



Rapport d'essai / Test report

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: ADEUNIS RF
Parc Technologique Pré-roux
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Objet / Subject

: Essais de compatibilité électromagnétique conformément aux normes /
Electromagnetic compatibility tests according to the standards
FCC CFR 47 Part 15, Subpart B et C
RSS-210 Issue 8

Matériel testé / Apparatus under test

- . Produit / Product : **Wireless Audio Conference System**
- . Marque / Trade mark : **VOKKERO SQUADRA**
- . Constructeur / Manufacturer : **ADEUNIS RF**
- . Type / Model : **ARF7822XX**
- . Type sous test / Model under test : **ARF7822AA**
- . N° de série / serial number : **B13360003B**
- . FCC ID : **U3Z-ARF7822**
- . IC ID : **7016A-ARF7822**

Date des essais / Test date

: Le 10, 11 et 16 Septembre 2013 / *September 10th, 11th and 16th, 2013*

Lieu d'essai / Test location

: **LCIE SUD-EST**
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38430 MOIRANS - FRANCE

Test réalisé par / Test performed by

: Anthony MERLIN

Ce document comporte / Composition of document : 43 pages.

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MOIRANS, LE 23 OCTOBRE 2013 / *OCTOBER 23RD, 2013*

Approuvé par / *Approved by*,
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LABORATOIRE CENTRAL DES
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1. TEST PROGRAM

Standard:

- FCC Part 15, Subpart C 15.247
- ANSI C63.4 (2003)
- RSS-210 Issue 8 – Dec 2010
- RSS-Gen Issue 3 – Dec 2010

EMISSION Test	LIMITS			RESULTS (Comments)
	Frequency	Quasi-peak value (dBµV)	Average value (dBµV)	
Limits for conducted disturbance at mains ports 150kHz-30MHz	150-500kHz	66 to 56	56 to 46	NA
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 9kHz-30MHz CFR 47 §15.209 (a) CFR 47 §15.247 (d) RSS-210 §A8.5	Measure at 300m 9kHz-490kHz : 67.6dBµV/m /F(kHz) Measure at 30m 490kHz-1.705MHz : 87.6dBµV/m /F(kHz) 1.705MHz-30MHz : 29.5 dBµV/m			PASS
Radiated emissions 30MHz-10GHz* CFR 47 §15.209 (a) CFR 47 §15.247 (d) RSS-210 §A8.5	Measure at 3m 30MHz-88MHz : 40 dBµV/m 88MHz-216MHz : 43.5 dBµV/m 216MHz-960MHz : 46.0 dBµV/m Above 960MHz : 54.0 dBµV/m			PASS
Maximum Peak Output Power CFR 47 §15.247 (b) RSS-210 §A8.4(1)	Limit: 24dBm Conducted or Radiated measurement			PASS
Hopping Channel Separation CFR 47 §15.247 (a) (1) RSS-210 §A8.1(b)	Minimum between: Two-third 20dB Bandwidth or 25kHz Whichever is greater			PASS
Number of Hopping Frequencies CFR 47 §15.247 (a) (1) (iii) RSS-210 §A8.1(d)	At least 25 channels used			PASS
Time of Occupancy (Dwell Time) CFR 47 §15.247 (a) (1) (iii) RSS-210 §A8.1(d)	Maximum 0.4 sec within 10sec			PASS
Band Edge Measurement CFR 47 §15.209 (a) CFR 47 §15.247 (d) RSS-210 §A8.5	Limit: -20dBc			PASS
Occupied bandwidth RSS-Gen §4.6.1	No limit			PASS
Receiver Spurious Emission** RSS-Gen §4.10	See RSS-Gen §4.10			NA

*§15.33: The highest internal source of a testing device is defined like more the highest frequency generated or used in the testing device or on which the testing device works or agrees.

- If the highest frequency of the internal sources of the testing device is lower than 108 MHz, measurement must be only performed until 1GHz.
- If the highest frequency of the internal sources of the testing device ranges between 108 MHz and 500 MHz, measurement must be only performed until 2GHz.
- If the highest frequency of the internal sources of the testing device ranges between 500 MHz and 1 GHz, measurement must be only performed until 5GHz.

If the highest frequency of the internal sources of the testing device is above 1 GHz, measurement must be only performed until 5 times the highest frequency or 40 GHz, while taking smallest of both.

**Testing covered the receive mode, and receiver spurious emissions are considered to be the same as transmitter.

**2. SYSTEM TEST CONFIGURATION****2.1. JUSTIFICATION**

The system was configured for testing in a typical fashion (as a customer would normally use it). Model ARF7822XX can set with different frequency tables:

Country	Variation	Reference
US/CANADA	US/CAN 6 users	ARF7822AA
	US/CAN 4+2 users	ARF7822BA
	US/CAN voice+whistle	ARF7822CA
	US/CAN 4+2 users FOOT	ARF7822DA

Users can choose frequency tables.

This test report presents test results on highest, middle and lowest channel on all applicable tests with all USA/Canada frequency tables if necessary to show compliance with Part15.247.



Frequency tables:

USA/Canada

	<i>US1</i>	<i>US2</i>	<i>US3</i>	<i>US4</i>	<i>US5</i>	<i>US6</i>
Fmin	902.969	903.638	902.300	902.634	902.300	902.300
Fmax	927.049	927.718	925.043	927.718	926.715	927.718
1	902.969	903.638	902.3	902.634	902.3	902.3
2	903.638	904.976	902.969	903.972	902.634	902.634
3	904.307	906.313	903.638	905.31	903.303	902.969
4	904.976	906.982	904.976	905.979	903.972	903.303
5	905.645	907.651	905.645	906.648	904.641	903.638
6	907.651	908.32	906.982	908.655	905.979	903.972
7	908.32	910.327	907.651	910.661	906.648	904.307
8	908.989	910.996	908.32	911.33	907.317	904.641
9	910.327	911.665	908.989	911.999	907.986	904.976
10	910.996	912.334	910.996	914.006	908.655	905.31
11	911.665	913.002	911.665	914.675	909.992	913.002
12	913.002	914.34	912.334	915.344	911.33	913.337
13	914.34	915.009	913.002	916.681	912.668	913.671
14	915.009	915.678	914.34	918.019	914.006	914.006
15	915.678	916.347	916.347	918.688	915.344	914.34
16	916.347	917.016	917.016	920.026	916.013	914.675
17	917.016	918.354	918.354	920.695	916.681	915.009
18	918.354	919.691	919.023	922.033	918.019	915.344
19	919.023	921.029	919.691	923.37	918.688	915.678
20	919.691	922.367	920.36	924.039	919.357	916.013
21	920.36	923.036	921.029	924.708	920.695	916.347
22	921.029	923.705	922.367	925.377	922.702	916.681
23	923.036	925.043	923.036	926.046	923.37	924.708
24	923.705	927.049	923.705	926.715	924.708	925.043
25	924.374	927.718	924.374	927.718	926.046	925.377
26	925.043	/	925.043	/	926.715	925.712
27	927.049	/	/	/	/	926.046
28	/	/	/	/	/	926.381
29	/	/	/	/	/	926.715
30	/	/	/	/	/	927.049
31	/	/	/	/	/	927.384
32	/	/	/	/	/	927.718



2.2. HARDWARE IDENTIFICATION

Equipment under test (EUT):

ARF7822AA

Serial number: B13360003B

- Internal max frequencies: 27MHz (Expected RF)

Power supply:

Battery Lithium-ion: 3.7VDC

During all the tests, EUT is supplied by battery or laboratory power supply.

Input/output:

- 1 x Micro/Headset connector, unshielded, length: 1m

Auxiliaries used for testing:

- 1 x Special configurator for tests settings

Equipment information:

- Frequency band:	[902 - 928] MHz
- Number of channel:	32 max, 25 min
- Channel tested:	Full test on 902.3MHz / 915.009MHz / 927.718MHz
- Modulation Technology:	<input checked="" type="checkbox"/> FHSS <input type="checkbox"/> DSSS
- Modulation type:	<input checked="" type="checkbox"/> GFSK <input type="checkbox"/> Pi/4 DQPSK <input type="checkbox"/> 8DPSK
Transfert data rate:	163.2kbps 2Mbps 3Mbps
- RF mode:	<input checked="" type="checkbox"/> TX/RX <input type="checkbox"/> RX <input type="checkbox"/> Standby
- Antenna type:	Internal, wire
- Antenna connector:	<input type="checkbox"/> Permanent external <input type="checkbox"/> Permanent internal
	<input type="checkbox"/> None <input checked="" type="checkbox"/> Temporary (only for tests)

2.3. EUT CONFIGURATION

A special configurator is provider to set special configuration.

Following tables, power level, modulation, data rate and RF signal are the same; just the channels and number are changed.

Special configuration:

- Permanent emission with modulation with choice of channel / table
- Permanent typical hopping sequence with choice of table

2.4. EQUIPMENT MODIFICATIONS

None

2.5. SPECIAL ACCESSORIES

None

3. RADIATED EMISSION DATA

3.1. TEST CONDITIONS

Date of test : September 10th, 2013
Test performed by : A.MERLIN
Atmospheric pressure : 988hPa
Relative humidity : 42%
Ambient temperature : 22°C

3.2. TEST SETUP

The installation of EUT is identical for pre-characterization measurement in a 3 meters semi anechoic chamber and for measures on a 10 meters Open site.





Radiated emission test setup



3.3. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Amplifier 8 GHz	HEROTEK	A1080304A	A7102024
Antenna Bi-log	CHASE	CBL6111A	C2040051
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052
Antenna Bi-log	CHASE	CBL6111A	C2040172
Antenna horn	EMCO	3115	C2042027
Cable N/N	-	-	A5329038
Cable	SUCOFLEX	106G	A5329061
Cable	UTIFLEX	-	A5329192
Cable N/N	-	-	A5329206
Cable (OATS)	-	-	A5329623
Semi-Anechoic chamber #3	SIEPEL	-	D3044017
Radiated emission comb generator	BARDET	-	A3169050
HF Radiated emission comb generator	LCIE SUD EST	-	A3169088
OATS	-	-	F2000409
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019
Receiver 20Hz-26.5GHz	ROHDE & SCHWARZ	ESIB26	A2642021
Spectrum analyser 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Receiver 20-1000MHz	ROHDE & SCHWARZ	ESVS30	A2642006
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371
Turntable / Mast controller (OATS)	ETS Lindgren	Model 2066	F2000372
Antenna mast (OATS)	ETS Lindgren	2071-2	F2000392
Turntable (OATS)	ETS Lindgren	Model 2187	F2000403
Table	MATURO Gmbh	-	F2000437
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444

3.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None



3.5. TEST SEQUENCE AND RESULTS

3.5.1. Pre-characterization at 3 meters [9kHz-30MHz]

A pre-scan of all the setup has been performed in a 3 meters semi anechoic chamber. The distance between EUT and antenna is 3 meters. For Pre-characterization, the loop antenna was rotated during the test for maximized the emission measurement. Measurement performed on 3 axis of EUT. Frequency band investigated is 9kHz to 30MHz.

The pre-characterization graphs are obtained in PEAK detection.

See graph for 9kHz-30MHz band:

0° polarization	Emr#1	Axis XY – FHSS US6 (worst case)	(See annex 1)
0° polarization	Emr#2	Axis Z – FHSS US6 (worst case)	(See annex 1)
90° polarization	Emr#3	Axis XY – FHSS US6 (worst case)	(See annex 1)
90° polarization	Emr#4	Axis Z – FHSS US6 (worst case)	(See annex 1)

3.5.2. Pre-characterization [30MHz-10GHz]

For frequency band 30MHz to 1GHz, a pre-scan of all the setup has been performed in a 3 meters semi anechoic chamber.

The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) polarization with a log-periodic antenna. The EUT is being rotated on 360° and on 3 axis during the measurement. The pre-characterization graphs are obtained in PEAK detection.

For frequency band 1GHz to 10GHz, a search is performed in the semi-anechoic chamber in order to determine frequencies radiated by the EUT.

See graphs for 30MHz-1GHz:

H polarization	Emr#5	Axis XY – FHSS US6 (worst case)	(See annex 1)
V polarization	Emr#6	Axis Z – FHSS US6 (worst case)	(See annex 1)
H polarization	Emr#7	Axis XY – FHSS US6 (worst case)	(See annex 1)
V polarization	Emr#8	Axis Z – FHSS US6 (worst case)	(See annex 1)

3.5.3. Characterization on 10 meters open site from 30MHz to 1GHz

The product has been tested at a distance of **10 meters** from the antenna and compared to the FCC part 15 subpart B §15.109 limits and C §15.209 limits. Measurement bandwidth was 120kHz from 30 MHz to 1GHz. Antenna height search was performed from 1m to 4m for both horizontal and vertical polarization. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on following tables.

Worst case final data result:

No	Frequency (MHz)	QPeak Limit (dBµV/m)	Qpeak * (dBµV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	163.848	43.5	33.4	-10.1	0	V	100	12.7	Axis Z
2	163.848	43.5	31.7	-11.8	10	H	320	12.7	Axis XY

*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)
(M@3m = M@10m+10.5dB)



3.5.4. Characterization on 3 meters anechoic chamber from 1GHz to 25GHz

The product has been tested at a distance of **3 meters** from the antenna and compared to the FCC part 15 subpart B §15.109 limits and C §15.209 limits. Measurement bandwidth was 1MHz from 1GHz to 25GHz. Antenna height search was performed from 1m to 4m for both horizontal and vertical polarization. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on following tables.

Frequency band 1GHz to 10GHz

Measurements are performed using a PEAK and Average detection. (RBW = 1MHz)

No	Frequency (GHz)	Limit Peak (dBµV/m)	Measure Peak (dBµV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
1	2706.900	74.0	67.0	-7.0	235	H	110	2.2	Axis Z
2	2745.027	74.0	67.2	-6.8	85	H	110	2.3	Axis Z
3	2783.154	74.0	67.0	-7.0	230	H	110	2.4	Axis Z
4	3609.200	74.0	61.1	-12.9	340	H	110	5.1	Axis X
5	3660.036	74.0	60.5	-13.5	10	H	110	5.3	Axis Z
6	3710.872	74.0	60.2	-13.8	330	H	110	5.4	Axis X
7	4511.500	74.0	58.9	-15.1	220	H	110	6.3	Axis Z
8	4575.045	74.0	59.7	-14.3	290	H	110	6.4	Axis X
9	4638.590	74.0	59.2	-14.8	210	H	110	6.6	Axis Z
10	5413.800	74.0	60.5	-13.5	280	H	110	8.2	Axis Z

No	Frequency (GHz)	Limit Average (dBµV/m)	Measure Average (dBµV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
1	2706.900	54.0	50.2	-3.8	235	H	110	2.2	Axis Z
2	2745.027	54.0	50.8	-3.2	85	H	110	2.3	Axis Z
3	2783.154	54.0	51.7	-2.3	230	H	110	2.4	Axis Z
4	3609.200	54.0	41.6	-12.4	340	H	110	5.1	Axis X
5	3660.036	54.0	42.4	-11.6	10	H	110	5.3	Axis Z
6	3710.872	54.0	42.1	-11.9	330	H	110	5.4	Axis X
7	4511.500	54.0	38.5	-15.5	220	H	110	6.3	Axis Z
8	4575.045	54.0	39.5	-14.5	290	H	110	6.4	Axis X
9	4638.590	54.0	39.3	-14.7	210	H	110	6.6	Axis Z
10	5413.800	54.0	39.3	-14.7	280	H	110	8.2	Axis Z

Note 1: Measures have been done at 3m distance.

Note 2: For Average measurement, dwell time factor is used (-15.5dB) see § Dwell time in this test report
 $20 \cdot \log(16.72/100) = -15.5\text{dB}$.

RESULTS: PASS



3.6. FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follow:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength
- RA = Receiver Amplitude
- AF = Antenna Factor
- CF = Cable Factor
- AG = Amplifier Gain

Assume a receiver reading of 52.5dB μ V is obtained. The antenna factor of 7.4 and a cable factor of 1.1 are added. The amplifier gain of 29dB is subtracted, giving a field strength of 32 dB μ V/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dB}\mu\text{V/m}$$

The 32 dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(32\text{dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}.$$

**4. MAXIMUM PEAK OUTPUT POWER (15.247)****4.1. TEST CONDITIONS**

Date of test : September 10th, 2013
Test performed by : A.MERLIN
Atmospheric pressure : 992mb
Relative humidity : 39%
Ambient temperature : 24°C

4.2. EQUIPMENT CONFIGURATION

Modulation: Typical
Hopping sequence: No

4.3. SETUP*Conducted measurement:*

The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency and using 3MHz RBW and 10MHz VBW.
The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

4.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Attenuator 10dB	AEROFLEX	-	A7122206
Cable	-	-	A5329604
Spectrum analyser 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011

4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None



5. HOPPING CHANNEL SEPARATION (15.247)

5.1. TEST CONDITIONS

Date of test : September 11th, 2013
Test performed by : A.MERLIN
Atmospheric pressure : 992mb
Relative humidity : 43%
Ambient temperature : 22°C

5.2. LIMIT

For frequency hopping system, hopping channel carrier frequencies must be separated by a minimum of 25kHz or the 20dB bandwidth of hopping channel, whichever is greater.

For frequency hopping system operating in the 902-928MHz with 20dB bandwidth of hopping channel is less than 250kHz:

- System shall use at least 50 channels
- Average time of occupancy on any frequency shall not greater than 0.4s within 20s period

For frequency hopping system operating in the 902-928MHz with 20dB bandwidth of hopping channel is equal or greater than 250kHz:

- System shall use at least 25 channels
- Average time of occupancy on any frequency shall not greater than 0.4s within 10s period

The maximum allowed 20dB bandwidth of hopping channel is 500kHz.

5.3. EQUIPMENT CONFIGURATION

Modulation: Typical
Hopping sequence: ON

5.4. SETUP – 20DB BANDWIDTH

The EUT is connected to spectrum analyzer. The EUT is turn ON and using the MaxHold function, the frequency separation of two frequencies that were attenuated 20dB from the Peak Output Power level. A delta marker is used to measure the frequency difference as the emission bandwidth.

5.5. SETUP – ADJACENT CHANNEL SEPARATION

The EUT is connected to spectrum analyzer. The EUT is turn ON and using the MaxHold function, the separation of two adjacent channels is recorded. A delta marker is used to measure the frequency difference.

**5.6. TEST EQUIPMENT LIST**

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Attenuator 10dB	AEROFLEX	-	A7122206
Cable	-	-	A5329604
Spectrum analyser 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011

5.1. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None



5.2. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	PASS / FAIL
64	902.300	329.365	500	PASS
102	915.009	329.365	500	PASS
140	927.718	329.365	500	PASS

20dB bandwidth: Same results followings tables

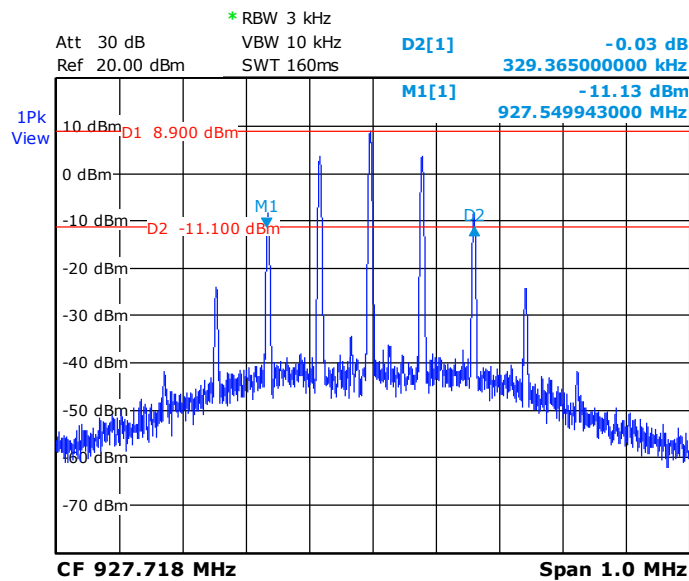
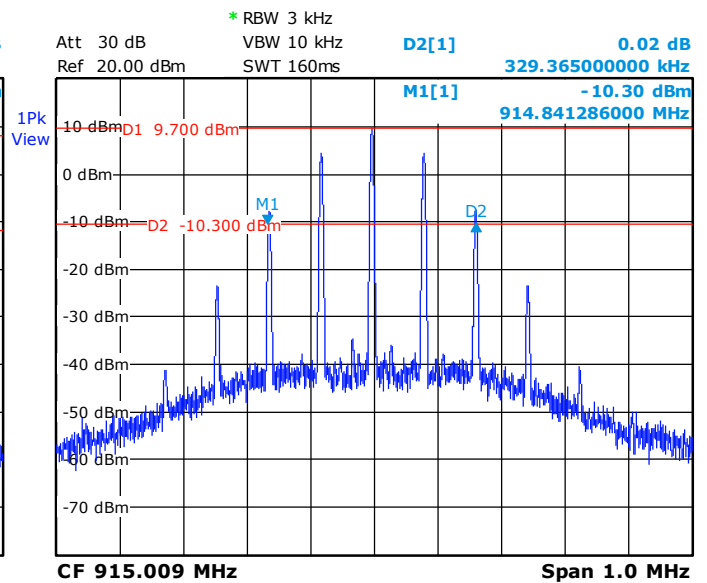
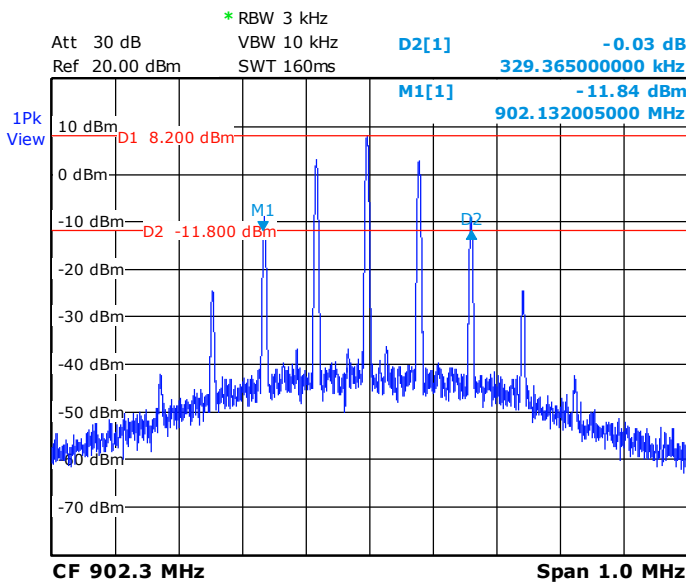




Table frequency	Adjacent Channel Separation (kHz)	Minimum Limit - 20dB Bandwidth (kHz)	PASS / FAIL
US1	670.7	329.365	PASS
US2	670.7	329.365	PASS
US3	670.7	329.365	PASS
US4	670.7	329.365	PASS
US5	335.3	329.365	PASS
US6	335.3	329.365	PASS

Adjacent channel separation: (minimum separation measured)
Table US1

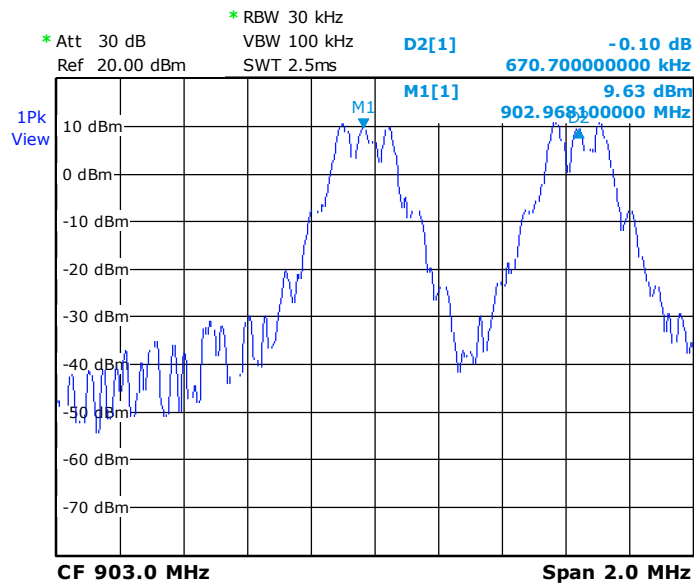


Table US2

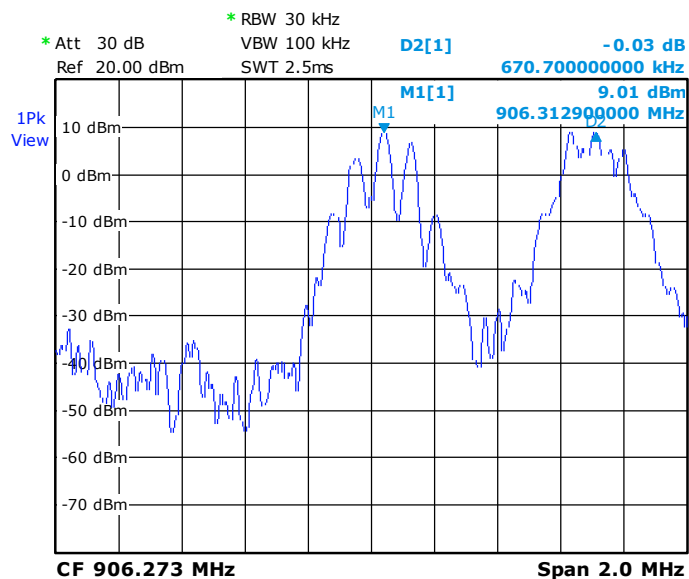




Table US3

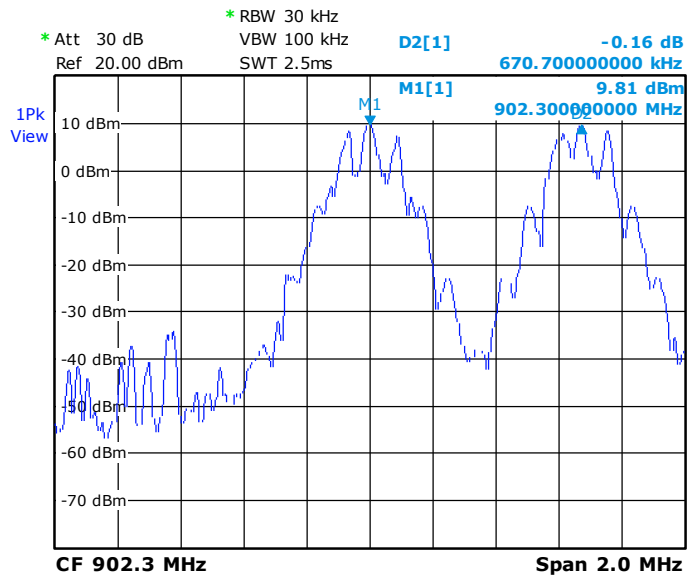


Table US4

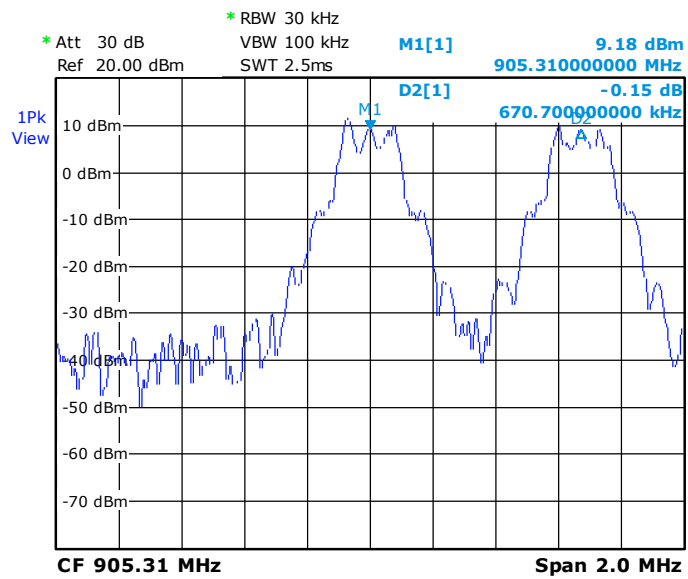


Table US5

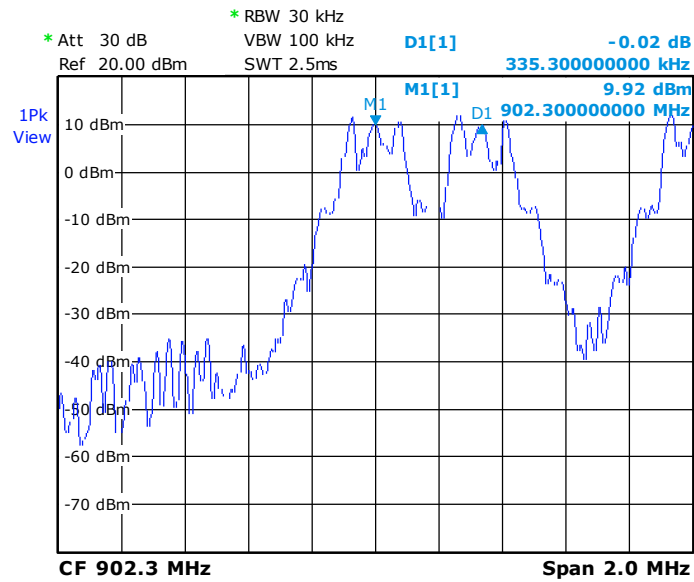
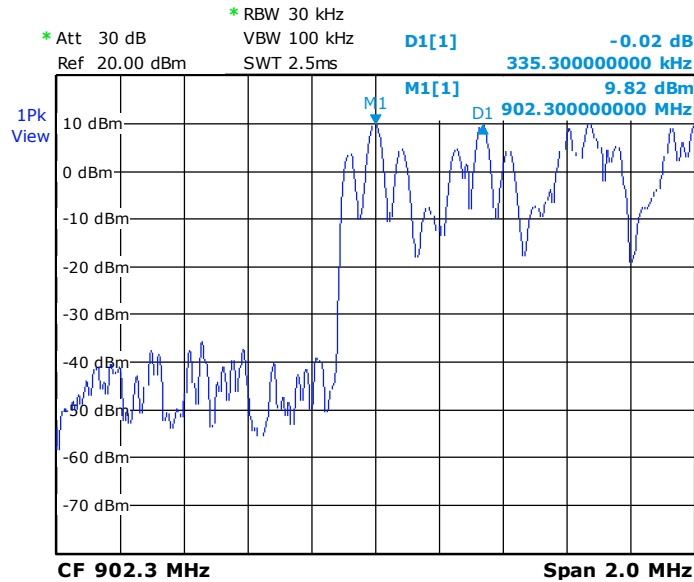


Table US6



**6. NUMBER OF HOPPING FREQUENCIES (15.247)****6.1. TEST CONDITIONS**

Date of test : September 11th, 2013
Test performed by : A.MERLIN
Atmospheric pressure : 992mb
Relative humidity : 43%
Ambient temperature : 22°C

6.2. LIMIT

For frequency hopping system operating in the 902-928MHz with 20dB bandwidth greater than 250kHz, at least 25 channels frequencies must be used.

6.3. EQUIPMENT CONFIGURATION

Modulation: Typical
Hopping sequence: YES (All tables)

6.4. SETUP

The EUT is connected to spectrum analyzer. The EUT is turn ON and using the MaxHold function and a delta marker the number of frequencies used for this FHSS system is recorded, see following graphs.

RBW: 100kHz
VBW: 300kHz

6.5. TEST EQUIPMENT LIST

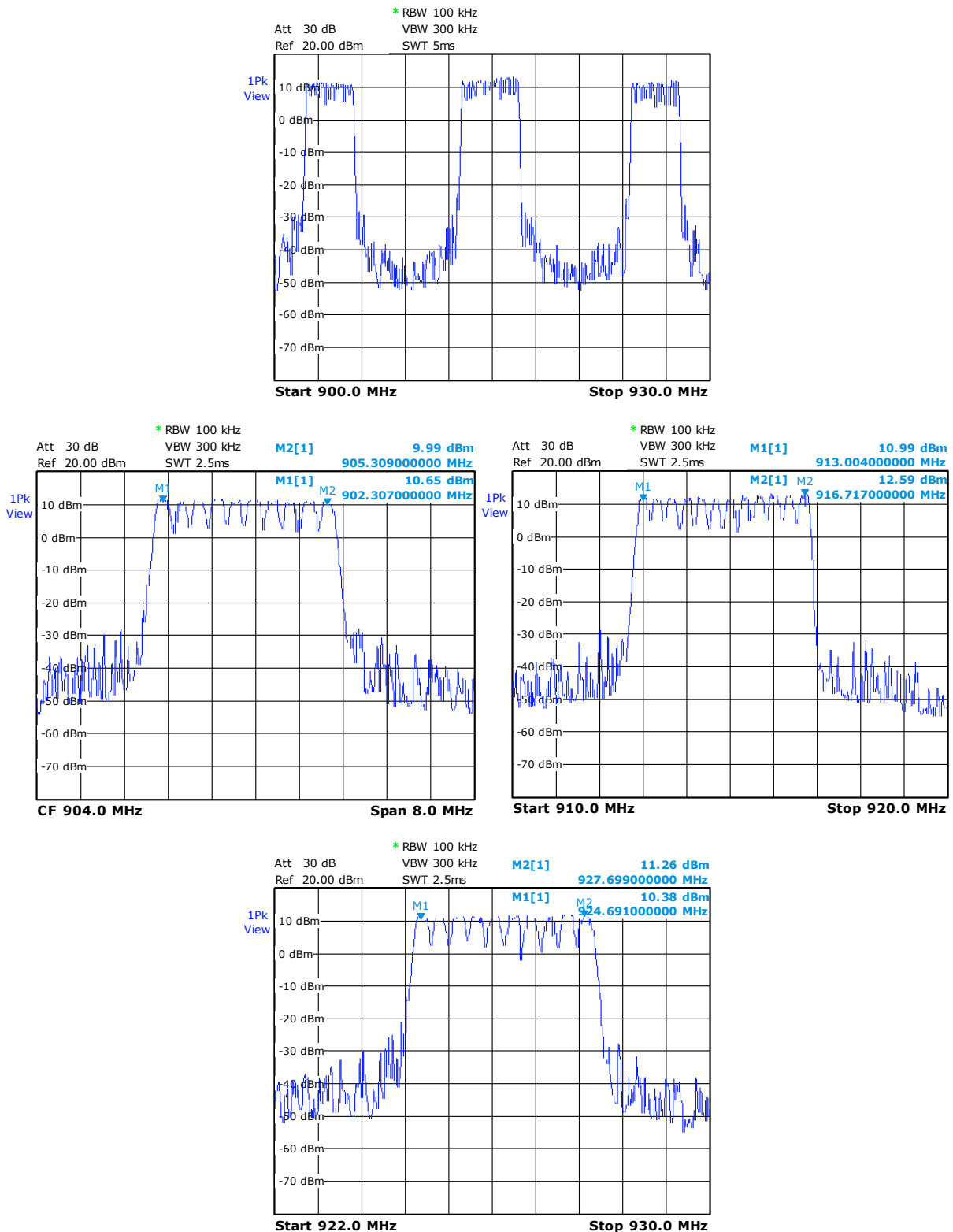
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Attenuator 10dB	AEROFLEX	-	A7122206
Cable	-	-	A5329604
Spectrum analyser 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011

6.1. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

6.2. TEST SEQUENCE AND RESULTS

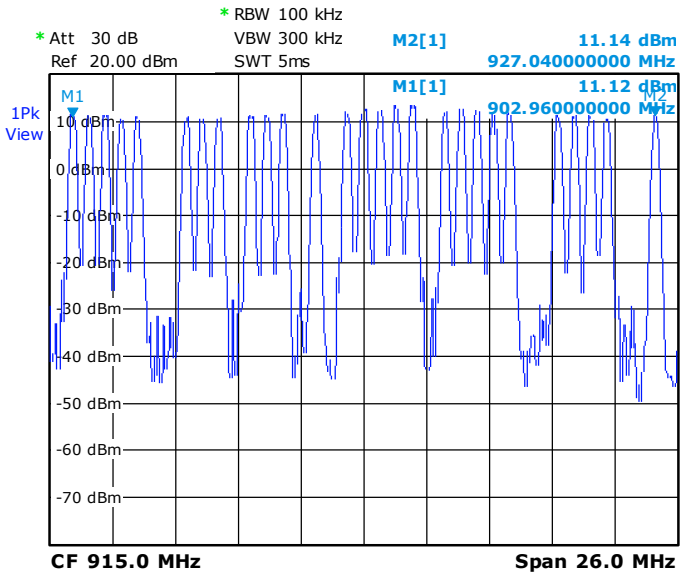
Table US6:



Number of frequency used in the hopping sequence:

32 channels (worst case)

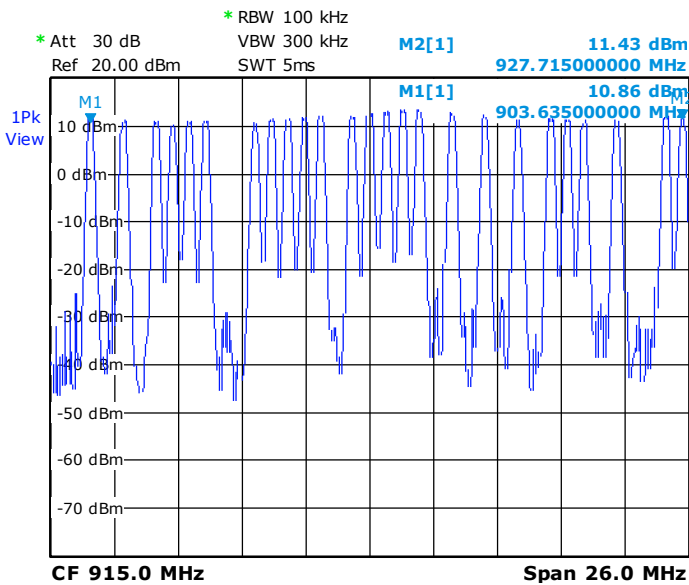
Table US1:



Number of frequency used in the hopping sequence:

27 channels

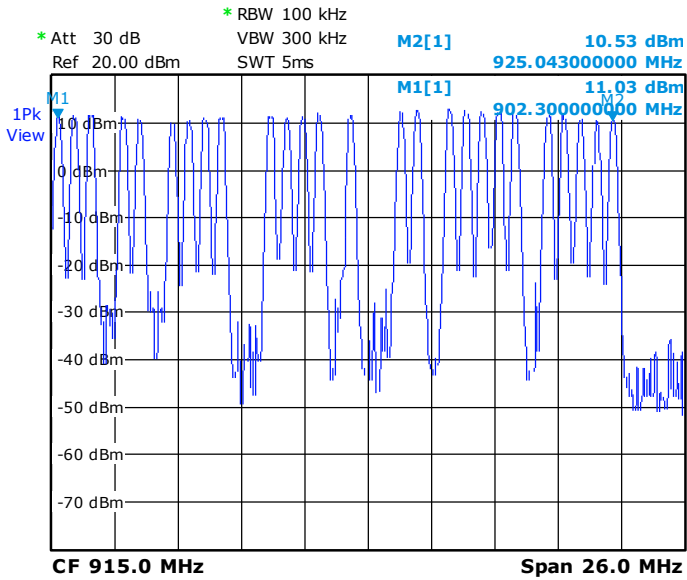
Table US2:



Number of frequency used in the hopping sequence:

25 channels

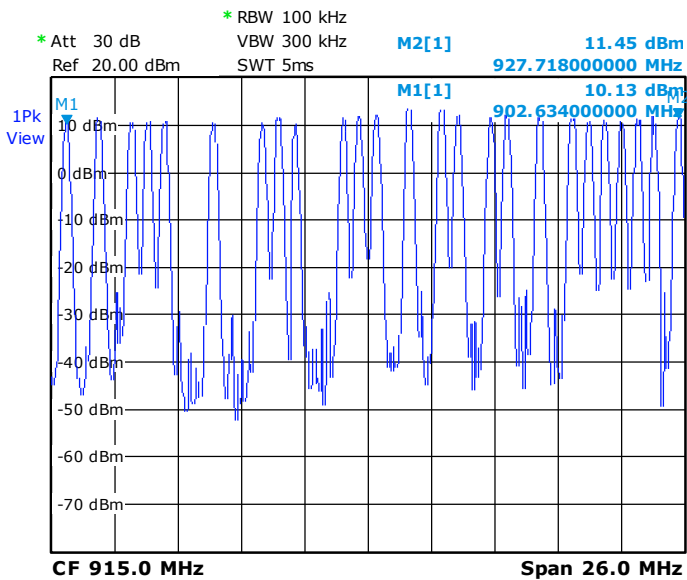
Table US3:



Number of frequency used in the hopping sequence:

26 channels

Table US4:

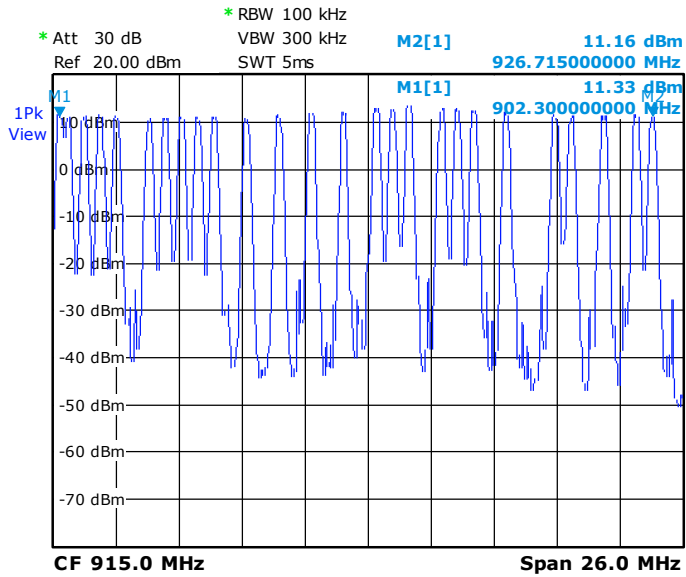


Number of frequency used in the hopping sequence:

25 channels



Table US5:



Number of frequency used in the hopping sequence:

26 channels

**7. TIME OF OCCUPANCY (DWELL TIME) (15.247)****7.1. TEST CONDITIONS**

Date of test : September 10th, 2013
Test performed by : A.MERLIN
Atmospheric pressure : 992mb
Relative humidity : 39%
Ambient temperature : 24°C

7.2. LIMIT

The average time of occupancy on any channel shall not be greater than 0.4 seconds within period of 10 seconds.

7.3. EQUIPMENT CONFIGURATION

Modulation: Typical
Hopping sequence: Yes (Same results following tables)

7.4. SETUP

The EUT is placed in an anechoic chamber. The EUT is turn ON; the Dwell Time is measured and calculated using the zero SPAN mode on a channel frequency and a SWEEP with an adapter value to measure the number of transmission within a period and the time of transmission

RBW: 100kHz
VBW: 300kHz

7.5. TEST EQUIPMENT LIST

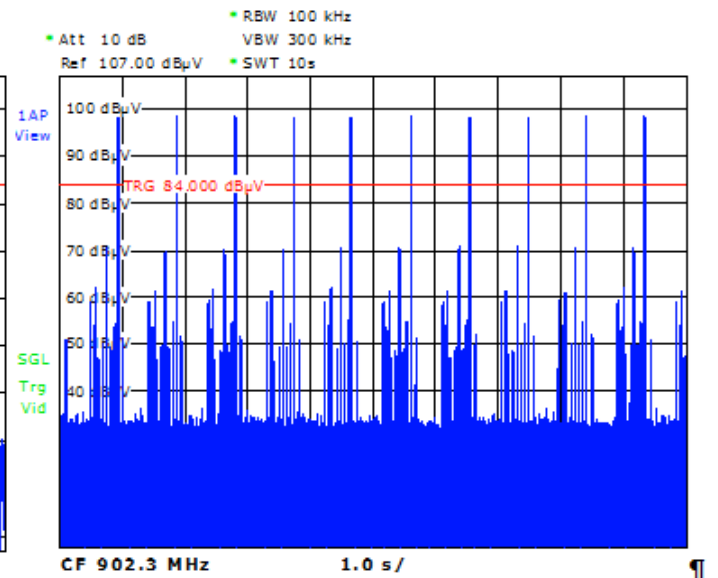
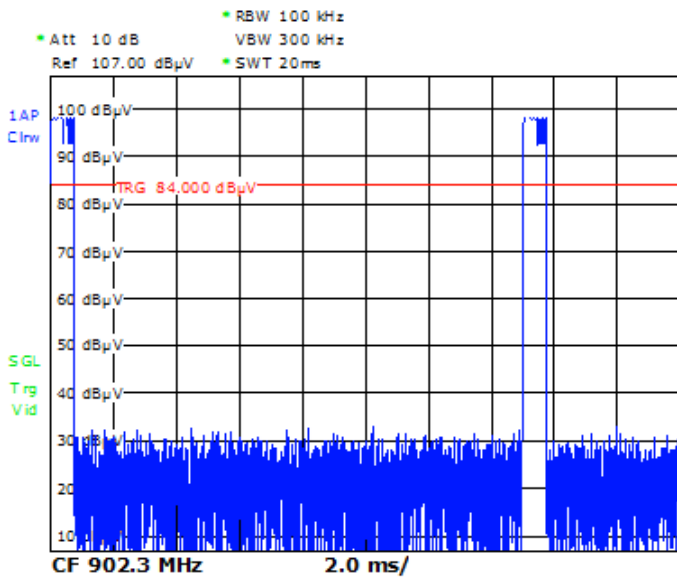
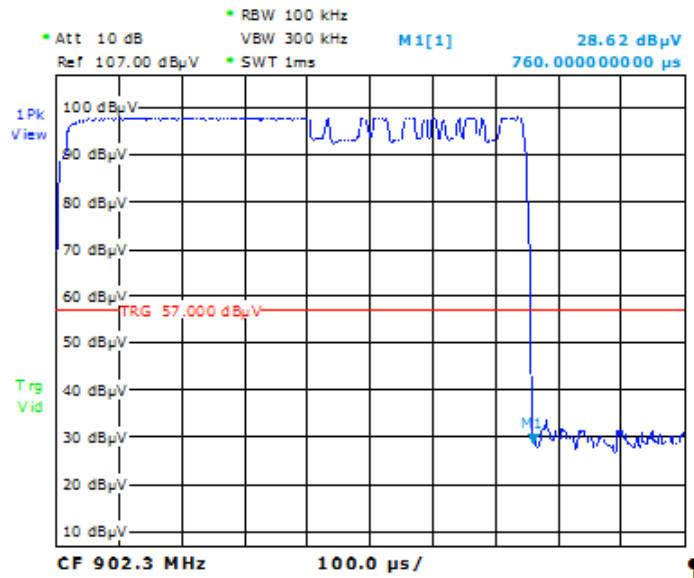
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Attenuator 10dB	AEROFLEX	-	A7122206
Cable	-	-	A5329604
Spectrum analyser 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011

7.1. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

7.2. TEST SEQUENCE AND RESULTS

Number of transmission in the period	Length of transmission time (ms)	Result (ms)	Limit (ms)	PASS / FAIL
22 (times/ 10 sec) * tps de transmit	0.760	16.72	400	PASS



**8. BAND EDGE MEASUREMENT (15.247)****8.1. TEST CONDITIONS**

Date of test : September 10th, 2013
Test performed by : A.MERLIN
Atmospheric pressure : 992mb
Relative humidity : 39%
Ambient temperature : 24°C

8.2. LIMIT

In Bandedge, the limit of spurious emissions are below -20dB of the highest emission level of operating band (in 100kHz RBW).

In the restrict band including bandedge, the limit of spurious emissions are 15.209. (RBW:1MHz / VBW:1MHz)

8.3. EQUIPMENT CONFIGURATION

Modulation: Typical
Hopping sequence: Yes

8.4. SETUP

The EUT is placed in an anechoic chamber; levels have been corrected to be in compliant with Peak Output Power measurement. The EUT is turn ON; the graphs of the restrict frequency band are recorded with a display line indicating the highest level and other the 20dB offset below to show compliance with 15.247 (d) and 15.205. The emissions in restricted bands are compared to 15.209 limits.

RBW: 100kHz
VBW: 300kHz

8.5. TEST EQUIPMENT LIST

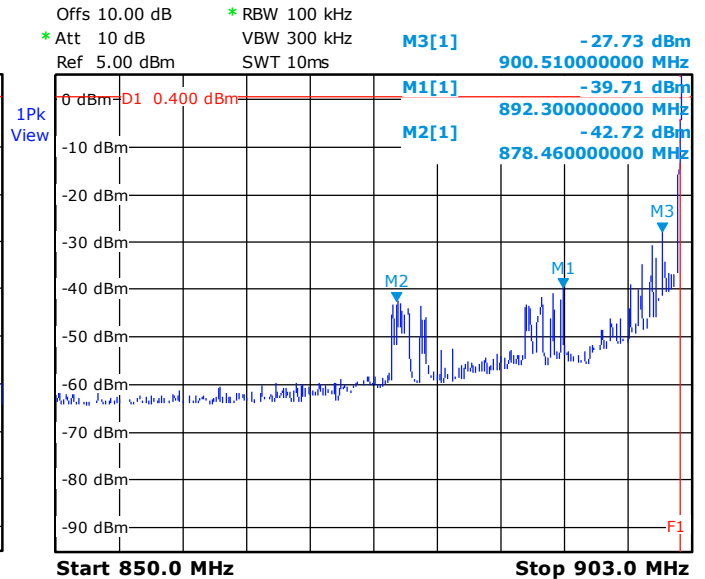
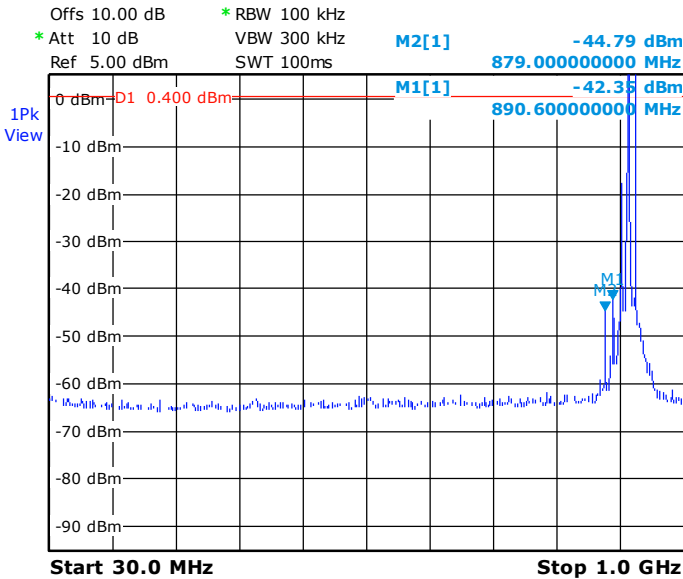
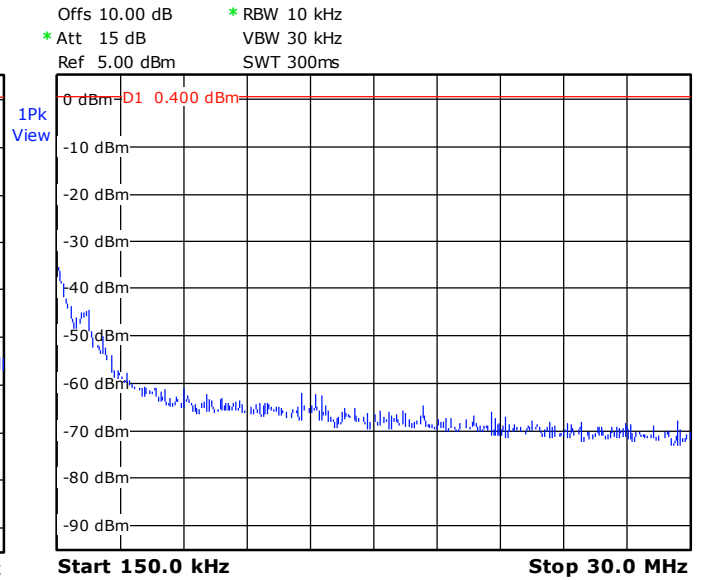
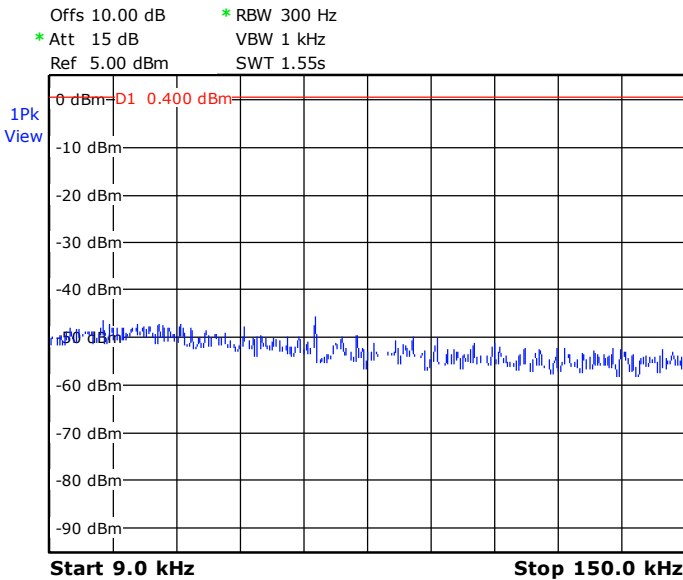
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Attenuator 10dB	AEROFLEX	-	A7122207
Cable	-	-	A5329604
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019
Receiver 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Spectrum Analyzer 9KHz – 26.5GHz	HEWLETT PACKARD	8593E	A4060018
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078

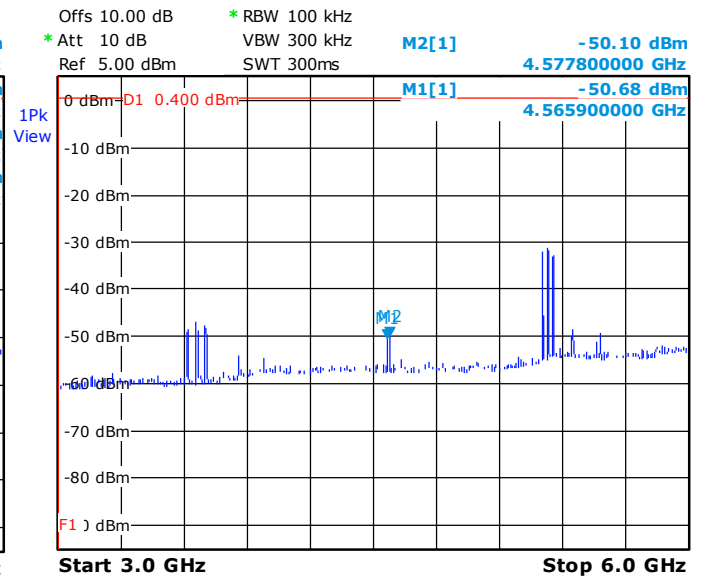
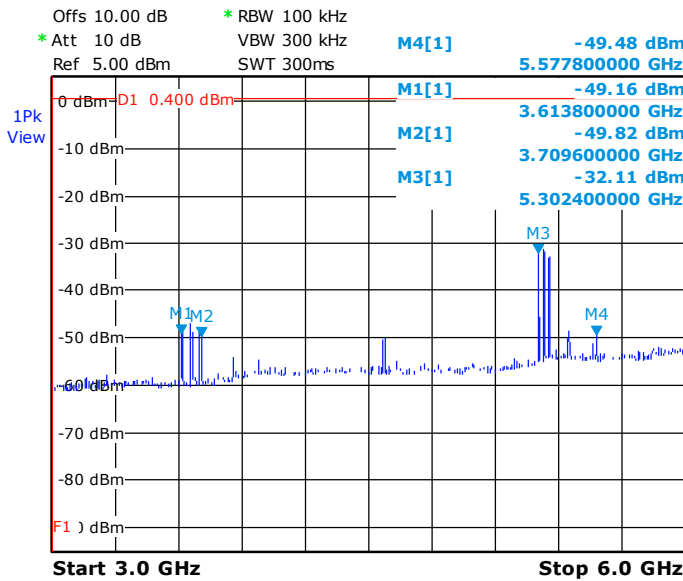
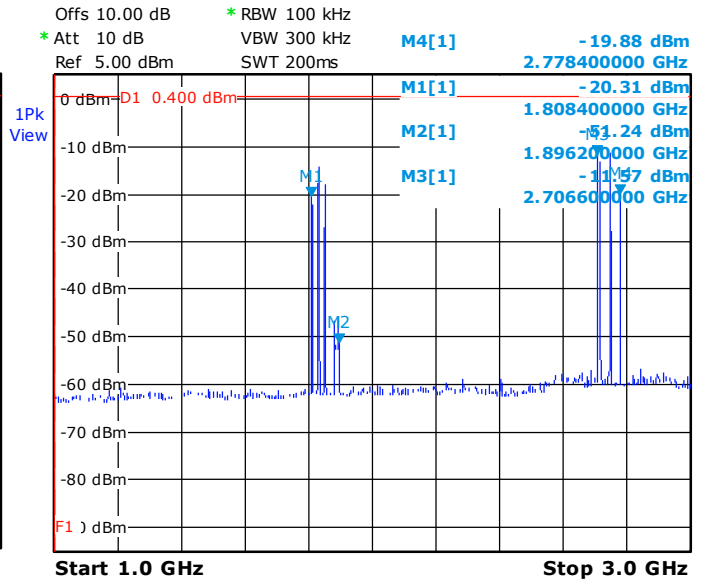
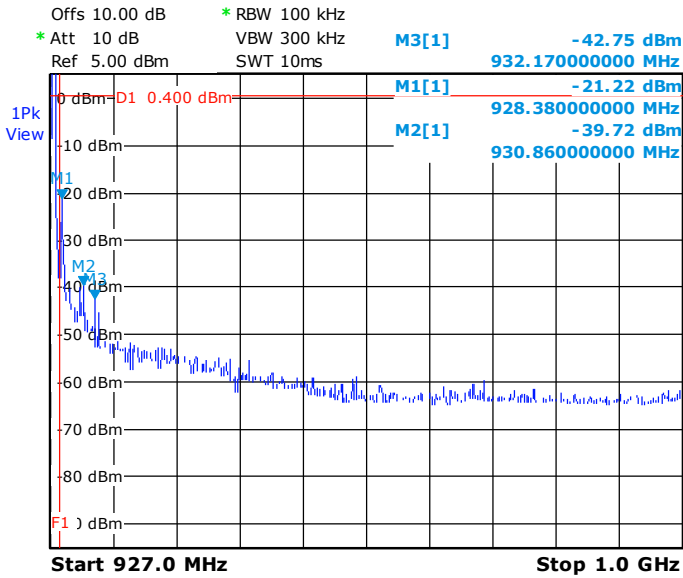
8.6. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

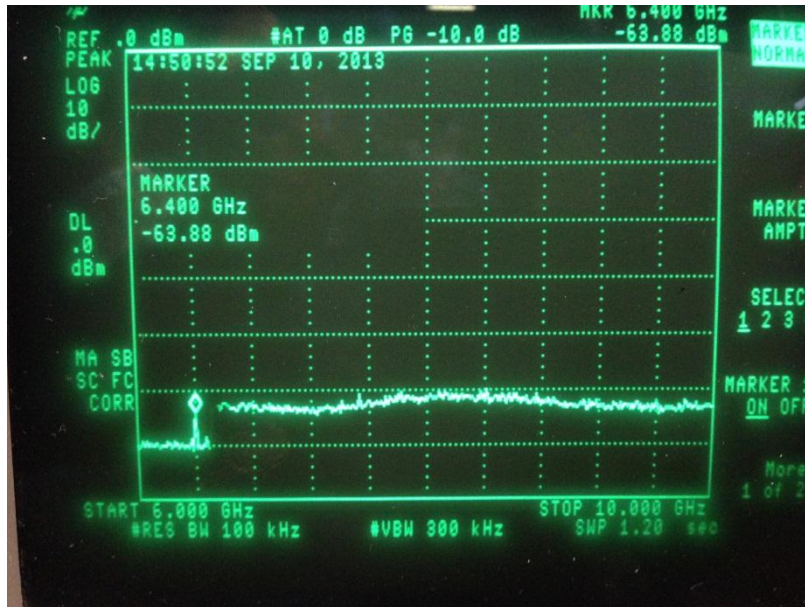
None



8.7. TEST SEQUENCE AND RESULTS







NOTE:

1. Average value = Peak value + 20 Log (duty cycle) = Peak value - 15.5dB.
2. The packet was the worst case duty cycle for a transmit dwell time on a channel, based upon the transmitter is on $0.760\mu\text{s} * 22$ during 10s per channel. Therefore, the duty cycle correction factor be equal to:
 $20\log(16.72/100) = -15.53\text{dB}$.



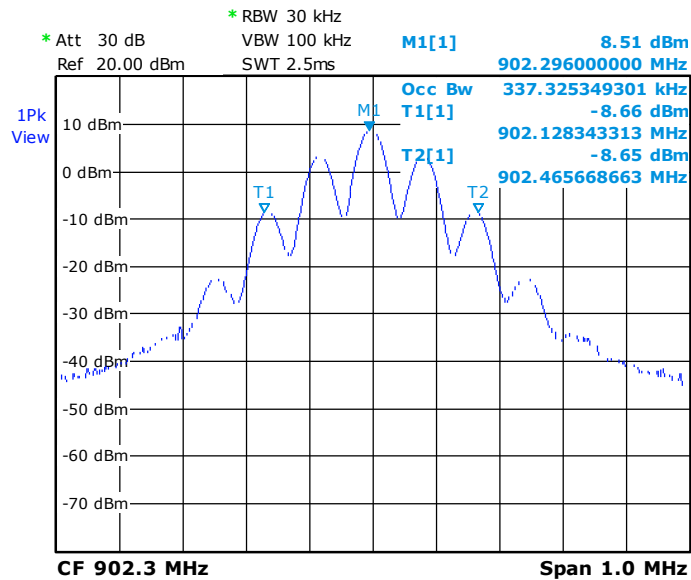
9. OCCUPIED BANDWIDTH

9.1. CLIMATIC CONDITIONS

Date of test : September 11th, 2013
Test performed by : A.MERLIN
Atmospheric pressure : 992mb
Relative humidity : 43%
Ambient temperature : 22°C

9.2. TEST RESULTS

Channel 64 – 902.3MHz



Measured occupied bandwidth is **337.325kHz**

Measurement settings:

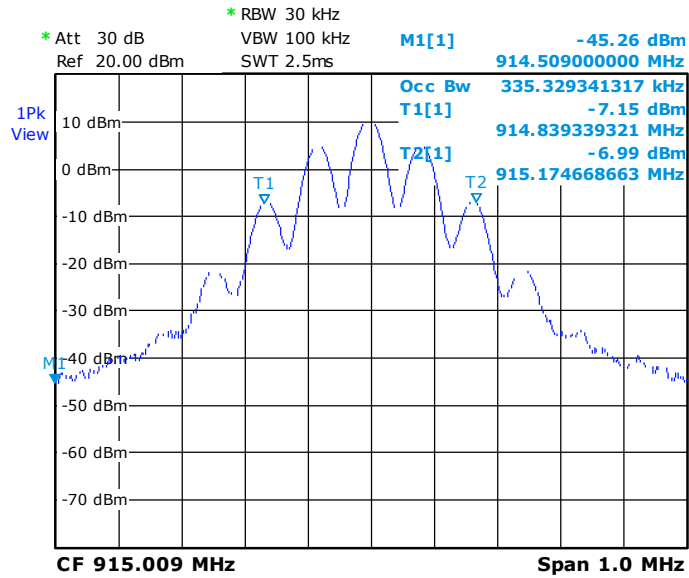
RBW used should not be lower than 1% of the selected span

RBW = 30kHz / Video BW = 100kHz / SPAN = 1MHz

The occupied bandwidth is measured with spectrum analyzer function OBW 99%.



Channel 102 – 915.009MHz



Measured occupied bandwidth is **335.329kHz**

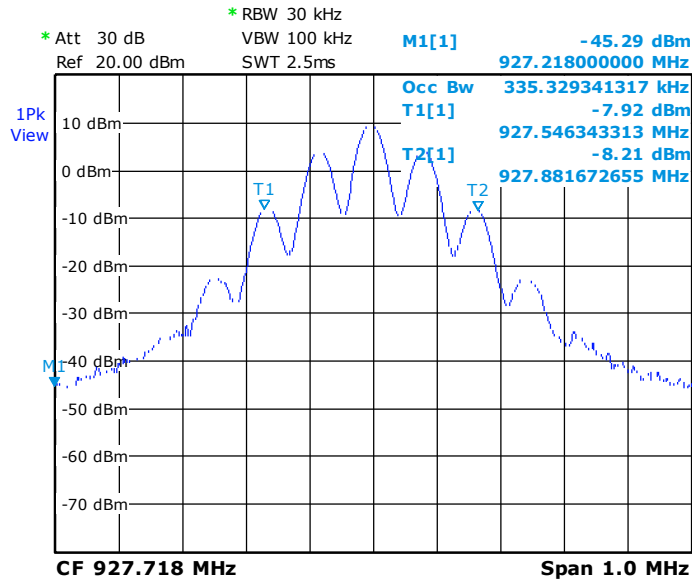
Measurement settings:

RBW used should not be lower than 1% of the selected span

RBW = 30kHz / Video BW = 100kHz / SPAN = 1MHz

The occupied bandwidth is measured with spectrum analyzer function OBW 99%.

Channel 140 – 927.718MHz



Measured occupied bandwidth is **335.329kHz**

Measurement settings:

RBW used should not be lower than 1% of the selected span

RBW = 30kHz / Video BW = 100kHz / SPAN = 1MHz

The occupied bandwidth is measured with spectrum analyzer function OBW 99%.

9.3. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Attenuator 10dB	AEROFLEX	-	A7122206
Cable	-	-	A5329604
Spectrum analyser 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011

9.1. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

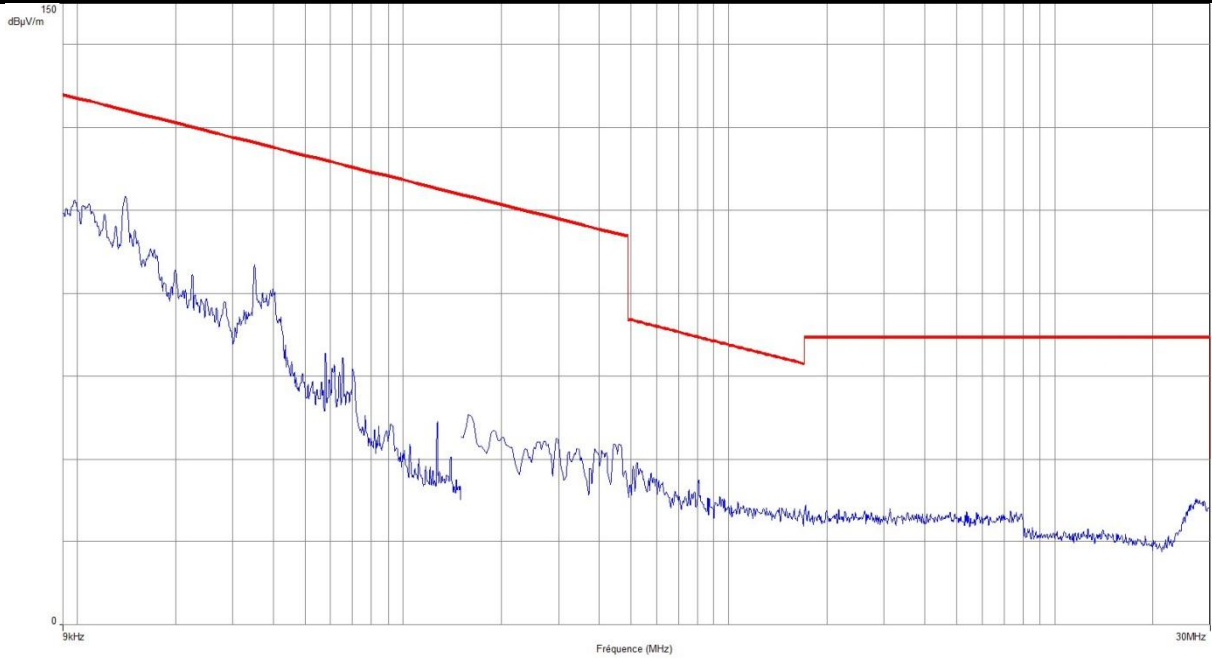
None



10. ANNEX 1 (GRAPHS)

RADIATED EMISSIONS

Graph name :	Emr#1	Test configuration:
Limit :	FCC Part15C	FHSS - XY - (0°)
Class :		
PARAMETERS		
Antenna polarization:	0°	Legend:
Azimuth :	0° - 360°	 Peak Measure
RBW :	300Hz / 10kHz	 QPeak Limit@3m
VBW :	1kHz / 30kHz	
Frequency :	9kHz - 30MHz	



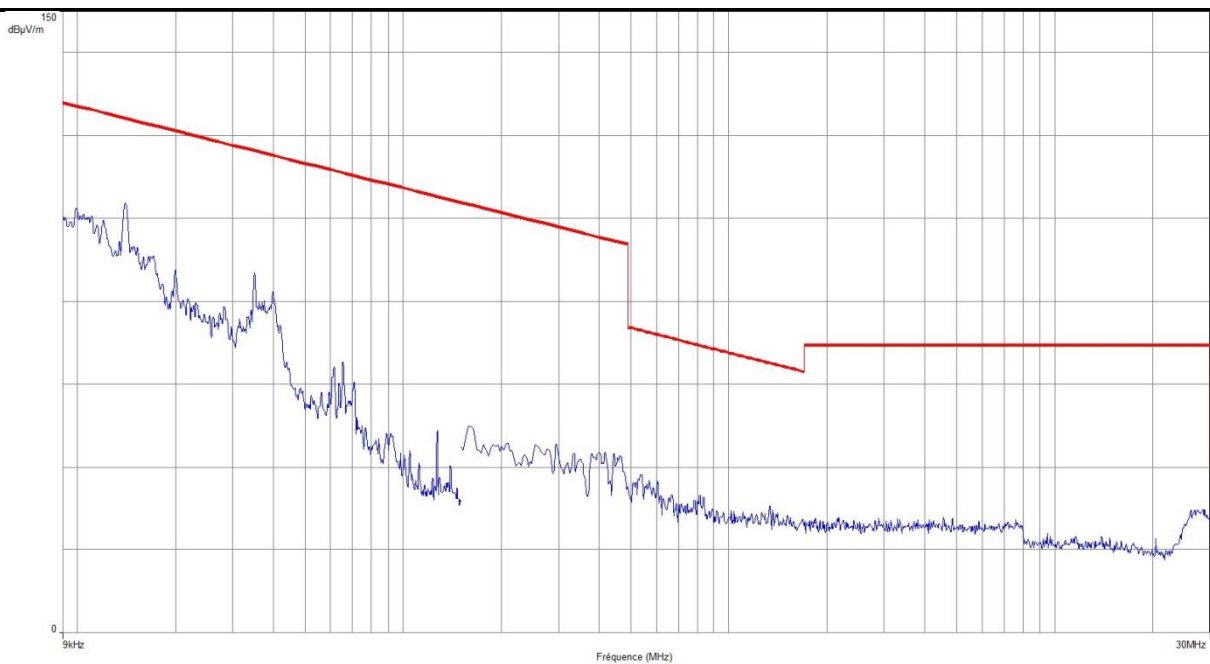


RADIATED EMISSIONS

Graph name :	Emr#2	Test configuration:
Limit :	FCC Part15C	FHSS - Z - (0°)
Class :		

PARAMETERS

Antenna polarization:	0°	Legend:
Azimuth :	0° - 360°	 Peak Measure
RBW :	300Hz / 10kHz	 QPeak Limit@3m
VBW :	1kHz / 30kHz	
Frequency :	9kHz - 30MHz	



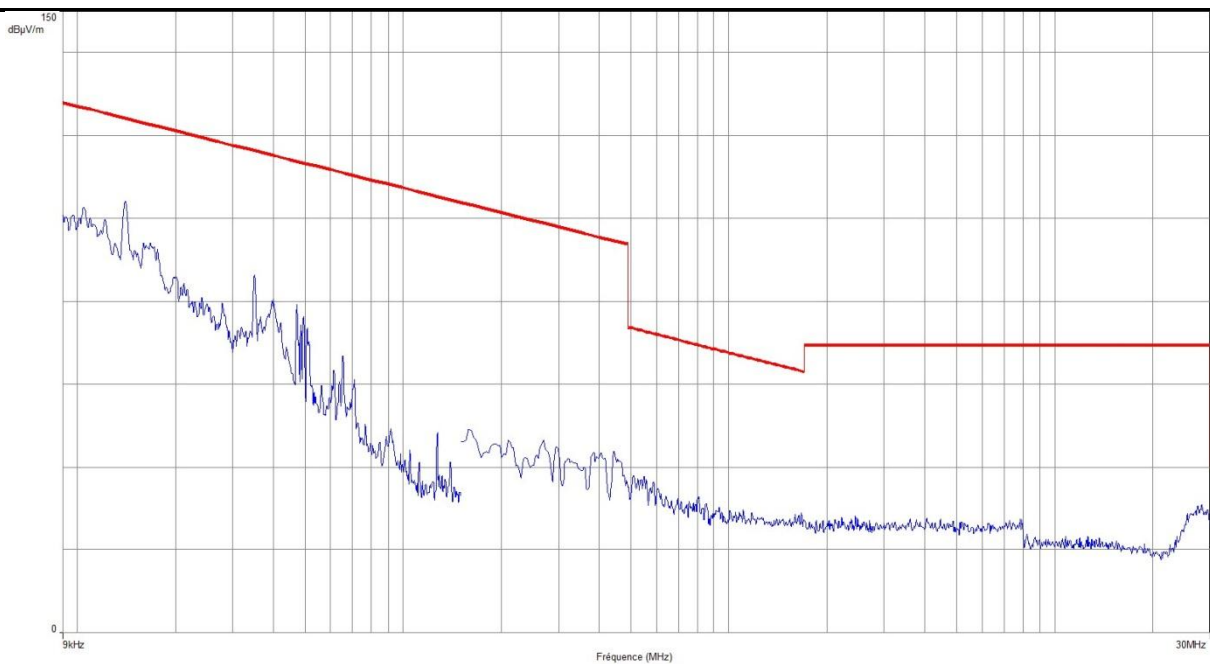


RADIATED EMISSIONS

Graph name :	Emr#3	Test configuration:
Limit :	FCC Part15C	FHSS - XY - (90°)
Class :		

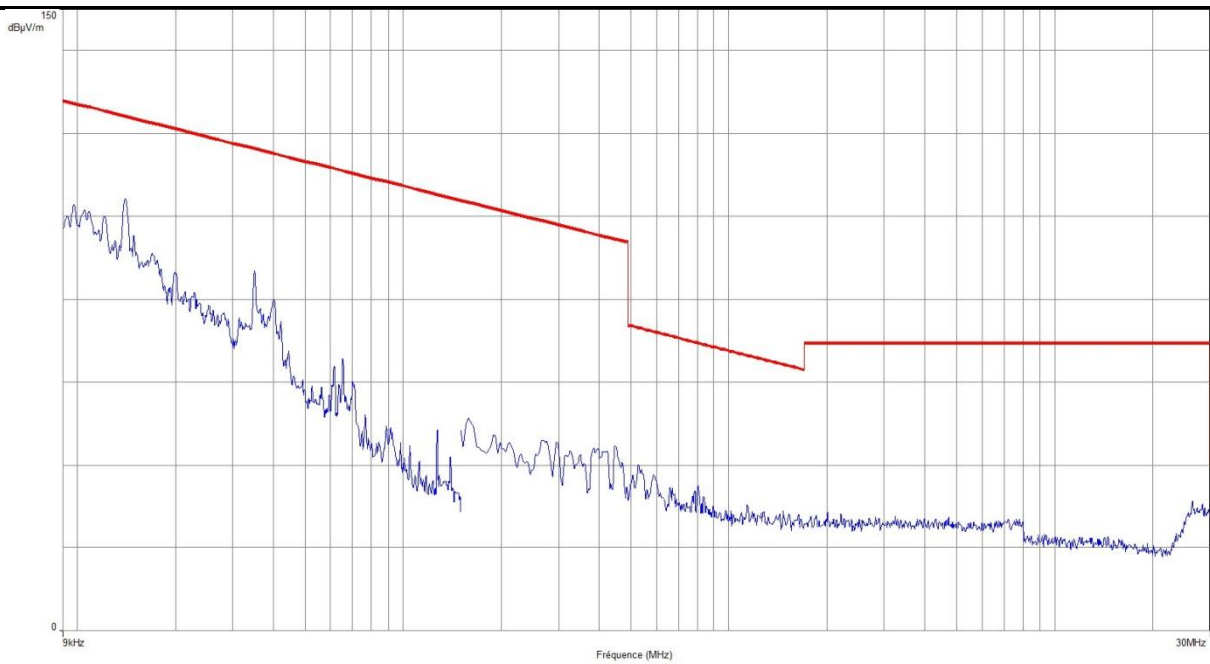
PARAMETERS

Antenna polarization:	90°	Legend:
Azimuth :	0° - 360°	Peak Measure
RBW :	300Hz / 10kHz	QPeak Limit@3m
VBW :	1kHz / 30kHz	
Frequency :	9kHz - 30MHz	



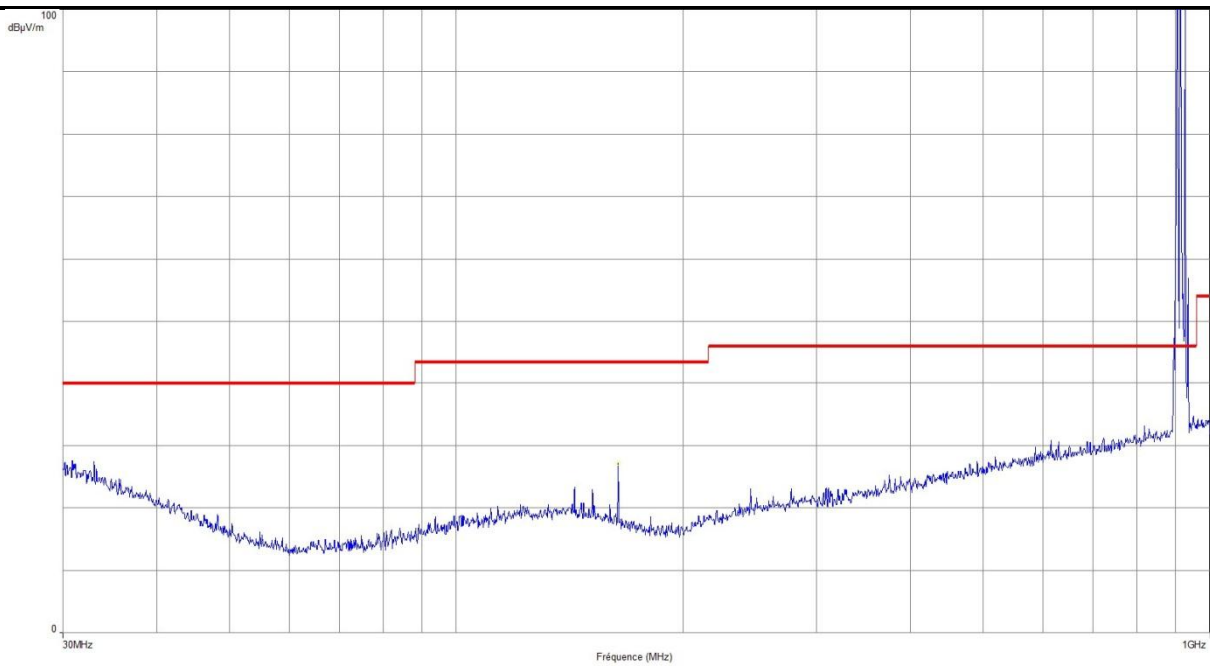


RADIATED EMISSIONS		
Graph name :	Emr#4	Test configuration:
Limit :	FCC Part15C	FHSS - Z - (90°)
Class :		
PARAMETERS		
Antenna polarization:	90°	Legend:
Azimuth :	0° - 360°	Peak Measure
RBW :	300Hz / 10kHz	QPeak Limit@3m
VBW :	1kHz / 30kHz	
Frequency :	9kHz - 30MHz	





RADIATED EMISSIONS		
Graph name :	Emr#5	Test configuration:
Limit :	FCC Part15C	FHSS - XY - (H) - FSL
Class :		
PARAMETERS		
Antenna polarization:	Horizontal	Legend:
Azimuth :	0° - 360°	Peak Measure
RBW :	100kHz	QPeak Limit@3m
VBW :	300kHz	
Frequency :	30MHz - 1GHz	



Frequency (MHz)	Peak (dBµV/m)
163.858	27.23

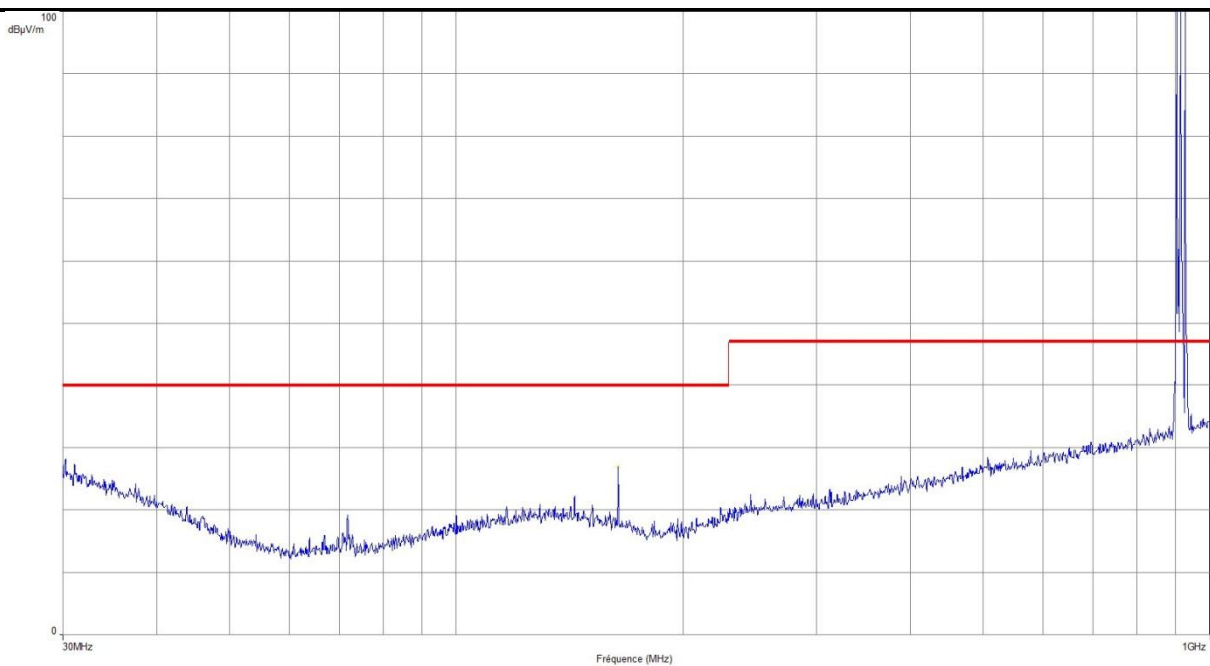


RADIATED EMISSIONS

Graph name :	Emr#6	Test configuration:
Limit :	EN 55022	FHSS - XY - (V) - FSL
Class :	B	

PARAMETERS

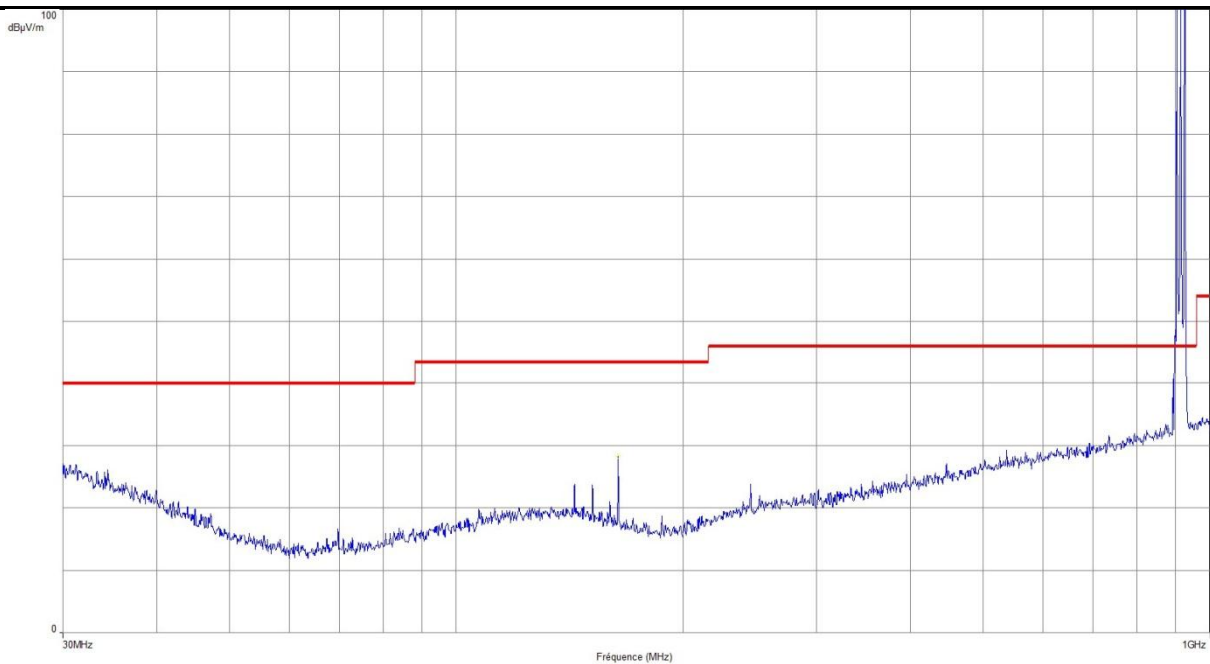
Antenna polarization:	Vertical	Legend:
Azimuth :	0° - 360°	█ Peak Measure
RBW :	100kHz	█ QPeak Limit@3m
VBW :	300kHz	
Frequency :	30MHz - 1GHz	



Frequency (MHz)	Peak (dBµV/m)
163.858	26.97



RADIATED EMISSIONS		
Graph name :	Emr#7	Test configuration:
Limit :	FCC Part15C	FHSS - Z - (H) - FSL
Class :		
PARAMETERS		
Antenna polarization:	Horizontal	Legend:
Azimuth :	0° - 360°	Peak Measure
RBW :	100kHz	QPeak Limit@3m
VBW :	300kHz	
Frequency :	30MHz - 1GHz	



Frequency (MHz)	Peak (dBµV/m)
163.841	28.3

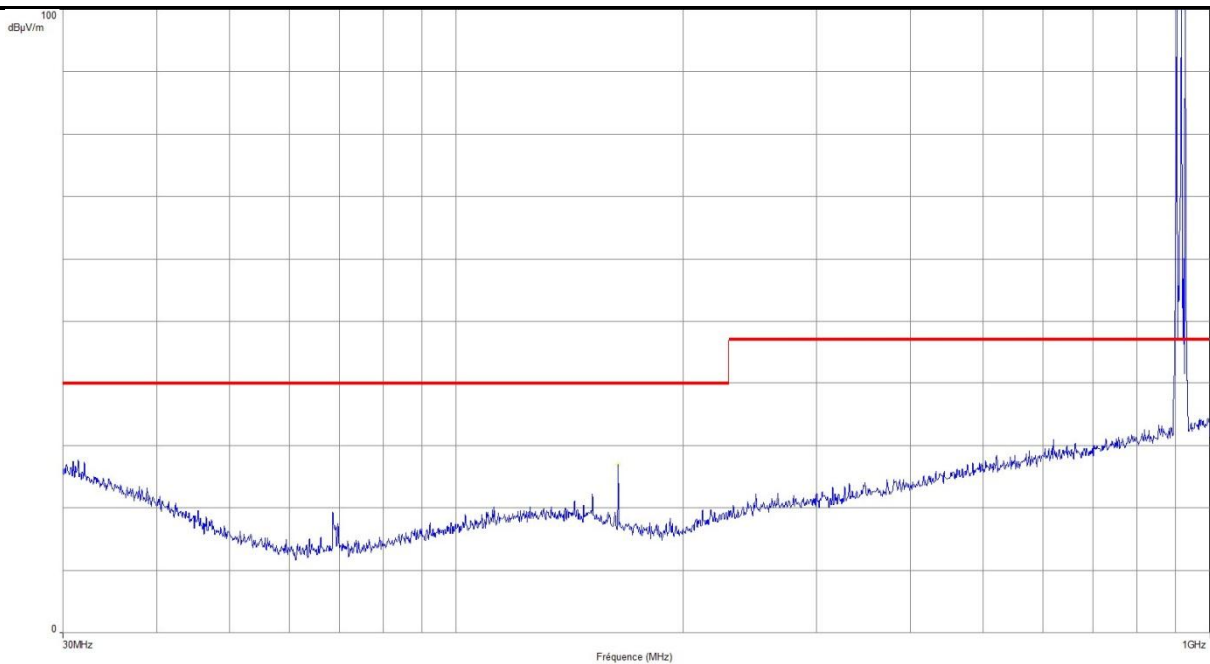


RADIATED EMISSIONS

Graph name :	Emr#8	Test configuration:
Limit :	EN 55022	FHSS - Z - (V) - FSL
Class :	B	

PARAMETERS

Antenna polarization:	Vertical	Legend:
Azimuth :	0° - 360°	█ Peak Measure
RBW :	100kHz	█ QPeak Limit@3m
VBW :	300kHz	
Frequency :	30MHz - 1GHz	



Frequency (MHz)	Peak (dBµV/m)
163.824	27.05



11. UNCERTAINTIES CHART

Type de mesure / Kind of measurement	Incertitude élargie laboratoire / Wide uncertainty laboratory (k=2) ± x	Incertitude limite du CISPR / CISPR uncertainty limit ± y
Mesure des perturbations conduites en tension sur le réseau d'énergie <i>Measurement of conducted disturbances in voltage on the power port</i>	3.57 dB	3.6 dB
Mesure des perturbations conduites en tension sur le réseau de télécommunication <i>Measurement of conducted disturbances in voltage on the telecommunication port.</i>	3.28 dB	A l'étude / Under consid.
Mesure des perturbations discontinues conduites en tension <i>Measurement of discontinuous conducted disturbances in voltage</i>	3.47 dB	3.6 dB
Mesure des perturbations conduites en courant <i>Measurement of conducted disturbances in current</i>	2.90 dB	A l'étude / Under consid.
Mesure du champ électrique rayonné sur le site en espace libre de Moirans <i>Measurement of radiated electric field on the Moirans open area test site</i>	5.07 dB	5.2 dB

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par la norme, la conformité de l'échantillon est établie directement par les niveaux limites applicables. / The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the standard. The conformity of the sample is directly established by the applicable limits values.