TEST REPORT

of

ARIB STD-T67

Equipment Under Test	:	RF-LINK MODULE
Model Name	:	RFHX-YA0H3-00
Applicant	:	iRevo-ASSA ABLOY Korea
Manufacturer	:	iRevo-ASSA ABLOY Korea
Date of Receipt	:	2018.12.04
Date of Test(s)	:	2018.12.21 ~ 2019.02.13
Date of Issue	:	2019.02.13

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

Tested By: **Changhyun Song** **Date:** **2019.02.13**

Technical Manager: **Hyunchae You** **Date:** **2019.02.13**

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Table of contents

1. General Information ---------- 3

2. Frequency tolerance ---------- 6

3. Occupied bandwidth (99%) ---------- 10

4. Antenna power ---------- 14

5. Adjacent-channel leakage power ---------- 16

6. Intensity of spurious emission or unwanted emission ---------- 20

7. Secondary radiated emissions ---------- 30

8. Carrier sensing ---------- 34

9. Transmission time ---------- 36

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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.

Telephone : +82 31 688 0901
FAX : +82 31 688 0921

1.2. Details of applicant

Applicant : iRevo-ASSA ABLOY Korea
Address : 10F of JEI PLATZ Bldg., 186, Gasan Digital 1-ro, Geumcheon-gu, Seoul, 08502 Republic of Korea
Contact Person : Jang, Soo-kyung
Phone No. : +82 2 2107 5741

1.3. Description of EUT

Kind of Product	RF-LINK MODULE
Model Name	RFHX-YA0H3-00
Power Supply	DC 6.0 V
Operating Conditions	-20 ℃~ +50 ℃
Frequency Range	449.712 5 ㎒
Declaration power	9.33 ㎽
Modulation Technique	FSK
Antenna Type	Internal Antenna
Antenna Gain	-4 ㏈i

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1.4. Test Equipment List

Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Authority	Cal. Method
Spectrum Analyzer	R&S	FSV43	100637	Jun. 03, 2018	SICT	c)
Signal Generator	Agilent	E8257D	MY51501169	Jul. 03, 2018	SICT	c)
Signal Generator	R&S	SMJ100A	100882	Jun. 15, 2018	SICT	c)
Attenuator	MCLI	FAS-12-10	1	Jun. 12, 2018	SICT	c)
Power Sensor	R&S	NRP-Z81	100748	Jun. 12. 2018	SICT	c)
Power Splitter	Mini-Circuits	ZFRSC-42-S+	UU1691438	Sep. 19, 2018	SICT	c)
DC Power Supply	Agilent	U8002A	MY50060028	Mar. 15, 2018	SICT	c)
DIGITAL MULTIMETER	HIOKI	DT4211	N0301231	Sep. 18, 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).

1.5. 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 22-2 of Article 88, Paragraph 1 or the test method more than equivalent."

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1.6. Summary of test results

The EUT has been tested according to the following specifications:

Applied standard : Radio equipment regulations and ARIB STD-T67		
Article Reference	**Test item**	**Result**
STD-T67 3.2	Frequency tolerance	Complied
STD-T67 3.2	Occupied bandwidth (99 %)	Complied
STD-T67 3.2	Antenna Power	Complied
STD-T67 3.2	Adjacent-channel leakage power	Complied
STD-T67 3.2	Intensity of spurious emission or unwanted emission	Complied
STD-T67 3.3	Secondary radiated emissions	Complied
STD-T67 3.4	Carrier sensing	Complied
STD-T67 3.4	Transmission time	Complied

1.7. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL013433	2019.01.17	Initial
1	F690501/RF-RTL013433-1	2019.02.08	Modified description of modulation technique and carrier sense level
2	F690501/RF-RTL013432-2	2019.02.13	Added transmission time test result

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2. Frequency tolerance

2.1. Test Setup

2.2. Limit

The frequency tolerance shall be ± 4 × 10^{-6} (4 ppm or below).

2.3. Test procedure

1. The EUT output is connected to a spectrum analyzer.
2. The EUT should be transmitted(Non-modulation) at a designated channel.
3. Set the spectrum analyzer in the following setting;
   RBW: 300 ㎐, VBW: 300 ㎐, Span: 20 ㎑, Sweep time: Auto and Detector mode: Peak

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2.4. Test result

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

- Test frequency: 449.712 5 ㎒

Test voltage($V_{d.c.}$)			Reading frequency	Frequency tolerance
V min	=	5.4	449.712 7 ㎒	0.44 ppm
V nom	=	6.0	449.712 7 ㎒	0.44 ppm
V max	=	6.6	449.712 7 ㎒	0.44 ppm

Note;

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

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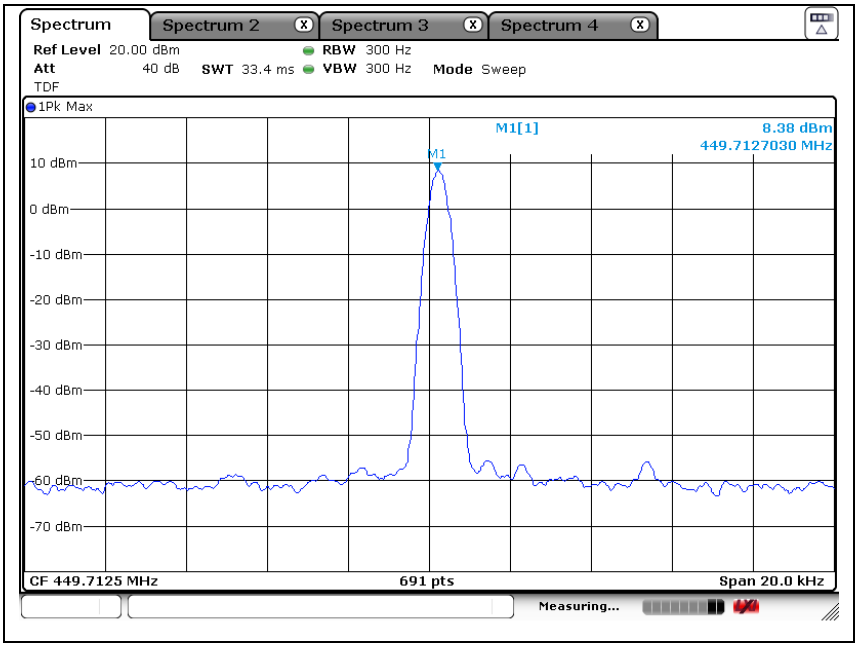
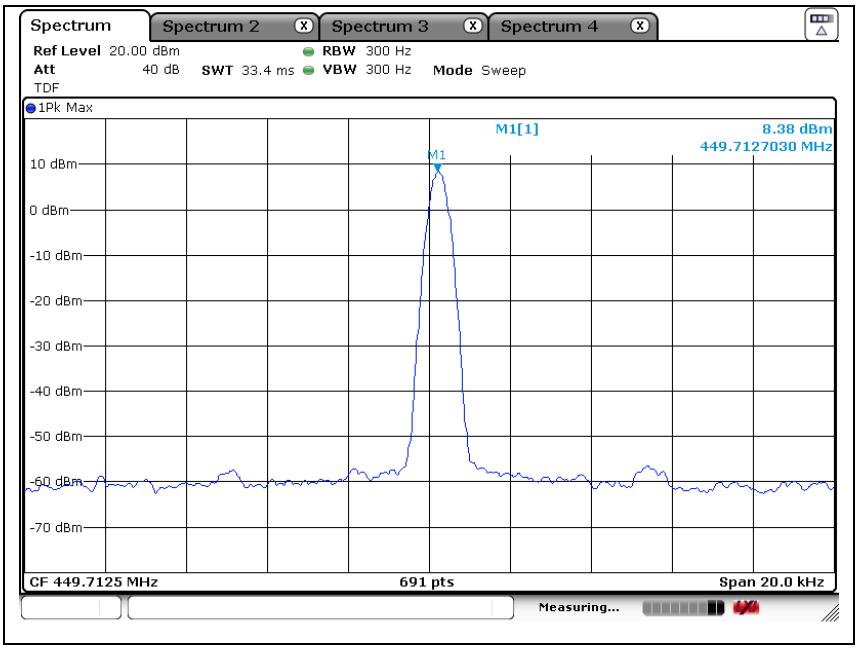
Test voltage : DC 5.4 V



Test voltage : DC 6.0 V



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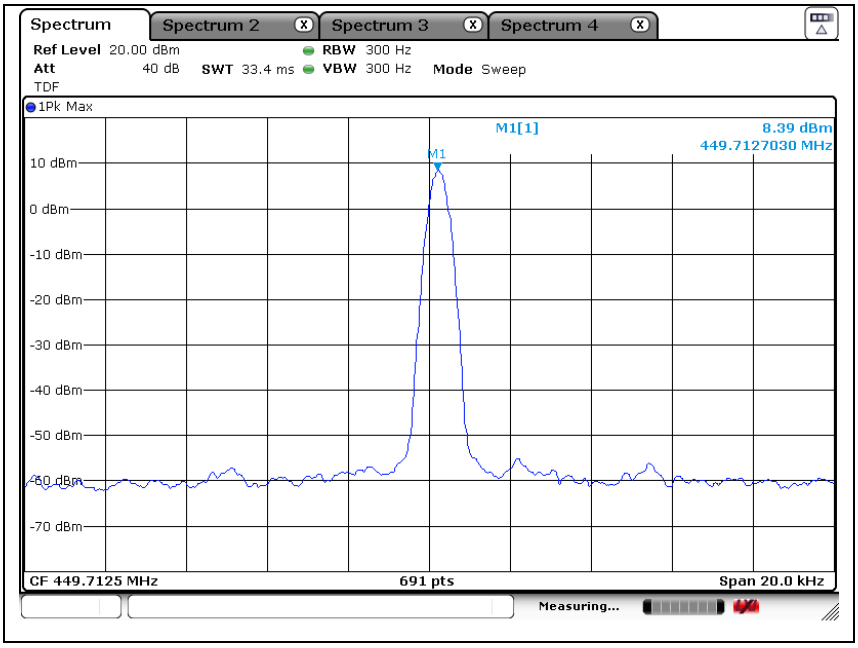
Test voltage : DC 6.6 V



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3. Occupied bandwidth (99 %)

3.1. Test Setup

3.2. Limit

The permissible value for a occupied bandwidth in the 400 ㎒ band shall be 8.5 ㎑.

3.3. Test Procedure

1. The EUT output is connected to a spectrum analyzer.
2. The EUT should be transmitted at a designated channel.
3. Set the spectrum analyzer in the following setting;
   RBW : 300 ㎐, VBW : 300 ㎐, Span : 50 ㎑.

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3.4. Test result

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

- Test frequency: 449.712 5 ㎒

Test voltage($V_{d.c.}$)			F_L Frequency	F_H Frequency	99% bandwidth
V min	=	5.4	449.709 7 ㎒	449.715 8 ㎒	6.08 ㎑
V nom	=	6.0	449.709 7 ㎒	449.715 8 ㎒	6.08 ㎑
V max	=	6.6	449.709 7 ㎒	449.715 8 ㎒	6.08 ㎑

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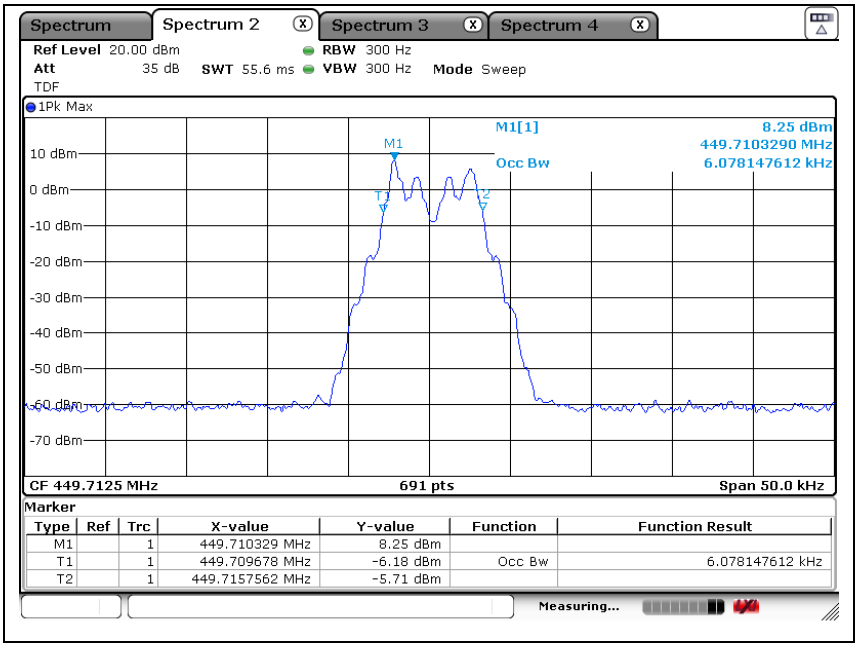
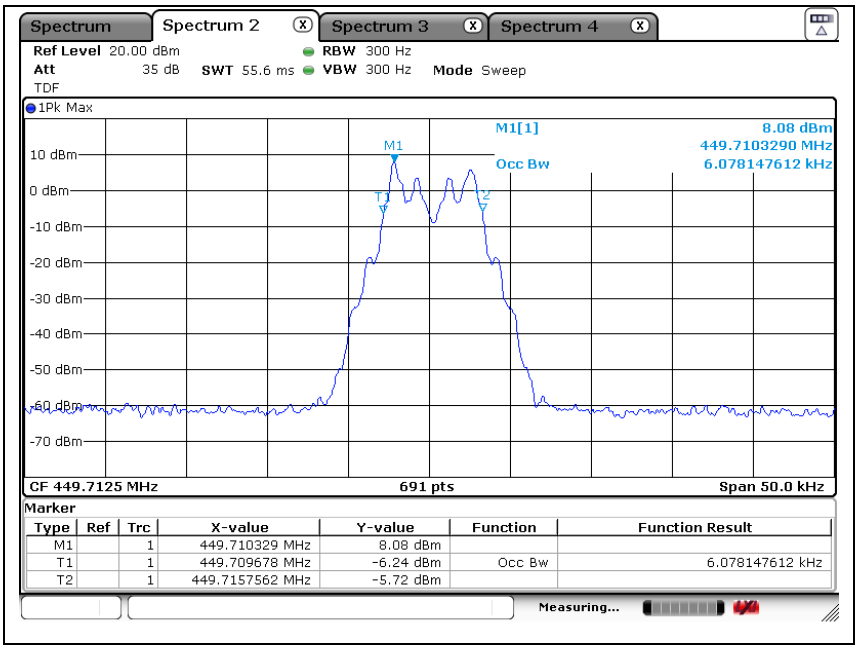
Test voltage : DC 5.4 V



Test voltage : DC 6.0 V



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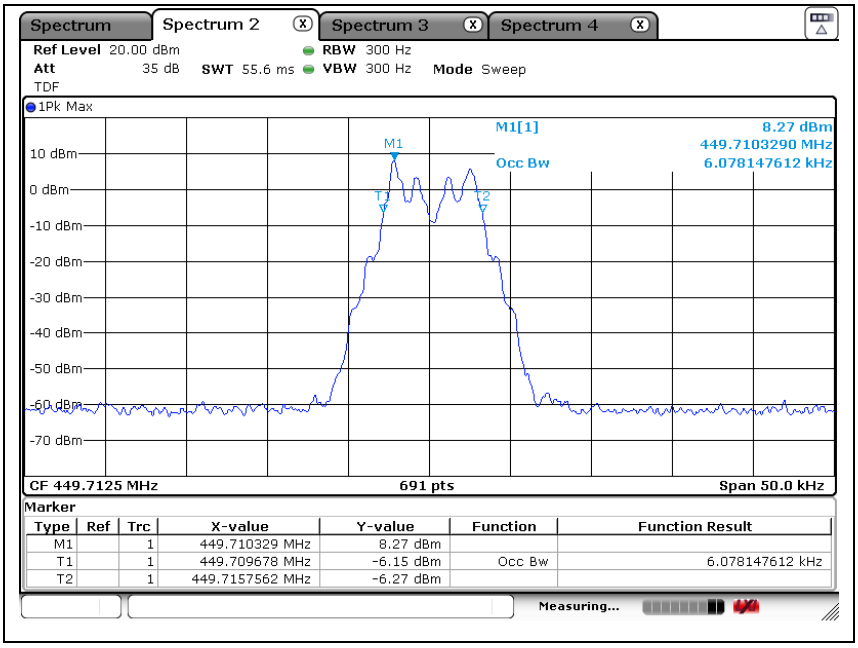
Test voltage : DC 6.6 V



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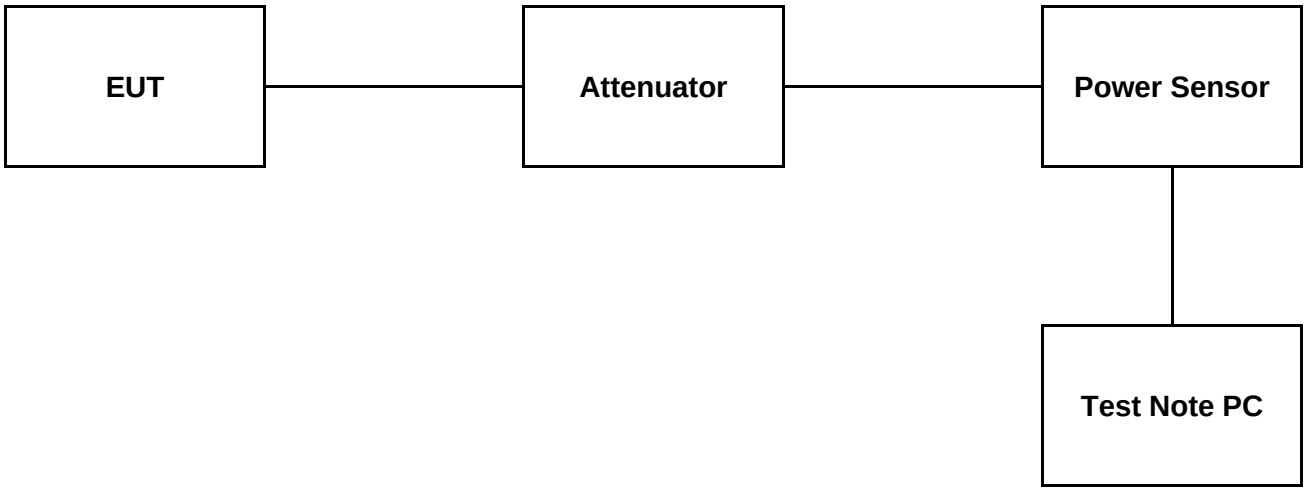
4. Antenna power

4.1. Test setup



4.2. Limit

The antenna power shall be 10 ㎽ or less (The tolerances for antenna power shall be +20 % to -50 %).

4.3. Test procedure

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power sensor.
3. Test program : (S/W name : R&S Power Viewer, Version : 3.2.0)
4. Measure power at a designated channel.

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4.4. Test result

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

- Test frequency: 449.712 5 ㎒

Test voltage ($V_{d.c.}$)	Declaration output power		E. I. R. P.	Antenna Gain	Output power		Power tolerance
V_{min} = 5.4	9.70 dBm	9.33 ㎽	5.70 dBm	-4.00 dBi	9.60 dBm	9.12 ㎽	-2.25 %
V_{nom} = 6.0	9.70 dBm	9.33 ㎽	5.70 dBm	-4.00 dBi	9.60 dBm	9.12 ㎽	-2.25 %
V_{max} = 6.6	9.70 dBm	9.33 ㎽	5.70 dBm	-4.00 dBi	9.59 dBm	9.10 ㎽	-2.47 %

Note;
Power tolerance = {[(O.P.)-(D.O.P.)] ÷ (D.O.P.)} × 100
** O.P. : Output power , D.O.P. : Declaration output power*

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5. Adjacent-channel leakage power

5.1. Test Setup

5.2. Limit

As for the adjacent-channel leakage power in the 400 ㎒ band, the power radiated into the ±4.25 ㎑ band of the frequency 12.5 ㎑ distant from the carrier frequency shall be lower than the carrier power by 40 ㏈ or more.

5.3. Test Procedure

1. The EUT output is connected to a spectrum analyzer.
2. The EUT should be transmitted at a designated channel.
3. Set the spectrum analyzer in the following setting;
   RBW : 300 ㎐, VBW : 300 ㎐, Span : 50 ㎑.

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5.4. Test result

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

- Test frequency: 449.712 5 ㎒

Test voltage($V_{d.c.}$)	Center frequency - 12.5 ㎑	Center frequency + 12.5 ㎑
V min = 5.4	61.36 ㏈	61.31 ㏈
V nom = 6.0	61.73 ㏈	61.57 ㏈
V max = 6.6	61.34 ㏈	61.41 ㏈

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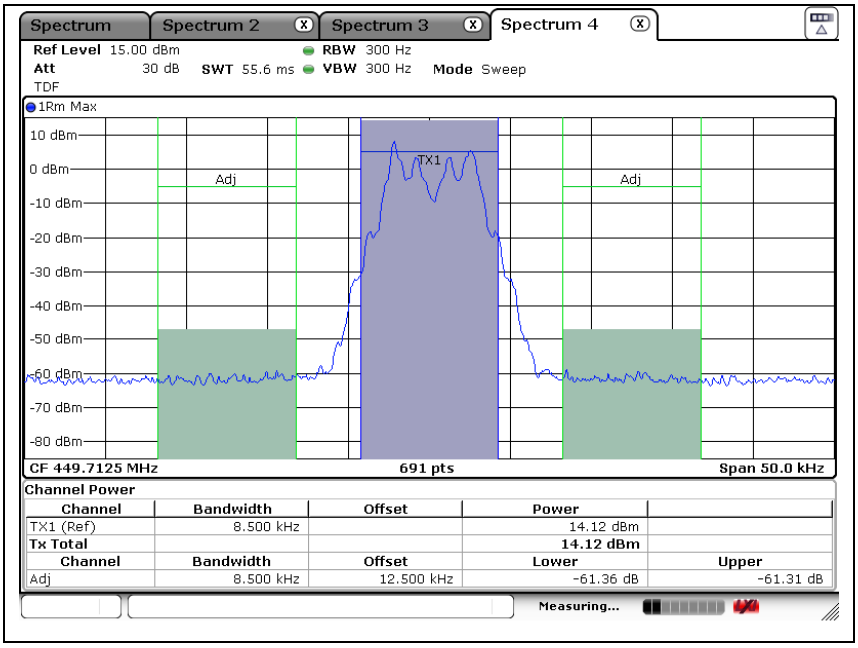
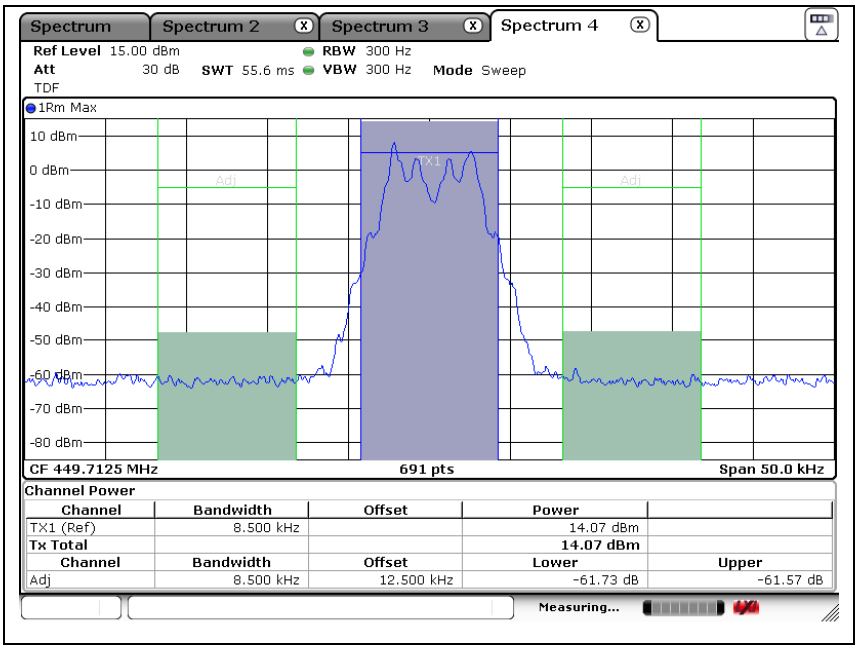
Test voltage : DC 5.4 V



Test voltage : DC 6.0 V



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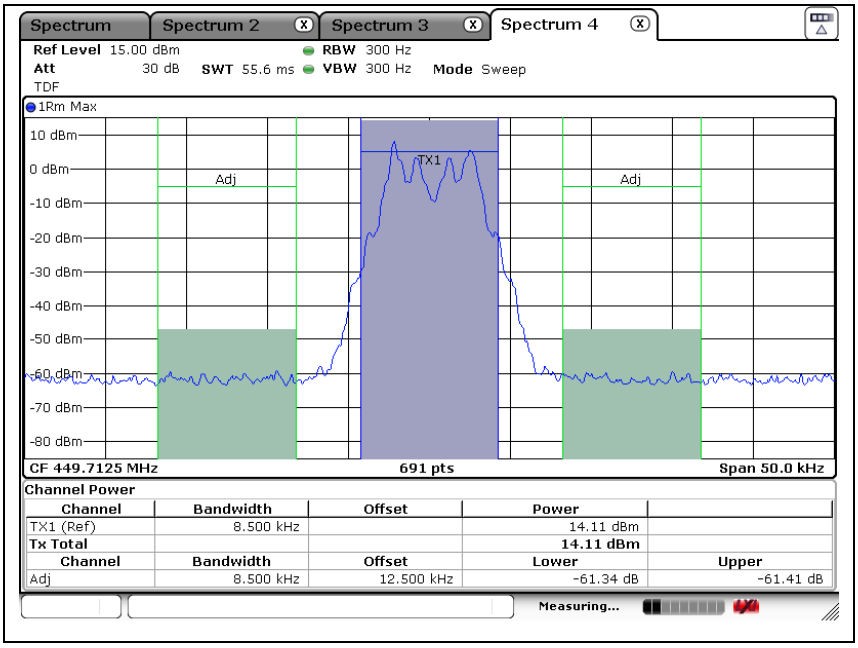
Test voltage : DC 6.6 V



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6. Intensity of spurious emission or unwanted emission

6.1. Test Setup

6.2. Limit

The permissible value of the intensity of spurious emissions in the out-of-band domain and the permissible value of the intensity of unwanted emissions in the spurious domain shall be 2.5 ㎼ or lower (-26.02 ㏈m).

6.3. Test Procedure

1. The EUT output is connected to a spectrum analyzer.
2. The EUT should be transmitted at a designated channel.
3. Set the spectrum analyzer in the following setting;
   Start : 30 ㎒, Stop : fc - 62.5 ㎑ – RBW 100 ㎑,
   Start : fc + 62.5 ㎑, Stop : 1 000 ㎒ – RBW 100 ㎑,
   Start : 1 000 ㎒, Stop : 5 000 ㎒ – RBW 1 ㎒,
   Sweep time : auto
4. For plots showing conducted spurious emissions, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as correction function.
   So, the reading values shown in plots were final result.

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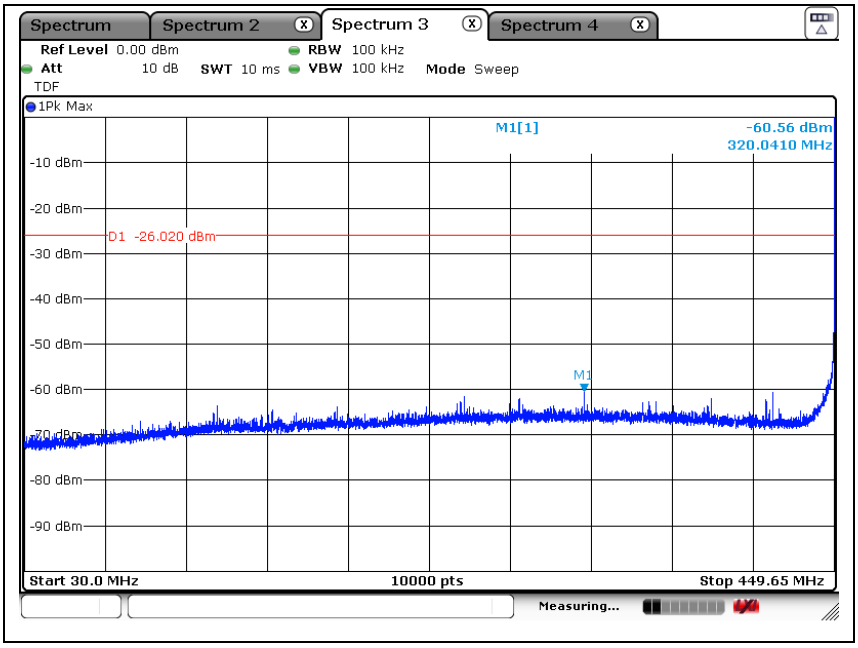
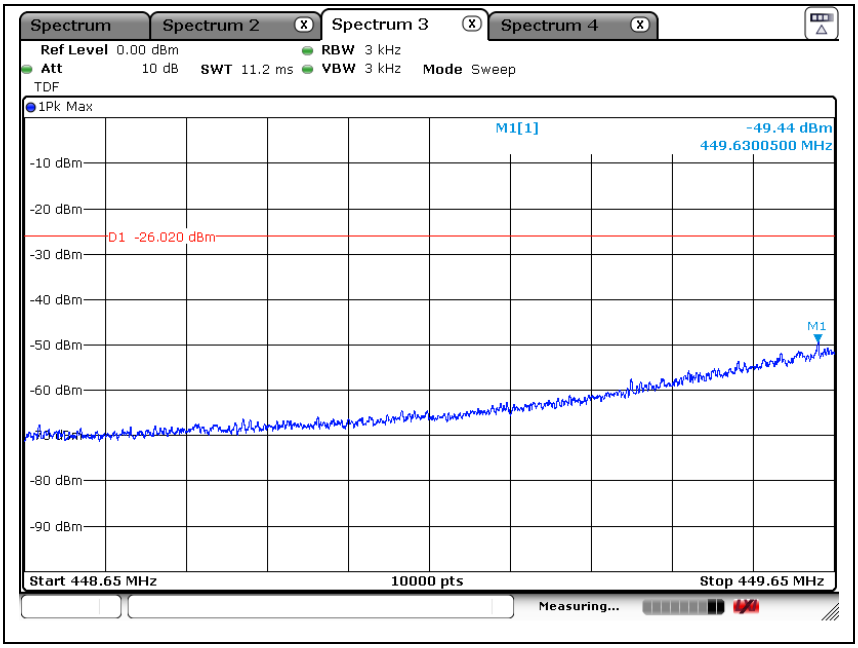
6.4. Test result

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

Test voltage : DC 5.4 V

30 ㎒ ~ 449.65 ㎒





10*log(100/3) = 15.23 ㏈, Final result = -34.21 ㏈ m

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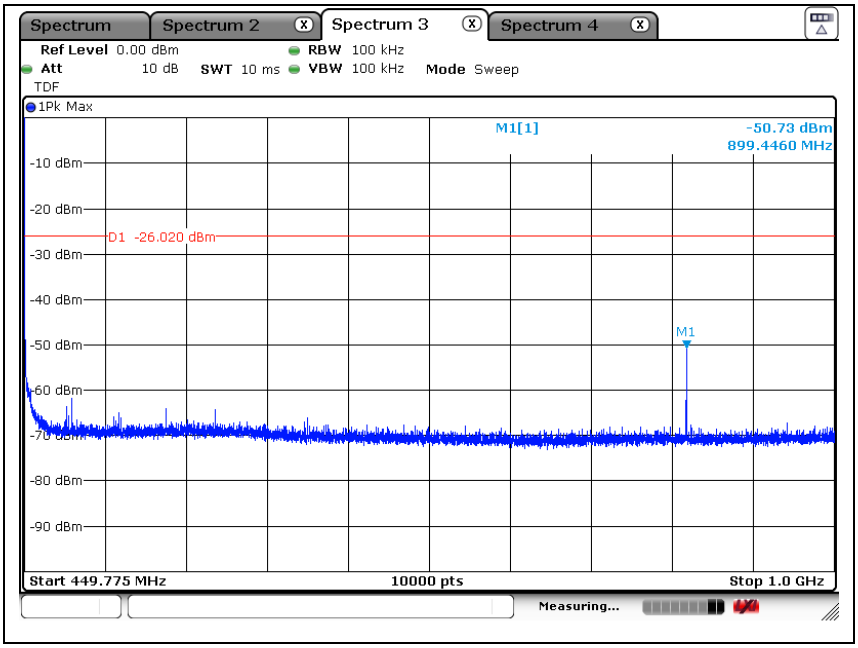
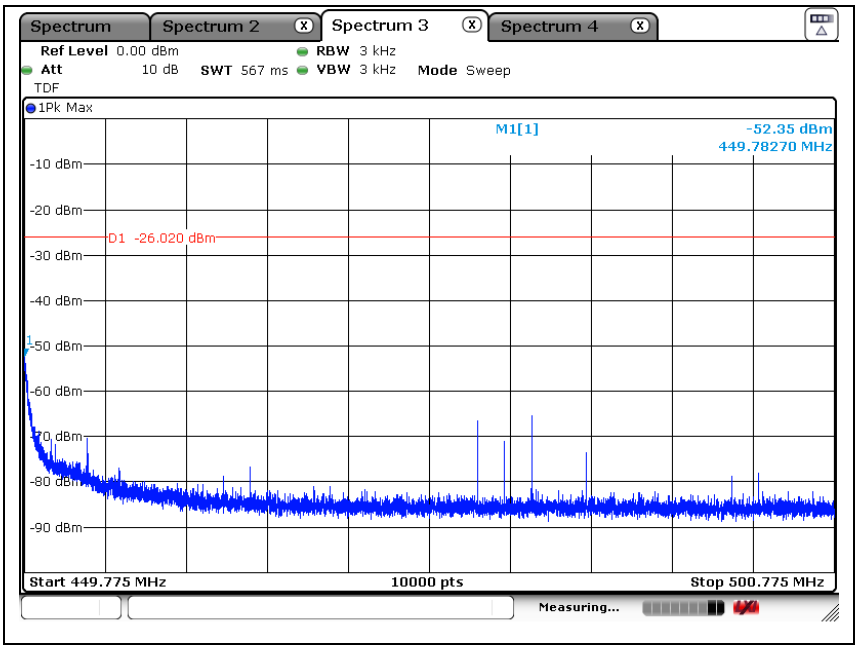
449.775 ㎒ ~ 1 000 ㎒





10*log(100/3) = 15.23 ㏈, Final result = -37.12 ㏈ m

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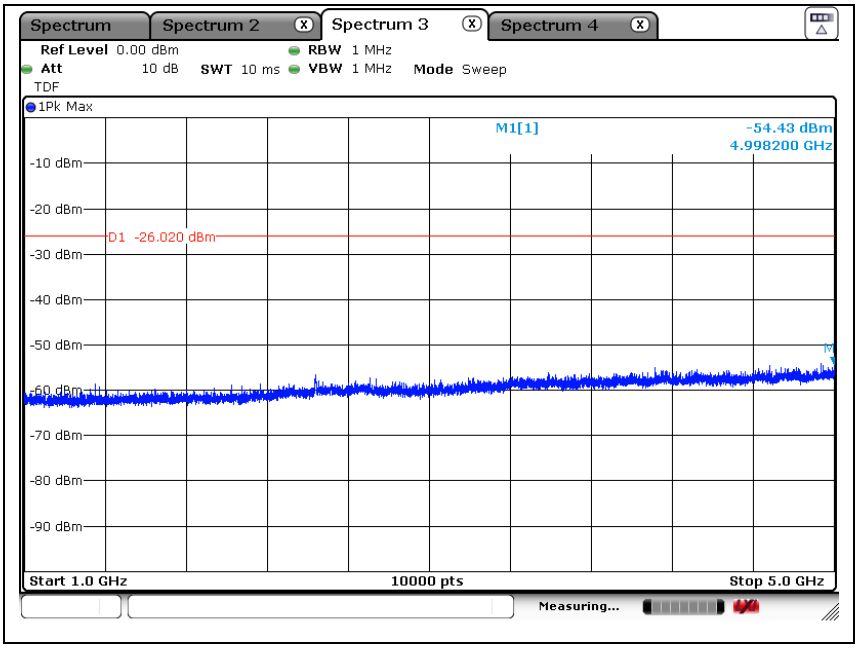
1 000 ㎒ ~ 5 000 ㎒



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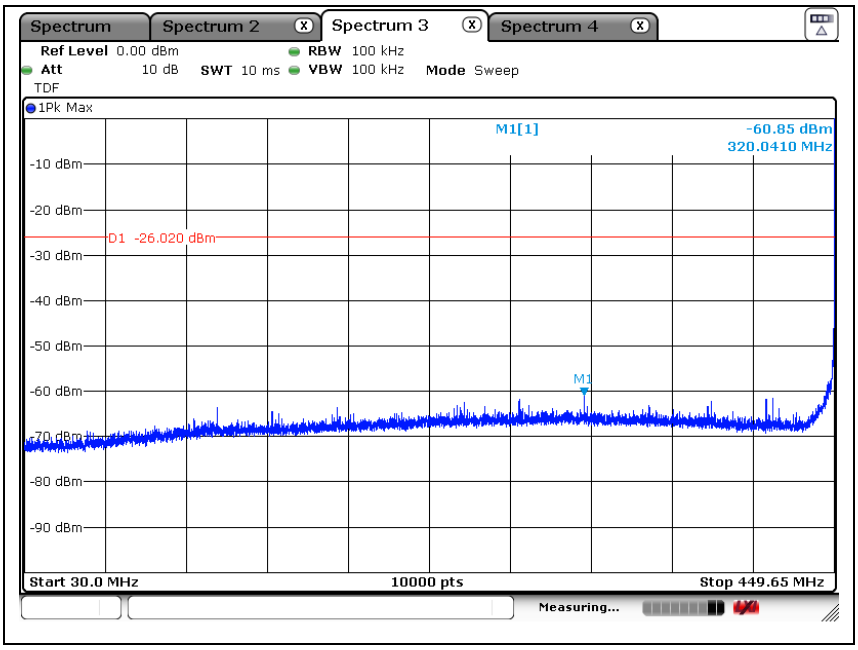
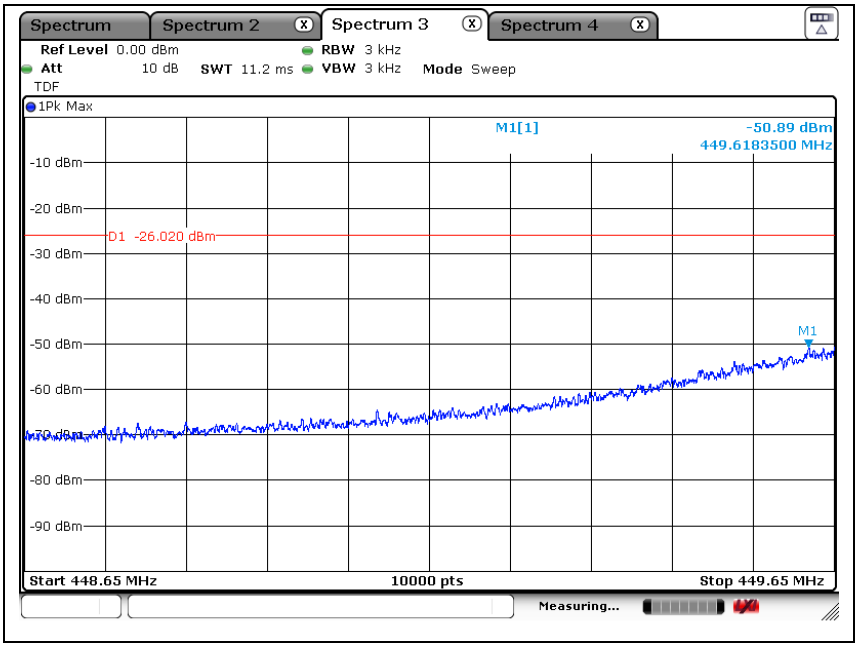
Test voltage : DC 6.0 V

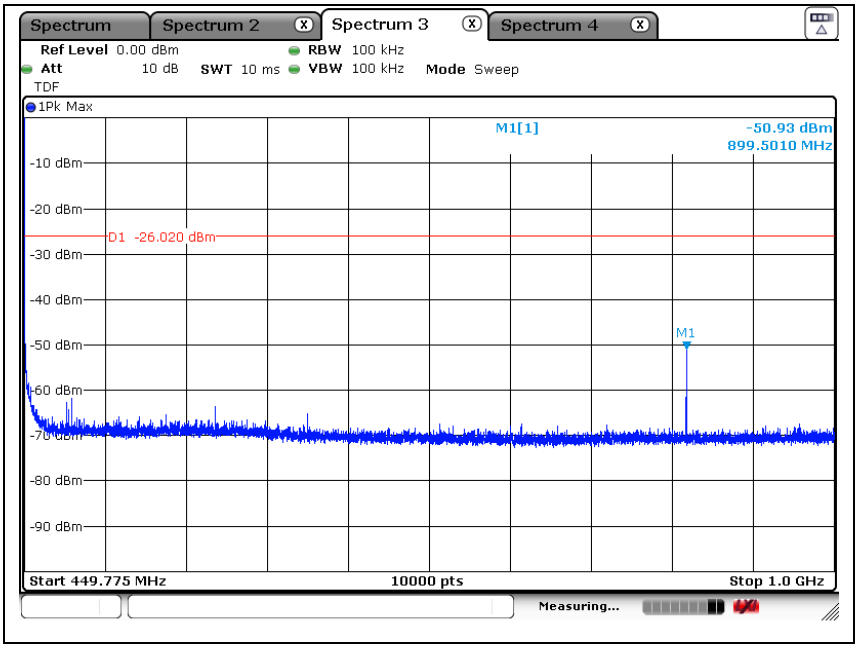
30 ㎒ ~ 449.65 ㎒

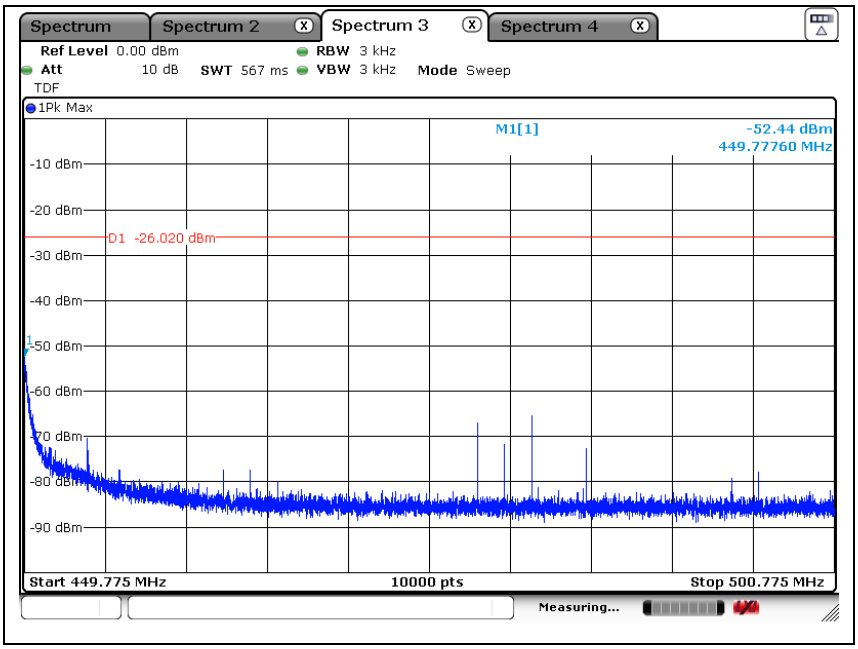




10*log(100/3) = 15.23 ㏈, Final result = -35.66 ㏈ m

449.775 ㎒ ~ 1 000 ㎒





10*log(100/3) = 15.23 ㏈, Final result = -37.21 ㏈ m

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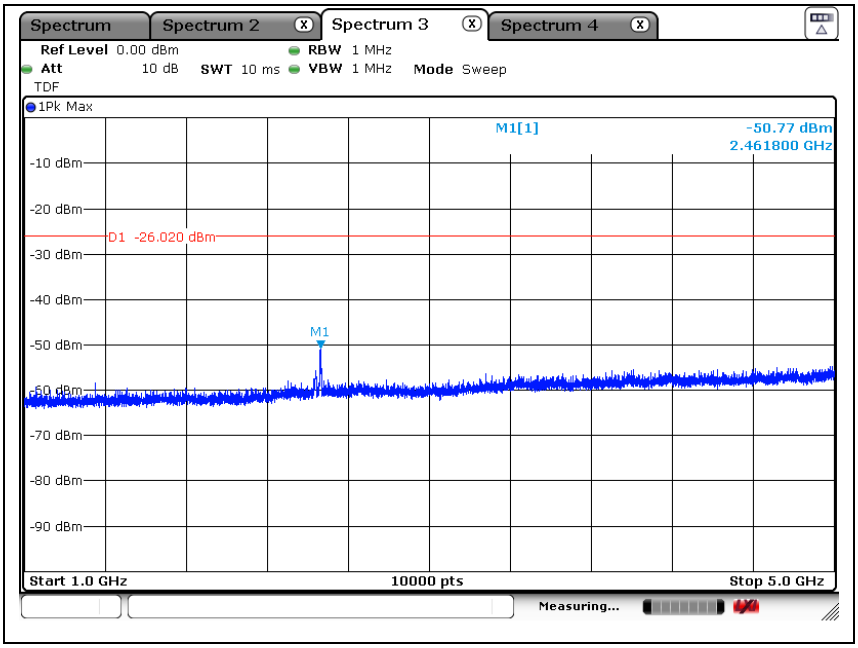
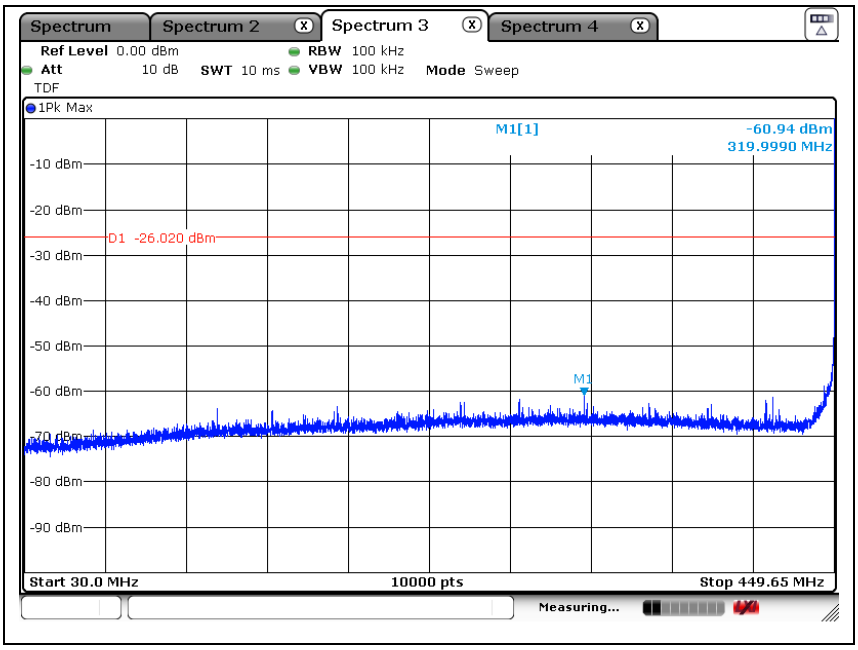
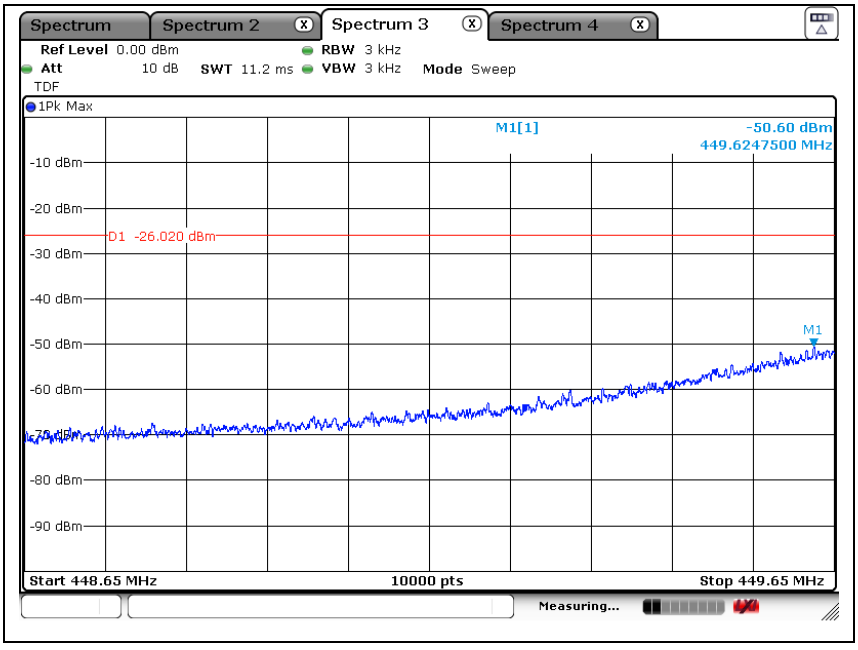
1 000 ㎒ ~ 5 000 ㎒


Spectrum
Spectrum 2
Spectrum 3
Spectrum 4
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB
SWT 10 ms
VBW 1 MHz
Mode Sweep
TDF
1Pk Max
M1[1]
-50.77 dBm
2.461800 GHz
-10 dBm
-20 dBm
D1 -26.020 dBm
-30 dBm
-40 dBm
M1
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
Start 1.0 GHz
10000 pts
Stop 5.0 GHz
Measuring...

Test voltage : DC 6.6 V

30 ㎒ ~ 449.65 ㎒





10*log(100/3) = 15.23 ㏈, Final result = -35.37 ㏈ m

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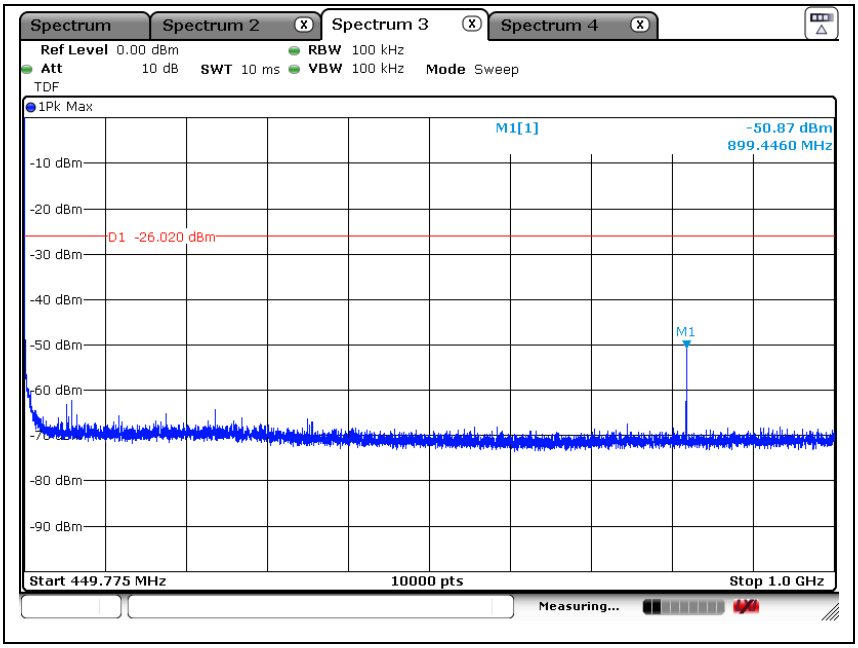
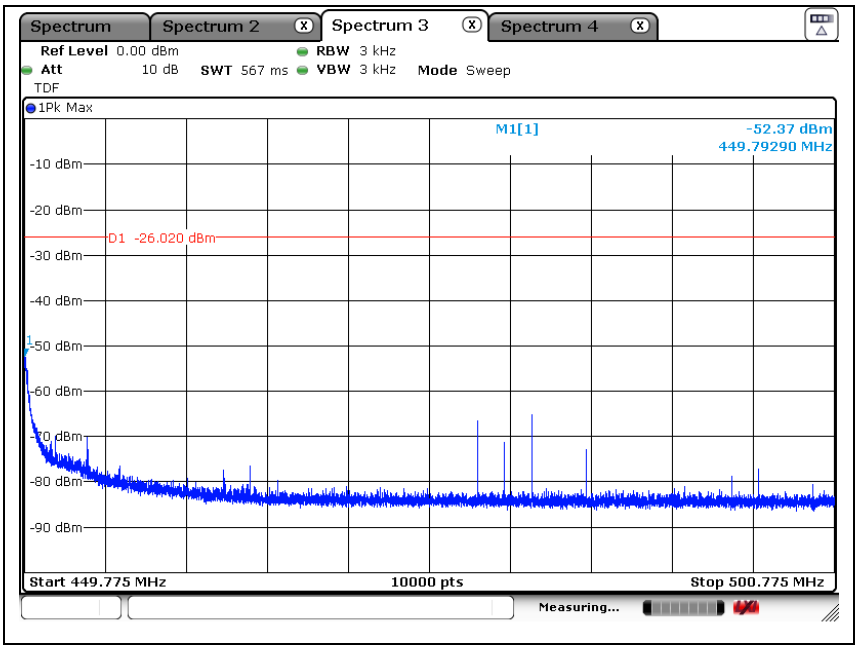
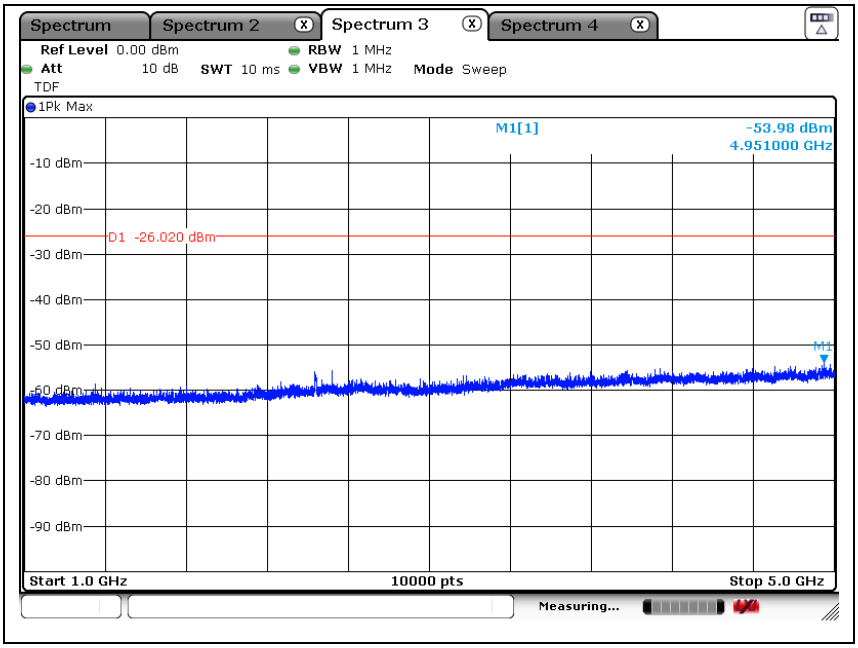
449.775 ㎒ ~ 1 000 ㎒





10*log(100/3) = 15.23 ㏈, Final result = -37.14 ㏈ m

1 000 ㎒ ~ 5 000 ㎒



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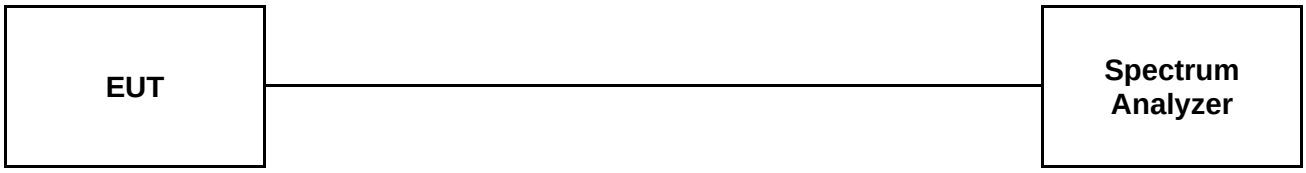
7. Secondary unwanted emission strength

7.1. Test Setup



7.2. Limit

That limit on secondary emissions radiated from the receiving equipment shall be, in terms of the power of a dummy antenna circuit that has the same electrical constant as the receiving antenna, 4 ㎱ or lower (-53.98 ㏈m) as measured using the circuit.

7.3. Test Procedure

1. The EUT output is connected to a spectrum analyzer.
2. The EUT should be transmitted at a designated channel.
3. Set the spectrum analyzer in the following setting;
   RBW(=VBW) :1 ㎒(above 1 ㎓), 100 ㎑(below 1 ㎓).
   Sweep time : auto, Start : 30 ㎒, Stop : 1 ㎓
   Sweep time : auto, Start : 1 ㎓, Stop : 5 ㎓
4. For plots showing conducted spurious emissions, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as correction function.
   So, the reading values shown in plots were final result.

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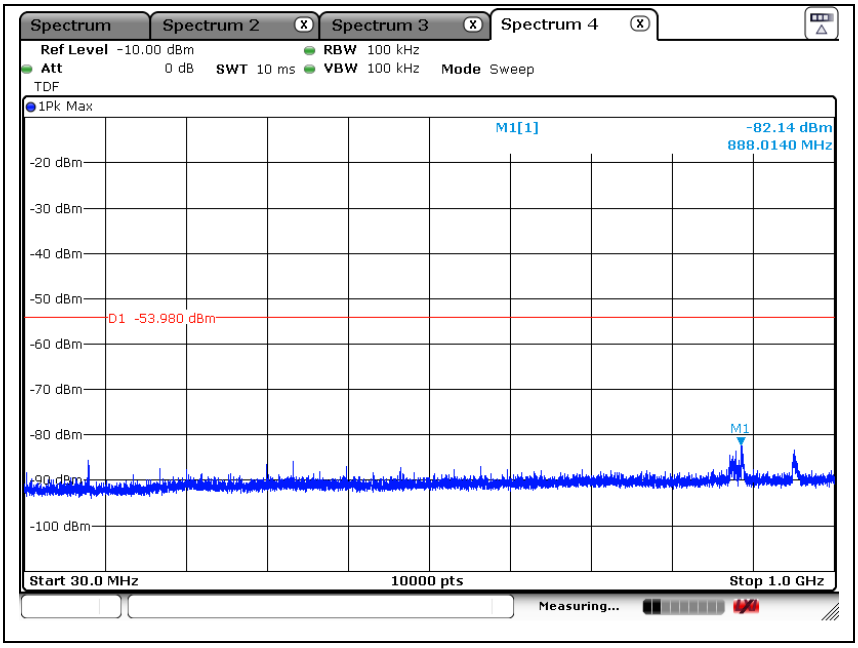
7.4. Test result

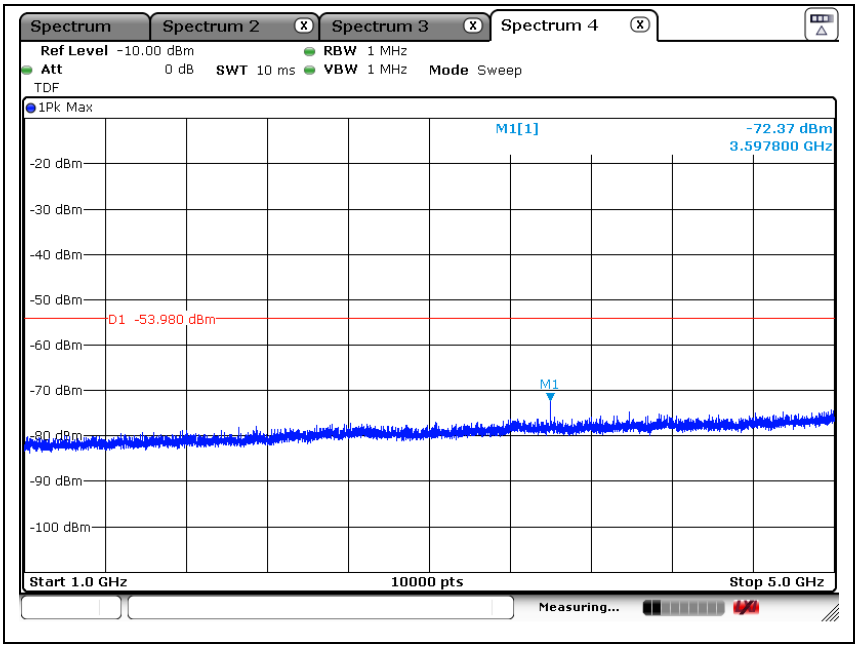
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Test voltage : DC 5.4 V

30 ㎒ ~ 1 000 ㎒



1 000 ㎒ ~ 5 000 ㎒



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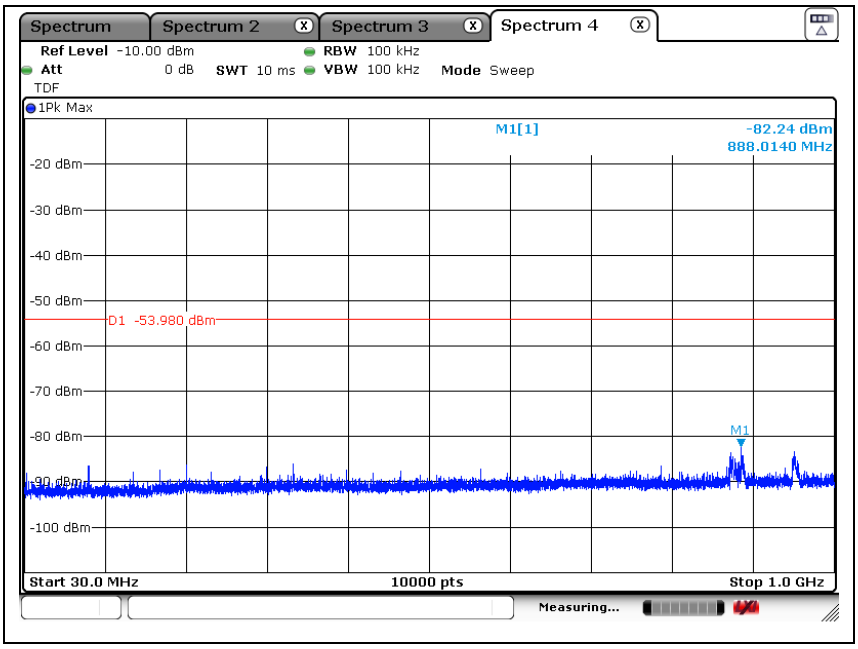
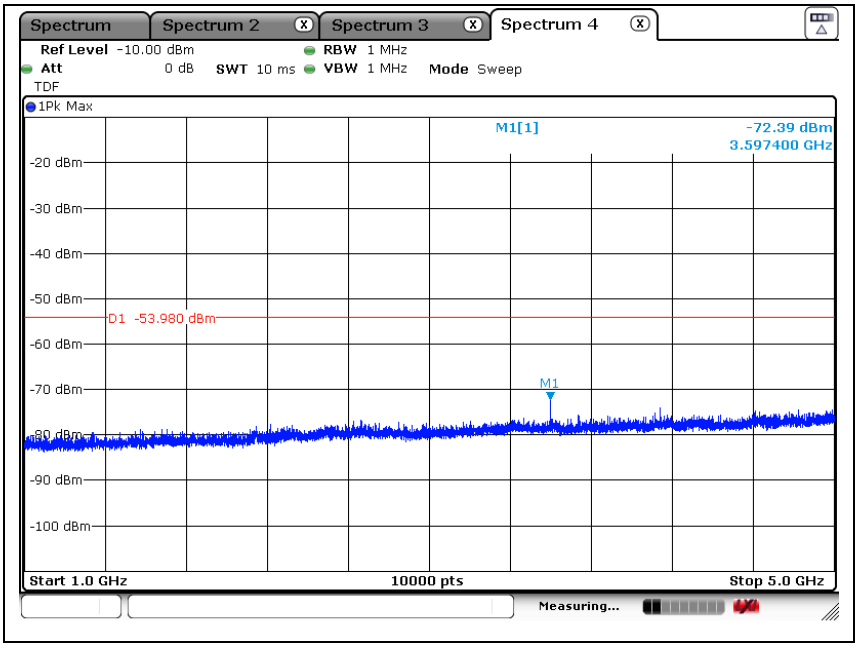
Test voltage : DC 6.0 V

30 ㎒ ~ 1 000 ㎒



1 000 ㎒ ~ 5 000 ㎒



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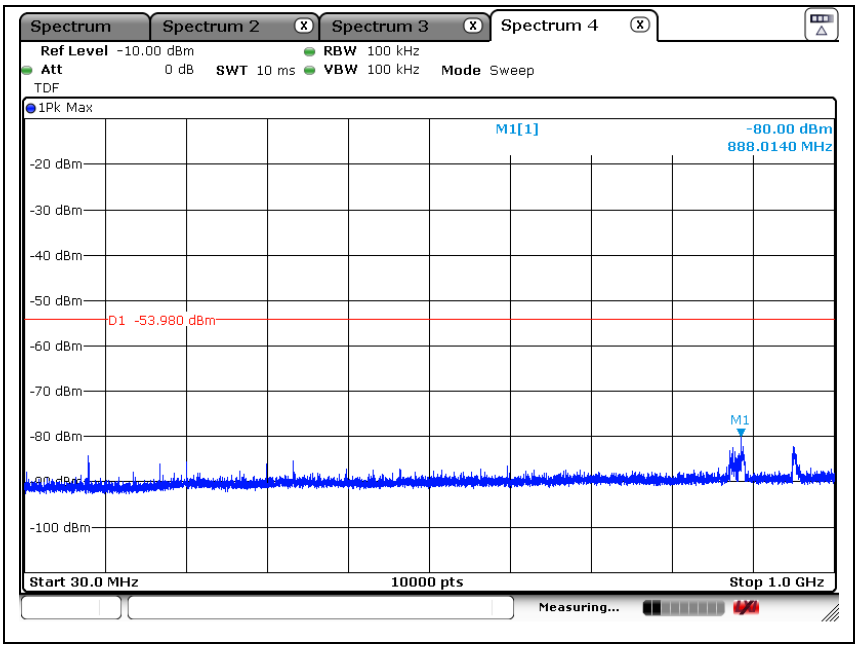
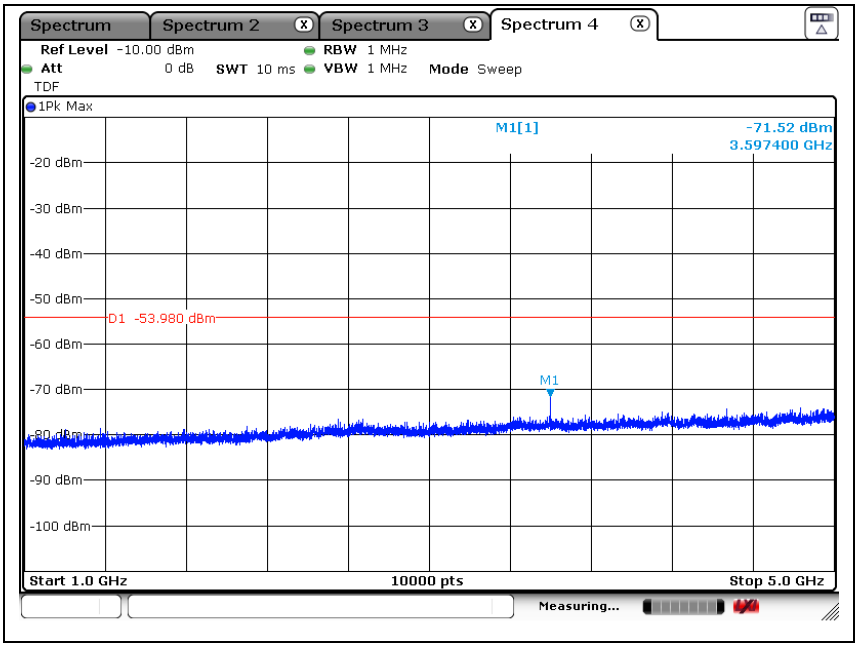
Test voltage : DC 6.6 V

30 ㎒ ~ 1 000 ㎒



1 000 ㎒ ~ 5 000 ㎒



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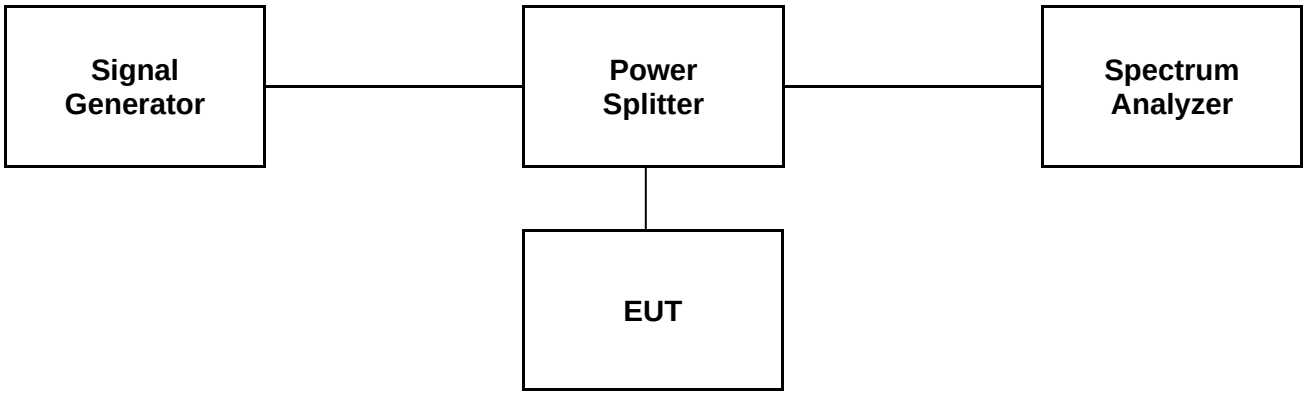
8. Carrier sensing

8.1. Test Setup



8.2. Limit

A circuit shall be considered idle when the voltage induced in an antenna with an absolute gain of 2.14 ㏈ is 3.55 ㎶(-96 ㏈m) in the 400 ㎒ band

8.3. Test Procedure

1. The EUT output is connected to a spectrum analyzer.
2. The carrier from signal generator be transmitted when the EUT should be transmitted at a designated channel.
3. Set the spectrum analyzer in the following setting;
   RBW : 300 ㎐, VBW : 300 ㎐, Span : 50 ㎑
4. Confirm EUT detected carrier wave or not

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8.4. Test result

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

- Test frequency: 449.712 5 ㎒

Test voltage($V_{d.c.}$)	Carrier sensing Detection
V nom = 6.0	-100.97 ㏈m

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9. Transmission time

9.1. Test Setup

9.2. Limit

Transmission time : 40 sec or less
Quiescence time : 2 sec or more

9.3. Test Procedure

1. The EUT output is connected to a spectrum analyzer.
2. The EUT should be transmitted at a designated channel.
3. Set the spectrum analyzer in the following setting;
   Span : 0 ㎐
   RBW(=VBW) : 100 ㎑
   Sweep time : 50 s
   Y axis : 10 dB/Div
   Detector : Positive peak
   Trigger : Rise

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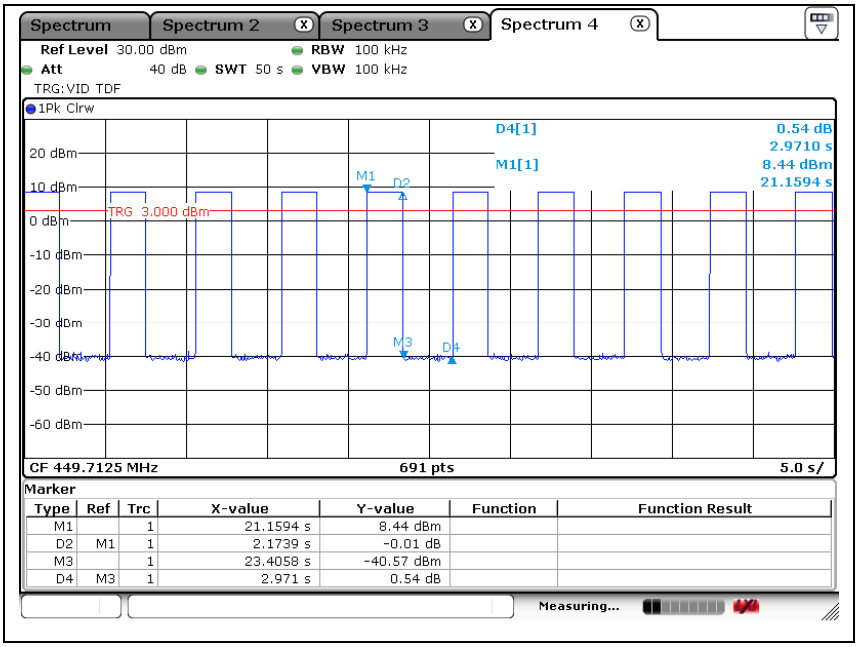
9.4. Test result

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

- Test frequency: 449.712 5 ㎒

Test voltage($V_{d.c.}$)	Transmission time	Quiescence time
V nom = 6.0	2.17 s	2.97 s

Test voltage : DC 6 V



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