

TEST REPORT For FCC

Test Report No. : TK-FR10003
Date of Issue : 01/14/2010
FCC ID : O25PZ-400NW
Description of Product : FM Handheld Transceiver
Model No. : PZ-400NW
Applicant : Unimo Technology Co.,Ltd
479-12 Bangbae-3Dong, Seocho-Gu, Seoul,
137-820 KOREA
Manufacturer : Unimo Technology Co.,Ltd
479-12 Bangbae-3Dong, Seocho-Gu, Seoul,
137-820 KOREA
Standards : FCC Part 2,90
Test Date : 01/06/2010 – 01/14/2010
Test Results : PASS FAIL

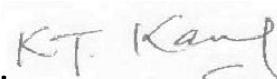
The test results relate only to the items tested.

Tested by:



Kyu-Chul Shin
Test Engineer
Date:01/14/2010

Reviewed by:



KT Kang
Technical Manager
Date: 01/14/2010

THRU-KES CO.,LTD.

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1.0 General Product Description

| | | |
|-------------------------|---|--|
| EUT Type | : | FM Handheld Transceiver |
| FCC Rule Part(s) | : | §2; §90 |
| Model name | : | Pz-400NW |
| Serial number | : | Identical prototype |
| Tx Freq. Range | : | 12.5KHz: 400.0124 MHz ~ 469.9875MHz 25KHz : 400.025 MHz ~ 469.975 MHz |
| Channel Space Bandwidth | : | 12.5KHz , 25kHz |
| Type of Modulation | : | 18K6F1D |
| Frequency Tolerance: | : | ± 0.00025 % (2.5ppm) |
| RF Output Power | : | 2W / 4W |
| Power Source | : | Li-ion Battery (DC 7.5V) |
| Antenna type | : | Whip antenna |

1.1 Tested Frequency

-12.5KHz

| | LOW | MID | HIGH |
|-----------------|----------|---------|----------|
| Frequency (MHz) | 400.0125 | 435.025 | 469.9875 |

-25KHz

| | LOW | MID | HIGH |
|-----------------|---------|---------|---------|
| Frequency (MHz) | 400.025 | 435.025 | 469.975 |

1.3 Model Differences

1.4 Device Modifications

The following modifications were necessary for compliance:
Not applicable

1.5 Peripheral Devices

| Device | Manufacturer | Model No. | Serial No. |
|--------|----------------------------|-----------|------------|
| E | Unimo Technology Co., Ltd. | PZ-400NW | - |
| U | | | |
| T | | | |

1.6 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

1.7 Test Facility

The measurement facility is located at 477-6, Hager-Ri, Yaju-Up, Yaju-Gun Kyunggi-Do, 469-803, Korea. Tel: +82-31-883-5092/Fax: +82-31-883-5169. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.8 Laboratory Accreditations and Listings

| Country | Agency | Scope of Accreditation | Logo |
|---------|--------|---|--|
| USA | FCC | 3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements. |  343818 |
| KOREA | KCC | EMI (10 meter Open Area Test Site and two conducted sites) Radio(3 & 10 meter Open Area Test Sites and one conducted site) |  KR100 |
| Canada | IC | 3 & 10 meter Open Area Test Sites and one conducted site |  4769B-1 |

2.0 Summary of tests

| FCC Part Section(s) | Parameter | Status (note 1) |
|---------------------|--|-----------------|
| 2.1046(a) | Carrier Output Power(Conducted) | C |
| 2.1051 | Unwanted Emissions (Transmitter Conducted) | C |
| 2.1053(a) | Field Strength of Spurious Radiation | C |
| 2.1049(c) (1) | Emission Masks(Occupied Bandwidth) | C |
| 90.214 | Transient Frequency Behavior | C |
| 2.1047(a) | Audio Frequency Response | C |
| 2.1047(b) | Modulation Limiting | C |
| 2.1055(a) (1) | Frequency Stability(Temperature Variation) | C |
| 2.1055(a) (1) | Frequency Stability(Voltage Variation) | C |
| 2.202(g) | Necessary Bandwidth and Emission Bandwidth | C |

The sample was tested according to the following specification:
FCC Rules and Regulations, Volume II : Part2, Sub-part J, Sections 2.947, 2.1033(c)
2.1046, 2.1047, 2.1079, 2.1051, 2.1053, 2.1055, 2.1057 and part 90

3 Transmitter requirements

3.1 Carrier Output Power(Conducted)

Definition:

- The carrier power output for a transmitter for this service is the available at the output terminals of the transmitter when the output terminals are connected to the standard transmitter load

Specification : 47CFR2.1046 (a)
Test method : ANSI/TIA-603-C

Test Setup Layout

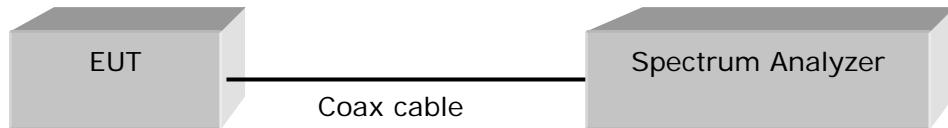


Figure 1 : Measurement setup for the carrier frequency separation

Test Data

-12.5KHz

| TEST CONDITIONS | | Carrier power(W) | | |
|-----------------|-------------|------------------|-------------|--|
| Power lever(W) | 400.0125MHz | 435.025MHz | 469.9875MHz | |
| 2 | 2.16 | 2.10 | 2.24 | |
| 4 | 4.19 | 4.09 | 4.05 | |

-25KHz

| TEST CONDITIONS | | Carrier power(W) | | |
|-----------------|------------|------------------|------------|--|
| Power lever(W) | 400.025MHz | 435.025MHz | 469.975MHz | |
| 2 | 2.09 | 2.04 | 1.98 | |
| 4 | 4.10 | 3.78 | 3.67 | |

3.2 Unwanted Emissions (Transmitter Conducted)

Definition:

- Conducted spurious emissions are emissions at the antenna terminals on a frequency or Frequencies which are outside a band sufficient to ensure transmission of information of required quality for the class of communication desired

Specification : 47CFR2.1051
Test method : ANSI/TIA-603-C

Test Setup Layout

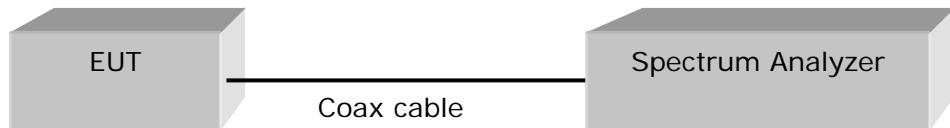


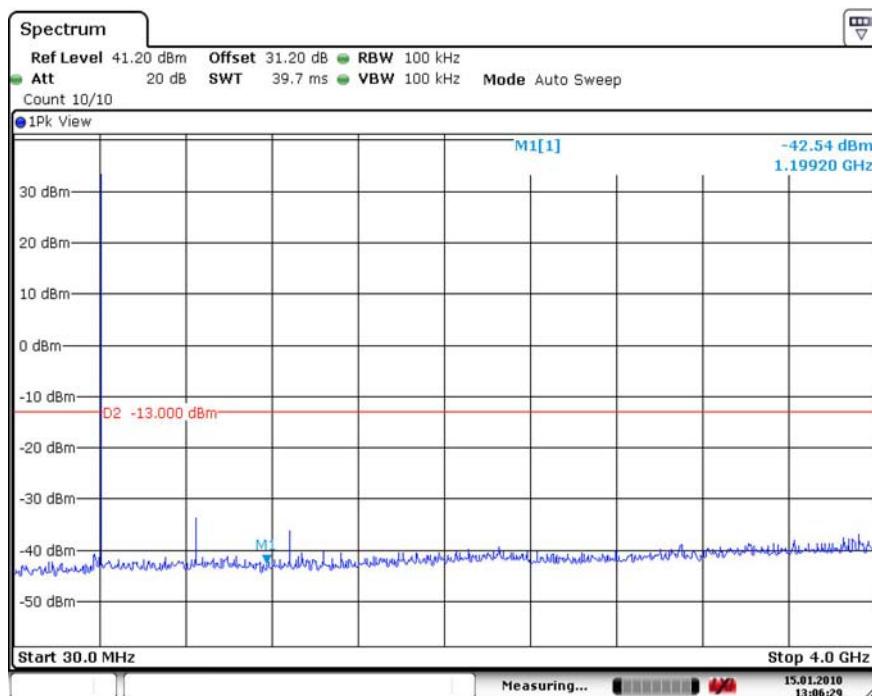
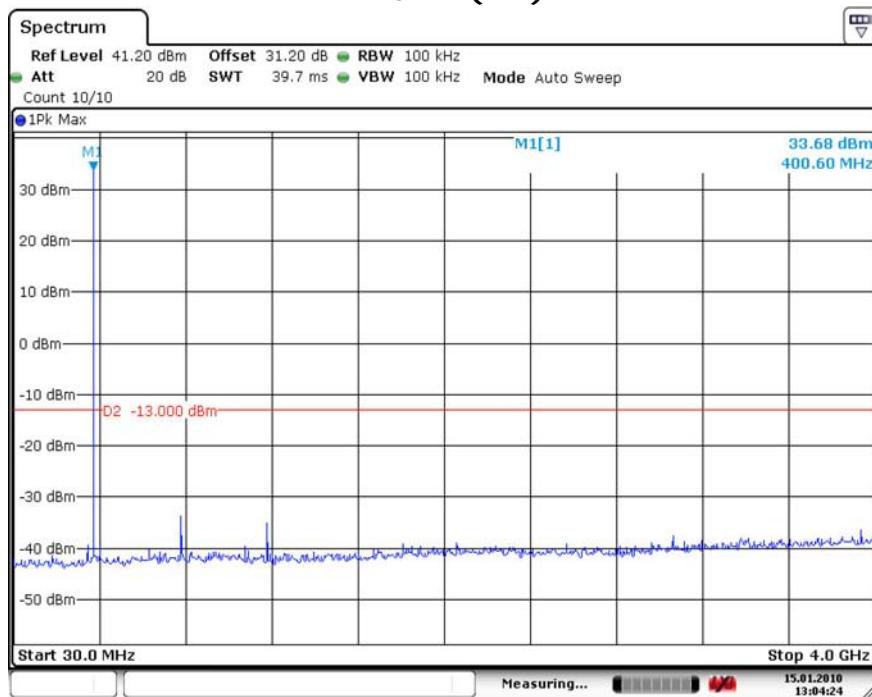
Figure 1 : Measurement setup for the carrier frequency separation

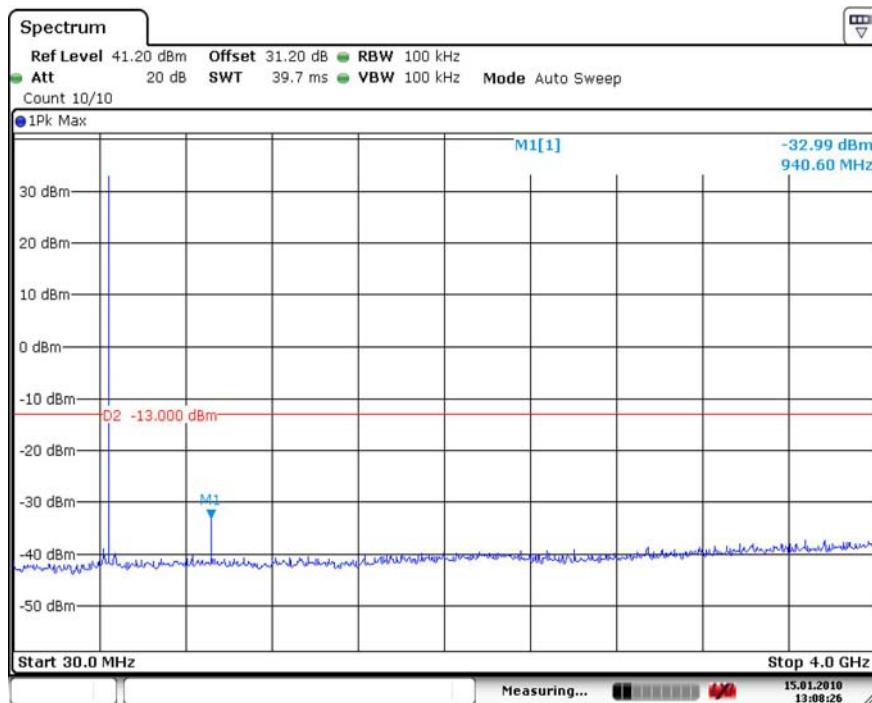
LIMIT

$$=43+10\log(P)\text{dBc} \text{ (or } -13\text{dBm})$$

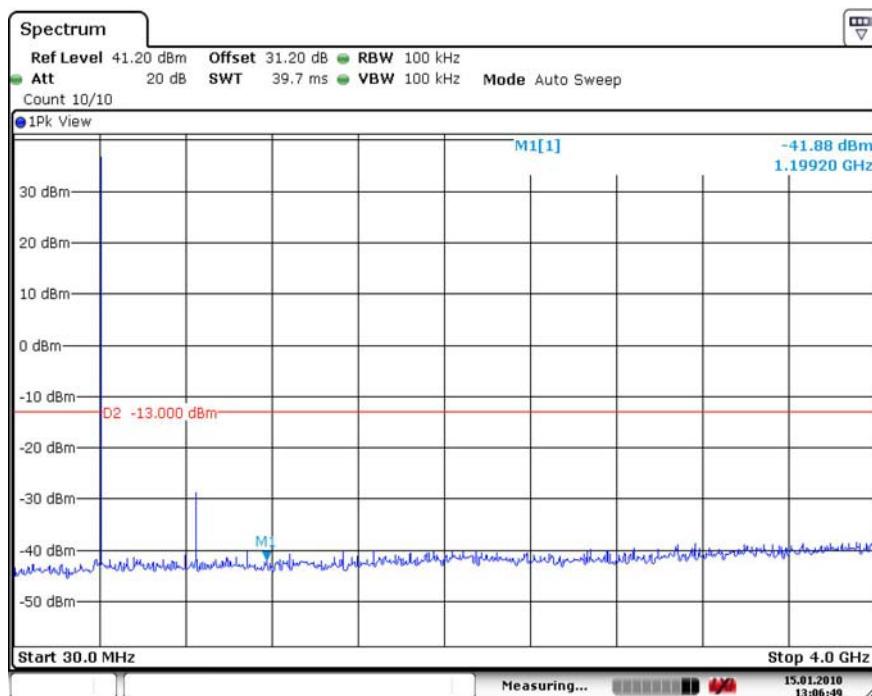
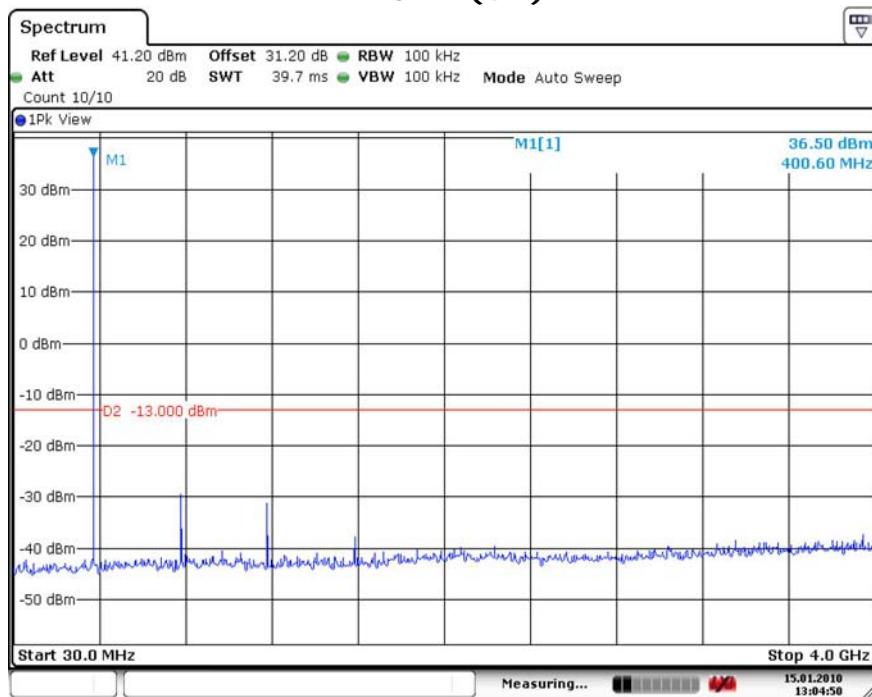
See next pages for actual measured spectrum plots.

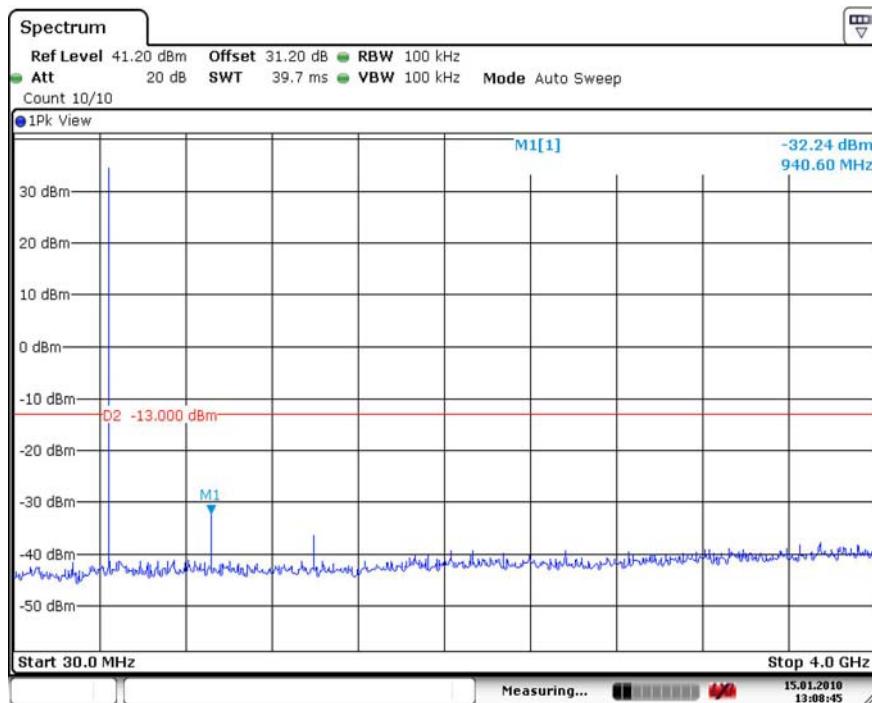
Unwanted Emissions 12.5KHz(2W)

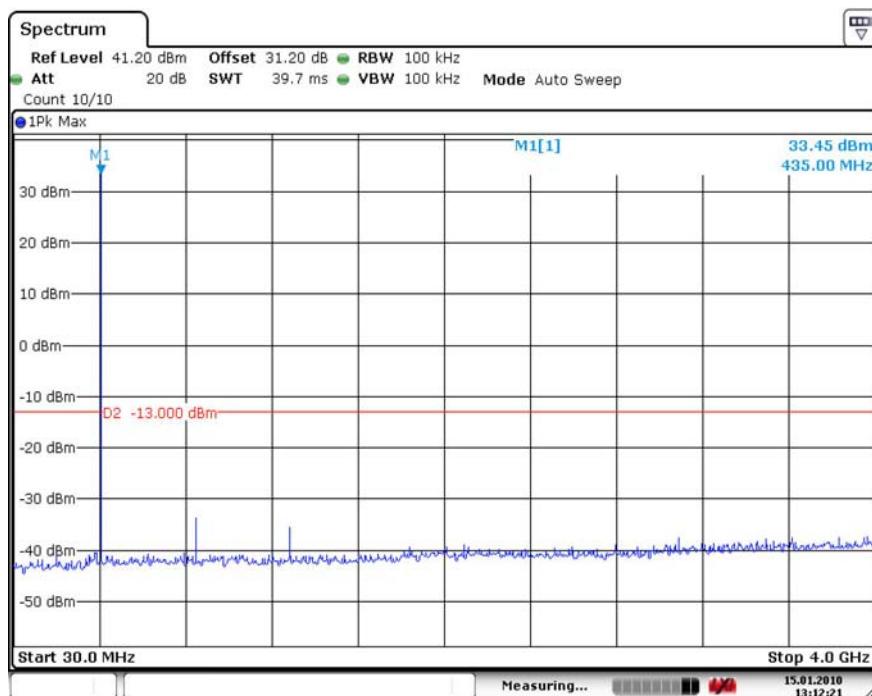
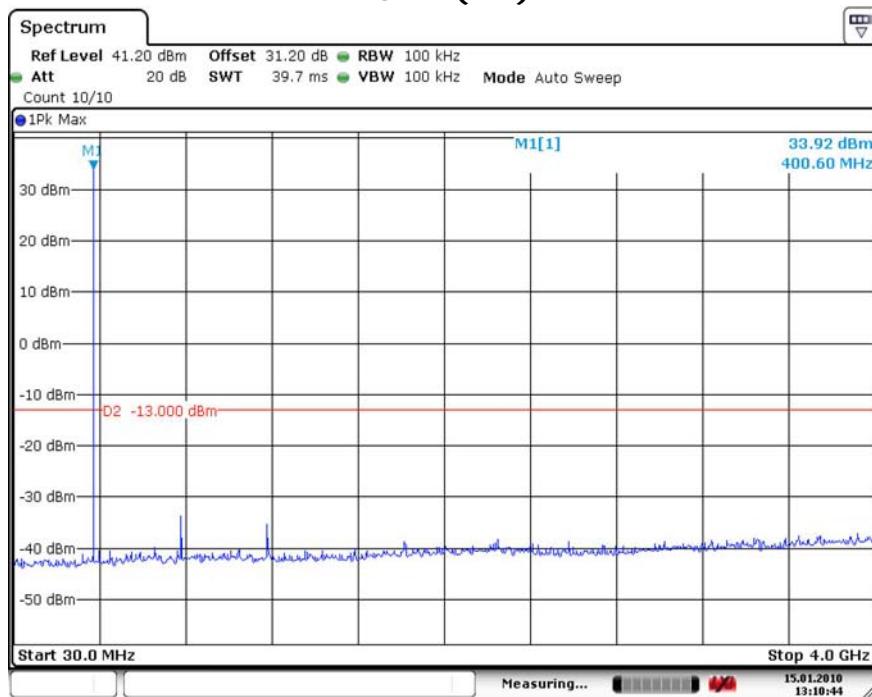


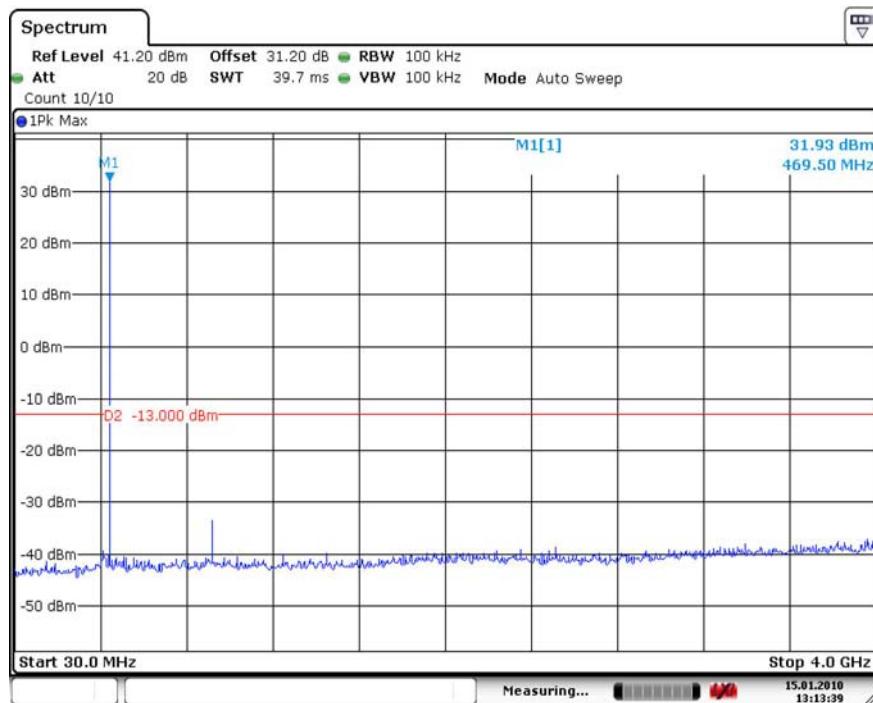


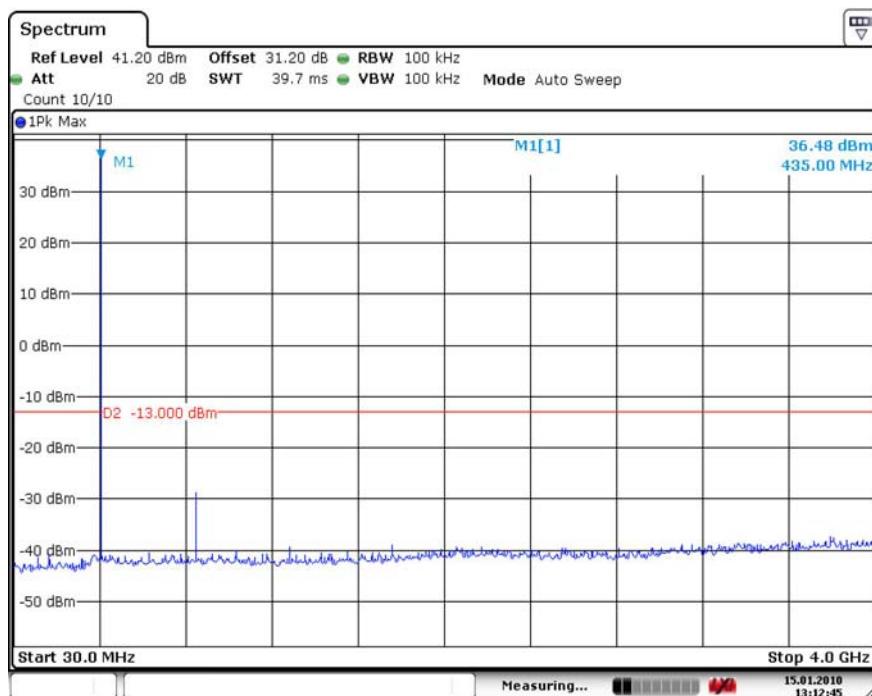
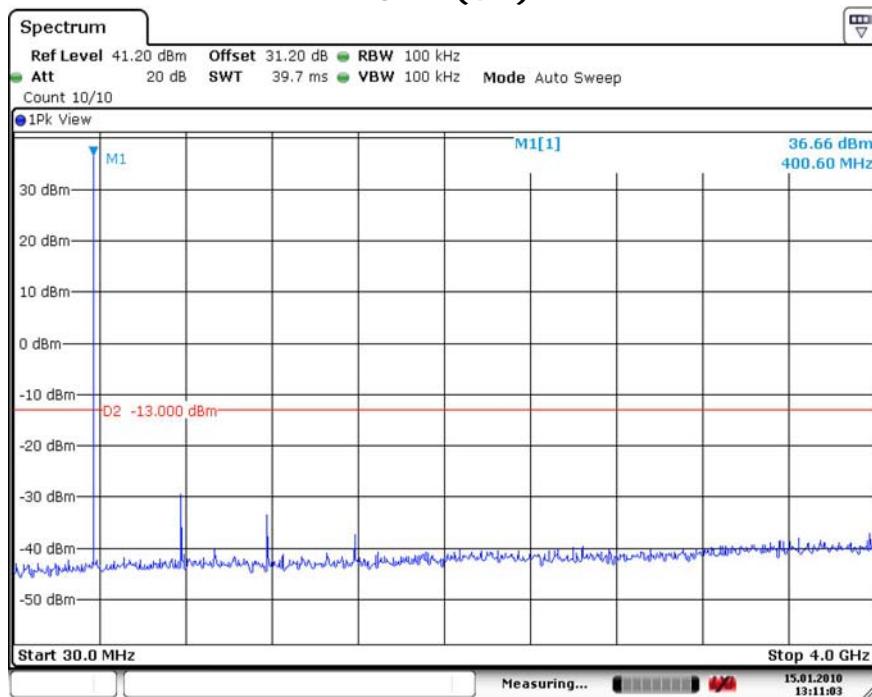
Unwanted Emissions 12.5KHz(4W)

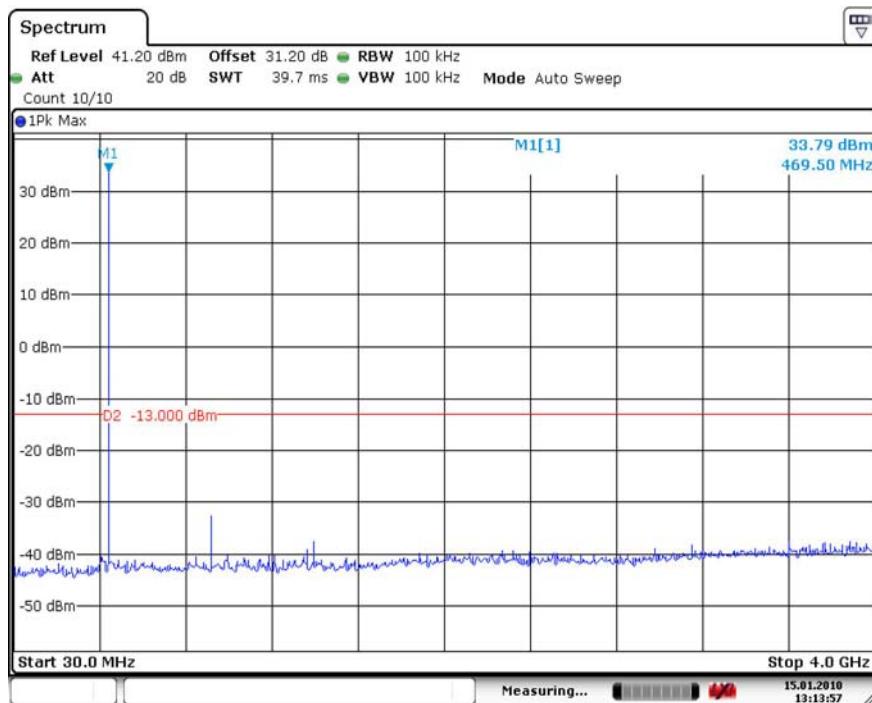




**Unwanted Emissions
25KHz(2W)**



**Unwanted Emissions
25KHz(4W)**



3.3 Field Strength of Spurious Radiation

Definition:

- Radiated spurious emissions are emissions from the equipment when transmitting into a non-radiating load on a frequency or frequencies which are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communications desire

Specification : 47CFR2.1053 , 90.210

Test method : ANSI/TIA-603-C

Measurement Procedure:

- The test sample was set up at a distance of three meters from the test instrument. Valid spurious signal were determined by switching the power on and off
- In the field, the test sample was placed on a wooden turntable above ground at three meters away from the search antenna
- The cables were oriented in order to obtain the maximum response. At each emission frequency, the turntable was rotated and the search antennas were raised and lowered vertically
- The emission was observed with both a vertically polarized and a horizontally polarized search antenna and the worst case was used.
- The field strength of each emission within 20dB of the limit was recorded and corrected with the appropriate cable and transducer factors.
- From the lowest frequency generated in the EUT and to at least the 10th harmonic of the carrier frequency, or 40GHz, whichever is lower.
- The worst case for all channels is shown

LIMIT

$$= 43 + 10\log(P)\text{dBc}(\text{or } -13\text{dBm})$$

Measurement Data : Attached for Worst Case

Channel Spacing : 25KHz
-Test result : Low Frequency
P=36.22dBm = 4.19 W

| Frequency (MHz) | Pol | Reading (dBm) | ERP measured (dBm) | Limit (dBc) |
|-----------------|-----|---------------|--------------------|-------------|
| 802.70 | v | -67.34 | -42.44 | 49.22 |
| 1199.20 | v | -75.29 | -45.19 | 49.22 |

Test result : mid Frequency
P=36.12dBm = 4.09 W

| Frequency (MHz) | Pol | Reading (dBm) | ERP measured (dBm) | Limit (dBc) |
|-----------------|-----|---------------|--------------------|-------------|
| 871.70 | v | -65.82 | -40.62 | 49.12 |
| - | - | - | - | - |

Test result : High Frequency
P=36.07dBm = 4.05 W

| Frequency (MHz) | Pol | Reading (dBm) | ERP measured (dBm) | Limit (dBc) |
|-----------------|-----|---------------|--------------------|-------------|
| 940.60 | v | -68.56 | -43.35 | 49.07 |
| 1411.70 | v | -77.13 | -44.99 | 49.07 |

3.4 Emission Masks(Occupied Bandwidth)

Definition:

- The term transmitter Sideband Spectrum denotes the energy produced at a discrete frequency separation from the carrier up to the test bandwidth due to all sources of unwanted noise within transmitter in a modulated condition.

Specification : 47CFR2.1053 , 90.210

Test method : ANSI/TIA-603-C

Measurement Procedure:

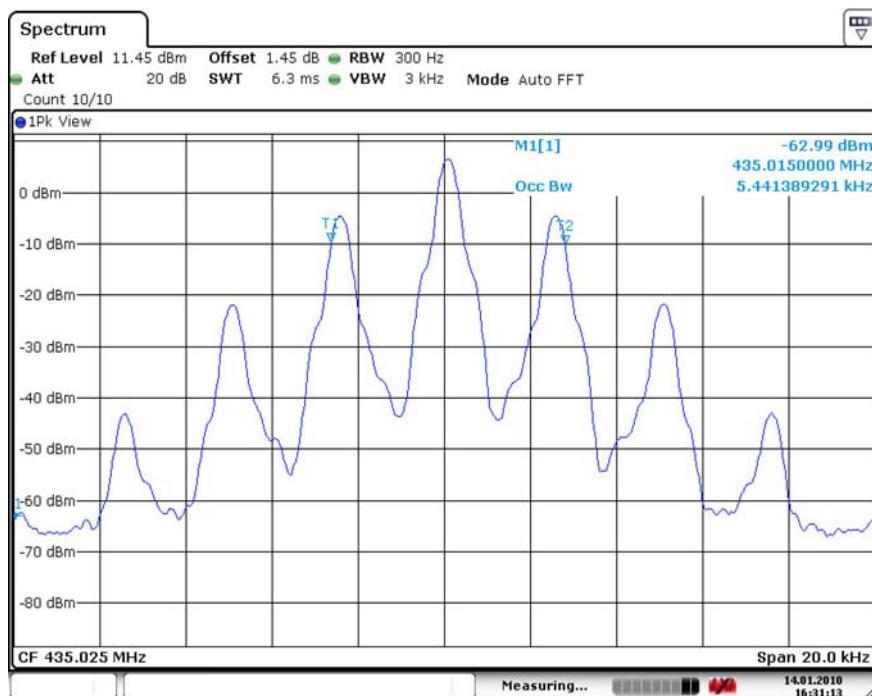
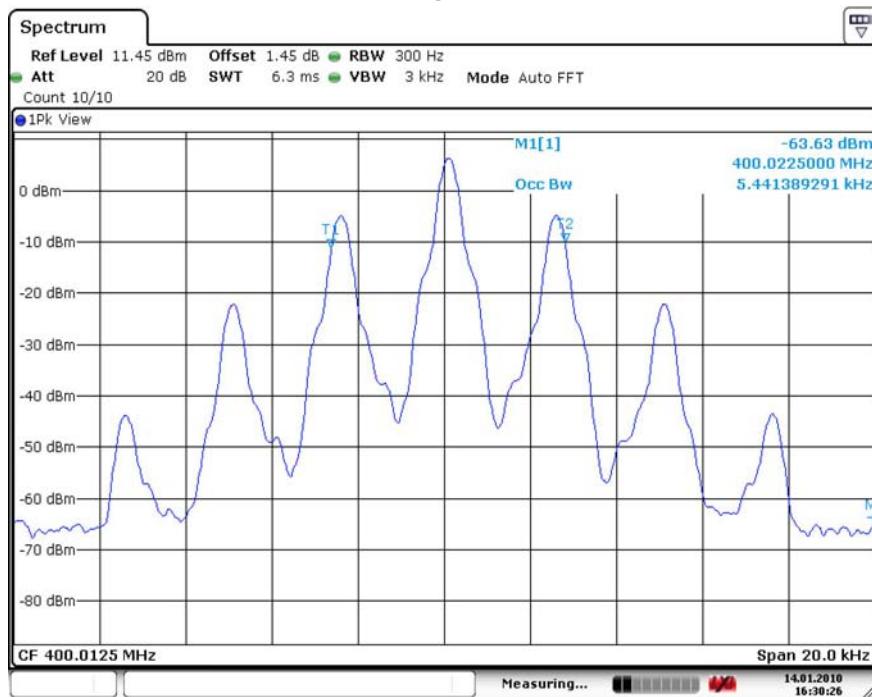
- The EUT and test equipment were set up as shown on the following page, with the Spectrum Analyzer connected.
- For EUT supporting audio modulation, the audio signal generator was adjusted to the frequency of maximum response and with output level set for $\pm 2.5 / \pm 1.25$ KHz deviation (or 50% modulation). With level constant, the signal level was increased 16dB
- For EUT supporting digital modulation, the digital modulation mode was operated to its maximum extent.
- The Occupied Bandwidth measured with the Spectrum Analyzer controls set as shown on the test results

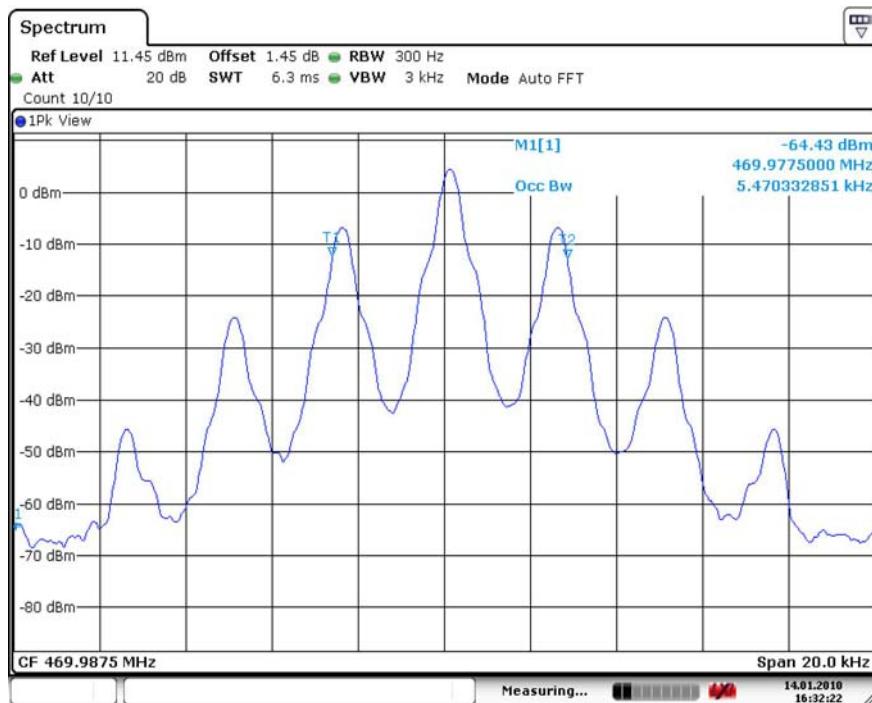
Test Data

| Frequency (MHz) | Channel Spacing (KHz) | Modulation | Measured 99% OBW at Maximum Freq. Deviation (KHz) | Maximum Authorized Bandwidth (KHz) |
|-----------------|-----------------------|---------------------------------|---|------------------------------------|
| 400.0125 | 12.5 | FM with 2.5KHz sine wave signal | 5.44 | 11.25 |
| 435.025 | 12.5 | FM with 2.5KHz sine wave signal | 5.44 | 11.25 |
| 469.9875 | 12.5 | FM with 2.5KHz sine wave signal | 5.47 | 11.25 |
| 400.025 | 25 | FM with 2.5KHz sine wave signal | 10.20 | 20.0 |
| 435.025 | 25 | FM with 2.5KHz sine wave signal | 10.20 | 20.0 |
| 469.975 | 25 | FM with 2.5KHz sine wave signal | 10.20 | 20.0 |

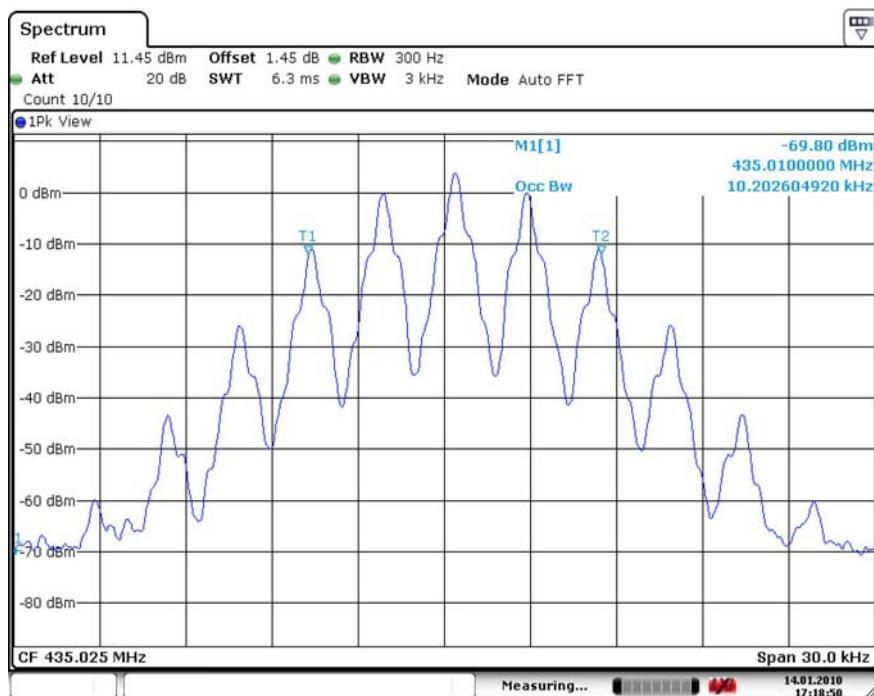
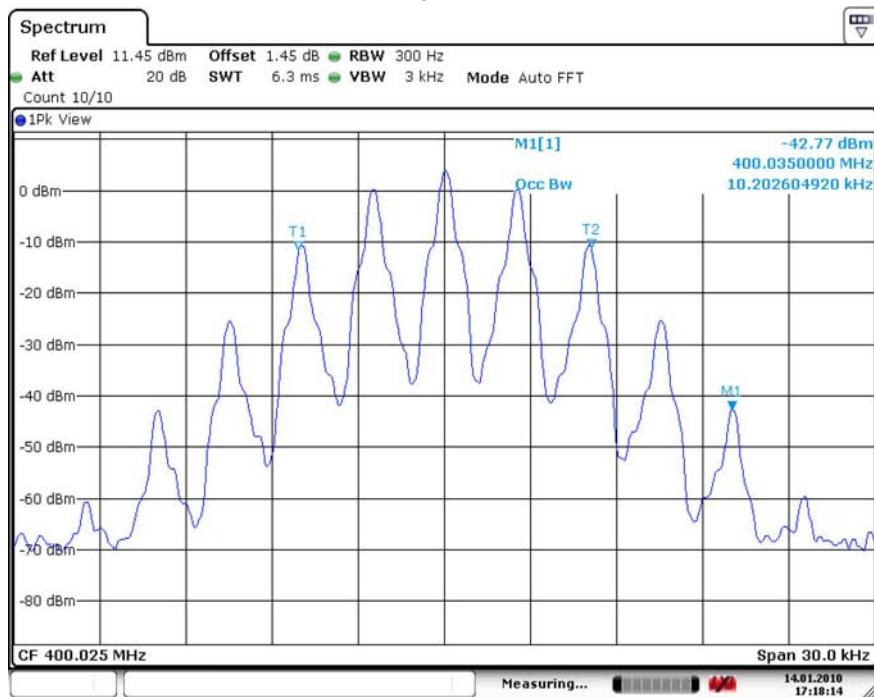
See next pages for actual measured spectrum plots.

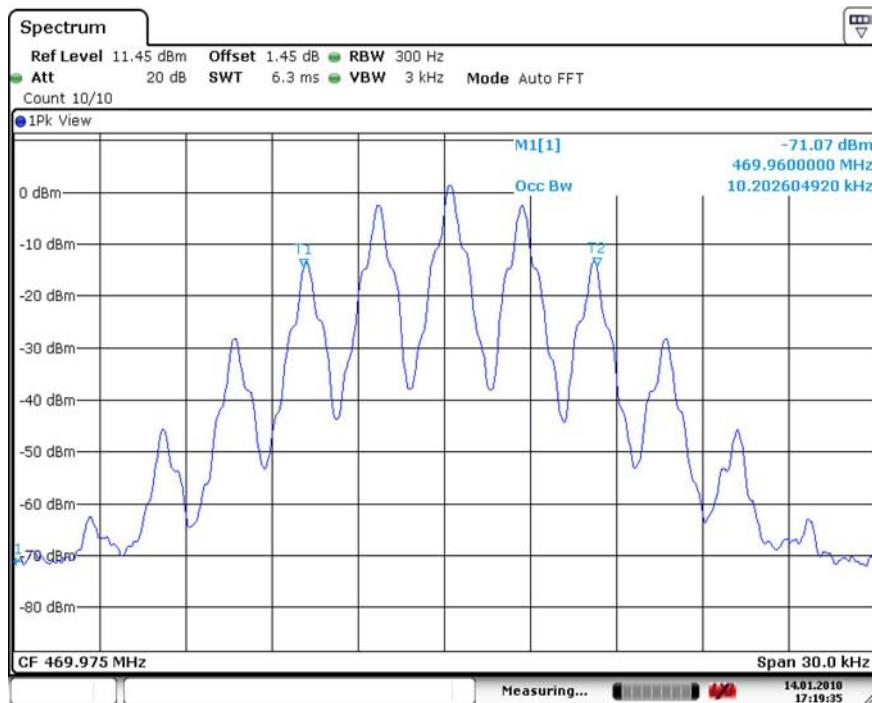
Occupied Bandwidth 12.5KHz



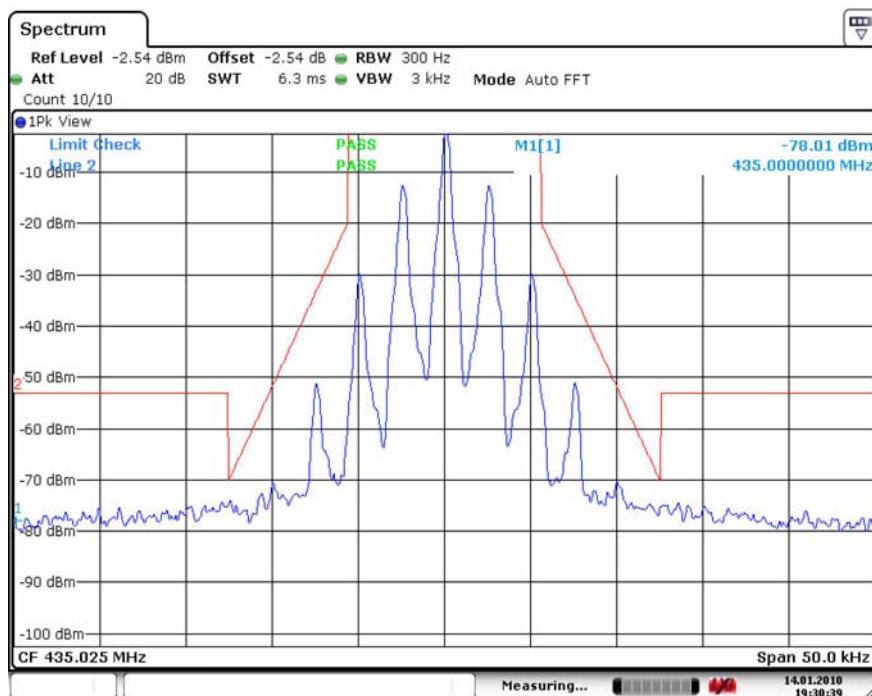
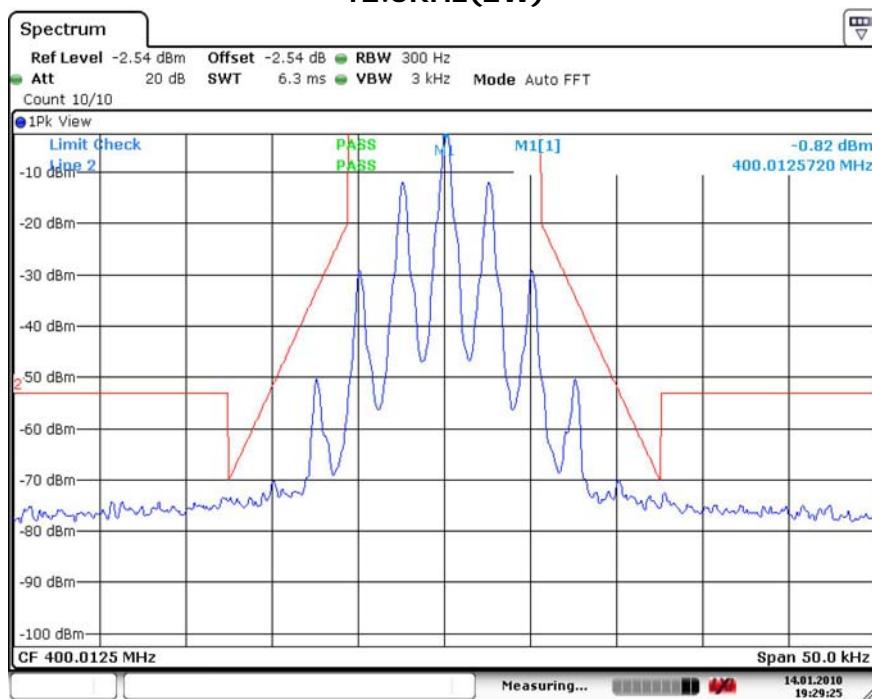


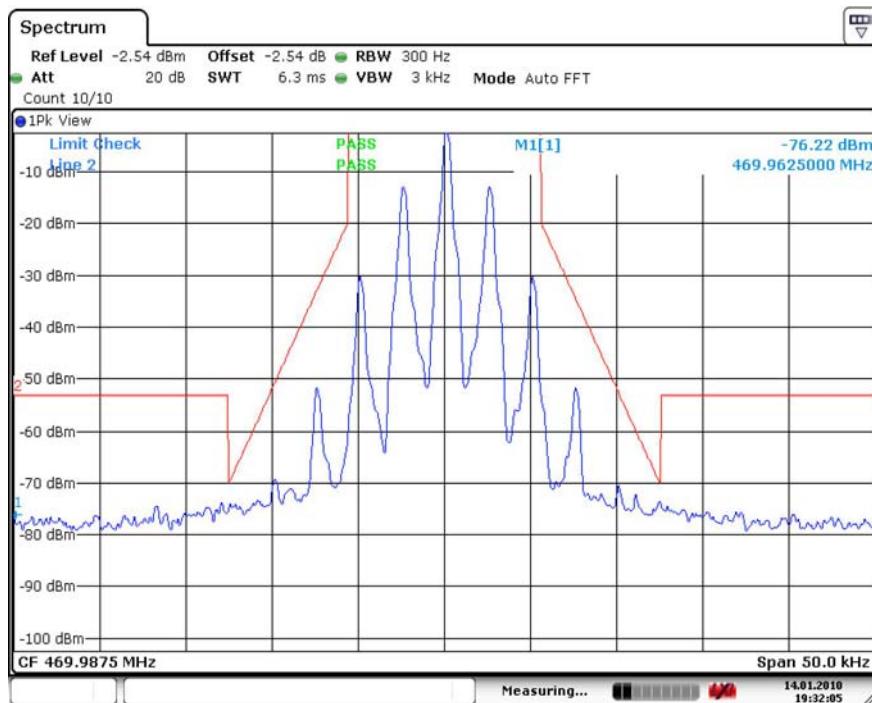
Occupied Bandwidth 25KHz



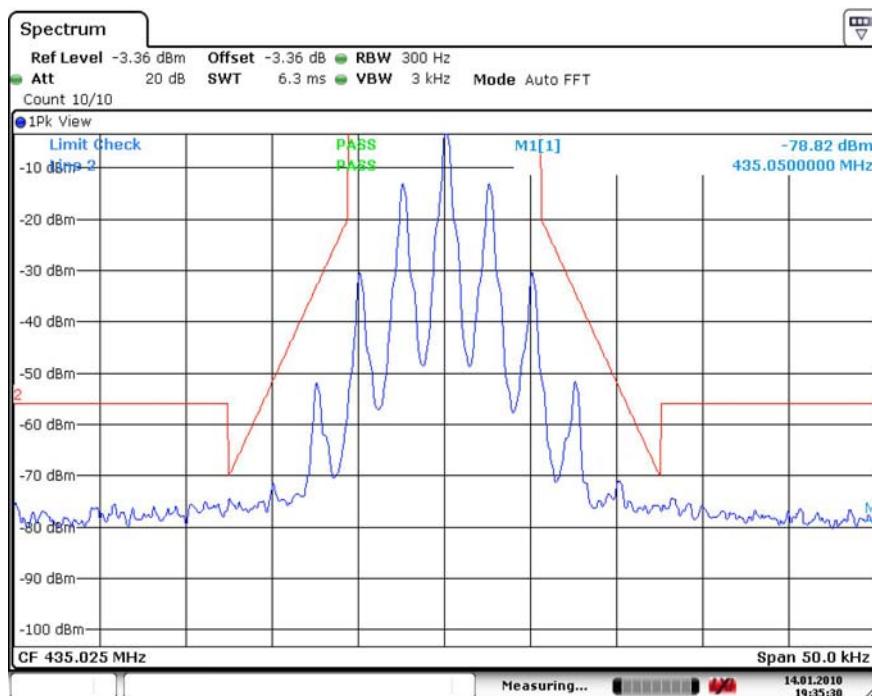
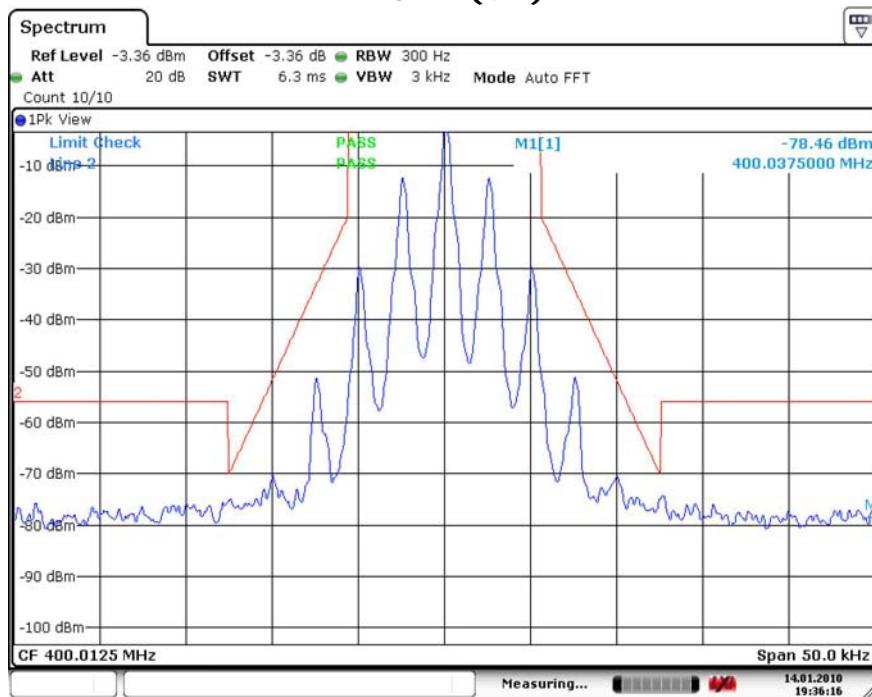


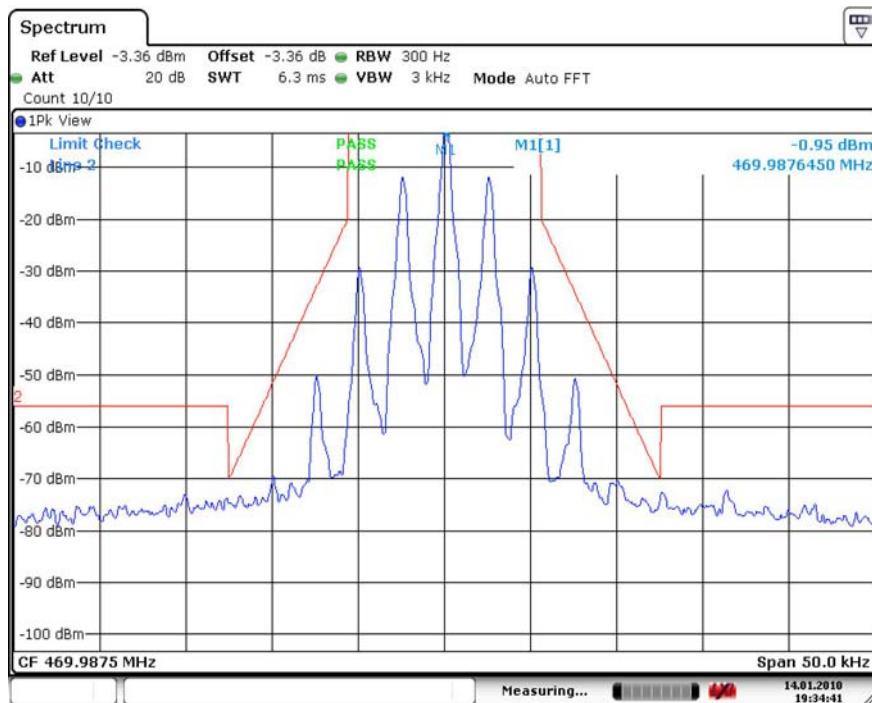
Emission Masks D 12.5KHz(2W)



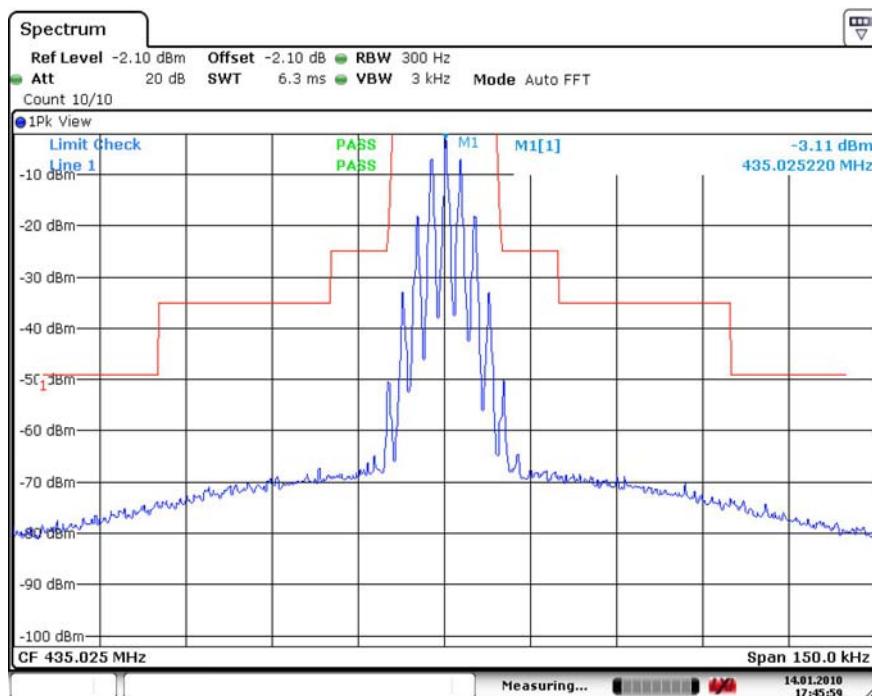
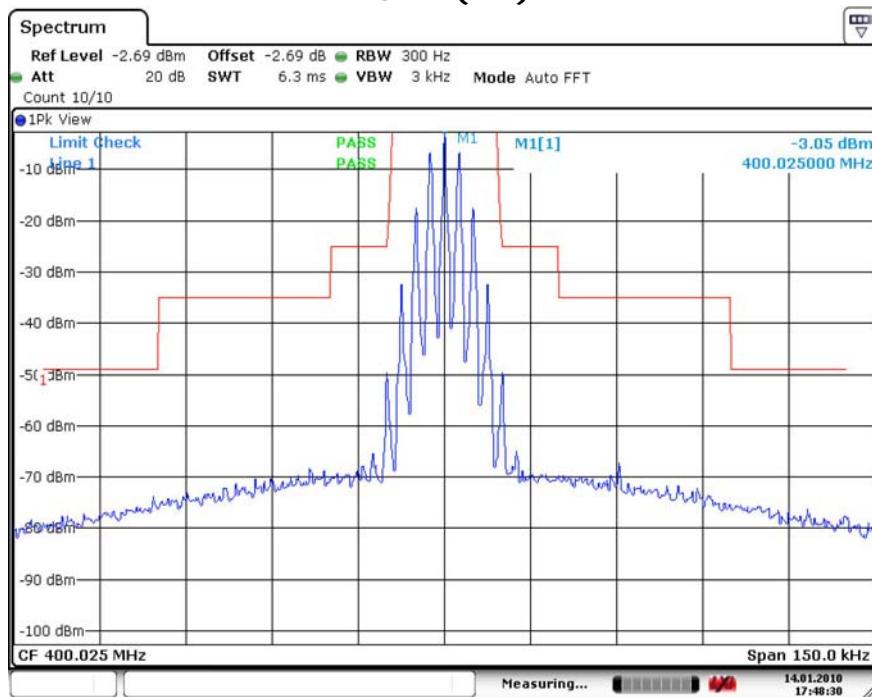


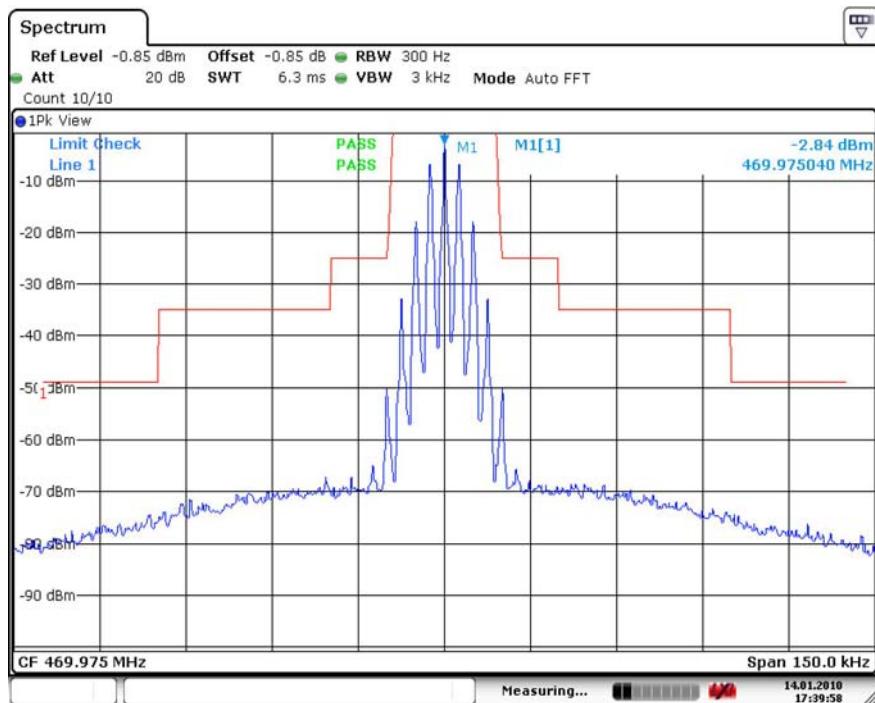
Emission Masks D 12.5KHz(4W)



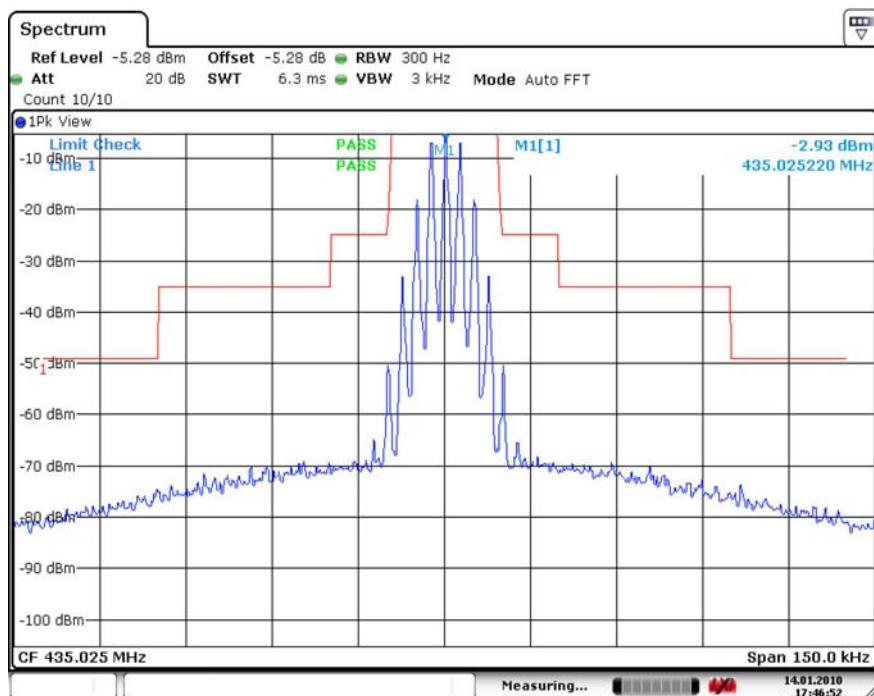
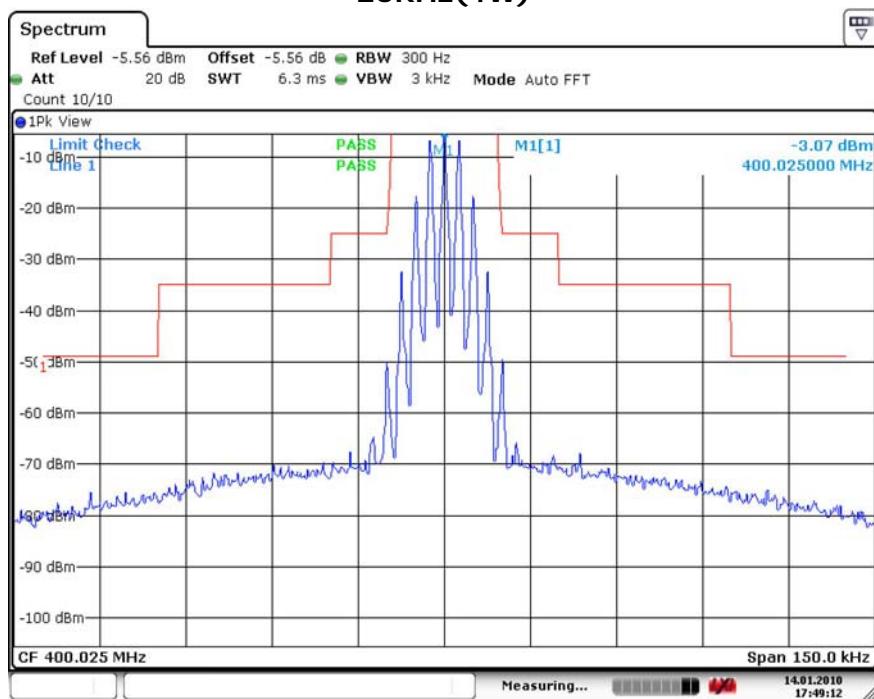


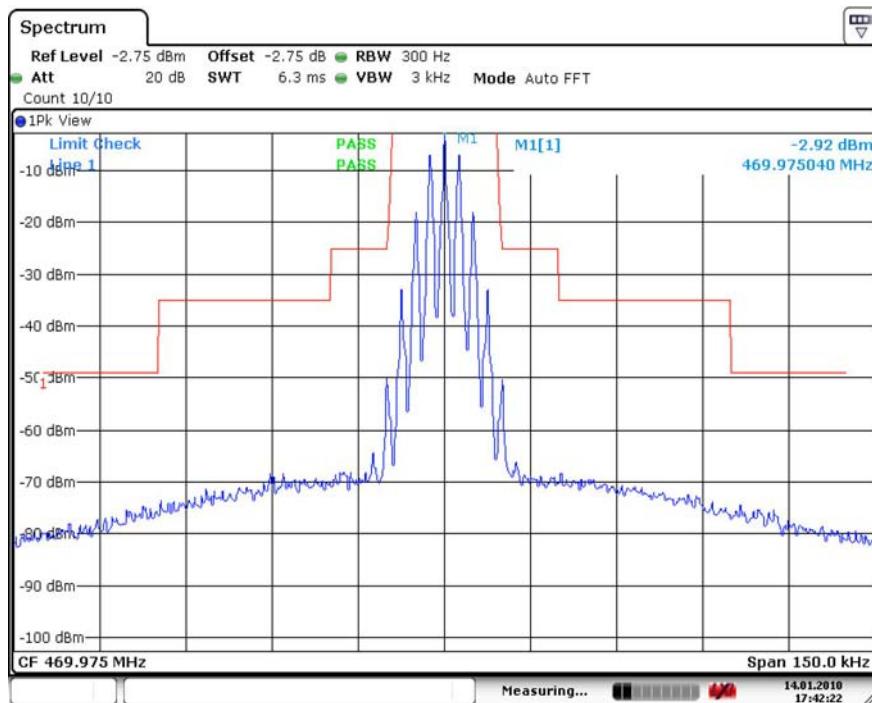
Emission Masks B 25KHz(2W)





Emission Masks B 25KHz(4W)





3.5 Transient Frequency Behavior

Definition:

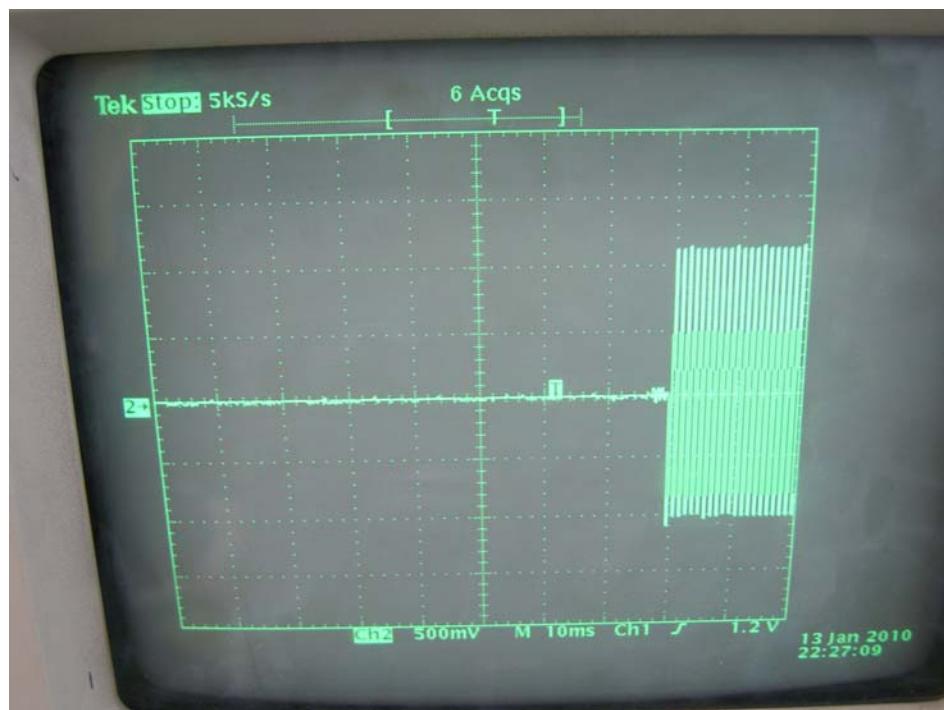
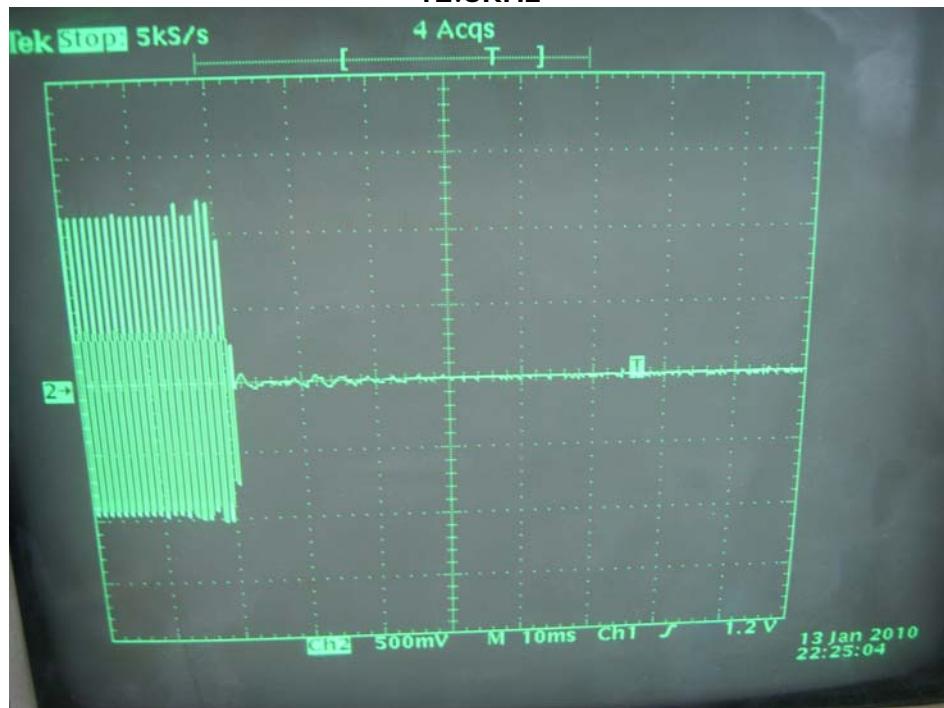
- The transient frequency behavior is a measure of the difference, as a function in time. Of the actual transmitter frequency to the assigned transmitter frequency when the transmitted RF output power is switched on or off.

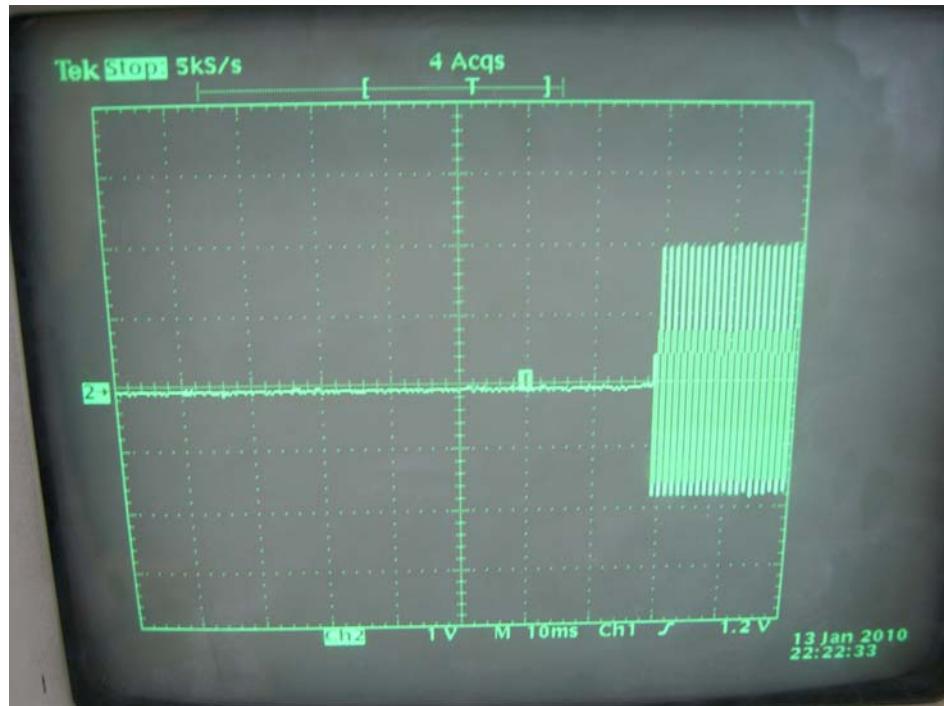
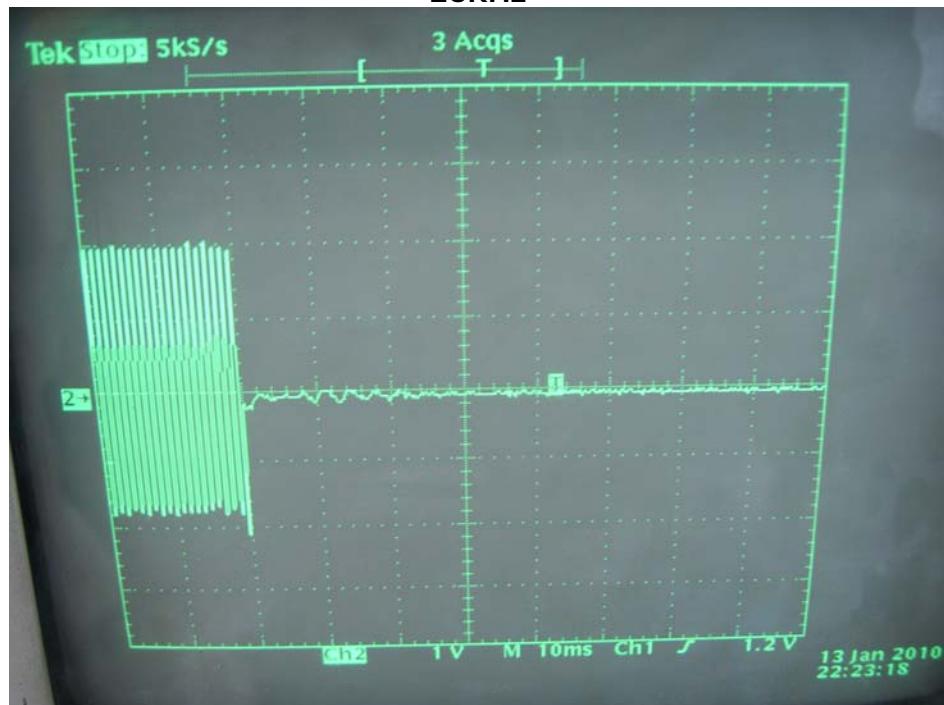
Specification : 47CFR90.214
Test method : ANSI/TIA/EIA-603-C-2004

Measurement Procedure:

- The EUT was set up as shown on the attached page, following TIA/EIA-603 step a, b, and c as a guide.
- The transmitter was turned on.
- Sufficient attenuation was provided so that the transmitter carrier level measured at the output of the combiner was 40dB below the maximum input level of the test receiver. This level was recorded as step f.
- The transmitter was turned off.
- An RF signal generator(1)modulated with a 1KHz tone at either 25,12.5,or6.25KHz deviation, and set to the same frequency as the assigned transmitter frequency, (2)was adjusted to a lever. -20dB below the level recorded for step f, as measured at the output of the combiner. This level was then fixed for the remainder of the test and is recorded at step h.
- The oscilloscope was set up using TIA/EIA-603 steps j and k as a guide, and to either 10ms/div(UHF) or 5ms/div(VHF)
- The 30dB attenuator was removed, the transmitter was turned on, and the level of the output of the combiner was recorded as step 1.
- The carrier on-time as referenced in TIA/EIA-603 steps m,n, and o was captured and plotted. The carrier off-time as referenced in TIA/EIA-603 steps p,q,r, and s was captured and plotted.
- For EUT supporting audio modulation, the audio signal generator was adjusted to the frequency of maximum response and with output level set for ± 2.5 / ± 1.25 kHz deviation (or 50% modulation). With level constant, the signal level was increased 16dB.
- For EUT supporting digital modulation, the digital modulation mode was operated to its maximum extent.
- The Occupied Bandwidth was measured with the Spectrum Analyzer controls set as shown on the test results.

See next pages for actual measured spectrum plots.

**Transient Frequency Behavior
12.5KHz**

**Transient Frequency Behavior
25KHz**

3.6 Audio Low Pass Filter(Vouce Input)

Definition:

The Audio Low Pass Filter Response is The Frequency Response of the post limiter low pass filter circuit above 3000Hz

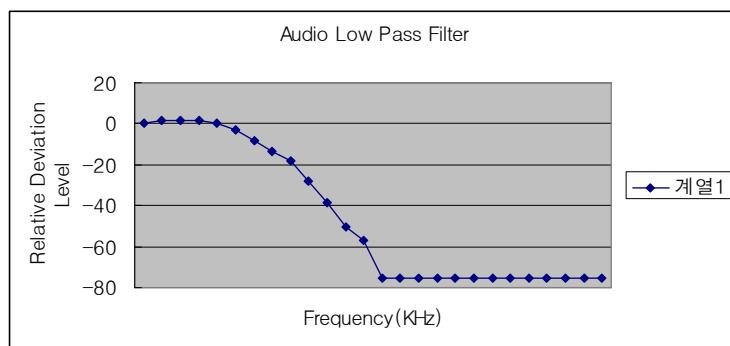
Specification : 47CFR2.1047(a)
Test method : ANSI/TIA/EIA-603-C-2004

Measurement Procedure:

- The EUT and test equipment were set up such that the audio input was connected at the input to the modulation limiter, and the modulated stage
- The audio output was connected at the output to the modulated stage

Test Data

| Audio Frequency Response | | | | | |
|--------------------------|----------|-----------|----------|-----------|----------|
| Freq.,KHz | Level,dB | Freq.,KHz | Level,dB | Freq.,KHz | Level,dB |
| 0.3 | -12.9 | 4.5 | -13.5 | 25.0 | -75.3 |
| 0.4 | -9.5 | 5.0 | -18.3 | 30.0 | -75.3 |
| 0.5 | -6.9 | 6.0 | -27.8 | 35.0 | -75.3 |
| 0.6 | -5.2 | 7.0 | -38.7 | 40.0 | -75.3 |
| 0.7 | -3.8 | 8.0 | -50.2 | 45.0 | -75.3 |
| 0.8 | -5.1 | 9.0 | -56.9 | 50.0 | -75.3 |
| 1.0 | 0 | 10.0 | -75.3 | | |
| 1.5 | 1.8 | 12.0 | -75.3 | | |
| 2.0 | 1.9 | 14.0 | -75.3 | | |
| 2.5 | 1.5 | 16.0 | -75.3 | | |
| 3.0 | 0.2 | 18.0 | -75.3 | | |
| 3.5 | -3.1 | 20.0 | -75.3 | | |
| 4.0 | -8.2 | 22.0 | -75.3 | | |



3.7 Audio Frequency Response

Definition:

- The Audio frequency response is the degree of closeness to which the frequency Deviation of the transmitter follows a prescribed characteristic

Specification : 47CFR2.1047(a)

Test method : ANSI/TIA/EIA-603-C-2004

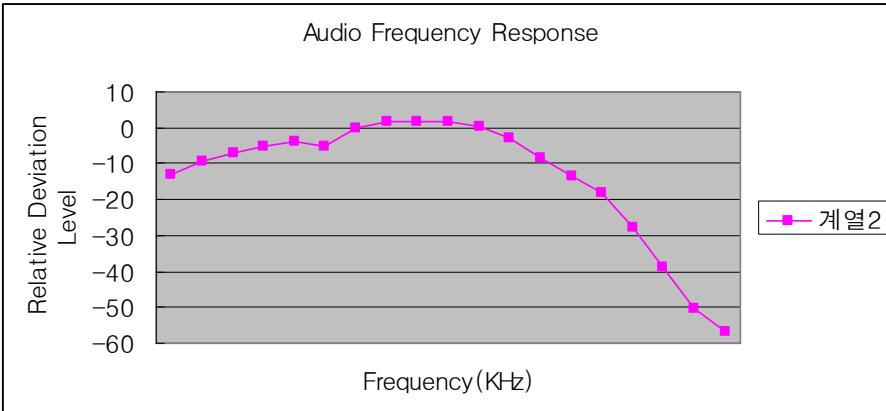
Measurement Procedure:

- The audio signal input was adjusted to obtain 20% modulation at 1KHz, and this point was taken as the 0dB reference level
- With input levels held constant and below limiting at all frequencies, the audio signal generator was varied from 300Hz to 30KHz
- The response in dB relative to 1KHz was then measured, using the Modulation Analyzer

Test Data

Operating Frequency : 400.0125MHz

| Audio Frequency Response | | | | | |
|--------------------------|----------|-------------|----------|-------------|----------|
| Freq.,KHz | Level,dB | Freq.,KHz | Level,dB | Freq.,KHz | Level,dB |
| 0.3 | -12.9 | 4.5 | -13.5 | 25.0 | -75.3 |
| 0.4 | -9.5 | 5.0 | -18.3 | 30.0 | -75.3 |
| 0.5 | -6.9 | 6.0 | -27.8 | 35.0 | -75.3 |
| 0.6 | -5.2 | 7.0 | -38.7 | 40.0 | -75.3 |
| 0.7 | -3.8 | 8.0 | -50.2 | 45.0 | -75.3 |
| 0.8 | -5.1 | 9.0 | -56.9 | 50.0 | -75.3 |
| 1.0 | 0 | 10.0 | -75.3 | | |
| 1.5 | 1.8 | 12.0 | -75.3 | | |
| 2.0 | 1.9 | 14.0 | -75.3 | | |
| 2.5 | 1.5 | 16.0 | -75.3 | | |
| 3.0 | 0.2 | 18.0 | -75.3 | | |
| 3.5 | -3.1 | 20.0 | -75.3 | | |
| 4.0 | -8.2 | 22.0 | -75.3 | | |



3.8 Modulation Limiting

Definition:

- Modulation limiting refers to the transmitter circuits ability to limit the transmitter from producing deviations due to modulation in excess of a rated system deviation

Specification : 47CFR2.1047(b)

Test method : ANSI/TIA/EIA-603-C-2004

Measurement Procedure:

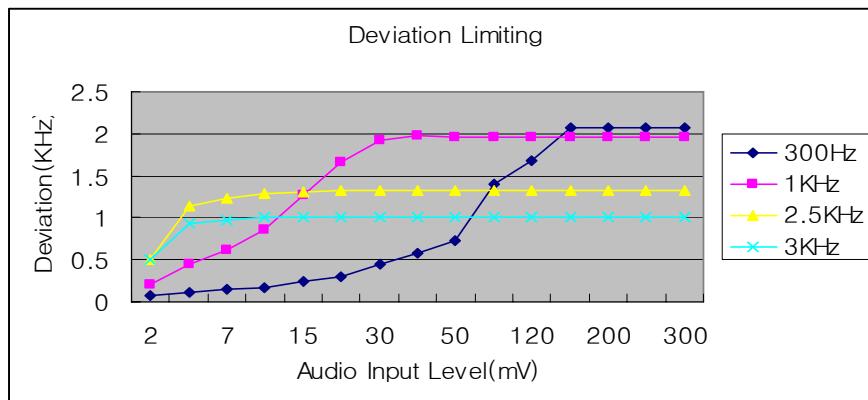
- The signal generator was connected to the input of the EUT as for "Frequency Response of the Modulating Circuit"
- The modulation response was measured for each of three frequencies (one of which was the frequency of maximum response), and the input voltage was varied and was observed on an Modulation Analyzer
- The input level was varied from 30% modulation($\pm 1.5\text{KHz}$ deviation) to at least 20dB higher than the saturation point

Test Data

Operating Frequency : 400.0125MHz

Channel Spacing : 12.5KHz

| Input Level (mV) | FM Deviation in KHz at Indicated Modulating Frequency | | | |
|------------------|---|------|--------|------|
| | 300Hz | 1KHz | 2.5KHz | 3KHz |
| 2 | 0.07 | 0.20 | 0.50 | 0.50 |
| 5 | 0.11 | 0.45 | 1.13 | 0.94 |
| 7 | 0.14 | 0.61 | 1.23 | 0.97 |
| 10 | 0.17 | 0.85 | 1.28 | 1.00 |
| 15 | 0.24 | 1.26 | 1.31 | 1.00 |
| 20 | 0.30 | 1.66 | 1.32 | 1.00 |
| 30 | 0.44 | 1.93 | 1.33 | 1.00 |
| 40 | 0.58 | 1.97 | 1.33 | 1.00 |
| 50 | 0.72 | 1.96 | 1.33 | 1.00 |
| 100 | 1.40 | 1.96 | 1.33 | 1.00 |
| 120 | 1.67 | 1.96 | 1.33 | 1.00 |
| 150 | 2.08 | 1.96 | 1.33 | 1.00 |
| 200 | 2.08 | 1.96 | 1.33 | 1.00 |
| 250 | 2.08 | 1.96 | 1.33 | 1.00 |
| 300 | 2.08 | 1.96 | 1.33 | 1.00 |



3.9 Frequency Stability

Definition:

- Modulation limiting refers to the transmitter circuits ability to limit the transmitter from producing deviations due to modulation in excess of a rated system deviation

Specification : 47CFR2.1055
Test method : ANSI/TIA/EIA-603-C-2004

Measurement Procedure:

- The frequency stability of the transmitter is measured by:
 - a) Temperature: The temperature is varied from -30°C to +60°C using an environmental chamber.
 - b) Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.
- Specification- The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.00025 (\pm 2.5\text{ppm})$ of the center frequency.
- Time Period and Procedure:
 1. The carrier frequency of the transmitter and the individual oscillators is measured at room temperature (25°C to 27°C to provide a reference).
 2. The equipment is subjected to an overnight “soak” at -30°C without power applied.
 3. After the overnight “soak” at 30°C (usually 14-16 hours), the equipment is turned on in a “standby” condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter and the individual oscillators is made within a three minute interval after applying power to the transmitter.
 4. Frequency measurements are made at 10°C interval up to room temperature.
At least a period of one and one half-hour is provided to allow stabilization of the equipment at each temperature level.
 5. Again the transmitter carrier frequency and the individual oscillators is measured at room temperature to begin measurement of the upper temperature levels.
 6. Frequency measurements are at 10 intervals starting at -30°C up to +60°C allowing at least two hours at each temperature for stabilization. In all measurements the frequency is measured within three minutes after re-applying power to the transmitter.
 7. The artificial load is mounted external to the temperature chamber. NOTE: The EUT is tested down to the battery endpoint.

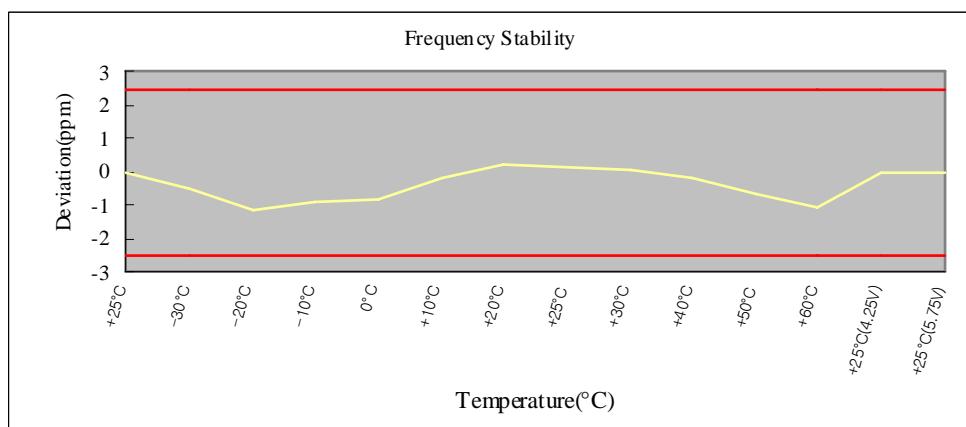
Test Data

Operating Frequency : 400.0125 MHz

Reference Voltage : 7.5 VDC Channel Spacing : 12.5 KHz

Deviation Limit : $\pm 0.00025\%$ or 2.5ppm

| VOLTAGE (%) | POWER (VDC) | TEMP (°C) | FREQ (Hz) | Deviation (%) |
|---------------|-------------|-----------|-------------|---------------|
| 100% | 7.5 | +25(Ref) | 400,012,576 | 0.000000 |
| 100% | | -30 | 400,012,389 | -0.000047 |
| 100% | | -20 | 400,012,131 | -0.000111 |
| 100% | | -10 | 400,012,215 | -0.000090 |
| 100% | | 0 | 400,012,258 | -0.000079 |
| 100% | | +10 | 400,012,501 | -0.000019 |
| 100% | | +20 | 400,012,662 | 0.000021 |
| 100% | | +25 | 400,012,639 | 0.000016 |
| 100% | | +30 | 400,012,595 | 0.000005 |
| 100% | | +40 | 400,012,514 | -0.000015 |
| 100% | | +50 | 400,012,327 | -0.000062 |
| 100% | | +60 | 400,012,150 | -0.000106 |
| 85% | 6.38 | +25 | 400,012,569 | -0.000002 |
| 115% | 8.63 | +25 | 400,012,584 | 0.000002 |
| BATT.ENDPOINT | 5.70 | +25 | 400,012,584 | 0.000002 |



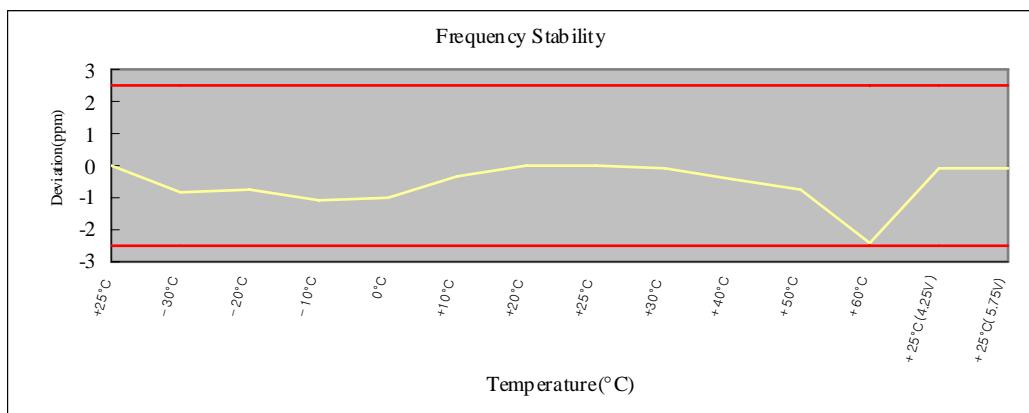
Test Data

Operating Frequency : 400.025 MHz

Reference Voltage : 7.5 VDC Channel Spacing : 25 KHz

Deviation Limit : $\pm 0.00025\%$ or 2.5ppm

| VOLTAGE (%) | POWER (VDC) | TEMP (°C) | FREQ (Hz) | Deviation (%) |
|---------------|-------------|-----------|-------------|---------------|
| 100% | 7.5 | +25(Ref) | 400,025,044 | 0.000000 |
| 100% | | -30 | 400,024,709 | -0.000084 |
| 100% | | -20 | 400,024,798 | -0.000071 |
| 100% | | -10 | 400,024,610 | -0.000108 |
| 100% | | 0 | 400,024,668 | -0.000094 |
| 100% | | +10 | 400,024,918 | -0.000031 |
| 100% | | +20 | 400,025,066 | 0.000005 |
| 100% | | +25 | 400,025,054 | 0.000002 |
| 100% | | +30 | 400,025,011 | -0.000008 |
| 100% | | +40 | 400,024,880 | -0.000041 |
| 100% | | +50 | 400,024,743 | -0.000075 |
| 100% | | +60 | 400,024,081 | -0.000241 |
| 85% | 6.38 | +25 | 400,025,038 | -0.000001 |
| 115% | 8.63 | +25 | 400,025,022 | -0.000005 |
| BATT.ENDPOINT | 5.70 | +25 | 400,025,022 | -0.000005 |



3.7 Frequency Stability

Specification : 47CFR2.1055

MODULATION = 16K0F3E

NECESSARY BANDWIDTH CALCULATION:

| | |
|-------------------------------|---------------------------|
| MAXIMUM MODULATION (M), kHz | = 3 |
| MAXIMUM DEVIATION (D), kHz | = 5 |
| CONSTANT FACTOR (K) | = 1 |
| NECESSARY BANDWIDTH (BN), kHz | = $(2 * M) + (2 * D * K)$ |
| | = 16 |

MODULATION = 11K0F3E

NECESSARY BANDWIDTH CALCULATION:

| | |
|-------------------------------|---------------------------|
| MAXIMUM MODULATION (M), kHz | = 3 |
| MAXIMUM DEVIATION (D), kHz | = 2.5 |
| CONSTANT FACTOR (K) | = 1 |
| NECESSARY BANDWIDTH (BN), kHz | = $(2 * M) + (2 * D * K)$ |
| | = 11 |

APPENDIX A – Test Equipment Used For Tests

| No | Description | Manufacturer | Model No. | Serial No. | Due Cal. |
|----|----------------------|------------------|---------------------|------------|------------|
| 1 | Test Receiver | Rohde & Schwarz | ESHS 10 | 862970/018 | 2010.06.1 |
| 2 | Test Receiver | Rohde & Schwarz | ESVS 10 | 826008/014 | 2010.05.2 |
| 3 | Spectrum Analyzer | Hewlett Packard | 8566B | 2311A02394 | 2010.05.1 |
| 4 | Spectrum Analyzer | Rohde & Schwarz | FSV30 | 100130 | 2010.12.1 |
| 5 | Modulation Analyzer | Hewlett Packard | 8901B | 3438A05094 | 2010.05.1 |
| 6 | Audio analyzer | Hewlett Packard | 8903B | 3011A12915 | 2010.05.1 |
| 7 | Preamplifier | Hewlett Packard | 8447F | 2805A02570 | 2010.05.1 |
| 8 | Preamplifier | A.H. Systems | PAM-0118 | 164 | 2010.04.1 |
| 9 | Signal Generator | Hewlett Packard | 8673D | 2708A00448 | 2010.05.1 |
| 10 | Power Meter | Hewlett Packard | 437B | 312U24787 | 2010.04.2 |
| 11 | Power Sensor | Hewlett Packard | 8482B | 3318A06943 | 2010.05.1 |
| 12 | Loop Antenna | Rohde & Schwarz | HFH2-Z2.335.4711.52 | 826532/006 | 2011.02.0 |
| 13 | Dipole Antenna | Rohde & Schwarz | VHAP | 574 | 2010.07.0 |
| 14 | Dipole Antenna | Rohde & Schwarz | VHAP | 575 | 2010.07.1 |
| 15 | Dipole Antenna | Rohde & Schwarz | UHAP | 545 | 2010.07.1 |
| 16 | Dipole Antenna | Rohde & Schwarz | UHAP | 546 | 2010.07.0 |
| 17 | Biconical Antenna | Eaton Corp. | 94455-1 | 0977 | 2010.07.0 |
| 18 | Biconical Antenna | EMCO | 3104C | 9111-2468 | 2010.07.0 |
| 19 | Log Periodic Antenna | EMCO | 3146 | 2051 | 2010.06.0 |
| 20 | Log Periodic Antenna | EMCO | 3146 | 8901-2320 | 2010.07.0 |
| 21 | Horn Antenna | A.H. Systems | SAS-571 | 414 | 2011.03.1 |
| 22 | LISN | EMCO | 3810/2 | 2228 | 2010.05.1 |
| 23 | Waveform Generator | Hewlett Packard | 33120A | US34001190 | 2010.05.1 |
| 24 | Digital Oscilloscope | Tektronix | TDS 340A | B012287 | 2010.05.15 |
| 25 | Dummy Load | Bird Electronics | 8251 | 11511 | 2010.04.1 |