

R041-15-106815-4A - DM / CBU

⇒ This report cancels and replaces the test report R041-15-106815-4A Ed.1

RADIO TEST REPORT

According to the standard(s):

FCC part 15 Subpart C
RSS-210 Issue 8, December 2010

Equipment under test:

X-NUCLEO-NFC03A1 NFC card reader board

FCC ID: YCPNFC03A1

IC: 8976A-NFC03A1

Company:

ST MICROELECTRONICS SAS

Diffusion: Mr ROMAN

(Company: ST MICROELECTRONICS SAS)

Number of pages: 31 including 1 annex

Ed.	Date	Modified page(s)	Technical verification Quality approval	
			Name	Visa
2	19 Jul. 16	Refer to lines in the margin	Olivier HEYER	

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NAME OF THE EQUIPMENT UNDER TEST (E.U.T.) : X-NUCLEO-NFC03A1 NFC card reader
board
FCC ID: YCPNFC03A1
IC: 8976A-NFC03A1

Serial number : 2160200020

Part number : MB1171 D-01

Software Version : Not communicated

MANUFACTURER'S NAME : ST MICROELECTRONICS SAS

APPLICANT'S ADDRESS:

Company : ST MICROELECTRONICS SAS

Address : 190 avenue Celestin Coq
13106 ROUSSET
FRANCE

Person(s) present during the tests : Mr ROMAN

Responsible : Mr ROMAN

DATE(S) OF TESTS : January 28th and 29th of 2016

TESTS LOCATION(S) : EMITECH MONTPELLIER laboratory in
VENDARGUES (34) - FRANCE
Open area test site in SALINELLES (30) -
FRANCE
FCC Test Firm Registration Number: 954701
IC Filing number: 4379C-1

TESTS SUPERVISOR(S) : None

TESTS OPERATOR(S) : David MONTAULON

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1. INTRODUCTION

This document submits the results of Electromagnetic Compatibility tests performed on the equipment X-NUCLEO-NFC03A1 NFC card reader board (denominated hereafter E.U.T.: equipment under test) according to document(s) listed below.

2. REFERENCE DOCUMENT(S)

FCC Part 15	Code of Federal Regulations Title 47 – Telecommunications Chapter 1 – Federal Communications Commission Part 15 – Radio frequency devices Subpart C – Intentional Radiators
RSS-210:2010 Issue 8, December 2010	Dispositifs de radio communication de faible puissance, exempts de licence (pour toutes les bandes de fréquences) : matériel de catégorie I
RSS-Gen: 2014 Issue 4, November 2014	Exigences générales et information relatives à la certification du matériel de radiocommunication
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

3. EQUIPMENT UNDER TEST CONFIGURATION

Equipment under test (E.U.T.) description: The X-NUCLEO-NFC03A1 is an NFC card reader evaluation board based on CR95HF integrated circuit to allow expansion of the STM32 Nucleo boards.

The CR95HF is card reader IC for contact-less application that provides the 13.56MHz air interface, frame coding and decoding for standard application such as Near Field Communication (NFC) and that communicates with the Host through UART or SPI interface. X-NUCLEO-NFC03A1 is compatible with the Arduino UNO R3 connector assignment.

This expansion board can be plugged into the Arduino UNO R3 connectors of any STM32 Nucleo board. The different expansion boards can be easily stacked to allow evaluation of different devices with NFC card reader.

FCC ID: YCPNFC03A1
IC: 8976A-NFC03A1

4. TECHNICAL SPECIFICATIONS

Presentation of equipment for testing purposes:

Frequency ranges used by the transmitter: 13.56MHz +/- 7 kHz

Equipment ☒ single-frequency
☐ two-frequency
☐ multi-frequency

Choice of model for testing:

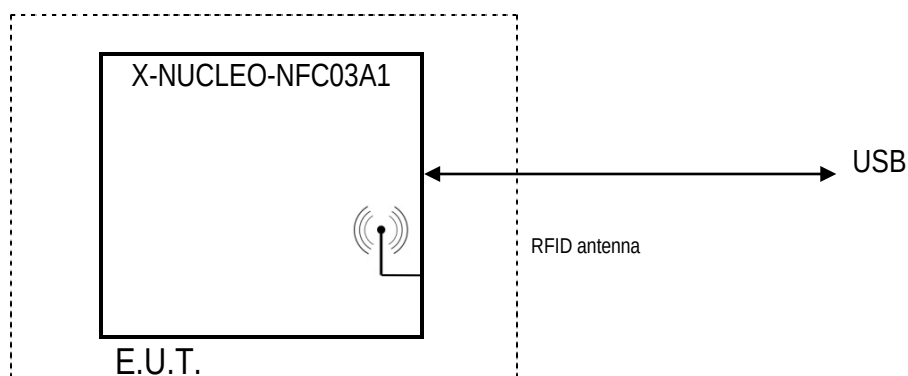
Test(s) frequency(ies): 13.56MHz

Extremes temperature ranges: -20°C/+50°C

Mechanical and electrical design:

Power source / Battery type: 5V USB

Antenna type: Integral



Auxiliary test equipment: Test PC

Equipment modifications applied during tests: Add of a ferrite Würth Elektronik 742 711 32 with one loop on USB cable.

5. SUMMARY OF TEST RESULTS

Tests designation	Results satisfying?	Comments
Antenna requirement - FCC part 15.203	YES	Integrated antennas
Restricted band of operation - FCC part 15.205 & RSS Gen:2014 table 6	YES	
Conducted power lines - FCC part 15.207 & RSS Gen:2014 table 3	YES	
Unwanted radiated emissions - FCC part 15.209 & RSS Gen:2014 table 5	YES	
Field strength - FCC part 15.225 a) to d) & RSS 210:2010 Annex 2.6	YES	
Frequency tolerance - FCC part 15.225 e)	YES	
Occupied Bandwidth - RSS Gen:2014 §6.6	YES	

N.P.: Not Performed.

N.A.: Not Applicable.

▪ In emission:

Sample subject to the test complies with prescriptions of the standard(s) FCC Part 15 Subpart C according to limits specified in this test report.

To declare, or not, the compliance with the specifications, it was not explicitly taken account of uncertainty associated with the results.

6. CONDUCTED EMISSIONS – SECTION 15.207 & RSS GEN:2014 TABLE 3

Standards: FCC part 15 Subpart C 15.207 & RSS Gen: 2014 table 3

Tests methods: ANSI C63.10:2013

Test configuration:

Tested cable(s)	Measure with	E.U.T. height
110Vac/60Hz power supply (Host PC)	L.I.S.N.	40cm
110Vac/60Hz power supply (Host PC)/RF on 50 Ohms load	L.I.S.N.	40cm

Frequency band	Tested cable(s)	Resolution bandwidth	Video bandwidth	Detection mode
150kHz-30MHz	110Vac/60Hz power supply (Host PC)	10KHz	30kHz	Peak
150kHz-30MHz	110Vac/60Hz power supply (Host PC)/RF on 50 Ohms load	10KHz	30kHz	Peak

The Host PC PSU is a standard power supply 110Vac/60Hz/24Vdc. (see photos in annex)

Additional test: Integrated antenna is replaced by an equivalent 50Ohms load.

Test method deviation: No

Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH	DATE CAL.	DATE VAL.
Cable	EMITECH	Current absorber sheath	10653	24/11/2015	24 months
Cable	MICRO-COAX	N-3m	10535	24/11/2015	24 months
Cable	MICRO-COAX	N-5m	10527	24/11/2015	24 months
LISN	AFJ	LT42C\10	12007	04/05/2015	12 months
PE chocke	EMITECH	PE chocke 100A	10071	#	#
PE chocke	EMITECH	PE chocke 16A	10080	#	#
Receiver	Agilent Technologies	E4440A	5824	11/01/2016	24 months
Receiver	Rohde & Schwarz	ESHS10	3371	16/04/2015	24 months
Shielded enclosure	RAY PROOF	C.GS3	1123	#	#
Software	Nexio	BAT EMC	0000	#	#
Thermohygrometer	Testo	608-H1	7561	26/09/2014	24 months
Thermohygrometer	Bioblock Scientific	Météostar	0963	31/10/2014	24 months

#: Permanent validity

BAT-EMC software version: V3.6.0.32

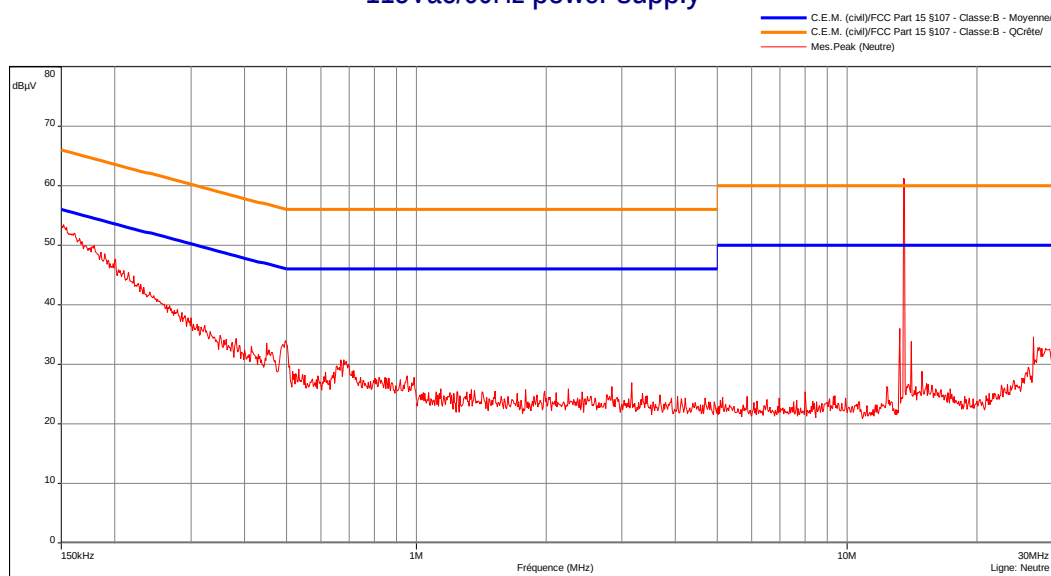
Results: See Graph(s) hereafter. Limits on the graphs are average and quasi-peak limits (upper limit).

Measurement uncertainty: +/- 3.53 dB

Conducted voltage emission (measurement)

115Vac/60Hz power supply

EMI2447



Date: 28/01/2016 17:22:42

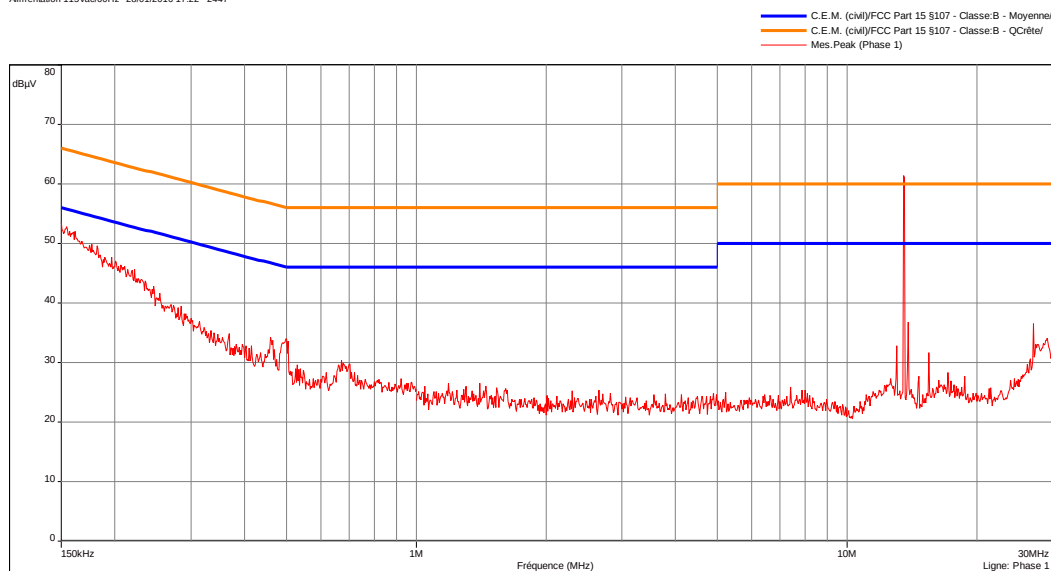
Technician: DM

Classe: B of the standard

Detection:
Peak

Modification(s) during test:
No

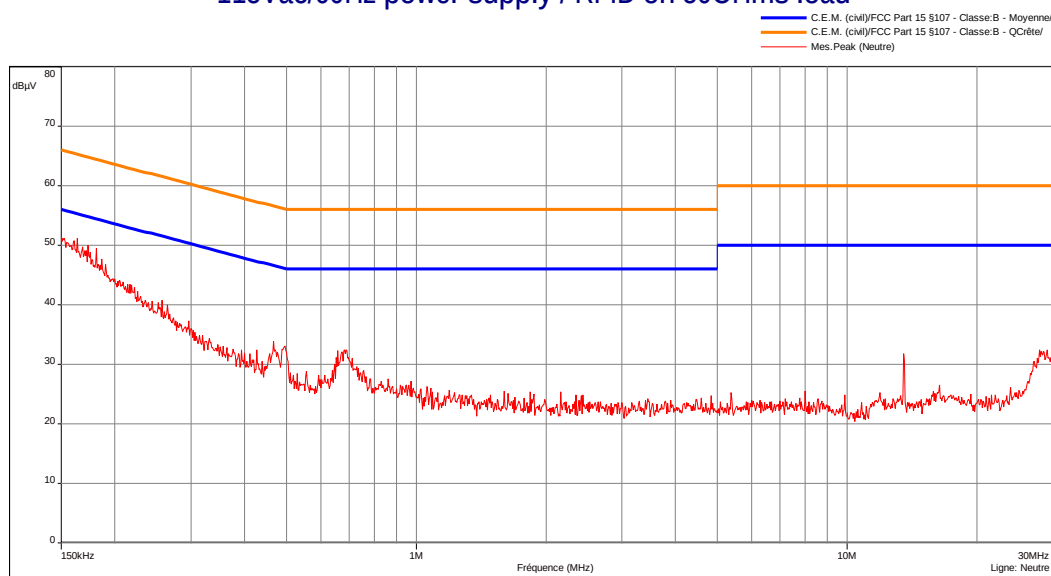
Alimentation 115Vac/60Hz - 28/01/2016 17:22 - 2447



Alimentation 115Vac/60Hz - 28/01/2016 17:22 - 2447

Conducted voltage emission (measurement) 115Vac/60Hz power supply / RFID on 50OHms load

EMI2465

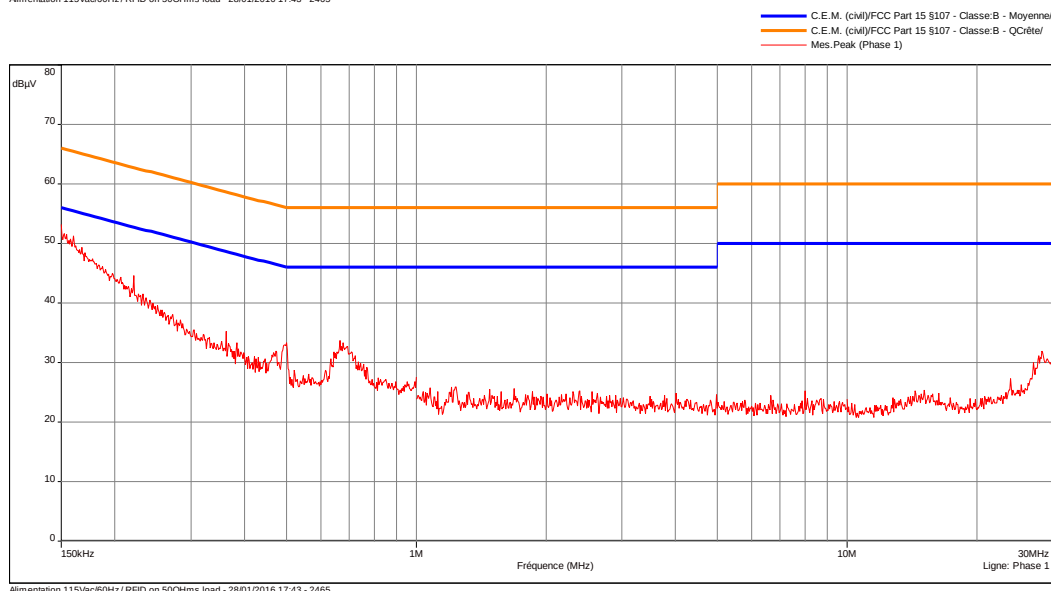


Date: 28/01/2016 17:43:47

Technician: DM

Classe: B of the standard

Detection:
Peak

Modification(s) during test:
No


7. UNWANTED RADIATED EMISSIONS – SECTION 15.209 & RSS GEN:2014 TABLE 5

Standards: FCC part 15 Radio part 15.209 & RSS Gen:2014 table 5

Tests methods: FCC part 15.209 and ANSI C63.10:2013

a) Pre-measurement in semi anechoic chamber:

Frequency band	Tested side	Resolution bandwidth	Video bandwidth	Detection mode	E.U.T. height
9kHz-150kHz	Front side	200Hz	1kHz	Peak	80cm
150kHz-30MHz	Front side	10kHz	30kHz	Peak	80cm
30MHz-1GHz	Front side	100kHz	300kHz	Peak	80cm

Measurements below 30MHz are done with a loop antenna as describe in the standard.

Measure is done with an antenna position of 0°, 90° and 45°.

Measurements are done in semi anechoic chamber at 3m. E.U.T. is set on a wooden table.

E.U.T. measurements are maximized at 360° in max-hold peak detection.

Limits:

From 9 kHz to 30MHz: Limit indicated on the curves is calculated with 40 dB/decade extrapolation factor and 51.5 dB conversion factor.

From 30MHz to 1GHz: quasi peak limit provided is the limit given in 15.209 and RSS Gen.

Above 1GHz average limits in restricted bands and general limits are 54dBμV/m. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20dB under any condition of modulation.

Test method deviation:

From 9 kHz to 30MHz: measurements are made in peak detection instead of average mode in frequency band 9 kHz-500 kHz

- Measurements are given in dBμA/m instead of μV/m
- Measuring distance is 3 meters instead of 30 and 300 meters

Radiated emissions limits in this frequency band are specified at 30 or 300 meters. Pre measurement distance used during the test, subject of this report, is 3 meters. Then published limits come from a theoretical conversion using an extrapolation factor of 40dB / decade.

Measuring distance: 3 meters

Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH	DATE CAL.	DATE VAL.
Antenna	Electro Metrics	BIA-30HF	1107	25/05/2015	36 months
Antenna	Rohde & Schwarz	HFH2-Z2	5825	27/01/2015	24 months
Antenna	Rohde & Schwarz	HL223	1137	25/04/2015	36 months
Cable	C&C	N-3m	10558	24/11/2015	24 months
Cable	MICRO-COAX	N-5m	10529	24/11/2015	24 months
Receiver	Agilent Technologies	E4440A	5824	11/01/2016	24 months
Shielded enclosure	RAY PROOF	C.V1	1123	#	#
Software	Nexio	BAT EMC	0000	#	#
Thermohygrometer	Testo	608-H1	7561	26/09/2014	24 months
Thermohygrometer	Bioblock Scientific	Météostar	0963	31/10/2014	24 months

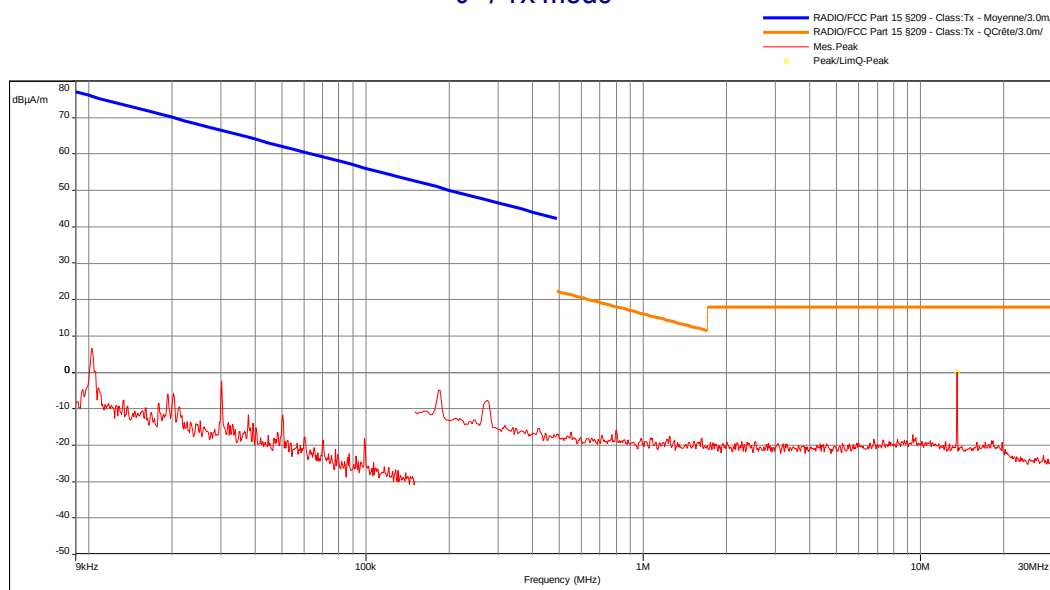
#: Permanent validity

BAT-EMC software version: V3.6.0.32
Results: See Graphs hereafter.

Radiated magnetic field emission (measurement)

0° / Tx mode

EMI2454



Date: 28/01/2016 11:37:34

Technician: DMO

Classe: Tx of the standard

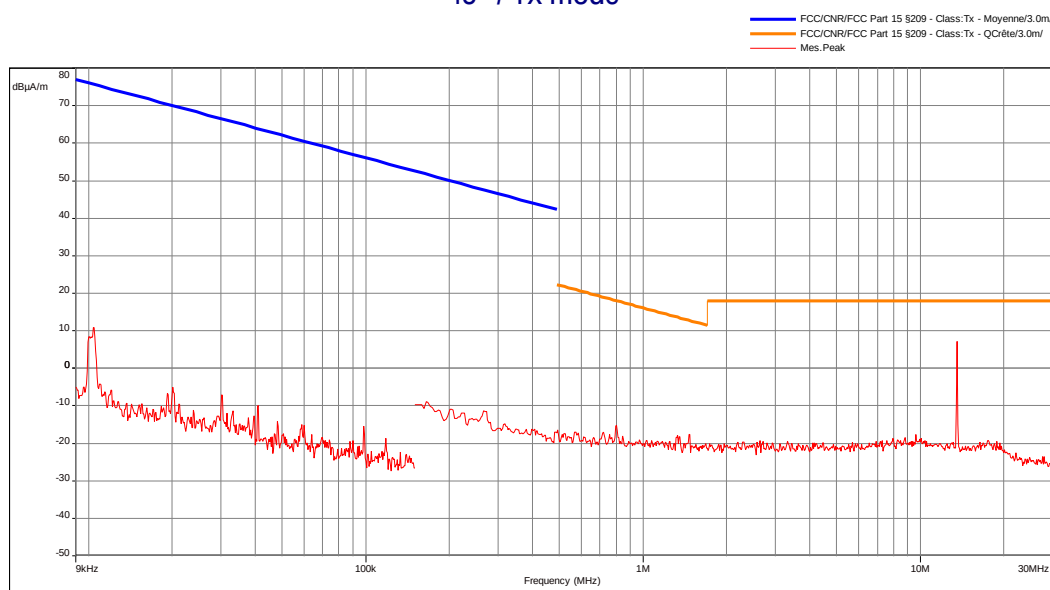
Detection:
Peak

Modification(s) during test:
None

Radiated magnetic field emission (measurement)

45° / Tx mode

EMI2455



Date: 28/01/2016 11:48:05

Technician: DMO

Classe: Tx of the standard

Detection:
Peak

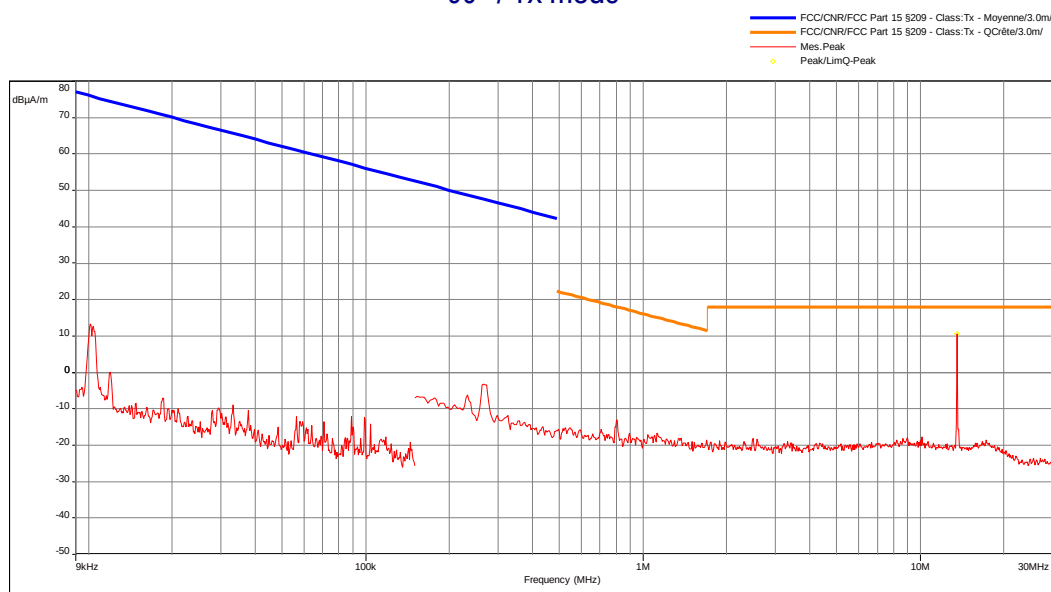
Modification(s) during test:
None

Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.

Radiated magnetic field emission (measurement)

EMI2456

90° / Tx mode



Date: 28/01/2016 11:54:42

Technician: DMO

Classe: Tx of the standard

Detection:
Peak

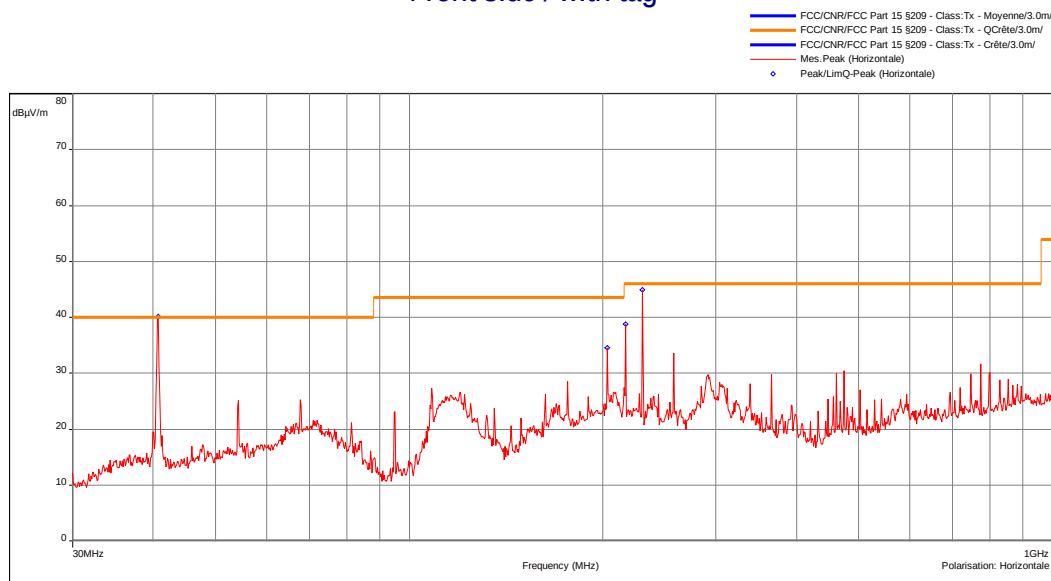
Modification(s) during test:
None

Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.

Radiated electric emission (measurement)

EMI2451

Front side / with tag

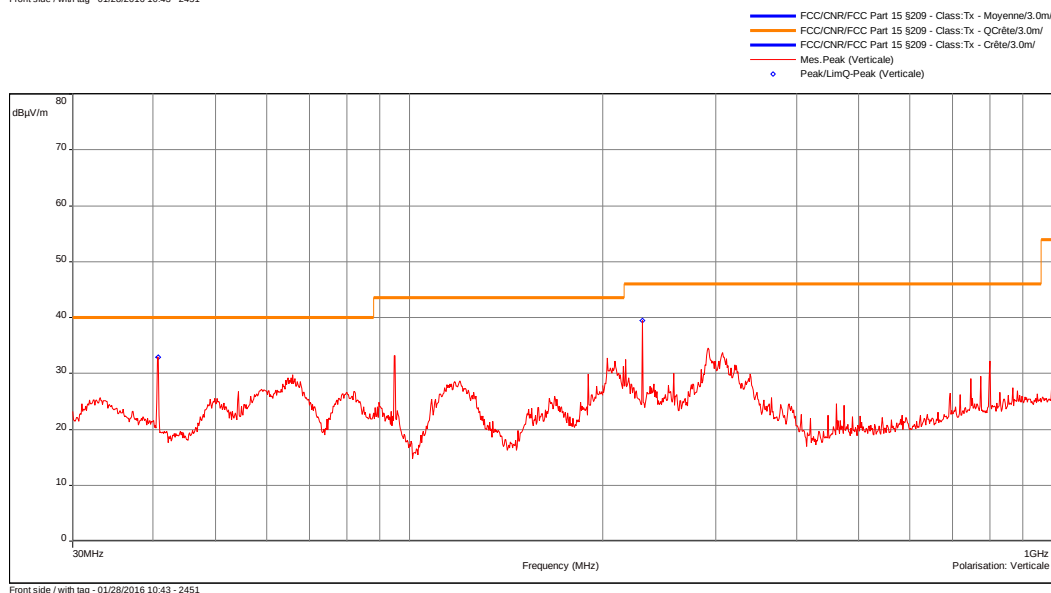


Date: 28/01/2016 10:43:18

Technician: DMO

Classe: Tx of the standard

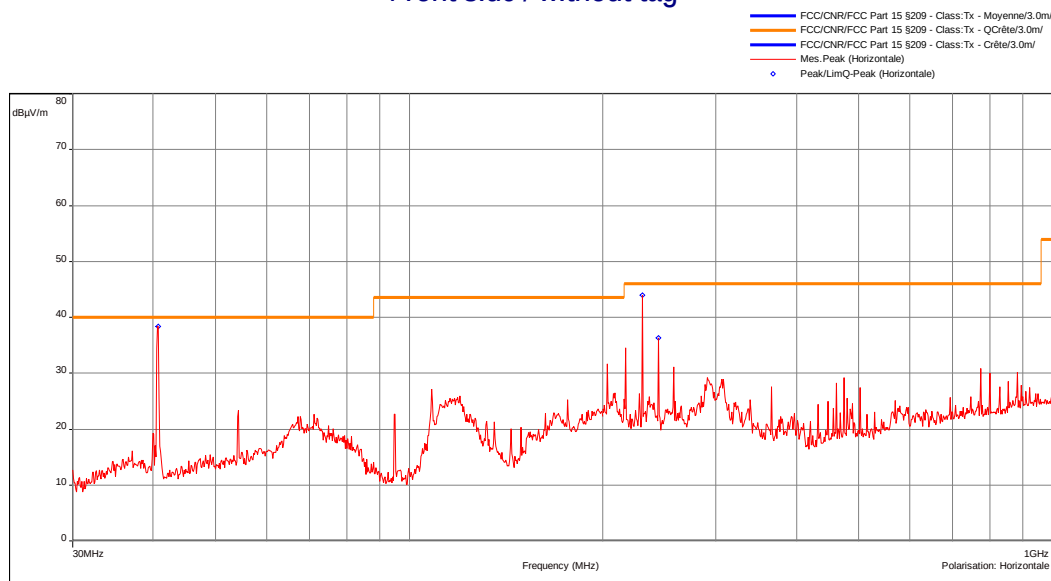
Detection:
 Peak

Modification(s) during test:
 No


Radiated electric emission (measurement)

EMI2452

Front side / without tag

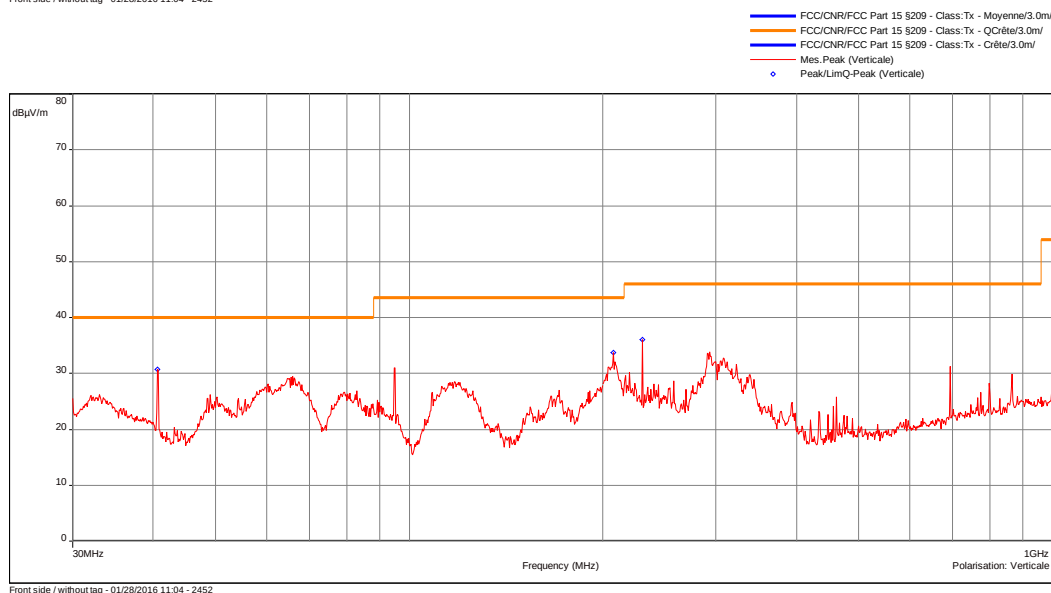


Date: 28/01/2016 11:04:06

Technician: DMO

Classe: Tx of the standard

Detection:
Peak

Modification(s) during test:
No


b) Measurement at 3 meters on open area test site:

Temperature (°C): 17

Humidity (%HR): 45

Pressure (hPa): -

Test configuration: For each measured frequencies, E.U.T. is set via a turntable in order to find the highest level. Test antenna is set between 1m and 4m in order to find the highest level in vertical and horizontal polarization. Only highest levels are recorded.

Frequency band	Initial position (0°)	Resolution bandwidth	Measuring distance	Detection mode	E.U.T. height
9kHz-150kHz	Front side	200Hz	10m	Quasi-peak	80cm
150kHz-30MHz	Front side	10kHz	10m	Quasi-peak	80cm
30MHz-1GHz	Front side	120kHz	3m	Quasi-peak	80cm

Test method deviation: Between 9 kHz to 30MHz: measurements are given in dBμA/m instead of dBμV/m (conversion factor: 51.5dB) and measuring distance is 10 meters instead of 300m.

Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH	DATE CAL.	DATE VAL.
Antenna	Electro Metrics	BIA-30HF	1107	25/05/2015	36 months
Antenna	Rohde & Schwarz	HFH2-Z2	5825	27/01/2015	24 months
Antenna	Rohde & Schwarz	HL223	1137	25/04/2015	36 months
Antenna mast	INNCO	MA4000-EP-O	10261	#	#
Cable	Huber Suhner	N-20m	8385	23/04/2015	24 months
Cable	Huber Suhner	N-14m	8146	25/09/2015	24 months
Receiver	Agilent Technologies	E4440A	5824	11/01/2016	24 months
Receiver	Rohde & Schwarz	ESVS10	3211	17/04/2015	24 months
Mast controller	INNCO	CO3000	10260	#	#
Open area test site	Emitech	Salinelles	3482	18/04/2014	36 months
Thermohygrometer	Testo	608-H2	12269	20/08/2015	24 months
Turntable	Heinrich Deisel	D4420	4038	#	#
Turntable controller	Heinrich Deisel	HD100	4036	#	#

#: Permanent validity

Results: See Boards hereafter.

Measurement uncertainty:

- +/- 4.84 dB (f<200MHz, Vertical)
- +/- 4.62 dB (f<200MHz, Horizontal)
- +/- 4.77 dB (f>200MHz, Vertical)
- +/- 4.78 dB (f<200MHz, Horizontal)
- +/- 5.16 dB (f>1GHz)

CR95HF EVAL BOARD REF. MB1171-D

Frequency (MHz)	Polarization	Azimuth (degree)	Antenna Height (cm)	Measure (dBμV/m)	Limit (dBμV/m)	Comments
230.50	Horizontal	278	100	34.04	46	C
216.96	Horizontal	0	100	27.26	46	C
203.40	Horizontal	129	100	29.05	43	C
230.50	Vertical	210	100	26.86	46	C
40.68	Vertical	250	100	27.00	40	C
94.96	Vertical	-	100	21.92(*)	43	C
40.69	Horizontal	0	267	29.90	40	C
108.40	Horizontal	0	100	17.33	43	C

(*) FM broadcast level.

C=Compliant

All other unwanted radiated spurious are at least 20 dB below specified limits

8. OPERATION WITHIN THE BAND 13.110-14.010 MHZ – SECTION 15.225

Standards: FCC Part 15 Radio part 15.225 a) to d) & RSS 210:2010 Annex 2.6

Tests methods: ANSI C63.10:2013

Test configuration:

Frequency band	Tested side	Resolution bandwidth	Video bandwidth	Detection mode	E.U.T. height
13.11MHz-14.01MHz	Front side / antenna 0	10kHz	30kHz	Peak	80cm
13.11MHz-14.01MHz	Front side / antenna 45	10kHz	30kHz	Peak	80cm
13.11MHz-14.01MHz	Front side / antenna 90	10kHz	30kHz	Peak	80cm

Measure is done with an antenna position of 0°, 90° and 45°. Only higher level is recorded

Test method deviation: Measurements are given in dBμA/m instead of dBμV/m (conversion factor: 51.5dB). Final measuring distance is 10m instead of 30 m.

Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH	DATE CAL.	DATE VAL
Antenna	Rohde & Schwarz	HFH2-Z2	5825	27/01/2015	24 months
Cable	Huber Suhner	N-20m	8385	23/04/2015	24 months
Receiver	Agilent Technologies	E4440A	5824	11/01/2016	24 months
Receiver	Rohde & Schwarz	ESHS10	3371	16/04/2015	24 months
Open area test site	Emitech	Salinelles	3482	18/04/2014	36 months
Thermohygrometer	Testo	608-H2	12269	20/08/2015	24 months
Turntable	Heinrich Deisel	D4420	4038	#	#
Turntable controller	Heinrich Deisel	HD100	4036	#	#

#: Permanent validity

Results: See Graph(s) hereafter

CR95HF EVAL BOARD REF. MB1171-D

Frequency (MHz)	Polarization	Azimet (degree)	Antenna Height (cm)	Measure (dBμA/m)	Limit (dBμA/m) (*)	Comments
13.56	Circular 0°	0	100	-9.37	51.58	C
13.56	Circular 45°	80	100	-6.47	51.58	C
13.56	Circular 90°	71	100	-3.31	51.58	C

C=Compliant

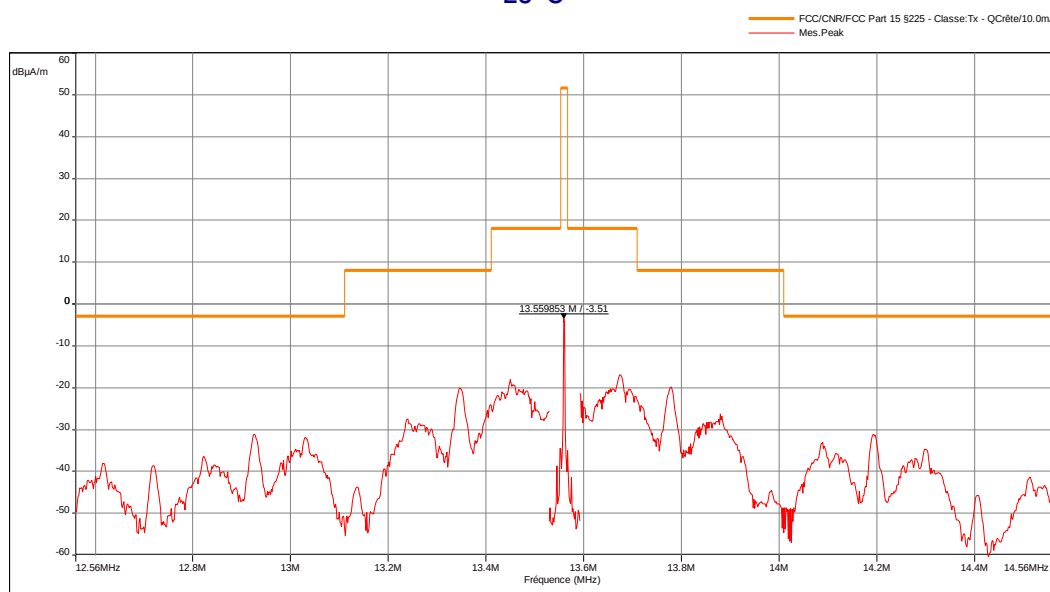
Carrier measurement at 10m: -3.31 dBμA/m (≈ 48.19 dBμV/m)

(*) Using an extrapolation factor of 40 dB/decade (as described in section 15.31 (f)), the level at 30m is about 29.11dBμV/m (28.54μV/m) for a limit at 15.848 mV/m.

Transmitter emission levels and spectrum mask measurements

EMI2435

23°C



Date: 29/01/2016 13:55:02

Technician: DMO

Detection:
Peak

T (°C): 22.8
H (%): 44.9
P (hpa): 1023

Comments:

Modification(s) during test:
None

Limit indicated on this plot is calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.

9. FREQUENCY TOLERANCE – SECTION 15.225

Standards: FCC Part 15 Radio part 15.225

Tests methods: FCC Part 15 Radio part 15.225 e)

Test configuration: A near field probe detects field near equipment (relative measurement).

Resolutions:

Frequency	Resolution bandwidth	Video bandwidth
13.56MHz	3Hz	10Hz

Test method deviation: No

Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH	CAL DATE	DATE VAL.
Antenna	EMITECH	3.5 cm	4653	#	#
Climatic enclosure	Secasi	SM600C	1670	23/10/2014	24 months
Multimeter	Agilent	U1252A	6138	24/11/2015	24 months
Power supply	KIKUSUI	PCR2000L	0800	24/11/2015	12 months
Receiver	Agilent	E4440A	5824	11/01/2016	24 months

#: Permanent validity

Standard limits: +/- 0.01% of the operating frequency

Results: See Board(s) below

Measurement uncertainty: +/- 1×10^{-7} (Radiofrequency)
+/- 1°C (Temperature)
+/- 5% (Humidity)

E.U.T. operating mode: with modulation

CR95HF EVAL BOARD REF. MB1171-D

Temperature		Power supply (Vdc) (USB)	Measured Frequency (MHz)	Frequency tolerance (%)	Limit (%)
Normal condition	+20°C (Humidity 31%)	5	13.559887	0.00000%	+/-0.01
Extremes conditions	-30°C	5	13.559874	-0.00010%	
	+50°C	5	13.559835	-0.00038%	

10. OCCUPIED BANDWIDTH – CNR-Gen § 6.6

Standard: CNR-Gen § 6.6

Test method: CNR-Gen § 6.6

Test configuration: A near field probe detects field near equipment (relative measurement).

Resolutions:

Frequency	Resolution bandwidth	Video bandwidth
13.56MHz	300Hz	910Hz

Test method deviation: No.

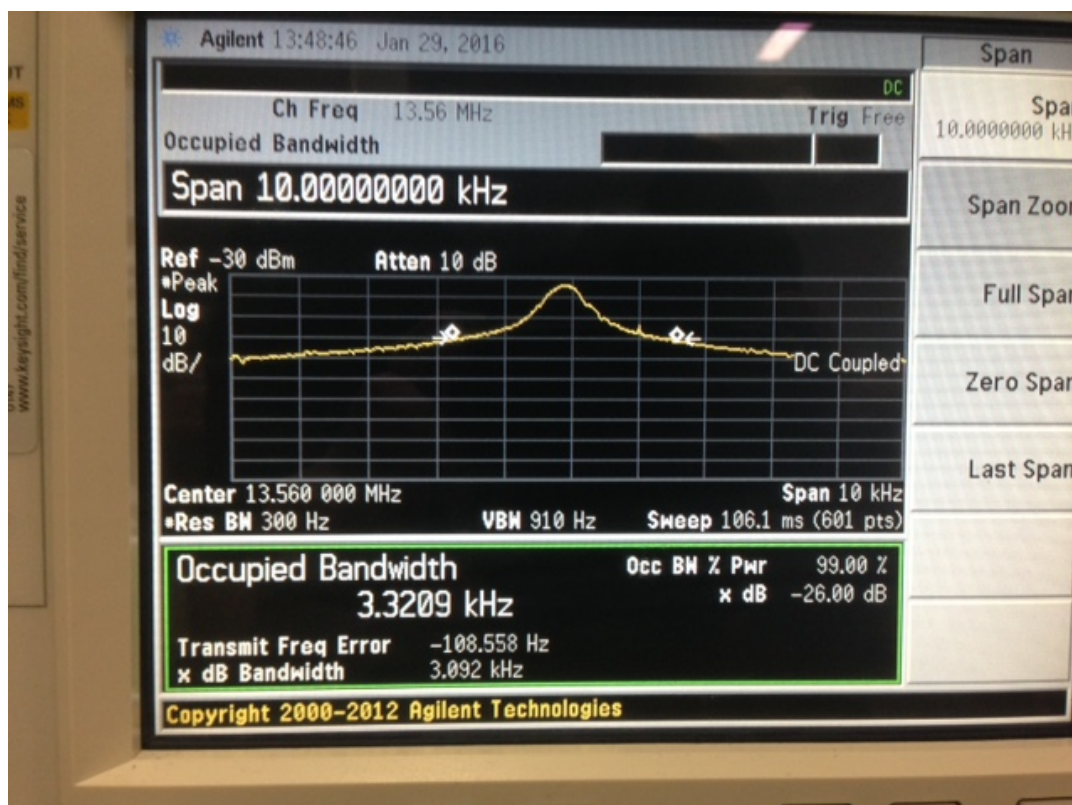
Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH	CAL DATE	DUE DATE
Antenna	Emitech	3.5 cm	4653	#	#
Receiver	Agilent	E4440A	5824	11/01/2016	24 months

#: Permanent validity

Standard limits: 14 kHz

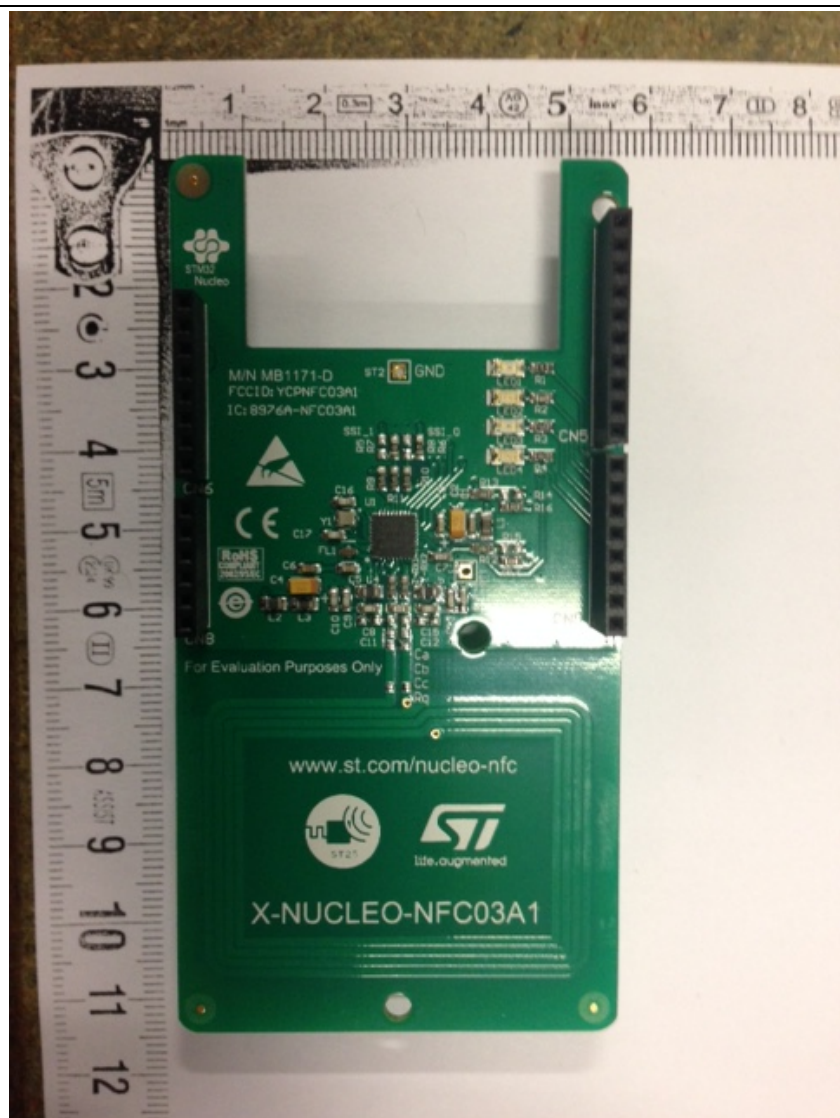
Results: measured occupied bandwidth: 3.3209kHz



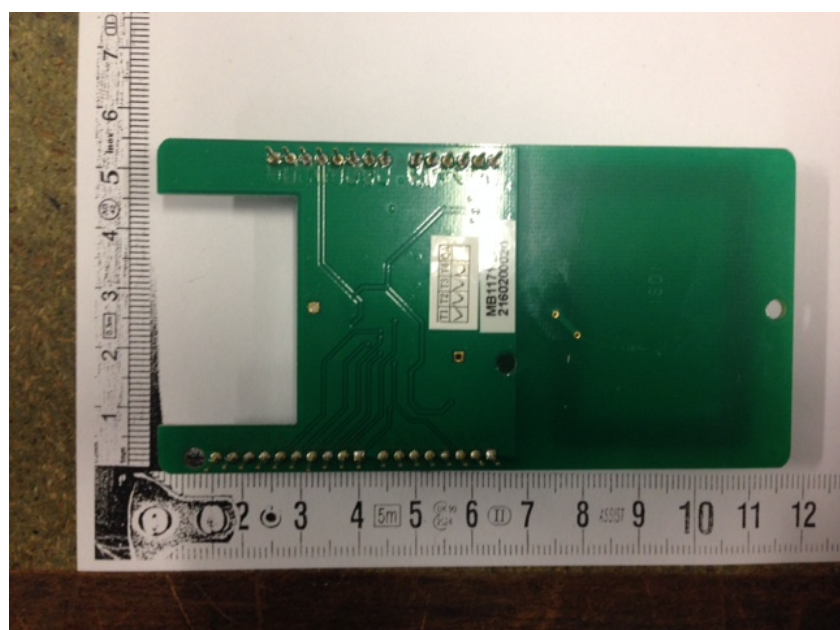
□□□ End of report – 1 annex to be forwarded □□□

ANNEX: PHOTOGRAPH(S)

E.U.T General view
(Top view)



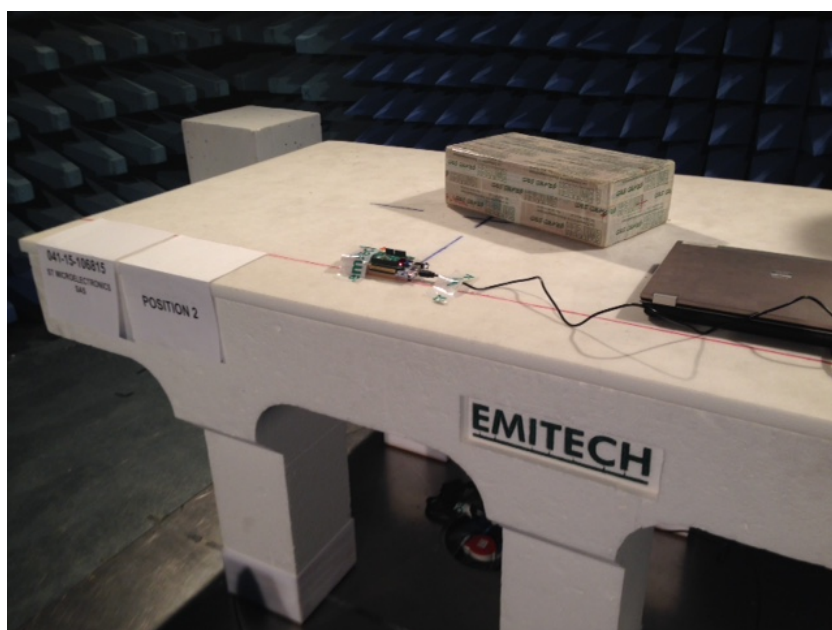
E.U.T General view
(Bottom view)



Radiated pre measurement



E.U.T. with test PC



Carrier measurement
(OATS)



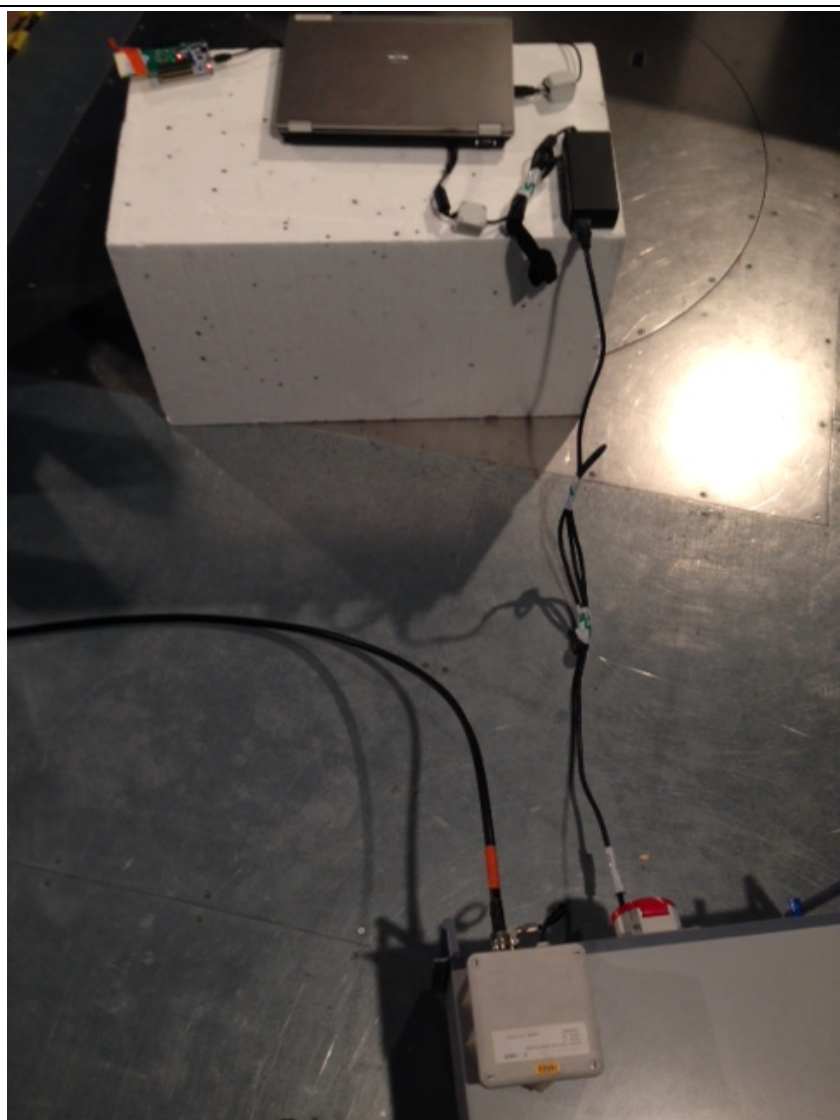
Radiated position
(OATS)



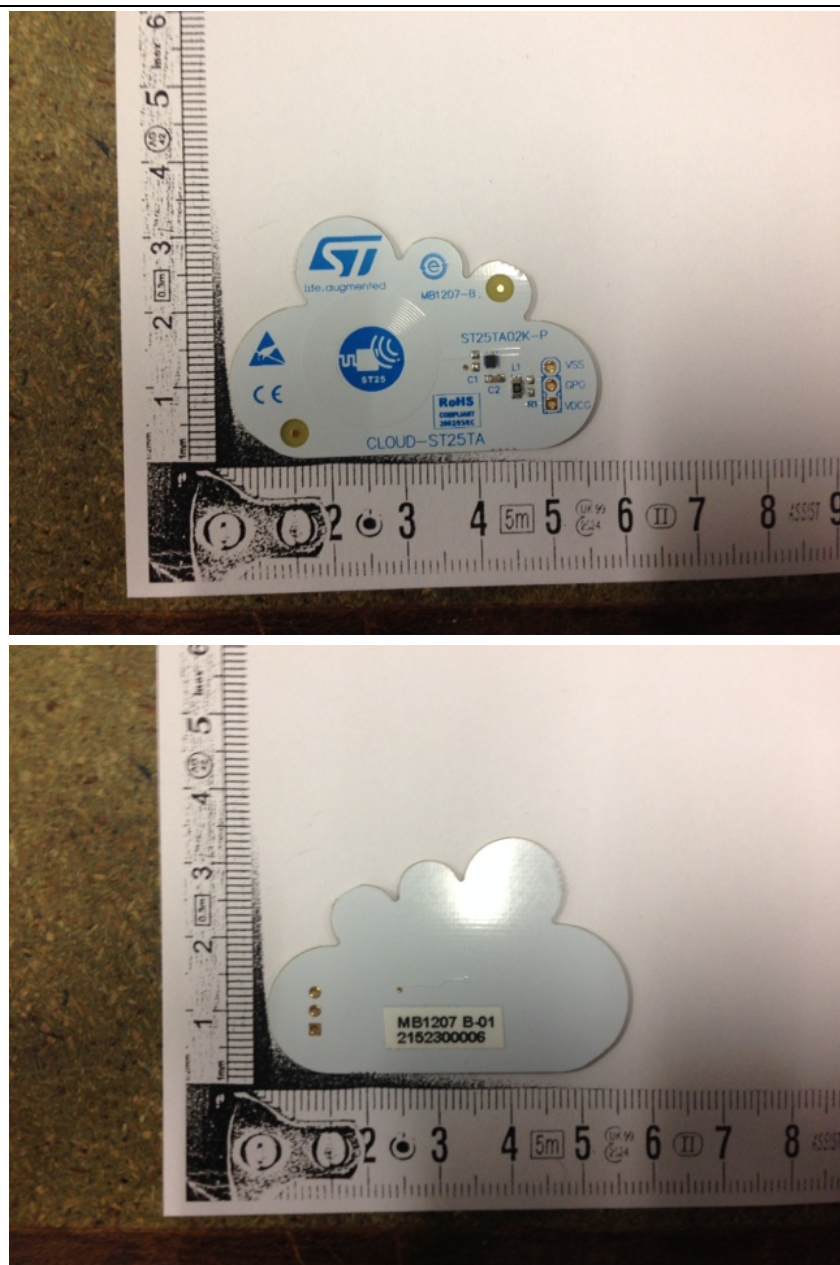
Radiated electric emission
(OATS)



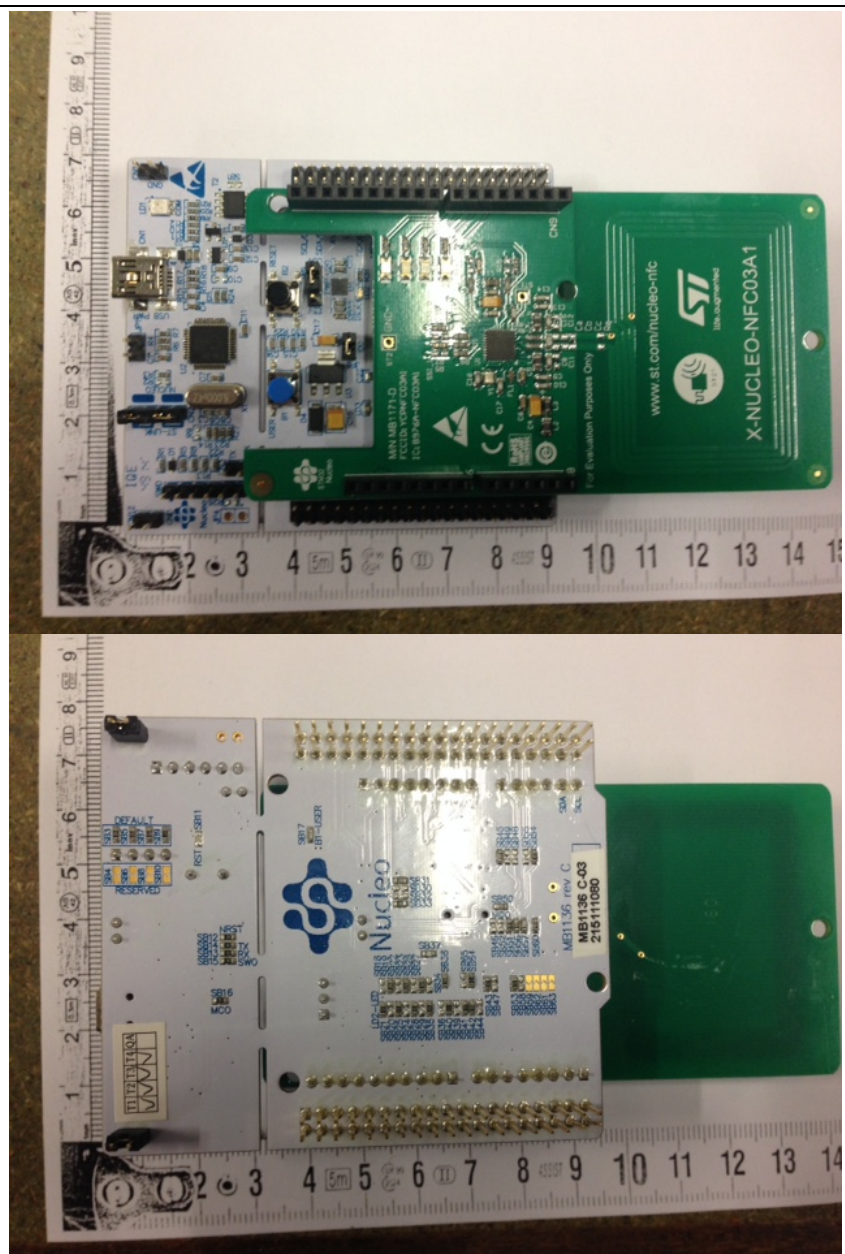
Conducted emissions



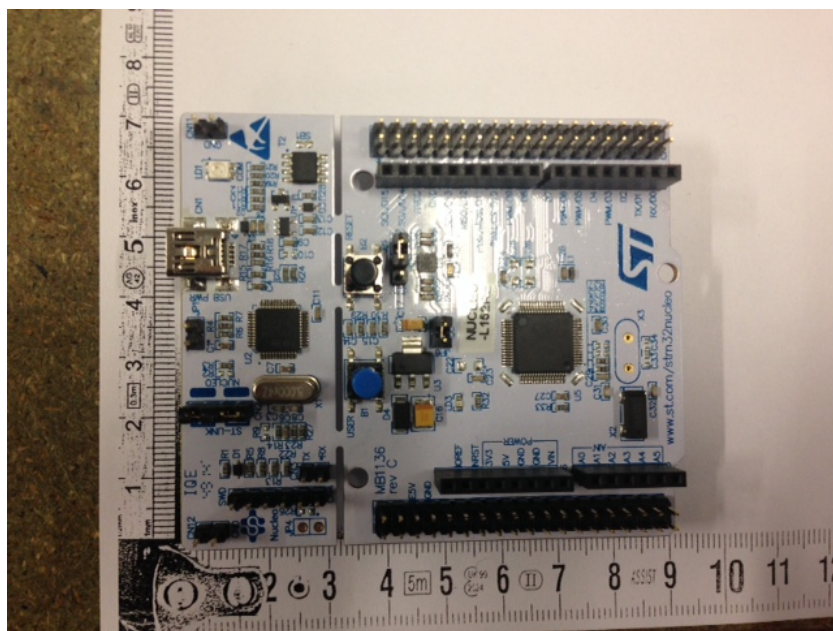
Tag used for radiated emission



E.U.T. on main host board (Nucleo)



Main host board (nucleo)



Test PC Used during tests



Test PC marking plate



Test PC PSU
(used also for Conducted
emission)

