

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 :

Samsung Electronics Co., Ltd.
129, Samsung-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677
Korea, Republic of
Attn : Mr. Gilryeong Koh

Dates of Issue : January 25, 2017

Test Report No. : NK-16-E-0822

Test Site : Nemko Korea Co., Ltd.
EMC site, Korea

FCC ID

A3LNQ9300

Trade Mark

SAMSUNG

Contact Person

Samsung Electronics Co., Ltd.
129, Samsung-ro, Yeongtong-gu, Suwon-si,
Gyeonggi-do, 16677 Korea, Republic of
Mr. Gilryeong Koh
Telephone No. : 82-10-4193-2598

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.



Jan 25, 2017

Tested By : Kyounghoon Lee
Engineer



Jan. 25, 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 :	Samsung Electronics Co., Ltd.
Contact Person :	Mr. Gilryeong Koh Tel No.: 82-10-4193-2598
Manufacturer :	Samsung Electronics Co., Ltd. 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677 Korea, Republic of

- FCC ID: A3LNQ9300
- Model: NQ70M6650DS
- Variant Model: NQ70M6650DG, NQ70M7770DS, NQ70M7770DG,
- Trade Mark: SAMSUNG
- EUT Type: Microwave Oven
- Applied Standard: FCC Part 18 & Part 2
- Test Procedure(s): MP-5:1986
- Dates of Test: November 28, 2016 to December 22, 2016
- Place of Tests: Nemko Korea Co., Ltd. EMC Site
- Test Report No.: NK-16-E-0822

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 **Samsung Electronics Co., Ltd.**

FCC ID : **A3LNQ9300, 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
16885 KOREA, REPUBLIC OF
Tel) + 82 31 330 1700
Fax) + 82 31 322 2332

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	Built-in
Rated voltage & frequency	a.c. 120 V, 60 Hz
Rated power Input	1 750 W
RF Power Output	950 W
Magnetron	OM-75P by Samsung

Component List

Item	Model	Manufacturer	Serial Number
Main Board 1	DE41-00470A	Samsung Electronics Co., Ltd.	N/A
Transformer	SHV-U1870C	DIGITAL POWER COMMUNICATIONS CO., LTD.	N/A
CAPACITOR	H.V.CAPACITOR	NINGBO	N/A
Magnetron	OM-75P	Samsung Electronics Co., Ltd.	N/A
SMPS	SLPS-250FEOT	ORIENTECH CO., LTD.	N/A
FUSE Board	SN-UF12C	Samsung Electronics Co., Ltd.	N/A
Main Board 2	MW8000J	Samsung Electronics Co., Ltd.	N/A
LCD Board	N/A	Samsung Electronics Co., Ltd.	N/A
WiFi Module	SWL-CQ52	Samsung Electronics 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 R&S signal generator.

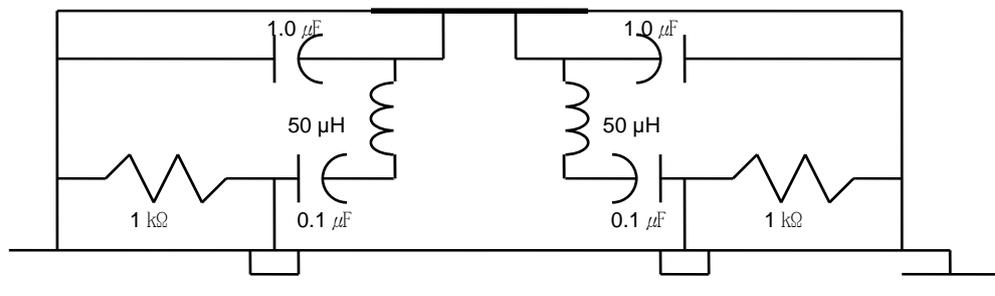


Fig. 2. LISN Schematic Diagram

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 (R&S/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, BBHA 9120 D) was used.

Final Measurements were made indoors at 3 m using Loop Antenna (R&S/HFH2-Z2) for measurement from 0.15 to 30 MHz with RBW 9 kHz & VBW 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 & VBW 100 kHz and made indoors at 3 m using Double Ridged Broadband Horn antenna (Schwarzbeck, BBHA 9120 D) for measurement from 1 GHz to 18 GHz with RBW 1 MHz & VBW 10 Hz.

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.

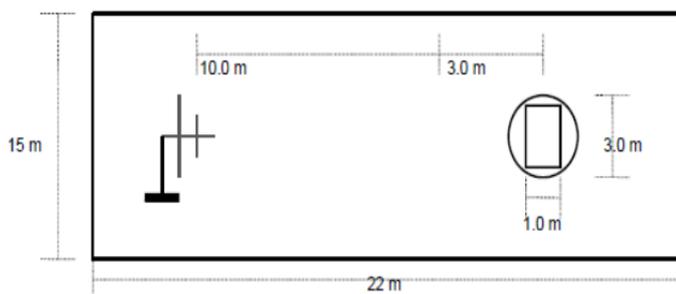


Fig. 3. Dimensions of 10 semi anechoic chamber

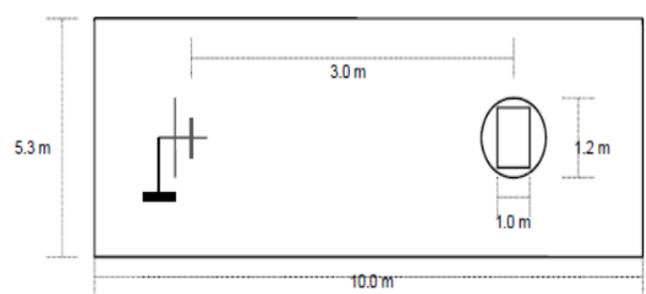


Fig. 4. Dimensions of 3 m full anechoic chamber

TEST DATA

Radiation Hazard

Probe Location	Maximum Leakage [mW/Cm2]	Limit [mW/Cm2]
A	0.06	1.00
B	0.02	1.00
C	0.02	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	1 750	1 792	2.4	+ 15 %

Output Power Measurement

Mass of the water [g]	Mass of the container [g]	Ambient temperature [°C]	Initial temperature [°C]	Final temperature [°C]	Heating time [s]	Power output [W]
1000	384.6	22.5	10	20.14	44	954

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 : **Kyounghoon Lee**

TEST DATA

Frequency measurements

► Frequency vs Line Voltage Variation Test

[Room Temperature : 20.0 °C]

Line Voltage Variation (a.c. V)	*)Pole	Frequency [MHz]	Allowed Tolerance for the ISM Band
96 (80 %)	H	Lower : 2 412.8	Lower : 2 400 MHz Upper : 2 500 MHz
	H	Upper : 2 478.8	
	V	Lower : 2 408.0	
	V	Upper : 2 477.6	
108 (90 %)	H	Lower : 2 427.8	
	H	Upper : 2 478.2	
	V	Lower : 2 432.6	
	V	Upper : 2 478.2	
120 (100 %)	H	Lower : 2 414.0	
	H	Upper : 2 478.8	
	V	Lower : 2 407.4	
	V	Upper : 2 477.6	
132 (110 %)	H	Lower : 2 407.4	
	H	Upper : 2 478.8	
	V	Lower : 2 406.2	
	V	Upper : 2 479.4	
150 (125 %)	H	Lower : 2 409.2	
	H	Upper : 2 479.4	
	V	Lower : 2 411.0	
	V	Upper : 2 479.4	

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 : **Kyounghoon Lee**

TEST DATA

► Frequency vs Load Variation Test

[Room Temperature : 20.0 °C]

Volume of water (ml)	*)Pole	Frequency [MHz]	Allowed Tolerance for the ISM Band
200	H	Lower : 2 444.6	Lower : 2 400 MHz Upper : 2 500 MHz
	H	Upper : 2 475.2	
	V	Lower : 2 417.0	
	V	Upper : 2 477.0	
400	H	Lower : 2 408.6	
	H	Upper : 2 478.8	
	V	Lower : 2 407.4	
	V	Upper : 2 477.6	
600	H	Lower : 2 409.2	
	H	Upper : 2 478.8	
	V	Lower : 2 407.4	
	V	Upper : 2 477.6	
800	H	Lower : 2 422.4	
	H	Upper : 2 479.4	
	V	Lower : 2 406.8	
	V	Upper : 2 478.2	
1000	H	Lower : 2 412.2	
	H	Upper : 2 479.4	
	V	Lower : 2 407.4	
	V	Upper : 2 479.4	

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



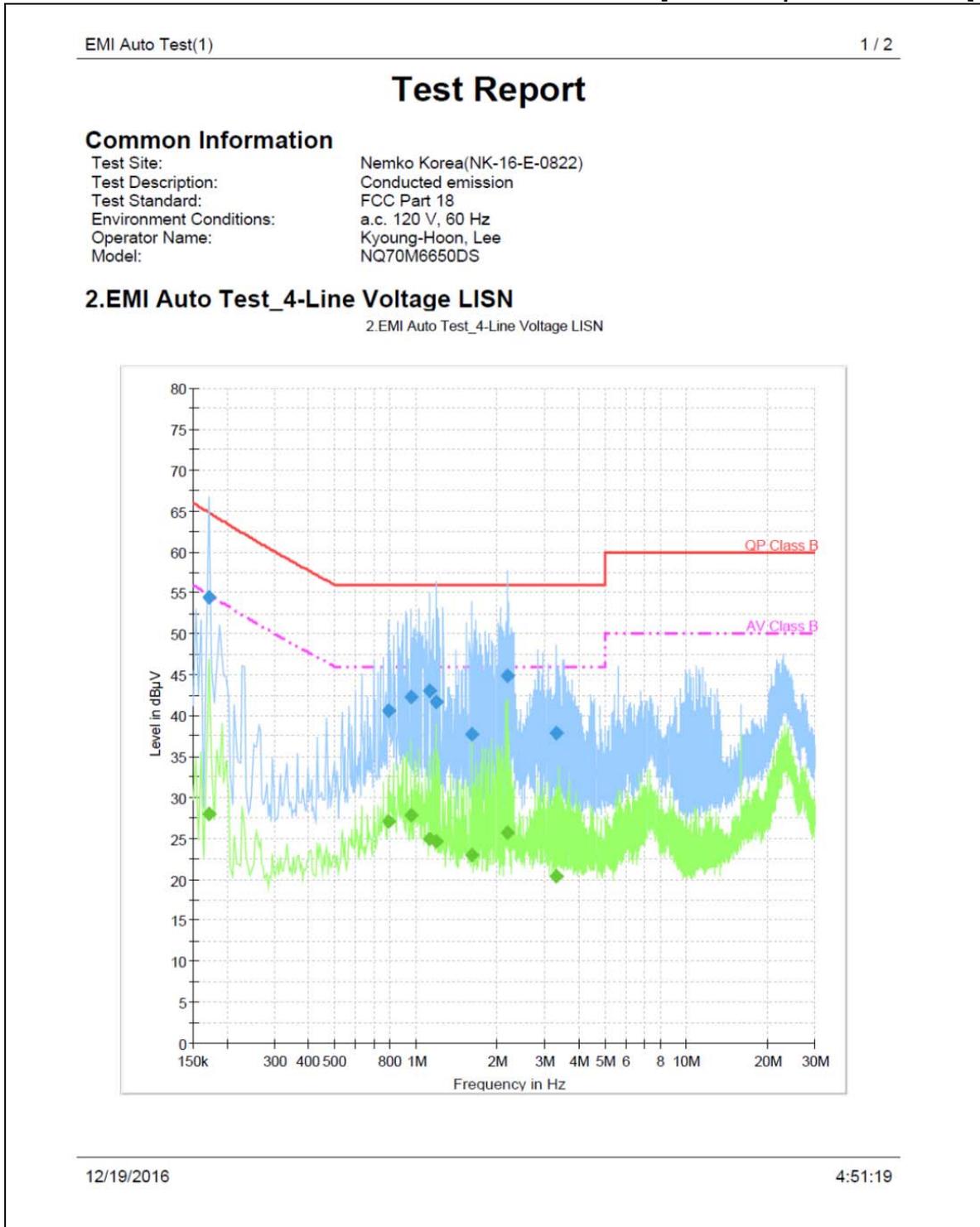
Tested by : **Kyoungsoon Lee**

TEST DATA

Conducted Emissions

FCC ID : A3LNQ9300

[Room Temperature : 17.1 °C]



EMI Auto Test(1)

2 / 2

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.172388	54.4	15000.0	9.000	GND	N	10.3	10.4	64.8	
0.791775	40.6	15000.0	9.000	GND	L1	10.3	15.4	56.0	
0.959681	42.3	15000.0	9.000	GND	L1	10.3	13.7	56.0	
1.123856	43.1	15000.0	9.000	GND	L1	10.4	12.9	56.0	
1.191019	41.7	15000.0	9.000	GND	L1	10.4	14.3	56.0	
1.605188	37.7	15000.0	9.000	GND	N	10.4	18.3	56.0	
2.183531	44.9	15000.0	9.000	GND	L1	10.4	11.1	56.0	
3.291712	37.8	15000.0	9.000	GND	L1	10.5	18.2	56.0	

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.172388	27.9	15000.0	9.000	GND	N	10.3	26.8	54.7	
0.791775	27.1	15000.0	9.000	GND	N	10.3	18.9	46.0	
0.959681	27.8	15000.0	9.000	GND	L1	10.3	18.2	46.0	
1.123856	24.9	15000.0	9.000	GND	N	10.4	21.1	46.0	
1.191019	24.6	15000.0	9.000	GND	L1	10.4	21.4	46.0	
1.605188	22.9	15000.0	9.000	GND	L1	10.4	23.1	46.0	
2.183531	25.8	15000.0	9.000	GND	L1	10.4	20.2	46.0	
3.291712	20.4	15000.0	9.000	GND	L1	10.5	25.6	46.0	

12/19/2016

4:51:19

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 "Kyoung-hoon Lee", is written over a horizontal line.

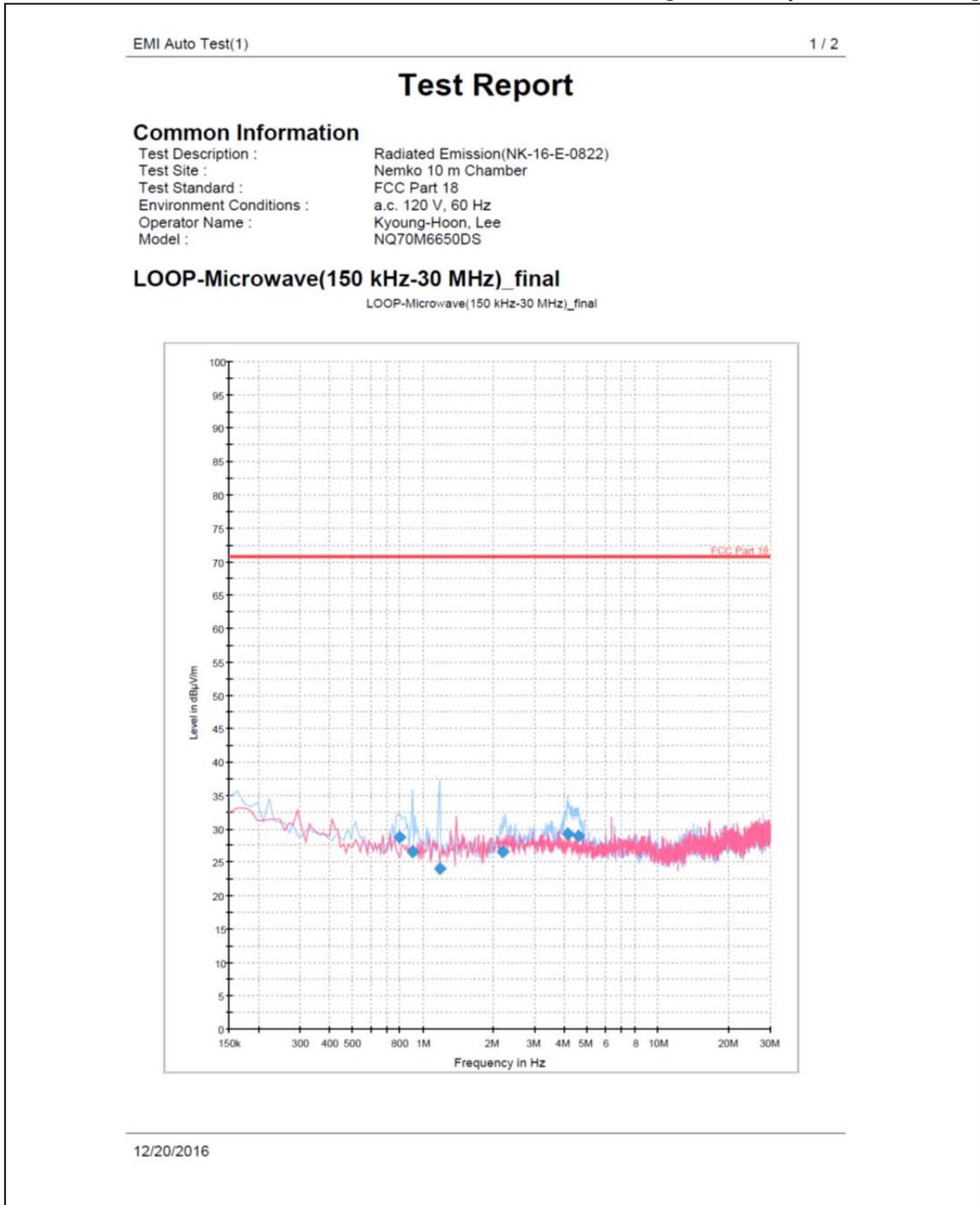
Tested by : Kyounghoon Lee

TEST DATA

Radiated Emissions (150 kHz to 30 MHz)

FCC ID : A3LNQ9300

[Room Temperature : 18.0 °C]



EMI Auto Test(1)

2 / 2

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
0.794760	28.8	15000.0	9.000	H	167.0	-23.4	41.9	70.7
0.902220	26.5	15000.0	9.000	H	127.0	-23.4	44.2	70.7
1.176840	24.0	15000.0	9.000	H	127.0	-23.3	46.7	70.7
2.191740	26.5	15000.0	9.000	H	209.0	-23.4	44.2	70.7
4.114080	29.3	15000.0	9.000	H	0.0	-23.1	41.4	70.7
4.591680	28.9	15000.0	9.000	H	209.0	-23.3	41.8	70.7

(continuation of the "Final Result 1" table from column 9 ...)

Frequency (MHz)	Comment
0.794760	
0.902220	
1.176840	
2.191740	
4.114080	
4.591680	

12/20/2016

<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 ml load was placed in the center of the oven.
6. The limit for consumer device is on the FCC Part section 18.305.



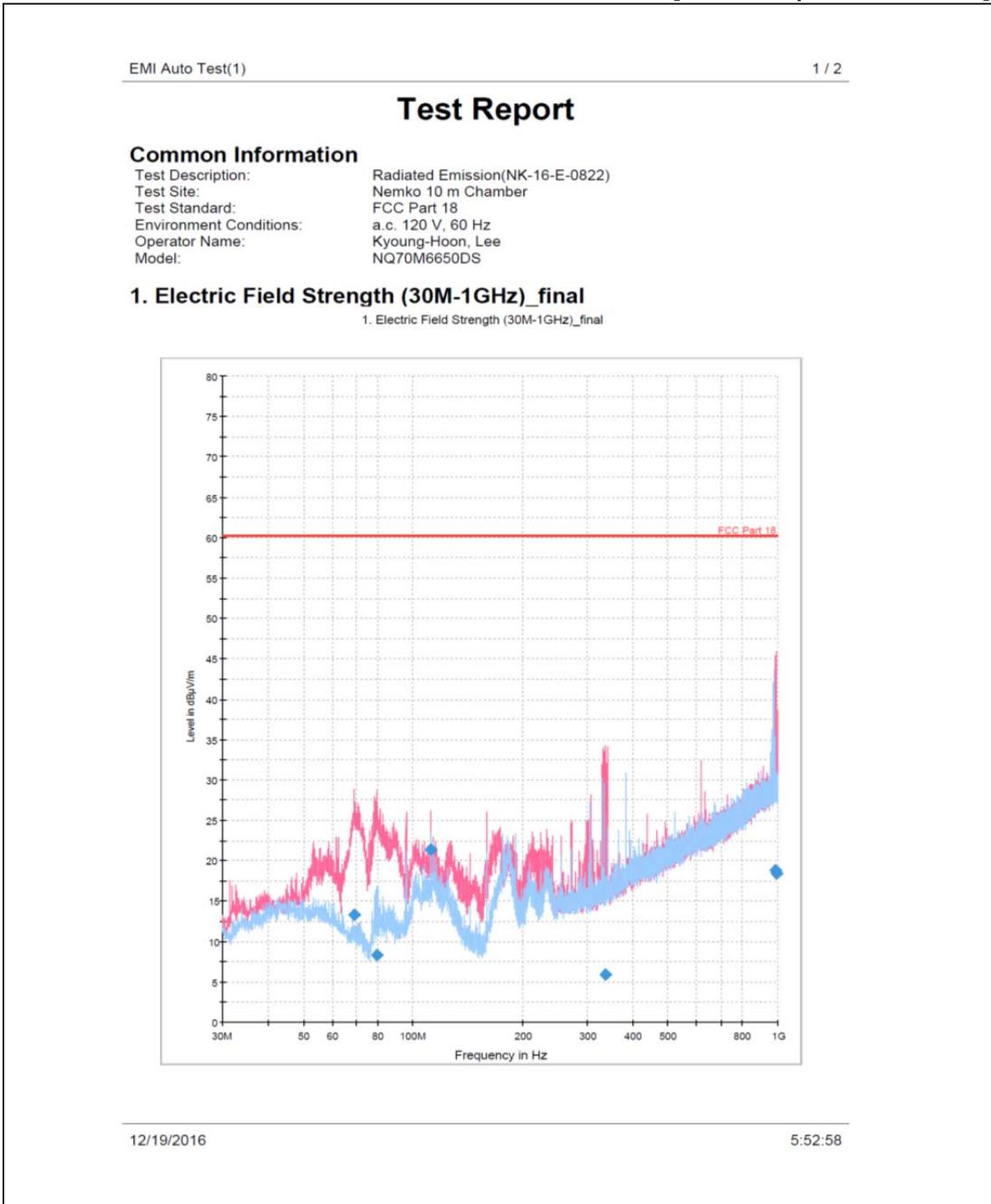
Tested by : **Kyounghoon Lee**

TEST DATA

Radiated Emissions (30 MHz to 1 GHz)

FCC ID : A3LNQ9300

[Room Temperature : 17.1 °C]



EMI Auto Test(1)

2 / 2

Final Result 1

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
68.945500	13.3	15000.0	120.000	120.0	V	323.0	-25.3	46.9	60.2
79.421500	8.3	15000.0	120.000	189.0	V	29.0	-27.7	51.9	60.2
111.674000	21.3	15000.0	120.000	100.0	V	166.0	-24.4	38.9	60.2
338.072000	6.0	15000.0	120.000	100.0	V	178.0	-17.0	54.2	60.2
984.092000	18.8	15000.0	120.000	330.0	V	34.0	-3.9	41.4	60.2
989.378500	18.4	15000.0	120.000	400.0	V	303.0	-3.8	41.8	60.2

(continuation of the "Final Result 1" table from column 10 ...)

Frequency (MHz)	Comment
68.945500	
79.421500	
111.674000	
338.072000	
984.092000	
989.378500	

12/19/2016

5:52:58

<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 mℓ load was placed in the center of the oven.
6. The limit for consumer device is on the FCC Part section 18.305.



Tested by : **Kyoung-hoon Lee**

TEST DATA

Radiated Emissions (Above 1 GHz)

FCC ID : A3LNQ9300

[Room Temperature : 20.0 °C]

Frequency (MHz)	Pol* (H/V)	Antenna Heights (cm)	Turntable Angles (°)	Reading Level (dBμV)	Total Loss** (dB)	Result at 3 m		K	Results at 300 m (μV/m)	Limits at 300 m (μV/m)
						(dBμV/m)	(μV/m)			
1 162.78	V	130	135	13.5	28.3	41.8	123.0	0.0046	0.6	34.5
4 950.64	H	130	45	39.3	8.5	47.8	245.5	0.01	2.5	34.5
7 425.36	V	130	0	40.7	14.3	55.0	562.3	0.01	5.6	34.5
9 901.84	V	130	0	38.5	18.0	56.5	668.3	0.01	6.7	34.5
12 377.30	H	190	45	35.4	21.4	56.8	691.8	0.01	6.9	34.5
15 168.39	H	160	45	32.5	24.7	57.2	724.4	0.01	7.2	34.5
17 319.48	H	190	135	34.1	28.3	62.4	1318.3	0.01	13.2	34.5

<Radiated Measurements at 3 meters>

NOTES:

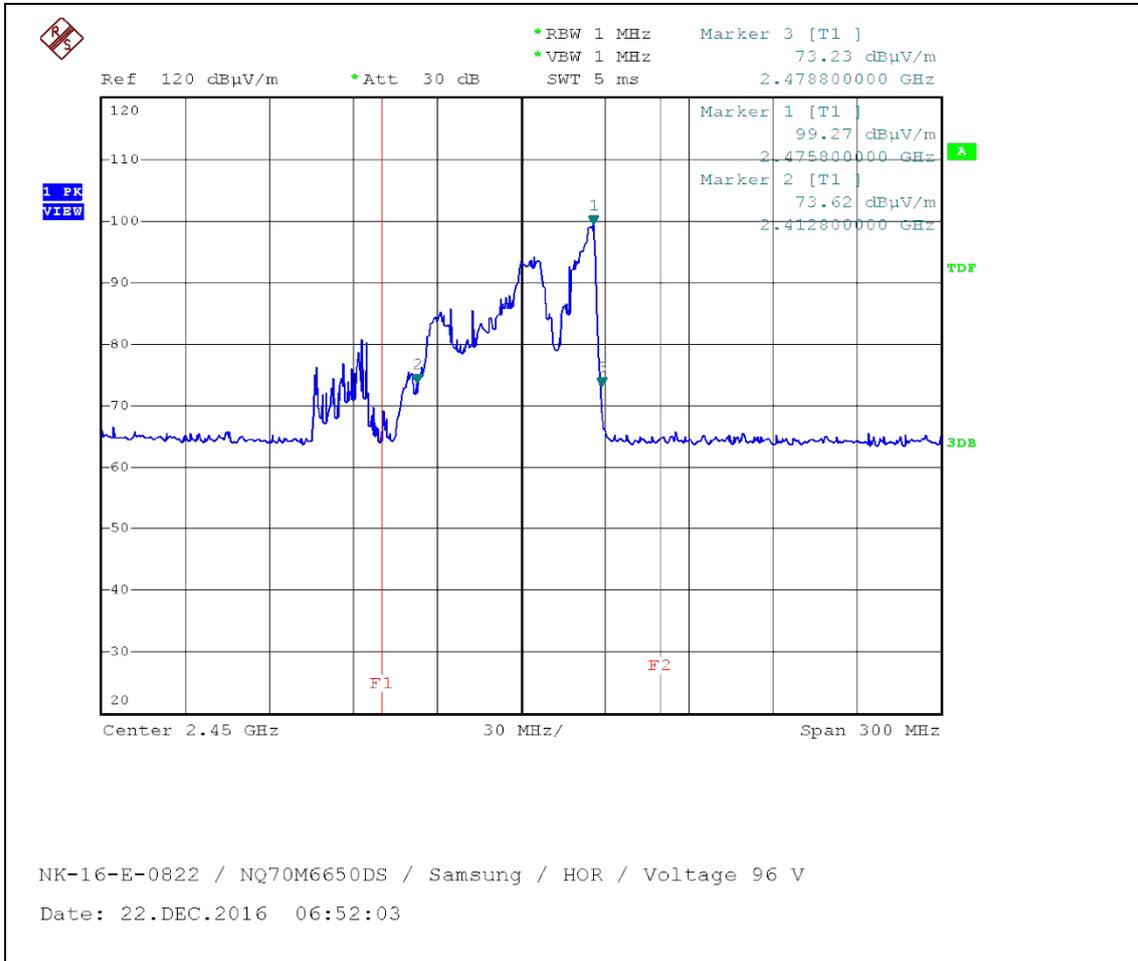
- * Pol. H=Horizontal V=Vertical
- ** Total Loss = Antenna Factor + Cables Loss + Amplifier + HPF (High Pass Filter)
- Field Strength (at 300 m) (uV/m) = $K * 10^{[Fieldstrength\ at\ 3\ m\ (dBuV/m) / 20]}$
- The limit at 300 meters is $25 * SQRT (RF\ Power/500)$
- Load for measurement of radiation on 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 : Kyounghoon Lee

PLOTS OF EMISSIONS

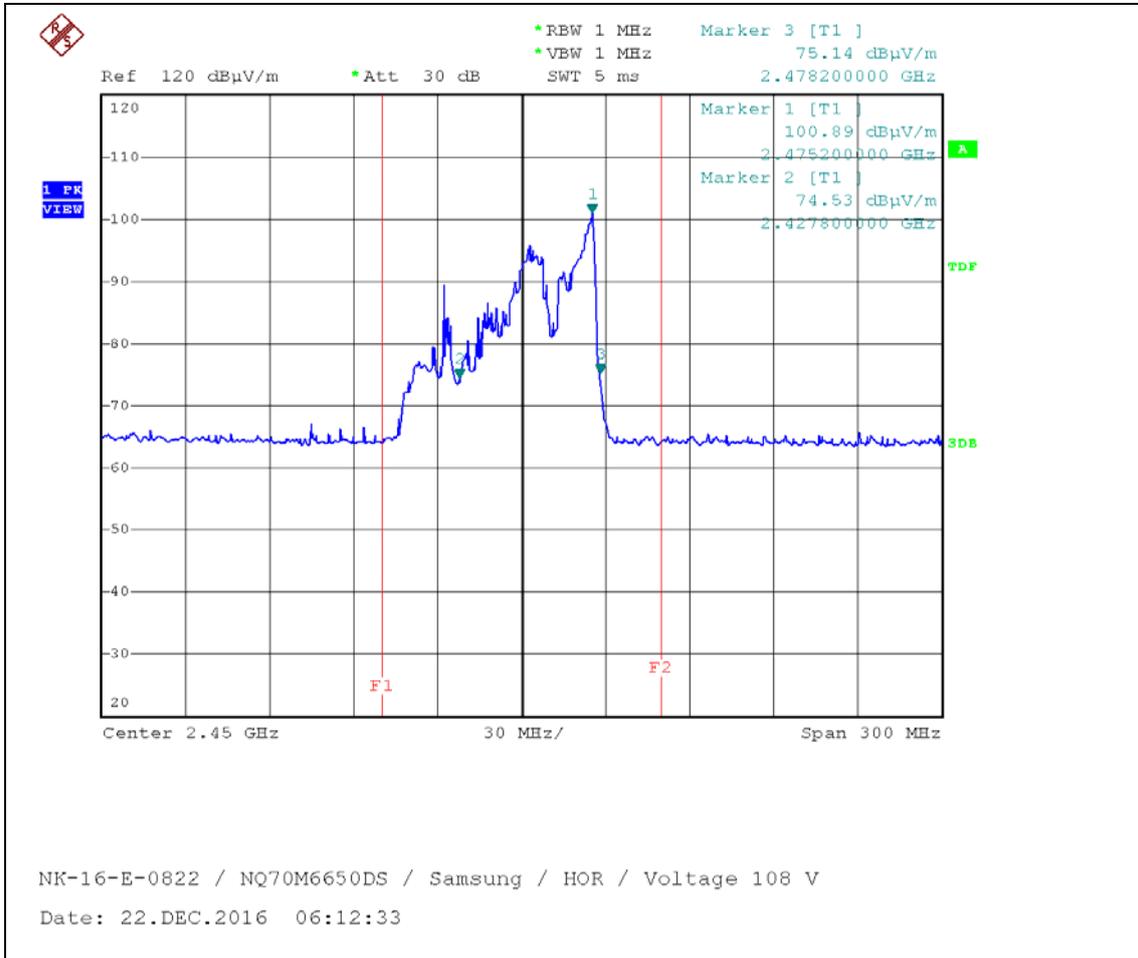
- **Frequency vs Line Voltage Variation Test**



Horizontal (96 V, 1000 mℓ)

PLOTS OF EMISSIONS

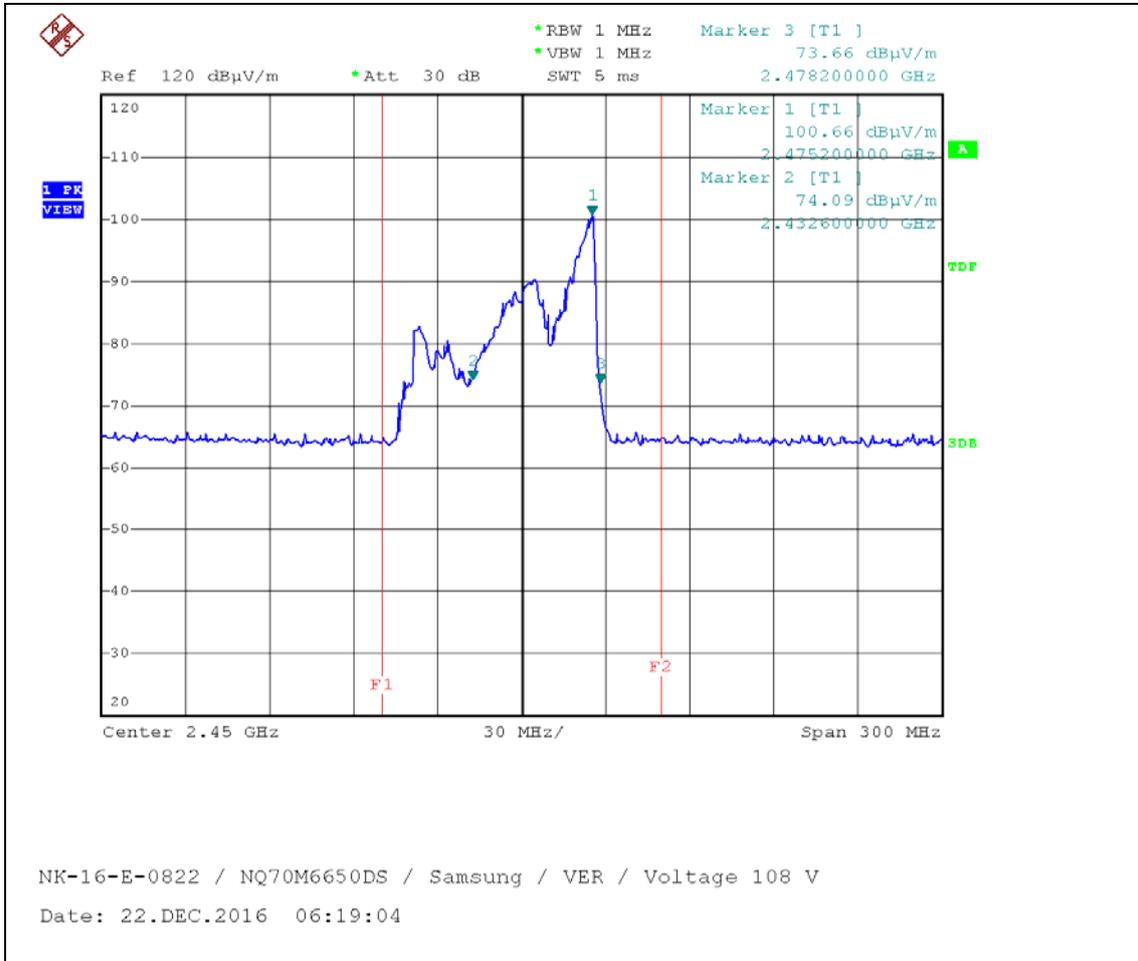
- **Frequency vs Line Voltage Variation Test**



Horizontal (108 V, 1000 mℓ)

PLOTS OF EMISSIONS

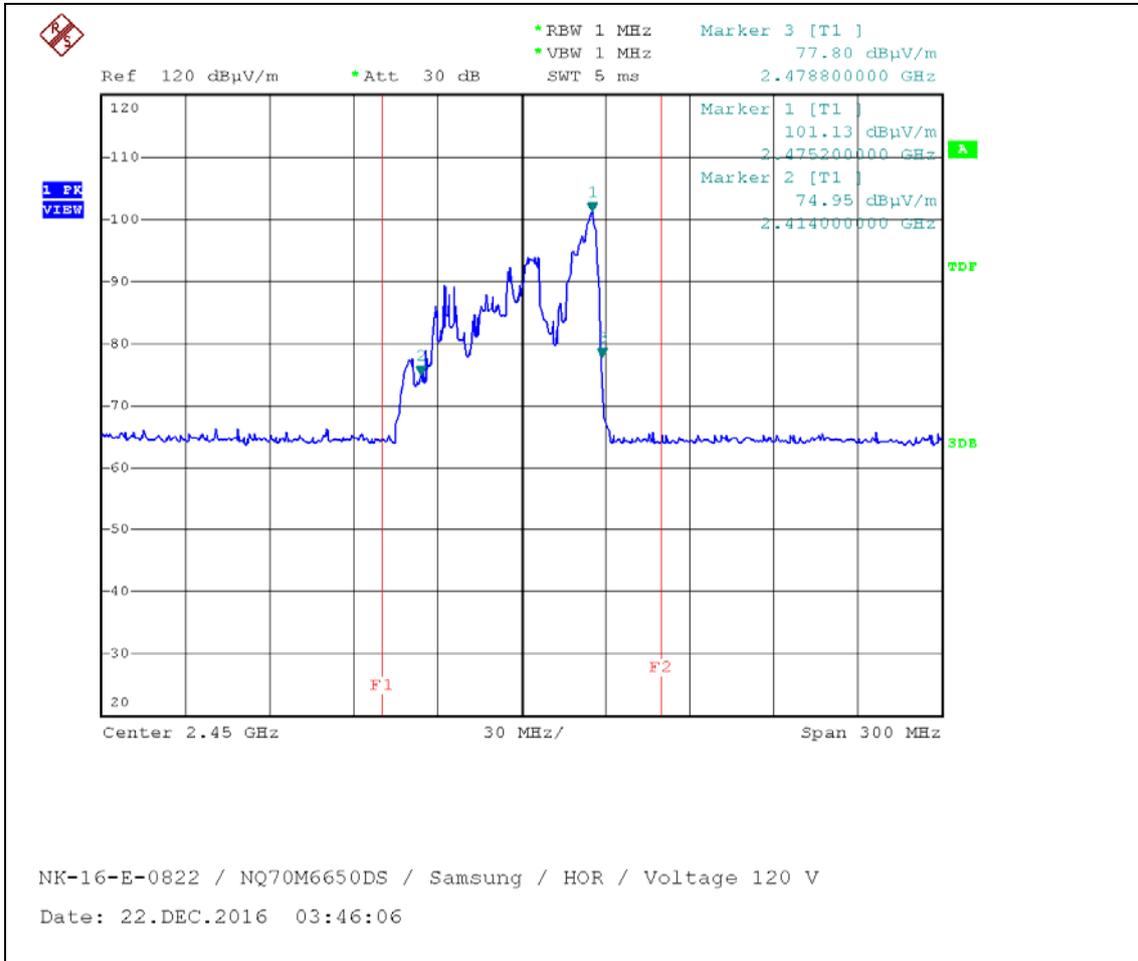
- **Frequency vs Line Voltage Variation Test**



Vertical (108 V, 1000 mℓ)

PLOTS OF EMISSIONS

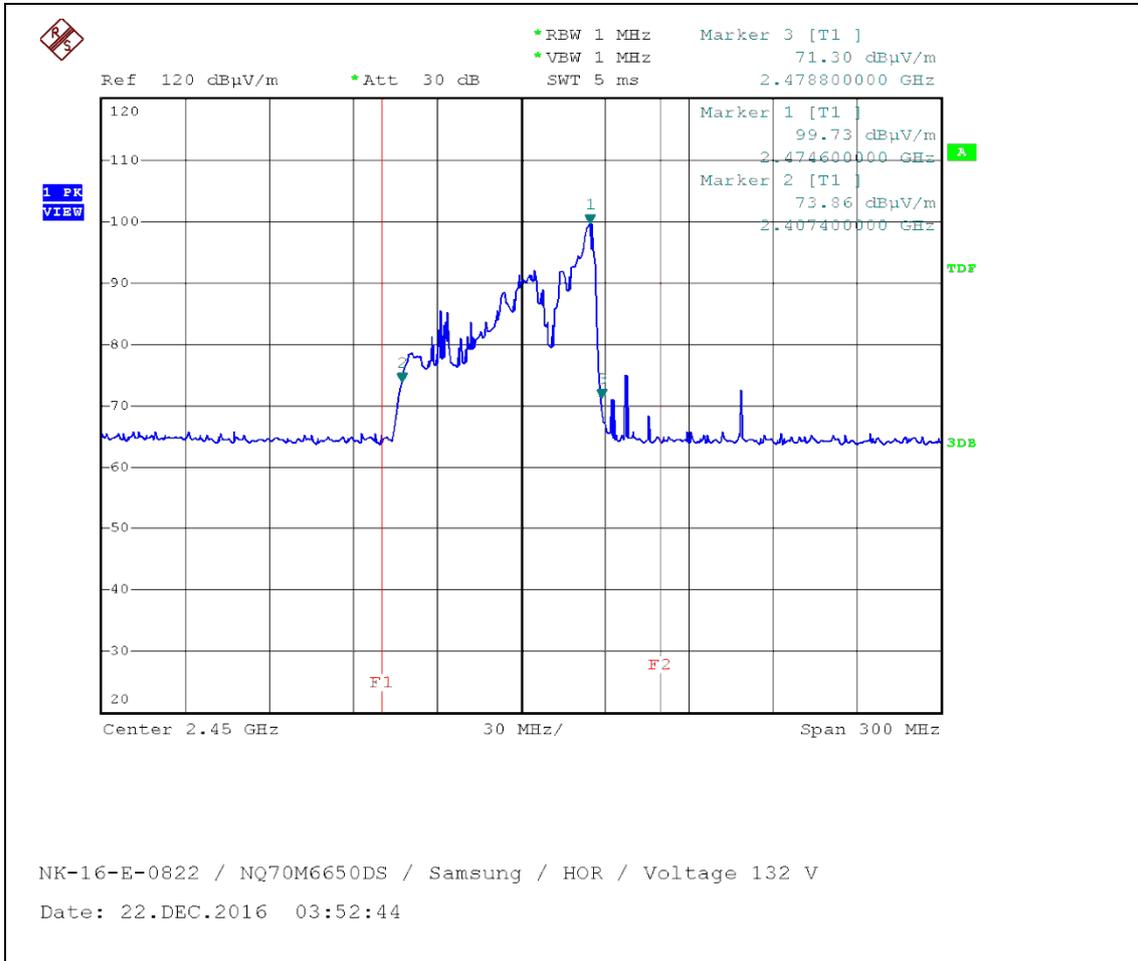
- **Frequency vs Line Voltage Variation Test**



Horizontal (120 V, 1000 mℓ)

PLOTS OF EMISSIONS

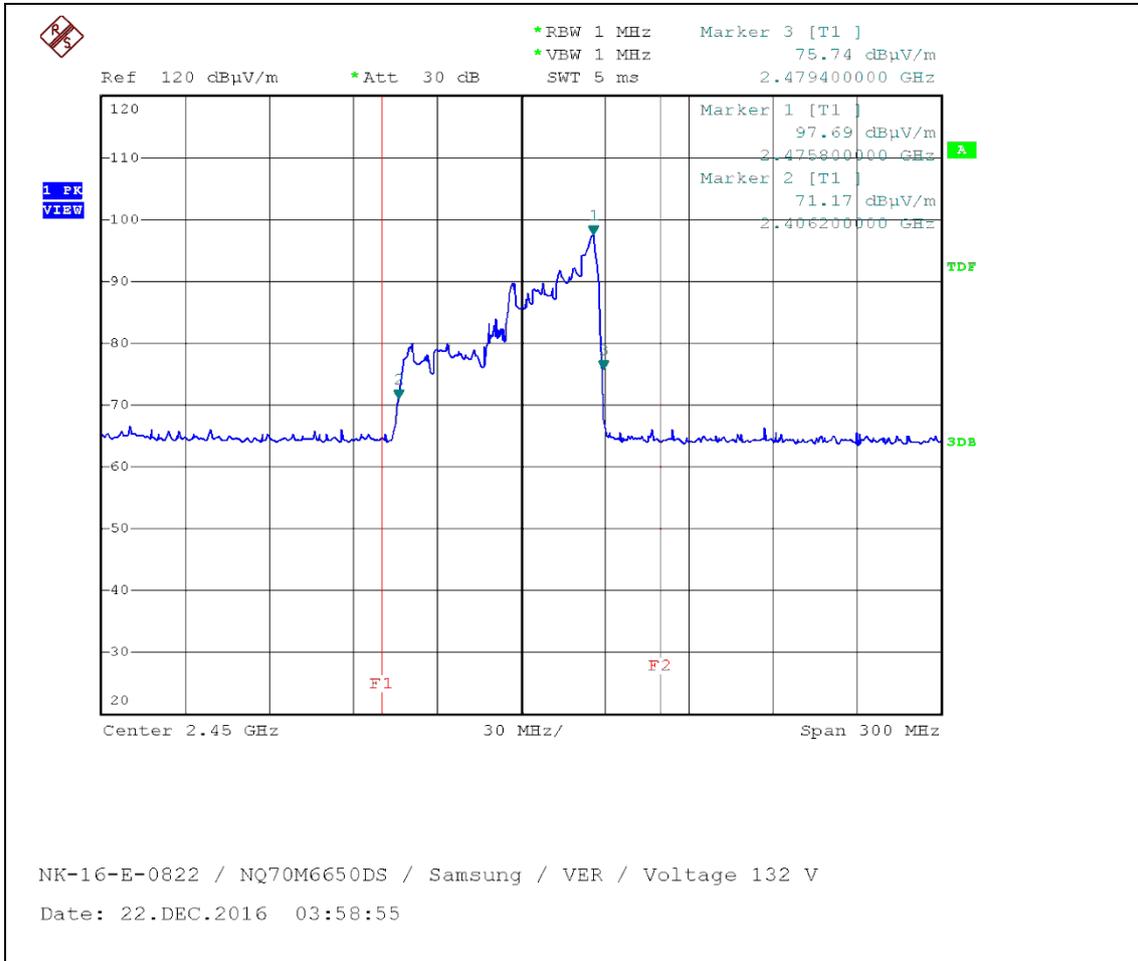
- **Frequency vs Line Voltage Variation Test**



Horizontal (132 V, 1000 mℓ)

PLOTS OF EMISSIONS

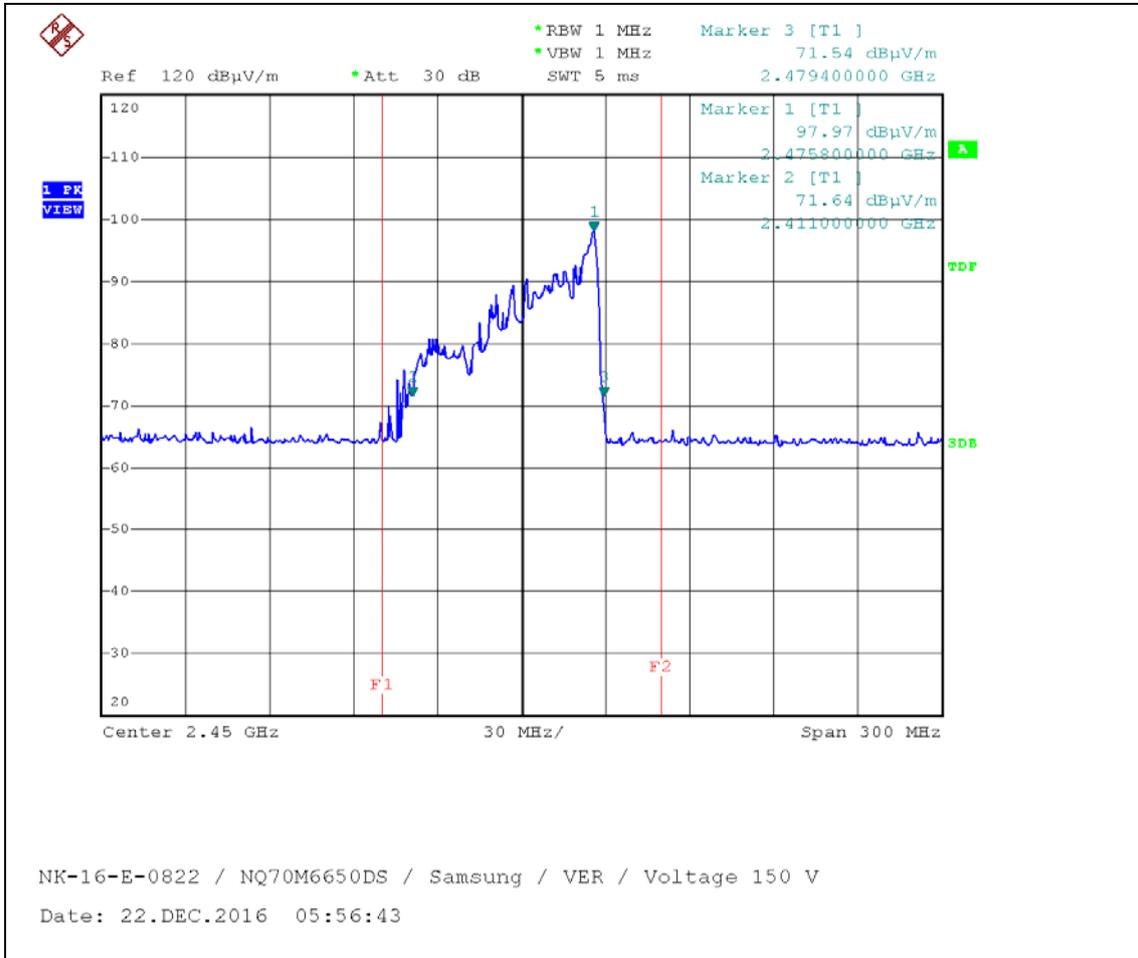
- **Frequency vs Line Voltage Variation Test**



Vertical (132 V, 1000 mℓ)

PLOTS OF EMISSIONS

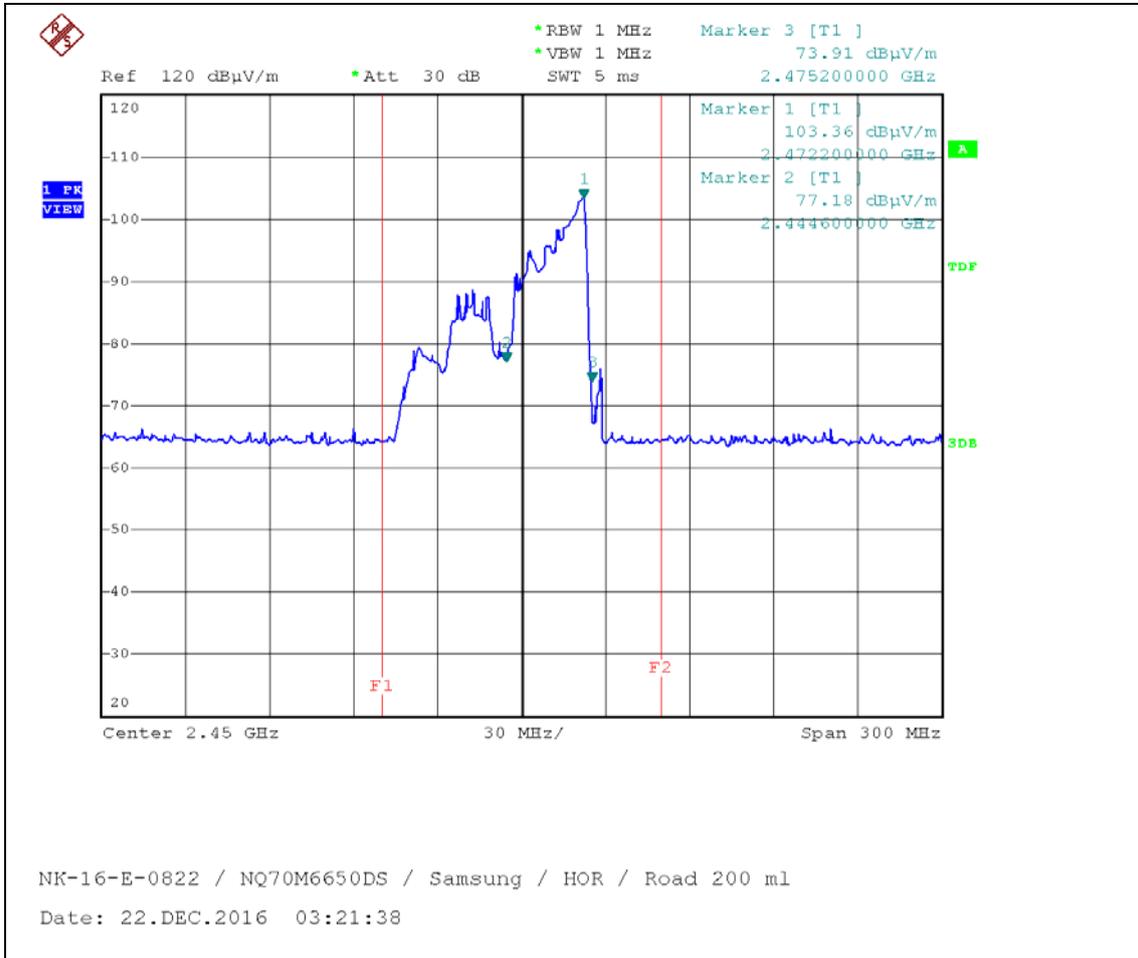
- **Frequency vs Line Voltage Variation Test**



Vertical (150 V, 1000 mℓ)

PLOTS OF EMISSIONS

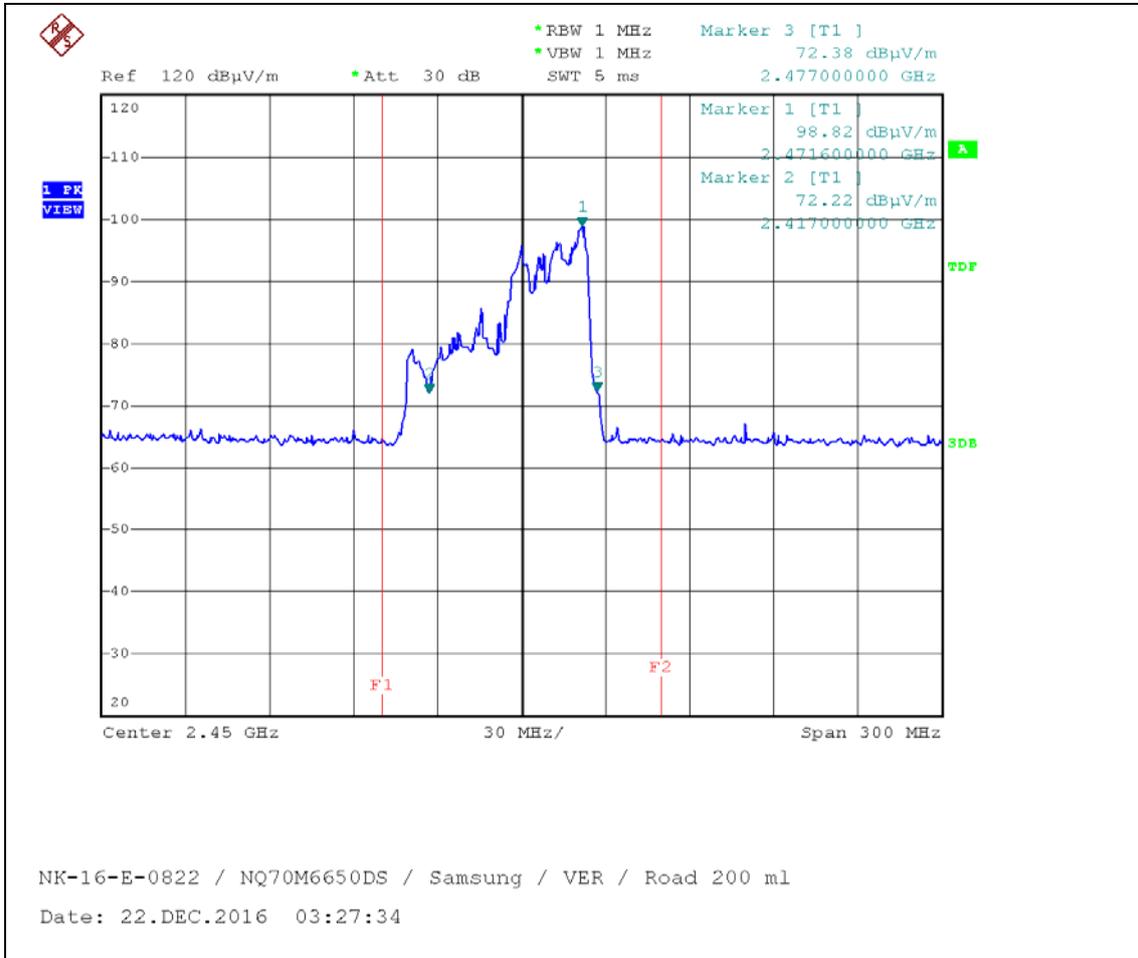
- **Frequency vs Load Variation Test**



Horizontal (120 V, 200 ml)

PLOTS OF EMISSIONS

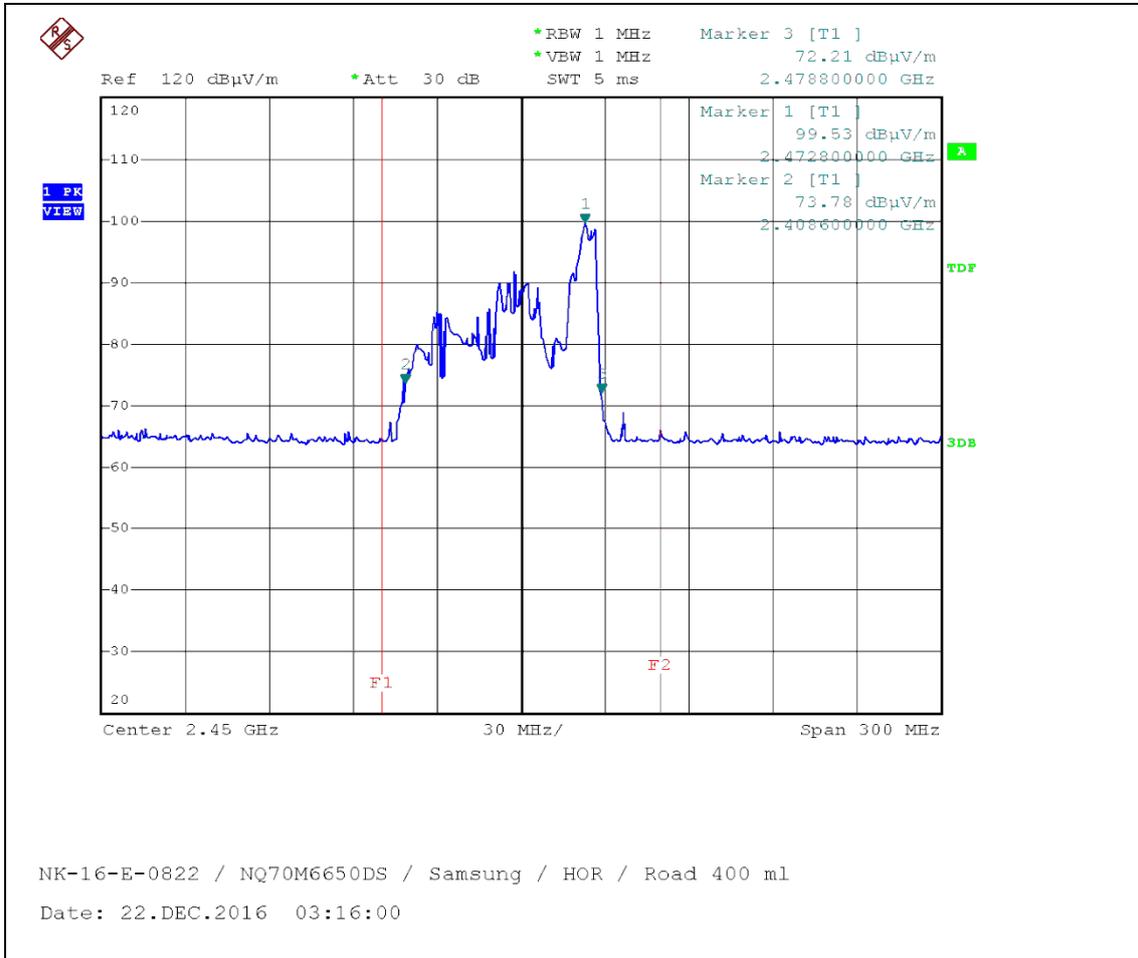
- **Frequency vs Load Variation Test**



Vertical (120 V, 200 ml)

PLOTS OF EMISSIONS

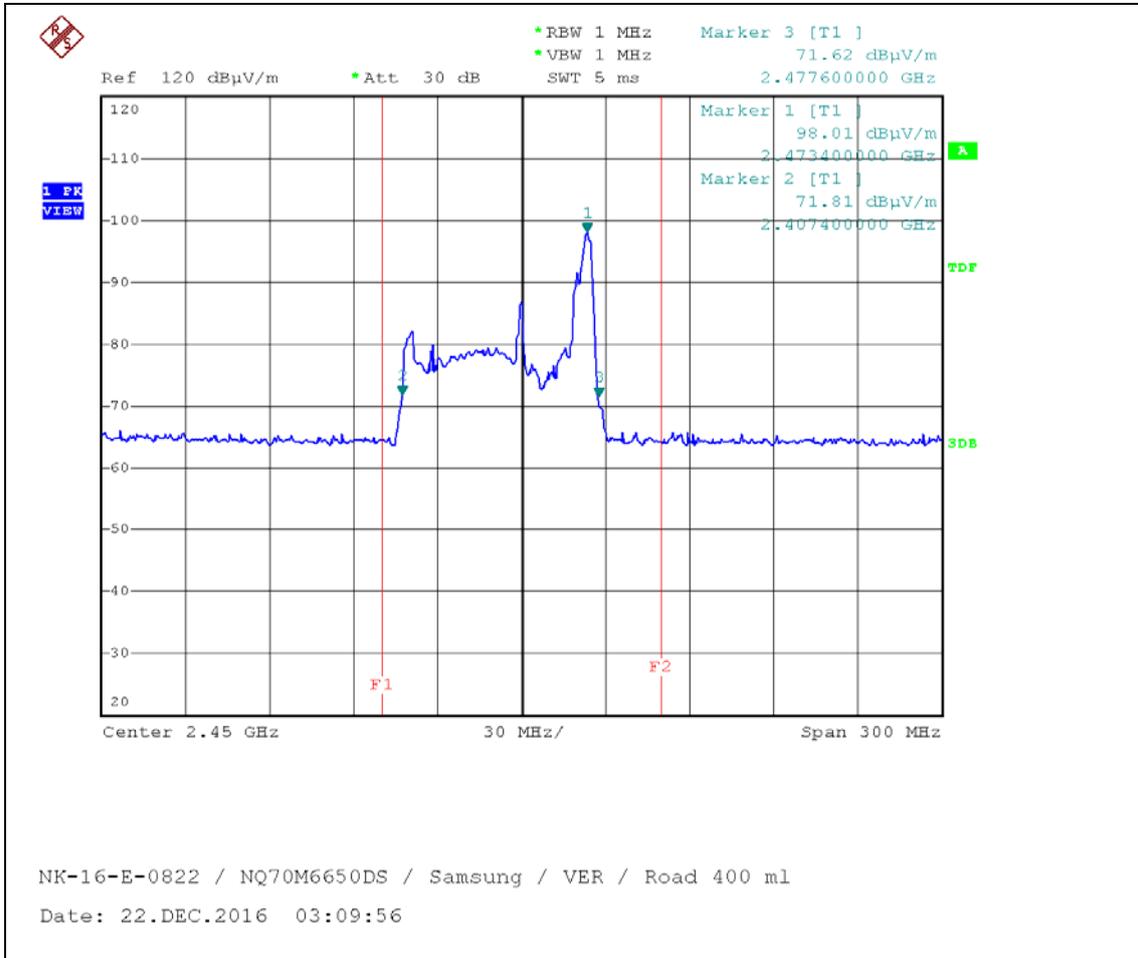
- **Frequency vs Load Variation Test**



Horizontal (120 V, 400 ml)

PLOTS OF EMISSIONS

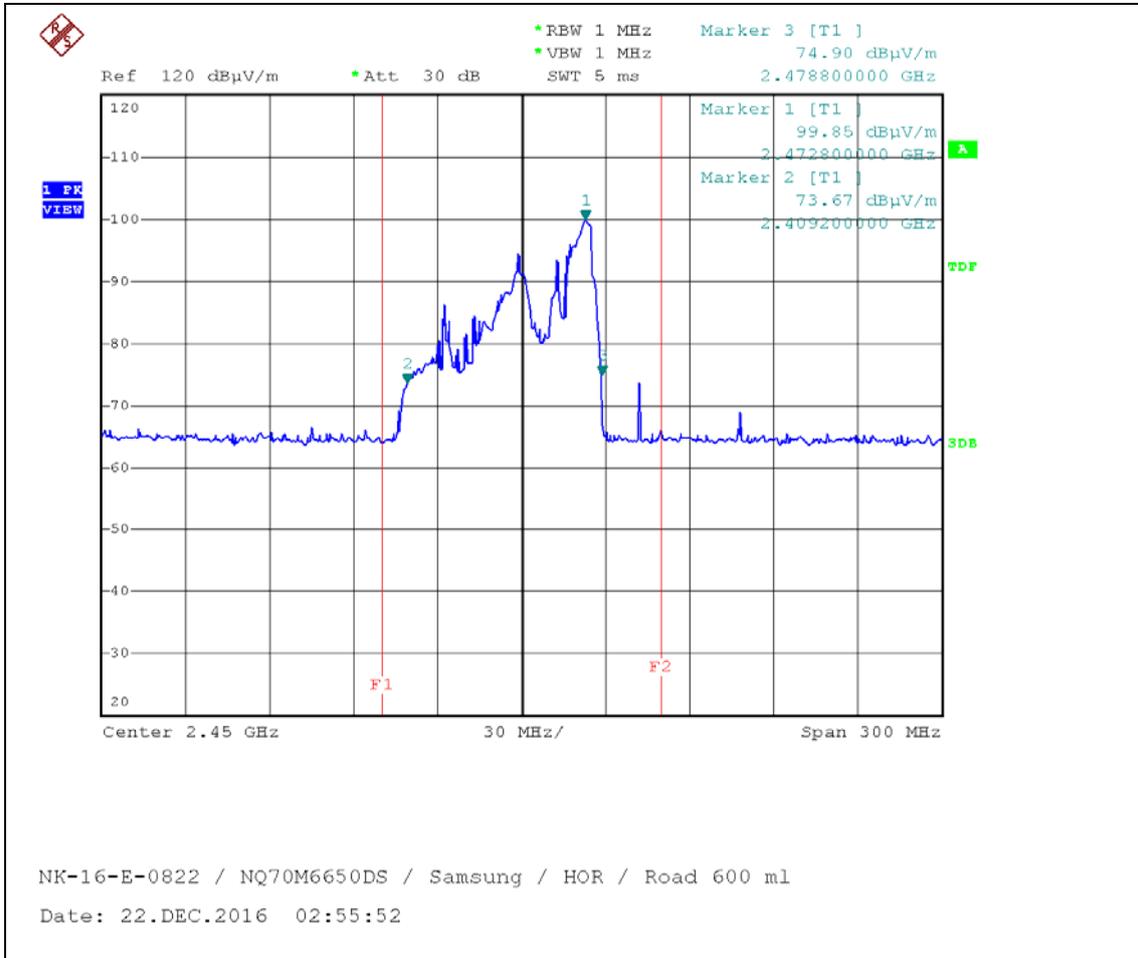
- **Frequency vs Load Variation Test**



Vertical (120 V, 400 ml)

PLOTS OF EMISSIONS

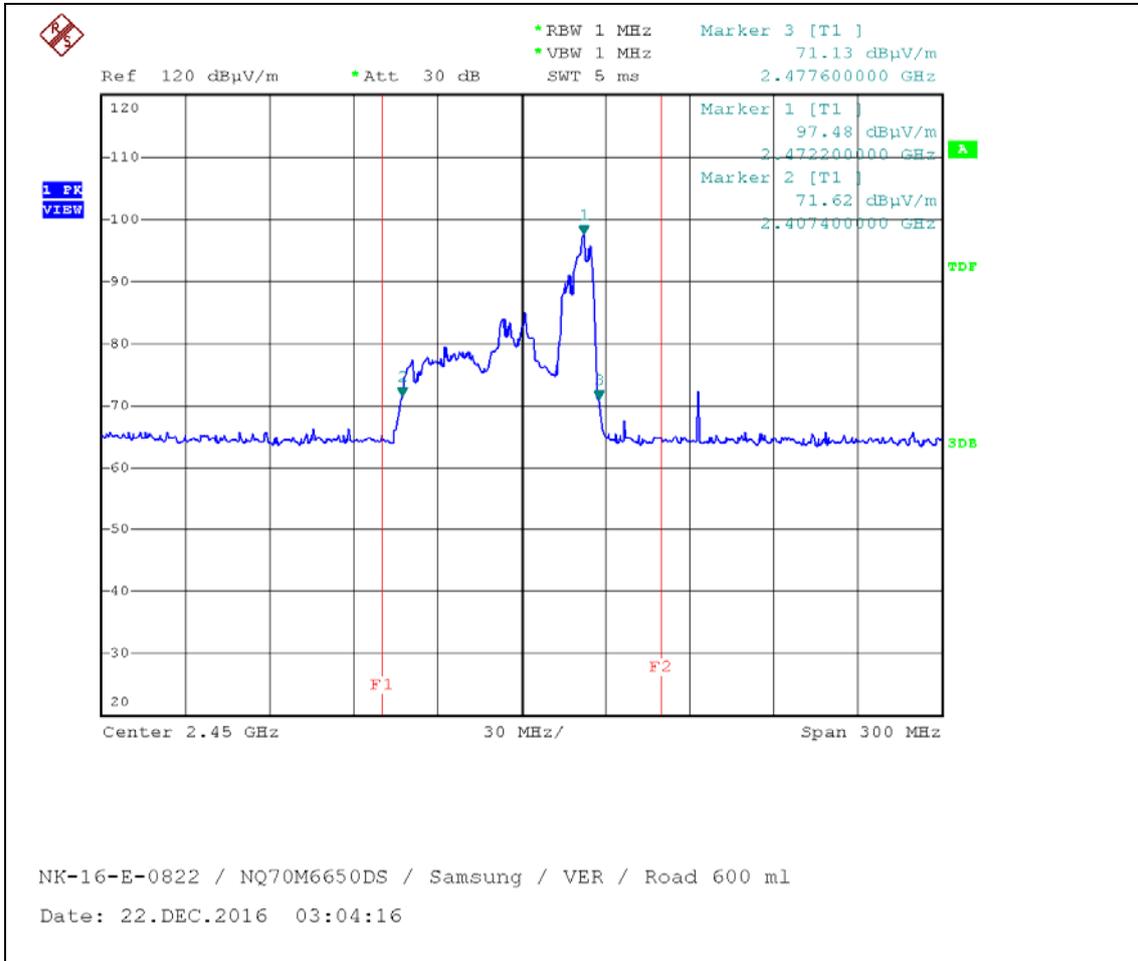
- **Frequency vs Load Variation Test**



Horizontal (120 V, 600 ml)

PLOTS OF EMISSIONS

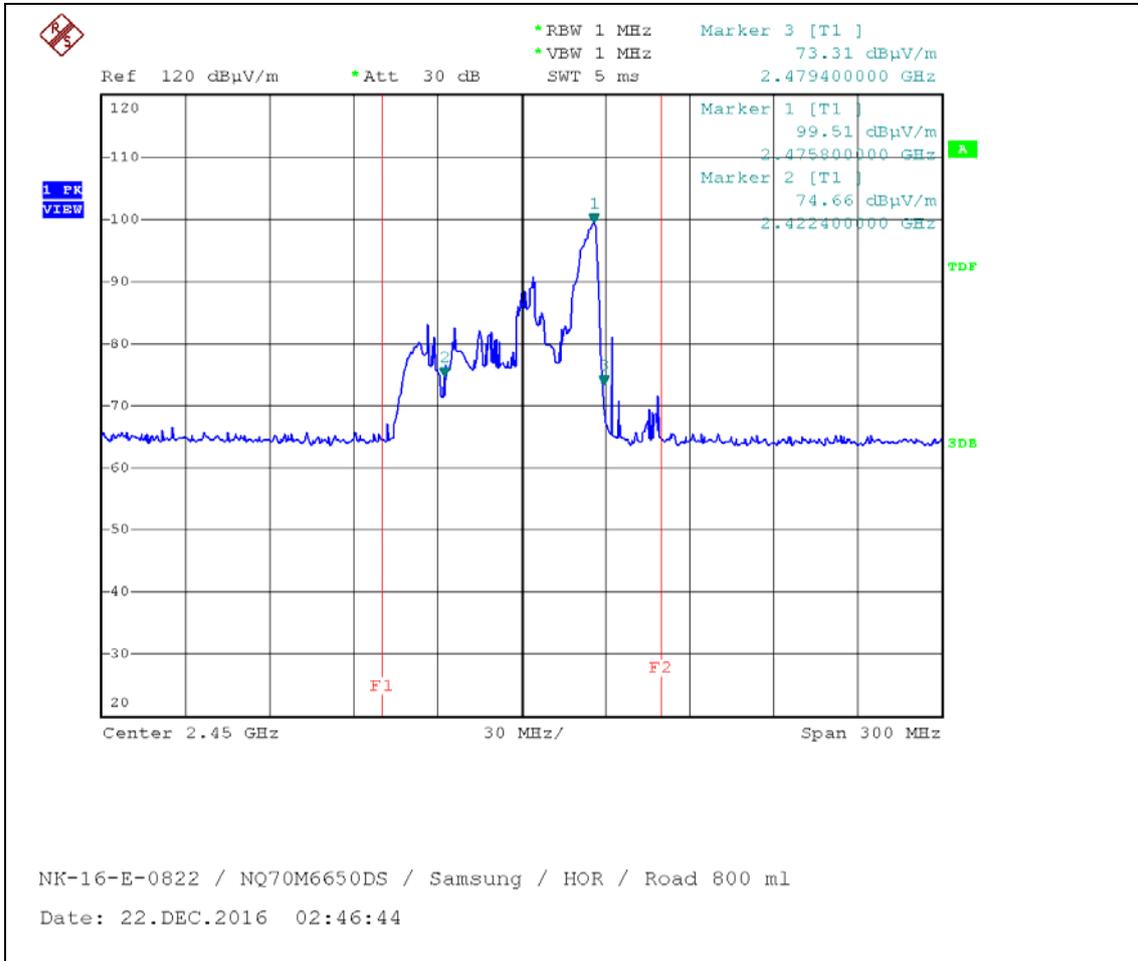
- **Frequency vs Load Variation Test**



Vertical (120 V, 600 ml)

PLOTS OF EMISSIONS

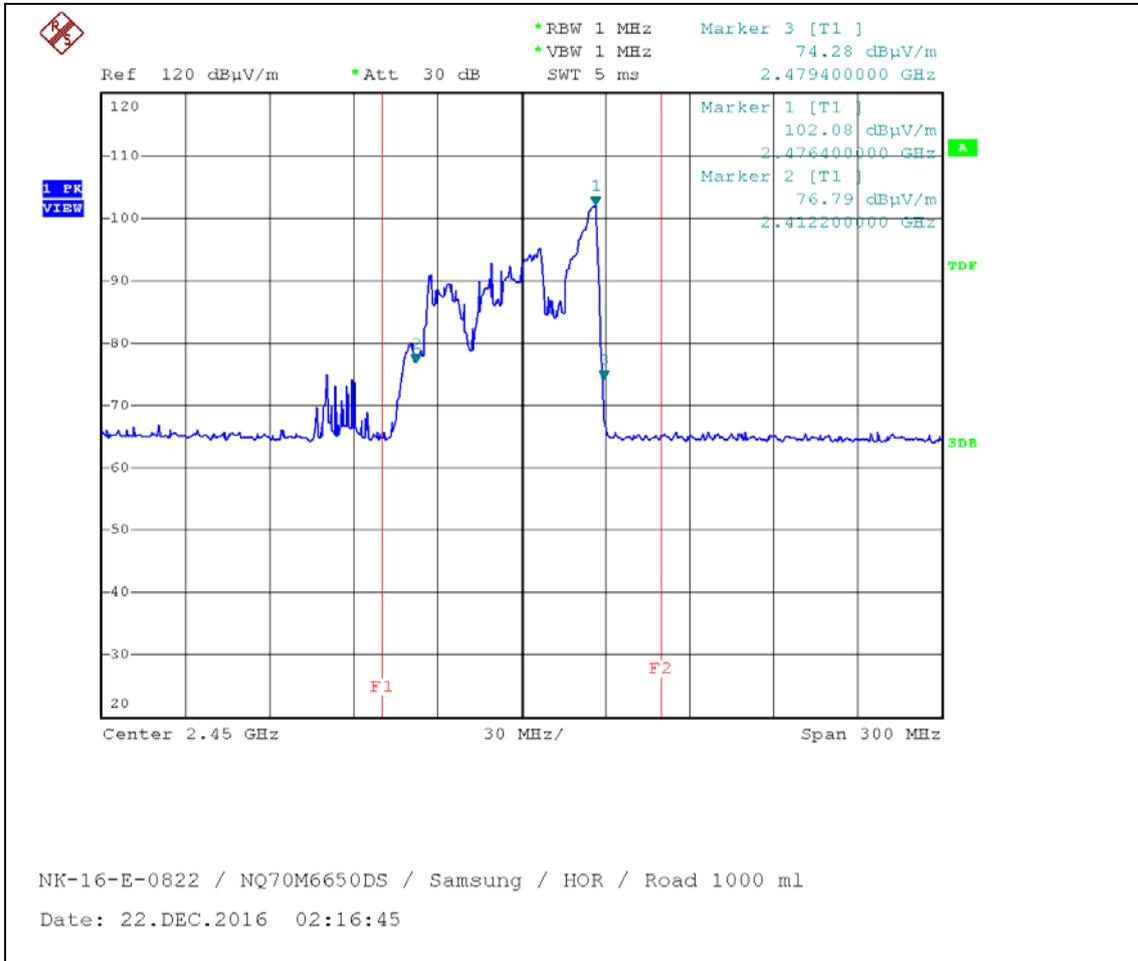
- **Frequency vs Load Variation Test**



Horizontal (120 V, 800 ml)

PLOTS OF EMISSIONS

- **Frequency vs Load Variation Test**



Horizontal (120 V, 1000 mℓ)

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 k	$u(X_i)$ (dB)	C_i	$C_i u(X_i)$ (dB)
		Value (dB)	Probability Distribution				
Measurement System Repeatability	R_s	0.10	normal 1	1.00	0.10	1	0.10
Receiver reading	R_i	± 0.02	normal 2	2.00	0.01	1	0.01
Attenuation AMN- Receiver	L_c	± 0.10	rectangular	$\sqrt{3}$	0.06	1	0.06
AMN Voltage division factor	L_{AMN}	± 0.09	normal 2	2.00	0.05	1	0.05
Sine wave voltage	dV_{SW}	± 0.17	normal 2	2.00	0.09	1	0.09
Pulse amplitude response	dV_{PA}	± 0.92	normal 2	2.00	0.50	1	0.50
Pulse repetition rate response	dV_{PR}	± 0.35	normal 2	2.00	0.18	1	0.18
Noise floor proximity	dV_{NF}	± 0.00	rectangular	$\sqrt{3}$	0.00	1	0.00
AMN Impedance	dZ	± 2.00	normal 2	2.00	1.00	1	1.00
Mismatch	M	+ 0.81 - 0.89	U-Shaped	$\sqrt{3}$	0.60	1	0.60
Remark	Using 50 Ω / 50 μ 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 k	$u(X_i)$ (dB)	C_i	$C_i u(X_i)$ (dB)
		Value (dB)	Probability Distribution				
Measurement System Repeatability	RS	0.67	normal 1	1.00	0.67	1	0.67
Receiver reading	Ri	± 0.02	normal 2	2.00	0.01	1	0.01
Sine wave voltage	dV_{sw}	± 0.17	normal 2	2.00	0.09	1	0.09
Pulse amplitude response	dV_{pa}	± 0.92	normal 2	2.00	0.46	1	0.46
Pulse repetition rate response	dV_{pr}	± 0.35	normal 2	2.00	0.18	1	0.18
Noise floor proximity	dV_{nf}	± 0.50	normal 2	2.00	0.25	1	0.25
Antenna Factor Calibration	A_F	± 2.00	rectangular	$\sqrt{3}$	1.15	1	1.15
Cable Loss	C_L	± 1.00	normal 2	2.00	0.50	1	0.50
Antenna Directivity	A_D	± 0.00	rectangular	$\sqrt{3}$	0.00	1	0.00
Antenna Factor Height Dependence	A_H	± 2.00	rectangular	$\sqrt{3}$	1.15	1	1.15
Antenna Phase Centre Variation	A_P	± 0.20	rectangular	$\sqrt{3}$	0.12	1	0.12
Antenna Factor Frequency Interpolation	A_i	± 0.25	rectangular	$\sqrt{3}$	0.14	1	0.14
Site Imperfections	S_i	± 4.00	triangular	$\sqrt{6}$	1.63	1	1.63
Measurement Distance Variation	D_V	± 0.60	rectangular	$\sqrt{3}$	0.35	1	0.35
Antenna Balance	D_{bal}	± 0.90	rectangular	$\sqrt{3}$	0.52	1	0.52
Cross Polarization	D_{Cross}	± 0.00	rectangular	$\sqrt{3}$	0.00	1	0.00
Mismatch	M	+ 0.98 - 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 k	$u(X_i)$ (dB)	C_i	$C_i u(X_i)$ (dB)
		Value (dB)	Probability Distribution				
Measurement System Repeatability	RS	0.21	normal 1	1.00	0.21	1	0.21
Receiver Reading	R_i	± 0.02	normal 2	2	0.01	1	0.01
Attenuation (antenna-receiver)	a_c	± 0.30	normal 2	2	0.15	1	0.15
Preamplifier gain	G_p	± 0.21	normal 2	2	0.11	1	0.11
Receiver Sine Wave	dV_{sw}	± 0.17	normal 2	2	0.09	1	0.09
Instability of preamp gain	dG_p	± 1.2	rectangular	$\sqrt{3}$	0.70	1	0.70
Noise Floor Proximity	dV_{nf}	± 0.70	rectangular	$\sqrt{3}$	0.40	1	0.40
Antenna Factor Calibration	AF	± 1.00	normal 2	2	0.50	1	0.50
Directivity difference	DF_{dir}	± 1.00	rectangular	$\sqrt{3}$	0.58	1	0.58
Phase Centre location	AP	± 0.30	rectangular	$\sqrt{3}$	0.17	1	0.17
Antenna Factor Frequency Interpolation	A_i	± 0.30	rectangular	$\sqrt{3}$	0.17	1	0.17
Site Imperfections	S_i	± 6.00	triangular	$\sqrt{6}$	2.45	1	2.45
Effect of setup table material	$dANT$	± 1.21	rectangular	$\sqrt{3}$	0.70	1	0.70
Separation distance	dD	± 0.50	rectangular	$\sqrt{3}$	0.29	1	0.29
Cross Polarization	DC_{cross}	± 0.00	rectangular	$\sqrt{3}$	0.00	1	0.00
Table height	dh	± 0.00	normal 2	2	0.00	1	0.00
Mismatch (antenna-Preamplifier)	M	+ 1.30 - 1.50	U-Shaped	$\sqrt{2}$	1.00	1	1.00
Mismatch (preamplifier-antenna)	M	+ 1.20 - 1.40	U-Shaped	$\sqrt{2}$	0.92	1	0.92
Combined Standard Uncertainty	Normal			$u_C = 6.26$ dB			
Expanded Uncertainty U	Normal ($k = 2$)			$U = 6.3$ dB (CL is 95 %)			

LIST OF TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Serial No.	Due to Calibration	Calibration Interval
1	Microwave survey meter	ETS Lindgren	1501	00033549	Feb.15 2017	2 year
2	LOOP ANTENNA	R&S	HFH2-Z2	N/A	Feb. 22 2018	2 years
3	EMI Test Receiver	R&S	ESCI	101041	Apr. 04 2017	1 year
4	Software	R&S	EMC32	Version 8.53.0	-	-
5	Artificial Mains Network	R&S	ESH2-Z5	100273	Apr. 04 2017	1 year
6	ATTENUATOR	FAIRVIEW	SA3N5W-10	N/A	Apr. 04 2017	1 year
7	EMI Test Receiver	R&S	ESU 40	100202	Apr. 04 2017	1 year
8	Software	R&S	EMC32	Version 8.53.0	-	-
9	TRILOG Broadband Test Antenna	SCHWARZBECK	VULB 9163	9163-423	Nov. 04 2017	2 year
10	ATTENUATOR	FAIRVIEW	SA3N5W-06	N/A	Apr. 04 2017	1 year
11	Controller	innco systems GmbH	CO2000-G	CO2000/562/ 23890210/L	N/A	N/A
12	Open Switch and Control Unit	R&S	OSP-120	100015	N/A	N/A
13	Antenna Mast (Left)	innco systems GmbH	MA4000-EP	N/A	N/A	N/A
14	Turn Table	innco systems GmbH	DT3000-3T	N/A	N/A	N/A
15	Signal Conditioning Unit	R&S	SCU 01	10030	Apr. 04 2017	1 year
16	Signal Conditioning Unit	Rohde & Schwarz	SCU 18	10065	Apr. 04 2017	1 year
17	DOUBLE RIDGED HORN ANTENNA	SCHWARZBECK	HF907	100197	Jun. 11 2017	2 year
18	TILT ANTENNA MAST	innco systems GmbH	MA4640-XP-EP	N/A	N/A	N/A

APPENDIX D – SCHEMATIC DIAGRAM

APPENDIX E – USER’S MANUAL

APPENDIX F – BLOCK DIAGRAM
