



Nemko Test Report: 44217RUS1rev1

Applicant: WatchGuard Video
3001 Summit Ave.
Plano, TX 75074
USA

Equipment Under Test: MIC-WRL-CHG-400
(E.U.T.)

FCC ID: YJV-CHG400

In Accordance With: **FCC Part 15, Subpart C, 15.247 &
Industry Canada, RSS-210, Issue 8**
Frequency Hopping Transmitters

Tested By: Nemko USA Inc.
802 N. Kealy
Lewisville, Texas 75057-3136

TESTED BY: 

David Light, Senior Wireless Engineer

DATE: 15 June 2010

APPROVED BY: 

Tom Tidwell, Telecom Direct

DATE: 26 July 2011

Total Number of Pages: 37

Table of Contents

SECTION 1. SUMMARY OF TEST RESULTS	3
SECTION 2. EQUIPMENT UNDER TEST (E.U.T.)	5
SECTION 3. CHANNEL SEPARATION	7
SECTION 4. TIME OF OCCUPANCY	10
SECTION 5. PEAK POWER OUTPUT	13
SECTION 6. SPURIOUS EMISSIONS (ANTENNA CONDUCTED)	16
SECTION 7. SPURIOUS EMISSIONS (RADIATED)	20
SECTION 8. RECEIVER SPURIOUS	25
SECTION 9. TEST EQUIPMENT LIST	26
ANNEX A - TEST DETAILS	27
ANNEX B - TEST DIAGRAMS	35

Nemko USA, Inc.

FCC PART 15, SUBPART C & Industry Canada RSS-210

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MIC-WRL-CHG-400

PROJECT NO.: 44217RUS1rev1

Section 1. Summary of Test Results

Manufacturer: WatchGuard Video

Model No.: MIC-WRL-CHG-400

Sample No.: 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, Paragraph 15.247 & Industry Canada RSS-210, Issue 8 for Frequency Hopping Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-2003 and FCC Notice DA 00-705. Radiated emissions are made in a semi-anechoic chamber. A description of the test facility is on file with the FCC and Industry Canada.

<input checked="" type="checkbox"/>	New Submission	<input type="checkbox"/>	Production Unit
<input type="checkbox"/>	Class II Permissive Change	<input checked="" type="checkbox"/>	Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See "Summary of Test Data".



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FCC PART 15, SUBPART C & Industry Canada RSS-210

EQUIPMENT: MIC-WRL-CHG-400

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

PROJECT NO.: 44217RUS1rev1

Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
Powerline Conducted Emissions	15.207(a)/RSS-Gen 7.2.2	NA
Channel Separation	15.247(a)(1)/RSS-210 A8.1(b)	Complies
Time of Occupancy	15.247(a)(1)/RSS-210 A8.1(c)	Complies
20 dB Occupied Bandwidth	15.247(a)(1)/RSS-210 A8.1(c)	Complies
Peak Power Output	15.247(b)/RSS-210 A8.4(1)	Complies
Spurious Emissions (Antenna Conducted)	15.247(d)(RSS-210 A8.5	NT
Spurious Emissions (Radiated)	15.247(d)/RSS-210 A8.5	Complies
Receiver Spurious Emissions	RSS-Gen 7.2.3	Complies

Footnotes:

- 1) The EUT is powered by 12 Vdc automotive battery.

Justification for Revision:

Revision 1) Updated report to current issue of RSS-210.

Section 2. Equipment Under Test (E.U.T.)**General Equipment Information****Frequency Band:**

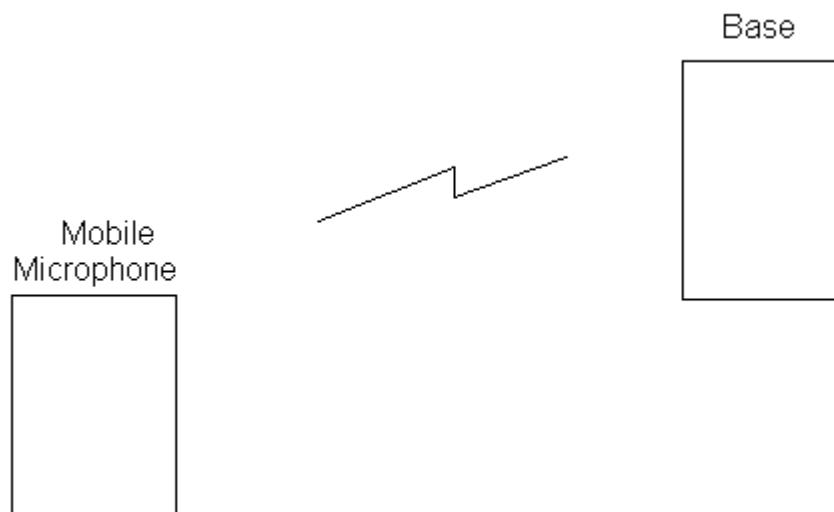
902 – 928 MHz
 2400 – 2483.5 MHz
 5725 – 5850 MHz

Operating Frequency Range: 902.25 to 927.50 MHz**Modulation Type:** FSK**Emission Designator:** 200KF1D**Number of Channels:** 50 to 51**Channel Spacing:** 500 kHz**20 dB Bandwidth:** 200 kHz**Transmitter ON time:** 361.62 mS in 20 seconds**Input power:** 12 Vdc**User Frequency Adjustment:** None

15.203 Antenna Restriction: The antenna installed with this radio device uses a standard SMA connector. However the use of this device is always in law enforcement vehicles and is professionally installed with the supplied antenna.

Description of EUT

Microphone system is comprised of one MIC-WRL-TRN-400 "Transmitter" component and one MIC-WRL-CHG-400 "Base" component. These two components operate as a pair and comprise the operational wireless microphone system.

System Diagram

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MIC-WRL-CHG-400

PROJECT NO.: 44217RUS1rev1

Section 3. Channel Separation

NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
TESTED BY: David Light	RSS-210 A8.1(b)
	DATE: 14 June 2010

Test Results: Complies.

Measurement Data: See 20 dB BW plot

Measured 20 dB bandwidth: 200 kHz
Channel Separation: 500 kHz

Equipment Used: 1464-1082-802

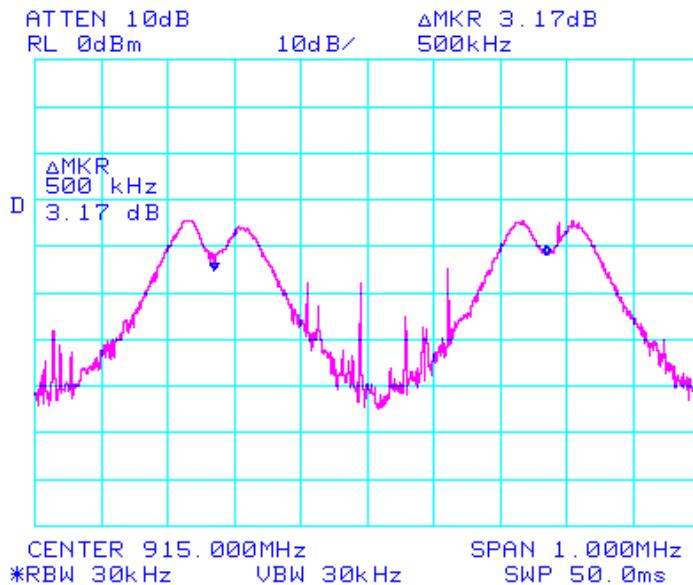
Measurement Uncertainty: 1X10⁻⁷ppm

Temperature: 22 °C

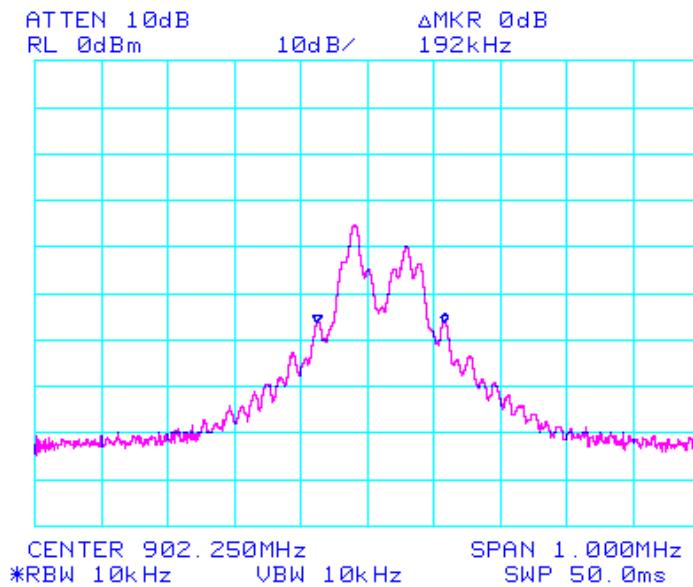
Relative Humidity: 35 %

Test Data

Channel Separation

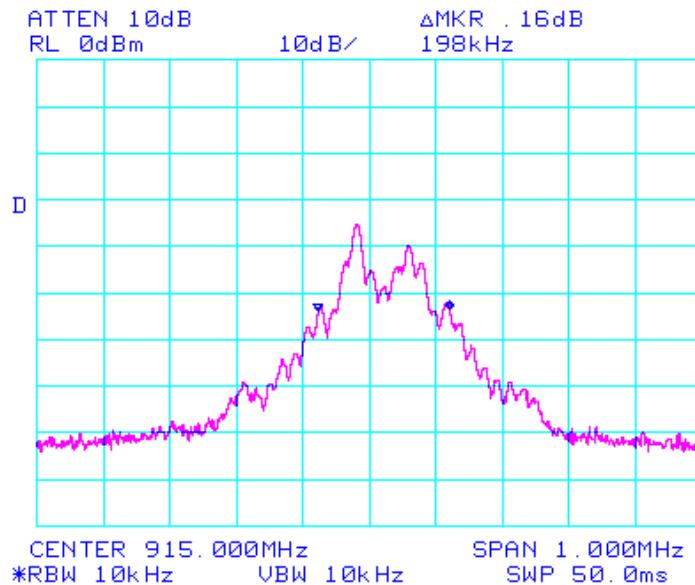


Low Channel

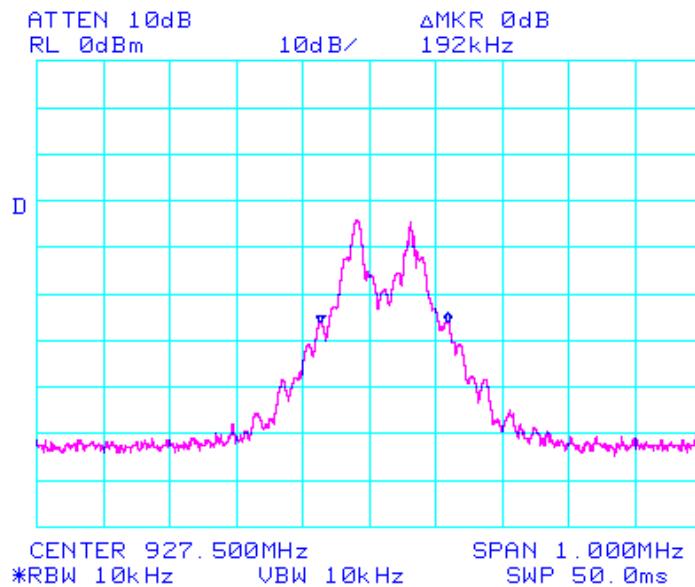


Test Data – 20 dB Bandwidth

Mid Channel



High Channel



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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MIC-WRL-CHG-400

PROJECT NO.: 44217RUS1rev1

Section 4. Time of Occupancy

NAME OF TEST: Time of Occupancy	PARA. NO.: 15.247(a)(1)
TESTED BY: David Light	RSS-210 A8.1(c)
	DATE: 14 June 2010

Test Results: Complies.

Measurement Data:

Maximum Dwell Time On Any Channel: 361.62 mS/20 seconds

Equipment Used: 1464-1082-802

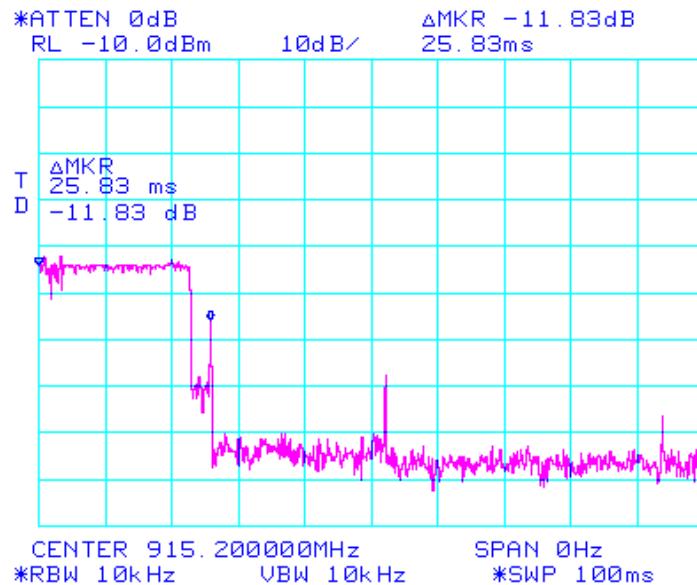
Measurement Uncertainty: 1X10⁻⁷ ppm

Temperature: 22 °C

Relative Humidity: 35 %

Test Data – Time of Occupancy

Pulse Width



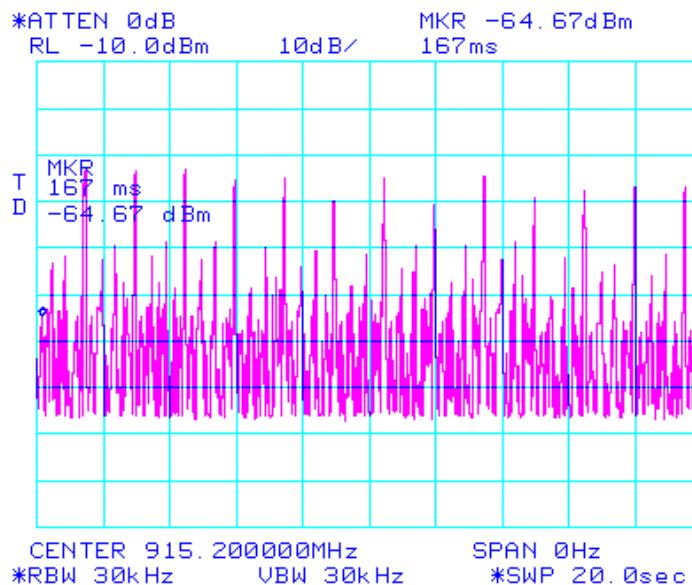
$$\text{Duty Cycle Correction} = 20 \log (25.83/100) = -11.78 \text{ dB}$$

Test Data – Time of Occupancy

Transmitter ON time

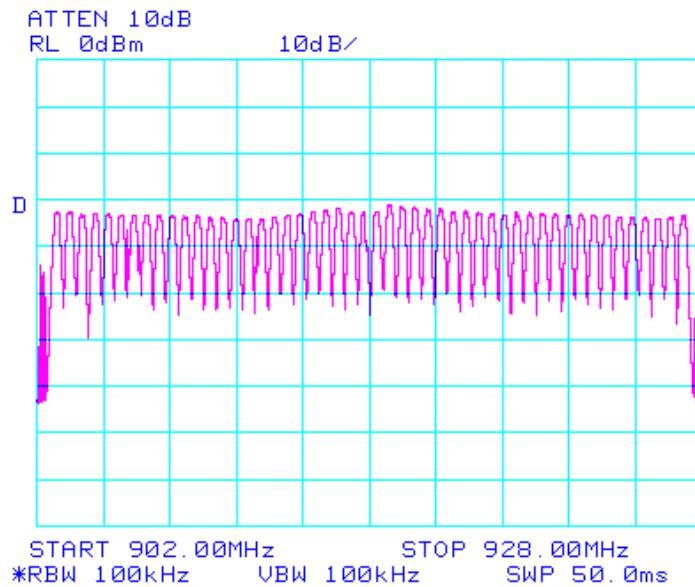
$$14 \text{ hops} @ 25.83 \text{ mS} = 361.62 \text{ mS}$$

Limit = 400 mS



Test Data – Time of Occupancy

Number of hopping channels



Section 5. Peak Power Output

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247 (b)
TESTED BY: David Light	RSS-210 A8.4(1)
	DATE: 14 June 2010

Test Results: Complies.**Measurement Data:** See attached plots.Detachable antenna? Yes No

Frequency (MHz)	Peak Power (dBm)	Peak Power (mW)	Antenna Type	Gain (dBi)	EIRP (dBm)	EIRP (mW)
902.25	20.83	121.1	Dipole	-2	18.83	76.4
915.00	20.67	116.7	Dipole	-2	18.67	73.6
927.50	19.67	92.7	Dipole	-2	17.67	58.5
Maximum EIRP (mW):						

- This device was tested at +/- 15% input power per 15.31(e), with no variation in output power.
- For battery powered equipment, the device was tested with a fresh battery per 15.31(e).
- The device was tested on three channels per 15.31(l).
- This test was performed radiated.

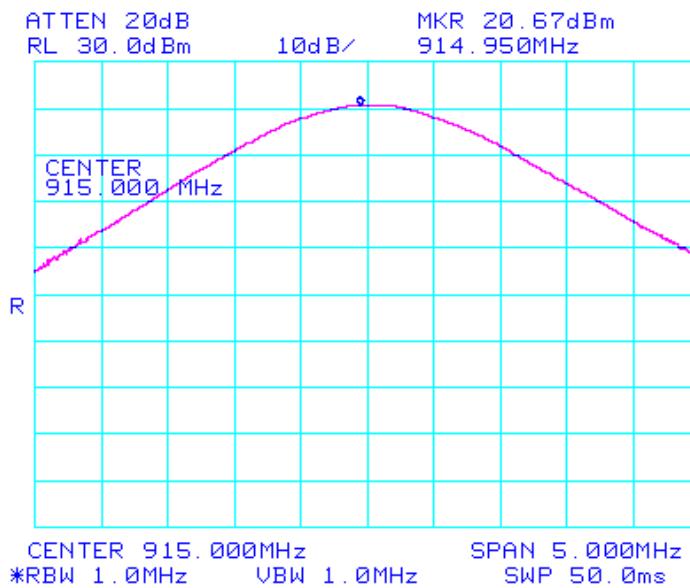
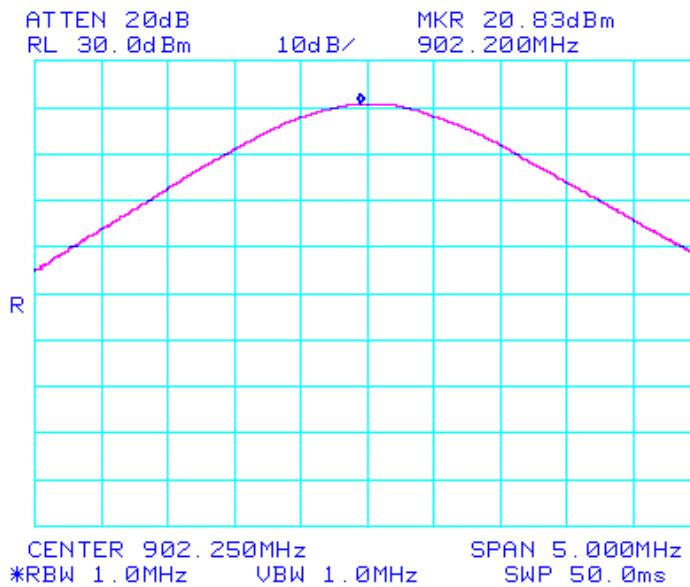
Equipment Used:**Measurement Uncertainty:** 1.7 dB**Temperature:** 22 °C**Relative Humidity:** 35 %**Analyzer Settings:** RBW/VBW = 1 MHz Peak Detector

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER
EQUIPMENT: MIC-WRL-CHG-400 PROJECT NO.: 44217RUS1rev1

Test Data – Peak Power

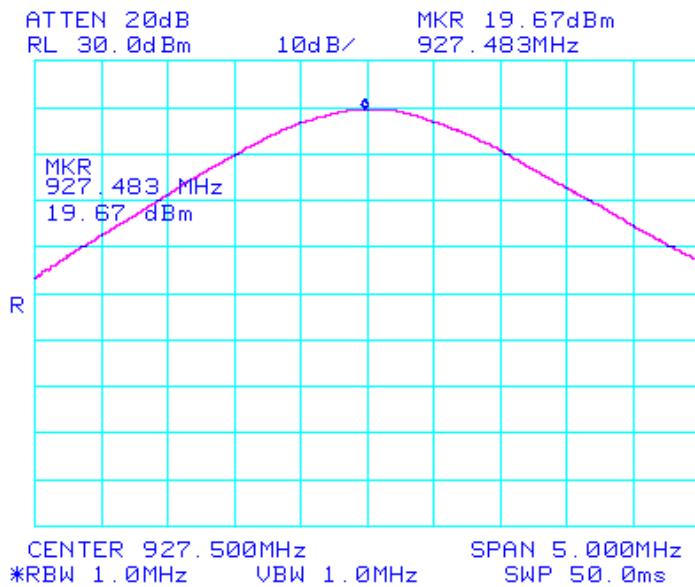


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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER
EQUIPMENT: MIC-WRL-CHG-400 PROJECT NO.: 44217RUS1rev1

Test Data – Peak Power



Nemko USA, Inc.

FCC PART 15, SUBPART C & Industry Canada RSS-210

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MIC-WRL-CHG-400

PROJECT NO.: 44217RUS1rev1

Section 6. Spurious Emissions (Antenna Conducted)

NAME OF TEST: Spurious Emissions (Antenna Conducted)	PARA. NO.: 15.247(d)
	RSS-210 A8.5
TESTED BY: David Light	DATE:14 June 2010

Test Results: Complies.

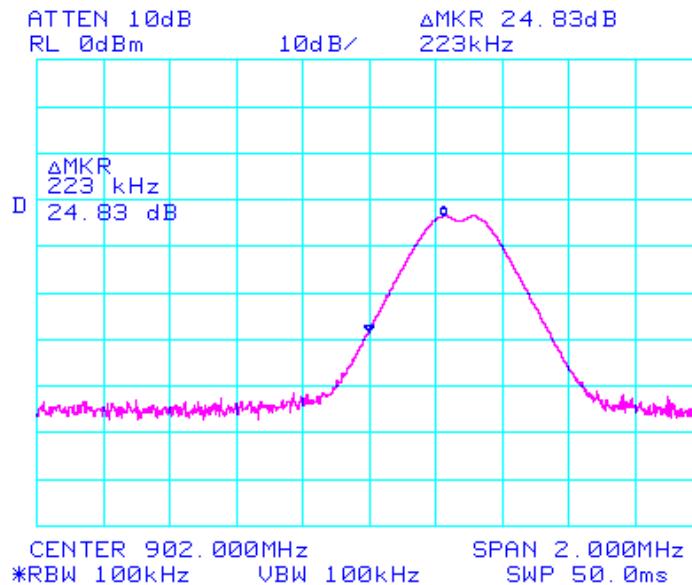
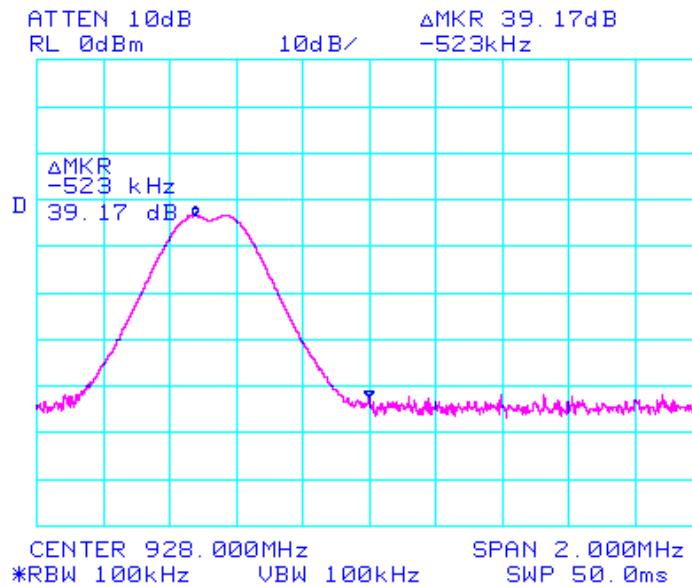
Measurement Data: See attached plots.

Equipment Used: 1464-1082-1472

Measurement Uncertainty: 1X10⁻⁷ ppm

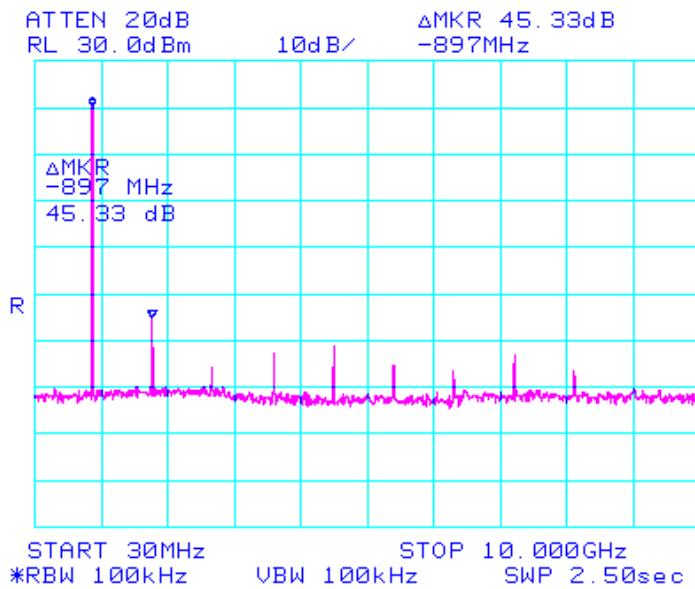
Temperature: 22 °C

Relative Humidity: 35 %

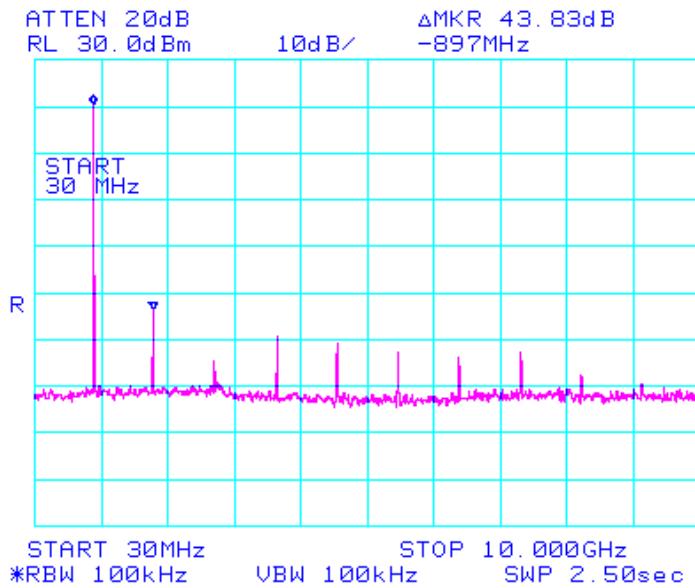
Test Data – Spurious Emissions at Antenna Terminals**Low Band Edge****Upper Band Edge**

Test Data – Spurious Emissions at Antenna Terminals

Spurs – Low Channel



Mid Channel



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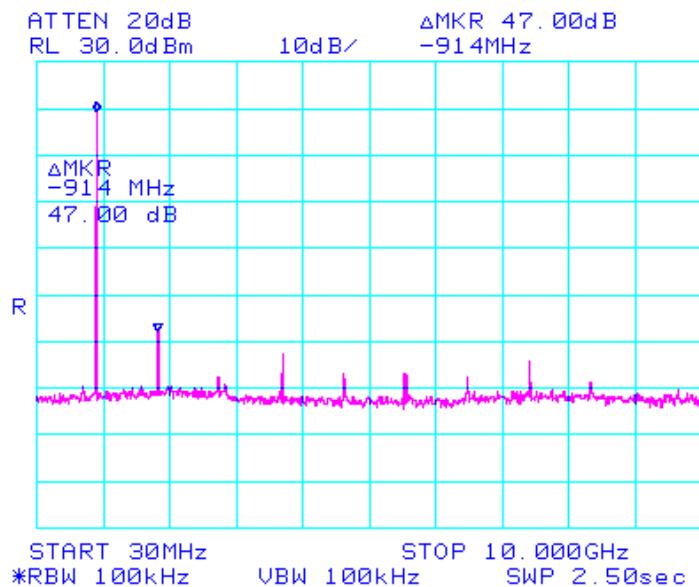
FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MIC-WRL-CHG-400

PROJECT NO.: 44217RUS1rev1

Test Data – Spurious Emissions at Antenna Terminals

Spurs – High Channel



Section 7. Spurious Emissions (Radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(d)
TESTED BY: David Light	RSS-210 A8.5
	DATE: 14 June 2010

Test Results: Complies. The worst case emission was 47.2 dB μ V/m at 2706.75 MHz. This is 6.8 dB below the specification limit of 54 dB μ V/m.

Measurement Data: See attached table.

Duty Cycle Calculation: Refer to page 11

Duty Cycle correction factor(dB) = $20 \log (rf_{ON} \text{ in ms}/10s)$

Notes:

- For handheld devices, the EUT was tested on three orthogonal axis'
- The device was tested from 30 MHz to the tenth harmonic of the highest fundamental frequency per 15.33
- The device was tested on three channels per 15.31(l).
- All emissions within 20 dB of the specification limit are reported.

Equipment Used: 1464-1484-1485-1480-993-1016-791

Measurement Uncertainty: +/-3.6 dB

Temperature: 22 °C

Relative Humidity: 35 %

Analyzer Settings: RBW/VBW = 1 MHz Peak detector

Test Data - Radiated Emissions

Low Channel

#	Freq MHz	Rdng dB μ V	Cable		Pre-A		Horn		Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
			Duty dB	dB	dB	dB	dB	dB					
1	2706.75	58.7	+0.8 +0.0	+2.8	-32.7	+29.3	+0.0	58.9	74.0	-15.1			Vert
2	2706.75	58.7	+0.8 Ave	+2.8 -11.7	-32.7	+29.3	+0.0	47.2	54.0	-6.8			Vert
3	3609.00	56.0	+0.8 +0.0	+2.8	-32.7	+30.3	+0.0	57.2	74.0	-16.8			Vert
4	3609.00	56.0	+0.8 Ave	+2.8 -11.7	-32.7	+30.3	+0.0	45.5	54.0	-8.5			Vert
5	4511.25	49.3	+1.0 -11.7	+3.1	-32.5	+32.0	+0.0	41.2	54.0	-12.8			Vert
6	5413.50	47.0	+1.2 Ave	+3.5 -11.7	-31.8	+33.6	+0.0	41.8	54.0	-12.2			Vert
7	6315.75	45.0	+1.3 Ave	+3.9 -11.7	-31.3	+34.9	+0.0	42.1	54.0	-11.9			Vert
8	7218.00	46.2	+1.2 +0.0	+3.9	-32.2	+35.8	+0.0	54.9	74.0	-19.1			Vert
9	7218.00	46.2	+1.2 -11.7	+3.9	-32.2	+35.8	+0.0	43.2	54.0	-10.8			Vert
10	8120.25	45.7	+1.4 +0.0	+4.3	-33.0	+37.6	+0.0	56.0	74.0	-18.0			Vert
11	8120.25	45.7	+1.4 Ave	+4.3 -11.7	-33.0	+37.6	+0.0	44.3	54.0	-9.7			Vert
12	9022.50	45.0	+1.4 Ave	+4.1 -11.7	-33.7	+37.0	+0.0	42.1	54.0	-11.9			Vert
13	2706.75	53.0	+0.8 Ave	+2.8 -11.7	-32.7	+29.3	+0.0	41.5	54.0	-12.5			Horiz
14	3609.00	52.7	+0.8 Ave	+2.8 -11.7	-32.7	+30.3	+0.0	42.2	54.0	-11.8			Horiz
15	4511.25	52.8	+1.0 +0.0	+3.1	-32.5	+32.0	+0.0	56.4	74.0	-17.6			Horiz
16	4511.25	52.8	+1.0 Ave	+3.1 -11.7	-32.5	+32.0	+0.0	44.7	54.0	-9.3			Horiz

Corr(dB μ V/m) = Rdng(dB) + Cables(dB) + PreA(dB) + Horn(dB) + Duty Cycle(dB)

Readings are Peak unless otherwise indicated.

Test Data - Radiated Emissions - Continued**Low Channel**

#	Freq MHz	Rdng dB μ V	Cable Duty dB	Cable dB	Pre-A dB	Horn dB	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
17	5413.50 Ave	46.2	+1.2 -11.7	+3.5	-31.8	+33.6	+0.0	41.0	54.0	-13.0	Horiz
18	6315.75	44.3	+1.3 +0.0	+3.9	-31.3	+34.9	+0.0	53.1	74.0	-20.9	Horiz
19	6315.75 Ave	44.3	+1.3 -11.7	+3.9	-31.3	+34.9	+0.0	41.4	54.0	-12.6	Horiz
20	7218.00	45.5	+1.2 +0.0	+3.9	-32.2	+35.8	+0.0	54.2	74.0	-19.8	Horiz
21	7218.00 Ave	45.5	+1.2 -11.7	+3.9	-32.2	+35.8	+0.0	42.5	54.0	-11.5	Horiz
22	8120.25 Ave	43.3	+1.4 -11.7	+4.3	-33.0	+37.6	+0.0	41.9	54.0	-12.1	Horiz
23	9022.50 Ave	45.2	+1.4 -11.7	+4.1	-33.7	+37.0	+0.0	42.3	54.0	-11.7	Horiz

Mid Channel

#	Freq MHz	Rdng dB μ V	Cable Duty dB	Cable dB	Pre-A dB	Horn dB	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
1	2745.00	54.8	+0.8 +0.0	+2.9	-32.7	+29.4	+0.0	55.2	74.0	-18.8	Horiz
2	2745.00 Ave	54.8	+0.8 -11.7	+2.9	-32.7	+29.4	+0.0	43.5	54.0	-10.5	Horiz
3	3660.00	54.3	+0.8 +0.0	+2.8	-32.6	+30.5	+0.0	55.8	74.0	-18.2	Horiz
4	3660.00 Ave	54.3	+0.8 -11.7	+2.8	-32.6	+30.5	+0.0	44.1	54.0	-9.9	Horiz
5	4575.00	54.8	+1.0 +0.0	+3.1	-32.5	+32.3	+0.0	58.7	74.0	-15.3	Horiz
6	4575.00 Ave	54.8	+1.0 -11.7	+3.1	-32.5	+32.3	+0.0	47.0	54.0	-7.0	Horiz
7	5490.00 Ave	47.2	+1.2 -11.7	+3.5	-31.8	+33.6	+0.0	42.0	54.0	-12.0	Horiz
8	6405.00	46.3	+1.3 +0.0	+3.9	-31.5	+35.1	+0.0	55.1	74.0	-18.9	Horiz
9	6405.00 Ave	46.3	+1.3 -11.7	+3.9	-31.5	+35.1	+0.0	43.4	54.0	-10.6	Horiz
10	7320.00	46.5	+1.2 +0.0	+4.0	-32.2	+35.8	+0.0	55.3	74.0	-18.7	Horiz
11	7320.00 Ave	46.5	+1.2 -11.7	+4.0	-32.2	+35.8	+0.0	43.6	54.0	-10.4	Horiz

Test Data - Radiated Emissions - Continued

Mid Channel

#	Freq MHz	Rdng dB μ V	Cable Duty dB	Cable dB	Pre-A dB	Horn dB	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
12	8235.00	44.3	+1.3 -11.7	+4.3	-33.3	+37.3	+0.0	42.2	54.0	-11.8	Horiz
13	9150.00	45.5	+1.3 +0.0	+4.3	-33.8	+37.0	+0.0	54.3	74.0	-19.7	Horiz
14	9150.00	45.5	+1.3 -11.7	+4.3	-33.8	+37.0	+0.0	42.6	54.0	-11.4	Horiz
15	2745.00	61.5	+0.8 +0.0	+2.9	-32.7	+29.4	+0.0	61.9	74.0	-12.1	Vert
16	2745.00	61.5	+0.8 -11.7	+2.9	-32.7	+29.4	+0.0	50.2	54.0	-3.8	Vert
17	3660.00	56.8	+0.8 +0.0	+2.8	-32.6	+30.5	+0.0	58.3	74.0	-15.7	Vert
18	3660.00	56.8	+0.8 -11.7	+2.8	-32.6	+30.5	+0.0	46.6	54.0	-7.4	Vert
19	4575.00	50.8	+1.0 +0.0	+3.1	-32.5	+32.3	+0.0	54.7	74.0	-19.3	Vert
20	4575.00	50.8	+1.0 -11.7	+3.1	-32.5	+32.3	+0.0	43.0	54.0	-11.0	Vert
21	5490.00	45.8	+1.2 -11.7	+3.5	-31.8	+33.6	+0.0	40.6	54.0	-13.4	Vert
22	6405.00	44.0	+1.3 -11.7	+3.9	-31.5	+35.1	+0.0	41.1	54.0	-12.9	Vert
23	7320.00	44.0	+1.2 -11.7	+4.0	-32.2	+35.8	+0.0	41.1	54.0	-12.9	Vert
24	8235.00	45.5	+1.3 +0.0	+4.3	-33.3	+37.3	+0.0	55.1	74.0	-18.9	Vert
25	8235.00	45.5	+1.3 -11.7	+4.3	-33.3	+37.3	+0.0	43.4	54.0	-10.6	Vert
26	9150.00	44.8	+1.3 -11.7	+4.3	-33.8	+37.0	+0.0	41.9	54.0	-12.1	Vert

Test Data - Radiated Emissions – Continued**High Channel**

#	Freq MHz	Rdng dB μ V	Cable Duty dB	Cable dB	Pre-A dB	Horn dB	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
1	2782.40	54.2	+0.8 +0.0	+2.9	-32.7	+29.4	+0.0	54.6	74.0	-19.4	Vert
2	2782.40	54.2	+0.8 -11.7	+2.9	-32.7	+29.4	+0.0	42.9	54.0	-11.1	Vert
3	3709.90	54.2	+0.8 +0.0	+2.8	-32.5	+30.6	+0.0	55.9	74.0	-18.1	Vert
4	3709.90	54.2	+0.8 -11.7	+2.8	-32.5	+30.6	+0.0	44.2	54.0	-9.8	Vert
5	4637.40	48.8	+1.0 -11.7	+3.2	-32.5	+32.5	+0.0	41.3	54.0	-12.7	Vert
6	5564.90	44.2	+1.2 -11.7	+3.5	-31.9	+33.7	+0.0	39.0	54.0	-15.0	Vert
7	6492.40	43.5	+1.3 -11.7	+4.0	-31.7	+35.2	+0.0	40.6	54.0	-13.4	Vert
8	7419.90	42.7	+1.2 -11.7	+4.1	-32.0	+35.9	+0.0	40.2	54.0	-13.8	Vert
9	8347.40	44.0	+1.2 -11.7	+4.4	-33.5	+37.1	+0.0	41.5	54.0	-12.5	Vert
10	9274.90	44.2	+1.2 -11.7	+4.4	-33.8	+37.1	+0.0	41.4	54.0	-12.6	Vert
11	2782.40	50.5	+0.8 -11.7	+2.9	-32.7	+29.4	+0.0	39.2	54.0	-14.8	Vert
12	3709.90	52.2	+0.8 -11.7	+2.8	-32.5	+30.6	+0.0	42.2	54.0	-11.8	Vert
13	4637.40	51.3	+1.0 +0.0	+3.2	-32.5	+32.5	+0.0	55.5	74.0	-18.5	Vert
14	4637.40	51.3	+1.0 -11.7	+3.2	-32.5	+32.5	+0.0	43.8	54.0	-10.2	Vert
15	5564.90	46.0	+1.2 -11.7	+3.5	-31.9	+33.7	+0.0	40.8	54.0	-13.2	Vert
16	6492.40	44.3	+1.3 -11.7	+4.0	-31.7	+35.2	+0.0	41.4	54.0	-12.6	Vert
17	7419.90	44.0	+1.2 -11.7	+4.1	-32.0	+35.9	+0.0	41.5	54.0	-12.5	Vert
18	8347.40	43.2	+1.2 -11.7	+4.4	-33.5	+37.1	+0.0	40.7	54.0	-13.3	Vert
19	9274.90	42.7	+1.2 -11.7	+4.4	-33.8	+37.1	+0.0	39.9	54.0	-14.1	Vert

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FCC PART 15, SUBPART C & Industry Canada RSS-210

EQUIPMENT: MIC-WRL-CHG-400

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

PROJECT NO.: 44217RUS1rev1

Section 8. Receiver Spurious

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: RSS-Gen 7.2.3
TESTED BY: David Light	DATE: 14 June 2010

Test Results: Complies. The worst case emission was 34.5 dB μ V/m at 915 MHz. This is 11.5 dB below the specification limit of 40 dB μ V/m.

Measurement Data: This was the only emission within 20 dB of the specification limit.

Equipment Used: 1464-1484-1485-1480-993-1016-791

Measurement Uncertainty: +/-3.6 dB

Temperature: 22 °C

Relative Humidity: 35 %

Analyzer Settings: Emissions < 1 GHz RBW/VBW=100 kHz Peak detector
Emissions > 1 GHz RBW/VBW=1 MHz Peak detector

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MIC-WRL-CHG-400

PROJECT NO.: 44217RUS1rev1

Section 9. Test Equipment List

Asset Tag	Description	Manufacturer	Model	Serial #	Last Cal	Next Cal
802	Near Field Probe Set	EMCO	7405	103	CNR	NA
993	Antenna, Horn	A.H. Systems	SAS-200/571	162	09-Sep-2009	09-Sep-2011
1016	Preamplifier	Hewlett Packard	8449A	2749A00159	23-Jun-2009	23-Jun-2010
1082	Cable, 2m	Astrolab	32027-2-29094-72TC		CBU	NA
1464	Spectrum Analyzer	Hewlett Packard	8563E	3551A04428	27-Feb-2009	27-Feb-2011
1480	Antenna, Bilog	Schaffner-Chase	CBL6111C	2572	28-Jan-2009	28-Jan-2010
1484	Cable	Storm	PR90-010-072		23-Jun-2009	23-Jun-2010
1485	Cable	Storm	PR90-010-216		23-Jun-2009	23-Jun-2010

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MIC-WRL-CHG-400

PROJECT NO.: 44217RUS1rev1

ANNEX A - TEST DETAILS

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EQUIPMENT: MIC-WRL-CHG-400

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

PROJECT NO.: 44217RUS1rev1

NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
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Minimum Standard:

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.

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EQUIPMENT: MIC-WRL-CHG-400

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

PROJECT NO.: 44217RUS1rev1

NAME OF TEST: Time of Occupancy

PARA. NO.: 15.247(a)(1)

Minimum Standard:

Frequency Band (MHz)	20 dB Bandwidth	No. of Hopping Channels	Average Time of Occupancy
902 - 928	<250 kHz	50	=<0.4 sec. in 20 sec.
902 – 928	=>250 kHz	25	=<0.4 sec. in 10 sec.
2400 – 2483.5	-----	75	=<0.4 sec. in 0.4 seconds multiplied by the number of hopping channels employed.
5725 – 5850	-----	75	=<0.4 sec. in 30 sec.

Method Of Measurement:

The spectrum analyzer is set as follows:

RBW: 1 MHz

VBW: = RBW

Span: 0 Hz

LOG dB/div.: 10 dB

Sweep: Sufficient to see one hop time sequence.

Trigger: Video

The occupancy time of one hop is measured as above. The average time of occupancy is calculated over the appropriate period of time from above table

Avg. time of occupancy = (period from table/duration of one hop)/no. of channels multiplied by the duration of one hop.

For instance:

If a 2.4 GHz system has a measured hop duration time of 1 msec. and uses 75 channels, then the average time of occupancy would be:

(30 sec./.001 sec.)/75 chan. = 400 x 1 msec. = 400 msec. or 0.4 sec. in 30 sec.

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EQUIPMENT: MIC-WRL-CHG-400

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER
PROJECT NO.: 44217RUS1rev1

NAME OF TEST: Occupied Bandwidth

PARA. NO.: 15.247(a)(1)

Minimum Standard:

Frequency Band (MHz)	Maximum 20 dB Bandwidth
902 - 928	500 kHz
2400 – 2483.5	Not defined
5725 – 5850	1 MHz

Method Of Measurement:

The spectrum analyzer is set as follows:

RBW: At least 1% of span/div.

VBW: >RBW

Span: Sufficient to display 20 dB bandwidth

LOG dB/div.: 10 dB

Sweep: Auto

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

NAME OF TEST: Peak Power Output

PARA. NO.: 15.247(b)

Minimum Standard:

Frequency Band (MHz)	No. of Hopping Channels	Maximum Peak Power Output at Antenna Port
902 - 928	at least 50	1 watt
902 – 928	25 - 49	0.25 watts
2400 – 2483.5	75	1 watt
5725 – 5850	75	1 watt

If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operation may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Direct Measurement Method For Detachable Antennas:

If the antenna is detachable, a peak power meter is used to measure the power output with the transmitter operating into a 50 ohm load. The dBi gain of the antenna(s) employed shall be reported.

Calculation Of EIRP For Integral Antenna:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

The RBW of the spectrum analyzer shall be set to a value greater than the measured 20 dB occupied bandwidth of the E.U.T.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER
EQUIPMENT: MIC-WRL-CHG-400

PROJECT NO.: 44217RUS1rev1

NAME OF TEST: Spurious Emissions at Antenna Terminals PARA. NO.: 15.247(d)

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength (μ V/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC**Method Of Measurement:**30 MHz - 10th harmonic plot

RBW: 100 kHz

VBW: 300 kHz

Sweep: Auto

Display line: -20 dBc

Lower Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 902 MHz, 2400 MHz, or 5725 MHz

Marker: Peak of fundamental emission

Marker Δ: Peak of highest spurious level below center frequency.

Upper Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 928 MHz, 2483.5 MHz, or 5850 MHz

Marker: Peak of fundamental emission

Marker Δ: Peak of highest spurious level above center frequency.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MIC-WRL-CHG-400

PROJECT NO.: 44217RUS1rev1

NAME OF TEST: Radiated Spurious Emissions

PARA. NO.: 15.247(d)

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits:

Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength (μ V/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC

15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.125-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41	1718		

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

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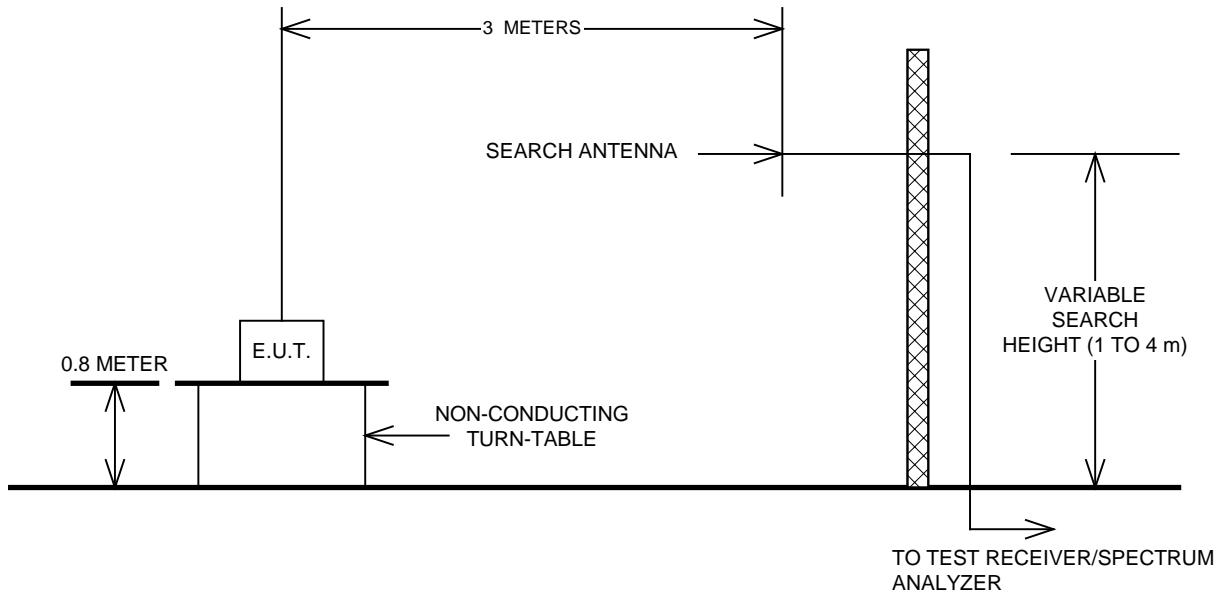
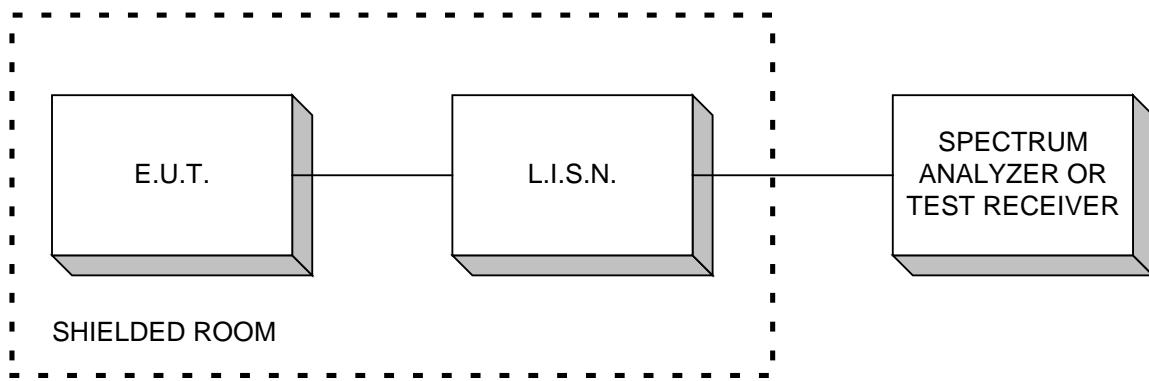
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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MIC-WRL-CHG-400

PROJECT NO.: 44217RUS1rev1

ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions**Conducted Emissions**

Peak Power at Antenna Terminals