

Exhibit E: Occupied Bandwidth

FCC ID: CW21669-3

Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Operating Band Investigated:

Low Channel - 152.87 MHz

Mid Channel - 161 MHz

High Channel - 170 MHz

Operating Modes Investigated:

Modulated with Random Data

Data Rates Investigated:

1200 baud (only data rate available)

Output Power Investigated:

+20 dBm (not user adjustable)

Power Input Settings Investigated:

Battery operated. Cannot be operated while connected to AC mains or any other power source.

Frequency range Investigated

Start Frequency	152.87 MHz	Stop Frequency	170 MHz
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Software\Firmware Applied During Test

Exercise software	1669-3 Firmware	Version	1.4
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Description

The system was tested using standard operating production software to exercise the functions of the device during the testing.

Equipment Modifications

No EMI suppression devices were added or modified. The EUT was tested as delivered.

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
Test Box	Rothenbuhler Engineering	1669-3	111

Cables

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Serial	No	1.8	No	Test Box	Unterminated
Test Probe	No	0.5	No	Test Box	Antenna Terminal

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

Measurement Equipment

Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	03/08/2001	12 mo
Power Meter	Hewlett Packard	E4418A	SPA	04/09/2001	12 mo
Power Sensor	Hewlett-Packard	8481H	SPB	07/10/2000	24 mo

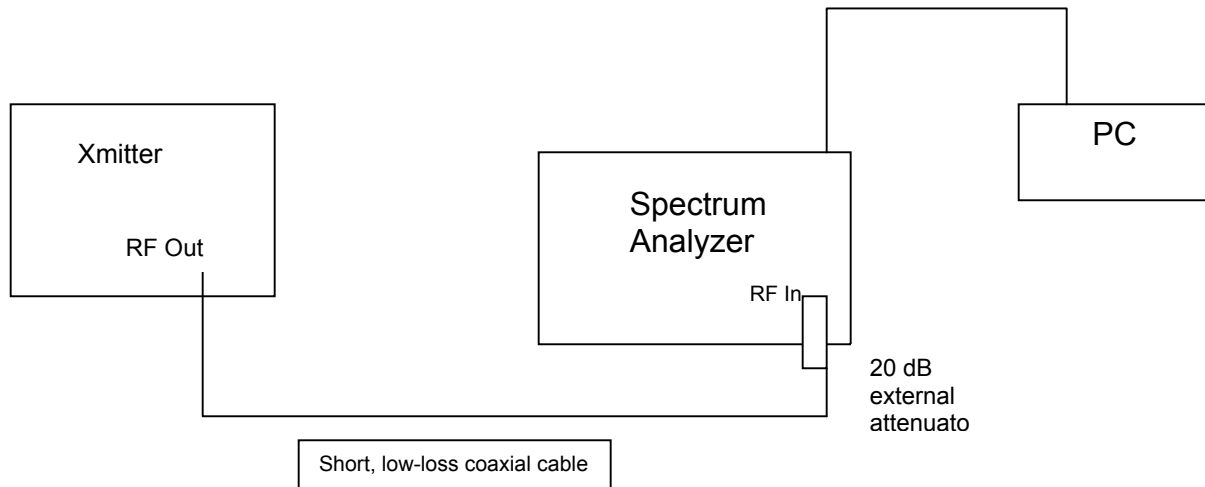
Test Description

Requirement: Per 47 CFR 90.217(b) and 2.1049, the Occupied Bandwidth was measured at the RF output terminals with analyzer plots made for each modulation type. The emission mask is any emission appearing on a frequency 25 kHz or more removed from the assigned frequency must be attenuated at least 30 dB below the unmodulated carrier.

Configuration: A 20 dB external attenuator was used. The attenuator and coaxial cable loss were compensated in the spectrum analyzer. A 300Hz resolution bandwidth with no video filtering and a peak detector were used. The RBW was sufficiently narrow to plot the actual bandwidth of the signal and not the filter response curve of the spectrum analyzer.

The emission mask defined by 90.217(b) is shown on each plot. The 0dB reference for the mask is the measured output power of the unmodulated carrier at that frequency.

Test Setup



Completed by:

A. U. K. P.

NORTHWEST
EMC

EMISSIONS DATA SHEET

Rev BETA
01/30/01

EUT:	Test Box Model 1669-3	Work Order:	ROTH0001
Serial Number:	111	Date:	01/07/02
Customer:	Rothenbuhler Engineering	Temperature:	73 F
Attendees:	Herb Hainey	Tested by:	Greg Kiemel
Customer Ref. No.:	N/A	Humidity:	38% RH
		Power:	N/A
		Job Site:	SU03

TEST SPECIFICATIONS

Specification:	47 CFR 2.1049 & 90.217(b)	Year:	Most Current	Method:	TIA/EIA-603	Year:	1993
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SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

1200 baud, random data. Max and only data rate.

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

The power of any emission must be attenuated below the specified emission mask. The 0 dB reference for the emission mask is the measured output power of 20.14 dBm

RESULTS

AMPLITUDE

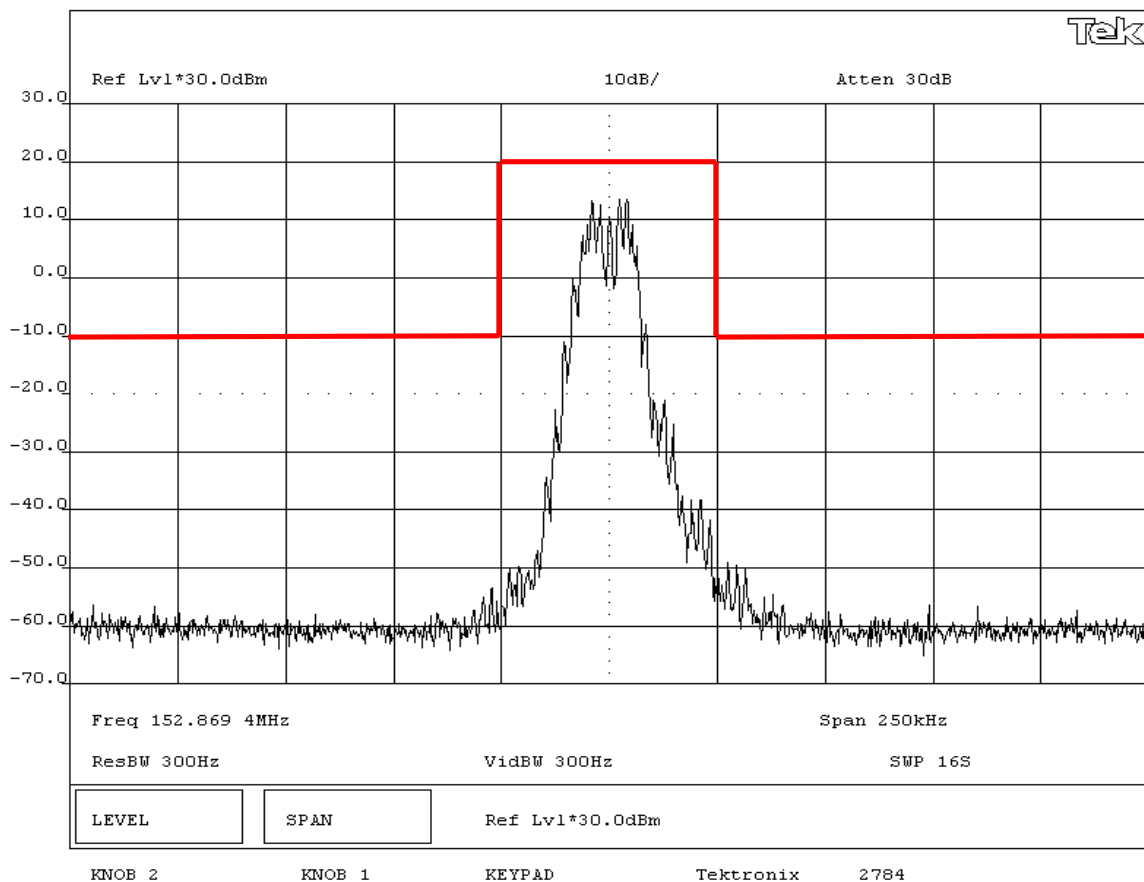
Pass

SIGNATURE

Tested By: 

DESCRIPTION OF TEST

Occupied Bandwidth at Low Channel - Mask for 12.5 kHz Channel BW



Necessary Bandwidth

Calculations are based on worst case alternating 10101010 data.

$$BaudRate(BR) = 1200$$

$$Tone1 = 1300Hz$$

$$Tone2 = 2100Hz$$

$$\begin{aligned} DeviationAudio(D_A) &= (Tone2 - Tone1) \div 2 \\ &= (2100 - 1300) \div 2 \\ &= 400Hz \end{aligned}$$

$$\begin{aligned} FrequencyCenterAudio(F_{CA}) &= ((Tone2 - Tone1) \div 2) + Tone1 \\ &= ((2100 - 1300) \div 2) + 1300 \\ &= 1700Hz \end{aligned}$$

$$\begin{aligned} BandWidthNecessaryAudio(BW_{NA}) &= F_{CA} \pm ((BR + 1.2 * D_A * 2) \div 2) \\ &= 1700 \pm ((1200 + 1.2 * 400 * 2) \div 2) \end{aligned}$$

$$LowerLimit \quad 620Hz$$

$$UpperLimit \quad ,2780Hz \quad HighestModulatingTone$$

$$DeviationRadioFrequency(D_{RF}) = 2KHz$$

$$ModulationHighestTone(M_{HT}) = 2780Hz$$

$$\begin{aligned} BandWidthNecessaryRadioFrequency(BW_{NRF}) &= 2 * M_{HT} + 1.0 * D_{RF} * 2 \\ &= 2 * 2780Hz + 1.0 * 2KHz * 2 \\ &= 9560Hz \end{aligned}$$