



Test report No:
NIE: 61571RRF.003

Test report

ETSI EN 300 330 v 2.1.1 (2017-02)

(*) Identification of item tested	SoC
(*) Trademark	Nordic
(*) Model and /or type reference	nRF52833
Other identification of the product	HW version: QIAA SW version: nDTM49658
(*) Features	IEEE 802.15.4, Bluetooth LE 5.0 and Proprietary
Manufacturer	NORDIC SEMICONDUCTOR Nordic Semiconductor ASA, Otto Nielsens veg 12, 7052, Trondheim, Norway
Test method requested, standard	ETSI EN 300 330 v.2.1.1 (2017-02). Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager
Date of issue	2019-12-10
Report template No	FDT08_22 (*) "Data provided by the client"

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Competences and guarantees

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Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample of nRF52833 consists of a System on Chip.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
62841/002	SoC	nRF52833	--	2019/10/09

Auxiliary elements used with the sample S/01

Control Nº	Description	Model	Serial Nº	Date of reception
---	Smartphone Android BQ	Aquaris X5 Plus	XN000860	---

Sample S/01 has undergone the following test(s): All tests indicated in Appendix A.

Test sample description

Ports..... :	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾
	-		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Supplementary information to the ports..... :	-				
Rated power supply	Voltage and Frequency				
	<input checked="" type="checkbox"/>	DC: 3 V			
Rated Power	-				
Clock frequencies	-				
Other parameters..... :	-				
Software version	nDTM49658				
Hardware version..... :	QIAA				
Dimensions in cm (W x H x D).... :	-				
Mounting position..... :	<input checked="" type="checkbox"/>	Other: SoC			
Modules/parts	Module/parts of test item		Type	Manufacturer	
	-				
Accessories (not part of the test item)	Description		Type	Manufacturer	
	-				
Documents as provided by the applicant..... :	Description		File name	Issue date	
	-				

Identification of the client

NORDIC SEMICONDUCTOR

Nordic Semiconductor ASA, Otto Nielsens veg 12, 7052, Trondheim, Norway

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-09-03
Date (finish)	2019-10-23

Document history

Report number	Date	Description
61571RRF.003	2019-12-10	First release

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C
	Max. = 35 °C
Relative humidity	Min. = 20 %
	Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C
	Max. = 35 °C
Relative humidity	Min. = 20 %
	Max. = 75 %
Air pressure	Min. = 860 mbar
	Max. = 1060 mbar

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C
	Max. = 35 °C
Relative humidity	Min. = 20 %
	Max. = 35 %
Air pressure	Min. = 860 mbar
	Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Ignacio Cabra and José Gabriel Pendón

Used instrumentation:

Conducted measurements:

	Last Calibration	Due Calibration
1. Shielded Room ETS LINDGREN S101	N.A.	N.A.
2. Chamber HERAEUS VMT 04/35	2018/06	2020/06
3. Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2019/09	2021/09
4. EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2018/10	2020/10

Radiated measurements:

	Last Calibration	Due Calibration
1. Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2. Shielded Room ETS LINDGREN S101	N.A.	N.A.
3. EMI Test Receiver ROHDE AND SCHWARZ ESR7	2018/10	2020/10
4. Active Loop Antenna HEWLETT PACKARD 11966A	2018/06	2020/06
5. Pre-Amplifier G>40dB 10MHz-6GHz, BONN ELEKTRONIK, BLNA 0160-01N	2019/02	2020/02
6. Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2017/09	2020/09

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

ETSI EN 300 330 PARAGRAPH			
Requirement – Test case		Verdict	Remark
4.3.1.	Permitted range of operating frequencies	P	
4.3.2.	Operating frequency ranges	P	
4.3.3.	Modulation bandwidth	P	
4.3.4.	Transmitter H-field requirements	P	
4.3.5.	Transmitter RF carrier current	N/A	(1)
4.3.6.	Transmitter radiated E-field	N/A	(1)
4.3.7.	Transmitter conducted spurious emissions	N/A	(1)
4.3.8.	Transmitter radiated spurious domain emission limits < 30 MHz	P	
4.3.9.	Transmitter radiated spurious domain emission limits > 30 MHz	P	
4.3.10.	Transmitter Frequency stability	N/A	(2)
4.4.2.	Receiver spurious radiation	N/A	(3)
4.4.3.	Receiver. Adjacent channel selectivity	N/A	(2)
4.4.4.	Receiver. Blocking or desensitization	N/A	(2)
<u>Supplementary information and remarks:</u>			
1) The equipment is a Product Class 1.			
2) Non-channelized system.			
3) The receiver is permanently co-located with the transmitter.			

Appendix A: Test results

TEST CONDITIONS	12
TEST 4.3.1.: Permitted range of operating frequencies	14
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TEST CONDITIONS

POWER SUPPLY (V):

Vn: 3 Vdc

Type of Power Supply: Internal (board).

The subscripts 'n', 'min' and 'max' mean nominal, minimum and maximum respectively.

(*): Declared by applicant.

TEMPERATURE (°C):

Tn: +15 to + 35.

Tmin: 0 (*)

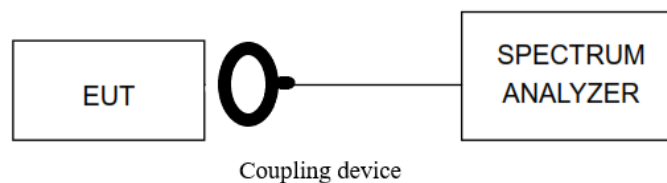
Tmax: +35 (*)

TEST FREQUENCIES:

Nominal Operating Frequency: 13.56 MHz

CONDUCTED MEASUREMENTS

The equipment under test EUT was set up in a shielded room and it is connected to the spectrum analyzer through a RF cable and a coupling device.



For extreme test conditions the EUT was placed inside a climatic chamber and connected to the spectrum analyzer using a low loss cable and a coupling device. An external DC power supply was connected to the EUT for voltage variation test.

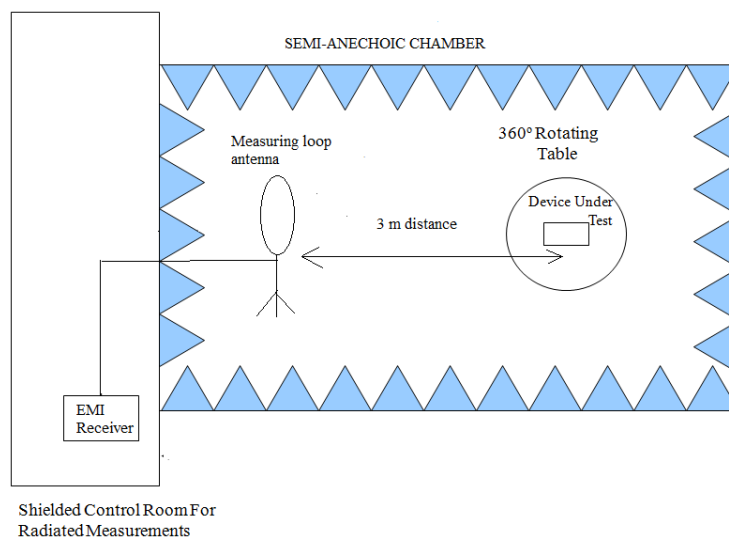
RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m (Loop antenna for the range between 9 kHz to 30 MHz and Bilog antenna for 30 MHz to 1 GHz).

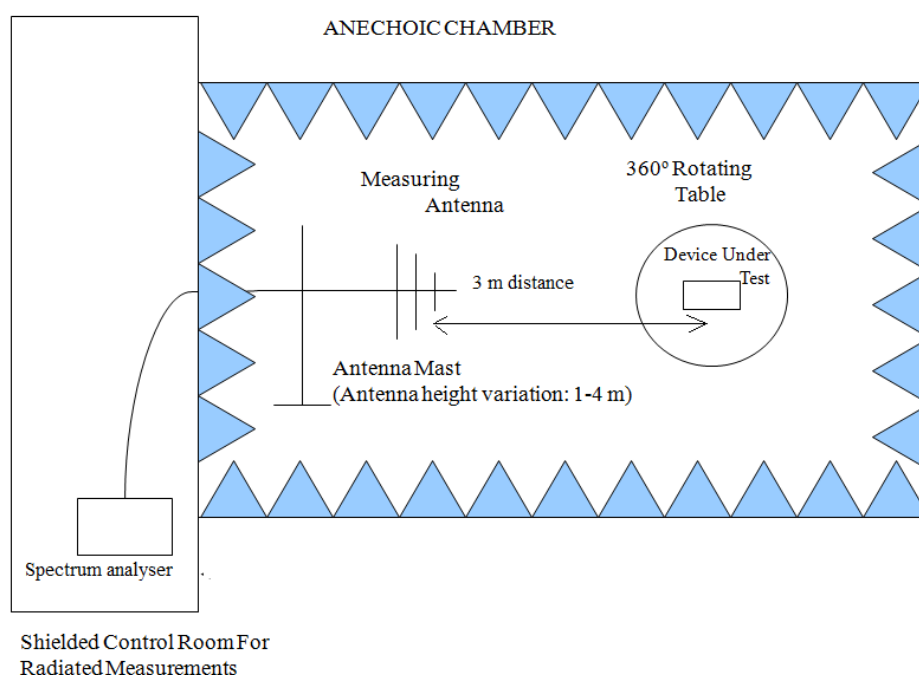
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

In the range between 9 kHz and 30 MHz the measurements were made in the three different orientation planes of the loop antenna to determine the maximum received field. Measurements above 30 MHz were made in both horizontal and vertical planes of polarization.

Radiated measurements setup $f < 30$ MHz:



Radiated measurements setup $f > 30$ MHz:



TEST 4.3.1.: Permitted range of operating frequencies

LIMITS:

Clause 4.3.1.3 of the standard ETSI EN 300 330 v2.1.1.

The permitted range of operating frequencies for intentional emissions shall be entirely within the frequency bands in the following table:

Table 1: Short Range Devices within the 9 kHz to 30 MHz permitted frequency bands

	Frequency Bands/frequencies	Applications
Transmit and Receive	9 kHz to 90 kHz	Inductive devices, Generic use
Transmit and Receive	90 kHz to 119 kHz	Inductive devices, Generic use
Transmit and Receive	119 kHz to 140 kHz	Inductive devices, Generic use
Transmit and Receive	140 kHz to 148,5 kHz	Inductive devices, Generic use
Transmit and Receive	148,5 kHz to 5 MHz	Inductive devices, Generic use
Transmit and Receive	400 kHz to 600 kHz	RFID only
Transmit and Receive	5 MHz to 30 MHz	Inductive devices, Generic use
Transmit and Receive	3 155 kHz to 3 400 kHz	Inductive devices, Generic use
Transmit and Receive	984 kHz to 7 484 kHz (Note 3, Centre frequency is 4 234 kHz)	Inductive devices, Railway applications
Transmit and Receive	4 516 kHz	Inductive devices, Railway applications
Transmit and Receive	6 765 kHz to 6 795 kHz	Inductive devices, Generic use
Transmit and Receive	7 400 kHz to 8 800 kHz	Inductive devices, Generic use
Transmit and Receive	10 200 kHz to 11.000 MHz	Inductive devices, Generic use
Transmit and Receive	11.810 MHz to 15.310 MHz (Centre frequency is 13.56 MHz)	RFID only
Transmit and Receive	12.5 MHz to 20 MHz	Inductive devices, Wireless healthcare
Transmit and Receive	13.553 MHz to 13.567 MHz	Inductive devices, Generic use
Transmit and Receive	26.957 MHz to 27.283 MHz	Inductive devices, Generic use
Transmit and Receive	27.090 MHz to 27.100 MHz	Inductive devices, Railway applications

NOTE 1: In addition, it should be noted that other frequency bands may be available in a country within the frequency range 9 kHz to 30 MHz.

NOTE 2: On non-harmonised parameters, national administrations may impose certain conditions such as the type of modulation, frequency, channel/frequency separations, maximum transmitter radiated power, duty cycle, and the inclusion of an automatic transmitter shut-off facility, as a condition for the issue of an Individual Rights for use of spectrum or General Authorization, or as a condition for use under "licence exemption" as it is in most cases for Short Range Devices.

NOTE 3: Transmitting only on receipt of a Balise/Eurobalise tele-powering signal from a train.

RESULTS:

The declared Nominal Operating Frequency is 13.56 MHz. RFID only.

Declared Permitted Range of Operating Frequencies used by the EUT: 11.81 – 15.31 MHz.

Verdict: PASS

TEST 4.3.2.: Operating frequency ranges

LIMITS:

Clause 4.3.2.3 of the standard ETSI EN 300 330 v 2.1.1.

The operating frequency ranges for intentional emissions shall be entirely within the frequency bands in the following table:

Table 1: Short Range Devices within the 9 kHz to 30 MHz permitted frequency bands

	Frequency Bands/frequencies	Applications
Transmit and Receive	9 kHz to 90 kHz	Inductive devices, Generic use
Transmit and Receive	90 kHz to 119 kHz	Inductive devices, Generic use
Transmit and Receive	119 kHz to 140 kHz	Inductive devices, Generic use
Transmit and Receive	140 kHz to 148.5 kHz	Inductive devices, Generic use
Transmit and Receive	148.5 kHz to 5 MHz	Inductive devices, Generic use
Transmit and Receive	400 kHz to 600 kHz	RFID only
Transmit and Receive	5 MHz to 30 MHz	Inductive devices, Generic use
Transmit and Receive	3 155 kHz to 3 400 kHz	Inductive devices, Generic use
Transmit and Receive	984 kHz to 7 484 kHz (Note 3, Centre frequency is 4 234 kHz)	Inductive devices, Railway applications
Transmit and Receive	4 516 kHz	Inductive devices, Railway applications
Transmit and Receive	6 765 kHz to 6 795 kHz	Inductive devices, Generic use
Transmit and Receive	7 400 kHz to 8 800 kHz	Inductive devices, Generic use
Transmit and Receive	10 200 kHz to 11.000 MHz	Inductive devices, Generic use
Transmit and Receive	11.810 MHz to 15.310 MHz (Centre frequency is 13,56 MHz)	RFID only
Transmit and Receive	12.5 MHz to 20 MHz	Inductive devices, Wireless healthcare
Transmit and Receive	13.553 MHz to 13.567 MHz	Inductive devices, Generic use
Transmit and Receive	26.957 MHz to 27.283 MHz	Inductive devices, Generic use
Transmit and Receive	27.090 MHz to 27.100 MHz	Inductive devices, Railway applications
NOTE 1: In addition, it should be noted that other frequency bands may be available in a country within the frequency range 9 kHz to 30 MHz.		
NOTE 2: On non-harmonised parameters, national administrations may impose certain conditions such as the type of modulation, frequency, channel/frequency separations, maximum transmitter radiated power, duty cycle, and the inclusion of an automatic transmitter shut-off facility, as a condition for the issue of an Individual Rights for use of spectrum or General Authorization, or as a condition for use under "licence exemption" as it is in most cases for Short Range Devices.		
NOTE 3: Transmitting only on receipt of a Balise/Eurobalise tele-powering signal from a train.		

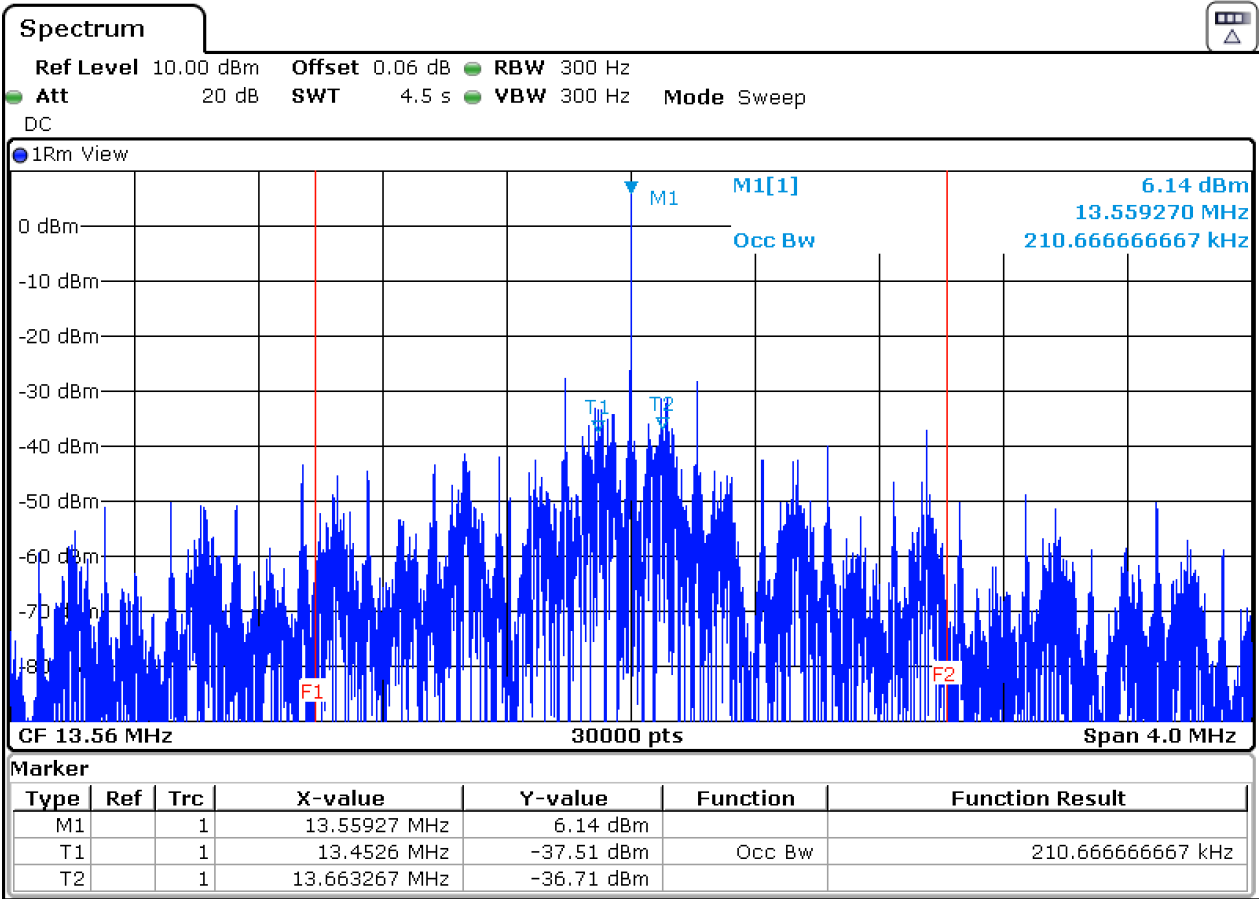
RESULTS:

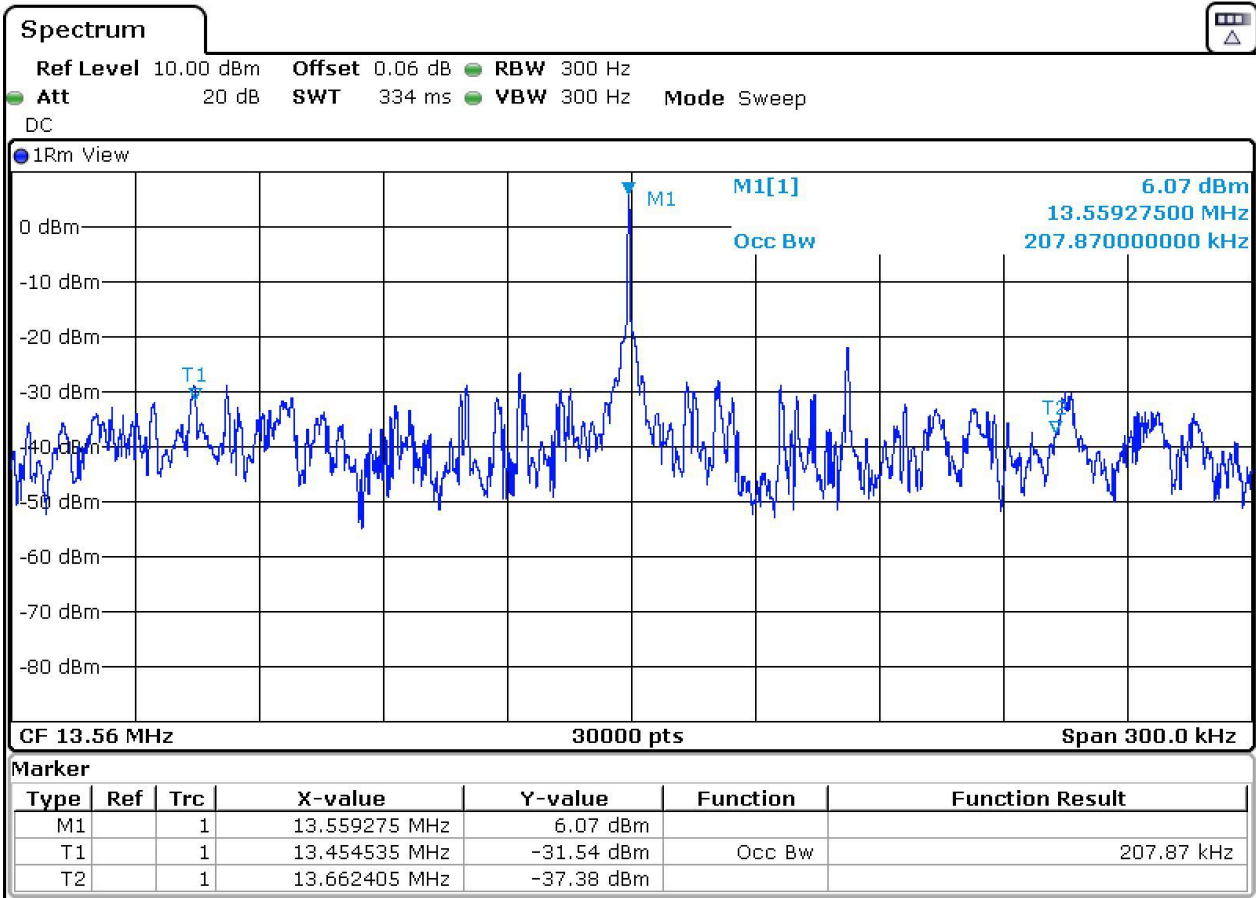
Type of Equipment: RFID Reader (13.56 MHz, RFID only).

Assigned Frequency Band: 11.81 – 15.31 MHz

The power envelope is:

TEST CONDITIONS		fL (MHz)	fH (MHz)	Center Frequency (MHz)
Tn	Vn	13.454535	13.662405	13.558470
Measurement uncertainty		< ± 1·10 ⁻⁷		





Verdict: PASS

TEST 4.3.3.: Modulation bandwidth

LIMITS:

Clause 4.3.3.3 of the standard ETSI EN 300 330 v 2.1.1.

The modulation bandwidth shall be within the assigned frequency band indicated in the following table or $\pm 7.5\%$ of the carrier frequency whichever is the smallest.

For RFID and EAS Systems, the modulation bandwidth shall be within the transmitter emission boundary of figures I.1., I.2., I3 and I4.

Table 1: Short Range Devices within the 9 kHz to 30 MHz permitted frequency bands

	Frequency Bands/frequencies	Applications
Transmit and Receive	9 kHz to 90 kHz	Inductive devices, Generic use
Transmit and Receive	90 kHz to 119 kHz	Inductive devices, Generic use
Transmit and Receive	119 kHz to 140 kHz	Inductive devices, Generic use
Transmit and Receive	140 kHz to 148.5 kHz	Inductive devices, Generic use
Transmit and Receive	148.5 kHz to 5 MHz	Inductive devices, Generic use
Transmit and Receive	400 kHz to 600 kHz	RFID only
Transmit and Receive	5 MHz to 30 MHz	Inductive devices, Generic use
Transmit and Receive	3 155 kHz to 3 400 kHz	Inductive devices, Generic use
Transmit and Receive	984 kHz to 7 484 kHz (Note 3, Centre frequency is 4 234 kHz)	Inductive devices, Railway applications
Transmit and Receive	4 516 kHz	Inductive devices, Railway applications
Transmit and Receive	6 765 kHz to 6 795 kHz	Inductive devices, Generic use
Transmit and Receive	7 400 kHz to 8 800 kHz	Inductive devices, Generic use
Transmit and Receive	10 200 kHz to 11.000 MHz	Inductive devices, Generic use
Transmit and Receive	11.810 MHz to 15.310 MHz (Centre frequency is 13,56 MHz)	RFID only
Transmit and Receive	12.5 MHz to 20 MHz	Inductive devices, Wireless healthcare
Transmit and Receive	13.553 MHz to 13.567 MHz	Inductive devices, Generic use
Transmit and Receive	26.957 MHz to 27.283 MHz	Inductive devices, Generic use
Transmit and Receive	27.090 MHz to 27.100 MHz	Inductive devices, Railway applications
NOTE 1: In addition, it should be noted that other frequency bands may be available in a country within the frequency range 9 kHz to 30 MHz.		
NOTE 2: On non-harmonised parameters, national administrations may impose certain conditions such as the type of modulation, frequency, channel/frequency separations, maximum transmitter radiated power, duty cycle, and the inclusion of an automatic transmitter shut-off facility, as a condition for the issue of an Individual Rights for use of spectrum or General Authorization, or as a condition for use under "licence exemption" as it is in most cases for Short Range Devices.		
NOTE 3: Transmitting only on receipt of a Balise/Eurobalise tele-powering signal from a train.		

RESULTS:

Type of Equipment: RFID (NFC at 13.56 MHz).
 Assigned Frequency Band: 11.81 - 15.31 MHz.
 Carrier Frequency: 13.56 MHz
 ± 7.5% of the carrier frequency: 12.543 - 14.577 MHz

The level of the carrier is below the appropriate spurious limit.

TEST CONDITIONS		fL (MHz)	fH (MHz)
Tn	Vn	13,558930	13,559618
Tmin	Vmin	13,558924	13,559630
	Vmax	13,558962	13,559646
Tmax	Vmin	13,558913	13,559599
	Vmax	13,558918	13,559607
Extreme frequencies		13.55813	13.559646
Measurement uncertainty (kHz)		< ± 0.07	

fL: Lowest frequency at 15 dB below the carrier.

fH: Highest frequency at 15 dB below the carrier.

Verdict: PASS

TEST 4.3.4.: Transmitter H-field requirements

LIMITS:

Clause 4.3.4.3 of the standard ETSI EN 300 330 v 2.1.1.

The maximum H-field strength is given in the following table:

Table 2: H-field limits at 10 m

Frequency range (MHz)	H-field strength limit (H_f) dB μ A/m at 10 m or specified in mW e.r.p.
$0.009 \leq f < 0.090$	72 descending 3 dB/oct above 0.03 MHz or according to note 1 (see note 5)
$0.09 \leq f < 0.119$	42
$0.119 \leq f < 0.135$	66 descending 3 dB/oct above 0.119 MHz or according to note 1 (see notes 3 and 5)
$0.135 \leq f < 0.140$	42
$0.140 \leq f < 0.1485$	37.7
$0.1485 \leq f < 30$	-5 (see note 4)
$0.315 \leq f < 0.600$	-5
$3.155 \leq f < 3.400$	13.5
4.234	9 (see note 9)
4.516	7
$7.400 \leq f < 8.800$	9
$10.2 \leq f < 11.00$	9
$12.5 \leq f \leq 20$	-7
$6.765 \leq f \leq 6.795$	42 (see notes 3 and 7)
$26.957 \leq f \leq 27.283$	42 (see note 3)
$13.410 \leq f \leq 13.553$, $13.567 \leq f \leq 13.710$	9 (see note 6)
$13.110 \leq f \leq 13.410$, $13.710 \leq f \leq 14.010$	-3.5 (see note 6)
$12.660 \leq f \leq 13.110$, $14.010 \leq f \leq 14.460$	-10 (see note 6)
$11.810 \leq f \leq 12.660$, $14.460 \leq f \leq 15.310$	-16 (see note 6)
$13.460 \leq f \leq 13.553$, $13.567 \leq f \leq 13.660$	27 (see note 6)
$13.360 \leq f \leq 13.460$, $13.660 \leq f \leq 13.760$	Linear transition from 27 to -3.5 (see note 6)
$13.110 \leq f \leq 13.360$, $13.760 \leq f \leq 14.010$	-3.5 (see note 6)
$12.660 \leq f \leq 13.110$, $14.010 \leq f \leq 14.460$	-5 (see note 6)
$13.553 \leq f \leq 13.567$	42 (see note 3) or 60 (see notes 2 and 3)
27.095	42
26.995, 27.045, 27.095, 27.145, 27.195 (see note 8)	100 mW

NOTE 1: For the frequency ranges 9 kHz to 135 kHz, the following additional restrictions apply to limits above 42 dB μ A/m: - for loop coil antennas with an area ≥ 0.16 m² this table and table B.1 with the antenna limitations apply; - for loop coil antennas with an area between 0.05 m² and 0.16 m² table B.1 applies with a correction factor. The limit is: table value + 10 \times log (area/0,16 m²); - for loop coil antennas with an area < 0.05 m² the limit is 10 dB below table B.1.

NOTE 2: For RFID (incl. NFC) and EAS applications only.

NOTE 3: Spectrum mask limit, see annex I.

NOTE 4: For further information see annex G.

NOTE 5: Limit is 42 dB μ A/m for the following spot frequencies: 60 kHz \pm 250 Hz, 66.6 kHz \pm 750 Hz, 75 kHz \pm 250 Hz, 77.5 kHz \pm 250 Hz, and 129.1 kHz \pm 500 Hz.

NOTE 6: Only in conjunction with spectrum mask, see annex I.

NOTE 7: The frequency range 6.765 MHz – 6.795 MHz is not a harmonised ISM frequency band according article 5.138 of the ITU Radio Regulations [i.13].

NOTE 8: Center frequencies for channelized systems by using ≤ 10 kHz bandwidth.

NOTE 9: The limit is valid in the range 984 kHz - 7 484 kHz for Transmitting only on receipt of a Balise/Eurobalise tele-powering signal from a train.

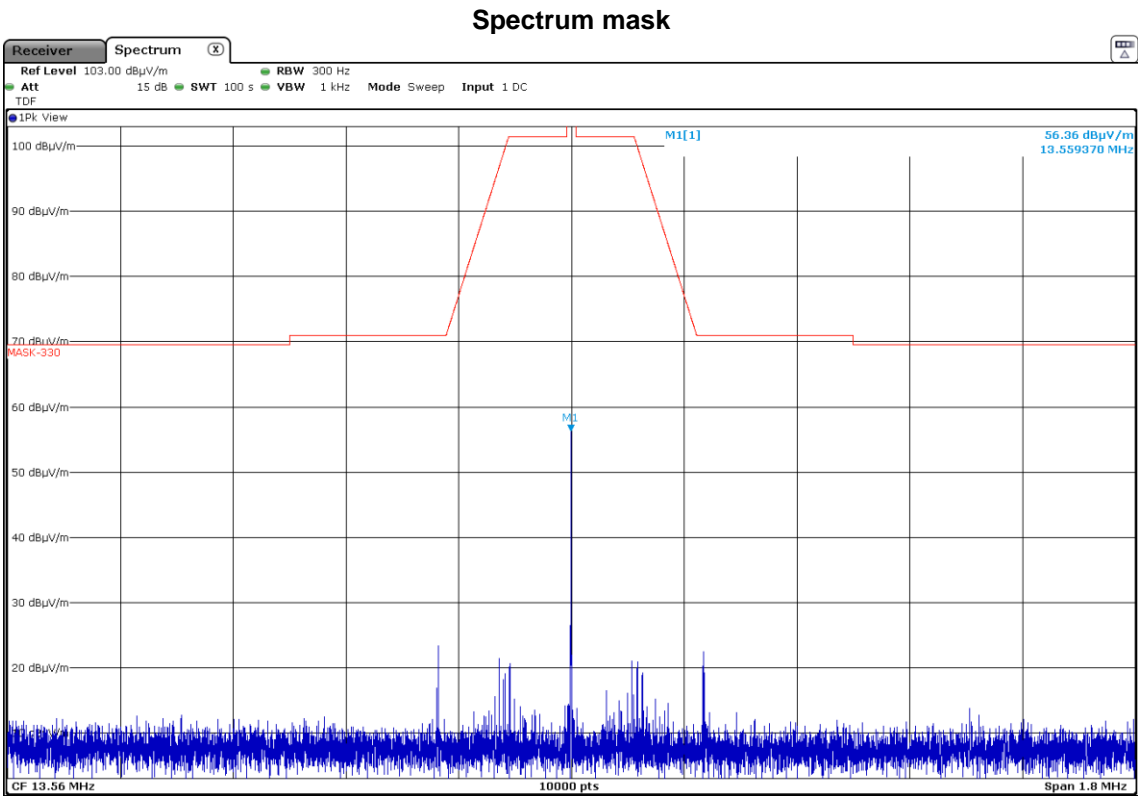
RESULTS:

The measurements have been made at 3 m, with the correction in the limits to 3 m according to annex H of standard ETSI EN 300 330 v 2.1.1.

Type of Equipment: RFID (NFC at 13.56 MHz).

Nominal Operating Frequency: 13.56 MHz.

TEST CONDITIONS		Maximum level H-field at 3 m (dBµA/m)	Corrected Limit H-field at 3 m (dBµA/m)
Tn	Vn	4.70	83
Tmin	Vmin	3.06	
	Vmax	2.94	
Tmax	Vmin	2.99	
	Vmax	3.18	
Measurement uncertainty		<±3.61 dB	



Verdict: PASS

TEST 4.3.8.: Transmitter radiated spurious domain emission limits < 30 MHz

LIMITS:

Clause 4.3.8.3. of the standard ETSI EN 300 330 v 2.1.1.

The radiated field strength of the spurious domain emissions below 30 MHz shall not exceed the generated H-field dBµA/m at 10 m given in the following table:

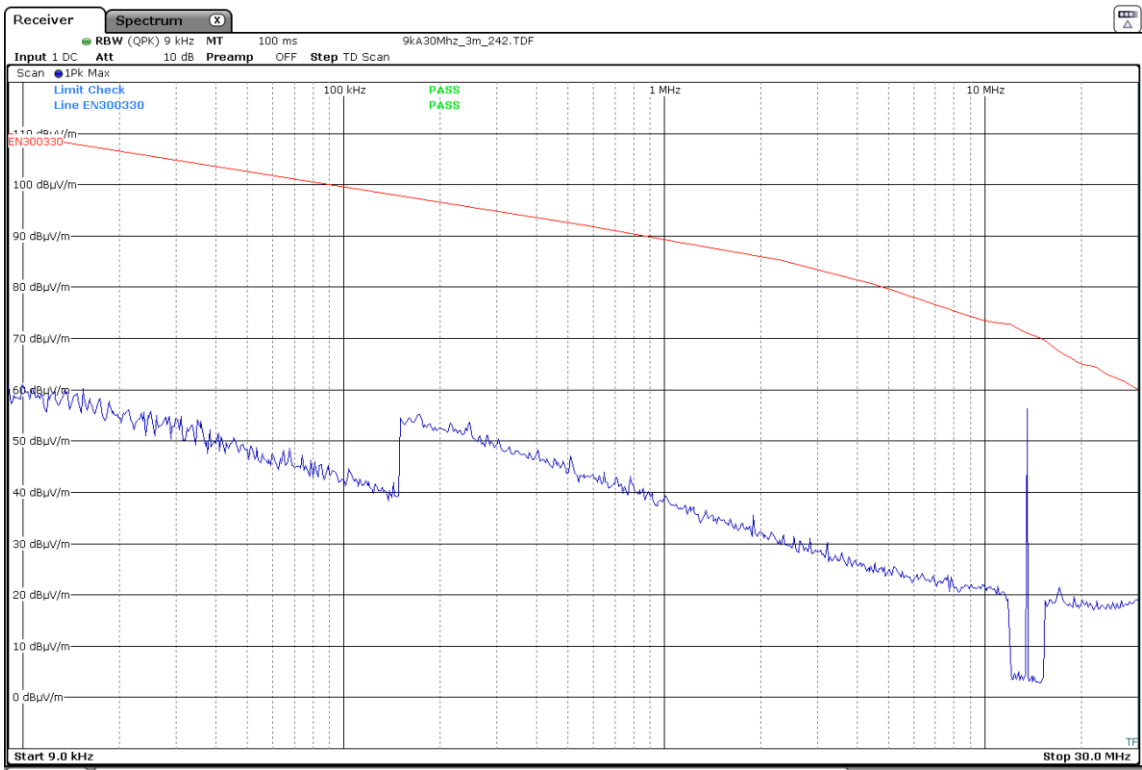
State	$9\text{ kHz} \leq f < 10\text{ MHz}$	$10\text{ MHz} \leq f < 30\text{ MHz}$
Operating	27 dBµA/m at 9 kHz and descending 3 dB/oct	-3.5 dBµA/m
Standby	5.5 dBµA/m at 9 kHz and descending 3 dB/oct	-25 dBµA/m

RESULTS:

The measurements have been made at 3 m, with the correction in the limits to 3 m according to annex H of standard ETSI EN 300 330 v 2.1.1.

No spurious frequency at less than 10 dB below the limit.

The equipment has no standby mode.



The plot shows the worst case result during scan with peak detector. The highest peak is the carrier frequency.

TEST 4.3.9.: Transmitter radiated spurious domain emission limits > 30 MHz

LIMITS:

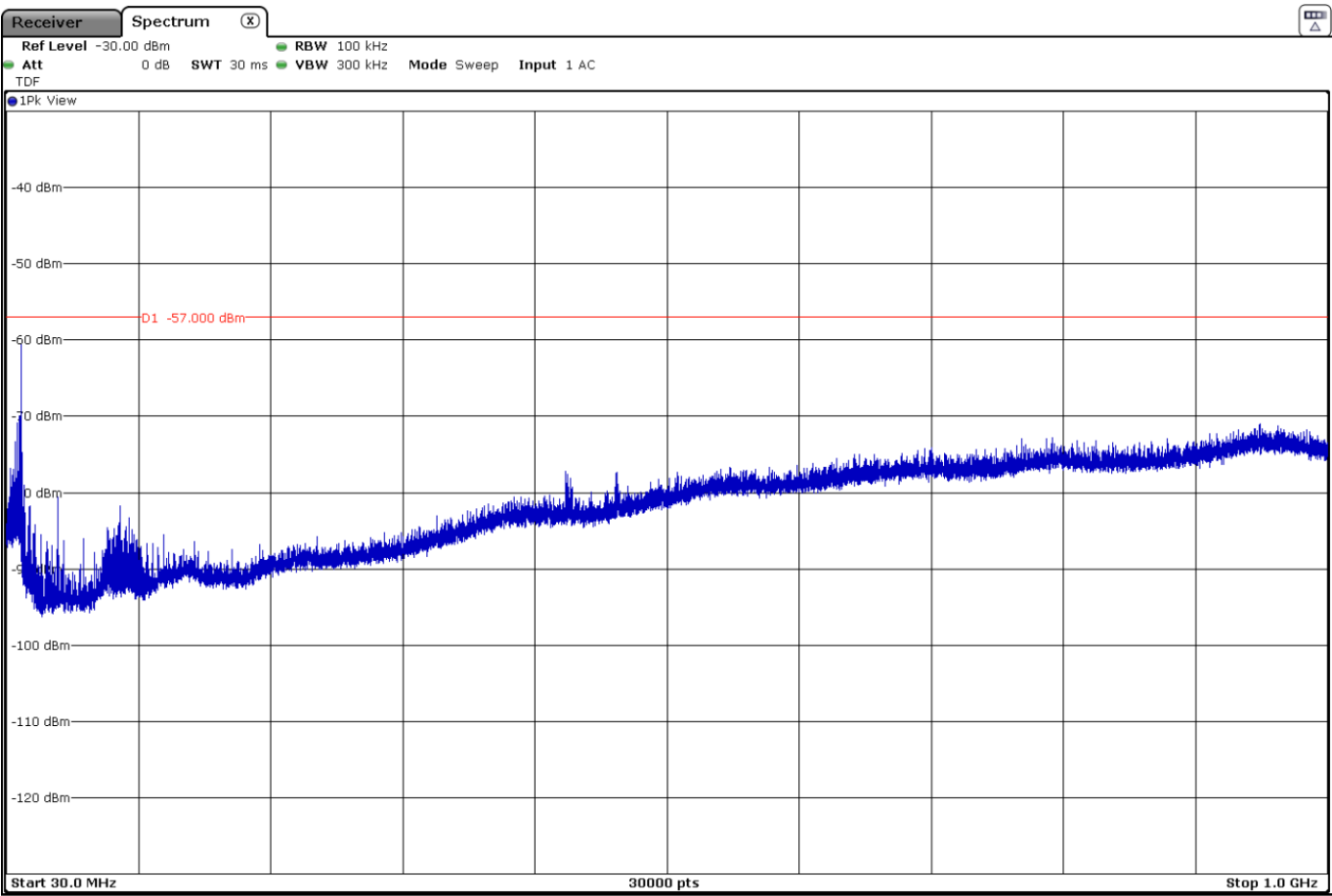
Clause 4.3.9.3 of the standard ETSI EN 300 330 v 2.1.1.

The power of any radiated emission shall not exceed the values given in the following table:

State	47 to 74 MHz 87.5 to 118 MHz 174 to 230 MHz 470 to 790 MHz	Other frequencies between 30 MHz to 1 GHz
Operating	4 nW (-54 dBm)	250 nW (-36 dBm)
Standby	2 nW (-57 dBm)	2 nW (-57 dBm)

RESULTS:

No spurious frequency at less than 10 dB below the limit.



The plot shows the worst case result during scan with peak detector.

Verdict: PASS

Appendix B: Photographs

EQUIPMENT VIEW

