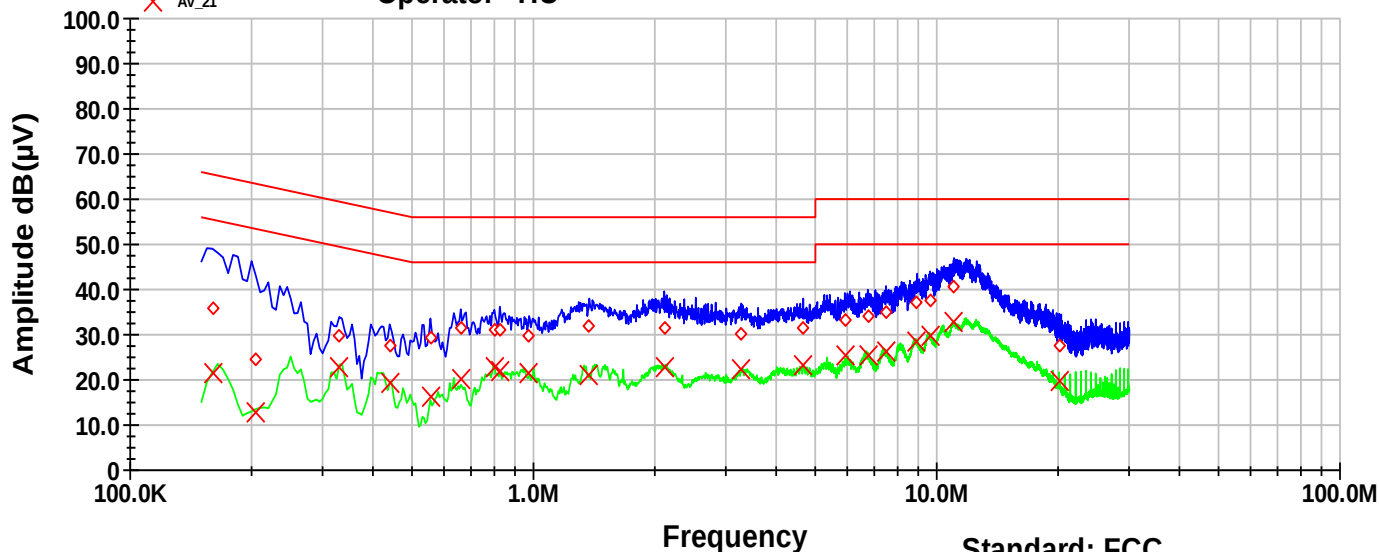
Test point: N
Operation mode: Accu charging mode
Remarks:
Date: 08.08.2013
Tested by: Huber Markus

Result: passed

— LmtAVVoltage
— LmtQPVoltage
— Peak_21
— AVG_21
◇ QP_21
× AV_21

Equipment - T3GES3S
Serial No. - 02N2504699
Op Mode 1 - Battery charging
Operator - HU

Peak Measurement
See Table for QP and AV values
N OM1



Standard: FCC
File Number: T34600-01HU

Frequency MHz	QP Level dB(μV)	QP Margin dB	QP Limit dB	AV Level dB(μV)	AV Margin dB	AV Limit dB
0.16	35.7	-29.8	65.5	21.6	-33.8	55.5
0.205	24.5	-38.9	63.4	13.0	-40.4	53.4
0.33	29.8	-29.7	59.5	22.6	-26.8	49.5
0.44	27.6	-29.4	57.1	19.3	-27.8	47.1
0.555	29.4	-26.6	56.0	16.1	-29.9	46.0
0.66	31.6	-24.4	56.0	20.0	-26.0	46.0
0.8	31.1	-24.9	56.0	22.7	-23.3	46.0
0.825	31.1	-24.9	56.0	21.8	-24.3	46.0
0.975	29.6	-26.4	56.0	21.4	-24.6	46.0
1.375	31.9	-24.1	56.0	21.3	-24.8	46.0
2.11	31.6	-24.4	56.0	22.8	-23.2	46.0
3.275	30.2	-25.8	56.0	22.3	-23.8	46.0
4.665	31.5	-24.5	56.0	23.1	-22.9	46.0
5.915	33.3	-26.7	60.0	25.3	-24.7	50.0
6.745	34.1	-25.9	60.0	25.5	-24.5	50.0
7.485	34.9	-25.1	60.0	26.2	-23.8	50.0
8.94	37.1	-22.9	60.0	28.6	-21.4	50.0
9.62	37.8	-22.2	60.0	29.7	-20.3	50.0
11.025	40.7	-19.3	60.0	32.9	-17.1	50.0
20.11	27.6	-32.4	60.0	19.9	-30.1	50.0

5.2 Field strength of the fundamental wave

For test instruments and accessories used see section 6 Part CPR 1.

5.2.1 Description of the test location

Test location: OATS1

Test distance: 3 metres

5.2.2 Photo documentation of the test set-up



5.2.1 Applicable standard

According to FCC Part 15C, Section 15.209:

The emissions from intentional radiators shall not exceed the effective field strength limits.

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5.2.2 Description of Measurement

The spurious emissions of the EUT have to be measured at an open area test site in the frequency range from 9 kHz to 1000 MHz using a tuned EMI receiver. The set up of the equipment under test will be in accordance with ANSI C63.4. The measurement has been performed at 3 m. The results have been compared to the limits defined at 30 m or 300 m distances according to FCC Part 15C, Section 15.31(f)(2) using an inverse linear distance extrapolation factor of 40 dB/decade. The final measurement has been performed with the EMI receiver using Quasi peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used, according to Section 15.209(d).

The resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz: RBW: 200 Hz

150 kHz – 30 MHz: RBW: 9 kHz

Example:

Frequency (MHz)	Level (dBμV)	+	Factor (dB)	=	Level dB(μV/m)	-	Limit dB(μV/m)	=	Delta (dB)
1.705	5	+	20	=	25	-	30	=	-5

5.2.3 Test result

Measurement distance: 3 m

Frequency (kHz)	Level PK (dBμV)	Level AV (dBμV)	Level QP (dBμV)	Band- width (kHz)	Correct. factor (dB)	Corrected Level PK dB(μV/m)	Corrected Level AV dB(μV/m)	Corrected Level QP dB(μV/m)	Limit AV dB(μV/m)	Delta (dB)
134.2	82.3	76.8	79.7	0.2	20	102.3	96.8	99.7	105.1	-8.3

Calculated value at distance: 300 m

Frequency (kHz)	Level PK (dBμV)	Level AV (dBμV)	Level QP (dBμV)	Band- width (kHz)	Correct. factor (dB)	Corrected Level PK dB(μV/m)	Corrected Level AV dB(μV/m)	Corrected Level QP dB(μV/m)	Limit AV dB(μV/m)	Delta (dB)
134.2	2.3	-3.2	-0.3	0.2	20	22.3	16.8	19.7	25.1	-8.3

Limit according to FCC Part 15C, Section 15.209(a):

Frequency (MHz)	Field strength of fundamental wave (μV/m)	dB(μV/m)	Measurement distance (metres)
0.009-0.490	2400/F(kHz)	--	300
0.490-1.705	24000/F (kHz)	--	30
1.705-30.0	30	29.5	30

The requirements are **FULFILLED**.

Remarks:

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5.3 Spurious emissions (magnetic field) 9 kHz – 30 MHz

For test instruments and accessories used see section 6 Part SER 1.

5.3.1 Description of the test location

Test location: OATS1

Test distance: 3 metres

5.3.2 Photo documentation of the test set-up



5.3.3 Applicable standard

According to FCC Part 15C, Section 15.209:

The emissions from intentional radiators shall not exceed the effective field strength limits.

FCC ID: NDX-GES3S

5.3.4 Description of Measurement

The spurious emissions of the EUT have to be measured at an open area test site in the frequency range from 9 kHz to 1000 MHz using a tuned EMI receiver. The set up of the equipment under test will be in accordance with ANSI C63.4. The measurement has been performed at 3 m. The results have been compared to the limits defined at 30 m or 300 m distances according to FCC Part 15C, Section 15.31(f)(2) using an inverse linear distance extrapolation factor of 40 dB/decade. The final measurement has been performed with the EMI receiver using Quasi peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used, according to Section 15.209(d).

The resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz: RBW: 200 Hz

150 kHz – 30 MHz: RBW: 9 kHz

Example:

Frequency (MHz)	Level (dBμV)	+	Factor (dB)	=	Level dB(μV/m)	-	Limit dB(μV/m)	=	Delta (dB)
1.705	5	+	20	=	25	-	30	=	-5

5.3.5 Test result

Measurement distance: 3 m

Frequency (MHz)	Level PK (dBμV)	Level AV (dBμV)	Level QP (dBμV)	Band- width (kHz)	Correct. factor (dB)	Corrected Level PK dB(μV/m)	Corrected Level AV dB(μV/m)	Corrected Level QP dB(μV/m)	Limit AV dB(μV/m)	Delta (dB)
0.402	54.4	51.4	53.8	9	20	74.4	71.4	73.8	95.51	-24.1

Calculated value at distance: 300m

Frequency (MHz)	Level PK (dBμV)	Level AV (dBμV)	Level QP (dBμV)	Band- width (kHz)	Correct. factor (dB)	Corrected Level PK dB(μV/m)	Corrected Level AV dB(μV/m)	Corrected Level QP dB(μV/m)	Limit AV dB(μV/m)	Delta (dB)
0.402	-25.6	-28.6	-26.2	9	20	-5.6	-8.6	-6.2	15.51	-21.4

Measurement distance: 3 m

Frequency (MHz)	Level PK (dBμV)	Level AV (dBμV)	Level QP (dBμV)	Band- width (kHz)	Correct. factor (dB)	Corrected Level PK dB(μV/m)	Corrected Level AV dB(μV/m)	Corrected Level QP dB(μV/m)	Limit AV dB(μV/m)	Delta (dB)
0.671	43.6	60.6	43.1	9	20	63.6	60.6	63.1	71.07	-10.5

Calculated value at distance: 30m

Frequency (MHz)	Level PK (dBμV)	Level AV (dBμV)	Level QP (dBμV)	Band- width (kHz)	Correct. factor (dB)	Corrected Level PK dB(μV/m)	Corrected Level AV dB(μV/m)	Corrected Level QP dB(μV/m)	Limit AV dB(μV/m)	Delta (dB)
0.671	3.6	0.6	3.1	9	20	23.6	20.6	23.1	31.07	-10.5

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Limit according to FCC Part 15 Subpart 15.209(a):

Frequency (MHz)	Field strength of spurious emissions		Measurement distance
	($\mu\text{V/m}$)	dB($\mu\text{V/m}$)	(metres)
0.009-0.490	2400/F(kHz)	--	300
0.490-1.705	24000/F (kHz)	--	30
1.705-30.0	30	29.5	30

The requirements are **FULFILLED**.

Remarks: All other unwanted emissions in the frequency range from 9 kHz to 30 MHz were
below < -10.5 dB $\mu\text{V/m}$.

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5.4 Emission Bandwidth

For test instruments and accessories used see section 6 Part MB.

5.4.1 Description of the test location

Test location: AREA4

5.4.2 Photo documentation of the test set-up



Fundamental [kHz] See Plot 1	20dB Bandwidth F1	20dB Bandwidth F2	Measured Bandwidth [kHz]
134.20	132.05	136.90	4.85

Remarks:

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5.4.3 Test protocol

Emission Bandwidth plots



* RBW 1 kHz

Marker 1 [T1]

* VBW 1 kHz

107.79 dBμV

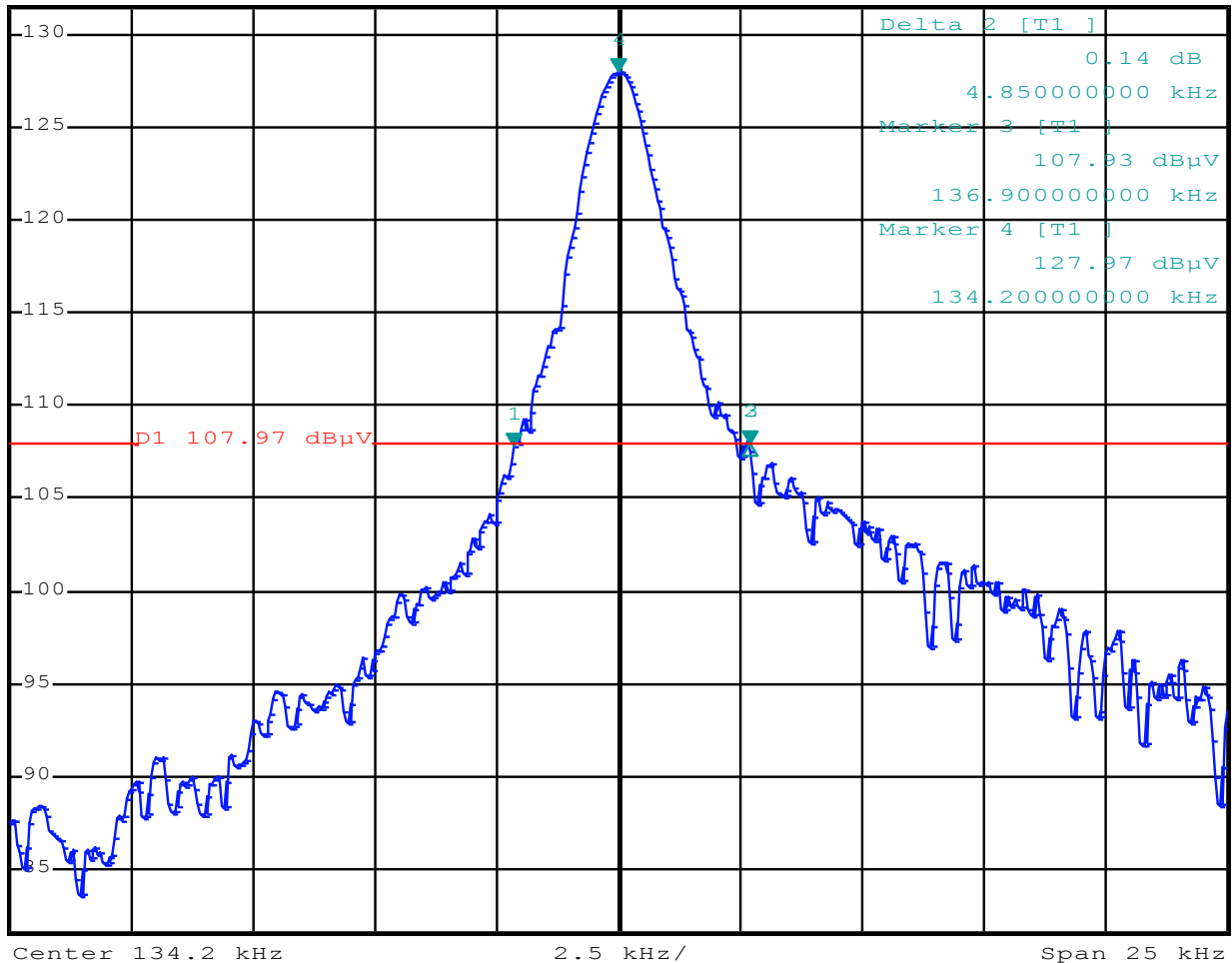
Ref 131.5 dBμV

Att 60 dB

SWT 50 ms

132.05000000 kHz

1 PK
VIEW



5.5 SAR test exclusion considerations

5.5.1 Applicable standard

According to RF exposure guidance:

Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

5.5.2 Determination of the standalone SAR test exclusion threshold

a) For Bluetooth device:

The minimum separation distance results from the application of the RFID reader which is handled by hand. This distance is assumed to < 5 mm from antenna to the hand of the user. The applicable distance is 5 mm.

The hand of the user is the nearest extremity of a human being therefore the threshold for 10-g is determined.

The formula under 4.3.1 1) for 100 MHz to 6 GHz for standalone equipment is used:

$$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 7.5;$$

The max power is according the equipment authorisation 2.5 mW at max frequency of 2.48 GHz. The max power inclusive tuneup tolerance is assumed to be 3 mW.

$$10\text{-g Threshold level} = (3.0 \text{ mW} / 5 \text{ mm}) \cdot \sqrt{2.48} = 0.6 \cdot 1.57 = 0.96 \leq 7.5;$$

Conclusion: The Threshold level is much smaller than the limit, no SAR measurement is necessary.

b) For RFID device:

The minimum separation distance results from the application of the RFID reader which is handled by hand. This distance is assumed to ≤ 50 mm from antenna to the hand of the user.

For frequencies below 100 MHz the Item 4.3.1 3) has to be considered:

The max power is according Item 5.2 of this test report 99.7 dB μ V/m at 3 m at frequency 134.2 kHz. The max fieldstrength inclusive tuneup tolerance is assumed (+3 dB) to be 102.7 dB μ V/m.

The fieldstrength is converted to power with the formula:

$$\begin{aligned} \text{EIRP} &= E + 20 \log(d) - 104.8; \\ \text{EIRP} &= 102.7 + 20 \log 3 - 104.8 = 7.4 \text{ dBm} = 5.6 \text{ mW}; \end{aligned}$$

The formula under 4.3.1 1) a) is applied:

$$[\text{Power allowed at numeric threshold for 50 mm in step 1}) + (\text{test separation distance} - 50 \text{ mm}) \cdot (f(\text{MHz})/150)] \text{ mW} \cdot [1 + \log(100/f(\text{MHz}))]$$

for test separation distances > 50 mm and < 200 mm.

$$10\text{-g Threshold level} = 5.6 \text{ mW} + (50 \text{ mm} - 50 \text{ mm}) \cdot (0.134 / 150) \cdot (1 + \log(100/0.134)) = 5.6 \leq 7.5;$$

Conclusion: The Threshold level is much smaller than the limit, no SAR measurement is necessary.

5.5.3 Determination of the SAR test exclusion threshold for simultaneous transmission

When both devices are active the max threshold level has to be summed and the total threshold level is determined.

$$\begin{aligned} \text{Level device 1} + \text{level device 2} &\leq 18.75; \\ 0.96 + 5.6 &= 6.6 \leq 18.75; \end{aligned}$$

Conclusion: The Threshold level is much smaller than the limit, no SAR measurement is necessary.
Device 1 and device 2 can be co-located without exceeding SAR limits.

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6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	ESHS 30	02-02/03-05-002	16/07/2014	16/07/2013		
	ESH 2 - Z 5	02-02/20-05-004	06/06/2014	06/06/2013	06/12/2013	06/06/2013
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2	02-02/50-05-155			05/10/2013	05/04/2013
	SP 103 /3.5-60	02-02/50-05-182				
CPR 1	ESR7	02-02/03-13-001	21/05/2014	21/05/2013		
	HFH 2 - Z 2	02-02/24-05-020	23/08/2014	23/08/2013	14/02/2014	14/02/2013
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
MB	FSP 30	02-02/11-05-001	18/10/2013	18/10/2012		
	HFRAE 5161 _ 50kHz-120M	02-02/24-11-004				
SER 1	ESR7	02-02/03-13-001	21/05/2014	21/05/2013		
	HFH 2 - Z 2	02-02/24-05-020	23/08/2014	23/08/2013	14/02/2014	14/02/2013
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				