Rev C

FCC Test Report for
47CFR15, Subpart B for Unintentional Radiators, per Section 101
Equipment authorization of unintentional radiators,
and
47CFR15, Subpart C for Intentional Radiators, per Section 249
Operation within the bands 5725-5875 MHz

on

BMW LP_MDD Microwave Sensor

[FCC ID: LQN2887]

part number

502887

itc report number

20021126-01-F15rC

manufacturer

Connaught Electronics Ltd.
IDA Industrial Estate
Dunmore Road, Tuam
County Galway, Ireland

judgement

Complies

tests and report by

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Registration number: TTI-P-G 159/98-00 (RES-GmbH)

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PART 1 General

Test Information

Product Name **Model(s)**	LP_MDD Microwave Sensor 502887	
Test Laboratory	ITC Engineering Services (ITC) 9959 Calaveras Road, PO Box 543 Sunol, CA 94586-0543 Tel: (925) 862-2944 Email: docs@itcemc.com Web Site: http://www.itcemc.com	Fax: (925) 862-9013
Test Number	20021126-01-F15rC	
Test Date(s)	December 23, 2002 to January 30, 2003	
Issue Date	May 05, 2003	
Project Engineer(s) & EMC Mgr	Sandra Sohn & O'lanre Owoborode	Bandele Adepoju

The electromagnetic interference tests, which this report describes, were performed by an independent electromagnetic compatibility consultant, ITC Engineering Services, Inc. (ITC), in accordance with the emissions requirements specified in the FCC rules, 47CFR Part 15, Subparts B and C. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications specified in this report for compliance must be implemented in all production units for compliance to be maintained.

Tests Performed:

Emissions Requirements:

- OPEN FIELD RADIATED EMISSIONS in accordance with the FCC PART 15 Sub-Part B.

RF Requirements:

- FIELD STRENGTH OF FUNDAMENTAL in accordance with the FCC 47 CFR 15.249(a)
- OPERATING BAND in accordance with FCC 47 CFR 15.249(a)
- HARMONIC EMISSIONS in accordance with the FCC 47 CFR 15.249(a)
- SPURIOUS EMISSIONS in accordance with the FCC 47 CFR 15.249(b)

PART 1 General (Cont)

Declaration/Disclaimer

ITC Engineering Services, Inc. (ITC) reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. ITC Engineering Services, Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from ITC Engineering Services, Inc. issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full with our written approval. The applicant/manufacturer shall not use this report to claim product endorsement by NVLAP or any US Government agency.

ITC Engineering Services, Inc. (ITC) is:
Accepted by the Federal Communications Commission (FCC) for FCC Methods, CISPR Methods and AUSTEL Technical Standards (Ref: NVLAP Lab Code 200172-0)

Approved by the Industry Canada for Telecom Testing

Certified by Rockford Engineering Services GmbH for EMC Testing according to the European EMC Directive 89/336/EEC per EN45001

Certified by Reg. TP for EMC Testing according to the European EMC Directive 89/336/EEC per EN45001 for RES GmbH (DAR-Registration number: TTI-P-G 159/98-00)

Certified by the Voluntary Control Council for Interference by Information Technology Equipment (VCCI) for EMC testing, in accordance with the Regulations for Voluntary Control Measures, Article 8, Registration Numbers - Site 1: C-1582 and R-1497.

PART 1 General (Cont)

Test Methodology

The electromagnetic interference tests, which this report describes, were performed by an independent electromagnetic compatibility consultant, ITC Engineering Services, Inc., in accordance with the FCC test procedure ANSI C63.4-1992.

Test Facility

The open area test site, the conducted measurement facility, and the test equipment used to collect the emissions data is located in Sunol, California, and is fully described in site attenuation report. The approved site attenuation description is on file at the Federal Communications Commission.

Table 1 Radio Device Measurement Information

Product Type **Model**	BMW LP_MDD Microwave Sensor 502887	
Applicant / Manufacturer Address	Connaught Electronics, Ltd. IDA Industrial Estate, Dunmore Road, Tuam, Co. Galway, Ireland	
Contact	Mr. Joe Danaher Tel: +353 932-5128	Danaherjoe@cel.ie Fax: +353 932-5133
Test Results	☑ **Complies**	❑ **Not Compliant**
Date(s) of Test(s)	December 23, 2002 to February 4, 2003	
Total Number of Pages including Appendices	32 Pages	
Test Report File No.	20021126-01-01-F15rC	

Table 2 Measurement Uncertainty

RF frequency	$\pm 1 \times 10^{-7}$ HP8565E
RF power, conducted	± 1.5 dB
Adjacent channel power	± 3 dB
Conducted emission of transmitter, valid up to 1 GHz	± 1.5 dB
Conducted emission of transmitter, valid up to 18 GHz	± 1.5 dB
Conducted emission of receivers	± 1.5 dB
Radiated emission of transmitter, valid up to 1 GHz	± 1.5 dB
Radiated emission of transmitter, valid up to 18 GHz	± 1.5 dB
Radiated emission of transmitter, valid up to 26 GHz	± 3 dB
Radiated emission of transmitter, valid up to 40 GHz	± 3 dB
Radiated emission of transmitter, valid up to 75 GHz	± 3 dB

Accuracy of Test Data

The test results contained in this report accurately represent the emissions generated by the sample equipment under test. ITC Engineering Services, Inc. (ITC) as an independent testing laboratory declares that the equipment as tested complies with the functional requirements of:

1. FCC standard 47CFR15.249.

for Intentional Radiators Operation within the bands 5725-5875 MHz.

Bandele Adepoju
EMC MANAGER

PART 2 RECEIVER MEASUREMENTS

OPEN FIELD RADIATED EMISSIONS

Test Specification: 47 CFR PART 15, Sub-Part B

The EUT was set up at 3 or 10 meters in accordance with the suggested configuration given in FCC Measurement Procedure ANSI C63.4-1992. The measurement instrumentation used was a receiver with bandwidth parameters as stipulated in ANSI C63.4-1992. The BMW LP_MDD Microwave Sensor was set up on a wooden non-conductive tabletop, 80 cm above the ground reference plane, in an open field. The transmit function was not activated for the tests.

Table 3 Test Equipment – Radiated Emissions Tests

Equipment Description	Manufacturer	Model Name	Serial Number
Spectrum Analyzer	Hewlett-Packard	8566B	2618A02909
Spectrum Analyzer Display	Hewlett-Packard	85662A	2848A17028
Quasi Peak Adapter	Hewlett-Packard	85650	2521A00871
Preselector	Hewlett-Packard	85685A	2620A00265
Spectrum Analyzer	Hewlett-Packard	8565E	2618A02909
Pre-amplifier	Hewlett-Packard 8449B		3008A00101
Pre-amplifier	Hewlett-Packard 83051A		3332A002B3
Antenna Cable	Hewlett-Packard (OPTK45)	RG8/u	-
Antenna Cable (high freq)	Specialty Cable Corp.	M17/60-RG142	-

Equipment calibration data is listed in Appendix A at the end of this report.

Table 4 Support Equipment – Radiated Emissions Tests

Description	Manufacturer	Model No.	Serial No.
DC Power Supply	BK Precision	1688	
Digital Multimeter	Fluke	16	

Test Procedure – Radiated Emissions Tests

The measurement range investigated was from 30 MHz to 30 GHz. For measurements below 1GHz, the BMW LP_MDD Microwave Sensor (the EUT) was set up at 10 meters on an Open Area Test Site (OATS) as described above, with the EUT running in a continuous mode. The EUT was rotated 360 degrees azimuth and the search antenna height varied 1 to 4m in order to maximize the emissions. Significant peaks from the EUT were then recorded to determine margin to the limits. For measurements above 1GHz, pre-scan measurements were first performed by collecting data with a spectrum analyzer at 3 meters in an Anechoic Chamber. The EUT running in continuous mode was rotated 360 degrees azimuth with the search antenna at a fixed height of 1meter and was also rotated in its x-y-z axis positions. Significant peaks were marked and then the highest emissions were analyzed in detail on an OATS at 3 meters. The EUT's exact position was retained on the OATS as found in the Anechoic Chamber. The search antenna height was varied 1 to 4m while operating the spectrum analyzer in fixed tuned mode to determine the precise amplitude of the emissions

Open Field Radiated Emissions (cont)

Spectrum Analyzer Configuration (during swept frequency scans) – Radiated Emissions

IF Bandwidth.....120 kHz
Measurements below 1000 MHz (unless stated otherwise)
Analyzer Mode (for Peak Measurements) ..... Peak/Log
Resolution Bandwidth..... 100 kHz
Video Bandwidth..... 100 kHz
Analyzer Mode (for Quasi-Peak Measurements)
Ouasi-Peak/Linear Resolution Bandwidth..... 1000 kHz
Video Bandwidth..... 1000 kHz
Measurements above 1000 MHz (unless stated otherwise)
Quasi-Peak Adapter Mode ..... Disabled
Analyzer Mode (for Peak Measurements) ..... Peak
Resolution Bandwidth..... 1000 kHz
Video Bandwidth..... 1000 kHz
Analyzer Mode (for Average Measurements)..... Video Filter
Resolution Bandwidth..... 1000 kHz
Video Bandwidth..... 10 Hz

Table 5 Data Table Legend and Field Strength Calculation – Radiated Emissions Tests

Detector mode: Peak (P) or Quasi-Peak (QP) or Average (A)

	Polarization	Antenna	Freq Range (MHz)
VB	Vertical	EMCO 3104/sn 3549 Biconical	30 – 200
HB	Horizontal	EMCO 3104/sn 3549 Biconical	30 – 200
VL	Vertical	EMCO 3146/sn. 2075 Log Periodic	200 – 1000
HL	Horizontal	EMCO 3146/sn. 2075 Log Periodic	200 – 1000
VH1	Vertical	EMC 3115/sn. 2362 Horn	Below 18000
HH1	Horizontal	EMC 3115/sn. 2362 Horn	Below 18000
VH2	Vertical	EMC 3116/sn. 2655 Horn	Below 26500
HH2	Horizontal	EMC 3116/sn. 2655 Horn	Below 26500
VH4	Vertical	S&D DBD-520 Horn	Below 75000
HH4	Horizontal	S&D DBD-520 Horn	Below 75000

The margin in the Table 6 is calculated as follows:

Margin = Corrected Amplitude – Limit, where Corrected Amplitude = Spectrum Analyzer Amplitude + Cable Loss + Antenna Factor – Pre-Amp Gain.

OPEN FIELD RADIATED EMISSIONS Results

Site Used – Radiated Emissions Measurement

- ☐ Test Site 1 - Shielded Room: 16' x 12' x 9'
- ☑ Test Site 1 - 3m Open Field Radiated Site
- ☐ Test Site 1 - 10m Open Field Radiated Site
- ☐ Test Site 2 - Environmental Lab
- ☐ EMC Lab 1 - Test Laboratory
- ☐ Semi-Anechoic Absorber Lined Shielded Room
- ☐ Other: _____

Administrative Details – Radiated Emissions Measurement

Test Date:	December 23, 2002
Test Engineer:	Sandra Sohn

Environmental Conditions – Radiated Emissions Measurement

Temperature	11.1°C
Humidity	49%

Table 6 Test Data for Radiated Emissions Measurement up to 1 GHz @ 10 meters

The table below shows a summary of the highest amplitudes of the radiated emissions from the equipment under test at various antenna heights, antenna polarization, and EUT orientations.

INDICATED		CORRECTION		CORR	TURNTABLE	ANT		CLASS A		CLASS B		
FREQ	AMPL	ANT	CAB	AMPL	ANG	HT	POL	AMPL	MARG	AMPL	MARG	DET
MHz	dBuV/m	dB	dB	dBuV/m	DEG	m	-	dBuV/m	dB	dBuV/m	dB	MODE
48.05	10.33	7.7	1.6	19.63	90	1	VB	–	–	30	-10.37	P
130.08	4.50	10.6	2.7	17.80	0	1	VB	–	–	33	-15.20	P
142.06	5.67	9.7	2.8	18.17	0	1	VB	–	–	33	-14.83	P
148.04	4.33	10.3	2.8	17.43	0	1	VB	–	–	33	-15.57	P
224.68	2.83	9.5	4.1	16.43	0	1	VL	–	–	36	-19.57	P
490.84	2.00	14.4	7.8	24.20	90	1	VL	–	–	36	-11.80	P
547.78	2.50	14.8	8.3	25.60	90	1	VL	–	–	36	-10.40	P
563.89	2.67	15.1	8.4	26.17	90	3	HL	–	–	36	-9.83	P
571.01	3.17	15.2	8.5	26.87	90	3	HL	–	–	36	-9.13	P
573.27	1.17	15.2	8.5	24.87	90	1	VL	–	–	36	-11.13	P
631.73	3.00	16.1	8.7	27.80	90	3	HL	–	–	36	-8.20	P
631.76	1.33	16.1	8.7	26.13	90	1	VL	–	–	36	-9.87	P
642.87	2.50	16.7	8.7	27.90	90	3	HL	–	–	36	-8.10	P

No emission of significant level was observed above 30 MHz thru 1GHz.

OPEN FIELD RADIATED EMISSIONS Results (cont)

Table 7 Test Data for Radiated Emissions Measurement above 1 GHz @ 3 meters

The table below shows a summary of the highest amplitudes of the radiated emissions from the equipment under test at various antenna heights, antenna polarization, and EUT orientations.

INDICATED		CORRECTION			CORR	TURNTABLE ANT			CLASS A		CLASS B		
FREQ	AMPL	ANT	CAB	Pre-AMP	AMPL	ANG	HT	POL	AMPL	MARG	AMPL	MARG	DET
MHz	dBuV/m	dB	dB	dB	dBuV/m	DEG	m	-	dBuV/m	dB	dBuV/m	dB	MODE
1045.1	30.72	24.3	1.1	30	36.12	90	1	VH1	–	–	54	-27.98	P
1046.2	29.05	25.3	1.1	30	25.45	90	3	HH1	–	–	54	-28.55	P
1057.2	31.30	24.3	1.1	30	26.70	90	1	VH1	–	–	54	-27.30	P
1064.4	31.88	24.4	1.2	30	27.58	90	1	VH1	–	–	54	-26.42	P
1072.0	30.83	24.4	1.2	30	27.53	90	1	VH1	–	–	54	-26.47	P
1076.4	30.72	24.4	1.3	30	26.42	90	1	VH1	–	–	54	-28.28	P
1084.4	30.12	24.4	1.3	30	25.82	90	1	VH1	–	–	54	-28.18	P
1108.4	32.00	24.5	1.4	30	27.90	90	1	VH1	–	–	54	-26.10	P
1117.3	30.53	24.5	1.5	30	26.53	90	1	VH1	–	–	54	-27.50	P
1129.4	31.38	24.6	1.5	30	27.48	90	1	VH1	–	–	54	-26.55	P
1137.0	30.67	25.8	1.5	30	27.97	90	3	HH1	–	–	54	-26.03	P
1172.0	31.60	25.9	1.6	30	29.10	90	3	HH1	–	–	54	-24.90	P
1190.0	31.60	26.1	1.7	30	29.40	90	3	HH1	–	–	54	-24.60	P
1205.1	33.36	26.1	1.7	30	31.16	90	3	HH1	–	–	54	-22.84	P
1233.9	32.00	26.2	1.7	30	29.90	90	3	HH1	–	–	54	-24.10	P
1262.7	31.36	26.3	1.8	30	29.46	90	3	HH1	–	–	54	-24.60	P
1318.7	33.55	26.6	1.9	30	32.05	90	3	HH1	–	–	54	-21.95	P
1332.0	31.33	25.3	2.0	30	28.63	90	1	VH1	–	–	54	-25.37	P
1343.2	31.88	25.3	2.0	30	29.18	90	1	VH1	–	–	54	-24.92	P
1352.0	31.67	26.8	2.0	30	30.47	90	3	HH1	–	–	54	-23.53	P
1663.0	30.53	26.3	3.3	30	30.13	90	1	VH1	–	–	54	-23.87	P
1696.0	28.70	27.5	3.4	30	29.60	90	3	HH1	–	–	54	-24.40	P
1724.0	31.22	27.7	3.4	30	32.32	90	3	HH1	–	–	54	-21.68	P
5830.0	27.63	35.7	6.0	30	39.33	0	1	VH1	–	–	54	-14.67	P

No emission of significant level was observed above 5830.0MHz

P = Peak
QP = Quasi Peak

Test Data Summary

The margin is calculated as follows:
Margin = Corrected Amplitude - Limit; where Corrected Amplitude = Amplitude + Cable Loss + Antenna Factor.

Conclusion

The BMW LP_MDD Microwave Sensor meets the requirements of FCC Part 15, Class B.

PART 3 RF MEASUREMENTS

Test Setup Configurations

EUT Description:
Connaught's LP_MDD Microwave Sensor, or the "EUT" as referred to in this report, is intentional radiator. It comes with an antenna permanently attached. The EUT, was set up on a wooden table, 80cm above the ground reference plane in an anechoic chamber and in an open field. It was powered and tested in normal continuous mode.

List of equipment used during RF Tests

Table 8: Support Equipment – RF Measurements

Description	Manufacturer	Model No.	Serial No.
DC Power Supply	BK Precision	1688	
Digital Multimeter	Fluke	16	

Voltage Tested: 13.5VDC

Table 9: Test Equipment – RF Measurements

Test Equipment	Manufacturer	Model Number	Serial Number
Preamplifier	Hewlett-Packard	8449B	3008A00101
Preamplifier	Hewlett-Packard	83051A	3332A002B3
RF Power Amplifier	Amplifier Research	5S1G4	18220
Signal Generator	Hewlett Packard	8673C	2918A00649
Quasi Peak Adapter	Hewlett-Packard	85650A	2521A00737
Spectrum Analyzer	Hewlett-Packard	8566B	2618A02909
Spectrum Analyzer Display	Hewlett-Packard		
Oscilloscope Receiver	LeCroy	WP960	2348
Signal Generator	Hewlett-Packard	8656B	2623A04271
Spectrum Analyzer	Hewlett-Packard	8591A	3149A2541
Signal Generator	Anritsu	Mg3690A	
LISN (25 Amp)	EMCO	38825/2	9210-2008
LISN	EMCO	3825/2R	1188/1001

Equipment calibration data is listed in Appendix A at the end of this report.

Table 10: Data Table Legend and Field Strength Calculation

Detector mode: Peak (P) or Quasi-Peak (QP) or Average (A)

	Polarization	Antenna	Freq Range (MHz)
VB	Vertical	EMCO 3104/sn 3549 Biconical	30 – 200
HB	Horizontal	EMCO 3104/sn 3549 Biconical	30 – 200
VL	Vertical	EMCO 3146/sn. 2075 Log Periodic	200 – 1000
HL	Horizontal	EMCO 3146/sn. 2075 Log Periodic	200 – 1000
VH1	Vertical	EMC 3115/sn. 2362 Horn	Below 18000
HH1	Horizontal	EMC 3115/sn. 2362 Horn	Below 18000
VH2	Vertical	EMC 3116/sn. 2655 Horn	Below 26500
HH2	Horizontal	EMC 3116/sn. 2655 Horn	Below 26500
VH4	Vertical	S&D DBD-520 Horn	Below 75000
HH4	Horizontal	S&D DBD-520 Horn	Below 75000

FIELD STRENGTH OF FUNDAMENTAL per 47 CFR 15.249(a)

Field Strength Measurement

The EUT was set up on a wooden non-conductive tabletop, 80 cm above the ground plane of the chamber. The measurement instrumentation used was a receiver with bandwidth parameters as stipulated in ANSI C63.4-1992. Pre-scan measurements were first performed by collecting data with a spectrum analyzer at 1 meter in an Anechoic Chamber. The EUT running in continuous mode, was rotated 360 degrees azimuth with the search antenna at a fixed height of 1 meter and was also rotated in its x-y-z axis positions. The highest peak and orientation was marked. The emission was then analyzed in detail on an Open Area Test Site (OATS) at 3 meters. The EUT's exact position was retained on the OATS as found in the Anechoic Chamber. The search antenna height was varied 1 to 4m while operating the spectrum analyzer in fixed tuned mode to determine the precise amplitude of the emission.

Site Used – Field Strength of Fundamental Measurements

- ☐ Test Site 1 - Shielded Room: 16' x 12' x 9'
- ☑ Test Site 1 - 3m Open Field Radiated Site
- ☐ Test Site 1 - 10m Open Field Radiated Site
- ☐ Test Site 2 - Environmental Lab
- ☐ EMC Lab 1 - Test Laboratory
- ☑ Semi-Anechoic Absorber Lined Shielded Room
- ☐ Other: _____

Administrative Details – Field Strength of Fundamental Measurements

Test Date(s):	January 8, 2003
Test Engineer(s):	Sandra Sohn

Environmental Conditions – Field Strength of Fundamental Measurements

Temperature	27°C
Humidity	35%

Table 11: Spectrum Analyzer Configuration (during swept frequency scans) – Fundamental Field Strength Measurement

Start Frequency ..... 5.293 GHz
Stop Frequency ..... 6.293 GHz
Sweep Speed ..... Manual
RES Bandwidth..... 1000 kHz
Video Bandwidth..... 1000 kHz
Quasi Peak Adapter Mode ..... Bypass
Quasi peak Adapter Bandwidth..... Disabled
Average Detector (for Peak measurements)..... Disabled
Average Detector (for Average measurements) ..... Enabled with 100 sweeps sampled

FIELD STRENGTH OF FUNDAMENTAL (cont)

Test Data – Field Strength of Fundamental

The measurement plot below represents the maximum worst-case result from the measurement performed in accordance to the requirements of this section.

Field Strength of Fundamental Plot

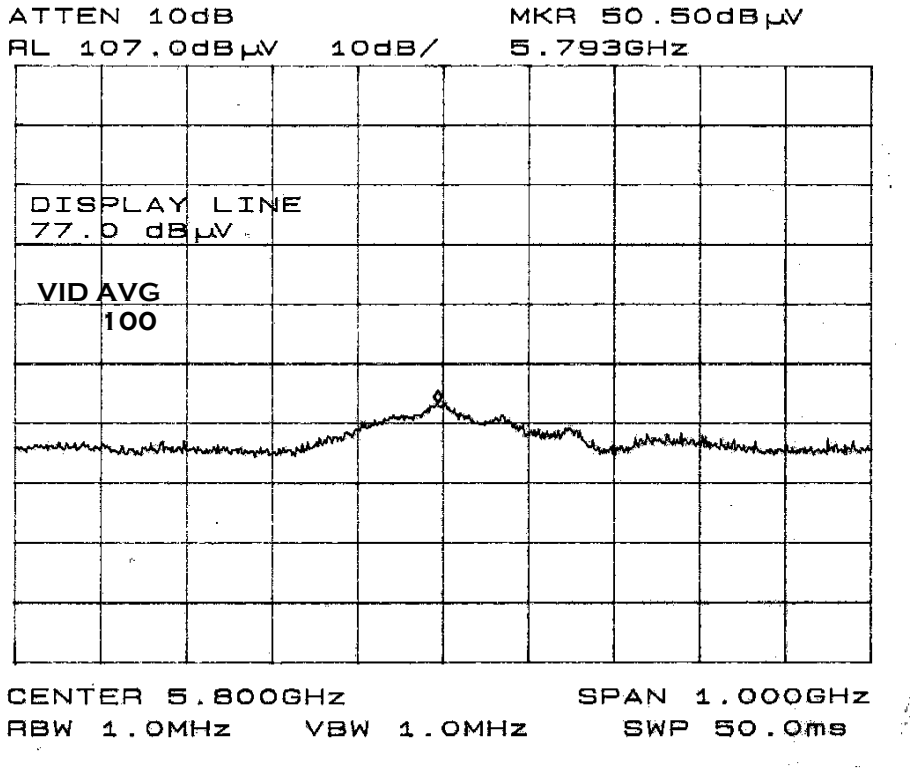

Figure 1: Plot of Field Strength of Fundamental Average Measurement Performed at 3-Meter Distance

Table 12: Field Strength of Fundamental Test Data – Average Measurement @ 3 meters

INDICATED		CORRECTION			CORR	TURNTABLE ANT			Limit		
FREQ	AMPL	ANT	CAB	PreAMP	AMPL	ANG	HT	POL	AMPL	MARG	DET
MHz	dBuV/m	dB	dB	dB	dBuV/m	DEG	m	-	dBuV/m	dB	MODE
5793.0	50.50	34.9	5.65	30	61.05	270	1.2	VH1	62	-0.95	A
5793.0	45.41	35.0	5.65	30	56.06	270	2	HH1	62	-5.94	A

Test-Data Summary – Average Measurement:

Maximum Average Level Frequency (Measured): 5793 MHz
Center Frequency (Rated): 5800 MHz
Average Level: 61.05dBµV/m
Average Limit (15.249) : 93.98dBµV/m
Measured Average Margin from Limit: 93.98dBµV/m – 61.05dBµV/m
32.93dBµV/m (below average limit)

FIELD STRENGTH OF FUNDAMENTAL (cont)

Test Data – Field Strength of Fundamental (cont)

Field Strength of Fundamental Plot (cont)

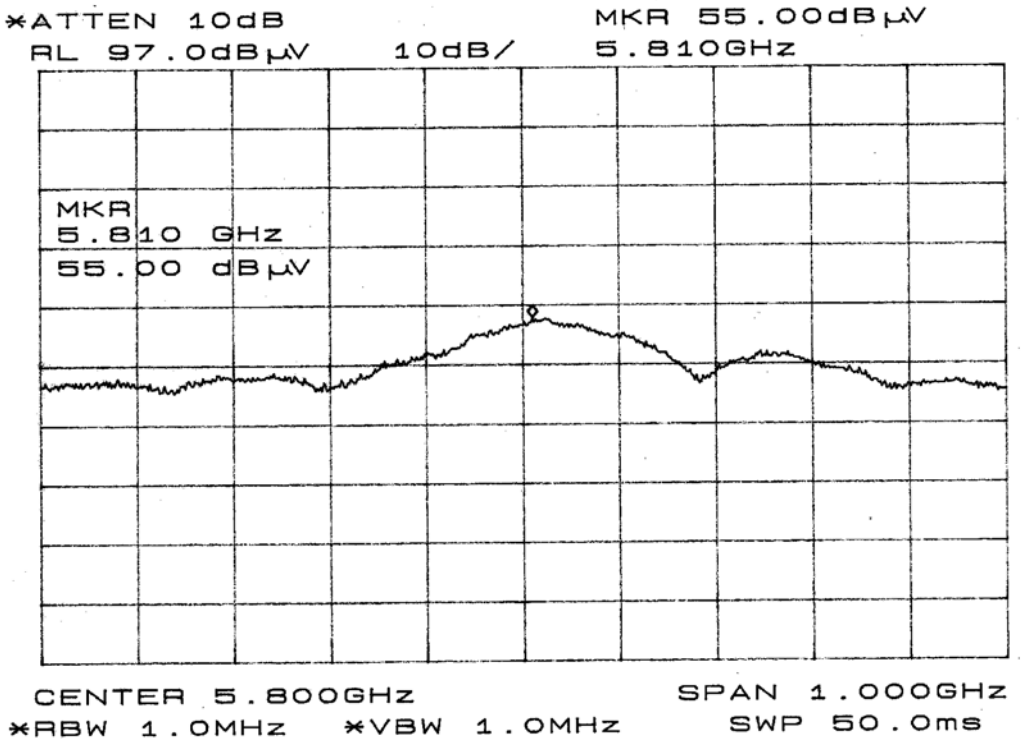

Figure 2: Plot of Field Strength of Fundamental Peak Measurement Performed at 3-Meter Distance

Table 13: Field Strength of Fundamental Test Data – Peak Measurement @ 3 meters

INDICATED		CORRECTION			CORR	TURNTABLE ANT			
FREQ	AMPL	ANT	CAB	PreAMP	AMPL	ANG	HT	POL	DET
MHz	dBuV/m	dB	dB	dB	dBuV/m	DEG	m	-	MODE
5810.0	55.00	34.9	5.64	30	64.64	270	1.2	VH1	P
5810.0	50.41	35.0	5.64	30	61.05	270	2	HH1	P

Test-Data Summary – Peak Measurement:

Peak Frequency (Measured): 5810 MHz
Center Frequency (Rated): 5800 MHz
Maximum Peak Level (Measured): 64.64dBµV/m
Average Limit (15.249) 93.98dBµV/m
Maximum Peak Limit (15.249d): 93.98dBµV/m + 20dB = 113.98dBµV
Measured Peak Margin from Limit: 113.98dBµV/m – 64.64dBµV/m= 49.34dB (below peak limit)

Duty Cycle (from page 17 below) -41.94dBµV
Average Level with Duty Cycle Correction 64.64dBµV/m – 41.94dBµV = 22.7dBµV/m
Calculated Average Margin from Limit 93.98dBµV/m – 22.7dBµV/m = 71.28dB (below average limit)

FIELD STRENGTH OF FUNDAMENTAL (cont)

Duty Cycle Measurement

The EUT was set up on a wooden non-conductive tabletop, 80 cm above the ground plane of a Semi-Anechoic Chamber. The EUT consists of an integral antenna. The instrumentation used for Duty Cycle measurement was a LeCroy oscilloscope receiver with bandwidth parameters as stipulated in CISPR16-1.

Site Used – Duty Cycle Measurement and Calculation

- ☐ Test Site 1 - Shielded Room: 16' x 12' x 9'
- ☑ Test Site 1 - 3m Open Field Radiated Site
- ☐ Test Site 1 - 10m Open Field Radiated Site
- ☐ Test Site 2 - Environmental Lab
- ☐ EMC Lab 1 - Test Laboratory
- ☑ Semi-Anechoic Absorber Lined Shielded Room
- ☐ Other: _____

Administrative Details – Duty Cycle Measurement and Calculation

Test Date(s):	December 27 to January 24, 2003
Test Engineer(s):	Sandra Sohn and O'lanre Olowoborode

Environmental Conditions – Duty Cycle Measurement and Calculation

Temperature	15.8°C to 24°C
Humidity	35% to 71%

Duty Cycle Measurement Data

The measurement field strength was determined from the average absolute voltage during a 100mSec interval during which the field strength was at its maximum value. The LP_MDD sensor is pulsed, producing a broad sinx/x spectrum with the main lobe width being **2/T** where **T is pulse width**. The plot and test data below represents the maximum worst-case results from the measurements performed in accordance to the requirements of the standard and extreme test conditions specified at the beginning of this section.

Duty Cycle Measurement Plot

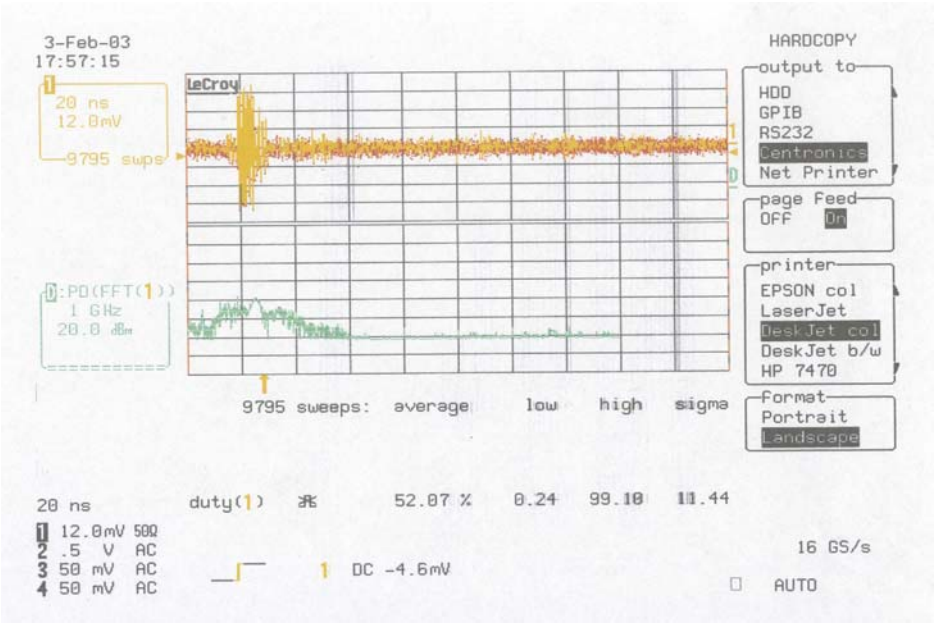

Figure 3: Duty Cycle Measurement Plot Performed at 1-Meter Distance

FIELD STRENGTH OF FUNDAMENTAL (cont)

Peak Limiting Calculation

Measurement-Plot Summary:

Duty Cycle "X"	=0.24+ (100-99.10-0.24)	=0.9%	=0.009	where X is ($0 < X \leq 1$)

47CFR 15.35c:

Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

Peak Level Calculation of Field Strength of Fundamental with Duty Cycle correction

The duty cycle rating from the manufacturer is 0.8% (or 0.008) over a 100mSec interval = 0.0008 seconds.

dB (in µV) Duty Cycle	= 0.0008 secs = 20log(0.008)	= -41.94dBµV
Average Level with Duty Cycle Correction	= 64.64dBµV/m – 41.94dBµV	= 22.7dBµV/m

BAND-EDGE LIMIT per 47 CFR 15.249(c)

Band-Edge Measurements

The EUT was set up on a wooden non-conductive tabletop, 80 cm above the ground plane of the chamber. The measurement instrumentation used was a receiver with bandwidth parameters as stipulated in ANSI C63.4-1992. Pre-scan measurements were first performed by collecting data with a spectrum analyzer on an Open Area Test Site (OATS) at a 1 meter distance. The EUT running in continuous mode was rotated 360 degrees azimuth and in its x-y-z axis positions with the search antenna height varied 1 to 4m while operating the spectrum analyzer in fixed tuned mode to determine the precise amplitude of the emission. Test was performed in both horizontal and vertical Antenna polarities. The highest peak, EUT orientation and antenna polarity was marked and recorded in the data below.

Site Used – Band-Edge Measurements

- ☐ Test Site 1 - Shielded Room: 16' x 12' x 9'
- ☑ Test Site 1 - 3m Open Field Radiated Site
- ☐ Test Site 1 - 10m Open Field Radiated Site
- ☐ Test Site 2 - Environmental Lab
- ☐ EMC Lab 1 - Test Laboratory
- ☐ Semi-Anechoic Absorber Lined Shielded Room
- ☐ Other: _____

Administrative Details – Band-Edge Measurements

Test Date(s):	June 16, 2003
Test Engineer(s):	Bandele Adepoju

Environmental Conditions – Band-Edge Measurements

Temperature	18.9°C
Humidity	68%

Table 14: Spectrum Analyzer Configuration (during swept frequency scans) – Band-Edge Measurements

Center Frequency ..... 5.800 GHz
Sweep Speed ..... Manual
RES Bandwidth..... 1000 kHz
Video Bandwidth..... 1000 kHz
Quasi Peak Adapter Mode ..... Bypass
Quasi peak Adapter Bandwidth..... Disabled
Average Detector..... Disabled

BAND-EDGE MEASUREMENT (cont)

Test Data – Field Strength of Fundamental

The measurement plot below represents the maximum worst-case result from the measurement performed in accordance to the requirements of this section.

Band-Edge Measurement Plot (Maximum In-Band Peak)

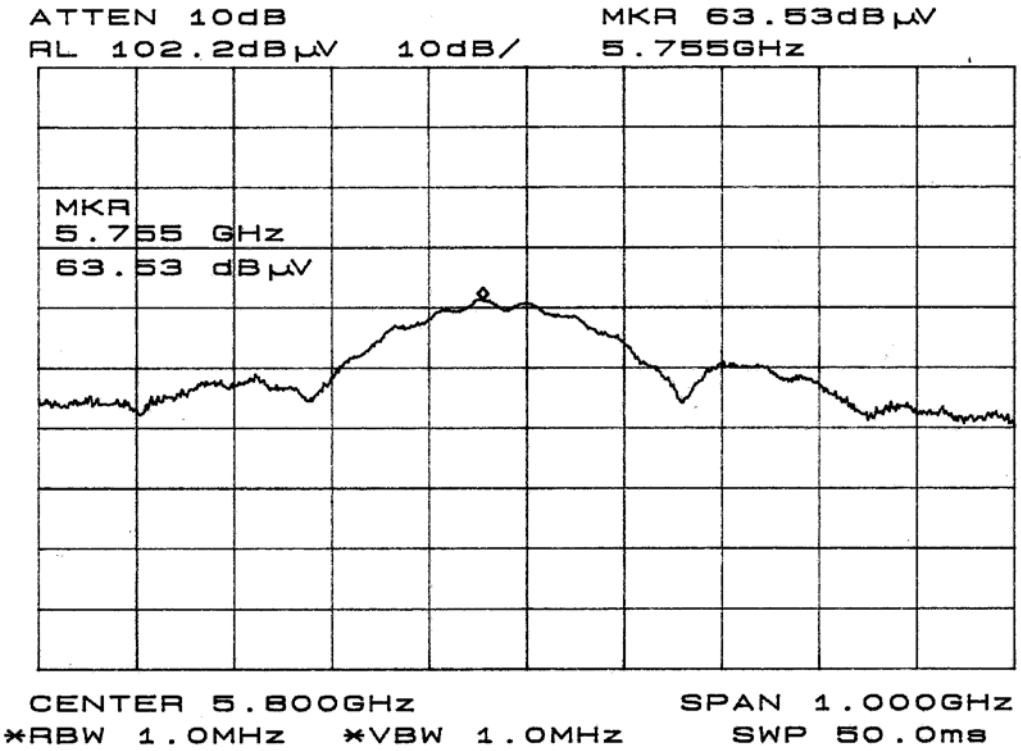

Figure 4: Plot of Band-Edge Measurement of Peak Frequency at a 1Meter Distance

Table 15: Band-Edge Measurement – Peak of Frequency @ 1Meter

INDICATED		CORRECTION			CORR	TURNTABLE ANT			
FREQ	AMPL	ANT	CAB	PreAMP	AMPL	ANG	HT	POL	DET
MHz	dBuV/m	dB	dB	dB	dBuV/m	DEG	m	-	MODE
5755.0	63.53	34.7	6.0	30	74.25	270	1.2	VH1	P

Test-Data Summary – Peak Measurement for Band-Edge:

Peak Frequency (In-Band): 5793 MHz
Center Frequency (Rated)): 5800 MHz
Maximum Peak Level (In-Band): 74.25dBμV/m

BAND-EDGE MEASUREMENT (cont)

Lower Band-Edge Measurement Plot

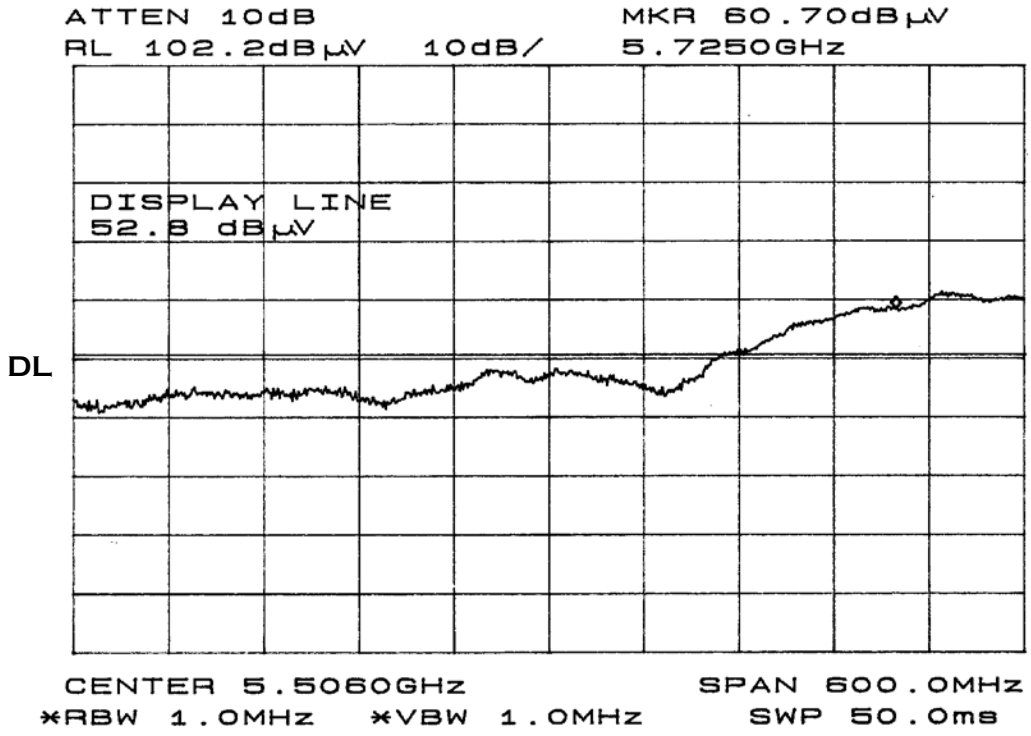

Figure 5: Plot of Band-Edge Measurement – at a 1Meter Distance (Lower Edge)

Table 16: Band-Edge Measurement – Lower Edge Measurement @ 1 meter

INDICATED		CORRECTION			CORR	TURNTABLE ANT			
FREQ	AMPL	ANT	CAB	PreAMP	AMPL	ANG	HT	POL	DET
MHz	dBuV/m	dB	dB	dB	dBuV/m	DEG	m	-	MODE
5755.0	60.70	34.7	6.00	30	71.40	270	1.2	VH1	P
DL	52.80	34.7	6.00	30	63.50	–	–	VH1	P

Test-Data Summary – Band-Edge Measurement (Lower Edge):

Band-Edge Frequency:	5725 MHz	
Center Frequency (Rated):	5800 MHz	
Maximum Peak Level (In-Band):	74.25dBµV/m	
Maximum Band-Edge Peak Level:	71.40dBµV/m	
Maximum Average Limit (FCC 15.249c):	63.52dBµV/m (@ 1 meter)	
Maximum Peak Limit (FCC 15.249c):	63.52dBµV/m (@ 1 meter) + 20dB	= 83.52dBµV/m
Band-Edge Peak Margin from Peak Limit:	83.52dBµV/m – 71.40dBµV/m	= 12.12dB (below peak limit)
Duty Cycle (from page 17 above)	-41.94dBµV	
Average Level with Duty Cycle Correction	71.40dBµV/m – 41.94dBµV	= 29.46dBµV/m
Calculated Average Margin from Limit	63.52dBµV/m – 29.46dBµV/m	= 34.04dB (below average limit)

BAND-EDGE MEASUREMENT (cont)

Upper Band-Edge Measurement Plot

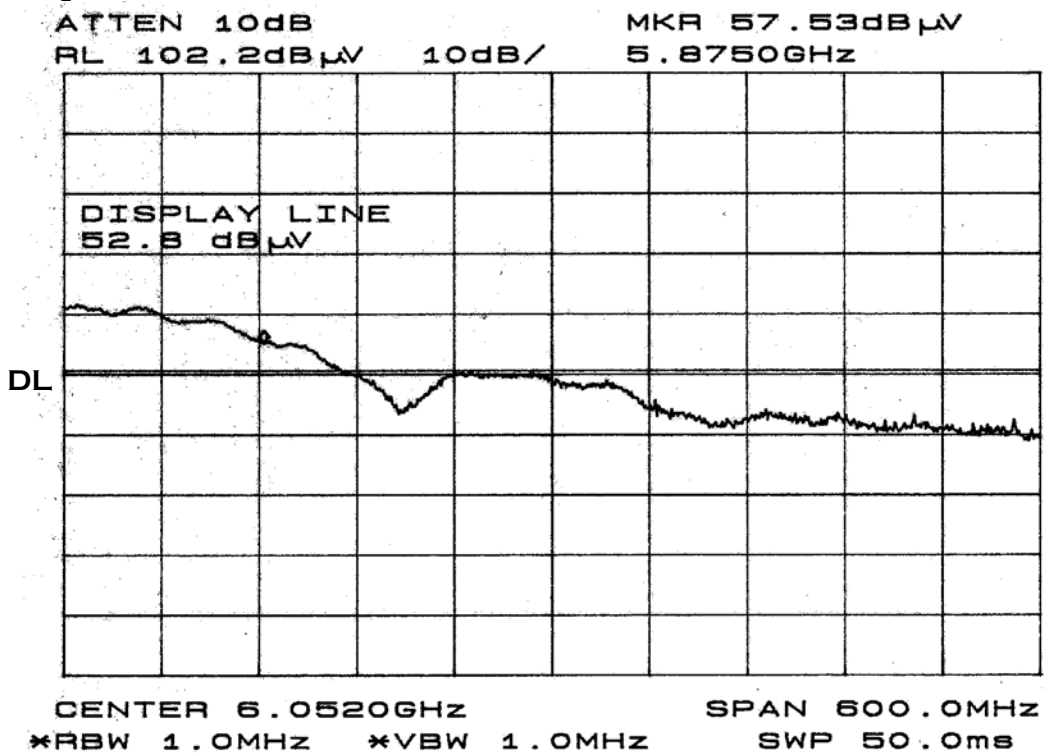

Figure 6: Plot of Band-Edge Measurement – at a 1Meter Distance (Upper Edge)

Table 17: Band-Edge Measurement – Upper Edge Measurement @ 1 meter

INDICATED		CORRECTION			CORR	TURNTABLE ANT			
FREQ	AMPL	ANT	CAB	PreAMP	AMPL	ANG	HT	POL	DET
MHz	dBuV/m	dB	dB	dB	dBuV/m	DEG	m	-	MODE
5875.0	57.53	34.7	6.00	30	68.23	270	1.2	VH1	P
DL	52.80	34.7	6.00	30	63.50	–	–	VH1	P

Test-Data Summary – Band-Edge Measurement (Upper Edge):

Band-Edge Frequency:	5875 MHz	
Center Frequency (Rated):	5800 MHz	
Maximum Peak Level (In-Band):	74.25dBµV/m	
Maximum Band-Edge Peak Level:	68.23dBµV/m	
Maximum Average Limit (FCC 15.249c):	63.52dBµV/m (@ 1 meter)	
Maximum Peak Limit (FCC 15.249c):	63.52dBµV/m (@ 1 meter) + 20dB	= 83.52dBµV/m
Band-Edge Peak Margin from Peak Limit:	83.52dBµV/m – 68.23dBµV/m	= 15.32dB (below peak limit)
Duty Cycle (from page 17 above)	-41.94dBµV	
Average Level with Duty Cycle Correction	68.23dBµV/m – 41.94dBµV	= 26.29dBµV/m
Calculated Average Margin from Limit	63.52dBµV/m – 26.29dBµV/m	= 37.32dB (below average limit)

OCCUPIED BANDWIDTH per 47 CFR 15.249(a)

For the measurements, a spectrum analyzer was used. The EUT was measured according to the method specified in ANSI C63.4-1992.

Site Used – Occupied Bandwidth Measurements

- ☐ Test Site 1 - Shielded Room: 16' x 12' x 9'
- ☑ Test Site 1 - 3m Open Field Radiated Site
- ☐ Test Site 1 - 10m Open Field Radiated Site
- ☐ Test Site 2 - Environmental Lab
- ☐ EMC Lab 1 - Test Laboratory
- ☑ Semi-Anechoic Absorber Lined Shielded Room
- ☐ Other: _____

Administrative Details – Occupied Bandwidth Measurements

Test Date(s):	January 27 to 30, 2003
Test Engineer(s):	Sandra Sohn

Environmental Conditions – Occupied Bandwidth Measurements

Temperature	15.8°C to 17.4°C
Humidity	63% to 73%

Test Measurement: Occupied Bandwidth Measurements (Performed in Anechoic Chamber)

The EUT was set up on a wooden non-conductive tabletop, 80 cm above the ground plane of the test location. Pre-scan measurements were first performed with a spectrum analyzer at 1 meter in a Semi-Anechoic Chamber. The EUT running in continuous mode was rotated 360 degrees azimuth with the search antenna in vertical polarity at a fixed height of 1 meter and was rotated in its x-y-z axis positions. It was also measured in the horizontal polarity. The analyzer was then placed in 'max-hold' mode to record signal level.

Test Measurement: Occupied Bandwidth (Performed on OATS)

To verify operating frequency range, the highest peak and orientation was marked. The emission was then set up at a 3 meters distance on a wooden non-conductive tabletop, 80 cm above the ground plane, on an Open Area Test Site (OATS) with specifications per ANSI C63.4-1992. The EUT's exact position was retained on the OATS as found in the Anechoic Chamber. Frequency offset was adjusted at a 30kHz bandwidth to determine final resolution bandwidth for measurements. The spectrum analyzer was set in video averaging mode with a minimum of 100 sweeps selected and was placed in 'max-hold' mode to record signal level. The search antenna height was varied 1 to 4m in both vertical and horizontal polarities while operating the spectrum analyzer in fixed tuned mode to determine the precise amplitude of the emission.

Table 18: Spectrum Analyzer Configuration (during swept frequency scans) – Spectrum Mask Measurement

Start Frequency ..... 5.277 GHz
Stop Frequency ..... 6.277 GHz
Sweep Speed ..... Manual
RES Bandwidth..... 1000 kHz
Video Bandwidth..... 1000 kHz
Quasi Peak Adapter Mode ..... Bypass
Quasi peak Adapter Bandwidth..... Disabled

OCCUPIED BANDWIDTH (cont)

Occupied Bandwidth Measurement Plot

The plot and test data below represents the maximum worst-case results from the measurements performed in accordance to the requirements of the standard and extreme test conditions specified at the beginning of this Part.

Spectrum Mask Measurement

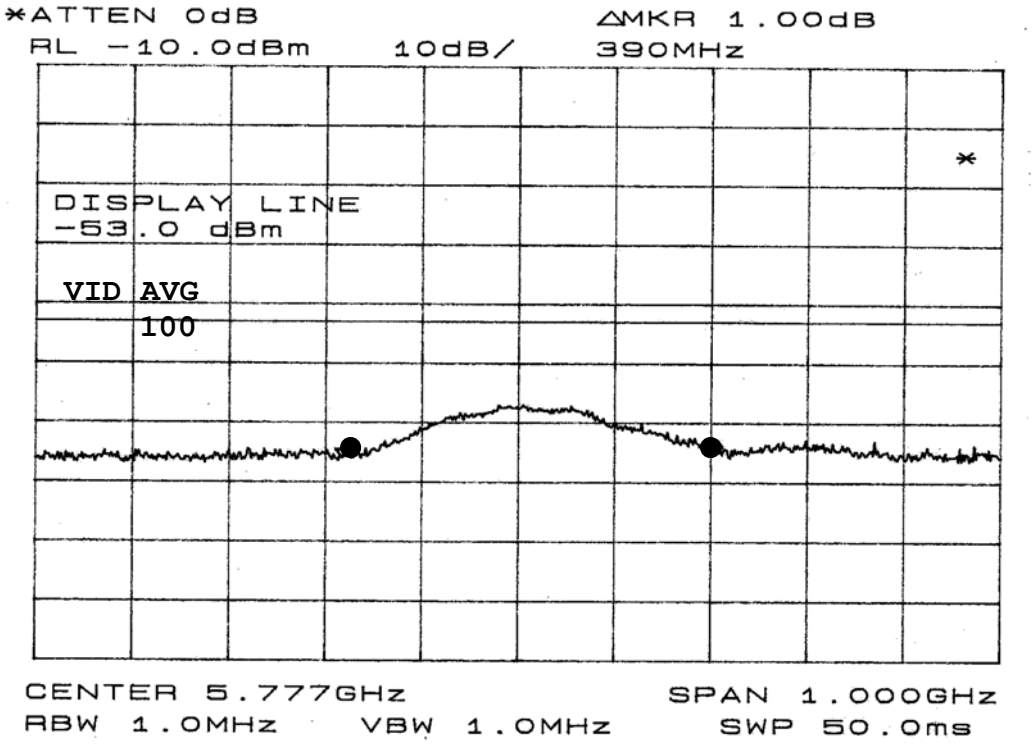

Figure 7: Occupied Bandwidth Plot

Test-Data Summary – Occupied Bandwidth:

Center Frequency (Rated): 5800 MHz
Frequency Bandwidth (Measured): 390 MHz

Occupied Bandwidth Data (Measured):

Upper Frequency (F_u)	= f_0 + 390/2	= 5800 MHz + 195	= 5995 MHz
Lower Frequency (f_L)	= f_0 – 390/2	= 5800 MHz – 195	= 5605 MHz

HARMONICS EMISSIONS per 47 CFR PART 15 SECTION 249(a)

Test Procedure – Harmonics Emissions

The EUT was placed on the wooden table and the measurements were made. Signals were measured with a Spectrum Analyzer, using the 50-ohm cable. For the measurements, pre-scan measurements were first performed by collecting data with a spectrum analyzer at 1 meter in an Anechoic Chamber. The EUT running in continuous mode, was rotated 360 degrees azimuth with the search antenna at a fixed height of 1 meter and was also rotated in its x-y-z axis positions.. The highest orientation and peak was marked and then the emission was analyzed in detail on an Open Area Test Site (OATS) at 3 meters. The EUT's exact position was retained on the OATS as found in the Anechoic Chamber. The search antenna height was varied 1 to 4m while operating the spectrum analyzer in fixed tuned mode to determine the precise amplitude of the emission.

Site Used – Harmonics Emissions Measurements

- ☐ Test Site 1 - Shielded Room: 16' x 12' x 9'
- ☑ Test Site 1 - 3m Open Field Radiated Site
- ☐ Test Site 1 - 10m Open Field Radiated Site
- ☐ Test Site 2 - Environmental Lab
- ☐ EMC Lab 1 - Test Laboratory
- ☑ Semi-Anechoic Absorber Lined Shielded Room
- ☐ Other: _____

Administrative Details – Harmonics Emissions Measurements

Test Date:	January 30, 2003
Test Engineer:	Sandra Sohn

Environmental Conditions – Harmonics Emissions

Temperature	17.2 °C
Humidity	72%

Table 19 Test Data – Harmonics Emissions (OATS Test @ 3 meters)

The table below shows the summary of the highest amplitudes of the harmonic RF radiated emissions from the equipment under test.

INDICATED		CORRECTION			CORR		TURNTABLE ANT			Limit		
FREQ	AMPL	ANT	CAB	Pre-AMP	AMPL	ANG	HT	POL	AMPL	MARG	DET	
MHz	dBuV/ m	dB	dB	dB	dBuV/m	DEG	m	-		dBuV/m	dB	MODE
11632	18.03	40.3	7.7	30	36.03	45	1	HH1	54*	-17.97		P
11632	19.2	39.9	7.7	30	36.80	45	1	VH1	54*	-17.20		P
17432	14.23	44.3	9.6	30	38.13	45	1	HH1	64	-25.87		P
17432	14.5	44.7	9.6	30	38.80	45	1	VH1	64	-25.20		P
23232	11.8	46.0	11.1	30	38.90	45	1	HH2	64	-25.10		P
23232	13.1	45.1	11.1	30	39.30	45	1	VH2	64	-24.70		P

No harmonic emissions of significant levels were observed above 5.8GHz.
No emissions were observed above 23.210GHz

*All harmonic emissions, including those within the restricted bands per 47CFR 15.205, are below the levels specified in the 47CFR15.209.

Test Data Summary

The margin in the Table 6 is calculated as follows:

Margin = Corrected Amplitude – Limit, where Corrected Amplitude = Spectrum Analyzer Amplitude + Cable Loss + Antenna Factor – Pre-Amp Gain.

Conclusion

The BMW LP_MDD Microwave Sensor meets the requirements of the test reference for Harmonic Emissions.

HARMONICS EMISSIONS (cont)

Spectrum Analyzer Configuration (during swept frequency scans) – Harmonic Emissions

IF Bandwidth.....120 kHz
Measurements below 1000 MHz (unless stated otherwise)
Analyzer Mode (for Peak Measurements) ..... Peak/Log
Resolution Bandwidth..... 100 kHz
Video Bandwidth..... 100 kHz
Analyzer Mode (for Quasi-Peak Measurements)
Ouasi-Peak/Linear Resolution Bandwidth..... 1000 kHz
Video Bandwidth..... 1000 kHz
Measurements above 1000 MHz (unless stated otherwise)
Quasi-Peak Adapter Mode ..... Disabled
Analyzer Mode (for Peak Measurements) ..... Peak
Resolution Bandwidth..... 1000 kHz
Video Bandwidth..... 1000 kHz
Analyzer Mode (for Average Measurements)..... Video Filter
Resolution Bandwidth..... 1000 kHz
Video Bandwidth..... 10 Hz

SPURIOUS EMISSIONS and Emissions in the RESTRICTED BANDS

Test Specification: FCC PART 15 SECTION 47 CFR 15.205
FCC PART 15 SECTION 47 CFR 15.249(b)

Test Procedure – Spurious Emissions:
The measurement range investigated was from 30 MHz to 40 GHz due to lack of emissions activity above 23GHz. For measurements below 1GHz, the BMW LP_MDD Microwave Sensor (the EUT) was set up at 10 meters on an Open Area Test Site (OATS) as described above, with the EUT running in a continuous mode. The EUT was rotated 360 degrees azimuth and the search antenna height varied 1 to 4m in order to maximize the emissions. Significant peaks from the EUT were then recorded to determine margin to the limits. For measurements above 1GHz, pre-scan measurements were first performed by collecting data with a spectrum analyzer at 1 meter in an Anechoic Chamber. The EUT running in continuous mode was rotated 360 degrees azimuth with the search antenna at a fixed height of 1meter and was also rotated in its x-y-z axis positions. Significant peaks were marked and then the highest emissions were analyzed in detail on an OATS at 3 meters. The EUT's exact worst case position was retained on the OATS as found in the Anechoic Chamber. The search antenna height was varied 1 to 4m while operating the spectrum analyzer in fixed tuned mode to determine the precise amplitude of the emissions.

Site Used – Harmonics Emissions Measurements

- ☐ Test Site 1 - Shielded Room: 16' x 12' x 9'
- ☑ Test Site 1 - 3m Open Field Radiated Site
- ☐ Test Site 1 - 10m Open Field Radiated Site
- ☐ Test Site 2 - Environmental Lab
- ☐ EMC Lab 1 - Test Laboratory
- ☑ Semi-Anechoic Absorber Lined Shielded Room
- ☐ Other: _____

Administrative Details – Spurious and Restricted Bands Emissions

Test Date:	January 29, 2003
Test Engineer:	Sandra Sohn

Environmental Conditions – Spurious and Restricted Bands Emissions

Temperature	16.1°C
Humidity	70%

Spectrum Analyzer Configuration (during swept frequency scans) – Spurious and Restricted Emissions

IF Bandwidth.....120 kHz
Measurements below 1000 MHz (unless stated otherwise)
Analyzer Mode (for Peak Measurements) ..... Peak/Log
Resolution Bandwidth..... 100 kHz
Video Bandwidth..... 100 kHz
Analyzer Mode (for Quasi-Peak Measurements)
Ouasi-Peak/Linear Resolution Bandwidth..... 1000 kHz
Video Bandwidth..... 1000 kHz
Measurements above 1000 MHz (unless stated otherwise)
Quasi-Peak Adapter Mode ..... Disabled
Analyzer Mode (for Peak Measurements) ..... Peak
Resolution Bandwidth..... 1000 kHz
Video Bandwidth..... 1000 kHz
Analyzer Mode (for Average Measurements)..... Video Filter
Resolution Bandwidth..... 1000 kHz
Video Bandwidth..... 10 Hz

SPURIOUS and RESTRICTED BANDS Emissions (cont)

Test Details – Spurious and Restricted Bands Emissions

Transmitter	Operating Mode
Limit	47CFR 15.209 (a)

Table 20 Test Data – Spurious and Restricted Bands Emissions (Measurements up to 1 GHz @ 3 meters)

The table below shows the summary of the highest amplitudes of the spurious RF radiated emissions from the equipment under test.

INDICATED		CORRECTION			CORR	TURNTABLE ANT			CLASS A		CLASS B		
FREQ	AMPL	ANT	CAB	Pre-AMP	AMPL	ANG	HT	POL	AMPL	MARG	AMPL	MARG	DET
MHz	dBuV/m	dB	dB	dB	dBuV/m	DEG	m	-	dBuV/m	dB	dBuV/m	dB	MODE
38.17	0.0	11.3	2	–	13.30	45	1	VB	–	–	40	-26.70	P
38.17	-4.0	12.0	2	–	10.00	45	1	HB	–	–	40	-30.00	P
48.10	17.30	7.7	2	–	27.00	90	1	VB	–	–	40	-13.00	P
132.58	-1.5	13.0	3	–	14.50	45	1	VB	–	–	43	-28.50	P
132.58	-2.5	12.3	3	–	12.80	0	1	HB	–	–	43	-30.20	P
142.03	10.57	9.7	3	–	23.27	0	1	VB	–	–	43	-19.73	P
224.68	7.88	9.5	5	–	22.38	0	1	VL	–	–	46	-23.62	P
240.73	-5.3	11.5	5	–	11.20	45	1	VL	–	–	46	-34.80	P
240.73	-0.7	12.0	5	–	16.30	0	1	HL	–	–	46	-29.70	P
331.52	-2.2	13.6	6	–	17.40	45	1	VL	–	–	46	-28.60	P
331.52	1.9	14.0	6	–	21.90	0	1	HL	–	–	46	-24.10	P
405.56	-3.0	16.3	9	–	22.30	45	1	VL	–	–	46	-23.70	P
405.56	0.0	16.8	9	–	25.80	0	1	HL	–	–	46	-20.20	P
490.84	8.20	14.4	9	–	31.60	90	1	VL	–	–	46	-14.40	P
547.78	8.50	14.8	9	–	26.80	90	1	VL	–	–	46	-19.20	P
563.89	7.67	15.1	9	–	31.77	90	3	HL	–	–	46	-14.23	P
571.01	8.63	15.2	9	–	32.83	90	3	HL	–	–	46	-13.17	P
573.27	1.17	15.2	9	–	25.37	90	1	VL	–	–	46	-20.63	P
611.25	1.5	18.8	9	–	29.30	45	1	VL	–	–	46	-16.70	P
611.25	2.2	19.3	9	–	30.50	0	1	HL	–	–	46	-15.50	P
631.73	8.30	16.1	9	–	33.40	90	3	HL	–	–	46	-12.60	P
631.76	6.53	16.1	9	–	31.63	90	1	VL	–	–	46	-14.37	P
642.87	8.60	16.7	9	–	34.30	90	3	HL	–	–	46	-11.70	P
964.04	1.7	24.6	11	–	37.30	0	1	HL	–	–	54	-16.70	P
964.04	-1.3	23.6	11	–	33.30	45	1	VL	–	–	54	-20.70	P
973.81	-2.3	23.7	11	–	32.40	45	1	VL	–	–	54	-21.60	P
973.81	1.0	24.6	11	–	36.60	0	1	HL	–	–	54	-17.40	P
980.27	-2.8	23.8	11	–	32.00	45	1	VL	–	–	54	-22.00	P
980.27	0.5	24.7	11	–	36.20	0	1	HL	–	–	54	-17.80	P
994.89	-1.0	24.2	11	–	34.20	45	1	VL	–	–	54	-19.80	P
994.89	0.8	24.9	11	–	36.70	0	1	HL	–	–	54	-17.30	P

No emission of significant level was observed above 994.89MHz.

SPURIOUS and RESTRICTED BANDS Emissions (cont)

Table 21 Test Data – Spurious and Restricted Bands Emissions (Measurement above 1 GHz @ 1 meter)

The table below shows a summary of the highest amplitudes of the radiated emissions from the equipment under test at various antenna heights, antenna polarization, and EUT orientations

INDICATED		CORRECTION			CORR	TURNTABLE ANT			CLASS A		CLASS B		
FREQ	AMPL	ANT	CAB	Pre-AMP	AMPL	ANG	HT	POL	AMPL	MARG	AMPL	MARG	DET
MHz	dBuV/m	dB	dB	dB	dBuV/m	DEG	m	-	dBuV/m	dB	dBuV/m	dB	MODE
1076.37	47.23	23.2	1.3	30	41.73	90	1	VH1	–	–	63.52	-21.79	P
1084.43	46.97	23.2	1.3	30	41.47	90	1	VH1	–	–	63.52	-22.05	P
1205.12	45.36	23.2	1.7	30	40.26	90	3	HH1	–	–	63.52	-23.26	P
1233.90	45.20	23.2	1.7	30	40.10	90	3	HH1	–	–	63.52	-23.42	P
1262.70	43.53	23.2	1.8	30	38.53	90	3	HH1	–	–	63.52	-24.99	P
1313.00	46.10	23.2	1.9	30	41.20	45	1	VH1	–	–	63.52	-22.32	P
1313.00	41.70	23.2	1.9	30	36.8	0 0	1	HH1	–	–	63.52	-26.72	P
1318.70	45.33	23.2	1.9	30	40.43	90	3	HH1	–	–	63.52	-23.09	P
1332.07	43.37	23.2	2.0	30	38.57	90	1	VH1	–	–	63.52	-25.52	P
1343.11	41.43	23.2	2.0	30	36.63	90	1	VH1	–	–	63.52	-26.89	P
1352.12	42.83	23.2	2.0	30	38.03	90	3	HH1	–	–	63.52	-25.49	P
1663.07	43.45	24.8	3.3	30	41.55	90	1	VH1		–	63.52	-21.97	P
1696.00	40.17	24.8	3.4	30	38.37	90	3	HH1	–	–	63.52	-25.15	P
1880.00	50.20	24.8	3.4	30	48.40	90	3	HH1	–	–	63.52	-15.12	P
2743.00	41.81	30.2	4.2	30	46.21	90	3	HH1	–	–	63.52	-17.31	P
4693.00	38.80	35.6	4.5	30	48.90	90	3	HH1	–	–	63.52	-13.62	P
5742.00*	63.30	34.7	6.0	30	74.00	220	1	VH1	–	–	103.52”	-35.57	P
5742.00*	47.70	34.7	6.0	30	58.40	220	2	HH1	–	–	103.52*	-45.12	P
5830.02	38.65	34.7	6.0	30	49.35	0	1	VH1	–	–	63.52	-14.17	P
6037.00	36.40	34.7	6.0	30	47.10	45	1	VH1	–	–	63.52	-16.42	P
6037.00	30.70	34.7	6.0	30	41.40	45	1	HH1	–	–	63.52	-22.12	P
7537.00	31.90	35.1	6.3	30	43.30	45	1	HH1	–	–	63.52	-20.22	P
7537.00	31.90	35.1	6.3	30	43.30	45	1	HH1	–	–	63.52	-20.22	P
8041.00	37.05	35.8	6.9	30	49.75	45	1	VH1	–	–	63.52	-13.77	P
8041.00	29.55	37.2	6.9	30	43.65	0	1	HH1	–	–	63.52	-19.87	P
11632.00	24.20	39.3	7.7	30	41.20	45	1	HH1	–	–	63.52	-22.32	P
11632.00	24.90	39.3	7.7	30	41.90	45	1	VH1	–	–	63.52	-21.62	P
17432.00	23.37	43.3	9.6	30	46.27	45	1	HH1	–	–	63.52	-17.25	P
17432.00	21.22	43.3	9.6	30	44.12	45	1	VH1	–	–	63.52	-19.40	P
23232.00	21.90	43.0	11.1	30	46.00	45	1	HH2	–	–	63.52	-17.52	P
23232.00	18.00	43.0	11.1	30	42.10	45	1	VH2	–	–	63.52	-21.42	P

No emission of significant level was observed above 23210MHz. It should also be noted that all emissions

*** Fundamental Frequency @ the 47CFR 15.249(a) limit measured @ 1 meter**

Test-Data Summary

The margin in the Table 6 is calculated as follows:
Margin = Corrected Amplitude – Limit, where Corrected Amplitude = Spectrum Analyzer Amplitude + Cable Loss + Antenna Factor – Pre-Amp Gain.

Conclusion

The BMW LP_MDD Microwave Sensor meets the requirements of the test reference for Spurious and Restricted Bands emissions levels specified in the 47CFR15.209

PART 4 APPENDICES

A. Test Equipment

Some or all of the following test equipment was used to measure the equipment under test:

Test Equipment	Manufacturer & Model Number	Serial Number	Calibration Due Date
Spectrum Analyzer	Hewlett Packard 8590A	2752 A02715	12/06/2003
Spectrum Analyzer	Hewlett-Packard 8590A	2542A11954	12/06/2003
Spectrum Monitor	Rhode & Schwarz EZM	881 334/025	03/01/2004
Test Receiver (9 kHz - 30 MHz)	Rhode & Schwarz ESH3	RES 0753	03/01/2004
Test Receiver (20-1300 MHz)	Rhode & Schwarz ESVP	RES 0749	03/01/2004
Spectrum Analyzer	Hewlett-Packard 8566B	2618A02909	12/06/2003
Spectrum Analyzer	Hewlett-Packard 8567A	2602A00239	12/06/2003
Spectrum Analyzer Display	Hewlett-Packard 85662A	2848A17028	12/06/2003
Quasi Peak Adapter	Hewlett-Packard 85650	2521A00871	12/06/2003
Preselector	Hewlett-Packard 85685A	2620A00265	03/01/2004
Oscilloscope Receiver	LeCroy WP960	2348	01/22/2004
Preamp	Hewlett-Packard 8447D	2648A04855	03/01/2004
Preamp	Hewlett-Packard 8449B	3008A00101	03/01/2004
Absorbing Clamp	MDS21	891 092/025	05/09/2003
Antenna Cable (OPTK45)	RG8/u	-	N/A
Antenna System	EMCO 3230	-	N/A
Biconical Antenna	EMCO 3104	3549	01/25/2004
L. P. Ant. (Site 1) (200-1000 MHz)	EMCO 3146	2075	01/25/2004
Adj. Elem. Dip. Ant. (28 MHz-1 GHz)	EMCO 3120	2632	03/01/2004
Horn Antenna	Eaton 96001	2632	01/12/2004
Horn Antenna	EMC3115	2655	01/15/2004
Horn Antenna	EMC3116		01/15/2004
Horn Antenna	S&D DBE-520		01/15/2004
LISN (25 Amp)	EMCO 38825/2	9210-2008	03/01/2004
LISN (100 Amp)	Solar 8610-50-TS-100N		03/01/2004
LISN	EMCO 3825/2R	1188/1001	03/01/2004
Computer	HP 000/300	RES 449	N/A
Remote Controlled 8 ft Rotating Table	RES RT1	Not Provided	N/A
Remote Controlled 25 ft Rotating Table	RES RT2	Not Provided	N/A
Remote Controlled 4 ft Rotating Table	RES RT3, RT4, RT5	Not Provided	N/A
Remote Controlled 4 m Antenna Mast	RES AM1	Not Provided	N/A
Remote Controlled 6 m Antenna Mast	RES AM2 & AM3	Not Provided	N/A
3 Phase 230 V~/50 Hz Generator	Not Provided	DB7130B40	05/02/2004
Oscilloscope (300 MHz)	Tektronix 2465B	602053	05/08/2003
Lindgren RF Shielded Enclosure	46-3/5-0	8220	N/A
Haefely ESD Simulator	PSD25B	081 486-02	05/21/2003
Hewlett Packard Signal Generator	HP8662A	2330A01371	05/21/2003
Amplifier Research Power Amplifier	100A100	10922	05/22/2003
Amplifier Research Power Amplifier	25W1000M7	10830	05/21/2003
Amplifier Research Field Strength Monitor	FM1000	60670	05/22/2003
Amplifier Research Isotropic Field Probe	FP1000	16270	05/18/2003
Amplifier Research L. P. Antenna (100-1000 MHz)	AT 1100	10537	05/17/2003
Amplifier Research F. Generator (10kHz - 100MHz)	AT500	11294	05/22/2003
Lindgren RFI Shielded Enclosure	46-2/5-0	8220	N/A
IFI Field Strength Meter	EFS-1	-	05/16/2003
IFI LDI	Not Provided	-	05/14/2003
Hewlett Packard Signal Generator	8673C	2918A00649	05/16/2003
Leader Functional Generator	LFG-1300S	7050152	05/16/2003
Haefely Burst-Tester Mainframe	PEFT.1	081 979-03	05/30/2003
Haefely Coupling Filter Module	PHV 4/1	081 979-03	05/31/2003
Haefely Control Unit Module	P90.1	0810979-03	05/28/2003
Haefely Power Supply Module	PP53.1	081 979-03	05/29/2003
Haefely Capacitive Coup. Clamp	IPA	083839-11	05/31/2003
Haefely Coupling Filter	FP 16/3-1	082529-12	05/30/2003

A. Test Equipment (Cont.)

Test Equipment	Manufacturer & Model Number	Serial Number	Calibration Due Date
Haefely Surge Generator	PC6-288-1	Not Provided	05/31/2003
Haefely Coupling Filter	FP 20/3-3	Not Provided	05/31/2003
Haefely Comm. Wave 1.2/50us, 8/20us.	PHV1	Not Provided	05/31/2003
Haefely H.V. Retractable Probe	-	Not Provided	05/31/2003
Topaz Electronics Isolation Transformer	16630	Not Provided	05/31/2003
HP Signal Generator	8673C	2918A00649	03/21/2004
HP Signal Generator	8656B	2623A04271	01/11/2004
Amplifier Research Power Amplifier	100A100	10922	05/22/2003
Amplifier Research Power Amplifier	25W1000M7	10830	05/21/2003
Amplifier Research Leveling Amplifier	999	Not Provided	N/A
Lindgren RFI Shielded Enclosure	46-2/5-0	8220	N/A
Hewlett Packard Spectrum Analyzer	8566B	2618A02909	12/06/2003
Westelle Power Supply	-	AF1AA	05/18/2003
Fischer Custom Comm. P.L. Coup/Decoup.	FCC-801-M3-25A	02003	01/21/2004
Fischer Custom Comm. Passive Impedance Adapt.	FCC-801-150-50-CDN	02013-02014	01/21/2004
Schaffner Main Frame	NSG200E	2514	05/12/2003
Schaffner Line Voltage Simulator	NSG203A	2514	05/12/2003
Tektronix Oscilloscope	2465B	B013718	05/09/2003
Powerstat Variac	GP58004	801-5218	05/11/2003
Schaffner Main Frame	NSG200E	2514	05/12/2003
HP HP6843A Harmonic & Flicker Test Sys.	3531A-00130		N/A
Acer Pentium 90	2600427019	N/A	N/A
Acer 6311-K Keyboard	K6311459320	N/A	N/A
Logitech M-SR14 Mouse	LT293C00116	N/A	N/A
Acer 2133S111 Monitor	M5A00000462C1A8A	N/A	N/A
HFTS Software Version HFTS A.00.05	-	N/A	N/A

Note for Test Equipment: The spectrum analyzers are self-calibrated every morning before test and are calibrated annually. All calibrations are traceable to the NIST.

B. EUT Technical Specification

Applicant	Connaught Electronics, Ltd. (CEL)		
Product Specifications			
Description	5.8GHz Short Distance Automobile Intrusion Sensor		
	Part Number(s)	CEL	502887
		BMW	6 917 557
	Trade Name	BMW LP_MDD Microwave Sensor	
	Serial Number(s)	552015	
	Central Processor	PIC 16LF876-041/SO	
	Cable(s)	n/a	
	Mainboard	Manufacturer	CEL
		Model	CTX0243
		Part Number	172887 rev 001.1
		Dimension	Approx. 65mm x 60mm
	Antenna Board	Manufacturer	CEL
		Model	CTX/A 0247
		Part Number	470806
		Dimension	Approx. 23mm x 10mm
		Layers	2-sided
		Antenna	Two (2) 10mm Dual loop, 1mm traces
	Transmit Frequency	5,800GHz	
	Pulse Width (Rated)	5 nSecs	
	Transmit Frequency Band	5,725 MHz to 5,875 MHz	
	Receiver Frequency Band	5,780 MHz to 5,820 MHz.	
	Connector(s)	One (1) 4-pin	p/n. 4-1393472-9
	Power Supply(s)	DC Cell	
		Input	9V to 16V/50mA
		Output	n/a
	Crystals/Oscillators	Resonator (U8) – 4MHz	

C. Modification Letter

To Whom It May Concern:

This is to certify that no modifications were necessary for BMW LP_MDD Microwave Sensor, model 502887 to comply with the required Requirements of:

FCC Rules and Regulations per 47 CFR 15.249

It is the manufacturer's responsibility to ensure that additional production units of the BMW LP_MDD Microwave Sensor model 502887 are manufactured with identical electrical and mechanical characteristics. For further information, please contact the manufacturer at:

Connaught Electronics, Ltd.
IDA Industrial Estate, Dunmore Road, Tuam,
Co. Galway, Ireland

Tel: +353 932-5128
Attention: Mr. Joe Danaher