

Nemko Test Report: 6L0188RUS1

Applicant: RF Monolithics, Inc.
4441 Sigma Road
Dallas, Tx 75244
USA

Equipment Under Test: DM2200-916VM
(E.U.T.)

In Accordance With: **FCC Part 15, Subpart C, 15.247**
Digital Transmission System Transmitter

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

Authorized By:

A handwritten signature in black ink, appearing to read 'Kevin Rose', with a stylized flourish at the end.

Kevin Rose Wireless Engineer

Date: May 10, 2006

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EQUIPMENT: DM2200-916VM

Section 1. Summary of Test Results

Manufacturer: RF Monolithics, Inc.

Model No.: DM2200-916VM

Serial No.: None

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 Digital Transmission Systems. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.



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.

See " Summary of Test Data".

**NVLAP LAB CODE: 100426-0**

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Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
Powerline Conducted Emissions	15.207(a)	NA
Minimum 6 dB Bandwidth	15.247(a)	Complies
Maximum Peak Power Output	15.247(b)	Complies
Spurious Emissions (Antenna Conducted)	15.247(d)	NA
Spurious Emissions (Restricted Bands)	15.247(d)	Complies
Peak Power Spectral Density	15.247(e)	Complies

Footnotes:

- 1) The device is battery powered.
- 2) The device has an integral antenna

Note: All measurements were made radiated. The device has an integral antenna. The manufacturers declared nominal power is 10 mW (10 dBm) at antenna terminal. Peak rf conducted power was measured at +11 dBm after correction for theoretical gain of the TX antenna.

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

General Equipment Information

Frequency Band:	902-928 MHz
Frequency of EUT:	916.5 MHz (+/-200 kHz)
Channel Spacing:	NA
User Frequency Adjustment:	None

Description of EUT

The DM2200 is a 916.5 MHz transceiver module intended for wireless industrial sensors and similar applications

System Diagram

EQUIPMENT: DM2200-916VM

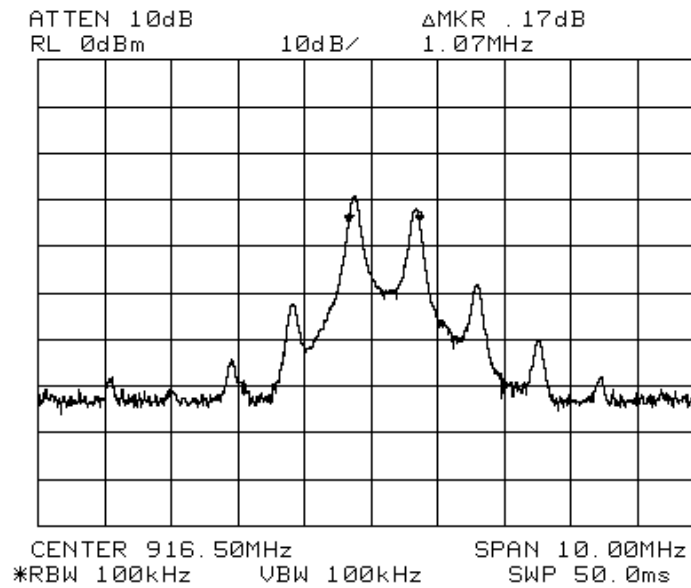
Section 3. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)
TESTED BY: David Light	DATE: 5/8/2006

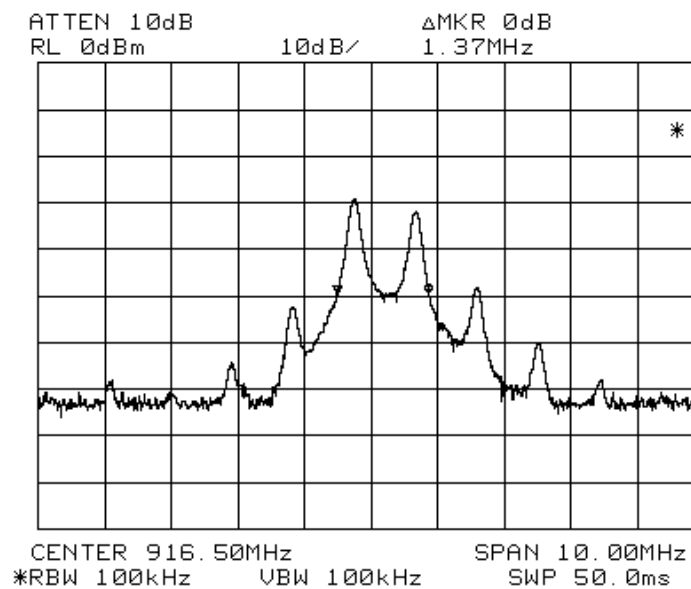
Test Results: Complies.**Test Conditions:** Temp.: 20°
 RH: 35%**Test Equipment Used:** 1464-1484-1485-1482-1016-791-759-760**Measurement Data:** See 6 dB BW plotMeasured 6 dB bandwidth: 1.07 MHz
Channel Separation: NA

Test Data – Occupied Bandwidth

6 dB for FCC



20 dB for IC



EQUIPMENT: DM2200-916VM

Section 4. Maximum Peak Output Power

NAME OF TEST: Maximum Peak Output power	PARA. NO.: 15.247(b)(1)
TESTED BY: David Light	DATE: 5/8/2006

Test Results: Complies.**Measurement Data:** Refer to attached data

The measurement was made with a new battery.

Field Strength of Spurious Emissions										
Page 1 of 1		Job No.: 6L0188		Date: 5/8/2006		Complete <u>X</u>				
Specification: 15.247		Temperature(°C): 20		Preliminary <u> </u>						
Tested By: David Light		Relative Humidity(%) 35								
E.U.T.: 900 MHz Tranceiver										
Configuration: Tx full power										
Sample No: 1										
Location: AC 3		RBW: 2 MHz		Measurement						
Detector Type: Peak		VBW: 2 MHz		Distance: 3 m						
Test Equipment Used										
Antenna: 993		Directional Coupler: <u> </u>								
Pre-Amp: <u> </u>		Cable #1: 1484								
Filter: <u> </u>		Cable #2: 1485								
Receiver: 1464		Cable #3: <u> </u>								
Attenuator #1: <u> </u>		Cable #4: <u> </u>								
Attenuator #2: <u> </u>		Mixer: <u> </u>								
Additional equipment used: <u> </u>										
Measurement Uncertainty: +/-1.7 dB										
Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBi)		EIRP (dBm)	EIRP (mW)	Polarity	Comments
916.5	-25.0	30.5		0	5.8		11.3	13.5831	V	
916.5	-33.5	30.0		0	3.6		0.1	1.0304	H	
Notes: Nominal output power at antenna terminal is rated at 10 mW nominal										

EQUIPMENT: DM2200-916VM

Section 5. Radiated Emissions

NAME OF TEST: Radiated Emissions	PARA. NO.: 15.247 (d)
TESTED BY: David Light	DATE: 5/8/2006

Test Results: Complies.**Test Conditions:** Temp.: 20°
RH: 35%**Test Equipment Used:** 1464-1484-1485-1482-1016-791-759-760**Measurement Data:** There were no emissions detected within 20 dB of the limit of -20 dBc specified in 15.247(d) or the restricted band limits of 15.205.

The spectrum was searched from 30 MHz to 10 GHz

RBW=VBW= 100 kHz for 15.247

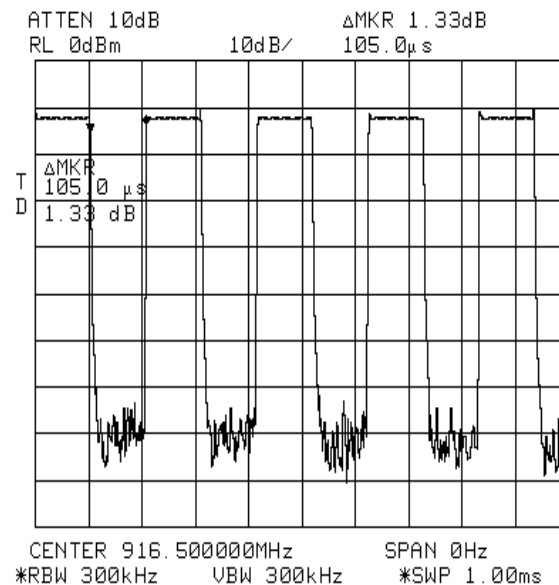
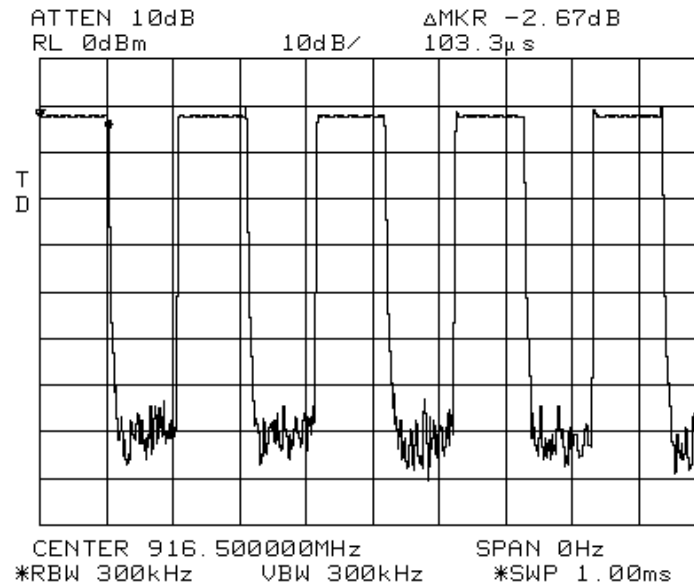
RBW=VBW=1 MHz for 15.205

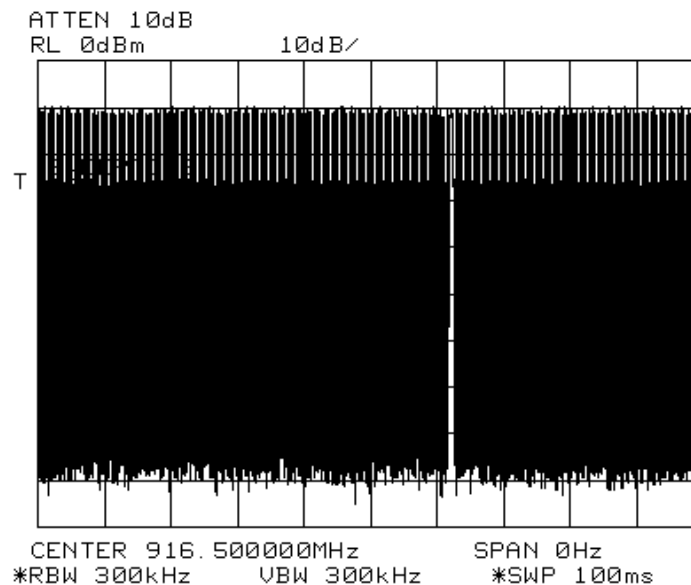
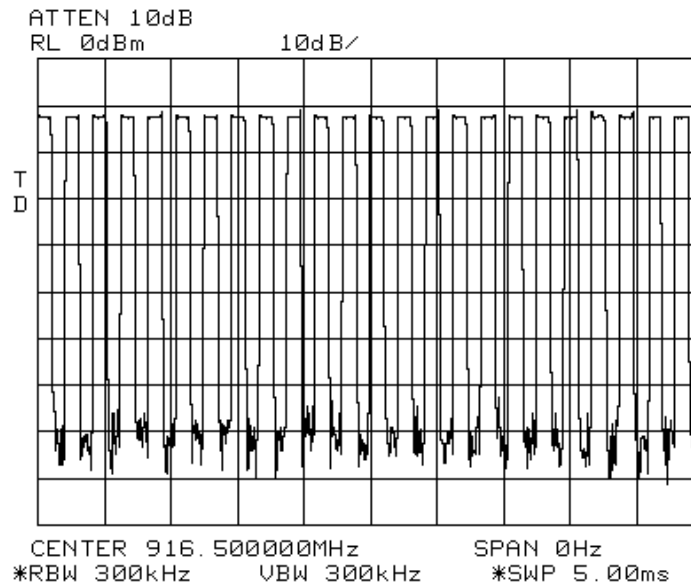
Detector: Peak

-6 dB correction for average measurements was applied if needed. Refer to attached plots.

The device was tested on three orthoonal axis to determine worst-case orientation.

Duty Cycle

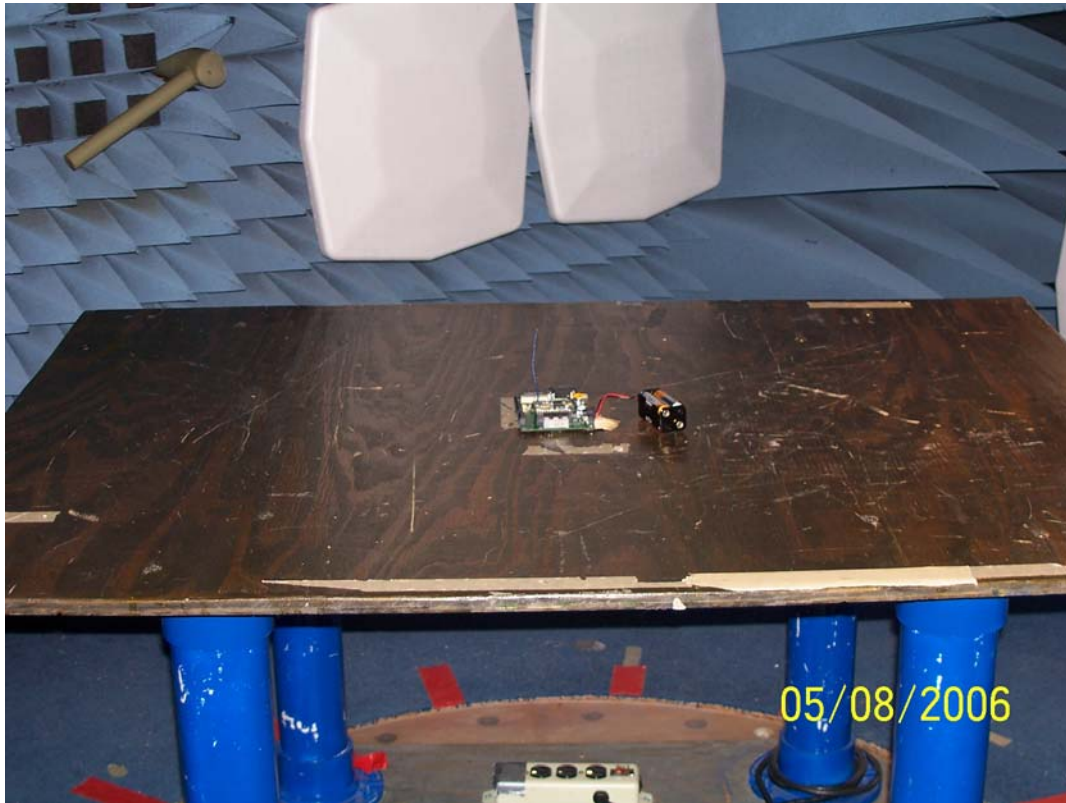


EQUIPMENT: DM2200-916VM**Duty Cycle**

103.3 μ S per pulse – Approximately 480 pulses in 100 mS = 49.58 mS

$20 \log (49.58/100) = -6.1 \text{ dB}$

Test Setup Photograph



EQUIPMENT: DM2200-916VM

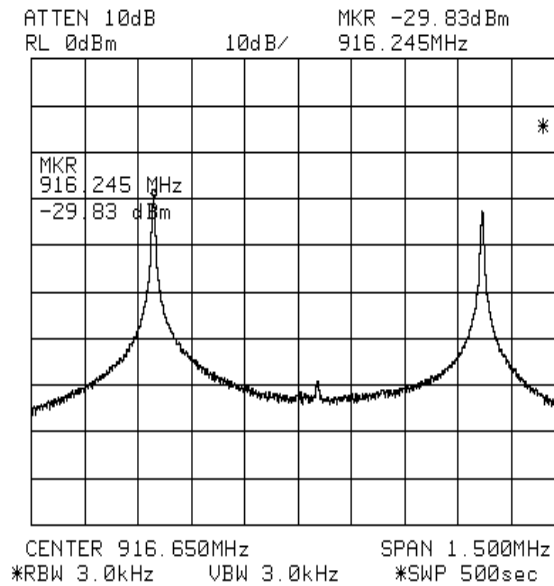
Section 6. Peak Power Spectral Density

NAME OF TEST: Peak Power Spectral Density	PARA. NO.: 15.247(e)
TESTED BY: David Light	DATE: 5/8/2006

Test Results: Complies.

Measurement Data: See attached data..

Peak Power Spectral Density



Power Density

Page 1 of 1

Job No.: 6L0188 Date: 5/8/2006 Complete X
Preliminary _____

Specification: 15.247 Temperature(°C): 20
Tested By: David Light Relative Humidity(%) 35
E.U.T.: 900 MHz Tranceiver
Configuration: Tx full power
Sample No: 1
Location: AC 3 RBW: 3 kHz Measurement
Detector Type: Peak VBW: 3 kHz Distance: 3 m

Test Equipment Used

Antenna: 993 Directional Coupler: _____
Pre-Amp: _____ Cable #1: 1484
Filter: _____ Cable #2: 1485
Receiver: 1464 Cable #3: _____
Attenuator #1: _____ Cable #4: _____
Attenuator #2: _____ Mixer: _____
Additional equipment used: _____
Measurement Uncertainty: +/-1.7 dB

Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBi)		EIRP (dBm)	EIRP (mW)	Polarity	Comments
916.5	-29.8	30.5		0	5.8		6.5	4.4978	V	

Notes: Nominal output power at antenna terminal is rated at 10 mW nominal

EQUIPMENT: DM2200-916VM

Section 7. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/14/05	01/15/07
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	08/26/05	08/26/06
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	08/26/05	08/26/06
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/01/05	08/02/07
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	02/13/06	02/13/07
760	Antenna biconical	Electro Metrics MFC-25	477	08/04/05	08/04/06
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	04/20/06	04/20/07
1481	Microwave Highpass Filter	K & L 3DH1-2000/T8000-0/0	4	Cal B4 Use	N/A
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	04/20/06	04/20/07

ANNEX A - TEST DETAILS

Nemko USA

FCC PART 15, SUBPART C
Digital Transmission Systems
Test Report No.: 6L0188RUS1

EQUIPMENT: DM2200-916VM

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
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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)

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.

Substitution Antenna Method for Integral Antennas:

The peak field strength of the carrier is measured in a worst-case configuration with a RBW > 5 times the occupied bandwidth of the transmitted waveform. For cases where the RBW of the test instrument is not sufficient, the power is measured using a peak power meter instead of the spectrum analyzer.

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

NAME OF TEST: Spurious Emissions(conducted)

PARA. NO.: 15.247(d)

Minimum Standard:

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

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ @ 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 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(d)

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

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

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ @ 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(e)

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

ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions

