



TEST REPORT

Eurofins KCTL Co.,Ltd. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-70-4904-0113 FAX: 82-505-299-8311 www.kctl.co.kr	Report No.: KR26-SRF0019 Page (1) of (72)	 KCTL
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1. Client

- Name : IRIVER
- Address : 5, Bangbae-ro 18-gil, Seocho-gu, Seoul, Republic of Korea
- Date of Receipt : 2025-11-25

2. Use of Report : Certification

3. Name of Product / Model : PD20 / PPR62

4. Manufacturer / Country of Origin : IRIVER / Korea

5. FCC ID : 2BO2WPPR62

5. Date of Test : 2026-01-06 to 2026-02-09

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

7. Test method used : FCC Part 15 Subpart E, 15.407

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

Affirmation	Tested by	Technical Manager
	Name : Yeonju Je (Signature) 	Name : Euijung Kim (Signature) 

2026-03-04

Eurofins KCTL Co.,Ltd.

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REPORT REVISION HISTORY

Date	Revision	Page No
2026-03-04	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 : IRIVER
 Address : 5, Bangbae-ro 18-gil, Seocho-gu, Seoul, Republic of Korea
 Manufacturer : IRIVER
 Address : 5, Bangbae-ro 18-gil, Seocho-gu, Seoul, Republic of Korea
 Factory : SEP CO.,LTD.
 Address : 100, Saneop-ro 92beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi-do, Republic of Korea
 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 : PD20
 Model : PPR62
 Modulation technique : Bluetooth(BDR/EDR) : GFSK, $\pi/4$ DQPSK, 8DPSK
 Bluetooth(BLE) : GFSK
 WIFI(802.11a/b/g/n/ac) : DSSS, OFDM
 Number of channels : Bluetooth : 79 ch
 BLE : 40 ch
 2.4 GHz WLAN : 11 ch (20 MHz), 7 ch (40 MHz)
 UNII-1 : 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
 UNII-3 : 5 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
 Power source : DC 3.8 V
 Antenna specification : LPS Antenna
 Antenna gain : BT/BLE/2.4 GHz WLAN : -3.551 dBi
 5 GHz WLAN UNII-1 : -4.347 dBi
 5 GHz WLAN UNII-3 : -9.624 dBi
 Frequency range : Bluetooth : 2 402 MHz ~ 2 480 MHz (BDR/EDR/BLE)
 2.4 GHz WLAN : 2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20)
 2 422 MHz ~ 2 452 MHz (802.11n_HT40)
 UNII-1 : 5 180 MHz ~ 5 240 MHz (802.11a/n_HT20)
 5 190 MHz ~ 5 230 MHz (802.11n_HT40)
 5 210 MHz (802.11ac_VHT80)
 UNII-3 : 5 745 MHz ~ 5 825 MHz (802.11a/n_HT20)
 5 755 MHz ~ 5 795 MHz (802.11n_HT40)
 5 775 MHz (802.11ac_VHT80)
 Software version : 1.0
 Hardware version : 1.0
 Test device serial No. : TP-70, TP-38(Conducted)
 TP-50(Radiated)
 Operation temperature : -10 °C ~ 50 °C

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Rechargeable Lithium-Ion Battery	Shenzhen Saijiaoyang Energy Technology Co., Ltd.	HCP6353106PNFC	N/A	DC 3.8 V, 5770 mAh 21.93 Wh

2.2. Frequency/channel operations

This device contains the following capabilities:

WLAN 5 GHz(802.11a/n_HT20/40/ac_VHT80)

UNII-1

Ch.	Frequency (MHz)
36	5 180
40	5 200
48	5 240

UNII-3

Ch.	Frequency (MHz)
149	5 745
157	5 785
165	5 825

Table 2.2.1. 802.11a/n_HT20 mode

UNII-1

Ch.	Frequency (MHz)
38	5 190
46	5 230

UNII-3

Ch.	Frequency (MHz)
151	5 755
159	5 795

Table 2.2.2. 802.11n_HT40 mode

UNII-1

Ch.	Frequency (MHz)
42	5 210

UNII-3

Ch.	Frequency (MHz)
155	5 775

Table 2.2.3 802.11ac_VHT80 mode

2.3. RF power setting in TEST SW

Test Program	Test Mode	Frequency	RF Power setting value
		[MHz]	
ADB	802.11a	5 180	13
		5 200	13
		5 240	13
		5 745	16
		5 785	16
		5 825	16
	802.11n_HT20	5 180	13
		5 200	13
		5 240	13
		5 745	16
		5 785	16
		5 825	16
	802.11n_HT40	5 190	14
		5 230	14
		5 755	16
		5 795	16
	802.11ac_VHT80	5 210	13
		5 775	16

2.4. Simultaneously transmission condition

Item	Technology	Test Mode	Frequency [MHz]
Case 1	WLAN 2.4 GHz	802.11n HT20	2 462
	Bluetooth	DH-5	2 402
Case 2	WLAN 5 GHz	802.11a	5 200
	Bluetooth	DH-5	2 402

Notes.

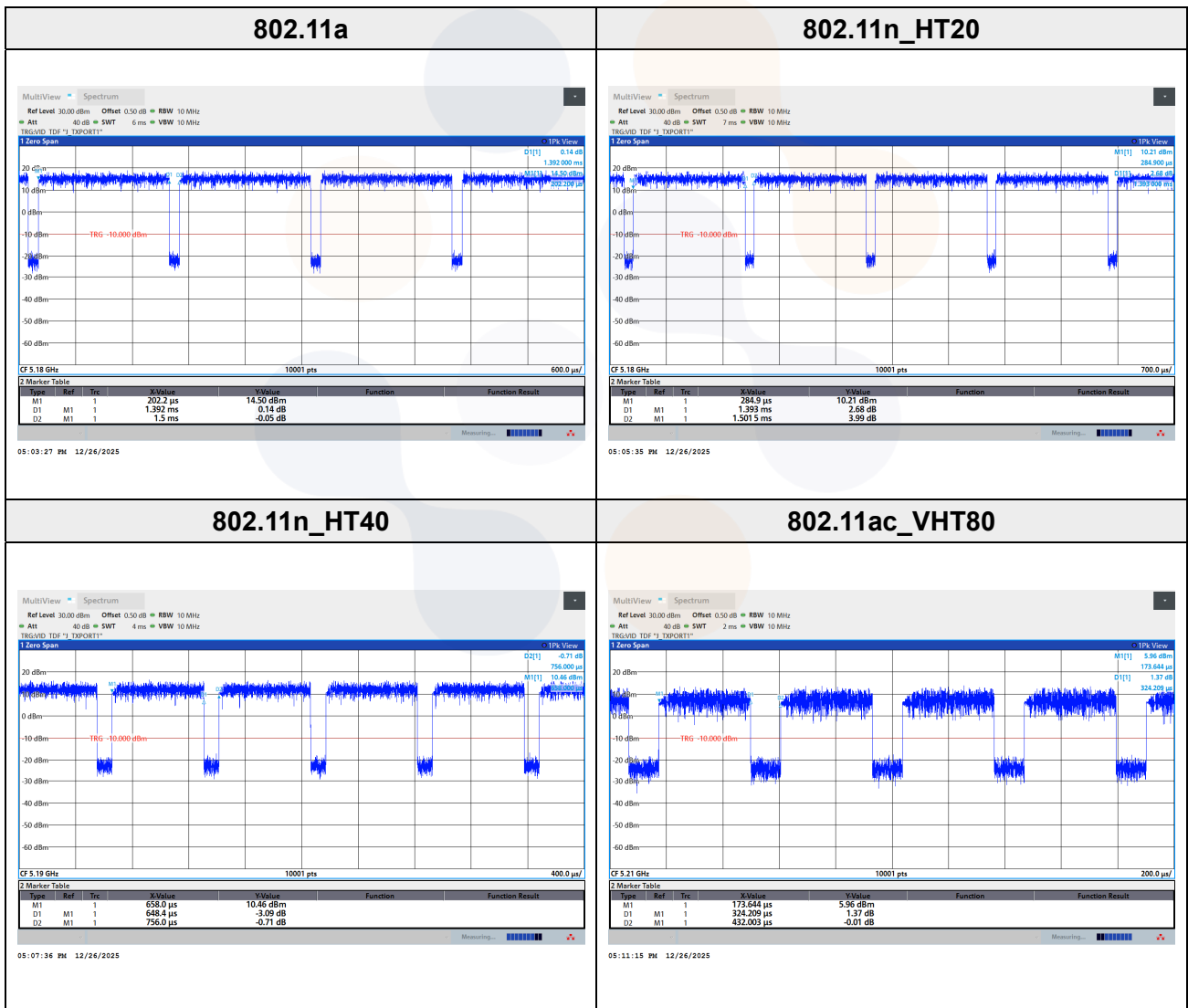
1. Simultaneous condition was performed as a worst case which is configured as a combination of lowest margin for each mode during radiated spurious emission.
2. For simultaneous spurious emission test result, please refer to 15.247_Bluetooth test report.

2.5. Duty Cycle Factor

Test mode	Period (ms)	T _{On} time (ms)	Duty cycle		Duty Cycle Factor (dB)
			(Linear)	(%)	
802.11a	1.500	1.392	0.928 0	92.80	0.32
802.11n_HT20	1.502	1.393	0.927 4	92.74	0.33
802.11n_HT40	0.756	0.648	0.857 1	85.71	0.67
802.11ac_VHT80	0.432	0.324	0.750 0	75.00	1.25

Notes.

1. Duty cycle (Linear) = T_{On} time / Period
2. DCF(Duty cycle factor) = 10log(1/duty cycle)
3. DCF is not compensated to average result if the duty cycle is more than 98%



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3. Antenna requirement

Requirement of FCC part section 15.203:

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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.

- The transmitter has attached LPS Antenna (internal antenna) on the board.
- The E.U.T Complies with the requirement of §15.203, §15.407



4. Summary of tests

FCC Part section(s)	Parameter	Test Condition	Test results
15.407(a)	Maximum conducted output power	Conducted	Pass
15.407(a)	Maximum power spectral density		Pass
15.407(a)	26 dB Channel Bandwidth		Pass
15.407(e)	6 dB Channel Bandwidth		Pass
15.207(a)	AC Conducted Emissions		Pass
15.407(b), 15.205(a), 15.209(a)	Spurious emission	Radiated	Pass
	Band-edge, restricted band		Pass

Notes:

1. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2. According to exploratory test no any obvious emission were detected from 9 kHz to 30 MHz. 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 based on KDB 414788.
3. 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.
4. The test procedure(s) in this report were performed in accordance as following.
 - ANSI C63.10-2020
 - KDB 789033 D02 v02r01
5. The worst-case data rates were:
 - 802.11a mode: 6Mbps
 - 802.11n_HT20 mode: MCS0
 - 802.11n_HT40 mode: MCS0
 - 802.11ac_VHT80 mode: MCS0

5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2020.

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 ($\pm$)	
Conducted RF Power	0.9 dB	
Conducted spurious emission	1.7 dB	
Radiated Emissions	Below 30 MHz	2.4 dB
	30 MHz to 1 000 MHz	2.6 dB
	1 000 MHz to 18 000 MHz	4.7 dB
	Above 18 000 MHz	4.8 dB
Conducted Emissions	150 kHz to 30 MHz	2.8 dB

6. Measurement results explanation example

The offset level is set in the spectrum analyzer to compensate the RF cable loss factor between EUT conducted output port and spectrum analyzer.

With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Frequency (MHz)	Factor(dB)	Frequency (MHz)	Factor(dB)
30	10.00	9 000	12.44
50	10.06	10 000	12.45
100	10.06	11 000	12.72
200	10.13	12 000	12.96
300	10.33	13 000	13.06
400	10.22	14 000	13.18
500	10.31	15 000	13.36
600	10.16	16 000	13.53
700	10.21	17 000	13.49
800	10.21	18 000	13.78
900	10.55	19 000	13.96
1 000	10.38	20 000	14.42
2 000	11.03	21 000	16.70
3 000	11.14	22 000	11.80
4 000	11.55	23 000	14.04
5 000	11.85	24 000	14.58
6 000	11.93	25 000	14.47
7 000	12.25	26 000	14.65
8 000	12.25	26 500	14.61

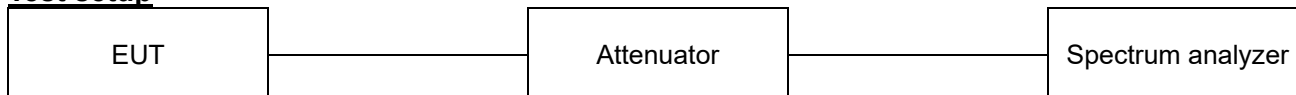
Note.

Offset(dB) = RF cable loss(dB) + Attenuator

7. Test results

7.1. Maximum conducted output power

Test setup



Limit

According to §15.407(a),

Band	EUT category		Conducted output power limit
UNII-1		Outdoor access point	1 W (30 dBm)
		Indoor access point	
		Fixed point-to-point access point	
	√	Client device	250 mW (23.98 dBm)
UNII-2A			250 mW or 11 dBm + 10logB ¹⁾
UNII-2C			250 mW or 11 dBm + 10logB ¹⁾
UNII-3		√	1 W (30 dBm)

Note:

1) Conducted output power limit B is the 26 dB emission bandwidth.

Test procedure

ANSI C63.10-2020-Section 12.4.2.4

KDB 789033 D02 v02r01 - Section E.2.d)

Test settings

Used test method is Section E.3.a)

◆ KDB 789033 D02 v02r01

Section E.3.a)

a) Method PM (Measurement using an RF average power meter):

- (i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the following conditions are satisfied:
 - The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
 - At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
 - The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
- (ii) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in II.B.
- (iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
- (iv) Adjust the measurement in dBm by adding 10 log (1/x) where x is the duty cycle (e.g., 10 log (1/0.25) if the duty cycle is 25%).

Test results

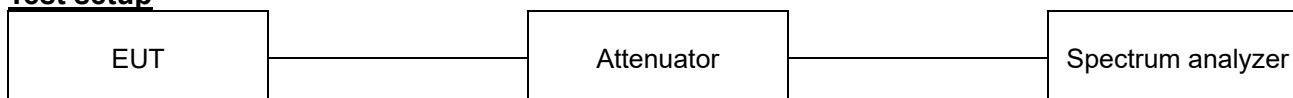
Test mode	Band	Frequency (MHz)	Measured power (dBm)	DCF (dB)	Conducted output power (dBm)	Conducted Power Limit (dBm)
					Average	
802.11a	UNII-1	5 180	8.46	0.32	8.78	23.98
		5 200	8.44		8.76	
		5 240	8.08		8.40	
	UNII-3	5 745	11.31		11.63	30.00
		5 785	11.38		11.70	
		5 825	11.46		11.78	
802.11n HT20	UNII-1	5 180	8.21	0.33	8.54	23.98
		5 200	8.20		8.53	
		5 240	8.08		8.41	
	UNII-3	5 745	11.11		11.44	30.00
		5 785	11.24		11.57	
		5 825	11.28		11.61	
802.11n HT40	UNII-1	5 190	7.22	0.67	7.89	23.98
		5 230	7.13		7.80	
	UNII-3	5 755	10.70		11.37	30.00
		5 795	10.82		11.49	
802.11ac VHT80	UNII-1	5 210	5.61	1.25	6.86	23.98
	UNII-3	5 775	10.03		11.28	30.00

Note.

1. Result(dBm) = Reading Power + D.C.F

7.2. Maximum Power Spectral Density

Test setup



Limit

According to §15.407(a)

Band	EUT category		Limit
UNII-1		Outdoor access point	17 dBm/MHz
		Indoor access point	
		Fixed point-to-point access point	
	√	Client device	11 dBm/MHz
UNII-2A			11 dBm/MHz
UNII-2C			11 dBm/MHz
UNII-3		√	30 dBm/500 kHz

Notes:

When using transmitting antennas with a directional gain exceeding 6 dBi, the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceed 6 dBi

Test procedure

ANSI C63.10-2020 Section 12.6, 12.4.2.4

KDB 789033 D02 v02r01 - Section F

Test settings (12.6)

Notwithstanding that some regulatory requirements refer to peak power spectral density (PPSD), in some cases the intent is to measure the maximum value of the time average of the power spectral density during a period of continuous transmission. The procedure for this method is as follows:

- Create an average power spectrum for the EUT operating mode being tested by following the instructions in 12.4.2 for measuring maximum conducted output power using a spectrum analyzer or EMI receiver; that is, select the appropriate test method (SA-1, SA-2, SA-3, or their respective alternatives) and apply it up to, but not including, the step labeled, "Compute power...." (This procedure is required even if the maximum conducted output power measurement was performed using the power meter method PM.)
- Use the peak search function on the instrument to find the peak of the spectrum.
- Make the following corrections to the peak value of the spectrum, if applicable:
 - If method SA-2 or SA-2A was used, then add $[10 \log (1 / D)]$, where D is the duty cycle, to the peak of the spectrum.
 - If method SA-3A was used and the linear mode was used in step h) of 12.4.2.7, add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
- The result is the PPSD.
- The procedure in item a) through item c) requires the use of 1 MHz resolution bandwidth to satisfy the 1 MHz measurement bandwidth specified by some regulatory authorities.⁸⁵ This requirement also permits use of resolution bandwidths less than 1 MHz "provided that the measured power is integrated to show the total power over the measurement bandwidth" (i.e., 1 MHz). If measurements are performed using a reduced resolution bandwidth and integrated over 1 MHz bandwidth, the following adjustments to the procedures apply:
 - Set $RBW \geq 1 / T$, where T is defined in 12.2 a).
 - Set $VBW \geq [3 \times RBW]$.

- 3) Care shall be taken such that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Test settings (12.4.2.4)

Method SA-2 uses trace averaging across ON and OFF times of the EUT transmissions, followed by duty cycle correction. The procedure for this method is as follows:

- Measure the duty cycle D of the transmitter output signal as described in 12.2.
- Set span to encompass the entire 99% OBW of the signal.
- Set RBW = 1 MHz.
- Set VBW ≥ 3 MHz.
- Number of points in sweep $\geq [2 \times \text{span} / \text{RBW}]$. (This gives bin-to-bin spacing $\leq \text{RBW} / 2$, so that narrowband signals are not lost between frequency bins.)
- Sweep time = auto.
- Detector = Power averaging (rms), if available. Otherwise, use sample detector mode.
- Do not use sweep triggering. Allow the sweep to “free run.”
- Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the ON and OFF periods of the transmitter.
- Compute power by integrating the spectrum across the 99% OBW of the signal using the instrument’s band-power measurement function with band limits set equal to the EBW or OBW band-edges. If the instrument does not have a band-power function, then sum the spectrum levels (in power units) at 1 MHz intervals extending across the 99% OBW of the spectrum.

Add $[10 \log (1 / D)]$, where D is the duty cycle, to the measured power to compute the average power during the actual transmission times (because the measurement represents an average over both the ON and OFF times of the transmission). For example, add $[10 \log (1 / 0.25)] = 6$ dB if the duty cycle is 25%.

Test results

Test mode	Band	Frequency (MHz)	Measured PSD (dB m/MHz)	DCF (dB)	Maximum PSD (dB m/MHz)	Limit (dB m/MHz)		
802.11a	UNII-1	5 180	-1.84	0.32	-1.52	11.00		
		5 200	-3.25		-2.93			
		5 240	-2.30		-1.98			
802.11n HT20		5 180	-2.70	0.33	-2.37		11.00	
		5 200	-3.39		-3.06			
		5 240	-2.71		-2.38			
802.11n HT40		5 190	-5.30	0.67	-4.63			11.00
		5 230	-5.20		-4.53			
802.11ac VHT80		5 210	-11.22	1.25	-9.97			

Notes:

1. Maximum PSD (dBm/MHz) = Measured PSD (dBm/MHz) + D.C.F (dB)

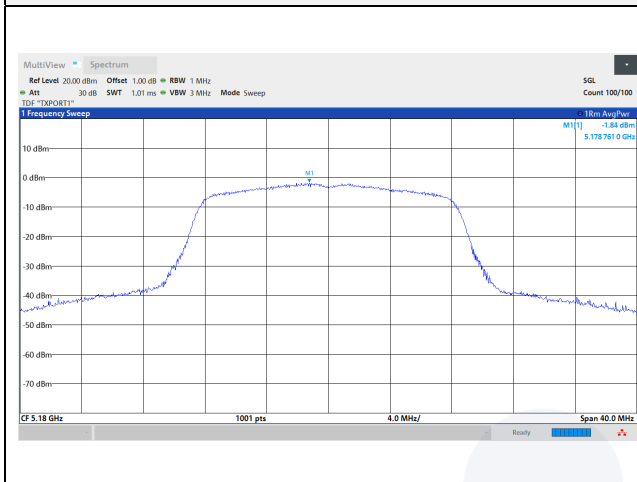
Test mode	Band	Frequency (MHz)	Measured PSD (dBm/ 500 kHz)	DCF (dB)	Maximum PSD (dBm/ 500 kHz)	Limit (dBm/ 500 kHz)		
802.11a	UNII-3	5 745	-2.25	0.32	-1.93	30.00		
		5 785	-1.98		-1.66			
		5 825	-1.37		-1.05			
802.11n HT20		5 745	-2.18	0.33	-1.85		30.00	
		5 785	-1.71		-1.38			
		5 825	-1.92		-1.59			
802.11n HT40		5 755	-5.69	0.67	-5.02			30.00
		5 795	-5.66		-4.99			
802.11ac VHT80		5 775	-9.29	1.25	-8.40			

Notes:

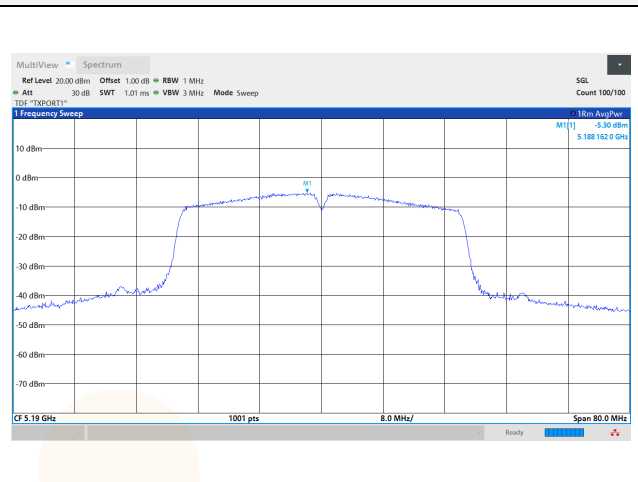
1. Maximum PSD (dB m/500 kHz) = Reading (dB m/500 kHz) + D.C.F (dB)

In order to simplify the report, attached plots were the worst case per bandwidth

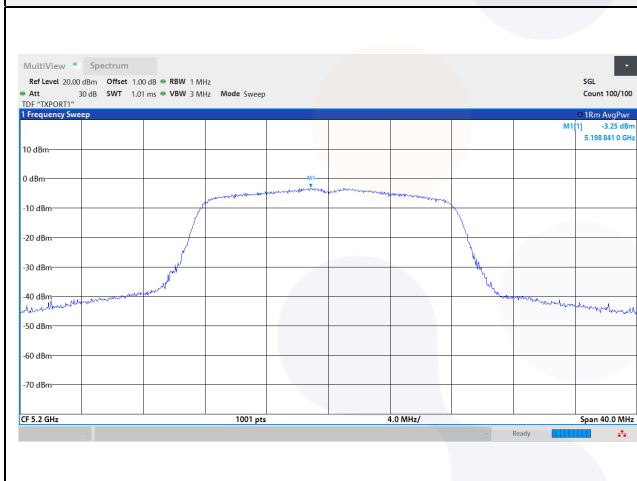
UNII-1 / 802.11a / 5 180 MHz



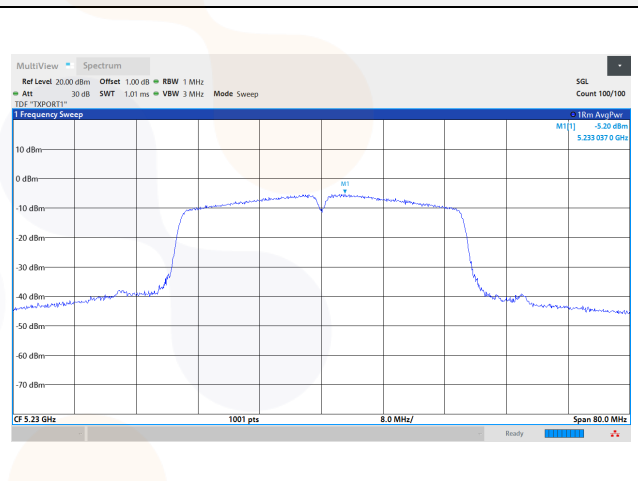
UNII-1 / 802.11n HT40 / 5 190 MHz



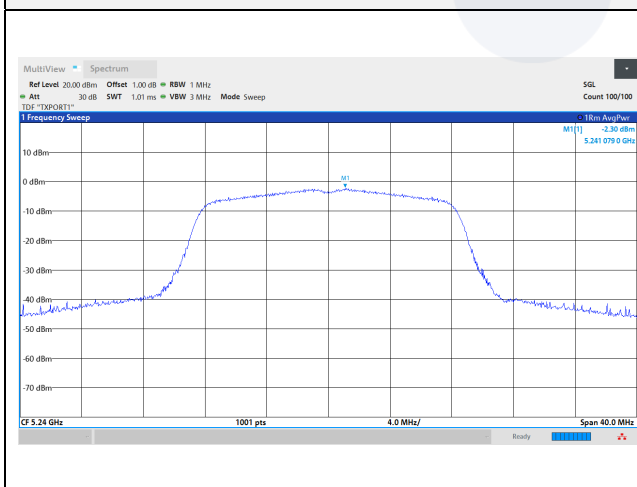
UNII-1 / 802.11a / 5 200 MHz



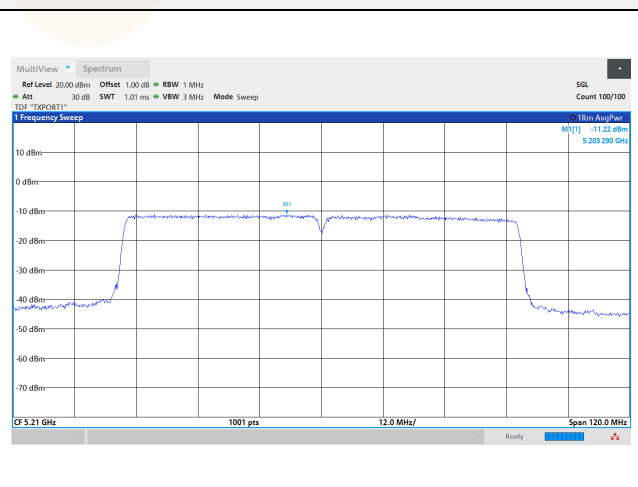
UNII-1 / 802.11n HT40 / 5 230 MHz



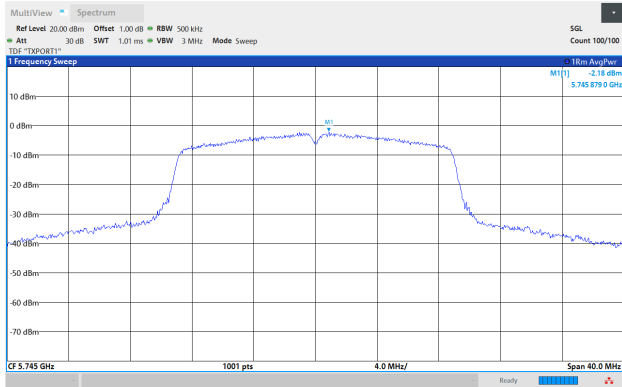
UNII-1 / 802.11a / 5 240 MHz



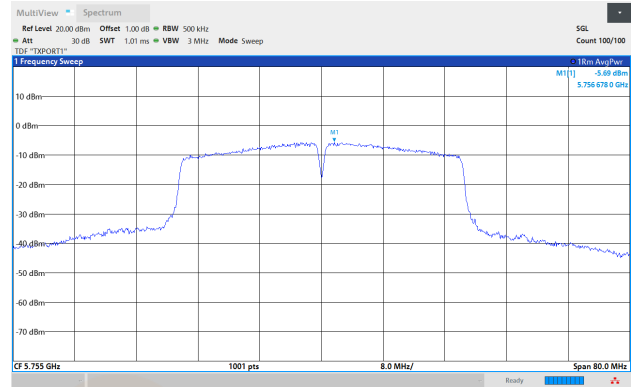
UNII-1 / 802.11ac VHT80 / 5 210 MHz



UNII-3 / 802.11n HT20 / 5 745 MHz



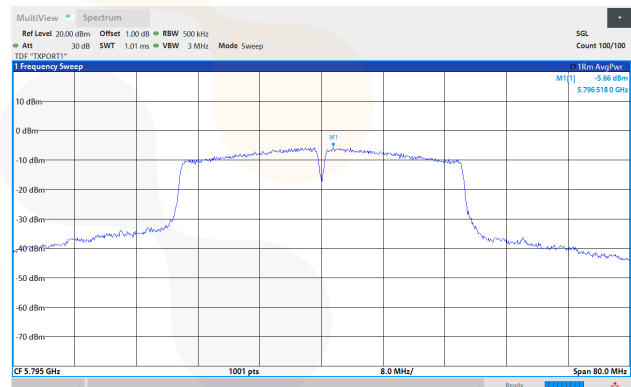
UNII-3 / 802.11n HT40 / 5 755 MHz



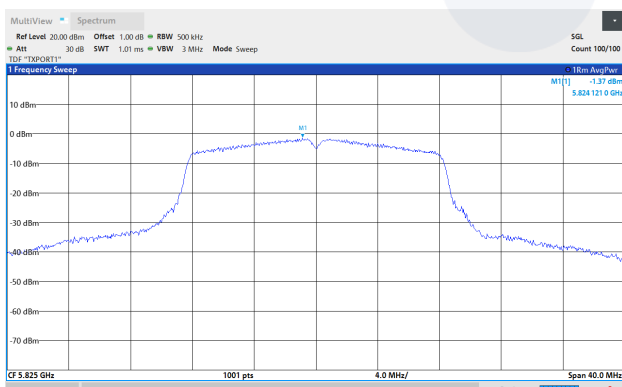
UNII-3 / 802.11n HT20 / 5 785 MHz



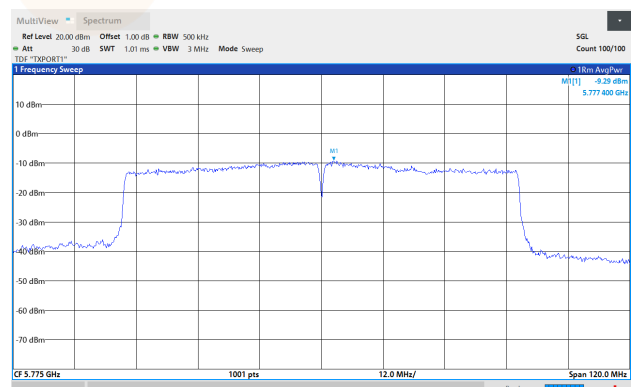
UNII-3 / 802.11n HT40 / 5 795 MHz



UNII-3 / 802.11a / 5 825 MHz

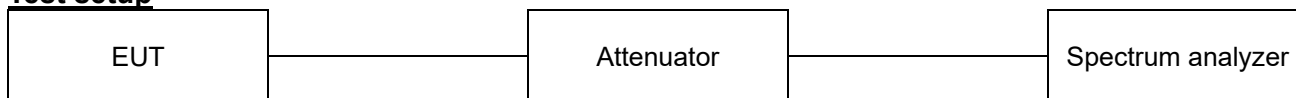


UNII-1 / 802.11ac VHT80 / 5 775 MHz



7.3. 26 dB Bandwidth & 99% Bandwidth

Test setup



Limit

N/A

Test procedure

ANSI C63.10-2020 Section 12.5.2, 6.9.3

KDB 789033 D02 v02r01 - Section C.1 (26dB bandwidth)

KDB 789033 D02 v02r01 - Section D (99% bandwidth)

Test settings

Emission bandwidth for all other bands (or 26 dB Bandwidth)

- Set RBW = Shall be in the range of 1% to 5% of the emission bandwidth.
- Set the VBW > RBW.
- Detector = Peak.
- Trace mode = max hold.
- Measure the maximum width of the emission that is 26 dB down from peak of the emission. Compare this with the RBW setting of the instrument. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is in the range of 1% to 5%.

Occupied bandwidth (or 99% Occupied Bandwidth)

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

The following procedure shall be used for measuring 99% power bandwidth:

- The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be at least three times the RBW, unless otherwise specified by the applicable requirement.
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (OBW/RBW)]$ below the reference level. Specific guidance is given in 4.1.6.2.
- Step a) through step c) might require iteration to adjust within the specified range.
- Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max-hold mode (until the trace stabilizes) shall be used.
- Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.
- If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power 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; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.
- The occupied bandwidth shall be reported by providing spectral plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

Test results

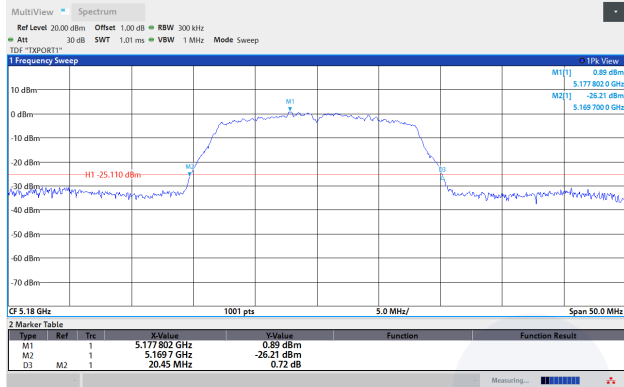
Test mode	Band	Frequency(MHz)	26 dB bandwidth (MHz)	99% bandwidth (MHz)
802.11a	UNII-1	5 180	20.450	16.832
		5 200	20.450	16.858
		5 240	20.400	16.868
802.11n HT20		5 180	20.300	17.672
		5 200	20.400	17.709
		5 240	20.300	17.687
802.11n HT40		5 190	45.100	36.291
		5 230	41.500	36.196
802.11ac VHT80		5 210	82.170	75.900

Note.

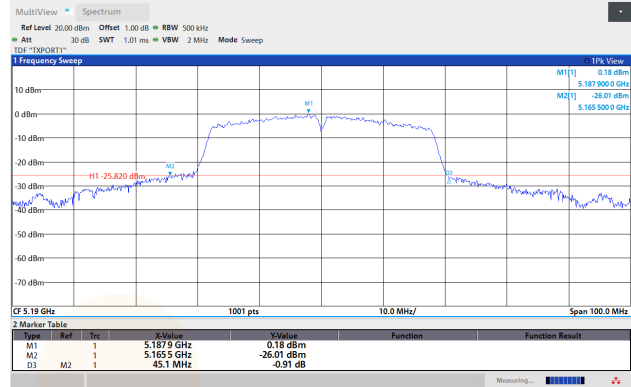
If 26dB Bandwidth across Band 2A or Band 1 but 99% test results are within the band no addition DFS test is needed on band 1.

In order to simplify the report, attached plots were the worst case per bandwidth
26 dB bandwidth

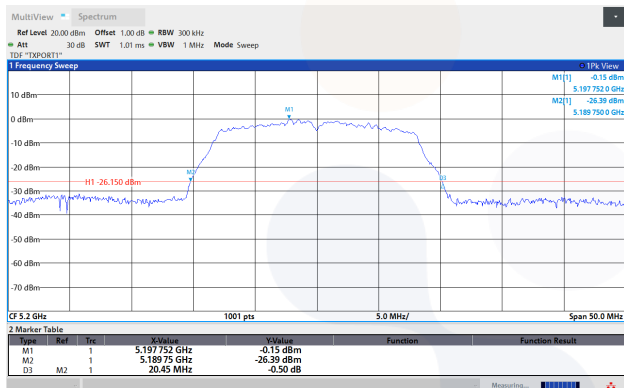
UNII 1 / 802.11a / Low ch.



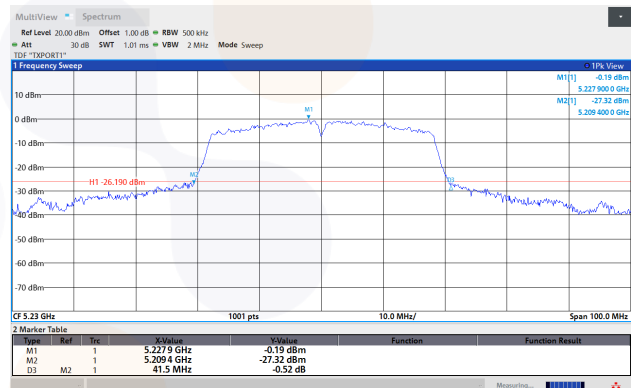
UNII 1 / 802.11n HT40 / Low ch.



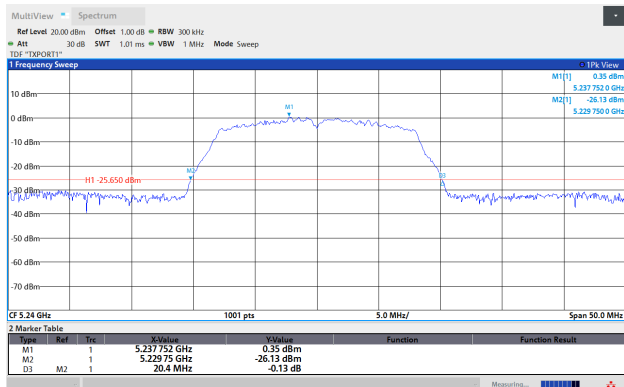
UNII 1 / 802.11a / Mid ch.



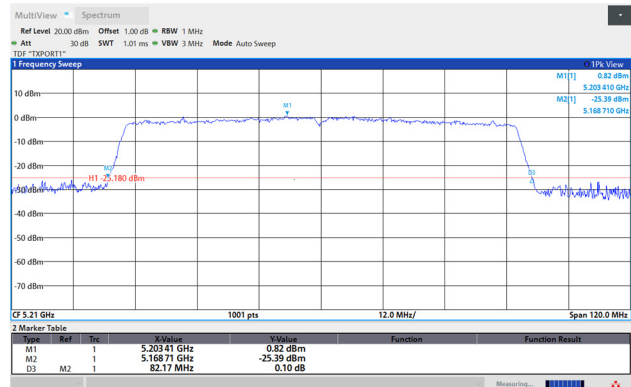
UNII 1 / 802.11n HT40 / High ch.



UNII 1 / 802.11a / High ch.



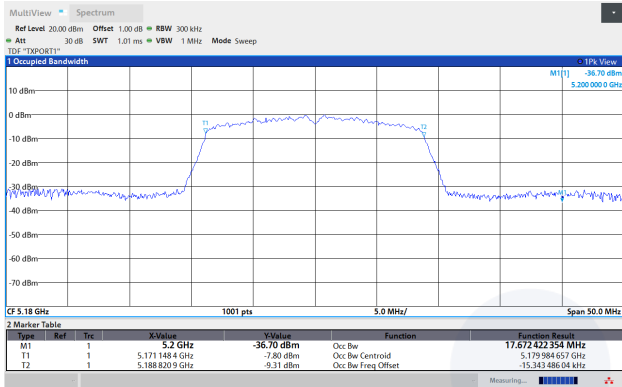
UNII 1 / 802.11ac VHT80 / Mid ch.



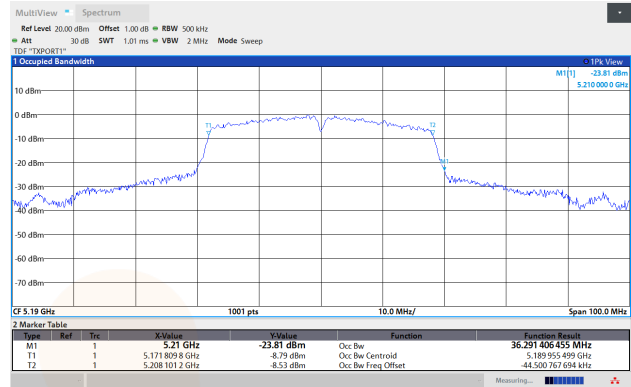
In order to simplify the report, attached plots were the worst case per bandwidth

99% bandwidth

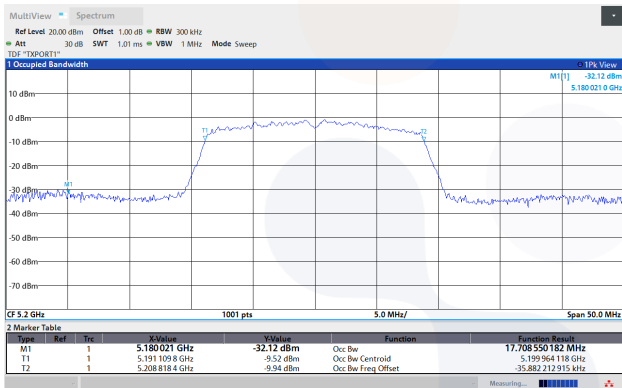
UNII 1 / 802.11n HT20 / Low ch.



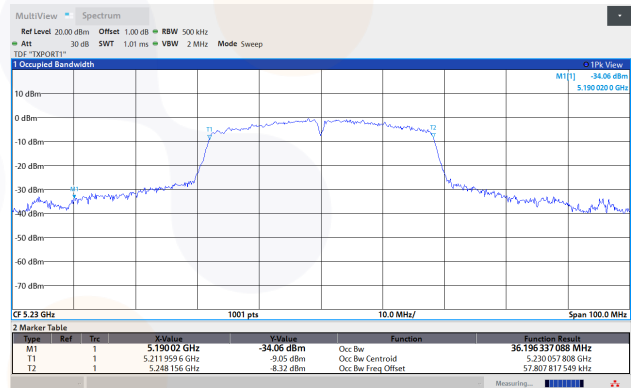
UNII 1 / 802.11n HT40 / Low ch.



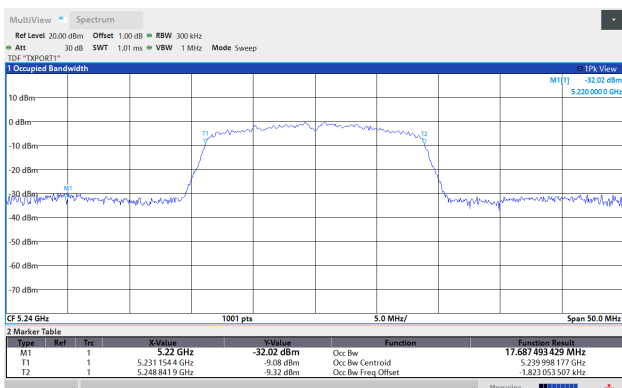
UNII 1 / 802.11n HT20 / Mid ch.



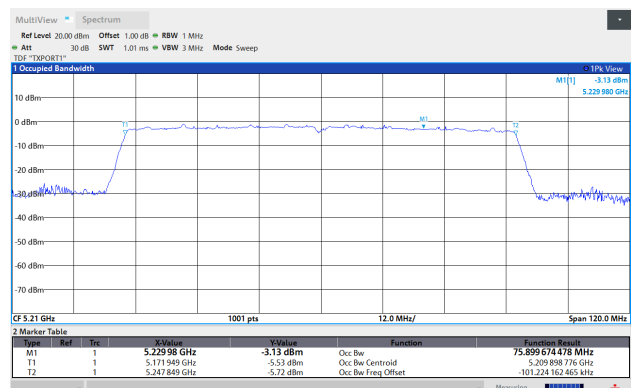
UNII 1 / 802.11n HT40 / High ch.



UNII 1 / 802.11n HT20 / High ch.

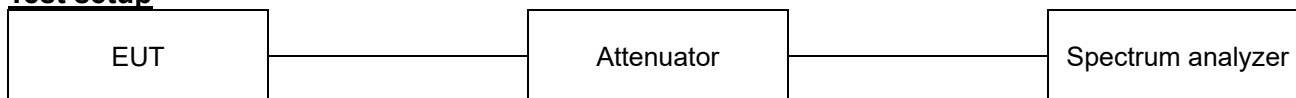


UNII 1 / 802.11ac VHT80 / Mid ch.



7.4. 6 dB Bandwidth

Test setup



Limit

According to §15.407(e),

For equipment operating in the band 5 725-5 850 MHz bands, the 6 dB bandwidth shall be at least 500 kHz

Test procedure

ANSI C63.10-2020 Section 12.5.1, 6.9.3

KDB 789033 D02 v02r01 - Section C.2

Test settings

Emission Bandwidth for the band 5.725 to 5.85 GHz and 5.850-5.895 GHz

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = No faster than coupled (auto) time.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

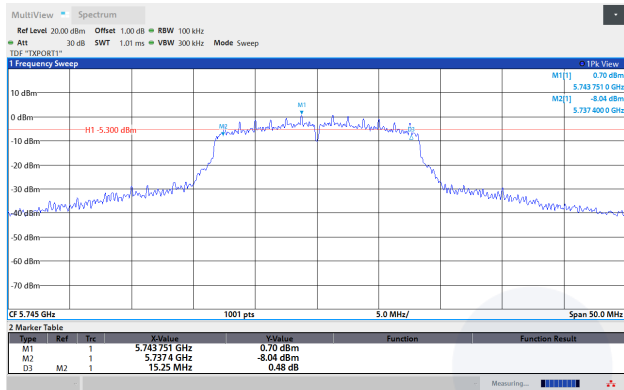
Test results

Test mode	Band	Frequency (MHz)	6 dB bandwidth (MHz)	Limit (MHz)
802.11a	UNII-3	5 745	15.250	0.500
		5 785	15.200	
		5 825	15.200	
802.11n HT20		5 745	15.250	
		5 785	15.200	
		5 825	15.200	
802.11n_HT40		5 755	35.300	
		5 795	35.300	
802.11ac_VHT80		5 775	75.480	

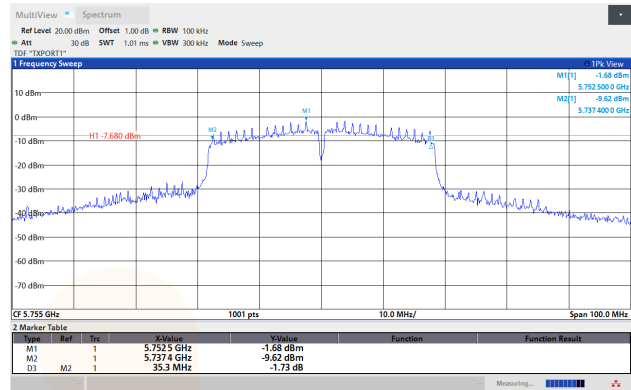
In order to simplify the report, attached plots were the worst case per bandwidth

6 dB bandwidth

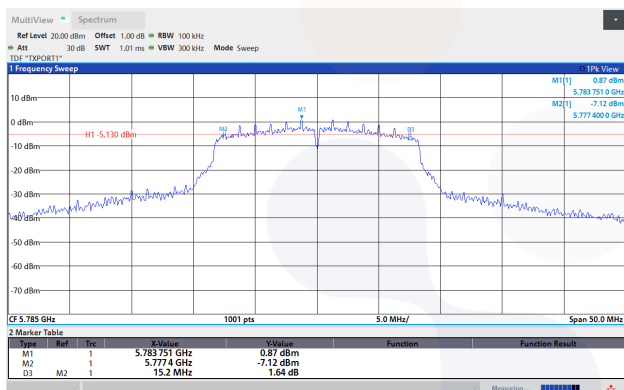
UNII 3 / 802.11a / Low ch.



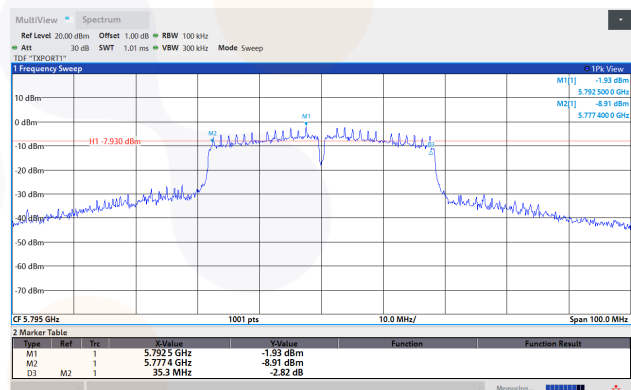
UNII 3 / 802.11n HT40 / Low ch.



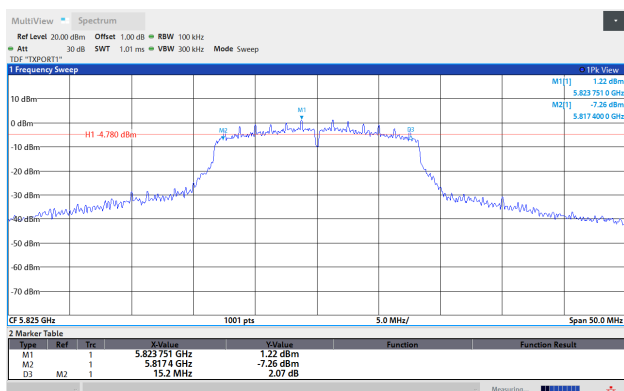
UNII 3 / 802.11a / Mid ch.



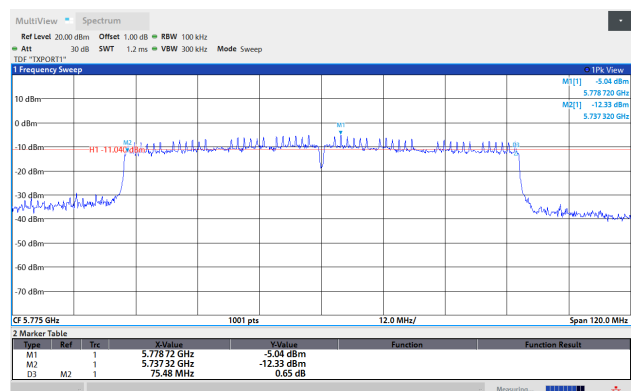
UNII 3 / 802.11n HT40 / High ch.



UNII 3 / 802.11a / High ch.



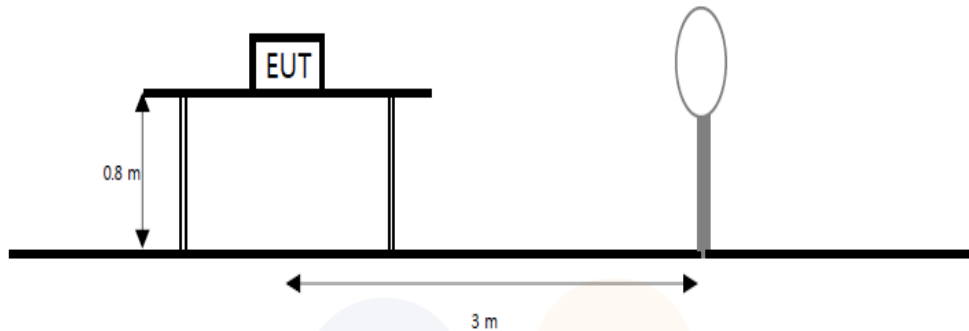
UNII 3 / 802.11ac VHT80 / Mid ch.



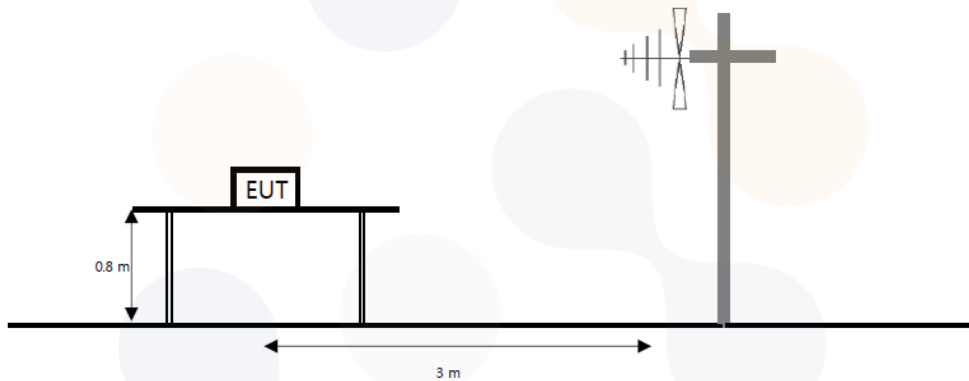
7.5. Spurious Emission, Band Edge and Restricted bands

Test setup

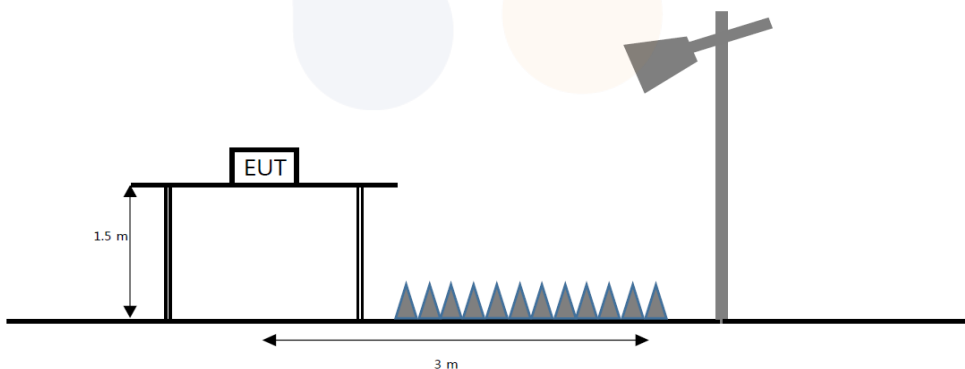
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions



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



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz emissions, whichever is lower.



Limit

According to section 15.209(a),

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 (MHz)	Field strength ($\mu\text{V}/\text{m}$)	Measurement distance (m)
0.009 - 0.490	2 400/F(kHz)	300
0.490 - 1.705	24 000/F(kHz)	30
1.705 - 30	30	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 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., Section 15.231 and 15.241.

According to section 15.205(a) and (b),

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.009 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 - 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 - 1 427	8.025 - 8.5
4.177 25 - 4.177 75	37.5 - 38.25	1 435 - 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 - 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 - 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 - 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 - 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 - 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525	2 483.5 - 2 500	17.7 - 21.4
8.376 25 - 8.386 75	25	2 690 - 2 900	22.01 - 23.12
8.414 25 - 8.414 75	156.7 - 156.9	3 260 - 3 267	23.6 - 24.0
12.29 - 12.293	162.012 5 - 167.17	3 332 - 3 339	31.2 - 31.8
12.519 75 - 12.520 25	167.72 - 173.2	3 345.8 - 3 358	36.43 - 36.5
12.576 75 - 12.577 25	240 - 285	3 600 - 4 400	Above 38.6
13.36 - 13.41	322 - 335.4		

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in section 15.209. At frequencies equal to or less than 1 000 MHz, compliance with the limits in section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 MHz, compliance with the emission limits in section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in section 15.35 apply to these measurements.

According to section 15.407(b),

undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz

For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

Test procedure

ANSI C63.10-2020 Section 6.10.6.2, 11.12.3.2, 12.7.5, 12.7.6, 12.7.7.2

KDB 789033 D02 V02r01 – Section G

Test settings

Peak field strength measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in table
3. VBW $\geq [3 \times \text{RBW}]$
4. Detector = peak
5. Sweep time = No faster than coupled (auto) time
6. Trace mode = max hold
7. Allow sweeps to continue until the trace stabilizes

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

Average field strength measurements

Trace averaging with continuous EUT transmission at full power

If the EUT can be configured or modified to transmit continuously ($D \geq 98\%$), then the average emission levels shall be measured using the following method (with EUT transmitting continuously):

- a) RBW = 1 MHz (unless otherwise specified).
- b) VBW $\geq [3 \times \text{RBW}]$.
- c) Detector = Power averaging (RMS), if $[\text{span} / (\# \text{ of points in sweep})] \leq (\text{RBW} / 2)$. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition is not satisfied, then the detector mode shall be set to peak.
- d) Averaging type = power (i.e., rms):
- e) As an alternative, the detector and averaging type may be set for linear voltage averaging.
- f) Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.
- g) Sweep time = auto.
- h) Perform a trace average of at least 100 traces.

Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction

If continuous transmission of the EUT ($D \geq 98\%$) cannot be achieved and the duty cycle is constant (duty cycle variations are less than $\pm 2\%$), then the following procedure shall be used:

- a) The EUT shall be configured to operate at the maximum achievable duty cycle.
- b) Measure the duty cycle D of the transmitter output signal as described in 11.6.
- c) $RBW = 1 \text{ MHz}$ (unless otherwise specified).
- d) $VBW \geq [3 \times RBW]$.
- e) Detector = Power averaging (RMS), if $[\text{span} / (\# \text{ of points in sweep})] \leq (RBW / 2)$. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
- f) Averaging type = power (i.e., rms):
- g) As an alternative, the detector and averaging type may be set for linear voltage averaging.
- h) Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.
- i) Sweep time = auto.
- j) Perform a trace average of at least 100 traces.
- k) A correction factor shall be added to the measurement results prior to comparing with the emission limit to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
 - l) If power averaging (rms) mode was used in step e), then the applicable correction factor is $[10 \log (1 / D)]$, where D is the duty cycle.
 - m) If linear voltage averaging mode was used in step e), then the applicable correction factor is $[20 \log (1 / D)]$, where D is the duty cycle.

Band edge measurements

Integration Method

If continuous transmission of the EUT ($D \geq 98\%$) cannot be achieved and the duty cycle is constant (duty cycle variations are less $\pm 2\%$), then the following procedure may be used to measure the average power of unwanted emissions within 2 MHz of the authorized band-edge:

- a) The EUT shall be configured to operate at the maximum achievable duty cycle.
- b) Measure the duty cycle D of the transmitter output signal as described in 11.6.
- c) Set instrument center frequency to the frequency of the emission to be measured.
- d) Set span to 2 MHz.
- e) RBW = 100 kHz.
- f) $VBW \geq 3 \times RBW$.
- g) Detector = Power averaging (rms), if $[\text{span} / (\# \text{ of points in sweep})] \leq (RBW / 2)$. Satisfying this condition might require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
- h) Averaging type = power (i.e., rms):
 - 1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
 - 2) Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.
- i) Sweep time = auto.
- j) Perform a trace average of at least 100 traces.
- k) Compute the power by integrating the spectrum over 1 MHz using the instrument's band-power measurement function with band limits set equal to the emission frequency ($f_{\text{emission}} \pm 0.5 \text{ MHz}$). If the spectrum analyzer does not have a band-power function, then sum the amplitude levels (in power units) at 100 kHz intervals extending across the 1 MHz spectrum defined by $f_{\text{emission}} \pm 0.5 \text{ MHz}$.
- l) A correction factor shall be added to the measurement results prior to comparing with the emission limit to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
 - 1) If power averaging (rms) mode was used in step f), then the applicable correction factor is $[10 \log (1 / D)]$, where D is the duty cycle.
 - 2) If linear voltage averaging mode was used in step f), then the applicable correction factor is $[20 \log (1 / D)]$, where D is the duty cycle.
 - 3) If a specific emission is demonstrated to be continuous ($D \geq 98\%$) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission. Reduction of the measured emission amplitude levels to account for operational duty cycle is not permitted. Determining compliance is based on emission levels occurring during transmission it is not based on an average across ON and OFF times of the transmitter.

Marker-delta method

The following procedure shall be used for the marker-delta method:

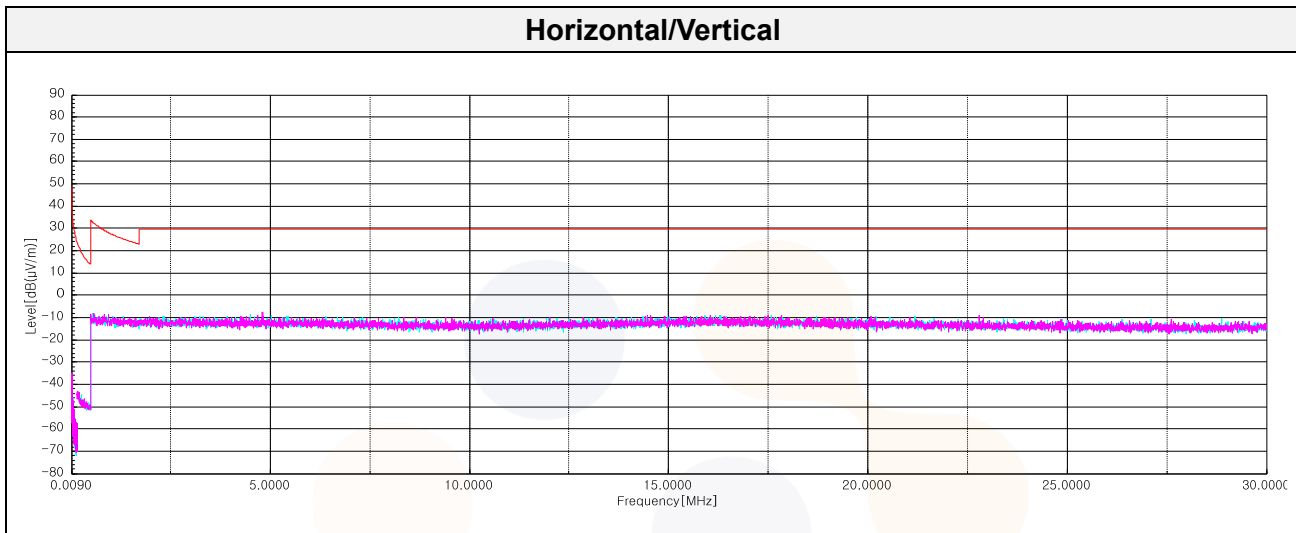
- a) Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function required for the frequency being measured. For example, for a device operating in the 902 MHz to 928 MHz band, use a 120 kHz RBW with a CISPR QP detector (a peak detector with 100 kHz RBW alternatively may be used). For transmitters operating above 1 GHz, use a 1 MHz RBW, a 3 MHz VBW, and a peak detector, as required.
 Repeat the measurement with an average detector (or alternatively, a peak detector and reduced VBW). For pulsed emissions, other factors shall be included; see 4.1.5.2.7.
- b) Choose an EMI receiver or spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the instrument RBW to 1% of the total span (but never less than 30 kHz), with a VBW equal to or greater than three times the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not an absolute field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.
- c) Subtract the delta measured in step b) from the field strengths measured in step a). The resulting field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge emissions compliance, where required.

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. Factors(dB) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) + or F_d (dB)
3. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
4. Average test would be performed if the peak result were greater than the average limit.
5. ¹⁾ means restricted band.
6. Below 30 MHz frequency range, In order to search for the worst result, all orientations about parallel, perpendicular, and ground-parallel were investigated then reported. when the emission level was higher than 20 dB of the limit, then the following statement shall be made: "No spurious emissions were detected within 20 dB of the limit."
7. Above 1 GHz the worst results between two antenna polarizations (H and V) were documented in the test report.
8. For above 1 GHz pre-scan to detect harmonic and spurious emissions, the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 kHz for peak measurements.

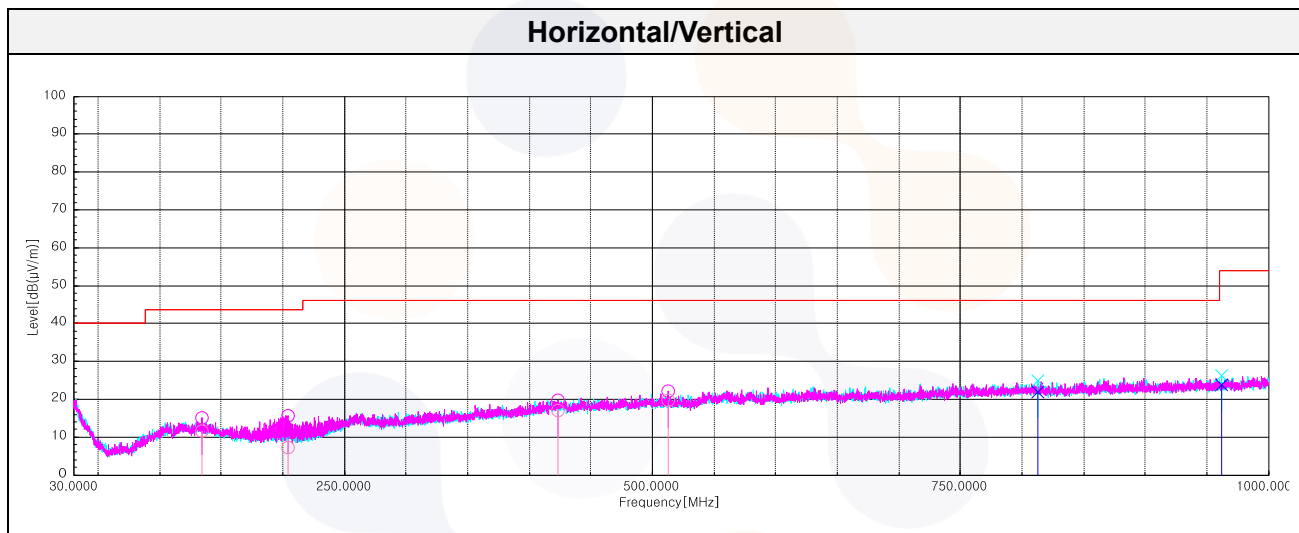
Test results (Below 30 MHz) – Worst case: 802.11a_UNII 3_5 825 MHz

Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
No spurious emissions were detected within 20 dB of the limit.									



Test results (Below 1 000 MHz) – Worst case: 802.11a_UNII 3_5 825 MHz

Frequency	Pol.	Reading	Amp. + Cable	Antenna Factor	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Quasi peak data								
134.52 ¹⁾	H	25.30	17.75	-31.40	-	11.65	43.52	31.87
203.99	H	22.90	15.30	-31.07	-	7.13	43.52	36.39
423.58	H	24.90	22.70	-30.50	-	17.10	46.02	28.92
512.45	H	26.60	23.40	-30.39	-	19.61	46.02	26.41
812.91	V	25.30	25.95	-29.28	-	21.97	46.02	24.05
961.81 ¹⁾	V	25.10	26.80	-27.96	-	23.94	54.00	30.06

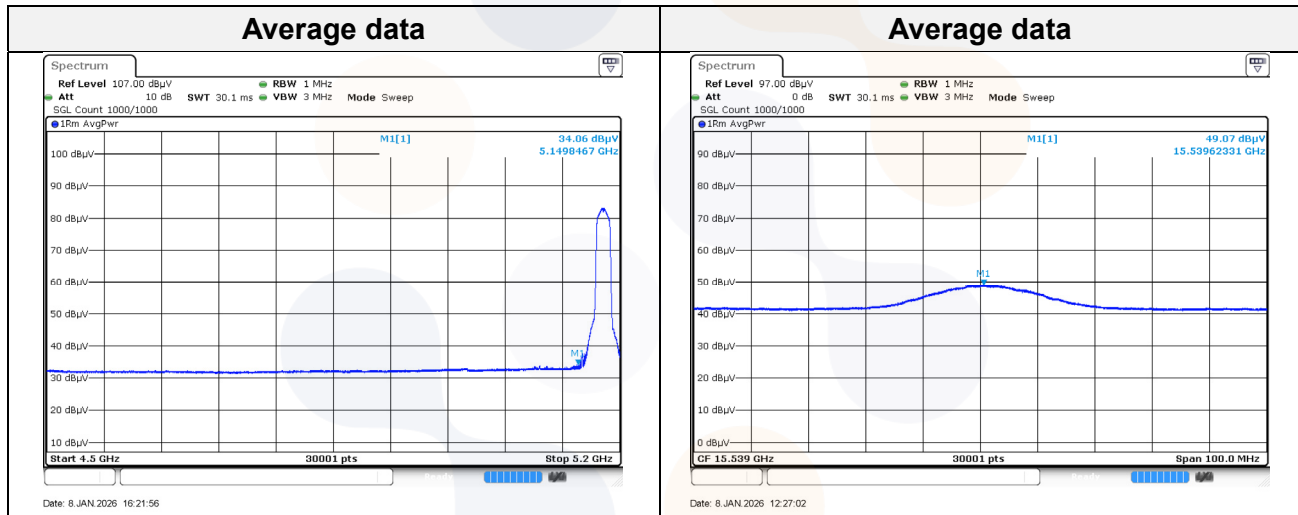


Test results (Above 1 000 MHz)

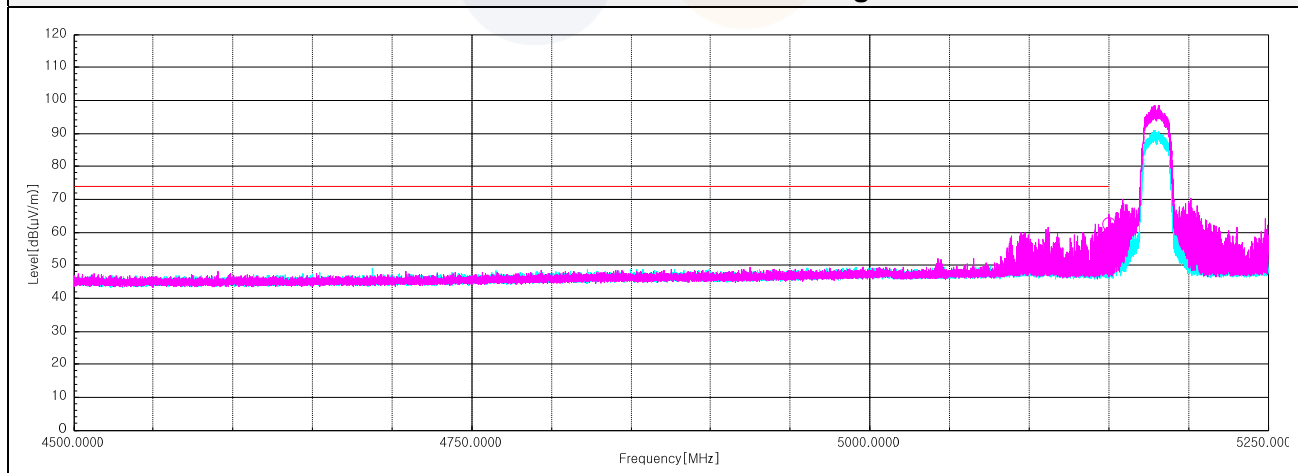
802.11a UNII 1

Lowest Channel (5 180 MHz)

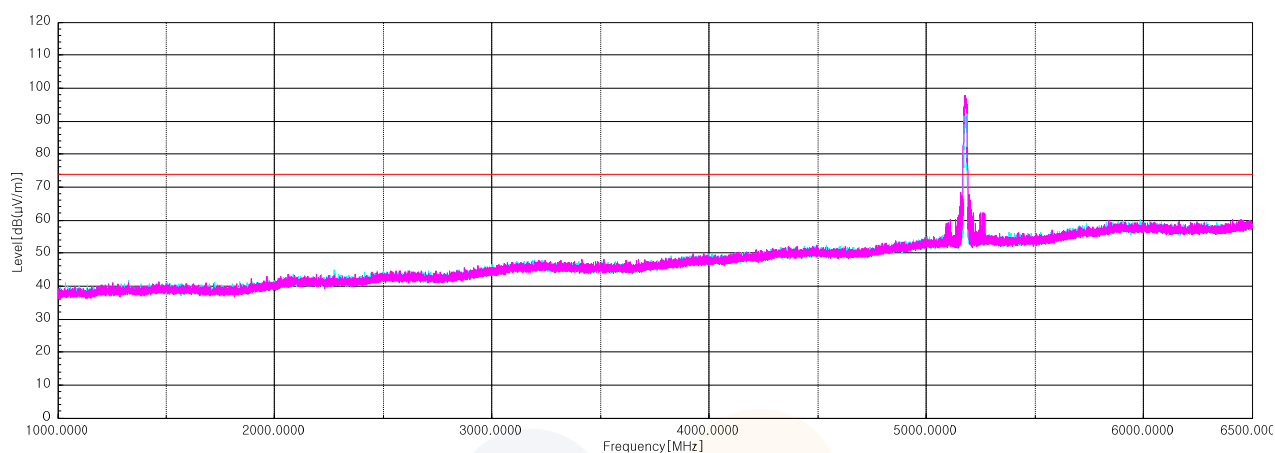
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
5 149.85 ¹⁾	H	57.20	33.30	-27.61	-	62.89	74.00	11.11
10 372.82	V	54.10	38.75	-39.98	-	52.87	68.20	15.33
15 539.62 ¹⁾	H	58.20	38.72	-37.93	-	58.99	74.00	15.01
Average Data								
5 149.85 ¹⁾	H	34.06	33.30	-27.61	0.32	40.07	54.00	13.93
15 539.62 ¹⁾	H	49.07	38.72	-37.93	0.32	50.18	54.00	3.82



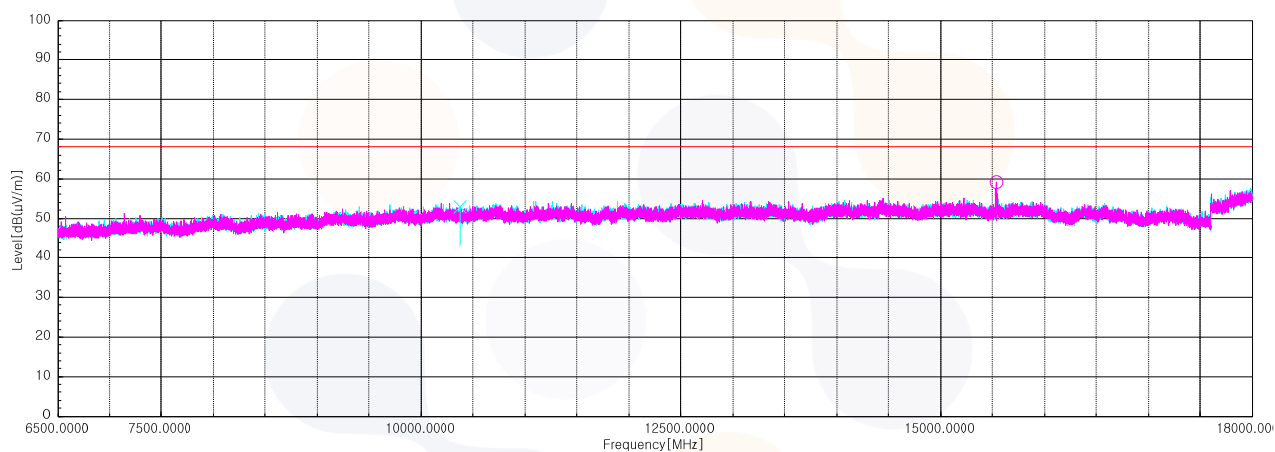
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 GHz ~ 6.5 GHz

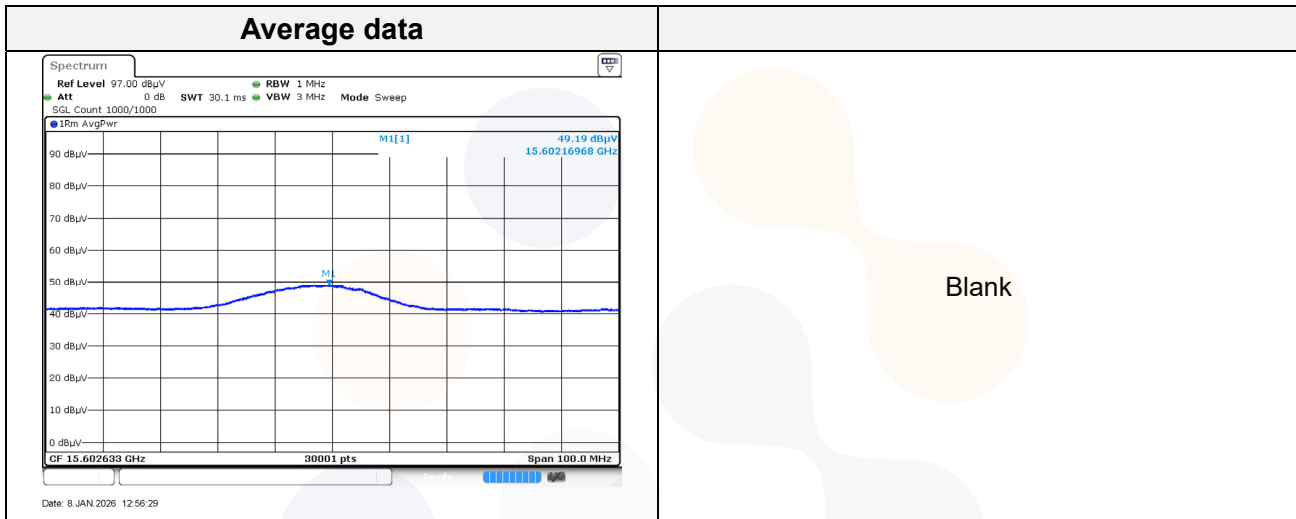


Horizontal/Vertical for 6.5 GHz ~ 18 GHz

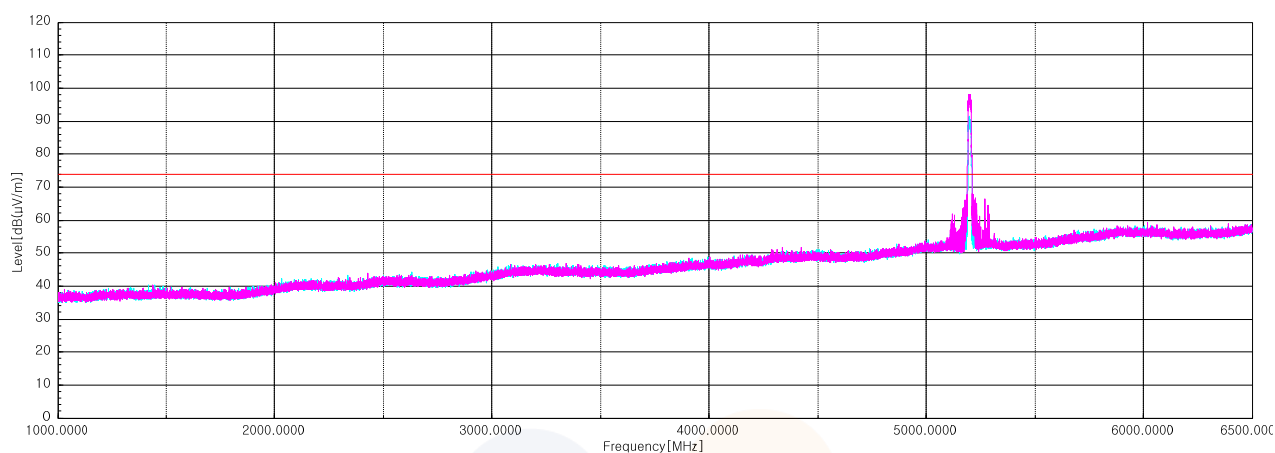


Middle Channel (5 200 MHz)

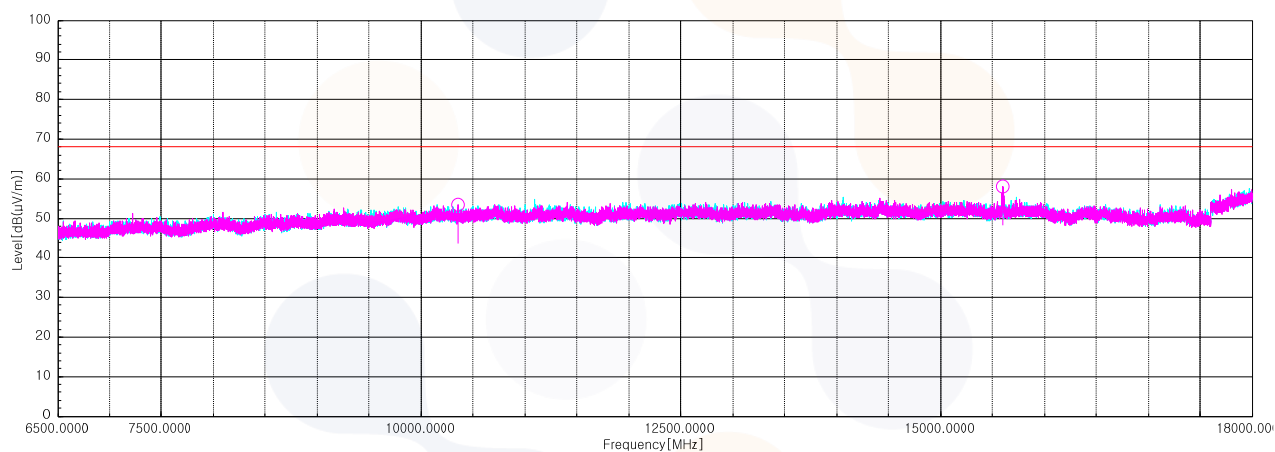
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
10 351.73	H	54.60	38.80	-39.98	-	53.42	68.20	14.78
15 602.17 ¹⁾	H	57.10	38.70	-37.73	-	58.07	74.00	15.93
Average Data								
15 602.17 ¹⁾	H	49.19	38.70	-37.73	0.32	50.48	54.00	3.52



Horizontal/Vertical for 1 GHz ~ 6.5 GHz

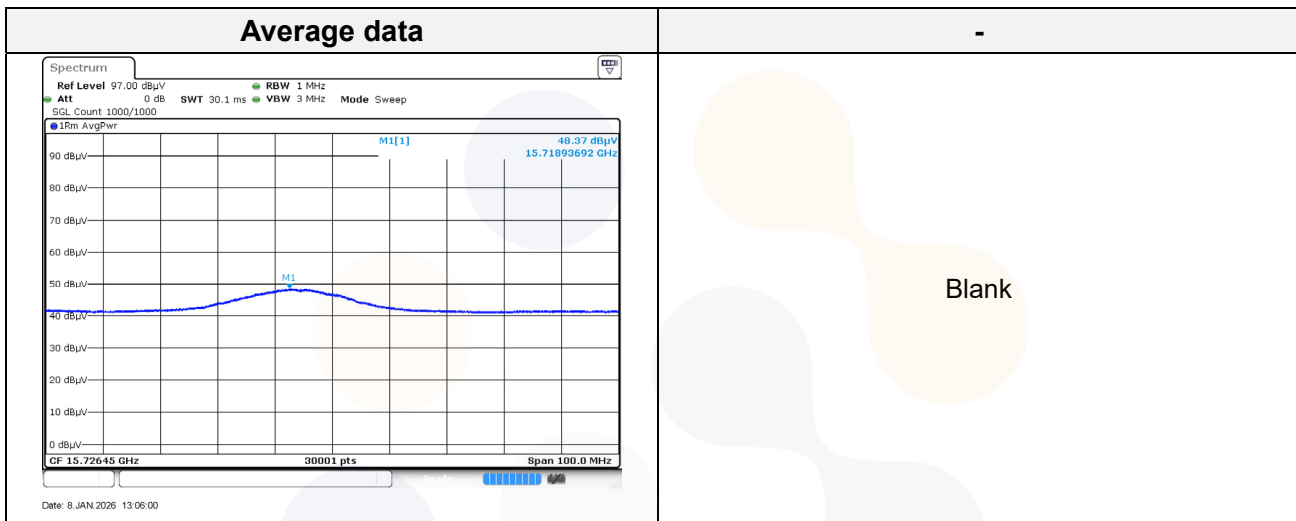


Horizontal/Vertical for 6.5 GHz ~ 18 GHz

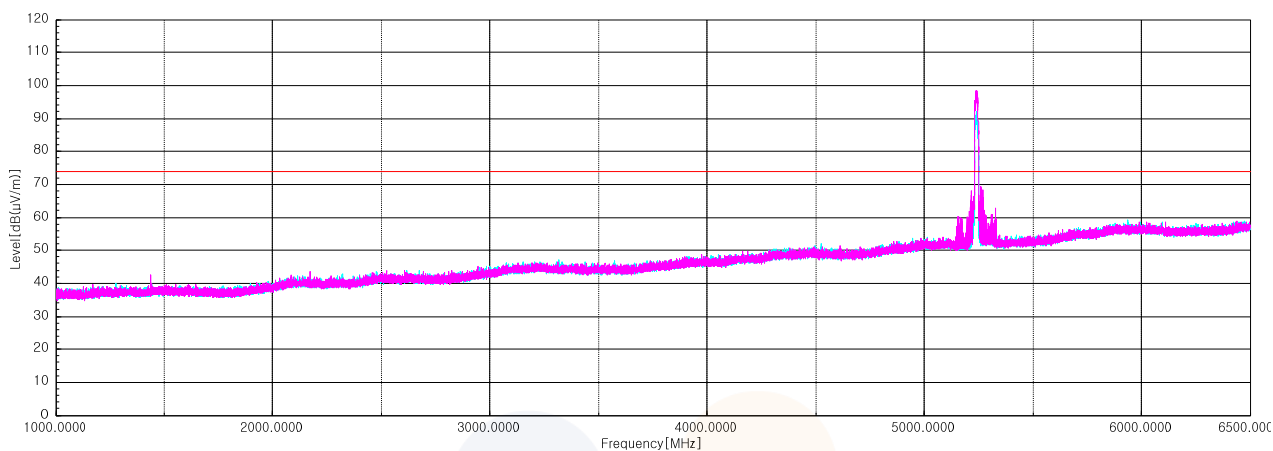


Highest Channel (5 240 MHz)

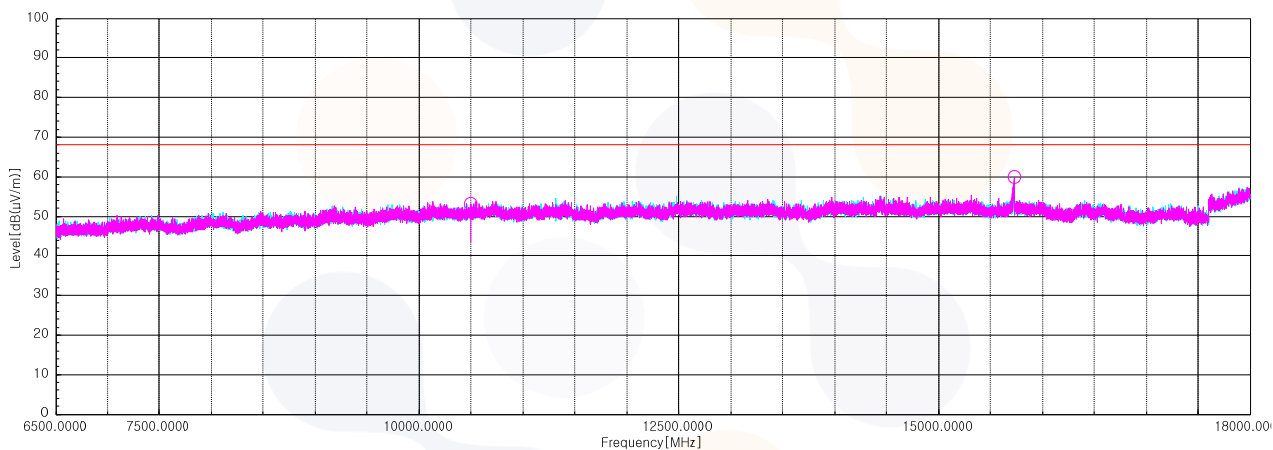
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
10 493.95	H	54.20	38.80	-40.00	-	53.00	68.20	15.20
15 718.94 ¹⁾	H	58.50	38.70	-37.37	-	59.83	74.00	14.17
Average Data								
15 718.94 ¹⁾	H	48.37	38.70	-37.37	0.32	50.02	54.00	3.98



Horizontal/Vertical for 1 GHz ~ 6.5 GHz



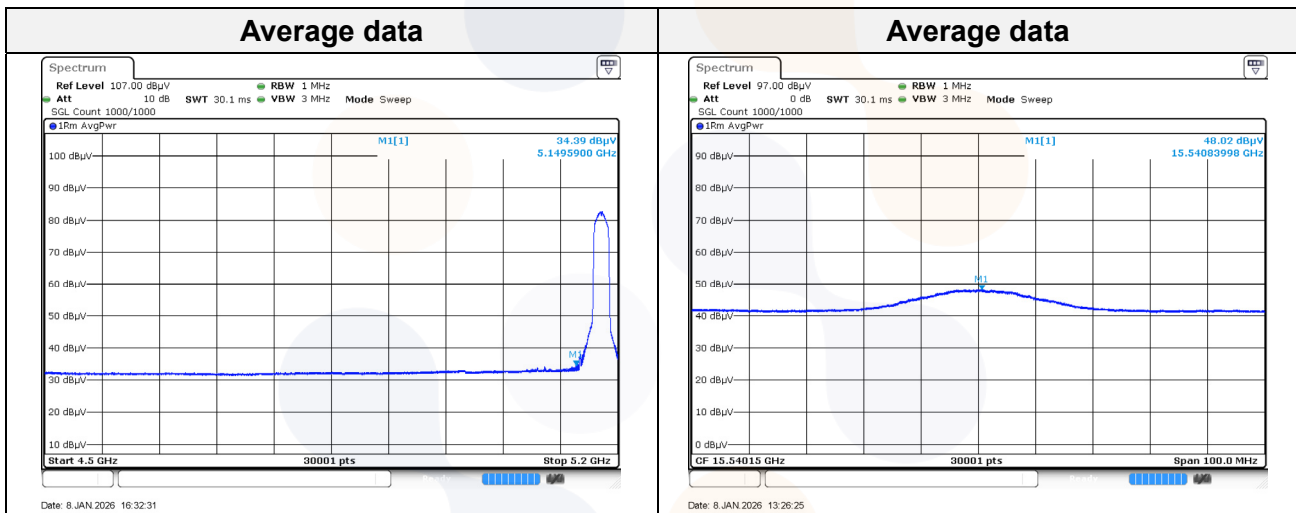
Horizontal/Vertical for 6.5 GHz ~ 18 GHz



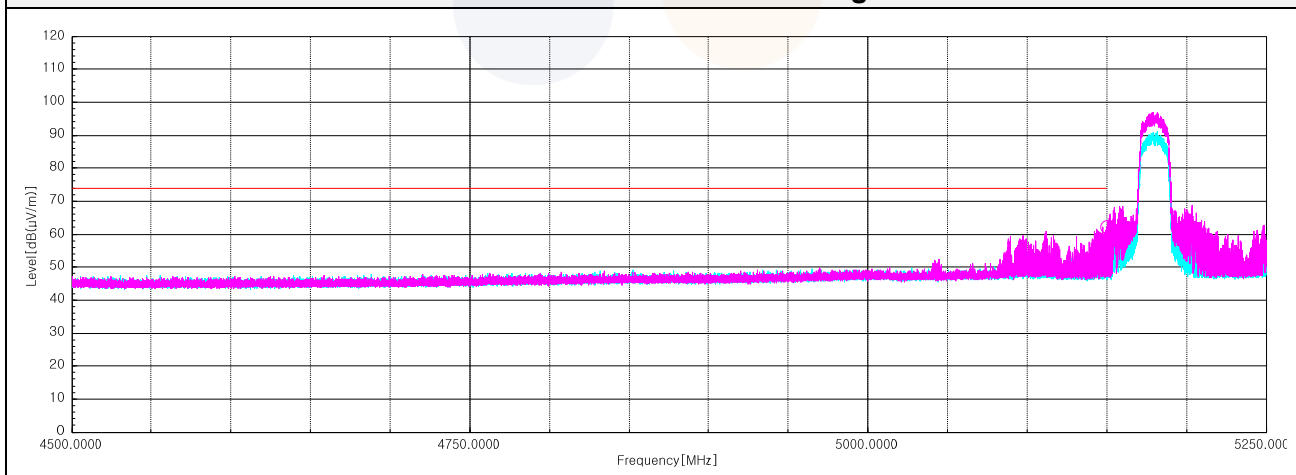
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Lowest Channel (5 180 MHz)

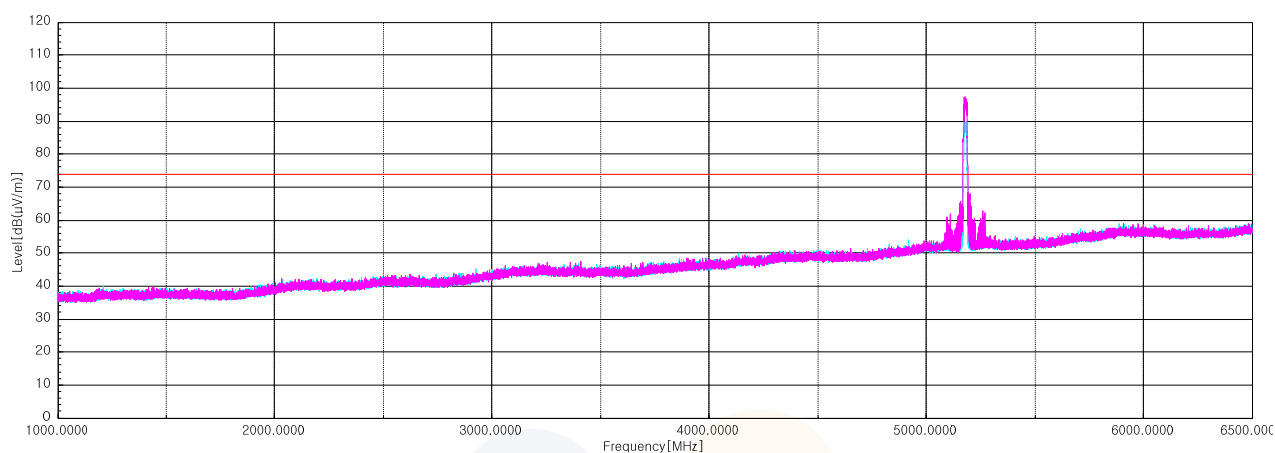
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
5 149.59 ¹⁾	H	56.90	33.30	-27.61	-	62.59	74.00	11.41
10 360.55	V	54.50	38.78	-39.98	-	53.30	68.20	14.90
15 540.84 ¹⁾	H	57.30	38.72	-37.92	-	58.10	74.00	15.90
Average Data								
5 149.59 ¹⁾	H	34.39	33.30	-27.61	0.33	40.41	54.00	13.59
15 540.84 ¹⁾	H	48.02	38.72	-37.92	0.33	49.15	54.00	4.85



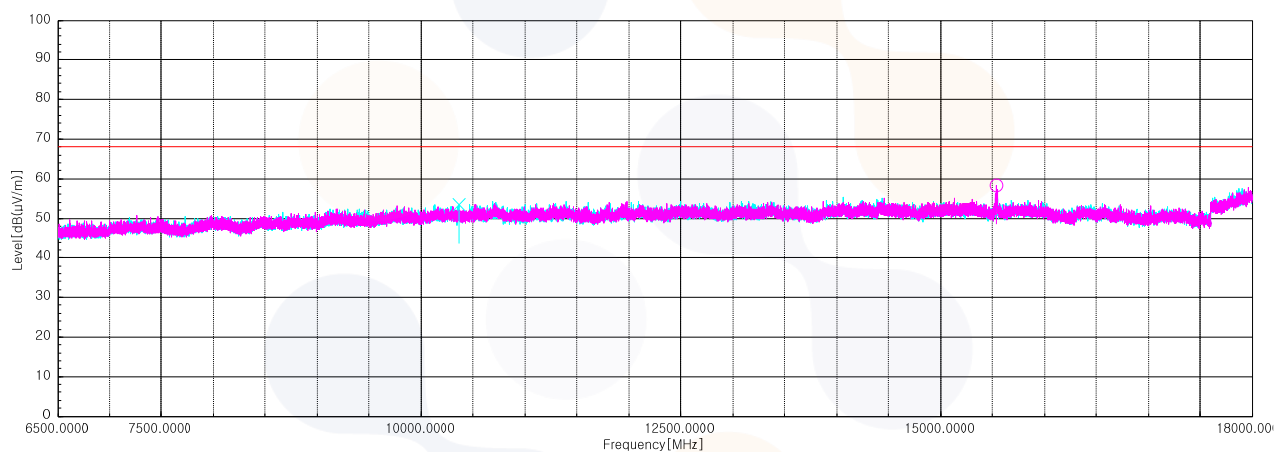
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 GHz ~ 6.5 GHz

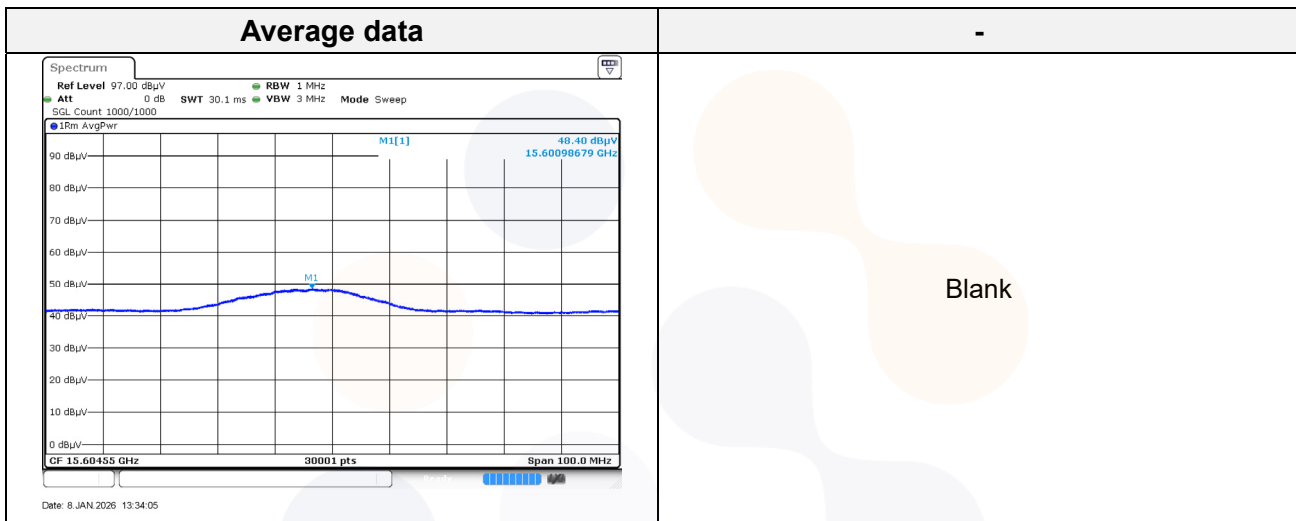


Horizontal/Vertical for 6.5 GHz ~ 18 GHz

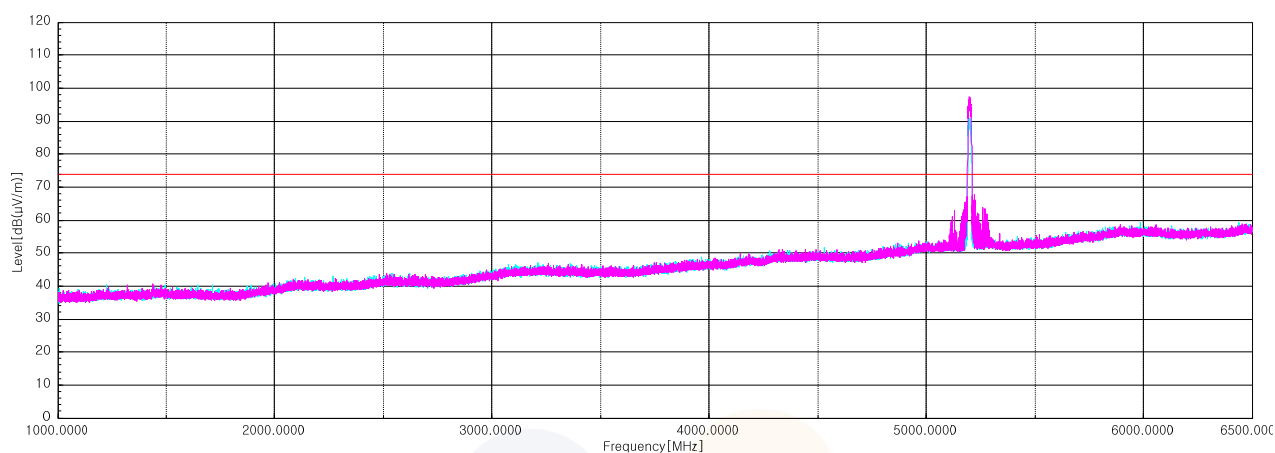


Middle Channel (5 200 MHz)

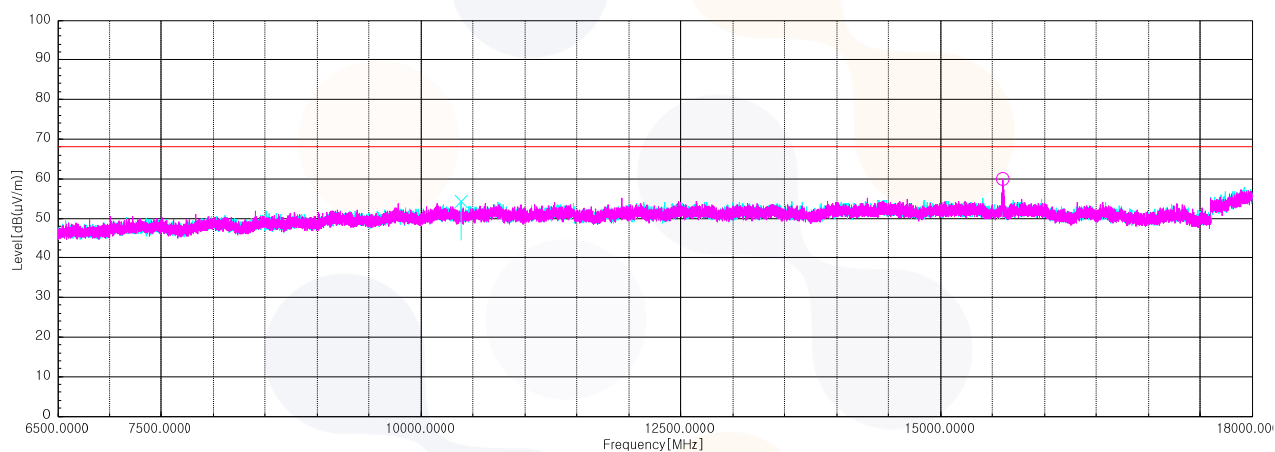
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
10 387.00	V	55.30	38.73	-39.99	-	54.04	68.20	14.16
15 600.99 ¹⁾	H	59.00	38.70	-37.73	-	59.97	74.00	14.03
Average Data								
15 600.99 ¹⁾	H	48.40	38.70	-37.73	0.33	49.70	54.00	4.30



Horizontal/Vertical for 1 GHz ~ 6.5 GHz

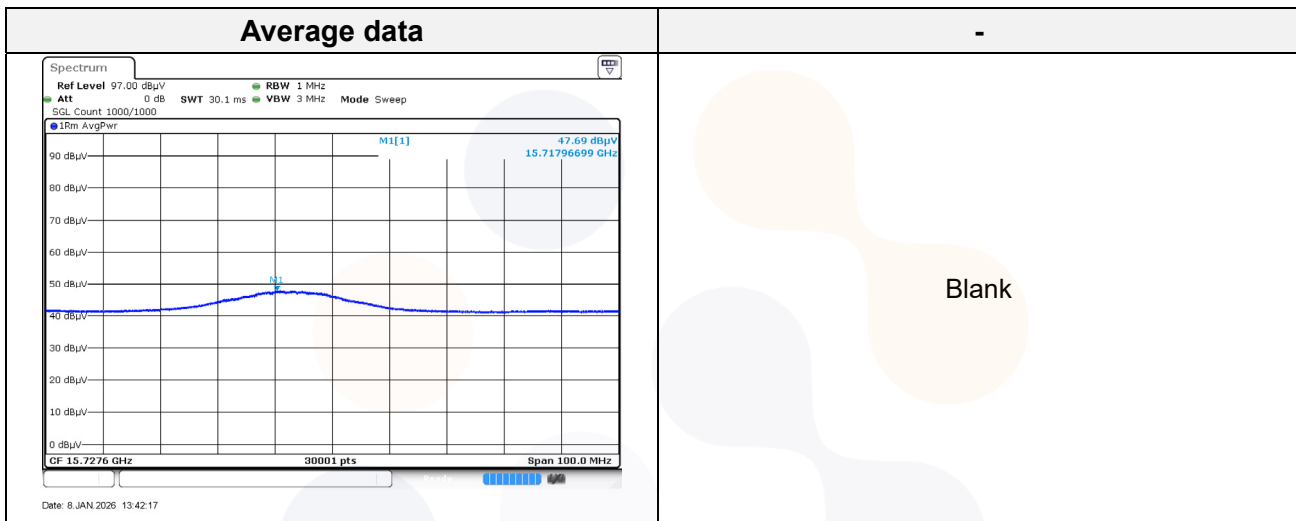


Horizontal/Vertical for 6.5 GHz ~ 18 GHz

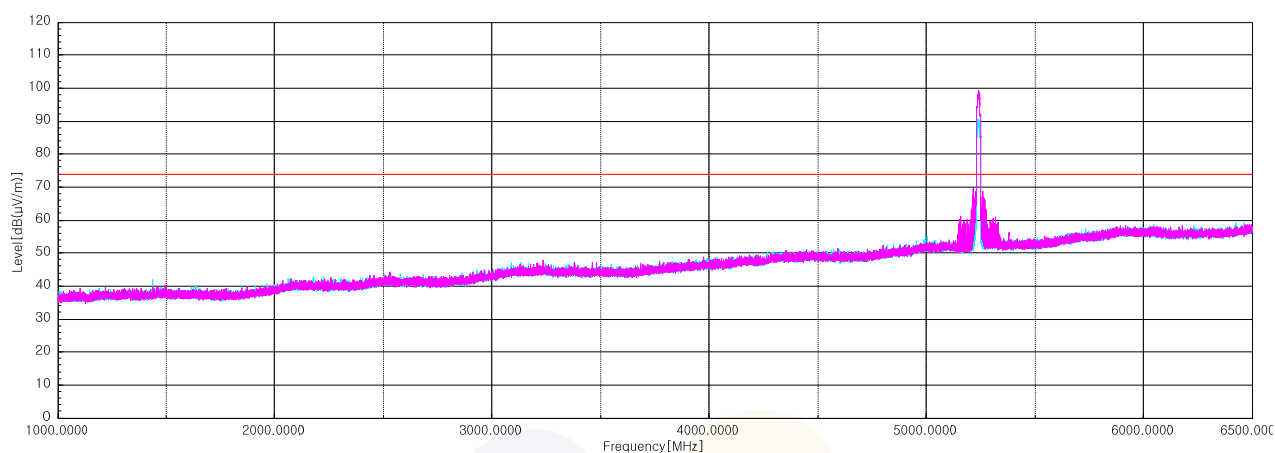


Highest Channel (5 240 MHz)

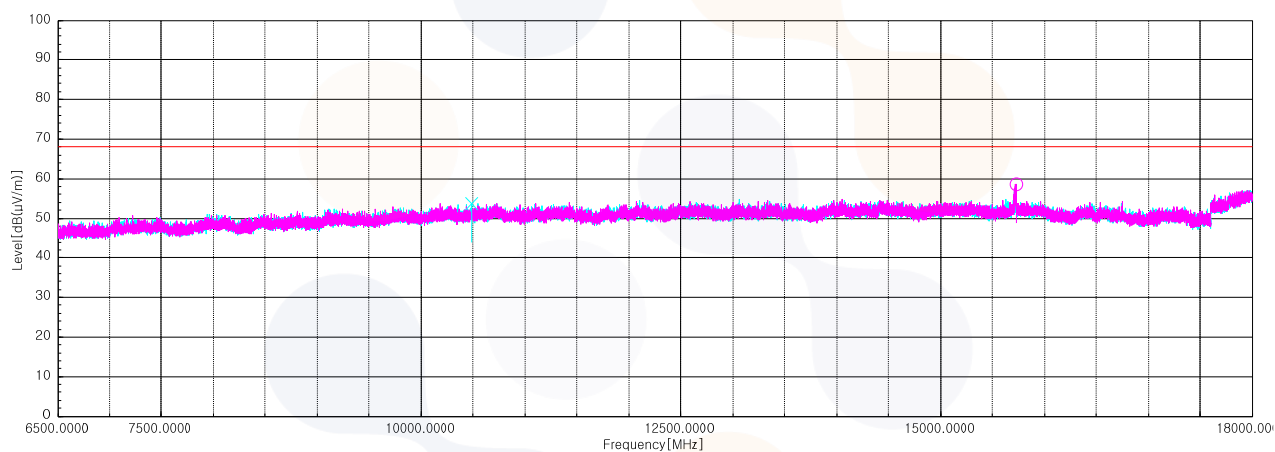
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
10 481.68	V	54.70	38.80	-40.00	-	53.50	68.20	14.70
15 717.97 ¹⁾	H	57.20	38.70	-37.37	-	58.53	74.00	15.47
Average Data								
15 717.97 ¹⁾	H	47.69	38.70	-37.37	0.33	49.35	54.00	4.65



Horizontal/Vertical for 1 GHz ~ 6.5 GHz



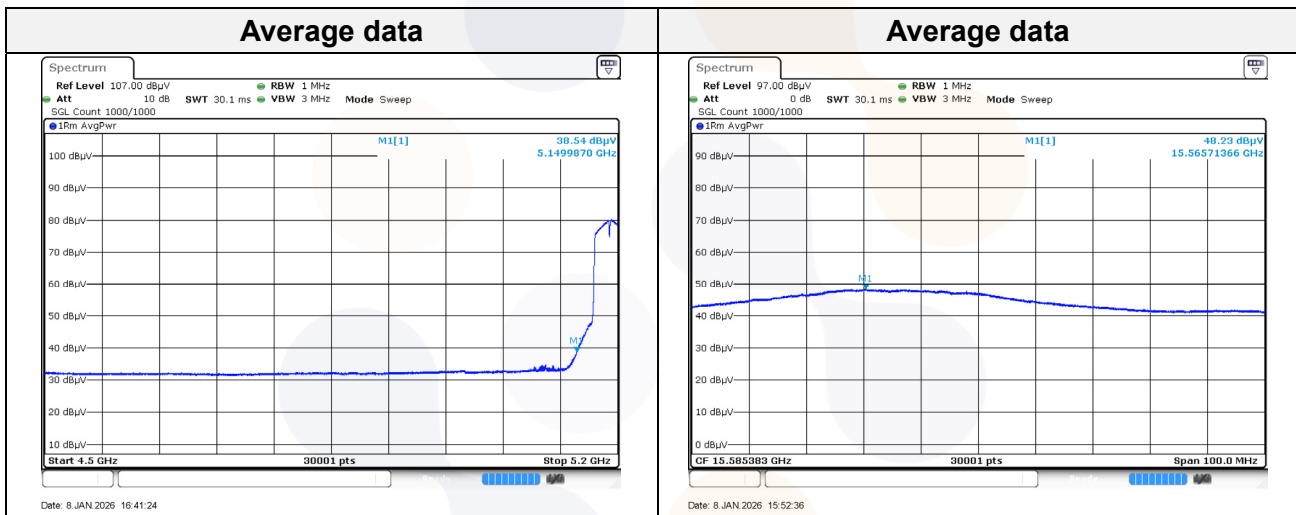
Horizontal/Vertical for 6.5 GHz ~ 18 GHz



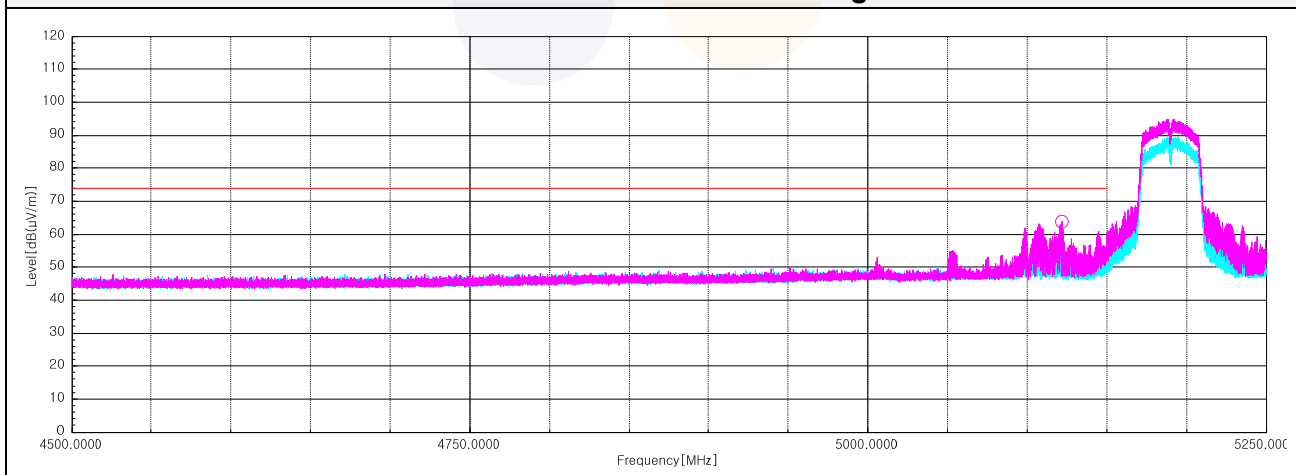
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Lowest Channel (5 190 MHz)

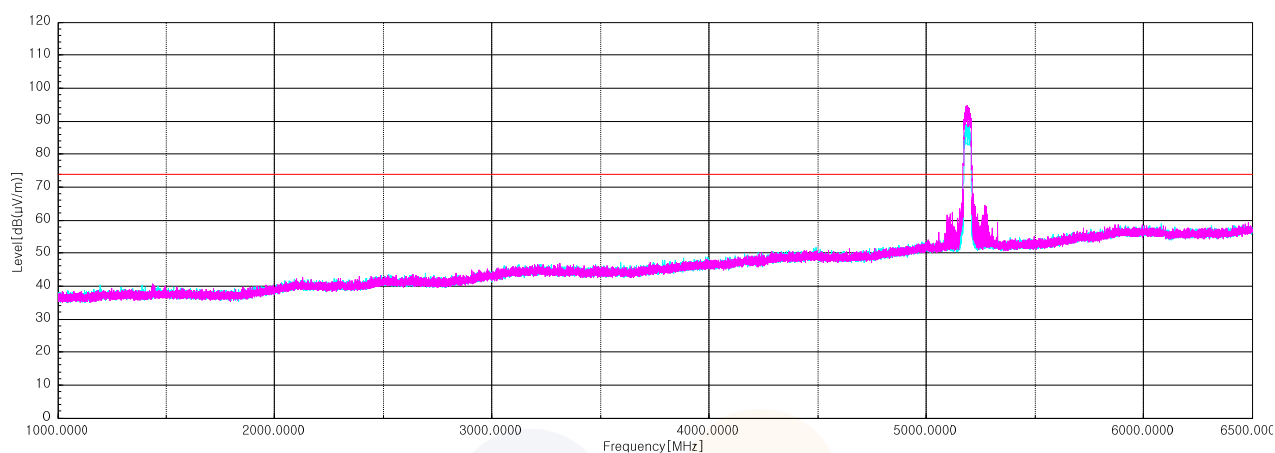
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
5 149.99 ¹⁾	H	58.30	33.30	-27.61	-	63.99	74.00	10.01
10 281.58	V	54.70	38.90	-39.97	-	53.63	68.20	14.57
15 565.71 ¹⁾	H	56.90	38.80	-37.84	-	57.86	74.00	16.14
Average Data								
5 149.99 ¹⁾	H	38.54	33.30	-27.61	0.67	44.90	54.00	9.10
15 565.71 ¹⁾	H	48.23	38.80	-37.84	0.67	49.86	54.00	4.14



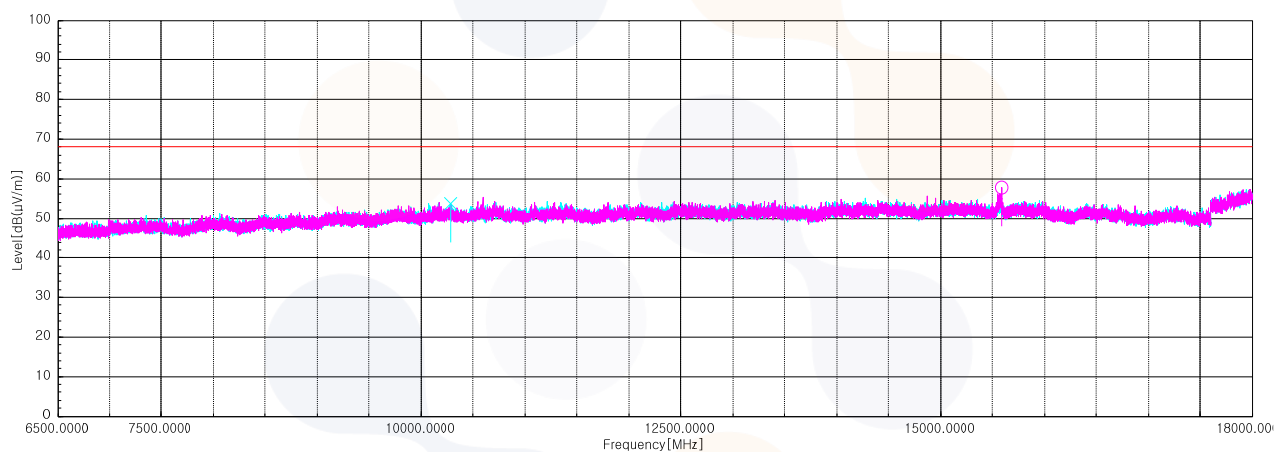
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 GHz ~ 6.5 GHz



Horizontal/Vertical for 6.5 GHz ~ 18 GHz



Highest Channel (5 230 MHz)

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
10 457.53	H	54.30	38.80	-39.99	-	53.11	68.20	15.09
15 693.46 ¹⁾	H	55.40	38.70	-37.45	-	56.65	74.00	17.35
Average Data								
15 693.46 ¹⁾	H	46.90	38.70	-37.45	0.67	48.82	54.00	5.18

