TEST REPORT

KES Co., Ltd.
#3002, #3503, #3701, 40, Simin-daero365beon-gil, Dongan-gu,
Anyang-si, Gyeonggi-do, 14057, Republic of Korea
Tel : +82-31-425-6200, Fax : +82-31-341-3838

■ **FCC & IC TEST REPORT**

1. Client

○ Name : Vieworks Co., Ltd.

○ Address : 41-3, Burim-ro, 170beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 14055, Republic of Korea

2. Sample Description

○ Product item : Wireless Module

○ Model name : F1CS43752_HP

○ Variant Moedl name : VWLM-1

○ Manufacturer etc. : F1 Media Co., Ltd.

3. Date of test : 2025.08.12 ~ 2025.12.12

4. Location of Test : ☑ Permanent Testing Lab ☐ On Site Testing

○ Adress : 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea

5. FCC & IC Rule part(s) : Part 15 Subpart C 15.247,
RSS-247 (Issue 4) & RSS-Gen (Issue 5)

6. Test result : PASS

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
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This laboratory is not accredited for the test results marked *.
This test report is not related to KOLAS accreditation.

Affirmation	Tested by Name : Gu-Bong, Kang (Signature)	Technical Manager Name : Yeong-Jun Cho (Signature)

[강구봉]2025/12/16

[조영준]2025/12/16

2025. 12. 16.

KES Co., Ltd.

REPORT REVISION HISTORY

Date	Test Report No.	Revision History
2025.12.16	KES-RF250753	Initial

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1. General information

Applicant:	Vieworks Co., Ltd.
Applicant address:	41-3, Burim-ro, 170beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 14055, Republic of Korea
Test site:	KES Co., Ltd.
Test site address:	☐ #3002, #3503, #3701, 40, Simin-daero365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Republic of Korea ☒ 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
Test Facility	FCC Accreditation Designation No.: KR0100, Registration No.: 444148 ISED Registration No.: 23298
FCC rule part(s):	15.247
FCC ID:	PFR-F1CS43752HP
IC rule part(s):	RSS-247 (Issue 4), RSS-Gen (Issue 5)
IC Number:	11233A-F1CS43752HP
Test device serial No.:	☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	Wireless Module
Frequency range & Number of channels	**2 402 ㎒ ~ 2 480 ㎒ (BDR) : 79 ch** 2 402 ㎒ ~ 2 480 ㎒ (LE 1 Mbps) : 40 ch 2 412 ㎒ ~ 2 462 ㎒ (802.11n_HT20) : 11 ch 5 180 ㎒ ~ 5 240 ㎒ (802.11a/n_HT20/ac_VHT20) : 4 ch UNII-1 5 190 ㎒ ~ 5 230 ㎒ (802.11n_HT40/ac_VHT40) : 2 ch 5 210 ㎒ (802.11ac_VHT80) : 1 ch 5 745 ㎒ ~ 5 825 ㎒ (802.11a/n_HT20/ac_VHT20) : 5 ch UNII-3 5 755 ㎒ ~ 5 795 ㎒ (802.11n_HT40/ac_VHT40) : 2 ch 5 775 ㎒ (802.11ac_VHT80) : 1 ch
Model	F1CS43752_HP
Derivative Model	VWLM-1
Modulation technique	**GFSK,** OFDM
Antenna specification	**ANT1 : FPCB Antenna (BT & WLAN)**, ANT2 : FPCB Antenna (WLAN only) ANT1 : 2.4 ㎓ : 2.13 ㏈i / 5.15~5.25 ㎓ : 0.699 ㏈i / 5.725~5.85 ㎓ : 1.889 ㏈i ANT2 : 2.4 ㎓ : 2.13 ㏈i / 5.15~5.25 ㎓ : 0.699 ㏈i / 5.725~5.85 ㎓ : 1.889 ㏈i
Power source	DC 3.3 V
H/W version	1.0
S/W version	1.0
Serial Number	WM00010

1.2. Test configuration

The **Vieworks Co., Ltd. // Wireless Module // F1CS43752_HP // FCC ID: PFR-F1CS43752HP // IC number : 11233A-F1CS43752HP** was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.247
ISED RSS-247 Issue 4 and RSS-Gen Issue 5
KDB 558074 D01 v05 r02
ANSI C63.10-2020 for FCC
ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 for IC

1.3. Information about derivative model

Derivative model **VWLM-1** has no electrical, circuitry, appearance, or color differences from the basic model **F1CS43752_HP**.
It is simply a way to manage different names for different vendors.

1.4. Accessory information

N/A

1.5. Device modifications

N/A

1.6. Antenna information

Mode	SISO		MIMO
	Antenna 1	Antenna 2	Antenna 1 + 2
BDR	✓	×	×
LE 1 Mbps	✓	×	×
802.11a	✓	✓	×
802.11n/ac	✓	✓	✓

✓ = Support; × = Not support

Antenna Model
Ant0 : 1832-6104-01A[B]
Ant1 : 1832-6104-01A[B]

Ant1 Gain (dBi)	Ant2 Gain (dBi)	Note
2.130	2.130	2 400 to 2 500 ㎒
0.699	0.699	5 150 to 5 250 ㎒
1.889	1.889	5 725 to 5 850 ㎒

1.7. Sample calculation

Where relevant, the following sample calculation is provided
For all conducted test items :

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator 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.

Offset(㏈) = RF cable loss(㏈) + attenuator factor(㏈).
= 1.55 + 20 = 21.55 (㏈)

For Radiation test :
Field strength level (㏈㎶/m) = Measured level (㏈㎶) + Antenna factor (㏈) + Cable loss (㏈) – Amplifier gain (㏈)

1.8. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.22 ㏈ (SHIELD ROOM #6)
Uncertainty for Radiation emission test (include Fundamental emission)	Below 1 ㎓	4.04 ㏈ (SAC #6)
	Above 1 ㎓	5.32 ㏈ (SAC #5)
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of *k*=2.		

1.9. Frequency/channel operations

Ch.	Frequency (㎒)	Rate(Mbps)
00	**2 402**	**BDR 1 Mbps**
.	.	.
.	.	.
40	**2 442**	**BDR 1 Mbps**
.	.	.
.	.	.
78	**2 480**	**BDR 1 Mbps**

Ch.	Frequency (㎒)	Rate(Mbps)
00	2 402	LE 1 Mbps
.	.	.
.	.	.
20	2 442	LE 1 Mbps
.	.	.
.	.	.
39	2 480	LE 1 Mbps

Ch.	Frequency (㎒)	Mode
1	2 412	802.11n_HT20
.	.	.
.	.	.
6	2 437	802.11n_HT20
.	.	.
.	.	.
11	2 462	802.11n_HT20

UNII-1

Ch.	Frequency (㎒)
36	5 180
44	5 220
48	5 240

UNII-3

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

802.11a/n_HT20/ac_VHT20 mode

UNII-1

Ch.	Frequency (㎒)
38	5 190
46	5 230

UNII-3

Ch.	Frequency (㎒)
151	5 755
159	5 795

802.11n_HT40/ac_VHT40 mode

UNII-1

Ch.	Frequency (㎒)
42	5 210

UNII-3

Ch.	Frequency (㎒)
155	5 775

802.11ac_VHT80 mode

1.10. Requirements for Bluetooth transmitter

15.247(a)(1) that the rx input bandwidths shift frequencies in synchronization with the transmitted signals.

Pseudorandom frequency hopping sequence
The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The nominal hop rate is 1 600 hops/s.

Equal hopping frequency use
The channels of this system will be used equally over the long-term distribution of the hopsets.

Example of a 79 hopping sequence in data mode:
24, 19, 61, 72, 77, 35, 69, 14, 32, 28, 51, 78, 62, 67, 40, 70, 25, 13, 26, 4, 29, 15, 20, 23, 38, 17, 59, 52, 2, 9, 74, 46, 3, 55, 50, 58, 34, 0, 12, 37, 7, 22, 65, 75, 48, 76, 63, 60, 47, 31, 5, 11, 16, 64, 10, 45, 54, 43, 66, 6, 68, 56, 21, 1, 71, 39, 8, 73, 36, 33, 42, 41, 30, 44, 53, 27, 18, 49, 57, 4, 72, 29, 32, 39, 1, 42, 34, 52, 19, 38, 20, 36, 17, 57, 7, 43, 40, 14, 62, 77, 15, 74, 35, 3, 73, 46, 33, 21, 41, 16, 64, 44, 25, 23, 22, 47, 26, 18, 28, 78, 37, 49, 13, 50, 66, 61, 0, 9, 59, 60, 67, 55, 27, 76, 31, 6, 12, 24, 58, 71, 75, 30, 53, 10, 56, 2, 45, 48, 68, 11, 65, 54, 5, 51, 63, 69, 70, 8

System receiver input bandwidth
Each channel bandwidth is 1 ㎒.
The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.

15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate it channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

2. Summary of tests

Section in FCC Part 15	Section in RSS-247 & Gen	Test description	Test results
-	RSS-Gen 6.7	99% Occupied bandwidth	Pass
15.247(a)(1)(iii)	-	20 dB bandwidth	Pass
15.247(b)(1)	RSS-247 6.2.3.1 (a), 6.2.3.2 (a)	Output power	Pass
15.247(a)(1)	RSS-247 6.2.3.1 (a)	Channel separation	Pass
15.247(a)(1)(iii)	RSS-247 6.2.3.1 (b)	Number of channels	Pass
15.247(a)(1)(iii)	RSS-247 6.2.3.1 (b)	Time of occupancy	Pass
15.205, 15.209	RSS-247 6.6, RSS-Gen 8.9, 8.10	Radiated restricted band and emission	Pass
15.207(a)	RSS-Gen 8.8	AC Conducted emissions	Pass
15.247(d)	RSS-247 6.6	Conducted spurious emission and band edge	Pass
15.203	-	Antenna Requirement	Pass

Note.

1. By the request of applicant, test is performed with power setting value below :

Mode	2.4 ㎓	
	Frequency (㎒)	Setting value
BDR	2 402 ~ 2 480	2

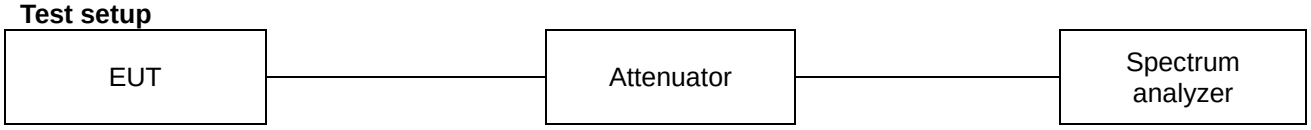
3. Test results

3.1. 99% Occupied Bandwidth

Test procedure

For FCC, ANSI C63.10-2020 - clause 6.9.2 and 6.9.3
For IC, ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 - clause 6.9.2 and 6.9.3

Test setup



Test setting

1. Span = 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.
2. RBW = The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW
3. VBW = shall be approximately three times the RBW
4. Sweep = auto
5. Detector function = Peak
6. Trace = Max hold

Limit

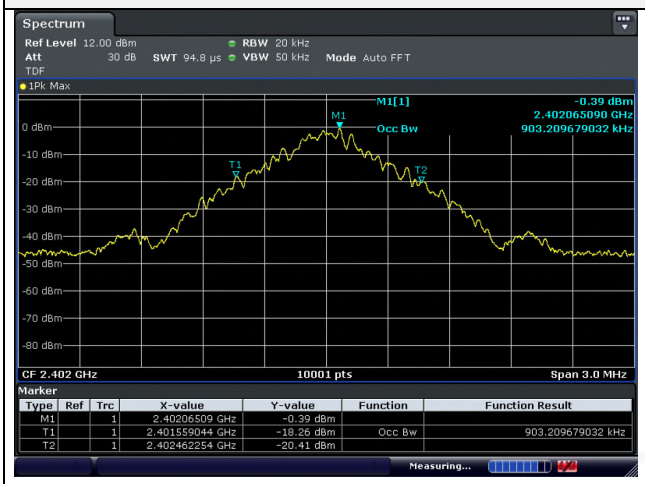
None; for reporting purpose only.

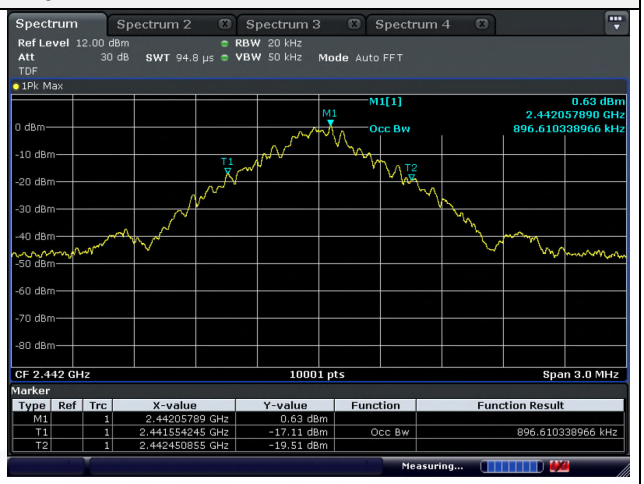
Mode : BDR 1 Mbps

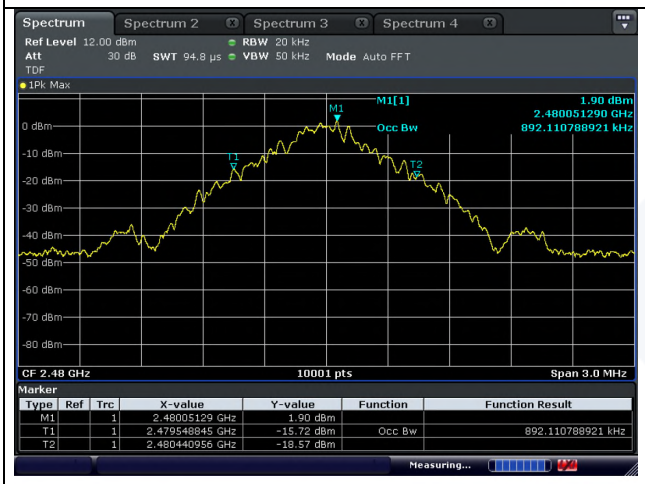
Frequency(㎒)	99% occupied bandwidth(㎒)	Limit(㎒)
2 402	0.90	-
2 442	0.90	
2 480	0.89	

Test plots

BDR 1 Mbps







Blank

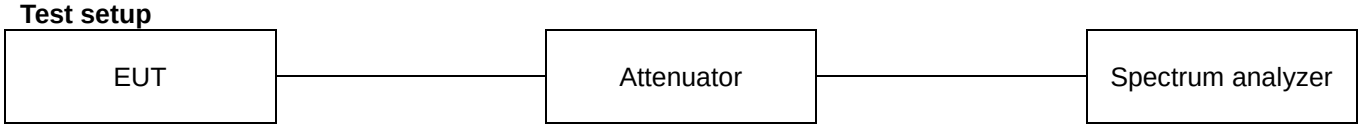
3.2. 20 dB bandwidth

Test procedure

For FCC, ANSI C63.10-2020

For IC, ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024

Test setup



Test setting

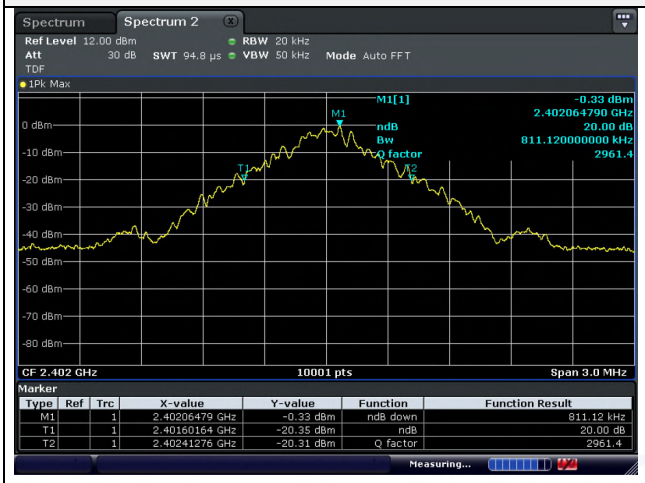
1. Span = Set between two times and five times the OBW
2. RBW ≥ 1 % to 5 %of the OBW
3. VBW ≥ 3 * RBW
4. Sweep = Auto
5. Detector function = Peak
6. Sweep = Auto couple
7. Trace mode = Max hold
8. All the trace to stabilize

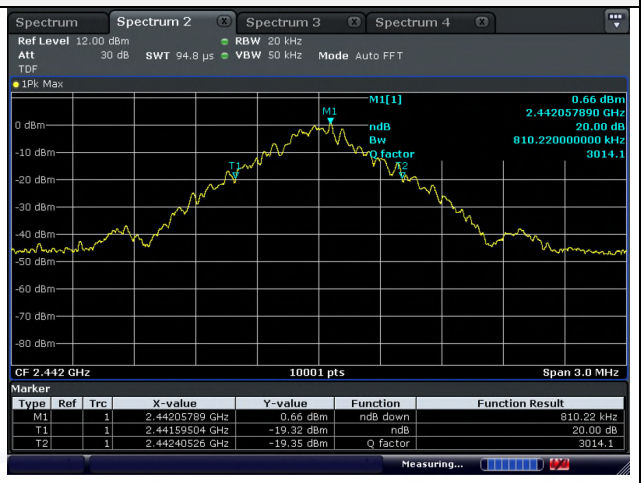
Limit

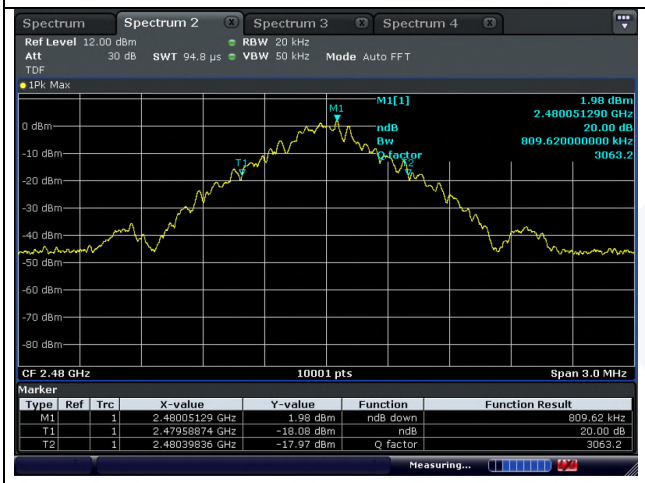
Not applicable

Frequency(㎒)	Channel no.	Data rate(Mbps)	Measured bandwidth(㎒)
2 402	00	BDR 1 Mbps	0.81
2 442	40		0.81
2 480	78		0.81

BDR 1 Mbps







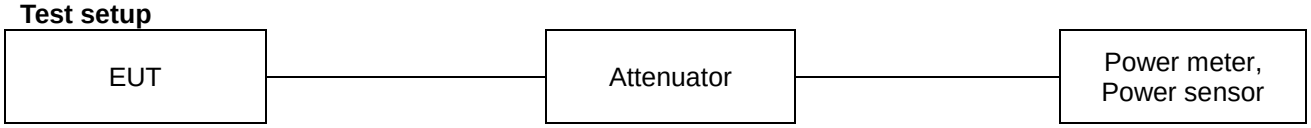
Blank

3.3. Output power

Test procedure

KDB 558074 v05r02,
For FCC, ANSI C63.10-2020 - Section 11.9.1.2 and 11.9.2.3.2
For IC, ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 - Section 11.9.1.2 and 11.9.2.3.2

Test setup



Test setting

Alternatively, measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Because the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

FCC Limit

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 ㎑ or the 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 ㎽.

According to §15.247(b)(1), For frequency hopping systems operating in the 2 400 ~ 2 483.5 ㎒ employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725 ~ 5 805 ㎒ band: 1 Watt.

According to §15.247(a)(4), The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 ㏈i.

IC Limit

According to RSS-247 6.2.3.1 (a), FHS operating in the band 2400-2483.5 ㎒ may have hopping channel carrier frequencies that are separated by 25 ㎑ or two-thirds of the 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

According to RSS-247 6.2.3.2 (a), if the hopset uses 75 or more hopping channels, the maximum peak conducted output power shall not exceed 1.0 W.

Test results

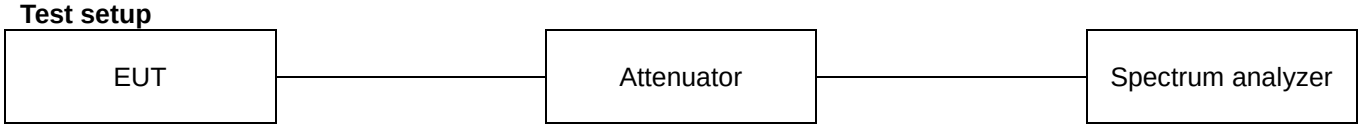
Frequency(㎒)	Channel no.	Data rate(Mbps)	Average Power (dBm)	Peak Power (dBm)	Power Limit (dBm)
2 402	00	BDR 1 Mbps	3.57	4.76	20.97
2 442	40		3.76	4.85	20.97
2 480	78		5.22	6.09	20.97

3.4. Carrier frequency separation

Test procedure

KDB 558074 v05r02
For FCC, ANSI C63.10-2020
For IC, ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024

Test setup



Test Setting

1. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
2. Span = wide enough to capture the peaks of two adjacent channels
3. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
4. Video (or Average) Bandwidth (VBW) ≥ RBW
5. Sweep = auto
6. Detector function = peak
7. Trace = max hold
8. Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A plot of the data shall be included in the test report.

FCC Limit

According to 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 ㎑ or the 20 ㏈ bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping system operating in 2 400 ~ 2 483.5 ㎒. Band may have hopping channel carrier frequencies that are separated by 25 ㎑ or two-third of 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 ㎽.

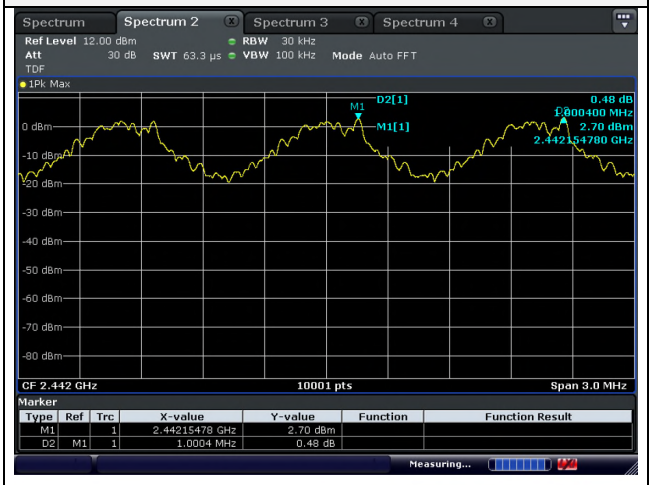
IC Limit

According to RSS-247 6.2.3.1 (a), FHS operating in the band 2400-2483.5 ㎒ may have hopping channel carrier frequencies that are separated by 25 ㎑ or two-thirds of the 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

Test results

Frequency(㎒)	Channel no.	Data rate(Mbps)	Channel Separation (㎒)	Limit (㎒)
2 442	40	BDR 1 Mbps	**1.000**	≥ 0.54

Hopping mode_BDR(1 Mbps)

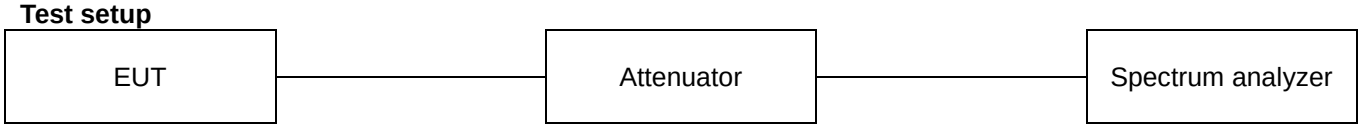


3.5. Number of hopping frequency

Test procedure

KDB 558074 v05r02,
For FCC, ANSI C63.10-2020
For IC, ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024

Test setup



Test setting

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings.

1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
2. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
3. VBW ≥ RBW.
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold

All the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

FCC Limit

According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2 400 ~ 2 483.5 ㎒ bands shall use at least 15 hopping frequencies.

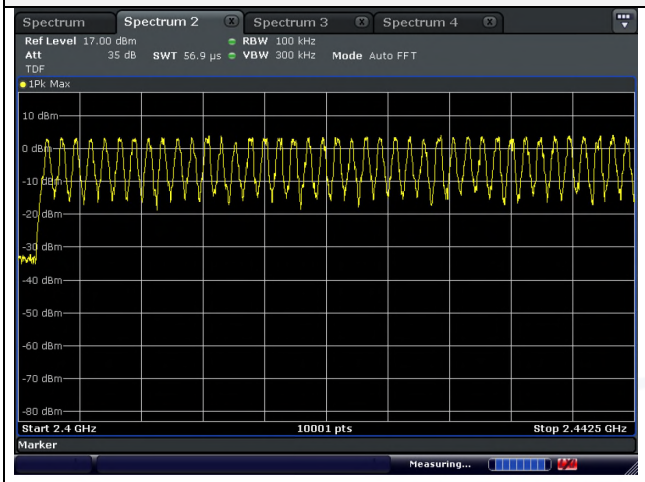
IC Limit

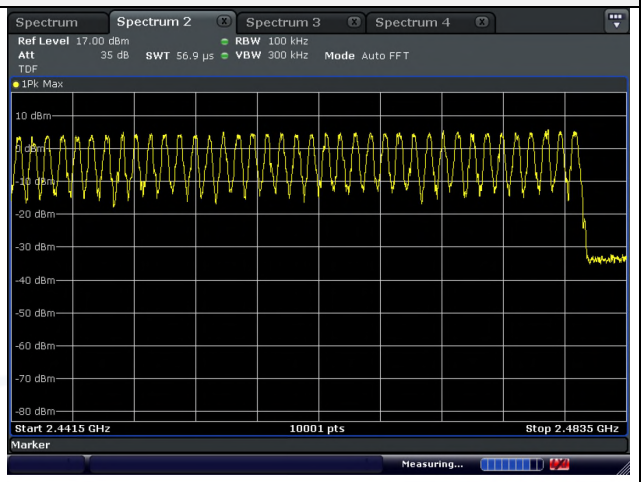
According to RSS-247 6.2.3.1(b), FHS operating in the band 2400-2483.5 ㎒ shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 s within a period of 0.4 s, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

requency	Data rate(Mbps)	Number of hopping frequency	Limit
2 402 ~ 2 480 ㎒	BDR 1 Mbps	79	≥ 15

Test results

Hopping mode_BDR(1 Mbps)



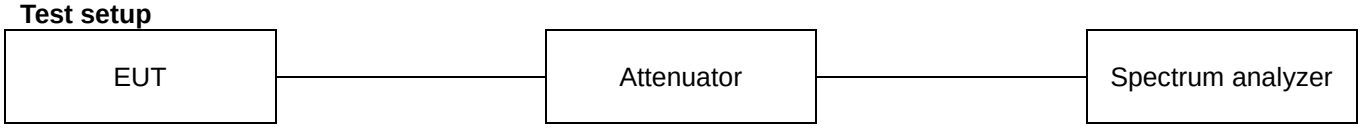


3.6. Time of occupancy

Test procedure

KDB 558074 v05r02
For FCC, ANSI C63.10-2020
For IC, ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024

Test setup



Test setting

1. The EUT must have its hopping function enabled.
2. Span = zero span, centered on a hopping channel
3. RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
4. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
5. Detector function = peak
6. Trace = max hold

FCC Limit

According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2 400 ~ 2 483.5 ㎒ band, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 31.6 second period.

A period time = 0.4(s) × 79 = 31.6(s)

Time of occupancy on the TX channel in 31.6 sec
= time domain slot length × (hop rate ÷ number of hop per channel) × 31.6

IC Limit

According to RSS-247 6.2.3.1(b), FHS operating in the band 2400-2483.5 ㎒ shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 s within a period of 0.4 s, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

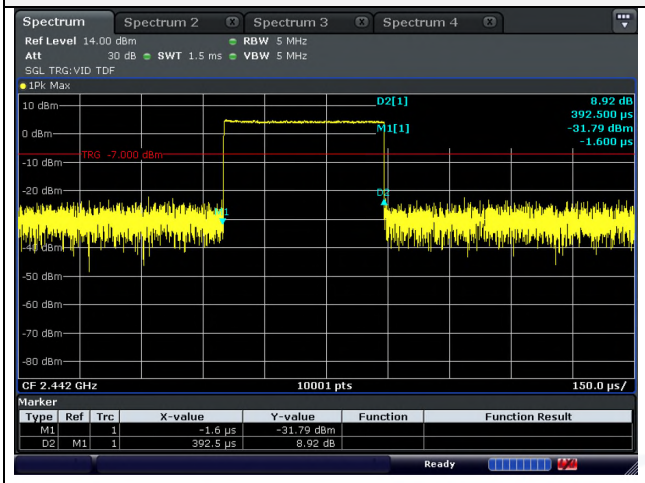
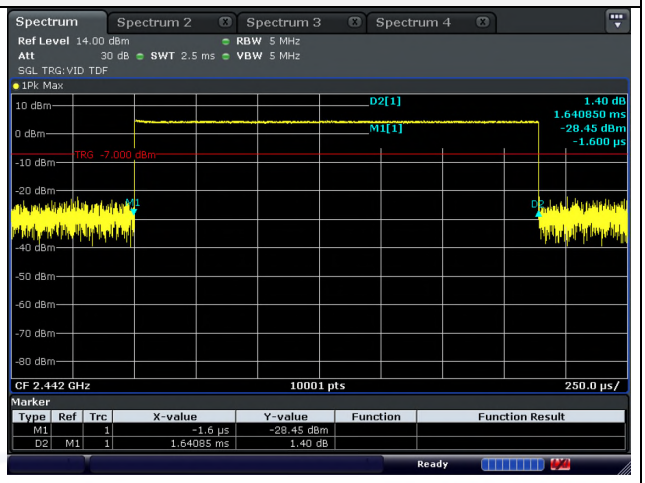
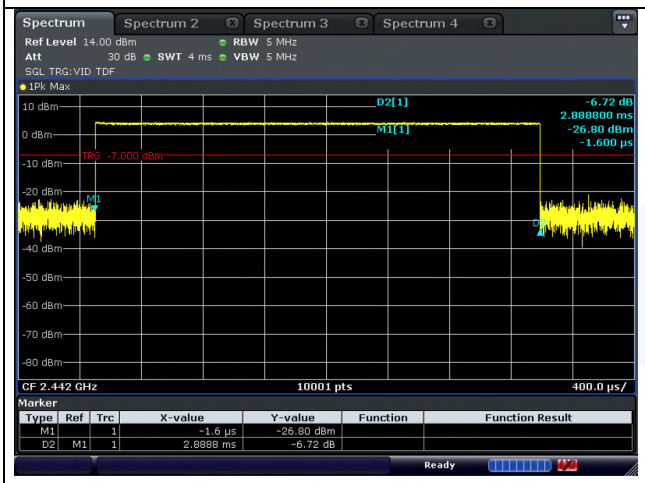
A period time = 0.4(s) × 79 = 31.6(s)

Time of occupancy on the TX channel in 31.6 sec
= time domain slot length × (hop rate ÷ number of hop per channel) × 31.6

Packet type	Frequency (㎒)	Dwell time (ms)	Time of occupancy on the Tx channel in 31.6 sec (ms)	Limit for time of occupancy on the Tx channel in 31.6 sec (ms)
DH1	2 442	0.393	125.76	400
DH3	2 442	1.641	262.56	400
DH5	2 442	2.889	308.16	400

Operation mode: GFSK, π/4DQPSK, 8DPSK

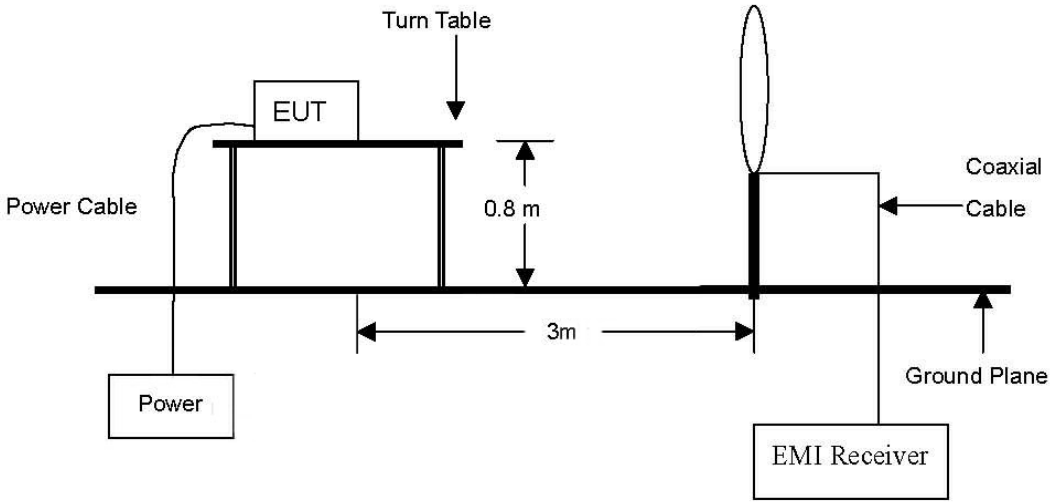
Note:
Normal Mode
DH1: Dwell time (ms) × [(1 600 ÷ 2) ÷ 79] × 31.6(s) = 125.76 (ms)
DH3: Dwell time (ms) × [(1 600 ÷ 4) ÷ 79] × 31.6(s) = 262.56 (ms)
DH5: Dwell time (ms) × [(1 600 ÷ 6) ÷ 79] × 31.6(s) = 308.16 (ms)

BDR(1 Mbps)	
	
	Blank

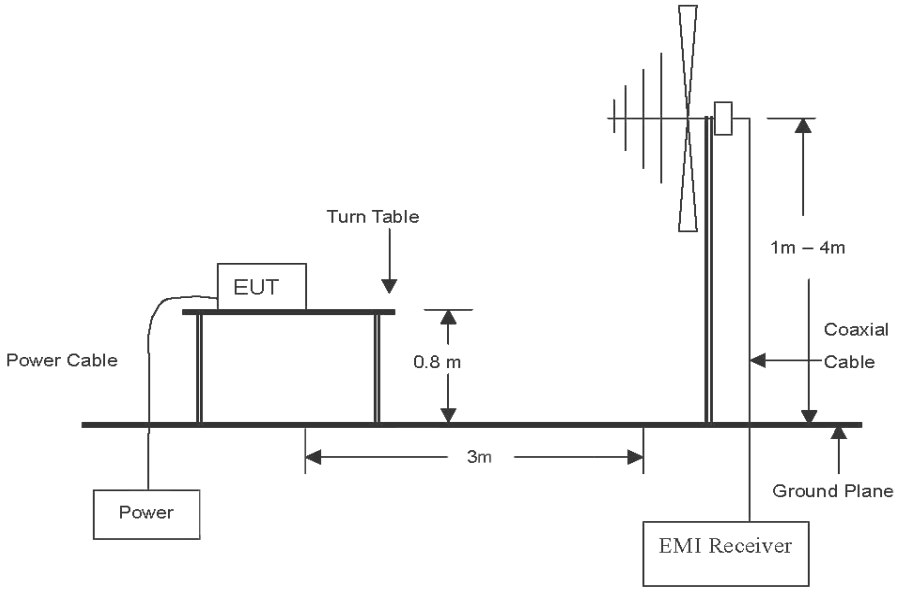
3.7. Radiated restricted band and emissions

Test setup

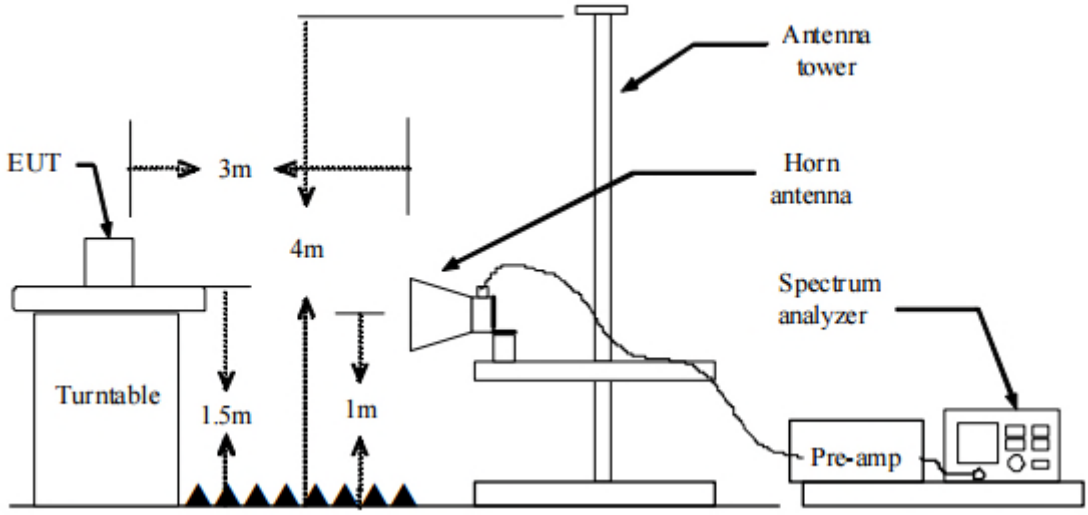
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



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



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



Test procedure

Radiated emissions from the EUT were measured according to the dictates in section 11.11 & 11.12 of ANSI C63.10-2020 (FCC) & ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 (IC).

Test procedure below 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel, ground parallel and perpendicular of the antenna are set to make the measurement. It was determined that **parallel** was worst-case orientation; therefore, all final radiated testing was performed with the EUT in **parallel.**
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum hold mode.

Test procedure above 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground for 30 ㎒-1 ㎓ and 1.5 meters for above 1 ㎓ at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The antenna is a bi-log antenna, a horn antenna, and its height are varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

5. Spectrum analyzer settings for f < 1 ㎓:
   ① Span = wide enough to fully capture the emission being measured
   ② RBW = 120 ㎑
   ③ VBW ≥ RBW
   ④ Detector = quasi peak
   ⑤ Sweep time = auto
   ⑥ Trace = max hold

6. Spectrum analyzer settings for *f* ≥1 ㎓: Peak
   ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
   ② RBW = 1 ㎒
   ③ VBW ≥ 3 ㎒
   ④ Detector = peak
   ⑤ Sweep time = auto
   ⑥ Trace = max hold
   ⑦ Trace was allowed to stabilize

7. Spectrum analyzer settings for *f* ≥1 ㎓: Average
   ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
   ② RBW = 1 ㎒
   ③ VBW ≥ 3 × RBW
   ④ Detector = RMS, if span/(# of points in sweep) ≤ (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.
   ⑤ 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 in order to use linear voltage averaging. Log or ㏈ averaging shall not be used.
   ⑥ Sweep = auto
   ⑦ Trace = max hold
   ⑧ Perform a trace average of at least 100 traces.
   ⑨ A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
      1) If power averaging (RMS) mode was used in step ⑤, then the applicable correction factor is 10 log(1/x), where x is the duty cycle.
      2) If linear voltage averaging mode was used in step ⑤, then the applicable correction factor is 20 log(1/x), where x is the duty cycle.
      3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

Note.

1. *f* <30 ㎒, extrapolation factor of 40 ㏈/decade of distance. $F_d = 40\log(D_m/D_s)$
   f ≥30 ㎒, extrapolation factor of 20 ㏈/decade of distance. $F_d = 20\log(D_m/D_s)$
   Where:
   F_d = Distance factor in ㏈
   D_m = Measurement distance in meters
   D_s = Specification distance in meters
2. Field strength(㏈㎶/m) = Level(㏈㎶) + CF (㏈) + or DCF(㏈)
3. Margin(㏈) = Limit(㏈㎶/m) - Field strength(㏈㎶/m)
4. Emissions below 18 ㎓ were measured at a 3 meter test distance while emissions above 18 ㎓ were measured at a 1 meter test distance with the application of a distance correction factor.
5. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z, it was determined that **X orientation** was worst-case orientation; therefore, all final radiated testing was performed with the EUT in **X orientation.**
6. The worst-case emissions are reported however emissions whose levels were not within 20 ㏈ of respective limits were not reported.
7. According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

FCC Limit

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

Frequency (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 ~ 0.490	300	2400/F(㎑)
0.490 ~ 1.705	30	24000/F(㎑)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 ~ 72 ㎒, 76 ~ 88 ㎒, 174 ~ 216 ㎒ or 470 ~ 806 ㎒. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

IC Limit

According to RSS-Gen, Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits：

Frequency (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 ~ 0.490	300	2 400 / F(㎑)
0.490 ~ 1.705	30	24 000 / F(㎑)
1.705 ~ 30.0	30	30
30 ~ 88	3	100
88 ~ 216	3	150
216 ~ 960	3	200
Above 960*	3	500

* Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

Note: Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

Duty cycle

Regarding to KDB 558074 D01_v05 r02, 6. Measurements of duty cycle and transmission duration shall be performed using one of the following techniques:

a) A diode detector and an oscilloscope that together have sufficiently short response time to permit accurate measurements of the on- and off-times of the transmitted signal.

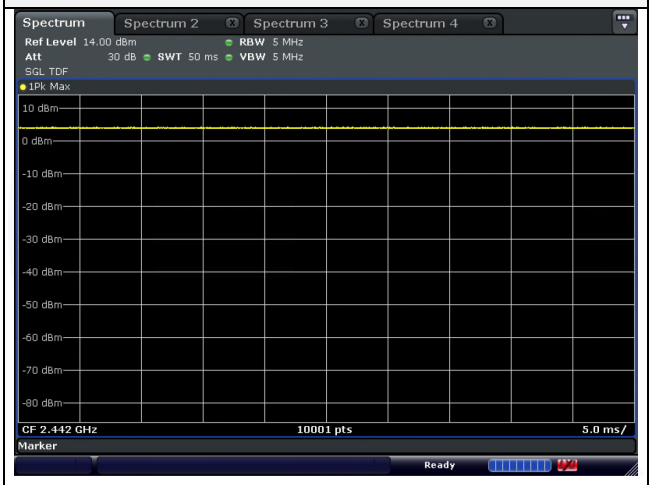
b) The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on- and off-times of the transmitted signal.

Mode	T_{on} time (㎳)	Period (㎳)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (㏈)
BDR(1 Mbps)	50.00	50.00	1.00	100.00	-

Duty cycle (Linear) = T_{on} time/Period

DCF(Duty cycle correction factor (㏈)) = 10log(1/duty cycle)

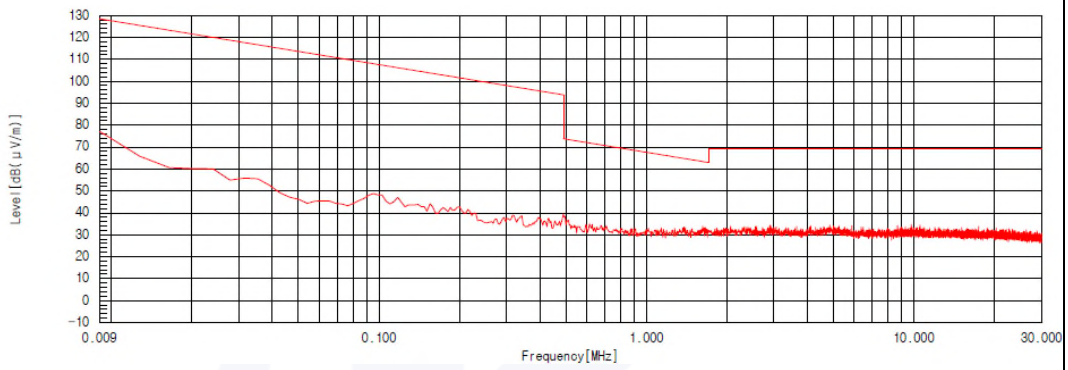
BDR (1 Mbps)



Test results (Below 30 ㎒)

Mode:	BDR (Worst case)
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Channel:	78 (Worst case)

Parallel



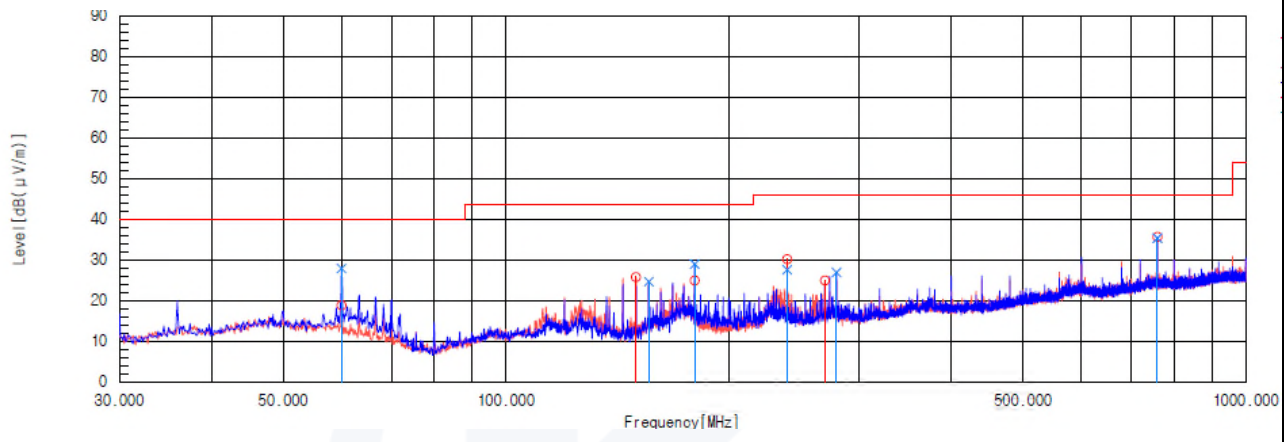
Note.

1. No spurious emission were detected under 30 ㎒.

Test results (Below 1 000 ㎒) – Worst case

Mode:	BDR (Worst case)
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Channel:	78 (Worst case)

Horizontal // Vertical



Final Result

No.	Frequency [MHz]	Pol	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	59.949	V	41.7	-13.8	27.9	40.0	12.1	110.0	80.3	
2	59.949	H	32.7	-13.8	18.9	40.0	21.1	397.0	54.5	
3	149.916	H	43.2	-17.4	25.8	43.5	17.7	189.0	323.7	
4	155.979	V	41.6	-16.9	24.7	43.5	18.8	120.0	128.0	
5	179.986	V	44.0	-15.0	29.0	43.5	14.5	100.0	34.2	
6	179.986	H	40.0	-15.0	25.0	43.5	18.5	103.0	352.1	
7	240.005	V	39.8	-12.2	27.6	46.0	18.4	153.0	193.2	
8	240.005	H	42.4	-12.2	30.2	46.0	15.8	109.0	101.4	
9	269.954	H	36.4	-11.4	25.0	46.0	21.0	199.0	330.3	
10	280.018	V	38.1	-11.1	27.0	46.0	19.0	110.0	34.2	
11	760.046	V	36.6	-1.2	35.4	46.0	10.6	100.0	330.2	
12	760.046	H	36.9	-1.2	35.7	46.0	10.3	100.0	282.8	

Test results (Above 1 000 ㎒)

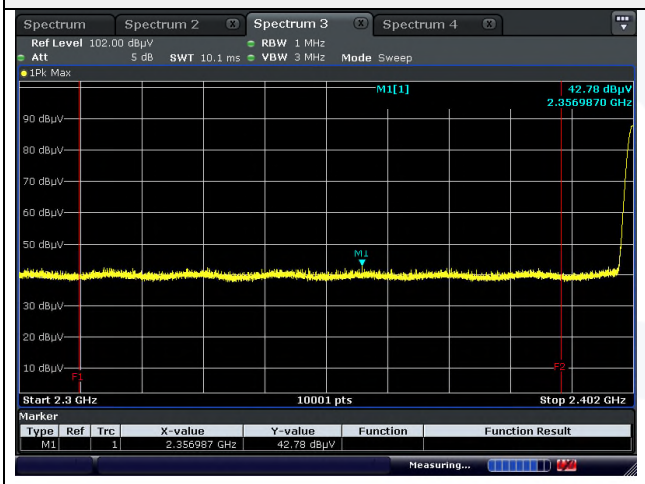
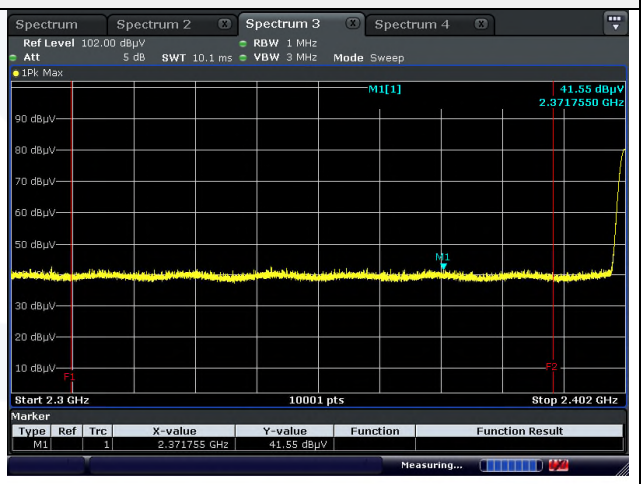
Mode:	BDR (1 Mbps)
Distance of measurement:	3 meter
Channel:	00

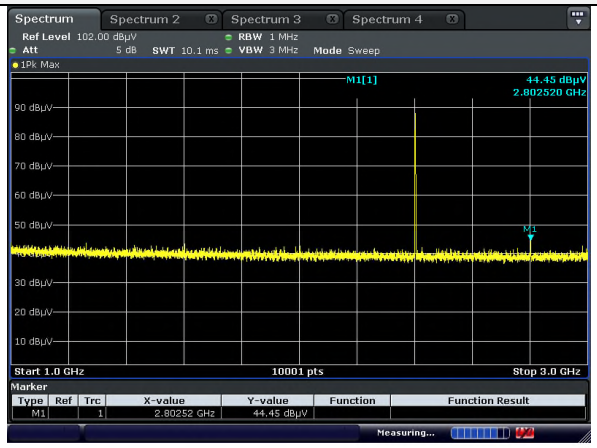
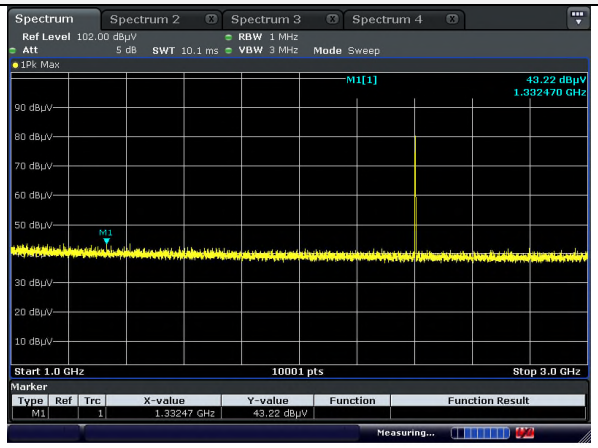
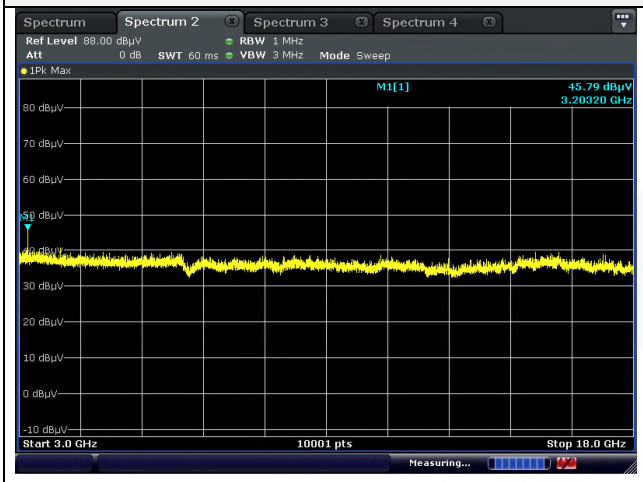
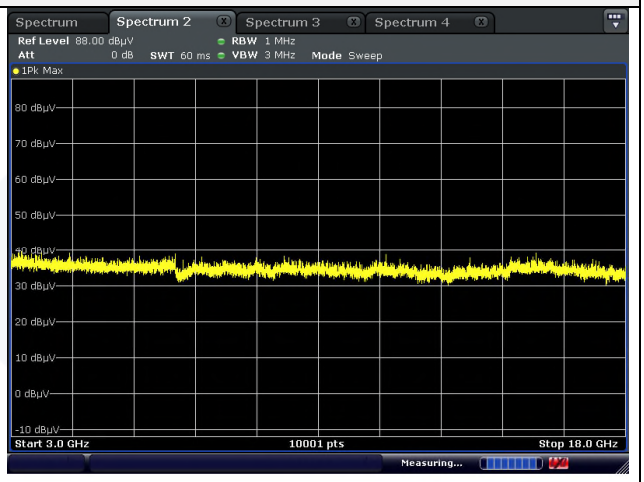
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1 332.47	43.22	Peak	V	-5.99	-	37.23	74.00	36.77
2 802.52	44.45	Peak	H	1.84	-	46.29	74.00	27.71
3 203.20	45.79	Peak	H	2.21	-	48.00	74.00	26.00

- **Band edge**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2 356.99	42.78	Peak	H	0.80	-	43.58	74.00	30.42
2 371.76	41.55	Peak	V	0.89	-	42.44	74.00	31.56

Restricted band // Horizontal // Peak	Restricted band // Vertical // Peak
	

Horizontal // Peak for 1 GHz to 3 GHz	Vertical // Peak for 1 GHz to 3 GHz
	
Horizontal // Peak for 3 GHz to 18 GHz	**Vertical // Peak for 3 GHz to 18 GHz**
	

Note.

1. Average test would be performed if the peak result were greater than the average limit.

Mode: BDR (1 Mbps)

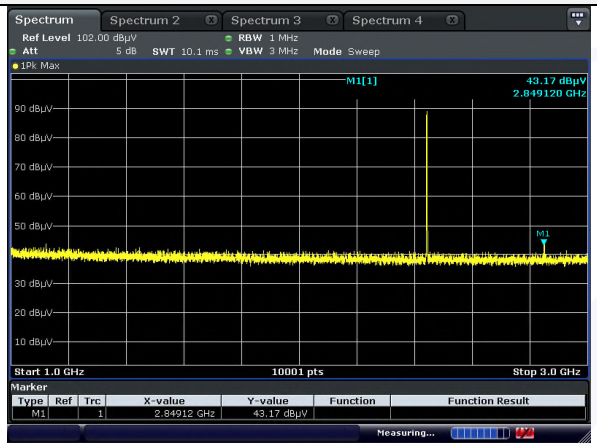
Distance of measurement: 3 meter

Channel: 40

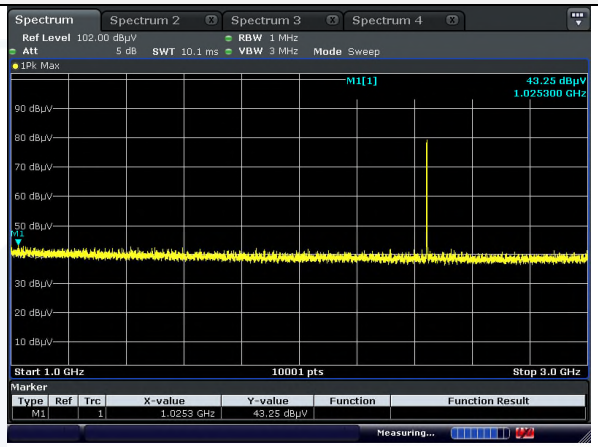
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1 025.30	43.25	Peak	V	-7.99	-	35.26	74.00	38.74
2 849.12	43.17	Peak	H	1.87	-	45.04	74.00	28.96
3 255.70	42.23	Peak	V	2.32	-	44.55	74.00	29.45

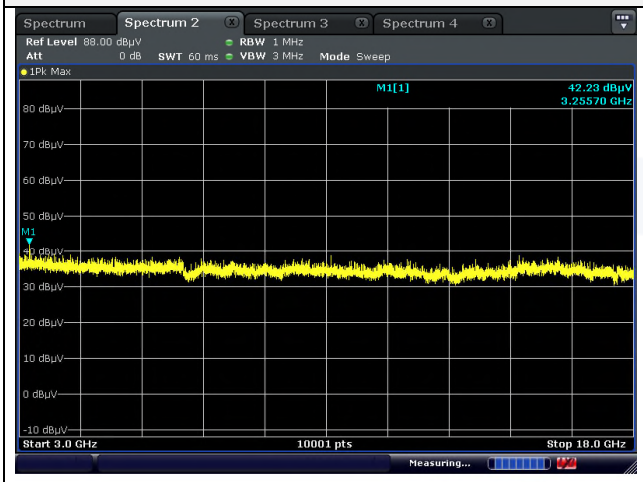
Horizontal // Peak for 1 ㎓ to 3 ㎓



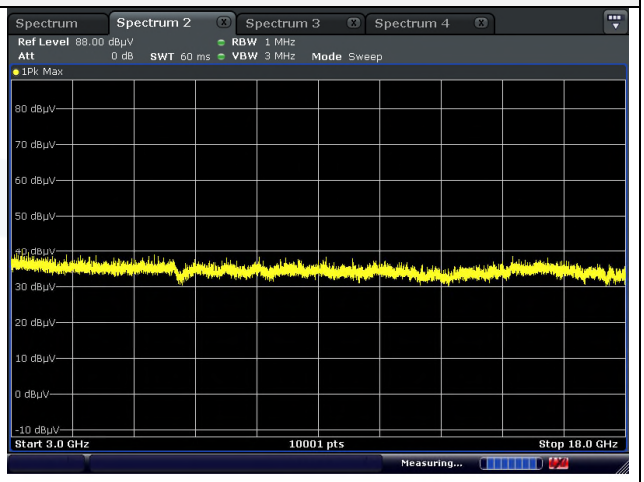
Vertical // Peak for 1 ㎓ to 3 ㎓



Horizontal // Peak for 3 ㎓ to 18 ㎓



Vertical // Peak for 3 ㎓ to 18 ㎓



Note.

1. Average test would be performed if the peak result were greater than the average limit.

Mode:	BDR (1 Mbps)
Distance of measurement:	3 meter
Channel:	78

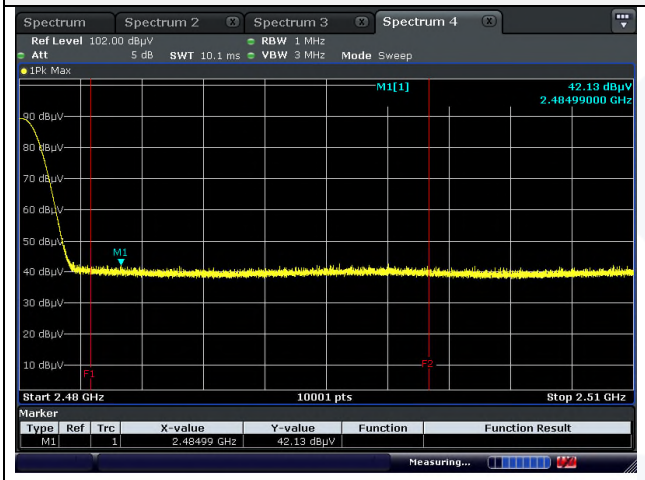
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1 583.24	43.55	Peak	V	-4.35	-	39.20	74.00	34.80
2 893.51	43.02	Peak	H	1.89	-	44.91	74.00	29.09

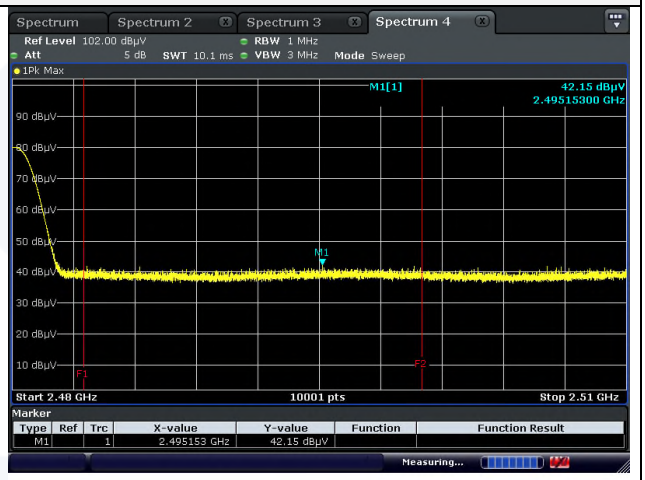
- **Band edge**

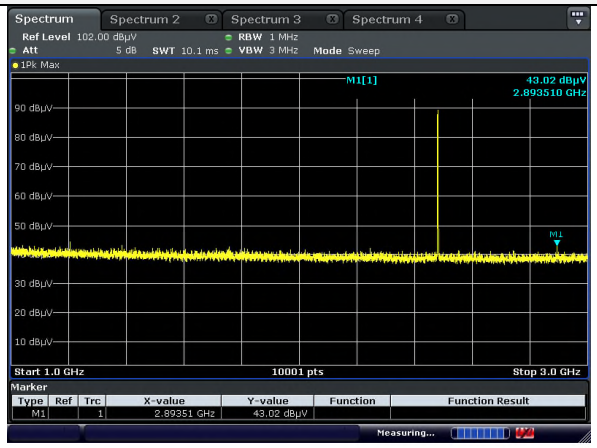
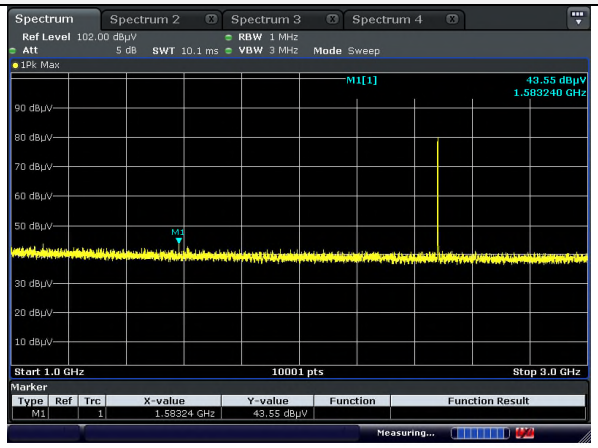
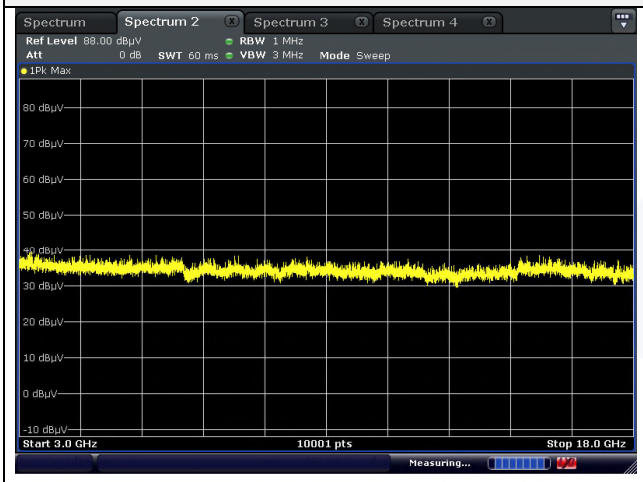
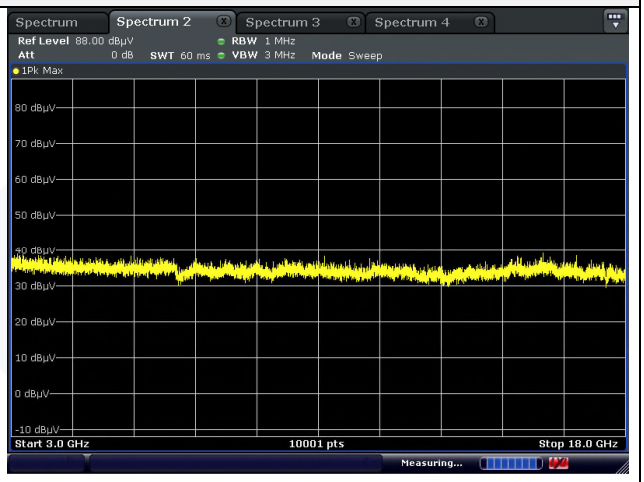
Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2 484.99	42.13	Peak	H	1.31	-	43.44	74.00	30.56
2 495.15	42.15	Peak	V	1.34	-	43.49	74.00	30.51

Restricted band // Horizontal // Peak



Restricted band // Vertical // Peak



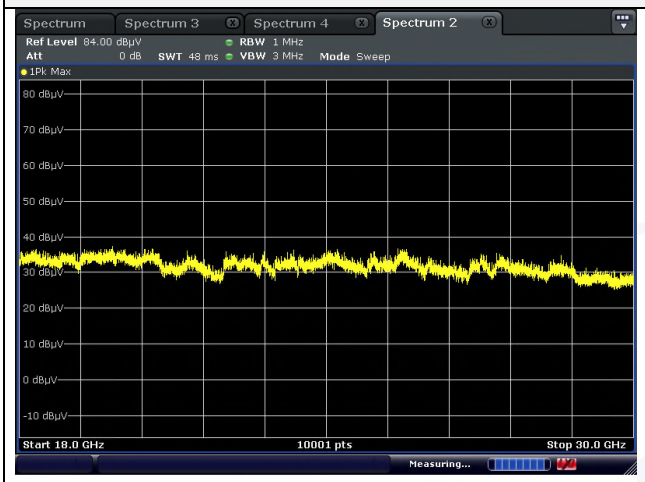
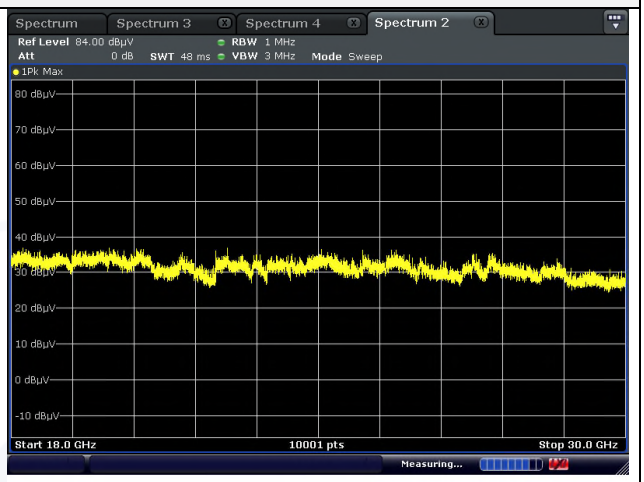
Horizontal // Peak for 1 ㎓ to 3 ㎓	Vertical // Peak for 1 ㎓ to 3 ㎓
	
Horizontal // Peak for 3 ㎓ to 18 ㎓	**Vertical // Peak for 3 ㎓ to 18 ㎓**
	

Note.

1. No spurious emission were detected above 3 ㎓.
2. Average test would be performed if the peak result were greater than the average limit.

Test results (18 ㎓ to 30 ㎓) – Worst case

Mode:	BDR (1 Mbps)
Distance of measurement:	3 meter
Channel:	78 (Worst case)

Horizontal	Vertical
	

Note.

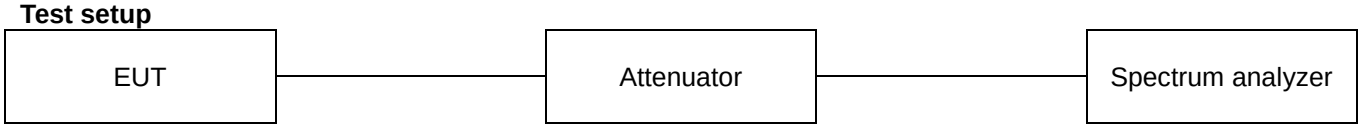
1. No spurious emission were detected above 18 ㎓.

3.8. Conducted band edge and out of band emissions

Test procedure

KDB 558074 v05r02,
For FCC, ANSI C63.10-2020
For IC, ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024

Test setup



Test setting

1. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.
2. RBW = 100 ㎑
3. VBW ≥ 300 ㎑
4. Detector = Peak
5. Number of sweep points ≥ 2 × Span/RBW
7. Trace mode = max hold
8. Sweep time = auto couple
9. The trace was allowed to stabilize

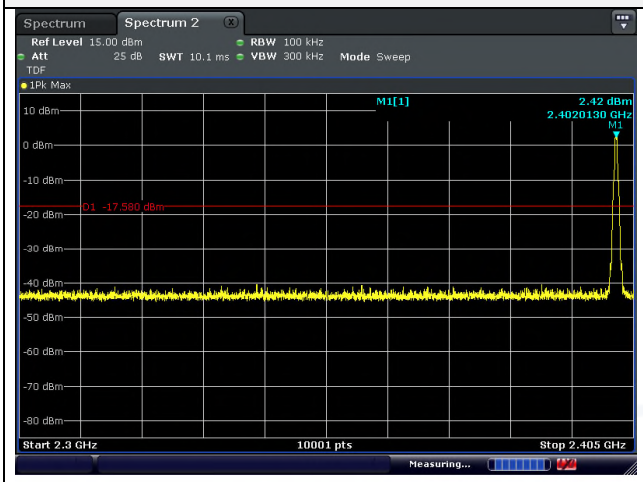
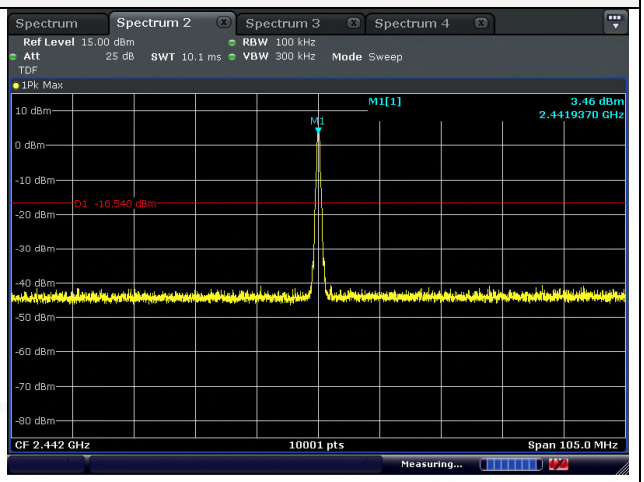
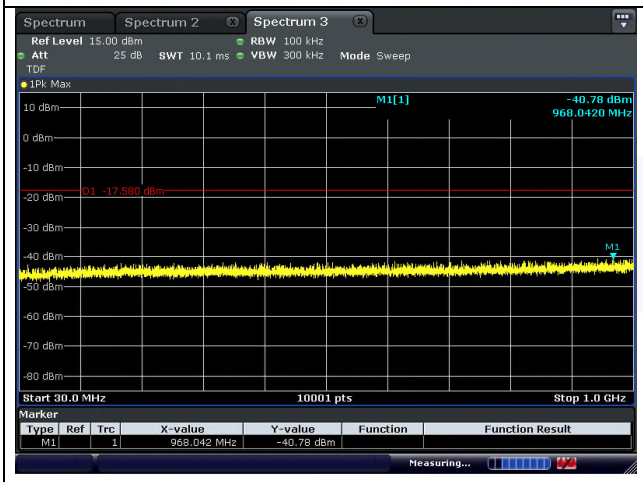
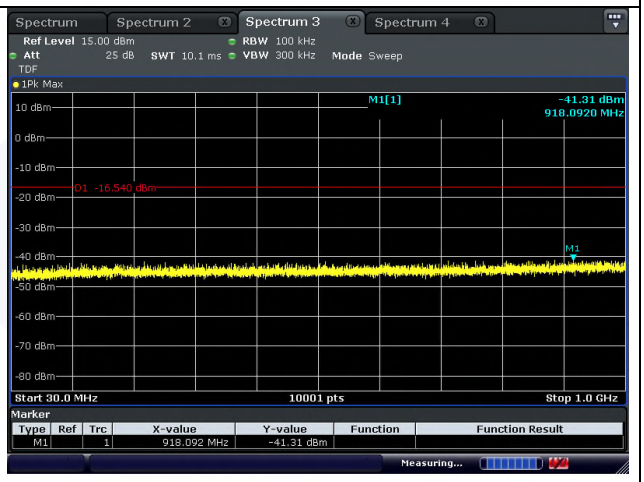
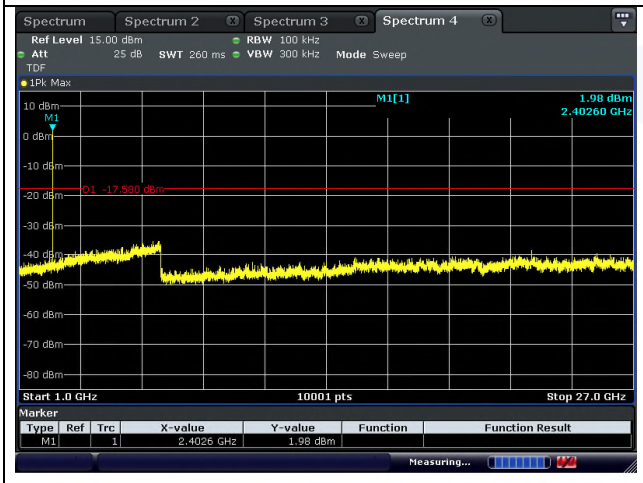
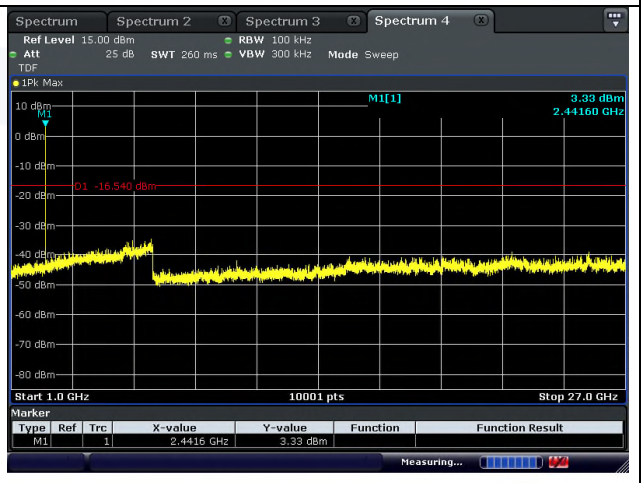
FCC Limit

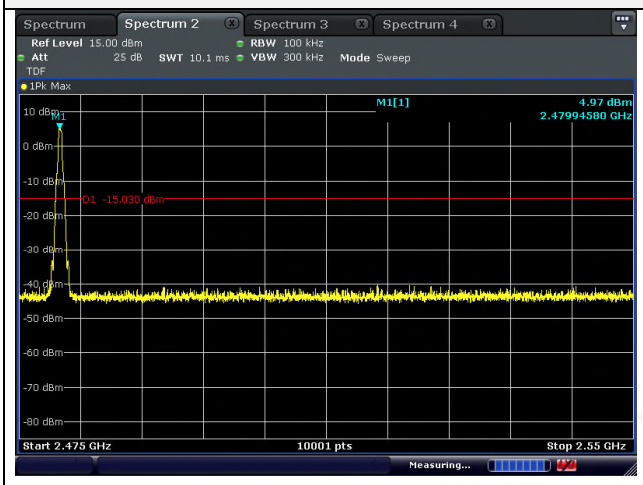
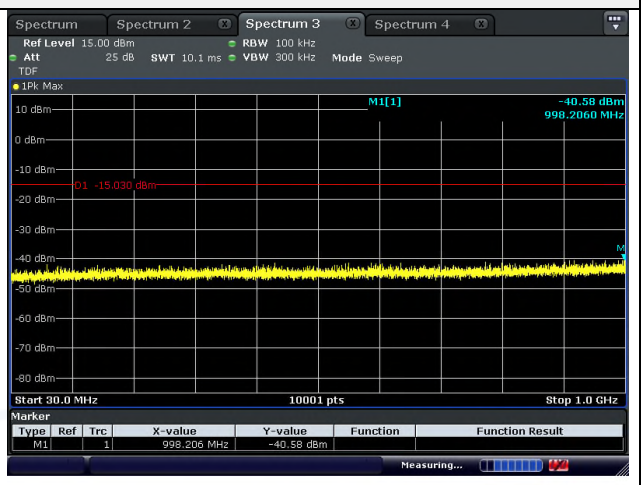
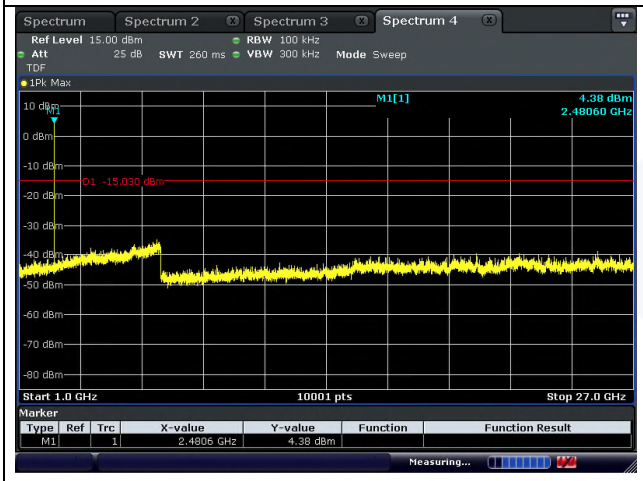
According to 15.247(d), in any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval , as permitted under paragraph(b)(3) of this section , the attenuation required under this paragraph shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in section 15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section 15.205(a), must also comply the radiated emission limits specified in section 15.209(a) (see section 15.205(c))

IC Limit

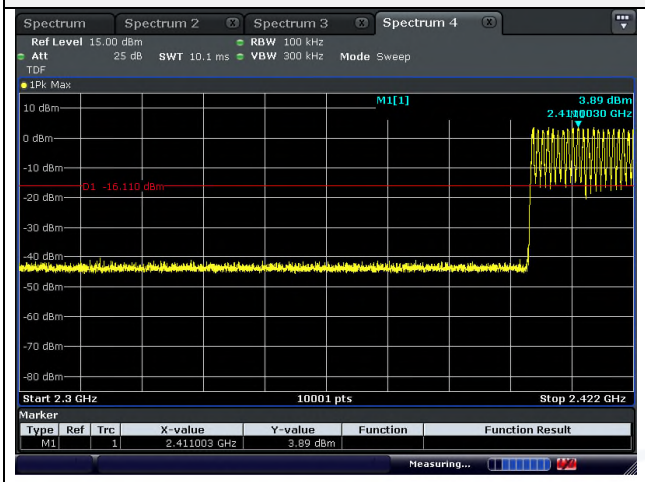
According to § RSS-247 6.6, In any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum device, digitally modulated device, or hybrid system is operating, the RF power that is produced shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power – based on either an RF conducted or a radiated measurement – provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 6.3.2, the attenuation required shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general field strength limits specified in RSS-Gen is not required.

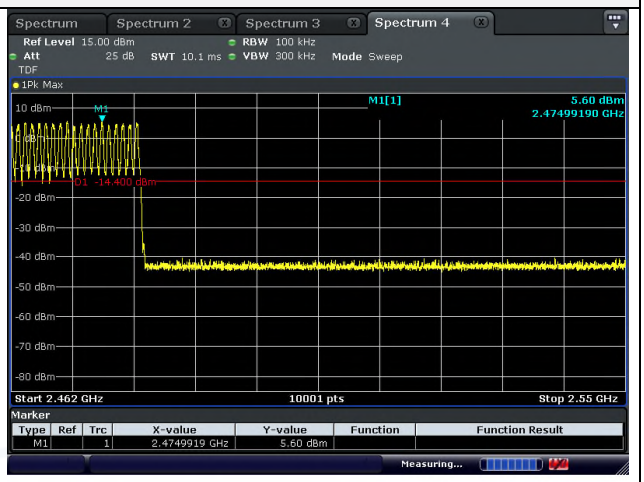
Test results

BDR(1 Mbps)	
2 402 ㎒	**2 442 ㎒**
	
	
	

BDR(1 Mbps)	
2 480 ㎒	
	
	BLANK

Hopping mode_BDR(1 Mbps)





3.9. AC conducted emissions

FCC Limit

According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50uH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

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

IC Limit

According to RSS-Gen 8.8, Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 ㎑ to 30 ㎒ shall not exceed the limits in table 4, as measured using a 50 μH / 50 Ω line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.

For an EUT that connects to the AC power lines indirectly, through another device, the requirement for compliance with the limits in table 4 shall apply at the terminals of the AC power-line mains cable of a representative support device, while it provides power to the EUT. The lower limit applies at the boundary between the frequency ranges. The device used to power the EUT shall be representative of typical applications.

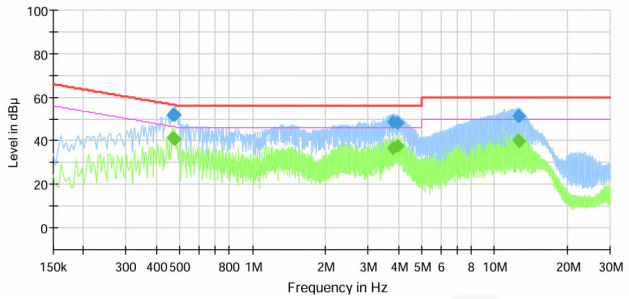
Frequency of Emission (㎒)	Conducted limit (㏈㎶)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

Test results

Mode: BDR

Channel: 78 (Worst case)

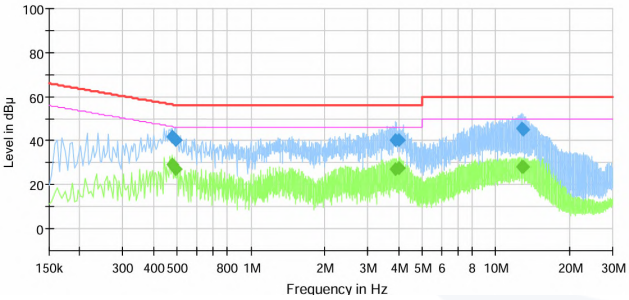
Hot Line



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.466000	---	41.47	46.58	5.11	1000.0	9.000	L1	19.7
0.466000	52.05	---	56.58	4.53	1000.0	9.000	L1	19.7
0.478000	---	40.93	46.37	5.44	1000.0	9.000	L1	19.7
0.478000	51.78	---	56.37	4.59	1000.0	9.000	L1	19.7
3.794000	---	36.67	46.00	9.33	1000.0	9.000	L1	20.0
3.794000	48.82	---	56.00	7.18	1000.0	9.000	L1	20.0
3.978000	---	37.63	46.00	8.37	1000.0	9.000	L1	20.0
3.978000	48.16	---	56.00	7.84	1000.0	9.000	L1	20.0
12.554000	---	40.02	50.00	9.98	1000.0	9.000	L1	20.6
12.554000	51.59	---	60.00	8.41	1000.0	9.000	L1	20.6
12.590000	---	39.89	50.00	10.11	1000.0	9.000	L1	20.6
12.590000	51.38	---	60.00	8.62	1000.0	9.000	L1	20.6

Neutral Line



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.478000	---	29.29	46.37	17.08	1000.0	9.000	N	19.6
0.478000	42.08	---	56.37	14.29	1000.0	9.000	N	19.6
0.494000	---	26.95	46.10	19.15	1000.0	9.000	N	19.6
0.494000	40.40	---	56.10	15.70	1000.0	9.000	N	19.6
3.886000	---	27.08	46.00	18.92	1000.0	9.000	N	19.9
3.886000	40.37	---	56.00	15.63	1000.0	9.000	N	19.9
4.002000	---	27.34	46.00	18.66	1000.0	9.000	N	19.9
4.002000	40.33	---	56.00	15.67	1000.0	9.000	N	19.9
12.786000	---	28.22	50.00	21.78	1000.0	9.000	N	20.5
12.786000	45.35	---	60.00	14.65	1000.0	9.000	N	20.5
12.966000	---	27.98	50.00	22.02	1000.0	9.000	N	20.5
12.966000	44.90	---	60.00	15.10	1000.0	9.000	N	20.5

3.10. Antenna Requirement

According to 15.207(a), 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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
Spectrum analyzer	R&S	FSV40	101725	1 year	2026.06.10
Spectrum analyzer	R&S	FSV40-N	102194	1 year	2026.07.31
SIGNAL GENERATOR	KEYSIGHT	N5182B	MY59100115	1 year	2026.04.16
SIGNAL GENERATOR	Anritsu	68369B	002118	1 year	2026.04.21
Power Meter	Anritsu	ML2495A	2010001	1 year	2026.04.16
Pulse Power Sensor	Anritsu	MA2411B	1911111	1 year	2026.04.16
Attenuator	Mini-Circuits	BW-S20-2W263A+	Y1	1 year	2026.02.10
LOOP ANTENNA	TESEQ	HLA6121	66547	2 years	2026.01.22
TRILOG-BROADBAND ANTENNA	Schwarzbeck	VULB 9163	714	2 years	2026.04.19
Attenuator	HUBER+SHHNER	6806.17.A	NONE	1 year	2026.02.13
ATTENUATOR	HP	8491B	23094	1 year	2026.02.13
Horn Antenna	A.H.	SAS-571	414	1 year	2026.01.13
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA 9170550	1 year	2026.01.13
Amplifier	SONOMA INSTRUMENT	310N	401123	1 year	2026.02.13
PREAMPLIFIER	HP	8449B	3008A00899	1 year	2026.03.05
BROADBAND AMPLIFIER	SCHWARZBECK	BBV9721	PS9721-003	1 year	2026.01.09
DC POWER SUPPLY	AGILENT	6632B	MY43004090	1 year	2026.06.12
EMI Test Receiver	R&S	ESR7	101190	1 year	2026.04.30
EMI Test Receiver	R&S	ESR3	101783	1 year	2026.11.03
PULSE LIMITER	R&S	ESH2-Z2	101915	1 year	2026.11.03
LISN	R&S	ENV216	101786	1 year	2026.01.09
Cable	-	-	#5	1 year	2026.10.31
Cable (SR #6)	RG 400	-	-	0.5 year	2026.01.25
Cable (SAC #5)	SUCOFLEX106	HUBER_SUHNER	-	0.5 year	2026.01.25
	SUCOFLEX106	HUBER_SUHNER	-		
	LH21D/2xSMA	OSI Cable	-		
Cable (SAC #6)	TCLH21D-SMSM-2.5M 0222	OSI Cable	-	0.5 year	2026.01.25
	TCLH21D-NMNM-10.0M 0222	OSI Cable	-		
	TCLH21D-SMSM-7.0M 0222	OSI Cable	-		

* Statement of Traceability: KES Co., Ltd. attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook computer	LG Electronics Inc.,	LGS53	306QCZP560949
Test Jig Board	N/A	N/A	N/A

The End.