



R051-24-12-100903-4/A Ed.1

This report cancels and replaces the test report N° R051-24-12-100903-4/A Edition 0

<p>RADIO test report</p> <p>according to standard: FCC Part 15 (2012)</p> <p>Equipment under test: ZBRN2 : MODBUS RS485 SERIAL LINE ACCESS POINT</p> <p>FCC ID: Y7HZBRN2</p> <p>Company: SCHNEIDER ELECTRIC</p>

DISTRIBUTION: Mr. Blanquart

Company: SCHNEIDER ELECTRIC

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PRODUCT: ZBRN2 : Modbus RS485 serial line access point

Reference / model: ZBRN2 : Modbus RS485 serial line access point
ZBRA2 : Passive antenna for access point

Serial number: 12-1412-01

MANUFACTURER: SCHNEIDER ELECTRIC

COMPANY SUBMITTING THE PRODUCT:

Company: SCHNEIDER ELECTRIC

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DATE(S) OF TEST: 26, 27 and 31 July 2012
1 and 3 August 2012
8 October 2012

TESTING LOCATION: EMITECH ATLANTIQUE laboratory at ANGERS (49) FRANCE
EMITECH ATLANTIQUE open area test site in LA POUZEZE (49)
FRANCE
FCC 2.948 Listed Site Registration Number: 101696
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TESTED BY: M. DUMESNIL

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1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment: ZBRN2 : Modbus RS485 serial line access point, in accordance with normative reference.

2. PRODUCT DESCRIPTION

ITU Emission code:	03MG1D
Class:	B (residential environment)
Utilization:	Wireless command for push button, sensor, beacon light...
Antenna type and gain:	internal PCB antenna: 5 dBi / ZBRA2 antenna assembly gain (¼ wave antenna + 2m cable): 0 dBi
Operating frequency range:	from 2405 MHz to 2480 MHz
Number of channels:	16
Channel spacing:	5 MHz
Frequency generation:	Quartz
Modulation:	Phase modulation O-QPSK
Power source:	24 VAC/DC or 240 VAC/DC
Software power setting:	E5 (not adjustable by party other than the manufacturer)

Power level, frequency range and channels characteristics are not user adjustable.
The details pictures of the product and the circuit boards are joined with this file.

3. NORMATIVE REFERENCE

The standards and testing methods related throughout this report are those listed below.
They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

FCC Part 15 (2012)	Radio Frequency Devices
ANSI C63.4 (2003)	Methods of Measurement of Radio-Noise Emissions from Low-voltage Electrical and Electronics Equipment in the range of 9 kHz to 40 GHz.
558074 D01 DTS v02	Guidance for Performing Compliance on Digital Transmission Systems Operating under §15.247

4. TEST METHODOLOGY

Radio performance tests procedures given in part 15:

Subpart B –Unintentional Radiators

Paragraph 107: Conducted limits

Paragraph 109: Radiated emission limits

Paragraph 111: Antenna power conduction limits for receivers

Subpart C – Intentional Radiators

Paragraph 203: Antenna requirement

Paragraph 205: Restricted bands of operation

Paragraph 207: Conducted limits

Paragraph 209: Radiated emission limits; general requirements

Paragraph 212: Modular transmitter

Paragraph 215: Additional provisions to the general radiated emission limitations

Paragraph 247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

5. TEST EQUIPMENT CALIBRATION DATES

Equipment	Model	Type	Last verification	Next verification	Validity
728	HP 11966C	Biconical antenna	03/09/2012	03/09/2016	03/11/2016
812	Fluke 77-2	Multimeter	22/03/2011	22/03/2013	22/05/2013
976	R&S ESH3-Z2	Transient limiter	25/01/2012	25/01/2014	25/03/2014
1058	R&S ESH3	Test receiver	24/01/2011	24/01/2013	24/03/2013
1092	HP 11947A	Transient limiter	25/01/2012	25/01/2014	25/03/2014
1204	Electrometrics EM-6961	Guide antenna	31/08/2012	31/08/2016	31/10/2016
1219	R&S ESVS10	Test receiver	14/06/2011	14/06/2013	14/08/2013
1274	Emitech	OATS	28/01/2010	28/01/2013	28/03/2013
1406	Emco 6502	Loop antenna	13/01/2011	13/01/2013	13/03/2013
1419	Dereix R213	Variac	/	/	*
1539	Oregon Scientific AB888	Meteo station	09/11/2012	09/11/2014	09/01/2015
1938	Electrometrics EM-6961	Guide antenna	31/08/2012	31/08/2016	31/10/2016
1939	IMC WR42	Guide antenna	20/04/2012	20/04/2016	20/06/2016
1999	R&S HL223	Logperiodic antenna	03/09/2012	03/09/2016	03/11/2016
2152	Proflin 2115-400	Power source	/	/	*
2648	ALC ALN02-0032	low-noise amplifier	17/08/2012	17/08/2013	17/10/2013
3036	ALC ALN02-0102	low-noise amplifier	01/02/2012	01/02/2013	01/04/2013
4088	R&S FSP40	Spectrum analyser	19/04/2012	19/04/2014	19/06/2014
5071	R&S FSEA	Spectrum analyser	05/07/2011	05/07/2013	05/09/2013
6609	Microtronics HPM11630	1 GHz high-pass filter	24/01/2012	24/01/2014	24/03/2014
8262	Filtek HP12/3200-5AA	3 GHz high-pass filter	11/05/2011	11/05/2013	11/07/2013
8460	Artificial main network LT 32C	RSIL	04/11/2011	04/11/2013	04/01/2014

** The equipment is not verified; instead, the output voltage is checked before each measurement with the calibrated multimeter.*

6. TESTS AND CONCLUSIONS

6.1 unintentional radiator (subpart B)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.107	CONDUCTED LIMITS	X				
FCC Part 15.109	RADIATED EMISSION LIMITS	X				
FCC Part 15.111	ANTENNA POWER CONDUCTED LIMITS FOR RECEIVER			X		

NAp: Not Applicable

NAs: Not Asked

6.2 intentional radiator (subpart C)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				<i>Note 1</i>
FCC Part 15.205	RESTRICTED BANDS OF OPERATION	X				
FCC Part 15.207	CONDUCTED LIMITS	X				
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				<i>Note 2</i>
FCC Part 15.212	MODULAR TRANSMITTERS			X		
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	<i>(a) Alternative to general radiated emission limits</i>	X				
	<i>(b) Unwanted emissions outside of §15.247 frequency bands</i>	X				<i>Note 3</i>
	<i>(c) 20 dB bandwidth and band-edge compliance</i>	X				
FCC Part 15.247	OPERATION WITHIN THE BANDS 902-928 MHZ, 2400-2483.5 MHz and 5725-5850 MHz					
	<i>(a) (1) Hopping systems</i>			X		
	<i>(a) (2) Digital modulation techniques</i>	X				<i>Note 4</i>
	<i>(b) Maximum peak output power</i>	X				<i>Note 5</i>
	<i>(c) Operation with directional antenna gains > 6 dBi</i>			X		
	<i>(d) Intentional radiator</i>	X				
	<i>(e) Peak power spectral density</i>	X				
	<i>(f) Hybrid system</i>			X		
	<i>(g) Frequency hopping requirements</i>			X		
	<i>(h) Frequency hopping intelligence</i>			X		
	<i>(i) RF exposure compliance</i>	X				<i>Note 6</i>

NAp: Not Applicable

NAs: Not Asked

Note 1: Internal PCB antenna or RP MCX connector for external antenna.

Note 2: See FCC part 15.247 (d).

Note 3: See FCC part 15.209. Unwanted emissions levels are all below the fundamental emission field strength level.

Note 4: The minimum 6 dB bandwidth of the equipment is 1680 kHz (see annex 1).

Note 5: We used the radiated method in open field. No deviation of the measured power is observed when power supply is changed at 85% and 115%.

Note 6: $PSD = EIRP/4\pi*R^2 = 7.586\text{ mW} /4*\pi*(20\text{ cm})^2 = 0.002\text{ mW/cm}^2$.*
Limit= 1 mW/cm².

The equipment fulfils the requirements on power density for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310.

Conclusion:

The sample of ZBRN2 : Modbus RS485 serial line access point submitted to the tests complies with the regulations of the standard FCC Part 15 in accordance with the limits or criteria defined in this report.

7. MEASUREMENT OF THE CONDUCTED DISTURBANCES

Standard: FCC Part 15

Test procedure: Paragraph 15.107

Limits: Class B

Test equipments:

TYPE	BRAND	EMITECH NUMBER
AC Power supply Proflin 2115-400	Schaffner	2152
Test receiver ESH3	Rohde & Schwarz	1058
Spectrum analyzer FSEA	Rohde & Schwarz	5071
Artificial main network LT32C	AFJ	8460
Transient limiter 11947A	Hewlett Packard	1092
Limiter ESH3-Z2	Rohde & Schwarz	0976
Meteo station AB888	Oregon Scientific	1539

Software used: BAT-EMC V3.6.0.24

Test set up:

The test unit is placed on a wooden table, 0.8 m over an horizontal reference plane and 0.4 m from a vertical reference plane. It is powered by an artificial main network placed on the ground reference plane.

The equipment is powered with the AC power operating voltage of 120 V / 60 Hz.

See photos in annex 5.

Frequency range: 150 kHz - 30 MHz

Detection mode: Peak / Average

Bandwidth: 10 kHz / 9kHz

Equipment under test operating condition:

The equipment is blocked in standby / reception mode.

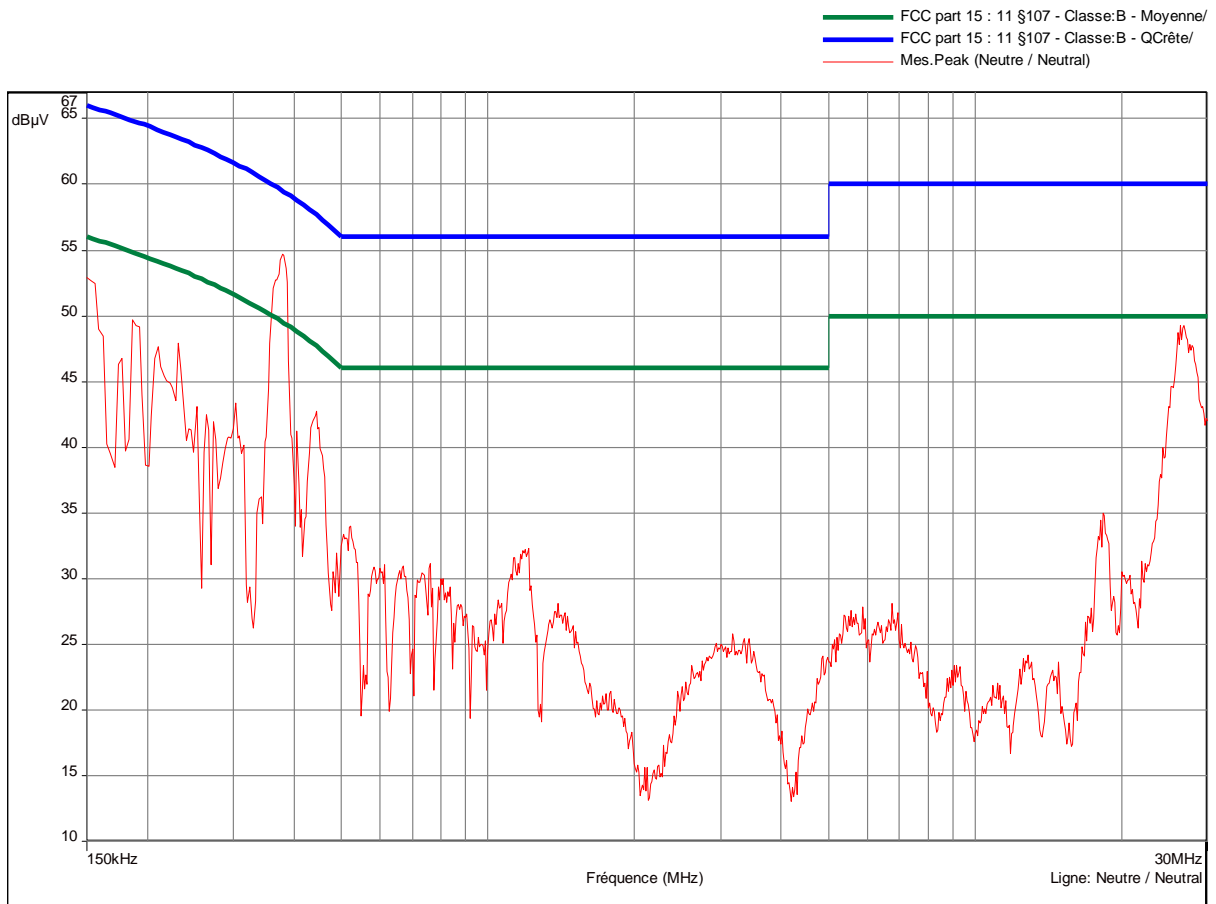
Results:

Ambient temperature (°C): 26.5
 Relative humidity (%): 49

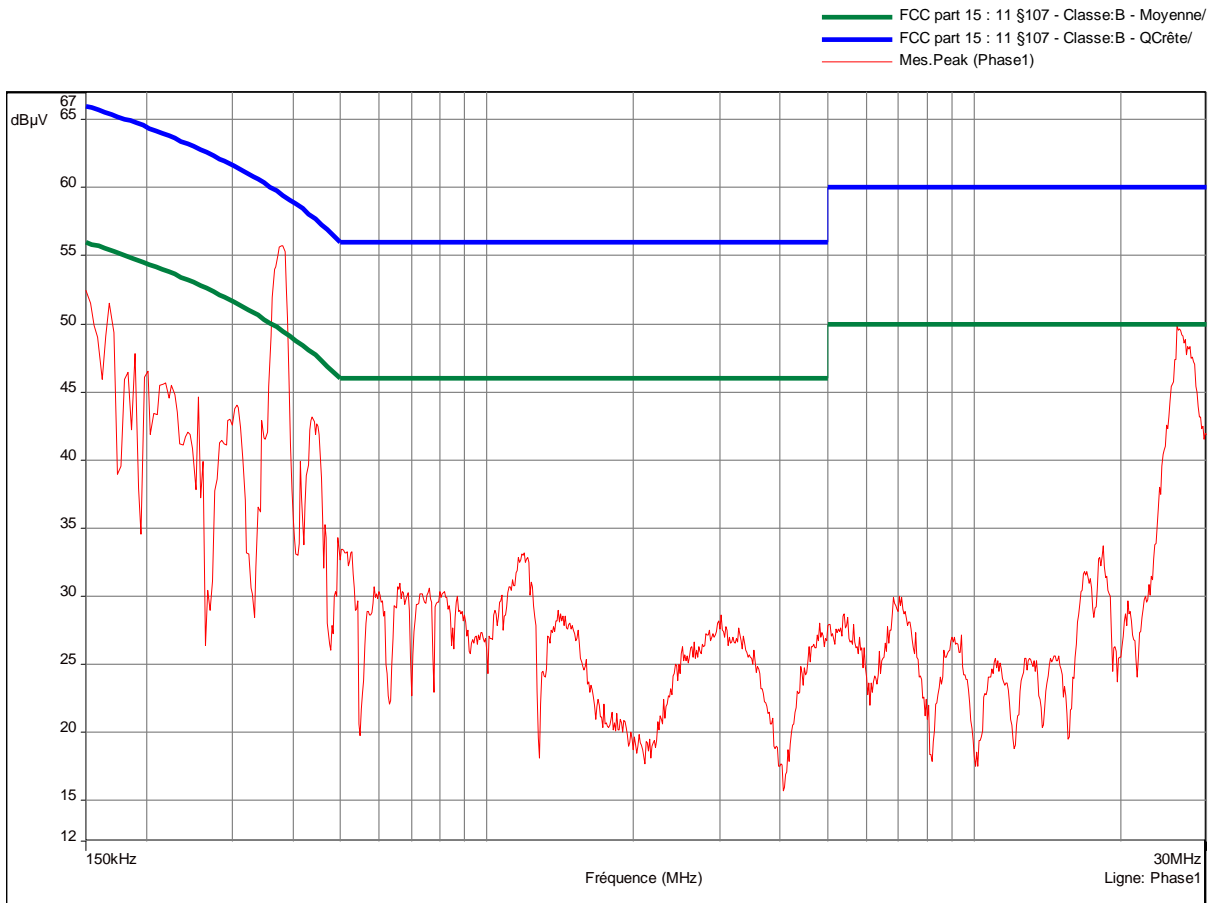
Measurement on the mains power supply:

The measurement is first realized with Peak detector.

Curve N° 1: measurement on the Neutral with peak detector

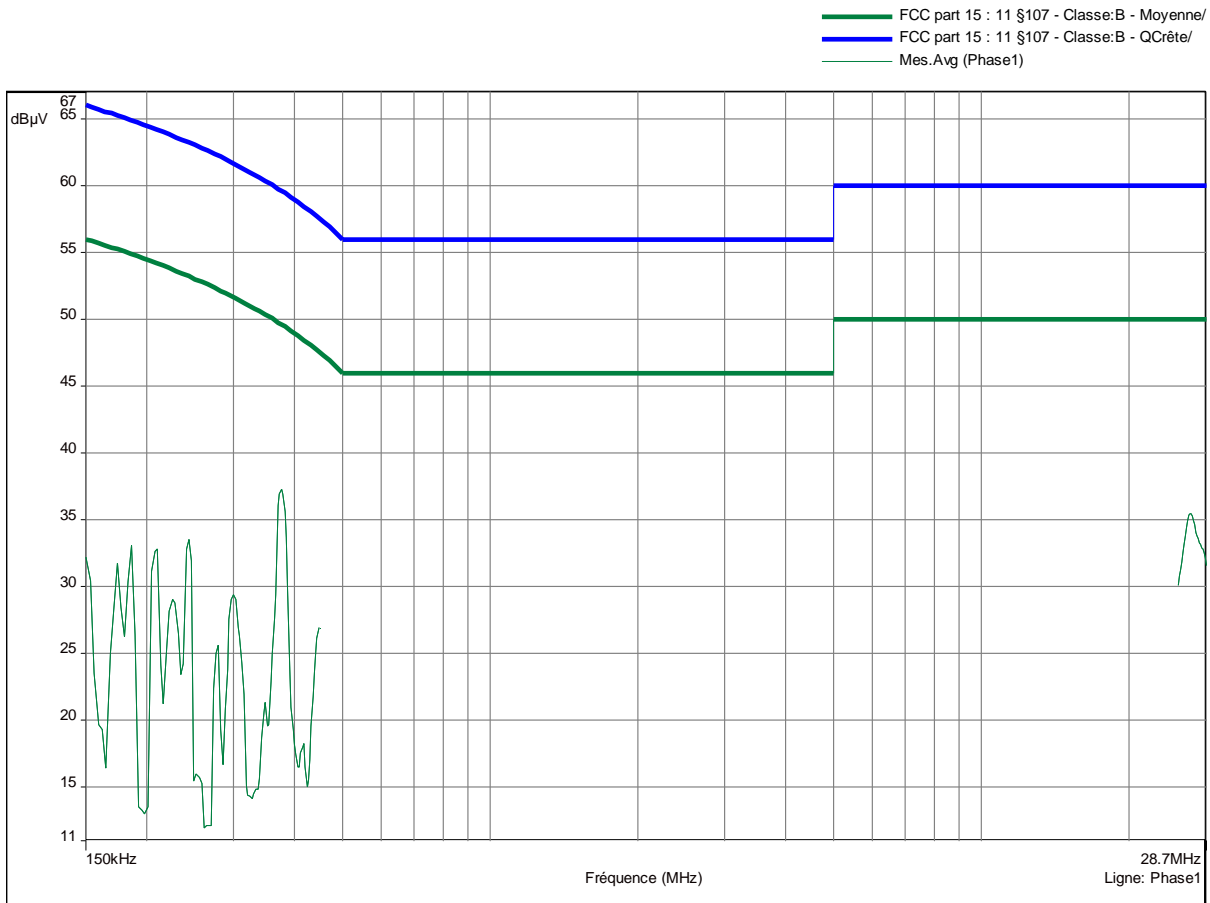


Curve N° 2: measurement on the Line with peak detector

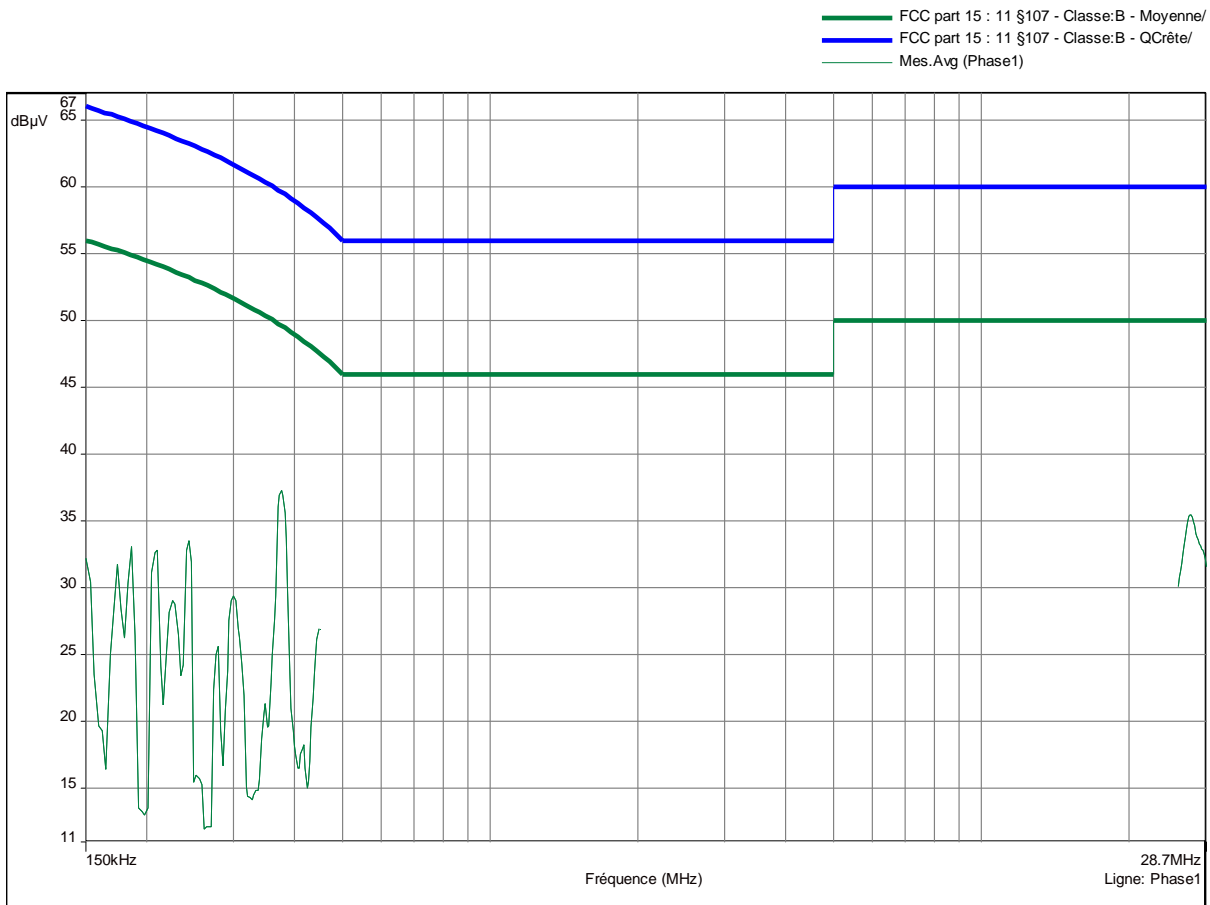


The frequencies which are not 6 dB under the Average limit are then analyzed with Average detector.

Curve N° 3: average measurement on the Neutral, for the frequency range: from 150 kHz to 450 kHz and from 25.2 MHz to 28.7 MHz.



Curve N° 4: average measurement on the Line, for the frequency range: from 150 kHz to 450 kHz and from 25.2 MHz to 28.7 MHz.



Test conclusion:

RESPECTED STANDARD

8. RADIATED EMISSION LIMITS

Standard: FCC Part 15

Test procedure: paragraph 109

Limit class: Class B

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Test receiver ESVS10	Rohde & Schwarz	1219
Spectrum analyzer FSP40	Rohde & Schwarz	4088
Biconical antenna 11966 C	Hewlett Packard	0728
Log periodic antenna HL 223	Rohde & Schwarz	1999
Double ridged guide antenna EM 6961	Electrometrics	1204
Preamplifier 1 to 18 GHz DB97-1852	DBS Microwave	2648
High pass filter HPM11630	Micro-tronics	6609
Open area test site	Emitech	1274
Multimeter 77-2	Fluke	0812
Variac R213	Dereix	1419
Meteo station meteostar	Bioblock Scientific	0943

Test set up:

The system is tested in an open area test site (OATS). The test unit is placed on a rotating table, 0.8m from a ground plane. Zero degree azimuths correspond to the front of the device under test.

See photos in annex 5.

Frequency range: From 30 MHz to 5th harmonic of the highest frequency used (2480MHz).

Detection mode: Quasi-peak (F < 1 GHz) Average (F > 1 GHz)

Bandwidth: 120 kHz (F < 1 GHz) 1 MHz (F > 1 GHz)

Distance of antenna: 3 meters

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal (only the highest level is recorded)

Equipment under test operating condition:

The equipment is blocked in standby / reception mode.

This test is first realized with the equipment’s internal antenna and repeated with ZBRA2 external antenna.

Results: (internal antenna)

Ambient temperature (°C): 29
 Relative humidity (%): 59

Power source: 120 V.a.c. through a variac

Sample N° 1: channel 11

FREQUENCIES (MHz)	Detector Av: Average QP: Quasi-Peak	Antenna height (cm)	Azimuth (degree)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
72	QP	100	254	V	23.8	40	16.2
120	QP	161	67	H	26.5	43.5	17
133	QP	233	65	H	28.9	43.5	14.6
287.2	QP	156	0	V	27.7	46	18.3
4810	Av	107	0	H	51.74	54	2.26

channel 18

FREQUENCIES (MHz)	Detector Av: Average QP: Quasi-Peak	Antenna height (cm)	Azimuth (degree)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
72	QP	100	254	V	23.8	40	16.2
120	QP	161	67	H	26.5	43.5	17
133	QP	233	65	H	28.9	43.5	14.6
287.2	QP	156	0	V	27.7	46	18.3
4880	Av	138	6	H	51.88	54	2.12

channel 26

FREQUENCIES (MHz)	Detector Av: Average QP: Quasi-Peak	Antenna height (cm)	Azimuth (degree)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
72	QP	100	254	V	23.8	40	16.2
120	QP	161	67	H	26.5	43.5	17
133	QP	233	65	H	28.9	43.5	14.6
287.2	QP	156	0	V	27.7	46	18.3
4960	Av	100	32	V	50.77	54	3.23

Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

Results: (external antenna)

Ambient temperature (°C): 21.5
 Relative humidity (%): 75

Power source: 120 V.a.c. through a variac

Sample N° 1: channel 11

FREQUENCIES (MHz)	Detector Av: Average QP: Quasi-Peak	Antenna height (cm)	Azimuth (degree)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
72	QP	100	254	V	23.8	40	16.2
120	QP	161	67	H	26.5	43.5	17
133	QP	233	65	H	28.9	43.5	14.6
287.2	QP	156	0	V	27.7	46	18.3
4810	Av	112	355	V	50.50	54	3.50

channel 18

FREQUENCIES (MHz)	Detector Av: Average QP: Quasi-Peak	Antenna height (cm)	Azimuth (degree)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
72	QP	100	254	V	23.8	40	16.2
120	QP	161	67	H	26.5	43.5	17
133	QP	233	65	H	28.9	43.5	14.6
287.2	QP	156	0	V	27.7	46	18.3
4880	Av	109	30	V	50.29	54	3.71

channel 26

FREQUENCIES (MHz)	Detector Av: Average QP: Quasi-Peak	Antenna height (cm)	Azimuth (degree)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
72	QP	100	254	V	23.8	40	16.2
120	QP	161	67	H	26.5	43.5	17
133	QP	233	65	H	28.9	43.5	14.6
287.2	QP	156	0	V	27.7	46	18.3
4960	Av	151	48	V	49.71	54	4.29

Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

Test conclusion:

RESPECTED STANDARD

9. MEASUREMENT OF THE CONDUCTED DISTURBANCES

Standard: FCC Part 15

Test procedure: Paragraph 15.207

Test equipments:

TYPE	BRAND	EMITECH NUMBER
AC Power supply Proflin 2115-400	Schaffner	2152
Test receiver ESH3	Rohde & Schwarz	1058
Spectrum analyzer FSEA	Rohde & Schwarz	5071
Artificial main network LT32C	AFJ	8460
Transient limiter 11947A	Hewlett Packard	1092
Limiter ESH3-Z2	Rohde & Schwarz	0976
Meteo station AB888	Oregon Scientific	1539

Software used: BAT-EMC V3.6.0.24

Test set up:

The test unit is placed on a wooden table, 0.8 m over an horizontal reference plane and 0.4 m from a vertical reference plane. It is powered by an artificial main network placed on the ground reference plane.

The equipment is powered with the AC power operating voltage of 120 V / 60 Hz.

See photos in annex 5.

Frequency range: 150 kHz - 30 MHz

Detection mode: Peak / Average

Bandwidth: 10 kHz / 9 kHz

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

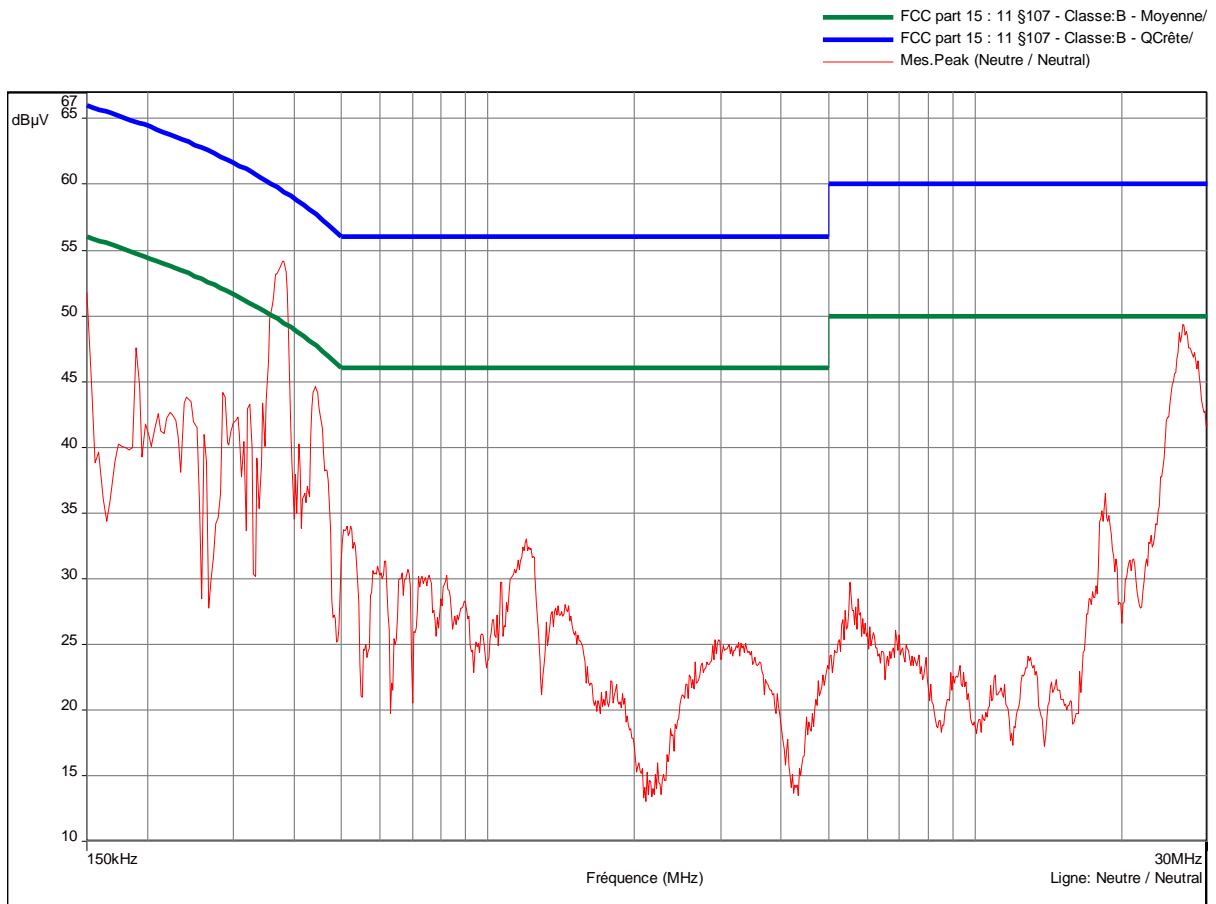
Results:

Ambient temperature (°C): 26.5
 Relative humidity (%): 49

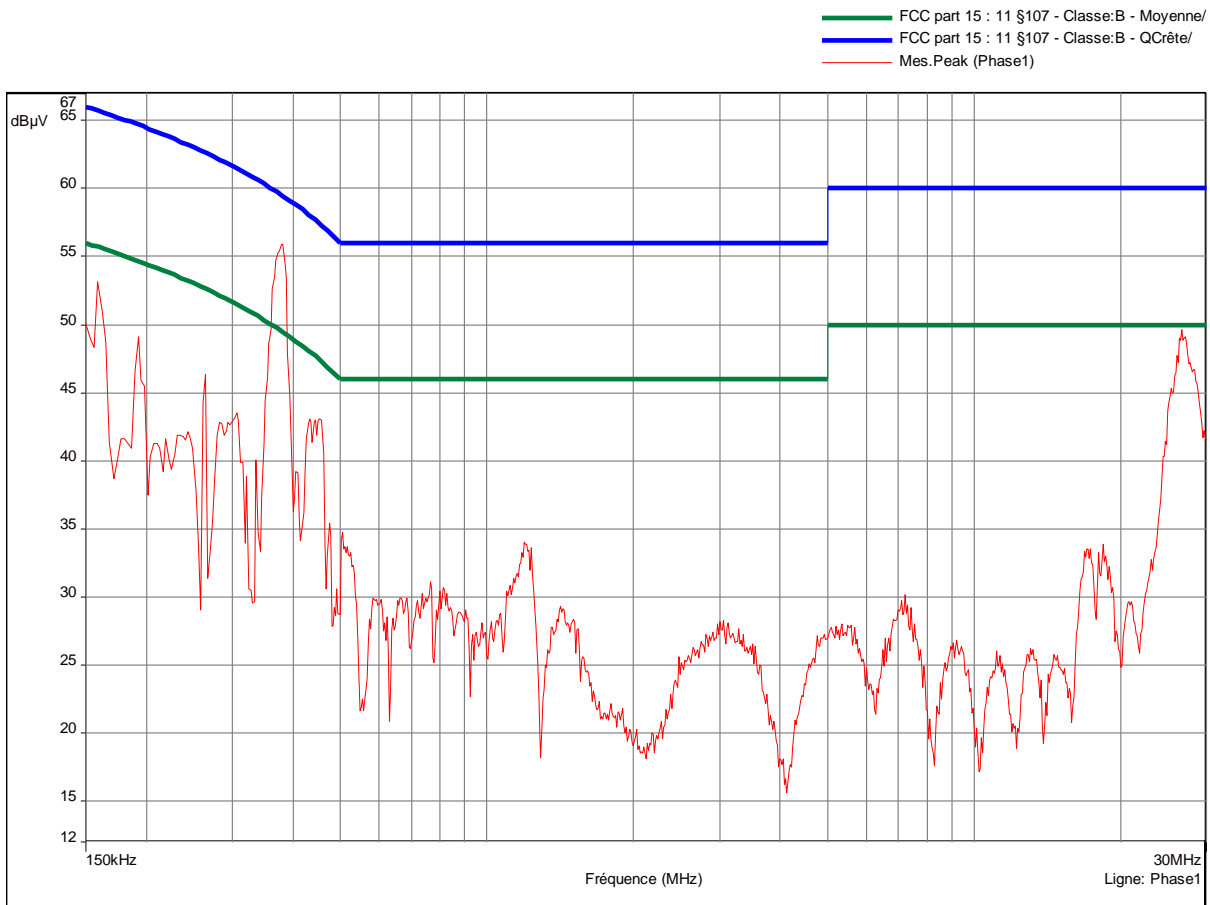
Measurement on the mains power supply:

The measurement is first realized with Peak detector.

Curve N° 5: measurement on the Neutral with peak detector

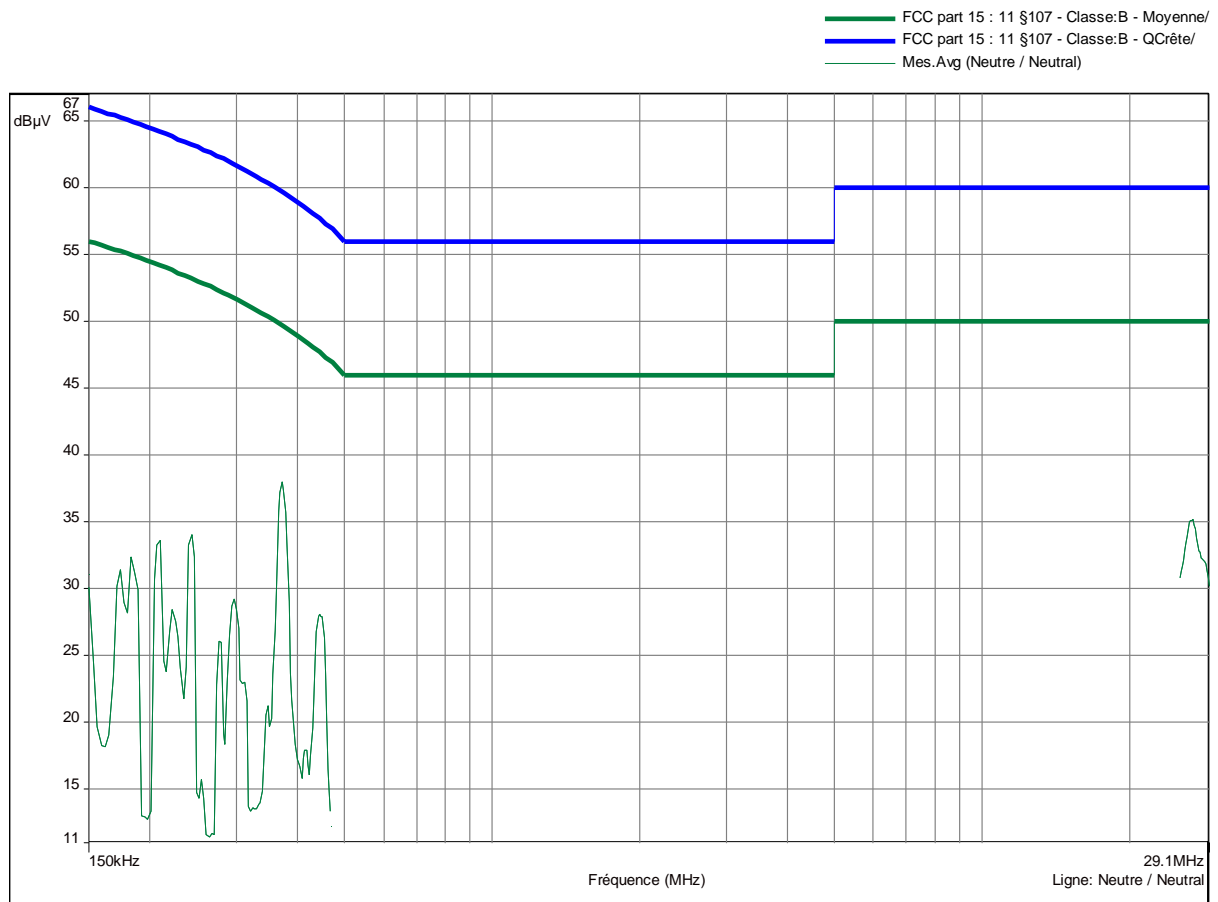


Curve N° 6: measurement on the Line with peak detector

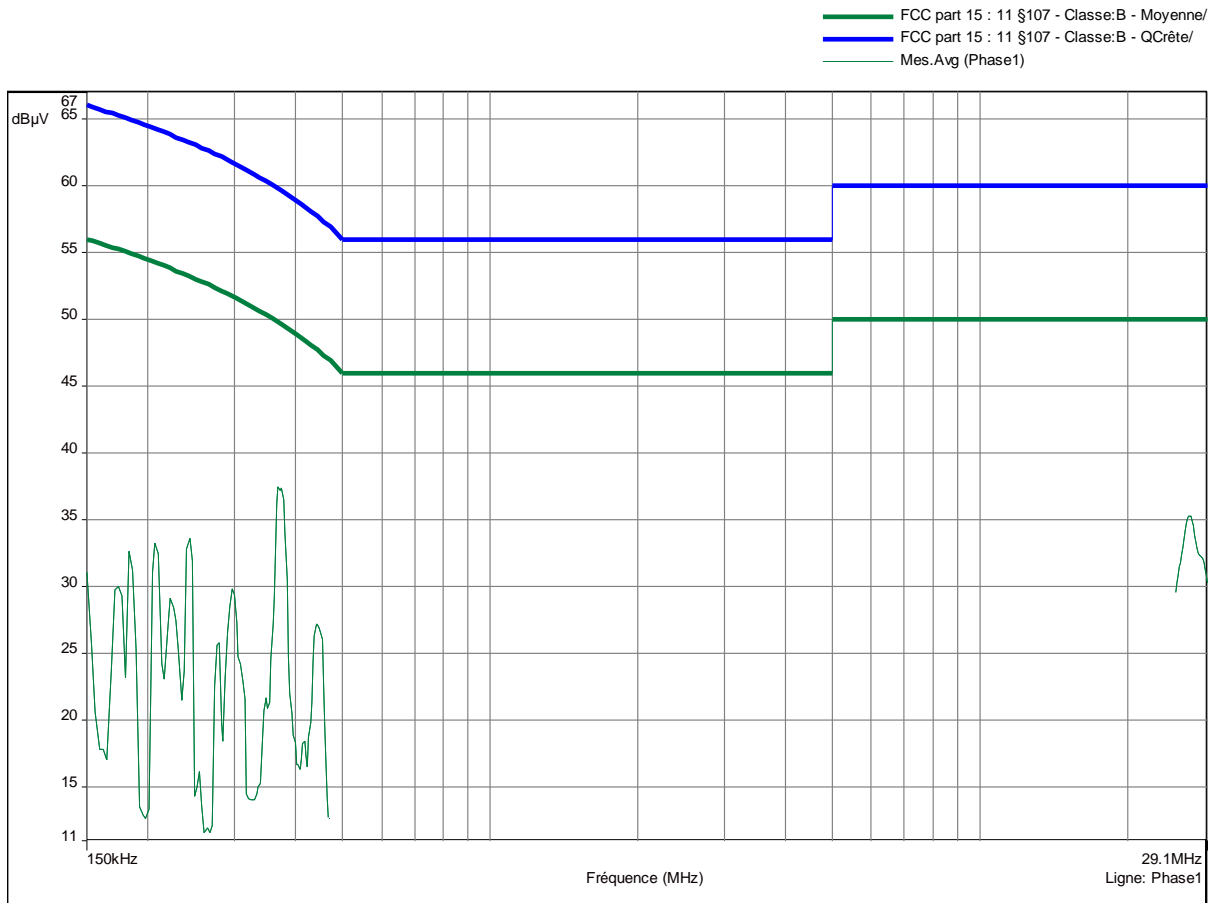


The frequencies which are not 6 dB under the Average limit are then analyzed with Average detector.

Curve N° 7: average measurement on the Neutral, for the frequency range: from 150 kHz to 470 kHz and from 25.3 MHz to 29.1 MHz.



Curve N° 8: average measurement on the Line, for the frequency range: from 150 kHz to 470 kHz and from 25.1 MHz to 29.1 MHz.



Test conclusion:

RESPECTED STANDARD

10. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS

Standard: FCC Part 15

Test procedure: Paragraph 15.215

Test equipments:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Double ridged guide antenna EM 6961	Electrometrics	1938
Multimeter 77-2	Fluke	0812
Variac R213	Dereix	1419
Meteo station AB888	Oregon Scientific	1539

Test set up:

Test realized in near field. All field strength measurements are correlated with the radiated maximum peak output power

Test operating condition of the equipment:

The equipment under test is blocked in continuous transmission mode, modulated by internal data signal, at the highest output power level which the transmitter is intended to operate.

This test is realized only with internal antenna (which produces the maximum of radiated power).

Results:

Ambient temperature (°C): 20.5
 Relative humidity (%): 47

Lower Band Edge: from 2398 MHz to 2400 MHz
 Upper Band Edge: from 2483.5 MHz to 2485.5 MHz

Sample n°1:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out-of-Band Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2405	101.27	Peak	2399.944	-46.52	54.75	81.27	26.52
2480	100.23	Peak	2483.883	-50.37	49.86**	74	24.14

* *Marker-Delta method*

** *The peak level is lower than the average limit (54 dBµV/m).*

20 dB bandwidth curves are given in annex 2; band-edge curves are given in annex 3.

Test conclusion:

RESPECTED STANDARD

11. MAXIMUM PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247 (b)

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Spectrum analyzer FSP40	Rohde & Schwarz	4088
Double ridged guide antenna EM 6961	Electrometrics	1204
Open area test site	Emitech	1274
Multimeter 77-2	Fluke	0812
Variac R213	Dereix	1419
Meteo station meteostar	Bioblock Scientific	0943

Test set up:

The system is tested in an open area test site (OATS). The EUT is placed on a rotating table, 0.8m from a ground plane. Zero degree azimuth corresponds to the front of the EUT.

The measurement of the electro-magnetic field is realized according to measurement procedure option 1 of paragraph 8 of 558074 D01 DTS v02).

Distance of antenna: 3 meters

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

This test is first realized with the equipment's internal antenna and repeated with ZBRA2 external antenna.

Results: (internal antenna)

Ambient temperature (°C): 21.5
 Relative humidity (%): 54

Power source: 120 V.a.c. through a variac

Sample N° 1: channel 11

EIRP (dBm)	Equivalent maximum conducted output power*		Limit (mW)
	(dBm)	(mW)	
+8.8	+3.8	2.399	1000

Polarization of test antenna: horizontal (height: 131 cm)

Position of equipment: see photos in annex 5 (azimuth: 7 degrees)

channel 18

EIRP (dBm)	Equivalent maximum conducted output power*		Limit (mW)
	(dBm)	(mW)	
+7.8	+2.8	1.905	1000

Polarization of test antenna: horizontal (height: 131 cm)

Position of equipment: see photos in annex 5 (azimuth: 0 degree)

channel 26

EIRP (dBm)	Equivalent maximum conducted output power*		Limit (mW)
	(dBm)	(mW)	
+6.7	+1.7	1.479	1000

Polarization of test antenna: horizontal (height: 129 cm)

Position of equipment: see photos in annex 5 (azimuth: 0 degree)

* $Output\ power = EIRP - declared\ antenna\ gain$
Antenna gain: 5 dBi

Results: (external antenna)

Ambient temperature (°C): 21.5
 Relative humidity (%): 75

Power source: 120 V.a.c. through a variac

Sample N° 1: channel 11

EIRP (dBm)	Equivalent maximum conducted output power*		Limit (mW)
	(dBm)	(mW)	
+3.9	+3.9	2.455	1000

Polarization of test antenna: vertical (height: 121 cm)

Position of equipment: see photos in annex 5 (azimuth: 349 degrees)

channel 18

EIRP (dBm)	Equivalent maximum conducted output power*		Limit (mW)
	(dBm)	(mW)	
+3.1	+3.1	2.042	1000

Polarization of test antenna: vertical (height: 120 cm)

Position of equipment: see photos in annex 5 (azimuth: 38 degrees)

channel 26

EIRP (dBm)	Equivalent maximum conducted output power*		Limit (mW)
	(dBm)	(mW)	
+1.8	+1.8	1.514	1000

Polarization of test antenna: vertical (height: 127 cm)

Position of equipment: see photos in annex 5 (azimuth: 330 degrees)

* $Output\ power = EIRP - declared\ antenna\ gain$
Antenna assembly gain: 0 dBi

Test conclusion:

RESPECTED STANDARD

12. INTENTIONAL RADIATOR

Standard: FCC Part 15

Test procedure: paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Test receiver ESH3	Rohde & Schwarz	1058
Test receiver ESVS10	Rohde & Schwarz	1219
Spectrum analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Biconical antenna 11966 C	Hewlett Packard	0728
Log periodic antenna HL 223	Rohde & Schwarz	1999
Double ridged guide antenna EM 6961	Electrometrics	1204
Preamplifier 1 to 18 GHz DB97-1852	DBS Microwave	2648
High pass filter HP 12/3200-5AA	Filtek	8262
Open area test site	Emitech	1274
Multimeter 77-2	Fluke	0812
Variac R213	Dereix	1419
Meteo station meteostar	Bioblock scientific	0943

Test set up:

The system is tested in an open area test site (OATS). The EUT is placed on a rotating table, 0.8m from a ground plane. Zero degree azimuths correspond to the front of the EUT.

See photos in annex 5.

Frequency range: From 9 kHz to 10th harmonic of the highest fundamental frequency (2480 MHz).

Detection mode: Quasi-peak (F < 1 GHz) Peak / Average (F > 1 GHz)

Bandwidth: 120 kHz (F < 1 GHz) 100 kHz / 1 MHz (F > 1 GHz)

Distance of antenna: 3 meters

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal (only the highest level is recorded)

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

This test is first realized with the equipment's internal antenna and repeated with ZBRA2 external antenna.

Results: (internal antenna)

Ambient temperature (°C): 27.5
 Relative humidity (%): 69

Power source: 120 Va.c. through a variac

Sample N° 1: channel 11

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
72	QP	100	254	120	V	23.8	40	16.2
120	QP	161	67	120	H	26.5	43.5	17
133	QP	233	65	120	H	28.9	43.5	14.6
287.2	QP	156	0	120	V	27.7	46	18.3
4810*	P	120	0	1000	H	59.84	74	14.16
4810*	Av	120	0	1000	H	43.01	54	10.99

channel 18

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
72	QP	100	254	120	V	23.8	40	16.2
120	QP	161	67	120	H	26.5	43.5	17
133	QP	233	65	120	H	28.9	43.5	14.6
287.2	QP	156	0	120	V	27.7	46	18.3
4880*	P	106	0	1000	H	59.06	74	14.94
4880*	Av	106	0	1000	H	42.58	54	11.42

channel 26

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
72	QP	100	254	120	V	23.8	40	16.2
120	QP	161	67	120	H	26.5	43.5	17
133	QP	233	65	120	H	28.9	43.5	14.6
287.2	QP	156	0	120	V	27.7	46	18.3
4960*	P	101	7	1000	H	58.27	74	15.73
4960*	Av	101	7	1000	H	41.73	54	12.27

* restricted bands of operation in 15.205

Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 101.37 dBμV/m on channel 18.

So the applicable limit is 81.37 dBμV/m.

In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

Results: (external antenna)

Ambient temperature (°C): 24.5
 Relative humidity (%): 75

Power source: 120 Va.c. through a variac

Sample N° 1: channel 11

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
72	QP	100	254	120	V	23.8	40	16.2
120	QP	161	67	120	H	26.5	43.5	17
133	QP	233	65	120	H	28.9	43.5	14.6
287.2	QP	156	0	120	V	27.7	46	18.3
4810*	P	100	68	1000	V	51.64	74	22.36
4810*	Av	100	68	1000	V	35.57	54	18.43

channel 18

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
72	QP	100	254	120	V	23.8	40	16.2
120	QP	161	67	120	H	26.5	43.5	17
133	QP	233	65	120	H	28.9	43.5	14.6
287.2	QP	156	0	120	V	27.7	46	18.3
4880*	P	125	0	1000	V	53.25	74	20.75
4880*	Av	125	0	1000	V	35.37	54	18.63

channel 26

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
72	QP	100	254	120	V	23.8	40	16.2
120	QP	161	67	120	H	26.5	43.5	17
133	QP	233	65	120	H	28.9	43.5	14.6
287.2	QP	156	0	120	V	27.7	46	18.3
4960*	P	111	15	1000	H	52.83	74	21.17
4960*	Av	111	15	1000	H	35.33	54	18.67

* restricted bands of operation in 15.205

Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 95.61 dB μ V/m on channel 26.

So the applicable limit is 75.61 dB μ V/m.

In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

Test conclusion:

RESPECTED STANDARD

13. PEAK POWER DENSITY

Standard: FCC Part 15

Test procedure: paragraph 15.247 (e)

Test equipments:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP40	Rohde & Schwarz	4088
Double ridged guide antenna EM 6961	Electrometrics	1204
Open area test site	Emitech	1274
Multimeter 77-2	Fluke	0812
Variac R213	Dereix	1419
Meteo station meteostar	Bioblock scientific	0943

Test set up:

The system is tested in an open area test site (OATS). The EUT is placed on a rotating table, 0.8m from a ground plane. Zero degree azimuth corresponds to the front of the EUT.

The measurement of the electro-magnetic field is realized according to measurement procedure option 1 of paragraph 9 of 558074 D01 DTS v02).

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

This test is first realized with the equipment's internal antenna and repeated with ZBRA2 external antenna.

Results: (internal antenna)

Ambient temperature (°C): 21.5
 Relative humidity (%): 54

Power source: 120 Va.c. through a variac

Sample N° 1: channel 11

	Peak power density at frequency: 2405 MHz
Normal test conditions	-9.16 dBm
Limits	+8 dBm

channel 18

	Peak power density at frequency: 2440 MHz
Normal test conditions	-9.06 dBm
Limits	+8 dBm

channel 26

	Peak power density at frequency: 2480 MHz
Normal test conditions	-10.20 dBm
Limits	+8 dBm

Results: (external antenna)

Ambient temperature (°C): 29.5
 Relative humidity (%): 75

Power source: 120 Va.c. through a variac

Sample N° 1: channel 11

	Peak power density at frequency: 2405 MHz
Normal test conditions	-11.59 dBm
Limits	+8 dBm

channel 18

	Peak power density at frequency: 2440 MHz
Normal test conditions	-11.92 dBm
Limits	+8 dBm

channel 26

	Peak power density at frequency: 2480 MHz
Normal test conditions	-11.60 dBm
Limits	+8 dBm

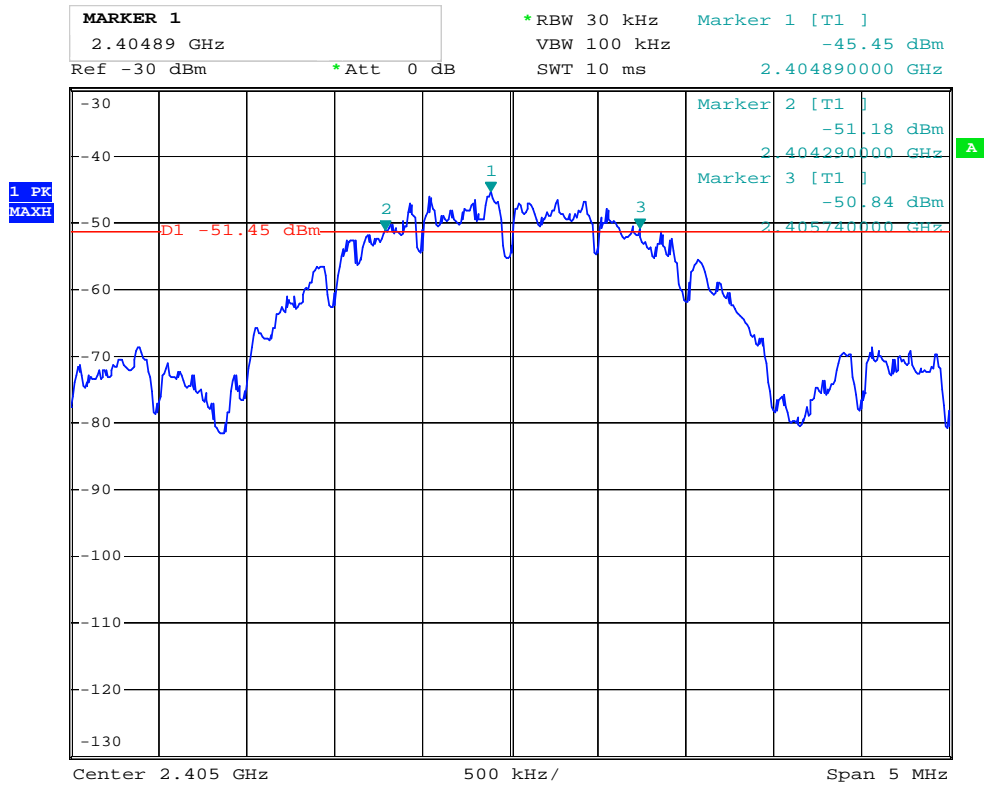
Test conclusion:

RESPECTED STANDARD

□□□ End of report, 5 annexes to be forwarded □□□

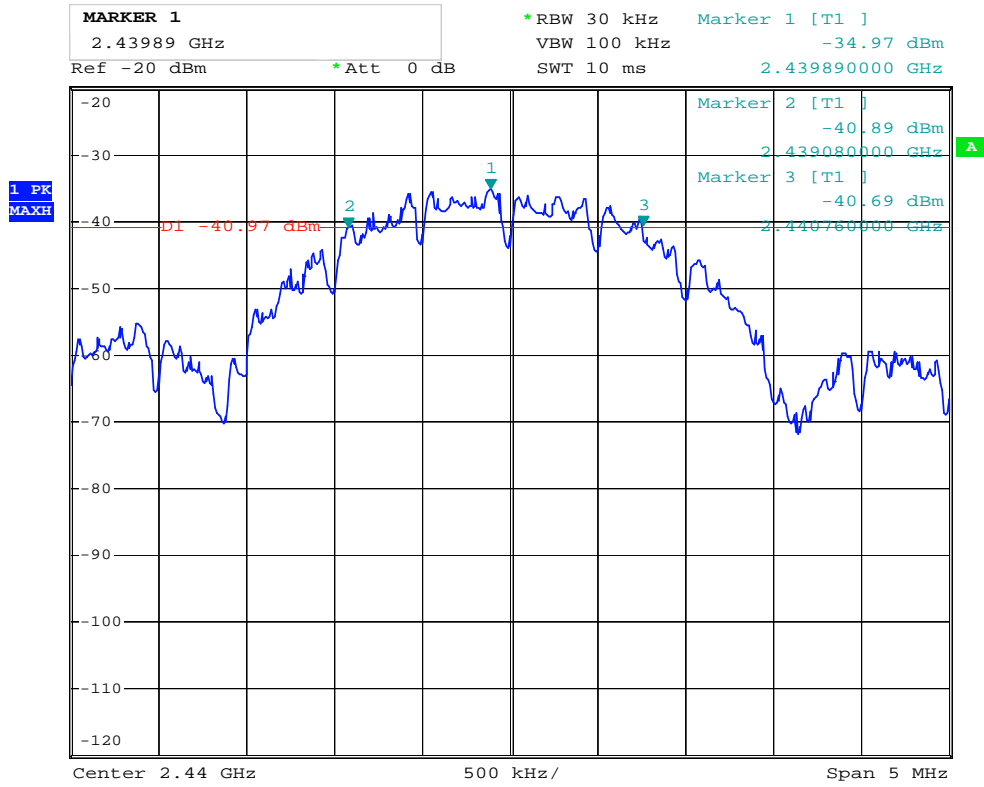
ANNEX 1: 6 dB bandwidth

Channel 11



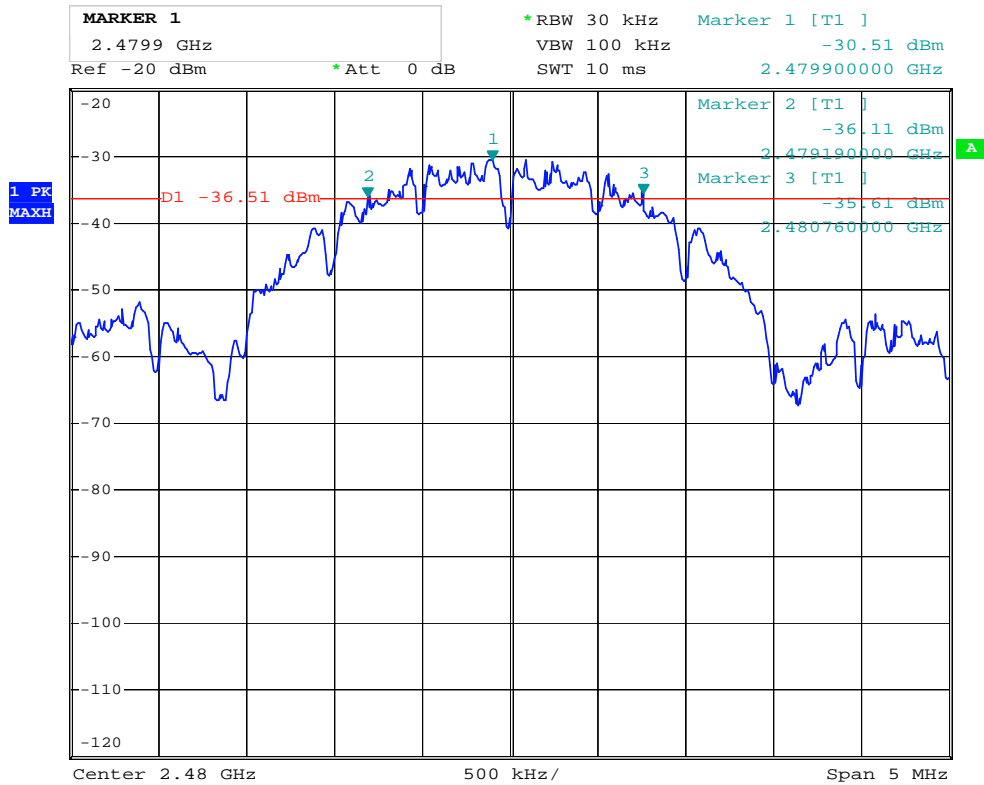
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Channel 18



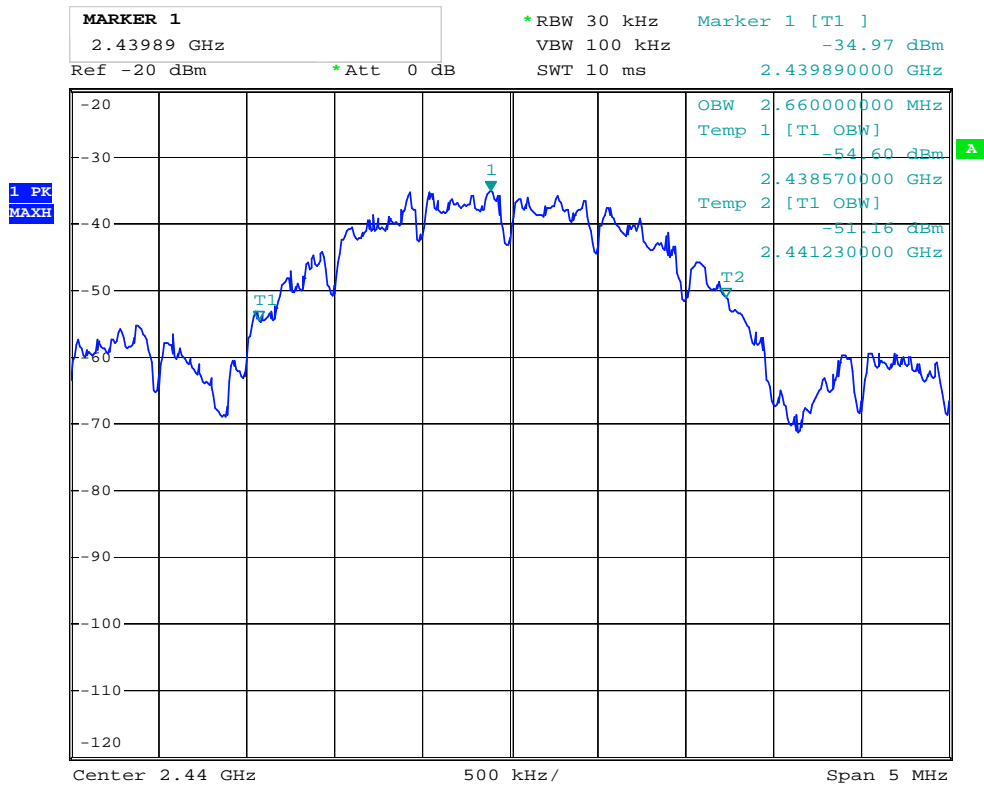
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Channel 26



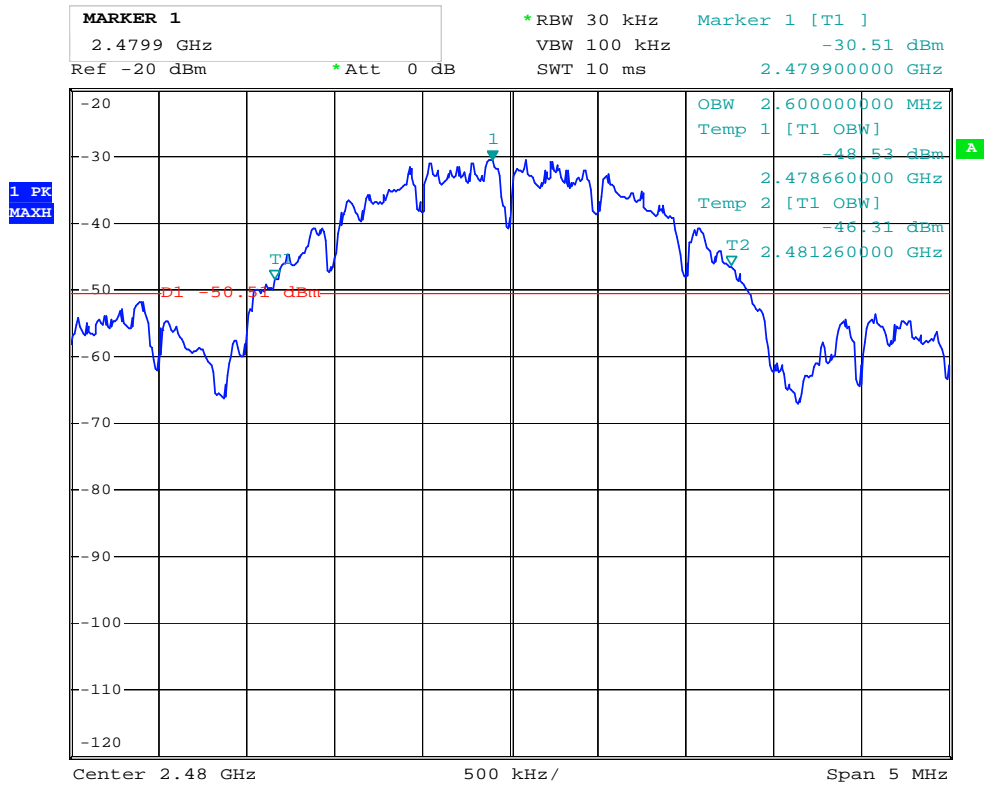
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Channel 18



Date: 3.AUG.2012 10:45:56

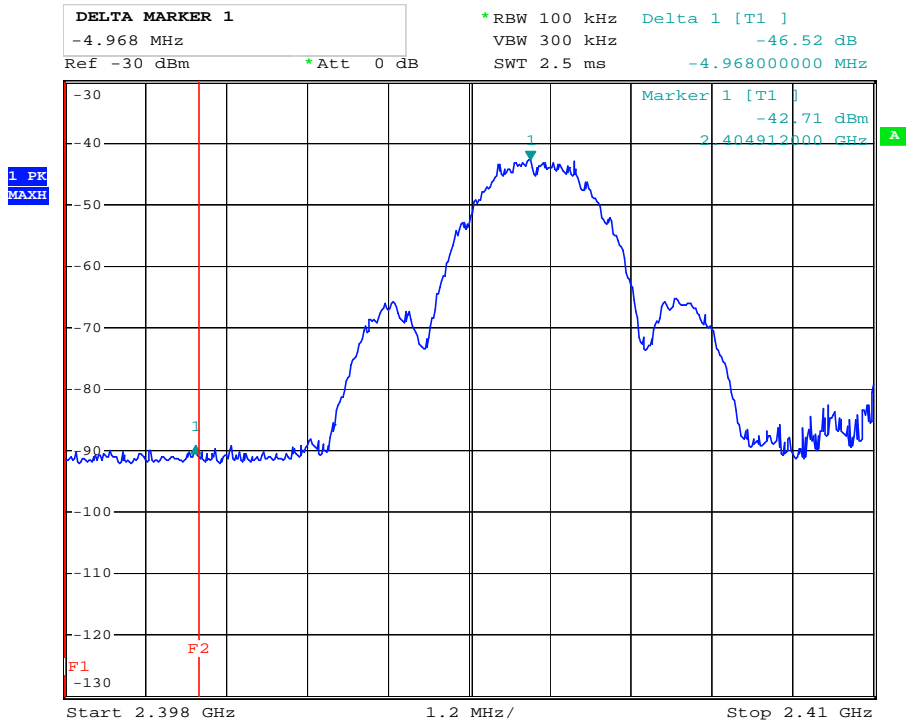
Channel 26



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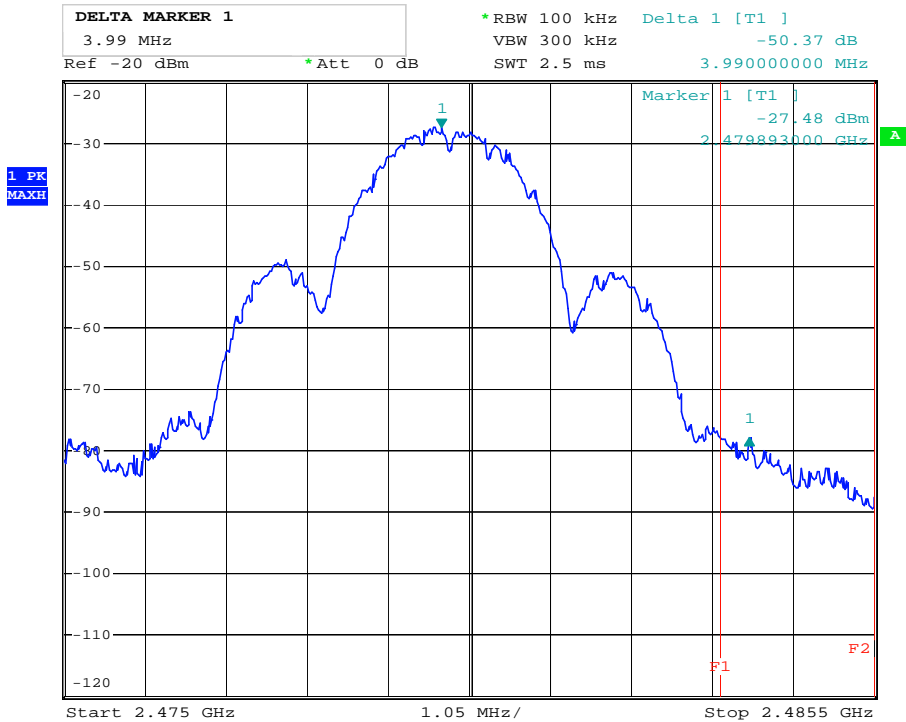
ANNEX 3: Band edge

Channel 11



Date: 3.AUG.2012 10:28:36

Channel 26



Date: 3.AUG.2012 10:34:22

ANNEX 4: Photos of EUT

GENERAL VIEW ZBRN2 + ZBRA2

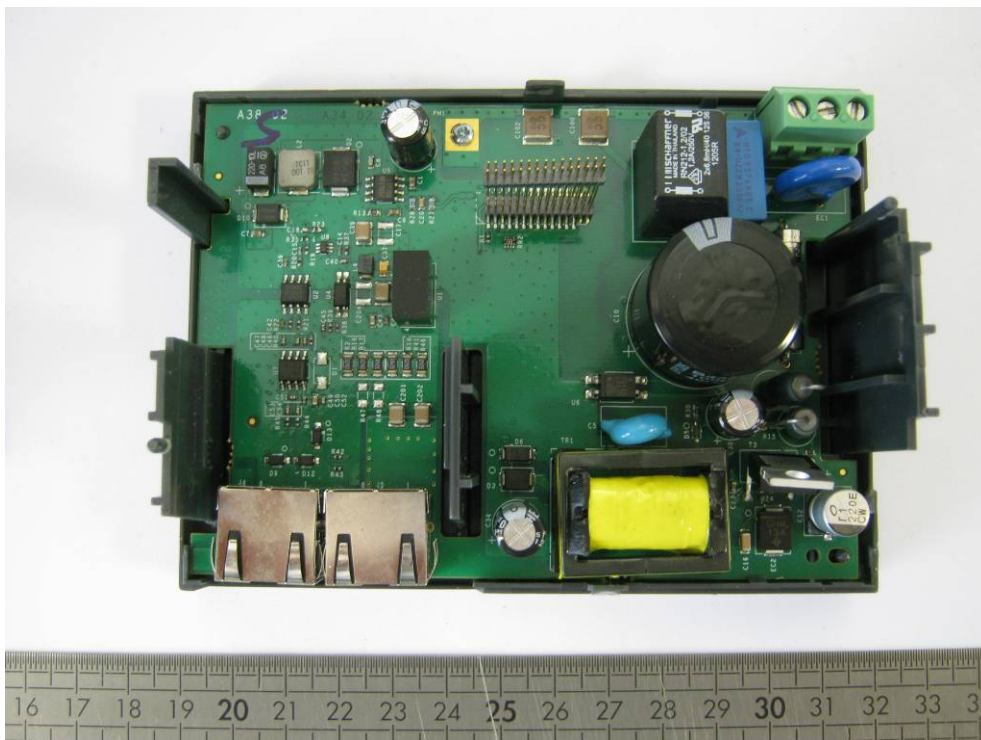
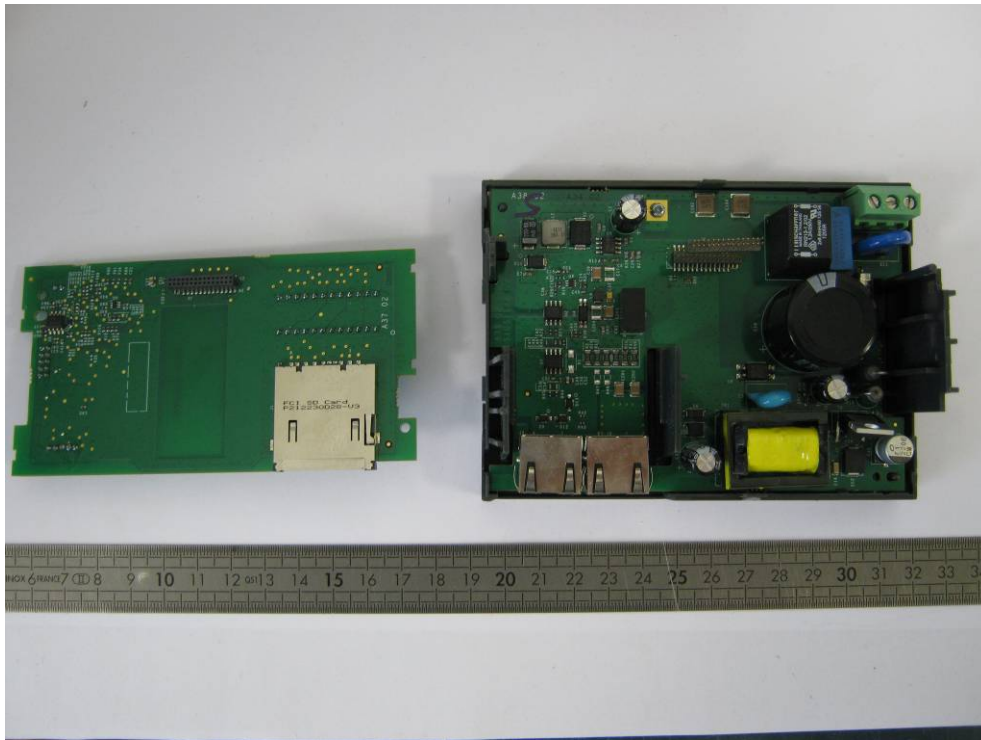


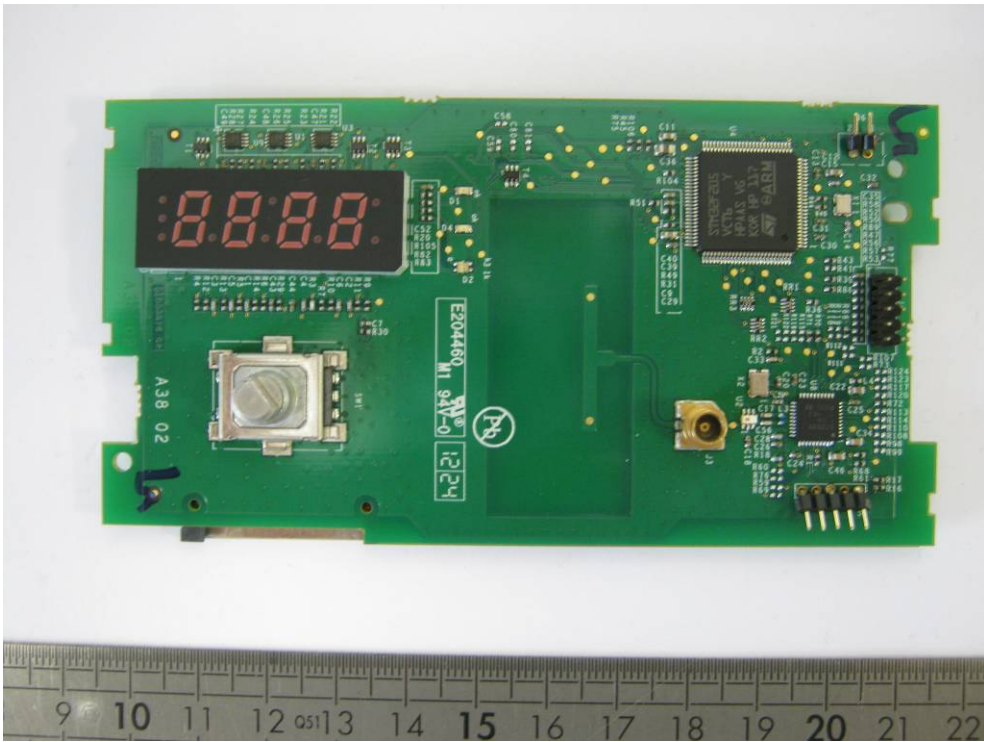
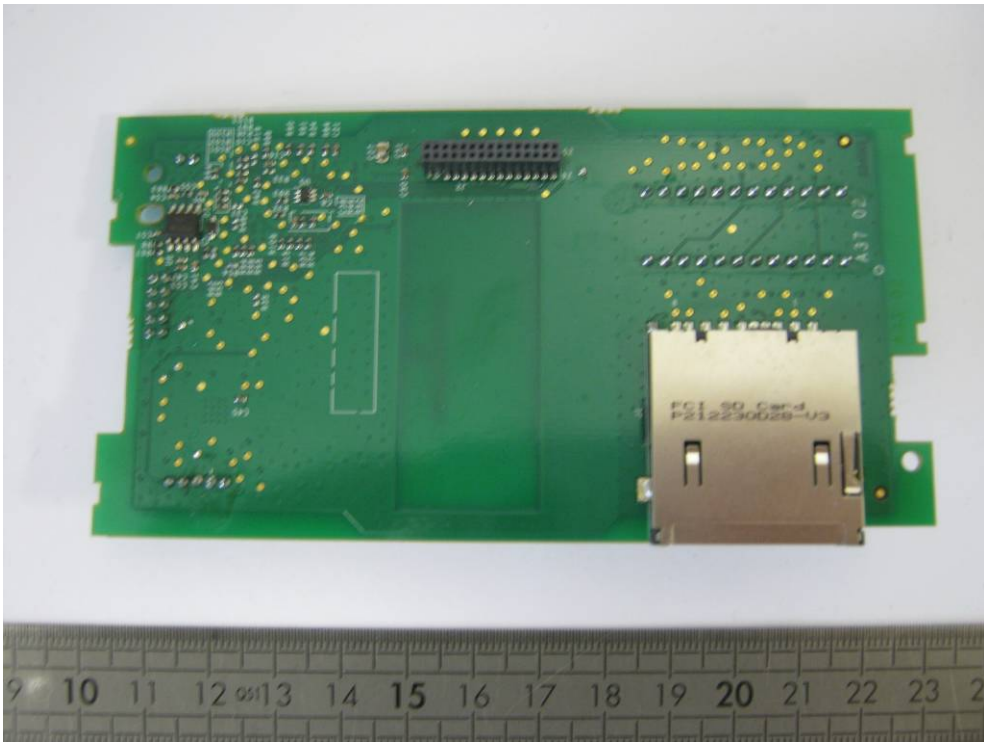
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PRINTED CIRCUIT BOARD ZBRN2





ANNEX 5: Test set-up

Conducted measurement

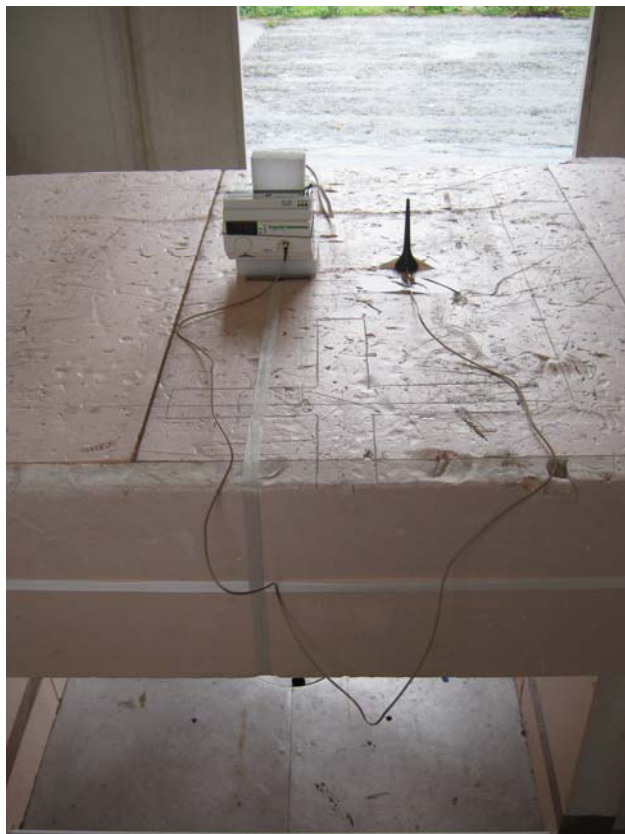


Radiated measurement

INTERNAL ANTENNA



EXTERNAL ANTENNA



1