TEST REPORT

REPORT NUMBER:	478602555
COMPANY NAME:	AIWA CO.,LTD.
EUT DESCRIPTION:	Retro bluetooth radio
MODEL:	FR-BD20
SERIAL NUMBER:	XXXXXX
ISSUE DATE:	25-Sep-18
DATE TESTED:	3-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])	0.000011W/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
Engineer Full Name:	Stephen Guo
Engineer Title:	Laboratory Manager
	UL Verification Services (Guangzhou) Co., LTD. Songshan Lake Branch

Tested By:	Kebo
Engineer Full Name:	Kebo Zhang
Engineer Title:	Engineer Project Associate
	UL Verification Services (Guangzhou) Co., LTD. Songshan Lake Branch

1. EUT Information

Report No. :	478602555
Applicant :	AIWA CO.,LTD.
Equipment Description:	Retro bluetooth radio
Model No. :	FR-BD20
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	
	[MHz]	Cable Loss [dB]	ATT/ [dB]	Cable Loss [dB]	ATT/ [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

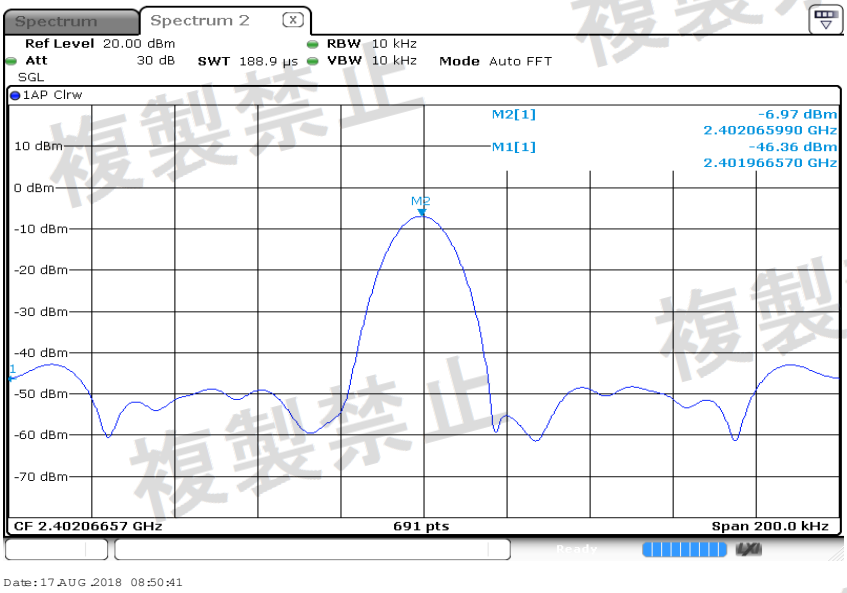
2.1. Frequency Tolerance

Job No.	478602555
Remark1	
Remark2	

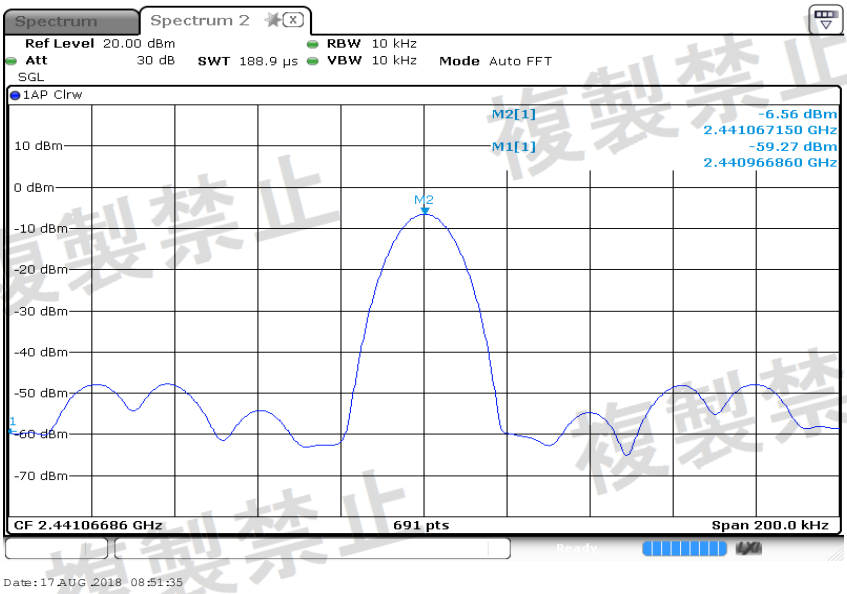
[DATA]

Voltage	Freq. [MHz]	Result [MHz]	Tolerance [kHz]	Tolerance [ppm]	Limit [ppm]
AC100V	2402	2402.0660	65.9900	27.47	±50.0
	2441	2441.0672	67.1500	27.51	±50.0
	2480	2480.0680	68.0200	27.43	±50.0

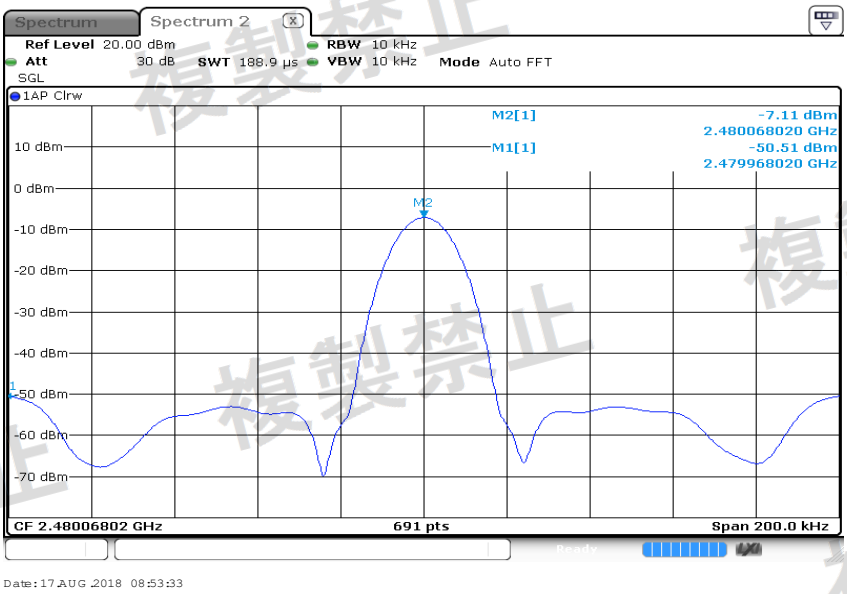
Tx1_Freq_Nom



Tx2_Freq_Nom



Tx3_Freq_Nom



2.2. Occupied Bandwidth / Spreading Bandwidth

Job No.	478602555
Remark1	
Remark2	

[DATA]

99% Occupied Frequency Bandwidth

Voltage	Freq. [MHz]	Result [MHz]	Limit [MHz]
AC100V	2441	78.2344	83.5

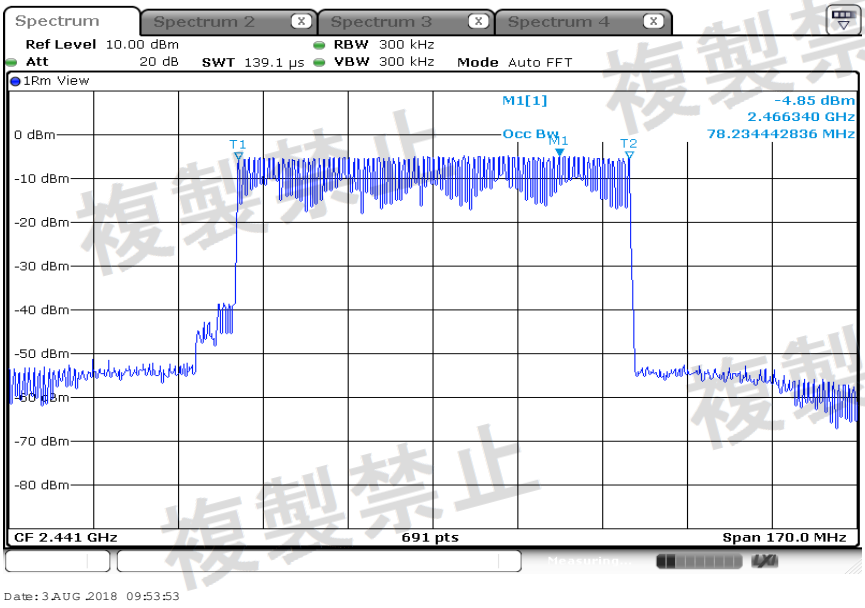
Spreading Bandwidth

Voltage	Freq. [MHz]	Result [MHz]	Result [kHz]	Limit [kHz]
AC100V	2441	70.6078	70608	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.

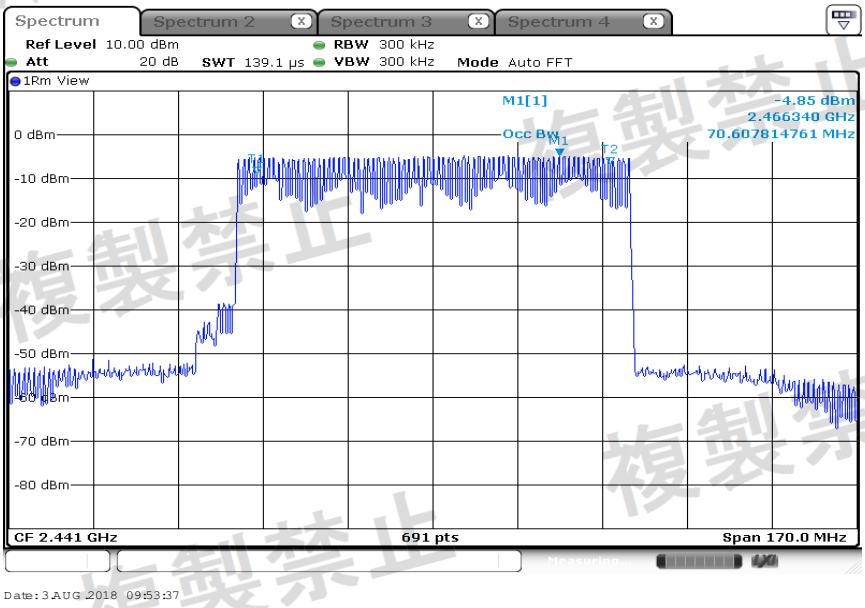
99% Occupied Frequency Bandwidth

Tx2_Hop99OBW_Nom



Spreading Bandwidth

Tx2_Hop90OBW_Nom



2.3. Unwanted Emission Strength

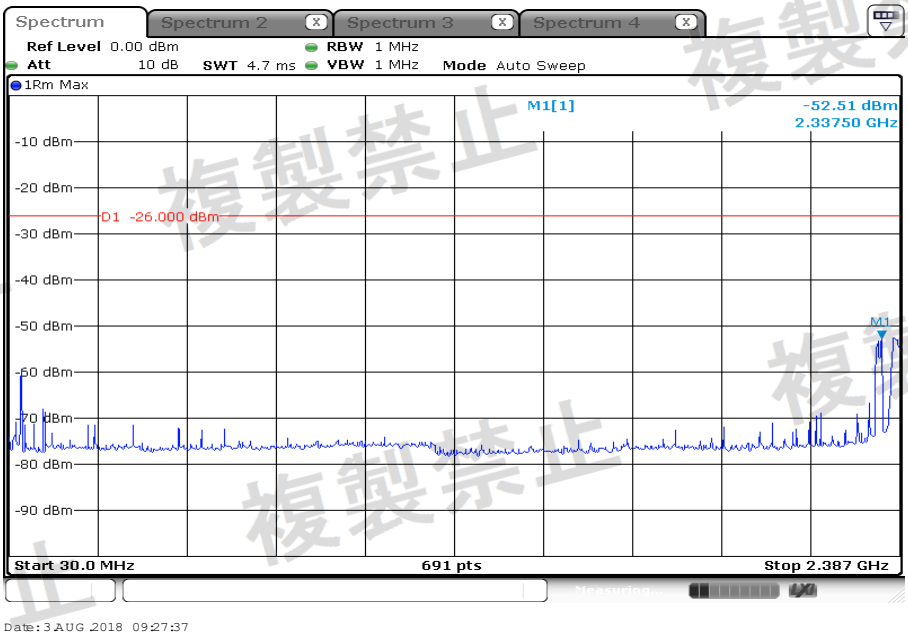
Job No.	478602555
Remark1	
Remark2	

[DATA]

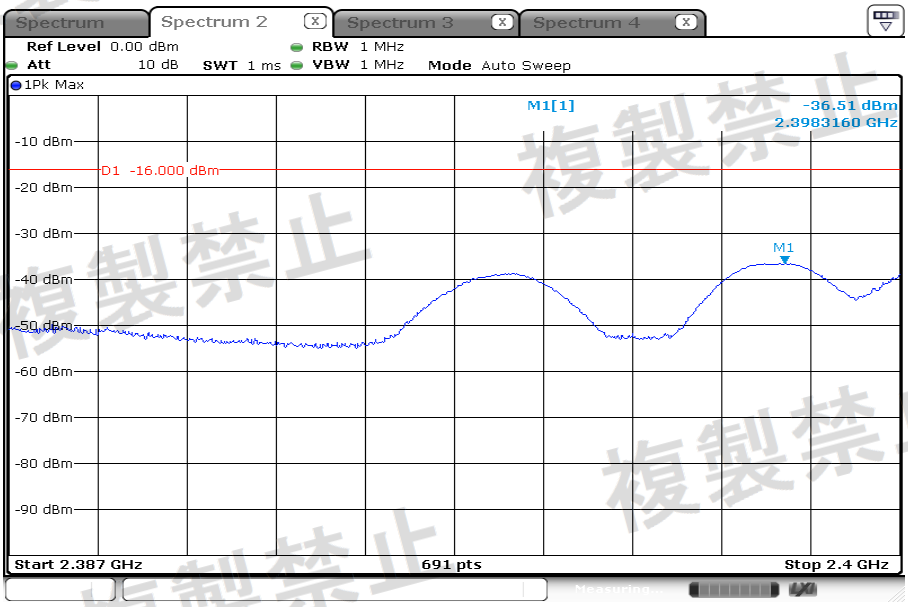
Voltage	Freq. [MHz]	Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Result [uW]	Limit [uW]	Remark
AC100V	2402	2337.50	-52.51	0.50	0.00	-52.01	0.006	2.500	♦1
		2398.32	-36.51	0.50	0.00	-36.01	0.251	25.000	♦2
		2496.28	-60.47	0.50	0.00	-59.97	0.001	25.000	♦3
		4804.65	-36.44	0.50	0.00	-35.94	0.255	2.500	♦4
	2441	2378.50	-56.97	0.50	0.00	-56.47	0.002	2.500	♦1
		2399.99	-52.82	0.50	0.00	-52.32	0.006	25.000	♦2
		2484.04	-59.97	0.50	0.00	-59.47	0.001	25.000	♦3
		4882.18	-41.27	0.50	0.00	-40.77	0.084	2.500	♦4
	2480	65.80	-57.71	0.50	0.00	-57.21	0.002	2.500	♦1
		2399.97	-62.02	0.50	0.00	-61.52	0.001	25.000	♦2
		2495.98	-46.60	0.50	0.00	-46.10	0.025	25.000	♦3
		4960.33	-43.68	0.50	0.00	-43.18	0.048	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)



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



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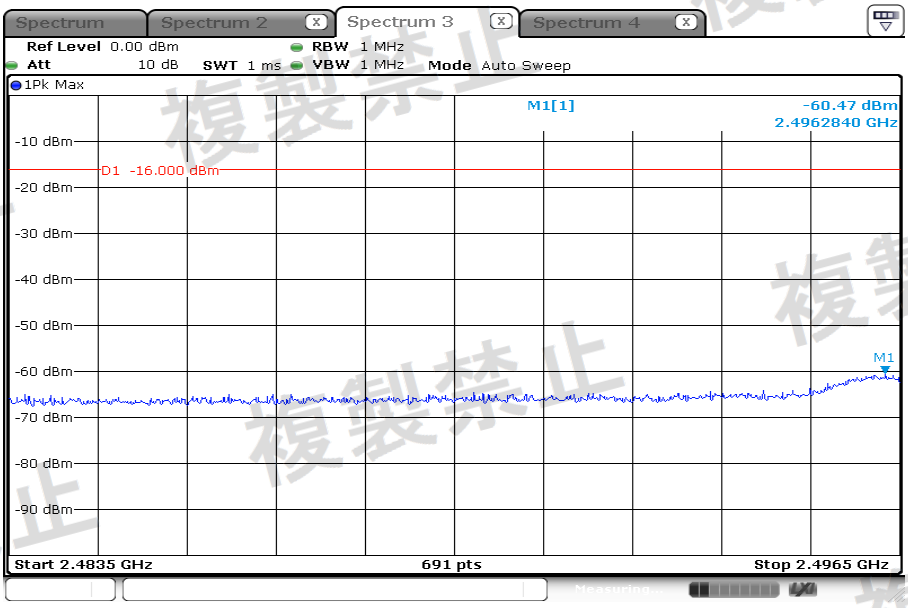
♦3:Freq Range3 (> 2,483.5MHz, ≤ 2,496.5MHz)



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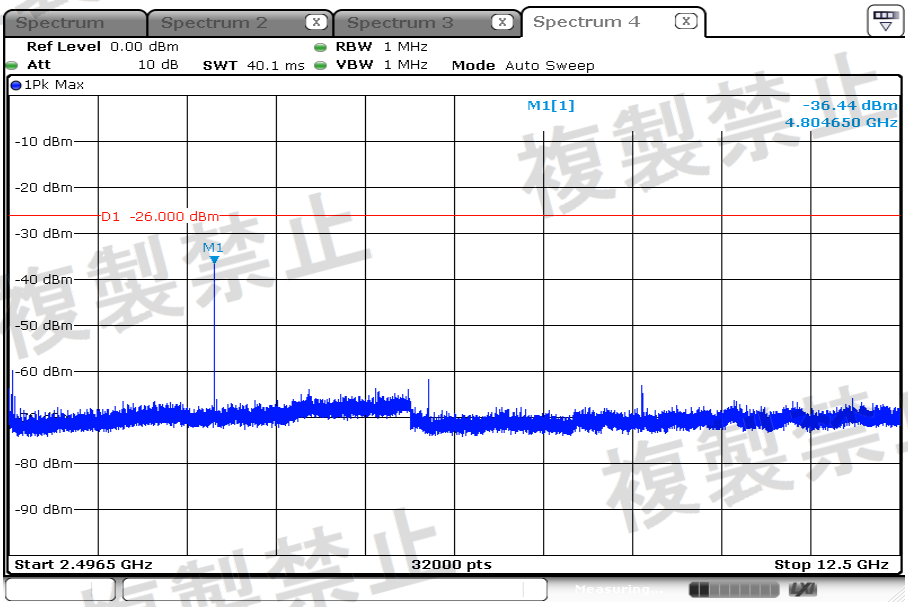
♦4:Freq Range4 (> 2,496.5MHz, ≤ 12.5GHz)



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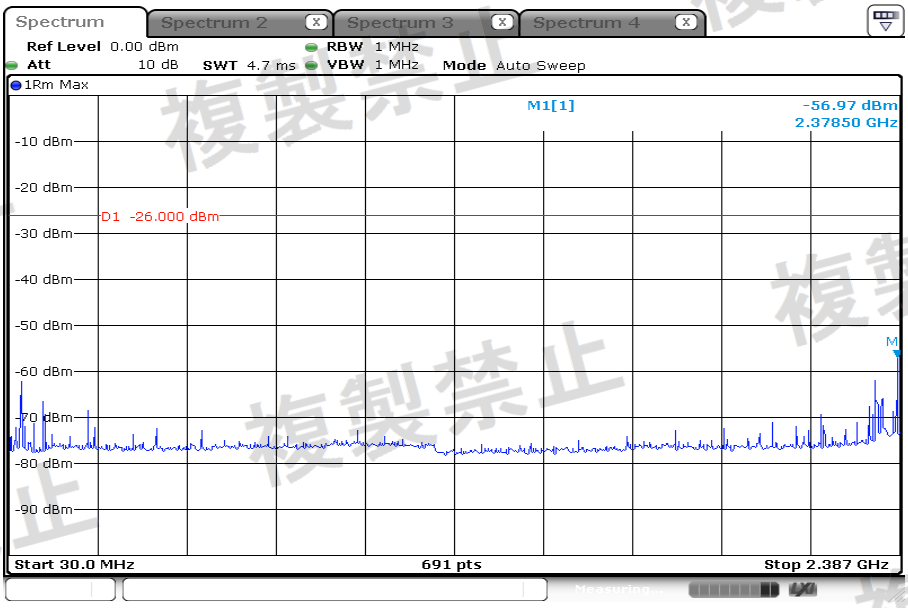
Frequency: 2441MHz

♦1:Freq Range1 (≥ 30MHz, < 2,387MHz)



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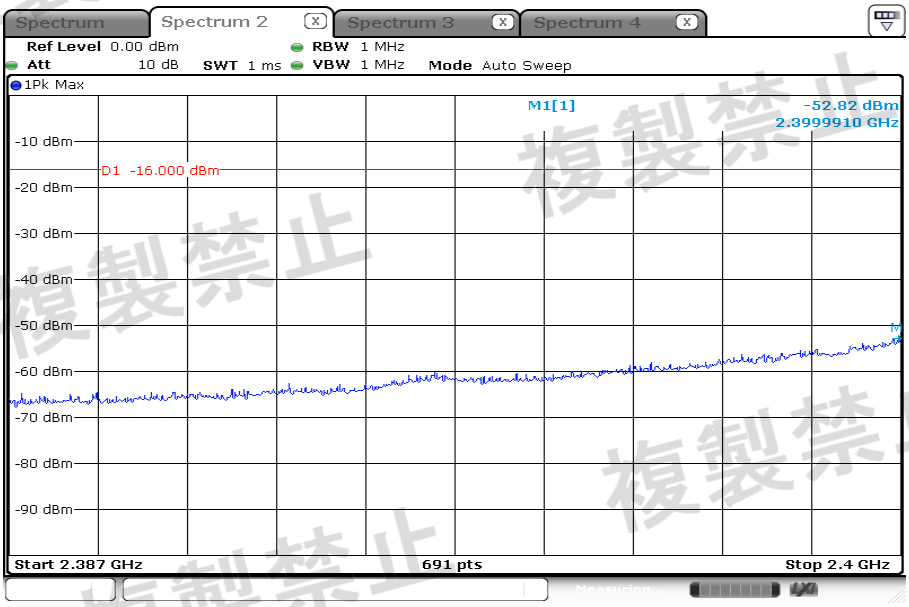
♦2:Freq Range2 (≥ 2,387MH z , < 2,400MHz)



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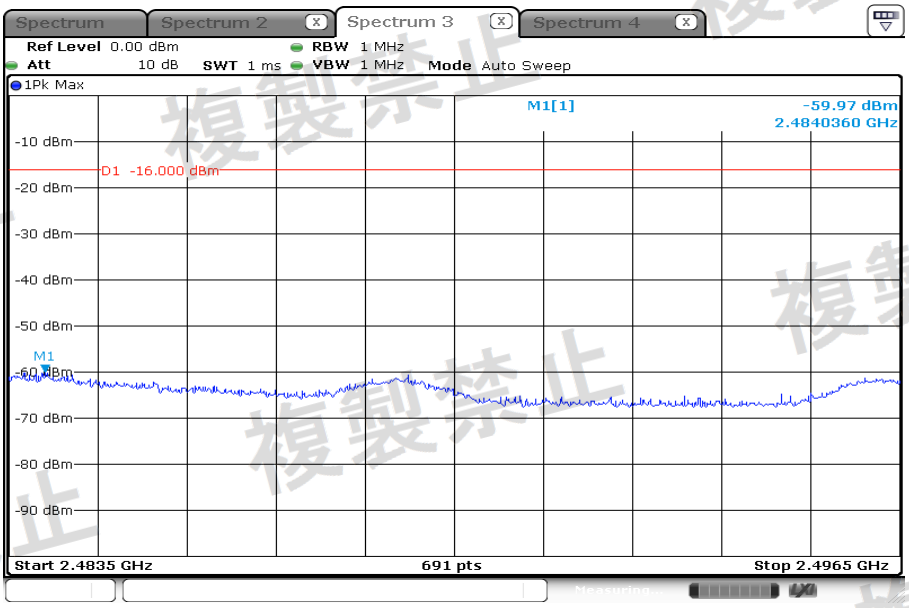
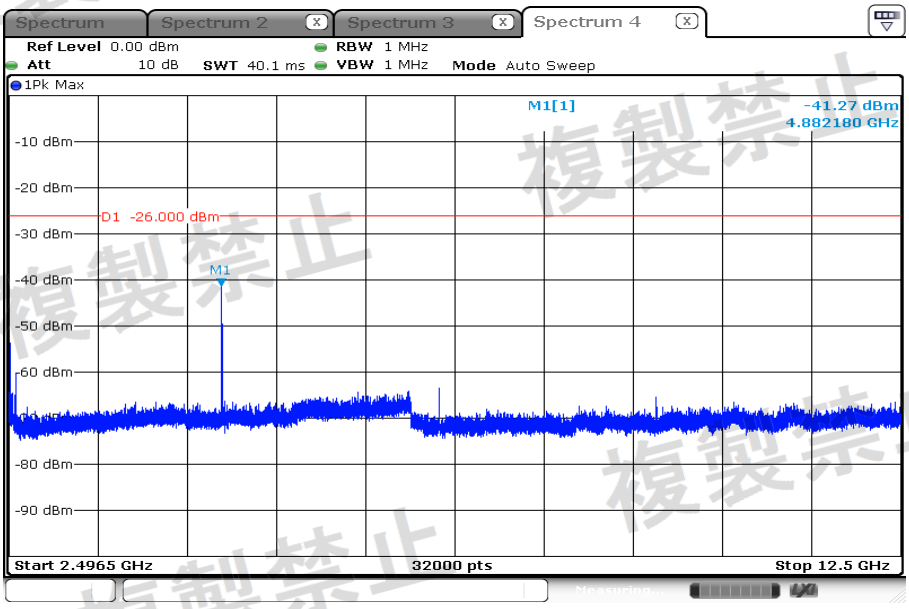
♦3:Freq Range3 (> 2,483.5MHz, ≤ 2,496.5MHz)



Date: 3.AUG.2018 09:30:07

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



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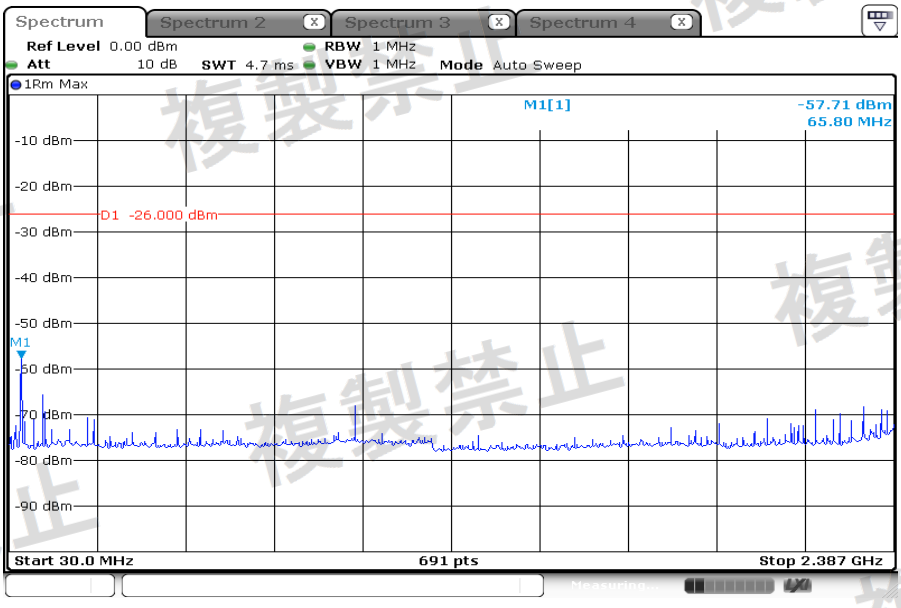
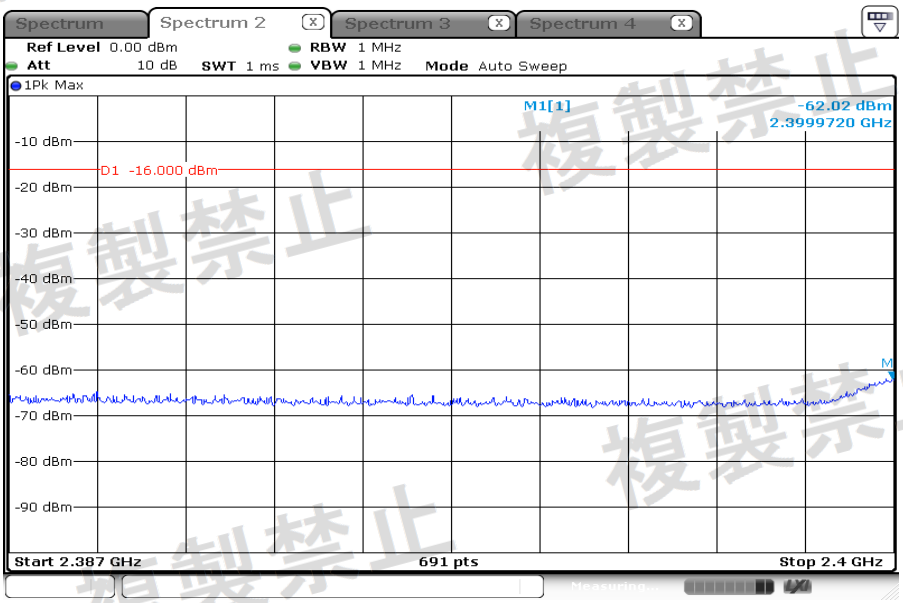
Frequency: 2480MHz

♦1:Freq Range1 (≥ 30MHz, < 2,387MHz)



Date: 3.AUG.2018 09:30:54

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



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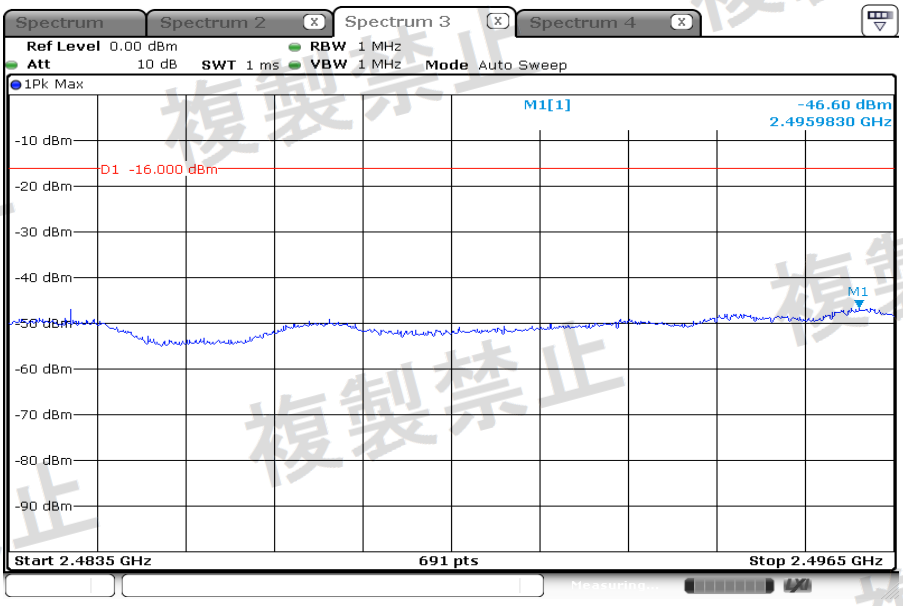
♦3:Freq Range3 (> 2,483.5MHz, ≤ 2,496.5MHz)



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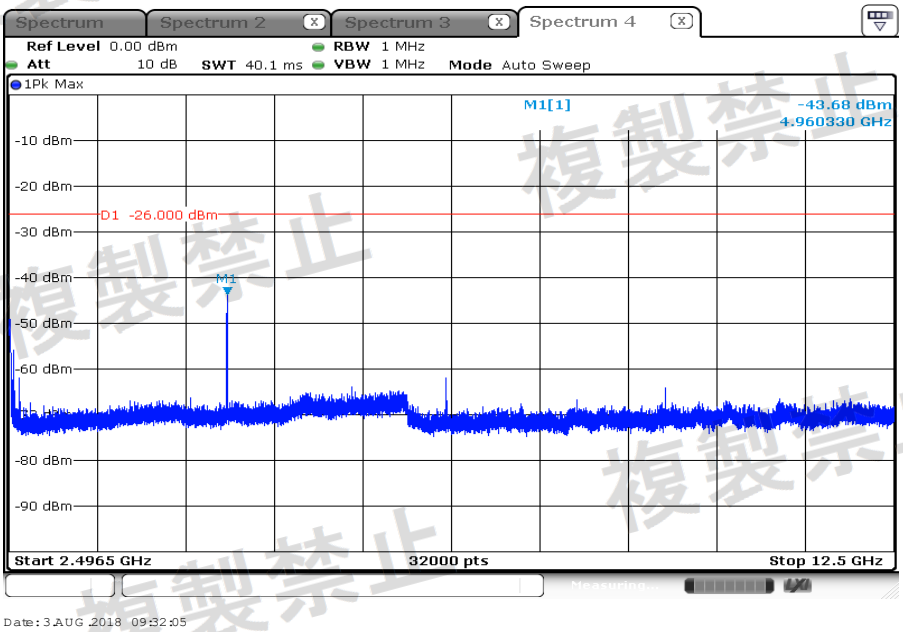
♦4:Freq Range4 (> 2,496.5MHz, ≤ 12.5GHz)



2.4. Output Power

Job No.	478602555
Remark1	
Remark2	

[DATA]

Voltage	Freq. [MHz]	P/M(AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result A [W]	Spreading Bandwidth [MHz]	Burst Rate	Result B [W/MHz]	Tolerance [%]	Limit [W/MHz]	Limit Tolerance [%]
AC100V	2402	-4.60	0.50	0.00	0.000389	70.6078	1.30	0.000007	-32.1	0.003000	+20 ～ -80
	2441	-4.25	0.50	0.00	0.000422	70.6078	1.30	0.000008	-26.4	0.003000	+20 ～ -80
	2480	-4.57	0.50	0.00	0.000392	70.6078	1.30	0.000007	-31.6	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)	0.000007	W/MHz
Declared Output Power 1	0.000011	W/MHz
＋20	0.000013	W/MHz
Middle (Declared Output Power -30%)	0.000007	W/MHz
-80	0.000002	W/MHz

Antenna Gain	0.50	dBi
E.I.R.P. for Declared Output Power 1	-19.27	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. 478602555
Remark1
Remark2

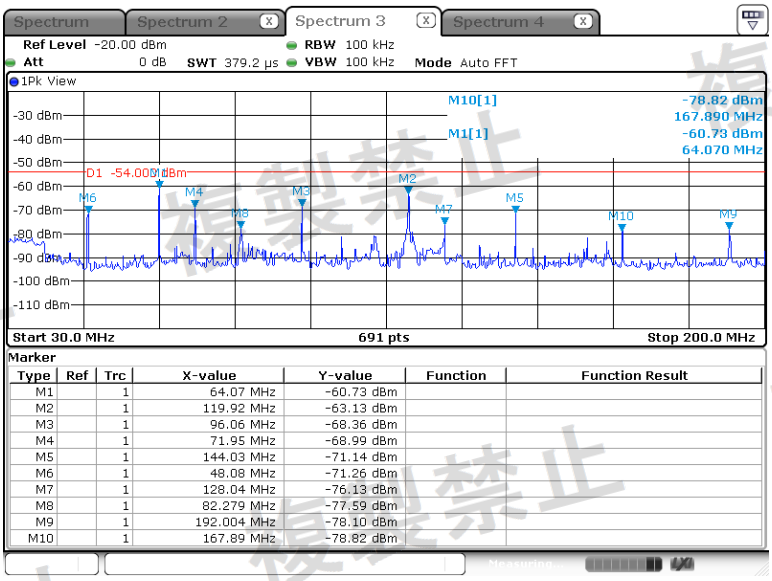
[DATA]

Voltage [V]	Freq. [MHz]	Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Result [nW]	Limit [nW]	Remark
AC100V	2402	64.1	-60.73	0.50	0.00	-60.23	0.948	4	♦5
		119.9	-63.13	0.50	0.00	-62.63	0.546	4	♦5
		96.1	-68.36	0.50	0.00	-67.86	0.164	4	♦5
		72.0	-68.99	0.50	0.00	-68.49	0.142	4	♦5
		144.0	-71.14	0.50	0.00	-70.64	0.086	4	♦5
		48.1	-71.26	0.50	0.00	-70.76	0.084	4	♦5
		128.0	-76.13	0.50	0.00	-75.63	0.027	4	♦5
		82.3	-77.59	0.50	0.00	-77.09	0.020	4	♦5
		192.0	-78.10	0.50	0.00	-77.60	0.017	4	♦5
		167.9	-78.82	0.50	0.00	-78.32	0.015	4	♦5
		239.9	-67.18	0.50	0.00	-66.68	0.215	4	♦5
		479.6	-71.55	0.50	0.00	-71.05	0.079	4	♦5
		660.2	-74.13	0.50	0.00	-73.63	0.043	4	♦5
		953.1	-74.87	0.50	0.00	-74.37	0.037	4	♦5
		256.2	-76.63	0.50	0.00	-76.13	0.024	4	♦5
		383.5	-77.60	0.50	0.00	-77.10	0.019	4	♦5
		264.3	-78.59	0.50	0.00	-78.09	0.016	4	♦5
		950.8	-79.61	0.50	0.00	-79.11	0.012	4	♦5
		360.4	-80.23	0.50	0.00	-79.73	0.011	4	♦5
		943.8	-80.48	0.50	0.00	-79.98	0.010	4	♦5
		The sum of the result exceeding 1/10 if the Limit[nW]:					2.514	4	♦5
		2426.5	-59.06	0.50	0.00	-58.56	1.393	20	♦6
	2441	63.8	-59.75	0.50	0.00	-59.25	1.189	4	♦5
		119.9	-62.34	0.50	0.00	-61.84	0.655	4	♦5
		96.1	-68.21	0.50	0.00	-67.71	0.169	4	♦5
		72.0	-68.65	0.50	0.00	-68.15	0.153	4	♦5
		48.1	-71.89	0.50	0.00	-71.39	0.073	4	♦5
		144.0	-72.08	0.50	0.00	-71.58	0.070	4	♦5
		128.0	-75.40	0.50	0.00	-74.90	0.032	4	♦5
		192.0	-77.16	0.50	0.00	-76.66	0.022	4	♦5
		167.9	-79.21	0.50	0.00	-78.71	0.013	4	♦5
		82.5	-81.52	0.50	0.00	-81.02	0.008	4	♦5
		239.9	-67.63	0.50	0.00	-67.13	0.194	4	♦5
		539.8	-68.63	0.50	0.00	-68.13	0.154	4	♦5
		943.8	-75.04	0.50	0.00	-74.54	0.035	4	♦5
		420.5	-75.81	0.50	0.00	-75.31	0.029	4	♦5
		360.3	-76.00	0.50	0.00	-75.50	0.028	4	♦5
		256.2	-76.29	0.50	0.00	-75.79	0.026	4	♦5
		953.1	-77.37	0.50	0.00	-76.87	0.021	4	♦5
		899.9	-78.01	0.50	0.00	-77.51	0.018	4	♦5
		383.5	-78.18	0.50	0.00	-77.68	0.017	4	♦5
		264.3	-78.31	0.50	0.00	-77.81	0.017	4	♦5
		The sum of the result exceeding 1/10 if the Limit[nW]:					2.922	4	♦5
		2480.1	-58.38	0.50	0.00	-57.88	1.629	20	♦6

	2480	64.1	-59.98	0.50	0.00	-59.48	1.127	4	♦5
		119.9	-67.47	0.50	0.00	-66.97	0.201	4	♦5
		96.1	-68.53	0.50	0.00	-68.03	0.157	4	♦5
		72.0	-69.23	0.50	0.00	-68.73	0.134	4	♦5
		48.1	-71.95	0.50	0.00	-71.45	0.072	4	♦5
		128.0	-73.20	0.50	0.00	-72.70	0.054	4	♦5
		144.0	-73.62	0.50	0.00	-73.12	0.049	4	♦5
		192.0	-78.40	0.50	0.00	-77.90	0.016	4	♦5
		167.9	-78.42	0.50	0.00	-77.92	0.016	4	♦5
		160.0	-83.36	0.50	0.00	-82.86	0.005	4	♦5
		239.9	-68.14	0.50	0.00	-67.64	0.172	4	♦5
		943.8	-71.13	0.50	0.00	-70.63	0.086	4	♦5
		539.8	-71.31	0.50	0.00	-70.81	0.083	4	♦5
		953.1	-73.83	0.50	0.00	-73.33	0.046	4	♦5
		950.8	-76.97	0.50	0.00	-76.47	0.023	4	♦5
		256.2	-77.03	0.50	0.00	-76.53	0.022	4	♦5
		264.3	-77.68	0.50	0.00	-77.18	0.019	4	♦5
		383.5	-77.80	0.50	0.00	-77.30	0.019	4	♦5
		660.2	-80.01	0.50	0.00	-79.51	0.011	4	♦5
		288.6	-80.23	0.50	0.00	-79.73	0.011	4	♦5
		The sum of the result exceeding 1/10 if the Limit[nW]:					2.324	4	♦5
		2402.5	-61.71	0.50	0.00	-61.21	0.76	20	♦6

Result = Reading + Cable Loss + Atten. Loss
♦5:Freq Range5 (≥ 30MHz, <1GHz)
♦6:Freq Range6 (≥ 1GHz, ≤ 12.5GHz)

Voltage: AC100V
Frequency: 2402MHz
♦5:Freq Range5-1 (≥ 30MHz, <1GHz)



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	64.07 MHz	-60.73 dBm		
M2		1	119.92 MHz	-63.13 dBm		
M3		1	96.06 MHz	-68.36 dBm		
M4		1	71.95 MHz	-68.99 dBm		
M5		1	144.03 MHz	-71.14 dBm		
M6		1	48.08 MHz	-71.26 dBm		
M7		1	128.04 MHz	-76.13 dBm		
M8		1	82.279 MHz	-77.59 dBm		
M9		1	192.004 MHz	-78.10 dBm		
M10		1	167.89 MHz	-78.82 dBm		

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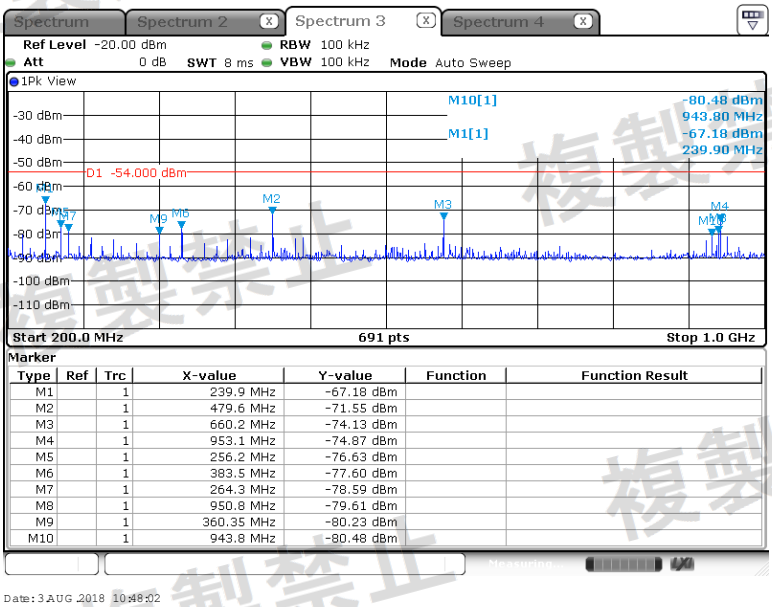
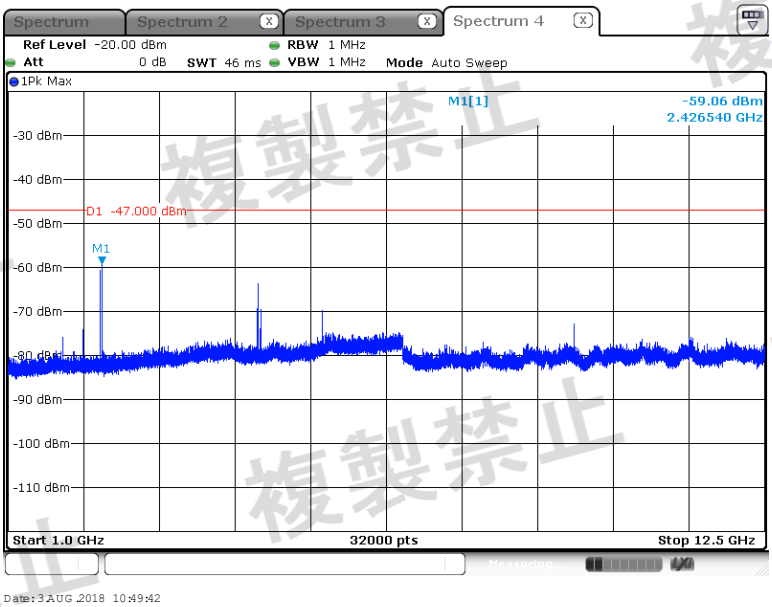
♦5:Freq Range5-2 (≥ 30MHz, <1GHz)

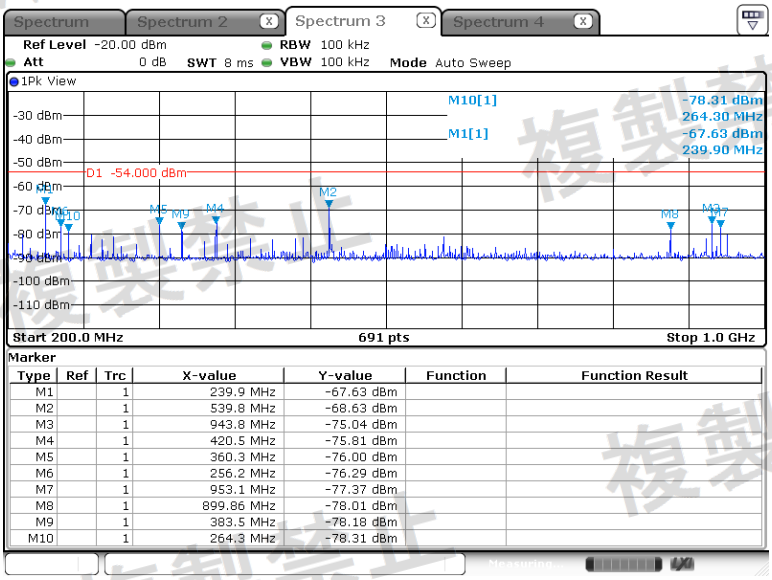


♦6:Freq Range6 (≥ 1GHz, ≤ 12.5GHz)



Frequency: 2441MHz

♦5:Freq Range5-1 (≥ 30MHz, <1GHz)



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	239.9 MHz	-67.63 dBm		
M2		1	539.8 MHz	-68.63 dBm		
M3		1	943.8 MHz	-75.04 dBm		
M4		1	420.5 MHz	-75.81 dBm		
M5		1	360.3 MHz	-76.00 dBm		
M6		1	256.2 MHz	-76.29 dBm		
M7		1	953.1 MHz	-77.37 dBm		
M8		1	899.86 MHz	-78.01 dBm		
M9		1	383.5 MHz	-78.18 dBm		
M10		1	264.3 MHz	-78.31 dBm		

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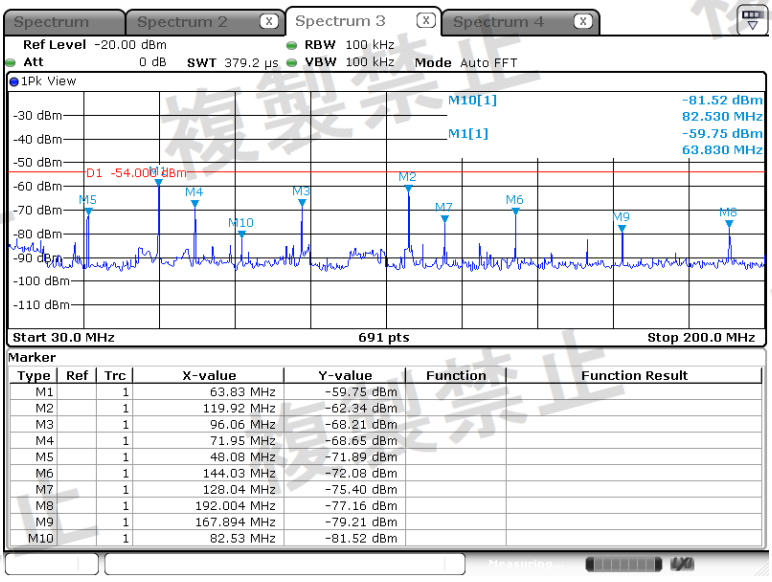
Frequency: 2480MHz

♦5:Freq Range5-2 (≥ 30MHz, <1GHz)



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	63.83 MHz	-59.75 dBm		
M2		1	119.92 MHz	-62.34 dBm		
M3		1	96.06 MHz	-68.21 dBm		
M4		1	71.95 MHz	-68.65 dBm		
M5		1	48.08 MHz	-71.89 dBm		
M6		1	144.03 MHz	-72.08 dBm		
M7		1	128.04 MHz	-75.40 dBm		
M8		1	192.004 MHz	-77.16 dBm		
M9		1	167.894 MHz	-79.21 dBm		
M10		1	82.53 MHz	-81.52 dBm		

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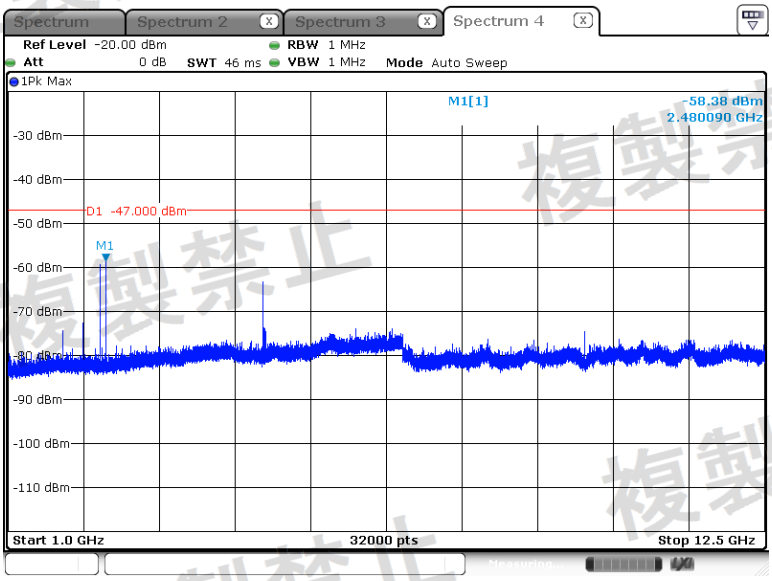
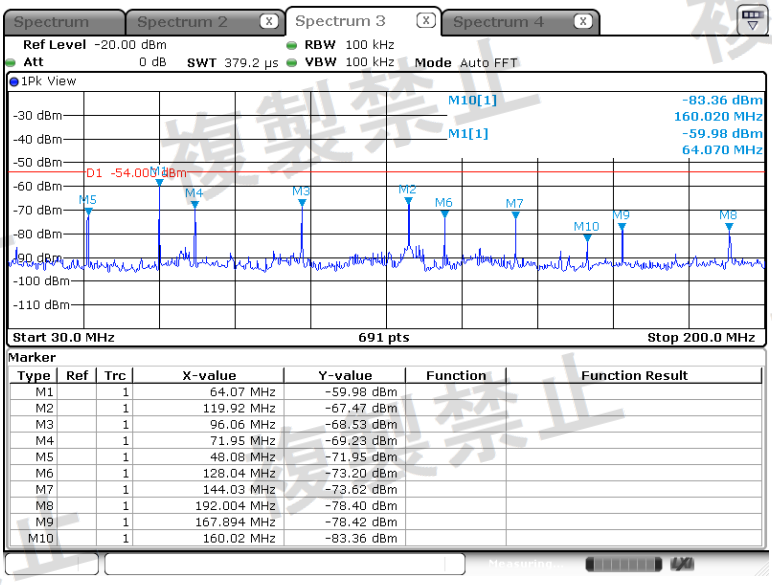
♦6:Freq Range6 (≥ 1GHz, ≤ 12.5GHz)



Frequency: 2480MHz

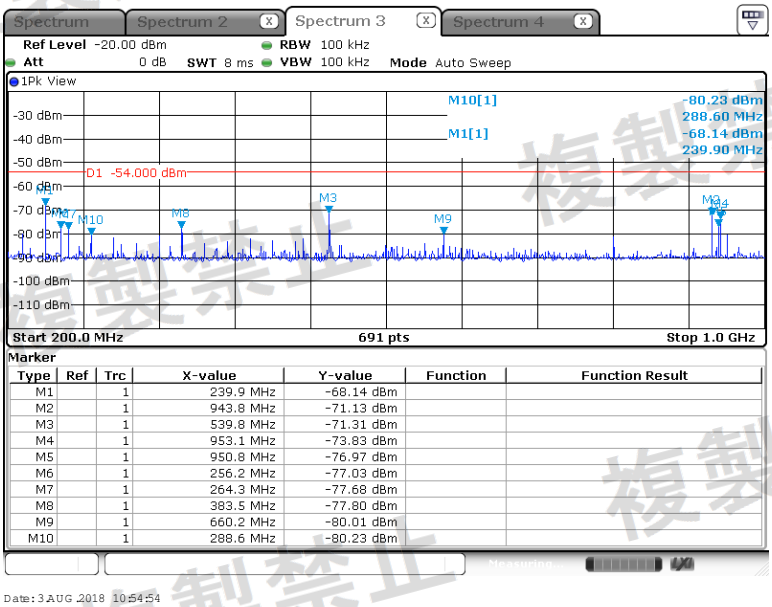
♦5:Freq Range5-1 (≥ 30MHz, <1GHz)



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	64.07 MHz	-59.98 dBm		
M2		1	119.92 MHz	-67.47 dBm		
M3		1	96.06 MHz	-68.53 dBm		
M4		1	71.95 MHz	-69.23 dBm		
M5		1	48.08 MHz	-71.95 dBm		
M6		1	128.04 MHz	-73.20 dBm		
M7		1	144.03 MHz	-73.62 dBm		
M8		1	192.004 MHz	-78.40 dBm		
M9		1	167.894 MHz	-78.42 dBm		
M10		1	160.02 MHz	-83.36 dBm		

♦5:Freq Range5-2 (≥ 30MHz, <1GHz)



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	239.9 MHz	-68.14 dBm		
M2		1	943.8 MHz	-71.13 dBm		
M3		1	539.8 MHz	-71.31 dBm		
M4		1	953.1 MHz	-73.83 dBm		
M5		1	950.8 MHz	-76.97 dBm		
M6		1	256.2 MHz	-77.03 dBm		
M7		1	264.3 MHz	-77.68 dBm		
M8		1	383.5 MHz	-77.80 dBm		
M9		1	660.2 MHz	-80.01 dBm		
M10		1	288.6 MHz	-80.23 dBm		

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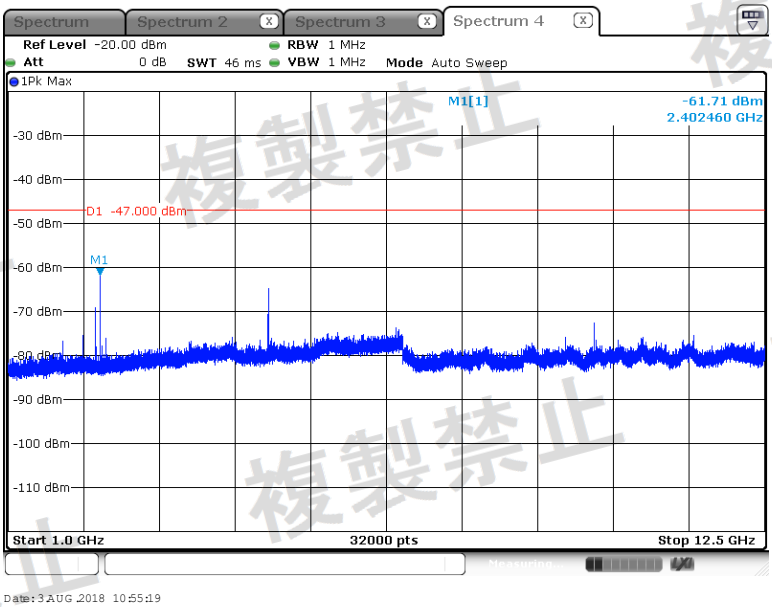
♦6:Freq Range6 (≥ 1GHz, ≤ 12.5GHz)



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2.6. Dwell Time/ Duty

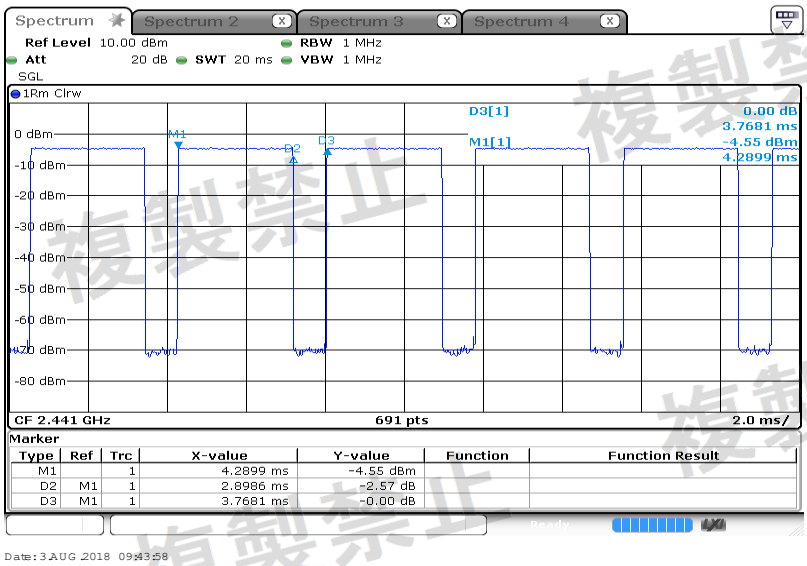
Job No. 478602555
Remark1
Remark2

[DATA]

Voltage [V]	Freq. [MHz]	[sec]	Spreading Bandwidth [MHz]	On Time [msec]	Period [msec]	Result (Duty) [%]	Symbol Rate [Mbps]	Hopping Number [times]	Result (Dwell time) [sec]	Limit [sec]
AC100V	2441	0.4	70.6078	2.899	3.768	76.9	1.0	79	0.275	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



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	24.1°C	59%	Kebo	Shielding RoomD
Occupied Bandwidth	3-Aug-18	24.3°C	55%	Kebo	Shielding Room D
Unwanted Emission Strength	3-Aug-18	24.3°C	55%	Kebo	Shielding Room D
Output Power/ E.I.R.P	3-Aug-18	24.3°C	55%	Kebo	Shielding Room D
Secondary Radiated Emission Strength	3-Aug-18	24.3°C	55%	Kebo	Shielding Room D
Burst Length / Duty	3-Aug-18	24.3°C	55%	Kebo	Shielding Room D

5. TEST CONFIGURATION

PHOTO