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Dates of Tests: May 15 ~ May 21, 2019

Test Report S/N: LR500171909AG

Test Site : LTA CO., LTD.

## JAPAN MIC Test Report

<b>Equipment Under Test</b>	DTS equipment
<b>Modle Name</b>	AC300F
<b>Serial Number</b>	N/A
<b>Applicant</b>	APS-ICT Co.,Ltd.
<b>Manufacturer</b>	APS-ICT Co.,Ltd.
<b>Date of Test(s)</b>	Aug 15 ~ Aug 23, 2019
<b>Date of Issue</b>	SEP 26, 2019

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
<b>APS-ICT Co.,Ltd.</b>  #1101 ACE Gwangmyeong Tower, 108 Haan-ro, Gwangmyeong-si Gyeonggi-do, 14319 KOREA  +82-10-5443-7930	<b>LTA</b>  243 Jubug-Ri, Yangji-Myeon, Yongin-Si, Gyeonggi-Do, Korea 17159  Tel: +82-31-444-7270 Fax: +82-31-444-7271

This test report is issued under the authority of:

The test was supervised by:

*JaBeom.Koo*

*Gyeong hun. Ko*

Ja-Beom Koo, Manager

Gyeong hun KO, Test Engineer

**Revision history**

Revision	Date of issue	Description	Revised by
--	SEP 26, 2019	Initial	-

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## 1. Applicant Information

### 1.1. Details of applicant

Applicant : APS-ICT Co.,Ltd.  
Address : #1101 ACE Gwangmyeong Tower, 108 Haan-ro, Gwangmyeong-si Gyeonggi-do, 14319 KOREA  
Contact Person : Jung Jae Lee  
TEL / FAX : +82-2-897-3321 / +82-2-897-3321

### 1.2. Manufacturer Information

Manufacturer : APS-ICT Co.,Ltd.  
Address : #1101 ACE Gwangmyeong Tower, 108 Haan-ro, Gwangmyeong-si Gyeonggi-do, 14319 KOREA

### 1.3. EUT Description

Kind of product	DTS equipment
Model name	AC300F
Serial Number	N/A
Power supply	DC 3.80 V
Frequency range	2 402 MHz ~ 2 480 MHz (Bluetooth LE)
Modulation technique	GFSK
Number of channels	40 ch. (Bluetooth LE)
Antenna gain	-9.20 dBi(Max.)

## 2. Summary of Test results

The EUT has been tested according to the following specifications

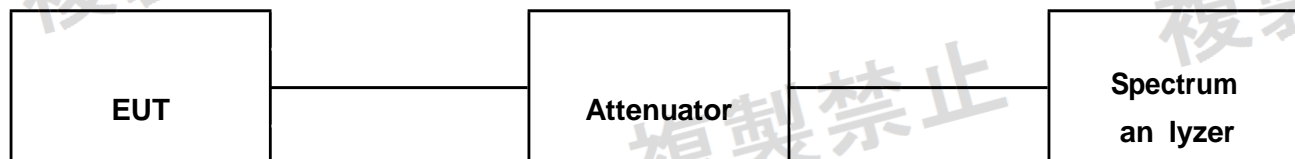
Section in Radio equipment regulations	Description of Test	Results
RE 5 Table No. 1	Frequency Tolerance	C
RE 6 Table No. 2	Occupied Bandwidth (99%) & Spread Bandwidth (90%)	C
RE 14, RE 49.20	Antenna power	C
RE 7	Unwanted emission strength	C
RE 24	RX spurious emission	C
RLE 6-2, RE 9-4	Interference Prevention Function	C

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

Standard: Article 2, Paragraph 1, item 19.

### 3 Frequency tolerance

#### 3.1 Test setup



#### 3.2 Limit

$\pm 50 \times 10^{-6}$  (50 ppm or below)

#### 3.3 Test procedure

The transmitter output is connected to the Spectrum analyzer	
Setting the spectrum analyzer is as follows.	
Center frequency	Operating frequency
Resolution BW	10 KHz
Video BW	10 KHz
Span	1 MHz
Sweep time	Auto
Detector mode	Positive peak
Trace mode	Max. hold

#### 3.4 Test results

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

Test mode : LE

Operating frequency	Test voltage (DC)	Measured value (MHz)	Tolerance (ppm)
Low frequency 2 402 (MHz)	4.18 (V)	2,402.012450	5.18
	3.80 (V)	2,402.012459	5.18
	3.42 (V)	2,402.012300	5.12
Middle frequency 2 442 (MHz)	4.18 (V)	2,442.012580	5.15
	3.80 (V)	2,442.012740	5.21
	3.42 (V)	2,442.012450	5.09
High frequency 2 480 (MHz)	4.18 (V)	2,480.013020	5.25
	3.80 (V)	2,480.012740	5.13
	3.42 (V)	2,480.013176	5.31

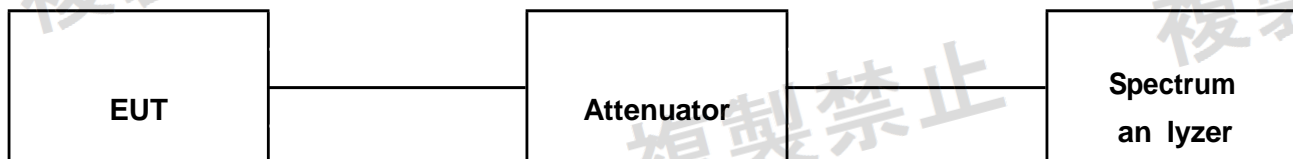
#### \* Remark

FT (ppm) = [(Measured value MHz) - Operating frequency(MHz)] / Operating frequency(MHz)  $\times 10^6$



## 4. Occupied bandwidth (99%) & Spread Bandwidth (90%)

### 4.1 Test setup



### 4.2 Limit

Occupied Bandwidth (99%):	26 MHz or less
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### 4.3 Test procedure

The transmitter output is connected to the Spectrum analyzer	
Setting the spectrum analyzer is as follows.	
Center frequency	Operating frequency
Resolution BW	300 KHz
Video BW	300 KHz
Span	5 MHz
Sweep time	Auto
Detector mode	Positive peak
Trace mode	Max. hold

### 4.4 Test results

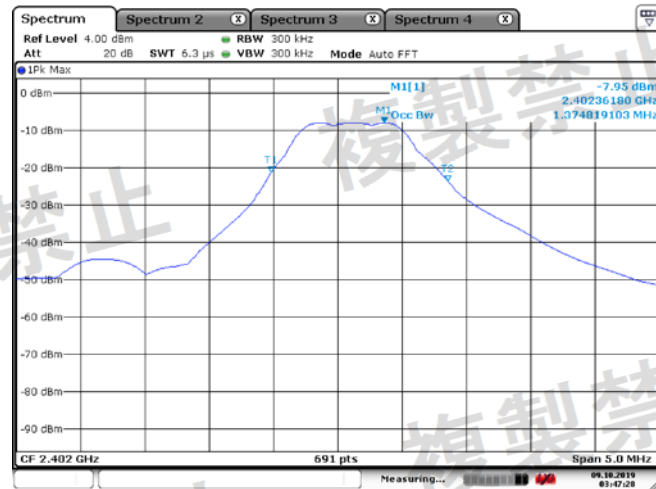
Ambient temperature: 24°C Relative humidity: 50% R.H.

Test mode : LE

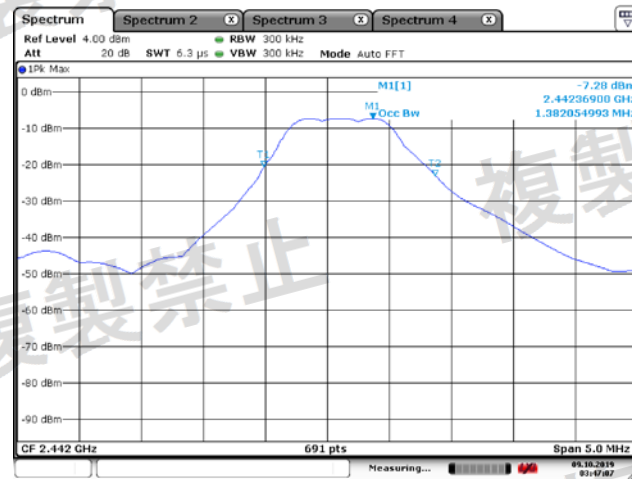
Test voltage	2,402 MHz	2,440 MHz	2,480 MHz
	99% (MHz)	99% (MHz)	99% (MHz)
4.18 (V)	1.38	1.38	1.38
3.80 (V)	1.37	1.38	1.38
3.42 (V)	1.37	1.37	1.37
Test voltage	90% (MHz)	90% (MHz)	90% (MHz)
4.18 (V)	0.868	0.871	0.877
3.80 (V)	0.868	0.868	0.875
3.42 (V)	0.866	0.868	0.875

Test Mode : LE / CH01,CH20,CH40 (Nomal Voltage)

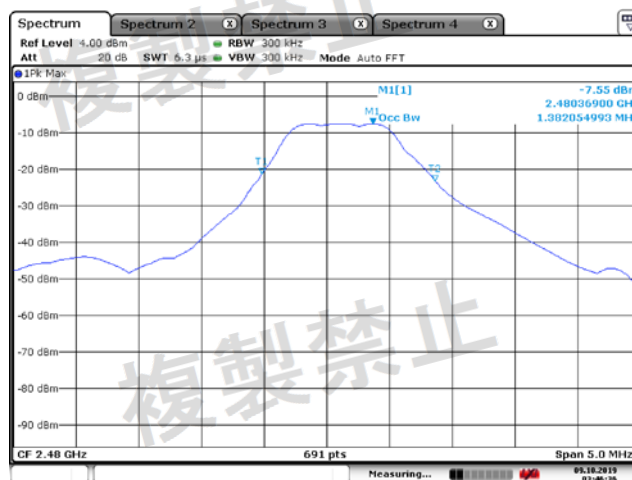
99 % OBW



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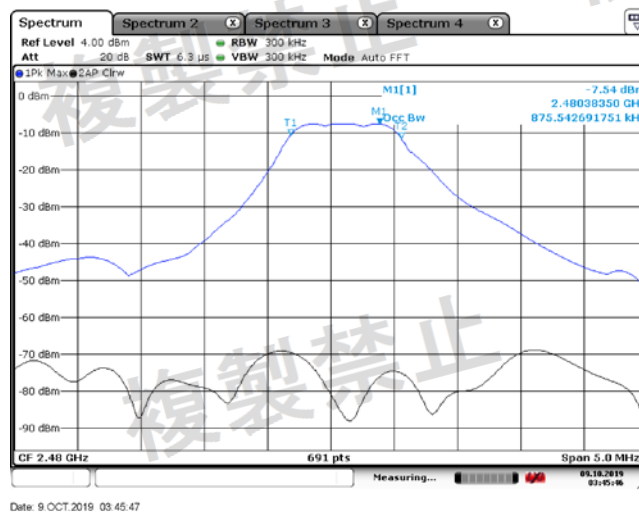
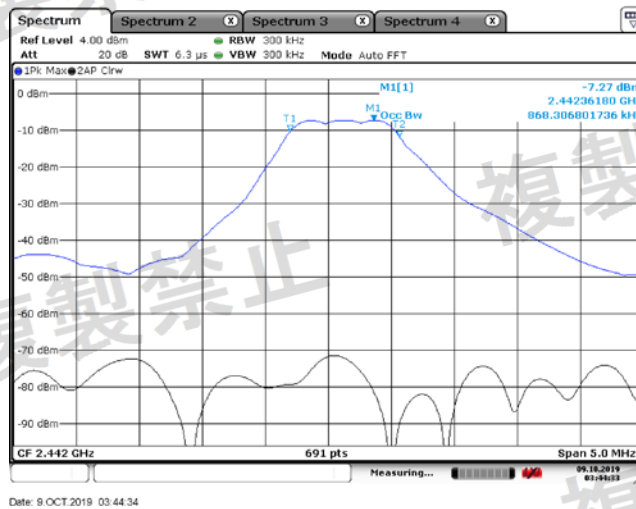
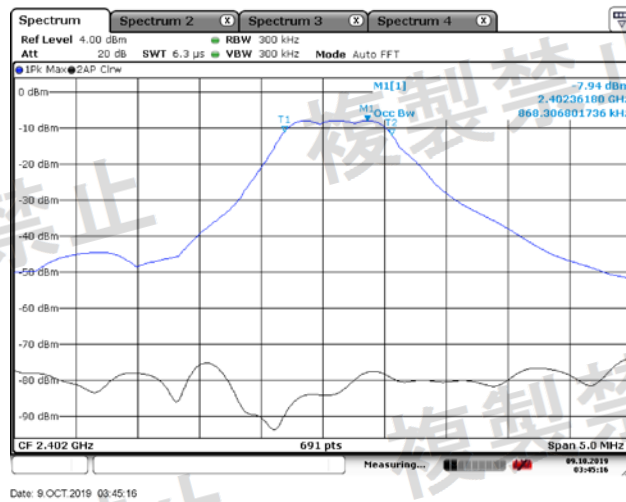


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Test Mode : LE / CH01,CH20,CH40 (Nomal Voltage)

90 % OBW



## 5. Antenna power

### 5.1 Test setup



### 5.2 Limit

Output power: 0.01 W or Below (LE)

Output power tolerance: Maximum +20 %, Minimum -80 %

### 5.3 Test procedure

1. The transmitter output is connected to the Power meter
2. Setting the EUT is operating frequency(hopping mode).

### 5.4 Test results

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

Test mode : LE

Test voltage (DC)	Frequency (MHz)	Measure value	Power tolerance(%)
		(mW)	
4.18 (V)	2 402	0.18	-10
	2 440	0.18	-10
	2 480	0.17	-15
3.80 (V)	2 402	0.16	-20
	2 440	0.18	-10
	2 480	0.17	-15
3.42 (V)	2 402	0.16	-20
	2 440	0.16	-20
	2 480	0.16	-20
Declared power(W)		0.0002	
Antenna gain( dBi)		-9.20 dBi	

Remark: Power tolerance (%) = {[Output power- Declared power] ÷ Declared power} ×100

## 6. Unwanted emission strength

### 6.1 Test setup



### 6.2 Limit

Spurious Emission / Unwanted Emission Strength, Spurious area	30MHz - 2387MHz ; 2.5 $\mu$ W/MHz or less
	2387MHz - 2400MHz ; 25 $\mu$ W/MHz or less
	2483.5MHz - 2496.5MHz ; 25 $\mu$ W/MHz or less
	2496.5MHz - 12.5GHz ; 2.5 $\mu$ W/MHz or less

### 6.3 Test procedure

1. Connect transmitter output to the spectrum analyzer input port.
2. The EUT should be transmitting at hopping mode
3. Unwanted emission strength is measured by following setting:
4. Set the spectrum analyzer RBW: 1 MHz(above 1 GHz), 100 kHz(below 1 GHz), VBW: same as RBW  
Sweep time : auto, Start : 30 MHz, Stop : 1 000 MHz. Sweep mode: single and mark highest level.
5. Set the spectrum analyzer RBW: 1 MHz, VBW: 1 MHz, Sweep time: auto, Start: 1 000 MHz, Stop: 2 387 MHz Sweep mode: single and mark highest level.
6. Set the spectrum analyzer RBW: 1 MHz, VBW: 1 MHz, Sweep time: auto, Start: 2 387 MHz, Stop: 2 400 MHz Sweep mode: single and mark highest level.
7. Set the spectrum analyzer RBW: 1 MHz, VBW: 1 MHz, Sweep time: auto, Start: 2 483.5 MHz, Stop: 2 496.5 MHz Sweep mode: single and mark highest level.
8. Set the spectrum analyzer RBW: 1 MHz, VBW: 1 MHz, Sweep time: auto, Start: 2 496.5 MHz, Stop: 26 GHz Sweep mode: single and mark highest level.
9. Detector mode: Peak mode.

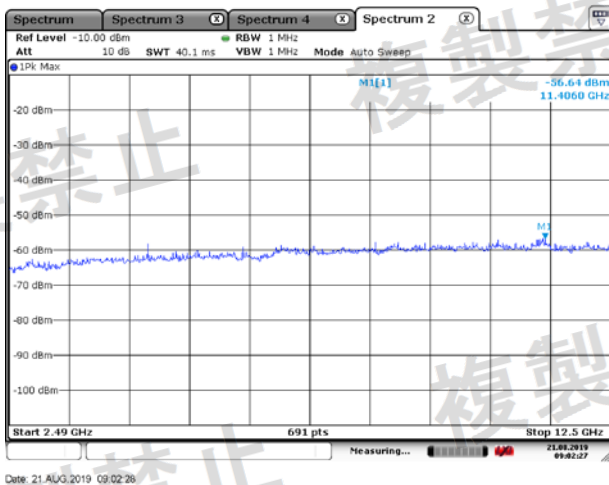
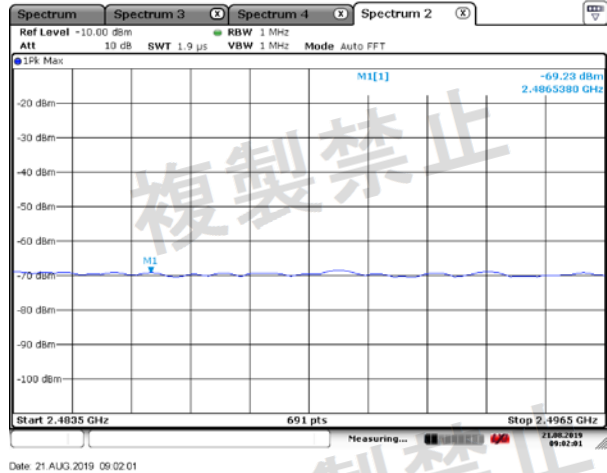
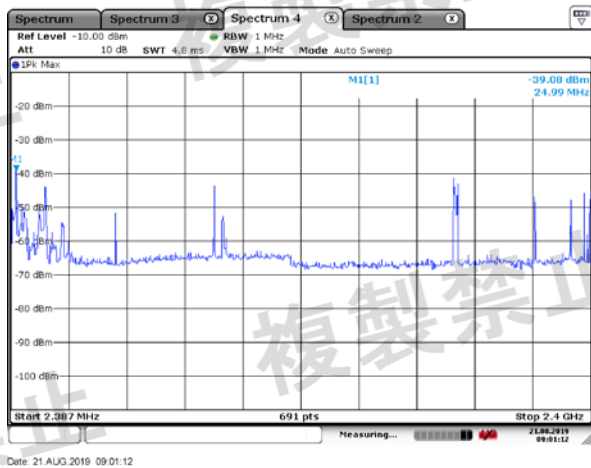
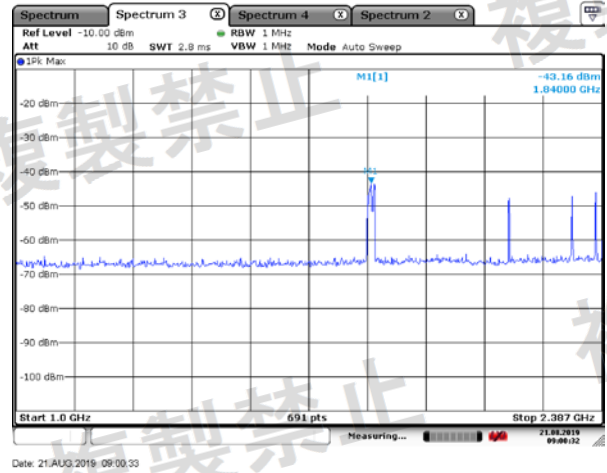
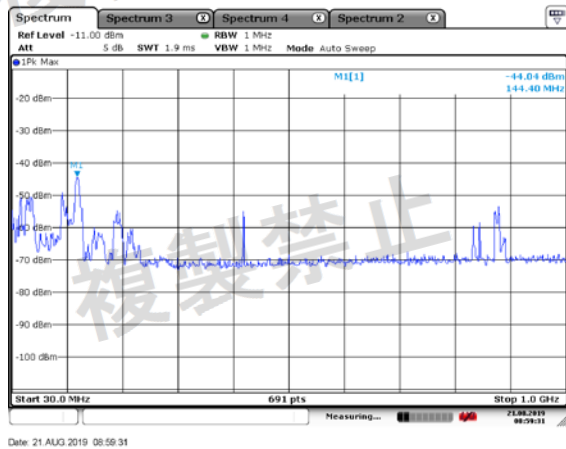
## 6.4 Test results

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

Test mode : LE

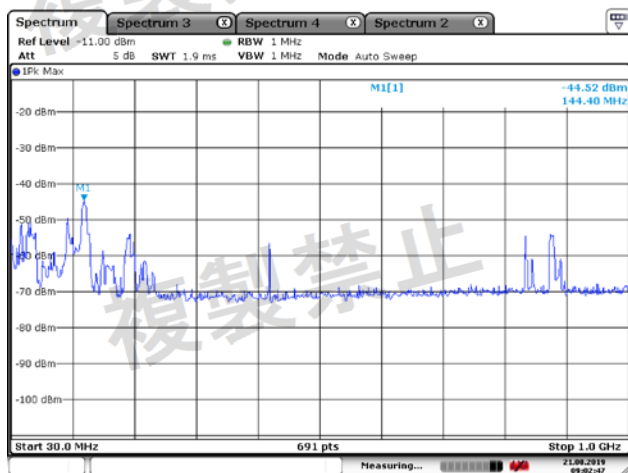
	Test mode		Max. emission value		
			4.18 (V)	3.80(V)	3.42 (V)
30 MHz ~ 1,000 MHz	2,402 MHz	Frequency(MHz)	985.230	986.70	967.279
		Value (dBm)	-52.44	-53.44	-53.63
	2,440 MHz	Frequency(MHz)	682.470	896.80	644.230
		Value (dBm)	-51.57	-53.94	-53.85
	2,480 MHz	Frequency(MHz)	921.730	992.30	935.100
		Value (dBm)	-52.10	-53.35	-53.62
1,000 MHz ~ 2,387 MHz	2,402 MHz	Frequency(MHz)	2,335.000	2,382.000	2,374.350
		Value (dBm)	-50.68	-50.11	-50.39
	2,440 MHz	Frequency(MHz)	1,853.200	1,890.200	1,935.100
		Value (dBm)	-53.73	-53.43	-54.02
	2,480 MHz	Frequency(MHz)	1,763.320	1,785.800	1,855.200
		Value (dBm)	-52.34	-52.43	-52.74
2,387 MHz ~ 2,400 MHz	2,402 MHz	Frequency(MHz)	2,398.335	2,399.991	2,399.041
		Value (dBm)	-31.80	-31.95	-32.06
	2,440 MHz	Frequency(MHz)	2,388.193	2,390.923	2,390.199
		Value (dBm)	-53.15	-53.23	-53.10
	2,480 MHz	Frequency(MHz)	2,338.120	2,388.420	2,389.370
		Value (dBm)	-53.35	-53.75	-53.93
2,483.5 MHz ~ 2,496.5 MHz	2,402 MHz	Frequency(MHz)	2,493.125	2,493.687	2,491.291
		Value (dBm)	-53.34	-53.56	-53.82
	2,440 MHz	Frequency(MHz)	2,491.170	2,492.671	2,494.349
		Value (dBm)	-52.87	-52.98	-53.09
	2,480 MHz	Frequency(MHz)	2,483.511	2,483.509	2,483.644
		Value (dBm)	-34.60	-34.63	-34.71
2,496.5 MHz ~ 12.5 GHz	2,402 MHz	Frequency(MHz)	6,830.000	6,858.000	6,866.000
		Value (dBm)	-48.76	-48.82	-48.75
	2,440 MHz	Frequency(MHz)	6,924.500	6,977.500	6,970.100
		Value (dBm)	-48.53	-48.68	-48.38
	2,480 MHz	Frequency(MHz)	6,822.000	6,846.500	6,848.700
		Value (dBm)	-48.55	-48.51	-48.31

## Test Mode :LE / CH1 (Nomal Voltage)

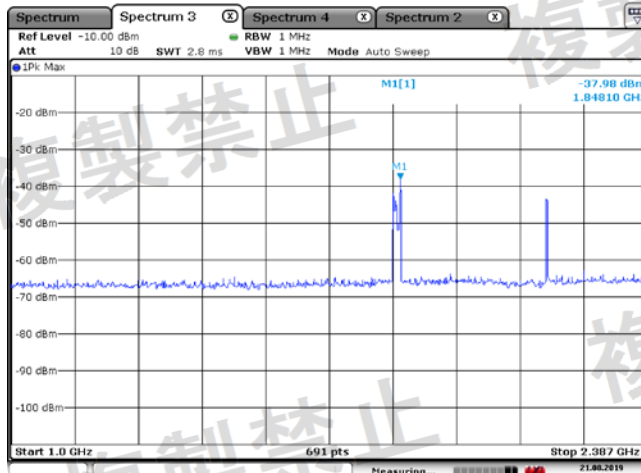




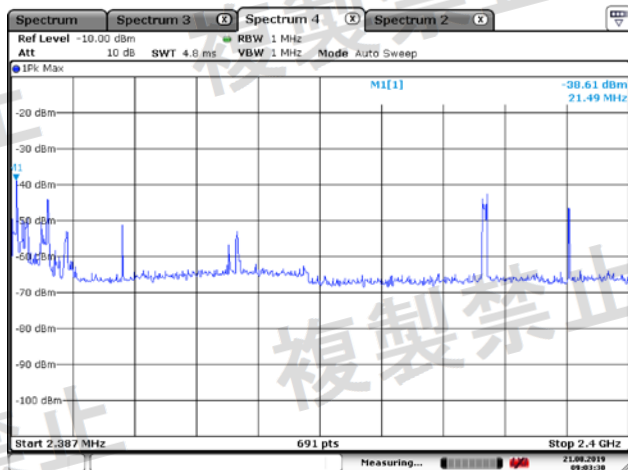
## Test Mode :LE / CH20 (Nomal Voltage)



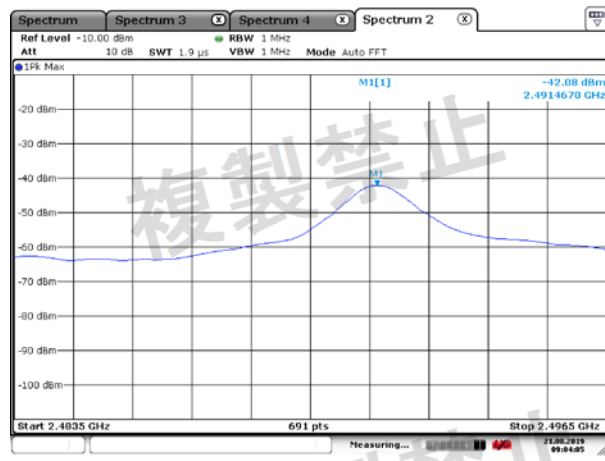
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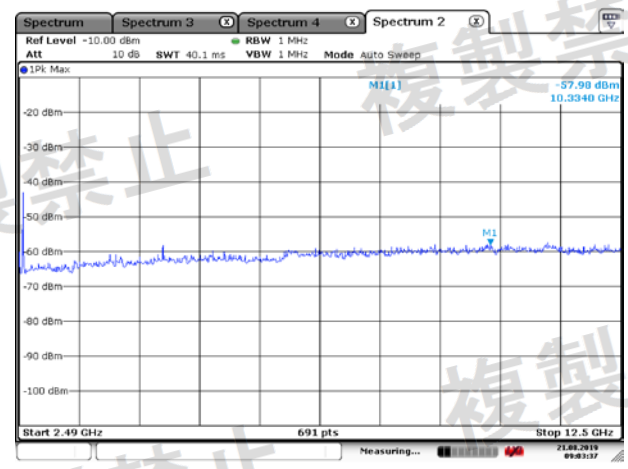
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Date: 21.AUG.2019 09:03:30



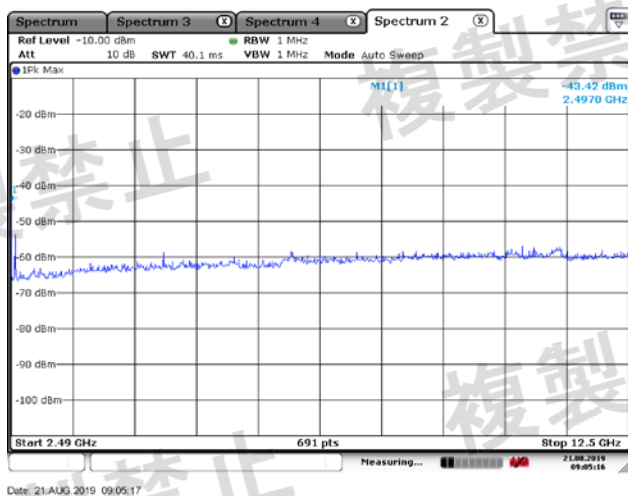
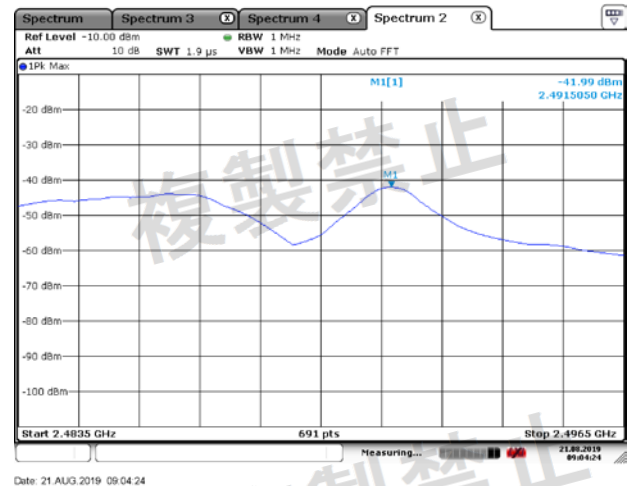
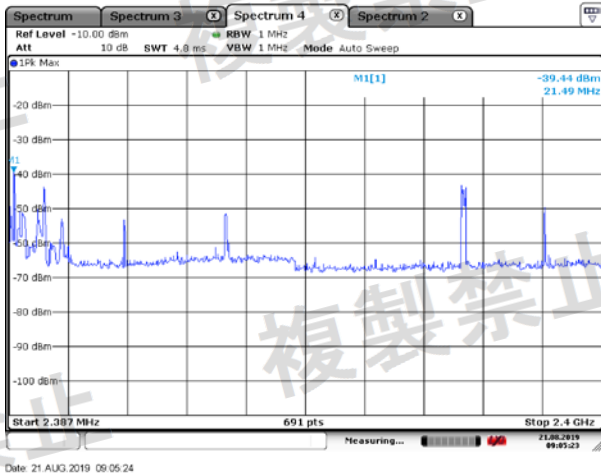
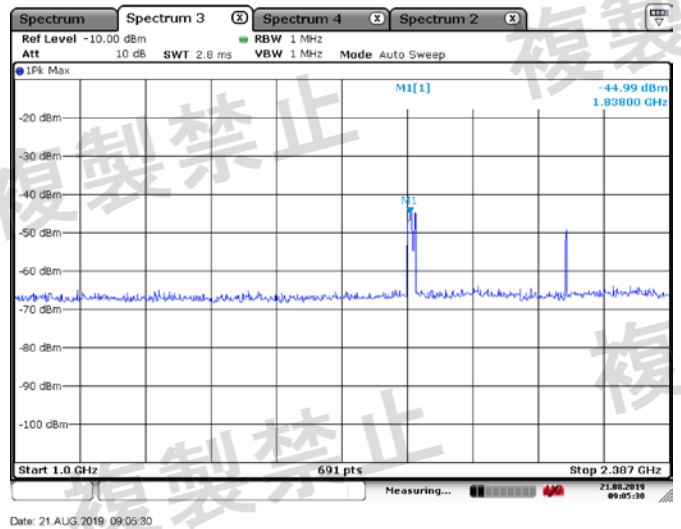
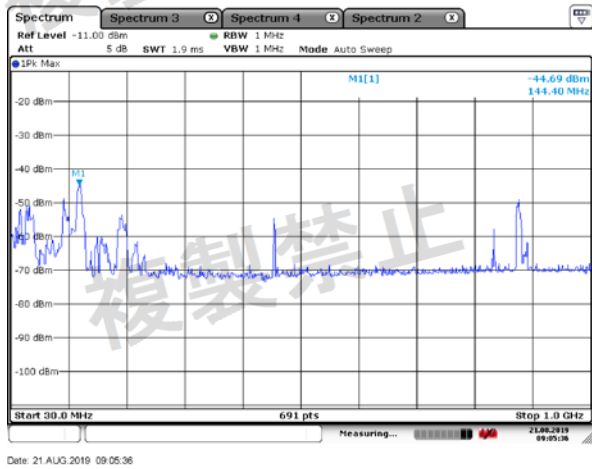
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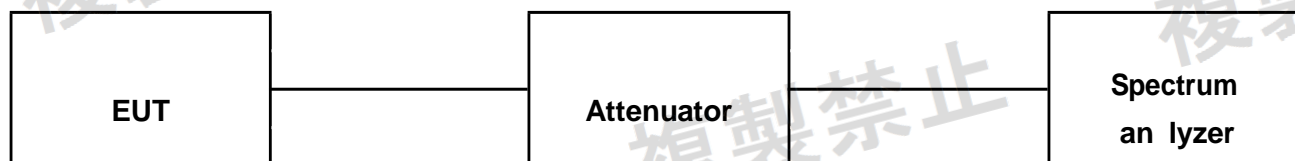


## Test Mode :LE / CH40 (Nomal Voltage)



## 7. RX spurious emission

### 7.1 Test setup



### 7.2 Limit

Below 1 GHz: 4 nW ( - 55 dBm ) or less

Above 1 GHz: 20 nW ( - 48 dBm ) or less

### 7.3 Test procedure

1. Connecy transmitter output to the spectrum analyzer input port
2. The EUT should be transmitting at low, middle and high channel.
3. RX spurious emission is measured by following setting:
4. Set the spectrum analyzer RBW: 100 kHz, VBW: 100 kHz, Sweep: Auto, Start: 30 MHz, Stop: 1 000 MHz Max hold view, mark highest level.
5. Set the spectrum analyzer RBW: 1 MHz, VBW: 1 MHz, Sweep: Auto, Start: 1 000 MHz, Stop: 12.5 GHz. Max hold view, mark highest level.
6. Detector mode: Peak mode

### 7.4 Test results

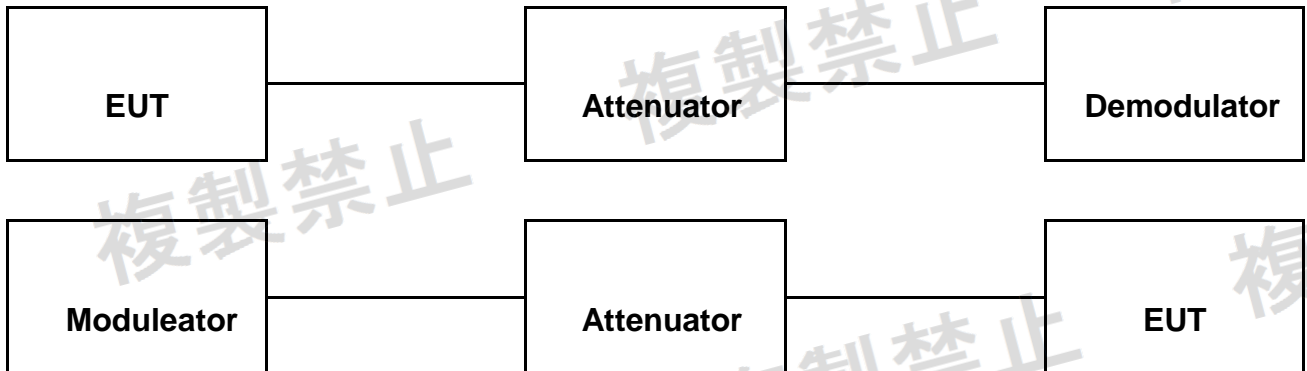
Ambient temperature: 24 °C Relative humidity: 50% R.H

Test mode : LE

	Test mode		Max. emission value		
			4.18 (V)	3.80 (V)	3.42 (V)
30 MHz ~ 1 000 MHz	2,402 MHz	Frequency(MHz)	950.683	950.700	950.676
		Value (dBm)	-83.24	-83.25	-83.25
	2,440 MHz	Frequency(MHz)	950.708	950.705	950.693
		Value (dBm)	-82.14	-82.16	-82.16
	2,480 MHz	Frequency(MHz)	911.536	911.541	911.505
		Value (dBm)	-82.12	-82.13	-82.13
1,000 MHz ~ 12.5GHz	2,402 MHz	Frequency(MHz)	1,839.990	1,840.034	1,840.013
		Value (dBm)	-71.43	-71.42	-71.44
	2,440 MHz	Frequency(MHz)	1,840.006	2,459.010	2,2753
		Value (dBm)	-70.81	-70.84	-70.83
	2,480 MHz	Frequency(MHz)	2,459.000	2,458.998	1,840.038
		Value (dBm)	-70.52	-70.59	-70.60

## 8 Interference prevention function

### 8.1 Test Setup



### 8.2 Limit

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

### 8.3 Test results

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

	Test voltage	2,402 MHz	2,440 MHz	2,480 MHz
BLE	4.18 (V)	Pass	Pass	Pass
	3.80 (V)	Pass	Pass	Pass
	3.42 (V)	Pass	Pass	Pass

## 9. CONSTRUCTION PROTECTION CONFIRMATION METHOD

### 9.1 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.

### 9.2 CONFIRMATION METHOD

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

Tick the appropriate box	
	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.
X	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	Nest Cal. Date
1	■	Signal Analyzer (9 kHz ~ 30 GHz)	FSV30	100757	R&S	1 year	2020-09-06
2	■	Signal Generator (~3.2 GHz)	8648C	3623A02597	HP	1 year	2020-03-20
3		SYNTHESIZED CW GENERATOR	83711B	US34490456	HP	1 year	2020-03-20
4		Attenuator (3 dB)	8491A	37822	HP	1 year	2020-09-06
5		Attenuator (10 dB)	8491A	63196	HP	1 year	2020-09-06
6		EMI Test Receiver (~7 GHz)	ESCI7	100722	R&S	1 year	2020-09-06
7		RF Amplifier (~1.3 GHz)	8447D OPT 010	2944A07684	HP	1 year	2020-09-06
8		RF Amplifier (1~26.5 GHz)	8449B	3008A02126	HP	1 year	2020-03-20
9		Horn Antenna (1~18 GHz)	3115	00114105	ETS	2 year	2020-08-04
10		DRG Horn (Small)	3116B	81109	ETS-Lindgren	2 year	2020-03-18
11		DRG Horn (Small)	3116B	133350	ETS-Lindgren	2 year	2020-03-18
12		TRILOG Antenna	VULB 9160	9160-3237	SCHWARZBECK	2 year	2021-03-20
13		Temp.Humidity Data Logger	SK-L200TH II A	00801	SATO	1 year	2020-03-20
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	2020-03-20
18	■	Power Sensor	8481A	3318A94972	HP	1 year	2020-09-06
19		Audio Analyzer	8903B	3729A18901	HP	1 year	2020-09-06
20		Modulation Analyzer	8901B	3749A05878	HP	1 year	2020-09-06
21		TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	JinYoung Tech	1 year	2020-09-06
22		Stop Watch	HS-3	812Q08R	CASIO	2 year	2020-03-18
23		LISN	KNW-407	8-1430-1	Kyoritsu	1 year	2020-09-06
24		Two-Lime V-Network	ESH3-Z5	893045/017	R&S	1 year	2020-03-18
25		UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	106243	R&S	1 year	2020-03-18
26		Highpass Filter	WHKX1.5/15G-10SS	74	Wainwright Instruments	1 year	2020-03-18
27		Highpass Filter	WHKX3.0/18G-10SS	118	Wainwright Instruments	1 year	2020-03-18
28		OSP120 BASE UNIT	OSP120	101230	R&S	1 year	2020-03-18
29		Signal Generator(100 kHz ~ 40 GHz)	SMB100A03	177621	R&S	1 year	2020-03-18
30		Signal Analyzer (10 Hz ~ 40 GHz)	FSV40	101367	R&S	1 year	2020-03-18
31		Active Loop Antenna	FMZB 1519	1519-031	SCHWARZBECK	2 year	2021-02-26