# FCC PART 74
# EMI MEASUREMENT AND TEST REPORT

For

## Nady Systems, Inc.

6701 Shellmond Street
Emeryville, CA 94608 USA

**FCC ID: BEK9E3UB16**

March 26, 2002

| **This Report Concerns:** | **Equipment Type:** |
|---|---|
| ☒ Original Report | Transmitter |

| | |
|---|---|
| **Test Engineer:** | Benjamin Jing |
| **Report No.:** | R0201189 |
| **Test Date:** | February 5, 2002 |
| **Reviewed By:** | Jeff Lee |
| **Prepared By:** | Bay Area Compliance Laboratory Corporation<br>230 Commercial Street<br>Sunnyvale, CA 94085<br>Tel: (408) 732-9162<br>Fax: (408) 732 9164 |

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# 1 - GENERAL INFORMATION

## 1.1 Product Description for Equipment Under Test (EUT)

| | |
|---|---|
| Applicant: | Nady Systems, Inc. |
| Product: | UHF Wireless Transmitter |
| Model Name: | UB-16 |
| Serial Number: | N/A |
| FCC ID: | BEK9E3UB16 |
| Transmitter Frequency: | 725.997-745.899MHz |
| Maximum Output Power: | 2.67dBm |
| Dimension: | 8.0” L x 5.0” W x 1.5” H |
| DC Voltage and Current: | 3Vdc/120mA |
| Applicable Standard: | FCC Part 74 Subpart H |

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

## 1.2 Objective

This report is prepared on behalf of *Nady Systems, Inc.* in accordance with Part 74 Subpart H of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for peak output power, modulation characteristics, occupied bandwidth of emission, spurious emission, field strength of spurious radiation, frequency stability and line conduction.

## 1.3 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.

## 1.4 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 C63.4-2000.

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, IEC/CISPR 22: 1998, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

## 1.5 Test Equipment List

| Manufacturer | Description | Model | Serial Number | Cal. Due Date |
|---|---|---|---|---|
| HP | Spectrum Analyzer | 8566B | 2610A02165 | 12/6/02 |
| HP | Spectrum Analyzer | 8593B | 2919A00242 | 12/20/02 |
| HP | Amplifier | 8349B | 2644A02662 | 12/20/02 |
| HP | Quasi-Peak Adapter | 85650A | 917059 | 12/6/02 |
| HP | Amplifier | 8447E | 1937A01046 | 12/6/02 |
| A.H. System | Horn Antenna | SAS0200/571 | 261 | 12/27/02 |
| Com-Power | Log Periodic Antenna | AL-100 | 16005 | 11/2/02 |
| Com-Power | Biconical Antenna | AB-100 | 14012 | 11/2/02 |
| Solar Electronics | LISN | 8012-50-R-24-BNC | 968447 | 12/28/02 |
| Com-Power | LISN | LI-200 | 12208 | 12/20/02 |
| Com-Power | LISN | LI-200 | 12005 | 12/20/02 |
| BACL | Data Entry Software | DES1 | 0001 | 12/20/02 |
| Rohde & Schwarz | Signal Generator | SMIQ03B | 1125.5555.03 | 7/10/02 |
| Rohde & Schwarz | I/Q Modulation Generator | AMIQ | 1110.2003.02 | 8/10/02 |

*** Statement of Traceability:** Bay Area Compliance Laboratory Corp. certifies that all calibration has been performed using standards traceable to National Institute of Standard and Technology (NIST).

# 2 - REQUIREMENTS OF PROVISIONS

## 2.1 Definition

Low Power Auxiliary Stations: Devices authorized as low power auxiliary stations are intended to transmit over distances of approximately 100 meters for uses such as wireless microphones, cue and control communications, and synchronization of TV camera signals.

Intentional radiator: a device that intentionally generates and emits radio frequency energy by radiation or induction.

Transmitter Power: the power at the transmitter output terminals and delivered to the antenna, antenna transmission line, or any other impedance-matched, radio frequency load. For the purpose of this subpart, the transmitter power is the carrier power.

## 2.2 Frequencies Available

According to Sec. 74.802 of Part 74, the following frequencies are available for low power auxiliary station:

Frequencies (MHz)

26.100-26.480
54.00-72.0
76.00-88.0
161.625-161.775 (except in Puerto Rico or the virgin Islands)
450.000-451.000
455.000-456.000
47.000-488.000
488.000-494.000 (except Hawaii)
614.000-806.000
944.000-952.000

## 2.3 Requirements and Test Summary

| FCC Rules | Rules Description | Test Result |
|---|---|---|
| §74.861(e) | Low power auxiliary transmitters not required to operate on specific carrier frequencies shall operate sufficiently within the authorized frequency band edges to insure the emission bandwidth falls entirely within the authorized band. | Compliant |
| §74.861(e)(1)(ii) | Maximum Output Power<br>For low power auxiliary station operating in the 614-806MHz band, the power of the measured unmodulated carrier power ant the output of the transmitter power amplifier (antenna input power) may not exceed 250mW | Compliant |
| §74.861(e)(3)<br>&<br>§2.1047(a) | Modulation Characteristics<br>Any form of modulation may be used. A maximum deviation of ±75 kHz is permitted when frequency modulation is employed. | Compliant |
| §74.831(e)(4) &<br>§2.1055(a)(1) | Frequencies Tolerance<br>The frequency tolerance of the transmitter shall be 0.005 percent | Compliant |
| §74.861(e)(5) &<br>§2.1049(c)(1) | Occupied Bandwidth<br>The operating bandwidth shall not exceed 200 kHz | Compliant |
| §74.861(e)(6) &<br>§2.1051 | Spurious Emissions at Antenna Terminals | Compliant |
| §74.861(e)(6) &<br>§2.1053 | Field Strength of Spurious Emissions | Compliant |

## 2.4 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)

# 3 - OUTPUT POWER MEASUREMENT

## 3.1 Provision Applicable

According to §74.861(e)(1)(ii), for low power auxiliary station operating in the 614-806MHz band, the power of the measured unmodulated carrier power ant the output of the transmitter power amplifier (antenna input power) may not exceed 250mW.

## 3.2 Test Procedure

The maximum peak output power was measured with a spectrum analyzer connected to the antenna terminal (conducted measurement) while EUT was operating in normal situation. Set RBW of spectrum analyzer to 100 kHz and VBW to 100 kHz.

## 3.3 Test equipment

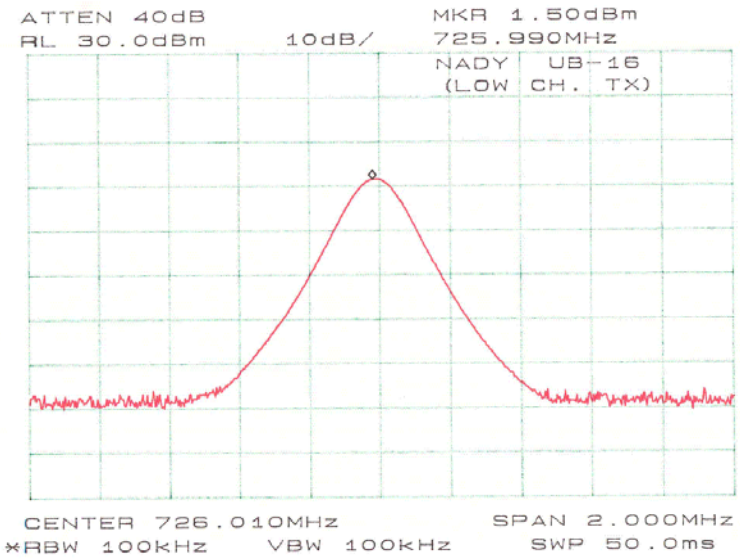
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter

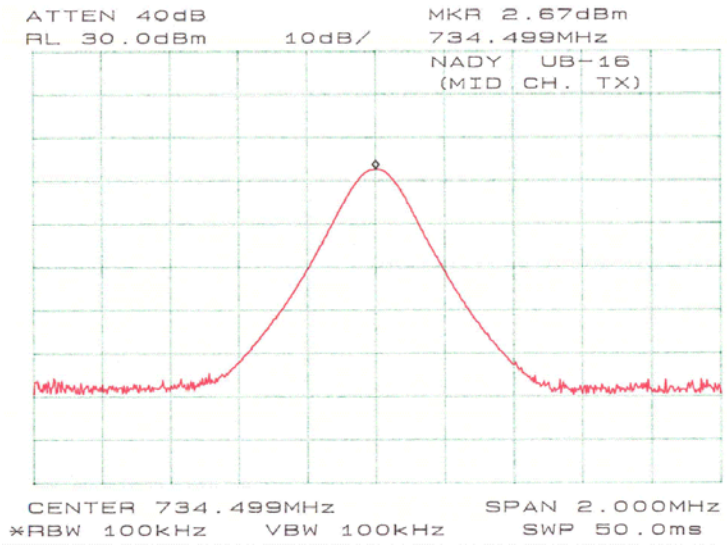
## 3.4 Test Results

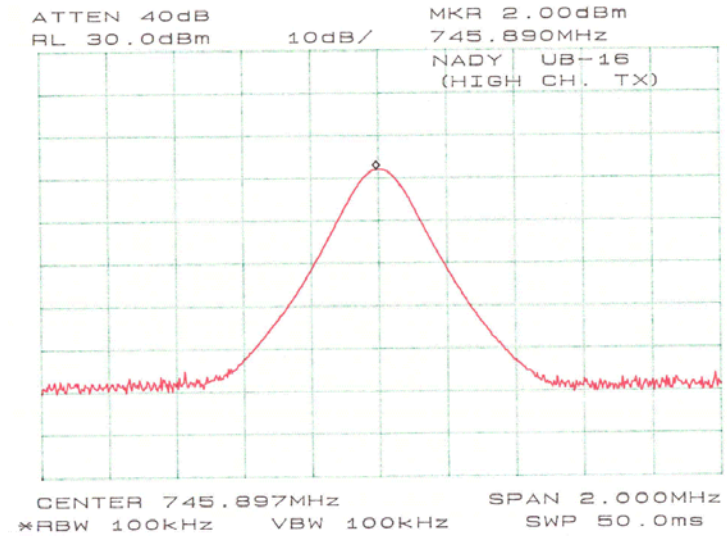
The measured result showed as follows:

Low Channel: 12.19dBm at 726.01MHz
Middle Channel: 12.31dBm at 734.49MHz
High Channel: 11.84dBm at 745.90MHz

The plot (s) of Maximum Output Peak Power was presented hereinafter as reference.


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 1.50dBm
725.990MHz
NADY UB-16
(LOW CH. TX)
CENTER 726.010MHz
SPAN 2.000MHz
*RBW 100kHz
VBW 100kHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 2.67dBm
734.499MHz
NADY UB-16
(MID CH. TX)
CENTER 734.499MHz
SPAN 2.000MHz
*RBW 100kHz
VBW 100kHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 2.00dBm
745.890MHz
NADY UB-16
(HIGH CH. TX)
CENTER 745.897MHz
SPAN 2.000MHz
*RBW 100kHz
VBW 100kHz
SWP 50.0ms

# 4 - MODULATION CHARACTERISTICS

## 4.1 Provision Applicable

According to FCC 2.1047 (a), for Voice Modulated Communication Equipment, the frequency response of the audio modulating circuit over a range of 100Hz to 5000Hz shall be measured. For equipment required to have an audio low-pass filter, the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be measured.

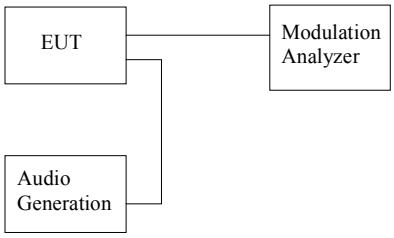
According to §74.861(e)(3), any form of modulation may be used. A maximum deviation of ±75 kHz is permitted when frequency modulation is employed.

## 4.2 Test Procedure

### 4.2.1 Frequency response of audio circuits

1) Position the EUT as shown in figure 1

Figure 1
Modulation Characteristic
Measurement Configuration




2) Adjust the audio input frequency for 100, 200, 500, 1000, 3000 and 5000Hz in sequence and the input level from 0V to maximum permitted input voltage with recording the change in output responding to respective input level

### 4.2.2 Modulation Limit

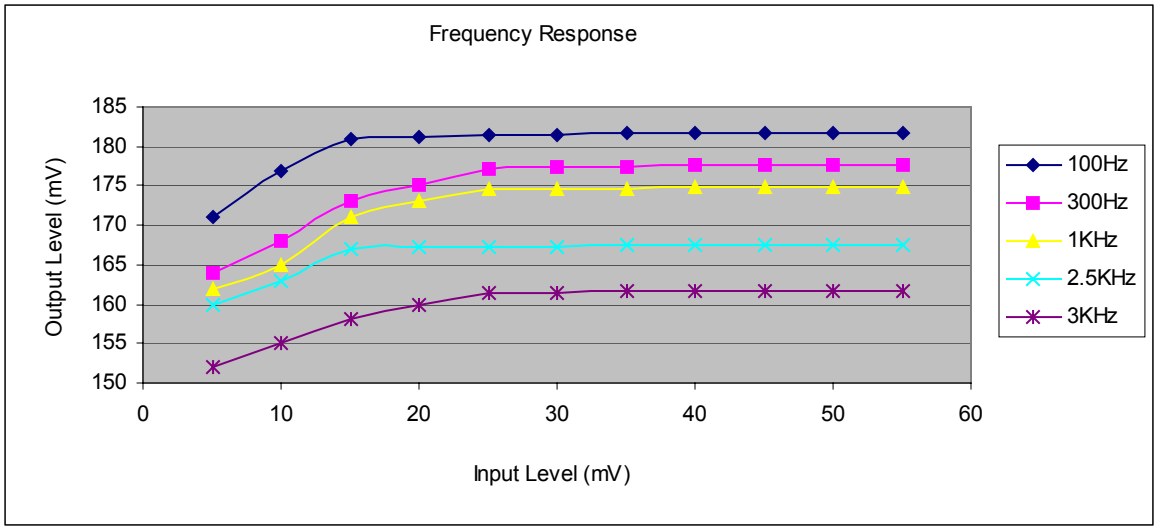
1) Position the EUT as shown in figure 1, adjust the audio input frequency to 100 Hz and the input level from 0V to maximum permitted input voltage with recording each carrier frequency deviation responding to respective input level.
2) Repeat step 1 with changing the input frequency for 200, 500, 1000, 3000 and 5000 Hz in sequence.

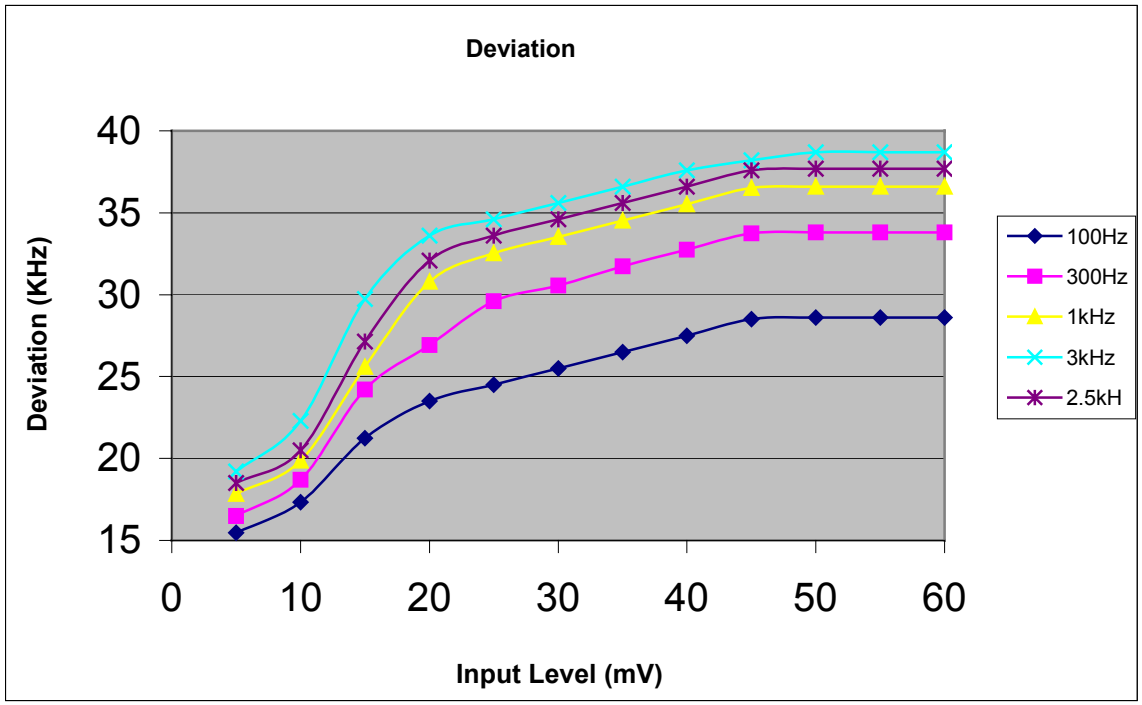
## 4.3 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
Hewlett Packard HP8901A Modulation Analyzer
Lecroy 9350A Oscillscope

## 4.4 Test Results

The plot(s) of modulation characteristic is presented hereinafter as reference.


Frequency Response
Output Level (mV)
185
180
175
170
165
160
155
150
0
10
20
30
40
50
60
Input Level (mV)
100Hz
300Hz
1KHz
2.5KHz
3KHz


Deviation
Deviation (KHz)
40
35
30
25
20
15
0
10
20
30
40
50
60
Input Level (mV)
100Hz
300Hz
1kHz
3kHz
2.5kH

# 5 - OCCUPIED BANDWIDTH OF EMISSION

## 5.1 Provision Applicable

According to FCC 2.1049 (c) (1), for radiotelephone transmitter, other than single sideband or independent sideband transmitter, when modulated by a 2.5 kHz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.

According to §74.861(e)(5), the operating bandwidth shall not exceed 200 kHz

## 5.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Install new batteries in the EUT. Turn on the EUT and set it to any one convenient frequency within its operating range.

## 5.3 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter

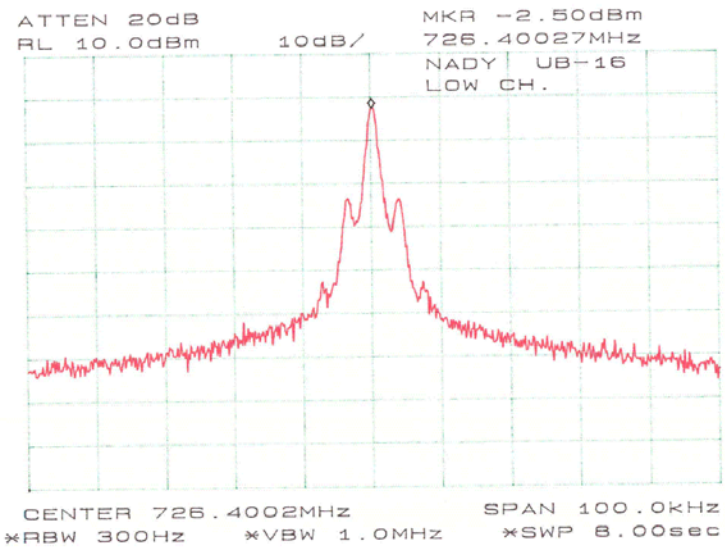
## 5.4 Test Results

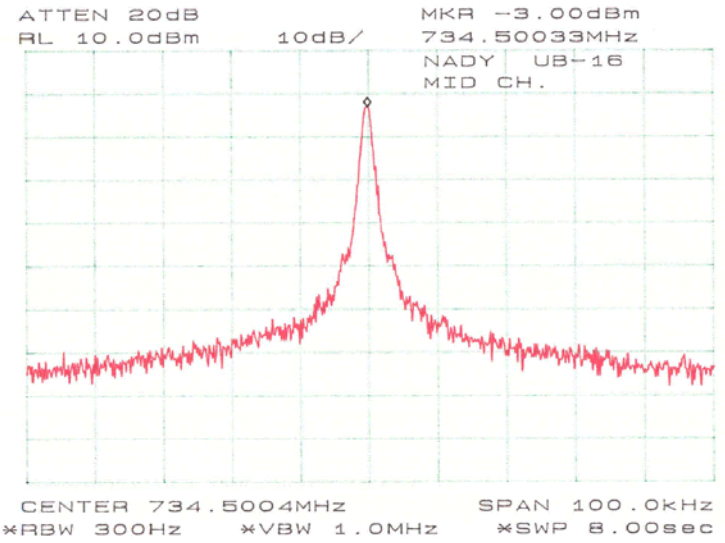
Please refer the following curve and plots.

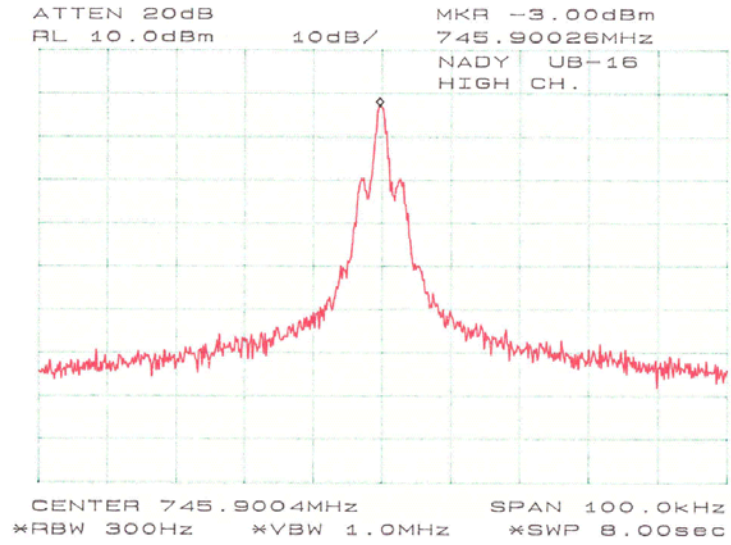
## 5.4 Emission Designator

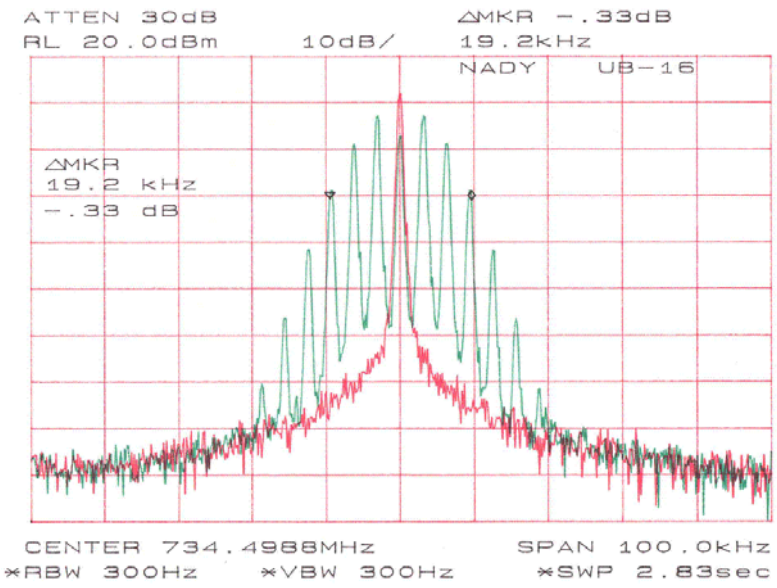
2M + 2D = (2x3kHz) + (2x38.5kHz) = 83K0F3E

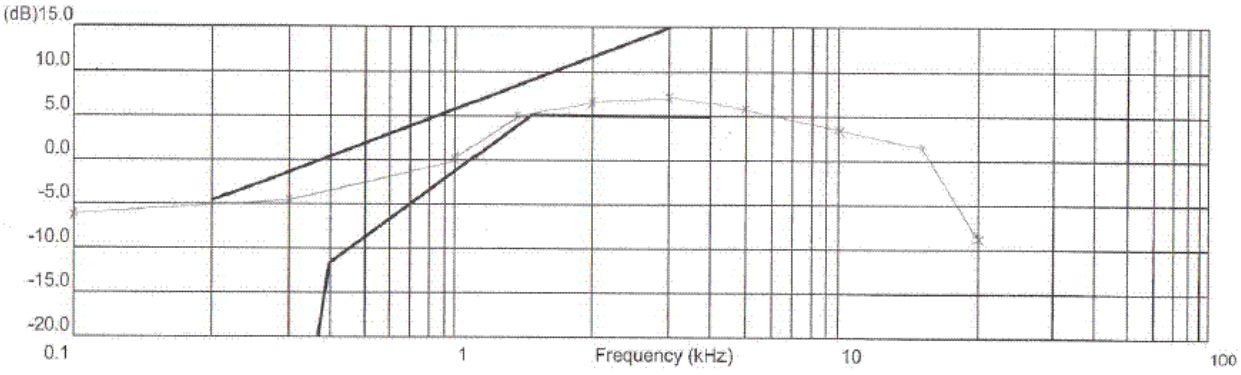
Please refer to the plots hereinafter.

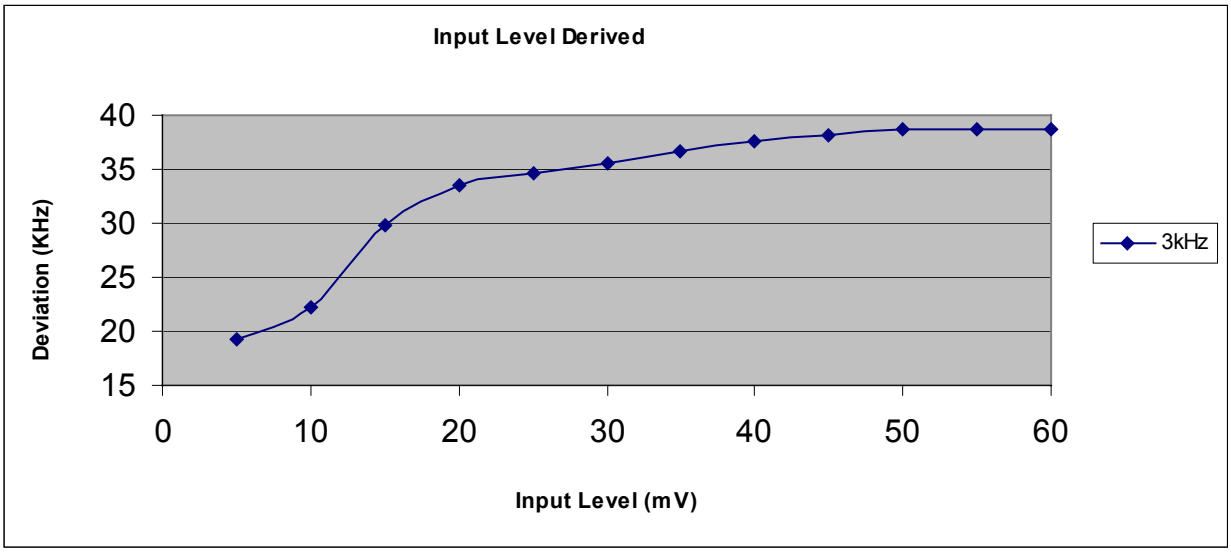

ATTEN 20dB
RL 10.0dBm
10dB/
MKR -2.50dBm
726.40027MHz
NADY UB-16
LOW CH.
CENTER 726.4002MHz
SPAN 100.0kHz
*RBW 300Hz
*VBW 1.0MHz
*SWP 8.00sec


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -3.00dBm
734.50033MHz
NADY UB-16
MID CH.
CENTER 734.5004MHz
SPAN 100.0kHz
*RBW 300Hz
*VBW 1.0MHz
*SWP 8.00sec


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -3.00dBm
745.90026MHz
NADY UB-16
HIGH CH.
CENTER 745.9004MHz
SPAN 100.0kHz
*RBW 300Hz
*VBW 1.0MHz
*SWP 8.00sec


ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR -.33dB
19.2kHz
NADY UB-16
ΔMKR
19.2 kHz
-.33 dB
CENTER 734.4988MHz
SPAN 100.0kHz
*RBW 300Hz
*VBW 300Hz
*SWP 2.83sec


(dB)15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
0.1
1
Frequency (kHz)
10
100


Input Level Derived
Deviation (KHz)
40
35
30
25
20
15
0
10
20
30
40
50
60
Input Level (mV)
3kHz

# 6 - FIELD STRENGTH OF EMISSION

## 6.1 Provision Applicable

According to FCC2.1053, measurements shall be made to detect spurious emission that may be radiated directly from the cabinet, control circuits, power leads, or intermediated circuit elements under normal condition of installation and operation. Information submitted shall include the relative radiated power of spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from a halfwave dipole antenna.

According to FCC74.861 (e)(6), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

1. on any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB.

2. on any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB.

3. on any frequency removed from the operating frequency by more than 250 percent up to and the authorized bandwidth shall be attenuated below the un-modulated carrier by at least 43 plus 10 Log (output power in watts)dB.

## 6.2 Test Procedure

1. Setup the configuration per figure 5 and 6 for frequencies measured below and above 1GHz respectively, adjusting the input voltage to produce the maximum power as measured in chapter 3.

2. Adjust the analyzer for each frequency measured in chapter 6 on a 1MHz frequency span and 100kHz resolution bandwidth.

3. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the height when the highest value is indicated on spectrum analyzer, the change the orientation of EUT on test table over a range for 0º to 360º, and record the highest value indicated on spectrum analyzer as reference value.

4. Repeat step 3 until all frequencies need to be measured were completed.

5. Repeat step 4 with search antenna in vertical polarized orientations.

6. Replace the EUT with a tuned dipole antenna (horn antenna for above 1GHz) relative to each frequency in horizontally polarized orientation and as the same polarized orientation with search antenna. Connect the tuned dipole antenna to a standard signal generator (SG) via a low loss cable. Power on the SG and tune the right frequency in measuring as well as set SG at an appreciated output level. Rise and lower the search antenna to get the highest value on spectrum analyzer, and then hold this position. Adjust the SG output to get an identical value derived from step 3 on spectrum analyzer. Record this value for result calculated.

7. repeat step 6 until all frequencies need to be measured were completed.

8. repeat step 7 in vertical polarized orientations.

## 6.3 Test Equipment

A.H. System Horn Antenna

High Pass Filter

Preamplifier

Hewlett Packard HP8566B Spectrum Analyzer

Hewlett Packard HP 7470A Plotter

## 6.4 Test Results

-20.5dB at 2178.03MHz
-19.6dB at 2203.50MHz
-19.5dB at 2237.68MHz

A plot with emission mask shows the compliance with the applicable requirements.

Low Frequency

| EUT | | | | | GENERATOR | | | | | | | | Absolute | Spurious | FCC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Indicated | | Table | Test Antenna | | Substituted | | Substitution Antenna | | Test Antenna | | Correction Factor | | Absolute | Spurious | Limit | Margin |
| Frequency | Ampl. | Angle | Height | Polar | Frequency | Level | Half-wavel. | Polar | Height | Polar | Antenna | Cable | Leval | Emissions | | |
| MHz | dBuV/m | Degree | Meter | H/V | MHz | dBm | cm | H/V | Meter | H/V | dB | dB | dBm | dB | dB | dB |
| 726.01 | 79.4 | 260 | 1.2 | V | 726.01 | 19.89 | 30 | V | 1.2 | V | 7.2 | 0.5 | 12.19 | | | |
| 726.01 | 79.1 | 270 | 1.5 | H | 726.01 | 19.75 | 30 | H | 1.5 | H | 7.2 | 0.5 | 12.05 | | | |
| 2178.03 | 51.8 | 0 | 1.2 | V | 2178.03 | -16.5 | 6 | V | 1.5 | V | 16.5 | 0.5 | -33.5 | 45.7 | 25.19 | -20.5 |
| 2178.03 | 49.7 | 30 | 1.2 | H | 2178.03 | -17.3 | 6 | H | 1.5 | H | 16.5 | 0.5 | -34.3 | 46.5 | 25.19 | -21.3 |
| 2904.04 | 51.2 | 180 | 1.5 | H | 2904.04 | -15.7 | 5 | H | 1.2 | H | 19.8 | 0.7 | -36.2 | 48.4 | 25.19 | -23.2 |
| 2904.04 | 49.7 | 160 | 1.5 | V | 2904.04 | -13.2 | 5 | V | 1.5 | V | 19.8 | 0.7 | -33.7 | 45.9 | 25.19 | -20.7 |
| 3630.05 | 48.8 | 90 | 1.8 | V | 3630.05 | -10.9 | 4 | V | 1.8 | V | 23.7 | 1.0 | -35.6 | 47.8 | 25.19 | -22.6 |
| 3630.05 | 49.3 | 110 | 1.5 | H | 3630.05 | -15.6 | 4 | H | 2 | H | 23.7 | 1.0 | -40.3 | 52.5 | 25.19 | -27.3 |
| 4356.06 | 45.6 | 230 | 2.0 | V | 4356.06 | -13.7 | 3.5 | V | 1.5 | V | 26.4 | 1.0 | -41.1 | 53.3 | 25.19 | -28.1 |
| 4356.06 | 38.1 | 250 | 2.2 | H | 4356.06 | -16.4 | 3.5 | H | 1.2 | H | 26.4 | 1.0 | -43.5 | 55.7 | 25.19 | -30.5 |

Middle Frequency

| EUT | | | | | GENERATOR | | | | | | | | Absolute | Spurious | FCC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Indicated | | Table | Test Antenna | | Substituted | | Substitution Antenna | | Test Antenna | | Correction Factor | | Absolute | Spurious | Limit | Margin |
| Frequency | Ampl. | Angle | Height | Polar | Frequency | Level | Half-wavel. | Polar | Height | Polar | Antenna | Cable | Leval | Emissions | | |
| MHz | dBuV/m | Degree | Meter | H/V | MHz | dBm | cm | H/V | Meter | H/V | dB | dB | dBm | dB | dB | dB |
| 734.5 | 81.4 | 130 | 1.0 | H | 734.5 | 19.62 | 30 | H | 1.2 | H | 7.2 | 0.5 | 11.92 | | | |
| 734.5 | 83.9 | 150 | 1.2 | V | 734.5 | 20.01 | 30 | V | 1.5 | V | 7.2 | 0.5 | 12.31 | | | |
| 2203.5 | 52.3 | 0 | 1.6 | V | 2203.5 | -15.6 | 6 | V | 1.5 | V | 16.5 | 0.5 | -32.6 | 44.9 | 25.31 | -19.6 |
| 2203.5 | 55.2 | 90 | 1.5 | H | 2203.5 | -19.6 | 6 | H | 1.8 | H | 16.5 | 0.5 | -36.6 | 48.9 | 25.31 | -23.6 |
| 2938 | 59.6 | 110 | 1.8 | V | 2938 | -12.8 | 5 | V | 1.2 | V | 19.8 | 0.7 | -33.3 | 45.6 | 25.31 | -20.3 |
| 2938 | 60.2 | 160 | 1.5 | H | 2938 | -16.9 | 5 | H | 1.2 | H | 19.8 | 0.7 | -37.4 | 49.7 | 25.31 | -24.4 |
| 3672.5 | 57.6 | 270 | 1.2 | H | 3672.5 | -7.2 | 4 | H | 1.5 | H | 23.7 | 1 | -31.9 | 44.2 | 25.31 | -18.9 |
| 3672.5 | 50.7 | 230 | 1.2 | V | 3672.5 | -10.6 | 4 | V | 1.5 | V | 23.7 | 1 | -35.4 | 47.7 | 25.31 | -22.4 |

High Frequency

| EUT | | | | | GENERATOR | | | | | | | | Absolute | Spurious | FCC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Indicated | | Table | Test Antenna | | Substituted | | Substitution Antenna | | Test Antenna | | Correction Factor | | Absolute | Spurious | Limit | Margin |
| Frequency | Ampl. | Angle | Height | Polar | Frequency | Level | Half-wavel. | Polar | Height | Polar | Antenna | Cable | Leval | Emissions | | |
| MHz | dBuV/m | Degree | Meter | H/V | MHz | dBm | cm | H/V | Meter | H/V | dB | dB | dBm | dB | dB | dB |
| 745.90 | 82.61 | 30 | 1.2 | V | 745.9 | 19.54 | 30 | V | 1.5 | V | 7.2 | 0.5 | 11.84 | | | |
| 745.90 | 79.52 | 0 | 1.2 | H | 745.9 | 18.95 | 30 | H | 1.2 | H | 7.2 | 0.5 | 11.25 | | | |
| 2237.68 | 54.50 | 270 | 1.5 | V | 2237.68 | -15.5 | 6 | V | 1.2 | V | 16.5 | 0.5 | -32.5 | 44.3 | 24.84 | -19.5 |
| 2237.68 | 52.90 | 250 | 1.5 | H | 2237.68 | -16.1 | 4 | H | 1.2 | H | 16.5 | 0.5 | -33.1 | 44.9 | 24.84 | -20.1 |
| 2983.58 | 51.60 | 160 | 1.2 | V | 2983.58 | -15.9 | 4 | V | 1.5 | V | 19.8 | 0.7 | -36.4 | 48.2 | 24.84 | -23.4 |
| 2983.58 | 50.73 | 45 | 1.5 | H | 2983.58 | -16.2 | 5 | H | 1.5 | H | 19.8 | 0.7 | -36.7 | 48.5 | 24.84 | -23.7 |
| 3927.48 | 56.10 | 130 | 1.8 | V | 3927.48 | -6.8 | 5 | V | 1.5 | V | 23.7 | 1 | -31.5 | 43.3 | 24.84 | -18.5 |
| 3927.48 | 55.40 | 110 | 1.5 | H | 3927.48 | -7.4 | 6 | H | 1.8 | H | 23.7 | 1 | -32.1 | 43.9 | 24.84 | -19.1 |
| 4475.40 | 41.63 | 230 | 1.2 | H | 4475.4 | -13.2 | 3.5 | H | 1.5 | H | 26.4 | 1.0 | -40.6 | 52.1 | 24.84 | -27.3 |
| 4475.40 | 39.80 | 330 | 1.2 | V | 4475.4 | -13.3 | 3.5 | V | 1.2 | V | 26.4 | 1.0 | -40.7 | 52.6 | 24.84 | -27.8 |

**Compliance Statement:**

According to FCC Part 15, at 3 meter distance the emission from an intentional radiator shall not exceed the field strength level 40dBuV/m within 30-88MHz, 43.5dBuV/m within 88-216MHz, 46dBuV/m within 226-960MHz, 54dBuV/m above 960MHz. The level of any unwanted emissions shall not exceed the level of the fundamental frequency.

The levels of unwanted emission of this device were below the above limits. The worst margin was –6.9dBuV/m at 66.79MHz for this device.

This device was compliant with the FCC Part 15.

# 7 - SPURIOUS EMISSION

## 7.1 Standard Applicable

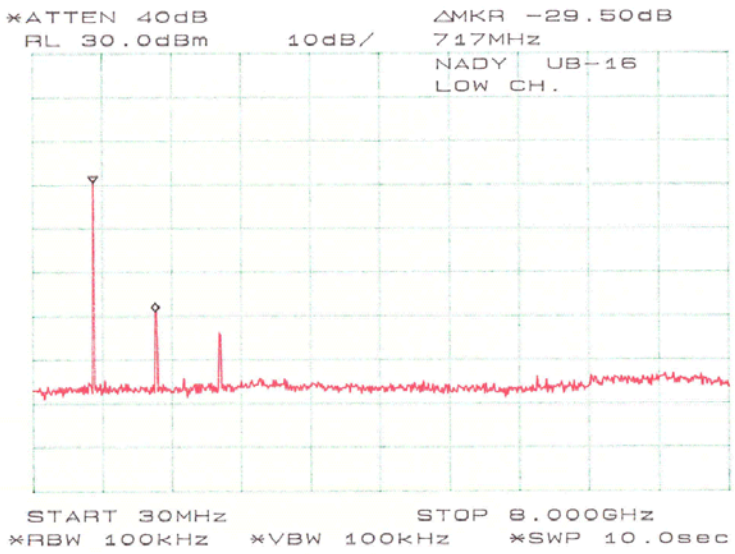
According to §15.209 (f) and §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation f a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit.

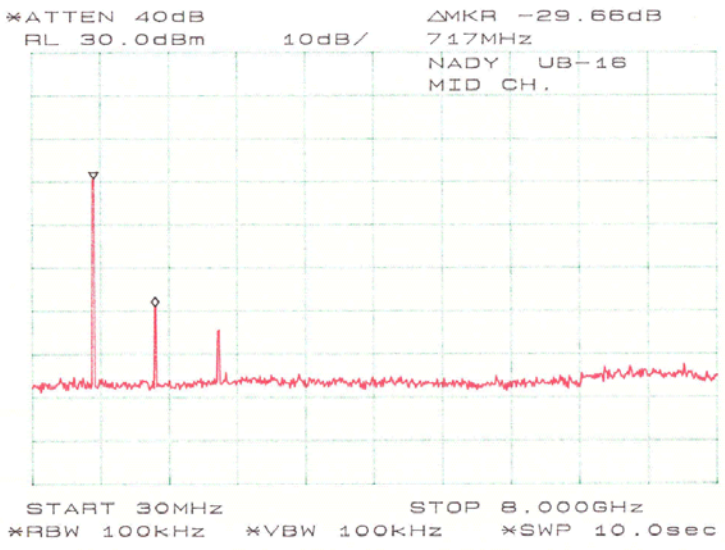
## 7.2 Measurement Procedure

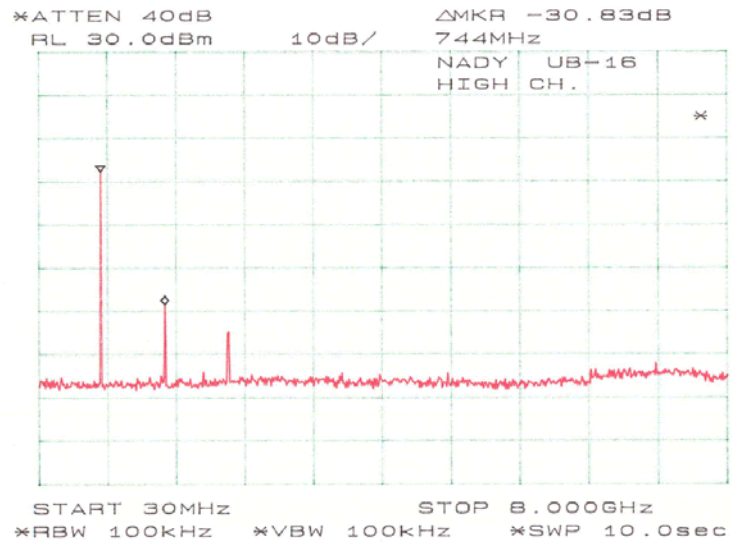
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument 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.

## 7.3 Measurement Data

Please refer to the following plots.


*ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -29.50dB
717MHz
NADY UB-16
LOW CH.
START 30MHz
STOP 8.000GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec


*ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -29.66dB
717MHz
NADY UB-16
MID CH.
START 30MHz
STOP 8.000GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec


*ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -30.83dB
744MHz
NADY UB-16
HIGH CH.
START 30MHz
STOP 8.000GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec

# 8 - FREQUENCY STABILITY MEASUREMENT

## 8.1 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 74.86(e)(4), the frequency tolerance of the transmitter shall be 0.005 percent.

## 8.2 Test Procedure

### A) Frequency stability versus environmental temperature

1. Setup the configuration per figure 7 for frequencies measured at ambient temperature if it is with 15ºC to 25ºC. otherwise, an environmental chamber set for a temperature of 20ºC shall be used. Install new batteries in the EUT.

2. Turn on EUT and set SA center frequency to the right frequency needs to be measured, then set SA RBW to 30kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.

3. Set the temperature of chamber to 50ºC. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.

4. Repeat step 2 with a 10ºC decreased per stage until the lowest temperature -30ºC is measured, record all measurement frequencies.

### B) Frequency stability versus input voltage

1. Setup the configuration per figure 7 for frequencies measured at ambient temperature if it is within 15ºC to 25ºC. otherwise, an environmental chamber set for a temperature of 20ºC shall be used. Install new batteries in the EUT.

2. Set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.

3. For battery operated only device, supply the EUT primary voltage at the battery operating end point which is specified by the manufactured and record the frequency.

## 8.3 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter

## 8.4 Test Results

Frequency stability versus environmental temperature

| Reference Frequency: 726.00MHz, Limit: 0.005% | | | | | | | |
|---|---|---|---|---|---|---|---|
| Environment Temperature (°C) | Power Supplied (Vdc) | Frequency Measure with Time Elapsed | | | | | |
| | | 2 Minutes | | 5 Minutes | | 10 Minutes | |
| | | MHz | % | MHz | % | MHz | % |
| 50 | New Batt. | 726.001 | 0.00014 | 725.997 | -0.00042 | 726.003 | 0.00042 |
| 40 | New Batt. | 726.000 | 0.0000 | 725.999 | -0.00014 | 726.001 | 0.00042 |
| 30 | New Batt. | 726.001 | 0.00014 | 726.001 | 0.00014 | 726.001 | 0.00042 |
| 20 | New Batt. | 726.0001 | 0.00014 | 726.001 | 0.00014 | 726.001 | 0.00014 |
| 10 | New Batt. | 726.003 | 0.00042 | 726.001 | 0.00014 | 726.001 | 0.00014 |
| 0 | New Batt. | 725.999 | -0.00014 | 726.000 | 0.0000 | 726.001 | 0.00014 |
| -10 | New Batt. | 725.999 | -0.00014 | 725.998 | -0.00028 | 726.001 | 0.00014 |
| -20 | New Batt. | 726.000 | 0.0000 | 725.998 | -0.00028 | 726.000 | 0.0000 |
| -30 | New Batt. | 725.999 | -0.00014 | 725.998 | -0.00028 | 726.003 | 0.00042 |

Frequency stability versus input voltage

| Reference Frequency: 726.00MHz | | | | | | |
|---|---|---|---|---|---|---|
| Power Supplied (Vdc) | Frequency Measure with Time Elapsed | | | | | |
| | 2 Minutes | | 5 Minutes | | 10 Minutes | |
| | MHz | % | MHz | % | MHz | % |
| 3.5 | 726.001 | 0.00014 | 725.999 | -0.00014 | 725.999 | -0.00014 |
| 3.5 | 725.999 | -0.00014 | 726.000 | 0.0000 | 726.003 | 0.00042 |
| 3.0 | 726.001 | 0.00014 | 726.003 | 0.00042 | 726.000 | 0.0000 |
| 3.0 | 726.001 | 0.00014 | 725.999 | -0.00014 | 726.003 | 0.00042 |
| 2.5 | 726.003 | 0.00042 | 726.000 | 0.0000 | 725.999 | -0.00014 |
| 2.5 | 726.000 | 0.0000 | 726.003 | 0.00042 | 726.000 | 0.0000 |

UB-16 is a handheld transmitter that is powered by 3Vdc battery. The battery operating end point is 2.5Vdc. Frequency stability was measured with reducing the voltage to the battery end point.

Test Result: The frequency tolerance rating is 0.00042% < 0.005%. Passed.