FCC CFR47 PART 15 CERTIFICATION

TEST REPORT

FOR

BLUETOOTH PROTOCOL ANALYZER

MODEL: BPA105

FCC ID: EZWBPA105

REPORT NUMBER: 02U1135-2

ISSUE DATE: MARCH 7, 2002

Prepared for
TEKTRONIX
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USA

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TABLE OF CONTENT

1. TEST RESULT CERTIFICATION

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EUT DESCRIPTION: BLUETOOTH PROTOCOL ANALYZER

MODEL NAME: BPA105

DATE TESTED: JANUARY 25 – MARCH 28, 2002

TYPE OF EQUIPMENT	INTENTIONAL RADIATOR
EQUIPMENT TYPE	2.4GHz TRANSCEIVER
MEASUREMENT PROCEDURE	ANSI 63.4 / 1992, TIA/EIA 603
PROCEDURE	CERTIFICATION
FCC RULE	CFR 47 PART 15 Subpart C

Compliance Certification Services, Inc. tested the above equipment for compliance with the requirement set forth in CFR 47, PART 15 Subpart 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:

MIKE HECKROTTE
CHIEF EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

Tested By:

KERWIN CORPUZ
ASSOCIATE EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. EUT DESCRIPTION

The Bluetooth Protocol Analyzer is a Frequency Hopping Spread Spectrum Wireless Transceiver that operates on the 2400 – 2483.5 MHz band. Using the Bluetooth Protocol Analyzer you can connect to and monitor the activity of a Bluetooth piconet and log data containing all of the baseband packets transmitted between the participating Bluetooth devices. There are two antennas in the unit, for both transmit and receive diversity. One is a PCB antenna with 2.52 dBi gain and the other is a Patch antenna with 2.17 dBi gain.

3. TEST METHODOLOGY

Both 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 and 2.1057.

4. TEST FACILITY

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.

5. ACCREDITATION AND LISTING

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))

5.1. Laboratory 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	200065-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	1300
Japan	VCCI	CISPR 22 Two OATS and one conducted Site	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	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	ELA-171
Taiwan	BSMI	CNS 13438	SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	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

6. CALIBRATION AND UNCERTAINTY

6.1. 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.

6.2. 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.

6.3. Test and Measurement Equipment

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

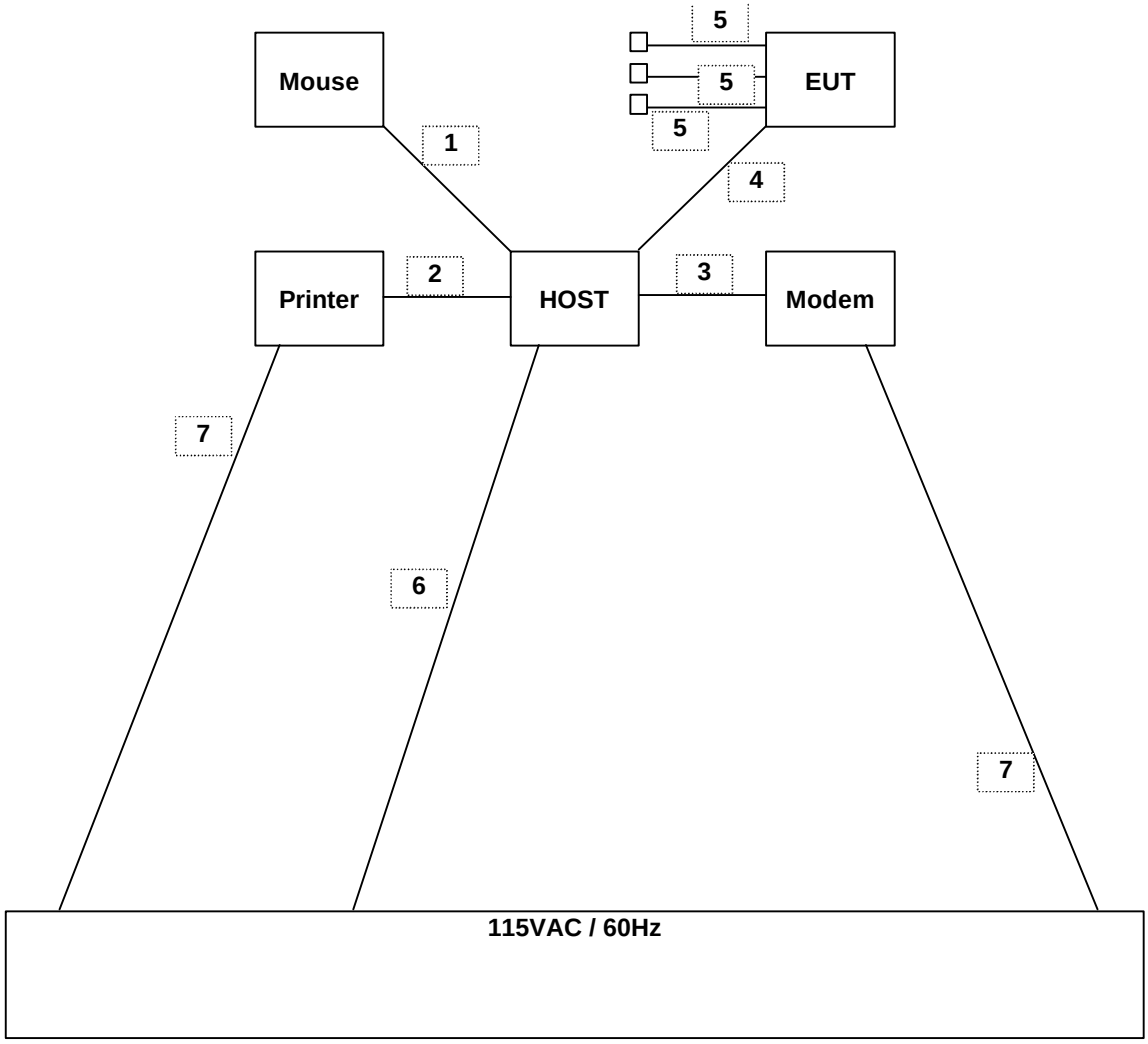
TEST AND MEASUREMENT EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due Date
Spectrum Analyzer	HP	8566B	3014A06685	6/28/02
Spectrum Display	HP	85662A	3026A19146	6/28/02
Quasi-Peak Detector	HP	85650A	3145A01654	6/28/02
Preamplifier	HP	8447D	2944A06589	8/10/02
Bilog Antenna	Chase	CBL6112B	2586	8/2/02
Line Filter	Lindgren	LMF-3489	497	N.C.R.
LISN	Fisher Custom Communication	LISN-50/250-25-2	2023	8/2/02
EMI Test Receiver	Rohde & Schwarz	ESHS 20	827129/006	4/2/02
Preamplifier (1 - 26.5GHz)	MITEQ	NSP2600-44	646456	4/12/02
Horn Antenna (1 - 18GHz)	EMCO	3115	6739	1/31/03
Horn Antenna (18 - 26GHz)	Antenna Research Associates	MWH 1826/B	1013	7/26/02
Harmonic Mixer (18-26.5GHz)	HP	11970K	3003A03109	9/23/02
Microwave Amplifier	HP	11975A	2517A01067	8/23/02
High Pass Filter (4.57GHz)	FSY Microwave	FM-4570-9SS	003	N.C.R.

7. SUPPORT EQUIPMENT / EUT SETUP

The following peripheral support equipment was utilized to operate the equipment under test:
* Was use for ITE devices minimum cofiguration reqiurement:

PERIPHERAL SUPPORT EQUIPMENT LIST				
Device Type	Manufacturer	Model	Serial Number	FCC ID
PC Laptop	COMPAQ	ARMADA 1573DM	3J89BZW6W6E1	DoC
* Mouse	ACER	90.AB362.003	80241954	EMJMUSJQ
* Modem	ACEEX	1414	9013537	IFAXDM1414
* Printer	HP	2225C+	2511S41679	BS46XU2225C

The following setup was used to operate the equipment under test:



SETUP BELOW 1 GHz TEST

SETUP ABOVE 1 GHz TEST

I/O CABLES

TEST I / O CABLES								
Cable No	I/O Port	# of I/O Port	Connector Type	Type of Cable	Cable Length	Data Traffic	Bundled	Remark
1	Mouse	1	PS/2	Drain-Wire	1.7m	Yes	No	N/A
2	Parallel	1	DB25	Shielded	2m	No	Yes	N/A
3	Serial	1	DB9	Shielded	1.5m	No	No	N/A
4	USB	1	USB	Shielded	1m	Yes	No	N/A
5	In/Out	3	Coaxial/BNC	Shielded	1m	No	Yes	Terminated with 50 ohm
6	AC	1	US 115V	Un-shielded	1.8m	No	Yes	Bundled during LC test
7	AC	1	US 115V	Un-shielded	2m	No	No	N/A

8. APPLICABLE RULES AND BRIEF TEST RESULT

§15.247 (b) (1) - POWER OUTPUT

(b) The maximum peak output power of the intentional radiator shall not exceed the following:
(1) For frequency hopping systems operating in the 2400-2483.5 MHz or 5725-5850 MHz band, and all direct sequence systems: 1 watt.

Spec limit: As specified above, 1W maximum.
Test result: No non-compliance noted.

Channel @ DH1 operation	*Frequency (MHz)*	*Output Power (watts)*
1	*2402*	*0.0388 (15.89 dBm)*
39	*2441*	*0.0463 (16.66 dBm)*
79	*2480*	*0.0583 (17.66 dBm)*

§15.247 (a) (1) – HOPPING FREQUENCY SEPERATION

(1) Frequency hopping systems shall have hopping channel carrier frequencies seperated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Spec limit: >968 kHz
Test result: No non-compliance noted.

Limit	*Measured Separation*
>968 kHz	*1 MHz*

§15.247 (a) (1) (ii) – NUMBER OF HOPPING FREQUENCIES

(ii) Frequency hopping systems operating in the 2400 – 2483.5 MHz and 5725 – 5850 MHz bands shall use at least 75 hopping frequencies.

Spec limit: >75 hopping frequencies.
Test result: No non-compliance noted.

Limit	*Measured Hopping Frequencies*
>75	*79*

§15.247 (a) (1) (ii) - BANDWIDTH LIMITATION

(a) (1) (ii) The maximum 20 dB bandwidth of the hopping channel is 1 MHz.

Spec limit: < 1 MHz.
Test result: No non-compliance noted.

Channel @ DH5 operation	*Frequency (MHz)*	*Bandwidth(MHz)*
1	*2402*	*0.968*
39	*2441*	*0.960*
79	*2480*	*0.960*

§15.247 (a) (1) (ii) – TIME OF OCCUPANCY

(a) (1) (ii) The average time of occupancy on any frequency shall not be greater than 0.4 seconds within 30 second period.

Time of Occupancy = (number of pulses in 30 sec period) * (duration of a single pulse)

Spec Limit: <0.4sec
Test result: No non-compliance noted.

Limit	*Number of Pulses in 30 sec*	*Duration of each pulse*	*Time of occupancy (sec)*
<0.4 sec	*52*	*2.85 msec*	*0.1482*

§15.247 (c) – SPURIOUS EMISSION

(c) 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)).

Test result: No non-compliance noted. See section 9.5 and 9.7.

§15.247 (d) and§15.247 (f) - 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.
(f) The direct sequence operating of the hydrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragragh (d) of this section.

Spec limit: < 8dBm.
Test result: No non-compliance noted.

Channel @ DH5 operation	*Frequency (MHz)*	*Results (dBm)*
1	*2402*	*3.45*
39	*2441*	*3.87*
79	*2480*	*5.09*

§15.247 (f) - PROCESSING GAIN

(f) Hybrid systems that employ a combination of both direct sequence and frequency hopping modulation techniques shall achieve a processing gain of at least 17 dB from the combined techniques. The processing gain represents the improvement to the received signal-to-noise ratio, after filtering to the information bandwidth, from the spreading/despreading function.

Spec limit: >17 dBm.
Test result: No non-compliance noted.

§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.

Spec limit: As specified above,.
Test result: No non-compliance noted. See section 9.7 Radiated Emission.

§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 15.207

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

Spec limit: As specified above.
Test result: No non-compliance noted.

§15.209- RADIATED EMISSION LIMITS; GENERAL REQUIREMENTS

(a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

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

FCC PART 15.209

MEASURING DISTANCE OF 3 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Spec limit: As specified above.
Test result: No non-compliance noted.

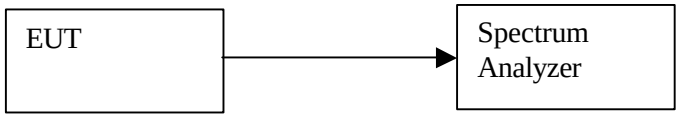
9. TEST SETUP, PROCEDURE AND RESULT

9.1. PEAK POWER OUTPUT

TEST SETUP

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
Above 1000	☒ Peak	☒ 1 MHz	☒ 1 MHz



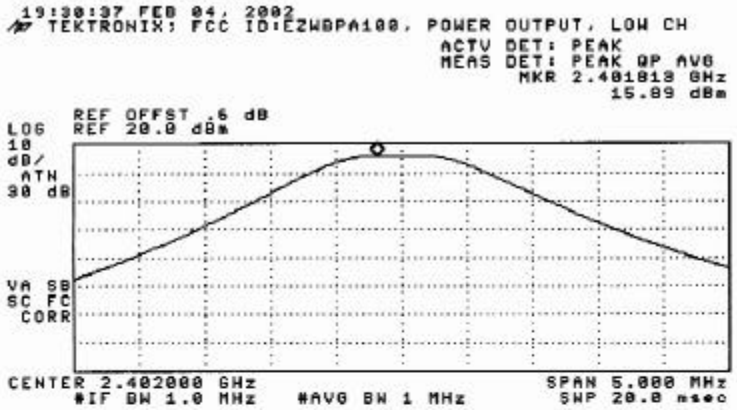
TEST PROCEDURE

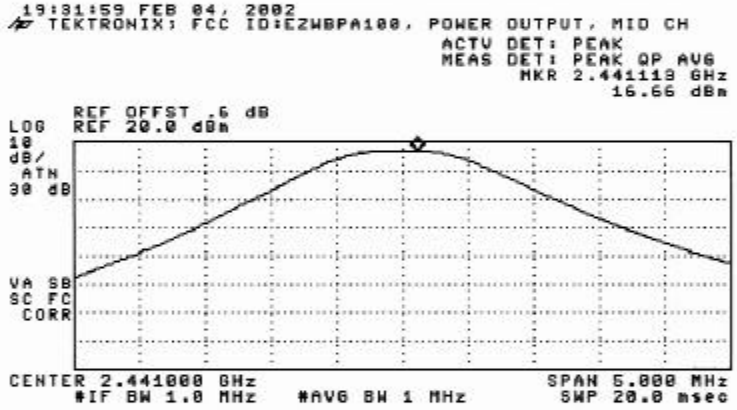
The EUT is configured on a test bench as shown above in a continuously transmitting / receiving mode. While the transceiver started, the analyzer MAX HOLD function is used to capture the emissions and a plot is made with the marker at the peak emission.

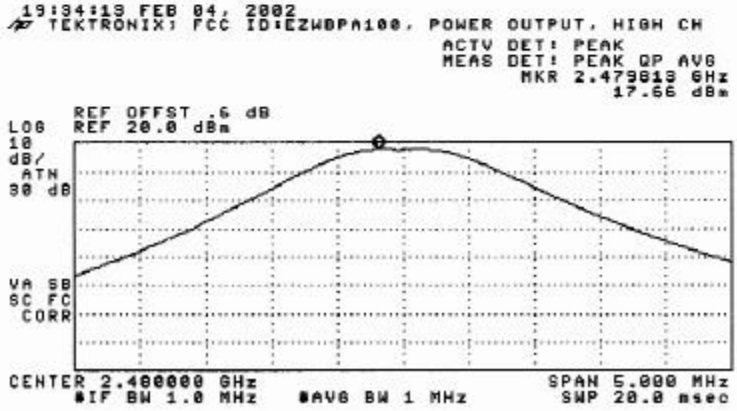
Channel @ operation DH1	*Frequency (MHz)*	*EUT reading (dBm)*
1	***2402***	***15.89***
39	***2441***	***16.66***
79	***2480***	***17.66***

See plot below:

POWER OUTPUT PLOT





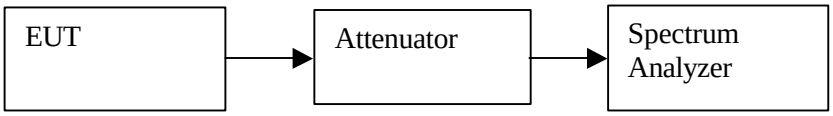


9.2. HOPPING FREQUENCY SEPARATION

TEST SETUP

Detector Function Setting of Test Receiver

Center Frequency (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
2441	☒ Peak	☒ 100 kHz	☒ 100 kHz

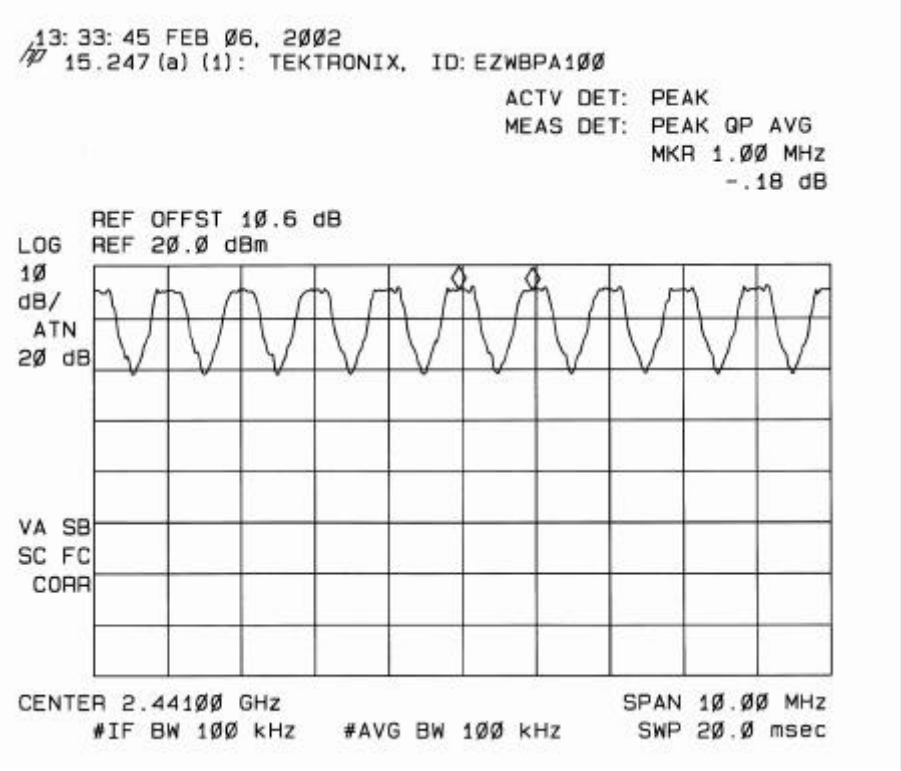


TEST PROCEDURE

Connect the Eut's antenna port to the Spectrum Analyzer's input port.
Set frequency span to at least 10 MHz. Let EUT to complete the pseudorandom hopping frequency then set marker delta to measure the seperation between each hopping frequency.

RESULT

No non-compliance noted. See plot below.

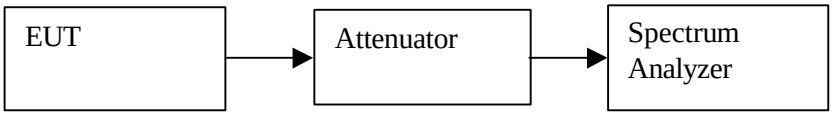


9.3. NUMBER OF HOPPING FREQUENCIES

TEST SETUP

Detector Function Setting of Test Receiver

Center Frequency (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
2441	☒ Peak	☒ 1 MHz	☒ 1 MHz

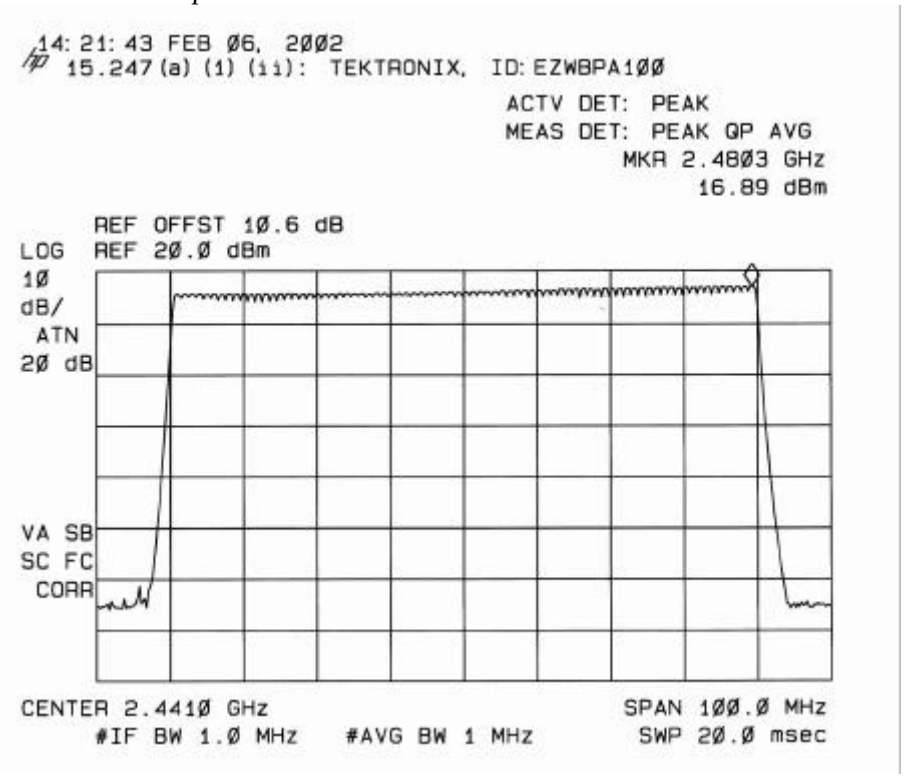


TEST PROCEDURE

Connect the Eut's antenna port to the Spectrum Analyzer's input port.
Set frequency span to at least 100 MHz. Let EUT to complete the pseudorandom hopping frequency then set trace A to maximum hold. Record data by plotting gragh.

RESULT

No non-compliance noted. See plot below.

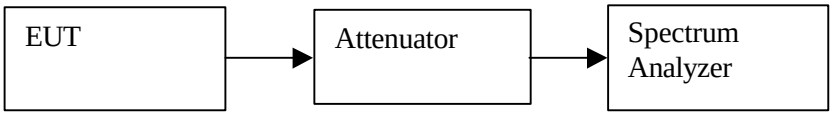


9.4. 20 dB BANDWIDTH MEASUREMENT

TEST SETUP

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
Above 1000	☒ Peak	☒ 10 kHz	☒ 10 kHz



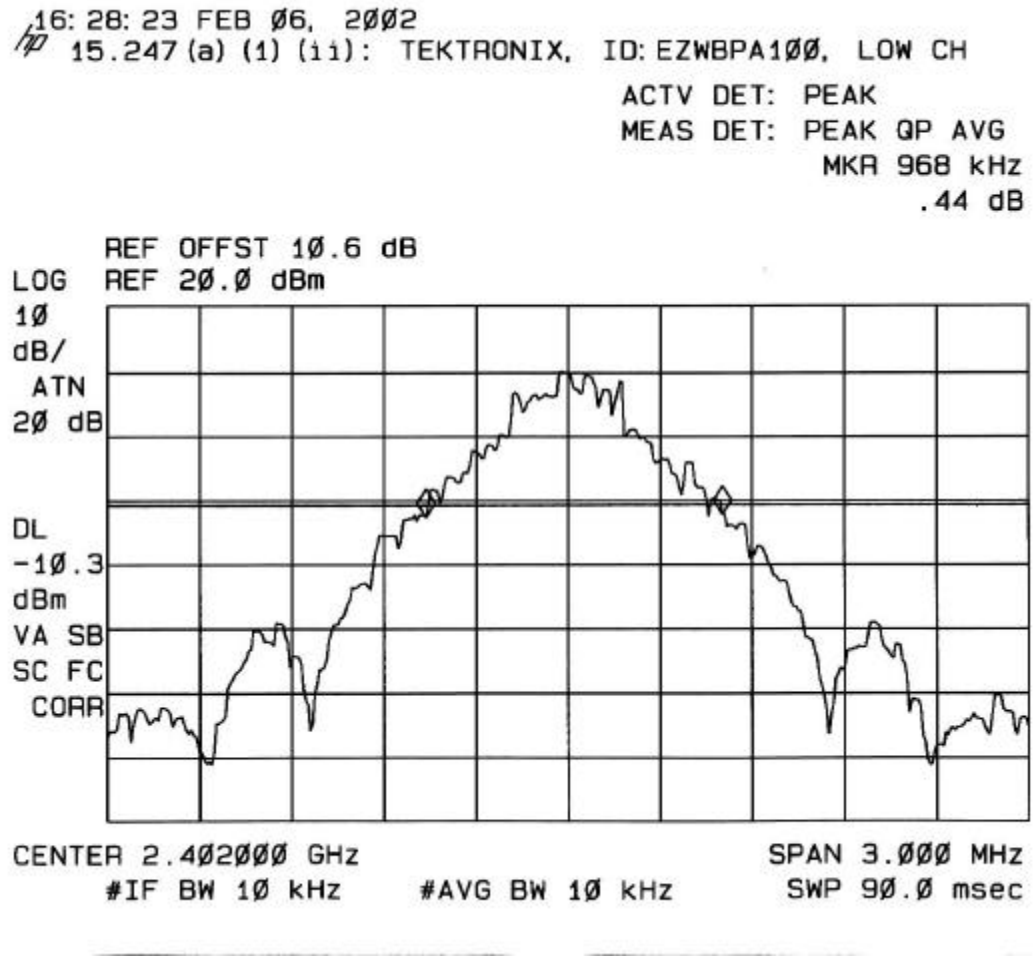
TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 10 kHz RBW and 10 kHz VBW.

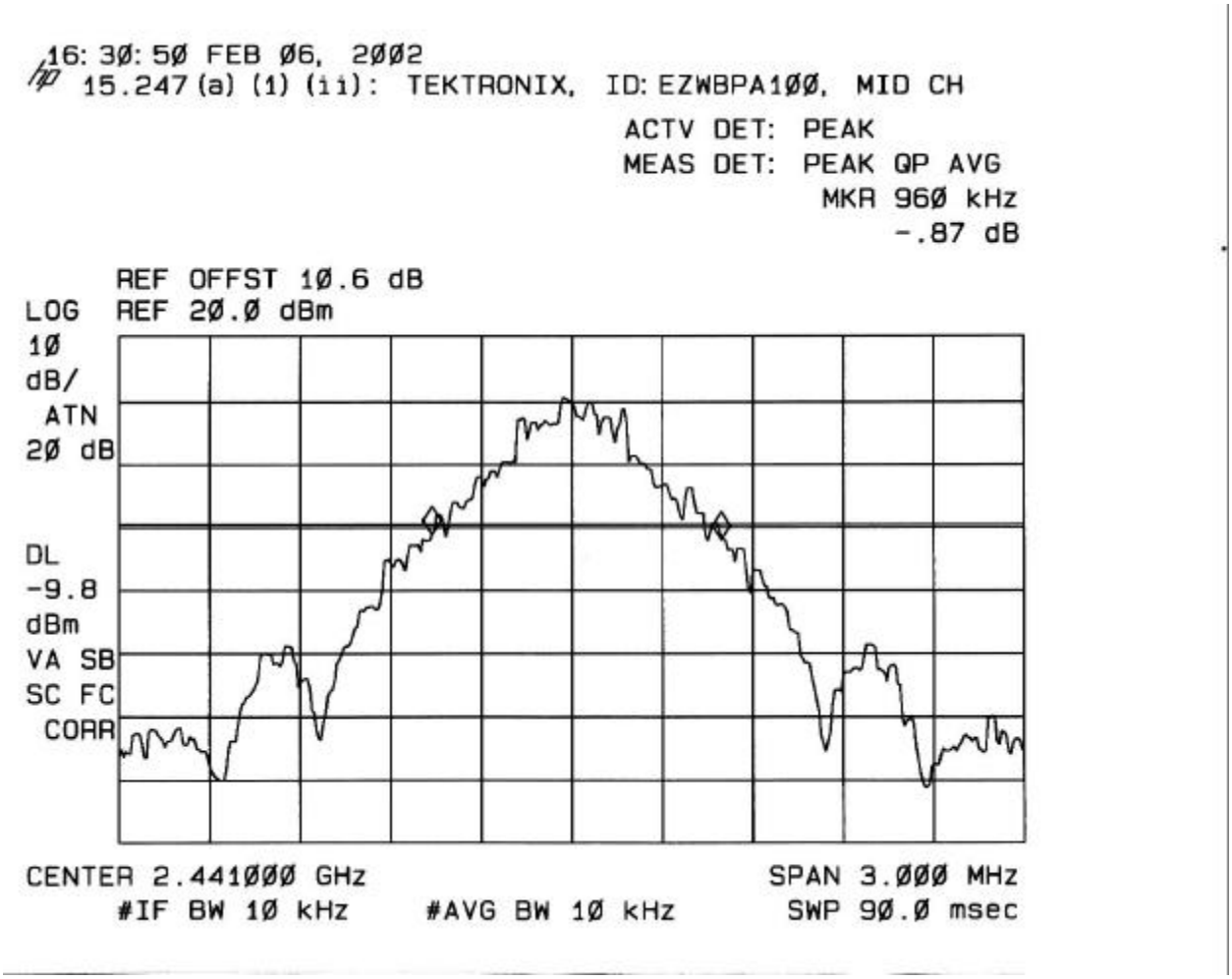
RESULT

No non-compliance noted. See plots below.

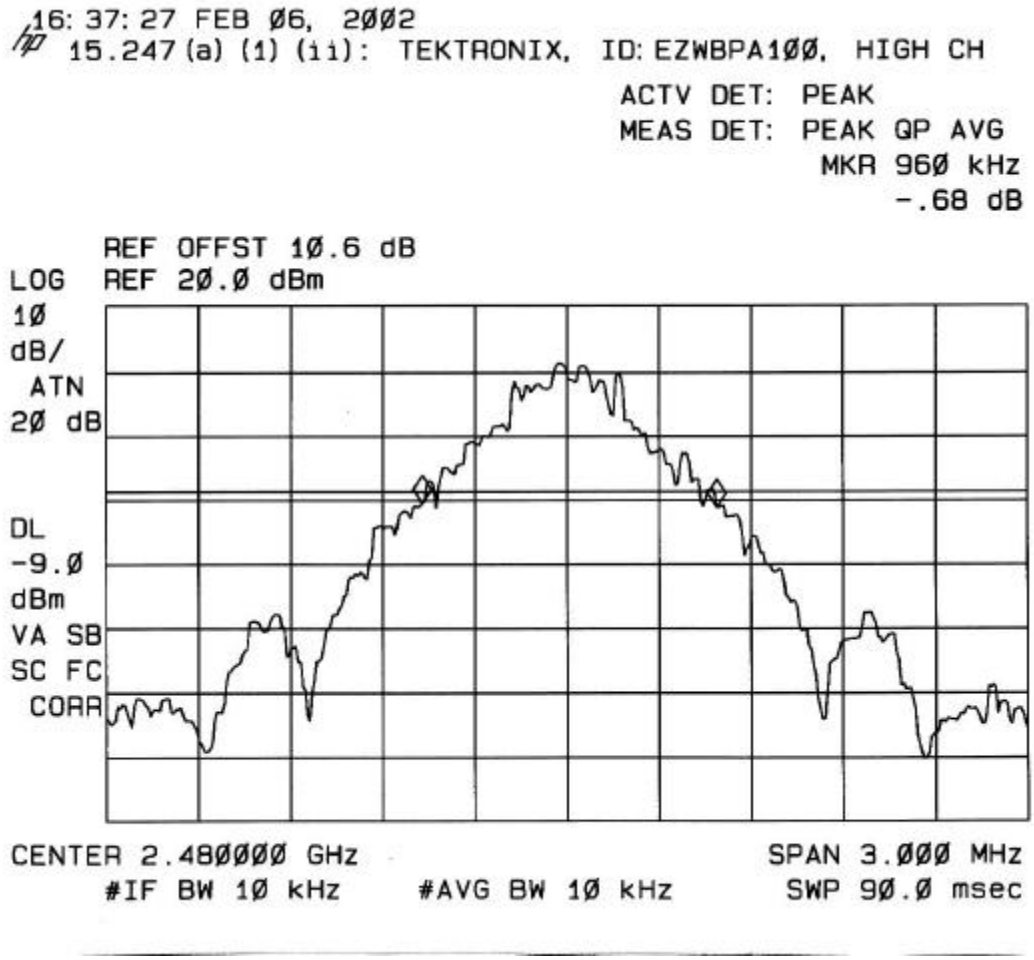
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

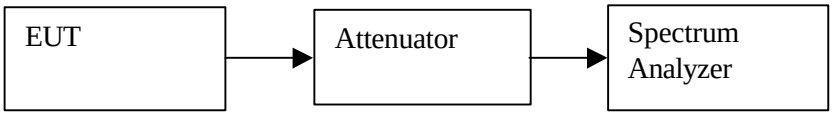


9.5. CONDUCTED SPURIOUS EMISSION

TEST SETUP

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
15 - 25000	☒ Peak	☒ 100 kHz	☒ 100 kHz



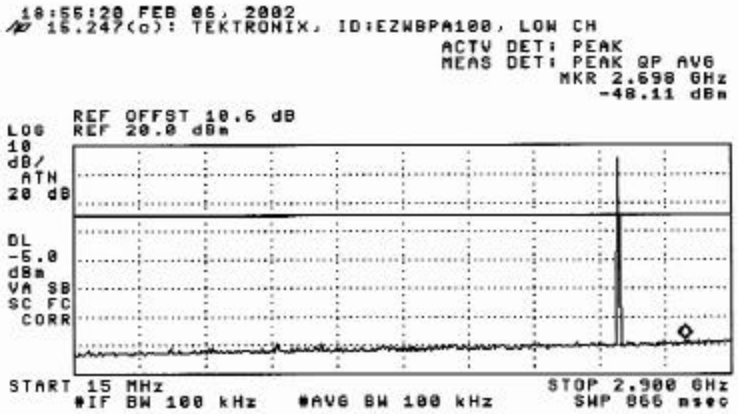
TEST PROCEDURE

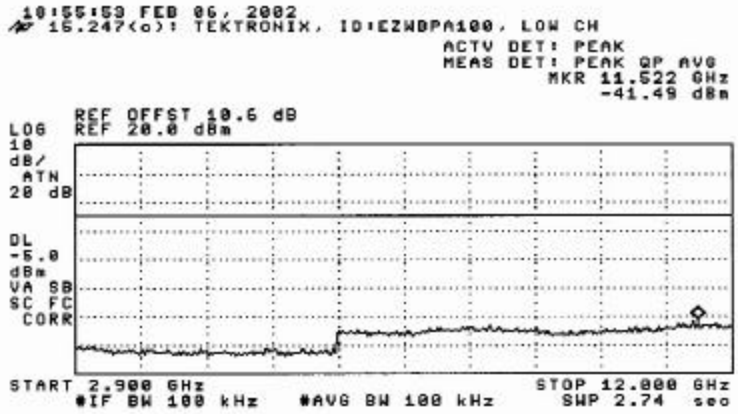
Connect the Eut's antenna port to the Spectrum Analyzer's input port.
Investigate the entire frequency of the carrier frequency, up to the tenth harmonic.

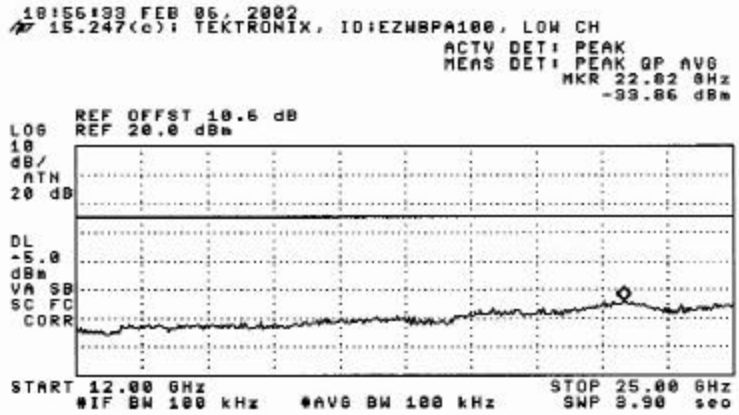
RESULT

No non-compliance noted. See below plots for LOW, MID, HIGH and HOPPING channels.

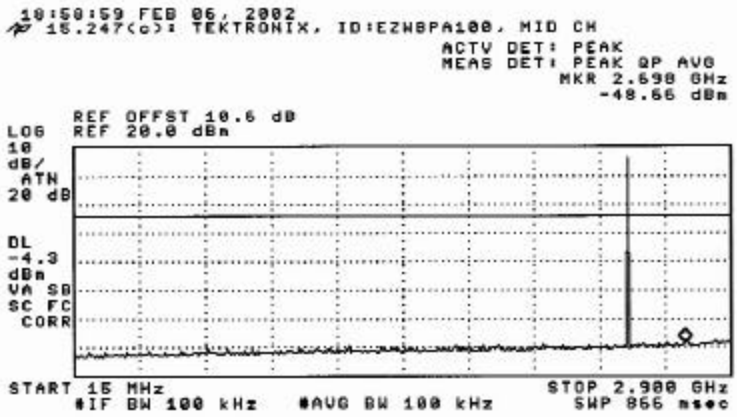
LOW CHANNEL

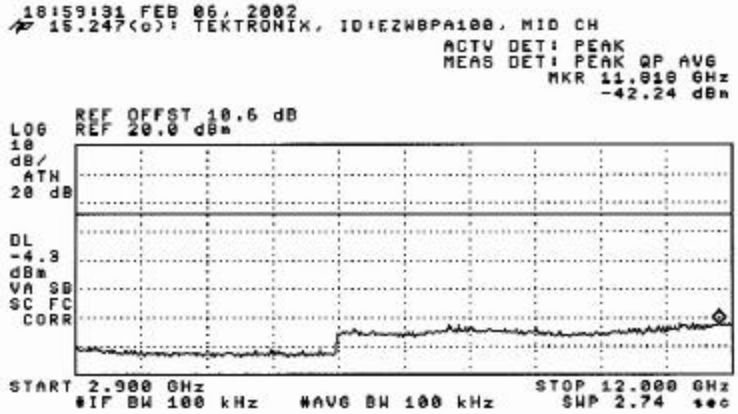


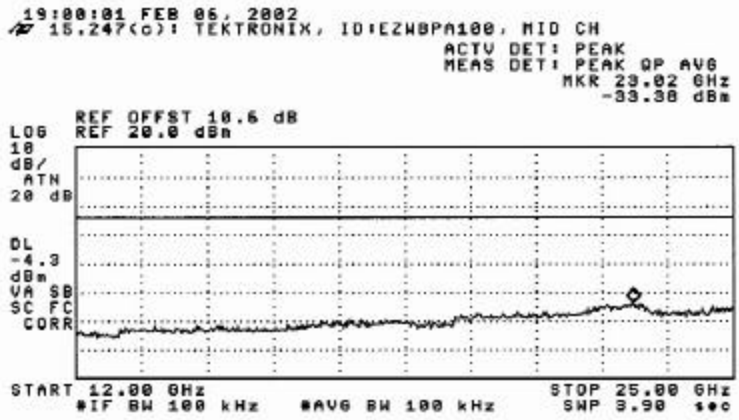




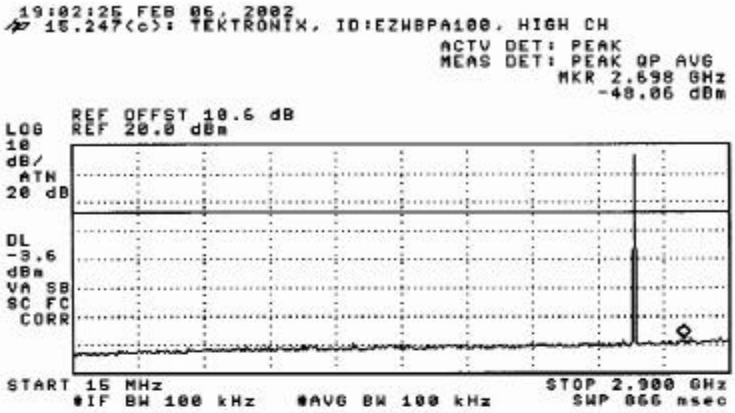
MID CHANNEL

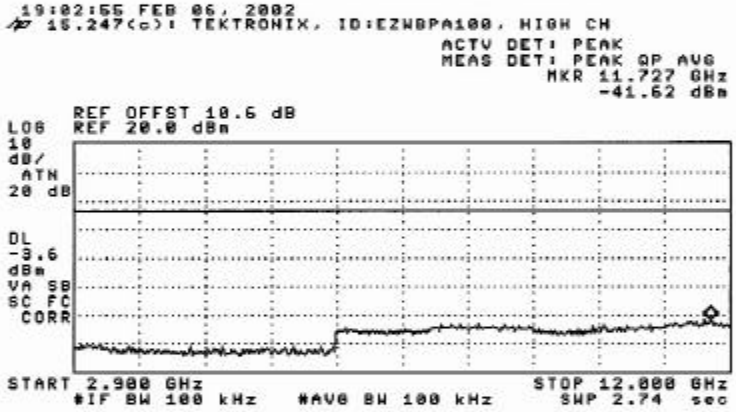


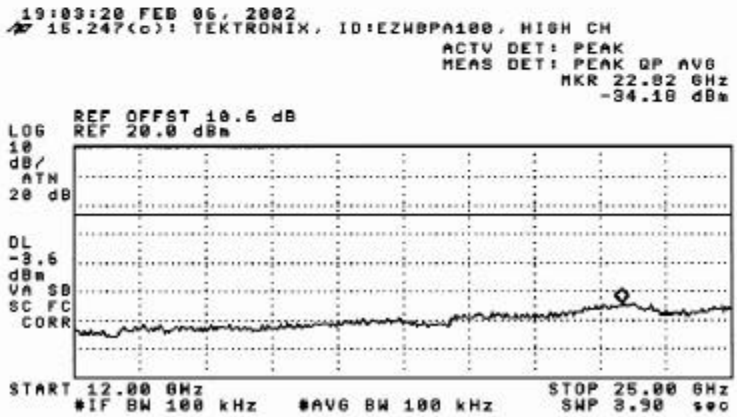




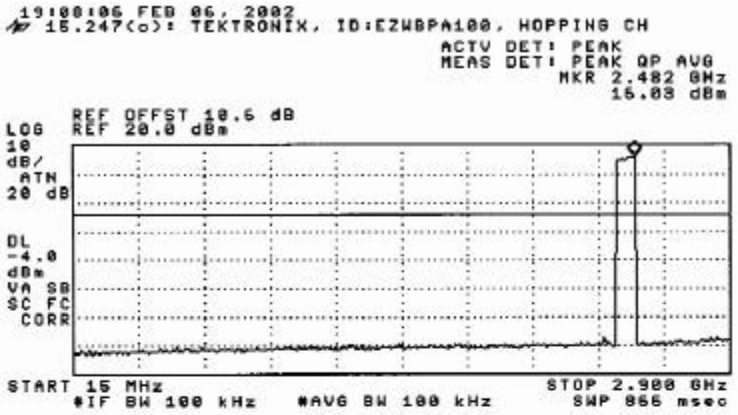
HIGH CHANNEL

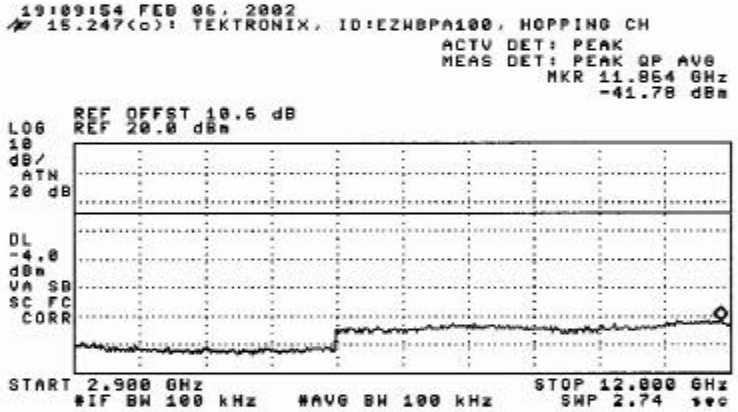


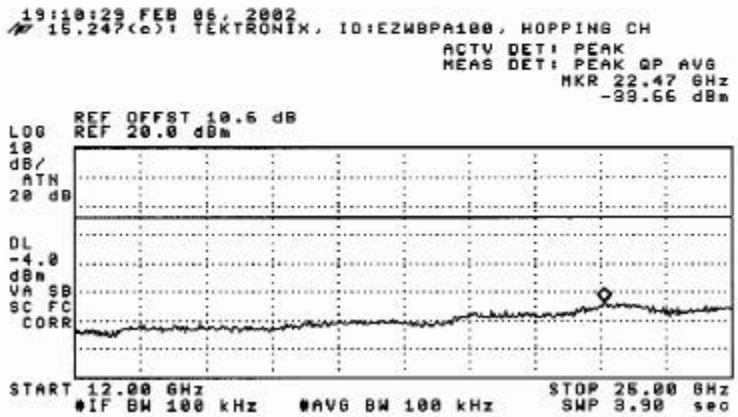




HOPPING CHANNEL





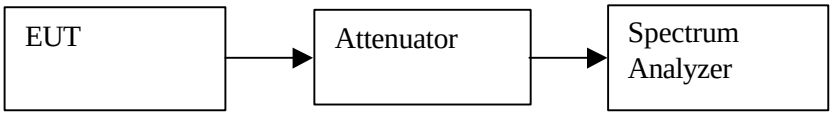


9.6. TIME OF OCCUPANCY

TEST SETUP

Detector Function Setting of Test Receiver

Center Frequency (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
2441	☒ Peak	☒ 1 MHz	☒ 1 MHz



TEST PROCEDURE

1. Set the transmitter to operate in its normal frequency hopping mode.
2. Set the spectrum analyzer CENTER FREQUENCY to one of the hopping channels, preferably near the center of the operating band. Set the SPAN to ZERO SPAN. Set the SWEEP TIME to 20msec. Then measuare the duration of a single pulse.
3. Set and SWEEP TIME to 30 seconds.
4. Run a total of 10 different 30 second sweeps. The maximum time of channel occupancy is determined by the maximum number of transmissions detected in any 30 second period as appropriate, times the duration of each transmission.

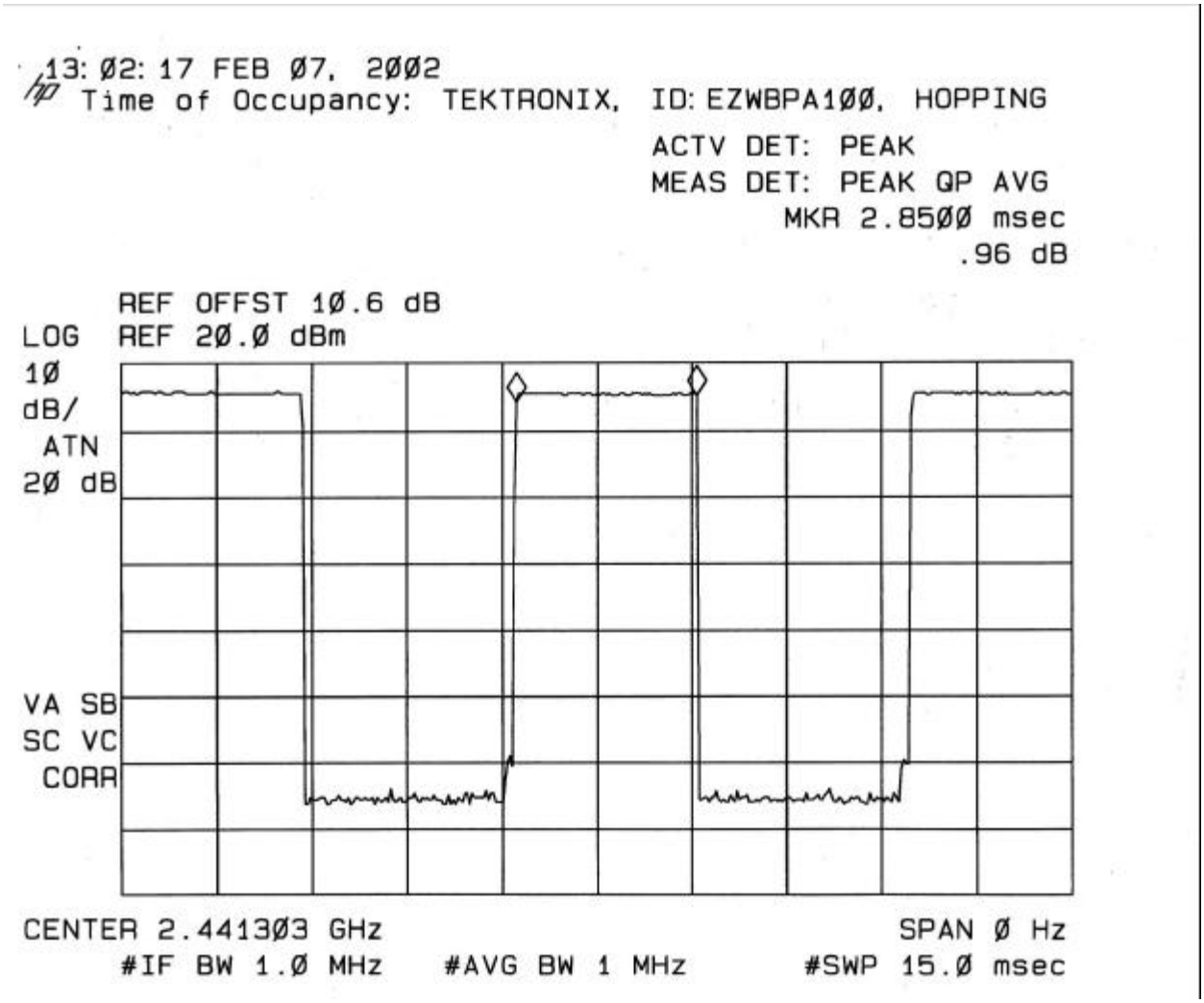
RESULT

No non-compliance noted.

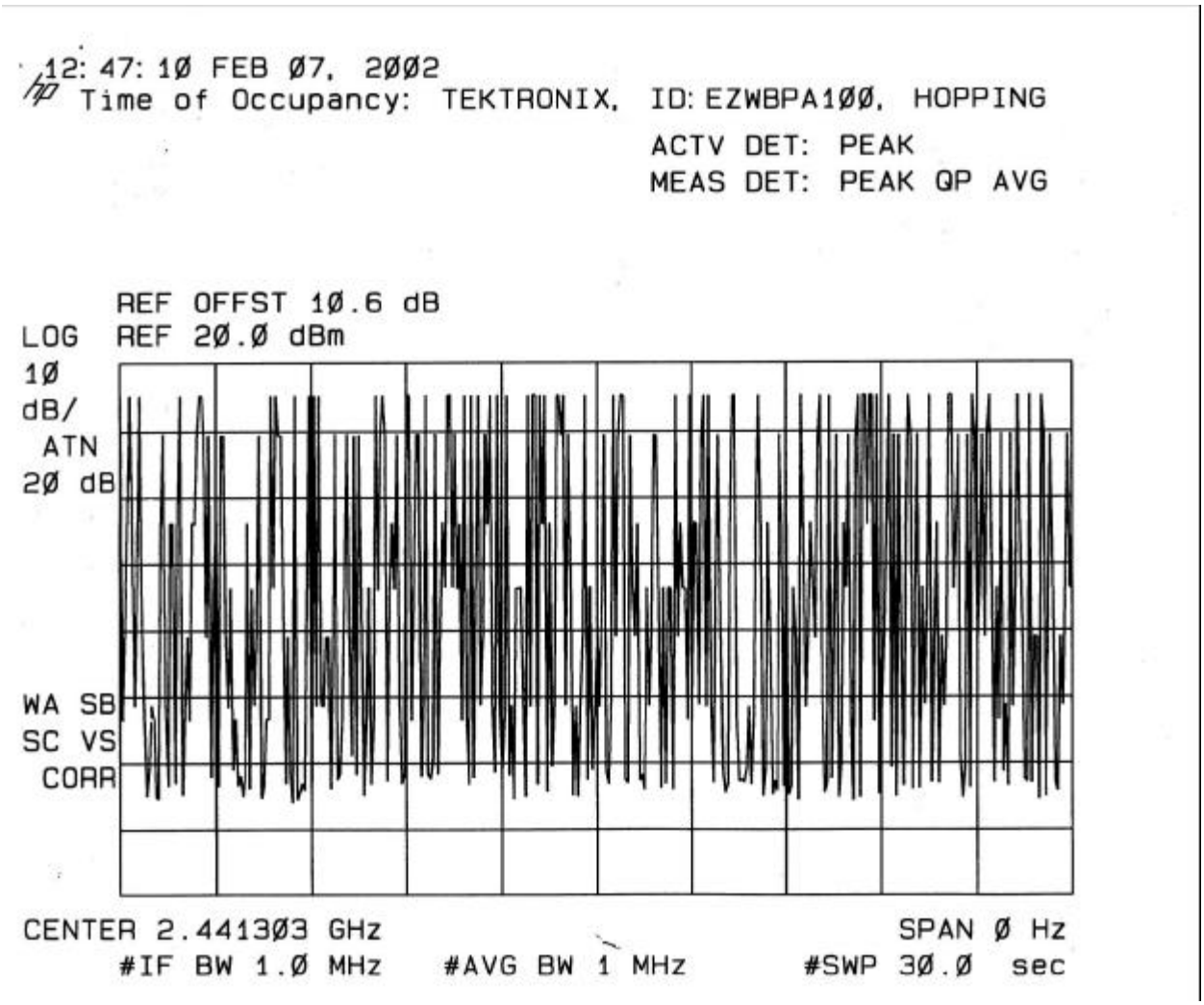
Time of Occupancy = (number of pulses in 30 sec period) * (duration of a single pulse)

Limit	*Number of Pulses in 30 sec*	*Duration of each pulse*	*Time of occupancy (sec)*
<0.4 sec	*52*	*2.85 msec*	*0.1482*

DURATION OF EACH PULSE



NUMBER OF PULSES IN 30 SECONDS

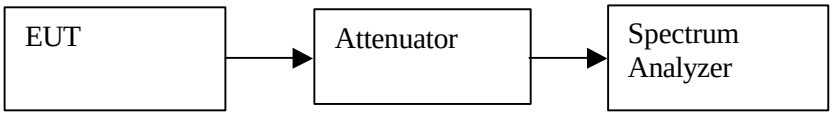


9.7. PEAK POWER SPECTRAL DENSITY

TEST SETUP

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
Above 1000	☒ Peak	☒ 3 kHz	☒ 3 kHz

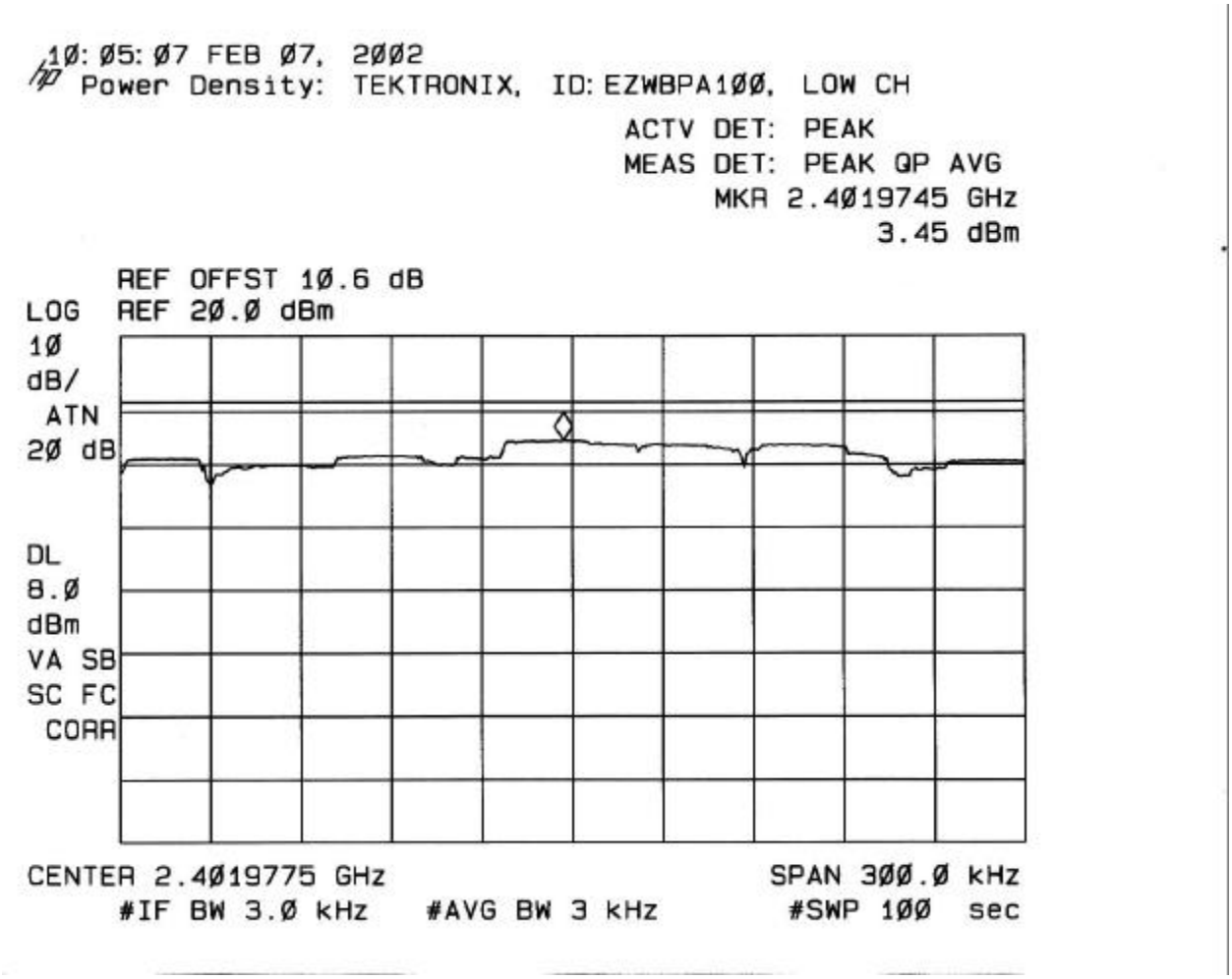


TEST PROCEDURE

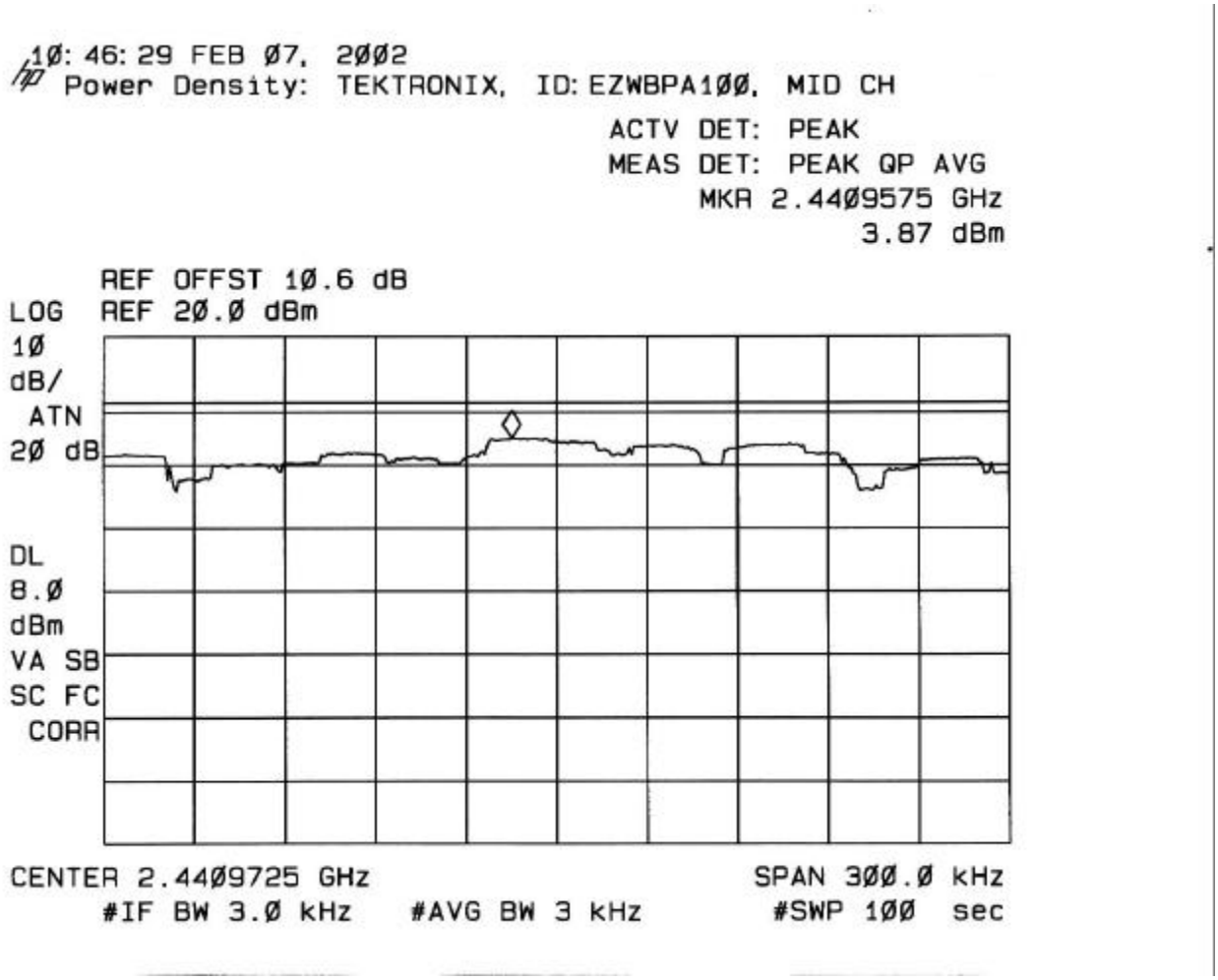
The transmitter output was connected to the spectrum analyzer through an attenuator, the bandwidth of the fundamental frequency was measured with the spectrum analyzer using 3 kHz RBW and 3 kHz VBW, set sweep time=span/3kHz. The power spectral density was measured and recorded.
The sweep time is allowed to be longer than span/3KHz for a full response of the mixer in the spectrum analyzer.

Result:
No non-compliance noted. See plot below.

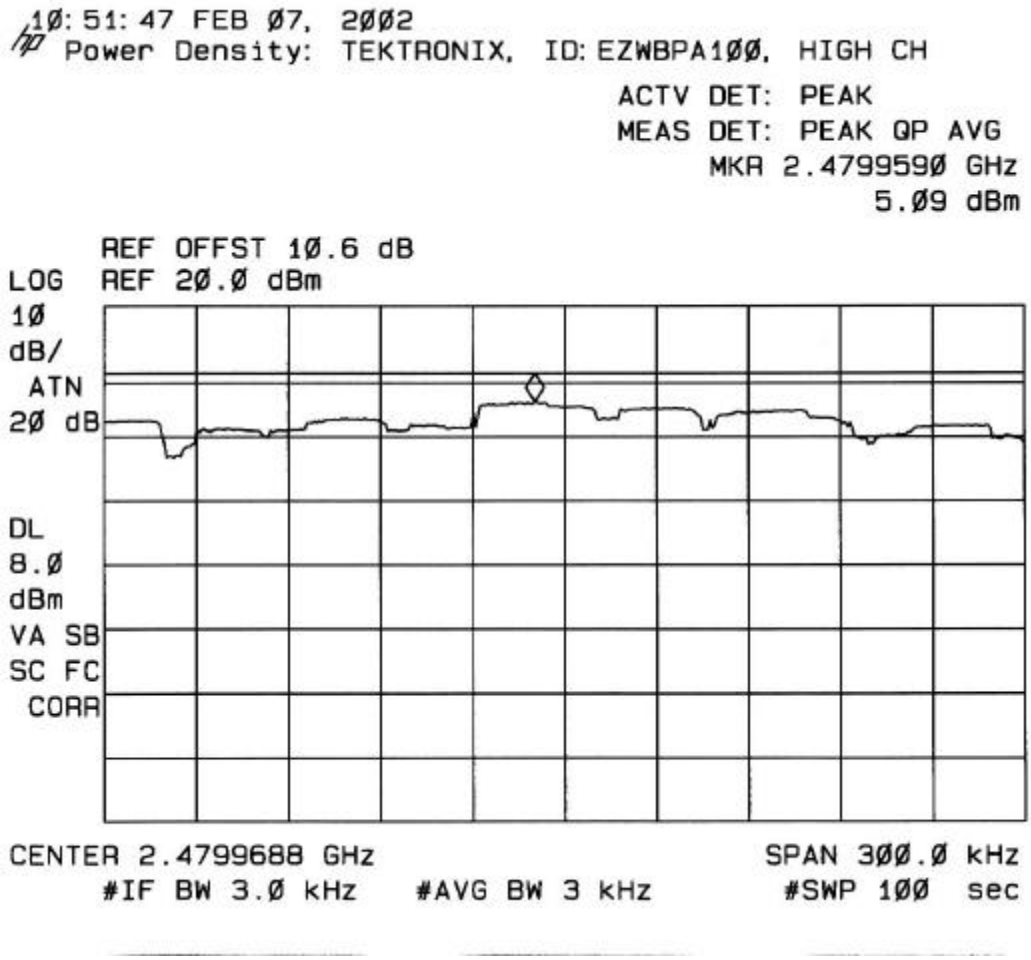
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL



9.5. PROCESSING GAIN

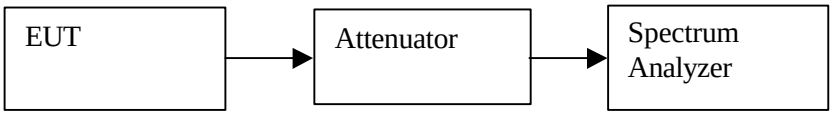
CUSTOMER PROVIDES PROCESSING GAIN. PLEASE SEE ATTACHMENT.

9.6. RESTRICTED BAND EDGE MEASUREMENT

TEST SETUP

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
Above 1000	☒ Peak ☐ Average	☒ 100 KHz ☐ 1 MHz	☒ 100 KHz ☐ 10 Hz



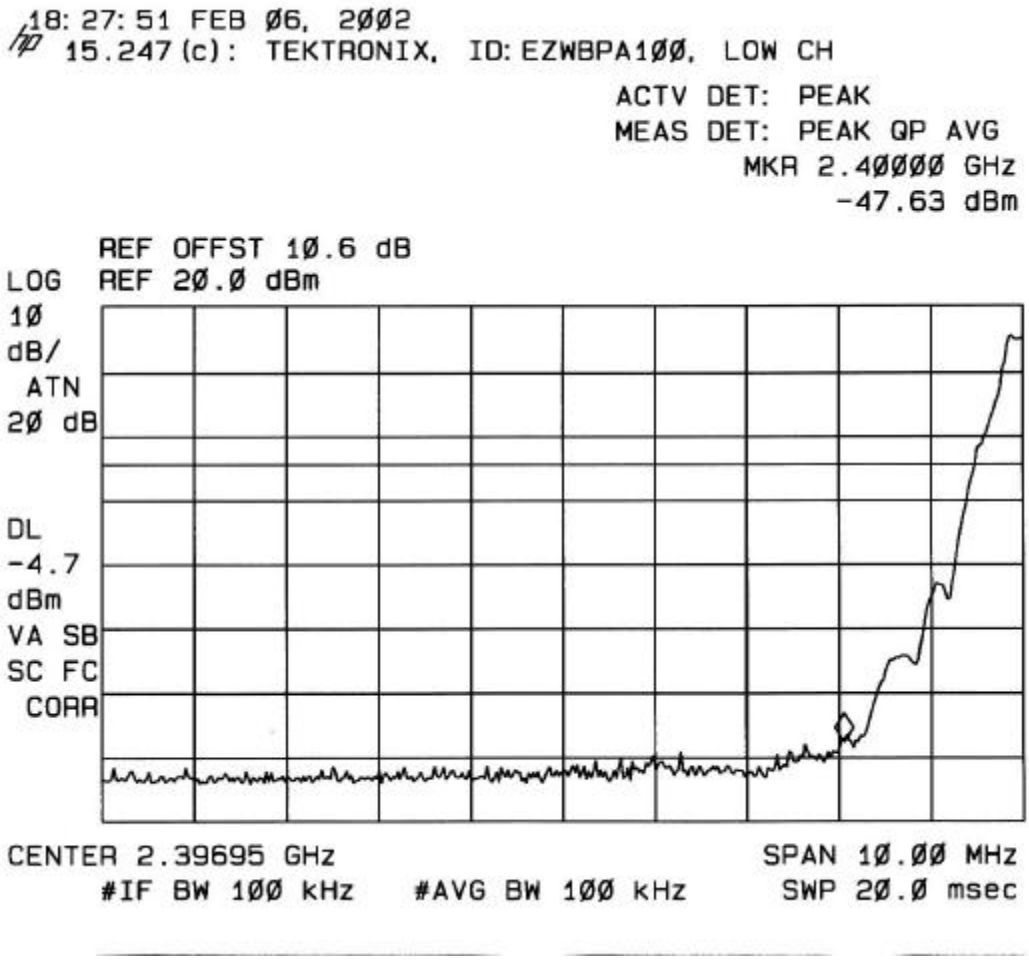
TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator; the lower and upper band edge of the EUT is investigated.
The resolutions and video bandwidth were set to 100kHz.

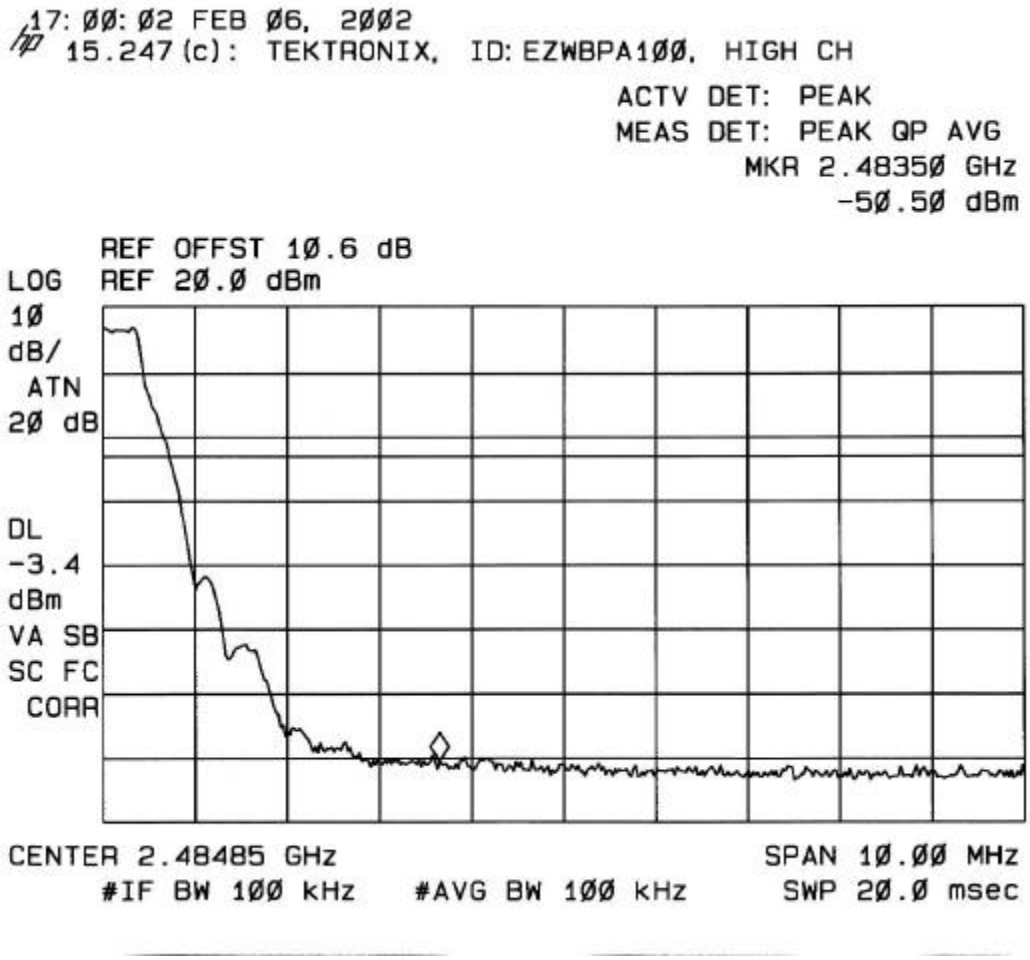
RESULT

No non-compliance noted. See plots below.

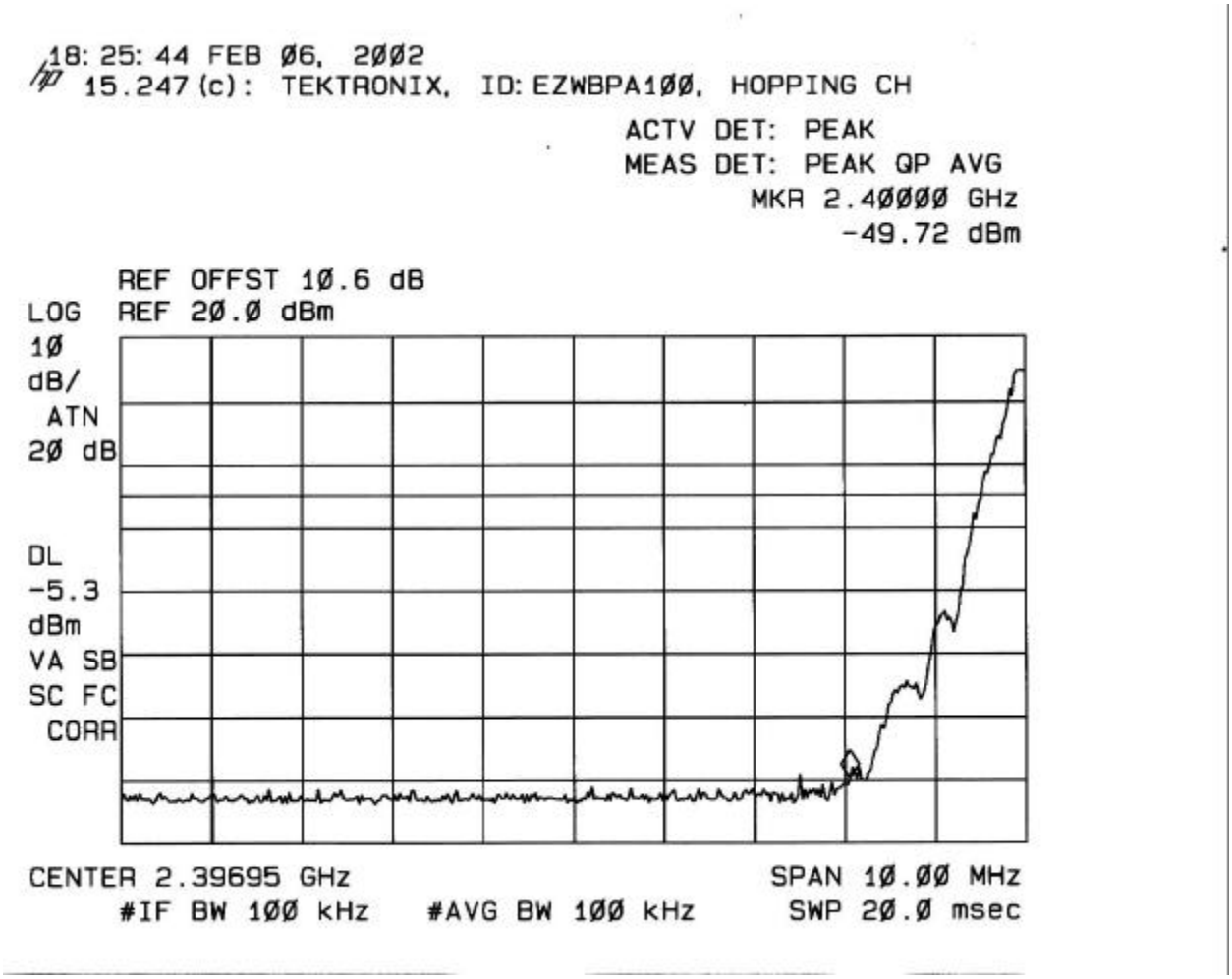
BANDEDGE @ LOW CHANNEL



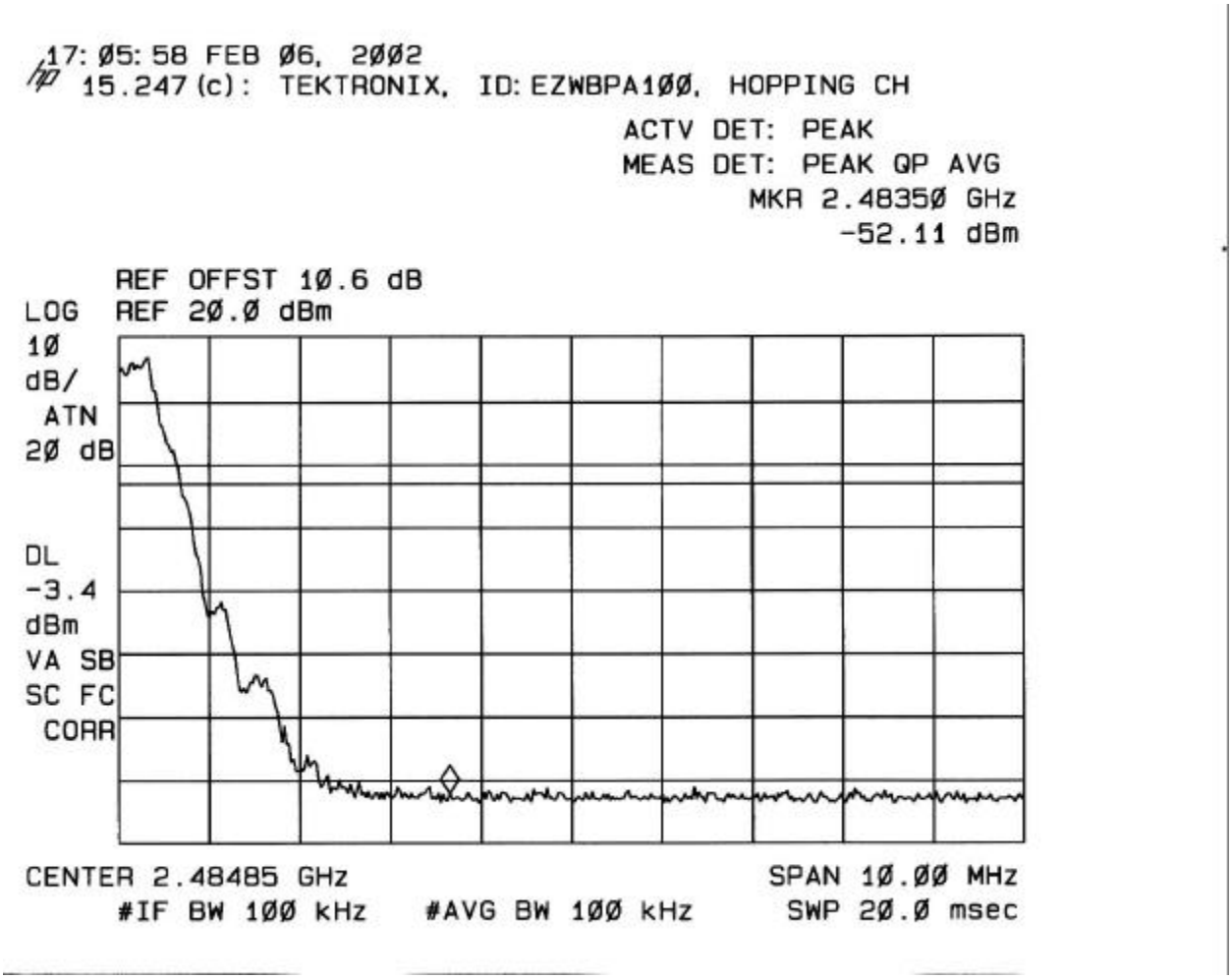
BANDEDGE @ HIGH CHANNEL



BANDEDGE @ HOPPING CHANNEL
MARKER SET TO LOW END



BANDEDGE @ HOPPING CHANNEL
MARKER SET TO HIGH END



9.7. RADIATED EMISSION

9.7.1. RADIATED EMISSION AND RESTRICTED BANDS

TEST SETUP

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	☒ Peak ☒ Quasi Peak	☒ 100 KHz ☒ 1 MHz	☒ 100 KHz ☒ 1 MHz
Above 1000	☒ Peak ☒ Average	☒ 1 MHz ☒ 1 MHz	☒ 1 MHz ☒ 10 Hz

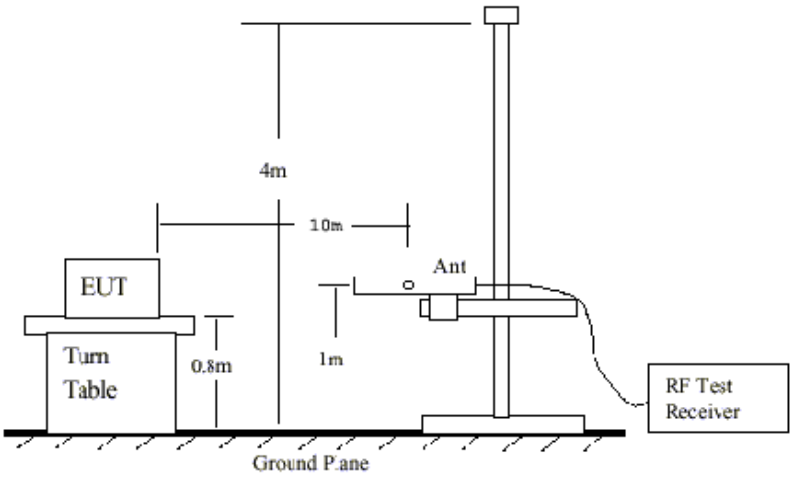


Fig 1: Radiated Emission Measurement 30 to 1000 MHz

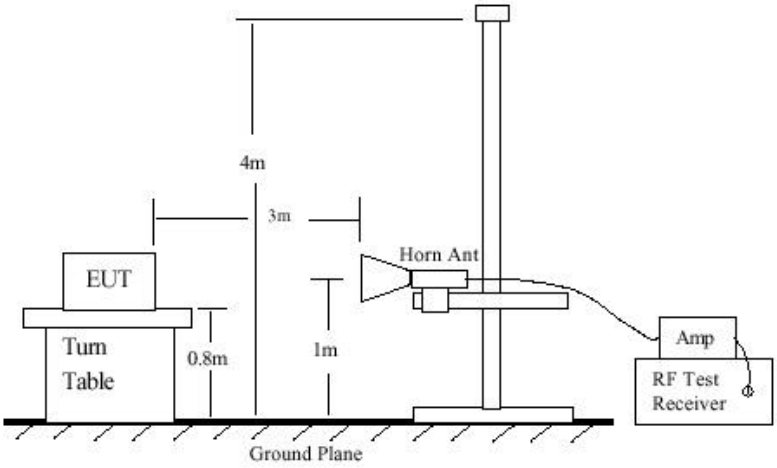


Fig 2: Radiated Emission Above 1000 MHz

TEST PROCEDURE

1. The EUT was placed on the turntable 0.8 meter above ground in 3 meter open area test site.
2. Set the resolution bandwidth to 100KHz in the test receiver and select Peak function to scan the frequency below 1 GHz.
3. Shift the interference-receiving antenna located in antenna tower upwards and downwards between 1 and 4 meters above ground and find out the local peak emission on frequency domain.
4. Locate the interference-receiving antenna at the position where the local peak reach the maximum emission.
5. Rotate the turntable and stop at the angle where the measurement device has maximum reading.
6. Shift the interference-receiving antenna again to detect the maximum emission of the local peak.
7. If the reading of the local peak under Peak function is lower than limit by 6dB, then Quasi Peak detection is not needed and this reading should be recorded. And if it is higher than Peak limit, then the test is fail. Others, switch the receiver to Quasi Peak

function, set the resolution bandwidth to 100kHz and repeat the procedures (3)~(6). If the reading is lower than limit, this reading should be recorded, otherwise, the test is fail.
8. Set the resolution and video bandwidth of the spectrum analyzer to 1MHz and repeat procedures (3)~(6) for frequency band from 1 GHz to 10 times carrier frequency.
9. If the reading for the local peak is lower than the Average limit, no further testing is needed in this local peak and this reading should be recorded. If it is higher than Average limit but lower than Peak limit, then set the resolution bandwidth to 1MHz and video bandwidth to 10Hz. Repeat procedures (3)~(6). If the maximum reading is lower than Average limit, then this reading should be recorded. If it is higher, then the test is fail.

RESULT

No non-compliance noted. See data below.

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 #:	02U1135
Report #:	020121B1
Date& Time:	01/21/02 3:03 PM
Test Engr:	KERWIN CORPUZ
Company:	TEKTRONIX
EUT Description:	Bluetooth Protocol Analyzer (M/N: BPA105)
Test Configuration :	EUT/Laptop/Mouse/Modem/Printer
Type of Test:	FCC CLASS B
Mode of Operation:	TX/RX continuously

<< Main Sheet

Freq. (MHz)	Reading (dBuV)	AF (dB)	Closs (dB)	Pre-amp (dB)	Level (dBuV/m)	Limit FCC_B	Margin (dB)	Pol (H/V)	Az (Deg)	Height (Meter)	Mark (P/Q/A)
304.00	52.70	12.84	3.81	28.84	40.51	46.00	-5.49	3mV	225.00	1.00	P
704.00	44.00	19.33	6.53	29.50	40.36	46.00	-5.64	3mV	180.00	2.40	P
416.00	47.70	16.97	4.67	29.41	39.93	46.00	-6.07	3mH	0.00	2.80	P
640.00	43.80	19.08	6.15	29.64	39.39	46.00	-6.61	3mV	180.00	2.40	P
320.00	51.00	13.36	3.94	28.92	39.37	46.00	-6.63	3mV	225.00	1.00	P
688.00	43.00	19.25	6.44	29.54	39.15	46.00	-6.85	3mV	200.00	2.40	P
6 Worst Data											

03/13/02 FCC Measurement (15.205)
Compliance Certification Services, Morgan Hill Open Field Site B

Tested by:
Jerry Hovey

Equipment for 1-18 GHz
HP8566B Analyzer
Miteq NSP2600-44 Preamp
EMCO 3115 Antenna
Cable: 14.0 feet

Equipment for 18 - 26 GHz
HP8566B Analyzer
HP 11975A Amplifier (LO)
HP 11970K External mixer/antenna
Cable: IF Only (321 MHz)
ARA MWH1826/B Antenna

FCC Measurement

Average Measurements:
1 MHz Resolution Bandwidth
10Hz Video Bandwidth

Peak Measurements:
1MHz Resolution Bandwidth
1MHz Video Bandwidth

Low Channel (2402 MHz)

f GHz	Dist feet	Read Peak dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Peak Lim dBuV/m	Avg Lim dBuV/m	Peak Mar dB	Ave Mar dB	Notes
4.804	3.3	59.3	45.6	33.8	5.3	-41.8	-9.5	1.0	48.1	34.4	74.0	54.0	**-25.9**	**-19.6**	V, Avg Noise Floor
7.206	3.3	59.3	45.6	36.9	6.8	-41.2	-9.5	1.0	53.3	39.6	74.0	54.0	**-20.7**	**-14.4**	V, Avg Noise Floor
9.608	3.3	72.8	52.0	38.5	7.9	-39.3	-9.5	1.0	71.4	50.6	74.0	54.0	**-2.6**	**-3.4**	V
12.010	3.3	72.5	51.8	39.3	8.8	-40.0	-9.5	1.0	72.1	51.4	74.0	54.0	**-1.9**	**-2.6**	V
14.412	3.3	64.2	48.2	41.3	10.0	-43.5	-9.5	1.0	63.5	47.5	74.0	54.0	**-10.5**	**-6.5**	V
16.814	3.3	59.0	44.6	41.0	11.4	-44.1	-9.5	1.0	58.8	44.4	74.0	54.0	**-15.2**	**-9.6**	V
19.216	3.3	59.7	45.6	31.9	12.6	-44.3	-9.5	1.0	51.4	37.3	74.0	54.0	**-22.6**	**-16.7**	Noise Floor
21.618	3.3	59.3	45.6	32.5	13.7	-44.5	-9.5	1.0	52.5	38.8	74.0	54.0	**-21.5**	**-15.2**	Noise Floor
24.020	0.6	45.0	34.6	32.1	2.5	0.0	-24.3	0.0	55.3	44.9	74.0	54.0	**-18.7**	**-9.1**	Noise Floor
4.804	3.3	54.0	58.1	33.8	5.3	-41.8	-9.5	1.0	42.8	46.9	74.0	54.0	**-31.2**	**-7.1**	H
7.206	3.3	54.0	57.2	36.9	6.8	-41.2	-9.5	1.0	48.0	51.2	74.0	54.0	**-26.0**	**-2.8**	H
9.608	3.3	58.6	44.7	38.5	7.9	-39.3	-9.5	1.0	57.2	43.3	74.0	54.0	**-16.8**	**-10.7**	H
12.010	3.3	54.0	39.9	39.3	8.8	-40.0	-9.5	1.0	53.6	39.5	74.0	54.0	**-20.4**	**-14.5**	Noise Floor
14.412	3.3	54.0	39.9	41.3	10.0	-43.5	-9.5	1.0	53.3	39.2	74.0	54.0	**-20.7**	**-14.8**	Noise Floor
16.814	3.3	54.0	39.9	41.0	11.4	-44.1	-9.5	1.0	53.8	39.7	74.0	54.0	**-20.2**	**-14.3**	Noise Floor
19.216	3.3	54.0	39.9	31.9	12.6	-44.3	-9.5	1.0	45.7	31.6	74.0	54.0	**-28.3**	**-22.4**	Noise Floor
21.618	3.3	54.0	39.9	32.5	13.7	-44.5	-9.5	1.0	47.2	33.1	74.0	54.0	**-26.8**	**-20.9**	Noise Floor
24.020	0.6	45.0	34.6	32.1	2.5	0.0	-24.3	0.0	55.3	44.9	74.0	54.0	**-18.7**	**-9.1**	Noise Floor

Mid Channel (2441 MHz)

f GHz	Dist feet	Read Peak dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Peak Lim dBuV/m	Avg Lim dBuV/m	Peak Mar dB	Avg Mar dB	Notes
4.882	3.3	59.0	43.1	34.0	5.4	-41.8	-9.5	1.0	48.1	32.2	74.0	54.0	**-25.9**	**-21.8**	V, Avg Noise floor
7.323	3.3	59.0	43.1	37.1	6.8	-41.1	-9.5	1.0	53.4	37.5	74.0	54.0	**-20.6**	**-16.5**	V, Avg Noise floor
9.764	3.3	62.0	48.7	38.6	8.0	-39.3	-9.5	1.0	60.8	47.5	74.0	54.0	**-13.2**	**-6.5**	V
12.205	3.3	59.0	43.1	39.2	8.9	-40.2	-9.5	1.0	58.5	42.6	74.0	54.0	**-15.5**	**-11.4**	Noise Floor
14.646	3.3	59.0	43.1	41.0	10.2	-44.0	-9.5	1.0	57.7	41.8	74.0	54.0	**-16.3**	**-12.2**	Noise Floor
17.087	3.3	59.0	43.1	42.5	11.5	-44.1	-9.5	1.0	60.5	44.6	74.0	54.0	**-13.5**	**-9.4**	Noise Floor
19.528	3.3	59.0	43.1	32.1	12.7	-44.4	-9.5	1.0	51.0	35.1	74.0	54.0	**-23.0**	**-18.9**	Noise Floor
21.969	3.3	59.0	43.1	32.5	13.8	-44.5	-9.5	1.0	52.4	36.5	74.0	54.0	**-21.6**	**-17.5**	Noise Floor
24.410	0.6	45.0	34.6	32.4	2.5	0.0	-24.3	0.0	55.6	45.2	74.0	54.0	**-18.4**	**-8.8**	Noise Floor
4.882	3.3	73.0	54.3	34.0	5.4	-41.8	-9.5	1.0	62.1	43.4	74.0	54.0	**-11.9**	**-10.6**	H
7.323	3.3	75.4	54.8	37.1	6.8	-41.1	-9.5	1.0	69.8	49.2	74.0	54.0	**-4.2**	**-4.8**	H
9.764	3.3	54.0	42.0	38.6	8.0	-39.3	-9.5	1.0	52.8	40.8	74.0	54.0	**-21.2**	**-13.2**	Noise Floor
12.205	3.3	54.0	42.0	39.2	8.9	-40.2	-9.5	1.0	53.5	41.5	74.0	54.0	**-20.5**	**-12.5**	Noise Floor
14.646	3.3	54.0	42.0	41.0	10.2	-44.0	-9.5	1.0	52.7	40.7	74.0	54.0	**-21.3**	**-13.3**	Noise Floor
17.087	3.3	54.0	42.0	42.5	11.5	-44.1	-9.5	1.0	55.5	43.5	74.0	54.0	**-18.5**	**-10.5**	Noise Floor
19.528	3.3	54.0	42.0	32.1	12.7	-44.4	-9.5	1.0	46.0	34.0	74.0	54.0	**-28.0**	**-20.0**	Noise Floor
21.969	3.3	54.0	42.0	32.5	13.8	-44.5	-9.5	1.0	47.4	35.4	74.0	54.0	**-26.6**	**-18.6**	Noise Floor
24.410	0.6	45.0	34.6	32.4	2.5	0.0	-24.3	0.0	55.6	45.2	74.0	54.0	**-18.4**	**-8.8**	Noise Floor

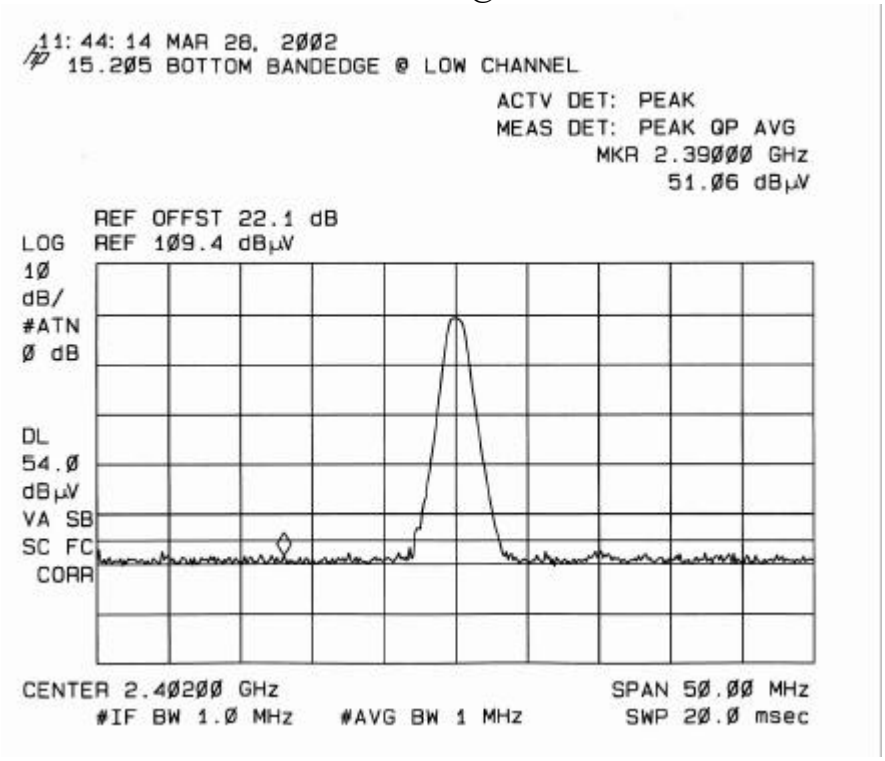
High Channel (2480 MHz)

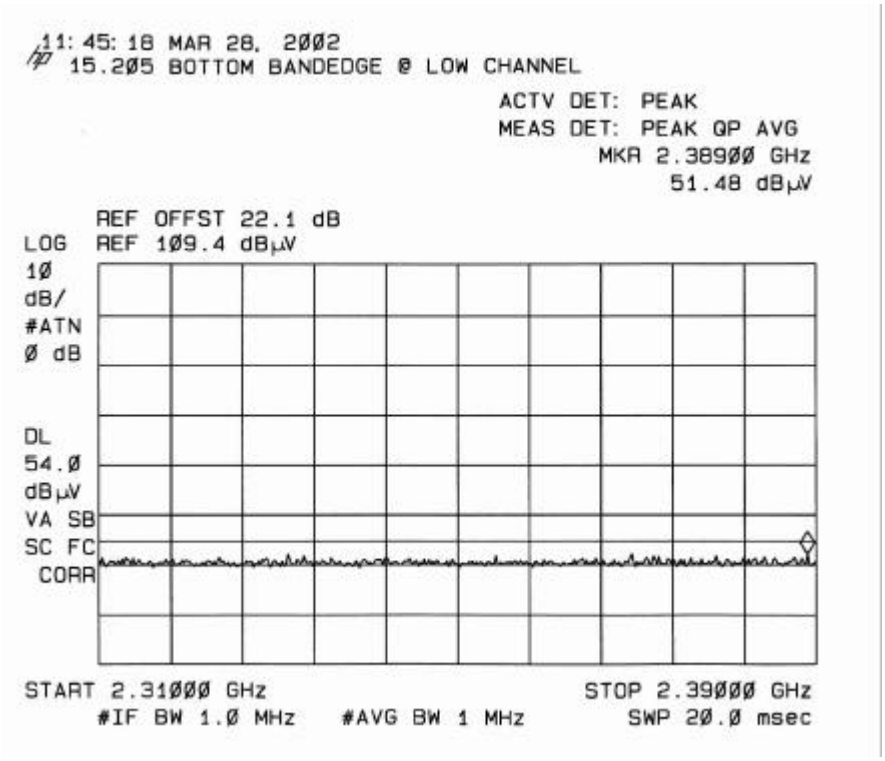
f GHz	Dist feet	Read Peak dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Peak Lim dBuV/m	Avg Lim dBuV/m	Peak Mar dB	Avg Mar dB	Notes
4.960	3.3	56.8	43.0	34.3	5.4	-41.8	-9.5	1.0	46.3	32.5	74.0	54.0	**-27.7**	**-21.5**	V, Avg Noise Floor
7.440	3.3	56.8	43.0	37.4	6.9	-41.0	-9.5	1.0	51.6	37.8	74.0	54.0	**-22.4**	**-16.2**	V, Avg Noise Floor
9.920	3.3	64.2	52.0	38.7	8.1	-39.3	-9.5	1.0	63.2	51.0	74.0	54.0	**-10.8**	**-3.0**	V
12.400	3.3	56.8	50.0	39.1	9.0	-40.3	-9.5	1.0	56.1	49.3	74.0	54.0	**-17.9**	**-4.7**	V
14.880	3.3	56.8	43.0	40.5	10.3	-44.4	-9.5	1.0	54.7	40.9	74.0	54.0	**-19.3**	**-13.1**	Noise Floor
17.360	3.3	56.8	43.0	44.6	11.7	-44.1	-9.5	1.0	60.4	46.6	74.0	54.0	**-13.6**	**-7.4**	Noise Floor
19.840	3.3	56.8	43.0	32.2	12.9	-44.4	-9.5	1.0	49.0	35.2	74.0	54.0	**-25.0**	**-18.8**	Noise Floor
22.320	0.6	44.1	34.5	32.5	2.4	0.0	-24.3	0.0	54.7	45.1	74.0	54.0	**-19.3**	**-8.9**	Noise Floor
24.800	0.6	45.0	34.6	32.7	2.5	0.0	-24.3	0.0	55.9	45.5	74.0	54.0	**-18.1**	**-8.5**	Noise Floor
4.960	3.3	68.6	53.5	34.3	5.4	-41.8	-9.5	1.0	58.1	43.0	74.0	54.0	**-15.9**	**-11.0**	H
7.440	3.3	69.1	53.5	37.4	6.9	-41.0	-9.5	1.0	63.9	48.3	74.0	54.0	**-10.1**	**-5.7**	H
9.920	3.3	54.2	42.8	38.7	8.1	-39.3	-9.5	1.0	53.2	41.8	74.0	54.0	**-20.8**	**-12.2**	Noise Floor
12.400	3.3	54.2	42.8	39.1	9.0	-40.3	-9.5	1.0	53.5	42.1	74.0	54.0	**-20.5**	**-11.9**	Noise Floor
14.880	3.3	54.2	42.8	40.5	10.3	-44.4	-9.5	1.0	52.1	40.7	74.0	54.0	**-21.9**	**-13.3**	Noise Floor
17.360	3.3	54.2	42.8	44.6	11.7	-44.1	-9.5	1.0	57.8	46.4	74.0	54.0	**-16.2**	**-7.6**	Noise Floor
19.840	3.3	54.2	42.8	32.2	12.9	-44.4	-9.5	1.0	46.4	35.0	74.0	54.0	**-27.6**	**-19.0**	Noise Floor
22.320	0.6	44.1	34.5	32.5	2.4	0.0	-24.3	0.0	54.7	45.1	74.0	54.0	**-19.3**	**-8.9**	Noise Floor
24.800	0.6	45.0	34.6	32.7	2.5	0.0	-24.3	0.0	55.9	45.5	74.0	54.0	**-18.1**	**-8.5**	Noise Floor

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

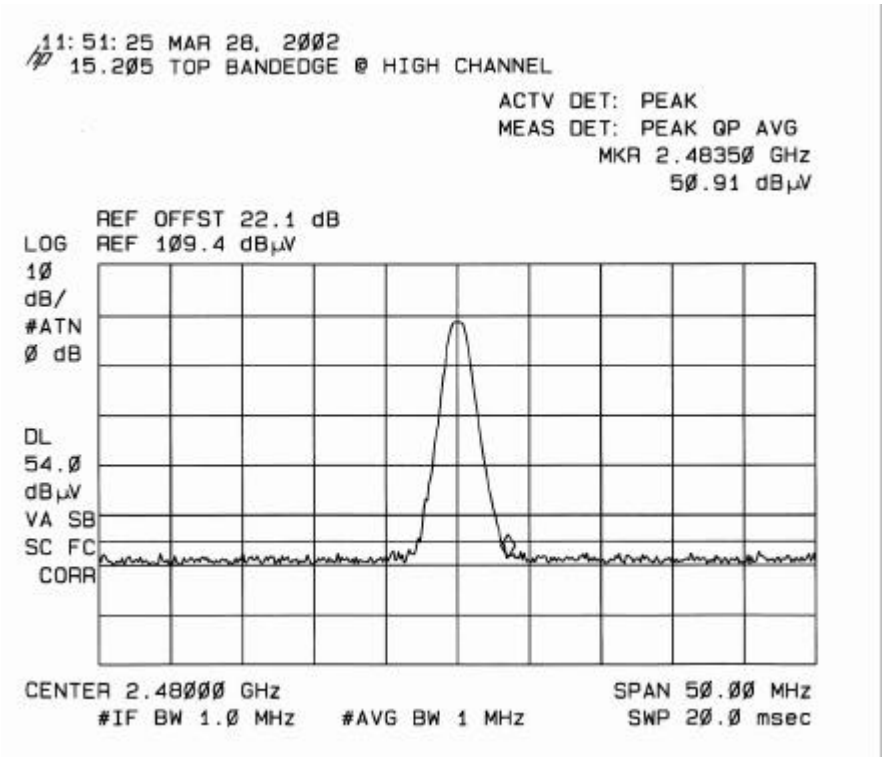
RESTRICTED BANDEDGE: 2310 – 2390 MHz and 2483.5 – 2500 MHz

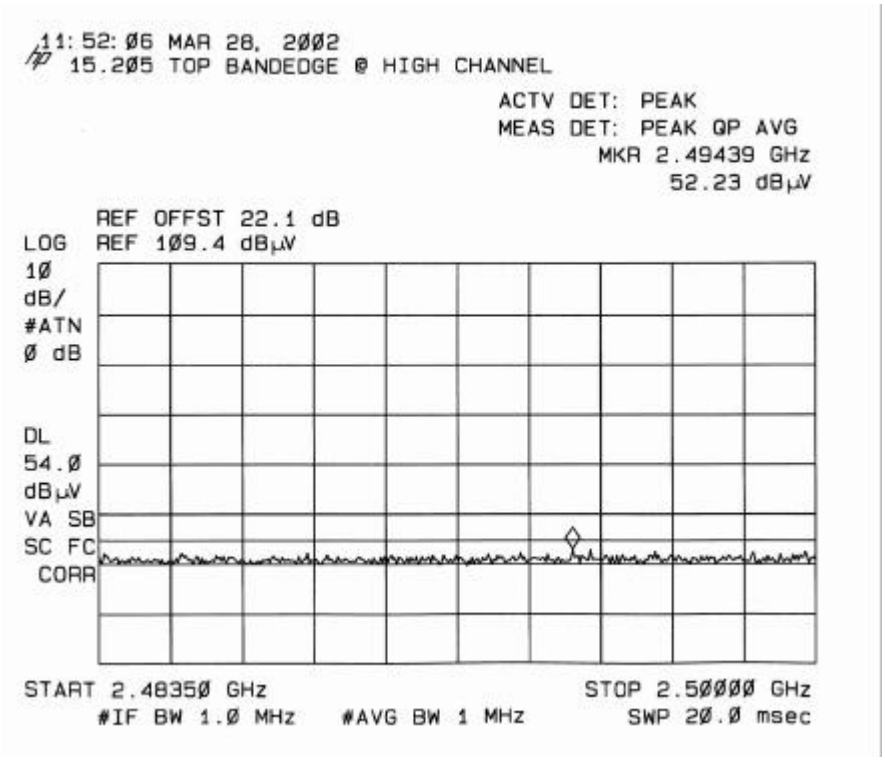
BOTTOM BANDEDGE @ LOW CHANNEL



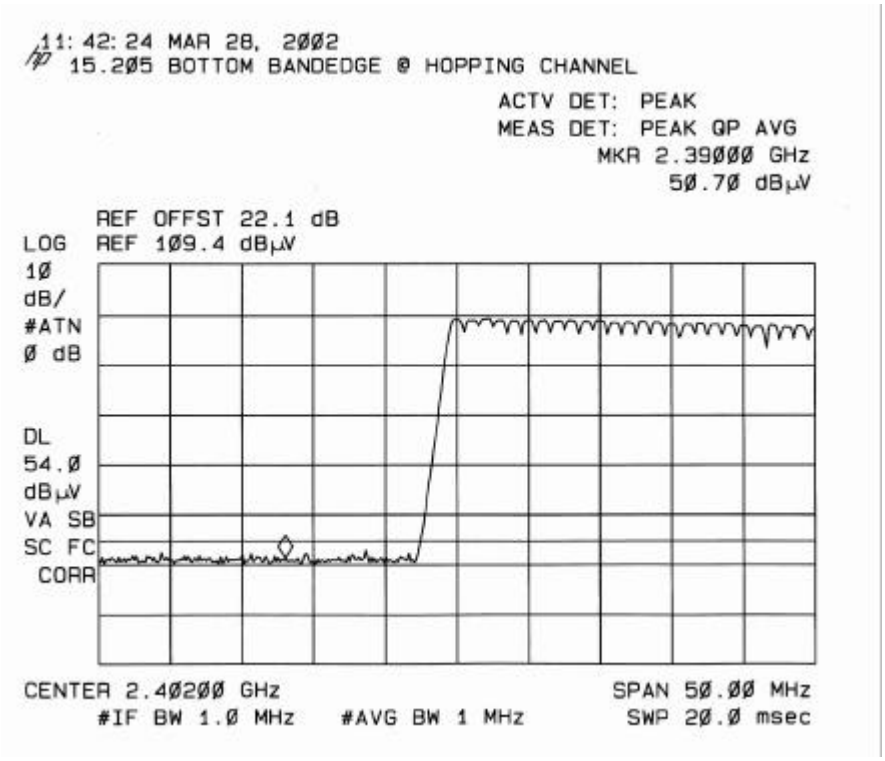


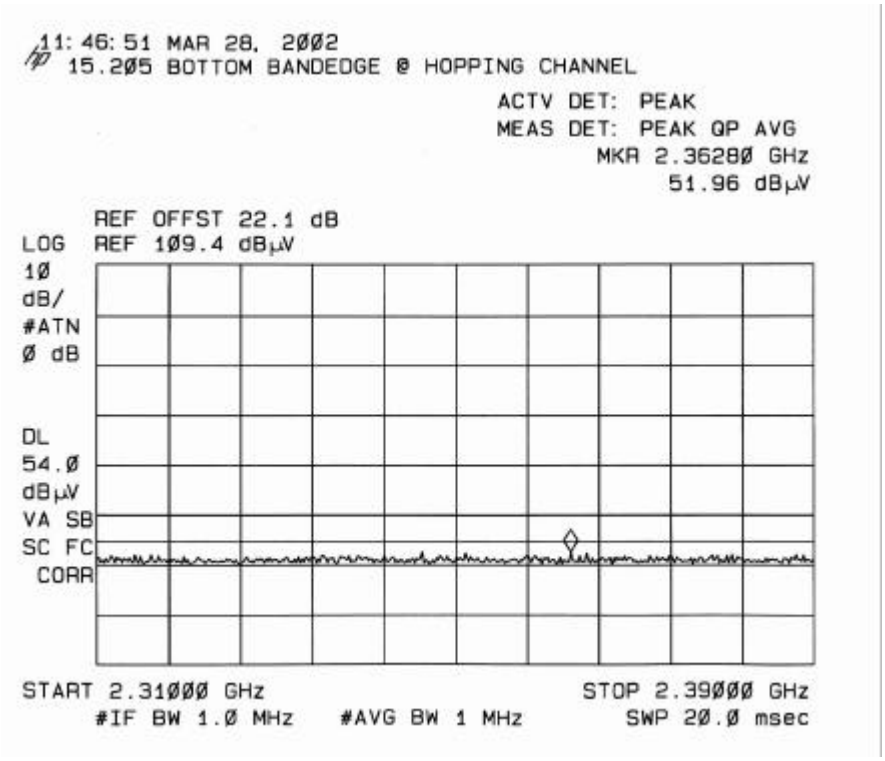
TOP BANDEDGE @ HIGH CHANNEL



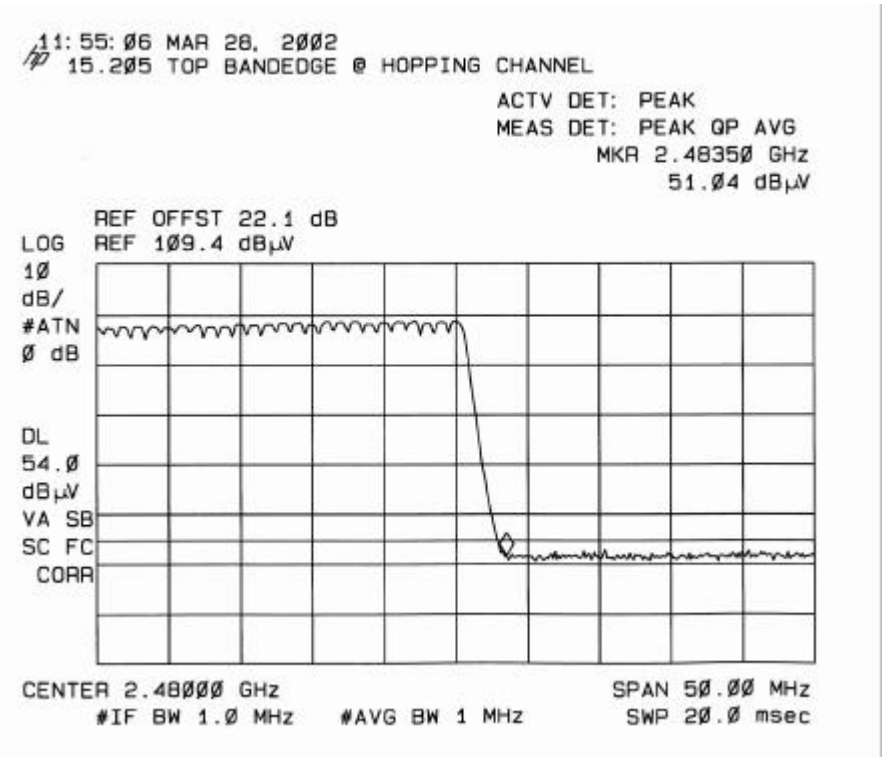


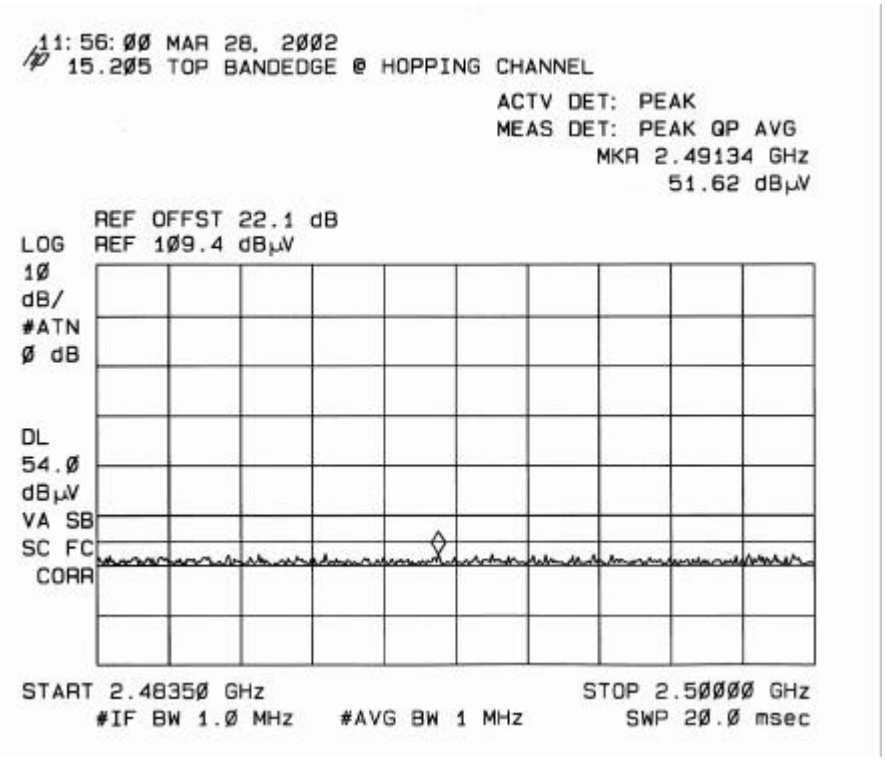
BOTTOM BANDEDGE @ HOPPING CHANNEL





TOP BANDEDGE @ HOPPING CHANNEL



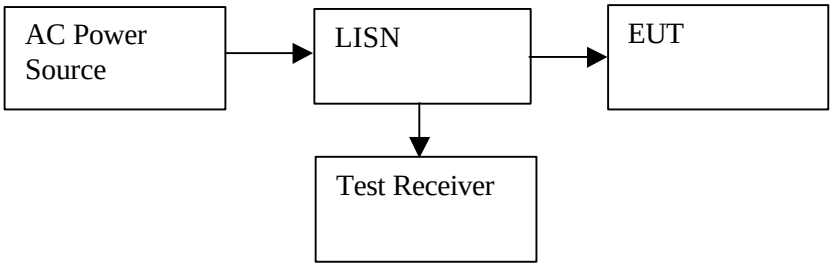


9.8. POWER LINE CONDUCTED EMISSION

TEST SETUP

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
450 KHz to 30 MHz	☐ Peak ☒ Quasi Peak	☒ 9 KHz	☒ 9 KHz



TEST PROCEDURE

1. The EUT was placed on a wooden table 80 cm above the horizontal ground plane and 40 cm away from the vertical ground plane. The EUT was set to transmit / receive in a continuous mode.

2. Conducted disturbance was measured between the phase lead and the ground, and between the neutral lead and the ground. The frequency 0.450 - 30 MHz was investigated.

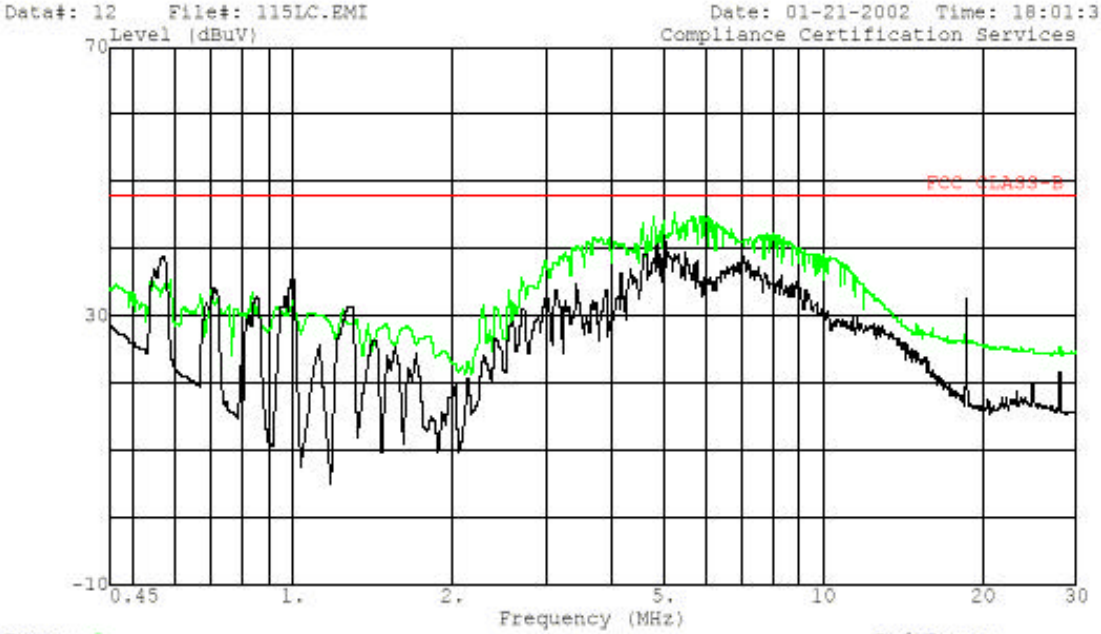
RESULT

No non-compliance noted. See Line Conduction plot

CONDUCTED EMISSIONS DATA (115VAC 60Hz)

Freq.	Reading			Closs	Limit	FCC_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
4.79	--	44.84	--	0.00	48.00	--	-3.16	--	L1
5.23	--	45.31	--	0.00	48.00	--	-2.69	--	L1
5.88	--	44.86	--	0.00	48.00	--	-3.14	--	L1
4.63	--	39.28	--	0.00	48.00	--	-8.72	--	L2
4.85	--	40.76	--	0.00	48.00	--	-7.24	--	L2
5.06	--	41.18	--	0.00	48.00	--	-6.82	--	L2
6 Worst Data									

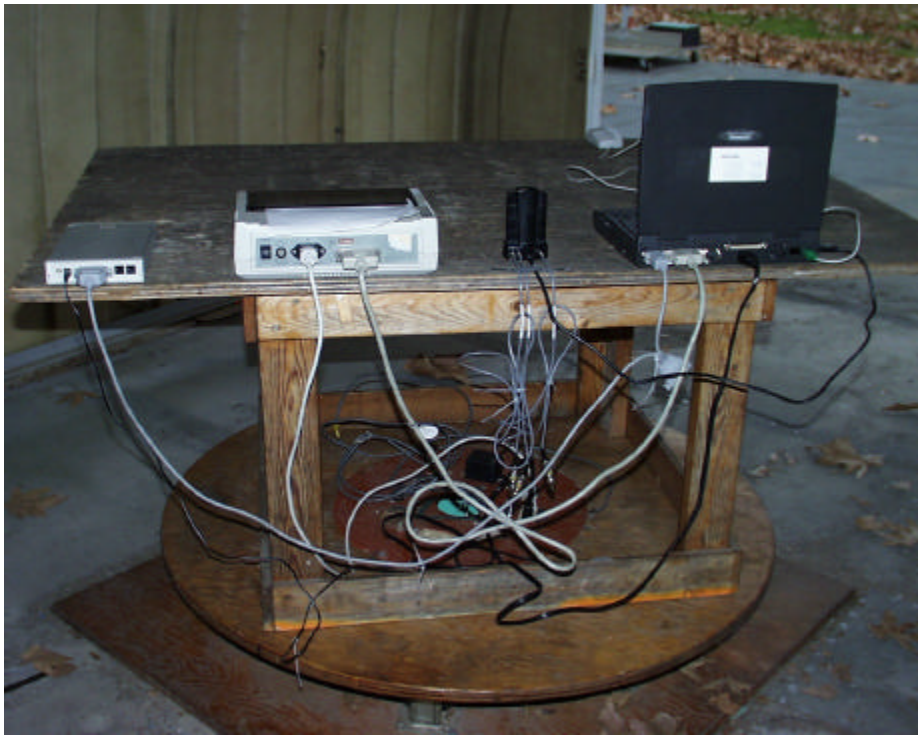
COMPLIANCE Engineering Services, Inc.
1366 Bordeaux Dr.
Sunnyvale, CA 94089-1005 USA
Tel: (408) 752-8166
Fax: (408) 752-8168



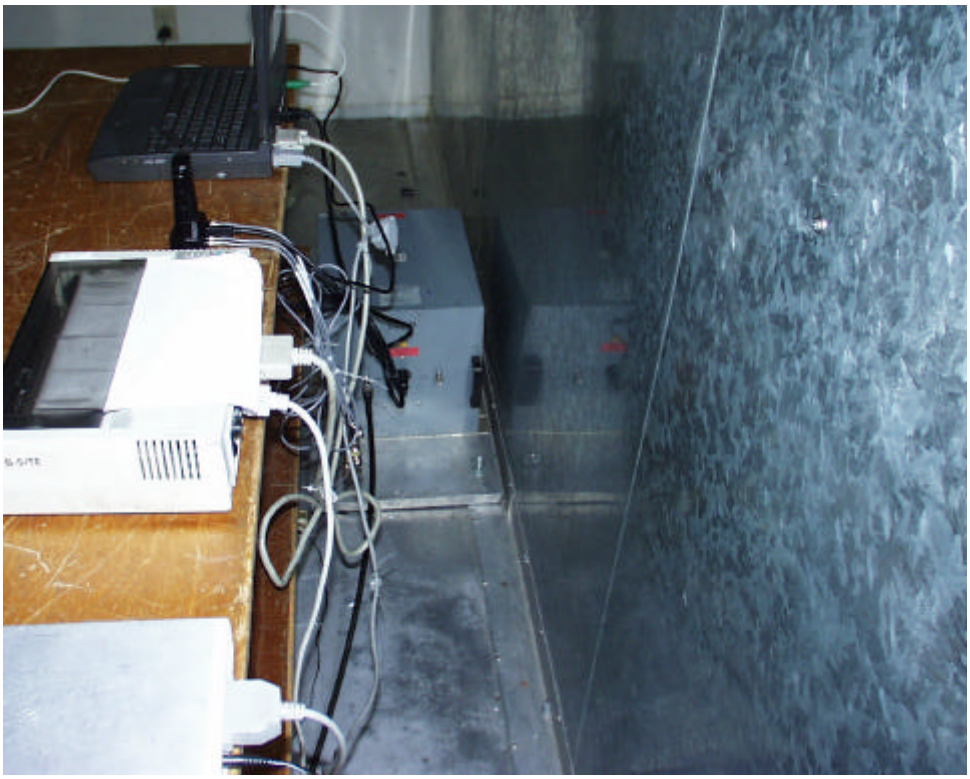
Trace: 5 Ref Trace:
Project No. : 02U1135
Report No. : 020121LC
Test Engr : Kerwin Corpuz
Company : Tektronix
EUT : BLUETOOTH PROTOCOL ANALYZER
Model : BPA105
Test Config.: EUT/Laptop/Mouse/Modem/Printer
Type of Test: FCC CLASS B
Mode of Op. : TX/RX continuous
: Quasi-Peak: L1(green), L2(black)
: 115Vac, 60Hz

9.9. SETUP PHOTOS

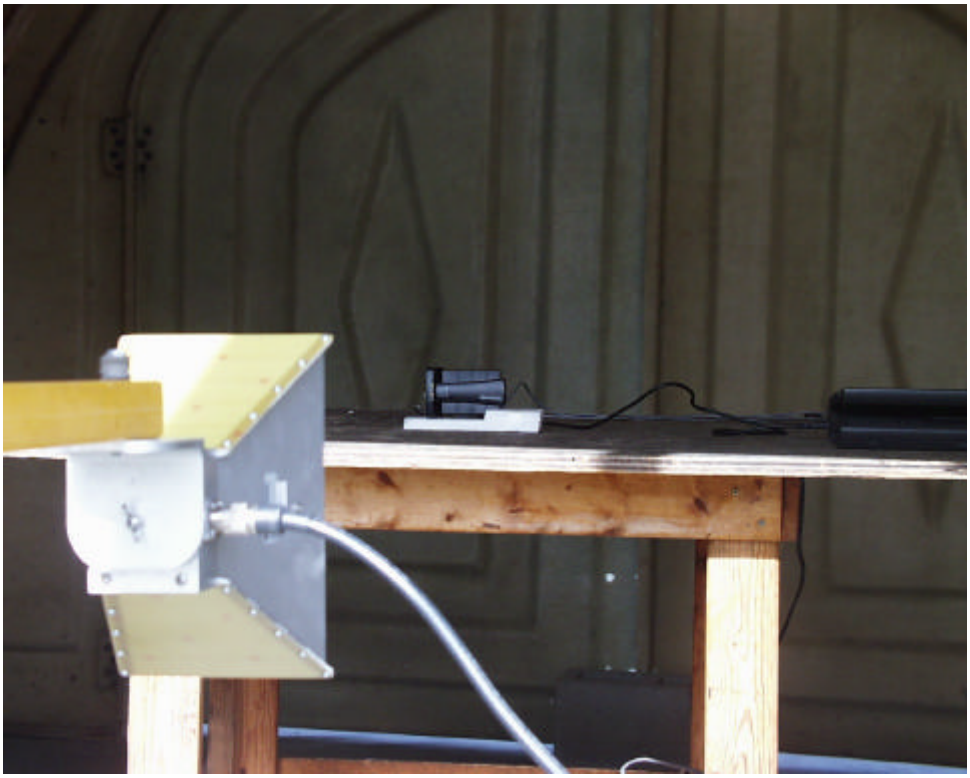
Radiated Emission below 1 GHz measurement



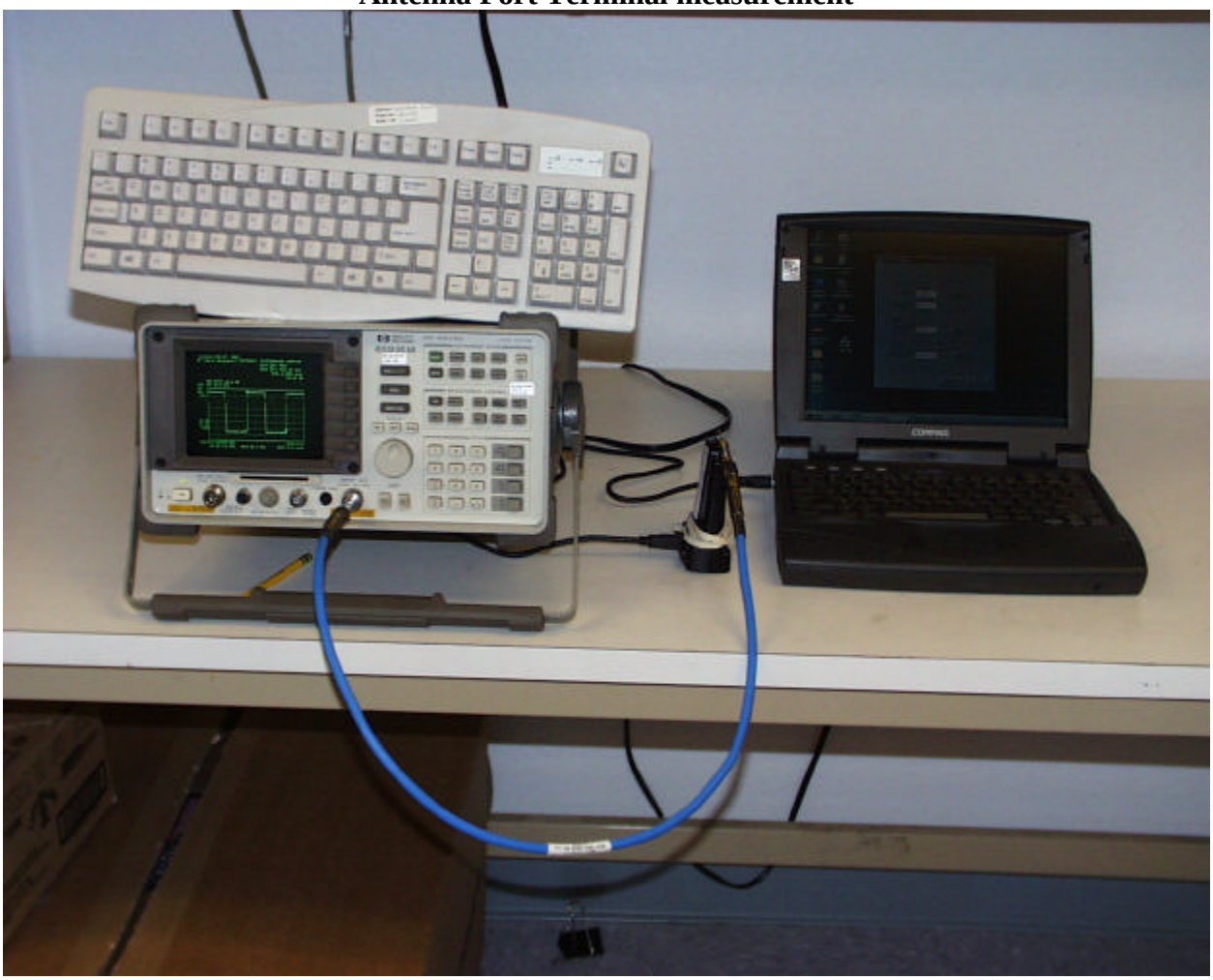
Conducted Emission measurement



Radiated Emission above 1 GHz measurement



Antenna Port Terminal measurement



END OF REPORT