

1TX 1RX

## 2.4GHz Band Wideband Low-Power Data Communication System (802.11g)

### TEST REPORT

To. **Digi International Inc.**



**DSP RESEARCH, INC.**

**Tested by;**

Hiraku Irie X  
Hiraku Irie

**Approved by;**

Koichi Minaki X  
Koichi Minaki

\_\_\_\_\_  
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# Table of Contents

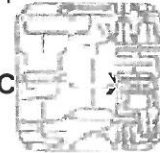
1. TEST RESULT REPORT .....	3
2. TEST RESULTS DATA FOR JAPANESE CERTIFICATION ...	4
3. Measurement Equipment List .....	6
4. About Uncertainty of Measured Value .....	7
5A. < Appendix > TX1 Measurement Result (with Image) .....	8
5A.1. Frequency Tolerance .....	8
5A.2. Occupied Bandwidth and Spread Bandwidth .....	10
5A.3. Transmission Output Power .....	12
5A.4. Unwanted Emission Strength .....	14
5A.5. Secondarily Emitted Radio Wave Strength .....	26
6. PHOTOS .....	35
6.1. Test Conditions Photographs .....	35

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# 1. TEST RESULT REPORT

Date of issue; 2012/10/1

Test Laboratory:  
**DSP RESEARCH, INC**

Inspection Result of Specified Radio Equipment is reported as mention in the following.

## Description

1. Model Name	W9M2443
2. Serial Number	N/A
3. Number of Tested Equipment	1
4. 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.
5. Date of Testing	2012/9/24
6. Place of Testing	DSP RESEARCH, INC. 1-4-3 Minatojima, Minamimachi, Chuo-ku, Kobe City, Hyogo, 650-0047, Japan
7. Test Result	PASS (Refer to attachment)
8. Measurement Equipment	Refer to Item 3
9. Classification of Specified Radio Equipment	Article 2 Clause 1 Item 19
10. Type of Emissions, Frequency and Declaration Output Power to be tested	D1D, G1D 2412~2472MHz(5MHz interval 13 channels) 0.003W/MHz

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**2. TEST RESULTS DATA FOR JAPANESE CERTIFICATION**

Environment of Test Room	Temperature	25 °C
	Humidity	58 %

Peak Antenna Gain	2.3	dBi
Declaration Output Power	3	mW/MHz
Declaration Output Power	4.7712	dBm/MHz
<b>E.I.R.P</b>	<b>7.0712</b>	<b>dBm/MHz</b>
Input Power Voltage	3.3	VDC

Tested Circuit Insertion Loss for TX	TX1	15.419	dB
	TX2		dB
	TX3		dB
Tested Circuit Insertion Loss for RX	RX1	2.586	dB
	RX2		dB
	RX3		dB
Burst	ON TIME	-Not applicable-	sec
	OFF TIME	-Not applicable-	sec
	Ratio	-Not applicable-	%
Packet Type (Mode)	-Not applicable-		mode

Test Category ; 2.4GHz Band Wideband Low-Power Data Communication System (802.11g)

Comprehensive operation test  
: In order to receive constant voltage from DC regulator, power supply voltage examines only by usual state voltage.

**2.1. TEST Results**

Measurement Frequency	MHz	2412	2442	2472	Result	NOTES
Channel Number	Ch.	1	7	13	----	
Reading Frequency (TX1)	MHz	2412.000145	2442.00013	2472.000108	----	
Frequency Tolerance (TX1)	ppm	0.06012	0.05324	0.04369	<b>PASS</b>	
Reading Frequency (TX2)	MHz					
Frequency Tolerance (TX2)	ppm					
Reading Frequency (TX3)	MHz					
Frequency Tolerance (TX3)	ppm					
Occupied Bandwidth (TX1)	MHz	17.12	17.12	17.12	<b>PASS</b>	
Spread Bandwidth (TX1)	MHz	15.04	15.04	15.04	----	<Reference>
Occupied Bandwidth (TX2)	MHz					
Spread Bandwidth (TX2)	MHz					
Occupied Bandwidth (TX3)	MHz					
Spread Bandwidth (TX3)	MHz					
RF Output Power (TX1)	mW/MHz	2.280	2.113	2.055	----	<Reference>
RF Output Power (TX2)	mW/MHz					
RF Output Power (TX3)	mW/MHz					
RF Output Power (TX1+2+3)	mW/MHz	2.280	2.113	2.055	----	<Reference>
RF Output Power Tolerance (TX1) or (TX1+2) or (TX1+2+3)	%	-24.01	-29.57	-31.49	<b>PASS</b>	
Real Total Output Power (TX1)	dBm	15.24	15.107	14.981	----	<Reference>
Real Total Output Power (TX2)	dBm					
Real Total Output Power (TX3)	dBm				----	<Reference>
Real Total Output Power (TX1) or (TX1+2) or (TX1+2+3)	dBm	15.240	15.107	14.981	----	<Reference>

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**TEST Results**

Measurement Frequency		MHz	2412	2442	2472	Result	NOTES
Channel Number		Ch.	1	7	13	-----	
Unwanted Emission Strength (TX1)	Under 2387MHz	μW/MHz	0.078145	0.101135	0.087277	<b>PASS</b>	
		MHz	2292.154	2322.166	2352.658	-----	
	2387-2400MHz	μW/MHz	1.841450	0.017096	0.087882	<b>PASS</b>	
		MHz	2399.854	2387.248	2392.222	-----	
	2483.5-2496.5MHz	μW/MHz	0.099289	0.017334	19.629082	<b>PASS</b>	
		MHz	2491.998	2484.406	2484.536	-----	
	2496.5 - 12.5GHz	μW/MHz	0.075492	0.082016	0.071928	<b>PASS</b>	
		MHz	2531.876	2562.428	2591.372	-----	
Unwanted Emission Strength (TX2)	Under 2387MHz	μW/MHz					
		MHz					
	2387-2400MHz	μW/MHz					
		MHz					
	2483.5-2496.5MHz	μW/MHz					
		MHz					
	2496.5MHz-12.5GHz	μW/MHz					
		MHz					
Unwanted Emission Strength (TX3)	Under 2387MHz	μW/MHz					
		MHz					
	2387-2400MHz	μW/MHz					
		MHz					
	2483.5-2496.5MHz	μW/MHz					
		MHz					
	2496.5MHz-12.5GHz	μW/MHz					
		MHz					
Unwanted Emission Strength (TX1) or (TX1+2) or (TX1+2+3)	Under 2387MHz	μW/MHz	0.078145	0.101135	0.087277	<b>PASS</b>	
		MHz	1TX	1TX	1TX	-----	
	2387-2400MHz	μW/MHz	1.841450	0.017096	0.087882	<b>PASS</b>	
		MHz	1TX	1TX	1TX	-----	
	2483.5-2496.5MHz	μW/MHz	0.099289	0.017334	19.629082	<b>PASS</b>	
		MHz	1TX	1TX	1TX	-----	
	2496.5MHz-12.5GHz	μW/MHz	0.075492	0.082016	0.071928	<b>PASS</b>	
		MHz	1TX	1TX	1TX	-----	
It should be added up all spurious measurement values within "Reference Bandwidth(=1MHz)" of the same frequency.							
Secondarily Emitted Radio Wave Strength (RX Spurious) (RX1)	Under 1GHz	nW	0.002634	0.002739	0.002107	<b>PASS</b>	
		MHz	963.3	961.4	316.38	-----	
	1 - 12.5GHz	nW	0.113920	0.133537	0.099220	<b>PASS</b>	
		MHz	11739	11822	11754.6	-----	
Secondarily Emitted Radio Wave Strength (RX Spurious) (RX2)	Under 1GHz	nW					
		MHz					
	1 - 12.5GHz	nW					
		MHz					
Secondarily Emitted Radio Wave Strength (RX Spurious) (RX3)	Under 1GHz	nW					
		MHz					
	1 - 12.5GHz	nW					
		MHz					
Secondarily Emitted Radio Wave Strength (RX Spurious) (RX1) or (RX1+2) or (RX1+2+3)	Under 1GHz	nW	0.002634	0.002739	0.002107	<b>PASS</b>	
		-----	-----	-----	-----	-----	
	1 - 12.5GHz	nW	0.113920	0.133537	0.099220	<b>PASS</b>	
		-----	-----	-----	-----	-----	
Interference Prevention Function		-----	good			<b>PASS</b>	

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### 3. Measurement Equipment List

Use	Int. No.	Kind of Equipment	Model No.	Manufacturer	Serial No.	Calibration Authority	Calibration Date
X	TD10205	Spectrum Analyzer	MS2687B	Anritsu Corporation	6100192047	Anritsu Corporation	2012/5/7
	TD10261	Spectrum Analyzer	MS2687B	Anritsu Corporation	6200573988	Anritsu Corporation	2012/4/4
	IS10362	Spectrum Analyzer	MS2692A	Anritsu Corporation	6200675544	Anritsu Corporation	2012/1/16
	IS10438	Spectrum Analyzer	MS2692A	Anritsu Corporation	6200882959	Anritsu Corporation	2012/7/12
	TD10150	Spectrum Analyzer	E4408B	Agilent Technologies	MY41440467	Anritsu Corporation	2011/1/14
X	TD10201	Power Meter	ML2438A	Anritsu Corporation	04170011	Anritsu Corporation	2011/11/2
	TD10283	Power Meter	ML2438A	Anritsu Corporation	6K00005544	Anritsu Corporation	2012/4/4
X	IS10316	Thermal Sensor	MA24004A	Anritsu Corporation	0917026	Anritsu Corporation	2011/11/2
	IS10317	Thermal Sensor	MA24004A	Anritsu Corporation	0917057	Anritsu Corporation	2012/4/4
	TD10145	CW Generator	MC3692A	Anritsu Corporation	30407	Anritsu Corporation	2012/5/8
	TD10225	Vector Signal Generator	MG3700A	Anritsu Corporation	6200446460	Anritsu Corporation	2012/3/5
	TD10228	Anechoic Chamber	J-carets2_Chamber	Training Research Co.,LTD.	-----	DSP Research, Inc.	2012/4/17
	TD10288	Temperature & Humidity Chamber	LHU-113	ESPEC Corp.	1012004887	ESPEC Corp.	2012/4/27
	IS10315	Vibration Unit	731-B	EMIC CORPORATION	3379	EMIC CORPORATION	2012/2/2
	TD10260	W-CDMA Signaling Tester	MD8480A	Anritsu Corporation	6100137579	DSP Research, Inc.	2012/6/28
	TD10293	Universal Radio Comm. Tester	CMU200	Rohde & Schwarz	112902	Rohde & Schwarz	2012/1/10
	TD10305	WiMAX Comm. Tester	CMW270	Rohde & Schwarz	100378	Rohde & Schwarz	2012/4/13
	IS10452	Wideband Radio Communication Tester	CMW500	Rohde & Schwarz	101183	Rohde & Schwarz	2012/8/28
	IS10541	Wideband Radio Communication Tester	CMW500	Rohde & Schwarz	126424	Rohde & Schwarz	2012/7/26
	IS10458	Digital Radio Tester for DECT	CTS60	Rohde & Schwarz	100947	Rohde & Schwarz	2011/10/10
	IS10374	Bluetooth Tester	MT8852B-042	Anritsu Corporation	1040003	Anritsu Corporation	2011/11/4
	IS10386	Signaling Tester	MD8470A	Anritsu Corporation	6200893236	Anritsu Corporation	2012/2/8
	TD10146	DC Power Supply	E3645A	Agilent Technologies	MY40000898	DSP Research, Inc.	2012/3/26
	IS10308	Dual Output DC Power Supply	E3648A	Agilent Technologies	MY09380004	DSP Research, Inc.	2012/3/26
	IS10137	Digital Phosphor Oscilloscope	TDS3032B	Tektronix Technology	B015188	Anritsu Corporation	2011/11/1
	IS10100	Digital Storage scope	DS8706	IWATSU	81571106	Anritsu Corporation	2011/11/1
	IS10106	Level Test Set	AE-9311	ANDO Electric	60361609	FUJITSU FACILITIES Ltd	2011/10/28
	IS10108	Telephone Unit Tester	AE-9303	ANDO Electric	60419502	FUJITSU FACILITIES Ltd	2011/10/28
	IS10211	Digital Insulation Tester	MY40-01	YOKOGAWA	84NA1249	Anritsu Corporation	2011/11/2
	IS10115	Level Meter	LM312	Oi Electric	100900	Anritsu Corporation	2011/11/1
	IS10212	Network/Spectrum Analyzer	MS420B	Anritsu Corporation	M27193	Anritsu Corporation	2011/11/9
	IS10249	Signaling Tester	MD1620C	Anritsu Corporation	M83464	Anritsu Corporation	2011/11/4
	IS10113	Oscillator	AG203D	KENWOOD	2050006	Anritsu Corporation	2011/11/10
	IS10071	ISDN Simulator	i6492	AD System Corporation	606575	DSP Research, Inc.	2011/10/6
	IS10072	ISDN Simulator	J-6004	AD System Corporation	40139	DSP Research, Inc.	2011/10/6
	IS10004	ISDN Simulator	J-9124AM	AD System Corporation	709546	DSP Research, Inc.	2011/10/6
	TD10226	802.11MON	DFS_Monitor1	DSP Research, Inc.	-----	DSP Research, Inc.	2011/10/6
	IS10170	SIP Protocol Monitor	CX750A	DSP Research, Inc.	-----	DSP Research, Inc.	2012/2/27

- Note : 1. The calibration of measurement equipment is valid for a one year period.  
 2. "X" used equipment.

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### 4. About Uncertainty of Measured Value

\*In this test, the influence of an error or uncertainty may be done according to the following factors.

- Bias of a measurement equipment, Change by aging, Attrition, Noise
- Skill and capability of an inspector
- Environment (Temperature, Humidity)
- Dispersion in a EUT (Equipment Under Test)
- Uncertainty of calibration of a measurement equipment

Therefore, Synthetic uncertainty is calculated using "k=2" of coverage factor, and about 95% of confidence level shall be obtained.

In consideration of the above, it judged as follows.

JUDGE	Measured value and Standard limit value	
PASS	<b>Case1</b>	*Even if it takes uncertainty into consideration, a standard limit value is fulfilled.
	<b>Case2</b>	*Although measured value is in a standard limit value, a limit value won't be fulfilled if uncertainty is taken into consideration.
FAIL	<b>Case3</b>	*Although measured value exceeds a standard limit value, a limit value will be fulfilled if uncertainty is taken into consideration.
	<b>Case4</b>	*Even if it takes uncertainty into consideration, a standard limit value isn't fulfilled.

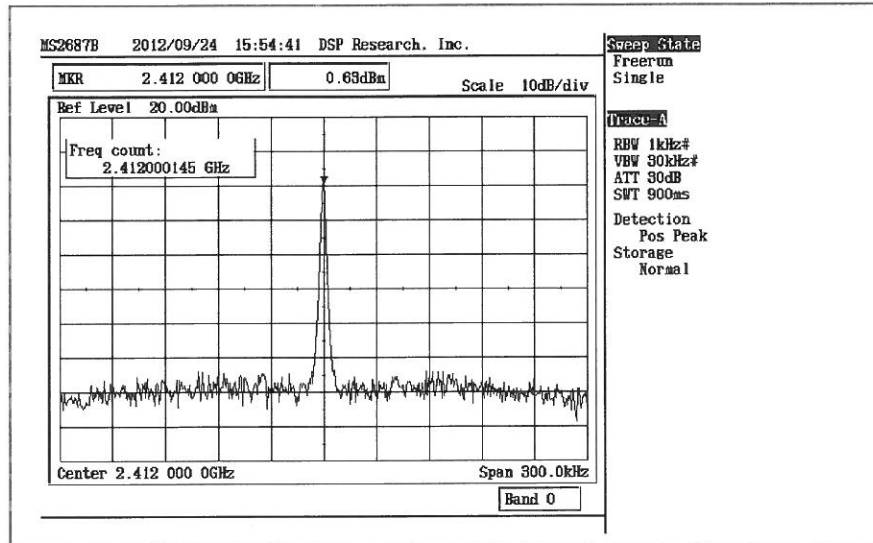
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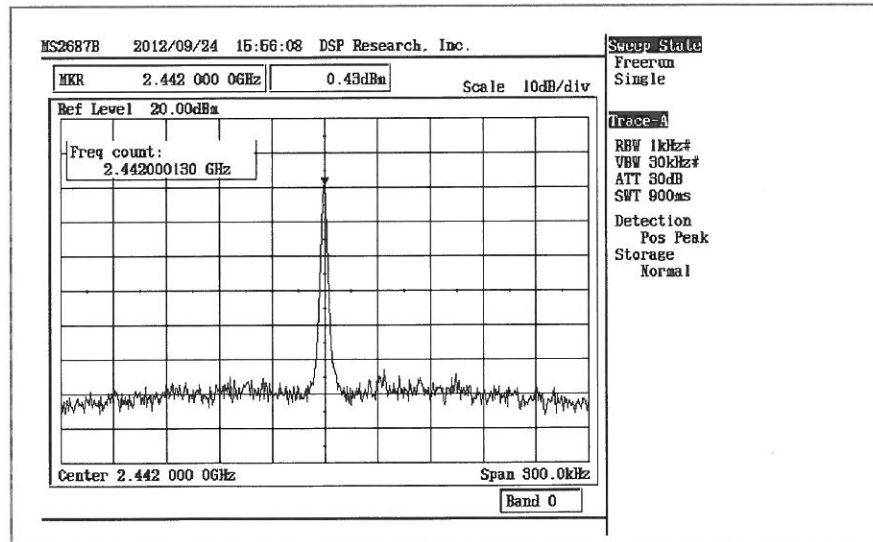
### 5A. < Appendix > TX1 Measurement Result

#### 5A.1. Frequency Tolerance

Channel 1: 2412MHz TX1



Channel 7: 2442MHz TX1



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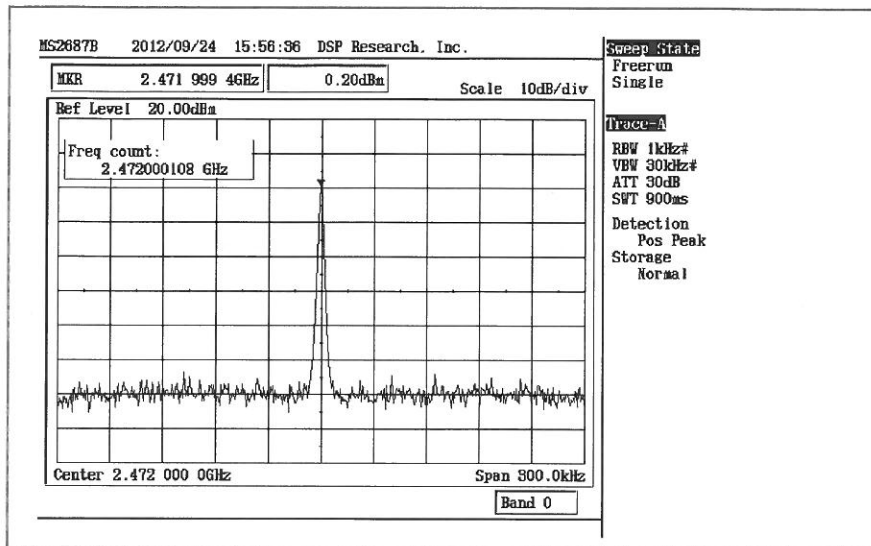
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Channel 13: 2472MHz TX1



Measurement Frequency	Reading Frequency	Frequency Tolerance	LIMIT	RESULT
2412 MHz	2412.000145 MHz	0.0601 ppm	±50ppm	PASS
2442 MHz	2442.000130 MHz	0.0532 ppm	±50ppm	PASS
2472 MHz	2472.000108 MHz	0.0437 ppm	±50ppm	PASS

***\*Japanese Regulation\****

- *Frequency Tolerance shall be within ±50ppm.*

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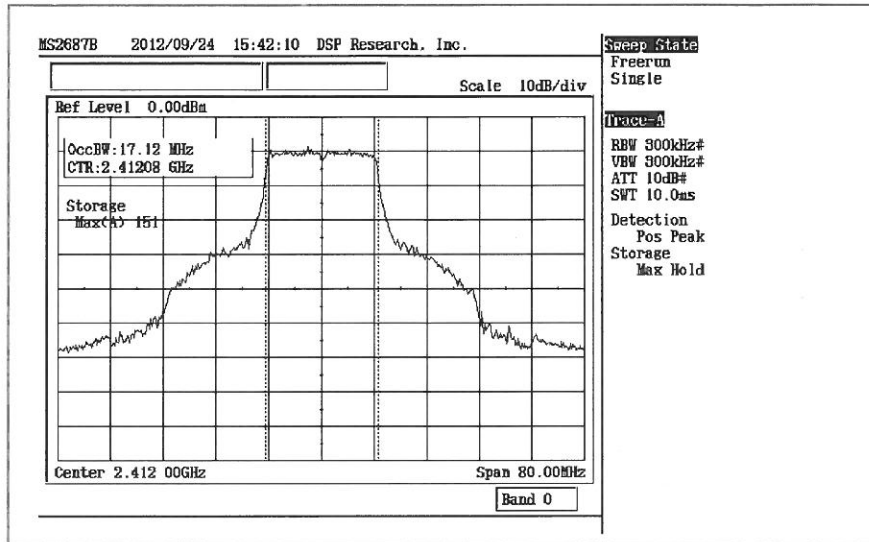
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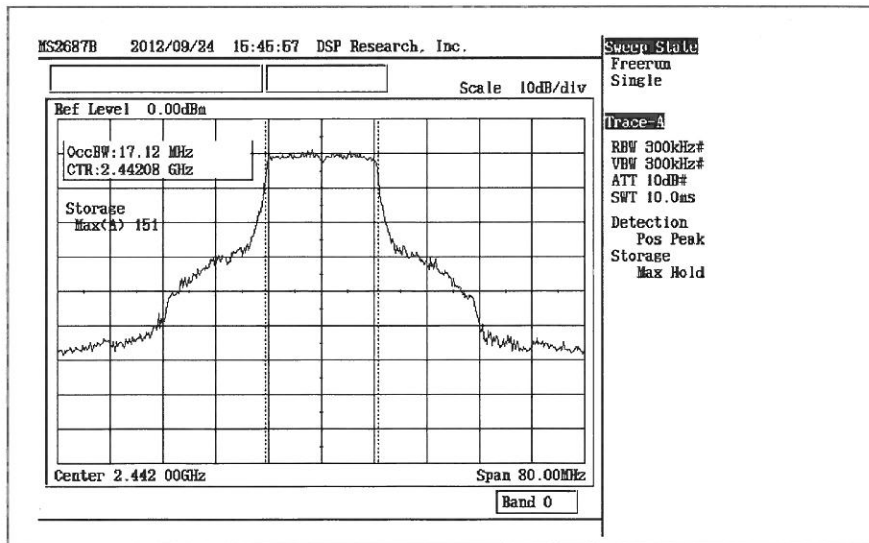
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### 5A.2. Occupied Bandwidth and Spread Bandwidth

Channel 1: 2412MHz TX1



Channel 7: 2442MHz TX1



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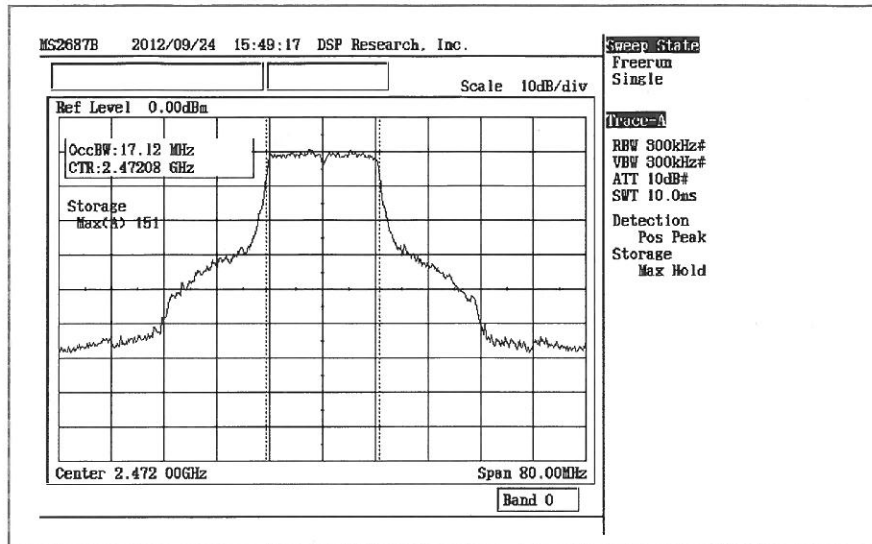
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**Channel 13: 2472MHz TX1**



Measurement Frequency	Category	Measurement Value	LIMIT	RESULT
2412 MHz	Occupied Bandwidth	17.1 MHz	26 MHz or below	PASS
	Spread Bandwidth	15.0 MHz	<Reference>	-----
	Spread Factor			-----
2442 MHz	Occupied Bandwidth	17.1 MHz	26 MHz or below	PASS
	Spread Bandwidth	15.0 MHz	<Reference>	-----
	Spread Factor			-----
2472 MHz	Occupied Bandwidth	17.1 MHz	26 MHz or below	PASS
	Spread Bandwidth	15.0 MHz	<Reference>	-----
	Spread Factor			-----

**\*Japanese Regulation\***

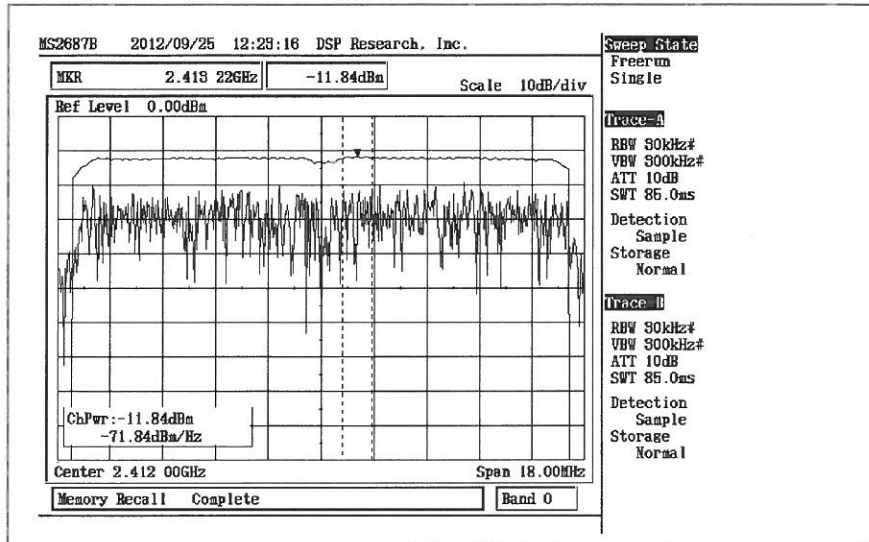
- Occupied Bandwidth shall be 26MHz or below.

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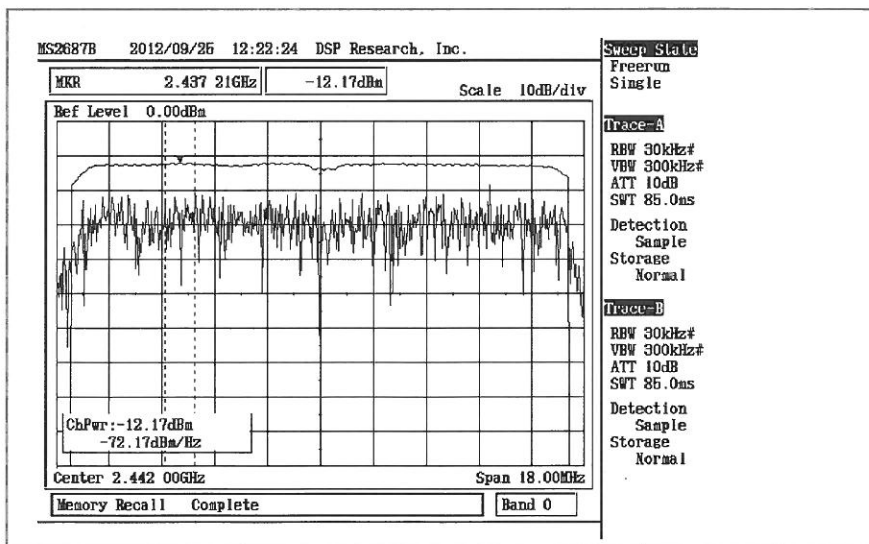
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### 5A.3. Transmission Output Power

Channel 1: 2412MHz TX1



Channel 7: 2442MHz TX1



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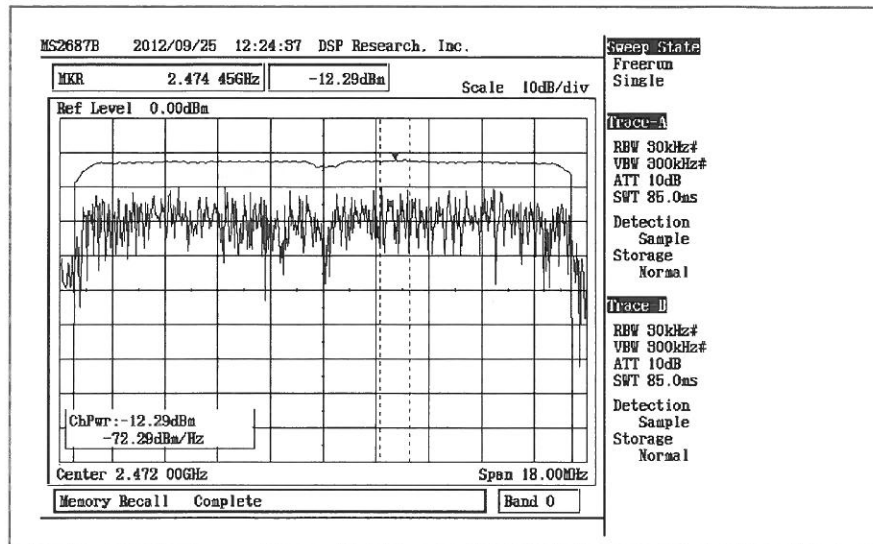
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Channel 13: 2472MHz TX1



Declaration Output Power :	Upper Limit	Result
3 mW/MHz	10 mW/MHz	PASS

Measurement Frequency	Category	Measurement Value	LIMIT
2412 MHz	Output Power	3.579 dBm/MHz	-----
		2.280 mW/MHz	
	Power Tolerance	-24.01 %	+20% to -80%
2442 MHz	Output Power	3.249 dBm/MHz	-----
		2.113 mW/MHz	
	Power Tolerance	-29.57 %	+20% to -80%
2472 MHz	Output Power	3.129 dBm/MHz	-----
		2.055 mW/MHz	
	Power Tolerance	-31.49 %	+20% to -80%

*\*Japanese Regulation\**

- *Output Power shall be 10mW/MHz or less.*
- *Output Power Tolerance shall be range from +20% to -80%.*

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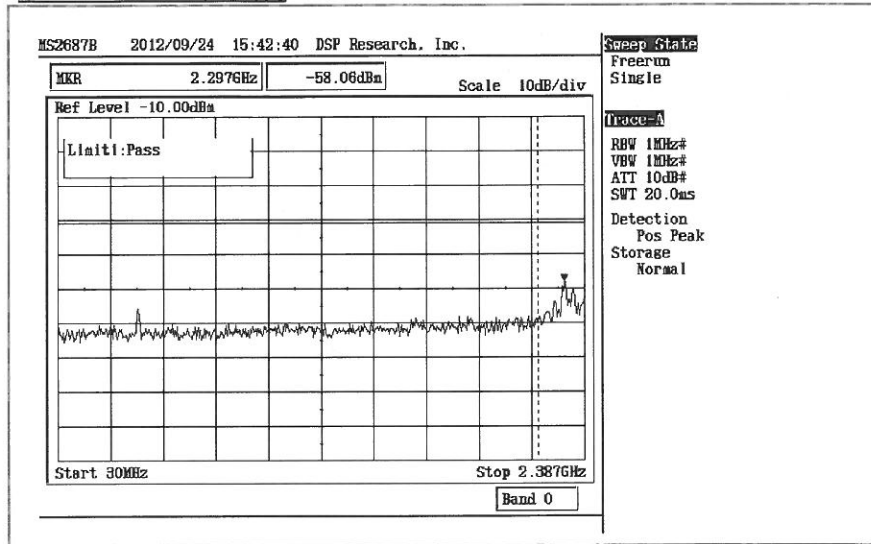
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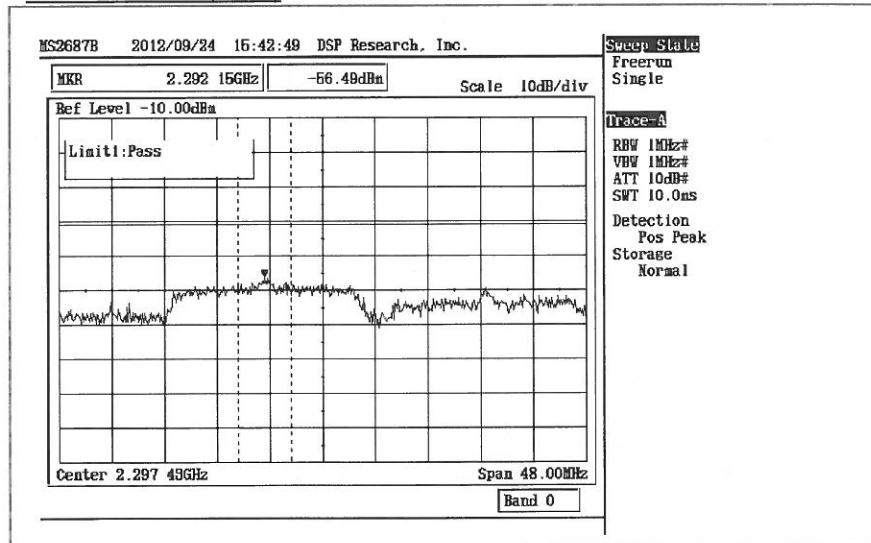
### 5A.4. Unwanted Emission Strength

Channel 1: 2412MHz TX1

30MHz-2387MHz (Search)



30MHz-2387MHz (Detail)



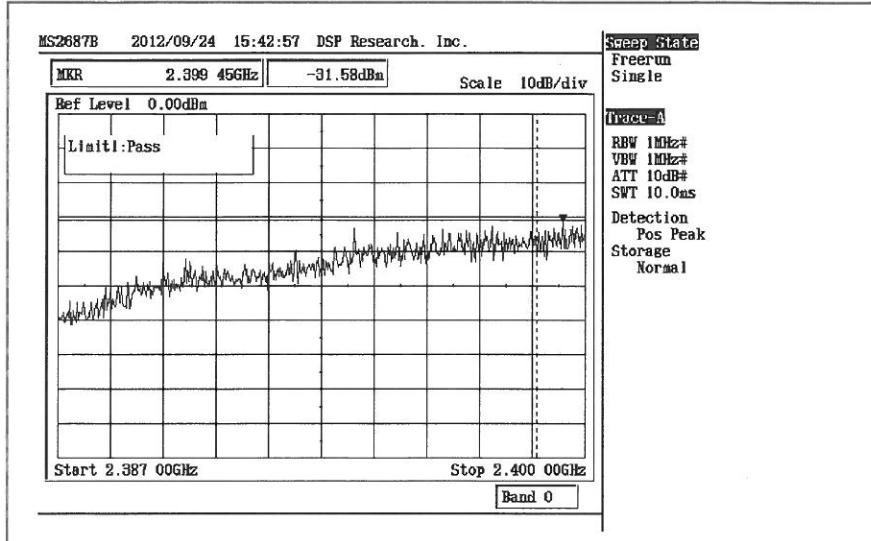
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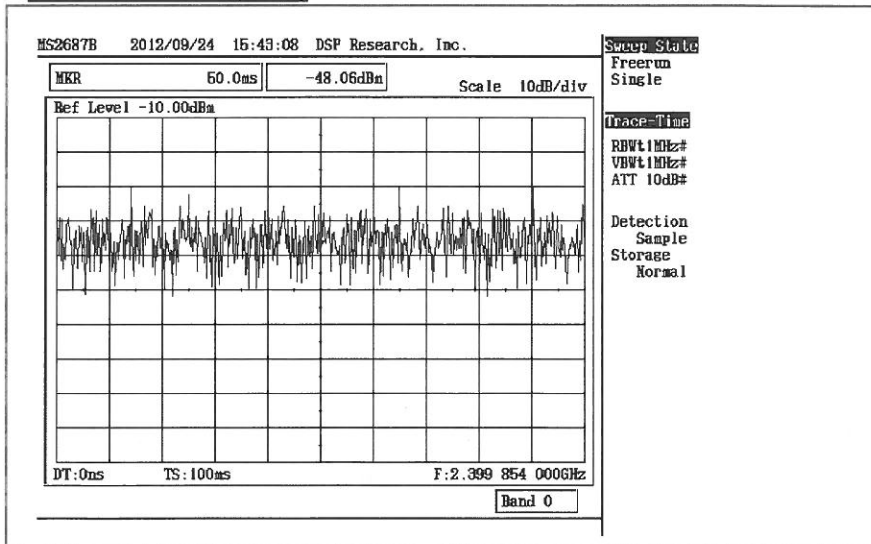
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Channel 1: 2412MHz TX1

2387MHz-2400MHz (Search)



2387MHz-2400MHz (Detail)



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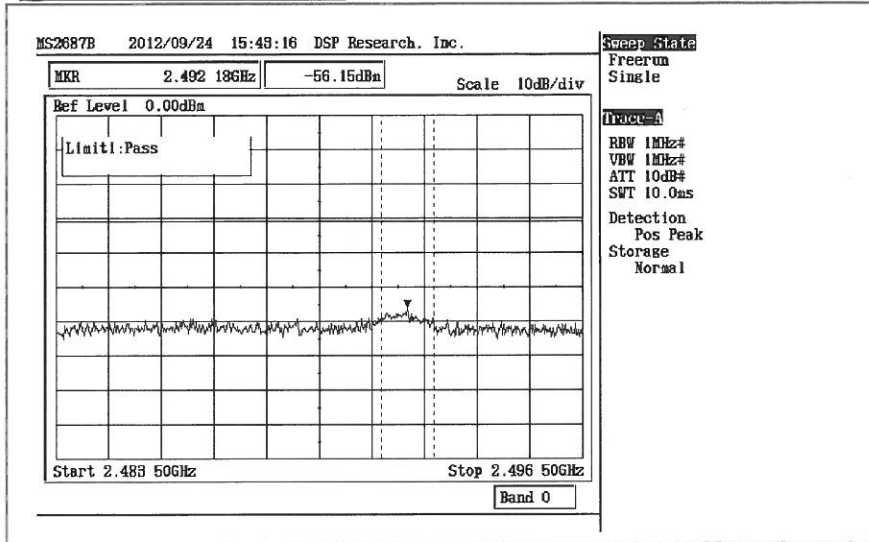
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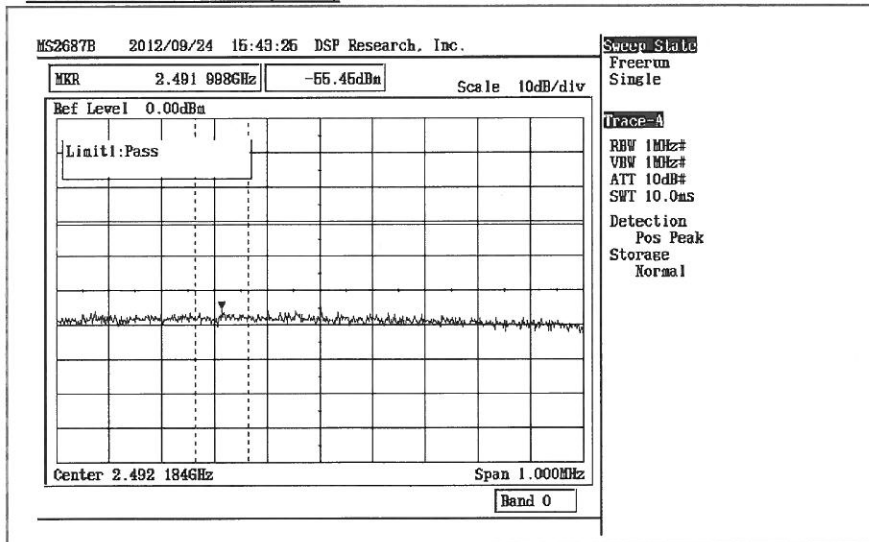
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**Channel 1: 2412MHz TX1**

2483.5MHz-2496.5MHz (Search)



2483.5MHz-2496.5MHz (Detail)



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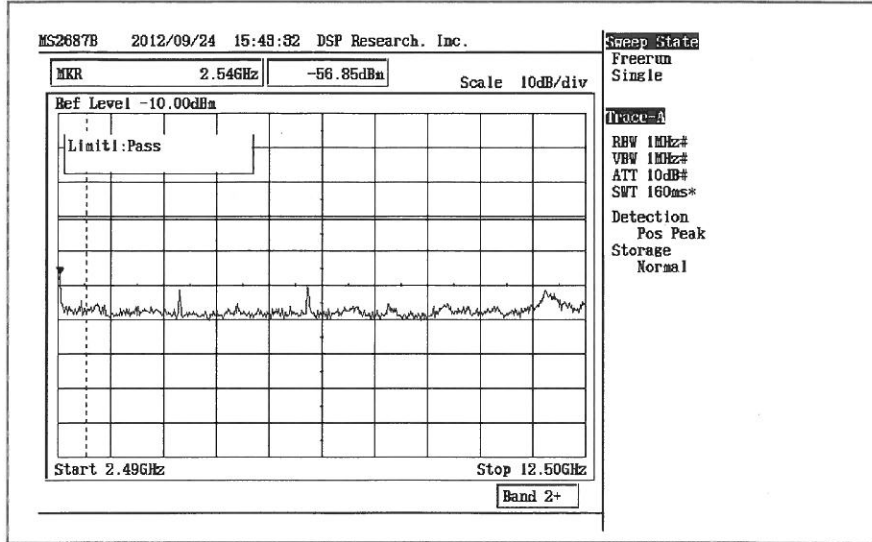
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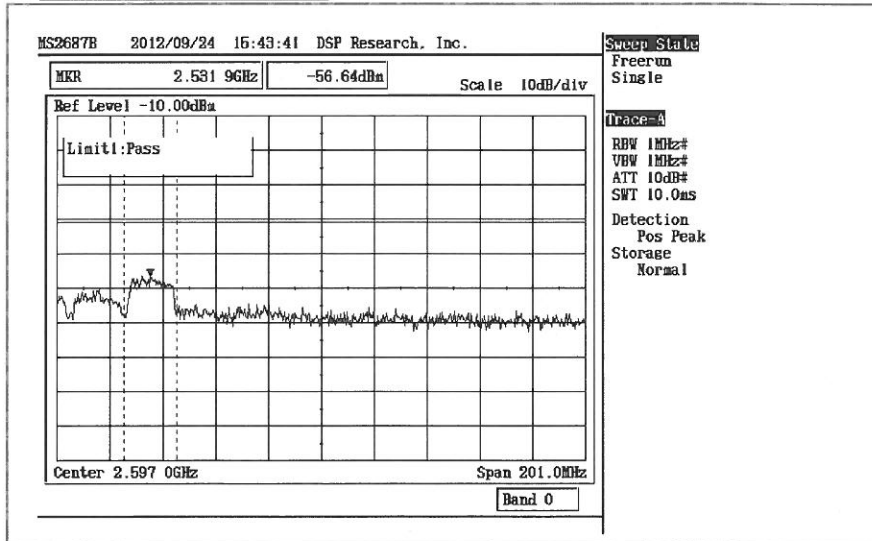
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Channel 1: 2412MHz TX1

2496.5MHz-12.5GHz (Search)



2496.5MHz-12.5GHz (Detail)



Frequency Range	Frequency	Measurement Value	LIMIT	RESULT
30MHz-2387MHz	2292.154MHz	-41.071dBm/MHz 0.078145 $\mu$ W/MHz	2.5 $\mu$ W/MHz	PASS
2387MHz-2400MHz	2399.854MHz	-27.3484dBm/MHz 1.841450 $\mu$ W/MHz	25 $\mu$ W/MHz	PASS
2483.5MHz-2496.5MHz	2491.998MHz	-40.031dBm/MHz 0.099289 $\mu$ W/MHz	25 $\mu$ W/MHz	PASS
2496.5MHz-12.5GHz	2531.876MHz	-41.221dBm/MHz 0.075492 $\mu$ W/MHz	2.5 $\mu$ W/MHz	PASS

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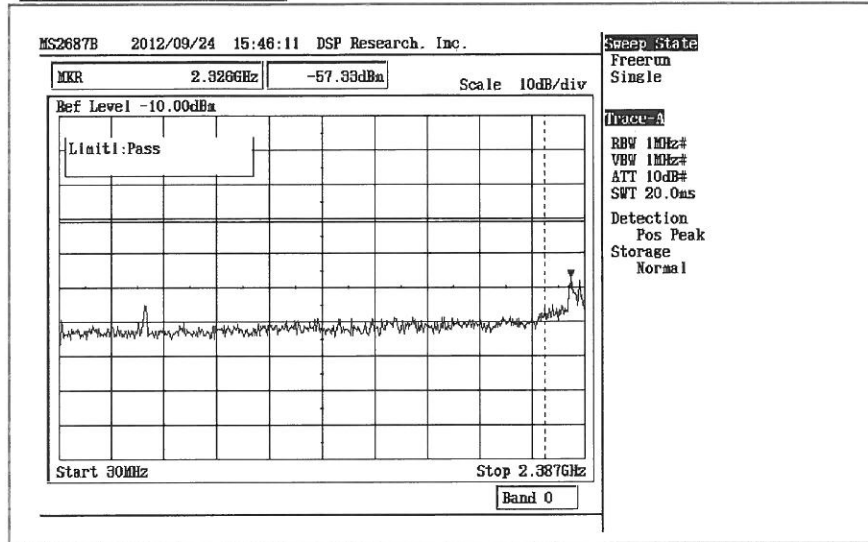
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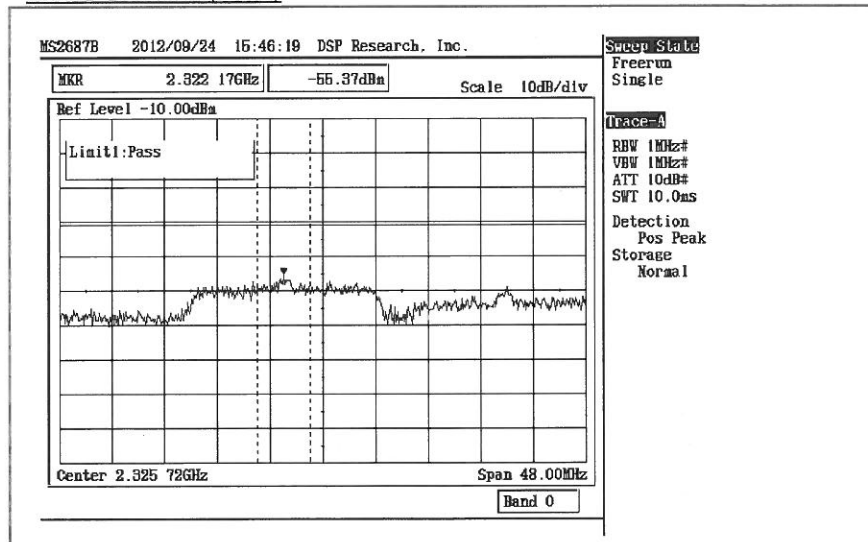
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**Channel 7: 2442MHz TX1**

**30MHz-2387MHz (Search)**



**30MHz-2387MHz (Detail)**



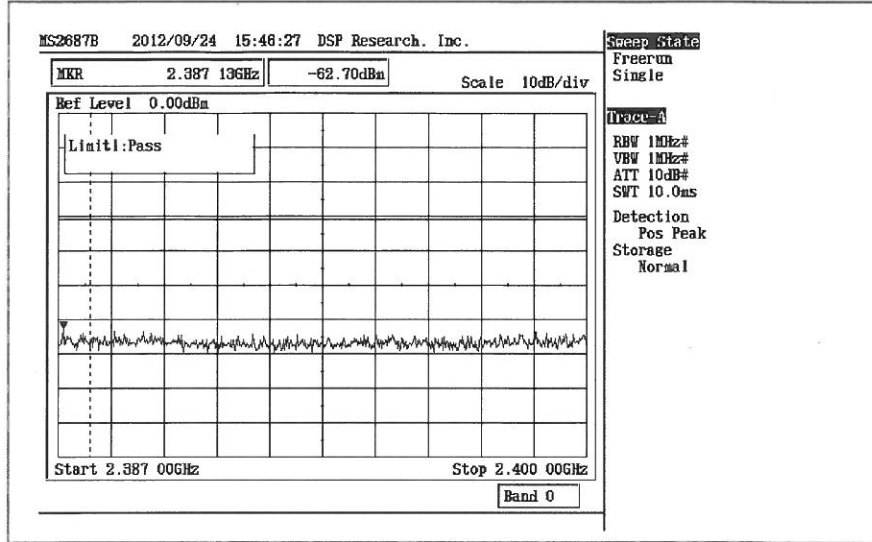
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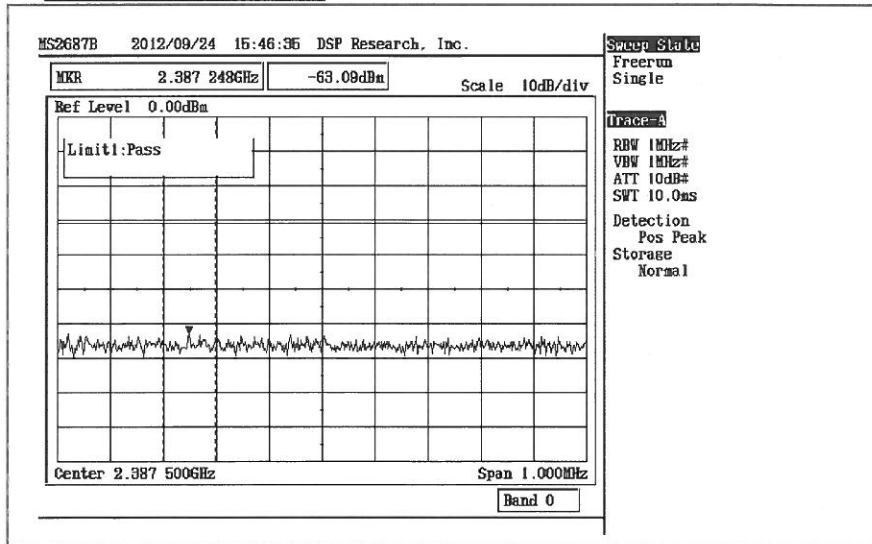
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**Channel 7: 2442MHz TX1**

**2387MHz-2400MHz (Search)**



**2387MHz-2400MHz (Detail)**



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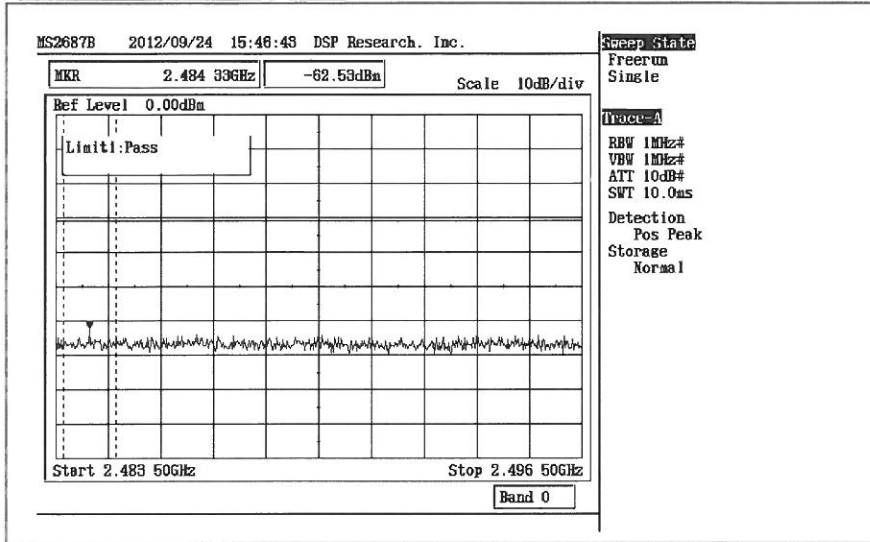
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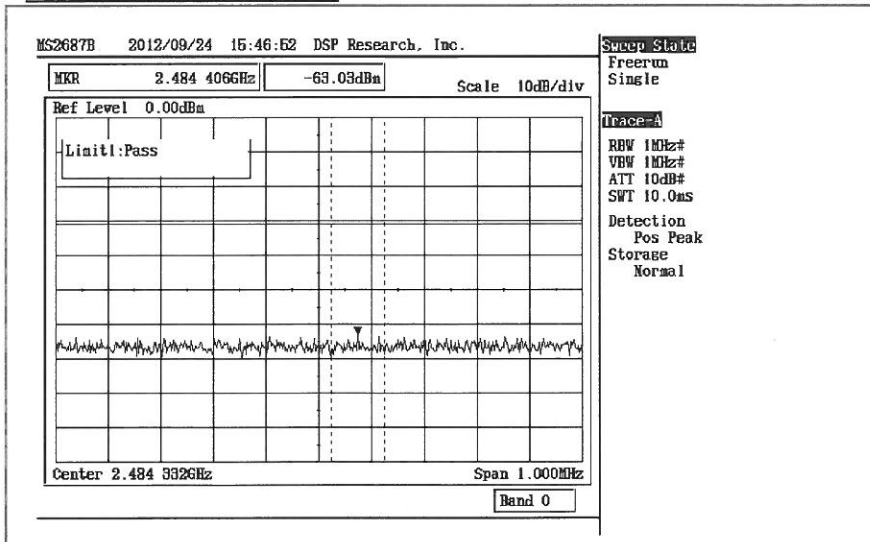
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**Channel 7: 2442MHz TX1**

**2483.5MHz-2496.5MHz (Search)**



**2483.5MHz-2496.5MHz (Detail)**



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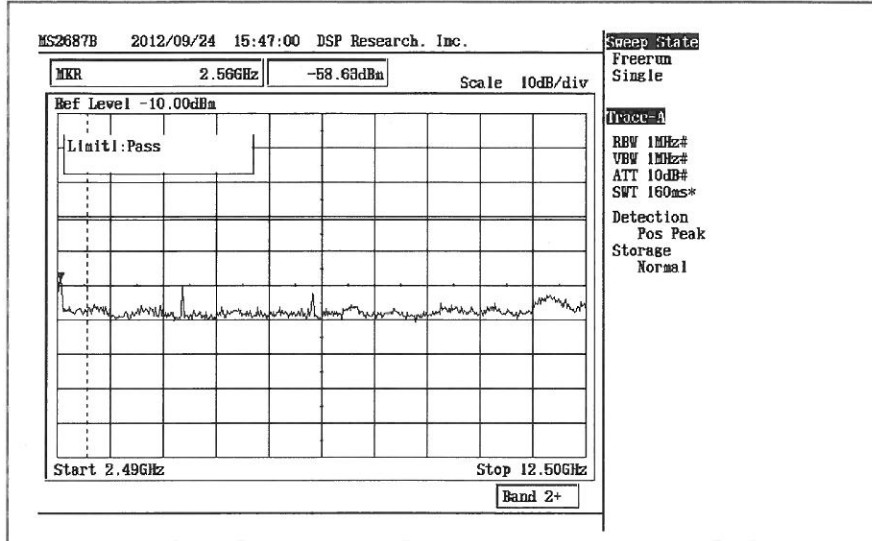
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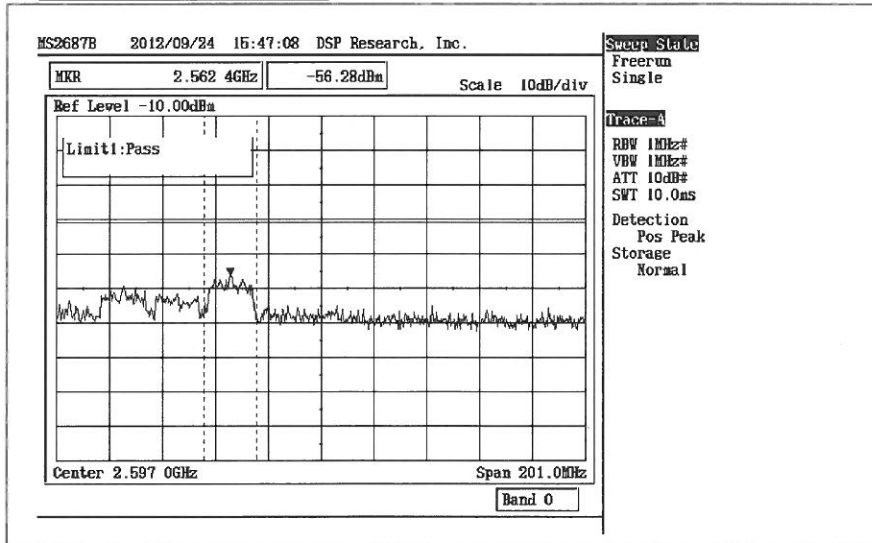


**Channel 7: 2442MHz TX1**

**2496.5MHz-12.5GHz (Search)**



**2496.5MHz-12.5GHz (Detail)**



Frequency Range	Frequency	Measurement Value		LIMIT	RESULT
30MHz-2387MHz	2322.166MHz	-39.951dBm/MHz	0.101135 $\mu$ W/MHz	2.5 $\mu$ W/MHz	PASS
2387MHz-2400MHz	2387.248MHz	-47.671dBm/MHz	0.017096 $\mu$ W/MHz	25 $\mu$ W/MHz	PASS
2483.5MHz-2496.5MHz	2484.406MHz	-47.611dBm/MHz	0.017334 $\mu$ W/MHz	25 $\mu$ W/MHz	PASS
2496.5MHz-12.5GHz	2562.428MHz	-40.861dBm/MHz	0.082016 $\mu$ W/MHz	2.5 $\mu$ W/MHz	PASS

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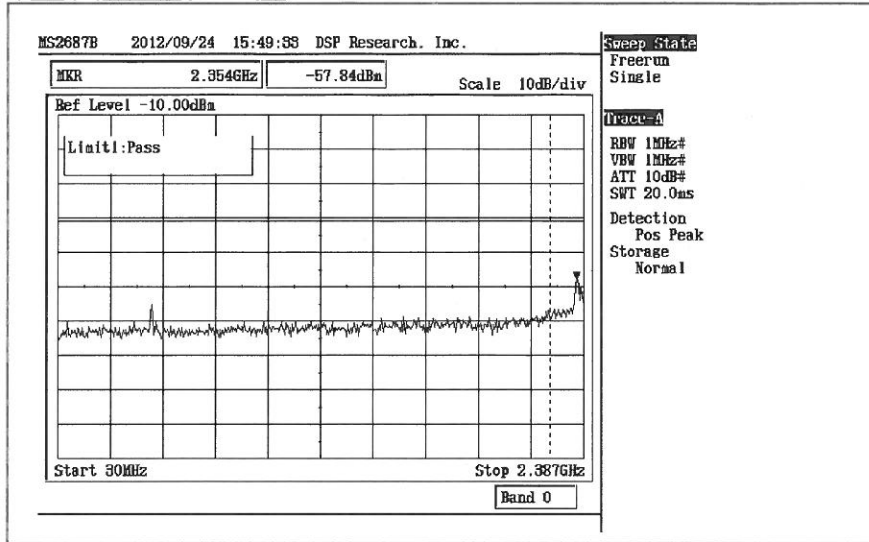
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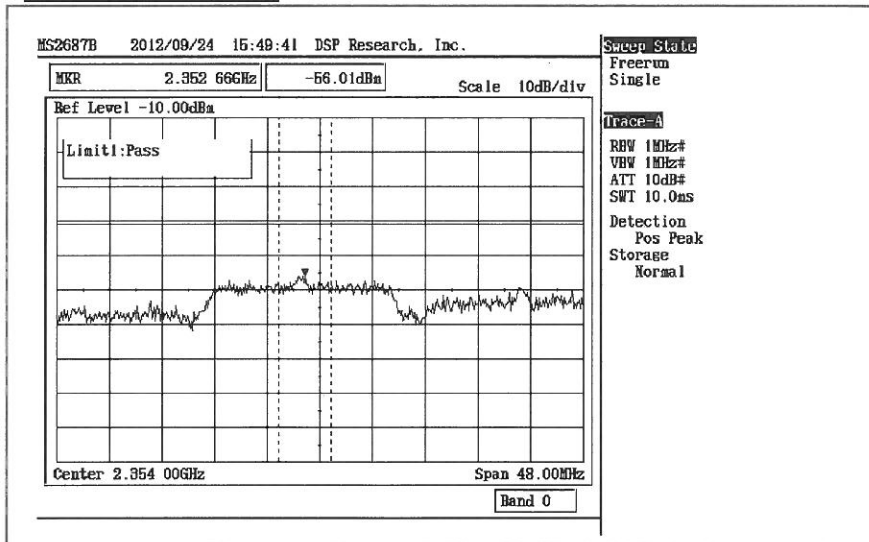
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**Channel 13: 2472MHz TX1**

**30MHz-2387MHz (Search)**



**30MHz-2387MHz (Detail)**



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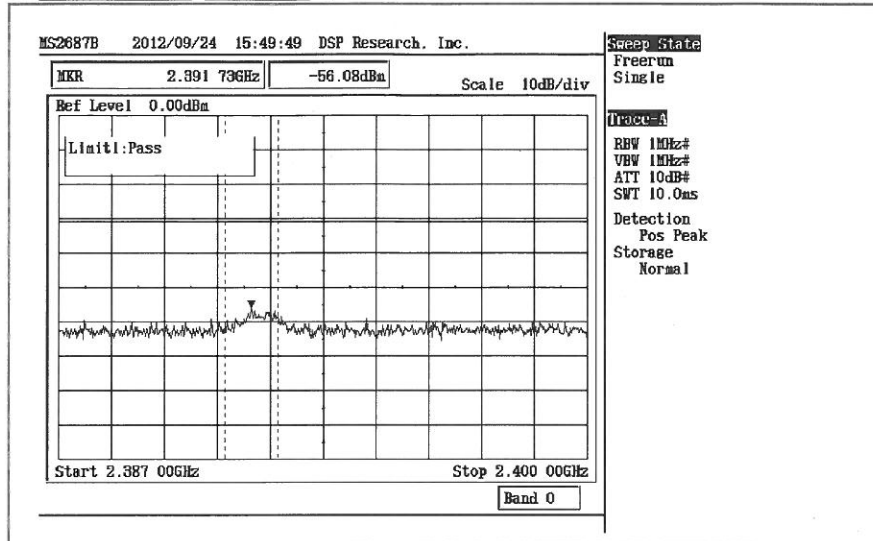
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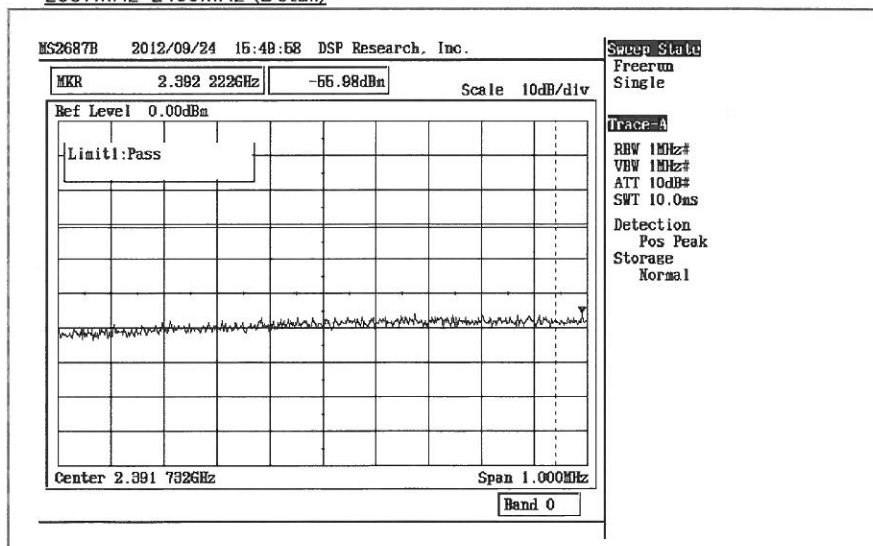
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Channel 13: 2472MHz TX1

2387MHz-2400MHz (Search)



2387MHz-2400MHz (Detail)



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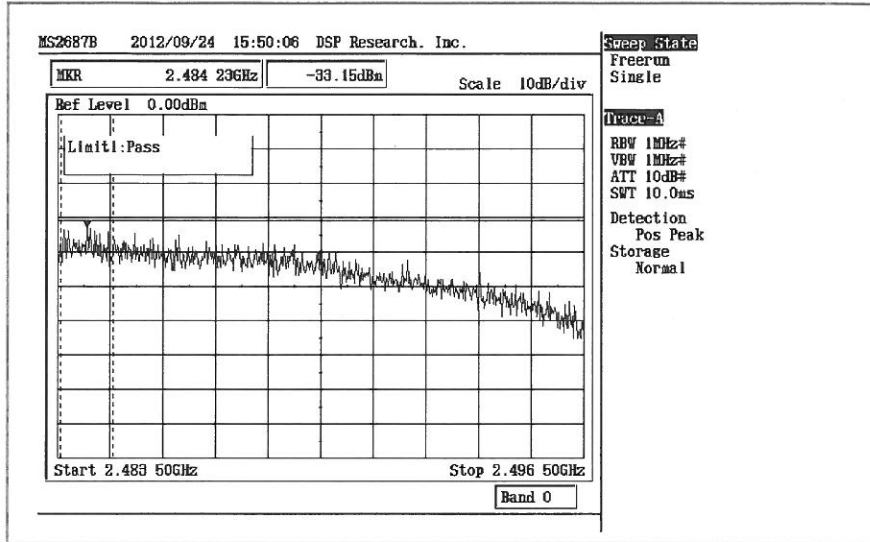
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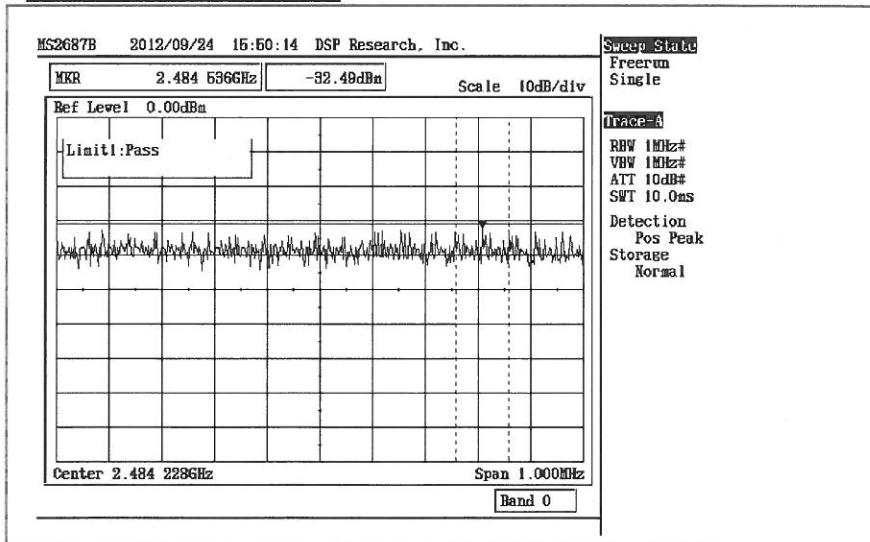
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**Channel 13: 2472MHz TX1**

**2483.5MHz-2496.5MHz (Search)**



**2483.5MHz-2496.5MHz (Detail)**



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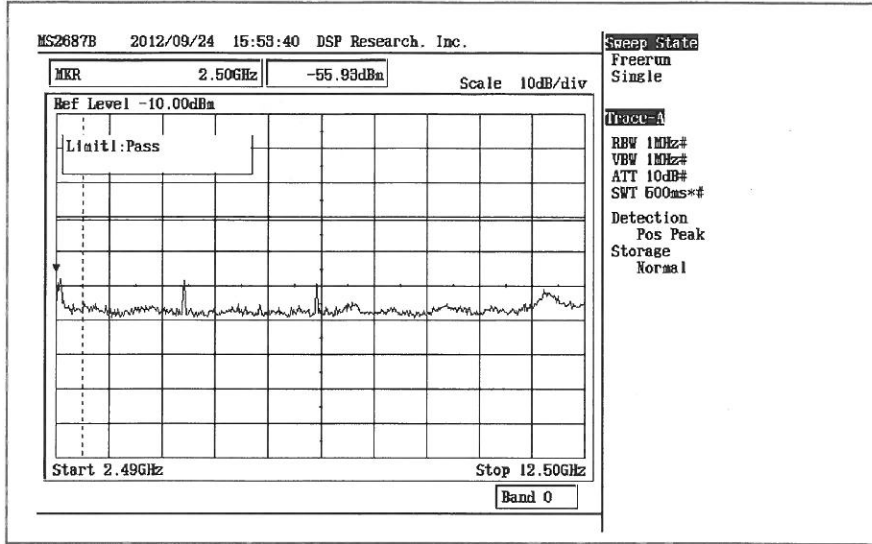
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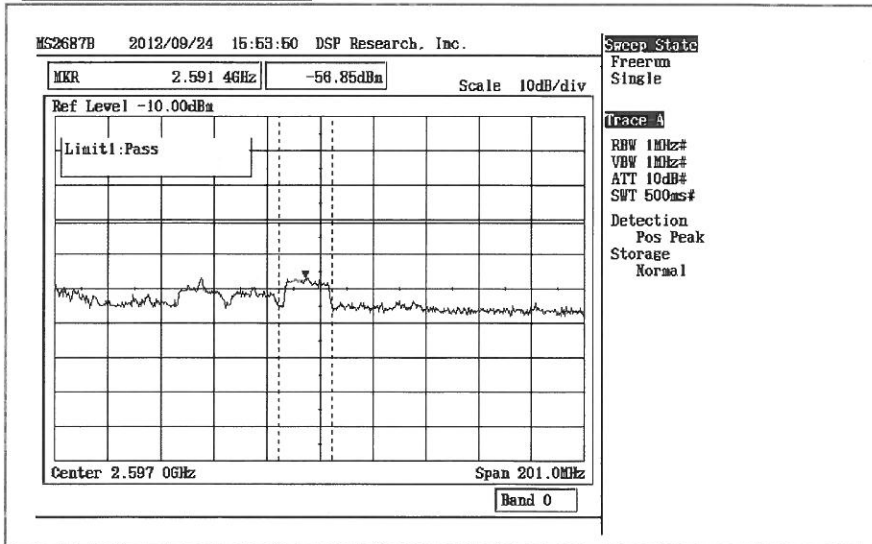
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**Channel 13: 2472MHz TX1**

**2496.5MHz-12.5GHz (Search)**



**2496.5MHz-12.5GHz (Detail)**



Frequency Range	Frequency	Measurement Value		LIMIT	RESULT
30MHz-2387MHz	2352.658MHz	-40.591dBm/MHz	0.087277 $\mu$ W/MHz	2.5 $\mu$ W/MHz	PASS
2387MHz-2400MHz	2392.222MHz	-40.561dBm/MHz	0.087882 $\mu$ W/MHz	25 $\mu$ W/MHz	PASS
2483.5MHz-2496.5MHz	2484.536MHz	-17.071dBm/MHz	19.629082 $\mu$ W/MHz	25 $\mu$ W/MHz	PASS
2496.5MHz-12.5GHz	2591.372MHz	-41.431dBm/MHz	0.071928 $\mu$ W/MHz	2.5 $\mu$ W/MHz	PASS

**\*Japanese Regulation\***

- 30MHz-2387MHz and 2496.5MHz-12.5GHz shall be 2.5microW or below.
- 2387MHz-2400MHz and 2483.5MHz-2496.5MHz shall be 25microW or below.

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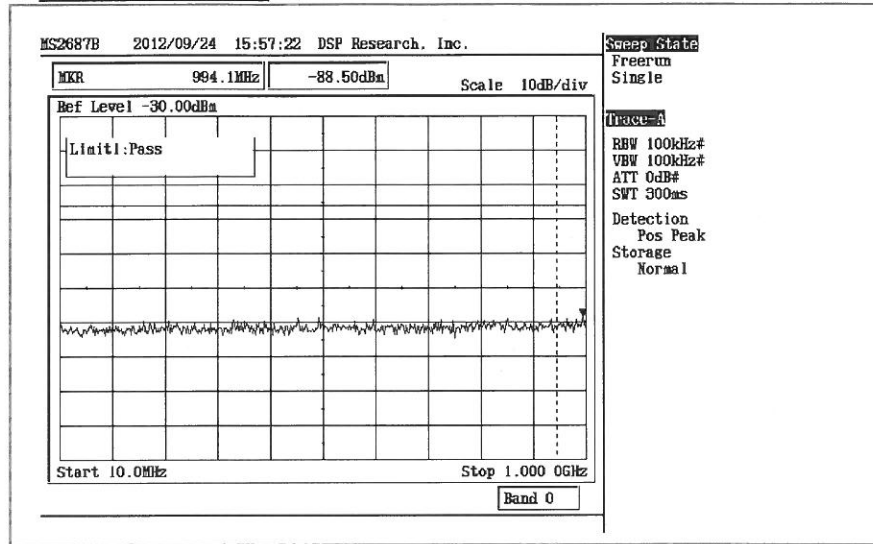
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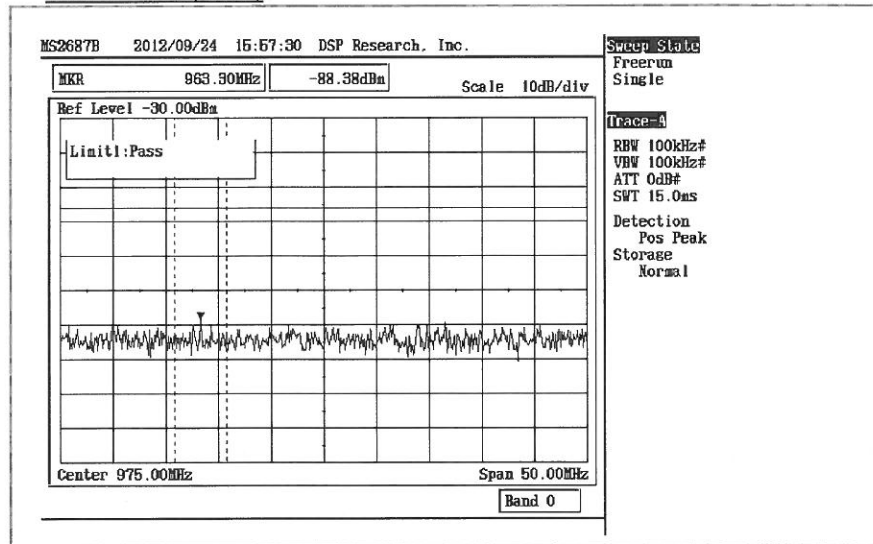
5A.5. Secondly Emitted Radio Wave Strength

Channel 1: 2412MHz RX1

10MHz-1GHz (Search)



10MHz-1GHz (Detail)



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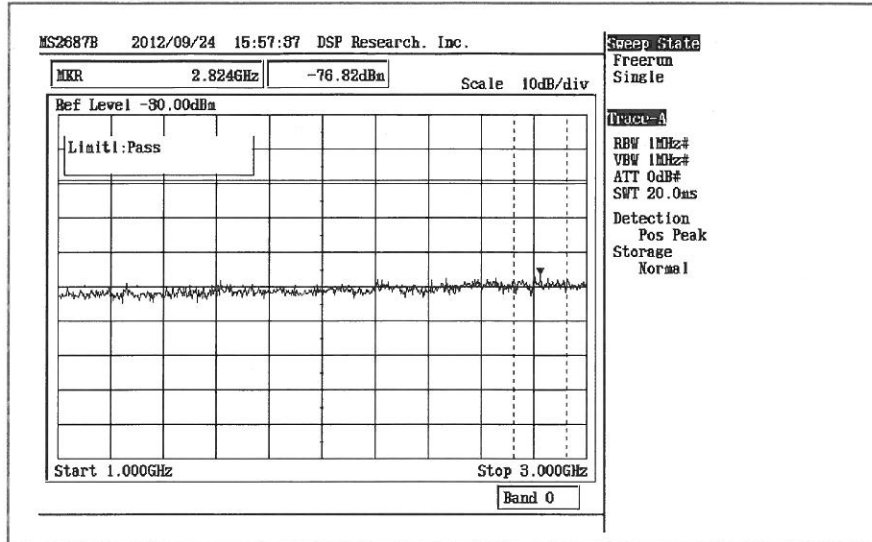
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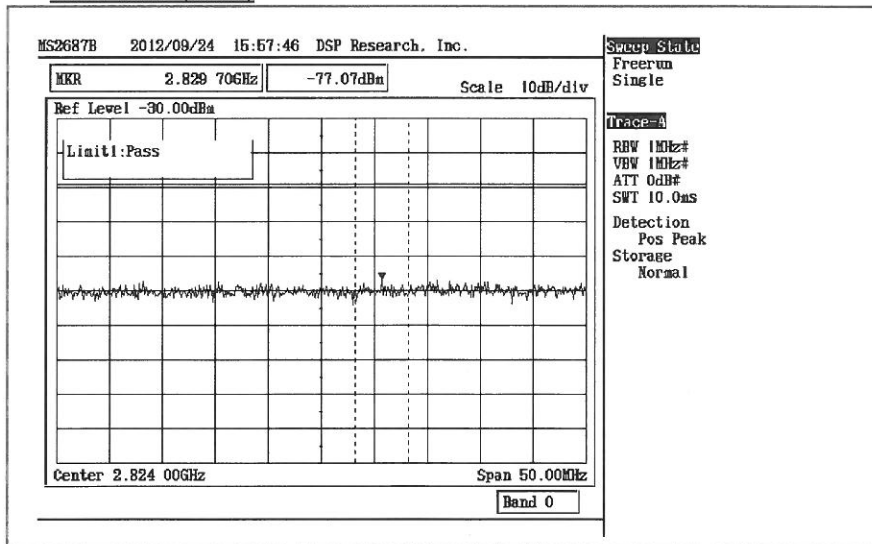
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**Channel 1: 2412MHz RX1**

1GHz-3GHz (Search)



1GHz-3GHz (Detail)



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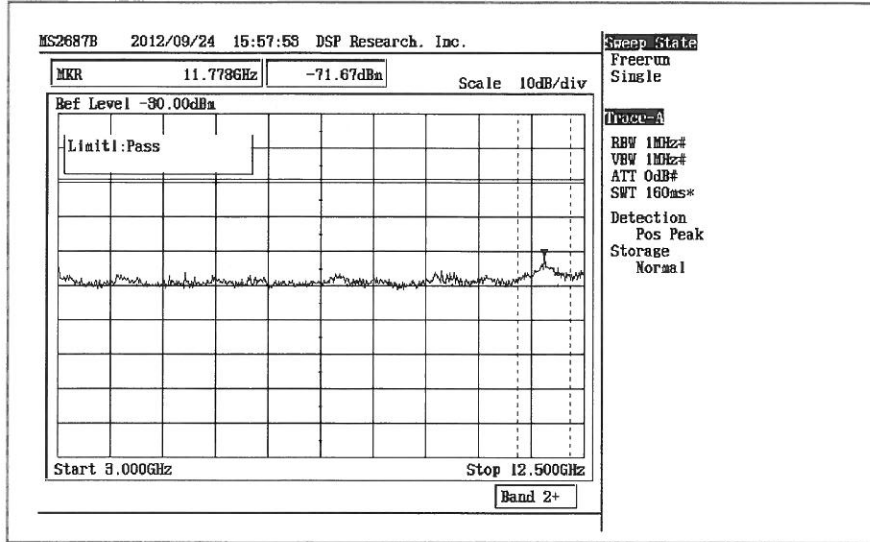
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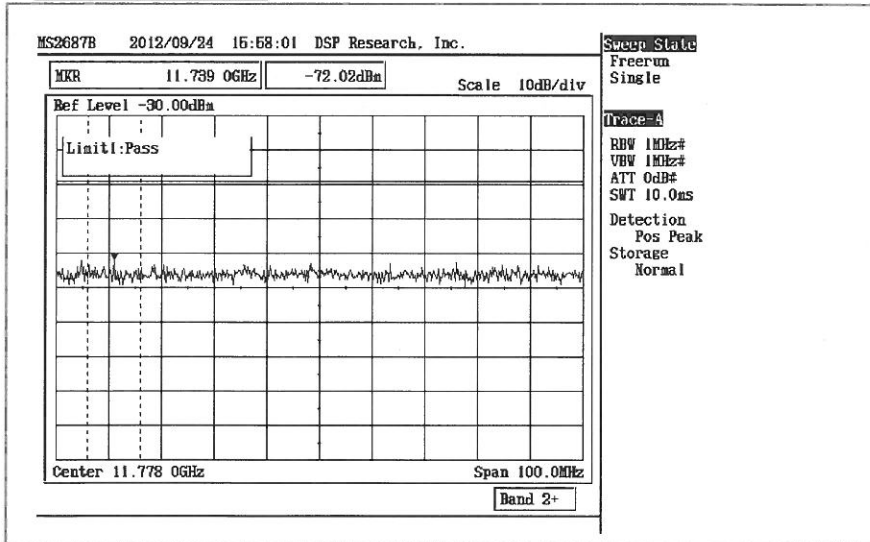
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**Channel 1: 2412MHz RX1**

3GHz-12.5GHz (Search)



3GHz-12.5GHz (Detail)



Frequency Range	Frequency	Measurement Value	LIMIT	RESULT
1GHz Under	963.3MHz	-85.794dBm 0.002634 nW	4 nW	PASS
1GHz Over	11739MHz	-69.434dBm 0.113920 nW	20 nW	PASS

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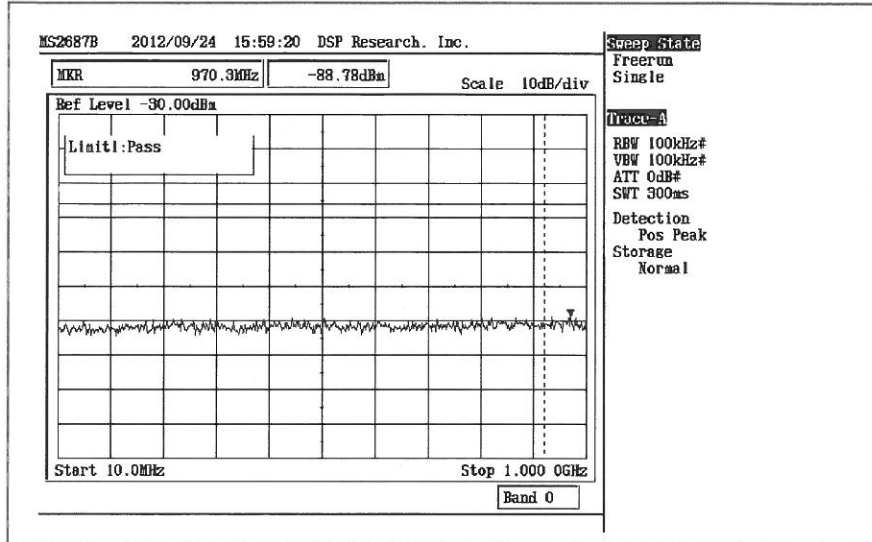
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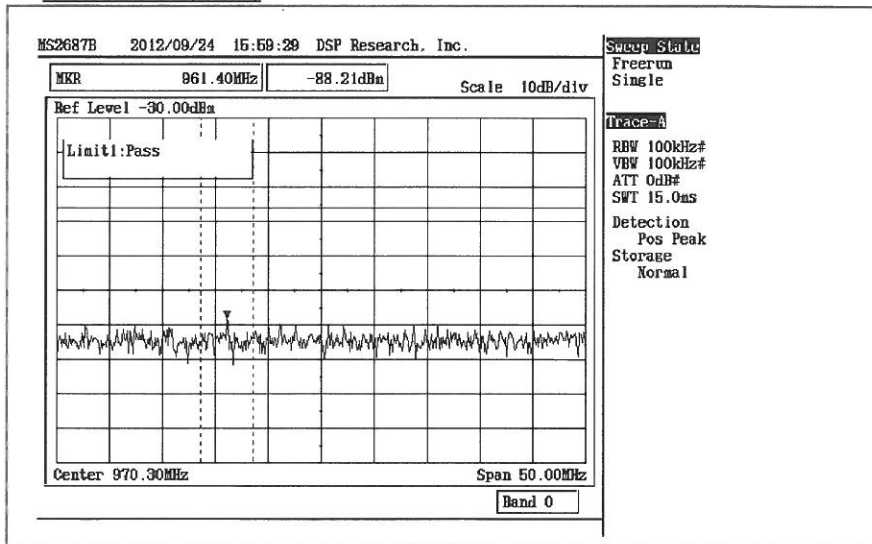


**Channel 7: 2442MHz RX1**

10MHz-1GHz (Search)



10MHz-1GHz (Detail)



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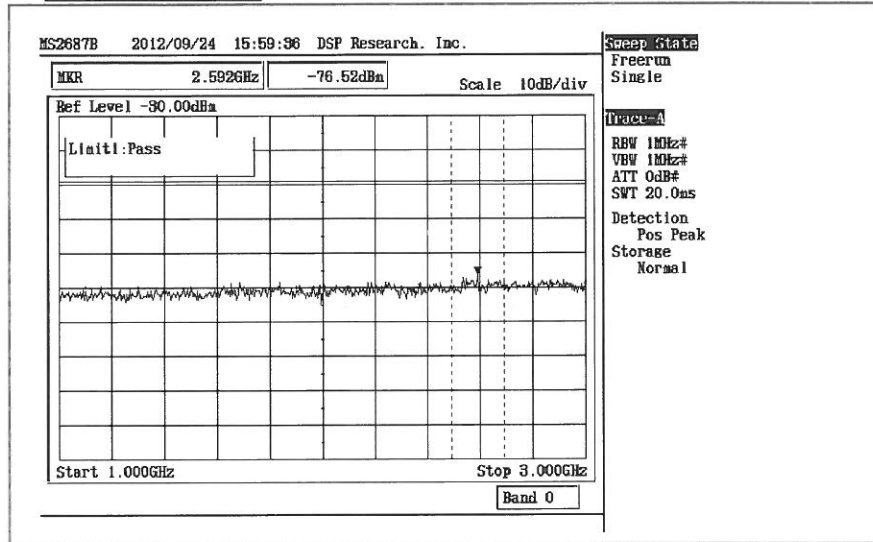
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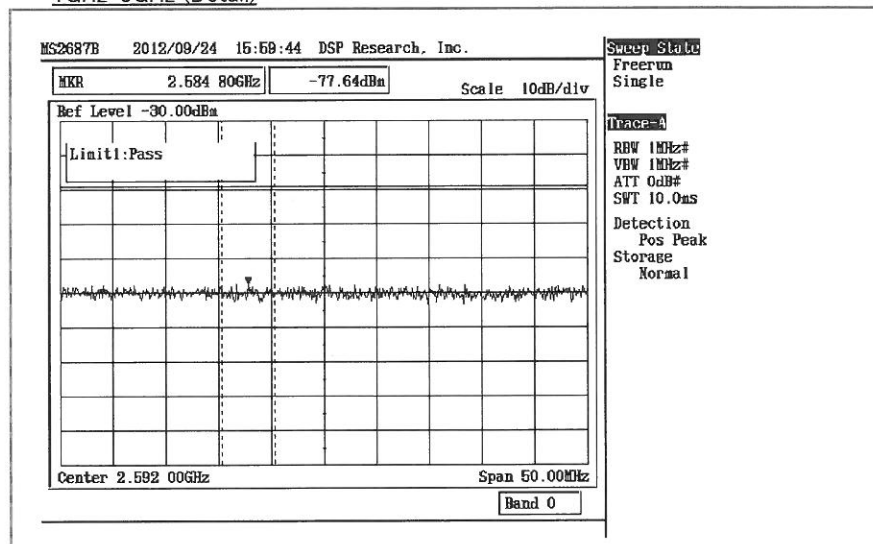
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**Channel 7: 2442MHz RX1**

1GHz-3GHz (Search)



1GHz-3GHz (Detail)



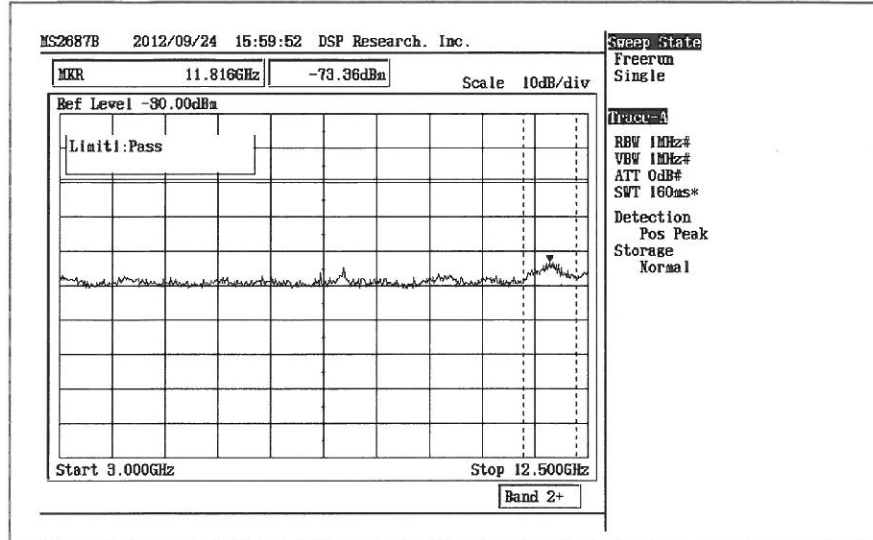
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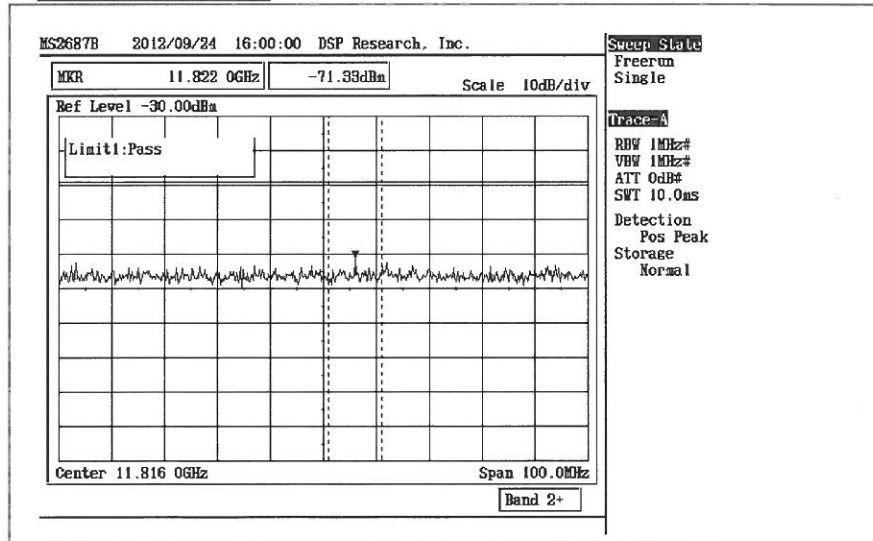
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**Channel 7: 2442MHz RX1**

**3GHz-12.5GHz (Search)**



**3GHz-12.5GHz (Detail)**



Frequency Range	Frequency	Measurement Value	LIMIT	RESULT
1GHz Under	961.4MHz	-85.624dBm 0.002739 nW	4 nW	PASS
1GHz Over	11822MHz	-68.744dBm 0.133537 nW	20 nW	PASS

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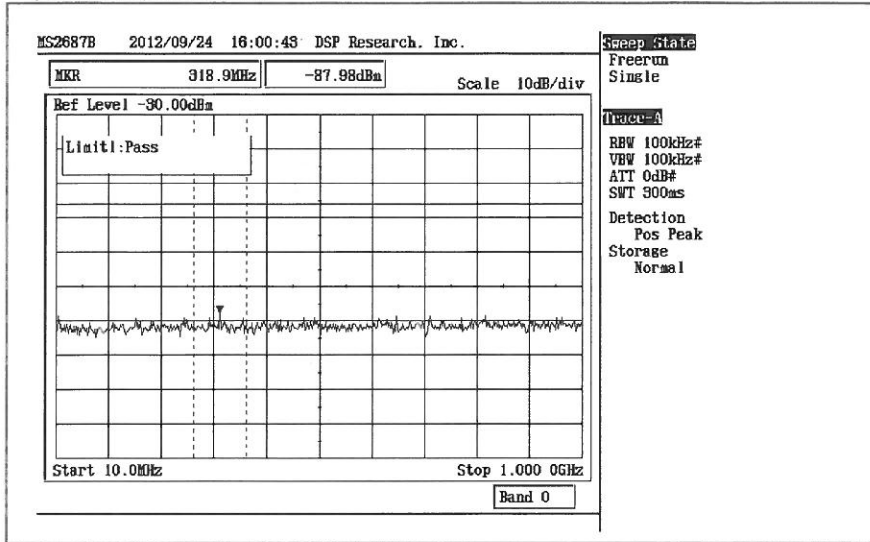
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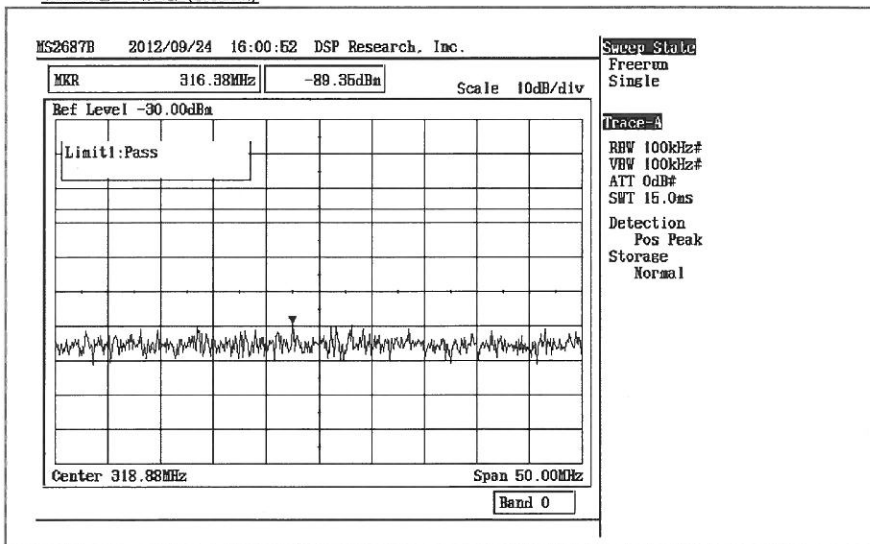
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**Channel 13: 2472MHz RX1**

10MHz-1GHz (Search)



10MHz-1GHz (Detail)



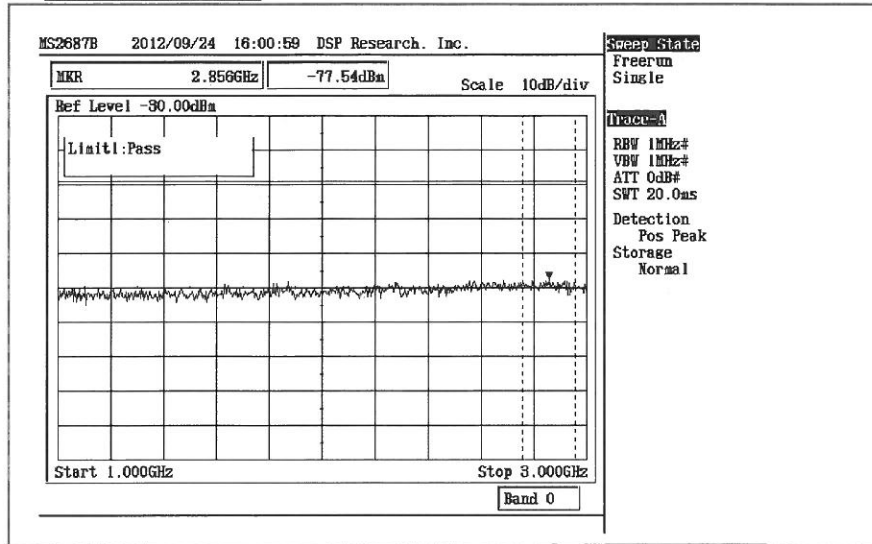
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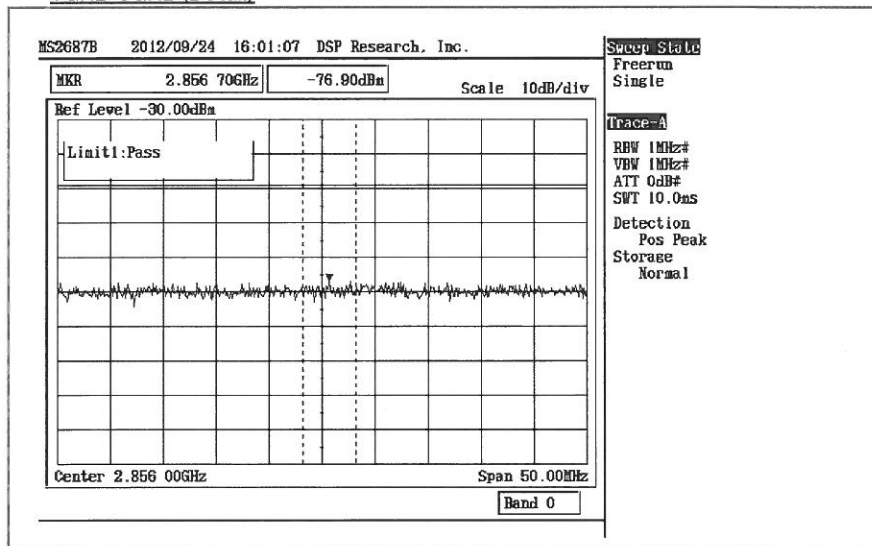
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**Channel 13: 2472MHz RX1**

1GHz-3GHz (Search)



1GHz-3GHz (Detail)



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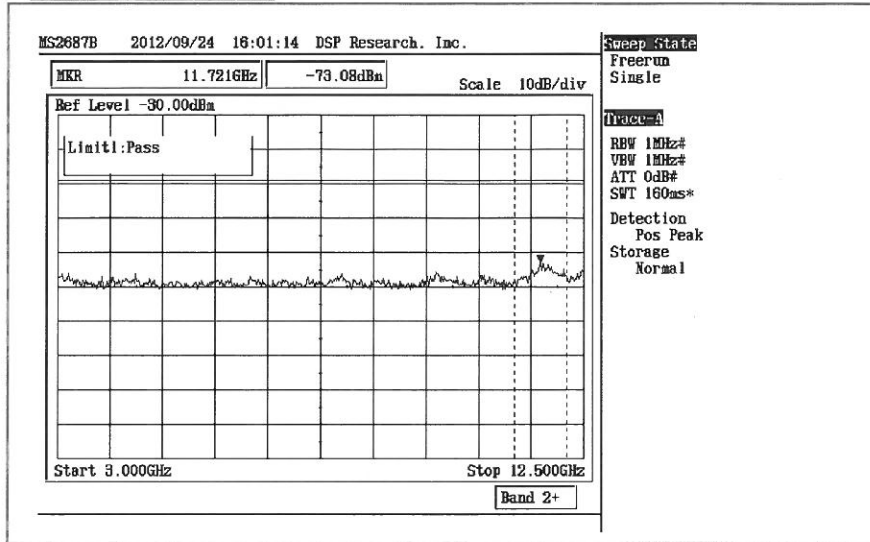
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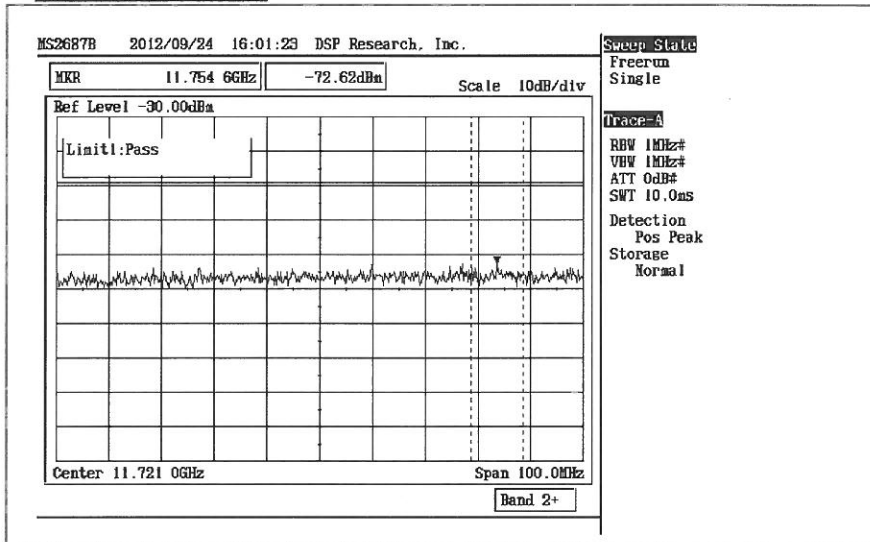
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**Channel 13: 2472MHz RX1**

3GHz-12.5GHz (Search)



3GHz-12.5GHz (Detail)



Frequency Range	Frequency	Measurement Value	LIMIT	RESULT
1GHz Under	316.38MHz	-86.764dBm 0.002107 nW	4 nW	PASS
1GHz Over	11754.6MHz	-70.034dBm 0.099220 nW	20 nW	PASS

***\*Japanese Regulation\****

- 1GHz under shall be 4nW or below.*
- 1GHz over shall be 20nW or below.*

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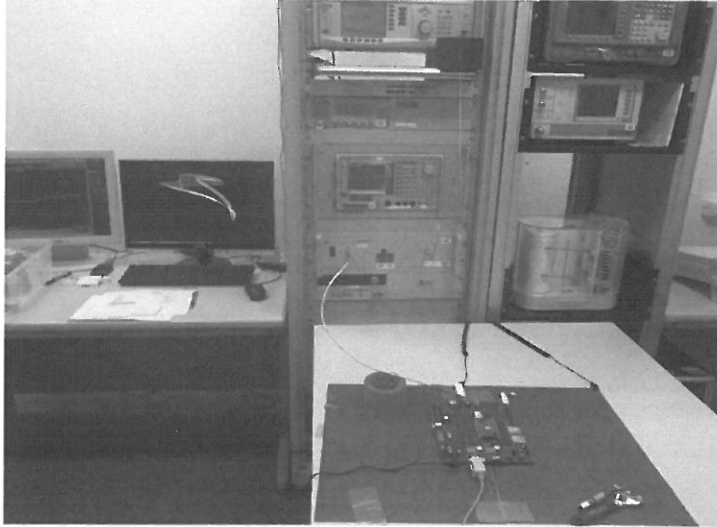
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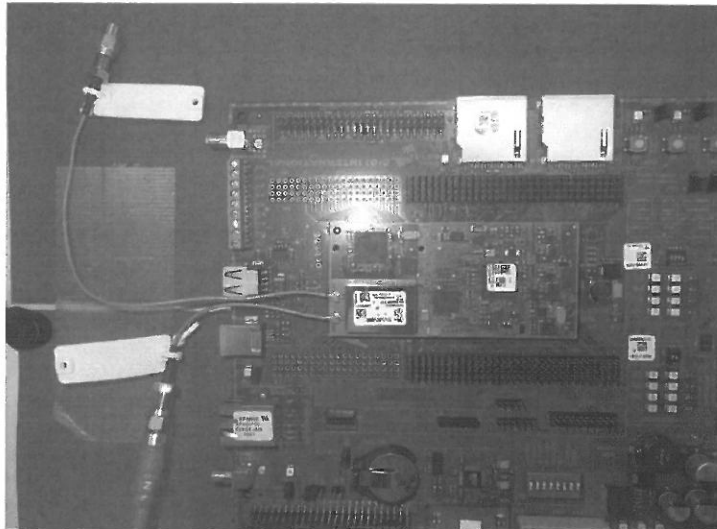
## 6. PHOTOGRAPHS

### 6.1. Test Conditions Photographs

RF Measurement Photo



Conducted Measurement Photo



**End of Report**

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