



TEST REPORT



Report No. : KES-RF240808

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KES Co., Ltd.

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

■ J-MIC TEST REPORT

1. Client

- Name : PARTRON ESL Co., Ltd.
- Address : 829-836, 42, Changeop-ro, Sujeong-gu, Seongnam-si, Gyeonggi-do, Republic of Korea

2. Sample Description

- Product item : InforTab
- Model name : IE290
- Manufacturer etc. : PARTRON VINA CO.,LTD.

3. Date of test : 2024.10.29 ~ 2024.11.07

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

- Address : #3002, #3503, #3701, 40, Simin-daero365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Republic of Korea

5. Test method used : The Radio Law, Annex 44

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 : Dong-Uk Kim (Signature)	Name : Young-Jin Lee (Signature)

2024. 12. 13.

KES Co., Ltd.

Accredited by KOLAS, Republic of KOREA

**REPORT REVISION HISTORY**

Date	Test Report No.	Revision History
2024.12.13	KES-RF240808	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: PARTRON ESL Co., Ltd.
Applicant address: 829-836, 42, Changeop-ro, Sujeong-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
Test site: KES Co., Ltd.
Test site address: ☒ #3002, #3503, #3701, 40, Simin-daero365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Republic of Korea
☐ 473-21, Gayeo-ro, Yeosu-si, Gyeonggi-do, Korea
Standard: ARIB STD-33
J-MIC Radio law: Article 2
Test device serial No.: ☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test: InforTab
Frequency range: 2 405 Mhz ~ 2 480 Mhz (Zigbee)
2 485 Mhz ~ 2 495 Mhz (Zigbee)
Model: IE290
Modulation technique: DSSS
Number of channels: 2 405 Mhz ~ 2 480 Mhz (Zigbee) : 16 ch
2 485 Mhz ~ 2 495 Mhz (Zigbee) : 3 ch
Antenna specification: PCB Antenna // Peak gain: 1.15 dBi
Power source: DC 3.0 V (Battery)
H/W version: V1.0
S/W version: V0078

**1.2. Information about derivative model**

N/A

1.3. Accessory information

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

1.4. Device modifications

N/A

1.5. Worst case data rate

1. Conducted test was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

1.6. Measurement Uncertainty

Test Item	Uncertainty
Uncertainty for Conducted Bandwidth test	385 420 Hz
Uncertainty for Conducted Output power test	1.06 dB
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.	



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.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 1.12 + 10 = 11.12 \text{ (dB)}\end{aligned}$$

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 Frequency/channel operations

Ch.	Frequency (MHz)	Mode
27	2 485	Zigbee
:	:	:
29	2 495	Zigbee

Note.

This test report is prepared according to the requirements of ISO/IEC 17025.

1.9. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- Standards:
Certification Ordinance Article 2 Clause 1 Item19-2
- Test Methods:
Ministry of Internal Affairs and Communications Notification Article 88 Appendix 44 Certification



2. Summary of tests

Parameter	Test results
Frequency Tolerance	Pass
Occupied Bandwidth	Pass
Spread Bandwidth	Pass
RF Output Power	Pass
Transmitter Spurious Emission	Pass
Secondary radiated emissions	Pass

Note:

1. NFC (13.56 MHz) function only supports reception.
2. By the request of the applicant, test was performed with condition below:

Mode	Frequency (MHz)	Power Setting value
Zigbee	2 485 MHz ~ 2 495 MHz	50

**3. Test results****3.1. Frequency tolerance****Test setup****Test procedure**

- (1) In case of unmodulated wave (serial or continuous burst), measure the frequency with frequency counter directly.
- (2) In case of burst wave, measure sufficient time and average with measured results.
- (3) In case of others, measure characteristic frequency with spectrum analyzer.

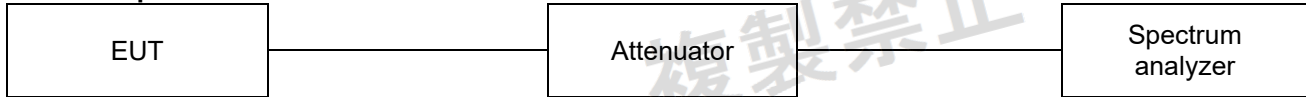
LimitPermission deviation $\pm 50 \times 10^{-6}$ **Test results**

Test voltage		Test mode	Frequency (MHz)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (ppm)
(%)	(V)					
110	DC 3.3	Zigbee	2 485	2 484.989 390	-10 610	-4.27
			2 495	2 494.989 282	-10 718	-4.30
100	DC 3.0	Zigbee	2 485	2 484.989 489	-10 511	-4.23
			2 495	2 494.989 278	-10 722	-4.30
90	DC 2.7	Zigbee	2 485	2 484.989 413	-10 587	-4.26
			2 495	2 494.989 287	-10 713	-4.29



3.2. Occupied Bandwidth

Test setup



Test procedure

Spectrum analyzer is set as follows.

Center frequency : Test frequency

Sweep frequency range : 2 to 3.5 times of tolerances

Resolution bandwidth : Tolerance 3% of the facilities provided in the rules

Video bandwidth : Similar resolution bandwidth

Y axis scale : 10 dB/Div

Input level : Well above the noise level of Spectrum analyzer

Sweep time : The minimum time that measurement accuracy is guaranteed (In case of burst wave, one burst includes per sample)

Sweep mode : Continuous Sweep

Detection mode : Positive Peak (Note)

Display mode : Max Hold (Note)

Note: in case of OFDM and except burst wave is as follows.

Average processing times : More than 10 times

Detection mode : Sample

Limit

Equal or less than 26 MHz for OFDM equipment with 20 MHz channel bandwidth.

Test results

Test voltage		Test mode	Occupied Bandwidth (MHz)	
(%)	(V)		Frequency (2 485 MHz)	Frequency (2 495 MHz)
110	DC 3.3	Zigbee	2.27	2.27
100	DC 3.0	Zigbee	2.26	2.27
90	DC 2.7	Zigbee	2.28	2.27



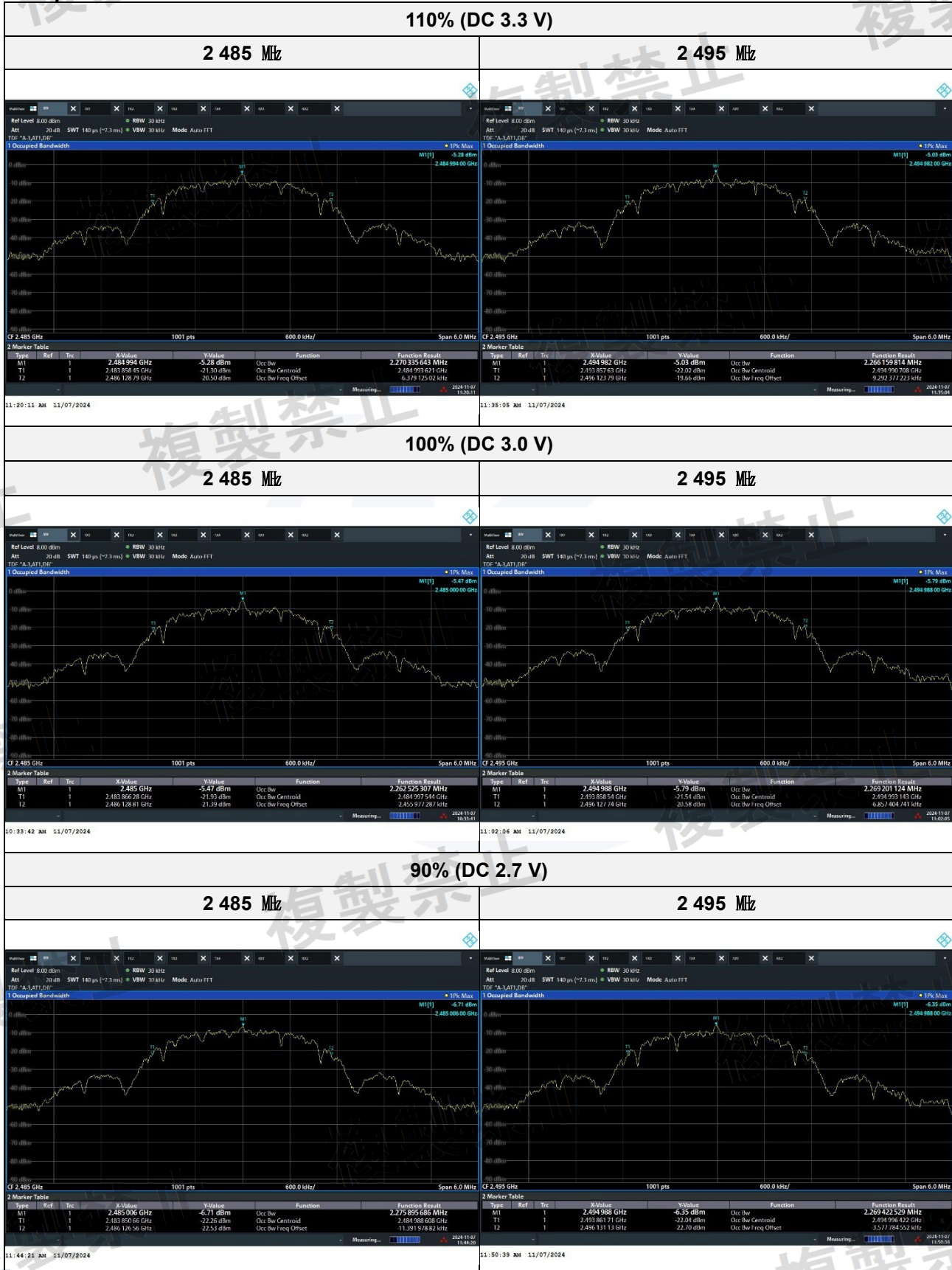
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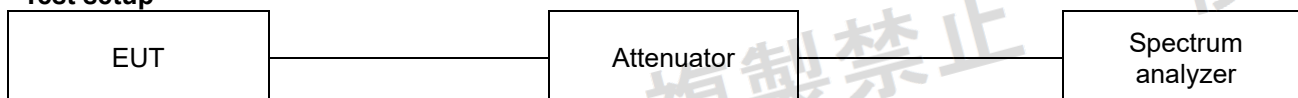
Test plots





3.3. Spread Bandwidth & Factor

Test setup



Test procedure

Spectrum analyzer is set as follows.

Center frequency : Test frequency

Sweep frequency range : 2 to 3.5 times of tolerances

Resolution bandwidth : Tolerance 3% of the facilities provided in the rules

Video bandwidth : Similar resolution bandwidth

Y axis scale : 10 dB/Div

Input level : Well above the noise level of Spectrum analyzer

Sweep time : The minimum time that measurement accuracy is guaranteed (In case of burst wave, one burst includes per sample)

Sweep mode : Continuous Sweep

Detection mode : Positive Peak (Note)

Display mode : Max Hold (Note)

Note: in case of OFDM and except burst wave is as follows.

Average processing times More than 10 times

Detection mode Sample

Limit

500 kHz or over

Test voltage		Test mode	Spread Bandwidth (MHz)	
(%)	(V)		Frequency (2 485 MHz)	Frequency (2 495 MHz)
110	DC 3.3	Zigbee	1.57	1.56
100	DC 3.0	Zigbee	1.55	1.57
90	DC 2.7	Zigbee	1.57	1.55



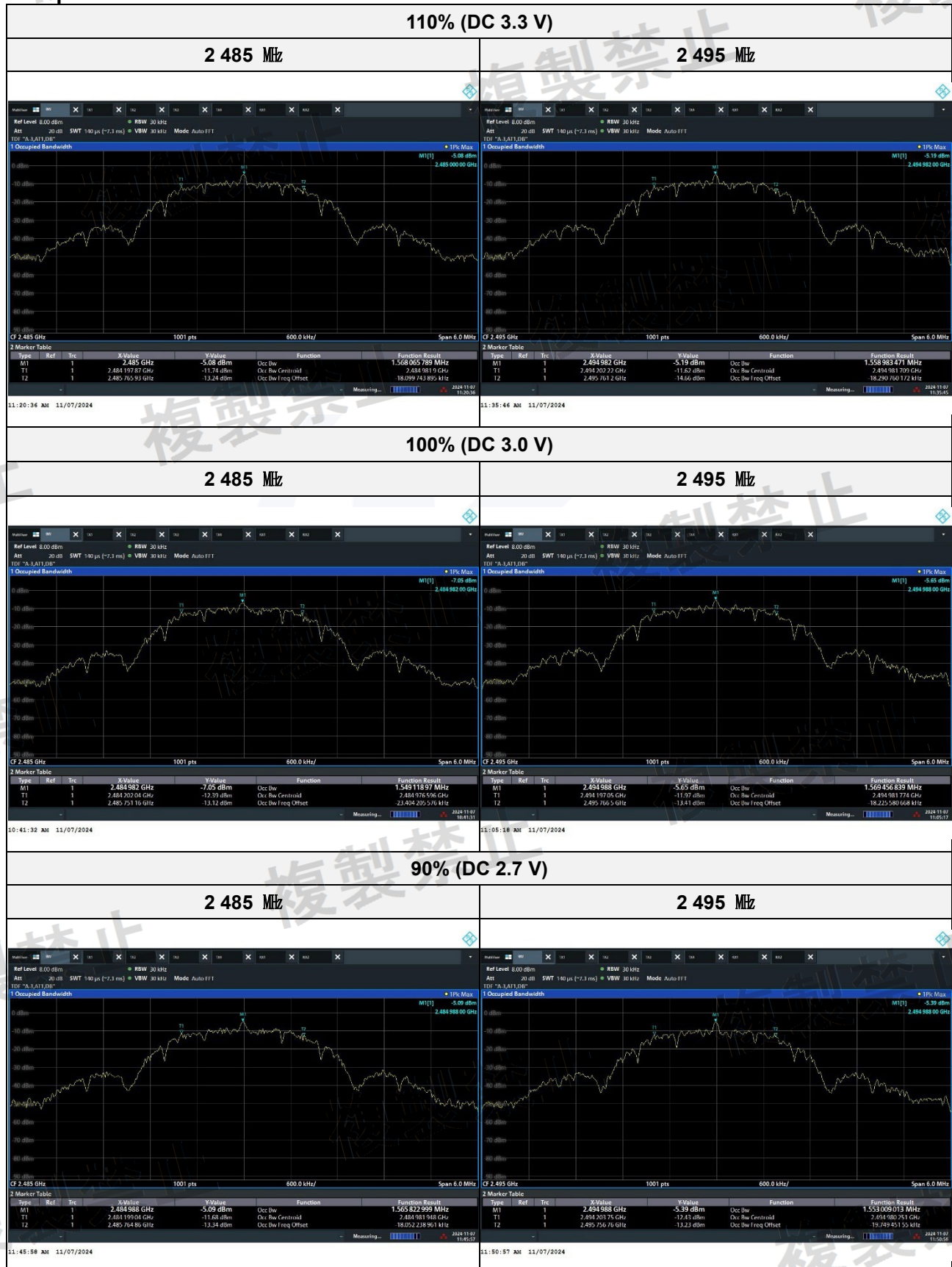
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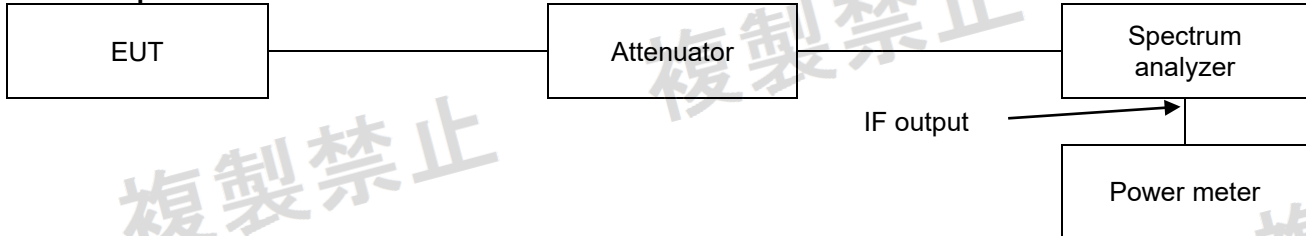
Test plots





3.4. RF output power

Test setup



Test procedure

- 1) Connect a power meter to IF outlet of the spectrum analyzer, and measure the maximum power
- 2) In case of continuous wave, antenna power is Compensate the maximum power of d) with (1)

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- (1) Measure equivalent noise bandwidth of the spectrum analyzer at 1MHz RBW, and compensate bandwidth as 1MHz equivalent band width.

Limit

Test mode	Rate power (mW)	Upper(mW) / +20%	Limit (mW)
Zigbee	10	12	10

Test results

Test voltage		Test mode	Frequency (MHz)	Output power (dBm/MHz)	Output power (mW)	E.I.R.P (dBm/MHz)	Deviation (%)
(%)	(V)						
110	DC 3.3	Zigbee	2 485	0.14	1.033	1.29	-89.67
			2 495	0.23	1.054	1.38	-89.46
100	DC 3.0	Zigbee	2 485	0.13	1.030	1.28	-89.70
			2 495	0.20	1.047	1.35	-89.53
90	DC 2.7	Zigbee	2 485	0.30	1.072	1.45	-89.28
			2 495	0.34	1.081	1.49	-89.19

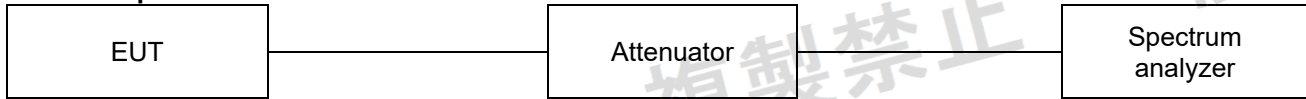
Note.

1. Output power is the result which the Burst Ratio is calculated.
2. E.I.R.P : Output power data + Ant. Max peak gain
3. Antenna gain : 1.15 dBi



3.5. Transmitter spurious emissions

Test setup



Test procedure

[Setting 1]

Setting of spectrum analyzer to measure spurious emission is as follows.

Sweep frequency range : $2\,471\text{ MHz} > f$ and $2\,497\text{ MHz} < f$,

$2\,445\text{ MHz} \leq f \leq 2\,471\text{ MHz}$ and $2\,497\text{ MHz} < f \leq 2\,523\text{ MHz}$

Resolution bandwidth : 1 MHz

Video bandwidth : Similar resolution bandwidth

Sweep time : The minimum time guaranteed measurement accuracy

Y axis scale : 10 dB/Div

Sweep mode : Single sweep

Detection mode : Positive Peak

Display mode : Maxhold

[Setting 2]

Setting of spectrum analyzer to measure spurious emission is as follows.

Sweep frequency range : Frequency of spurious emission found using [Setting 1]

Span : 0 Hz

Resolution bandwidth : 1 MHz

Video bandwidth : Similar resolution bandwidth

Sweep time : The minimum time guaranteed measurement accuracy

Y axis scale : 10 dB/Div

Sweep mode : Single sweep

Detection mode : Sample

Display mode : Maxhold

[Setting 3]

Setting of spectrum analyzer to measure spurious emission is as follows.

Sweep frequency range : $2\,445\text{ MHz} \leq f \leq 2\,471\text{ MHz}$ and $2\,497\text{ MHz} < f \leq 2\,523\text{ MHz}$

Resolution bandwidth : 30 kHz

Video bandwidth : Similar resolution bandwidth

Sweep time : The minimum time guaranteed measurement accuracy

Y axis scale : 10 dB/Div

Sweep mode : Single sweep

Detection mode : Sample

Display mode : Maxhold



1. After configuring the spectrum analyzer to [Setting 1], search for spurious emissions from 30 MHz to 12.5 GHz. If the sweep range does not cover the required measurement frequency range then the measurement range will need to be divided into sufficient sections of size [RBW x Sweep Data Points]. If spurious emissions greater than less Limit are found, then more detailed measurements are required, go to step (2)

2. Configure the spectrum analyzer using [Setting 2] and measure average signal amplitude. If the spurious emission is burst type (Intermittent), then the average value shall not include signal OFF time. If spurious emissions ranging from 30 MHz to 2 445 MHz and from 2 523 MHz to 12.5 GHz are over the limit, then the test result is Fail. If spurious emissions ranging from 2 445 MHz to 2 471 MHz and from 2 497 MHz to 2 523 MHz are over the limit, then further detailed measurements are required, go to step (3).

3. Calculate the spurious emission value (Calculated Value) using following the formula below:

Calculated Value = (Measured Value usin [Setting 3] + 15.22 dB)

Note: 15.2 dB adjustment is derived from the Conversion Factor of RBW

Conversion Factor of RBW = $10 \times \text{Log} (\text{Reference Bandwidth} / \text{RBW of measurement}) = 15.22 \text{ [dB]}$

Where: Reference Bandwidth = 1 MHz, RBW of measurement = 30 kHz

Limit

1. Less than 2 458 MHz : Equal or less than $2.5 \mu\text{W/MHz}$ ($\approx -26 \text{ dBm}$)
2. 2 458 MHz ~ 2 471 MHz : Equal or less than $25 \mu\text{W/MHz}$ ($\approx -16 \text{ dBm}$)
3. 2 497 MHz ~ 2 510 MHz : Equal or less than $25 \mu\text{W/MHz}$ ($\approx -16 \text{ dBm}$)
4. More than 2 510 MHz : Equal or less than $2.5 \mu\text{W/MHz}$ ($\approx -26 \text{ dBm}$)



Test results

Test item: Less than 2 458 MHz

Test voltage		Test mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm/MHz)
(%)	(V)				
110	DC 3.3	Zigbee	2 485	2209.40	-46.49
			2 495	2374.30	-46.13
100	DC 3.0	Zigbee	2 485	2427.70	-44.29
			2 495	2442.20	-44.25
90	DC 2.7	Zigbee	2 485	2219.10	-45.91
			2 495	2202.10	-45.89

Test item: 2 458 MHz ~ 2 471 MHz

Test voltage		Test mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm/MHz)
(%)	(V)				
110	DC 3.3	Zigbee	2 485	2465.89	-44.98
			2 495	2468.88	-45.99
100	DC 3.0	Zigbee	2 485	2461.81	-47.16
			2 495	2466.53	-47.28
90	DC 2.7	Zigbee	2 485	2469.98	-47.88
			2 495	2462.24	-47.41

Test item: 2 497 MHz ~ 2 510 MHz

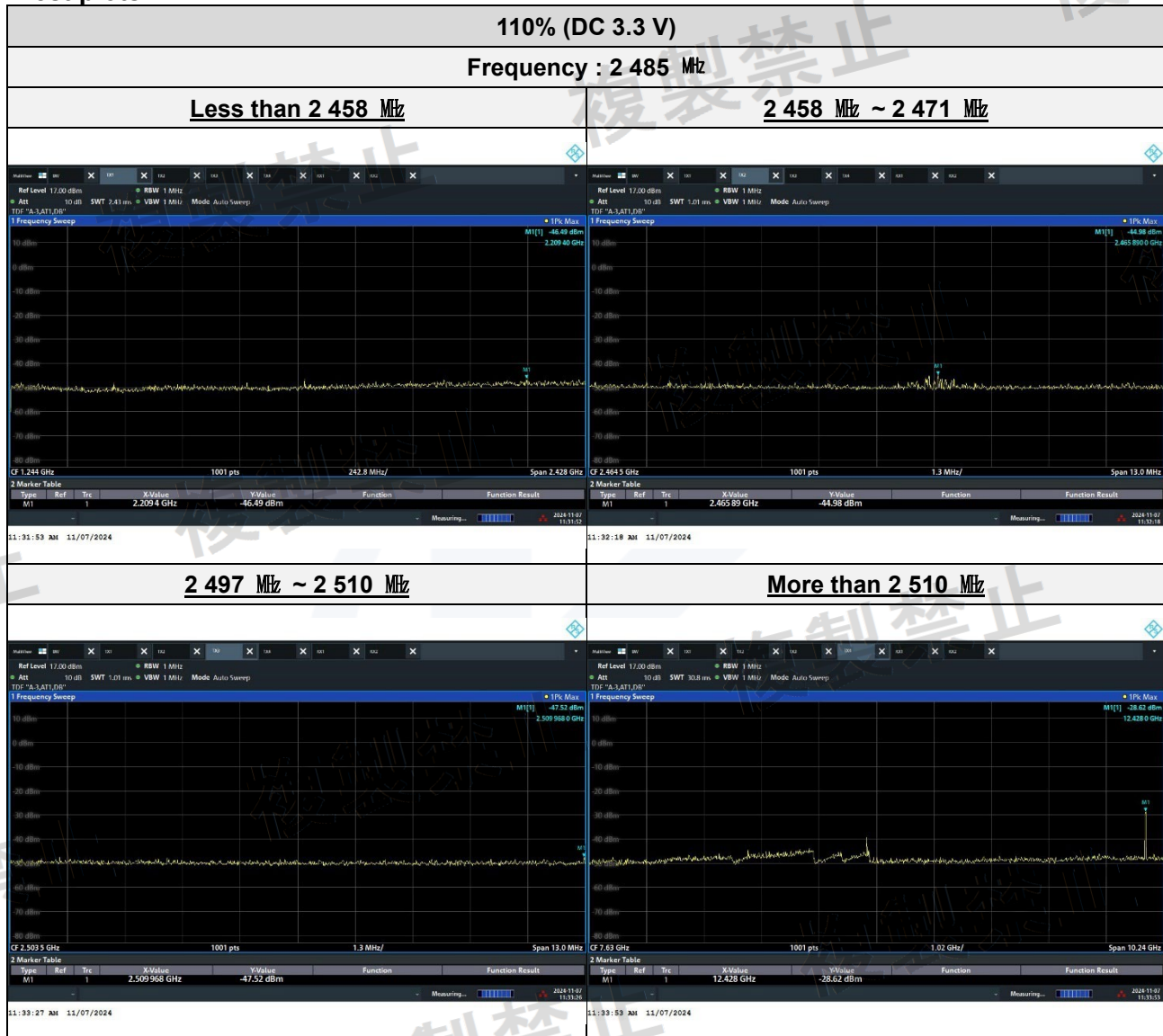
Test voltage		Test mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm/MHz)
(%)	(V)				
110	DC 3.3	Zigbee	2 485	2509.97	-47.52
			2 495	2497.01	-16.86
100	DC 3.0	Zigbee	2 485	2504.29	-44.31
			2 495	2497.03	-17.33
90	DC 2.7	Zigbee	2 485	2500.36	-47.13
			2 495	2497.02	-17.38

Test item: More than 2 510 MHz

Test voltage		Test mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm/MHz)
(%)	(V)				
110	DC 3.3	Zigbee	2 485	12428.0	-28.62
			2 495	12469.0	-29.06
100	DC 3.0	Zigbee	2 485	12418.0	-28.46
			2 495	12479.0	-28.91
90	DC 2.7	Zigbee	2 485	12418.0	-28.32
			2 495	12469.0	-28.72



Test plots

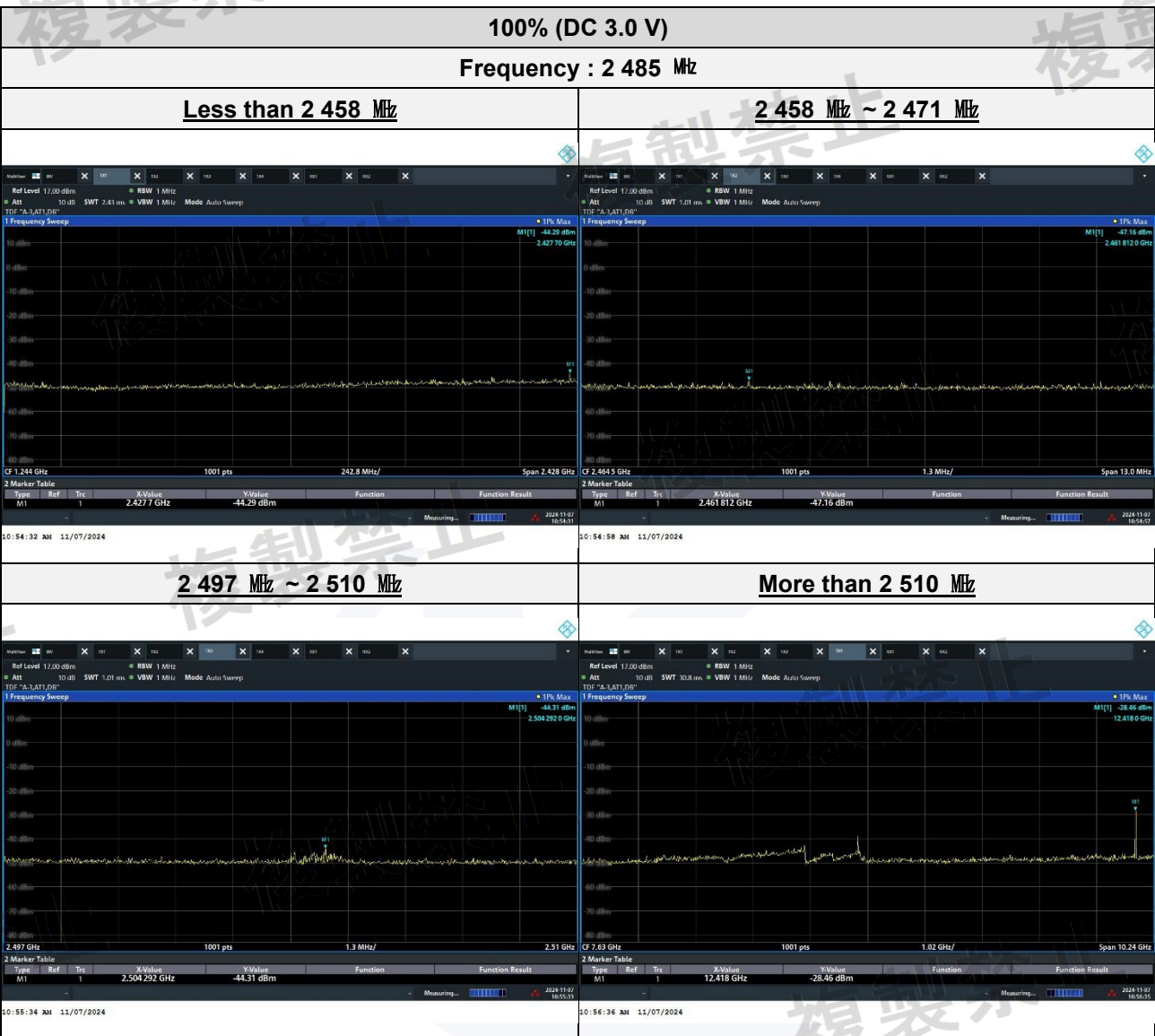




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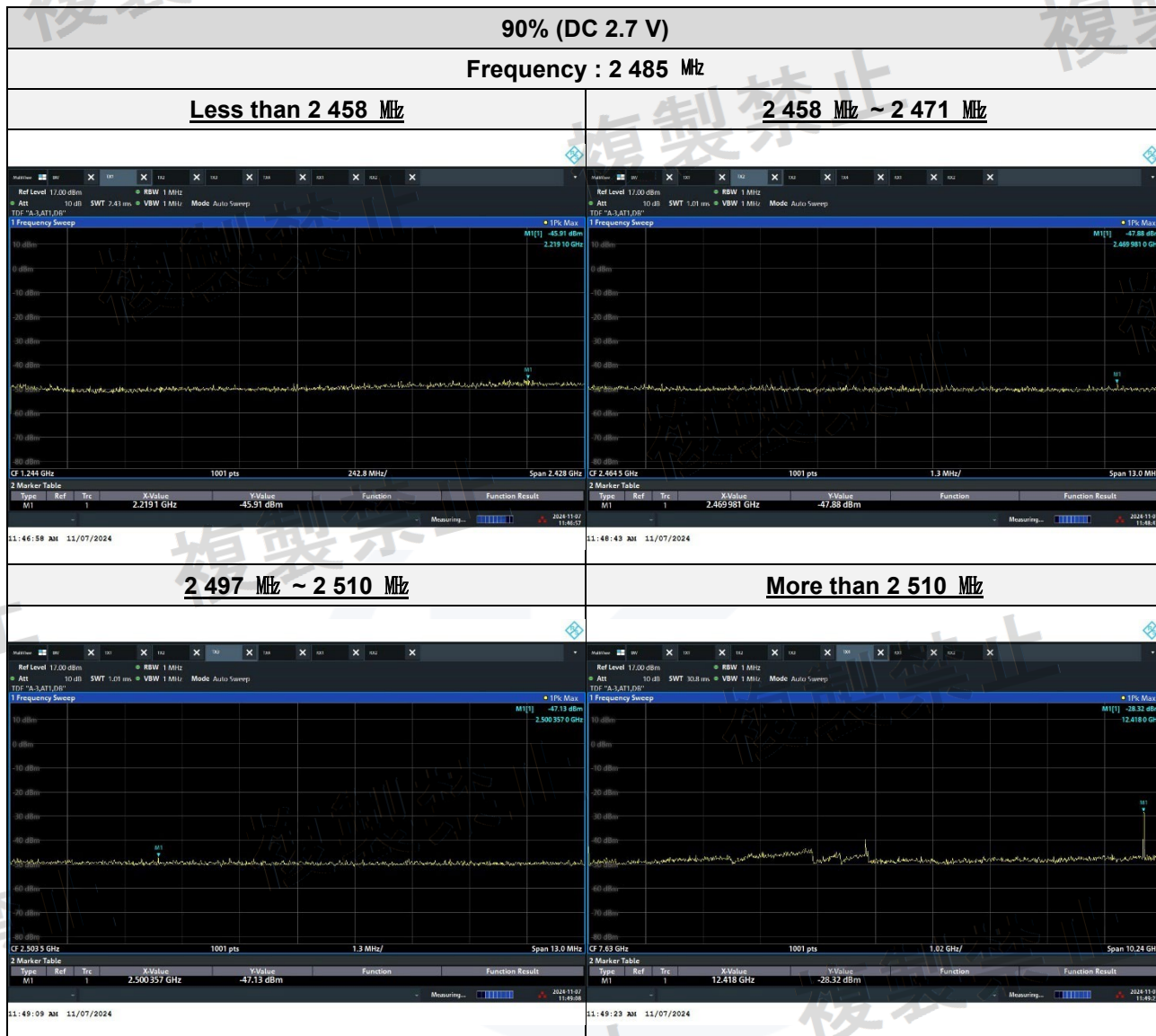




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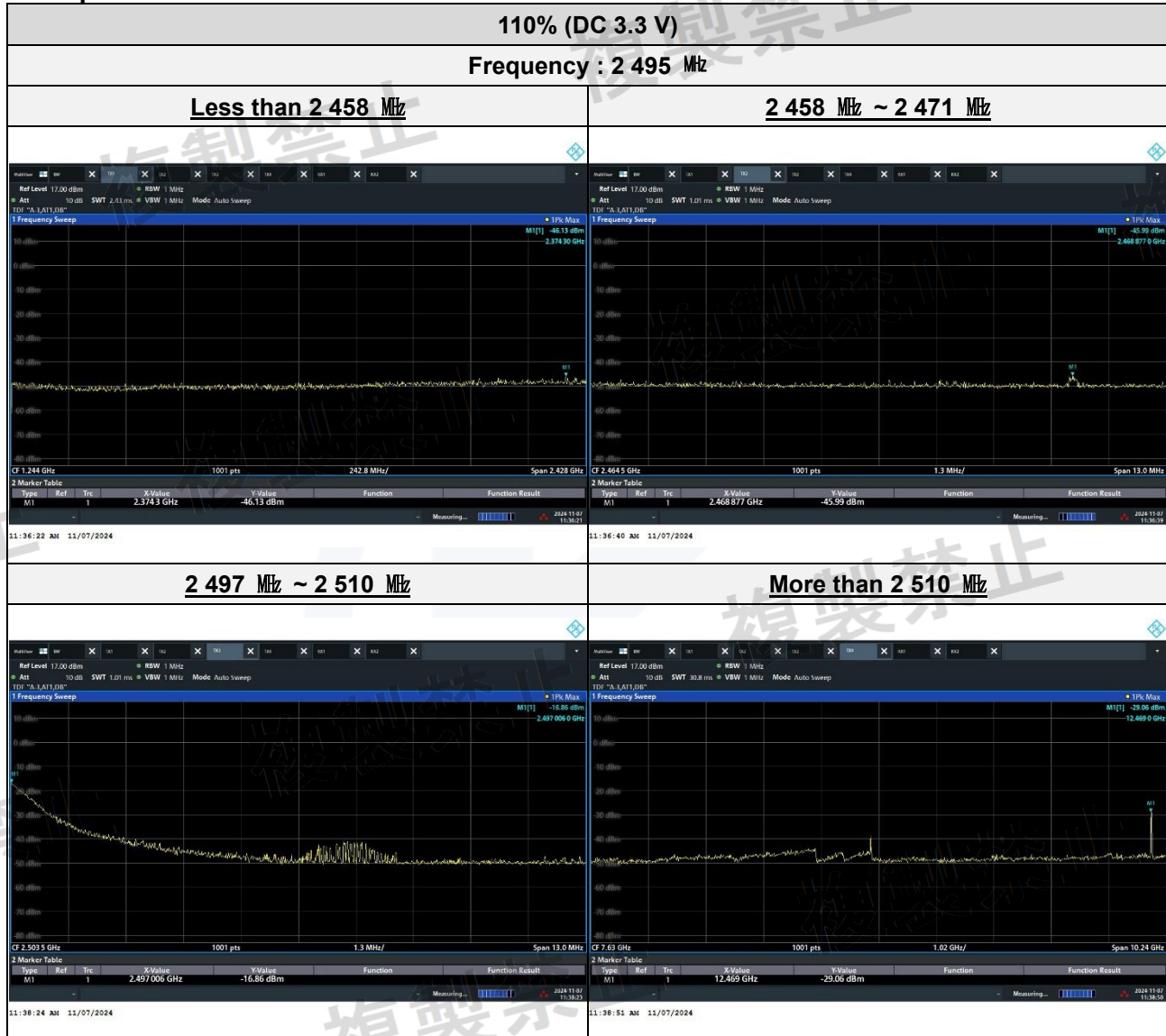
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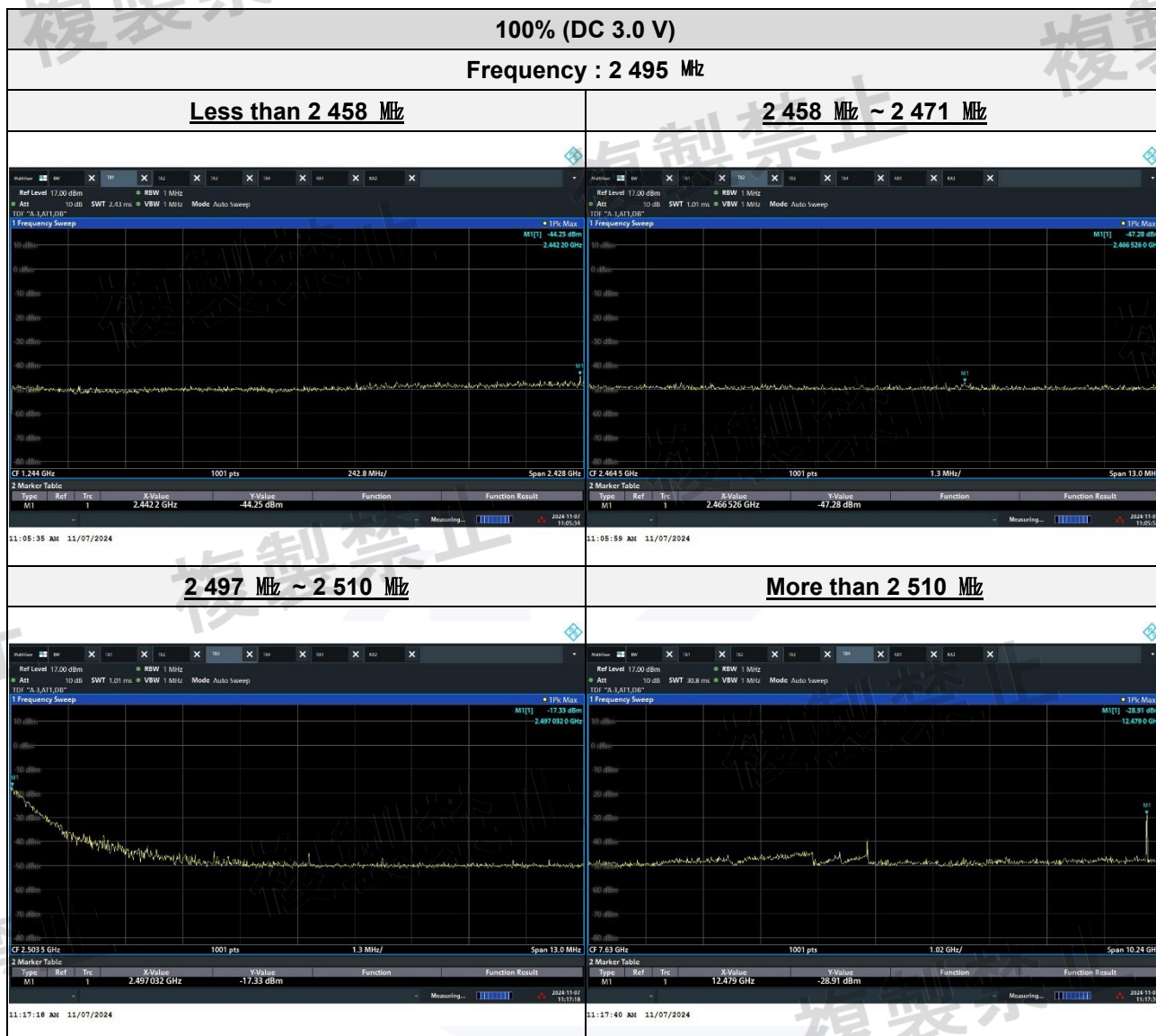
Test plots





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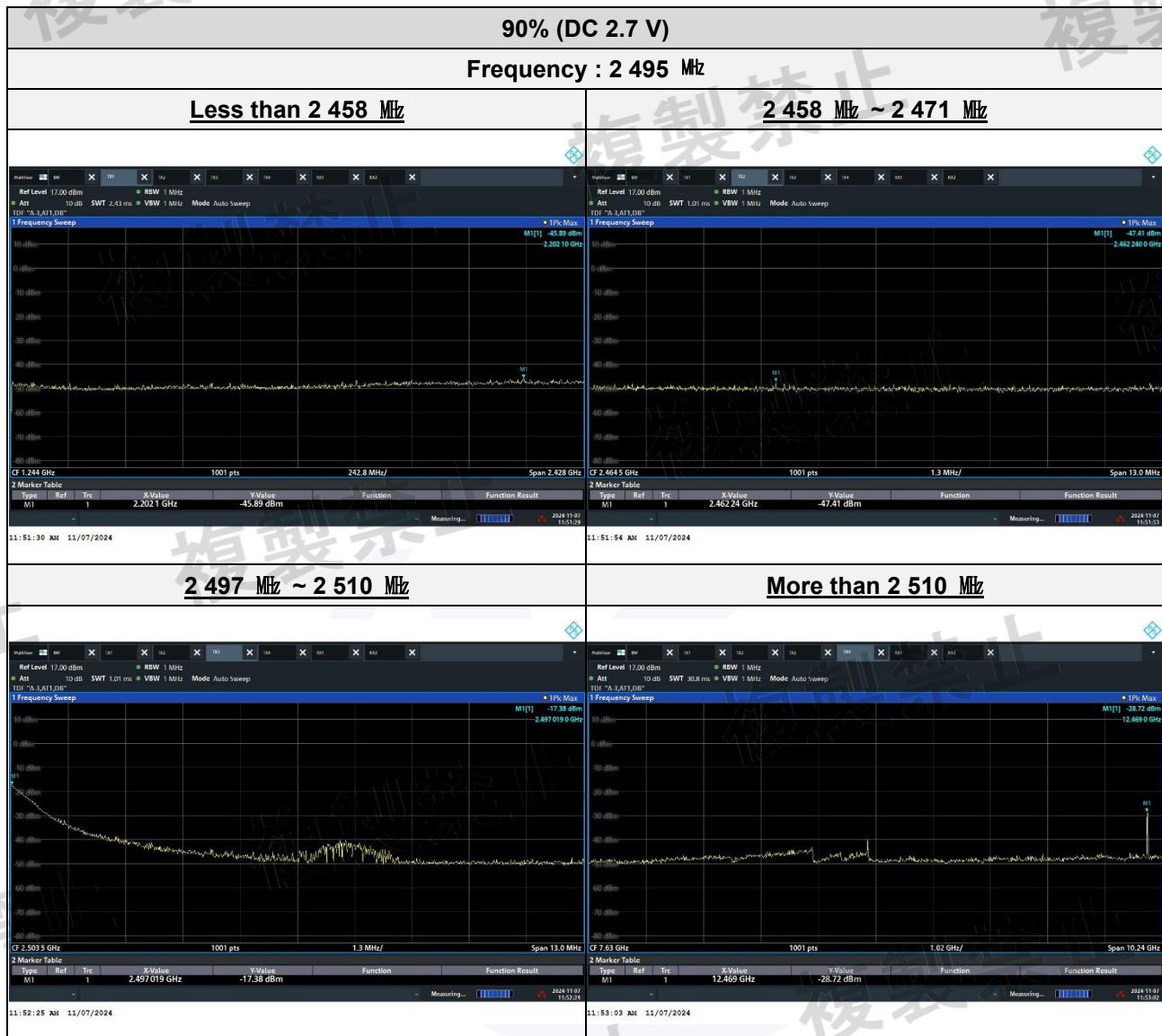
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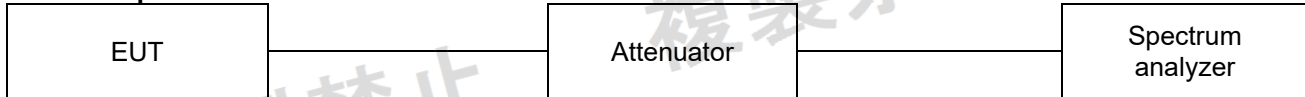
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3.6. Secondary radiated emissions

Test setup



Test procedure

(1) Setting of spectrum analyzer is as follows while searching a spurious emission.

Sweep frequency range : From 30 MHz up to 12.5 GHz

Resolution bandwidth : Less than 1 GHz : 100 kHz, 1 GHz or more : 1 MHz

Video bandwidth : Same as resolution bandwidth

Sweep time : The minimum time guaranteed measurement accuracy

Y axis scale : 10 dB/Div

Sweep mode : Single sweep

Detection mode : Positive Peak

(2) Setting of spectrum analyzer is as follows while measuring a spurious emission.

Center frequency : Detected spurious frequency

Sweep frequency range : 0 Hz

Resolution bandwidth : Less than 1 GHz : 100 kHz, 1 GHz or more : 1 MHz

Video bandwidth : Same as resolution bandwidth

Sweep time : The minimum time guaranteed measurement accuracy

Y axis scale : 10 dB/Div

Sweep mode : Single sweep

Detection mode : Sample

Limit

1. Less than 1 GHz : Equal or less than 4 nW($\approx$ -53.98 dBm)

2. 1 GHz ~ less than 12.5 GHz : Equal or less than 20 nW($\approx$ -46.99 dBm)

Test results

Test item: Less than ~ 1 GHz

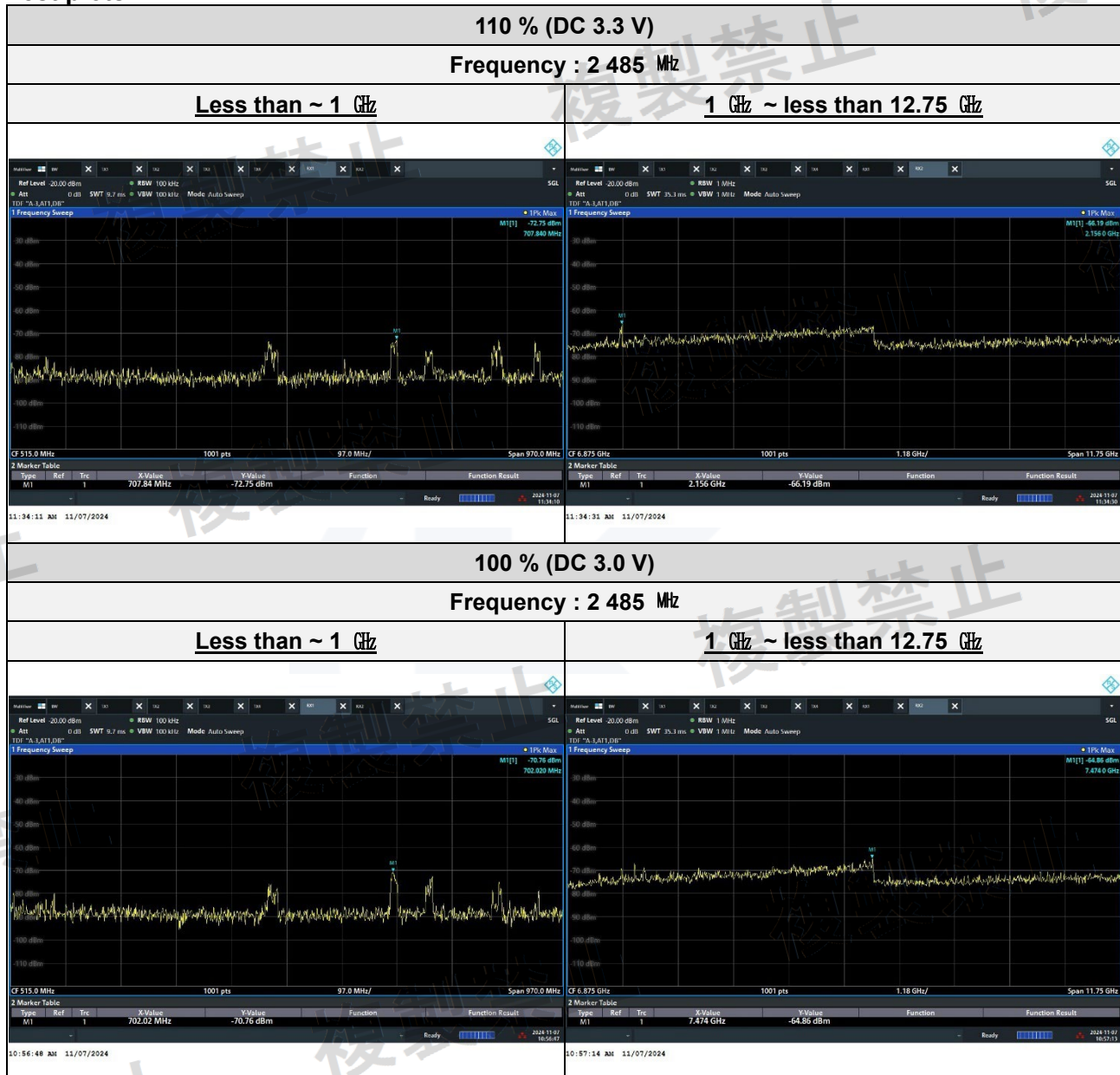
Test voltage		Test mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm)
(%)	(V)				
110	DC 3.3	Zigbee	2 485	707.84	-72.75
			2 495	706.87	-71.68
100	DC 3.0	Zigbee	2 485	702.02	-70.76
			2 495	887.11	-72.09
90	DC 2.7	Zigbee	2 485	483.02	-68.69
			2 495	707.84	-68.18

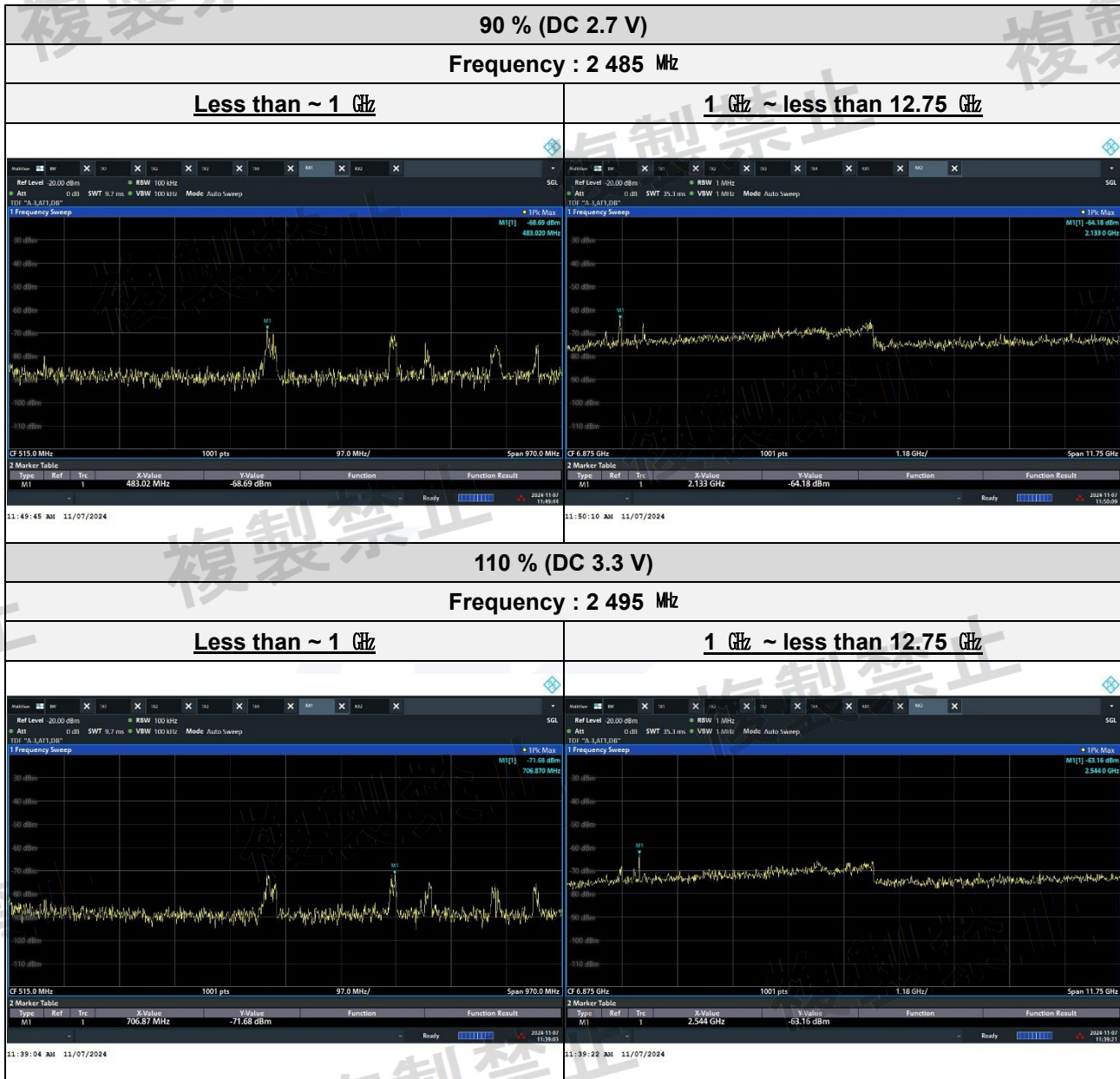
Test item: 1 GHz ~ less than 12.5 GHz

Test voltage		Test mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm)
(%)	(V)				
110	DC 3.3	Zigbee	2 485	2156.00	-66.19
			2 495	2544.00	-63.16
100	DC 3.0	Zigbee	2 485	7474.00	-64.86
			2 495	2438.00	-63.13
90	DC 2.7	Zigbee	2 485	2133.00	-64.18
			2 495	5607.00	-64.69



Test plots

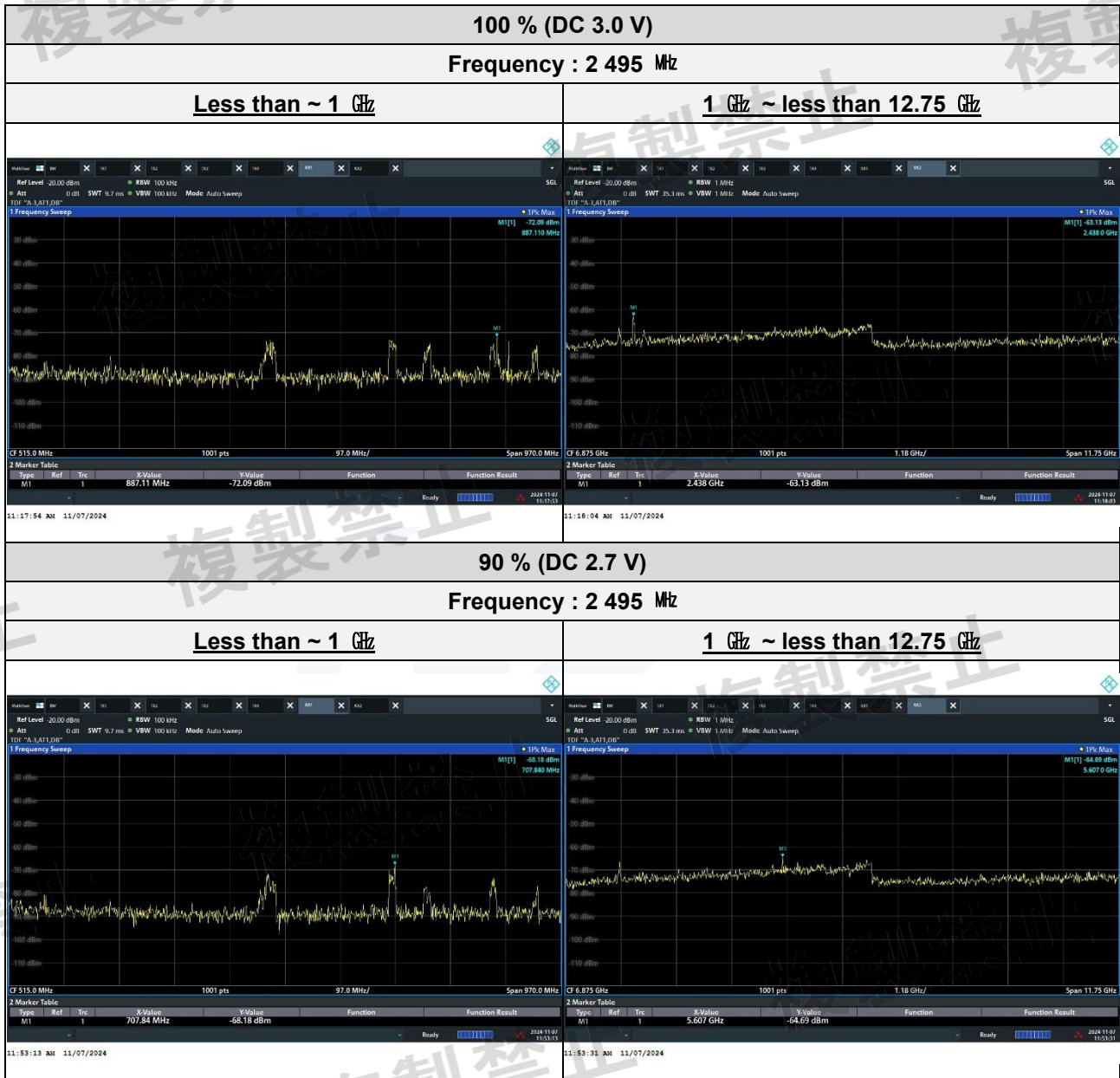






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**Appendix A. Measurement equipment**

Equipment 24-2 paragraph4 「ハ」	Manufacturer	Model	Serial No.	Calibration Interval	Calibration Lab	Calibration due.
SPECTRUM ANALYZER	R&S	FSV40-N	102194	1 year	HCT	2025.08.05
SPECTRUM ANALYZER	R&S	FSV3030	101800	1 year	HCT	2025.01.11
SIGNAL GENERATOR	Anritsu	68369B	992113	1 year	HCT	2025.01.11
Power Meter	Anritsu	ML2495A	1438001	1 year	HCT	2025.01.11
Pulse Power Sensor	Anritsu	MA2411B	1339205	1 year	HCT	2025.01.11
ATTENUATOR	Mini-Circuits	BW-S10- 2W263+	1	1 year	HCT	2025.01.15
DC POWER SUPPLY	HP	6632B	MY43004114	1 year	HCT	2025.01.11
Frequency Counter	HP	5352B	3049A01336	1 year	HCT	2025.01.12
DIGITAL MULTI METER	TEKTRONIX	DMM916	138401	1 year	HCT	2025.01.11

* 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.,	LG15U47	612QCGW556391
Test jig	N/A	N/A	N/A

The end.