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Test report No.:
KES-RF-23T0068
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TEST REPORT

Part 15 C & RSS-247 (Issue 2)

Equipment under test GIMBAL CAMERA
Model name NC-200
FCC ID 2ADTG-NC200
IC number 12594A-NC200
Applicant THINKWARE CORPORATION
Manufacturer THINKWARE CORPORATION
Date of test(s) 2023.04.12 ~ 2023.05.19
Date of issue 2023.05.22

Issued to
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Test and report completed by :	Report approval by :
	
Gu-Bong, Kang Test engineer	Yeong-Jun Cho Technical manager

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Revision history

Revision	Date of issue	Test report No.	Description
-	2023.05.22	KES-RF-23T0068	Initial

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1. General information

Applicant: THINKWARE CORPORATION
Applicant address: A, 9FL., Samwhan Hipex, 240, Pangyoyeok-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea
Test site: KES Co., Ltd.
Test site address: 3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
 473-29, Gayeo-ro, Yeosu-si, Gyeonggi-do, Korea
Test Facility: FCC Accreditation Designation No.: KR0100, Registration No.: 444148
ISED Registration No.: 23298
FCC rule part(s): 15.247
IC rule part(s): RSS-247
FCC ID: 2ADTG-NC200
IC Number : 12594A-NC200
Test device serial No.: Production Pre-production Engineering

1.1. EUT description

Equipment under test: GIMBAL CAMERA
Frequency range: **2 402 MHz ~ 2 480 MHz (LE 1 Mbps)**
2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20)
2 422 MHz ~ 2 452 MHz (802.11n_HT40)
UNII-1 (for FCC): 5 180 MHz ~ 5 240 MHz (802.11a/n_HT20/ac_VHT20)
5 190 MHz ~ 5 230 MHz (802.11n_HT40/ac_VHT40)
5 210 MHz (802.11ac_VHT80)
UNII-3 (for IC): 5 745 MHz ~ 5 825 MHz (802.11a/n_HT20/ac_VHT20)
5 755 MHz ~ 5 795 MHz (802.11n_HT40/ac_VHT40)
5 775 MHz (802.11ac_VHT80)
Model: NC-200
Modulation technique: GFSK, DSSS, OFDM
Number of channels: **2 402 MHz ~ 2 480 MHz (LE 1 Mbps) : 40 ch**
2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20) : 11 ch
2 422 MHz ~ 2 452 MHz (802.11n_HT40) : 7 ch
UNII-1 (for FCC): 5 180 MHz ~ 5 240 MHz (802.11a/n_HT20/ac_VHT20) : 4 ch
5 190 MHz ~ 5 230 MHz (802.11n_HT40/ac_VHT40) : 2 ch
5 210 MHz (802.11ac_VHT80) : 1 ch
UNII-3 (for IC): 5 745 MHz ~ 5 825 MHz (802.11a/n_HT20/ac_VHT20) : 5 ch
5 755 MHz ~ 5 795 MHz (802.11n_HT40/ac_VHT40) : 2 ch
5 775 MHz (802.11ac_VHT80) : 1 ch

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Antenna specification	Chip Antenna // Peak gain: 1.86 dBi for 2.4 GHz // Peak gain: 1.88 dBi for 5 GHz
Power source	DC 3.7 V (Battery)
H/W version	MAIN Board V3.2.0 LCD Board V3.2.0 POWER Board V4.0.0 SENSOR Board V4.0.0 MOTOR Board V4.0.0 IMU Board V4.0.0
S/W version	CAMERA F/F 0.0.04 GIMBAL F/W 1.0.9

1.2. Test configuration

The **THINKWARE CORPORATION // GIMBAL CAMERA // NC-200 //**

FCC ID: 2ADTG-NC200 // IC : 12594A-NC200 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 2 and RSS-Gen Issue 5
KDB 558074 D01 v05 r02
ANSI C63.10-2013

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1.3. Derivative Model Information

N/A

1.4. Accessory information

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

1.5. 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.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 0.74 + 10 = 10.74 \text{ (dB)}\end{aligned}$$

For Radiation test :

Field strength level (dB μ V/m) = Measured level (dB μ V) + Antenna factor (dB) + Cable loss (dB) – Amplifier gain (dB)

1.6. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.38 dB (SHIELD ROOM #6)
Uncertainty for Radiation emission test (include Fundamental emission)	Below 1GHz	4.50 dB (SAC #6)
	Above 1GHz	4.90 dB (SAC #5)
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.		

1.7. Frequency/channel operations

Ch.	Frequency (MHz)	Mode
<u>00</u>	<u>2 402</u>	<u>LE 1 Mbps</u>
⋮	⋮	⋮
<u>20</u>	<u>2 442</u>	<u>LE 1 Mbps</u>
⋮	⋮	⋮
<u>39</u>	<u>2 480</u>	<u>LE 1 Mbps</u>

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

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

UNII-1 (for FCC)

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

UNII-3 (for IC)

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

802.11a/n_HT20/ac_VHT20 mode

UNII-1 (for FCC)

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

UNII-3 (for IC)

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

802.11n_HT40/ac_VHT40 mode

UNII-1 (for FCC)

Ch.	Frequency (MHz)
42	5 210

UNII-3 (for IC)

Ch.	Frequency (MHz)
155	5 775

802.11ac_VHT80 mode

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2. Summary of tests

Section in FCC Part 15	Section in RSS-247 & Gen	Parameter	Test results
-	RSS-Gen 6.7	99% Occupied bandwidth	N/T ⁽¹⁾
15.247(a)(2)	RSS-247 5.2(a)	6 dB bandwidth	N/T ⁽¹⁾
15.247(b)(3)	RSS-247 5.4(d)	Output power	Pass
15.247(e)	RSS-247 5.2(b)	Power spectral density	N/T ⁽¹⁾
15.205, 15.209	RSS-247 5.5, RSS-Gen 8.9, 8.10	Radiated restricted band and emission	Pass
15.247(d)	RSS-247 5.5	Conducted spurious emission and band edge	N/T ⁽¹⁾
15.207	RSS-Gen 8.8	AC Conducted emissions	Pass
15.203	-	Antenna Requirement	Pass

* N/T is Not Tested.

Note :

1. This product is equipped with an approved module, please refer to Module Report below for details.

Report No. :

FCC : NTC1712033FV00, NTC1712035FV00, TCT171018E032

IC : EC1905007RI01, EC1905007RI03, EC1905007RI04

2. By the request of the applicant, test was performed with condition below:

2.4 GHz		
Mode	Frequency (MHz)	Setting value
LE 1 Mbps	2 402 ~ 2 480 MHz	default
802.11b	2 412 ~ 2 462 MHz	7
802.11g		7
802.11n_HT20		7
802.11n_HT40	2 422 ~ 2 452 MHz	7
5 GHz UNII-1 (for FCC)		
Mode	Frequency (MHz)	Setting value
802.11a	5 180 ~ 5 240 MHz	11
802.11n_HT20		11
802.11ac_VHT20		11
802.11n_HT40	5 190 ~ 5 230 MHz	11
802.11ac_VHT40		11
802.11ac_VHT80	5 210 MHz	11
5 GHz UNII-3 (for IC)		
Mode	Frequency (MHz)	Setting value
802.11a	5 745 ~ 5 825 MHz	5
802.11n_HT20		5
802.11ac_VHT20		5
802.11n_HT40	5 755 ~ 5 795 MHz	6
802.11ac_VHT40		6
802.11ac_VHT80	5 775 MHz	6

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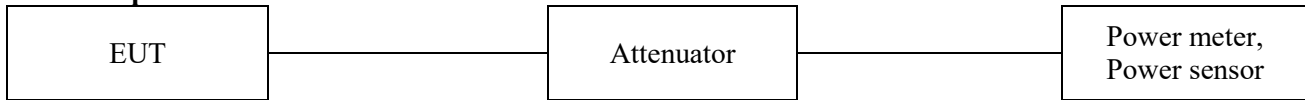
3. Test results

3.1. Output power

Test procedure

ANSI C63.10-2013 - Section 11.9.1.3 and 11.9.2.3.2

Test setup



ANSI C63.10-2013 - Section 11.9.1.3

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.

ANSI C63.10-2013 - Section 11.9.2.3.2

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 is required.

Limit

According to §15.247(b)(3), For systems using digital modulation in the 902~928 MHz, 2 400~2 483.5 MHz, and 5 725~5 850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted out-put power. Maximum Conducted Out-put Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(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. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to RSS-247 5.4 (d), For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W, except as provided in Section 5.4(e).

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.



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Test results

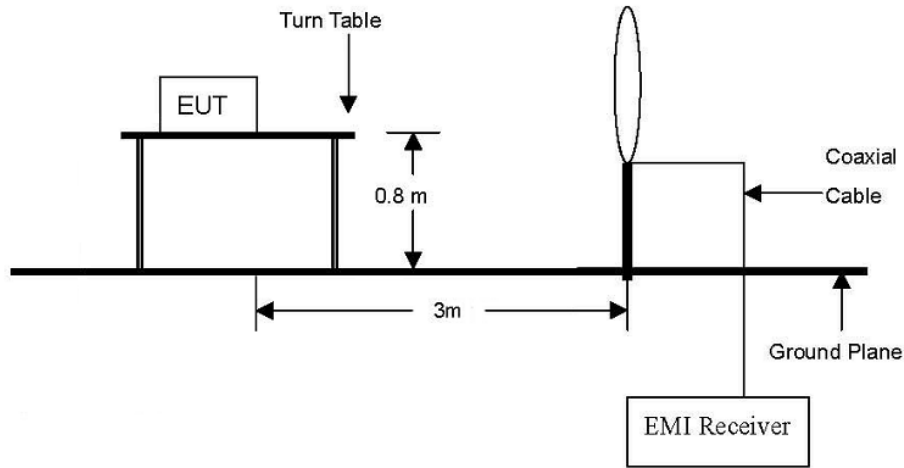
Measured output power (dBm)						
Mode	2 402 MHz		2 442 MHz		2 480 MHz	
	Average	Peak	Average	Peak	Average	Peak
LE 1 Mbps	-1.98	-1.65	-1.94	-1.54	-2.05	-1.75

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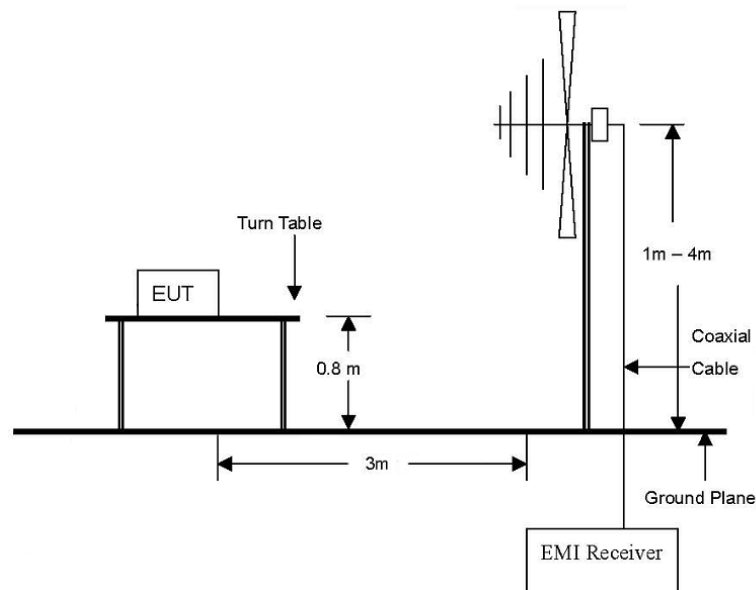
3.2. Radiated restricted band and emissions

Test setup

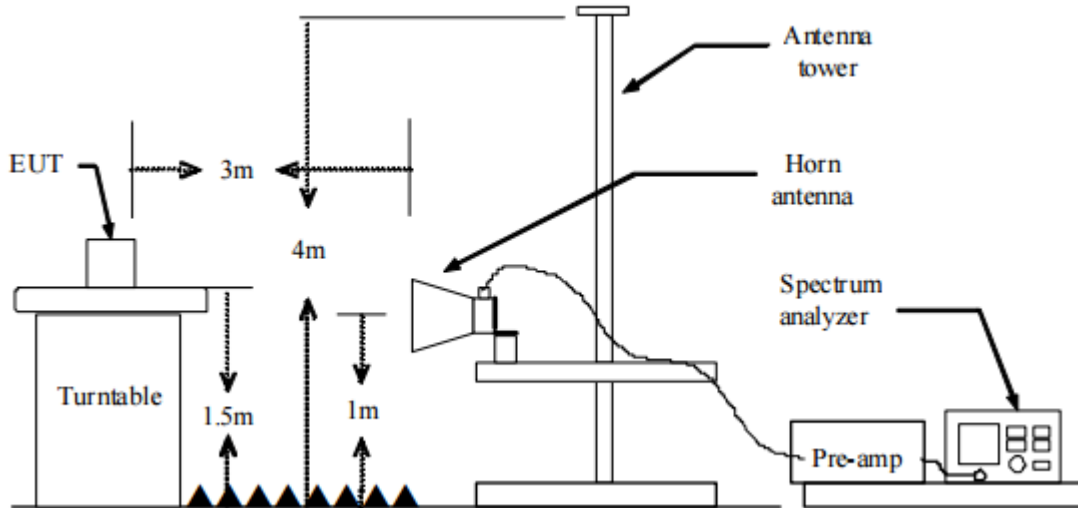
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.



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.



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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 \geq 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 span/(# of points in sweep) \leq (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
- 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.
7. 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**.
8. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
9. 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.



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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 ($\mu\text{V}/\text{m}$)
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.

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 (MHz)	Distance (Meters)	Radiated ($\mu\text{V}/\text{m}$)
0.009 ~ 0.490	300	2 400 / F(kHz)
0.490 ~ 1.705	30	24 000 / F(kHz)
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

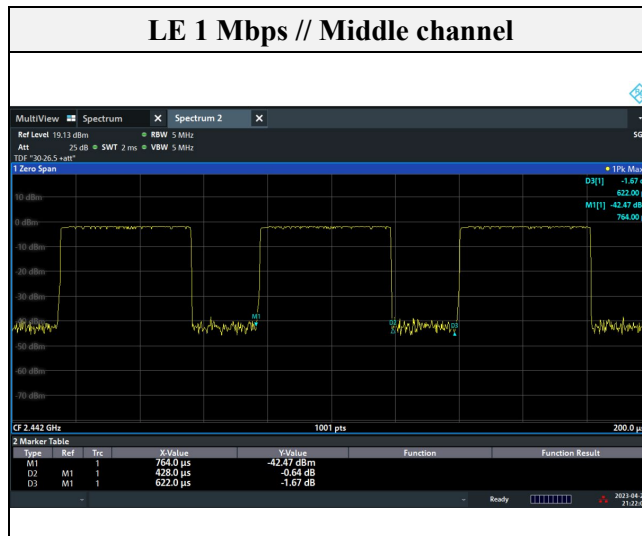
Regarding to KDB 558074 D01_v04, 6.0, the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below.

Set $RBW \geq OBW$ if possible; otherwise, set RBW to the largest available value. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$ and the number of sweep points across duration T exceeds 100.

Test mode	T _{on} time (ms)	Period (ms)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (dB)
LE 1 Mbps	0.428	0.622	0.69	68.81	1.62

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

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



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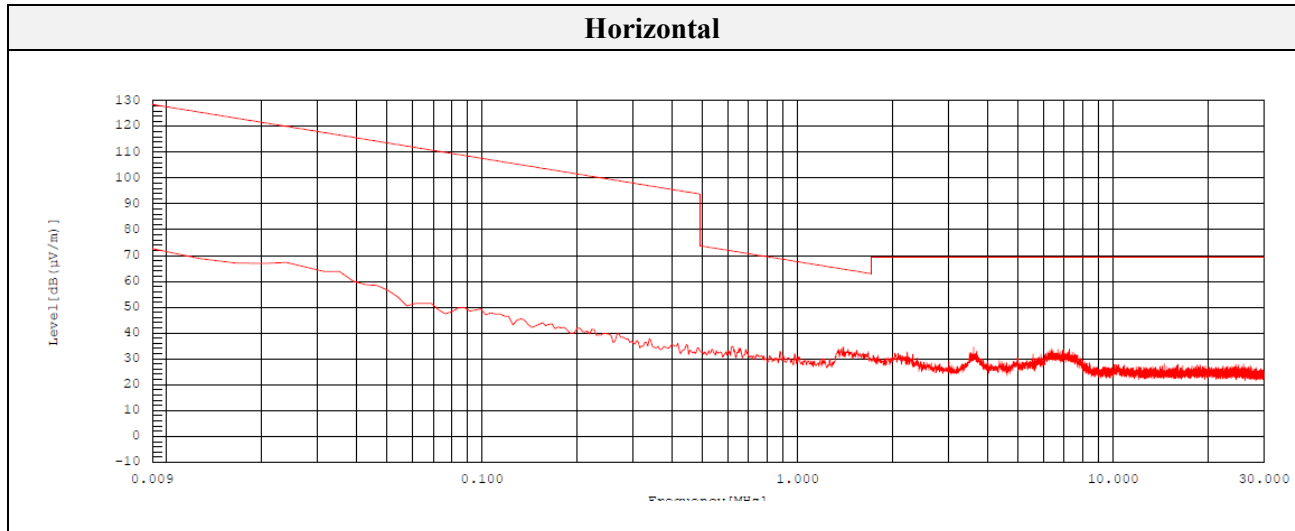
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Test results (Below 30 MHz)

Mode: LE 1 Mbps
Channel: 20 (Worst case)
Distance of measurement: 3 meter



Note.

1. No spurious emission were detected under 30 MHz.

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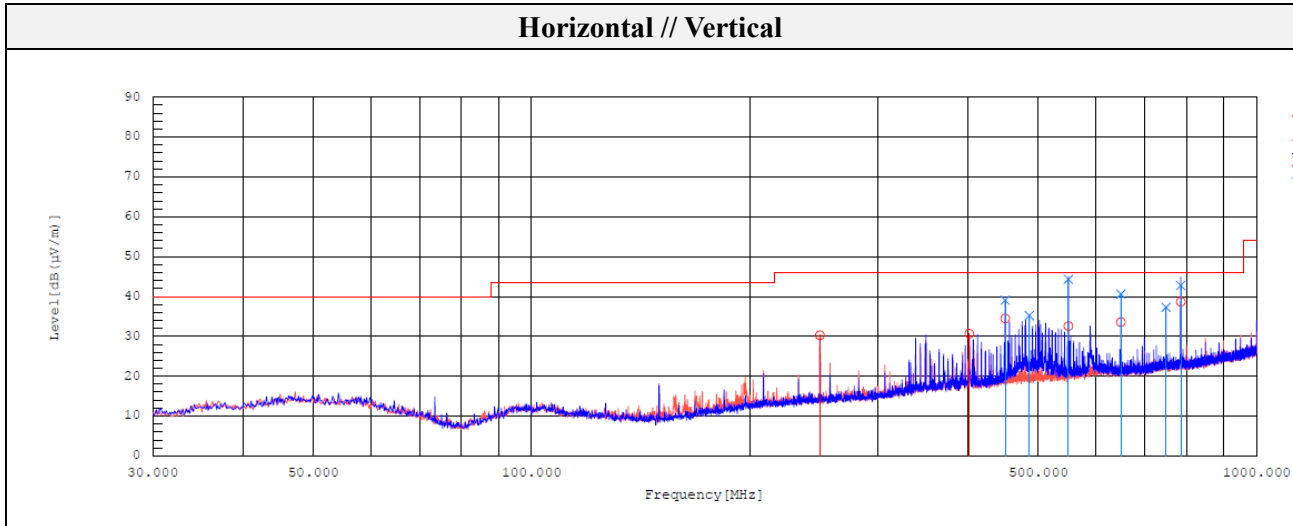
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Test results (Below 1 000 MHz)

Mode: LE 1 Mbps
 Channel: 20 (Worst case)
 Distance of measurement: 3 meter



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	249.948	H	41.4	-11.1	30.3	46.0	15.7	100.1	97.2	
2	401.631	H	37.9	-7.2	30.7	46.0	15.3	100.1	337.3	
3	450.010	H	40.8	-6.3	34.5	46.0	11.5	100.1	229.2	
4	450.010	V	45.4	-6.3	39.1	46.0	6.9	100.0	27.7	
5	485.658	V	40.8	-5.6	35.2	46.0	10.8	100.0	265.7	
6	550.041	H	37.3	-4.7	32.6	46.0	13.4	200.1	91.1	
7	550.041	V	49.0	-4.7	44.3	46.0	1.7	100.0	359.9	
8	650.073	H	37.3	-3.7	33.6	46.0	12.4	100.1	337.3	
9	650.073	V	44.3	-3.7	40.6	46.0	5.4	100.0	22.8	
10	749.983	V	39.6	-2.3	37.3	46.0	8.7	149.8	7.2	
11	785.994	H	40.8	-2.1	38.7	46.0	7.3	100.1	229.2	
12	785.994	V	44.9	-2.1	42.8	46.0	3.2	149.8	270.0	

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Test results (Above 1 000 MHz)

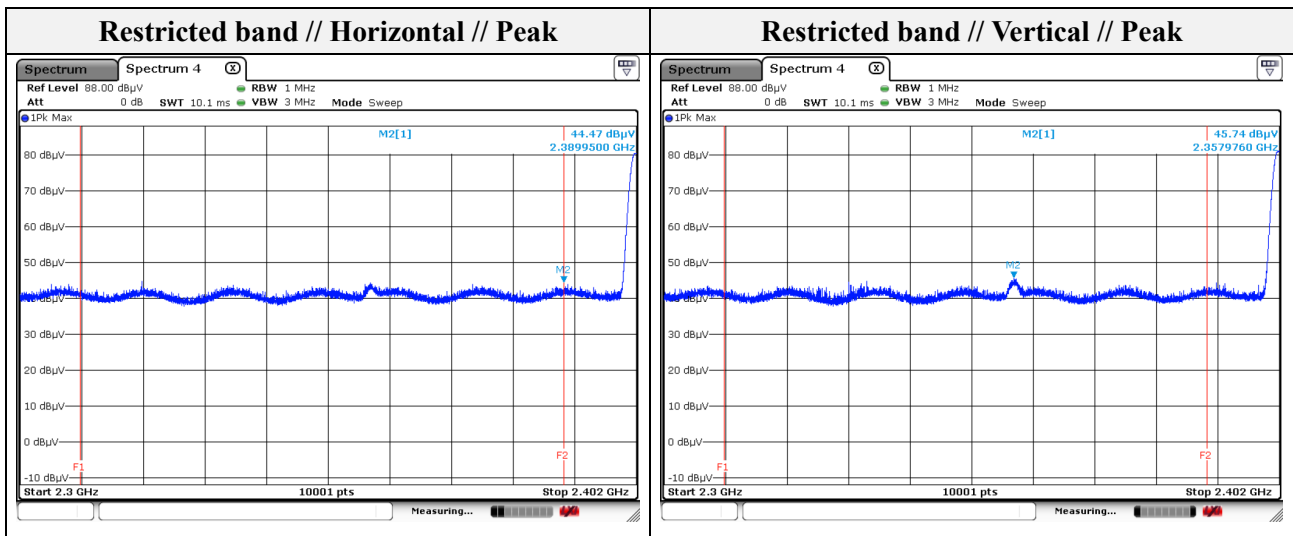
Mode: LE 1 Mbps
 Channel: 00
 Distance of measurement: 3 meter

- Spurious

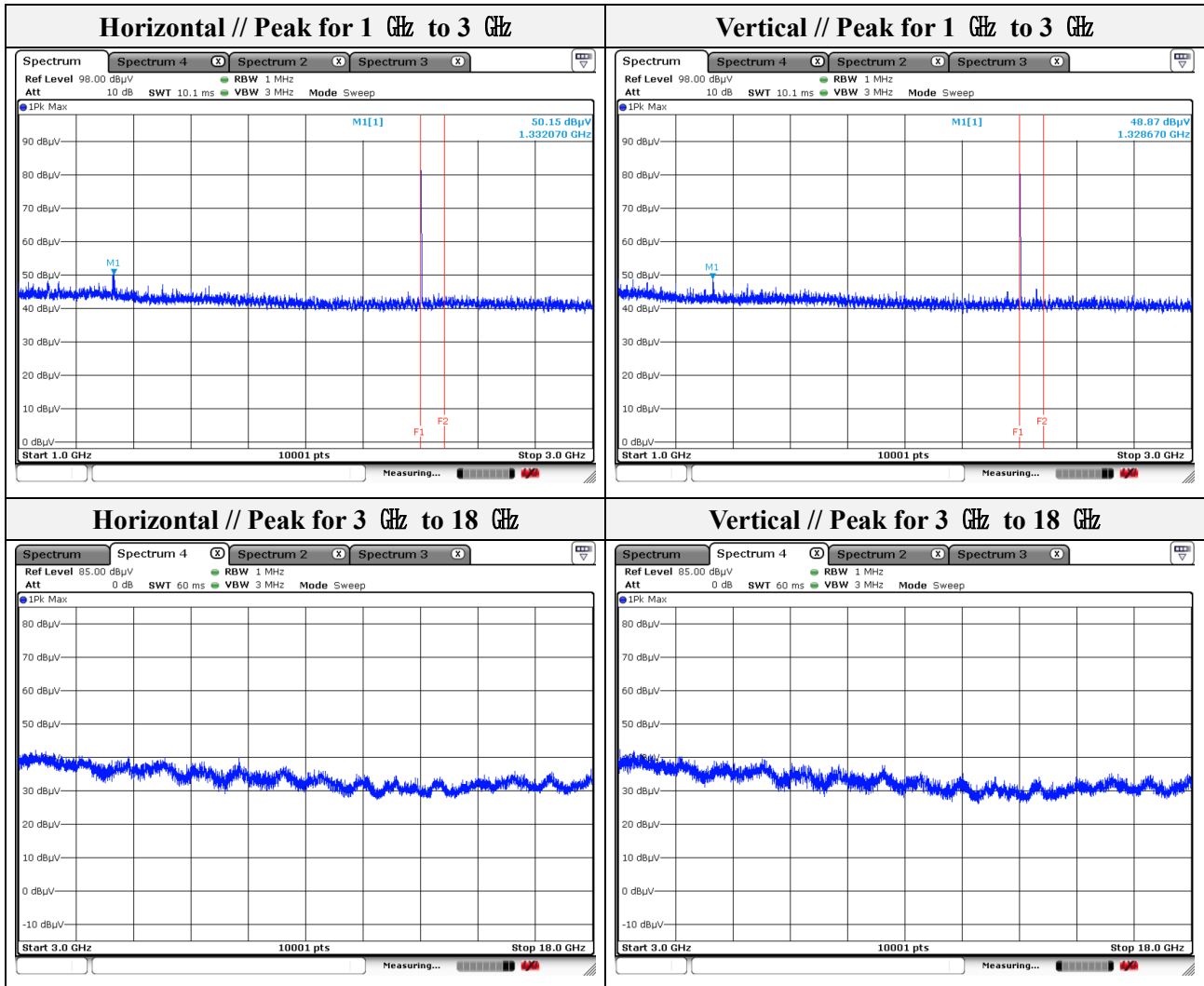
Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1 328.67	48.87	Peak	V	-7.57	-	41.30	74.00	32.70
1 332.07	50.15	Peak	H	-7.54	-	42.61	74.00	31.39

- 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)
2 357.98	45.74	Peak	V	-1.87	-	43.87	74.00	30.13
2 389.95	44.47	Peak	H	-1.86	-	42.61	74.00	31.39



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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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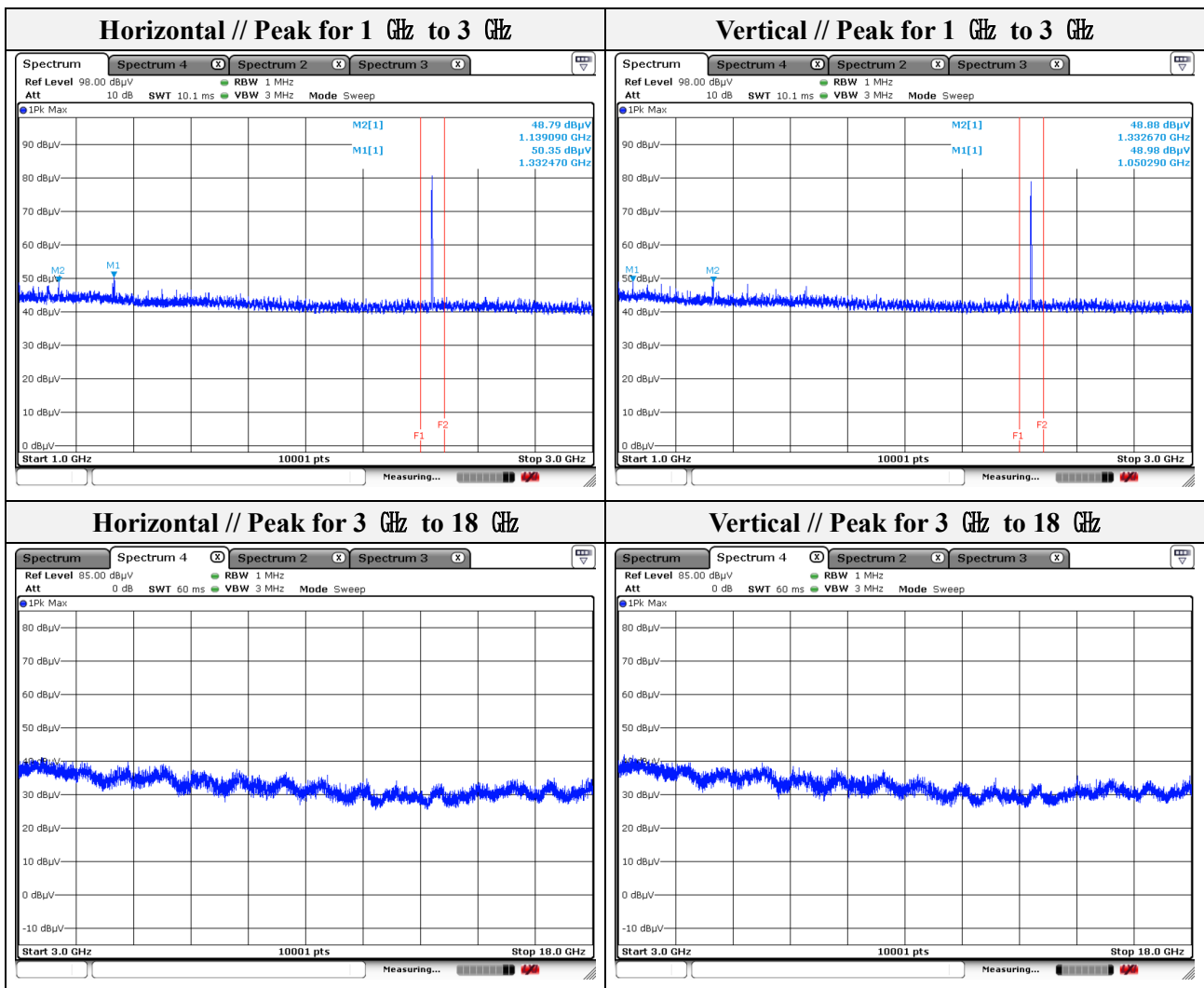
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Mode: LE 1 Mbps
 Channel: 20
 Distance of measurement: 3 meter

- **Spurious**

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 050.29	48.98	Peak	V	-9.64	-	39.34	74.00	34.66
1 139.09	48.79	Peak	H	-9.05	-	39.74	74.00	34.26
1 332.47	50.35	Peak	H	-7.53	-	42.82	74.00	31.18
1 332.67	48.88	Peak	V	-7.53	-	41.35	74.00	32.65



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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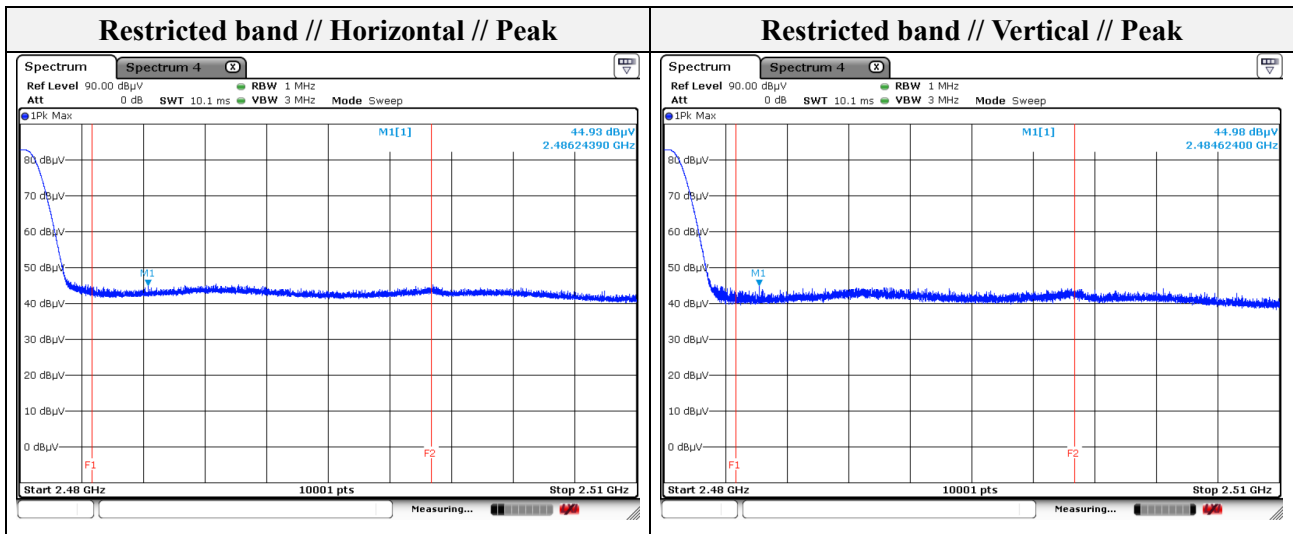
Mode: LE 1 Mbps
 Channel: 39
 Distance of measurement: 3 meter

- Spurious

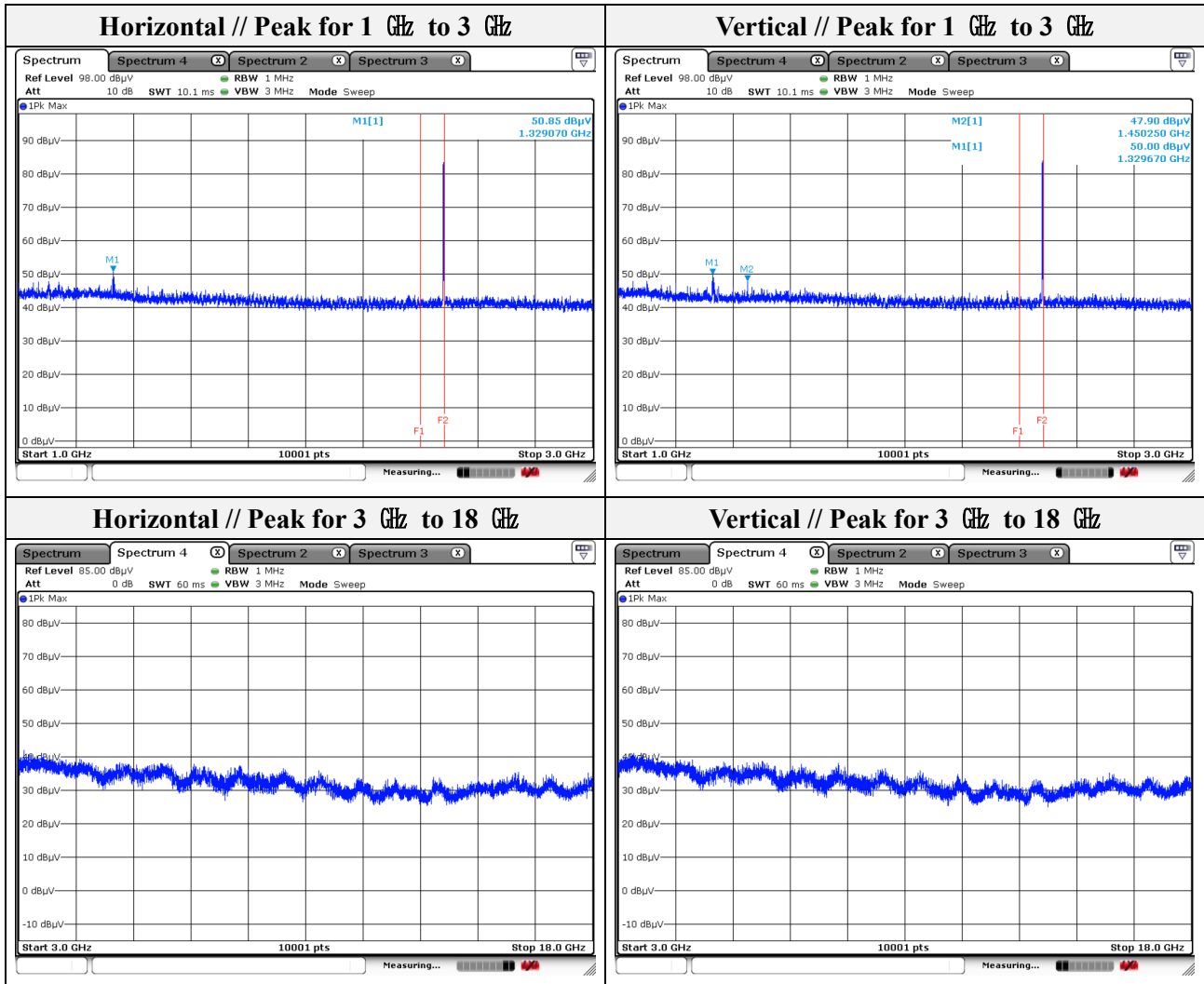
Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 329.07	50.85	Peak	H	-7.56	-	43.29	74.00	30.71
1 329.67	50.00	Peak	V	-7.56	-	42.44	74.00	31.56
1 450.25	47.90	Peak	V	-6.82	-	41.08	74.00	32.92

- 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)
2 484.62	44.98	Peak	V	-1.66	-	43.32	74.00	30.68
2 486.24	44.93	Peak	H	-1.66	-	43.27	74.00	30.73



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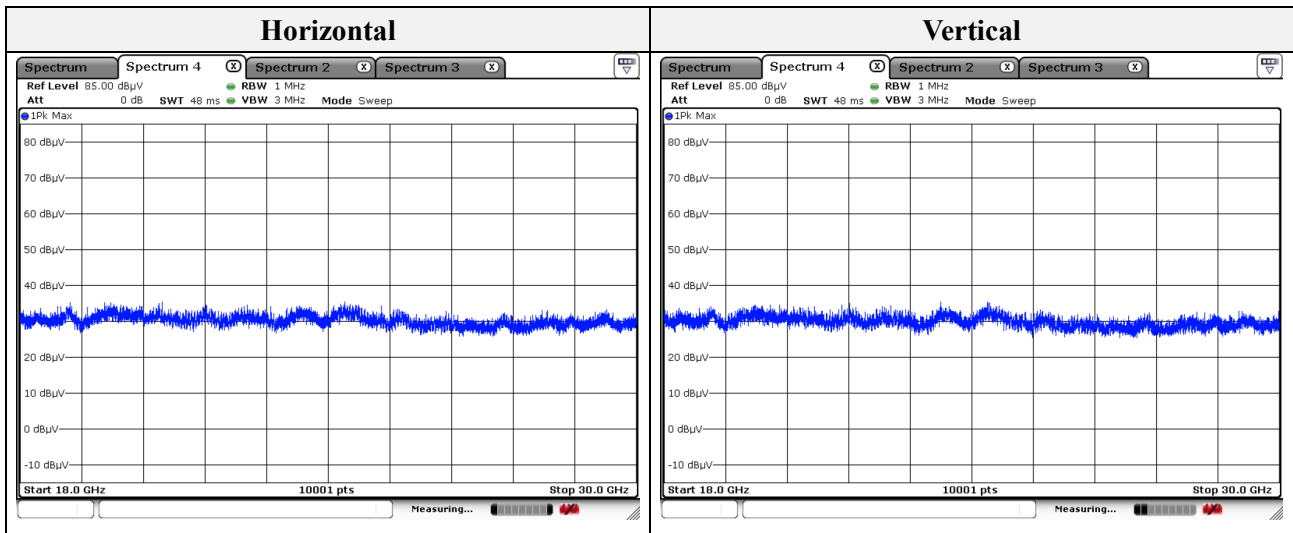


Note.

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)

Mode: LE 1 Mbps
 Channel: 20 (Worst case)
 Distance of measurement: 3 meter



Note.

1. No spurious emission were detected above 18 GHz.

3.3. AC conducted emissions

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



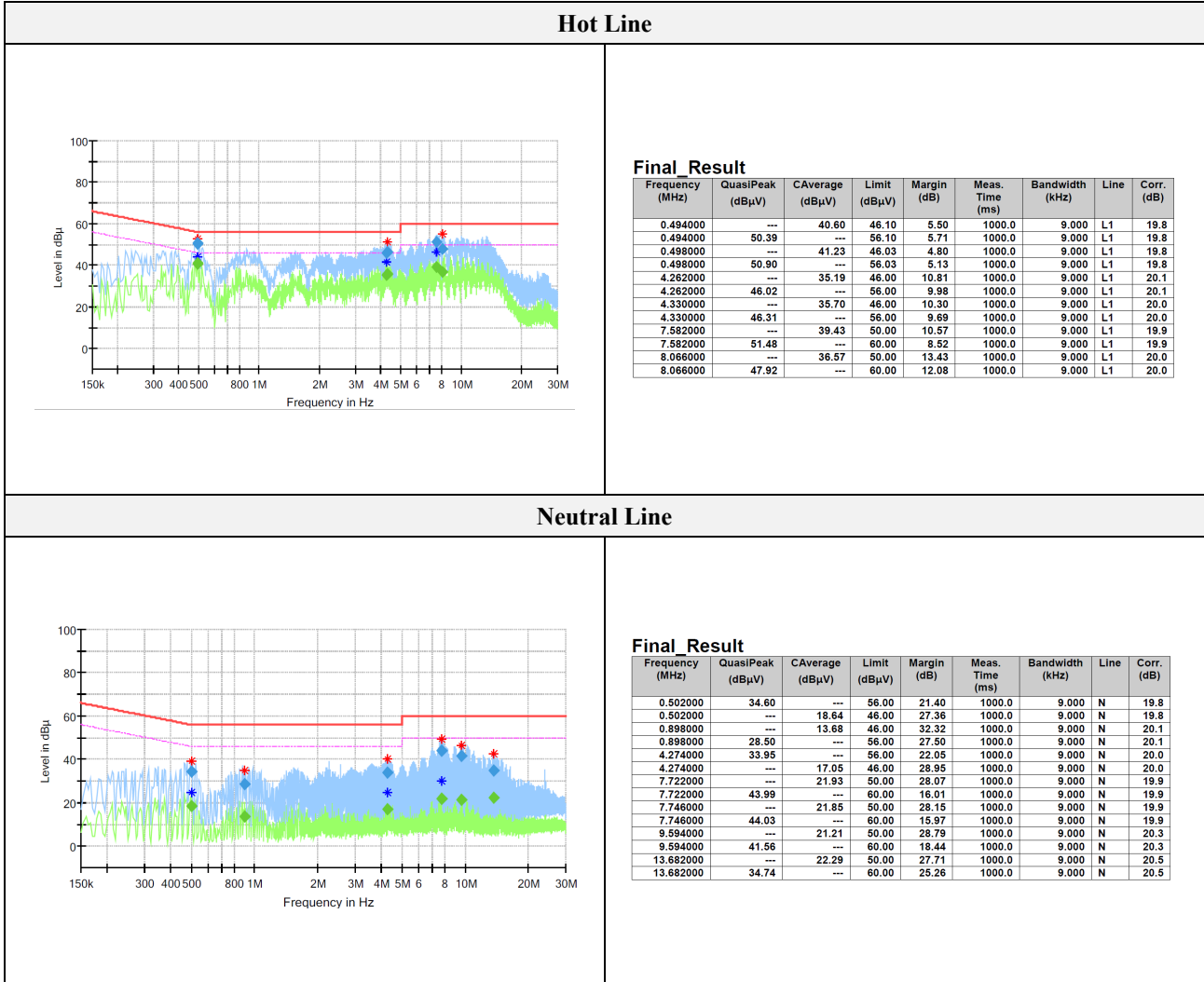
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Test results

Mode: LE 1 Mbps
Channel: 20 (Worst case)



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3.4. 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.



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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	101725	1 year	2023.06.16
MXG Vector SIGNAL GENERATOR	Agilent	N5182A	MY50143829	1 year	2024.01.12
SIGNAL GENERATOR	Anritsu	68369B	002118	1 year	2023.05.13 2024.05.12
BAND REJECT FILTER	MICRO-TRONICS	BRM50702	G272	1 year	2024.01.12
BAND REJECT FILTER	MICRO-TRONICS	BRM50716	G199	1 year	2024.01.12
Attenuator	Mini-Circuits	BW-S10-2W263+	3	1 year	2024.01.13
Attenuator	HUBER+SUHNER	6806.17.A	-	1 year	2024.03.21
Power Meter	Anritsu	ML2495A	2010001	1 year	2023.04.27 2024.04.19
Pulse Power Sensor	Anritsu	MA2411B	1911111	1 year	2023.04.27 2024.04.18
Loop Antenna	Schwarzbeck	FMZB1513	1513-257	2 years	2025.01.16
BILOG ANTENNA	Schwarzbeck	VULB 9168	9168-461	2 years	2024.04.27
Horn Antenna	A.H	SAS-571	414	1 year	2024.01.16
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA 9170550	1 year	2024.01.16
Amplifier	SONOMA INSTRUMENT	310N	401123	1 year	2023.06.02
PREAMPLIFIER	HP	8449B	3008A00538	1 year	2023.06.02
BROADBAND AMPLIFIER	SCHWARZBECK	BBV9721	PS9721-003	1 year	2024.01.16
DC POWER SUPPLY	SORENSEN	DCS40-75E	1408A02745	1 year	2024.01.12
EMI Test Receiver	R&S	ESU26	100517	1 year	2023.08.01
EMI Test Receiver	R&S	ESR3	101783	1 year	2023.11.11
PULSE LIMITER	R&S	ESH2-Z2	101915	1 year	2023.11.10
LISN	R&S	ENV216	101787	1 year	2023.11.10

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook computer	LG Electronics Inc.,	LGS53	306QCZP560949

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Appendix B. Test setup photos



The end of test report.

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