Global No.1 Testing Laboratory Universal Certification Solution

FCC TEST REPORT

Product name:	KM-RF
FCC ID:	2AEWA-IS-5000N2
Model:	IS-5000N2
Standards:	FCC CFR 47 PART 15 SUBPART C, Section 15.225
Applicant:	KOREA MATSUI INC.
Test Report No.:	UCSFR-1506-002

UCS Co., Ltd.

#702, AnyangMegavalley, 268 Hagui-ro, Dongan-gu, Anyang-si, Gyeonggi-do, 431-767 Korea.
Tel: +82-31-420-5680 / Fax: +82-31-420-5685 / Open Site: +82-31-355-2666
Online: http://www.ucs.co.kr

FCC Test Report

Report Number		UCSFR-1506-002		
Applicant	Company Name	KOREA MATSUI INC.		
	Address	Gojan-Dong, 358, Chungneungdae-ro, Nam-dong-gu, Incheon, Korea		
Product	Product Name	KM-RF		
	FCC ID	2AEWA-IS-5000N2		
	Model No.	IS-5000N2		
	Manufacturer	NEO SMART		
	Serial No.	-	Country of origin	Korea
Other	Receipt Date	2015.05.12	Receipt Number	UCS-R-2015-328
	Issued Date	2015.06.01	Tested Date	2015.05.20 ~ 2015.05.21
Standards		FCC CFR 47 PART 15 SUBPART C, Section 15.225		
Tested by		H. K. Lee (Sign)		
Approved by		Y. M. Choi (Sign)		

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Tel : +82-31-420-5680, Fax : +82-31-420-5685

Contents

Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
UCSFR-1406-002	01-June-2015	Initial Issue	All

1. Applicant Information

Applicant Name	: KOREA MATSUI INC.
Address	: Gojan-Dong, 358, Chungneungdae-ro, Nam-dong-gu, Incheon, Korea
Manufacturer	: NEO SMART
Addressant Name	: 517-14, Sangdaewondong, Jungwon-gu, Seongnam, Gyeonggi-do, (Seongnam Industrial Park No. 504)
Country of Origin	: Korea

2. EUT (Equipment under test) Information

Product name	KM-RF
Model name	IS-5000N2
Power source	DC 12 V (Used AC/DC Adapter)
Ferquency range	13.56 MHz
Modulation Technique	ASK
Antenna specification	PCB Pattern Antenna

3. Laboratory Information

UCS Co., Ltd.

#702, Anyang Megavalley799, Gwanyang2-dong, Dongan-gu, Anyang-si, Gyeonggi-do, 431-767, Korea

ER Center

#476-4, Hwalcho-dong, Hwaseong-si, Gyeonggi-do, 445-150, Korea

Test site

- FCC Registration Number : 803225
- This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.

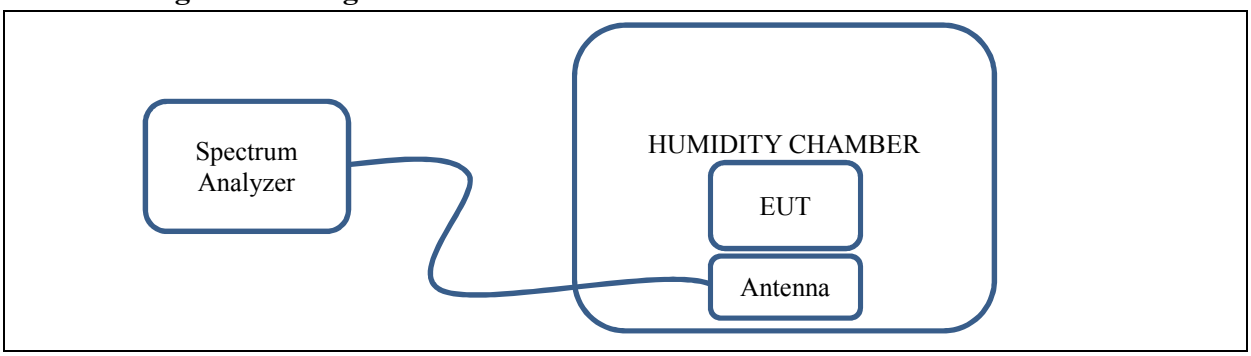
4. Test Configuration and Condition

4.1 EUT operating condition

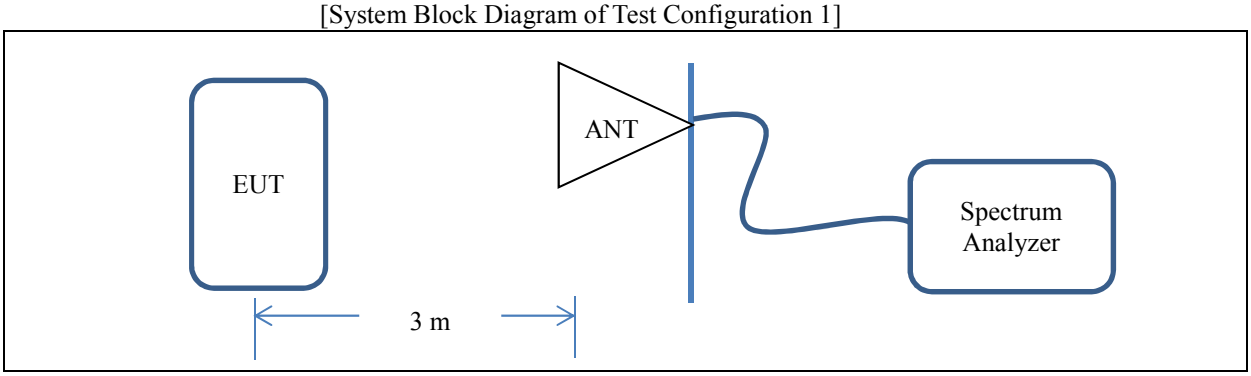
- The EUT had been tested under the operating condition.
- There are one channels have been tested as following:

Channel	Frequency (MHz)
Fundamental	13.56

4.2 EUT test configuration diagram



[System Block Diagram of Test Configuration 1]



[System Block Diagram of Test Configuration 2]

4.3 Peripheral equipments list for test

Equipment Name	Model	Serial Number	Manufacturer
Note Book	-	-	DELL
Note Book Adapter	LA65N	-	DELL
EFM Networks	H505	-	Ip TIME
EFM Networks Adapter	120-S325	-	-
RF Card	SSA021F090050KODM	1437	-
Adapter	120-S325	-	-

4.4 Cable connections

Start		End		Cable	
Name	**I/O Port**	**Name**	**I/O Port**	**Length**	**Spec.**
EUT	LAN	EFM Networks	LAN	3.0	Unshielded
EUT	DC in	Adapter	DC out	1.0	Unshielded
EUT	-	RF Card	-	-	-
EFM Networks	LAN	Note Book	LAN	3.0	Unshielded

4.5 EUT modifications

- None

5. Summary of Test Results and Measurement Procedures

5.1 Summary of test results

Standard	Test Item	CFR 47 Section	Result
FCC CFR 47 PART 15 SUBPART C, Section 15.225	Radiated Electric Field Emissions	15.225(a) (b) (c)	PASS
	Radiated Electric Field Emissions	15.225(d)	PASS
	Frequency Stability	15.225(e)	PASS
	AC Power Line Conducted Emissions	15.207	PASS
	20 dB Bandwidth	15.215(c)	PASS

5.2 AC powerline conducted emission test

The EUT was connected to adaptor and the power of adaptor was connected to LISN. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2009 to determine the worse operating conditions.

5.3 Radiated emission test

Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10:2009 to determine the worse operating conditions. The radiated emissions measurements were performed on the 3 m open area test site.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

6. Test Results

6.1 Radiated Electric Field Emissions

6.1.1 Regulation

According to §15.225(a), The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

According to §15.225(b), Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

According to §15.225(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

6.1.2 Test Condition

- The EUT is placed on a turntable, which is 0.8m above ground plane.
- Three orientation for the EUT were tried to find out which orientation produces the worst emissions.
- The loop antenna was also moved around to find out worst position for the emissions.
- Set RBW of Spectrum analyzer to 9 kHz, VBW=10 kHz, Sweep=1s
- The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 uV/m at 30 meters.

6.1.3 Test Data

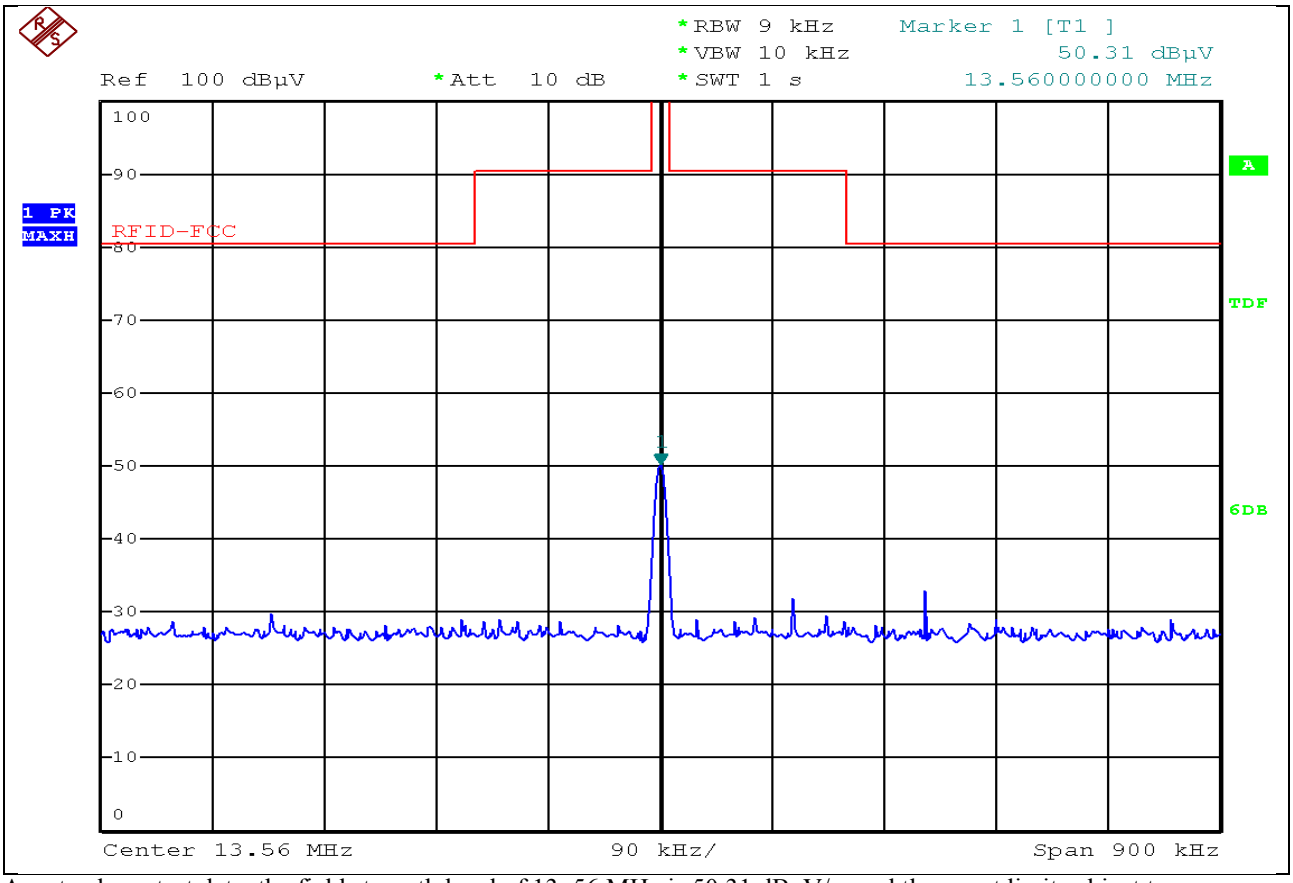
6.1.3.1 Operation Frequency Band: (13.553 ~ 13.567) MHz

Radiated Emission		Ant	Correction Factors		Total	FCC	
Freq. [MHz]	Amplitud [dBµV]	Pol.	Antenna [dB/m]	Cable [Db]	Amplitude [dBµV/m]	Limit [dBµV/m]	Margin [dB]
13.56	40.21	H	10.07	0.03	50.31	124	73.69
13.56	31.39	V	10.07	0.03	41.49	124	82.51

* Remark: The EUT was tested at 3 m, so conversation factor was included at above limit.

6.1.3.2 Operation frequency band: Below 13.553 MHz and above 13.567 MHz

- The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.



Acc. to above test data, the field strength level of 13. 56 MHz is 50.31 dBuV/m and the worst limit subject to 15.225 (b) and (c) is 80.5 dBuV/m, so the EUT meets the requirement.

6.2 Spurious Emission Test

6.2.1 Regulation

According to §15.225(d), The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

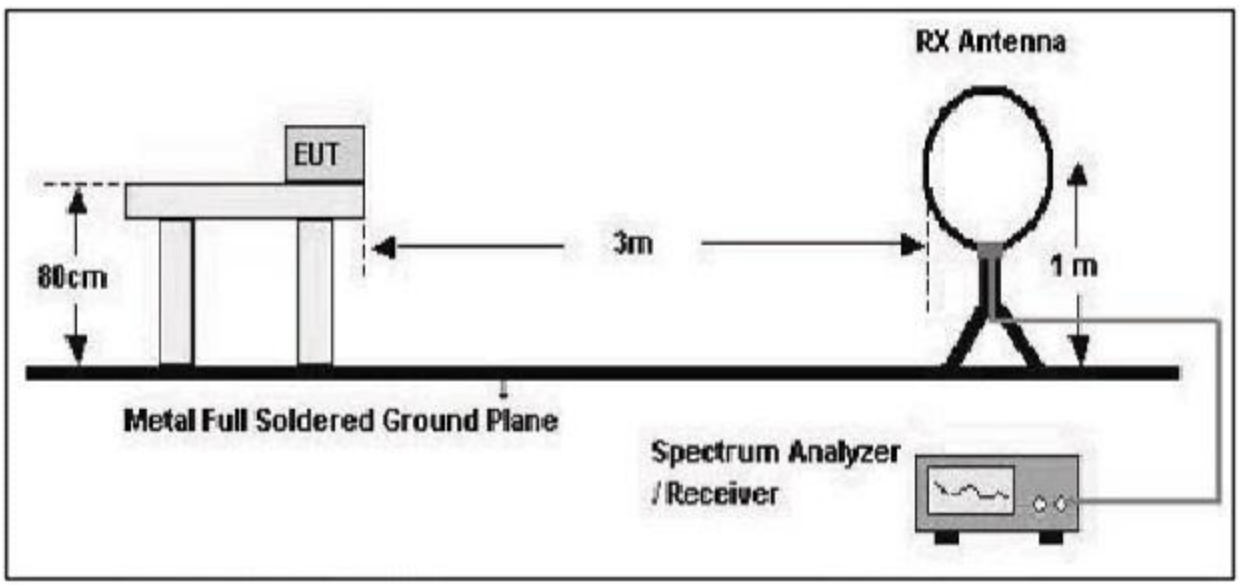
According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency [MHz]	Field strength [μV/m]	Field strength [dBμV/m]	Measurement distance [m]
0.009 ~ 0.490	2 400 / F (kHz)	-	300
0.490 ~ 1.705	24 000 / F (kHz)	-	30
1.705 ~ 30	30	29.5	30
30 ~ 88	100	40.0	3
88 ~ 216	150	43.5	3
216 ~ 960	200	46.0	3
Above 960	500	54.0	3

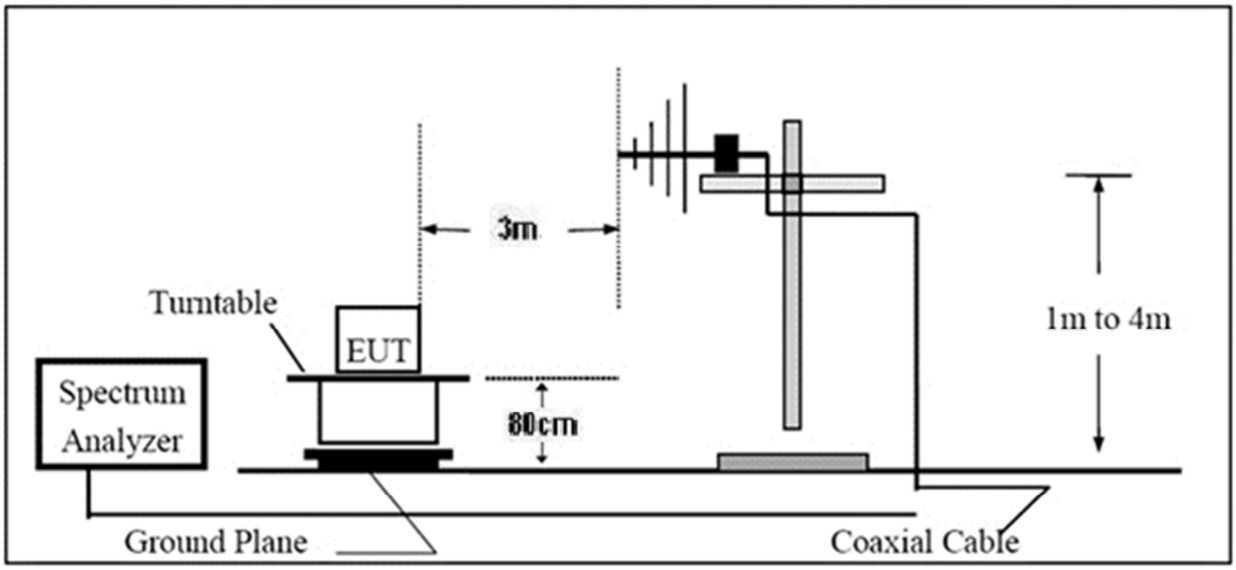
The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1 000 MHz are based on the average value of measured emissions.

6.2.2 Test setup layout

6.2.2.1 Radiated emission test set-up, frequency below 30 MHz



6.2.2.2 Radiated emission test set-up, frequency below 1 000 MHz



6.2.3 Test Data

Measured values of the Field strength of spurious emission					
Frequency [MHz]	**Detect Mode**	**Polarization [V/H]**	**Emission Level [dBµV/m]**	**Limit [dBµV/m]**	**Margin [dB]**
Average/Peak/Quasi-peak data, emissions below 30 MHz					
		No Critical peaks Found			
Quasi-peak data, emissions below 1 000 MHz					
54.24	Qausi-peak	V	33.46	40.00	-6.54
108.48	Qausi-peak	V	34.27	43.52	-9.25
122.04	Qausi-peak	V	37.67	43.52	-5.85
149.16	Qausi-peak	V	41.41	43.52	-2.11
284.76	Qausi-peak	V	37.20	46.02	-8.82
350.02	Qausi-peak	V	37.17	46.02	-8.85
352.02	Qausi-peak	V	23.33	46.02	-22.69

* Remark: “H”: Horizontal, “V”: Vertical

* Margin [dB] = Emission Level [dBµV/m] – Limit [dBµV/m]

6.3 Frequency Stability

6.3.1 Regulation

According to §15.225(e), The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

6.3.2 Test Condition

1. Frequency stability vs. temperature measurement
   -The EUT was placed into the constant temperature chamber.
   -The spectrum analyzer was used to read the EUT operating frequency.
   -Set the constant temperature chamber temperature within the range of -20°C to +50°C
2. Frequency stability vs. input voltage measurement
   -The EUT was placed into the constant temperature chamber and set the temperature to 20°C.
   -The spectrum analyzer was used to read the EUT operating frequency.
   -The EUT is powered with the DC Power Supplied it with 85% and 115% voltage, and measured the EUT operating frequency.

6.3.3 Test Data

<table>
<tr><th colspan="7">Measured values of the Frequency Stability</th></tr>
<tr><th rowspan="2">Frequency [Hz]</th><th colspan="4">Test Data [Hz]</th><th rowspan="2">Limit [Hz]</th><th rowspan="2">Verdict</th></tr>
<tr><th>-20°C</th><th>-10°C</th><th>0°C</th><th>+10°C</th></tr>
<tr><td rowspan="8">13 560 000</td><td>13 560 493</td><td>13 560 489</td><td>13 560 478</td><td>13 560 449</td><td rowspan="8">± 1 356 Hz
(13 559 644
~
13 562 356)</td><td rowspan="8">PASS</td></tr>
<tr><td>+20°C</td><td>+30°C</td><td>+40°C</td><td>+50°C</td></tr>
<tr><td>13 560 382</td><td>13 560 423</td><td>13 560 455</td><td>13 560 500</td></tr>
<tr><td colspan="4">Test Voltage</td></tr>
<tr><td colspan="2">Power 85%</td><td colspan="2">Power 115%</td></tr>
<tr><td colspan="2">13 560 384</td><td colspan="2">13 560 387</td></tr>
</table>

*Note

- Limit : Operating frequency X (±) 0.0001 = (±) 1356 Hz
- Within the band : 13559644 Hz - 13562356 Hz

6.4 20 dB bandwidth

6.4.1 Regulation

15.215(c), Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the 20 dB bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

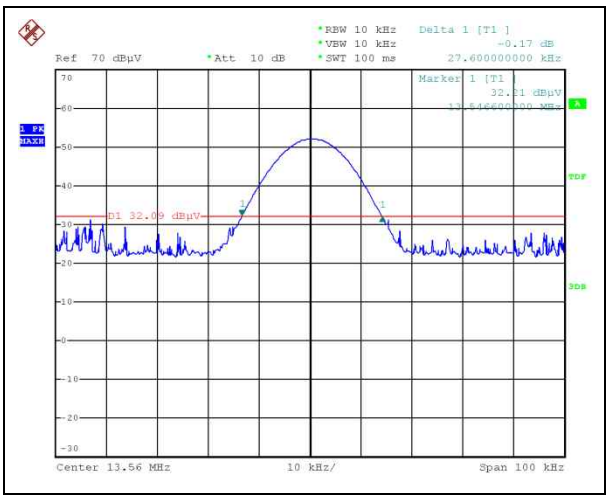
6.4.2 Test condition

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 10 kHz, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.

6.4.3 Test Data

Measured values of the 20 dB Bandwidth		
Operating Frequency [MHz]	**Measured Value [kHz]**	**Verdict**
13.56	27.6	Pass

6.4.4 Plot of the 20 dB channel bandwidth



6.5 AC power line conducted emissions

6.5.1 Regulation

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission [MHz]	Conducted limit [dBμV]	
	Qausi-peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency.

6.5.2 Test procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω / 50 μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

6.5.3 Test Data

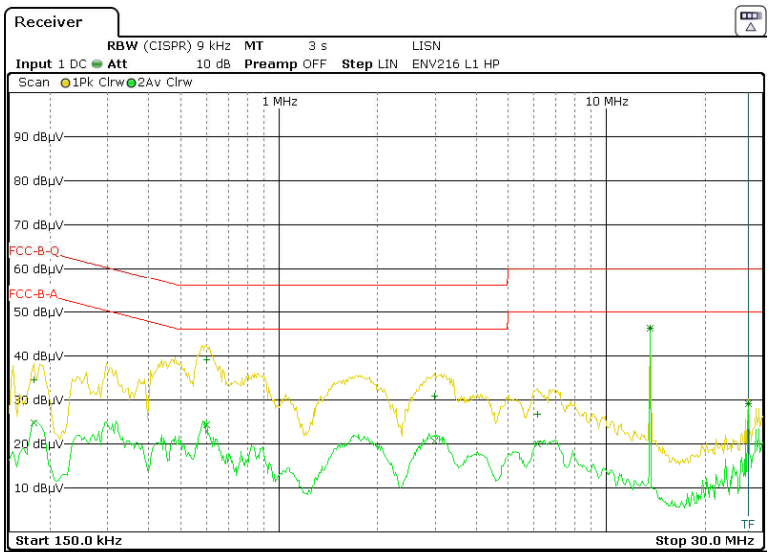
Table 8: Measured values of the AC Power Line Conducted Emissions

Frequency [MHz]	Factor		Line	Quasi-Peak			Average		
	LISN [dB]	Cable [dB]		Limit [dBµV]	Reading [dBµV]	Results [dBµV]	Limit [dBµV]	Reading [dBµV]	Results [dBµV]
0.19	10.16	0.13	N	64.04	24.74	35.03	54.04	14.87	25.16
0.60	10.05	0.17	H	56.00	29.02	39.24	46.00	14.24	24.46
1.67	9.94	0.22	N	56.00	21.25	31.41	46.00	12.92	23.08
6.17	9.88	0.31	H	60.00	16.45	26.64	50.00	9.80	19.99
13.56	9.92	0.49	H	60.00	36.16	46.57	50.00	36.05	46.46
27.12	9.96	0.79	H	60.00	18.96	29.71	50.00	18.92	29.67

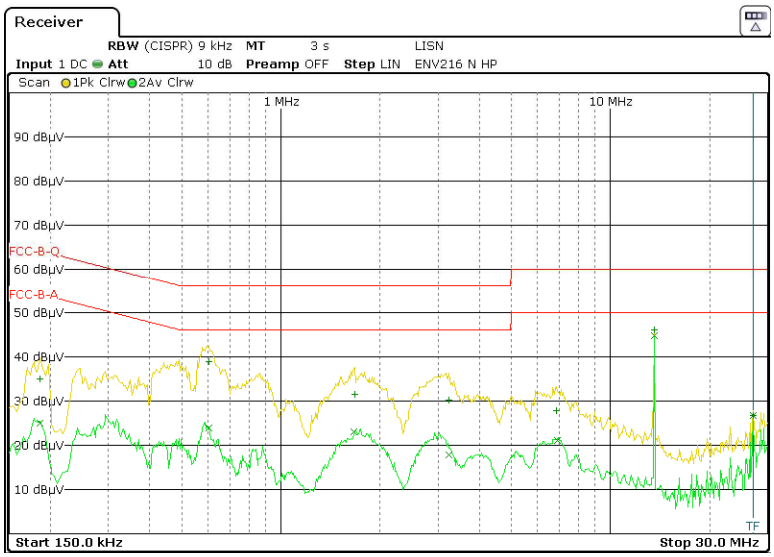
***** Remark: “H”: Hot Line, “N”: Neutral Line

6.5.4 Plot of the ac power line conducted emissions

[Hot line]



[Neutral line]



7. Test Equipment Used For Test

Used	Description	Manufacturer	Model Name	Serial Number	Specifications	Next Cal. Data
■	Spectrum Analyzer	H.P	E4407B	US39010225	9 kHz ~ 26.5 GHz	2016-02-10
□	EPM-P SERIES POWER METER	Agilent	E4416A	GB38272722	1 CH 100-240 VAC	2015-05-28
□	Power Sensor	Agilent	8481A	US41030240	MAX.23 dBm AVG, 18 GHz	2015-08-28
■	Test receiver	ROHDE& SCHWARZ	ESPI3	101171	9 kHz ~ 3 GHz	2015-08-08
■	BI-LOG ANT	SCHWARZBECK	VULB 9163	691	30 MHz ~ 1 GHz	2016-05-28
■	Loop Antenna	EMCO	6502	9801-3191	9 kHz ~ 30 MHz	2016-02-04
□	Horn antenna	Schwarzbeck	BBHA 9120D	769	1 GHz ~ 18 GHz	2015-11-29
□	Horn antenna	Schwarzbeck	BBHA 9120D	768	1 GHz ~ 18 GHz	2016-02-26
□	Horn antenna	Schwarzbeck	BBHA9170	BBHA9170178	18 GHz ~ 40 GHz	2016-02-26
■	Amplifier	310N	291723	SONOMA	9 kHz ~ 1 GHz	2015-08-28
□	Microwave Preamplifier	Agilent	8449B	3008A02014	1 GHz ~ 26.5 GHz	2016-02-12
■	DC Power Supply	Maynuo	M8811	0800109600111030 46	30 V 5 A	2015-08-29
□	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESR7	101120	10 Hz ~ 7 GHz	2015-12-26
□	LISN	SCHWARZBECK	NSLK 8127	8127518	9 kHz ~ 30 MHz	2015-08-28