



EMC TEST REPORT

Nr 2769-FCC

This test report applies only on equipment described hereafter.

Proposal number: 200301-2131

Date.....: March 3rd to 6th and 25th, 2003
Location.....: SMEE **Actions Mesures** Laboratory - 38 VOIRON
Performed by.....: Laurent CHAPUS
Customer.....: **ASK** (Represented by Mr. LOGNON)
Les Bouillides – 15, Traverse des Brucs
06560 Valbonne Sophia Antipolis
FRANCE

Product.....: **HCR 800 / HCR 805**
With docking station HCC 100
Type of test.....: **Radiated and Conducted Emission Test**

Applied standards.....: ANSI C63-4 (1992+2000)
CISPR22 (1997) + A1 (2000)
47 CFR Part 15 Subpart B and Subpart C

Result of tests.....: Samples tested in configuration and description presented in this test report comply with prescriptions and limits of FCC Part 15, in radiated and conducted emissions.

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Written by.....: Laurent CHAPUS

Date : June 25th, 2003

Signature

Approved by.....: Jean-Pierre ORY



1. System test configuration

1.1. Justification

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

The HCR 800/805 is an intentional radiator when it is used as a contactless smartcard reader and is subject to the regulations of the Part 15, Subpart C.

It can be also used as a peripheral device when the collected and stored data are transferred from the handheld reader to a computer with the USB interface of the HCC 100 docking station (unintentional radiator, coupler circuit is off in this case).

1.2. HARDWARE IDENTIFICATION:

* **Equipment Under Test (EUT):** HCR 800 / HCR 805 sn: 0306001 or 0306038
With USB docking station HCC 100 sn: Proto

- Configuration :

The HCR 800 / HCR 805 is configured for the MIFARE® cryptography.
(Equipment in this case is named HCR 805)

- Input/output on HCR 800/805:

- Interface connector HCR 800/805 to the HCC100 docking station

- Input/output on HCC 100 docking station:

- Interface connector with the HCR 800/805
- USB cable, shielded, fixed on the equipment: 2m

- Frequencies :

FREQUENCY	SOURCE	USE
CPU and peripherals (HCR 800/805)		
22,1184MHz	Oscillator	Main clock frequency for ARM microprocessor
32,768KHz	Quartz	Real Time Clock
10MHz	Quartz	LCD display main clock
Coupler (HCR 800/805)		
27,120MHz	Oscillator	Main clock frequency for RF treatments, FPGA clock
22,1184MHz	Microcontroller	Microcontroller internal frequency
13,56MHz	FPGA	Carrier frequency and digital filters
9,04MHz	FPGA	SAM main clock source
4,52MHz	SAM electrical interface, FPGA	SAM clock source
3,6864MHz	Resonator	Microcontroller
847,500KHz	Contactless card sub-carrier, FPGA	FPGA internal treatments
423,750KHz	FPGA	FPGA internal treatments
211,875KHz	FPGA	FPGA internal treatments
105,937KHz	FPGA, RF data rate	FPGA internal treatments



FCCID : QYEHCCRDE0207523

Docking station (HCC 100)		
6MHz	Resonator	USB/RS232 chip main clock

- Equipment information :
Radiated fundamental frequency of the HCR800/805 is 13.56MHz

1.3. Auxiliaries

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

Trade Mark - Model Number (Serial number)	FCC ID	Description	Cable description
ASK - HCR 800 / HCR 805 (1) (Sn : 0306001)	QYEHCCRDE0 207523	Handheld contactless reader	No cable
ASK - HCC 100 (1) (Sn : Proto)	QYEHCCRDE0 207523	USB Docking station for HCR 800/805 reader	USB shielded cable (fixed on the equipment)
HEWLETT PACKARD Vectra VLI8 PIII-500 P/N: D7963A (sn: FR94020533) (2)	DOC	Personnel computer	All data cables are shielded. Power cable unshielded.
HEWLETT PACKARD P/N: D2846 (sn JP74001000) (2)	DOC	21" color monitor	Shielded video cable with ferrites at each end. Power cable unshielded.
HEWLETT PACKARD P/N: C4734-60111 (sn: M971168931) (2)	GYUR38SK	Keyboard	Shielded cable
Microsoft X04-72167 (sn: 9916996-5) (2)	DOC	Mouse	Shielded cable
HEWLETT PACKARD Deskjet 895 Cxi (sn: MY9761915S) (2)	DOC	Parallel printer	HP 24542D shielded parallel cable DC power cable unshielded
HEWLETT PACKARD 48GX (sn: ID83802369) (2)	None	Serial calculator	Shielded serial cable
LABTEC LT-100 (sn: none) (2)	None	Headset	Stereo audio cable
TELEX Model 700 373 000A (2)	None	Microphone	Stereo audio cable
ASK - C.Ticket ISO 14443-2-3 Mode A and mode B (3)	None	Contactless paper ticket	-

- (1): Equipment under test
(2): Equipment used for test of the HCR 800/805 with docking station HCC 100.
(3): Equipment used for the test of the HCR 800/805 reader alone.

1.4. Equipment modifications

None.



1.5. EUT Exercise software

The EUT exercise program used during radiated and conducted testing was designed to exercise the HCR 800/805 in a manner similar to a typical use. Communication mode A and B (contactless reader) of the standard ISO/IEC 14443-2 are tested.

The inboard software used during the evaluation of the HCR 800/805 alone permits the emission with mode A or B modulation or an emission without modulation.

While testing the HCR 800/805 with the docking station HCC 100, a data file of 0.5Mo is transferred from the computer to the reader through the USB link. Software used is ZOC-PRO.exe (V4.10 - USB to serial port emulator software), running under windows 98. The HCR 800/805 is in a maintenance mode in this case.

1.6. Special accessories

The USB interface cable used for compliance testing is shielded as normally supplied. All these cables are normally recommended to be used with the product.

1.7. I/O cables

Cables used for the test of the HCR 800/805 with the HCC 100 docking station:

- 1x USB 1.0 cable, shielded: 2m (fixed on HCC 100)
- 2x AC power cords (PC and monitor): 1.5m
- 1x Standard video cable SVGA (with two integrated ferrites): 1.5m

2. Radiated emission data

2.1. SET-UP

The EUT is placed on a non-conducting table of 80cm height.



FCCID : QYEHCRDDE0207523



HCR 800/805 test (Handheld reader)



HCR 800/805 with docking station HCC 100



FCCID : QYEHCRRDDE0207523

Equipment configuration and running mode - HCR 800/805 alone:

- A contactless paper ticket (mode A or mode B) is placed above the reader.

Equipment configuration and running mode - HCR 800/805 with HCC 100 docking station:

- The docking station is connected to the PC with the USB cable
- Data transfer on the USB link between PC and reader.

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

2.2. TEST EQUIPMENT

Test equipment up to 1GHz on 10 meters open site:

Equipment	Company	Model	Serial	Calibration Due
Spectrum Analyzer	HP	8568B	2732A04140	March 22 nd , 2003
Quasi-Peak adapter	HP	85650A	2811A01136	March 22 nd , 2003
RF Pre-selector	HP	85685A	2833A00773	March 22 nd , 2003
Biconical Antenna	EMCO	3104C	9401-4636	April 4 th , 2003
Log Periodic Antenna	EMCO	3146	2178	April 4 th , 2003
Spectrum Analyzer	HP	8593E	3409u00537	June 29 th , 2003
Loop antenna	Electro-metrics	EM-6879	690234	February 10 th , 2004
Amplifier	HP	8447F H64	3113A06394	March 28 th , 2003
OATS				April 9 th , 2003

EMCO-1050, 6 meters height antenna mast & EMCO-1060, 3 meters diameter Turntable.

A 10 meters Open site located in SMEE *Actions Mesures* - Voiron (FRANCE).

Pre-scan, test equipment up to 1GHz:

Equipment	Company	Model	Serial	Calibration Due
EMC Analyzer	HP	8591EM	3536A00384	March 29 th , 2003
Amplifier	HP	8447F H64	3113A06394	March 28 th , 2003
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628	March 29 th , 2003
Loop antenna	Electro-metrics	EM-6879	690234	February 10 th , 2004

2.3. TEST SEQUENCE AND RESULTS

2.3.1. Pre-characterization at 3 meters [9kHz-30MHz] - HCR 800/805 alone

A pre-scan of all the setup has been performed in a 3 meters full anechoic chamber. The distance between EUT and antenna is 3 meters. Pre-characterization is performed in vertical (V) polarization and the loop antenna position was rotated during the test for maximized the emission measurement.

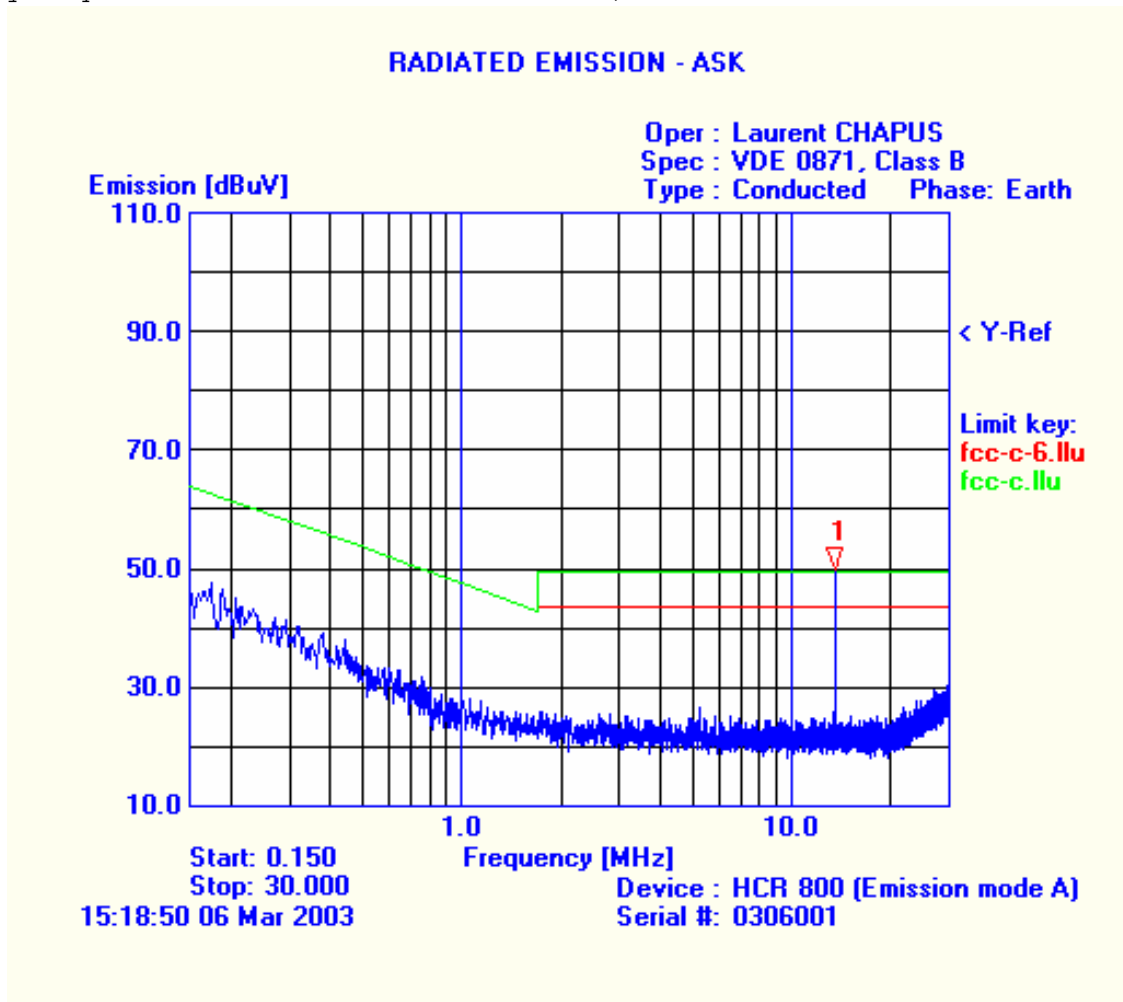
Frequency band investigated is 9kHz to 30MHz.

See below graph examples between 150MHz to 30MHz:



FCCID : QYEHCRRDDE0207523

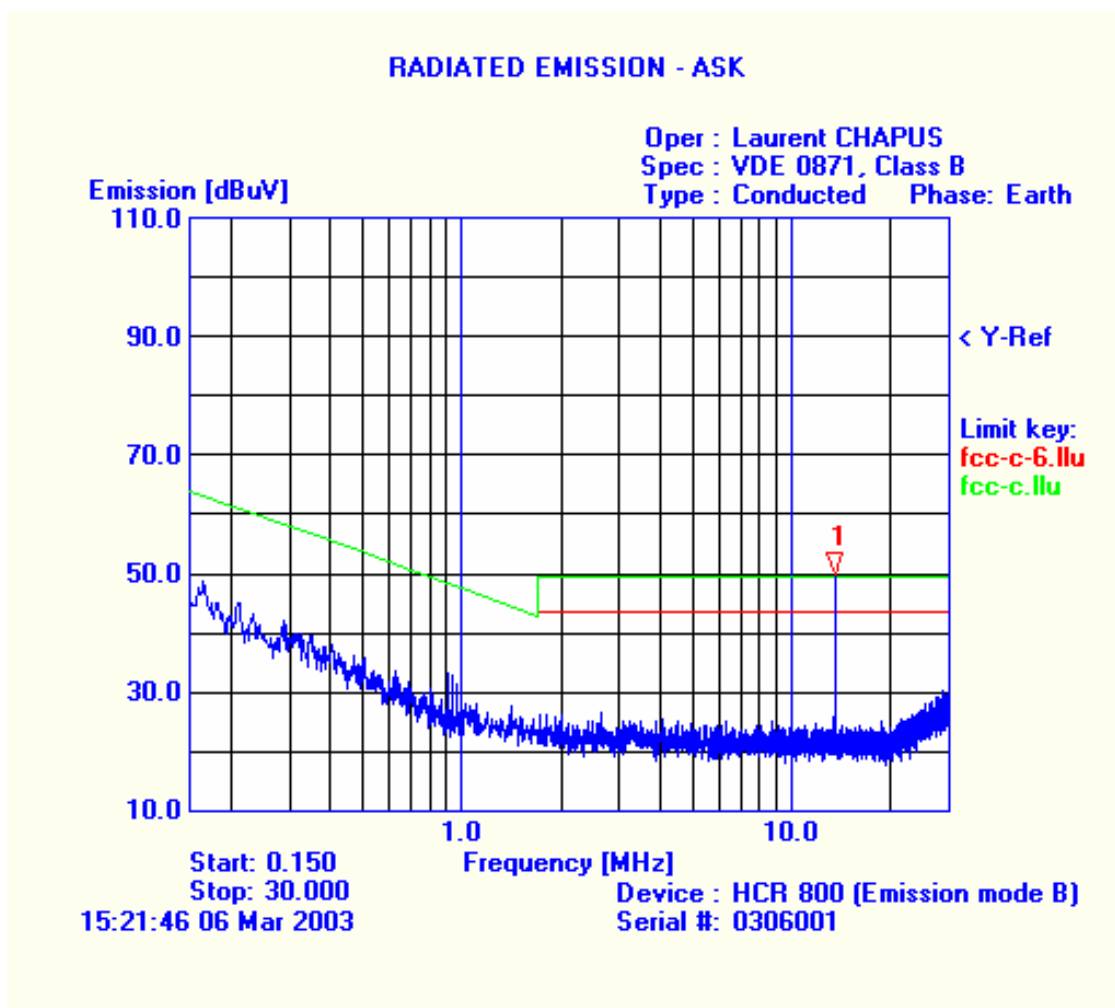
(No frequency observed between 9kHz to 150KHz)



*Result for 150MHz to 30MHz (Intentional radiator mode A)
(Marker n°1 is 13.56MHz)*



FCCID : QYEHCRDDE0207523



*Result for 150MHz to 30MHz (Intentional radiator mode B)
(Marker n°1 is 13.56MHz)*

2.3.2.Pre-characterization at 3 meters [30MHz-1GHz]

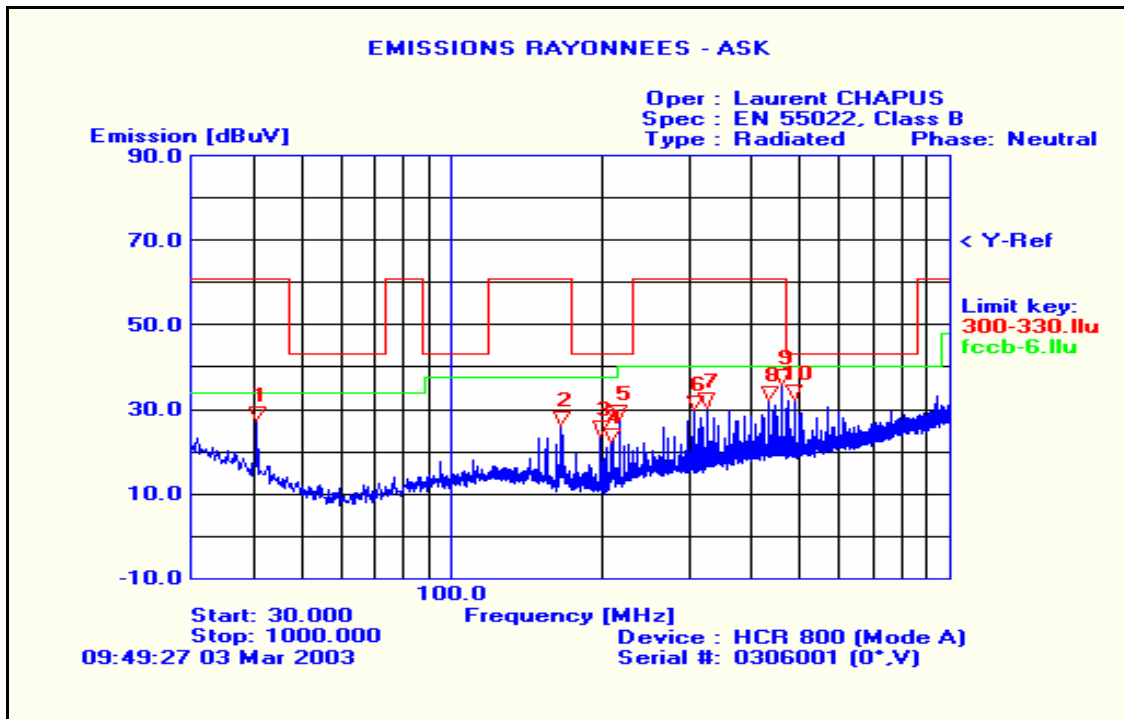
A pre-scan of all the setup has been performed in a 3 meters full anechoic chamber. The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) polarization with a log-periodic antenna Chase CBL6111A and on 4 faces of the EUT.

Pre-characterization is performed with mode A and B of the intentional radiator HCR 800/805 alone and with the reader plugged on the docking station HCC 100.

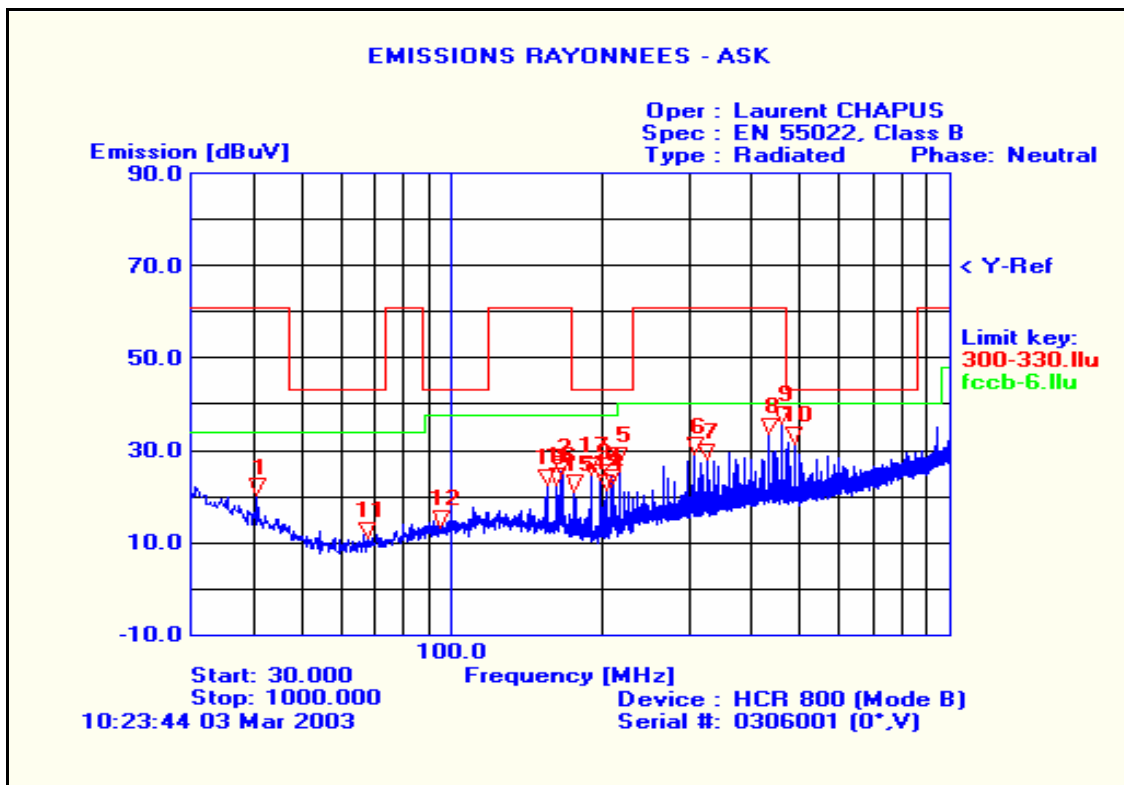
See below graph examples between 30MHz to 1GHz.



FCCID : QYEHCRRDDE0207523



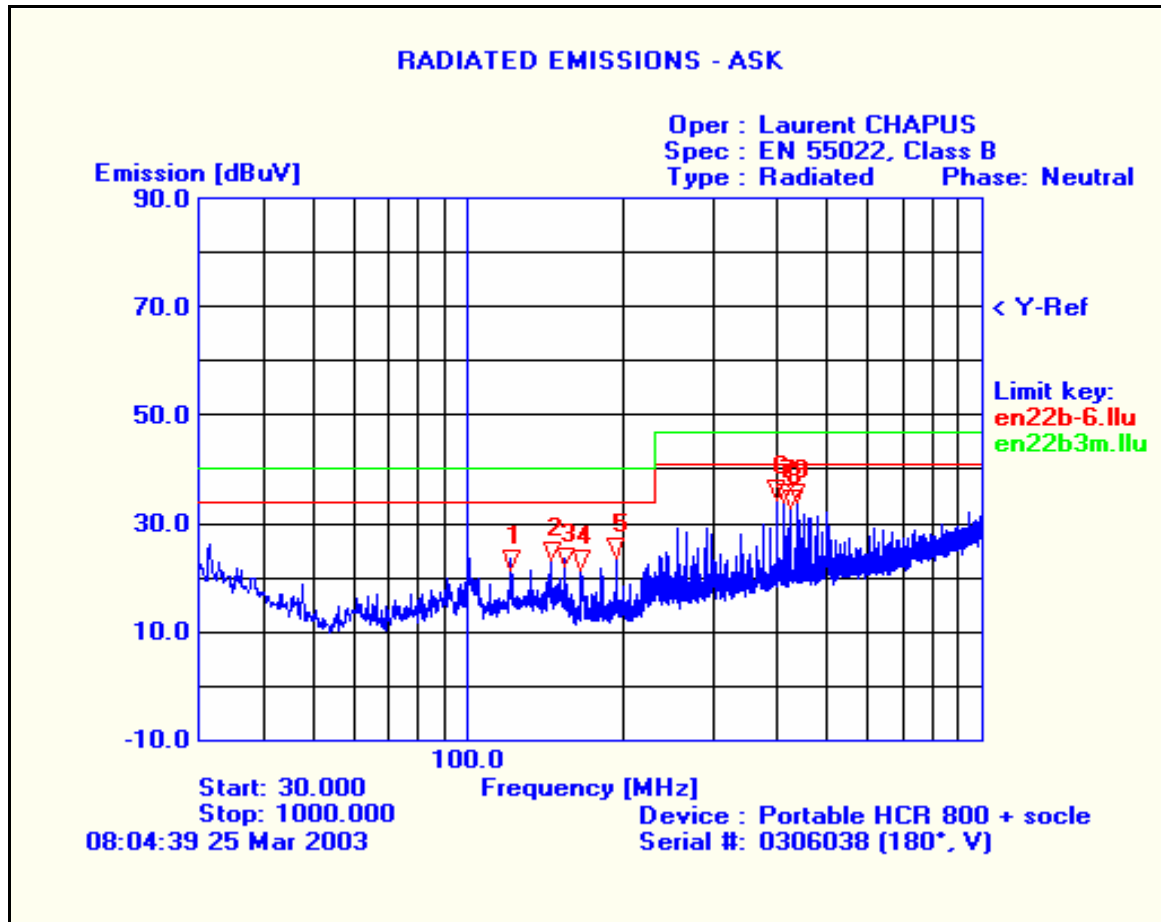
Result for 30MHz to 1GHz (Intentional radiator mode A)



Result for 30MHz to 1GHz (Intentional radiator mode B)



FCCID : QYEHCRRDDE0207523



Result for 30MHz to 1GHz (HCR 800/805 with docking station HCC 100)

2.3.3.Characterization on 10 meters open site below 30 MHz - HCR 800/805

The product has been tested according to ANSI C63.4(1992), 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 **10 meters** from the antenna and compared to the FCC part 15 subpart C §15.225 limits in the frequency range 13.553MHz 13.567MHz. Measurement bandwidth was 9kHz.

Antenna height was 1m for both horizontal and vertical polarization.

Antenna was rotated around its vertical axis.

Continuous linear turntable azimuth search was performed with 360 degrees range.

No other frequency than the carrier at 13.56MHz is measured on the 10 meters open site.

Equipment was moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on clauses 2.3.1.



FCCID : QYEHCRDDE0207523

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Turntable Angle (deg)	Ant. Pol./ Angle (deg)	Tot Corr (dB)
13.56* ¹	80.0	34.1* ²	-45.9	88°	V / 90°	35.4

*¹: Fundamental - 15.225 limits. Measure have been done at 10m distance and corrected according to requirements of 15.209.e)

*² : Highest level observed for mode A and mode B modulation. Tests are performed using a new fully charged battery.

2.3.4.Characterization on 10 meters open site from 30MHz to 1GHz HCR 800/805

The product has been tested according to ANSI C63.4(1992), 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 **10 meters** from the antenna and compared to the FCC part 15 subpart 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.

Equipment was moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on clause 2.3.2.

Result mode A:

No	Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.698	40.0	32.5	-7.5	221	H	378	11.6	*
2	154.839	43.5	35.3	-8.2	66	V	103	16.3	*
3	162.714	43.5	31.1	-12.4	272	H	362	17.6	*
4	166.097	43.5	32.8	-10.7	19	V	101	17.7	*
5	199.086	43.5	33.3	-10.2	86	H	393	19.9	*
6	203.406	43.5	32.2	-11.3	98	H	371	15.6	*
7	210.114	43.5	34.5	-9.0	152	V	107	15.6	*
8	216.972	46.0	33.9	-12.1	3	V	107	15.6	*
9	307.377	46.0	37.7	-8.3	282	H	254	17.9	*
10	325.460	46.0	35.4	-10.6	284	H	225	18.2	*
11	433.886	46.0	38.9	-7.1	207	H	221	20.2	*
12	461.062	46.0	41.3	-4.7	186	V	313	21.0	*
13	488.173	46.0	39.1	-6.9	263	V	293	21.8	*

*: The results are extrapolated with §15.31 requirements for measuring distance other than what is specified.



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Result mode B:

No	Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.638	40.0	32.3	-7.7	152	V	303	11.6	*
2	154.848	43.5	35.9	-7.6	70	V	107	16.3	*
3	210.114	43.5	35.3	-8.2	54	V	104	15.6	*
4	216.964	46.0	34.5	-11.5	5	V	107	15.6	*
5	461.058	46.0	41.1	-4.9	189	V	309	21.0	*

*: The results are extrapolated with §15.31 requirements for measuring distance other than what is specified.

**2.3.5.Characterization on 10 meters open site from 30MHz to 1GHz
HCR 800/805 with docking station HCC 100**

The product has been tested according to ANSI C63.4-(1992), CISPR22-1997/A1:2000 and EN55022:1998/A1:2000. 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 with 230V@50Hz power line voltage, at a distance of 10 meters from the antenna and compared to the CISPR 22 Class B limits. Measurement bandwidth was 120kHz from 30MHz 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.

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 clause 2.3.2

Result:

No	Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	31.948	30.0	24.6	-5.4	299	V	101	13.0	*
2	121.261	30.0	24.6	-5.4	115	V	106	16.6	*
3	145.588	30.0	22.9	-7.1	47	V	101	14.9	*
4	182.328	30.0	26.1	-3.9	307	H	327	18.7	*
5	194.049	30.0	24.2	-5.8	278	H	357	19.6	*
6	255.603	37.0	33.1	-3.9	75	H	377	15.8	*
7	398.140	37.0	33.7	-3.3	30	V	357	19.2	*
8	412.261	37.0	30.2	-6.8	42	V	380	19.6	*
9	424.395	37.0	29.2	-7.8	23	V	340	19.9	*
10	436.526	37.0	32.2	-4.8	199	V	367	20.3	*
11	442.375	37.0	31.5	-5.5	92	H	202	20.4	*
12	500.048	37.0	29.2	-7.8	51	H	147	22.1	*



2.4. 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 is 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.

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



3. Conducted emission data

The product has been tested according to ANSI C63.4-(1992), CISPR22-1997/A1:2000 and EN55022:1998/A1:2000.

The product has been tested with 110V@60Hz power line voltage and compared to the CISPR22 Class B limits. Measurement bandwidth was 9kHz from 150kHz to 30MHz.

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 non-conducting table of 80cm height. The cable of the power supply of the PC has been shorted to 1meter length. The HCC 100 is connected to the computer with the USB cable.



Equipment configuration and running mode - HCR 800/805 with HCC 100 docking station:

- The docking station is connected to the PC with the USB cable
- Data transfer on the USB link between PC and reader.



FCCID : QYEHCRRDDE0207523

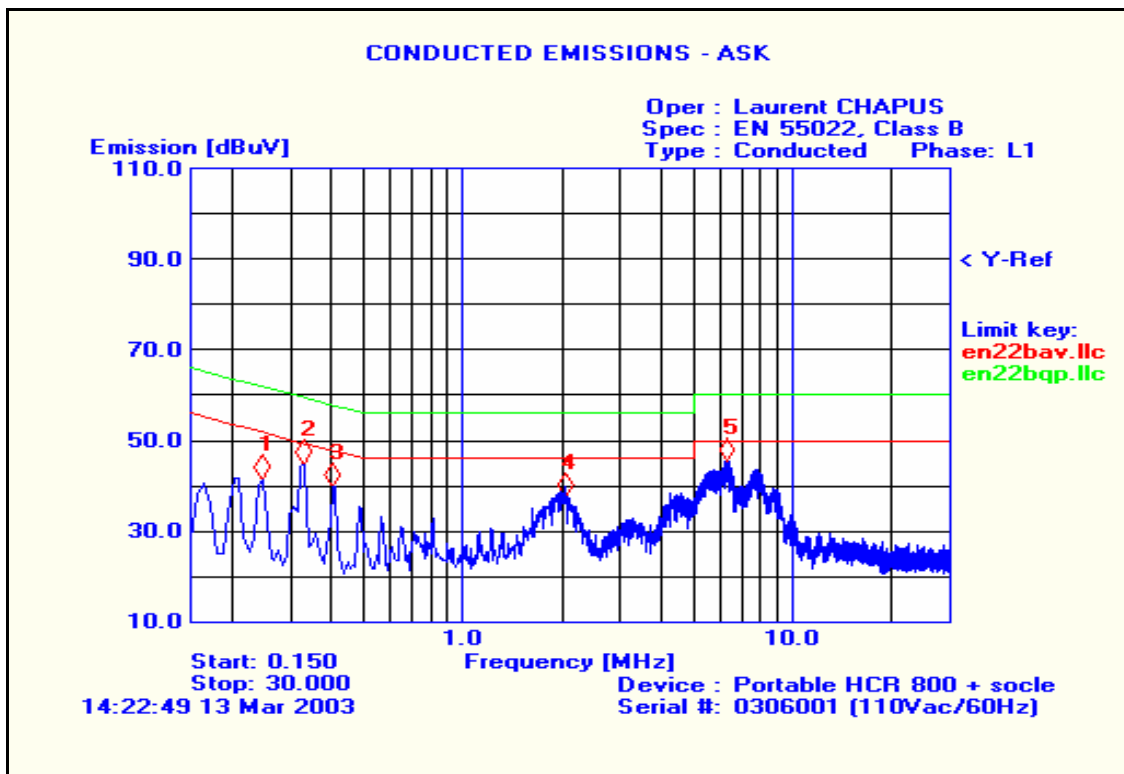
3.2. TEST EQUIPMENT

Equipment	Company	Model	Serial	Calibration Due
EMC Analyzer	HP	8591EM	3536A00384	March 29 th , 2003
Test receiver	Rohde&Schwarz	ESH3	872079/117	March 21 st , 2003
Transient Limiter	HP	11947A	3107A01596	March 28 th , 2003
LISN(auxiliary)	EMCO	3810/2SH	9511-11821628	December 12 th , 2003
LISN(measure)	Telemeter	NNB-2/16Z	98010	September 13 th , 2003
50 Ω / 50 μ H	Electronis			
Faraday room	Rayproof		4854	none

3.3. TEST SEQUENCE AND RESULTS

Measures are performed on line 1 and on the neutral of the power supply of the PC.

3.3.1. Line conducted emission data on HCC 100

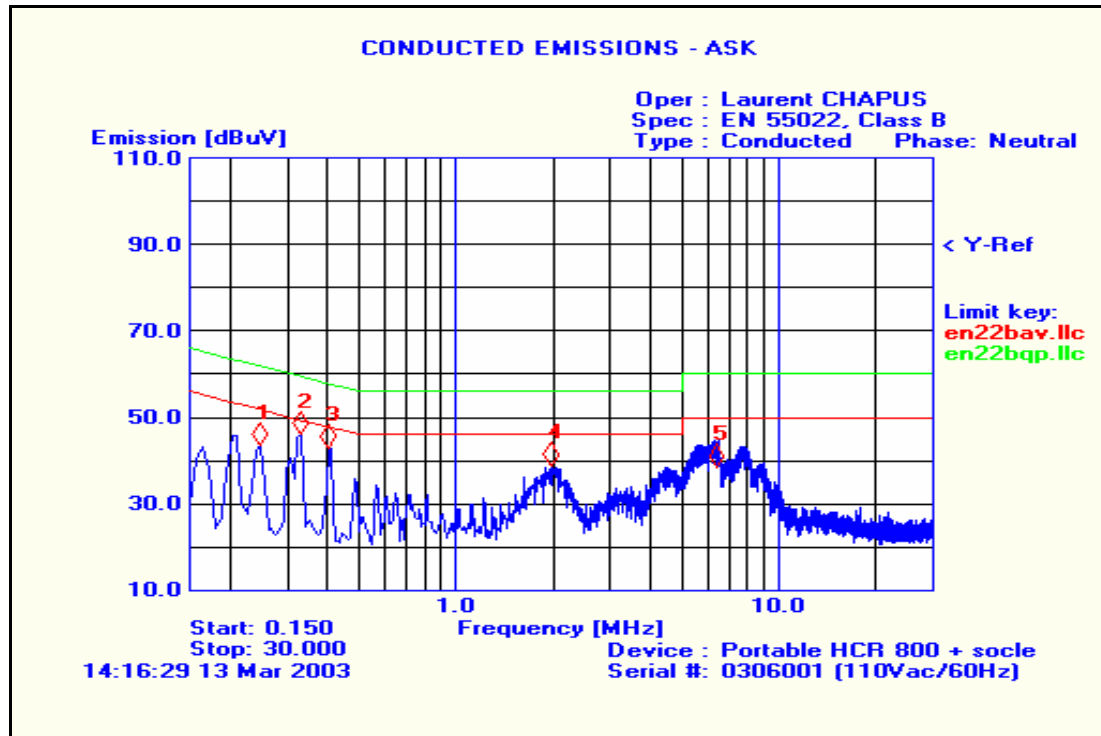


Num.	Freq. [MHz]	Peak [dBuV]	Q-Peak [dBuV]	QP limit [dBuV]	QP delta [dBuV]	Average [dBuV]	AVG Limit [dBuV]	AVG Delta [dBuV]	Comment
1	0.2432	42.5	39.3	62.0	-22.7	39.3	52.0	-12.7	
2	0.3242	45.6	42.3	59.2	-16.9	42.3	49.2	-6.9	
3	0.4043	41.5	37.8	57.7	-19.9	36.2	47.7	-11.5	
4	2.0539	38.0	34.3	56.0	-21.7	34.3	46.0	-11.7	
5	6.3434	46.2	42.1	60.0	-17.9	41.8	50.0	-8.2	



FCCID : QYEHCRDDE0207523

3.3.2.Neutral conducted emission data on HCC 100



Num.	Freq. [MHz]	Peak [dBuV]	Q-Peak [dBuV]	QP limit [dBuV]	QP delta [dBuV]	Average [dBuV]	AVG Limit [dBuV]	AVG Delta [dBuV]	Comment
1	0.2432	43.4	41.3	62.0	-20.7	41.3	52.0	-10.7	
2	0.3242	47.3	44.3	59.2	-14.9	44.3	49.2	-4.9	
3	0.4043	44.0	40.0	57.7	-17.7	37.6	47.7	-10.1	
4	2.0539	39.1	34.3	56.0	-21.7	34.3	46.0	-11.7	
5	6.3434	42.1	41.8	60.0	-18.2	41.8	50.0	-8.2	



FCCID : QYEHCRDDE0207523

4. Field strength of fundamental §15.225(a)

The polarization of the measurements for the larger power level is vertical (the test is performed for both vertical and horizontal axis, and the loop antenna position was rotated during the test for maximized the emission measurement.)

Measure have been done at 10m distance and corrected following requirements of 15.209.e)

Equipment was moved to position that maximized emission.

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Turntable Angle (deg)	Ant. Pol./ Angle (deg)	Tot Corr (dB)
13.56* ¹	80.0	34.1* ²	-45.9	88°	V / 90°	35.4

*¹: Fundamental - 15.225 limits. Measure have been done at 10m distance and corrected according to requirements of 15.209.e)

*²: Highest level observed for mode A and mode B modulation. Tests are performed using a new fully charged battery.

Limits Subclause §15.225(a)

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
13.56	10 000 80dBµV/m	30

5. Fundamental frequency tolerance (15.225.c)

The frequency tolerance of the carrier signal shall be maintained within +/-0.01% of the operating frequency when the temperature is varied from -20°C to +50°C

5.1. Temperature fluctuation

Temperature has been set at -20°C and +50°C with a new fully charge battery.

Frequency of carrier: 13.56 MHz

Upper limit: 13.561356 MHz

Lower limit: 13.558644 MHz

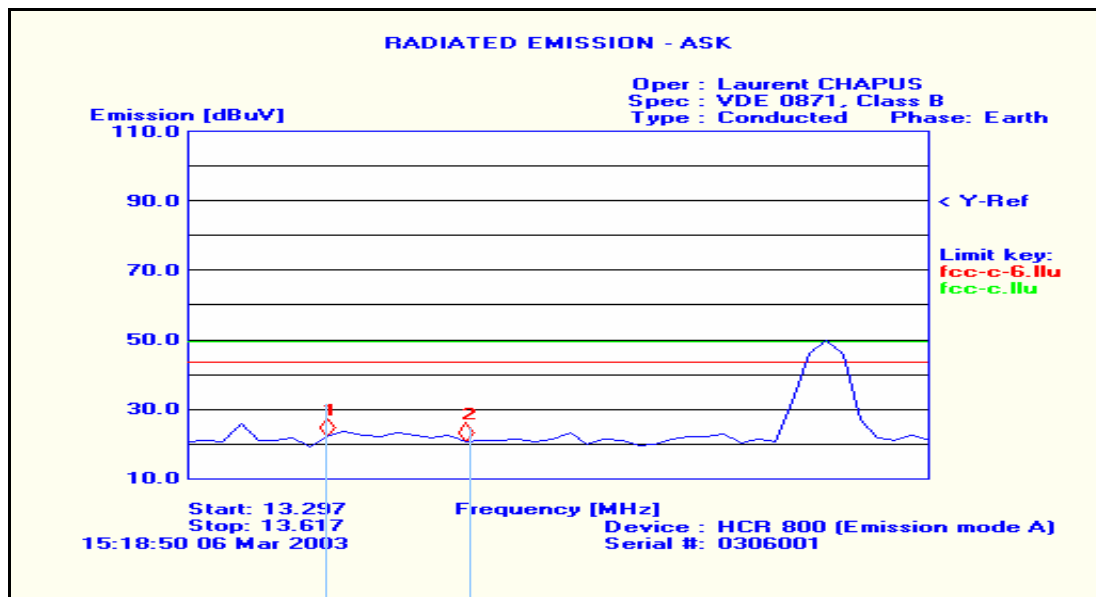
Temperature	-20°C	20°C	+50°C
Frequency (MHz)	13.559788	13.559823	13.559833
Result	Pass	-	Pass



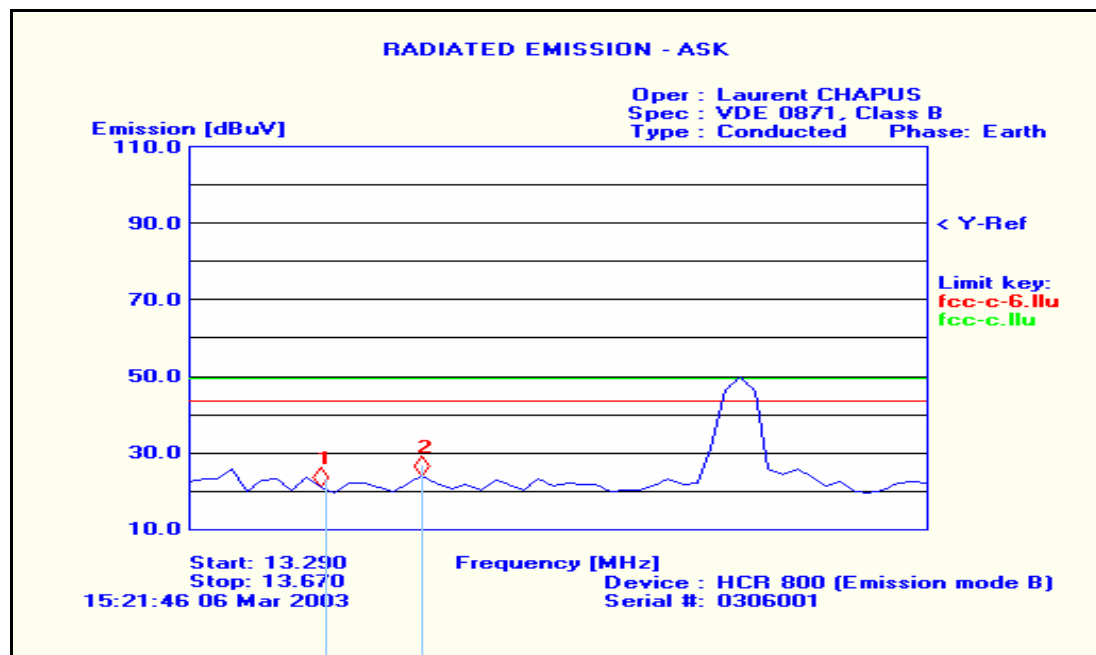
FCCID : QYEHCRDDE0207523

6. Occupied bandwidth §15.205

Here is a plot for mode A and B emission of the occupied bandwidth which shows that the 13.36MHz - 13.41MHz restricted band is free of spurious emission.



13.36MHZ-13.41MHZ



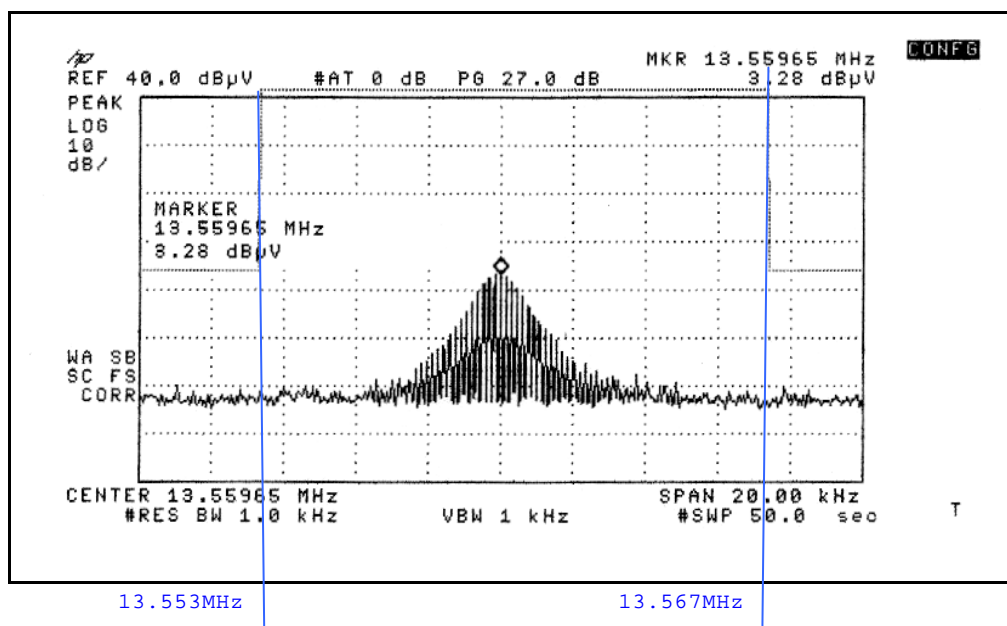
13.36MHZ-13.41MHZ



FCCID : QYEHCRDDE0207523

7. Band-edge compliance §15.209

ISM bandwidth: 13.553 - 13.567MHz



End of Tests