



TEST REPORT

Eurofins KCTL Co.,Ltd. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-70-5008-1021 FAX: 82-505-299-8311 www.kctl.co.kr	Report No.: KR23-SRF0195 Page (1) of (33)	KCTL
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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 : 2023-05-01

2. Use of Report : FCC Class II permissive change

3. Name of Product / Model : BioStation3 / BS3-APWB

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

5. FCC ID : TKWBS3-APWB

6. IC Certificate No. : 23080-BS3APWB

7. Date of Test : 2023-06-29 to 2023-07-17

8. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing
 (Address:65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea)

9. Test method used : FCC Part 15 Subpart C, 15.225
 RSS-210 Issue 10 April 2020
 RSS-Gen Issue 5 February 2021

10. Test Result : Refer to the test result in the test report

Affirmation	Tested by Name : Eunseong Lim (Signature) 	Technical Manager Name : Heesu Ahn (Signature)
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2023-08-03

Eurofins KCTL Co.,Ltd.

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 Eurofins KCTL Co.,Ltd.

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REPORT REVISION HISTORY

Date	Revision	Page No
2023-08-03	Originally issued	-

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General remarks for test reports

Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

☐ Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:

Procedure number, issue date and title:

Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

☒ Statement not required by the standard or client used for type testing

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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, Seongnam-si, Gyeonggi-do 13554 Korea (Republic Of)
 Laboratory : Eurofins KCTL Co.,Ltd.
 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
 CAB Identifier: KR0040, ISED Number: 8035A
 KOLAS No.: KT231

2. Device information

Equipment under test : BioStation3
 Model : BS3-APWB
 Frequency range : 2 402 MHz ~ 2 480 MHz (Bluetooth Low Energy)
 2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20)
 13.56 MHz (NFC)
 125 kHz (RFID)
 Modulation technique : GFSK (Bluetooth Low Energy)
 DSSS, OFDM(802.11b/g/n_HT20), ASK (NFC, RFID)
 Number of channels : 40 ch (Bluetooth Low Energy), 11 ch (802.11b/g/n_HT20)
 1 ch (NFC, RFID)
 Power source : DC 12 V, DC 24 V, PoE 48 V
 Antenna specification : PCB antenna (Bluetooth Low Energy)
 FPCB Antenna(802.11b/g/n_HT20)
 PCB Loop antenna (NFC)
 Coil antenna (RFID)
 Antenna gain : -2.42 dBi (Bluetooth Low Energy)
 0.63 dBi (802.11b/g/n_HT20)
 Software version : 1.0.0
 Hardware version : 1.0.0
 Operation temperature : -20 °C ~ 50 °C
 Test device serial No. : Conducted : 547841650
 Radiated : 538153331

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
N/A	-	-	-	-

2.2. Frequency/channel operations

This device contains the following capabilities:

NFC, RFID(125 kHz), Bluetooth Low Energy, WIFI (802.11b/g/n HT20)

Frequency (MHz)
13.56

Table 2.2.1. NFC mode

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 transmitter has permanently attached PCB Loop antenna (internal antenna) on board.

4. Summary of tests

FCC Part section(s)	IC Rule reference	Parameter	Test Condition	Test results
15.225(a)	RSS-210 B.6 (I)	In-band Fundamental Emission	Radiated	Pass
15.225(b), (c)	RSS-210 B.6 (II), (III)	In-band Spurious Emission		Pass
15.225(d) 15.209	RSS-210 B.6 (IV) RSS-Gen Issue 9 (8.9)	Out-of-band Spurious Emission		Pass
15.225(e)	RSS-210 B.6 (b)	Frequency Stability Tolerance	Conducted	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: (N/T: Not Tested, N/A: Not Applicable)

- 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.
- The fundamental of the EUT was investigated in three orthogonal orientations X, Y, Z It was determined that **Y** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **Y** orientation
- The test procedure(s) in this report were performed in accordance as following.
 - ANSI C63.10-2013
- The radiated test was performed with and without passive tag. The test results shown in the following sections represent the worst case emissions.
 - Worst Case : Without passive tag

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 or 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.

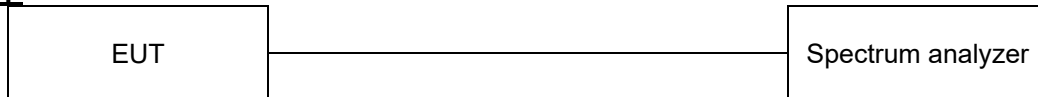
Parameter	Expanded uncertainty ($\pm$)	
Radiated spurious emissions	9 kHz ~ 30 MHz	2.3 dB
	30 MHz ~ 1 000 MHz	2.5 dB
	1 000 MHz ~ 18 000 MHz	4.7 dB
	Above 18 000 MHz	4.8 dB
Conducted Emissions	150 kHz ~ 30 MHz	2.7 dB



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

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Test settings

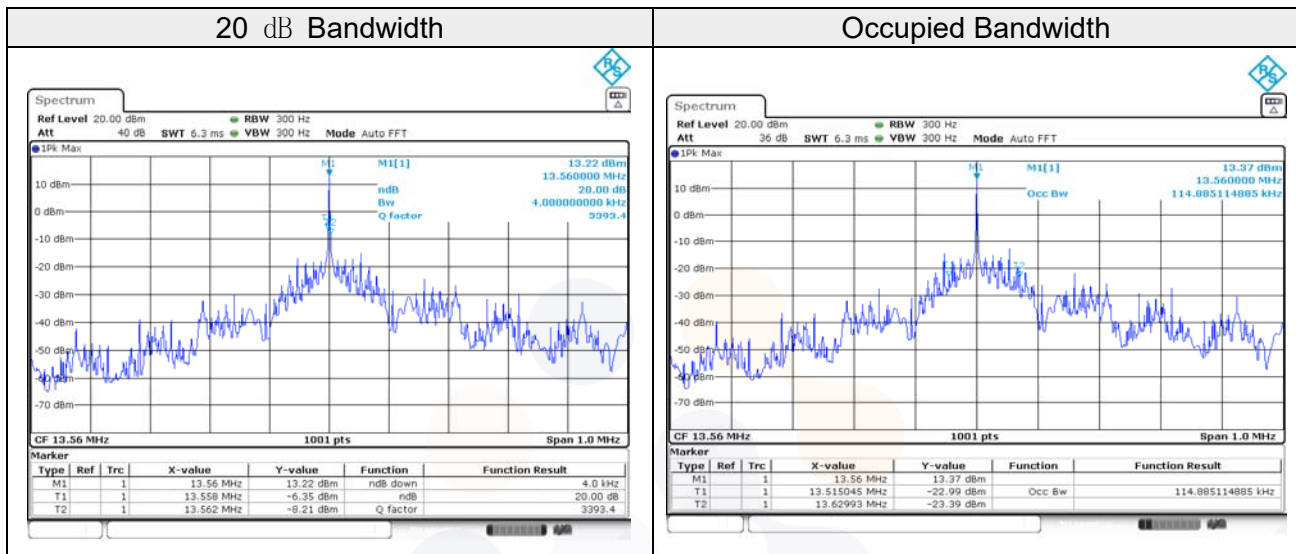
The occupied bandwidth is measured as the width of the spectral envelope of the modulated signal, at an amplitude level reduced from a reference value by a specified ratio (or in decibels, a specified number of dB down from the reference value). Typical ratios, expressed in dB, are -6 dB, -20 dB, and -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 $\geq 3 \times$ 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

[DC 12 V]

Frequency [MHz]	20 dB Bandwidth [MHz]		Limit [MHz]	20 dB Bandwidth [kHz]	Occupied Bandwidth (99 % BW) [kHz]
13.56	Lowest Frequency	13.558 0	13.110 0	4.00	114.89
	Highest Frequency	13.562 0	14.010 0		

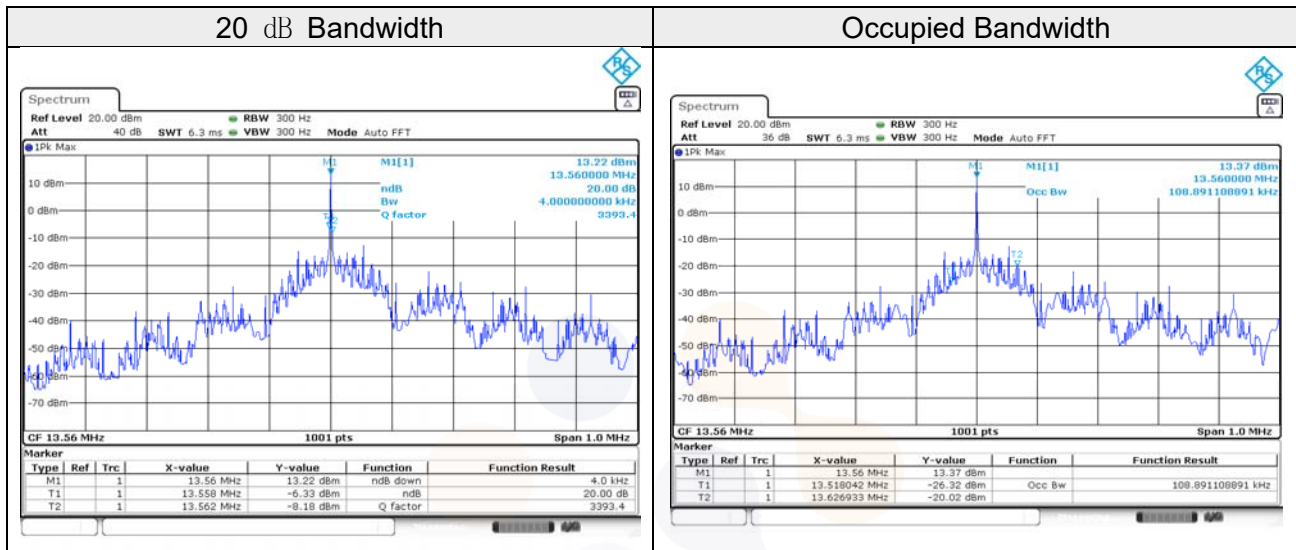


Note:

Because the measured signal is CW/CW-like, adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW

[DC 24 V]

Frequency [MHz]	20 dB Bandwidth [MHz]		Limit [MHz]	20 dB Bandwidth [kHz]	Occupied Bandwidth (99 % BW) [kHz]
13.56	Lowest Frequency	13.5580	13.110 0	4.00	108.89
	Highest Frequency	13.5620	14.010 0		

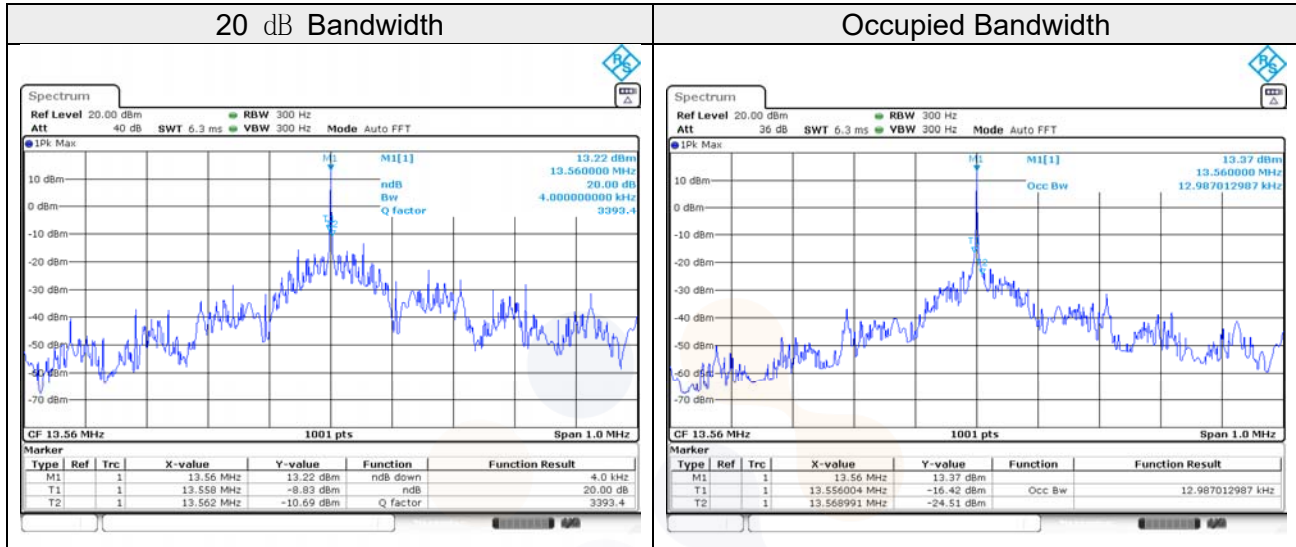


Note:

Because the measured signal is CW/CW-like, adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW

[PoE 48 V]

Frequency [MHz]	20 dB Bandwidth [MHz]		Limit [MHz]	20 dB Bandwidth [kHz]	Occupied Bandwidth (99 % BW) [kHz]
13.56	Lowest Frequency	13.558 0	13.110 0	4.00	12.99
	Highest Frequency	13.562 0	14.010 0		

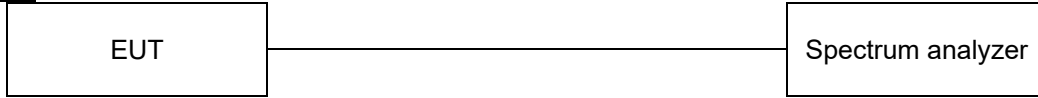


Note:

Because the measured signal is CW/CW-like, adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW

6.2. Frequency tolerance

Test setup



Limit

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

[DC 12 V]

Voltage [%]	Voltage [V]	TEMP [°C]	Maintaining time	Measure frequency [Hz]	Frequency deviation [Hz]	Deviation [%]
100	12.00	20	Startup	13 559 652	348.0	-0.002 57
			2 minutes	13 559 887	113.0	-0.000 83
			5 minutes	13 559 835	165.0	-0.001 22
			10 minutes	13 559 928	72.0	-0.000 53
		-20	Startup	13 558 805	1195.0	-0.008 81
			2 minutes	13 558 764	1236.0	-0.009 12
			5 minutes	13 559 035	965.0	-0.007 12
			10 minutes	13 558 778	1222.0	-0.009 01
		-10	Startup	13 559 109	891.0	-0.006 57
			2 minutes	13 559 122	878.0	-0.006 48
			5 minutes	13 559 199	801.0	-0.005 91
			10 minutes	13 559 390	610.0	-0.004 50
		0	Startup	13 559 640	360.0	-0.002 66
			2 minutes	13 559 619	381.0	-0.002 81
			5 minutes	13 559 778	222.0	-0.001 64
			10 minutes	13 559 815	185.0	-0.001 36
		10	Startup	13 559 866	134.0	-0.000 99
			2 minutes	13 559 790	210.0	-0.001 55
			5 minutes	13 559 813	187.0	-0.001 38
			10 minutes	13 559 835	165.0	-0.001 22
		25	Startup	13 559 752	248.0	-0.001 83
			2 minutes	13 559 718	282.0	-0.002 08
			5 minutes	13 559 838	162.0	-0.001 20
			10 minutes	13 559 845	155.0	-0.001 14
		30	Startup	13 559 562	438.0	-0.003 23
			2 minutes	13 559 665	335.0	-0.002 47
			5 minutes	13 559 530	470.0	-0.003 47
			10 minutes	13 559 608	392.0	-0.002 89
		40	Startup	13 559 715	285.0	-0.002 10
			2 minutes	13 559 643	357.0	-0.002 63
			5 minutes	13 559 531	469.0	-0.003 46
			10 minutes	13 559 612	388.0	-0.002 86
		50	Startup	13 560 000	0.0	0.000 00
			2 minutes	13 559 964	36.0	-0.000 27
			5 minutes	13 560 200	-200.0	0.001 48
			10 minutes	13 560 018	-18.0	0.000 13
85	10.20	20	Startup	13 559 799	201.0	-0.001 48
			2 minutes	13 559 694	306.0	-0.002 26
			5 minutes	13 559 312	688.0	-0.005 07
			10 minutes	13 559 032	968.0	-0.007 14
115	13.80	20	Startup	13 559 813	187.0	-0.001 38
			2 minutes	13 559 685	315.0	-0.002 32
			5 minutes	13 559 231	769.0	-0.005 67
			10 minutes	13 559 643	357.0	-0.002 63

[DC 24 V]

Voltage	Voltage	TEMP	Maintaining time	Measure frequency	Frequency deviation	Deviation
[%]	[V]	[°C]		[Hz]	[Hz]	[%]
100	24.00	20(Ref.)	Startup	13 559 913	87.0	-0.000 64
			2 minutes	13 560 148	-148.0	0.001 09
			5 minutes	13 560 096	-96.0	0.000 71
			10 minutes	13 560 189	-189.0	0.001 39
		-20	Startup	13 559 066	934.0	-0.006 89
			2 minutes	13 559 025	975.0	-0.007 19
			5 minutes	13 559 296	704.0	-0.005 19
			10 minutes	13 559 039	961.0	-0.007 09
		-10	Startup	13 559 370	630.0	-0.004 65
			2 minutes	13 559 383	617.0	-0.004 55
			5 minutes	13 559 460	540.0	-0.003 98
			10 minutes	13 559 651	349.0	-0.002 57
		0	Startup	13 559 901	99.0	-0.000 73
			2 minutes	13 559 880	120.0	-0.000 89
			5 minutes	13 560 039	-39.0	0.000 29
			10 minutes	13 560 076	-76.0	0.000 56
		10	Startup	13 560 127	-127.0	0.000 94
			2 minutes	13 560 051	-51.0	0.000 38
			5 minutes	13 560 074	-74.0	0.000 55
			10 minutes	13 560 096	-96.0	0.000 71
		25	Startup	13 560 013	-13.0	0.000 10
			2 minutes	13 559 979	21.0	-0.000 16
			5 minutes	13 560 099	-99.0	0.000 73
			10 minutes	13 560 106	-106.0	0.000 78
		30	Startup	13 559 823	177.0	-0.001 31
			2 minutes	13 559 926	74.0	-0.000 55
			5 minutes	13 559 791	209.0	-0.001 54
			10 minutes	13 559 869	131.0	-0.000 97
		40	Startup	13 559 976	24.0	-0.000 18
			2 minutes	13 559 904	96.0	-0.000 71
			5 minutes	13 559 792	208.0	-0.001 53
			10 minutes	13 559 873	127.0	-0.000 94
		50	Startup	13 560 261	-261.0	0.001 93
			2 minutes	13 560 225	-225.0	0.001 66
			5 minutes	13 560 461	-461.0	0.003 40
			10 minutes	13 560 279	-279.0	0.002 06
85	20.40	20	Startup	13 560 060	-60.0	0.000 44
			2 minutes	13 559 955	45.0	-0.000 33
			5 minutes	13 559 573	427.0	-0.003 15
			10 minutes	13 559 293	707.0	-0.005 21
115	27.60	20	Startup	13 560 074	-74.0	0.000 55
			2 minutes	13 559 946	54.0	-0.000 40
			5 minutes	13 559 492	508.0	-0.003 75
			10 minutes	13 559 904	96.0	-0.000 71

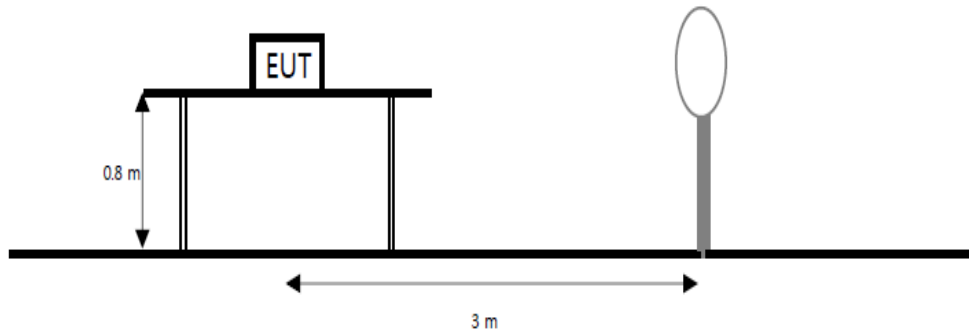
[PoE 48 V]

Voltage	Voltage	TEMP	Maintaining time	Measure frequency	Frequency deviation	Deviation
[%]	[V]	[°C]		[Hz]	[Hz]	[%]
100	48.00	20(Ref.)	Startup	13 559 937	63.0	-0.000 47
			2 minutes	13 560 074	-74.0	0.000 55
			5 minutes	13 560 022	-22.0	0.000 16
			10 minutes	13 560 115	-115.0	0.000 85
		-20	Startup	13 558 992	1008.0	-0.007 43
			2 minutes	13 558 951	1049.0	-0.007 74
			5 minutes	13 559 222	778.0	-0.005 74
			10 minutes	13 558 965	1035.0	-0.007 63
		-10	Startup	13 559 296	704.0	-0.005 19
			2 minutes	13 559 309	691.0	-0.005 10
			5 minutes	13 559 386	614.0	-0.004 53
			10 minutes	13 559 577	423.0	-0.003 12
		0	Startup	13 559 827	173.0	-0.001 28
			2 minutes	13 559 806	194.0	-0.001 43
			5 minutes	13 559 965	35.0	-0.000 26
			10 minutes	13 560 002	-2.0	0.000 02
		10	Startup	13 560 053	-53.0	0.000 39
			2 minutes	13 559 977	23.0	-0.000 17
			5 minutes	13 560 000	0.0	0.000 00
			10 minutes	13 560 022	-22.0	0.000 16
		25	Startup	13 559 939	61.0	-0.000 45
			2 minutes	13 559 905	95.0	-0.000 70
			5 minutes	13 560 025	-25.0	0.000 18
			10 minutes	13 560 032	-32.0	0.000 24
		30	Startup	13 559 749	251.0	-0.001 85
			2 minutes	13 559 852	148.0	-0.001 09
			5 minutes	13 559 717	283.0	-0.002 09
			10 minutes	13 559 795	205.0	-0.001 51
		40	Startup	13 559 902	98.0	-0.000 72
			2 minutes	13 559 830	170.0	-0.001 25
			5 minutes	13 559 718	282.0	-0.002 08
			10 minutes	13 559 799	201.0	-0.001 48
		50	Startup	13 560 187	-187.0	0.001 38
			2 minutes	13 560 151	-151.0	0.001 11
			5 minutes	13 560 387	-387.0	0.002 85
			10 minutes	13 560 205	-205.0	0.001 51
85	40.80	20	Startup	13 559 986	14.0	-0.000 10
			2 minutes	13 559 881	119.0	-0.000 88
			5 minutes	13 559 499	501.0	-0.003 70
			10 minutes	13 559 219	781.0	-0.005 76
115	55.20	20	Startup	13 560 000	0.0	0.000 00
			2 minutes	13 559 872	128.0	-0.000 94
			5 minutes	13 559 418	582.0	-0.004 29
			10 minutes	13 559 830	170.0	-0.001 25

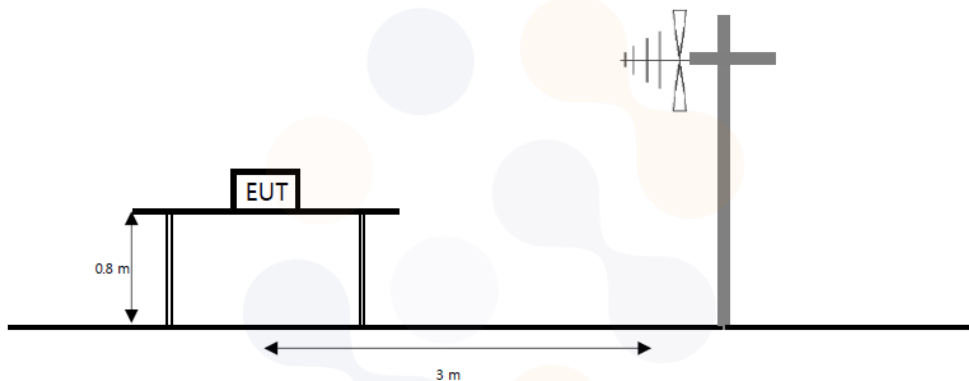
6.3. Radiated spurious emissions

Test setup

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



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



Limit

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

15.225 (b), RSS-210 B.6.(a).(ii) 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.

15.225 (c), RSS-210 B.6 (a).(iii) 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.

15.225 (d), RSS-210 B.6.(a).(iv) RSS-Gen Issue 9 (8.9) 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.

Frequency (MHz)	Field Strength ($\mu V/m$)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30(29.54 dB $\mu V/m$)	30
30.0-88.0	100(40 dB $\mu V/m$)	3
88-216	150(43.5 dB $\mu V/m$)	3
216-960	200 (46 dB $\mu V/m$)	3
Above 960	500 (53.98 dB $\mu V/m$)	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 $\geq 3 \times$ 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 kHz to 150 kHz	200 Hz to 300 Hz
0.15 MHz to 30 MHz	9 kHz to 10 kHz
30 MHz to 1 000 MHz	100 kHz to 120 kHz
> 1 000 MHz	1 MHz

Notes:

1. $f < 30$ MHz, extrapolation factor of 40 dB/decade of distance. $F_d = 40 \log(D_m/D_s)$
 $f \geq 30$ MHz, extrapolation factor of 20 dB/decade of distance. $F_d = 20 \log(D_m/D_s)$
 Where:
 F_d = Distance factor in dB
 D_m = Measurement distance in meters
 D_s = Specification distance in meters
2. Measurements were performed at 3m and the data was extrapolated to the specified measurement distance of 30m using the square of an inverse linear distance extrapolation factor (40 dB/decade) as specified in § 15.31(f)(2). Extrapolation Factor = $40 \log_{10}(30/3) = 40$ dB.
3. (dB) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) + or F_d (dB)
4. Result = Reading + Cable loss + Amp gain + Ant. factor - Distance factor
5. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
6. All measurements were recorded using a spectrum analyzer employing a quasi-peak detector.
7. Below 30 MHz 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.
8. Face-on = Parallel, Face-off = Perpendicular

[DC 12 V]

Test results for fundamental

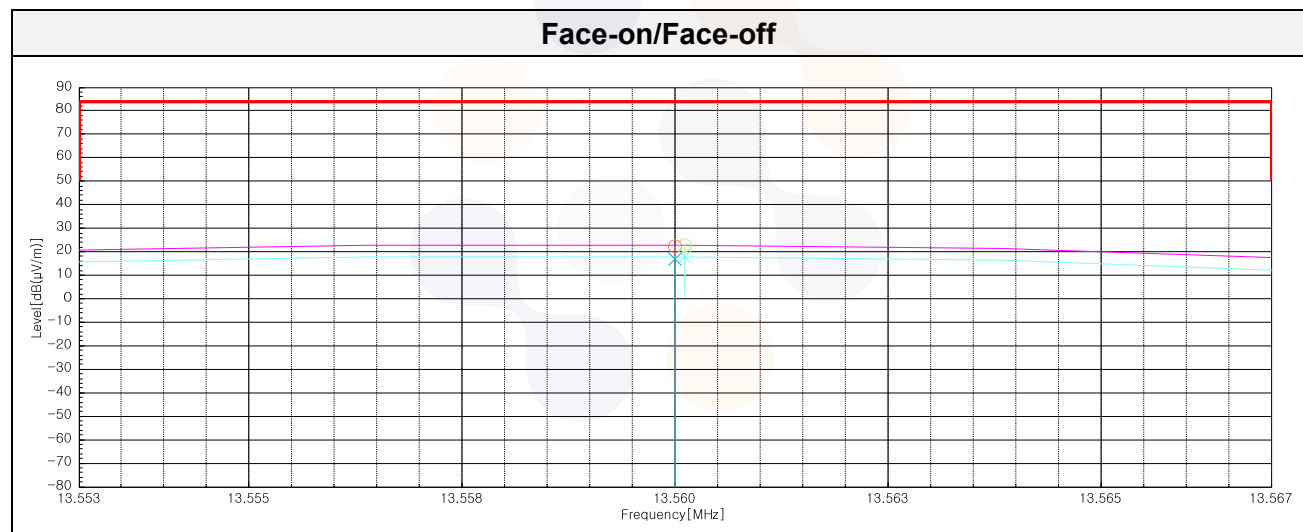
15.225 (a), RSS-210 B.6.(a).(i) 13.553-13.567 MHz

[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
13.56	74.30	20.31	-31.13	40.00	23.48	84.00	60.52

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
13.56	68.90	20.31	-31.13	40.00	18.08	84.00	65.92



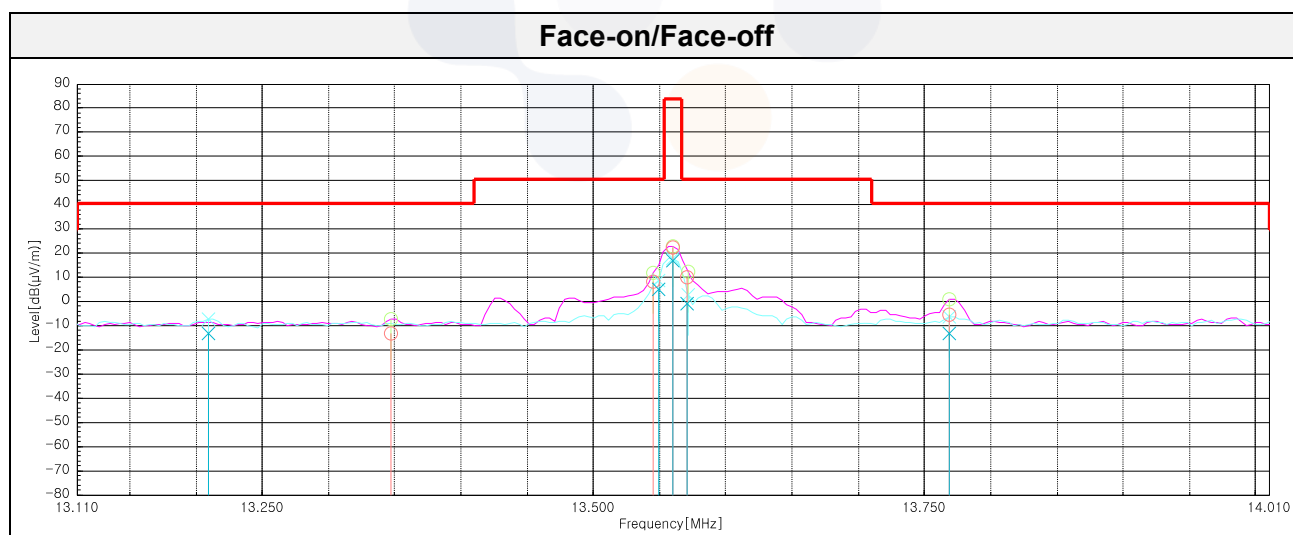
Test results for in-band & out-band (9 kHz to 30 MHz)
15.225 (b,c), RSS-210 B.6.(a).(ii, iii) 13.110-14.010 MHz

[Face-on]

Frequency (MHz)	Reading (dB(μV))	Antenna Factor (dB)	Amp. + Cable (dB)	Distance Factor (dB)	Result (dB(μV/m))	Limit (dB(μV/m))	Margin (dB)
Quasi peak data							
13.35	38.80	20.30	-31.14	40.00	-12.04	40.50	52.54
13.55	60.10	20.31	-31.13	40.00	9.28	50.50	41.22
13.57	62.10	20.31	-31.13	40.00	11.28	50.50	39.22
13.77	46.40	20.33	-31.14	40.00	-4.41	40.50	44.91

[Face-off]

Frequency (MHz)	Reading (dB(μV))	Antenna Factor (dB)	Amp. + Cable (dB)	Distance Factor (dB)	Result (dB(μV/m))	Limit (dB(μV/m))	Margin (dB)
Quasi peak data							
13.21	38.70	20.29	-31.15	40.00	-12.16	40.50	52.66
13.55	57.10	20.31	-31.13	40.00	6.28	50.50	44.22
13.57	51.10	20.31	-31.13	40.00	0.28	50.50	50.22
13.77	38.80	20.33	-31.14	40.00	-12.01	40.50	52.51



Note. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to $Y-51.5 = Z$ dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit.

Test results (9 kHz to 30 MHz)

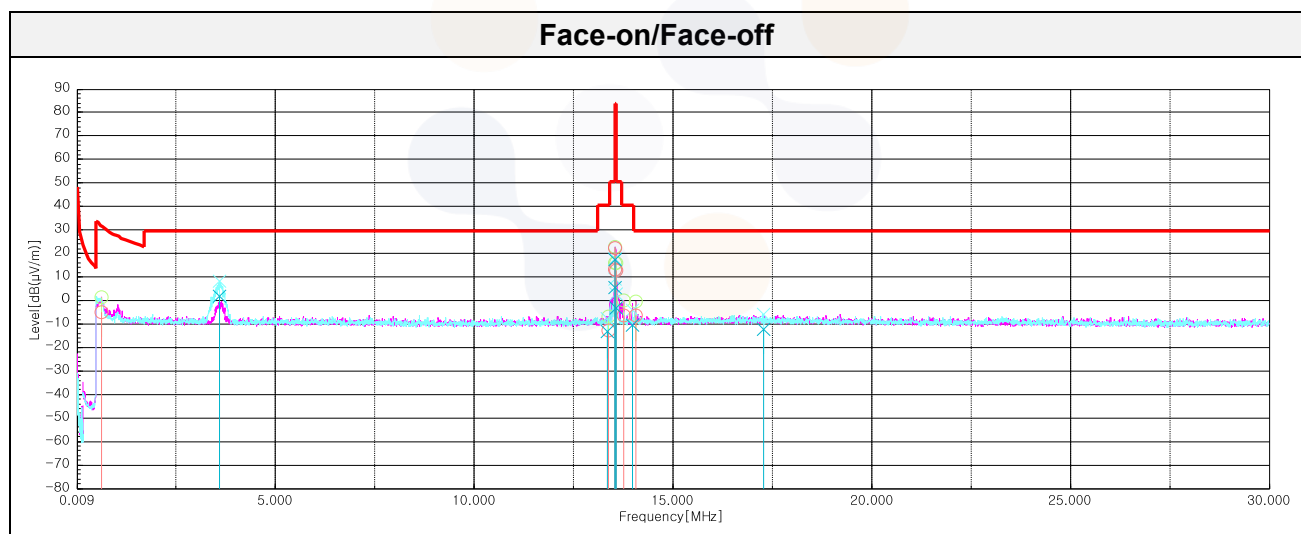
15.225 (d), RSS-210 B.6.(a).(iv) 0.009-30 MHz

[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
0.62	47.30	19.92	-32.20	40.00	-4.98	32.50	37.48
19.33	38.10	20.66	-30.86	40.00	-12.10	29.54	41.64

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
3.62	55.30	20.13	-31.72	40.00	3.71	32.50	28.79
19.99	38.60	20.70	-30.85	40.00	-11.55	29.54	41.09

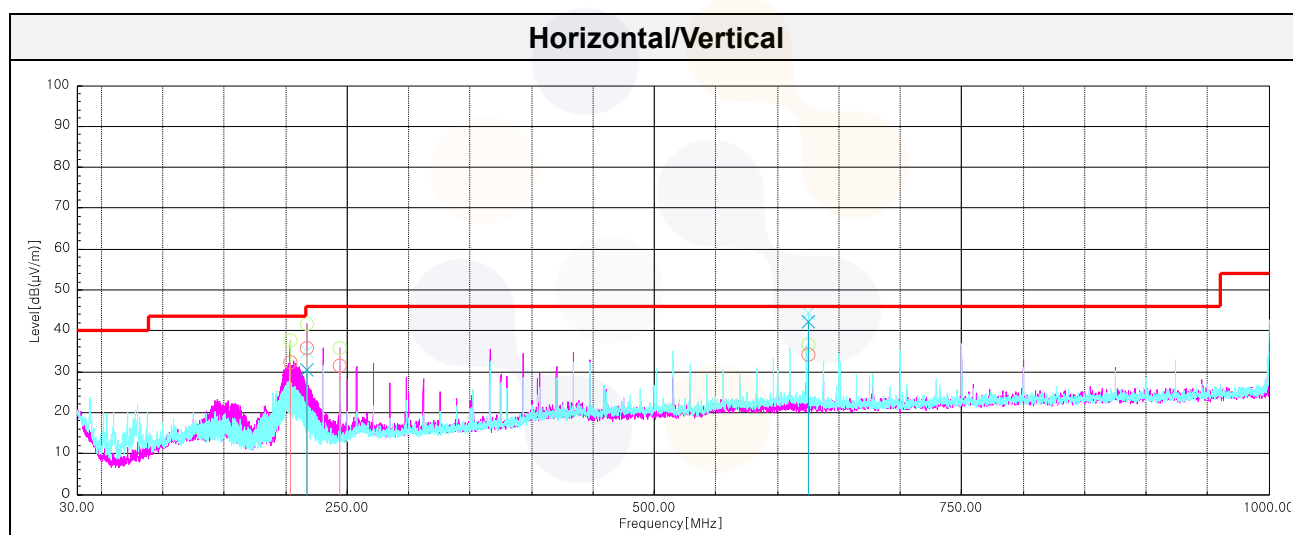


Note. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to $Y-51.5 = Z$ dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit.

Test results (Below 1 000 MHz)

15.225 (d), RSS-210 B.6.(a).(iv) 30-1 000 MHz

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data								
203.39	H	48.30	15.37	-30.26	-	33.41	40.00	6.59
216.97	H	52.10	14.95	-30.34	-	36.71	43.50	6.79
244.13 ¹⁾	H	45.10	17.72	-30.28	-	32.54	46.00	13.46
216.97	V	46.90	14.95	-30.34	-	31.51	46.00	14.49
624.97	V	48.30	24.55	-29.73	-	43.12	46.00	2.88
625.10	H	40.10	24.55	-29.73	-	34.92	46.00	11.08



[DC 24 V]

Test results for fundamental

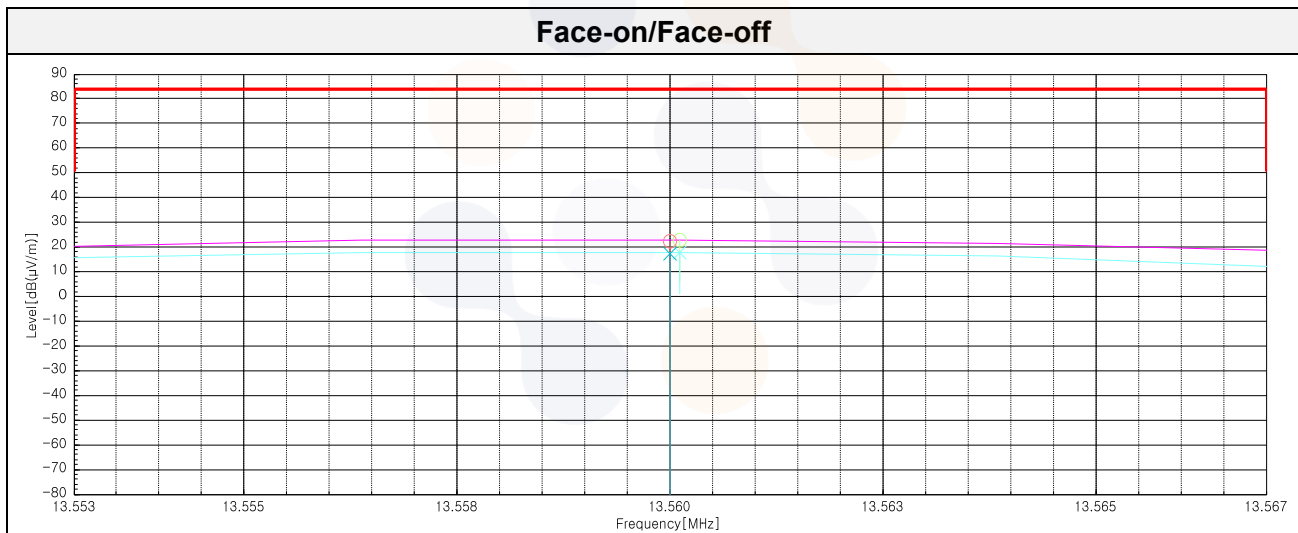
15.225 (a), RSS-210 B.6.(a).(i) 13.553-13.567 MHz

[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
13.56	74.20	20.31	-31.13	40.00	23.38	84.00	60.62

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
13.56	69.20	20.31	-31.13	40.00	18.38	84.00	65.62



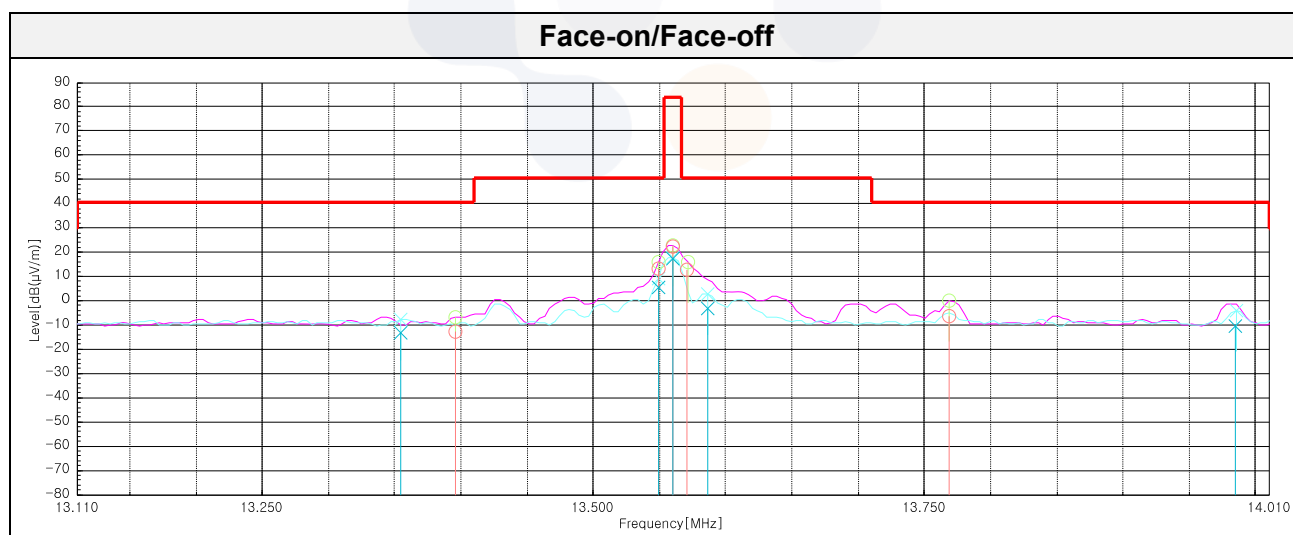
Test results for in-band & out-band (9 kHz to 30 MHz)
15.225 (b,c), RSS-210 B.6.(a).(ii, iii) 13.110-14.010 MHz

[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
13.40	39.20	20.30	-31.14	40.00	-11.64	40.50	52.14
13.55	65.10	20.31	-31.13	40.00	14.28	50.50	36.22
13.57	64.60	20.31	-31.13	40.00	13.78	50.50	36.72
13.77	45.30	20.33	-31.14	40.00	-5.51	40.50	46.01

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
13.36	38.60	20.30	-31.14	40.00	-12.24	40.50	52.74
13.55	57.30	20.31	-31.13	40.00	6.48	50.50	44.02
13.59	48.90	20.32	-31.13	40.00	-1.91	50.50	52.41
13.99	41.30	20.34	-31.14	40.00	-9.50	40.50	50.00



Note. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to $Y-51.5 = Z$ dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit.

Test results (9 kHz to 30 MHz)

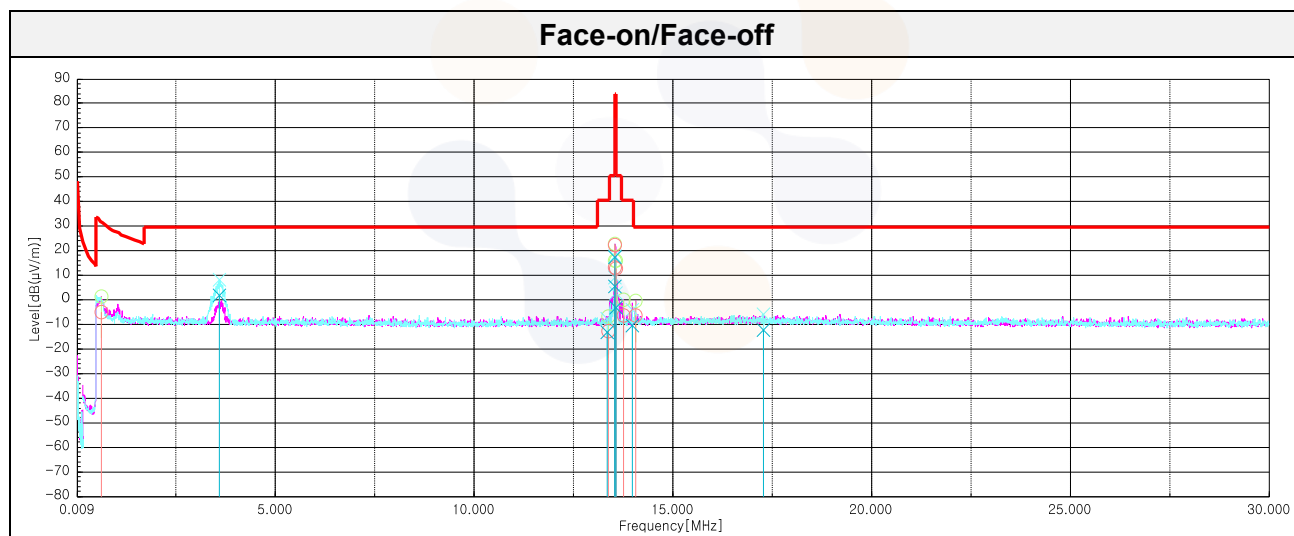
15.225 (d), RSS-210 B.6.(a).(iv) 0.009-30 MHz

[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
0.63	47.60	19.93	-32.20	40.00	-4.67	32.50	37.17
14.06	45.20	20.34	-31.13	40.00	-5.59	29.54	35.13

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
3.61	38.10	20.13	-31.72	40.00	-13.49	32.50	45.99
17.27	38.60	20.54	-30.97	40.00	-11.83	29.54	41.37

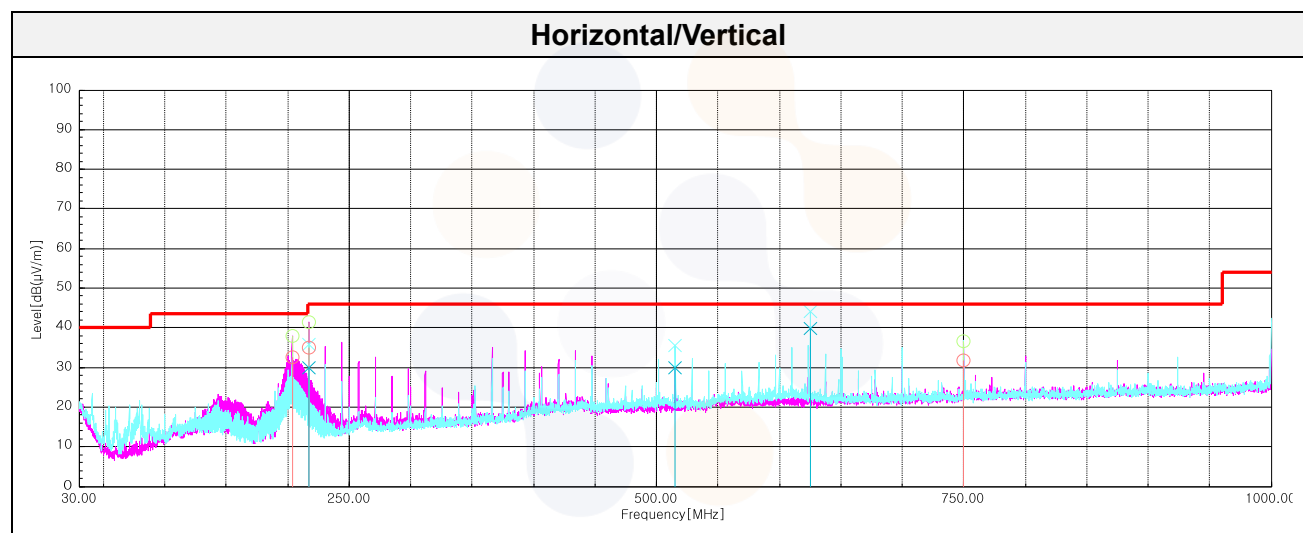


Note. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to $Y-51.5 = Z$ dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit.

Test results (Below 1 000 MHz)

15.225 (d), RSS-210 B.6.(a).(iv) 30-1 000 MHz

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data								
203.39	H	48.70	15.37	-30.26	-	33.81	43.50	9.69
216.97	H	51.30	14.95	-30.34	-	35.91	43.50	7.59
216.97	V	46.30	14.95	-30.34	-	30.91	46.00	15.09
515.36	V	37.30	23.30	-29.89	-	30.71	46.00	15.29
625.10	V	45.70	24.55	-29.73	-	40.52	46.00	5.48
750.10	H	36.30	25.50	-29.39	-	32.41	46.00	13.59



[PoE 48 V]

Test results for fundamental

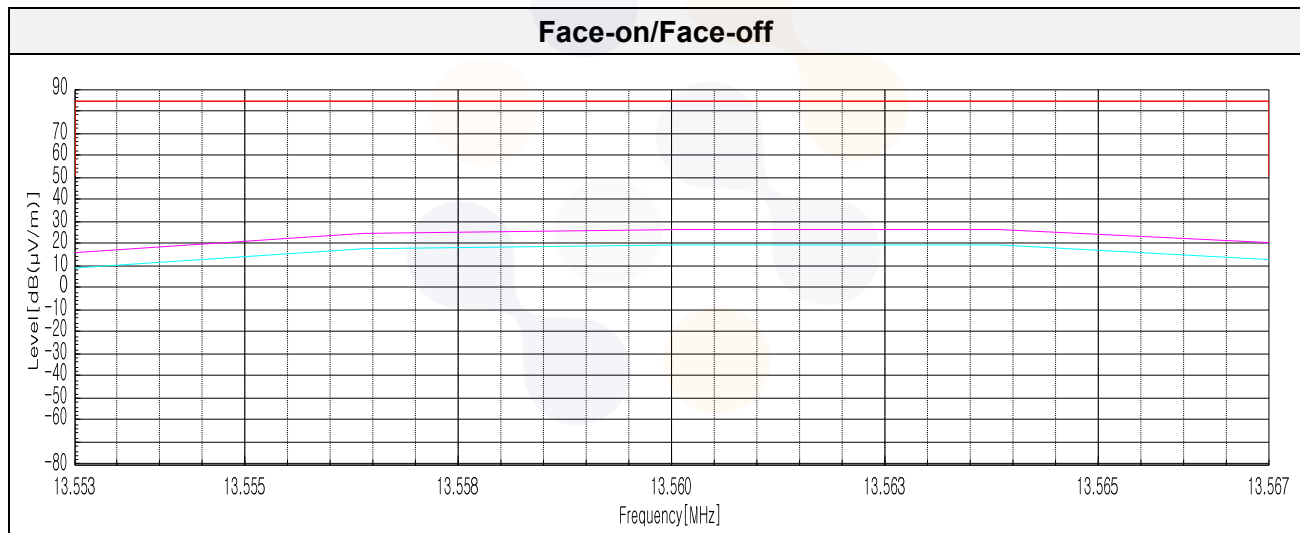
15.225 (a), RSS-210 B.6.(a).(i) 13.553-13.567 MHz

[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
13.56	75.90	20.31	-31.13	40.00	25.08	84.00	58.92

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
13.56	69.40	20.31	-31.13	40.00	18.58	84.00	65.42



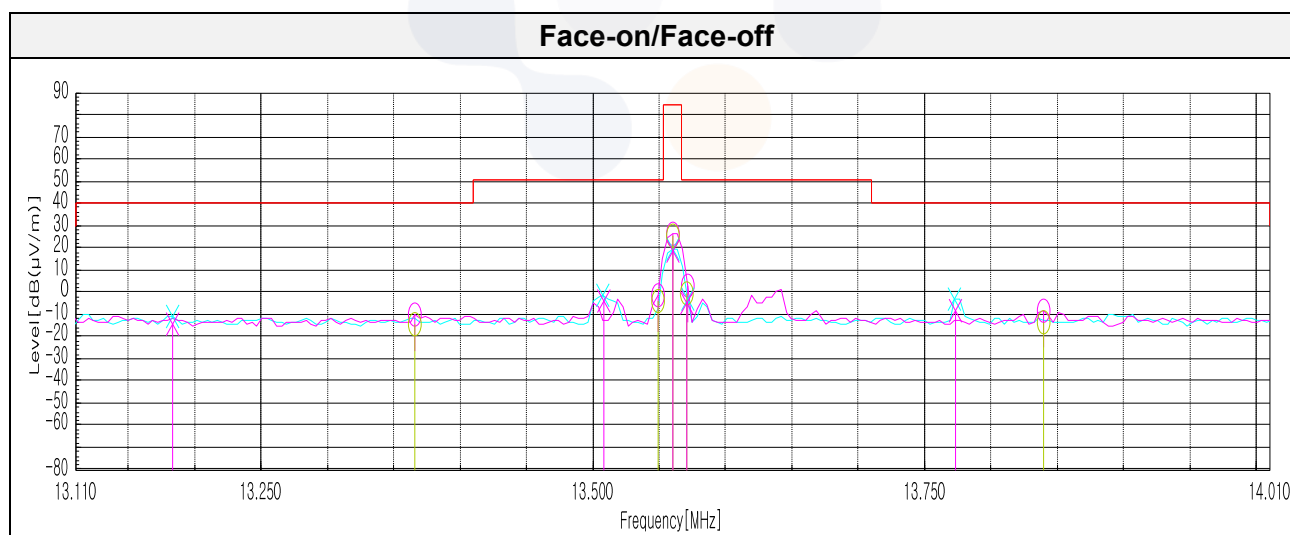
Test results for in-band & out-band (9 kHz to 30 MHz)
15.225 (b,c), RSS-210 B.6.(a).(ii, iii) 13.110-14.010 MHz

[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
13.37	35.80	20.30	-31.14	40.00	-15.04	40.50	55.54
13.55	46.60	20.31	-31.13	40.00	-4.22	50.50	54.72
13.57	50.30	20.31	-31.13	40.00	-0.52	50.50	51.02
13.84	37.30	20.33	-31.14	40.00	-13.51	40.50	54.01

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
13.18	35.90	20.29	-31.16	40.00	-14.97	40.50	55.47
13.51	46.10	20.31	-31.13	40.00	-4.72	50.50	55.22
13.57	45.20	20.31	-31.13	40.00	-5.62	50.50	56.12
13.77	42.50	20.33	-31.14	40.00	-8.31	40.50	48.81



Note. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to $Y-51.5 = Z$ dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit.

Test results (9 kHz to 30 MHz)

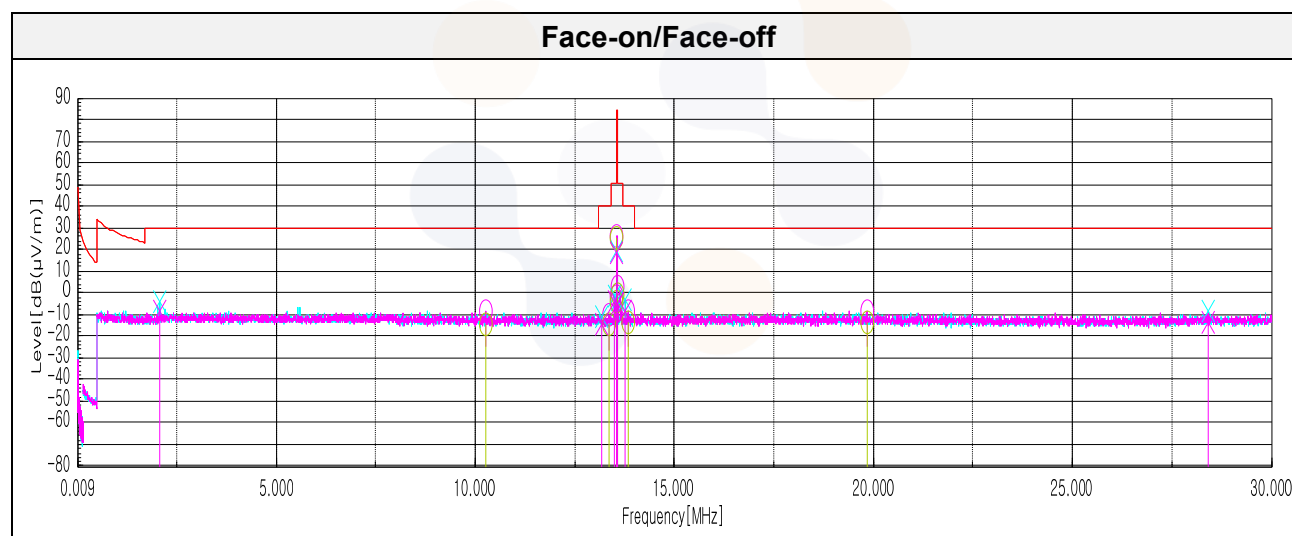
15.225 (d), RSS-210 B.6.(a).(iv) 0.009-30 MHz

[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
10.26	47.50	36.10	20.12	-31.28	135.00	32.50	-102.50
19.84	45.10	36.30	20.69	-30.85	132.94	29.50	-103.44

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data							
2.09	41.20	43.20	20.05	-31.83	136.28	32.50	-103.78
28.42	52.60	36.30	20.45	-30.52	139.87	29.50	-110.37

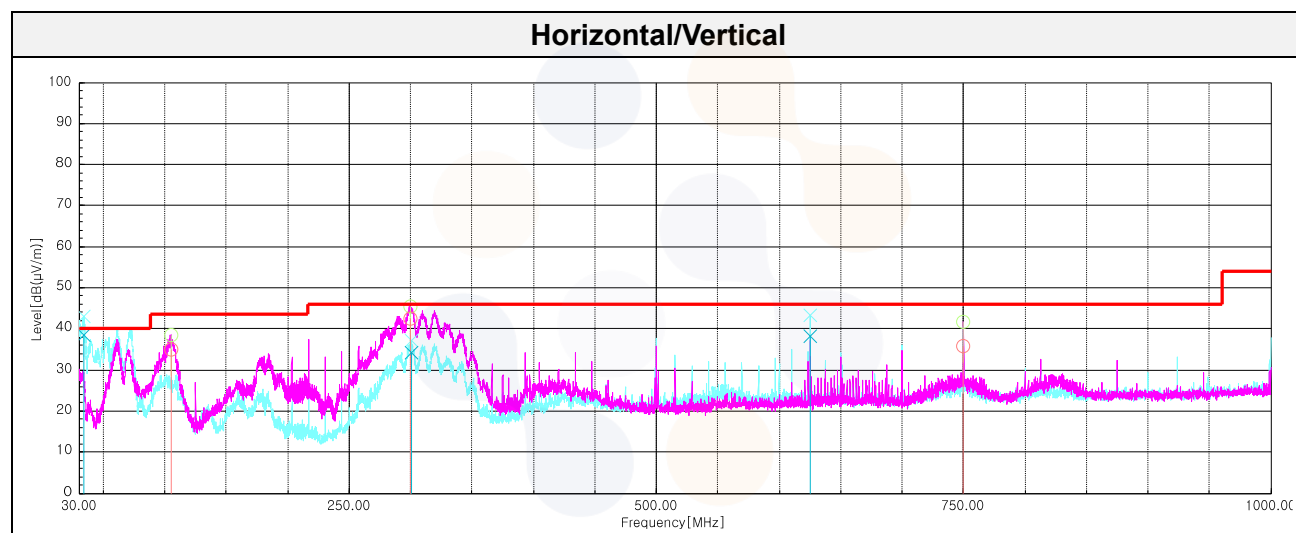


Note. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to Y-51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit.

Test results (Below 1 000 MHz)

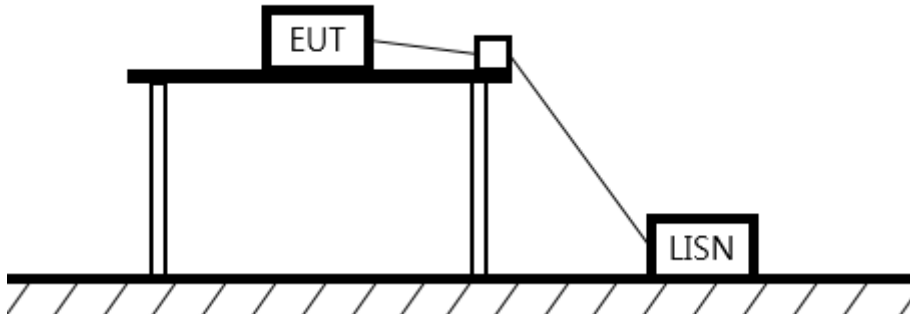
15.225 (d), RSS-210 B.6.(a).(iv) 30-1 000 MHz

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data								
33.64	V	47.20	22.72	-31.01	-	38.91	43.50	4.59
300.51	V	46.20	19.10	-30.17	-	35.13	46.00	10.87
624.97	V	44.30	24.55	-29.73	-	39.12	46.00	6.88
105.18	H	49.10	17.42	-30.63	-	35.89	46.00	10.11
299.90	H	54.50	19.10	-30.18	-	43.42	46.00	2.58
750.10	H	40.30	25.50	-29.39	-	36.41	46.00	9.59



6.4. AC Conducted emission

Test setup



Limit

According to 15.207(a) and 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 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall be 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.

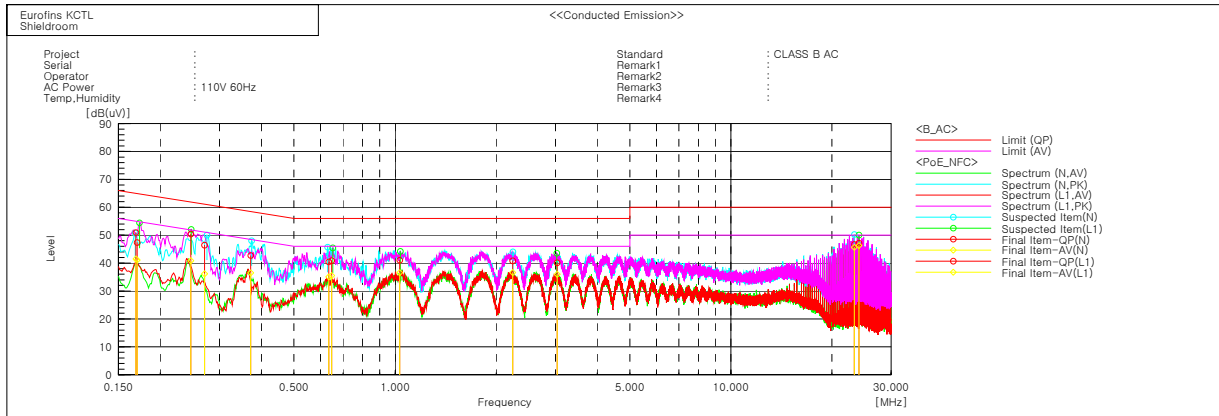
Frequency of Emission (MHz)	Conducted limit (dB μ V/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

Measurement procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 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 μ H 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.

Test results

[PoE 48 V]



Final Result

--- N Phase ---									
No.	Frequency	Reading QP	Reading CAV	c.f	Result QP	Result CAV	Limit QP	Limit AV	Margin
	[MHz]	[dB(μV)]	[dB(μV)]	[dB]	[dB(μV)]	[dB(μV)]	[dB(μV)]	[dB(μV)]	QP CAV
1	0.17071	37.3	30.9	10.1	47.4	41.0	64.9	54.9	17.5 13.9
2	0.2707	36.8	26.6	9.6	46.4	36.2	61.1	51.1	14.7 14.9
3	0.37178	32.9	26.6	9.8	42.7	36.4	58.5	48.5	15.8 12.1
4	0.63424	30.6	25.3	9.8	40.4	35.1	56.0	46.0	15.6 10.9
5	2.24085	31.1	26.9	9.7	40.8	36.6	56.0	46.0	15.2 9.4
6	23.30697	36.8	35.7	9.9	46.7	45.6	60.0	50.0	13.3 4.4

--- L1 Phase ---									
No.	Frequency	Reading QP	Reading CAV	c.f	Result QP	Result CAV	Limit QP	Limit AV	Margin
	[MHz]	[dB(μV)]	[dB(μV)]	[dB]	[dB(μV)]	[dB(μV)]	[dB(μV)]	[dB(μV)]	QP CAV
1	0.16922	40.8	31.4	10.1	50.9	41.5	65.0	55.0	14.1 13.5
2	0.24647	40.8	31.3	9.6	50.4	40.9	61.9	51.9	11.5 11.0
3	0.64795	31.1	25.7	9.8	40.9	35.5	56.0	46.0	15.1 10.5
4	1.03315	31.3	26.9	9.7	41.0	36.6	56.0	46.0	15.0 9.4
5	3.03724	30.4	26.2	9.7	40.1	35.9	56.0	46.0	15.9 10.1
6	24.06568	37.1	36.3	10.0	47.1	46.3	60.0	50.0	12.9 3.7

7. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
DC Power Supply	AGILENT	E3632A	MY40006352	24.04.27
Spectrum Analyzer	R&S	FSVA40	101575	24.06.19
Spectrum Analyzer	AGILENT	E4440A	MY46186407	24.03.22
Amplifier	SONOMA INSTRUMENT	310N	421821	23.12.14
Bilog Antenna	Teseq GmbH	CBL 6112D	63756	24.11.17
Loop Antenna	R&S	HFH2-Z2	100355	24.08.10
Controller	innco systems GmbH	CO3000	CO3000/1442/54 370322/P	N/A
Antenna Mast	innco systems GmbH	MA4640-XP-ET	N/A	N/A
Turn Device	innco systems GmbH	DS1200-S-1t	N/A	N/A
Signal Generator	R&S	SMB100A	176206	24.01.19
Spectrum Analyzer	R&S	FSV30	100914	24.07.03

End of test report