

TEST REPORT

of

ARIB STD-T66

Equipment Under Test : Hybrid PIO
Model Name : CTS-HPIO-M2
Applicant : CANTOPS CO., LTD.
Manufacturer : CANTOPS CO., LTD.
Date of Receipt : 2019.11.04
Date of Test(s) : 2019.11.18 ~ 2019.11.26
Date of Issue : 2019.12.05

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

Tested By:



Jaehoon Kim

Date:

2019.12.05

Technical
Manager:



Hyunchae You

Date:

2019.12.05

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

Table of contents

1. General Information -----	3
2. Frequency Tolerance -----	6
3. Occupied Bandwidth (99 %) -----	11
4. Spurious Emission Intensity -----	16
5. Antenna Power -----	21
6. Secondary Radiated Emissions -----	29
7. Interference Prevention Function -----	34
8. Test Methodology & Conditions -----	35

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

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 : CANTOPS CO., LTD.

Address : (A-1002 Digital Empire BLDG), 16, Deogyong-daero 1556beon-gil, Yeongtong-gu, Suwon-si, Gyeonggi-do, Republic of Korea

Contact Person : Park, Hyo-suk

Phone No. : +82 31 303 8960

1.3. Details of manufacturer

Company : Same as applicant

Address : Same as applicant

1.4. Description of EUT

Kind of Product	Hybrid PIO
Model Name	CTS-HPIO-M2
Power Supply	DC 24 V
Frequency Range	2 405 MHz ~ 2 480 MHz
Modulation Technique	GFSK
Number of Channels	76 channels
Rated Output Power	2 mW
Antenna Type	External Type(Dipole Antenna)
Antenna Gain	2.10 dB i
H/W version	Rev 1.0
S/W version	Rev 1.0

1.5. Declaration by the manufacturer

- The EUT has 2 external antennas. Antennas cannot be operating simultaneously.

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

1.6. Test Equipment List

Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Authority	Cal. Method
Spectrum Analyzer	R&S	FSV30	103100	Jun. 19, 2019	SICT	c)
Signal Generator	Agilent	E8257D	MY51501169	Jul. 03, 2019	SICT	c)
Attenuator	MCLI	FAS-12-10	1	Jun. 07, 2019	SICT	c)
DC Power Supply	Agilent	U8002A	MY50060028	Mar. 12, 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).

1.7. 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.

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

1.8. 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
STD-T66 3.4	Interference Prevention Function	Complied

1.9. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501-RF-RTL000016	2019.11.27	Initial
1	F690501-RF-RTL000016-1	2019.12.05	Modified Antenna Gain

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

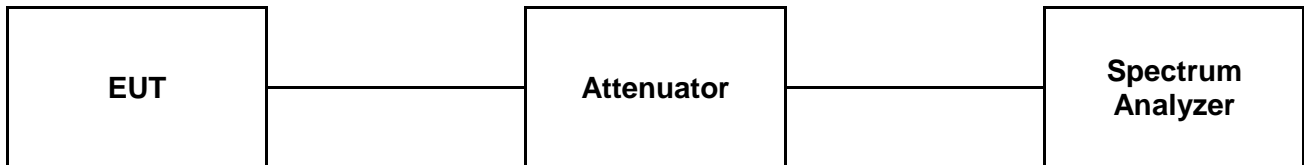
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

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
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.

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

2.4. Test result

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

Ant.1

Test voltage(V _{d.c.})	Measured frequency (MHz)	Reading frequency (MHz)	Frequency tolerance [ppm]
V _{Nom} = 24	Low Ch. (2 405)	2 405.037 000	15.38
	Middle Ch. (2 440)	2 440.035 000	14.34
	High Ch. (2 480)	2 480.035 000	14.11

Ant.2

Test voltage(V _{d.c.})	Measured frequency (MHz)	Reading frequency (MHz)	Frequency tolerance [ppm]
V _{Nom} = 24	Low Ch. (2 405)	2 405.036 000	14.97
	Middle Ch. (2 440)	2 440.034 000	13.93
	High Ch. (2 480)	2 480.034 000	13.71

Note;

1. FT (ppm) = [(RF-MF)/MF] × 10⁶
- FT: Frequency Tolerance, RF: Reading Frequency and MF: Measurement Frequency

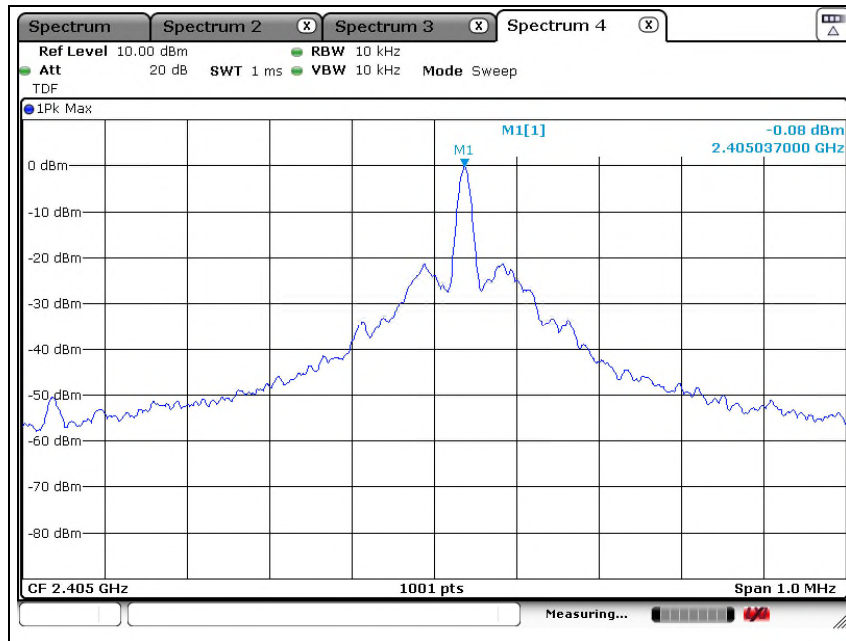
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

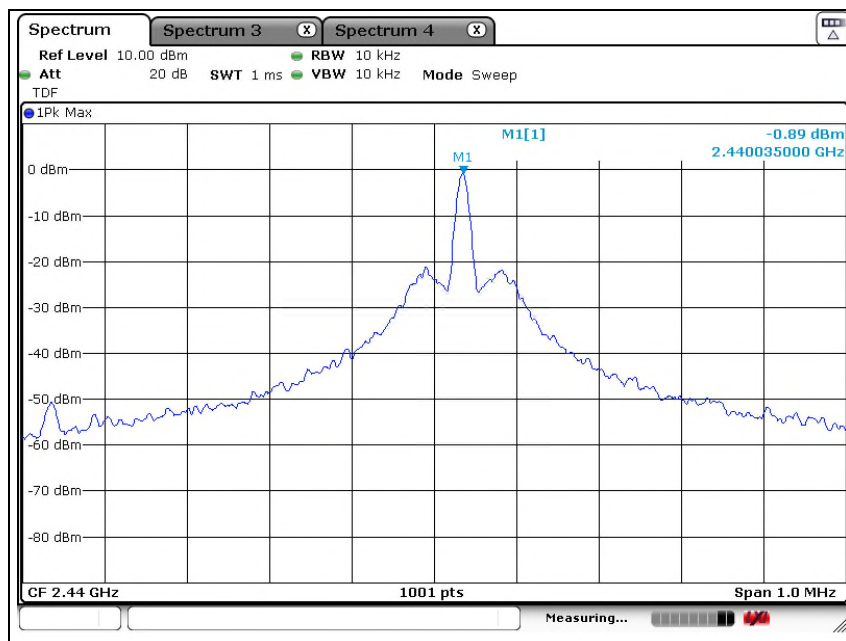
Normal voltage

Ant.1

Low channel



Middle channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

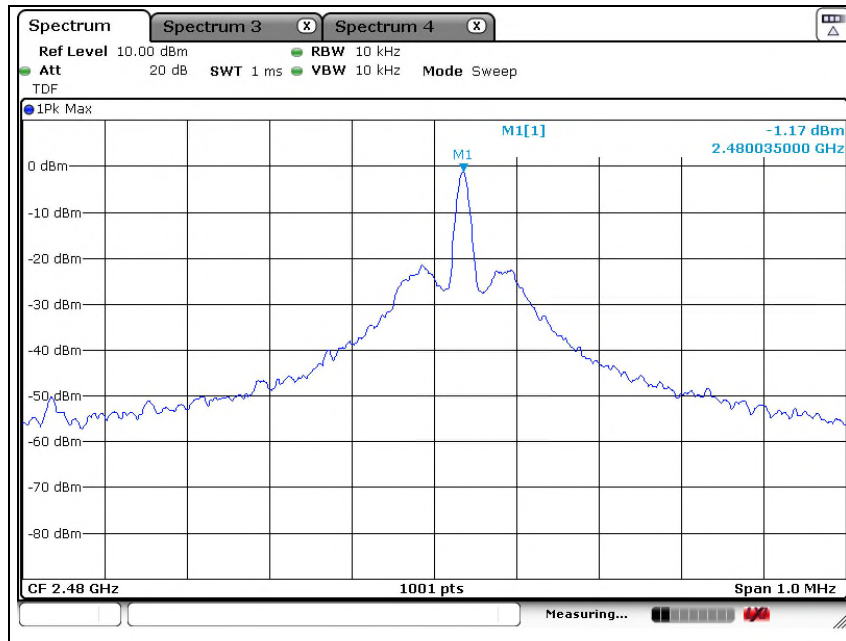
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

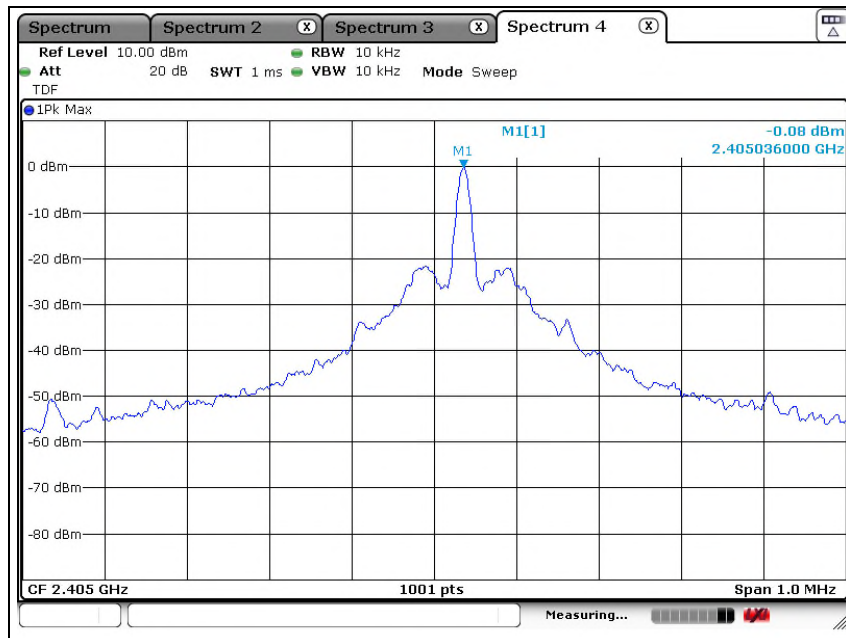
A4(210 mm x 297 mm)

High channel



Ant.2

Low channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

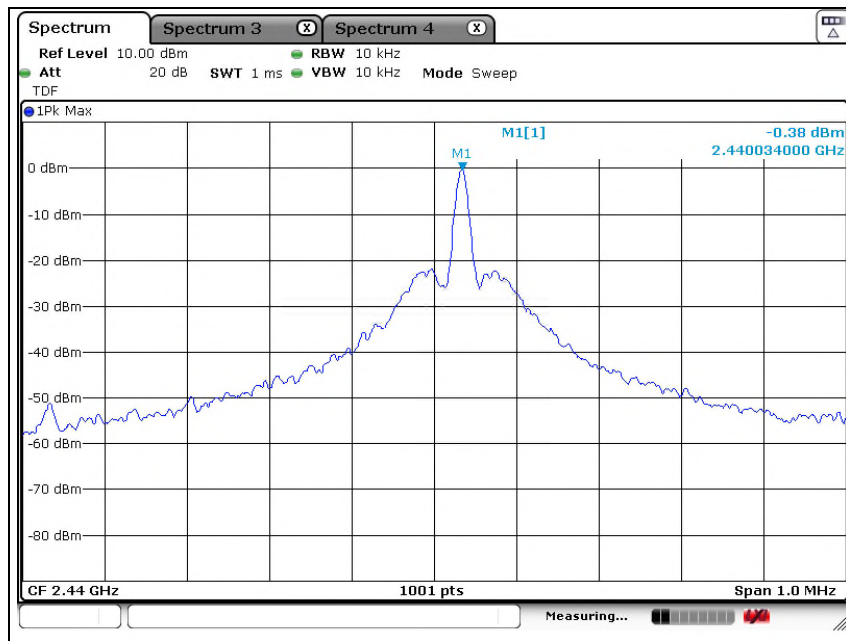
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

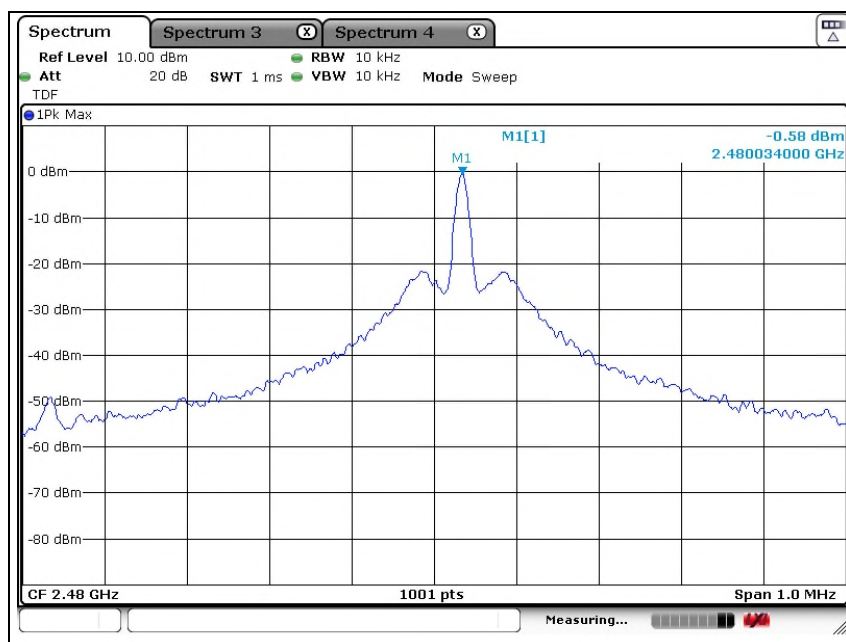
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle channel



High channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

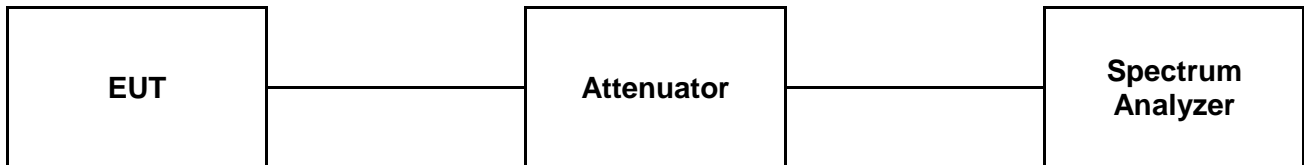
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

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. Occupied Bandwidth is measured by following setting:

Use OBW capability of spectrum analyzer

Center frequency	: 2 405 MHz, 2 440 MHz, 2 480 MHz
Span	: 5 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 %

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

3.4. Test result

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

Ant.1

Test voltage(V _{d.c.})	Measured frequency (MHz)	Occupied bandwidth (MHz)
V _{Nom} = 24	Low Ch. (2 405)	1.044
	Middle Ch. (2 440)	1.049
	High Ch. (2 480)	1.039

Ant.2

Test voltage(V _{d.c.})	Measured frequency (MHz)	Occupied bandwidth (MHz)
V _{Nom} = 24	Low Ch. (2 405)	1.044
	Middle Ch. (2 440)	1.049
	High Ch. (2 480)	1.034

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

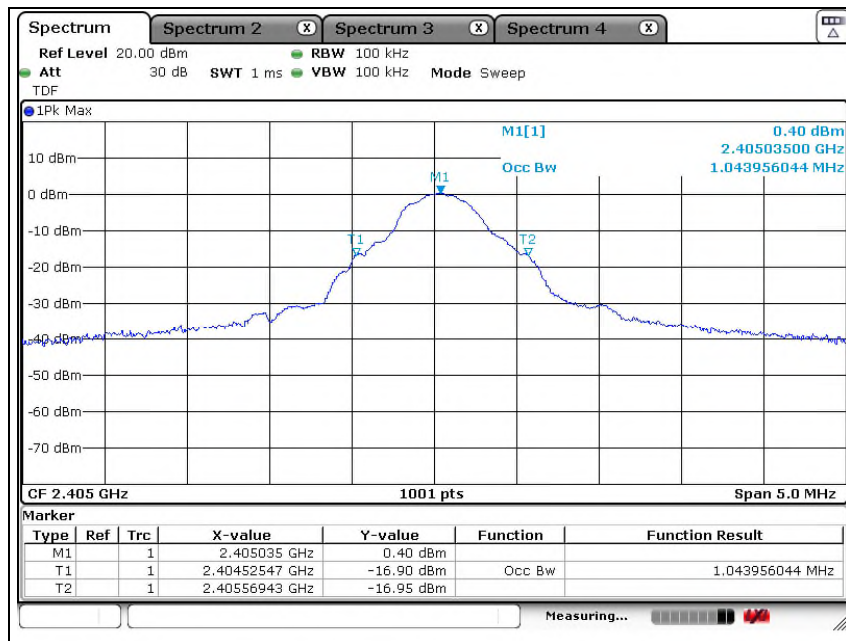
A4(210 mm x 297 mm)

Occupied Bandwidth (99 %)

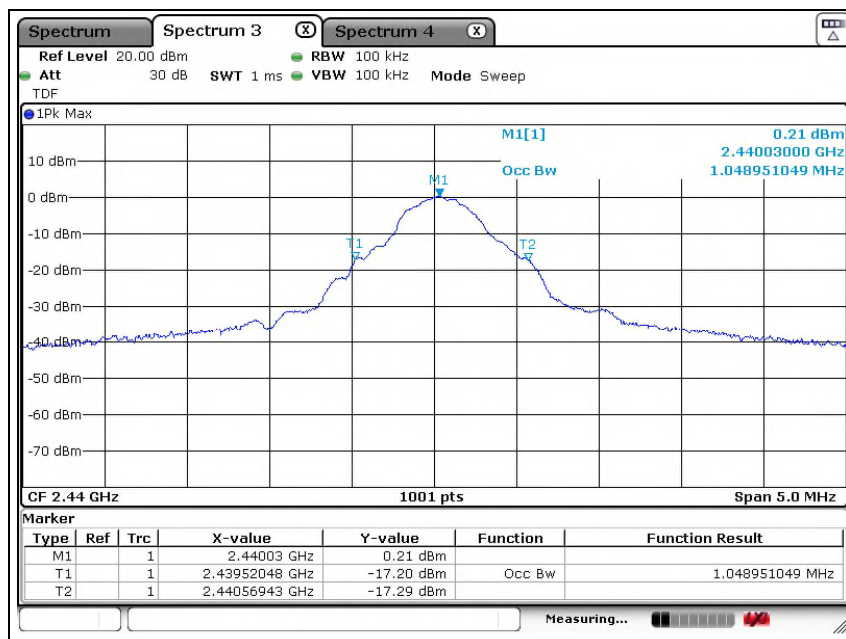
Normal voltage

Ant.1

Low channel



Middle channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

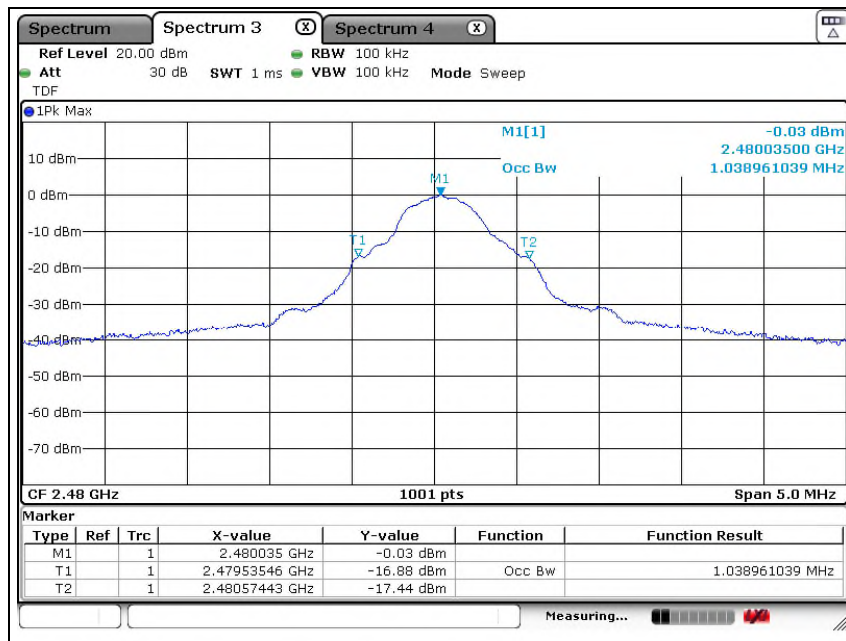
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

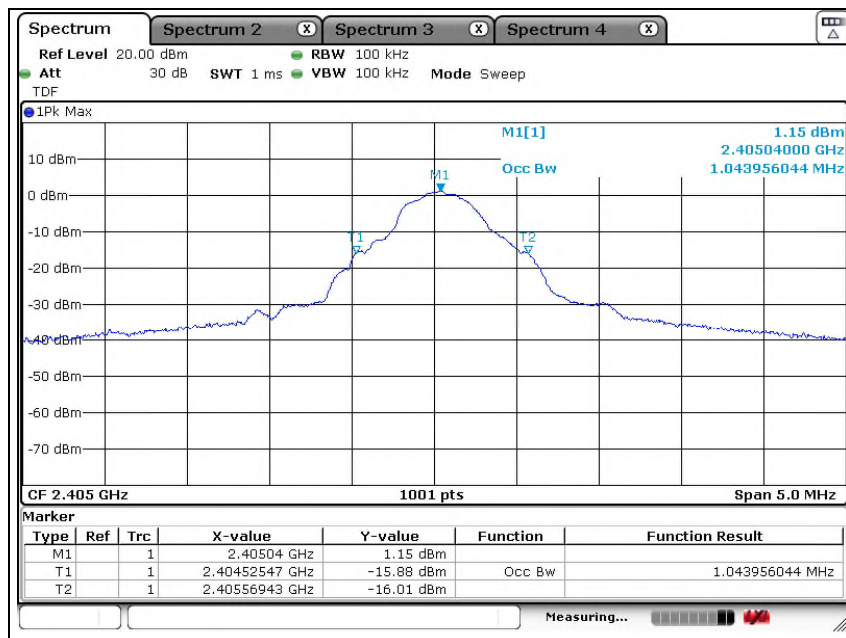
A4(210 mm x 297 mm)

High channel



Ant.2

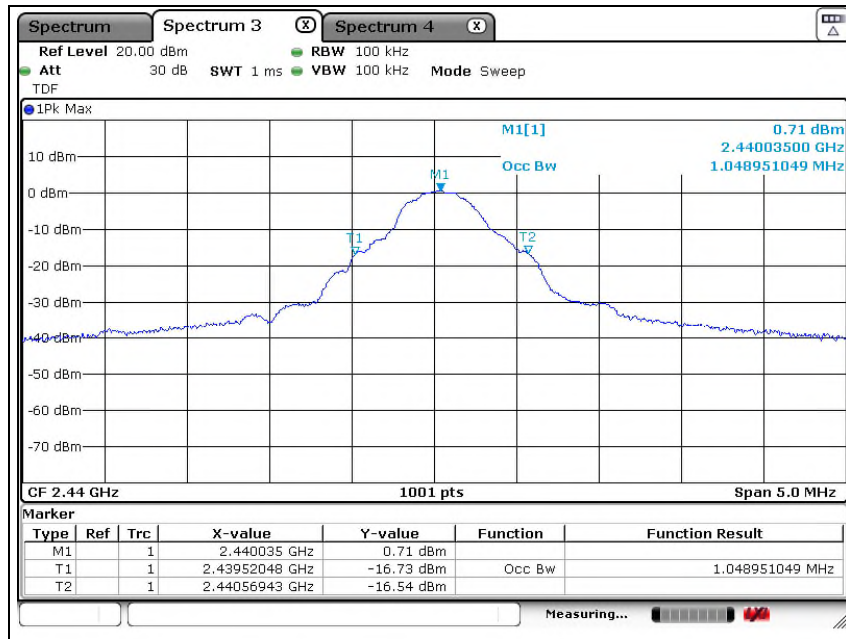
Low channel



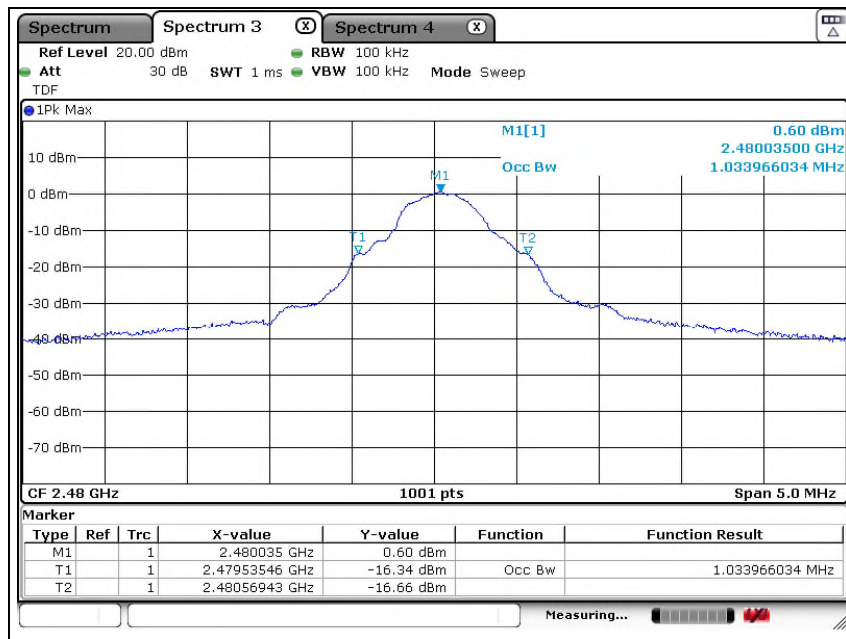
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

Middle channel



High channel



4. Spurious Emission Intensity

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

4.1. Test Setup



4.2. Limit

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

[Setting 1]

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.

Search for spurious emissions from 30 MHz to 12.5 GHz.

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

4.4. Test result

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

Ant.1

Test voltage (V _{d.c.})	Frequency Range (MHz)	Measured	Low Ch. (2 405 MHz)	Middle Ch. (2 440 MHz)	High Ch. (2 480 MHz)	Limit
V _{nom} = 24	Below 2 387	Frequency (GHz)	2.386	2.364	2.383	-
		Level (dB m/MHz)	-39.09	-48.64	-53.71	-26
		Level (μW/MHz)	0.123 310	0.013 677	0.004 256	2.5
	2 387 to 2 400	Frequency (GHz)	2.400	2.400	2.399	-
		Level (dB m/MHz)	-27.17	-45.31	-50.15	-16
		Level (μW/MHz)	1.918 669	0.029 444	0.009 661	25
	2 483.5 to 2 496.5	Frequency (GHz)	2.496	2.485	2.484	-
		Level (dB m/MHz)	-49.32	-45.45	-24.51	-16
		Level (μW/MHz)	0.011 695	0.028 510	3.539 973	25
	Above 2 496.5	Frequency (GHz)	2.497	2.498	2.497	-
		Level (dB m/MHz)	-52.11	-48.94	-38.30	-26
		Level (μW/MHz)	0.006 152	0.012 764	0.147 911	2.5

Ant.2

Test voltage (V _{d.c.})	Frequency Range (MHz)	Measured	Low Ch. (2 405 MHz)	Middle Ch. (2 440 MHz)	High Ch. (2 480 MHz)	Limit
V _{nom} = 24	Below 2 387	Frequency (GHz)	2.375	2.379	2.373	-
		Level (dB m/MHz)	-43.29	-48.51	-53.08	-26
		Level (μW/MHz)	0.046 881	0.014 093	0.004 920	2.5
	2 387 to 2 400	Frequency (GHz)	2.400	2.400	2.394	-
		Level (dB m/MHz)	-26.74	-43.96	-48.86	-16
		Level (μW/MHz)	2.118 361	0.040 179	0.013 002	25
	2 483.5 to 2 496.5	Frequency (GHz)	2.486	2.484	2.484	-
		Level (dB m/MHz)	-48.77	-44.36	-23.61	-16
		Level (μW/MHz)	0.013 274	0.036 644	4.355 119	25
	Above 2 496.5	Frequency (GHz)	2.499	2.500	2.502	-
		Level (dB m/MHz)	-50.53	-48.09	-39.23	-26
		Level (μW/MHz)	0.008 851	0.015 524	0.119 399	2.5

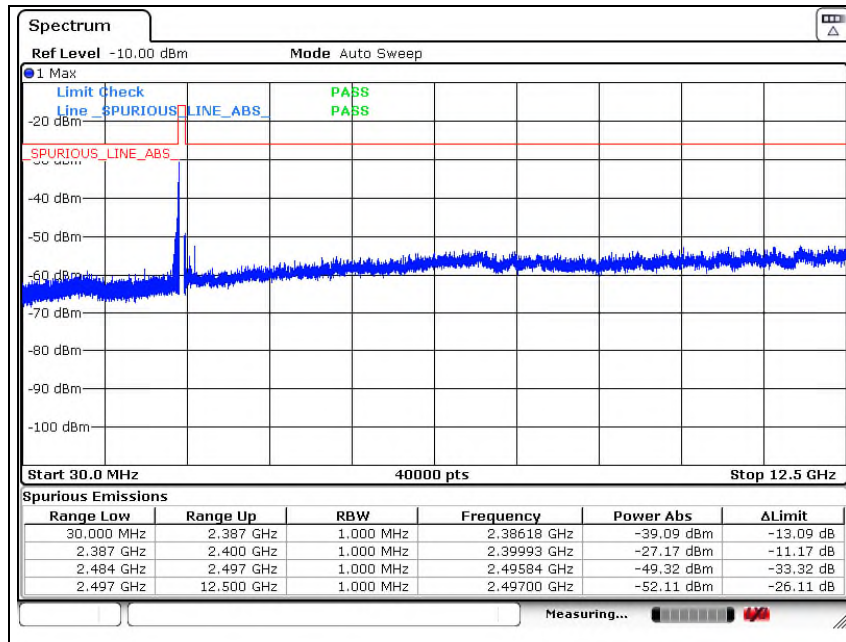
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

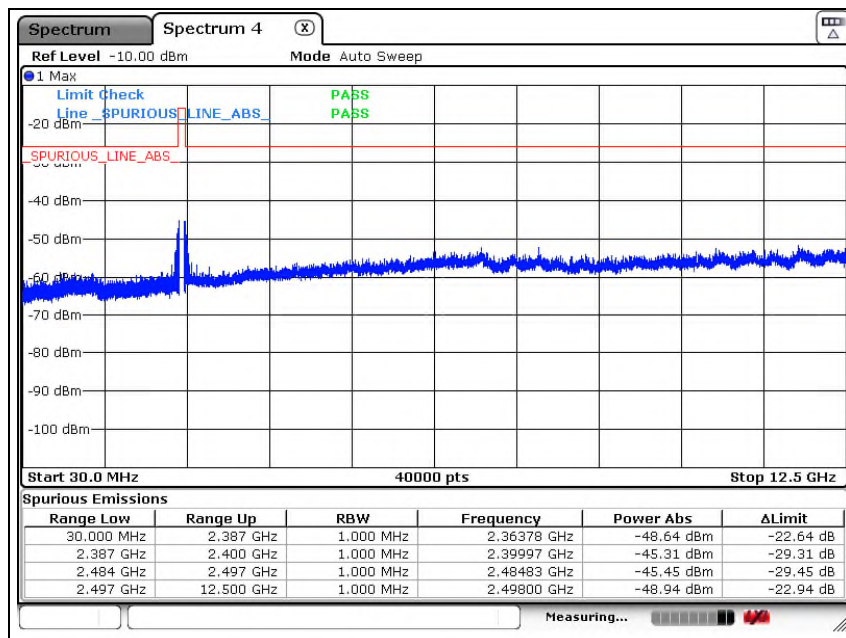
Normal voltage

Ant.1

Low channel



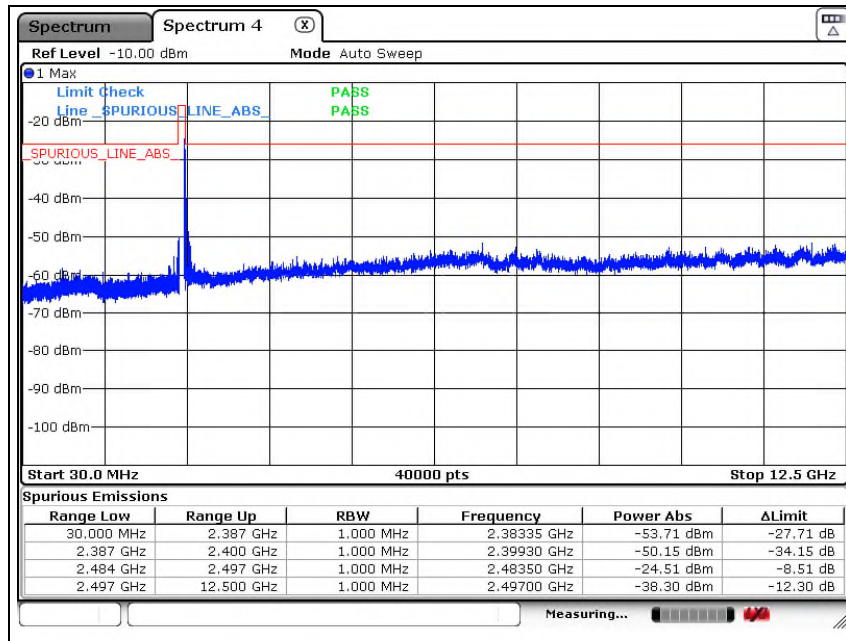
Middle channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

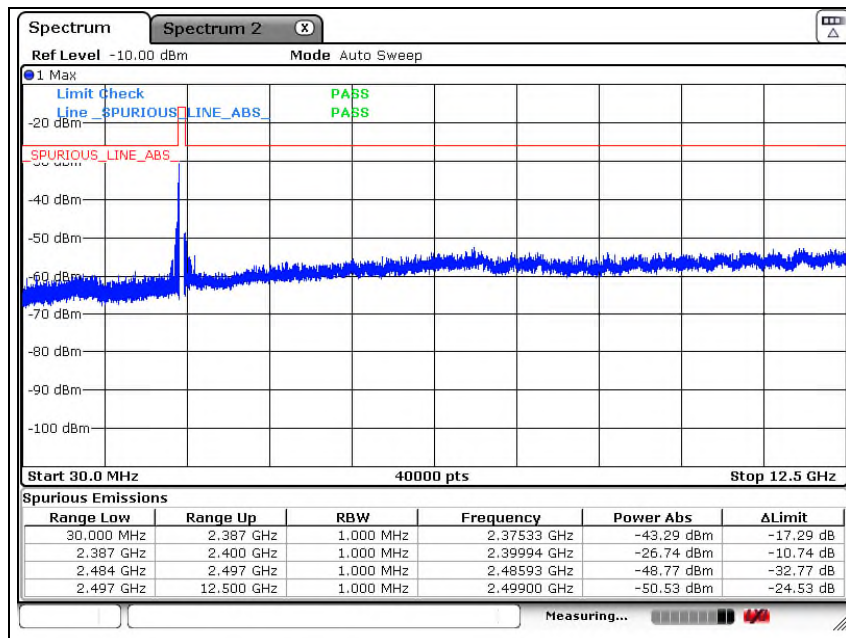
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

High channel



Ant.2

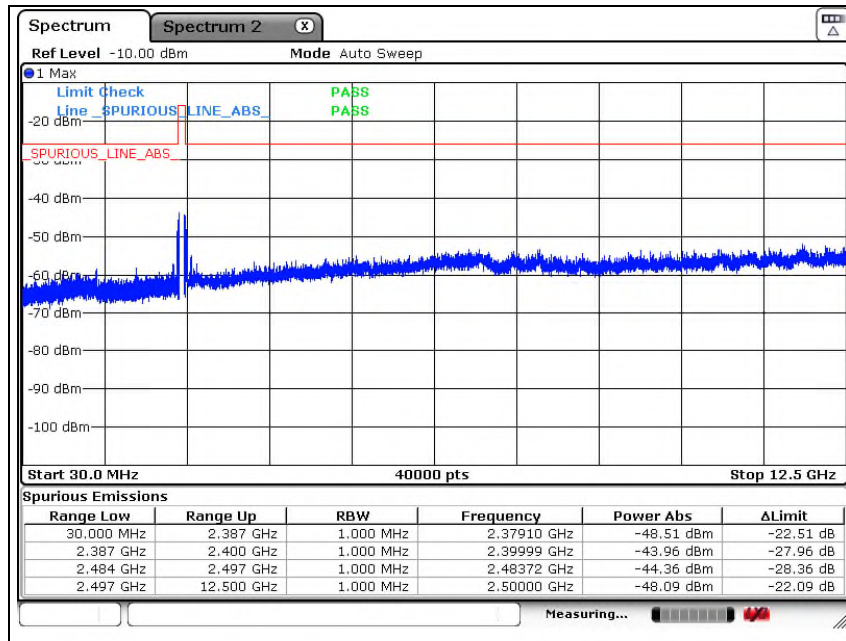
Low channel



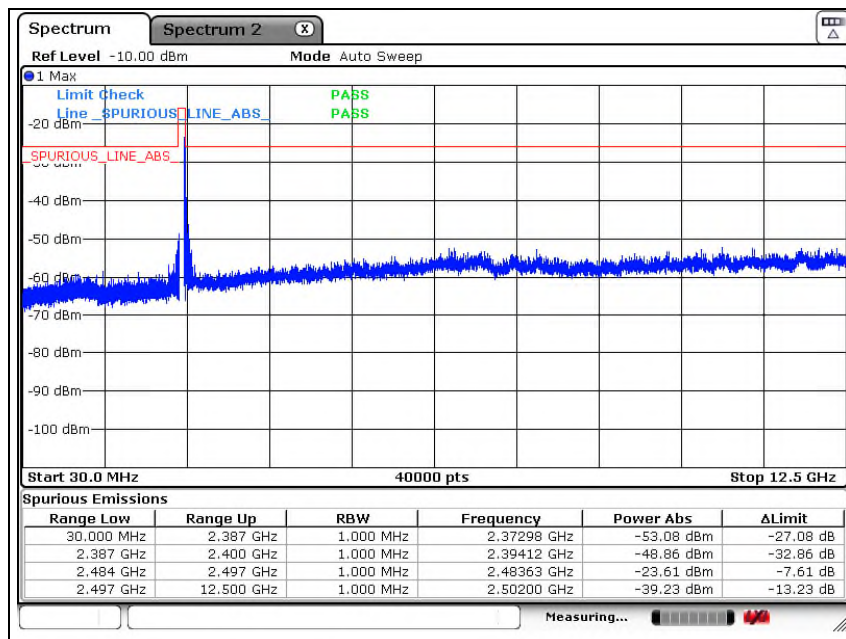
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

Middle channel



High channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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;

[Setting 1]

–Search for peak power frequency according to below settings

Center frequency : 2 405 MHz, 2 440 MHz, 2 480 MHz
Span : 2.5 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

[Setting 2]

–Measurement of average antenna power according to below settings

Center frequency : Frequency of peak power [Setting 1]
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
Indication mode : Max hold
Measure the Average Burst Power of the frequency

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

5.4. Test result

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

Ant.1

Test voltage(V _{d.c.})	Channel (MHz)	Antenna gain (dB i)	Rated Output Power		E.I.R.P. (dB m)	Average Burst Power		Power Tolerance (%)
V _{Nom} = 24	Low Ch. (2 405)	2.10	2.00 mW	3.01 dB m	5.11	1.03 mW	0.12 dB m	-48.60
	Middle Ch. (2 440)	2.10	2.00 mW	3.01 dB m	5.11	0.96 mW	-0.20 dB m	-52.25
	High Ch. (2 480)	2.10	2.00 mW	3.01 dB m	5.11	0.92 mW	-0.36 dB m	-54.00

Ant.2

Test voltage(V _{d.c.})	Channel (MHz)	Antenna gain (dB i)	Rated Output Power		E.I.R.P. (dB m)	Average Burst Power		Power Tolerance (%)
V _{Nom} = 24	Low Ch. (2 405)	2.10	2.00 mW	3.01 dB m	5.11	1.19 mW	0.74 dB m	-40.70
	Middle Ch. (2 440)	2.10	2.00 mW	3.01 dB m	5.11	1.09 mW	0.38 dB m	-45.45
	High Ch. (2 480)	2.10	2.00 mW	3.01 dB m	5.11	1.07 mW	0.29 dB m	-46.55

Note;

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

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

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

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

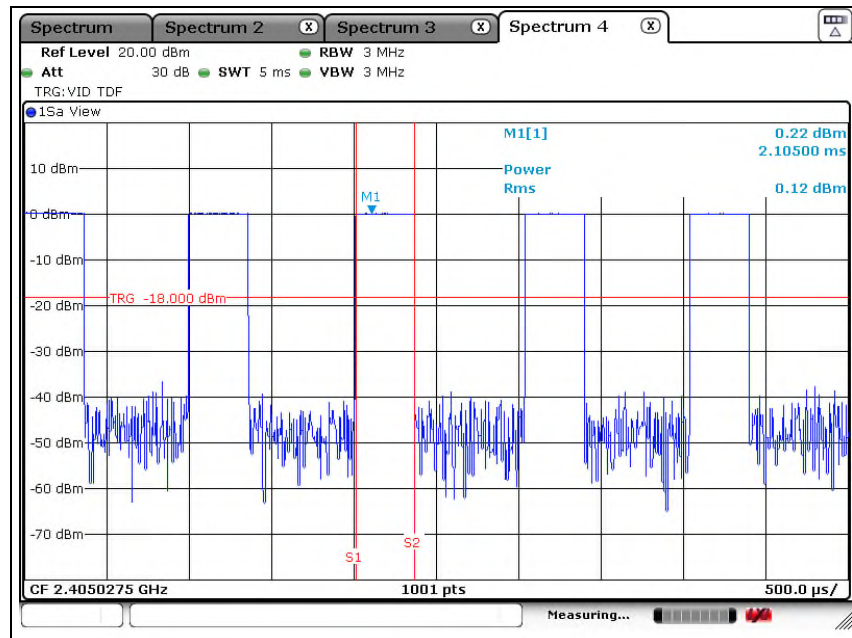
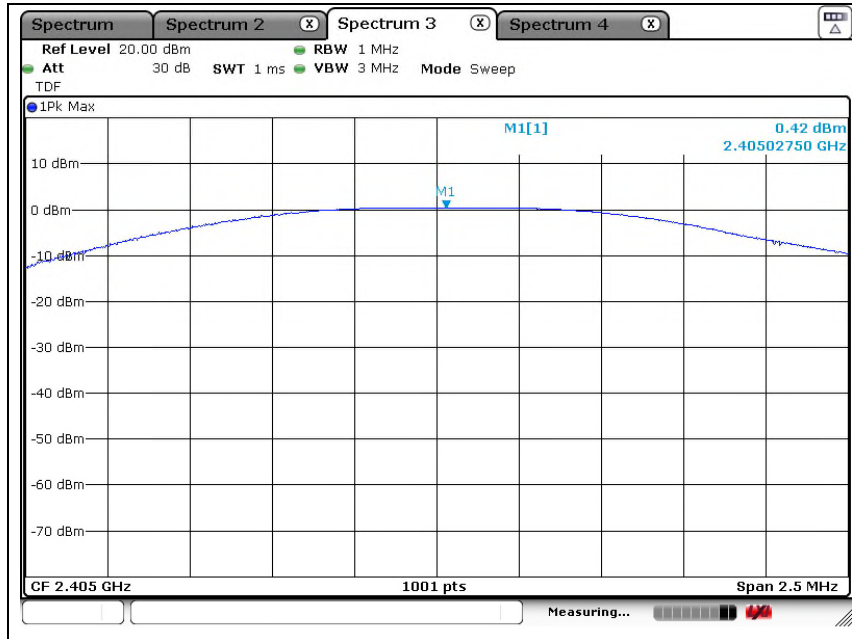
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm × 297 mm)

Normal voltage

Ant.1

Low channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

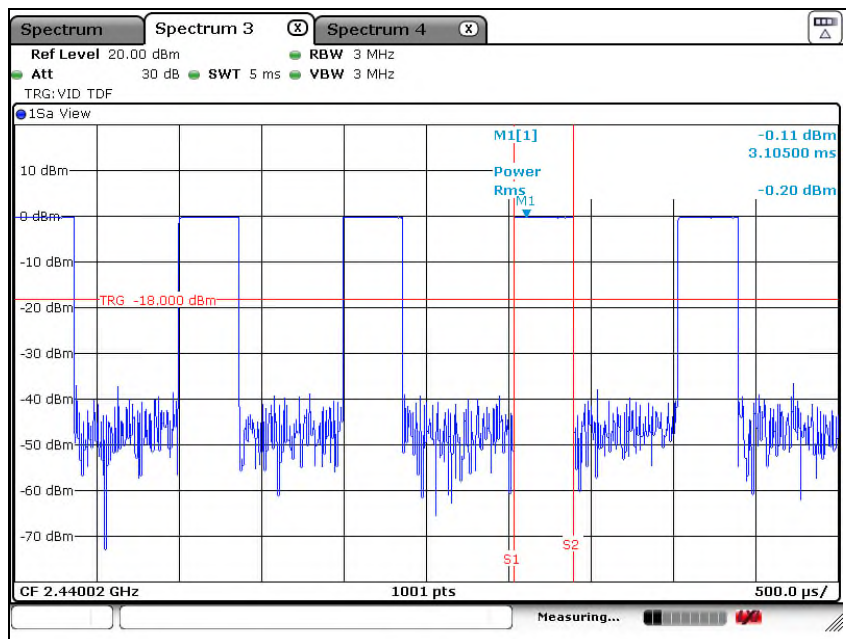
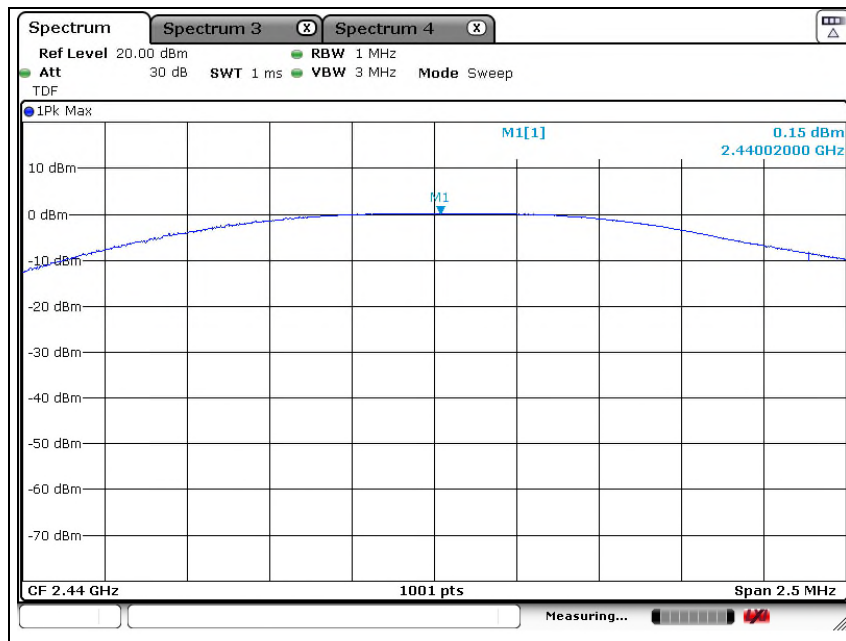
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

Middle channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

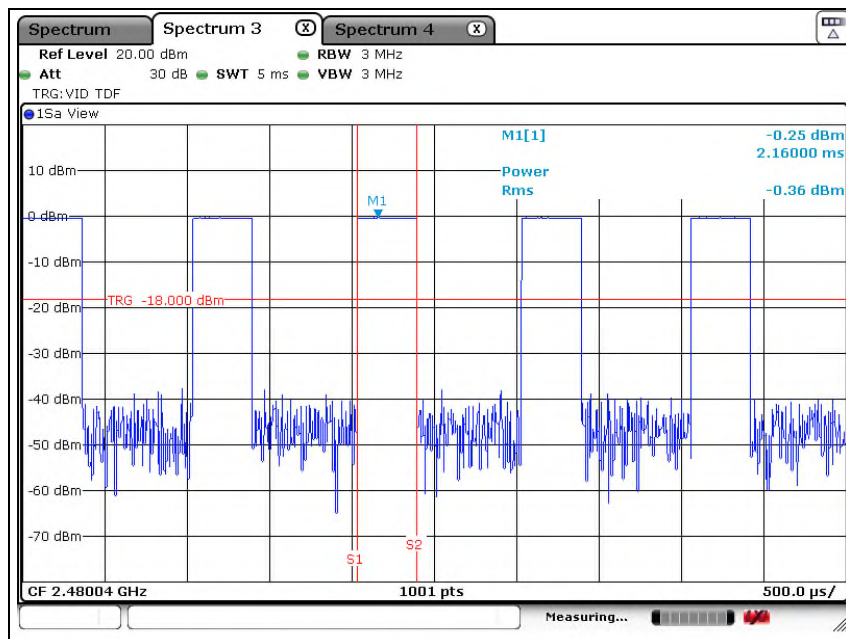
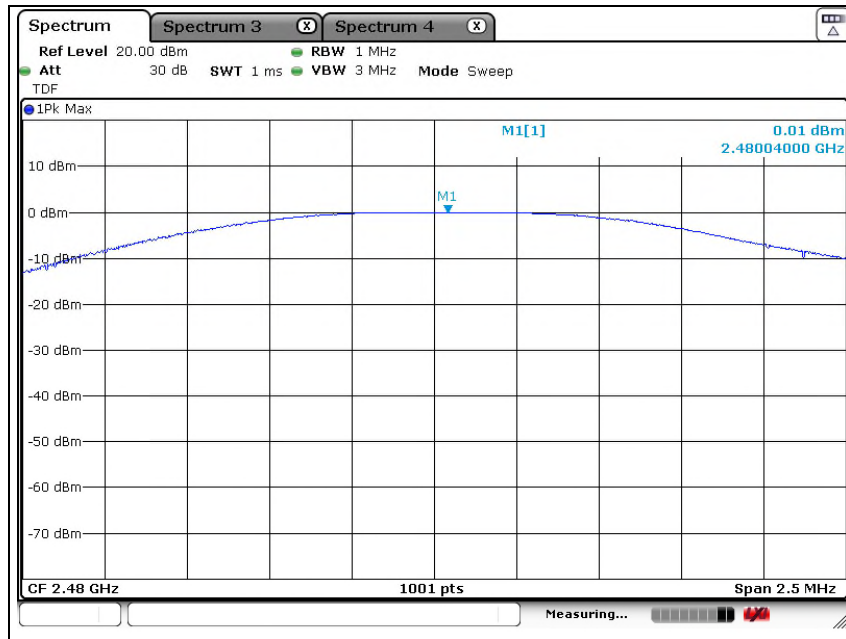
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

High channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

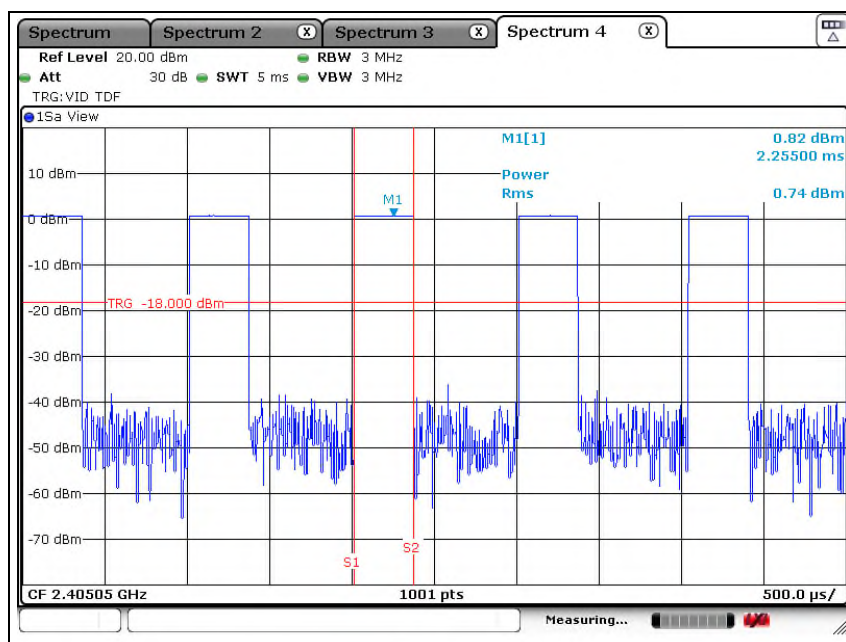
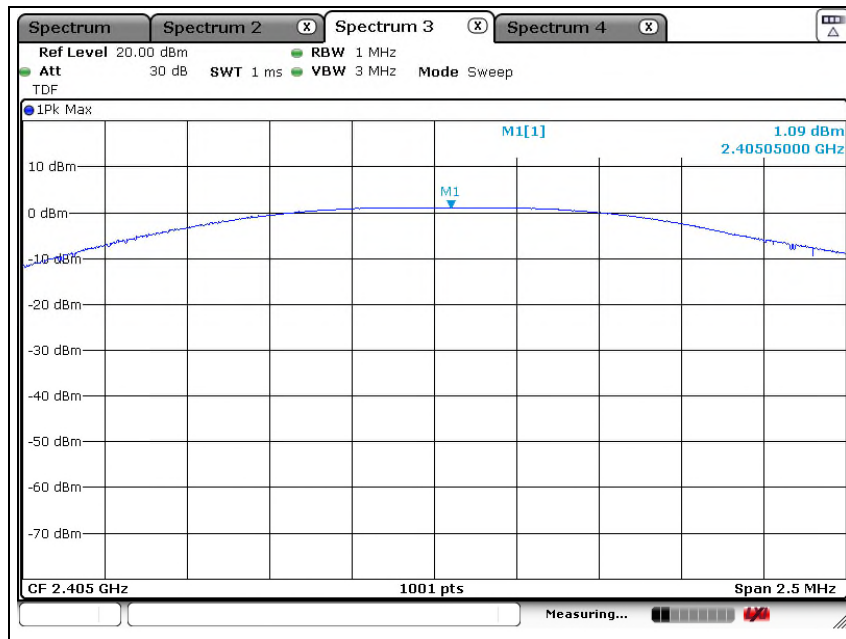
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

Ant.2

Low channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

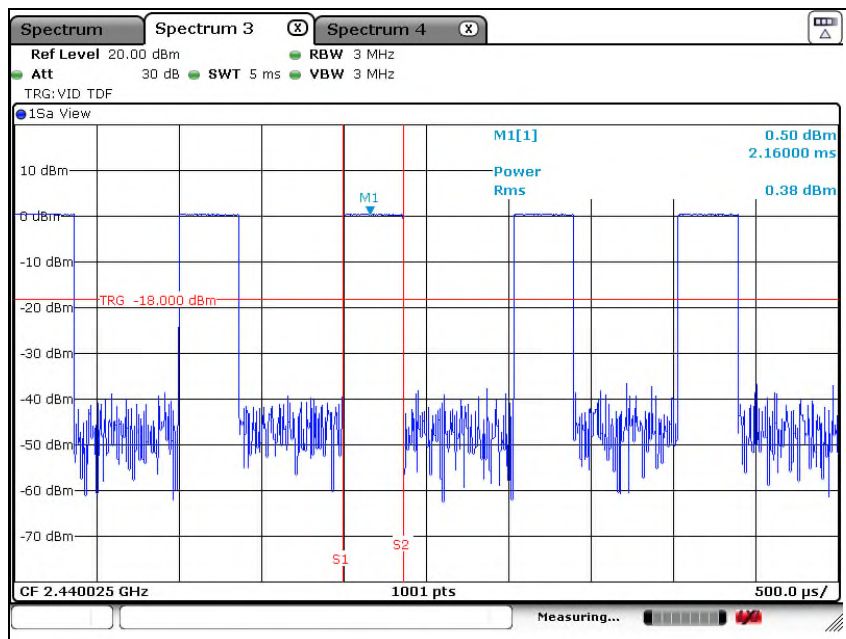
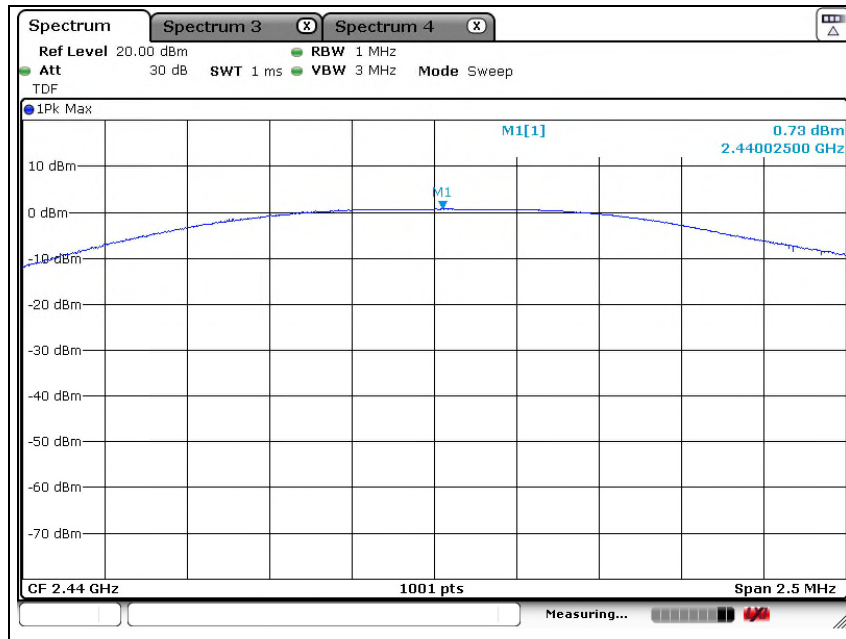
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

Middle channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

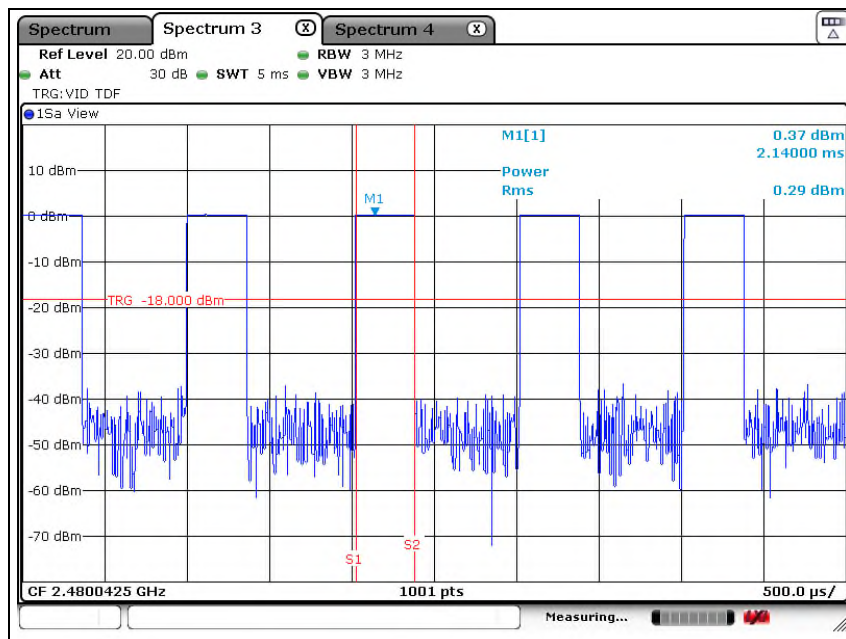
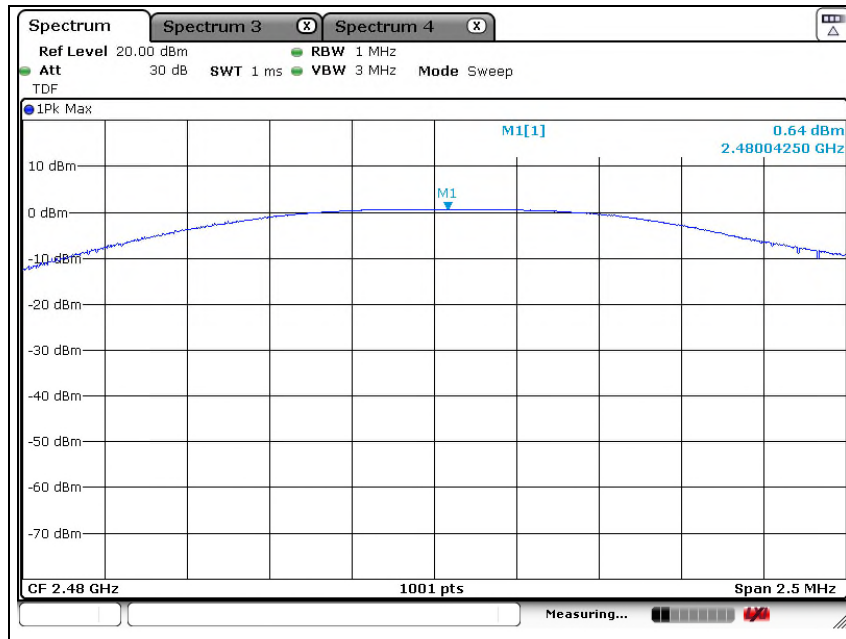
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

High channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

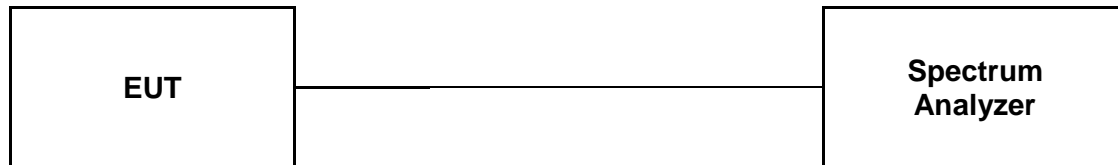
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

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

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.

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

6.4. Test result

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

Ant.1

Test voltage (V _{d.c.})	Frequency Range (MHz)	Measured	Low Ch. (2 405 MHz)	Middle Ch. (2 440 MHz)	High Ch. (2 480 MHz)	Limit
V _{nom} = 24	Below 1 000	Frequency (GHz)	0.878	0.890	0.954	-
		Level (dB m)	-87.80	-88.10	-88.31	-54
		Level (nW)	0.001 660	0.001 549	0.001 476	4
	1 000 to 12 500	Frequency (GHz)	2.751	2.791	2.837	-
		Level (dB m)	-68.28	-68.85	-69.39	-47
		Level (nW)	0.148 594	0.130 317	0.115 080	20

Ant.2

Test voltage (V _{d.c.})	Frequency Range (MHz)	Measured	Low Ch. (2 405 MHz)	Middle Ch. (2 440 MHz)	High Ch. (2 480 MHz)	Limit
V _{nom} = 24	Below 1 000	Frequency (GHz)	0.809	0.855	0.753	-
		Level (dB m)	-87.71	-88.41	-88.08	-54
		Level (nW)	0.001 694	0.001 442	0.001 556	4
	1 000 to 12 500	Frequency (GHz)	2.751	2.791	2.837	-
		Level (dB m)	-67.90	-68.03	-69.14	-47
		Level (nW)	0.162 181	0.157 398	0.121 899	20

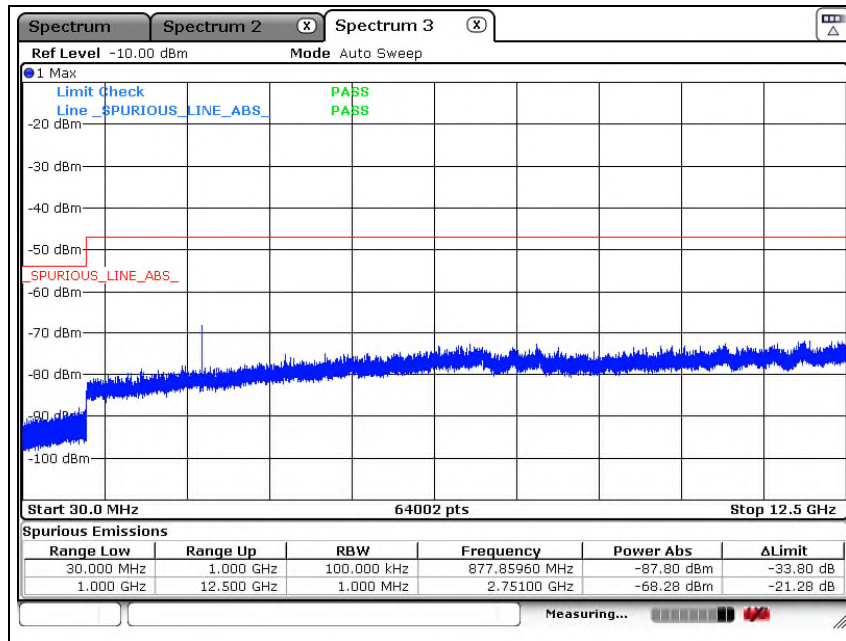
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

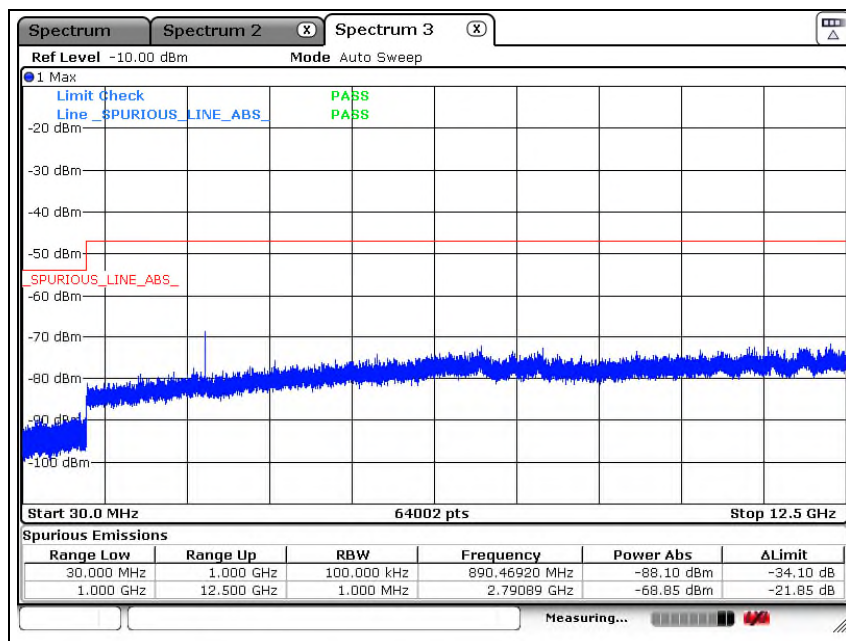
Normal voltage

Ant.1

Low channel



Middle channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

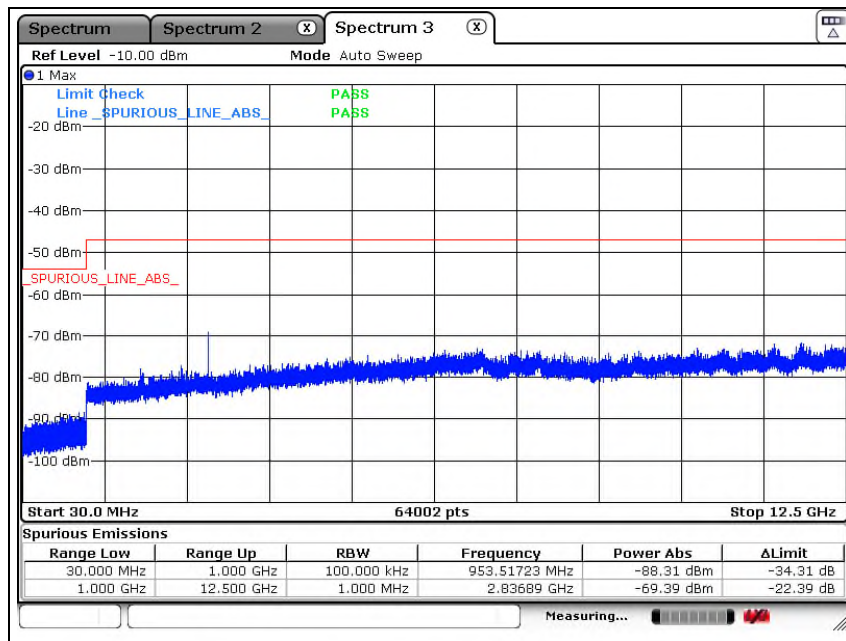
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

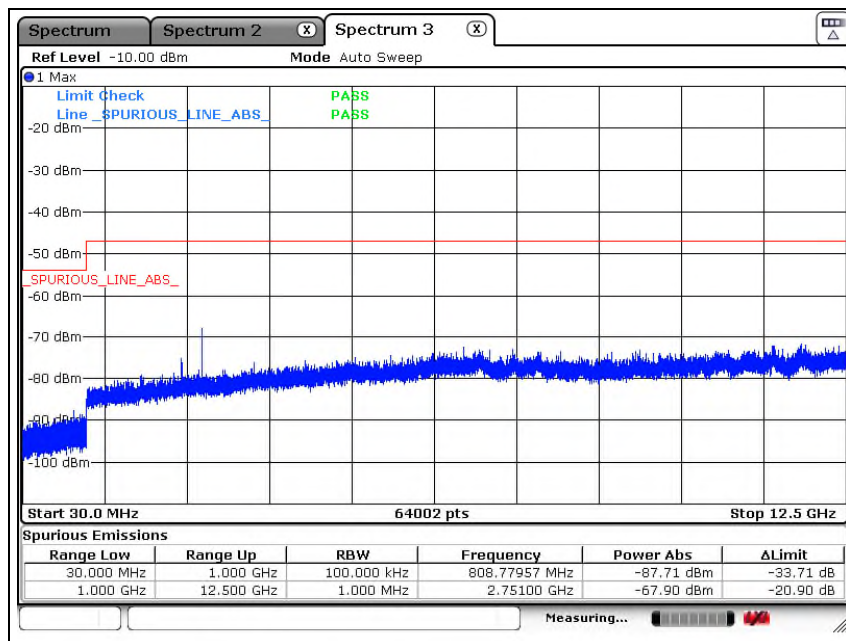
A4(210 mm x 297 mm)

High channel



Ant.2

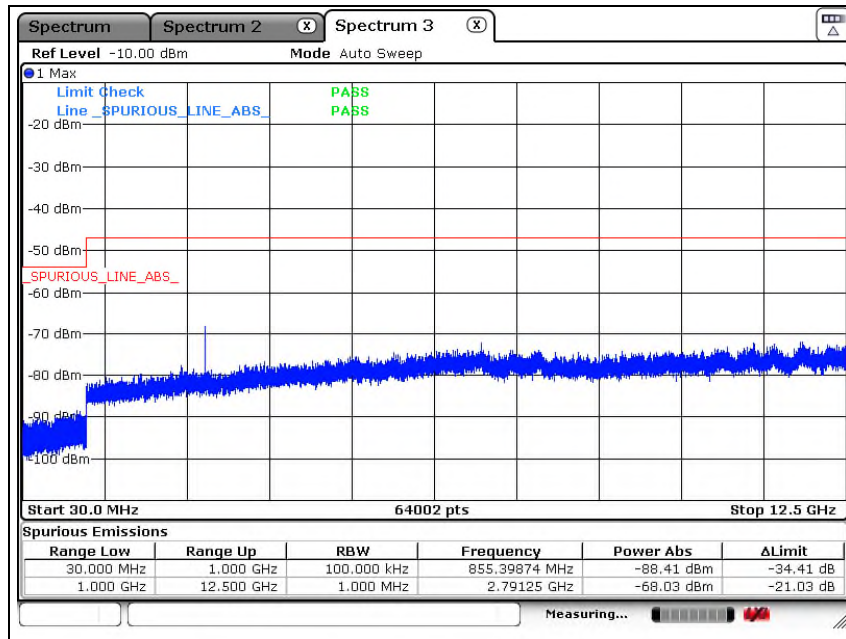
Low channel



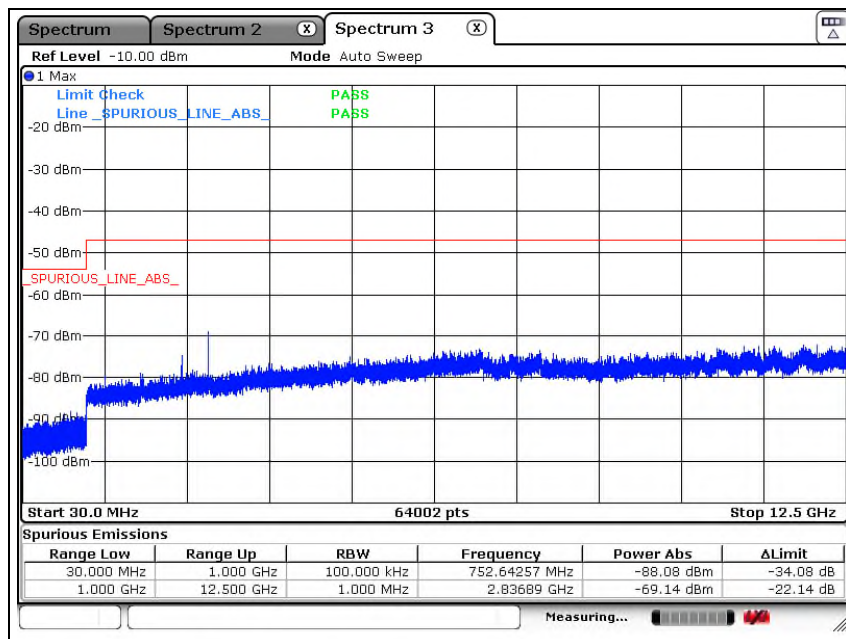
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

Middle channel



High channel



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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 : **8439-A020CBDB**

The unit does meet the requirements. (Pass)

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

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 _{d.c.})	24.000	26.400	21.600
RF Part Output voltage (V _{d.c.})	3.2878	3.2877 (-0.003 %)	3.2877 (-0.003 %)

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 -

The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)