



Tecnolab del Lago Maggiore S.r.l.  
ISTITUTO DI PROVE, MISURE E RICERCHE, ING. MICHELE SETARO  
Via dell'Industria, 20  
28924 Verbania Fondotoce (VB) – Italy

TEST REPORT RP010611

EMC test for FCC Certification procedure on  
VD1

2011/05/19

Page 1 di 26

CUSTOMER  
Cliente

**Open Data s.r.l.**  
Via Anticolana km 0,300  
03012 Anagni (FR)  
Italy

CONTRACT  
Commessa

**CO018710- 2010/11/30**

TEST REPORT  
Rapporto di Prova

**RP010611**

**EMC test for FCC Certification procedure on VD1**

APPLICABLE STANDARDS  
Norme di riferimento

- **FCC Rules : Code of Federal Regulations (CFR) no. 47 Ch1  
(10-1-09 Edition)  
PART 15 - RADIO FREQUENCY DEVICES**

2011/05/19

Assistant Head of Sector  
Eng. Marco Mai

Head of Sector  
Eng. Danilo Prina

Head of Laboratory  
Eng. Michele Setaro

Questo documento è firmato elettronicamente; le firme sono certificate da InfoCert S.p.a.  
*This document is signed electronically; signatures are certified by InfoCert S.p.a.*

Data  
Date

Redazione  
Redaction

Verifica Tecnica  
Technical Check

Autorizzazione  
Authorization



Tecnolab del Lago Maggiore S.r.l.  
ISTITUTO DI PROVE, MISURE E RICERCHE, ING. MICHELE SETARO  
Via dell'Industria, 20  
28924 Verbania Fondotoce (VB) – Italy

## TEST REPORT RP010611

### EMC test for FCC Certification procedure on VD1

2011/05/19

Page 2 di 26

Table of contents	Page.n.
<b>1. GENERAL REMARKS</b>	<b>3</b>
1.1 Customer data	3
1.2 Identification of equipment and/or subsystem under test (EUT)	3
1.3 Identification of auxiliary equipment not under test (AE)	3
1.4 Identification of connecting cables	3
1.5 Sampling	3
<b>2. SCOPE</b>	<b>3</b>
<b>3. APPLICABLE DOCUMENTS</b>	<b>3</b>
3.1 Applicability	3
3.2 Definitions and glossary of terms	4
3.3 Other definitions and abbreviations	4
<b>4. EUT FUNCTIONAL DESCRIPTION</b>	<b>4</b>
4.1 EUT description and operating method during tests	4
4.2 Test set-up and EUT configuration	4
<b>5. TECHNICAL COMPETENCE</b>	<b>4</b>
<b>6. TEST PERFORMED</b>	<b>5</b>
<b>6.1 General</b>	<b>5</b>
6.1.1 Test firm identification	5
6.1.2 List and description of tests	5
6.1.3 Uncertainty of measurement	5
<b>6.2 Conducted Emission measurements</b>	<b>6</b>
<b>6.3 Radiated Emission measurements</b>	<b>7</b>
<b>6.4 Occupied bandwidth</b>	<b>8</b>
<b>7. ANNEXES</b>	<b>9</b>

**TECNOLAB**

Tecnolab del Lago Maggiore S.r.l.  
ISTITUTO DI PROVE, MISURE E RICERCHE, ING. MICHELE SETARO  
Via dell'Industria, 20  
28924 Verbania Fondotoce (VB) – Italy

**TEST REPORT RP010611****EMC test for FCC Certification procedure on  
VD1**

2011/05/19

Page 3 di 26

**1. GENERAL REMARKS****1.1 Customer data**

Customer:	<b>Open Data s.r.l.</b>
Address:	Via Anticolana km 0,300 03012 Anagni (FR) Italy

**1.2 Identification of equipment and/or subsystem under test (EUT)**

EUT (equipment or subsystem) n°:	1
Mark:	<b>Open Data</b>
Model:	VD1
FCC ID	ZMNVD1USA
Acceptance code:	AC017711/1
Receiving date:	2011/03/21
Description:	The device VD1 is a 2 digit LED display, used to show queue numbers in the queuing system. See Annex 1 and 2 of this test report.

**1.3 Identification of auxiliary equipment not under test (AE)**

EUT does not require auxiliary equipment for its operation.

**1.4 Identification of connecting cables**

Cable nr.:	CV1
Description and length:	AC power input cable. (UL) SPT-2 105°C VW-1 18AWGx2C E137357. Length: 1,5m.

**1.5 Sampling**

The results shown in this Technical Report exclusively refer to the sample under test, taken away from the production by Customer. Extension of test results to the whole production is the responsibility of manufacturer/importer.

**2. SCOPE**

Scope of the test and the measurement is to supply the Customer with useful indications in order to evaluate EUT compliance with Electromagnetic Compatibility Reference Standards; the performed test plan is required from the manufacturer.

**3. APPLICABLE DOCUMENTS**

FCC Rules	FCC Rules : Code of Federal Regulations (CFR) no. 47 Ch1 (10-1-09 Edition) PART 15 - RADIO FREQUENCY DEVICES
-----------	---

**3.1 Applicability**

Applicable parties regarding the certification procedure for intentional radiator operating at frequency 433,9 MHz.

According to the definition 15.3 (o)EUT is an Intentional Radiator with periodic operation at frequency 433,9 MHz so it shall fulfil provisions of 47CFR part 15 Subpart C – intentional radiators – and section



Tecnolab del Lago Maggiore S.r.l.  
ISTITUTO DI PROVE, MISURE E RICERCHE, ING. MICHELE SETARO  
Via dell'Industria, 20  
28924 Verbania Fondotoce (VB) – Italy

## TEST REPORT RP010611

### EMC test for FCC Certification procedure on VD1

2011/05/19

Page 4 di 26

15.231. Section 15.231 is applicable because EUT is a manually operated transmitter who employ a switch that will automatically deactivate the transmitter within not more than 5 seconds after activation.

### 3.2 Definitions and glossary of terms

Applicable IEC 50 IEV Standard definitions.

AE	Auxiliary Equipment
CE	Conducted Emission
EMC	Electromagnetic Compatibility
EUT	Equipment Under Test
RE	Radiated Emission

### 3.3 Other definitions and abbreviations

GRP	Ground reference plane
BH	Biconical antenna in horizontal polarization
BV	Biconical antenna in vertical polarization
LH	Log-periodic antenna in horizontal polarization
LV	Log-periodic antenna in vertical polarization
HH	Horn antenna in horizontal polarization
HV	Horn antenna in vertical polarization
Loop F	Loop antenna in frontal position
Loop L	Loop antenna in lateral position
Pass	In compliance with reference Standard
Fail	Not in compliance with reference Standard

## 4. EUT FUNCTIONAL DESCRIPTION

### 4.1 EUT description and operating method during tests

The device VD1 is a 2 digit LED display, used to show queue numbers in the queuing system. The display is activated by one or more remote controls, namely by both VT1 and VT2. The main function of the display is to increase queue number, by pressing the biggest button of the remote control. The device was tested by moving forward in a progressive manner the numbers.

### 4.2 Test set-up and EUT configuration

EUT is powered with 135Vac 60Hz via an external power supply.

## 5. TECHNICAL COMPETENCE

Technicians qualified for the execution of the tests are engineers with at least three months of experience in Measurements and Testing.

**TECNOLAB**

Tecnolab del Lago Maggiore S.r.l.  
ISTITUTO DI PROVE, MISURE E RICERCHE, ING. MICHELE SETARO  
Via dell'Industria, 20  
28924 Verbania Fondotoce (VB) – Italy

**TEST REPORT RP010611****EMC test for FCC Certification procedure on  
VD1**

2011/05/19

Page 5 di 26

**6. TEST PERFORMED****6.1 General****6.1.1 Test firm identification**

Tests were performed at laboratory: Tecnolab del Lago Maggiore S.r.l., Via dell'Industria 20, 28924 Verbania Fondotoce (VB) ITALY.

REGISTRATION NUMBER: **868554**

**6.1.2 List and description of tests**

Test	Applicable Standard	Port	Paragraph of this test report	Result
Antenna requirement	47 CFR 15.203 /15.204	/	/	Use of permanently attached antenna shall be considered sufficient to comply the provisions of this section.
Conducted emissions measurements	47 CFR 15.207 (a)	AC Power port	6.2	Pass
Radiated emissions measurements	47 CFR 15.205 47 CFR 15.209 47 CFR 15.231 (b)	Enclosure port	6.3	Pass
Occupied bandwidth for device operating over 70 MHz and under 900 MHz	47 CFR 15.231 (c)	Enclosure port	6.3	Pass

**6.1.3 Uncertainty of measurement**

The uncertainty of measurement stated in this document are expressed as expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor  $K = 2$  corresponding to a confidence level of about 95%.



Tecnolab del Lago Maggiore S.r.l.  
ISTITUTO DI PROVE, MISURE E RICERCHE, ING. MICHELE SETARO  
Via dell'Industria, 20  
28924 Verbania Fondotoce (VB) – Italy

## TEST REPORT RP010611

### EMC test for FCC Certification procedure on VD1

2011/05/19

Page 6 di 26

## 6.2 Conducted Emission measurements

<b>Date:</b>	2011/03/21																	
<b>Enviromental condition:</b>	Temperature=18-25°C – Humidity= 30-50%																	
<b>Applicable Standard:</b>	47 CFR 15.207 (a)																	
<b>Test levels/Limits:</b>	The reference limits for intentional radiators are: <table><tr><td>Frequency range</td><td>Limits (detector)</td></tr><tr><td>0.15 - 0.5 MHz</td><td>66-56 dB<math>\mu</math>V (QP)</td></tr><tr><td>“</td><td>56-46 dB<math>\mu</math>V (AVG)</td></tr><tr><td>0.5 - 5 MHz</td><td>56 dB<math>\mu</math>V (QP)</td></tr><tr><td>“</td><td>46 dB<math>\mu</math>V (AVG)</td></tr><tr><td>5 - 30 MHz</td><td>60 dB<math>\mu</math>V (QP)</td></tr><tr><td>“</td><td>50 dB<math>\mu</math>V (AVG)</td></tr></table>				Frequency range	Limits (detector)	0.15 - 0.5 MHz	66-56 dB $\mu$ V (QP)	“	56-46 dB $\mu$ V (AVG)	0.5 - 5 MHz	56 dB $\mu$ V (QP)	“	46 dB $\mu$ V (AVG)	5 - 30 MHz	60 dB $\mu$ V (QP)	“	50 dB $\mu$ V (AVG)
Frequency range	Limits (detector)																	
0.15 - 0.5 MHz	66-56 dB $\mu$ V (QP)																	
“	56-46 dB $\mu$ V (AVG)																	
0.5 - 5 MHz	56 dB $\mu$ V (QP)																	
“	46 dB $\mu$ V (AVG)																	
5 - 30 MHz	60 dB $\mu$ V (QP)																	
“	50 dB $\mu$ V (AVG)																	
<b>Test procedure:</b>	Test is performed on each wires (L1,L2) of the cable CV1 in the configuration of the top-table equipments with EUT1 135Vac/60Hz powered via an external power supply and LISN.																	
<b>Test set-up:</b>	ANSI C63.4 (2009) See par. 4.2 and annex 3 of this test report. The measures shown in annexes listed below were obtained considering the correction factors of cables and LISN used for the test.																	
<b>Meas. Uncertainty:</b>	3,48 dB																	
<b>Test results:</b>	<b>PASS</b> The emissions from the EUT conducted with PK detector are over the AVG limits; investigations with AVG detectors are necessary. The measurements performed are showed in following annexes: 4. L1: measurement with PK detector in the range 0.15-30 MHz; 5. L2: measurement with PK detector in the range 0.15-30 MHz;																	
<b>Test instrumentation:</b>																		
code	type	mark	model	Calibration until														
STRIC001	EMI receiver	Hewlett-Packard	8542E	29/03/2012														
STRET003	LISN 10 A	EMCO	3810/2	10/11/2012														
STAT001	transient limiter	Hewlett-Packard	11947A	13/11/2011														
STCAM001	semi-anechoic chamber	Panashield-TDK-Protecno	-	-														



Tecnolab del Lago Maggiore S.r.l.  
ISTITUTO DI PROVE, MISURE E RICERCHE, ING. MICHELE SETARO  
Via dell'Industria, 20  
28924 Verbania Fondotoce (VB) – Italy

## TEST REPORT RP010611

### EMC test for FCC Certification procedure on VD1

2011/05/19

Page 7 di 26

#### 6.3 Radiated Emission measurements

<b>Date:</b>	2011/03/21																		
<b>Enviromental condition:</b>	Temperature= 18-25 °C – Humidity= 30-50%																		
<b>Applicable Standard:</b>	47 CFR 15.205 / 47 CFR 15.209 / 47 CFR 15.231 (b)																		
<b>Test levels/Limits:</b>	<p>The electric field radiated emissions is measured at a distance of 3 m from the EUT. The reference limits at 3 m are:</p> <table><thead><tr><th>Frequency range</th><th>Limits (detector)</th></tr></thead><tbody><tr><td>5-30 MHz</td><td>69.5 dB<math>\mu</math>V/m (QP)</td></tr><tr><td>30-88 MHz</td><td>40 dB<math>\mu</math>V/m (QP)</td></tr><tr><td>88-216 MHz</td><td>43.5 dB<math>\mu</math>V/m (QP)</td></tr><tr><td>216-960 MHz</td><td>46 dB<math>\mu</math>V/m (QP)</td></tr><tr><td>960-1000 MHz</td><td>54 dB<math>\mu</math>V/m (QP)</td></tr></tbody></table> <p>In accordance with part 15.231 (b) the field strength of emission from intentional radiator shall not exceed the following average limit:</p> <table><thead><tr><th>Frequency</th><th>Limits (detector)</th></tr></thead><tbody><tr><td>433,9 MHz</td><td>80.8 dB<math>\mu</math>V/m (AVG)</td></tr><tr><td>Spurious emission</td><td>60.8 dB<math>\mu</math>V/m (AVG)</td></tr></tbody></table> <p>In accordance with part 15.31 (f) 2, where the measurement distance was specified to be 30 or 300 meters, a correction factor was applied in order to permit measurement to be performed at a separation distance. The applied formula for limits at 30 meter is : Extrapolation (dB)= 40log (300 meter/30 meter) = +80dB Extrapolation (dB)= 40log (30 meter/30 meter) = +40dB</p>	Frequency range	Limits (detector)	5-30 MHz	69.5 dB $\mu$ V/m (QP)	30-88 MHz	40 dB $\mu$ V/m (QP)	88-216 MHz	43.5 dB $\mu$ V/m (QP)	216-960 MHz	46 dB $\mu$ V/m (QP)	960-1000 MHz	54 dB $\mu$ V/m (QP)	Frequency	Limits (detector)	433,9 MHz	80.8 dB $\mu$ V/m (AVG)	Spurious emission	60.8 dB $\mu$ V/m (AVG)
Frequency range	Limits (detector)																		
5-30 MHz	69.5 dB $\mu$ V/m (QP)																		
30-88 MHz	40 dB $\mu$ V/m (QP)																		
88-216 MHz	43.5 dB $\mu$ V/m (QP)																		
216-960 MHz	46 dB $\mu$ V/m (QP)																		
960-1000 MHz	54 dB $\mu$ V/m (QP)																		
Frequency	Limits (detector)																		
433,9 MHz	80.8 dB $\mu$ V/m (AVG)																		
Spurious emission	60.8 dB $\mu$ V/m (AVG)																		
<b>Test procedure:</b>	<p>Measurements are performed with horizontal and vertical polarization of Loop, biconical and log-periodic antennas. The antenna was positioned between 1 and 4 meters high. EUT1 was located on a turntable, the turntable was rotated fully from 0° to 360°.</p> <p>It was recorded the highest level of the electromagnetic radiation disturbance at each frequency.</p>																		
<b>Test set-up:</b>	<p>ANSI C63.4 (2009)</p> <p>See par. 4.2 and annex 6 of this test report.</p> <p>The measures shown in annexes listed below were obtained considering the correction factors of cables and antennas used for the test.</p>																		
<b>Measurement Uncertainty:</b>	5.2 dB.																		
<b>Test results:</b>	<p><b>PASS</b></p> <p>The radiated emissions from the EUT was conducted with PK detector. Because the field strength of emission from intentional radiator is over the limits, it was necessary an investigations with AVG detector, applying 15.231 (b) exception limits. The performed measurements are showed in the annexes:</p> <ol style="list-style-type: none"><li>7. BH: measurement with PK detector in the range 30-216MHz;</li><li>8. BV: measurement with PK detector in the range 30-216MHz;</li><li>9. LV measurement with PK detector in the range 216-1000 MHz;</li><li>10. LH measurement with PK detector in the range 216-1000 MHz;</li><li>11. LH measurement with AVG detector in the range 433.5-434.4 MHz;</li><li>12. LV measurement with AVG detector in the range 433.5-434.4 MHz;</li><li>13. LH measurement with AVG detector in the range 867.5-868.5 MHz;</li><li>14. LV measurement with AVG detector in the range 867.5-868.5 MHz;</li></ol>																		



Tecnolab del Lago Maggiore S.r.l.  
ISTITUTO DI PROVE, MISURE E RICERCHE, ING. MICHELE SETARO  
Via dell'Industria, 20  
28924 Verbania Fondotoce (VB) – Italy

## TEST REPORT RP010611

### EMC test for FCC Certification procedure on VD1

2011/05/19

Page 8 di 26

15. HV measurement with AVG detector in the range 1000-5000 MHz;  
16. HH measurement with AVG detector in the range 1000-5000 MHz;

Transmitter activated manually

Duty cycle factor (dB) =  $20 \log (37.5\text{ms}/100\text{ms}) = -8.6 \text{ dB}$

For fundamental: Highest peak value = 84.7 dBuV/m

Average value:  $84.7 - 8.6 = 76.1 \text{ dBuV/m} < 80.8 \text{ dBuV/m}$  (reference limit for fundamental)

For spurious emission: highest peak value = 68.1 dBuV/m      Average value:  $68.1 - 8.6 = 59.5 \text{ dBuV/m} < 60.8 \text{ dBuV/m}$  (reference limit for spurious emission)

The radiated emissions are under reference limits.

#### Test instrumentation:

code	type	mark	model	Calibration until
STRIC001	EMI receiver	Hewlett-Packard	8542E	29/03/2012
STANT019	log-periodic antenna	Emco	3148	04/01/2013
STANT020	biconical antenna	Emco	3110B	09/08/2011
STANT023	Horn antenna	SCHAFFNER	BBHA9120D	04/01/2013
STANT009	Loop Antenna	EMCO	6507	19/10/2013
STCAM001	semi-anechoic chamber	Panashield-TDK-Protecno	-	-

#### 6.4 Occupied bandwidth

<b>Date:</b>	2011/03/21			
<b>Enviromental condition:</b>	Temperature= 18-25 °C – Humidity= 30-50%			
<b>Applicable Standard:</b>	47 CFR 15.231(c)			
<b>Test levels/Limits:</b>	The bandwidth of the emission shall be no wider than 0,25% of the center frequency for device operating above 70 MHz and under 900 MHz: Frequency: 433.9 MHz. Maximum Bandwidth allow at -20dB: 1,08 MHZ			
<b>Test procedure:</b>	Measured performed at 3m.			
<b>Test set-up:</b>	ANSI C63.4 (2009)			
<b>Measurement Uncertainty:</b>	<1.5 dB.			
<b>Test results:</b>	<b>PASS</b>  The performed measure is shown in annex: 17. L: measurement with PK detector in the range 432.9-434.9 MHz;  Maximum Bandwidth measured at -20dB: 0.410 MHZ			
<b>Test instrumentation:</b>				
code	type	mark	model	Calibration until
STRIC016	EMC Analyzer	Hewlett-Packard	E7405A	11/11/2013
STANT019	log-periodic antenna	Emco	3148	04/01/2013
STCAM001	Semi-anechoic chamber	Panashield-TDK-Protecno	-	-



**TECNOLAB****Tecnolab del Lago Maggiore S.r.l.****ISTITUTO DI PROVE, MISURE E RICERCHE, ING. MICHELE SETARO**

Via dell'Industria, 20

28924 Verbania Fondotoce (VB) – Italy

**TEST REPORT RP010611****EMC test for FCC Certification procedure on  
VD1**

2011/05/19

Page 9 di 26

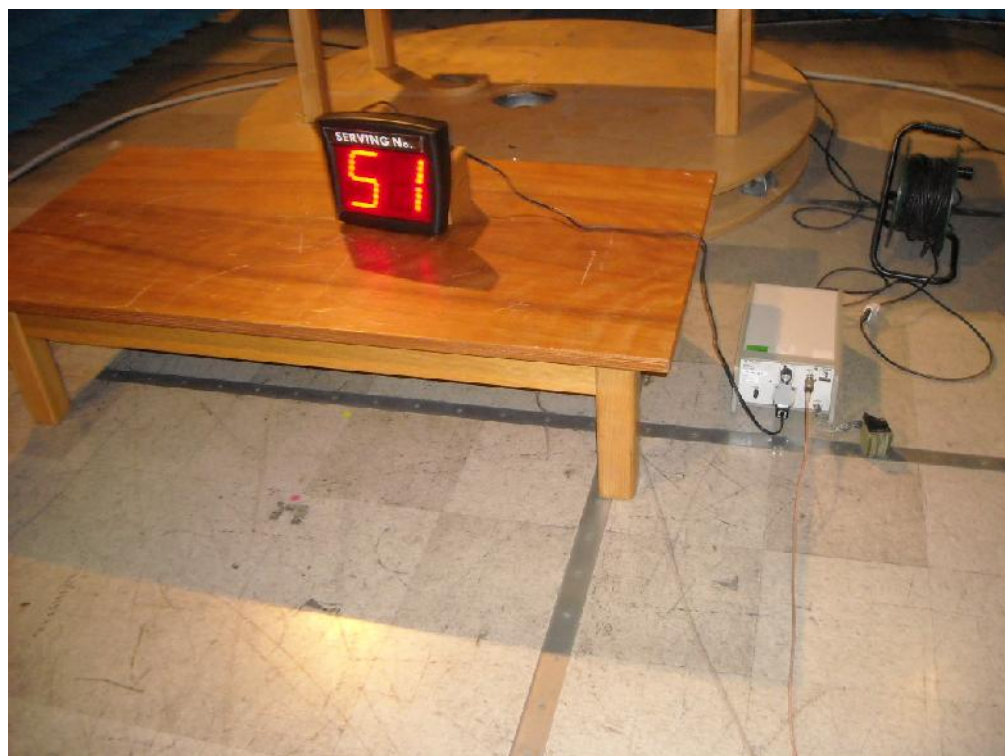
**7. ANNEXES**

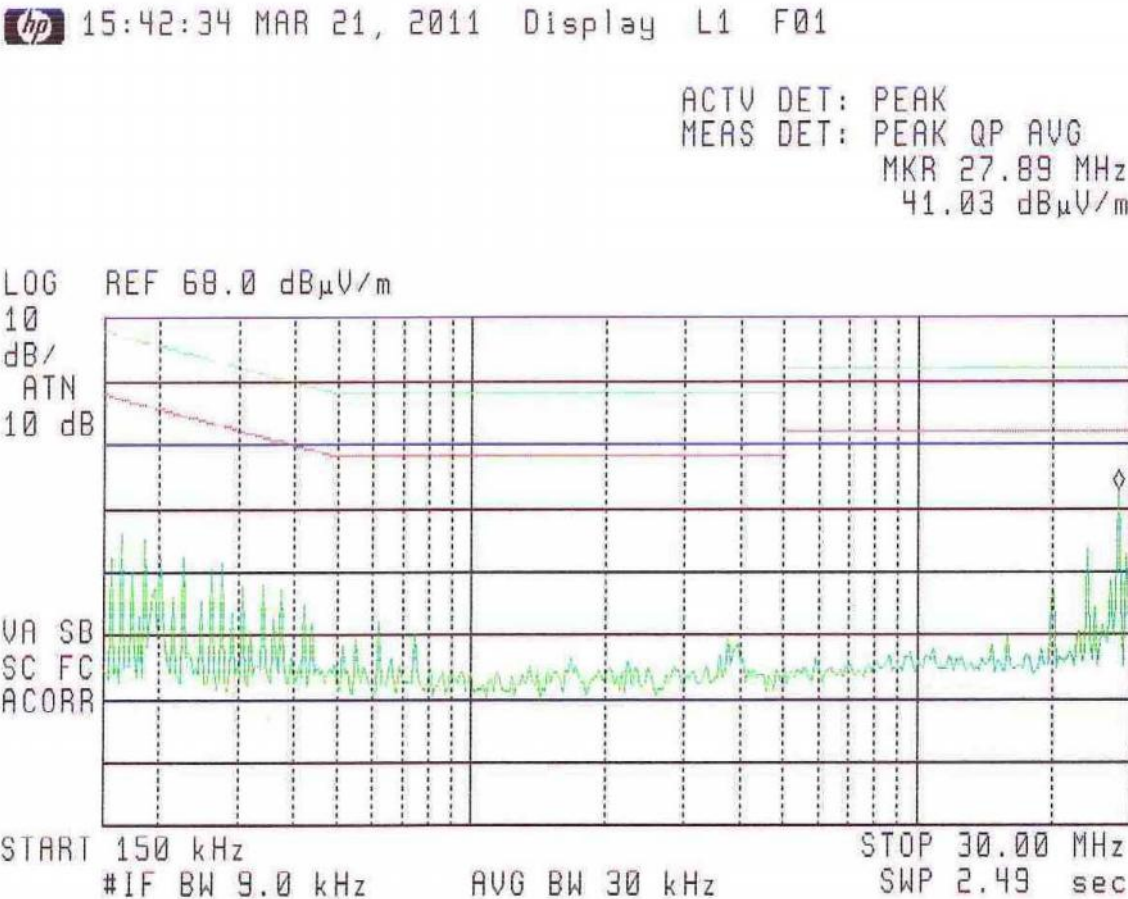
Nr.	Description
1	External view description and labeling position
2	Internal view description
3	Conducted emissions set-up
4-5	Conducted emissions results
6	Radiated emission set-up
7-16	Radiated emission results
17	Occupied bandwidth


VD1USA



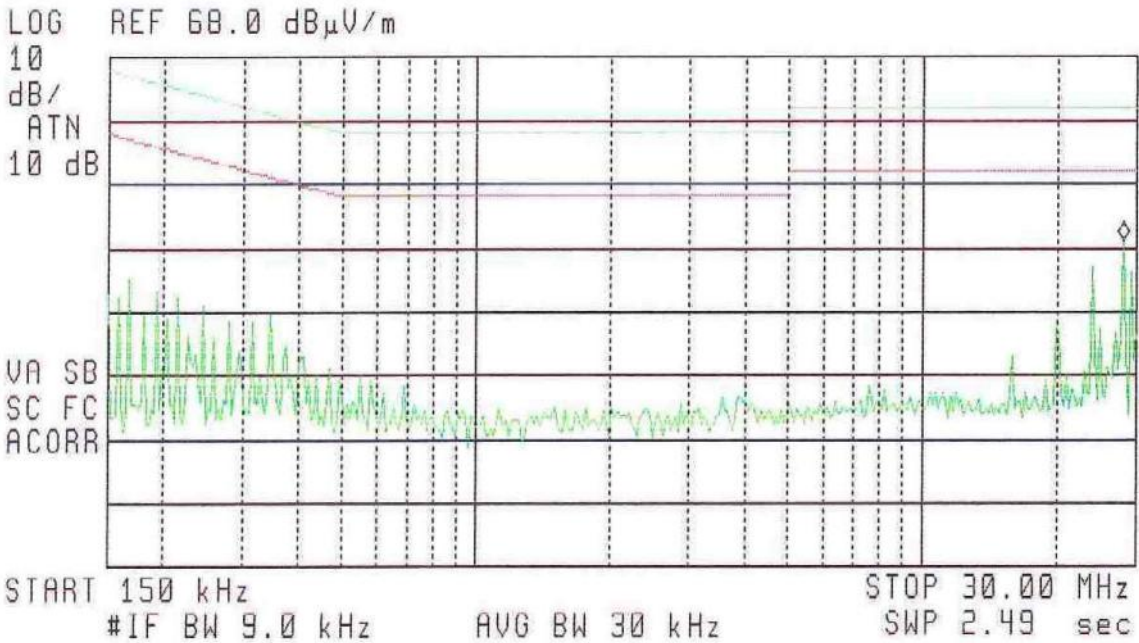






 15:45:06 MAR 21, 2011 Display L2 F01

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 27.89 MHz  
39.07 dB $\mu$ V/m








30-216 MHz



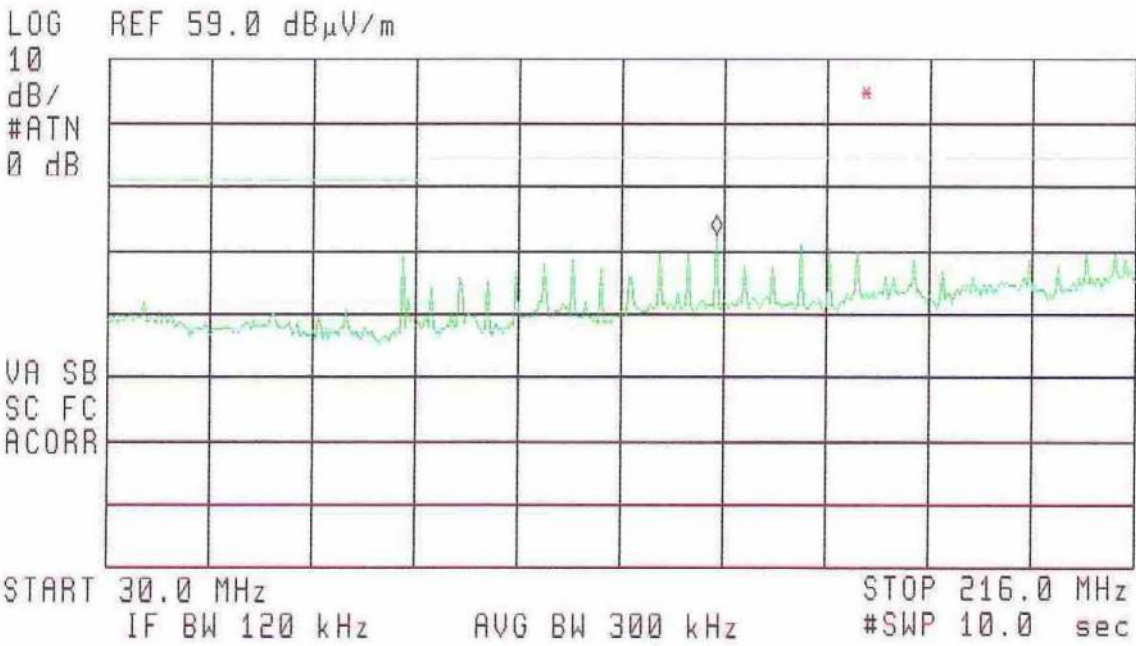
216-1000 MHz




1000-5000 MHz

 15:27:22 MAR 21, 2011 Display 1,5m H F07

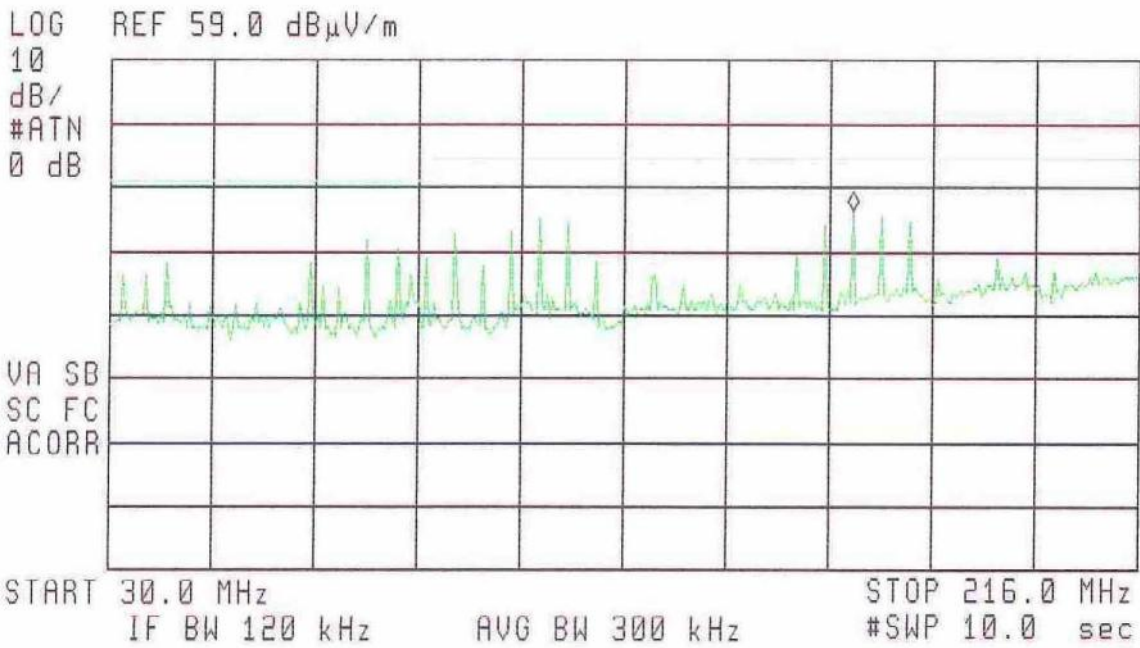
ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 140.2 MHz  
31.44 dB $\mu$ V/m






 15:29:36 MAR 21, 2011 Display 1m V F08

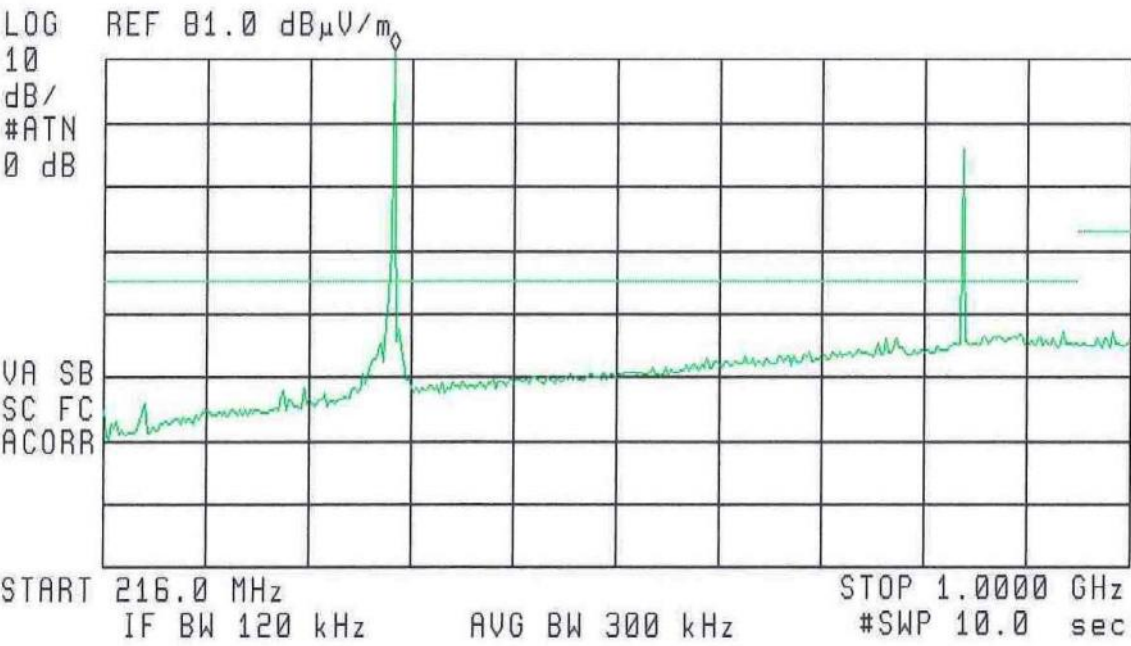
ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 164.4 MHz  
35.32 dB $\mu$ V/m




 12:18:20 MAR 21, 2011 Display V 1m F01

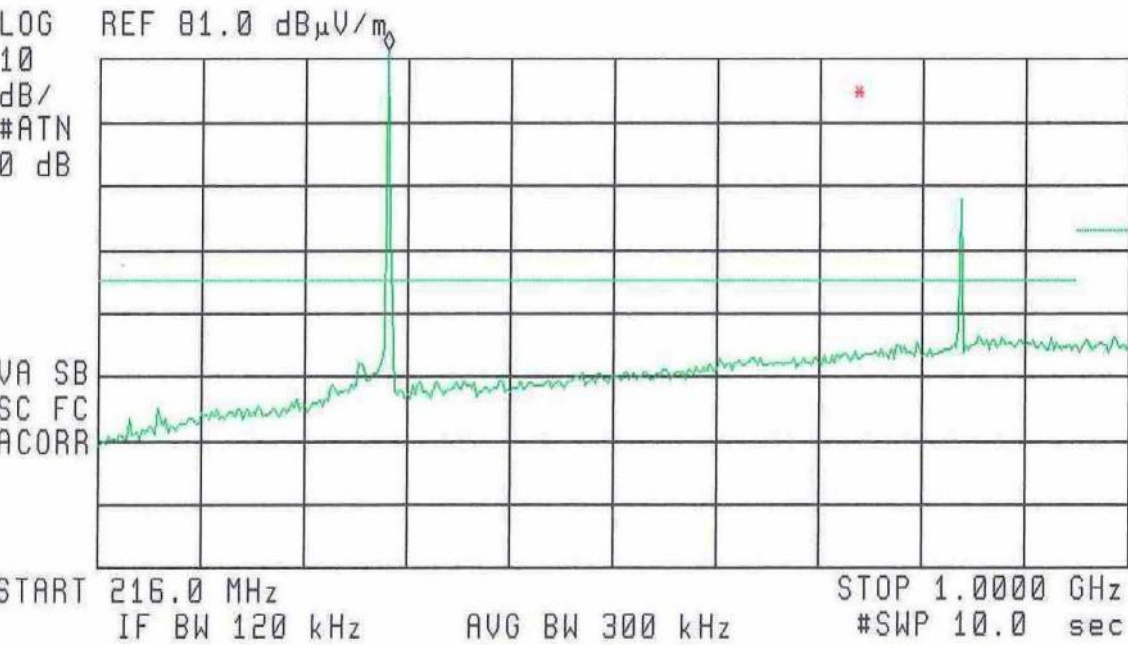
REF LEVEL  
81.0 dB $\mu$ V/m

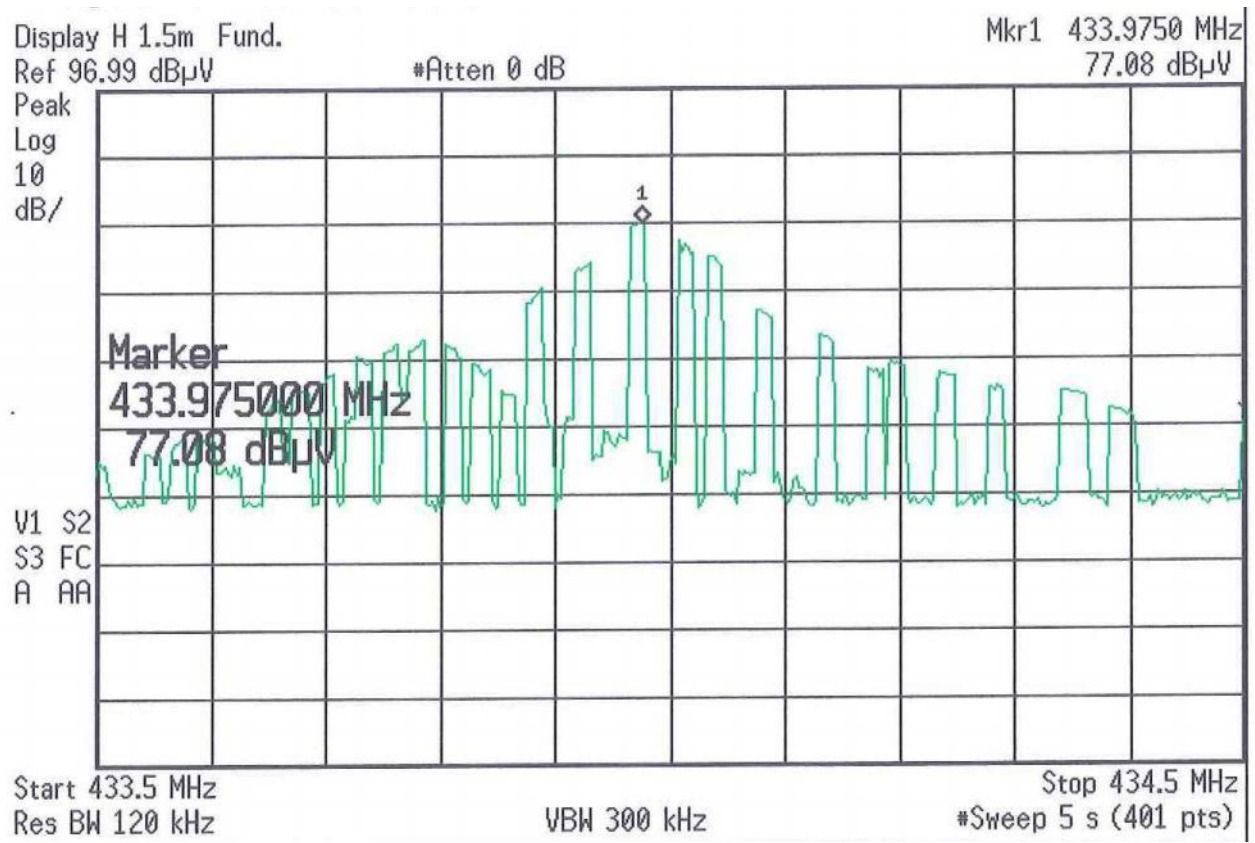
ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 437.5 MHz  
85.93 dB $\mu$ V/m

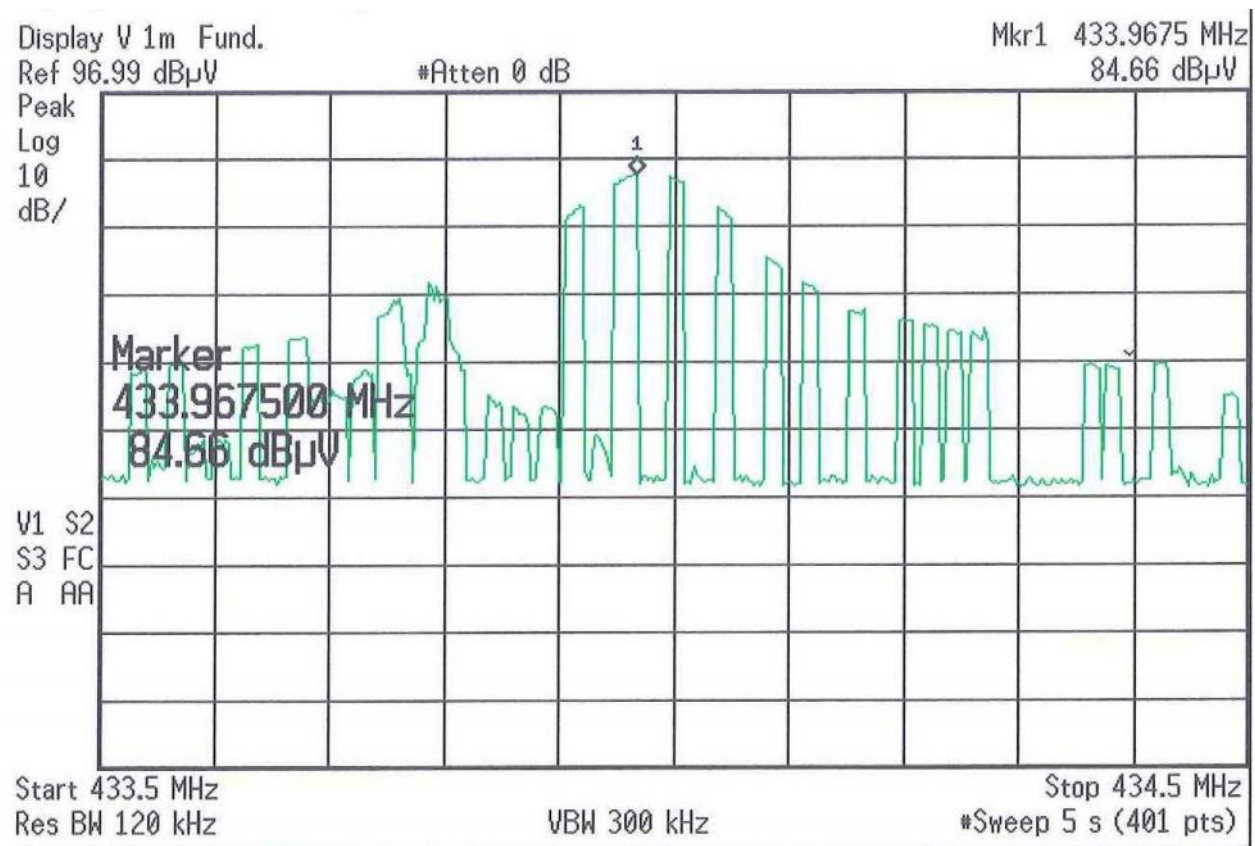


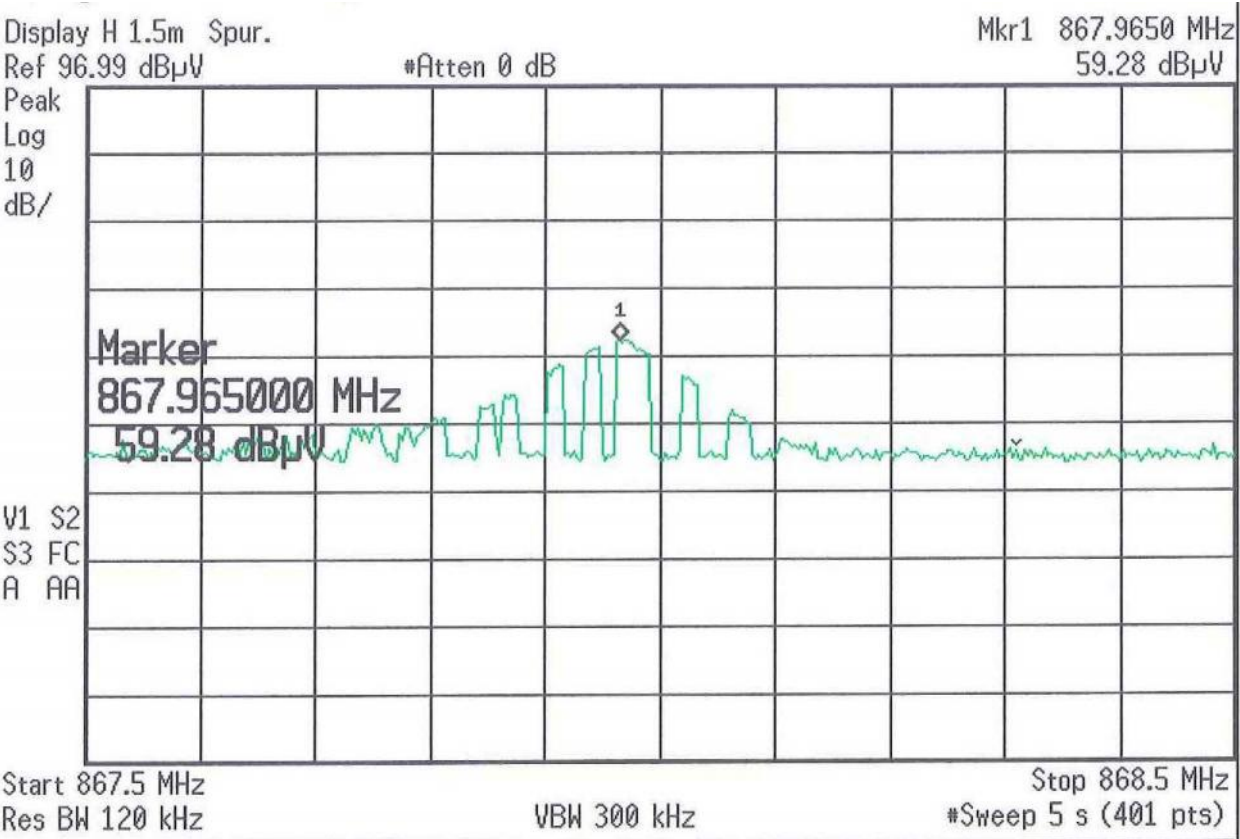
 12:20:29 MAR 21, 2011 Display H 1,5m F02

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 435.5 MHz  
85.94 dB $\mu$ V/m

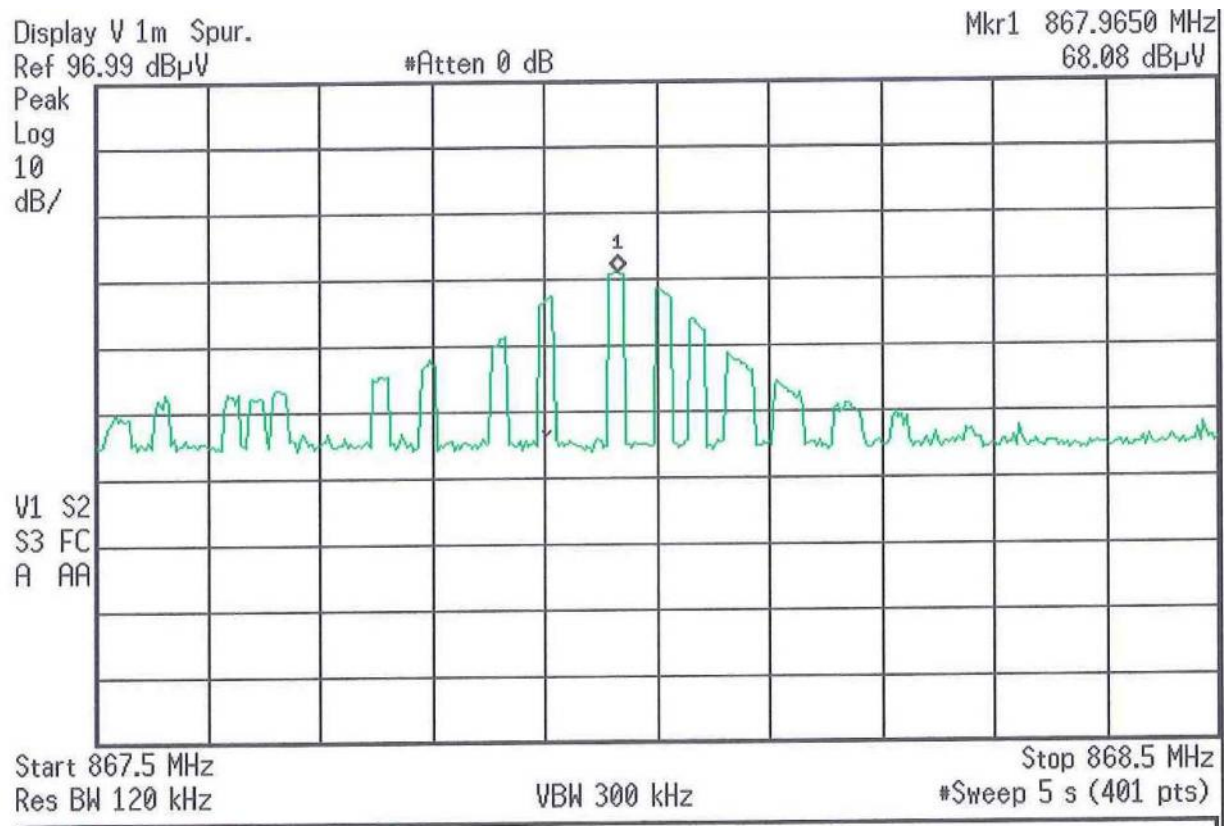






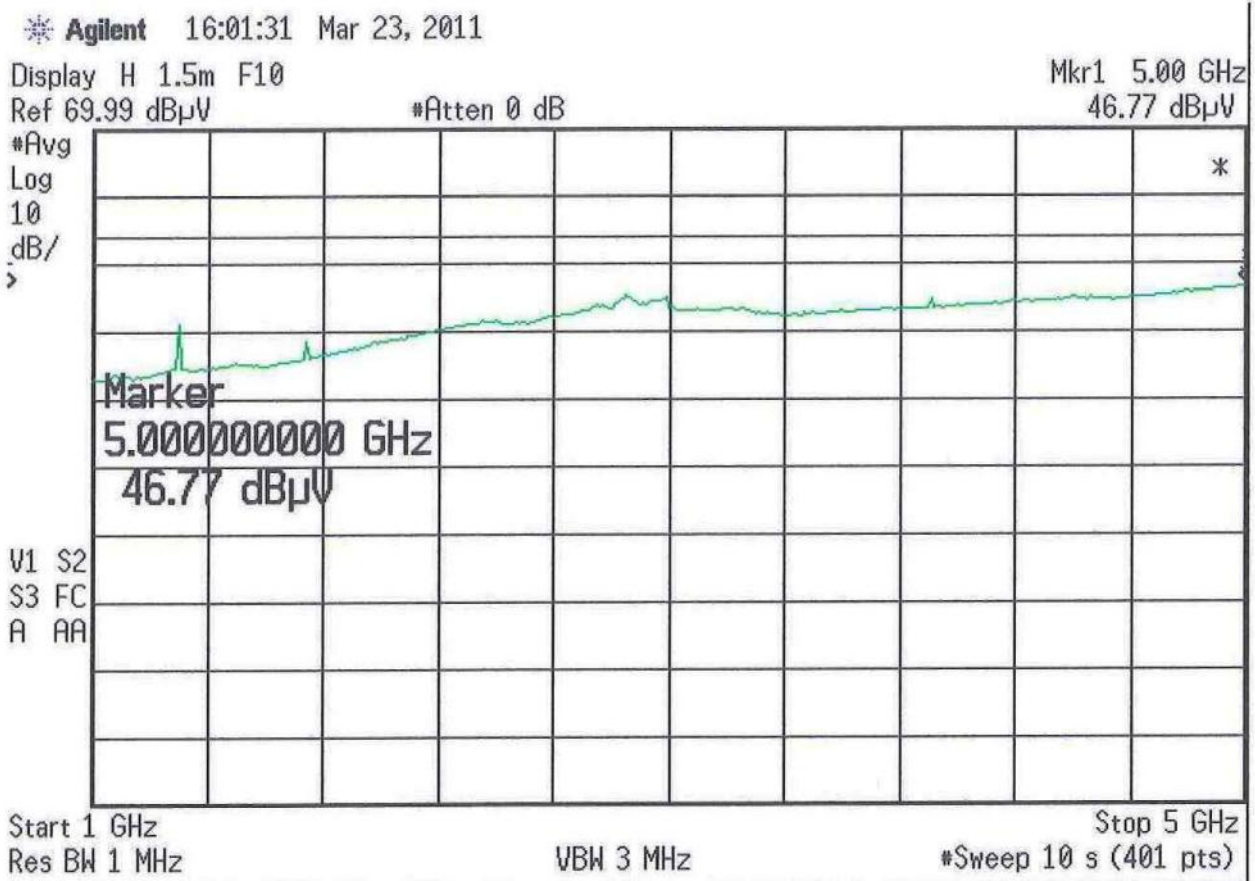


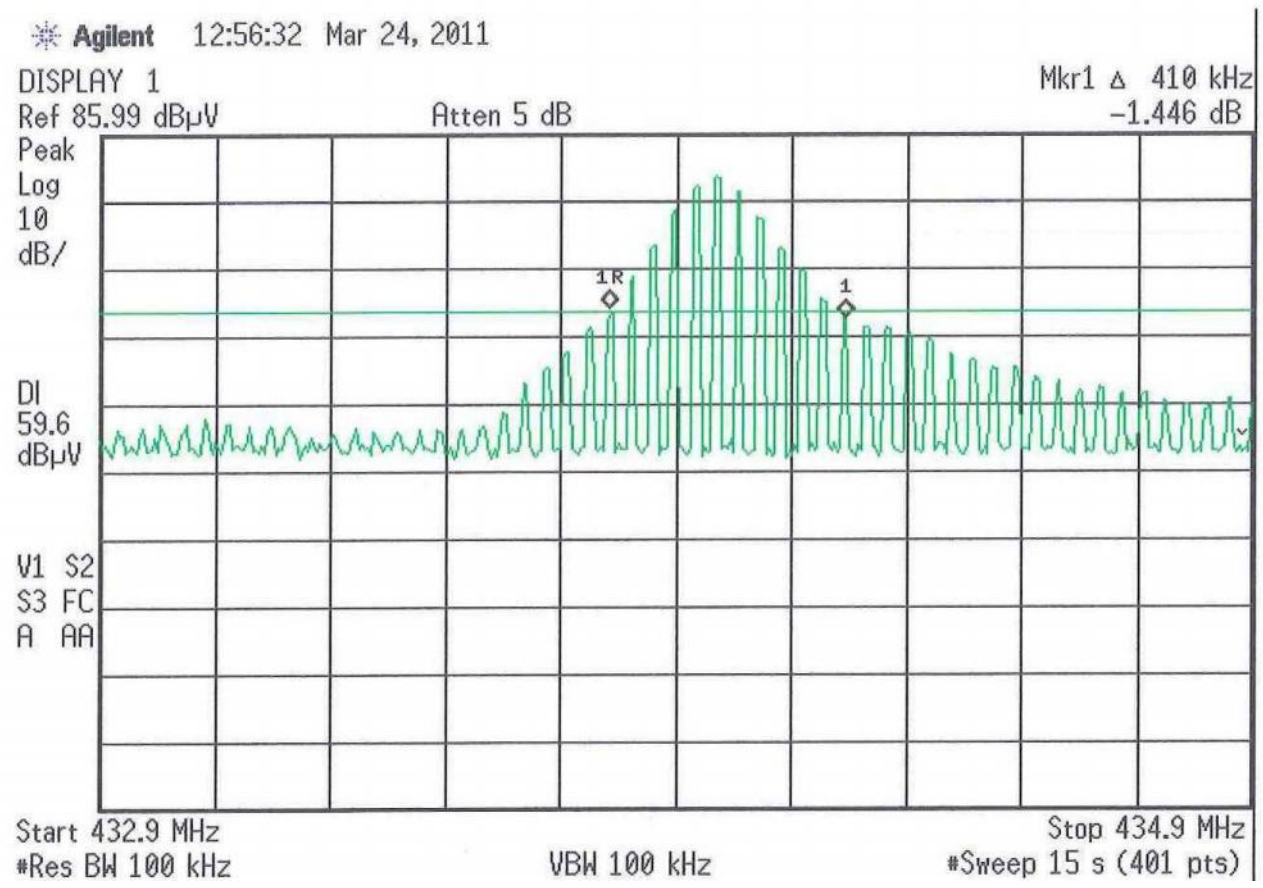












-----END OF TEST REPORT RP010611-----