



Rapport d'essai / Test report

N° 333785-A1-R3-E

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: PHONAK COMMUNICATION AG
LAENGGASSE 17
3280 MURTEN - SWITZERLAND

Objet / Subject

**: Essais de compatibilité électromagnétique conformément aux normes
FCC CFR 47 Part 95**
*Electromagnetic compatibility tests according to the standards
FCC CFR 47 Part 95*

Matériel testé / Apparatus under test :

- . Produit / Product** : **Solution auditive RF / RF hearing product**
- . Marque / Trade mark** : **PHONAK COMMUNICATION AG**
- . Constructeur / Manufacturer** : **PHONAK COMMUNICATION AG**
- . Type / Model** : **Inspiro Audio Hub**
- . N° de série / serial number** : **TX16_V4.0_02**
- . FCC ID** : **KWC-HUB**
- . IC** : **2262A-HUB**

Date des essais / Test date

: Du 13 au 29 Février 2012 / From February 13th to 29th, 2012

Lieu d'essai / Test location

: LCIE SUD-EST
ZI Centr'Alp – 170 rue de Chatagnon
38430 MOIRANS - FRANCE

Test réalisé par / Test performed by

: Anthony MERLIN

Ce document comporte / Composition of document : 18 pages.

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MOIRANS, LE 16 MARS 2012 / MARCH 16TH, 2012

Approuvé par / Approved by
Jacques LAFQUIN



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1. TEST PROGRAM

Standard:

- FCC Part 95 / Part2
- ANSI C63.4 (2009) and TIA-603-C
- RSS 210 Issue 8 – Dec 2010
- RSS-Gen Issue 3 – Dec 2010

EMISSION TEST	LIMITS	RESULTS (Comments)
Maximum Peak Output Power Part95.639 (e) RSS 210 Annex 4	Limit: 20dBm Conducted or Radiated measurement	PASS
Modulation Characteristics Part2.1046 Part2.1047 (b)	Frequency response of audio circuit: ±25kHz Modulation limiting of audio input circuit	PASS
Unwanted emissions – Occupied bandwidth Part95.635 (c) and 95.633 (d) (2) Part2.1049 RSS 210 Annex 4	FCC: 25kHz / 30dBc and 43+10log(Carrier power W) IC: Mask C	PASS
Unwanted emissions – Spurious emissions Radiated Part95.635 (c) Part2.1051 RSS 210 Annex 4	FCC: 25kHz / 30dBc and 43+10log(Carrier power W) IC: Mask C	See test report: 333785-A1-R1-E
Frequency Stability Part95.629 Part2.1055	Limit: 50ppm	PASS

***§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.

2. SYSTEM TEST CONFIGURATION

2.1. JUSTIFICATION

The system was configured for testing in a typical fashion (as a customer would normally use it).

2.2. HARDWARE IDENTIFICATION

• Equipment under test (EUT):

INSPIRO Audio Hub

Serial number: TX16_V4.0_02

• Power supply n°1:

- AC / DC Adaptor: Goldem Profit Electronics Ltd, model GPE060A-050100-Z, Sn: A/12297EA
- Rating: 100-240VAC 0.2A, 5VDC 1A.
- Frequency: 50/60Hz

During all the tests, EUT is supplied by this AC/DC adaptor.

• Power supply n°2:

- Mini USB port: 5VDC

During all the tests, EUT is supplied by USB port of laptop.

• Input/output:

- 1 x Power supply port, mini USB
- 2 x Audio IN, jack
- 1 x Mini USB female, for INSPIRO

• Auxiliaries used for testing:

- 1 x INSPIRO, PHONAK, Sn: S0948NY4YF, for charging.
- 1 x Laptop LENOVO with its AC/DC adaptor.

• I/O cables used for testing:

- AC/DC adaptor cable, mini USB, shielded, length: 2m.
- 2 x Audio jack cables, shielded, length: 2m

• Equipment information:

- | | | |
|------------------------|--|--|
| - Type: | ☒ Radio microphone | ☐ In ear monitoring |
| | ☐ Tour guide system | ☐ other: |
| - Frequency band: | [216-217] MHz | |
| - Channel bandwidth: | 25kHz | |
| - Channel tested: | 216.0125MHz / 216.5125MHz / 216.9875MHz | |
| - Modulation type: | FM | |
| - RF mode: | ☒ TX | ☐ RX |
| - Antenna type: | Audio IN cable used | |
| - Antenna connector: | ☐ Permanent external | ☐ Permanent internal |
| | ☒ None | ☒ Temporary (only for tests) |
| - Normal power source: | 5VDC Mini USB supplied by AC/DC adaptor | |





2.3. EUT CONFIGURATION

Following configurations are set to performed different tests:

- Permanent emission with modulation on highest, middle and lowest channel used.
- Permanent standby mode

Software used: Phonak AudioHub RF Test Interface v1.1 Preliminary

Inspiro Audio Hub can charge INSPIRO (itself is set OFF) and emit simultaneously, tests results presented in this test report is the worst case.

2.4. EQUIPMENT MODIFICATIONS

None

2.5. SPECIAL ACCESSORIES

None

**3. MAXIMUM TRANSMITTER POWER****3.1. TEST CONDITIONS**

Date of test : February 13th, 2012
Test performed by : A.MERLIN
Atmospheric pressure : 1002hPa
Relative humidity : 16%
Ambient temperature : 20°C

3.2. SETUP

Radiated measurement: Qualification measurements on the 10 meters open site

The setup is 0.8m above the ground reference plane on an insulating support. Distance between measuring antenna and the EUT is 10 meters. The measuring antenna is in vertical and then in horizontal polarization. Measurement bandwidth was 30kHz RBW and 100kHz VBW. 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. The substitution antenna replaces the equipment under test for Effective Radiated Power (ERP) measurement. Power is measured for the same level of radiated field strength obtained on the measuring antenna.

3.3. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N°LCIE
Attenuator 10dB	-	-	A7122126
Cable SMA/SMA	-	-	A5329041
Receiver 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Attenuator 10dB	-	-	A7122126
Cable SMA/SMA	-	-	A5329041
Cable SMA/SMA	-	-	A5329373
Cable	-	-	A5329545

3.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

3.1. TEST RESULTS

Channel Frequency (MHz)	E.R.P Measured (dBm)	E.R.P Limit (dBm)	PASS / FAIL
216.0125	6.9	20.0	P
216.4875	6.8	20.0	P
216.9875	6.9	20.0	P

**4. MODULATION CHARACTERISTICS****4.1. TEST CONDITIONS**

Date of test : February 14th, 2012
Test performed by : A.MERLIN
Atmospheric pressure : 1004hPa
Relative humidity : 21%
Ambient temperature : 21°C

4.2. FREQUENCY RESPONSE OF AUDIO CIRCUIT - SETUP

An audio signal at 1kHz was adjusted for approximately 100% rated FM deviation. While maintaining the same amplitude (100mV), the frequency is varied from 0.2kHz to 9kHz. The FM deviation is measured and recorded at several frequencies in order to determine the frequency response.

4.1. LIMIT

Limit: $\pm 25\text{kHz}$

4.2. MODULATION LIMITIN OF AUDIO INPUT CIRCUIT - SETUP

This test carried out using a 1kHz tone adjusted to give approximately 100% modulation, with a test signal level being 100mV. A series of test voltages were used at four different frequencies in order to assess the limiting characteristics of the modulation input circuitry.

4.3. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Attenuator 10dB	-	-	A7122126
Cable SMA/SMA	-	-	A5329041
Wareform Generator 15MHz	HEWLETT PACKARD	33120A	A5442026
Receiver 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020

4.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

**4.5. FREQUENCY RESPONSE OF AUDIO CIRCUIT - RESULTS**

Audio (kHz)	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.5	2.0	2.5
FM Deviation ($\pm$ kHz)	± 3.6	± 3.8	± 3.3	± 3.3	± 3.1	± 3.0	± 2.9	± 2.8	± 2.5	± 2.8	± 2.7	± 2.3

Audio (kHz)	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	9.0
FM Deviation ($\pm$ kHz)	± 3.2	± 3.7	± 4.2	± 4.7	± 5.2	± 5.7	± 6.1	± 5.8	± 0.8	± 0.7	± 0.8	± 0.8

4.6. MODULATION LIMITIN OF AUDIO INPUT CIRCUIT - RESULTS

Audio Frequency Signal: 200Hz										
Audio Signal Level (mV)	50	60	80	100	120	140	160	180	200	
FM Deviation ($\pm$ kHz)	± 2.6	± 3.1	± 3.9	± 4.2	± 3.9	± 4.0	± 4.1	± 4.0	± 4.0	

Audio Frequency Signal: 1000Hz										
Audio Signal Level (mV)	50	60	80	100	120	140	160	180	200	
FM Deviation ($\pm$ kHz)	± 2.0	± 2.0	± 2.9	± 3.2	± 3.2	± 3.2	± 3.2	± 3.2	± 3.2	± 2.9

Audio Frequency Signal: 3500Hz										
Audio Signal Level (mV)	50	60	80	100	120	140	160	180	200	
FM Deviation ($\pm$ kHz)	± 3.5	± 3.5	± 3.5	± 3.5	± 3.5	± 3.5	± 3.5	± 3.5	± 3.5	± 3.5

Audio Frequency Signal: 7000Hz										
Audio Signal Level (mV)	50	60	80	100	120	140	160	180	200	
FM Deviation ($\pm$ kHz)	± 0.8	± 0.8	± 0.8	± 0.8	± 0.8	± 0.8	± 0.8	± 0.8	± 0.8	± 0.8

Result: PASS

**5. OCCUPIED BANDWIDTH AND UNWANTED EMISSIONS****5.1. TEST CONDITIONS**

Date of test : February 14th, 2012
Test performed by : A.MERLIN
Atmospheric pressure : 1004hPa
Relative humidity : 21%
Ambient temperature : 21°C

5.1. LIMIT – PART95**FCC CFR47 Part 95.633 Emission bandwidth - LPRS equipment:**

- (d) For transmitters in the LPRS:
(2) The channel bandwidth for standard band frequencies is 25 kHz.

FCC CFR47 Part 95.635 Unwanted Radiation - LPRS equipment:

- (c) For transmitters designed to operate in the LPRS, emissions shall be attenuated in accordance with the following:
(1) Emissions for LPRS transmitters operating on standard band channels (25 kHz) shall be attenuated below the unmodulated carrier in accordance with the following:
(i) Emissions 12.5 kHz to 22.5 kHz away from the channel center frequency: at least 30 dB; and
(ii) Emissions more than 22.5 kHz away from the channel center frequency: at least $43 + 10\log(\text{carrier power in watts})$ dB.

5.2. LIMIT – RSS 210

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are equal to 0.5% of the total mean power radiated by a given emission.

Mask C

- (a) At least 30 dB for emissions 12.5 kHz to 22.5 kHz removed from the channel centre frequency
(b) At least $55 + 10 \log_{10}(P)$ dB or to the general field strength limits listed in RSS-Gen, whichever is less stringent, for emissions more than 22.5 kHz removed from the channel centre frequency.

**5.3. 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 300Hz RBW and 1kHz VBW for SPAN 50kHz.

The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

Spurious on conducted measurement:

For unwanted emissions from 9k to 150kHz, using 300Hz RBW and 1kHz VBW

For unwanted emissions from 150k to 30MHz, using 10kHz RBW and 30kHz VBW

For unwanted emissions from 30MHz to 1GHz, using 100kHz RBW and 300kHz VBW

For unwanted emissions from 1GHz to 6GHz, using 1MHz RBW and 3MHz VBW

5.4. TEST EQUIPMENT LIST

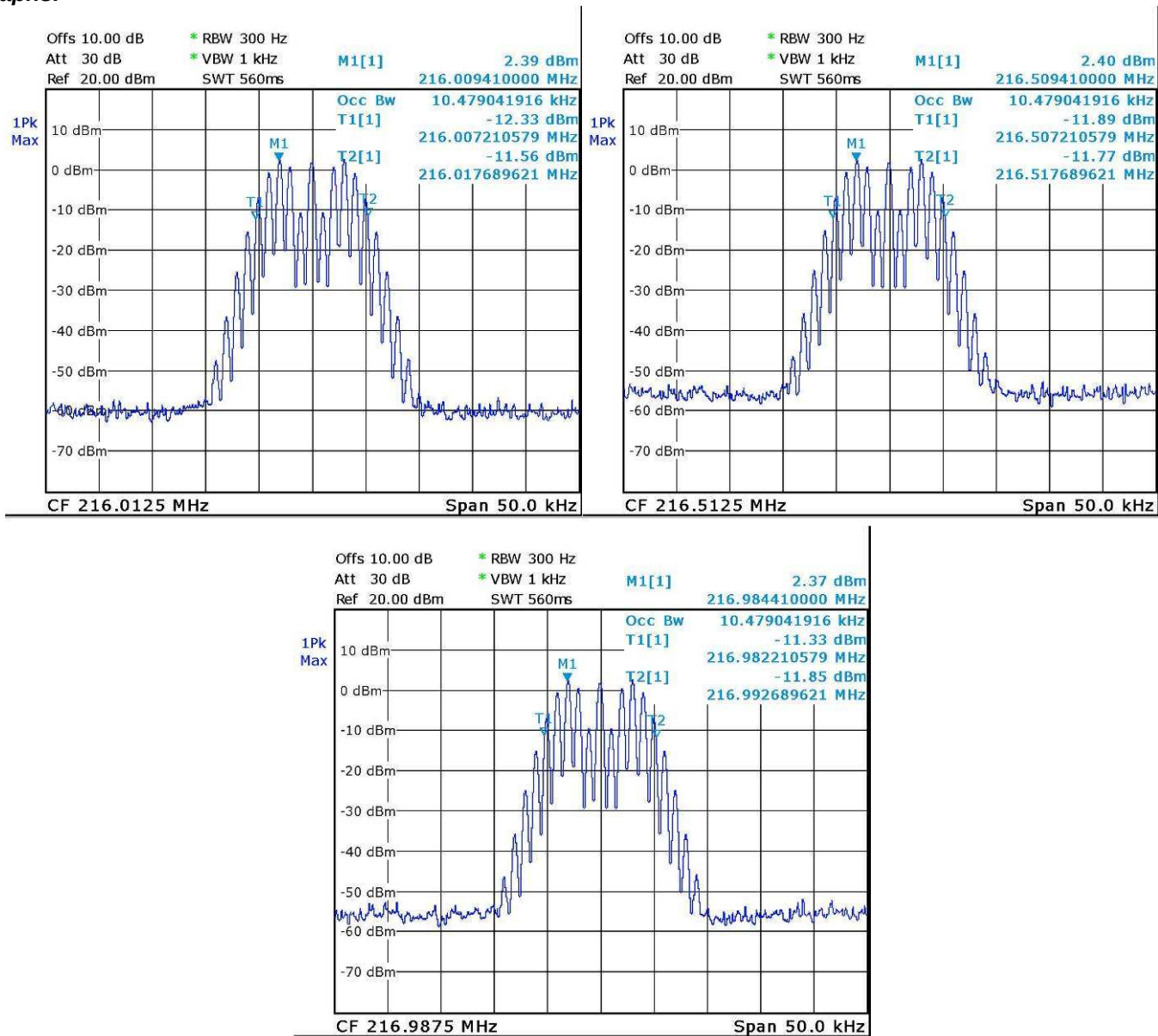
DESCRIPTION	MANUFACTURER	MODEL	N°LCIE
Attenuator 10dB	-	-	A7122126
Cable SMA/SMA	-	-	A5329041
Waveform Generator 15MHz	HEWLETT PACKARD	33120A	A5442026
Receiver 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020

5.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

5.6. RESULTS – OCCUPIED BANDWIDTH

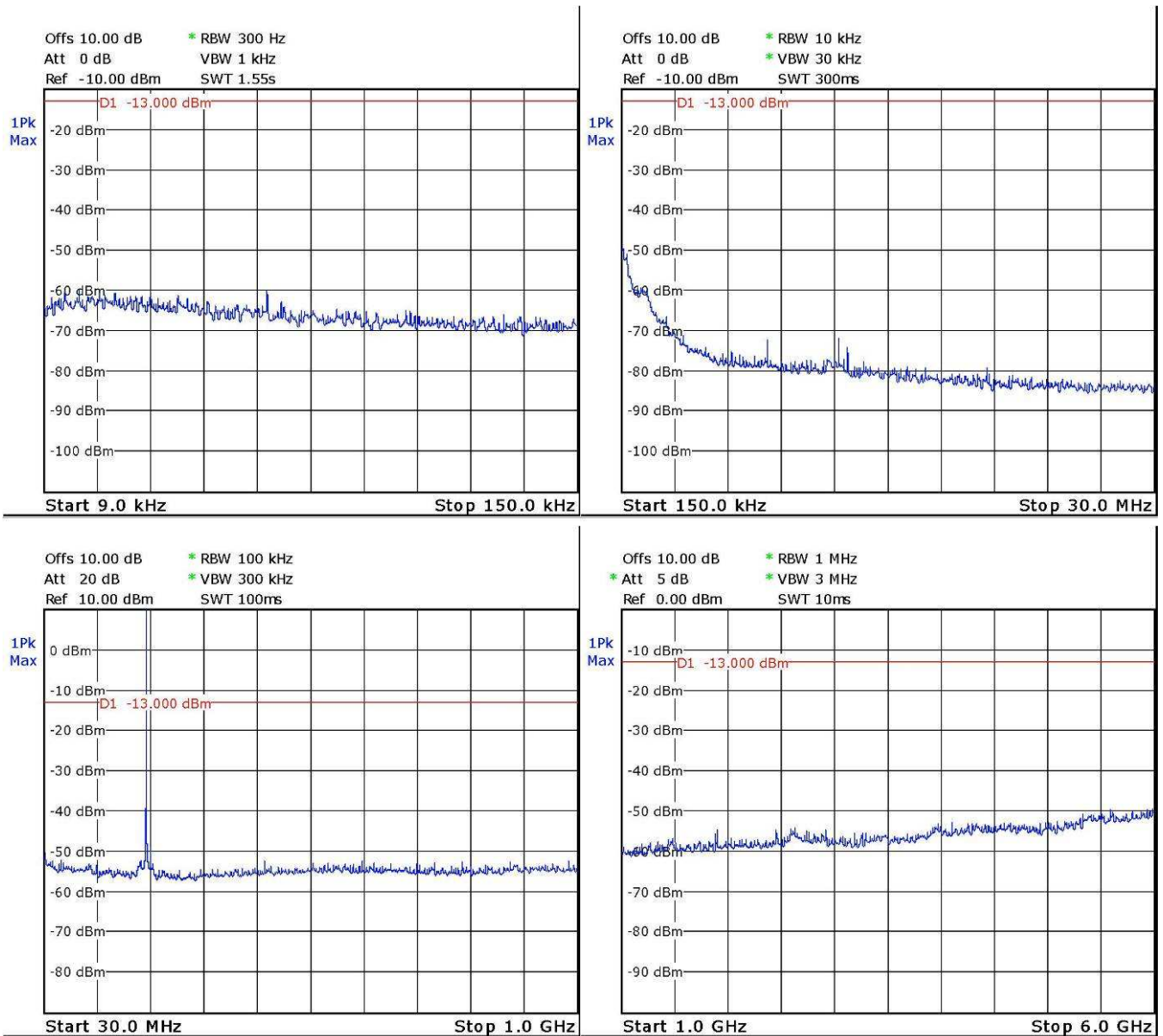
Graphs:



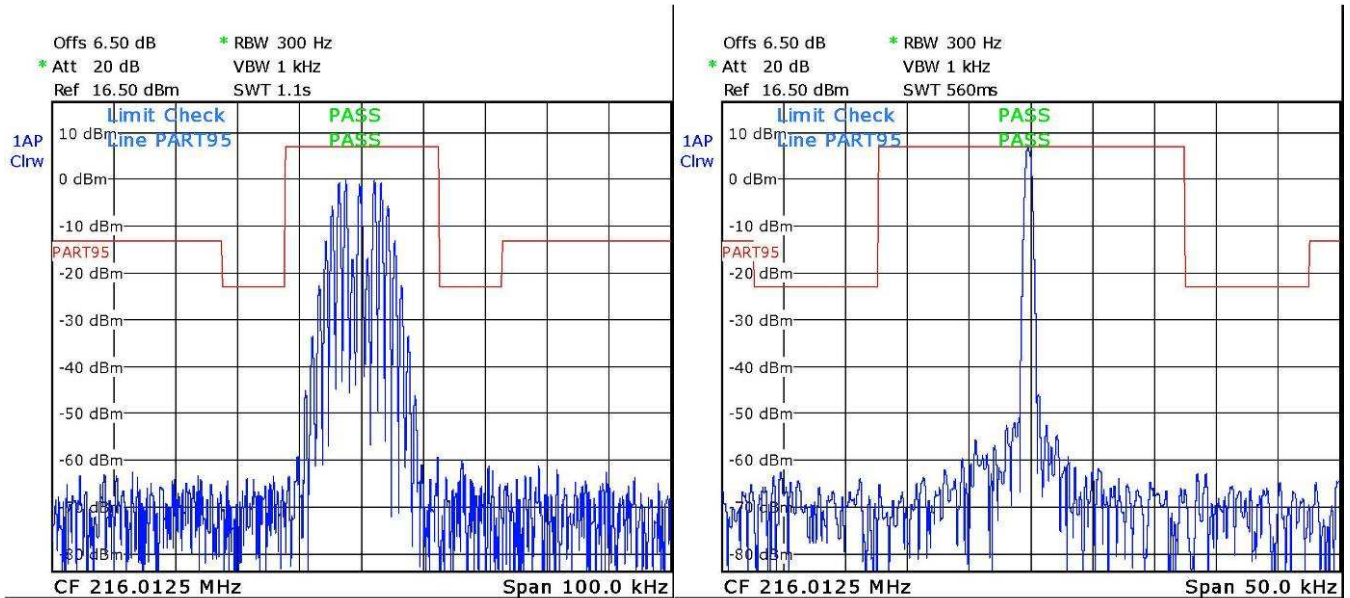
Channel (MHz)	216.0125	216.5125	216.9875
Occupied Bandwidth (kHz)	10.479	10.479	10.479

5.1. RESULTS – UNWANTED EMISSIONS - MASK

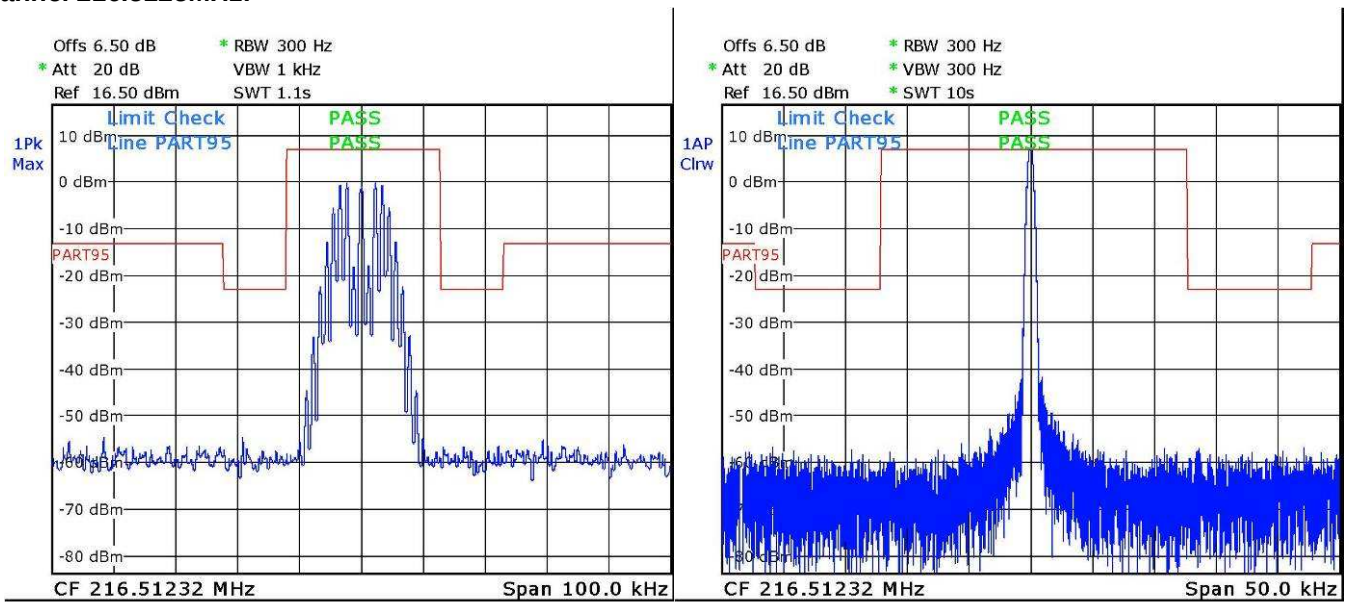
Graphs:



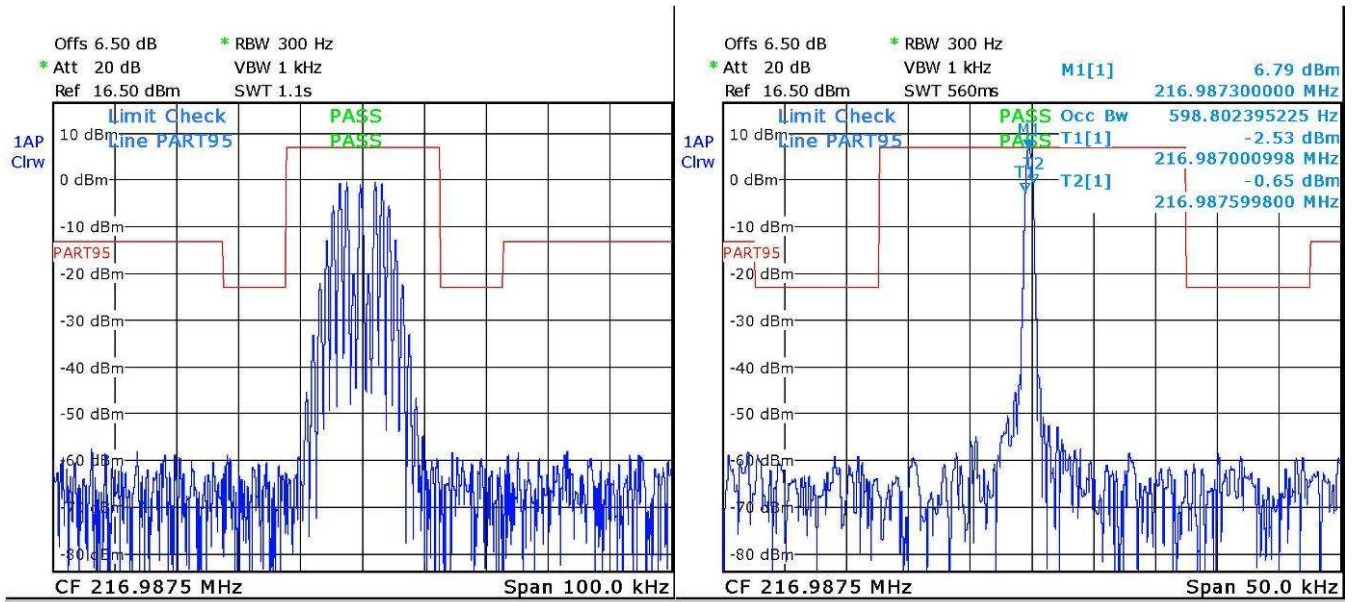
Channel 216.0125MHz:



Channel 216.5125MHz:



Channel 216.9875MHz:



**6. FREQUENCY STABILITY****6.1. TEST CONDITIONS**

Date of test : February 16th, 2012
Test performed by : A.MERLIN

6.2. SETUP

The temperature is varied from -30°C to +50°C at the nominal power voltage and the primary power voltage is varied from 85% to 115% of the rated supply voltage at 20°C.

Temperature has been set at +20°C, -20°C and +50°C.

Frequency of carrier: 216.5125 MHz

The equipment (RF box) is set in a climatic chamber. Measure is performed on one channel of RF module.

6.1. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Attenuator 10dB	-	-	A7122126
Cable SMA/SMA	-	-	A5329373
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117
Multimeter	FLUKE	289	A1240230
Power supply DC 300W / 150V-6A	SODILEC	7SDLIN/GB AUTO 300	A7043036
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019
Data Logger	AGILENT	34970A	A6440083
Data Logger card	AGILENT	34970A	A6449036

6.2. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

**6.1. LIMIT – Part95****FCC CFR47 Part 95.629 LPRS equipment:**

(a) LPRS transmitters may operate on any frequency listed in paragraphs (b), (c), and (d) of this section. Channels 19, 20, 50, and 151–160 are available exclusively for law enforcement tracking purposes. AMTS transmissions are limited to the 216.750–217.000 MHz band for low power point-to-point network control communications by AMTS coast stations. Other AMTS transmissions in the 216–217 MHz band are prohibited.

(b) Standard band channels.

(1) The following table indicates standard band frequencies. The channel bandwidth is 25 kHz.

Channel No.	Center frequency (MHz)	Channel No.	Center frequency (MHz)
1	216.0125	21	216.5125
2	216.0375	22	216.5375
3	216.0625	23	216.5625
4	216.0875	24	216.5875
5	216.1125	25	216.6125
6	216.1375	26	216.6375
7	216.1625	27	216.6625
8	216.1875	28	216.6875
9	216.2125	29	216.7125
10	216.2375	30	216.7375
11	216.2625	31	216.7625
12	216.2875	32	216.7875
13	216.3125	33	216.8125
14	216.3375	34	216.8375
15	216.3625	35	216.8625
16	216.3875	36	216.8875
17	216.4125	37	216.9125
18	216.4375	38	216.9375
19	216.4625	39	216.9625
20	216.4875	40	216.9875

(2) LPRS transmitters operating on standard band channels must be maintained within a frequency stability of 50 parts per million.

6.2. LIMIT – RSS 210**Industry Canada RSS 210 – Annex 4 §A4.3:**

LPRS transmitters operating on standard band channels must be maintained within a frequency stability of 50 parts per million.



6.1. RESULTS

Power supply: AC/DC adaptor

Temperature	-30°C	-20°C	20°C	+50°C
Voltage				
Mains voltage: 110V/60Hz				
Frequency Drift (MHz)	+ 0.000033	+ 0.000023	REF	+ 0.000037
Carrier level (dBc)	+ 0.7	+ 0.6	REF	- 0.9
Mains voltage: 93,5V/60Hz				
Frequency Drift (MHz)	+ 0.000033	- 0.000364	- 0.000002	+ 0.000038
Carrier level (dBc)	+ 0.6	+ 0.5	- 0.2	- 0.9
Mains voltage: 126V/60Hz				
Frequency Drift (MHz)	+ 0.000038	+ 0.000021	- 0.000004	+ 0.000035
Carrier level (dBc)	+ 0.7	+ 0.6	+ 0.0	- 0.6

Power supply: USB Laptop

Temperature	-30°C	-20°C	20°C	+50°C
Voltage				
Mains voltage: 5VDC				
Frequency Drift (MHz)	+ 0.000050	+ 0.000030	REF	+ 0.000111
Carrier level (dBc)	- 0.10	- 0.20	REF	- 0.30
Mains voltage: 4VDC				
Frequency Drift (MHz)	+ 0.000055	+ 0.000032	+ 0.000000	+ 0.000118
Carrier level (dBc)	- 0.20	- 0.60	- 0.30	- 0.50
Mains voltage: 6VDC				
Frequency Drift (MHz)	+ 0.000057	+ 0.000032	+ 0.000000	+ 0.000109
Carrier level (dBc)	- 0.10	- 0.20	+ 0.00	- 0.20

Frequency drift measured is **364 Hz** when the temperature is varied from -30°C to +50°C and voltage is varied from 120V/60Hz $\pm$ 15%.

Limit: 10800Hz

Result: PASS

**7. 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.