

# TEST REPORT

of

## ARIB STD-T66

Equipment Under Test : RF Module  
Model Name : LZM-001  
Applicant : LG Electronics Inc.  
Manufacturer : LG Electronics Inc.  
Date of Receipt : 2018.11.30  
Date of Test(s) : 2018.12.12 ~ 2018.12.18  
Date of Issue : 2018.12.19

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

Tested By:

  
Lily Jung

Date:

2018.12.19

Technical  
Manager:

  
Harim Lee

Date:

2018.12.19

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RTT5041-19(2017.07.10)(0)

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A4(210 mm x 297 mm)

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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 : LG Electronics Inc.

Address : 170, Seongsanpaechong-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do,  
51533, Republic of Korea

Contact Person : Jung, Hyeon-soo

Phone No. : +82 55 260 3966

### 1.3. Details of manufacturer

Company : LG Electronics Inc.

Address : 170, Seongsanpaechong-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do,  
51533, Republic of Korea

### 1.4. Description of EUT

Kind of Product	RF Module
Model Name	LZM-001
Power Supply	DC 5.0 V
Frequency Range	2 405 MHz ~ 2 480 MHz
Modulation Technique	DSSS
Number of Channels	16 channels
Rated Output Power	10.0 mW/MHz
Antenna Type	PCB Antenna
Antenna Gain	1.5 dBi
H/W version	1.0
S/W version	1.0

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## 1.5. Test Equipment List

Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Authority	Cal. Method
Spectrum Analyzer	R&S	FSV30	103102	Jun. 11, 2018	SICT	c)
Signal Generator	Agilent	E8257D	MY51501169	Jul. 03, 2018	SICT	c)
Attenuator	MCLI	FAS-12-10	1	Jun. 12, 2018	SICT	c)
DC Power Supply	Agilent	U8002A	MY50060028	Mar. 15, 2018	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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## 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 %) and Spread Bandwidth (90 %)	Complied
STD-T66 3.2	Spurious Emission Intensity	Complied
STD-T66 3.2	Antenna Power	Complied
STD-T66 3.3	Secondary Radiated Emissions	Complied
STD-T66 3.4	Interference Prevention Function	Complied

## 1.8. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL013321	2018.12.19	Initial

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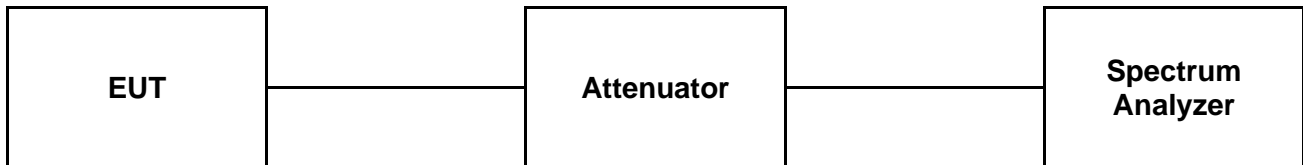
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## 2. Frequency Tolerance

### 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 channel.
3. Set the spectrum analyzer as below;

Center frequency	: 2 405 MHz, 2 440 MHz, 2 480 MHz (Zigbee)
Span	: 1 MHz
RBW	: 10 kHz
VBW	: 10 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 voltage(V <sub>d.c.</sub> )	Measured frequency (MHz)	Reading frequency (MHz)	Frequency tolerance [ppm]
V <sub>Nom</sub> = 5.0	Low Ch. (2 405)	2 404.999 000	-0.42
	Middle Ch. (2 440)	2 440.001 000	0.41
	High Ch. (2 480)	2 479.999 000	-0.40

Note;

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

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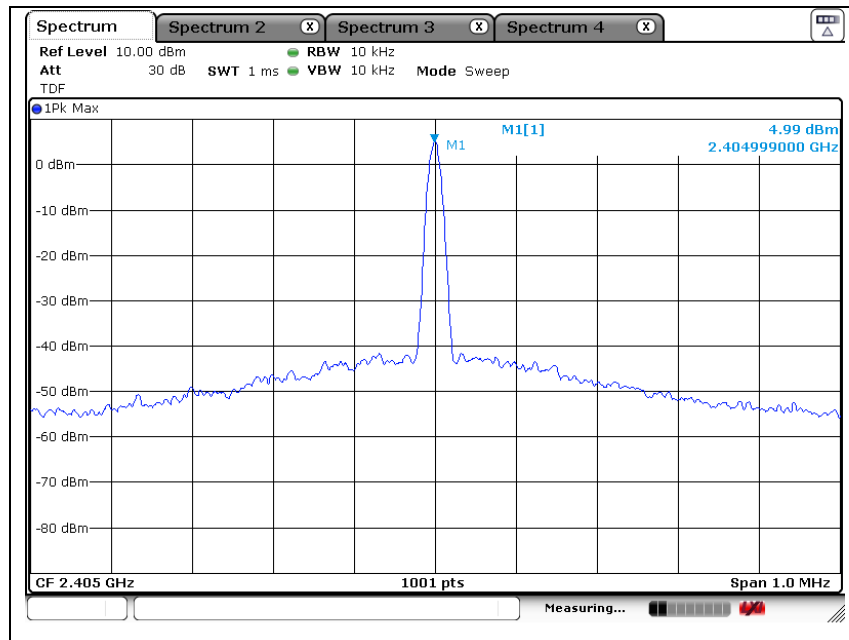
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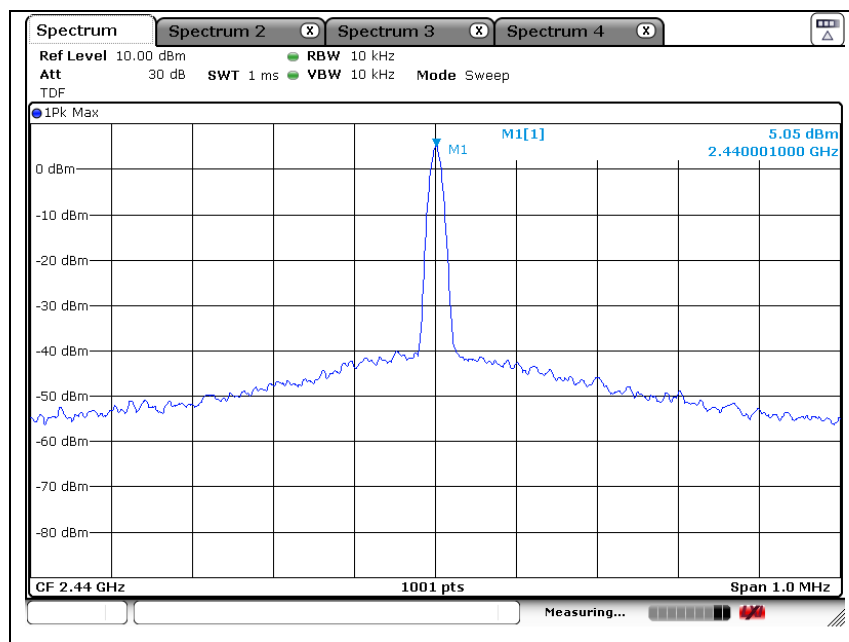
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## Normal voltage

Low channel



Middle channel



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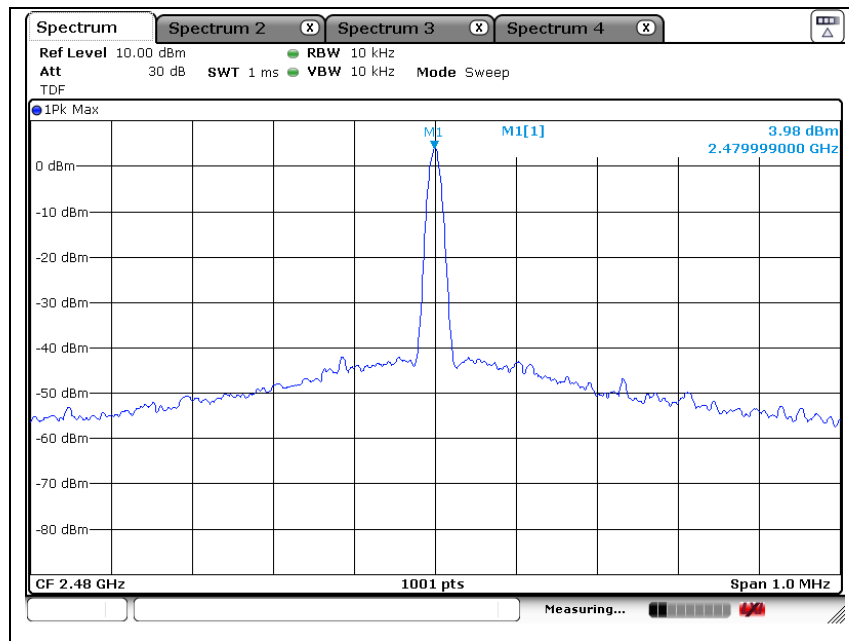
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## High channel



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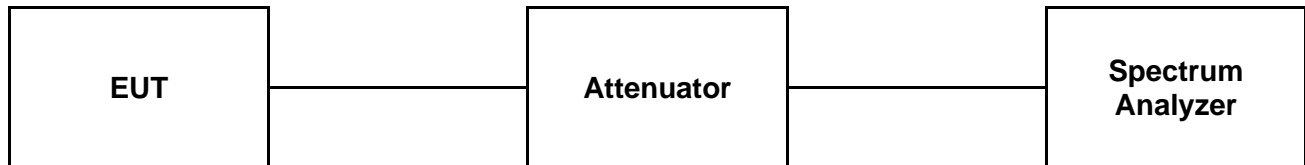
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### 3. Occupied Bandwidth (99 %) and Spread Bandwidth (90 %)

#### 3.1. Test Setup



#### 3.2. Limit

[Occupied Bandwidth]  
26 MHz or less

[Spread Bandwidth]  
500 kHz or more

#### 3.3. Test Procedure

1. Connect transmitter output to the spectrum analyzer input port.
2. Occupied Bandwidth and Spread Bandwidth is measured by following setting:

Use OBW capability of spectrum analyzer

[Occupied Bandwidth (99 %)]

Center frequency : 2 405 MHz, 2 440 MHz, 2 480 MHz  
 Span : 10 MHz  
 RBW : 100 kHz  
 VBW : 100 kHz  
 Sweep time : Auto  
 Sweep data points : 1 001 or greater  
 Detector mode : Positive peak  
 Indication mode : Max hold  
 BW setting : 99 %

[Spread Bandwidth (90 %)]

Center frequency : 2 405 MHz, 2 440 MHz, 2 480 MHz  
 Span : 10 MHz  
 RBW : 100 kHz  
 VBW : 100 kHz  
 Sweep time : Auto  
 Sweep data points : 1 001 or greater  
 Detector mode : Positive peak  
 Indication mode : Max hold  
 BW setting : 90 %

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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)	Spread bandwidth (MHz)
V <sub>Nom</sub> = 5.0	Low Ch. (2 405)	2.288	1.598
	Middle Ch. (2 440)	2.278	1.558
	High Ch. (2 480)	2.318	1.628

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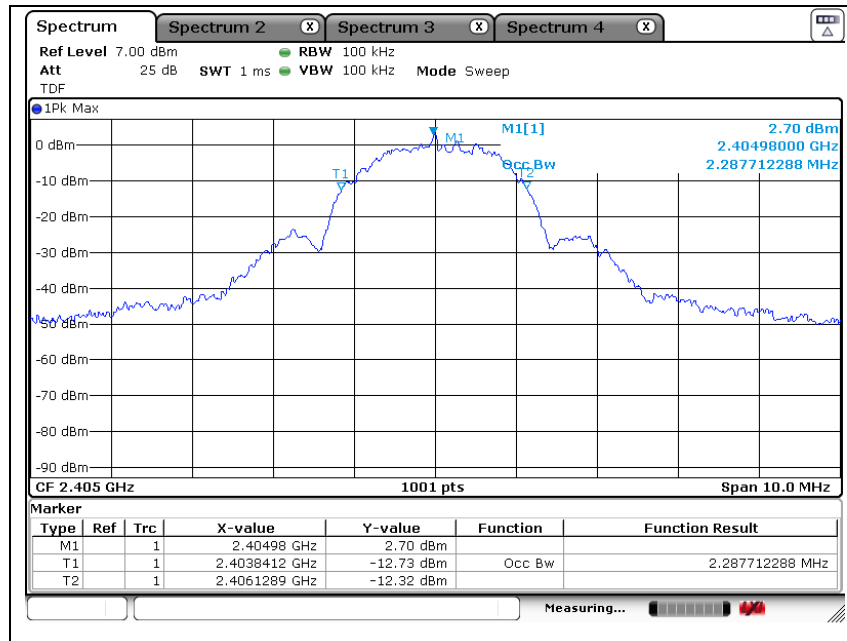
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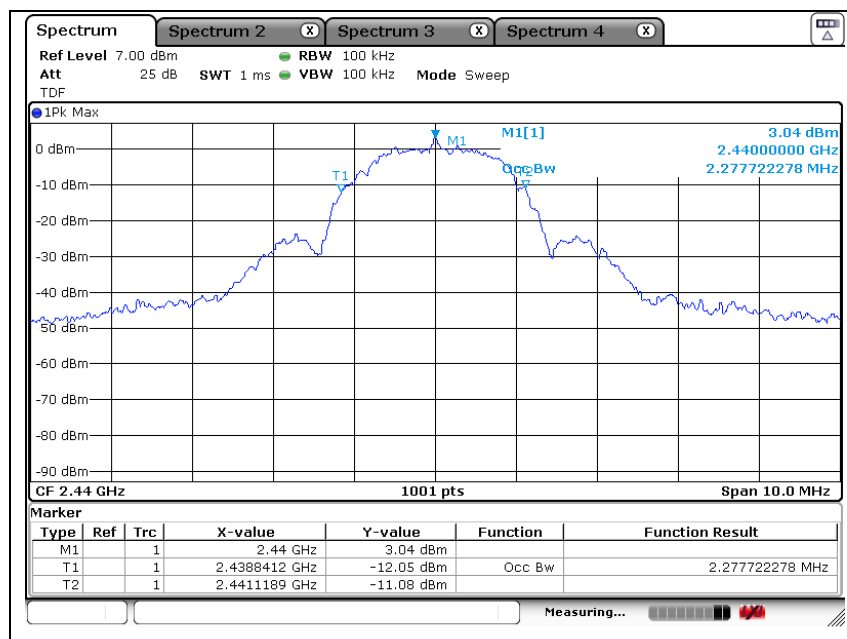
## Occupied Bandwidth (99 %)

### Normal voltage

#### Low channel

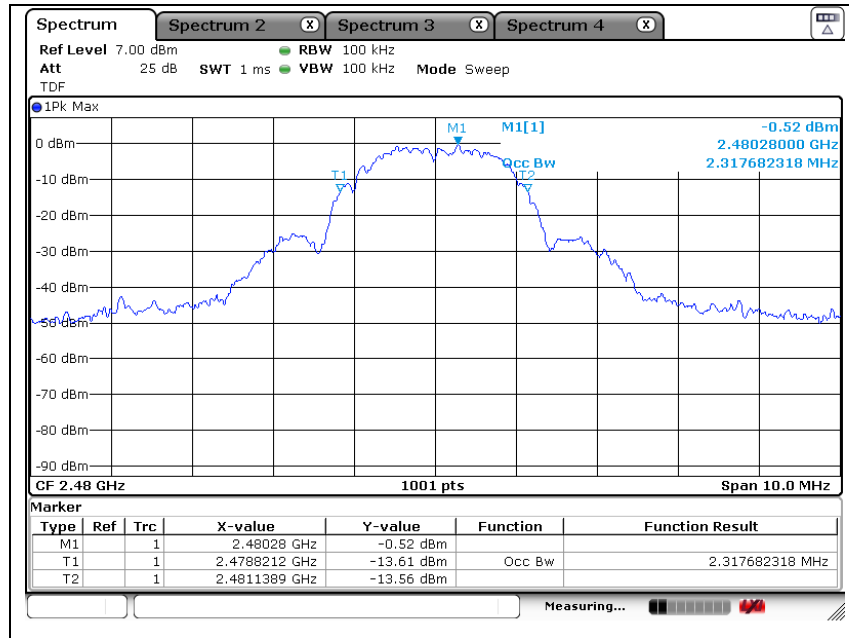


#### Middle channel



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## High channel

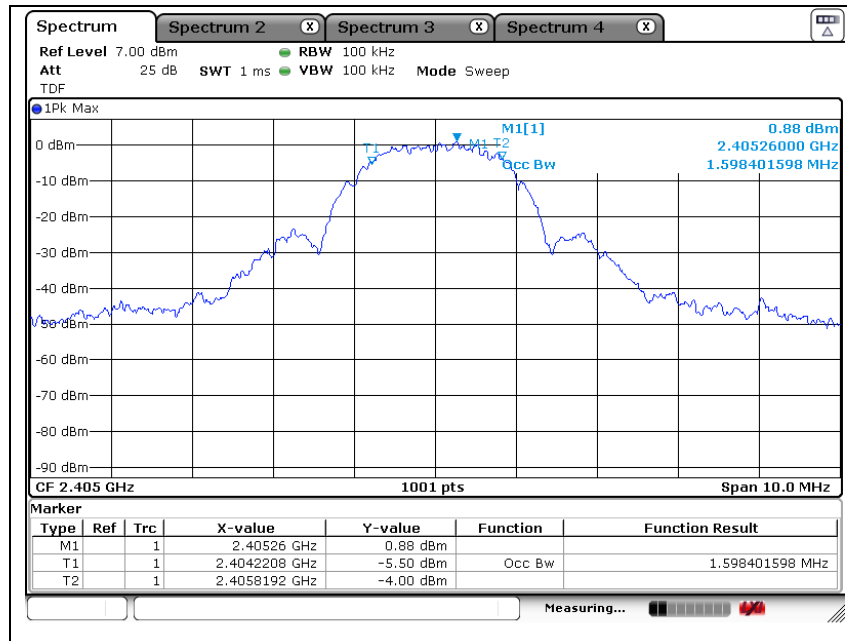


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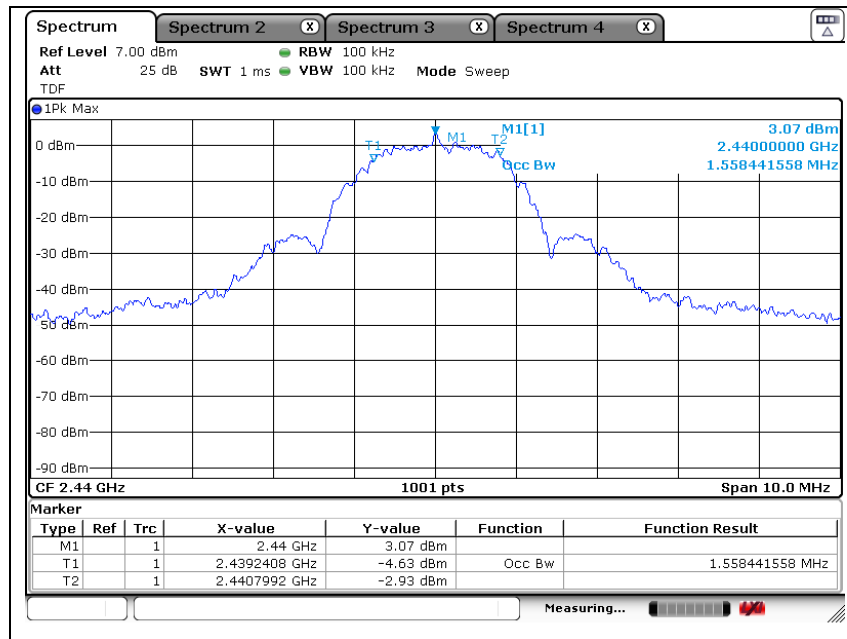
## Spread Bandwidth (90 %)

### Normal voltage

#### Low channel

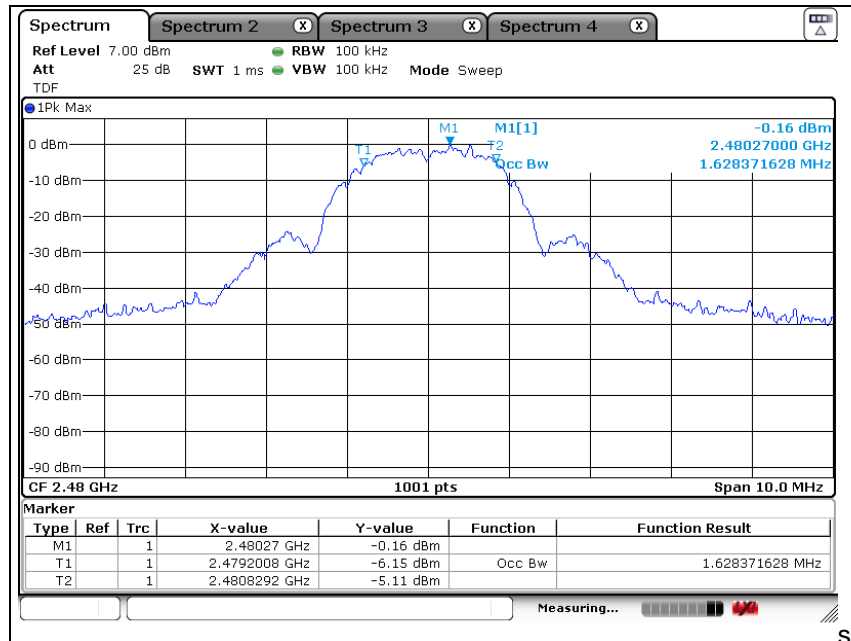


#### Middle channel



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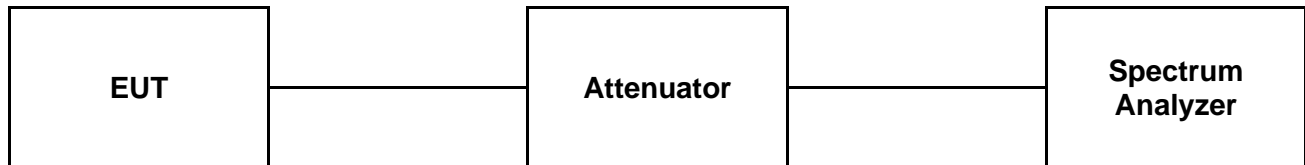
## High channel



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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. (2 405 MHz)	Middle Ch. (2 440 MHz)	High Ch. (2 480 MHz)	Limit
V <sub>nom</sub> = 5.0	Below 2 387	Frequency (GHz)	2.237	1.941	2.163	-
		Level (dB m/MHz)	-48.58	-48.18	-48.40	-26
		Level (μW/MHz)	0.013 868	0.015 205	0.014 454	2.5
	2 387 to 2 400	Frequency (GHz)	2.398	2.400	2.393	-
		Level (dB m/MHz)	-47.07	-48.47	-47.39	-16
		Level (μW/MHz)	0.019 638	0.014 223	0.018 239	25
	2 483.5 to 2 496.5	Frequency (GHz)	2.484	2.493	2.485	-
		Level (dB m/MHz)	-47.08	-47.46	-46.06	-16
		Level (μW/MHz)	0.019 588	0.017 947	0.024 774	25
	Above 2 496.5	Frequency (GHz)	6.924	6.932	6.989	-
		Level (dB m/MHz)	-42.18	-42.55	-42.56	-26
		Level (μW/MHz)	0.060 534	0.055 590	0.055 463	2.5

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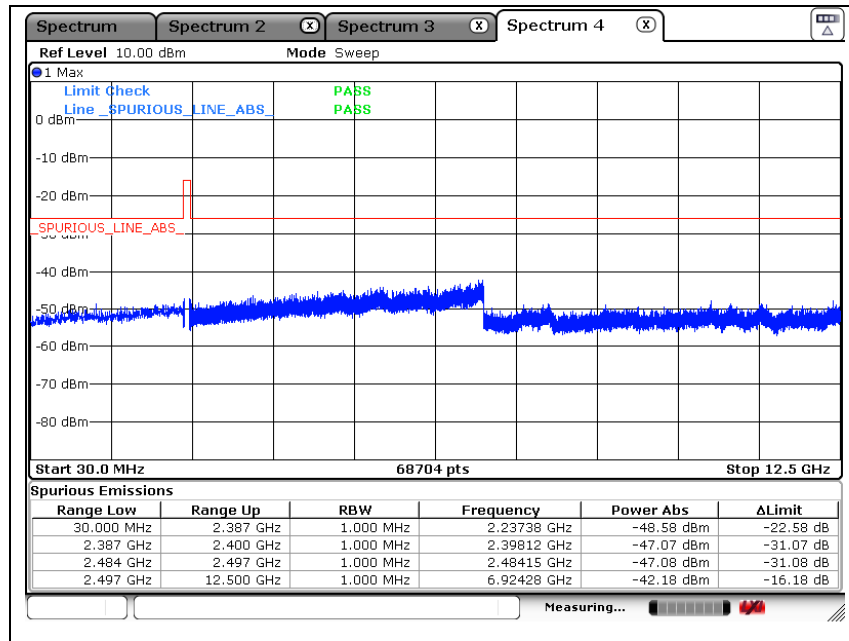
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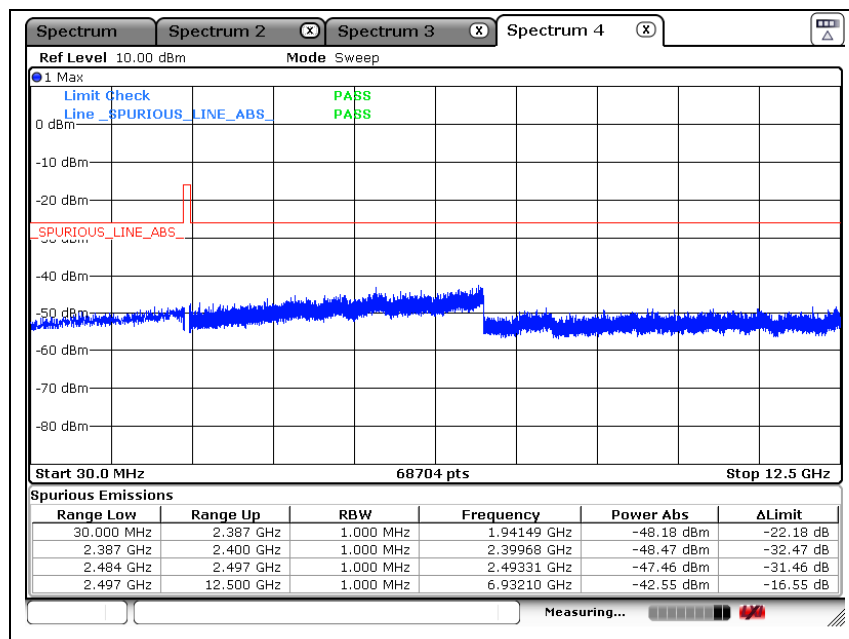
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## Normal voltage

### Low channel

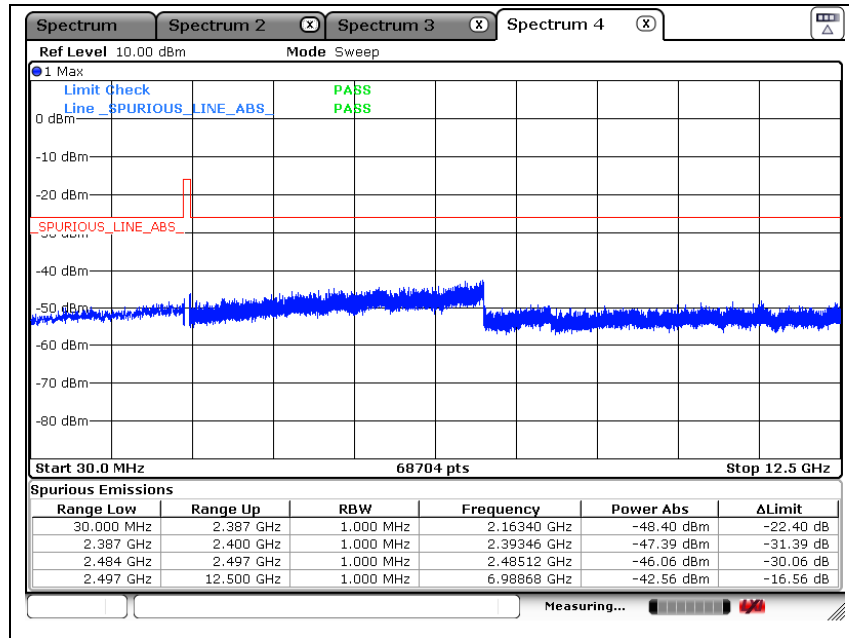


### Middle channel



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High channel



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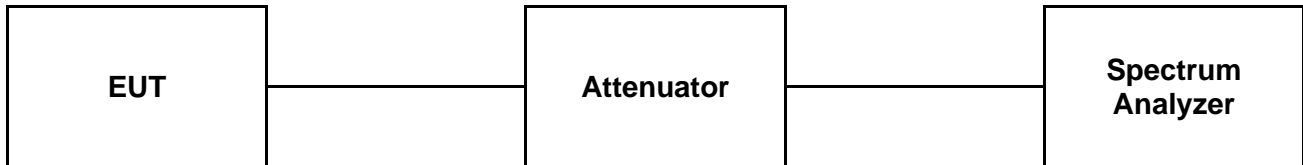
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## 5. Antenna Power

### 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/MHz 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 : 2 405 MHz, 2 440 MHz, 2 480 MHz  
Span : 5 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 : 1 MHz  
VBW : 1 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  
Indication mode : Max hold

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 (MHz)	Antenna gain (dBi)	Rated Output Power		E.I.R.P. (dB m)	Average Burst Power		Power Tolerance (%)
V <sub>Nom</sub> = 5.0	Low Ch. (2 405)	1.50	10.00 mW/MHz	10.00 dB m/MHz	11.50	3.04 mW/MHz	4.83 dB m/MHz	-69.60
	Middle Ch. (2 440)	1.50	10.00 mW/MHz	10.00 dB m/MHz	11.50	2.96 mW/MHz	4.72 dB m/MHz	-70.40
	High Ch. (2 480)	1.50	10.00 mW/MHz	10.00 dB m/MHz	11.50	2.42 mW/MHz	3.83 dB m/MHz	-75.80

### Note;

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

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

E.I.R.P. (dB m) = Antenna gain (dBi) + Rated Output Power (dB m/MHz)

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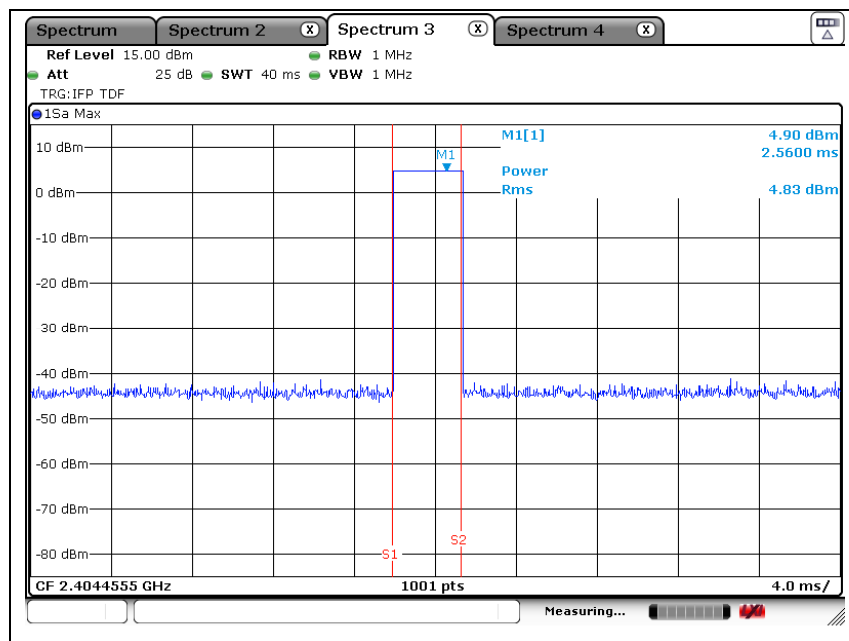
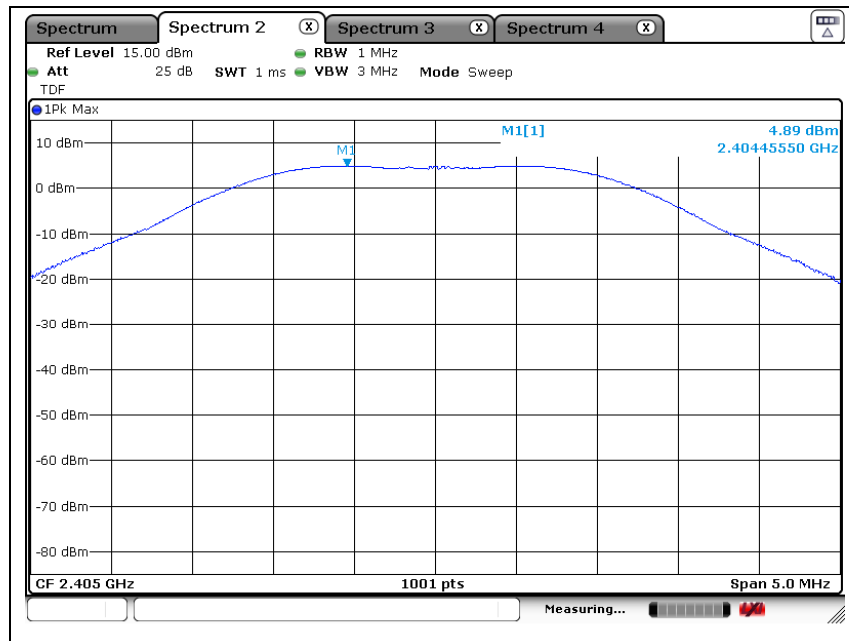
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## Normal voltage

Low channel



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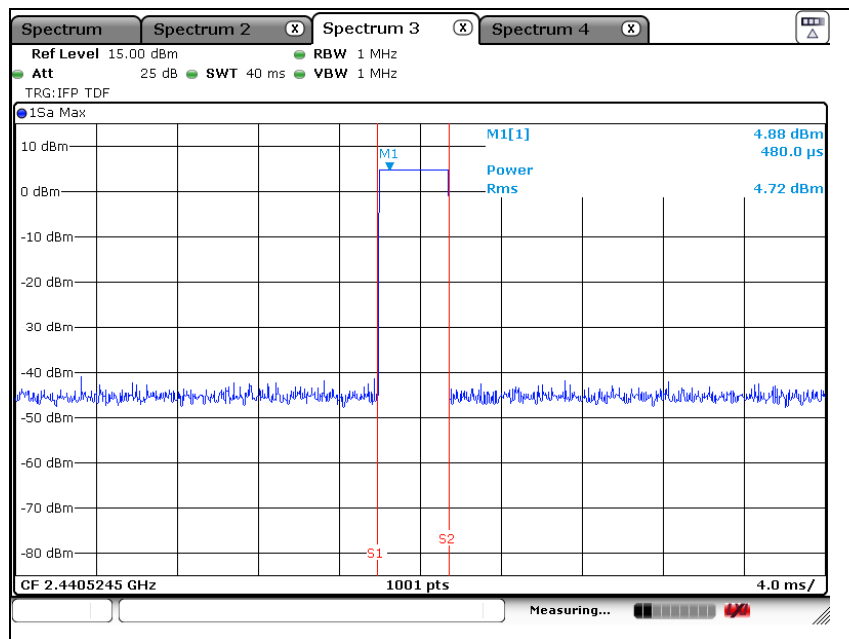
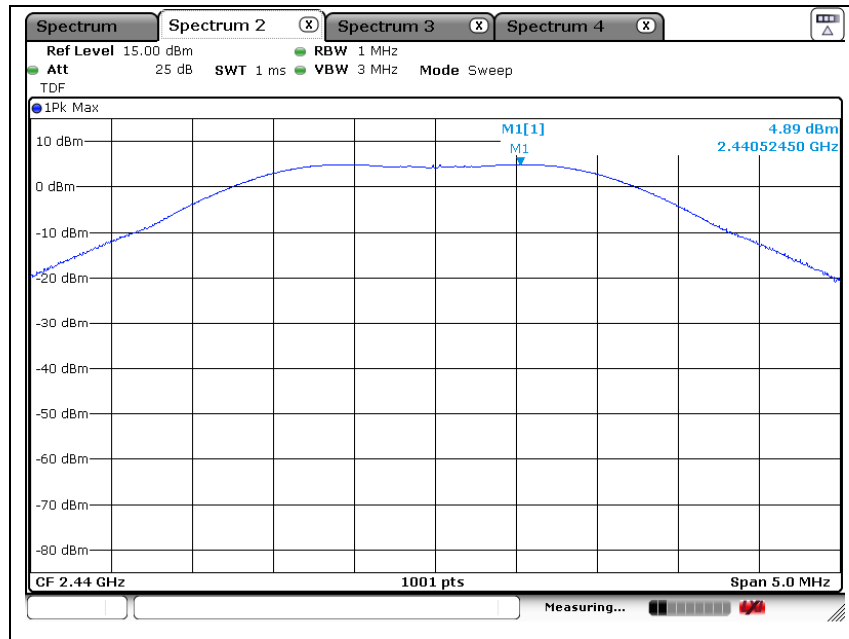
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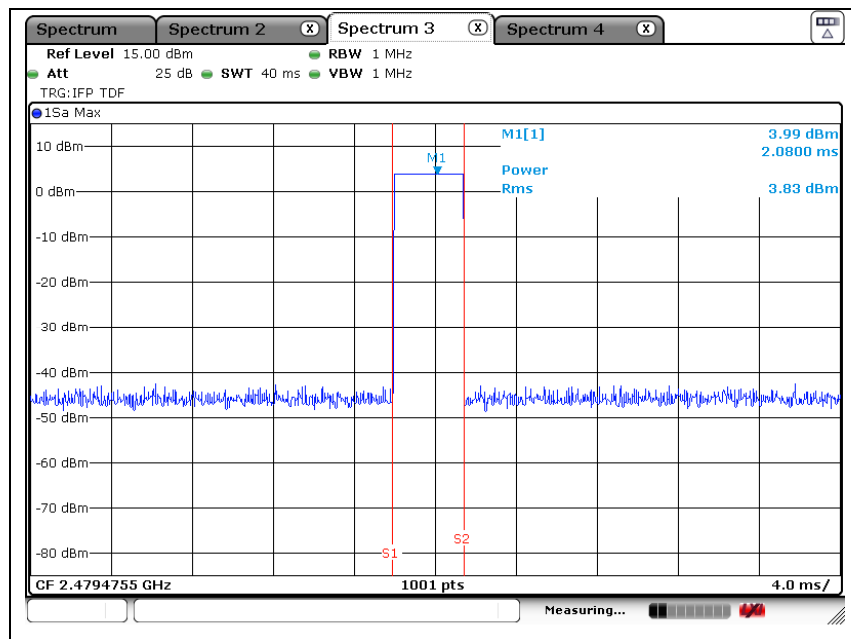
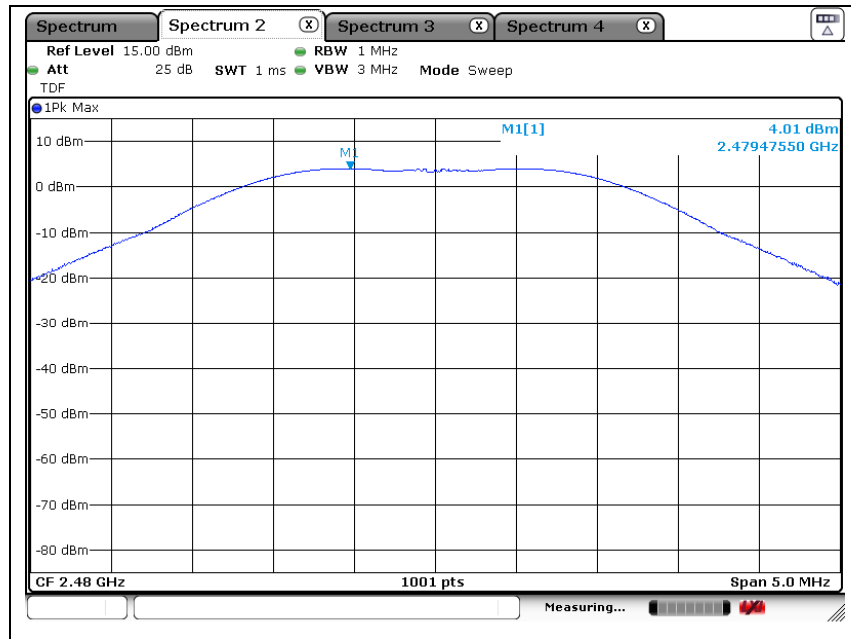
A4(210 mm x 297 mm)

## Middle channel



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## High channel

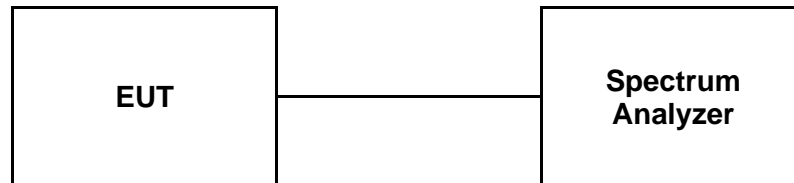


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## 6. Secondary Radiated Emissions

### 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

#### [Setting 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. (2 440 MHz)	High Ch. (2 480 MHz)	Limit
V <sub>nom</sub> = 5.0	Below 1 000	Frequency (GHz)	0.038	0.038	0.038	-
		Level (dB m)	-76.35	-76.05	-76.53	-54
		Level (nW)	0.023 174	0.024 831	0.022 233	4
	1 000 to 12 500	Frequency (GHz)	6.846	6.595	1.934	-
		Level (dB m)	-71.00	-71.58	-71.10	-47
		Level (nW)	0.079 433	0.069 502	0.077 625	20

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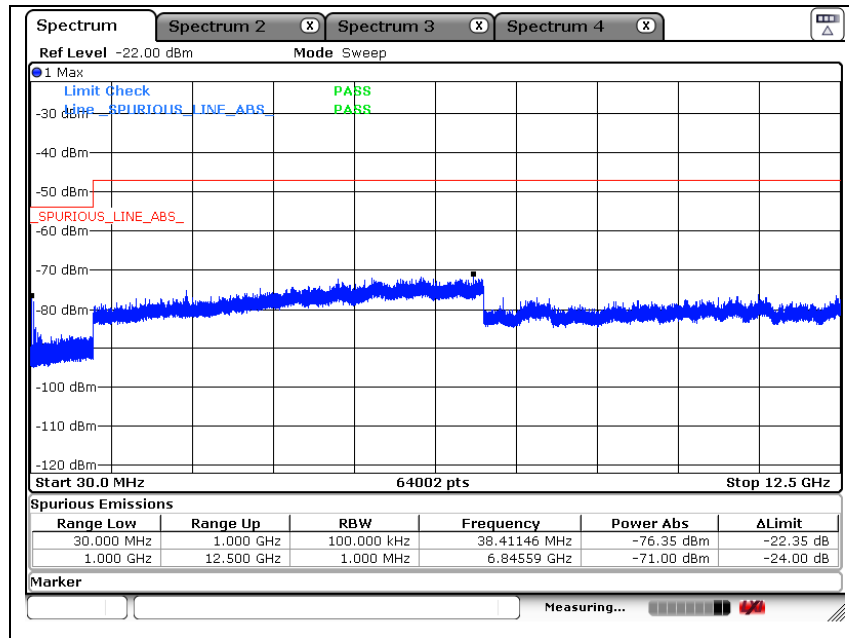
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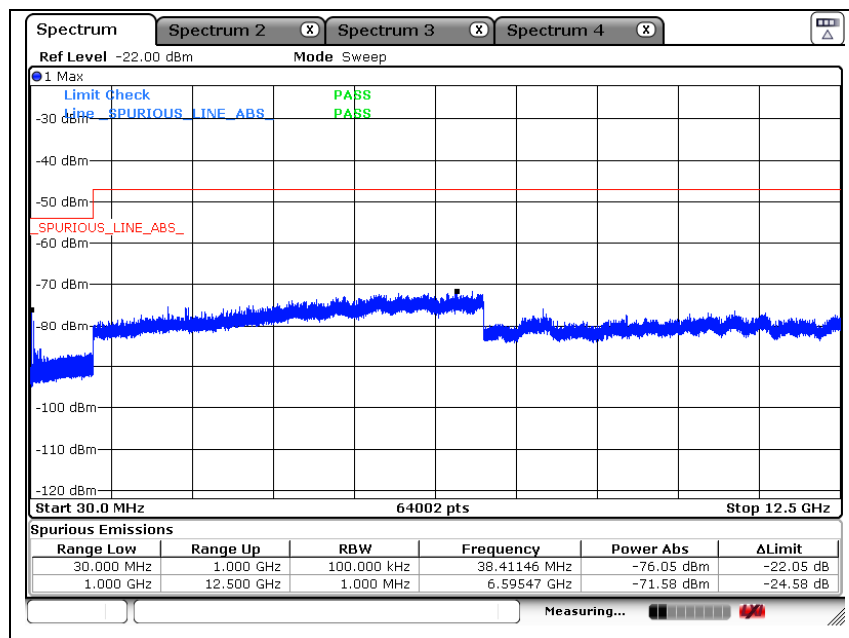
A4(210 mm x 297 mm)

## Normal voltage

Low channel

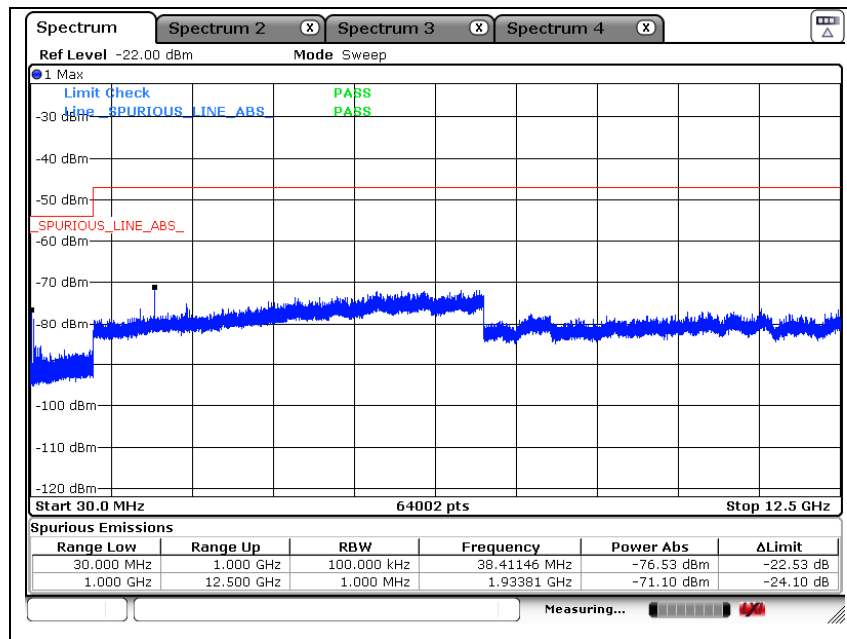


Middle channel



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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 :

Unique ID : 90fd9ffffe561cc9

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> )	5.00	5.50	4.50
RF Part Output voltage (V <sub>d.c.</sub> )	3.322	3.323 (+0.03 %)	3.323 (+0.03 %)

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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