TEST REPORT

Part 15 Subpart C 15.247

Equipment under test Flat Panel Digital X-ray Detector

Model name Prudent 1212

FCC ID 2AWVMPRUDENT1212

Applicant PIXXGEN Corporation

Manufacturer PIXXGEN Corporation

Date of test(s) 2020.09.09 ~ 2020.09.18

Date of issue 2020.10.23

Issued to
PIXXGEN Corporation
5F, SMART BAY, 123, Beolmal-ro, Dongan-gu, Anyang-si,
Gyeonggi-do, Republic of Korea
Tel: +82-70-4846-8891 / Fax: +82-70-4846-8891

Issued by
KES Co., Ltd.
3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si,
Gyeonggi-do, 14057, Korea
473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450

Test and report completed by :	Report approval by :
	
Young-Jun, Cho Test engineer	Young-Jin, Lee Technical manager

Revision history

Revision	Date of issue	Test report No.	Description
-	2020.10.23	KES-RF1-20T0200	Initial

TABLE OF CONTENTS

1. General information

Applicant:	PIXXGEN Corporation
Applicant address:	5F, SMART BAY, 123, Beolmal-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Republic of 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, Yeoju-si, Gyeonggi-do, Korea
Test Facility	FCC Accreditation Designation No.: KR0100, Registration No.: 444148
FCC rule part(s):	15.247
FCC ID:	2AWVMPRUDENT1212
Test device serial No.:	☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	Flat Panel Digital X-ray Detector
Frequency range	**2 412 ㎒ ~ 2 462 ㎒ (11n_HT20)** UNII-1 5 180 ㎒ ~ 5 240 ㎒ (11ac_VHT20)
Model:	Prudent 1212
Modulation technique	WIFI : OFDM
Number of channels	**2 412 ㎒ ~ 2 462 ㎒ (11n_HT20) : 11 ch** 5 180 ㎒ ~ 5 240 ㎒ (11ac_VHT20) : 4ch
Antenna specification	2.4 ㎓ Antenna type : PCB antenna, Peak gain : 2.27 ㏈i 5 ㎓ Antenna type : : PCB antenna, Peak gain(UNII-1) : 1.86 ㏈i
Power source	DC 14.8 V (Battery)
H/W version	v1.0.0
S/W version	v1.0.0.3

1.2. Test configuration

The **PIXXGEN Corporation // Prudent 1212 // FCC ID: 2AWVMPRUDENT1212** was tested per the guidance of KDB 558074 D01 v05r02, ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

1.3. Device modifications

N/A

1.4. Frequency/channel operations

Ch.	Frequency (㎒)	Mode
01	2412	802.11n_HT20
. .	. .	. .
06	2437	802.11n_HT20
. .	. .	. .
11	2462	802.11n_HT20

1.5. Worst case data rate

1. Radiated emission was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.
2. Worst-case data rates were:
   802.11n_HT20: **MCS0**

1.6. Accessory information

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

1.7. Antenna information

Mode	SISO		MIMO
	Antenna 0	Antenna 1	Antenna 0 + 1
802.11n(HT20)	✔	✕	✕

✔ = Support; ✕ = Not support

Antenna Model : Xls-857 (PCB antenna)

Ant0 Gain (㏈i)	Ant1 Gain (㏈i)	Note
2.27	-	2 412 to 2 462 ㎒
1.86	1.86	5 180 to 5 240 ㎒

1.8. Measurement results explanation example

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(㏈).
= 1.01 + 10 = 11.01 (㏈)

1.9. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.46 dB
Uncertainty for Radiation emission test (include Fundamental emission)	Below 1㎓	4.40 dB
	Above 1㎓	5.94 dB
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.		

2. Summary of tests

Reference	Parameter	Test results
15.247(a)(2)	6 dB bandwidth	N/A(1)
15.247(b)(3)	Output power	N/A(1)
15.247(e)	Power spectral density	N/A(1)
15.205, 15.209	Radiated restricted band and emission	Pass
15.247(d)	Conducted spurious emission and band edge	N/A(1)
15.207(a)	AC conducted emissions	N/A(2)

Note :

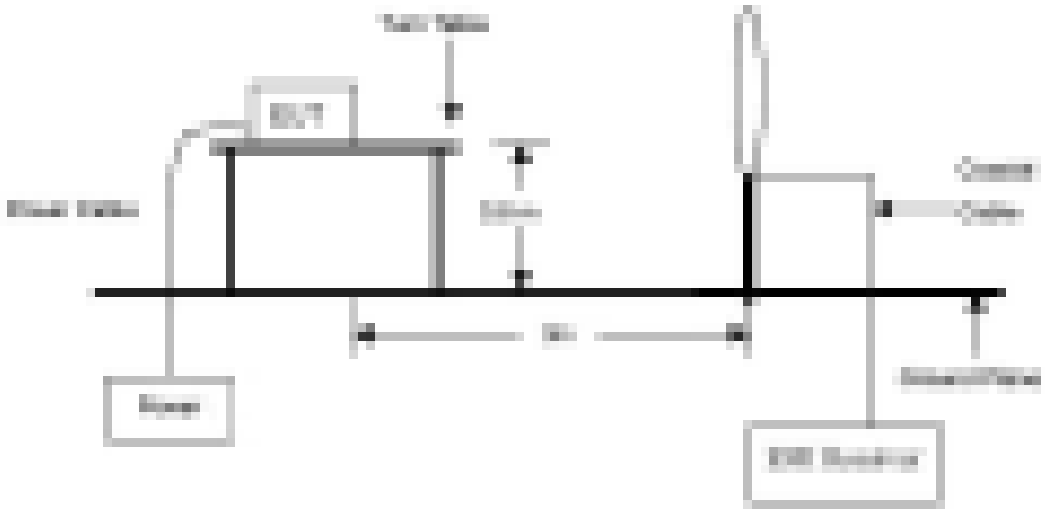
1) Please Refer to the approved Module Report (Report No.: KES-RF1-20T0137) for result of existing test items. The output power setting is same as original module and confirmed that RF conducted tests of original report remain valid for this filing.
2) EUT is operated only from dedicated batteries, with no provisions for connection to the public utility ac power lines.

3. Test results

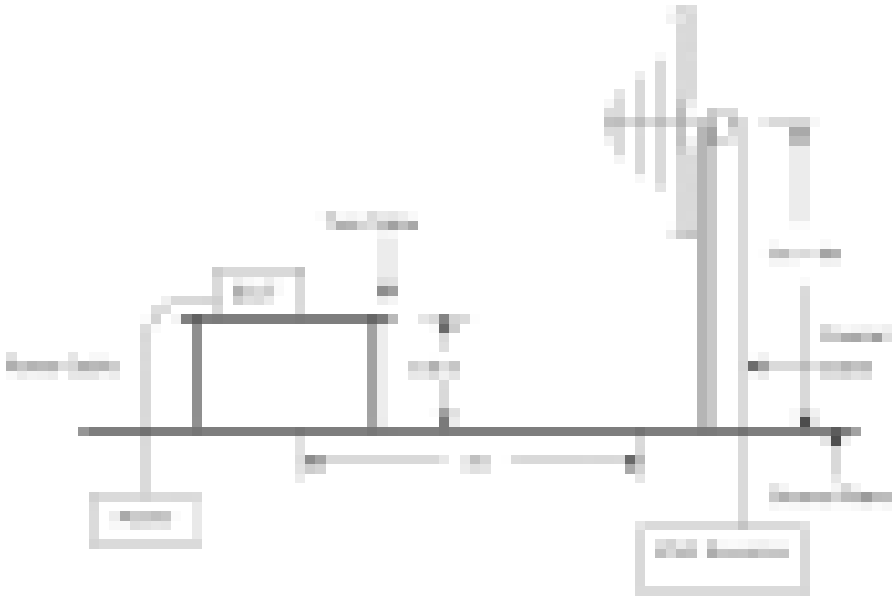
3.1. Radiated restricted band and emissions

Test setup

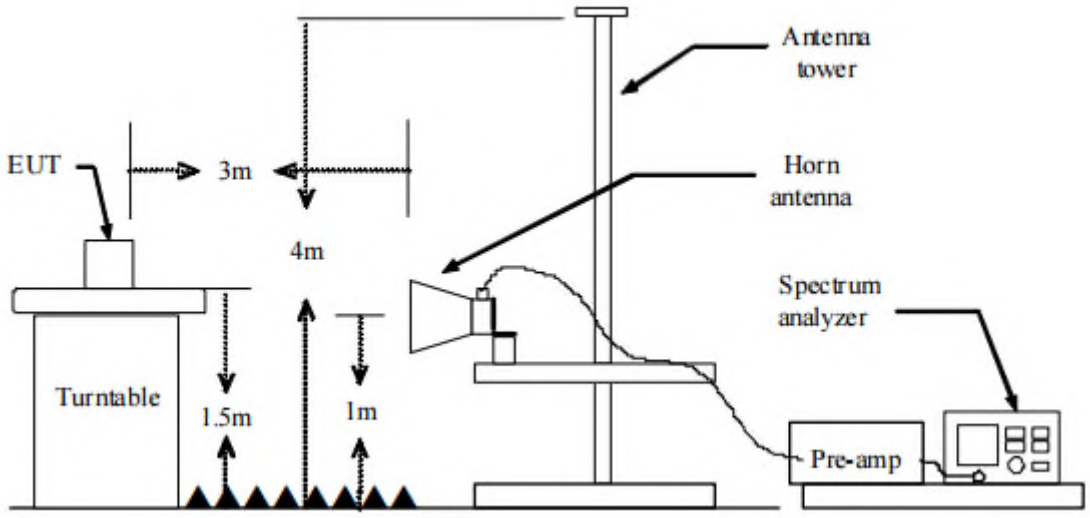
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



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 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 and perpendicular of the antenna are set to make the measurement.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization and Parallel to the ground plane in detecting antenna.
4. 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.
5. 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 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 $f < 1$ ㎓:
   ① Span = wide enough to fully capture the emission being measured
   ② RBW = 100 ㎑
   ③ VBW ≥ RBW
   ④ Detector = quasi peak

⑤ Sweep time = auto
⑥ Trace = max hold

6. Spectrum analyzer settings for $f \geq 1$ ㎓: 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 $f \geq 1$ ㎓: 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. $F_d = 40\log(D_m/Ds)$
   f ≥30 ㎒, extrapolation factor of 20 ㏈/decade of distance. $F_d = 20\log(D_m/Ds)$
   Where:
   F_d = Distance factor in ㏈
   D_m = Measurement distance in meters
   D_s = Specification distance in meters
3. CF(Correction factors(㏈)) = Antenna factor(㏈/m) + Cable loss(㏈) + or Amp. gain(㏈) + or F_d(㏈)
8. Field strength(㏈㎶/m) = Level(㏈㎶) + CF (㏈) + or DCF(㏈)
9. Margin(㏈) = Limit(㏈㎶/m) - Field strength(㏈㎶/m)
10. 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.
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 ㏈ of respective limits were not reported.
9. All channels, modes (e.g. 802.11b/g/n (20 ㎒ BW)), and modulations/data rates were investigated among DTS band. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.
10. According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒. Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test 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.

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.

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.

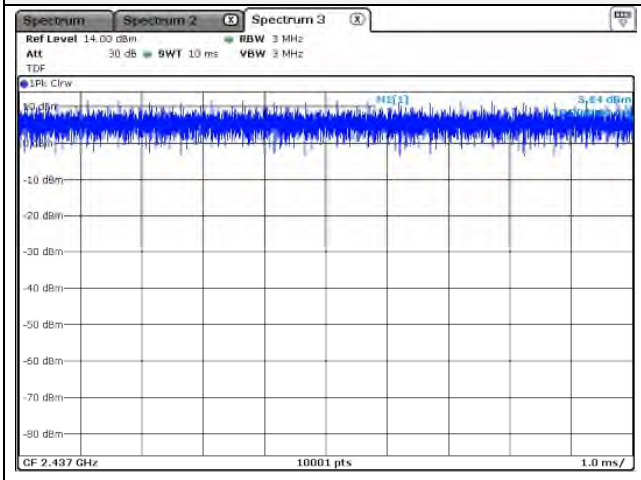
Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100.

Test mode	T_{on} time (㎳)	Period (㎳)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (㏈)
802.11n(HT20)	10	10	1	100	0

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

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

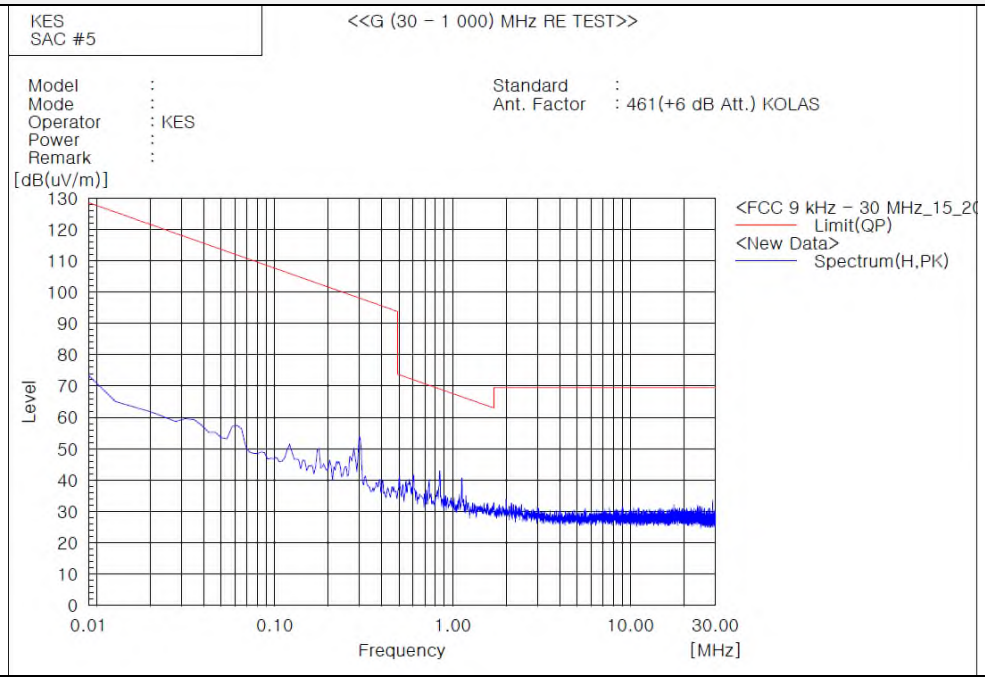
Test plots

802.11n(HT20) // Middle channel	
	Blank

Test results (Below 30 ㎒)

Mode:	802.11n_HT20
Distance of measurement:	3 meter
Channel:	11 (Worst case)

Horizontal

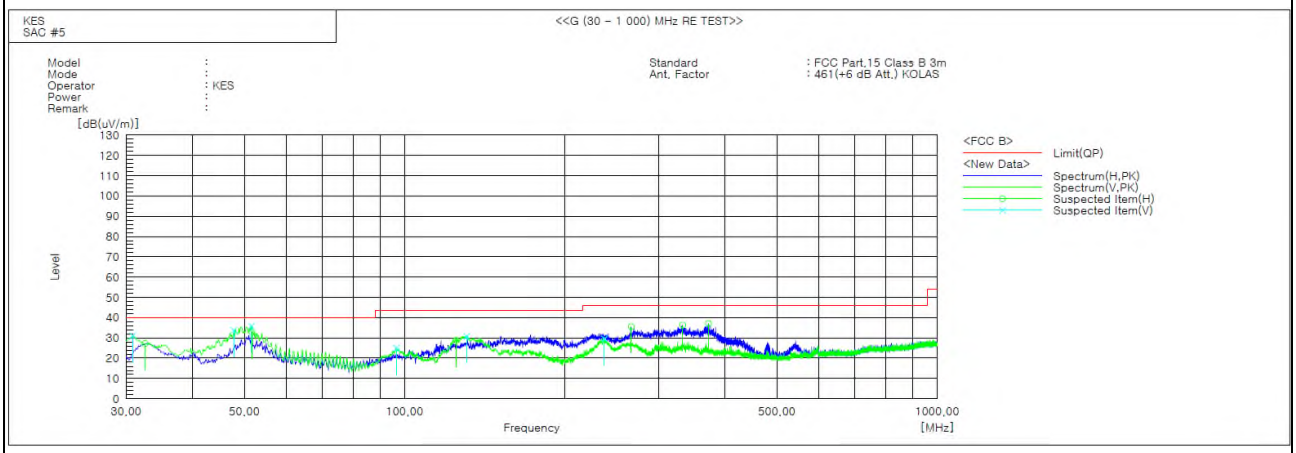


Note.
1. No spurious emission were detected Below 30 ㎒.

Test results (Below 1 000 ㎒) – Worst case

Mode:	802.11n_HT20
Distance of measurement:	3 meter
Channel:	11 (Worst case)

Horizontal // Vertical



No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	30.849	V	45.3	-14.2	31.1	40.0	8.9	100.0	200.0	
2	32.546	H	41.3	-14.1	27.2	40.0	12.8	400.0	135.9	
3	47.824	V	46.5	-12.8	33.7	40.0	6.3	400.0	123.9	
4	51.583	V	48.9	-13.0	35.9	40.0	4.1	100.0	114.6	
5	51.704	H	45.6	-13.0	32.6	40.0	7.4	400.0	182.1	
6	96.566	V	43.0	-18.1	24.9	43.5	18.6	100.0	84.7	
7	124.939	H	43.6	-14.8	28.8	43.5	14.7	200.0	34.5	
8	130.880	V	44.8	-14.0	30.8	43.5	12.7	200.0	10.1	
9	237.216	V	44.3	-14.7	29.6	46.0	16.4	100.0	33.2	
10	266.438	H	48.8	-13.2	35.6	46.0	10.4	100.0	235.7	
11	332.640	H	48.0	-11.6	36.4	46.0	9.6	100.0	92.8	
12	372.046	H	48.0	-10.9	37.1	46.0	8.9	100.0	97.6	

Mode: 802.11n(HT20)

Distance of measurement: 3 meter

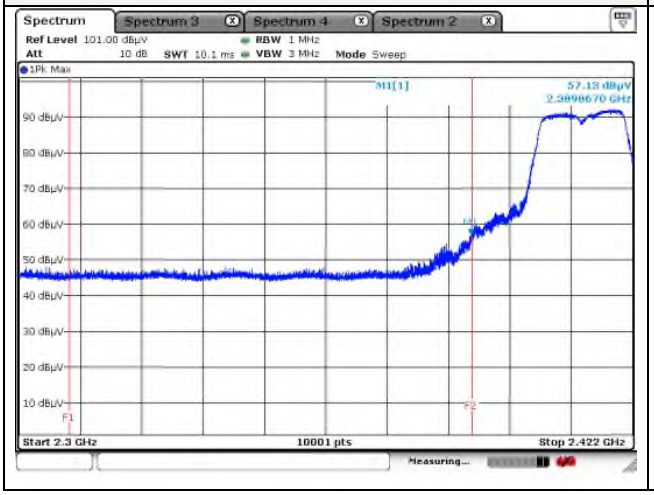
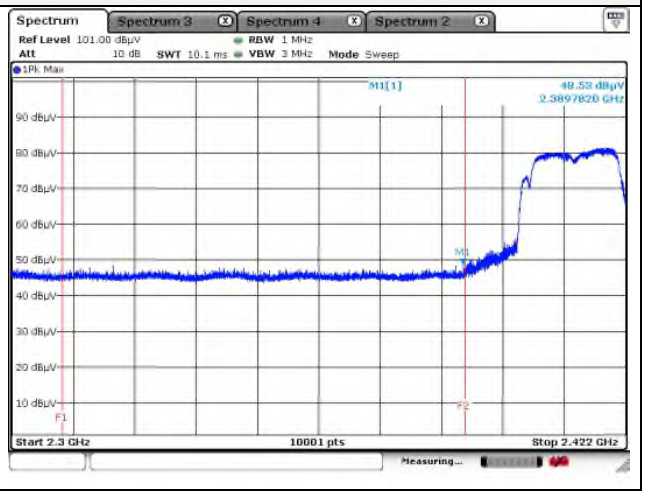
Channel: 01

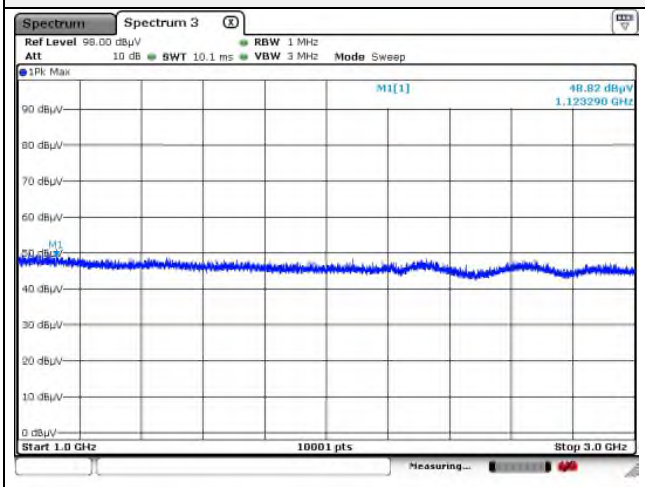
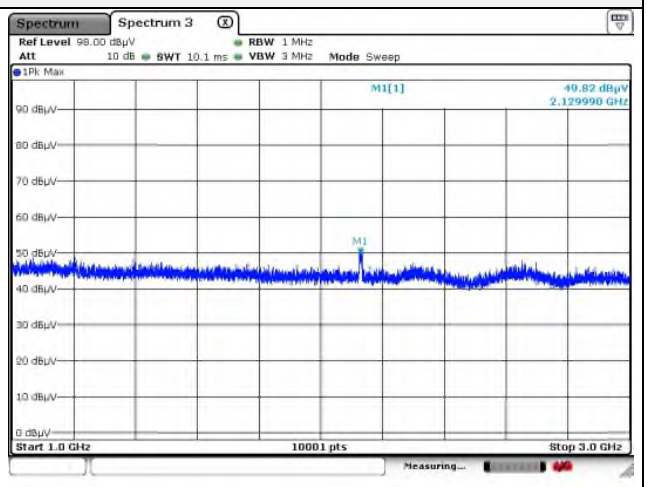
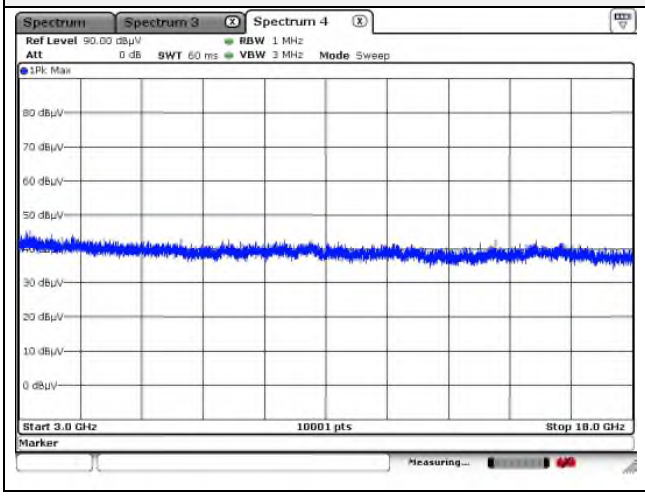
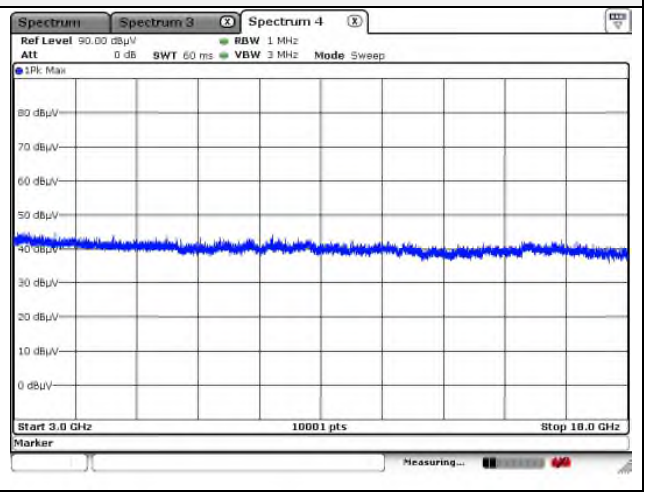
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1123.29	48.82	Peak	H	-10.77	-	38.05	74.00	35.95
2129.99	49.82	Peak	V	-4.83	-	44.99	74.00	29.01

- **Band edge**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2389.87	57.13	Peak	H	-3.72	-	53.41	74.00	20.59
2389.78	48.53	Peak	V	-3.72	-	44.81	74.00	29.19

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.

Mode: 802.11n(HT20)

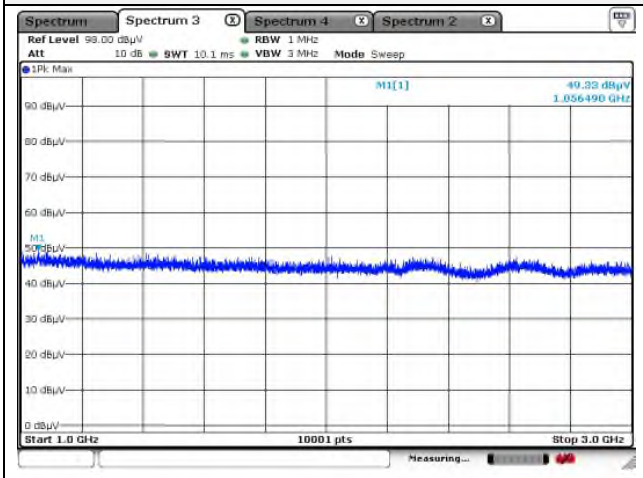
Distance of measurement: 3 meter

Channel: 06

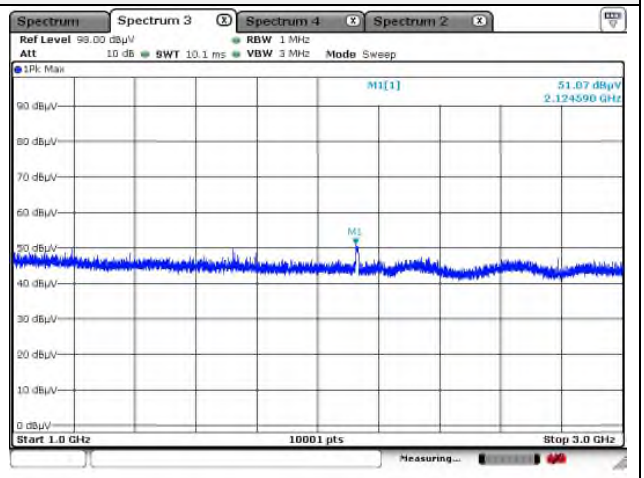
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1056.49	49.33	Peak	H	-11.07	-	38.26	74.00	35.74
2124.59	51.07	Peak	V	-4.86	-	46.21	74.00	27.79

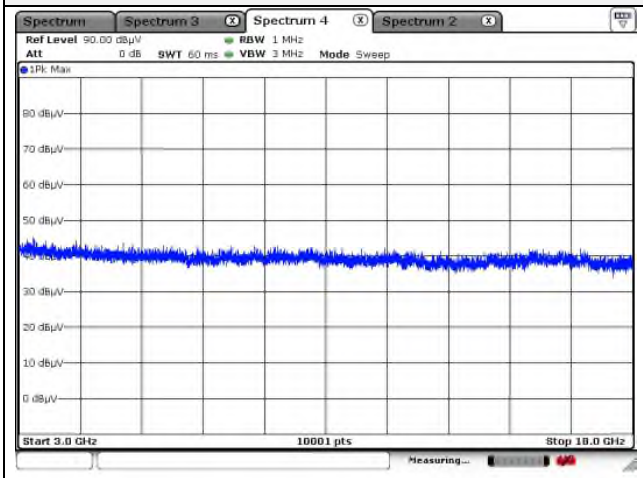
Horizontal // Peak for 1 ㎓ to 3 ㎓



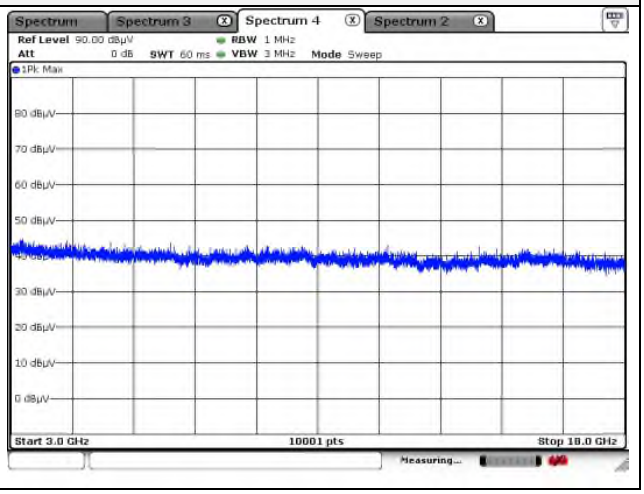
Vertical // Peak for 1 ㎓ to 3 ㎓



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.

Mode: 802.11n(HT20)

Distance of measurement: 3 meter

Channel: 11

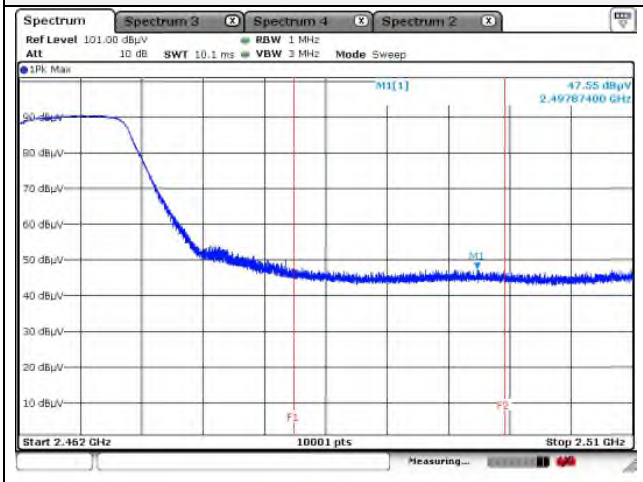
- **Spurious**

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1152.28	48.60	Peak	H	-10.63	-	37.97	74.00	36.03
2126.79	50.37	Peak	V	-4.85	-	45.52	74.00	28.48

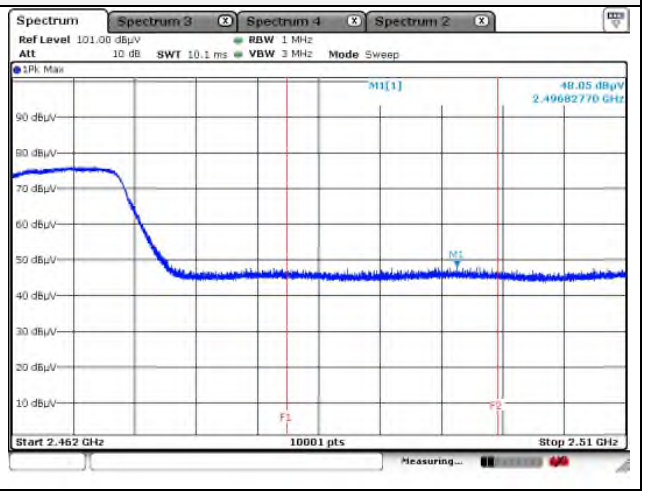
- **Band edge**

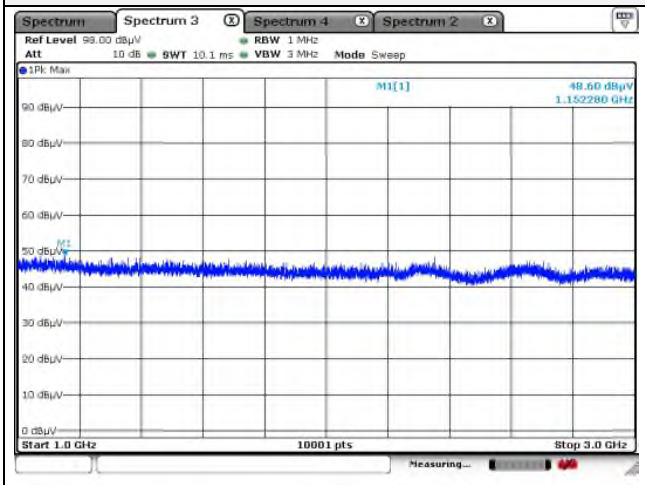
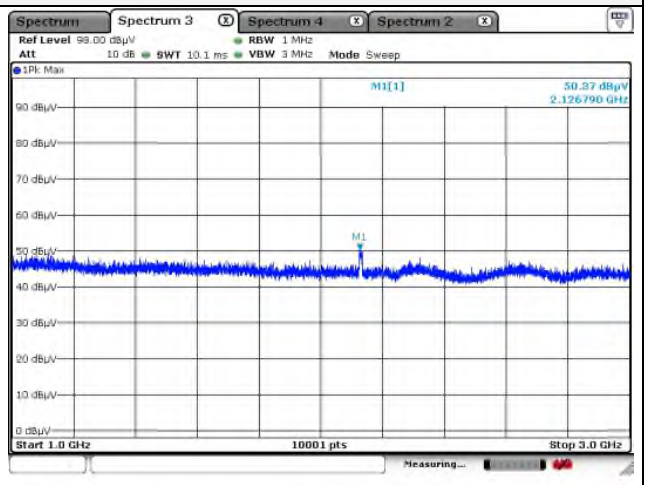
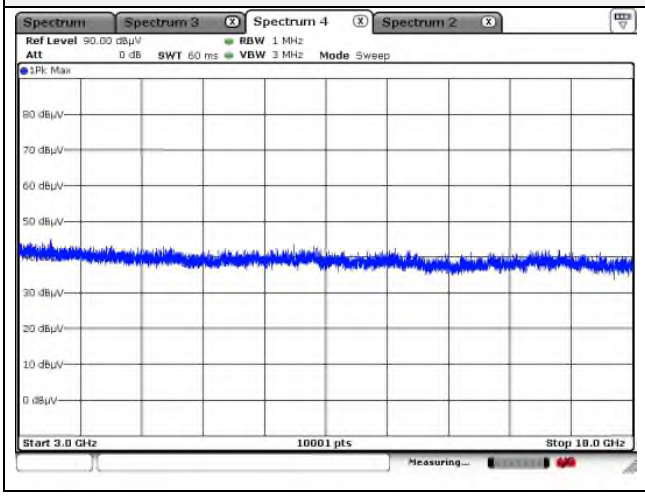
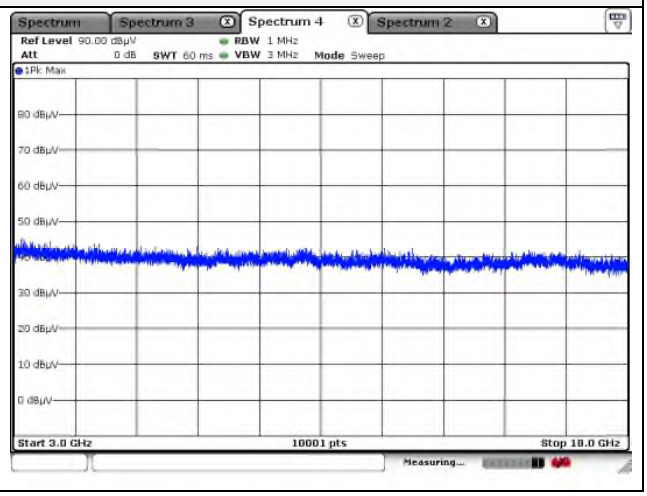
Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2497.87	47.55	Peak	H	-3.30	-	44.25	74.00	29.75
2496.83	48.05	Peak	V	-3.30	-	44.75	74.00	29.25

Restricted band // Horizontal // Peak



Restricted band // Vertical // Peak

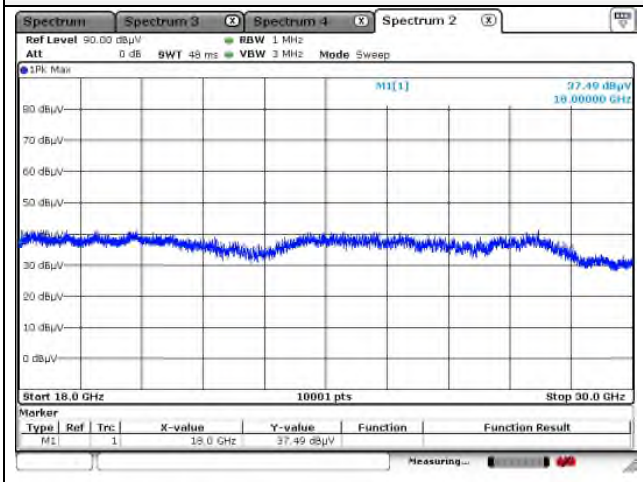
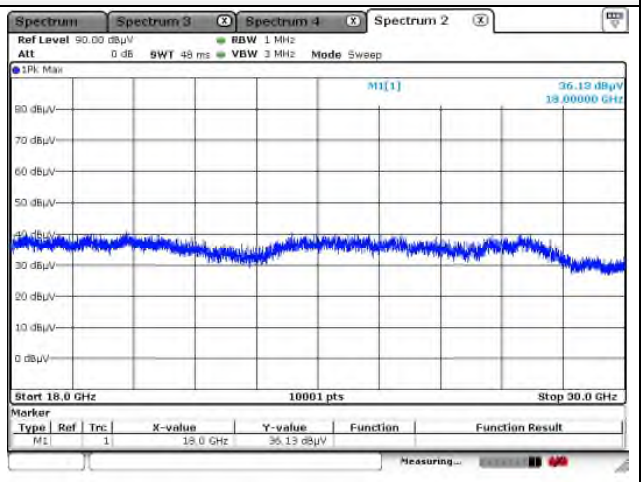


Horizontal // Peak for 1 ㎓ to 3 ㎓	Vertical // Peak for 1 ㎓ to 3 ㎓
	
Horizontal // Peak for 3 ㎓ to 18 ㎓	**Vertical // Peak for 3 ㎓ to 18 ㎓**
	

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:	802.11n_HT20
Distance of measurement:	3 meter
Channel:	11 (Worst case)

Horizontal	Vertical
	

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

Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
SPECTRUM ANALYZER	R&S	FSV40	101725	1 year	2021.06.22
8360B Series Swept Signal Generator	HP	83630B	3844A00786	1 year	2021.01.15
SIGNAL GENERATOR	KEYSIGHT	N5182B	MY59100115	1 year	2021.05.12
ATTENUATOR	Mini-Circuits	BW-S10-2W263+	1	1 year	2021.01.17
Loop Antenna	Schwarzbeck	FMZB1513	225	2 years	2021.02.15
BILOG ANTENNA	VULB 9168	SCHWARZBECK	9168-461	2 years	2022.05.26
HORN ANTENNA	A.H.	SAS-571	414	1 years	2021.01.31
BAND REJECT FILTER	MICRO-TRONICS	BRM50702	G272	1 year	2021.01.15
BAND REJECT FILTER	MICRO-TRONICS	BRM50716	G199	1 year	2021.01.15
AMPLIFIER	310N	SONOMA INSTRUMENT	401123	1 year	2021.06.08
PREAMPLIFIER	8449B	AGILENT	8008A01640	1 year	2021.04.01
ATTENUATOR	F04-C1206-01	SRT	20022403	1 year	2021.05.06
EMI Test Receiver	R&S	ESU26	100552	1 year	2021.04.01

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook computer	LG Electronics Inc.,	15UD590	904QCSF564006