FCC PART 95
EMI MEASUREMENT AND TEST REPORT

For

Medical Data Electronics

12723 Wentworth St.
Arleta, CA 91331

FCC ID: EHCDS2

2003-04-15

This Report Concerns:	Equipment Type:
☒ Original Report	Medical Telemetry Transmitter

Test Engineer:	Benjamin Jing
Report Number:	R0303311
Test Date:	2003-03-31
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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *Medical Data Electronics's* Model: *DS2* or the "EUT" as referred to in this report is an Agnel MP Telemetry Transmitter. The EUT measures approximately *4.5'Lx2.0"Wx1.25"H.*

** The test data was only good for test sample. There may have deviation for other product samples.*

1.2 Objective

This report is prepared on behalf of *Medical Data Electronics* in accordance with Part 95 Subpart H of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for effective radiated power, modulation characteristics, occupied bandwidth, radiated spurious emissions, AC line conducted emissions and frequency stability.

1.3 Related Grant/Submission

No Related Submittals.

1.4 Test Methodology

Measurements contained in this report were also conducted with TIA/EIA Standard 603, Telecommunications Industry Association Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.5 Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22: 1997, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Date
HP	Spectrum Analyzer	8568B	Panel 2408A00105 Display 2403A06544	2003-05-01
HP	Spectrum Analyzer	8593A	29190A00242	2003-05-01
HP	Amplifier	8447E	1937A01054	2003-05-01
HP	Quasi-Peak Adapter	85650A	2521A00718	2003-05-01
Com-Power	Biconical Antenna	AB-100	14012	2003-05-01
Com-Power	LISN	LI-200	12005	2004-03-28
Com-Power	LISN	LI-200	12008	2004-03-28
Com-Power	Log Periodic Antenna	AL-100	16091	2003-05-01
Com-Power	Log Periodic Antenna	AB-900	15049	2003-05-01
Rohde & Schwarz	EMI Test Receiver	ESPI	1147 8007 07	2003-12-03

*** Statement of Traceability:** Bay Area Compliance Laboratory Corp. certifies that all calibration has been performed using suitable standards traceable to NATIONAL INSTITUTE of STANDARDS and TECHNOLOGY. (NIST)

2 - SYSTEM TEST CONFIGURATION

2.1 Justification

The EUT was tested under typical operating modes to represent the worst-case results during the final qualification test.

2.2 EUT Test Configuration

The EUT was powered and fully operated by the power switch. One of the two channels was set up by the manufacturer.

2.3 Special Accessories

As shown in section 2.7, interface cable used for compliance testing is shielded as normally supplied by customer and its respective support equipment manufacturers.

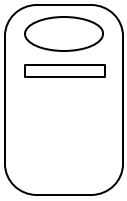
2.4 Schematics / Block Diagram

Please refer to Appendix D.

2.5 Equipment Modifications

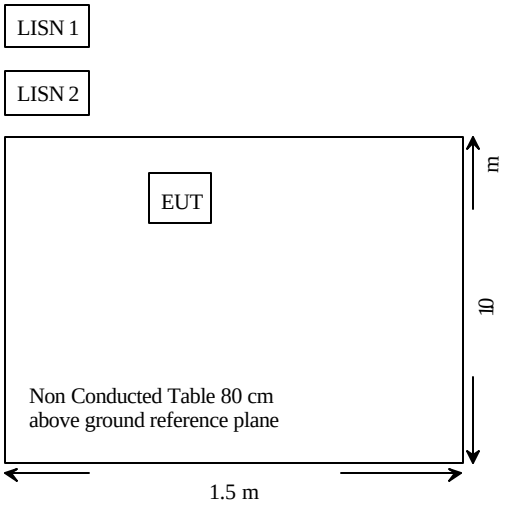
No modification was made by BACL Corp. to make sure the EUT to comply with the applicable limits.

2.6 Configuration of Test System



2.7 Test Setup Block Diagram

For tabletop systems, the EUT shall be centered laterally on the tabletop and its rear shall be flushed with the rear of the table. If the EUT is a stand-alone unit, it shall be placed in the center of the tabletop.



3 - REQUIREMENTS OF PROVISIONS

3.1 Requirements and Test Summary

FCC Rules	Rules Description	Requirement	Result
Transmitter Section			
2.1046 95.1111 95.1115	Effective Radiated Power	≤200 mV/m at 3 meter for WMTS	Complied
2.1047	Modulation Characteristics	Complied	Complied
2.1049 95.633 (a)	Occupied Bandwidth	20 kHz	Complied
2.1053 95.1115	Field Strength of Radiation Emission	Worst Case < 43.4dBuV	Complied
2.1051	Spurious Emission at Antenna Terminal	Complied	Complied
15.107	Line Conducted Emissions	N/A	Complied
2.1055 95.621 95.627	Frequency Stability Vs. Temperature Vs. Voltage	Complied	Complied
Receiver Section			
15.109 (a)	Radiated Emission	Worst case < 34.5dBuV	Complied

3.2 Labeling Requirement

Each equipment for which a type acceptance applications is filed on or after May 1, 1981, shall bear an identification plate or label pursuant to §2.295 (Identification of Equipment) and §2.926 (FCC identifier)

In August 1996 the Federal Communications Commissions (FCC) adopted RF exposure guidelines with safety levels for hand-held wireless devices.

Generally users manual contains a RF exposure statement to indicate compliance with FCC requirements.

The users manual should also contain required information and instruction pursuant to 95.653.

4 - EFFECTIVE RADIATED POWER

4.1 Provision Applicable

Per FCC §2.1046 and FCC § 95.1111 (a) (3), effective radiated power must be reported.

4.2 Test Procedure

1. On a test site, the EUT shall be placed at 1.5m height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3m from EUT to correspond to the frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the quasi-peak detector is used for the measurement.
4. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6. The transmitter shall then the rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a tuned dipole (substitution antenna).
10. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
17. The measure of the effective radiated power is the large of the two levels recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.

4.3 Test Results

The measured output power showed as follows:

Low Channel (Channel 1): 4.2 dBm at 608.0125 MHz
High Channel (Channel 14): 4.4 dBm at 613.9875 MHz

5 - MODULATION CHARACTERISTIC

5.1 Applicable Standard

Requirement: FCC § 2.1047.

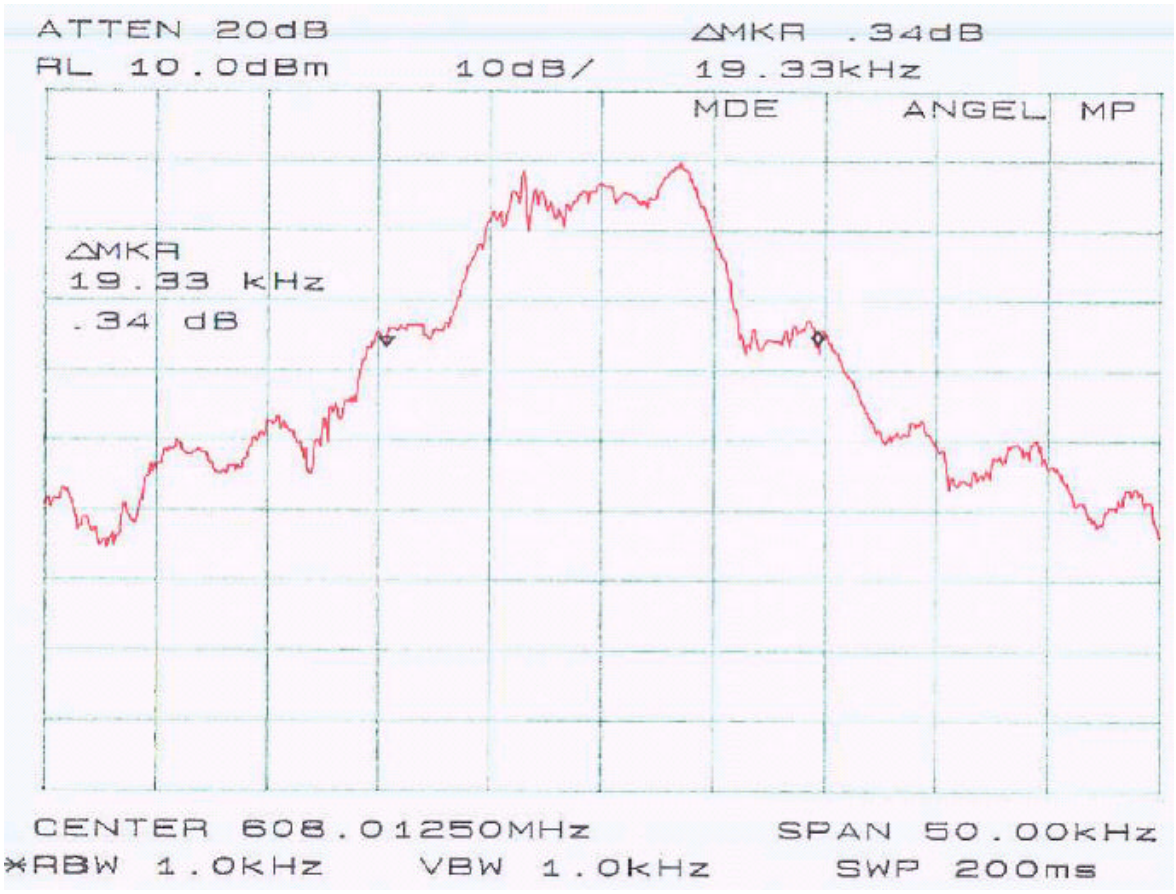
5.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 1 KHz.

5.3 Test Results

Please refer to the hereinafter plots.



6 - OCCUPIED BANDWIDTH

6.1 Applicable Standard

Requirements: CFR 47, Section 2.1049, FCC § 95.633(a), the authorized bandwidth is 20KHz.

6.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

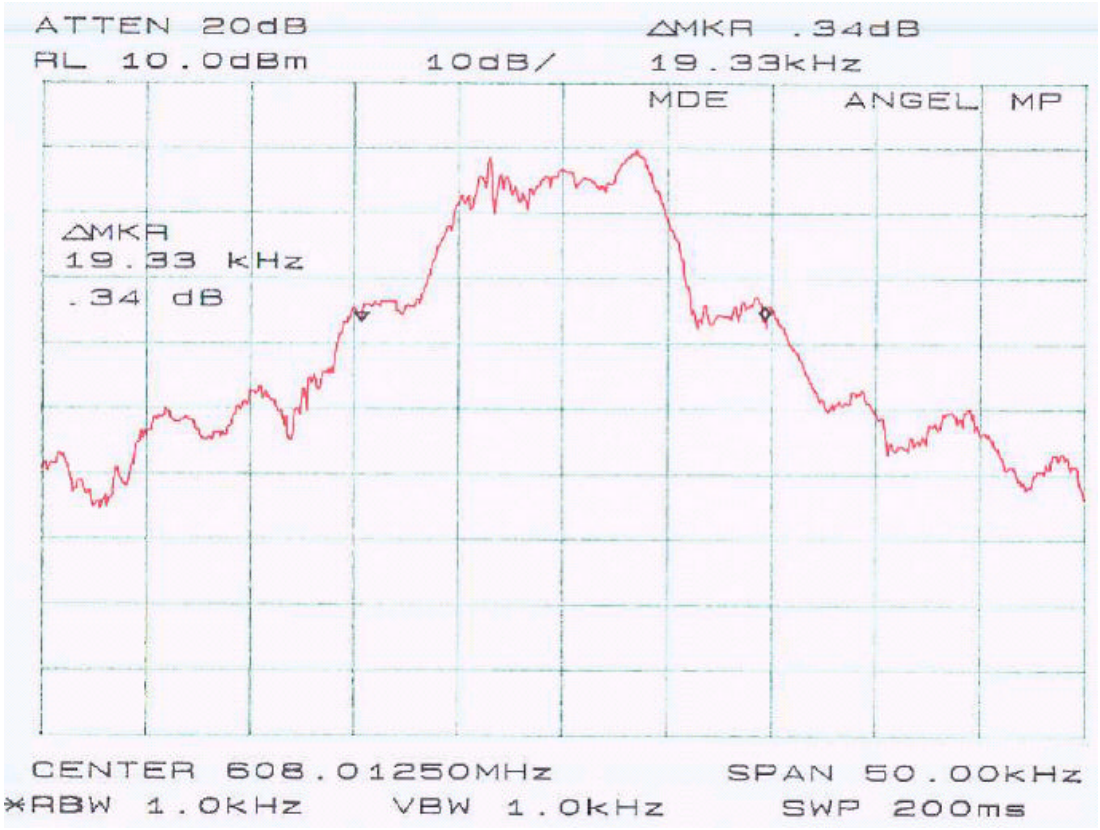
The resolution bandwidth of the spectrum analyzer was set at 1 KHz and the emission bandwidth was recorded.

6.3 Test Equipment

Hewlett Packard HP8564E Spectrum Analyzer, Calibration Due Date: 2003-08-01.
Hewlett Packard HP 7470A Plotter, Calibration not required.

6.4 Test Results

Please refer to the following plots.



7 – FIELD STRENGTH OF RADIATED EMISSION DATA

7.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is ±4.0 dB.

7.2 EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup in accordance with the ANSI C63.4 - 1992. The specification used was the FCC 95 Subpart H limits.

The EUT was put in the front of the test table and tested in all 3 orthogonal positions..

7.3 Spectrum Analyzer Setup

Per customer request, the system was tested to 8000 MHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Range	***RBW***	***Video B/W***
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz

7.4 Test Procedure

For the radiated emissions test, the power cord of the host system and all support equipment were connected to the AC floor outlet.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combinations.

All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dBµV of specification limits), and are distinguished with a "**Qp**" in the data table.

7.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBµV means the emission is 7dBµV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Part 95 Subpart H Limit

7.6 Summary of Test Results

According to the data in section 4.7, the EUT complied with the FCC Part 95, Subpart H standards, and had the worst margin of:

-10.6 dB (Ave) at **1824.03 MHz** in the **Horizontal** polarization, **Low Frequency, 3 meters**

-11.8 dB (Ave) at **1841.70 MHz** in the **Horizontal** polarization, **High Frequency, 3 meters**

-11.5 dB (Ave) at **300.74 MHz** in the **Horizontal** polarization, **Unwanted Emission, 3 meters**

Low Frequency, 30MHz to 8GHz, 3 meters

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 95 Subpart H	
Frequency MHz	Ampl. dBmV/m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBmV/m	Cable DB	Amp. DB	Corr. Ampl. dBmV/m	Limit dBmV/m	Margin dB
1824.03	45.5	Avg.	0	1.2	h	25.3	2.6	30.0	43.4	54	-10.6
1216.02	41.6	Avg.	110	1.2	h	25.9	3.7	30.0	41.2	54	-12.8
1824.03	42.7	Avg.	60	1.5	v	25.3	2.6	30.0	40.6	54	-13.4
1216.02	40.6	Avg.	150	1.5	v	25.9	3.7	30.0	40.2	54	-13.8
2432.04	36.9	Avg.	230	1.5	v	28.1	3.4	30.0	38.4	54	-15.7
2432.04	35.2	Avg.	210	1.2	h	28.1	3.4	30.0	36.7	54	-17.4
608.01	53.2	Peak, Fund.	270	1.8	h	20.1	3.0	25.0	51.3	106	-54.7
608.01	49.6	Peak, Fund.	30	1.5	v	20.1	3.0	25.0	47.7	106	-58.3

High Frequency, 30MHz to 8GHz, 3 meters

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 95 Subpart H	
Frequency MHz	Ampl. dBmV/m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBmV/m	Cable DB	Amp. DB	Corr. Ampl. dBmV/m	Limit dBmV/m	Margin dB
1841.70	44.3	Avg.	270	1.2	h	25.3	2.6	30.0	42.2	54	-11.8
1227.80	41.2	Avg.	90	1.2	h	25.9	3.7	30.0	40.8	54	-13.2
1841.70	42.6	Avg.	90	1.0	v	25.3	2.6	30.0	40.5	54	-13.5
1227.80	40.6	Avg.	180	1.0	v	25.9	3.7	30.0	40.2	54	-13.8
2455.60	35.2	Avg.	270	1.5	v	28.1	3.4	30.0	36.6	54	-17.4
2455.60	34.9	Avg.	0	1.5	h	28.1	3.4	30.0	36.4	54	-17.7
613.90	53.9	Peak, Fund.	30	1.8	h	20.0	3.3	25.0	52.2	106	-53.8
613.90	51.3	Peak, Fund.	0	1.5	v	20.0	3.3	25.0	49.6	106	-56.4

Unwanted Emission, 30MHz to 1GHz, 3 meters

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 95 Subpart H	
Frequency MHz	Ampl. dBmV/m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBmV/m	Cable DB	Amp. DB	Corr. Ampl. dBmV/m	Limit dBmV/m	Margin dB
300.74	39.8	Peak	90	1.5	h	15.1	4.6	25.0	34.5	46	-11.5
408.35	38.4	Peak	270	1.2	v	16.5	2.9	25.0	32.8	46	-13.2
192.50	37.6	Peak	0	1.5	h	14.4	2.7	25.0	29.7	46	-16.3

Note: 106dBuV/m = 200mV/m; 54dBuV/m = 500uV/m; 46dBuV/m = 200uV/m

8 - SPURIOUS EMISSION AT ANTENNA TERMINAL

8.1 Standard Applicable

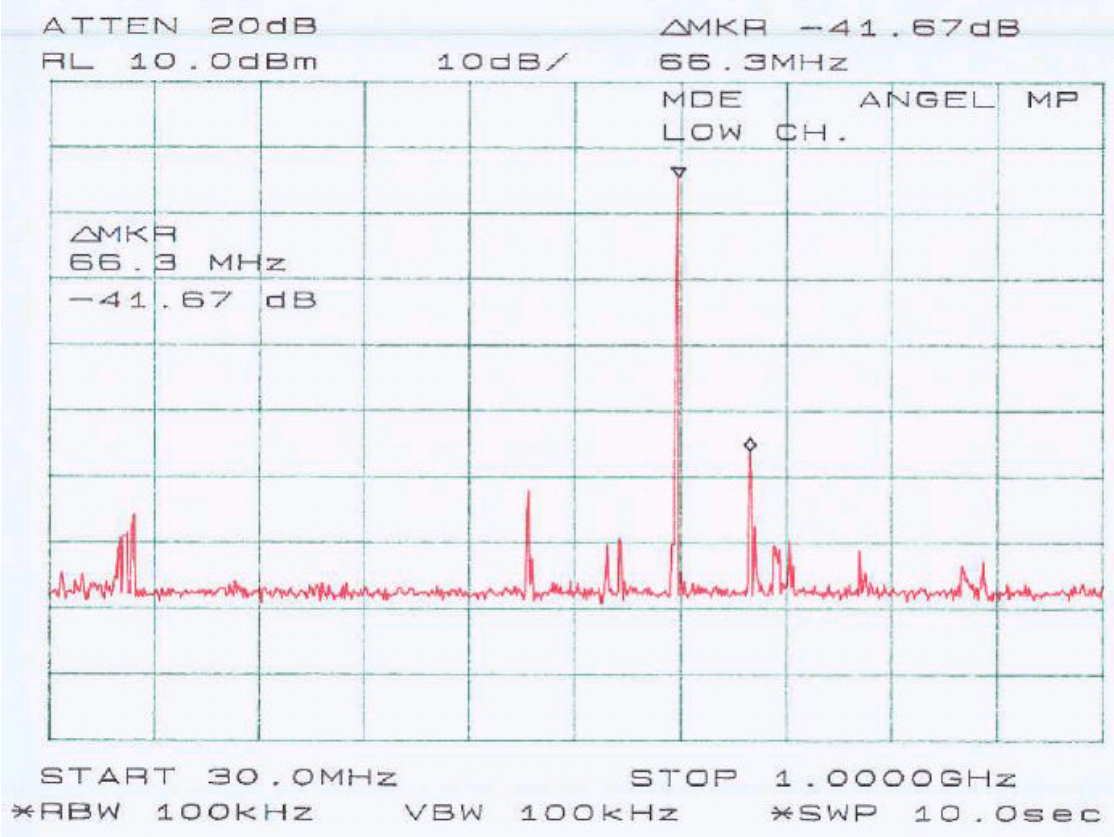
Requirements: FCC §2.1051.

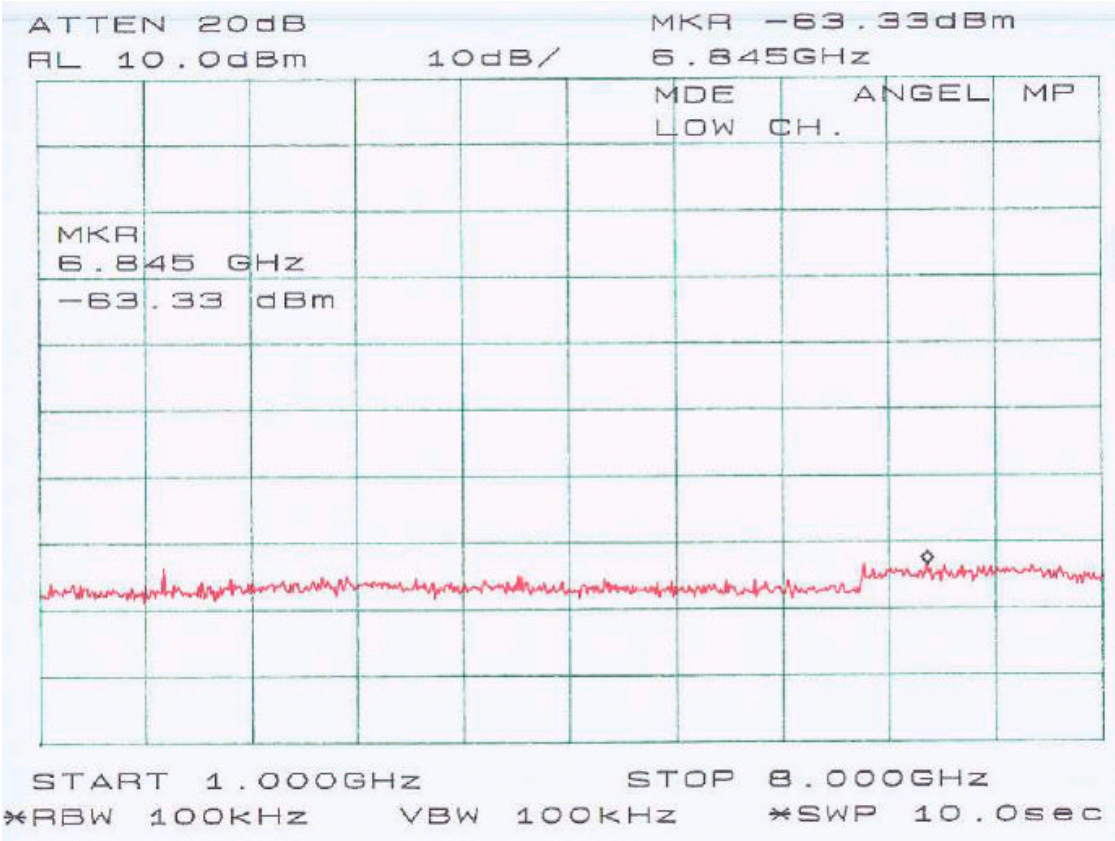
8.2 Measurement Procedure

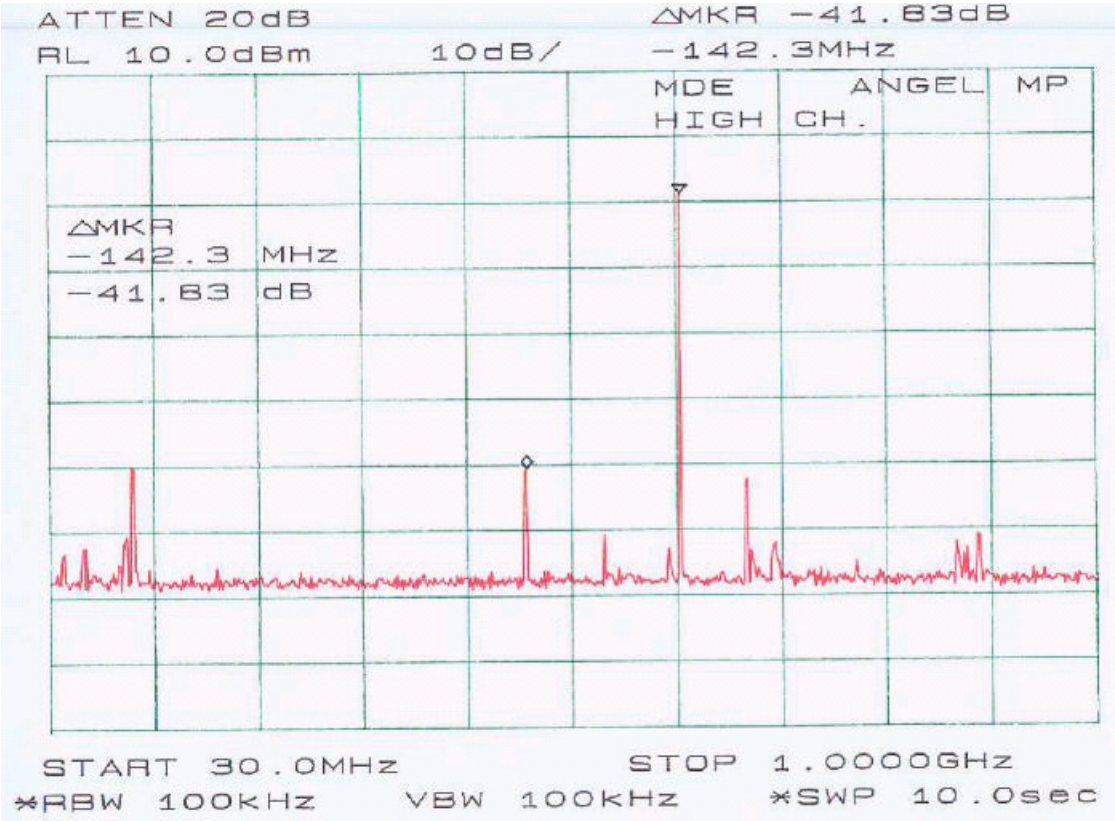
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the SA on Max-Hold Mode, and then keep the EUT in transmitting mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

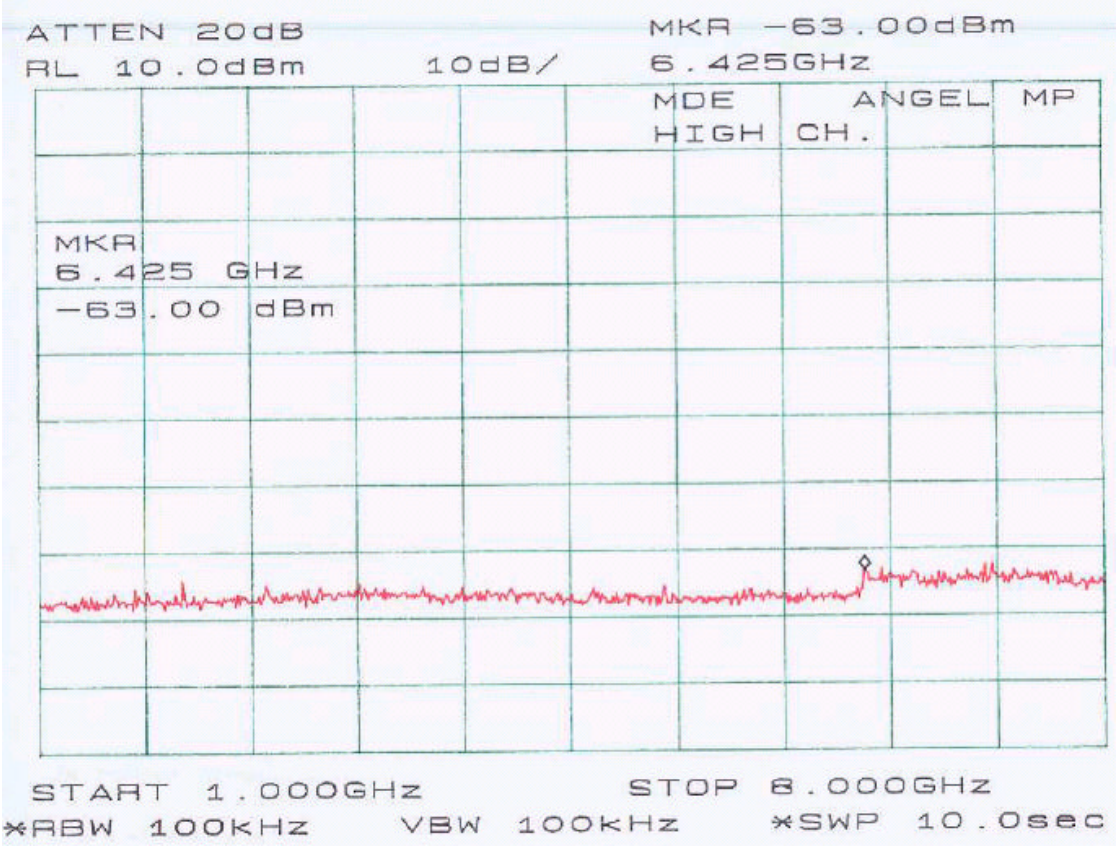
8.3 Result

Please refer the hereinafter plots for more information.


ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -41.67dB
66.3MHz
MDE ANGEL MP
LOW CH.
ΔMKR
66.3 MHz
-41.67 dB
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -63.33dBm
6.845GHz
MDE ANGEL MP
LOW CH.
MKR
6.845 GHz
-63.33 dBm
START 1.000GHz
STOP 8.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec


ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -41.83dB
-142.3MHz
MDE ANGEL MP
HIGH CH.
ΔMKR
-142.3 MHz
-41.83 dB
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -63.00dBm
6.425GHz
MDE ANGEL MP
HIGH CH.
MKR
6.425 GHz
-63.00 dBm
START 1.000GHz
STOP 8.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec

9 - AC LINE CONDUCTED EMISSIONS

9.1 Applicable Requirements

According to ANSI C63.4 and FCC §15.107, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is connected 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.

9.2 Test Procedure

The EUT shall be connected to the DC power supply which shall be connected to the AC line through the first LISN. Both hot and neutral leads shall be tested.

9.3 Test Equipment

HP 8566B Spectrum Analyzer
LISN

9.4 Test Results

Not applicable because of battery operation.

10 - FREQUENCY STABILITY MEASUREMENT

10.1 Provision Applicable

According to FCC §2.1055(a)(1), the frequency stability shall be measure with variation of ambient temperature from –30ºC to +50ºC, and according to FCC 2.1055(d)(2), the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point which is specified by the manufacturer.

According to FCC §95.1115 (e), manufacturers of wireless medical telemetry devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all of the manufacturer's specified conditions.

10.2 Test Procedure

10.2.1 Frequency stability versus environmental temperature

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feedthrough attenuators. The EUT was placed inside the temperature chamber.

After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

10.2.2 Frequency Stability versus Input Voltage

At room temperature (25±5°C), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for nominal and end point input voltage.

10.3 Test Results

Reference Frequency: 608.0125 MHz			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed	
		MCF (MHz)	PPM Error
40	New Batt.	608.0127	0.33
30	New Batt.	608.0126	0.16
20	New Batt.	608.0125	0.0
10	New Batt.	608.0125	0.0
0	New Batt.	608.0124	-0.2

Frequency Stability Versus Input Voltage

Reference Frequency: 462.5625 MHz, Limit: 2.5ppm						
Power Supplied (Vdc)	Frequency Measure with Time Elapsed					
	2 Minutes		5 Minutes		10 Minutes	
	MHz	ppm	MHz	ppm	MHz	ppm
3.3	608.1024	-0.2	608.1024	-0.2	608.1024	-0.2

End Point = 3.3 Vdc

Conclusion: The EUT complied with the applicable Frequency Stability Limits.