

## Nemko Korea Co., Ltd.

155 & 159, Osan-Ro, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 16885 KOREA, REPUBLIC OF  
TEL : + 82 31 330 1700 FAX : + 82 31 322 2332

### FCC EVALUATION REPORT FOR CERTIFICATION

#### Applicant :

Dongbu Daewoo Electronics Corporation  
(Cheongcheon-dong), 12, Bupyeongbuk-ro  
236 beon-gil, Bupyeong-gu, Incheon,  
Korea, Republic of  
Attn : Mr. Byung-Seok, Kim

Dates of Issue : June 30, 2017  
Test Report No. : NK-17-E-0499  
Test Site : Nemko Korea Co., Ltd.  
EMC site, Korea

FCC ID

**C5F7NF4AMO600N**

Trade Mark

**DAEWOO**

Contact Person

Dongbu Daewoo Electronics Corporation  
(Cheongcheon-dong), 12, Bupyeongbuk-ro  
236 beon-gil, Bupyeong-gu, Incheon, Korea, Republic of  
Mr. Byung-Seok, Kim  
Telephone No. : + 82 32 510 7919

|                    |                        |
|--------------------|------------------------|
| Applied Standard : | FCC Part 18 & Part 2   |
| Classification :   | Consumer ISM equipment |
| EUT Type :         | Microwave Oven         |

The device bearing the Trade Mark and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in MP-5:1986.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.



June 30, 2017

Tested By : Dosheung Shin  
Engineer



June 30, 2017

Reviewed By : Changsoo Choi  
Technical Manager

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## SCOPE

*Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 18.*

**Responsible Party :** Dongbu Daewoo Electronics Corporation

**Contact Person :** Mr. Byung-Seok, Kim  
Tel No.: + 82 32 510 7919

**Manufacturer :** Dongbu Daewoo Electronics Corporation  
(Cheongcheon-dong), 12, Bupyeongbuk-ro 236 beon-gil,  
Bupyeong-gu, Incheon, Korea, Republic of

**Factory :** Dongbu Daewoo Microwave Oven (Tianjin) Co., Ltd.  
NO. 34, CHANGHWA STREET, DAGANG DEVELOPMENT AREA,  
BINHAI NEW DISTRICT, TIANJIN, 300270 CHINA

- FCC ID: C5F7NF4AMO600N
- Model: KOR-4A\*\*  
Note 1) First "\*\*" : 0 ~ 9 or A ~ Z (Enclosure design difference)  
Note 2) Second "\*\*" : 0 ~ 9 (Mechanical type) or A ~ Z (Electronic type)
- Trade Mark: DAEWOO
- EUT Type: Microwave Oven
- Applied Standard: FCC Part 18 & Part 2
- Test Procedure(s): MP-5:1986
- Dates of Test: June 02, 2017 to June 26, 2017
- Place of Tests: Nemko Korea Co., Ltd. EMC Site
- Test Report No.: NK-17-E-0499

## INTRODUCTION

The measurement procedure described in MP5:1986 for Methods of Measurement of radiated, powerline conducted radio noise, frequency and power output was used in determining emissions emanating from **Dongbu Daewoo Electronics Corporation**.

FCC ID : **C5F7NF4AMO600N, Microwave Oven**.

These measurement tests were conducted at **Nemko Korea Co., Ltd. EMC Laboratory**.

The site address is 155 & 159, Osan-Ro, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 16885 KOREA, REPUBLIC OF

The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 kilometers (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 kilometers (18 miles) south-southeast from central Seoul.

The Nemko Korea Co., Ltd. has been accredited as a Conformity Assessment Body (CAB).



Nemko Korea Co., Ltd.  
155 & 159, Osan-Ro, Mohyeon-Myeon,  
Cheoin-Gu, Yongin-Si, Gyeonggi-Do  
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Fig. 1. The map above shows the Seoul in Korea vicinity area.  
The map also shows Nemko Korea Corporation Ltd. EMC Lab and Incheon Airport.

## EUT INFORMATION

### EUT Information

|                           |                                |
|---------------------------|--------------------------------|
| Intended use              | Household                      |
| Type of appliance         | Counter-top Type               |
| Rated voltage & frequency | a.c. 120 V, 60 Hz Single Phase |
| Rated power output        | 600 W                          |
| Rated power consumption   | 1 000 W                        |
| Magnetron                 | 2M218 (DAEWOO)                 |
| Clock(s)                  | 4 MHz                          |

### Component List

| Item              | Model          | Manufacturer                                   | Serial Number |
|-------------------|----------------|------------------------------------------------|---------------|
| Diode H.V.        | CL01-12        | GAOXING                                        | N/A           |
| Fan Motor         | OEM-10DWX1-A07 | OH SUNG                                        | N/A           |
| H.V. CAPACITOR    | 2100VAC 0.70uF | ELCOMTEC/BICAI/Anhui Juan Kuang/Mascotop       | N/A           |
| Noise Filter      | DWLF-M12       | N/A                                            | N/A           |
| Magnetron         | 2M218          | DAEWOO                                         | 170523BD      |
| Board             | M325           | DAEWOO                                         | 3514330740    |
| SYNCHRONOUS MOTOR | 49TYZ-A1       | YUYAO JING CHENG HIGH & NEW TECHNOLOGY CO.,LTD | N/A           |
| Trans H.V.        | DYAS60A0-4A    | DIGITAL POWER COMMUNICATIONS CO.,LTD.          | N/A           |

## ***DESCRIPTION OF TESTS***

---

### **Radiation Hazard**

A 700 ml water load was placed in the center of the oven.

The power setting was set to maximum power.

While the oven was operating, the Microwave Survey Meter probe was moved slowly around the door seams to check for leakage.

### **Input Power Measurement**

A 700 ml water load was placed in the center of the oven and the oven set to maximum power. A 700 ml water load was chosen for its compatibility.

Input power and current were measured using a Power Analyzer.

Manufacturers to determine their input ratings commonly use this procedure.

### **Output Power Measurement**

The Caloric Method was used to determine maximum output power.

The initial temperature of a 1000 ml water load was measured. The water load was placed in the center of the oven. The oven was operated at maximum output power for 47 seconds. Then the temperature of the water re-measured.

### **Frequency Measurements**

Following the above test, after operating the oven long enough to assure that stable operating temperature were obtained, the operating frequency was monitored as the input voltage was varied between 80 percent to 125 percent of the nominal rating.

And the load quantity was reduced by evaporation to approximately 20 % of the original quantity with nominal rating.

## DESCRIPTION OF TESTS

### Conducted Emissions

The Line conducted emission test facility is located inside a 4 x 7 x 2.5 m shielded enclosure.

It is manufactured by EM engineering. The shielding effectiveness of the shielded room is in accordance with MIL-STD-285 or NSA 65-6.

A 1 m x 1.5 m wooden table 0.8 m height is placed 0.4 m away from the vertical wall and 0.5 m away from the side of wall of the shielded room Rohde & Schwarz (ESH2-Z5) of the 50 ohm / 50 uH Line Impedance Stabilization Network(LISN) is bonded to the shielded room.

The EUT is powered from the Rohde & Schwarz (ESH2-Z5) LISN.

Power to the LISN s are filtered by high-current high insertion loss power line filters.

The purpose of filter is to attenuate ambient signal interference and this filter is also bonded to shielded enclosure. All electrical cables are shielded by tinned copper zipper tubing with inner diameter of 1 / 2 ".

If d.c. power device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the LISNs,

All interconnecting cables more than 1 m were shortened by non-inductive bundling (serpentine fashion) to a 1 m length.

Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The spectrum was scanned from 150 kHz to 30 MHz with 20 ms sweep time.

The frequency producing the maximum level was re-examined using the EMI test receiver. (Rohde & Schwarz ESCI).

The detector functions were set to quasi-peak mode & average mode.

The bandwidth of receiver was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.

Each emission was maximized by; switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux a.c. outlet, if applicable; whichever determined the worst case emission.

Each EME reported was calibrated using the ROHDE & SCHWARZ signal generator.

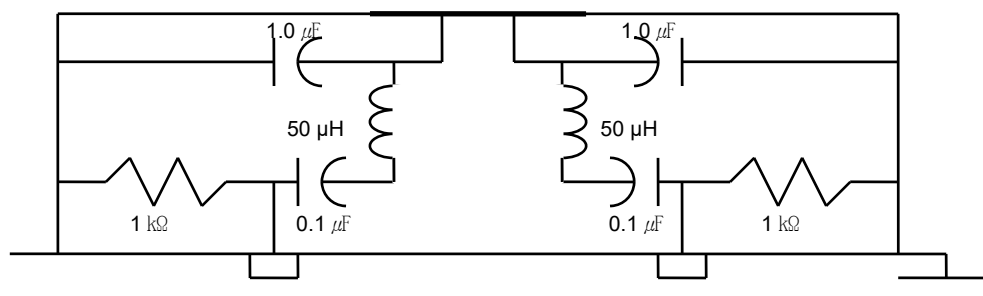


Fig. 2. LISN Schematic Diagram

## DESCRIPTION OF TESTS

### Radiated Emissions

Measurement were made indoors at 10 m & 3 m using antenna, signal conditioning unit and EMI test receiver to determine the frequency producing the maximum EME.

Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The Technology configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna was note for each frequency found.

The spectrum was scanned from 0.15 MHz to 30 MHz using Loop Antenna

(ROHDE & SCHWARZ/HFH2-Z2)

and from 30 MHz to 1000 MHz using TRILOG Broadband Test Antenna (Schwarzbeck, VULB 9163).

Above 1 GHz, Double Ridged Broadband Horn antenna (Schwarzbeck, HF907) was used.

Final Measurements were made indoors at 3 m using Loop Antenna

(ROHDE & SCHWARZ/HFH2-Z2) for measurement from 0.15 to 30 MHz with RBW 9 kHz and

made indoor at 10 m using TRILOG Broadband Test Antenna (Schwarzbeck, VULB 9163) for measurement from 30 MHz to 1000 MHz with RBW 100 kHz and made indoors at 3 m using Double Ridged Broadband Horn antenna (Schwarzbeck, HF907) for measurement from 1 GHz to 18 GHz with RBW 1 MHz.

The detector function were set to quasi peak mode and the bandwidth of the receiver were set to 9 kHz, 100 kHz and peak mode 1 MHz depending on the frequency or type of signal.

The Double Ridged Broadband Horn antenna was tuned to the frequency found during preliminary radiated measurements.

The EUT support equipment and interconnecting cables were re-configured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8 m high non- metallic 1.0 X 1.5 meter table.

The EUT, support equipment and interconnecting cables were re-arranged and manipulated to maximize each EME emission.

The EUT is rotated about its vertical axis on the turntable, and the polarization and height of the receiving antenna are varied to obtain the highest field strength on the particular frequency under observation.

Each EME reported was calibrated using the R/S signal generator.

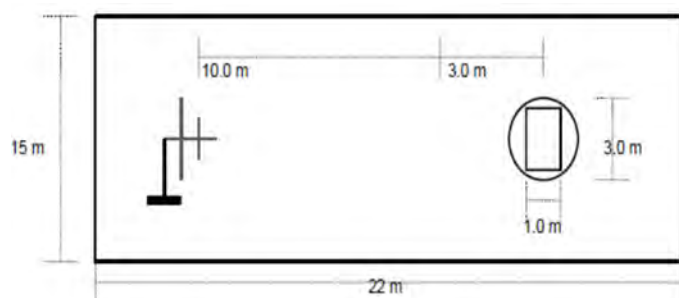


Fig. 3. Dimensions of 10 semi anechoic chamber

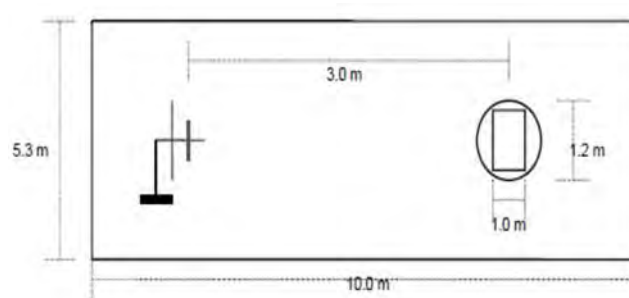


Fig. 4. Dimensions of 3 m full anechoic chamber

## TEST DATA

### Radiation Hazard

| Probe Location | Maximum Leakage<br>[mW/Cm2] | Limit<br>[mW/Cm2] |
|----------------|-----------------------------|-------------------|
| A              | 0.02                        | 1.00              |
| B              | 0.01                        | 1.00              |
| C              | 0.01                        | 1.00              |
| D              | 0.01                        | 1.00              |
| All others     | 0.01                        | 1.00              |

### Input Power Measurement

| Operation mode | P rated (W) | P (W) | dP (%) | Required dP (%) |
|----------------|-------------|-------|--------|-----------------|
| Power Input    | 1000        | 985   | -1.5   | + 15 %          |

### Output Power Measurement

| Quantity<br>of Water<br>[ml] | Mass of the<br>container<br>[g] | Ambient<br>temperature<br>[°C] | Initial<br>temperature<br>[°C] | Final<br>temperature<br>[°C] | Heating<br>time<br>[s] | Power<br>output<br>[W] |
|------------------------------|---------------------------------|--------------------------------|--------------------------------|------------------------------|------------------------|------------------------|
| 1 000                        | 400                             | 20.0                           | 10                             | 19.8                         | 70                     | 586                    |

Formula :

$$P = \frac{4.187 \times m_w \times (T_1 - T_0) + 0.55 \times m_c \times (T_1 - T_A)}{t}$$

NOTE :

$P$  is the microwave power output (W)

$m_w$  is the mass of the water (g)

$m_c$  is the mass of the container (g)

$T_A$  is the ambient temperature (°C)

$T_0$  is the initial temperature of the water (°C)

$T_1$  is the final temperature of the water (°C)

$t$  is the heating time (s), excluding the magnetron filament heating-up time.



Tested by : **Dosheung Shin**

## TEST DATA

### Frequency measurements

#### ► Frequency vs Line Voltage Variation Test

[Room Temperature : 23.4 °C]

| Line Voltage Variation (a.c. V) | *)Pole | Frequency [MHz] | Allowed Tolerance for the ISM Band     |
|---------------------------------|--------|-----------------|----------------------------------------|
| 96 (80 %)                       | H      | Lower : 2 422.5 | Lower : 2 400 MHz<br>Upper : 2 500 MHz |
|                                 | H      | Upper : 2 468.7 |                                        |
|                                 | V      | Lower : 2 419.7 |                                        |
|                                 | V      | Upper : 2 474.5 |                                        |
| 108 (90 %)                      | H      | Lower : 2 419.2 |                                        |
|                                 | H      | Upper : 2 465.3 |                                        |
|                                 | V      | Lower : 2 419.7 |                                        |
|                                 | V      | Upper : 2 460.5 |                                        |
| 120 (100 %)                     | H      | Lower : 2 423.5 |                                        |
|                                 | H      | Upper : 2 467.7 |                                        |
|                                 | V      | Lower : 2 420.1 |                                        |
|                                 | V      | Upper : 2 456.7 |                                        |
| 132 (110 %)                     | H      | Lower : 2 420.6 |                                        |
|                                 | H      | Upper : 2 461.5 |                                        |
|                                 | V      | Lower : 2 408.1 |                                        |
|                                 | V      | Upper : 2 477.4 |                                        |
| 150 (125 %)                     | H      | Lower : 2 419.7 |                                        |
|                                 | H      | Upper : 2 467.7 |                                        |
|                                 | V      | Lower : 2 419.2 |                                        |
|                                 | V      | Upper : 2 460.5 |                                        |

#### NOTE :

1. \*Pol. H = Horizontal V = Vertical
2. Initial load : 1 000 ml of water in the beaker.
3. Line voltage varied from 80 % to 125 %.
4. ISM Frequency : 2 450 MHz, Tolerance : ± 50 MHz

**RESULT : Pass**


Tested by : **Dosheung Shin**

## TEST DATA

### ► Frequency vs Load Variation Test

[Room Temperature : 23.4 °C]

| Volume of water<br>(ml) | *)Pole | Frequency<br>[MHz] | Allowed Tolerance for<br>the ISM Band  |
|-------------------------|--------|--------------------|----------------------------------------|
| 200                     | H      | Lower : 2 412.9    | Lower : 2 400 MHz<br>Upper : 2 500 MHz |
|                         | H      | Upper : 2 480.7    |                                        |
|                         | V      | Lower : 2 406.2    |                                        |
|                         | V      | Upper : 2 480.2    |                                        |
| 400                     | H      | Lower : 2 416.8    |                                        |
|                         | H      | Upper : 2 455.2    |                                        |
|                         | V      | Lower : 2 415.3    |                                        |
|                         | V      | Upper : 2 452.4    |                                        |
| 600                     | H      | Lower : 2 425.0    |                                        |
|                         | H      | Upper : 2 458.1    |                                        |
|                         | V      | Lower : 2 418.2    |                                        |
|                         | V      | Upper : 2 458.6    |                                        |
| 800                     | H      | Lower : 2 410.0    |                                        |
|                         | H      | Upper : 2 476.4    |                                        |
|                         | V      | Lower : 2 413.4    |                                        |
|                         | V      | Upper : 2 459.1    |                                        |
| 1000                    | H      | Lower : 2 414.4    |                                        |
|                         | H      | Upper : 2 474.5    |                                        |
|                         | V      | Lower : 2 419.2    |                                        |
|                         | V      | Upper : 2 459.6    |                                        |

#### NOTE :

1. \*Pol. H = Horizontal, V = Vertical
2. The water load was varied between 200 ml to 1 000 ml.
3. Frequency was measured by using nominal voltage (a.c. 120 V).
4. ISM Frequency : 2 450 MHz, Tolerance : ± 50 MHz

**RESULT : Pass**


Tested by : **Dosheung Shin**

## TEST DATA

### Conducted Emissions

FCC ID : C5F7NF4AMO600N

[Room Temperature : 21.8 °C]

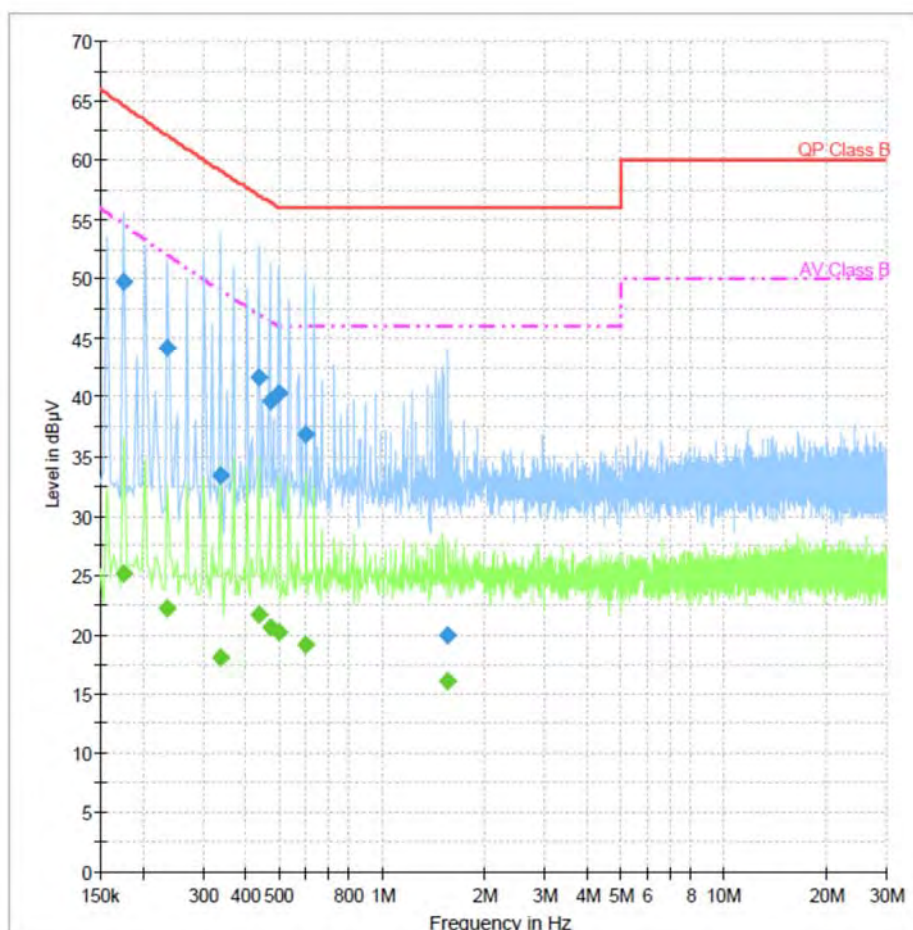
### Test Report

#### Common Information

|                         |                           |
|-------------------------|---------------------------|
| Test Site:              | Nemko Korea(NK-17-E-0499) |
| Test Description:       | Conducted emission        |
| Test Standard:          | FCC Part 18               |
| Environment Conditions: | a.c. 120 V, 60 Hz         |
| Operator Name:          | Doseung,Shin              |
|                         | Microwave                 |

#### 2.EMI Auto Test\_4-Line Voltage LISN

2.EMI Auto Test\_4-Line Voltage LISN



6/20/2017

11:47:30

### Final Result 1

| Frequency (MHz) | QuasiPeak (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | PE  | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|------------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.176119        | 49.7             | 15000.0         | 9.000           | GND | N    | 10.2       | 14.8        | 64.6         |         |
| 0.235819        | 44.2             | 15000.0         | 9.000           | GND | N    | 10.3       | 17.8        | 62.0         |         |
| 0.336562        | 33.4             | 15000.0         | 9.000           | GND | N    | 10.3       | 25.7        | 59.1         |         |
| 0.437306        | 41.7             | 15000.0         | 9.000           | GND | N    | 10.3       | 15.3        | 57.0         |         |
| 0.470888        | 39.6             | 15000.0         | 9.000           | GND | N    | 10.3       | 16.8        | 56.5         |         |
| 0.500738        | 40.4             | 15000.0         | 9.000           | GND | N    | 10.3       | 15.6        | 56.0         |         |
| 0.601481        | 36.9             | 15000.0         | 9.000           | GND | N    | 10.3       | 19.1        | 56.0         |         |
| 1.556681        | 20.0             | 15000.0         | 9.000           | GND | N    | 10.3       | 36.0        | 56.0         |         |

### Final Result 2

| Frequency (MHz) | CAverage (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | PE  | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|-----------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.176119        | 25.2            | 15000.0         | 9.000           | GND | N    | 10.2       | 29.4        | 54.6         |         |
| 0.235819        | 22.2            | 15000.0         | 9.000           | GND | N    | 10.3       | 29.8        | 52.0         |         |
| 0.336562        | 18.1            | 15000.0         | 9.000           | GND | N    | 10.3       | 31.0        | 49.1         |         |
| 0.437306        | 21.7            | 15000.0         | 9.000           | GND | N    | 10.3       | 25.4        | 47.0         |         |
| 0.470888        | 20.6            | 15000.0         | 9.000           | GND | N    | 10.3       | 25.8        | 46.5         |         |
| 0.500738        | 20.2            | 15000.0         | 9.000           | GND | N    | 10.3       | 25.8        | 46.0         |         |
| 0.601481        | 19.2            | 15000.0         | 9.000           | GND | N    | 10.3       | 26.8        | 46.0         |         |
| 1.556681        | 16.1            | 15000.0         | 9.000           | GND | N    | 10.3       | 29.9        | 46.0         |         |

6/20/2017

11:47:30

**NOTES:**

- 1. Measurements using quasi-peak mode & average mode.**
- 2. If no frequencies are specified in the tables, no measurement for quasi-peak or average was necessary.**
- 3. Line : L = Line , N = Neutral**
- 4. The limit for consumer device is on the FCC Part section 18.307(b).**

A handwritten signature in blue ink, appearing to read 'DS' or 'Shin', is positioned above a horizontal line.

**Tested by : Dosheung Shin**

## TEST DATA

### Radiated Emissions (150 kHz to 30 MHz)

FCC ID : C5F7NF4AMO600N

[Room Temperature : 22.4 °C]

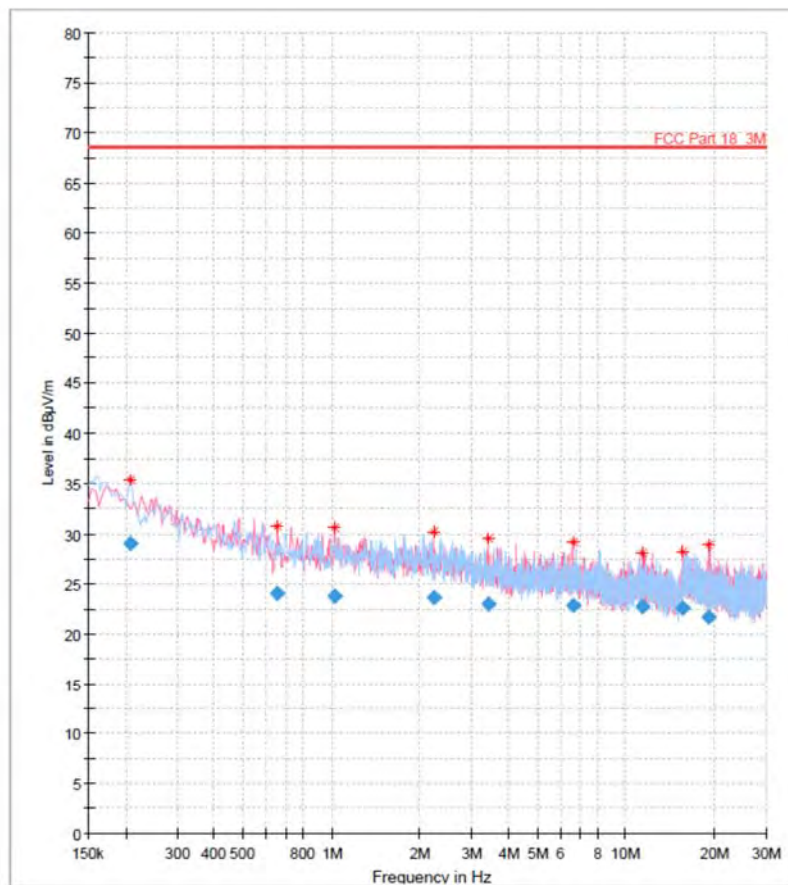
#### Test Report

##### Common Information

|                          |                                 |
|--------------------------|---------------------------------|
| Test Description :       | Radiated Emission(NK-17-E-0499) |
| Test Site :              | Nemko 10 m Chamber              |
| Test Standard :          | FCC Part 18                     |
| Environment Conditions : | a.c. 120 V, 60 Hz               |
| Operator Name :          | Doseung Shin                    |
|                          | Microwave                       |

##### Full Spectrum

Full Spectrum



6/23/2017

# Final Result

| Frequency (MHz) | QuasiPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-----|---------------|------------|
| 0.206715        | 29.05              | 68.60          | 39.55       | 15000.0         | 9.000           | H   | 30.0          | -23.7      |
| 0.657450        | 24.01              | 68.60          | 44.59       | 15000.0         | 9.000           | V   | 198.0         | -23.7      |
| 1.027590        | 23.77              | 68.60          | 44.83       | 15000.0         | 9.000           | V   | 206.0         | -23.3      |
| 2.227560        | 23.69              | 68.60          | 44.91       | 15000.0         | 9.000           | V   | 326.0         | -23.1      |
| 3.430515        | 23.00              | 68.60          | 45.60       | 15000.0         | 9.000           | V   | 270.0         | -23.2      |
| 6.660285        | 22.83              | 68.60          | 45.77       | 15000.0         | 9.000           | V   | 243.0         | -23.1      |
| 11.361660       | 22.73              | 68.60          | 45.88       | 15000.0         | 9.000           | V   | 113.0         | -23.1      |
| 15.564540       | 22.54              | 68.60          | 46.06       | 15000.0         | 9.000           | V   | 30.0          | -23.1      |
| 19.167435       | 21.72              | 68.60          | 46.88       | 15000.0         | 9.000           | V   | 320.0         | -23.0      |

(continuation of the "Final\_Result" table from column 15 ...)

| Frequency (MHz) | Comment                |
|-----------------|------------------------|
| 0.206715        | 8:31:30 AM - 6/23/2017 |
| 0.657450        | 8:33:50 AM - 6/23/2017 |
| 1.027590        | 8:34:12 AM - 6/23/2017 |
| 2.227560        | 8:35:56 AM - 6/23/2017 |
| 3.430515        | 8:35:05 AM - 6/23/2017 |
| 6.660285        | 8:34:39 AM - 6/23/2017 |
| 11.361660       | 8:33:09 AM - 6/23/2017 |
| 15.564540       | 8:32:36 AM - 6/23/2017 |
| 19.167435       | 8:35:34 AM - 6/23/2017 |

6/23/2017

<Radiated Measurements at 3 meters >

**NOTES:**

1. \*Pol. H = Horizontal V = Vertical
2. \*\*AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
3. Distance Correction factor :  $20 * \log (300 / 3) = 40 \text{ dBuV/m}$
4. The limit at 300 meters is  $20 * \log (25 * \text{SQRT} (\text{RF Power} / 500))$
5. All other emissions were measured while a 700  $\text{m}\ell$  load was placed in the center of the oven.
6. The limit for consumer device is on the FCC Part section 18.305.

A handwritten signature in blue ink, appearing to read 'DS' or 'Dosheung', is positioned above a horizontal line.

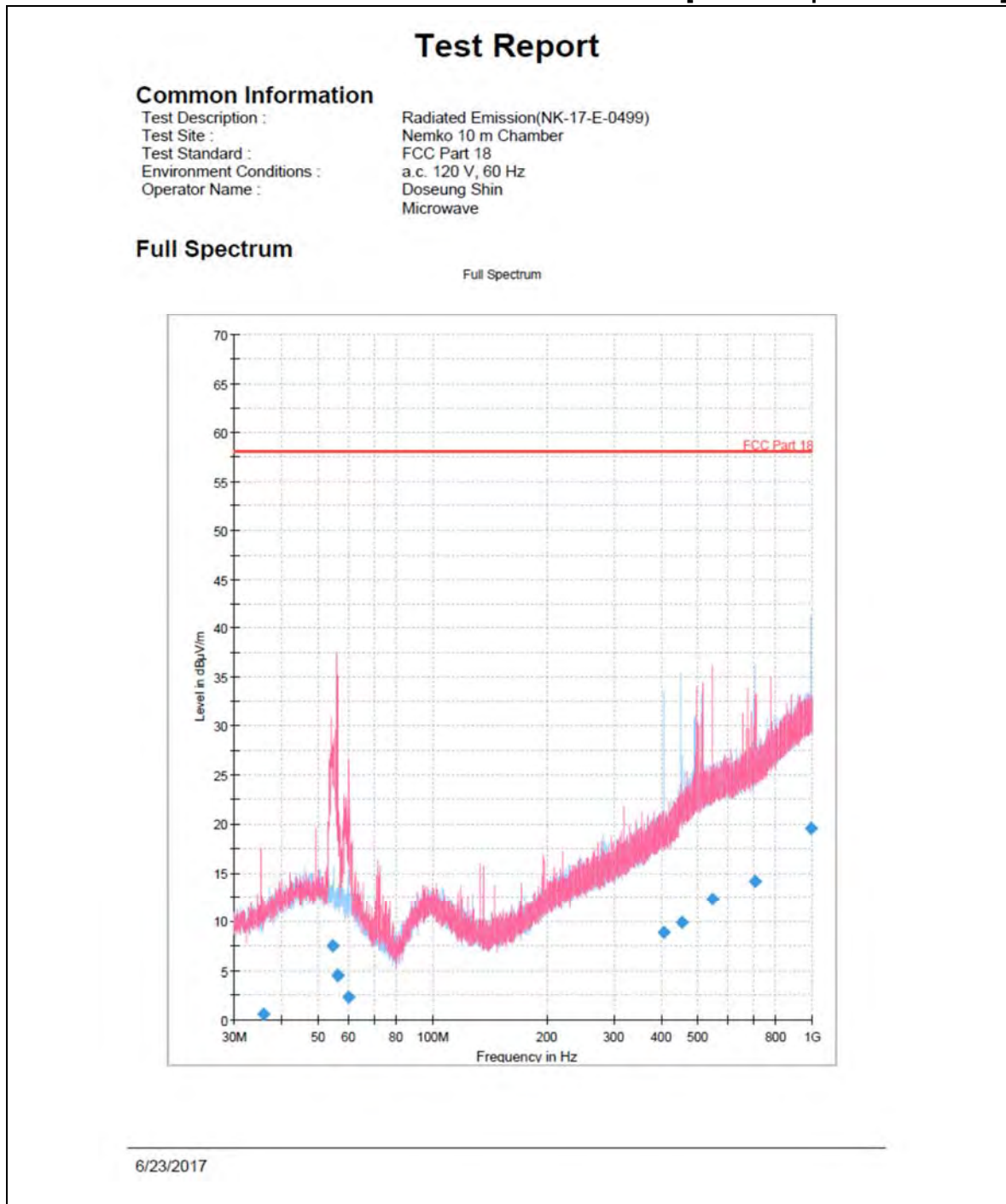
Tested by : **Dosheung Shin**

## TEST DATA

### Radiated Emissions (30 MHz to 1 GHz)

FCC ID : C5F7NF4AMO600N

[Room Temperature : 22.3 °C]



### Final Result

| Frequency<br>(MHz) | Average<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) | Meas.<br>Time<br>(ms) | Bandwidth<br>(kHz) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB) |
|--------------------|---------------------|-------------------|----------------|-----------------------|--------------------|----------------|-----|------------------|---------------|
| 35.887487          | 0.54                | 58.10             | 57.56          | 15000.0               | 120.000            | 176.0          | V   | 328.0            | -23.9         |
| 54.504220          | 7.50                | 58.10             | 50.60          | 15000.0               | 120.000            | 130.0          | V   | 139.0            | -21.8         |
| 56.135827          | 4.52                | 58.10             | 53.58          | 15000.0               | 120.000            | 176.0          | V   | 328.0            | -22.1         |
| 60.110700          | 2.29                | 58.10             | 55.81          | 15000.0               | 120.000            | 130.0          | V   | 78.0             | -22.7         |
| 407.623880         | 8.86                | 58.10             | 49.24          | 15000.0               | 120.000            | 370.0          | H   | 0.0              | -13.4         |
| 452.230073         | 9.89                | 58.10             | 48.21          | 15000.0               | 120.000            | 377.0          | H   | 12.0             | -12.0         |
| 544.443373         | 12.32               | 58.10             | 45.78          | 15000.0               | 120.000            | 376.0          | V   | 328.0            | -9.3          |
| 704.827600         | 14.12               | 58.10             | 43.98          | 15000.0               | 120.000            | 130.0          | H   | 212.0            | -6.6          |
| 993.834793         | 19.52               | 58.10             | 38.58          | 15000.0               | 120.000            | 100.0          | H   | 27.0             | -2.1          |

6/23/2017

<Radiated Measurements at 10 meters>

**NOTES:**

1. \*Pol. H = Horizontal V = Vertical
2. \*\*AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
3. Distance Correction factor :  $20 * \log (300/10) \doteq 29.5 \text{ dB } \mu\text{N/m}$
4. The limit at 300 meters is  $20 * \log (25 * \text{SQRT} (\text{RF Power}/500))$
5. All other emissions were measured while a 700  $\text{m}\ell$  load was placed in the center of the oven.
6. The limit for consumer device is on the FCC Part section 18.305.

A handwritten signature in blue ink, appearing to read 'DS' or 'Shin', is positioned above a horizontal line.

Tested by : **Dosheung Shin**

## TEST DATA

### Radiated Emissions (Above 1 GHz)

FCC ID : C5F7NF4AMO600N

[Room Temperature : 23.4 °C]

| Frequency | Pol*  | Antenna Heights | Turntable Angles | Reading Level | Total Loss** | Result at 3 m |        | K     | Results at 300 m | Limits at 300 m |
|-----------|-------|-----------------|------------------|---------------|--------------|---------------|--------|-------|------------------|-----------------|
| (MHz)     | (H/V) | (cm)            | (°)              | (dBμV)        | (dB)         | (dBμV/m)      | (μV/m) |       | (μV/m)           | (μV/m)          |
| 2 372.33  | V     | 100.0           | 0                | 64.9          | -2.5         | 62.4          | 1310.7 | 0.006 | 7.9              | 27.1            |
| 2 392.43  | V     | 100.0           | 0                | 45.8          | 16.1         | 61.9          | 1241.7 | 0.006 | 7.4              | 27.1            |
| 7 341.41  | V     | 100.0           | 0                | 38.9          | -0.8         | 38.1          | 80.1   | 0.01  | 0.8              | 27.1            |
| 8 253.50  | H     | 199.6           | 30               | 38.4          | 1.4          | 39.8          | 97.3   | 0.01  | 1.0              | 27.1            |
| 9 767.87  | V     | 299.7           | 300              | 36.9          | 2.8          | 39.7          | 96.8   | 0.01  | 1.0              | 27.1            |
| 14 675.01 | H     | 199.6           | 0                | 34.6          | 8.0          | 42.6          | 134.9  | 0.01  | 1.3              | 27.1            |
| 17 193.33 | H     | 299.7           | 300              | 32.2          | 12.5         | 44.7          | 172.6  | 0.01  | 1.7              | 27.1            |

### <Radiated Measurements at 3 meters>

#### NOTES:

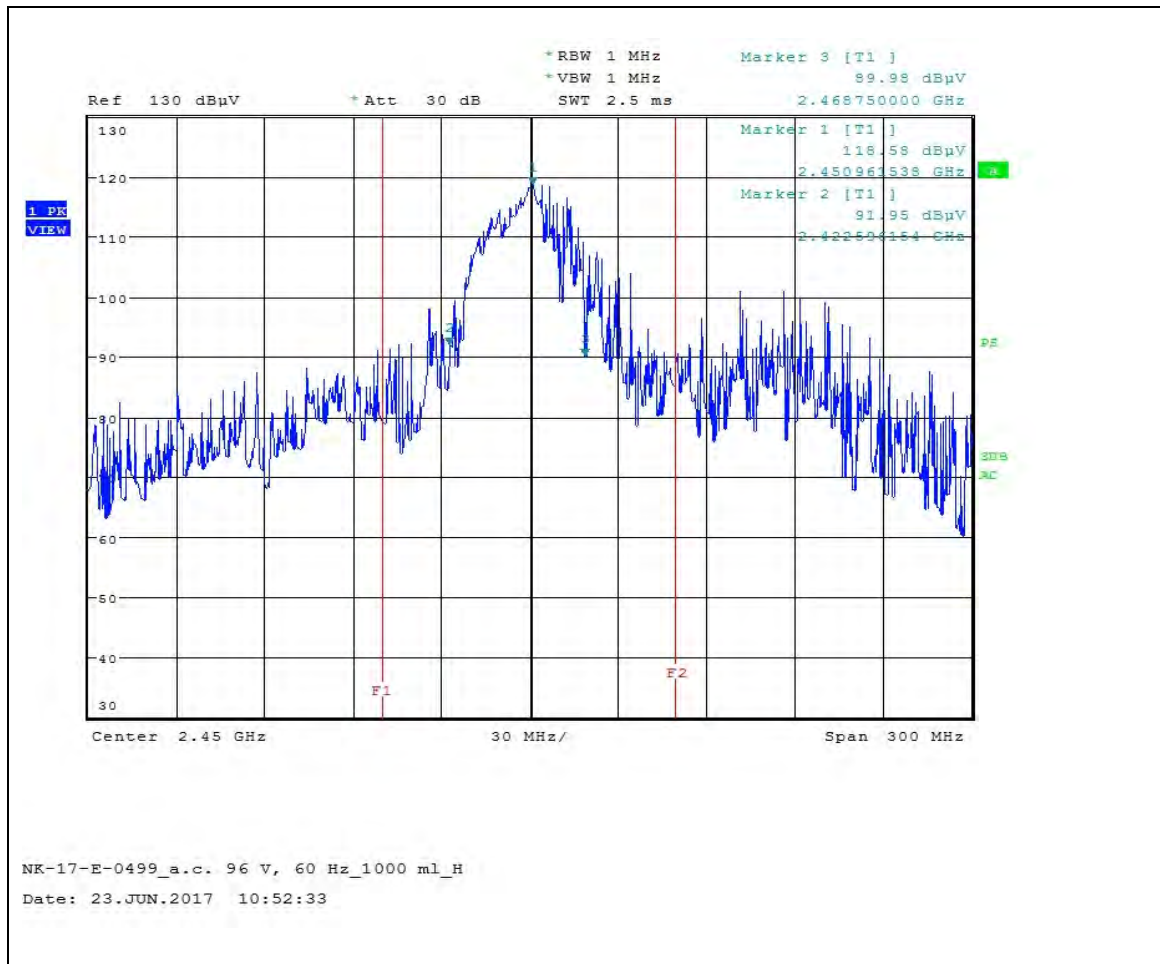
- \* Pol. H =Horizontal V=Vertical
- \*\* Total Loss = Antenna Factor + Cables Loss + Amplifier + HPF (High Pass Filter)
- Field Strength (at 300 m) (uV/m) =  $K * 10^{[Fieldstrength\ at\ 3\ m\ (dBuV/m) / 20]}$
- The limit at 300 meters is  $25 * \sqrt{RF\ Power/500}$
- Load for measurement of radiation on second and third harmonic : Two loads, one of 700 ml and the other of 300 ml, of water were used. Each load was tested both with the beaker located in the center of the oven and with it in the corner.
- The test was performed at peak detector mode with average.
- The limit for consumer device is on the FCC Part section 18.305.



Tested by : Dosheung Shin

## PLOTS OF EMISSIONS

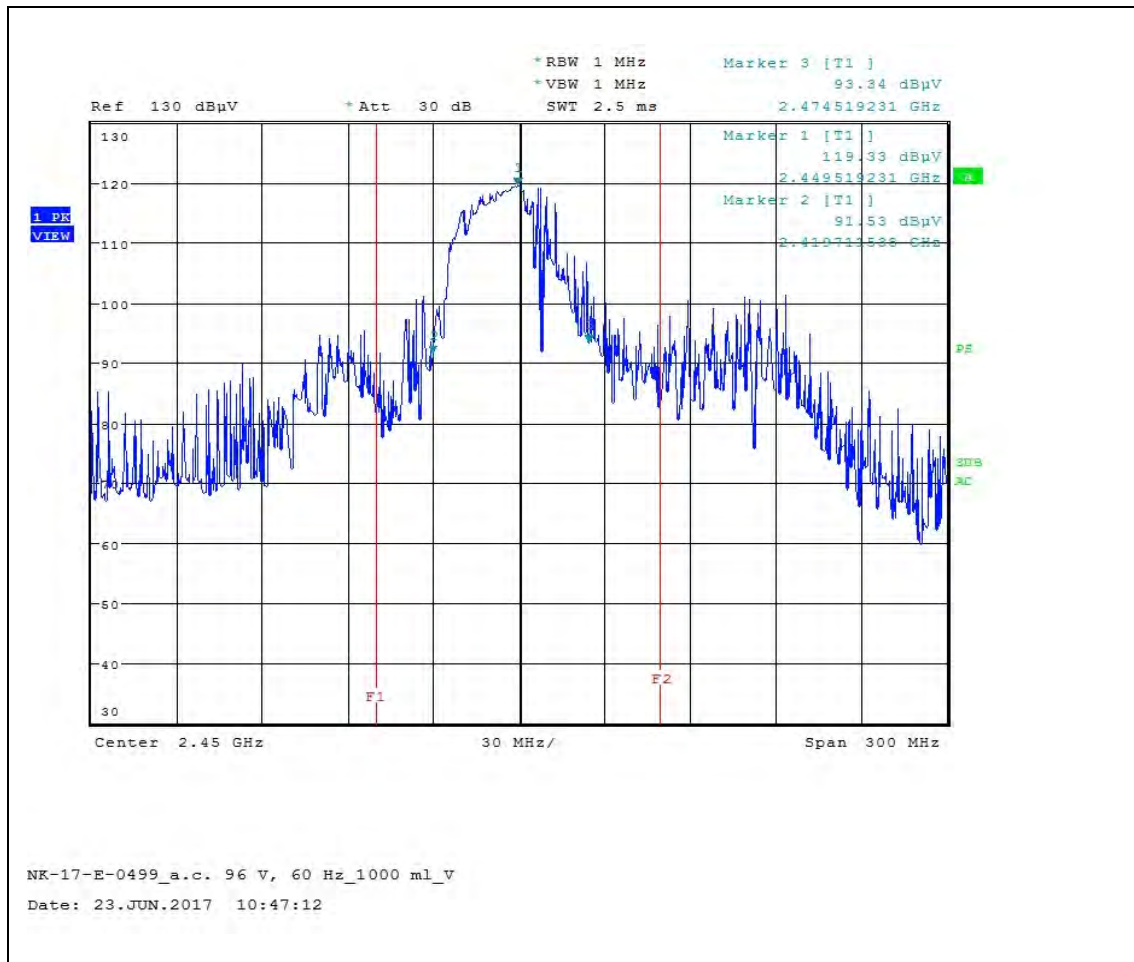
- Frequency vs Line Voltage Variation Test



Horizontal (96 V, 1000 ml)

## PLOTS OF EMISSIONS

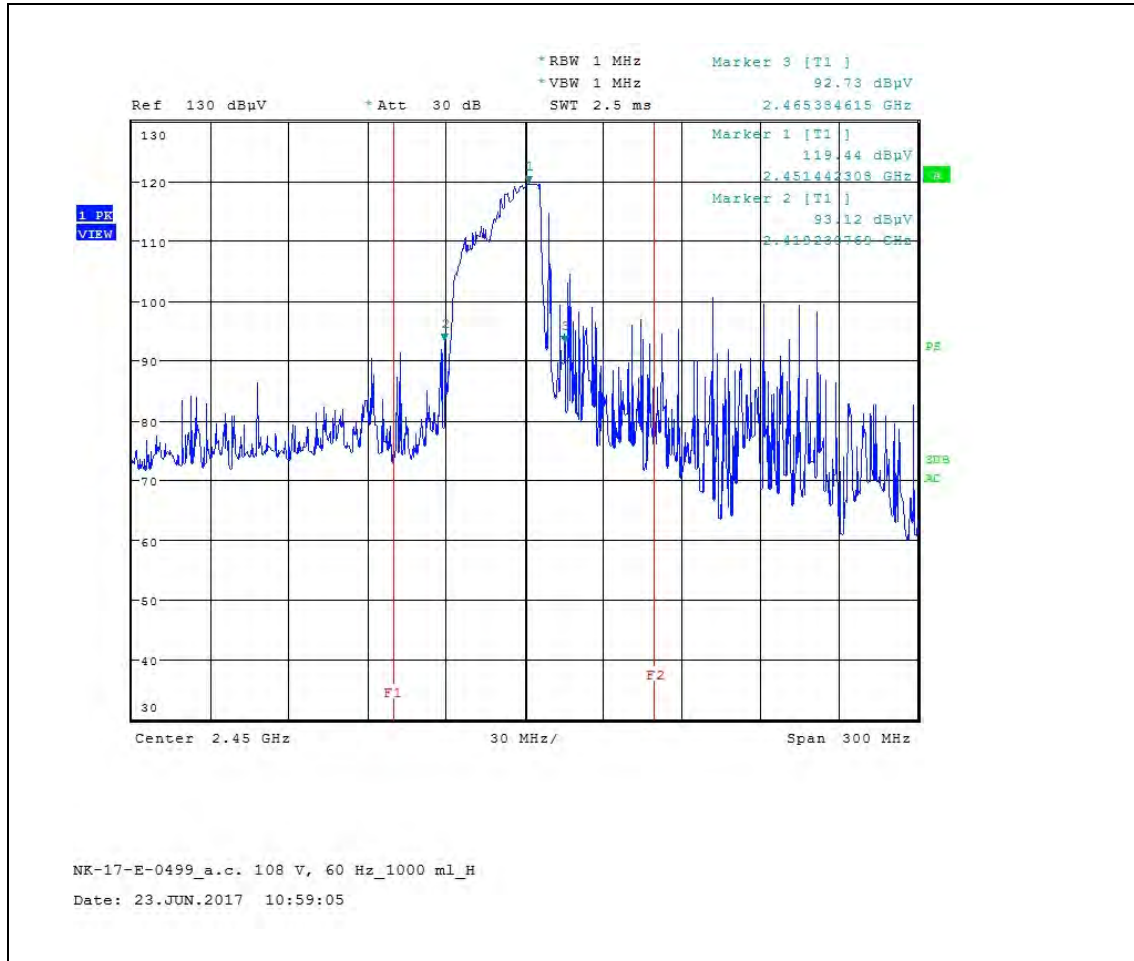
- Frequency vs Line Voltage Variation Test



Vertical (96 V, 1000 ml)

## PLOTS OF EMISSIONS

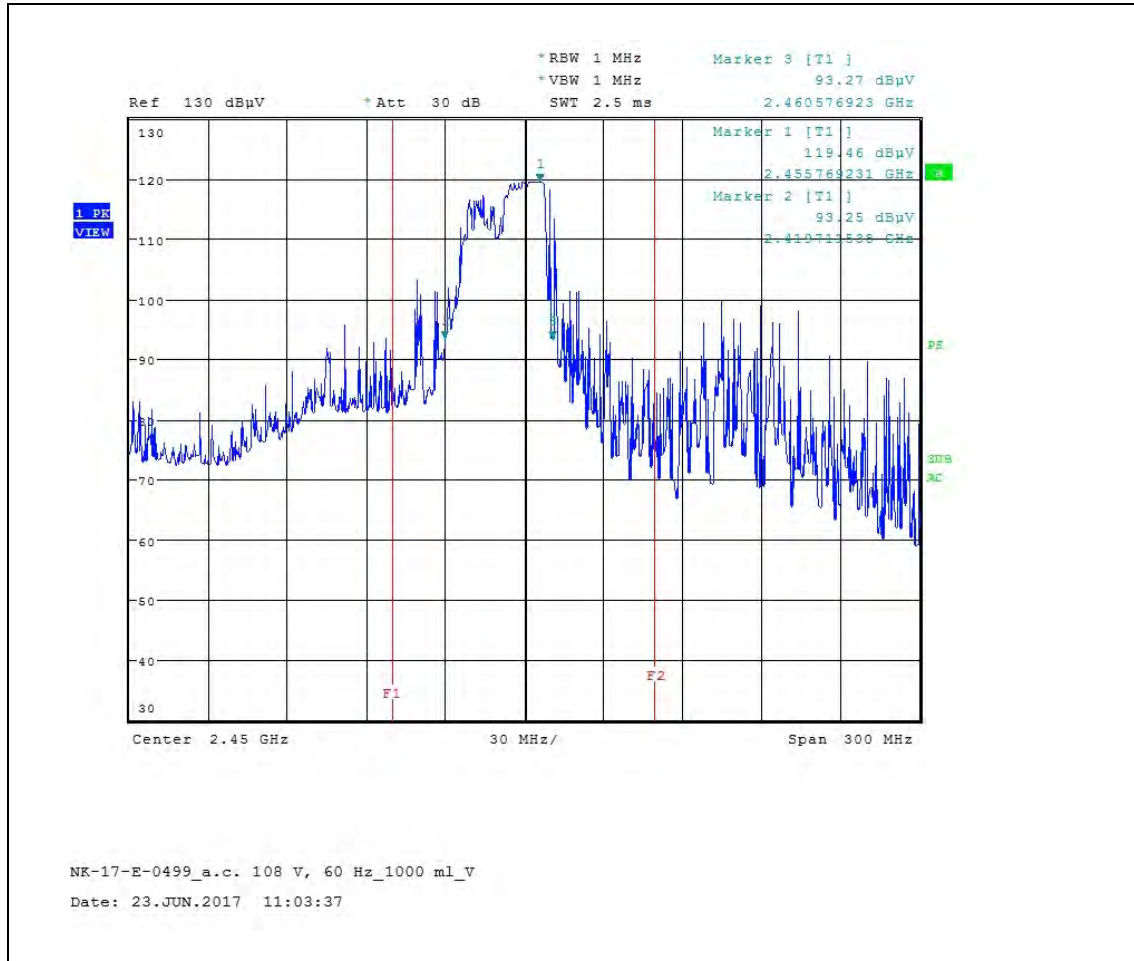
- Frequency vs Line Voltage Variation Test



Horizontal (108 V, 1000 ml)

## PLOTS OF EMISSIONS

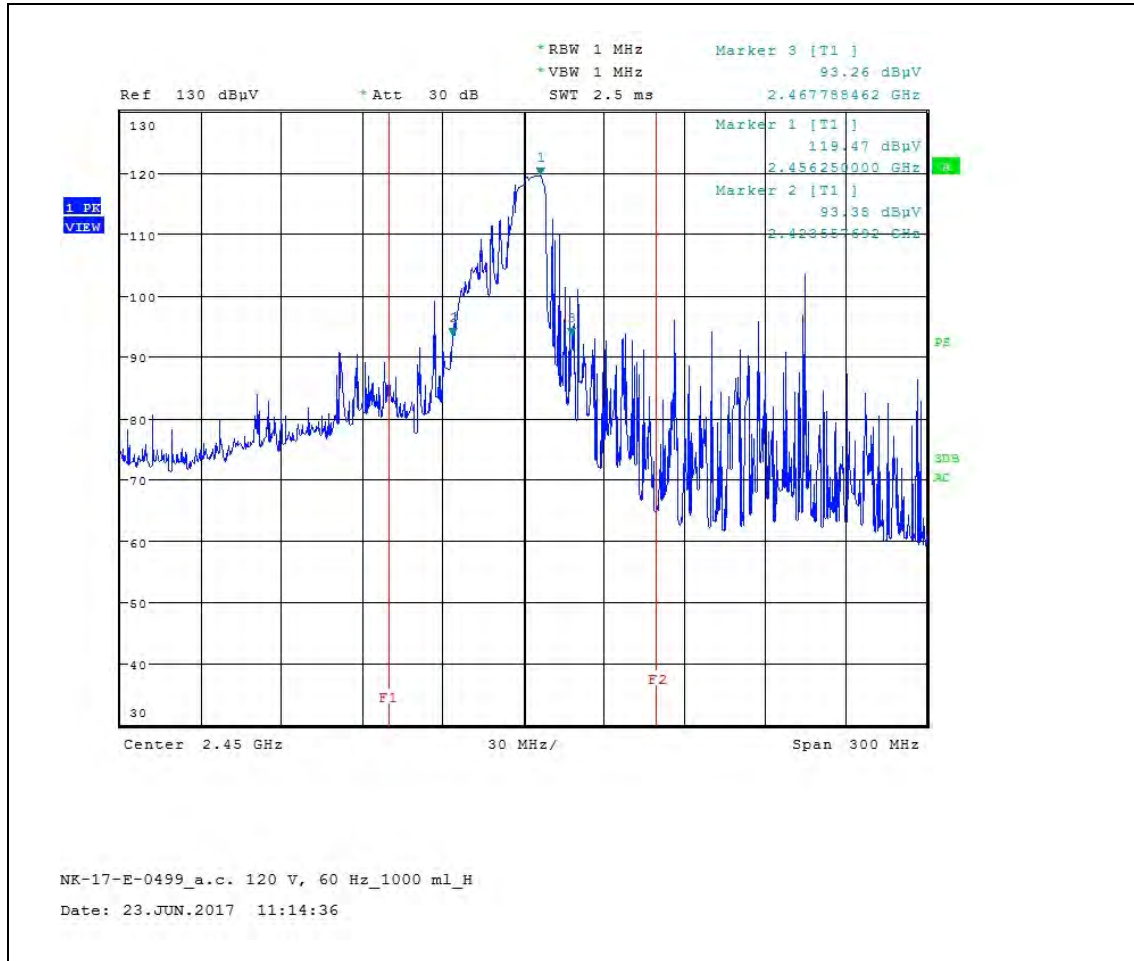
- Frequency vs Line Voltage Variation Test



Vertical (108 V, 1000 ml)

## PLOTS OF EMISSIONS

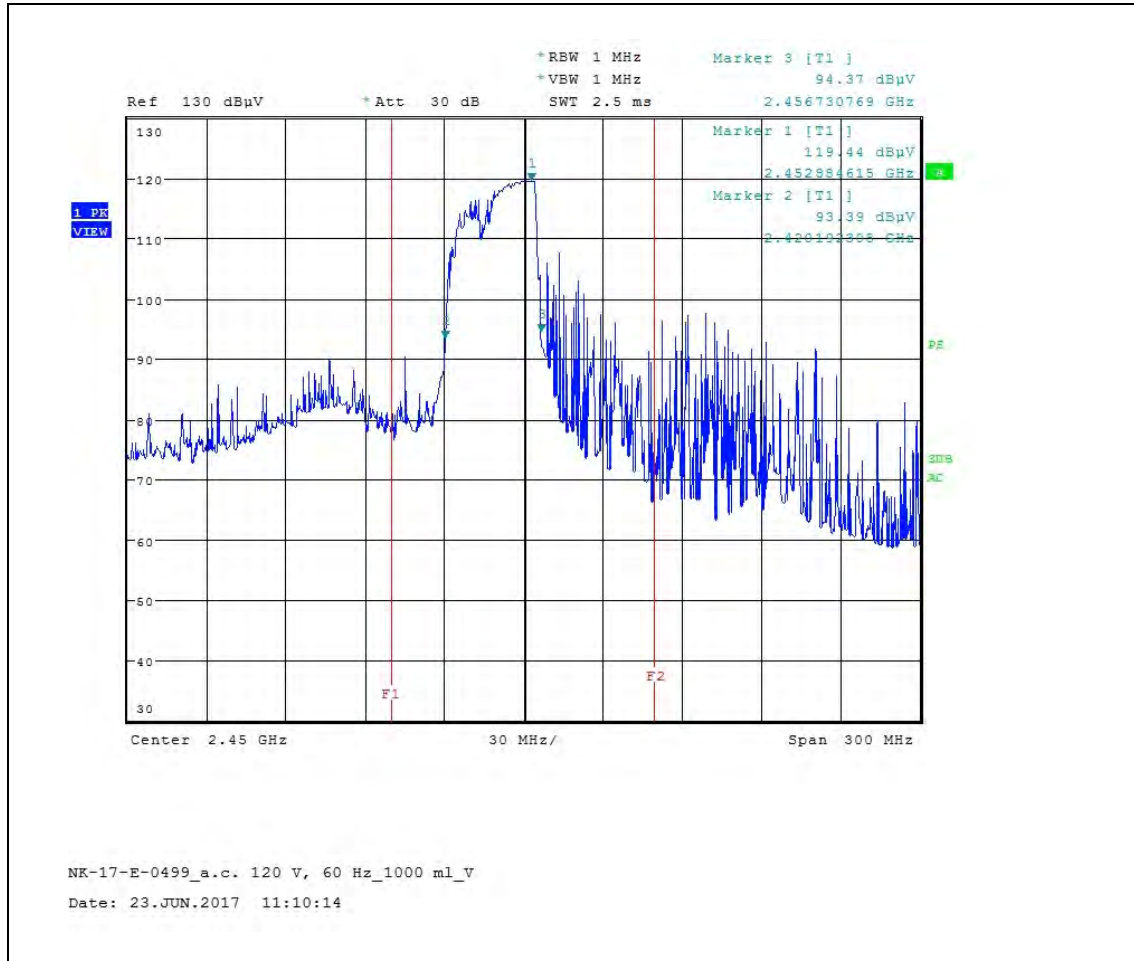
- Frequency vs Line Voltage Variation Test



Horizontal (120 V, 1000 ml)

## PLOTS OF EMISSIONS

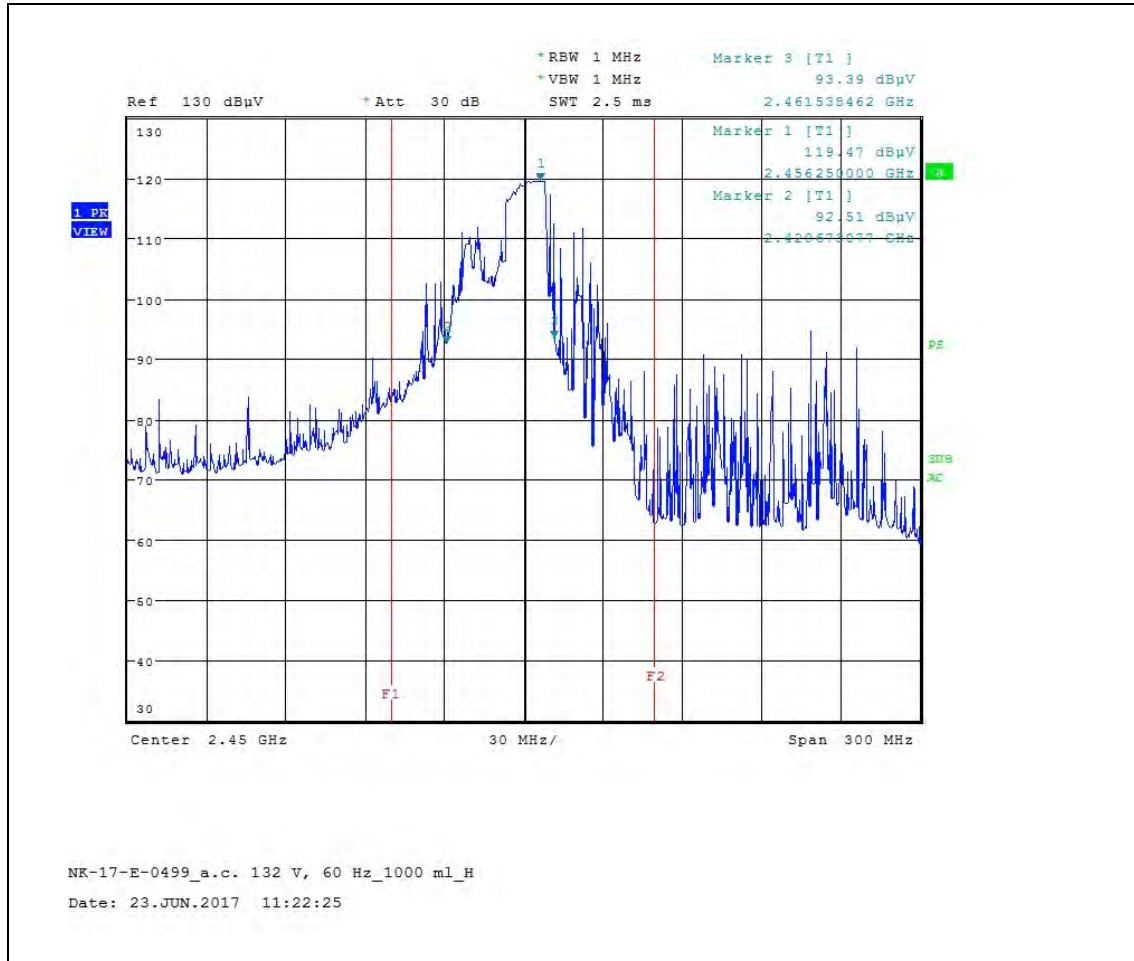
- Frequency vs Line Voltage Variation Test



Vertical (120 V, 1000 mℓ)

## PLOTS OF EMISSIONS

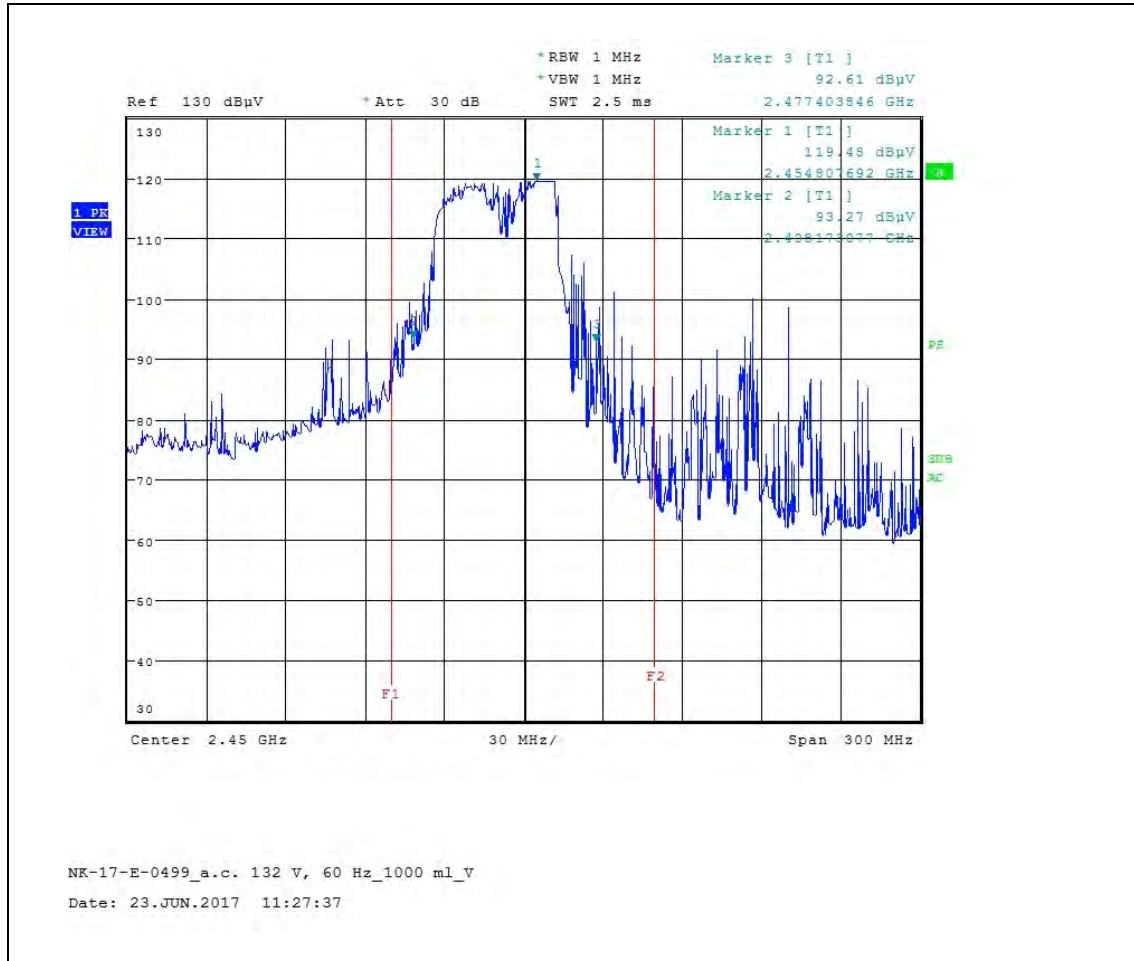
- Frequency vs Line Voltage Variation Test



Horizontal (132 V, 1000 ml)

## PLOTS OF EMISSIONS

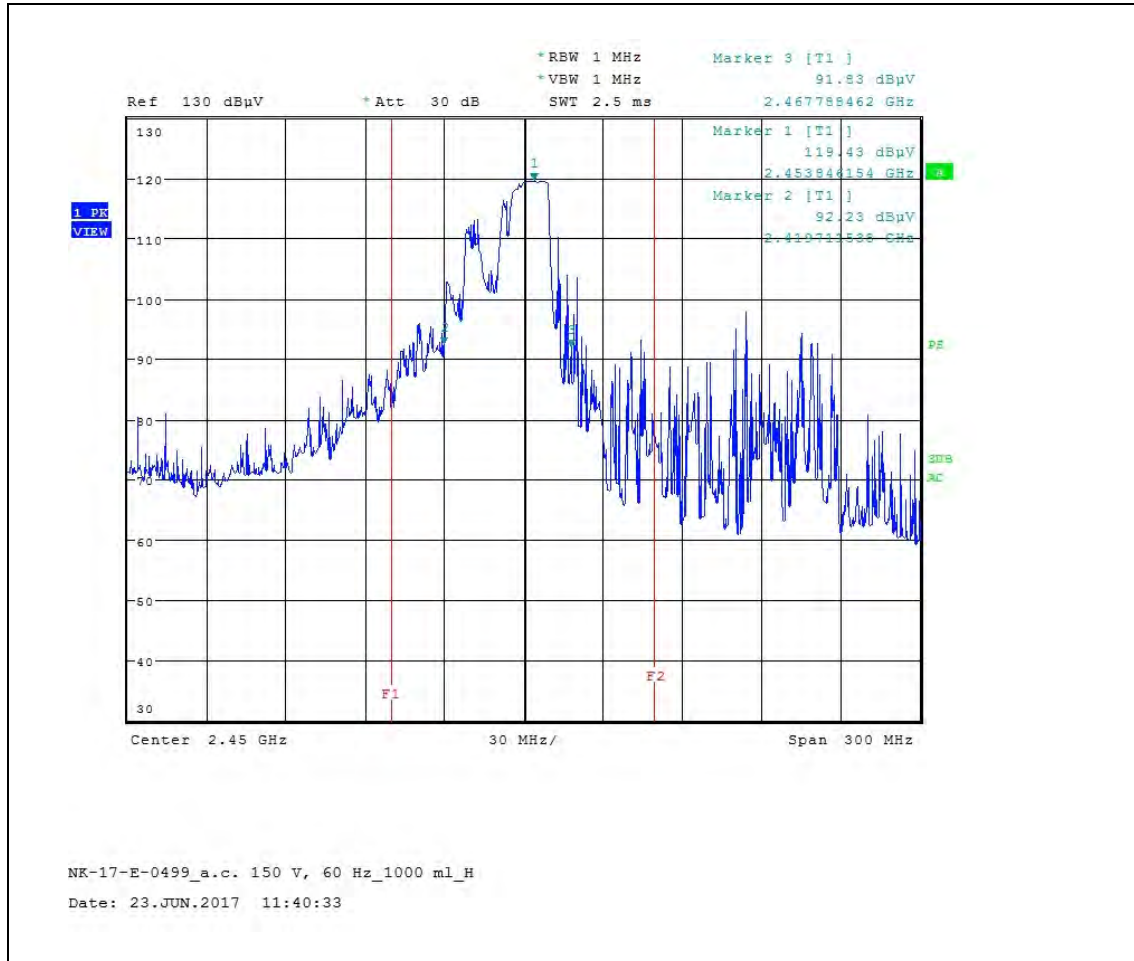
- Frequency vs Line Voltage Variation Test



Vertical (132 V, 1000 ml)

## PLOTS OF EMISSIONS

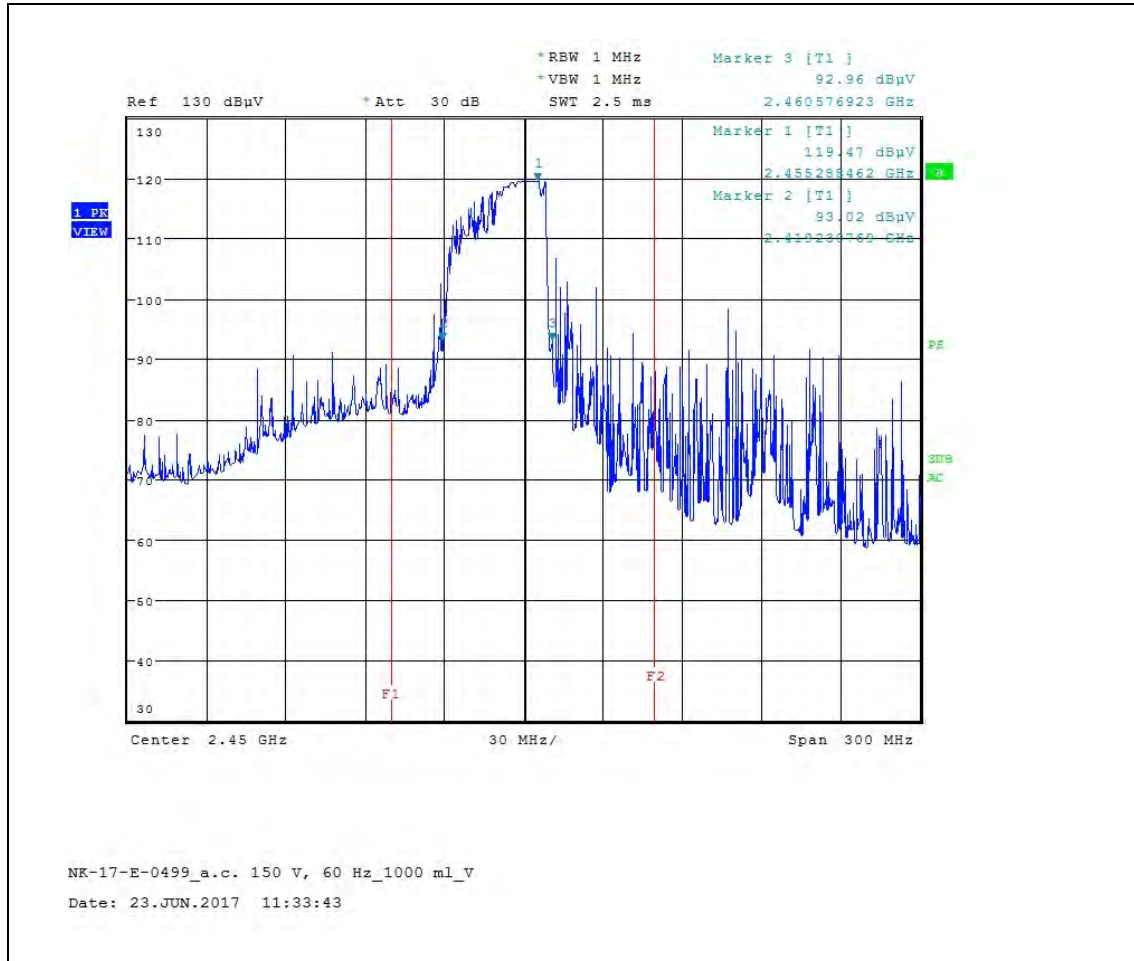
- Frequency vs Line Voltage Variation Test



Horizontal (150 V, 1000 ml)

## PLOTS OF EMISSIONS

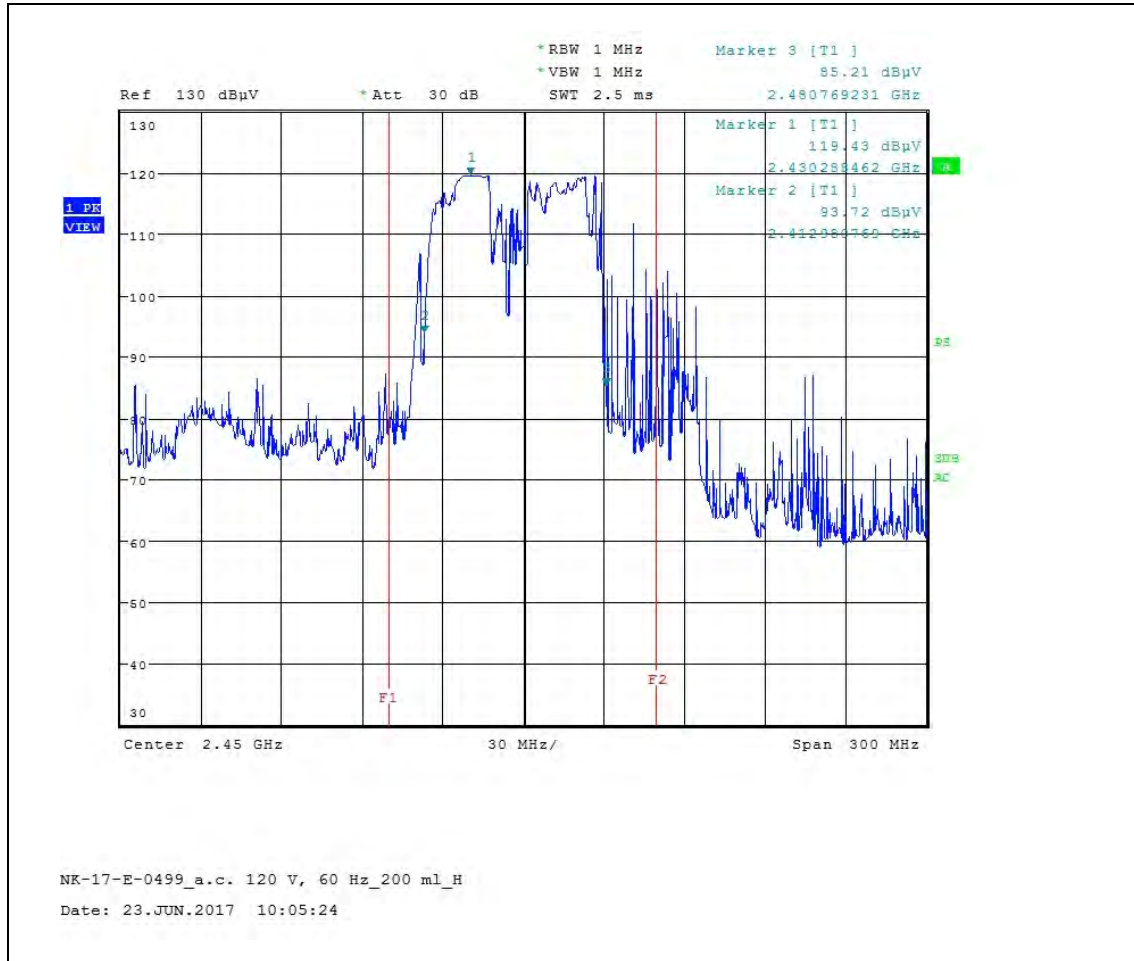
- Frequency vs Line Voltage Variation Test



Vertical (150 V, 1000 mV)

## PLOTS OF EMISSIONS

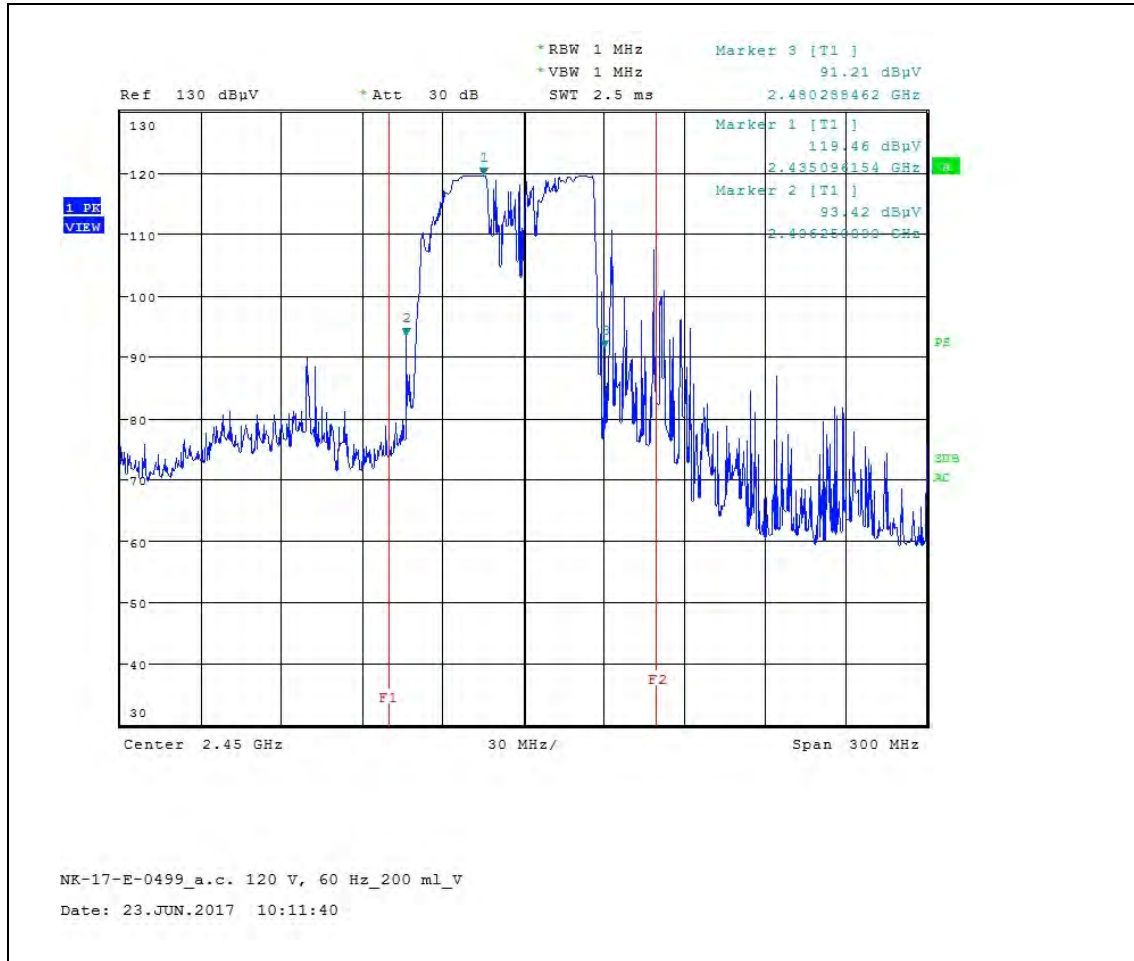
- Frequency vs Load Variation Test



Horizontal (120 V, 200 ml)

## PLOTS OF EMISSIONS

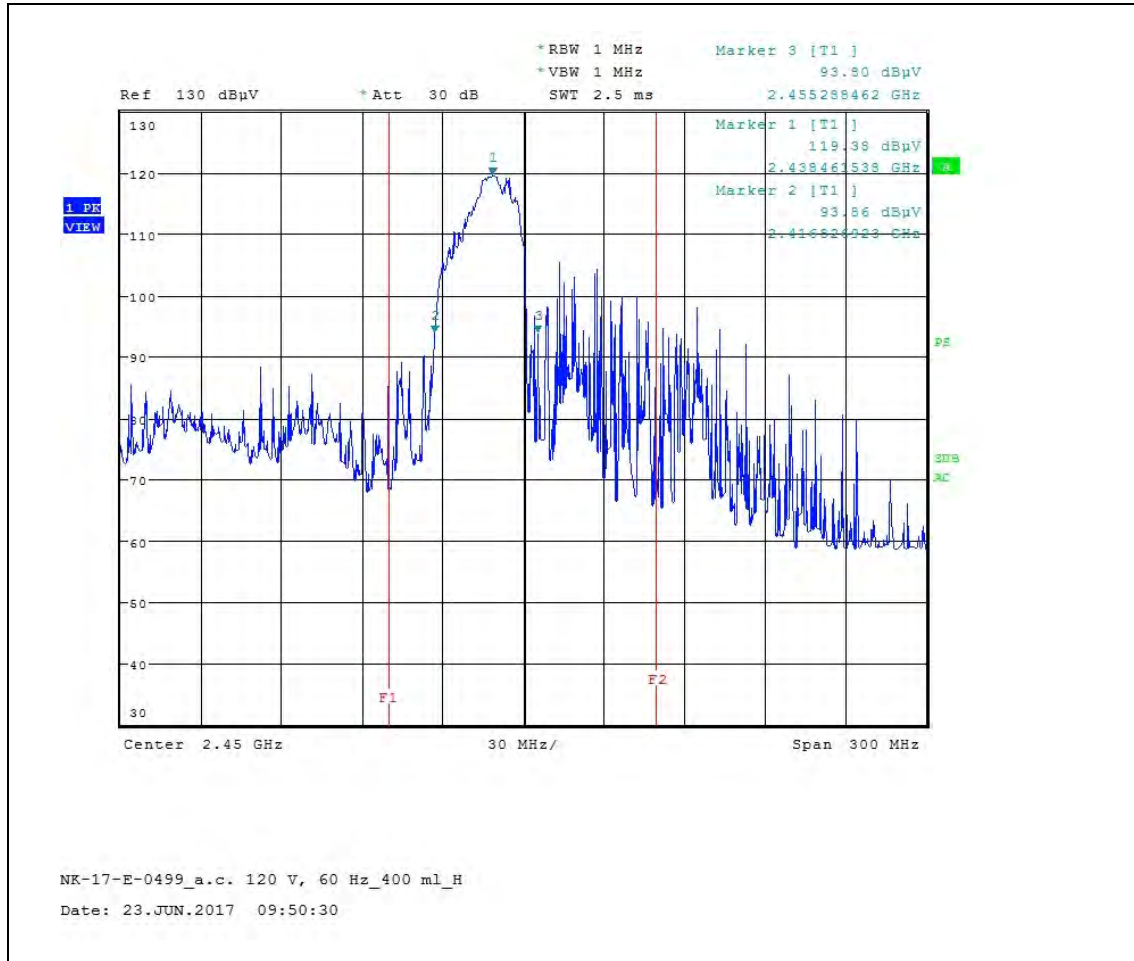
- Frequency vs Load Variation Test



Vertical (120 V, 200 ml)

## PLOTS OF EMISSIONS

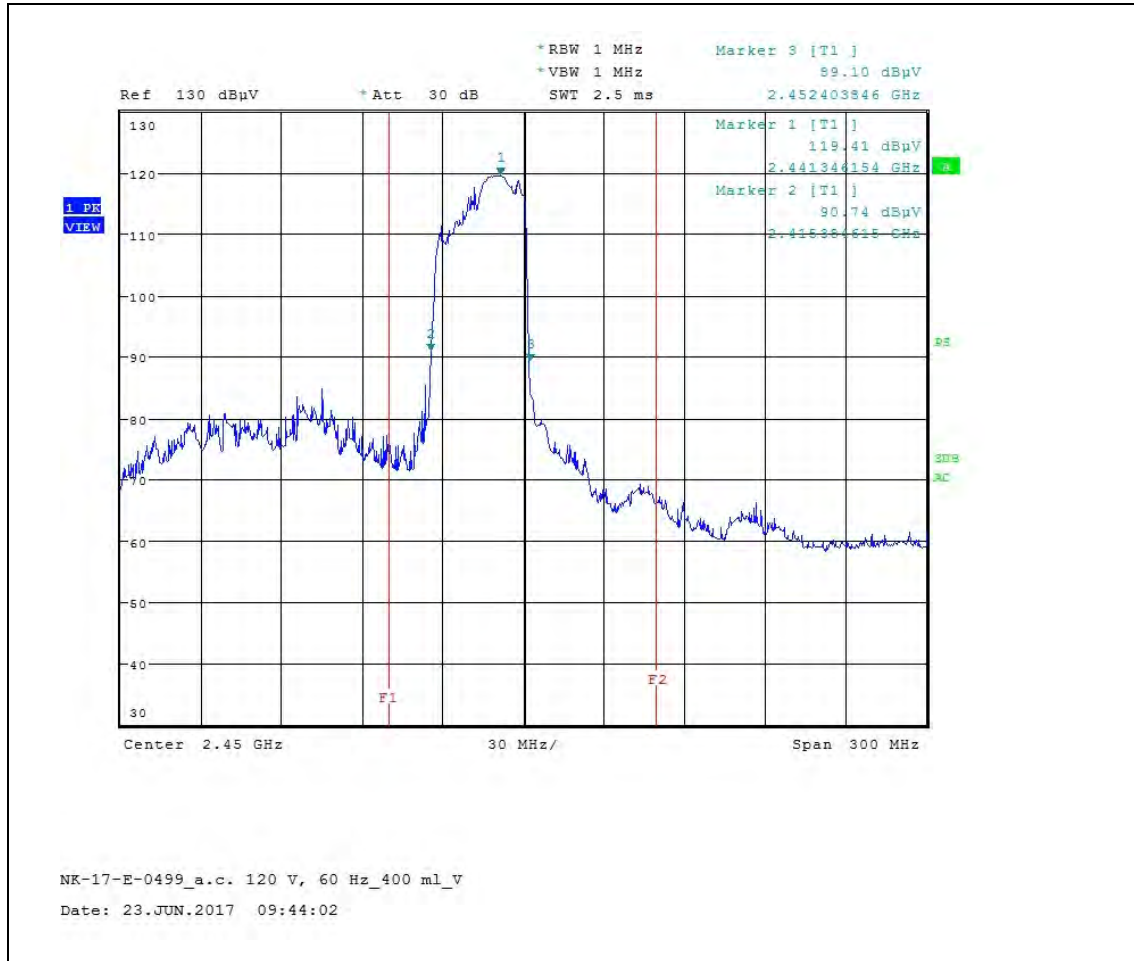
- Frequency vs Load Variation Test



Horizontal (120 V, 400 ml)

## PLOTS OF EMISSIONS

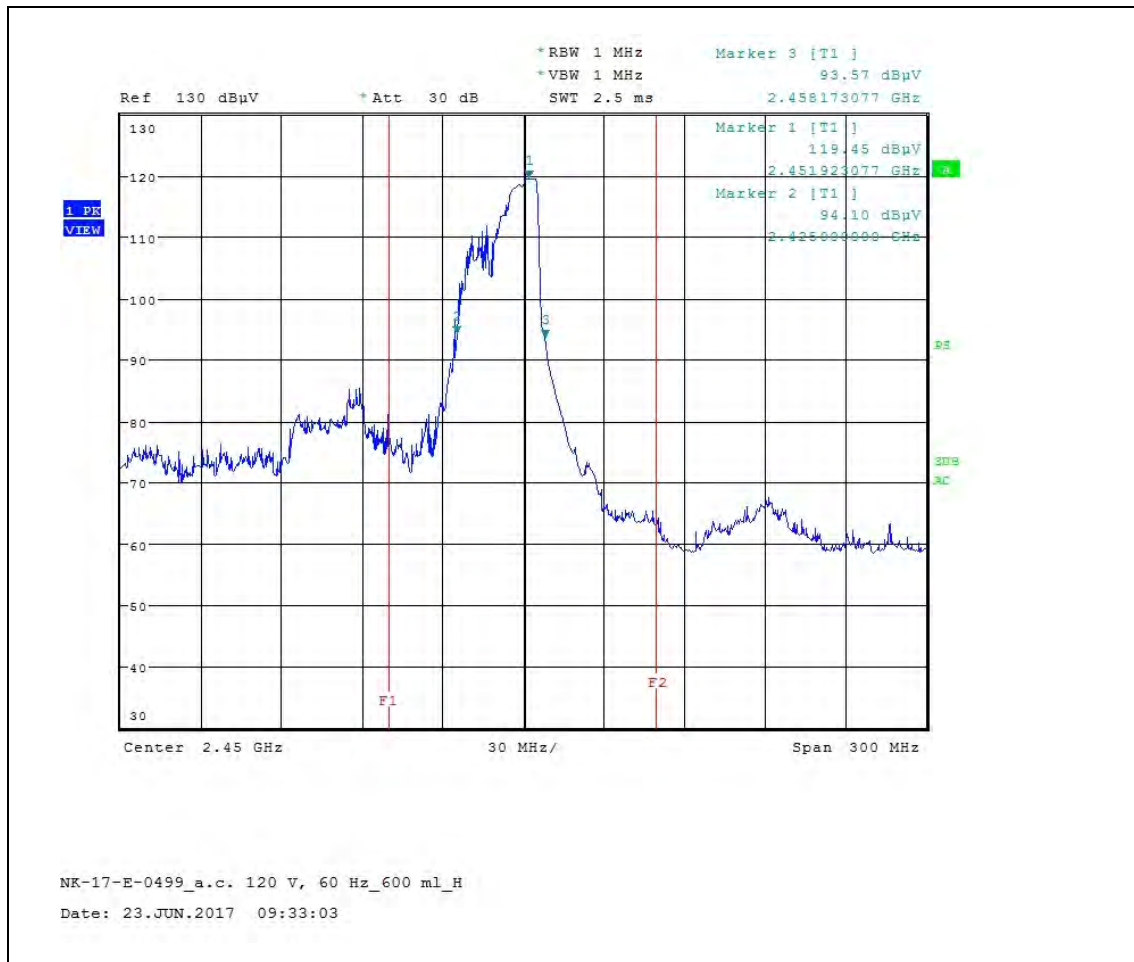
- Frequency vs Load Variation Test



Vertical (120 V, 400 ml)

## PLOTS OF EMISSIONS

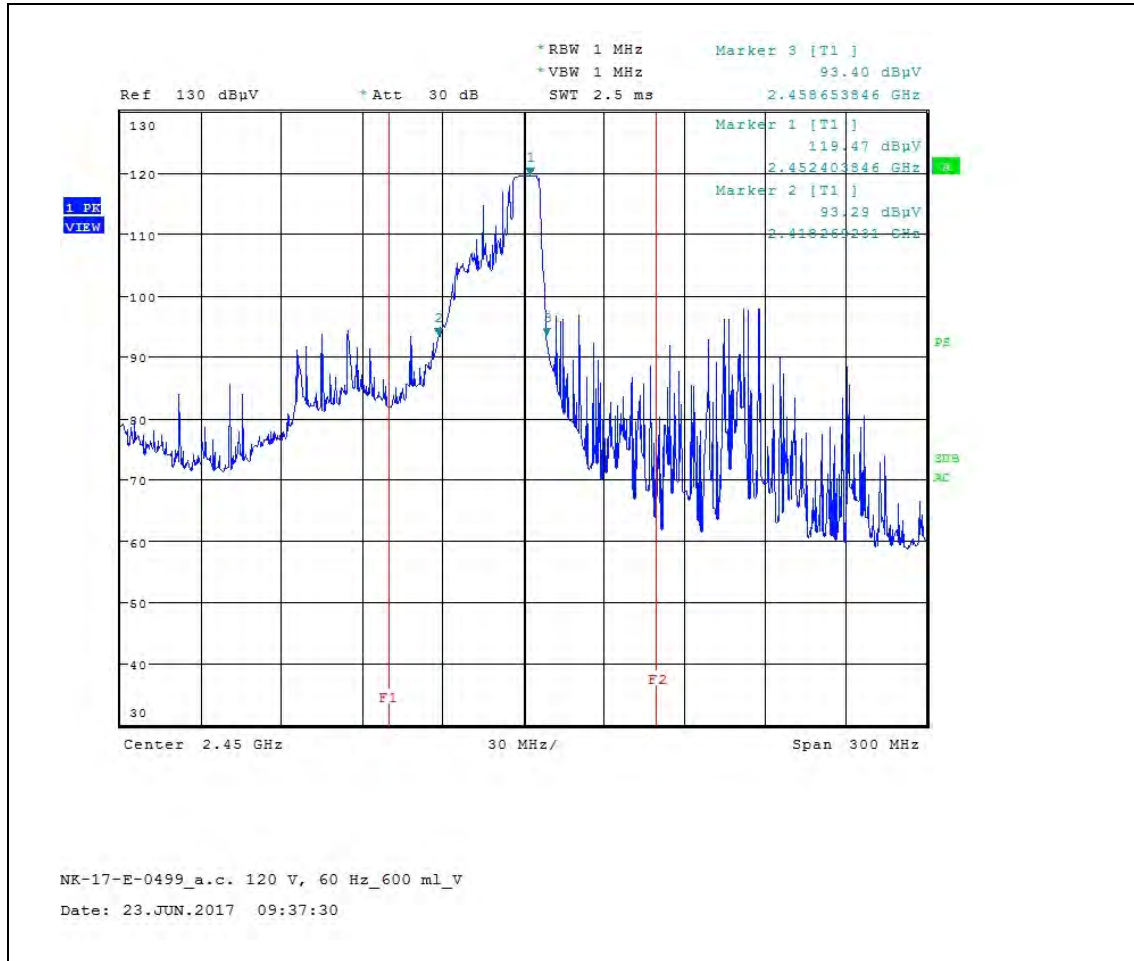
- Frequency vs Load Variation Test



Horizontal (120 V, 600 ml)

## PLOTS OF EMISSIONS

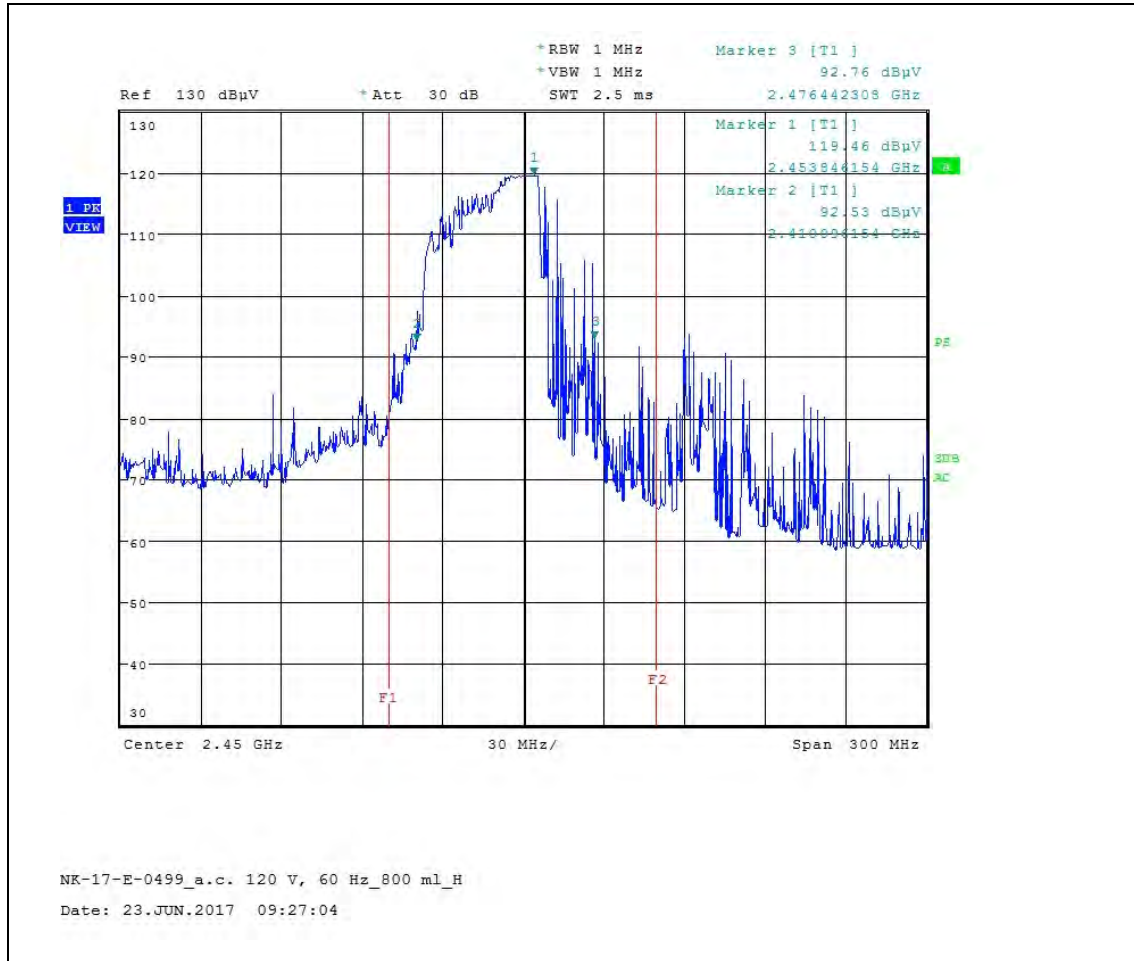
- Frequency vs Load Variation Test



Vertical (120 V, 600 ml)

## PLOTS OF EMISSIONS

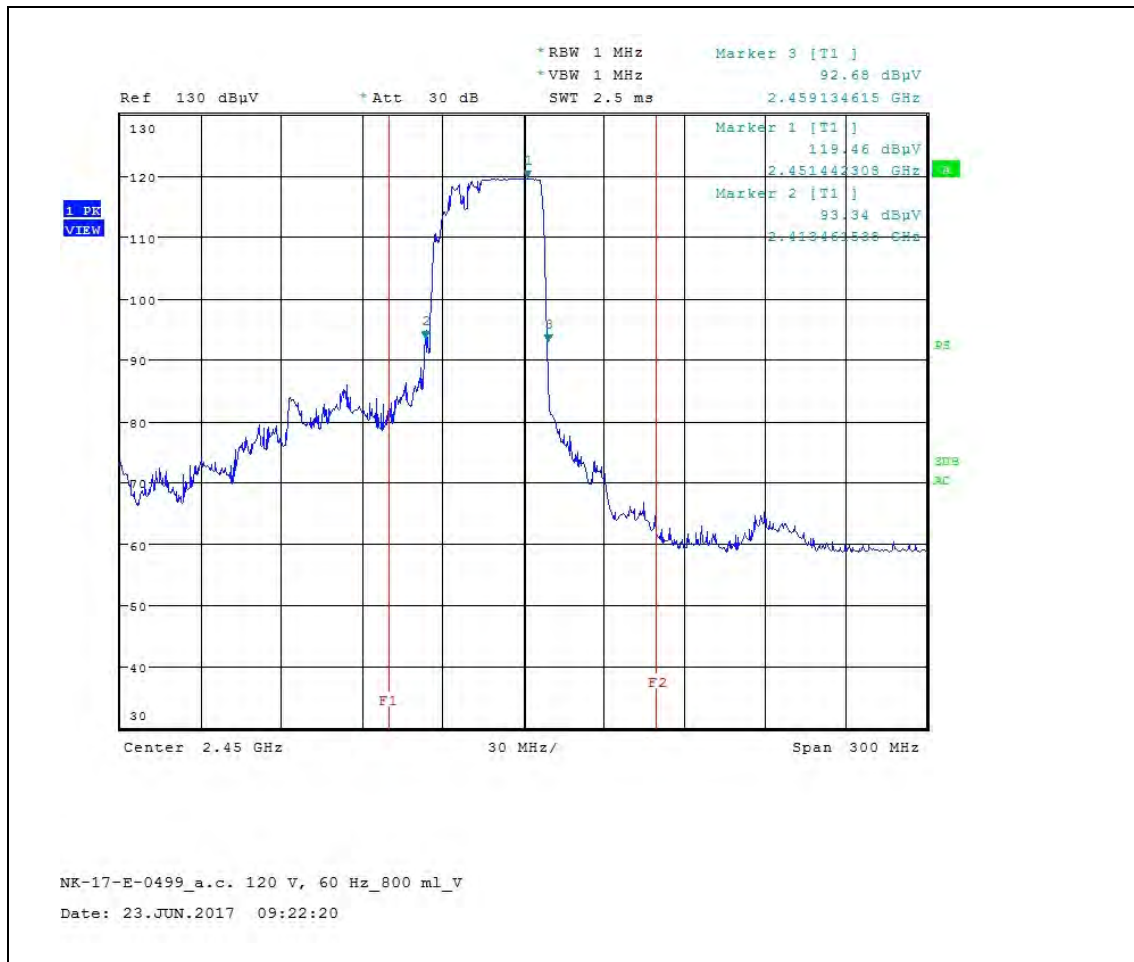
- Frequency vs Load Variation Test



Horizontal (120 V, 800 ml)

## PLOTS OF EMISSIONS

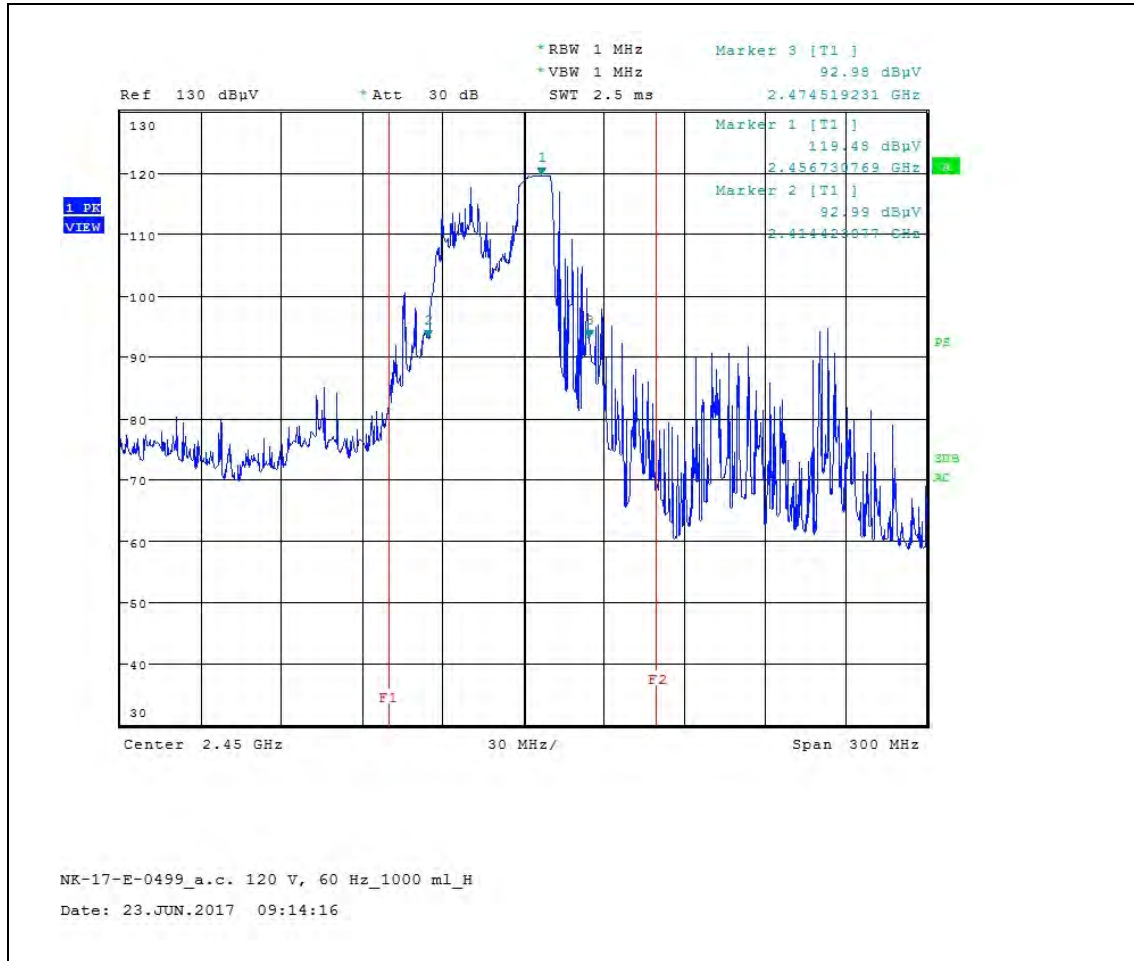
- Frequency vs Load Variation Test



Vertical (120 V, 800 ml)

## PLOTS OF EMISSIONS

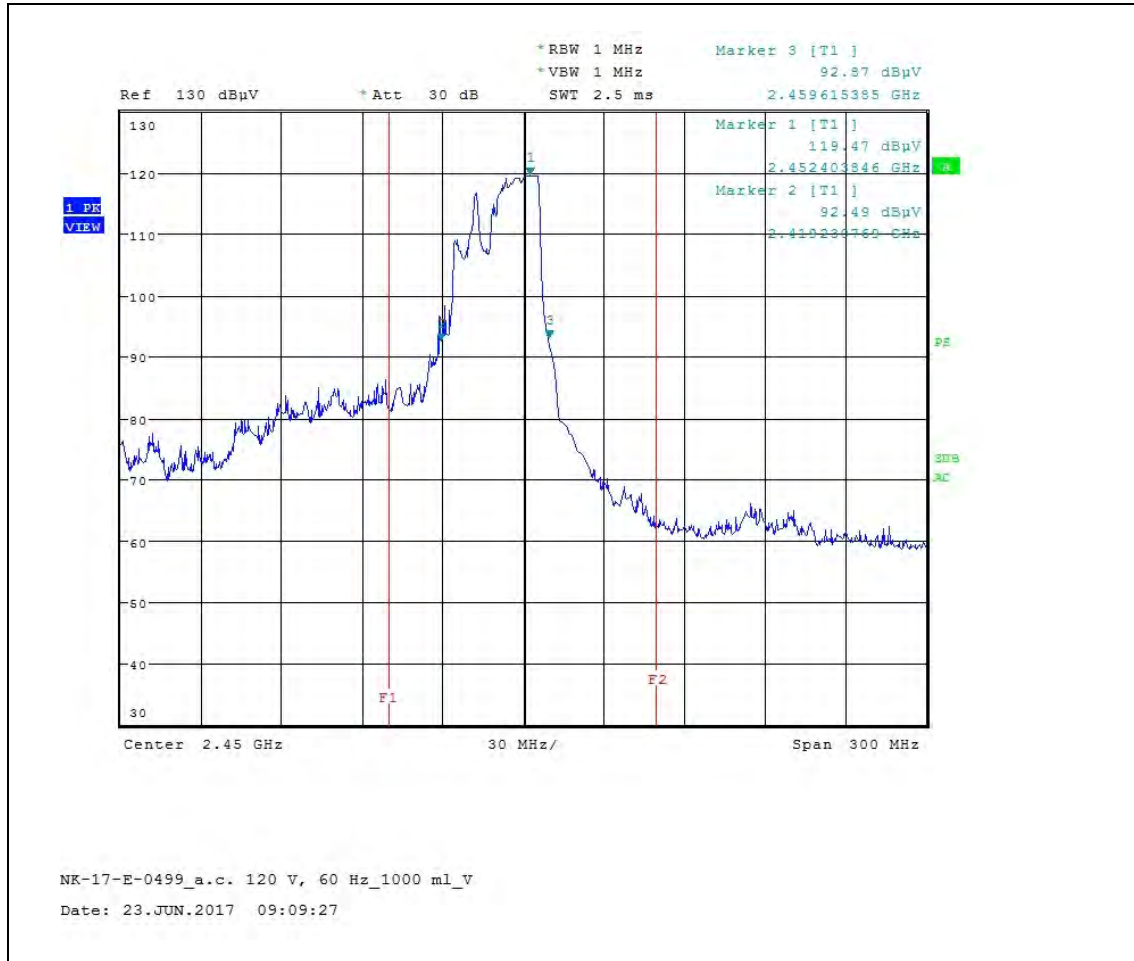
- Frequency vs Load Variation Test



Horizontal (120 V, 1000 ml)

## PLOTS OF EMISSIONS

- Frequency vs Load Variation Test



Vertical (120 V, 1000 mV)

## ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of measurement uncertainty contained in CISPR 16-4-2 with the confidence level of 95 %

### 1. Conducted Uncertainty Calculation

| Source of Uncertainty            | $X_i$                              | Uncertainty of $X_i$ |                             | Coverage factor<br>$k$    | $u(X_i)$<br>(dB) | $C_i$ | $C_i u(X_i)$<br>(dB) |
|----------------------------------|------------------------------------|----------------------|-----------------------------|---------------------------|------------------|-------|----------------------|
|                                  |                                    | Value<br>(dB)        | Probability<br>Distribution |                           |                  |       |                      |
| Measurement System Repeatability | $R_s$                              | 0.10                 | normal 1                    | 1.00                      | 0.10             | 1     | 0.10                 |
| Receiver reading                 | $R_i$                              | $\pm 0.02$           | normal 2                    | 2.00                      | 0.01             | 1     | 0.01                 |
| Attenuation AMN-Receiver         | $L_c$                              | $\pm 0.10$           | rectangular                 | $\sqrt{3}$                | 0.06             | 1     | 0.06                 |
| AMN Voltage division factor      | $L_{AMN}$                          | $\pm 0.09$           | normal 2                    | 2.00                      | 0.05             | 1     | 0.05                 |
| Sine wave voltage                | $dV_{SW}$                          | $\pm 0.17$           | normal 2                    | 2.00                      | 0.09             | 1     | 0.09                 |
| Pulse amplitude response         | $dV_{PA}$                          | $\pm 0.92$           | normal 2                    | 2.00                      | 0.50             | 1     | 0.50                 |
| Pulse repetition rate response   | $dV_{PR}$                          | $\pm 0.35$           | normal 2                    | 2.00                      | 0.18             | 1     | 0.18                 |
| Noise floor proximity            | $dV_{NF}$                          | $\pm 0.00$           | rectangular                 | $\sqrt{3}$                | 0.00             | 1     | 0.00                 |
| AMN Impedance                    | $dZ$                               | $\pm 2.00$           | normal 2                    | 2.00                      | 1.00             | 1     | 1.00                 |
| Mismatch                         | $M$                                | + 0.81<br>- 0.89     | U-Shaped                    | $\sqrt{3}$                | 0.60             | 1     | 0.60                 |
| Remark                           | Using 50 $\Omega$ / 50 $\mu$ H AMN |                      |                             |                           |                  |       |                      |
| Combined Standard Uncertainty    | Normal                             |                      |                             | $u_c = 1.29$ dB           |                  |       |                      |
| Expanded Uncertainty U           | Normal ( $k = 2$ )                 |                      |                             | $U = 2.6$ dB (CL is 95 %) |                  |       |                      |

## 2. Radiation Uncertainty Calculation (Below 1 GHz)

| Source of Uncertainty                  | $X_i$              | Uncertainty of $X_i$ |                             | Coverage factor<br>$k$ | $u(X_i)$<br>(dB) | $C_i$ | $C_i u(X_i)$<br>(dB) |
|----------------------------------------|--------------------|----------------------|-----------------------------|------------------------|------------------|-------|----------------------|
|                                        |                    | Value<br>(dB)        | Probability<br>Distribution |                        |                  |       |                      |
| Measurement System Repeatability       | $RS$               | 0.67                 | normal 1                    | 1.00                   | 0.67             | 1     | 0.67                 |
| Receiver reading                       | $Ri$               | $\pm 0.02$           | normal 2                    | 2.00                   | 0.01             | 1     | 0.01                 |
| Sine wave voltage                      | $dV_{sw}$          | $\pm 0.17$           | normal 2                    | 2.00                   | 0.09             | 1     | 0.09                 |
| Pulse amplitude response               | $dV_{pa}$          | $\pm 0.92$           | normal 2                    | 2.00                   | 0.46             | 1     | 0.46                 |
| Pulse repetition rate response         | $dV_{pr}$          | $\pm 0.35$           | normal 2                    | 2.00                   | 0.18             | 1     | 0.18                 |
| Noise floor proximity                  | $dV_{nf}$          | $\pm 0.50$           | normal 2                    | 2.00                   | 0.25             | 1     | 0.25                 |
| Antenna Factor Calibration             | $A_F$              | $\pm 2.00$           | rectangular                 | $\sqrt{3}$             | 1.15             | 1     | 1.15                 |
| Cable Loss                             | $C_L$              | $\pm 1.00$           | normal 2                    | 2.00                   | 0.50             | 1     | 0.50                 |
| Antenna Directivity                    | $A_D$              | $\pm 0.00$           | rectangular                 | $\sqrt{3}$             | 0.00             | 1     | 0.00                 |
| Antenna Factor Height Dependence       | $A_H$              | $\pm 2.00$           | rectangular                 | $\sqrt{3}$             | 1.15             | 1     | 1.15                 |
| Antenna Phase Centre Variation         | $A_P$              | $\pm 0.20$           | rectangular                 | $\sqrt{3}$             | 0.12             | 1     | 0.12                 |
| Antenna Factor Frequency Interpolation | $A_i$              | $\pm 0.25$           | rectangular                 | $\sqrt{3}$             | 0.14             | 1     | 0.14                 |
| Site Imperfections                     | $S_i$              | $\pm 4.00$           | triangular                  | $\sqrt{6}$             | 1.63             | 1     | 1.63                 |
| Measurement Distance Variation         | $D_V$              | $\pm 0.60$           | rectangular                 | $\sqrt{3}$             | 0.35             | 1     | 0.35                 |
| Antenna Balance                        | $D_{bal}$          | $\pm 0.90$           | rectangular                 | $\sqrt{3}$             | 0.52             | 1     | 0.52                 |
| Cross Polarization                     | $D_{Cross}$        | $\pm 0.00$           | rectangular                 | $\sqrt{3}$             | 0.00             | 1     | 0.00                 |
| Mismatch                               | $M$                | + 0.98<br>- 1.11     | U-Shaped                    | $\sqrt{2}$             | 0.74             | 1     | 0.74                 |
| EUT Volume Diameter                    | $V_d$              | 0.33                 | normal 1                    | 1.00                   | 0.33             | 1     | 0.11                 |
| Combined Standard Uncertainty          | Normal             |                      |                             | $u_c = 2.72$ dB        |                  |       |                      |
| Expanded Uncertainty U                 | Normal ( $k = 2$ ) |                      |                             | 5.4 dB (CL is 95 %)    |                  |       |                      |

### 3. Radiation Uncertainty Calculation (Above 1 GHz)

| Source of Uncertainty                  | $X_i$              | Uncertainty of $X_i$ |                             | Coverage factor<br>$k$    | $u(X_i)$<br>(dB) | $C_i$ | $C_i u(X_i)$<br>(dB) |
|----------------------------------------|--------------------|----------------------|-----------------------------|---------------------------|------------------|-------|----------------------|
|                                        |                    | Value<br>(dB)        | Probability<br>Distribution |                           |                  |       |                      |
| Measurement System Repeatability       | $RS$               | 0.07                 | normal 1                    | 1.00                      | 0.07             | 1     | 0.07                 |
| Receiver Reading                       | $R_i$              | $\pm 0.27$           | normal 2                    | 2                         | 0.14             | 1     | 0.14                 |
| Attenuation (antenna-receiver)         | $a_c$              | $\pm 0.30$           | normal 2                    | 2                         | 0.15             | 1     | 0.15                 |
| Preamplifier gain                      | $G_p$              | $\pm 0.23$           | normal 2                    | 2                         | 0.12             | 1     | 0.12                 |
| Receiver Sine Wave                     | $dV_{sw}$          | $\pm 0.27$           | normal 2                    | 2                         | 0.14             | 1     | 0.14                 |
| Instability of preamp gain             | $dG_p$             | $\pm 1.2$            | rectangular                 | $\sqrt{3}$                | 0.70             | 1     | 0.70                 |
| Noise Floor Proximity                  | $dV_{nf}$          | $\pm 0.70$           | rectangular                 | $\sqrt{3}$                | 0.40             | 1     | 0.40                 |
| Antenna Factor Calibration             | $AF$               | $\pm 0.79$           | normal 2                    | 2                         | 0.40             | 1     | 0.40                 |
| Directivity difference                 | $DF_{dir}$         | $\pm 1.00$           | rectangular                 | $\sqrt{3}$                | 0.58             | 1     | 0.58                 |
| Phase Centre location                  | $AP$               | $\pm 0.30$           | rectangular                 | $\sqrt{3}$                | 0.17             | 1     | 0.17                 |
| Antenna Factor Frequency Interpolation | $A_i$              | $\pm 0.30$           | rectangular                 | $\sqrt{3}$                | 0.17             | 1     | 0.17                 |
| Site Imperfections                     | $S_i$              | $\pm 6.00$           | triangular                  | $\sqrt{6}$                | 2.45             | 1     | 2.45                 |
| Effect of setup table material         | $d_{ANT}$          | $\pm 1.21$           | rectangular                 | $\sqrt{3}$                | 0.70             | 1     | 0.70                 |
| Separation distance                    | $dD$               | $\pm 0.50$           | rectangular                 | $\sqrt{3}$                | 0.29             | 1     | 0.29                 |
| Cross Polarization                     | $DC_{cross}$       | $\pm 0.00$           | rectangular                 | $\sqrt{3}$                | 0.00             | 1     | 0.00                 |
| Table height                           | $dh$               | $\pm 0.00$           | normal 2                    | 2                         | 0.00             | 1     | 0.00                 |
| Mismatch (antenna-Preamplifier)        | $M$                | + 1.30<br>- 1.50     | U-Shaped                    | $\sqrt{2}$                | 1.00             | 1     | 1.00                 |
| Mismatch (preamplifier-antenna)        | $M$                | + 1.20<br>- 1.40     | U-Shaped                    | $\sqrt{2}$                | 0.92             | 1     | 0.92                 |
| Combined Standard Uncertainty          | Normal             |                      |                             | $u_c = 6.24$ dB           |                  |       |                      |
| Expanded Uncertainty U                 | Normal ( $k = 2$ ) |                      |                             | $U = 6.2$ dB (CL is 95 %) |                  |       |                      |

## LIST OF TEST EQUIPMENT

| No. | Instrument                    | Manufacturer       | Model        | Serial No.            | Due to Calibration | Calibration Interval |
|-----|-------------------------------|--------------------|--------------|-----------------------|--------------------|----------------------|
| 1   | LOOP ANTENNA                  | ROHDE & SCHWARZ    | HFH2-Z2      | N/A                   | Feb. 13 2019       | 2 years              |
| 2   | Microwave survey meter        | ETS Lindgren       | 1501         | 00033549              | Feb. 20 2018       | 2 year               |
| 3   | EMI Test Receiver             | ROHDE & SCHWARZ    | ESCI         | 101041                | Apr. 03 2018       | 1 year               |
| 4   | Software                      | ROHDE & SCHWARZ    | EMC32        | Version 8.53.0        | -                  | -                    |
| 5   | ARTIFICIAL MAINS NETWORK      | ROHDE & SCHWARZ    | ESH2-Z5      | 100273                | Apr. 04 2018       | 1 year               |
| 6   | EMI TEST RECEIVER             | ROHDE & SCHWARZ    | ESW8         | 100994                | Apr. 03 2018       | 1 year               |
| 7   | ATTENUATOR                    | FAIRVIEW           | SA3N5W-10    | N/A                   | Apr. 03 2018       | 1 year               |
| 8   | EMI Test Receiver             | ROHDE & SCHWARZ    | ESU 40       | 100202                | Apr. 04 2018       | 1 year               |
| 9   | Software                      | ROHDE & SCHWARZ    | EMC32        | Version 10.10.01      | -                  | -                    |
| 10  | TRILOG Broadband Test Antenna | SCHWARZBECK        | VULB 9163    | 9163-01027            | Apr. 18 2019       | 2 year               |
| 11  | ATTENUATOR                    | FAIRVIEW           | SA3N5W-06    | N/A                   | Jan. 09 2018       | 1 year               |
| 12  | Controller                    | innco systems GmbH | CO2000-G     | CO2000/562/23890210/L | N/A                | N/A                  |
| 13  | Open Switch and Control Unit  | ROHDE & SCHWARZ    | OSP-120      | 100015                | N/A                | N/A                  |
| 14  | Antenna Mast (Left)           | innco systems GmbH | MA4000-EP    | N/A                   | N/A                | N/A                  |
| 15  | Turn Table                    | innco systems GmbH | DT3000-3T    | N/A                   | N/A                | N/A                  |
| 16  | Signal Conditioning Unit      | ROHDE & SCHWARZ    | SCU 01       | 10030                 | Apr. 03 2018       | 1 year               |
| 17  | Signal Conditioning Unit      | Rohde & Schwarz    | SCU 18       | 10065                 | May. 29 2018       | 1 year               |
| 18  | ANTENNA MAST (RIGHT)          | innco systems GmbH | MA4000-EP    | N/A                   | N/A                | N/A                  |
| 19  | DOUBLE RIDGED HORN ANTENNA    | SCHWARZBECK        | HF907        | 102585                | Jan.18 2019        | 2 year               |
| 20  | Open Switch and Control Unit  | ROHDE & SCHWARZ    | OSP-120      | 101766                | N/A                | N/A                  |
| 21  | TILT ANTENNA MAST             | innco systems GmbH | MA4640-XP-EP | N/A                   | N/A                | N/A                  |
| 22  | CONTROLLER                    | innco systems GmbH | CO3000       | CO3000/937/38330516/L | N/A                | N/A                  |
| 23  | Turntable                     | innco systems GmbH | DT2000-2t    | N/A                   | N/A                | N/A                  |

## ***APPENDIX D – SCHEMATIC DIAGRAM***

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## ***APPENDIX E – USER’S MANUAL***

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## ***APPENDIX F – BLOCK DIAGRAM***

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