Nemko USA, Inc.
2210 Faraday Street, Suite 150
Carlsbad, CA 92008
Phone (760) 444-3500 Fax (760) 444-3505

CERTIFICATION TEST REPORT

Applicant:	LINEAR CORPORATION 1950 CAMINO VIDA ROBLE Carlsbad, CA 92008
Equipment Under Test (EUT):	REMOTE SPEAKER MICROPHONE SYSTEM
Model:	RSM-WALL
FCC ID: IC:	EF4AAE00452 1078A-AAE00452
In Accordance With:	FCC Part 15 Subpart C, 15.247 IC RSS-210 Issue 8 December 2010 IC RSS-Gen Issue 3 December 2010
Authorized By:	Nemko USA Inc. 11696 Sorrento Valley Road, Suite F San Diego, CA 92121
Tested By:	Mark Phillips, EMC/RF Test Engineer
Date: Report Number: Project Number: Nex Number: Total Number of Pages:	JANUARY 31, 2013 2013 01228788-FCC 10236006 228788 46

Applicant Affirmation

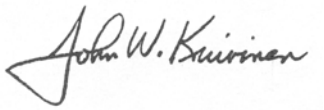
John Kuivinen representing Linear Corporation hereby affirms:

a) That he/she has reviewed and concurs that the test shown in this report are reflective of the operational characteristics of the device for which certification is sought;

b) That the device in this test report will be representative of production units;

c) That all changes (in hardware and software/firmware) to the subject device will be reviewed.

d) That any changes impacting the attributes, functionality or operational characteristics documented in this report will be communicated to the body responsible for approving (certifying) the subject equipment.



John Kuivinen Printed name of official	Signature of official
1950 Camino Vida Roble Address	January 31, 2013 Date
760-438-7138 Telephone number	johnk@linearcorp.com Email address of official

NOTE—This affirmation must be signed by the responsible party before it is submitted to a regulatory body for approval.

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Section 1. Summary of Test Results

1.1 General

All measurements are traceable to national standards

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15; Subpart C and RSS-210, Issue 8 December 2010. Radiated tests were conducted is accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC and IC.

The assessment summary is as follows:

Apparatus Assessed:	RSM-WALL
Specifications:	FCC Part 15 Subpart C, 15.247 IC RSS-210 Issue 8 December 2010
Date Received in Laboratory:	JANUARY 14, 2013 TO JANUARY 21, 2013
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None

1.2 Report Release History:

REVISION	DATE	COMMENTS	
-	JANUARY 31, 2013	Prepared By:	Mark Phillips
-	JANUARY 31, 2013	Initial Release:	A. Laudani

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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TESTED BY:  Date: January 31, 2013
Mark Phillips, EMC Test Engineer

APPROVED BY:  Date: January 31, 2013
Alan Laudani, EMC/RF Test Engineer

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Section 2: Equipment Under Test

2.1 Product Identification

DEVICE	MANUFACTURER MODEL # SERIAL #	POWER CABLE
EUT - Remote Speaker Microphone System	Linear Corporation Model: RSM-WALL Serial #: None	1.8m, unshielded, 2 wire, hardwired to wall mount P/S
Support – Power Supply	Sure-Power SW-050050A (5VDC 500mA) Serial#: None	Wall Mount 2 Prong Power Supply
Support – Notebook PC	Lenovo Thinkpad T420 Serial#: PB-CKYA8 12/04	1.8m, shielded, 2 wire, 20VDC to Notebook P/S
Support – Notebook PC P/S	Lenovo 42T4438 Serial#:11S42T4438Z1ZHY622D5TV	90cm, unshielded, 2 wire, 2 prong AC plug

Connection	I/O Cable
No Connections	

2.2 Theory of Operation

The RSM-WALL is a remote wall mount unit in a Remote Speaker Microphone System. Its function is to communicate wirelessly with a base station. The RSM-WALL has no software.

The EUT's performance during test was evaluated against the performance criterion specified by applicable test standards. Performance results are detailed in the test results section of this report.

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2.3 Technical Specifications of the EUT

Manufacturer:	Linear Corporation
Operating Frequency:	2401.056 to 2482.272 MHz in the 2400-2483.5 MHz Band
Number of Operating Frequencies:	95
Output Power:	0.439 W
Modulation:	TDMA
Antenna Data:	Integral antenna traces (2) on circuit board
Antenna Connector:	None
Power Source:	5VDC from 120VAC 60Hz Wall Mount Supply

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Section 3: Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.247
Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz and 24.0-24.25 GHz bands.

IC RSS-210 Issue 8 December 2010
Low-power Licence-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment. Annex 8 - Frequency Hopping and Digital Modulation Systems Operating in the Bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

IC RSS-Gen Issue 3 December 2010
General Requirements and Information for the Certification of Radio-communication Equipment

3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	15.6 – 23.3 ^{o}C
Humidity range	16 - 46 %
Pressure range	86 - 106 kPa
Power supply range	+/- 1% of rated voltages

3.4 Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
911	Spectrum Analyzer	Agilent	E4440A	US41421266	10/15/2012	10/15/2013
110	Antenna, LPA	Electrometrics	LPA-25	1217	4/1/2011	4/1/2013
128	Antenna, Bicon	EMCO	3104	2882	3/21/2011	3/21/2013
132	Loop Antenna	Electro-Metrics	ALP-10	139	4/21/2011	4/21/2013
529	Antenna, DRWG	EMCO	3115	2505	10/31/2012	10/31/2014
901	Preamplifier	Sonoma	310 N	130607	10/15/2012	10/15/2013
E1013	Antenna	EMCO	3116	00119488	1/10/2012	1/10/2014
317	Preamplifier	HP	8449A	2749A00167	6/11/2012	6/11/2013
835	Spectrum Analyzer	R&S	FSEK	829058/005	9/6/2012	9/6/2013
E1017	Spectrum Analyzer	R&S	FSP7	839337/0022	3/8/2012	3/8/2013

Registration of the OATS are on file with the Federal Communications Commission, and are also registered with Industry Canada under Site Numbers 2040B-3.

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Section 4: Observations

4.1 Modifications Performed During Assessment

No modifications were performed during assessment.

4.2 Record Of Technical Judgments

No technical judgements were made during the assessment.

4.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

4.4 Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedure

4.5 Test Deleted

No Tests were deleted from this assessment.

4.6 Additional Observations

There were no additional observations made during this assessment.

Section 5: Results Summary

This section contains the following:

Test Results

The column headed “Required” indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N No: not applicable / not relevant
Y Yes: Mandatory i.e. the apparatus shall conform to these test.
N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

5.1 Test Results

Part 15	RSS-210	Test Description	Required	Result
15.207 (a)	RSS-Gen 7.2.2	Conducted Emission Limit	Y	Pass
15.247 a1i	A8.1(c)	20dB & 99% Bandwidth	Y	Pass
12.247a1	A8.1(c)	Channel Separation | Average time of occupancy	Y	Pass
15.247a1i	A8.1(c)	Number of Hopping Channels	Y	Pass
15.247 b1	A8.4	Peak Output Power	Y	Pass
15.209 a 15.247c	A8.5	Radiated Emissions within Restricted Bands	Y	Pass
15.247c	A8.5	Bandedge	Y	Pass
15.109	RSS-GEN 4.10	Receiver Spurious Emissions	Y	Pass

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Appendix A: Test Results

Power Line Conducted Emissions

15.207(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

Test Conditions:

Sample Number:	Error! Bookmark not defined.	Temperature:	20°C
Date:	January 18, 2013	Humidity:	31 %
Modification State:	Low ,Mid and High Channel	Tester:	Mark Phillips
		Laboratory:	Nemko SR2

Test Results: EUT complies

See attached plots

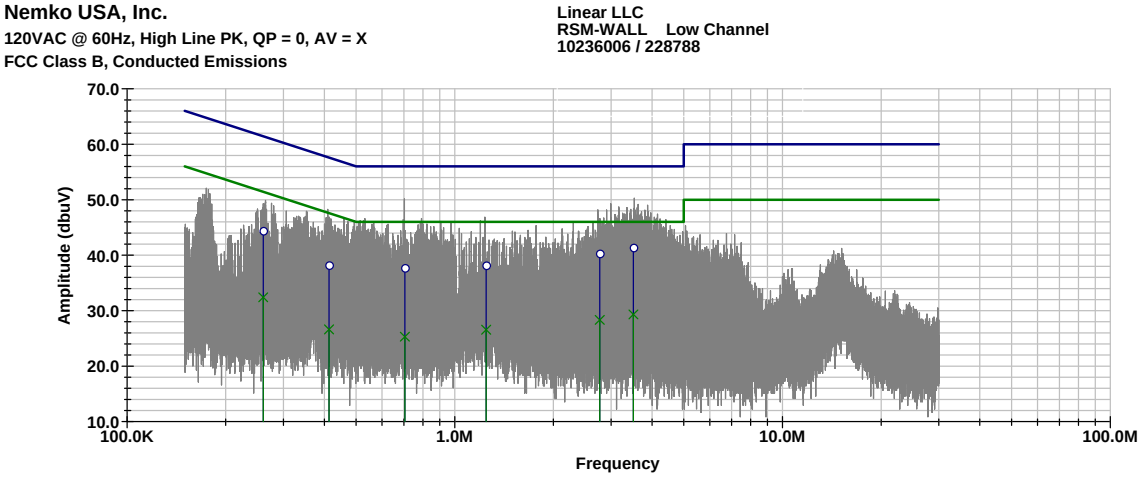
Test Parameters

Peak RBW: 100kHz VBW: 100kHz
Quasi-Peak: RBW 9kHz, VBW 30 kHz
Average: RBW 9kHz, VBW 30 kHz
Quasi-Peak Limit Blue Line, Average Limit Green Line

Test mode Transmitting with Antenna 1 in flat position was noted to be worst case.

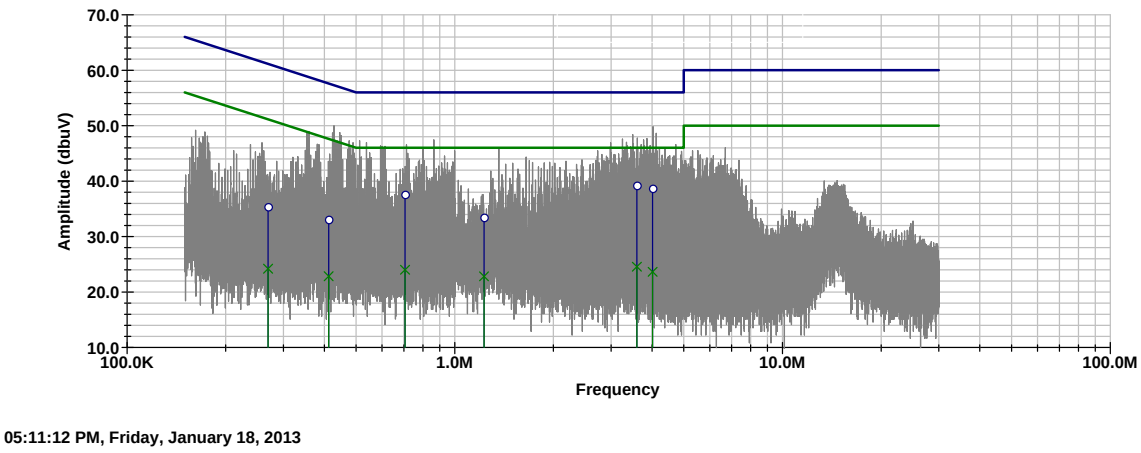
Low Channel

Client	Linear Corporation	Temperature	19	°C
NEx #:	228788	Relative Humidity	21	%
EUT Name	Remote Speaker Microphone System	Barometric Pressure	100.8	kPa
EUT Model	RSM-WALL	Test Location	Ground Plane	
Governing Doc	CFR 47, Part 15B, Sec. 15.107	Test Engineer	Mark Phillips	
Basic Standard	ANSI C63.4	Date	January 18, 2013	
Mode:	Transmitting/Receiving on Low Channel	Voltage:	120 Vac Line 1	



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
260.4	44.4	32.4	61.4	51.4	-17.0	-19.0
413.5	38.2	26.6	57.6	47.6	-19.4	-21.0
704.6	37.7	25.3	56.0	46.0	-18.3	-20.7
1247.3	38.2	26.5	56.0	46.0	-17.8	-19.5
2770.2	40.3	28.3	56.0	46.0	-15.7	-17.7
3509.1	41.4	29.3	56.0	46.0	-14.6	-16.7

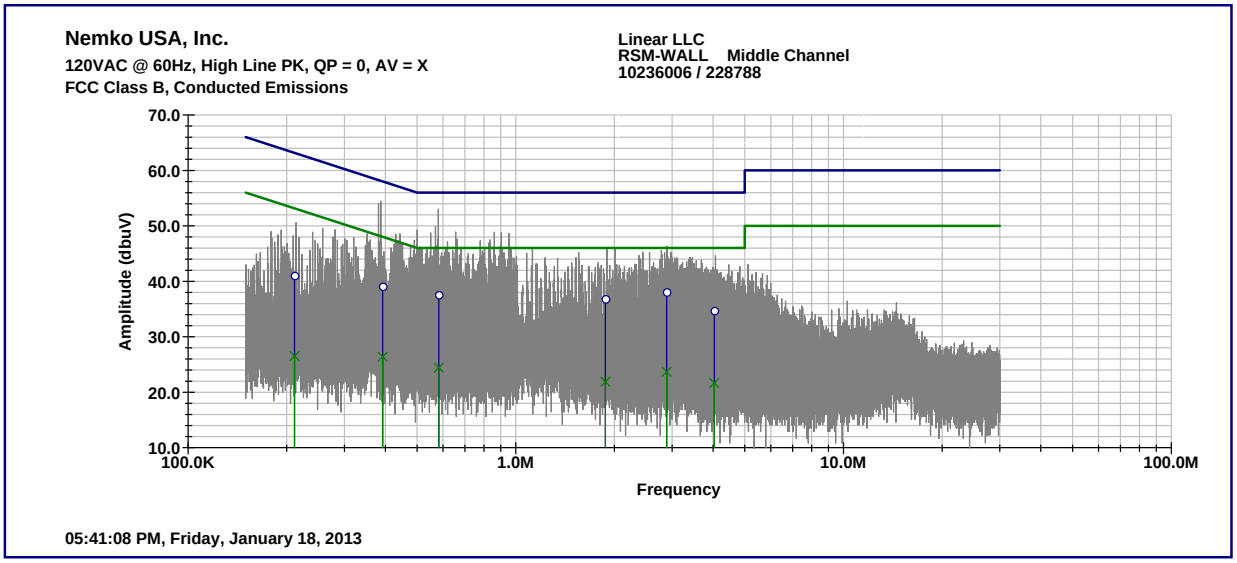
Client	Linear Corporation	Temperature	19	°C
NEx #:	228788	Relative Humidity	21	%
EUT Name	Remote Speaker Microphone System	Barometric Pressure	100.8	kPa
EUT Model	RSM-WALL	Test Location	Ground Plane	
Governing Doc	CFR 47, Part 15B, Sec. 15.107	Test Engineer	Mark Phillips	
Basic Standard	ANSI C63.4	Date	January 18, 2013	
Mode:	Transmitting/Receiving on Low Channel	Voltage:	120 Vac Line 2	



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
269.3	35.4	24.2	61.1	51.1	-25.7	-26.9
412.4	33.1	22.8	57.6	47.6	-24.5	-24.8
704.9	37.6	24.0	56.0	46.0	-18.4	-22.0
1228.3	33.5	22.8	56.0	46.0	-22.5	-23.2
3595.0	39.2	24.6	56.0	46.0	-16.8	-21.4
4015.8	38.7	23.6	56.0	46.0	-17.3	-22.4

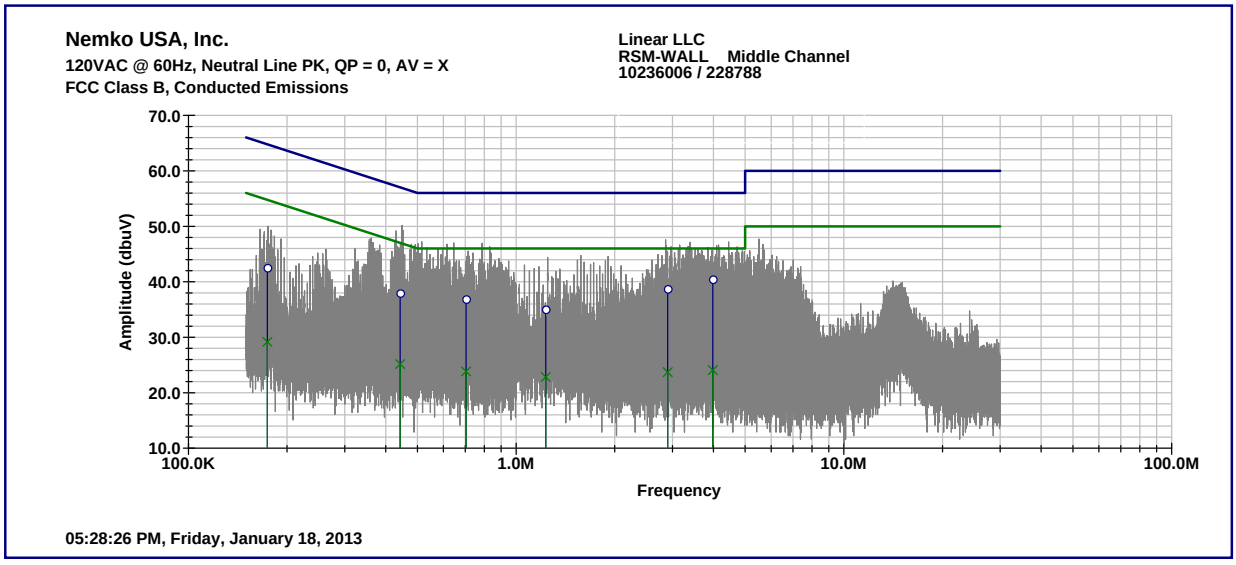
Mid Channel

Client	Linear Corporation	Temperature	19	°C
NEx #:	228788	Relative Humidity	21	%
EUT Name	Remote Speaker Microphone System	Barometric Pressure	100.8	kPa
EUT Model	RSM-WALL	Test Location	Ground Plane	
Governing Doc	CFR 47, Part 15B, Sec. 15.107	Test Engineer	Mark Phillips	
Basic Standard	ANSI C63.4	Date	January 18, 2013	
Mode:	Transmitting/Receiving on Mid Channel	Voltage:	120 Vac Line 1	



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
211.3	41.0	26.5	63.2	53.2	-22.2	-26.7
392.6	39.1	26.4	58.0	48.0	-18.9	-21.6
582.2	37.6	24.4	56.0	46.0	-18.4	-21.6
1877.7	36.8	21.9	56.0	46.0	-19.2	-24.1
2885.9	38.1	23.7	56.0	46.0	-17.9	-22.3
4036.5	34.7	21.6	56.0	46.0	-21.3	-24.4

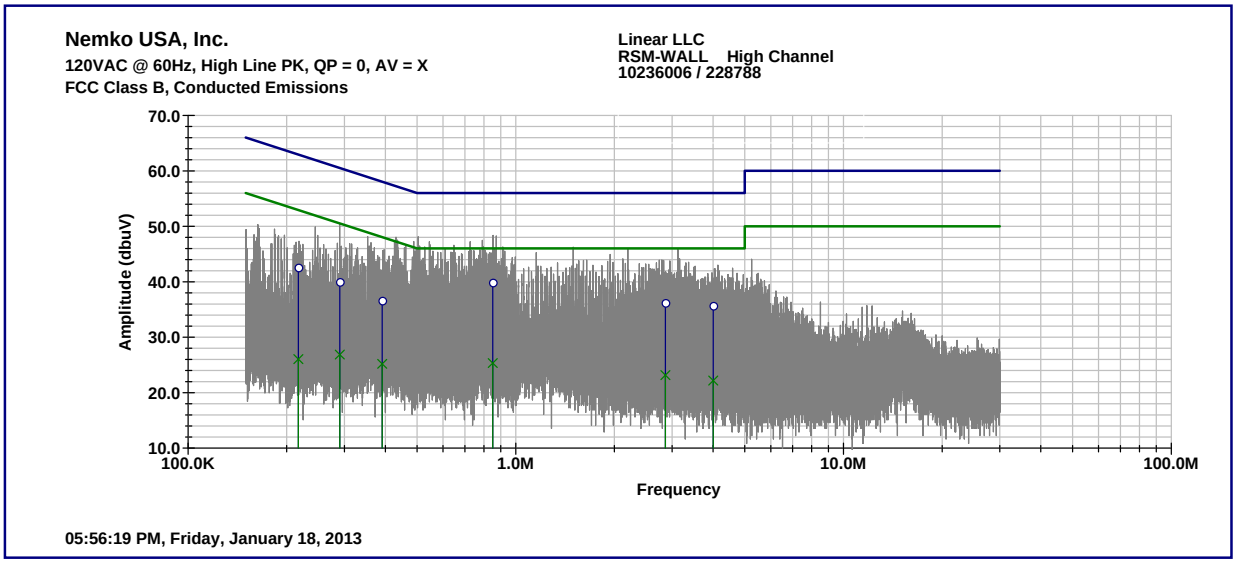
Client	Linear Corporation	Temperature	19	°C
NEx #:	228788	Relative Humidity	21	%
EUT Name	Remote Speaker Microphone System	Barometric Pressure	100.8	kPa
EUT Model	RSM-WALL	Test Location	Ground Plane	
Governing Doc	CFR 47, Part 15B, Sec. 15.107	Test Engineer	Mark Phillips	
Basic Standard	ANSI C63.4	Date	January 18, 2013	
Mode:	Transmitting/Receiving on Mid Channel	Voltage:	120 Vac Line 2	



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
174.2	42.5	29.2	64.8	54.8	-22.3	-25.6
442.9	38.0	25.1	57.0	47.0	-19.0	-21.9
703.7	36.9	23.8	56.0	46.0	-19.1	-22.2
1231.4	35.0	22.8	56.0	46.0	-21.0	-23.2
2900.8	38.7	23.7	56.0	46.0	-17.3	-22.3
3982.8	40.4	24.1	56.0	46.0	-15.6	-21.9

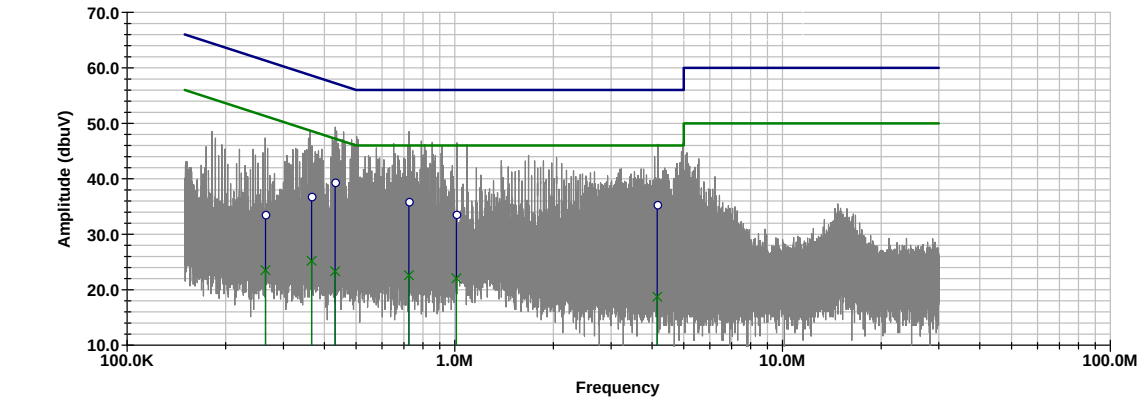
High Channel

Client	Linear Corporation	Temperature	19	°C
NEx #:	228788	Relative Humidity	21	%
EUT Name	Remote Speaker Microphone System	Barometric Pressure	100.8	kPa
EUT Model	RSM-WALL	Test Location	Ground Plane	
Governing Doc	CFR 47, Part 15B, Sec. 15.107	Test Engineer	Mark Phillips	
Basic Standard	ANSI C63.4	Date	January 18, 2013	
Mode:	Transmitting/Receiving on High Channel	Voltage:	120 Vac Line 1	



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
217.1	42.6	26.0	62.9	52.9	-20.3	-26.9
290.4	40.0	26.9	60.5	50.5	-20.5	-23.6
391.3	36.6	25.2	58.0	48.0	-21.4	-22.8
850.9	39.9	25.3	56.0	46.0	-16.1	-20.7
2861.6	36.2	23.2	56.0	46.0	-19.8	-22.8
4004.9	35.7	22.2	56.0	46.0	-20.3	-23.8

Client	Linear Corporation	Temperature	19	°C
NEx #:	228788	Relative Humidity	21	%
EUT Name	Remote Speaker Microphone System	Barometric Pressure	100.8	kPa
EUT Model	RSM-WALL	Test Location	Ground Plane	
Governing Doc	CFR 47, Part 15B, Sec. 15.107	Test Engineer	Mark Phillips	
Basic Standard	ANSI C63.4	Date	January 18, 2013	
Mode:	Transmitting/Receiving on High Channel	Voltage:	120 Vac Line 2	



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
264.5	33.5	23.5	61.3	51.3	-27.8	-27.8
365.6	36.8	25.2	58.6	48.6	-21.8	-23.4
431.6	39.4	23.3	57.2	47.2	-17.8	-23.9
724.9	35.9	22.6	56.0	46.0	-20.1	-23.4
1012.2	33.6	22.0	56.0	46.0	-22.4	-24.0
4148.4	35.3	18.7	56.0	46.0	-20.7	-27.3

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20 dB/ 99% Bandwidth

Clause 15.247(a)(1)(i) (i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500kHz.

Test Conditions:

Sample Number:	RSM-WALL	Temperature:	19°C
Date:	1/15/2013	Humidity:	22 %
Modification State:	Lo/Mid/High Channels	Tester:	Mark Phillips
		Laboratory:	Nemko GP1

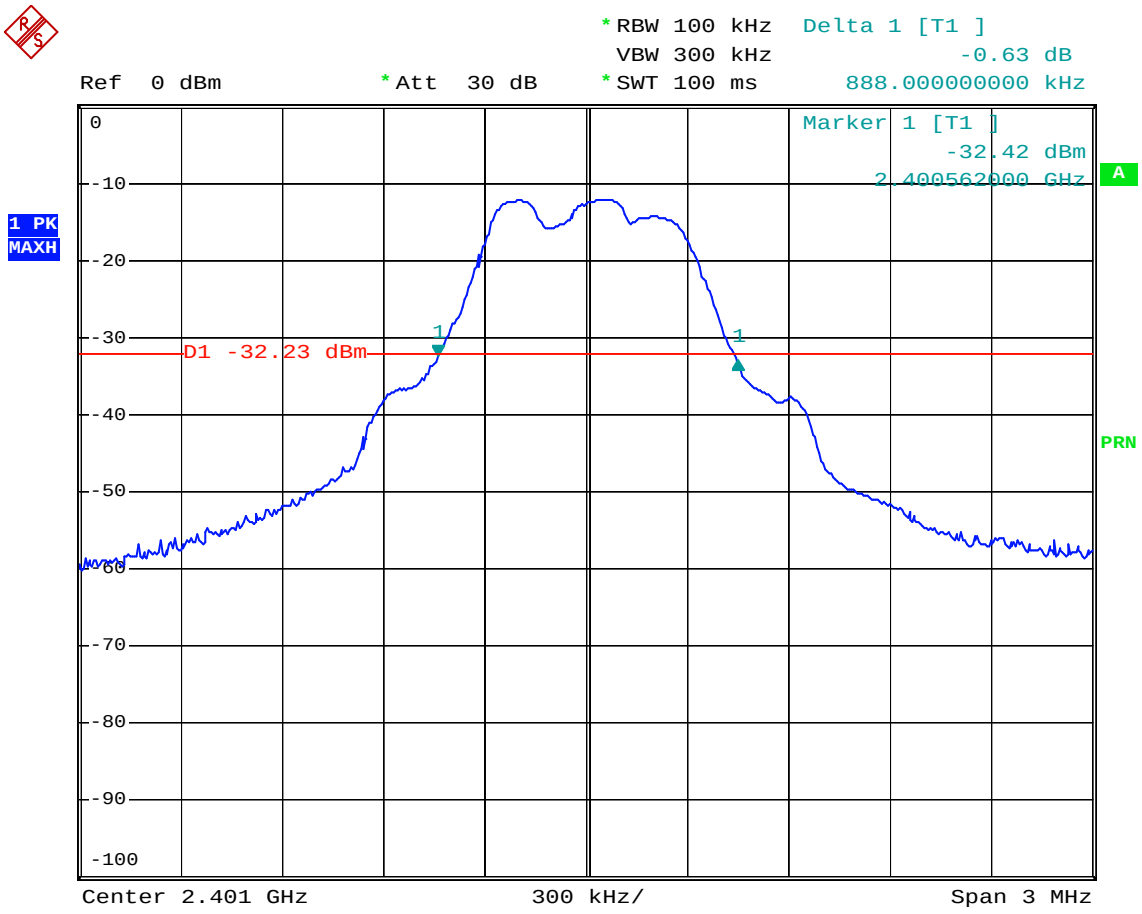
Test Results: EUT complies

- This was a radiated test.
- The EUT was placed <1m from the receiving antenna to allow a representative signal to fill the display > 30dB from the noise floor.
- The Spectrum Analyzer RES BW was set to 100 kHz.
- For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier.
- A PEAK output reading was taken, a DISPLAY line was drawn 20 dB lower than PEAK level.
- The 20 dB bandwidth was determined from where the channel output spectrum intersected the display line.
- Bandwidth measurements were first taken with antenna number 1.
- Bandwidth measurements were repeated with antenna number 2.
- Span is wide enough to capture the channel transmission
- RBW is 1% of the span
- VBW is 3X RBW
- Sweep is auto
- Detector is Peak
- Trace is Max Hold
- 99% bandwidth: Used Spectrum Analyzer's programmed function.
- 20 dB bandwidth: A peak output max hold reading was taken, a display line was drawn 20 dB lower than peak level. The 20 dB bandwidth was determined from where the channel output spectrum intersected the display line.
- Observed maximum 20 dB BW is 888 kHz (low channel).
- Observed maximum 20 dB BW is 876 kHz (high channel).
- 2401.000 MHz – (888/2) kHz = 2400.556 MHz (within the frequency band)
- 2482.280 MHz + (876/2) kHz = 2482.718 MHz (within the frequency band)

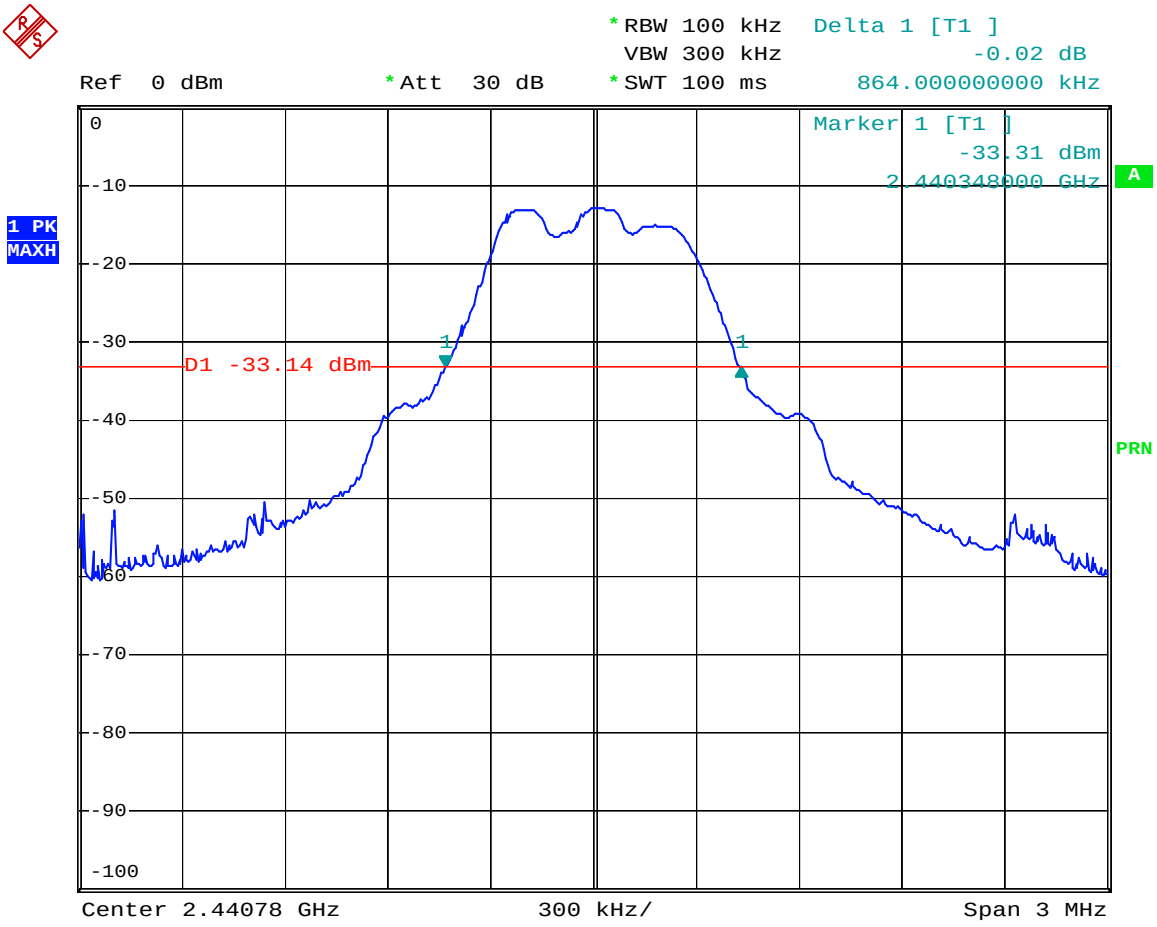
Channel Range	Mode	20dB Bandwidth	99% Bandwidth
Low (2401.056 MHz)	Antenna 1	888 kHz	750 kHz
	Antenna 2	876 kHz	750 kHz
Mid (2440.800 MHz)	Antenna 1	864 kHz	738 kHz
	Antenna 2	858 kHz	738 kHz
High (2482.280 MHz)	Antenna 1	876 KHz	762 kHz
	Antenna 2	876 kHz	756 kHz

20dB Bandwidth

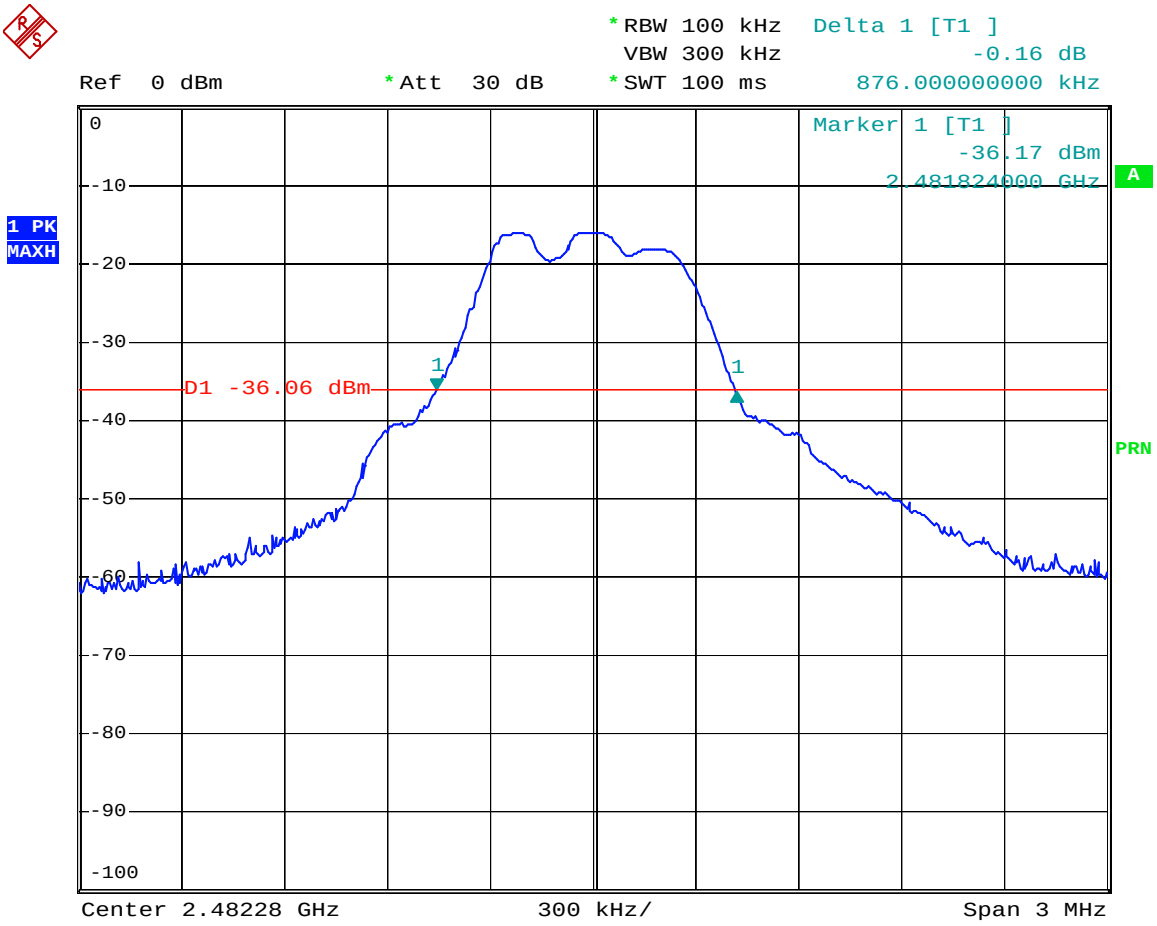
Low Channel (Antenna 1)



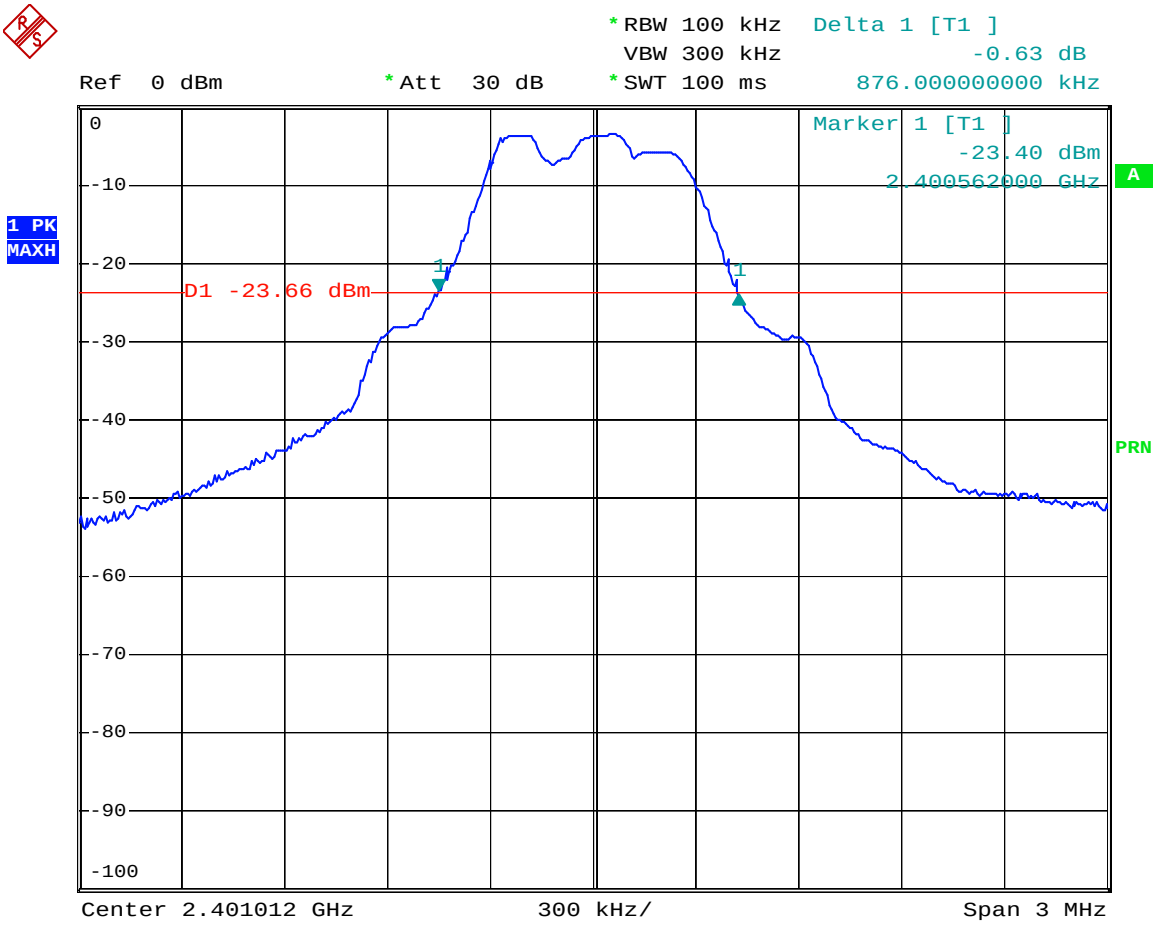
Mid Channel (Antenna 1)



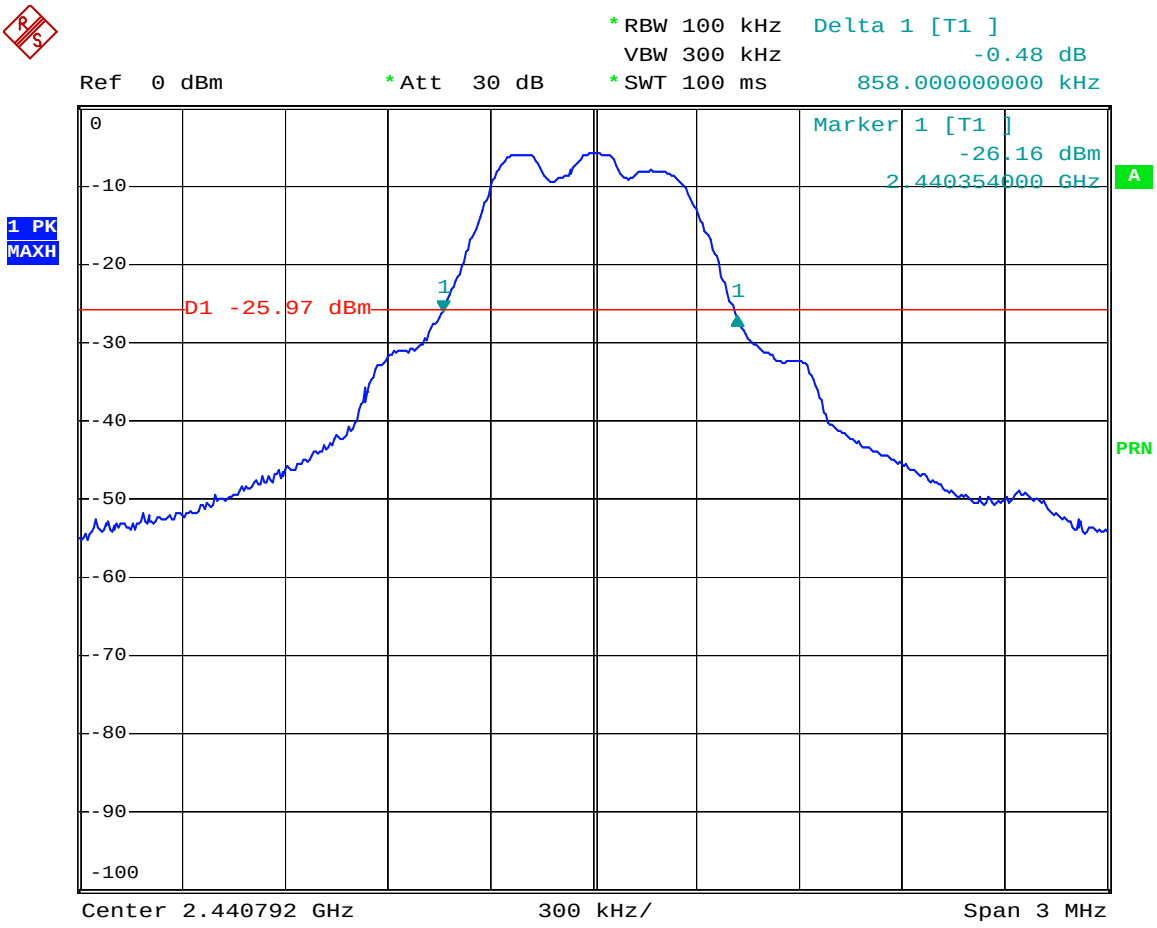
High Channel (Antenna 1)



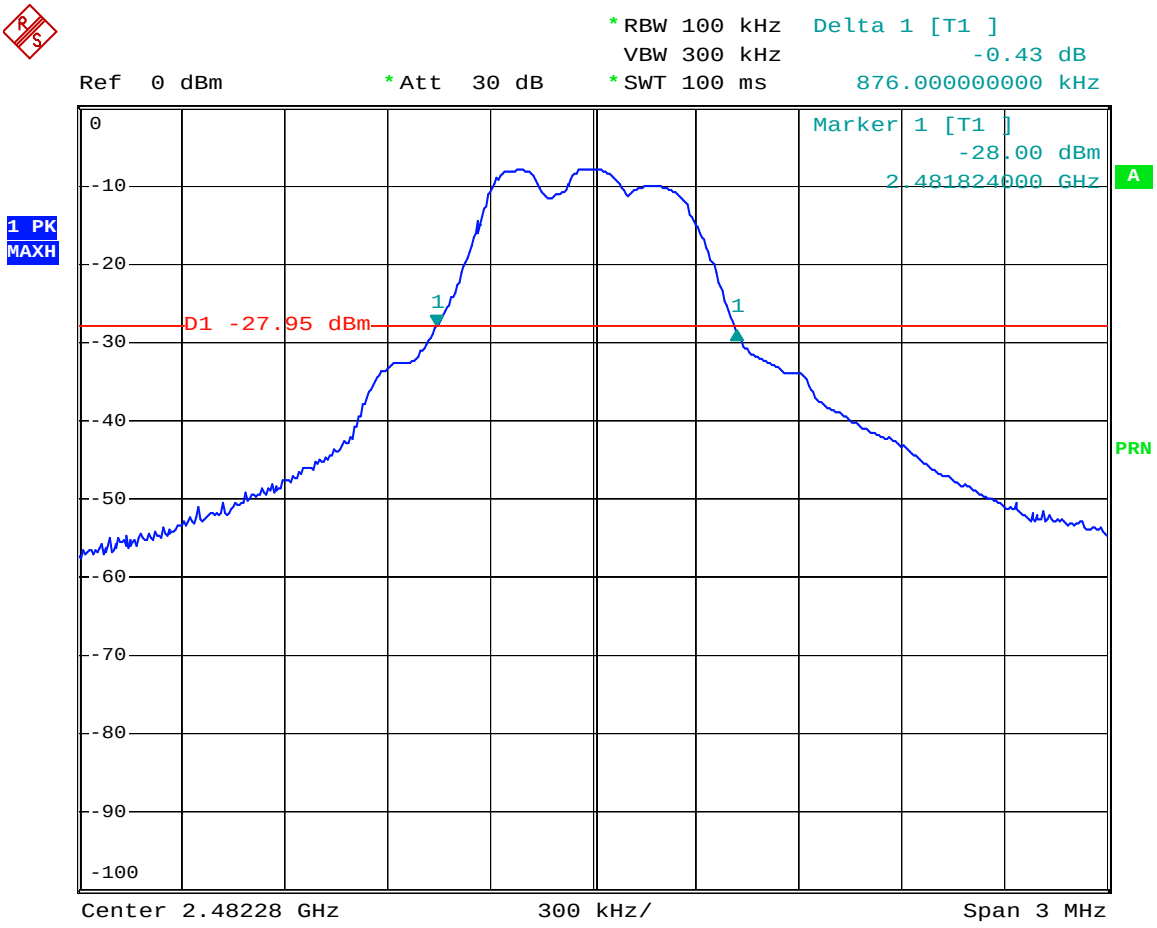
Low Channel (Antenna 2)



Mid Channel (Antenna 2)

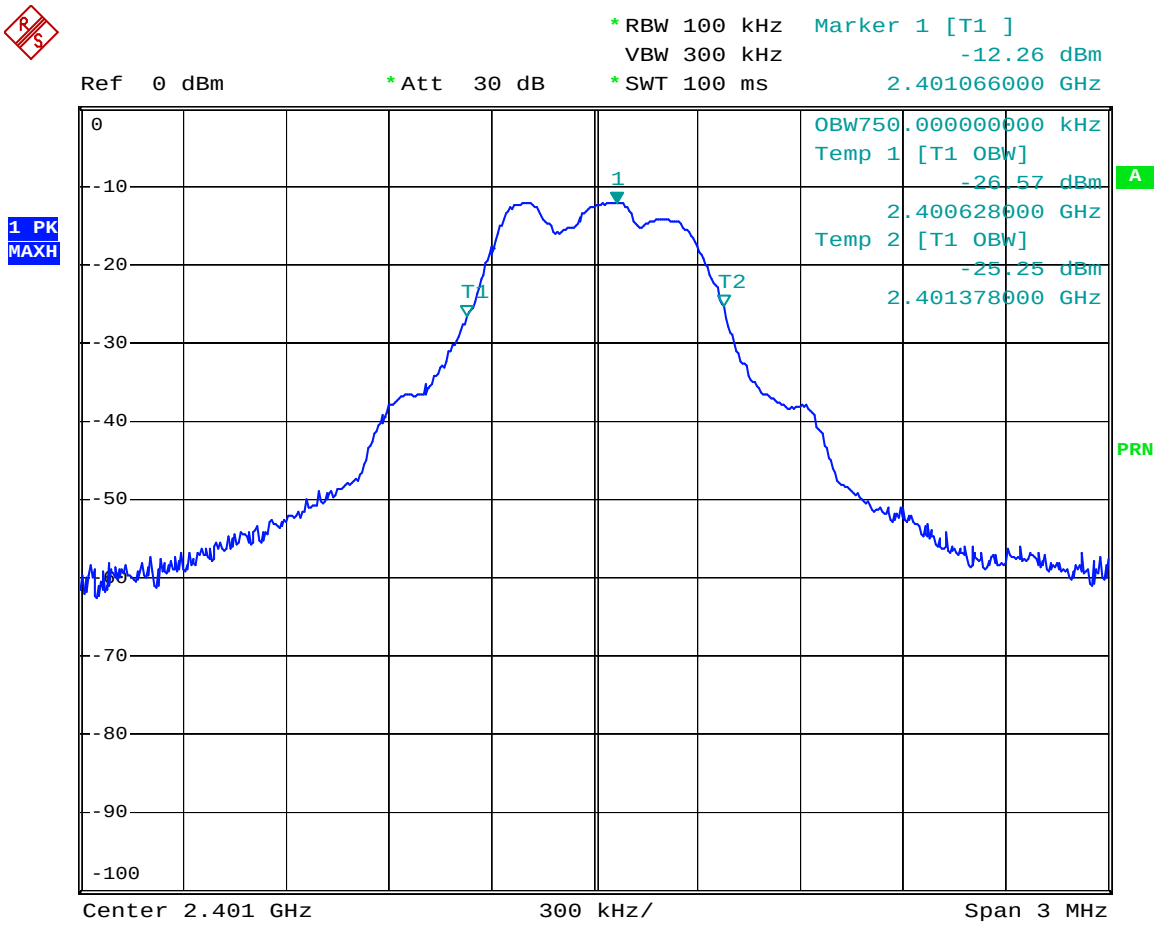


High Channel (Antenna 2)

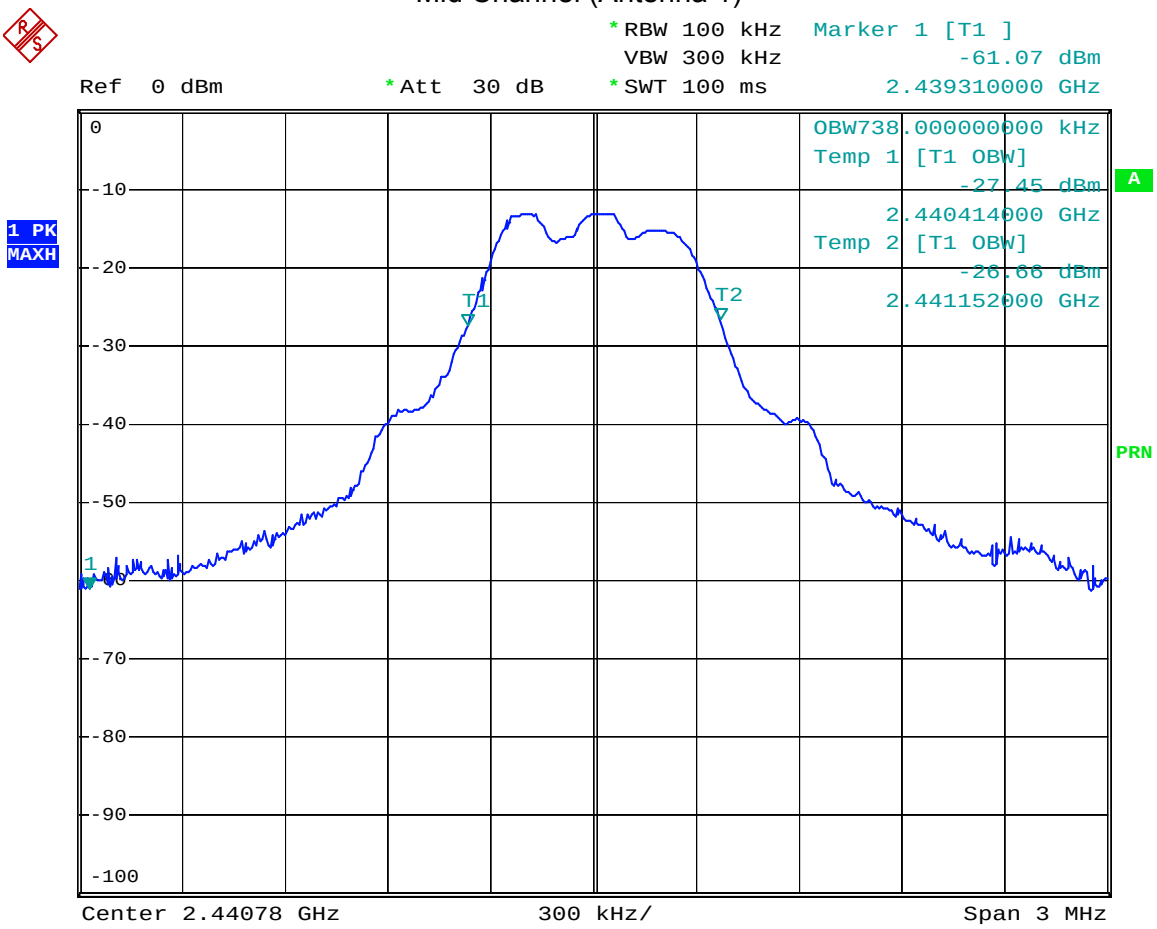


99% Bandwidth

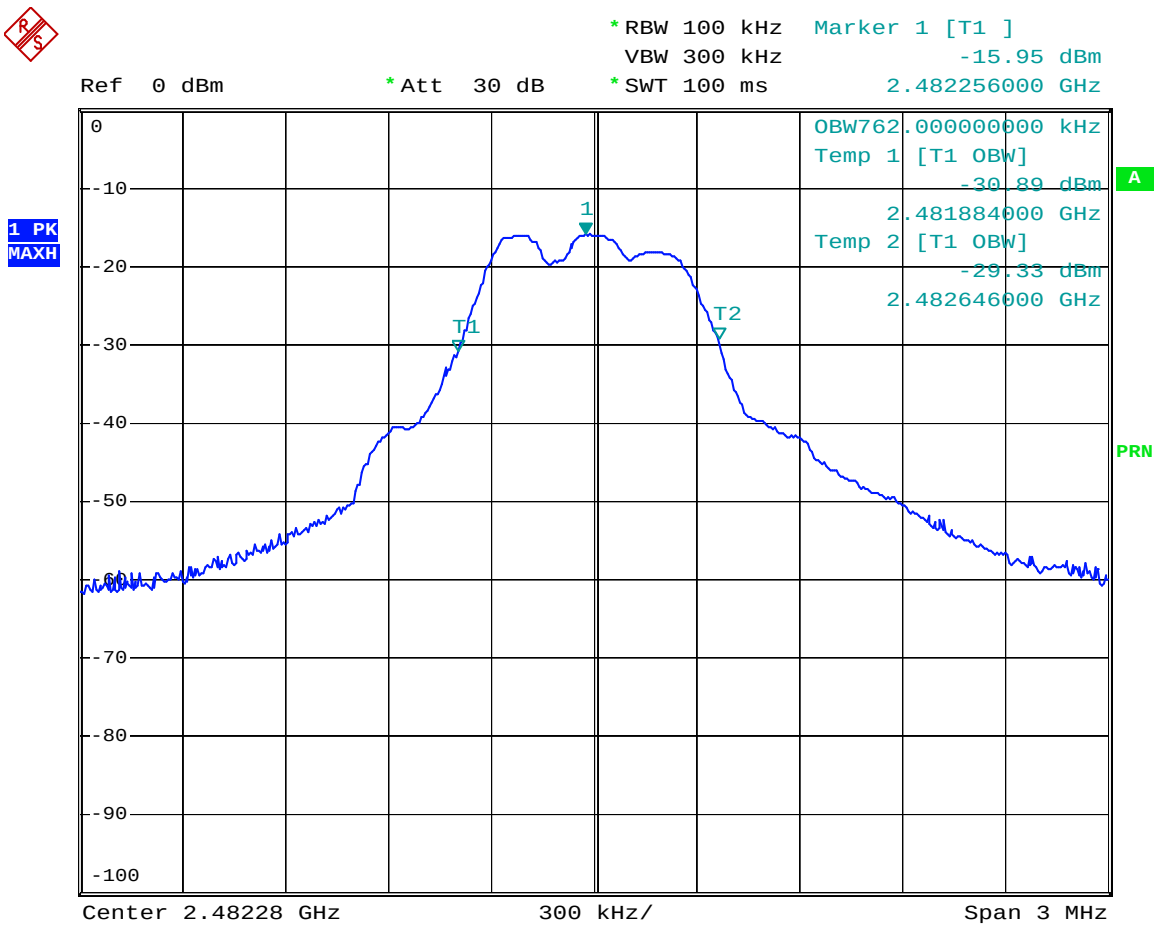
Low Channel (Antenna 1)



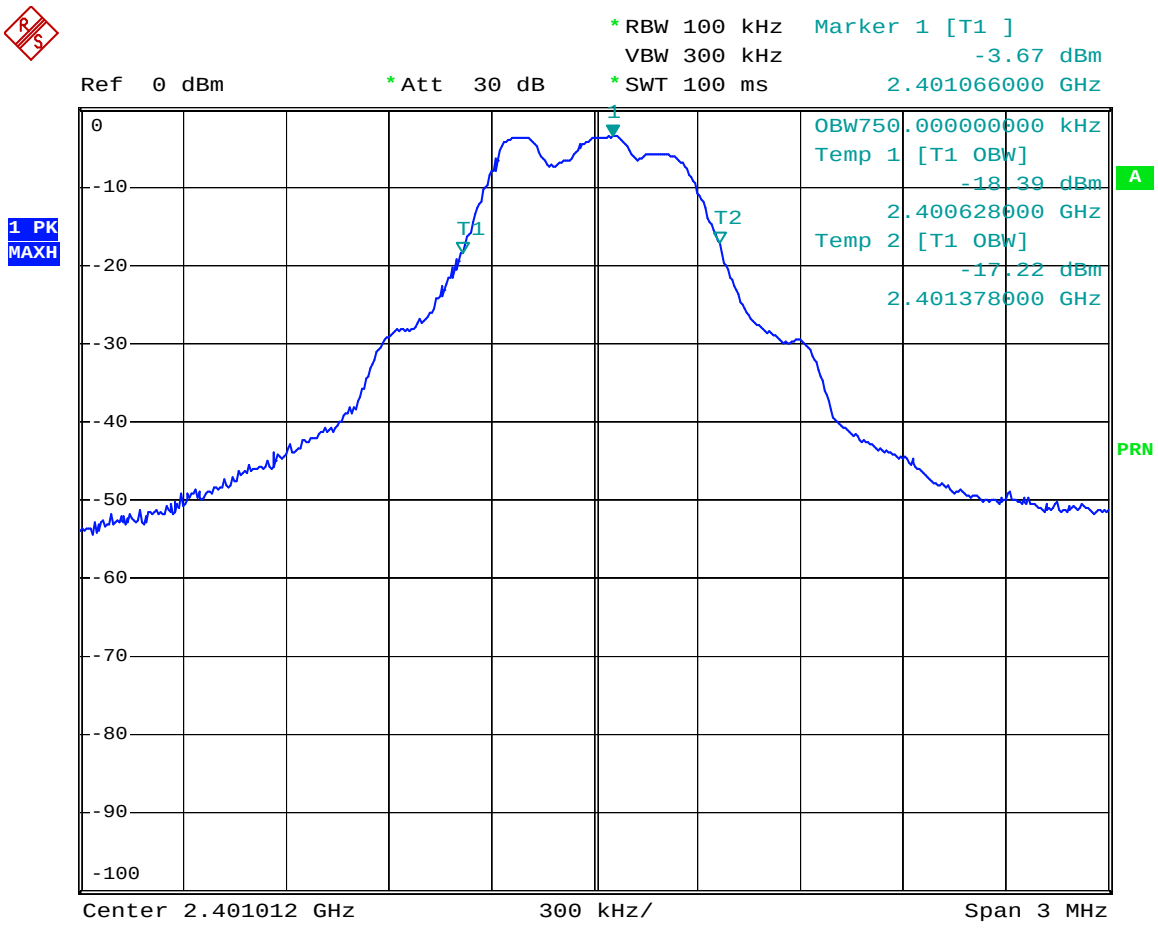
Mid Channel (Antenna 1)



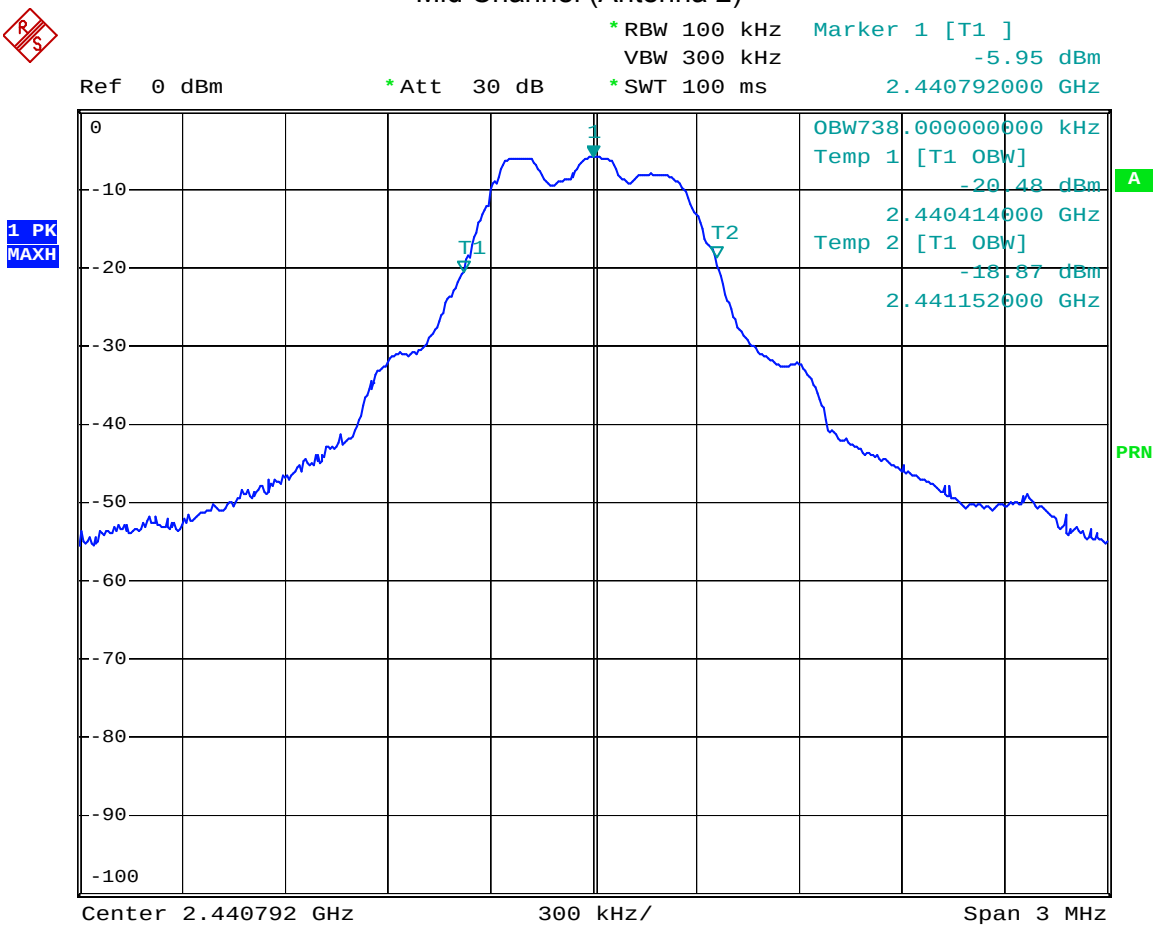
High Channel (Antenna 1)



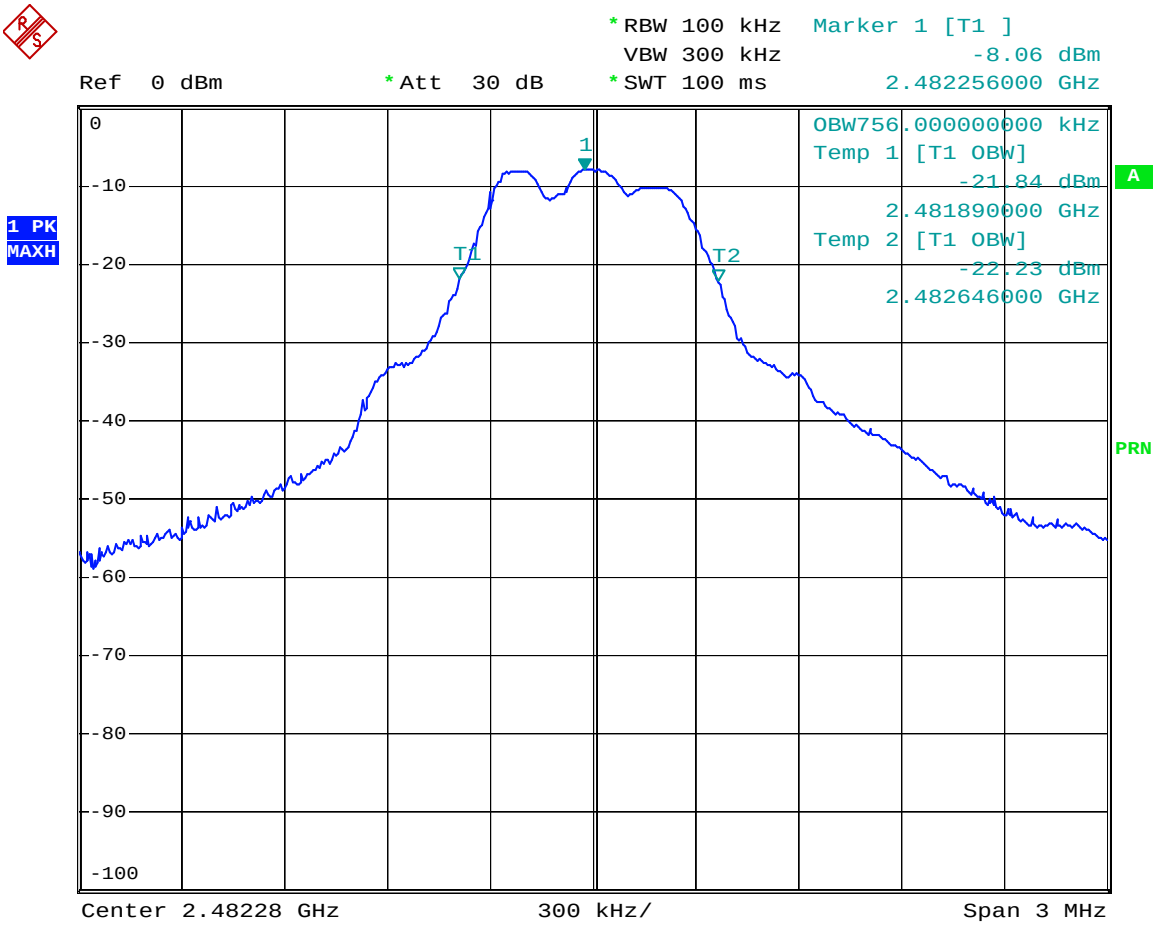
Low Channel (Antenna 2)



Mid Channel (Antenna 2)



High Channel (Antenna 2)



Frequency hopping systems operating in the 2400-2483.5 MHz band

Clause 15.247(a)(1)(iii)
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used

Test Conditions:

Sample Number:	RSM-WALL	Temperature:	20°C
Date:	1-21-2013	Humidity:	24 %
Modification State:	Frequency Hopping	Tester:	Mark Phillips
		Laboratory:	Nemko

Test Results:

The EUT was placed <1m from the receiving antenna to allow a representative signal to fill the display > 30dB from the noise floor. The Spectrum Analyzer RES BW was set to 100 kHz. The test sample was set to hopping mode and the frequency span was set zero. The sweep was set to 10 seconds.

10 occurrences in 10 seconds x 830 us = 8.3 ms which is less than 400 ms
EUT complies.

Duty Cycle Factor Calculation

10 times in 10 seconds is equivalent to 1 time in any 100 ms, 1 second a part.
0.83 ms in 100 ms = 0.0083
20 x log(0.0083) = -41.6 dB

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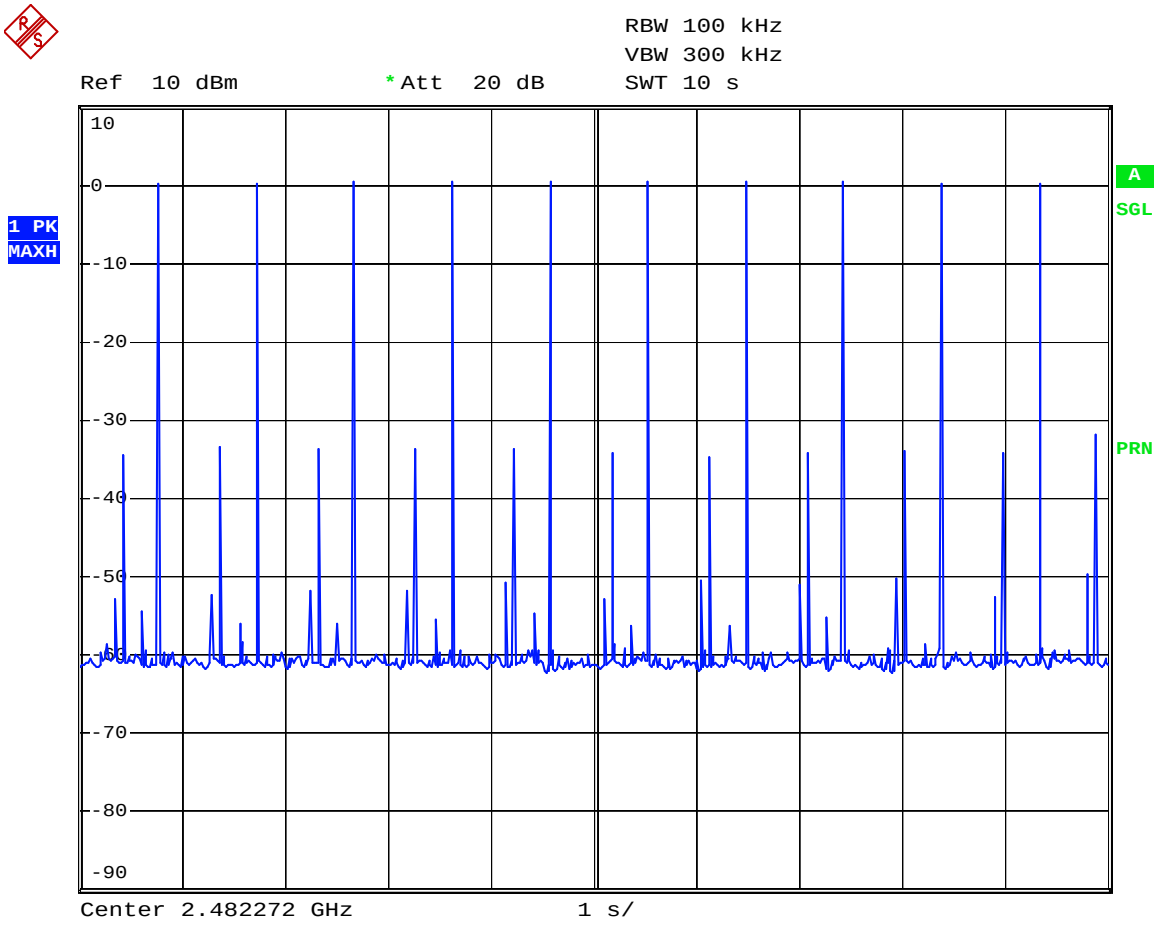
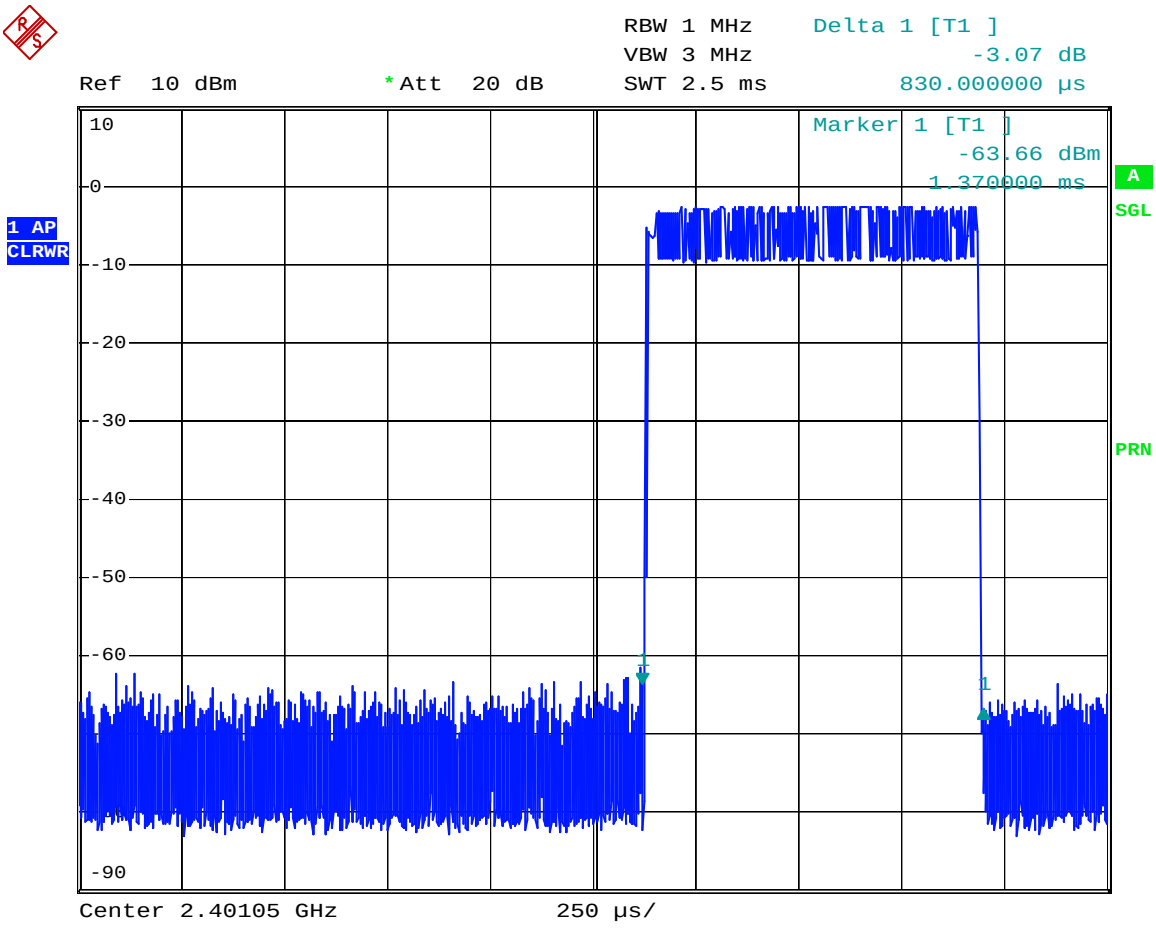
Time of Occupancy

This channel was on 10 times in 10 seconds.
Other emissions are reflections of adjacent channels.



This channel was on 830 us.



Channel Separation

Clause 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

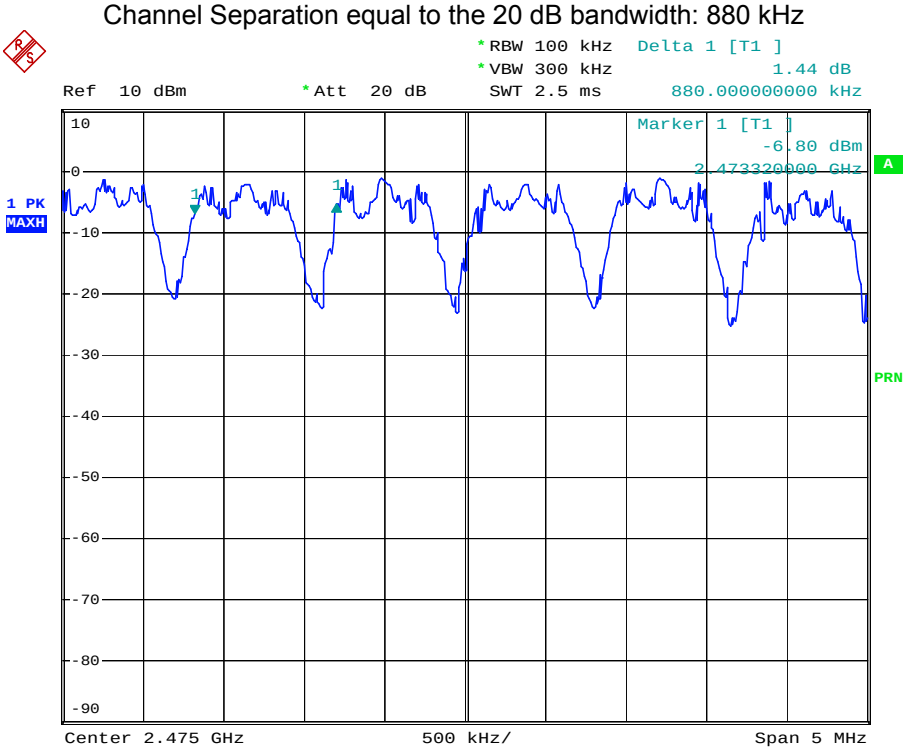
Test Conditions:

Sample Number:	RSM-WALL	Temperature:	20°C
Date:	1-21-2013	Humidity:	24 %
Modification State:	Frequency Hopping	Tester:	Mark Phillips
		Laboratory:	Nemko

Test Results: EUT Complies

- The Spectrum Analyzer RES BW was set to 100 kHz.
- Detector was peak, max hold.
- The test sample was set to hopping mode and the frequency span was set to a value to capture two or more hopping channels.
- Marker delta shows frequency separation.

Channel Separation equal to the 20 dB bandwidth: 880 kHz



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Frequency Plan

Clause 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Test Conditions:

Sample Number:	RSM-WALL	Temperature:	20°C
Date:	1-21-2013	Humidity:	24 %
Modification State:	Frequency Hopping	Tester:	Mark Phillips
		Laboratory:	Nemko

Test Results:

The Frequency Plan is discussed in the Technical Description exhibit and was reviewed by this test engineer and was found to comply.

- 95 channels: channel 0 at 2401.056 MHz to channel 94 at 2482.272 MHz
- Pseudo-Random Hopping Sequence:

0	14	78	8	6	89	53	12	67	29	44	1
19	57	7	81	94	3	39	71	25	69	80	52
65	35	46	79	36	28	82	50	62	90	55	43
66	85	76	60	23	68	72	32	7	92	5	61
20	91	2	16	21	9	48	73	4	31	93	10
40	17	59	84	22	47	63	27	75	49	41	34
86	51	37	24	11	83	54	64	13	74	45	30
58	70	15	38	72	87	14	77	26	56	88	33
42	18										

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Number of Hopping Channels

Clause 15.247(a)(1)(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

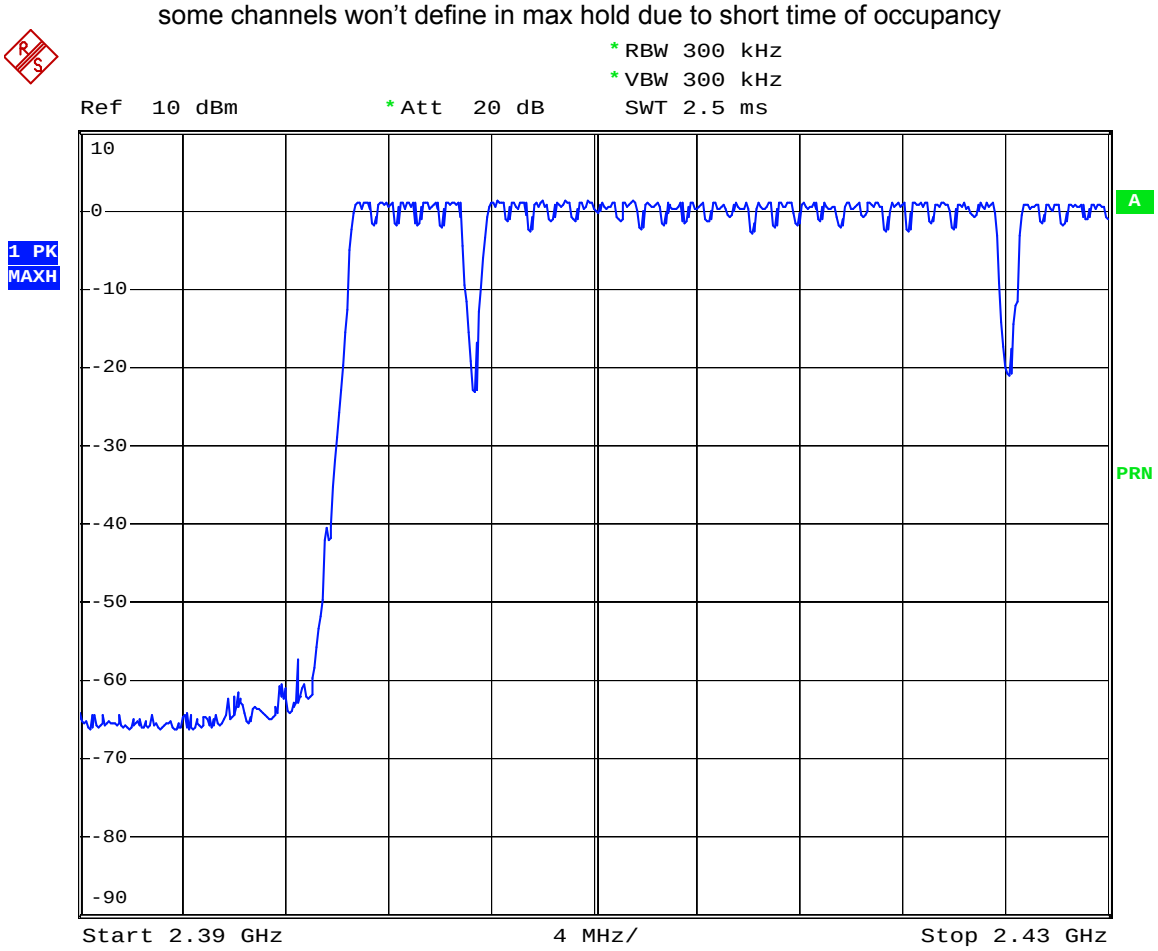
Test Conditions:

Sample Number:	RSM-WALL	Temperature:	20°C
Date:	1-21-2013	Humidity:	24 %
Modification State:	Frequency Hopping	Tester:	Mark Phillips
		Laboratory:	Nemko

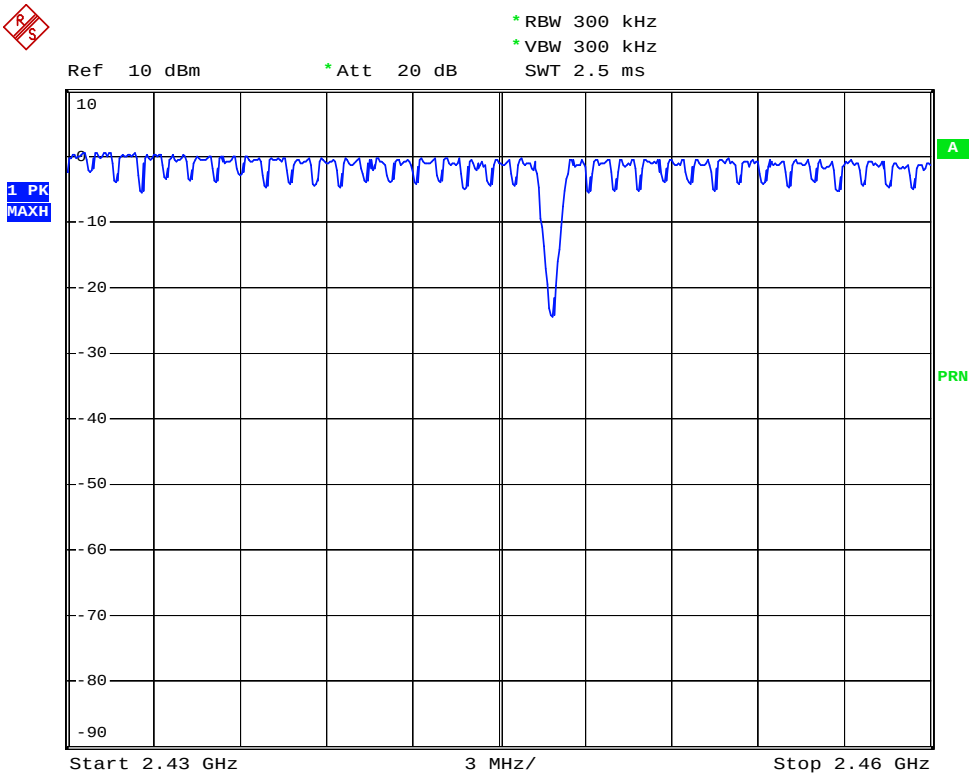
Test Results: > 25 hopping frequencies, (95 Channels), EUT complies.

- The Spectrum Analyzer RES BW was set to 300 kHz to discriminate channels.

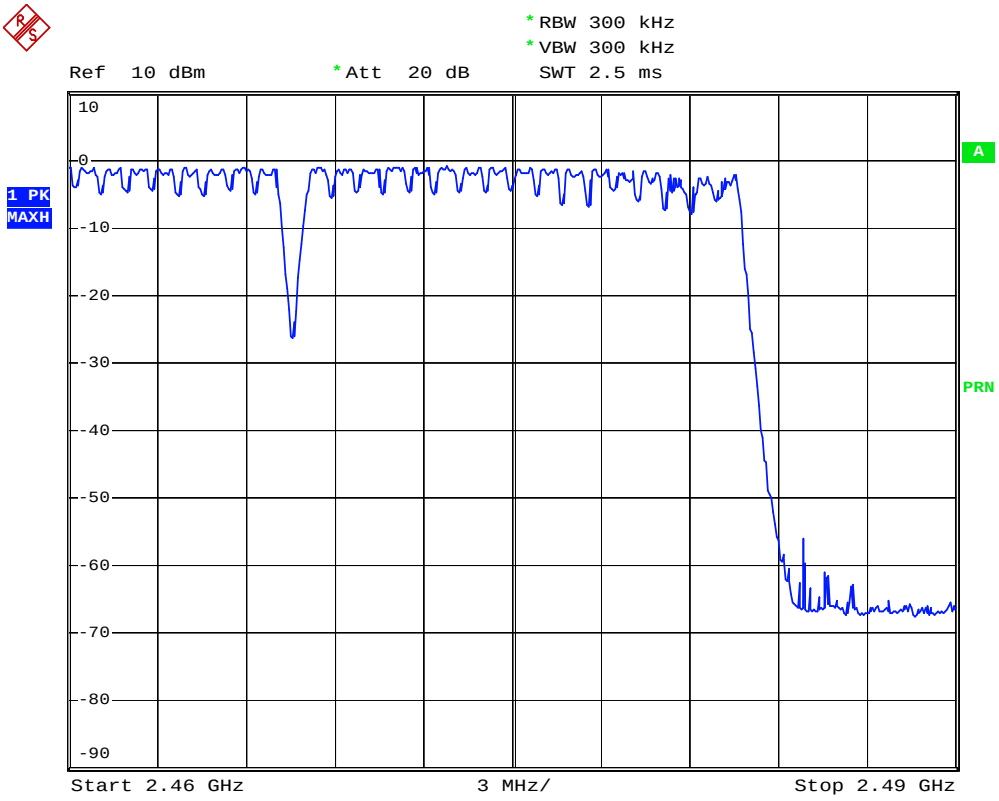
32 channels,
some channels won't define in max hold due to short time of occupancy



33 channels



25 channels



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Radiated Emissions within Restricted Bands

Clause 15.209(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (uV/meter)	Measurement Distance (meter)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a) must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

Test Conditions:

Sample Number:	RSM-WALL	Temperature:	20°C
Date:	1-17-2013	Humidity:	18%
Modification State:	Lo/Mid/High Channels	Tester:	Mark Phillips
		Laboratory:	10 m Chamber

Test Results:

See Table Below.

Additional Observations:

The Spectrum was searched from 7 MHz to the 10th Harmonic.
Two orthogonal axes (upright and flat) were tried to maximize emissions. Worst case was used in measurements presented.

There are no emissions found that apply to the restricted bands defined in FCC Part 15 Subpart C, 15.205. The EUT was measured on two orthogonal axes. Worst case measured with antenna horizontal and vertical. Measurements below 1GHz were performed at 3m with a Quasi-Peak detector while Peak and Average detectors were used above 1GHz.
As the emission is pulsing, a duty cycle factor was introduced to spurious harmonics. See calculation in section on Time of Occupancy.

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Radiated Spurious Emissions

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a) must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

Test Conditions:

Sample Number:	RSM-WALL	Temperature:	20°C
Date:	1-17-2013	Humidity:	18%
Modification State:	Lo/Mid/High Channels	Tester:	Mark Phillips
		Laboratory:	10m Chamber

Test Results: EUT complies, See table and plots below.

Additional Observations:

- RBW is 100 kHz below 1000 MHz, 1 MHz above 1000 MHz
- VBW is 3X RBW
- Sweep is auto.
- Detector is Peak, Trace is Max Hold
- As the emission is pulsing, a duty cycle factor was introduced to spurious harmonics. See calculation in section on Time of Occupancy.
- Emissions were searched from 7 MHz to 2400 MHz and from 2483.5 MHz to 25000 MHz
- Antenna 1 and 2 were investigated and did not factor in the spurious emissions. The stronger emission was used in table below.
- There are no emissions found that apply to the restricted bands defined in FCC Part 15 Subpart C, 15.205.
- All other emissions were found to be more than 20dB below the limit and have not been reported per FCC rule 15.31(o).

Radiated Emissions 30 MHz to 1000 MHz

Math: Corrected Reading =
Max of Vertical or Horizontal measured + Antenna Factor + Cable Loss – preamplifier (if used). – Duty Cycle Factor

CR/SL Dif = Limit – Corrected Reading. Pass if result is negative.

Peak At 2390 MHz: = 34.5 dBµV + 28.1 dBµV/m + 8.9 dB = 71.4 dBµV/m
Average = Peak + Duty Cycle Factor = 71.4 dBµV/m -20xLog(0.83) = 29.8 dBµV/m

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Bandedge Measurements

Radiated Emissions Data

Job # :	10236006	Date :	1/17/13	Page 1 of 1	
NEX#:	228788	Time :	19:50		
		Staff :	MP		
Client Name :	Linear LLC			EUT Voltage :	120VAC
EUT Name :	Remote Speaker Microphone System			EUT Frequency :	60Hz
EUT Model # :	RSM-WALL			Phase:	1
EUT Serial # :					
EUT Config. :	Transmitting				
				Distance < 1000 MHz:	3 m
				Distance > 1000 MHz:	3 m
Specification :	CFR47 Part 15, Subpart C, 15.247				
Loop Ant. #:	132				
Bicon Ant.#:	128_3m	Temp. (°C) :	20		
Log Ant.#:	110_3m	Humidity (%) :	18		
DRG Ant. #	529	Spec Analyzer #:	911		
Cable LF#:	SAC_10m	Analyzer Display #:	911		
Cable HF#:	WCC	Quasi-Peak Detector #:	911		
Preamp LF#:	902	Duty Cycle (%):	0.83		
Preamp HF#	317				

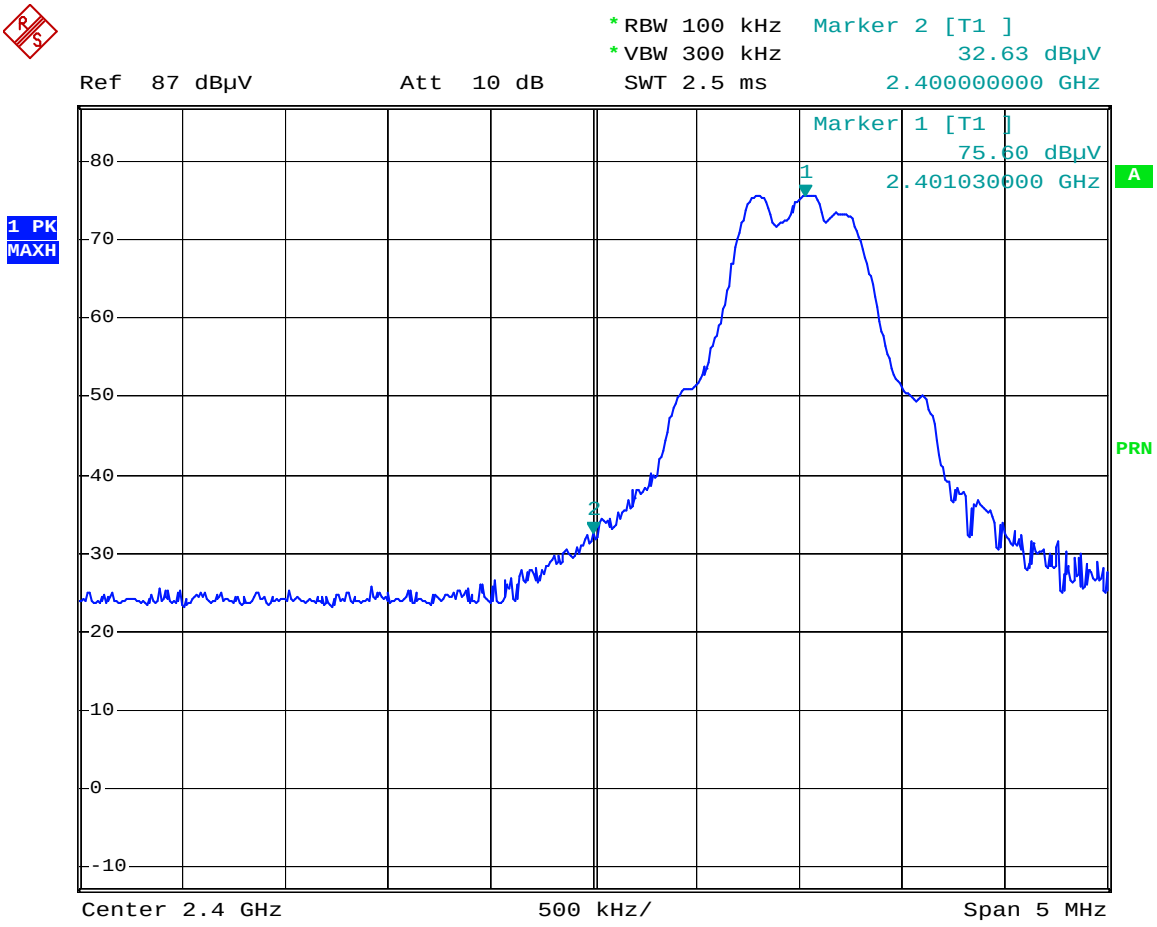
Quasi-Peak	RBW:	120 kHz
	Video Bandwidth	300 kHz
Peak	RBW:	1 MHz
	Video Bandwidth	3 MHz
Average = Peak + Duty Cycle Factor		
DCF = 20 x log(duty cyle)		

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.
Measurements above 1 GHz are Average values, unless otherwise stated.

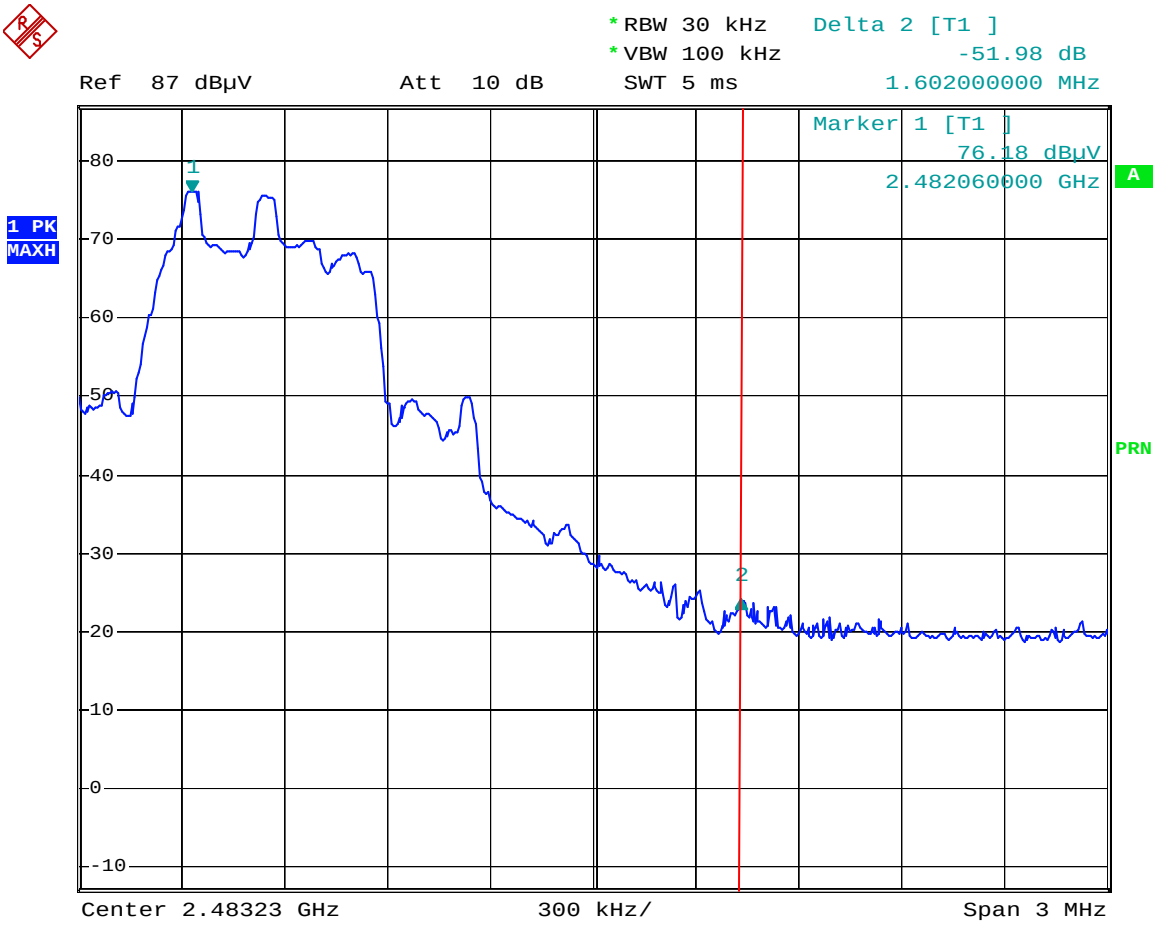
Meas. Freq. (MHz)	Meter Reading **Vertical**	Meter Reading **Horizontal**	Det.	EUT Side DEG	Ant. Height cm	Max. Reading (dBµV)	Corrected Reading (dBµV/m)	Spec. limit (dBµV/m)	CR/SL Diff. (dB)	Pass Fail	Comment
2401.056	86.4	77.8	P	238	100	86.4	123.8	125.2	-1.4	Pass	Fundamental 1MHz RBW
2400.000	32.6	31.8	P	226	100	32.6	70.0	105.2	-35.2	Pass	100kHz RBW (-20dBc)
2390.000	34.5	33.6	P	220	100	34.5	71.4	74.0	-2.5	Pass	1MHz RBW (Restricted)
2390.000	34.5	33.6	A	220	100	34.5	29.8	54.0	-24.2	Pass	
2482.272	82.4	81.6	P	249	100	82.4	119.8	125.2	-5.4	Pass	Fundamental 1MHz RBW
2482.272	76.4	75.2	P	249	100	76.4	113.8	125.2	-11.4	Pass	30kHz RBW Fundamental
2483.542	24.0	22.6	P	240	100	24.0	61.4	74.0	-12.6	Pass	30kHz RBW Band Edge
2483.542	30.0	28.9	P	312	100	30.0	67.4	74.0	-6.6	Pass	Subtract Marker-Delta
2483.542	30.0	28.9	A	312	100	30.0	25.8	54.0	-28.2	Pass	

For the upper bandedge, Mark Delta method was employed to meet the limit due to digital spurs of the fundamental. The delta between the Peak and bandedge taken at RBW of 30 kHz was subtracted from the Peak measurement taken at 1 MHz.

Low Channel Band Edge



High Channel Band Edge
Use of Marker Delta Method
Redline 2483.5 MHz



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Peak Output Power

Clause 15.247(b)(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

Test Conditions:

Sample Number:	RSM-WALL	Temperature:	18°C
Date:	1-14- 2013	Humidity:	15%
Modification State:	Lo/Mid/High Channels	Tester:	Mark Phillips
		Laboratory:	10m Chamber

Test Results: EUT complies.

The EUT was investigated with a variac that showed no output power differences when the line voltage was varied by +/- 15 % of nominal 120 Vac.

Emissions read at max hold, peak while turntable and antenna mast height varied for full effect.

Radiated Peak Output Power:

Channel	Frequency	Peak Output Power (dBµV/m)	Calculated Output Power (W)
Low	2401.056	123.8	0.439
Mid	2440.800	121.8	
High	2482.272	122.6	

Field Strength in V/m = (5.5 * sqrt (Power in Watts *ant. gain)) / distance
10^((dBuV/m-120)/20) = Volts/m
Field Strength in Volts/m = 5.5 x Square Root (Power in W)/3m
Power in Watts = (Field Strength x 3/5.5)^2

Antenna gain of dipole = 2.15 dBi
123.8 dBuV/m = 1.549 V/m
Field Strength of 1.549 V/m @ 3m with gain 2.15 dBi = 0.439 W.

Radiated Emissions Data

Job # :	10236006	Date :	01-14-13	Page 1 of 1	
NEX#:	228788	Time :	19:00		
		Staff :	MP		
Client Name :	Linear LLC			EUT Voltage :	120VAC
EUT Name :	Remote Speaker Microphone System			EUT Frequency :	60Hz
EUT Model # :	RSM-WALL			Phase:	1
EUT Serial # :					
EUT Config. :	Transmiting				
				Distance < 1000 MHz:	3 m
				Distance > 1000 MHz:	3 m
Specification :	CFR47 Part 15, Subpart C 15.247				
Loop Ant. #:	NA				
Bicon Ant.#:	NA	Temp. (°C) :	18		
Log Ant.#:	110_3m	Humidity (%) :	15		
DRG Ant. #	529	Spec Analyzer #:	911		
Cable LF#:	SAC_10m	Analyzer Display #:	911		
Cable HF#:	WCC	Quasi-Peak Detector #:	911		
Preamp LF#:	902	Duty Cycle (%):	0.83		
Preamp HF#	317				

Quasi-Peak	RBW: 120 kHz
	Video Bandwidth 300 kHz
Peak	RBW: 1 MHz
	Video Bandwidth 3 MHz
Average = Peak + Duty Cycle Factor	
DCF = 20 x log(duty cyle)	

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.
Measurements above 1 GHz are Average values, unless otherwise stated.

Meas. Freq. (MHz)	Meter Reading **Vertical**	Meter Reading **Horizontal**	Det.	EUT Side DEG	Ant. Height cm	Max. Reading (dBµV)	Corrected Reading (dBµV)	Spec. limit (dBµV)	CR/SL Diff. (dB)	Pass Fail	Comment
2401.056	86.4	77.8	P	238.0	100.0	86.4	123.8	125.2	-1.4	Pass	Ant. 1 Low (Flat)
2401.056	84.6	83.1	P	223.0	100.0	84.6	122.0	125.2	-3.2	Pass	Ant. 1 Low (Upright)
2440.800	77.1	84.7	P	251.0	100.0	84.7	122.1	125.2	-3.1	Pass	Ant. 1 Mid (Flat)
2440.800	83.4	77.7	P	49.0	100.0	83.4	120.8	125.2	-4.4	Pass	Ant. 1 Mid (Upright)
2482.272	77.2	85.2	P	203.0	100.0	85.2	122.6	125.2	-2.6	Pass	Ant. 1 High (Flat)
2482.272	82.4	81.6	P	249.0	100.0	82.4	119.8	125.2	-5.4	Pass	Ant. 1 High (Upright)
2401.056	78.7	84.4	P	233.0	100.0	84.4	121.8	125.2	-3.4	Pass	Ant. 2 Low (Flat)
2401.056	84.5	83.8	P	258.0	100.0	84.5	121.9	125.2	-3.3	Pass	Ant.2 Low (Upright)
2440.800	76.7	84.4	P	65.0	100.0	84.4	121.8	125.2	-3.4	Pass	Ant. 2 Mid (Flat)
2440.800	81.5	82.3	P	55.0	100.0	82.3	119.7	125.2	-5.5	Pass	Ant. 2 Mid (Upright)
2482.272	80.7	83.0	P	289.0	100.0	83.0	120.4	125.2	-4.8	Pass	Ant. 2 High (Flat)
2482.272	83.2	81.6	P	252.0	100.0	83.2	120.6	125.2	-4.6	Pass	Ant/ 2 High (Upright)

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Receiver Spurious Emissions

The following receiver spurious emission limits shall be complied with:
(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1.
Table 1 - Spurious Emission Limits for Receivers

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 meters)
30-88	100
88-216	150
216-960	200
Above 960	500

Test Conditions:

Sample Number:	RSM-WALL	Temperature:	20°C
Date:	1-17-2013	Humidity:	18%
Modification State:	Receive	Tester:	Mark Phillips
		Laboratory:	10m Chamber

Test Results: EUT does not have a receive mode separate from transmit mode.

- All emissions were found to be more than 20dB below the limit and have not been reported per FCC rule 15.31(o).