FCC CFR47 PART 15 SUBPART C CERTIFICATION

AND

FCC CFR47 PART 15 SUBPART B VERIFICATION

TEST REPORT

FOR

FHP WIRELESS, INC.

SMARTPOINT / ROUTEPOINT WIRELESS MESHED ROUTER

MODEL NUMBER: RP-01-00C-C-N-00, SP-01-00C-C-N-00

FCC ID: P9JSP-01-00C-C

REPORT NUMBER: 02U1392-1

ISSUE DATE: AUGUST 28, 2002

Prepared for
FHP WIRELESS, INC.
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1. TEST RESULT CERTIFICATION

COMPANY NAME: FHP WIRELESS INC.
1710 SOUTH AMPHLETT BOULEVARD
SAN MATEO, CA 94402 USA

EUT DESCRIPTION: 802.11B WIRELESS MESHED ROUTER

MODEL NUMBER: RP-01-00C-C-N-00, SP-01-00C-C-N-00

DATE TESTED: AUGUST 5 – AUGUST 27, 2002

TYPE OF EQUIPMENT	INTENTIONAL RADIATOR
EQUIPMENT TYPE	2.4 - 2.4835 GHz TRANSCEIVER, DIGITAL DEVICE
MEASUREMENT PROCEDURE	ANSI 63.4 / 1992, TIA/EIA 603
PROCEDURE	CERTIFICATION
FCC RULE	CFR 47 PART 15.B AND CFR 47 PART 15.C

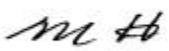
Compliance Certification Services, Inc. tested the above equipment for compliance with the requirements set forth in CFR 47, PART 15, Subparts B and C. The equipment in the configuration described in this report, shows the measured emission levels emanating from the equipment do not exceed the specified limit.

Note: This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.

Approved & Released For CCS By:

STEVE CHENG
EMC ENGINEERING MANAGER
COMPLIANCE CERTIFICATION SERVICES

Tested By:



MIKE HECKROTTE
CHIEF ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. EUT DESCRIPTION

The SmartPoint and RoutePoint products are 802.11b wireless access points with mesh routing capabilities. The SmartPoint and RoutePoint products are identical except for the software personalities configured on the products at the factory.

Unlike conventional access point deployments, which require a wired backbone, FHP's technology can be used to create large networks with wired connections to only a few of the access points. Units without wired connections will automatically detect other SmartPoints and RoutePoints and wirelessly route data traffic through the optimal multi-hop path back to a wired RoutePoint. SmartPoints are all wireless access points or “nodes”. RoutePoints are access points with Ethernet connections or “gateways”.

The 802.11b PCMCIA card is a ZCOMAX XI-325H2 80mW transceiver (FCC ID M4Y 325H2). The SmartPoint and RoutePoint devices must be installed by a qualified technician, and quality ethernet cables should be used.

There are two available antenna configurations. One uses a single 12.0 dBi gain Patch antenna with no diversity. The other uses two identical Omni antennas for receive diversity operation; the available Omni antenna gains are 7.4 dBi, 5.0 dBi and 1.5 dBi.

The SmartPoint and RoutePoint products are also Class A digital devices.
.

3. TEST METHODOLOGY

Conducted and radiated testing were performed according to the procedures documented on chapter 13 of ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, and 15.407.

4. FACILITIES AND ACCREDITATION

4.1. FACILITIES AND EQUIPMENT

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

Receiving equipment (i.e., receiver, analyzer, quasi-peak adapter, pre-selector) and LISNs conform to CISPR specifications for "Radio Interference Measuring Apparatus and Measurement Methods," Publication 16.

4.2. LABORATORY ACCREDITATIONS AND LISTINGS

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code: 200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT (1300F2)).

4.3. TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	NVLAP*	FCC Part 15, CISPR 22, AS/NZS 3548,IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11, CNS 13438	NVLAP 200065-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	FC 1300
Japan	VCCI	CISPR 22 Two OATS and one conducted Site	VCCI R-1014, R-619, C-640
Norway	NEMKO	EN50081-1, EN50081-2, EN50082-1, EN50082-2, IEC61000-6-1, IEC61000-6-2, EN50083-2, EN50091-2, EN50130-4, EN55011, EN55013, EN55014-1, EN55104, EN55015, EN61547, EN55022, EN55024, EN61000-3-2, EN61000-3-3, EN60945, EN61326-1	N ELA 117
Norway	NEMKO	EN60601-1-2 and IEC 60601-1-2, the Collateral Standards for Electro-Medical Products. MDD, 93/42/EEC, AIMD 90/385/EEC	N ELA-171
Taiwan	BSMI	CNS 13438	SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	Canada IC2324 A,B,C, and F

* No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

5.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Radiated Emission	
30MHz – 200 MHz	+/- 3.3dB
200MHz – 1000MHz	+4.5/-2.9dB
1000MHz – 2000MHz	+4.6/-2.2dB
Power Line Conducted Emission	
150kHz – 30MHz	+/-2.9

Any results falling within the above values are deemed to be marginal.

5.3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST AND MEASUREMENT EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due Date
Spectrum Analyzer	HP	8566B	3014A06685	6/1/03
Spectrum Display	HP	85662A	2152A03066	6/1/03
Quasi-Peak Detector	HP	85650A	3145A01654	6/1/03
Preamplifier	HP	8447D	2944A06833	8/22/03
Log Periodic Antenna	EMCO	3146	9107-3163	3/30/03
Biconical Antenna	Eaton	94455-1	1197	3/30/03
LISN	F.C.C.	LISN-50/250-25-2	2023	8/2/02
EMI Test Receiver	Rohde & Schwarz	ESHS 20	827129/006	4/17/03
Spectrum Analyzer	HP	8563E	3720A07066	3/18/04
Spectrum Analyzer	HP	8564E	3943A01643	7/22/03
Preamplifier (1 - 26.5GHz)	HP	NSP2600-44	646456	4/26/03
Horn Antenna (1 - 18GHz)	EMCO	3115	6717	1/31/03
High Pass Filter (4.57GHz)	FSY Microwave	FM-4570-9SS	003	N.C.R.
Amplifier	HP	11975A	2517A01067	8/23/02
External Mixer (26.5 – 40 GHz)	HP	11970A	3008A04190	9/22/02
Horn Antenna (26.5 – 40 GHz)	Dico	1149	2	N.C.R.

6. SETUP OF EQUIPMENT UNDER TEST

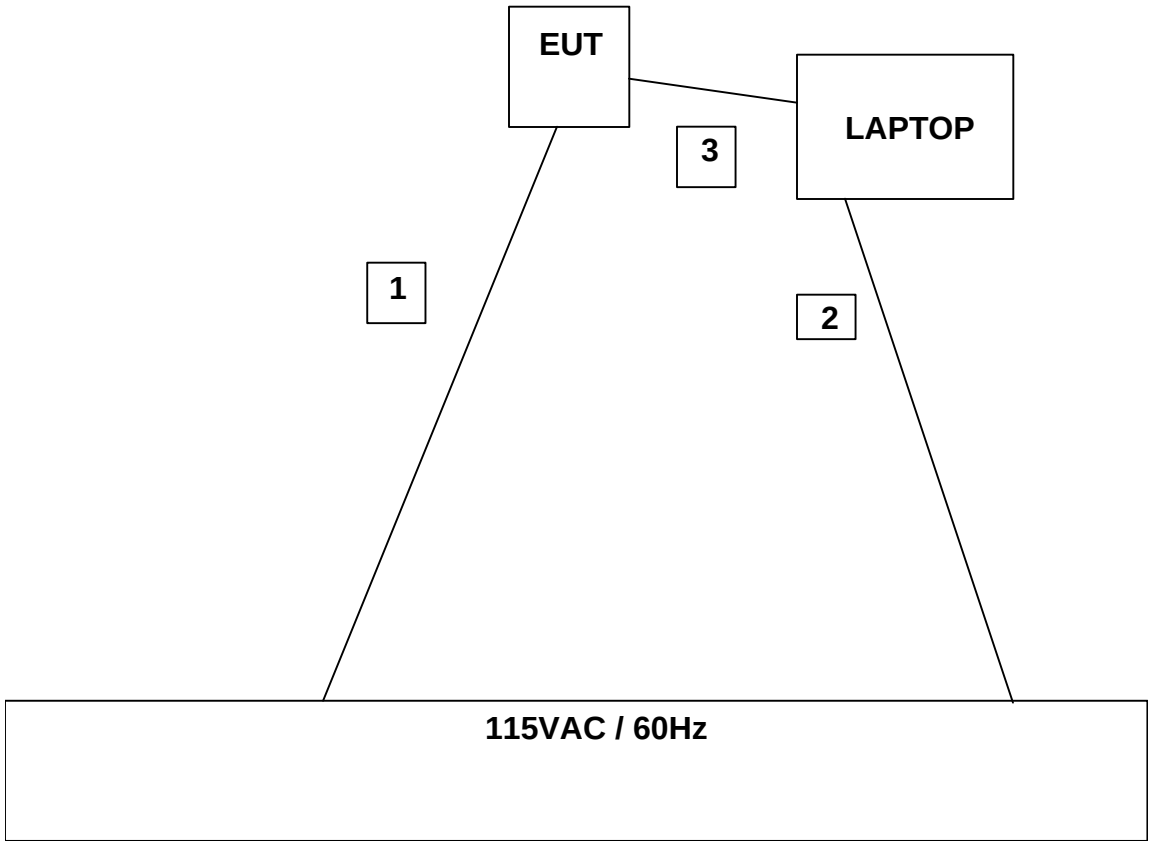
SUPPORT EQUIPMENT

Device Type	Manufacturer	Model	Serial Number	FCC ID
Laptop	HP	Pavillion xf235	TW21906585	DoC
AC Power Adapter	HP	ADP-75HP	MUT0217005049	DoC
AC Power Adapter	CUI Stack	DV-1280	N/A	N/A
Ethernet Power Adapter	3COM	61-0127-000	N/A	N/A

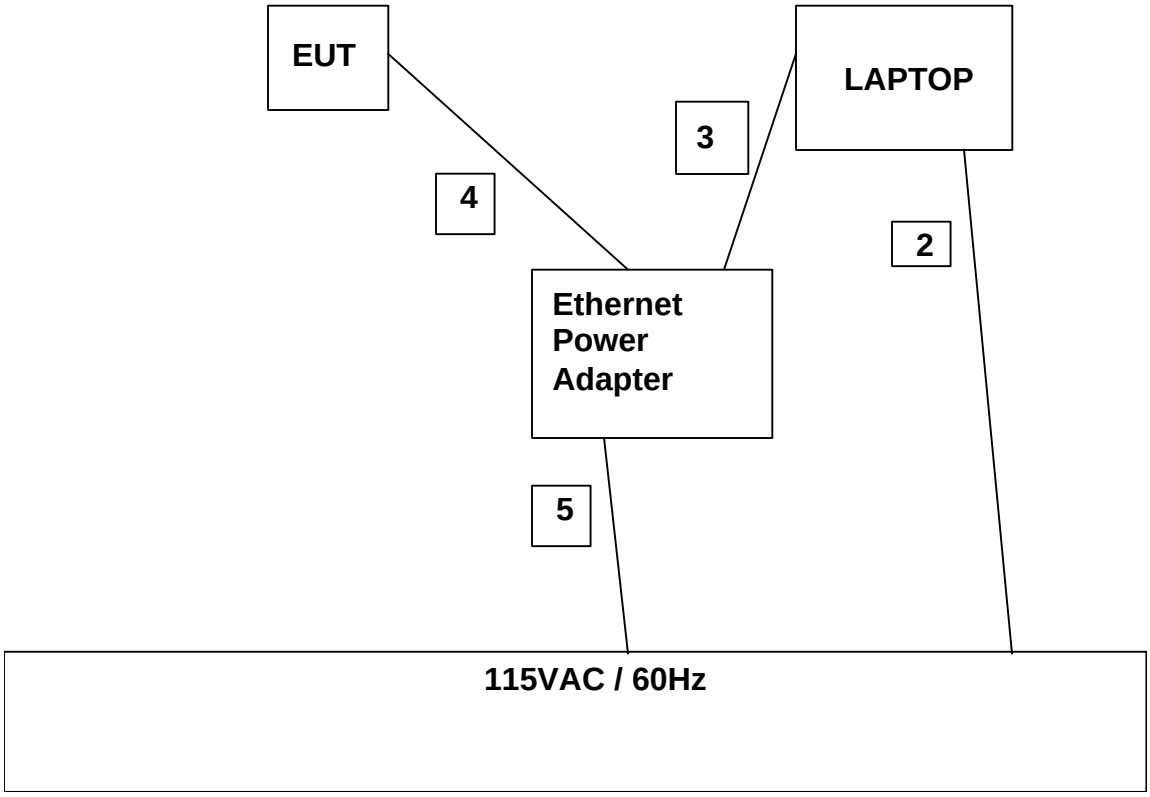
I/O CABLES

Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115	Unshielded	2 m	Integrated with AC Adapter
2	AC	1	US115	Unshielded	1 m	Integrated with AC Adapter
3	RJ45	1	RJ45	Shielded	2 m	Reversing Cable
4	RJ45	1	RJ45	Shielded	2 m	Non-reversing Cable
5	AC	1	US115	Unshielded	1 m	

SETUP DIAGRAM FOR SELF-CONTAINED POWER CONFIGURATION



SETUP DIAGRAM FOR POWER OVER ETHERNET CONFIGURATION



7. APPLICABLE RULES

§15.247 (a)- BANDWIDTH

(2) For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

§15.247 (b)- POWER OUTPUT

The maximum peak output power of the intentional radiator shall not exceed the following:

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz , and 5725-5850 MHz bands: 1 watt.

(4) Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Specification Limit: Maximum Antenna Gain = 12.0 dBi, therefore the limit is 24 dBm

§15.247 (b)- RADIO FREQUENCY EXPOSURE

(5) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See §1.1307(b)(1) of this chapter.

§15.247 (c)- SPURIOUS EMISSIONS

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in§15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

§15.247 (d)- PEAK POWER SPECTRAL DENSITY

(d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

§15.205- RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]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
6.215 - 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	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.207- CONDUCTED LIMITS

(a) For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed 250 microvolts. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

FCC PART 15.207

FREQUENCY RANGE	FIELD STRENGTH (Microvolts)	FIELD STRENGTH (dBuV)/QP
450kHz-30MHz	250	48

§15.109- RADIATED EMISSION LIMITS

(b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency (MHz)	Field Strength (microvolts/meter)
30 - 88	90
88 - 216	150
216 - 960	210
Above 960	300

(c) In the emission table above, the tighter limit applies at the band edges.

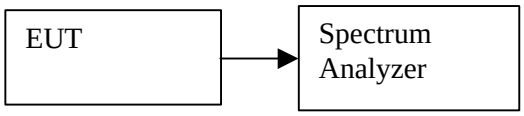
FCC PART 15.109

MEASURING DISTANCE OF 10 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	90	40
88-216	150	43.5
216-960	210	46.4
Above 960	300	49.5

8. TEST SETUP, PROCEDURE AND RESULT

8.1. 6 dB BANDWIDTH

TEST SETUP



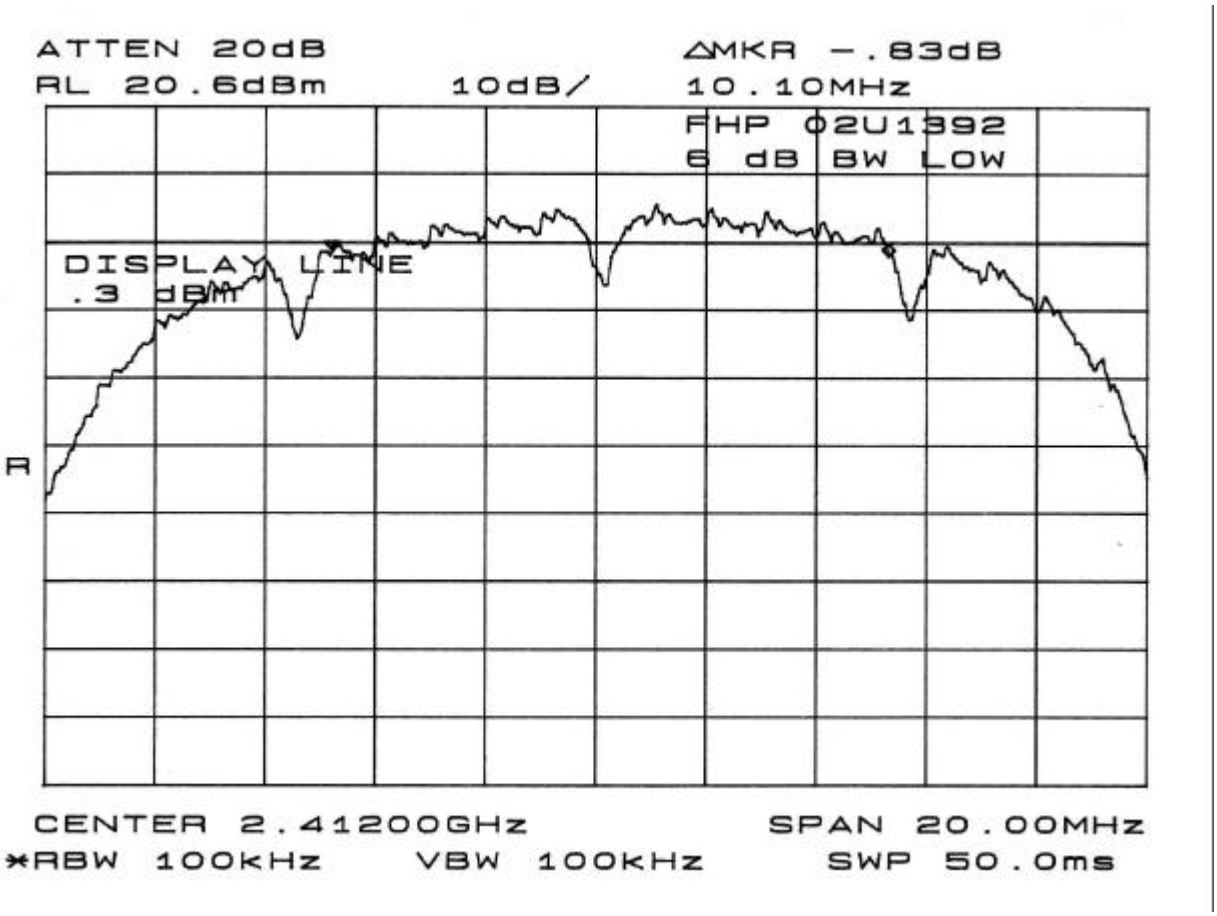
TEST PROCEDURE

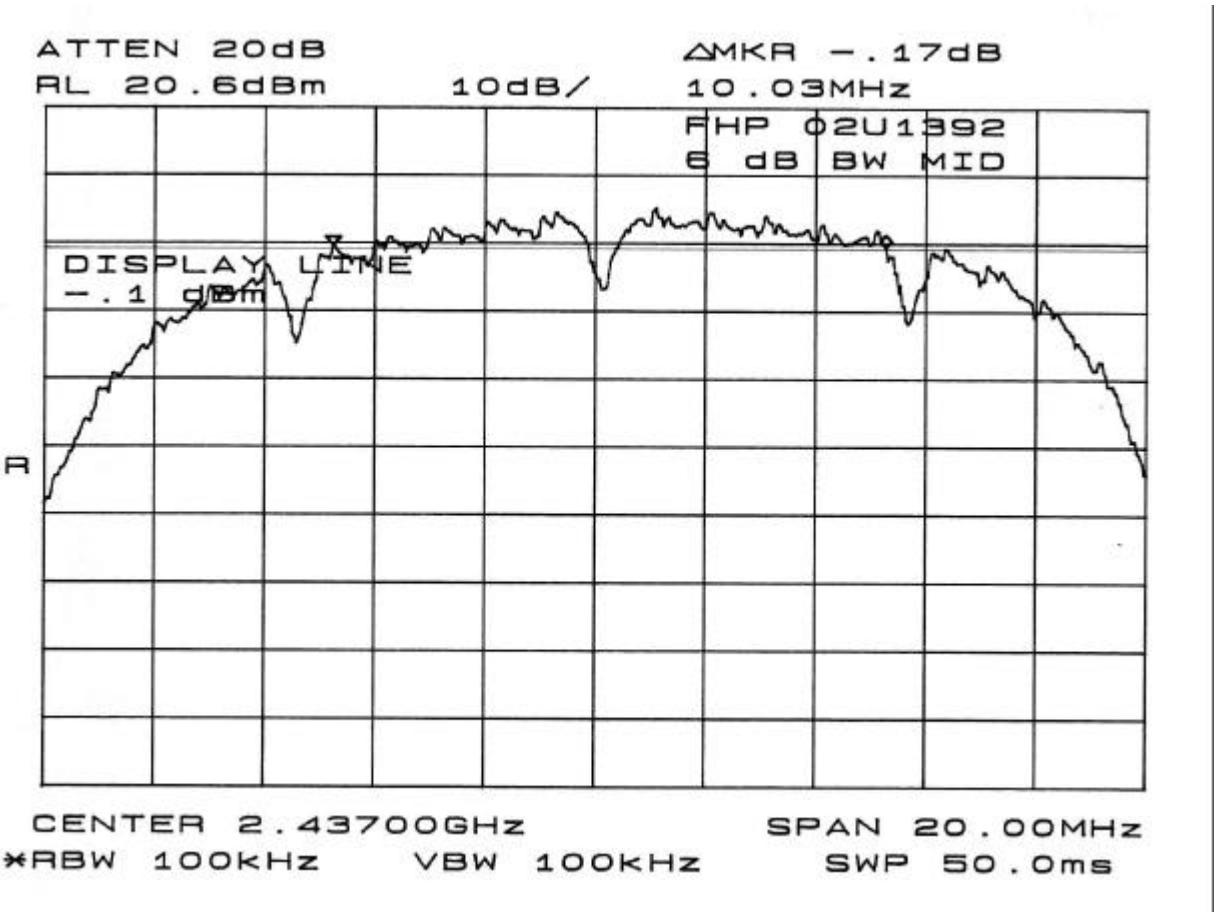
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection is used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.

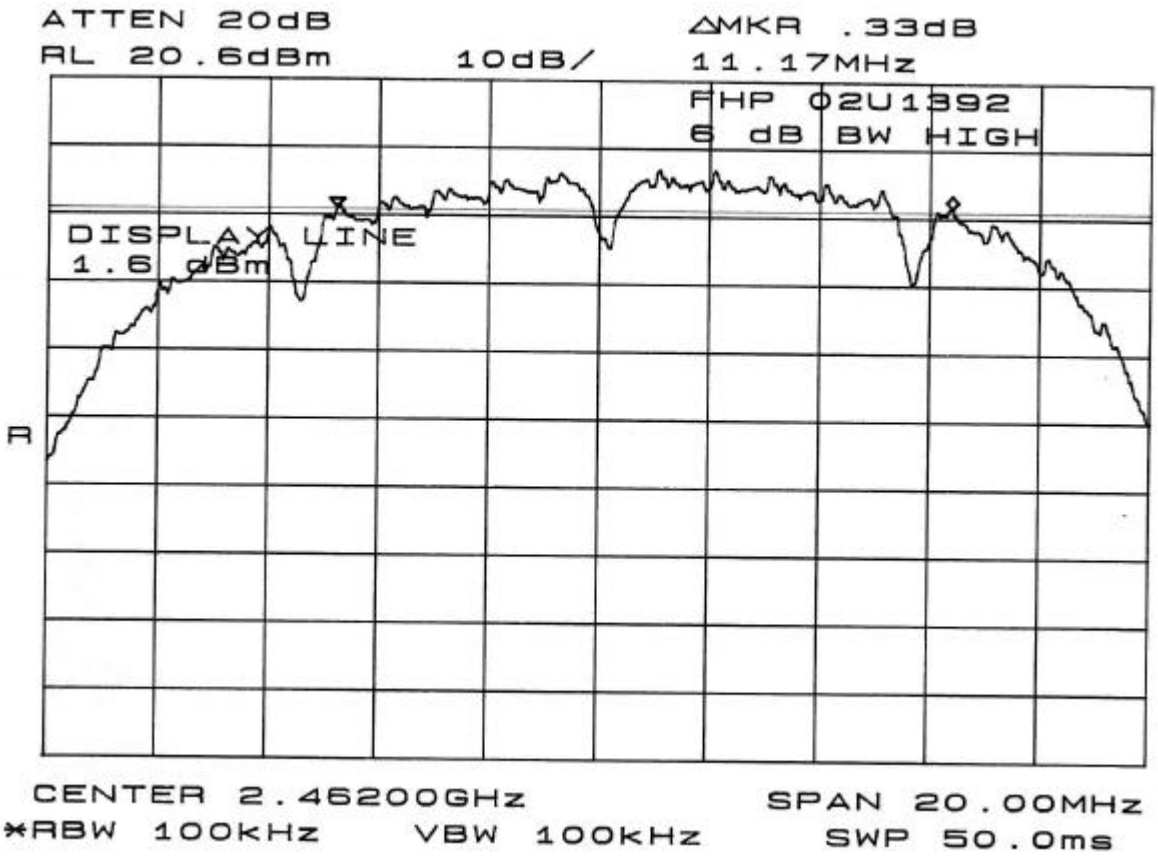
RESULTS

No non-compliance noted:

Channel	Frequency (MHz)	B (kHz)	Limit (kHz)	Margin (kHz)
Low	2412	10100	500	9600
Middle	2437	10030	500	9530
High	2462	11170	500	10670



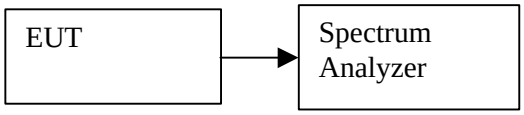




8.2. EMISSION BANDWIDTH

This measurement is used to determine the channel bandwidth for the peak power measurement.

TEST SETUP

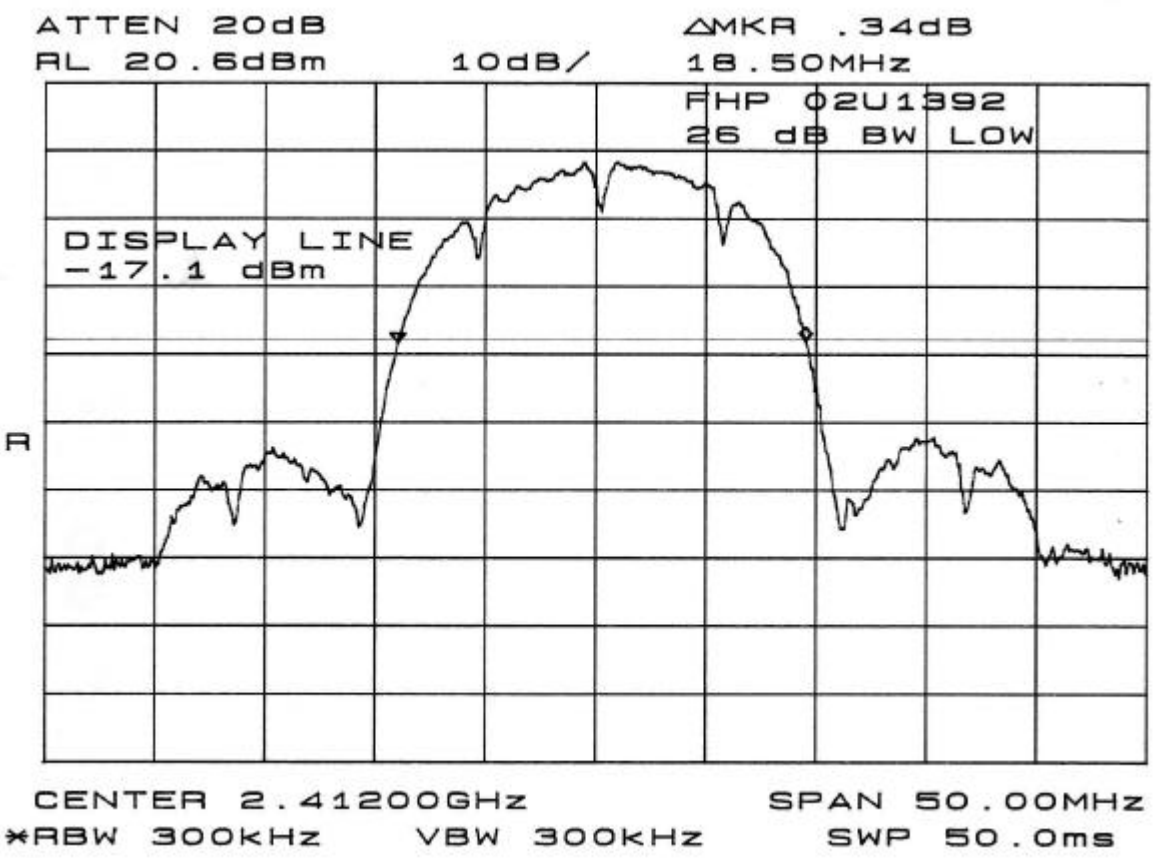


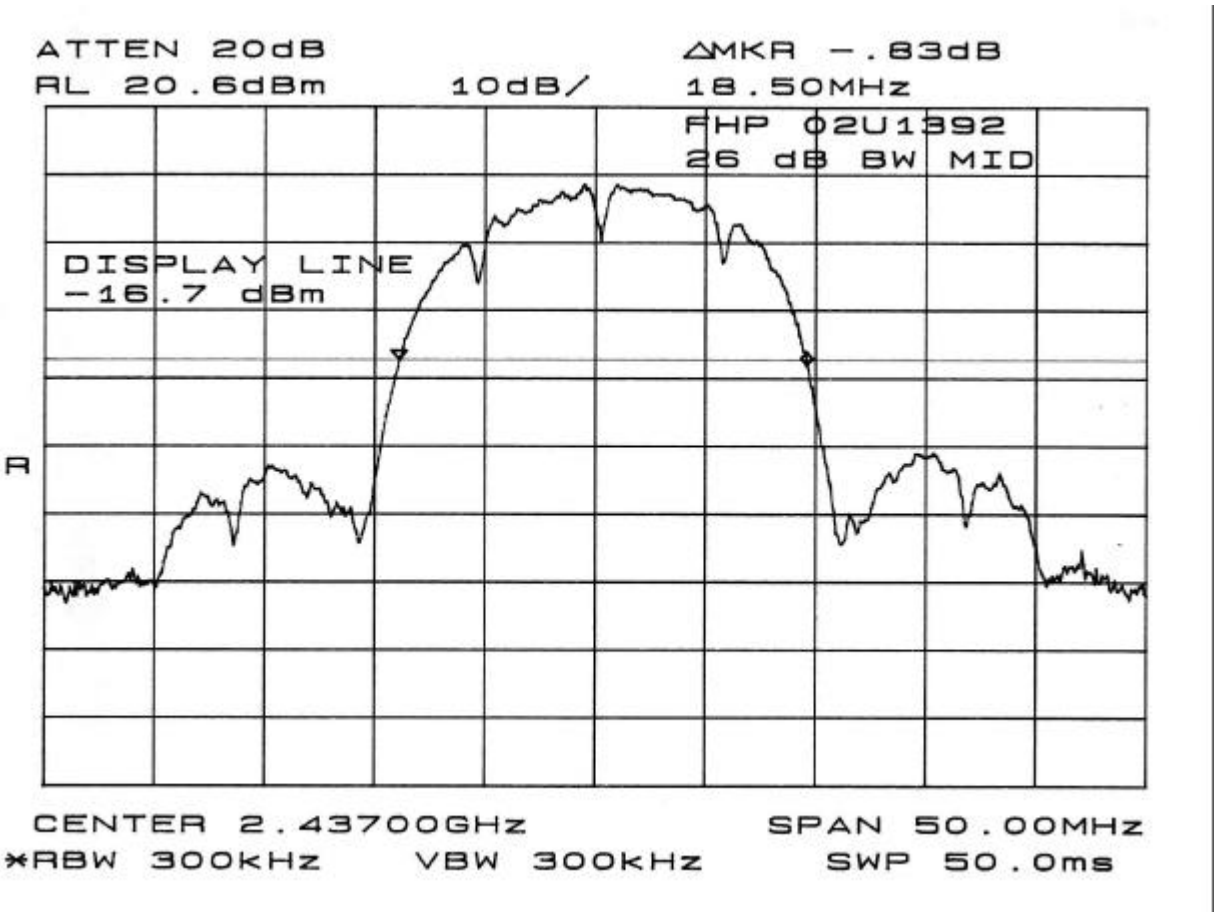
TEST PROCEDURE

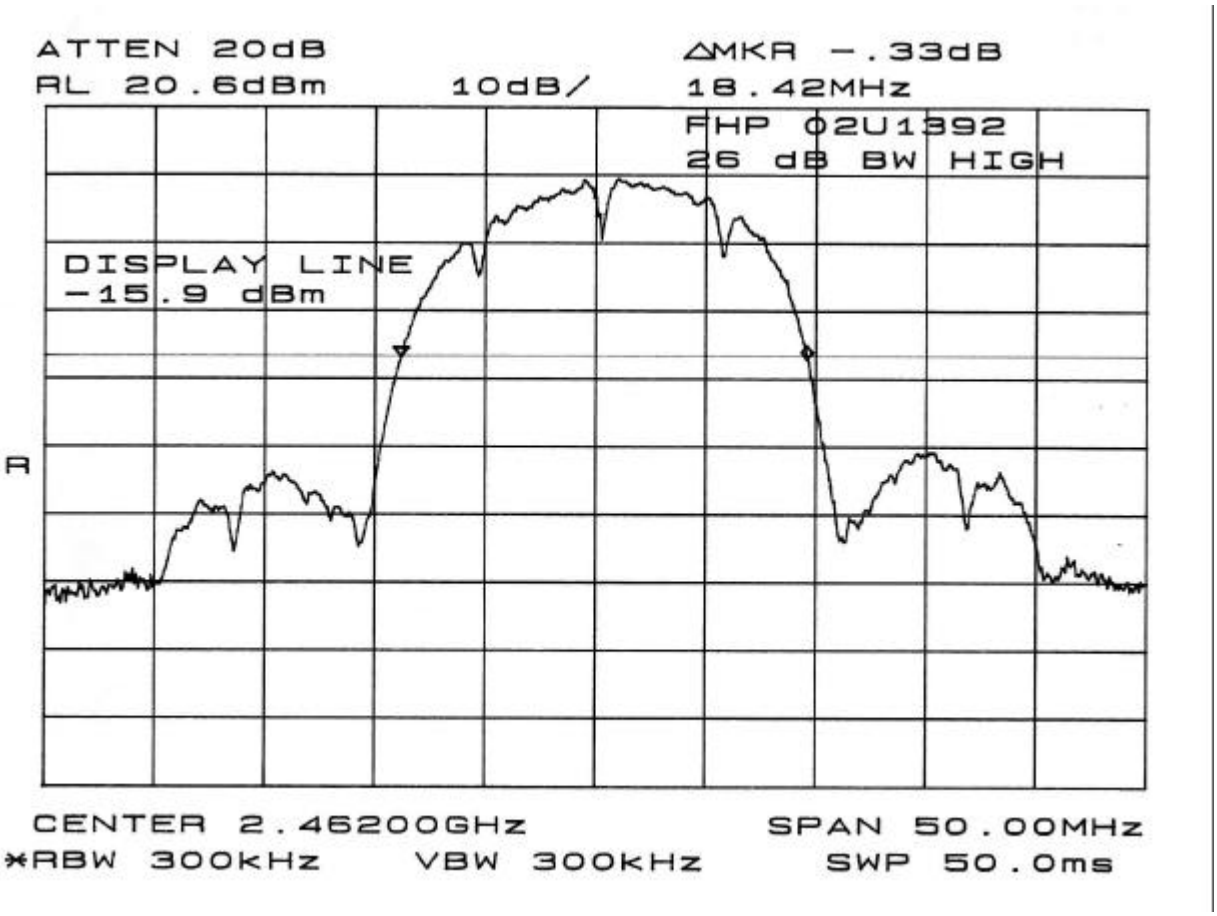
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to approximately 1% of the emission bandwidth and peak detection is used. The emission bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 26 dB.

RESULTS

Channel	Frequency (MHz)	B (MHz)
Low	2412	18.50
Middle	2437	18.50
High	2462	18.42

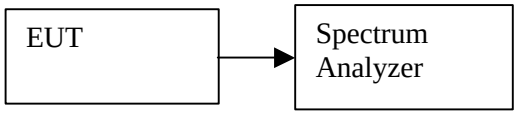






8.3. PEAK POWER

TEST SETUP



TEST PROCEDURE

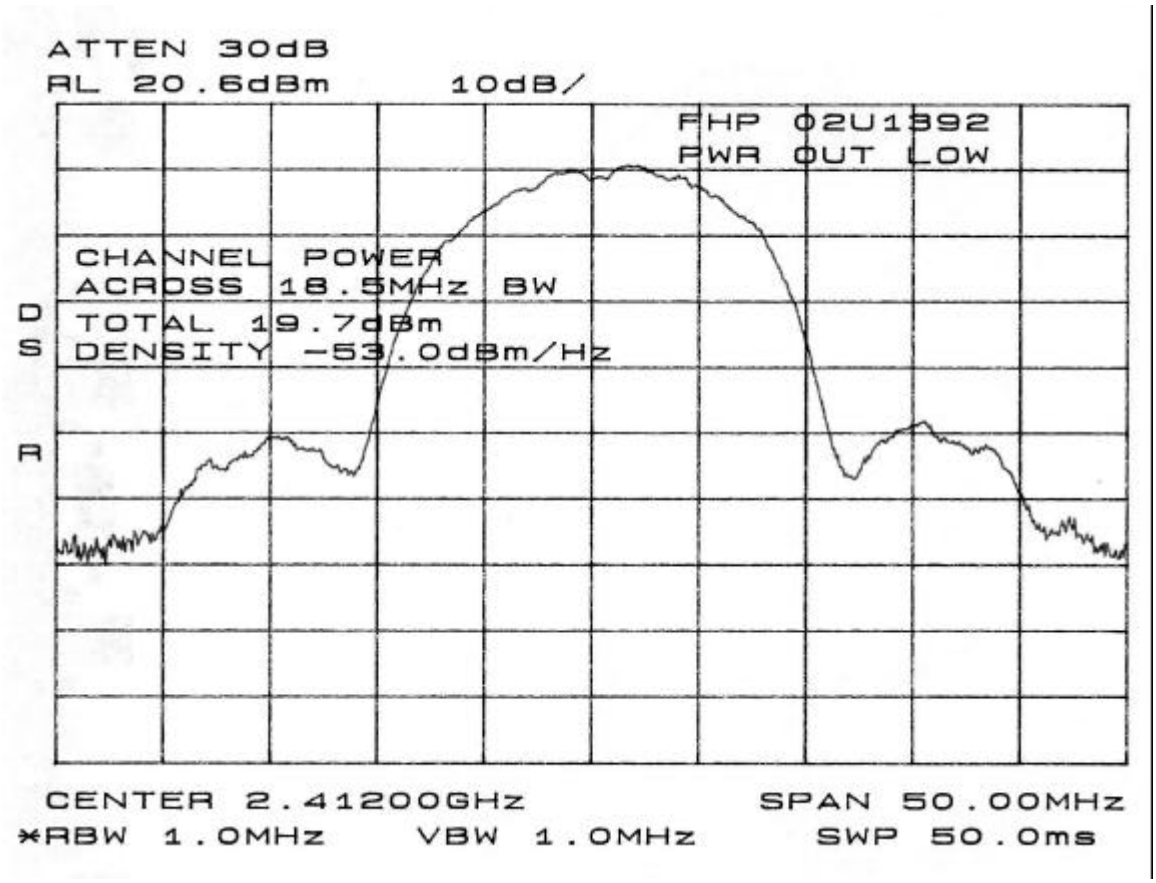
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth and video bandwidth are both set to 1 MHz.

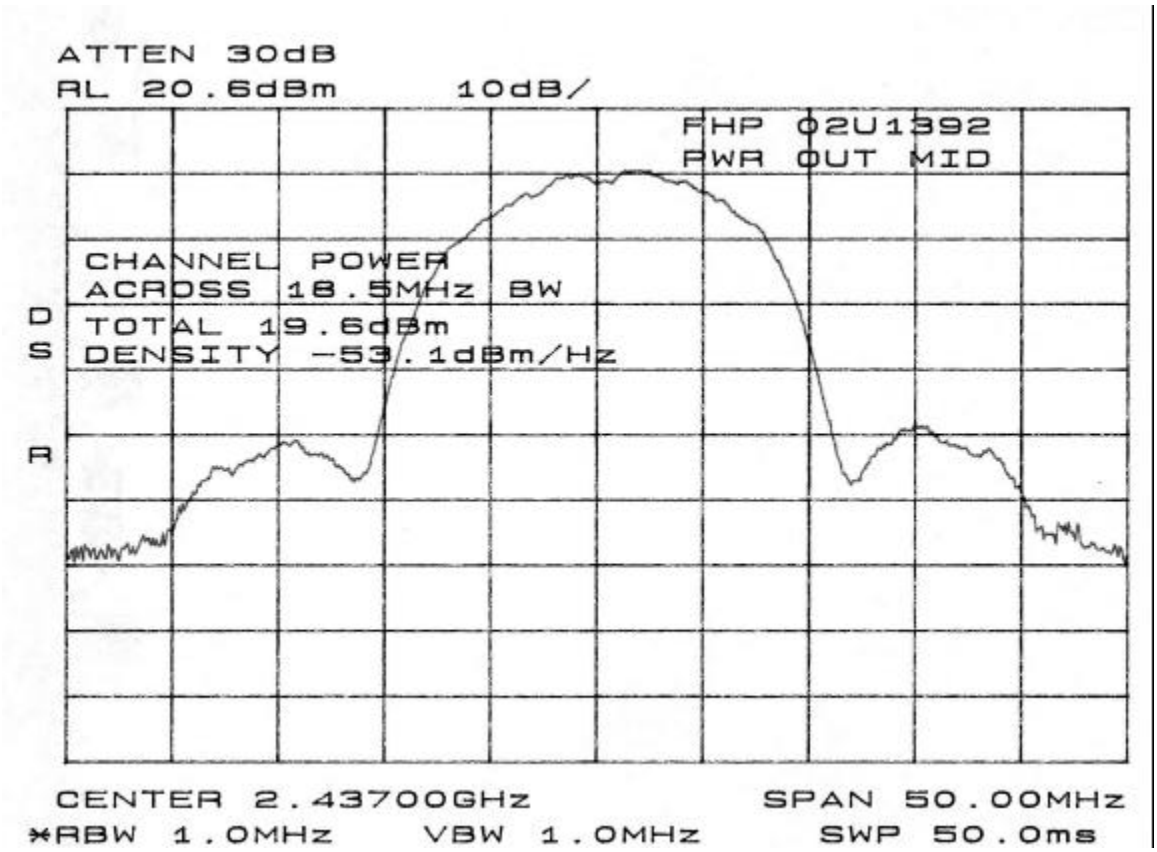
Peak detection is used, and the peak power is determined by channel integration over the previously measured emission bandwidth.

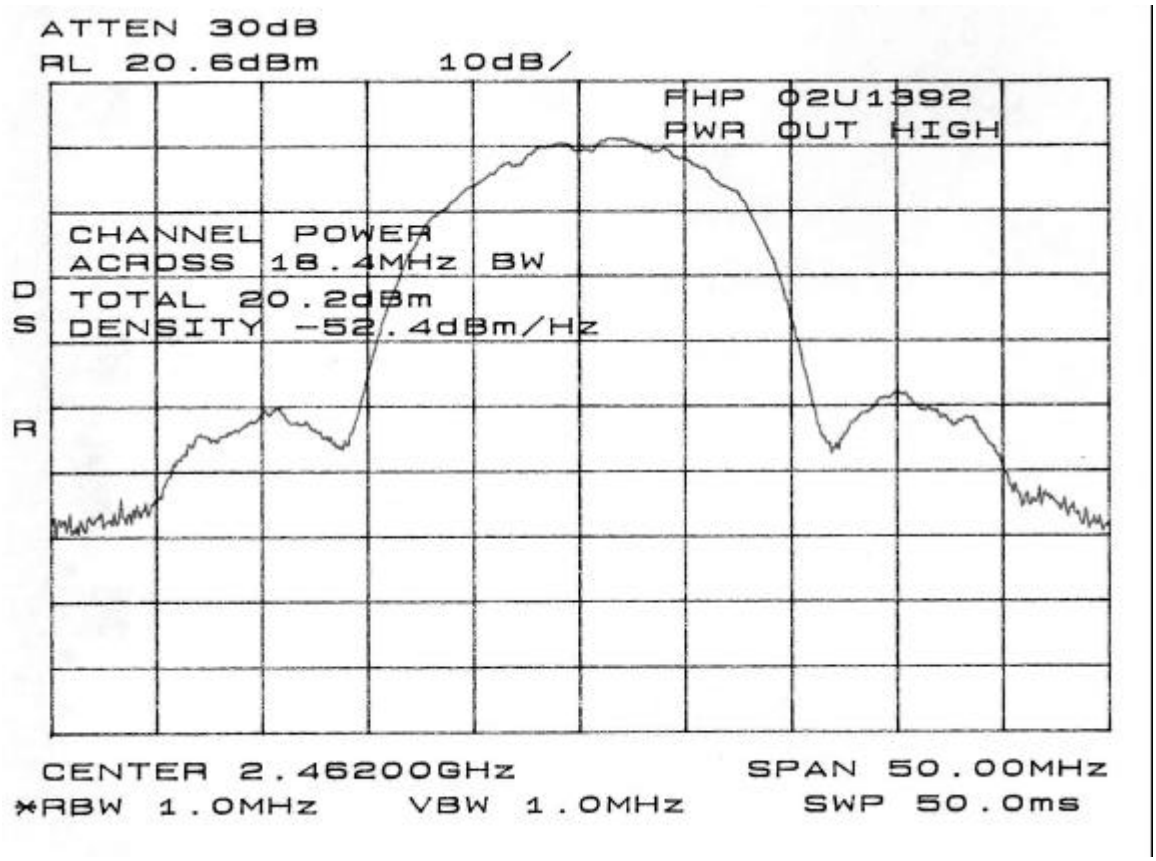
RESULTS

No non-compliance noted:

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin dB
Low	2412	19.7	24	-4.3
Middle	2437	19.6	24	-4.4
High	2462	20.2	24	-3.8

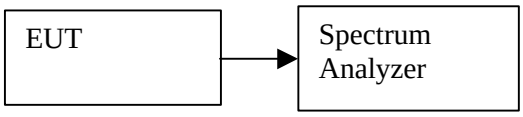






8.4. PEAK POWER SPECTRAL DENSITY

TEST SETUP



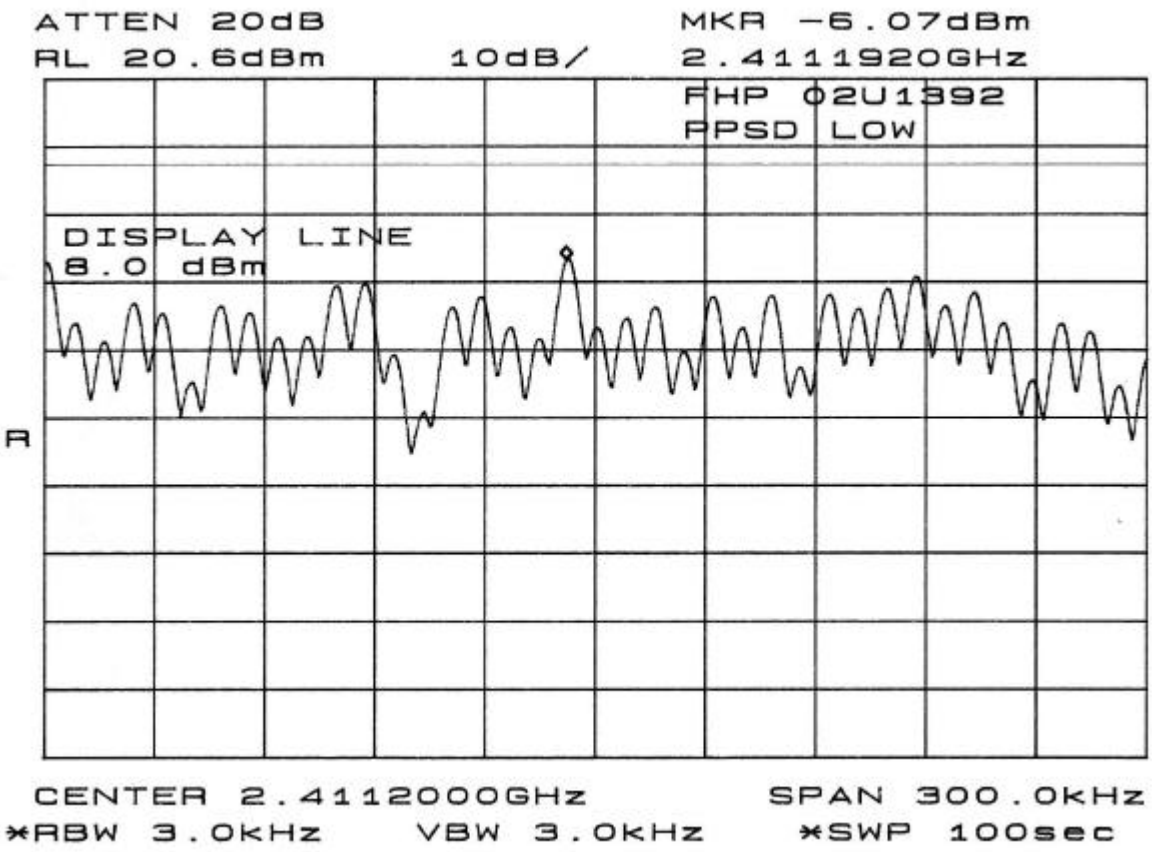
TEST PROCEDURE

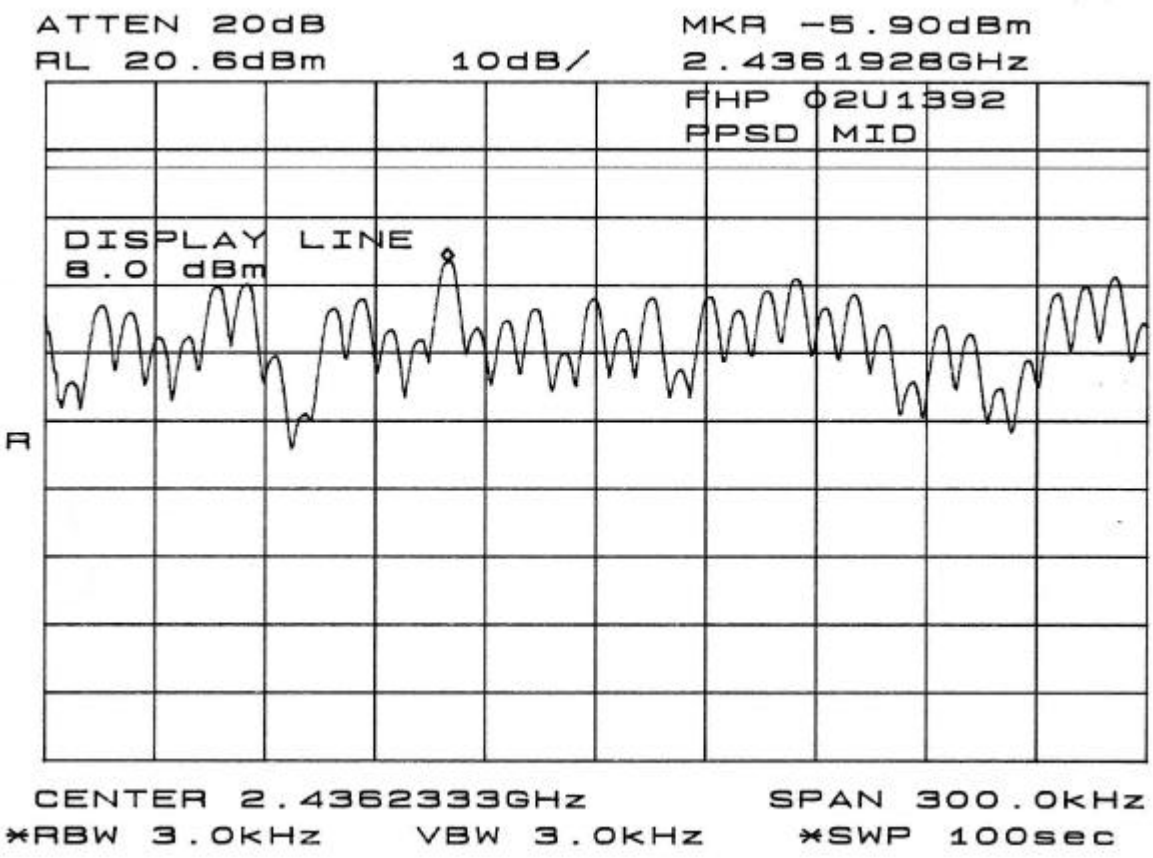
The transmitter output is connected to the spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = VBW = 3KHz, sweep time = span / 3 kHz, and video averaging is turned off. The PPSD is the highest level found across the emission in any 3 kHz band.

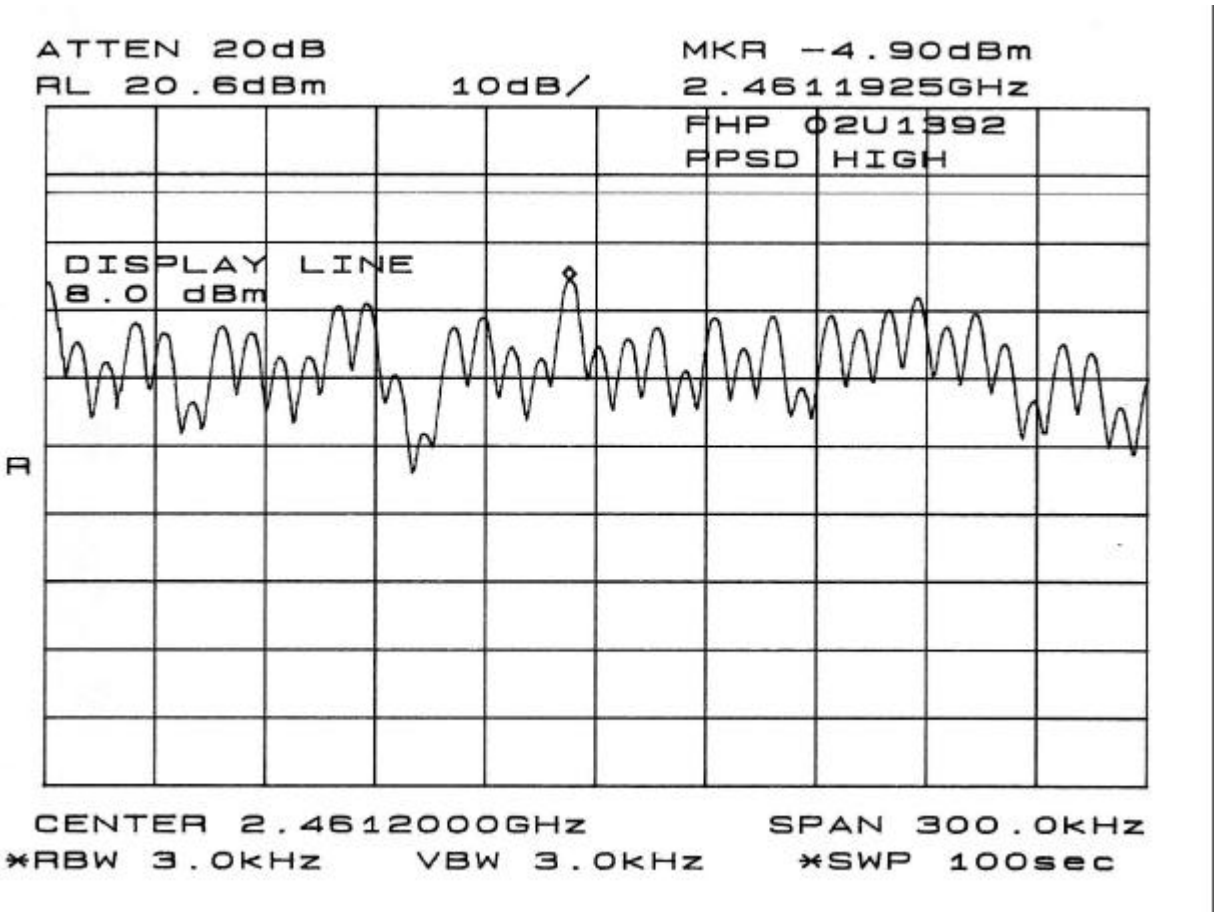
RESULTS

No non-compliance noted:

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin dB
Low	2412	-6.07	8	-1.93
Middle	2437	-5.90	8	-2.10
High	2462	-4.90	8	-3.10







8.5. MAXIMUM PERMISSIBLE EXPOSURE

CALCULATIONS

Given

$E = \sqrt{(30 * P * G)} / d$

and

$S = E \wedge 2 / 3770$

where

E = Field Strength in Volts / meter
P = Power in Watts
G = Numeric antenna gain
d = distance in meters
S = Power Density in milliwatts / square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$d = \sqrt{((30 * P * G) / (3770 * S))}$

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and

d (cm) =100 * d (m)

yields

$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$

$d = 0.282 * \sqrt{(P * G / S)}$

where

d = distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW / cm^2

Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and

G (numeric) = 10 ^ (G (dBi) / 10)

yields

$$d = 0.282 * 10 ^ ((P + G) / 20) / \sqrt{S}$$ Equation (1)

where
d = MPE safe distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW / cm^2

RESULTS

No non-compliance noted:

EUT output power = 20.2 dBm
Antenna Gain = 12.0 dBi
S = 1.0 mW / cm^2 from 1.1310 Table 1

Substituting these parameters into Equation (1) above:

MPE Safe Distance = 11.5 cm

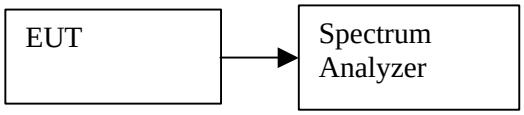
NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

8.6. SPURIOUS EMISSIONS – CONDUCTED MEASUREMENTS

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit.

Also, conducted RF measurements of the transmitter output over the 30 MHz to 26.5 GHz band were made in order to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

Measurements are made at the lower band edge and the restricted band adjacent to the lower edge of the authorized band, with the transmitter set to the lowest channel.

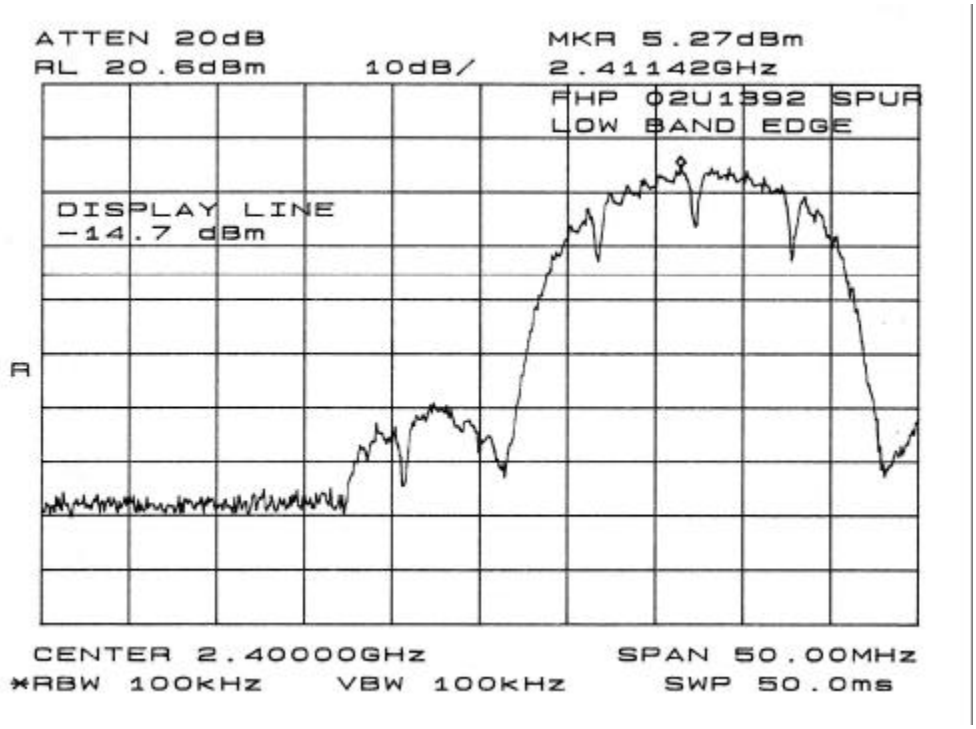
Measurements are made at the upper band edge and the restricted band adjacent to the upper edge of the authorized band, with the transmitter set to the highest channel.

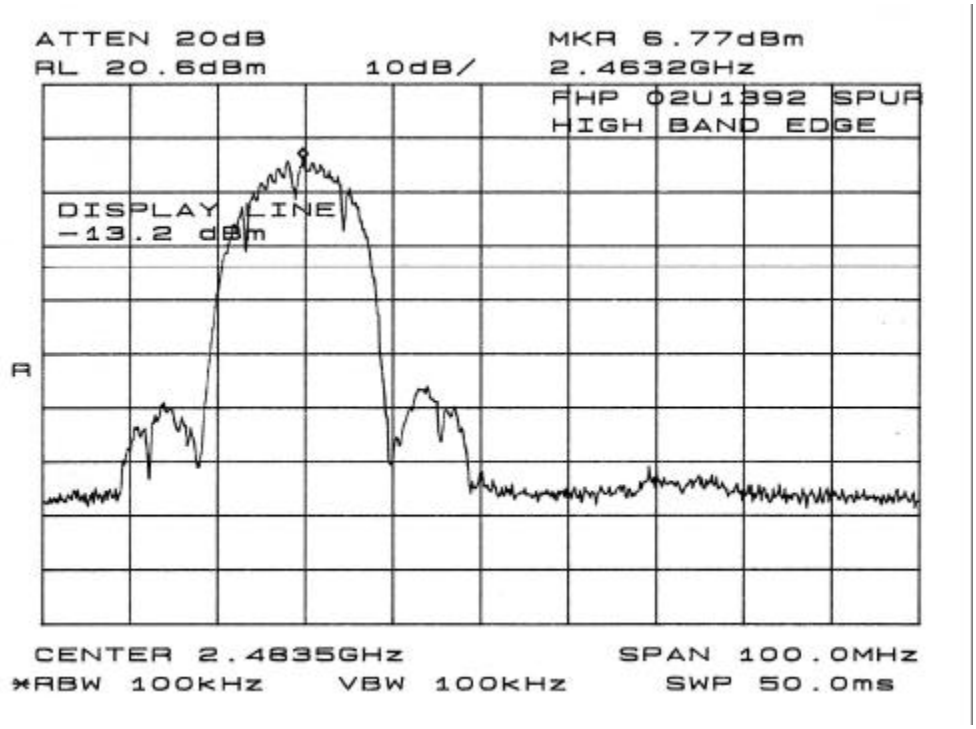
Measurements are made over the 30 MHz to 26.5 GHz range with the transmitter set to the lowest, middle, and highest channels.

RESULTS

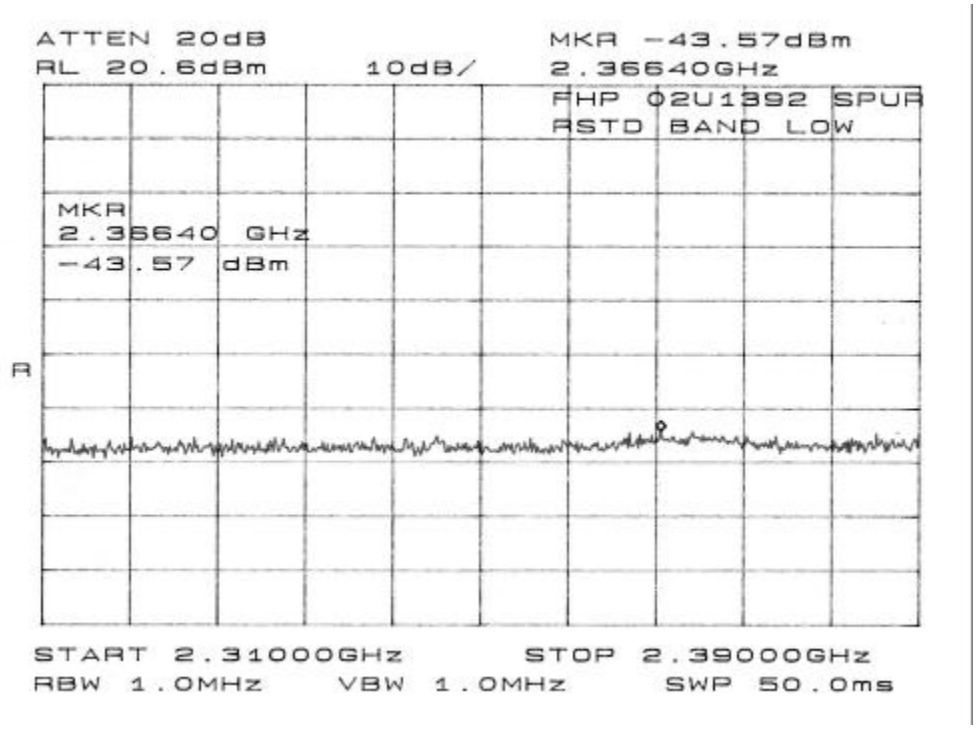
No non-compliance noted:

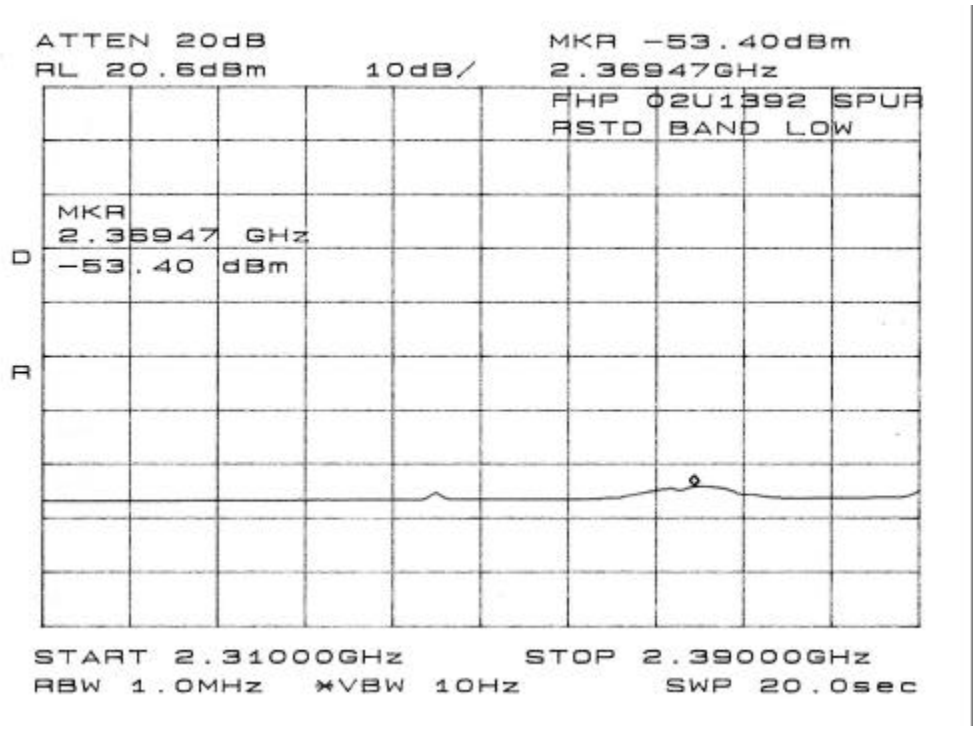
BAND EDGE

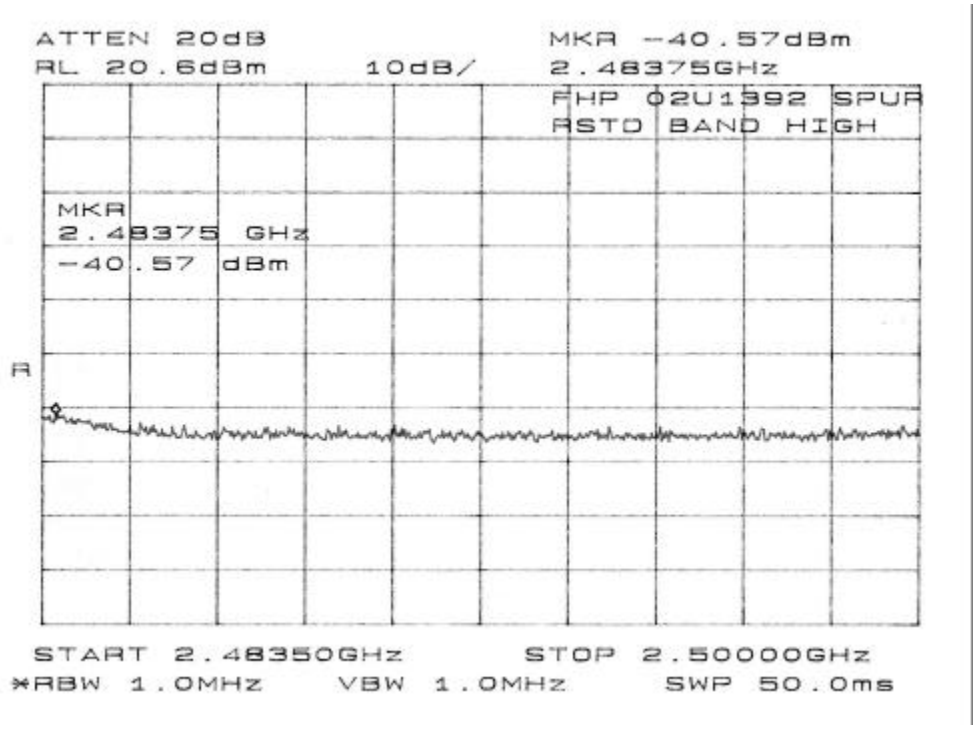


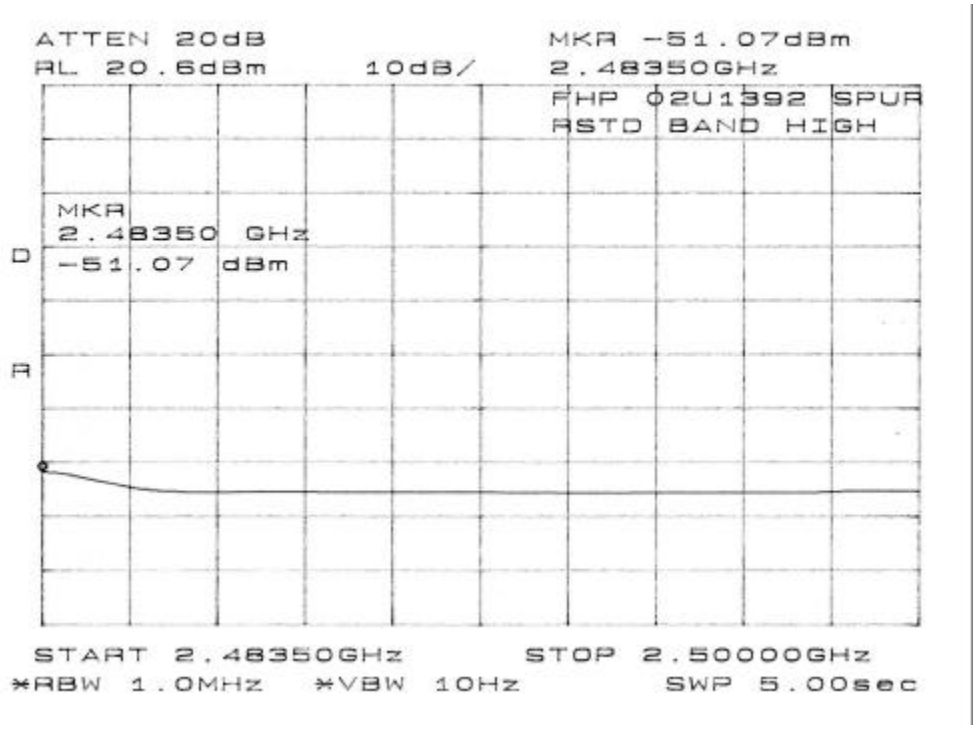


RESTRICTED BANDS

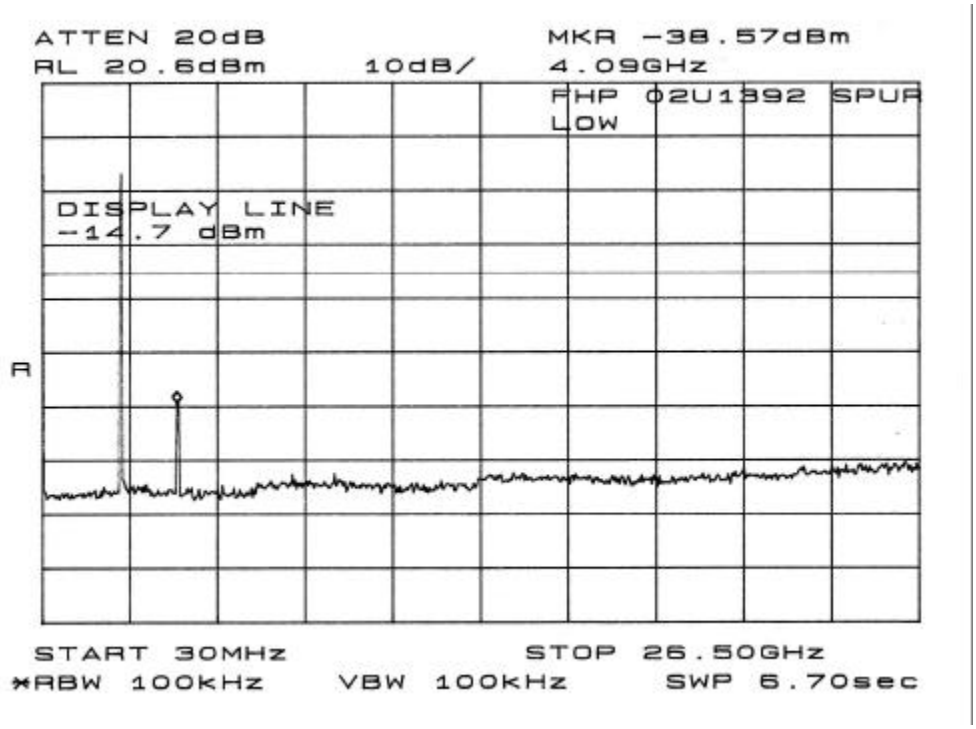


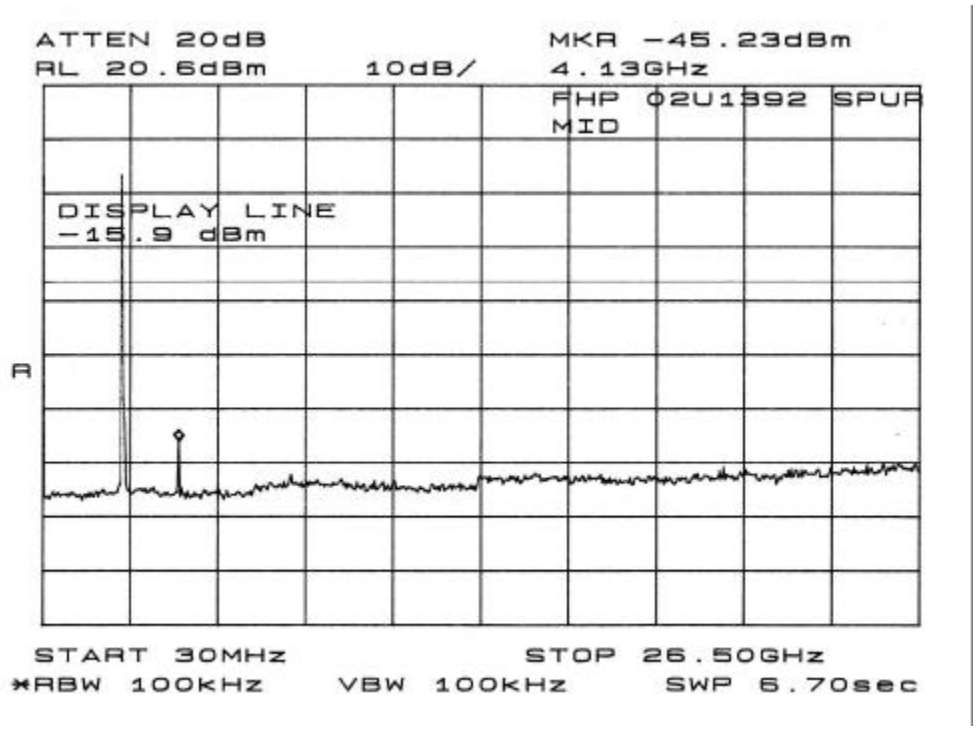


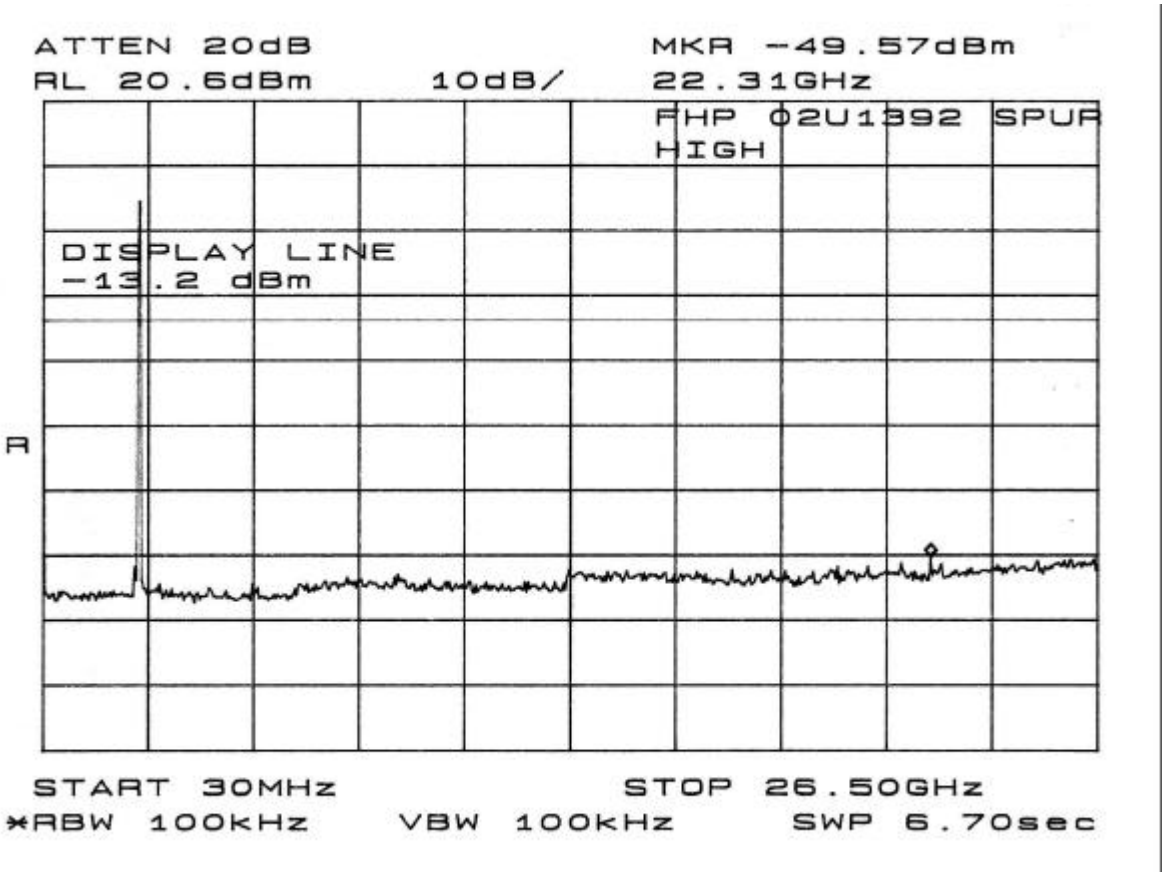




SPURIOUS PLOTS







8.7. UNDESIRABLE EMISSIONS – RADIATED MEASUREMENTS

8.7.1. SETUP AND PROCEDURE

TEST SETUP

For measurements of the EUT as a transmitter with the Patch antenna, the EUT and the laptop were placed on the turntable base and the antenna was mounted on a typical mast. The antenna is connected to the EUT via a coaxial cable.

For measurements of the EUT as a transmitter with Omni antennas, the EUT was placed on the wooden table and the laptop was placed on the turntable base. The antennas were connected directly to the EUT.

For transmitter tests, the laptop was used only to set the EUT to the desired frequency, the desired receive diversity mode, and to continuous RF transmission.

For measurements of the EUT as a digital device the EUT and all other support equipment were placed on a wooden table 80 cm above the ground plane. For digital device tests, the laptop was used to set the EUT to continuously transmit ethernet packets and then the laptop was reconnected to the EUT to receive the ethernet packets.

The EUT is configured in accordance with Section 8 of ANSI C63.4/1992.

TEST PROCEDURE

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz outside restricted bands, the resolution bandwidth is set to 100 kHz. Peak detection is used.

For measurements above 1 GHz within restricted bands, the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26.5 GHz is investigated.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The frequency span is set small enough to easily differentiate between broadcast stations, intermittent ambient signals and EUT emissions. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the suspected signal. Measurements were made with the antenna polarized in both the vertical and the horizontal positions.

SYSTEM NOISE FLOOR FOR HARMONIC AND SPURIOUS MEASUREMENTS

Compliance Certification Services

Worst Case Radiated Emissions System Noise Floor

Each band below corresponds to each horn antenna band
Uses the lowest gain preamplifier; actual preamp used may have higher gain
Uses the longest typical cable configuration; actual cables used may have less loss
Noise floor field strength results are compared to the FCC 15.205 Restricted Band limit

Specification Distance: 3 meters

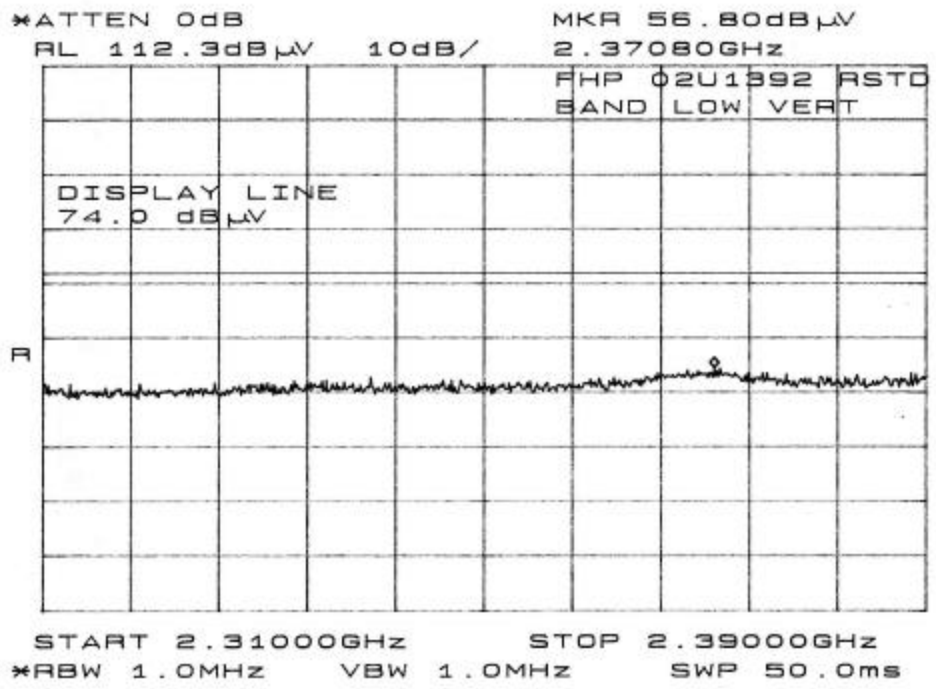
Freq GHz	SA dBuV	AF dB/m	Distance m	Distance dB	Preamp dB	Cable dB	Field dBuV/m	Limit dBuV/m	Margin dB
1 to 18 GHz band									
RBW = 1 MHz, peak detection									
18	41.9	47.8	1	-9.5	32.6	13.5	61.06	74	-12.94
RBW = 1 MHz, average detection									
18	28.7	47.8	1	-9.5	32.6	13.5	47.86	54	-6.14
18 to 26 GHz band									
RBW = 1 MHz, peak detection									
26	44.6	33.4	1	-9.5	35.0	19.5	52.96	74	-21.04
RBW = 1 MHz, average detection									
26	32.4	33.4	1	-9.5	35.0	19.5	40.76	54	-13.24
26 to 40 GHz band									
External mixer is used for this band									
Preamplifier is internal to Spectrum Analyzer, with gain factor built into firmware									
Antenna is mounted directly on external mixer, therefore cable = 0 dB									
RBW = 1 MHz, peak detection									
40	39.2	44.5	0.3	-20.0	0.0	0	63.70	74	-10.30
RBW = 1 MHz, average detection									
40	27.2	44.5	0.3	-20.0	0.0	0	51.70	54	-2.30

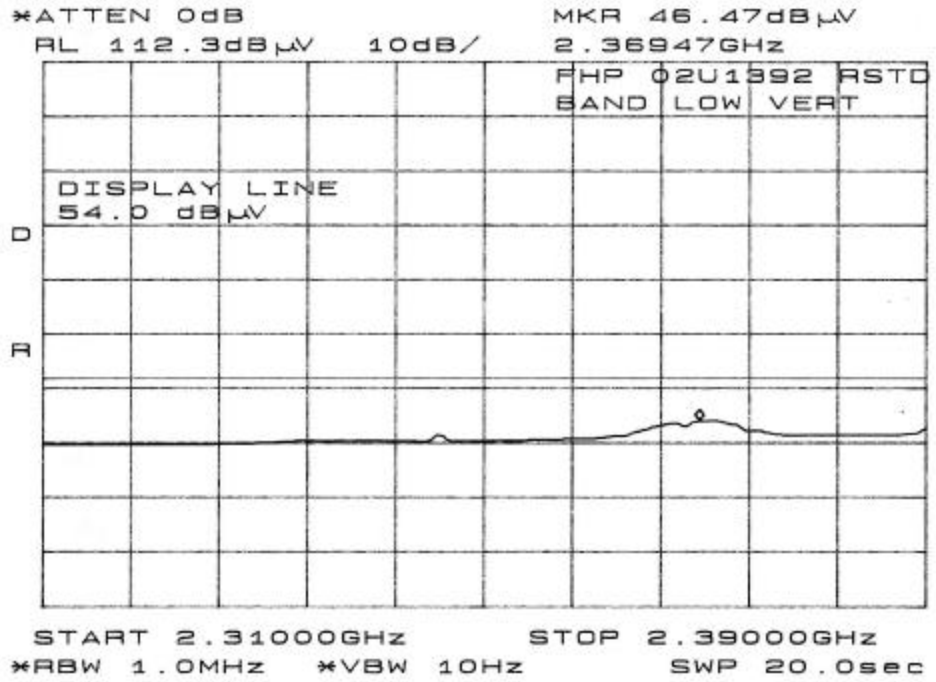
TEST RESULTS

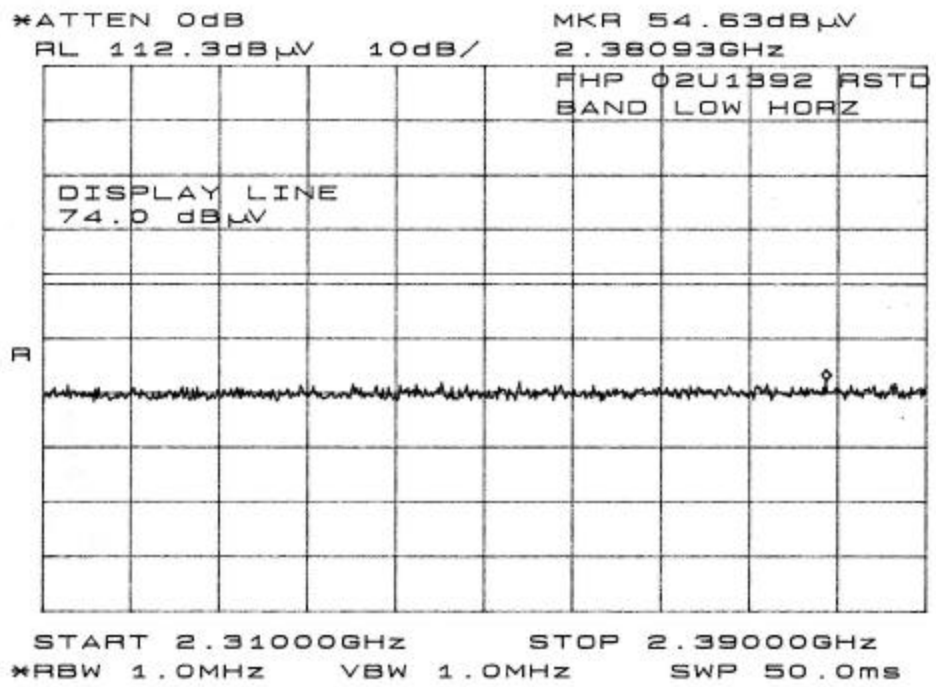
No non-compliance noted:

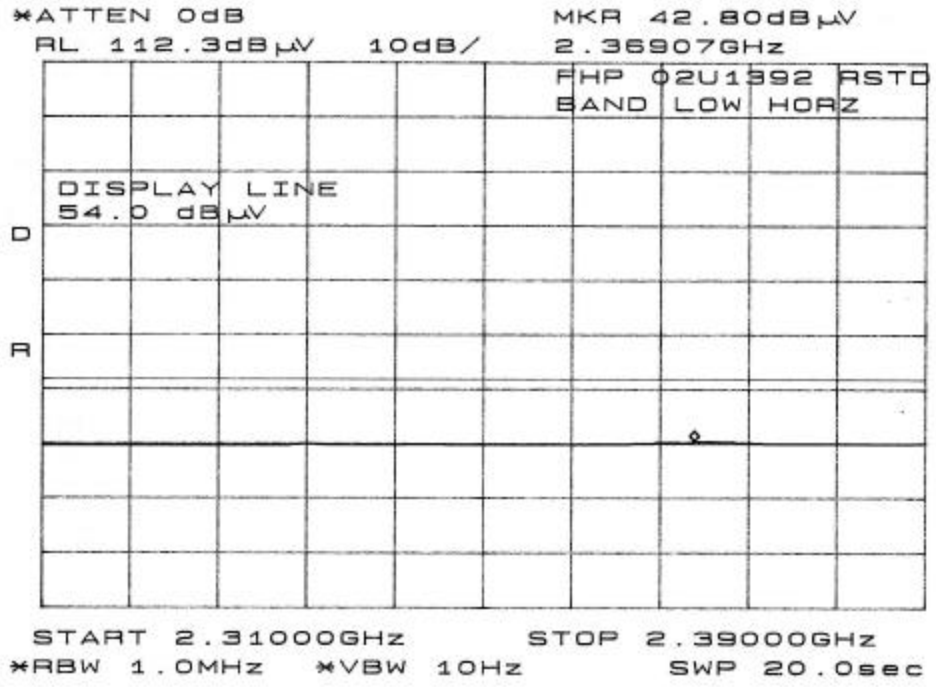
8.7.2. TRANSMITTER TEST RESULTS

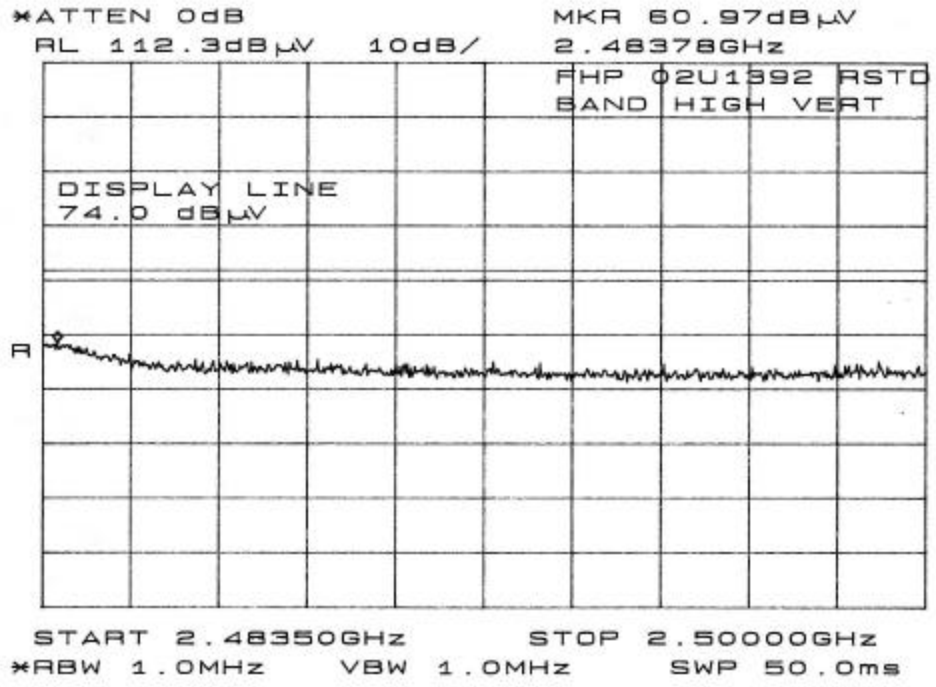
12 dBi PATCH ANTENNA - BAND EDGE RADIATED EMISSIONS

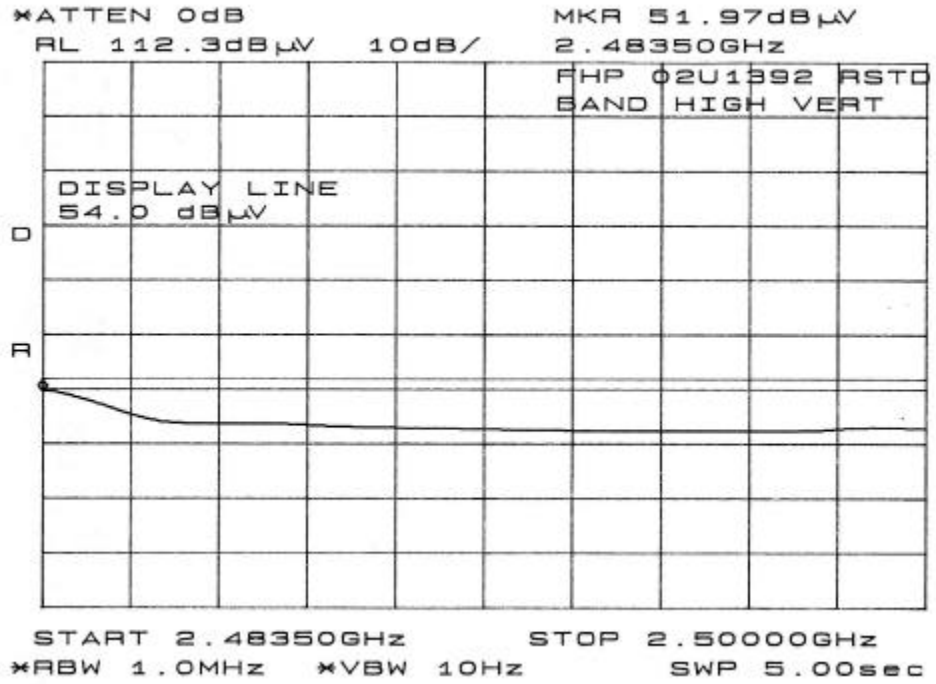


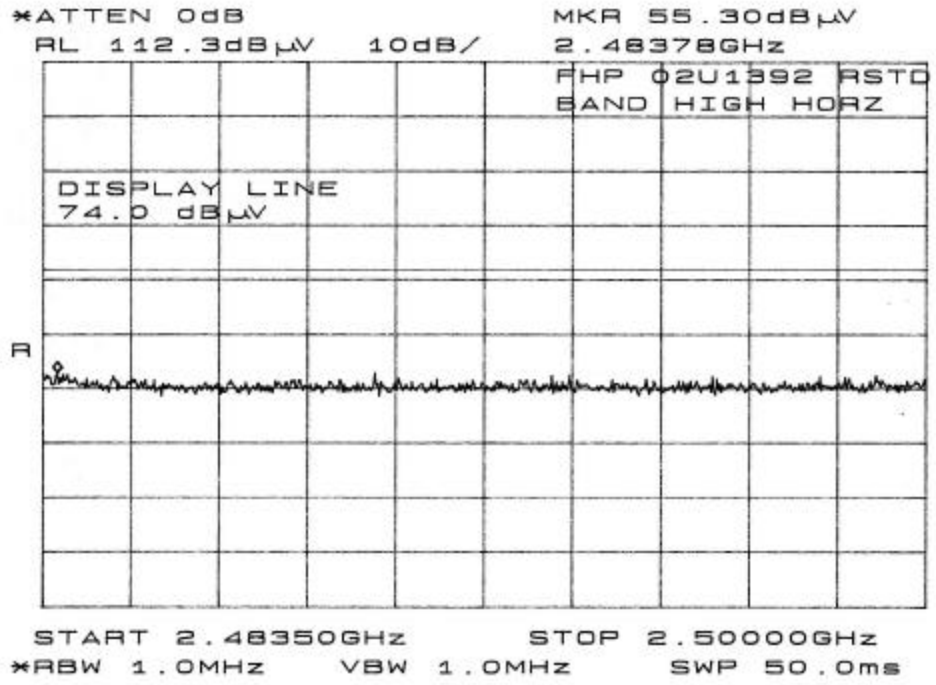


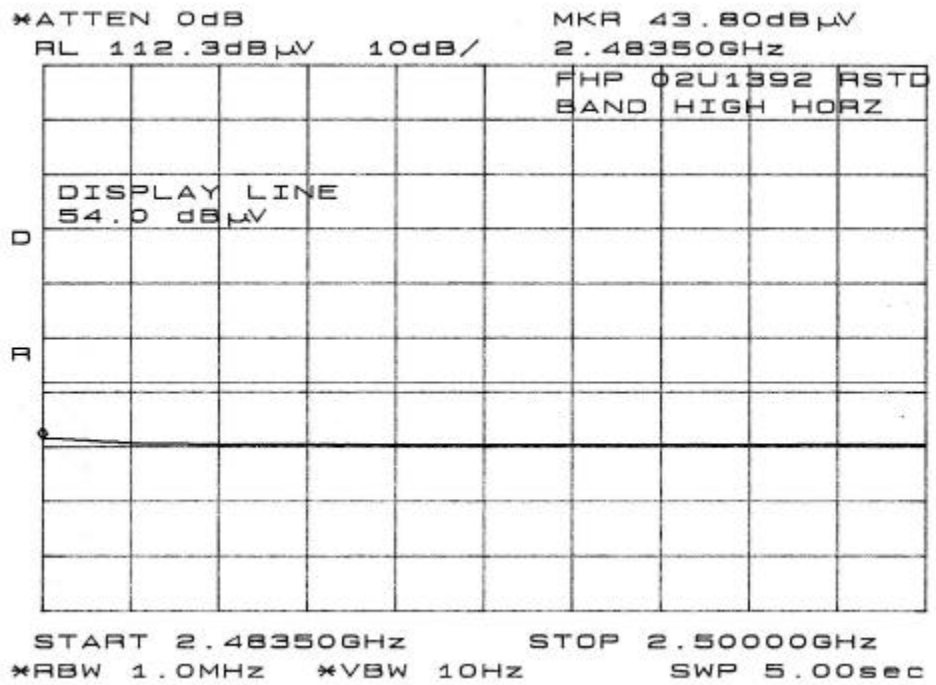












12 dBi PATCH ANTENNA SPURIOUS RADIATED EMISSIONS

Compliance Certification Services B-Site 8/6/02 Mike H

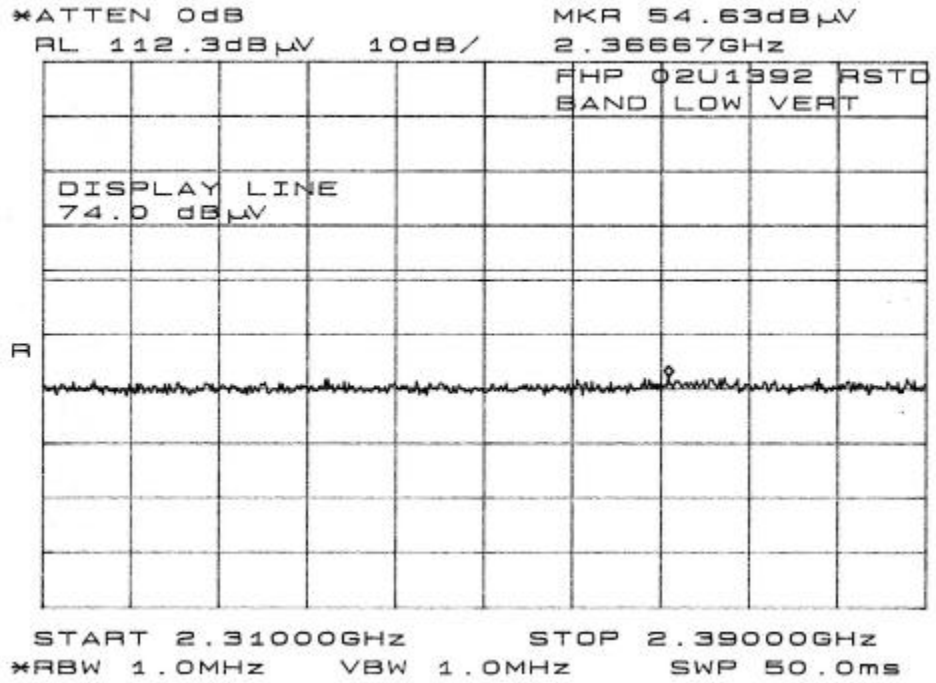
Radiated Emissions FHP with 12 dBi Long Patch Antenna, No Diversity

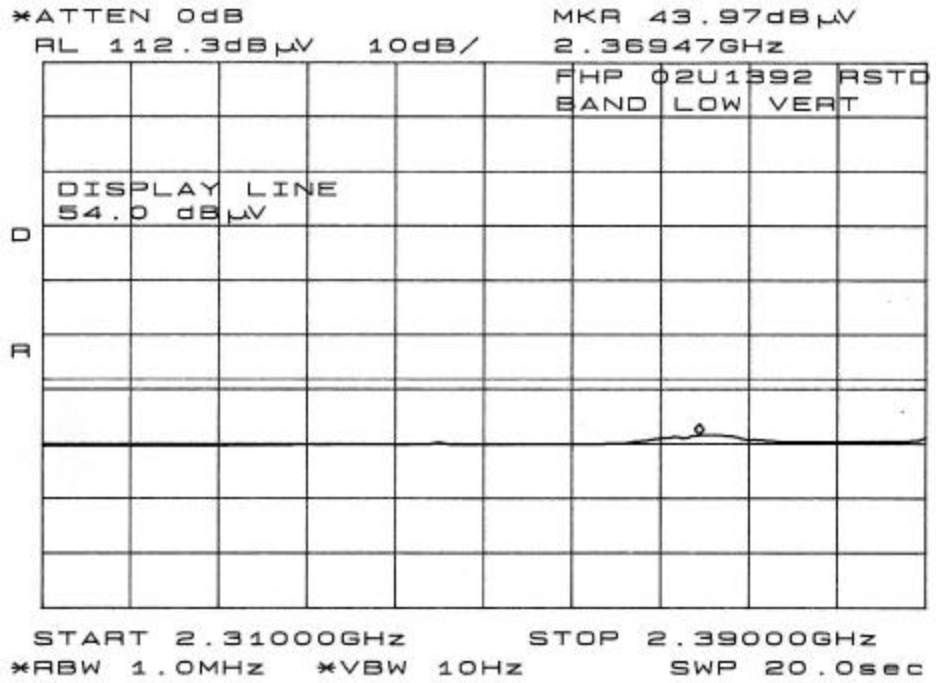
FCC 15.247 Mode: Transmitting

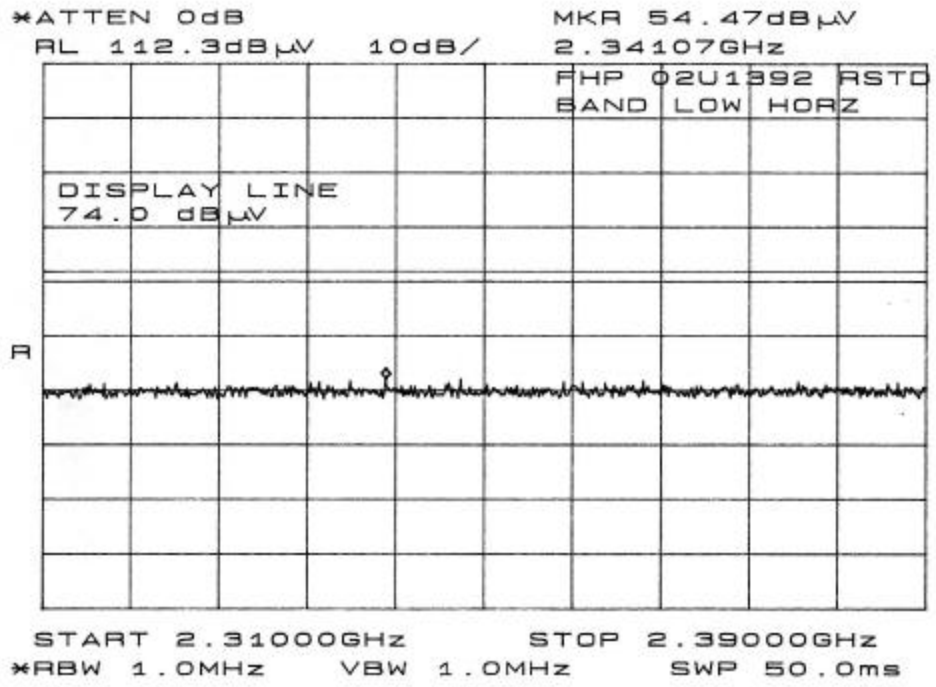
Specification Distance: 3 meters

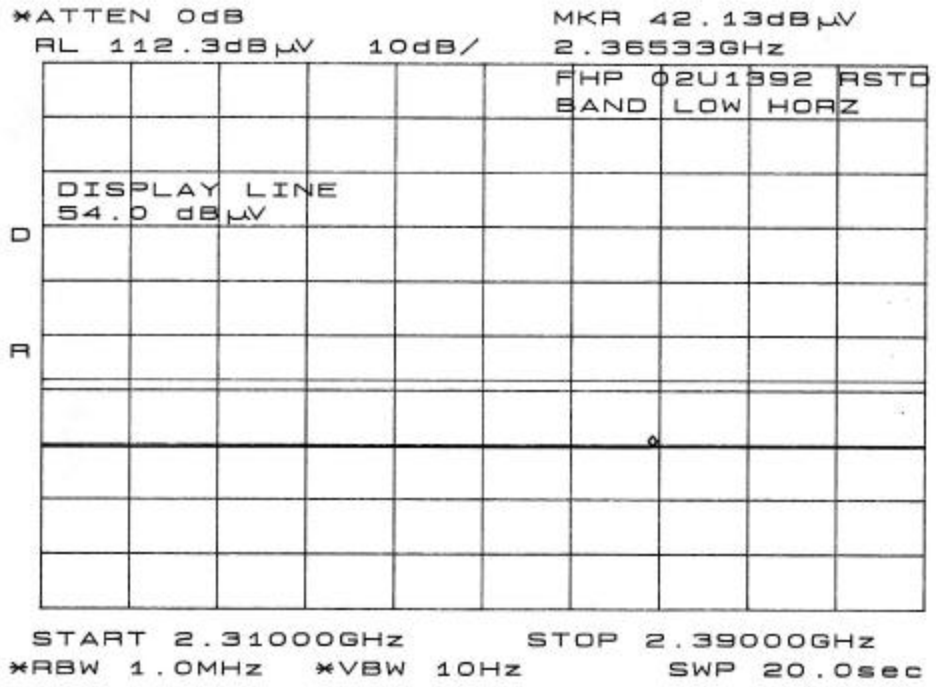
Freq MHz	Pol V/H	Det	SA dBuV	AF dB/m	Dist m	Dist dB	Preamp dB	Cable / HPF dB	Field dBuV/m	Limit dBuV/m	Margin dB
2412	V	100k	87.17	28.9	1.5	-6.0	0.0	2.5	112.55		
2412	H	100k	73.5	28.9	1.5	-6.0	0.0	2.5	98.88		
4075.5	V	Peak	55.17	33.2	1.5	-6.0	34.8	8.5	56.05	74	-17.95
4075.5	V	Avg	52.83	33.2	1.5	-6.0	34.8	8.5	53.71	54	-0.29
4075.5	H	Peak	53.67	33.2	1.5	-6.0	34.8	8.5	54.55	74	-19.45
4075.5	H	Avg	51.33	33.2	1.5	-6.0	34.8	8.5	52.21	54	-1.79
4824	V	Peak	43.33	33.9	1.5	-6.0	34.5	5.8	42.51	74	-31.49
4824	V	Avg	32.33	33.9	1.5	-6.0	34.5	5.8	31.51	54	-22.49
4824	H	Peak	43.33	33.9	1.5	-6.0	34.5	5.8	42.51	74	-31.49
4824	H	Avg	32	33.9	1.5	-6.0	34.5	5.8	31.18	54	-22.82
2437	V	100k	87.17	28.9	1.5	-6.0	0.0	2.5	112.55		
2437	H	100k	72.83	28.9	1.5	-6.0	0.0	2.5	98.21		
4125.5	V	Peak	52.67	33.2	1.5	-6.0	34.8	8.5	53.55	74	-20.45
4125.5	V	Avg	50	33.2	1.5	-6.0	34.8	8.5	50.88	54	-3.12
4125.5	H	Peak	49.5	33.2	1.5	-6.0	34.8	8.5	50.38	74	-23.62
4125.5	H	Avg	45.83	33.2	1.5	-6.0	34.8	8.5	46.71	54	-7.29
4874	V	Peak	45.16	34	1.5	-6.0	34.5	5.8	44.44	74	-29.56
4874	V	Avg	36.83	34	1.5	-6.0	34.5	5.8	36.11	54	-17.89
4874	H	Peak	45.33	34	1.5	-6.0	34.5	5.8	44.61	74	-29.39
4874	H	Avg	35	34	1.5	-6.0	34.5	5.8	34.28	54	-19.72
2462	V	100k	88.5	29	1.5	-6.0	0.0	2.5	113.98		
2462	H	100k	74.33	29	1.5	-6.0	0.0	2.5	99.81		
4175.5	V	Peak	44.67	33.2	1.5	-6.0	34.8	8.5	45.55	74	-28.45
4175.5	V	Avg	36.67	33.2	1.5	-6.0	34.8	8.5	37.55	54	-16.45
4175.5	H	Peak	43	33.2	1.5	-6.0	34.8	8.5	43.88	74	-30.12
4175.5	H	Avg	32.83	33.2	1.5	-6.0	34.8	8.5	33.71	54	-20.29
4924	V	Peak	45.17	34.2	1.5	-6.0	34.5	5.8	44.65	74	-29.35
4924	V	Avg	35.5	34.2	1.5	-6.0	34.5	5.8	34.98	54	-19.02
4924	H	Peak	43.83	34.2	1.5	-6.0	34.5	5.8	43.31	74	-30.69
4924	H	Avg	34.17	34.2	1.5	-6.0	34.5	5.8	33.65	54	-20.35

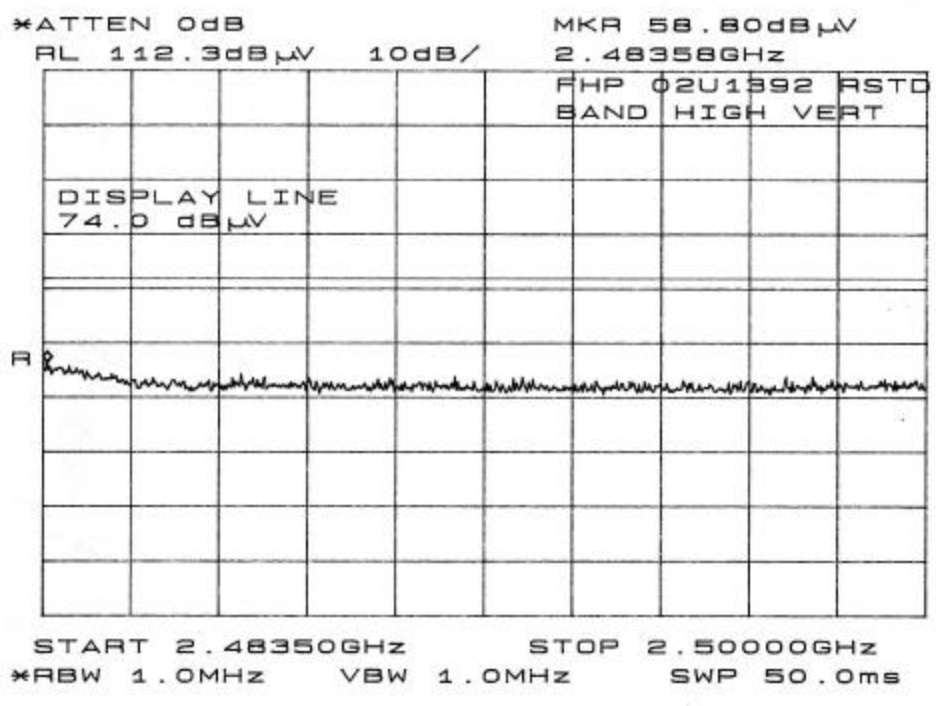
7.4 dBi OMNI ANTENNAS BAND EDGE RADIATED EMISSIONS

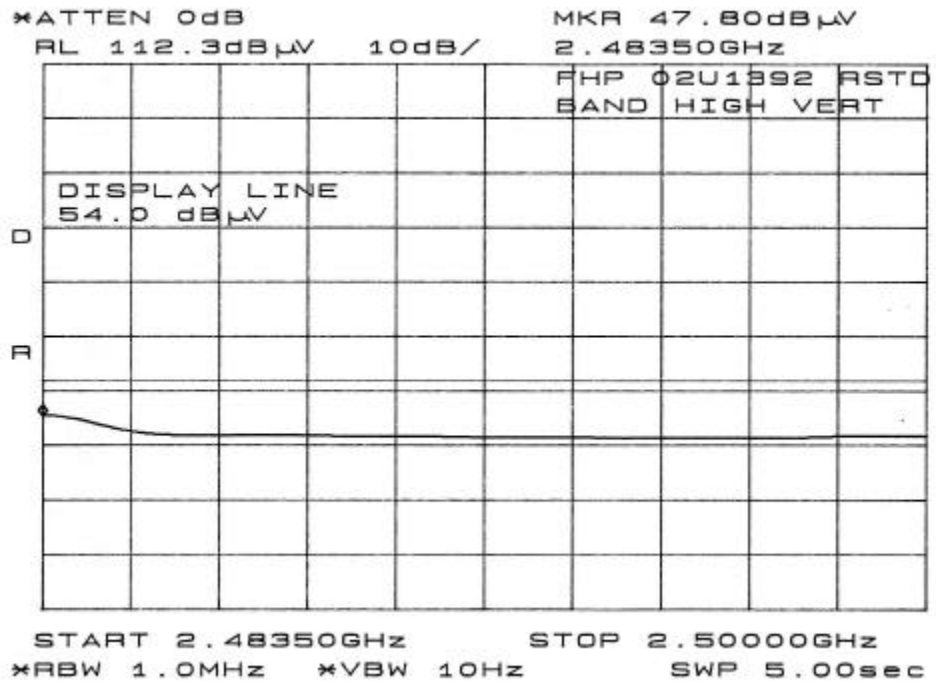


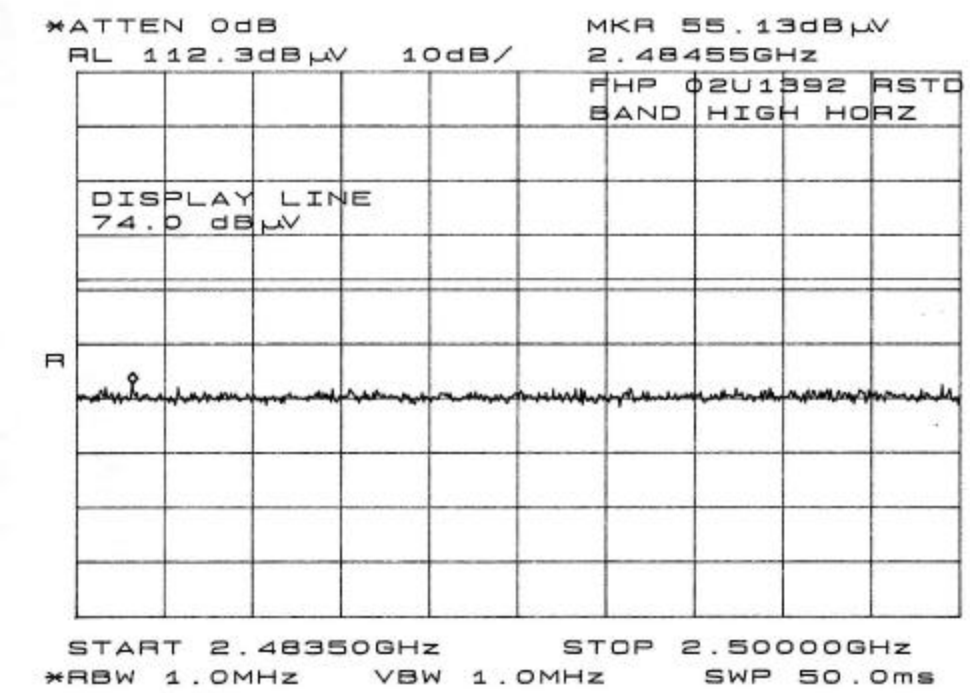


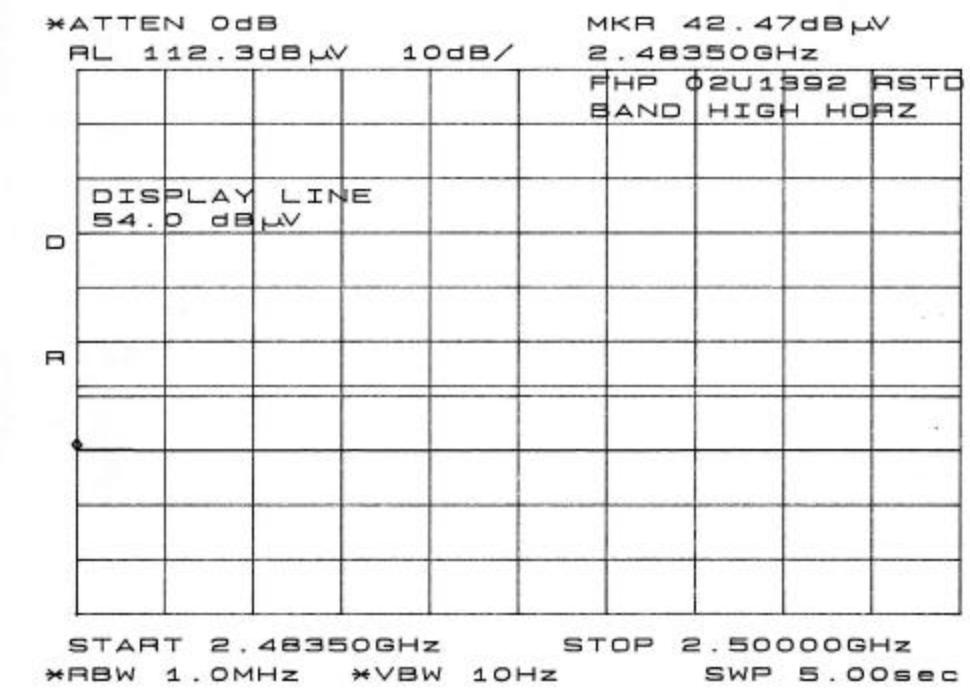












7.4 dBi OMNI ANTENNAS SPURIOUS RADIATED EMISSIONS

Compliance Certification Services B-Site 8/8/02 Mike H

Radiated Emissions FHP with 7.4 dBi Omni Antennas, mounted with elbows, Rx Diversity

FCC 15.247 Mode: Transmitting

Specification Distance: 3 meters

Freq MHz	Pol V/H	Det	SA dBuV	AF dB/m	Dist m	Dist dB	Preamp dB	Cable / HPF dB	Field dBuV/m	Limit dBuV/m	Margin dB
2412	V	100k	82	28.9	1.5	-6.0	0.0	2.5	107.38		
2412	H	100k	66.05	28.9	1.5	-6.0	0.0	2.5	91.43		
4075.5	V	Peak	53.33	33.2	1.5	-6.0	34.8	8.5	54.21	74	-19.79
4075.5	V	Avg	50.67	33.2	1.5	-6.0	34.8	8.5	51.55	54	-2.45
4075.5	H	Peak	52	33.2	1.5	-6.0	34.8	8.5	52.88	74	-21.12
4075.5	H	Avg	48.67	33.2	1.5	-6.0	34.8	8.5	49.55	54	-4.45
4824	V	Peak	46.33	33.9	1.5	-6.0	34.5	5.8	45.51	74	-28.49
4824	V	Avg	38.67	33.9	1.5	-6.0	34.5	5.8	37.85	54	-16.15
4824	H	Peak	43.83	33.9	1.5	-6.0	34.5	5.8	43.01	74	-30.99
4824	H	Avg	32.5	33.9	1.5	-6.0	34.5	5.8	31.68	54	-22.32
2437	V	100k	81.83	28.9	1.5	-6.0	0.0	2.5	107.21		
2437	H	100k	66.83	28.9	1.5	-6.0	0.0	2.5	92.21		
4125.5	V	Peak	47	33.2	1.5	-6.0	34.8	8.5	47.88	74	-26.12
4125.5	V	Avg	41.5	33.2	1.5	-6.0	34.8	8.5	42.38	54	-11.62
4125.5	H	Peak	43.67	33.2	1.5	-6.0	34.8	8.5	44.55	74	-29.45
4125.5	H	Avg	34.17	33.2	1.5	-6.0	34.8	8.5	35.05	54	-18.95
4874	V	Peak	45.5	34	1.5	-6.0	34.5	5.8	44.78	74	-29.22
4874	V	Avg	36.83	34	1.5	-6.0	34.5	5.8	36.11	54	-17.89
4874	H	Peak	43.5	34	1.5	-6.0	34.5	5.8	42.78	74	-31.22
4874	H	Avg	31	34	1.5	-6.0	34.5	5.8	30.28	54	-23.72
2462	V	100k	83.5	29	1.5	-6.0	0.0	2.5	108.98		
2462	H	100k	68.67	29	1.5	-6.0	0.0	2.5	94.15		
4175.5	V	Peak	42	33.2	1.5	-6.0	34.8	8.5	42.88	74	-31.12
4175.5	V	Avg	29.5	33.2	1.5	-6.0	34.8	8.5	30.38	54	-23.62
4175.5	H	Peak	41.33	33.2	1.5	-6.0	34.8	8.5	42.21	74	-31.79
4175.5	H	Avg	28.67	33.2	1.5	-6.0	34.8	8.5	29.55	54	-24.45
4924	V	Peak	44.5	34.2	1.5	-6.0	34.5	5.8	43.98	74	-30.02
4924	V	Avg	36.5	34.2	1.5	-6.0	34.5	5.8	35.98	54	-18.02
4924	H	Peak	43.67	34.2	1.5	-6.0	34.5	5.8	43.15	74	-30.85
4924	H	Avg	31.67	34.2	1.5	-6.0	34.5	5.8	31.15	54	-22.85

8.7.3. DIGITAL DEVICE TEST RESULTS

DIGITAL DEVICE RADIATED EMISSIONS – BENCHTOP MOUNTING WITH SELF-CONTAINED POWER

COMPLIANCE Certification Services

FCC, VCCI, CISPR, CE, AUSTEL, NZ
UL, CSA, TUV, BSMI, DHHS, NVLAP

561F MONTEREY ROAD, SAN JOSE, CA 95037-9001
PHONE: (408) 463-0885 FAX: (408) 463-0888

Project #:	02U1392
Report #:	020826A1
Date& Time:	08/26/02 2:07 PM
Test Engr:	Mike Heckrotte
Company:	FHP WIRELESS
EUT Description:	SmartPoint Wireless Router (Indoor Unit)
Test Configuration :	Bench Mount Config EUT, Power Brick, Laptop
Type of Test:	FCC Radiated
Mode of Operation:	Pinging Ethernet

<< Main Sheet

Freq. (MHz)	Reading (dBuV)	AF (dB)	Closs (dB)	Pre-amp (dB)	Level (dBuV/m)	Limit FCC_A	Margin (dB)	Pol (H/V)	Az (Deg)	Height (Meter)	Mark (P/Q/A)
233.33	55.20	11.19	2.43	27.10	41.71	46.40	-4.69	10mV	180.00	1.20	P
166.67	47.00	16.46	2.01	27.36	38.12	43.50	-5.38	10mV	135.00	1.00	P
500.00	44.70	17.97	3.68	28.40	37.95	46.40	-8.45	10mV	180.00	1.00	P
433.33	44.70	16.40	3.39	28.01	36.49	46.40	-9.91	10mV	270.00	1.00	P
300.00	44.50	14.71	2.80	27.06	34.95	46.40	-11.45	10mV	180.00	1.00	P
166.67	39.30	16.46	2.01	27.36	30.42	43.50	-13.08	10mH	270.00	1.00	P
6 Worst Data											

DIGITAL DEVICE RADIATED EMISSIONS – WALL MOUNTING WITH SELF-CONTAINED POWER

COMPLIANCE Certification Services

FCC, VCCI, CISPR, CE, AUSTEL, NZ
UL, CSA, TUV, BSMI, DHHS, NVLAP

561F MONTEREY ROAD, SAN JOSE, CA 95037-9001
PHONE: (408) 463-0885 FAX: (408) 463-0888

Project #: 02U1392
Report #: 020826A2
Date& Time: 08/26/02 3:48 PM
Test Engr: Mike Heckrotte

Company: FHP WIRELESS
EUT Description: SmartPoint Wireless Router (Indoor Unit)
Test Configuration : Wall Mount Config EUT, Power Brick, Laptop
Type of Test: FCC Radiated
Mode of Operation: Pinging Ethernet

<< Main Sheet

Freq. (MHz)	Reading (dBuV)	AF (dB)	Closs (dB)	Pre-amp (dB)	Level (dBuV/m)	Limit FCC_A	Margin (dB)	Pol (H/V)	Az (Deg)	Height (Meter)	Mark (P/Q/A)
233.33	59.00	11.19	2.43	27.10	45.51	46.40	-0.89	10mH	180.00	3.00	P
233.33	58.40	11.19	2.43	27.10	44.91	46.40	-1.49	10mV	45.00	1.20	P
433.33	51.80	16.40	3.39	28.01	43.59	46.40	-2.81	10mV	270.00	1.00	P
433.33	49.20	16.40	3.39	28.01	40.99	46.40	-5.41	10mH	90.00	2.00	P
166.67	46.50	16.46	2.01	27.36	37.62	43.50	-5.88	10mV	270.00	1.00	P
400.00	48.20	15.62	3.25	27.81	39.26	46.40	-7.14	10mH	180.00	2.00	P
6 Worst Data											

DIGITAL DEVICE RADIATED EMISSIONS – BENCHTOP MOUNTING WITH POWER OVER ETHERNET

COMPLIANCE Certification Services

FCC, VCCI, CISPR, CE, AUSTEL, NZ
UL, CSA, TUV, BSMI, DHHS, NVLAP

561F MONTEREY ROAD, SAN JOSE, CA 95037-9001
PHONE: (408) 463-0885 FAX: (408) 463-0888

Project #:	02U1392
Report #:	020827A2
Date& Time:	08/27/02 10:29 AM
Test Engr:	Mike Heckrotte

Company:	FHP WIRELESS
EUT Description:	SmartPoint Wireless Router (Indoor Unit)
Test Configuration :	Bench Mount Config EUT, Power Over Ethernet, Laptop
Type of Test:	FCC Radiated
Mode of Operation:	Pinging Ethernet

<< Main Sheet

Freq. (MHz)	Reading (dBuV)	AF (dB)	Closs (dB)	Pre-amp (dB)	Level (dBuV/m)	Limit FCC_A	Margin (dB)	Pol (H/V)	Az (Deg)	Height (Meter)	Mark (P/Q/A)
966.67	48.30	23.40	5.28	28.26	48.72	49.50	-0.78	10mV	180.00	3.50	P
233.33	58.70	11.19	2.43	27.10	45.21	46.40	-1.19	10mV	270.00	1.00	P
766.67	47.80	21.36	4.62	28.58	45.20	46.40	-1.20	10mV	90.00	1.50	P
233.33	57.20	11.19	2.43	27.10	43.71	46.40	-2.69	10mH	270.00	3.50	P
166.67	45.60	16.46	2.01	27.36	36.72	43.50	-6.78	10mV	270.00	1.00	P
500.00	44.10	17.97	3.68	28.40	37.35	46.40	-9.05	10mV	270.00	1.00	P
6 Worst Data											

DIGITAL DEVICE RADIATED EMISSIONS – WALL MOUNTING WITH POWER OVER ETHERNET

COMPLIANCE Certification Services

FCC, VCCI, CISPR, CE, AUSTEL, NZ
UL, CSA, TUV, BSMI, DHHS, NVLAP

561F MONTEREY ROAD, SAN JOSE, CA 95037-9001
PHONE: (408) 463-0885 FAX: (408) 463-0888

Project #:	02U1392
Report #:	020827A1
Date& Time:	08/27/02 8:42 AM
Test Engr:	Mike Heckrotte
Company:	FHP WIRELESS
EUT Description:	SmartPoint Wireless Router (Indoor Unit)
Test Configuration :	Wall Mount Config Eut, Power Over Ethernet, Laptop
Type of Test:	FCC Radiated
Mode of Operation:	Pinging Ethernet

<< Main Sheet

Freq. (MHz)	Reading (dBuV)	AF (dB)	Closs (dB)	Pre-amp (dB)	Level (dBuV/m)	Limit FCC A	Margin (dB)	Pol (H/V)	Az (Deg)	Height (Meter)	Mark (P/Q/A)
966.67	48.00	23.40	5.28	28.26	48.42	49.50	-1.08	10mV	0.00	3.00	P
766.67	47.50	21.36	4.62	28.58	44.90	46.40	-1.50	10mV	45.00	1.50	P
233.33	53.70	11.19	2.43	27.10	40.21	46.40	-6.19	10mV	90.00	1.00	P
400.00	47.40	15.62	3.25	27.81	38.46	46.40	-7.94	10mH	180.00	2.00	P
166.67	44.00	16.46	2.01	27.36	35.12	43.50	-8.38	10mV	90.00	1.00	P
500.00	43.60	17.97	3.68	28.40	36.85	46.40	-9.55	10mV	180.00	1.00	P
6 Worst Data											

8.8. POWER LINE CONDUCTED EMISSIONS

TEST SETUP

The EUT is placed on a wooden table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane on the floor. The laptop was used to set the EUT to continuously transmit ethernet packets and then the laptop was reconnected to the EUT to receive the ethernet packets.

TEST PROCEDURE

The resolution bandwidth is set to 9 kHz for both peak detection and quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

No non-compliance noted:

Self-Contained Power

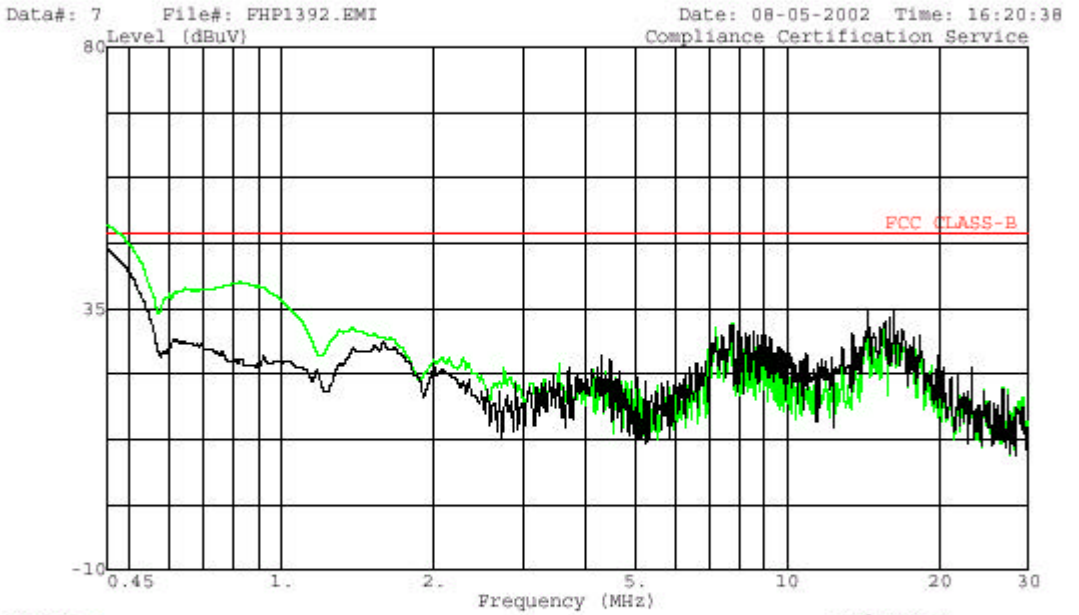
Line	Frequency (MHz)	Detection	Voltage (dBuV)	Limit (dBuV)	Margin dB
1	0.450	QP	42.8	48	-5.2
2	0.450	Peak	45.3	48	-2.7
1	7.79	Peak	32.3	48	-15.7
1	14.45	Peak	32.8	48	-15.2
2	14.45	Peak	34.7	48	-13.3
2	16.25	Peak	34.8	48	-13.2

Power Over Ethernet

Line	Frequency (MHz)	Detection	Voltage (dBuV)	Limit (dBuV)	Margin dB
2	0.694	Peak	43.5	48	-4.5
1	0.699	Peak	43.7	48	-4.3
1	1.03	Peak	44.0	48	-4.0
2	1.03	Peak	43.2	48	-5.7
1	1.56	Peak	44.4	48	-3.6
2	1.56	Peak	43.0	48	-5.0

CONDUCTED EMISSIONS WITH SELF-CONTAINED POWER

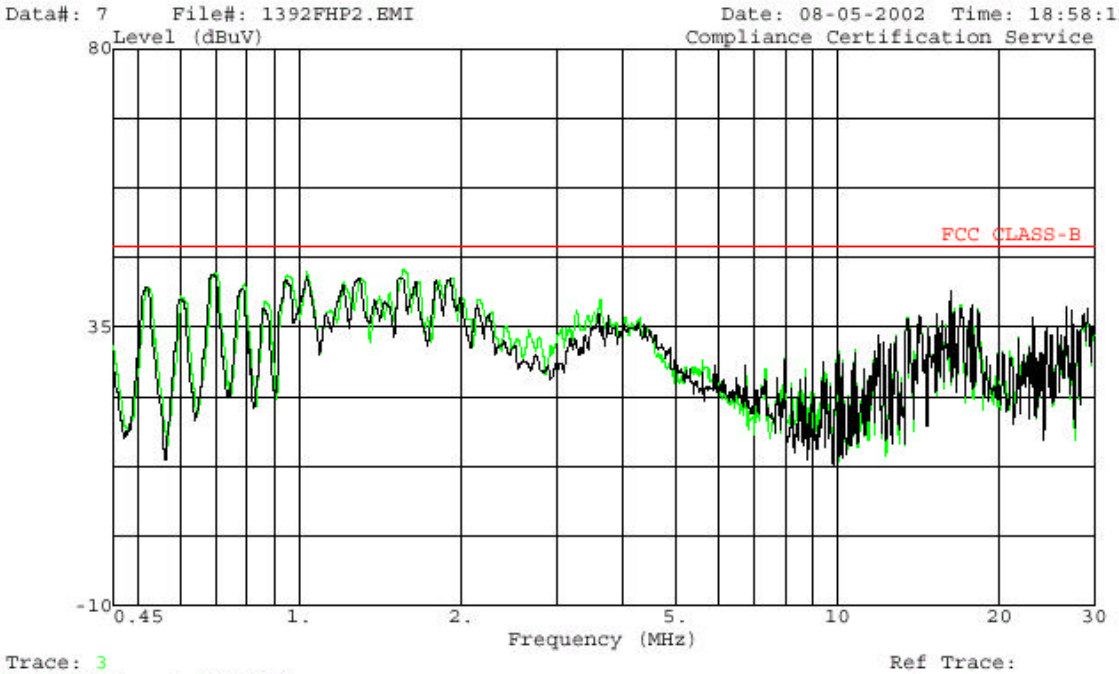
COMPLIANCE Engineering Services, Inc.
561F Monterey Road,
San Jose, CA 95037 USA
Tel: (408) 463-0885
Fax: (408) 463-0888



Trace: 3 Ref Trace:
Project # : 02U1392
Test Engineer: Mike Heckrotte
Company : FHP Wireless
EUT : 2.4 GHz Wireless Mesh Router
: Model : SmartPoint
Test Config : EUT, Laptop
Type of Test : FCC 15.247
Mode of Op. : TX, Pinging Ethernet
: PK: L1(Green), L2(Black)
: 115VAC, 60Hz

CONDUCTED EMISSIONS WITH POWER OVER ETHERNET

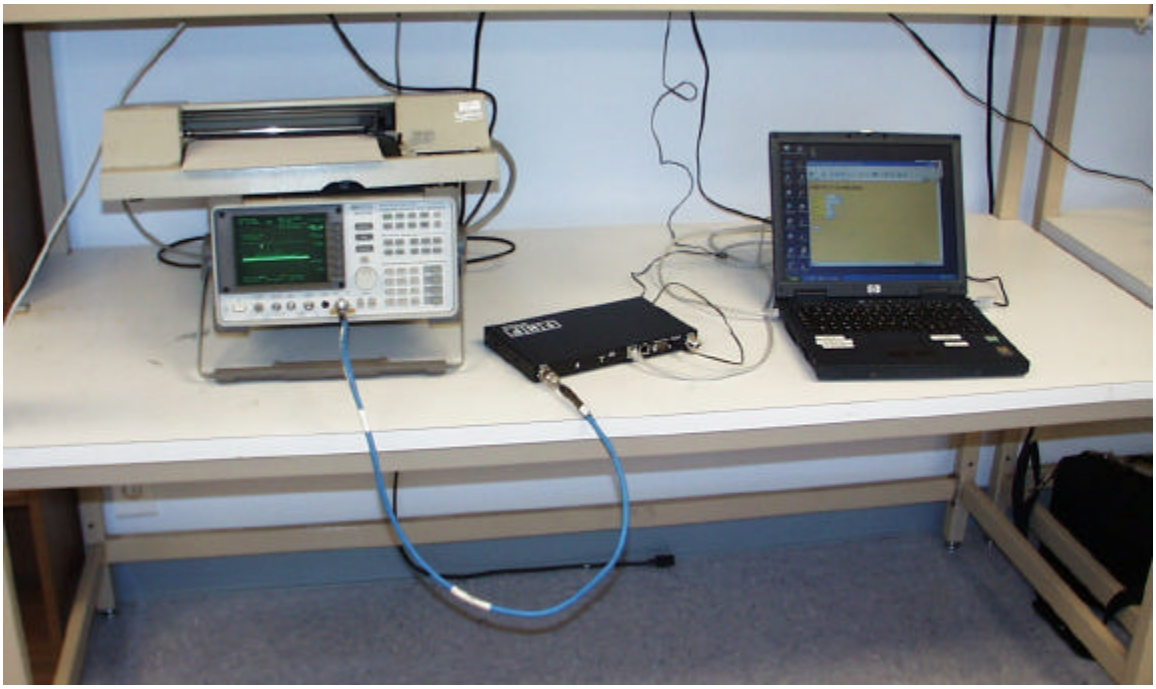
561F Monterey Road,
San Jose, CA 95037 USA
Tel: (408) 463-0885
Fax: (408) 463-0888



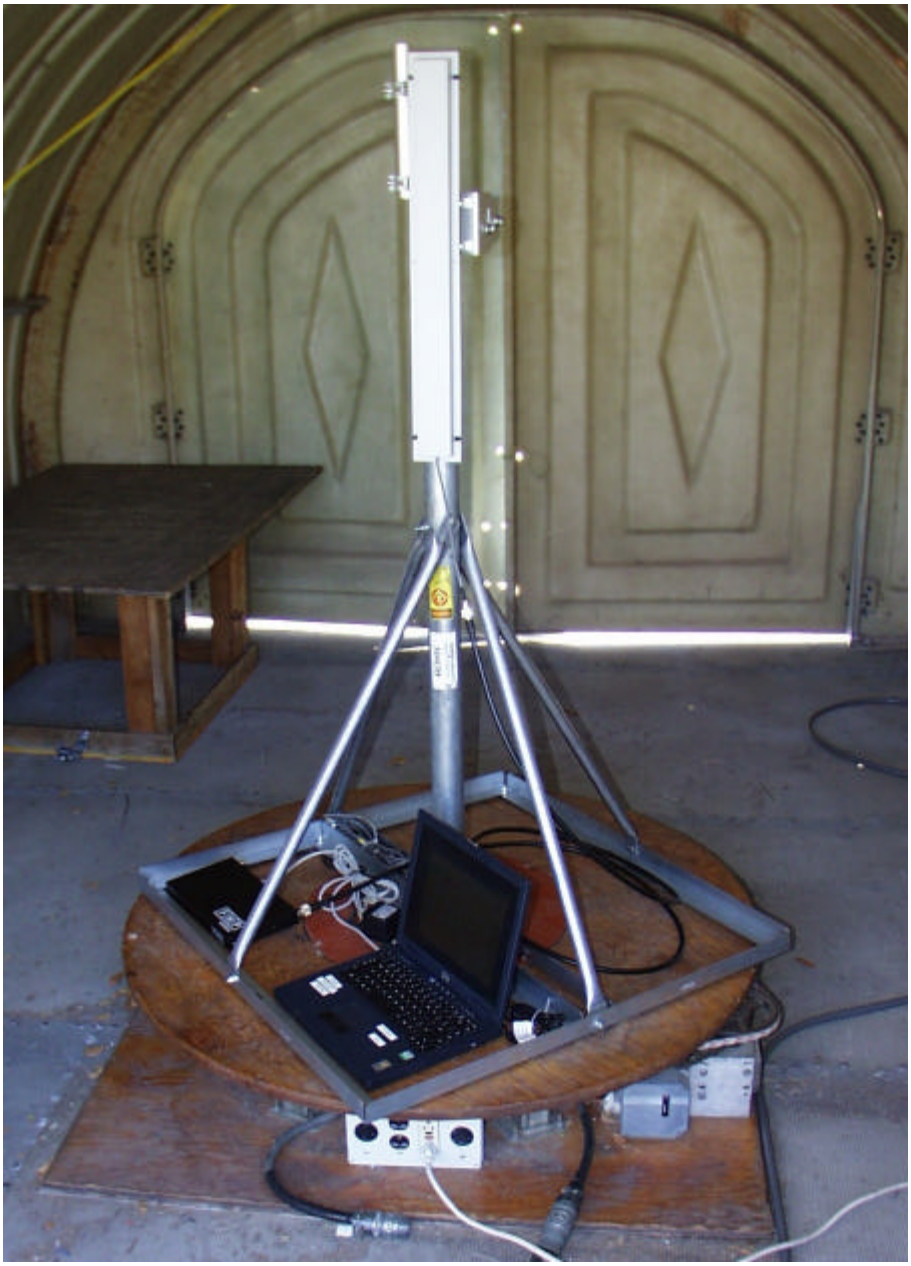
Trace: 3 Ref Trace:
Project # : 02U1392
Test Engineer: Mike Heckrotte
Company : FHP Wireless
EUT : 2.4 GHz Wireless Mesh Router
: Model : SmartPoint
Test Config : EUT, Ethernet Power Supply, Laptop
Type of Test : FCC 15.247
Mode of Op. : TX, Pinging Ethernet
: PK: L2(Black), L1(Green)
: 115VAC, 60Hz

8.9. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP



TRANSMITTER RADIATED RF MEASUREMENT SETUP WITH PATCH ANTENNA



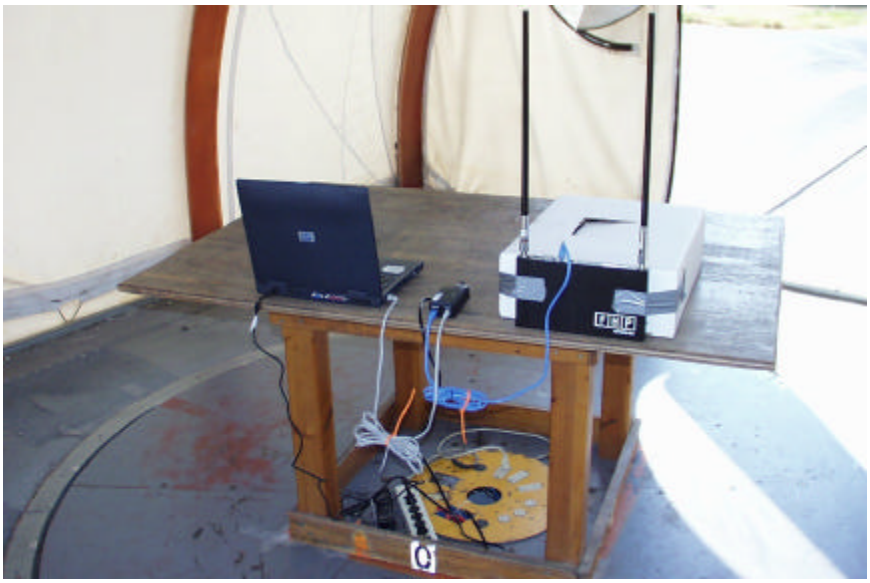
TRANSMITTER RADIATED RF MEASUREMENT SETUP WITH OMNI ANTENNAS

DIGITAL DEVICE RADIATED EMISSIONS MEASUREMENT SETUP FOR BENCHTOP MOUNTING WITH SELF-CONTAINED POWER

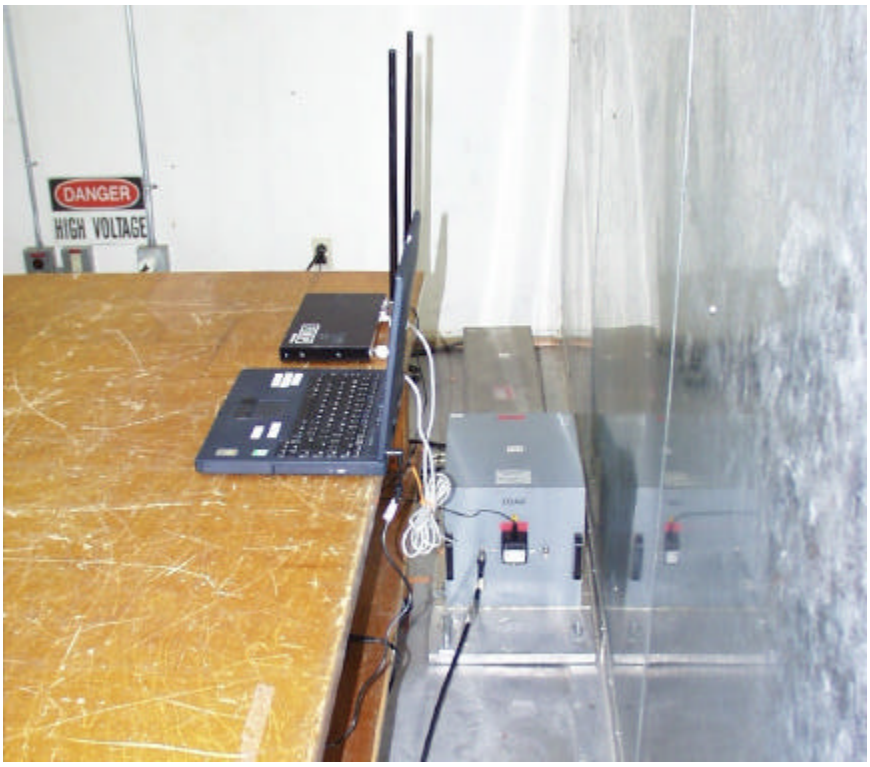
DIGITAL DEVICE RADIATED EMISSIONS MEASUREMENT SETUP FOR WALL MOUNTING WITH SELF-CONTAINED POWER

DIGITAL DEVICE RADIATED EMISSIONS MEASUREMENT SETUP FOR BENCHTOP MOUNTING WITH POWER OVER ETHERNET

DIGITAL DEVICE RADIATED EMISSIONS MEASUREMENT SETUP FOR WALL MOUNTING WITH POWER OVER ETHERNET



POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP FOR SELF-CONTAINED POWER



POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP FOR POWER OVER ETHERNET

END OF REPORT