FCC CFR47 PART 15 SUBPART C
CERTIFICATION
TEST REPORT

FOR

BLUETOOTH MODULE

MODEL NUMBER: A1044

BRAND NAME: APPLE BLUETOOTH MODULE

FCC ID: BCGA1044

REPORT NUMBER: 02U1697-1B

ISSUE DATE: DECEMBER 31, 2002

Prepared for
APPLE COMPUTER
1 INFINITE LOOP
CUPERTINO, CA 95014

Prepared by
COMPLIANCE CERTIFICATION SERVICES
561F MONTEREY ROAD,
MORGAN HILL, CA 95037, USA
TEL: (408) 463-0885
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1. TEST RESULT CERTIFICATION

COMPANY NAME: APPLE COMPUTER
1 INFINITE LOOP
CUPERTINO, CA 95014

EUT DESCRIPTION: BLUETOOTH MODULE

MODEL NAME: A1044

DATE TESTED: DECEMBER 9 – DECEMBER 24, 2002

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	NO NON-COMPLIANCE NOTED

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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 ENGINEER
COMPLIANCE CERTIFICATION SERVICES

Tested By:

NEELESH RAJ
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

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2. EUT DESCRIPTION

Apple is developing a Bluetooth module, code named Q23 to be installed in various Apple host system computers. The Q23 project uses the CSR BlueCore2 External chip, BC212015. Q23 will come in two versions with slightly different board layouts. The layouts are unique in order to accommodate different USB interfaces to the host systems motherboard. The two versions are code named Q23p and Q23d. The Portable host systems will use Q23p and the desktop host systems will use Q23d. In each case, they will use the same CSR chip and the technical details described below apply to both versions.

Q23 Technical Description Details

The following technical description details apply to the Q23 project

Name: Apple Bluetooth Module
Modulation: Frequency Hopping Spread Spectrum
Operating Frequency Range: 2402 MHz – 2480 MHz
Number of Channels: 79 equally spaced
RF Chip Manufacturer: CSR
RF Chip Name and Model Number : CSR BC212015
Digital Interface: USB
Power Interface: 3.3 Volts
Maximum conducted output power: +7 dBm
Receiver Sensitivity (0.1% Bit Error Rate, 20C): -83 dBm
ACL Data transfer rate: 720 kbps
20 dB Bandwidth for modulated carrier <1 MHz
Carrier Frequency Drift < +/- 12 kHz (20C)
RF Interface: Hirose U.FL connector
The CSR BC212015 is a Bluetooth 1.1 compliant, single chip radio and base band IC for Bluetooth 2.4 GHz systems.

The EUT has a peak output power of 7.37dBm and a max antenna gain of –1.6dBi.

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3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with 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.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

Radiated Emission measurements were performed at the Apple Computer 10 meter semi-anechoic Test Site (Evelyn 1), located at 123 East Evelyn Ave., Mountain View, California. Conducted Emissions were performed at the Apple Computer EMC compliance lab located at 20650 Valley Green Drive, Cupertino, California.

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)).

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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	商 檢 SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	Canada IC2324 A,B,C, and F

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CALIBRATION AND UNCERTAINTY

4.4. MEASURING INSTRUMENT CALIBRATION

The measurement instruments utilized to perform the tests documented in this report have been calibrated in accordance with the manufacturer's recommendations, and are traceable to national standards.

4.5. 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.

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4.6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
Signal Generator, 10 MHz ~ 20 GHz	HP	83732B	US3449059	3/29/03
Quasi-Peak Adaptor	HP	85650A	2811A01335	5/23/03
SA Display Section 1	HP	85662A	3026A19146	5/23/03
SA RF Section, 22 GHz	HP	85660B	2140A01296	5/23/03
Oscilloscope, 100MHz 4Ch.	HP	54601A	3106A00123	11/6/03
Spectrum Analyzer	HP	8593EM	3710A00205	6/11/03
Spectrum Analyzer	HP	8564E	3943A01643	7/22/03
DC Power Supply	KENWOOD	PA36-3A	N/A	N/A
Environmental Test Chamber	THERMOTRON	SE600-10-10	29800	3/18/03
Power Meter	AGLIENT	E4416A	GB41291160	8/9/03
Power Sensor	AGLIENT	E44164	US40440755	8/9/03

Equipment Description	Model Number	Serial Number	Last Calibration	Next Calibration
Spectrum Analyzer	Rohde & Schwarz ESI	1088.7490_26	30 Aug 2002	30 Aug 2003
Receiver	ESI 26	1088.7490_26	30 Aug 2002	30 Aug 2003
Antenna	EMCO 3115	9205-3852	5 Sep 2000	5 Sep 2003
Antenna	18-26 GHz Horn	1264	1 Sep 2001	1 Nov 2003
Amplifier	Apple1m	1	12 Dec 2002	12 Dec 2003
Amplifier	HP 8449B (1-26.5 GHz)	3008A00713	4 Mar 2002	4 Mar 2003
Cable	Flexco FC182	FC182_4m	15 Dec 2002	15 Dec 2003

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5. SETUP OF EQUIPMENT UNDER TEST

SETUP INFORMATION FOR TRANSMITTER TESTS

SUPPORT EQUIPMENT

TEST PERIPHERALS				
Device Type	Manufacturer	Model Number	Serial Number	FCC ID
LAPTOP	APPLE	POWERBOOK G4	SQT24300RDT2	N/A
LAPTOP	APPLE	POWERBOOK G4	SQT20600IDUT	N/A
IBOOK	APPLE	IBOOK	PT324110	N/A
MONITOR	APPLE	M7768	N/A	DoC
MOUSE	APPLE	N/A	N/A	N/A
KYB	APPLE	N/A	NK9021G3UF86	N/A

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	USB	3	USB	SHIELDED	1.5M	YES	NO	
2	PWR	1	AC PWR	UNSHIELDED	1.6M	NO	NO	

TEST SETUP

The EUT was connected to the laptop via its USB port.

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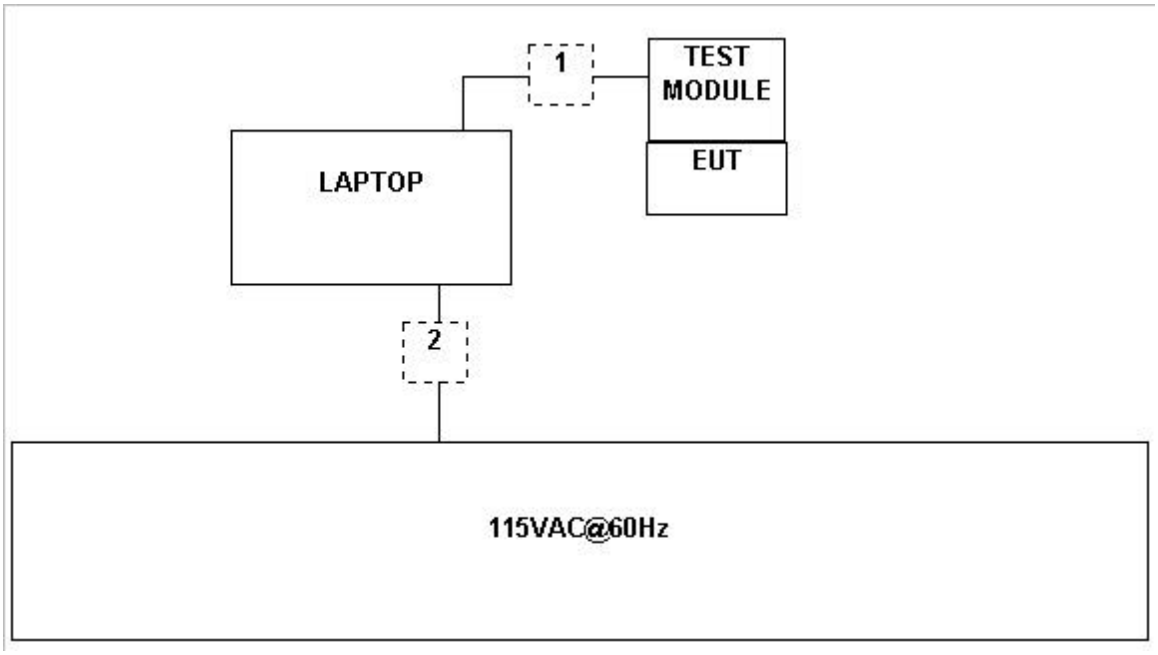
SETUP DIAGRAM FOR TRANSMITTER TESTS



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SETUP INFORMATION FOR DIGITAL DEVICE TESTS

SUPPORT EQUIPMENT

TEST PERIPHERALS				
Device Type	Manufacturer	Model Number	Serial Number	FCC ID
LAPTOP	APPLE	POWERBOOK G4	SQT24300RDT2	N/A
LAPTOP	APPLE	POWERBOOK G4	SQT20600IDUT	N/A
IBOOK	APPLE	IBOOK	PT324110	N/A
MONITOR	APPLE	M7768	N/A	DoC
MOUSE	APPLE	N/A	N/A	N/A
KYB	APPLE	N/A	NK9021G3UF86	N/A

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	USB	3	USB	SHIELDED	1.5M	YES	NO	
2	PWR	1	AC PWR	UNSHIELDED	1.6M	NO	NO	

TEST SETUP

The EUT was connected to the laptop via its USB port.

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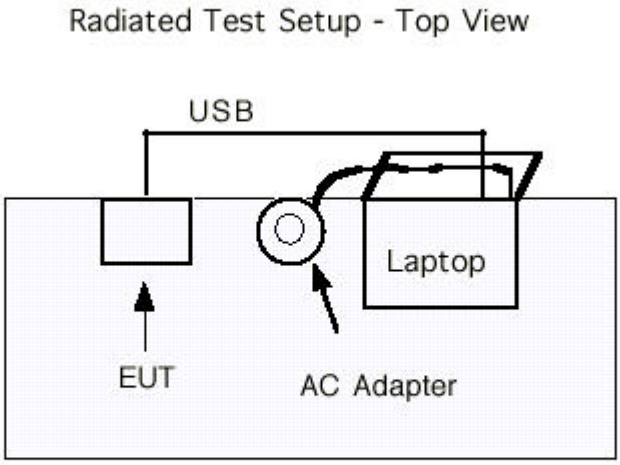
SETUP DIAGRAM FOR DIGITAL DEVICE TESTS



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6. APPLICABLE RULES

§15.247 (a) – HOPPING FREQUENCY SEPARATION

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

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

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 non-overlapping channels.

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

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems which use fewer than 75 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 non overlapping channels are used.

§15.247 (b)- POWER OUTPUT

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 band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(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), (b)(2), and b(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§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.

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§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) 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 digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

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§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.

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§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.

§15.209- RADIATED EMISSION LIMITS

(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 (microvolts/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.

Frequency Range (MHz)	Field Strength (uV/m at 3 m)	Field Strength (dBuV/m at 3 m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

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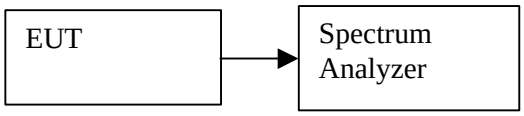
7. TEST SETUP, PROCEDURE AND RESULT

7.1. 20 dB BANDWIDTH

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The hopping function is turned off and the transmitter is set to a fixed frequency. The spectrum analyzer center frequency is set to the transmitter frequency. The RBW and VBW are set to 10 kHz.

RESULTS

Reporting requirement only; No non-compliance noted:

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
Low	2402	830
Middle	2441	830
High	2480	830

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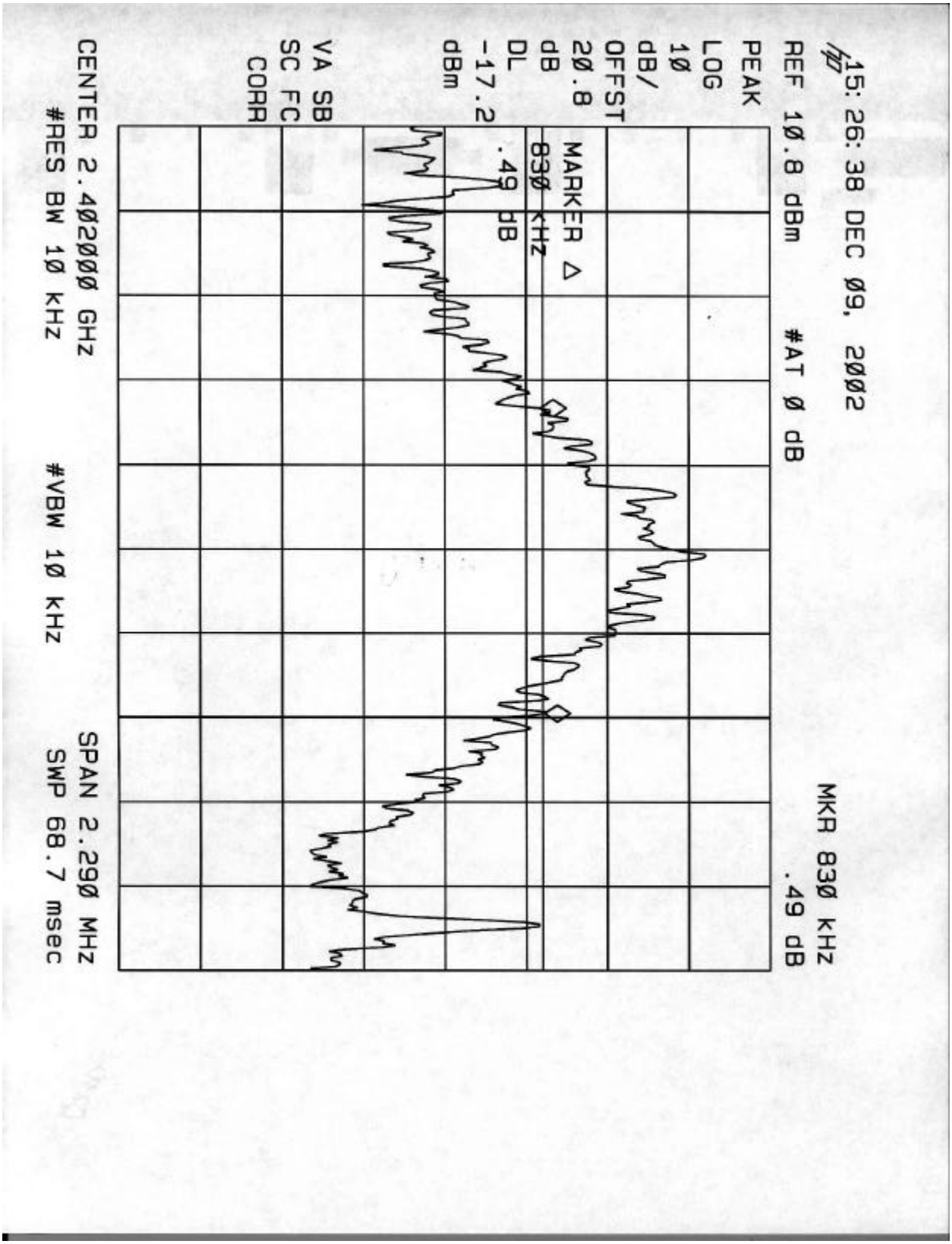

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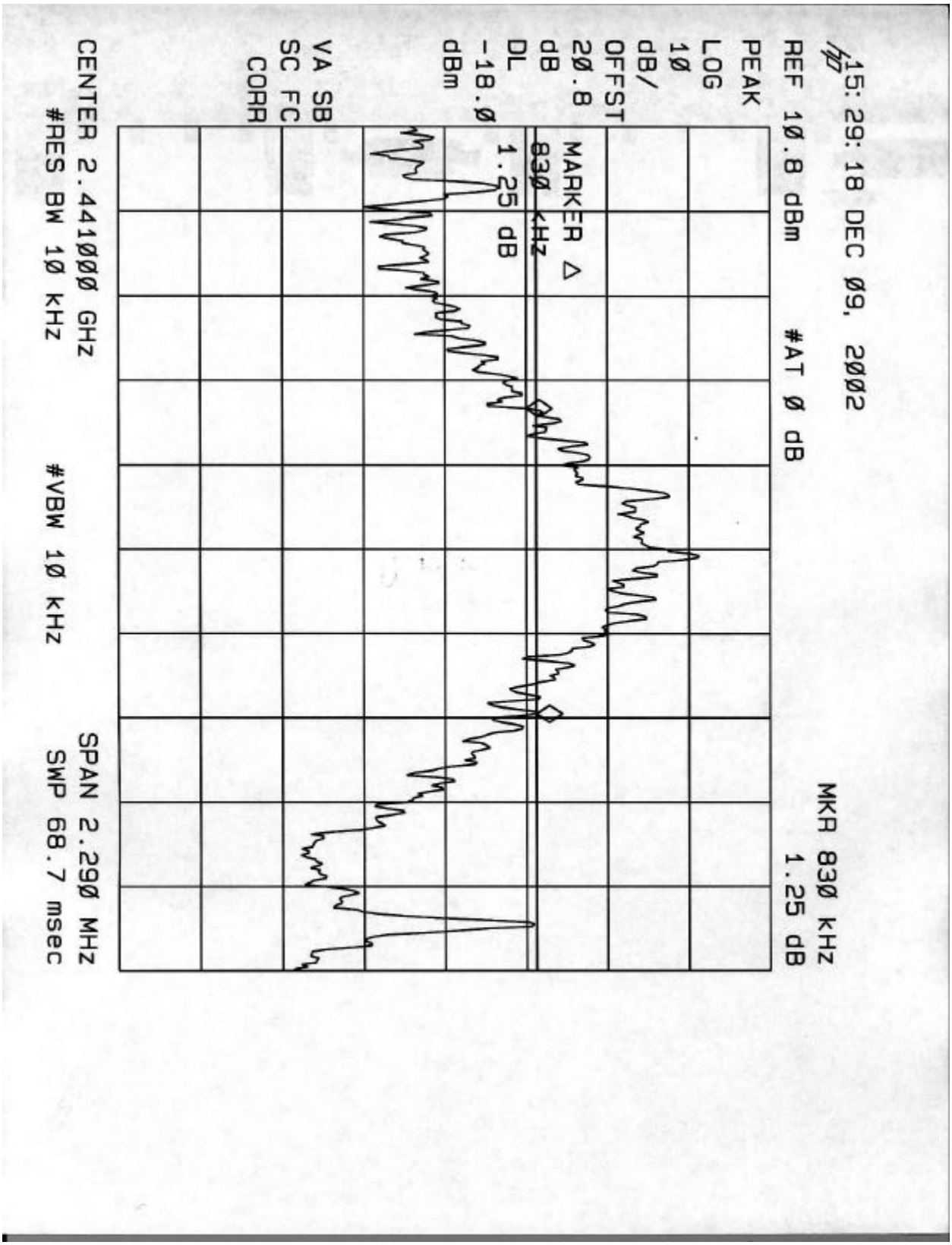

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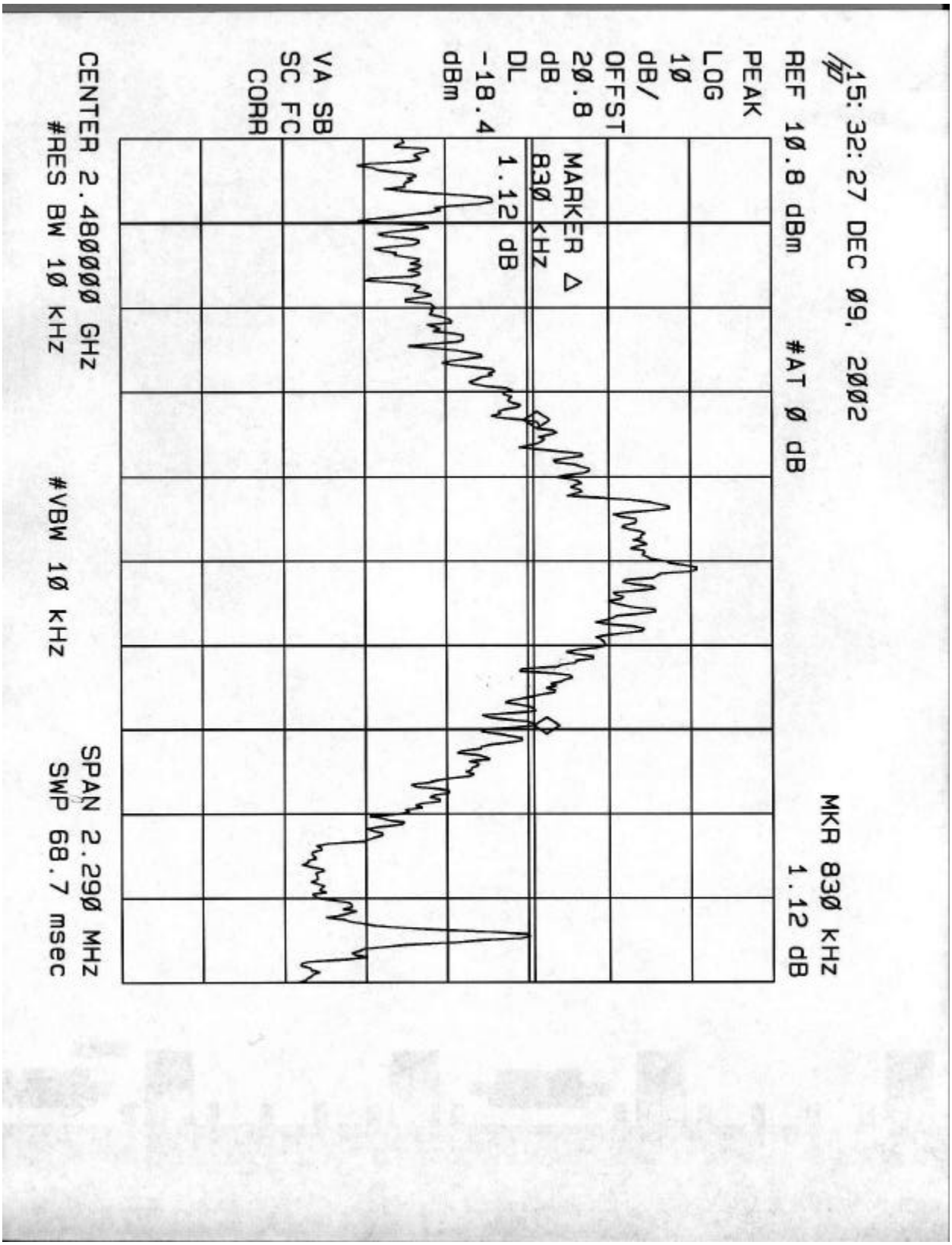

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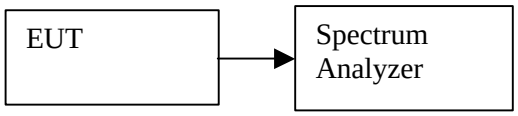
7.2. HOPPING FREQUENCY SEPARATION

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW and VBW are set to 100 kHz, the frequency span is set to 10 MHz and the trace function to max hold.. The EUT is allowed to complete the pseudorandom hopping sequence, then the separation between two adjacent hopping frequencies is measured.

LIMIT

The 20 dB bandwidth is 830KHz, which is less than the frequency separation.

RESULTS

No non-compliance noted:

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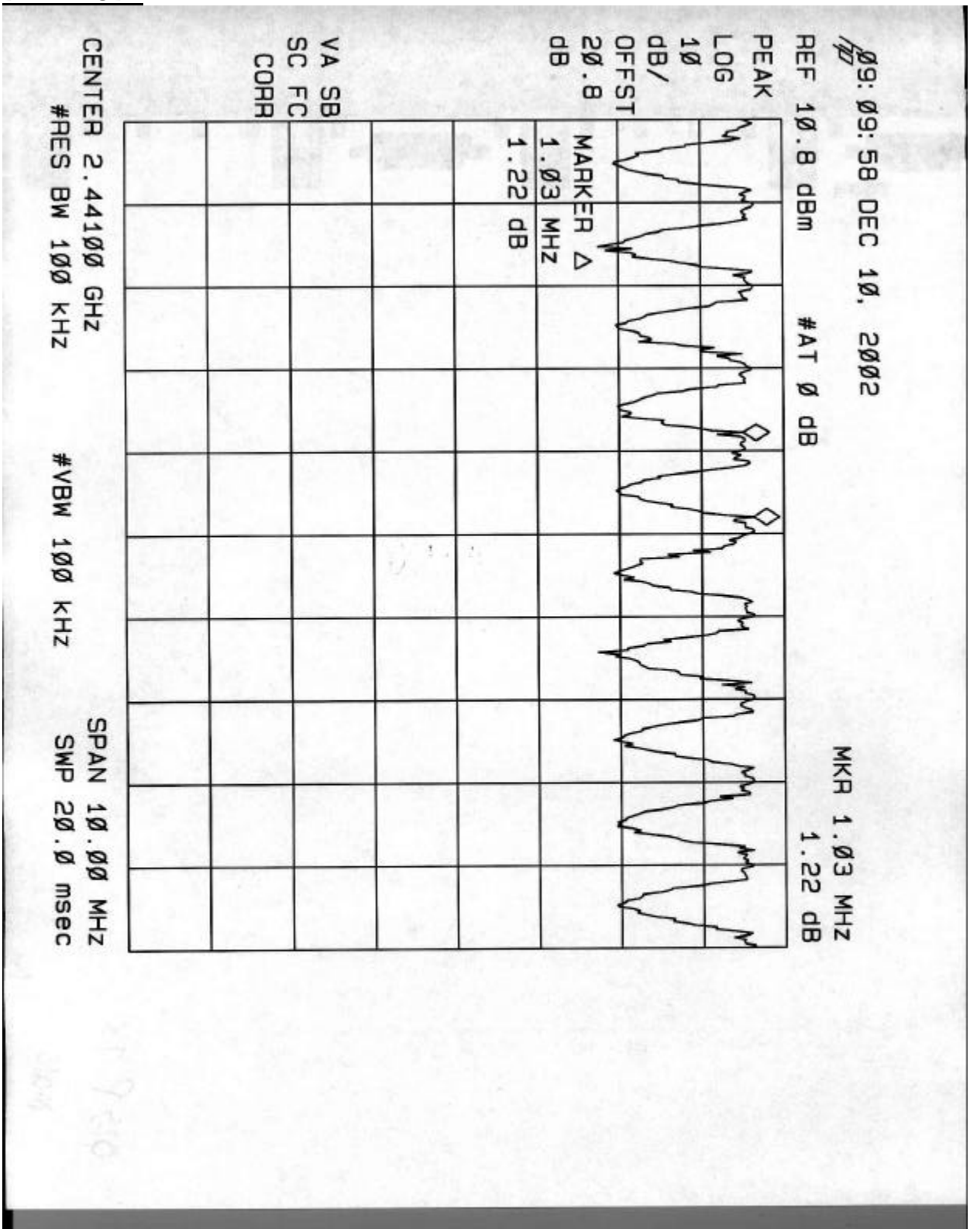
DATA MODE



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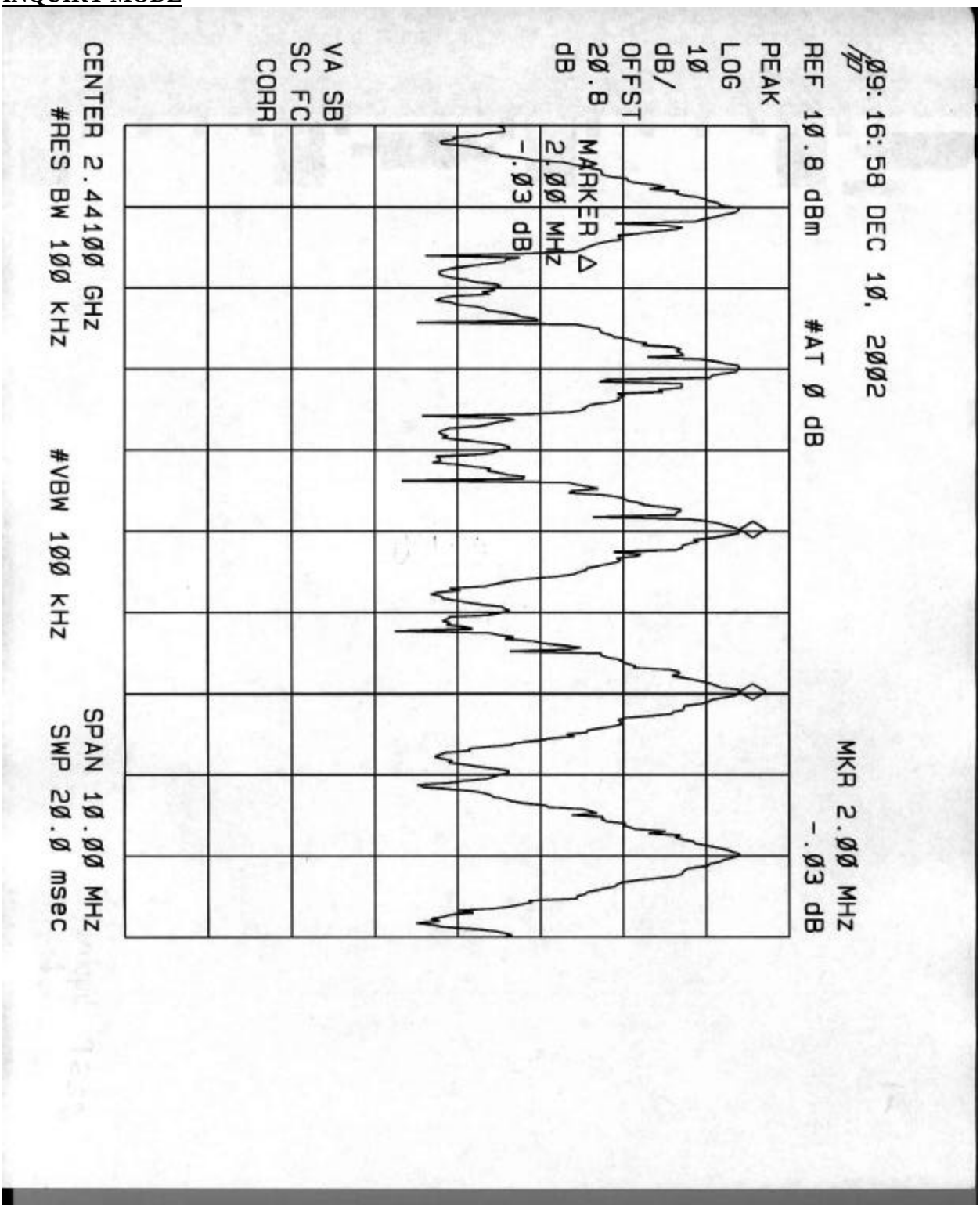
INQUIRY MODE



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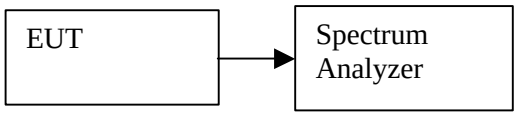
7.3. NUMBER OF HOPPING FREQUENCIES

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW and VBW are set to 1 MHz, the frequency span is set to 100 MHz and the trace function to max hold. The EUT is allowed to complete the pseudorandom hopping sequence, then the number of hopping frequencies is counted.

RESULTS

No non-compliance noted:

Mode	Number of Frequencies	Limit
Inquiry	32	Reporting Requirement Only
Data	79	75 Minimum

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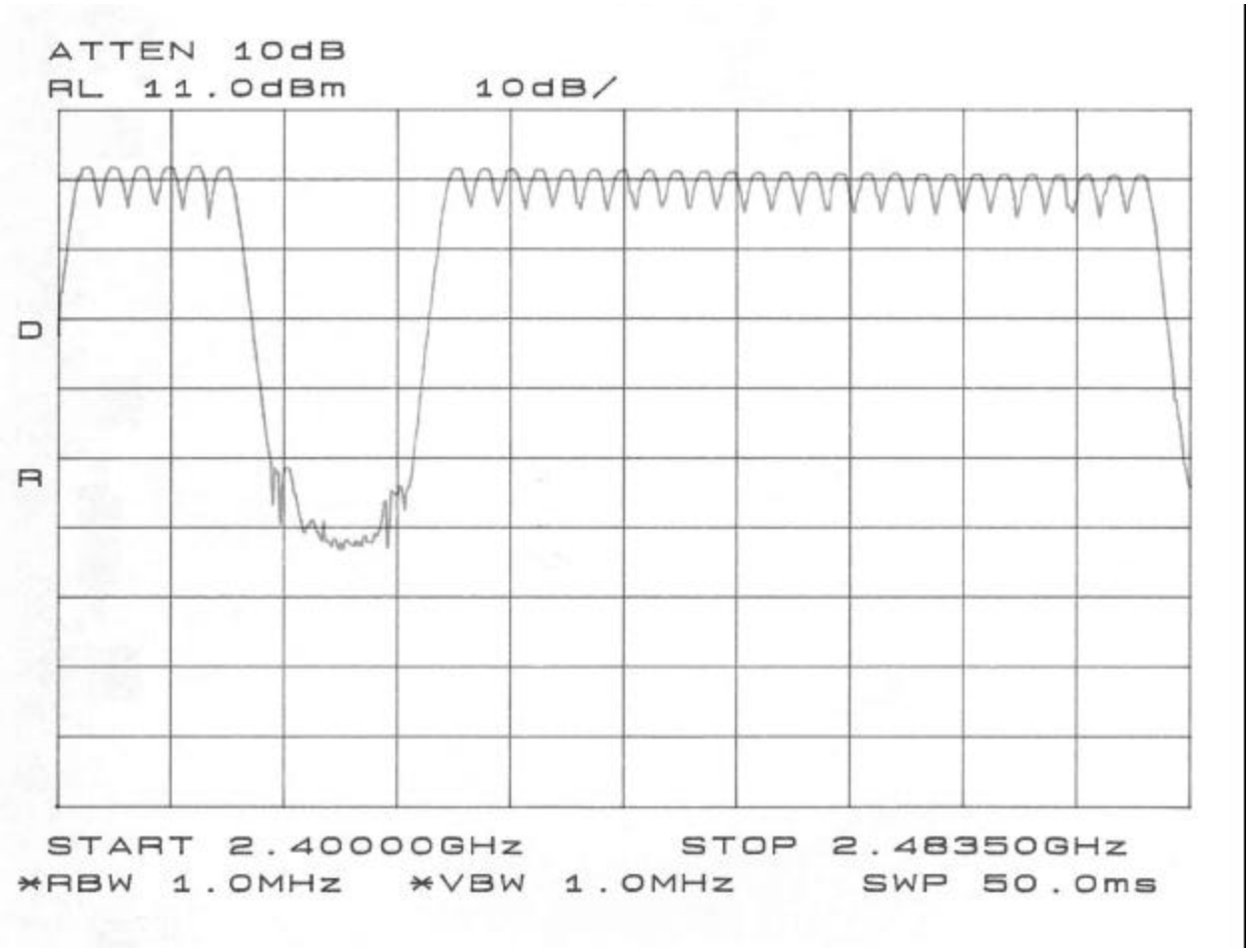
INQUIRY MODE



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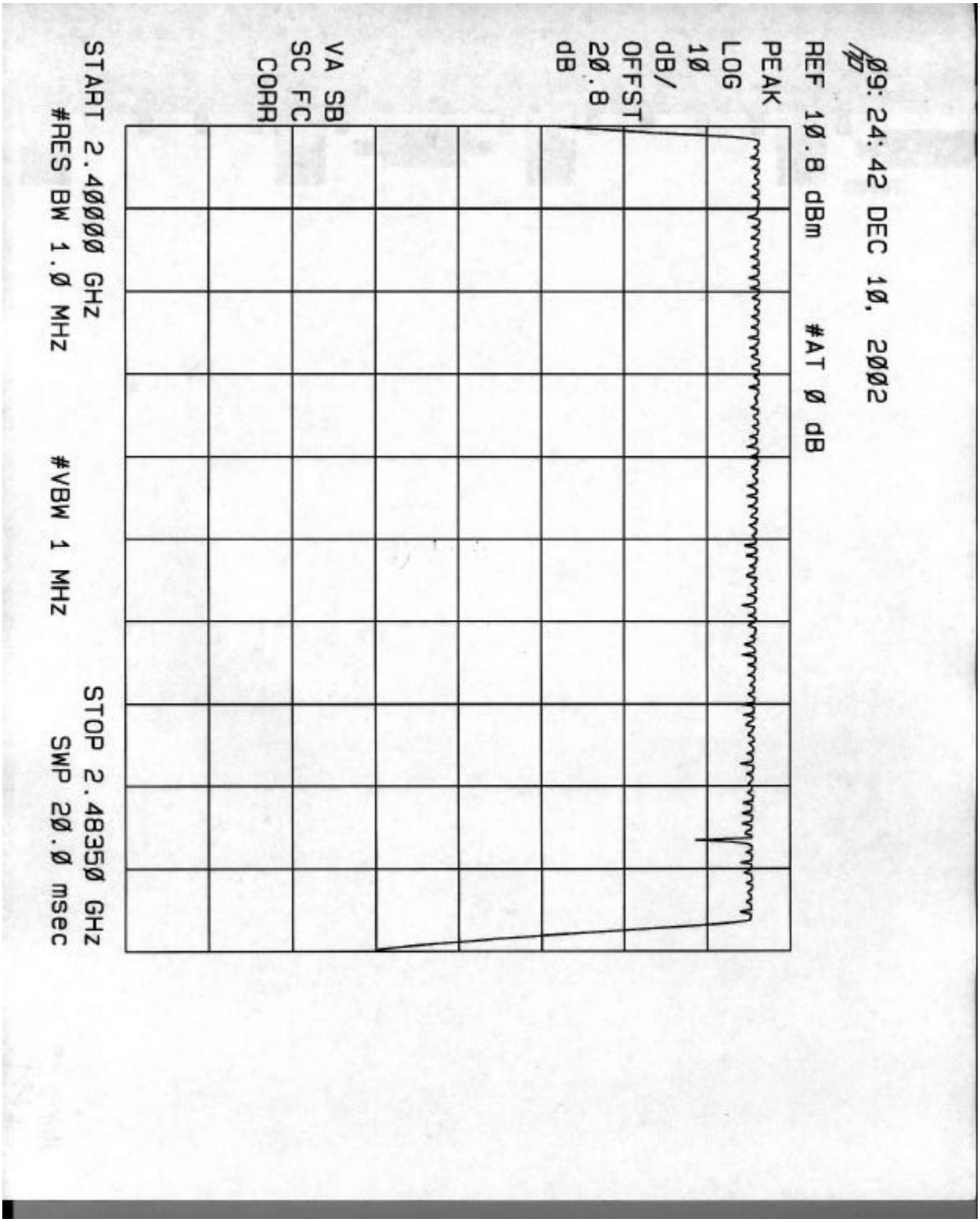
DATA MODE



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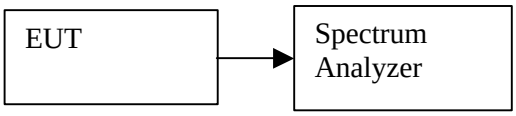
7.4. TIME OF OCCUPANCY

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer.

The dwell time of 0.2552s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is a follows:
Dwell time = time slot length * hop rate / number of hopping channels *30s
Example for a DH1 packet (with a maximum length of one time slot)
Dwell time = 420 µs * 1600 1/s / 79 * 30s = 0.2552s (in a 30s period)
For multi-slot packet the hopping is reduced according to the length of the packet.
Example for a DH5 packet (with a maximum length of five time slots)
Dwell time = 5 * 420 µs * 1600 * 1/5 *1/s / 79 * 30s = 0.2552s (in a 30s period)

RESULTS

No non-compliance noted:

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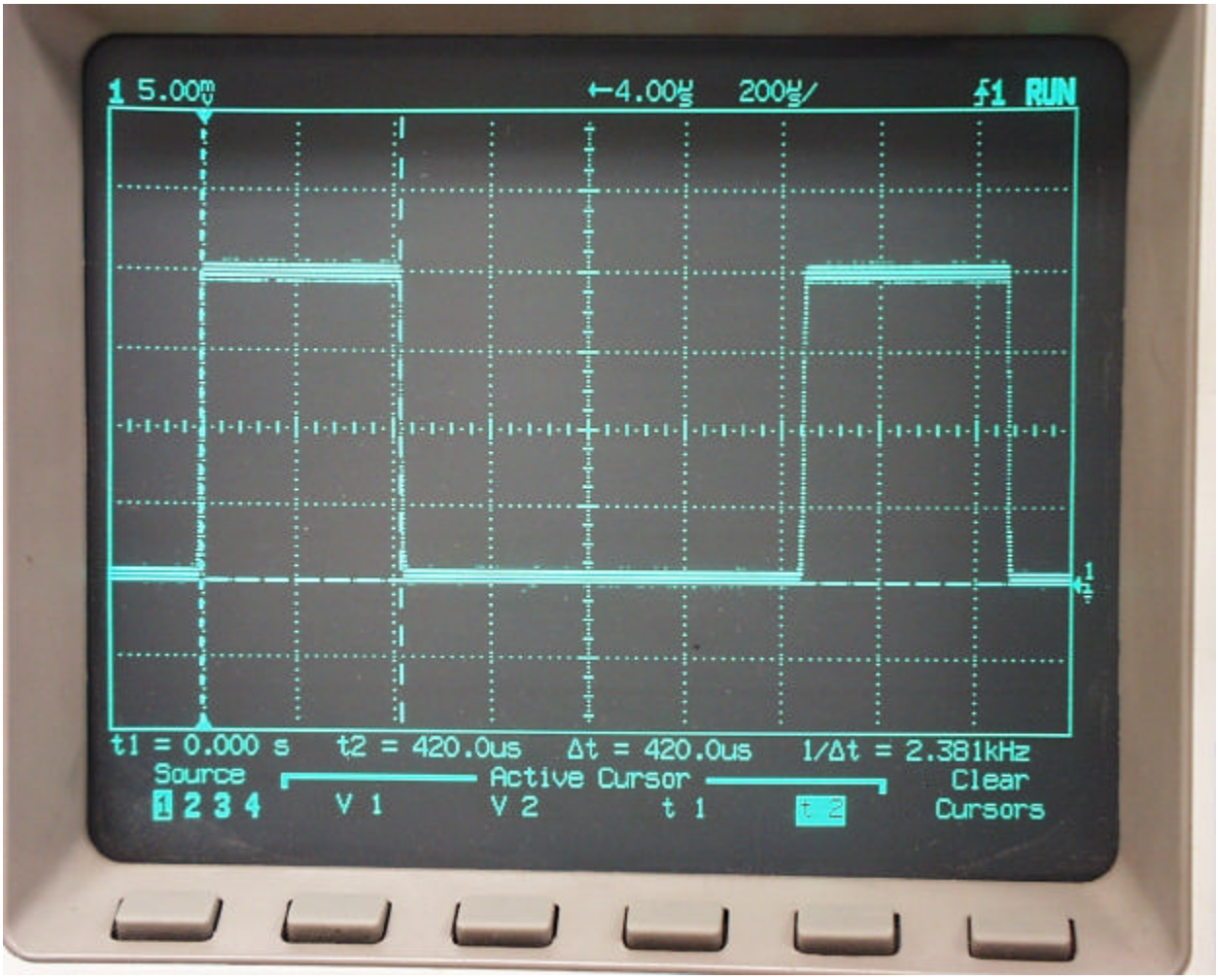
PULSE WIDTH



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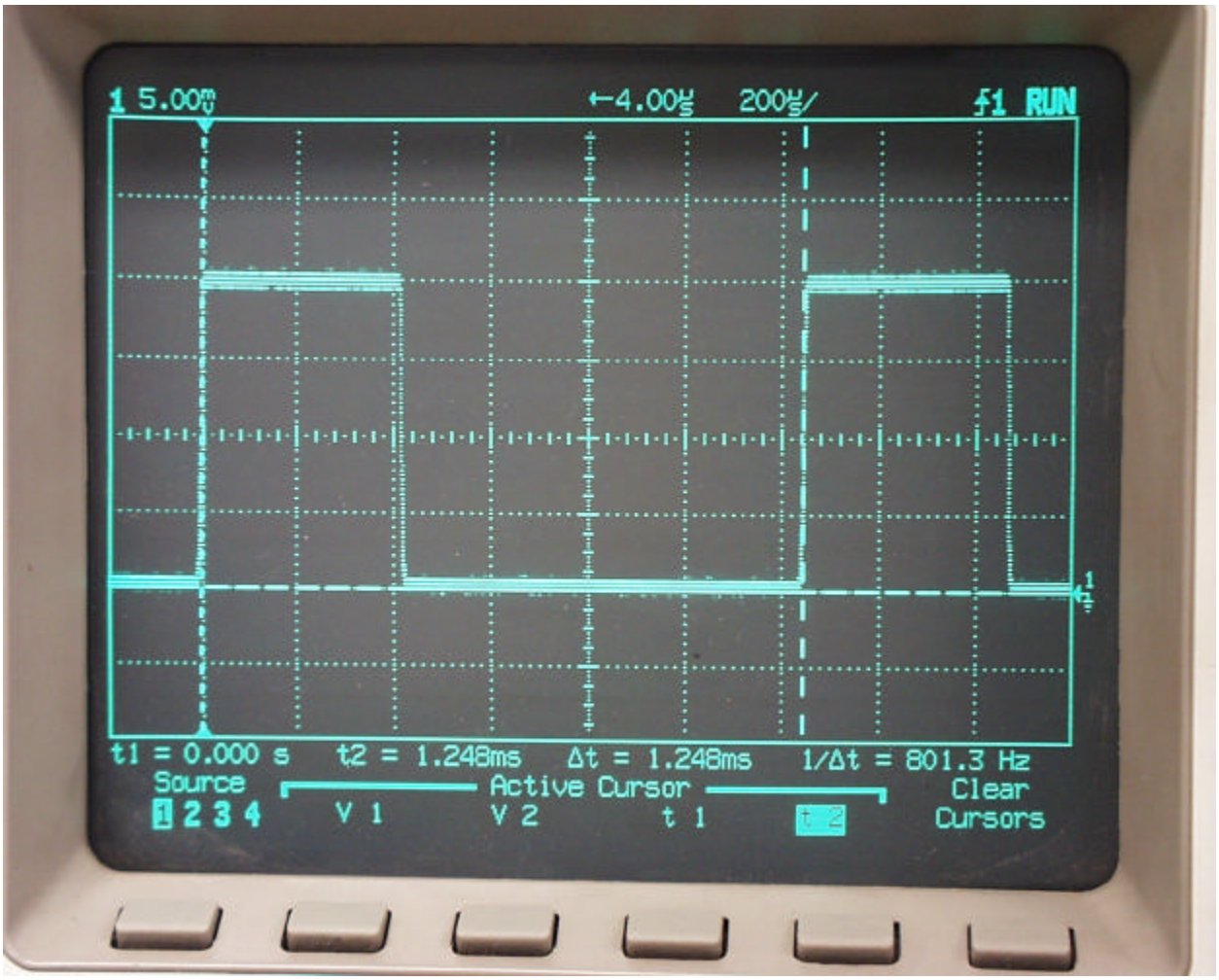

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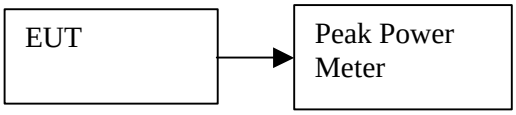
7.5. PEAK POWER

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to the peak power meter.

The hopping function is turned off.

LIMIT

At least 75 hopping frequencies are used and the maximum antenna gain = -1.6dBi, therefore the limit is 30 dBm.

RESULTS

No non-compliance noted:

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.37	30	-22.63
Middle	2441	6.61	30	-23.39
High	2480	6.1	30	-23.9

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