



TEST REPORT



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■ FCC TEST REPORT

1. Client

- Name : MOVON Corporation
- Address : 140-28 Samsung Dong, Kangnam Ku, Seoul, South Korea

2. Sample Description

- Product item : Wi-Fi 6 and Bluetooth 5.x SOM
- Model name : WBT-MSB
- Manufacturer etc. : Movon Corporation

3. Date of test : 2023.12.15 ~ 2024.01.29

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

- Address : 473-21, Gayeo-ro, Yeosu-si, Gyeonggi-do, Korea

5. Test method used : Part 15 Subpart C 15.247

6. Test result : PASS

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

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

2024 . 01. 29.

KES Co., Ltd.

Accredited by KOLAS, Republic of KOREA



REPORT REVISION HISTORY

Date	Test Report No.	Revision History
2024.01.29	RF-230793	Initial

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Use of uncertainty of measurement for decisions on conformity (decision rule):

- ☒ No decision rule is specified by the standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty("simple acceptance" decision rule, previously known as "accuracy method").
- ☐ Other (to be specified, for example when required by the standard or client)



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1. General information

Applicant: MOVON Corporation
Applicant address: 140-28 Samsung Dong, Kangnam Ku, Seoul, South 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, Yeosu-si, Gyeonggi-do, Korea
Test Facility: FCC Accreditation Designation No.: KR0100, Registration No.: 444148
FCC rule part(s): 15.247
FCC ID: TDU-WBT-MSB
Test device serial No.: ☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test: Wi-Fi 6 and Bluetooth 5.x SOM
Frequency range & Number of channels: **2 402 MHz ~ 2 480 MHz (BDR/EDR) : 79 ch**
2 402 MHz ~ 2 480 MHz (LE 1 Mbps/LE 2 Mbps) : 40 ch
2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20/ax_HE20) : 11 ch
2 422 MHz ~ 2 452 MHz (802.11n_HT40/ax_HE40) : 7 ch
5 180 MHz ~ 5 240 MHz (802.11a/n_HT20/ac_VHT20/ax_HE20) : 4 ch
UNII-1 5 190 MHz ~ 5 230 MHz (802.11n_HT40/ac_VHT40/ax_HE40) : 2 ch
5 210 MHz (802.11ac_VHT80/ax_HE80) : 1 ch
5 260 MHz ~ 5 320 MHz (802.11a/n_HT20/ac_VHT20/ax_HE20) : 4 ch
UNII-2A 5 270 MHz ~ 5 310 MHz (802.11n_HT40/ac_VHT40/ax_HE40) : 2 ch
5 290 MHz (802.11ac_VHT80/ax_HE80) : 1 ch
5 500 MHz ~ 5 720 MHz (802.11a/n_HT20/ac_VHT20/ax_HE20) : 12 ch
UNII-2C 5 510 MHz ~ 5 710 MHz (802.11n_HT40/ac_VHT40/ax_HE40) : 6 ch
5 530 MHz ~ 5 690 MHz (802.11ac_VHT80/ax_HE80) : 3 ch
5 745 MHz ~ 5 825 MHz (802.11a/n_HT20/ac_VHT20/ax_HE20) : 5 ch
UNII-3 5 755 MHz ~ 5 795 MHz (802.11n_HT40/ac_VHT40/ax_HE40) : 2 ch
5 775 MHz (802.11ac_VHT80/ax_HE80) : 1 ch
Model: WBT-MSB
Modulation technique: **GFSK, π /4DQPSK, 8DPSK, DSSS, OFDM**
Antenna specification: 2.4 GHz band Chip Antenna // Peak gain: 0.01 dBi
5 GHz band Chip Antenna // Peak gain: -2.18 dBi
Power source: DC 3.3 V & DC 1.8 V
H/W version: V003
S/W version: V003

**1.2. Test configuration**

The **MOVON Corporation // Wi-Fi 6 and Bluetooth 5.x SOM // WBT-MSB // FCC ID: TDU-WBT-MSB** was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.247

KDB 558074 D01 v05 r02

ANSI C63.10-2013

1.3. Information about derivative model

N/A

1.4. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
-	-	-	-	-

1.5. Device modifications

N/A



1.6. 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:

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

System receiver input bandwidth

Each channel bandwidth is 1 MHz.

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 its 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.



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.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 1.36 + 10 = 11.36 \text{ (dB)}\end{aligned}$$

For Radiation test :

$$\text{Field strength level (dB}\mu\text{V/m)} = \text{Measured level (dB}\mu\text{V)} + \text{Antenna factor (dB)} + \text{Cable loss (dB)} - \text{Amplifier gain (dB)}$$

1.8. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.22 dB (SHIELD ROOM #6)
Uncertainty for Radiation emission test (include Fundamental emission)	Below 1 GHz	4.04 dB (SAC #6)
	Above 1 GHz	5.32 dB (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 (MHz)	Rate(Mbps)
00	2 402	BDR 1 Mbps, EDR 2 Mbps, EDR 3 Mbps
.	.	.
40	2 442	BDR 1 Mbps, EDR 2 Mbps, EDR 3 Mbps
.	.	.
78	2 480	BDR 1 Mbps, EDR 2 Mbps, EDR 3 Mbps

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

Ch.	Frequency (MHz)	Mode
1	2 412	802.11b/g/n_HT20/ax_HE20
.	.	.
6	2 437	802.11b/g/n_HT20/ax_HE20
.	.	.
11	2 462	802.11b/g/n_HT20/ax_HE20

Ch.	Frequency (MHz)	Mode
3	2 422	802.11n_HT40/ax_HE40
.	.	.
6	2 437	802.11n_HT40/ax_HE40
.	.	.
9	2 452	802.11n_HT40/ax_HE40

**UNII-1**

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

UNII-2A

Ch.	Frequency (MHz)
52	5 260
56	5 280
64	5 320

UNII-2C

Ch.	Frequency (MHz)
100	5 500
120	5 600
144	5 720

UNII-3

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

802.11a/n_HT20/ac_VHT20/ax_HE20 mode**UNII-1**

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

UNII-2A

Ch.	Frequency (MHz)
54	5 270
62	5 310

UNII-2C

Ch.	Frequency (MHz)
102	5 510
118	5 590
142	5 710

UNII-3

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

802.11n_HT40/ac_VHT40/ax_HE40 mode**UNII-1**

Ch.	Frequency (MHz)
42	5 210

UNII-2A

Ch.	Frequency (MHz)
58	5 290

UNII-2C

Ch.	Frequency (MHz)
106	5 530
122	5 610
138	5 690

UNII-3

Ch.	Frequency (MHz)
155	5 775

802.11ac_VHT80/ax_HE80 mode



2. Summary of tests

Section in FCC Part 15	Test description	Test results
-	99% Occupied bandwidth	Pass
15.247(a)(1)(iii)	20 dB bandwidth	Pass
15.247(b)(1)	Output power	Pass
15.247(a)(1)	Channel separation	Pass
15.247(a)(1)(iii)	Number of channels	Pass
15.247(a)(1)(iii)	Time of occupancy	Pass
15.205, 15.209	Radiated restricted band and emission	Pass
15.207(a)	AC Conducted emissions	Pass ^{Note.1}
15.247(d)	Conducted spurious emission and band edge	Pass
15.203	Antenna Requirement	Pass

Note.

1. Because this product operates only when DC 3.3 V and DC 1.8 V are supplied simultaneously, the AC Conducted emissions test was performed once on the DC 3.3 V line and once on the DC 1.8 V line.
2. By the request of applicant, test is performed with power setting value below :

Mode	Frequency (MHz)	Setting value
BDR 1 Mbps	2 402 ~ 2 480	10
EDR 2 Mbps		10
EDR 3 Mbps		10

3. This product is capable of simultaneous BT and 2.4 GHz WLAN operation, so tests were conducted in that mode.



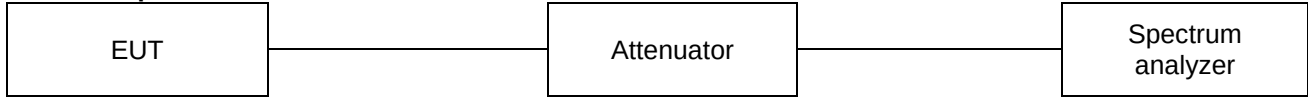
3. Test results

3.1. 99% Occupied Bandwidth

Test procedure

ANSI C63.10-2013 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(MHz)	99% occupied bandwidth(MHz)	Limit(MHz)
2 402	1.02	-
2 442	1.01	
2 480	1.01	

Mode : EDR 2 Mbps

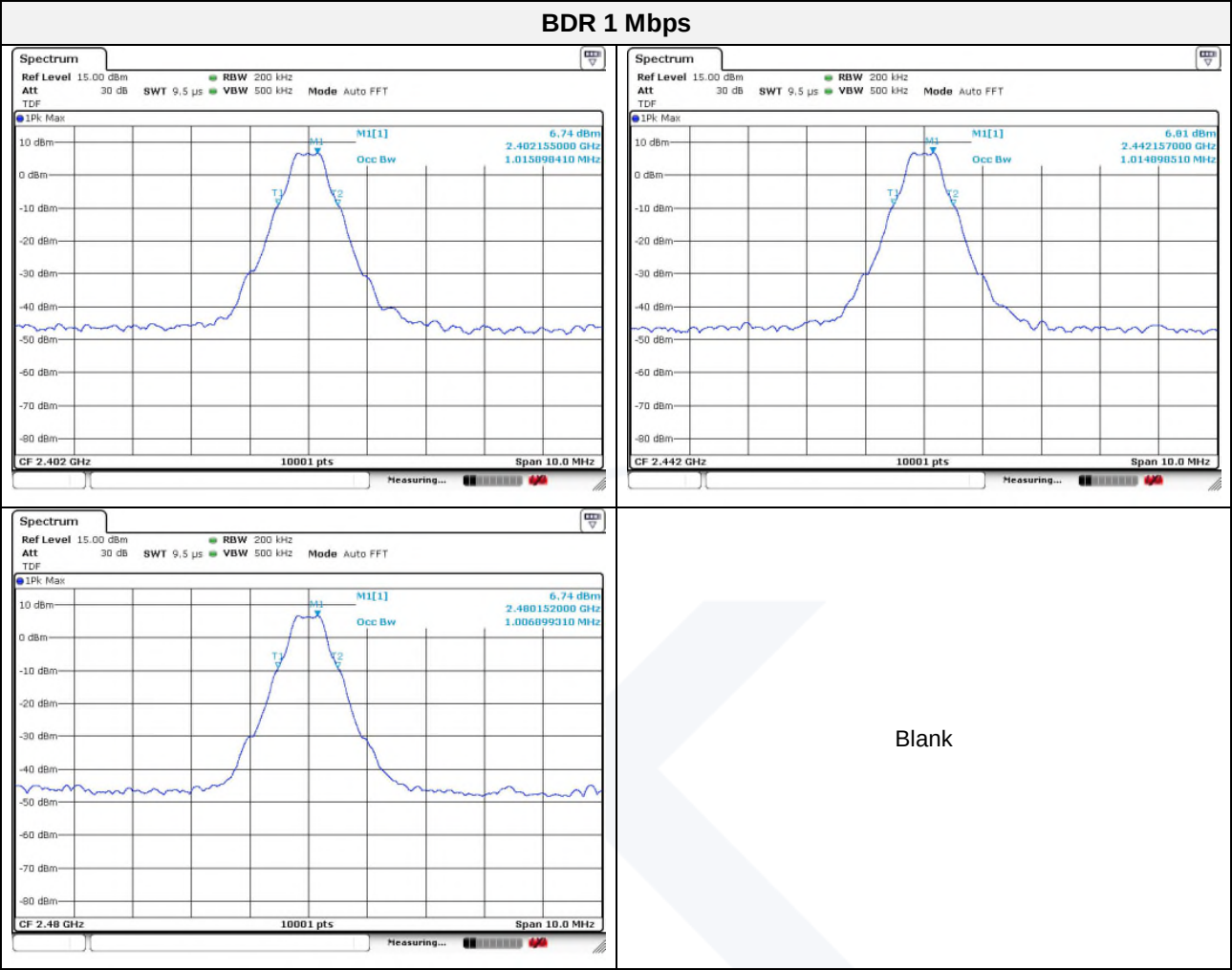
Frequency(MHz)	99% occupied bandwidth(MHz)	Limit(MHz)
2 402	1.32	-
2 442	1.31	
2 480	1.31	

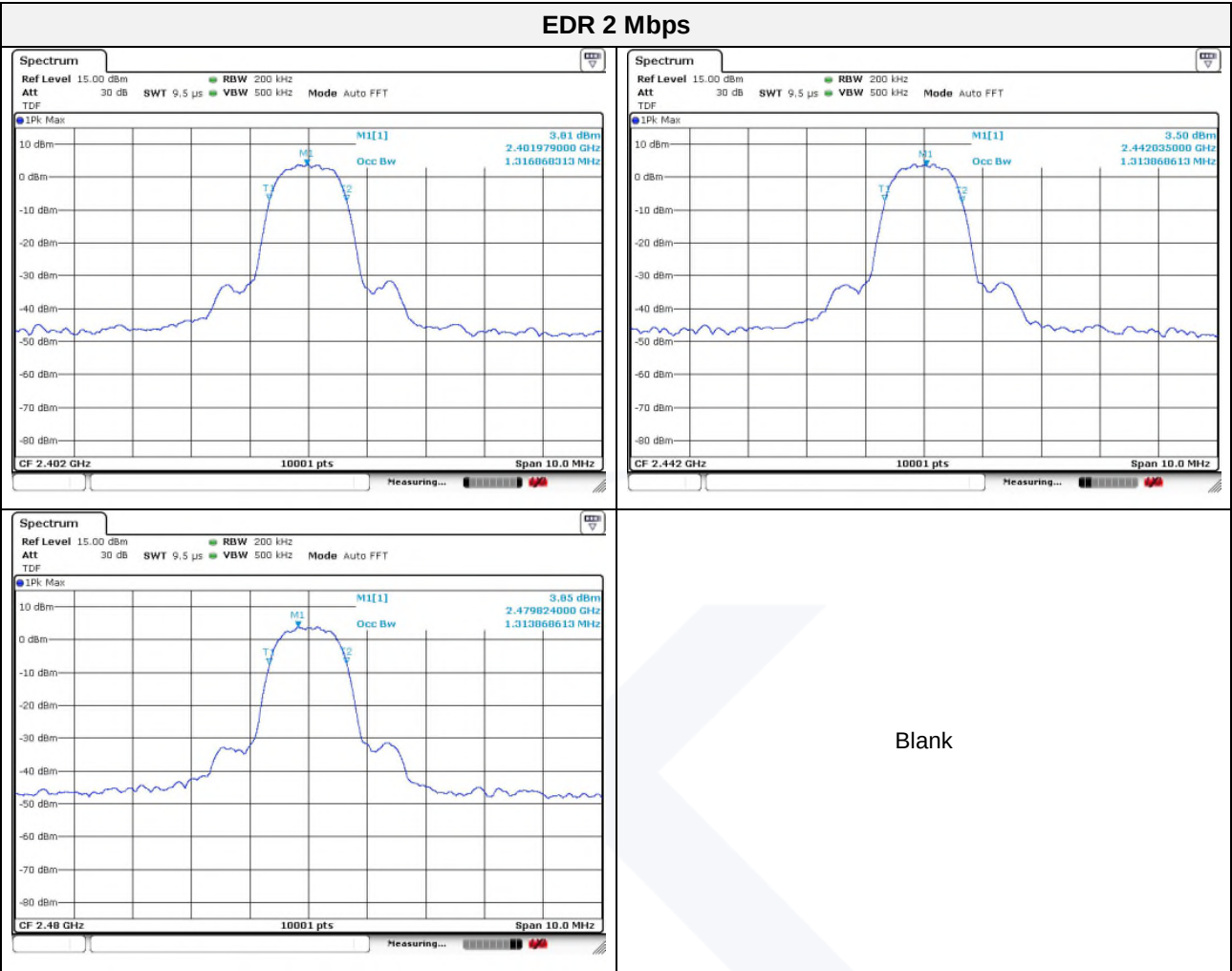
Mode : EDR 3 Mbps

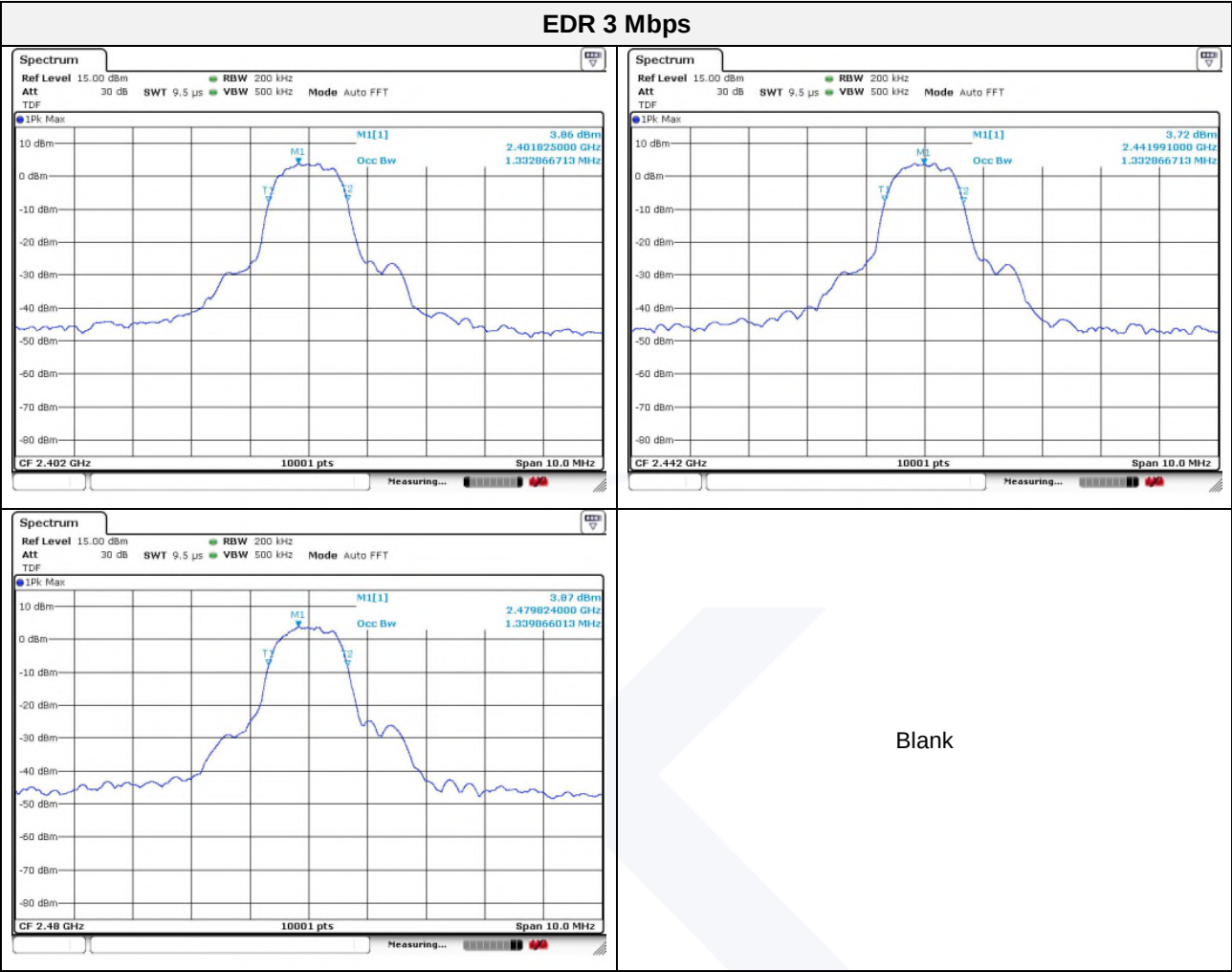
Frequency(MHz)	99% occupied bandwidth(MHz)	Limit(MHz)
2 402	1.33	-
2 442	1.33	
2 480	1.34	



Test plots







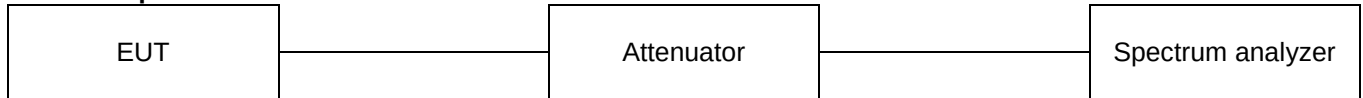


3.2. 20 dB bandwidth

Test procedure

ANSI 63.10-2013

Test setup



Test setting

1. Span = Set between two times and five times the OBW
2. RBW $\geq 1\%$ to 5 % of the OBW
3. VBW $\geq 3 * RBW$
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



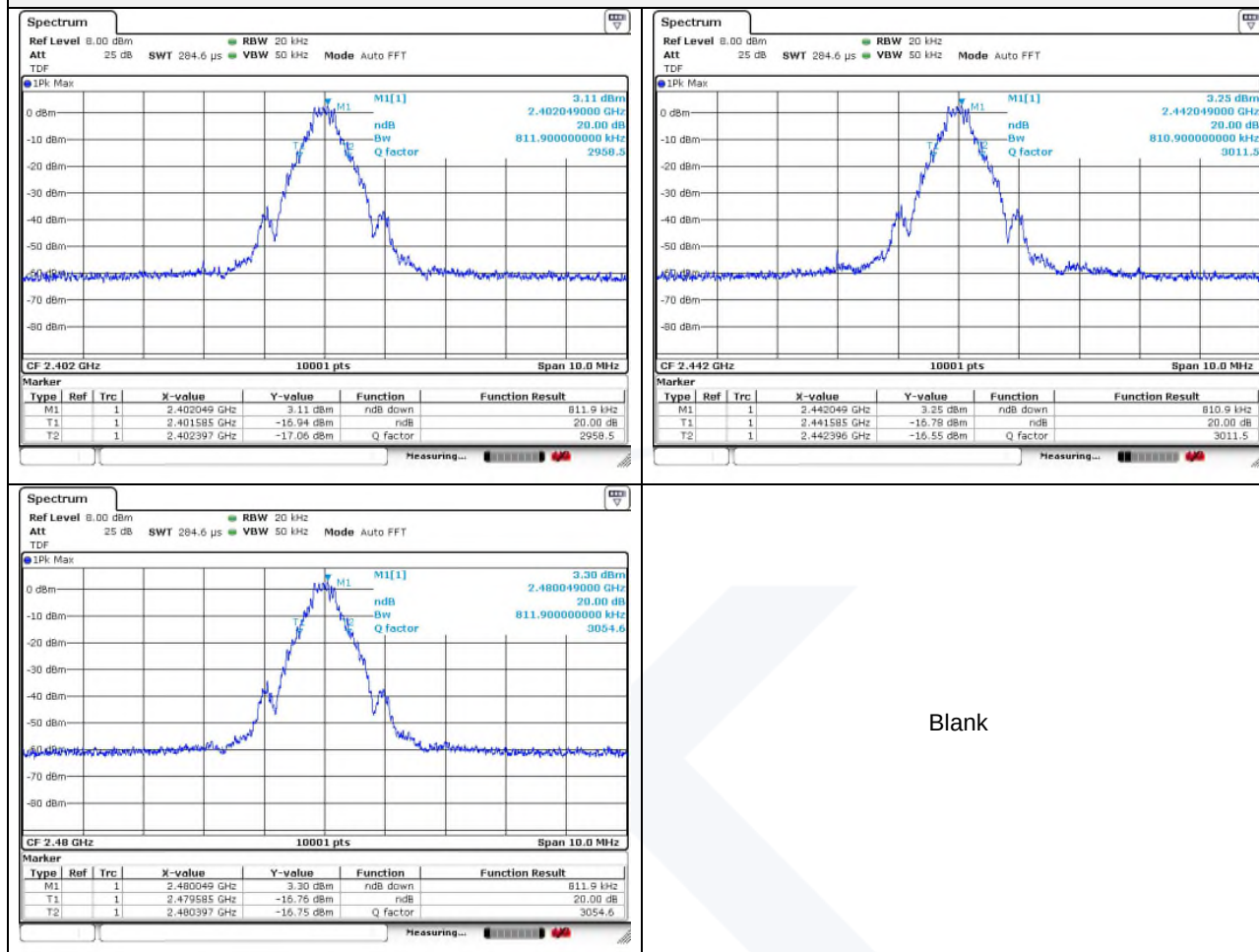


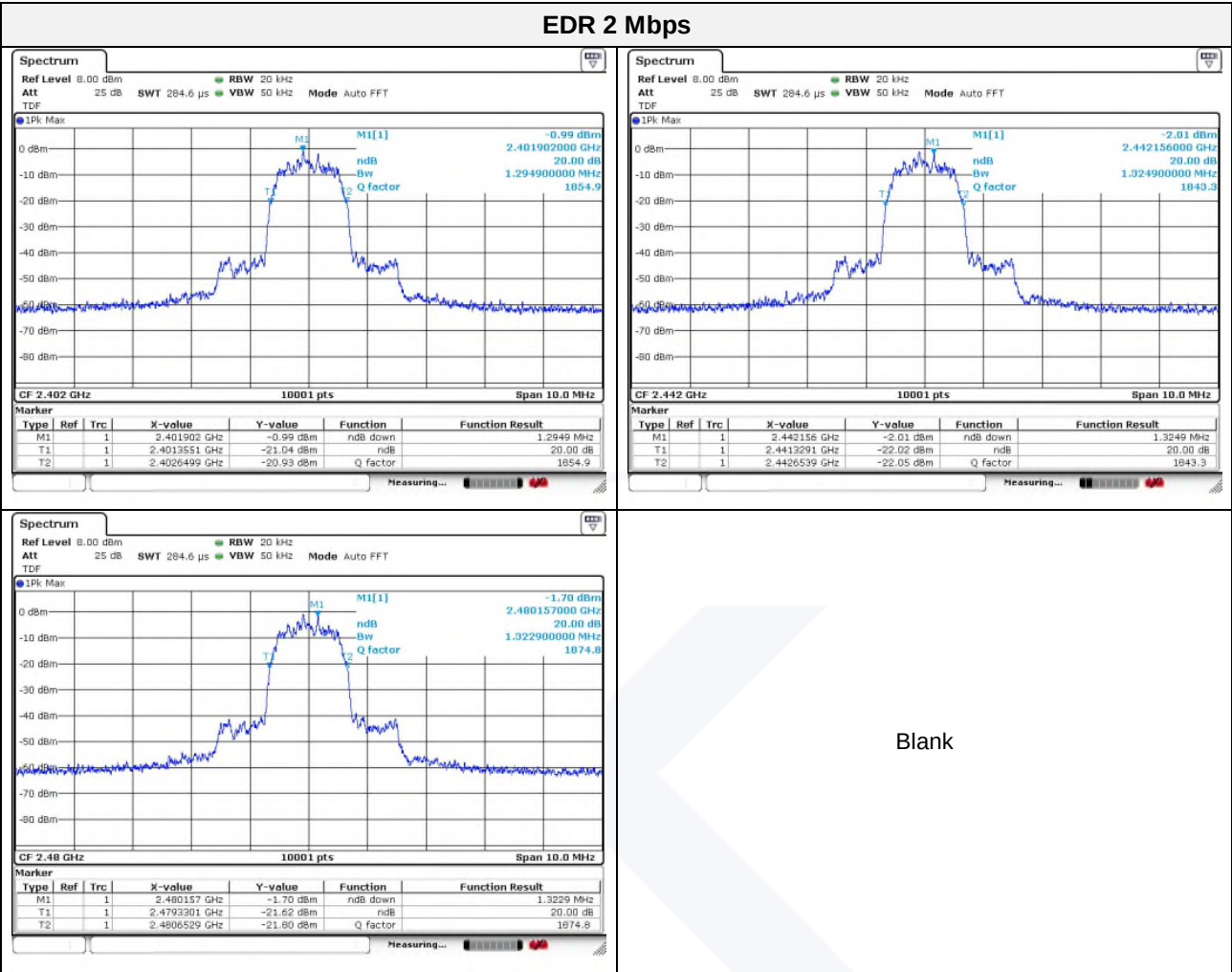
Frequency(MHz)	Channel no.	Data rate(Mbps)	Measured bandwidth(MHz)
2 402	00	BDR 1 Mbps	0.81
2 442	40		0.81
2 480	78		0.81
2 402	00	EDR 2 Mbps	1.29
2 442	40		1.32
2 480	78		1.32
2 402	00	EDR 3 Mbps	1.29
2 442	40		1.29
2 480	78		1.29

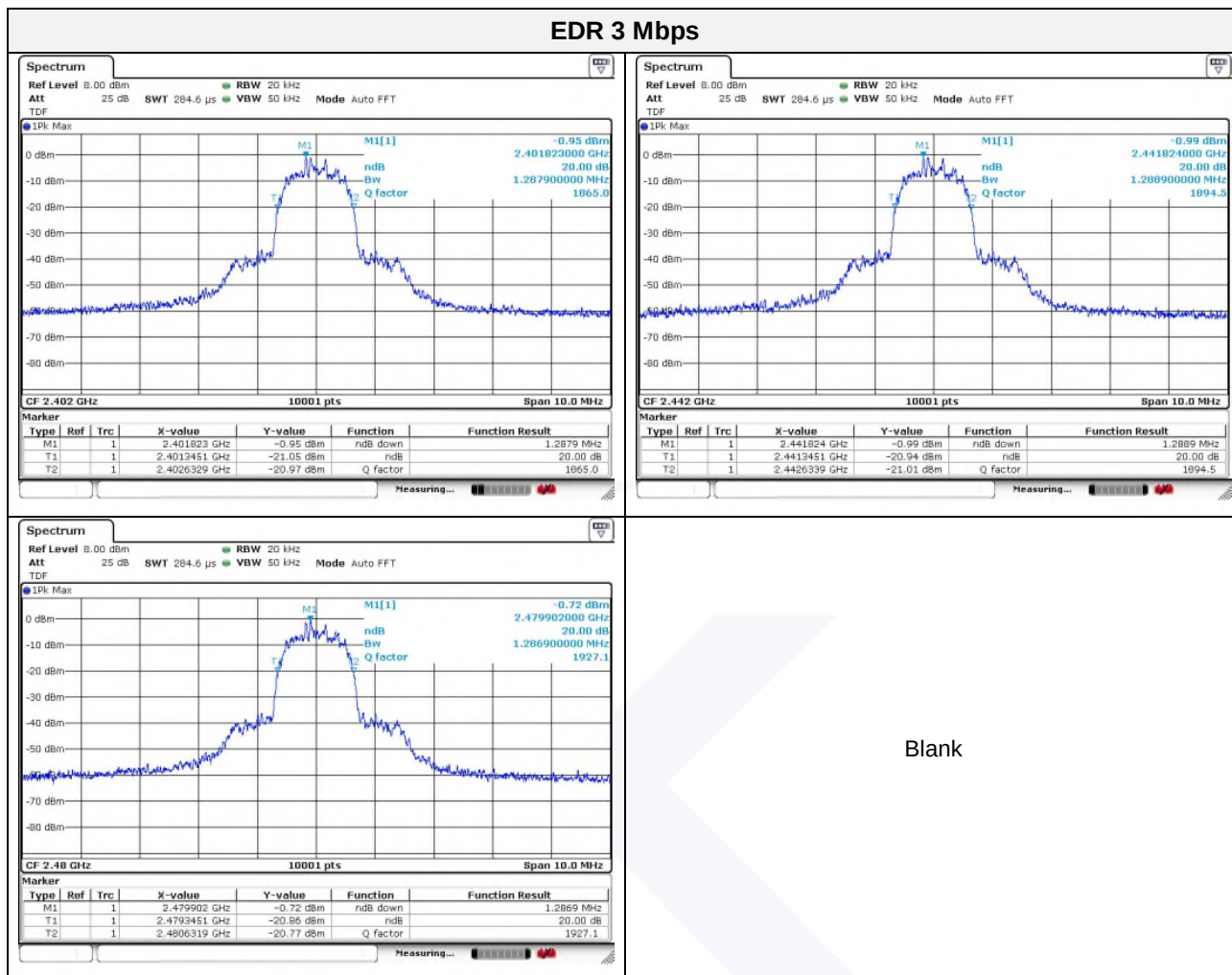




BDR 1 Mbps







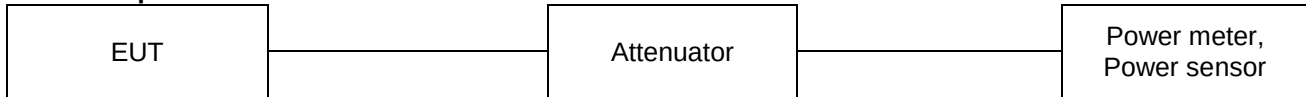


3.3. Output power

Test procedure

KDB 558074 v05r02 & ANSI 63.10-2013 – Section 11.9.2.1 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 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

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

**Test results**

Frequency(MHz)	Channel no.	Data rate(Mbps)	Average Power (dBm)	Peak Power (dBm)	Power Limit (dBm)
2 402	00	BDR 1 Mbps	7.51	7.61	20.97
2 442	40		7.60	7.70	20.97
2 480	78		7.60	7.69	20.97
2 402	00	EDR 2 Mbps	4.43	6.85	20.97
2 442	40		4.53	6.98	20.97
2 480	78		4.54	6.96	20.97
2 402	00	EDR 3 Mbps	4.43	7.13	20.97
2 442	40		4.53	7.23	20.97
2 480	78		4.53	7.24	20.97

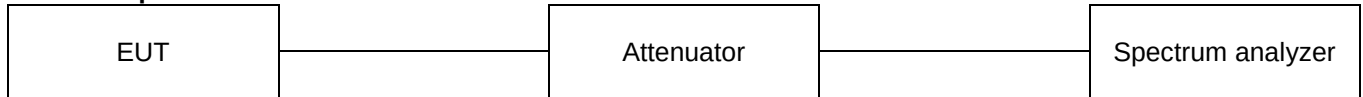


3.4. Carrier frequency separation

Test procedure

KDB 558074 v05r02 & ANSI 63.10-2013

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) $\geq$ 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.

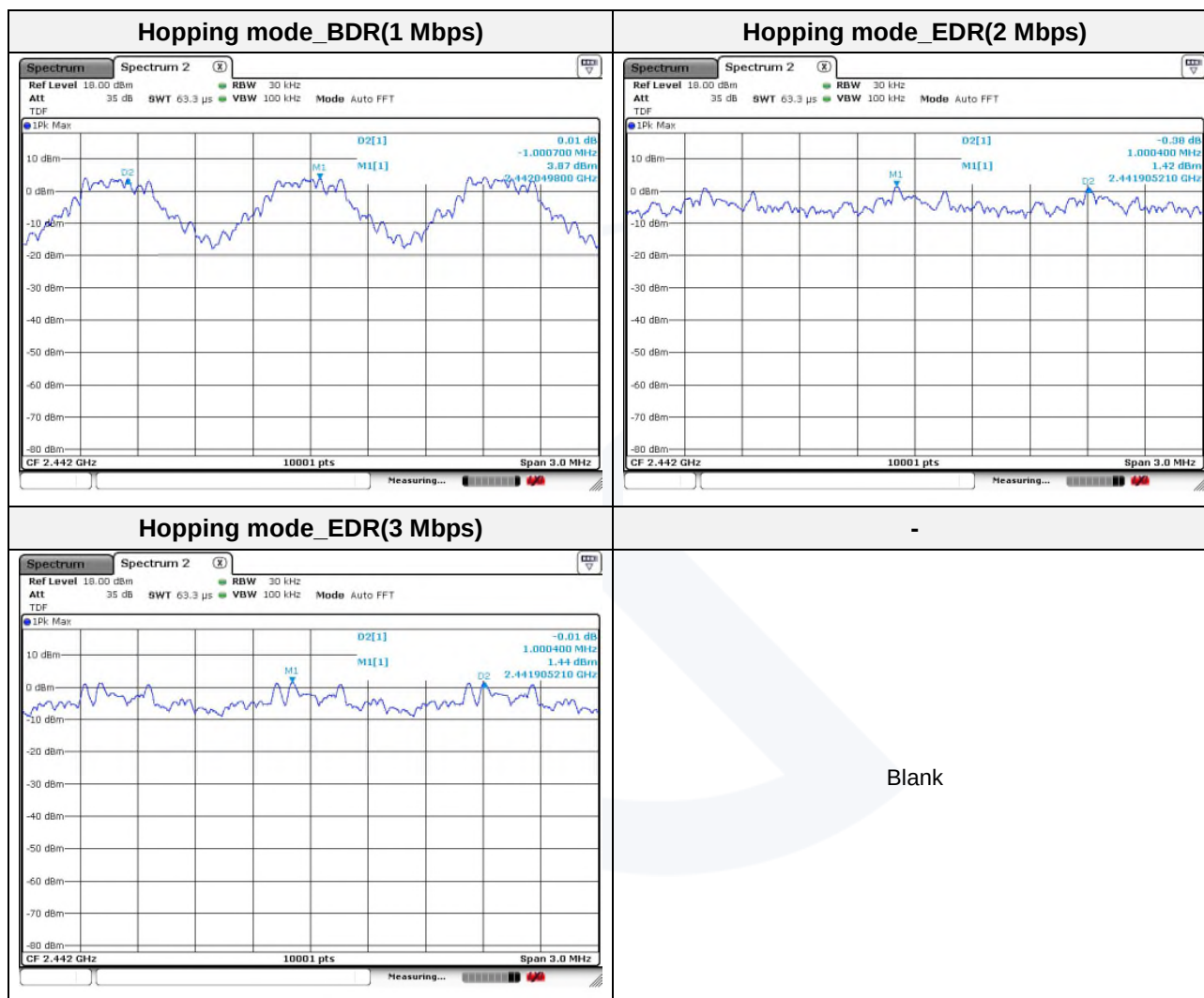
FCC Limit

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



Test results

Frequency(MHz)	Channel no.	Data rate(Mbps)	Channel Separation (MHz)	Limit (MHz)
2 442	40	BDR 1 Mbps	1.001	≥ 0.54
2 442	40	EDR 2 Mbps	1.000	≥ 0.88
2 442	40	EDR 3 Mbps	1.000	≥ 0.86



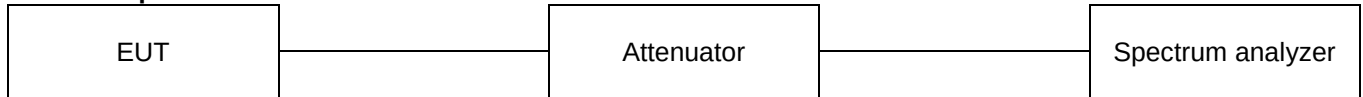


3.5. Number of hopping frequency

Test procedure

KDB 558074 v05r02 & ANSI 63.10-2013

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 $\geq$ 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.

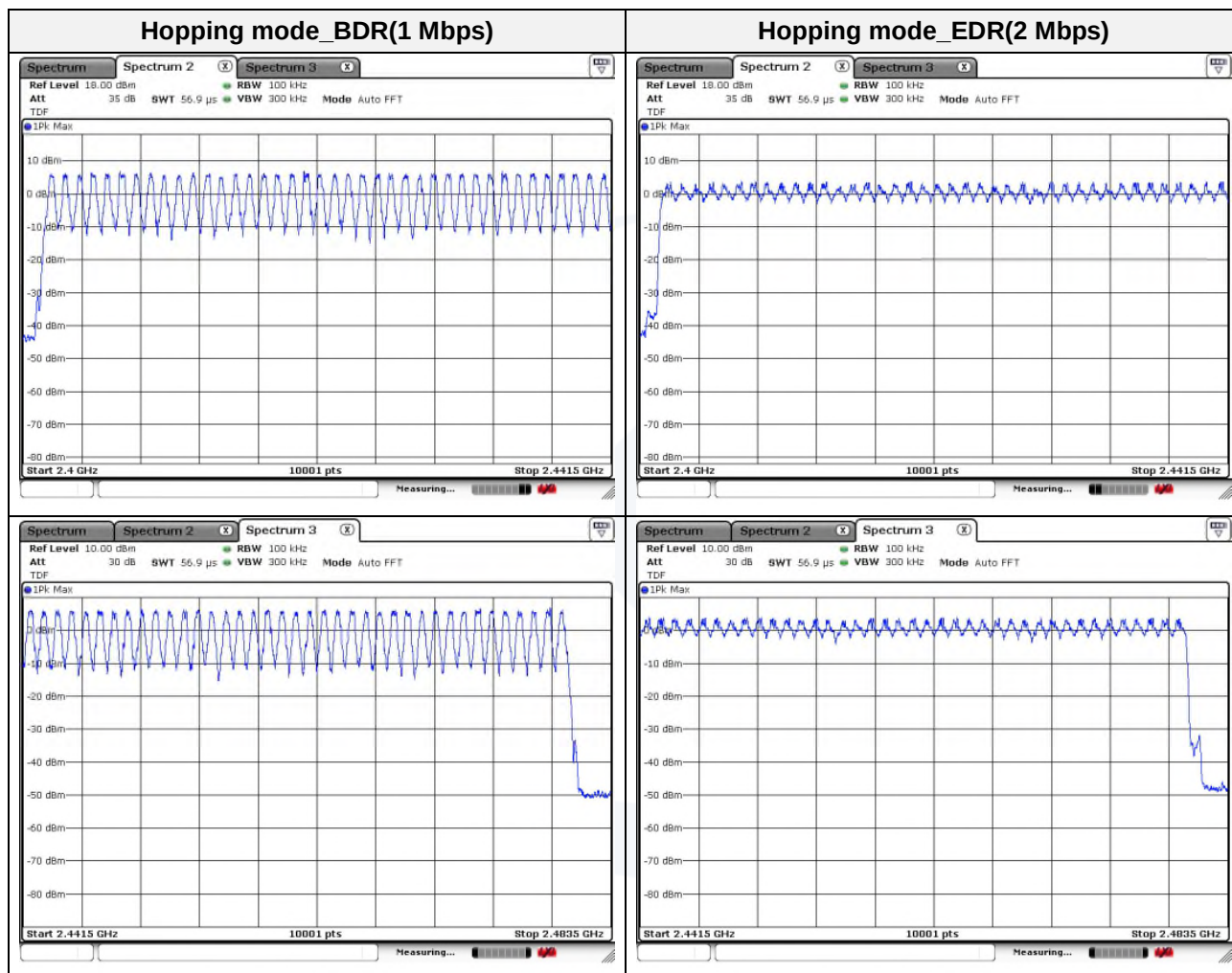
FCC Limit

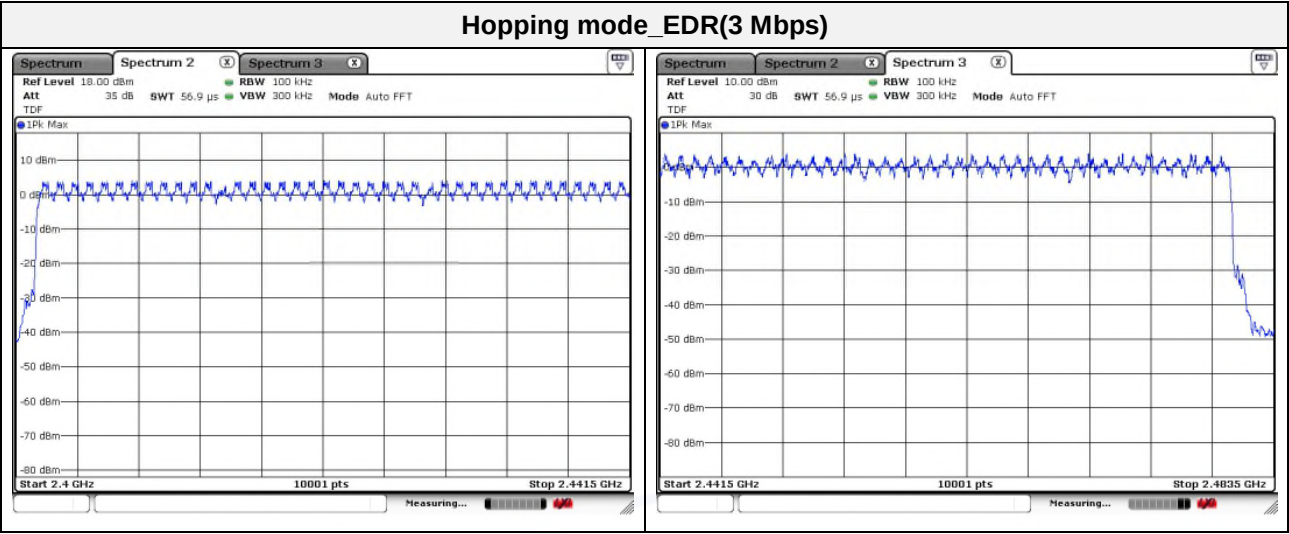
According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2 400 ~ 2 483.5 MHz bands shall use at least 15 hopping frequencies.



requency	Data rate(Mbps)	Number of hopping frequency	Limit
2 402 ~ 2 480 MHz	BDR 1 Mbps	79	≥ 15
2 402 ~ 2 480 MHz	EDR 2 Mbps	79	≥ 15
2 402 ~ 2 480 MHz	EDR 3 Mbps	79	≥ 15

Test results





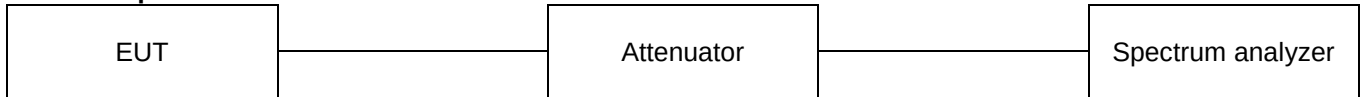


3.6. Time of occupancy

Test procedure

KDB 558074 v05r02 & ANSI 63.10-2013

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 $\leq$ channel spacing and where possible RBW should be set $\gg 1 / T$, 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 MHz band, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 31.6 second period.

$$A \text{ period time} = 0.4(s) \times 79 = 31.6(s)$$

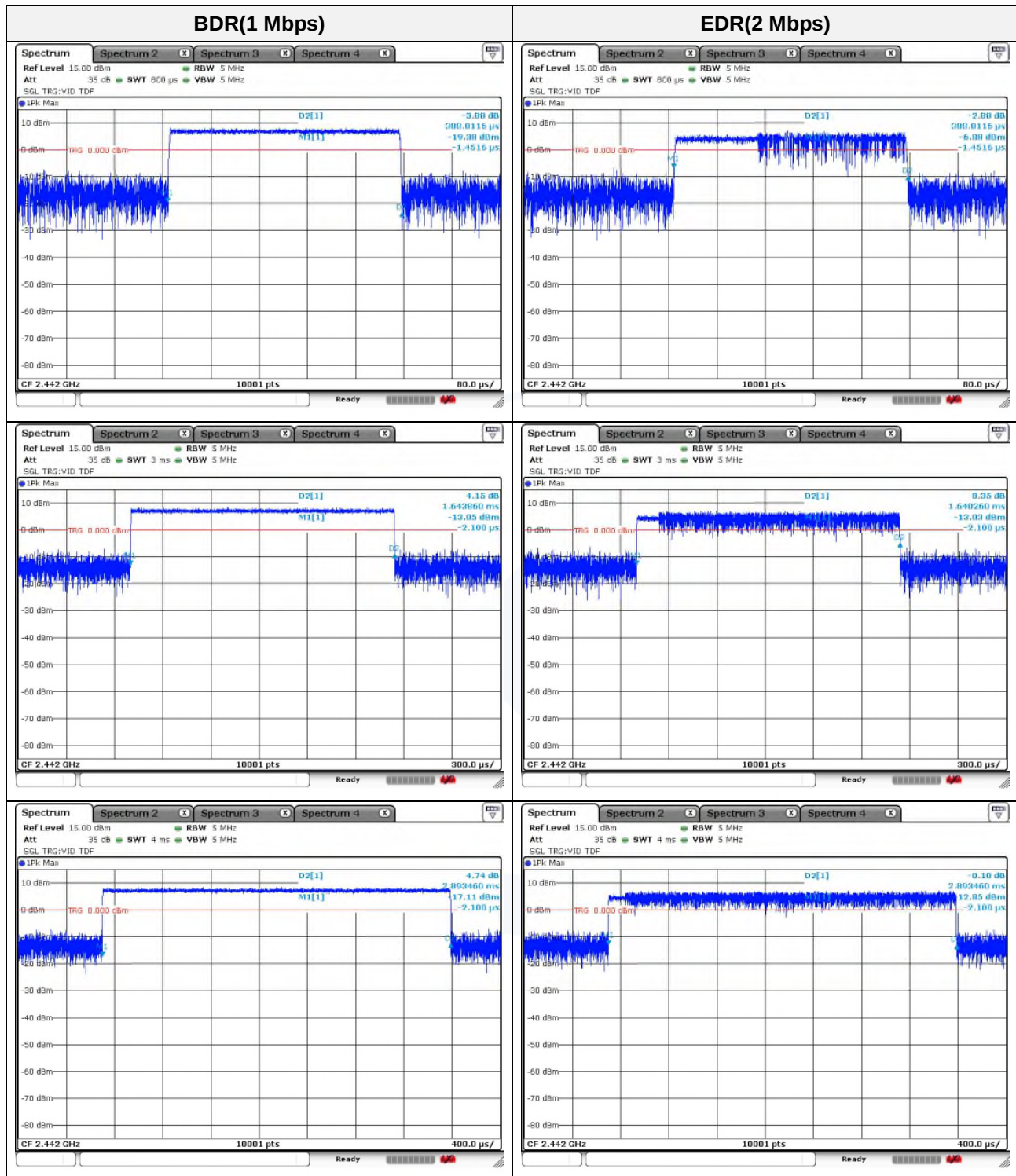
$$\begin{aligned} &\text{Time of occupancy on the TX channel in 31.6 sec} \\ &= \text{time domain slot length} \times (\text{hop rate} \div \text{number of hop per channel}) \times 31.6 \end{aligned}$$

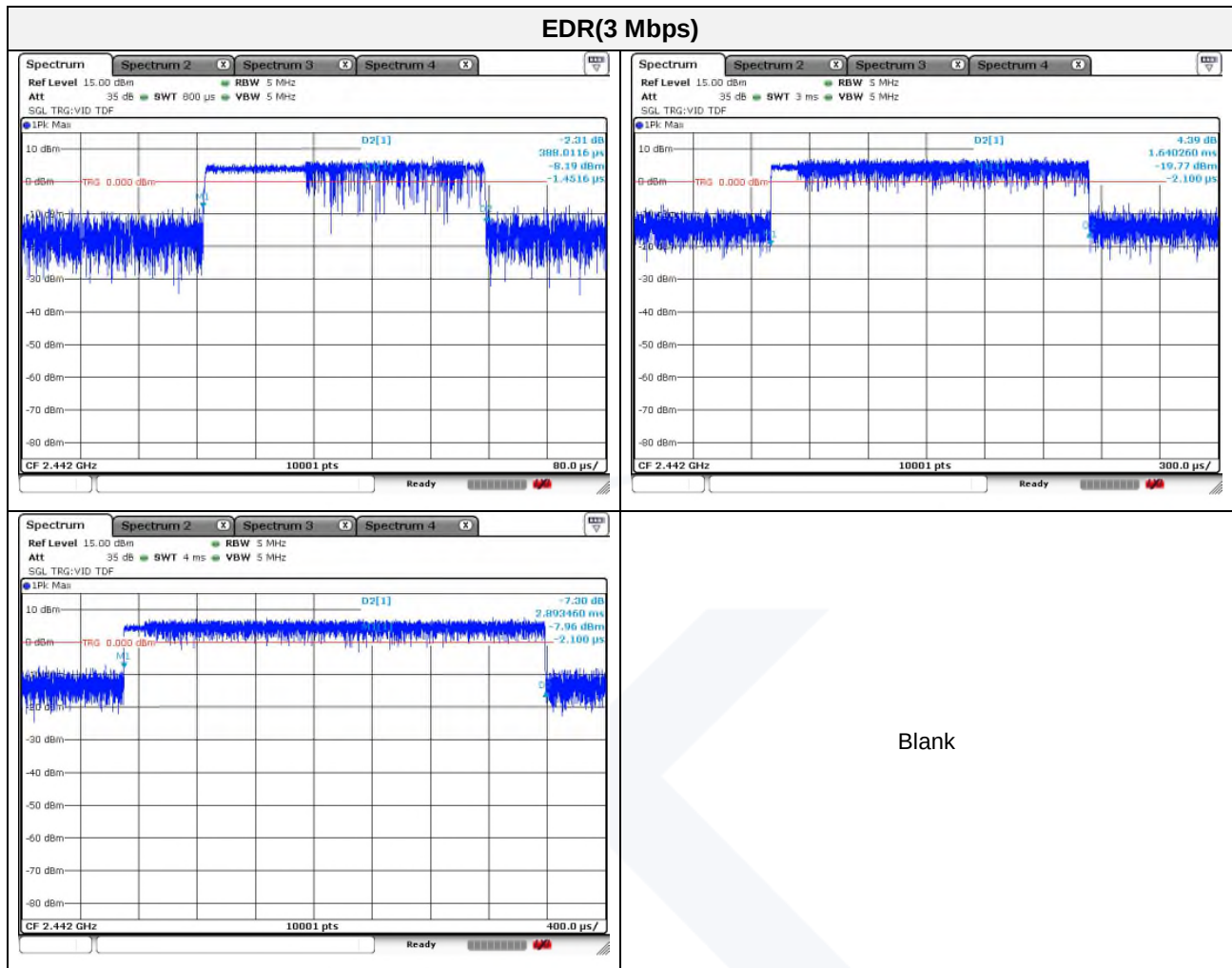


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Packet type	Frequency (MHz)	Dwell time (ms)	Time of occupancy on the Tx channel in 31.6 sec (ms)	Limit for time of occupancy on the Tx channel in 31.6 sec (ms)
DH1	2 442	0.418	124.48	400
DH3	2 442	1.688	263.04	400
DH5	2 442	2.928	308.59	400
2-DH1	2 442	0.430	124.16	400
2-DH3	2 442	1.688	262.40	400
2-DH5	2 442	2.928	308.59	400
3-DH1	2 442	0.430	124.16	400
3-DH3	2 442	1.688	262.40	400
3-DH5	2 442	2.928	308.59	400

Operation mode: GFSK, $\pi/4$ DQPSK, 8DPSK**Note:****Normal Mode**DH1: Dwell time (ms) $\times [(1\ 600 \div 2) \div 79] \times 31.6(s) = 124.48\ (ms)$ DH3: Dwell time (ms) $\times [(1\ 600 \div 4) \div 79] \times 31.6(s) = 263.04\ (ms)$ DH5: Dwell time (ms) $\times [(1\ 600 \div 6) \div 79] \times 31.6(s) = 308.59\ (ms)$ 2-DH1: Dwell time (ms) $\times [(1\ 600 \div 2) \div 79] \times 31.6(s) = 124.16\ (ms)$ 2-DH3: Dwell time (ms) $\times [(1\ 600 \div 4) \div 79] \times 31.6(s) = 262.40\ (ms)$ 2-DH5: Dwell time (ms) $\times [(1\ 600 \div 6) \div 79] \times 31.6(s) = 308.59\ (ms)$ 3-DH1: Dwell time (ms) $\times [(1\ 600 \div 2) \div 79] \times 31.6(s) = 124.16\ (ms)$ 3-DH3: Dwell time (ms) $\times [(1\ 600 \div 4) \div 79] \times 31.6(s) = 262.40\ (ms)$ 3-DH5: Dwell time (ms) $\times [(1\ 600 \div 6) \div 79] \times 31.6(s) = 308.59\ (ms)$



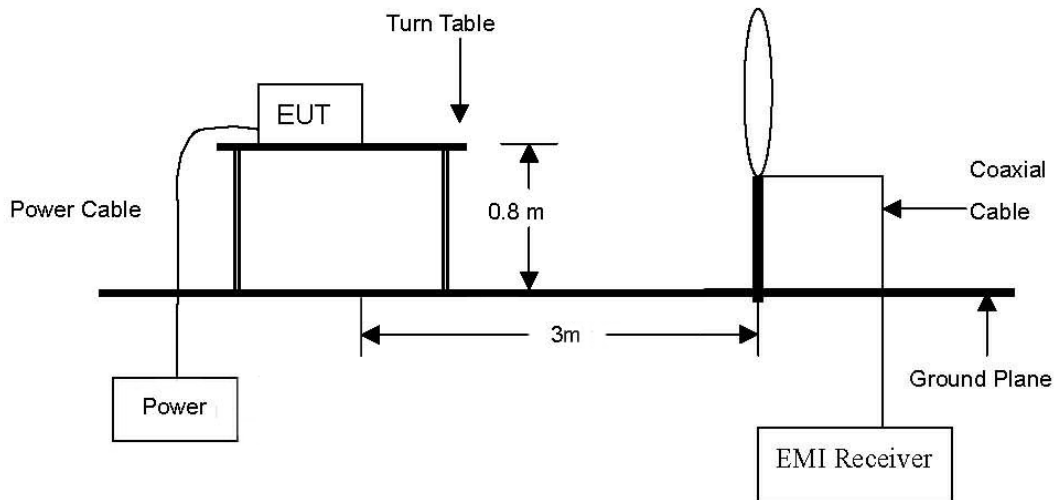




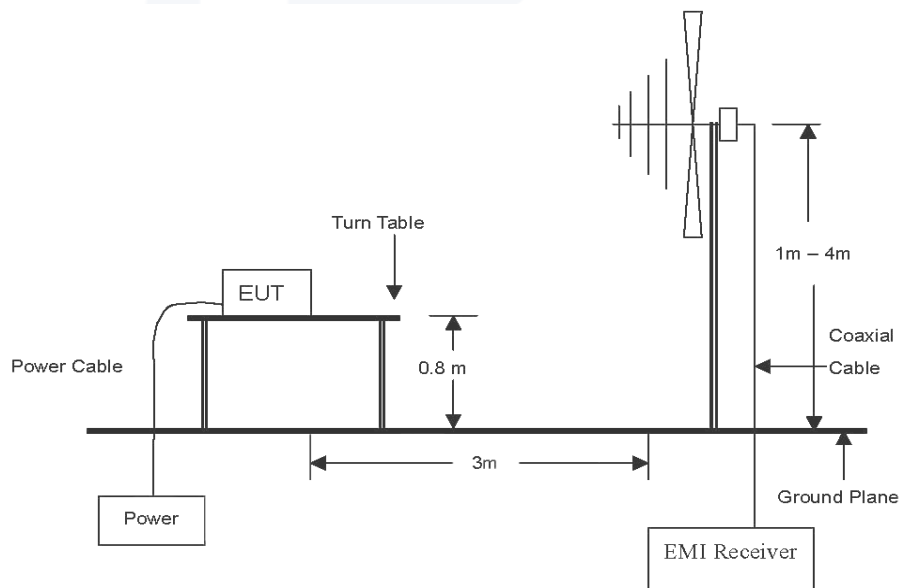
3.7. Radiated restricted band and emissions

Test setup

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

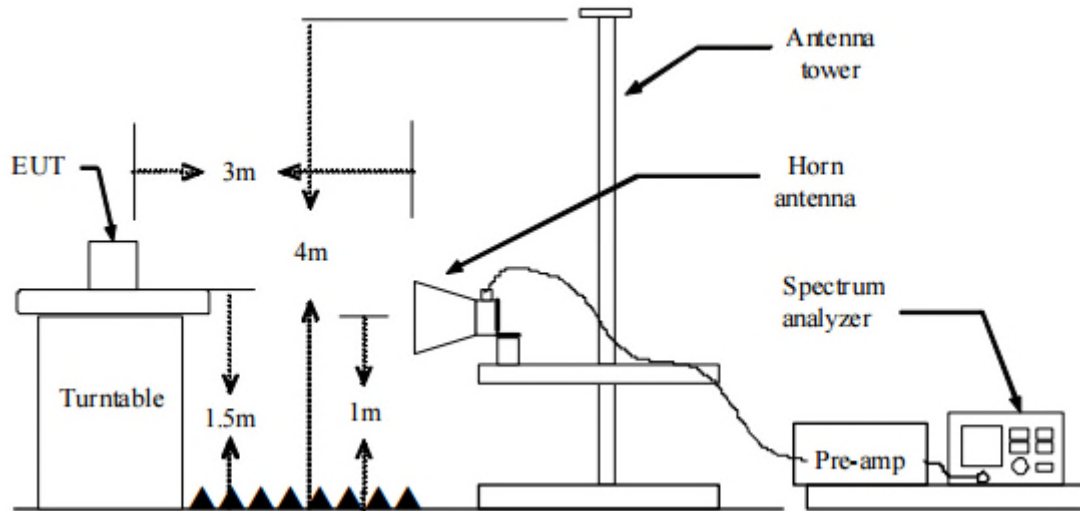


The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.





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.



Test procedure

Radiated emissions from the EUT were measured according to the dictates in section 11.11 & 11.12 of ANSI C63.10-2013.

Test procedure below 30 MHz

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 MHz

1. The EUT was placed on the top of a rotating table 1.5 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. 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 $f < 1$ GHz:
 - ① Span = wide enough to fully capture the emission being measured
 - ② RBW = 100 kHz
 - ③ VBW $\geq$ RBW
 - ④ Detector = quasi peak
 - ⑤ Sweep time = auto
 - ⑥ Trace = max hold



6. Spectrum analyzer settings for $f \geq 1$ GHz: Peak

- ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- ② RBW = 1 MHz
- ③ VBW ≥ 3 MHz
- ④ Detector = peak
- ⑤ Sweep time = auto
- ⑥ Trace = max hold
- ⑦ Trace was allowed to stabilize

7. Spectrum analyzer settings for $f \geq 1$ GHz: Average

- ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- ② RBW = 1 MHz
- ③ VBW $\geq 3 \times$ RBW
- ④ Detector = 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 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 dB 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. $f < 30$ 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. Field strength(dB μ V/m) = Level(dB μ V) + CF (dB) + or DCF(dB)
3. Margin(dB) = Limit(dB μ V/m) - Field strength(dB μ V/m)
4. Emissions below 18 GHz were measured at a 3 meter test distance while emissions above 18 GHz 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 dB of respective limits were not reported.
7. 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.

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 (MHz)	Distance (Meters)	Radiated (μ V/m)
0.009 ~ 0.490	300	2400/F(kHz)
0.490 ~ 1.705	30	24000/F(kHz)
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 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., Sections 15.231 and 15.241.



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Duty cycle

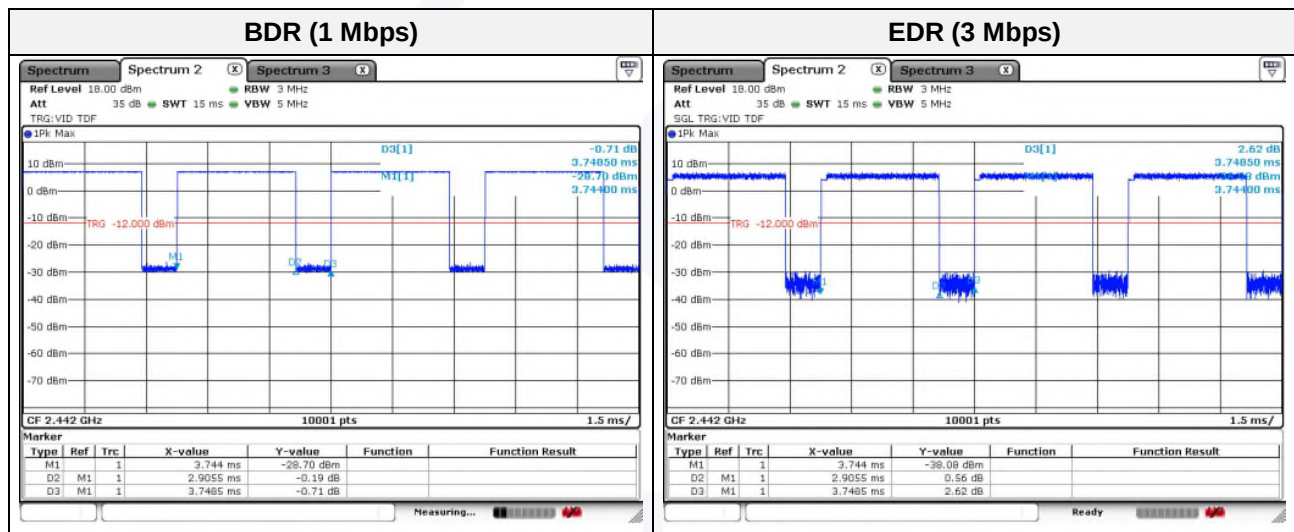
Regarding to KDB 558074 D01_v05 r02, 6. Measurements of duty cycle and transmission duration shall be performed using one of the following techniques:

- A 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.
- 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 (ms)	Period (ms)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (dB)
BDR(1 Mbps)	2.91	3.75	0.78	77.60	1.10
EDR(3 Mbps)	2.91	3.75	0.78	77.60	1.10

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

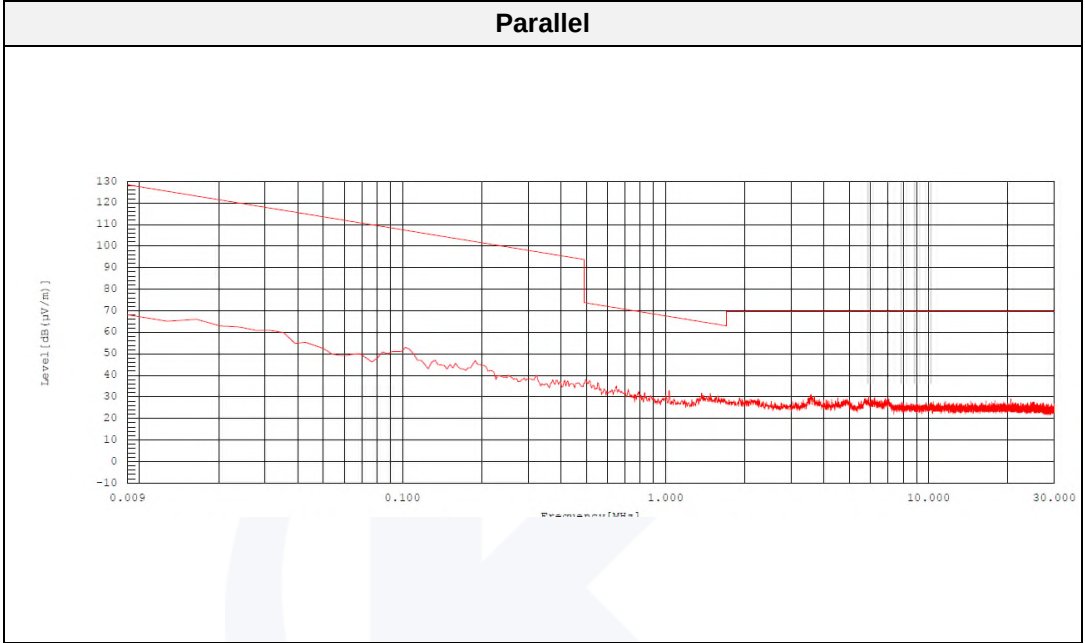
DCF(Duty cycle correction factor (dB)) = 10log(1/duty cycle)





Test results (Below 30 MHz)

Mode:	BDR (Worst case)
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Channel:	40 (Worst case)

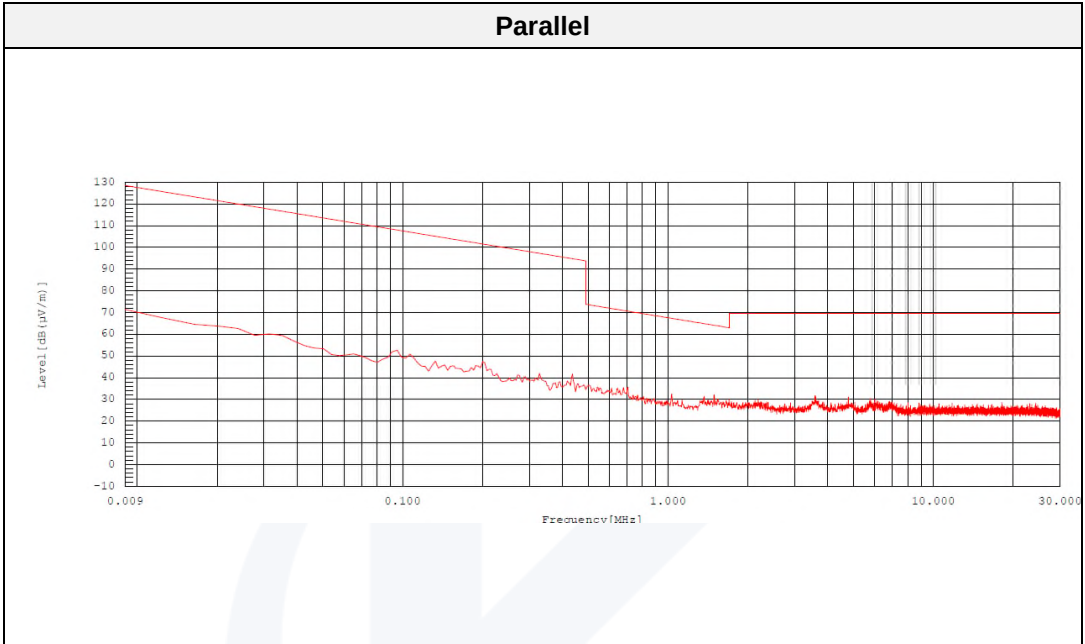


Note.

1. No spurious emission were detected under 30 MHz.



Mode:	BDR (Worst case)+802.11n_HT20 (MCS0) (Worst case)
Distance of measurement:	3 meter
Channel:	40 (BDR, Worst case)+6 (802.11n_HT20, Worst case)

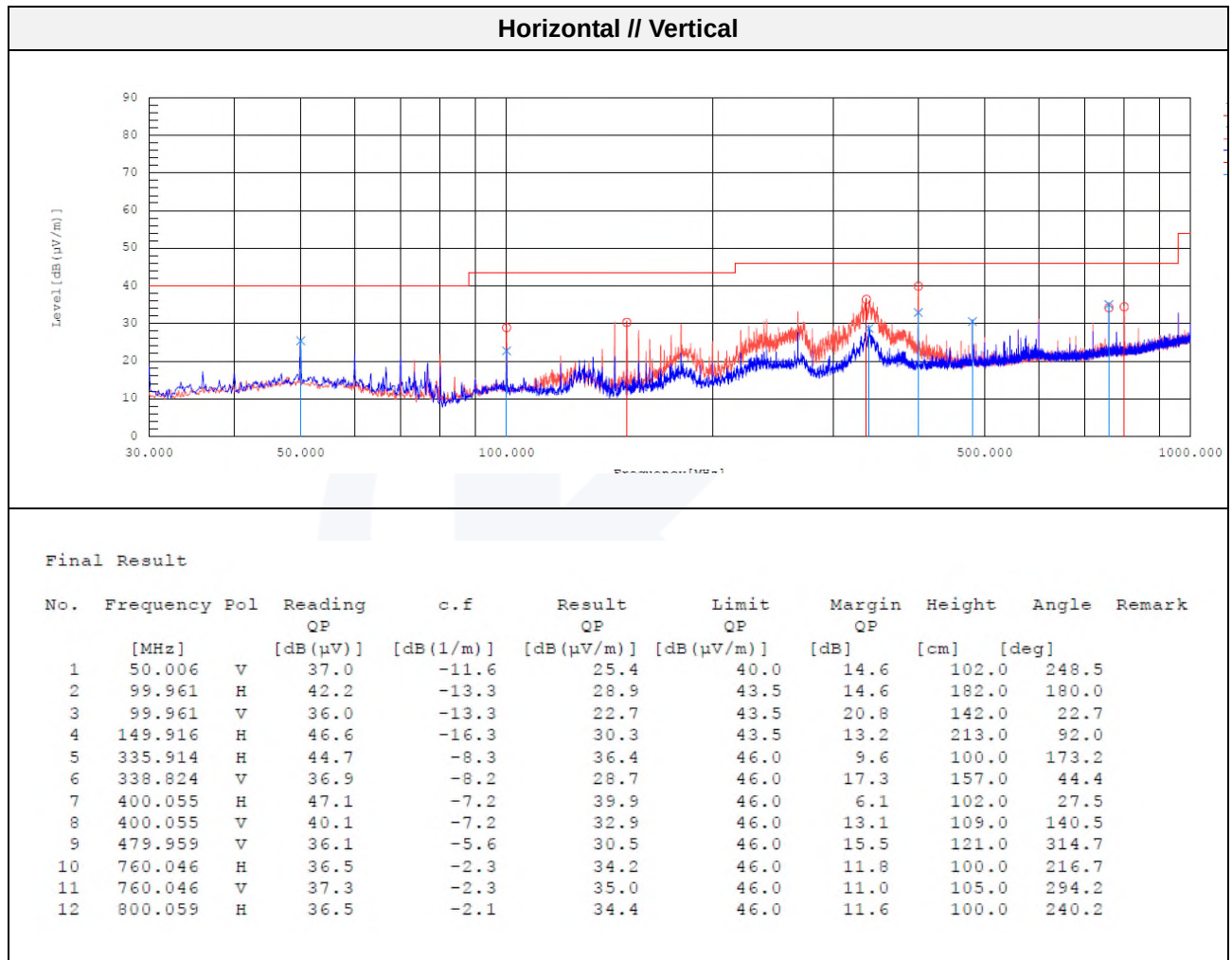


Note.

1. No spurious emission were detected under 30 MHz.

**Test results (Below 1 000 MHz) – Worst case**

Mode: BDR (Worst case)
Transfer rate: 1 Mbps
Distance of measurement: 3 meter
Channel: 40 (Worst case)



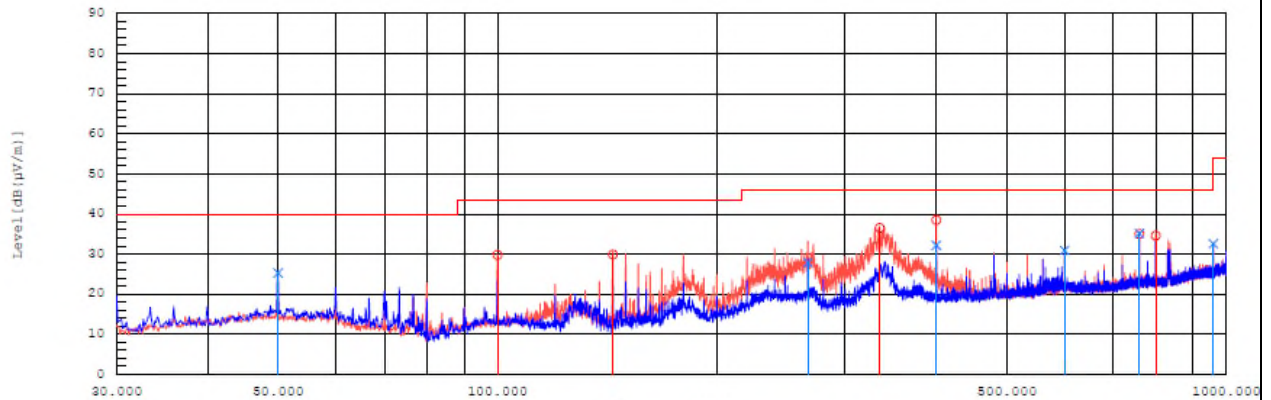


Mode: BDR (Worst case)+802.11n_HT20 (MCS0) (Worst case)

Distance of measurement: 3 meter

Channel: 40 (BDR, Worst case)+6 (802.11n_HT20, 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	50.006	V	36.9	-11.6	25.3	40.0	14.7	105.0	273.8	
2	99.961	H	43.1	-13.3	29.8	43.5	13.7	182.0	164.6	
3	143.975	H	46.0	-16.1	29.9	43.5	13.6	231.0	98.5	
4	266.680	V	38.2	-10.4	27.8	46.0	18.2	142.0	136.2	
5	334.580	H	44.9	-8.4	36.5	46.0	9.5	100.0	243.3	
6	400.055	H	45.7	-7.2	38.5	46.0	7.5	108.0	155.0	
7	400.055	V	39.4	-7.2	32.2	46.0	13.8	100.0	140.5	
8	599.996	V	34.4	-3.5	30.9	46.0	15.1	142.0	22.7	
9	760.046	H	37.3	-2.3	35.0	46.0	11.0	126.0	220.6	
10	760.046	V	37.4	-2.3	35.1	46.0	10.9	105.0	162.4	
11	800.059	H	36.7	-2.1	34.6	46.0	11.4	113.0	243.3	
12	959.988	V	31.2	1.4	32.6	46.0	13.4	110.0	273.8	

**Test results (Above 1 000 MHz)**

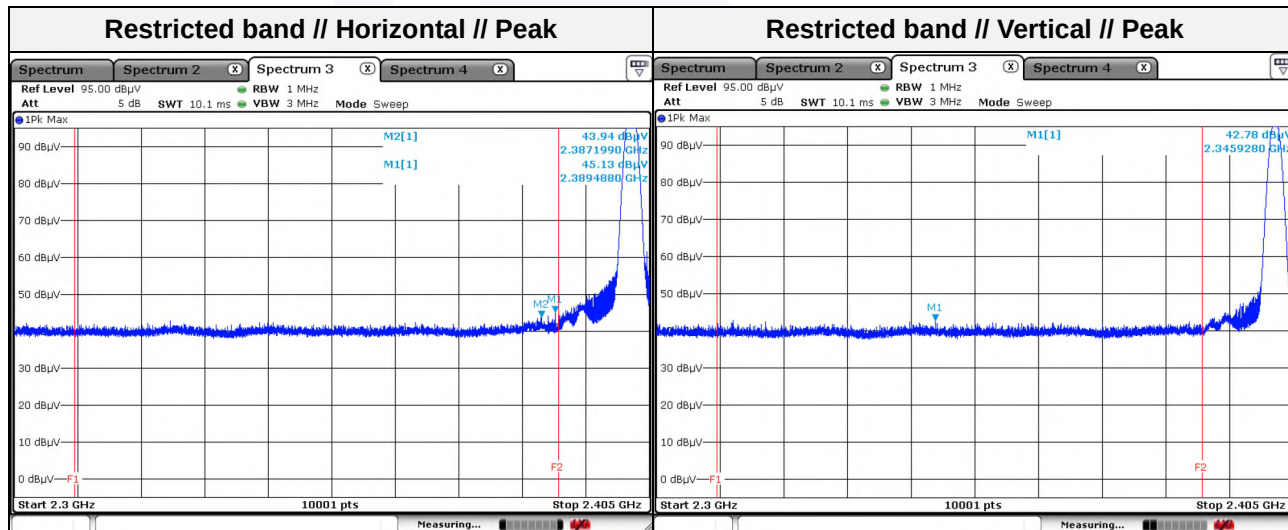
Mode: BDR (1 Mbps)
Distance of measurement: 3 meter
Channel: 00

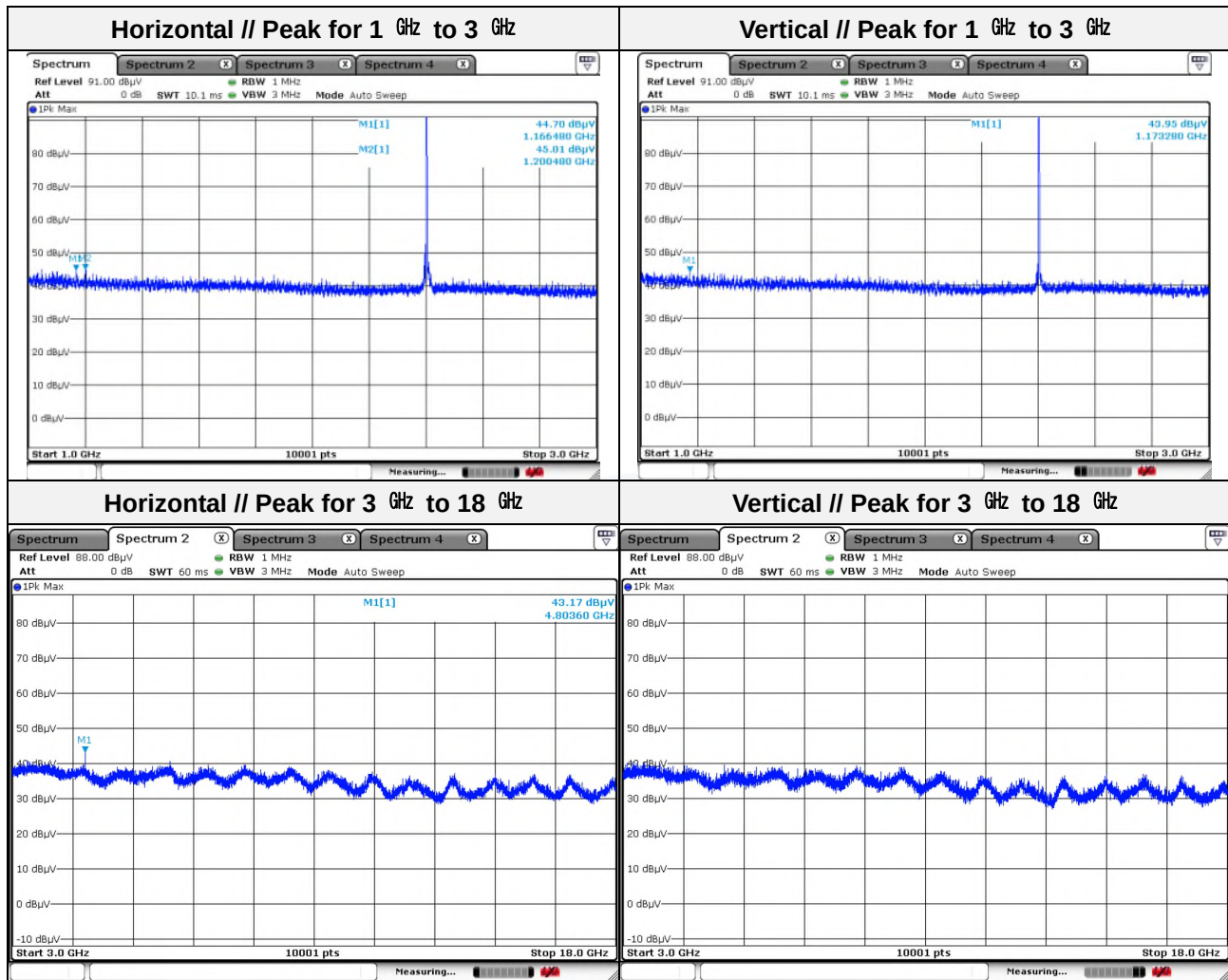
- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 166.48	44.70	Peak	H	-7.34	-	37.36	74.00	36.64
1 173.28	43.95	Peak	V	-7.31	-	36.64	74.00	37.36
1 200.48	45.01	Peak	H	-7.17	-	37.84	74.00	36.16
4 803.60	43.17	Peak	H	5.10	-	48.27	74.00	25.73

- Band edge

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 345.93	42.78	Peak	V	-2.64	-	40.14	74.00	33.86
2 387.20	43.94	Peak	H	-2.52	-	41.42	74.00	32.58
2 389.49	45.13	Peak	H	-2.52	-	42.61	74.00	31.39





Note.

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

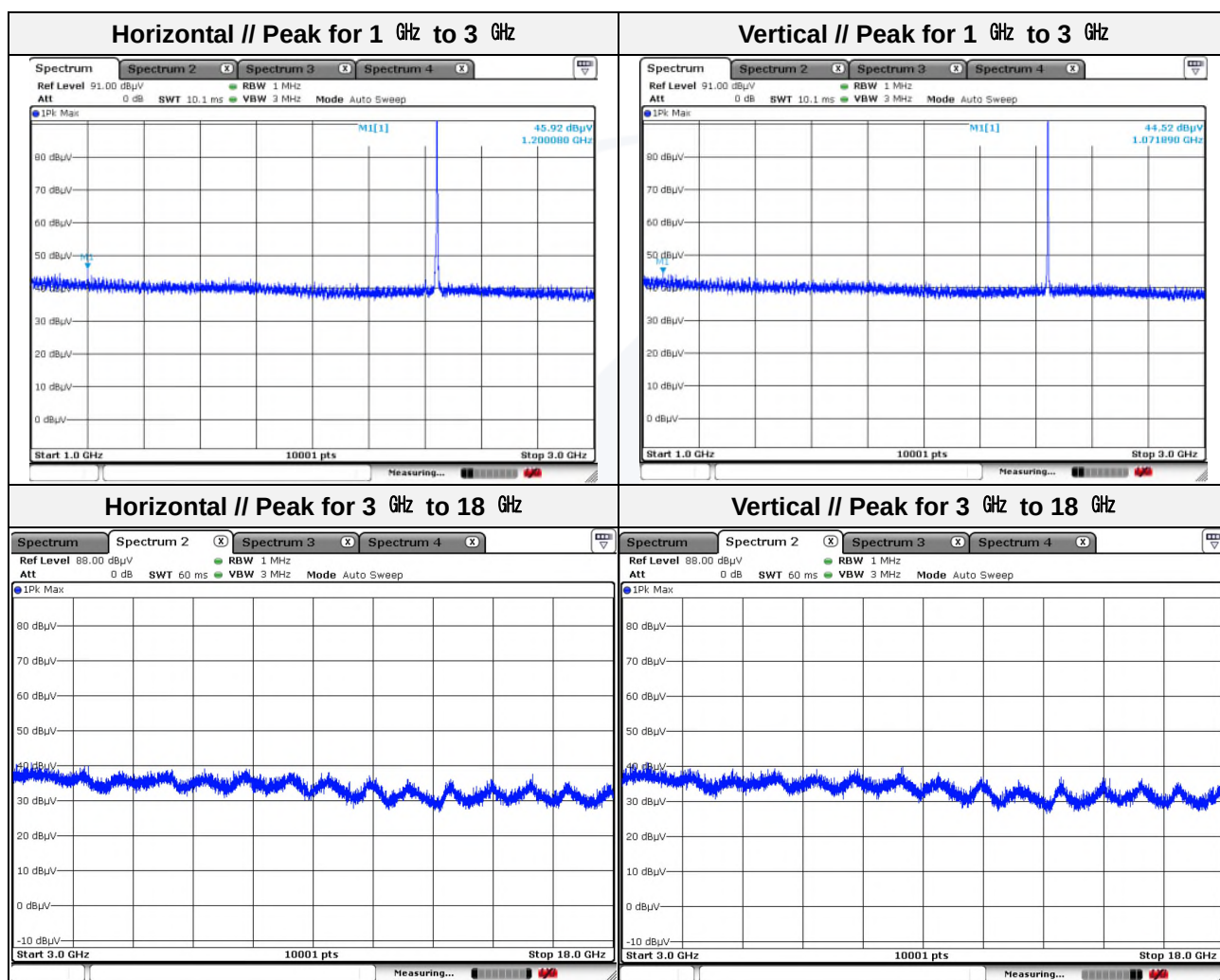


Report No. : RF-230793

Mode: BDR (1 Mbps)
Distance of measurement: 3 meter
Channel: 40

- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1 071.89	44.52	Peak	V	-7.83	-	36.69	74.00	37.31
1 200.08	45.92	Peak	H	-7.17	-	38.75	74.00	35.25



Note.

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



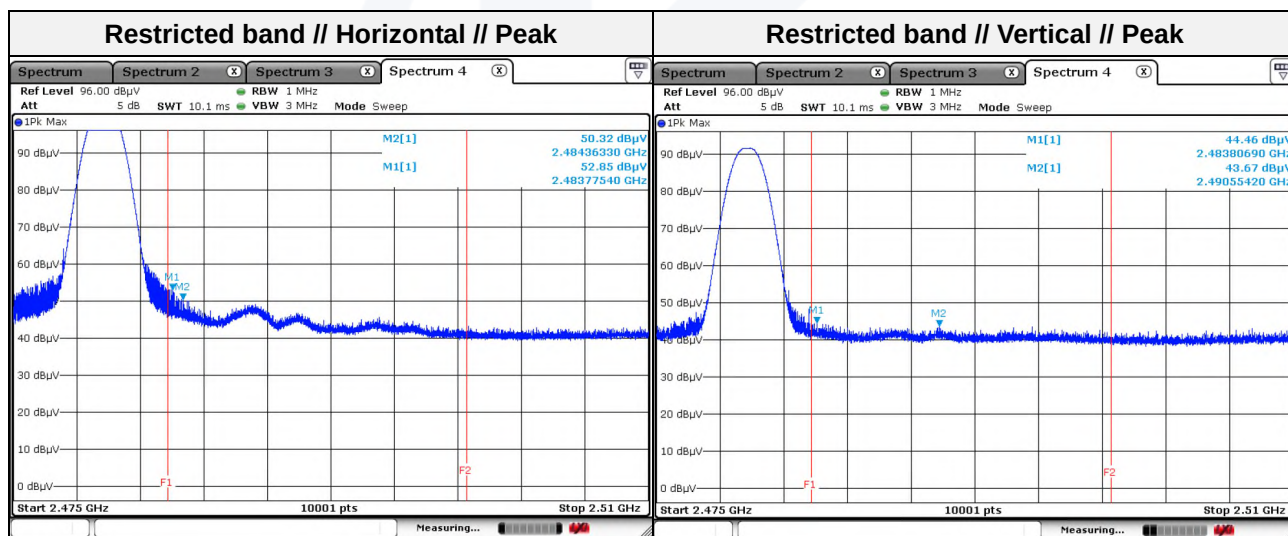
Mode: BDR (1 Mbps)
Distance of measurement: 3 meter
Channel: 78

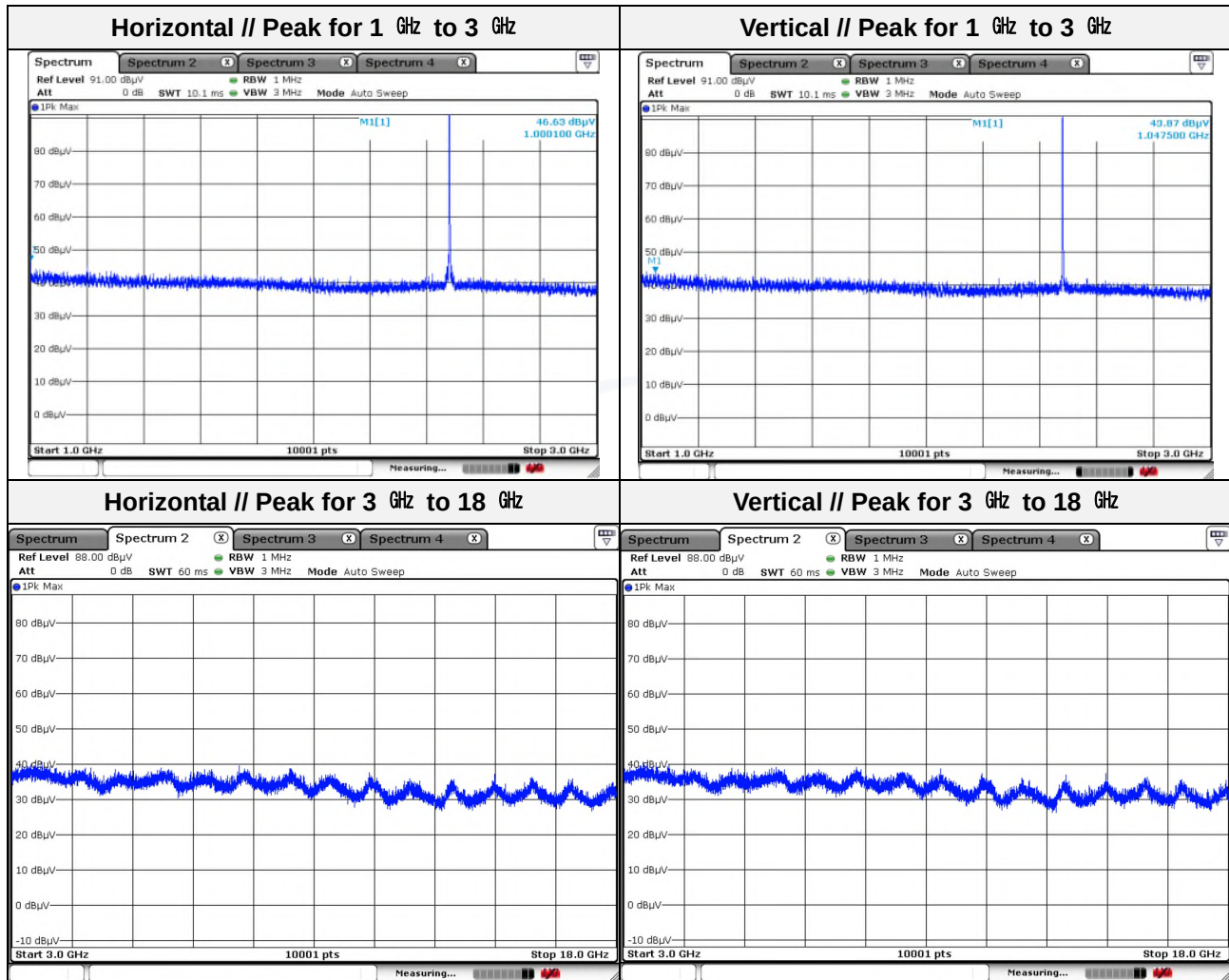
- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1 000.10	46.63	Peak	H	-8.20	-	38.43	74.00	35.57
1 047.50	43.87	Peak	V	-7.96	-	35.91	74.00	38.09

- Band edge

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2 483.78	52.85	Peak	H	-2.28	-	50.57	74.00	23.43
2 483.81	44.46	Peak	V	-2.28	-	42.18	74.00	31.82
2 484.36	50.32	Peak	H	-2.28	-	48.04	74.00	25.96
2 490.55	43.67	Peak	V	-2.27	-	41.40	74.00	32.60





Note.

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



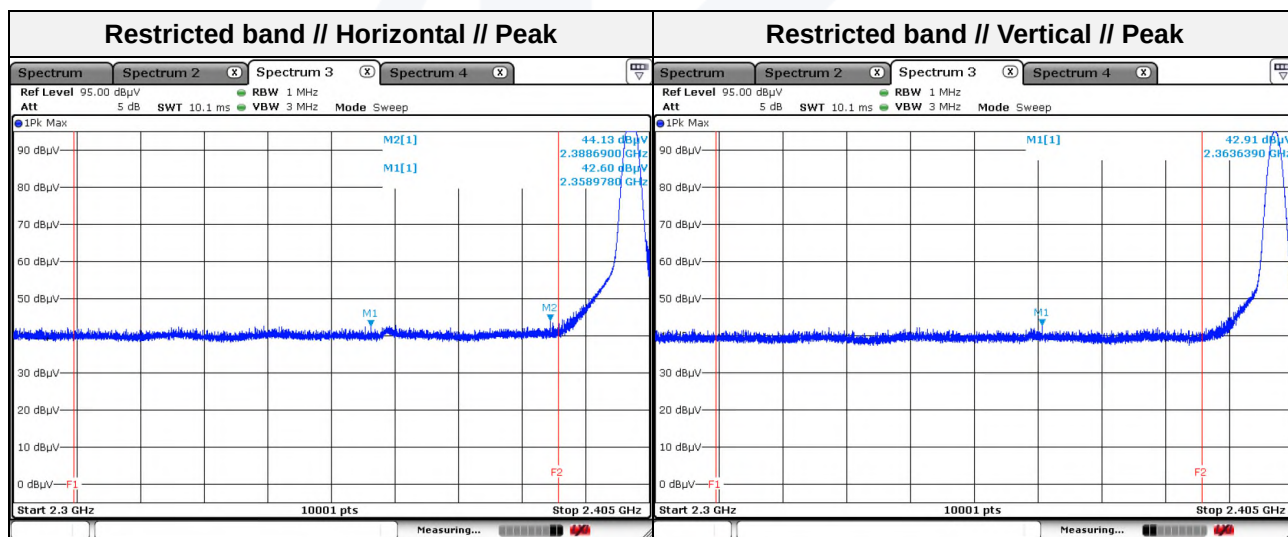
Mode: EDR (3 Mbps)
Distance of measurement: 3 meter
Channel: 00

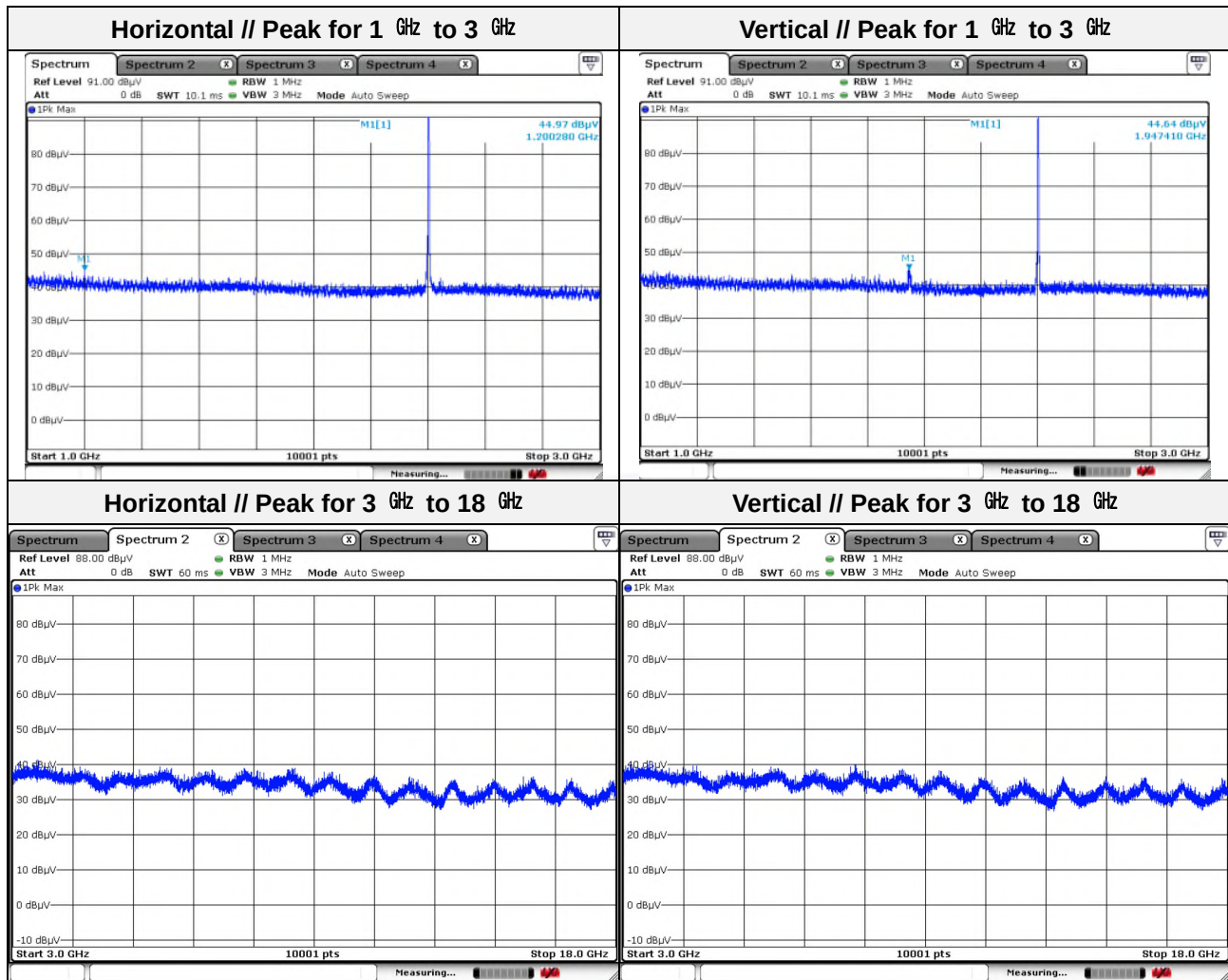
- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1 200.28	44.97	Peak	H	-7.17	-	37.80	74.00	36.20
1 947.41	44.64	Peak	V	-3.79	-	40.85	74.00	33.15

- Band edge

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2 358.98	42.60	Peak	H	-2.60	-	40.00	74.00	34.00
2 363.64	42.91	Peak	V	-2.59	-	40.32	74.00	33.68
2 388.69	44.13	Peak	H	-2.52	-	41.61	74.00	32.39





Note.

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

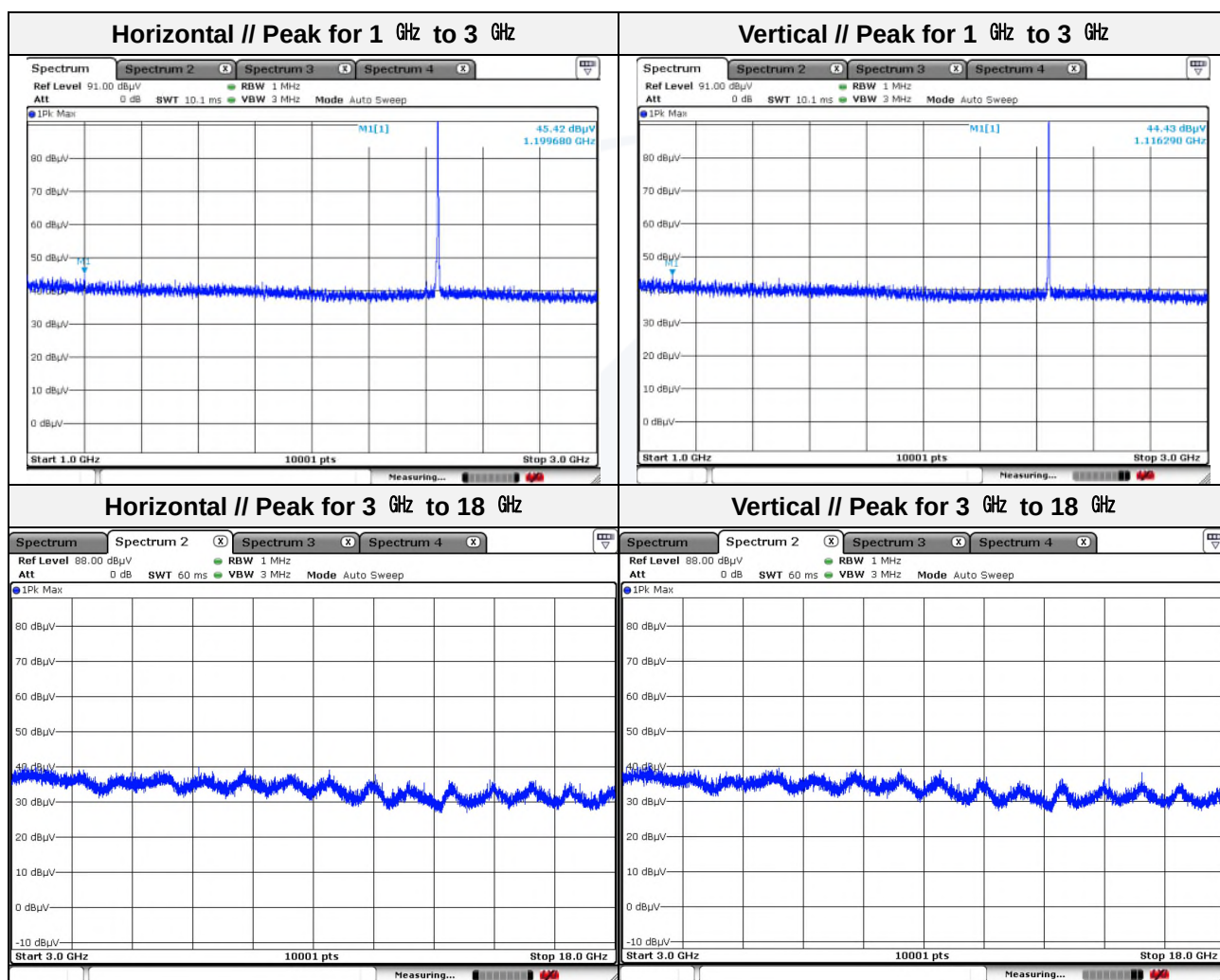


Report No. : RF-230793

Mode: EDR (3 Mbps)
Distance of measurement: 3 meter
Channel: 40

- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 116.29	44.43	Peak	V	-7.60	-	36.83	74.00	37.17
1 199.68	45.42	Peak	H	-7.17	-	38.25	74.00	35.75



Note.

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



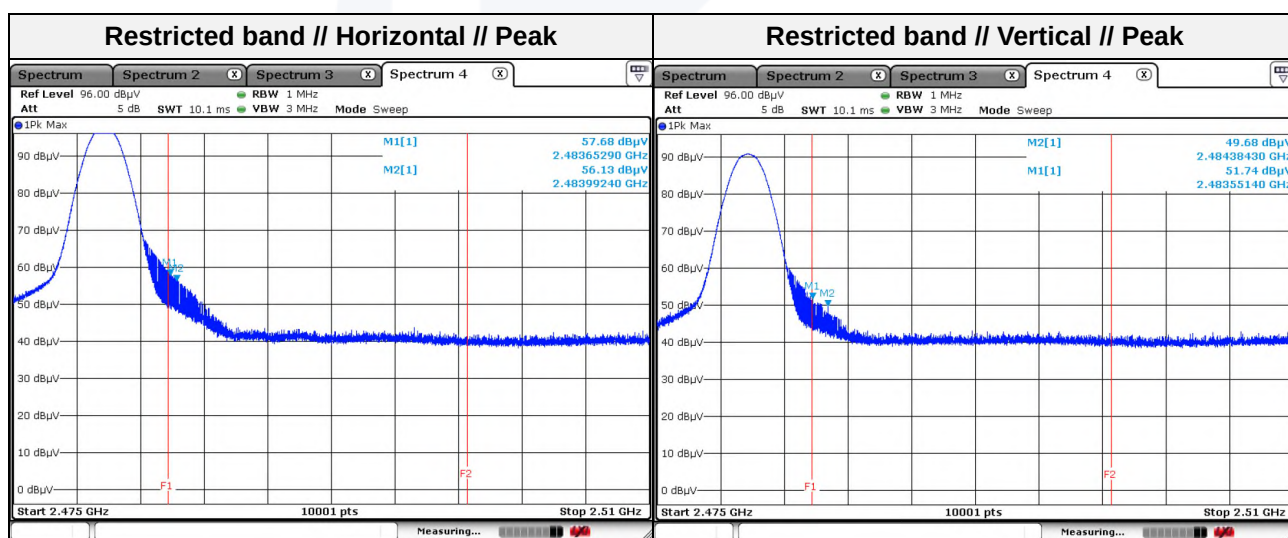
Mode: EDR (3 Mbps)
Distance of measurement: 3 meter
Channel: 78

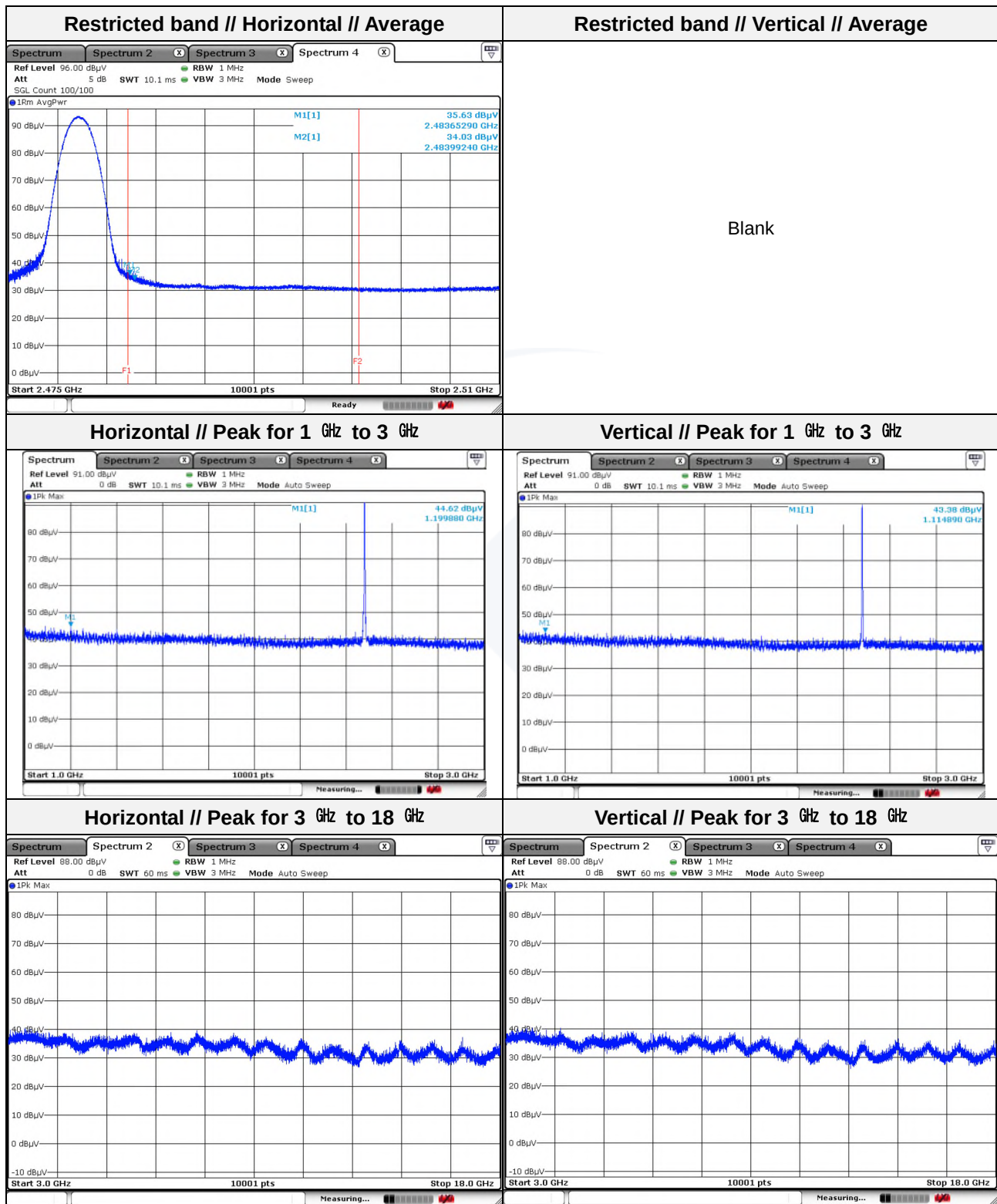
- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 114.89	43.38	Peak	V	-7.61	-	35.77	74.00	38.23
1 199.88	44.62	Peak	H	-7.17	-	37.45	74.00	36.55

- Band edge

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 483.55	51.74	Peak	V	-2.29	-	49.45	74.00	24.55
2 483.65	57.68	Peak	H	-2.29	-	55.39	74.00	18.61
2 483.65	35.63	Average	H	-2.29	1.10	34.44	54.00	19.56
2 483.99	56.13	Peak	H	-2.28	-	53.85	74.00	20.15
2 483.99	34.03	Average	H	-2.28	1.10	32.85	54.00	21.15
2 484.38	49.68	Peak	V	-2.28	-	47.40	74.00	26.60





Note.

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



Mode: BDR (Worst case)+802.11n_HT20 (MCS0) (Worst case)

Distance of measurement: 3 meter

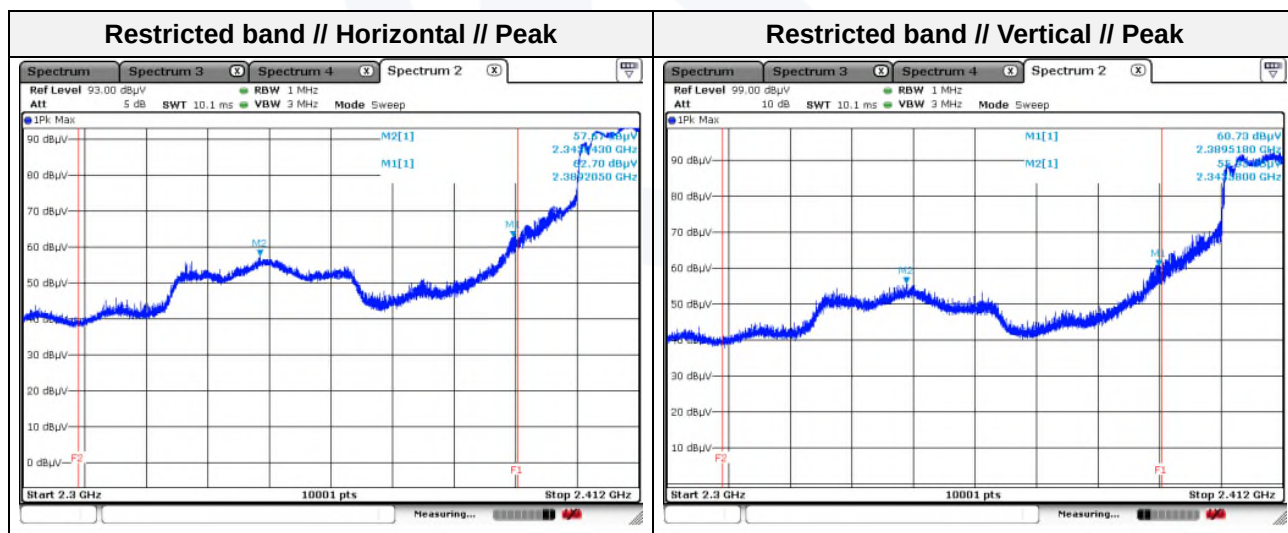
Channel: 0 (BDR)+1(802.11n_HT20)

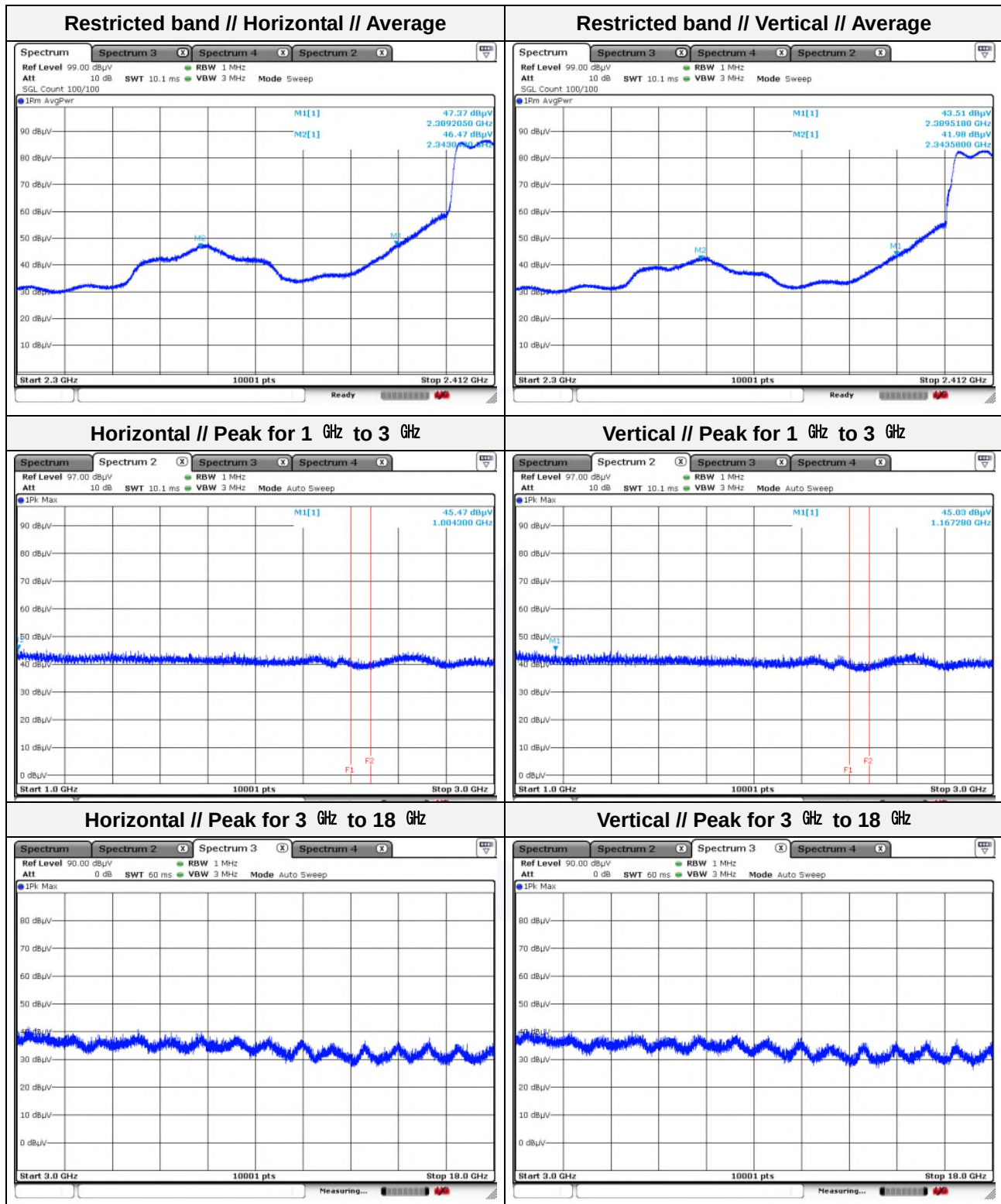
- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 004.30	45.47	Peak	H	-8.18	-	37.29	74.00	36.71
1 167.28	45.03	Peak	V	-7.34	-	37.69	74.00	36.31

- Band edge

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 343.04	57.67	Peak	H	-2.65	-	55.02	74.00	18.98
2 343.04	46.47	Average	H	-2.65	1.10	44.92	54.00	9.08
2 343.58	55.95	Peak	V	-2.64	-	53.31	74.00	20.69
2 343.58	41.98	Average	V	-2.64	1.10	40.44	54.00	13.56
2 389.21	62.70	Peak	H	-2.52	-	60.18	74.00	13.82
2 389.21	47.37	Average	H	-2.52	1.10	45.95	54.00	8.05
2 389.52	60.73	Peak	V	-2.52	-	58.21	74.00	15.79
2 389.52	43.51	Average	V	-2.52	1.10	42.09	54.00	11.91





Note.

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



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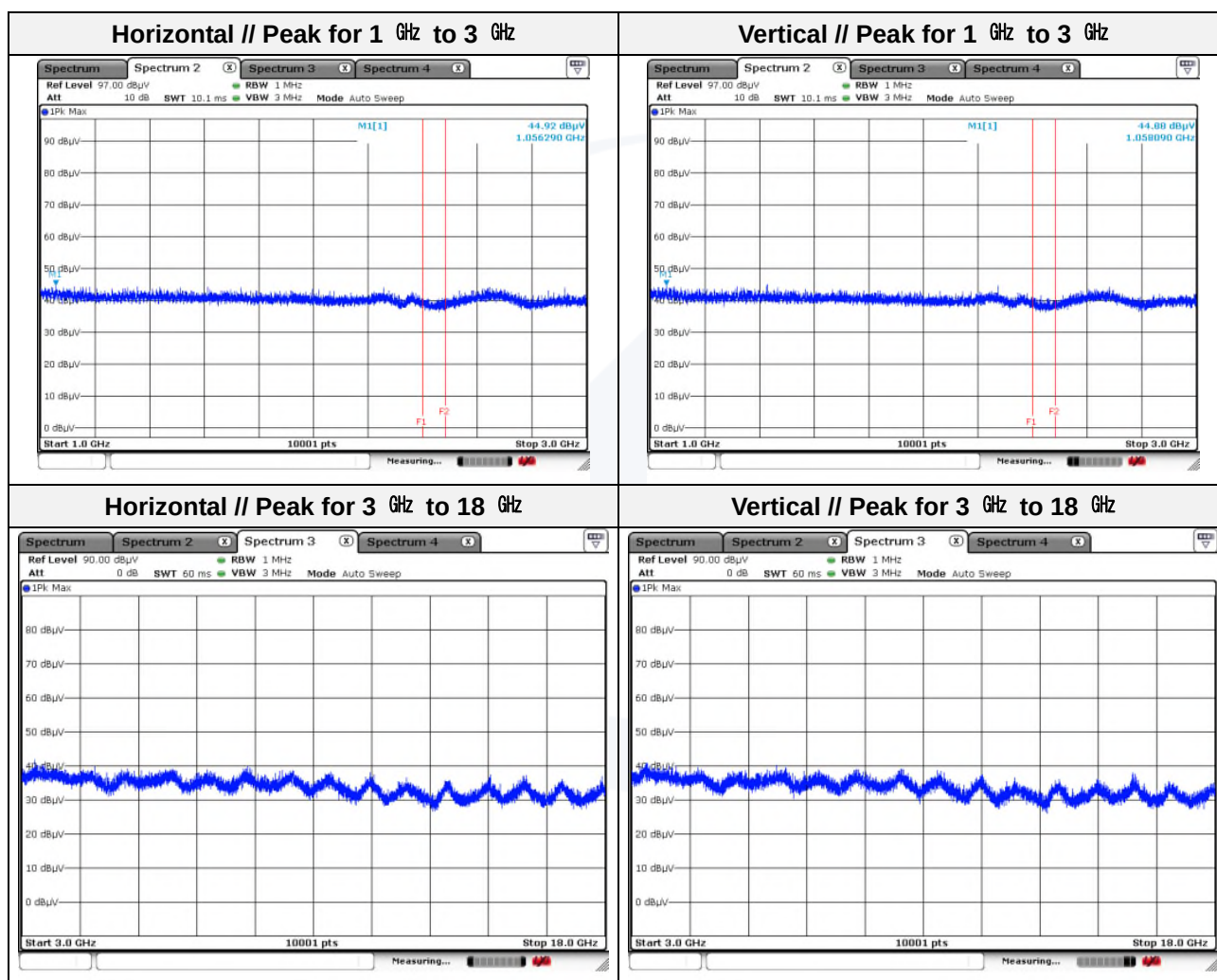
Mode: BDR (Worst case)+802.11n_HT20 (MCS0) (Worst case)

Distance of measurement: 3 meter

Channel: 40 (BDR)+6(802.11n_HT20)

- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1 056.29	44.92	Peak	H	-7.91	-	37.01	74.00	36.99
1 058.09	44.88	Peak	V	-7.90	-	36.98	74.00	37.02



Note.

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



Mode: BDR (Worst case)+802.11n_HT20 (MCS0) (Worst case)

Distance of measurement: 3 meter

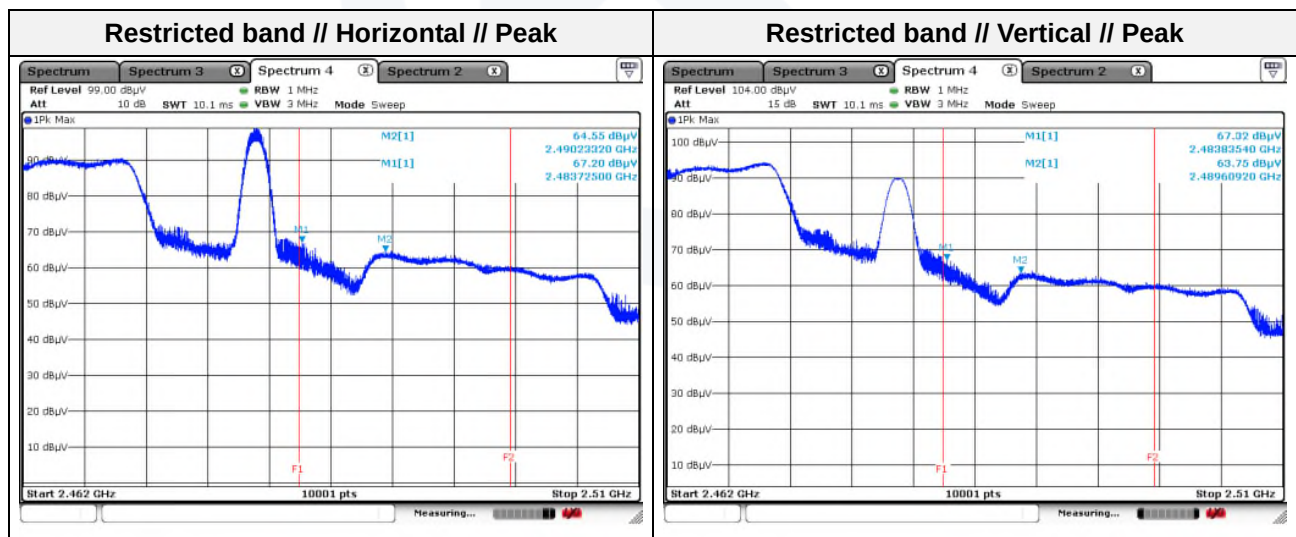
Channel: 78 (BDR)+11(802.11n_HT20)

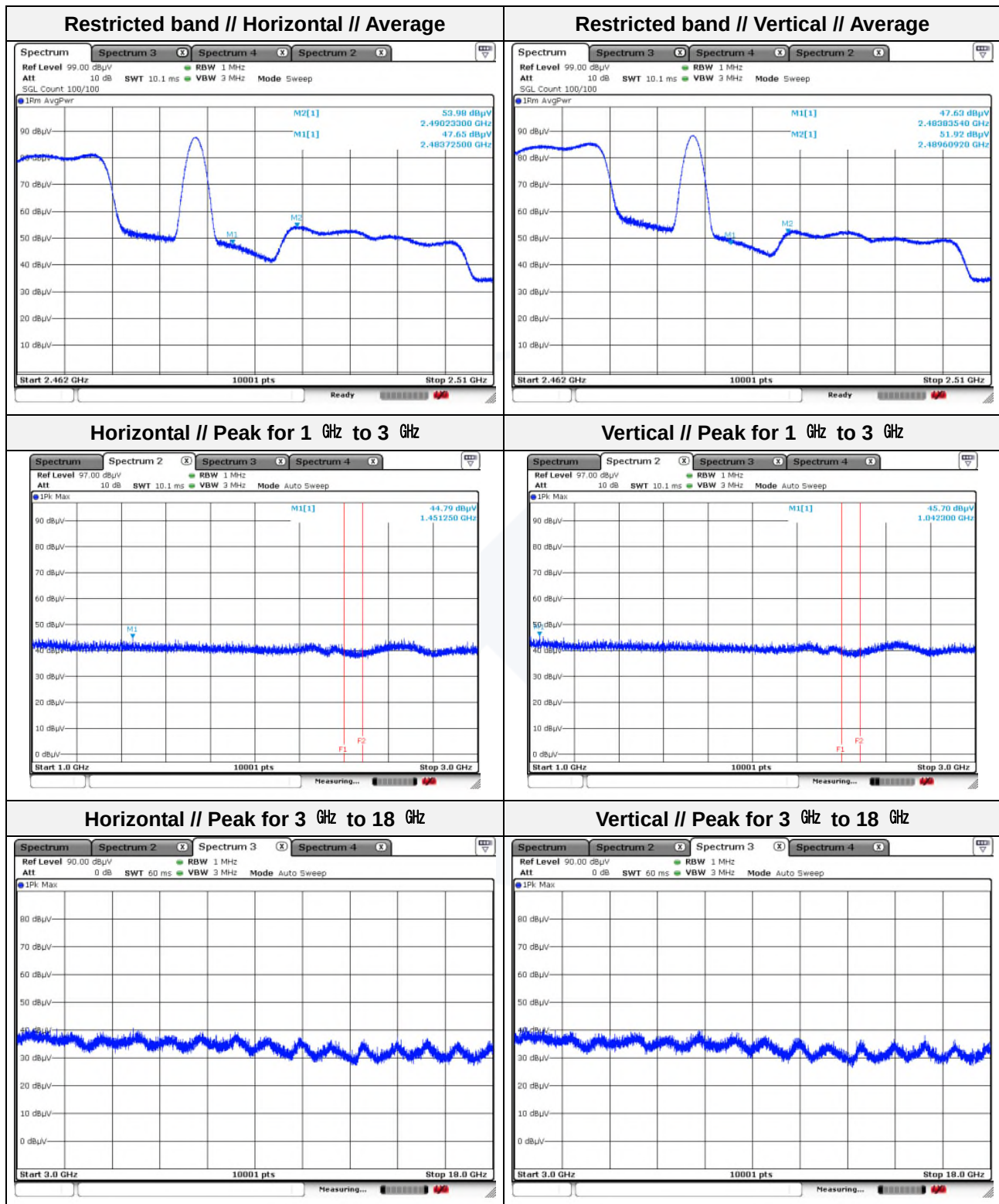
- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 042.30	45.70	Peak	V	-7.98	-	37.72	74.00	36.28
1 451.25	44.79	Peak	H	-5.93	-	38.86	74.00	35.14

- Band edge

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 483.73	67.20	Peak	H	-2.29	-	64.91	74.00	9.09
2 483.73	47.65	Average	H	-2.29	1.10	46.46	54.00	7.54
2 483.84	67.32	Peak	V	-2.28	-	65.04	74.00	8.96
2 483.84	47.63	Average	V	-2.28	1.10	46.45	54.00	7.55
2 489.61	63.75	Peak	V	-2.27	-	61.48	74.00	12.52
2 489.61	51.92	Average	V	-2.27	1.10	50.75	54.00	3.25
2 490.23	64.55	Peak	H	-2.27	-	62.28	74.00	11.72
2 490.23	53.98	Average	H	-2.27	1.10	52.81	54.00	1.19



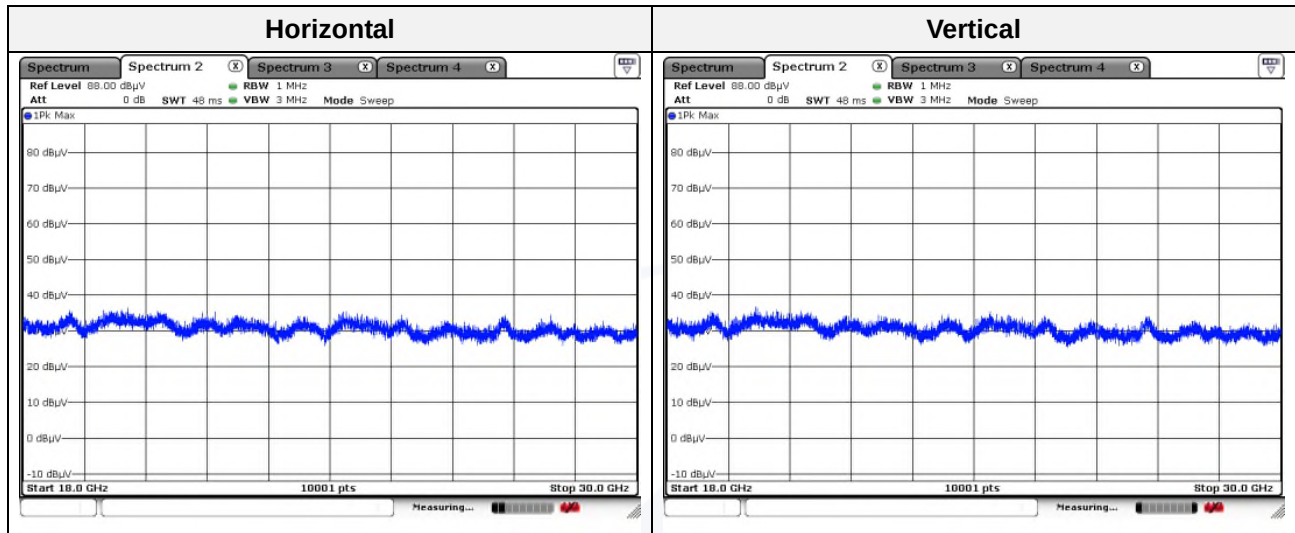


Note.

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

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

Mode: BDR (1 Mbps) (Worst case)
Distance of measurement: 3 meter
Channel: 40 (Worst case)

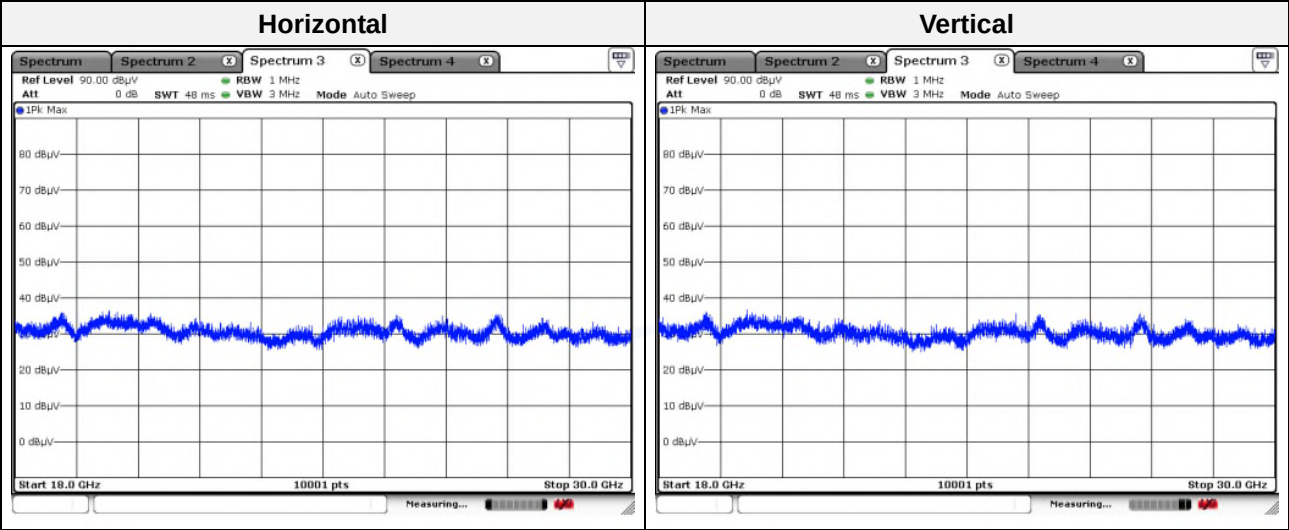


Note.

1. No spurious emission were detected above 18 GHz.



Mode:	BDR (Worst case)+802.11n_HT20 (MCS0) (Worst case)
Distance of measurement:	3 meter
Channel:	40 (BDR, Worst case)+6 (802.11n_HT20, Worst case)



Note.
1. No spurious emission were detected above 18 GHz.

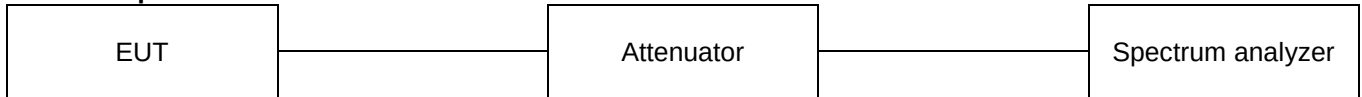


3.8. Conducted band edge and out of band emissions

Test procedure

KDB 558074 v05r02 & ANSI 63.10-2013

Test setup



Test setting

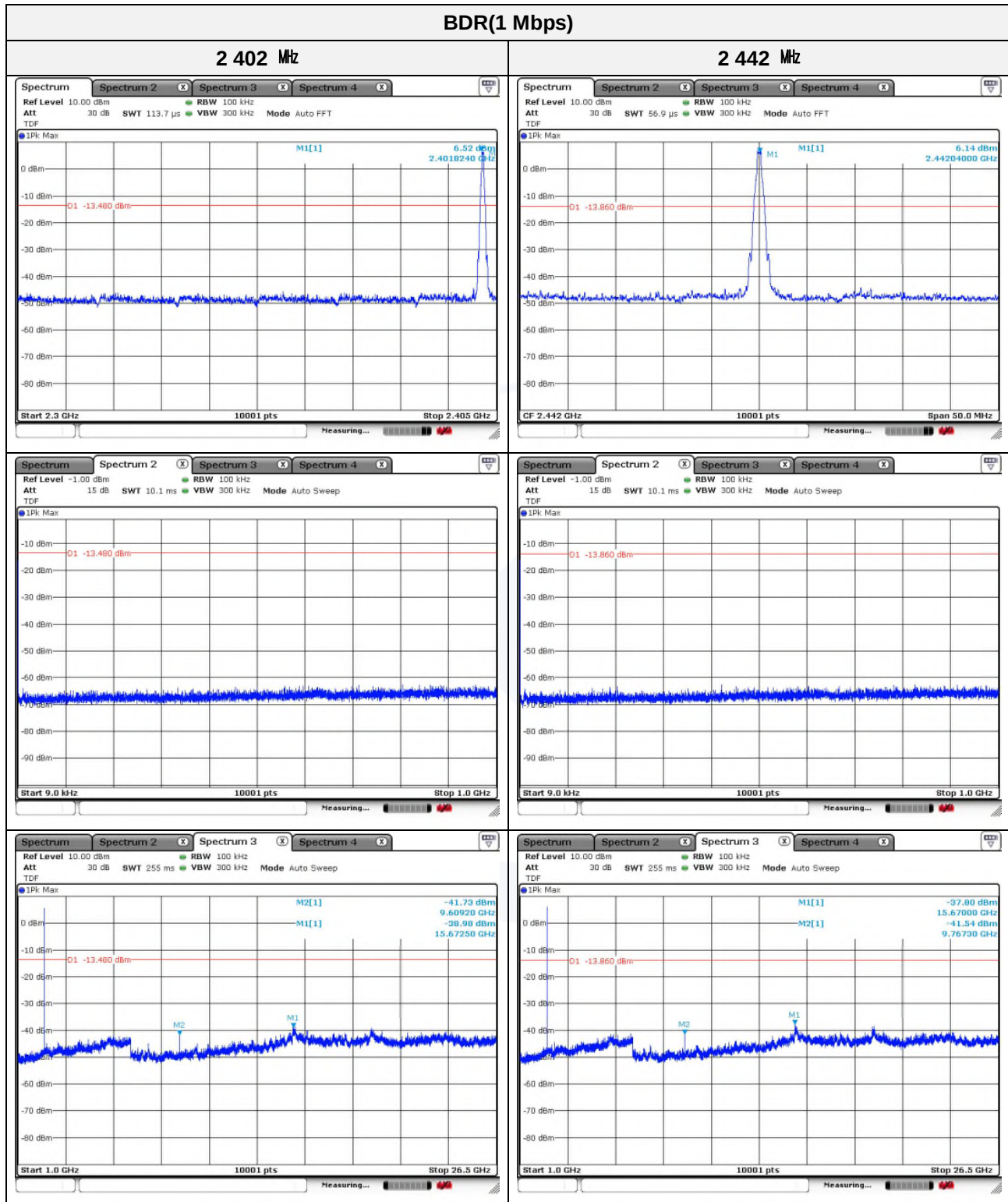
1. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.
2. RBW = 100 kHz
3. VBW $\geq$ 300 kHz
4. Detector = Peak
5. Number of sweep points $\geq 2 \times \text{Span/RBW}$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

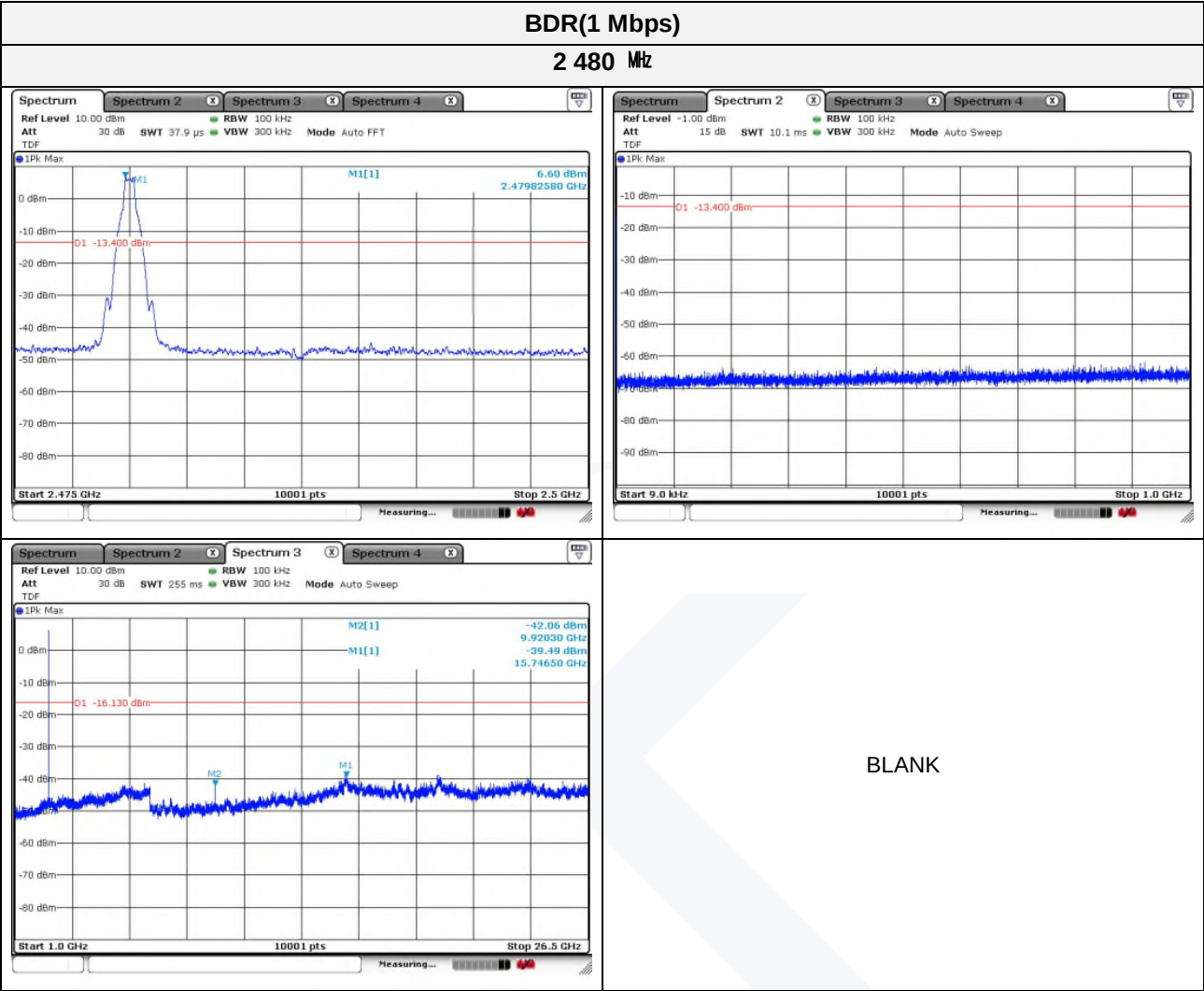
FCC Limit

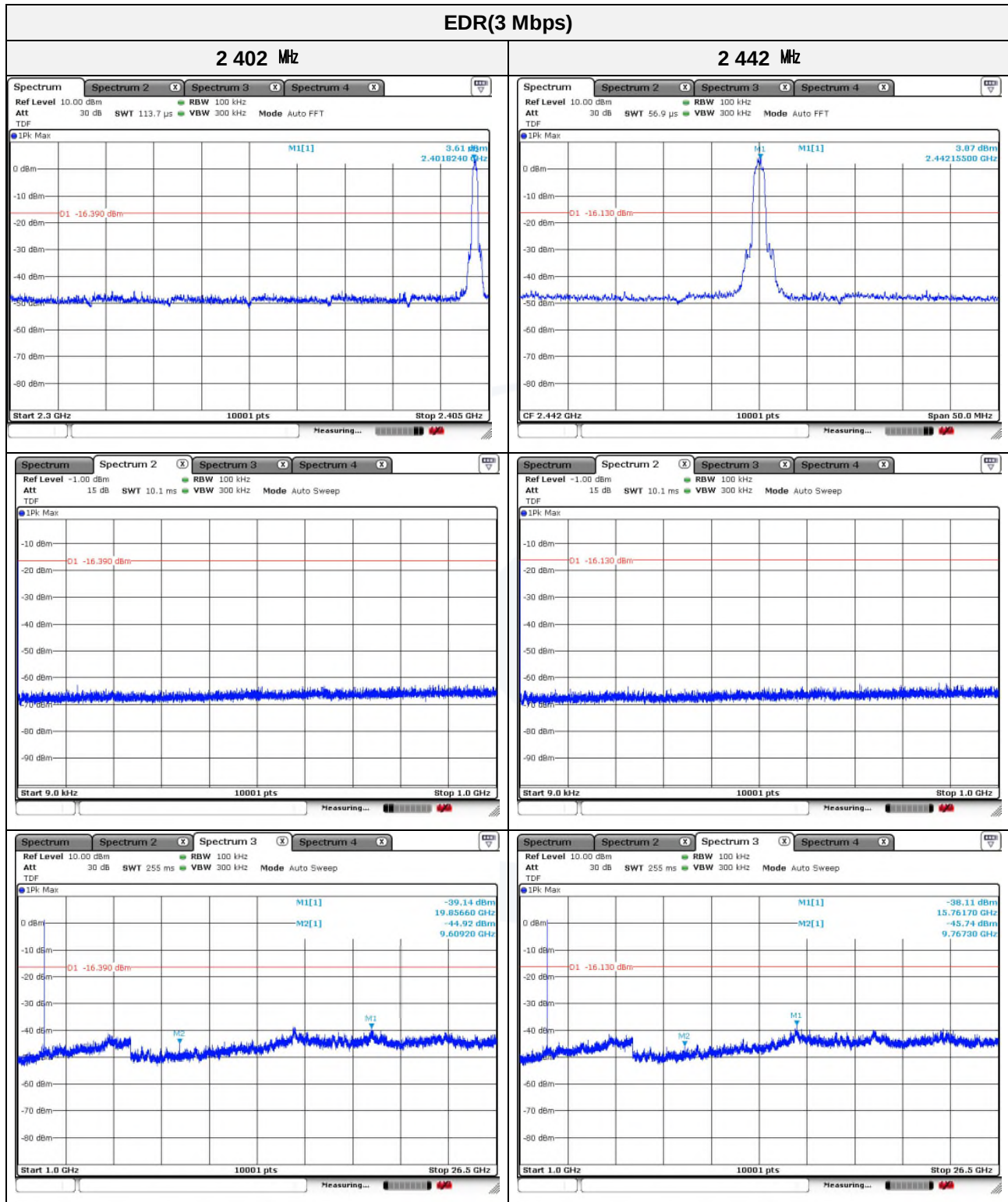
According to 15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within 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 dB instead of 20 dB. 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))

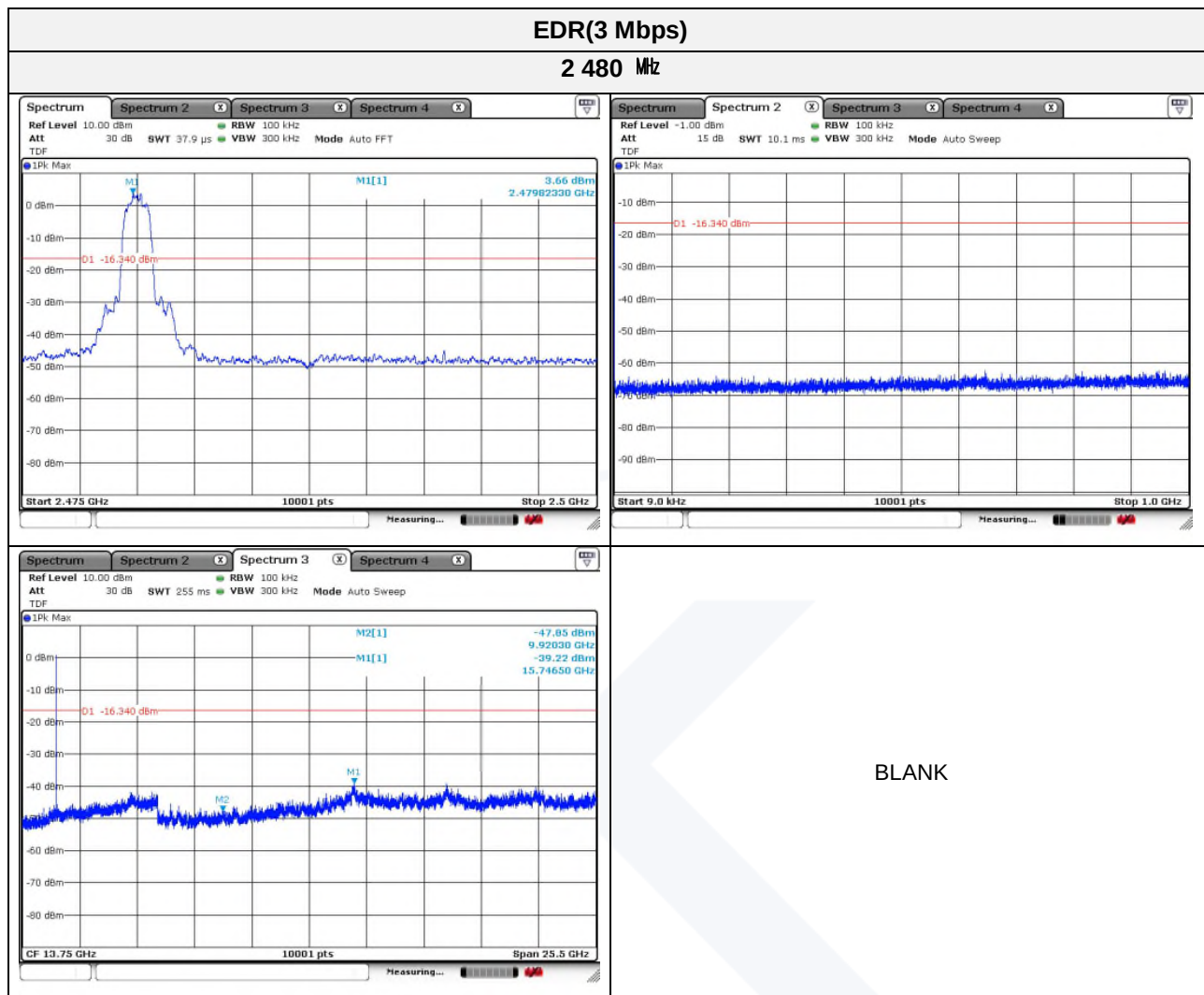


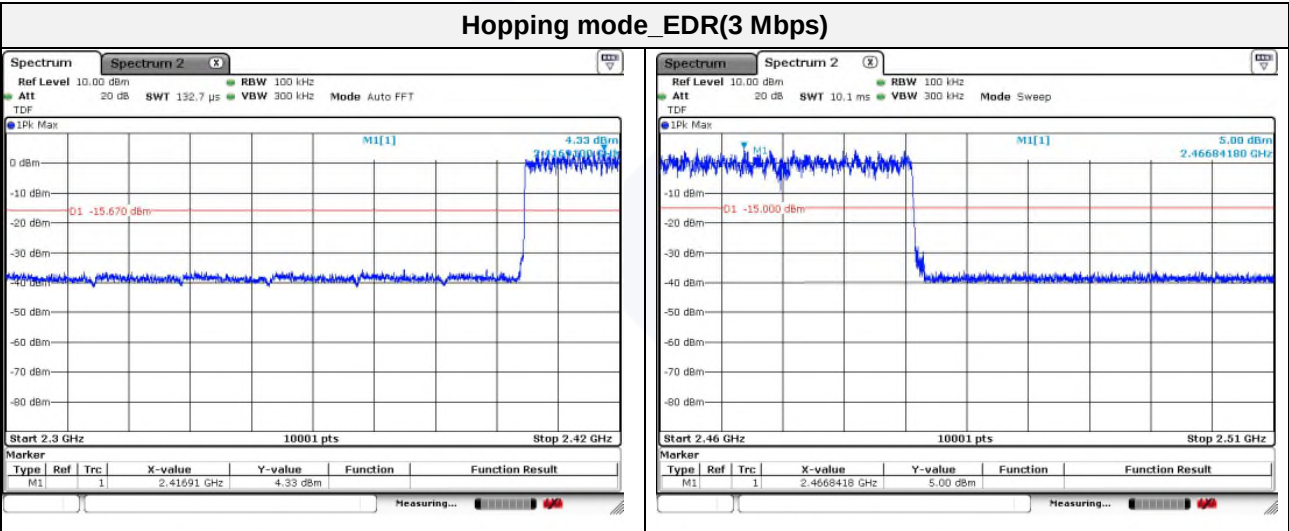
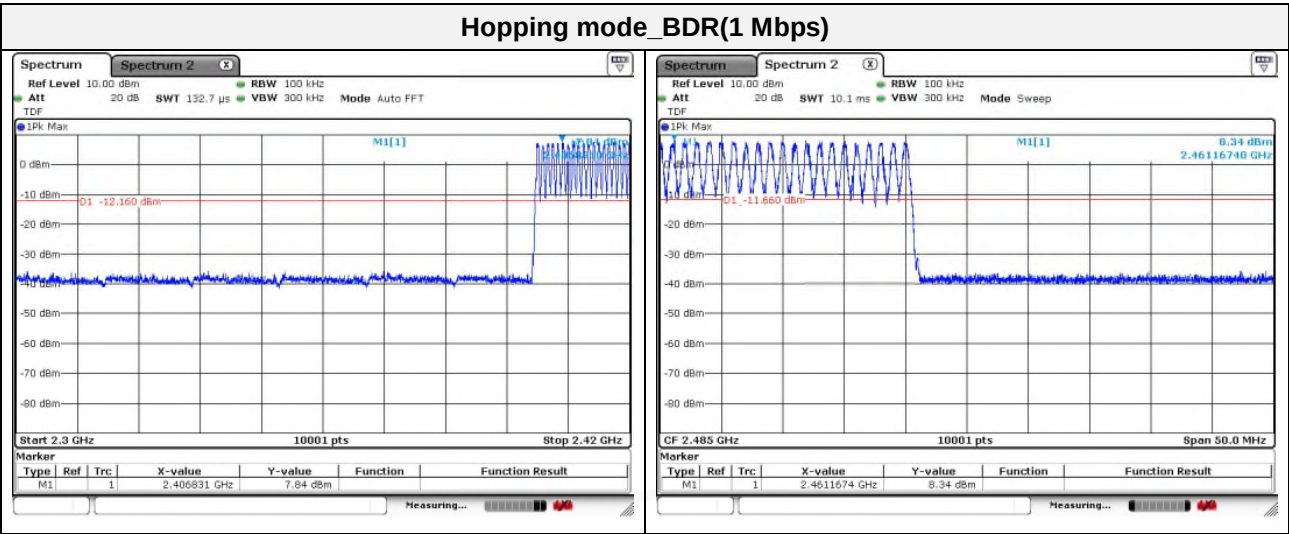
Test results













3.9. AC conducted emissions

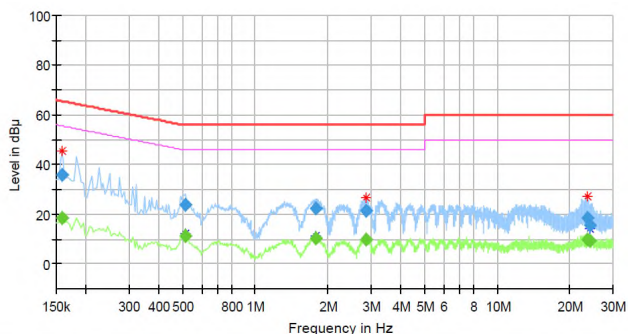
FCC Limit

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 kHz to 30 MHz, 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.

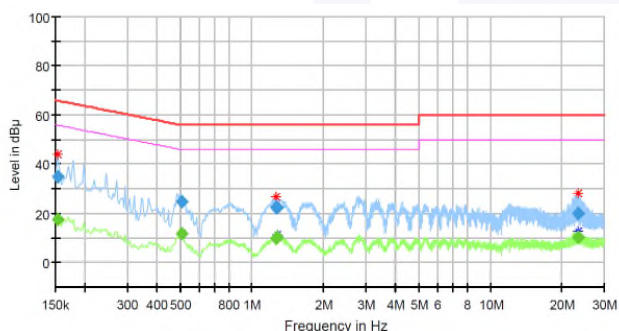
Frequency of Emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

**Test results**

Mode: BDR (Worst case)_DC 3.3 V
Transfer rate: 1 Mbps
Channel: 40 (Worst case)

Hot Line**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.158000	---	18.66	55.57	36.91	1000.0	9.000	L1	19.5
0.158000	35.65	---	65.57	29.92	1000.0	9.000	L1	19.5
0.514000	---	11.18	46.00	34.82	1000.0	9.000	L1	19.6
0.514000	23.98	---	56.00	32.02	1000.0	9.000	L1	19.6
1.778000	---	10.13	46.00	35.87	1000.0	9.000	L1	19.7
1.778000	22.19	---	56.00	33.81	1000.0	9.000	L1	19.7
2.870000	---	9.93	46.00	36.07	1000.0	9.000	L1	19.8
2.870000	21.45	---	56.00	34.55	1000.0	9.000	L1	19.8
23.626000	---	9.84	50.00	40.16	1000.0	9.000	L1	21.1
23.626000	18.43	---	60.00	41.57	1000.0	9.000	L1	21.1
24.202000	---	9.21	50.00	40.79	1000.0	9.000	L1	21.1
24.202000	15.53	---	60.00	44.47	1000.0	9.000	L1	21.1

Neutral Line**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154000	---	17.45	55.78	38.33	1000.0	9.000	N	19.5
0.154000	34.83	---	65.78	30.95	1000.0	9.000	N	19.5
0.506000	---	11.84	46.00	34.16	1000.0	9.000	N	19.6
0.506000	24.81	---	56.00	31.19	1000.0	9.000	N	19.6
1.258000	---	9.97	46.00	36.03	1000.0	9.000	N	19.6
1.258000	22.20	---	56.00	33.80	1000.0	9.000	N	19.6
1.274000	---	10.14	46.00	35.86	1000.0	9.000	N	19.6
1.274000	22.41	---	56.00	33.59	1000.0	9.000	N	19.6
23.330000	---	10.13	50.00	39.87	1000.0	9.000	N	21.2
23.330000	20.04	---	60.00	39.96	1000.0	9.000	N	21.2
23.454000	---	10.27	50.00	39.73	1000.0	9.000	N	21.2
23.454000	19.72	---	60.00	40.28	1000.0	9.000	N	21.2

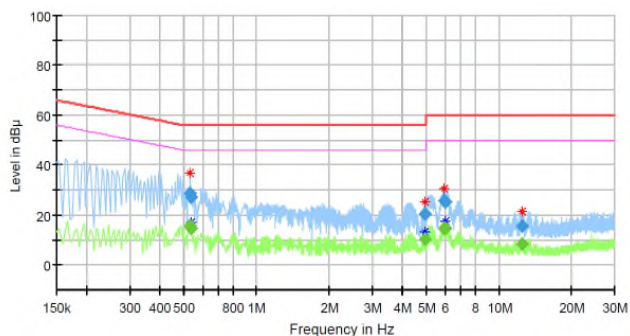


Mode: BDR (Worst case)_DC 1.8 V

Transfer rate: 1 Mbps

Channel: 40 (Worst case)

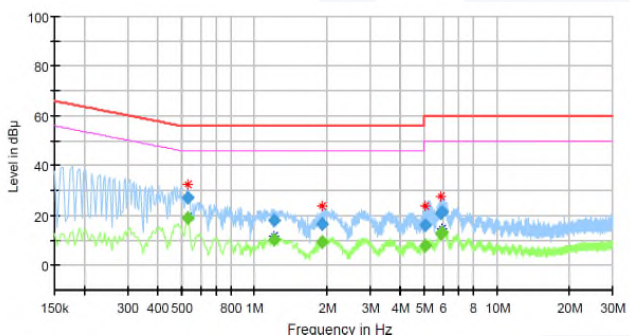
Hot Line



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.534000	28.64	---	56.00	27.36	1000.0	9.000	L1	19.6
0.534000	---	15.70	46.00	30.30	1000.0	9.000	L1	19.6
0.538000	26.91	---	56.00	29.09	1000.0	9.000	L1	19.6
0.538000	---	14.53	46.00	31.47	1000.0	9.000	L1	19.6
4.982000	20.26	---	56.00	35.74	1000.0	9.000	L1	20.0
4.982000	---	10.06	46.00	35.94	1000.0	9.000	L1	20.0
5.982000	25.50	---	60.00	34.50	1000.0	9.000	L1	20.1
5.982000	---	14.68	50.00	35.32	1000.0	9.000	L1	20.1
6.038000	25.27	---	60.00	34.73	1000.0	9.000	L1	20.1
6.038000	---	14.45	50.00	35.55	1000.0	9.000	L1	20.1
12.546000	---	8.30	50.00	41.70	1000.0	9.000	L1	20.5
12.546000	15.54	---	60.00	44.46	1000.0	9.000	L1	20.5

Neutral Line



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.530000	27.11	---	56.00	28.89	1000.0	9.000	N	19.6
0.530000	---	19.04	46.00	26.96	1000.0	9.000	N	19.6
1.210000	18.01	---	56.00	37.99	1000.0	9.000	N	19.6
1.210000	---	10.28	46.00	35.72	1000.0	9.000	N	19.6
1.898000	16.51	---	56.00	39.49	1000.0	9.000	N	19.7
1.898000	---	9.10	46.00	36.90	1000.0	9.000	N	19.7
5.066000	---	8.08	50.00	41.92	1000.0	9.000	N	20.0
5.066000	16.08	---	60.00	43.92	1000.0	9.000	N	20.0
5.902000	---	12.71	50.00	37.29	1000.0	9.000	N	20.1
5.902000	20.94	---	60.00	39.06	1000.0	9.000	N	20.1
5.978000	---	13.21	50.00	36.79	1000.0	9.000	N	20.1
5.978000	21.42	---	60.00	38.58	1000.0	9.000	N	20.1

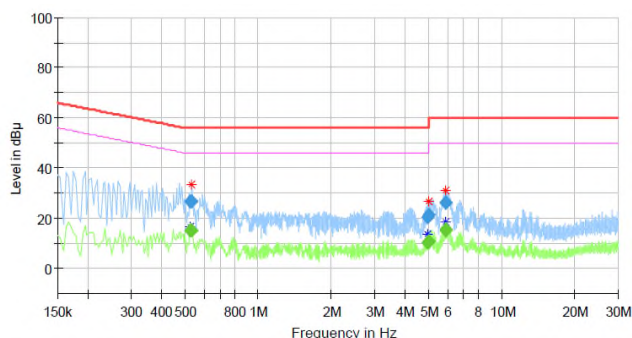


Mode: BDR (Worst case)+802.11n_HT20 (MCS0) (Worst case) _DC 3.3 V

Transfer rate: 1 Mbps

Channel: 40 (BDR, Worst case)+6 (802.11n_HT20, Worst case)

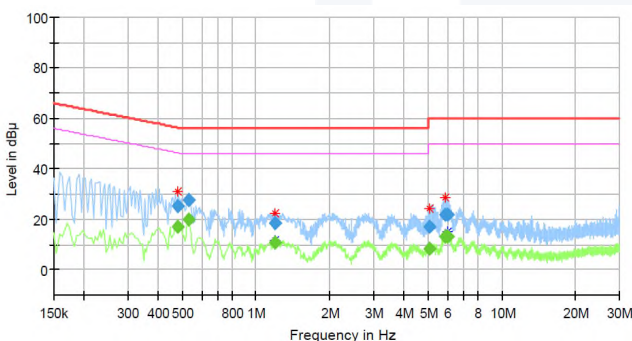
Hot Line



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.526000	---	15.09	46.00	30.91	1000.0	9.000	L1	19.6
0.526000	26.44	---	56.00	29.56	1000.0	9.000	L1	19.6
0.534000	---	15.14	46.00	30.86	1000.0	9.000	L1	19.6
0.534000	26.49	---	56.00	29.51	1000.0	9.000	L1	19.6
4.954000	---	10.32	46.00	35.68	1000.0	9.000	L1	20.0
4.954000	20.59	---	56.00	35.41	1000.0	9.000	L1	20.0
4.998000	---	10.90	46.00	35.10	1000.0	9.000	L1	20.0
4.998000	21.36	---	56.00	34.64	1000.0	9.000	L1	20.0
5.894000	---	15.36	50.00	34.64	1000.0	9.000	L1	20.1
5.894000	26.34	---	60.00	33.66	1000.0	9.000	L1	20.1
5.902000	---	15.18	50.00	34.82	1000.0	9.000	L1	20.1
5.902000	26.22	---	60.00	33.78	1000.0	9.000	L1	20.1

Neutral Line



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.482000	25.29	---	56.30	31.01	1000.0	9.000	N	19.6
0.482000	---	17.02	46.30	29.28	1000.0	9.000	N	19.6
0.530000	27.67	---	56.00	28.33	1000.0	9.000	N	19.6
0.530000	---	19.81	46.00	26.19	1000.0	9.000	N	19.6
1.198000	18.35	---	56.00	37.65	1000.0	9.000	N	19.6
1.198000	---	10.98	46.00	35.02	1000.0	9.000	N	19.6
5.066000	---	8.33	50.00	41.67	1000.0	9.000	N	20.0
5.066000	16.84	---	60.00	43.16	1000.0	9.000	N	20.0
5.898000	---	13.21	50.00	36.79	1000.0	9.000	N	20.1
5.898000	22.02	---	60.00	37.98	1000.0	9.000	N	20.1
5.990000	---	13.37	50.00	36.63	1000.0	9.000	N	20.1
5.990000	21.87	---	60.00	38.13	1000.0	9.000	N	20.1

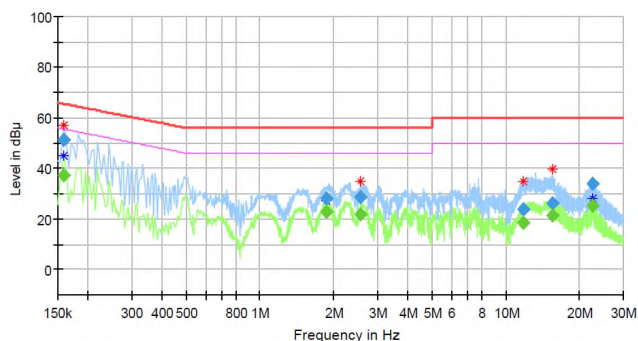


Mode: BDR (Worst case)+802.11n_HT20 (MCS0) (Worst case) _DC 1.8 V

Transfer rate: 1 Mbps

Channel: 40 (BDR, Worst case)+6 (802.11n_HT20, Worst case)

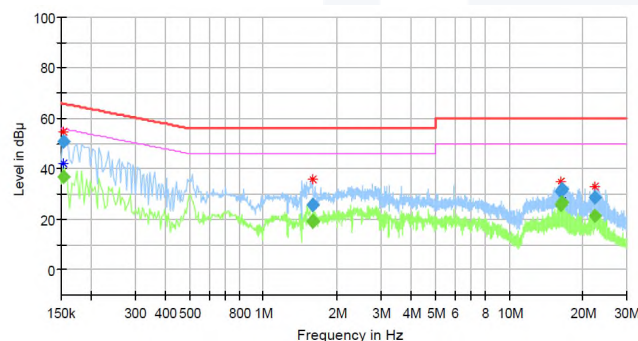
Hot Line



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.158000	51.47	---	65.57	14.10	1000.0	9,000	L1	19.5
0.158000	---	37.20	55.57	18.37	1000.0	9,000	L1	19.5
1.862000	28.02	---	56.00	27.98	1000.0	9,000	L1	19.7
1.862000	---	22.73	46.00	23.27	1000.0	9,000	L1	19.7
2.566000	28.42	---	56.00	27.58	1000.0	9,000	L1	19.7
2.566000	---	21.72	46.00	24.28	1000.0	9,000	L1	19.7
11.826000	---	18.54	50.00	31.46	1000.0	9,000	L1	20.5
11.826000	23.61	---	60.00	36.39	1000.0	9,000	L1	20.5
15.426000	---	21.48	50.00	28.52	1000.0	9,000	L1	20.7
15.426000	26.42	---	60.00	33.58	1000.0	9,000	L1	20.7
22.498000	---	25.20	50.00	24.80	1000.0	9,000	L1	21.1
22.498000	33.81	---	60.00	26.19	1000.0	9,000	L1	21.1

Neutral Line



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154000	50.80	---	65.78	14.98	1000.0	9,000	N	19.5
0.154000	---	36.97	55.78	18.81	1000.0	9,000	N	19.5
1.578000	25.59	---	56.00	30.41	1000.0	9,000	N	19.7
1.578000	---	19.05	46.00	26.95	1000.0	9,000	N	19.7
1.590000	25.72	---	56.00	30.28	1000.0	9,000	N	19.7
1.590000	---	19.39	46.00	26.61	1000.0	9,000	N	19.7
16.258000	30.91	---	60.00	29.09	1000.0	9,000	N	20.8
16.258000	---	25.67	50.00	24.33	1000.0	9,000	N	20.8
16.458000	31.80	---	60.00	28.20	1000.0	9,000	N	20.8
16.458000	---	26.72	50.00	23.28	1000.0	9,000	N	20.8
22.214000	---	21.25	50.00	28.75	1000.0	9,000	N	21.1
22.214000	28.41	---	60.00	31.59	1000.0	9,000	N	21.1



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	FSV3044	101272	1 year	2024.03.16
Spectrum analyzer	R&S	FSV40-N	102194	1 year	2024.08.08
SIGNAL GENERATOR	KEYSIGHT	N5182B	MY59100115	1 year	2024.04.19
SIGNAL GENERATOR	Anritsu	68369B	002118	1 year	2024.05.12
Power Meter	Anritsu	ML2495A	2010001	1 year	2024.04.19
Pulse Power Sensor	Anritsu	MA2411B	1911111	1 year	2024.04.18
Attenuator	Mini-Circuits	BW-S10-2W263+	2	1 year	2024.01.13 2025.01.15
Attenuator	HP	8494B	2630A12857	1 year	2024.01.12 2025.01.12
Attenuator	HP	8495B	2814A14772	1 year	2024.01.12 2025.01.12
Attenuator	Agilent	8494B	MY42143296	1 year	2024.01.12 2025.01.12
ACTIVE LOOP ANTENNA	SCHWARZBECK	FMZB 1513	1513-257	2 years	2025.03.22
TRILOG-BROADBAND ANTENNA	Schwarzbeck	VULB 9163	714	2 years	2024.04.19
BAND REJECT FILTER	MICRO-TRONICS	BRM50702	G272	1 year	2024.01.12 2025.01.12
Attenuator	HUBER+SHHNER	6806.17.A	NONE	1 year	2024.03.21
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1802	1 year	2024.11.03
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA 9170550	1 year	2024.01.16 2025.01.16
Amplifier	SONOMA INSTRUMENT	310N	186549	1 year	2024.03.21
PREAMPLIFIER	HP	8449B	3008A00538	1 year	2024.05.31
BROADBAND AMPLIFIER	SCHWARZBECK	BBV9721	PS9721-003	1 year	2024.01.16 2025.01.15
DC POWER SUPPLY	AGILENT	6632B	MY43004090	1 year	2024.06.19
DC POWER SUPPLY	AGILENT	6632B	MY43004130	1 year	2024.06.14
EMI Test Receiver	R&S	ESU26	100517	1 year	2024.07.31
EMI Test Receiver	R&S	ESR3	101783	1 year	2024.11.08
PULSE LIMITER	R&S	ESH2-Z2	101915	1 year	2024.11.08
LISN	R&S	ENV216	101787	1 year	2024.11.08

* 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 of test report.