

# TEST REPORT

of

## ARIB STD-T66

Equipment Under Test : KamiBot Pi  
 Model Name : KamiBot Pi-001  
 Applicant : 3.14 Co., Ltd.  
 Manufacturer : 3.14 Co., Ltd.  
 Date of Receipt : 2019.09.30  
 Date of Test(s) : 2019.11.14 ~ 2019.11.20  
 Date of Issue : 2019.12.10

In the configuration tested, the EUT complied with the standards specified above.

**Tested By:**



Lily Jung

**Date:**

**2019.12.10**

**Technical Manager:**



Hyunchoe You

**Date:**

**2019.12.10**

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## 1. General information

### 1.1. Testing laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

- Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>.

Phone No. : +82 31 688 0901

Fax No. : +82 31 688 0921

### 1.2. Details of applicant

Applicant : 3.14 Co., Ltd.

Address : 201, 40, Yeonam-ro, Buk-gu, Daegu, Republic of Korea

Contact Person : Chae, Deok-byeong

Phone No. : +82 70 5102 9367

### 1.3. Details of manufacturer

Company : Same as applicant

Address : Same as applicant

### 1.4. Description of EUT

<b>Kind of Product</b>	KamiBot Pi
<b>Model Name</b>	KamiBot Pi-001
<b>Power Supply</b>	DC 3.70 V
<b>Frequency Range</b>	2 402 MHz ~ 2 480 MHz
<b>Modulation Technique</b>	GFSK
<b>Number of Channels</b>	40 channels
<b>Antenna Type</b>	Internal Antenna
<b>Antenna Gain</b>	2.30 dB i

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## 1.5. Test Equipment List

Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Authority	Cal. Authority
Spectrum Analyzer	R&S	FSV30	101004	Jun. 19, 2019	SICT	c)
Signal Generator	R&S	SMF100A	102098	Sep. 07, 2019	SICT	c)
Attenuator	MCLI	FAS-12-10	2	Jun. 07, 2019	SICT	c)
DC Power Supply	R&S	HMP2020	020089489	May. 21, 2019	SICT	c)
DIGITAL MULTIMETER	HIOKI	DT4211	N0301231	Sep. 18, 2019	SICT	c)

### Note;

- a): Calibration conducted by the National Institute of Information and Communications Technology or a designated calibration agency under Article 102-18 paragraph (1).
- b): Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law. (Law No. 51 of 1992)
- c): Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1).
- d): Calibration conducted by using other equipment that listed above from a) to c).

## 1.6. Test method

Measurement was conducted by the following test method:

The test method of Ordinance Concerning Technical Regulations Conformity Certification etc. of Specified Radio Equipment in Annex 1, the Ministry of Internal Affairs and Communication notification in Annex 43 of Article 88, Paragraph 1 or the test method more than equivalent.

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RTT5041-19(2019.04.24)(1)

Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210mm x 297mm)

## 1.7. Summary of test results

The EUT has been tested according to the following specifications:

Applied standard : Radio equipment regulations and ARIB STD-T66		
Article Reference	Test item	Result
STD-T66 3.2	Frequency Tolerance	Complied
STD-T66 3.2	Occupied Bandwidth (99 %)	Complied
STD-T66 3.2	Spurious Emission Intensity	Complied
STD-T66 3.2	Antenna Power	Complied
STD-T66 3.3	Secondary Radiated Emissions	Complied

## 1.8. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL014587	2019.12.10	Initial

## 1.9. Abbreviations

$V_{min}$  : Minimum Voltage  
 $V_{nom}$  : Nominal Voltage  
 $V_{max}$  : Maximum Voltage

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## 2. Frequency Tolerance

### 2.1. Test Setup



### 2.2. Limit

Tolerance of frequency:  $\pm 50 \times 10^{-6}$  or less.

### 2.3. Test procedure

1. Connect transmitter output to the spectrum analyzer input port.
2. The EUT should be transmitting at low, middle and high channels.
3. Set the spectrum analyzer as below;

Center frequency:	2 402 MHz, 2 442 MHz, 2 480 MHz (Bluetooth Low Energy)
Span:	3 MHz
RBW:	1 kHz
VBW:	1 kHz
Sweep time:	Auto
Sweep data points:	1 001 or greater
Detector mode:	Positive peak
Indication mode:	Max hold

4. Find the peak carrier signal and measure its frequency.

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## 2.4. Test result

Ambient temperature : (23 ± 1) °C  
 Relative humidity : 47 % R.H.

- Test mode: Modulated (GFSK)

Test voltage (V <sub>d.c.</sub> )	Measured frequency (MHz)	Reading frequency (MHz)	Frequency tolerance [ppm]
V <sub>nom</sub> = 3.70	Low Ch. (2 402)	2 402.027 000	11.24
	Middle Ch. (2 442)	2 442.030 000	12.29
	High Ch. (2 480)	2 480.030 000	12.10

### Note;

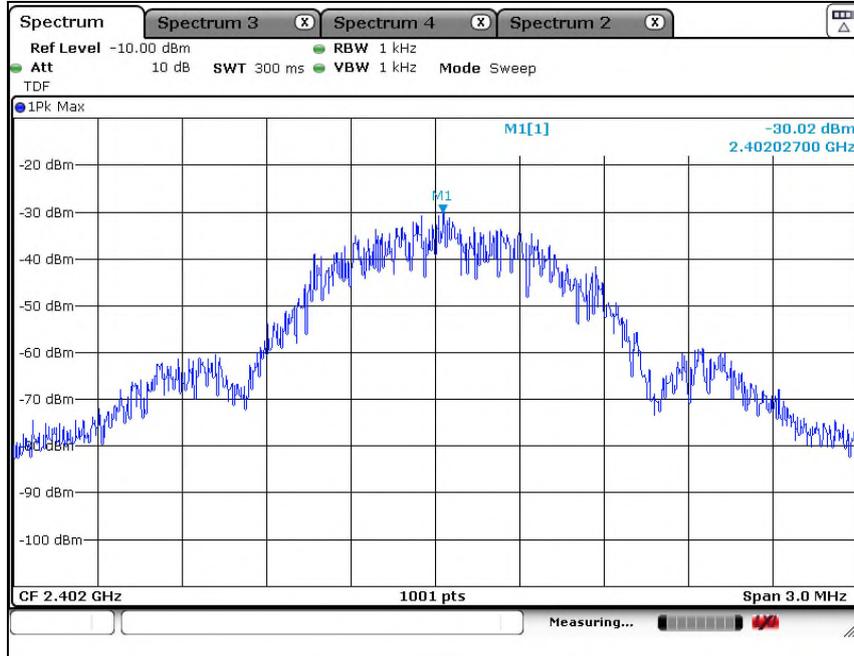
- FT (ppm) = [(RF-MF)/MF] × 10<sup>6</sup>  
 - FT: Frequency Tolerance, RF: Reading Frequency and MF: Measurement Frequency

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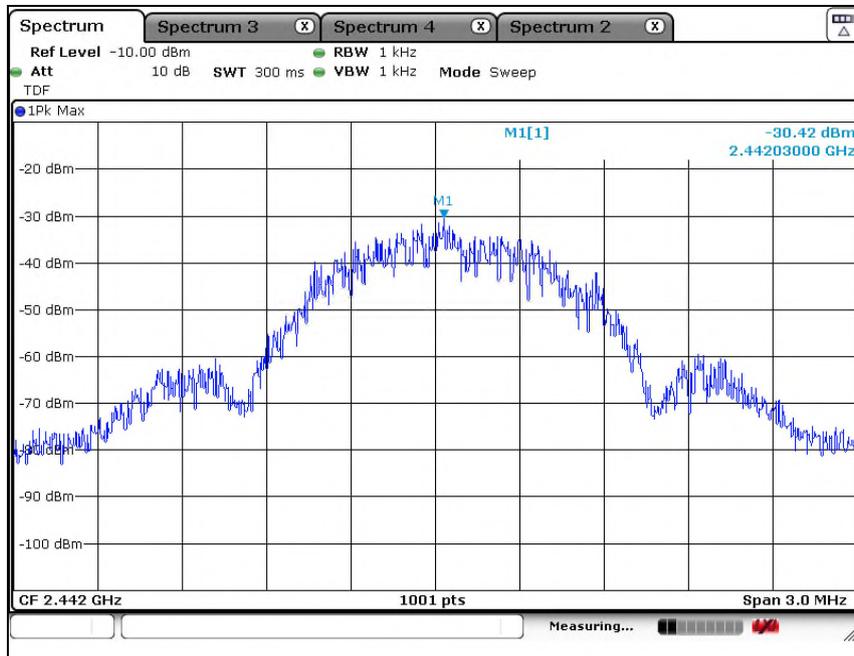
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## - Test mode: Modulated (GFSK)

Low channel



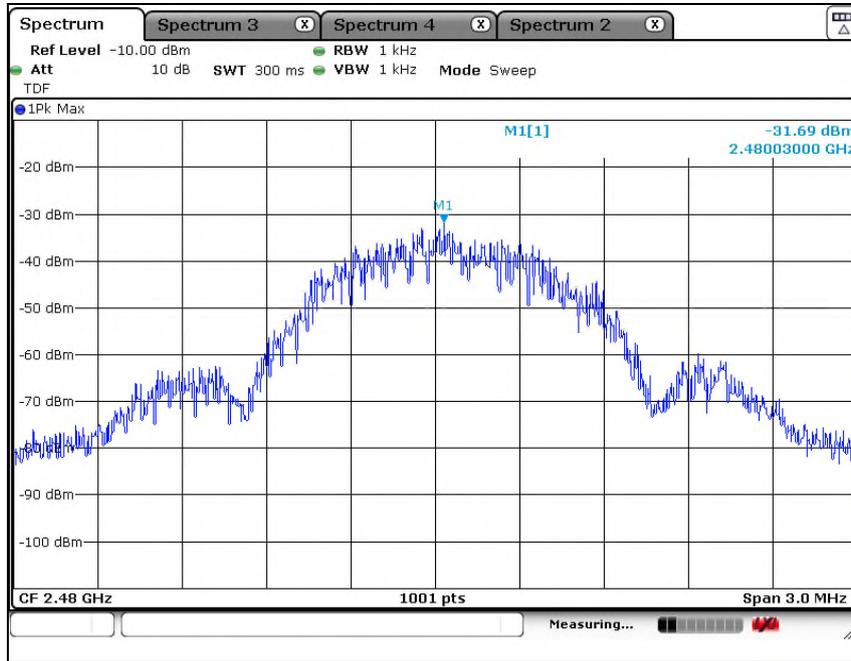
Middle channel



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High channel



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### 3. Occupied Bandwidth (99 %)

#### 3.1. Test Setup



#### 3.2. Limit

26 MHz or less

#### 3.3. Test Procedure

1. Connect transmitter output to the spectrum analyzer input port.
2. Measure the signal bandwidth using a spectrum analyzer.
3. Set the spectrum analyzer as below;

Center frequency:	2 402 MHz, 2 442 MHz, 2 480 MHz
Span:	10 MHz
RBW:	300 kHz
VBW:	300 kHz
Sweep time:	Auto
Sweep data points:	1 001 or greater
Detector mode:	Positive peak
Indication mode:	Max hold
BW setting:	99 %

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### 3.4. Test result

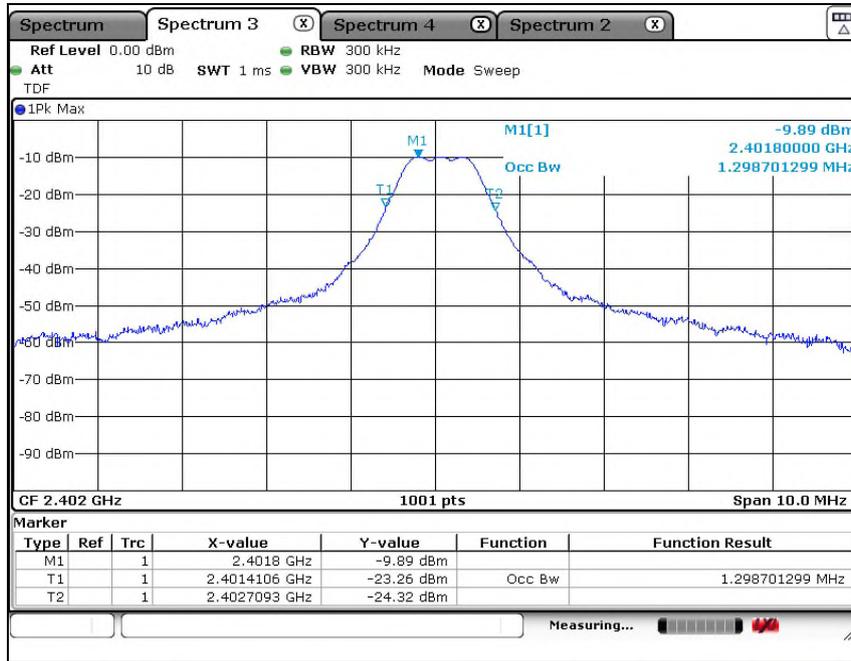
Ambient temperature : (23 ± 1) °C  
 Relative humidity : 47 % R.H.

Test voltage (V <sub>d.c.</sub> )	Measured frequency (MHz)	Occupied bandwidth (MHz)
V <sub>nom</sub> = 3.70	Low Ch. (2 402)	1.30
	Middle Ch. (2 442)	1.31
	High Ch. (2 480)	1.32

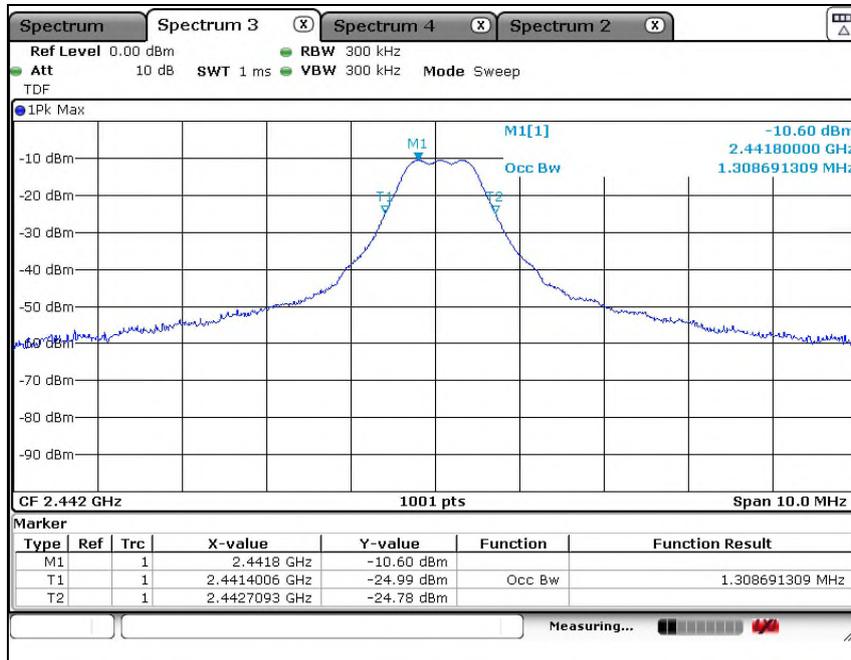
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Low channel

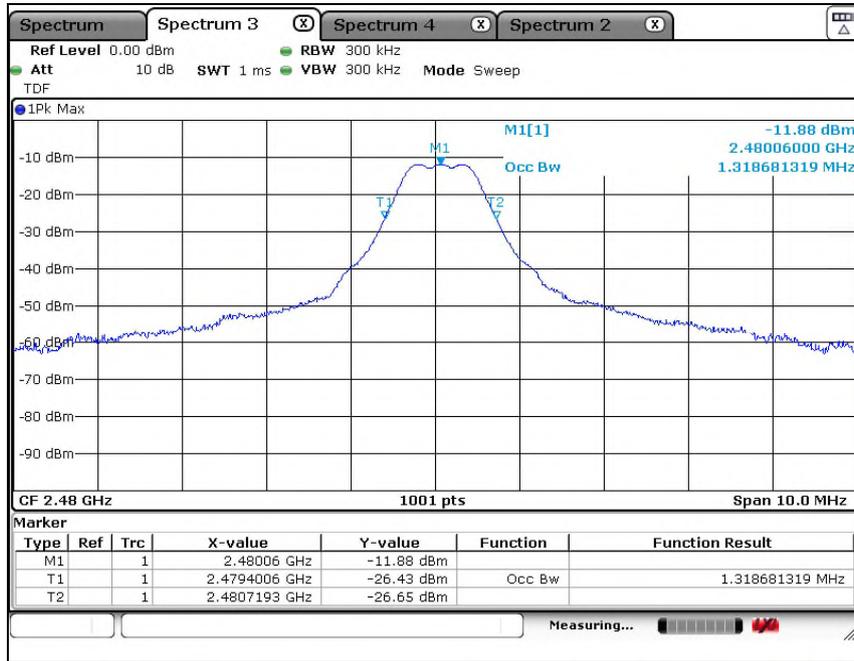


Middle channel



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High channel



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## 4. Spurious Emission Intensity

### 4.1. Test Setup



### 4.2. Limit

Below 2 387 MHz:	2.5 $\mu$ W (-26 dB m)/MHz or less
2 387 to 2 400 MHz:	25.0 $\mu$ W (-16 dB m)/MHz or less
2 483.5 to 2 496.5 MHz:	25.0 $\mu$ W (-16 dB m)/MHz or less
Over 2 496.5 MHz:	2.5 $\mu$ W (-26 dB m)/MHz or less

### 4.3. Test Procedure

1. Connect transmitter output to the spectrum analyzer input port.
2. Configure the EUT
  - Test channels: low, middle, high

Frequency range:	30 MHz to 12.5 GHz, except for 2 400 MHz to 2 483.5 MHz
RBW:	1 MHz
VBW:	1 MHz
Sweep time:	Minimum time required to make an accurate measurement
Sweep data points:	1 001 or greater
Detector mode:	Positive peak
Indication mode:	Max hold

Note: sweep shall be repeated until the max hold waveform is stable.

3. Search for spurious emissions from 30 MHz to 12.5 GHz

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#### 4.4. Test result

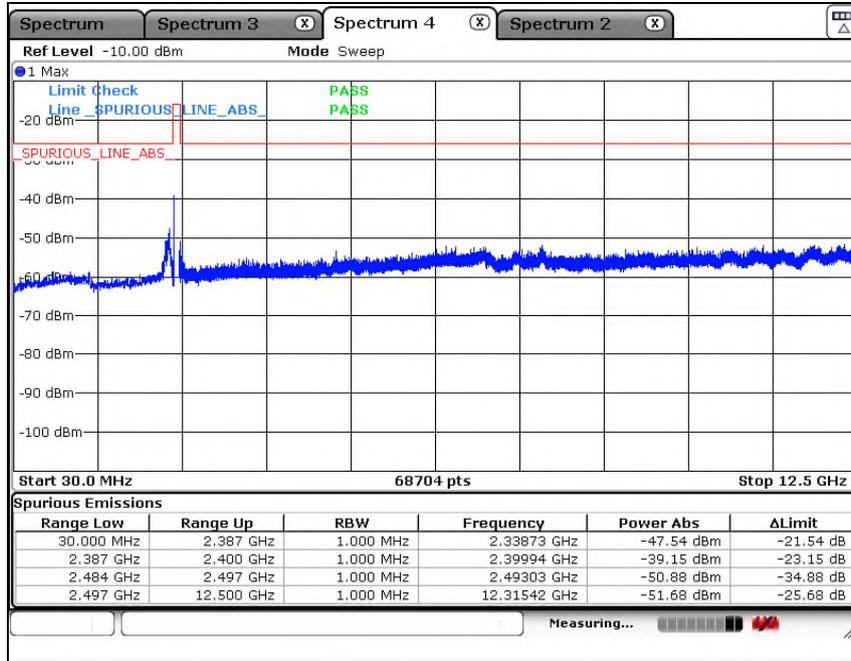
Ambient temperature : (23 ± 1) °C  
 Relative humidity : 47 % R.H.

Test voltage (V <sub>d.c.</sub> )	Frequency range (MHz)	Measured	Low Ch. (2 402 MHz)	Middle Ch. (2 442 MHz)	High Ch. (2 480 MHz)	Limit
V <sub>nom</sub> = 3.70	Below 2 387	Frequency (GHz)	2.339	2.372	2.353	-
		Level (dB m/MHz)	-47.54	-51.65	-52.79	-26
		Level (μW/MHz)	0.017 620	0.006 839	0.005 260	2.5
	2 387 to 2 400	Frequency (GHz)	2.400	2.392	2.388	-
		Level (dB m/MHz)	-39.15	-49.68	-50.05	-16
		Level (μW/MHz)	0.121 619	0.010 765	0.009 886	25
	2 483.5 to 2 496.5	Frequency (GHz)	2.493	2.492	2.484	-
		Level (dB m/MHz)	-50.88	-51.02	-49.03	-16
		Level (μW/MHz)	0.008 166	0.007 907	0.012 503	25
	Above 2 496.5	Frequency (GHz)	12.315	11.894	11.721	-
		Level (dB m/MHz)	-51.68	-51.98	-51.14	-26
		Level (μW/MHz)	0.006 792	0.006 339	0.007 691	2.5

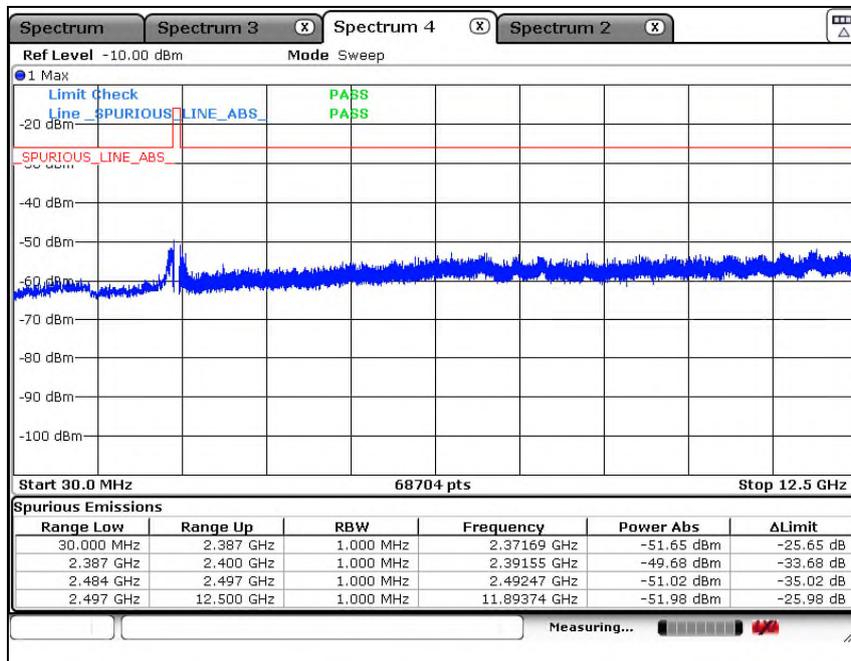
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Low channel

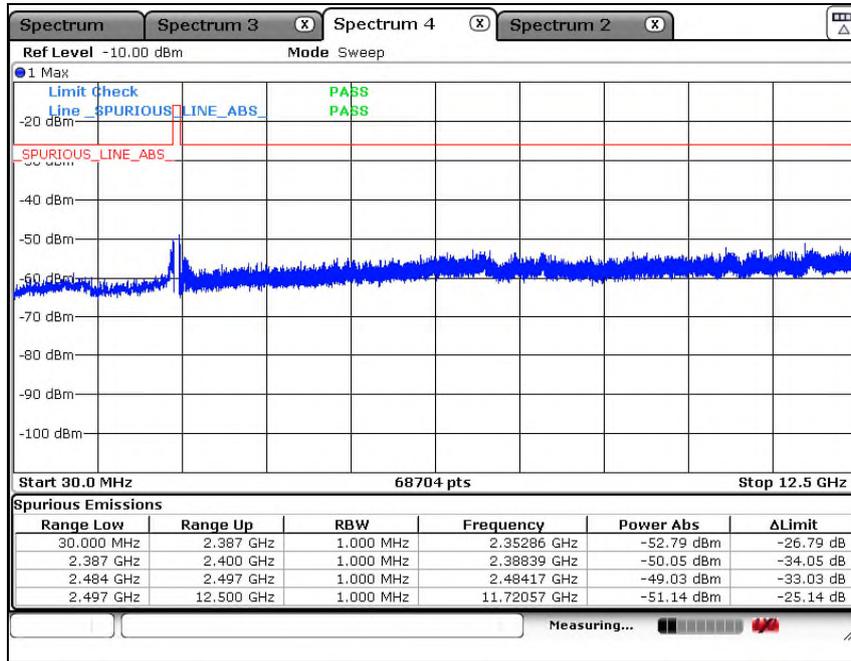


Middle channel



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High channel



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## 5. Antenna Power

### 5.1. Test setup



### 5.2. Limit

The difference between measured output power and the rated output power shall be within a tolerance of +20 % to -80 %. In addition, the rated output power shall not be over the limits shown below.

Limit (rated output power, upper limit)

- 10 mW or less

### 5.3. Test procedure

1. Connect transmitter output to the spectrum analyzer input port.

2. Configure the spectrum analyzer as below;

–Search for peak power frequency according to below settings

Center frequency: 2 402 MHz, 2 442 MHz, 2 480 MHz

Span: 10 MHz

RBW: 1 MHz

VBW: 3 MHz

Sweep time: Auto

Sweep data points: 1 001 or greater

Detector mode: Positive peak

Indication mode: Max hold

Find the frequency of maximum transmitted power

–Measurement of average antenna power according to below settings

Center frequency: Frequency of peak power

Span: 0 Hz

RBW: 3 MHz

VBW: 3 MHz

Sweep: Minimum time required to make an accurate measurement.

For burst type (intermittent) transmission, sweep time shall be greater than one burst Interval.

Sweep data points: 1 001 or greater

Detector mode: Sample

Measure the Average Burst Power of the frequency

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## 5.4. Test result

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

Test voltage (V <sub>d.c.</sub> )	Channel	Antenna gain (dB i)	Rated Output Power			E.I.R.P. (dB m)	Average Burst Power			Power Tolerance (%)
V <sub>nom</sub> = 3.70	Low Ch. (2 402 MHz)	2.30	0.10 mW	-10.00 dB m	-7.70	0.10 mW	-9.80 dB m	0.00		
	Middle Ch. (2 442 MHz)	2.30	0.10 mW	-10.00 dB m	-7.70	0.09 mW	-10.55 dB m	-10.00		
	High Ch. (2 480 MHz)	2.30	0.10 mW	-10.00 dB m	-7.70	0.06 mW	-11.94 dB m	-40.00		

### Note;

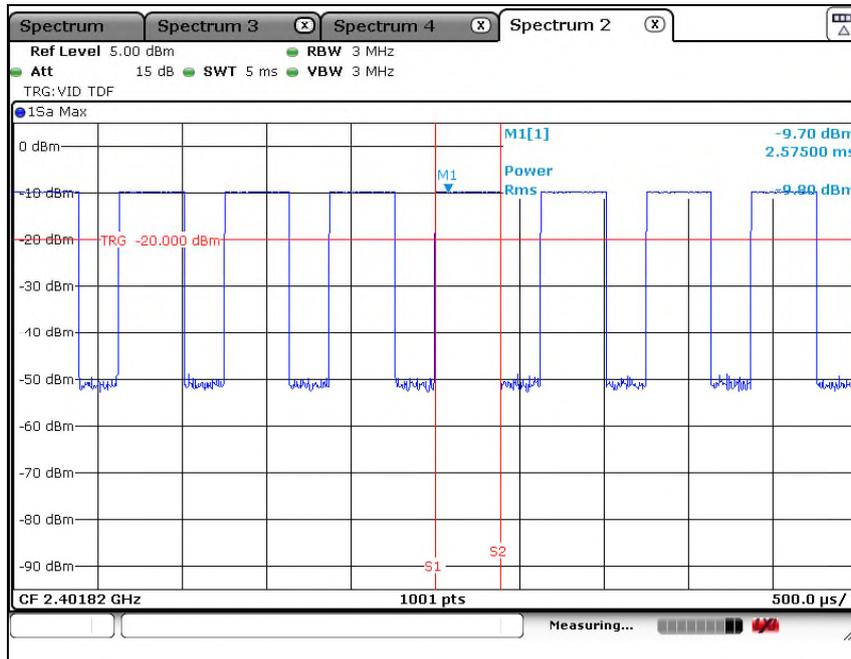
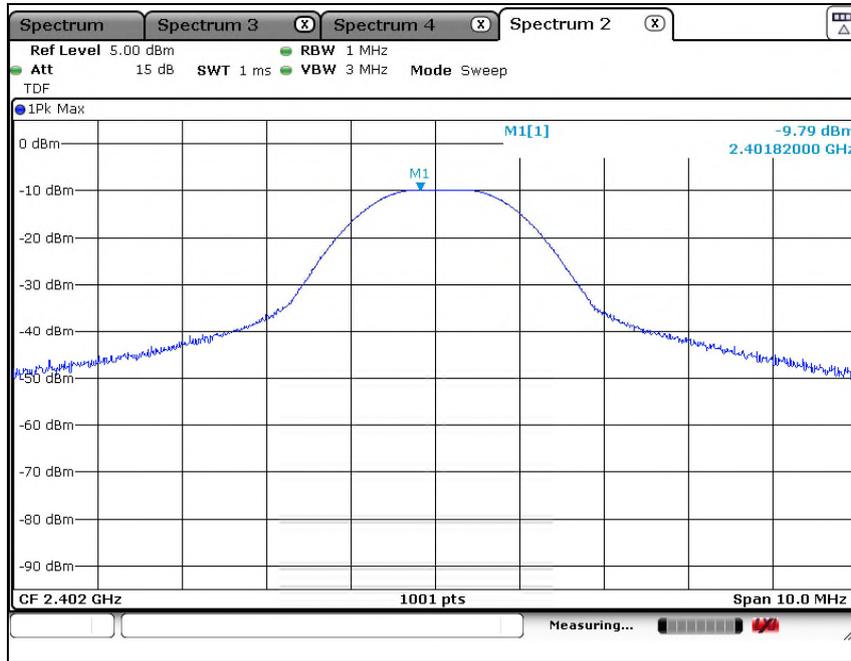
Antenna Power (mW) = Average Burst Power (mW)

Power Tolerance (%) = {[Antenna Power (mW) - Rated Output Power (mW)] ÷ Rated Output Power (mW)} × 100

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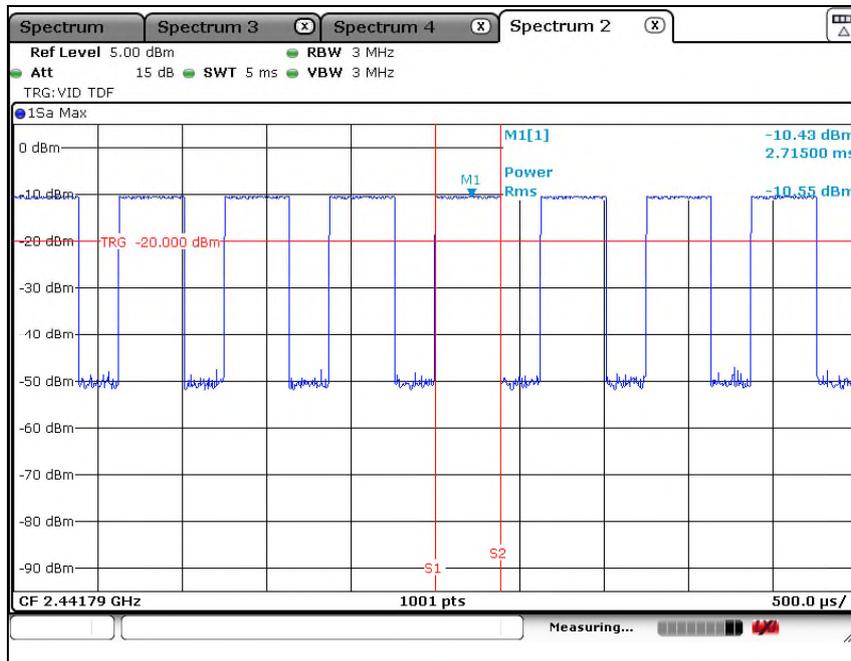
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Low channel



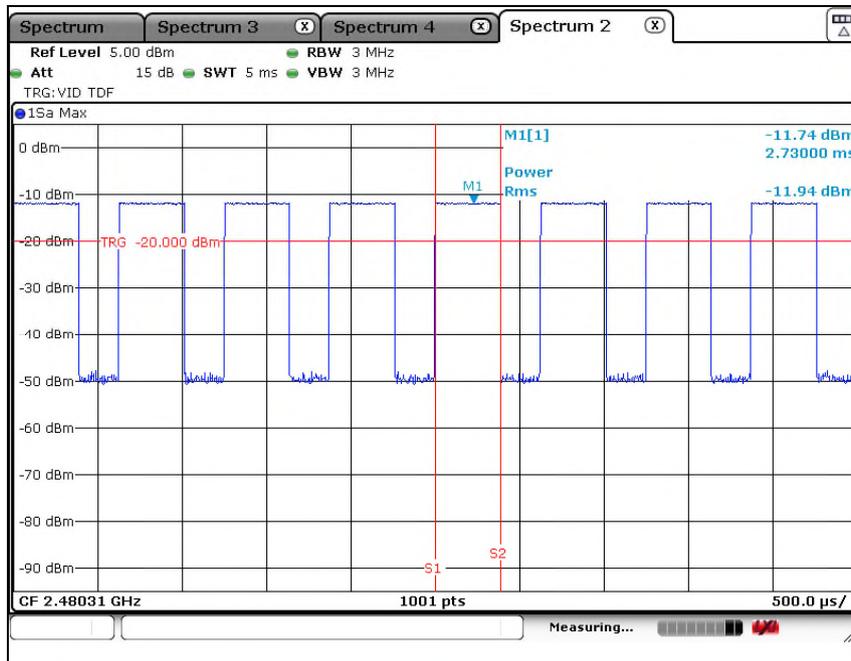
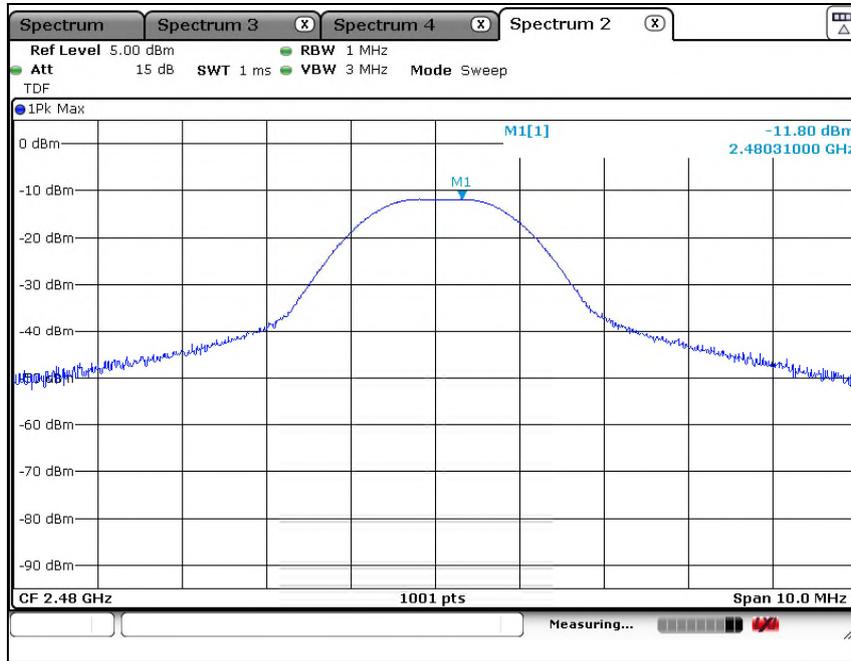
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Middle channel



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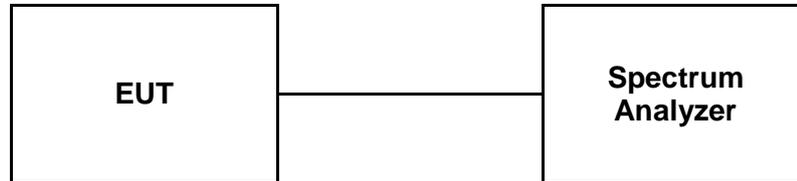
High channel



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## 6. Secondary Radiated Emissions

### 6.1. Test Setup



### 6.2. Limit

Below 1 GHz : 4 nW (-54 dB m) or less  
 Above 1 GHz : 20 nW (-47 dB m) or less

### 6.3. Test Procedure

1. Configure the spectrum analyzer as below;

Frequency range: 30 MHz - 12.5 GHz  
 RBW: Below 1 GHz: 100 kHz  
       Above 1 GHz: 1 MHz  
 VBW: Below 1 GHz: 100 kHz  
       Above 1 GHz: 1 MHz  
 Sweep time: Auto  
 Sweep data points: 1 001 or greater  
 Detector mode: Positive peak  
 Indication mode: Max hold

Search for spurious emissions in the range 30 MHz to 12.5 GHz.

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#### 6.4. Test result

Ambient temperature : (23 ± 1) °C

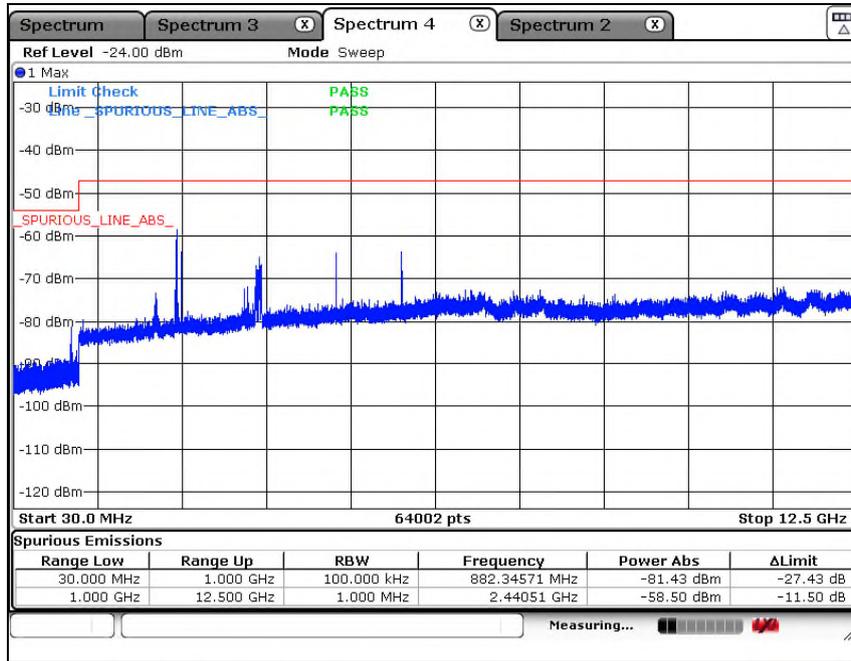
Relative humidity : 47 % R.H.

Test voltage (V <sub>d.c.</sub> )	Frequency Range (MHz)	Measured	Low Ch. (2 402 MHz)	Middle Ch. (2 442 MHz)	High Ch. (2 480 MHz)	Limit
V <sub>nom</sub> = 3.700	30 to 1 000	Frequency (GHz)	0.882	0.882	0.882	-
		Level (dB m/100 kHz)	-81.43	-81.43	-82.25	-53.98
		Level (nW/100 kHz)	0.007 194	0.007 194	0.005 957	4.00
	1 000 to 12 500	Frequency (GHz)	2.441	2.439	2.440	-
		Level (dB m/MHz)	-58.50	-59.53	-59.46	-46.99
		Level (nW/MHz)	1.412 538	1.114 295	1.132 400	20.00

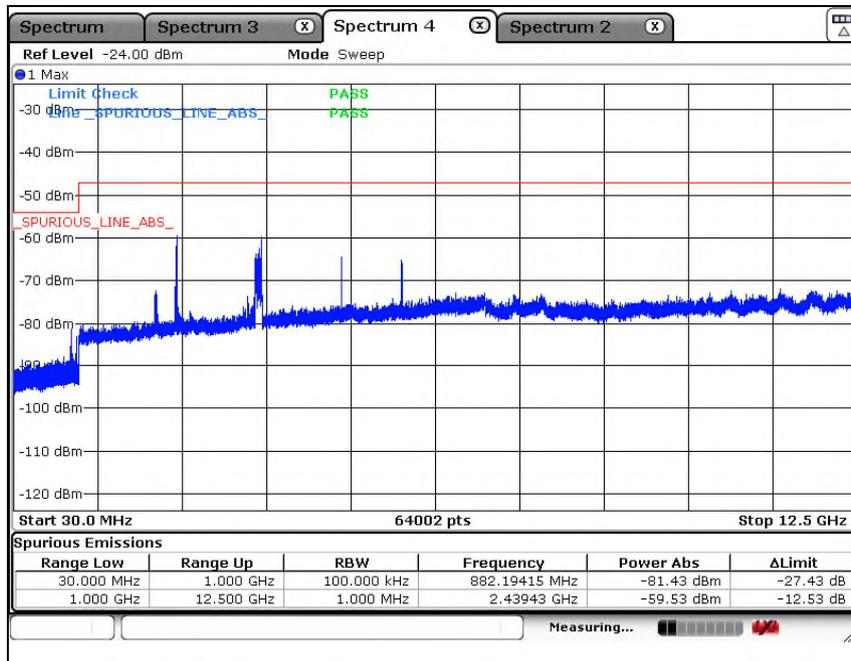
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Low channel

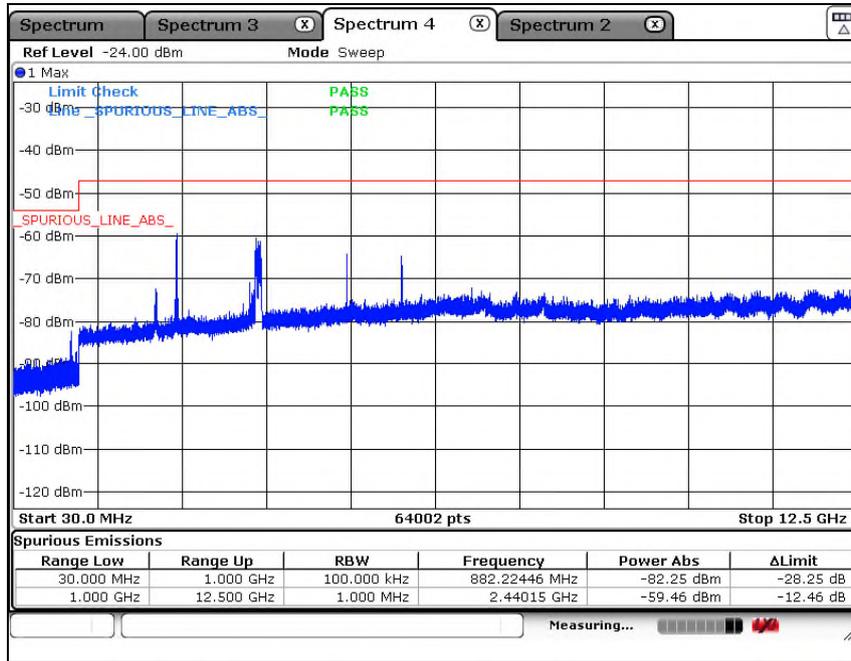


Middle channel



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High channel



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## 7. Interference Prevention Function

### 7.1. Test Procedure

- (1) For EUTs capable of automatically transmitting identification data
  - a. Transmit identification data from EUT to Demodulator
  - b. Confirm identification data is correctly received by Demodulator
- (2) For EUTs capable of automatically receiving identification data
  - c. Transmit identification data from Link Partner to EUT
  - d. Confirm communication link is established
  - e. Link Partner shall respond by transmitting different identification data back to the EUT
  - f. Confirm EUT stops transmitting, or confirm EUT recognizes that the two identification data are different

If the applicant has documentary evidence to show that their EUT complies with the requirements of the Interference Prevent Function then the EUT can be exempt from this test.

### 7.2. Test result

EUT Details : D3:32:DB:A9:9A:03

The unit does meet the requirements. (Pass)

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## 8. Test Methodology & Conditions

### 8.1. Test Condition

Ambient temperature : (23 ± 1) °C  
 Relative humidity : 47 % R.H.

Voltage Fluctuation Test	Normal Voltage	High voltage + 10 % of normal voltage	Low voltage - 10 % of normal voltage
EUT Input voltage (V <sub>d.c.</sub> )	3.70	4.07	3.33
RF Part Output voltage (V <sub>d.c.</sub> )	3.278	3.278	3.278

Voltage Variation (%) = (Output high or Low Voltage - Output normal voltage) / Output normal voltage \* 100  
 During the input supply voltage to the EUT from the external power source is varied by +/- 10 % if output voltage had been confirmed that the fluctuation of power supply to the RF circuit of EUT (excluding power source) is equal to or less than +/- 1 %. Exempt extremely high and low supply voltage condition tests, EUT only operated in normal voltage to test all regulations.

**- End of the Test Report -**

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