

Test Report

Project Number: 01069-10

Prepared for:

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TYPE CERTIFICATION TEST REPORT

Wireless Speakers Transmitter
Model Number WS920

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1. EUT Description

The Equipment Under Test (EUT) is the **Core Technology, Wireless Speaker Transmitter**.

Specific test requirements for this device include the following:

47 CFR 15.249	Fundamental Transmit Power
47 CFR 15.249 15.205 & 15.209	Spurious Radiated Power
47 CFR 15.231	Occupied Bandwidth
47 CFR 15.203	Antenna Requirement
47 CFR 15.207	Conducted Emissions

The system tested consisted of the following:

Manufacturer & Model	FCC ID #	Description
Core Technology	OU4-WS920	Wireless Speaker Transmitter

1.1. EUT Operation

The **Wireless Speakers Transmitter** was tested with the wireless link active and fully modulated. Setup and operational modes cover worst case configuration and operational modes for the device.

2. Radiated Emissions Testing

Professional Testing (EMI), Inc. (PTI), follows the guidelines of NIST for all uncertainty calculations, estimates and expressions thereof for EMC testing.

Radiated emission measurements were made of the Fundamental and Spurious Emission and Conducted Emissions levels for the **Wireless Speakers Transmitter**. Measurements of the occupied bandwidth were also made for the equipment.

Measurements of the maximum emission levels for the fundamental and the spurious/harmonic emissions of the **Wireless Speakers Transmitter** were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

Tests of the fundamental for the device were performed to determine the worst case polarization of the devices. The fundamental emissions of the device were

measured with the antennas of the devices vertical and horizontal to the ground plane.

2.1. Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable which allows 360 degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. For spurious/harmonic measurements above 1GHz, the measurement antenna was placed 1 meter from the EUT. The radiated emissions were maximized by configuring the EUT, by rotating the EUT, and by raising and lowering the antenna from 1 to 4 meters.

A Spectrum Analyzer with peak detection was used to find the maximums of the radiated emissions during the variability testing. A drawing showing the test setup is given as Figure 1.

2.2. Test Criteria

The FCC Part 15.249 radiated limits are given below for an intentional radiator operating in the 902 to 928 MHz band. The reference distance for each limit is also shown in this table.

Signal Type	Test Distance	Field Strength	
		$\mu\text{V/m}$	$\text{dB } \mu\text{V/m}$
Fundamental	3	50,000	93.9
Spurious/Harmonics	3	500	53.9
Spurious/Harmonics	1	1,500	63.5

In addition to these requirements, the EUT must meet the restricted emission band requirements of §15.205. For this frequency range, the unintentional radiated emission limits of §15.231 for a 902 to 928 MHz radiator and the restricted band limits of §15.205 are identical. Measurements of the harmonic were performed to the 10th harmonic of the fundamental.

2.3. Test Results

The radiated test data is included as Appendix B. The emissions were maximized at each frequency and the highest emissions identified were measured using peak detection. The radiated emissions generated by the **Wireless Speakers Transmitter** are below the FCC Part 15.249 maximum emission criteria.

3. Occupied Bandwidth Measurements

Measurements of the occupied bandwidth for the fundamental signals of the of the **Wireless Speakers Transmitter** were made at the Professional Testing's Round Rock, Texas laboratory. All measurements were made in a controlled indoor environment in a configuration which did not present measurement distortion or ambient interference.

3.1. Test Procedure

1. The EUT was placed on a non-conductive table 0.8 meters above the floor. The table was rotated to an angle that presented the highest signal level.
2. The Spectrum Analyzer was set to a resolution bandwidth of 100 kHz. Peak detection was used for all tests. The display was set with the maximum amplitude near the displayed center frequency and with a display width sufficient to view the occupied bandwidth.
3. The occupied bandwidth was measured based on a 20 dB criteria (20 dB down either side of the emission from the nominal center of the emission).

A drawing showing the test setup is given as Figure 1.

3.2. Test Criteria

The FCC rules do not specify a bandwidth requirement in 47 CFR 15.249. For comparison purposes, the limit of occupied bandwidth for 47 CFR 15.231 devices operating over 900 MHz is used, which restricts devices to 0.5% of the center frequency. For a center frequency of 916.5 MHz the occupied bandwidth requirement is 4.58 MHz.

Measurement of the occupied bandwidth was performed to verify that the emission bandwidth did not change beyond what is typically seen for the **Wireless Speakers Transmitter**.

3.3. Test Results

The occupied bandwidth test data is included in Appendix C. The occupied bandwidth for the fundamental frequency (916.5 MHz) is 450 kHz. The figure is typical for the Wireless Speakers Transmitter.

The intended center frequency for the EUT was centered at 916.5 MHz. The center frequency is within the allowed band. The fundamental signal generated by **Wireless Speakers Transmitter** is within the band allowed under FCC Part 15.249 emission band criteria.

4. Antenna Requirement

An analysis of the **Wireless Speakers Transmitter** was performed to determine compliance with Section 15.203 of the Rules. This section requires specific handling and control of antennas used for devices subject to regulation under the Intentional Radiator portions of Part 15.

4.1. Evaluation Procedure

The structure and application of the **Wireless Speakers Transmitter** were analyzed with respect to the rules. The antenna for this unit is permanently attached to the unit and is not accessible by the user and an auxiliary antenna port is not present.

4.2. Evaluation Criteria

Section 15.203 of the rules states that the subject device must meet at least one of the following criteria:

- (a) Antenna be permanently attached to the unit.
- (b) Antenna must use a unique type of connector to attach to the EUT.
- (c) Unit must be professional installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

4.3. Evaluation Results

The **Wireless Speakers Transmitter** meets the criteria of this rule by virtue of having an antenna permanently attached to the unit. The EUT is therefore compliant with §15.203.

5. Conducted Emissions Testing

Professional Testing (EMI), Inc. (PTI), follows the guidelines of NIST for all uncertainty calculations, estimates and expressions thereof for EMC testing. Conducted emission measurements were made of the AC power to the Base Station (PC) attached to the **Wireless Speakers Transmitter**.

Measurements of the conducted emission levels for the Base Station attached to the **Wireless Speakers Transmitter** were made at the Professional Testing laboratory, located in Round Rock, Texas to determine the radio noise conducted from the EUT.

Tests of both the phase and neutral of the AC power feeding the device were performed to determine the emissions coming from the device.

5.1. Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The AC power cord was connected to a LISN. The test setup, cable placement and relative distances were configured per ANSI C63.4.

A Spectrum Analyzer with quasi-peak detection was used to find the maximums of the conducted emissions during the testing.

5.2. Test Criteria

The FCC Part 15.207 conducted limits are given below for emissions in the 0.45 to 30.0 MHz band.

Frequency Range	Field Strength	
	μV	$\text{dB } \mu\text{V}$
0.45 – 30.0	250	48.0

5.3. Test Results

The conducted test data is included as Appendix D. The highest emissions were identified and measured using quasi-peak detection. The conducted emissions generated by the Base Station and **Wireless Speakers Transmitter** are below the FCC Part 15.207 criteria.

6. Modifications to Equipment

There were no modifications made on the **Wireless Speakers Transmitter** during the performance of the test program in order to meet the FCC criteria.

7. List of Test Equipment

A list of the test equipment utilized to perform the testing is given below. The date of calibration is given for each.

Electromagnetic Emissions Test Equipment		
Device Description	Date Last Calibration	Date Calibrated Due
HP 8566B Spectrum Analyzer	07/22/00	07/22/01
HP 85650A Quasi Peak Adapter	07/22/00	07/22/01
HP 8447E Preamp	11/11/99	11/11/00
EMCO 3146 Log Antenna	12/21/99	12/21/00
EMCO 3115 Microwave	5/21/00	5/21/01

Antenna		
MITEQ Preamp 1-20 GHz	5/10/00	5/10/01
Advantest R3265 Spectrum Analyzer	11/5/00	11/5/01
Tektronix 2706 Preselector	11/5/00	11/5/01
Compliance Design B-100 Biconical Antenna	11/5/00	11/5/01

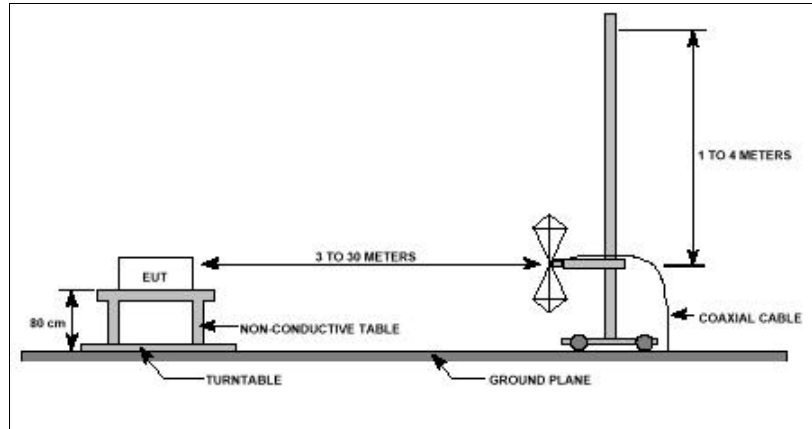


FIGURE 1: Radiated Emissions Test Setup

8. Appendix A: Fundamental Radiated Emissions Data

Grantee: Core Technology
Model: Wireless Speakers Transmitter
M/N: OU4-WS920
S/N: 001
Project: 01069-10

Date: 10/9/00
Measurement Distance (m): 3
Detector Function: Peak

Antenna Polarization - Vertical

Frequency	EUT Dir.	Ant. Height	Rec. Level	Ant. Factor	Cable Loss	Corrected Level	Limit	Margin
MHz	Deg.	m	dB ÷V	dB/m	dB	dB ÷V/m	dB ÷V /m	dB
916.77	40	1.2	68.4	21.7	10.3	100.4	114	13.6

Date: 10/9/00
Measurement Distance (m): 3
Detector Function: Quasi-Peak

Antenna Polarization - Vertical

Frequency	EUT Dir.	Ant. Height	Rec. Level	Ant. Factor	Cable Loss	Corrected Level	Limit	Margin
MHz	Deg.	m	dB ÷V	dB/m	dB	dB ÷V/m	dB ÷V /m	dB
916.77	40	1.2	61.9	21.7	10.3	93.9	94	0.1

Antenna Polarization - Horizontal

Frequency	EUT Dir.	Ant. Height	Rec. Level	Ant. Factor	Cable Loss	Corrected Level	Limit	Margin
MHz	Deg.	m	dB ÷V	dB/m	dB	dB ÷V/m	dB ÷V /m	dB
916.77	270	1.0	59.9	21.7	10.3	91.9	94	2.1

9. Appendix B: Spurious Radiated Emissions

Grantee: Core Technology
Model: Wireless Speakers Transmitter
M/N: OU4-WS920
S/N: 001
Project: 01069-10

Date: 10/9/00
Measurement Distance (m): 1
Detector Function: Peak

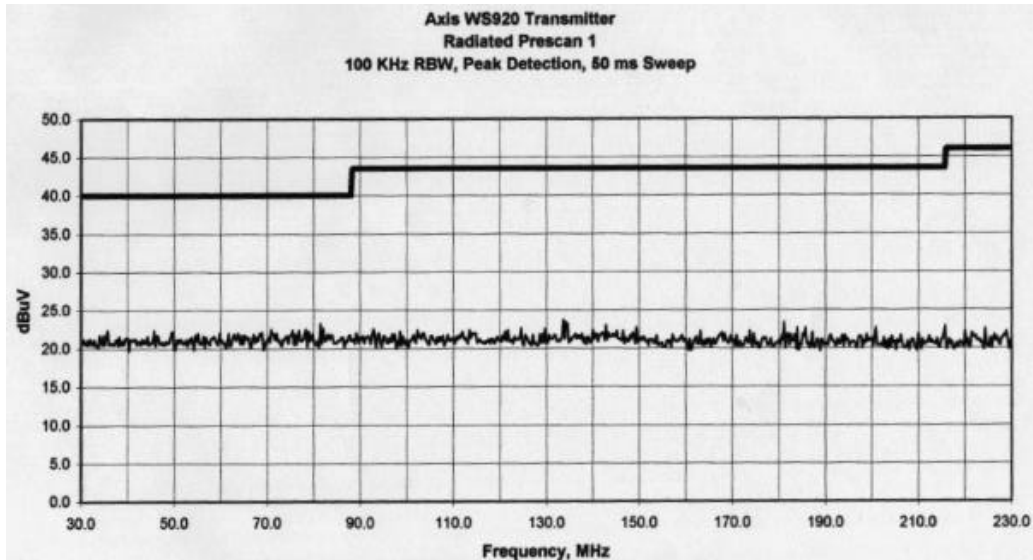
Antenna Polarization - Horizontal

Frequency	EUT Dir.	Ant. Height	Rec. Level	Correction Factor	Corrected Level	Limit	Margin
MHz	Deg.	m	dBuV	dB/m	dBuV/m	dBuV/m	dB
1833.00	180	1.0	46.8	4.6	42.2	63.5	-21.3
2748.70	85	1.0	53.1	3.4	49.7	63.5	-13.8
3666.60	90	1.0	40.5	0.8	39.7	63.5	-23.8
4579.10	180	1.0	43.6	-1.5	45.1	63.5	-18.4
5500.60	10	1.0	34.3	-4.0	38.3	63.5	-25.2
6416.30	260	1.0	29.9	-6.4	36.3	63.5	-27.2
7332.16	180	1.0	29.4	-8.2	37.6	63.5	-25.9
8247.67	180	1.0	28.4	-8.6	37.0	63.5	-26.5
9164.44	180	1.0	28.4	-9.1	37.5	63.5	-26.0

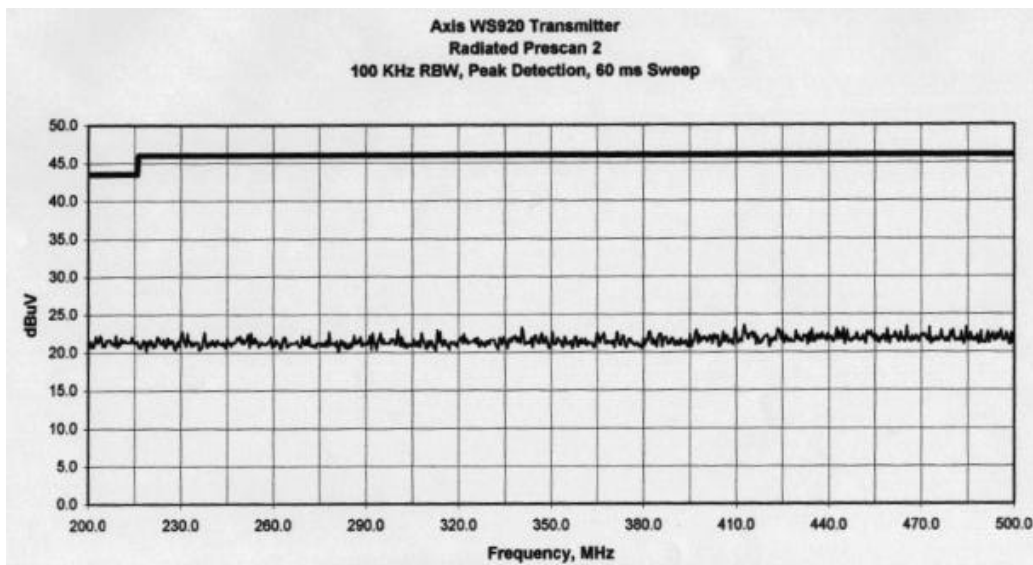
Date: 10/9/00
Measurement Distance (m): 1
Detector Function: Peak

Antenna Polarization - Vertical

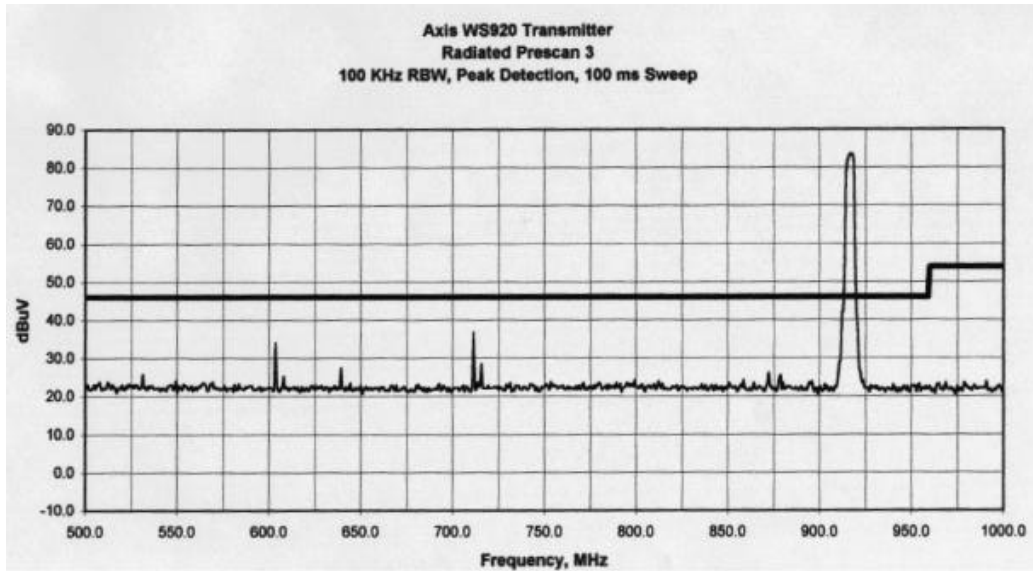
Frequency	EUT Dir.	Ant. Height	Rec. Level	Correction Factor	Corrected Level	Limit	Margin
MHz	Deg.	m	dBuV	dB/m	dBuV/m	dBuV/m	dB
1833.00	10	1.0	62.1	4.6	57.5	63.5	-6.0
2748.70	0	1.0	64.6	3.4	61.2	63.5	-3.3
3666.60	270	1.0	43.3	0.8	42.5	63.5	-23.0
4579.10	170	1.0	45.2	-1.5	46.7	63.5	-19.8
5500.60	330	1.0	33.9	-4.0	37.9	63.5	-29.6
6416.30	250	1.0	31.6	-6.4	38.0	63.5	-30.5
7332.16	270	1.0	30.3	-8.2	38.5	63.5	-31.0
8247.67	300	1.0	30.6	-8.6	39.2	63.5	-31.3
9164.44	270	1.0	28.4	-9.1	37.5	63.5	-34.0



FCC 15.109(a): Radiated, 3M, Class B Limit
100 kHz RBW, Peak Detection, 50 ms Sweep



FCC 15.109(a): Radiated, 3M, Class B Limit
100 kHz RBW, Peak Detection, 60 ms Sweep



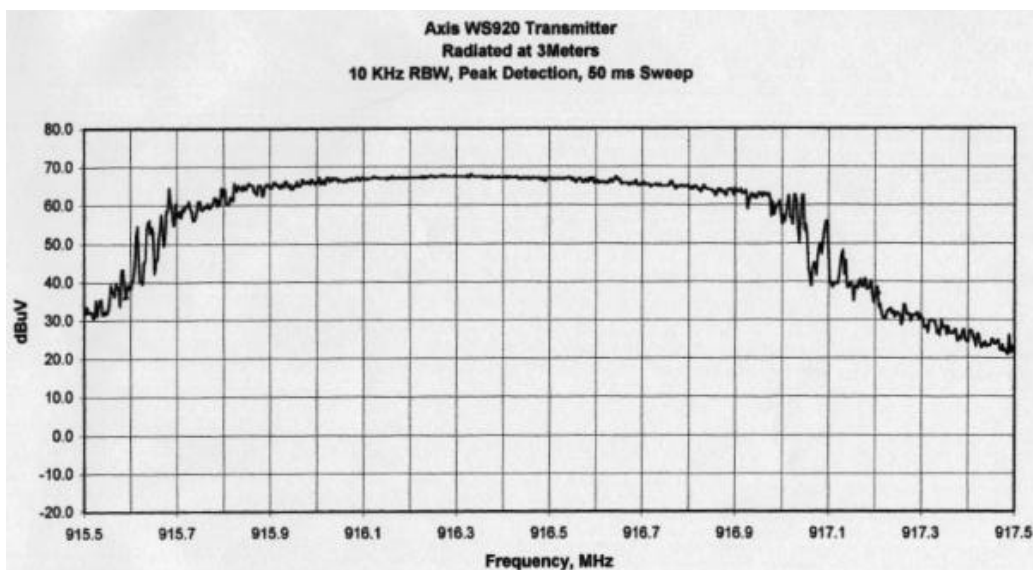
FCC 15.109(a): Radiated, 3M, Class B Limit
100 kHz RBW, Peak Detection, 100 ms Sweep

10. Appendix C: Occupied Bandwidth

Grantee: Core Technology
Model: Wireless Speakers Transmitter
M/N: OU4-WS920
S/N: 001
Project: 01069-10

Date: 7/17/00
Resolution Bandwidth: 100 kHz
Detection Function: Peak
Sweep Time: 50 mS

20 dB Bandwidth: 1.50 MHz



100 kHz RBW, Peak Detection, 50 ms Sweep

11. Appendix D: Conducted Emissions

Grantee: Core Technology
Model: Wireless Speakers Transmitter
M/N: OU4-WS920
S/N: 001
Project: 01069-10

Date: 7/17/00
Detector Function: Peak

Line Tested - Phase

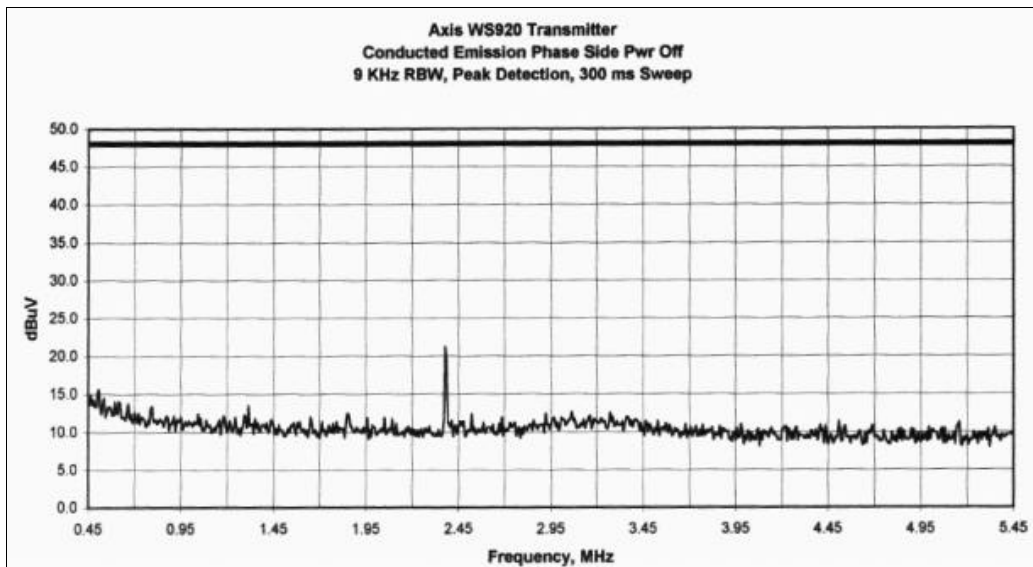
Frequency	Rec. Level	Cable Loss	LISN Factor	Corrected Level	QP Limit	Margin
MHz	dB ìV	dB	dB	dB ìV	dB ìV	dB
.548	37.2	.1	.3	37.5	48.0	10.5
1.11	27.5	.1	.3	27.9	48.0	20.1
1.48	23.0	.1	.3	23.4	48.0	24.6
3.56	20.5	.1	.4	21.0	48.0	27.0
20.3	13.0	.9	.2	14.1	48.0	33.9
25.0	16.6	.9	.5	18.0	48.0	30.0

Line Tested - Neutral

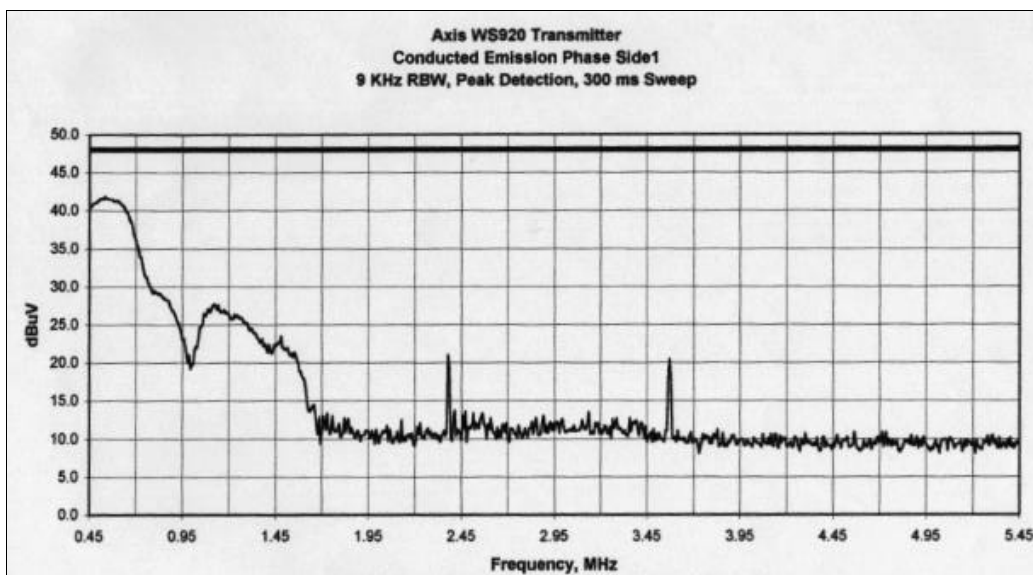
Frequency	Rec. Level	Cable Loss	LISN Factor	Corrected Level	QP Limit	Margin
MHz	dB ìV	dB	dB	dB ìV	dB ìV	dB
.555	39.1	.1	.3	39.5	48.0	8.5
.80	35.0	.1	.3	35.4	48.0	12.6
1.075	32.0	.1	.3	32.4	48.0	15.6
2.15	20.0	.1	.3	20.4	48.0	27.6
2.45	20.6	.1	.3	21.0	48.0	27.0
3.56	20.6	.1	.4	21.1	48.0	26.9
25.0	15.2	.9	.5	16.6	48.0	31.4

Line Tested - Phase

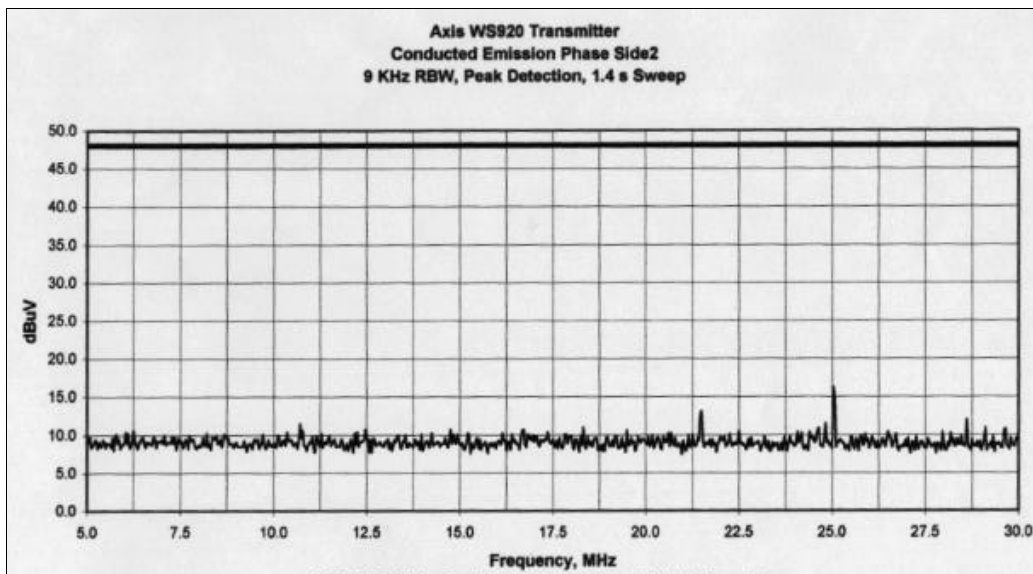
BASELINE SCAN – EUT POWERED OFF



**FCC 15.107(b): Conducted, Q-Pk, Class B Limit
9 kHz RBW, Peak Detection, 300 ms Sweep**

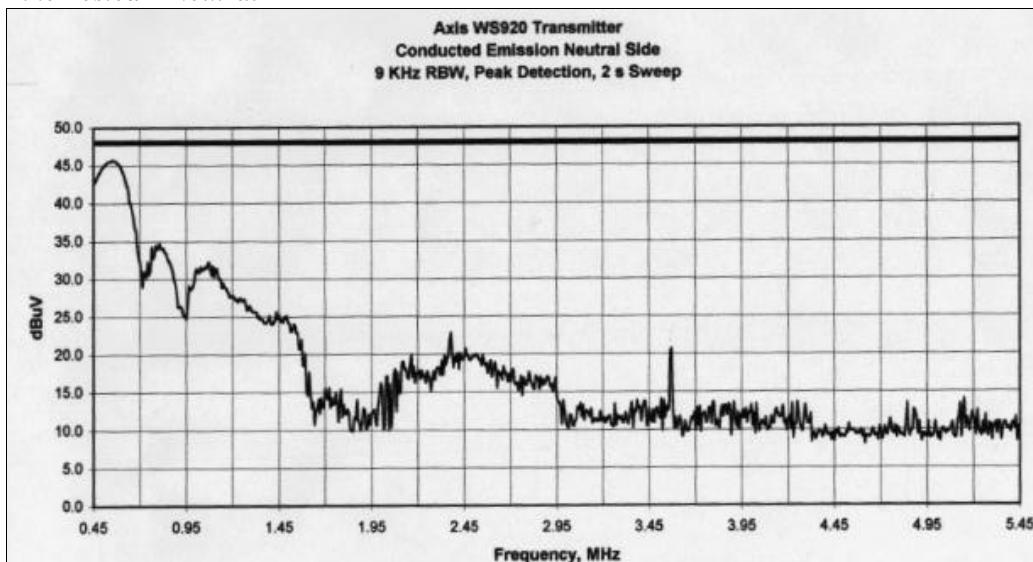


**FCC 15.107(b): Conducted, Q-Pk, Class B Limit
9 kHz RBW, Peak Detection, 300 ms Sweep**

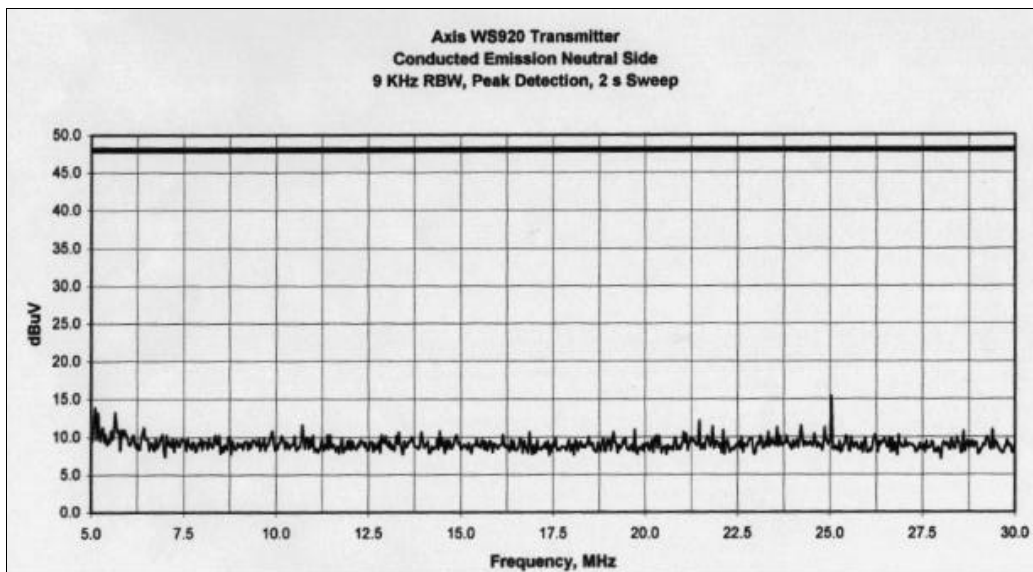


FCC 15.107(b): Conducted, Q-Pk, Class B Limit
9 kHz RBW, Peak Detection, 1.4 S Sweep

Line Tested – Neutral



FCC 15.107(b): Conducted, Q-Pk, Class B Limit
9 kHz RBW, Peak Detection, 2 S Sweep



**FCC 15.107(b): Conducted, Q-Pk, Class B Limit
9 kHz RBW, Peak Detection, 2 S Sweep**