TEST DATA

T-2350 (Digital Body Wire) RF Power Output:

Relevant FCC Chapter:

"§ 2.1046 Measurements required: RF power output.

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

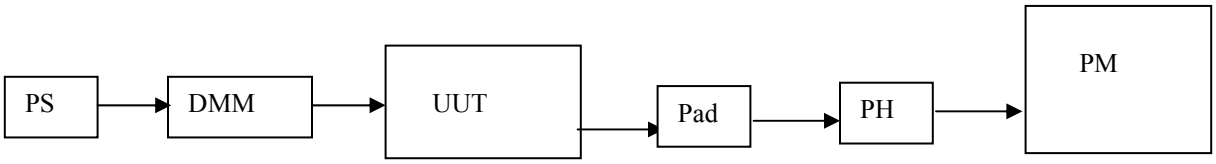
§ 2.1033 Application for certification.

(c) Applications for equipment other than that operating under parts 15 and 18 of the rules shall be accompanied by a technical report containing the following information:

(8) The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range."

Test Setup:

The setup for this test is shown below.



PS – Power Supply – Kikisui PAB18-38
DMM – Digital Multi-Meter – HP 3478A – 2619A31605
UUT – T-2350 Digital Body Wire
Pad – 10 dB Pad – Mini Circuits CAT10
PH – Power Head – HP 8481A – SN 2702A53289
PM – Power Meter - HP 437B - SN 2342A06759

Test Method:

The unit under test was set to a frequency 162.5 MHz, then calibrated to 1 watt at a supply voltage of 9.0 VDC. For the data collection, the RF output of the UUT was measured at three frequencies across the operating band. The power was measured with the 10 dB pad (50 ohms, pure resistive) connected directly to the RF output of the UUT.

Test Results:

The results of the test are shown in Figures 1 and 2.

RF power output and current consumption as a function of frequency and supply voltage

Frequency (MHz)	9.0 VDC	
	Pout (mW)	I (mA)
150	800	210
162.5	1000	235
174	920	242

Figure 1 - Power Output (Pursuant to FCC Requirement 2.1046a) – Raw Data

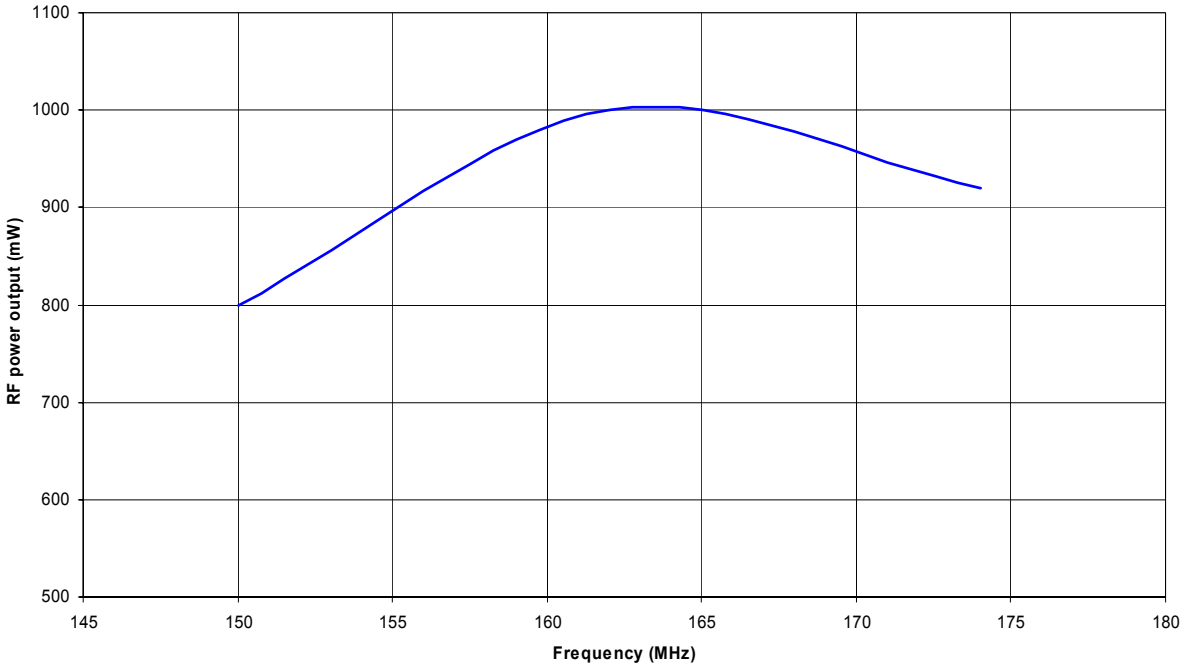


Figure 2 - RF Power Output As A Function of Frequency (Pursuant to FCC Requirement 2.1046a)

T-2350 (Digital Body Wire) Modulation Characteristics - Deviation Frequency Response

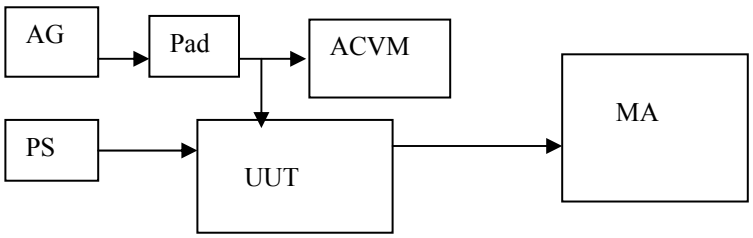
Relevant FCC Chapter:

"§ 2.1047 Measurements required: Modulation characteristics.

(a) *Voice modulated communication equipment.* A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted."

Test Setup:

The setup for this test is shown below.



AG – Audio Generator – Leader LAG120B – SN 7090853
PS – Power Supply – Kikisui PAB18-38
Pad – 10 dB Pad – Mini Circuits CAT10
ACVM – AC Volt Meter – Leader LMV181A – 3100941
UUT – T-2350 Digital Body Wire
MA – Modulation Analyzer – IFR 2975 – SN 598001503

Test Method:

The unit under test was calibrated to 100% modulation with a 1 kHz tone resulting in FM deviation of 2.5 kHz at the Narrow Band setting and 5 kHz at the Wide Band setting. For the purposes of the test, the audio input of the unit was driven with a level adequate to modulate the carrier at 20% (for both the Narrow and Wide Band settings) from 100 Hz to 3100 Hz with measurements being taken at every 100 Hz.

Test Results:

The results of the test are shown in Figures 3 and 4 . Below 300 Hz it was not possible to drive the input level high enough to elicit a 20% modulation level. This is due to the design of the AGC circuit, described in detail in the Circuit Description document that is part of this filing.

AC mV RMS Required to Maintain Deviation (500 Hz for Narrow, 1kHz for Wide)

Hz x 100	Narrow Band Modulation		Wide Band Modulation	
	AGC On	AGC Off	AGC On	AGC Off
1	*	*	*	*
2	2.35	*	*	*
3	1.30	20.5	1.30	21.3
4	.9	14.5	.94	15.0
5	.72	11.75	.75	12.0
6	.59	9.25	.61	9.60
7	.5	7.65	.52	7.90
8	.43	6.30	.47	6.80
9	.40	5.70	.41	6.00
10	.39	5.40	.39	5.55
11	.36	5.00	.36	5.10
12	.34	4.50	.34	4.60
13	.32	4.20	.33	4.30
14	.31	4.05	.32	4.10
15	.31	3.85	.31	4.00
16	.30	3.75	.30	3.80
17	.29	3.55	.29	3.60
18	.28	3.40	.28	3.40
19	.27	3.20	.28	3.20
20	.26	3.00	.27	3.10
21	.26	2.72	.26	3.00
22	.25	2.68	.25	2.70
23	.24	2.55	.25	2.60
24	.24	2.45	.24	2.50
25	.24	2.45	.24	2.45
26	.24	2.55	.25	2.55
27	.24	2.63	.26	2.65
28	.25	2.89	.26	2.90
29	.27	3.25	.28	3.25
30	.30	3.75	.32	3.80
31	.54	8.70	.57	9.80
32	1.1	*	1.20	*
33	6.3	*	7.40	*

* unable to achieve 20% deviation

Figure 3 - Deviation Frequency Response (Pursuant to FCC Requirement 2.1047a) – Raw Data

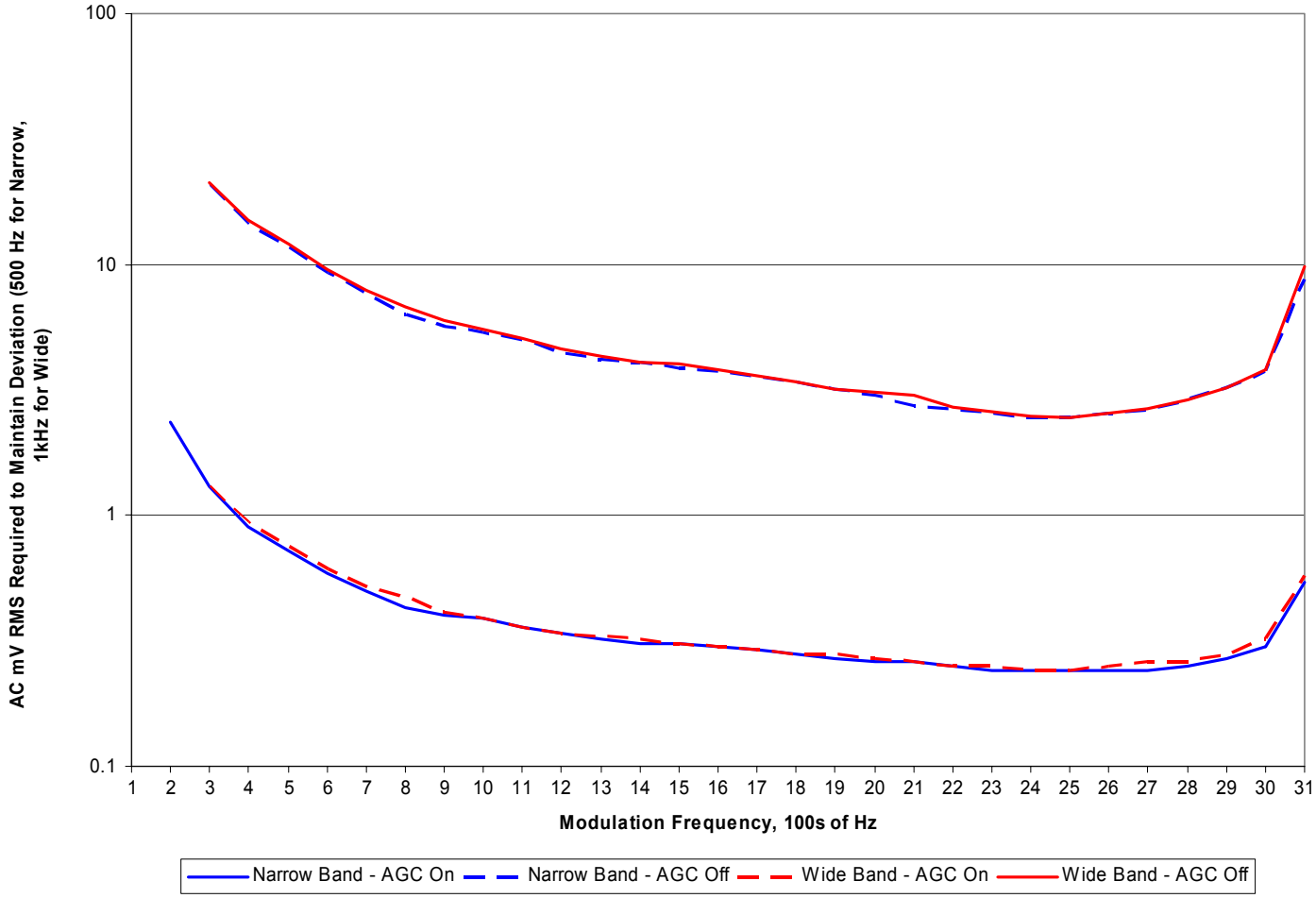


Figure 4 – Audio Sensitivity as a Function of Input Frequency (Pursuant to FCC Requirement 2.1047a)

T-2350 (Digital Body Wire) Modulation Characteristics – Modulation Sensitivity

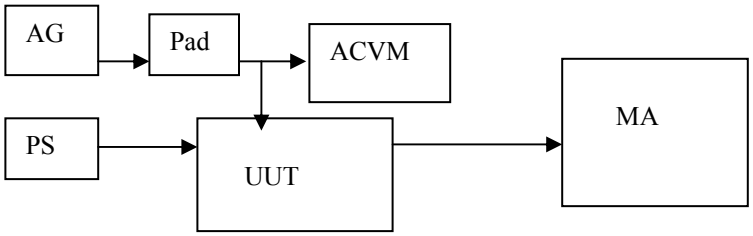
Relevant FCC Chapter:

"§ 2.1047 Measurements required: Modulation characteristics.

(b) *Equipment which employs modulation limiting*. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed. "

Test Setup:

The setup for this test is shown below.



AG – Audio Generator – Leader LAG120B – SN 7090853
PS – Power Supply – Kikisui PAB18-38
Pad – 10 dB Pad – Mini Circuits CAT10
ACVM – AC Volt Meter – Leader LMV181A – 3100941
UUT – T-2350 Digital Body Wire
MA – Modulation Analyzer – IFR 2975 – SN 598001503

Test Method:

The unit under test was calibrated to 100% modulation with a 1 kHz tone at a level of 50 mV RMS. This resulted in FM deviation of 2.5 kHz at the Narrow Band setting and 5 kHz at the Wide Band setting. For the purposes of the test, the audio input of the unit was driven at 10 mv intervals from 10 to 100 AC mvRMS, as well as 1 AC mV RMS and 5 AC mV RMS, for each of the audio tones of 500, 1000, and 3000 Hz. At each voltage interval and frequency, the deviation was recorded with the unit in Narrow Band mode, AGC on and off, and Wide Band mode, AGC on and off. Measurements above 100% modulation at each frequency were not recorded.

Test Results:

The results of the test are shown in Figures 5, 6 and 7.

Kilohertz of deviation as a function of audio input level at various frequencies

Audio Input ACmvRMS	500 Hz				1000 Hz				3000 Hz			
	Narrow		Wide		Narrow		Wide		Narrow		Wide	
	AGC On	AGC Off	AGC On	AGC Off	AGC On	AGC Off	AGC On	AGC Off	AGC On	AGC Off	AGC On	AGC Off
1	700	110	1360	140	1400	150	2840	200	2050	200	4070	310
5	1020	230	1970	460	1800	490	3940	880	2.72*	700	5.36*	1280
10	1040	450	1980	880	2080	880	4200	1710		1300		2470
20	1080	850	2010	1670	2150	1750	4270	3500		2440		4750
30	1100	1070	2200	2130	2290	2190	4480	4500		2.62*		5.15*
40	1600	1590	3200	3170	2.6*	2.6*	5.34*	5.37*				
50	2060	2060	4190	4180								
60	2320	2310	4730	4710								
70	2.52*	2.52*	5.17*	5.15*								
80												
90												
100												

* - 100% modulation reached

Figure 5 - Modulation Sensitivity (Pursuant to FCC Requirement 2.1047b) – Raw Data

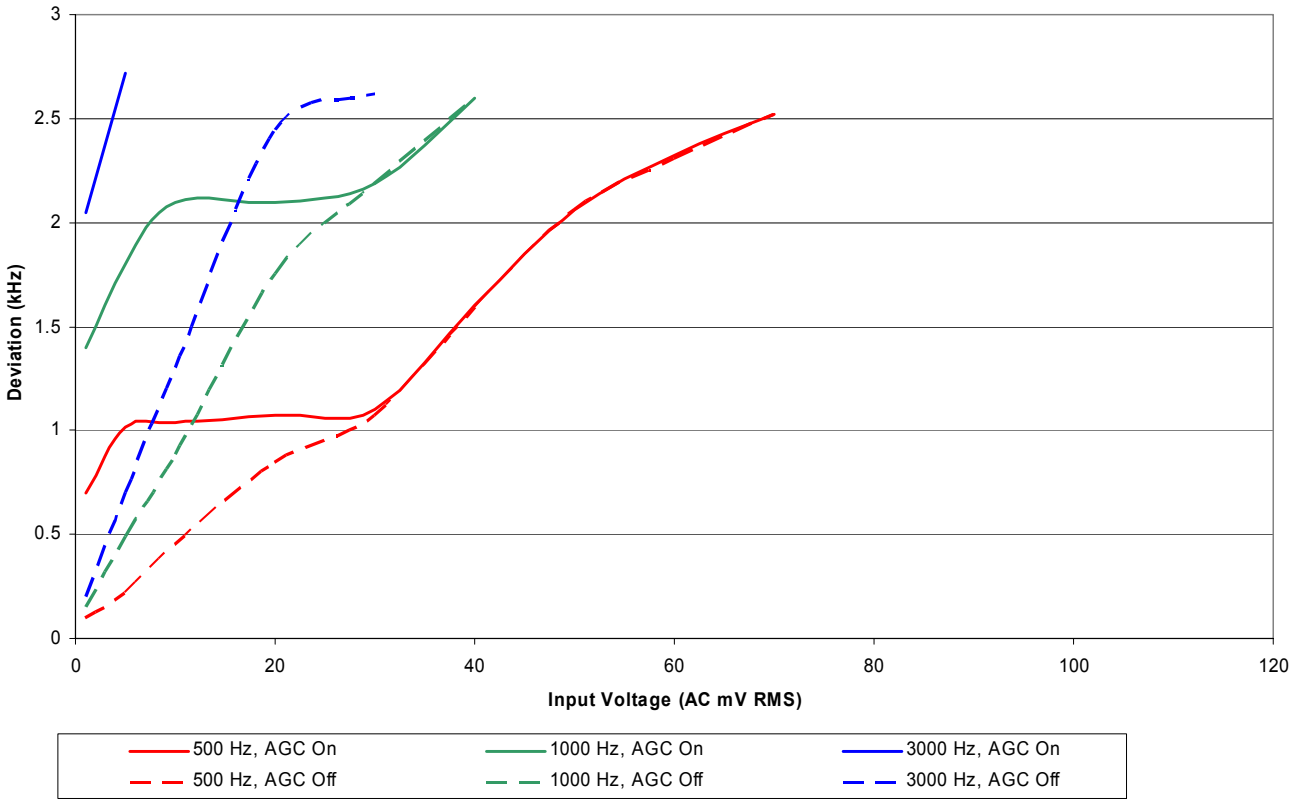


Figure 6 - Narrow Band Modulation Sensitivity (Pursuant to FCC Requirement 2.1047b)

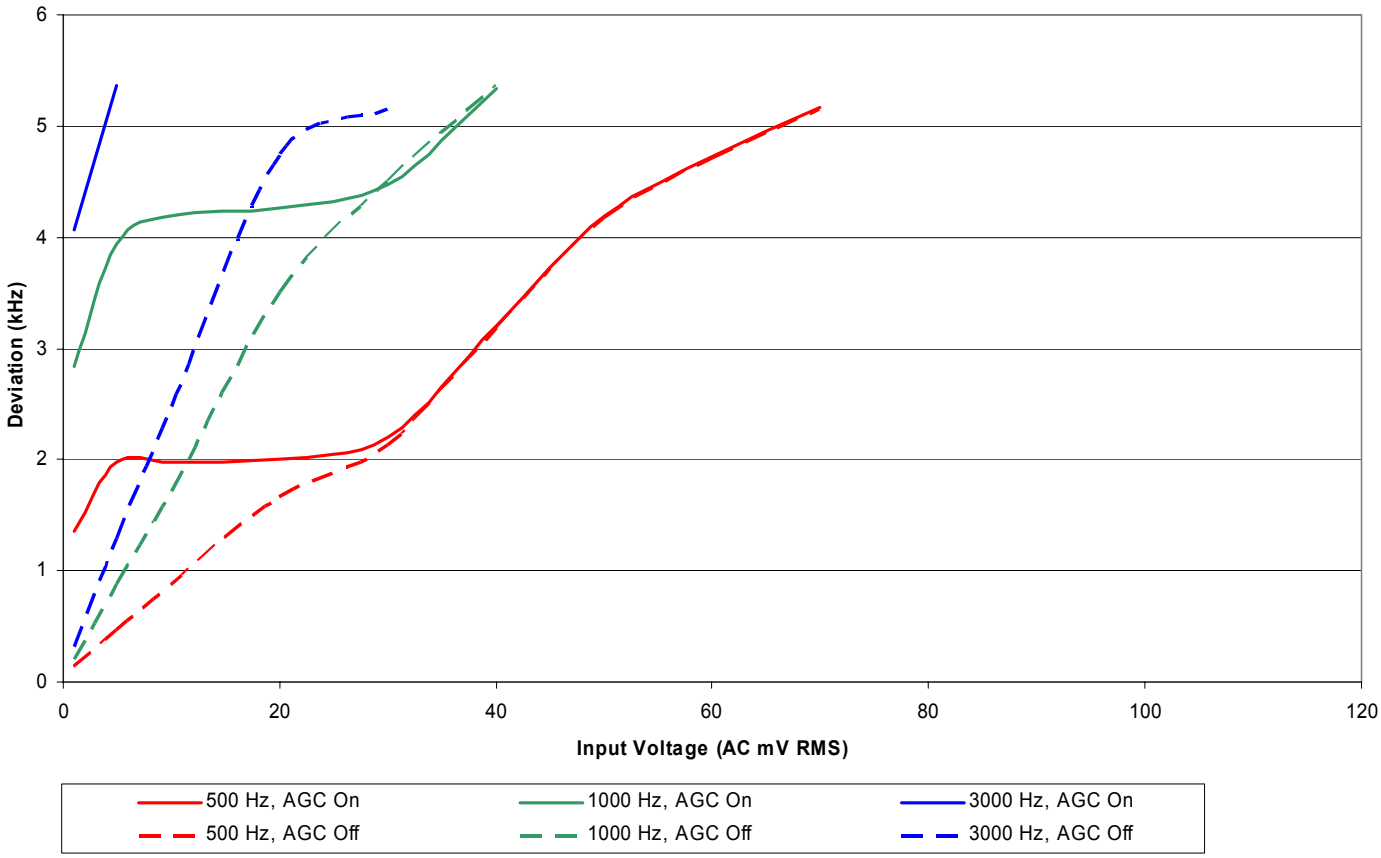


Figure 7 - Wide Band Modulation Sensitivity (Pursuant to FCC Requirement 2.1047b)

T-2350 (Digital Body Wire) Occupied Bandwidth

Relevant FCC Chapters:

§ 2.1049 Measurements required: Occupied bandwidth.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(c) Radiotelephone transmitters equipped with a device to limit modulation or peak envelope power shall be modulated as follows.

(1) Other than single sideband or independent sideband transmitters—when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

§ 90.210 Emission masks.

(The T-2350 is designed to operate at either 12.5 kHz bandwidth (aka Narrow), 25 kHz bandwidth (Wide), or off. Under Section 90 part 210, the masks for equipment designated to operate in the 150 to 174 MHz band are specified in the Applicable Emission Masks Chart, footnote 2.)

" [2] Equipment designed to operate with a 25 kHz channel bandwidth must meet the requirements of Emission Mask B or C, as applicable. Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D"

(d) *Emission Mask D - 12.5 kHz channel bandwidth equipment.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27 dB.

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

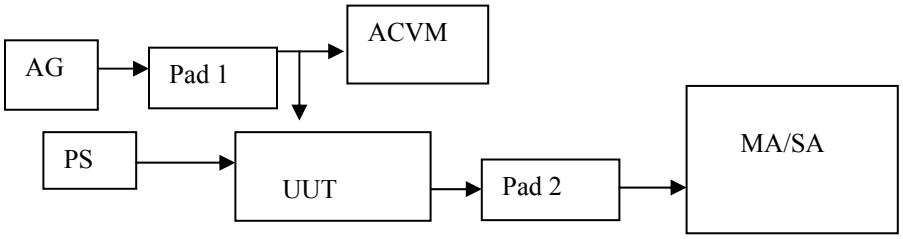
(b) *Emission Mask B - 25 kHz channel bandwidth equipment.* For transmitters that are equipped with an audio lowpass filter pursuant to § 90.211(a), the power of any emission must be below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

Test Setup:
The setup for this test is shown below.



AG – Audio Generator – Leader LAB120B – SN 7090853
PS – Power Supply – Kikisui PAB 18-3A
Pad 1 – 10 dB Pad – Mini Circuits CAT10
ACVM – AC Volt Meter – Leader LMV181A – SN 3100941
UUT – T-2350 Digital Body Wire
MA – Modulation Analyzer – IFR 2975 – SN 598001503
SA – Spectrum Analyzer – Advantest R3131 – SN
Pad 2 – 10 dB Pad – Mini Circuits CAT10

Test Method:
With the carrier frequency 162.500000MHz and the Power Supply set to 9.0 VDC, the unit under test was calibrated to 100% modulation with a 1 kHz tone at a level of 10 mV RMS. The Unit was then modulated with a 2500 Hz tone at a level of %50 – 1.25 kHz. The input level was then increased by 16 dB. The deviation was measured using the IFR 2975 Modulation analyzer, then the output was switched to the spectrum analyzer for the purpose of measuring the occupied bandwidth. The spectrum was measured with the unit set to each of the following modes:

Unmodulated Carrier
Narrow Band, Digital Voice Modulation
Narrow Band, AGC On
Narrow Band, AGC Off
Wide Band, AGC On
Wide Band, AGC Off

For the purpose of calculating mask segments, the power of the unmodulated carrier was 1 watt, therefore:

90.210 (b) (3) 43 + 10log(1) = 43 dB
90.210 (d) (3) 50 + 10log(1) = 50 dB

The mask calculations are shown in figures 8, 9, and10

Test Results:
The results of the test are shown in Figures11 - 16.
The unit under test passes per the criteria established in 2.1049 and 90.210.

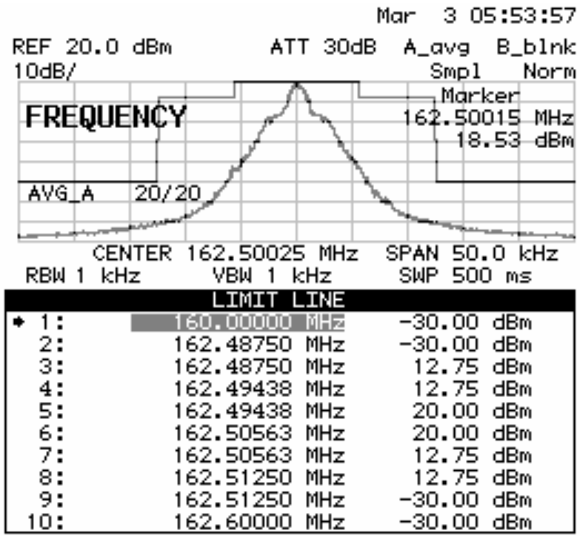


Figure 8 – Mask 90.210d3 Parameters

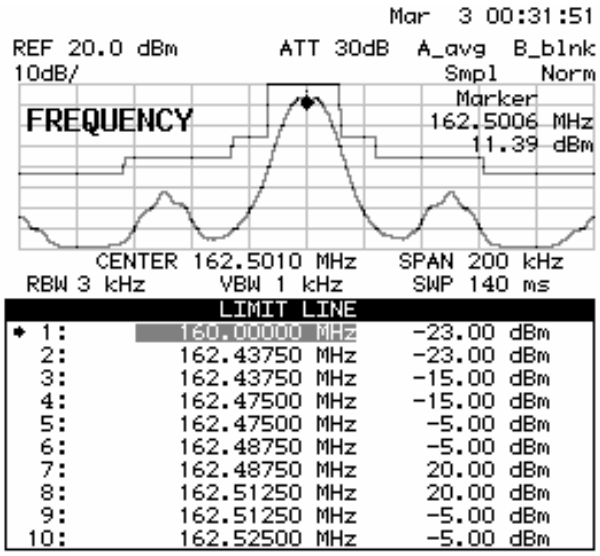


Figure 9 – Mask 90.210b3 Parameters (Part 1)

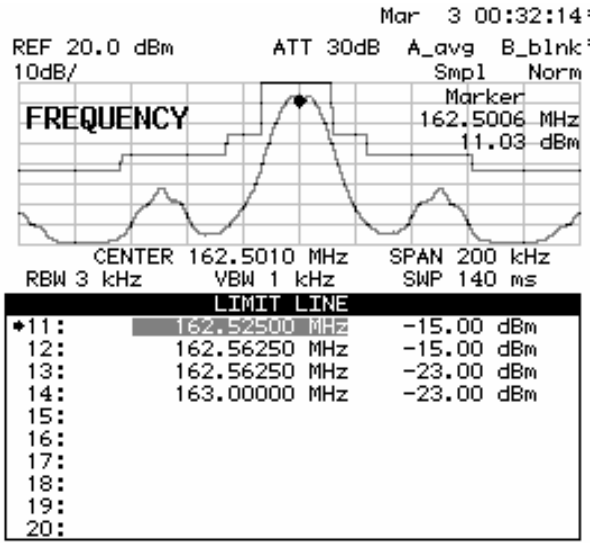


Figure 10 – Mask 90.210b3 Parameters (Part 2)

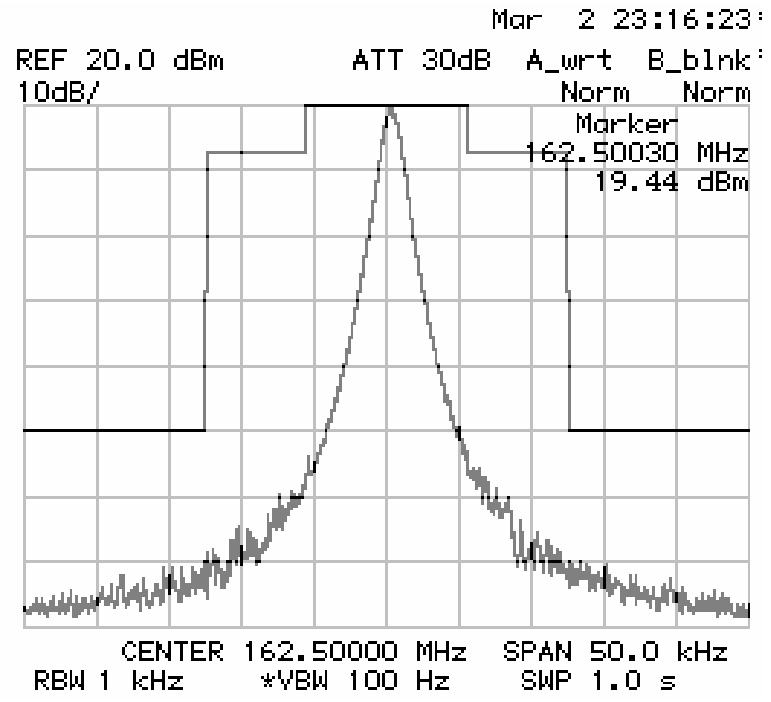


Figure 11 – Unmodulated Carrier

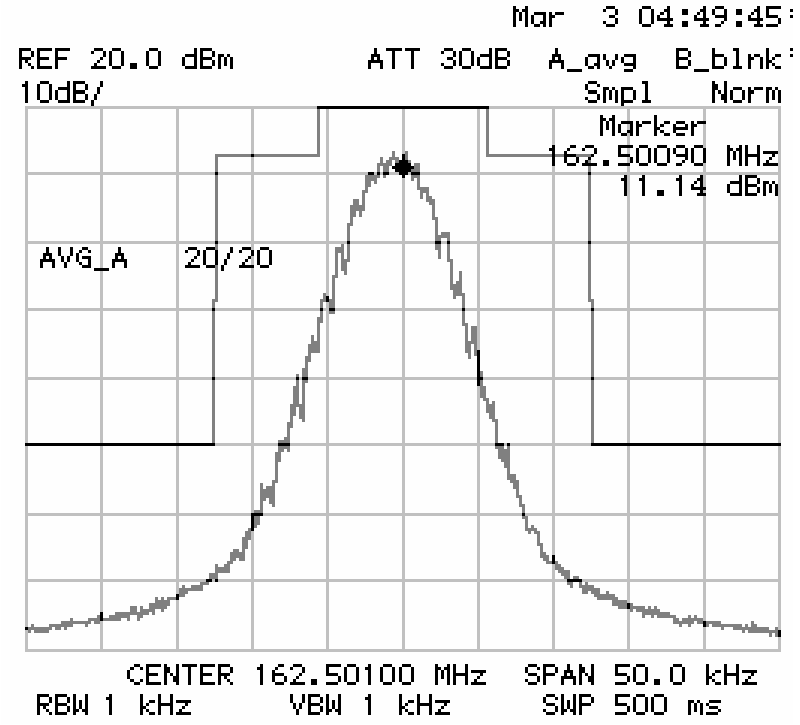


Figure 12 – Digital Modulation

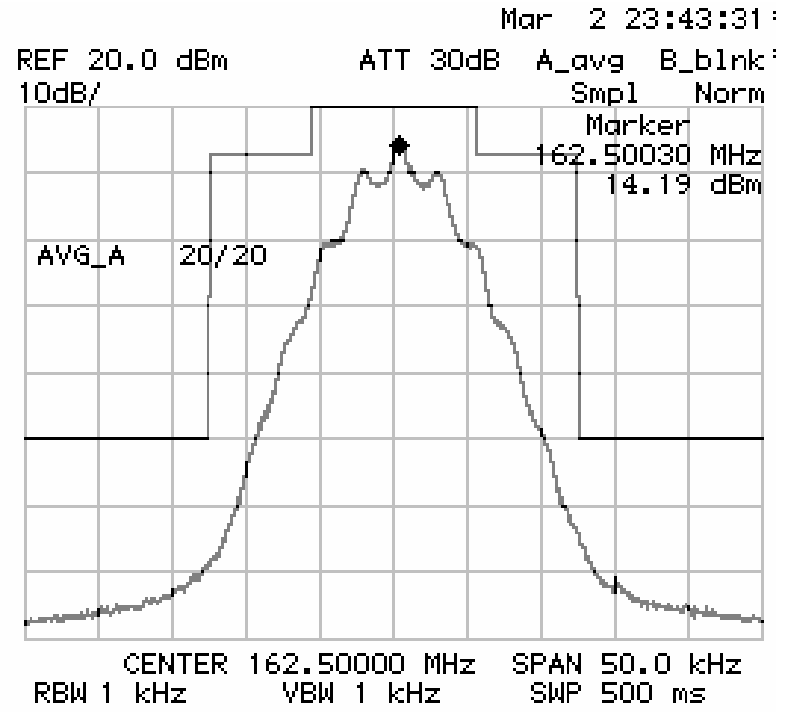


Figure 13 – Narrow Band, AGC On

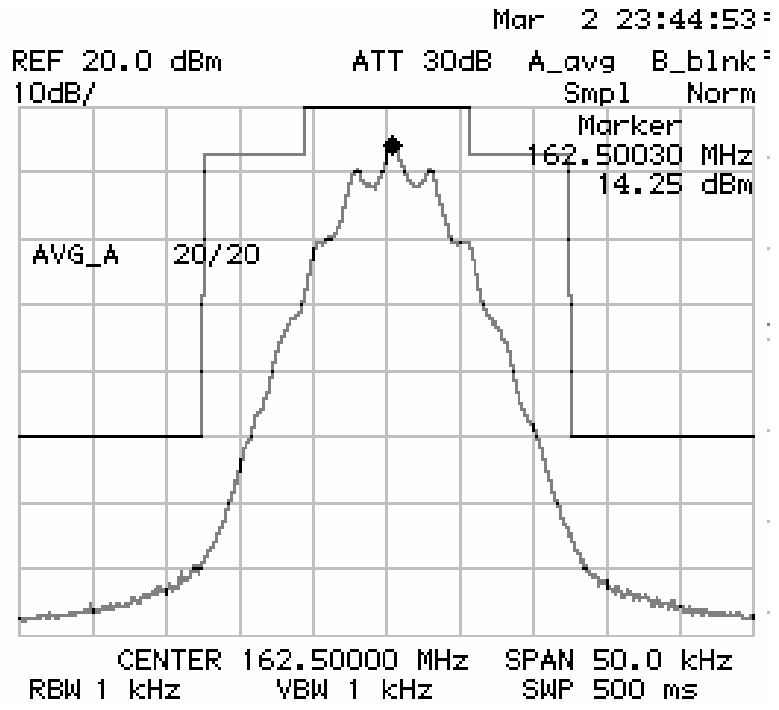


Figure 14 – Narrow Band, AGC Off

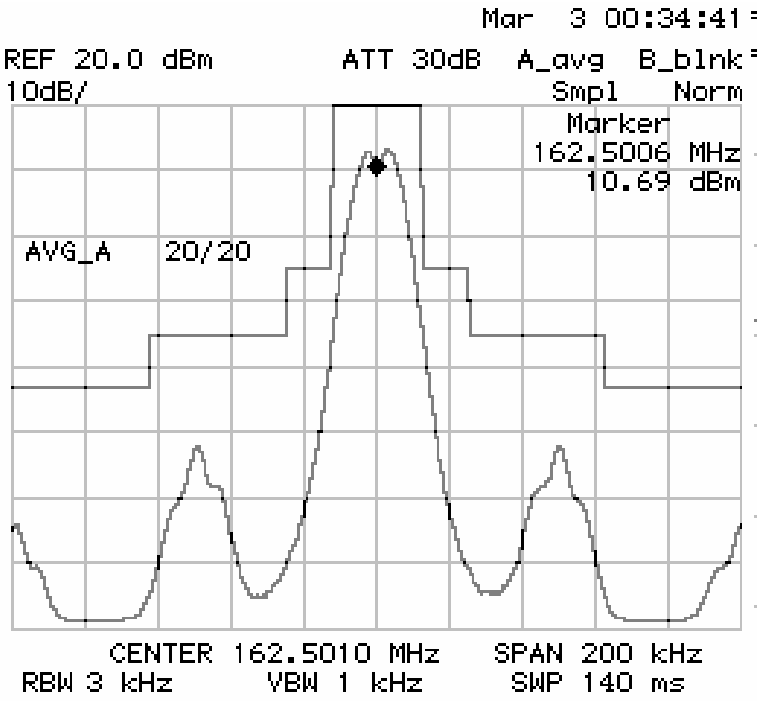


Figure 15 – Wide Band, AGC On

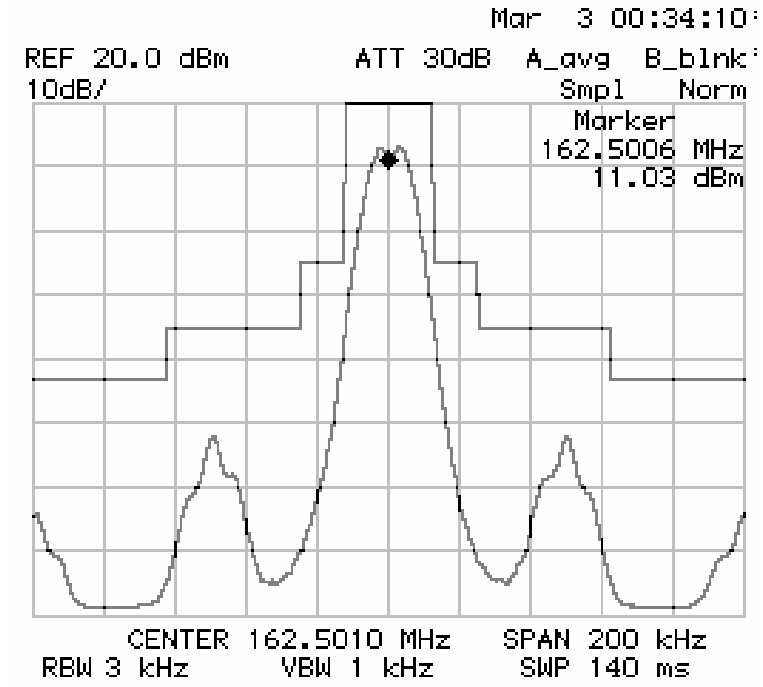


Figure 16 – Wide Band, AGC Off

T-2350 (Digital Body Wire) Spurious Emissions at Antenna Terminals

Relevant FCC Chapters:

§ 2.1051 Measurements required: Spurious emissions at antenna terminals.

The radio frequency powers within the voltage or generated equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

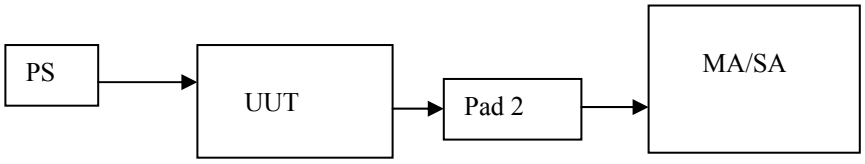
Harmonic	Frequency (MHz)	Narrow and Level (dBc)	Wide band level (dBc)

§ 2.1049 Measurements required: Occupied bandwidth. (c) (1)

§ 90.210 Emission masks. (b) (d)

Test Setup:

The setup for this test is shown below.



PS – Power Supply – Hewlett-Packard HP6207B – SN 1149A01889
UUT – T-2350 Digital Body Wire
MA – Modulation Analyzer – Marconi 2955R – SN 132260-001
SA – Spectrum Analyzer – Advantest R3162 – SN 120401992
Pad 2 – 10 dB Pad – Mini Circuits CAT10

Test Method:

The method used for testing Spurious Emissions is identical to the method used for testing the Occupied Bandwidth. The spectrum was measured with the unit set to each of the following modes:

Narrow Band, AGC On
Wide Band, AGC On

For the purpose of calculating mask segment (b)(3), the power of the unmodulated carrier was 1 watt, therefore

$$43 + 10\log(1) = 43 \text{ dBc}$$

Test Results:

The results of the test are shown in Figures 17, 18, and 19.
The unit under test passes per the criteria established in 2.1051, 2.1049, and 90.210.

F2	324	-62	-60
F3	486	>-70	>-70
F4	648	>-70	>-70
F5	810	>-70	>-70
F6	972	>-70	>-70
F7	1134	>-70	>-70
F8	1296	>-70	>-70
F9	1458	>-70	>-70
F10	1620	>-70	>-70
F11	1782	>-70	>-70

F12	1944	>-70	>-70

Figure 17 – Spurious Emissions (Pursuant to FCC Requirement 2.1051) – Raw Data F0 162.500000MHz – 0dB ref.

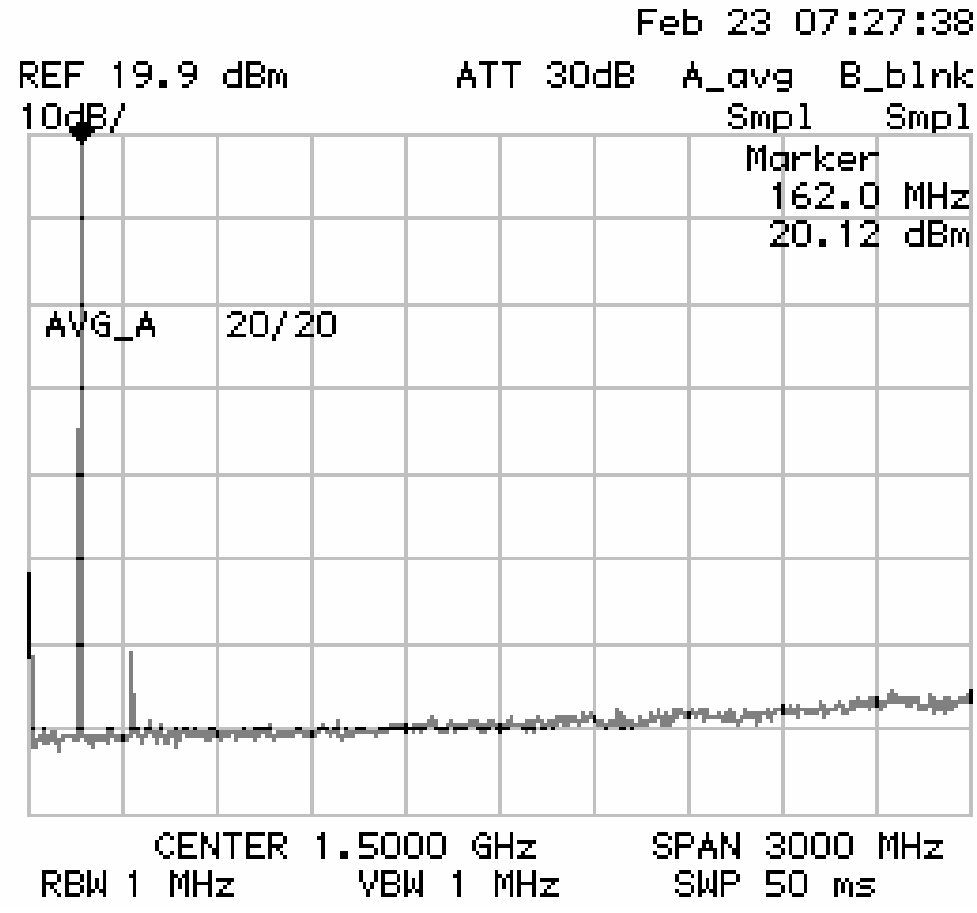


Figure 18 – Narrow Band Spurious Emissions – Spectral Display

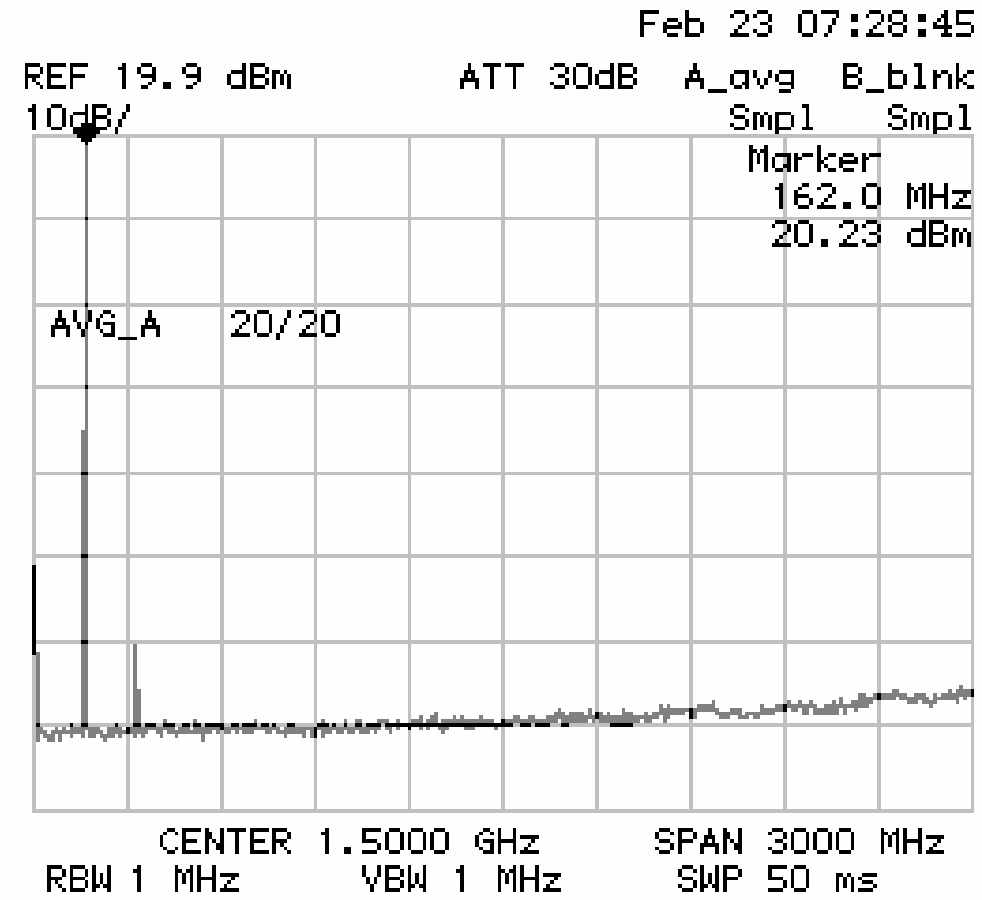


Figure 19 – Wide Band Spurious Emissions – Spectral Display

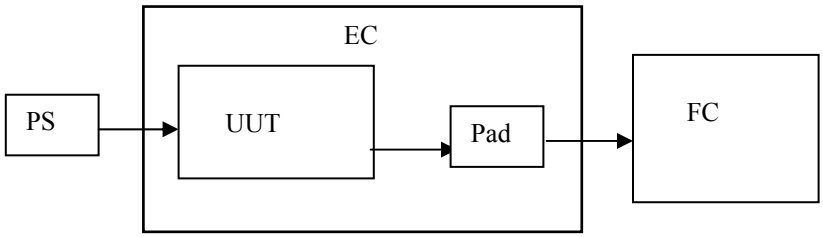
T-2350 (Digital Body Wire) Frequency Stability: Temperature Stability

Relevant FCC Chapter:
"§ 2.1055 Measurements required: Frequency Stability.
(a) The frequency stability shall be measured with variation of ambient temperature as follows:
(1) From -30° to +50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

[The T-2350 does not qualify under part 47, chapter 2.1055 (a)(2) or (a)(3)]
(c) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

90.213
(paraphrased) - For stations operating at less than 2 watts, with a 12.5 KHz channel spacing, and in the frequency band between 150 and 174 MHz, the frequency stability shall be less than 5 PPM

Test Setup:
The setup for this test is shown below.



PS – Power Supply – BK 1743 – SN 273 0200 0483
EC – Environmental Chamber – Applied Systems BK-1101 – SN 8665
UUT – T-2350 Digital Body Wire
Pad – 10 dB Pad – Mini-Circuits CAT 10
FC – Frequency Counter – HP 5351B – SN 3049A01169

Test Method:
The unit under test was powered at 9.0 VDC and set to a carrier frequency of 162.5 MHz. The unit was calibrated to 162.5 MHz at an ambient temperature of 22.3° C. The Environmental Chamber was set to –30° C and swept to +70° C in 10° steps. Due to the small size of the chamber and the UUT, the unit was left at each temperature for 30 minutes before the measurement was made. Since there is no method of keying the transmitter or any form of heating element in the UUT, those results are not required.

Test Results:
The results of the test are shown in Figures 20 and 21.

Frequency Deviation (PPM) as a function of temperature

Temp (°C)	Fr Dev. (PPM)
-30	-.04
-20	+.07
-10	+.27
0	+.37
10	+.21
20	0
30	0
40	-.24
50	+.83
60	+1.85
70	+3.01

Figure 20 – Frequency Stability (Pursuant to FCC Requirement 2.1055a) – Raw Data

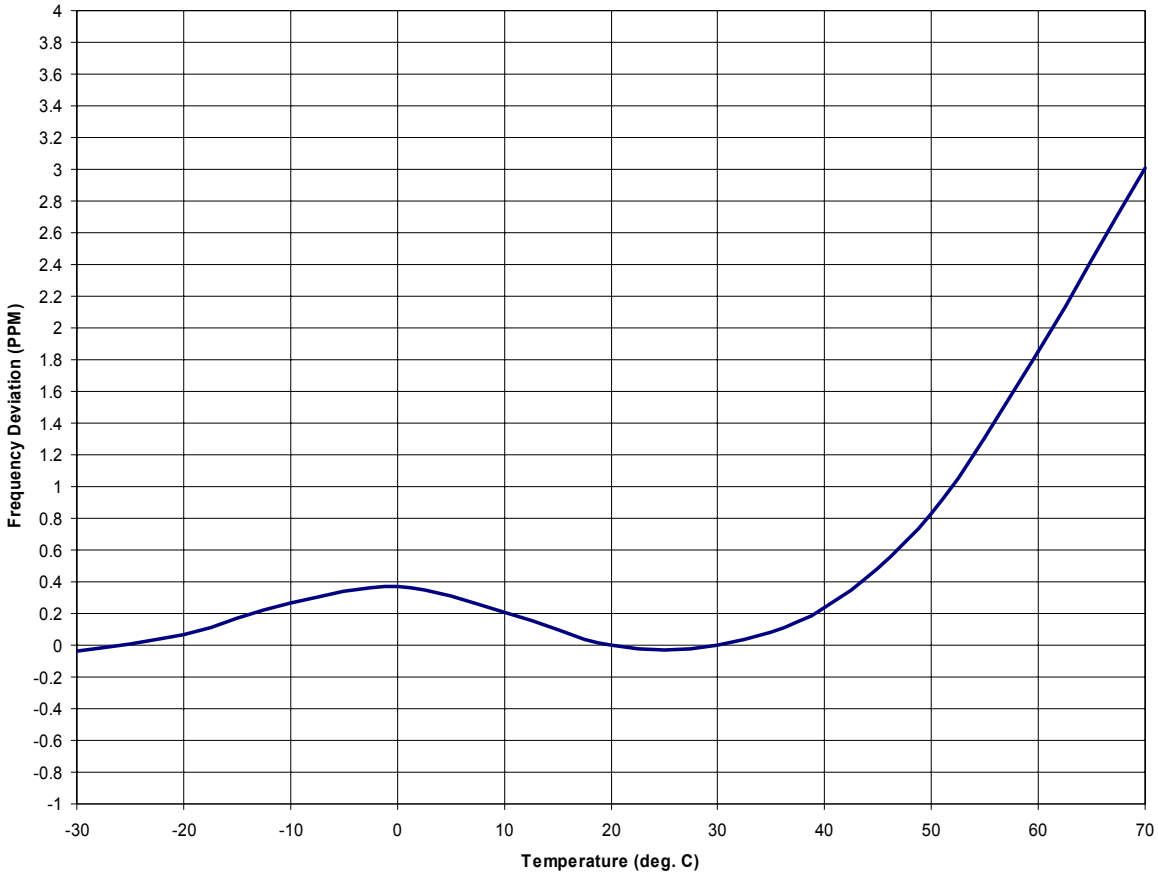
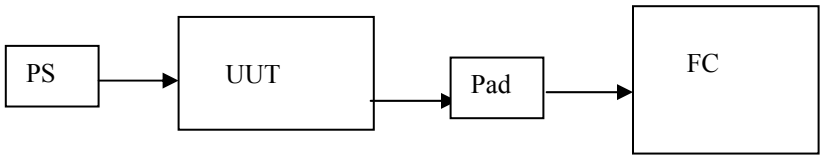


Figure 21 - Frequency Deviation (PPM) as a Function of Temperature (Pursuant to FCC Requirement 2.1055a)

T-2350 (Digital Body Wire) Frequency Stability: Power Supply Stability

Relevant FCC Chapter:
"§ 2.1055 Measurements required: Frequency Stability.
(d) The frequency stability shall be measured with variation of primary supply voltage as follows:
(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

Test Setup:
The setup for this test is shown below.



PS – Power Supply – Hewlett-Packard HP6207B – SN 1149A01889
UUT – T-2350 Digital Body Wire
Pad – 10 dB Pad – Mini-Circuits 10
FC – Frequency Counter – HP 5351B – SN 3049A01169

Test Method:
The unit was calibrated to 162500000Hz with a battery voltage of 9.0 VDC
The Frequency output of the unit under test was measured at supply voltages from 4.0 VDC to 9.0 VDC in .5 VDC increments.

Test Results: The results of the test are shown in Figures 22 and 23.

Frequency Deviation (Hz) as a function of supply voltage

Voltage (VDC)	Fr Dev. (Hz)
4.0	5
4.5	5
5.0	5
5.5	5
6.0	5
6.5	5
7.0	0
7.5	0
8.0	0
8.5	0
9.0	0

Figure 22 – Frequency Stability (Pursuant to FCC Requirement 2.1055d) – Raw Data

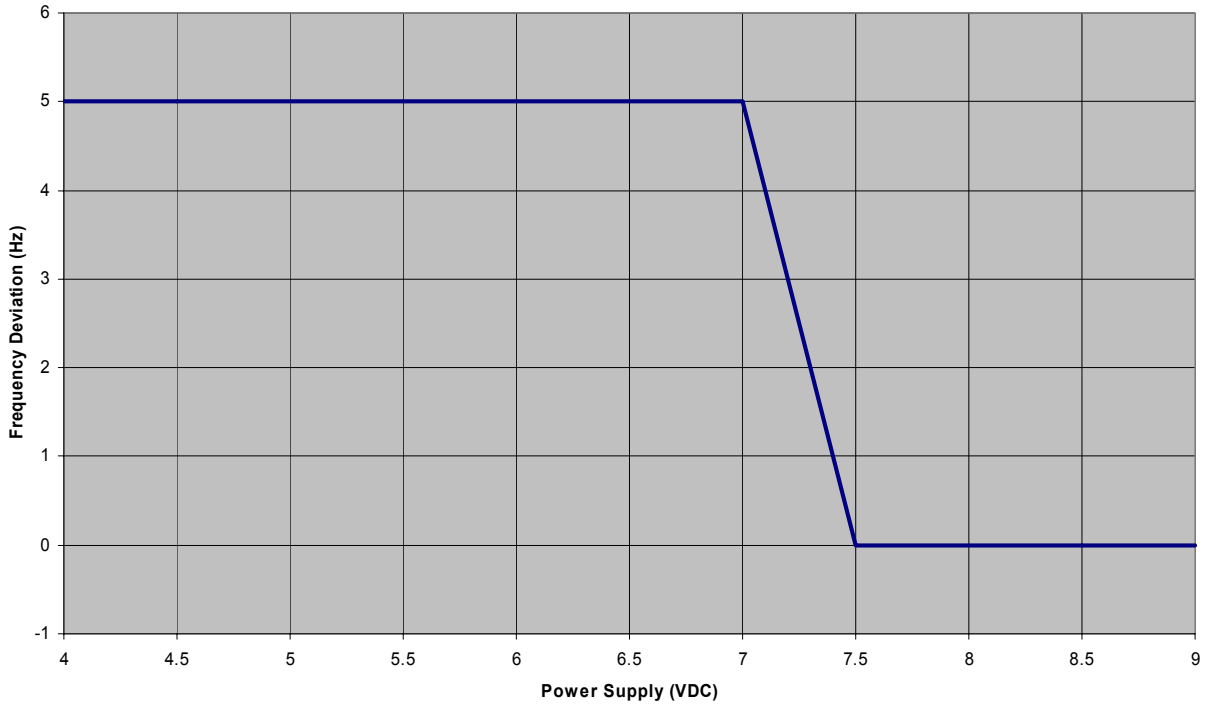


Figure 23 - Frequency Deviation (Hz) as a Function of Supply Voltage (Pursuant to FCC Requirement 2.1055d)