TEST REPORT

KCTL Inc.
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

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, 15.225
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.

Report revision history

Date	Revision	Page No
2019-10-10	Initial report	-
2019-11-13	Revised 20dB BW and the calibration internal of test equipment	11, 25

Note. The report No. KR19-SRF0155 is superseded by the report No. KR19-SRF0155-A.

CONTENTS

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

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	13.56

Table 2.3.1. NFC

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 The antenna connector is available to general public. Please refer to the internal photos.

4. Summary of tests

FCC Part section(s)	IC Rule reference	Parameter	Test results
15.225(a)	RSS-210 B.6 (a)	In-band Fundamental Emission	Pass
15.225(b)	RSS-210 B.6 (b)	In-band Spurious Emission	Pass
15.225(c)	RSS-210 B.6 (c)	In-band Spurious Emission	Pass
15.225(d) 15.209	RSS-210 B.6 (d) RSS-Gen Issue 9 (8.9)	Out-of–band Spurious Emission	Pass
15.225(e)	RSS-210 B.6	Frequency Stability Tolerance	Pass
15.215(c)	-	20 dB Bandwidth	Pass
-	RSS-Gen Issue 5 (6.7)	Occupied Bandwidth	Pass
15.207(a)	RSS-Gen Issue 5 (8.8)	AC Conducted emissions	Pass

Notes:

1. 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 based on KDB 414788.
2. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that Z orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in Z orientation
3. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.10-2013

5. Measurement uncertainty

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

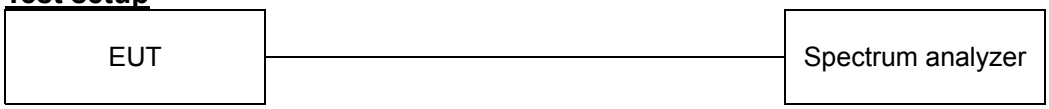
All measurement uncertainty values are shown with a coverage factor of k=2 to indicated a 95 % level of confidence. The measurement data shown herein meets of exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine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

Parameter	Expanded uncertainty (±)	
Radiated spurious emissions	9 ㎑ ~ 30 ㎒	2.28 dB
	30 ㎒ ~ 300 ㎒	4.98 dB
	300 ㎒ ~ 1 000 ㎒	5.14 dB
	1 ㎓ ~ 6 ㎓	6.70 dB
	Above 6 ㎓	6.60 dB
Conducted emissions	9 ㎑ ~ 150 ㎑	3.66 dB
	150 ㎑ ~ 30 ㎒	3.26 dB

6. Test results

6.1. 20 dB Bandwidth & 99% Bandwidth

Test setup



Limit

According to §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, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

According to RSS-Gen Issue 5 (6.7) The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth.
When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

Test procedure

ANSI C63.10-2013 - Section 6.9.2

Test settings

The occupied bandwidth is measured as the width of the spectral envelope of the modulated signal, at an amplitude level reduced from a reference value by a specified ratio (or in decibels, a specified number of dB down from the reference value). Typical ratios, expressed in dB, are −6 dB, −20 dB, and −26 dB, corresponding to 6 dB BW, 20 dB BW, and 26 dB BW, respectively. In this subclause, the ratio is designated by "−xx dB." The reference value is either the level of the unmodulated carrier or the highest level of the spectral envelope of the modulated signal, as stated by the applicable requirement. Some requirements might specify a specific maximum or minimum value for the "−xx dB" bandwidth; other requirements might specify that the "−xx dB" bandwidth be entirely contained within the authorized or designated frequency band.

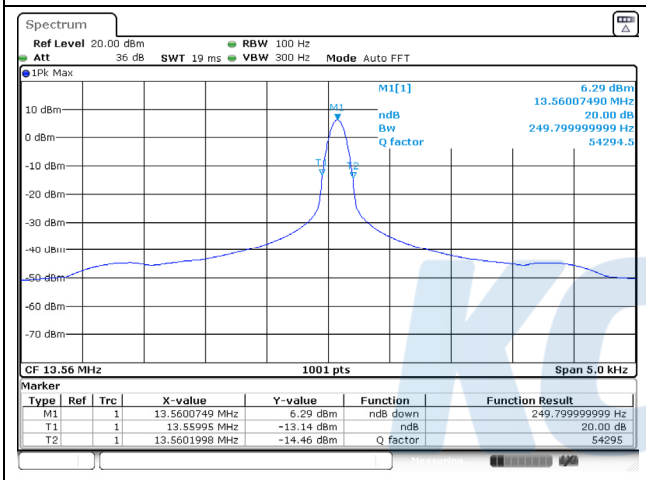
a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency.
b) Span: Two times and five times the OBW.
c) RBW = 1 % to 5 % of the OBW and VBW ≥ 3 x RBW
d) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation.
e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target "−xx dB down" requirement; that is, if the requirement calls for measuring the −20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.
f) Detector: peak
g) Trace mode: max hold.
h) Allow the trace to stabilize.
i) Determine the "−xx dB down amplitude" using ((reference value) − xx). Alternatively, this calculation may be made by using the marker-delta function of the instrument.
j) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j)
k) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the "−xx dB down amplitude" determined in step h). If a marker is below this "−xx dB down amplitude" value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the "−xx dB down amplitude" determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.

Test results

Voltage	Frequency	20 dB Bandwidth [MHz]	Limit [MHz]	Occupied Bandwidth (99 % BW) [kHz]
12 V	Lowest Frequency	13.559 950	13.110 000	0.225
	Highest Frequency	13.560 200	14.010 000	
48 V	Lowest Frequency	13.559 945	13.110 000	0.275
	Highest Frequency	13.560 190	14.010 000	

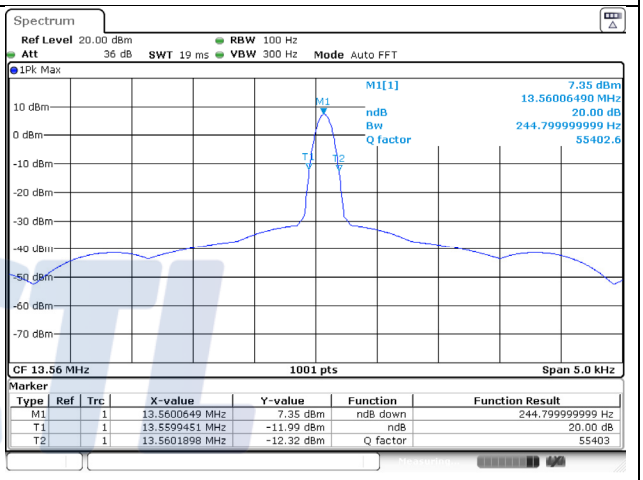
12 V

20 dB Bandwidth

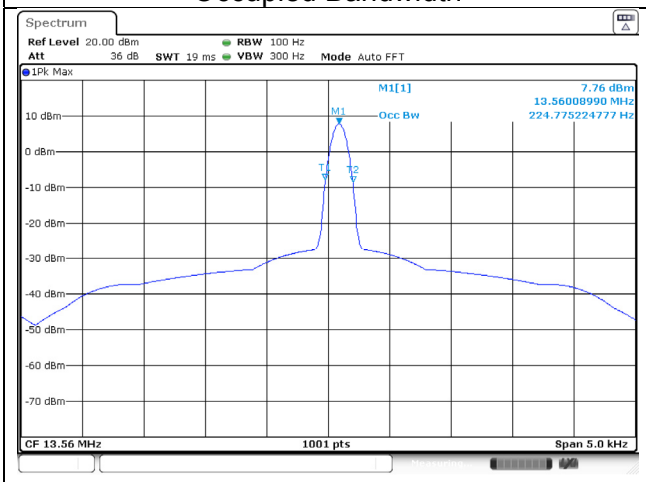


48 V

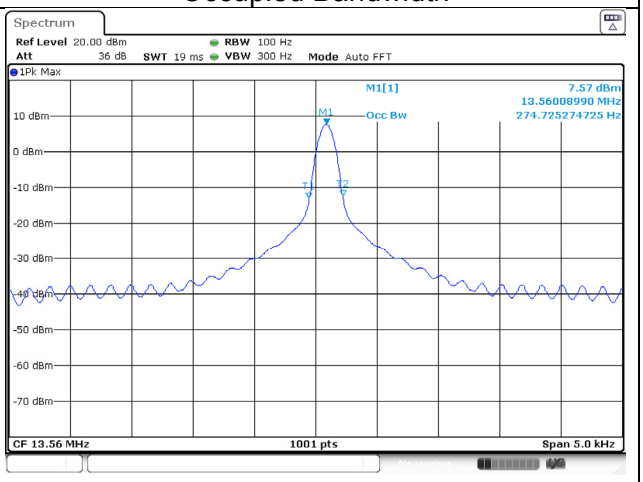
20 dB Bandwidth



Occupied Bandwidth

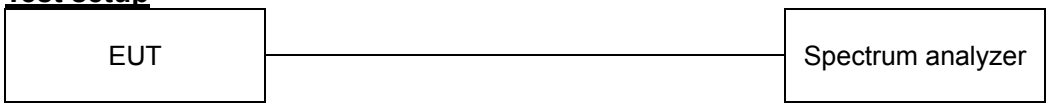


Occupied Bandwidth



6.2. Frequency tolerance

Test setup



Limit

According to 15.225 (e), RSS-210 B.6 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.

Test procedure

ANSI C63.10-2013 - Section 6.8.1

Test results

12 V

Voltage	Voltage	TEMP	Maintaining time	Measure frequency	Frequency deviation	Deviation
[%]	[V]	[℃]		[㎐]	[㎐]	[%]
100.00	12.00	22	Startup	13 560 082	-82.0	0.000 61
			2 minutes	13 560 082	-82.0	0.000 61
			5 minutes	13 560 082	-82.0	0.000 61
			10 minutes	13 560 082	-82.0	0.000 61
		-20	Startup	13 560 176	-176.0	0.001 30
			2 minutes	13 560 176	-176.0	0.001 30
			5 minutes	13 560 177	-177.0	0.001 31
			10 minutes	13 560 177	-177.0	0.001 31
		-10	Startup	13 560 163	-163.0	0.001 20
			2 minutes	13 560 163	-163.0	0.001 20
			5 minutes	13 560 163	-163.0	0.001 20
			10 minutes	13 560 163	-163.0	0.001 20
		0	Startup	13 560 152	-152.0	0.001 12
			2 minutes	13 560 152	-152.0	0.001 12
			5 minutes	13 560 152	-152.0	0.001 12
			10 minutes	13 560 152	-152.0	0.001 12
		10	Startup	13 560 118	-118.0	0.000 87
			2 minutes	13 560 118	-118.0	0.000 87
			5 minutes	13 560 117	-117.0	0.000 86
			10 minutes	13 560 117	-117.0	0.000 86
		20	Startup	13 560 086	-86.0	0.000 63
			2 minutes	13 560 085	-85.0	0.000 63
			5 minutes	13 560 086	-86.0	0.000 63
			10 minutes	13 560 085	-85.0	0.000 63
		30	Startup	13 560 062	-62.0	0.000 46
			2 minutes	13 560 062	-62.0	0.000 46
			5 minutes	13 560 062	-62.0	0.000 46
			10 minutes	13 560 062	-62.0	0.000 46
		40	Startup	13 560 058	-58.0	0.000 43
			2 minutes	13 560 058	-58.0	0.000 43
			5 minutes	13 560 058	-58.0	0.000 43
			10 minutes	13 560 058	-58.0	0.000 43
		50	Startup	13 560 049	-49.0	0.000 36
			2 minutes	13 560 049	-49.0	0.000 36
			5 minutes	13 560 048	-48.0	0.000 35
			10 minutes	13 560 049	-49.0	0.000 36
85.00	10.20	22	Startup	13 560 088	-88.0	0.000 65
			2 minutes	13 560 088	-88.0	0.000 65
			5 minutes	13 560 088	-88.0	0.000 65
			10 minutes	13 560 088	-88.0	0.000 65
115.00	13.80	22	Startup	13 560 094	-94.0	0.000 69
			2 minutes	13 560 094	-94.0	0.000 69
			5 minutes	13 560 093	-93.0	0.000 69
			10 minutes	13 560 094	-94.0	0.000 69

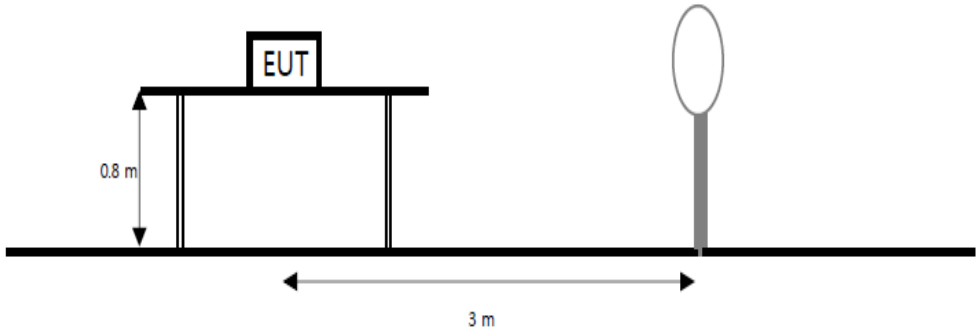
48 V

Voltage	Voltage	TEMP	Maintaining time	Measure frequency	Frequency deviation	Deviation
[%]	[V]	[℃]		[㎐]	[㎐]	[%]
100.00	48.00	22	Startup	13 560 080	-80.0	0.000 59
			2 minutes	13 560 080	-80.0	0.000 59
			5 minutes	13 560 079	-79.0	0.000 58
			10 minutes	13 560 079	-79.0	0.000 58
		-20	Startup	13 560 184	-184.0	0.001 36
			2 minutes	13 560 184	-184.0	0.001 36
			5 minutes	13 560 184	-184.0	0.001 36
			10 minutes	13 560 185	-185.0	0.001 36
		-10	Startup	13 560 168	-168.0	0.001 24
			2 minutes	13 560 168	-168.0	0.001 24
			5 minutes	13 560 167	-167.0	0.001 23
			10 minutes	13 560 167	-167.0	0.001 23
		0	Startup	13 560 072	-72.0	0.000 53
			2 minutes	13 560 072	-72.0	0.000 53
			5 minutes	13 560 072	-72.0	0.000 53
			10 minutes	13 560 072	-72.0	0.000 53
		10	Startup	13 560 122	-122.0	0.000 90
			2 minutes	13 560 122	-122.0	0.000 90
			5 minutes	13 560 122	-122.0	0.000 90
			10 minutes	13 560 122	-122.0	0.000 90
		20	Startup	13 560 088	-88.0	0.000 65
			2 minutes	13 560 088	-88.0	0.000 65
			5 minutes	13 560 088	-88.0	0.000 65
			10 minutes	13 560 088	-88.0	0.000 65
		30	Startup	13 560 064	-64.0	0.000 47
			2 minutes	13 560 063	-63.0	0.000 47
			5 minutes	13 560 063	-63.0	0.000 47
			10 minutes	13 560 064	-64.0	0.000 47
		40	Startup	13 560 060	-60.0	0.000 44
			2 minutes	13 560 060	-60.0	0.000 44
			5 minutes	13 560 060	-60.0	0.000 44
			10 minutes	13 560 061	-61.0	0.000 45
		50	Startup	13 560 051	-51.0	0.000 38
			2 minutes	13 560 051	-51.0	0.000 38
			5 minutes	13 560 051	-51.0	0.000 38
			10 minutes	13 560 050	-50.0	0.000 37
85.00	40.80	22	Startup	13 560 077	-77.0	0.000 57
			2 minutes	13 560 077	-77.0	0.000 57
			5 minutes	13 560 077	-77.0	0.000 57
			10 minutes	13 560 078	-78.0	0.000 58
115.00	55.20	22	Startup	13 560 081	-81.0	0.000 60
			2 minutes	13 560 081	-81.0	0.000 60
			5 minutes	13 560 081	-81.0	0.000 60
			10 minutes	13 560 081	-81.0	0.000 60

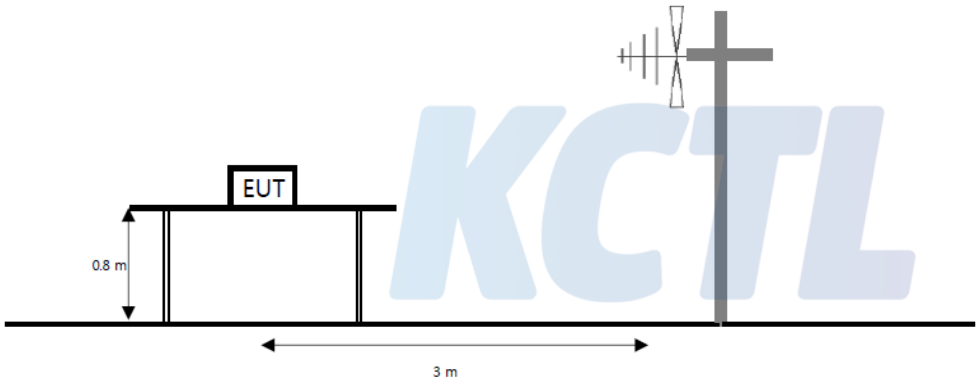
6.3. Radiated spurious emissions

Test setup

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



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



Limit

15.225 (a), RSS-210 B.6 (a) The field strength of any emission within the band 13.553-13.567 ㎒ shall not exceed 15, 848 microvolts/meter at 30 meters.

15.225 (b), RSS-210 B.6 (b) With in the bands 13.410-13.553 ㎒ and 13.567-13.710 ㎒, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

15.225 (c), RSS-210 B.6 (c) With in the bands 13.110-13.410 ㎒ and 13.710-14.010 ㎒, the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

15.225 (d), RSS-210 B.6 (d), RSS-Gen Issue 9 (8.9) The Field Strength of any emissions appearing outside of the 13.110-14.010 ㎒ band shall not exceed the general radiated emission limits in 15.209.

Frequency (㎒)	Field Strength (㎶/m)	Measurement distance (meters)
0.009-0.490	2400/F(㎑)	300
0.490-1.705	24000/F(㎑)	30
1.705-30.0	30(29.54 dB㎶/m)	30
30.0-88.0	100(40 dB㎶/m)	3
88-216	150(43.5 dB㎶/m)	3
216-960	200 (46 dB㎶/m)	3
Above 960	500 (53.98 dB㎶/m)	3

Test procedure
ANSI C63.10-2013 - Section 6.4, 6.5

Test settings

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in table
3. VBW ≥ 3 x RBW
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Table. RBW as a function of frequency

Frequency	RBW
9 ㎑ to 150 ㎑	200 ㎐ to 300 ㎐
0.15 ㎒ to 30 ㎒	9 ㎑ to 10 ㎑
30 ㎒ to 1 000 ㎒	100 ㎑ to 120 ㎑
> 1 000 ㎒	1 ㎒

Notes:

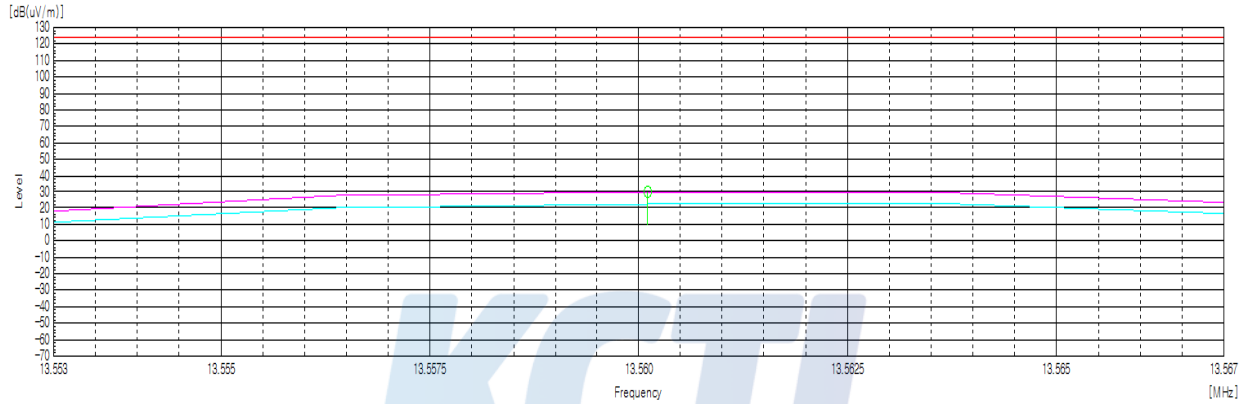
1. *f* <30 ㎒, extrapolation factor of 40 dB/decade of distance. F_d = 40log(D_m/Ds)
   f ≥30 ㎒, extrapolation factor of 20 dB/decade of distance. F_d = 20log(D_m/Ds)
   Where:
   F_d= Distance factor in dB
   D_m= Measurement distance in meters
   D_s= Specification distance in meters
2. According to part 15.31(f)(2), an extrapolation factor of 40 dB/decade is applied because measured distance of radiated emission is 3 m.
3. Factors(dB) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) + or F_d(dB)
4. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
5. All measurements were recorded using a spectrum analyzer employing a quasi-peak detector.

Test results for fundamental

13.553-13.567 MHz

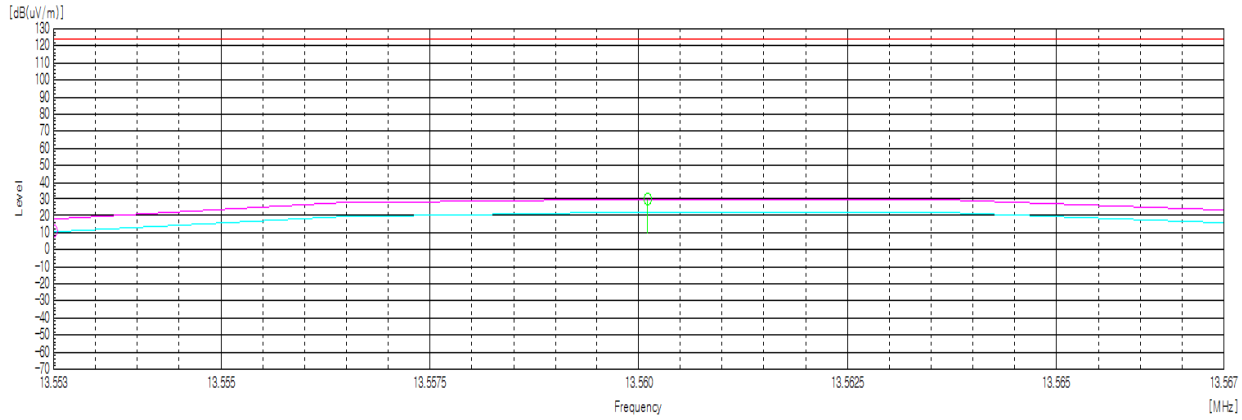
12 V

Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data									
13.56	H	78.20	-37.49	-32.67	19.16	-	27.20	124.00	96.80
Face On/Face Off									



48 V

Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data									
13.56	H	74.70	-37.49	-32.67	19.16	-	23.70	124.00	100.30
Face On/Face Off									



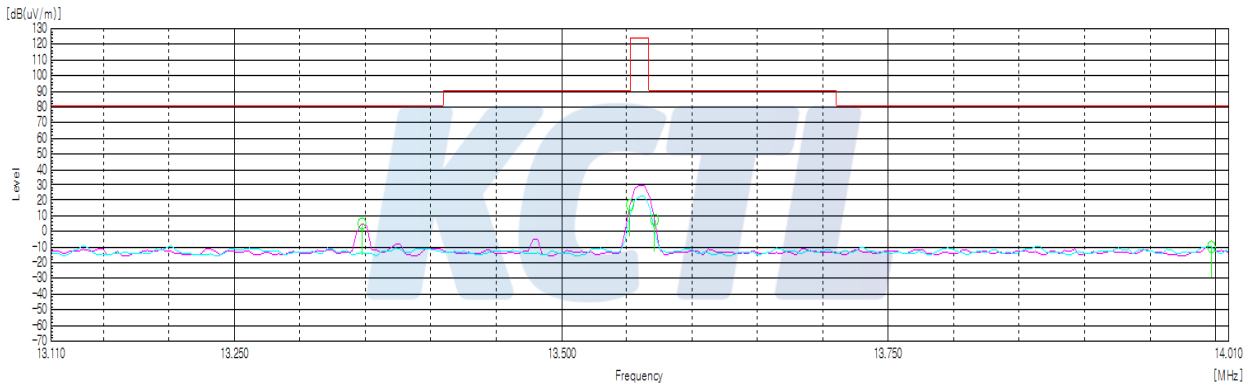
Test result for in-band & out-band(9 kHz to 30 MHz)

13.110-14.010 MHz

12 V

Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data									
13.35	H	38.60	-37.49	-32.67	19.16	-	-12.40	80.50	92.90
13.55	H	60.80	-37.49	-32.67	19.16	-	9.80	90.50	80.70
13.57	H	48.90	-37.49	-32.67	19.16	-	-2.10	90.50	92.60
14.00	H	36.70	-37.39	-32.67	19.16	-	-14.20	80.50	94.70

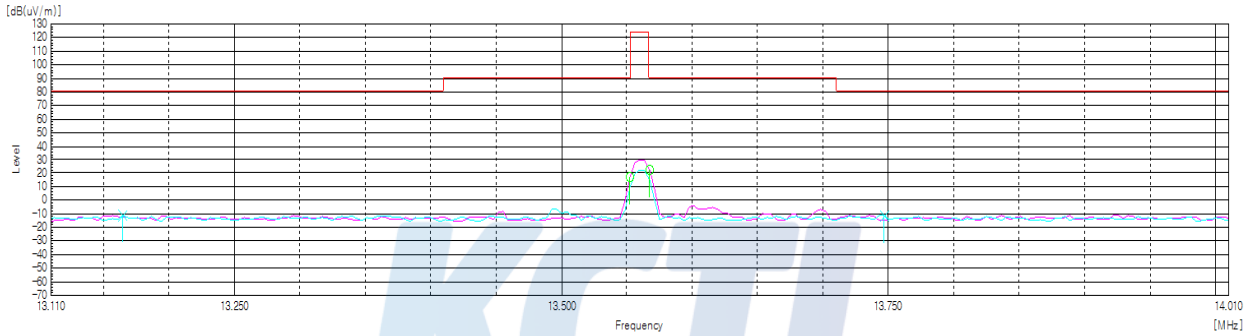
Face On/Face Off



48 V

Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data									
13.17	V	36.70	-37.49	-32.67	19.16	-	-14.30	80.50	94.80
13.55	H	62.10	-37.49	-32.67	19.16	-	11.10	90.50	79.40
13.57	H	57.10	-37.49	-32.67	19.16	-	6.10	90.50	84.40
13.75	V	35.10	-37.49	-32.67	19.16	-	-15.90	80.50	96.40

Face On/Face Off

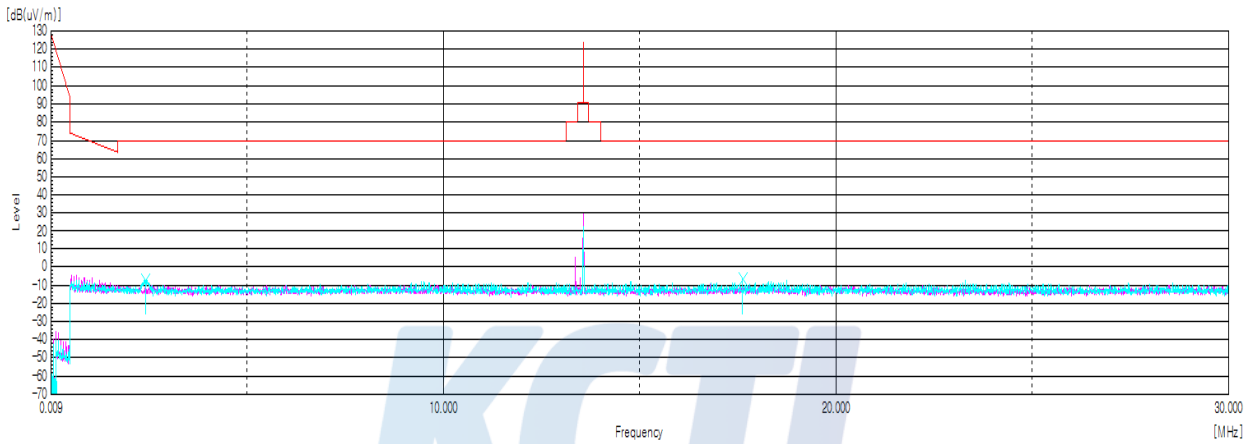


Test results (9 ㎑ to 30 ㎒)

12 V

Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data									
2.41	V	43.80	-38.51	-32.71	19.32	-	-8.10	69.50	77.60
17.62	V	36.70	-37.46	-32.68	19.54	-	-13.90	69.50	83.40

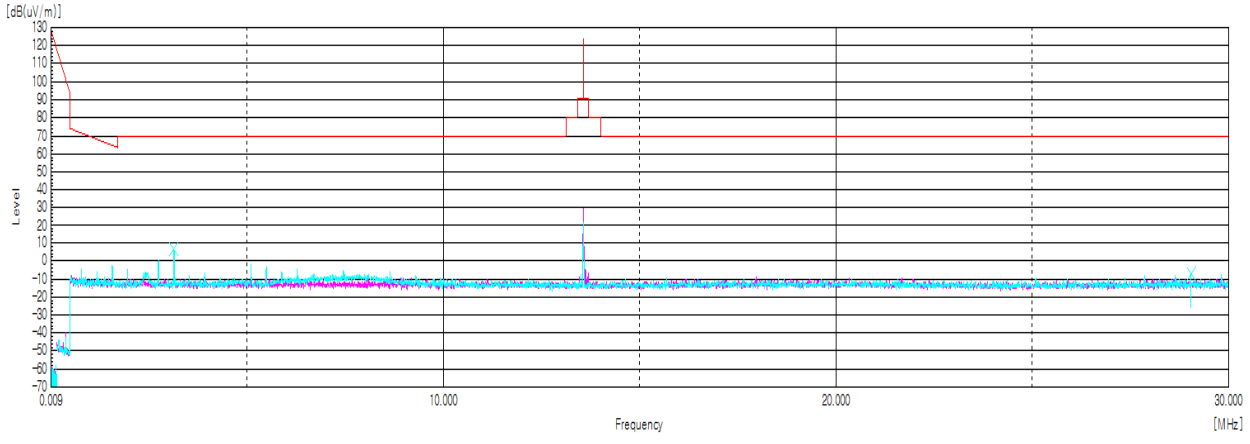
Face On/Face Off



48 V

Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data									
3.14	V	56.90	-38.43	-32.70	19.33	-	5.10	69.50	64.40
29.03	V	38.10	-37.63	-32.69	20.12	-	-12.10	69.50	81.60

Face On/Face Off

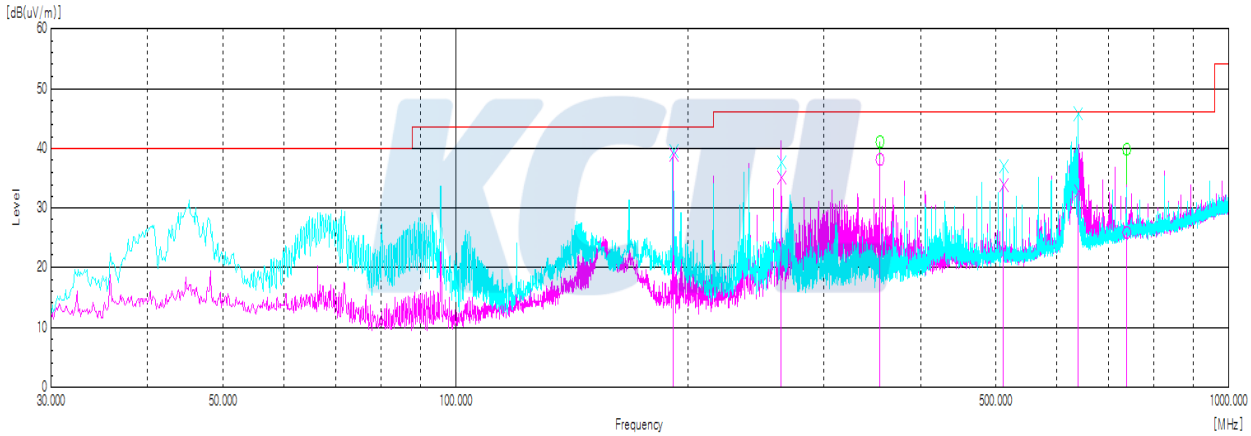


Test results (Below 1000 ㎒)

12 V

Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data									
191.38	V	51.20	3.04	-30.50	15.26	-	39.00	43.50	4.50
264.01	V	45.20	3.61	-32.09	18.48	-	35.20	46.00	10.80
354.22	H	45.20	4.25	-31.81	20.56	-	38.20	46.00	7.80
510.64	V	36.00	5.20	-30.84	23.44	-	33.80	46.00	12.20
638.19	V	32.40	5.90	-30.25	24.75	-	32.80	46.00	13.20
737.37	H	23.40	6.35	-29.01	25.26	-	26.00	46.00	20.00

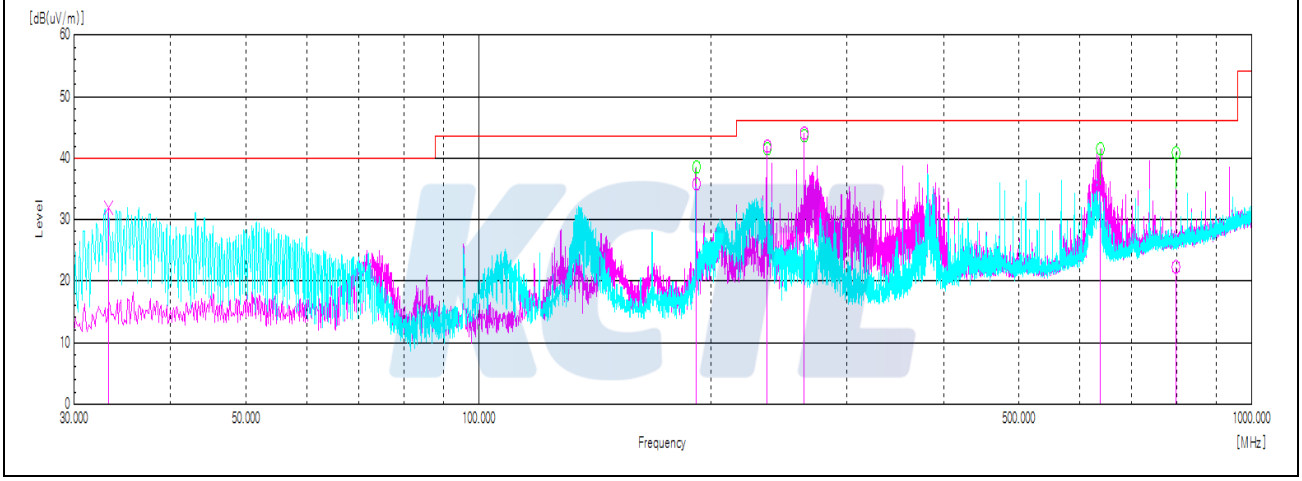
Face On/Face Off



48 V

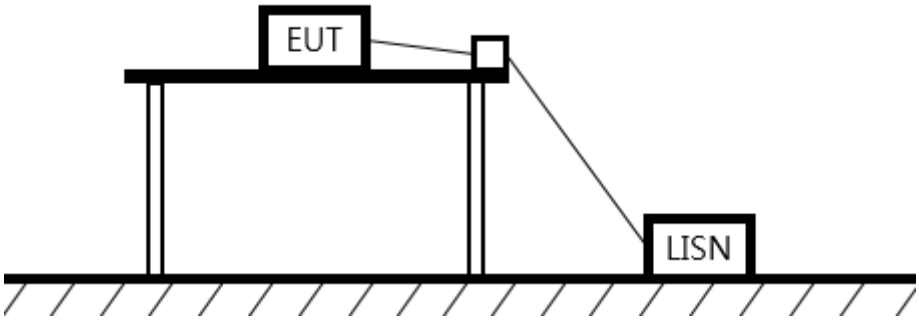
Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data									
33.27	V	45.10	1.15	-37.52	23.17	-	31.90	40.00	8.10
191.38	H	47.90	3.04	-30.50	15.26	-	35.70	43.50	7.80
236.13	H	53.10	3.40	-31.90	17.40	-	42.00	46.00	4.00
264.01	H	54.00	3.61	-32.09	18.48	-	44.00	46.00	2.00
636.98	H	35.20	5.90	-30.25	24.75	-	35.60	46.00	10.40
798.00	H	19.20	6.59	-29.08	25.69	-	22.40	46.00	23.60

Face On/Face Off



6.4. AC Conducted emission

Test setup



Limit

According to 15.207(a), RSS-Gen Issue 5 (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.

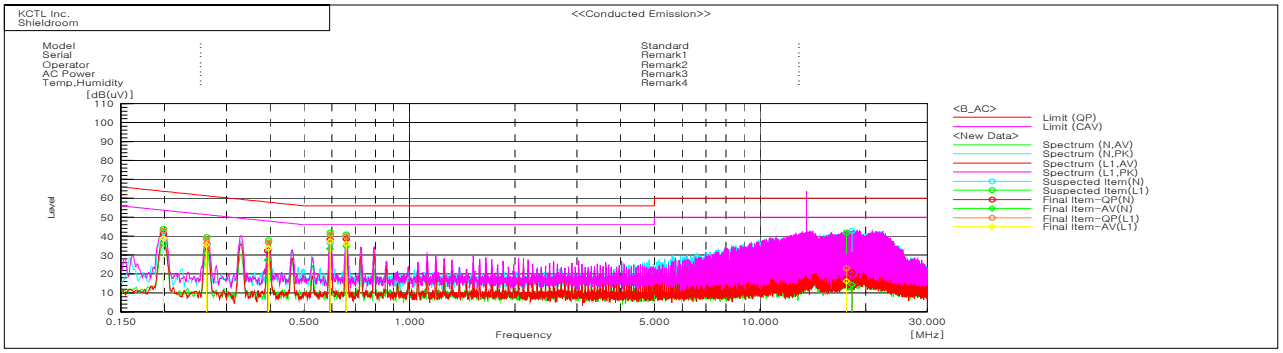
Frequency of Emission (㎒)	Conducted limit (dBμV/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

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 ㅡ 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.

Test results

12 V



Final Result

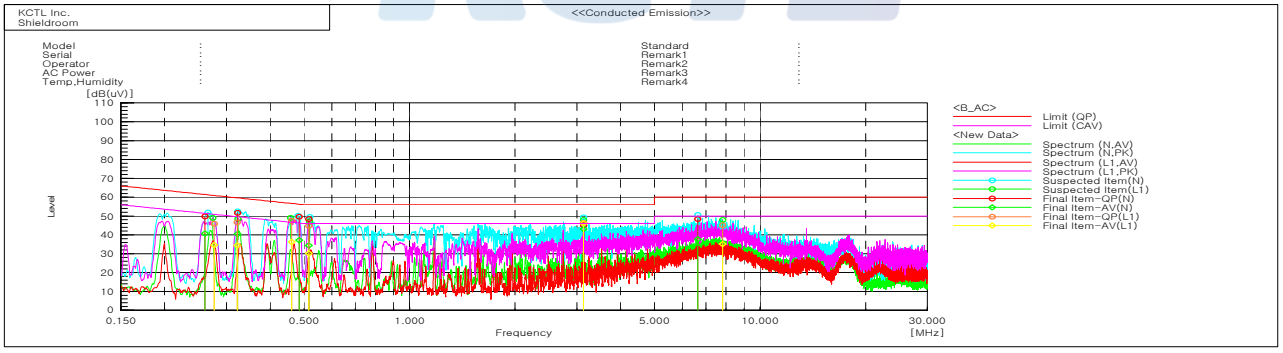
--- N Phase ---

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	0.19854	31.1	26.2	9.9	41.0	36.1	63.7	53.7	22.7	17.6
2	0.26394	26.0	21.5	9.6	35.6	31.1	61.3	51.3	25.7	20.2
3	0.39392	22.5	17.6	9.8	32.3	27.4	58.0	48.0	25.7	20.6
4	0.59331	28.2	23.5	9.9	38.1	33.4	56.0	46.0	17.9	12.6
5	0.65971	28.8	24.9	9.8	38.6	34.7	56.0	46.0	17.4	11.3
6	18.29456	10.8	4.3	10.0	20.8	14.3	60.0	50.0	39.2	35.7

--- 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	0.19837	32.9	29.0	10.0	42.9	39.0	63.7	53.7	20.8	14.7
2	0.2631	28.8	25.7	9.7	38.5	35.4	61.3	51.3	22.8	15.9
3	0.39507	26.7	23.7	9.9	36.6	33.6	58.0	48.0	21.4	14.4
4	0.59377	30.8	27.5	9.9	40.7	37.4	56.0	46.0	15.3	8.6
5	0.65997	29.9	26.1	9.9	39.8	36.0	56.0	46.0	16.2	10.0
6	17.62295	12.9	6.0	10.1	23.0	16.1	60.0	50.0	37.0	33.9

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	0.26094	40.2	31.1	9.6	49.8	40.7	61.4	51.4	11.6	10.7
2	0.3232	42.0	30.7	9.7	51.7	40.4	59.6	49.6	7.9	9.2
3	0.48377	39.8	27.2	9.9	49.7	37.1	56.3	46.3	6.6	9.2
4	0.51591	38.5	24.5	9.9	48.4	34.4	56.0	46.0	7.6	11.6
5	3.13517	35.5	33.4	9.7	45.2	43.1	56.0	46.0	10.8	2.9
6	6.64536	38.6	27.9	9.7	48.3	37.6	60.0	50.0	11.7	12.4

--- 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	0.2772	36.2	24.9	9.7	45.9	34.6	60.9	50.9	15.0	16.3
2	0.322	36.9	24.6	9.8	46.7	34.4	59.7	49.7	13.0	15.3
3	0.46082	37.5	26.3	9.9	47.4	36.2	56.7	46.7	9.3	10.5
4	0.51528	35.0	20.3	9.9	44.9	30.2	56.0	46.0	11.1	15.8
5	3.13341	36.7	36.4	9.7	46.4	46.1	56.0	46.0	9.6	-0.1
6	7.82268	35.2	25.3	9.8	45.0	35.1	60.0	50.0	15.0	14.9

7. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Spectrum Analyzer	R & S	FSV30	100808	19.07.30	20.07.30
Temp & Humid Chamber	ESPEC CORP	SH-661	92004048	19.01.04	20.01.04
EMI TEST RECEIVER	R & S	ESCI7	100732	19.08.22	20.08.22
Bi-Log Antenna	SCHWARZBECK	VULB 9168	583	18.05.04	20.05.04
Amplifier	SONOMA INSTRUMENT	310N	284608	19.08.22	20.08.22
COAXIAL FIXED ATTENUATOR	Agilent	8491B-003	2708A18758	18.05.04	20.05.04
LOOP Antenna	R & S	HFH2-Z2	100355	18.09.28	20.09.28
Antenna Mast	Innco Systems	MA4640-XP-ET	-	-	-
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
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
Cable Assembly	RadiAll	2301761768000PJ	1724.659	-	-
Cable Assembly	gigalane	RG-400	-	-	-
Cable Assembly	HUER+SUHNER	SUCOFLEX 104	MY4342/4	-	-

End of test report