TEST REPORT

REPORT NUMBER:	4788602555
COMPANY NAME:	AIWA CO.,LTD.
EUT DESCRIPTION:	Retro Bluetooth Radio
MODEL:	SB-FH20
SERIAL NUMBER:	XXXXXX
ISSUE DATE:	25-Sep-18
DATE TESTED:	15-Aug-18 to 17-Aug-18
APPLICABLE STANDARDS:	JAPAN RADIO LAW RADIO EQUIPMENT REGULATIONS
TEST METHOD:	Notice 88 of Ordinance Concerning Technical Regulations Conformity Certification of Specified Radio Equipment
Place of Testing:	UL Verification Services (Guangzhou) Co., Ltd., Song Shan Lake Branch Building 10, Innovation Technology Park, No. 1, Li Bin Road, Song Shan Lake Hi-Tech Development Zone Dongguan, People's Republic of China

Test Result:

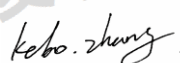|	
Classification of Specified Radio Equipment:	Article 2 Clause 1 Item 19
Type of radio wave, Frequency and antenna power:	F1D 2402-2480MHz (Interval of 1MHz 79ch[Normal]) 0.000008W/MHz

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services (Guangzhou) Co., Ltd., Song Shan Lake Branch and all revisions are duly noted

Approved & Released By:	Stephen	Tested By:	Kebo
Engineer Full Name:	Stephen Guo	Engineer Full Name:	Kebo Zhang
Engineer Title:	Laboratory Manager	Engineer Title:	Engineer Project Associate
UL Verification Services (Guangzhou) Co., LTD. Songshan Lake Branch		UL Verification Services (Guangzhou) Co., LTD. Songshan Lake Branch	

1. EUT Information

Report No. : 4788602555

Applicant : AIWA CO.,LTD.

Equipment Description: Retro Bluetooth Radio

Model No. : SB-FH20

Serial No. : XXXXXX

The number of Tx Antenna : 1

Mode : DH5

Max Antenna Gain : 0.50dBi

Type of Radio wave : F1D

Supply Voltage
○ DC   ● AC   100.00V
-

Modulation
● FH (Bluetooth)

Voltage Condition
● Non-Extreme   ○ Extreme

Normal AC100V
Normal-10% -
Normal+10% -

EUT has
● ANT Connector
○ No ANT Connector   distance -

The worst-case data rate for each mode is determined to be as follows, based on preliminary
test of the chipset utilized in this radio.
All final tests were made at DH5.

Factors

		Other than for Power		For Power	
		Cable Loss	ATT/	Cable Loss	ATT/
	[MHz]	[dB]	[dB]	[dB]	[dB]
Low Channel (Tx1)	2402	0.50	0.00	0.50	0.00
Middle Channel (Tx2)	2441	0.50	0.00	0.50	0.00
High Channel (Tx3)	2480	0.50	0.00	0.50	0.00

2.TEST Result

2.1. Frequency Tolerance

Job No.   4788602555

Remark1

Remark2

[DATA]

Voltage	Freq. [MHz]	Result [MHz]	Tolerance [kHz]	Tolerance [ppm]	Limit [ppm]
AC100V	2402	2402.0576	57.6000	23.98	±50.0
	2441	2441.0582	58.1800	23.83	±50.0
	2480	2480.0590	59.0000	23.79	±50.0

Tx1_Freq_Nom

Date:17.AUG,2018 10:22:00
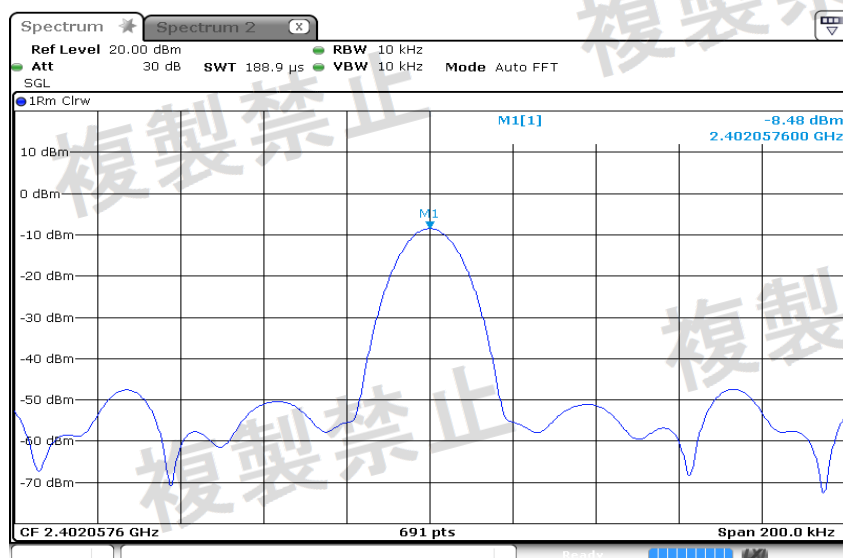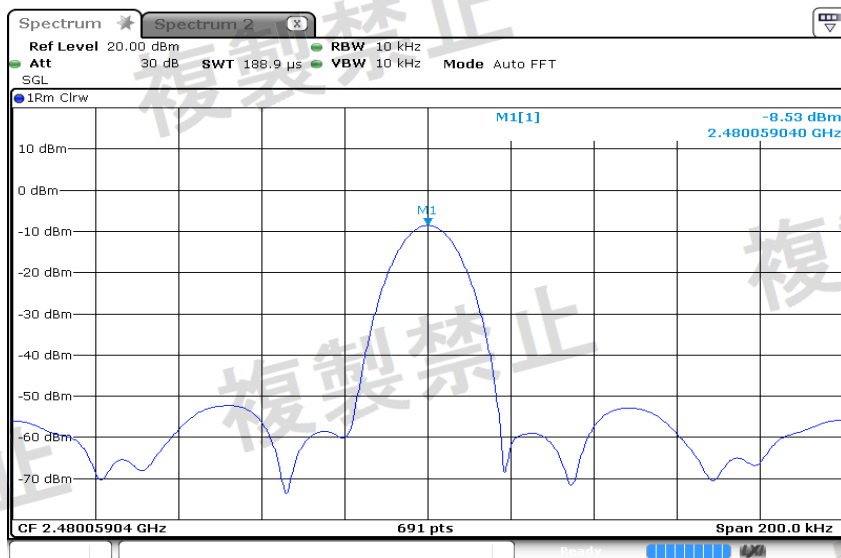
Tx2_Freq_Nom
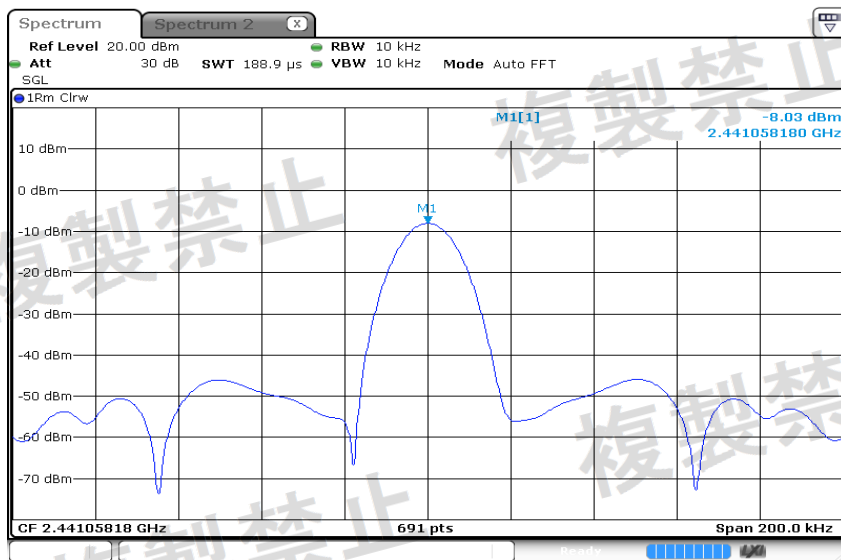
Date: 17 AUG .2018 10:24:45

Tx3_Freq_Nom

Date: 17 AUG .2018 10:25:20

2.2. Occupied Bandwidth / Spreading Bandwidth

Job No.   4788602555
Remark1
Remark2

[DATA]

99% Occupied Frequency Bandwidth

Voltage	Freq. [MHz]	Result [MHz]	Limit [MHz]
AC100V	2441	77.9884	83.5

Spreading Bandwidth

Voltage	Freq. [MHz]	Result [MHz]	Result [kHz]	Limit [kHz]
AC100V	2441	70.1157	70116	500

Since it was confirmed that there is no difference for each channel by application documents of hopping sequences, only 2441MHz was carried out as a representative.
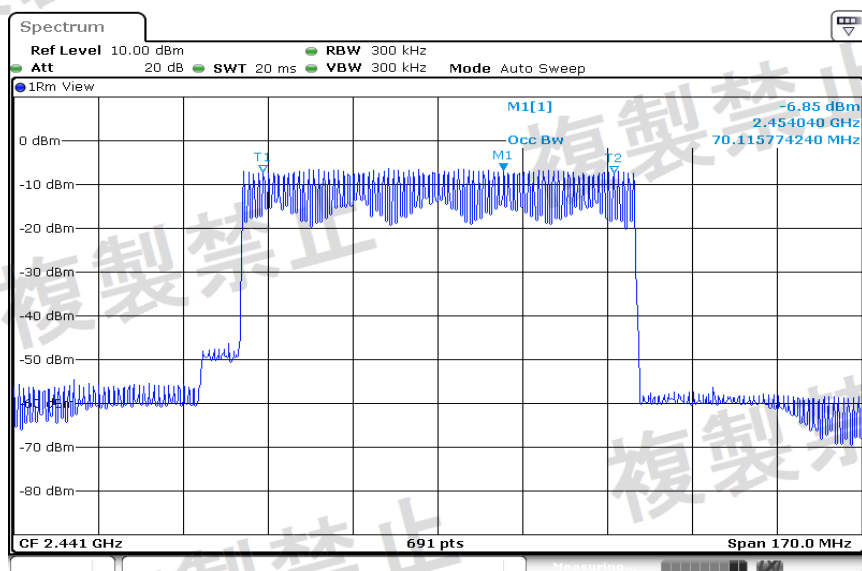
99% Occupied Frequency Bandwidth
Tx2_Hop99OBW_Nom
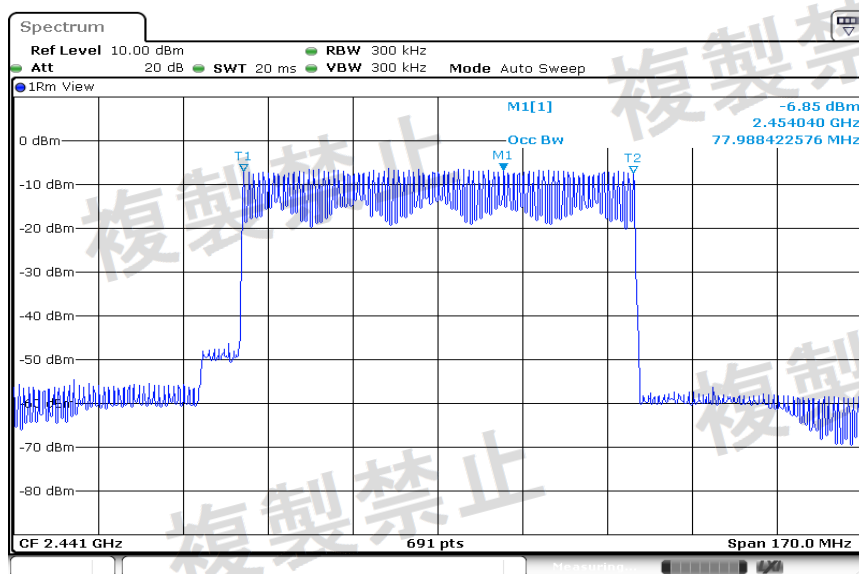
Date: 15 AUG .2018 05:18:15

Spreading Bandwidth

Tx2_Hop90OBW_Nom

Date:15.AUG.2018 05:18:42

2.3. Unwanted Emission Strength

Job No.   4788602555
Remark1
Remark2

[DATA]

Voltage	Freq.	Freq.	S/A Reading	Cable Loss	Atten. Loss	Result	Result	Limit	Remark
	[MHz]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[uW]	[uW]	
AC100V	2402	833.30	-44.91	0.50	0.00	-44.41	0.036	2.500	♦1
		2394.33	-40.28	0.50	0.00	-39.78	0.105	25.000	♦2
		2496.17	-58.76	0.50	0.00	-58.26	0.001	25.000	♦3
		4804.65	-45.55	0.50	0.00	-45.05	0.031	2.500	♦4
	2441	2378.50	-58.32	0.50	0.00	-57.82	0.002	2.500	♦1
		2399.77	-54.36	0.50	0.00	-53.86	0.004	25.000	♦2
		2495.98	-59.05	0.50	0.00	-58.55	0.001	25.000	♦3
		4882.80	-42.54	0.50	0.00	-42.04	0.063	2.500	♦4
	2480	2361.40	-64.57	0.50	0.00	-64.07	0.000	2.500	♦1
		2399.99	-63.13	0.50	0.00	-62.63	0.001	25.000	♦2
		2496.34	-47.90	0.50	0.00	-47.40	0.018	25.000	♦3
		4960.64	-45.16	0.50	0.00	-44.66	0.034	2.500	♦4

Sample Calculation :

Result = Reading + Cable Loss + Atten. Loss

♦1:Freq Range1 (≥ 30MHz, < 2,387MHz)

♦2:Freq Range2 (≥ 2,387MHz, < 2,400MHz)

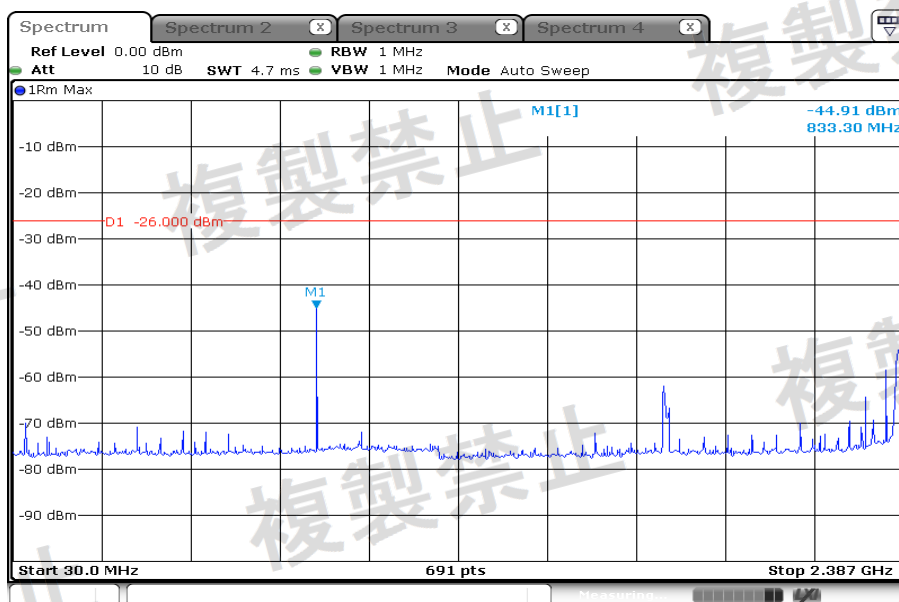♦3:Freq Range3 (> 2,483.5MHz, ≤ 2,496.5MHz)

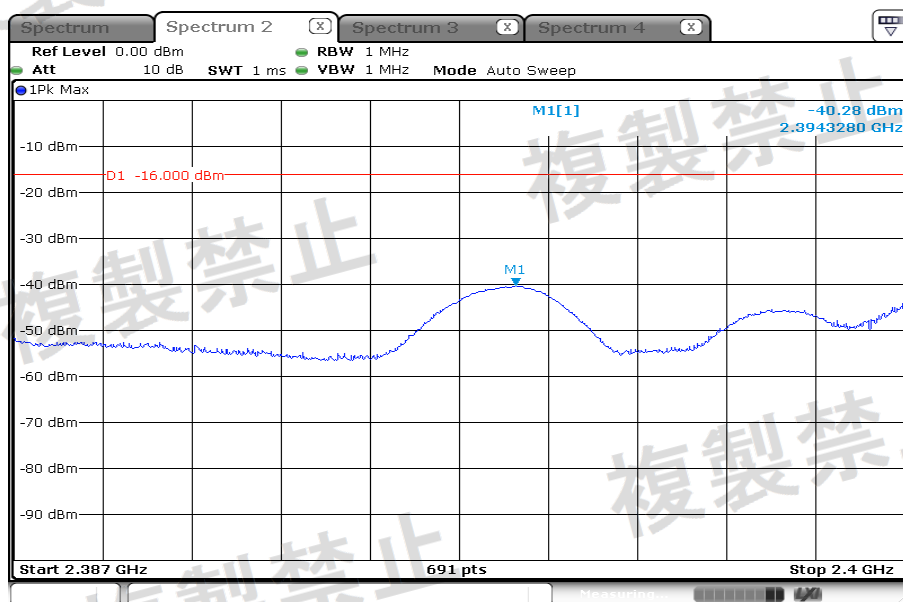♦4:Freq Range4 (> 2,496.5MHz, ≤ 12.5GHz)

Voltage: AC100V

Frequency: 2402MHz

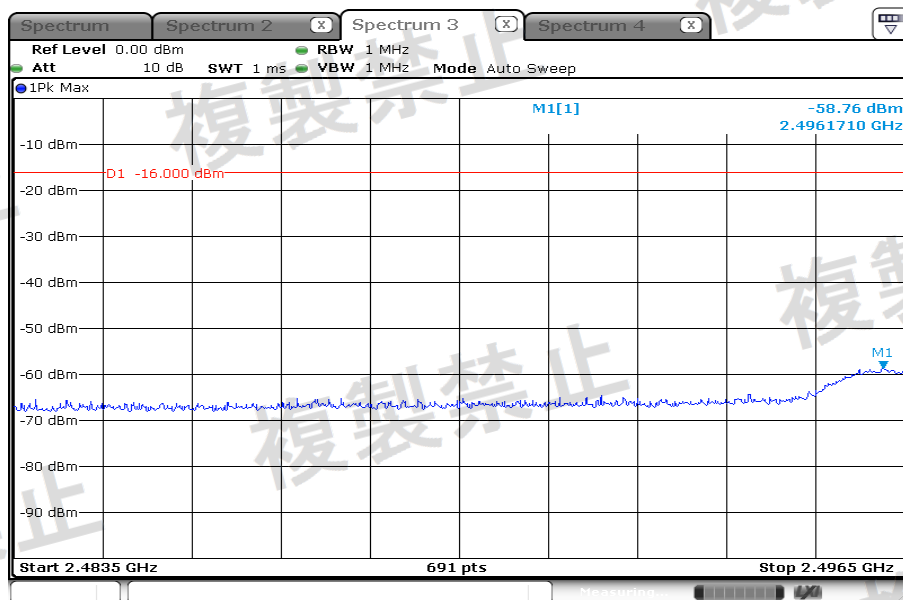♦1:Freq Range1 (≥ 30MHz, < 2,387MHz)

Date:15.AUG.2018 05:27:17

♦2:Freq Range2（≥ 2,387MH z , < 2,400MHz）

Spectrum | Spectrum 2 (X) | Spectrum 3 (X) | Spectrum 4 (X)

Ref Level 0.00 dBm　　RBW 1 MHz
Att　　　10 dB　SWT 1 ms　VBW 1 MHz　Mode Auto Sweep
1Pk Max

M1[1]　　　　-40.28 dBm
　　　　　　2.3943280 GHz

D1 -16.000 dBm

Start 2.387 GHz　　　691 pts　　　Stop 2.4 GHz

Date:15.AUG.2018　05:28:11

♦3:Freq Range3（> 2,483.5MHz, ≤ 2,496.5MHz）

Spectrum | Spectrum 2 (X) | Spectrum 3 (X) | Spectrum 4 (X)

Ref Level 0.00 dBm　　RBW 1 MHz
Att　　　10 dB　SWT 1 ms　VBW 1 MHz　Mode Auto Sweep
1Pk Max

M1[1]　　　　-58.76 dBm
　　　　　　2.4961710 GHz

D1 -16.000 dBm

Start 2.4835 GHz　　　691 pts　　　Stop 2.4965 GHz

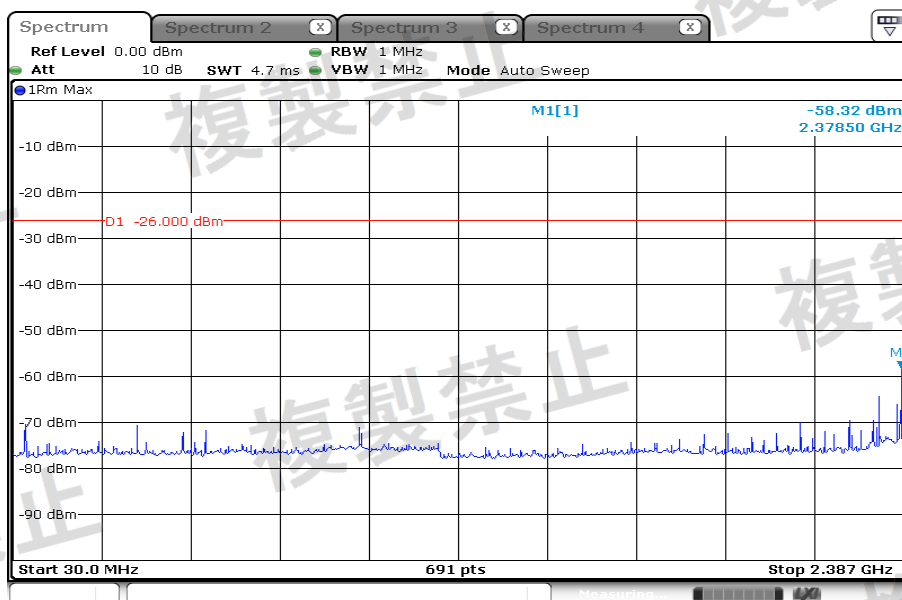Date:15.AUG.2018　05:28:44

♦4:Freq Range4 (> 2,496.5MHz, ≤ 12.5GHz)
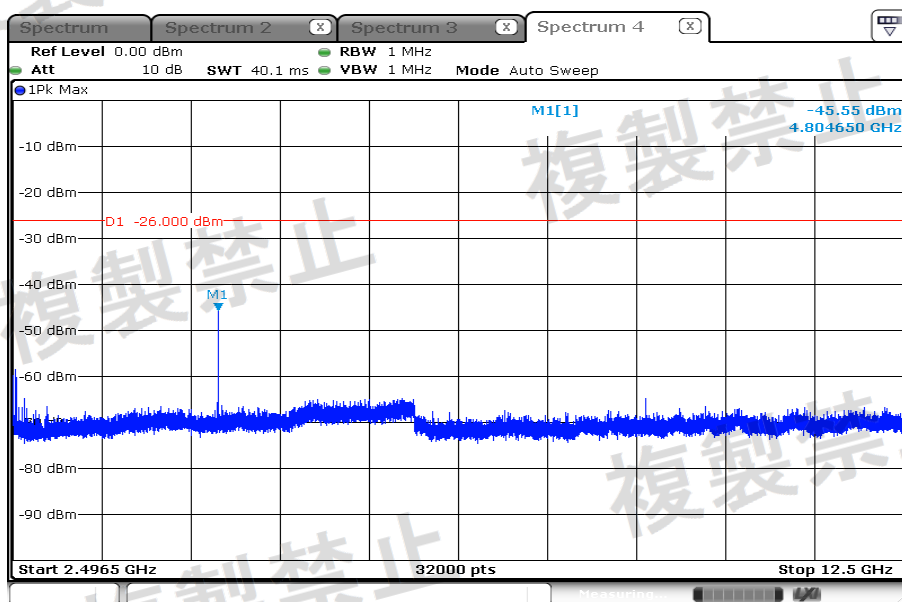
Date:15.AUG.2018 05:29:03

Frequency: 2441MHz
♦1:Freq Range1 (≥ 30MHz, < 2,387MHz)
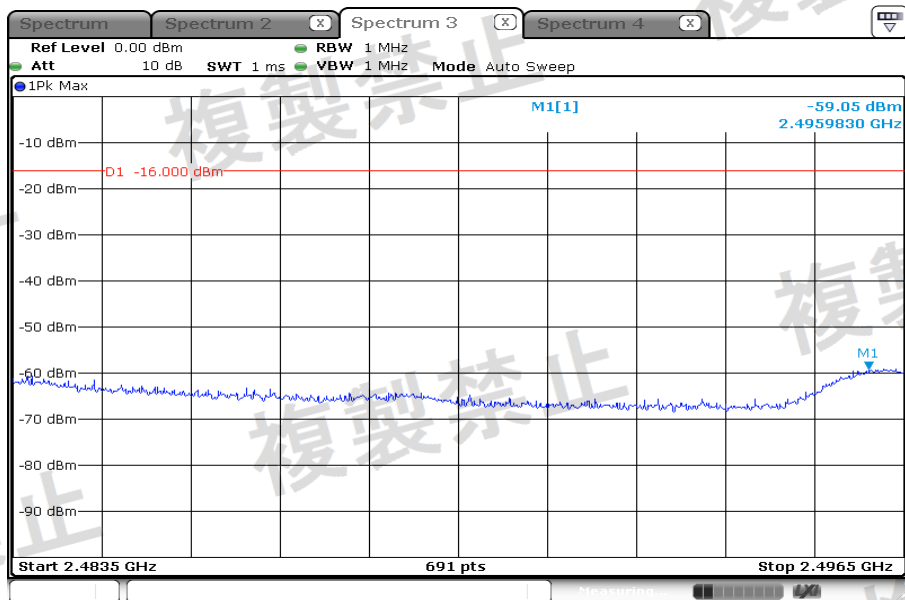

Date:15.AUG.2018 05:29:41

♦2:Freq Range2 (≥ 2,387MH z , < 2,400MHz)

Spectrum | Spectrum 2 (x) | Spectrum 3 (x) | Spectrum 4 (x)

Ref Level 0.00 dBm　　　RBW 1 MHz
Att　　10 dB　SWT 1 ms　VBW 1 MHz　Mode Auto Sweep
1Pk Max

M1[1]　　　　　　-54.36 dBm
　　　　　　　　2.3997650 GHz

D1 -16.000 dBm

Start 2.387 GHz　　　　　691 pts　　　　　Stop 2.4 GHz

♦3:Freq Range3 (> 2,483.5MHz, ≤ 2,496.5MHz)

Spectrum | Spectrum 2 (x) | Spectrum 3 (x) | Spectrum 4 (x)

Ref Level 0.00 dBm　　　RBW 1 MHz
Att　　10 dB　SWT 1 ms　VBW 1 MHz　Mode Auto Sweep
1Pk Max

M1[1]　　　　　　-59.05 dBm
　　　　　　　　2.4959830 GHz

D1 -16.000 dBm

Start 2.4835 GHz　　　　　691 pts　　　　　Stop 2.4965 GHz

♦4:Freq Range4 (> 2,496.5MHz, ≤ 12.5GHz)

Frequency: 2480MHz
♦1:Freq Range1 (≥ 30MHz, < 2,387MHz)
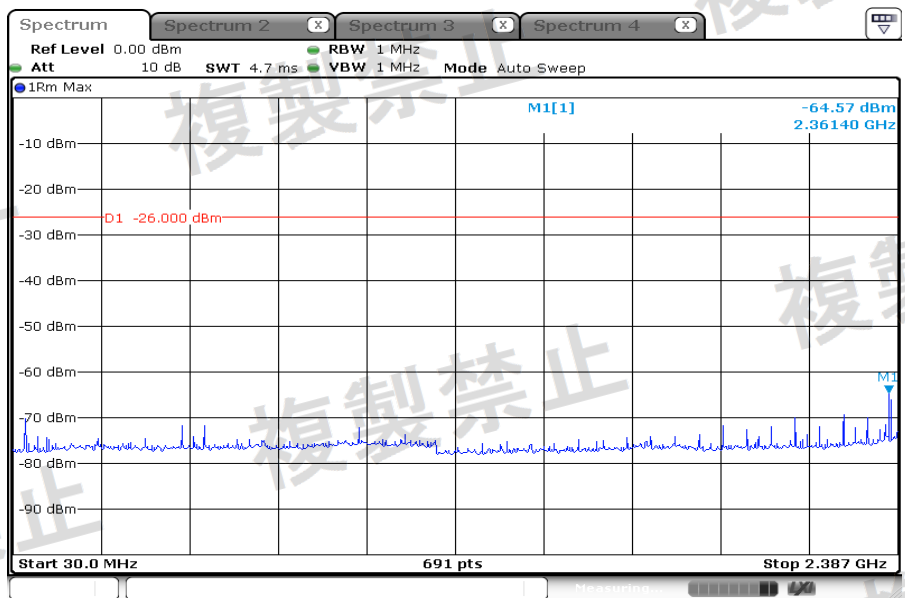
◆2:Freq Range2（≥ 2,387MH z , < 2,400MHz）
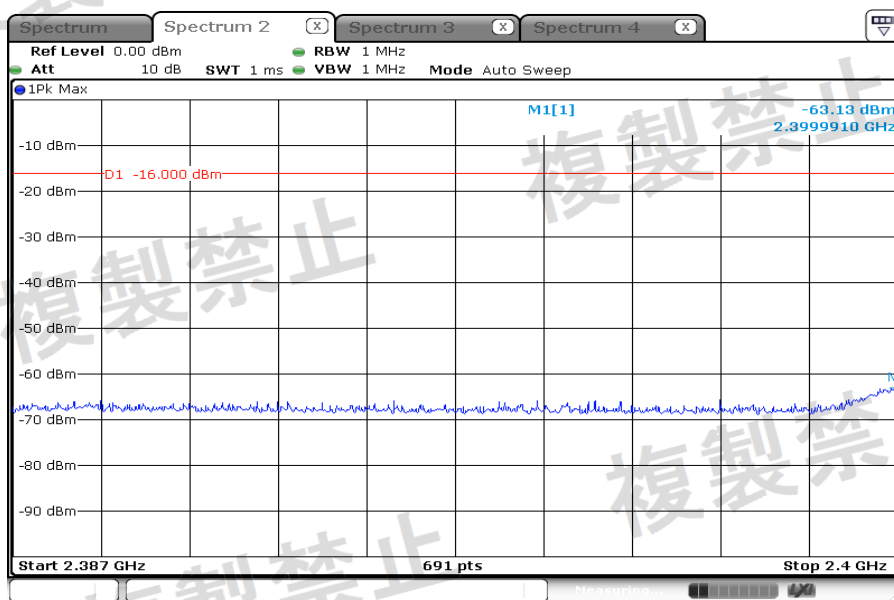
Date: 15.AUG.2018 05:35:41

◆3:Freq Range3（> 2,483.5MHz, ≤ 2,496.5MHz）
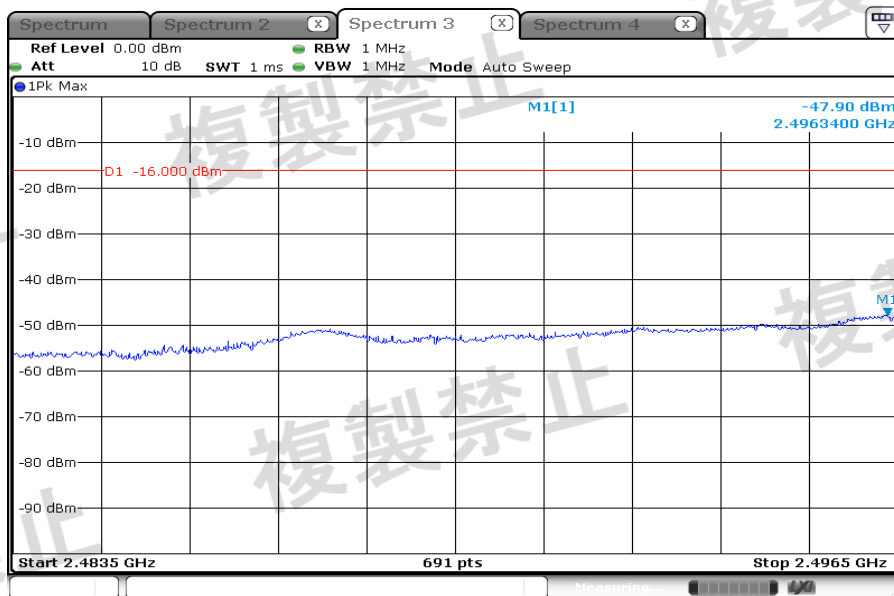
Date: 15.AUG.2018 05:36:04

♦4:Freq Range4 (> 2,496.5MHz, ≤ 12.5GHz)

Spectrum | Spectrum 2 | Spectrum 3 | Spectrum 4

Ref Level 0.00 dBm   RBW 1 MHz
Att 10 dB   SWT 40.1 ms   VBW 1 MHz   Mode Auto Sweep
1Pk Max

M1[1]   -45.16 dBm
4.960640 GHz

-10 dBm
-20 dBm
D1 -26.000 dBm
-30 dBm
-40 dBm
M1
-50 dBm
-60 dBm
-80 dBm
-90 dBm

Start 2.4965 GHz   32000 pts   Stop 12.5 GHz
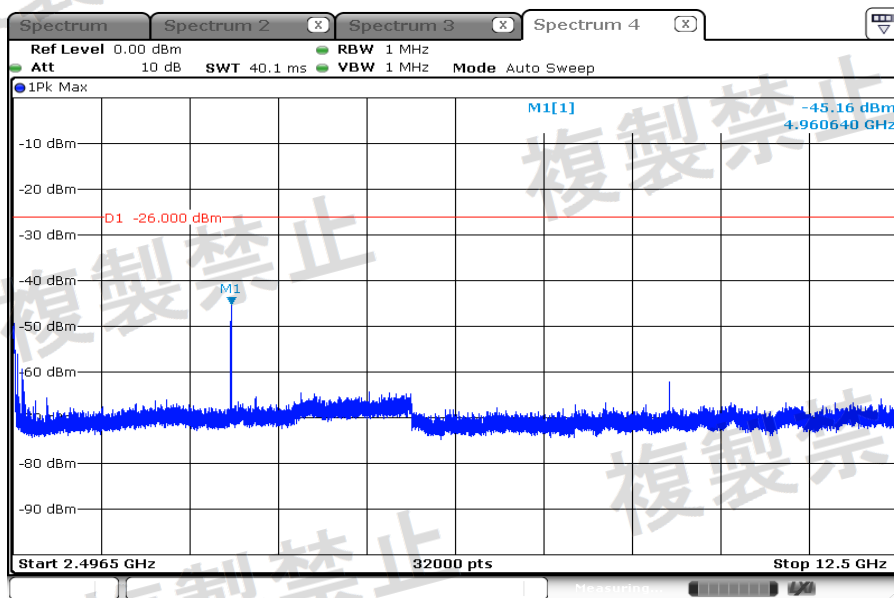
Date:15.AUG.2018 05:36:26

2.4. Output Power

Job No. 4788602555
Remark1
Remark2

[DATA]

Voltage	Freq.	P/M(AV) Reading	Cable Loss	Atten. Loss	Result A	Spreading Bandwidth	Burst Rate	Result B	Tolerance	Limit	Limit Tolerance
	[MHz]	[dBm]	[dB]	[dB]	[W]	[MHz]		[W/MHz]	[%]	[W/MHz]	[%]
AC100V	2402	-6.00	0.50	0.00	0.000282	70.1157	1.30	0.000005	-33.8	0.003000	+20 ～ -80
	2441	-5.34	0.50	0.00	0.000328	70.1157	1.30	0.000006	-22.9	0.003000	+20 ～ -80
	2480	-5.97	0.50	0.00	0.000284	70.1157	1.30	0.000005	-33.3	0.003000	+20 ～ -80

Sample Calculation :

Result A = 10 ^ ((P/M Reading [dBm] (Detector:AV) + Cable Loss + Atten. Loss) / 10)
Result B= (Result A / Spreading Bandwidth) * Burst Rate
Tolerance = Result / Declared Output Power * 100 - 100.

[Declared Output Power]

Average of Power between Channels (79HOP)	0.000006	W/MHz
Declared Output Power 1	0.000008	W/MHz
+20	0.000009	W/MHz
Middle (Declared Output Power -30%)	0.000006	W/MHz
-80	0.000002	W/MHz

Antenna Gain	0.50	dBi
E.I.R.P. for Declared Output Power 1	-20.53	dBm/MHz
Limit	12.14	dBm/MHz

Sample Calculation :

E.I.R.P. for Declared Output Power = 10 * Log (Declared Output Power * 1000) + Antenna Gain

2.5. Secondary Radiated Emission Strength

Job No. 4788602555

Remark1

Remark2

[DATA]

Voltage	Freq.	Freq.	S/A Reading	Cable Loss	Atten. Loss	Result	Result	Limit	Remark
[V]	[MHz]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[nW]	[nW]	
AC100V	2402	360.6	-66.70	0.50	0.00	-66.20	0.240	4	♦5
		1766.4	-59.98	0.50	0.00	-59.48	1.127	20	♦6
	2441	64.4	-67.17	0.50	0.00	-66.67	0.215	4	♦5
		1767.1	-58.60	0.50	0.00	-58.10	1.549	20	♦6
	2480	479.9	-66.75	0.50	0.00	-66.25	0.237	4	♦5
		2452.8	-56.79	0.50	0.00	-56.29	2.35	20	♦6

Result = Reading + Cable Loss + Atten. Loss

♦5:Freq Range5 ($\geq$ 30MHz, <1GHz)

♦6:Freq Range6 ($\geq$ 1GHz, $\leq$ 12.5GHz)

Voltage: AC100V

Frequency: 2402MHz

♦5:Freq Range5 ($\geq$ 30MHz, <1GHz)

Date:15 AUG 2018 07:39:27

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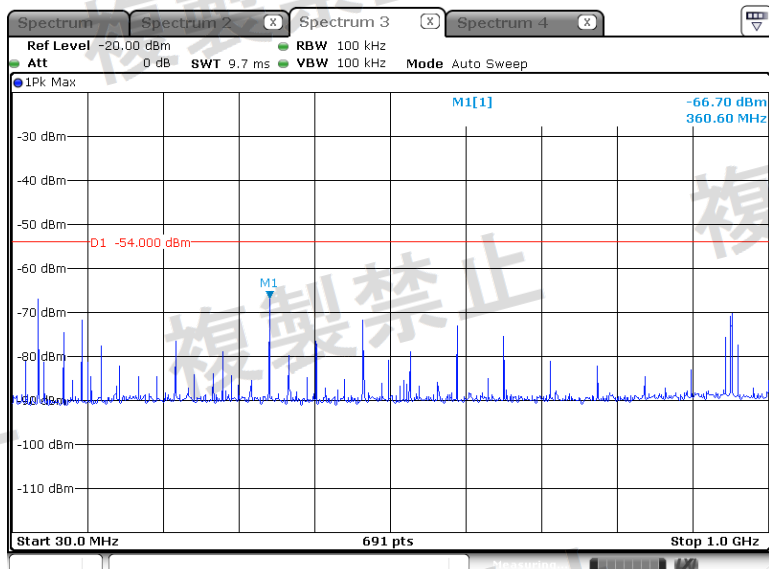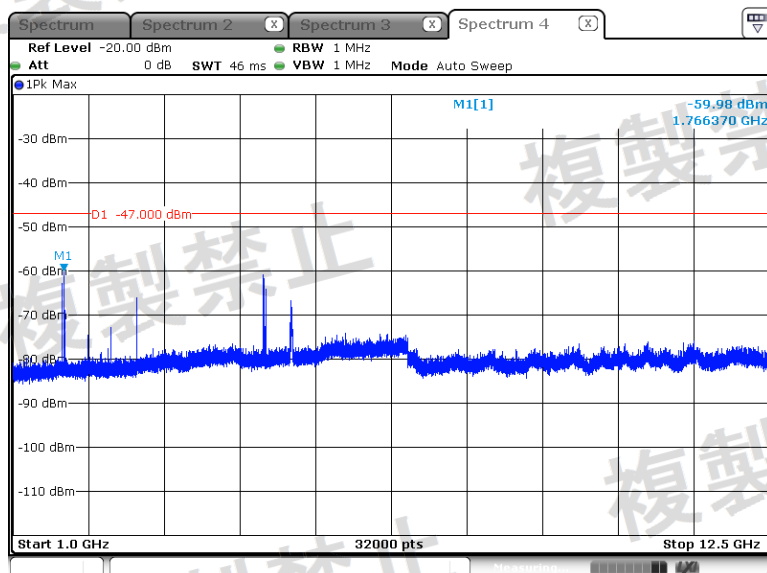
♦6:Freq Range6 (≥ 1GHz, ≤ 12.5GHz)

Frequency: 2441MHz
♦5:Freq Range5 (≥ 30MHz, <1GHz)
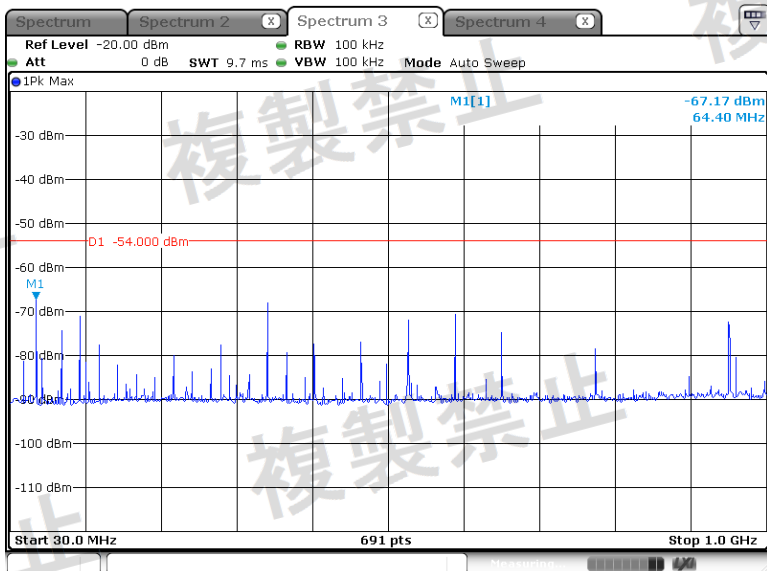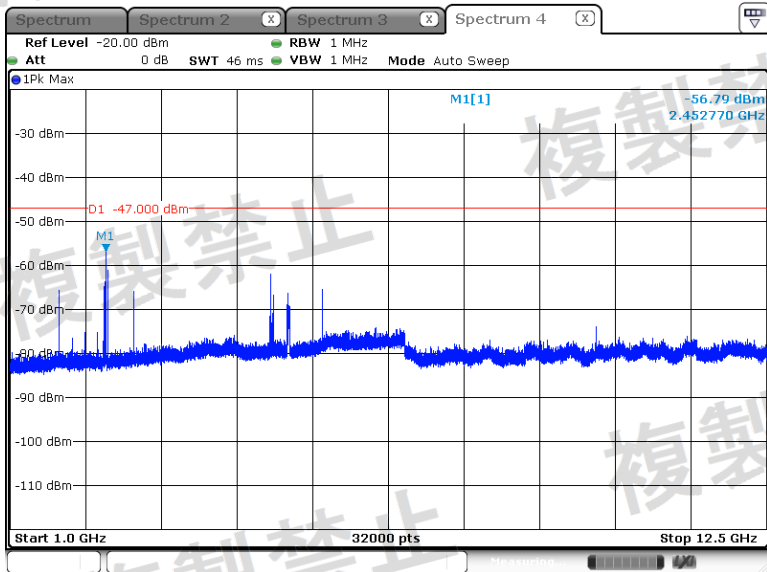
♦6:Freq Range6 (≥ 1GHz, ≤ 12.5GHz)
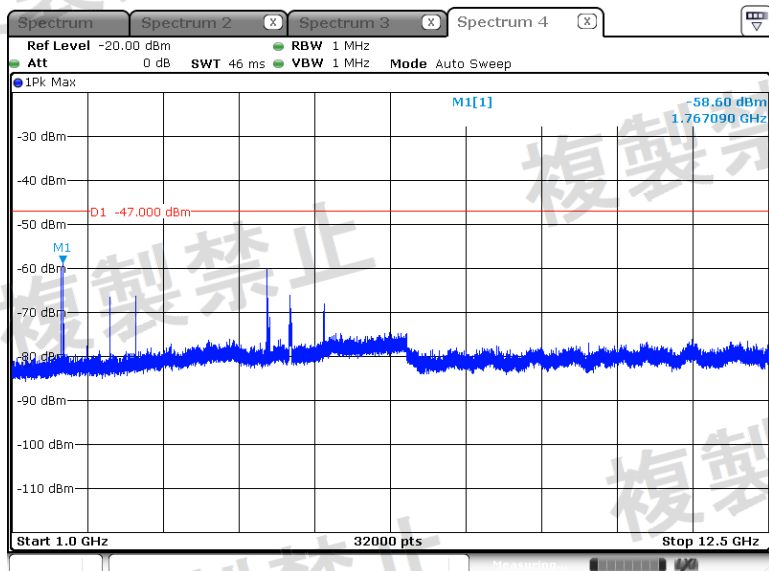
Date:15.AUG.2018 07:41:42

Frequency: 2480MHz
♦5:Freq Range5 (≥ 30MHz, <1GHz)
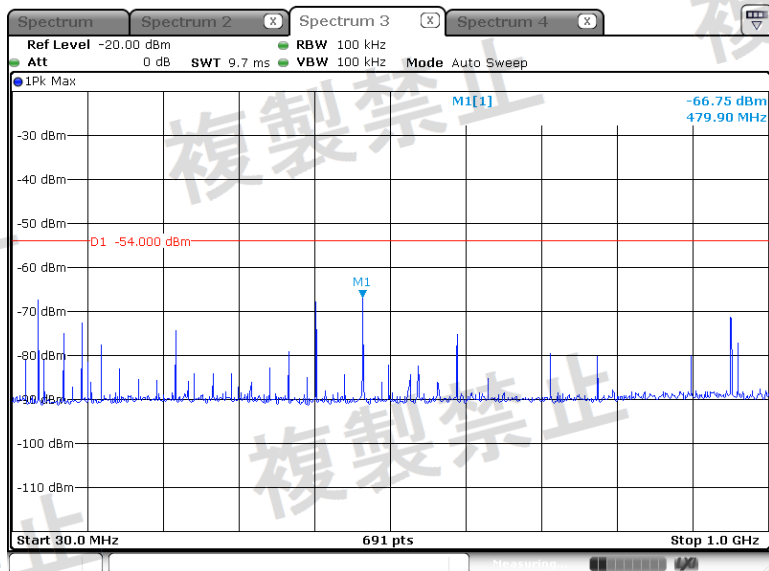
Date:15.AUG.2018 07:42:15

♦6:Freq Range6 (≥ 1GHz, ≤ 12.5GHz)

Date: 15 AUG 2018 07:43:05

## 2.6. Dwell Time/ Duty

Job No.   4788602555
Remark1
Remark2

[DATA]

Voltage	Freq.		Spreading Bandwidth	On Time	Period	Result (Duty)	Symbol Rate	Hopping Number	Result (Dwell time)	Limit
[V]	[MHz]	[sec]	[MHz]	[msec]	[msec]	[%]	[Mbps]	[times]	[sec]	[sec]
AC100V	2441	0.4	70.1157	2.899	3.768	76.9	1.0	79	0.273	0.4

Sample Calculation :

Result(Duty) = On Time / Period * 100

Result（Dwell Time)= (0.4 * Spreading Bandwidth [MHz] * On Time / Symbol Rate [Mbps]) / (Period * Hopping Number）

Tx2_BurstRate_Nom
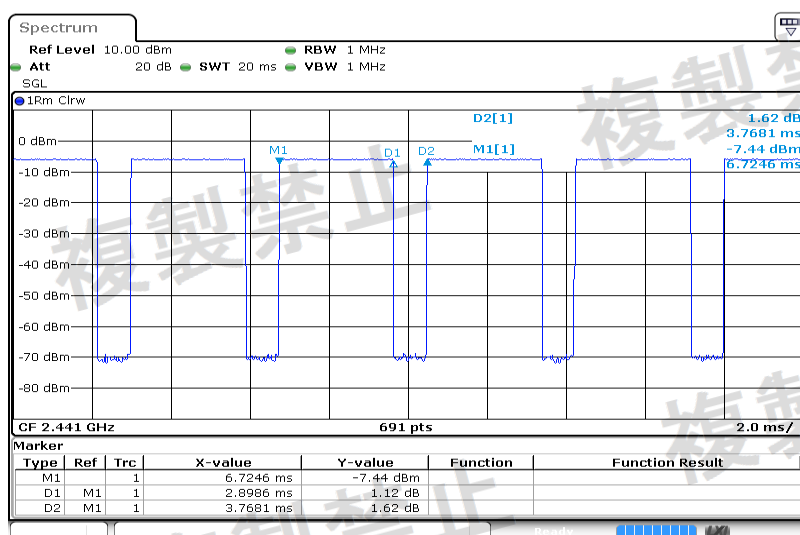
Date:15.AUG.2018 05:16:23

3. Measurement Equipment

Use	Int. No.	Kind of Equipment	Model No.	Manufacturer	Serial No.	Calibration Authority	Calibration Date
	0	PXA signal analyzer	N9030A	Keysight	MY55410512	CEPREI	12-Dec-17
X	0	Power Meter	N1912A	Keysight	MY55416024	CEPREI	12-Dec-17
X	0	Signal Analyzer	FSV40	R&S	101118	CEPREI	12-Dec-17
X	0	Power Sensor	E9323A	Keysight	MY55420006	CEPREI	12-Dec-17

Note :
1. The calibration of measurement equipment is valid for a one year period.
2. "X" used equipment.
3. All equipment is calibrated and traceable to ISO17025

4. Test Condition

Test Item	Date	Temp	Hum	Engineer	Test Room
Frequency Tolerance	17-Aug-18	24.2°C	58%	Kebo	Shielding RoomD
Occupied Bandwidth	15-Aug-18	24.5°C	53%	Kebo	Shielding Room D
Unwanted Emission Strength	15-Aug-18	24.5°C	53%	Kebo	Shielding Room D
Output Power/ E.I.R.P	15-Aug-18	24.5°C	53%	Kebo	Shielding Room D
Secondary Radiated Emission Strength	15-Aug-18	24.5°C	53%	Kebo	Shielding Room D
Burst Length / Duty	15-Aug-18	24.5°C	53%	Kebo	Shielding Room D

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5. TEST CONFIGURATION

PHOTO