

Test Report

Radio Characteristics

Product	Development Kit		
Name and address of the applicant	Nordic Semiconductor ASA Otto Nielsens vei 12, 7004 Trondheim, Norway		
Name and address of the manufacturer	Nordic Semiconductor ASA Otto Nielsens vei 12, 7004 Trondheim, Norway		
Model	nRF52840-DK		
Rating	3V Lithium battery or 5Vdc, 50mA (USB)		
Trademark	Nordic Semiconductor		
Serial number	683703601		
Additional information	13.56MHz NFC-A receiver		
Tested according to	ETSI EN 300 330 V2.1.1 (2017-02) parts of		
Order number	372254		
Tested in period	2019.05.16 – 2019.05.20		
Issue date	2019.10.02		
Name and address of the testing laboratory	 Instituttveien 6 Kjeller, Norway Tel: +47 22 96 03 30 Fax: +47 22 96 05 50   An accredited technical test executed under the Norwegian accreditation scheme		
	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">  Prepared by [G.Suhanthakumar] </div> <div style="width: 45%;">  Approved by [Frode Sveinsen] </div> </div>		
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CONTENTS

1	GENERAL INFORMATION	3
1.1	Tested Item.....	3
1.2	Test Environment.....	4
1.2.1	Normal test condition	4
1.2.2	Extreme test conditions	4
1.3	Test Engineer	4
1.4	Test Equipment.....	4
1.5	Other Comments	4
2	TEST REPORT SUMMARY	5
2.1	General.....	5
2.2	Test Summary	6
4	Receiver Conformance Requirement.....	8
4.4.1	General.....	8
4.1.1	Receiver spurious emissions < 30MHz.....	9
4.1.2	Receiver spurious emissions > 30MHz.....	12
4.1.3	Adjacent channel selectivity.....	14
4.1.4	Receiver Blocking or desensitization	15
5	Test Setups	16
6	PHOTOGRAPHS OF THE EUT	17
7	Test Equipment Used	19

1 GENERAL INFORMATION

1.1 Tested Item

Name :	Nordic Semiconductor
Model/version :	nRF52840-DK
Serial number :	683703601
Hardware identity and/or version:	V1.1.0
Software identity and/or version :	TBD
Operating frequencies:	13.56MHz
Assigned frequency band :	13,553 MHz to 13,567 MHz
Tuneable Bands :	1
Number of Channels :	1
Operating Modes :	RX only
Type of Modulation :	/
User Frequency Adjustment :	None
Rated Output Power :	N/A
Type of Power Supply :	3.0Vdc battery
Antenna Connector :	NO
Antenna type :	Antenna type 2
Antenna size:	1.239 *10 ⁻³ m ²
Product class:	1
Receiver class:	N/A

Description of Tested Device(s)

The nRF52840-DK is a versatile single board development kit for Bluetooth 5, Bluetooth mesh, Thread, Zigbee, 802.15.4, ANT and 2.4 GHz proprietary applications on the nRF52840 SoC.

It also supports development for the nRF52811 SoC.

It facilitates development exploiting all features of the nRF52840 SoC. It includes an NFC antenna that quickly enables utilization of the NFC-A tag peripheral. All GPIOs are available via edge connectors and headers, and 4 buttons and 4 LEDs simplifies input and output to and from the SoC.

1.2 Test Environment

1.2.1 Normal test condition

Temperature:	20 - 25 °C
Relative humidity:	30 - 45 %
Normal test voltage:	3Vdc

The values are the limit registered during the test period.

1.2.2 Extreme test conditions

Not applicable

1.3 Test Engineer

Kristian Osvoll and G.Suwanthakumar

1.4 Test Equipment

See list of test equipment in clause 7.

1.5 Other Comments

All relevant measurements are performed for the NFC receiver and results are passed.

2 TEST REPORT SUMMARY

2.1 General

The tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with

ETSI EN 300 330-1 V2.1.1 (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

The test methods have been in accordance with TM-NO-WLS-500, TM-NO-WLS-204A and EN 300 330 where applicable.

Radiated tests were performed in accordance with TM-NO-WLS-500, TM-NO-WLS-204A and EN 300 330

Radiated emissions are made in a 10m semi-anechoic chamber < 30MHz and in 3 m chamber for > 30MHz.

☒ Production Unit

☐ Pre-production Unit



THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

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2.2 Test Summary

Harmonized Standard EN 300 330							
Relationship between the present document and the essential requirements of Directive 2014/53/EU							
Technical Requirement reference			Technical Requirement Conditionality		Test Specification		
No	Description	Reference Clause No	U/C	Condition		Conformance Clause No	P/F/NA
1	Permitted range of operating frequencies	4.3.1	U			4.3.1.4	NA ¹
2	Operating frequency ranges	4.3.2	U			6.2.2	NA ¹
3	Modulation bandwidth	4.3.3	U			6.2.3	NA ¹
4	Transmitter H-field requirements	4.3.4	C	Only for equipment under class 1 and class 2, in clause 6.1.2		6.2.4	NA ¹
5	Transmitter RF carrier current	4.3.5	C	Only for equipment under class 3 in clause 6.1.2		6.2.5	NA ¹
6	Transmitter radiated E-Field	4.3.6	C	Only for equipment under class 4 in clause 6.1.2		6.2.6	NA ¹
7	Transmitter conducted spurious emissions	4.3.7	C	Only for equipment under class 3 in clause 6.1.2		6.2.7	NA ¹
8	Transmitter radiated spurious domain emission limits < 30MHz	4.3.8	U			6.2.8	NA ¹
9	Transmitter radiated spurious domain emission limits > 30MHz	4.3.9	C	For equipment under class 1, 2 and 4 in clause 6.1.2		6.2.9	NA ¹
10	Transmitter frequency Stability	4.3.10	C	Only for channelized systems		6.2.10	NA ¹
11	Receiver spurious emissions	4.4.2	C	Does only apply to receivers which a not co-located with transmitters		6.3.1	P
12	Adjacent channel selectivity	4.4.3	C	Only for channelized systems in clause 4.4.1		6.3.2	NA ²
13	Receiver blocking or desensitization	4.4.4	C	Not for tagging systems in clause 4.4.1		6.3.3	NA ³

- 1 The EUT is NFC -A receiver tag
- 2 Non channelized receiver operates in 13,56MHz band
- 3 NFC receiver for very short distance (max 3 cm).

Key to columns:

Essential Requirement:

No: A unique identifier for one row of the table which may be used to identify a requirement.

Description: textual reference to the requirement.

Clause number: Identification of clause(s) defining the essential requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

U/C Indicates whether the requirement is to be *unconditionally* applicable (U) or is *conditional* upon the suppliers claimed functionality of the equipment (C).

Condition: Explains the conditions when the requirement shall or shall not be applicable for a requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

4 Receiver Conformance Requirement

EN 300 330 CI 4.4.1

4.1 General

Technologies	Receiver spurious emission (clause 4.4.2)	Adjacent channel selectivity (clause 4.4.3)	Blocking or desensitization (clause 4.4.4)
NFC tag*	Yes	No (note 2)	No (note 1)
<p>NOTE 1: Blocking or desensitization not needed because of the physical co-location of RX to TX in tagging systems where the RX and TX operate simultaneously. The TX signal is used for the RX baseband mixing. The TX signal at the RX input is about 90 dB above the receiver sensitivity or tagging signal level the receiver (see ETSI TR 103 059 [i.9], figure 8).</p> <p>Furthermore given the very short communication ranges for most applications (e.g. NFC, RFID), a given interference blocking signal will have to be about 90 dB higher as the transmitter signal at the transceiver antenna, which is unlikely to happen.</p> <p>NOTE 2: This requirement can only be required where a frequency plan with standard channel spacing is consistently used, for example in the 27 MHz band.</p>			

*According to the manufacturer the tested device is a NFC tag in receiver mode only.

EN 300 330 CI 4.4.2

4.2 Receiver spurious emissions < 30MHz

Frequency (MHz)	Measured radiated field strength (dBuA/m)	Limit (dBuA/m)
13.56	-29.9	< -25
Measurement uncertainty	U ₉₅ : +1.8/-2.1 dB	

*QP detector

Limit 4.4.2.3

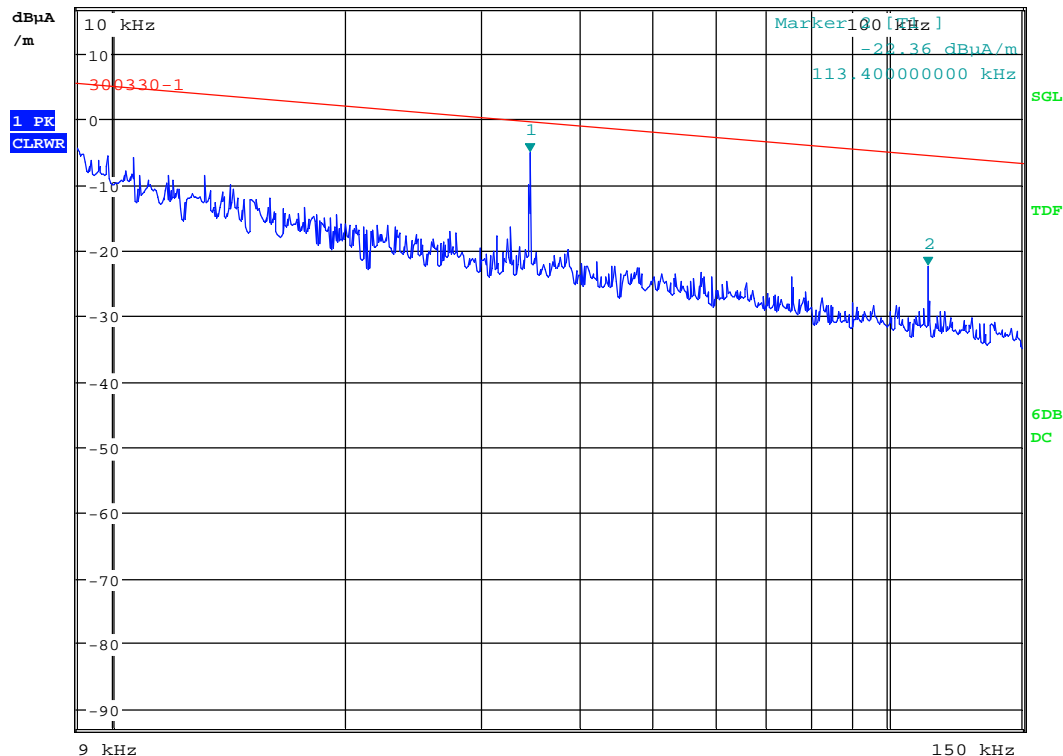
State	Frequency $9 \text{ kHz} \leq f < 10 \text{ MHz}$	Frequency $10 \text{ MHz} \leq f < 30 \text{ MHz}$
RX	5.5 dB μ A/m at 9 kHz descending 3 dB/oct	-25 dB μ A/m

Test Equipment Used: 1,2,3



MARKER 1
34.52 kHz
Step AUTO Att 0 dB

RBW 200 Hz MT 50 ms PREAMP OFF
Marker 1 [T1]
-5.01 dBμA/m
34.52000000 kHz

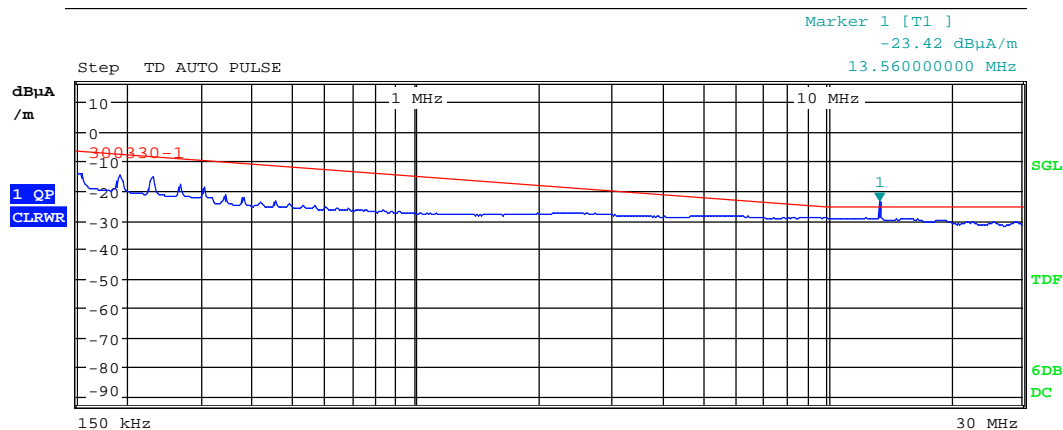
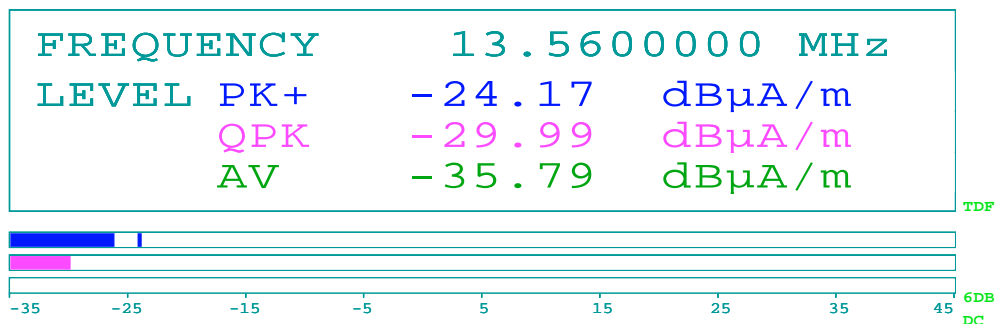


Date: 16.MAY.2019 08:00:37

Spurious emission 9kHz – 150kHz (PK scan), The spurious emissions 14.52kHz is not from the EUT. It is from the test setup.



Att 0 dB AUTO RBW 9 kHz
MT 2 s
PREAMP ON



Date: 16.MAY.2019 08:12:22

Spurious emission 150kHz – 30MHz (QP scan)

EN 300 330 CI 4.4.2

4.3 Receiver spurious emissions > 30MHz

Frequency (MHz)	Spurious emission level (dBm)	Limit (dBm)
30 - 1000	< -68	< -57
Measurement uncertainty	25 - 80MHz ± 4.23 dB 80 - 1080MHz ± 2.80 dB 180 - 1000MHz ± 2.54 dB	

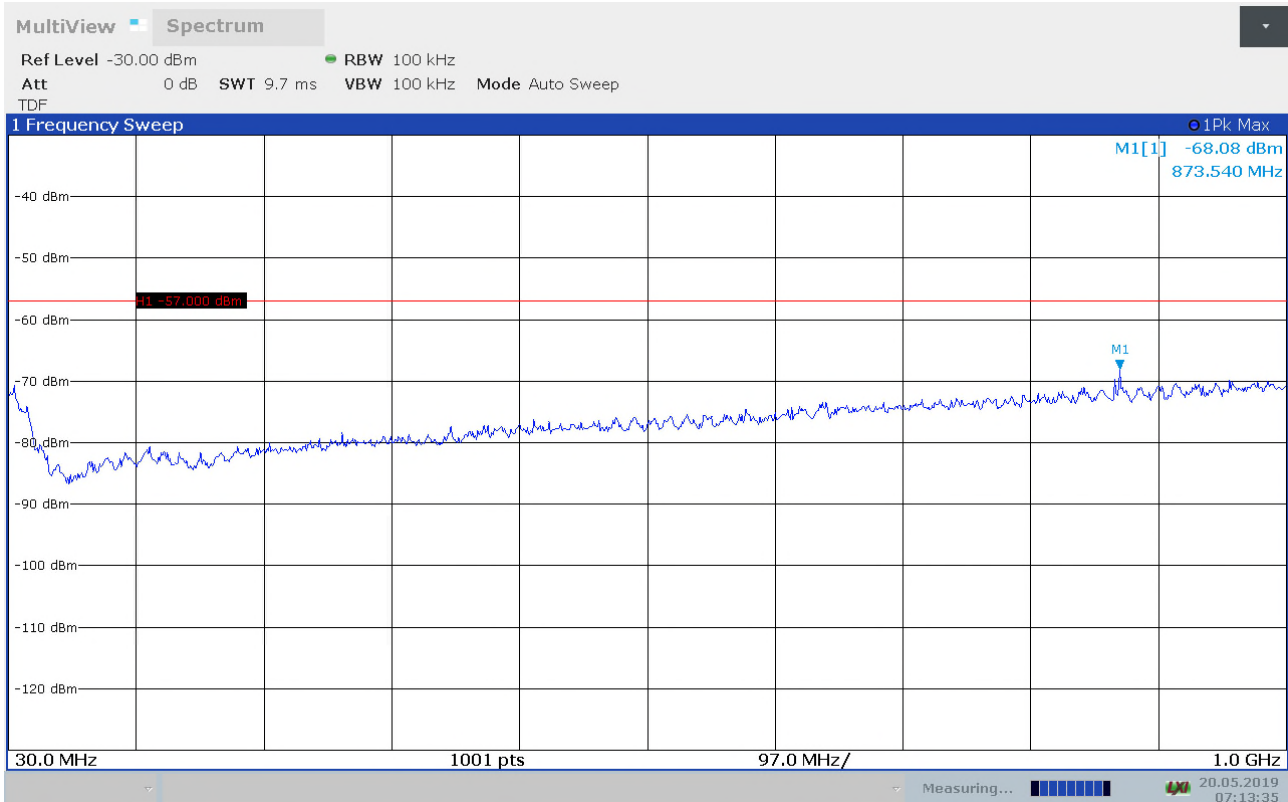
PK scan

Please see the attached graphs below

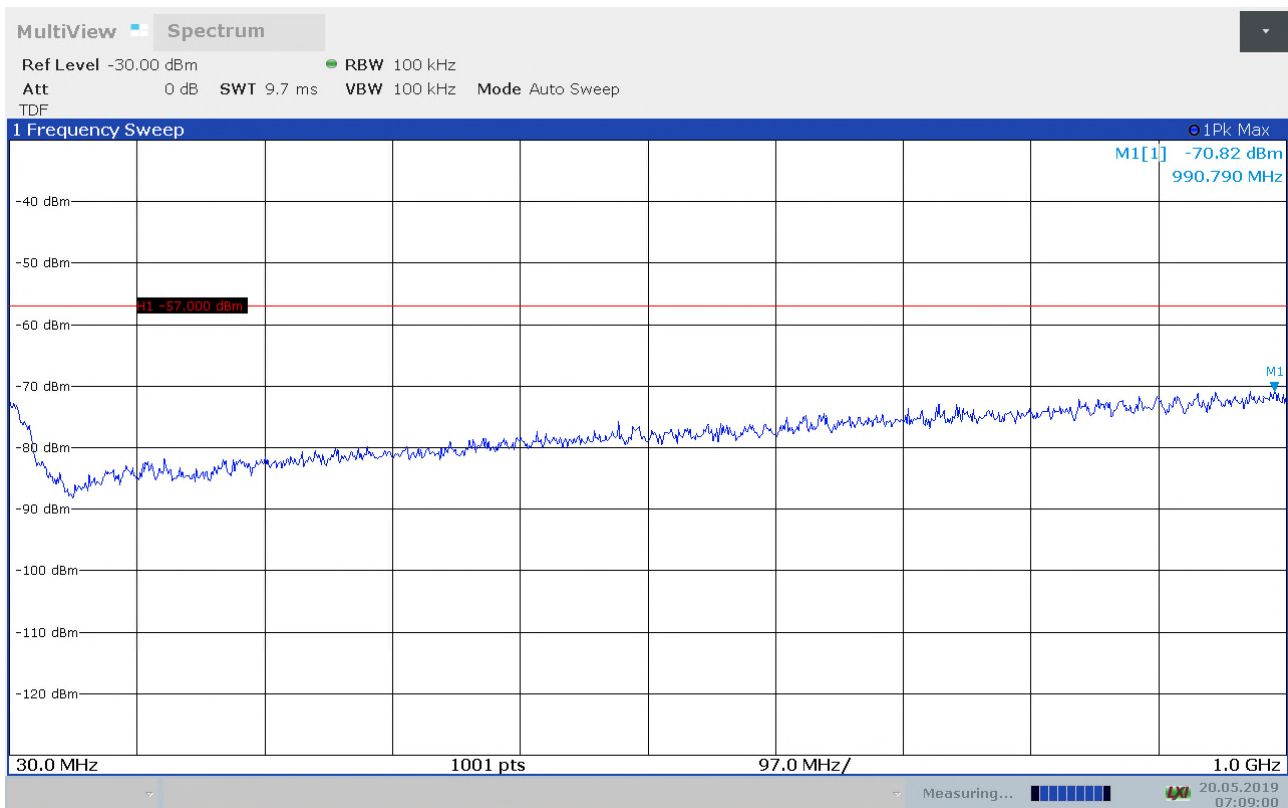
Limits 4.4.2.3

State	Frequencies between 30 to 1000 MHz
RX	2 nW (< -57 dBm)

Test Equipment Used: 4,5,6,7



VP : 30 - 1000MHz



HP: 30 - 1000MHz

EN 300 330 Cl. 4.4.3

4.4 Adjacent channel selectivity

N/A

This requirement can only be required where a frequency plan with standard channel spacing is consistently used, for example in the 27 MHz band.

Limit 4.4.4.3

Channel spacing \leq 25kHz	Channel spacing $>$ 25kHz
≥ 60 dB	≥ 70 dB

Test Equipment Used: /

EN 300 330 Cl. 4.4.4

4.5 Receiver Blocking or desensitization

N/A

NFC receiver for very short communication distance. (max 3cm)

Limit 4.4.4.3

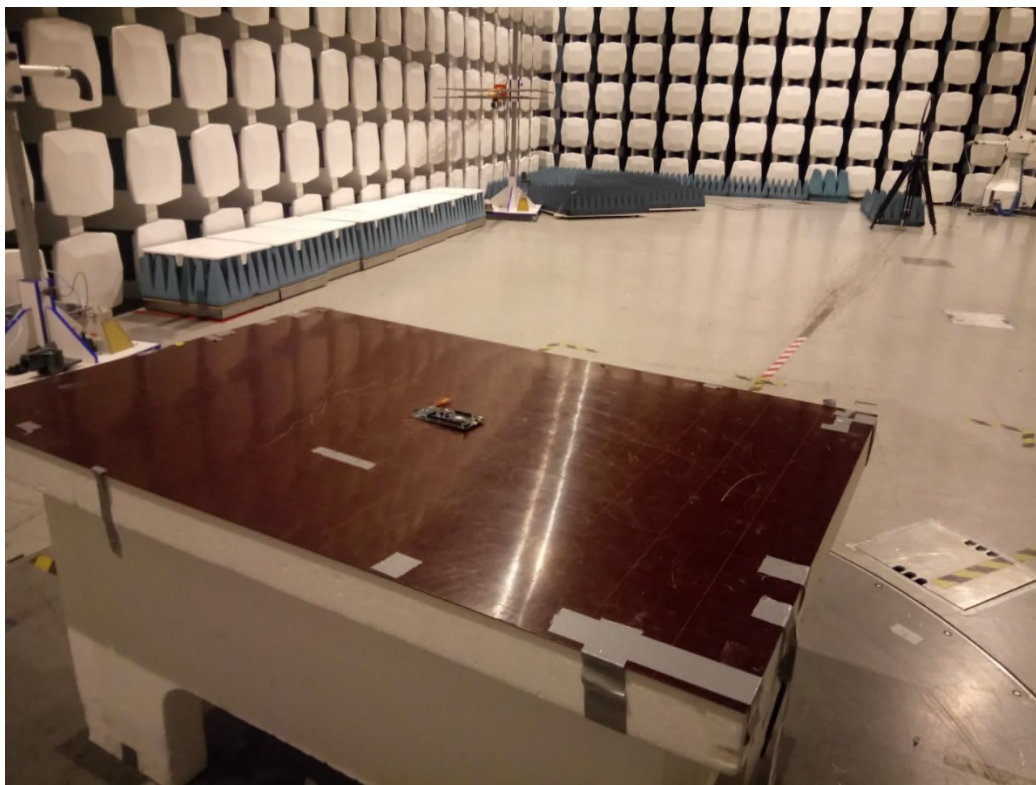
The blocking ratio, for any frequency within the specified ranges, shall not be less than the values given in table 10, except at frequencies on which spurious responses are found. The limit value is determined by a reference limit (Ref) multiplied by a correction factor depending of the appropriate receiver category.

Table 10: Receiver blocking or desensitization limits

Generator B frequency offset, $ f_A - f_B $, either by a) or b) whichever is greater (see note 3)			Limit (dB)
a) per clause 7.4, indent a)		b) per clause 7.4, indent b)	
$f_A < 500$ kHz	$f_A \geq 500$ kHz	value of N_B , see below	
± 100 kHz	± 500 kHz	2	Reference Limit $\times 1/2$ (see note 2)
± 200 kHz	± 1 MHz	4	Reference Limit $\times 2/3$ (see note 2)
± 300 kHz	± 2 MHz	8	Reference Limit $\times 5/6$ (see note 2)
± 500 kHz	± 5 MHz	20	Reference Limit (see note 1)
NOTE 1: Reference limit (Ref) = 30 dB at 9 kHz increasing with 10 dB/decade to 65,2 dB at 30 MHz.			
NOTE 2: The limit is a fractional dB value of the reference limit.			
NOTE 3: Generator B frequencies below 9 kHz are not specified.			

Test Equipment Used: /

5 Test Setups

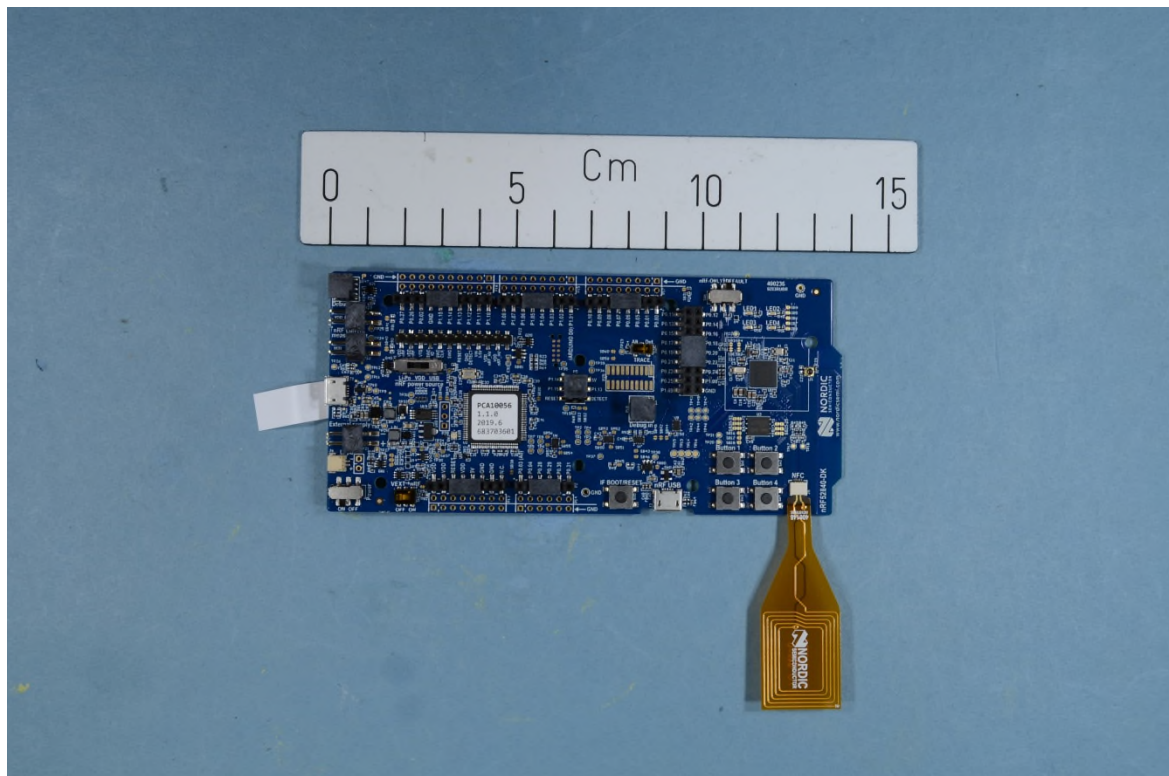


Radiated measurements at 10m - < 30MHz

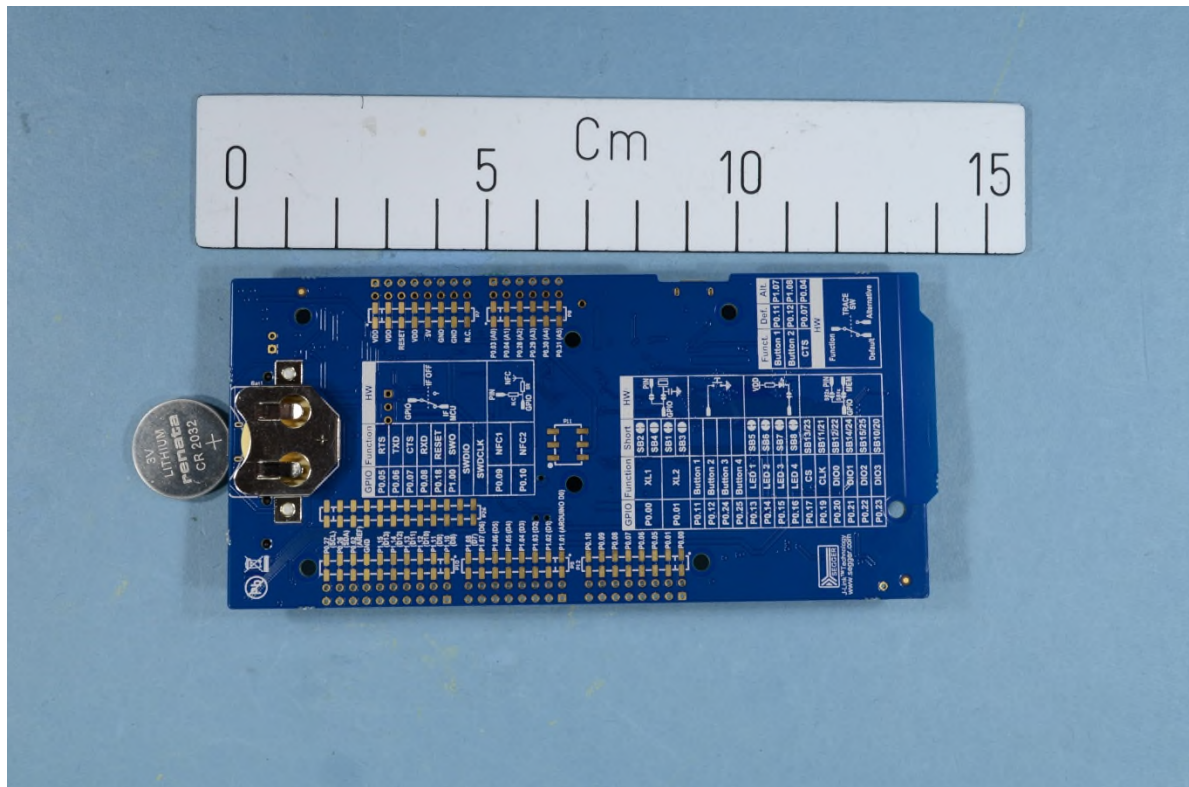


Radiated measurements >30MHz

6 PHOTOGRAPHS OF THE EUT



nRF52840-DK – Front side with NFC antenna



nRF52840-DK – Rear side



NFC antenna – front side



NFC antenna – Rear side

7 Test Equipment Used

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the test house.

Nr	Lab Nr	Description	Manufacturer	Type	Cal date	Cal due.
1.	LR 1660	Antenna, loop	R&S	HFH2-Z2	2016.11	2019.11
2.	LR 1410	Shielded room	ETS Euroshield	Semi-anechoic	N/A	
3.	LR 1639	EMI Receiver	Rohde & Schwarz	ES40	2019.03	2020.03
4.	LR 1640	Spectrum Analyzer	R&S	FSW26	2019.01	2021.01
5.	LR 1734	Antenna bilog	Sunol	JB3	2018.05	2020.05
6.	LR 1552	Amplifier, preamp	Miteq	AFS4	2019.04	2020.04
7.	LR 1570	Shielded room	Rainford	Anechoic	N/A	
8.	LR 1137	Attenuator	Suhner	6810.17.A	Cal b4 use	
9.	LR 1100	Antenna Inductive Probe	R&S	HFH2-Z4	Cal b4 use	
10.	LR 1083	Climate Chamber Temp	ACS	TY 80	2019.03	2020.03
11.	LR 1515	AC power source	Agilent	6812B	2017.09	2019.09
12.	LT 5218	Multimeter, Digital	Fluke	45	2018.11	2020.11

Revisions

Revision #	Date	Order #	Description
00	2019.10.02	372254	First issued