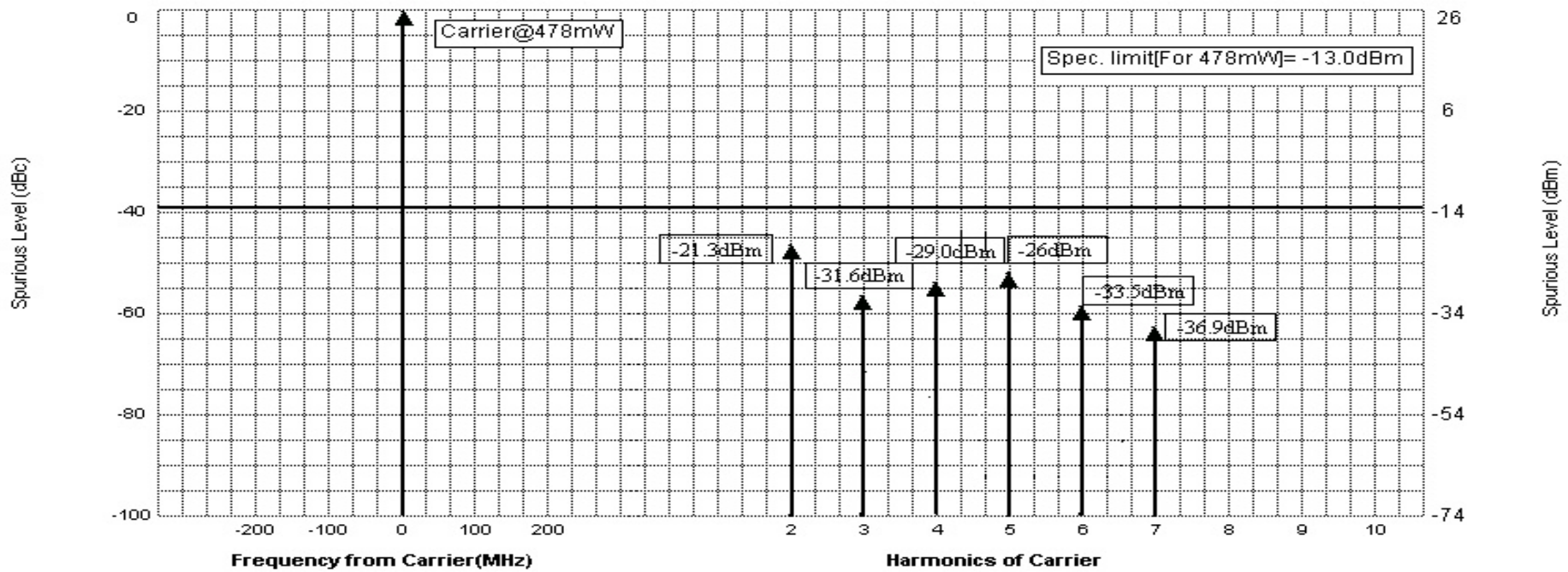
Transmitter Radiated Spurious and Harmonic Emissions 800 - Graph



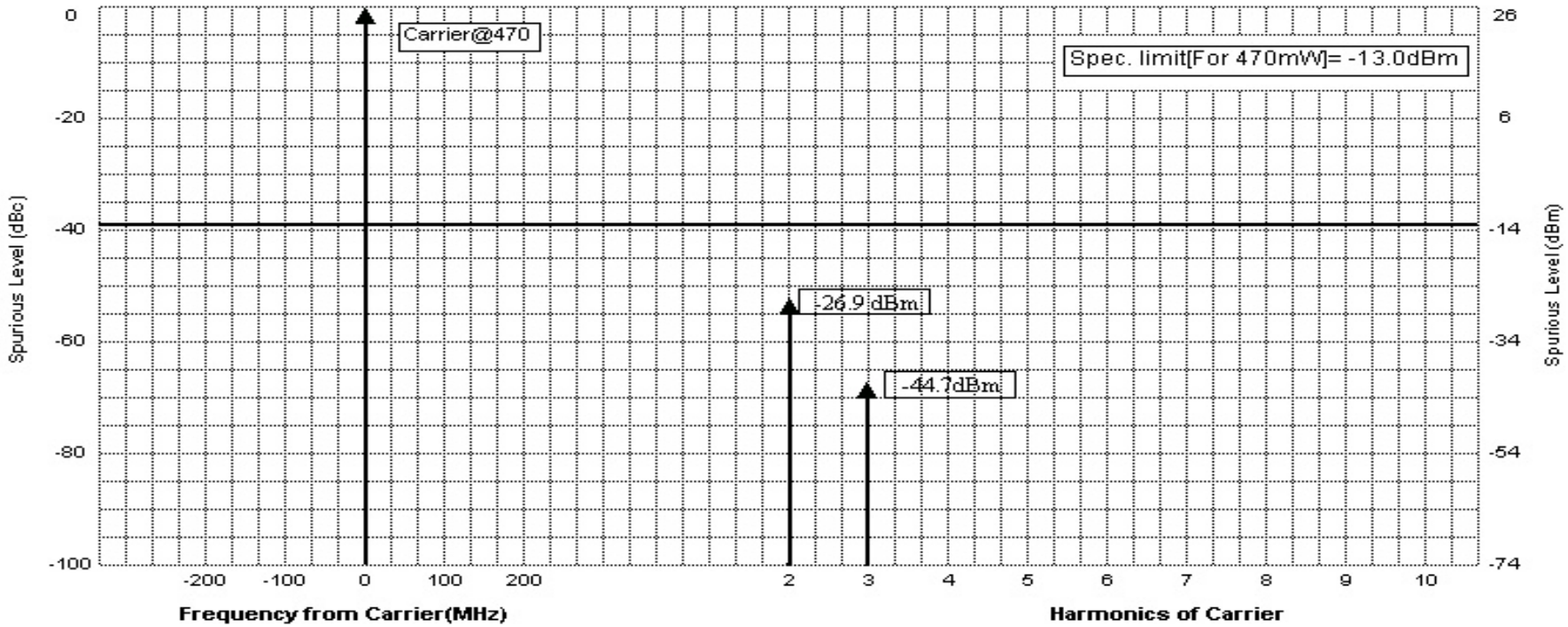
Digital Transmitter Radiated Spurious Emissions

Carrier Power: 478mW to 5.7mW in 4dB steps.

Carrier Frequency: 824.01MHz to 848.97MHz in 30KHz steps.

* Each reported emission reflects the highest absolute level found among all power levels, channels and operating modes.
* All emissions not reported were greater than 8 dB below the FCC specification.
* No signals greater than -81 dBm were found in the 869MHz to 894MHz band.
* Spectrum was searched from 50 KHz to the 10th Harmonic of the transmitter.

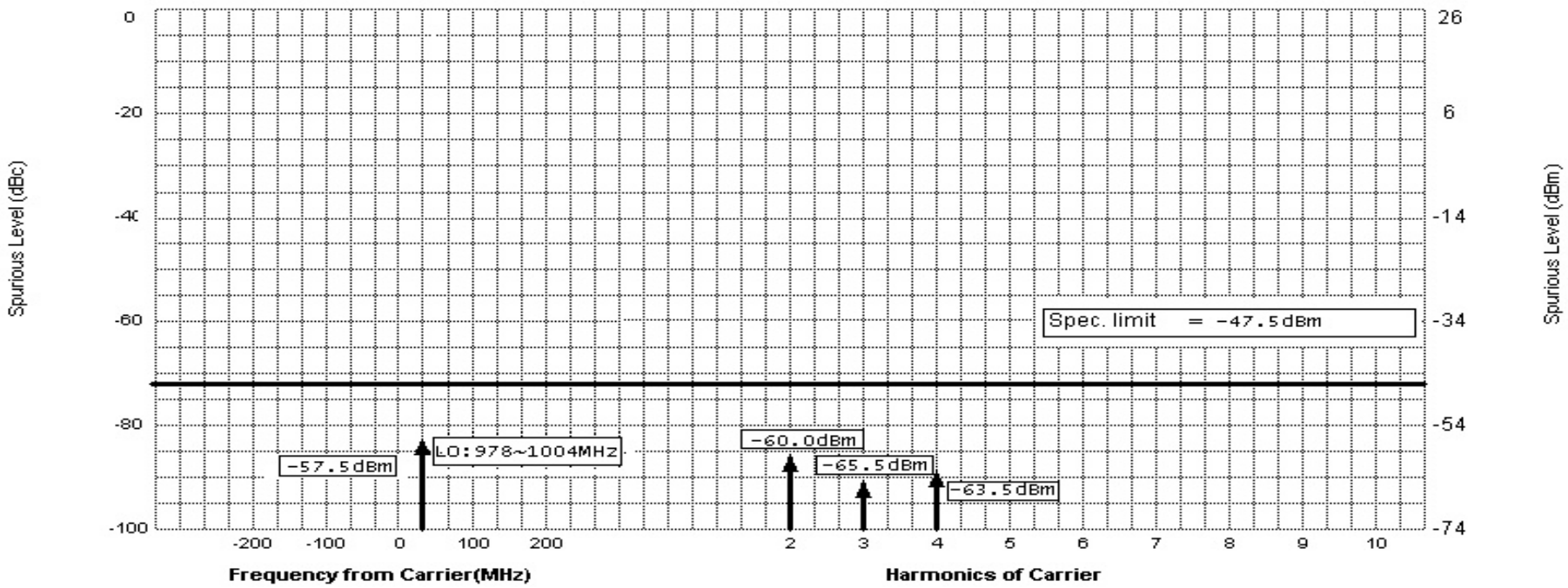
Transmitter Radiated Spurious and Harmonic Emissions 1900 - Graph



Digital Transmitter Radiated Spurious Emissions

Carrier Power: 470mW to 0.11mW in 4dB steps.
Carrier Frequency: 1851.25MHz to 1908.75MHz in 50KHz steps.
* Each reported emission reflects the highest absolute level found among all power levels, channels and operating modes.
* All emissions not reported were greater than 10 dB below the FCC specification.
* No signals greater than -81 dBm were found in the 1930MHz to 1990MHz band.
* Spectrum was searched from 50 KHz to the 10th Harmonic of the transmitter.

RX Radiated Spurious and Harmonic Emissions 800 - Graph

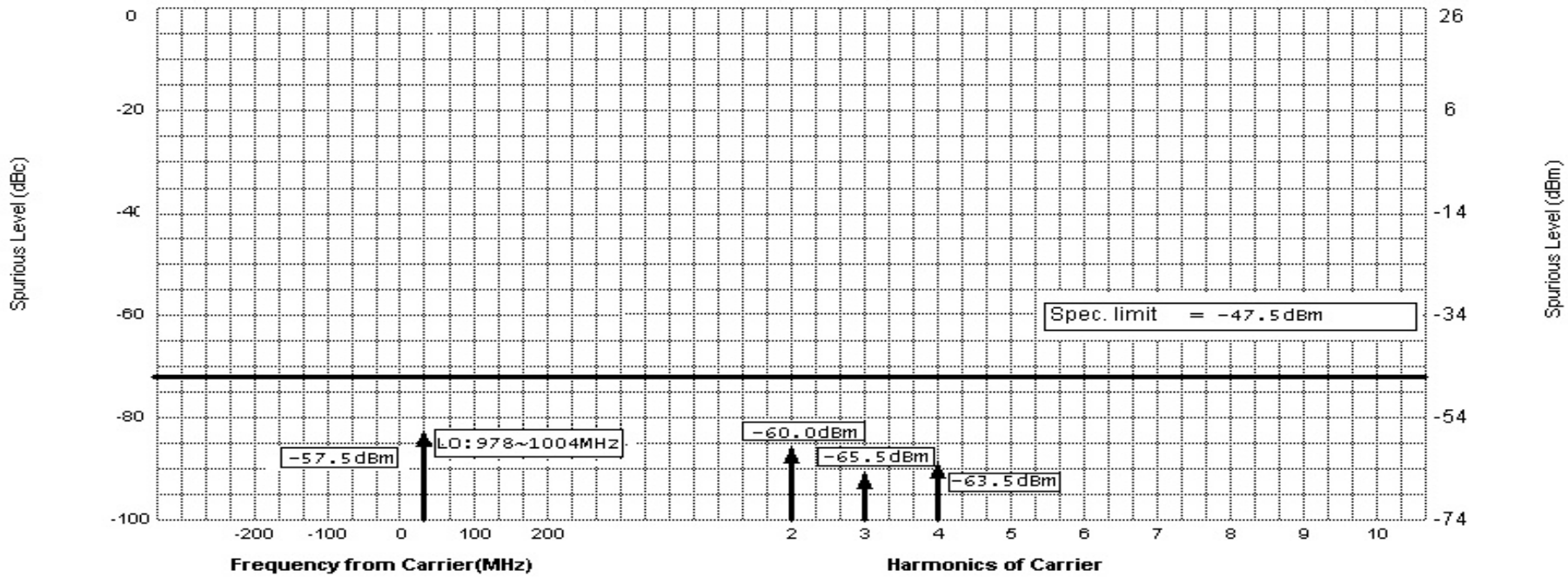


Analog Transmitter Radiated Spurious Emissions

Local Frequency: 978.69MHz to 1003.6MHz in 30KHz steps.

* Each reported emission reflects the highest absolute level found among all power levels, channels and operating modes.
* All emissions not reported were greater than 10dB below the FCC specification.
* No signals greater than -81 dBm were found in the 869MHz to 894MHz band.
* Spectrum was searched from 50 KHz to the 10th Harmonic of the transmitter.

RX Radiated Spurious and Harmonic Emissions 800 - Graph

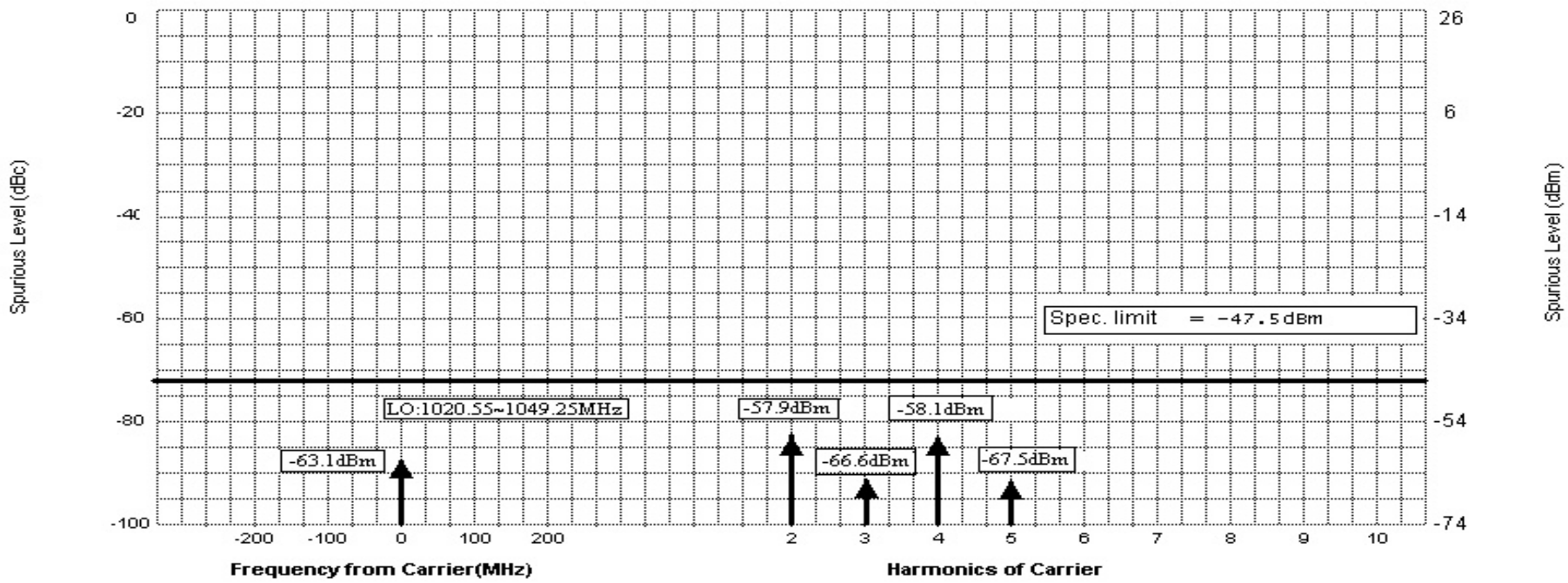


Digital Transmitter Radiated Spurious Emissions

Local Frequency: 978.69MHz to 1003.6MHz in 30KHz steps.

* Each reported emission reflects the highest absolute level found among all power levels, channels and operating modes.
* All emissions not reported were greater than 10dB below the FCC specification.
* No signals greater than -81 dBm were found in the 869MHz to 894MHz band.
* Spectrum was searched from 50 KHz to the 10th Harmonic of the transmitter.

RX Radiated Spurious and Harmonic Emissions1900- Graph

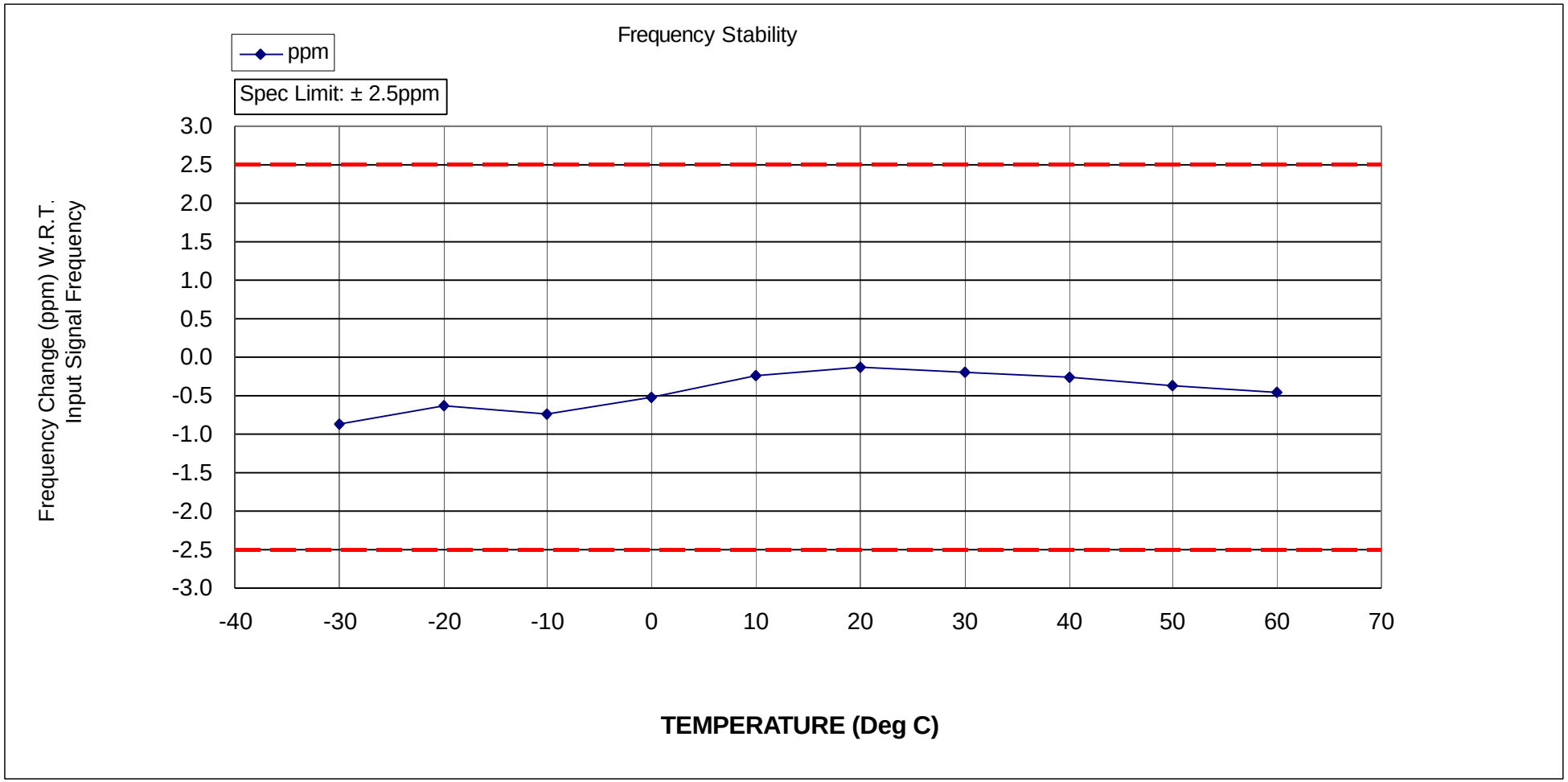


Digital Transmitter Radiated Spurious Emissions

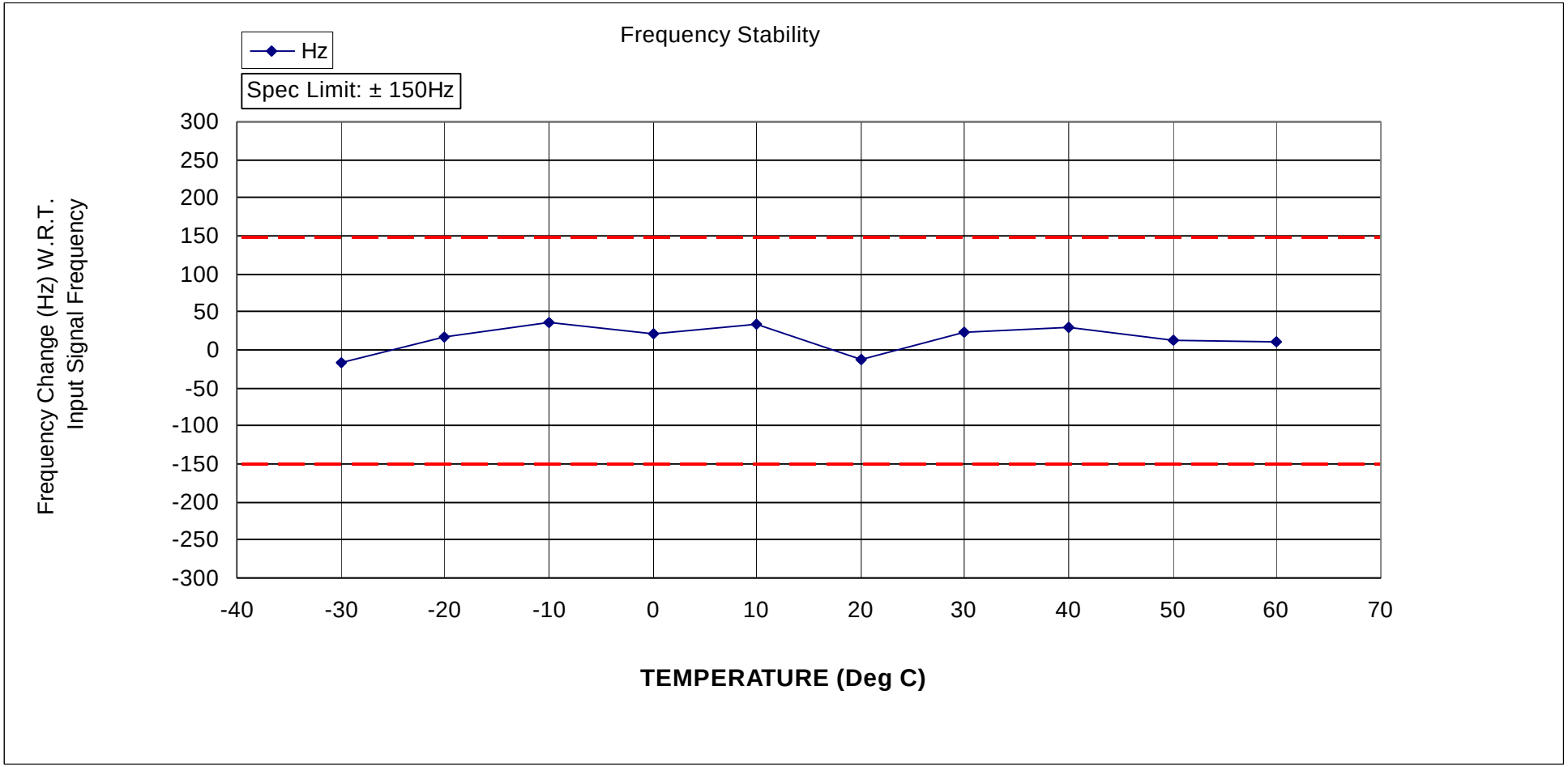
Local Frequency: 1020.55MHz to 1049.25MHz in 50 KHz steps.

* Each reported emission reflects the highest absolute level found among all power levels, channels and operating modes.
* All emissions not reported were greater than 10dB below the FCC specification.
* No signals greater than -81 dBm were found in the 1930MHz to 1990 MHz band.
* Spectrum was searched from 50 KHz to the 10th Harmonic of the transmitter.

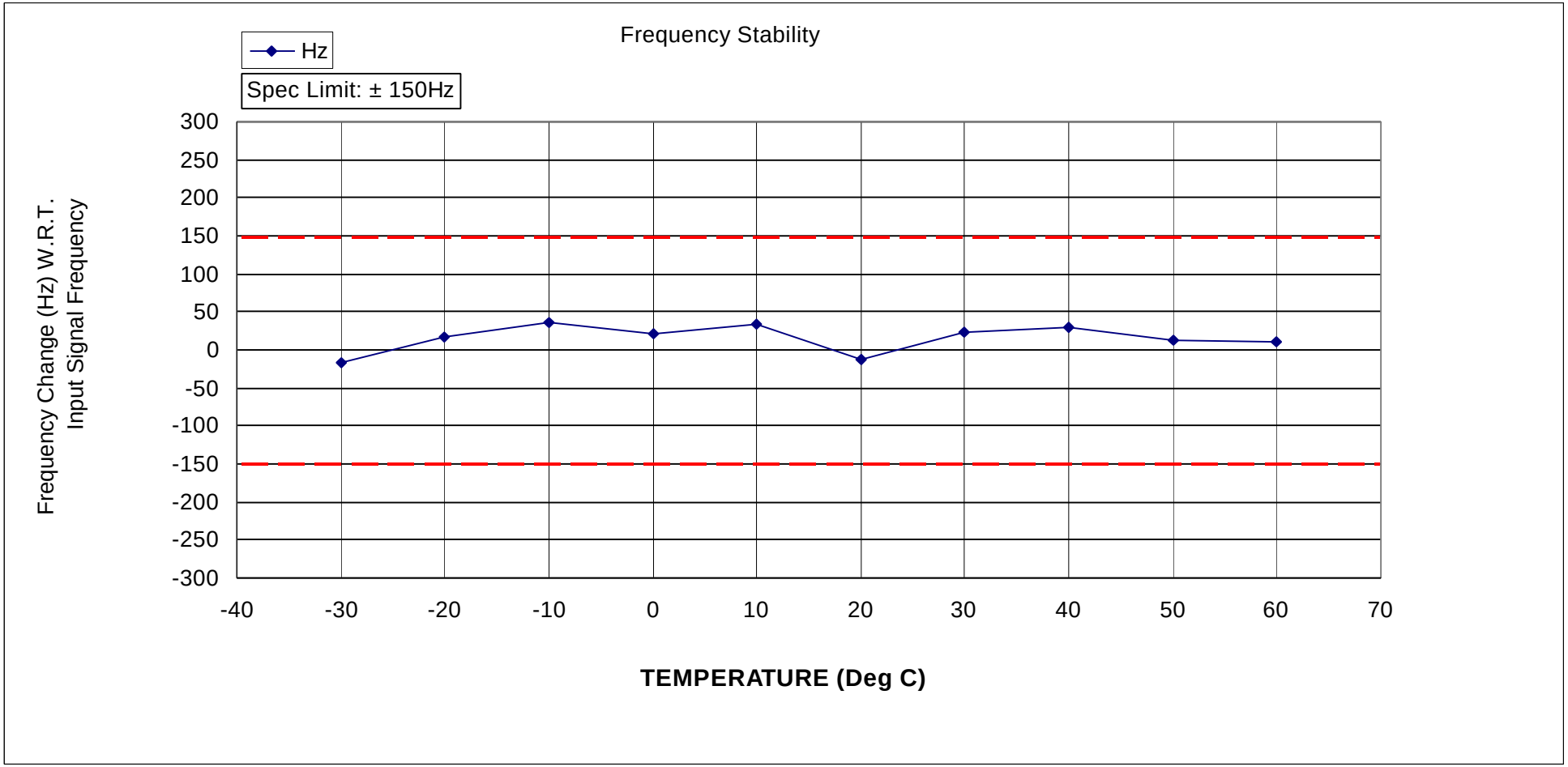
Frequency Change vs. Temperature (Analog Mode)-Graph



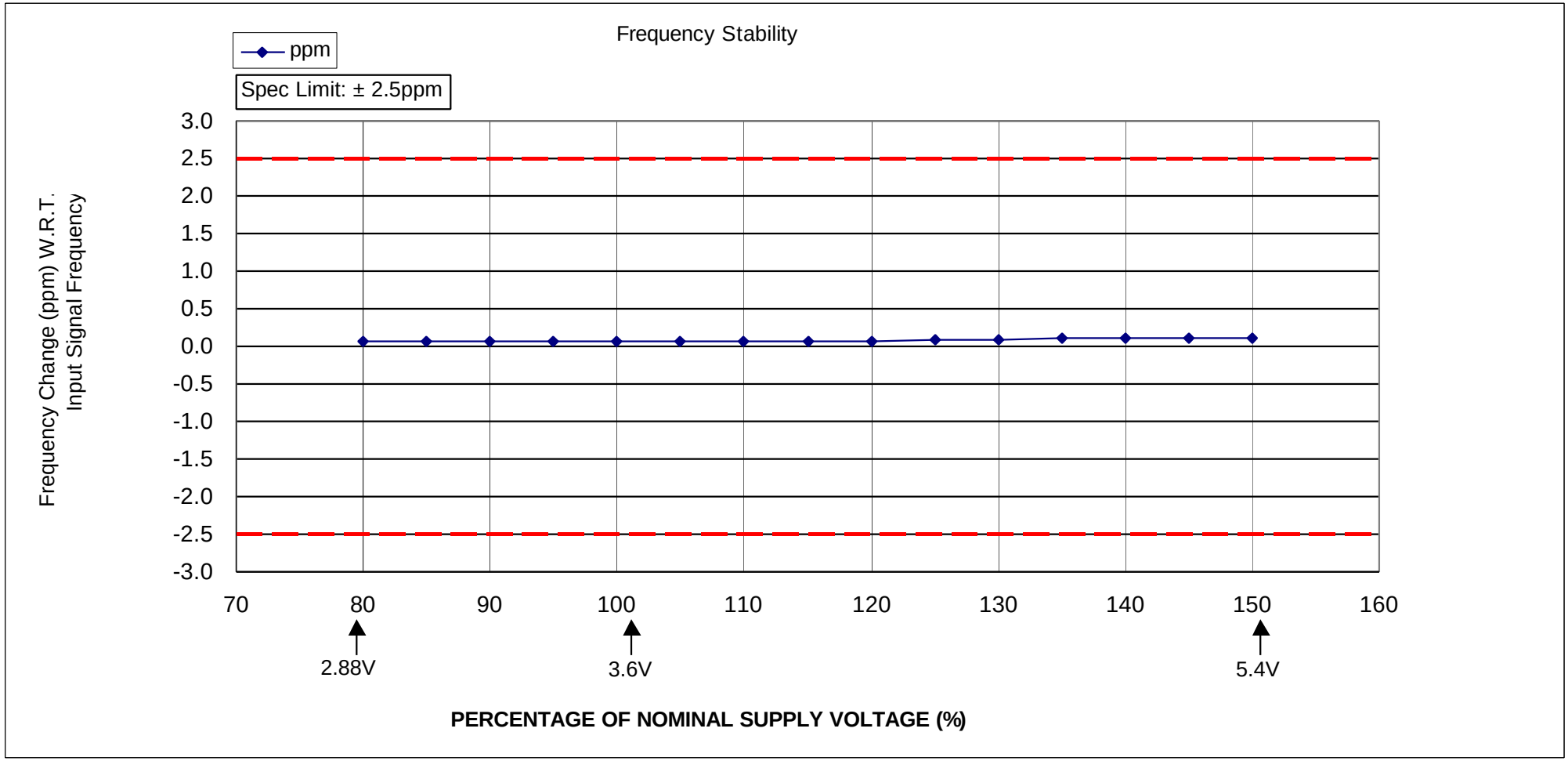
Frequency Change vs. Temperature (Digital Mode(800MHz))-Graph



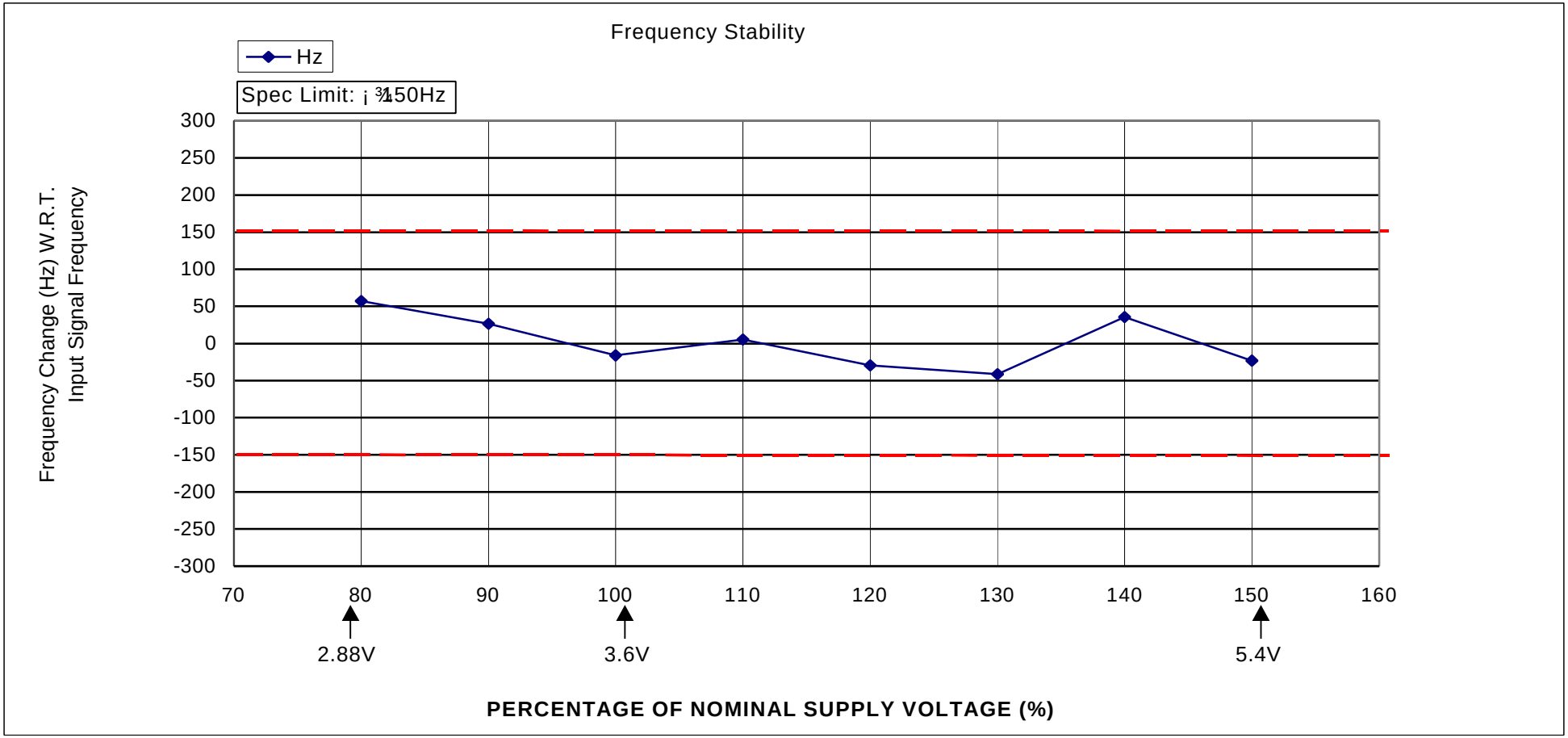
Frequecy Change vs. Temperature (Digital Mode(1900MHz))-Graph



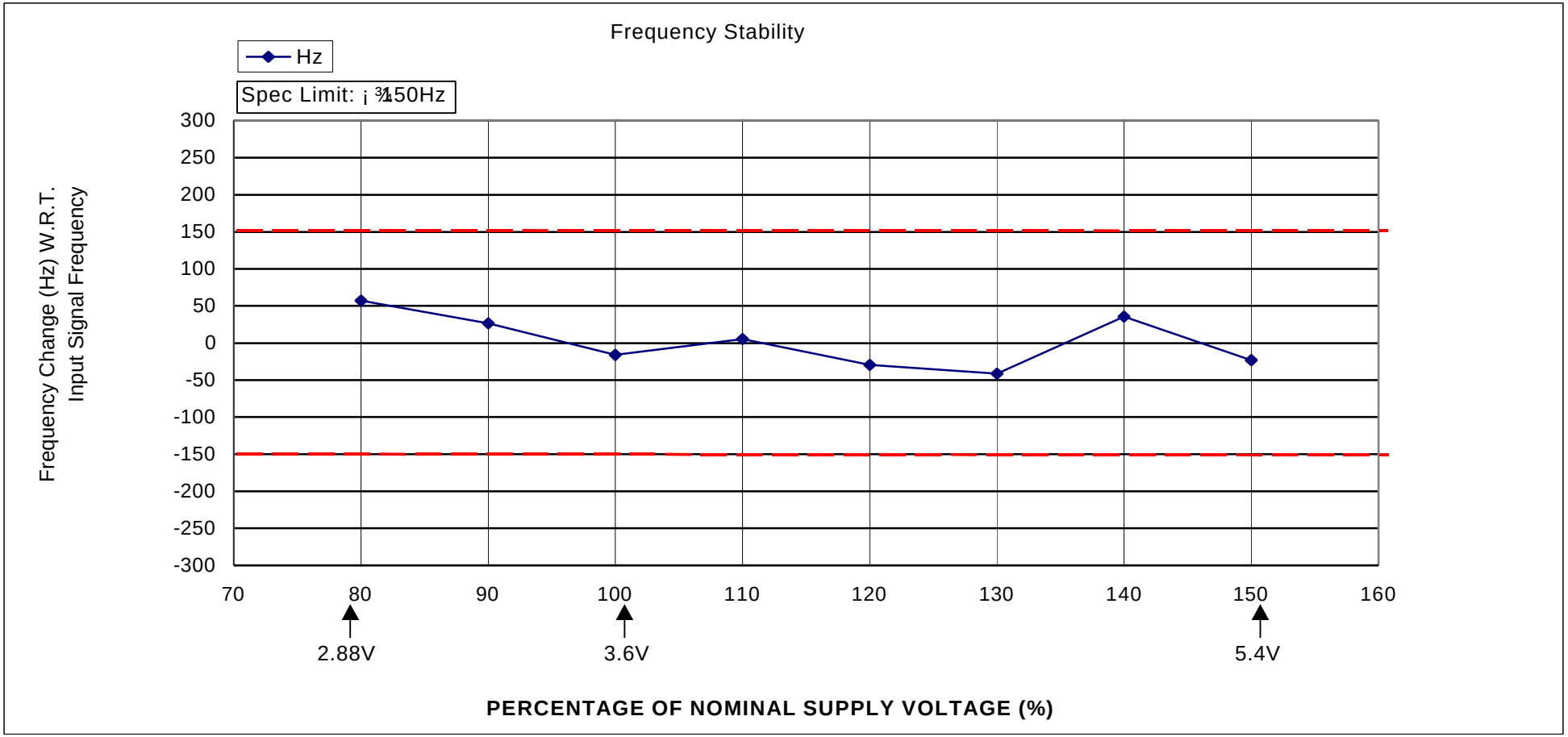
Frequency Change vs. Supply Voltage (Analog Mode)-Graph



Frequency Change vs. Supply Voltage (Digital Mode(800MHz))-Graph



Frequency Change vs. Supply Voltage (Digital Mode(1900MHz))-Graph



MEASUREMENT TECHNIQUES

2.991 Measurements Required: Conducted Spurious and Harmonic Emissions at Antenna Terminals (Analog Mode)

Graph attached
EXHIBIT 6G1

Definition - (as used herein) Spurious radiations are the radio frequency voltages or power generated within the equipment and appearing at the equipment's output terminals when properly loaded with its characteristic non-radiating artificial load.

Minimum standard Conducted spurious and harmonic emissions shall be attenuated 43dB 10 Log10(the mean power output). In the range of frequencies between 869.04MHz and 893.97MHz, and from 1930 MHz to 1990 MHz, no spur shall exceed -80dBm.

Method of Measurement The antenna port of the sample was directly coupled to the input of the EMI receiver through a special coupling cable and a 10 dB passive attenuator. Scans were then performed from 30 MHz to 6.5 GHz, while observing the fundamental signal level, plus low order harmonics or other spurious signals. The frequency range of 1 to 6.5GHz was then inspected, and the level of the harmonics was measured and recorded. The output of the sample was then switched to a Hewlett Packard HP8563E spectrum analyzer to verify harmonic signal levels out to the tenth harmonic. The bandwidth was initially set to 1MHz for signature scans, and then reduced to 30 kHz to measure individual signal strengths.

Measurements Required: Conducted Spurious and Harmonic Emissions at Antenna Terminals (Digital Mode)

Graph Attached
EXHIBIT 6G2 and 6G3

Definition - (as used herein) Spurious radiations are the radio frequency voltages or power generated within the equipment and appearing at the equipment's output terminals when properly loaded with its characteristic non-radiating artificial load.

Minimum standard Conducted spurious and harmonic emissions shall be attenuated 43dB 10 Log10(the mean power output). In the range of frequencies between 869.04MHz and 893.97MHz, and from 1930 MHz to 1990 MHz, no spur shall exceed -80dBm.

Method of Measurement - The transmitter was modulated with OQPSK modulation using pseudo random data. The antenna port of the sample was directly coupled to the input of the EMI receiver through a special coupling cable and a 10 dB passive attenuator. Scans were then performed from 30 MHz to 6.5 GHz, while observing the fundamental signal level, plus low order harmonics or other spurious signals. The frequency range of 1 to 6.5GHz was then inspected, and the level of the harmonics was measured and recorded. The output of the sample was then switched to a Hewlett Packard HP8563E spectrum analyzer to verify harmonic signal levels out to the tenth harmonic. The bandwidth was initially set to 1MHz for signature scans, and then reduced to 30 kHz to measure individual signal strengths.

2.993 Measurements Required: Radiated Spurious and Harmonic Radiation (Analog and Digital Modes)

Graph attached
EXHIBIT 6H1, 6H2 and 6H3

Definition - Radiated spurious and harmonic emissions are frequencies from the equipment when loaded into a non-radiating load on a frequency or frequencies which are outside an occupied band sufficient to insure transmission of information of required quality for the class of communications desired. The reduction in the level of these spurious emissions will not effect the quality of the information being transmitted.

Minimum standard - Radiated spurious emissions and harmonic emissions shall be attenuated 43dB 10 Log10(the mean power output). In the range of frequencies between 869.04MHz and 893.97MHz, and from 1930 MHz to 1990 MHz, no spur shall exceed -80dBm.

Method of Measurement:

Test Site - Schaumburg, Illinois, a region which is reasonably free from RF interference. A non-metallic building has been constructed to a special design which minimizes disturbances to RF radiation patterns. The building houses both the equipment under test and all the control and measurement equipment.

Installation of Equipment:

The equipment under test is placed on the turntable, connected to a dummy RF load, and then placed in normal operation using the intended power source. A receiving antenna located 3 meters from the turntable picks up any signal radiated from the transmitter and its operating accessories. The antenna is adjustable in height and can be horizontally and vertically polarized. Tunable receivers covering the necessary frequency range are used to detect and measure any radiation picked up by the antenna.

Measurement Procedure

The equipment is adjustable to obtain peak readings of received signals wherever they occur in the spectrum by:

1. Rotating the transmitter under test.

2. Adjusting the antenna height.

The testing procedure is repeated for both horizontal and vertical polarization of the receiving antenna. Relative signal strength is indicated on meters built into the receiver. To obtain actual radiated signal strength, a standard signal generator with calibrated output is substituted for the transmitter under test. The signal generator is adjusted in output until a reading identical to that obtained with the actual transmitter is obtained at the receiver. Signal strength is then read directly from the generator. Actual measurements are recorded on the attached graph.

2.994 Measurements Required: RX Radiated Spurious and Harmonic Radiation (Analog and Digital Modes)

Graph attached
EXHIBIT 6J1, 6J2 and 6J3

Definition - Radiated spurious emissions are those spurious emission generated or amplified in a receiver and radiated by antenna ,housing and all power, control and audio leads normally connected to the receiver .

Minimum standard - Radiated spurious emissions and harmonic emissions shall be attenuated as follow.

Frequency range	Maximum allowable EIRP
25 to 70	-45dBm
70 to 130	-41dBm
130 to 174	-41~ -32dBm
174 to260	-32dBm
260 to 470	-32~ -26dBm
470 to 2000	-21dBm

Method of Measurement:

Test Site - Schaumburg, Illinois, a region which is reasonably free from RF interference. A non-metallic building has been constructed to a special design which minimizes disturbances to RF radiation patterns. The building houses both the equipment under test and all the control and measurement equipment.

Installation of Equipment:

The equipment under test is placed on the turntable, connected to a dummy RF load, and then placed in normal operation using the intended power source. A receiving antenna located 3 meters from the turntable picks up any signal radiated from the receiver and its operating accessories. The antenna is adjustable in height and can be horizontally and vertically polarized. Tunable receivers covering the necessary frequency range are used to detect and measure any radiation picked up by the antenna.

Measurement Procedure

The equipment is adjustable to obtain peak readings of received signals wherever they occur in the spectrum by:

1. Rotating the transmitter under test.

2. Adjusting the antenna height.

The testing procedure is repeated for both horizontal and vertical polarization of the receiving antenna. Relative signal strength is indicated on meters built into the receiver. To obtain actual radiated signal strength, a standard signal generator with calibrated output is substituted for the receiver under test. The signal generator is adjusted in output until a reading identical to that obtained with the actual receiverer is obtained at the receiver. Signal strength is then read directly from the generator. Actual measurements are recorded on the attached graph.

2.995 Measurements Required: Frequency Stability (Analog and Digital Modes)

Definition - The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

Minimum standard - In the analog modes, the minimum frequency stability shall be ±0.000075% referenced to a received carrier frequency from a base station. This meets the requirement for operational accuracy of 0.00025% in wide mode and 0.00010% in narrow mode. In digital mode, the minimum frequency stability shall be ±300 Hz referenced to a received carrier frequency from a base station. This meets the requirement for operational accuracy of 0.00005% in digital mode.

Method of Measurement - Frequency measurements shall be made at the extremes of the temperature range -30° to +60°C and at intervals of not more than 10°C throughout the range. A period of time sufficient to stabilize all of the components in the equipment shall be allowed prior to each frequency measurement. The frequency of the transmitter shall be measured by extracting a sample of the carrier and measuring its center frequency by equipment having a degree of accuracy of at least 10 times that of the minimum to be measured.

The frequency stability of transmitting equipment shall be checked with variations in:

(a) Temperature: Vary the ambient from -30°C to +60°C.

Graphs attached EXHIBITS

(b) Primary Supply Voltage:

Vary the primary supply voltage over the specified battery voltage range.

Graphs attached EXHIBITS

Timing Period and Procedure for Frequency Stability Measurements

1. The carrier frequency of the transmitter was measured at room temperature (usually between 25° and 27°C) to provide a reference.

2. The equipment was then subjected to an overnight soak at -30°C without any power applied.

3. After an overnight soak at -30°C, measurement of the carrier frequency of the transmitter was made within a three minute interval after applying power to the transmitter.

4. Frequency measurements were made at each 10 ^{o}C interval (-30°, -20 ^{o}, -10 ^{o}, 0 ^{o}, +10 ^{o}, +20 ^{o}, +30 ^{o}, +40 ^{o}, +50 ^{o}, +60 ^{o}). A period of at least one hour was provided to allow stabilization of the equipment at each temperature level.

5. In all measurements, at the various temperature intervals, the temperature was held to ±1°C from the temperature level.

6. The artificial load was mounted external to the temperature chamber.