R051-24-12-100903-3/A Ed.1

This report cancels and replaces the test report N° R051-24-12-100903-3/A Edition 0

RADIO test report

according to standard:
FCC Part 15 (2012)

Equipment under test:
ZBRN1 : MULTIPLE PROTOCOLS ACCESS POINT + ZBRCETH : MODBUS/TCP ETHERNET MODULE

FCC ID: Y7HZBRN1

Company:
SCHNEIDER ELECTRIC

DISTRIBUTION: Mr. BLANQUART **Company: SCHNEIDER ELECTRIC**

Number of pages: 51 including 5 annexes

Ed.	Date	Modified pages	Written by Name	Visa	Technical Verification Quality Approval Name	Visa
1	1/29/2013	42-43-44 -51	M. DUMESNIL	M. D.	BERTHAUD L.	

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This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of the whole manufactured products of the tested sample.

PRODUCT:	**ZBRN1 : Multiple protocols access point + ZBRCETH : Modbus/TCP Ethernet module**
Reference / model:	ZBRN1: Multiple protocols access point ZBRCETH : Modbus/TCP Ethernet module ZBRA2 : Passive external antenna for access point
Serial number:	12-1411-01
MANUFACTURER:	SCHNEIDER ELECTRIC

COMPANY SUBMITTING THE PRODUCT:

Company:	SCHNEIDER ELECTRIC
Address:	Boulevard Salvador Allende ZI D'ESPAGNAC BP 660 16340 L'ISLE D'ESPAGNAC FRANCE
Responsible:	Mr. BLANQUART
DATE(S) OF TEST:	26, 27 and 31 July 2012 1 and 3 August 2012 8 and 9 October 2012
TESTING LOCATION:	EMITECH ATLANTIQUE laboratory at ANGERS (49) FRANCE EMITECH ATLANTIQUE open area test site in LA POUEZE (49) FRANCE FCC 2.948 Listed Site Registration Number: 101696 FCC Accredited Site Registration Number: 896948
TESTED BY:	M. DUMESNIL

CONTENTS

TITLE **PAGE**

1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment:
ZBRN1 : Multiple protocols access point + ZBRCETH : Modbus/TCP Ethernet module, 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	Profline 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 analyzer	19/04/2012	19/04/2014	19/06/2014
5071	R&S FSEA	Spectrum analyzer	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				*Note 1*
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				*Note 2*
FCC Part 15.212	MODULAR TRANSMITTERS			X		
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	(a) Alternative to general radiated emission limits	X				
	(b) Unwanted emissions outside of §15.247 frequency bands	X				*Note 3*
	(c) 20 dB bandwidth and band-edge compliance	X				
FCC Part 15.247	OPERATION WITHIN THE BANDS 902-928 MHZ, 2400-2483.5 MHz and 5725-5850 MHz					
	(a) (1) Hopping systems			X		
	(a) (2) Digital modulation techniques	X				*Note 4*
	(b) Maximum peak output power	X				*Note 5*
	(c) Operation with directional antenna gains > 6 dBi			X		
	(d) Intentional radiator	X				
	(e) Peak power spectral density	X				
	(f) Hybrid system			X		
	(g) Frequency hopping requirements			X		
	(h) Frequency hopping intelligence			X		
	(i) RF exposure compliance	X				*Note 6*

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 1510 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% of nominal voltage.

*Note 6: PSD = EIRP/4*π*R^2 = 7.586/4*π*(20 cm)² = 0.002 mW/cm²*
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 ZBRN1 : Multiple protocols access point + ZBRCETH : Modbus/TCP Ethernet module 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 Profline 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.

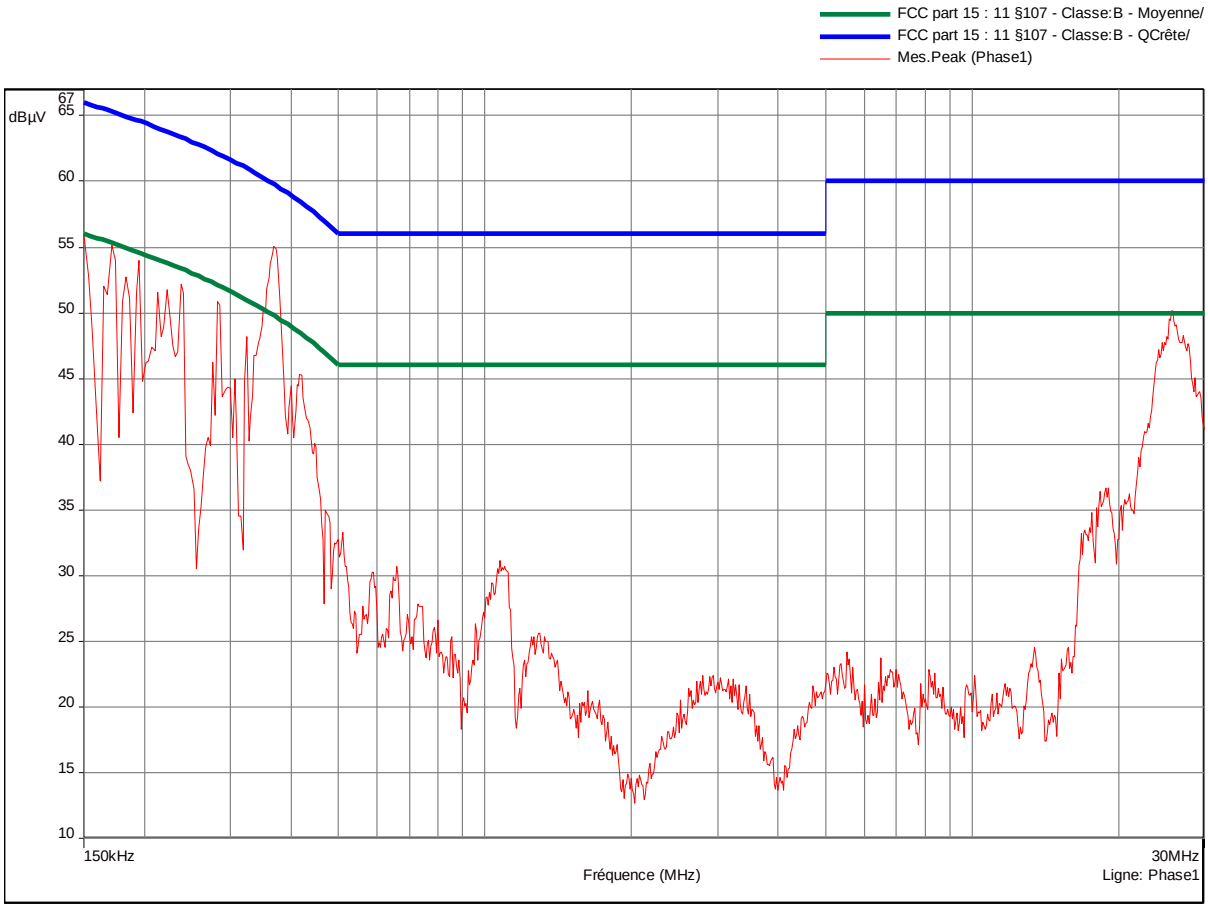
Results:

Ambient temperature (°C): 25.5
Relative humidity (%): 49

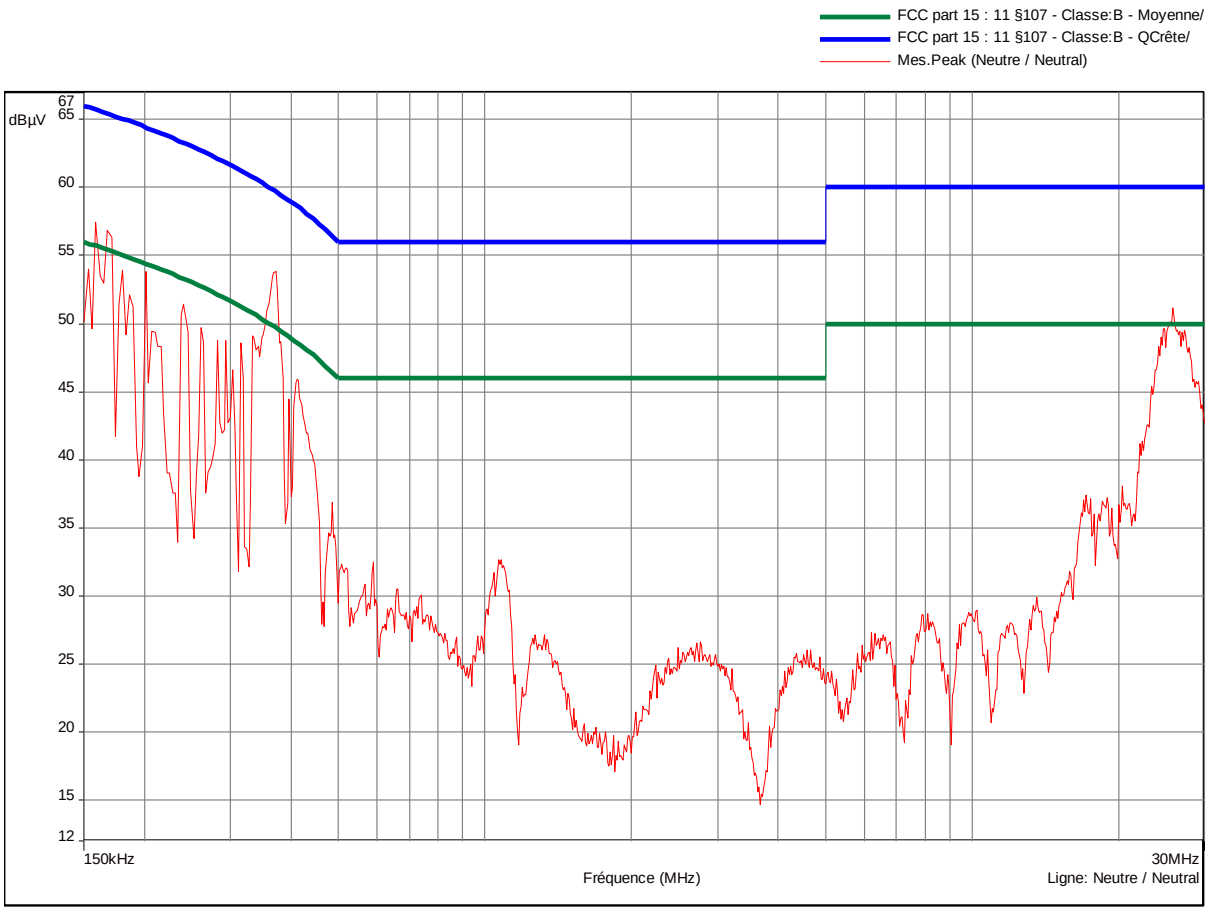
Measurement on the mains power supply:

The measurement is first realized with Peak detector.

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

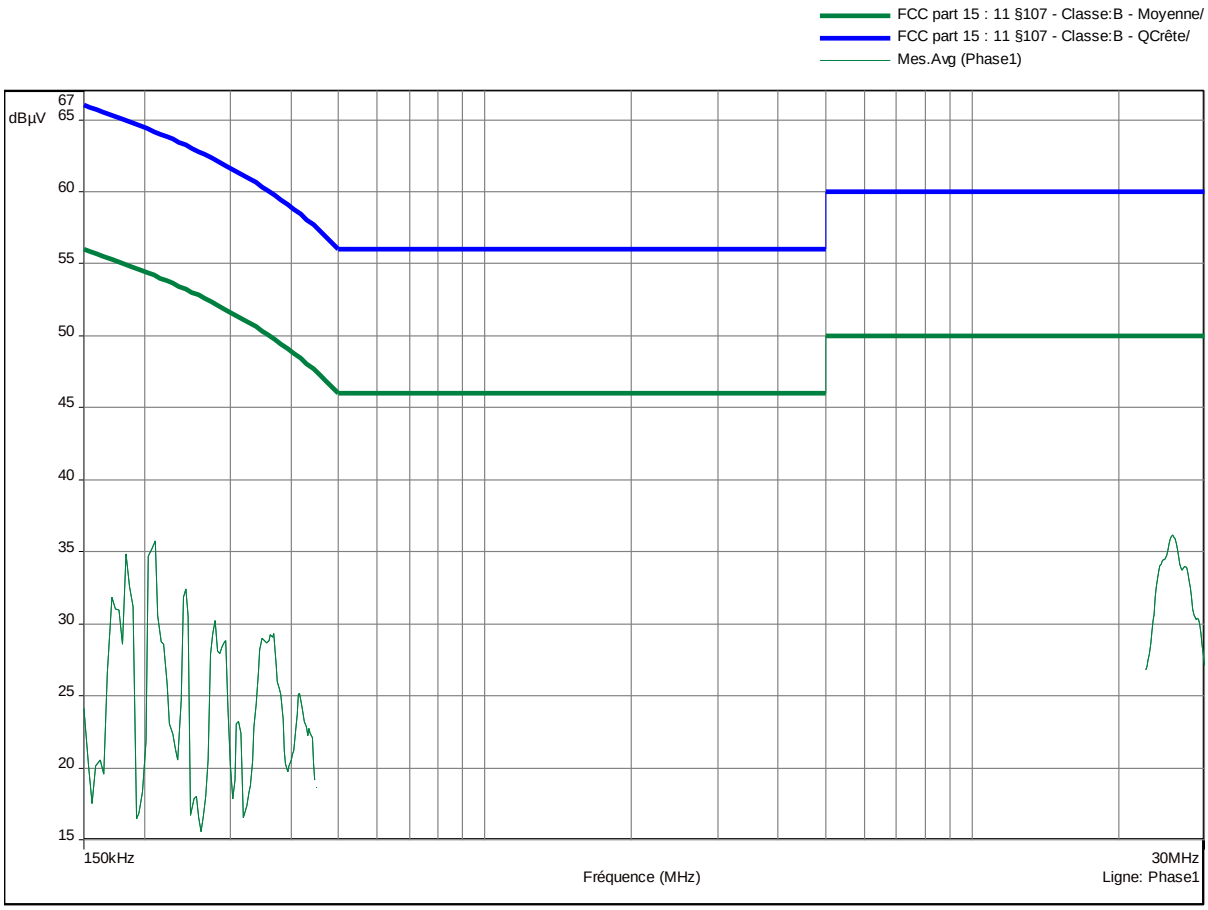


Curve N° 2: measurement on the Line with peak detector

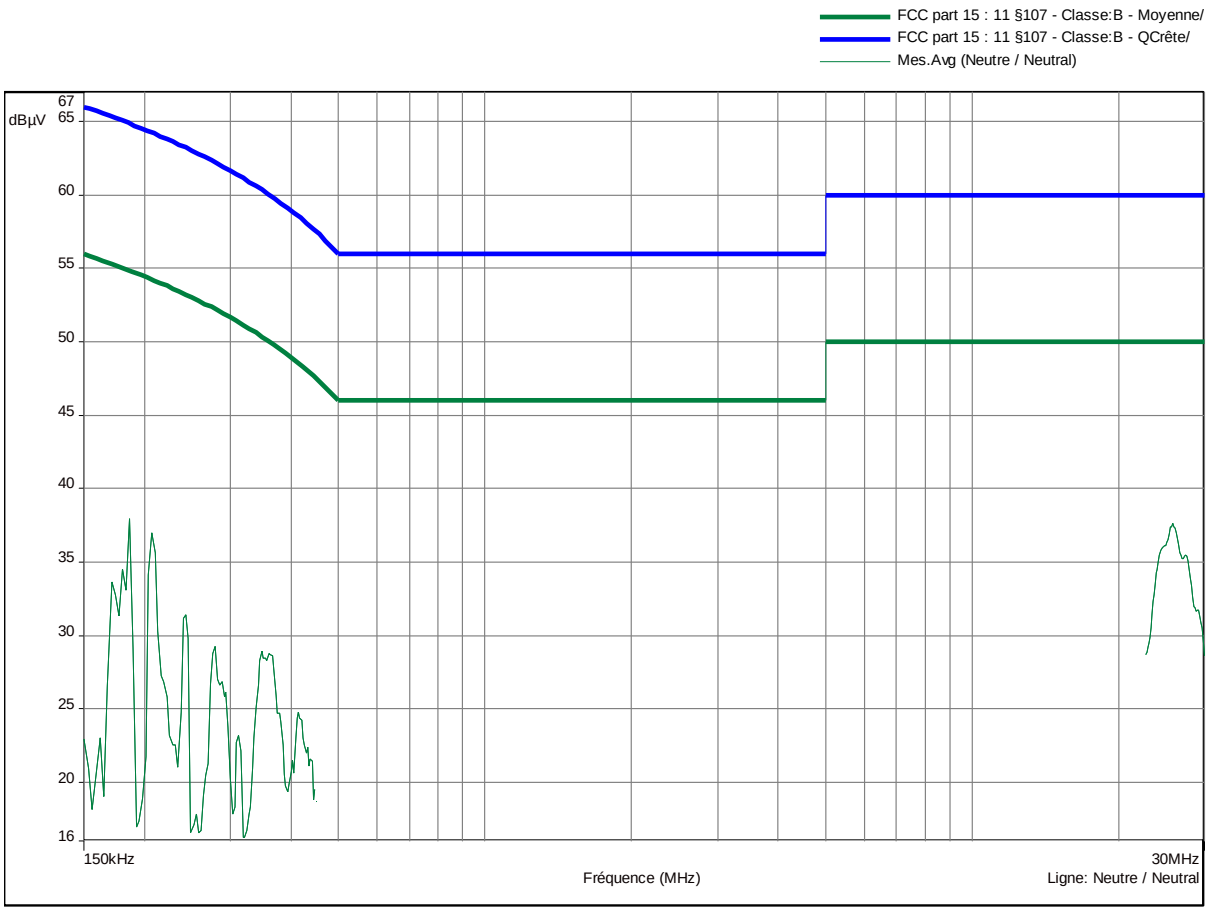


The frequencies which are not 6 dB under the Average limit are then analyzed with Average detector.

Curve N° 3: average measurement on the Neutral, for the frequency range: from 150 kHz to 450 kHz and from 22.8 MHz to 30 MHz.



Curve N° 4: average measurement on the Line, for the frequency range: from 150 kHz to 450 kHz and from 22.8 MHz to 30 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): 30.5
Relative humidity (%): 54

Power source: 120 Va.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)
53.47	QP	310	64	H	22.8	40	17.2
144	QP	143	86	H	30.3	43.5	13.2
300.20	QP	100	66	H	35.6	46	10.4
400.27	QP	100	42	H	33.2	46	12.8
575.40	QP	150	216	H	34.2	46	11.8
625.42	QP	126	26	H	37.8	46	8.2
675.45	QP	116	13	H	42	46	4
700.48	QP	109	257	H	38.2	46	7.8
725.50	QP	112	252	H	41	46	5
750.52	QP	107	356	H	34.1	46	11.9
775.53	QP	172	263	H	36.2	46	9.8
825.56	QP	143	19	H	33.2	46	12.8
875.59	QP	100	237	H	35.5	46	10.5
975.67	QP	137	268	H	31.8	54	22.2
4810	Av	239	0	V	52.35	54	1.65

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)
53.47	QP	310	64	H	22.8	40	17.2
144	QP	143	86	H	30.3	43.5	13.2
300.20	QP	100	66	H	35.6	46	10.4
400.27	QP	100	42	H	33.2	46	12.8
575.40	QP	150	216	H	34.2	46	11.8
625.42	QP	126	26	H	37.8	46	8.2
675.45	QP	116	13	H	42	46	4
700.48	QP	109	257	H	38.2	46	7.8
725.50	QP	112	252	H	41	46	5
750.52	QP	107	356	H	34.1	46	11.9
775.53	QP	172	263	H	36.2	46	9.8
825.56	QP	143	19	H	33.2	46	12.8
875.59	QP	100	237	H	35.5	46	10.5
975.67	QP	137	268	H	31.8	54	22.2
4880	Av	107	41	V	53.63	54	0.37

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)
53.47	QP	310	64	H	22.8	40	17.2
144	QP	143	86	H	30.3	43.5	13.2
300.20	QP	100	66	H	35.6	46	10.4
400.27	QP	100	42	H	33.2	46	12.8
575.40	QP	150	216	H	34.2	46	11.8
625.42	QP	126	26	H	37.8	46	8.2
675.45	QP	116	13	H	42	46	4
700.48	QP	109	257	H	38.2	46	7.8
725.50	QP	112	252	H	41	46	5
750.52	QP	107	356	H	34.1	46	11.9
775.53	QP	172	263	H	36.2	46	9.8
825.56	QP	143	19	H	33.2	46	12.8
875.59	QP	100	237	H	35.5	46	10.5
975.67	QP	137	268	H	31.8	54	22.2
4960	Av	237	0	V	52.80	54	1.20

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 Va.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)
53.47	QP	310	64	H	22.8	40	17.2
144	QP	143	86	H	30.3	43.5	13.2
300.20	QP	100	66	H	35.6	46	10.4
400.27	QP	100	42	H	33.2	46	12.8
575.40	QP	150	216	H	34.2	46	11.8
625.42	QP	126	26	H	37.8	46	8.2
675.45	QP	116	13	H	42	46	4
700.48	QP	109	257	H	38.2	46	7.8
725.50	QP	112	252	H	41	46	5
750.52	QP	107	356	H	34.1	46	11.9
775.53	QP	172	263	H	36.2	46	9.8
825.56	QP	143	19	H	33.2	46	12.8
875.59	QP	100	237	H	35.5	46	10.5
975.67	QP	137	268	H	31.8	54	22.2
4810	Av	111	12	V	50.65	54	3.35

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)
53.47	QP	310	64	H	22.8	40	17.2
144	QP	143	86	H	30.3	43.5	13.2
300.20	QP	100	66	H	35.6	46	10.4
400.27	QP	100	42	H	33.2	46	12.8
575.40	QP	150	216	H	34.2	46	11.8
625.42	QP	126	26	H	37.8	46	8.2
675.45	QP	116	13	H	42	46	4
700.48	QP	109	257	H	38.2	46	7.8
725.50	QP	112	252	H	41	46	5
750.52	QP	107	356	H	34.1	46	11.9
775.53	QP	172	263	H	36.2	46	9.8
825.56	QP	143	19	H	33.2	46	12.8
875.59	QP	100	237	H	35.5	46	10.5
975.67	QP	137	268	H	31.8	54	22.2
4880	Av	107	47	V	50.85	54	3.15

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)
53.47	QP	310	64	H	22.8	40	17.2
144	QP	143	86	H	30.3	43.5	13.2
300.20	QP	100	66	H	35.6	46	10.4
400.27	QP	100	42	H	33.2	46	12.8
575.40	QP	150	216	H	34.2	46	11.8
625.42	QP	126	26	H	37.8	46	8.2
675.45	QP	116	13	H	42	46	4
700.48	QP	109	257	H	38.2	46	7.8
725.50	QP	112	252	H	41	46	5
750.52	QP	107	356	H	34.1	46	11.9
775.53	QP	172	263	H	36.2	46	9.8
825.56	QP	143	19	H	33.2	46	12.8
875.59	QP	100	237	H	35.5	46	10.5
975.67	QP	137	268	H	31.8	54	22.2
4960	Av	107	38	V	50.79	54	3.21

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 Profline 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.

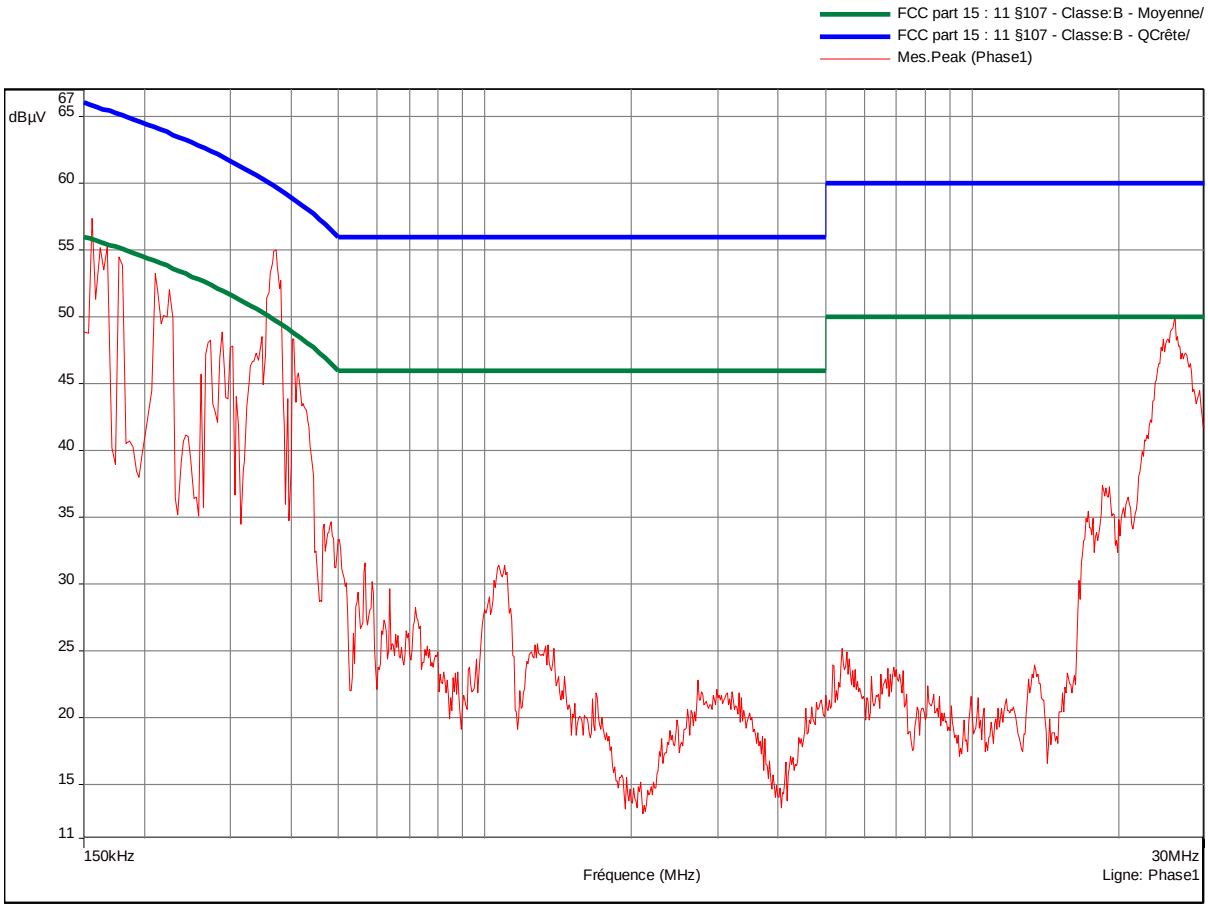
Results:

Ambient temperature (°C): 26
Relative humidity (%): 50

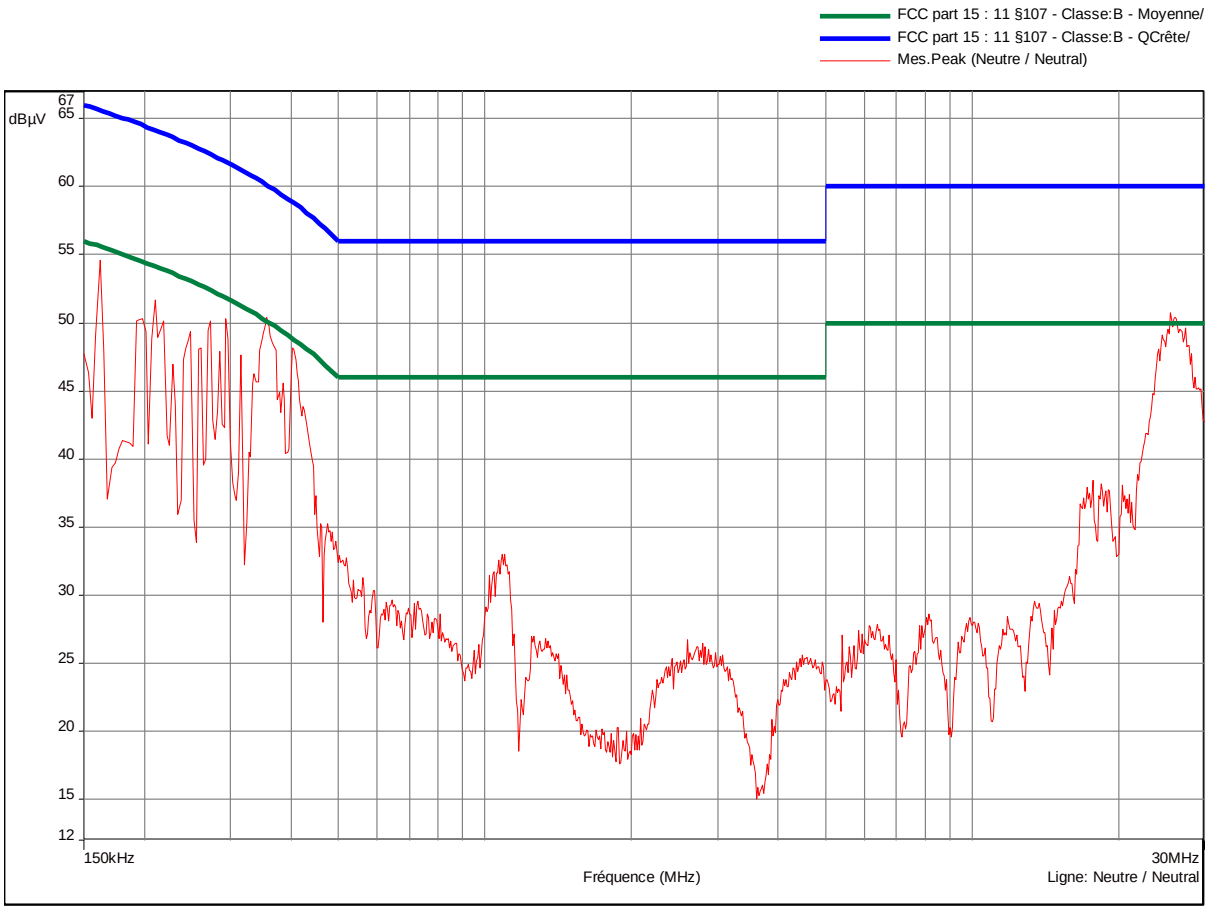
Measurement on the mains power supply:

The measurement is first realized with Peak detector.

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

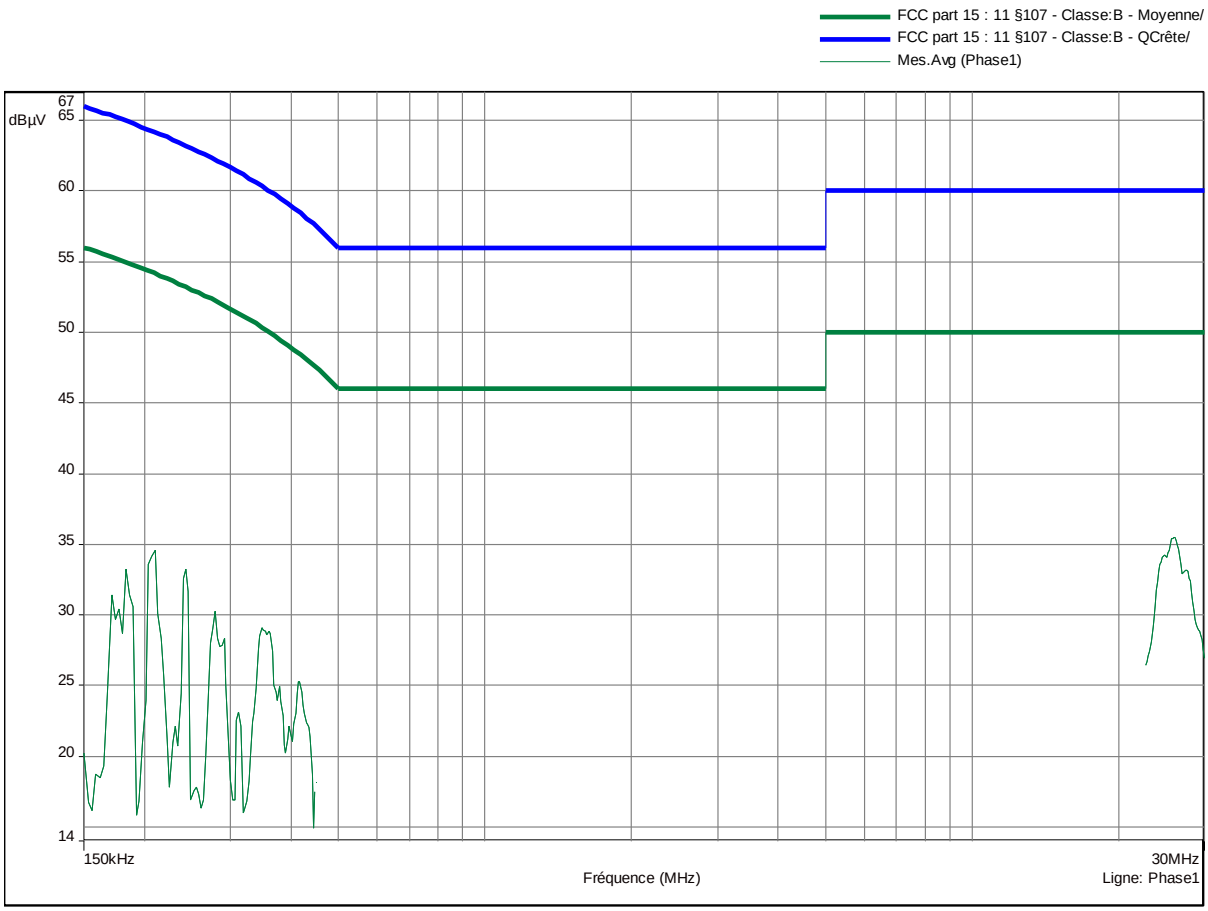


Curve N° 6: measurement on the Line with peak detector

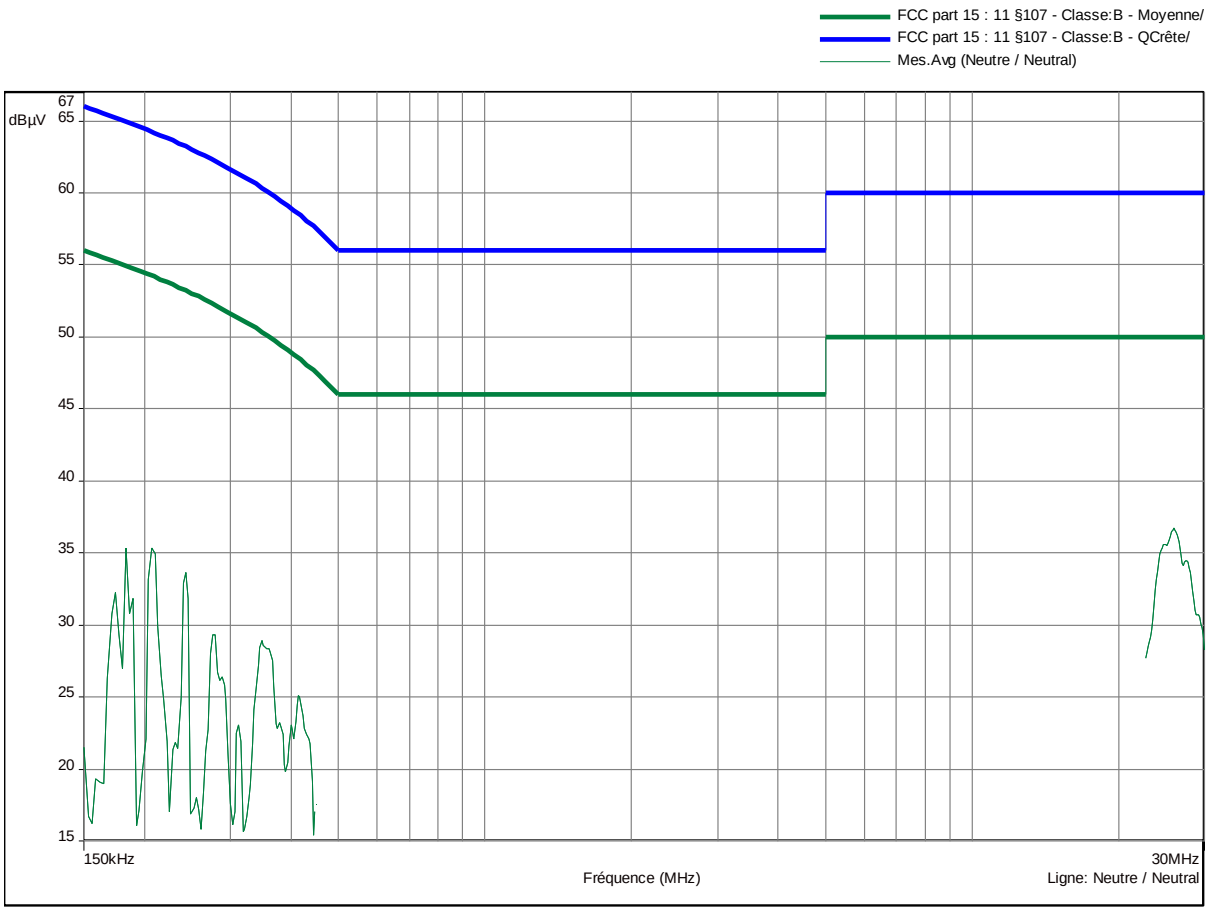


The frequencies which are not 6 dB under the Average limit are then analyzed with Average detector.

Curve N° 7: average measurement on the Neutral, for the frequency range: from 150 kHz to 450 kHz and from 22.8 MHz to 30 MHz.



Curve N° 8: average measurement on the Line, for the frequency range: from 150 kHz to 450 kHz and from 22.8 MHz to 30 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 output 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	101.13	Peak	2399.848	-55.36	45.77	81.13	35.36
2480	98.35	Peak	2483.589	-48.58	49.77**	74	24.23

* *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 test unit is placed on a rotating table, 0.8m from a ground plane. Zero degree azimuth corresponds to the front of the device under test.

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): 25
Relative humidity (%): 57

Power source: 120 Va.c. through a variac

Sample N° 1: channel 11

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

Polarization of test antenna: horizontal (height: 129 cm)
Position of equipment: see photos in annex 5 (azimuth: 352 degrees)

channel 18

EIRP (dBm)	Equivalent maximum conducted output power* (dBm)	(mW)	Limit (mW)
+7.6	+2.6	1.819	1000

Polarization of test antenna: horizontal (height: 130 cm)
Position of equipment: see photos in annex 5 (azimuth: 0 degrees)

channel 26

EIRP (dBm)	Equivalent maximum conducted output power* (dBm)	(mW)	Limit (mW)
+7.2	+2.2	1.047	1000

Polarization of test antenna: horizontal (height: 130 cm)
Position of equipment: see photos in annex 5 (azimuth: 0 degrees)

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

Results: (external antenna)

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

Power source: 120 Va.c. through a variac

Sample N° 1: channel 11

EIRP (dBm)	Equivalent maximum conducted output power* (dBm)	(mW)	Limit (mW)
+3.4	+3.4	2.188	1000

Polarization of test antenna: vertical (height: 157 cm)
Position of equipment: see photos in annex 5 (azimuth: 340 degrees)

channel 18

EIRP (dBm)	Equivalent maximum conducted output power* (dBm)	(mW)	Limit (mW)
+2.1	+2.1	1.622	1000

Polarization of test antenna: vertical (height: 101 cm)
Position of equipment: see photos in annex 5 (azimuth: 334 degrees)

channel 26

EIRP (dBm)	Equivalent maximum conducted output power* (dBm)	(mW)	Limit (mW)
+2	+2	1.585	1000

Polarization of test antenna: vertical (height: 126 cm)
Position of equipment: see photos in annex 5 (azimuth: 333 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 10^{th} 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): 28
Relative humidity (%): 67

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)
53.47	QP	310	64	120	H	22.8	40	17.2
144	QP	143	86	120	H	30.3	43.5	13.2
300.20	QP	100	66	120	H	35.6	46	10.4
400.27	QP	100	42	120	H	33.2	46	12.8
575.40	QP	150	216	120	H	34.2	46	11.8
625.42	QP	126	26	120	H	37.8	46	8.2
675.45	QP	116	13	120	H	42	46	4
700.48	QP	109	257	120	H	38.2	46	7.8
725.50	QP	112	252	120	H	41	46	5
750.52	QP	107	356	120	H	34.1	46	11.9
775.53	QP	172	263	120	H	36.2	46	9.8
825.56	QP	143	19	120	H	33.2	46	12.8
875.59	QP	100	237	120	H	35.5	46	10.5
975.67	QP	137	268	120	H	31.8	54	22.2
4810*	P	107	0	1000	H	61.82	74	12.18
4810*	Av	107	0	1000	H	44.77	54	9.23

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)
53.47	QP	310	64	120	H	22.8	40	17.2
144	QP	143	86	120	H	30.3	43.5	13.2
300.20	QP	100	66	120	H	35.6	46	10.4
400.27	QP	100	42	120	H	33.2	46	12.8
575.40	QP	150	216	120	H	34.2	46	11.8
625.42	QP	126	26	120	H	37.8	46	8.2
675.45	QP	116	13	120	H	42	46	4
700.48	QP	109	257	120	H	38.2	46	7.8
725.50	QP	112	252	120	H	41	46	5
750.52	QP	107	356	120	H	34.1	46	11.9
775.53	QP	172	263	120	H	36.2	46	9.8
825.56	QP	143	19	120	H	33.2	46	12.8
875.59	QP	100	237	120	H	35.5	46	10.5
975.67	QP	137	268	120	H	31.8	54	22.2
4880*	P	103	0	1000	H	61.33	74	12.67
4880*	Av	103	0	1000	H	44.91	54	9.09

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)
53.47	QP	310	64	120	H	22.8	40	17.2
144	QP	143	86	120	H	30.3	43.5	13.2
300.20	QP	100	66	120	H	35.6	46	10.4
400.27	QP	100	42	120	H	33.2	46	12.8
575.40	QP	150	216	120	H	34.2	46	11.8
625.42	QP	126	26	120	H	37.8	46	8.2
675.45	QP	116	13	120	H	42	46	4
700.48	QP	109	257	120	H	38.2	46	7.8
725.50	QP	112	252	120	H	41	46	5
750.52	QP	107	356	120	H	34.1	46	11.9
775.53	QP	172	263	120	H	36.2	46	9.8
825.56	QP	143	19	120	H	33.2	46	12.8
875.59	QP	100	237	120	H	35.5	46	10.5
975.67	QP	137	268	120	H	31.8	54	22.2
4960*	P	103	326	1000	H	58.83	74	15.17
4960*	Av	103	326	1000	H	42.38	54	11.62

* 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 101.13 dBµV/m on channel 11.
So the applicable limit is 81.13 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): 20.5
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)
53.47	QP	310	64	120	H	22.8	40	17.2
144	QP	143	86	120	H	30.3	43.5	13.2
300.20	QP	100	66	120	H	35.6	46	10.4
400.27	QP	100	42	120	H	33.2	46	12.8
575.40	QP	150	216	120	H	34.2	46	11.8
625.42	QP	126	26	120	H	37.8	46	8.2
675.45	QP	116	13	120	H	42	46	4
700.48	QP	109	257	120	H	38.2	46	7.8
725.50	QP	112	252	120	H	41	46	5
750.52	QP	107	356	120	H	34.1	46	11.9
775.53	QP	172	263	120	H	36.2	46	9.8
825.56	QP	143	19	120	H	33.2	46	12.8
875.59	QP	100	237	120	H	35.5	46	10.5
975.67	QP	137	268	120	H	31.8	54	22.2
4810*	P	100	310	1000	V	56.36	74	17.64
4810*	Av	100	310	1000	V	36.49	54	17.51

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)
53.47	QP	310	64	120	H	22.8	40	17.2
144	QP	143	86	120	H	30.3	43.5	13.2
300.20	QP	100	66	120	H	35.6	46	10.4
400.27	QP	100	42	120	H	33.2	46	12.8
575.40	QP	150	216	120	H	34.2	46	11.8
625.42	QP	126	26	120	H	37.8	46	8.2
675.45	QP	116	13	120	H	42	46	4
700.48	QP	109	257	120	H	38.2	46	7.8
725.50	QP	112	252	120	H	41	46	5
750.52	QP	107	356	120	H	34.1	46	11.9
775.53	QP	172	263	120	H	36.2	46	9.8
825.56	QP	143	19	120	H	33.2	46	12.8
875.59	QP	100	237	120	H	35.5	46	10.5
975.67	QP	137	268	120	H	31.8	54	22.2
4880*	P	237	19	1000	V	56.52	74	17.48
4880*	Av	237	19	1000	V	36.04	54	17.96

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)
53.47	QP	310	64	120	H	22.8	40	17.2
144	QP	143	86	120	H	30.3	43.5	13.2
300.20	QP	100	66	120	H	35.6	46	10.4
400.27	QP	100	42	120	H	33.2	46	12.8
575.40	QP	150	216	120	H	34.2	46	11.8
625.42	QP	126	26	120	H	37.8	46	8.2
675.45	QP	116	13	120	H	42	46	4
700.48	QP	109	257	120	H	38.2	46	7.8
725.50	QP	112	252	120	H	41	46	5
750.52	QP	107	356	120	H	34.1	46	11.9
775.53	QP	172	263	120	H	36.2	46	9.8
825.56	QP	143	19	120	H	33.2	46	12.8
875.59	QP	100	237	120	H	35.5	46	10.5
975.67	QP	137	268	120	H	31.8	54	22.2
4960*	P	100	22	1000	H	53.96	74	20.04
4960*	Av	100	22	1000	H	35.70	54	18.30

* 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 96.09 dBµV/m on channel 26.
So the applicable limit is 76.09 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)).

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): 25
Relative humidity (%): 57

Power source: 120 Va.c. through a variac

Sample N° 1: channel 11

	Peak power density at frequency: 2405 MHz
Normal test conditions	-9.30 dBm
Limits	+8 dBm

channel 18

	Peak power density at frequency: 2440 MHz
Normal test conditions	-10.04 dBm
Limits	+8 dBm

channel 26

	Peak power density at frequency: 2480 MHz
Normal test conditions	-12.08 dBm
Limits	+8 dBm

Results: (external antenna)

Ambient temperature (°C): 21.5
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	-13.70 dBm
Limits	+8 dBm

channel 18

	Peak power density at frequency: 2440 MHz
Normal test conditions	-13.21 dBm
Limits	+8 dBm

channel 26

	Peak power density at frequency: 2480 MHz
Normal test conditions	-13.30 dBm
Limits	+8 dBm

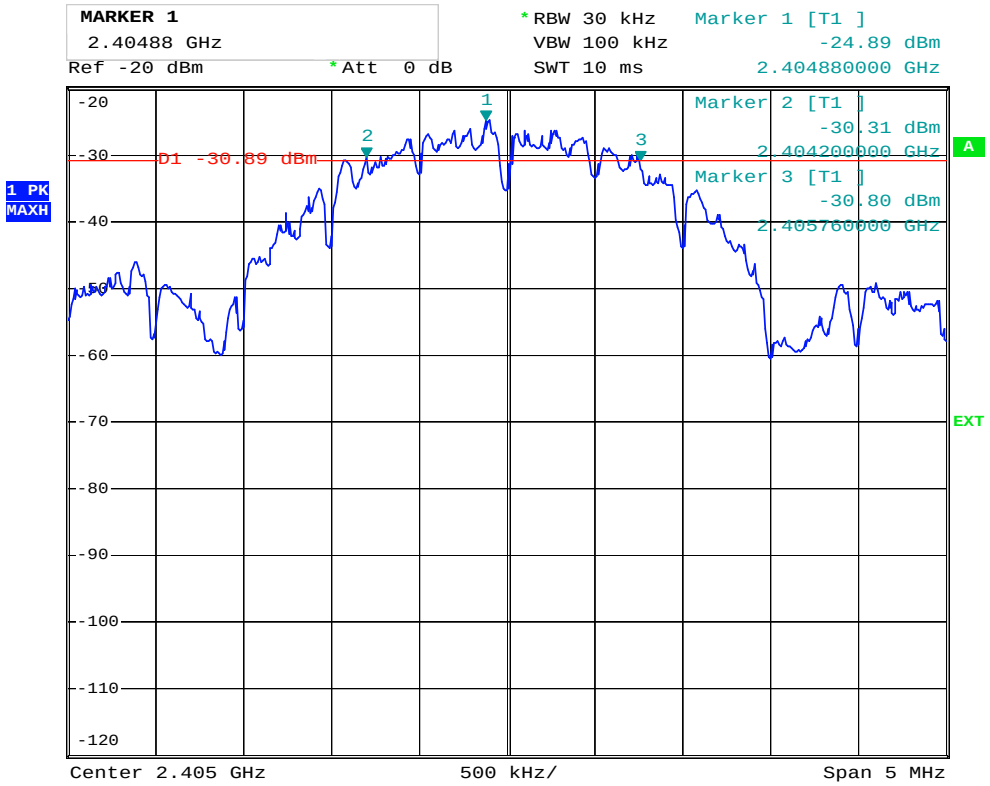
Test conclusion:

RESPECTED STANDARD

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

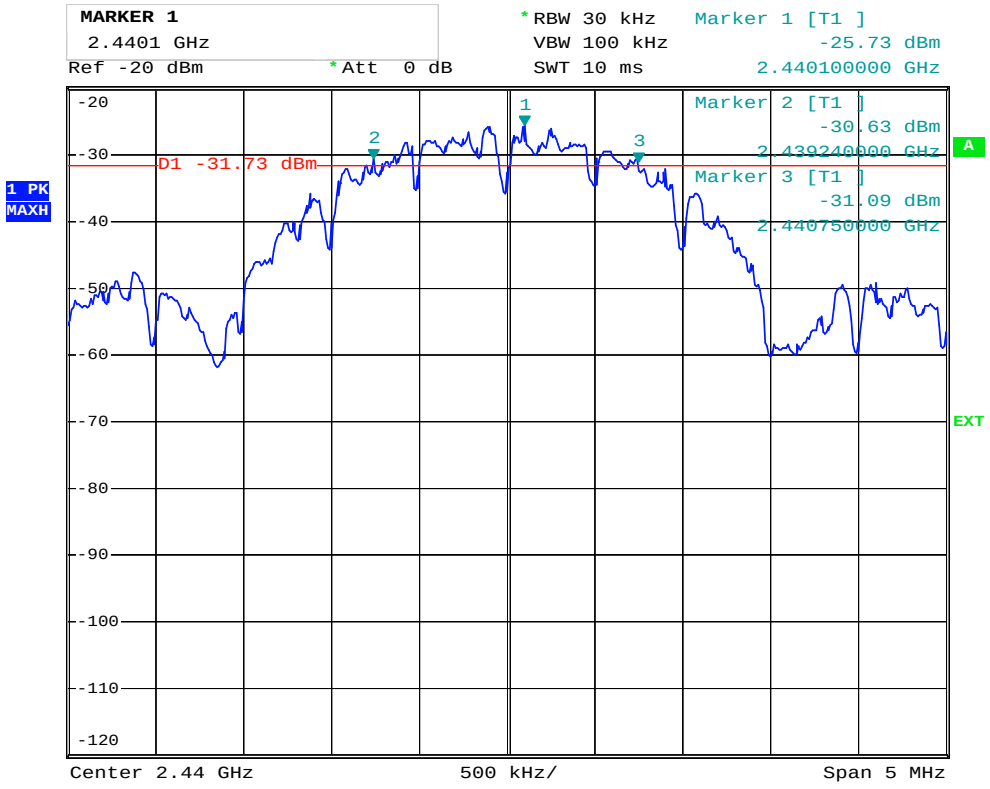
ANNEX 1: 6 dB bandwidth

Channel 11



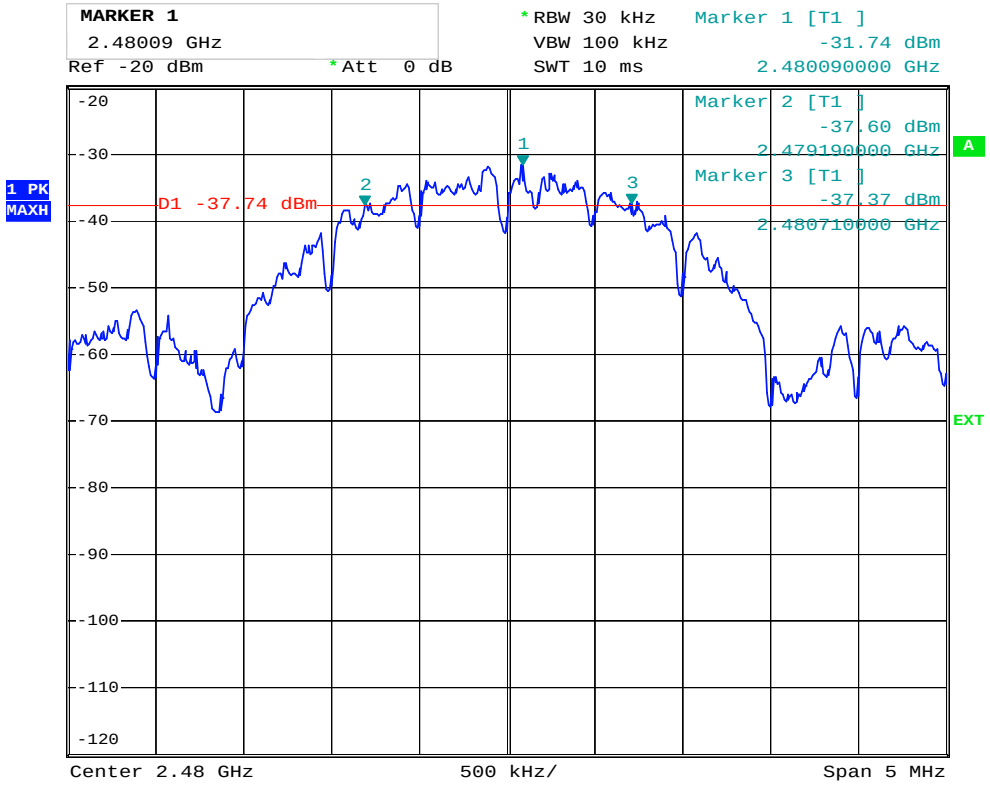
Date: 3.AUG.2012 11:37:51

Channel 18



Date: 3.AUG.2012 11:49:21

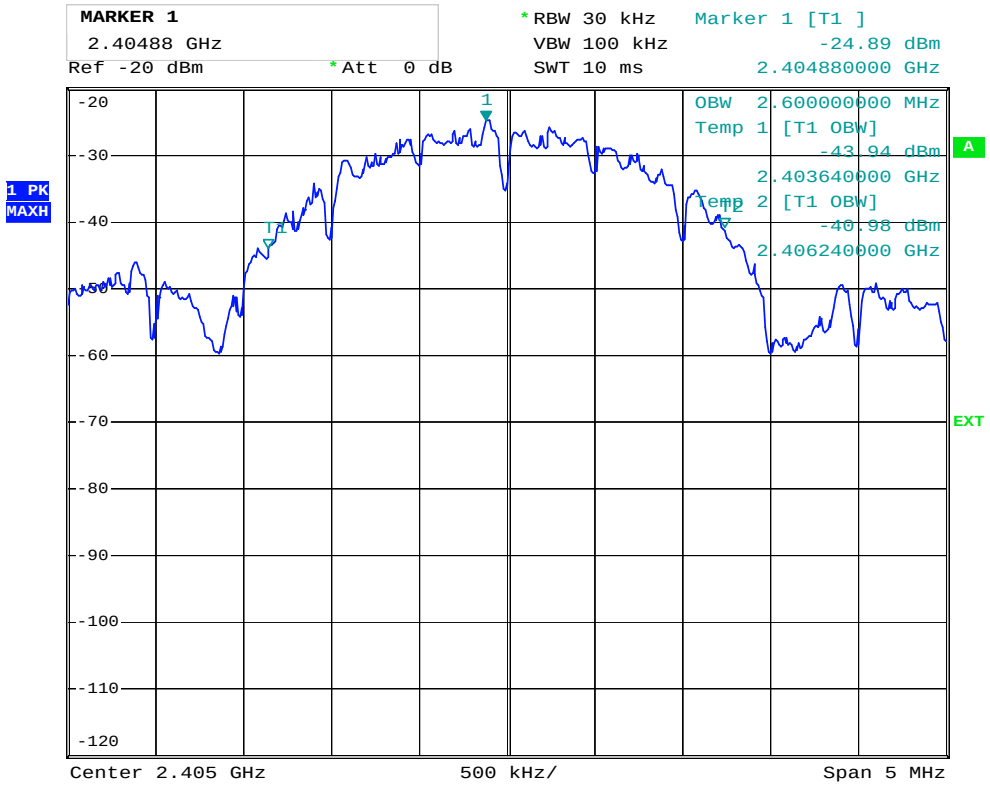
Channel 26



Date: 3.AUG.2012 11:54:44

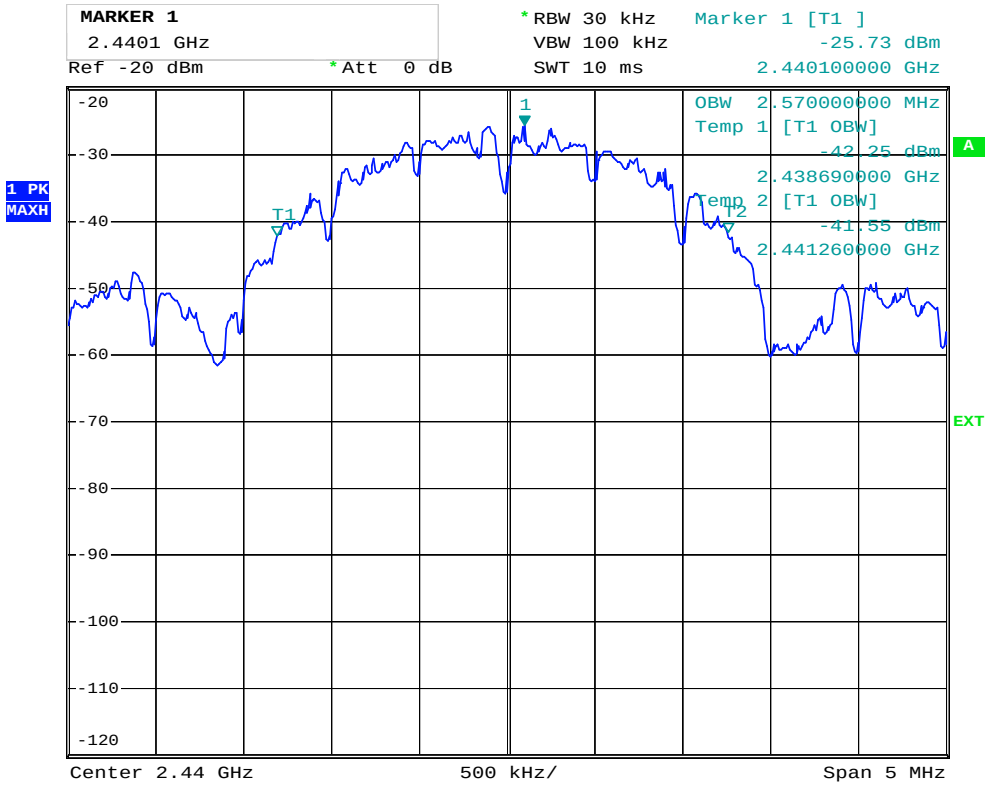
ANNEX 2: 20 dB bandwidth

Channel 11



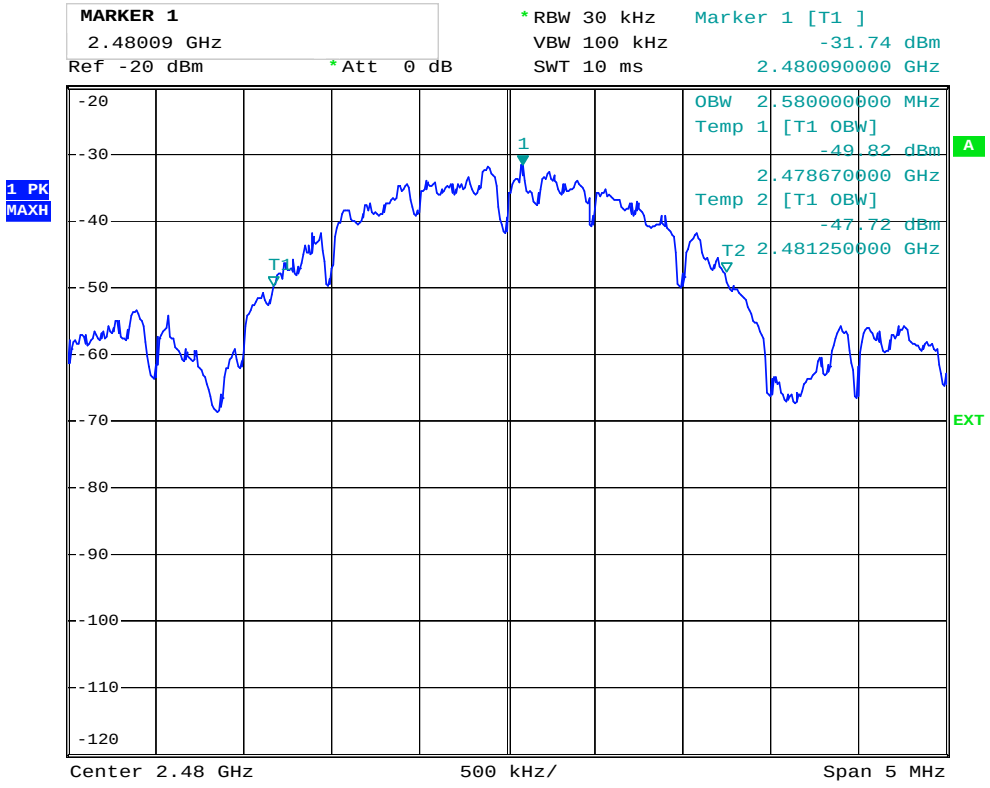
Date: 3.AUG.2012 11:42:11

Channel 18



Date: 3.AUG.2012 11:50:48

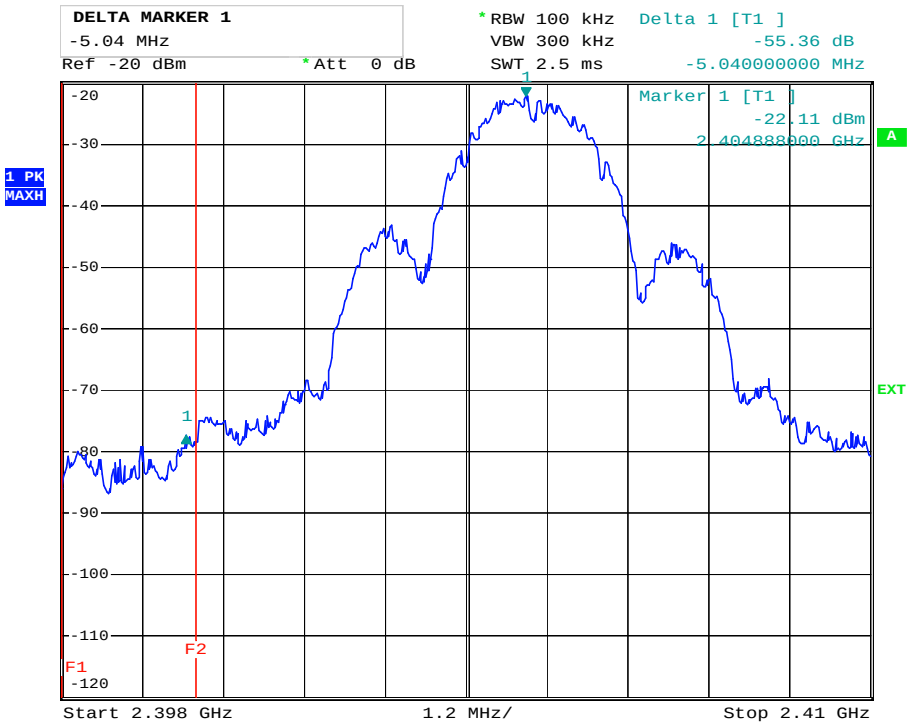
Channel 26



Date: 3.AUG.2012 11:56:31

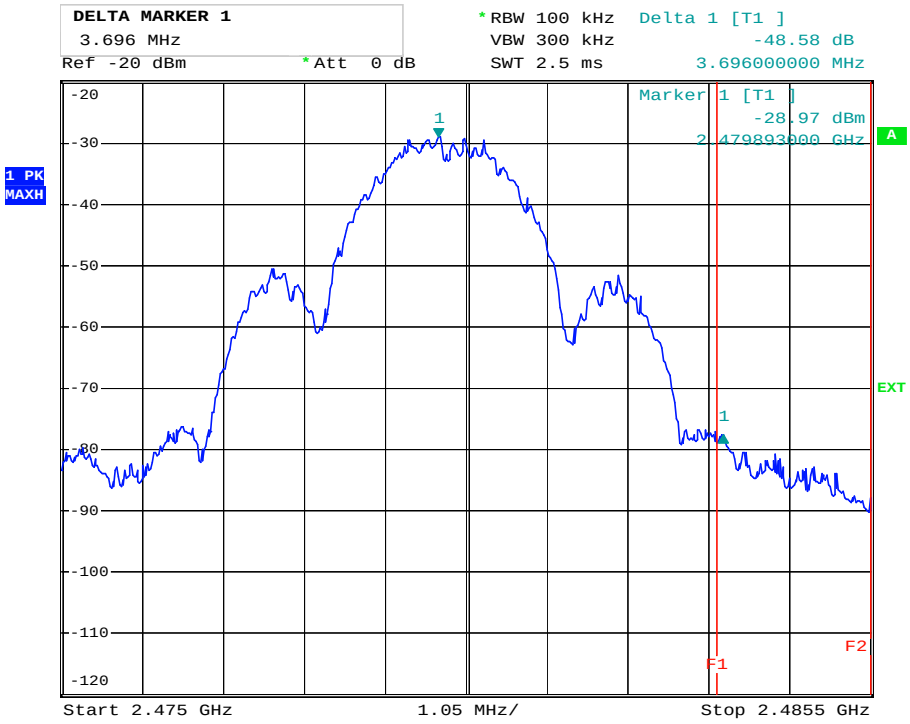
ANNEX 3: Band edge

Channel 11



Date: 3.AUG.2012 11:43:46

Channel 26



Date: 3.AUG.2012 11:57:55

ANNEXE 4: Photos of EUT

GENERAL VIEW ZBRN1 + ZBRCETH + ZBRA2

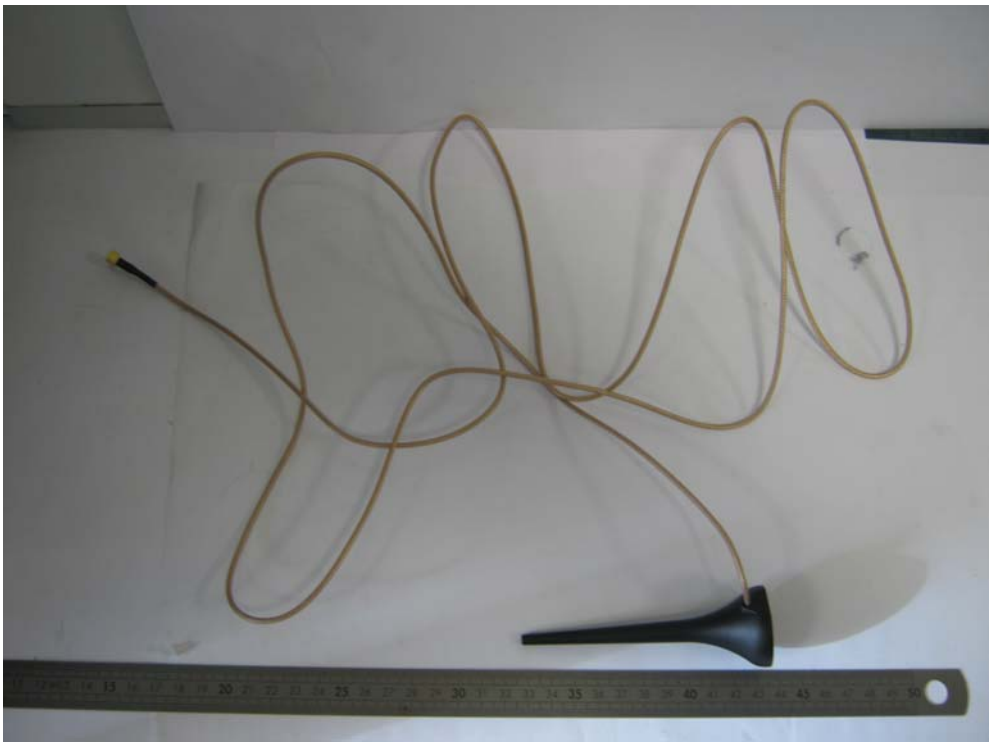
1

1

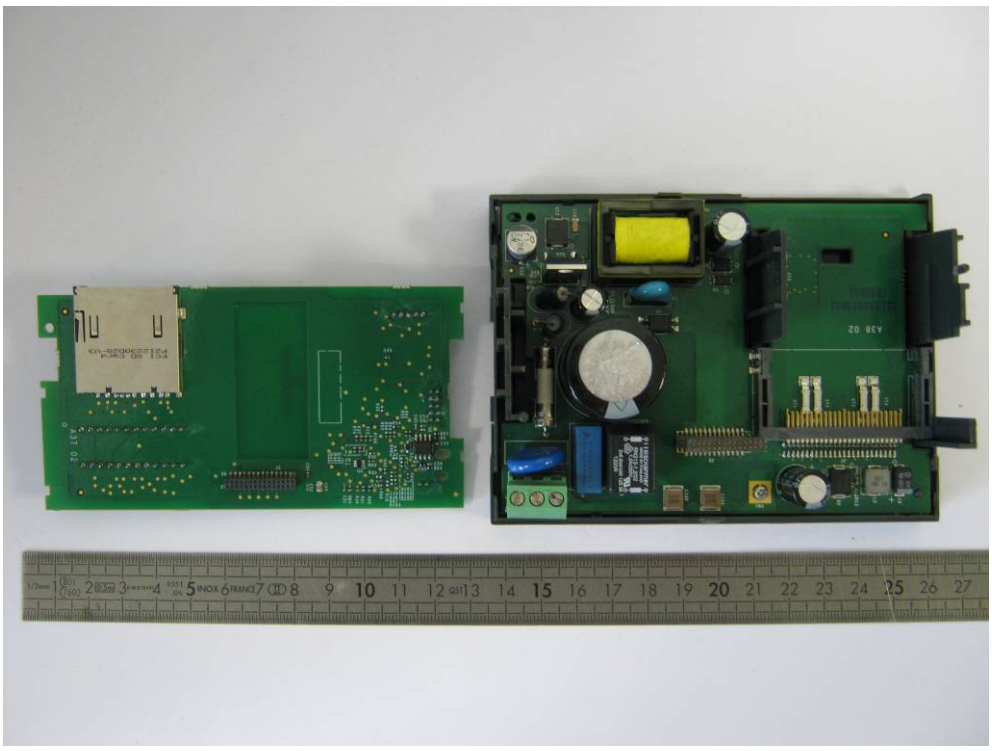

TM168BACW
BACnet / IP
LISTED
Ind.Cont.Eq
543F
LR 32678
MADE IN INDIA (BANGALORE)
PV 01
RL 01
TM168BACW
ZA12089X1933

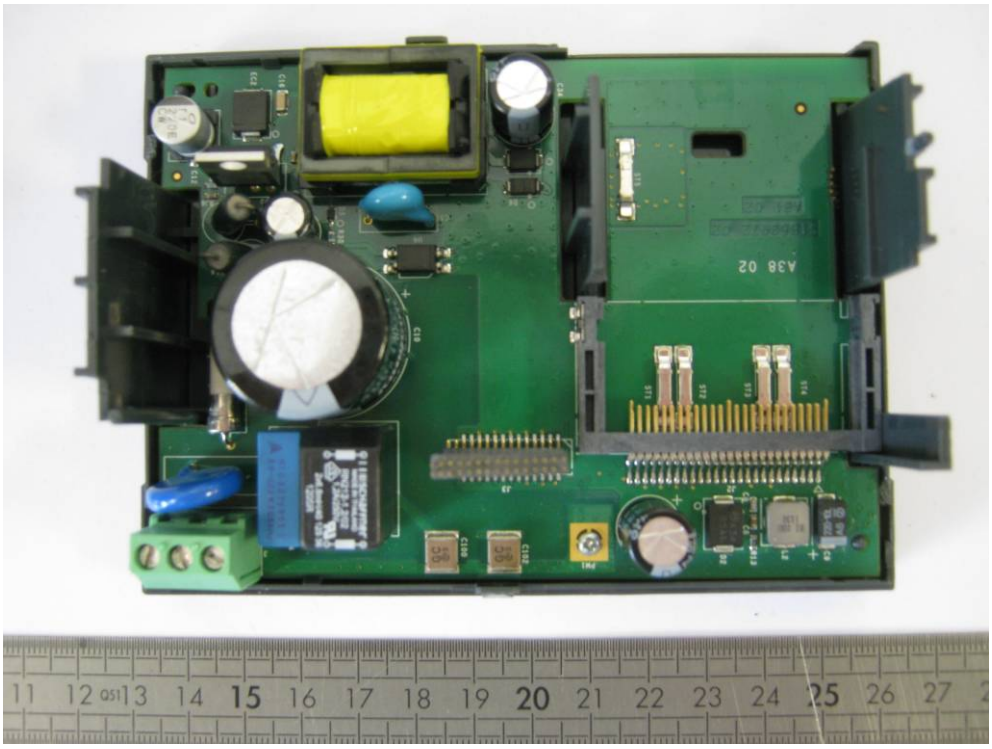

LNK
NS
MS
LNK
MAC 00-C0-B7-C3-E6-2E
Ethernet
Schneider
Electric
PUSH

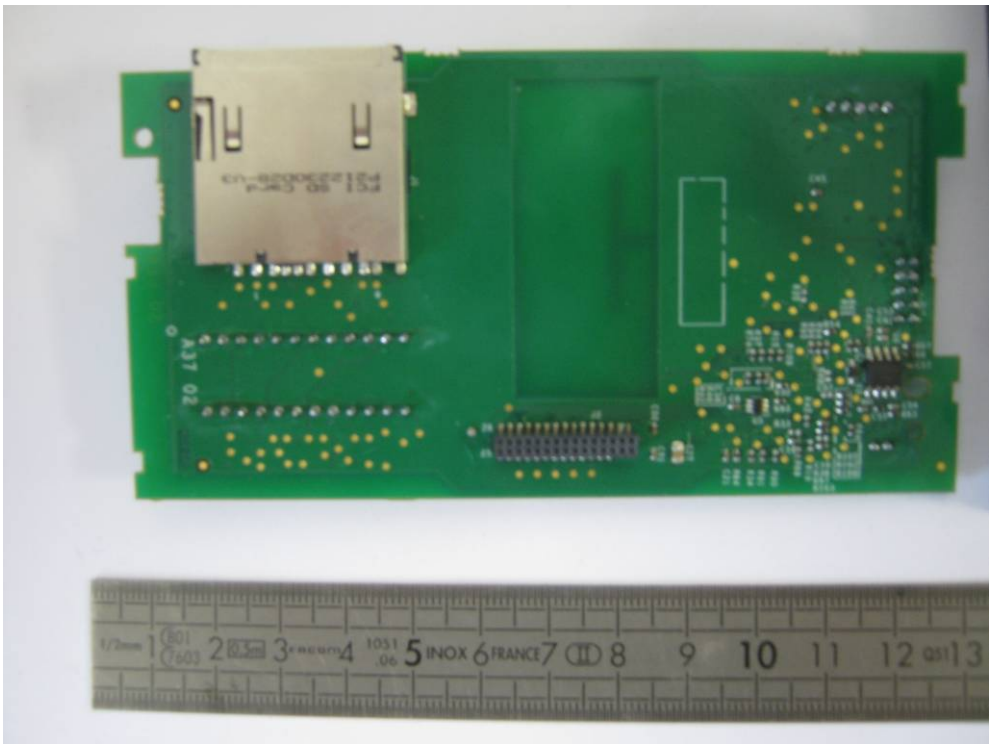
1

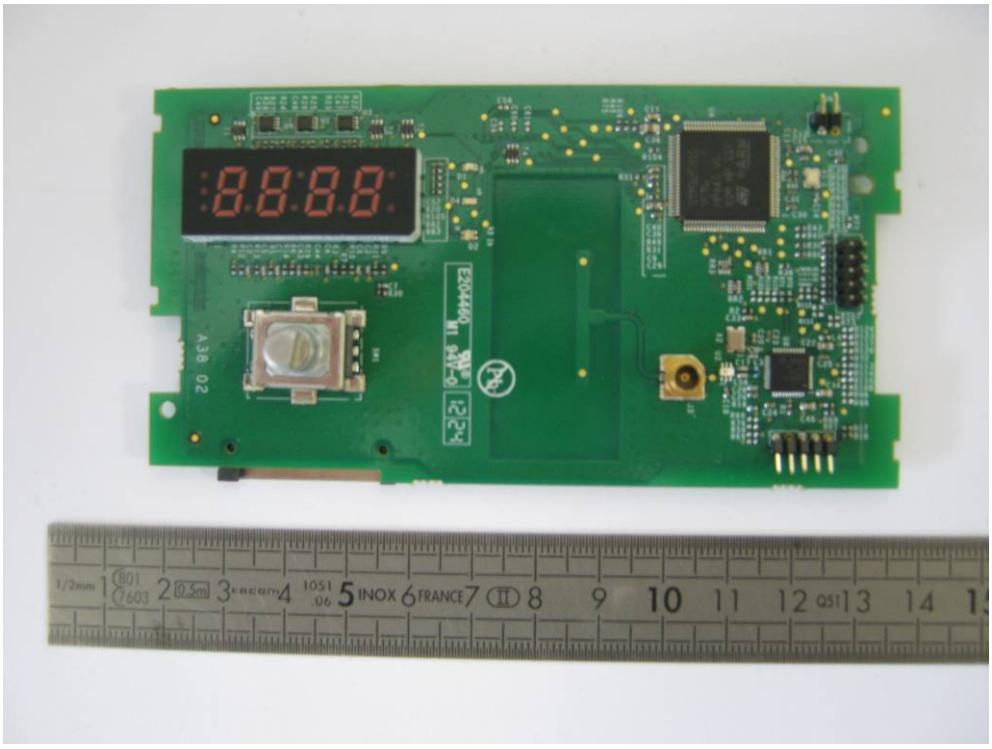


PRINTED CIRCUIT BOARD ZBRN1

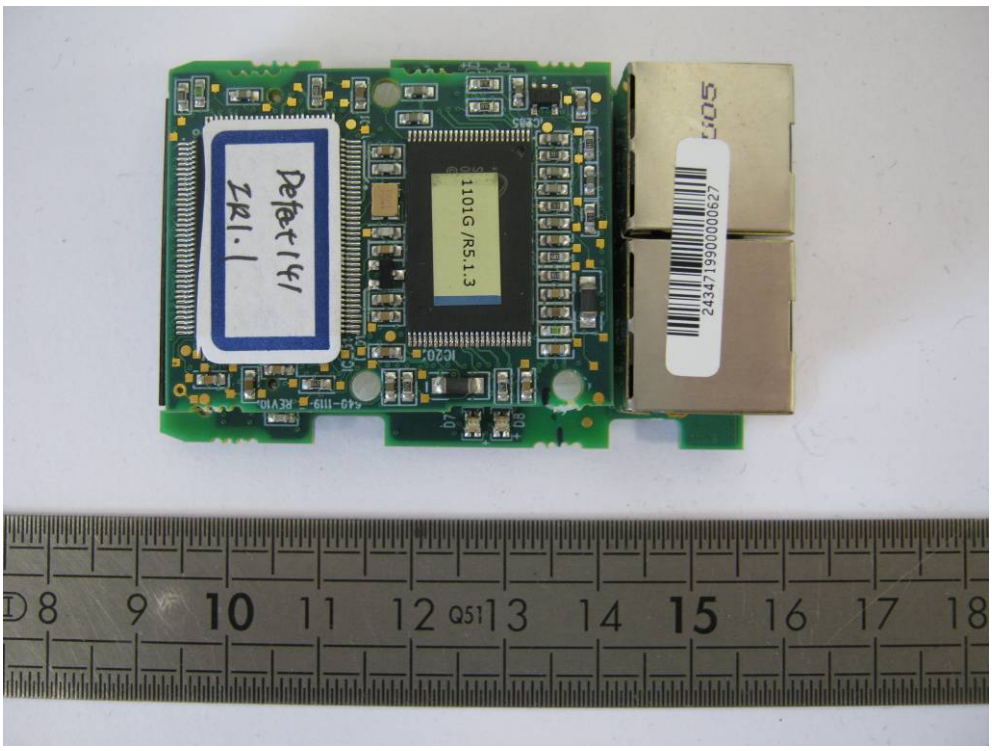


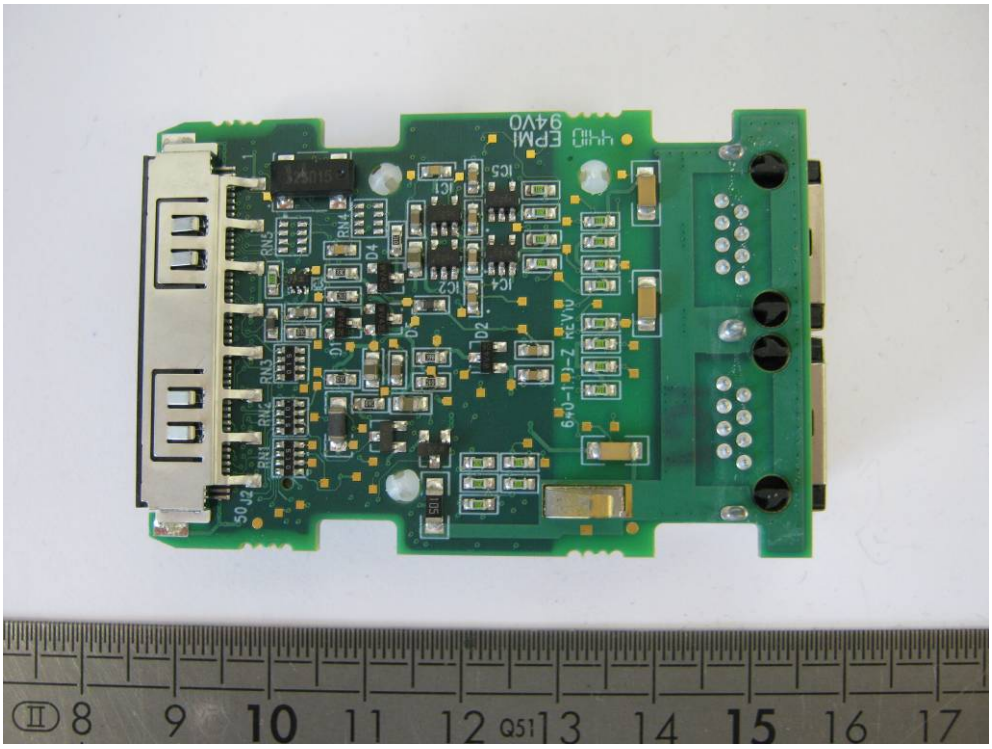






PRINTED CIRCUIT BOARD ZBRCETH






APC
359-0267-Z
NN2N790
102BT
L-RHODES11
FALCO
L01054
CHINA 1021
2434719900000627

ANNEX 5: Test set-up

Conducted measurement

Radiated measurement

INTERNAL ANTENNA

EXTERNAL ANTENNA

1