

TEST REPORT

of

ARIB STD-T66

Equipment Under Test : KingBlade X Ver.5 BLE
Model Name : KBX5
Applicant : Ruifan Japan Ltd.
Manufacturer : Twinklers Limited
Date of Receipt : 2018.07.05
Date of Test(s) : 2018.08.01 ~ 2018.08.13
Date of Issue : 2019.04.24

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

Tested By:



Patrick Kang

Date:

2019.04.24

Technical
Manager:



Hyunchoe You

Date:

2019.04.24

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RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

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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 : Ruifan Japan Ltd.

Address : 3F SAT.1 Bldg., 2-20-4 Minami Aoyama, Minato-ku Tokyo Japan 107-0062

Contact Person : Shigeki Miyako

Phone No. : +81 (0)3 6432 9001

1.3. Details of manufacturer

Company : Twinklers Limited

Address : Li Song Lang Industrial Estate #1, Li-Song-Lang Shenzhen 518106, China

1.4. Description of EUT

Kind of Product	KingBlade X Ver.5 BLE
Model Name	KBX5
Power Supply	DC 4.5 V
Frequency Range	2 402 MHz ~ 2 480 MHz (Bluetooth Low Energy)
Modulation Technique	GFSK
Number of Channels	40 channels
Rated Output Power	0.5 mW
Antenna Type	PCB Antenna
Antenna Gain	-2.87 dBi

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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. 21, 2018	SICT	c)
Signal Generator	R&S	SMBV100A	259067	Jun. 15, 2018	SICT	c)
Signal Generator	R&S	SMR40	100272	Jun. 12, 2018	SICT	c)
Attenuator	MCLI	FAS-12-10	1	Jun. 12, 2018	SICT	c)
DC Power Supply	Agilent	U8002A	MY53150029	Jun. 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 %)	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-RTL012965	2018.08.14	Initial
1	F690501/RF-RTL012965-1	2019.04.24	Added Interference Prevention Function

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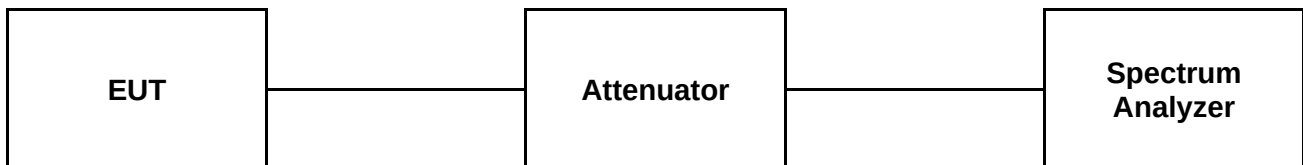
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2. Frequency Tolerance

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 channels.
3. Set the spectrum analyzer as below;

Center frequency: 2 402 MHz, 2 440 MHz, 2 480 MHz (Bluetooth Low Energy)
 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 _{d.c.})	Measured frequency (MHz)	Reading frequency (MHz)	Frequency tolerance [ppm]
V _{Min} = 4.05	Low Ch. (2 402)	2 401.955	-18.73
	Middle Ch. (2 440)	2 439.954	-18.85
	High Ch. (2 480)	2 479.954	-18.55
V _{Nom} = 4.50	Low Ch. (2 402)	2 401.956	-18.32
	Middle Ch. (2 440)	2 439.953	-19.26
	High Ch. (2 480)	2 479.953	-18.95
V _{Max} = 4.95	Low Ch. (2 402)	2 401.955	-18.73
	Middle Ch. (2 440)	2 439.953	-19.26
	High Ch. (2 480)	2 479.953	-18.95

Note;

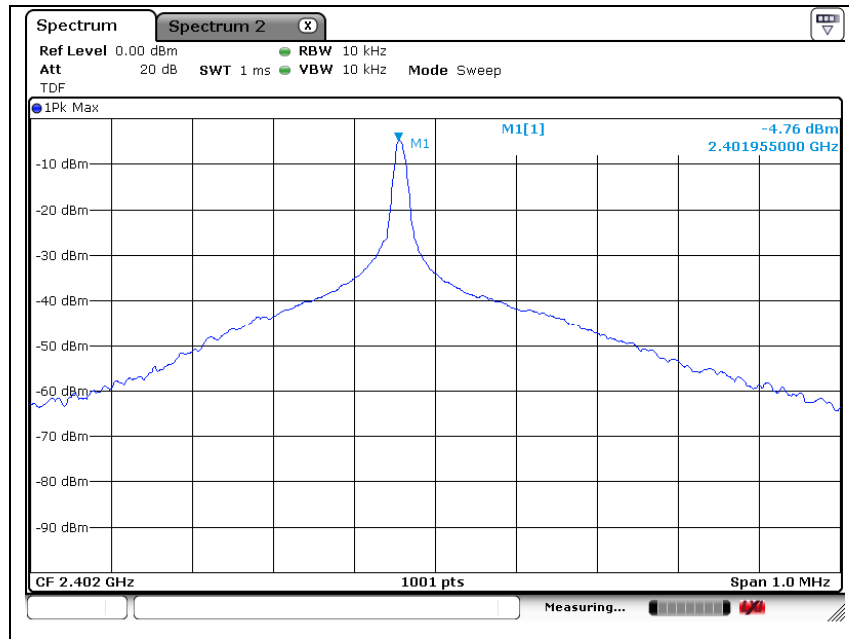
1. FT (ppm) = [(RF-MF)/MF] × 10⁶
- FT: Frequency Tolerance, RF: Reading Frequency and MF: Measurement Frequency

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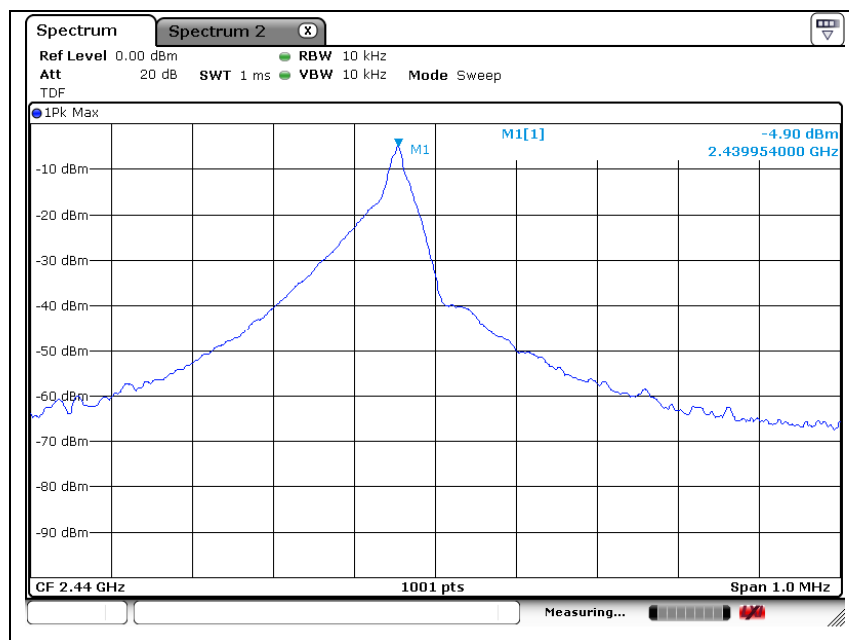
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Low voltage

Low channel



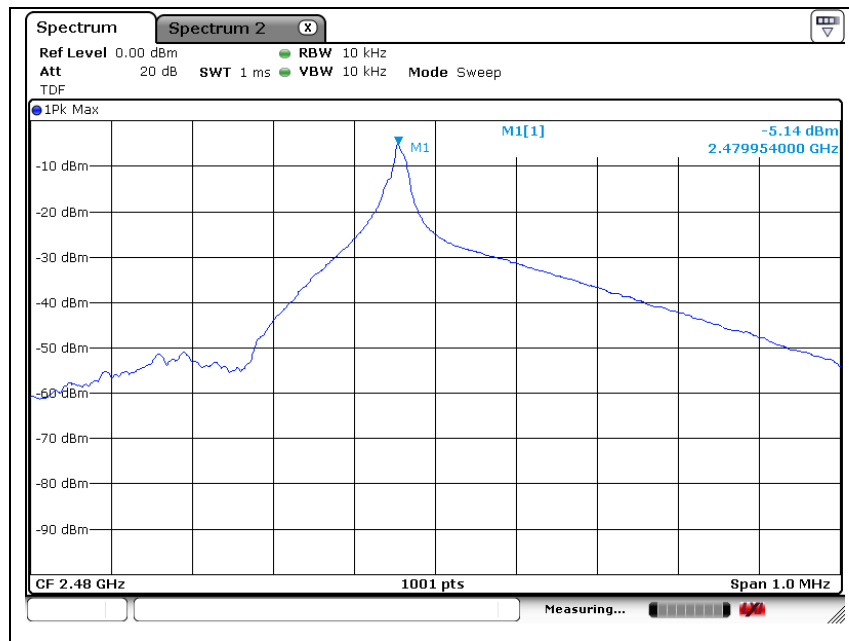
Middle channel



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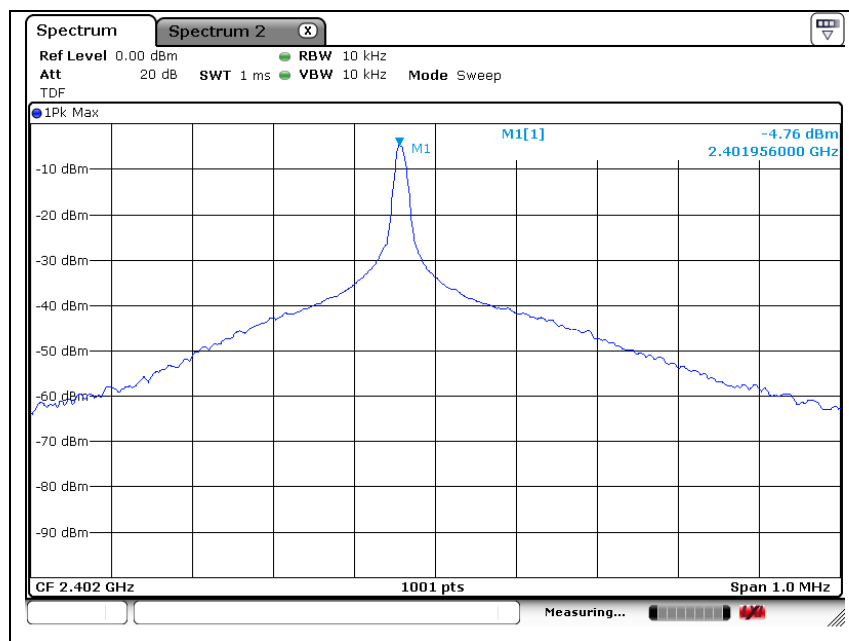
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High channel



Normal voltage

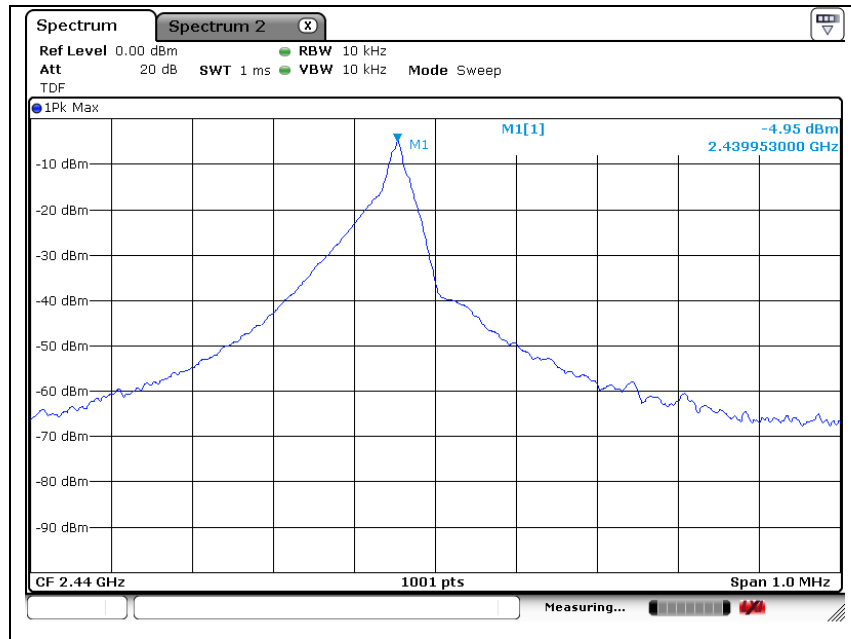
Low channel



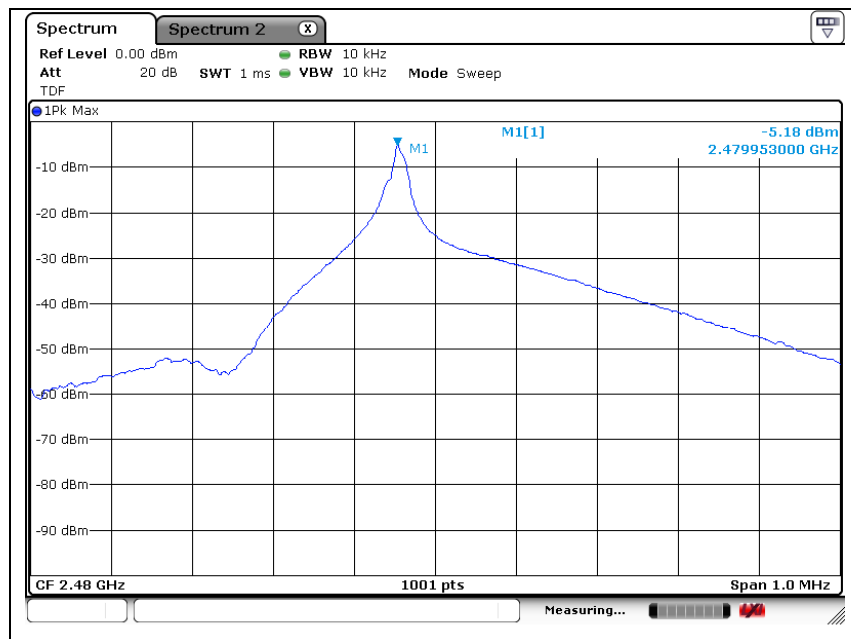
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Middle channel



High channel

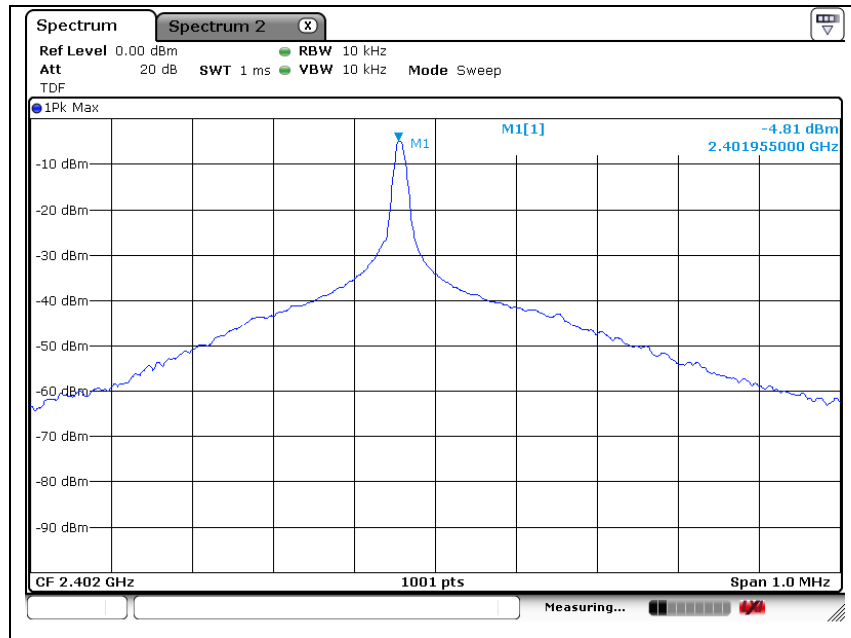


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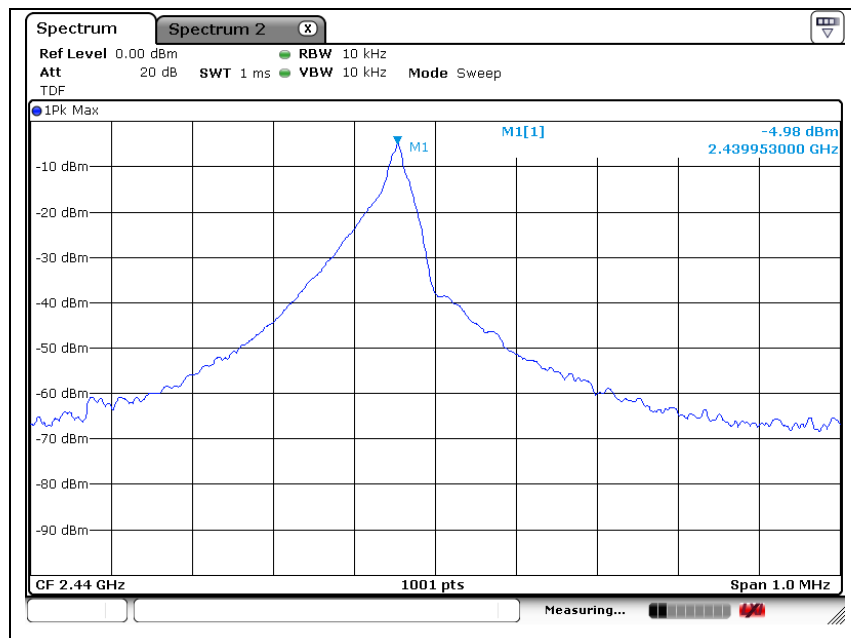
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High voltage

Low channel



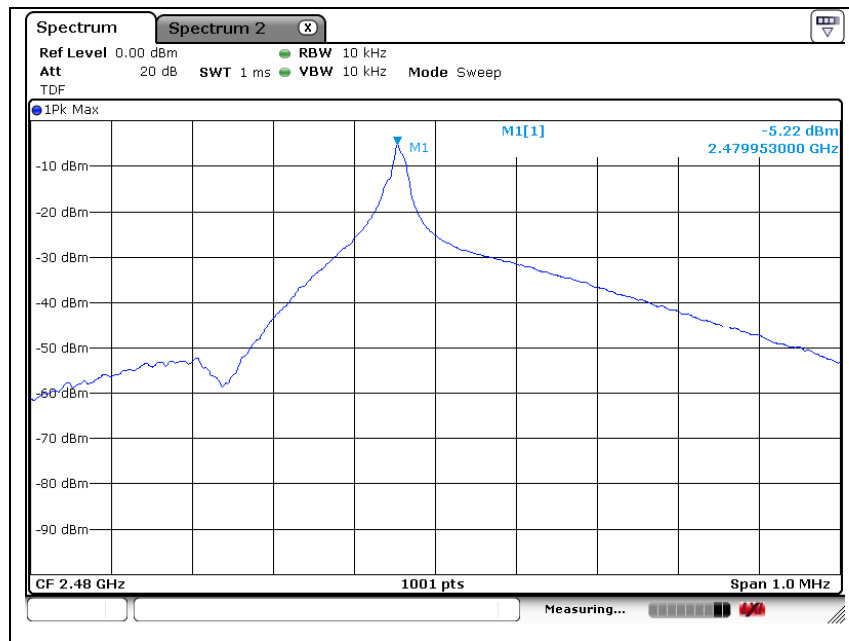
Middle channel



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High channel

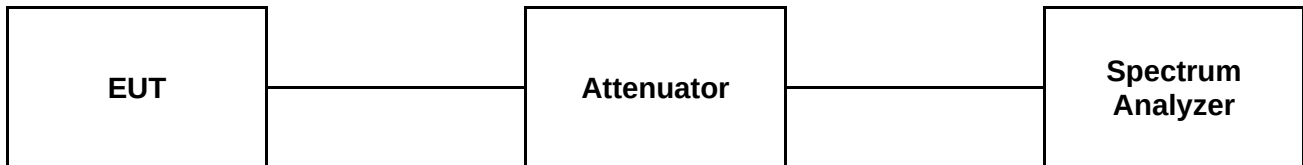


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3. Occupied Bandwidth (99 %)

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, 2 440 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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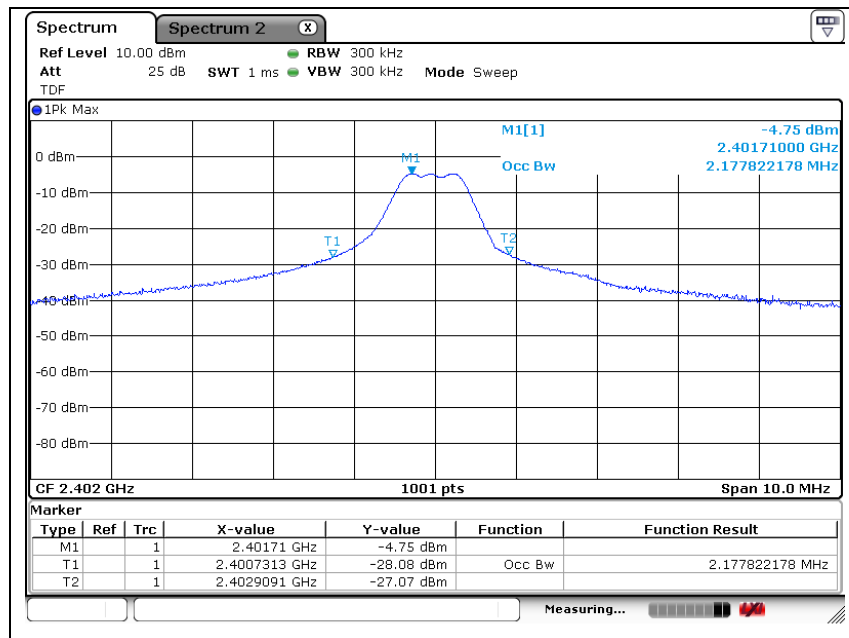
3.4. Test result

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

Test voltage (V _{d.c.})	Measured frequency (MHz)	Occupied bandwidth (MHz)
V _{Min} = 4.05	Low Ch. (2 402)	2.178
	Middle Ch. (2 440)	2.068
	High Ch. (2 480)	2.098
V _{Nom} = 4.50	Low Ch. (2 402)	2.178
	Middle Ch. (2 440)	2.068
	High Ch. (2 480)	2.088
V _{Max} = 4.95	Low Ch. (2 402)	2.198
	Middle Ch. (2 440)	2.078
	High Ch. (2 480)	2.088

Low voltage

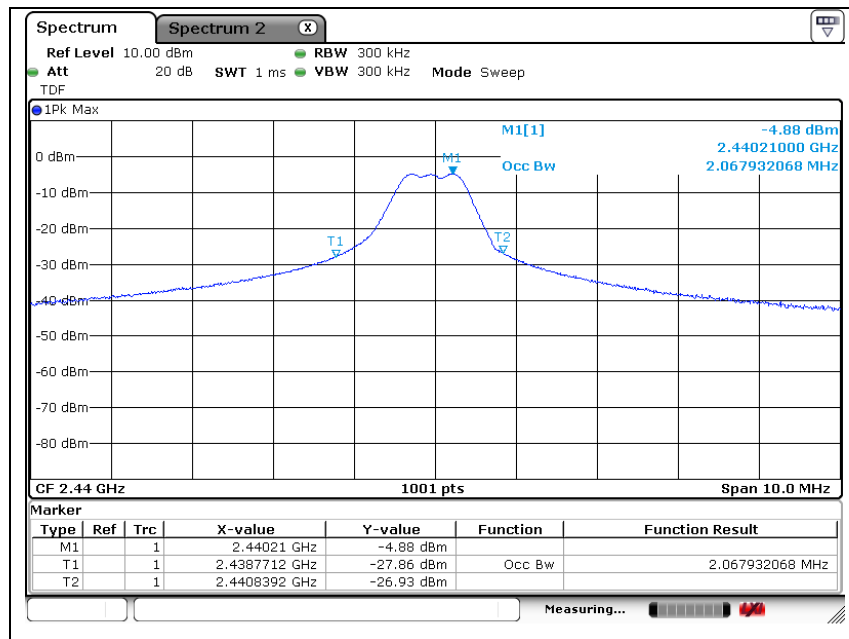
Low channel



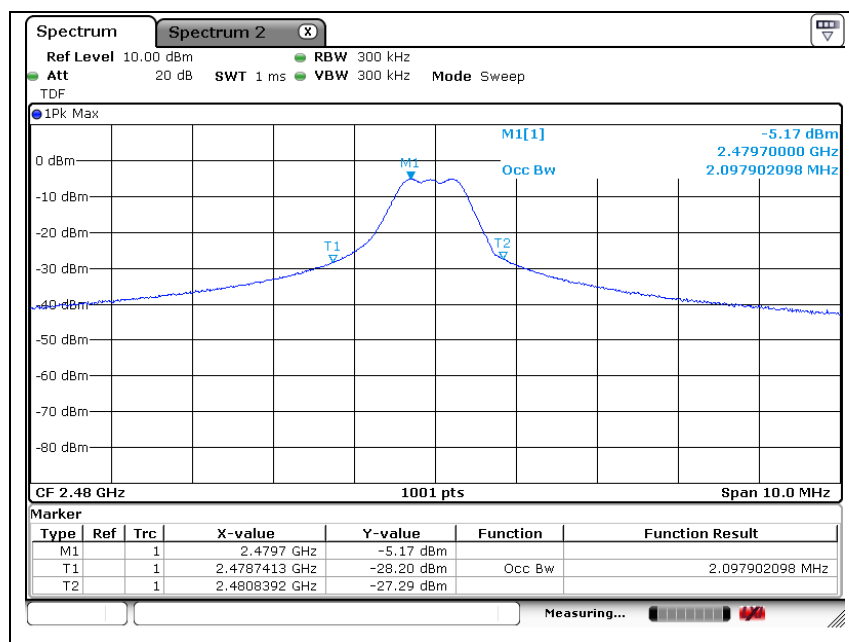
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Middle channel



High channel



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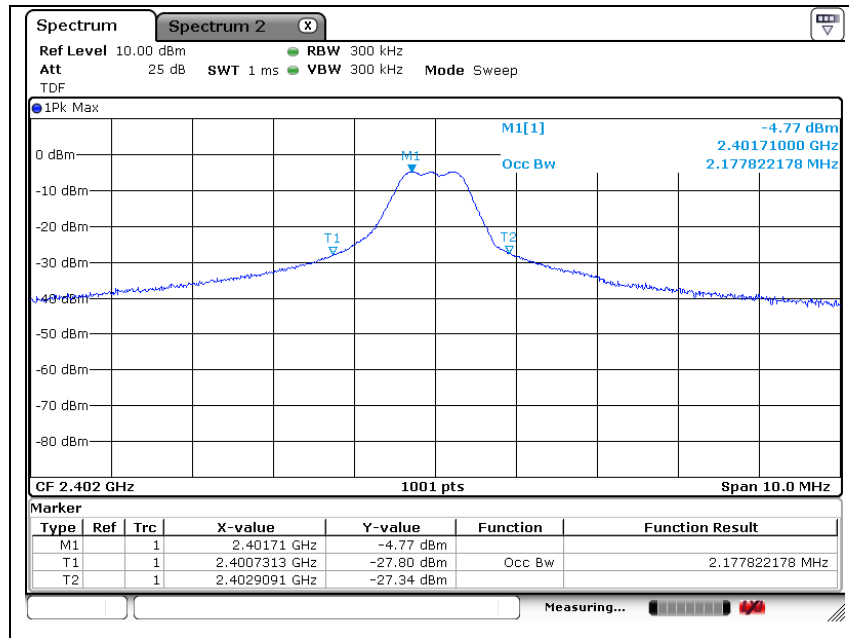
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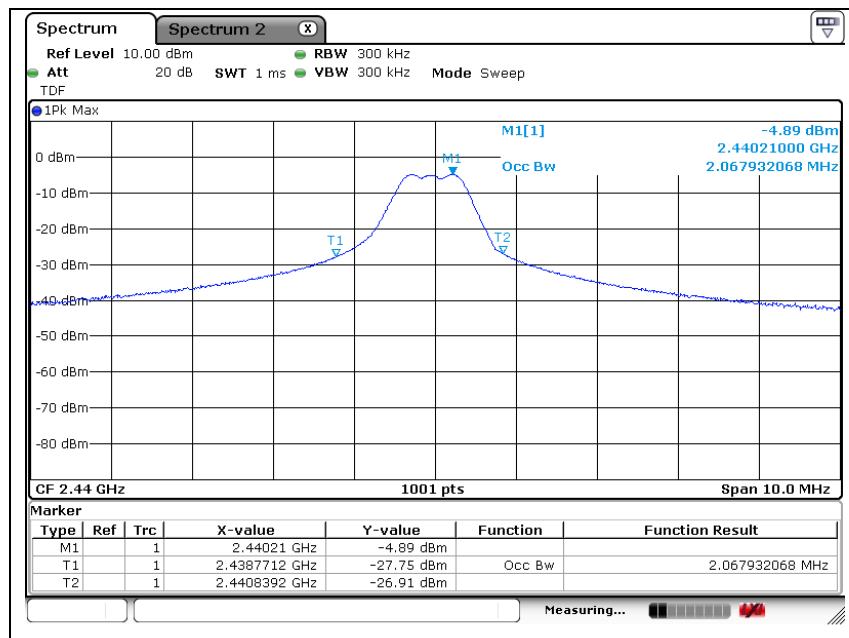
A4(210 mm x 297 mm)

Normal voltage

Low channel



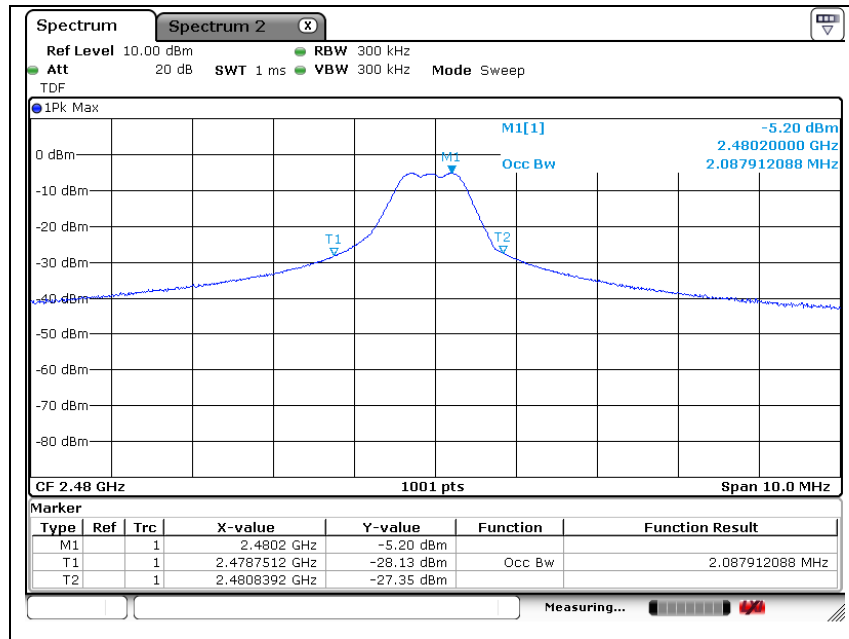
Middle channel



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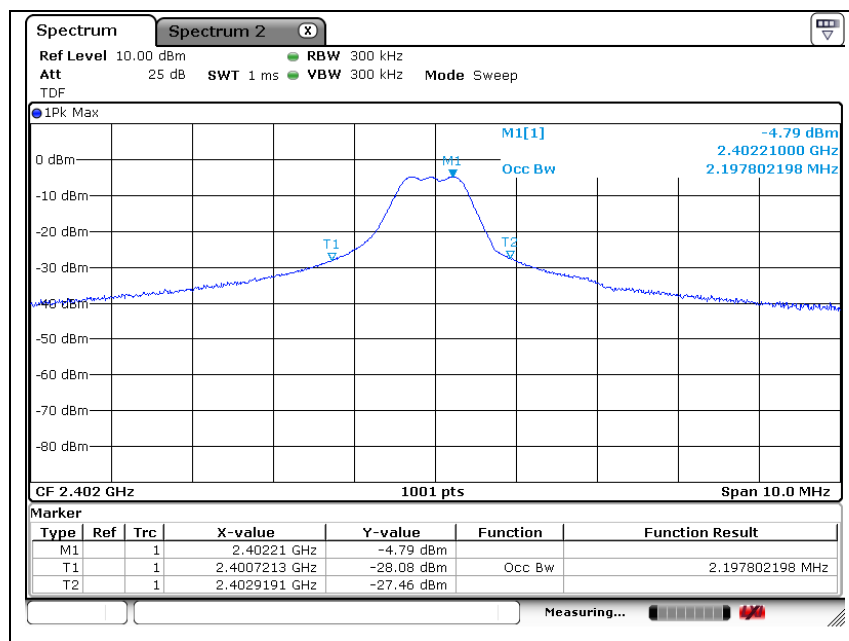
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High channel



High voltage

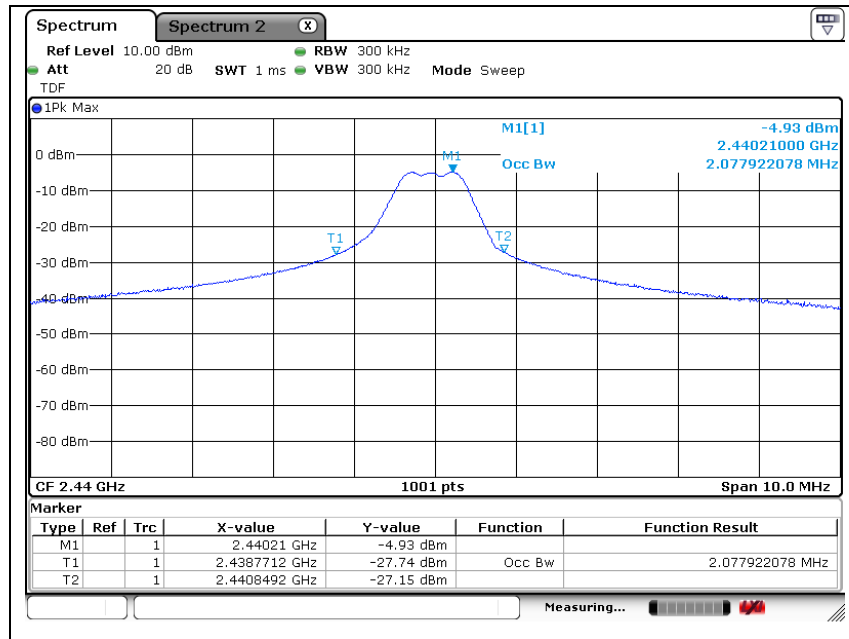
Low channel



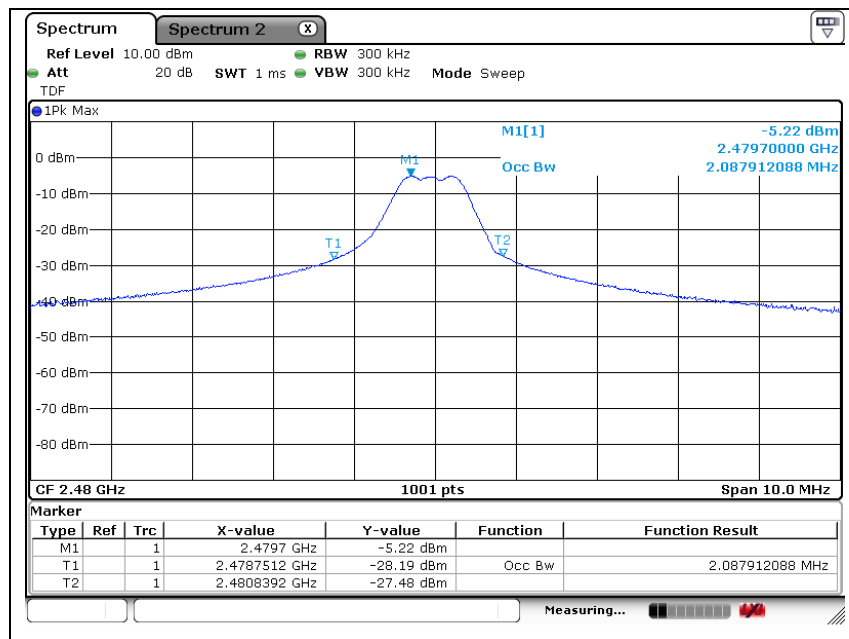
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Middle channel



High channel

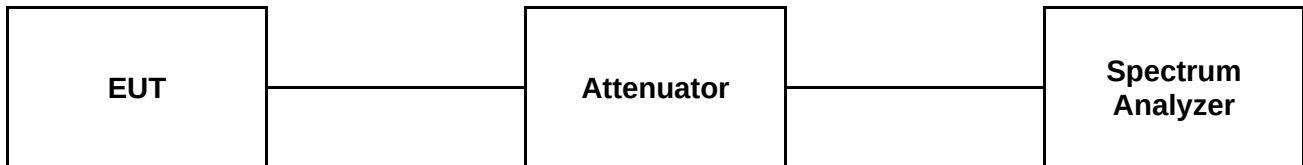


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4. Spurious Emission Intensity

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

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 (see note)

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

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.

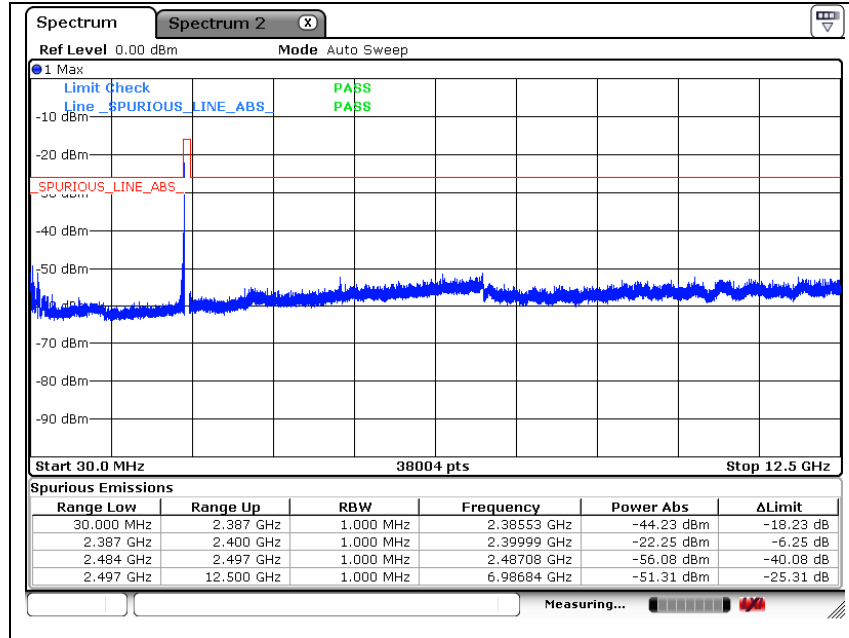
Test voltage (V _{d.c.})	Frequency range (MHz)	Measured	Low Ch. (2 402 MHz)	Middle Ch. (2 440 MHz)	High Ch. (2 480 MHz)	Limit
V _{min} = 4.05	Below 2 387	Frequency (GHz)	2.386	0.034	0.033	-
		Level (μW/MHz)	0.037 757	0.008 395	0.009 528	2.5
		Level (dB m/MHz)	-44.23	-50.76	-50.21	-26
	2 387 to 2 400	Frequency (GHz)	2.400	2.398	2.399	-
		Level (μW/MHz)	5.956 621	0.007 656	0.001 660	25
		Level (dB m/MHz)	-22.25	-51.16	-57.80	-16
	2 483.5 to 2 496.5	Frequency (GHz)	2.487	2.484	2.484	-
		Level (μW/MHz)	0.002 466	0.008 128	0.922 571	25
		Level (dB m/MHz)	-56.08	-50.90	-30.35	-16
	Above 2 496.5	Frequency (GHz)	6.987	6.995	2.497	-
		Level (μW/MHz)	0.007 396	0.007 870	0.038 019	2.5
		Level (dB m/MHz)	-51.31	-51.04	-44.20	-26
V _{nom} = 4.50	Below 2 387	Frequency (GHz)	2.386	0.034	0.033	-
		Level (μW/MHz)	0.041 976	0.008 954	0.009 376	2.5
		Level (dB m/MHz)	-43.77	-50.48	-50.28	-26
	2 387 to 2 400	Frequency (GHz)	2.400	2.396	2.394	-
		Level (μW/MHz)	5.861 382	0.007 379	0.002 042	25
		Level (dB m/MHz)	-22.32	-51.32	-56.90	-16
	2 483.5 to 2 496.5	Frequency (GHz)	2.488	2.484	2.484	-
		Level (μW/MHz)	0.002 698	0.007 925	0.907 821	25
		Level (dB m/MHz)	-55.69	-51.01	-30.42	-16
	Above 2 496.5	Frequency (GHz)	6.989	6.977	2.497	-
		Level (μW/MHz)	0.007 112	0.006 982	0.037 068	2.5
		Level (dB m/MHz)	-51.48	-51.56	-44.31	-26
V _{max} = 4.95	Below 2 387	Frequency (GHz)	2.384	0.033	0.033	-
		Level (μW/MHz)	0.036 058	0.007 727	0.008 091	2.5
		Level (dB m/MHz)	-44.43	-51.12	-50.92	-26
	2 387 to 2 400	Frequency (GHz)	2.400	2.397	2.393	-
		Level (μW/MHz)	5.861 382	0.007 656	0.001 762	25
		Level (dB m/MHz)	-22.32	-51.16	-57.54	-16
	2 483.5 to 2 496.5	Frequency (GHz)	2.484	2.486	2.484	-
		Level (μW/MHz)	0.002 636	0.007 516	0.893 305	25
		Level (dB m/MHz)	-55.79	-51.24	-30.49	-16
	Above 2 496.5	Frequency (GHz)	6.423	4.881	2.497	-
		Level (μW/MHz)	0.006 457	0.007 816	0.038 637	2.5
		Level (dB m/MHz)	-51.90	-51.07	-44.13	-26

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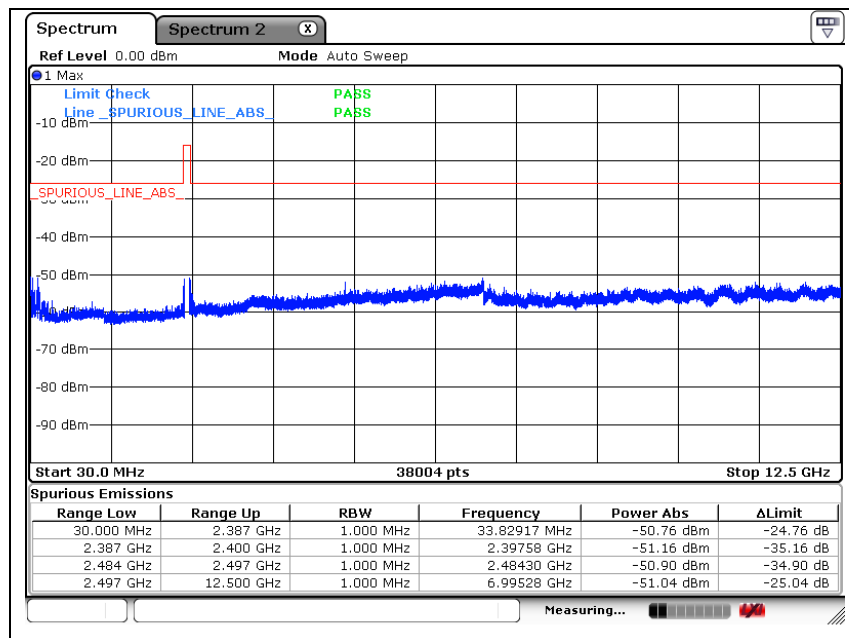
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Low voltage

Low channel



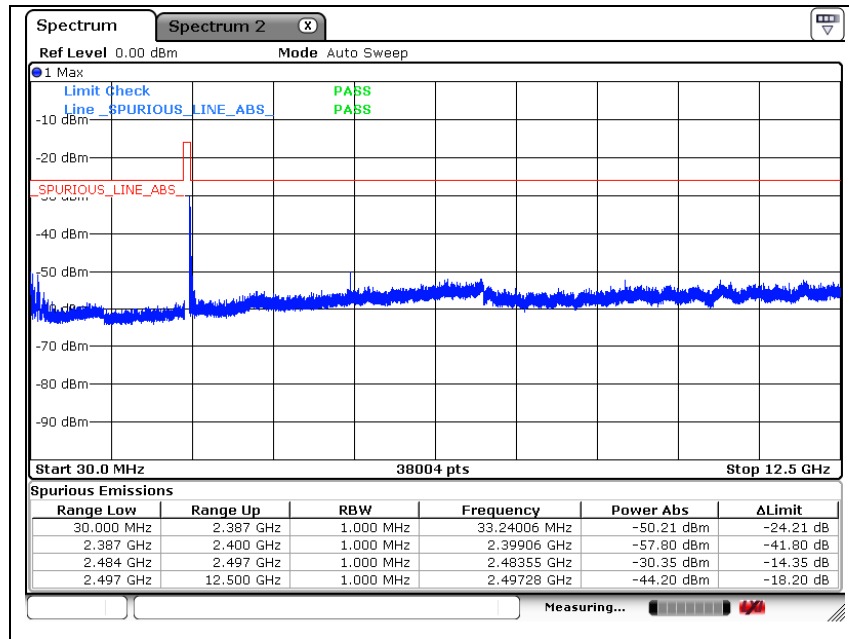
Middle channel



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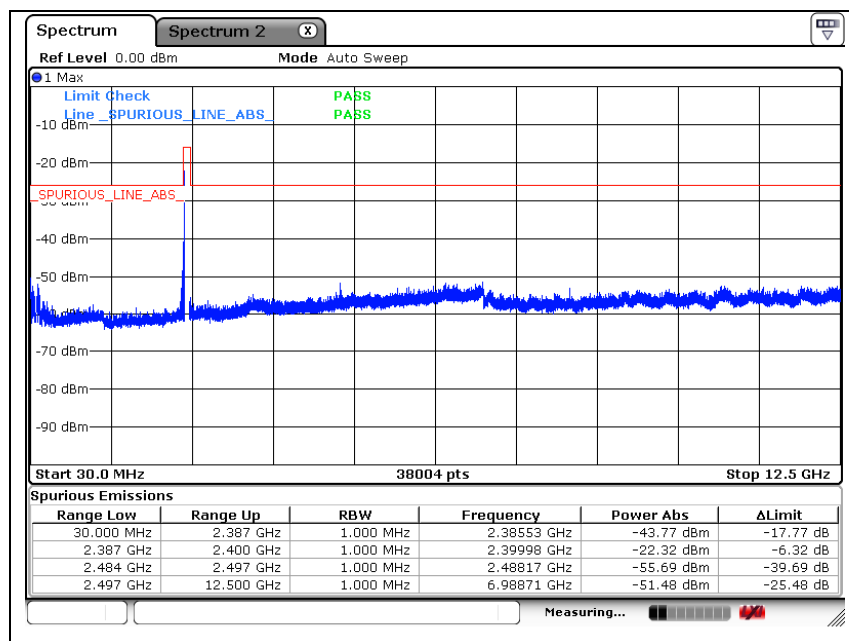
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

High channel



Normal voltage

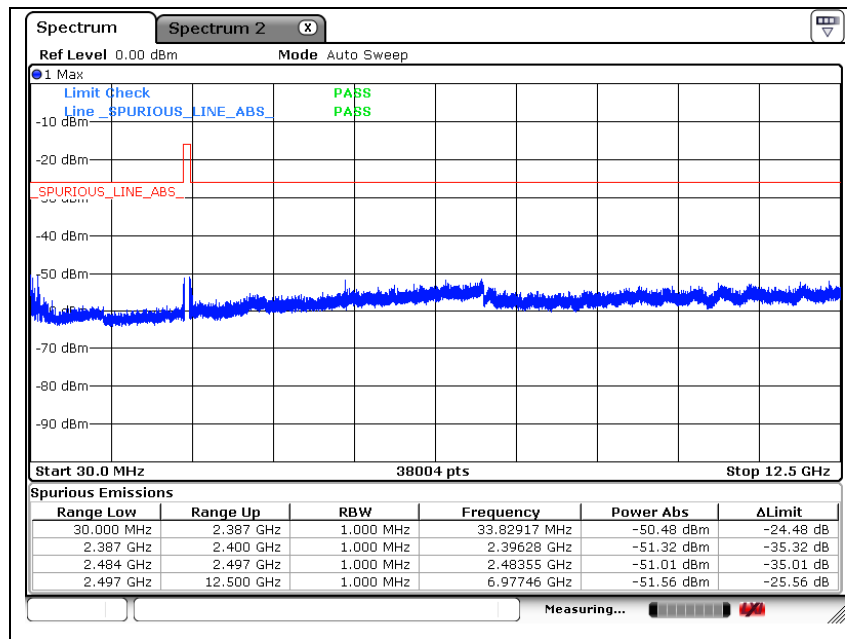
Low channel



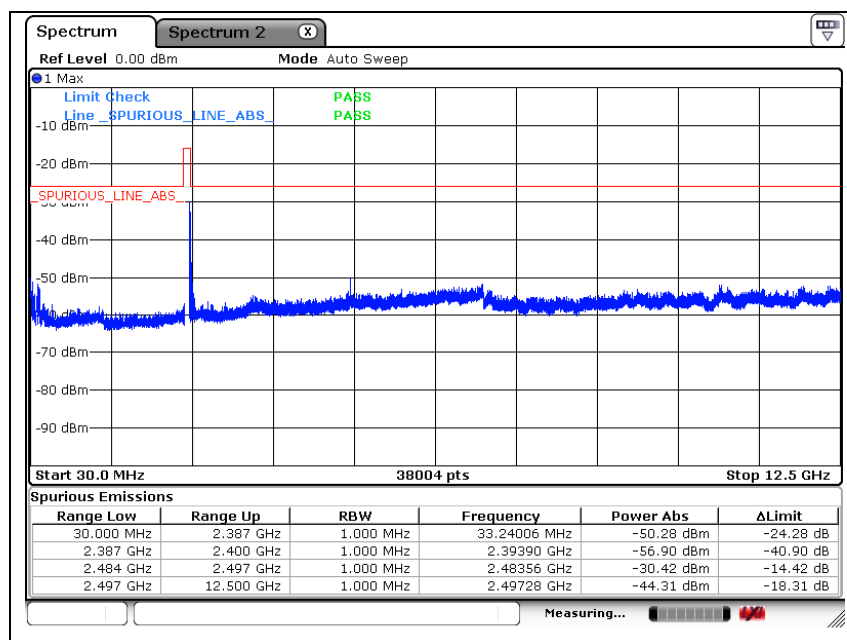
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Middle channel



High channel



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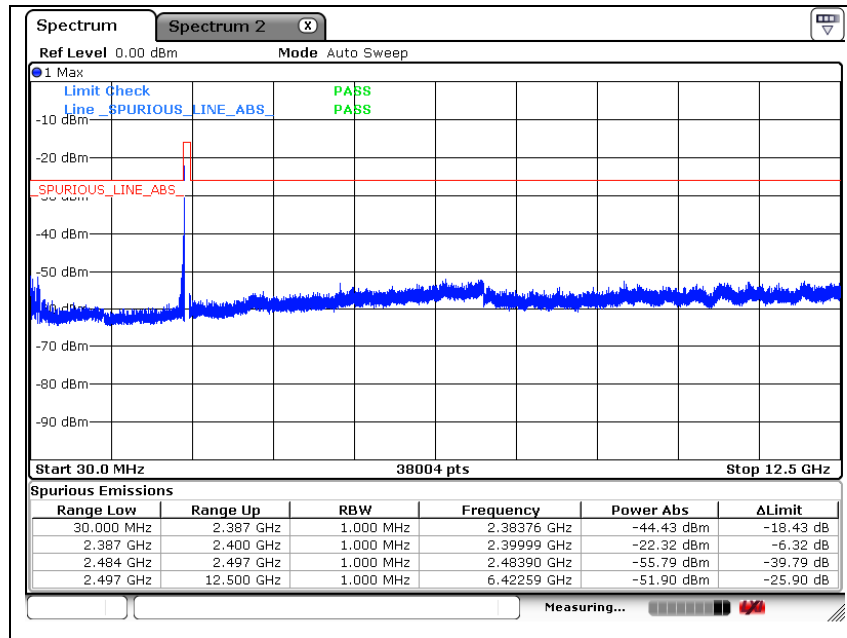
RTT5041-19(2019.04.24)(1)

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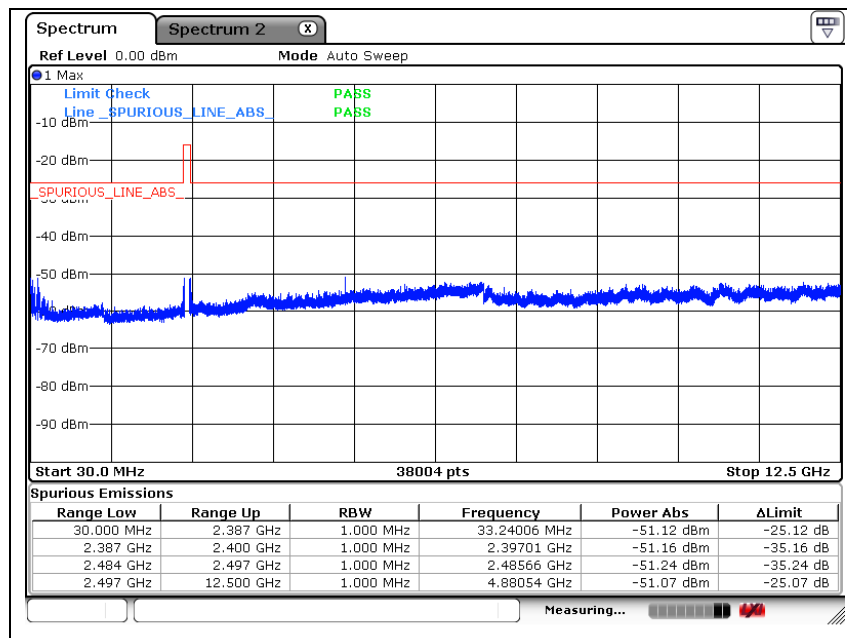
A4(210 mm x 297 mm)

High voltage

Low channel



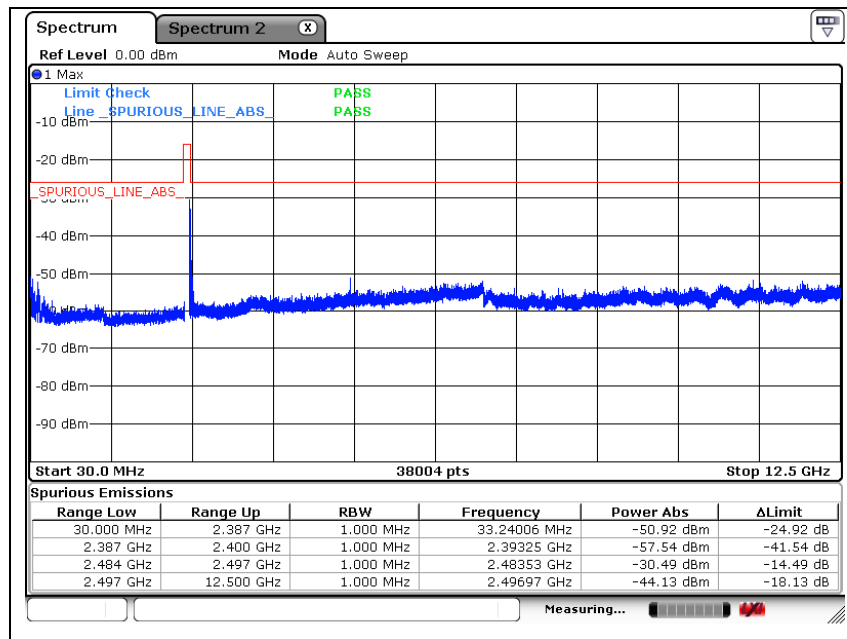
Middle channel



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High channel

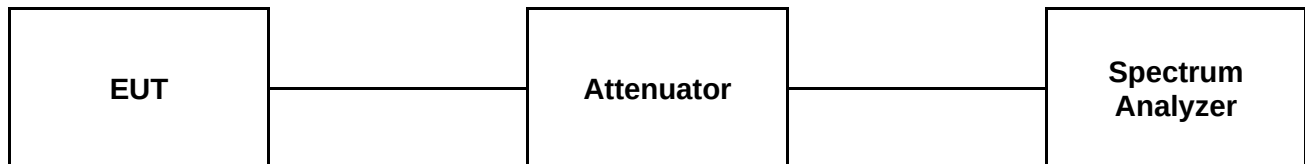


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5. Antenna Power

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;

[Setting 1] Search for peak power frequency

Center frequency: 2 402 MHz, 2 440 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.

[Setting 2] Measurement of average antenna power for LE

Frequency: Frequency of peak power found using [setting1]
 Span: 0 Hz
 RBW: 3 MHz
 VBW: 3 MHz
 Detector mode: Sample
 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

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 _{d.c.})	Channel	Antenna gain (dB i)	Rated Output Power		E.I.R.P. (dB m)	Average Burst Power		Power Tolerance (%)
V _{Min} = 4.05	Low Ch. (2 402 MHz)	-2.87	0.50 mW	-3.01 dB m	-5.88	0.33 mW	-4.78 dB m	-34
	Middle Ch. (2 440 MHz)	-2.87	0.50 mW	-3.01 dB m	-5.88	0.32 mW	-4.93 dB m	-36
	High Ch. (2 480 MHz)	-2.87	0.50 mW	-3.01 dB m	-5.88	0.31 mW	-5.15 dB m	-38
V _{Nom} = 4.50	Low Ch. (2 402 MHz)	-2.87	0.50 mW	-3.01 dB m	-5.88	0.33 mW	-4.82 dB m	-34
	Middle Ch. (2 440 MHz)	-2.87	0.50 mW	-3.01 dB m	-5.88	0.32 mW	-4.93 dB m	-36
	High Ch. (2 480 MHz)	-2.87	0.50 mW	-3.01 dB m	-5.88	0.30 mW	-5.22 dB m	-40
V _{Max} = 4.95	Low Ch. (2 402 MHz)	-2.87	0.50 mW	-3.01 dB m	-5.88	0.32 mW	-4.89 dB m	-36
	Middle Ch. (2 440 MHz)	-2.87	0.50 mW	-3.01 dB m	-5.88	0.31 mW	-5.02 dB m	-38
	High Ch. (2 480 MHz)	-2.87	0.50 mW	-3.01 dB m	-5.88	0.30 mW	-5.26 dB m	-40

Note;

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

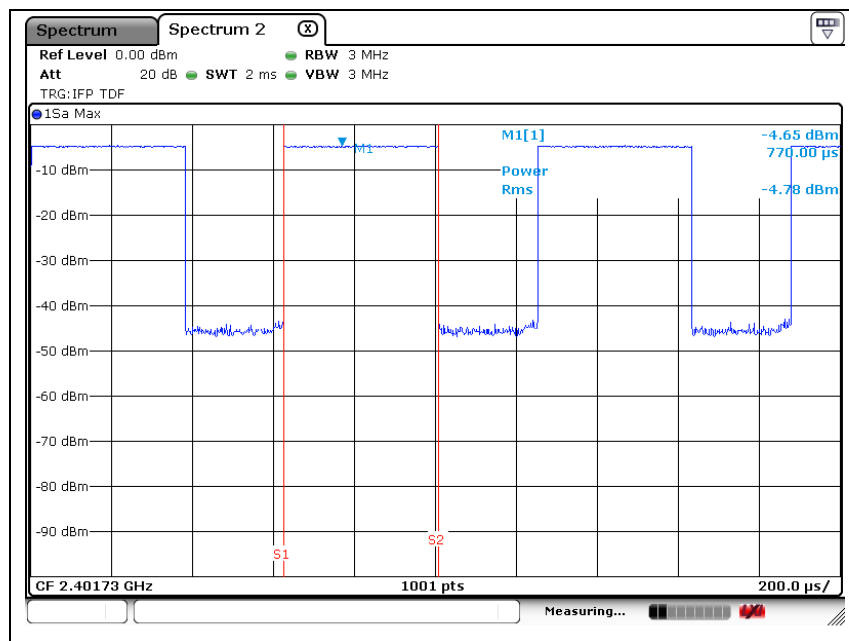
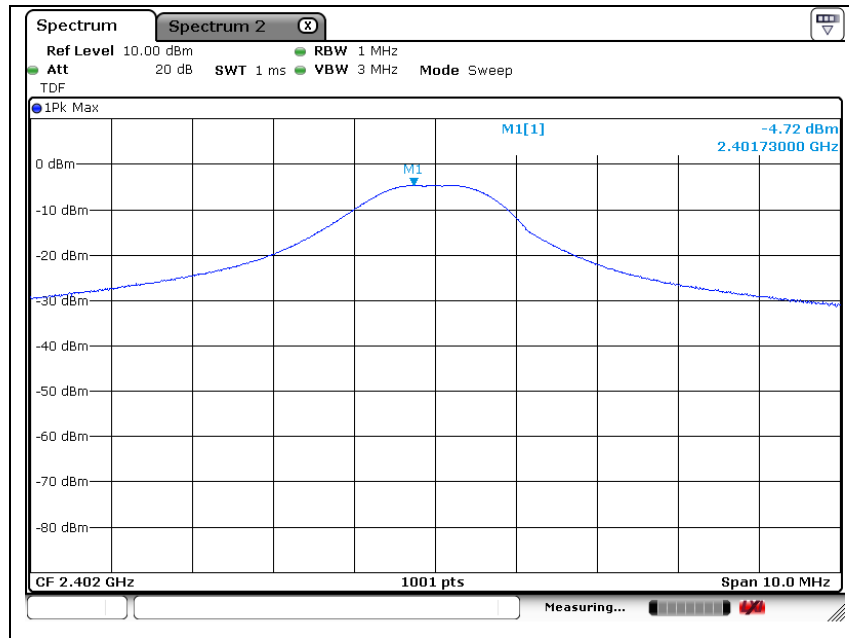
Power Tolerance (%) = {[Antenna Power (mW) - Rated Output Power (mW)] ÷ Rated Output Power (mW)} × 100

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Low voltage

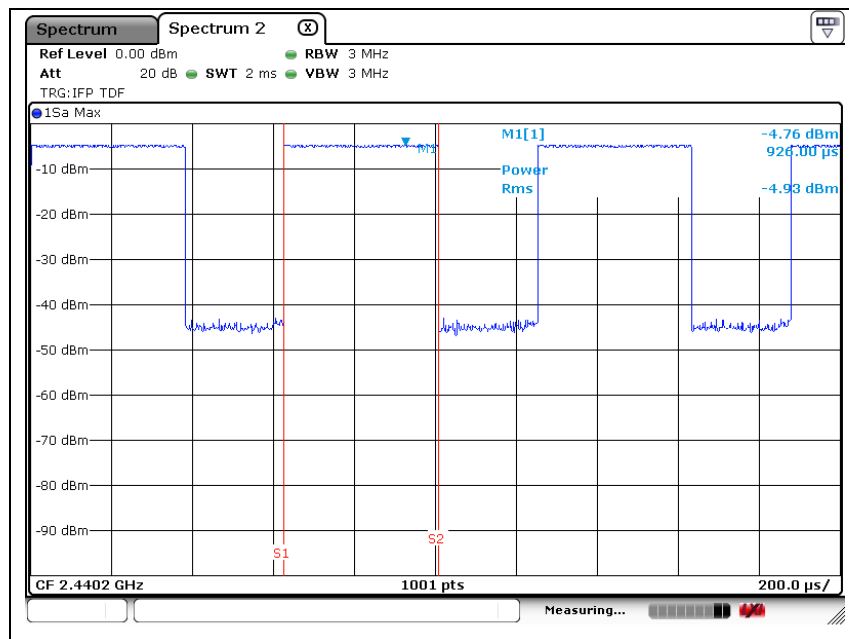
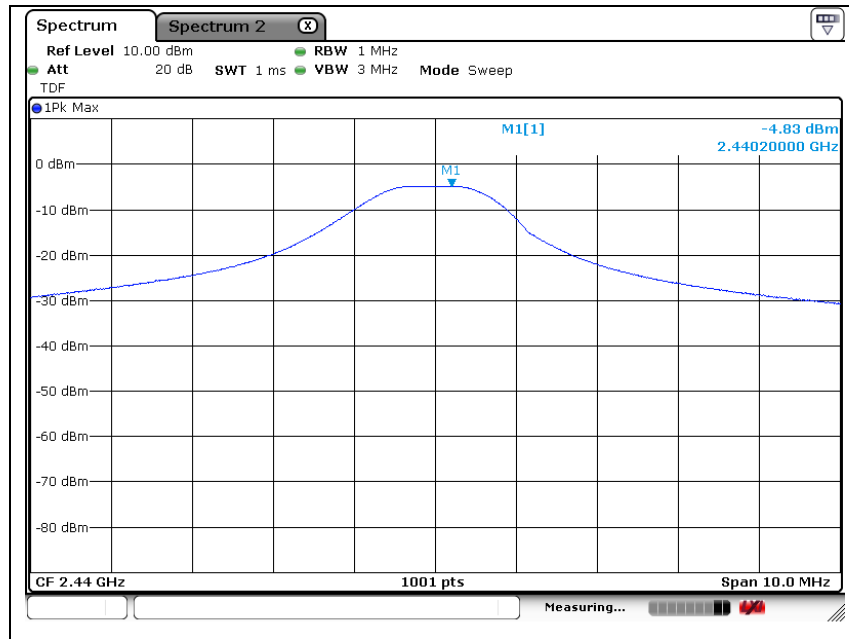
Low channel



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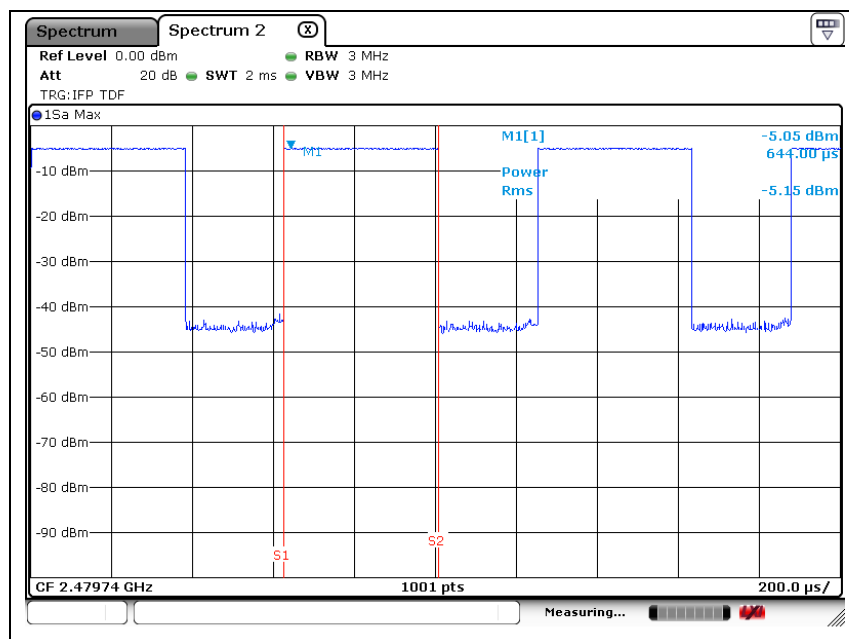
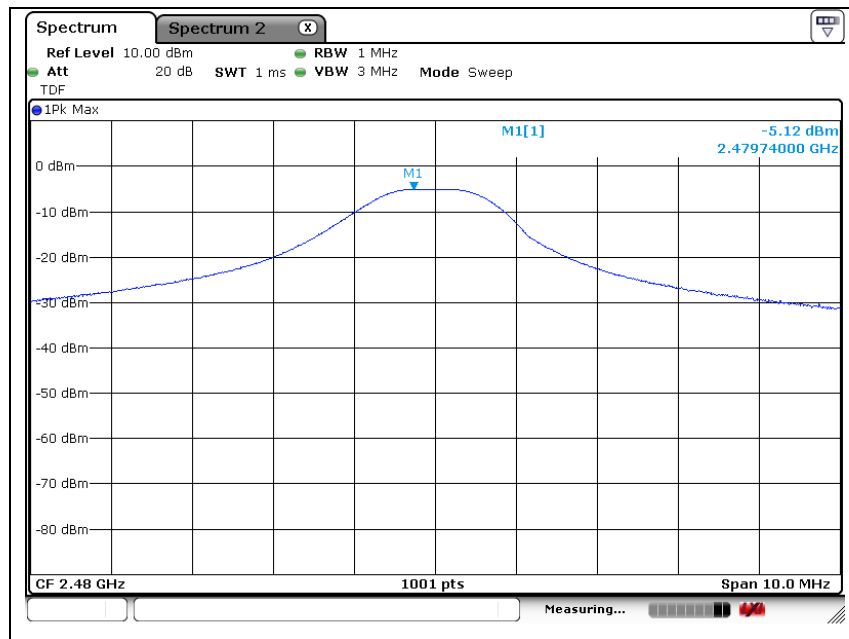
Middle channel



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High channel



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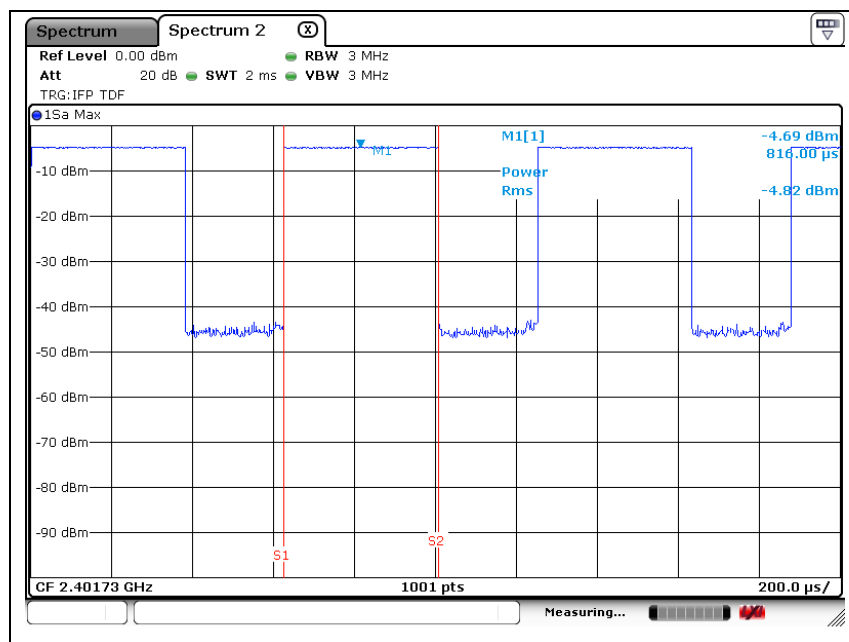
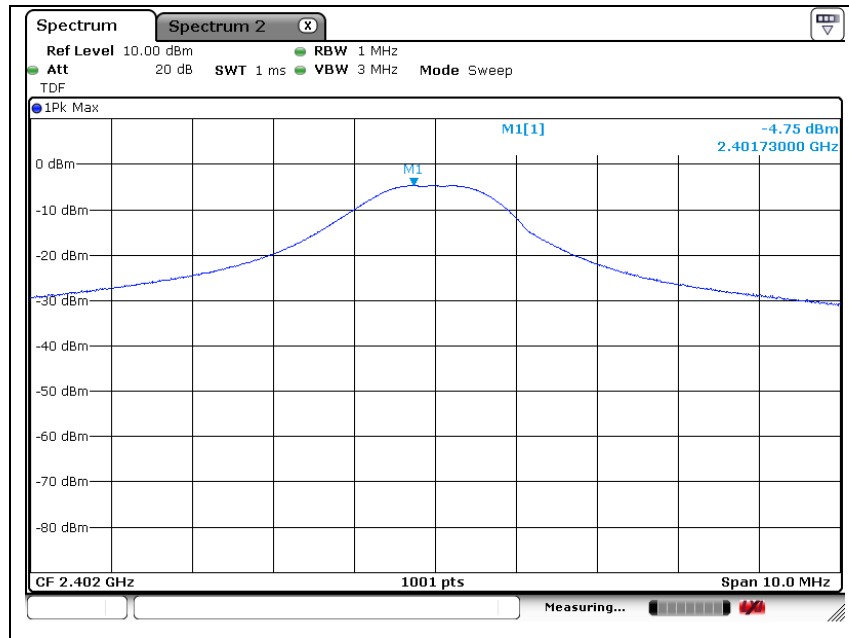
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

Normal voltage

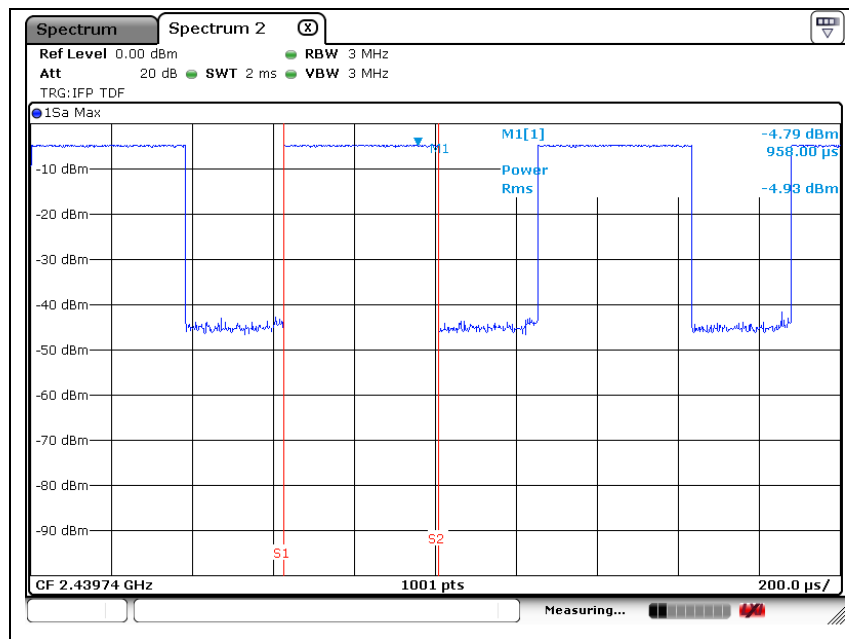
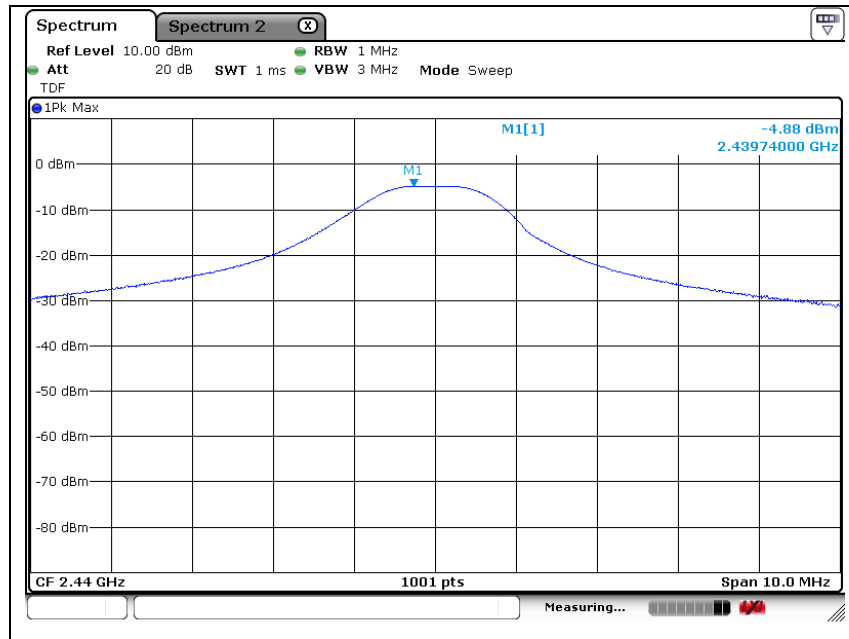
Low channel



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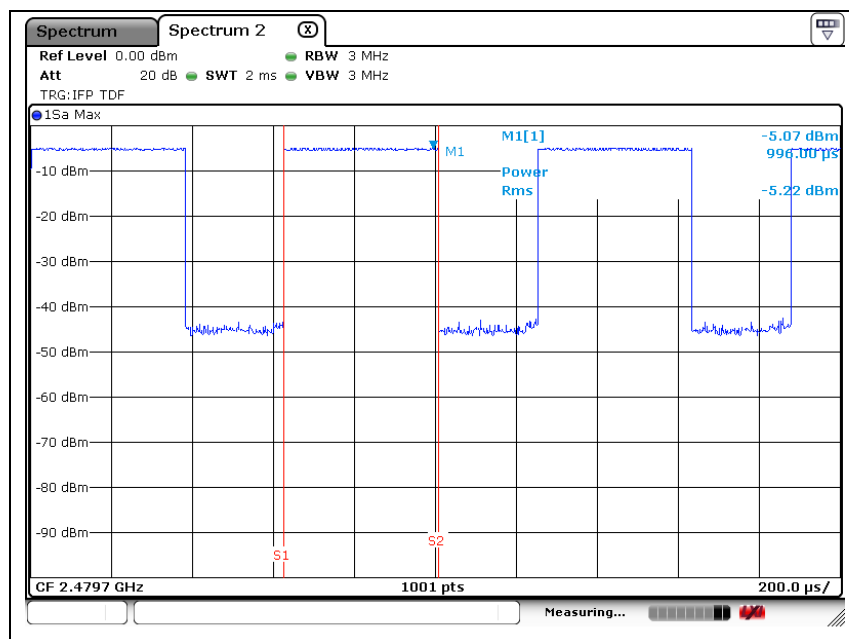
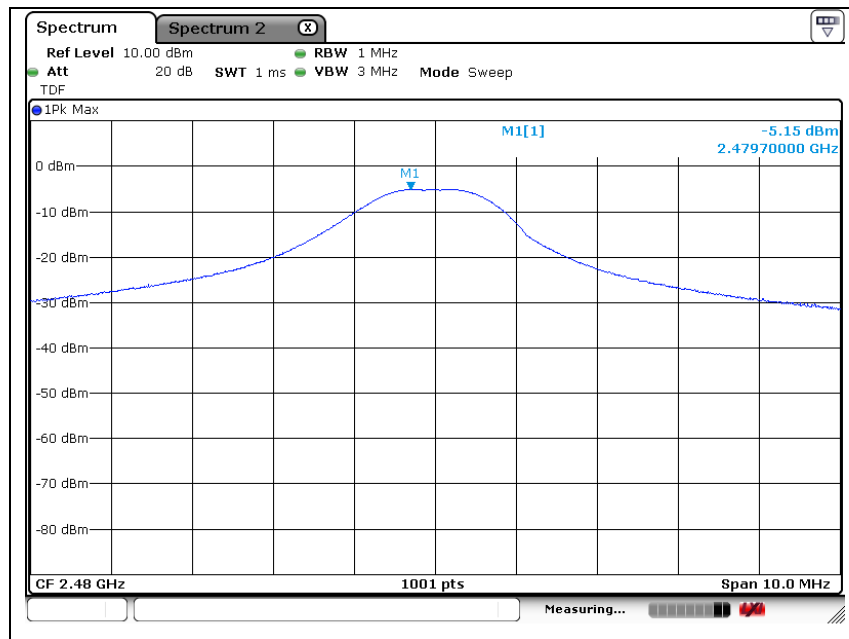
Middle channel



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High channel

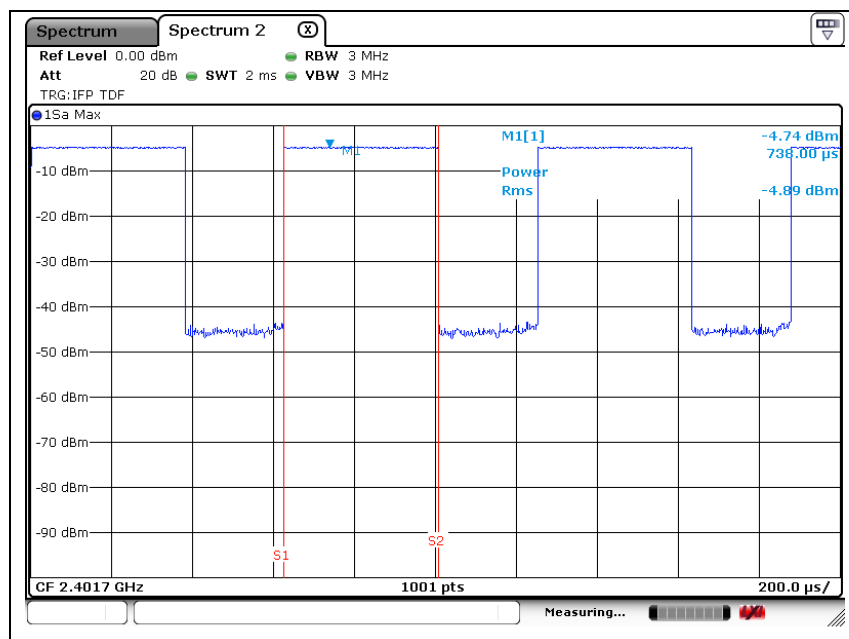
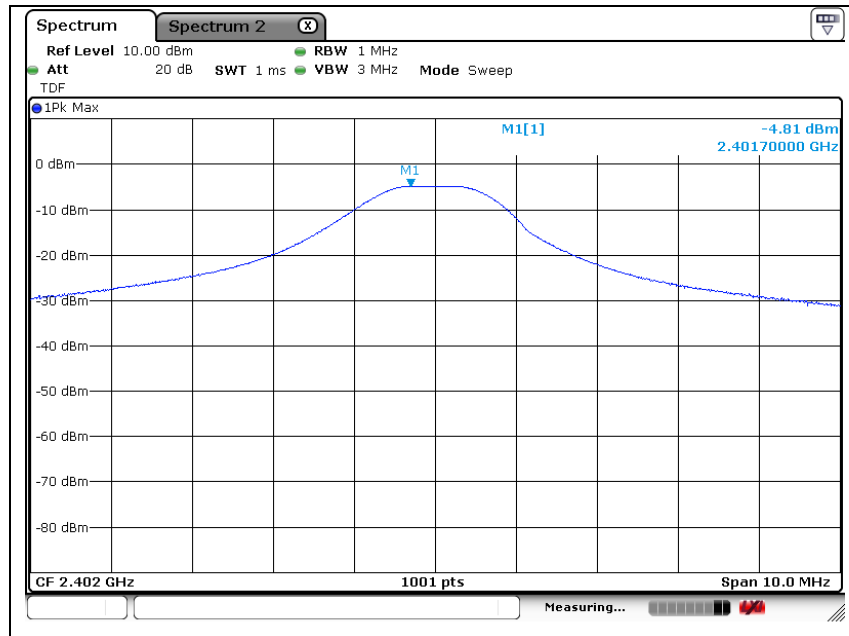


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High voltage

Low channel



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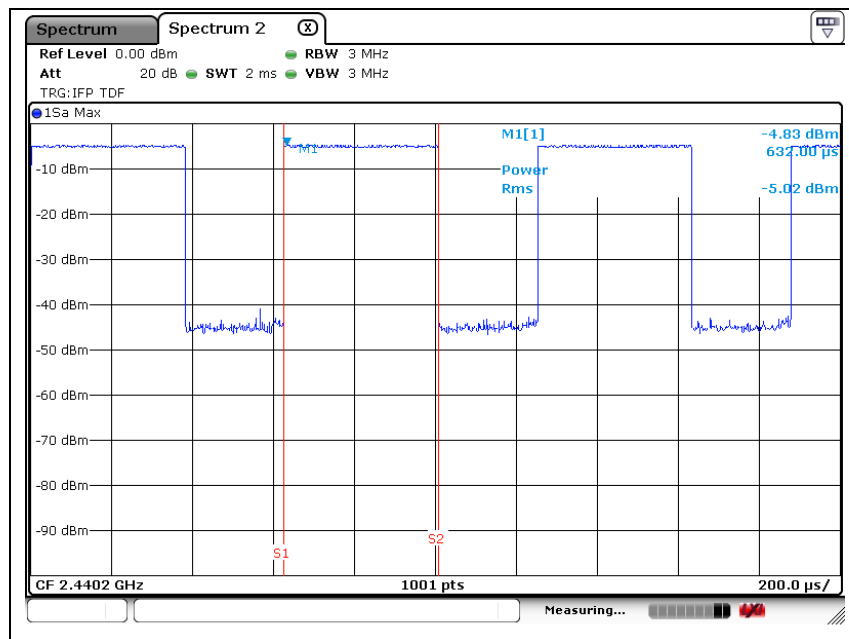
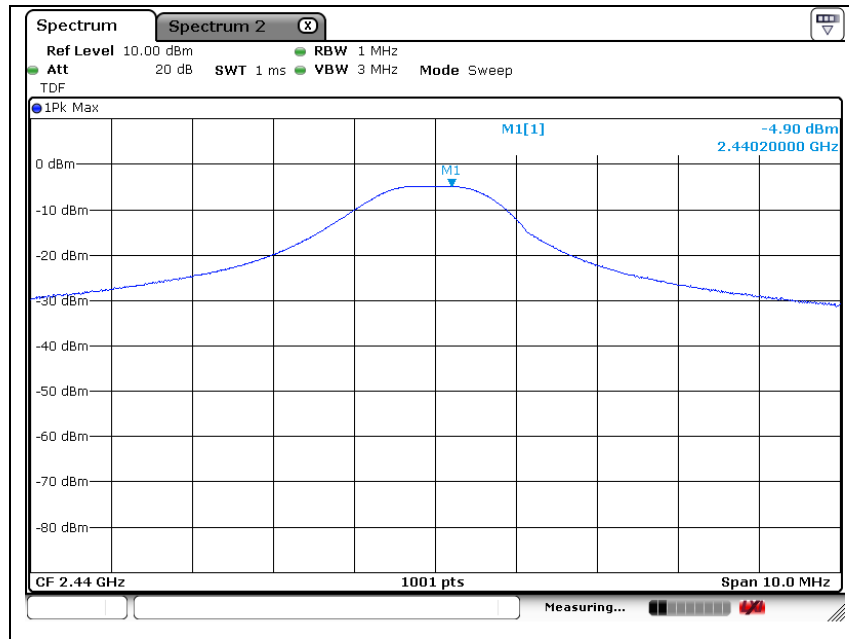
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A4(210 mm x 297 mm)

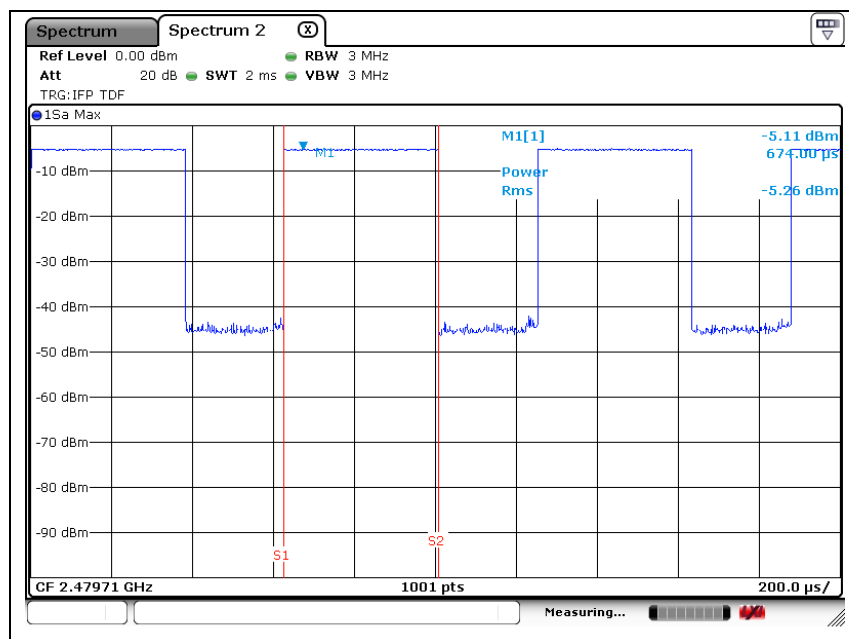
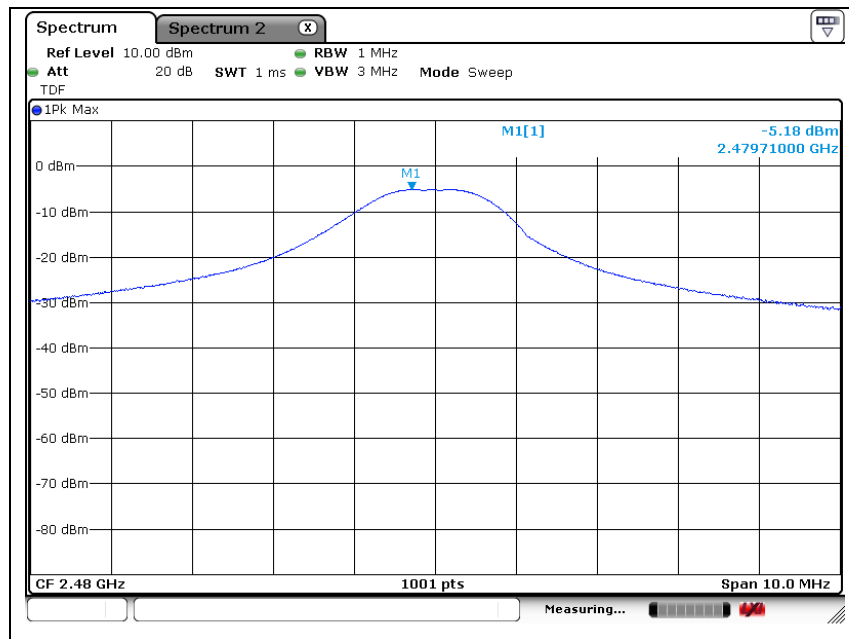
Middle channel



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High channel



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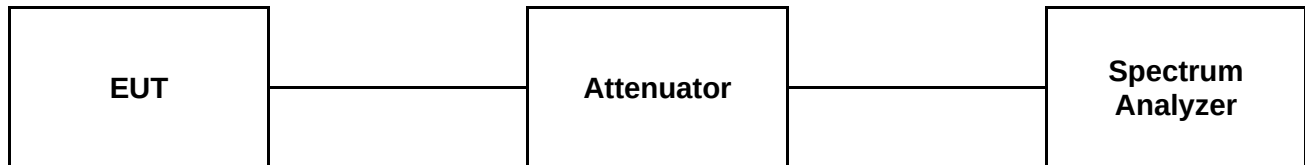
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A4(210 mm x 297 mm)

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 to 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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A4(210 mm x 297 mm)

6.4. Test result

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

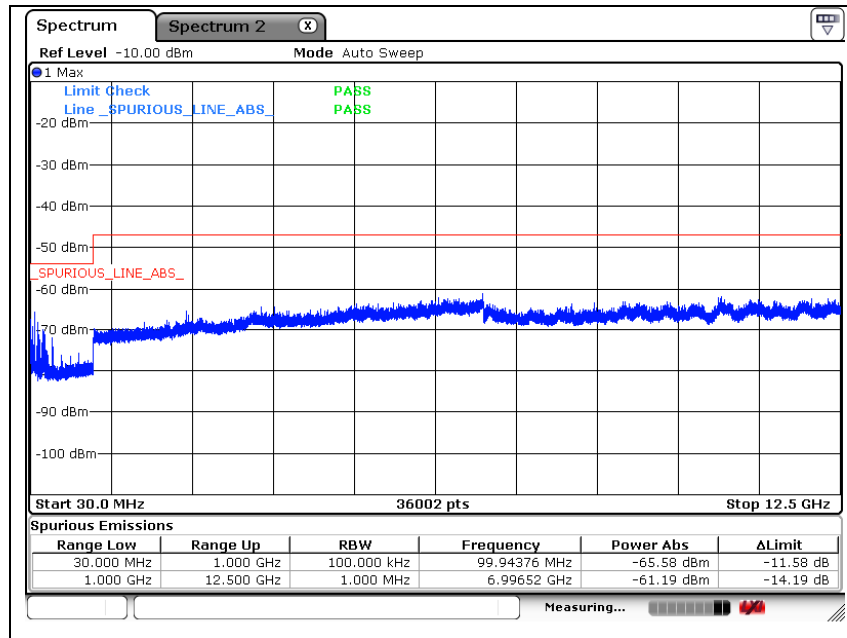
Test voltage (V _{d.c.})	Frequency Range (MHz)	Measured	Low Ch. (2 402 MHz)	Middle Ch. (2 440 MHz)	High Ch. (2 480 MHz)	Limit
V _{min} = 4.05	30 to 1 000	Frequency (GHz)	0.100	0.100	0.100	-
		Level (nW)	0.276 694	0.287 740	0.273 527	4
		Level (dB m)	-65.58	-65.41	-65.63	-54
	1 000 to 12 500	Frequency (GHz)	6.997	6.979	6.998	-
		Level (nW)	0.760 326	0.680 769	0.635 331	20
		Level (dB m)	-61.19	-61.67	-61.97	-47
V _{nom} = 4.50	30 to 1 000	Frequency (GHz)	0.100	0.100	0.100	-
		Level (nW)	0.267 301	0.318 420	0.275 423	4
		Level (dB m)	-65.73	-64.97	-65.60	-54
	1 000 to 12 500	Frequency (GHz)	11.225	6.490	6.602	-
		Level (nW)	0.656 145	0.741 310	0.680 769	20
		Level (dB m)	-61.83	-61.30	-61.67	-47
V _{max} = 4.95	30 to 1 000	Frequency (GHz)	0.100	0.100	0.100	-
		Level (nW)	0.255 859	0.283 792	0.268 534	4
		Level (dB m)	-65.92	-65.47	-65.71	-54
	1 000 to 12 500	Frequency (GHz)	6.616	6.994	6.990	-
		Level (nW)	0.639 735	0.619 441	0.717 794	20
		Level (dB m)	-61.94	-62.08	-61.44	-47

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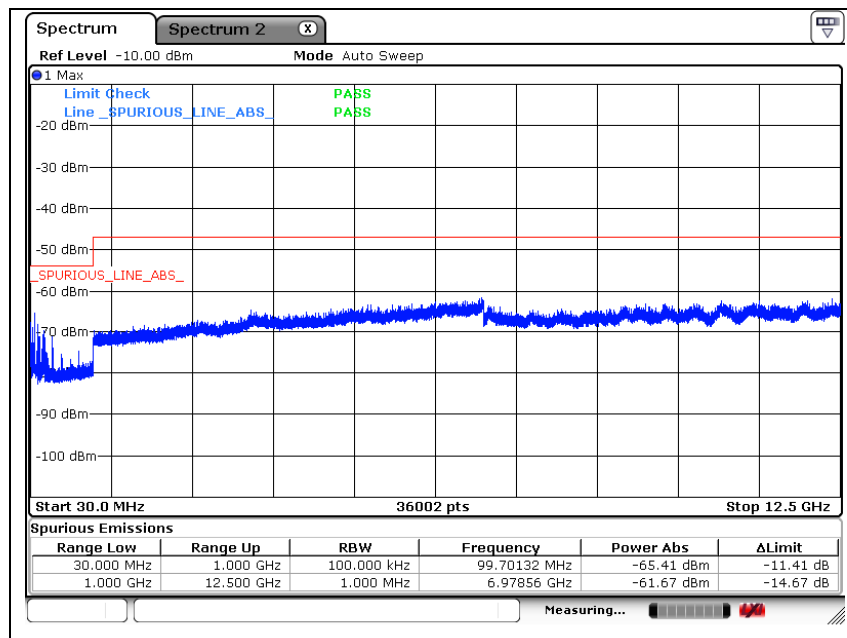
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

Low voltage

Low channel



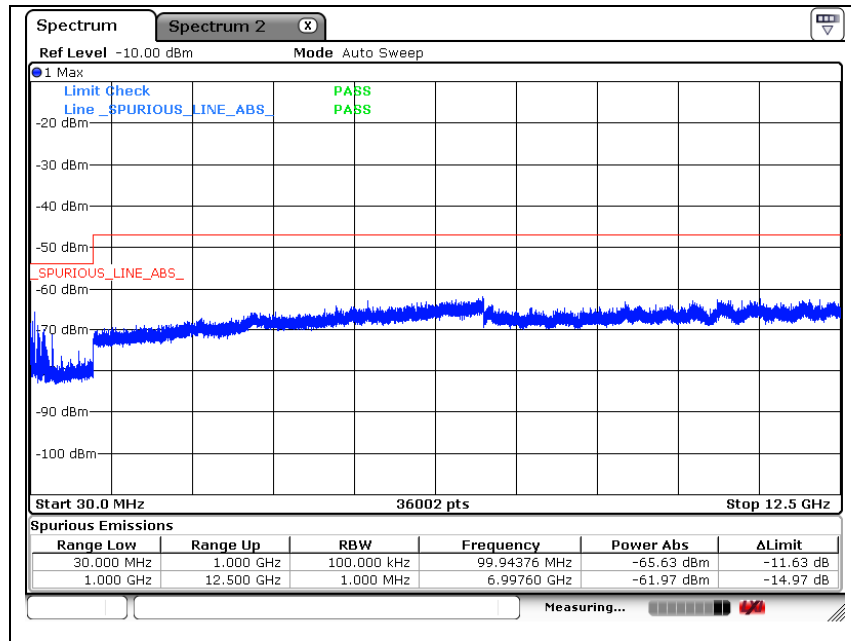
Middle channel



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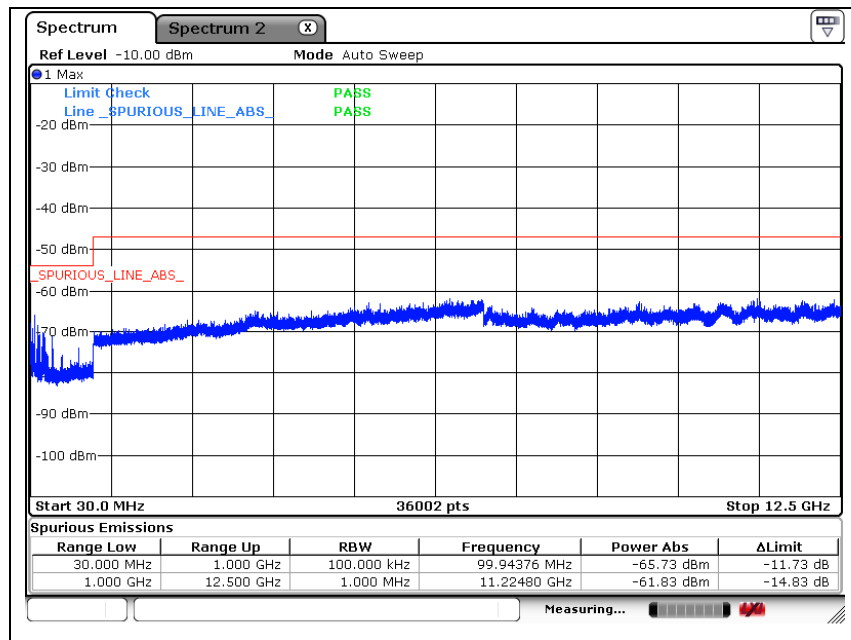
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

High channel



Normal voltage

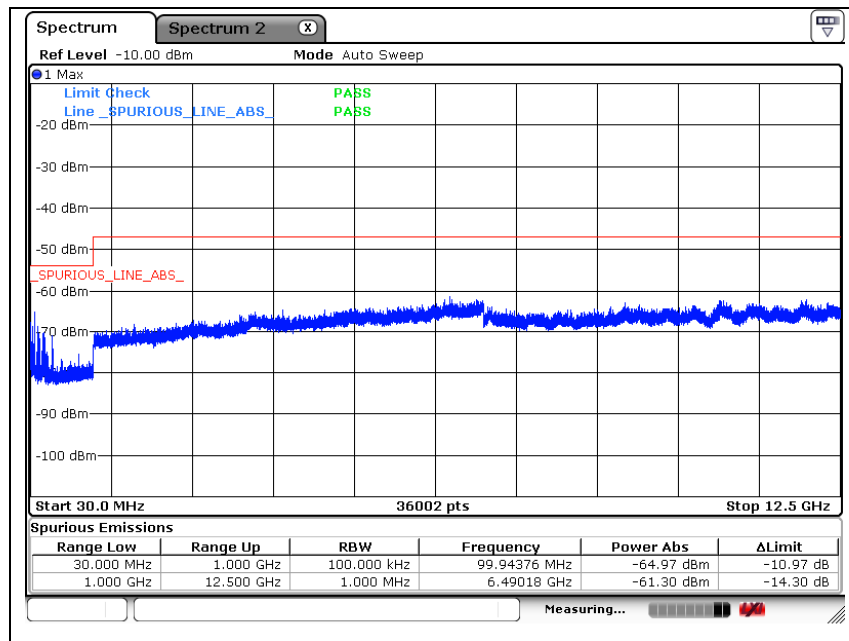
Low channel



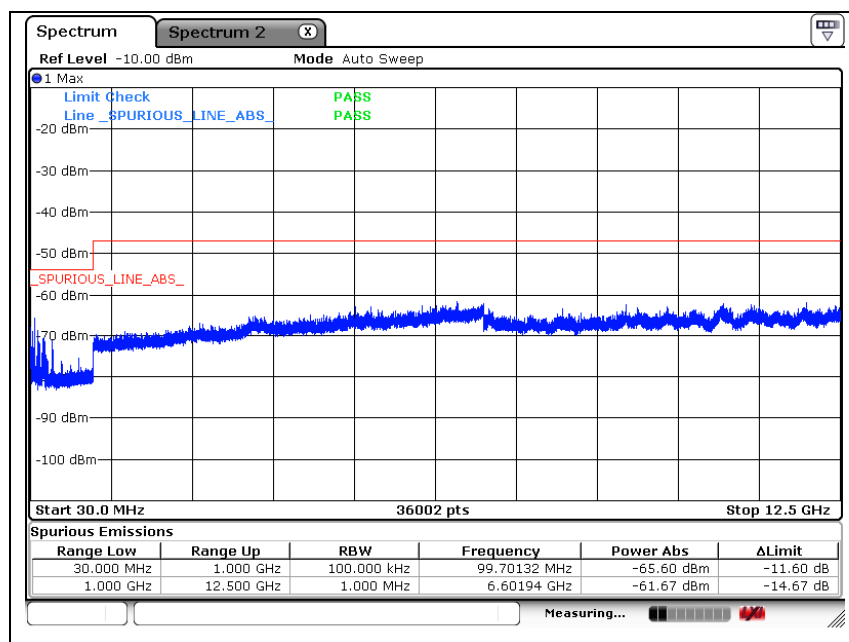
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Middle channel



High channel

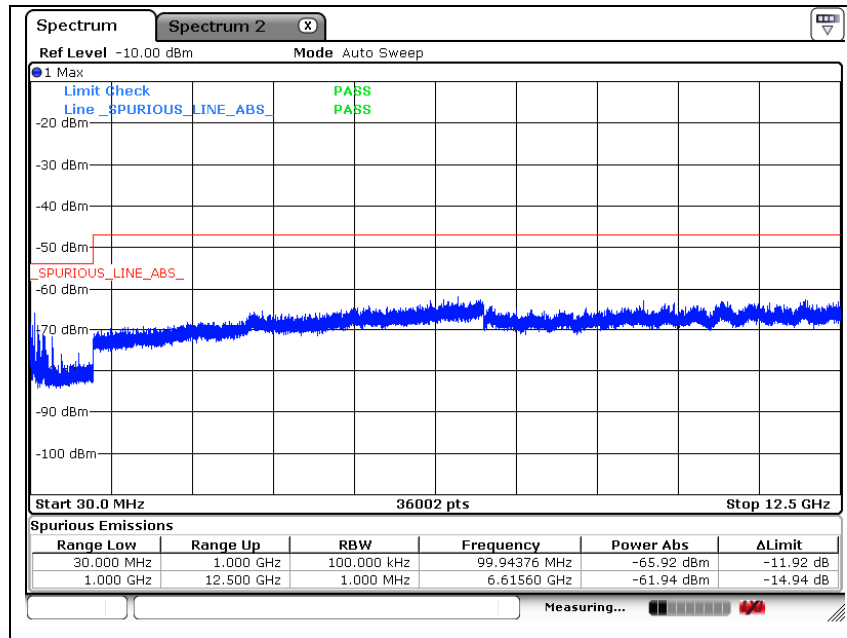


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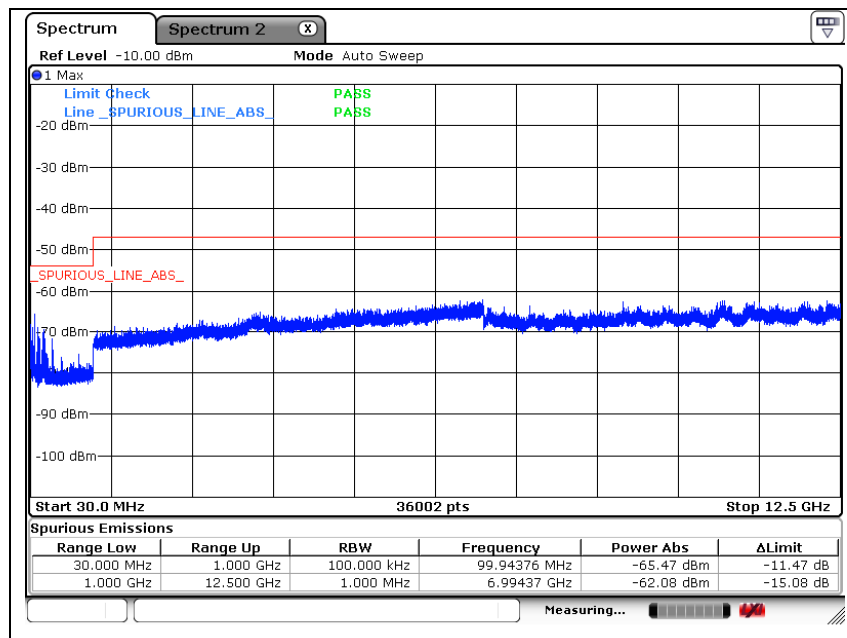
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

High voltage

Low channel



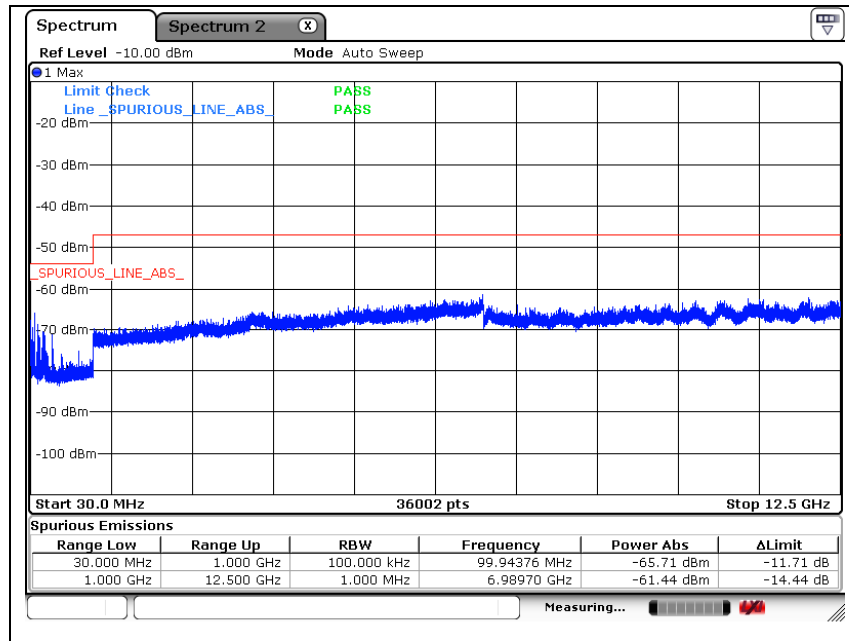
Middle channel



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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 :

KBX5

00:A0:50:10:15:34

The unit does meet the requirements. (Pass)

- 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.

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A4(210 mm x 297 mm)