TEST REPORT

RADIO

Number	125244-651735B
Composition of document	24 pages
FCC Registration Number	166175 (FAR) or 888863 (Ecuelles)
Industry Canada Number	6230B
Standards	47 CFR Part 15.225 RSS-210, Issue 8 RSS-Gen, Issue 3
Issued to	BIO RAD Loboratories 18, Avenue du polygône 42300 ROANNE CEDEX
Apparatus under test	RFID Tag Reader
Trade mark	BIO RAD
Manufacturer	BIO RAD
Type	DTE4027+3
Serial number	01305S6/0013
IC	11658A
FCC ID	GC769029
Test date	2014/01/06 & 2014/01/08
Tests performed by	Armand MAHOUNGOU & Laurent DENEUX
Test site	Fontenay aux Roses/ Ecuelles
Date of issue	2014/01/31

Written by :
Armand MAHOUNGOU & Laurent DENEUX
Tests operator

LABORATOIRE CENTRAL DES INDUSTRIES ELECTRIQUES
S.A.S au capital de 15.745.984 €
RCS Nanterre B 408 363 174
33 avenue du General Leclerc
F - 92260 FONTENAY AUX ROSES

Approved by :
Stéphane PHOUDIAH
Technical manager

SUMMARY

1. TEST PROGRAM

References

Standards:
- 47 CFR Part 15C
- RSS-210
- RSS-Gen
- CISPR 16-4-2
- ANSI C63.4

Standard Section	Test Description	TEST RESULT - Comments
RSS-Gen § 4.6.1	Occupied Bandwidth	PASS (No Limit applicable)
CFR 47 § 15.225 (e) RSS-210 § A2.6	Frequency tolerance	PASS
CFR 47 § 15.207 RSS-210 § 2.5.1	AC Power Line Conducted Emissions	PASS
CFR 47 § 15.225 (a) (b) (c) RSS-210 § A2.6 (a) (b) (c)	Field strength within the band 13.110-14.010 MHz	PASS
CFR 47 § 15.209 (a) CFR 47 § 15.225 (d) RSS-210 § 2.5.1	Field strength outside of the bands 13.110-14.010 MHz	PASS
RSS-Gen § 4.10	Receiver Radiated emissions	NA (Transceiver equipment. Include in Field strength test)

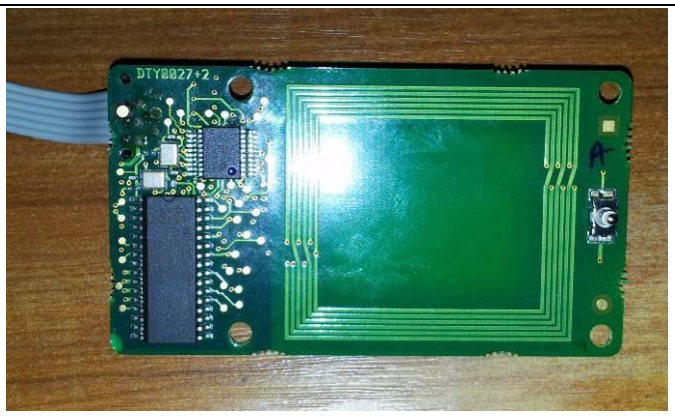
PASS: EUT complies with standard's requirement
FAIL: EUT does not comply with standard's requirement
NA: Not Applicable
NP: Test Not Performed

2. EQUIPMENT DESCRIPTION

2.1. HARDWARE & SOFTWARE IDENTIFICATION

- **Equipment under test (EUT):**

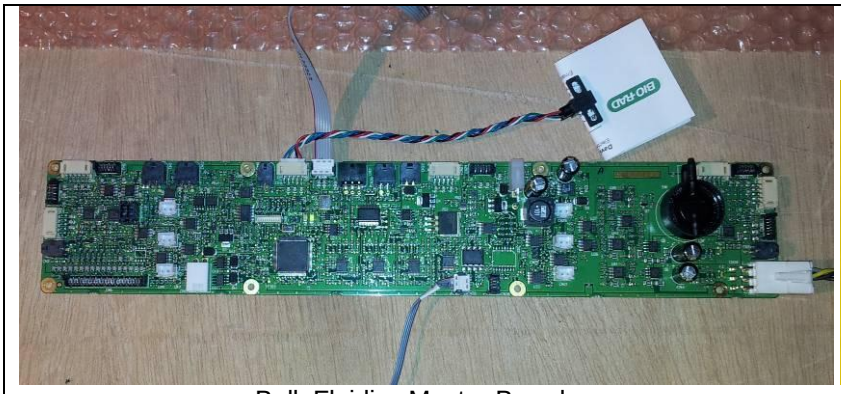
Front face



Rear face

Photograph of EUT

- **Auxiliary equipment (AE) used for testing:**



Bulk Fluidics Master Board

Contactless Card

Photograph of AE

- **Software identification:**

-Software version: PIC-MIFARE-CCL-170813, Version 1.10

Input/output:

-Input Power

- **Equipment information:**

- External antenna connector: No
- Frequency band allocated: 13.553MHz to 13.567MHz
- Frequency band used: 13.56MHz
- Modulation: ASK 100%
- Number of channel: 1
- Antenna type: Integral
- Stand By mode: No
- Maximum Antenna Gain: No available information
- Type of power source: External power supply
- Power supply: Vmin: 4.5V
  Vnom: 5 V
  Vmax: 5.5 V
- Temperature range: Tmin: -30°C (IC) -20°C (FCC)
  Tnom: 20°C
  Tmax: +50°C

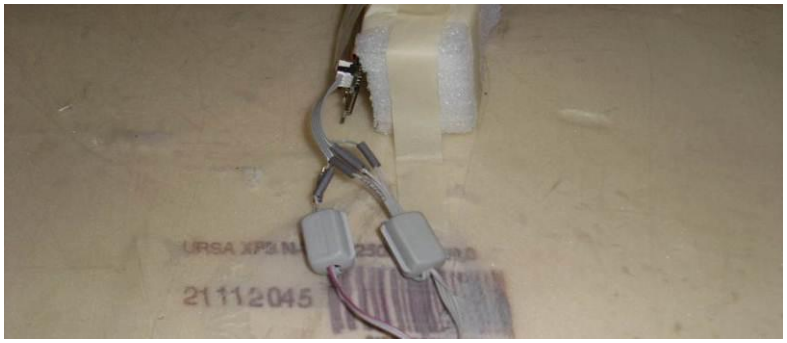
2.2. RUNNING MODE

The EUT is set in the following modes during tests:
-Communication with a tag

2.3. EQUIPEMENT LABELLING

2.4. EQUIPMENT MODIFICATIONS

- Adding a ferrite reference 7427114 on power wires (5V) of flat cable (J1 connector)
- Adding a ferrite reference 7427114 on data wires (5V) of flat cable (J1 connector)



3. OCCUPIED BANDWIDTH

3.1. TEST CONDITIONS

Test performed by : Armand MAHOUNGOU
Date of test : 2014/01/08
Ambient temperature : 23°C
Relative humidity : 36%

3.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a spectrum analyzer on the EUT with a test fixture. The product has been tested according to the RSS-GEN § 4.6.1 reference method.

Spectrum Analyzer Setting:
Center frequency= 13.56MHz
Span= 3MHz
Amplitude= Sufficient to observe the signal amplitude
RBW= 1% of span
VBW= 3*RBW
Sweep= Auto
Trace= Max Hold
Detector= Peak
Occupied Bandwidth 99% activated

Photograph for Occupied Bandwidth

Photograph for Occupied Bandwidth

3.3. RESULTS

Temperature	**Tnom**
Voltage	**Vnom**
Frequency	13.56
Occupied Bandwidth (kHz)	1418.447

See graphics in annex

Result: **PASS**

Limit: → None

4. FREQUENCY TOLERANCE

4.1. TEST CONDITIONS

Test performed by : Armand MAHOUNGOU
Date of test : 2014/01/08
Ambient temperature : 23°C
Relative humidity : 36%

4.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a spectrum analyzer on the EUT a test fixture.

Spectrum Analyzer Setting:
Center frequency= 13.56MHz
Span= 300kHz
Amplitude= Sufficient to observe the signal amplitude
RBW= 3kHz
VBW= 10kHz
Sweep= Auto
Trace= Max Hold
Detector= Peak

Photograph for Frequency tolerance

Photograph for Frequency tolerance

4.3. RESULTS

Temperature	Tmin (IC)	Tmin (FCC)	Tnom	Tmax
Voltage:	**Vmin**			
Frequency (MHz)	13,56	13,56015	13,56012	13,56015
Frequency Drift (%)	-0,0009	0,0002	0,0000	0,0002
Voltage:	**Vnom**			
Frequency (MHz)	13,56015	13,56015	13,56012	13,56018
Frequency Drift (%)	0,0002	0,0002	Reference	0,0004
Voltage:	**Vmax**			
Frequency (MHz)	13,56015	13,5603	13,56024	13,5603
Frequency Drift (%)	0,0002	0,0013	0,0009	0,0013

Result: PASS

Limit: → +/- 0.01%

5. AC POWER LINE CONDUCTED EMISSIONS

5.1. TEST CONDITIONS

Test performed by : Laurent Deneux
Date of test : 2014/01/06
Ambient temperature : 22°C
Relative humidity : 47%

5.2. TEST SETUP

The product has been tested according to ANSI C63.4-(2003) method. The EUT is placed on the ground reference plane, at 80cm from the LISN. The distance between the EUT and the vertical ground plane is 40cm. Auxiliaries are powered by another LISN. The cable has been shorted to 1meter length. The EUT is powered through the LISN. Measurement is made with a receiver in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary. The LISN (measure) is 50Ω / 50µH. Interconnecting cables and equipment's were moved to position that maximized emission.

Photograph for AC Power Line Conducted Emissions (Front view)

Photograph for AC Power Line Conducted Emissions (Rear view)

5.3. RESULTS

Antenna Connected

Phase Line

Frequency (MHz)	Peak Level (dBµV/m)	Quasi-Peak Level (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Average Level (dBµV/m)	Average Limit (dBµV/m)
0.183	53	-	34.4	23.7	54.4
0.286	47.5	-	60.7	19.6	56.7
0.696	38.9	-	56	16.3	46
13.56	48.9	-	60	42.5	50
27.12	32.5	-	60	-	50

Neutral Line

Frequency (MHz)	Peak Level (dBµV/m)	Quasi-Peak Level (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Average Level (dBµV/m)	Average Limit (dBµV/m)
0.181	53.2	-	64.4	24	54.4
0.275	45.8	-	61	14.7	51
0.692	37.5	-	56	16.6	46
13.56	48.9	-	60	42.3	50
27.12	36.4	-	60	-	50

See annex for graphics

Result: PASS

Limit: → **Quasi-Peak**
0,15kHz to 0,5MHz: 66dBµV/m to 56dBµV/m*
0,5MHz to 5MHz: 56dBµV/m
5MHz to 30MHz: 60dBµV/m

Average
0,15kHz to 0,5MHz: 56dBµV/m to 46dBµV/m*
0,5MHz to 5MHz: 46dBµV/m
5MHz to 30MHz: 50dBµV/m

*Decreases with the logarithm of the frequency

6. FIELD STRENGTH WITHIN THE BAND 13.110-14.010MHZ

6.1. TEST CONDITIONS

Test performed by : Laurent Deneux
Date of test : 2014/01/06
Ambient temperature : 19°C
Relative humidity : 49%

6.2. TEST SETUP

The product has been tested according to ANSI C63.4 (2003). The EUT is placed on an open area test site. Distance between measuring antenna and the EUT is 3m. Test is performed in parrallel and perpendicular axis with a loop antenna. Measurement bandwidth was 9kHz. The level has been maximised by the turntable rotation of 360 degrees range on the 3 axis of EUT. Antenna height was 1m.

Photograph for Field strength within the band 13.110-14.010MHz

6.3. *RESULTS*

Characterization on an open test site:

Parallel Axis

Frequency (MHz)	QPeak Level (dBµV/m) (3m)	Limit (dBµV/m) (3m)
Below 13.110	<34	69.5
13.110 to 13.410	40	80.5
13.410 to 13.553	41.5	90.5
13.553 to 13.567	57.3	124
13.567 to 13.710	41.5	90.5
13.710 to 14.010	40.5	80.5
Above 14.010	<34	69.5

Perpendicular Axis

Frequency (MHz)	QPeak Level (dBµV/m) (3m)	Limit (dBµV/m) (3m)
Below 13.110	37	69.5
13.110 to 13.410	45	80.5
13.410 to 13.553	49	90.5
13.553 to 13.567	63.7	124
13.567 to 13.710	45	90.5
13.710 to 14.010	43	80.5
Above 14.010	36	69.5

See annex for graphics

Result: PASS

Limit: →

Below 13.110MHz:	69.5dBµV/m (3m) or 29.5dBµV/m (30m)
13.110MHz to 13.410MHz:	106µV/m (30m) or 80.5dBµV/m (3m)
13.410MHz to 13.553MHz:	334µV/m (30m) or 90.5dBµV/m (3m)
13.553MHz to 13.567MHz:	15848µV/m (30m) or 124dBµV/m (3m)
13.567MHz to 13.710MHz:	334µV/m (30m) or 90.5dBµV/m (3m)
13.710MHz to 14.010MHz:	106µV/m (30m) or 80.5dBµV/m (3m)
Above 14.010MHz:	69.5dBµV/m (3m) or 29.5dBµV/m (30m)

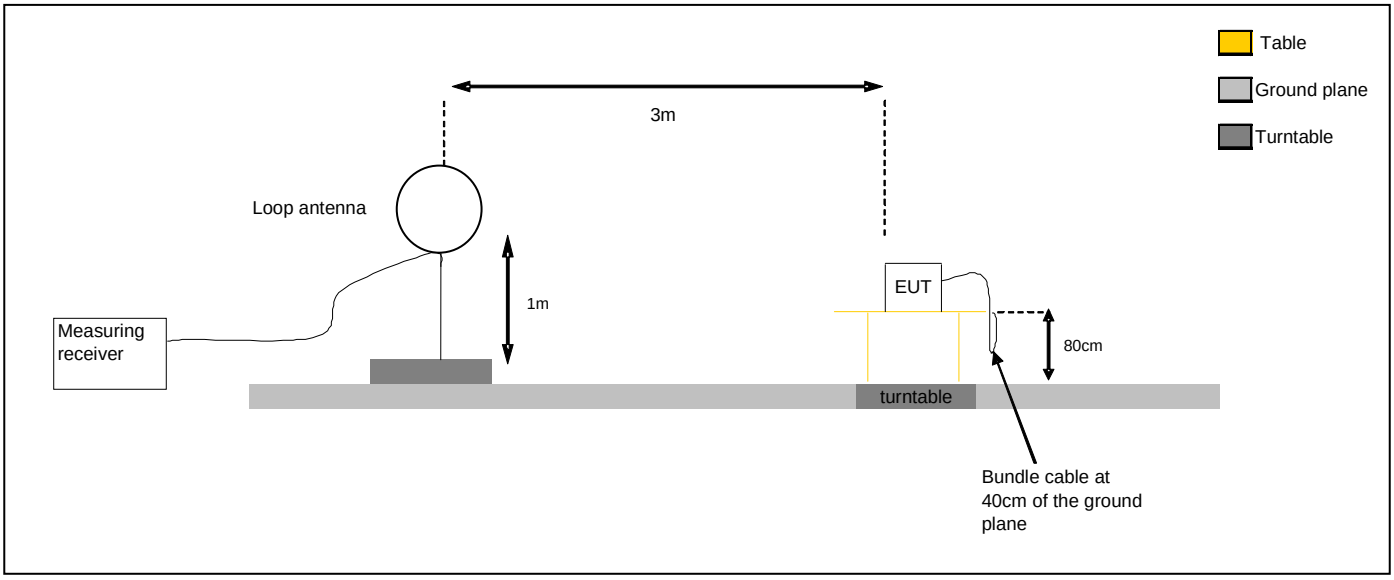
7. FIELD STRENGTH OUTSIDE OF THE BANDS 13.110-14.010 MHZ

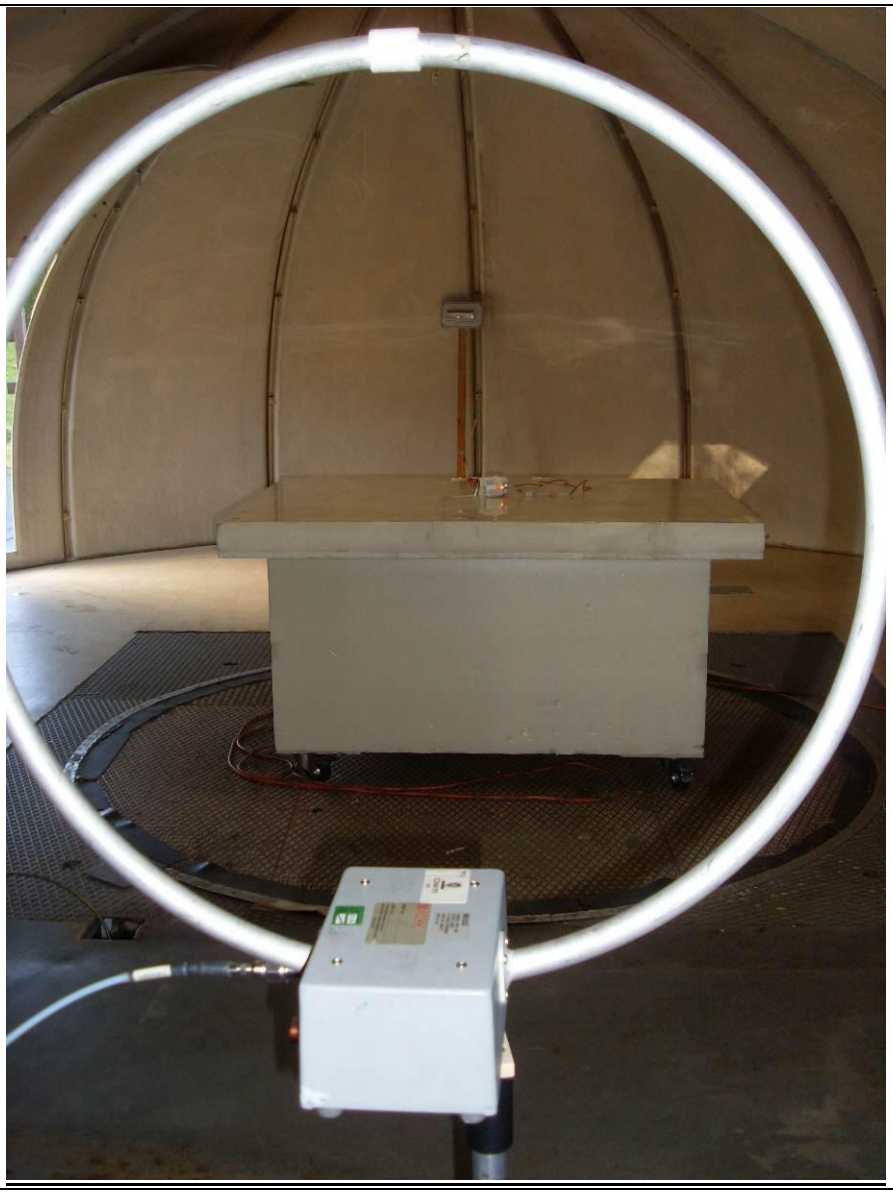
7.1. TEST CONDITIONS

Test performed by : Laurent Deneux
Date of test : 2014/01/06
Ambient temperature : 19°C
Relative humidity : 49%

7.2. TEST SETUP

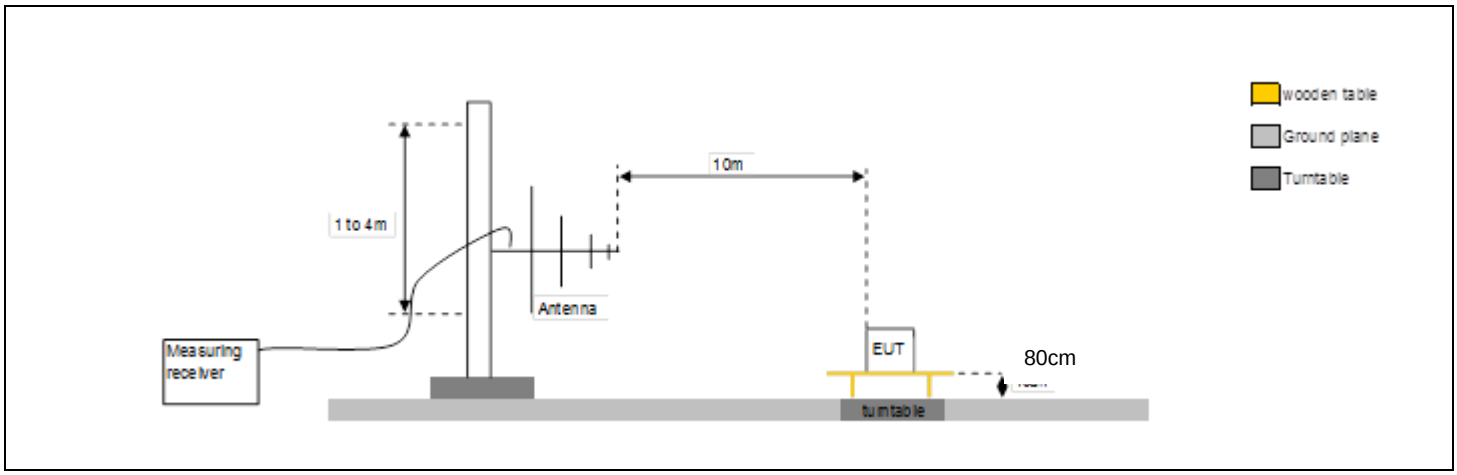
The product has been tested according to ANSI C63.4 (2003). The EUT is placed on an open area test site.
The EUT is placed at 3m distance of the loop antenna (0.009 to 30MHz) on a table 80cm height. The level has been maximised by turning the EUT with the rotating table and with the antenna at 0° and 90° around its vertical and horizontal axes. Antenna height was 1m. Pre scans were performed on the EUT put on its three axes to determine the position with maximum radiation.

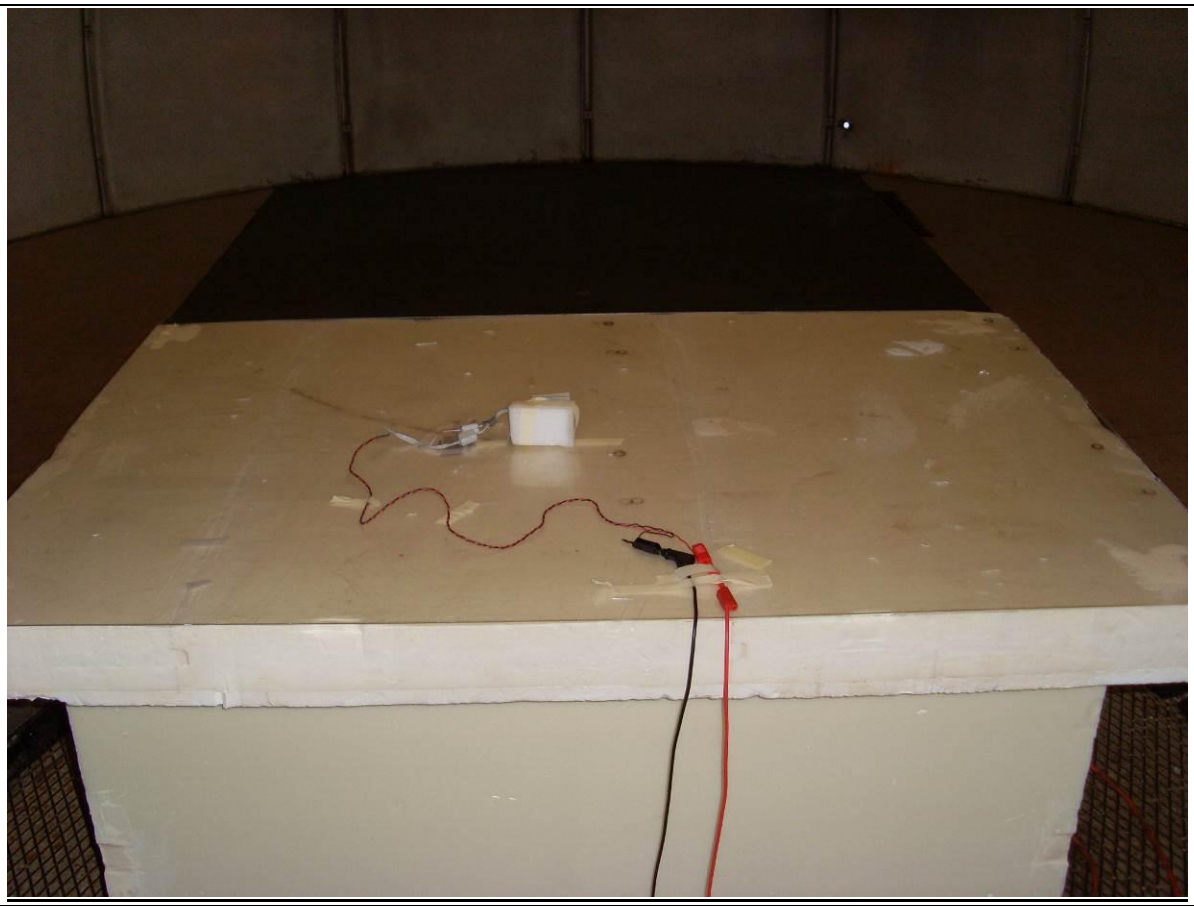




Photograph for Field strength below 30MHz

The product has been tested according to ANSI C63.4 (2003). The EUT is placed on an open area test site
The EUT is placed at 10m distance of the Bilog (30 to 1000MHz) or horn (above 1GHz) antenna on a table 80cm height.
The level has been maximised by turning the EUT with the rotating table and with the antenna in horizontal and vertical polarity. Antenna height search was performed from 1 to 4m





Photograph for Field strength above 30MHz

7.3. RESULTS

- **Characterization on an open test site (9kHz to 30MHz):**

Perpendicular antenna
Below 30Mhz

Frequency (MHz)	QPeak Level (dBµV/m)	Limit (3m) (dBµV/m)
27.12	23.7	69.5

Paralell antenna
Below 30Mhz

Frequency (MHz)	QPeak Level (dBµV/m)	Limit (3m) (dBµV/m)
27.12	20.3	69.5

Result: PASS

Limit: → 9kHz to 0,490MHz: 2400/F(kHz)µV/m (300m) or (20log(2400/F(kHz))+80)dBµV/m (3m) QPeak
0,490MHz to 1.705MHz: 240000/F(kHz)µV/m (30m) or (20log(24000/F(kHz))+40)dBµV/m (3m) QPeak
1.705MHz to 30MHz: 30µV/m (30m) or 69.54dBµV/m (3m) QPeak

Characterization on an open test site (30MHz to 1000MHz)

Worst frequencies		
Frequency MHz	Measured level dBµV/m	Limit level FCC Part.15 Class B
31	27.4	29.5
33.8	27.6	29.5
54.2	29.1	29.5
162.7	28.6	33
203.4	29.3	33
623.8	28.7	35.5

See annex for graphics

Characterization on an open test site (1GHz to 18GHz)

No significant spurious has been observed

See annex for graphics

Result: PASS

Limit: →
30MHz to 88MHz: 100µV/m (3m) or 40dBµV/m (3m) or 29.5dBµV/m (10m) QPeak
88MHz to 216MHz: 150µV/m (3m) or 43,5dBµV/m (3m) or 33dBµV/m (10m) QPeak
216MHz to 960MHz: 200µV/m (3m) or 46dBµV/m (3m) or 35.5dBµV/m (10m) QPeak
960MHz to 1000MHz: 500µV/m (3m) or 54dBµV/m (3m) or 43.5dBµV/m (10m) QPeak
Above 1000MHz: 5012µV/m (3m) or 74dBµV/m or 63.5dBµV/m (10m) Peak
500µV/m (3m) or 54dBµV/m (3m) or 43.5dBµV/m (10m) Average

8. TEST EQUIPMENT LIST

Frequency Tolerance & Occupied Bandwidth					
Apparatus	**Trade Mark**	**Type**	**Registration number**	**Calibration date**	**Calibration due**
Spectrum analyzer	ROHDE & SCHWARZ	FSL	A4060032	2012/11	2014/11
Climatic Chamber	SECASI Technologies	SLT-34	D1024029	2012/11	2014/11
DC Power Supply	ROHDE & SCHWARZ	NGSM 32/10	A70040074	2013/01	2014/01
RF Cable	-	-	A5329433	2013/03	2014/03
Acquisition/Control unit	HEWLETT-PACKARD	3852A	B4046055	2013/05	2014/05
Multimeter	KEITHLEY	2000	A1241084	2013/01	2014/01
Field strength outside of the bands 13.110-14.010 MHz					
Apparatus	**Trade Mark**	**Type**	**Registration number**	**Calibration date**	**Calibration due**
EMI Test Receiver	ROHDE & SCHWARZ	ESU	A2642018	2013/04	2014/04
Preamplifier	HEWLETT PACKARD	8449B	A4069002	2012/11	2013/11
Bilog antenna	CHASE	CBL 6112A	C2040040	2013/03	2014/03
Horn antenna	EMV	3115	C2040023	2013/04	2014/04
Loop Antenna	EMCO	6502	C2040159	2013/05	2014/05
RF Cable	-	-	A5329449	2013/09	2014/09
RF Cable	-	-	A5329365	2013/03	2014/03
RF Cable	-	-	A5329444	2013/09	2014/09
Field strength within the band 13.110-14.010MHz					
Apparatus	**Trade Mark**	**Type**	**Registration number**	**Calibration date**	**Calibration due**
Open test site	LCIE	-	F2000400	2013/04	2014/04
EMI Test Receiver	ROHDE & SCHWARZ	ESU	A2642018	2013/04	2014/04
Loop Antenna	EMCO	6502	C2040159	2013/05	2014/05
Cable	-	-	A5329449	2013/09	2014/09
Cable	-	-	A5329365	2013/03	2014/03
cable	-	-	A5329444	2013/09	2014/09
AC Power Line Conducted Emissions					
Apparatus	**Trade Mark**	**Type**	**Registration number**	**Calibration date**	**Calibration due**
EMI Test Receiver	ROHDE & SCHWARZ	ESU	A2642018	2013/04	2014/04
Pulse limiter	RHODE & SCHWARZ	ESH3-Z2	A2649008	2013/02	2014/02
V LISN	ROHDE & SCHWARZ	ESH2-Z5	C2322001	2013/06	2014/06
Ground plan	LCIE	-	-	-	-
RF Cable	-	-	A5329417	2013/09	2014/09

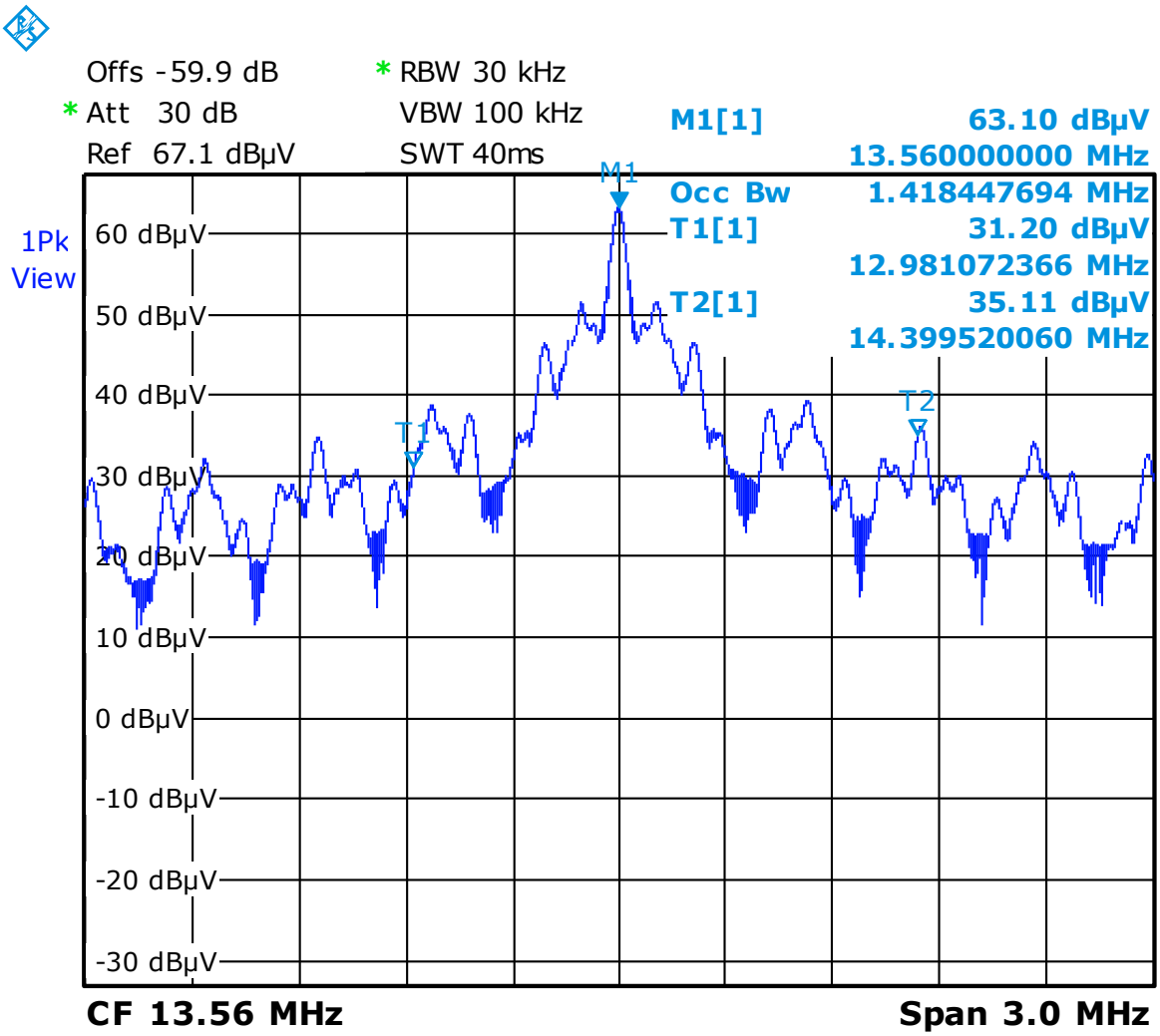
Note :In our Quality System, the Calibration due of our equipment is more or less 2 months.

9. UNCERTAINTIES CHART

Kind of test	Measurement uncertainties (k=2) ±x(dB) / (Hz)	Limit for uncertainties ±y(dB)
TRANSMITTER REQUIREMENTS		
Radio frequency	$\pm 2.10^{-8}$ Hz	$\pm 1.10^{-7}$ Hz
RF Conducted power	±0.6 dB	±1.5 dB
Spurious emissions • Frequency < 1000 MHz • Frequency > 1000 MHz	 ±3.9 dB ±3.1 dB	±6 dB
Spurious in conduction	±1.6 dB	±3 dB
Temperature	±0.5°C	±1°C
Humidity	±2.5 %	±10 %

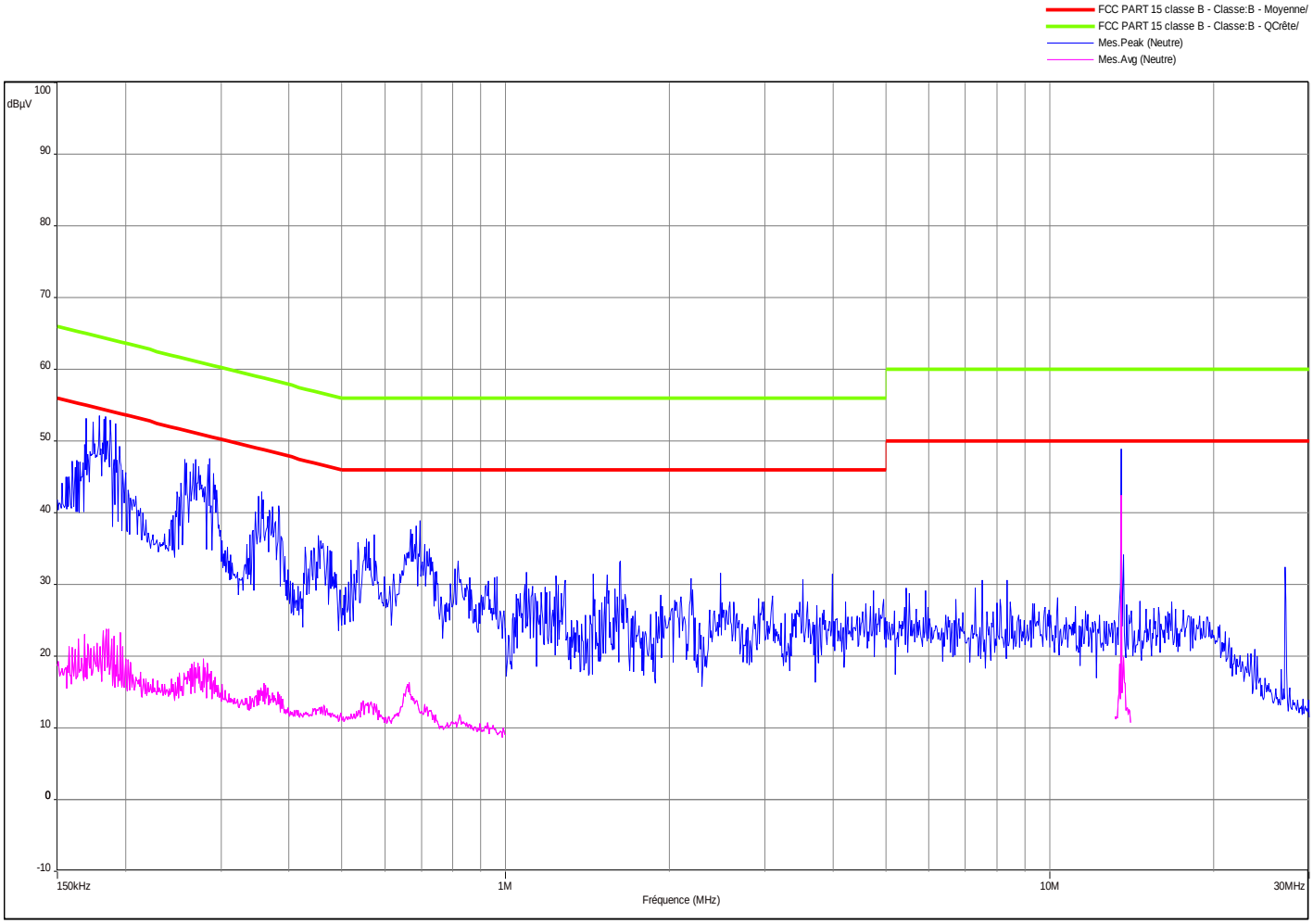
10. ANNEX (GRAPHS)

Occupied Bandwidth
Temperature: Tnom
Voltage: Vnom

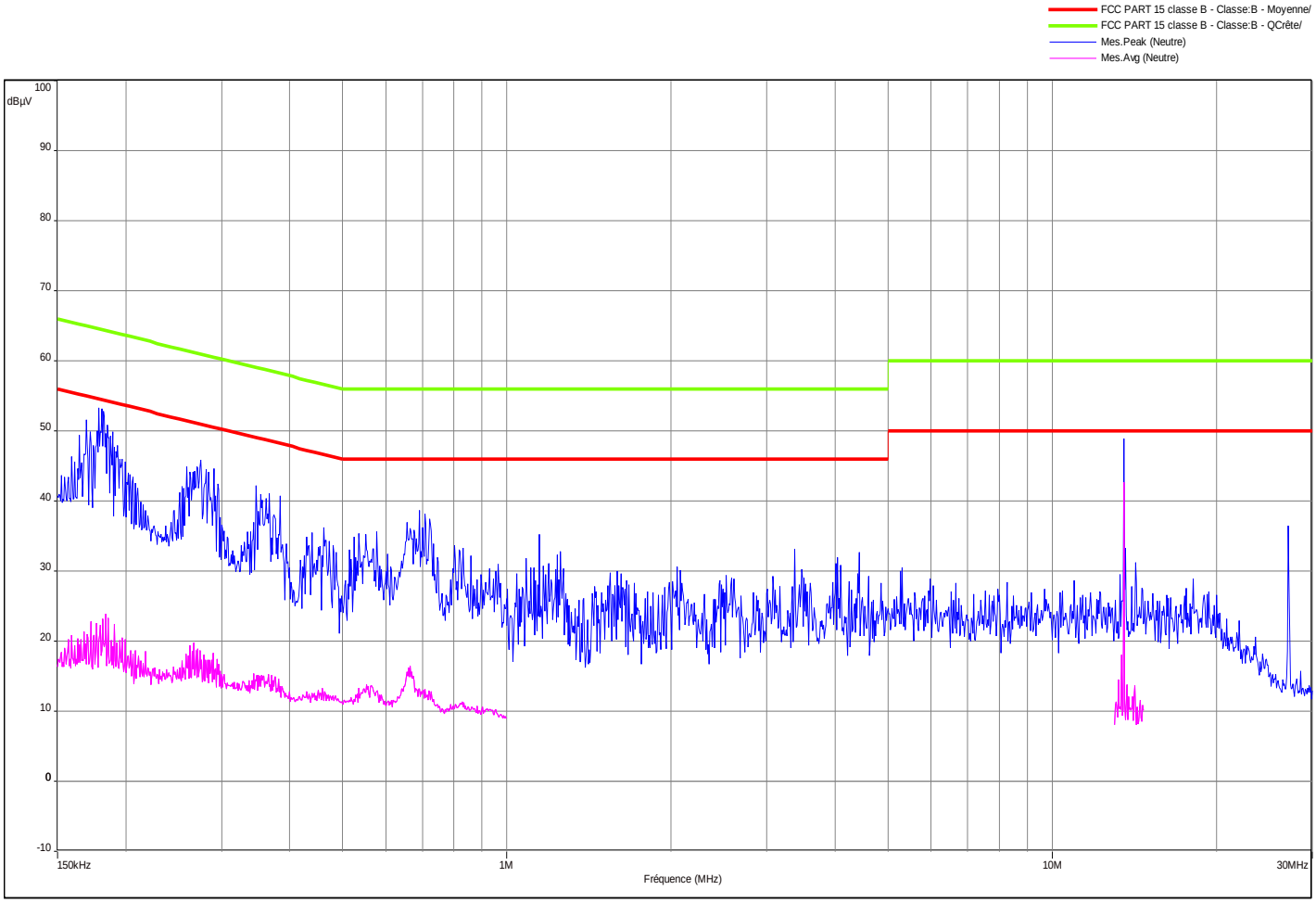


Date: 8.JAN.2014 13:42:11

AC power line conduted emissions
Antenna Connected
FCC Part.15 class B
BIO RAD
RFID Module
Type : DTE4027 Vers.+3
Conductor 1 ; 120V-60Hz
Peak and average value



AC power line conduted emissions
Antenna Connected
FCC Part.15 class B
BIO RAD
RFID Module
Type : DTE4027 Vers.+3
Conductor 2 ; 120V-60Hz
Peak and average value



Radiated Emissions
FCC Part.15 class B
BIO RAD
RFID Module
Type : DTE4027 Vers.+3
Quasi Peak measurement