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Dates of Tests: Jan 20 ~ Mar 03, 2021

Test Report S/N: LR500172106AK

Test Site : LTA CO., LTD.

JAPAN MIC Test Report

Equipment Under Test	RFID Reader equipment
Modle Name	a611
Serial Number	N/A
Applicant	Apulsetechnology Co.,Ltd.
Manufacturer	Apulsetechnology Co.,Ltd.
Date of Test(s)	Jun 07 ~ Jun 18, 2021
Date of Issue	June 21, 2021

This test report is prepared according to the requirements of ISO / IEC 17025.

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

Issue to	Issue by
<p>Phoenix Solution Co., Ltd.</p> <p>Aube Building 1F, 5-181, Kuratsuki, Kanazawa City, Ishikawa Prefecture, Japan 920-8203</p> <p>+81-76-256-2811</p>	<p>LTA</p> <p>243 Jubug-Ri, Yangji-Myeon, Yongin-Si, Gyeonggi-Do, Korea 17159</p> <p>Tel: +82-31-444-7270 Fax: +82-31-444-7271</p>

This test report is issued under the authority of:

JaBeom.Koo

Ja-Beom Koo, Manager

The test was supervised by:

Eun-Hwan Jung

Eun-Hwan Jung, Test Engineer

Revision history

Revision	Date of issue	Description	Revised by
--	June 21, 2021	Initial	-

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1. Applicant Information

1.1. Details of applicant

Applicant : Apulsetechnology Co.,Ltd.
 Address : A-1403, Gwangmyeongtechnopark, 60, Haan-ro, Gwangmyeong-si, Gyeonggi-do, Korea
 Contact Person : KIM NAM JOONG
 TEL / FAX : +82-10-5526-0605 / +82-70-4222-5686

1.2. Manufacturer Information

Manufacturer : Apulsetechnology Co.,Ltd.
 Address : A-1403, Gwangmyeongtechnopark, 60, Haan-ro, Gwangmyeong-si, Gyeonggi-do, Korea

1.3. EUT Description

Kind of product	RFID Smart Reader
Model name	a611
Serial Number	N/A
Power supply	DC 4.2 V
Frequency range	916.8 MHz, 918.0 MHz, 919.2 MHz, 920.4 MHz, 920.6 MHz, 920.8 MHz, 921.0 MHz, 921.2 MHz, 921.4 MHz, 921.6 MHz, 921.8 MHz, 922.0 MHz, 922.2 MHz, 922.4 MHz, 922.6 MHz, 922.8 MHz, 923.0 MHz, 923.2 MHz, 923.4MHz
Moduleation technique	ASK
Number of channels	19 ch.
Antenna gain	0.88 dBi (Max.)

- Note : When actual product is released, only one port is used to fix

2. Summary of test results

The EUT has been tested according to the following specifications

MIC Notice No.88 Annex1, Annex 22 Article 2, Paragraph 1, Item 8 Section in Radio equipment regulations	Description of Test	Results
2	Frequency Error	C
3	Occupied Bandwidth	C
4	Transmitter Spurious Emission and Unwanted Emission Intensity	C
5	Antenna Output Power and Output Power Tolerance	C
6	Adjacent channel Leakage Power	C
7	Receiver Spurious Emission and Unwanted Emission Intensity	C
8	Transmitting Time Restrictions	C
9	Carrier Sense Capability	C
Note 1	Construction Protection Confirmation	C
Note 2	Interference Prevention Function	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Standard: Article 2, Paragraph 1, item 8.

3 Frequency tolerance

3.1 Test setup



3.2 Limit

$\pm 20 \times 10^{-6}$ (20 ppm or less)

3.3 Test results

Ambient temperature: 24 °C Relative humidity: 50 % R.H

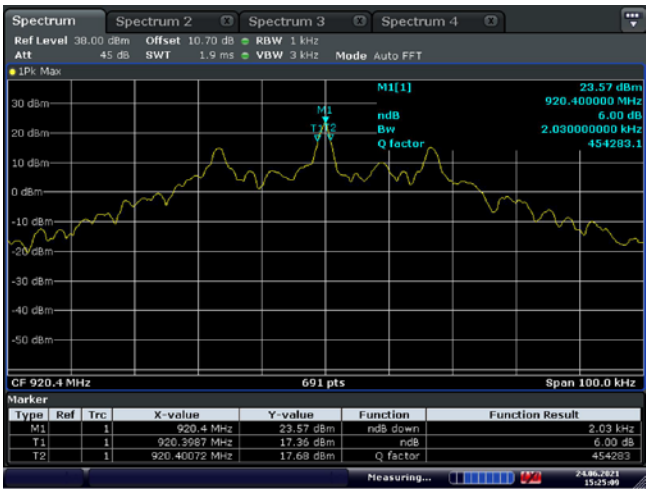
Test mode : 900 MHz RFID

Voltage	Measurement Frequency	Frequency tolerance		Limit
V	MHz	MHz	ppm	20 ppm
Vlow	916.8	920.39981	-0.21	
	920.4	923.40022	0.24	
	923.4	916.80010	0.11	
Vnormal	916.8	920.39971	-0.32	
	920.4	923.40015	0.16	
	923.4	916.80015	0.16	
Vhigh	916.8	920.39983	-0.18	
	920.4	923.40019	0.20	
	923.4	920.39981	-0.21	

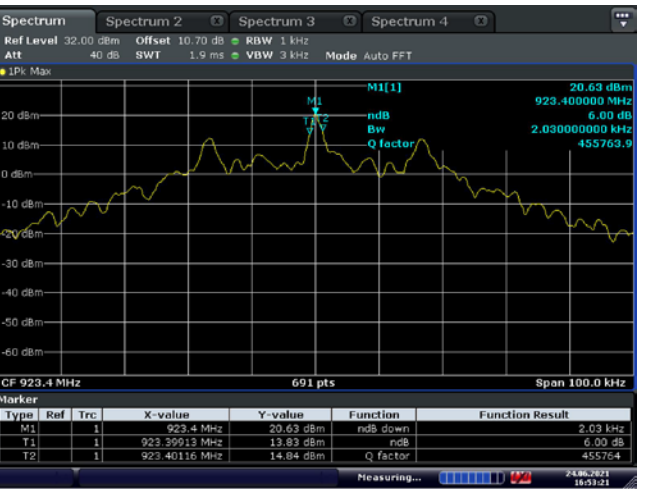
Low



Middle



High



4. Occupied bandwidth (99%)

4.1 Test setup



4.2 Limit

According to the regulation of the radio frequency equipment annex 2 clause 28, for low power radio frequency equipment ,the limit of occupied bandwidth is: ≤200 kHz; ≤400 kHz; ≤600 kHz; ≤800 kHz; ≤1000 kHz

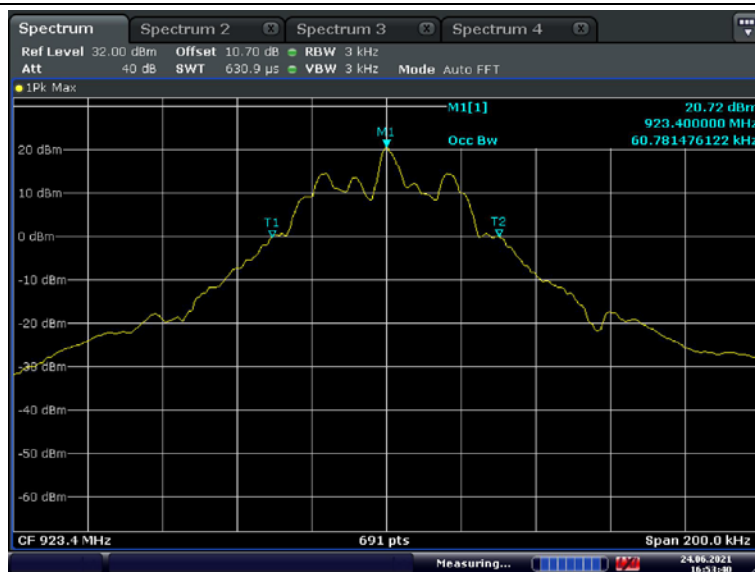
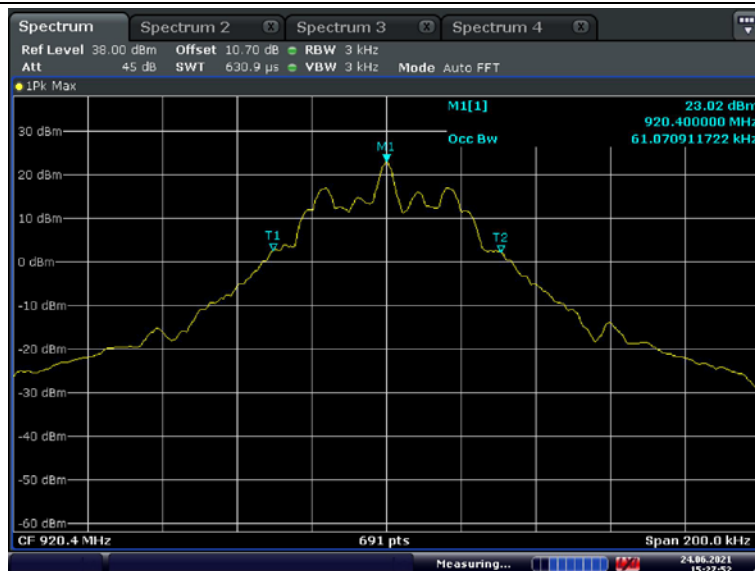
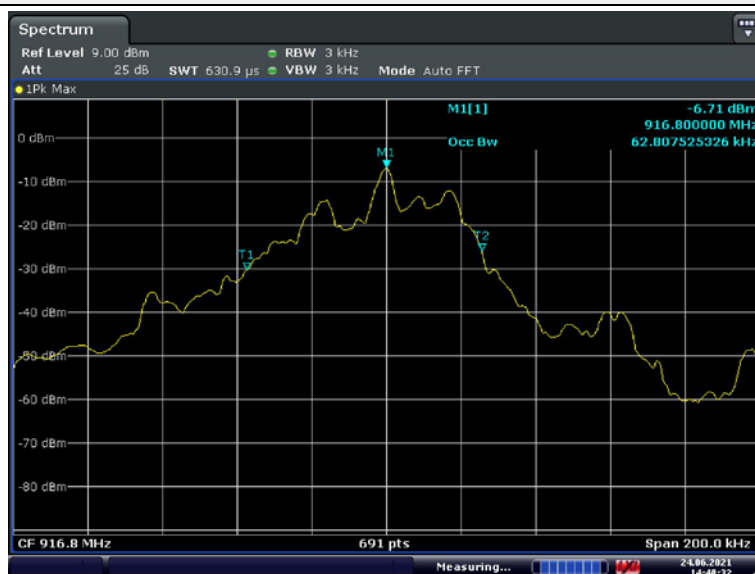
4.3 Test results

Ambient temperature: 24℃ Relative humidity: 50% R.H.

Test mode : 900 MHz RFID

Measurement Frequency (kHz)	916.8	920.4	923.4	Result
Measurement Voltage				
Vnormal	62.81	61.07	60.78	PASS
Vlow	62.81	61.07	60.78	
Vhigh	62.81	61.07	60.78	

Normal Voltage



5. Unwanted Emission Intensity

5.1 Test setup



5.2 Limit

Unwanted Emission Intensity in the spurious area:

Frequency Band	Limit
30 MHz – 710 MHz	-36 dBm/100kHz or less
710 MHz – 900 MHz	-55 dBm/1MHz or less
900 MHz – 915 MHz	-55 dBm/100kHz or less
915 MHz – 915.7 MHz	-36 dBm/100kHz or less
915.7 MHz – 923.5MHz (Except 100x(n+1)from the center freq of radio ch)	-29 dBm/100kHz or less
923.5MHz – 930MHz	-36 dBm/100kHz or less
930 MHz – 1000 MHz	-55 dBm/100kHz or less
1000 MHz – 1215 MHz	-45 dBm/1MHz or less
1215 MHz – 5000 MHz	-30 dBm/1MHz or less

5.3 Test results

Ambient temperature: 24℃ Relative humidity: 50% R.H

±

Test mode : 900 MHz RFID

Measurement Voltage		Vdc	Low			Result
Measurement Frequency		MHz	Vnormal	Vlow	Vhigh	
Unwanted Emission Strength	Under 710MHz	dBm/100kHz	-59.27	-59.04	-58.80	PASS
		MHz	153.50	153.65	153.76	----
	710MHz - 900MHz	dBm/MHz	-58.54	-58.43	-58.35	PASS
		MHz	772.28	772.48	772.61	----
	900MHz - 915MHz	dBm/100kHz	-59.04	-58.96	-58.89	PASS
		MHz	911.99	912.20	912.50	----
	915MHz - 915.7MHz	dBm/100kHz	-47.56	-47.31	-47.25	PASS
		MHz	915.57	915.90	916.17	----
	915.7MHz - 915.9MHz	dBm/100kHz	-43.56	-43.32	-43.22	PASS
		MHz	915.90	916.15	916.49	----
	923.3 MHz - 923.5MHz	dBm/100kHz	-57.84	-57.75	-57.51	PASS
		MHz	923.47	923.84	924.19	----
	923.5MHz - 930MHz	dBm/100kHz	-57.55	-57.49	-57.40	PASS
		MHz	923.99	924.09	924.22	----
	930MHz - 1000MHz	dBm/100kHz	-59.39	-59.28	-59.08	PASS
		MHz	949.80	949.94	950.21	----
	1000MHz - 1.215GHz	dBm/ MHz	-55.36	-55.22	-55.12	PASS
		MHz	1017.89	1018.06	1018.33	----
	1.125GHz - 5GHz	dBm/MHz	-34.31	-34.25	-34.03	PASS
		MHz	1831.20	1831.33	1831.65	----

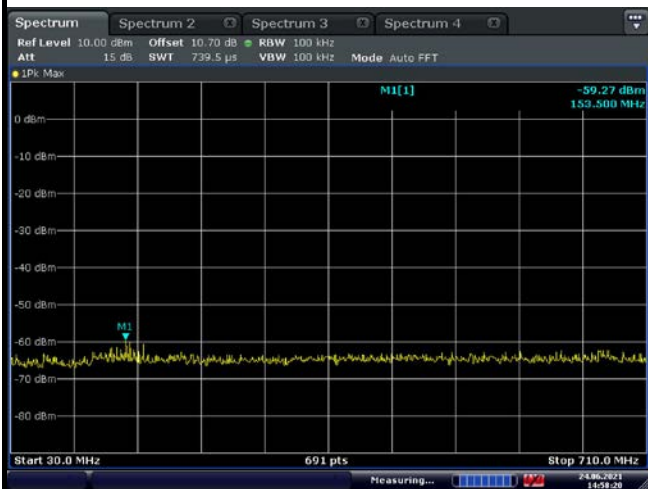
Measurement Voltage		Vdc	Middle			Result
Measurement Frequency		MHz	Vnormal	Vlow	Vhigh	
Unwanted Emission Strength	Under 710MHz	dBm/100kHz	-60.88	-60.63	-60.40	PASS
		MHz	148.58	148.69	148.95	-----
	710MHz - 900MHz	dBm/MHz	-58.00	-57.83	-57.60	PASS
		MHz	779.15	779.34	779.65	-----
	900MHz - 915MHz	dBm/100kHz	-58.19	-57.94	-57.71	PASS
		MHz	911.99	912.22	912.50	-----
	915MHz - 915.7MHz	dBm/100kHz	-53.45	-53.38	-53.29	PASS
		MHz	915.53	915.84	916.06	-----
	915.7MHz - 916.2MHz	dBm/100kHz	-54.13	-54.02	-53.85	PASS
		MHz	916.00	916.09	916.38	-----
	923.0MHz - 923.5MHz	dBm/100kHz	-55.47	-55.41	-55.35	PASS
		MHz	923.09	923.19	923.28	-----
	923.5MHz - 930MHz	dBm/100kHz	-56.12	-55.98	-55.80	PASS
		MHz	923.65	923.81	924.01	-----
	930MHz - 1000MHz	dBm/100kHz	-60.18	-59.95	-59.88	PASS
		MHz	967.43	967.63	967.90	-----
	1000MHz - 1.215GHz	dBm/ MHz	-53.74	-53.65	-53.50	PASS
		MHz	1004.51	1004.77	1005.13	-----
	1.125GHz - 5GHz	dBm/MHz	-32.54	-32.35	-32.17	PASS
		MHz	1842.20	1842.40	1842.61	-----

Measurement Voltage		Vdc	High			Result
Measurement Frequency		MHz	Vnormal	Vlow	Vhigh	
Unwanted Emission Strength	Under 710MHz	dBm/100kHz	-61.02	-60.78	-60.57	PASS
		MHz	138.74	138.86	139.06	-----
	710MHz - 900MHz	dBm/MHz	-61.14	-61.05	-60.96	PASS
		MHz	868.52	868.86	869.20	-----
	900MHz - 915MHz	dBm/100kHz	-59.70	-59.47	-59.39	PASS
		MHz	911.99	912.20	912.38	-----
	915MHz - 915.7MHz	dBm/100kHz	-55.06	-54.84	-54.77	PASS
		MHz	915.12	915.26	915.50	-----
	915.7MHz - 921.4MHz	dBm/100kHz	-41.76	-41.55	-41.44	PASS
		MHz	918.61	918.74	918.94	-----
	925.4MHz - 930MHz	dBm/100kHz	-42.93	-42.69	-42.61	PASS
		MHz	924.98	925.34	925.52	-----
	930MHz - 1000MHz	dBm/100kHz	-60.22	-60.05	-59.81	PASS
		MHz	952.54	952.78	953.13	-----
	1000MHz - 1.215GHz	dBm/ MHz	-53.65	-53.56	-53.50	PASS
		MHz	1003.27	1003.45	1003.74	-----
	1.125GHz - 5GHz	dBm/MHz	-37.62	-37.52	-37.34	PASS
		MHz	1847.70	1847.99	1848.25	-----

Unwanted Emission Intensity (dBm) = Spectrum Reading + Cable Loss

Normal Voltage : Low

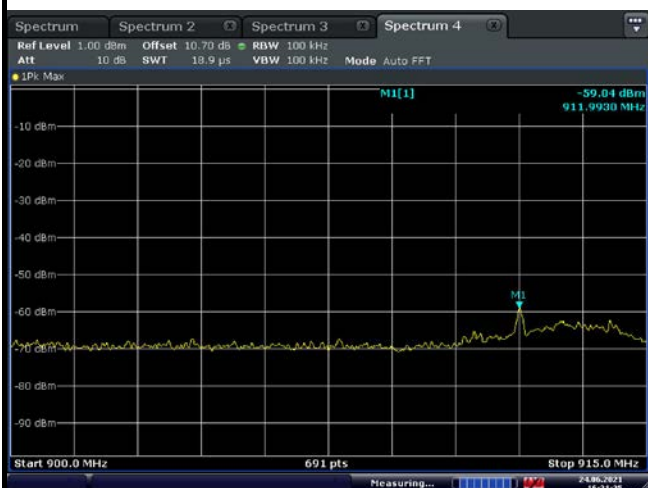
Under 710 MHz



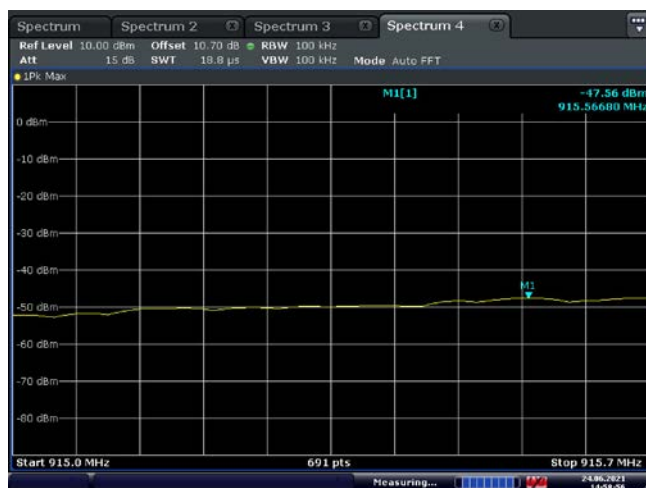
710 MHz to 900 MHz



900 MHz to 915 MHz



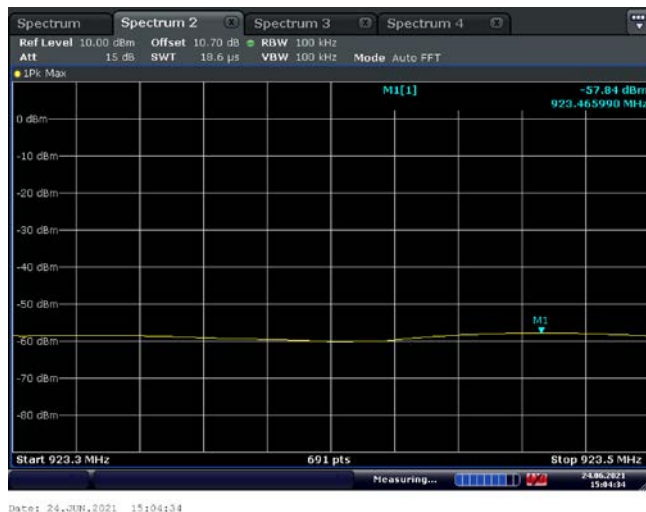
915 MHz to 915.7 MHz



915.7 MHz to 915.9 MHz



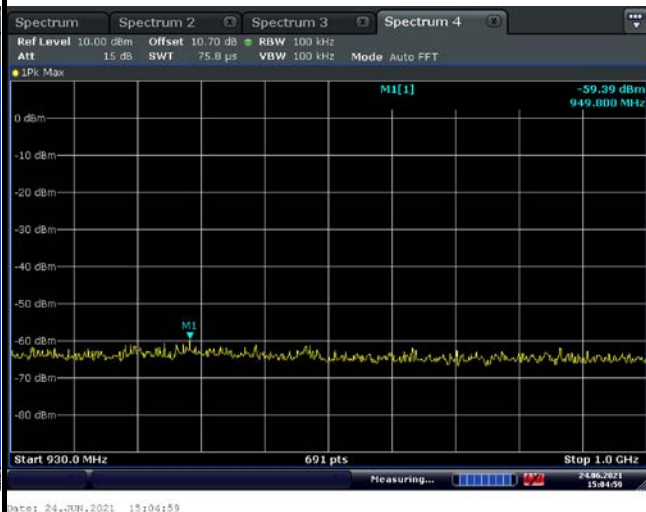
923.3 MHz to 923.5 MHz



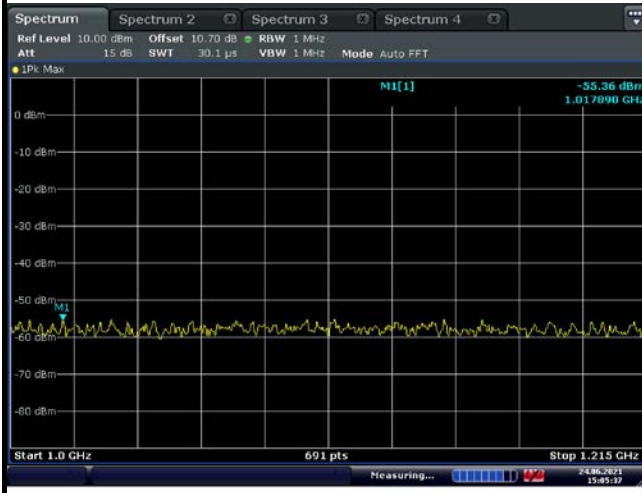
923.5 MHz to 930 MHz



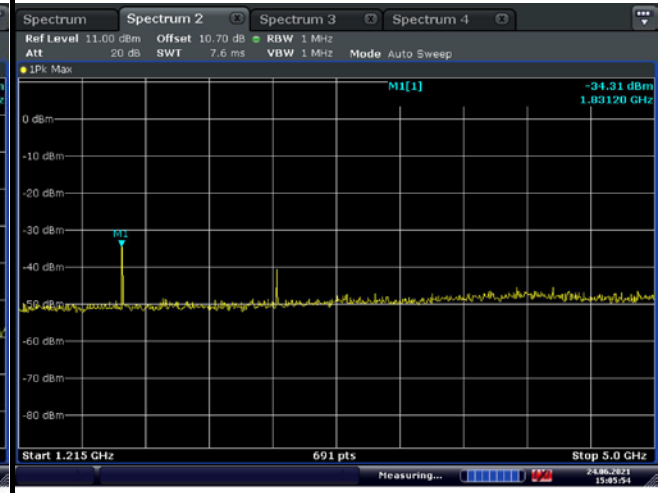
930 MHz to 1000 MHz



1000 MHz to 1215 MHz

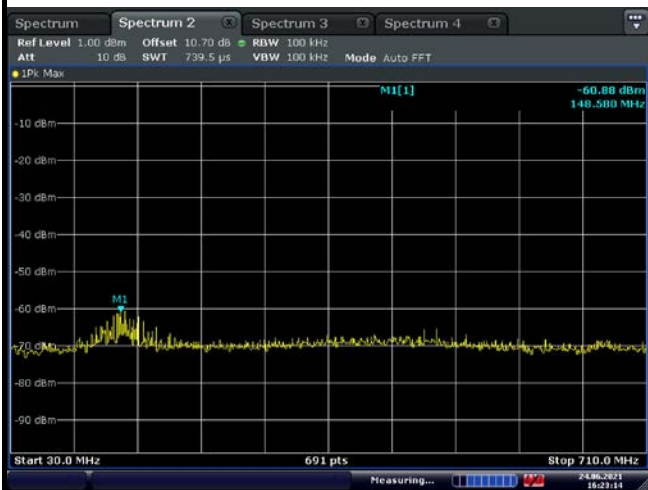


1215 MHz to 5000 MHz

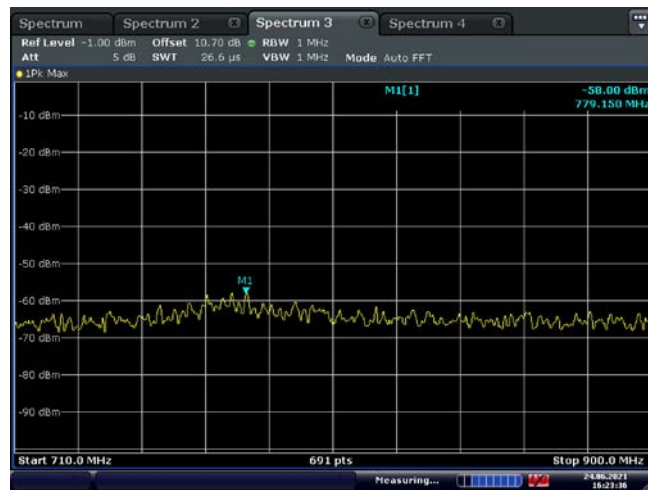


Normail Voltage : Middle

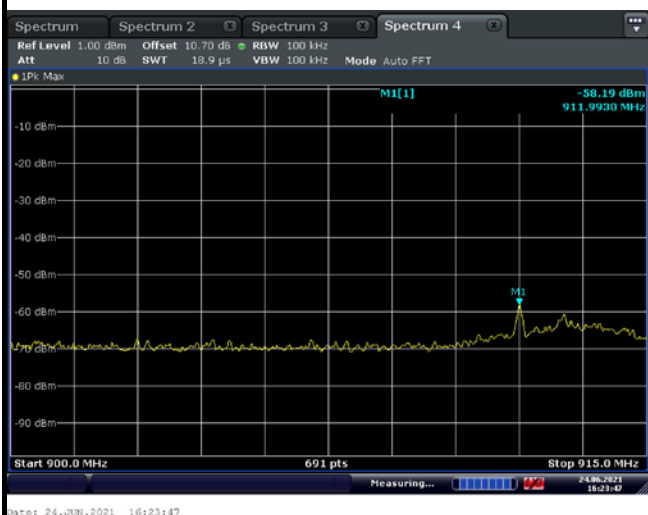
Under 710 MHz



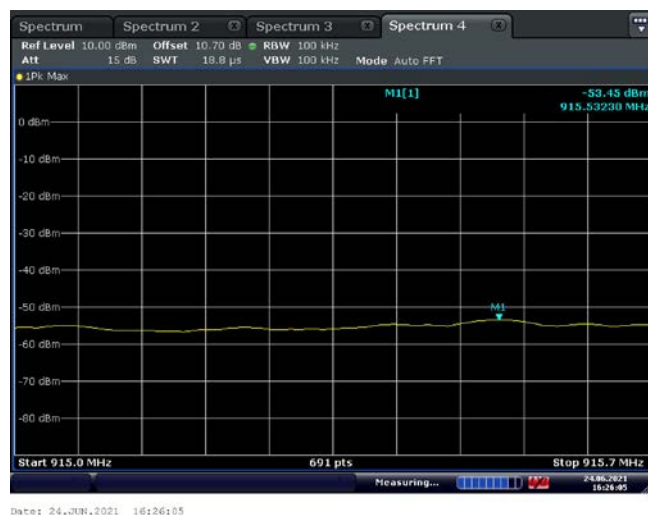
710 MHz to 900 MHz



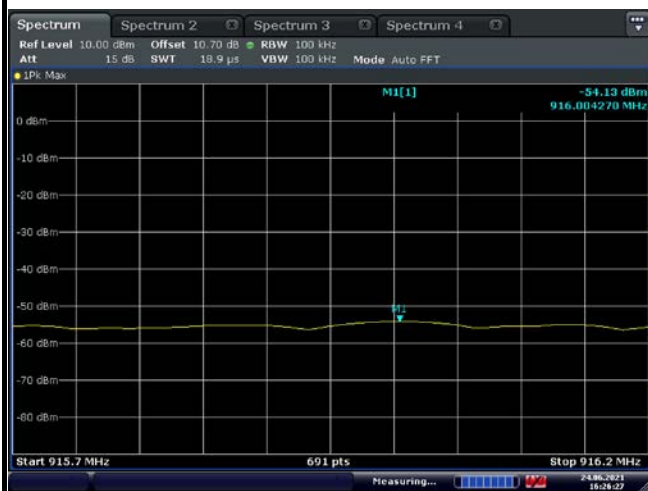
900 MHz to 915 MHz



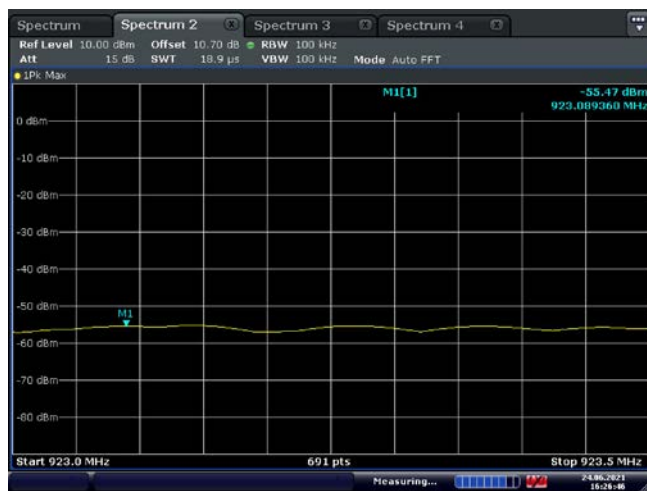
915 MHz to 915.7 MHz



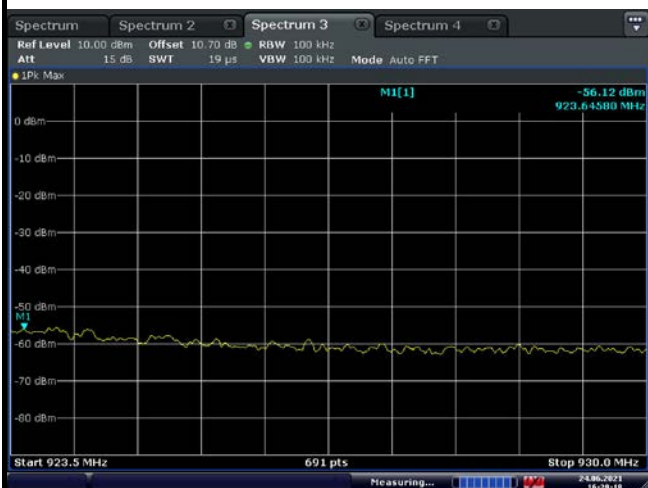
915.7 MHz to 916.2 MHz



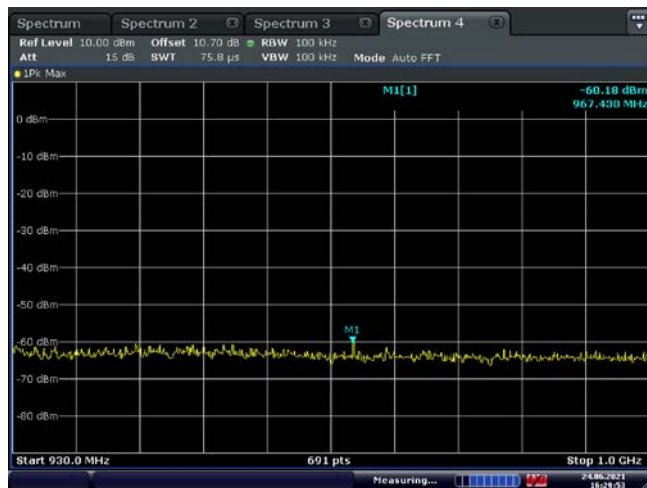
923.0 MHz to 923.5 MHz



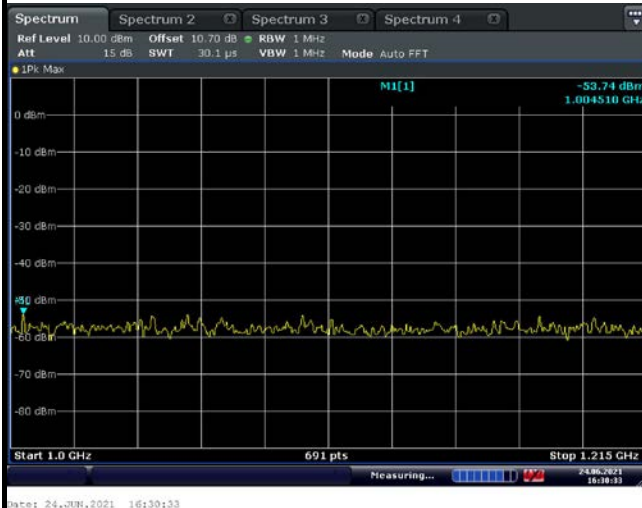
923.5 MHz to 930 MHz



930 MHz to 1000 MHz

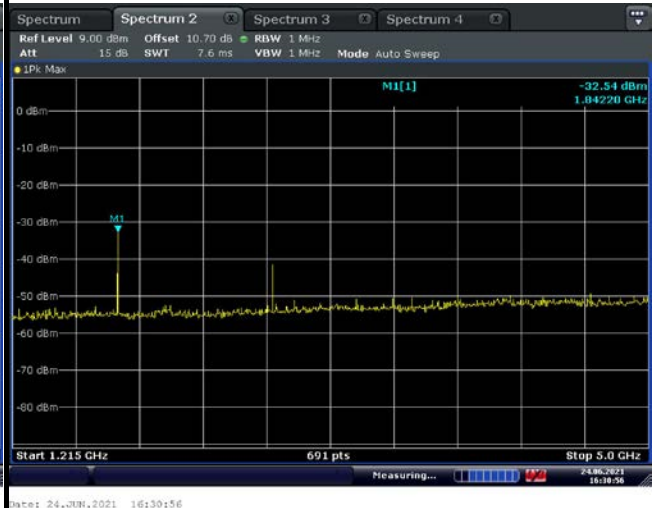


1000 MHz to 1215 MHz



Date: 24.JUN.2021 16:30:33

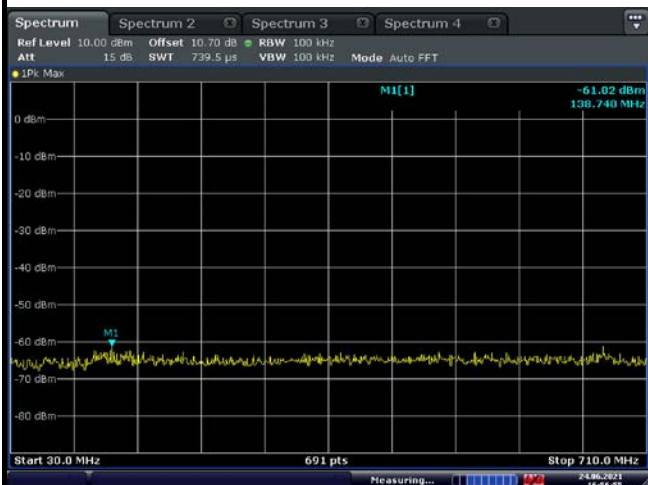
1215 MHz to 5000 MHz



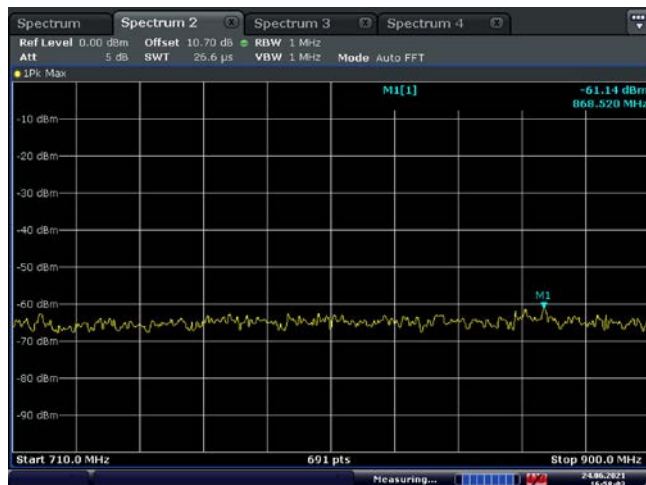
Date: 24.JUN.2021 16:30:56

Normail Voltage : High

Under 710 MHz



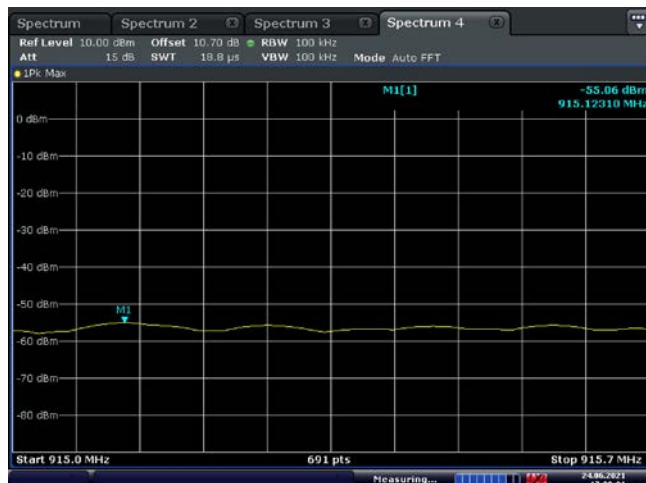
710 MHz to 900 MHz



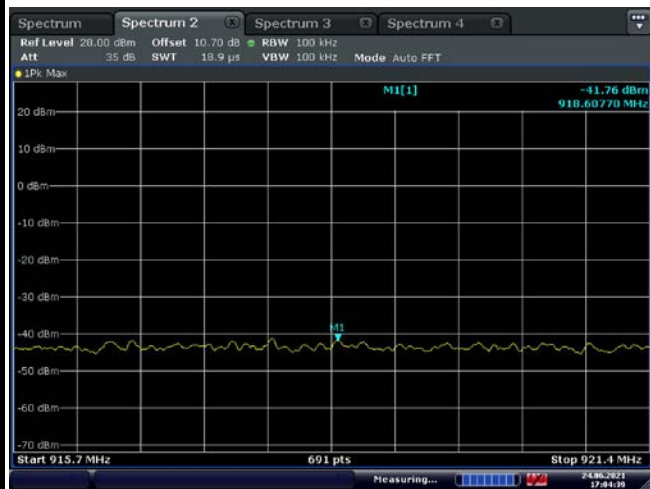
900 MHz to 915 MHz



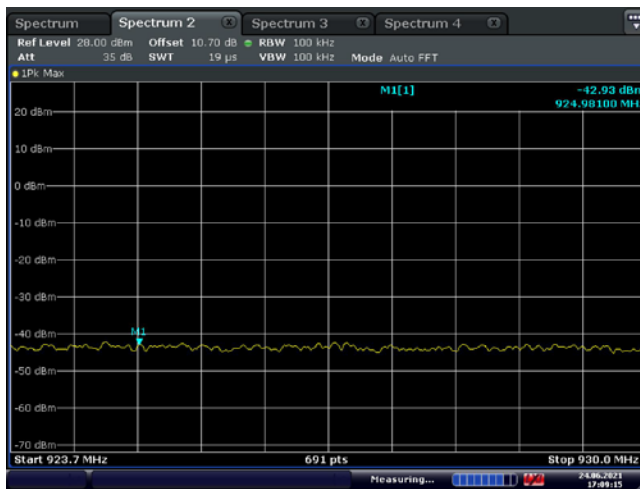
915 MHz to 915.7 MHz



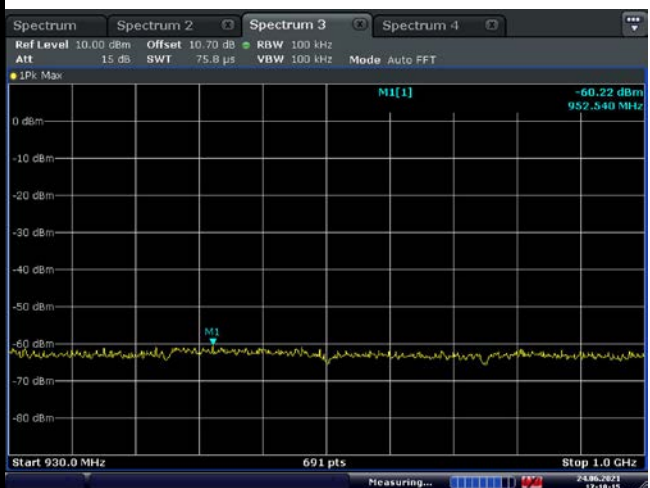
915.7 MHz to 921.4 MHz



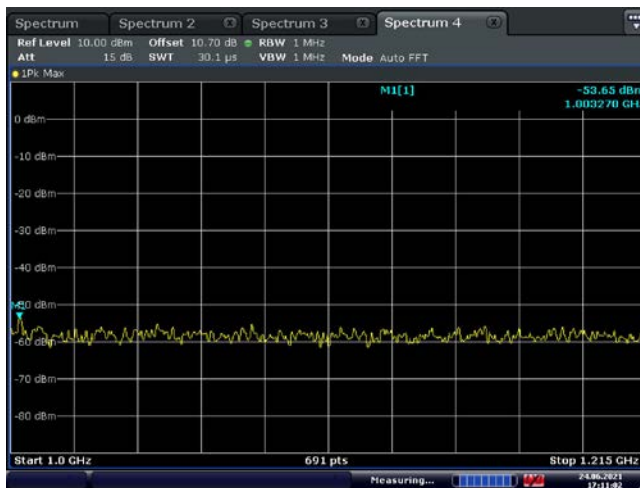
923.7 MHz to 930.0 MHz



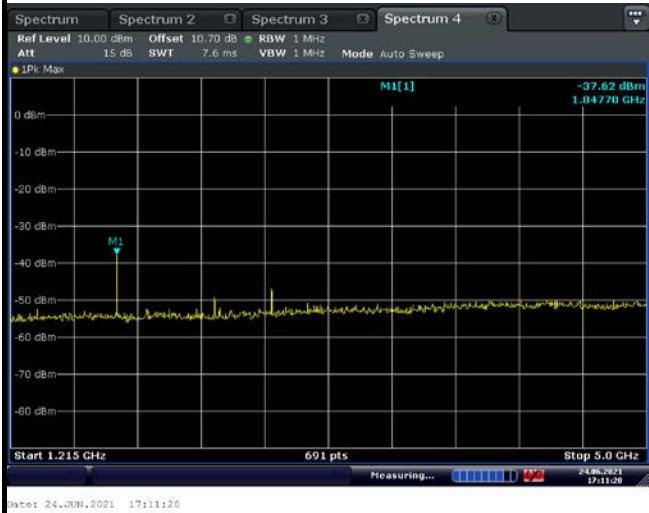
930 MHz to 1000 MHz



1000 MHz to 1215 MHz



1215 MHz to 5000 MHz



6. Antenna power

6.1 Test setup



6.2 Limit

Output Power ≤ 0.25 W

Output Power Tolerance must be within +20%, -80%

6.3 Test results

Ambient temperature: 24 °C Relative humidity: 50 % R.H.

Test mode : 900 MHz RFID

Voltage	Measurement Frequency	Result		Limit
V	MHz	dBm	mW/MHz	-80 ~ +20 %
V _{normal}	Low	23.31	214.29	-14.28
	Middle	22.58	181.13	-27.55
	High	22.39	173.38	-30.65
V _{low}	Low	23.33	215.42	-13.83
	Middle	22.59	181.70	-27.32
	High	22.43	175.11	-29.96
V _{high}	Low	23.39	218.13	-12.75
	Middle	22.62	182.73	-26.91
	High	22.48	176.92	-29.23

Declared Power : 0.25 W

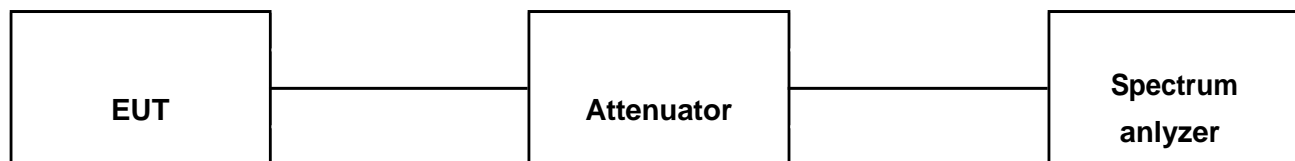
Peak Ant Gain : 0.88 dBi

Note:

- 1) Antenna Output power (dBm) = Power Meter Raw of EUT + Transmitter Duty Cycle Factor
- 2) Antenna Output Power Tolerance = ((Antenna Output power -Rated Power)/ Rated Power)*100%.
- 3) EIRP = Antenna Power + Antenna Gain.
- 4) Transmission Antenna Gain and Transmission Radiation Angle Width are not required since EIRP less than 16 dBm.

7. Adjacent Channel Leakage Power

7.1 Test setup



7.2 Limit

0.5 dBm or less

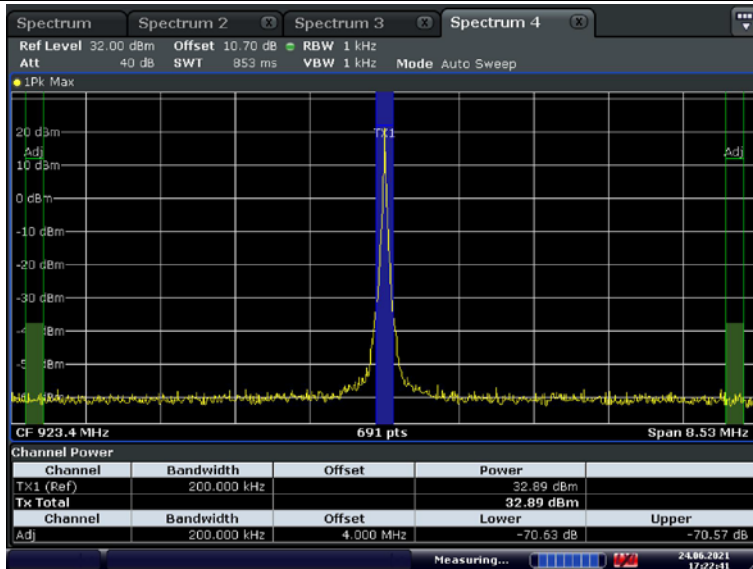
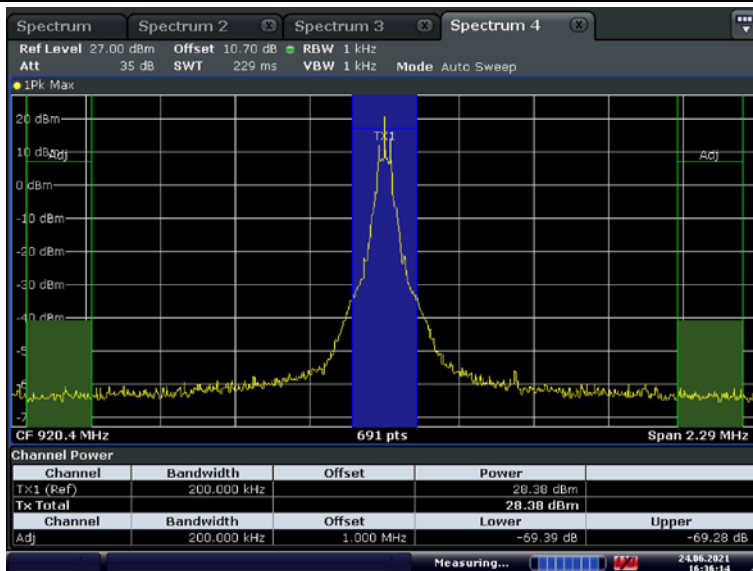
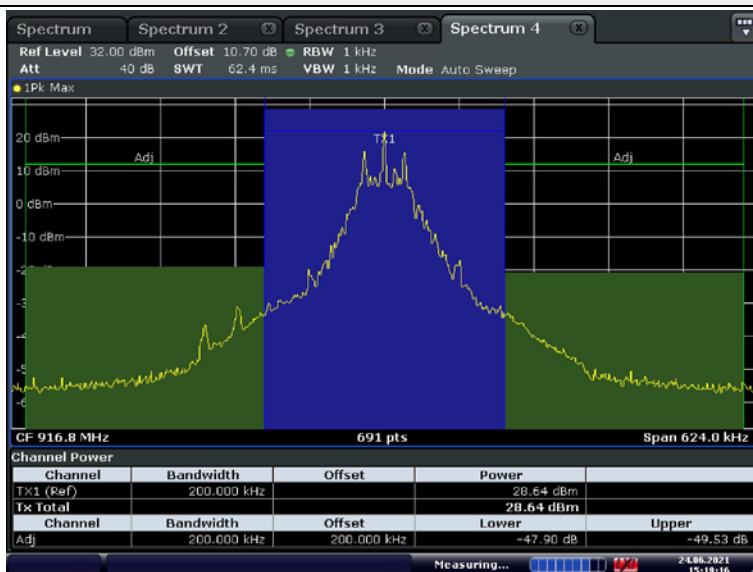
7.4 Test results

Ambient temperature: 24°C Relative humidity: 50% R.H.

Test mode : 900 MHz RFID

Measurement Frequency		MHz	Low	Middle	High	Result
Adjacent Channel Leakage Power	CF - (200 X n)-200KHz	dB	49.90	69.39	70.63	PASS
		dBm	-26.59	-46.81	-48.24	
	CF + (200 X n)+200KHz	dB	49.53	69.28	70.57	PASS
		dBm	-26.22	-46.70	-48.18	

Normal Voltage



8. RX spurious emission

8.1 Test setup



8.2 Limit

Frequency Band	Limit
30MHz - 710 MHz	-54 dBm/100kHz or less
710 MHz – 900 MHz	-55 dBm/1MHz or less
900 MHz – 915 MHz	-55 dBm/100kHz or less
915 MHz – 930 MHz	-54 dBm/100kHz or less
930 MHz – 1000 MHz	-55 dBm/100kHz or less
1000 MHz – 5000 MHz	-47 dBm/1MHz or less

8.3 Test results

Ambient temperature: 24℃ Relative humidity: 50% R.H

Test mode : 900 MHz RFID

Measurement Voltage		Vdc	4.20	4.62	3.78	Result
Measurement Frequency		MHz	920.4	920.4	920.4	
Secondarily emitted radio wave strength	Under 710 MHz	dBm/100kHz	-73.10	-72.89	-73.04	PASS
		MHz	662.27	662.69	662.63	-----
	710 - 900 MHz	dBm/1MHz	-72.90	-72.92	-72.68	PASS
		MHz	717.29	718.01	718.51	-----
	900 – 915 MHz	dBm/100kHz	-73.13	-73.05	-72.92	PASS
		MHz	906.05	906.57	906.62	-----
	915 – 930 MHz	dBm/100kHz	-82.71	-82.55	-82.56	PASS
		MHz	926.99	927.57	927.80	-----
	930 – 1 GHz	dBm/100kHz	-81.40	-81.27	-81.22	PASS
		MHz	948.39	949.45	949.54	-----
	1 – 5 GHz	dBm/MHz	-60.16	-60.09	-59.94	PASS
		MHz	2166.40	2166.52	2166.91	-----

9. Transmitting Time Restrictions

9.1 Test Setup



9.2 Limit

Sending duration: equal to 4 sec or less.

Pause duration: equal to 0.05 sec or more.

The sum of emission time per arbitrary one hour: equal to 360 sec or less

9.3 Test Procedure

Transmit modulated wave at center frequency with burst wave

which is the longest ON and the shortest OFF

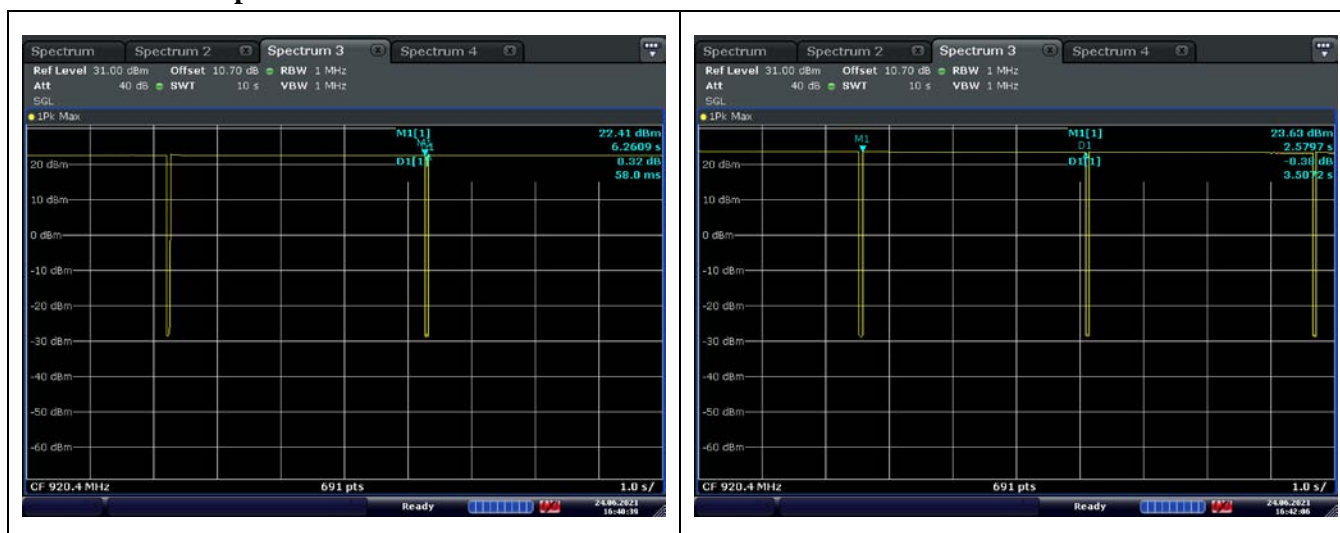
9.4 Test results

Ambient temperature: 24℃ Relative humidity: 50% R.H.

Sending duration	3.5	sec
Pause duration	0.06	sec
*The sum of emission time per arbitrary one	Pass (289 sec)	

* Note: Manufacture claimed the device sum of emission time per arbitrary one hour less than 360sec

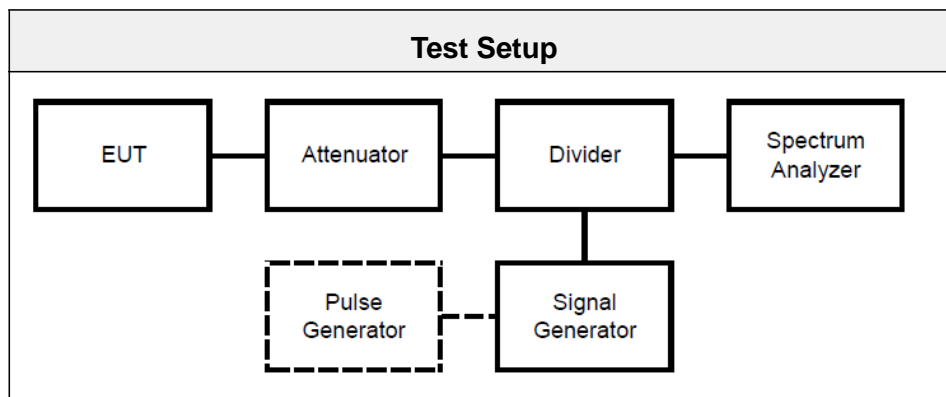
Test Result: Compliance



10. Carrier Sense Capability

10.1 Test Setup

EUT stop RF transmission signal after carrier inject to EUT



10.2 Test Procedure

In the case that the EUT has the function of automatically transmitting the identification code:

- 1) SG adjusted the frequency as same as the EUT receiving channel and emitted the absence of modulation from SG and power level is above $7\mu V$.
- 2) Turn off the RF signal of the SG.
- 3) EUT have transmitted the maximum modulation signal and fixed channelize.
- 4) Setting of SA: RBW/VBW=100kHz/100kHz, Span=300kHz, trig=free run, Detect mode=positive peak
- 5) SG RF signal on.
- 6) EUT shall be stop the transmitted any signal and SG RF signal off the EUT will be continuous transmitted signal.

10.3 Limit

Radio equipment used mainly on the same premises and automatically transmits or receives identification code

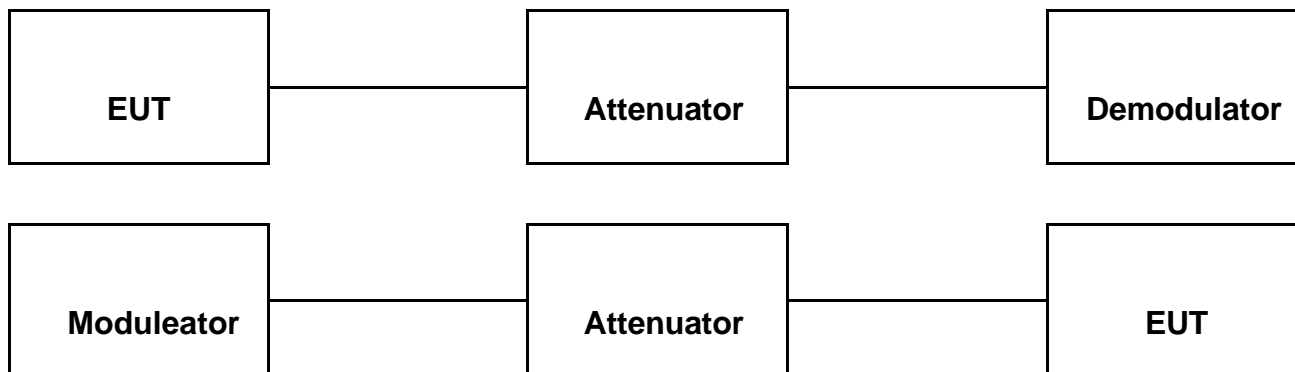
10.4 Test results

Ambient temperature: 24°C Relative humidity: 50% R.H.

Carrier Sensing Function	-----	good	PASS
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8 Interference prevention function

8.1 Test Setup



8.2 Test Procedure

In the case that the EUT has the function of automatically transmitting the identification code:

- 1) Transmit the predetermined identification codes from EUT
- 2) Check the transmitted identification codes with the demodulator.

In the case of receiving the identification codes:

- 1) Transmit the predetermined identification codes from the counterpart.
- 2) Check if communication is normal
- 3) Transmit the signal other than predetermined ID codes from the counterpart.
- 4) Check if the EUT stops the transmission, or if it displays that identification codes are different from the predetermined ones'

*In this case, the device link mobile via BLE and use App to check the identification codes

8.3 Test results

Ambient temperature: 24℃ Relative humidity: 50% R.H.

MAC Address	Result
00043E5	Compliance

12. CONSTRUCTION PROTECTION CONFIRMATION METHOD

12.1 Limit

(See Article 49-20, Item1-a of the Ordinance Regulating Radio Equipment)

The high-frequency section and modulation section of the radio equipment except for the antenna system shall not be capable of being opened easily.

12.2 CONFIRMATION METHOD

The RF and modulation portions are protected against illegal modification as following method:

Tick the appropriate box	
X	1. Sealed with special screws.
	2. Plastic chassis is being welded using ultrasonic waves.
	3. Chassis is glued using a special adhesive.
	4. Metal covers are spot-fused.
	5. Cover is specially interlocked.
	6. RF and Modulation components are covered with shielding case and this shielding case is soldered.
	7. Shield case is welded at RF and modulation parts, and ID-ROM is welded using the BGA Method.
	8. Shield case is welded at RF and modulation parts, and ID-ROM is glued at its lead with a special adhesive
	9. Shield case is welded at RF and modulation parts, and ID-ROM is glued with a non-transparent laminating agent.
	10. RF and Modulation parts are mounted on PCB with surface mount technology, and there is no any adjustable part on PCB or adjustable parts are not exposed.

APPENDIX

TEST EQUIPMENT USED FOR TESTS

	Use	Description	Model No.	Serial No.	Manufacturer	Interval	Next Cal. Date
1	■	Signal Analyzer (9 kHz ~ 30 GHz)	FSV30	100757	R&S	1 year	2021-09-07
2	■	Signal Generator (~3.2 GHz)	8648C	3623A02597	HP	1 year	2022-03-16
3		SYNTHESIZED CW GENERATOR	83711B	US34490456	HP	1 year	2022-03-16
4		Attenuator (3 dB)	8491A	37822	HP	1 year	2021-09-07
5		Attenuator (10 dB)	8491A	63196	HP	1 year	2021-09-07
6		EMI Test Receiver (~7 GHz)	ESC17	100722	R&S	1 year	2021-09-07
7		RF Amplifier (~1.3 GHz)	8447D OPT 010	2944A07684	HP	1 year	2021-09-07
8		RF Amplifier (1~26.5 GHz)	8449B	3008A02126	HP	1 year	2022-03-16
9		Horn Antenna (1~18 GHz)	3115	00114105	ETS	2 year	2022-09-10
10		DRG Horn (Small)	3116B	81109	ETS-Lindgren	2 year	2022-03-18
11		DRG Horn (Small)	3116B	133350	ETS-Lindgren	2 year	2022-03-18
12		TRILOG Antenna	VULB 9160	9160-3237	SCHWARZBECK	2 year	2023-03-20
13		Temp.Humidity Data Logger	SK-L200TH II A	00801	SATO	1 year	2022-03-16
14		Splitter (SMA)	ZFSC-2-2500	SF617800326	Mini-Circuits	-	-
15	■	DC Power Supply	6674A	3637A01657	Agilent	-	-
17	■	Power Meter	EPM-441A	GB32481702	HP	1 year	2022-03-16
18	■	Power Sensor	8481A	3318A94972	HP	1 year	2021-09-07
19		Audio Analyzer	8903B	3729A18901	HP	1 year	2021-09-07
20		Modulation Analyzer	8901B	3749A05878	HP	1 year	2021-09-07
21	■	TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	JinYoung Tech	1 year	2021-09-07
22		Stop Watch	HS-3	812Q08R	CASIO	2 year	2022-03-18
23		LISN	KNW-407	8-1430-1	Kyoritsu	1 year	2022-03-16
24		Two-Lime V-Network	ESH3-Z5	893045/017	R&S	1 year	2022-03-16
25		UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	106243	R&S	1 year	2022-03-16
26		Highpass Filter	WHKX1.5/15G-10SS	74	Wainwright Instruments	1 year	2022-03-16
27		Highpass Filter	WHKX3.0/18G-10SS	118	Wainwright Instruments	1 year	2022-03-16
28		OSP120 BASE UNIT	OSP120	101230	R&S	1 year	2022-03-16
29		Signal Generator(100 kHz ~ 40 GHz)	SMB100A03	177621	R&S	1 year	2022-03-16
30		Signal Analyzer (10 Hz ~ 40 GHz)	FSV40	101367	R&S	1 year	2022-03-16