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TEST REPORT

KCTL Inc.
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Suwon-si, Gyeonggi-do, 16677, Korea
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KCTL

1. Client

- Name : SUPREMA INC
- Address : 17F-5, Parkview officetower,, 248, Jeongjail-ro, Bundang-gu, Seongnam-si, Gyeonggi-do 13554 Korea (Republic Of)
- Date of Receipt : 2019-06-12

2. Use of Report : -

3. Name of Product and Model : NOVUS / NVS07-D2FR2MKG

4. Manufacturer and Country of Origin : SUPREMA INC / Korea

5. FCC ID : TKWNVS07

6. IC Certification : 23080-NVS07

7. Date of Test : 2019-08-29 to 2019-09-10

8. Test Standards : FCC Part 15 Subpart C, 15.209
RSS-210 Issue 9 August 2016
RSS Gen Issue 5 March 2019

9. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : Taekyong Nam (Signature)	Technical Manager Name : Seungyong Kim (Signature)

2019-11-13

KCTL Inc.

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

Report revision history

Date	Revision	Page No
2019-10-10	Initial report	-
2019-11-13	Revised the calibration internal of test equipment	17

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Note. The report No. KR19-SRF0154 is superseded by the report No. KR19-SRF0154-A.

CONTENTS

This test report shall not be reproduced, except in full, without the written approval

1. General information

Client	:	SUPREMA INC
Address	:	17F-5, Parkview officetower,, 248, Jeongjail-ro, Bundang-gu, Seongnam-si, Gyeonggi-do 13554 Korea (Republic Of)
Manufacturer	:	SUPREMA INC
Address	:	17F-5, Parkview officetower,, 248 Jeongjail-ro Bundang-gu Seongam-si, Gyeonggi-do 13554 Korea (Republic Of)
Laboratory	:	KCTL Inc.
Address	:	65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Accreditations	:	FCC Site Designation No: KR0040, FCC Site Registration No: 687132 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056 Industry Canada Registration No. : 8035A KOLAS No.: KT231

2. Device information

Equipment under test	:	NOVUS
Model	:	NVS07-D2FR2MKG
Frequency range	:	125 ㎑(RFID), 13.56 ㎒(NFC)
Modulation technique	:	ASK
Power source	:	DC 12 V, PoE 48 V
Antenna specification	:	Integrated antenna (NFC / RFID)
Software version	:	V 1.0.0
Hardware version	:	V 1.0.0
Test device serial No.	:	N/A
Operation temperature	:	-20 ℃ ~ 50 ℃

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
I. T. E. Power Supply	BridgePower Corp	JPW128KA1200N05	-	INPUT : 100-240 V / 1.0 A OUTPUT : 12 V / 2.5 A
AC/DC Adapter	SUNELECTRONICS	MH-48175	-	INPUT : 220 V / 1.5 A OUTPUT : 48 V / 1.75 A

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2.2. Information about derivative model

The difference between basic model and derivative models is:

The firmware is the same for each model and it has derivative models by optional components. Optional components can be assembled or removed on the base model.

Optional components are like below:
Memory, Fingerprint Sensor, Magnetic Swipe Reader, RFID Module, Keypad, GPS Module

2.3. Frequency/channel operations

This device contains the following capabilities:
125 ㎑(RFID), 13.56 ㎒(NFC)

Ch.	Frequency (㎑)
01	125

Table 2.3.1. RFID

KCTL

3. Antenna requirement

Requirement of FCC part section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

Requirement of RSS-Gen Section 6.8:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

- The Integrated Antenna is an internal antenna. The antenna connector available to general public. Please refer to the internal photos.

4. Summary of tests

FCC Part section(s)	IC Rule reference	Parameter	Test results
15.209	RSS-210 Issue 9 (8.9)	Field Strength of Fundamental and Spurious Emission	Pass
-	RSS-Gen Issue 5 (6.7)	Occupied Bandwidth	Pass
15.203	RSS-Gen Issue 5 (6.8)	Antenna requirement	Pass
15.207	RSS-Gen Issue 5 (8.8)	AC Conducted Emission	Pass

Notes:

1. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that X orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in X orientation.
2. According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field site based on KDB 414788.
3. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.10-2013
4. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of k=2 to indicated a 95 % level of confidence. The measurement data shown herein meets of exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

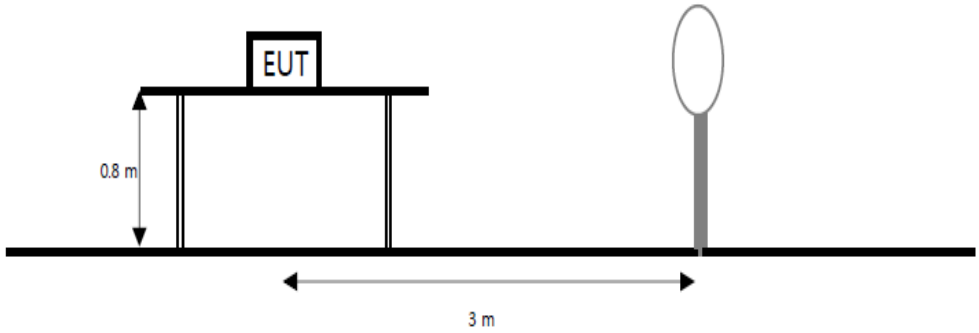
Parameter	Expanded uncertainty (±)	
Radiated spurious emissions	9 ㎑ ~ 30 ㎒	2.28 ㏈

6. Test results

6.1. Field Strength of Fundamental and Spurious Emission

Test setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions



Limit

According to section 15.209(a), RSS-Gen(8.9) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (㎒)	Field strength (㎶/m)	Measurement distance (m)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	30
1.705 - 30	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 ㎒, 76–88 ㎒, 174–216 ㎒ or 470–806 ㎒. However, operation within these frequency bands is permitted under other sections of this part, e.g., Section15.231 and 15.241.

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Test procedure

ANSI C63.10-2013

Test settings

Test Procedures for emission from 9 ㎑ to 30 ㎒

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.

b. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.

c. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.

d. The test-receiver system was set to Peak and Average Detect Function and Specified Bandwidth with Maximum Hold Mode.

e. Below 30 ㎒ frequency range, all orientations about parallel, perpendicular, and ground-parallel were investigated then reported and the worse orientations of Face-on and Face-off were set for final test.

Notes:

1. *f* <30 ㎒, extrapolation factor of 40 ㏈/decade of distance. $F_d = 40\log(D_m/Ds)$
   Where:
   F_d = Distance factor in ㏈
   D_m = Measurement distance in meters
   D_s = Specification distance in meters
2. The test measurement distance is 3 meter
3. Limit (㏈(㎶/m)) = For 0.009 ㎒ - 0.490 ㎒, 20*log(2 400/F(㎑)) ㏈(㎶/m)
   For 0.490 ㎒ - 1.705 ㎒, 20*log(24 000/F(㎑)) ㏈(㎶/m)
   For 1.705 ㎒ - 30 ㎒, 20*log(30) = 29.54 ㏈(㎶/m)

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Test results

Radiated Emissions Fundamental & 9 ㎑ to 30 ㎒

12 V

[Face On]

Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result at 3m	Result at 300m	Limit at 300m	Margin
(㎒)	(dB(㎶))	Mode	(dB)	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB(㎶/m))	(dB)
0.125	83.90	AV	19.5	-31.7	-80.0	-92.2	71.7	-8.30	25.67	33.97

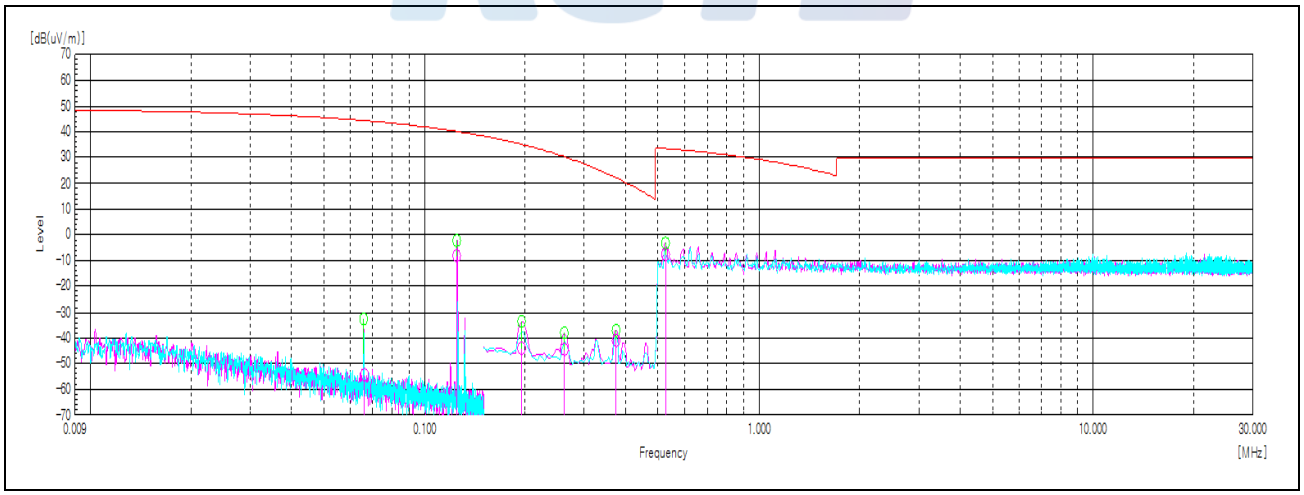
Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result at 3m	Result at 30m or 300m	Limit at 30m or 300m	Margin
(㎒)	(dB(㎶))	Mode	(dB)	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB(㎶/m))	(dB)
0.066	37.80	AV	19.5	-31.6	-80.0	-92.1	25.7	-54.26	31.21	85.47
0.195	48.20	AV	19.4	-31.6	-80.0	-92.2	36.0	-43.96	21.80	65.76
0.262	47.90	AV	19.4	-31.7	-80.0	-92.3	35.6	-44.40	19.24	63.64
0.374	51.00	AV	19.4	-31.6	-80.0	-92.2	38.8	-41.23	16.15	57.38
0.527	44.30	QP	19.3	-31.3	-40.0	-52.0	32.3	-7.72	33.17	40.89

Note.

1) Factor(dB) = Antenna Factor + Amp. Gain + Cable Loss + distance factor(dB)

2) -80 is distance factor = 40*log(3/300), -40 is distance factor = 40*log(3/30)

3) Result at 30 m



48 V

[Face On]

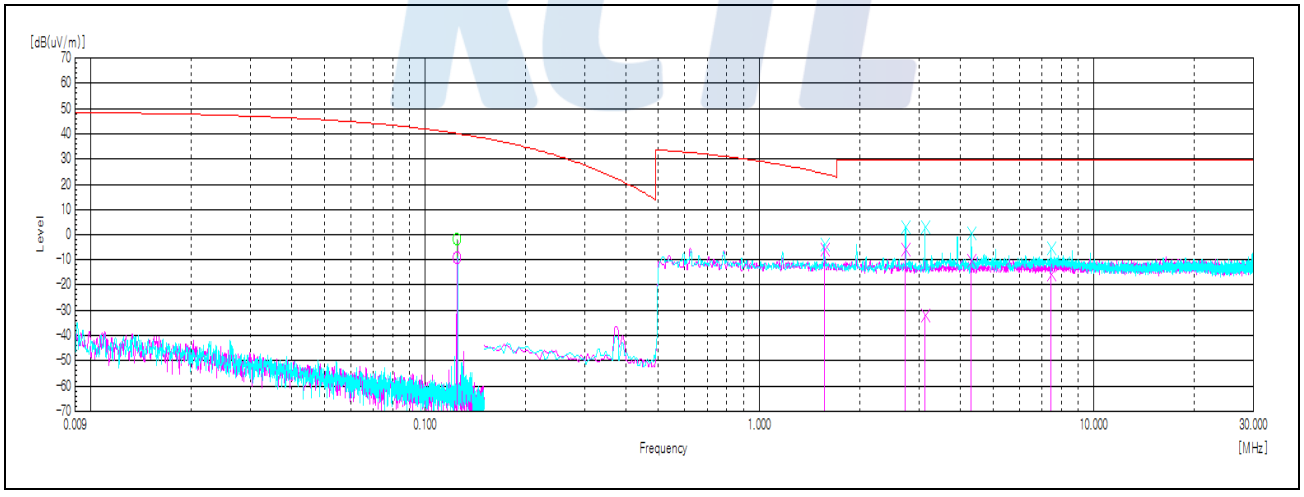
Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result at 3m	Result at 300m	Limit at 300m	Margin
(㎒)	(dB(㎶))	Mode	(dB)	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB(㎶/m))	(dB)
0.125	83.20	AV	19.5	-31.7	-80.0	-92.2	71.0	-9.00	25.67	34.67

[Face Off]

Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result at 3m	Result at 30m or 300m	Limit at 30m or 300m	Margin
(㎒)	(dB(㎶))	Mode	(dB)	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB(㎶/m))	(dB)
1.564	46.40	QP	19.3	-31.2	-40.0	-51.9	34.5	-5.53	23.72	29.25
2.736	46.20	QP	19.2	-31.0	-40.0	-51.8	34.4	-5.56	29.54	35.10
3.131	20.20	QP	19.2	-31.0	-40.0	-51.8	8.4	-31.56	29.54	61.10
4.303	41.20	QP	19.2	-30.7	-40.0	-51.5	29.7	-10.27	29.54	39.81
7.433	35.70	QP	19.4	-30.6	-40.0	-51.2	24.5	-15.52	29.54	45.06

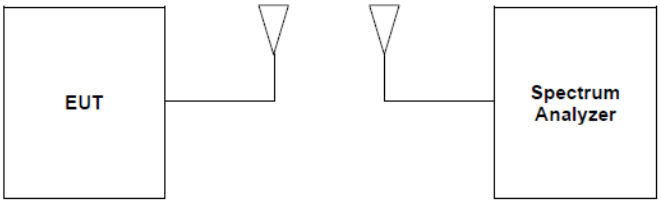
Note.

1) Factor(dB) = Antenna Factor + Amp. Gain + Cable Loss + distance factor(dB)
2) -80 is distance factor = 40*log(3/300), -40 is distance factor = 40*log(3/30)
3) Result at 30 m



6.2. Occupied Bandwidth

Test setup



Limit

For reporting purpose only

Test settings

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

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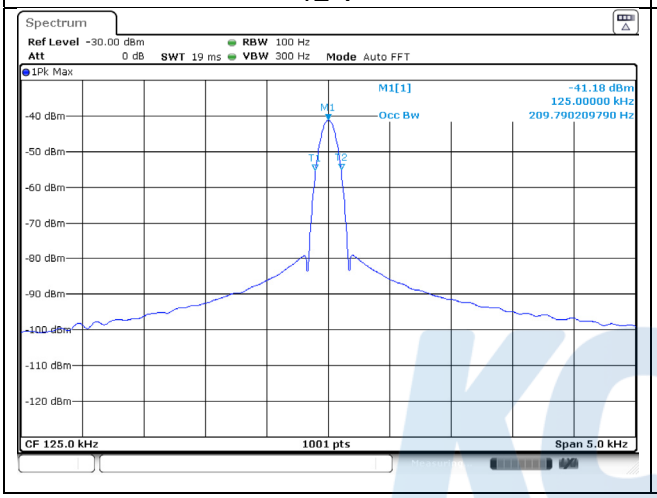
Test results

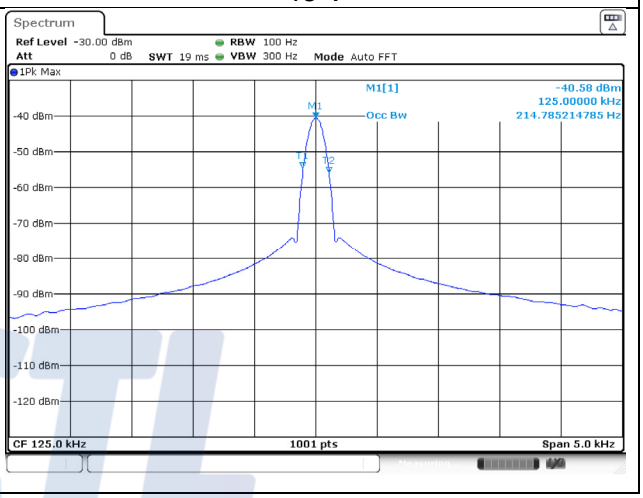
Frequency (㎑)		Occupied Bandwidth (㎐)	Limit
125	12 V	209.79	Reporting purpose only
	48 V	214.79	

Test Plots

12 V

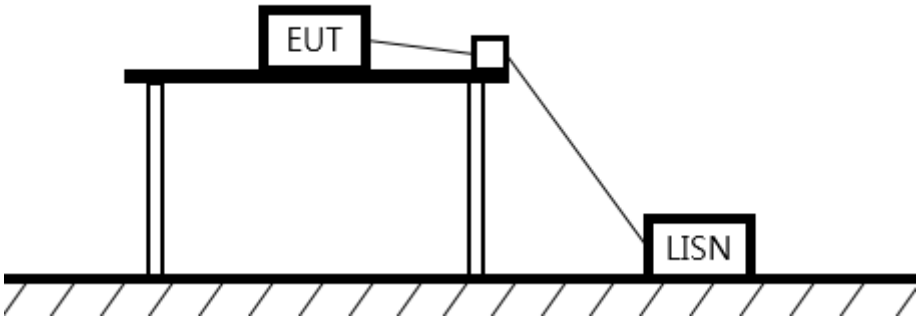


48 V



6.3. AC Conducted emission

Test setup



Limit

According to 15.207(a), RSS-Gen(8.8) 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 frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50uH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

Frequency of Emission (㎒)	Conducted limit (dB㎶/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

Measurement procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 ㎝ in which is located 40 ㎝ 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 50Ω/50μH 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 ㎒ to 30 ㎒.
5. The measurements were made with the detector set to peak amplitude within a bandwidth of 10 ㎑ or to quasi-peak and average within a bandwidth of 9 ㎑. The EUT was in transmitting mode during the measurements.

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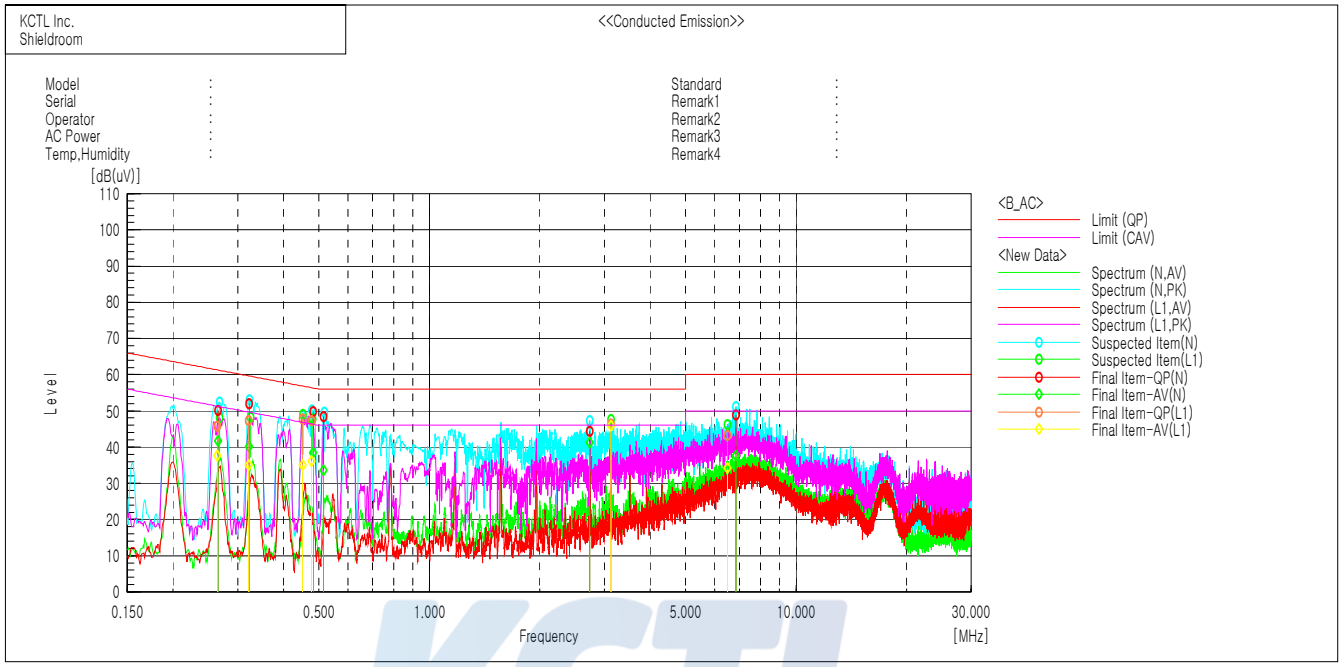
Test results

12 V



Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.26542	40.6	32.1	9.6	50.2	41.7	61.3	51.3	11.1	9.6
2	0.32251	42.3	30.5	9.7	52.0	40.2	59.6	49.6	7.6	9.4
3	0.48225	39.9	28.5	9.9	49.8	38.4	56.3	46.3	6.5	7.9
4	0.51466	38.5	23.6	9.9	48.4	33.5	56.0	46.0	7.6	12.5
5	2.73796	34.7	31.6	9.7	44.4	41.3	56.0	46.0	11.6	4.7
6	6.84992	39.2	28.0	9.7	48.9	37.7	60.0	50.0	11.1	12.3

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.26422	36.1	27.9	9.7	45.8	37.6	61.3	51.3	15.5	13.7
2	0.32185	37.5	25.2	9.8	47.3	35.0	59.7	49.7	12.4	14.7
3	0.4516	37.9	25.0	9.9	47.8	34.9	56.8	46.8	9.0	11.9
4	0.47719	37.5	26.2	9.9	47.4	36.1	56.4	46.4	9.0	10.3
5	3.12941	36.6	36.2	9.7	46.3	45.9	56.0	46.0	9.7	0.1
6	6.5051	33.6	24.5	9.7	43.3	34.2	60.0	50.0	16.7	15.8

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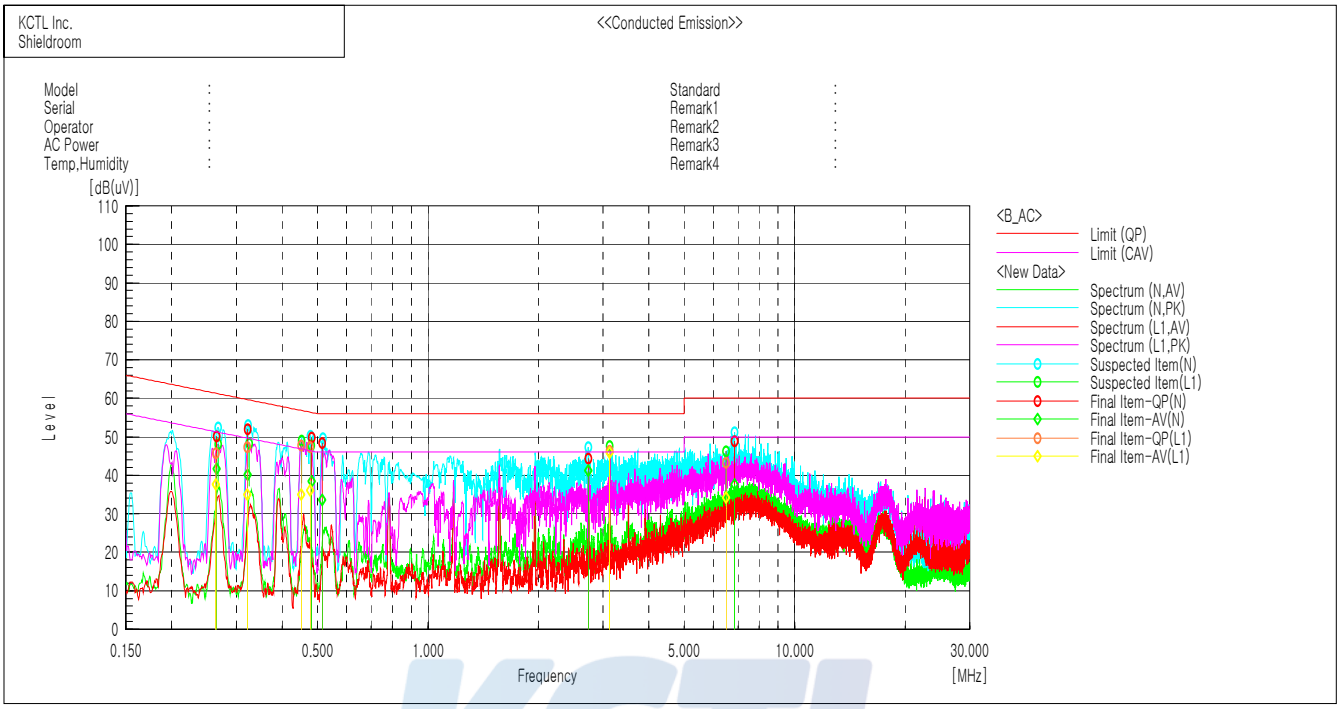
48 V



Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.26542	40.6	32.1	9.6	50.2	41.7	61.3	51.3	11.1	9.6
2	0.32251	42.3	30.5	9.7	52.0	40.2	59.6	49.6	7.6	9.4
3	0.48225	39.9	28.5	9.9	49.8	38.4	56.3	46.3	6.5	7.9
4	0.51466	38.5	23.6	9.9	48.4	33.5	56.0	46.0	7.6	12.5
5	2.73796	34.7	31.6	9.7	44.4	41.3	56.0	46.0	11.6	4.7
6	6.84992	39.2	28.0	9.7	48.9	37.7	60.0	50.0	11.1	12.3

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.26422	36.1	27.9	9.7	45.8	37.6	61.3	51.3	15.5	13.7
2	0.32185	37.5	25.2	9.8	47.3	35.0	59.7	49.7	12.4	14.7
3	0.4516	37.9	25.0	9.9	47.8	34.9	56.8	46.8	9.0	11.9
4	0.47719	37.5	26.2	9.9	47.4	36.1	56.4	46.4	9.0	10.3
5	3.12941	36.6	36.2	9.7	46.3	45.9	56.0	46.0	9.7	0.1
6	6.5051	33.6	24.5	9.7	43.3	34.2	60.0	50.0	16.7	15.8

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7. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Vector Signal Generator	R&S	SMBV100A	257566	19.07.16	20.07.16
Signal Generator	R&S	SMB100A	176206	19.01.25	20.01.25
Spectrum Analyzer	R&S	FSV30	100808	19.07.30	20.07.30
DC Power Supply	AGILENT	E3632A	MY40001543	19.05.13	20.05.13
EMI TEST RECEIVER	R&S	ESCI7	100732	19.08.22	20.08.22
Loop Antenna	R&S	HFH2-Z2	100355	18.09.28	20.09.28
AMPLIFIER	SONOMA	310N	284608	19.08.22	20.08.22
Antenna Mast	Innco Systems	MA4000-EP	303	-	-
Turn Table	Innco Systems	DT2000	79	-	-
TWO-LINE V - NETWORK	R&S	ENV216	101584	19.04.05	20.04.05
EMI TEST RECEIVER	R & S	ESCI3	100710	19.08.22	20.08.22
Cable Assembly	RadiAll	2301761768000PJ	1724.659	-	-
Cable Assembly	gigalane	RG-400	-	-	-
Cable Assembly	HUER+SUHNER	SUCOFLEX 104	MY4342/4	-	-

End of test report

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