

Nemko Test Report: 2L0135RUS1

Applicant: Graviton
9820 Towne Centre Drive
San Diego, CA 92121

Equipment Under Test: MSG with Internal RPC
(E.U.T.) Model#: 0229

In Accordance With: **FCC Part 15, Subpart C, 15.247**
Direct Sequence Spread Spectrum Transmitters

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



Authorized By: David Light, Senior Wireless Technician

Date:

Total Number of Pages: 34

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Section 1. Summary of Test Results

Manufacturer: Graviton

Name: MSG-0229

Model No.: 0229

Serial No.: Sample #01

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 for Direct Sequence Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-1992. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.



New Submission



Production Unit



Class II Permissive Change



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. None**

See "Summary of Test Data".

**NVLAP LAB CODE: 100426-0**

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FCC PART 15, SUBPART C

DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MSG w/ Internal RPC Model 0229 PROJECT NO.: **2L0135RUS1**

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
Powerline Conducted Emissions	15.207(a)	48 dB μ V	Complies
Minimum 6 dB Bandwidth	15.247(a)(2)	>500 kHz	Complies
Maximum Peak Power Output	15.247(b)(1)	<1 Watt	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	-20 dBc/100kHz	Complies
Spurious Emissions (Restricted Bands)	15.247(c)	< 74 dBuV/m Peak < 54 dBuV/m Avg	Complies
Peak Power Spectral Density	15.247(d)	+8 dBm/3kHz	Complies

Footnotes:

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DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: **MSG w/ Internal RPC Model 0229** PROJECT NO.: **2L0135RUS1**

Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

Frequency Band:

- 902 – 928 MHz
- 2410 – 2479 MHz
- 5725 – 5850 MHz

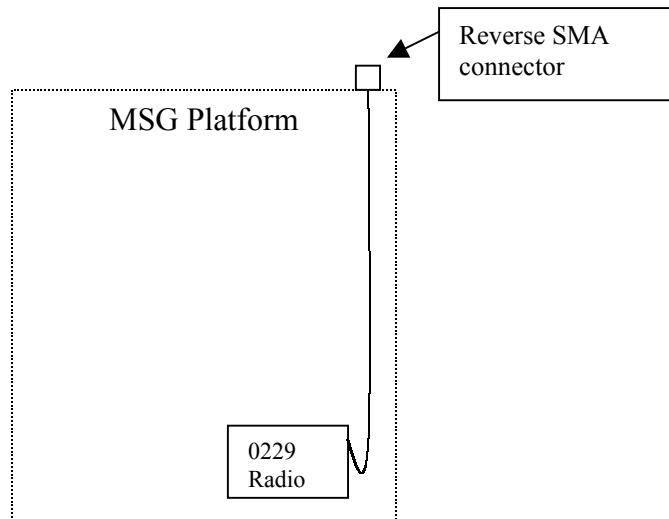
User Frequency Adjustment:

Software controlled

Theory of Operation

The MSG-0229 is a Multi-Services Gateway product that includes a computer platform with a wireless data radio operating in the 2.4 – 2.4835 GHz ISM band. The radio rf output is a reverse SMA connector and the antenna provided with the unit has the matching connector.

System Diagram



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FCC PART 15, SUBPART C

DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: [MSG w/ Internal RPC Model 0229](#) PROJECT NO.: [2L0135RUS1](#)

Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207
TESTED BY: Tom Tidwell	DATE: 8/28/2002

Test Results: Complies.

Measurement Data: .450 MHz – 30 MHz 48 dBuV

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DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MSG w/ Internal RPC Model 0229 PROJECT NO.: 2L0135RUS1



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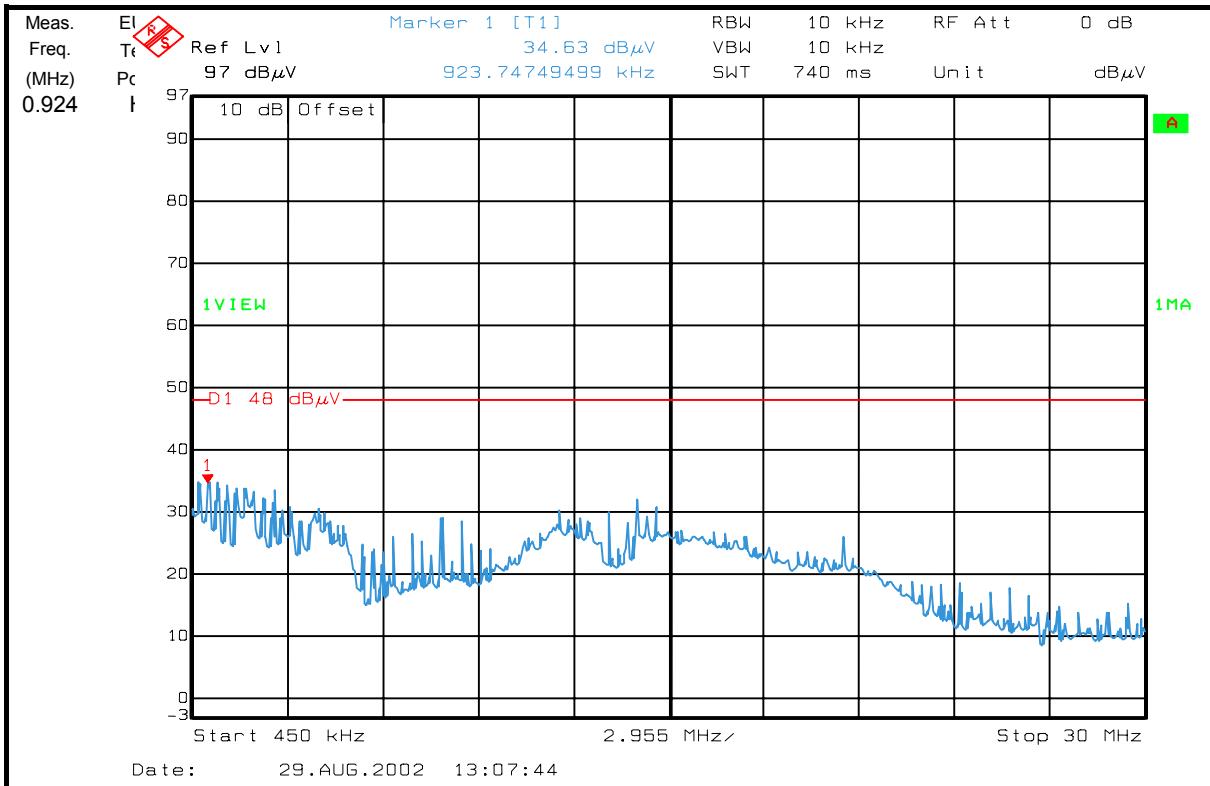
Conducted Emissions Powerline Voltage Measurement

Complete _____
Preliminary _____

Job # : 2L0135R Test # : CEPV-01
Page 1 of 2

Client Name : GRAVITON
EUT Name : MSG with internal RPC
EUT Model # : 229
EUT Part # : NA
EUT Serial # : NA
EUT Config. : TX @ MID BAND

Specification :	15.207	Reference :	
Transducer # :	545	Temp. (deg. C) :	24
HP Filter # :	1555	Humidity (%) :	40
Cable 1 # :	1547	EUT Voltage :	115
Cable 2 # :	1114	EUT Frequency :	60
Detector 1 # :	1036	Peak Bandwidth:	10kHz
Detector 2 # :		QP Bandwidth	10kHz
Limiter # :	674	Avg. Bandwidth	10kHz
		Date :	8/29/02
		Time :	13:00
		Staff :	TNT
		Location :	LAB 4
		Photo ID:	NA





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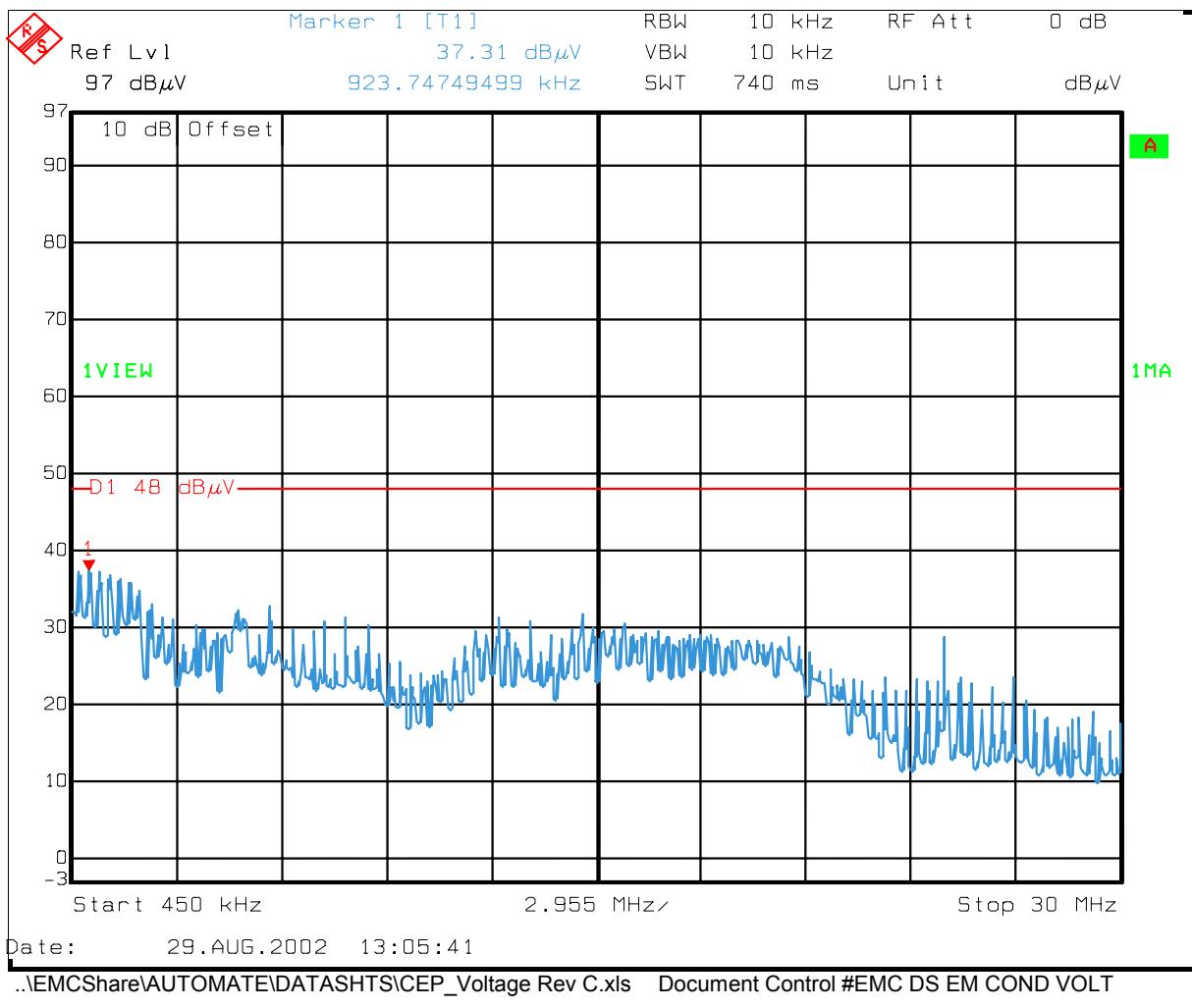
Conducted Emissions
Powerline Voltage Measurement

Complete X
Preliminary _____

Job #: 2L0135R Test #: CEPV-01
Page 2 of 2

Client Name : GRAVITON
EUT Name : MSG with internal RPC
EUT Model # : 229
EUT Part # : NA
EUT Serial # : NA
EUT Config. : TX @ MID BAND

Specification : 15.207 Reference : _____



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DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MSG w/ Internal RPC Model 0229 PROJECT NO.: **2L0135RUS1**



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DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MSG w/ Internal RPC Model 0229 PROJECT NO.: 2L0135RUS1

Section 4. Minimum 6 dB Bandwidth

NAME OF TEST: Minimum 6 dB Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: Tom Tidwell	DATE: 8/28/2002

Test Results: Complies.

Measurement Data: See 6 dB BW plot
Measured 6 dB bandwidth: 1.766 MHz

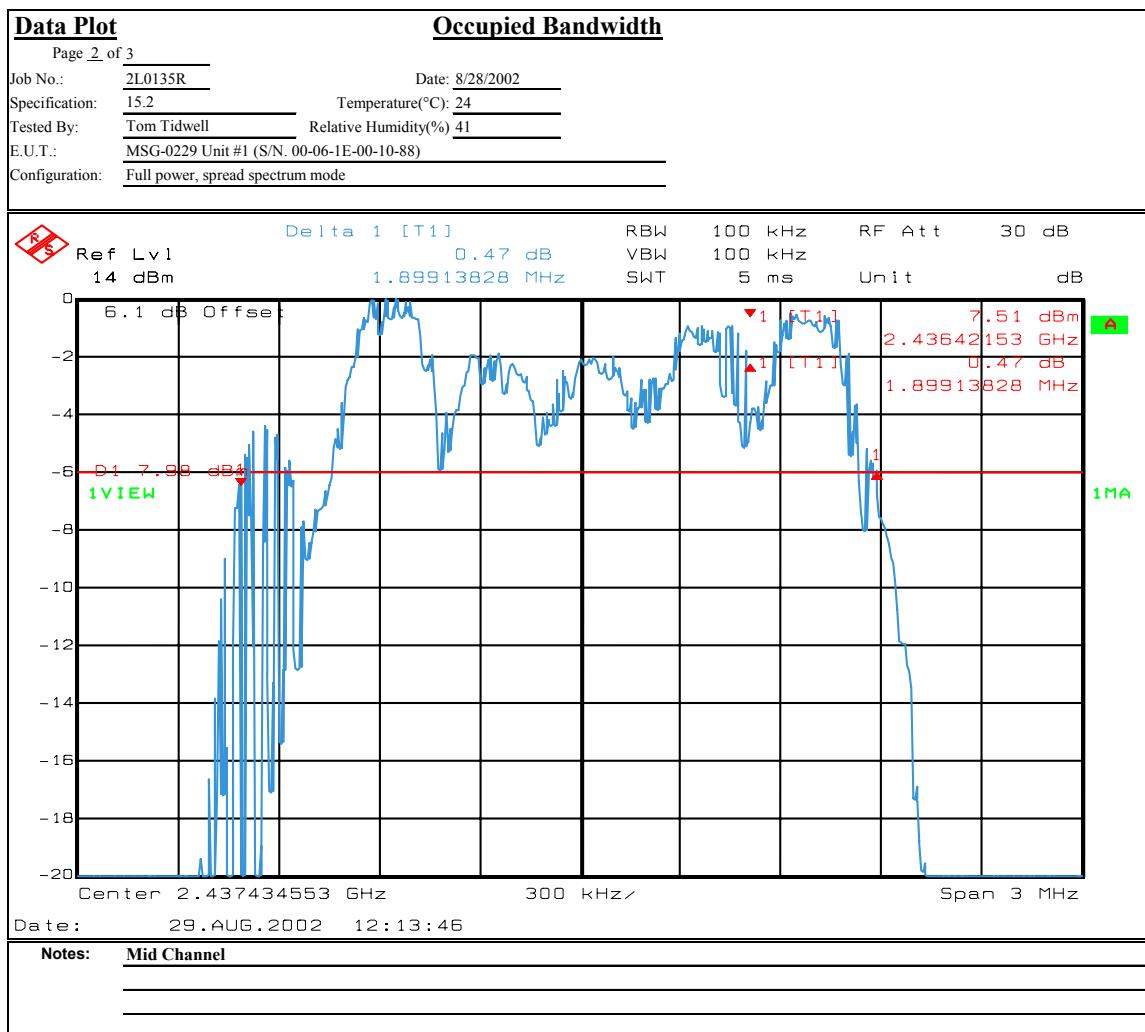
Equipment Used: 1464-1484-1485-1304

Measurement Uncertainty: +/- 0.7 dB

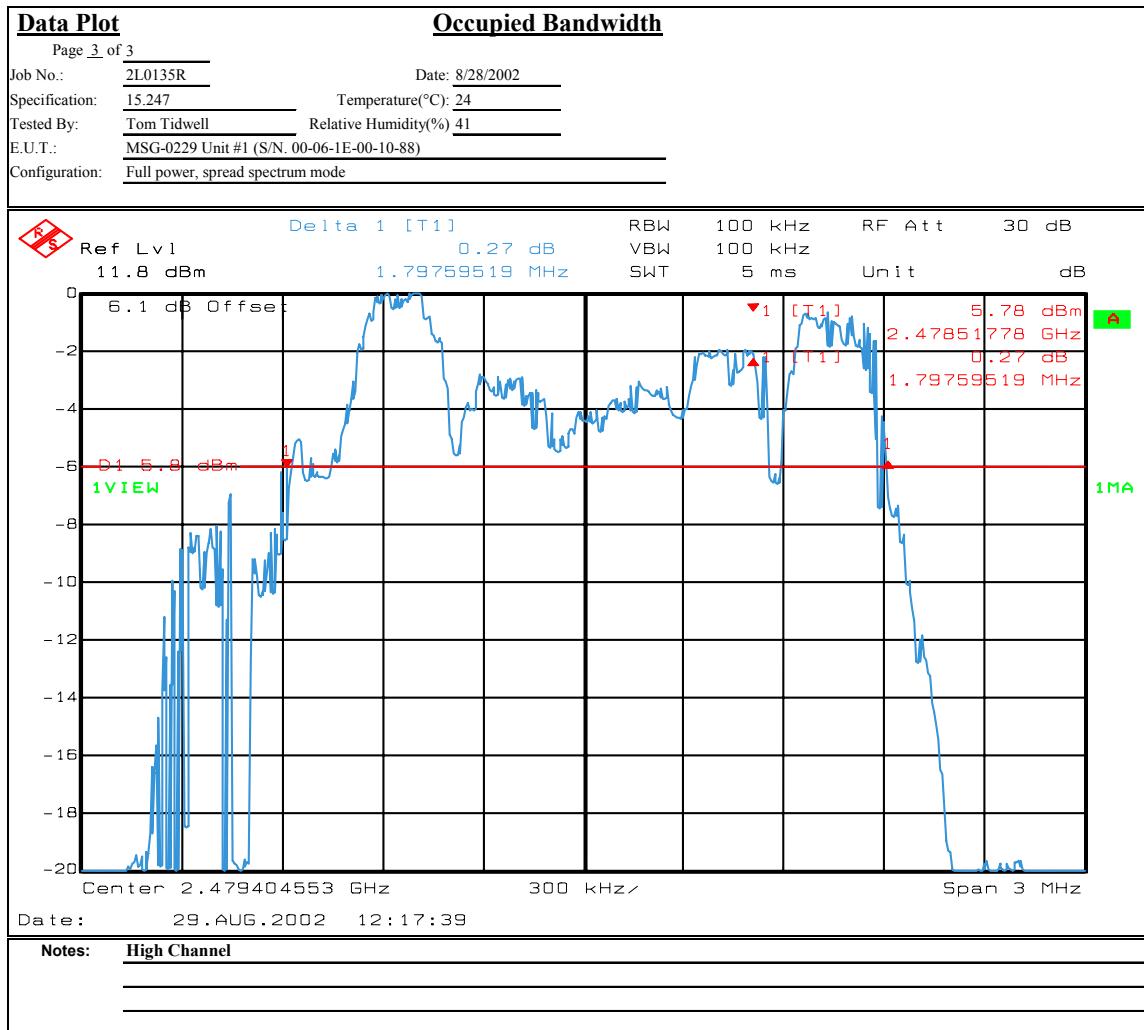
Test Plots – 6 dB Bandwidth

<u>Data Plot</u>		<u>Occupied Bandwidth</u>				
Page <u>1</u> of <u>3</u>				Complete <input checked="" type="checkbox"/> Preliminary: <input type="checkbox"/>		
Job No.:	2L0135R	Date:	8/28/2002			
Specification:	15.247	Temperature(°C):	24			
Tested By:	Tom Tidwell	Relative Humidity(%):	41			
E.U.T.:	MSG-0229 Unit #1 (S/N. 00-06-1E-00-10-88)					
Configuration:	Full power, spread spectrum mode					
Sample Number:	S03					
Location:	Lab 1	RBW:	100 kHz			
Detector Type:	Peak	VBW:	100 kHz			
<u>Test Equipment Used</u>						
Antenna:	Directional Coupler:					
Pre-Amp:	Cable #1: 1627					
Filter:	Cable #2:					
Receiver:	1036	Cable #3:				
Attenuator #1	Cable #4:					
Attenuator #2:	Mixer:					
Additional equipment used:	2 x 3 dB SMA attenuator					
Measurement Uncertainty:	+/-1.7 dB					
Notes:	Low Channel					

Test Plots – 6 dB Bandwidth



Test Plots – 6 dB Bandwidth



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DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MSG w/ Internal RPC Model 0229 PROJECT NO.: 2L0135RUS1

Section 5. Maximum Peak Output Power

NAME OF TEST: Maximum Peak Output power	PARA. NO.: 15.247(b)(1)
TESTED BY: Tom Tidwell	DATE: 8/21/2002

Test Results: Complies.

Measurement Data:

Channel	Peak Power
Low	+17.1 dBm
Mid	+19.0 dBm
High	+16.4 dBm

The Peak Power Output was measured using a peak power meter.

The AC input was varied from 102 – 208 VAC and no effect was noted on rf power output or spurious emission levels.

Antenna: 0 dBi gain

Equipment used: 1029, 1030

Measurement Uncertainty: +/- 0.7 dB

Section 6. RF Exposure

NAME OF TEST: RF Exposure	PARA. NO.: 15.247(b)(4)
TESTED BY: Tom Tidwell	DATE: 8/23/2002

Test Results: Complies.**Measurement Data:****Prediction of MPE limit at a given distance**

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal: 19.00 (dBm)Maximum peak output power at antenna input terminal: 79.43282347 (mW)Antenna gain(typical): 0 (dBi)Maximum antenna gain: 1 (numeric)Prediction distance: 20 (cm)Prediction frequency: 2400 (MHz)MPE limit for uncontrolled exposure at prediction frequency: 1 (mW/cm^2)Power density at prediction frequency: 0.015803 (mW/cm^2)Maximum allowable antenna gain: 18.01269855 (dBi)

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DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MSG w/ Internal RPC Model 0229 PROJECT NO.: 2L0135RUS1

Section 7. Spurious Emissions (radiated)

NAME OF TEST: Spurious Emissions	PARA. NO.: 15.247 (c)
TESTED BY: Tom Tidwell	DATE: 8/21/2002

Test Results: Complies.

Measurement Data: See attached table.

Duty Cycle Calculation:

Duty Cycle correction factor(dB) = $20 \log (\text{rf}_{\text{ON}} \text{ in ms} / 100\text{ms})$

Measurement Uncertainty: +/- 0.7 dB

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DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MSG w/ Internal RPC Model 0229 PROJECT NO.: 2L0135RUS1

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DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: [MSG w/ Internal RPC Model 0229](#) PROJECT NO.: [2L0135RUS1](#)

Radiated Photographs (Worst Case Configuration)



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DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: [MSG w/ Internal RPC Model 0229](#) PROJECT NO.: [2L0135RUS1](#)

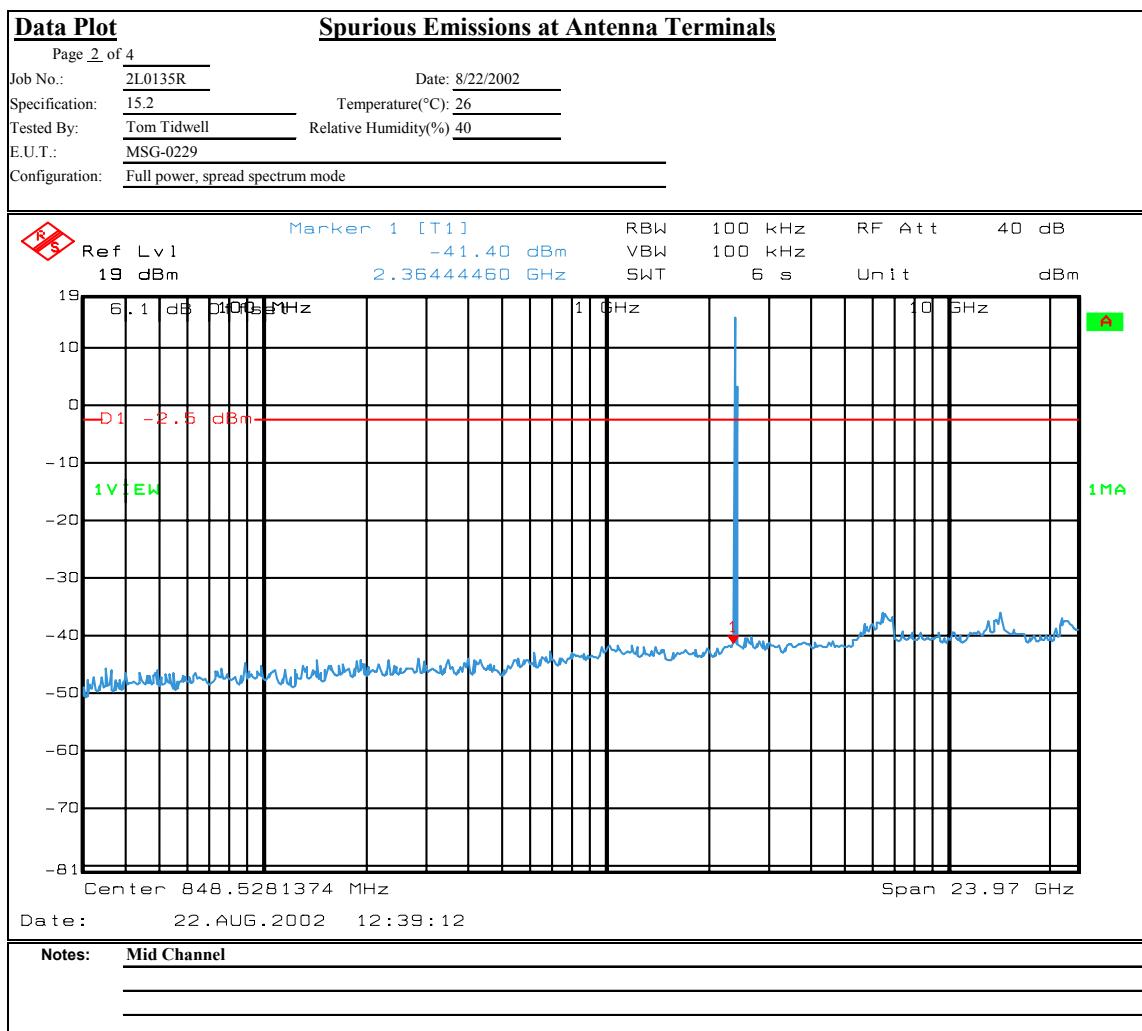
Section 8. Spurious Emissions (Antenna Conducted)

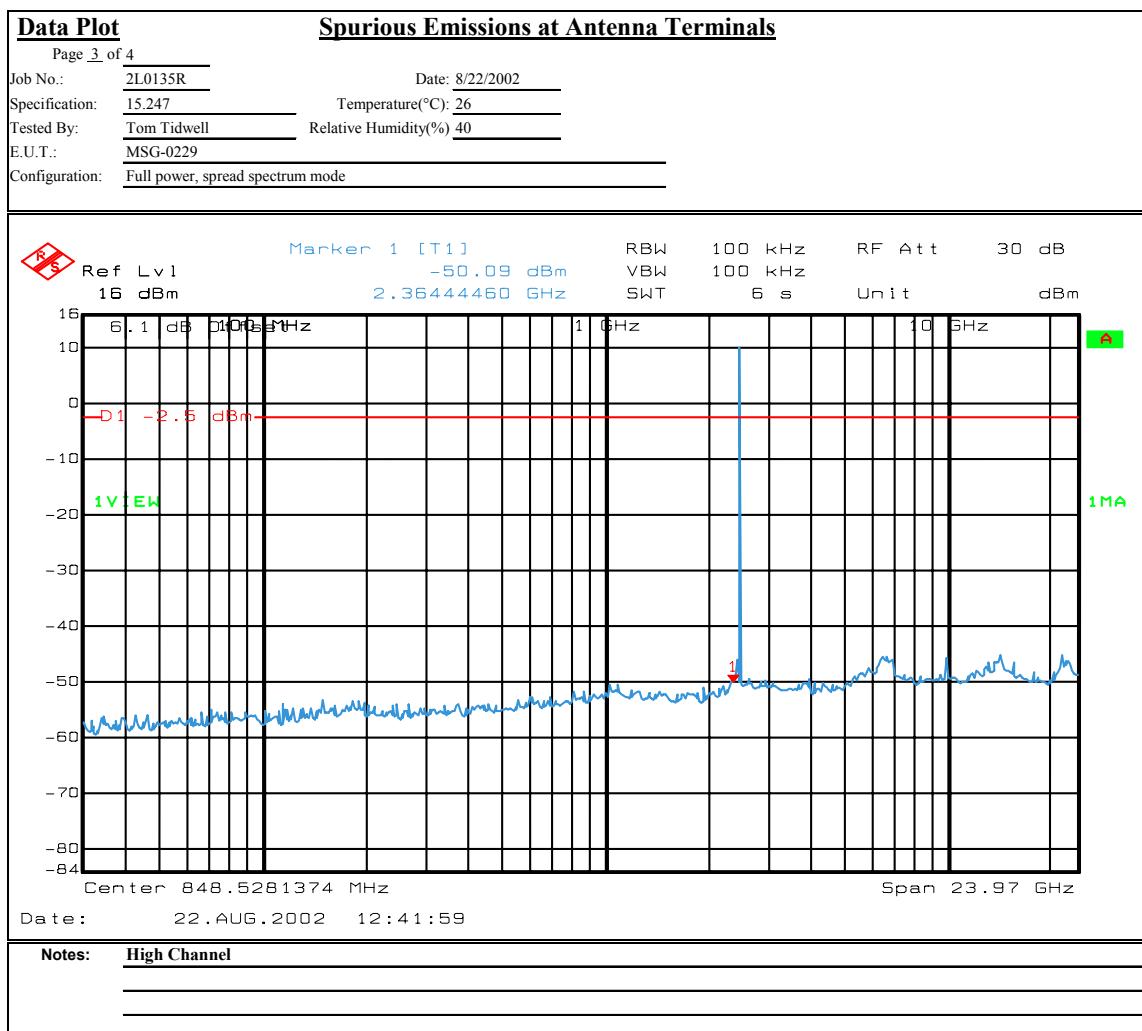
NAME OF TEST: Spurious Emissions	PARA. NO.: 15.247 (c)
TESTED BY: Tom Tidwell	DATE: 8/22/2002

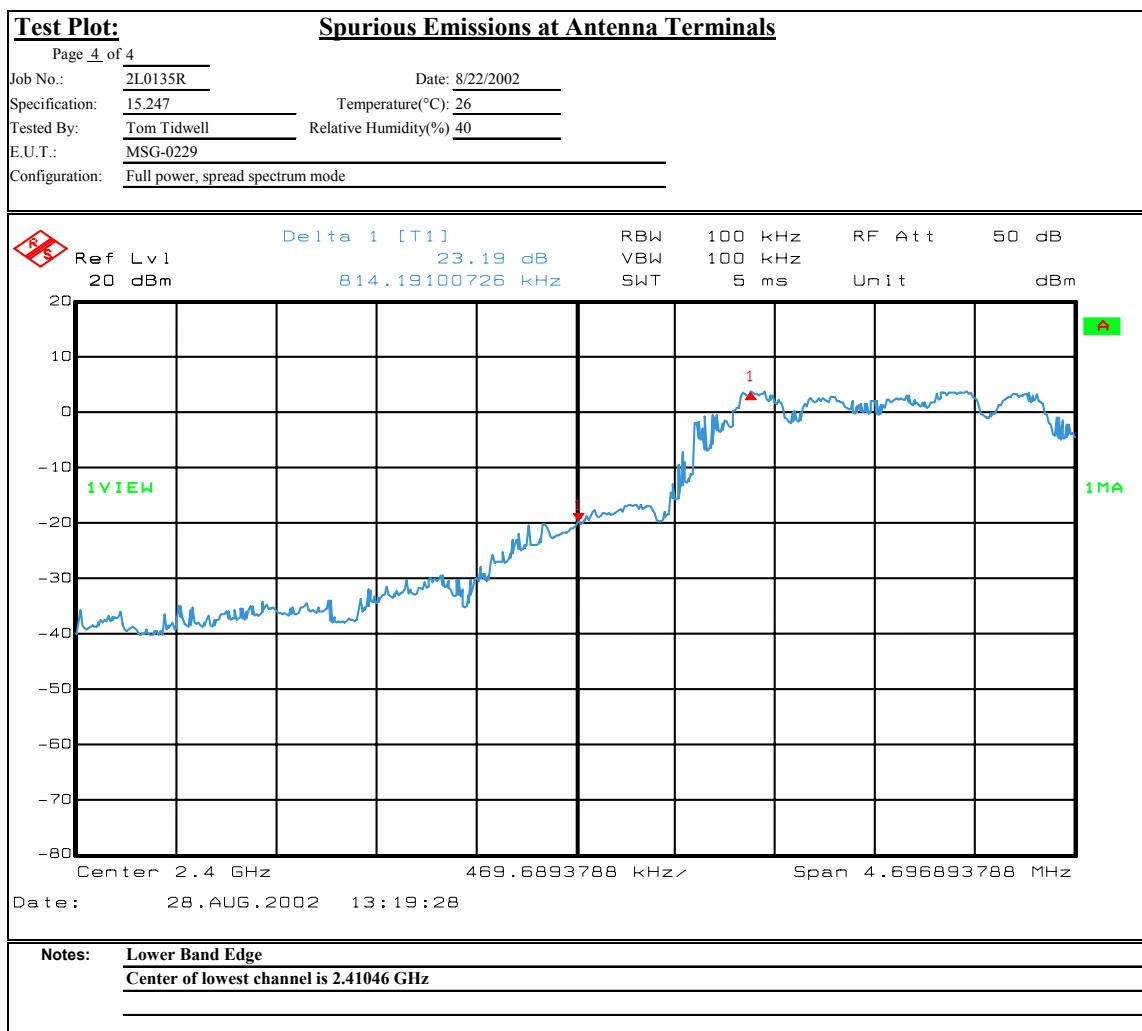
Test Results: Complies.

Measurement Data: See attached table.

Data Plot		Spurious Emissions at Antenna Terminals							
Page <u>1</u> of <u>4</u>		Date: <u>8/22/2002</u>			Complete <u>X</u>				
Job No.:	2L0135R	Specification:	15.247	Temperature(°C):	26	Preliminary: _____			
Tested By:	Tom Tidwell	Relative Humidity(%)	40						
E.U.T.:	MSG-0229								
Configuration:	Full power, spread spectrum mode								
Sample Number:	S03								
Location:	Lab 1	RBW:	100 kHz						
Detector Type:	Peak	VBW:	100 kHz						
Test Equipment Used									
Antenna:	Directional Coupler: _____								
Pre-Amp:	Cable #1: 1627								
Filter:	Cable #2: _____								
Receiver:	1036	Cable #3: _____							
Attenuator #1	Cable #4: _____								
Attenuator #2:	Mixer: _____								
Additional equipment used:	3 dB SMA attenuator								
Measurement Uncertainty:	+/-1.7 dB								
Notes:	Low Channel								







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FCC PART 15, SUBPART C

DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: **MSG w/ Internal RPC Model 0229** PROJECT NO.: **2L0135RUS1**

Section 9. Peak Power Spectral Density

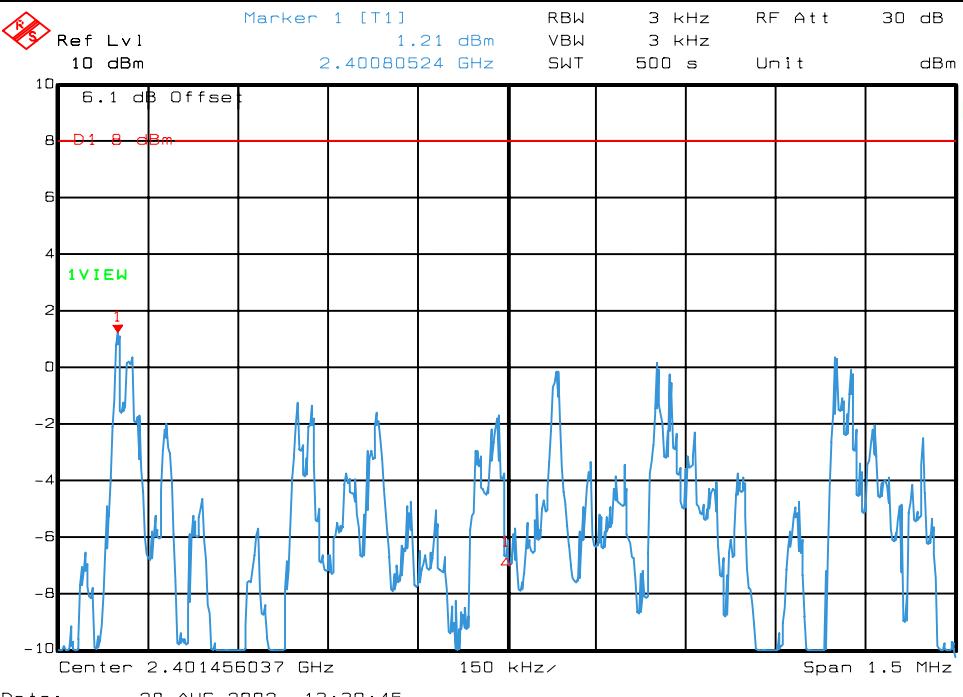
NAME OF TEST: Peak Power Spectral Density	PARA. NO.: 15.247(d)
TESTED BY: Tom Tidwell	DATE: 8/28/2002

Test Results: Complies.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- 0.7 dB

Test Data – Peak Power Spectral Density

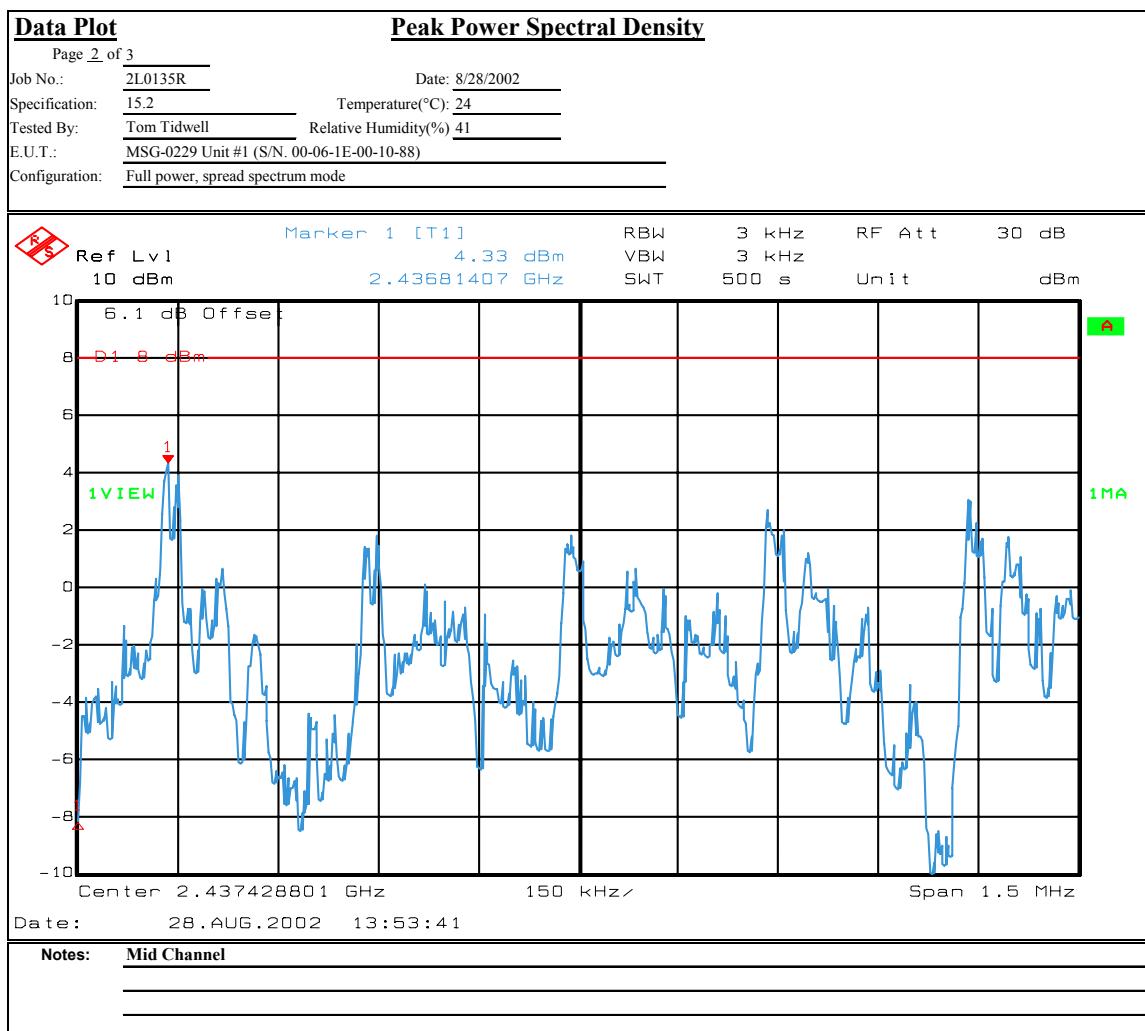
Data Plot		Peak Power Spectral Density			
Page <u>1</u> of 3				Complete <input checked="" type="checkbox"/> Preliminary: _____	
Job No.:	2L0135R	Date:	8/28/2002		
Specification:	15.247	Temperature(°C):	24		
Tested By:	Tom Tidwell	Relative Humidity(%):	41		
E.U.T.:	MSG-0229 Unit #1 (S/N. 00-06-1E-00-10-88)				
Configuration:	Full power, spread spectrum mode				
Sample Number:	S03				
Location:	Lab 1	RBW:	3 kHz		
Detector Type:	Peak	VBW:	3 kHz		
Test Equipment Used					
Antenna:	Directional Coupler:				
Pre-Amp:	Cable #1: 1627				
Filter:	Cable #2:				
Receiver:	1036	Cable #3:			
Attenuator #1	Cable #4:				
Attenuator #2:	Mixer:				
Additional equipment used:	2 x 3 dB SMA attenuator				
Measurement Uncertainty:	+/-1.7 dB				
 <p>Marker 1 [T1] 1.21 dBm 2.40080524 GHz</p> <p>Ref Lvl 10 dBm</p> <p>RBW 3 kHz RF Att 30 dB VBW 3 kHz Unit dBm SWT 500 s</p> <p>6.1 dB Offset</p> <p>D1 8 dBm</p> <p>1VIEW</p> <p>Date: 28.AUG.2002 13:39:45</p>					
Notes:	Low Channel				

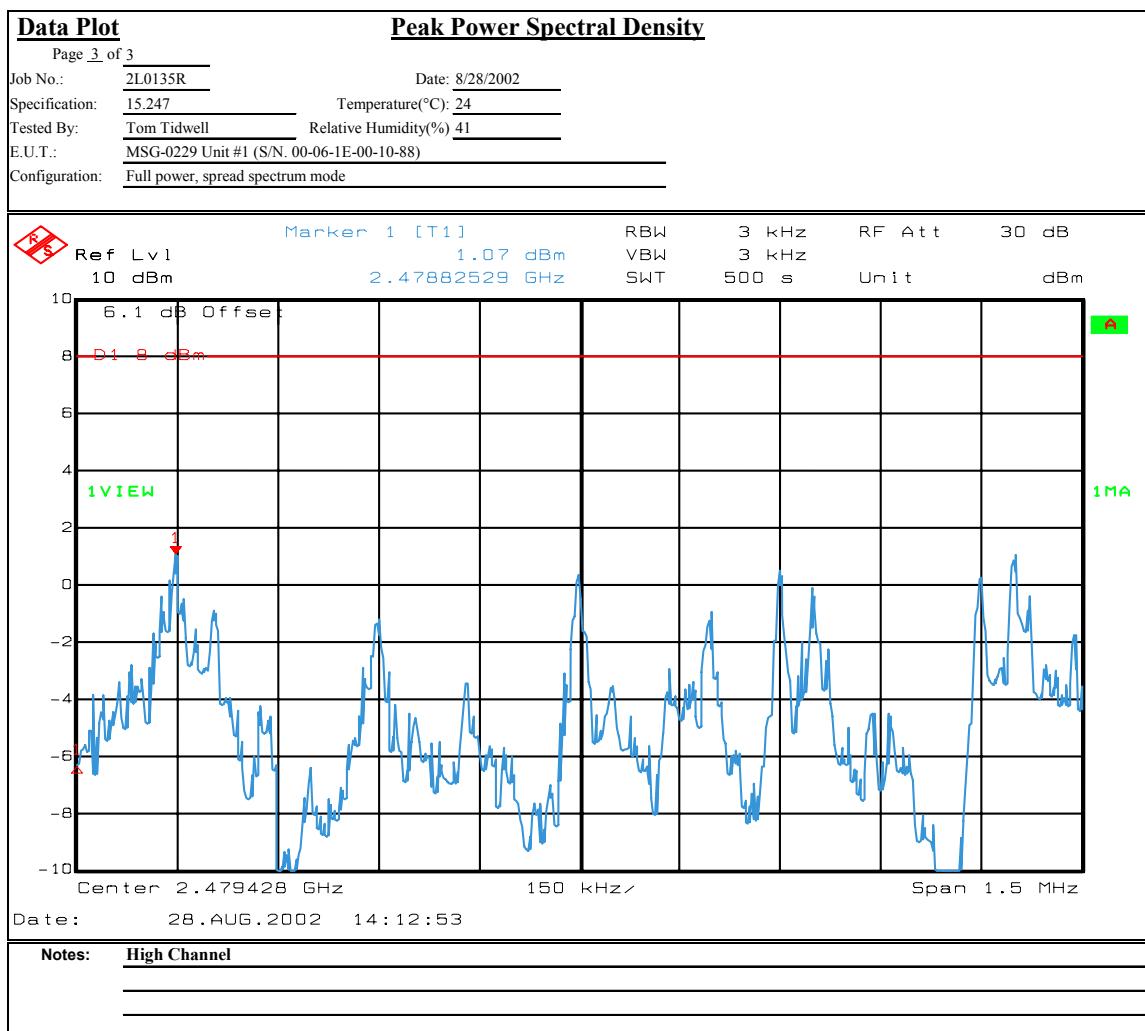
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FCC PART 15, SUBPART C

DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MSG w/ Internal RPC Model 0229 PROJECT NO.: 2L0135RUS1





Nemko Dallas**FCC PART 15, SUBPART C****DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER****EQUIPMENT: MSG w/ Internal RPC Model 0229 PROJECT NO.: 2L0135RUS1****Section 10. Test Equipment List**

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1029	PEAK POWER METER	HP 8900D	3303U0012	08/13/02	08/13/03
1030	PEAK POWER SENSOR	HP 84811A	2539A03573	08/13/02	08/13/03
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	12/18/01	12/19/03
1427	Probe antenna	Electro Metrics MFB-25	477	CNR	N/A
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	07/30/01	07/31/03
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	07/15/02	07/15/03
1482	Band Pass Filter	K & L 11SH10-4000/T12000-0/0	2	Cal B4 Use	N/A
1484	Cable 2.0-18.0 GHz	Storm PR90-010-072	N/A	07/15/02	07/15/03
1485	Cable 2.0-18.0 GHz	Storm PR90-010-216	N/A	07/15/02	07/15/03
1555	Filter high pass 5 kHz	Solar Electronics 7930-5.0	933125	06/06/02	06/06/03
1258	LISN .15 MHz-30 MHz	EMCO 0	1305	07/09/02	07/09/03
1555	Filter high pass 5KHz	Solar Electronics 7930-5.0	933125	06/06/02	06/06/03
971	CABLE, 3.4m	KTL RG223	N/A	08/05/02	08/05/03
1978	CABLE, 2.8m.	KTL RG223	N/A	11/09/01	11/09/02
1038	CABLE, .5m	KTL RG223	N/A	06/06/02	06/06/03
966	Receiver	Rohde & Schwartz ESH2	880370/029	06/27/02	06/27/03

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DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: **MSG w/ Internal RPC Model 0229** PROJECT NO.: **2L0135RUS1**

ANNEX A - TEST DETAILS

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FCC PART 15, SUBPART C

DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: **MSG w/ Internal RPC Model 0229** PROJECT NO.: **2L0135RUS1**

NAME OF TEST: Powerline Conducted Emissions

PARA. NO.: 15.207(a)

Minimum Standard: The R.F. that is conducted back onto the AC power line on any frequency within the band 0.45 to 30 MHz shall not exceed 250 μ V (48 dB μ V) across 50 ohms.

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FCC PART 15, SUBPART C

DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: **MSG w/ Internal RPC Model 0229** PROJECT NO.: **2L0135RUS1**

NAME OF TEST: Minimum 6 dB bandwidth

PARA. NO.: 15.247(a)(2)

Minimum Standard: The minimum 6 dB bandwidth shall be at least 500 kHz

NAME OF TEST: Maximum Peak Output Power

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

Minimum Standard: The maximum peak output power shall not exceed 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 6 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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DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: **MSG w/ Internal RPC Model 0229** PROJECT NO.: **2L0135RUS1**

NAME OF TEST: RF Exposure

PARA. NO.: 15.247(b)(4)

Minimum Standard: Systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines stipulated in 1.1307(b)(1) of CFR 47.

NAME OF TEST: Spurious Emissions(conducted)

PARA. NO.: 15.247(c)

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 ($\mu\text{V/m} @ 3\text{m}$)	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 IS SEARCHED TO THE 10th HARMONIC OF THE HIGHEST FREQUENCY GENERATED IN THE EUT.

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

NAME OF TEST: Radiated Spurious Emissions

PARA. NO.: 15.247(c)

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

NAME OF TEST: Transmitter Power Density

PARA. NO.: 15.247(d)

Minimum Standard: The transmitted power density averaged over any 1 second interval shall not be greater than +8 dBm in any 3 kHz bandwidth.

Method Of Measurement: The spectrum analyzer is set as follows:

RBW: 3 kHz

VBW: >3 kHz

Span: => measured 6 dB bandwidth

Sweep: Span(kHz)/3 (i.e. for a span of 1.5 MHz the sweep rate is 1500/3 = 500 sec.

LOG dB/div.: 2 dB

Note: For devices with spectrum line spacing =< 3 kHz, the RBW of the analyzer is reduced until the spectral lines are resolved. The measurement data is normalized to 3 kHz by summing the power of all the individual spectral lines within a 3 kHz band in linear power units.

For Devices With Integral Antenna:

For devices with non-detachable antennas, the received field strength is peaked and the spectrum analyzer is set as above. The peak emission level is then measured and converted to a field strength by adding the appropriate antenna factor and cable loss. This field strength is then converted to an equivalent isotropic radiated power using the same method as described for Peak Power output.

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: Processing Gain

PARA. NO.: 15.247(e)

Minimum Standard: The processing gain shall be at least 10 dB.**Method Of Measurement:** The CW jamming margin method was used to determine the processing gain. A CW signal generator is stepped across the passband of the receiver in 50 kHz increments. At each point the signal generator level required to obtain the recommended bit error rate is recorded. The jammer to signal ratio (J/S) is then calculated. The worst 20% of the J/S points is discarded. The lowest remaining J/S ratio is used to calculate the processing gain.**Calculation Of Processing Gain:**

The processing gain was determined by measuring the jamming margin of the E.U.T. and using the following formula:

$$\text{Jamming Margin} = G_p - (S/N)_{\text{out}} - L_{\text{sys}}$$

For a receiver using non-coherent detection the value $(S/N)_{\text{out}}$ is calculated using the formula:

$P_e = (1/2)\text{EXP}\{-E/2N_0\}$ where P_e is the probability of error (minimum Bit Error Rate required for proper operation).

E/N_0 is $(S/N)_{\text{out}}$

for example, for a bit error rate of 10^{-4} a S/N ratio of 12.3 dB is required.

L_{sys} (system losses) is assumed to be 2 dB.

$$\text{Therefore } G_p = M_j + (S/N)_{\text{out}} + L_{\text{sys}}$$

Measurement performed at a channel in the center of the operating band of the EUT.

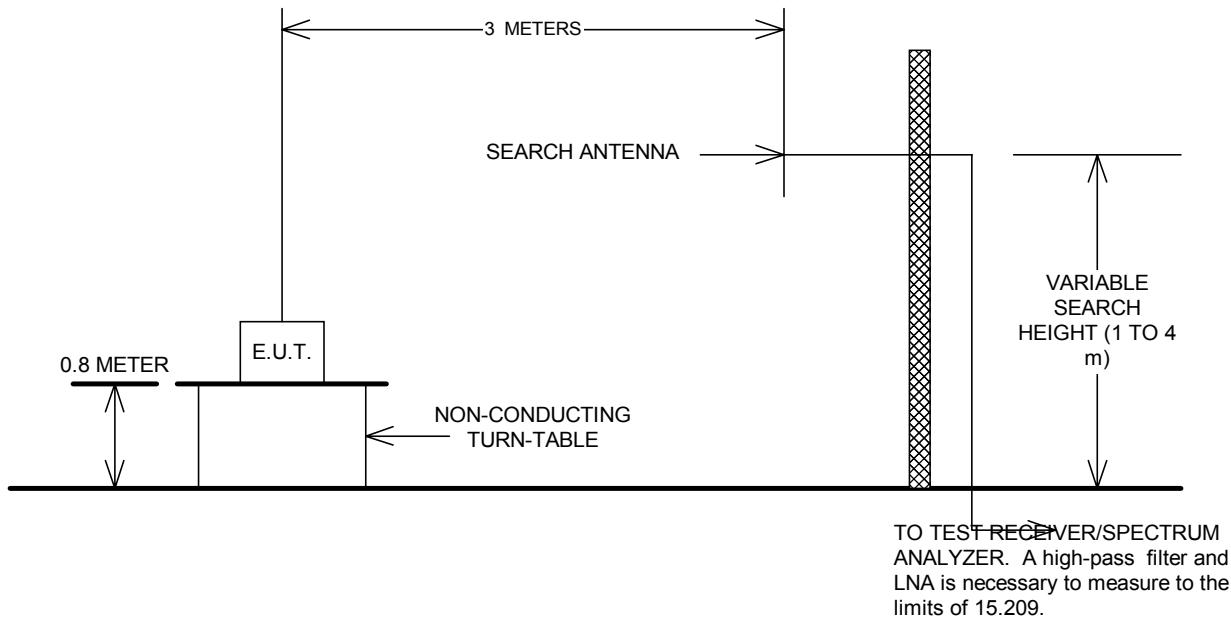
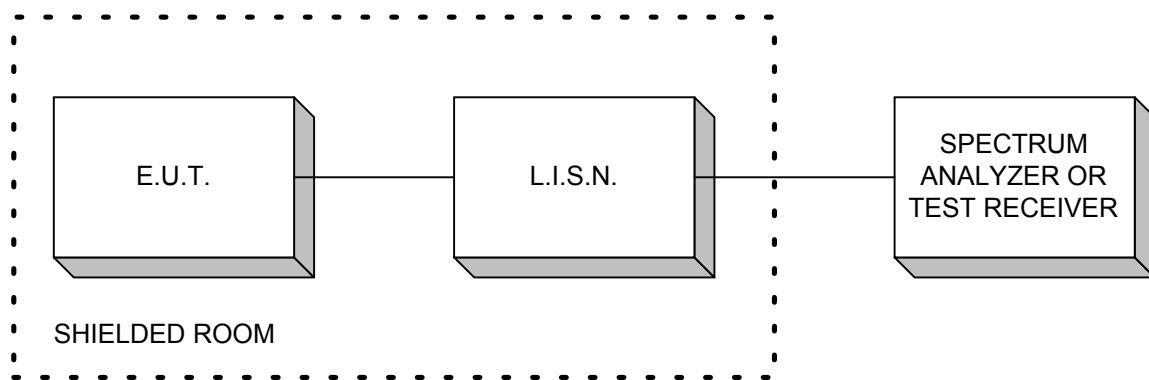
Nemko Dallas

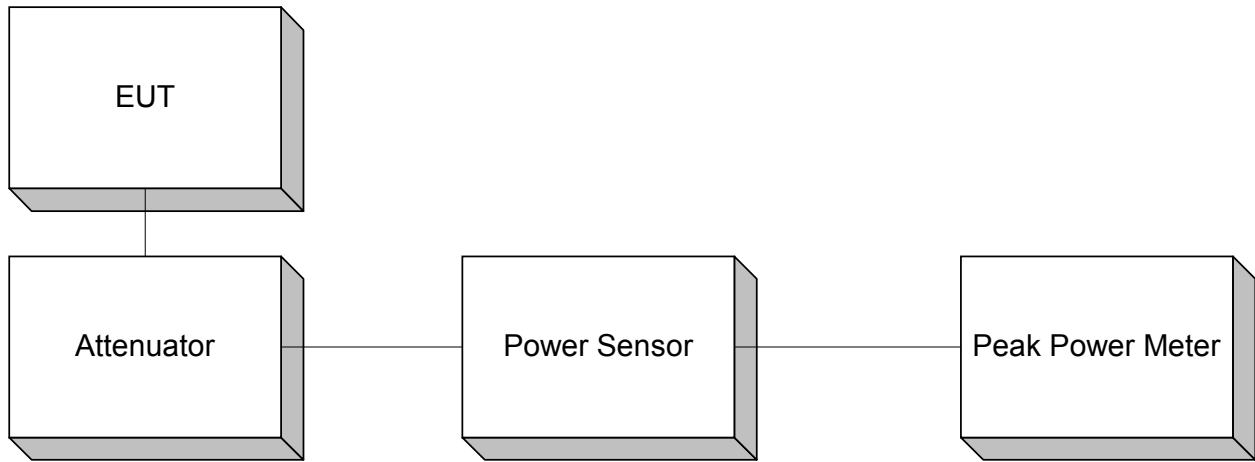
FCC PART 15, SUBPART C

DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: MSG w/ Internal RPC Model 0229 PROJECT NO.: 2L0135RUS1

ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions**Conducted Emissions**

Peak Power At Antenna Terminals

Minimum 6 dB Bandwidth
Peak Power Spectral Density
Spurious Emissions (conducted)

