

FCC Part 15 Subpart E Test Report

Western Multiplex

U-NII Radio

Model: 28010-XXXX

FCC ID: HZB-U58-100

Job # 3013884

Report # 30138841

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1.0 Summary of Tests**Western Multiplex, MODEL: 28010-XXXX**
FCC ID: HZB-U58-100

Test	Reference	Results
Output power	15.407(a)	Complies, see sec. 4.1 of this report
26 dB Bandwidth	15.407(a)	For calculation only, see sec. 4.2 of this report
Power Density	15.407(a)(5)	Complies, see sec. 4.3 of this report
The ratio of the peak excursion of the modulation envelope to the peak transmit power	15.407(a)(6)	Complies, see sec. 4.4 of this report
Out-of-band Antenna Conducted Emission	15.407(b)	Complies, see sec. 4.5 of this report
Spurious Radiated Emission from transmitter	15.407(b)	Complies, see sec. 4.6 of this report
Radiated Emission in Restricted Bands	15.209, 15.205	Complies, see sec. 4.6 of this report
Radiated Emission from digital part and receiver	15.209	Complies, see sec. 4.7 of this report
AC Conducted Emission	15.207	Complies, see sec. 4.8 of this report
Requirement	15.407(c)	Complies, see Appendix
Requirement	15.407(g)	Complies, see Appendix
Radiation Exposure Requirement	1.1310	Complies, see file "RF Exposure Statement"
Antenna Requirement	15.203	Not applicable, The EUT requires professional installation

Note: According to the test results, the maximum allowed antenna gain is 35 dB. When a higher gain antenna is used, the output power will have to be reduced.

2.0 General Description

2.1 Product Description

The EUT Model No.: 28010-XXXX is an intentional transmitter used for wireless point-to-point communications operating in the frequency range 5.725 - 5.825 GHz.

A pre-production version of the sample was received on November 22, 2001 in good operating condition.

Overview of the U-NII Radio, Model 28010-XXXX

Applicant	Western Multiplex Corporation
Trade Name & Model No.	Tsunami 100 Wireless Bridge Ethernet Bridge, Model: 28010-XXXX
FCC Identifier	HZB-U58-100
Use of Product	Point-to-point fixed wireless communication network
Manufacturer & Model of Spread Spectrum Module	Western Multiplex, Model 28010-XXXX
Type of Transmission	FDD
Rated RF Output (dBm)	≤ 18.0 dBm *
Frequency Range (MHz)	2 Channels in 5747-5803 MHz frequency ranges
Number of Channel(s)	2
Antenna(s) & Gain, dBi	2' Parabolic Antenna, 28.5 dBi 8' Parabolic Antenna, 39.7 dBi 1' Flat Panel Antenna, 23.5 dBi 2' Flat Panel Antenna, 28.0 dBi
Antenna Requirement	☐ The EUT uses a permanently connected antenna. ☐ The antenna is affixed to the EUT using a unique connector which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector. ☒ The EUT requires professional installation (supporting documentation is attached).
Manufacturer name & address	Western Multiplex Corporation 1196 Borregas Avenue Sunnyvale, California 94089

* The output power depends on the gain of the antenna used.

2.2 Related Submittal(s) Grants

None.

2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Data Sheet**" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

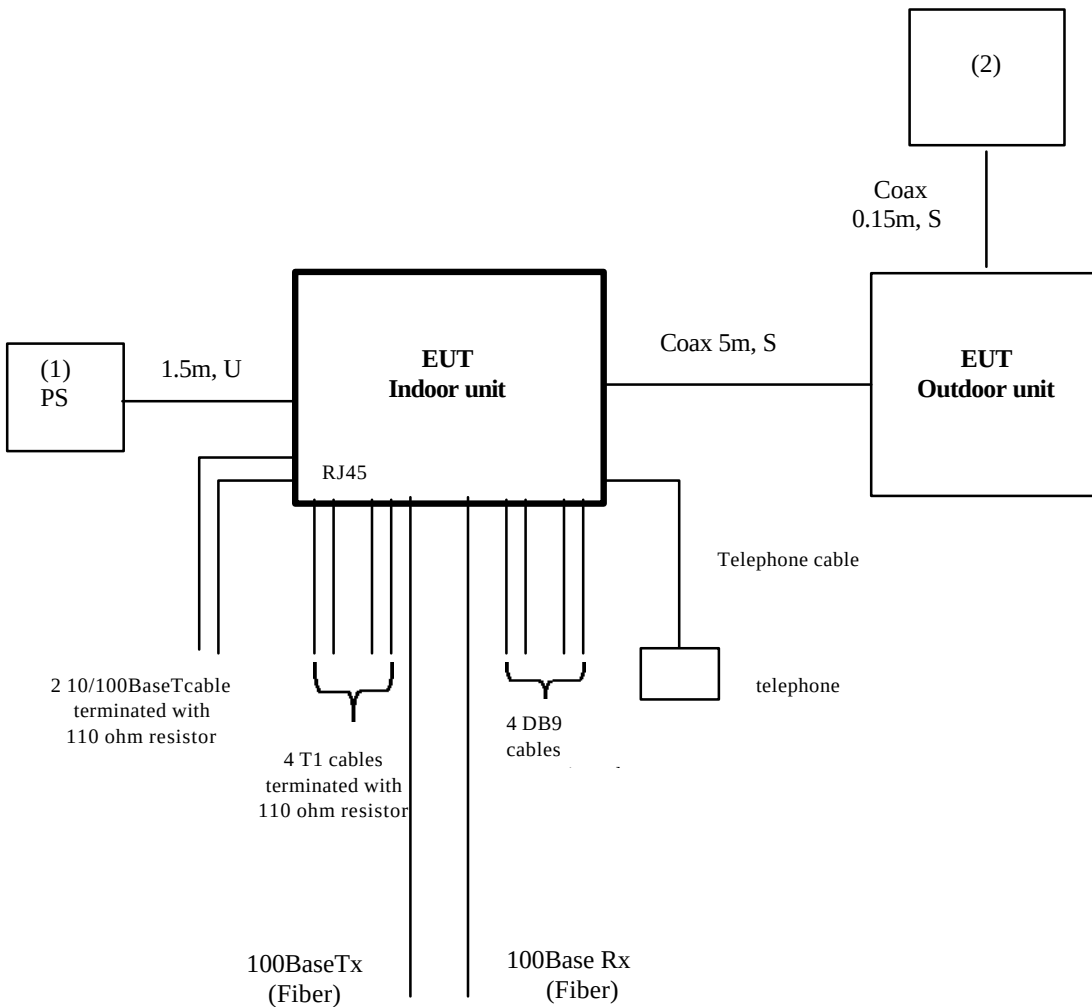
The open area test site and conducted measurement facility used to collect the radiated data is site 2. This test facility and site measurement data have been fully placed on file with the FCC and NVLAP accredited.

Western Multiplex, Model No: 28010-XXXX
FCC ID: HZB-U58-100**Date of Test: Nov. 28-30, Dec. 7, 2001****3.0 System Test Configuration**

3.1 Support Equipment and description

Item #	Description	Model No.	Serial No.
1	HP DC Power Supply	6296A	2234A-04250
2	Gabriel Electronics 1' Directional Flat Panel Antenna	DFPD1-52	N/A
2	Gabriel Electronics 2' Directional Flat Panel Antenna	DFPD2-52	N/A
2	Gabriel Electronics 2' Parabolic Antenna	SSP2-52B	N/A
2	Gabriel Electronics 8' Parabolic Antenna	SSD8-52	N/A

3.2 Block Diagram of Test Setup



All the cables are S, 1 m

S = Shielded
U = Unshielded

F = With Ferrite
M = Length in Meters

3.3 Justification

For emission testing, the Equipment under Test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

For radiated emission measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. For emissions testing, the units were setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing.

3.5 Mode of operation during test

100% time transmitting signal on low and high channels.

3.6 Modifications required for Compliance

The following modifications were installed during compliance testing in order to bring the product into compliance (Please note that this list does not include changes made specifically by Western Multiplex prior to compliance testing):

No modifications were made to the EUT by Intertek Testing Services.

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results**4.1 Conducted Output Power at Antenna Terminal**
FCC Rule 15.407(a)**Requirement:**

For fixed point-to-point U-NII devices operating in 5.725-5.825 GHz band, the peak transmit power shall not exceed the lesser of 1 Watt (30 dBm) or 17 dBm+10Log(B), where B is the 26dB emission bandwidth in MHz (for antenna gain up to 23 dBi). For devices operating in 5.25-5.35 GHz band, the peak transmit power shall not exceed the lesser of 250 mW (24 dBm) or 11 dBm + 10Log(B), where B is the 26 dB emission bandwidth in MHz (for antenna gain up to 6 dBi).

Procedure:

The antenna port of the EUT was connected to the input of a power meter. Power was read directly from the meter and cable loss connection was added to the reading to obtain power at the EUT antenna terminal.

Result:

Frequency, MHz	Output Power, mW	Output Power, dBm	EIRP Limit, dBm	Maximum allowed antenna gain, dBi
Low Channel: 5803	63.1	18.0	53.0	35.0 *
High Channel: 5747	63.1	18.0	53.0	35.0 *

* When a higher gain antenna is used, the Output Power will have to be reduced.

- 4.2 26 dB Bandwidth
FCC Rule 15.407(a) (for calculation only)

Procedure:

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer Res BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 26 dB lower than PEAK level. The 26-dB bandwidth was determined from where the channel output spectrum intersected the display line.

Result:

Frequency, MHz	26 dB Bandwidth, MHz
5803	29.4
5747	29.1

Refer to the following plots for 26-dB bandwidth:

Plot 1a: Low Channel 26 dB Bandwidth

Plot 1b: High Channel 26 dB Bandwidth







4.3 Power Density
FCC Rule 15.407(a)(3)

Requirement:

For fixed point-to-point U-NII devices operating in 5.725-5.825 GHz band the peak power spectral density shall not exceed 17 dBm in any 1 MHz band (for antenna gain up to 23 dBi).

For devices operating in 5.25-5.35 GHz band peak power spectral density shall not exceed 11 dBm in any 1 MHz band (for antenna gain up to 6 dBi).

Procedure:

Antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

The spectrum analyzer Resolution Bandwidth was set to 1 MHz and Video Bandwidth was set to 7 MHz. The START and STOP frequencies were set to the band edges of the maximum output passband. The spectrum analyzer was set to average mode by sampling, 100 sweeps were used. Maximum power spectral density reading was recorded.

Result:

Frequency MHz	Power Density dBm	EIRP Limit dBm	Maximum Allowed Antenna Gain dBi
5803	-1.4	40.0	41.4 *
5747	-1.4	40.0	41.4 *

Refer to the following plots for power density data:

Plot 2a: Low Channel Power Density

Plot 2b: High Channel Power Density

* When a higher gain antenna is used, the Output Power should be reduced and, as a result, the Power Density is in compliance with EIRP Power Density Limit.







- 4.4 The ratio of the peak excursion of the modulation envelope to the peak power
FCC Rule 15.407(a)(6)

Requirement:

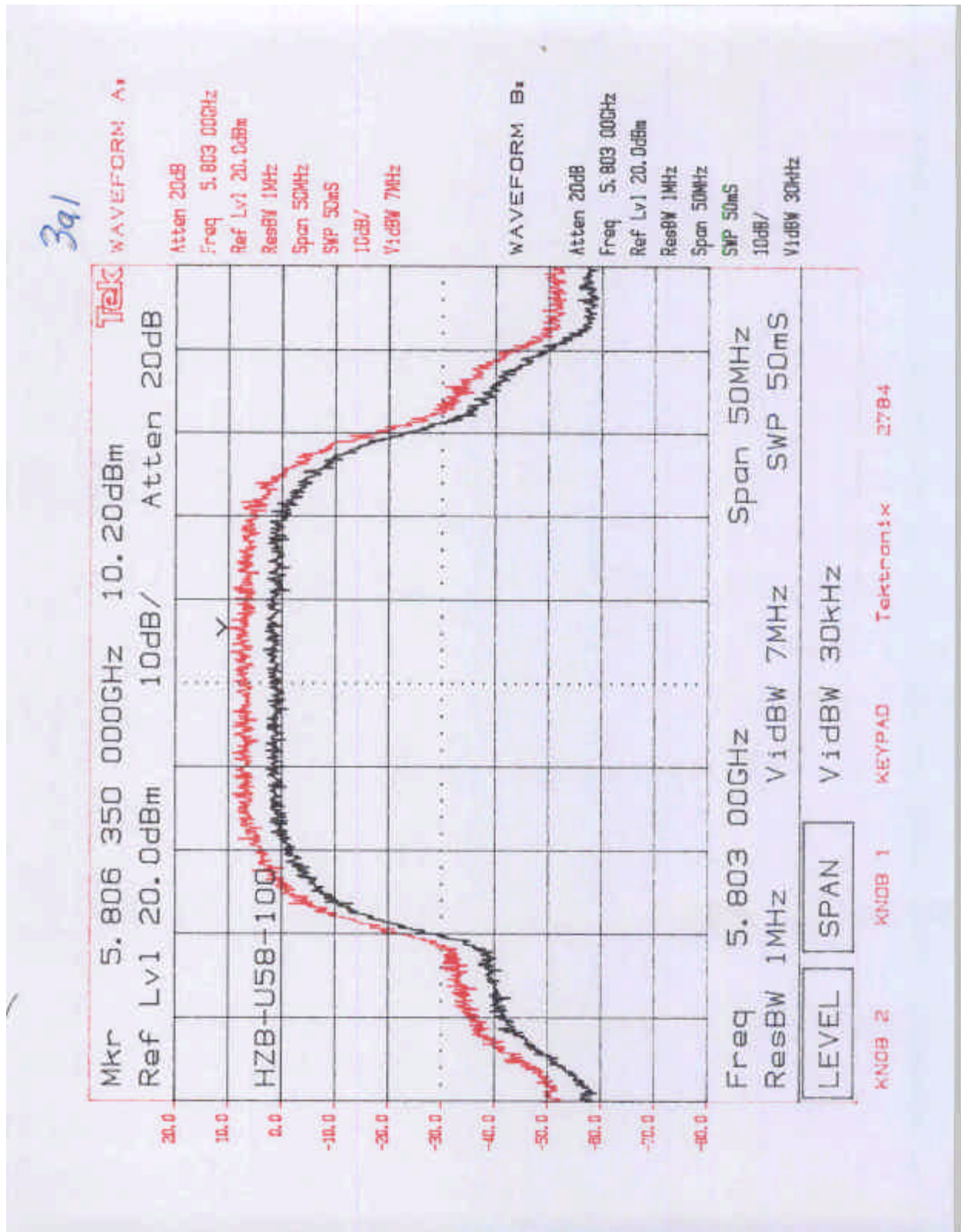
The ratio of the peak excursion of the modulation envelope to the peak transmit power shall not exceed 13 dB.

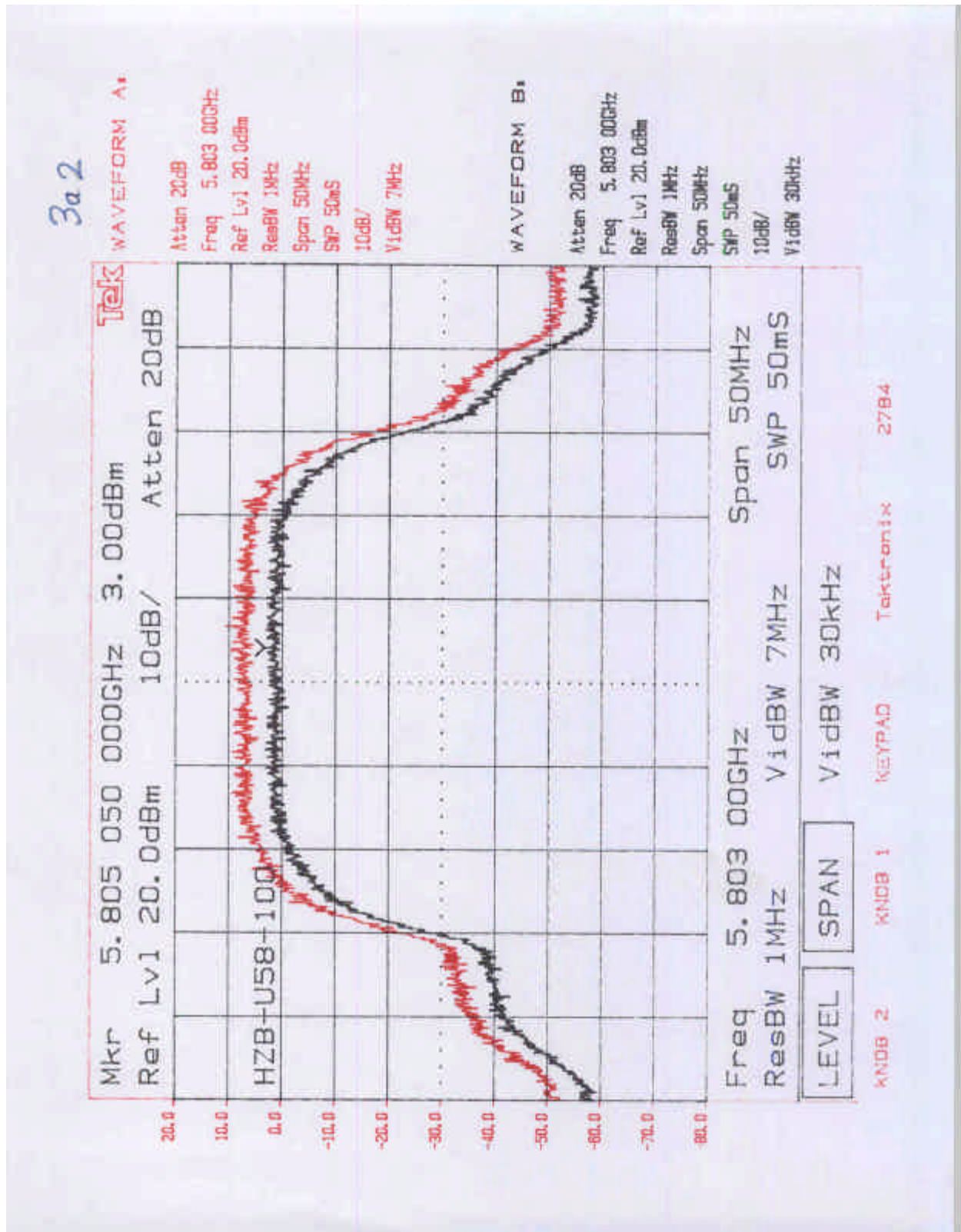
Procedure:

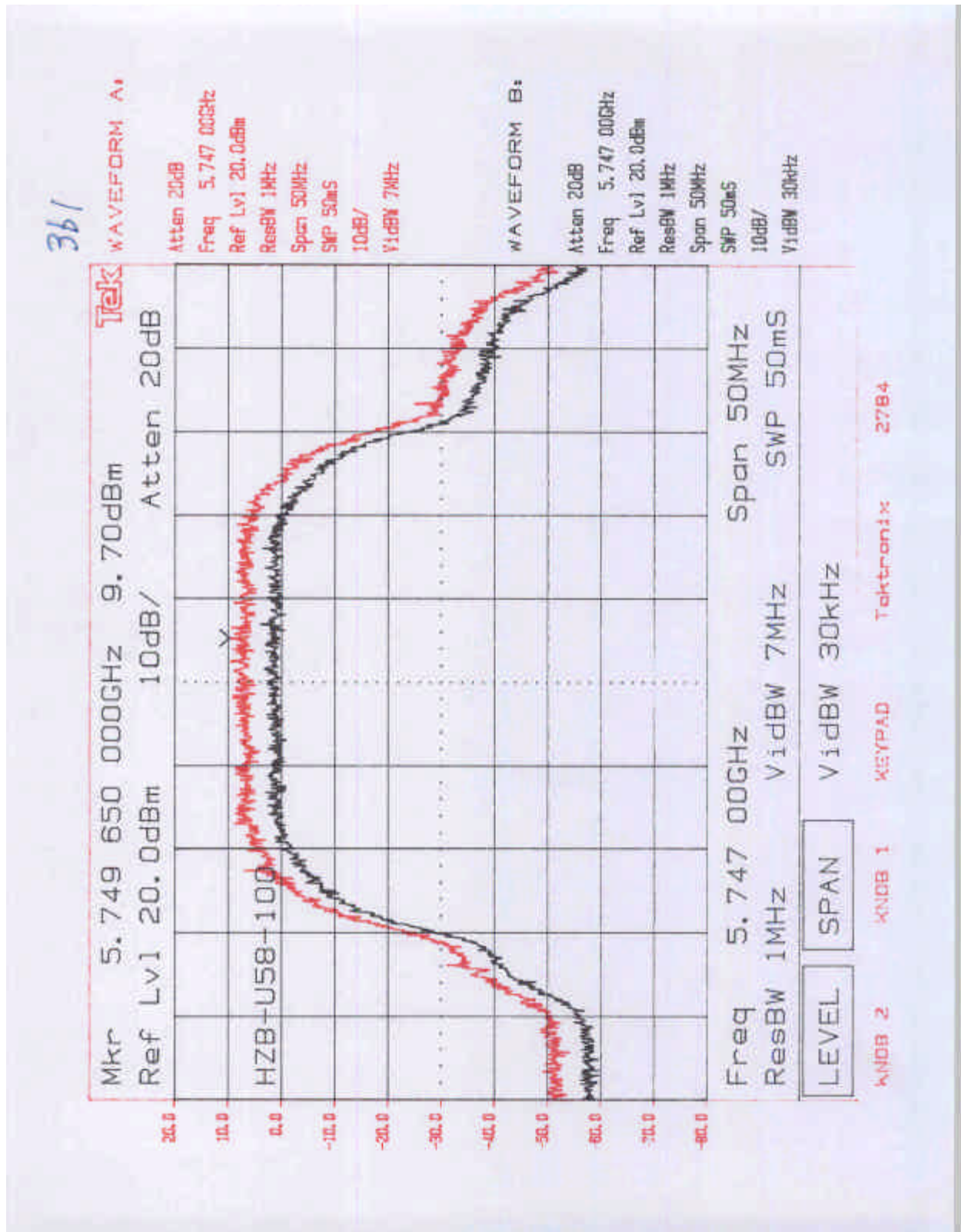
Spectrum Analyzer was connected to the output of the EUT. The Resolution Bandwidth was set to 1 MHz. Two plots were made in each band: with the Video Bandwidth set to 7 MHz and with the Video Bandwidth set to 30 kHz. The difference between spectrum analyzer readings indicates the ratio of the peak excursion of the modulation envelope to the peak transmit power.

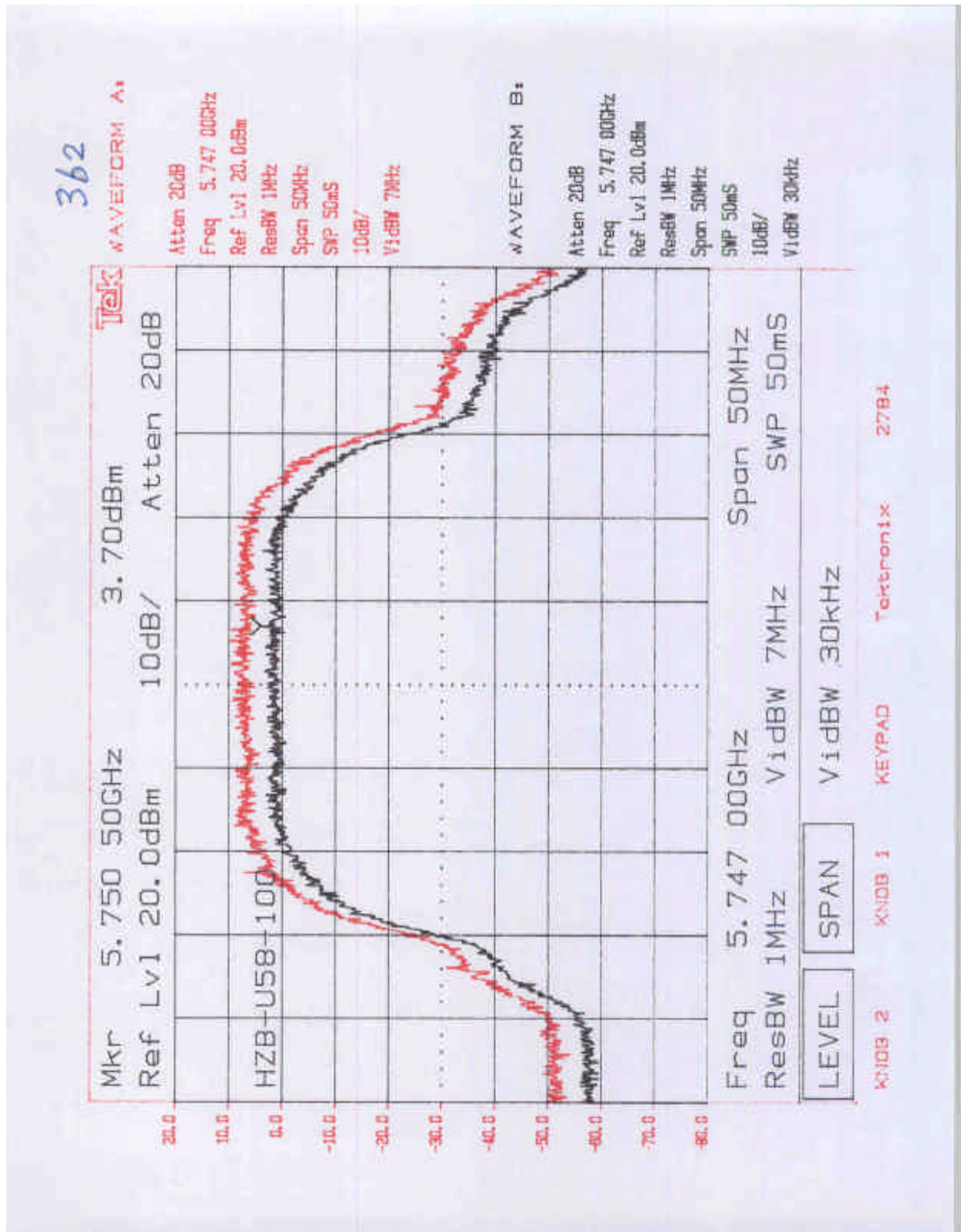
Test Result:

See attached plots 3.a1, 3.a2 and 3.b1, 3.b2. for the ratio of the peak excursion of the modulation envelope to the peak power. The maximum Ratio is 7.2 dB.









4.5 Out-of-Band Conducted Emissions
FCC Rule 15.407(b)

Requirement:

For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed and EIRP of -27 dBm/MHz.

The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

Procedure:

Spectrum Analyzer was connected to the output of the EUT. For measurements above 1 GHz, the Resolution Bandwidth was set to 1 MHz; for measurements below 1 GHz, the Resolution Bandwidth was set 100 kHz, and the Video Bandwidth was set to 100 kHz. Several plots were made in the frequency range from 5715 to 5835 MHz.

In addition, plots were made in the frequency range from 30 MHz to 40 GHz.

Result:

Refer to the following plots and data tables (on the next page) for out-of-band conducted emissions data:

Plot 4.a1 – 4.a10: Low Channel Emissions

Plot 4.b1 – 4.b10: High Channel Emissions



Operating Frequency	Frequency, MHz	Level, dBm	Limit, dBm/MHz	Maximum allowed antenna gain,* dBi
5803 MHz	5715	-70.5 from plot 4.a3	-27.0	43.5
	5725	-70.8 from plot 4.a4	-17.0	53.8
	5826	-66.8 from plot 4.a5	-17.0	49.8
	5835	-69.3 from plot 4.a6	-27.0	42.3

Operating Frequency	Frequency, MHz	Level, dBm	Limit, dBm/MHz	Maximum allowed antenna gain,* dBi
5747 MHz	5715	-68.4 from plot 4.b3	-27.0	41.4
	5725	-64.2 from plot 4.b4	-17.0	47.2
	5825	-69.4 from plot 4.b5	-17.0	52.4
	5835	-69.8 from plot 4.b6	-27.0	42.8

* Maximum antenna gain without reducing the Output Power.

When a higher gain antenna is used, the Output Power should be reduced and, as a result, the Out-of-Band emission is in compliance with EIRP Limit.

