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LCIE

Rapport d'essai / Test report

JDE : 60046327 N° 200605-3107CR-R1-E

DELIVRE A / ISSUED TO : TAGSYS S.A.
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13821 La PENNE SUR HUVEAUNE
FRANCE

Objet / Subject : Essais de compatibilité électromagnétique conformément aux normes FCC CFR 47 Part 15, Subpart C, 15.247.
Electromagnetic compatibility tests according to the standards FCC CFR 47 Part 15, Subpart , 15.247 (Frequency Hopping System).

Matériel testé / Apparatus under test :

- Produit / Product : Lecteur TAG RFID / *RFID tag Reader*
- Marque / Trade mark : TAGSYS
- Constructeur / Manufacturer : TAGSYS
- Type / Model : AK TAG READER
- N° de série / serial number : IN21000157
- FCC ID : QHKAKTAGREADER

Date des essais / Test date : 12 et 16 mai 2006 / *May 12th and 16th, 2006*

Lieu d'essai / Test location : LCIE
ZI des Blanchisseries
38500 VOIRON - France

Test réalisé par / Test performed by : Laurent CHAPUS

Ce document comporte /Composition of document : 20 pages.

VOIRON, LE 7 JUILLET 2006 / JULY 7TH, 2006

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L C I E

FCC ID: QHKAKTAGREADER

1. Summary of Test Results

TEST	Paragraph number	Spec.	RESULTS (comments)
Power line conducted emissions	15.207 (a)	Table 15.207 (a)	PASS See page 4 to 7
Channel separation	15.247 (a)(1)	Greater of 25 kHz or 20dB bandwidth	PASS See page 8 to 9
Time of Occupancy	15.247 (a)(1)(ii)	< 0.4s in 20s	PASS See page 10
20dB Occupied bandwidth	15.247 (a)(1)	500kHz	PASS See page 11 to 12
Peak Power Output	15.247 (b)	1 Watt (30dBm)	PASS (*) See page 13 to 16
Spurious emissions (Antenna conducted)	15.247 (c)	- 20dBc	PASS See page 17 to 18
Spurious emissions (Radiated)	15.247 (c)	Table 15.209 (a)	PASS See page 19 to 21

(*): output power at antenna port limited by software at 28dBm



FCC ID: QHKAKTAGREADER

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):

AK TAG READER

Sn: IN21000157

* Configuration:

- Dimensions : 250x300x60mm
- Frequency band : from 902.75 to 927.27MHz
- Number of channel : 50
- Channel spacing : 500kHz
- E/S : DC IN (9V-12VDC, 1.6A)
RS232
- Reader module : SIRIT infinity 210
- Rated output power : 29dBm (Software controlled)

The output power is limited at 28dBm by software in order to reach the MPE limit (RF exposure) at 20cm.

- Firmware module : .06A

2.3. AUXILIARIES

The FCC IDs for all equipment, more description of all cables used in the tested system are :

Trade Mark - Model Number (Serial number)	FCC ID	Description	Cable description
AK TAG READER (sn: IN21000157)	QHKAKTAGREADER	RFID tag reader	Power cord unshielded, RS232 cable shielded.
PHIHONG Model: PSA21R-120 (sn: P51401856A7)	none	AC/DC Power supply Out 12Vdc regulated /1.67A	DC power cord unshielded.
Hewlett Packard VECTRA VL420 DT pn: P5755-60201 (sn: FR14122957)	DOC	Personal computer	Power cord unshielded. All other cable shielded.
Hewlett Packard pn:D2846 (sn: JP74001000)	DOC	Monitor	Power cord unshielded. Video cable shielded
Hewlett Packard pn:C4736A (sn: LZA4000061)	DZL211092	MOUSE	PS2 cable
Hewlett Packard pn:C4774 (sn: M990814763)	GYUR73SK	Keyboard	PS2 cable
TAGSYS	none	TAG	

* : Equipment under test.

2.4. EQUIPMENT MODIFICATIONS

None.

2.5. EUT EXERCISE SOFTWARE

The EUT exercise program used during radiated and conducted testing was designed to exercise the equipment under test in a manner similar to a typical use. (Continually reading of tag ID, frequency hopping is enabled with the AK EXPLORER.EXE software). If needed, the EUT was transmitting continuous and hopping function is disabled, using the TABTEST.EXE program.



FCC ID: QHKAKTAGREADER

3. Powerline Conducted Emission Test

The product has been tested according to ANSI C63.4-(2003) and FCC Part 15 subpart C.

The product has been tested with 110V/60Hz power line voltage and compared to the FCC Part 15 subpart C §15.207 limits. Measurement bandwidth was 9kHz from 150 kHz to 30 MHz.

Measurement was initially made with an HP-8591EM Spectrum Analyzer in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement with the Rohde & Schwarz ESH3 receiver 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.

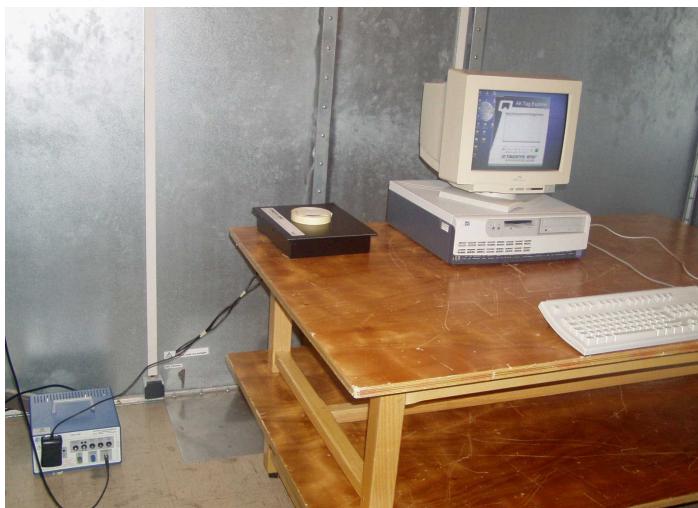
The Peak data are shown on the following plots. Quasi-Peak and Average measurements are detailed in a table with frequencies and levels measured.

Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on the following page.

3.1. SET-UP

The EUT is placed on a table at 0.8m height. The cable of the power adapter has been shorted to 1meter length. The EUT (AC/DC power adapter) is powered trough the LISN (measure). The peripheral equipment (PC) is connected to a separate LISN.

- EUT is ON
- The tag ID is being read continually (frequency hopping in enable).



Conducted emission test



FCC ID: QHKAKTAGREADER

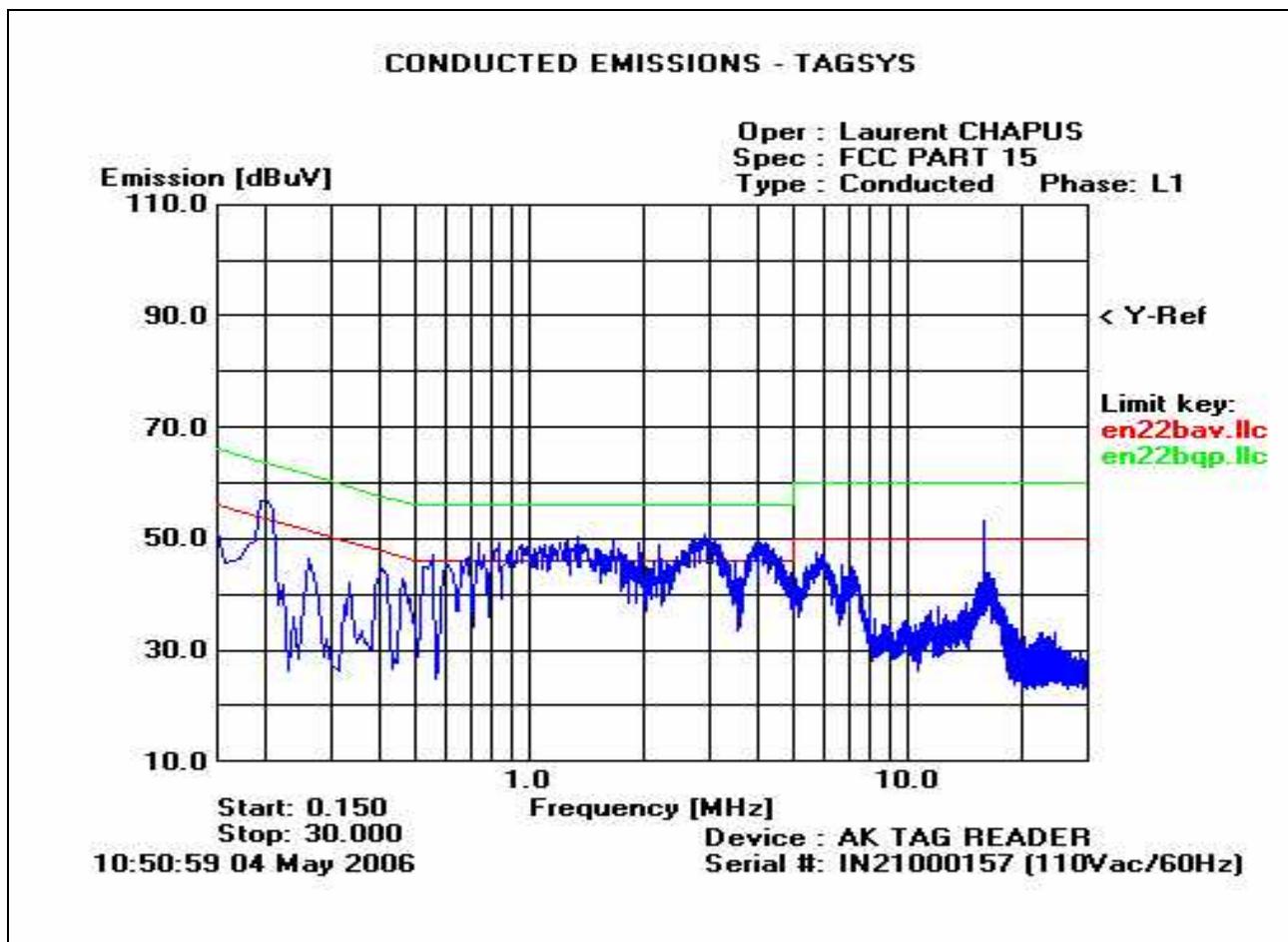
3.2. TEST EQUIPMENT

Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Test receiver	Rohde&Schwarz	ESH3	872079/117
Transient Limiter	HP	11947A	3107A01596
LISN(auxiliary)	EMCO	3820/2	9309-2122
LISN(measure)	Telemeter	TGmbH NNB 2/16	0001300
50Ω / 50µH	Electronis		
Faraday room	Rayproof		4854

3.3. TEST SEQUENCE AND RESULTS

Measures are performed on Line 1 and on the Neutral of the power supply.

3.3.1. Line (L1) conducted emission data



(RBW = 9kHz, VBW = 30kHz)

Marker	Freq. [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.203	56.74	55.1*	52.2*	53.50
2	0.550	48.40	45.06	34.41	46.00
3	0.960	50.18	44.91	30.22	46.00
4	1.150	49.39	43.93	28.32	46.00
5	1.360	51.56	46.17	31.30	46.00
6	1.680	50.06	45.07	31.06	46.00
7	1.960	46.38	41.09	24.01	46.00
8	2.200	48.14	42.11	26.02	46.00



FCC ID: QHKAKTAGREADER

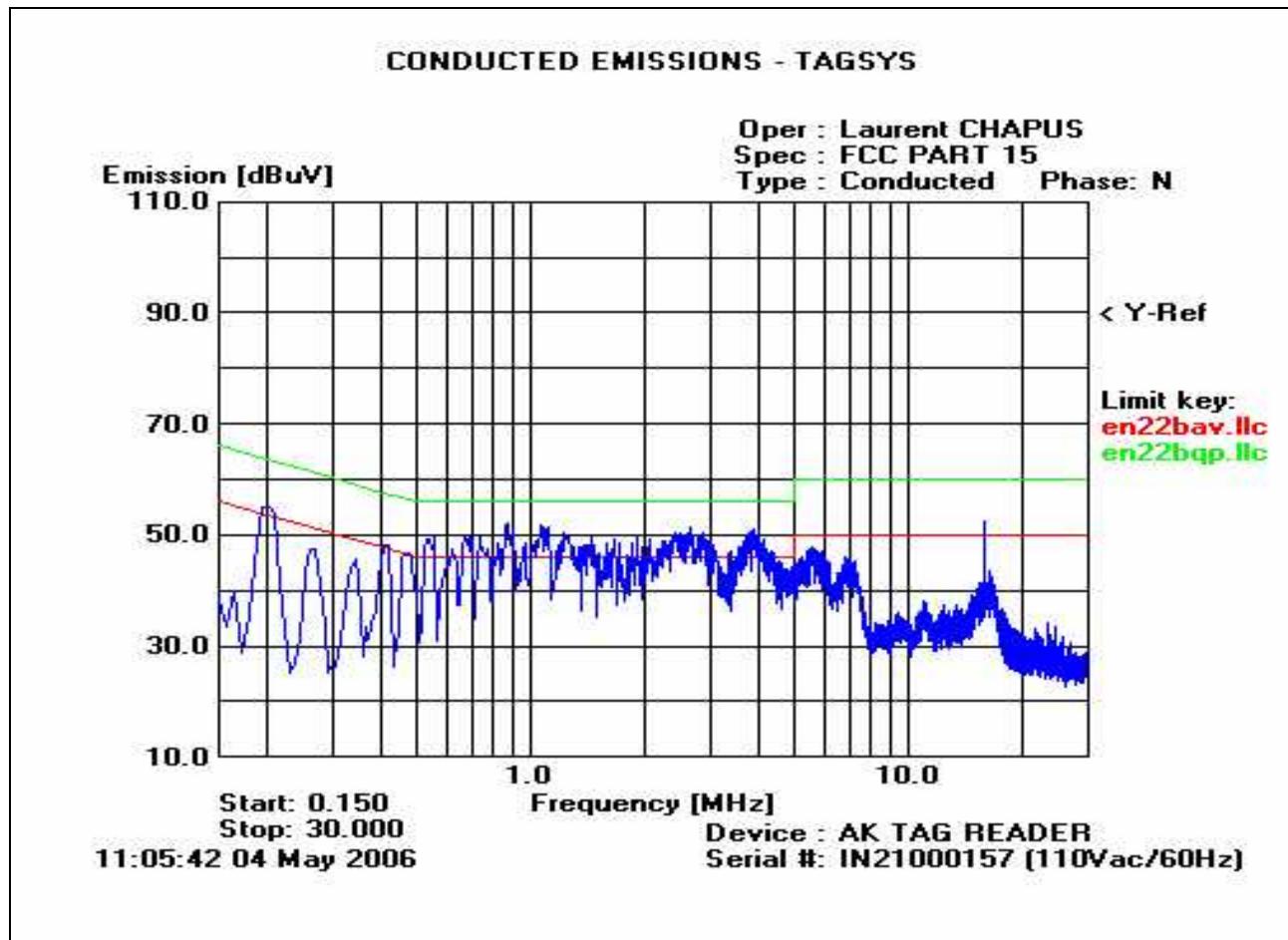
9	2.690	51.15	46.32	31.92	46.00
10	2.890	51.13	46.17	32.44	46.00
11	3.080	50.24	45.13	30.98	46.00
12	3.940	50.04	44.86	31.25	46.00
13	4.100	50.05	44.74	31.90	46.00
14	5.920	47.52	42.92	30.63	50.00
15	16.00	53.89	52.4*	48.3*	50.00

*: ESH3 measurement



FCC ID: QHKAKTAGREADER

3.3.2. Neutral conducted emission data



(RBW = 9kHz, VBW = 30kHz)

Marker	Freq. [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.200	56.15	54.8*	51.8*	52.00
2	0.420	48.22	42.66	33.16	46.00
3	0.480	49.43	45.13	34.07	46.00
4	0.540	49.84	46.68	35.59	46.00
5	0.730	50.91	45.91	30.84	46.00
6	0.870	51.47	48.20	33.40	46.00
7	1.070	50.93	47.30	31.71	46.00
8	1.230	49.75	45.45	29.10	46.00
9	1.390	49.32	45.44	29.34	46.00
10	1.460	49.21	45.18	31.94	46.00
11	1.660	48.55	43.92	29.41	46.00
12	1.860	49.68	43.04	28.14	46.00
13	2.370	50.63	46.35	31.80	46.00
14	2.660	51.42	46.39	33.27	46.00
15	2.890	49.85	44.48	29.88	46.00
16	3.770	50.00	45.04	31.43	46.00
17	3.930	50.56	45.41	31.25	46.00
18	5.790	47.22	42.00	29.88	50.00
19	7.170	45.76	39.49	27.63	50.00
20	16.01	53.67	51.7*	47.5*	50.00

*: ESH3 measurement



FCC ID: QHKAKTAGREADER

4. Channel Separation

4.1. SET-UP

The EUT is placed on a table at 0.8m height in the full anechoic chamber.

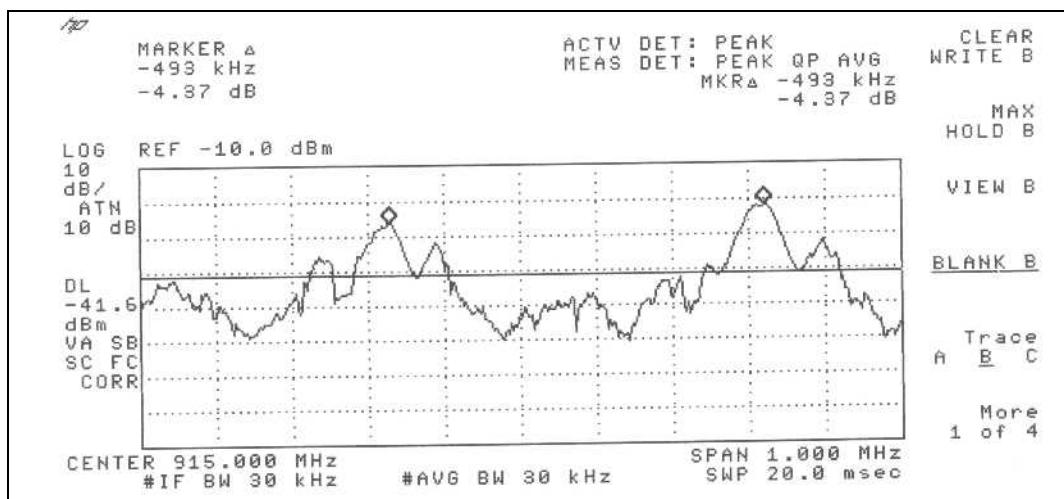
4.2. TEST EQUIPMENT

Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628
Cable			A5329045VO

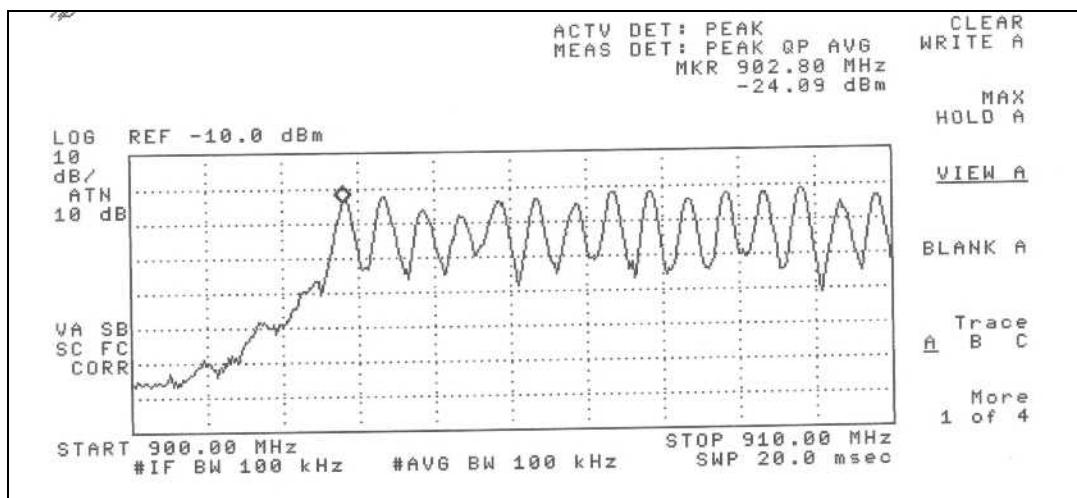
4.3. MEASUREMENT DATA

Measured channel separation: 500kHz

Measured number of channel : 50



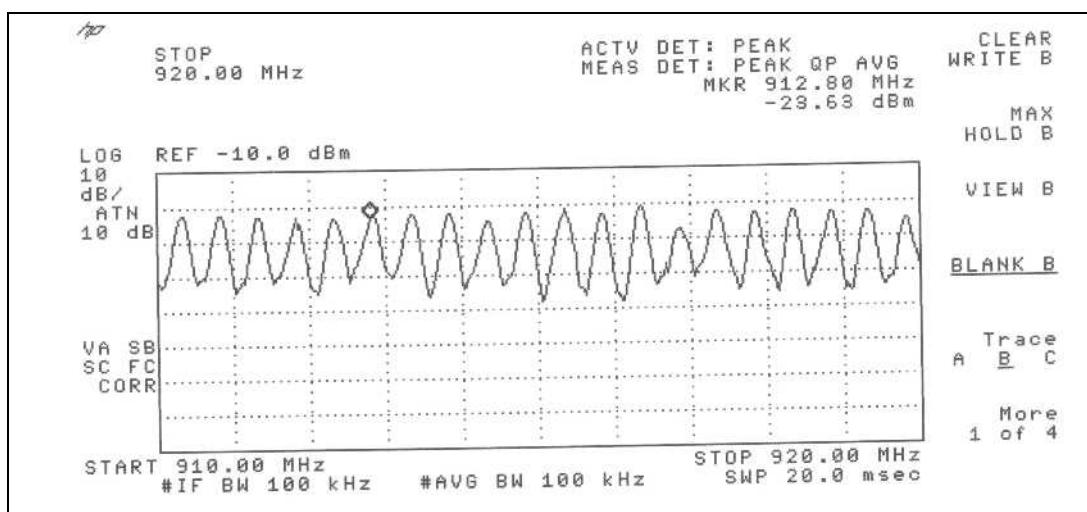
Channel separation



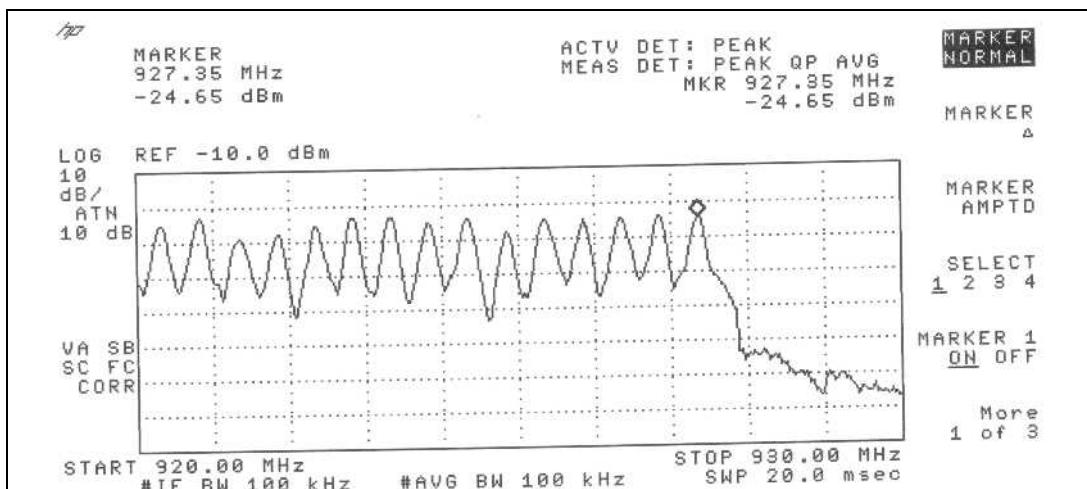
Number of channel (LOW band): 15 channels



FCC ID: QHKAKTAGREADER



Number of channel (MID band): 20 channels



Number of channel (HIGH band): 15 channels



FCC ID: QHKAKTAGREADER

5. Time of Occupancy

5.1. *SET-UP*

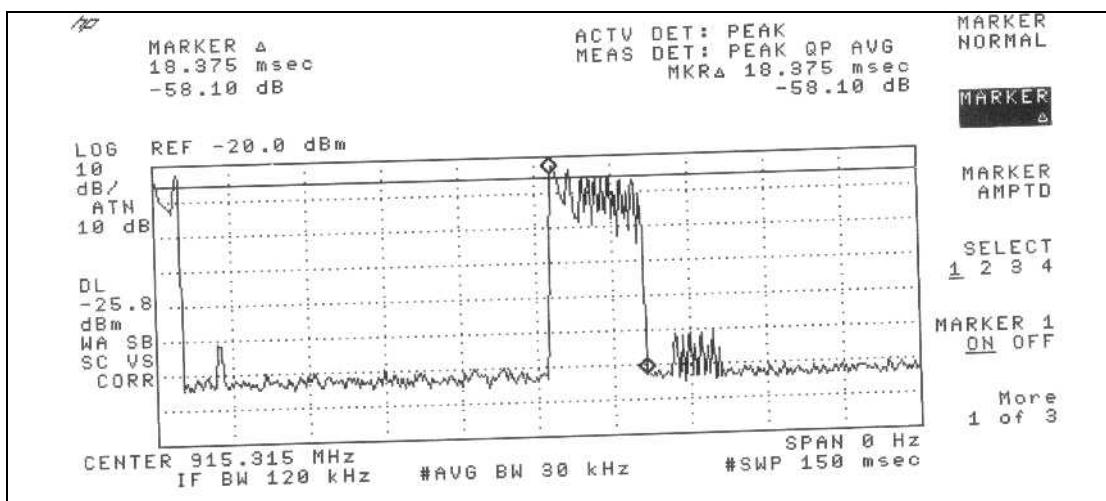
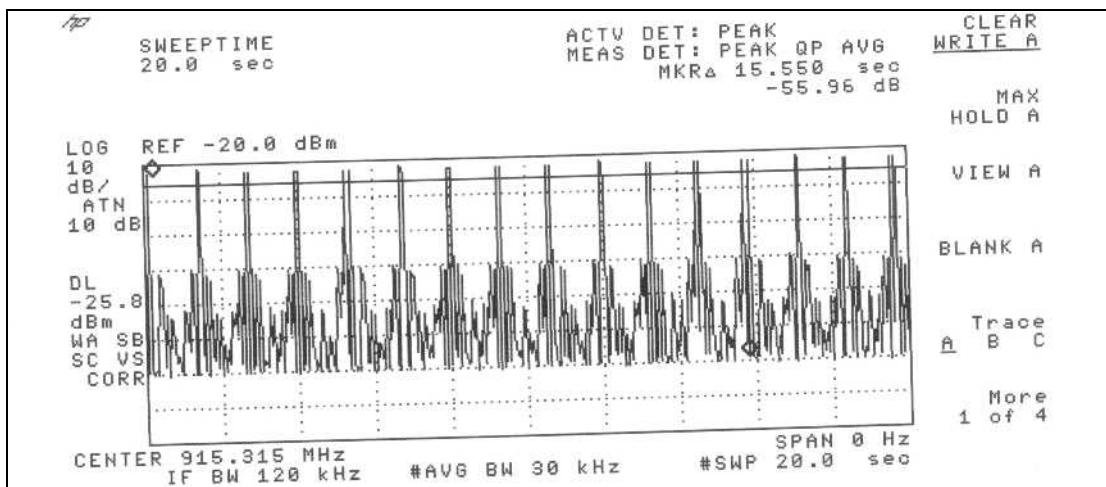
The EUT is placed on a table at 0.8m height in the full anechoic chamber.

5.2. TEST EQUIPMENT

Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628
Cable			A5329045VO

5.3. MEASUREMENT DATA

Measured time of occupancy : 23.375ms on a channel appearing 16 times in a period of 20s → **374ms**





FCC ID: QHKAKTAGREADER

6. Occupied Bandwidth

6.1. SET-UP

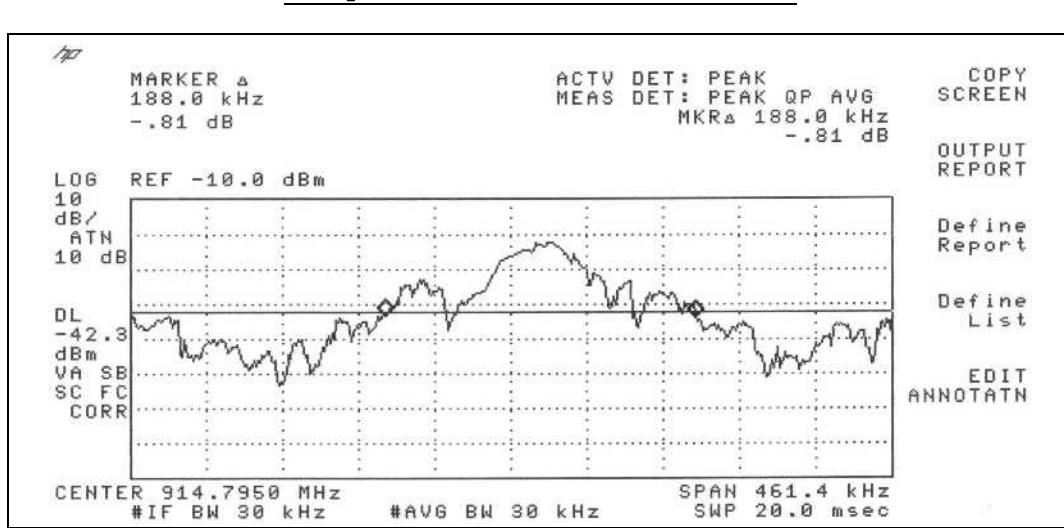
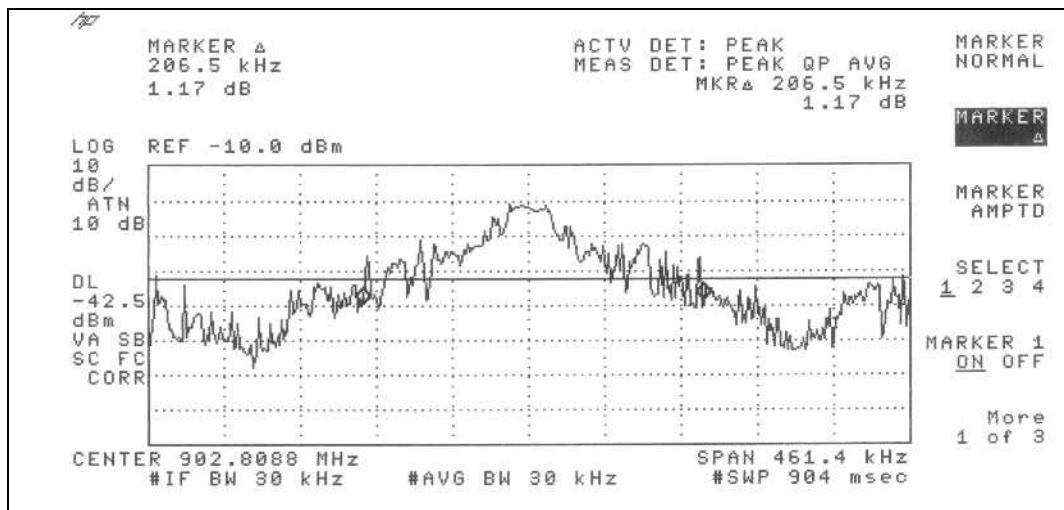
The EUT is placed on a table at 0.8m height in the full anechoic chamber.

6.2. TEST EQUIPMENT

Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628
Cable			A5329045VO

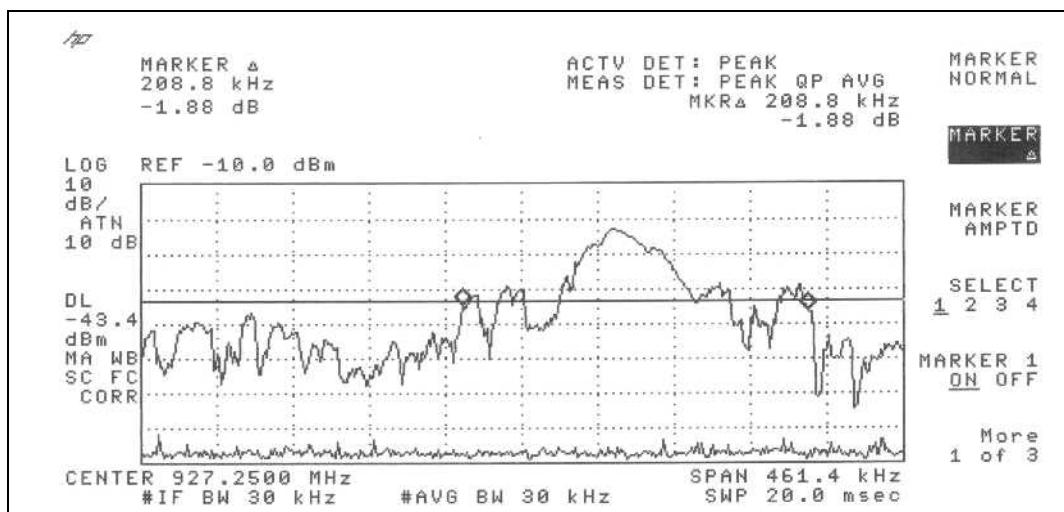
6.3. MEASUREMENT DATA

Measured 20dB bandwidth: 208.8kHz





FCC ID: QHKAKTAGREADER



Occupied bandwidth : HIGH channel



FCC ID: QHKAKTAGREADER

7. Peak Power Output (Conducted)

7.1. SET-UP

The EUT is placed on a table at 0.8m height.

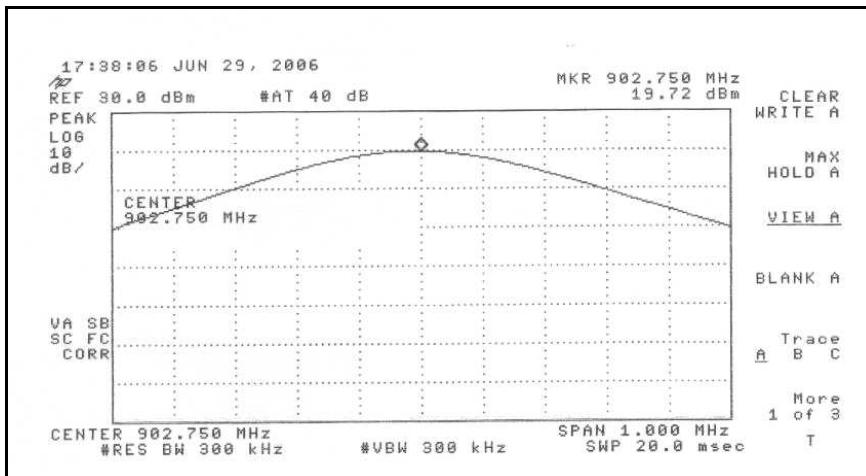
7.2. TEST EQUIPMENT

Equipment	Company	Model	Serial
EMC Analyzer	HP	8593E	3409u00537
Attenuator	HP	10dB	
Programmable power supply	HP	6842A	3531A00109

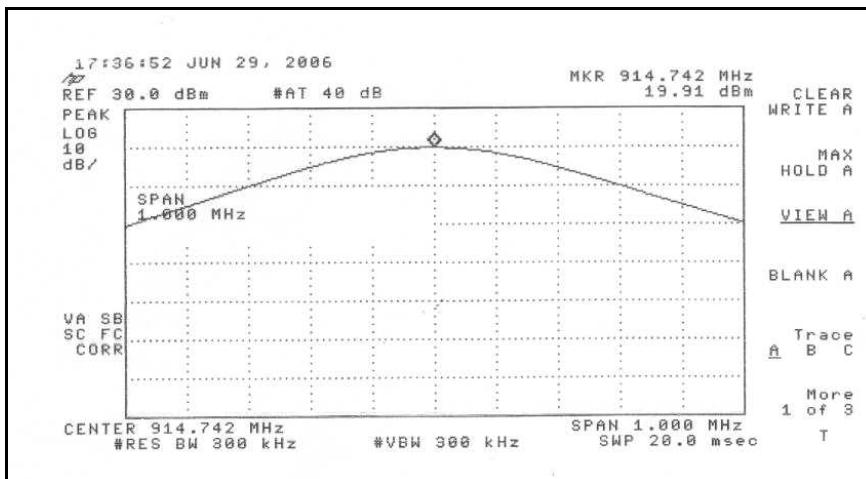
7.3. MEASUREMENT DATA

7.3.1. Peak Output power (Frequency hopping disable)

Output power is set at +30dBm (Software controlled)



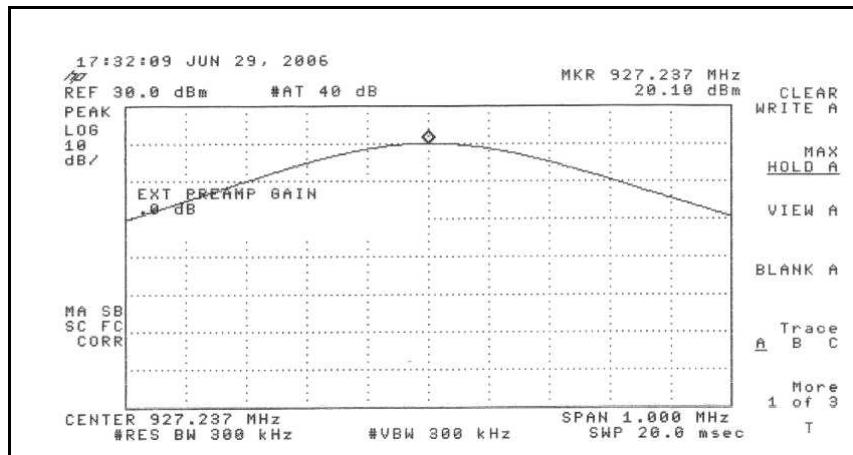
Peak output power : low channel (Attenuator = 9.9dB)



Peak output power : mid channel (Attenuator = 9.9dB)



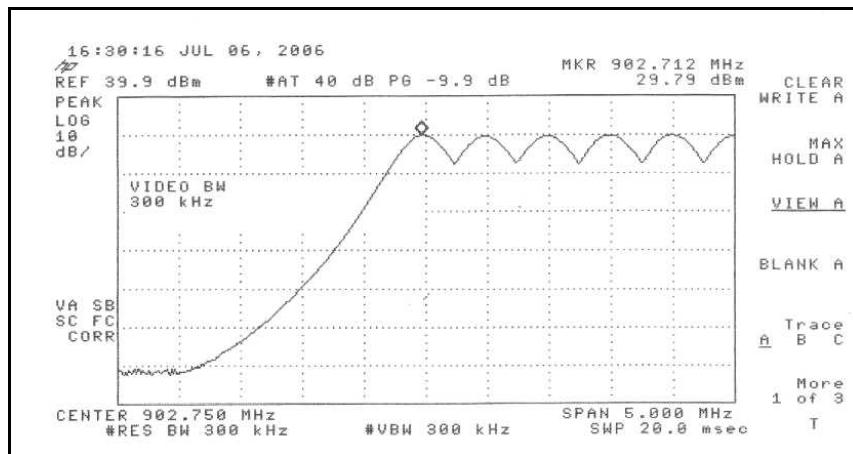
FCC ID: QHKAKTAGREADER



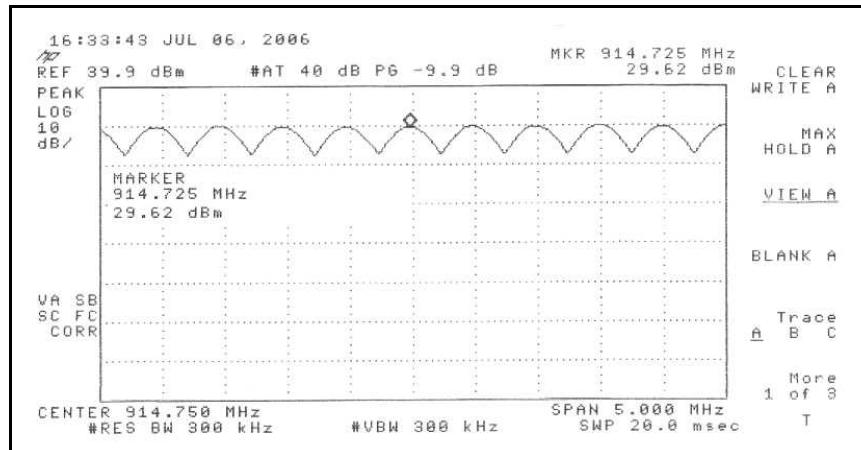
Peak output power : mid channel (Attenuator = 9.9dB)

7.3.2. Peak Output power (Frequency hopping enable)

Output power is set at +30dBm (Software controlled)



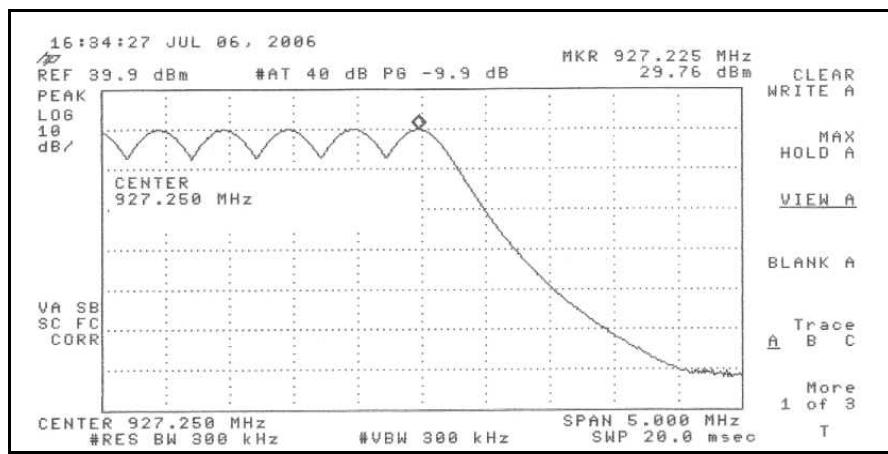
Peak output power : low channel



Peak output power : mid channel



FCC ID: QHKAKTAGREADER



Peak output power : high channel

Antenna gain is 6.7dBi, **Limit: 0.851W** (30dBm-0.7dB)
Output power is limited at 28dBm (Software controlled)

7.3.3. Peak Output power - Summary results (Primary voltage fluctuation)

Output power is set at +28dBm (Software controlled)

Channel	LOW	MID	HIGH
Power voltage: 110V Frequency (MHz) Carrier level	902.74845 27.6 dBm	914.74842 27.7 dBm	927.24840 27.9 dBm
Power voltage: 93.5V Frequency (MHz) Carrier level	902.74845 27.6 dBm	914.74842 27.7 dBm	927.24840 27.9 dBm
Power voltage: 126.5V Frequency (MHz) Carrier level	902.74845 27.6 dBm	914.74842 27.7 dBm	927.24840 27.9 dBm
Result	Pass	Pass	Pass



FCC ID: QHKAKTAGREADER

8. Spurious Emissions (Conducted)

8.1. SET-UP

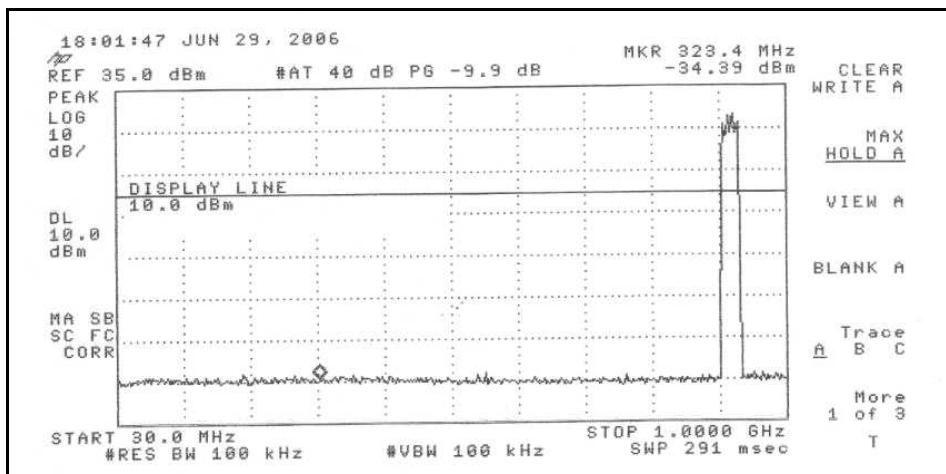
The EUT is placed on a table at 0.8m height.

8.2. TEST EQUIPMENT

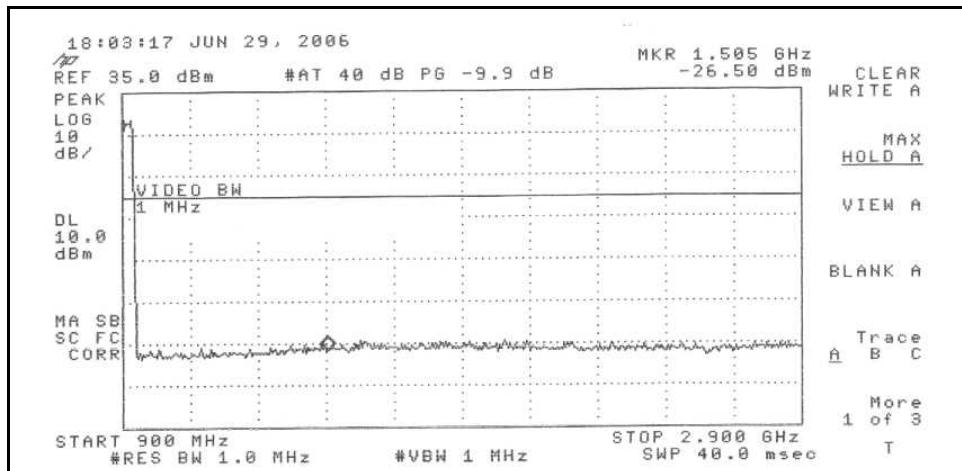
Equipment	Company	Model	Serial
EMC Analyzer	HP	8593E	3409u00537
Attenuator	HP	10dB	

8.3. MEASUREMENT DATA

Frequency hopping is enable



30MHz-1GHz

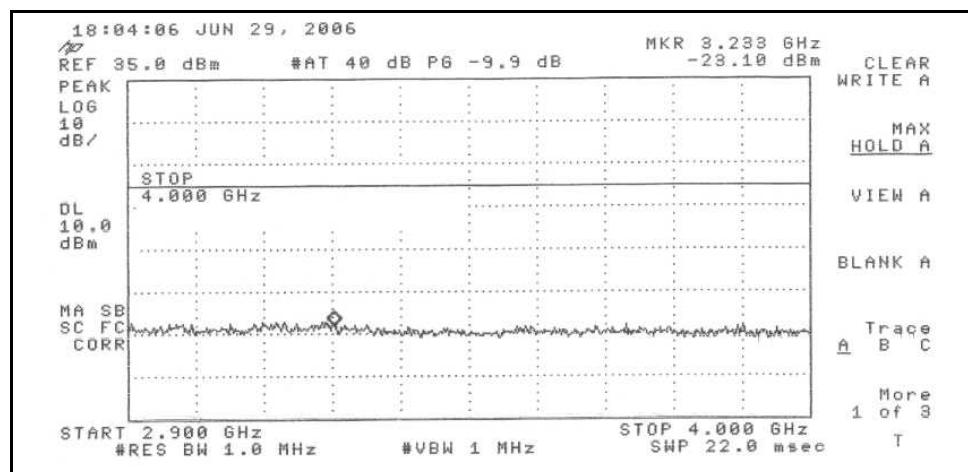


1GHz-2.9GHz

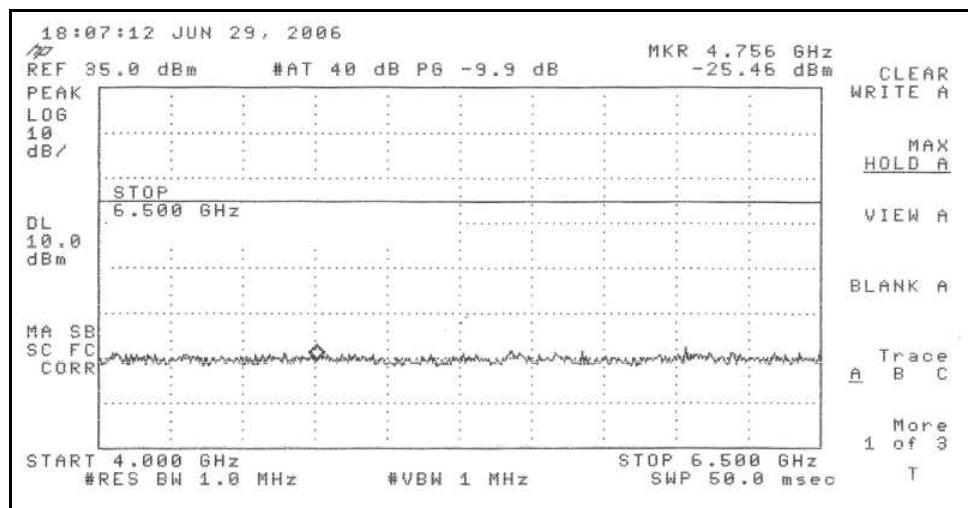


L C I E

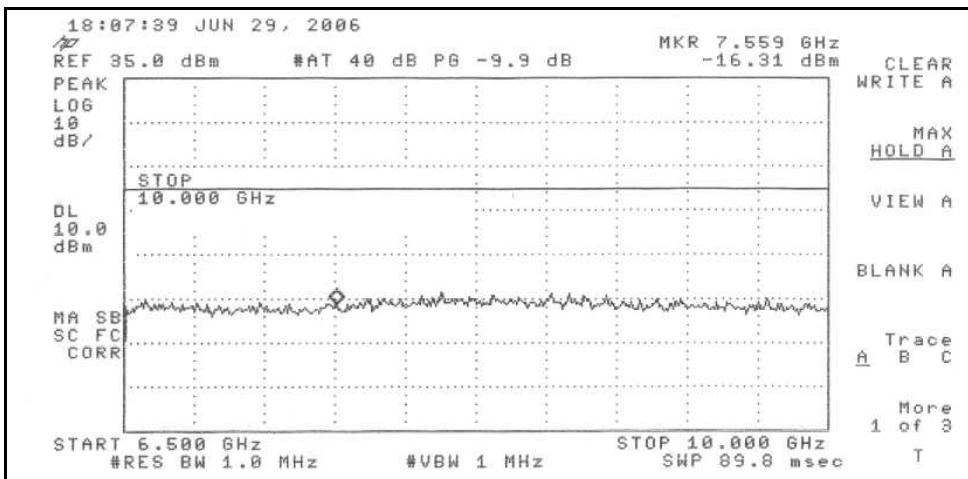
FCC ID: QHKAKTAGREADER



2.9GHz-4GHz



4GHz-6.5GHz



6.5GHz-10GHz



FCC ID: QHKAKTAGREADER

9. Spurious Emissions (Radiated)

9.1. SET-UP

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

The EUT is placed on a non-conducting table of 80cm height. A Tag is set on the reader.

Equipment configuration and running mode:

- EUT is ON;
- EUT was transmitting continuous and hopping function was disable for spurious emissions measurement.
- EUT was transmitting continuous and hopping function was enable for band edge measurement.

The product has been tested according to ANSI C63.4(2003), FCC part 15 subpart C. Radiated Emission were measured on an open area test site. A description of the facility is on file with the FCC.

The product has been tested at a distance of **3 meters** from the antenna. The RBW and VBW are 1MHz for peak measurement.

For average measurement, the RBW is 1MHz and VBW is 10Hz.

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.

Equipment was moved to position that maximized emission.



9.2. TEST EQUIPMENT

Test Equipment up to 10GHz on 3 meters open site:

Equipment	Company	Model	Serial
Spectrum Analyzer	HP	8593E	3409u00537
Double ridged waveguide horn antenna	EMCO	ETS 3115	6382
Amplifier	SMEE	1-8GHz	

EMCO-1050, 6 meters height antenna mast & EMCO-1060, 3 meters diameter Turntable. A 10 meters Open site located in **LCIE** - Voiron (FRANCE).



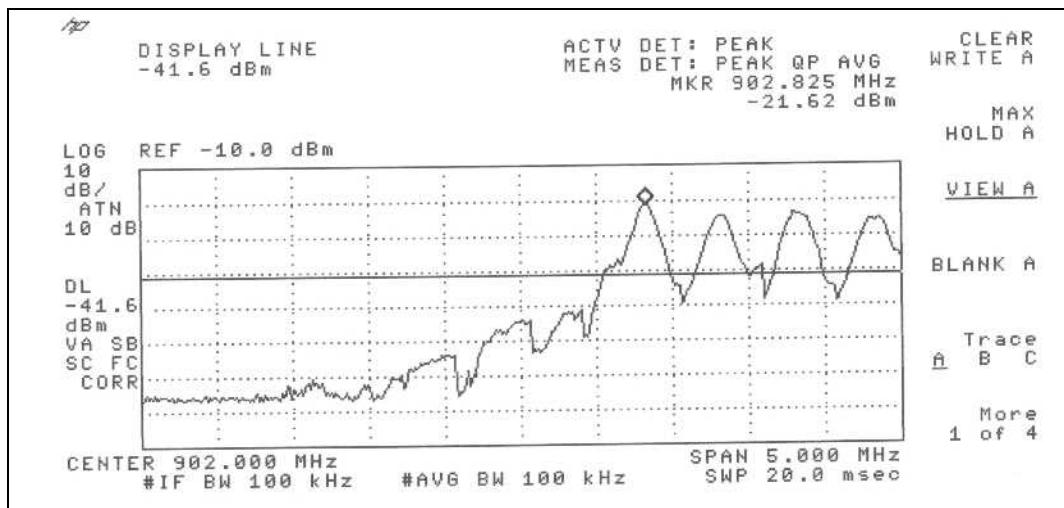
L C I E

FCC ID: QHKAKTAGREADER

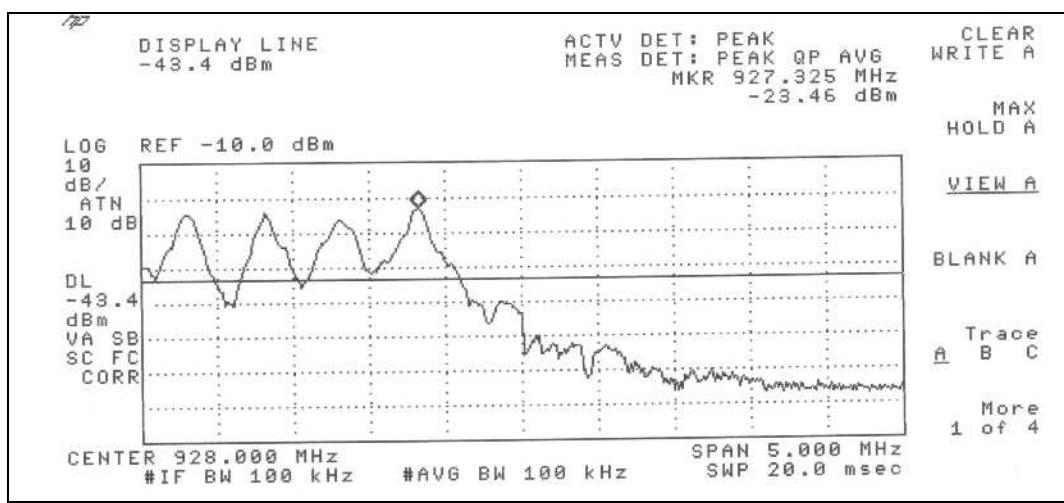
Pre-scan, test equipment up to 10GHz:

Equipment	Company	Model	Serial
Spectrum Analyzer	HP	8593E	3409u00537
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628
Double ridged waveguide horn antenna	EMCO	ETS 3115	6382
Amplifier	SMEE	1-8GHz	
Cable	SUNHER		A5329038VO

9.3. Measurement data: Band Edge plots



Low Band Edge



High Band Edge



FCC ID: QHKAKTAGREADER

9.4. Measurement data: spurious emissions

EUT Configuration: Transmit at 902.75MHz

No	Frequency (MHz)	Corr Fact	Corrected reading (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Peak / Average	Comments
1	902.75		127.3 *	-			Fundamental
2	1805.50	28.6	44.1	54.0	- 9.9	PK	
3	2708.25	31.5	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
4	3611.00	34.2	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
5	4513.75	35.3	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
6	5416.50	36.3	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
7	6319.25	37.9	< 40.0	54.0	< 14.0	PK	(Noise floor)
8	7222.00	39.2	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
9	8124.75	40.0	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
10	9027.50	40.3	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)

EUT Configuration: Transmit at 914.75MHz

No	Frequency (MHz)	Corr Fact	Corrected reading (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Peak / Average	Comments
1	914.75		126.1 *	-			Fundamental
2	1829.50	28.6	38.1	54.0	- 15.9	PK	
3	2744.25	31.5	42.7	54.0	- 11.3	PK	Restricted band
4	3659.00	34.2	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
5	4573.75	35.3	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
6	5488.50	36.3	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
7	6403.25	37.9	< 40.0	54.0	< 14.0	PK	(Noise floor)
8	7318.00	39.2	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
9	8232.75	40.0	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
10	9147.50	40.3	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)

EUT Configuration: Transmit at 927.25MHz

No	Frequency (MHz)	Corr Fact	Corrected reading (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Peak / Average	Comments
1	927.25		127.2 *	-			Fundamental
2	1854.50	28.6	39.7	54.0	- 14.3	PK	
3	2781.75	31.5	44.2	54.0	- 9.8	PK	Restricted band
4	3709.00	34.2	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
5	4636.25	35.3	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
6	5563.50	36.3	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
7	6490.75	37.9	< 40.0	54.0	< 14.0	PK	(Noise floor)
8	7418.00	39.2	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
9	8345.25	40.0	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)
10	9272.50	40.3	< 40.0	54.0	< 14.0	PK	Restricted band (Noise floor)

*: Measure performed at 10m distance and corrected according to requirements of 15.209.e) (M@3m = M@10m+10.5dB). All others frequencies are measured at 3m.