A

3M Corp.

Application
For Certification
OPTICOM GPS Transmitter

FCC ID: DGF-OpticomGPS

June, 2002

A

TABLE OF CONTENTS

A

1.0 GENERAL DESCRIPTION

1.1 Related Submittals Grants

This is single application of the *OPTICOM GPS Transmitter Model: 1010* for Certification under FCC Part 15, Subpart C.
There are no other simultaneous applications.
The Receiver portion will be verified under Declaration of Conformity.

1.2 Product Description

The *OPTICOM GPS Transmitter* is a part of the Traffic Light Control System. The *OPTICOM GPS Transmitter* is a Frequency Hopping System Transmitter operating within 2400-2483.5MHz frequency band under Section 15.247. The intended use of the *OPTICOM GPS Transmitter* unit is to generate a RF signal, deliver the signal to the antenna in order to communicate with the *OPTICOM GPS Receiver*. The *OPTICOM GPS Transmitter* is connected to the Control unit and powered from the Control unit.

RF Power Output:

1 Watt maximum (30dBm)

Antenna Description:

7cm monopole antenna
Gain: 2.2 dBi
Impedance: 50Ω
Connector: SMA

A

1.3 Test Methodology

Emission measurements were performed according to the procedures specified in **ANSI C63.4-1992** and FCC Public Notice DA 00-705: March 30, 2000. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in Appendices D and E were followed. All field strength radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

The test site facility used to collect the radiated and conducted measurement data is located at 7250 Hudson Blvd., Suite 100, Oakdale, Minnesota. This test facility has been fully described in a report dated on January 2000 submitted to your office. Please reference the site registration number: 90706, dated May 19, 2000.

A

2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

None

2.2 EUT Exercising Software

The *OPTICOM GPS Transmitter* was operated in continuous frequency hopping transmission mode and in continuous single channel transmission mode. The Computer using Microsoft Hyper Terminal software controlled these modes of operation.

2.3 Special Accessories

There are no special accessories necessary for compliance of these products.

2.4 Equipment Modification

No modifications were installed during the testing.

2.5 Support Equipment List and Description

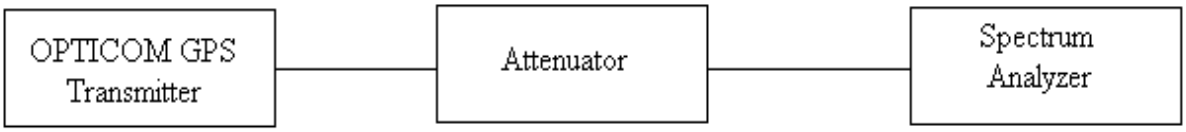
Gateway Laptop Computer
1611A BK Precision DC Power Supply, s/n 241-00988

A

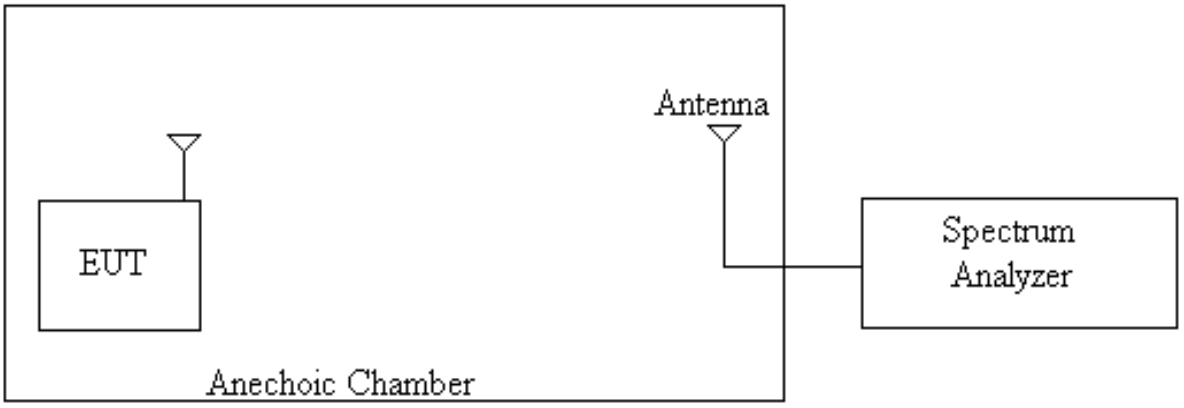
2.6 Test Configuration Block Diagrams

The EUT was connected to the Control unit. The EUT was set up as tabletop equipment.

Measurements at Antenna Terminal



Field Strength Measurements



A

3.0 TEST RESULTS

Data is included for the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs, data tables and graphical representations of the emissions are included.

The EUT is intended for operation under the requirements of Part 15 Subpart C. Specific test requirements include the following:

47 CFR 15.247(a)(1)	Hopping Channel Frequency Separation
47 CFR 15.247(b)(1)	Number of Hopping Frequencies
47 CFR 15.247(a)(1)(ii)	Time of Occupancy (Dwell Time)
47 CFR 15.247(a)(1)(ii)	20dB Bandwidth
47 CFR 15.247(b)(1)	Peak Output Power
47 CFR 15.247(c)	Band Edge Compliance
47 CFR 15.205, 15.209	Spurious Emissions

A

3.1 Hopping Channel Frequency Separation

The Hopping Channel Frequency Separation measurements were made on two adjacent channels.

Test Procedure

The Hopping Channel Frequency Separation was measured in max hold analyzer mode with span wide enough to capture the peaks of two adjacent channels.

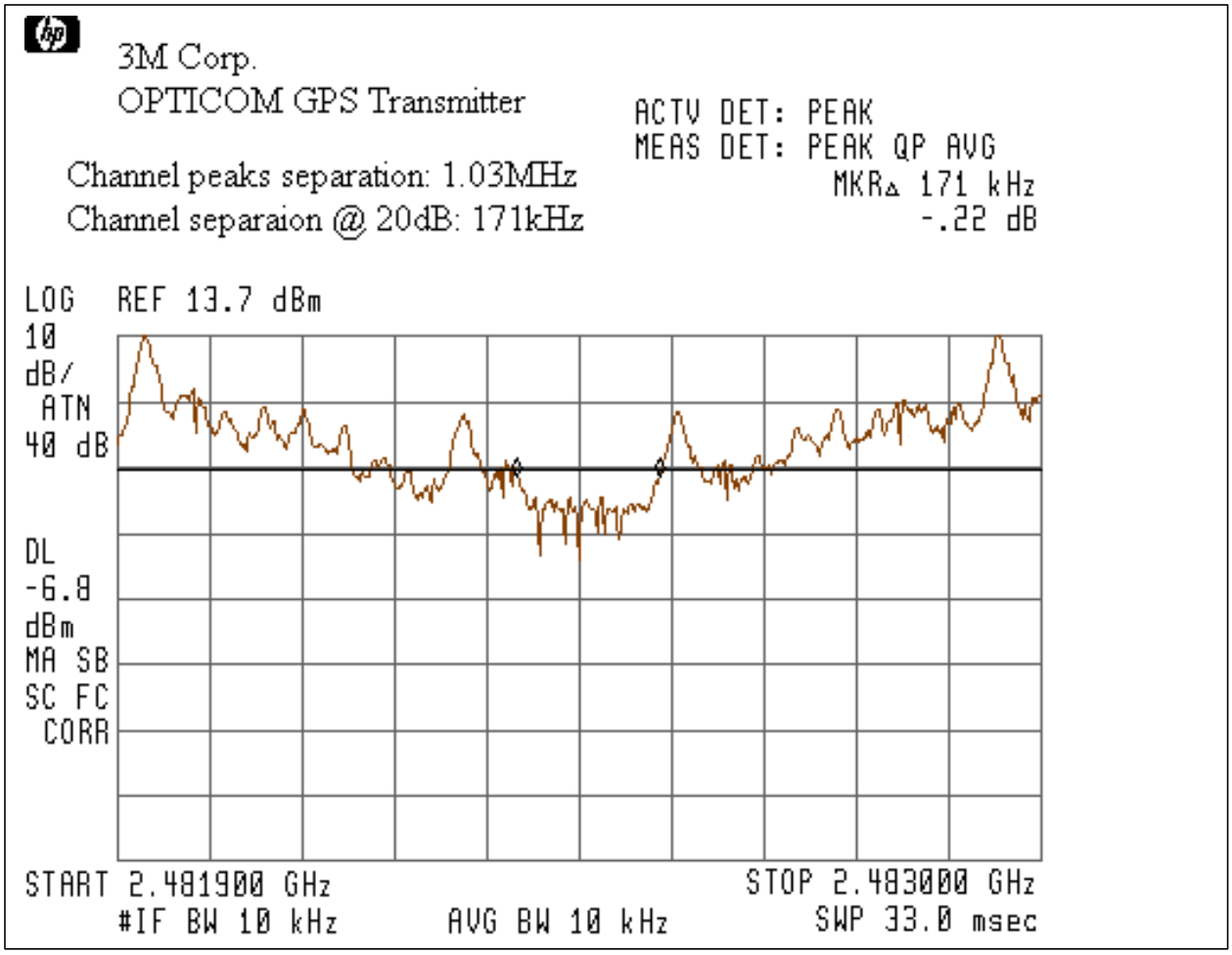
Table # 3-1-1 and Graph # 3-1-1 show the Hopping Channel Frequency Separation.

Table # 3-1-1

	Measured Separation kHz	Minimum Requirements kHz	Test result
Peak Separation	1030.0	25.0	Pass
Separation at -20dB level	171.0	25.0	Pass

A

Graph # 3-1-1


3M Corp.
OPTICOM GPS Transmitter
Channel peaks separation: 1.03MHz
Channel separaion @ 20dB: 171kHz
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 171 kHz
-.22 dB
LOG
10
dB/
ATN
40 dB
REF 13.7 dBm
DL
-6.8
dBm
MA SB
SC FC
CORR
START 2.481900 GHz
#IF BW 10 kHz
AVG BW 10 kHz
STOP 2.483000 GHz
SWP 33.0 msec

A

3.2 Number of Hopping Frequencies, FCC 15.247(b)(1)

The device's 81 Hopping Channels were measured.

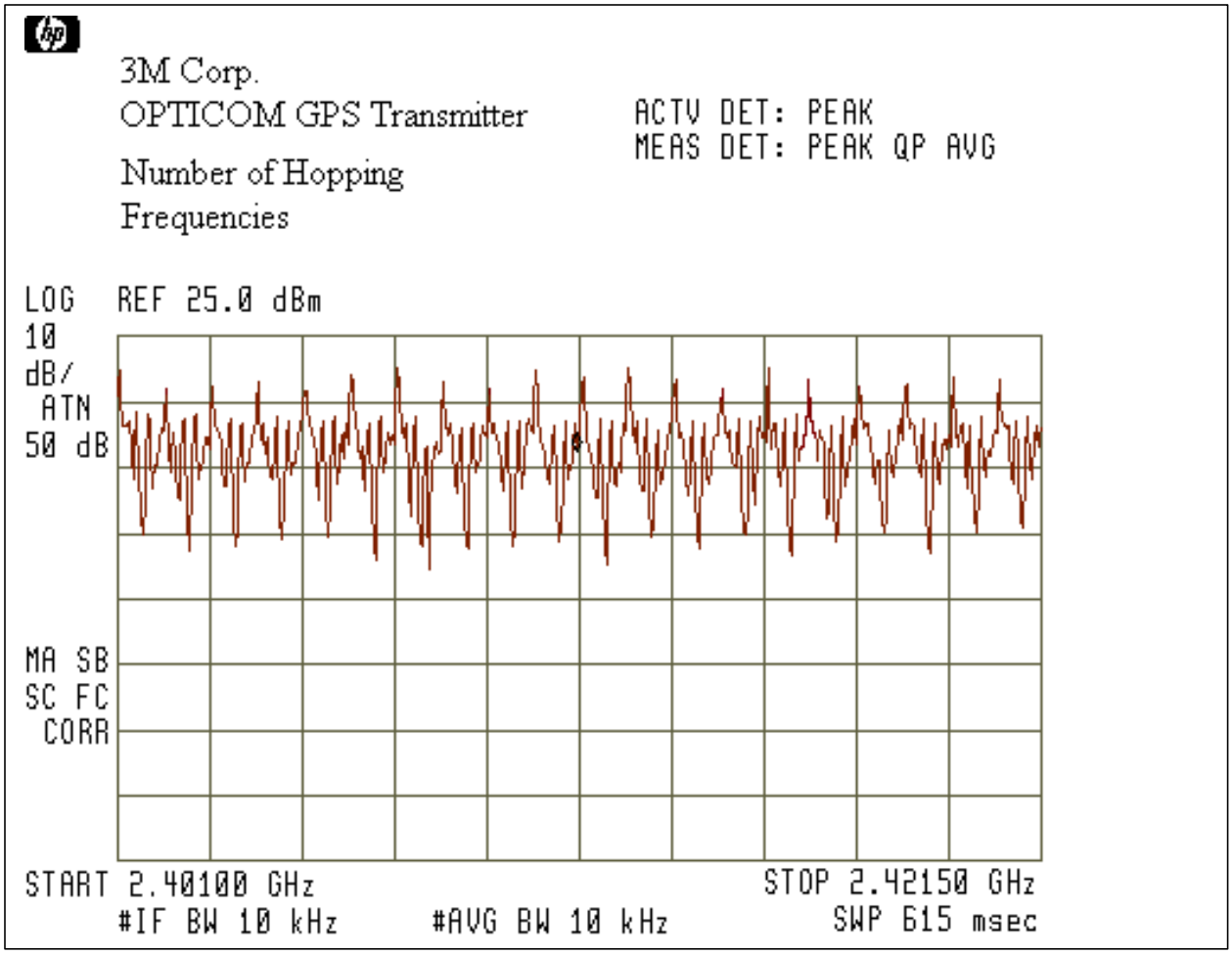
Test Procedure

The Number of Hopping Channels was measured in "max hold" analyzer mode. The frequency range was divided in four sub-ranges to clearly show all hopping frequencies.

Graphs ## 3-2-1, 3-2-2, 3-2-3, and 3-2-4 show the Number of Hopping Frequencies.

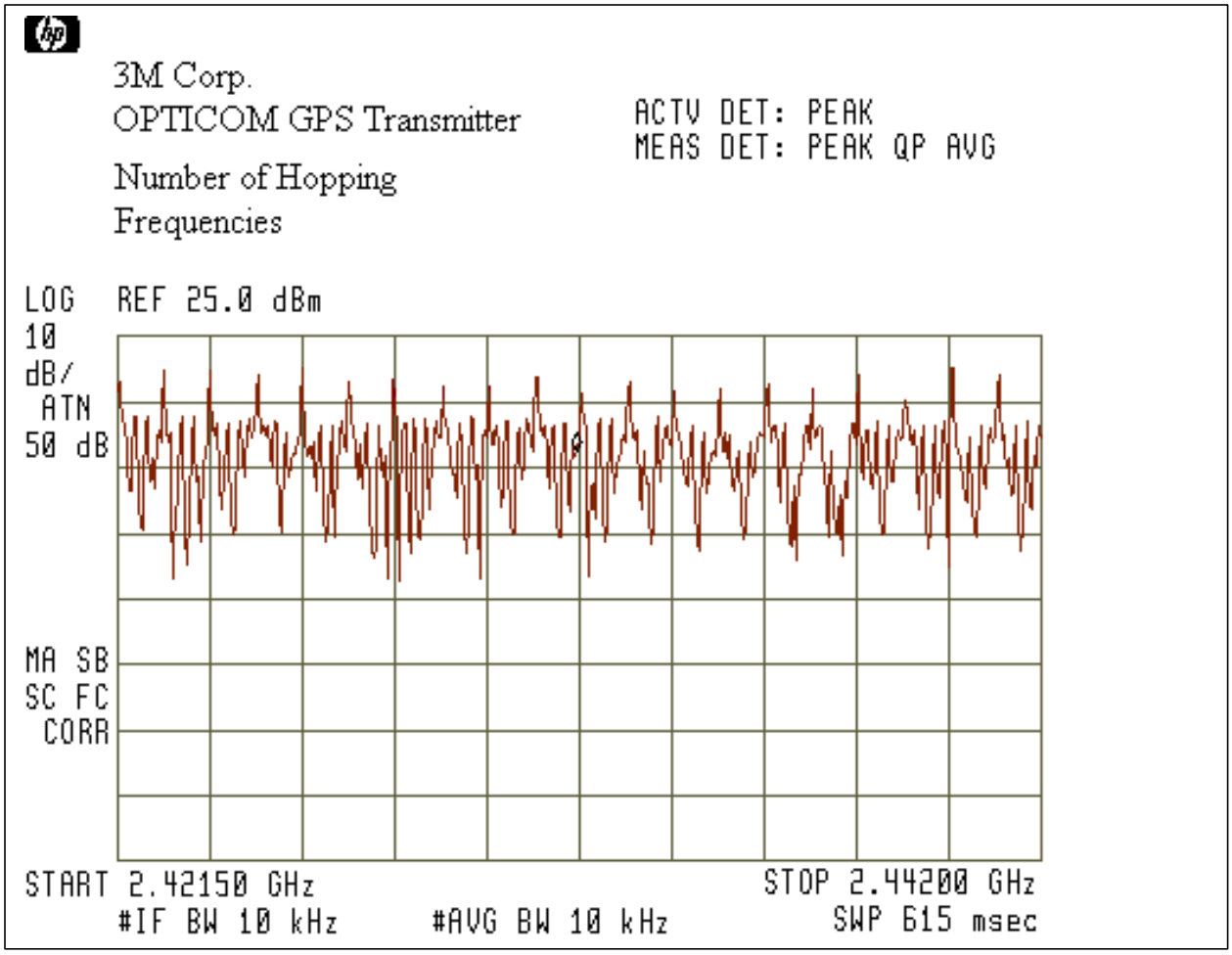
A

Graph # 3-2-1


3M Corp.
OPTICOM GPS Transmitter
Number of Hopping Frequencies
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
LOG
10
dB/
ATN
50 dB
REF 25.0 dBm
MA SB
SC FC
CORR
START 2.40100 GHz
#IF BW 10 kHz
#AVG BW 10 kHz
STOP 2.42150 GHz
SWP 615 msec

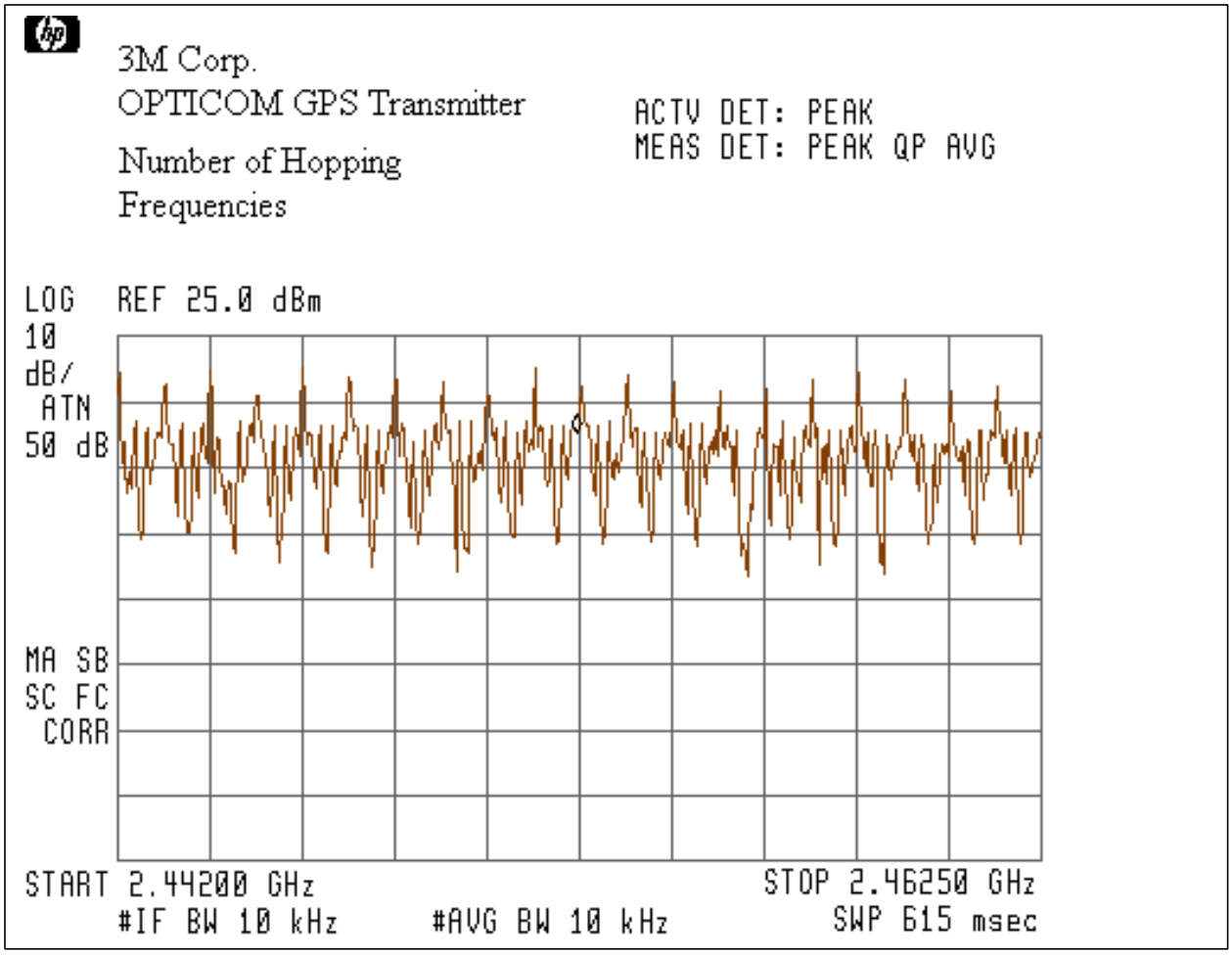
A

Graph # 3-2-2


3M Corp.
OPTICOM GPS Transmitter
Number of Hopping Frequencies
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
LOG
10
dB/
ATN
50 dB
REF 25.0 dBm
MA SB
SC FC
CORR
START 2.42150 GHz
STOP 2.44200 GHz
#IF BW 10 kHz
#AVG BW 10 kHz
SWP 615 msec

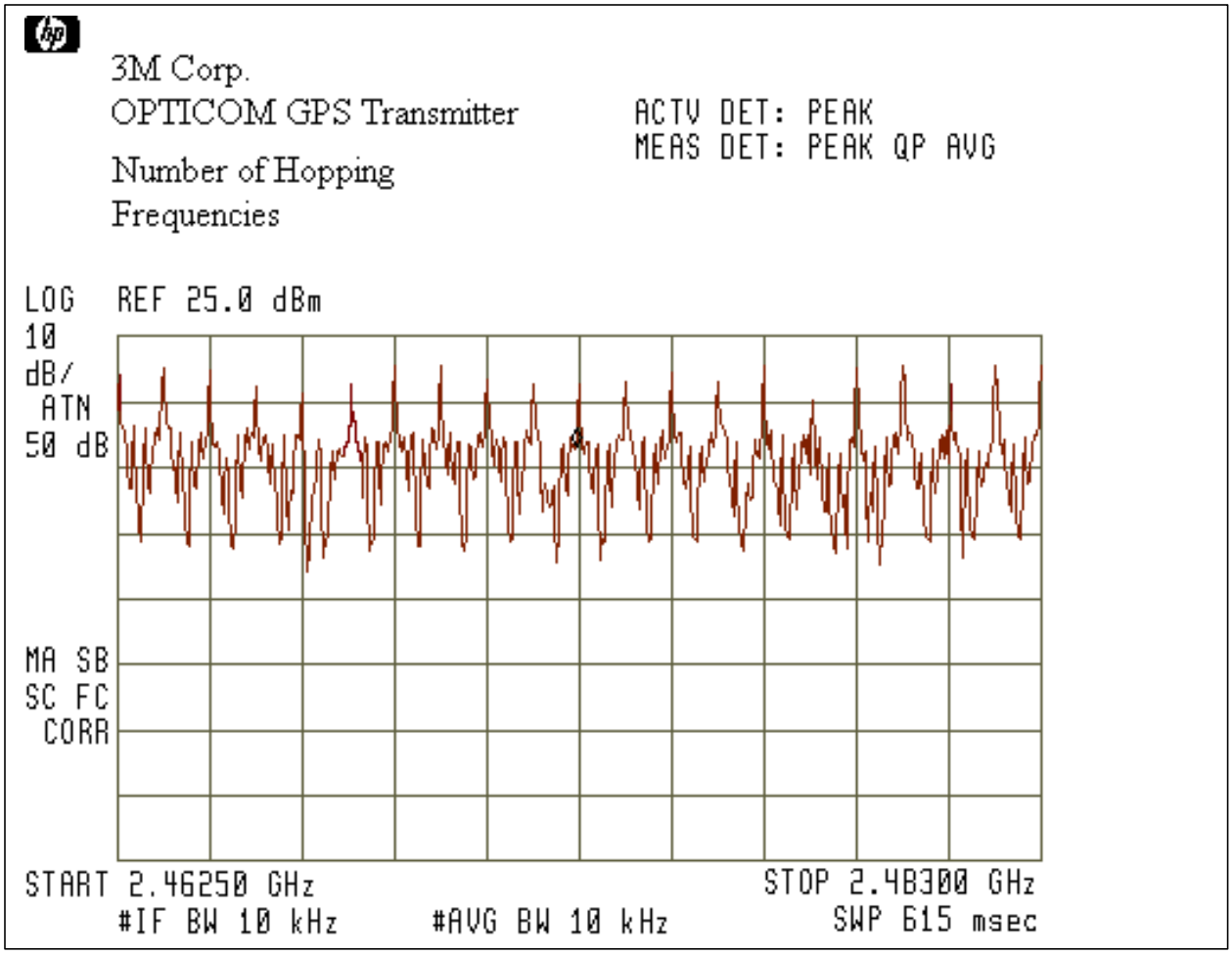
A

Graph # 3-2-3


3M Corp.
OPTICOM GPS Transmitter
Number of Hopping Frequencies
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
LOG
10
dB/
ATN
50 dB
REF 25.0 dBm
MA SB
SC FC
CORR
START 2.44200 GHz
#IF BW 10 kHz
#AVG BW 10 kHz
STOP 2.46250 GHz
SWP 615 msec

A

Graph # 3-2-4


3M Corp.
OPTICOM GPS Transmitter
Number of Hopping Frequencies
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
LOG
10
dB/
ATN
50 dB
REF 25.0 dBm
MA SB
SC FC
CORR
START 2.46250 GHz
#IF BW 10 kHz
#AVG BW 10 kHz
STOP 2.4B300 GHz
SWP 615 msec

A

3.3 Time of Occupancy (Dwell Time), FCC 15.247(a)(1)(ii)

Time of Occupancy was measured at the antenna terminal of the EUT for Channel 41.

Test Procedure

The Time of Occupancy was measured in "max hold" analyzer mode with zero span and different sweep time to calculate the Time of Occupancy.

Graphs ## 3-3-1, 3-3-2, and 3-3-3 show the Time of Occupancy test results.

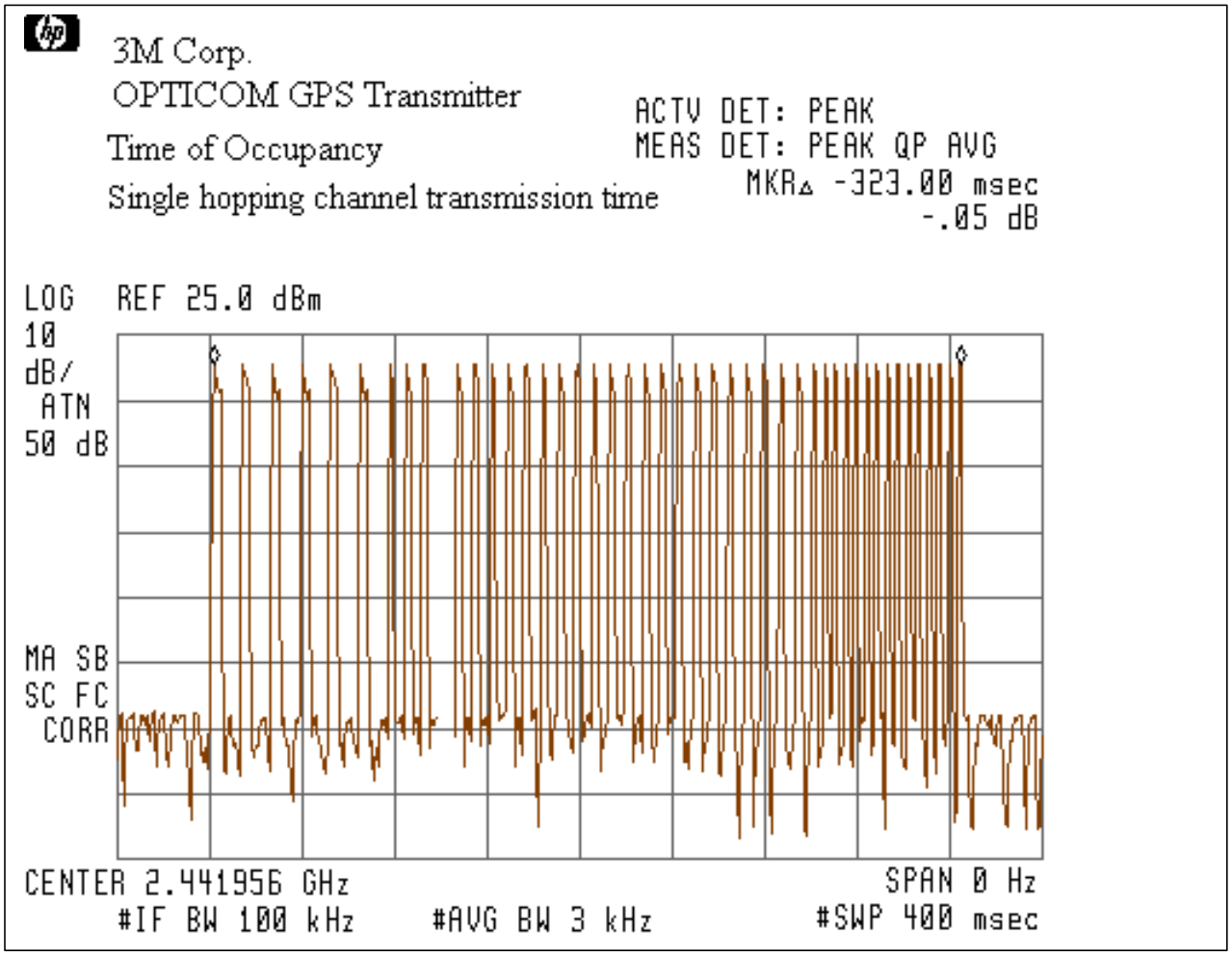
Time of Occupancy Calculation

Single channel transmitting time: T = 323ms (Graph # 3-3-1)
Maximum number of single channel transmissions within a 30sec period: N = 2 (Graph # 3-3-2)
Pulse train duty cycle during one transmission session: R = 0.25 (Graph # 3-3-3)

Time of Occupancy = T x N x R = 323ms x 2 x 0.25 = 162ms
The Maximum Average Time of Occupancy = 400ms.

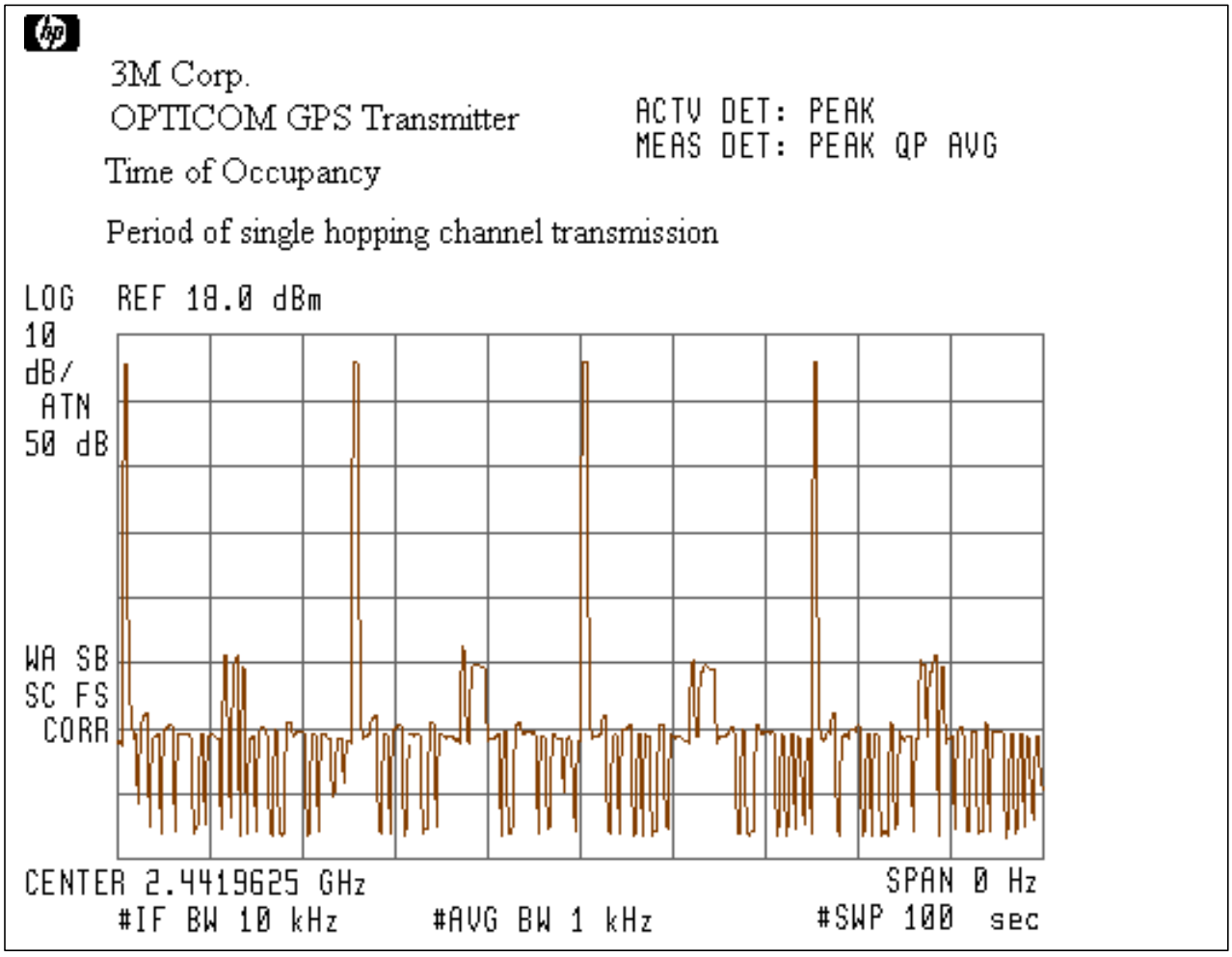
A

Graph # 3-3-1


3M Corp.
OPTICOM GPS Transmitter
Time of Occupancy
Single hopping channel transmission time
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ -323.00 msec
-.05 dB
LOG
10
dB/
ATN
50 dB
REF 25.0 dBm
MA SB
SC FC
CORR
CENTER 2.441956 GHz
#IF BW 100 kHz
#AVG BW 3 kHz
SPAN 0 Hz
#SWP 400 msec

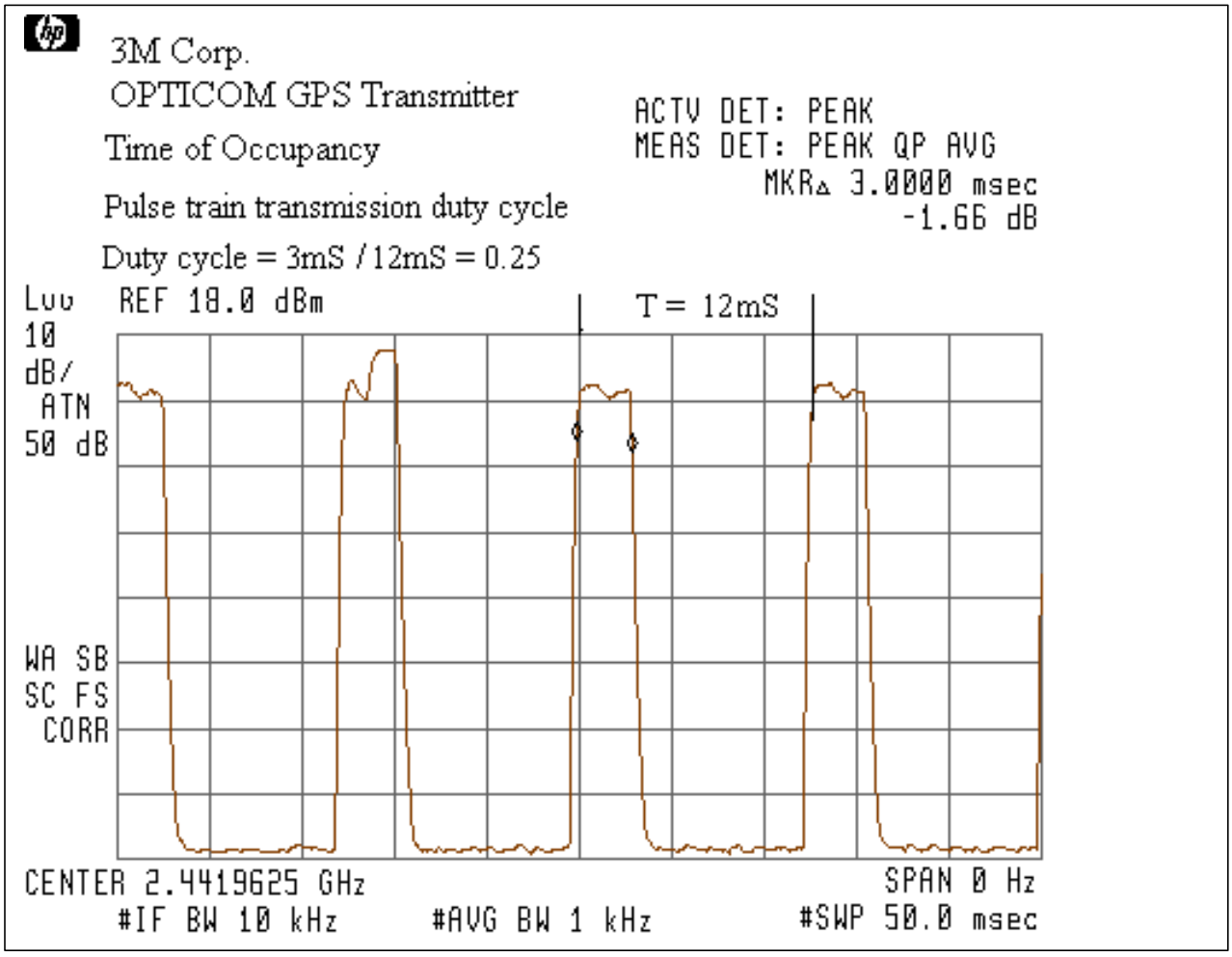
A

Graph # 3-3-2


3M Corp.
OPTICOM GPS Transmitter
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
Time of Occupancy
Period of single hopping channel transmission
LOG REF 18.0 dBm
10
dB/
ATN
50 dB
WA SB
SC FS
CORR
CENTER 2.4419625 GHz
SPAN 0 Hz
#IF BW 10 kHz
#AVG BW 1 kHz
#SWP 100 sec

A

Graph # 3-3-3


3M Corp.
OPTICOM GPS Transmitter
Time of Occupancy
Pulse train transmission duty cycle
Duty cycle = 3mS / 12mS = 0.25
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 3.0000 msec
-1.66 dB
T = 12mS
Luu
REF 18.0 dBm
10
dB/
ATN
50 dB
WA SB
SC FS
CORR
CENTER 2.4419625 GHz
SPAN 0 Hz
#IF BW 10 kHz
#AVG BW 1 kHz
#SWP 50.0 msec

A

3.4 20dB Bandwidth, FCC 15.247(a)(1)(ii)

20dB bandwidth was measured for Channel 41 to determine compliance with Standard requirements.

Test Procedure

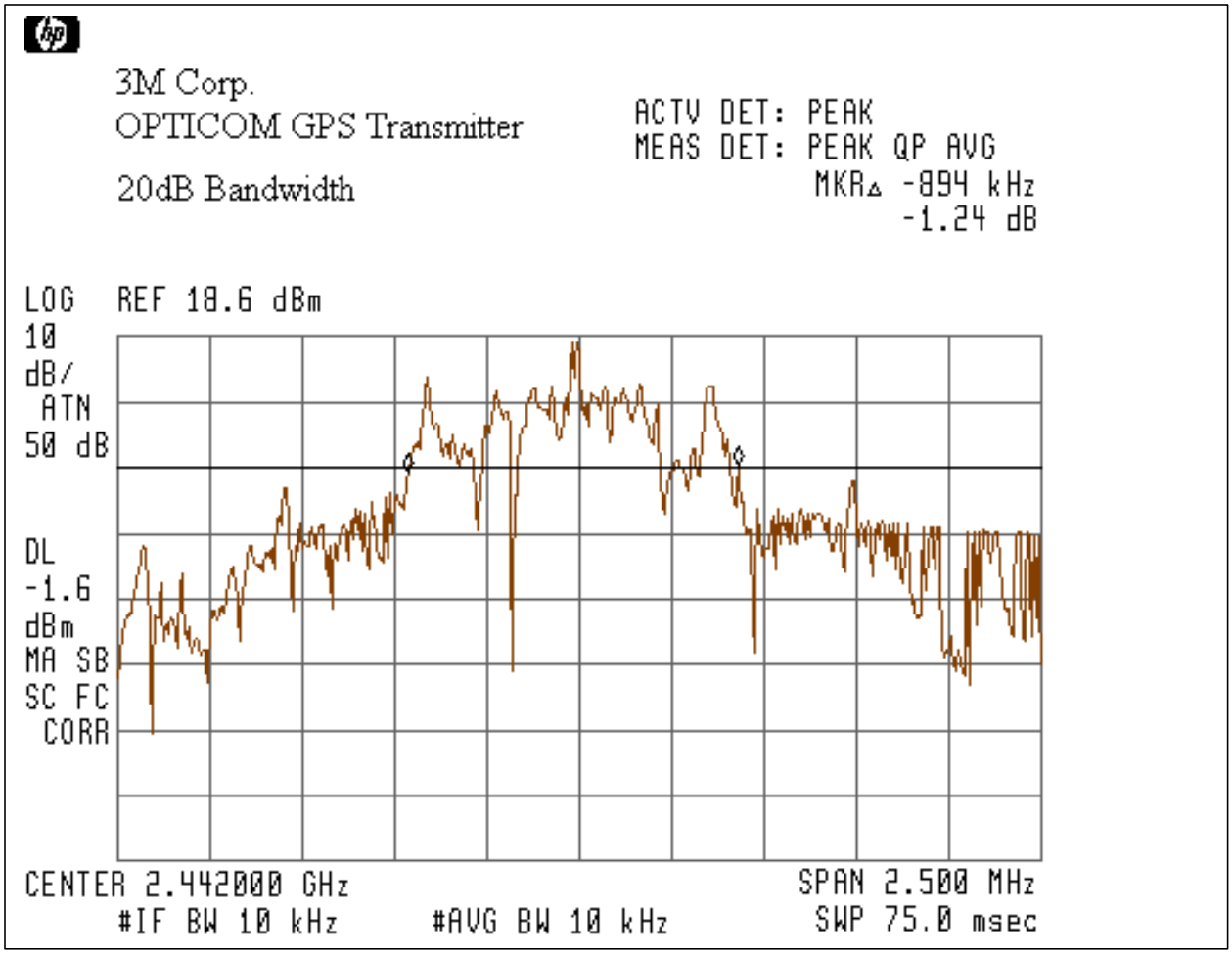
The 20dB bandwidth was measured at the EUT antenna terminal in max hold analyzer mode with span wide enough to capture the hopping channel emissions.

Graph # 3-4-1 shows the 20dB bandwidth.

Measured 20dB bandwidth is 894kHz.
The maximum 20dB hopping channel bandwidth is 1000kHz.

A

Graph # 3-4-1


3M Corp.
OPTICOM GPS Transmitter
20dB Bandwidth
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ -894 kHz
-1.24 dB
LOG
10
dB/
ATN
50 dB
REF 18.6 dBm
DL
-1.6
dBm
MA SB
SC FC
CORR
CENTER 2.442000 GHz
#IF BW 10 kHz
#AVG BW 10 kHz
SPAN 2.500 MHz
SWP 75.0 msec

A

3.5 Peak Output Power, FCC 15.247(c), 2.1046

Peak Output measurements were made at the low, center, and high frequency channels (channels 1, 41, and 81).

Test Procedure

The Peak Power Output for the device was measured at the maximum power transmission condition. The transmitter antenna port was connected to the Spectrum analyzer via 6dB attenuator.

Total Power was calculated from Measured Power adding 7.2dB factor of the external-of-analyzer attenuator (including cable loss).

Maximum Output Power at Antenna Terminal calculation
According to the FCC 15.247(b)(1), the maximum peak output power is 1 Watt (30dBm) for transmitters with maximum antenna gain below 6dBi
Maximum output power at the antenna terminal = Measured Peak Output Power plus external-of-analyzer attenuator.

Table # 3-5-1 and Graphs ## 3-5-1, 3-5-2, and 3-5-3 show the Peak Output Power at the antenna terminal.
Note: Emission level shown in the Graphs does not include 7.2dB attenuation factor of the attenuator.

A

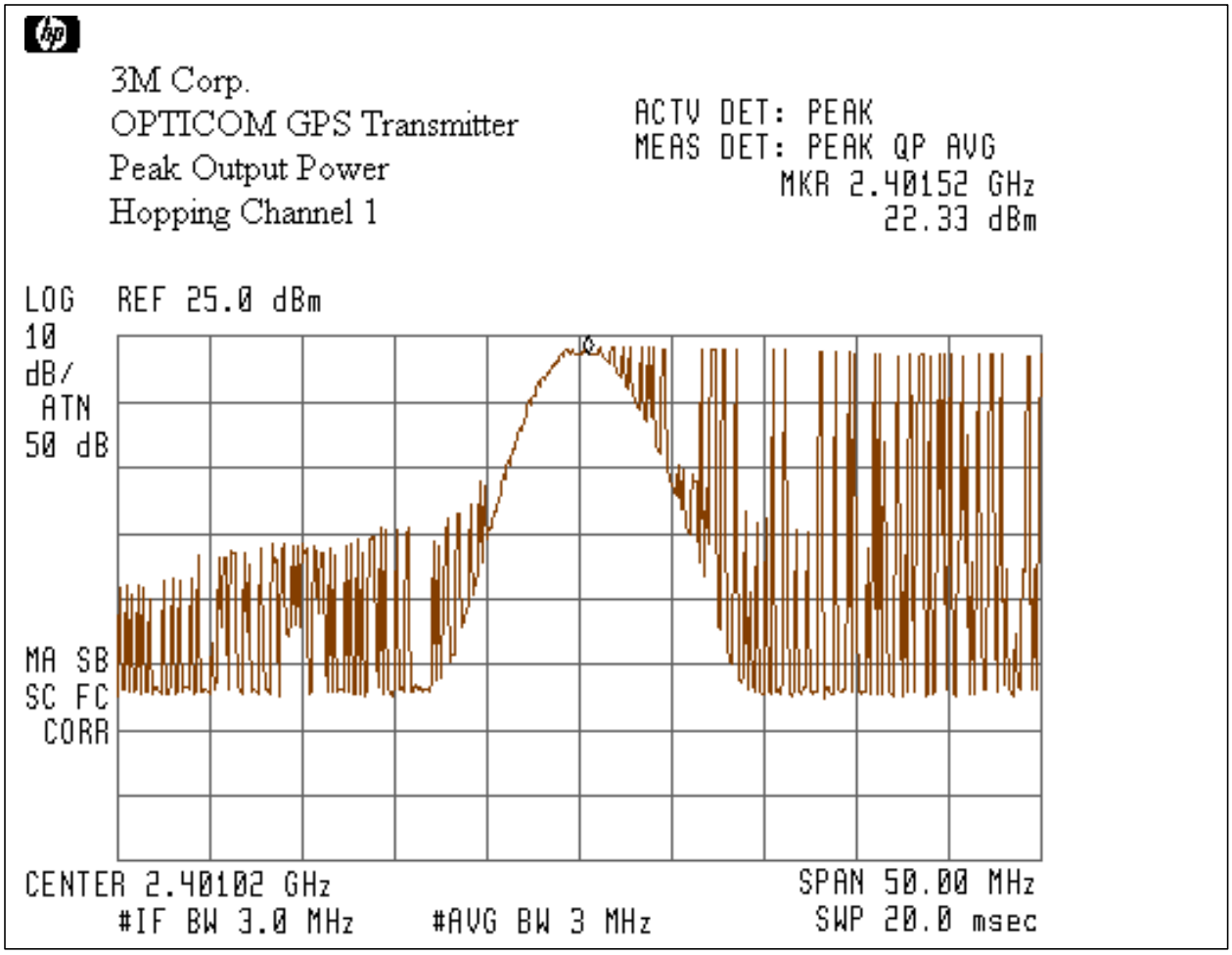
RF Power Output **Date:** 04-30-2002
Company: 3M Corp.
Model: Opticom GPS Transmitter
Test Engineer: Norman Shpilsher
Special Config. Info: The EUT antenna terminal was connected to the Spectrum Analyzer through the attenuator 7.2dB (including cable loss).
Standard: FCC Part 15.247(b)(1) and Part 2.1046

Table # 3-5-1

Output Freq. MHz	Measured Power dBm	Attenuator and Cable factor dB	Total Power dBm	Maximum Power dBm	Margin dB	Comments
Channel 1	22.33	7.2	29.5	30.0	-0.5	
Channel 41	22.44	7.2	29.6	30.0	-0.4	
Channel 81	22.29	7.2	29.5	30.0	-0.5	

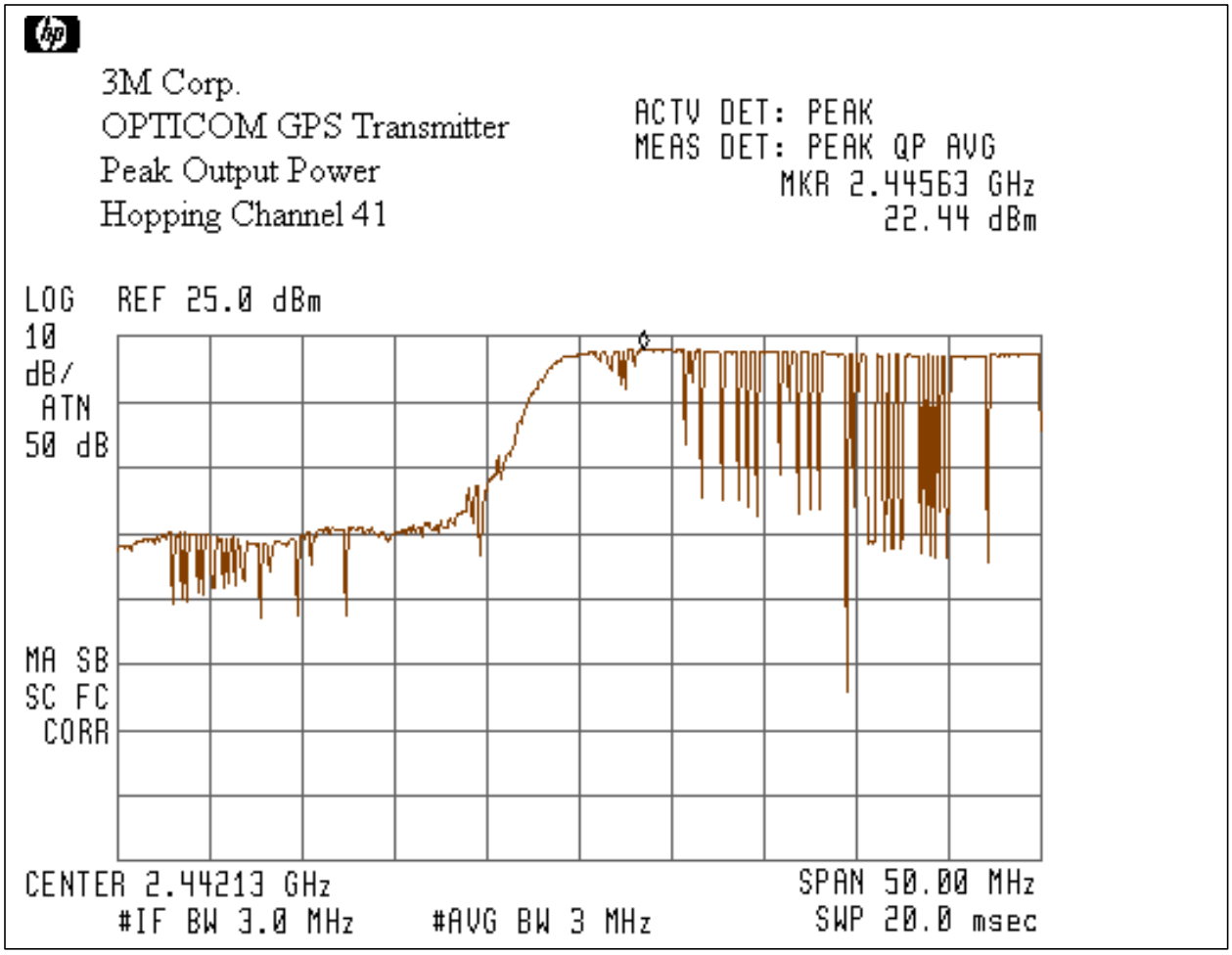
A

Graph # 3-5-1


3M Corp.
OPTICOM GPS Transmitter
Peak Output Power
Hopping Channel 1
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.40152 GHz
22.33 dBm
LOG
10
dB/
ATN
50 dB
REF 25.0 dBm
MA SB
SC FC
CORR
CENTER 2.40102 GHz
#IF BW 3.0 MHz
#AVG BW 3 MHz
SPAN 50.00 MHz
SWP 20.0 msec

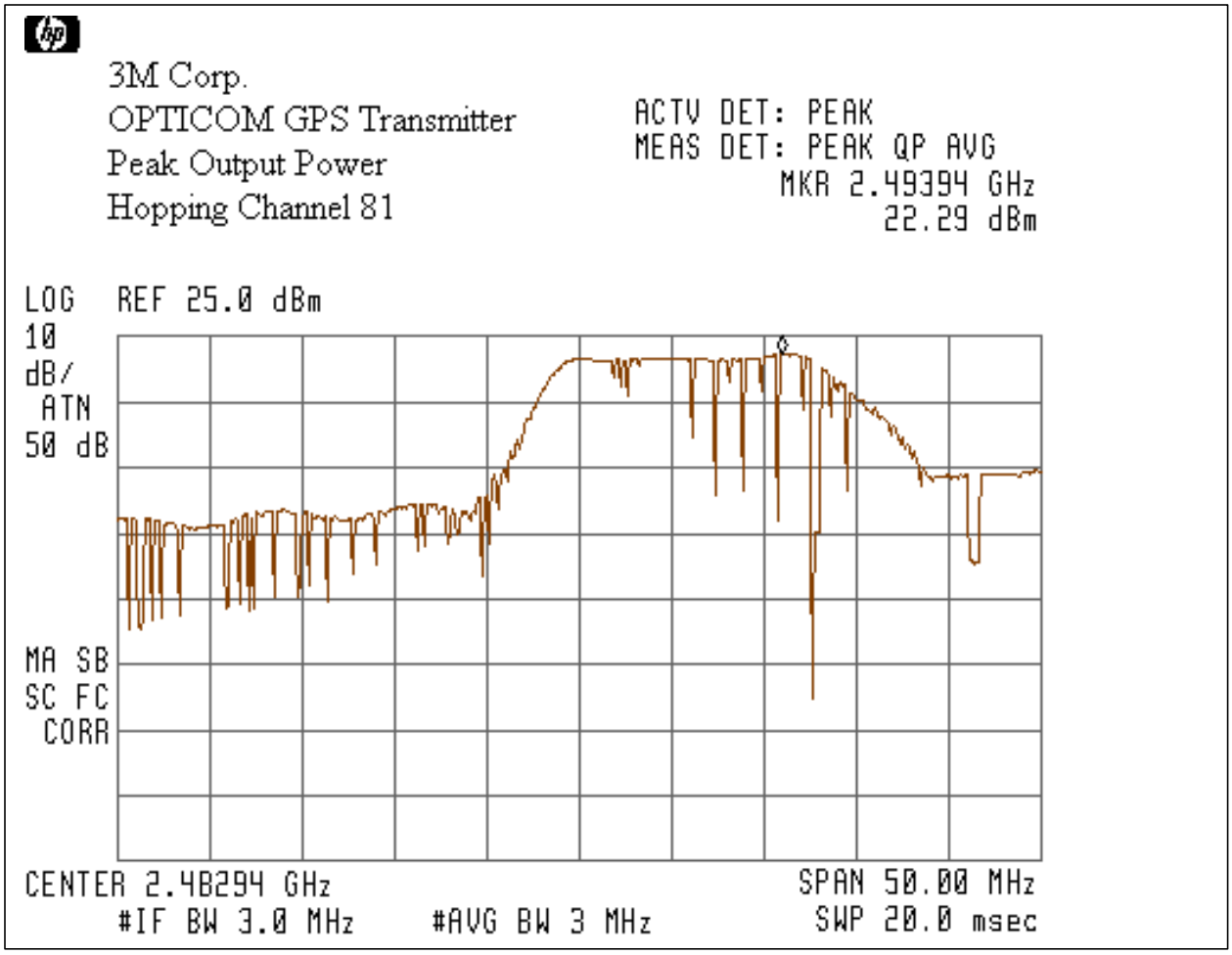
A

Graph # 3-5-2


3M Corp.
OPTICOM GPS Transmitter
Peak Output Power
Hopping Channel 41
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.44563 GHz
22.44 dBm
LOG
10
dB/
ATN
50 dB
REF 25.0 dBm
MA SB
SC FC
CORR
CENTER 2.44213 GHz
#IF BW 3.0 MHz
#AVG BW 3 MHz
SPAN 50.00 MHz
SWP 20.0 msec

A

Graph # 3-5-3


3M Corp.
OPTICOM GPS Transmitter
Peak Output Power
Hopping Channel 81
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.49394 GHz
22.29 dBm
LOG
10
dB/
ATN
50 dB
REF 25.0 dBm
MA SB
SC FC
CORR
CENTER 2.48294 GHz
#IF BW 3.0 MHz
#AVG BW 3 MHz
SPAN 50.00 MHz
SWP 20.0 msec

A

3.6 Band Edge Compliance, FCC 15.247(c), 2.1051

Left and right band-edge compliance measurements were made at Channel 1 and Channel 81 for band-edge frequencies of 2400.0 and 2483.5MHz respectively.

Test Procedure

The Spurious Emissions at the Antenna Terminal of the EUT were measured at the maximum power. The transmitter antenna port was connected to the Spectrum analyzer via anattenuator.

The Band-Edge Emissions Attenuation calculation
The Band-Edge Emissions Attenuation was calculated using the output power P at Channel 1 or Channel 81 and spurious emissions E at band-edges of 2400.0 and 2483.5MHz respectively

The Band-Edge Emissions Attenuation = $P - E$

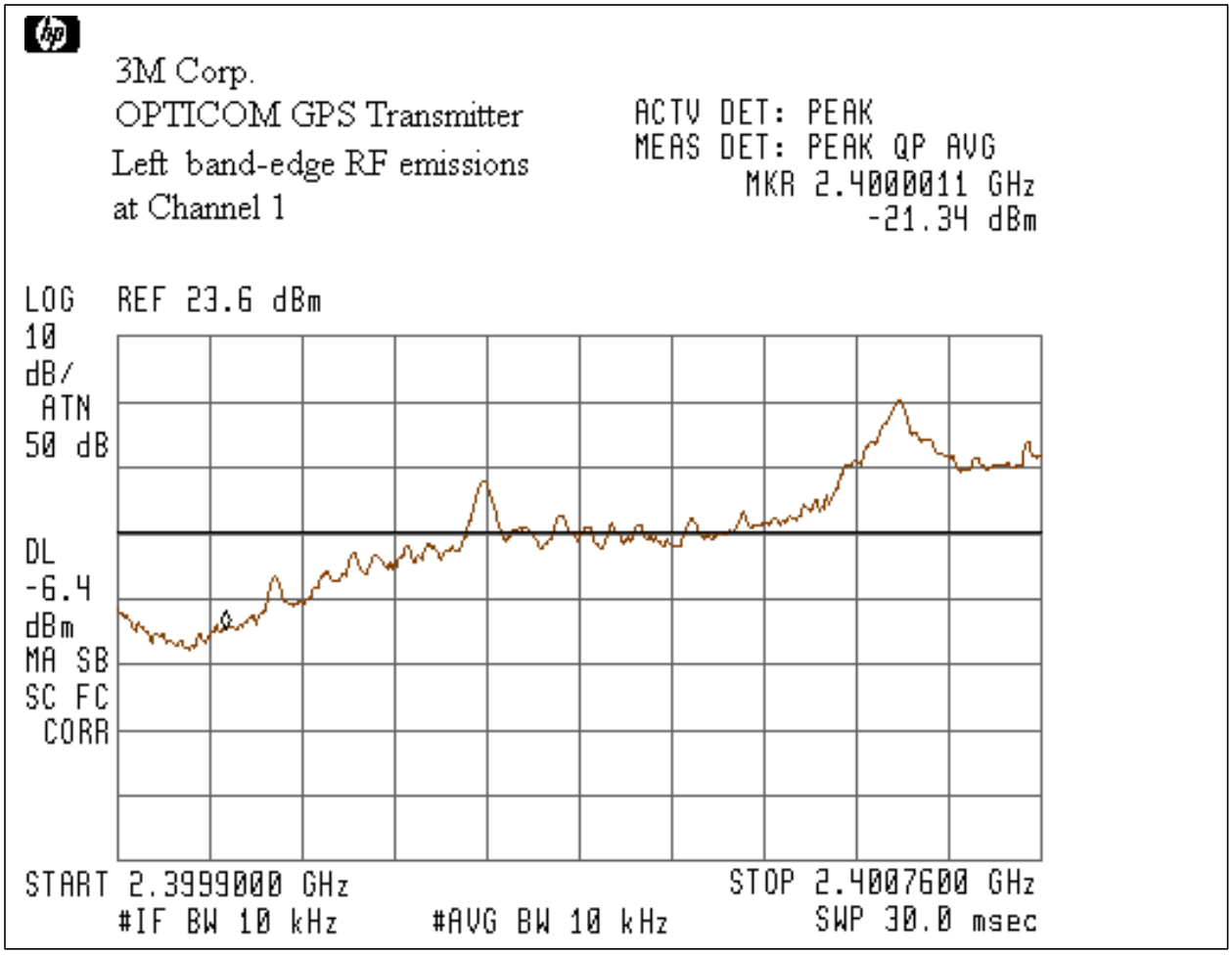
Table below and Graphs ## 3-6-1 and 3-6-2 show the band-edge emissions attenuation at the antenna terminal

Table # 3-6-1

Center of Output Emissions MHz	Edge Freq. MHz	Power at center of emissions dBm	Power at band-edge dBm	Measured Atten. dB	Minimum Atten. dB	Margin
2401.02	2400.00	13.6	-21.3	34.9	20.0	-14.9
2482.94	2483.50	20.6	-5.7	26.3	20.0	-6.3

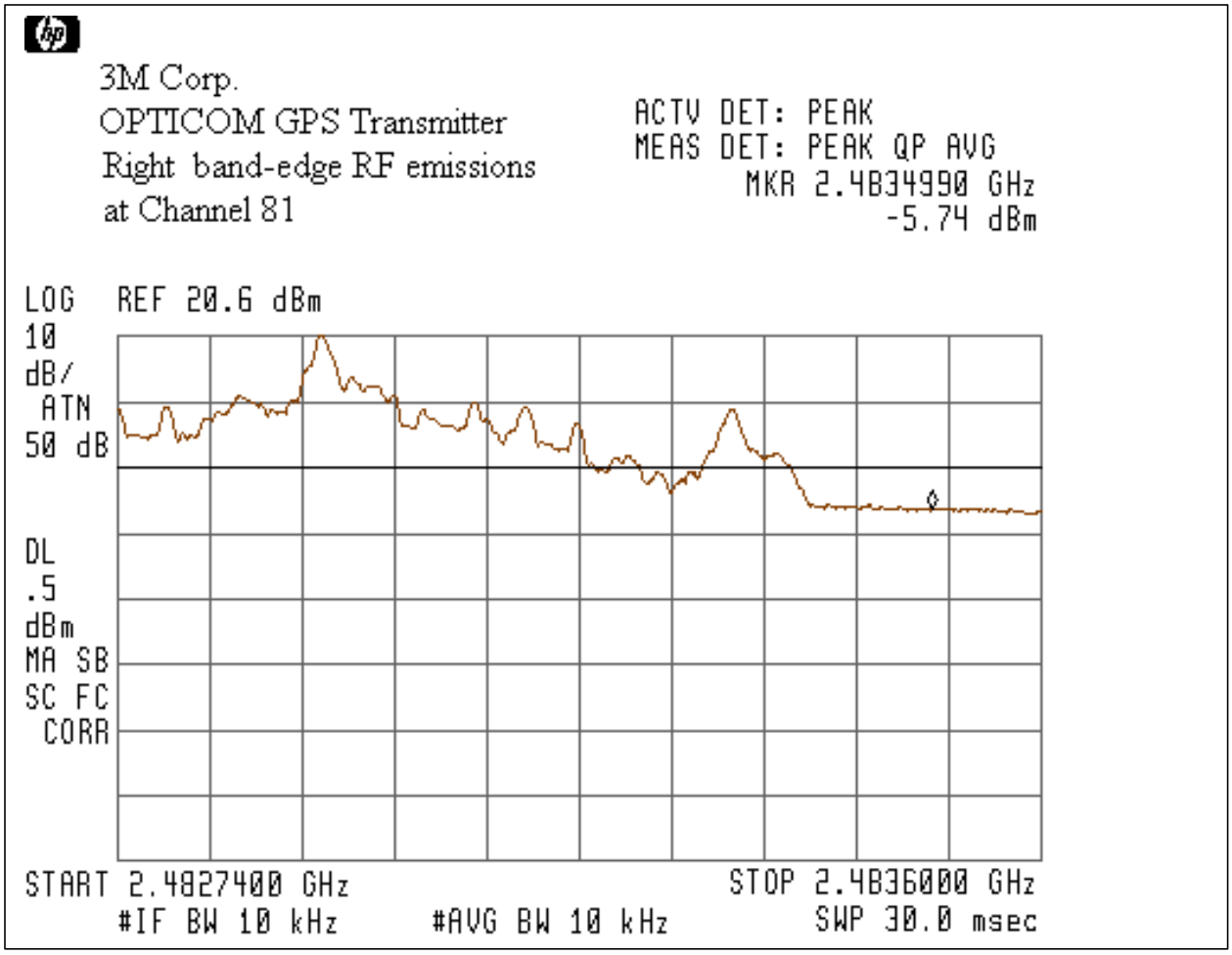
A

Graph # 3-6-1


3M Corp.
OPTICOM GPS Transmitter
Left band-edge RF emissions
at Channel 1
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.4000011 GHz
-21.34 dBm
LOG
10
dB/
ATN
50 dB
REF 23.6 dBm
DL
-6.4
dBm
MA SB
SC FC
CORR
START 2.3999000 GHz
#IF BW 10 kHz
#AVG BW 10 kHz
STOP 2.4007600 GHz
SWP 30.0 msec

A

Graph # 3-6-2


3M Corp.
OPTICOM GPS Transmitter
Right band-edge RF emissions
at Channel 81
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.4834990 GHz
-5.74 dBm
LOG REF 20.6 dBm
10
dB/
ATN
50 dB
DL
.5
dBm
MA SB
SC FC
CORR
START 2.4827400 GHz
#IF BW 10 kHz
#AVG BW 10 kHz
STOP 2.4836000 GHz
SWP 30.0 msec

A

3.7 Spurious Radiated Emissions, FCC 15.205, 15.209, and 2.1051

Field Strength of Spurious Emissions measurements were measured in the frequency range up to 24.84GHz (10^{th} harmonic).

Test Procedure

The EUT was placed on a non-conductive table 0.8m above the ground plane inside the Anechoic Chamber. The table was centered on a motorized turntable, which allows 360-degree rotation. The measurement antenna was positioned at a distance of 3m. The radiated emissions were maximized by configuring the EUT, by rotating the EUT, by changing antenna polarization, and by changing antenna height from 1 to 4m. Field strength was measured and calculated (See Section 3.8).

The Table # 3-7-1 and Graphs ## 3-7-1, 3-7-2, 3-7-3, 3-7-4, and 3-7-5 show the Field Strength of Spurious Emissions in the Restricted Bands of Operation according to FCC 15.205. No emissions above the floor noise were detected above the 9^{th} harmonic.

Note: Emission level shown on the Graphs does not include the Antenna and Cable correction factors and Pre-amplifier gain.

A

SpuriousRadiated Emissions **Date:** 05-03-2002

Company: 3M Corp.

Model: Opticom GPS Transmitter

Test Engineer: Norman Shpilsher

Special Info:

Limits FCC 15.209

Test Site: 3 m Anechoic Chamber

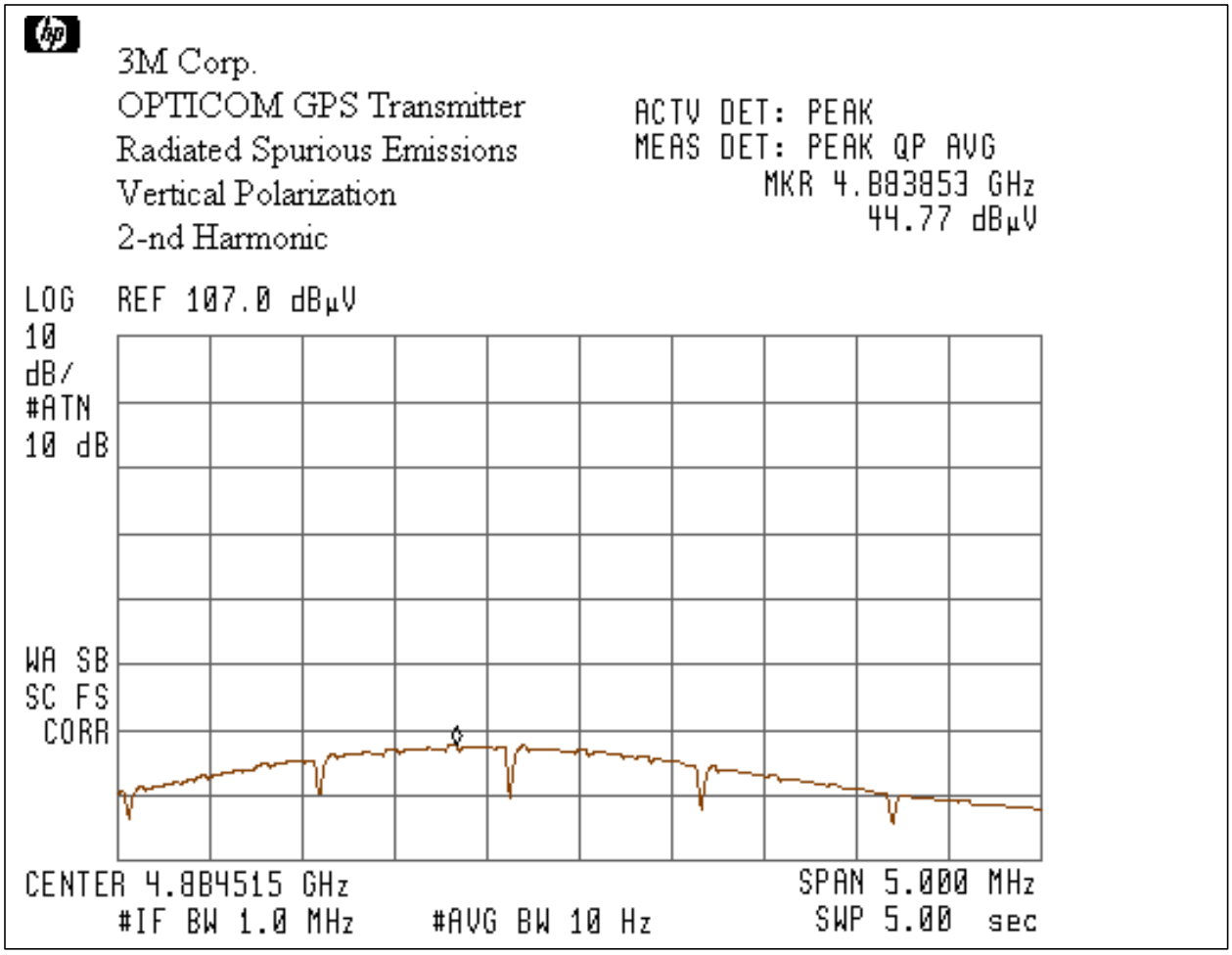
Note: Table shows harmonics spurious emissions in the Restricted Bands of Operation per FCC 15.205.
All readings were taken with Resolution Bandwidth 1MHz and Video Bandwidth 10Hz.
Readings at 12.21 and 14.65GHz were taken with 1m measurement distance;
limits for these frequencies was extrapolated to 64dBμV/m.

Table # 3-7-1

Frequency	Antenna			Amplifier	Avg. Reading	Total	Limit	Margin
MHz	Polarity	Hts(cm)	Factor(dB/m)	Gain (dB)	dBμV	dBμV/m	dBμV/m	dB
4884.52	V	110	39.76	32.28	44.70	52.2	54.0	-1.8
4884.52	H	100	39.76	32.28	39.70	47.2	54.0	-6.8
7326.74	V	112	44.36	32.30	39.70	51.8	54.0	-2.2
7326.74	H	105	44.36	32.30	37.20	49.3	54.0	-4.7
12210.55	V	178	51.86	31.54	39.80	60.1	64.0	-3.9
12210.55	H	100	51.86	31.54	38.20	58.5	64.0	-5.5
14652.51	V	100	52.38	32.00	30.85	51.2	64.0	-12.8
14652.51	H	100	52.38	32.00	28.70	49.1	64.0	-14.9

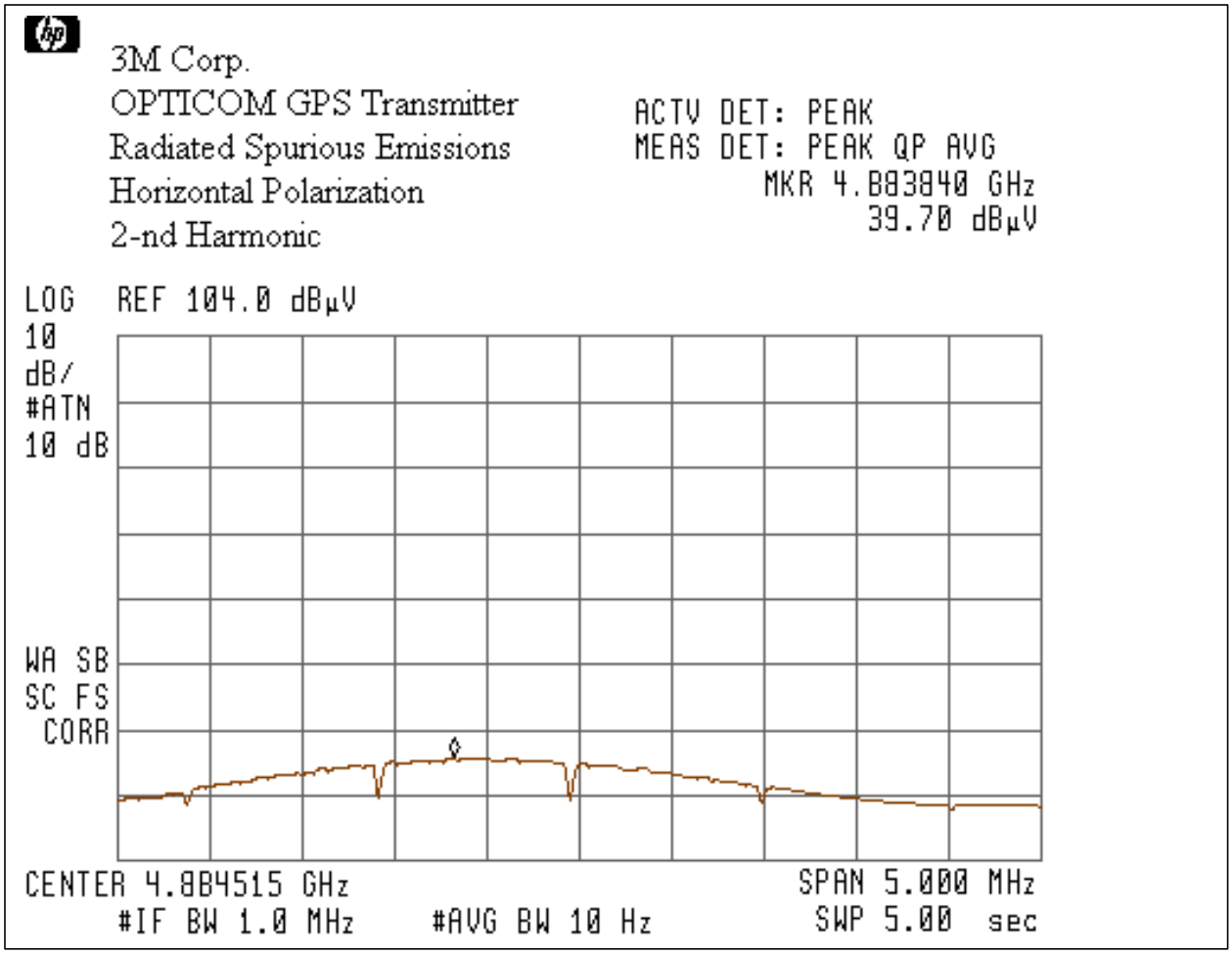
A

Graph # 3-7-1


3M Corp.
OPTICOM GPS Transmitter
Radiated Spurious Emissions
Vertical Polarization
2-nd Harmonic
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 4.883853 GHz
44.77 dBµV
LOG
10
dB/
#ATN
10 dB
REF 107.0 dBµV
WA SB
SC FS
CORR
CENTER 4.884515 GHz
#IF BW 1.0 MHz
#AVG BW 10 Hz
SPAN 5.000 MHz
SWP 5.00 sec

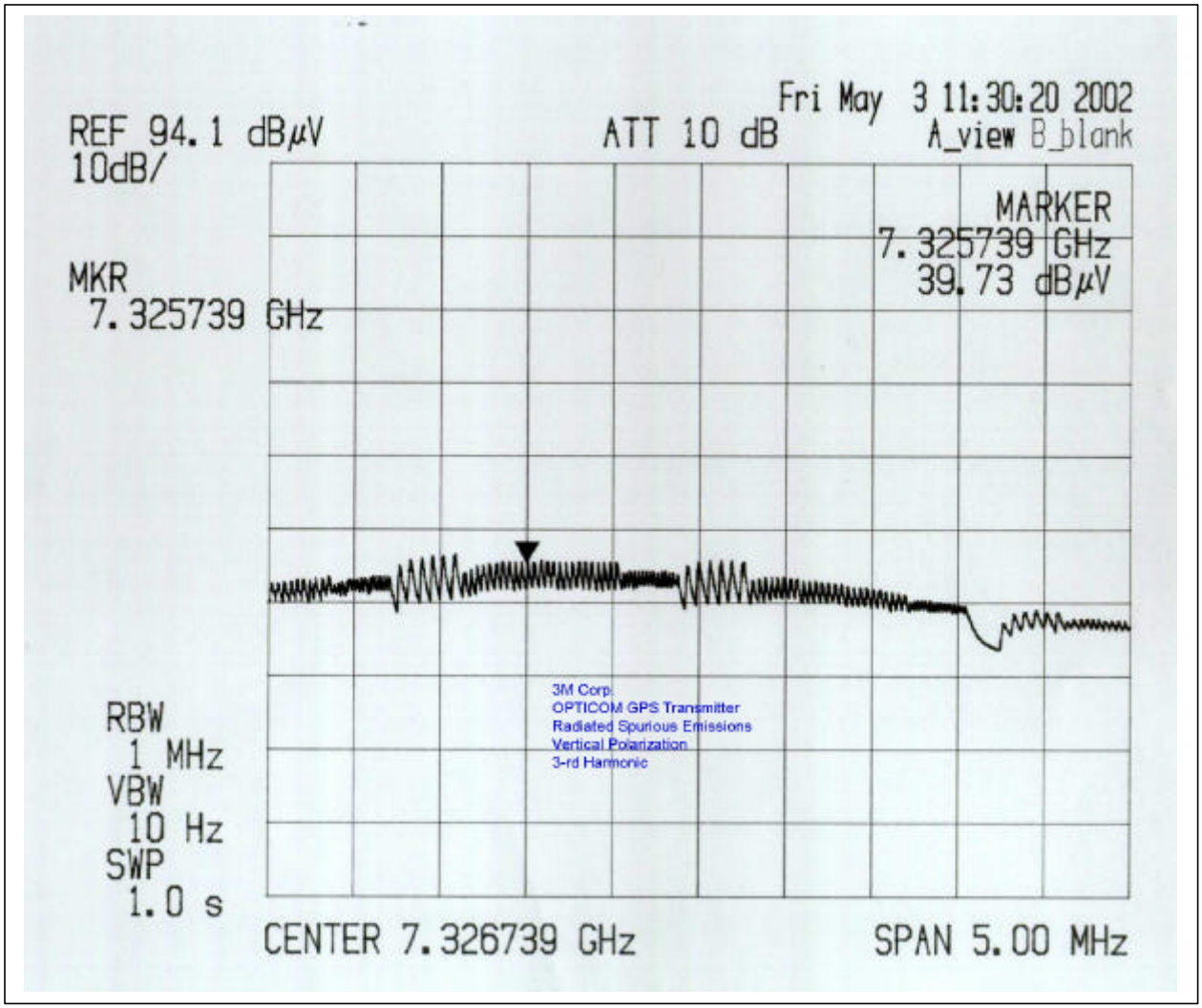
A

Graph # 3-7-2


3M Corp.
OPTICOM GPS Transmitter
Radiated Spurious Emissions
Horizontal Polarization
2-nd Harmonic
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 4.883840 GHz
39.70 dBµV
LOG
10
dB/
#ATN
10 dB
REF 104.0 dBµV
WA SB
SC FS
CORR
CENTER 4.884515 GHz
#IF BW 1.0 MHz
#AVG BW 10 Hz
SPAN 5.000 MHz
SWP 5.00 sec

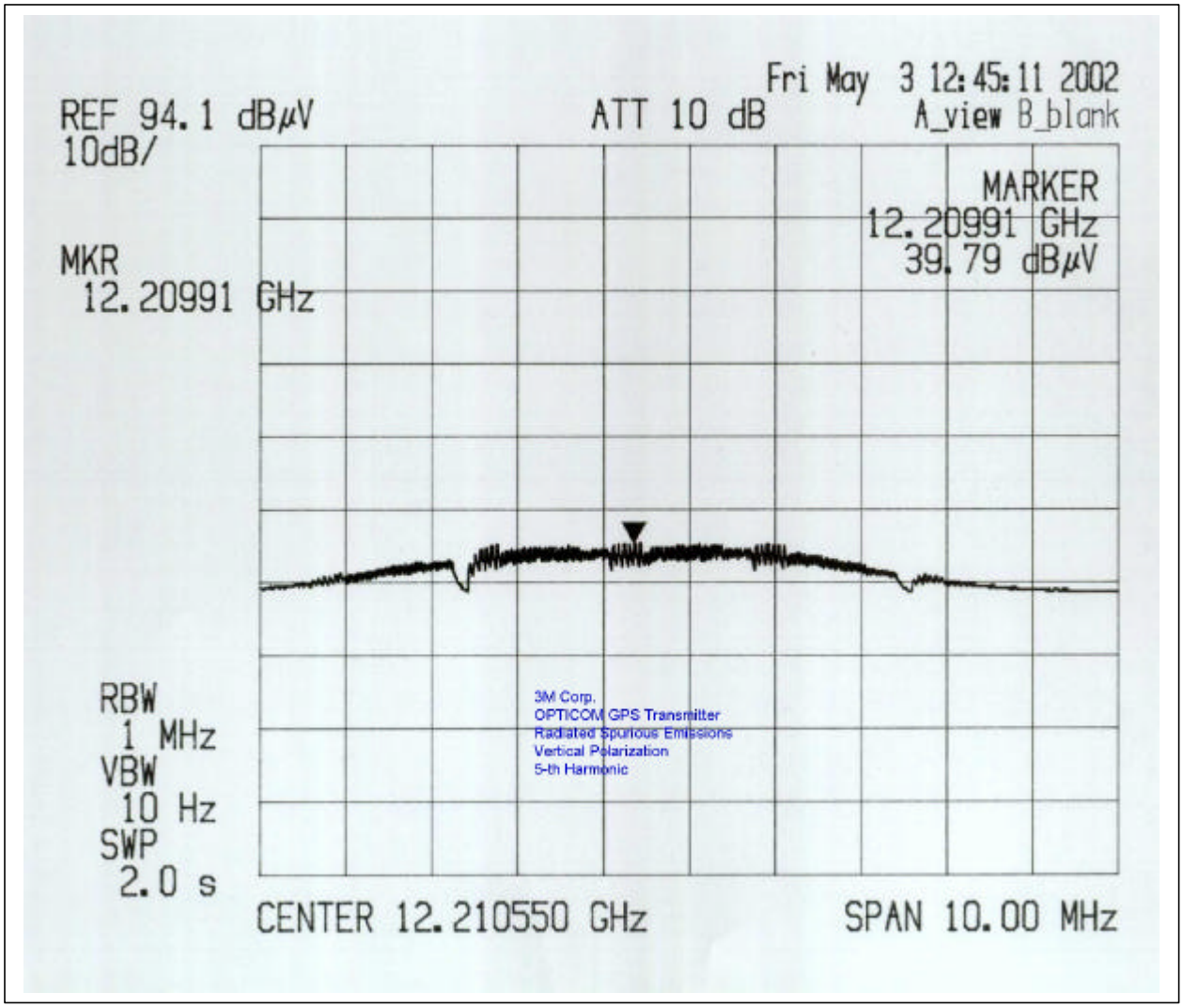
A

Graph # 3-7-3


Fri May 3 11:30:20 2002
REF 94.1 dBµV
ATT 10 dB
A_view B_blank
10dB/
MARKER
7.325739 GHz
39.73 dBµV
MKR
7.325739 GHz
3M Corp.
OPTICOM GPS Transmitter
Radiated Spurious Emissions
Vertical Polarization
3-rd Harmonic
RBW
1 MHz
VBW
10 Hz
SWP
1.0 s
CENTER 7.326739 GHz
SPAN 5.00 MHz

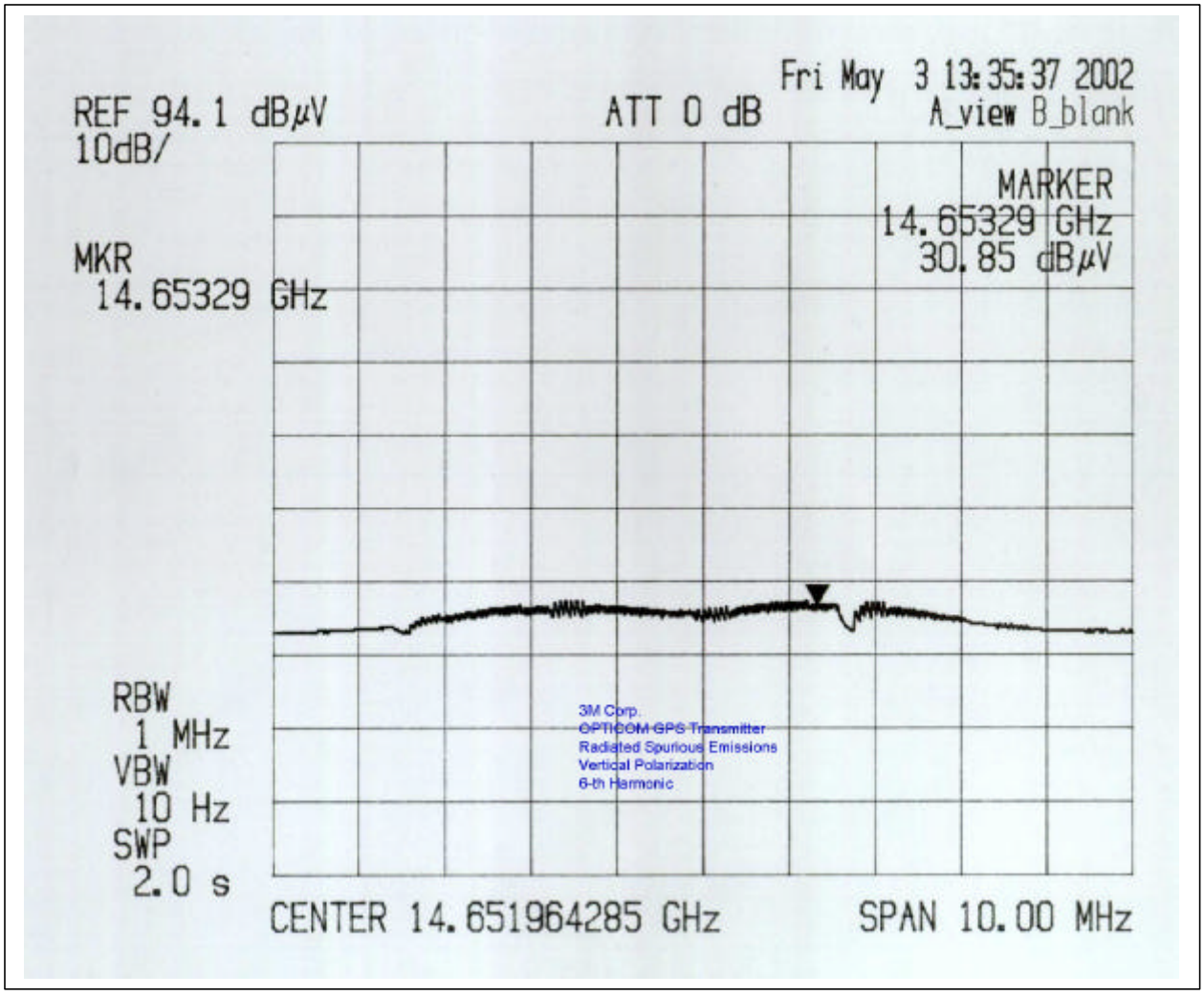
A

Graph # 3-7-4


Fri May 3 12:45:11 2002
REF 94.1 dBµV
ATT 10 dB
A_view B_blank
10dB/
MARKER
12.20991 GHz
39.79 dBµV
MKR
12.20991 GHz
3M Corp.
OPTICOM GPS Transmitter
Radiated Spurious Emissions
Vertical Polarization
5-th Harmonic
RBW
1 MHz
VBW
10 Hz
SWP
2.0 s
CENTER 12.210550 GHz
SPAN 10.00 MHz

A

Graph # 3-7-5


Fri May 3 13:35:37 2002
REF 94.1 dBµV
ATT 0 dB
A_view B_blank
10dB/
MARKER
14.65329 GHz
30.85 dBµV
MKR
14.65329 GHz
3M Corp.
OPTICOM GPS Transmitter
Radiated Spurious Emissions
Vertical Polarization
6-th Harmonic
RBW
1 MHz
VBW
10 Hz
SWP
2.0 s
CENTER 14.651964285 GHz
SPAN 10.00 MHz

A

3.8 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(μV/m)
RA = Receiver Amplitude in dB(μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(m^{-1})
AG = Amplifier Gain in dBi

Assume a receiver reading of 48.1 dB(μV) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dBi is subtracted giving field strength of 41.1 dB(μV/m).

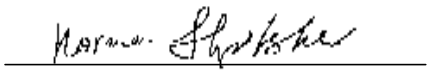
RA = 48.1 dB(μV)
AF = 7.4 dB(m^{-1})
CF = 1.6 dB
AG = 16.0 dBi
FS = RF + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(μV/m)

In the tables the Cable correction factors are included to the Antenna Factors.

Tested by:

Norman Shpilsher
EMC Project Engineer
Intertek Testing Services NA, Inc.

Signature



Signature

Date: June 6, 2002

A

4.0 TEST EQUIPMENT

Receivers/Spectrum Analyzers

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
HP85462A Receiver RF Section	3325A00106	07/01	07/02	X
HP85460A RF Filter Section	3330A00109	07/01	07/02	X
Advantest Spectrum Analyzer R3271A	55050084	05/31/01	05/31/02	X
HP 83017A Microwave Amplifier	3123A00475	09/01	09/02	X

Antennas

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
Schaffner-Chase Bicono-Log Antenna	2468	11/01	11/02	X
EMCO Horn antenna 3115	9507-4513	09/01	09/02	X
EMCO Horn antenna 3115	6579	12/01	12/02	
EMCO Horn antenna 3116	9904-2423	10/01	10/02	X

Artificial Mains Networks/Absorbing Clamps

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
FCC LISN-2	316	01/02	01/03	
FCC-LISN-50-25-2	2014	04/02	04/03	

Generators, Power Source, Environmental Chamber

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
Rohde & Schwarz SMT 03, Signal Generator	DE12157	06/01	06/02	
HP 6813B AC Power Source/Analyzer	3524A00552	07/01	07/02	
ESPEC Environmental Chamber EWPH781-CCA	304469	10/01	10/02	

A

EXHIBIT I

TEST SET UP PHOTOS

A

EXHIBIT II

FCC ID LABEL LOCATION

(See ID Label/Location Info. Attachments)

A

EXHIBIT III

EXTERNAL PHOTOS

A

EXHIBIT IV

INTERNAL PHOTOS

A

EXHIBIT V

ELECTRICAL SCHEMATICS AND BLOCK DIAGRAM

(See Block Diagram and Schematic Attachments)

A

EXHIBIT VI

USER MANUAL AND OPERATIONAL DESCRIPTION

(See User Manual and Operational Description Attachments)