EMC TEST REPORT

Nr 3634-A1-FCC

This test report applies only on equipment described hereafter.

Proposal number: 200512-2878

Date .....:	December 27th and 28th, 2005
Location.....:	**LCIE** ZI des Blanchisseries 38500 VOIRON - France
Performed by.....:	Laurent CHAPUS
Customer**.....:**	**ASK** (Represented by Mr. PARRAULT) 2405, route des Dolines 06560 SOPHIA ANTIPOLIS FRANCE

Product.....:	**RDR 416/417**
Type of test .....:	**Radiated and Conducted Emission Test**

Applied standards.....:	ANSI C63-4 (2003) 47 CFR Part 15 Subpart C

Result of tests.....:	**Sample tested in configuration and description presented in this test report complies with prescriptions and limits of FCC Part 15, subpart C, in radiated and conducted emissions.**

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Written by.....: Laurent CHAPUS

Date : February 28th, 2006 Signature

Approved by .....: Jacques LORQUIN

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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 RDR416 / RDR417 is an intentional radiator as it is used as a contactless smartcard reader and is subject to the regulations of the Part 15, Subpart C.

1.2. HARDWARE IDENTIFICATION:

*** Equipment Under Test (EUT): RDR417 sn: 05520005**

- Configuration :

The RDR 417 is configured for the MIFARE® cryptography, ISO 14443 A or B and ISO 15693 standards using the RC632 chip. (Version without ISO 15693 is called RDR 416, using RC531 chip).

- Input/output on RDR 417:

- USB interface shielded cable, fixed on the equipment: 1m (with ferrite clamp on EUT's side)

- Frequencies :

FREQUENCY	SOURCE	USE
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
4,52MHz	SAM electrical interface, FPGA	SAM clock source
3,6864MHz	Resonator	Microcontroller
847,500KHz	Contactless card sub-carrier	RC632 internal treatments
105,937KHz	RF basic data rate	RC632 internal treatments
6MHz	Resonator	USB chip main clock (Max data rate: 12MBit/s)

- Equipment information :

Radiated fundamental frequency of the RDR416/417 is 13.56MHz
Power input voltage: 5V from USB port

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 – RDR417 (1) (Sn : 05520005)	**QYERDR41X**	**USB contactless reader**	**USB cable, shielded with ferrite clip on reader side.**
DELL Latitude D600 TAG: 9VH931J	E2K24CLNS	Personnel computer (Laptop)	Power cables unshielded. USB shielded
ASK – C.Ticket or smartcard ISO 14443-2-3 (Mode A and mode B) ISO 15693	None	Contactless paper ticket and smartcard	-

(1): Equipment under test

1.4. Equipment modifications

None.

1.5. EUT Exercise software

The EUT exercise program used during radiated and conducted testing was exercised the RDR 417 in a manner similar to a typical use, excepted that the RF field is ON permanently with smartcard readings.
Smartcards for mode A, B and ISO15693 are tested.
PC Software used: POOLING V4.07b.EXE or ASK-MONITOR.EXE

1.6. Special accessories

The USB interface cable used for compliance testing is shielded as normally supplied. The equipment is supplied with a ferrite clamp on the USB cable (Ferrite type WE 7427114)
All these cables are normally recommended to be used with the product.

1.7. I/O cables

Cables used for the test of the RDR 417:
- 1x USB cable, shielded: 1m
- 1x AC power cord (PC): 1.8m

2. Radiated emission data

2.1. SET-UP

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

Radiated emission test setup

Equipment configuration and running mode:
A contactless smartcard or paper ticket (mode A or mode B or ISO15693) is placed on the top side of the reader.

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.

2.2. TEST EQUIPMENT

Test equipment up to 1GHz on 3/10 meters open site:

Equipment	Company	Model	Serial
Spectrum Analyzer	HP	8568B	2732A04155
Quasi-Peak adapter	HP	85650A	2811A01134
RF Pre-selector	HP	85685A	2837A00784
Biconical Antenna	EMCO	3104C	9401-4636
Log Periodic Antenna	EMCO	3146	2178
Spectrum Analyzer	HP	8593E	3409u00537
Loop antenna	Electro-metrics	EM-6879	690234
Amplifier	HP	8447F H64	3113A06394
OATS			

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

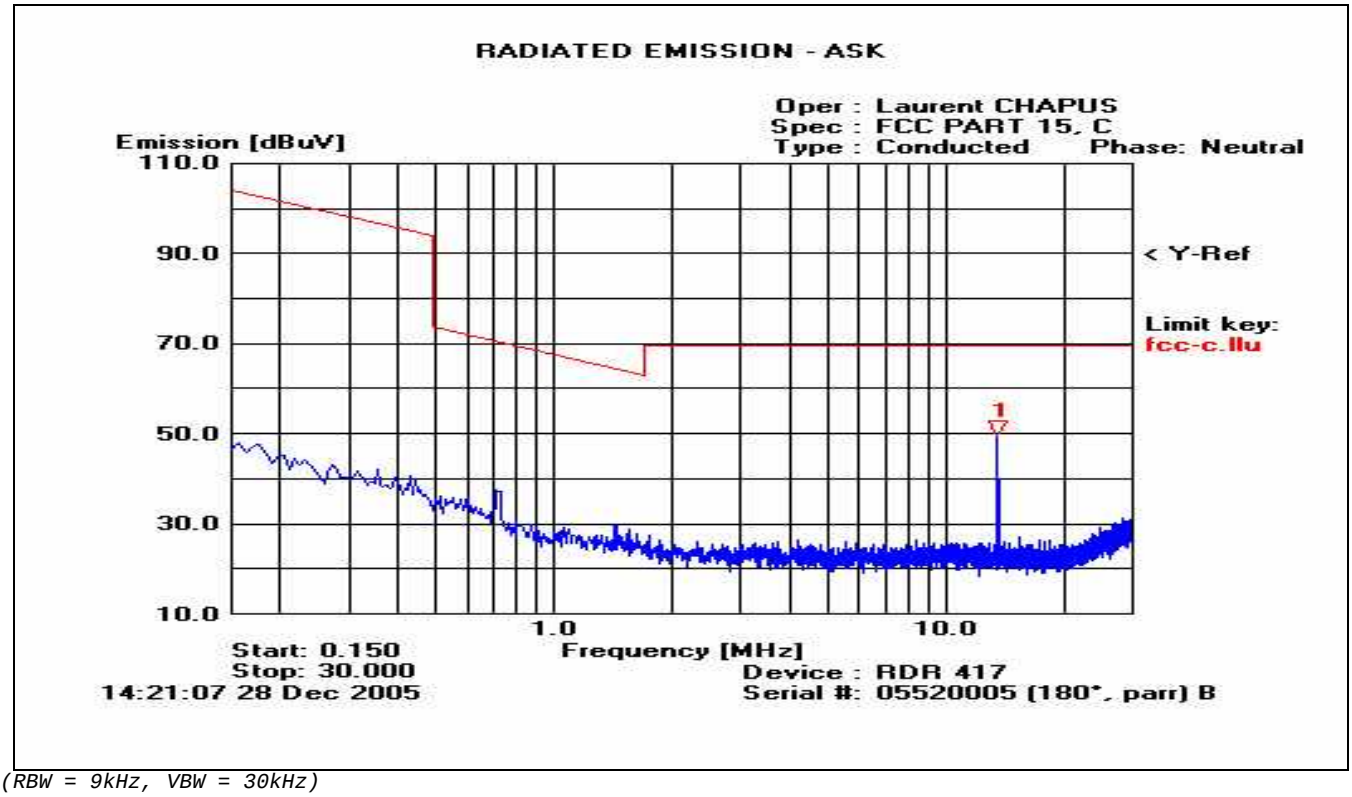
Pre-scan, test equipment up to 1GHz:

Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Amplifier	HP	8447F H64	3113A06394
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628
Loop antenna	Electro-metrics	EM-6879	690234

2.3. TEST SEQUENCE AND RESULTS

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

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:
(No frequency observed between 9kHz to 150KHz)

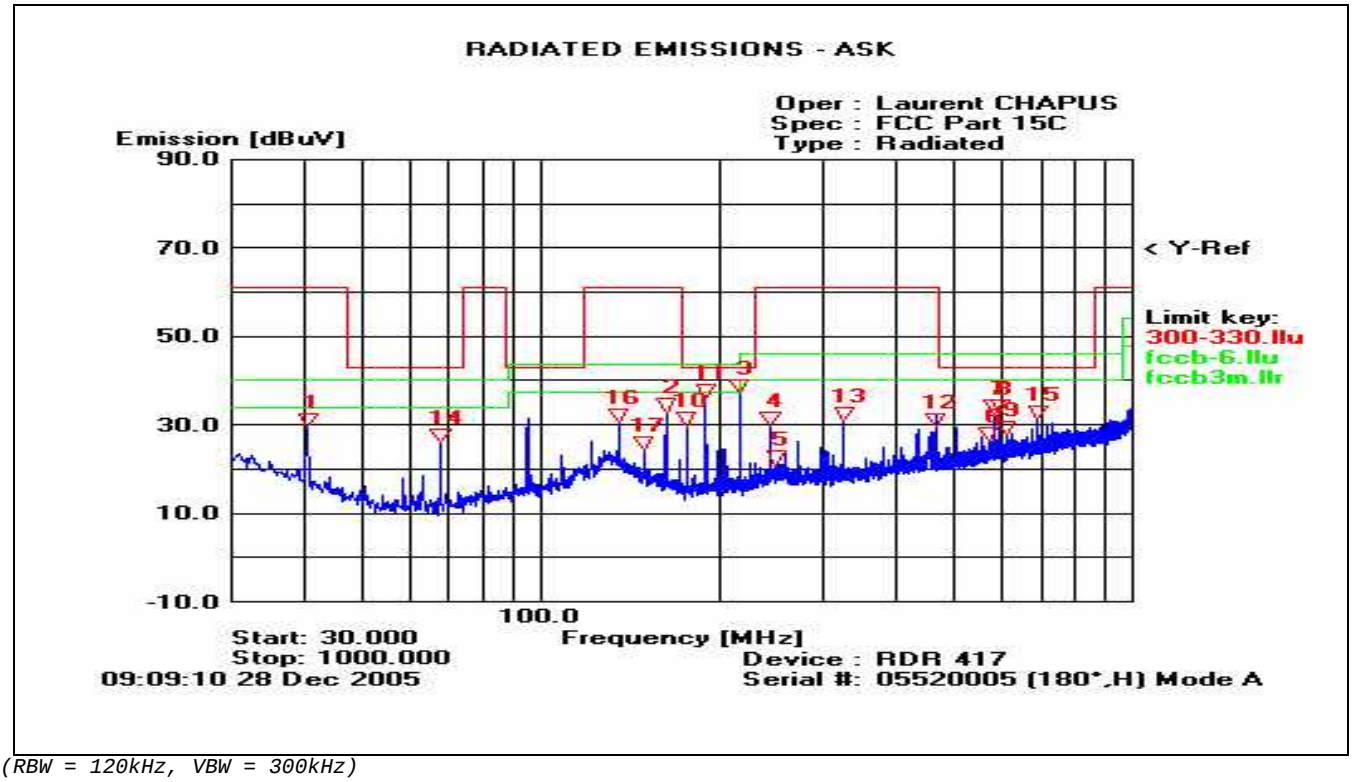


(RBW = 9kHz, VBW = 30kHz)

Result for 150MHz to 30MHz
(Marker n°1 is 13.56MHz)

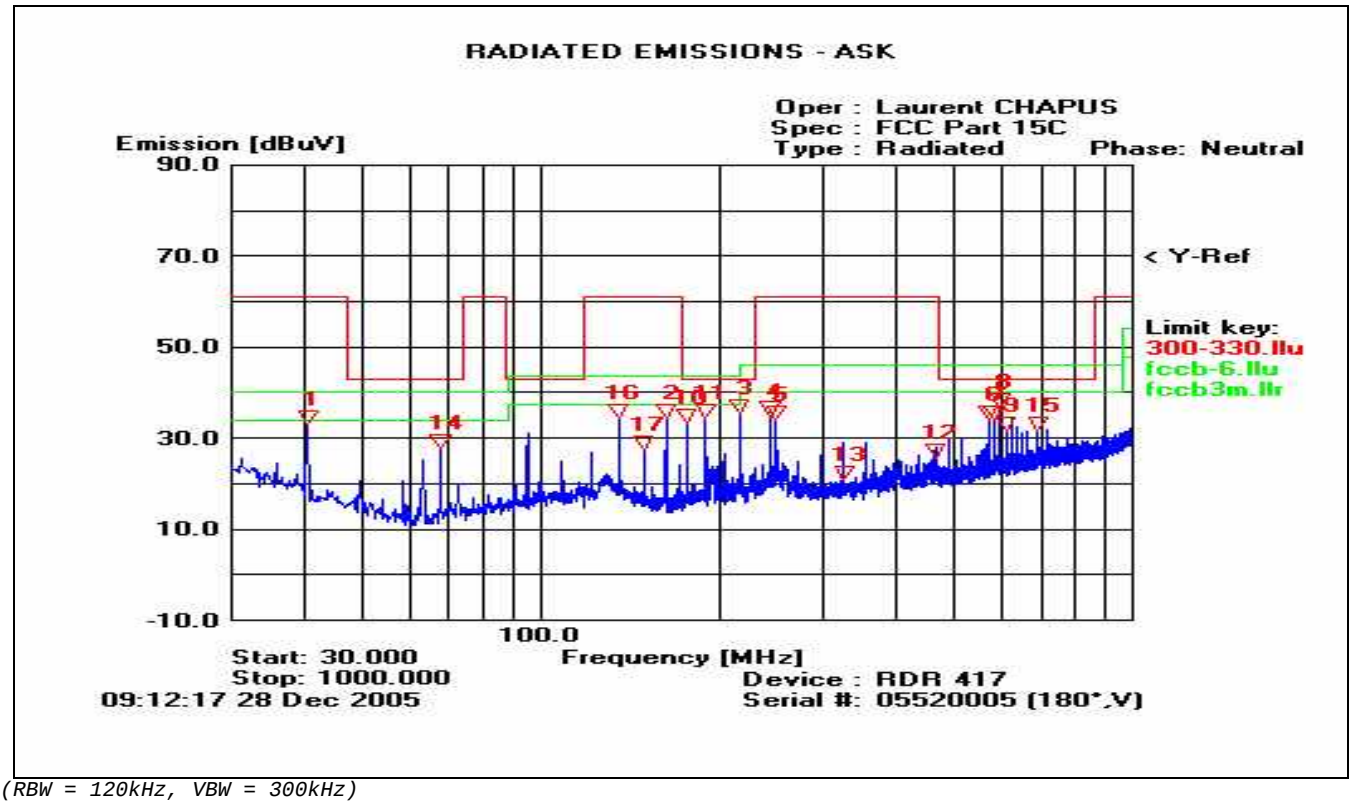
2.3.2.Pre-characterization at 3 meters [30MHz-1GHz]

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.
See below graph examples between 30MHz to 1GHz.



(RBW = 120kHz, VBW = 300kHz)

Result for 30MHz to 1GHz (Measuring antenna pol. H, smartcard mode A)



(RBW = 120kHz, VBW = 300kHz)

Result for 30MHz to 1GHz (Measuring antenna pol. V, smartcard mode A)

2.3.3.Characterization on 10 meters open site below 30 MHz

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 **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 was found and 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.

Frequency (MHz)	QPeak Lmt (dBµV/m) @ 30m	QPeak (dBµV/m)	QPeak-Lmt (dB)	Turntable Angle (deg)	Ant. Pol./ Angle (deg)	Tot Corr (dB)
13.56*[1]	84.0	20.1	-63.9	120°	V / 45°	35.3

*[1]: Fundamental – 15.225 limits. Measure have been done at 10m distance and corrected according to requirements of 15.209.e) (M@30m = M@10m-19.1dB)
*[2] : Highest level observed for mode A, mode B and ISO15693 smartcards.

Limits Subclause §15.225(a)

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
13.56	15 848 84dBµV/m	30

2.3.4.Characterization on 3 meters open site from 30MHz to 1GHz

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 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.

Results:

No	Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.703	40.0	39.8	**-0.2**	335	V	100	11.1	Worst margin
2	67.823	40.0	38.7	**-1.3**	160	V	100	9.7	
3	135.614	43.5	39.1	**-4.4**	230	V	100	14.7	
4	149.181	43.5	30.8	**-12.7**	155	V	120	14.8	
5	162.731	43.5	39.2	**-4.3**	160	V	100	17.3	
6	176.261	43.5	40.0	**-3.5**	65	H	180	17.9	
7	189.841	43.5	38.8	**-4.7**	35	H	160	18.9	
8	216.955	46.0	45.0	**-1.0**	40	H	130	15.6	
9	244.096	46.0	44.0	**-2.0**	40	H	120	15.3	
10	250.003	46.0	27.1	**-18.9**	15	V	230	15.3	
11	325.436	46.0	38.7	**-7.3**	35	H	120	18.1	
12	463.908	46.0	31.7	**-14.3**	15	H	150	21.1	
13	569.542	46.0	37.9	**-8.1**	245	H	170	23.2	
14	583.094	46.0	43.2	**-2.8**	45	V	150	23.3	
15	596.651	46.0	41.1	**-4.9**	240	H	150	23.5	
16	610.209	46.0	40.7	**-5.3**	65	V	120	23.8	
17	691.565	46.0	35.7	**-10.3**	315	H	160	26.0	

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 52.5dBµV 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 dBµV/m.
FS = 52.5 + 7.4 + 1.1 – 29 = 32 dBµV/m
The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.
Level in µV/m = Common Antilogarithm [(32dBµV/m)/20] = 39.8 µV/m.

3. Conducted emission data

The product has been tested according to ANSI C63.4-(2003).

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

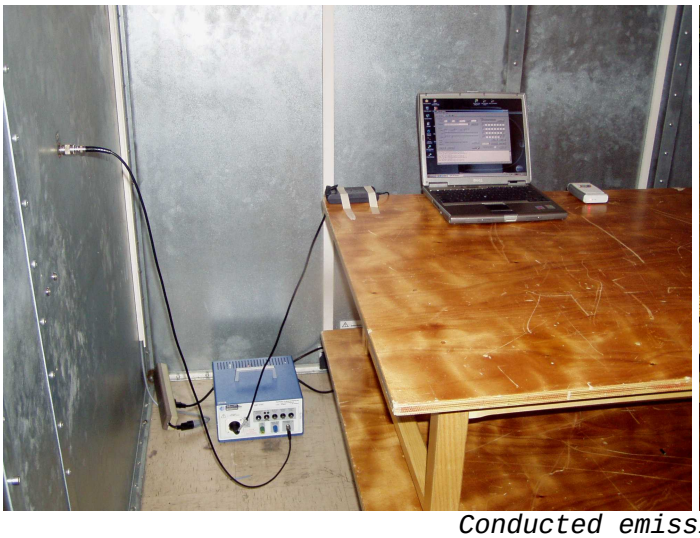
Measurement was initially made with an HP-8591EM Spectrum Analyzer in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement with the Rohde & Schwarz ESH3 receiver for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits 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 is 1 meter length. The RDR417 is connected to the computer with the USB cable.



Conducted emission test setup

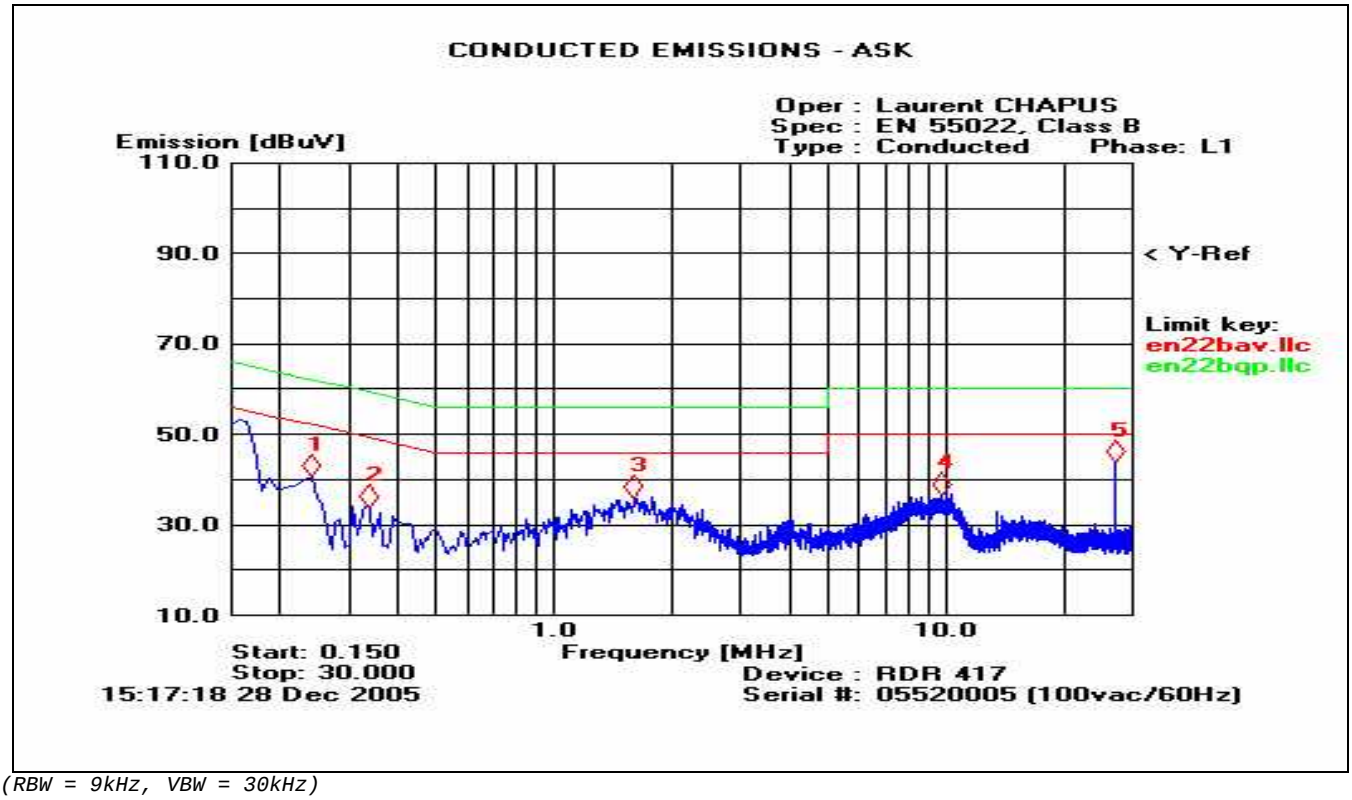
3.2. TEST EQUIPMENT

Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Test receiver	Rohde&Schwarz	ESH3	872079/117
Transient Limiter	HP	11947A	3107A01596
LISN(auxiliary)	EMCO	3810/2SH	9511-11821628
LISN(measure) 50Ω / 50µH	Telemeter Electronic	NNB-2/16Z	98010
Faraday room	Rayproof		4854

3.3. TEST SEQUENCE AND RESULTS

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

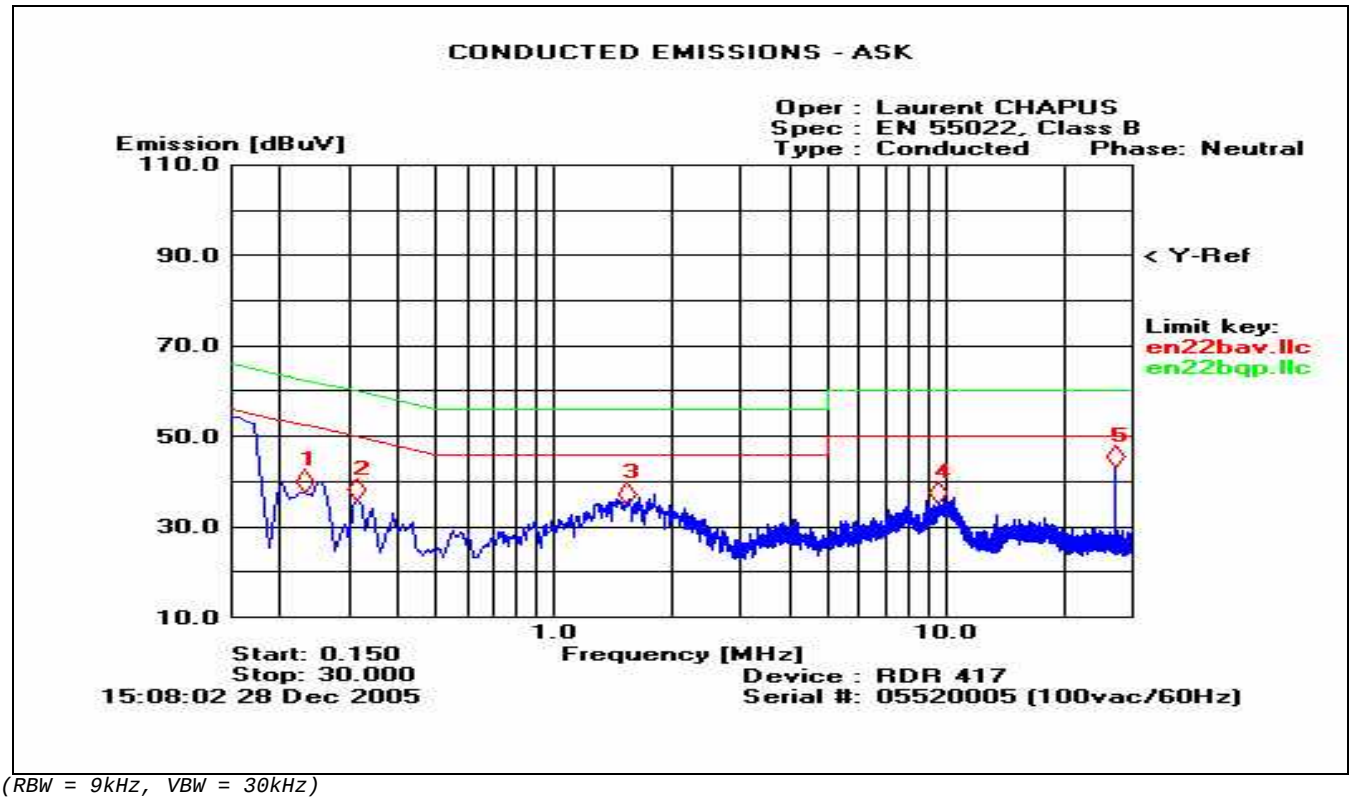
3.3.1.Line (L1) conducted emission data



(RBW = 9kHz, VBW = 30kHz)

Marker	Freq. [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.230	40.71	37.53	22.09	52.00
2	0.340	36.67	31.42	19.24	48.00
3	1.640	36.89	31.34	20.71	46.00
4	9.680	35.46	30.87	24.79	50.00
5	27.12	44.21	43.08	38.86	50.00
6	0.150	53.62	46.22	24.71	54.00

3.3.2.Neutral conducted emission data



(RBW = 9kHz, VBW = 30kHz)

Marker	Freq. [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.230	41.32	38.02	22.69	52.00
2	0.310	36.74	33.25	18.62	48.00
3	1.780	35.20	30.79	20.80	46.00
4	9.680	35.63	30.63	24.41	50.00
5	27.12	43.77	42.56	38.40	50.00
6	0.150	51.60	47.92	27.36	54.00

4. 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

4.1. TEST EQUIPMENT

Equipment	Company	Model	Serial
Biconical Antenna	EMCO	3104C	9401-4636
Spectrum Analyzer	HP	8593E	3409u00537
Loop antenna	Electro-metrics	EM-6879	690234
Climatic chamber	BIA		
DC power supply	ELC	AL924	
Multimeter	FLUKE 87 IV		

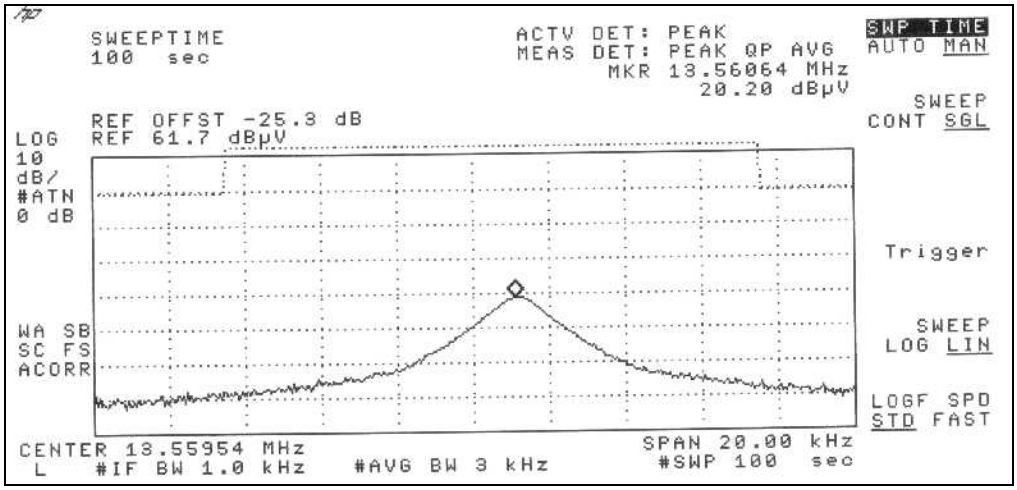
4.2. Temperature fluctuation

Temperature has been set at –20°C and +50°C.
The RDR417 is powered by 5Vdc from the USB port. The power voltage is being varied from 4.3V to 5.25Vdc.
Frequency of carrier: 13.56 MHz
Upper limit: 13.561356 MHz
Lower limit: 13.558644 MHz

Temperature	-20°C	25°C	+50°C
Power voltage: 5Vdc Frequency (MHz) Carrier level	 13.560070 -0.35dBc	 13.560018 REF	 13.560115 -0.25dBc
Power voltage: 4.30V Frequency (MHz) Carrier level	 13.560070 -1.75dBc	 13.560018 -1.45dBc	 13.560115 -1.55dBc
Power voltage: 5.25V Frequency (MHz) Carrier level	 13.560070 +0.05dBc	 13.560018 +0.30dBc	 13.560115 +0.25dBc
Result	Pass	-	Pass

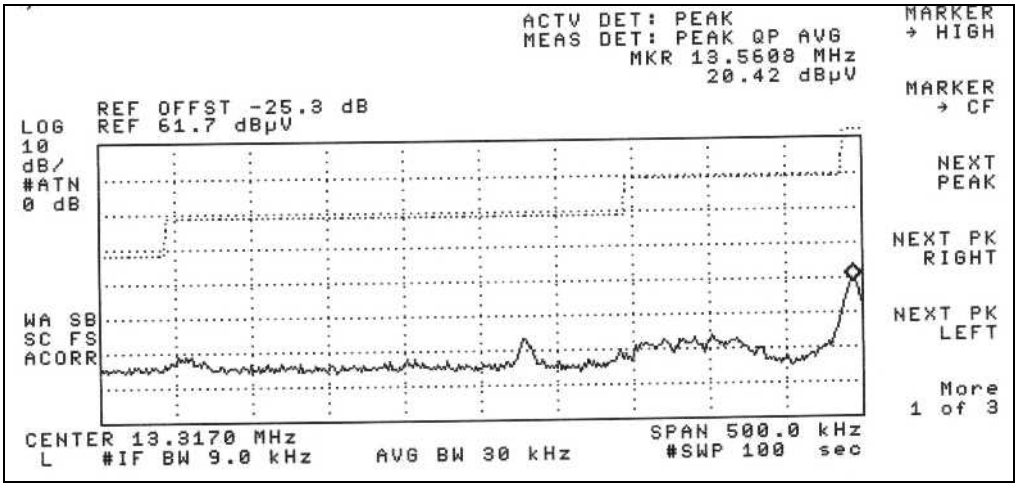
5. Band-edge compliance §15.209

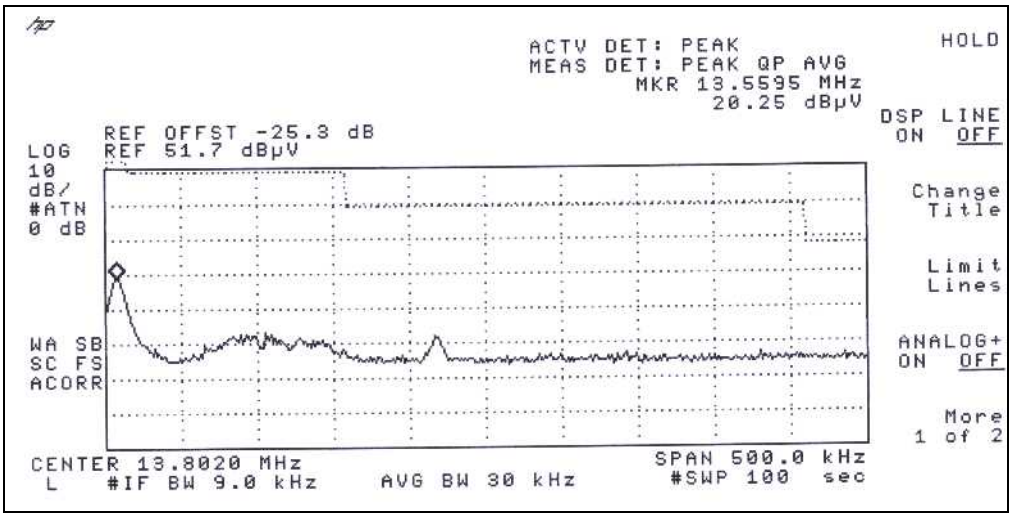
5.1. Band 13.553-13.567MHz



RBW = 1kHz

5.2. Outside of band 13.553-13.567MHz





RBW = 9kHz

End of Tests