# 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**<br>ZI des Blanchisseries<br>38500 VOIRON - France |
| Performed by.....: | Laurent CHAPUS |
| Customer**.....:** | **ID3 Semiconductors**<br>5, rue de la Verrerie<br>38120 LE FONTANIL CORNILLON<br>FRANCE |

| | |
|---|---|
| Product.....: | **CL1356T** |
| Type of test .....: | **Radiated and Conducted Emission Test** |

| | |
|---|---|
| Applied standards.....: | ANSI C63-4 (2003)<br>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)<br>Antenna + Led: coaxial + 2 wires (1m)<br>Dc input cable: unshielded (1.4m) |
| **EGSTON<br>N2EFSW3 12V 500mA<br>Input 100V/240Vac** | **None** | **Power supply unit 12V / 500mA** | Dc input cable : 1.4m |
| COMPAQ PIII DESKPRO<br>Sn: 8146FR4Z02GN | DOC | Personnel computer (Desktop) | Power cables unshielded<br>USB shielded<br>SVGA shielded |
| HEWLETT PACKARD<br>P/N: D2846, 21’’ monitor<br>Sn: JPB4001000 | DOC | Video monitor SVGA 21’’ | Power mains unshielded<br>SVGA shielded with ferrites at each end |
| COMPAQ KB-9963<br>Sn: BZIAZOLBUMFOAF | DOC | Keyboard | PS2 cable |
| Microsoft X04-72167<br>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).

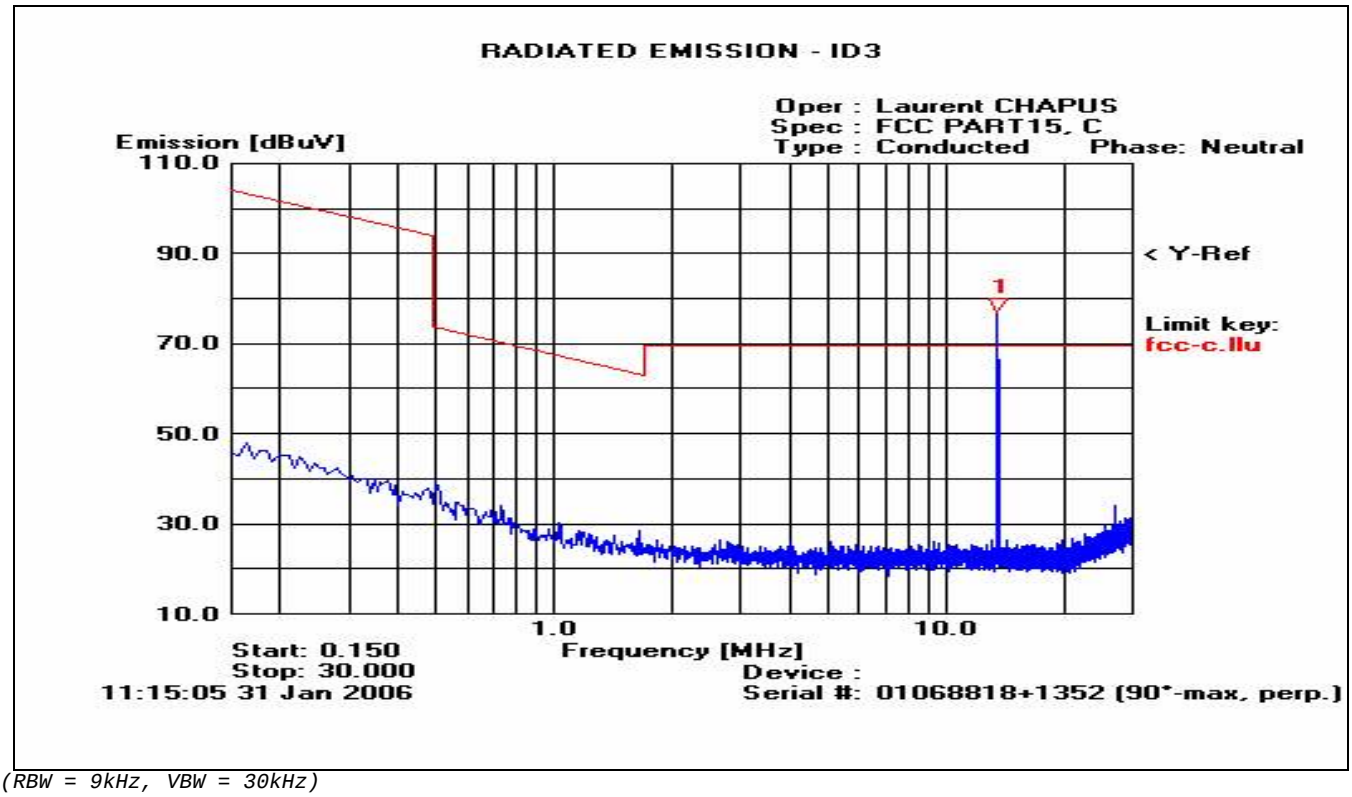
Pre-scan, test equipment up to 1GHz:

| 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)

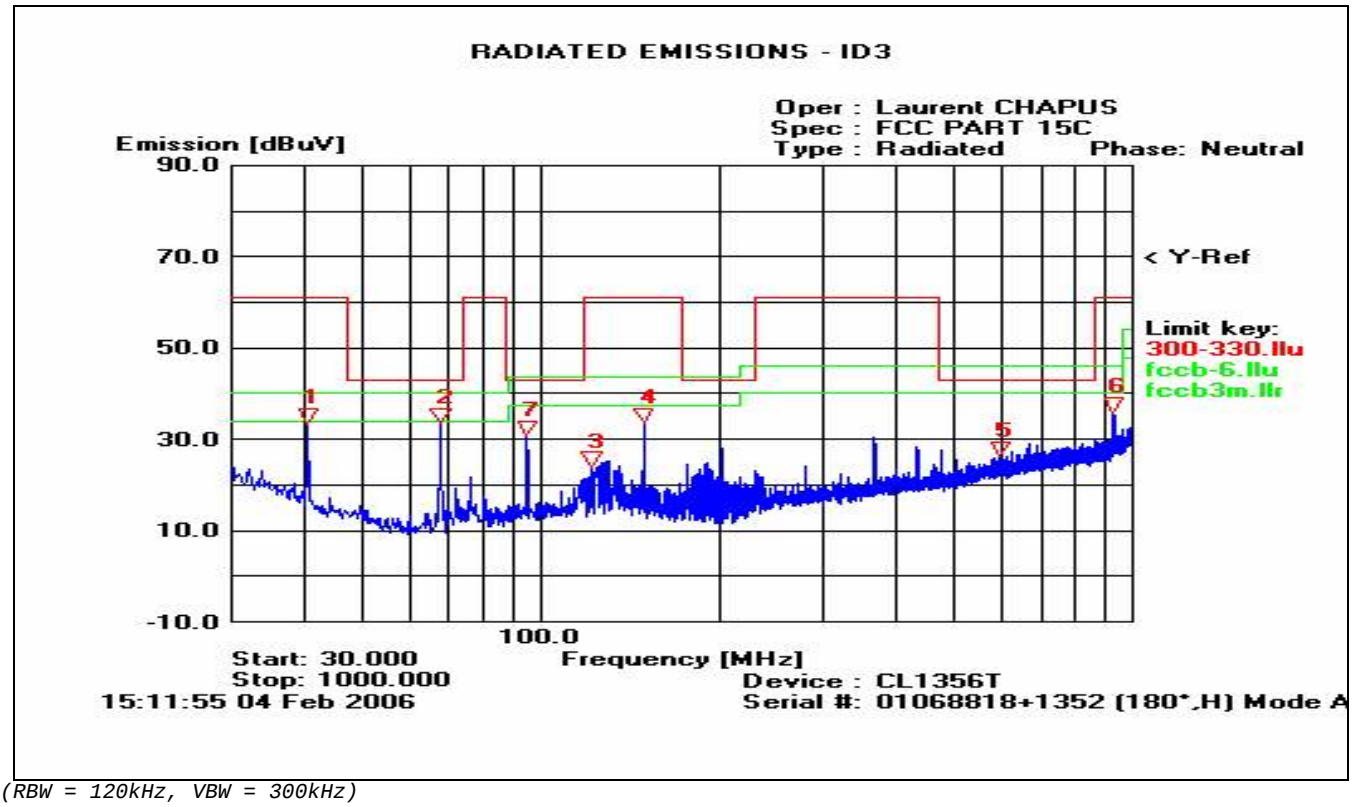



*(RBW = 9kHz, VBW = 30kHz)*

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

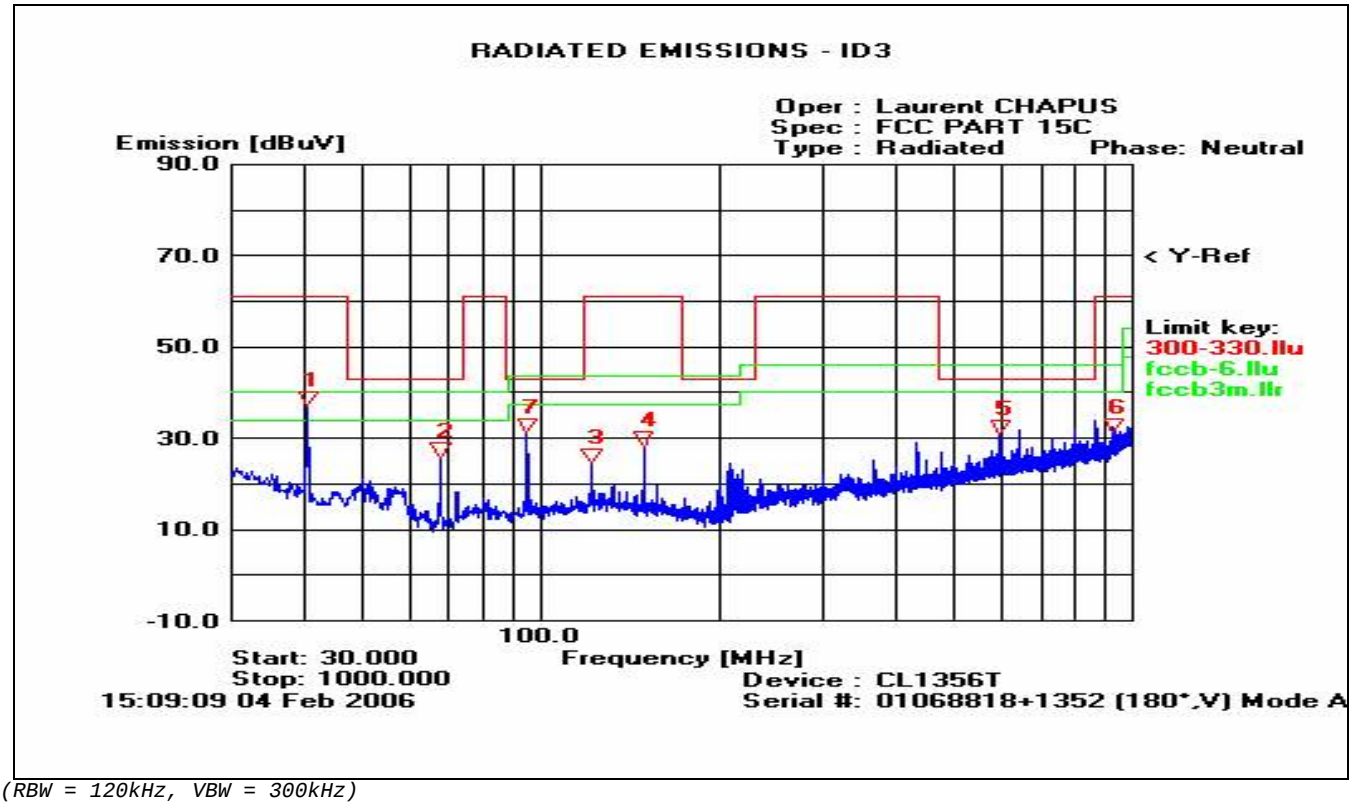
### 2.3.2.Pre-characterization at 3 meters [30MHz-1GHz]

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.



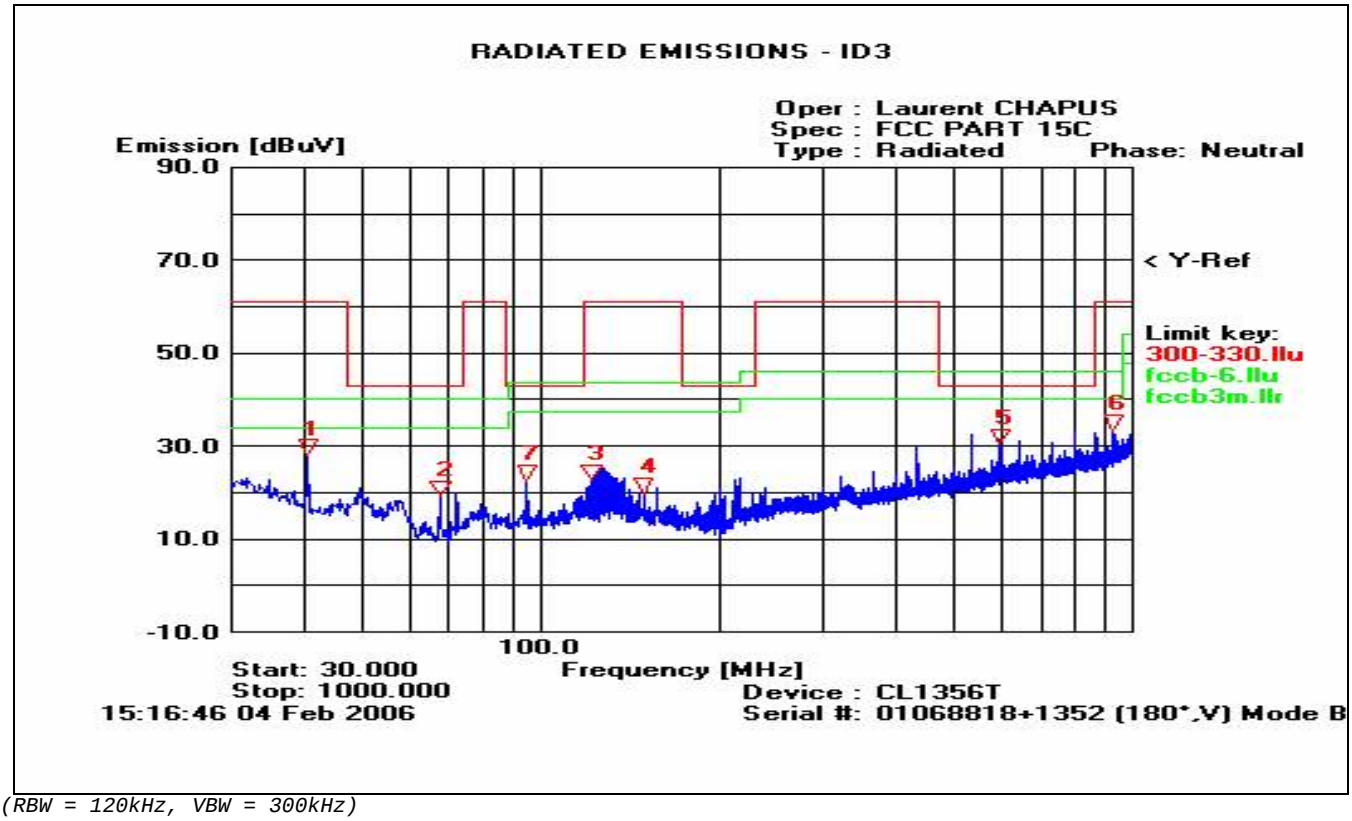

*(RBW = 120kHz, VBW = 300kHz)*

***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<br>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*

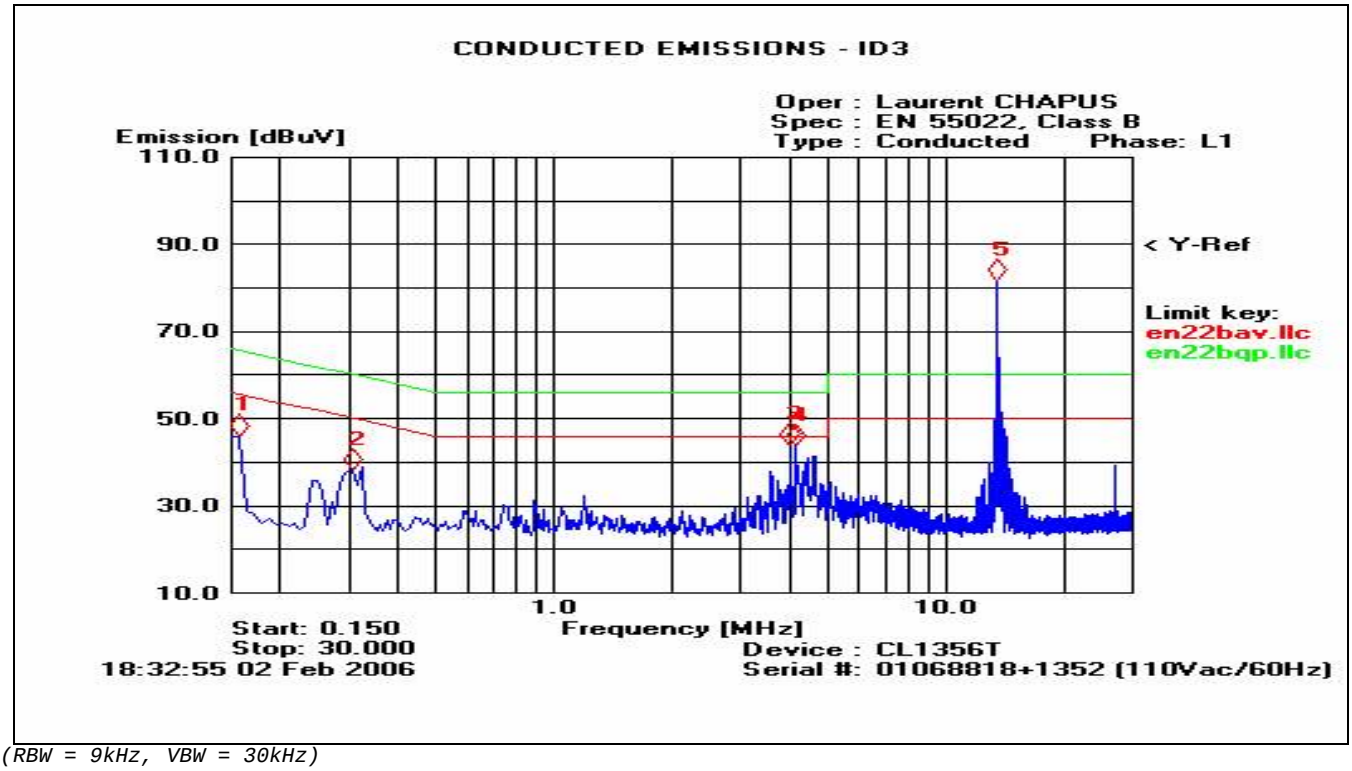
## 3.2. TEST EQUIPMENT

| 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)

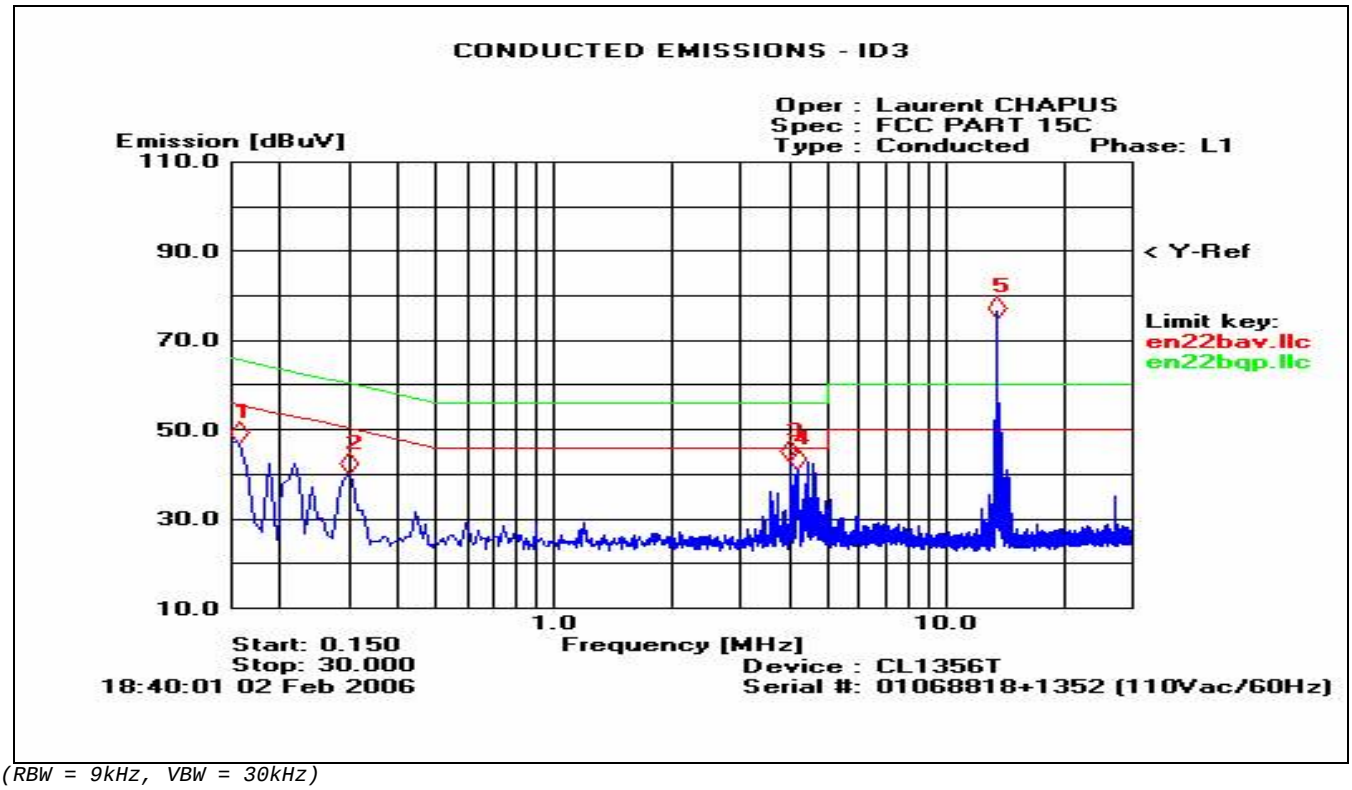
### 3.3.1.Line (L1) conducted emission data




*(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 |

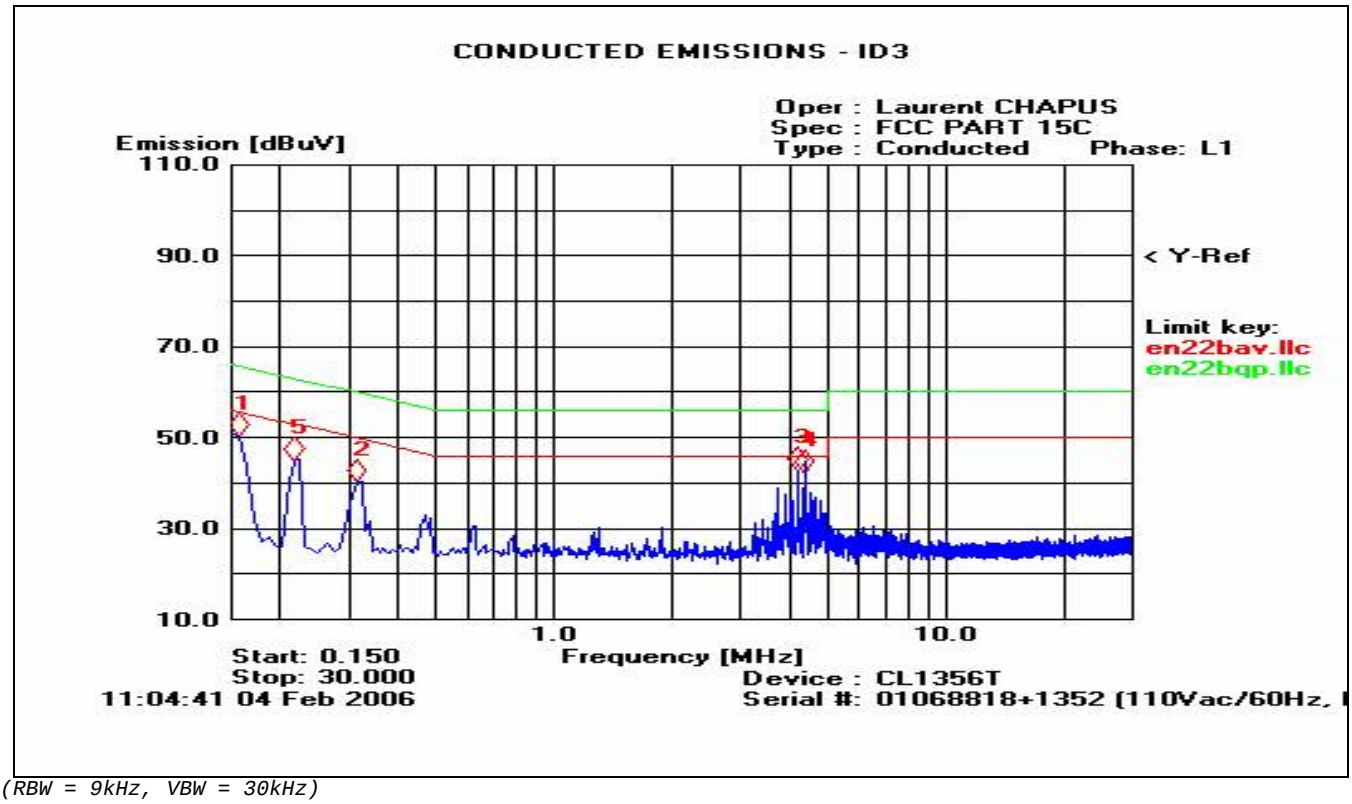
### 3.3.2.Neutral conducted emission data




*(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 |

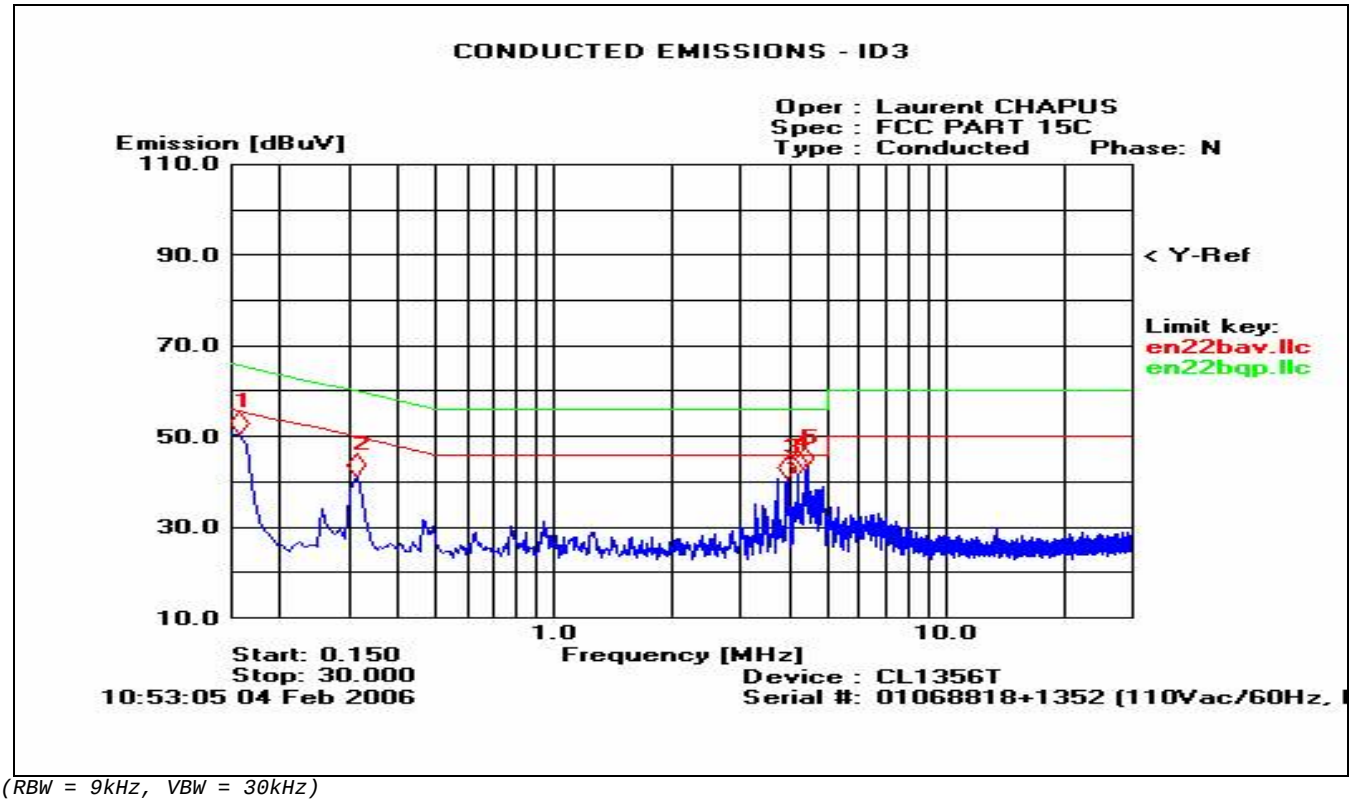
### 3.3.3.Line (L1) conducted emission data with dummy load (50Ω )




*(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 |

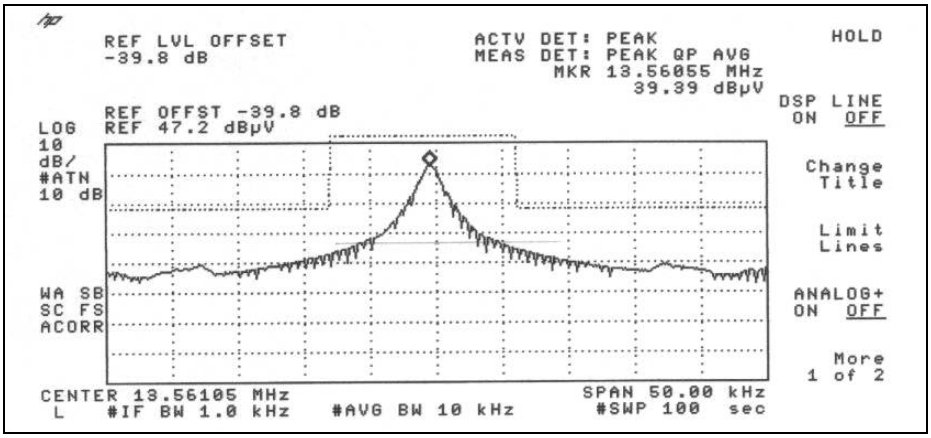
## *4.2. Voltage and Temperature fluctuation*

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**<br>Frequency (MHz)<br>Carrier level | 13.559635<br>-1.0 dBc | **13.559540**<br>**REF** | 13.559530<br>-0.6 dBc |
| **Power voltage: 93.5V**<br>Frequency (MHz)<br>Carrier level | 13.559635<br>-1.0 dBc | 13.559540<br>0dBc | 13.559530<br>-0.6 dBc |
| **Power voltage: 126.5V**<br>Frequency (MHz)<br>Carrier level | 13.559635<br>-1.0 dBc | 13.559540<br>0dBc | 13.559530<br>-0.6 dBc |
| **Result** | Pass | - | Pass |

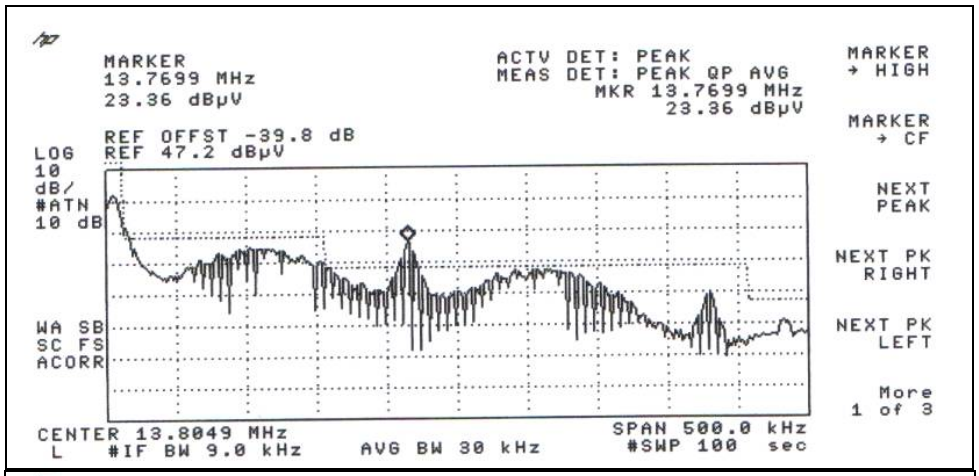
# 5. Band-edge compliance §15.209

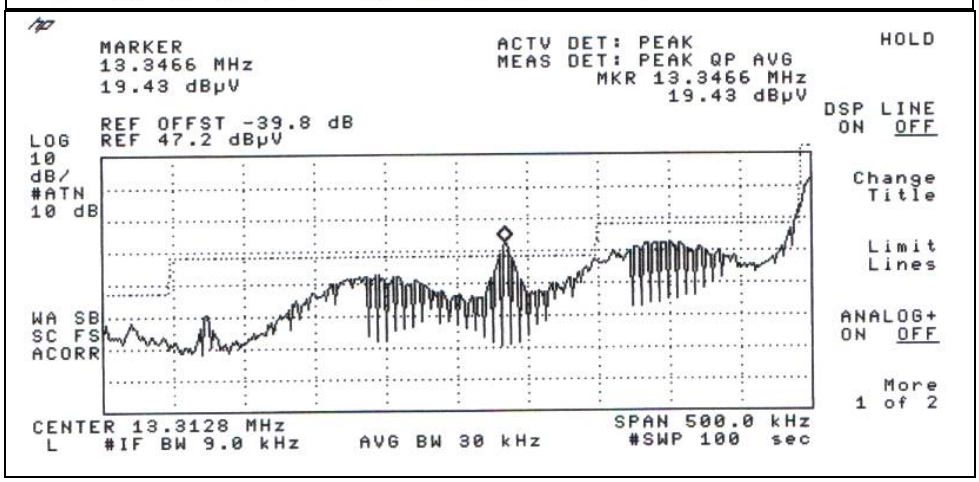
## 5.1. Band 13.553-13.567MHz

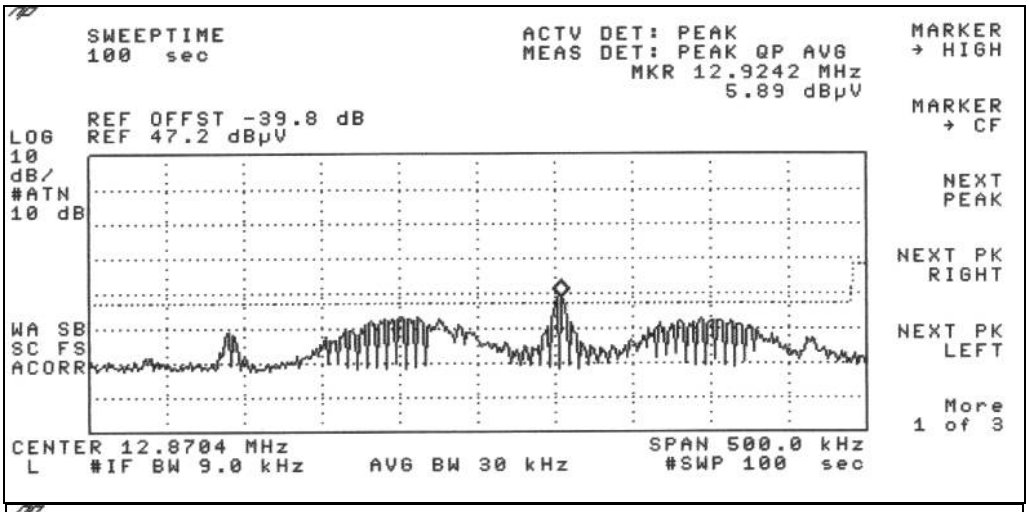


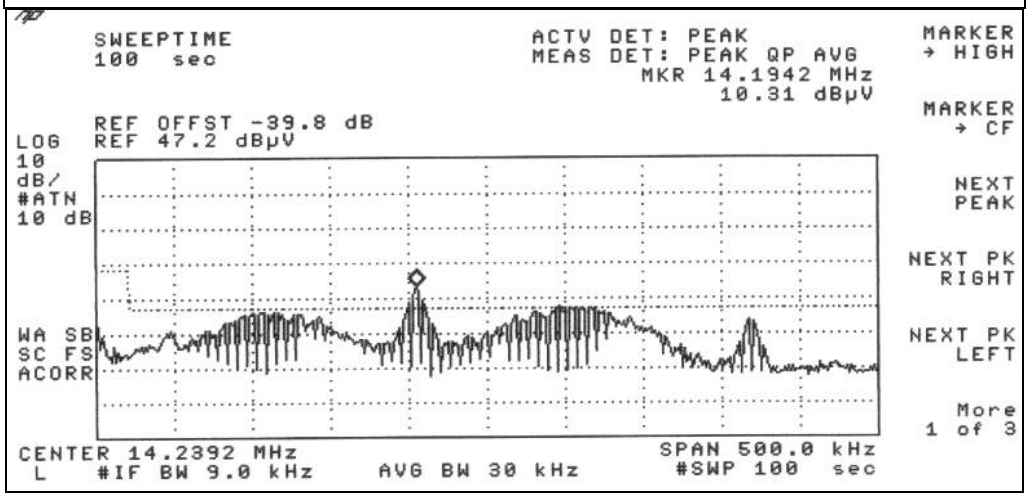

*RBW = 1kHz*

## 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***