EMC TEST REPORT

Nr 3667-FCC

This test report applies only on equipment described hereafter.

Proposal number: 200601-2916

Date .....: January 31st to February 3rd, 2006

Location.....: **LCIE**
ZI des Blanchisseries
38500 VOIRON - France

Performed by.....: Laurent CHAPUS

Customer**.....:** **ID3 Semiconductors**
5, rue de la Verrerie
38120 LE FONTANIL CORNILLON
FRANCE

Product.....: **CL1356T**

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

LCIE
Laboratoire Central
des Industries Electriques
Une société de Bureau Veritas

33, av du Général Leclerc
BP 8
92266 Fontenay-aux-Roses cedex
France

Tél : +33 1 40 95 60 60
Fax : +33 1 40 95 86 56
contact@lcie.fr
www.lcie.fr

Société anonyme à directoire
et conseil de surveillance
au capital de 15 745 984 €
RCS Nanterre B 408 363 174

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 CL1356T 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):
  CL1356T
  With reader **PN: 085K0481** **sn: 01068818**
  And contactless tablet (antenna) **PN: 805K0477** **sn: 01061352**
  (1m coaxial cable between reader and contactless antenna, fixed on EUT)

- Input/output on the CL1356T:
  - Input power (DC 12V)
  - USB port

- Frequencies:
  - 12MHz (USB)
  - 2MHz
  - 13,56MHz and 135.6MHz
  - 24.5MHz
  - Reading data rate: 106kHz or 212kHz or 424kHz or 847kHz

- Equipment information:

Radiated fundamental frequency of the CL1356T is 13.56MHz
Product with integrated and dedicated antenna (no possibility to use another antenna, no connector between reader and contactless tablet)

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
ID3 – CL1356T (1) (Sn : 01068818)	**TPD5K048**	**USB contactless reader**	USB cable: shielded (2m) Antenna + Led: coaxial + 2 wires (1m) Dc input cable: unshielded (1.4m)
EGSTON N2EFSW3 12V 500mA Input 100V/240Vac	**None**	**Power supply unit 12V / 500mA**	Dc input cable : 1.4m
COMPAQ PIII DESKPRO Sn: 8146FR4Z02GN	DOC	Personnel computer (Desktop)	Power cables unshielded USB shielded SVGA shielded
HEWLETT PACKARD P/N: D2846, 21'' monitor Sn: JPB4001000	DOC	Video monitor SVGA 21''	Power mains unshielded SVGA shielded with ferrites at each end
COMPAQ KB-9963 Sn: BZIAZOLBUMFOAF	DOC	Keyboard	PS2 cable
Microsoft X04-72167 sn: 9916996-5	DOC	Mouse	PS2 cable
Passport with integrated smartcard ISO 14443-2-3 (Mode A)	None	Contactless paper passport and smartcard	-

Trade Mark – Model Number (Serial number)	FCC ID	Description	Cable description
Smartcard (mode B)			

(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 CL1356T in a manner similar to a typical use. The smartcard data is being read continually during the test.
Smartcards for ISO14443-2-3 standard, mode A and B, are tested.
PC Software used: ID3 DEMO APPLICATION.EXE

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 CL1356T are:
- 1x USB cable, shielded: 2m
- 1x DC power cord: 1.4m (attached on power adapter)
- 2x AC power cords: 1.8m (PC and monitor)
- 1x SVGA standard video cable: 1.5m

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 (mode A passport or mode B smartcard) is placed on the top side of the reader (antenna tablet).

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 frequency band investigated was 9kHz to 2GHz.

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
Double ridged waveguide horn antenna	EMCO	ETS 3115	
Amplifier	HP	8447F H64	3113A06394
Amplifier	SMEE	1-8GHz	
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).

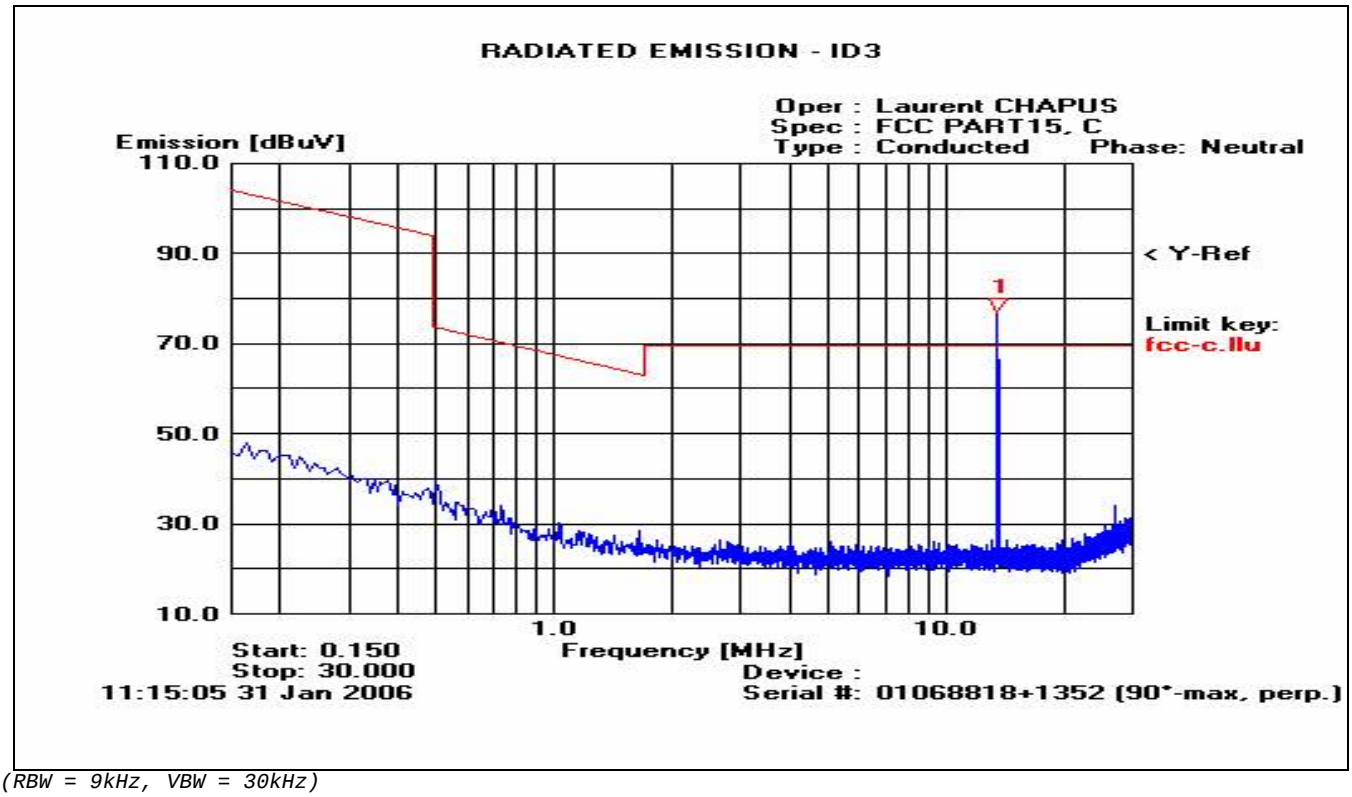
Pre-scan, test equipment up to 1GHz:

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
Double ridged waveguide horn antenna	EMCO	ETS 3115	
Amplifier	SMEE	1-8GHz	

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)

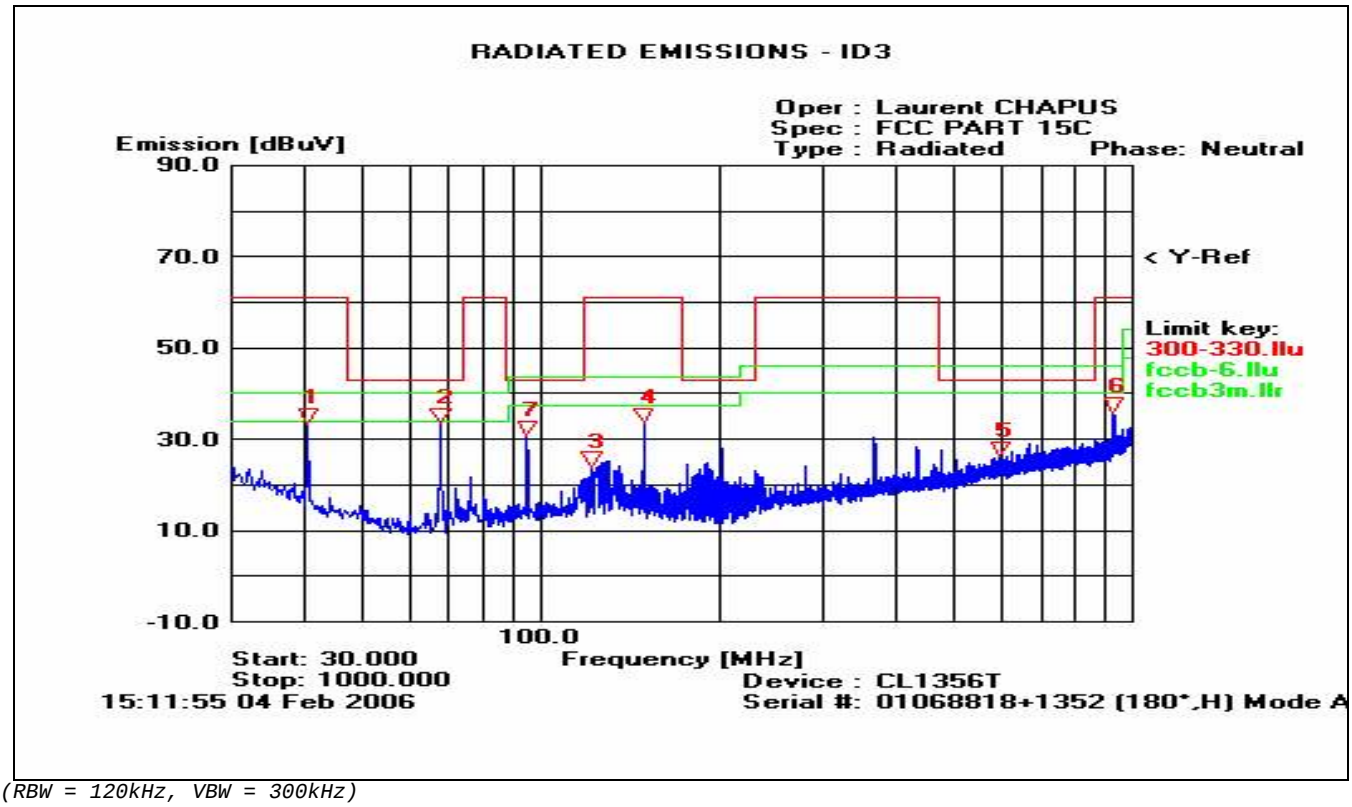


(RBW = 9kHz, VBW = 30kHz)

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

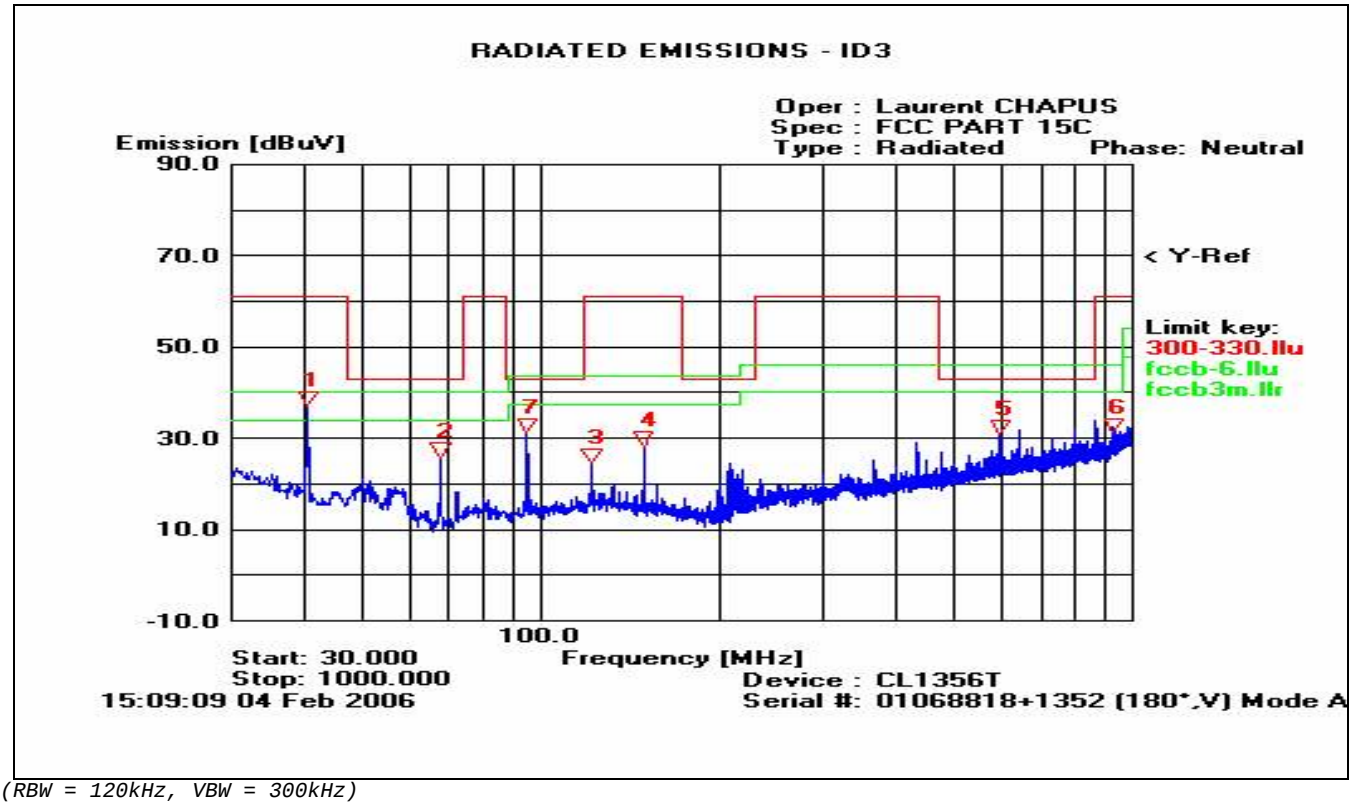
2.3.2.Pre-characterization at 3 meters [30MHz-1GHz]

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.



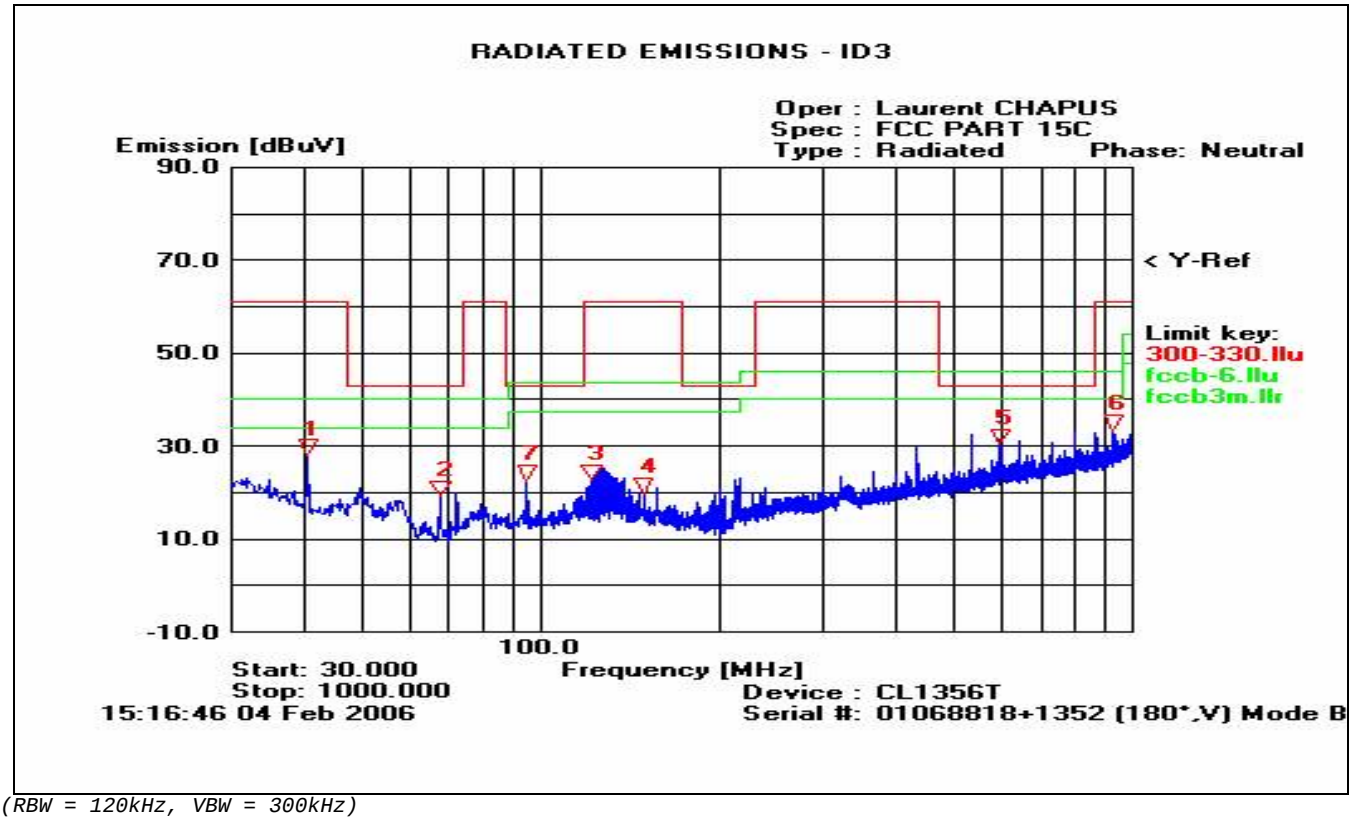
(RBW = 120kHz, VBW = 300kHz)

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)



(RBW = 120kHz, VBW = 300kHz)

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

2.3.3.Pre-characterization at 3 meters [1GHz-2GHz]

A pre-scan of all the setup has been performed in a 3 meters full anechoic chamber. In order to determine frequencies to measure on open site, a manual search is performed in anechoic chamber.

2.3.4.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	55.6	-28.4	0°	V / 90°	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 or without card.

Limits Subclause §15.225(a)

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

2.3.5.Characterization on 3 meters open site from 30MHz to 2GHz

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.
Above 1GHz, the RBW and VBW are 1MHz. A peak and average measurement were performed.
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 (30MHz to 1GHz, RBW = 120kHz)

No	Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.679	40.0	34.3	**-5.7**	90	H	220	11.1	
2	67.781	40.0	39.9	**-0.1**	230	H	300	9.7	Worst margin
3	122.030	43.5	40.1	**-3.4**	250	V	100	15.9	
4	149.151	43.5	38.3	**-5.2**	175	H	130	14.8	
5	176.525	43.5	38.6	**-4.9**	140	H	160	17.9	
6	364.574	46.0	32.6	**-13.4**	310	H	130	18.7	
7	599.631	46.0	35.8	**-10.2**	300	H	140	23.6	
8	927.866	46.0	41.5	**-4.5**	310	V	310	28.9	

Results (1GHz to 2GHz, PEAK Measurement, RBW = 1MHz)

No	Frequency (GHz)	PEAK Lmt (dBµV/m)	PEAK (dBµV/m)	Peak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
9	1.063	74.5	50.3	**-24.2**	0	H	100	26.0	
10	1.463	74.5	58.1	**-16.4**	179	H	100	27.2	Worst margin
11	1.593	74.5	55.0	**-19.5**	240	V	137	29.4	
12	1.728	74.5	52.9	**-21.6**	137	H	144	29.4	
13	1.865	74.5	51.2	**-23.3**	187	H	137	29.4	
14	1.995	74.5	49.8	**-24.7**	181	H	133	29.4	

Results (1GHz to 2GHz, Average Measurement, RBW = 1MHz)

No	Frequency (GHz)	AVG Lmt (dBµV/m)	AVG (dBµV/m)	AVG-Lmt (dB)
9	1.063	54.5	37.2	**-17.3**
10	1.463	54.5	43.3	**-11.2**
11	1.593	54.5	39.9	**-14.6**
12	1.728	54.5	38.0	**-13.5**
13	1.865	54.5	39.2	**-15.3**
14	1.995	54.5	33.9	**-20.6**

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 CL1356T is connected to the computer with the USB cable. The AC/DC power adapter is plugged directly in the LISN.

Conducted emission test setup

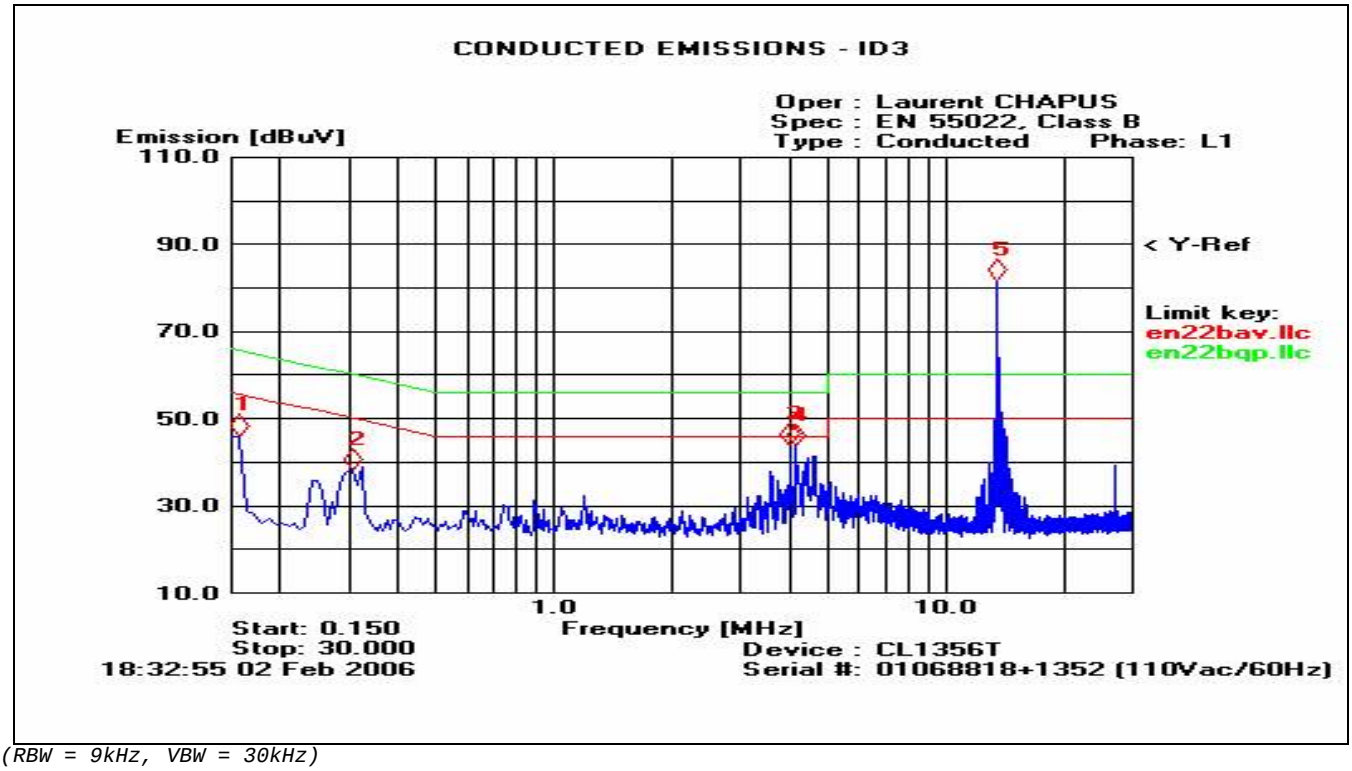
3.2. TEST EQUIPMENT

Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Test receiver	Rohde&Schwarz	ESH3	872079/117
Transient Limiter	HP	11947A	3107A01596
LISN(auxiliary)	EMCO	3825/2	9309-2122
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 AC/DC power adapter .
A measurement is also performed with a 50Ω dummy load connected at the end of the antenna coaxial cable. (replacing the antenna)

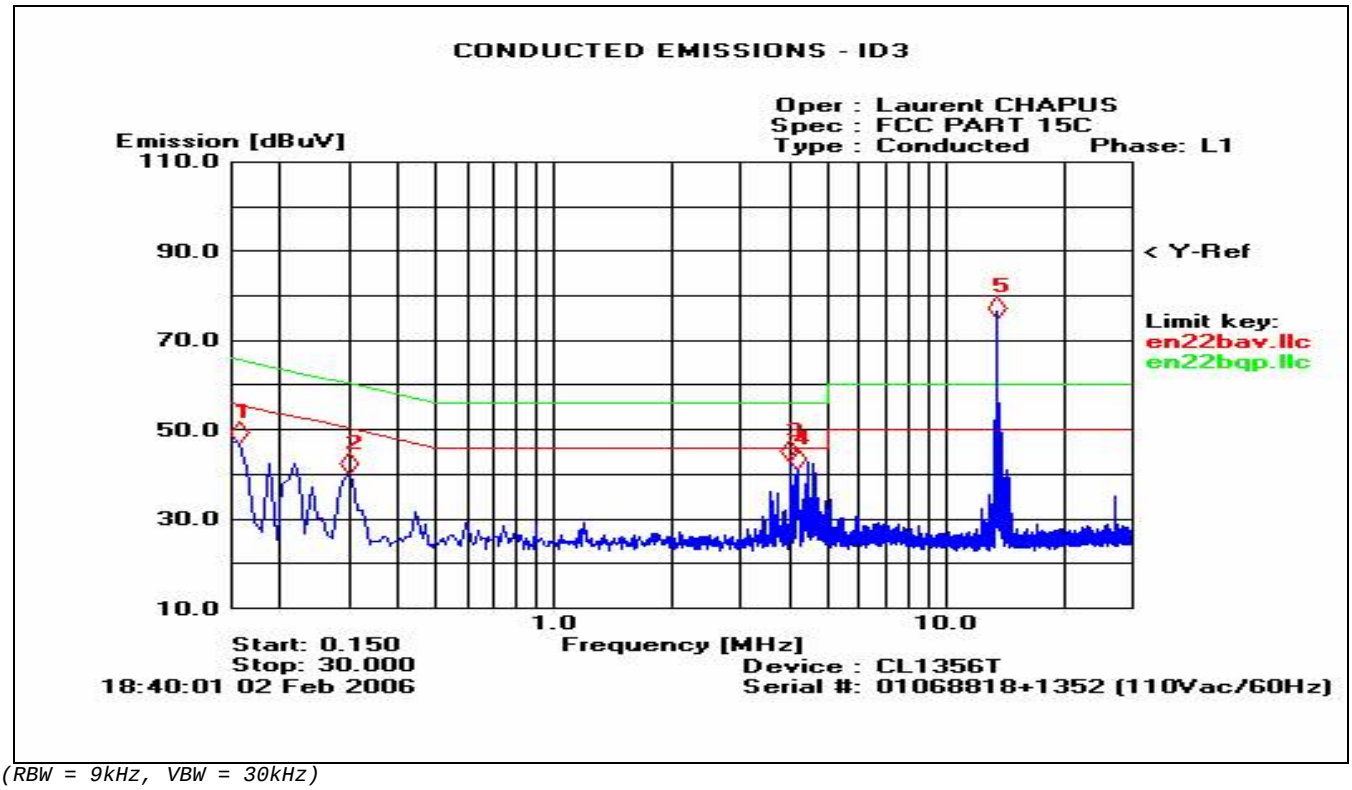
3.3.1.Line (L1) conducted emission data



(RBW = 9kHz, VBW = 30kHz)

Marker	Freq. [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.160	46.45	35.51	18.27	54.00
2	0.300	39.28	33.20	23.42	50.00
3	4.010	44.22	37.18	18.61	46.00
4	4.160	43.30	35.33	18.85	46.00
5	13.56	81.52	81.19	* 80.29	* 50.00
6	13.49	59.19	46.73	22.71	50.00
7	13.62	60.35	46.26	24.55	50.00

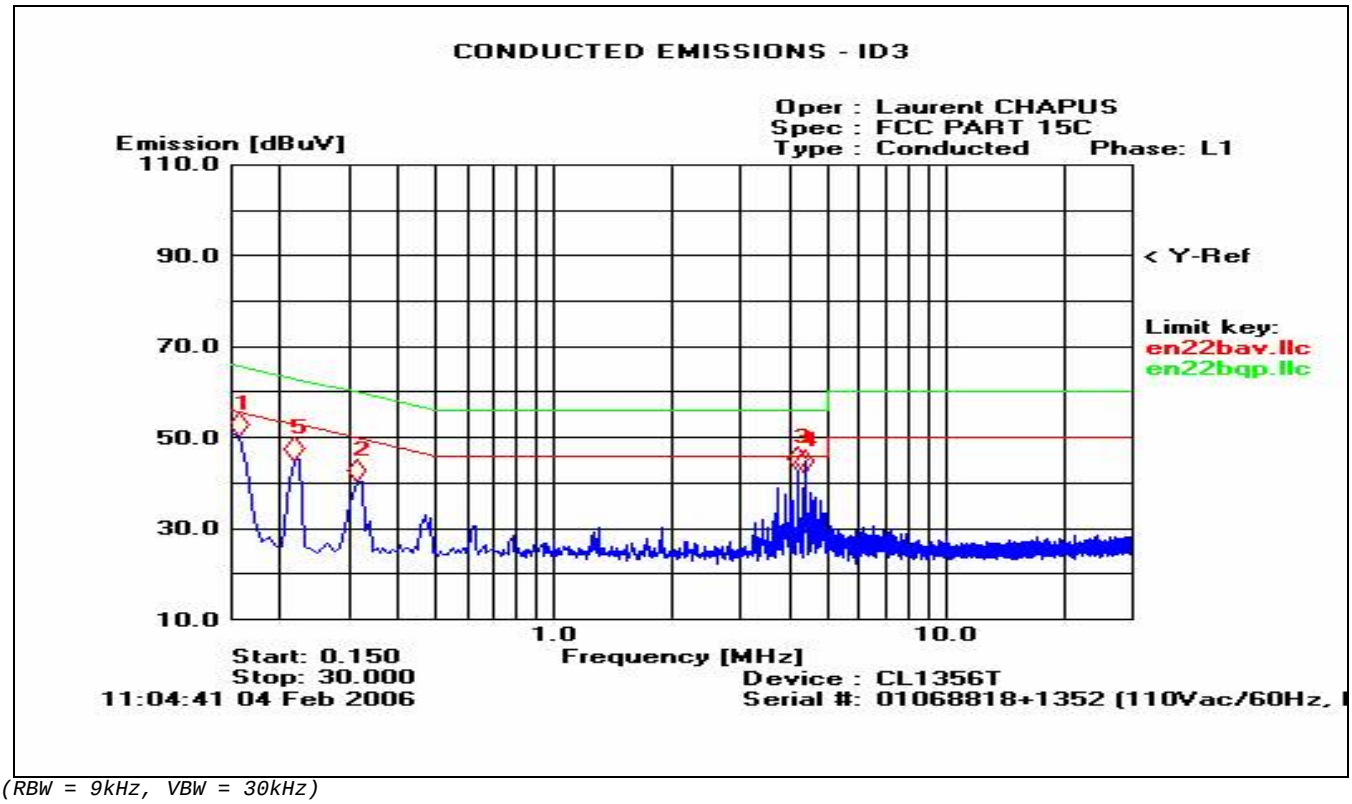
3.3.2.Neutral conducted emission data



(RBW = 9kHz, VBW = 30kHz)

Marker	Freq. [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.160	48.95	47.38	40.10	54.00
2	0.300	41.55	39.10	30.37	50.00
3	4.010	43.16	35.13	16.51	46.00
4	4.160	42.20	35.46	16.10	46.00
5	13.56	76.36 *	76.05 *	74.14 *	50.00
6	13.49	55.58	40.61	18.92	50.00
7	13.62	55.73	40.08	20.00	50.00

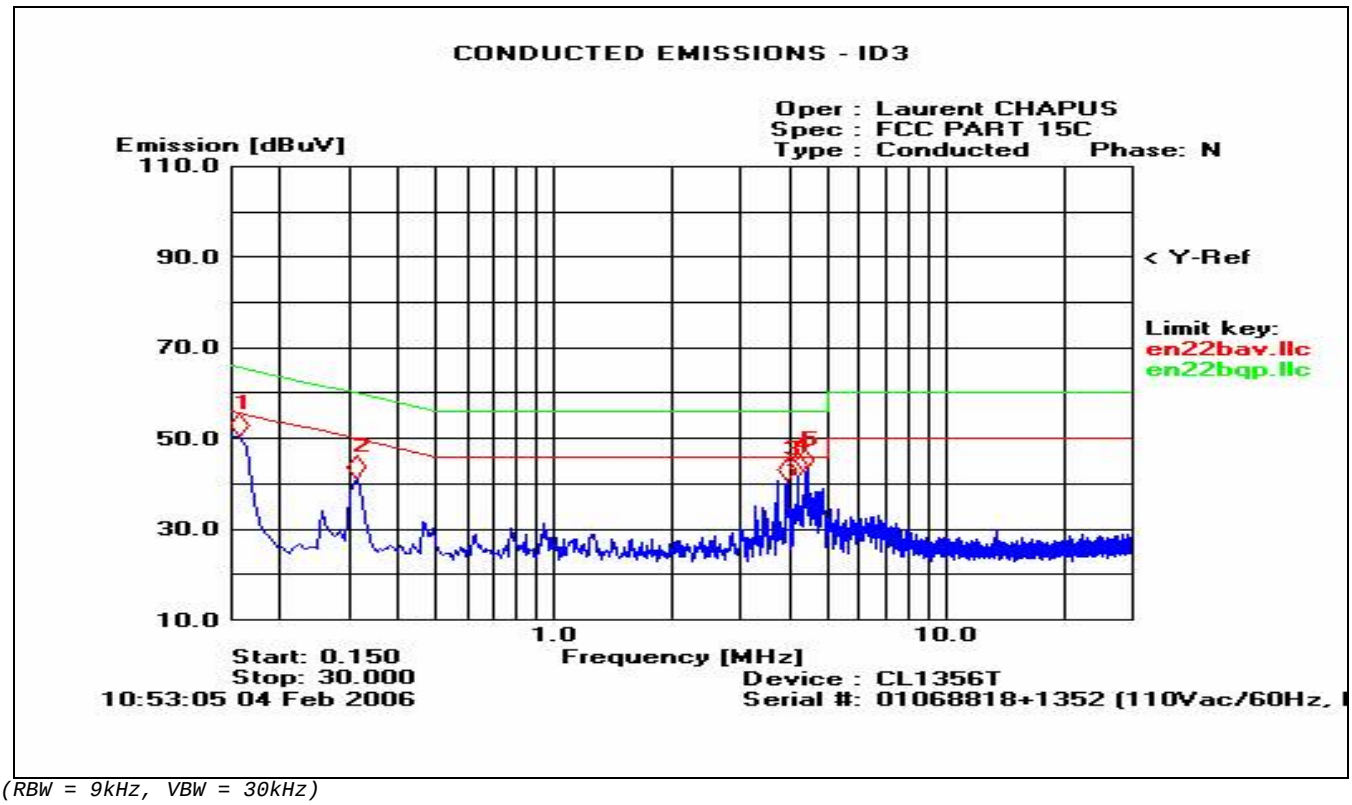
3.3.3.Line (L1) conducted emission data with dummy load (50Ω)



(RBW = 9kHz, VBW = 30kHz)

Marker	Freq. [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.160	49.00	47.18	38.91	54.00
2	0.310	41.88	40.12	29.06	48.00
3	4.190	42.99	34.98	15.74	46.00
4	4.370	43.74	34.57	16.06	46.00
5	0.220	44.78	33.42	15.64	52.00

3.3.4.Neutral (N) conducted emission data with dummy load (50Ω)



(RBW = 9kHz, VBW = 30kHz)

Marker	Freq. [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.160	50.42	47.48	32.56	54.00
2	0.310	41.04	38.95	26.51	50.00
3	3.930	33.87	29.78	17.81	46.00
4	4.190	43.56	36.23	18.42	46.00
5	4.370	45.00	39.00	22.63	46.00

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 and the input mains voltage is varied from 93.5V to 126.5V. (110V/60Hz ± 15%)

4.1. TEST EQUIPMENT

Equipment	Company	Model	Serial
Spectrum Analyzer	HP	8593E	3409u00537
Loop antenna	Electro-metrics	EM-6879	690234
Climatic chamber	BIA		
Programmable AC power supply	HP	HP 6842A	3531A00109

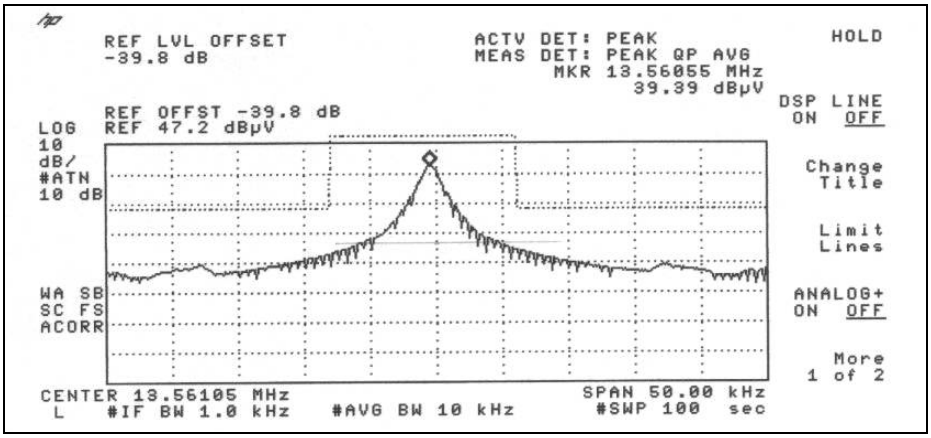
4.2. Voltage and Temperature fluctuation

Temperature has been set at +25°C, –20°C and +50°C.
Mains voltage is 110V/60Hz, 93.5V or 126.5V
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: 110V Frequency (MHz) Carrier level	 13.559635 -1.0 dBc	 **13.559540** **REF**	 13.559530 -0.6 dBc
Power voltage: 93.5V Frequency (MHz) Carrier level	 13.559635 -1.0 dBc	 13.559540 0dBc	 13.559530 -0.6 dBc
Power voltage: 126.5V Frequency (MHz) Carrier level	 13.559635 -1.0 dBc	 13.559540 0dBc	 13.559530 -0.6 dBc
Result	Pass	-	Pass

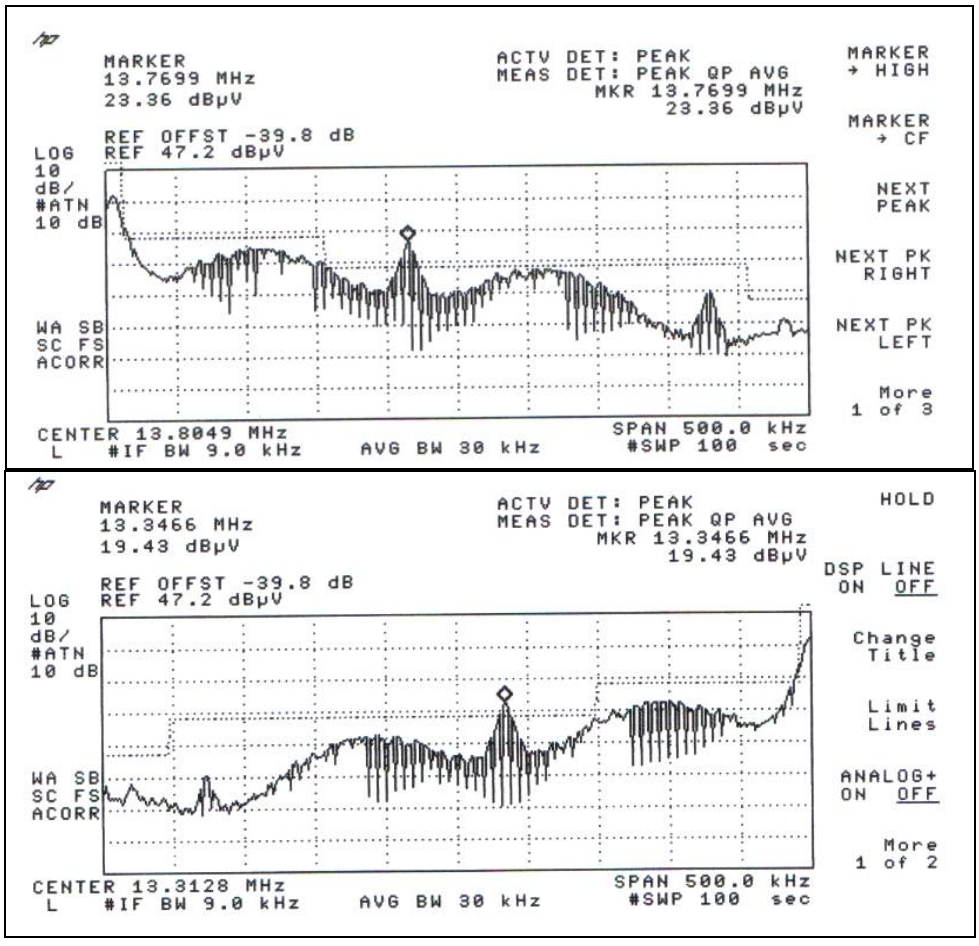
5. Band-edge compliance §15.209

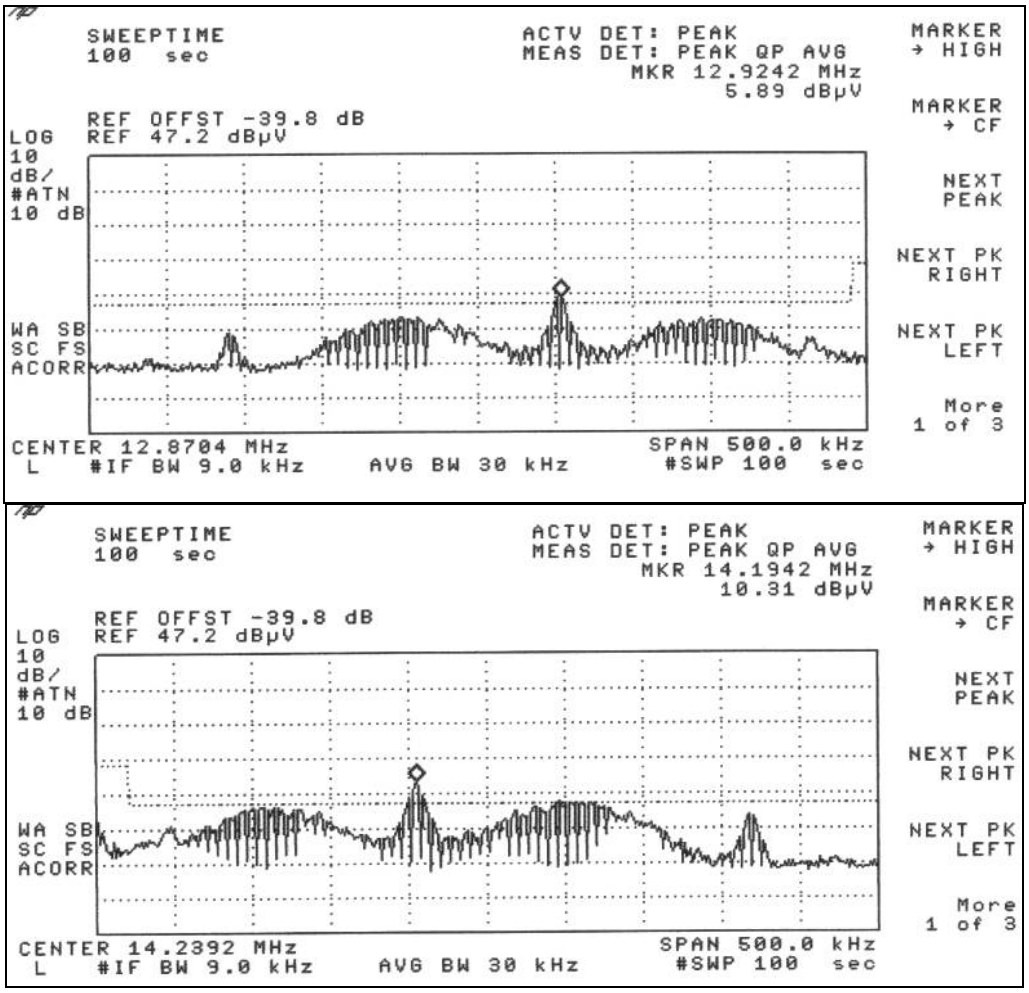
5.1. Band 13.553-13.567MHz



RBW = 1kHz

5.2. Outside of band 13.553-13.567MHz





RBW = 9kHz
Note: limits shown on plots are 10dB below regulatory limits.

5.3. Quasi-peak measurement

A quasi-peak measurement is performed for any strong signal. RBW is 9kHz.

Frequency	Limit (30m)	PEAK (measure 30m)	PEAK-LIMIT (margin)	Quasi-Peak (measure 30m)	QP-Limit (margin)
(MHz)	dBµV/m	dBµV/m	dB	dBµV/m	dB
13.45830	50.5	35.2	-15.3	**21.9**	**-28.6**
13.34898	40.5	35.6	-4.9	**26.5**	**-14.0**
13.27280	40.5	25.5	-15.0	**11.9**	**-28.6**
12.92418	29.5	21.9	-7.6	**13.0**	**-16.5**
13.65173	50.5	37.5	-13.0	**26.4**	**-24.1**
13.77275	40.5	39.6	-0.9	**30.5**	**-10.0**
13.85200	40.5	37.7	-2.8	**26.1**	**-14.4**
14.19420	29.5	26.5	-3.0	**17.3**	**-12.2**

Measure have been done at 10m distance and corrected according to requirements of 15.209.e) (M@30m = M@10m-19.1dB)

End of Tests