



R051-24-11-105713-2/A Ed. 0

RADIO test report

according to standard:
CFR 47 - FCC Part 15

Equipment under test:
ZIGBIT 900 ROUTER BOX
Model: COFRROUTCA

FCC ID:
A29-COFRROUTCA

Company:
STANDARD INDUSTRIE

DISTRIBUTION: Mr DUHAUTOIS

Company: STANDARD INDUSTRIE

Number of pages: 28 including 5 annexes

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PRODUCT: Zigbit 900 router box

Reference / model: COFROUTCA

Serial number: Not communicated

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DATE(S) OF TEST: 18, 25 and 30 November 2011
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2 March 2012

TESTING LOCATION: EMITECH ATLANTIQUE laboratory at JUIGNE SUR LOIRE (49)
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EMITECH ATLANTIQUE open area test site in JUIGNE SUR
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FCC Registration Number: 90469

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1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment:
Zigbit 900 router box – Model: COFRROUTCA in accordance with normative reference.

2. PRODUCT DESCRIPTION

ITU Emission code: 1M03-G1D

Class: B (residential environment)

Utilization: device used to relay RF signals when devices (any kind) are too far from each other

Antenna type and gain: dedicated antenna (reverse SMA connector), 3 dBi

Operating frequency range: 915 MHz

Number of channels: 1

Channel spacing: not concerned

Frequency generation: quartz 8 MHz and phase-locked loop

Modulation: BPSK (Binary Phase Shifting Key)

Power source: 120 V.a.c. / 60 Hz

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.

CFR 47 - FCC Part 15 (2011) 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 Meas guidance v01 Guidance for performing Compliance Measurement on Digital Transmission Systems (DTS) 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	Validity
M00001	1251RP	Alternative power supply 1000VA *	/	/
M01100	/	Controller turn table open area	/	/
M01101	/	Controller antenna positioning open area	/	/
M01128	HFH2-Z2	Magnetic field antenna	April-10	April-12
M02020	ESI7	EMI receiver	June-11	June-12
M02021	FSEM30	Spectrum analyser	May-11	May-12
M02027	ESH3-Z5	LISN 16A (single phase)	June-11	June-12
M02031	CBL 6112A	Antenna Bilog	June-11	June-12
M02032	CBL 6112A	Antenna Bilog	June-11	June-12
M02040	EZ25	150KHz hight pass	February-11	February-12
M02093	/	10 m open area test site	June-11	June-12
M02094	8mx5mx4m	Cage 2 : semi-anéchoic 8mx5mx4m	September-11	September-12
M02098	11mx7mx5m	Cage 1 : semi-anechoic 11mx7mx5m	September-11	September-12
M02100	/	Pre-scan cable cage 1	June-11	June-12
M04028	MN5102B	Multimeter	January-11	January-12
M05024	3115	Horn antenna 1-18GHz	March-11	March-12
M06036	11947A	Transient limiter	February-11	February-12
M07001	IDM106N	Multimeter	January-11	January-12
M07002	IDM106N	Multimeter	January-11	January-12
M08006	WS9232	Small meteorological station	April-10	April-12
M97002	HUGER	Small meteorological station	April-10	April-12

* 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	<i>Note</i>
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

Note: only test of FCC part 15.207 have been realized.

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					
	(a) <i>Alternative to general radiated emission limits</i>	X				
	(b) <i>Unwanted emissions outside of §15.247 frequency bands</i>	X				<i>Note 3</i>
	(c) <i>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					
	(a) (1) <i>Hopping systems</i>			X		
	(a) (2) <i>Digital modulation techniques</i>	X				<i>Note 4</i>
	(b) <i>Maximum peak output power</i>	X				
	(c) <i>Operation with directional antenna gains > 6 dBi</i>			X		
	(d) <i>Intentional radiator</i>	X				
	(e) <i>Peak power spectral density</i>	X				
	(f) <i>Hybrid system</i>			X		
	(g) <i>Frequency hopping requirements</i>			X		
	(h) <i>Frequency hopping intelligence</i>			X		
	(i) <i>RF exposure compliance</i>	X				<i>Note 5</i>

NAp: Not Applicable

NAs: Not Asked

Note 1: dedicated antenna (reverse SMA connector).

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 549 kHz (see annex I).

Note 5: $PSD = EIRP/4*\pi*R^2 = 24.266 \text{ mW}/4*\pi*(20 \text{ cm})^2 = 4.8x10^{-3} \text{ mW/cm}^2$ (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 Zigbit 900 router box – Model: COFRROUTCA 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. RADIATED EMISSION LIMITS**Standard:** FCC Part 15**Test procedure:** paragraph 109**Limit class:** Class B**Test equipments:**

TYPE	BRAND	EMITECH NUMBER
EMI receiver ESI7	Rohde & Schwarz	M02020
Spectrum analyzer FSEM30	Rohde & Schwarz	M02021
Antenna bilog CBL 6112A	CHASE	M02031
Antenna bilog CBL 6112A	CHASE	M02032
Horn antenna 1-18 GHz 3115	EMCO	M05024
Controller antenna positioning open area	EMCO	M01101
Controller turntable open area	EMCO	M01100
Cage 1: semi anechoic 11mx7mx5m	SIDT	M02098
Cage 2: semi anechoic 8mx5mx4m	SIDT	M02094
10m open area test site	EMITECH	M02093
Alternative power supply 1000VA1251 RP	California instruments	M00001
Multimeter IDM106N	ISO-TECH	M07002
Multimeter MN5102B	AOIP	M04028
Small meteorological station WS9232	La Crosse technology	M08006
Small meteorological station	HUGER	M97002

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 photo in annex 5.

Frequency range: From 30 MHz to 5th harmonic of the highest frequency used (915 MHz).**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.

Results:

Ambient temperature (°C): 22.8
Relative humidity (%): 56

Power source: 120 V.a.c. / 60 Hz

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
32.906	QP	100	84	V	30.79	40	9.21
38.356	QP	100	0	V	32.82	40	7.18
54.693	QP	100	0	V	32.38	40	7.62
54.785	QP	100	355	V	32.28	40	7.72
57.285	QP	100	137	V	31.66	40	8.34
57.504	QP	100	145	V	31.72	40	8.28
57.849	QP	100	288	V	29.65	40	10.35
58.154	QP	100	0	V	30.34	40	9.66
58.719	QP	110	0	V	30.20	40	9.80
59.178	QP	110	0	V	30.11	40	9.89

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

Test conclusion:

RESPECTED STANDARD

8. MEASUREMENT OF THE CONDUCTED DISTURBANCES**Standard:** FCC Part 15**Test procedure:** Paragraph 15.207**Test equipments:**

TYPE	BRAND	EMITECH NUMBER
LISN 16A (single phase) ESH3-Z5	Rohde & Schwarz	M02027
EMI receiver ESI7	Rohde & Schwarz	M02020
Pre-Scan cable cage 1	Emitech	M02100
Alternative power supply 1000VA1251 RP	California instruments	M00001
150 kHz high pass EZ25	Rohde & Schwarz	M02040
Transient limiter 11947A	Hewlett Packard	M06036
Cage 1: semi anechoic 11mx7mx5m	SIDT	M02098

Software used: Mes-émi-V2.5**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**Bandwidth:** 10 kHz**Equipment under test operating condition:**

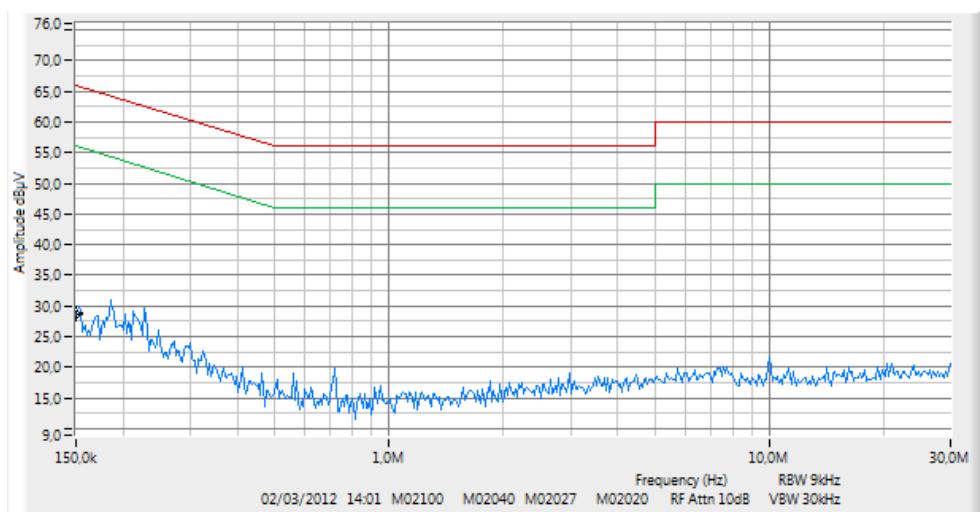
The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Results:**Measurement on the mains power supply:**

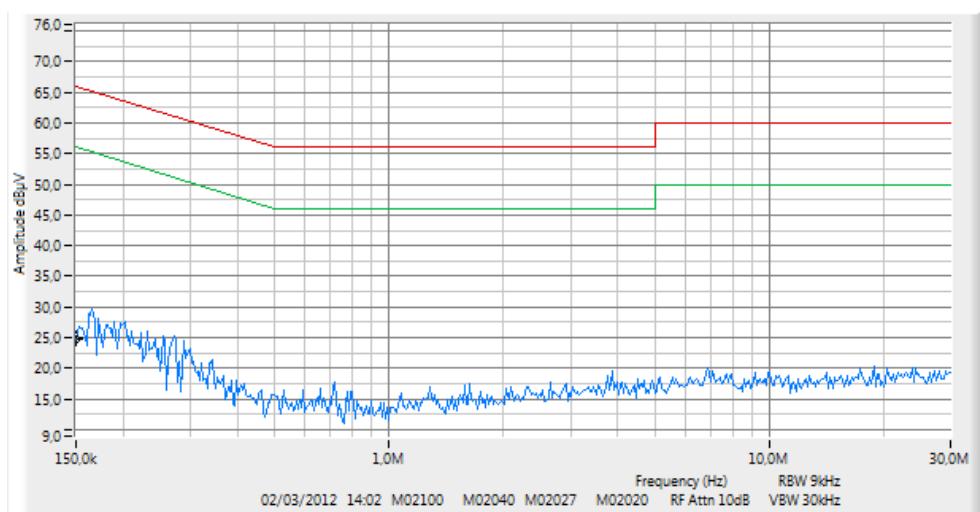
The measurement is first realized with Peak detector.

CURVE N° 1:

Measurement on the Neutral with peak detector

**CURVE N° 2:**

Measurement on the Line with peak detector

**Test conclusion:**

RESPECTED STANDARD

9. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS**Standard:** FCC Part 15**Test procedure:** Paragraph 15.215**Test equipments:**

TYPE	BRAND	EMITECH NUMBER
EMI receiver ESI7	Rohde & Schwarz	M02020
Spectrum analyzer FSEM30	Rohde & Schwarz	M02021
Alternative power supply 1000VA1251 RP	California instruments	M00001
Multimeter IDM106N	ISO-TECH	M07002
Multimeter MN5102B	AOIP	M04028
Small meteorological station WS9232	La Crosse technology	M08006
Small meteorological station	HUGER	M97002

Test set up:

The equipment under test is connected to the measuring equipment via a 50Ω attenuator.

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.

Results:

Ambient temperature (°C): 21.5
Relative humidity (%): 50

Power source: 120 Va.c. / 60 Hz

Lower Band Edge: From 900 MHz to 902 MHz
Upper Band Edge: From 928 MHz to 930 MHz

Sample n°1:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dB μ V/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out-of-Band Emission Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
915	105.94	Peak	900.55	-66.19	39.75	85.32	45.57
915	105.94	peak	929.36	-66.28	39.66	85.32	45.66

* *Marker-Delta method*

The band edge and 20 dB bandwidth plots are given in annex 2 and 3

Test conclusion:

RESPECTED STANDARD

10. MAXIMUM PEAK OUTPUT POWER**Standard:** FCC Part 15**Test procedure:** paragraph 15.247 (b)**Test equipments:**

TYPE	BRAND	EMITECH NUMBER
Spectrum analyzer FSEM30	Rohde & Schwarz	M02021
Alternative power supply 1000VA1251 RP	California instruments	M00001
Multimeter IDM106N	ISO-TECH	M07002
Small meteorological station	HUGER	M97002

Test set up:

The measure is realized in conducted mode with a spectrum analyzer.

The measurement is realized, with a resolution bandwidth and video bandwidth adjusted at 10 MHz.

Measurement procedure PK1 of 558074 D01 DTS Meas guidance v01.

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.

Results:

Ambient temperature (°C): 21.5
Relative humidity (%): 50

Power source: 120 V a.c. / 60 Hz

Sample n° 1

	Conducted power (dBm):	Conducted power (W)	Limit (W)
Normal test conditions	+10.85	12.16×10^{-3}	1

Test conclusion:

RESPECTED STANDARD

11. INTENTIONAL RADIATOR**Standard:** FCC Part 15**Test procedure:** paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)**Test equipments:**

TYPE	BRAND	EMITECH NUMBER
EMI receiver ESI7	Rohde & Schwarz	M02020
Spectrum analyzer FSEM30	Rohde & Schwarz	M02021
Magnetic field antenna HFH2-Z2	Rohde & Schwarz	M01128
Antenna bilog CBL 6112A	CHASE	M02031
Antenna bilog CBL 6112A	CHASE	M02032
Horn antenna 1-18 GHz 3115	EMCO	M05024
Controller antenna positioning open area	EMCO	M01101
Controller turntable open area	EMCO	M01100
10m open area test site	EMITECH	M02093
Cage 1: semi anechoic 11mx7mx5m	SIDT	M02098
Cage 2: semi anechoic 8mx5mx4m	SIDT	M02094
Alternative power supply 1000VA1251 RP	California instruments	M00001
Multimeter IDM106N	ISO-TECH	M07001
Multimeter IDM106N	ISO-TECH	M07002
Multimeter MN5102B	AOIP	M04028
Small meteorological station WS9232	La Crosse technology	M08006
Small meteorological station	HUGER	M97002

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 photo in annex 5.

Frequency range: From 9 kHz to 10th harmonic of the highest fundamental frequency (915 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.

Results:

Ambient temperature (°C): 22.8
 Relative humidity (%): 56

Power source: 120 V.a.c. / 60 Hz

Sample n° 1

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)
32.906	QP	100	84	120	V	30.79	40	9.21
38.356	QP	100	0	120	V	32.82	40	7.18
54.693	QP	100	0	120	V	32.38	40	7.62
54.785	QP	100	355	120	V	32.28	40	7.72
57.285	QP	100	137	120	V	31.66	40	8.34
57.504	QP	100	145	120	V	31.72	40	8.28
57.849	QP	100	288	120	V	29.65	40	10.35
58.154	QP	100	0	120	V	30.34	40	9.66
58.719	QP	110	0	120	V	30.20	40	9.80
59.178	QP	110	0	120	V	30.11	40	9.89
1830	P	100	45	100	V	54.95	85.32	30.37

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 105.32 dB μ V/m so the applicable limit is 85.32 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

12. PEAK POWER DENSITY**Standard:** FCC Part 15**Test procedure:** paragraph 15.247 (e)**Test equipments:**

TYPE	BRAND	GYL TECHNOLOGIE NUMBER
Spectrum analyzer FSEM30	Rohde & Schwarz	M02021
Alternative power supply 1000VA1251 RP	California instruments	M00001
Multimeter IDM106N	ISO-TECH	M07002
Small meteorological station	Huger	M97002

Test set up:

We used the same test set-up as the peak output power measurement.

Resolution bandwidth: 100 kHz

Video bandwidth: 300 kHz

Measurement procedure PKPSD of 558074 D01 DTS Meas guidance v01.

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): 21.5
Relative humidity (%): 50

Power source: 120 V a.c. / 60 Hz

Sample n° 1

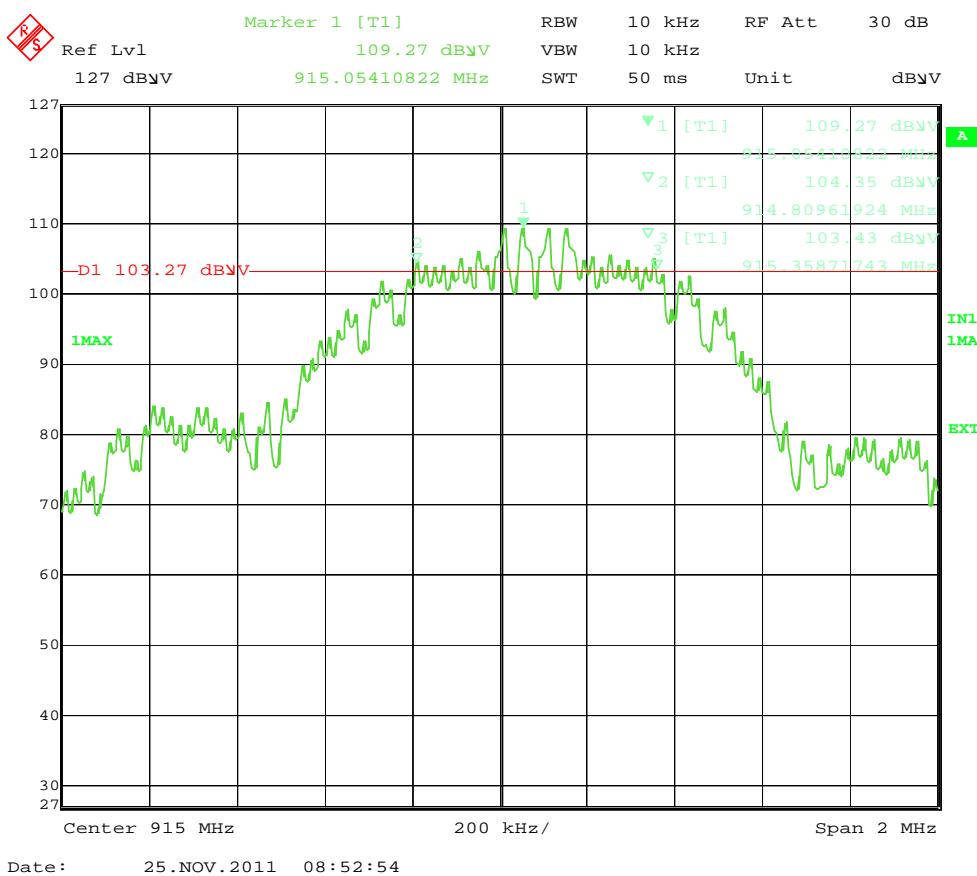
Peak power density at frequency: 915 MHz	
Normal test conditions	+2.79 dBm
Limits	+8 dBm

Test conclusion:

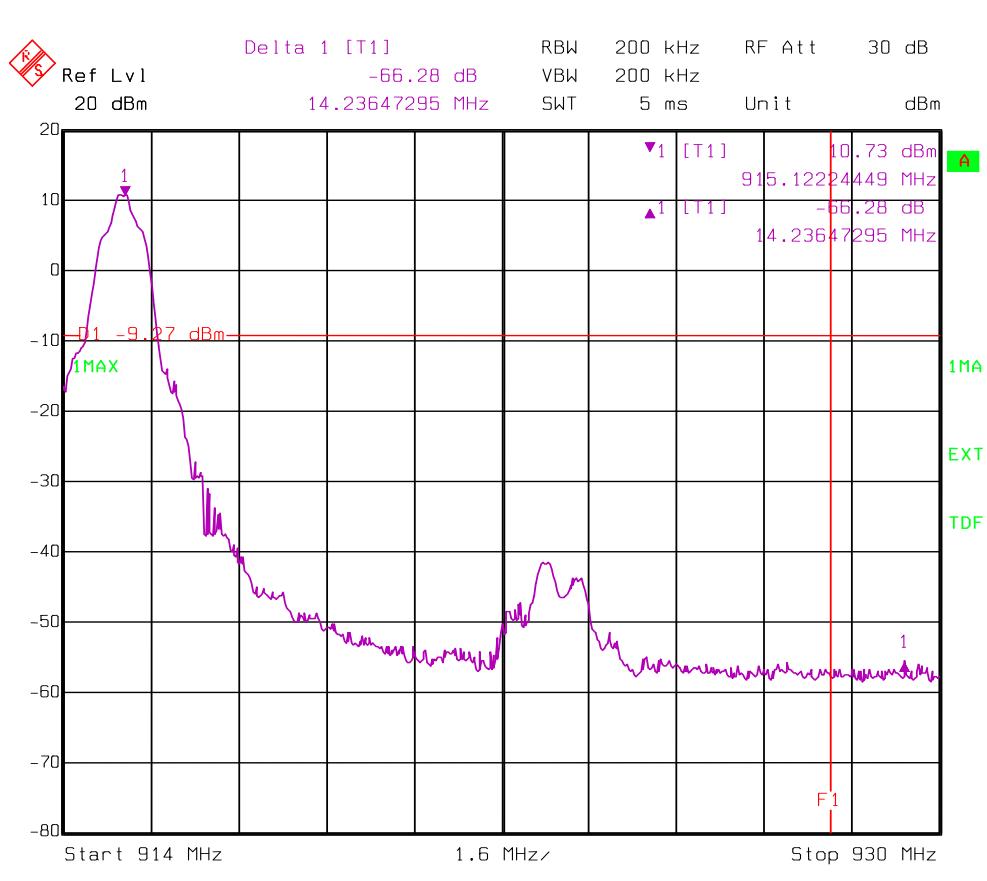
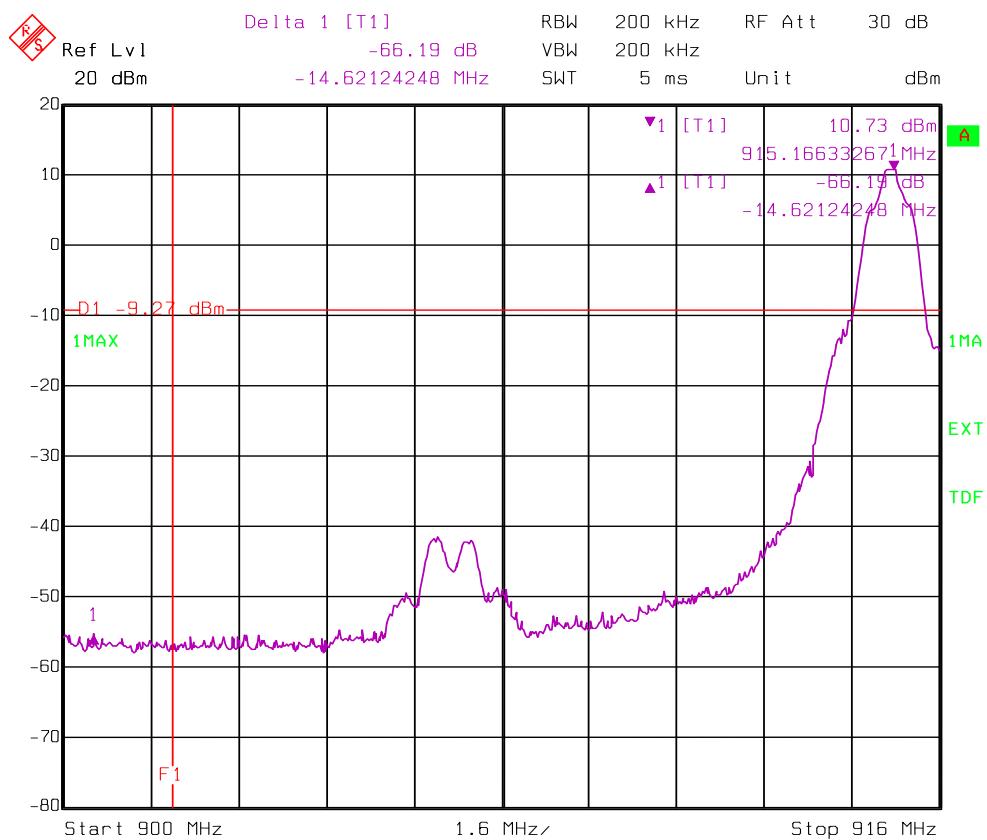
RESPECTED STANDARD

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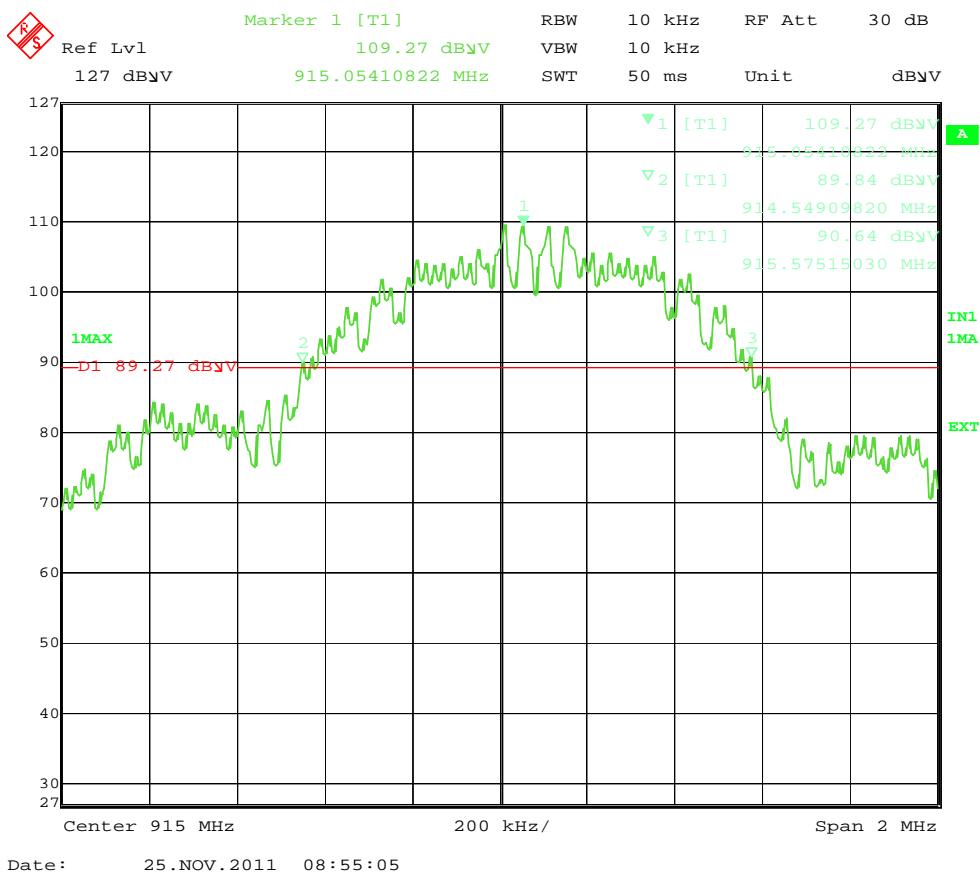
ANNEX 1: 6 dB BANDWIDTH



ANNEX 2: BANDE EDGE

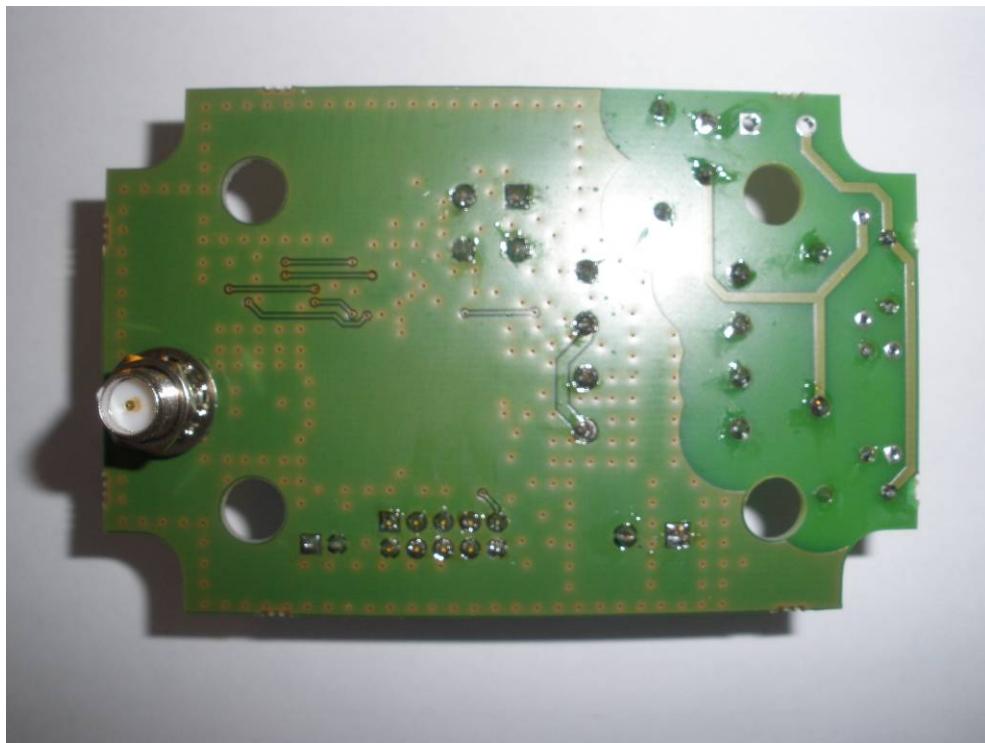


ANNEX 3: 20 dB BANDWIDTH

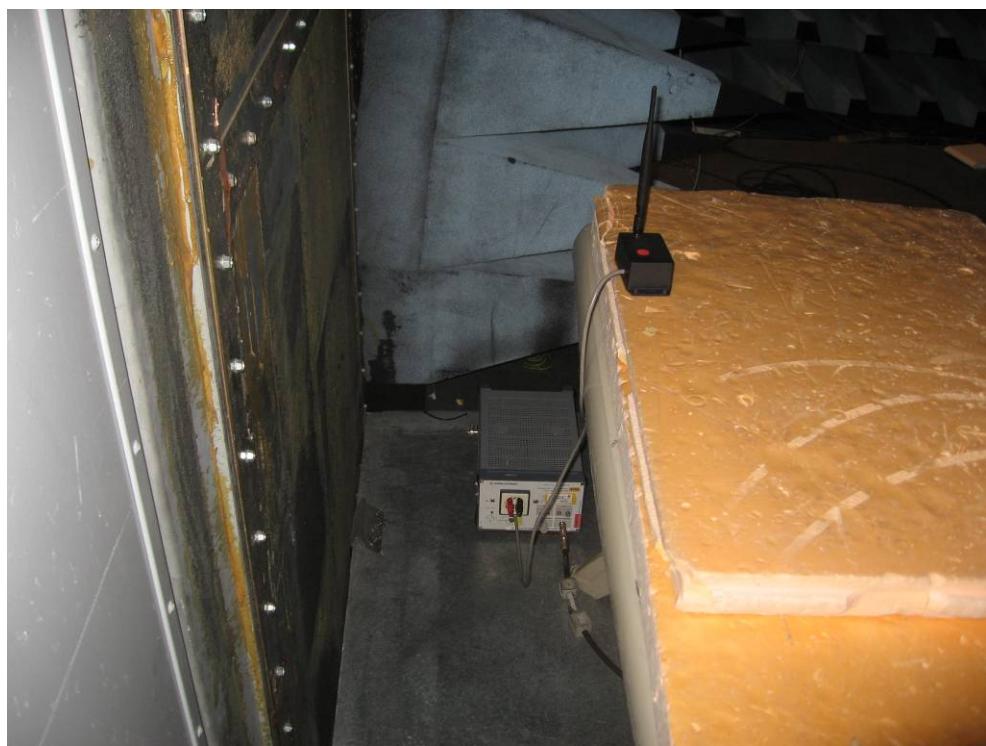


ANNEX 4: PHOTOS OF THE EQUIPMENT UNDER TEST**GENERAL VIEW**

INTERNAL VIEW

PRINTED CIRCUIT BOARD: FACE 1**PRINTED CIRCUIT BOARD: FACE 2**

ANTENNA

ANNEX 5: TEST SET UP AND OPEN AREA TEST SITE**RADIATED MEASUREMENT****CONDUCTED MEASUREMENT**

OPEN AREA TEST SITE