Lab Code: 200707-0

# FCC PART 90 TYPE APPROVAL

# EMI MEASUREMENT AND TEST REPORT

For

## Klein Electronics, Inc.

349 North Vinewood Street, Escondido, CA 92029, USA

## FCC ID: U7GBLACKBOXBV

| **Report Type:** | **Product Type:** |
|---|---|
| Original Report | VHF Two-Way Radio |

| | |
|---|---|
| **Test Engineer:** | Allan An |
| **Report Number:** | RSZ10110552 |
| **Report Date:** | 2010-11-25 |
| **Reviewed By:** | Merry Zhao<br>EMC Engineer |
| **Prepared By:** | Bay Area Compliance Laboratories Corp. (Shenzhen)<br>6/F, the 3rd Phase of WanLi Industrial Building,<br>ShiHua Road, FuTian Free Trade Zone<br>Shenzhen, Guangdong, China<br>Tel: +86-755-33320018<br>Fax: +86-755-33320008 |

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# GENERAL INFORMATION

## Product Description for Equipment Under Test (EUT)

The *Klein Electronics, Inc's* product, model number: *Bantam-V (FCC ID: U7GBLACKBOXBV) or* the "EUT" as referred to in this report is a *VHF Two-way radio* that operates in the frequency band 136~174 MHz and with two channel spacing of 12.5 kHz (narrow-band)/25 kHz (wide-band). The EUT is measured approximately 11.5 cm (L) x 5.9 cm (W) x 3.4 cm (H), rated input voltage: DC 7.5 V battery.

** All measurement and test data in this report was gathered from production sample serial number: 1011021 (Assigned by BACL, Shenzhen). The EUT was received on 2010-11-05.*

## Objective

This Type approval report is prepared on behalf of *Klein Electronics, Inc* in accordance with Part 2, and Part 90 of the Federal Communication Commissions rules.

## Related Submittal(s)/Grant(s)

No related submittal(s).

## Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA 603-C and ANSI 63.4-2003.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

The uncertainty of any RF tests which use conducted method measurement is $\pm$0.96 dB, the uncertainty of any radiation emissions measurement is $\pm$4.0 dB.

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located in the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 21, 2007. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratories Corp. (Shenzhen) is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200707-0).


The current scope of accreditations can be found at http://ts.nist.gov/standards/scopes/2007070.htm.

# SYSTEM TEST CONFIGURATION

## Description of Test Configuration

The system was configured for testing in a test mode which has been done in the factory.

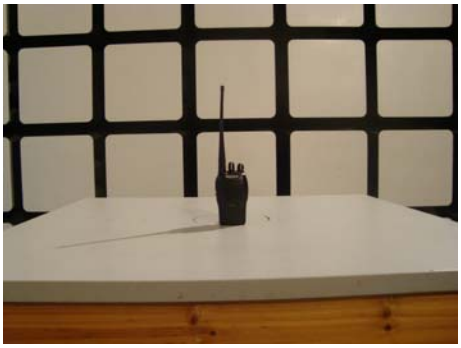
## Equipment Modifications

No modifications were made to the unit tested.

## Configuration of Test Setup

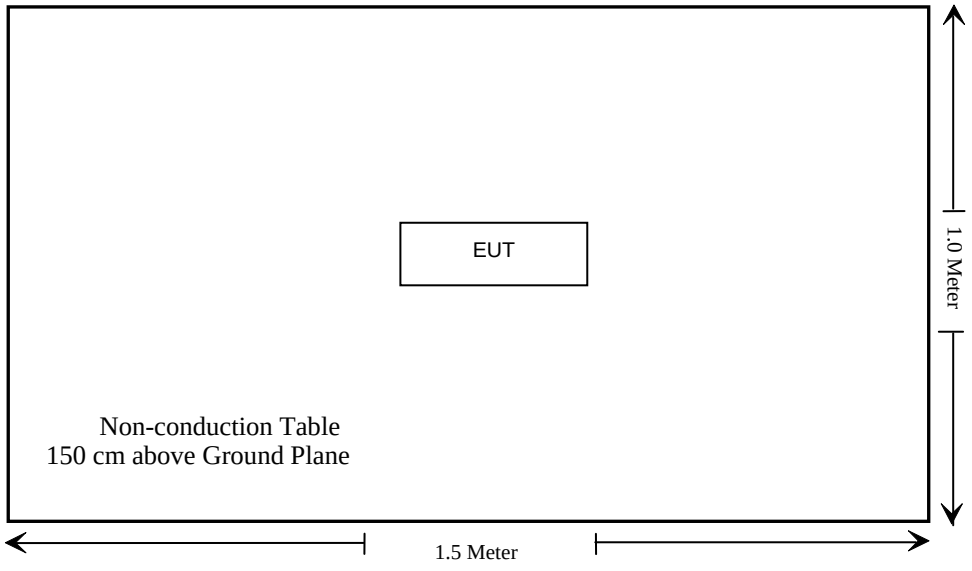
Lie

Side



Stand

## Block Diagram of Test Setup



# SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test | Results |
|---|---|---|
| §1.1307 (b); §2.1093 | RF Exposure Infomqation | Compliance* |
| §2.1046; §90.205 | RF Output Power | Compliance |
| §2.1047; §90.207 | Modulation Characteristic | Compliance |
| §2.1049; §90.209; §90.210 | Occupied Bandwidth & Emission Mask | Compliance |
| §2.1051; §90.210 | Spurious Emission at Antenna Terminal | Compliance |
| §2.1053; §90.210 | Spurious Radiated Emissions | Compliance** |
| §2.1055; §90.213 | Frequency Stability | Compliance |
| §90.214 | Transient Frequency Behavior | Compliance |

Note: ** Please refer to related KDB.
** With measurement uncertainty.

# FCC §2.1046 & §90.205 - RF OUTPUT POWER

## Applicable Standard

FCC §2.1046 and §90.205.

## Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| Sunol Sciences | Broadband Antenna | JB1 | A040904-1 | 2010-03-11 | 2011-03-11 |
| Sunol Sciences | Bilog Antenna | JB1 | A040904-2 | 2010-05-05 | 2011-05-05 |
| Rohde & Schwarz | EMI Test Receiver | ESCI | 100035 | 2009-11-24 | 2010-11-24 |
| HP | Signal Generator | HP8657A | 2849U00982 | 2010-10-28 | 2011-10-27 |

*** Statement of Tractability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

## Test Procedure

1) Conducted RF Output Power:

TIA-603-C section 2.2.1

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

Spectrum Analyzer setting:

| ***RBW*** | ***Video B/W*** |
|---|---|
| *100 kHz* | *300 kHz* |

2) Radiated Power Output (ERP)

TIA-603-C section 2.2.17

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT, during the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to teeth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the ERP were measured by the substitution.

Absolute level=substituted level+Antenna gain-Cable Loss

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 °C |
| **Relative Humidity:** | 56% |
| **ATM Pressure:** | 100.1 kPa |

*The testing was performed by Allan An on 2010-11-17.*

*Test Mode: Transmitting*

**Test Result:** Compliance.

Please refer to following table and plots

Antenna Port Conducted Output Power:

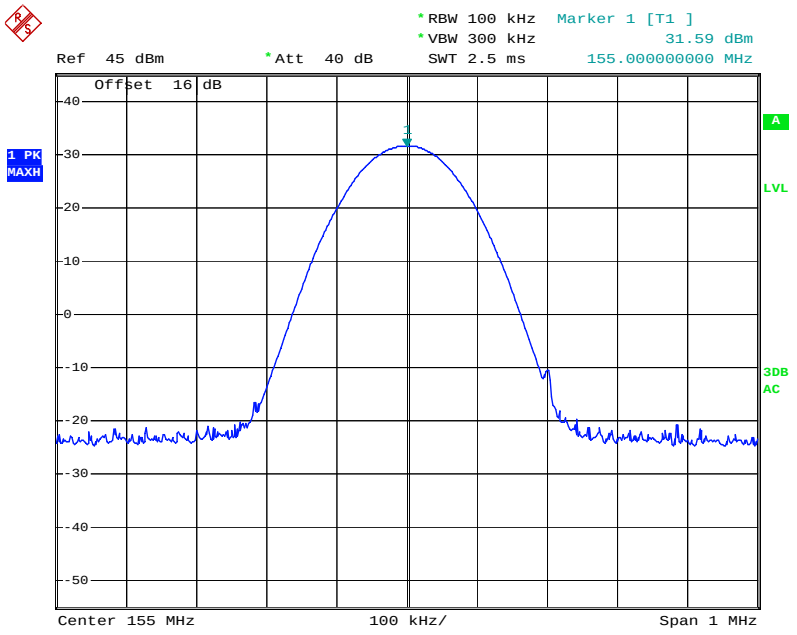
| Frequency Spacing (kHz) | Frequency (MHz) | Output Power (dBm) | Output Power (Watt) | Emission power | Comment |
|---|---|---|---|---|---|
| Middle Channle | | | | | |
| 12.5 | 155.00 | 36.46 | 4.426 | High | PK |
| 12.5 | 155.00 | 31.59 | 1.442 | Low | PK |
| 25 | 155.00 | 36.43 | 4.395 | High | PK |
| 25 | 155.00 | 31.57 | 1.435 | Low | PK |

Effective Radiated Power (ERP)

| Indicated | | Table | Test Antenna | | Substituted | | | | | Absolute Level ( dBm) | Output Power (Watt) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Freq. (MHz) | S.A. Amp. (dBµV) | Angle Degree | Height (m) | Polar (H/V) | Freq. (MHz) | Level (dBm) | Polar (H/V) | Antenna Gain Cord. (dBd) | Cable Loss ( dB) | | |
| 12.5 kHz Channel Spacing | | | | | | | | | | | |
| 155.00 | 111.58 | 0 | 1.6 | V | 155.00 | 36.5 | V | 0 | 0.26 | 36.24 | 4.21 |
| 155.00 | 96.30 | 156 | 1.1 | H | 155.00 | 19.8 | H | 0 | 0.26 | 19.54 | 0.09 |
| 25 kHz Channel Spacing | | | | | | | | | | | |
| 155.00 | 111.31 | 0 | 1.6 | V | 155.00 | 36.3 | V | 0 | 0.26 | 36.04 | 4.02 |
| 155.00 | 95.99 | 160 | 1.1 | H | 155.00 | 19.5 | H | 0 | 0.26 | 19.24 | 0.08 |

## Antenna Port Conducted Output Power:

### Low Channel, 12.5 kHz Channel Spacing

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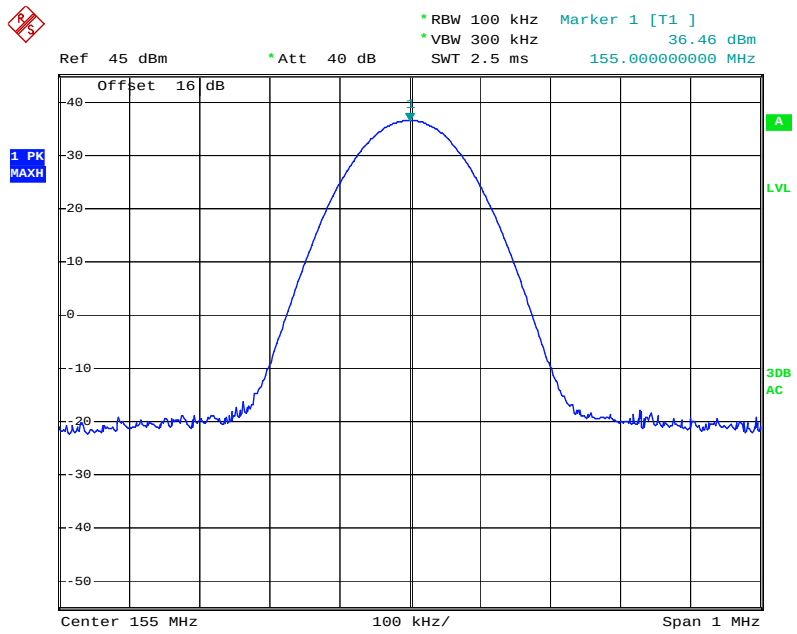
### High Channel, 12.5 kHz Channel Spacing

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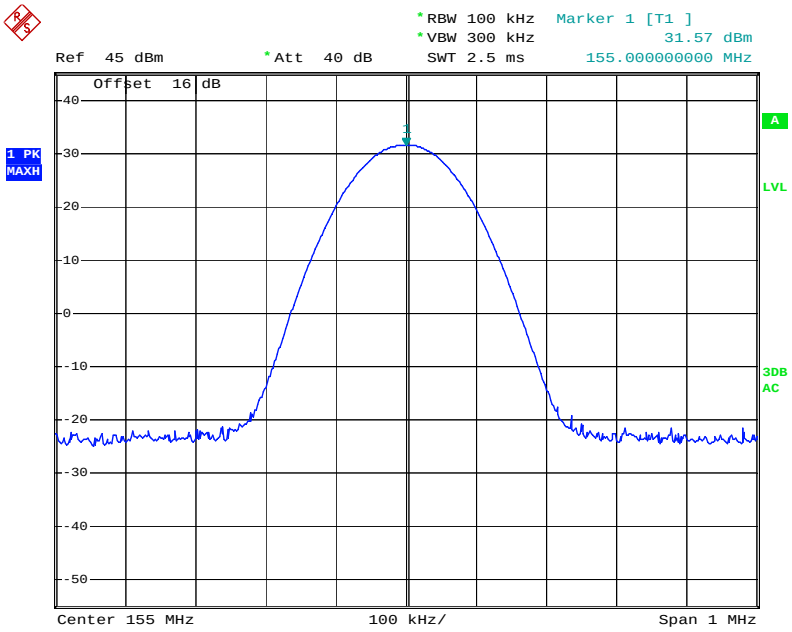
## Low Channel, 25 kHz Channel Spacing

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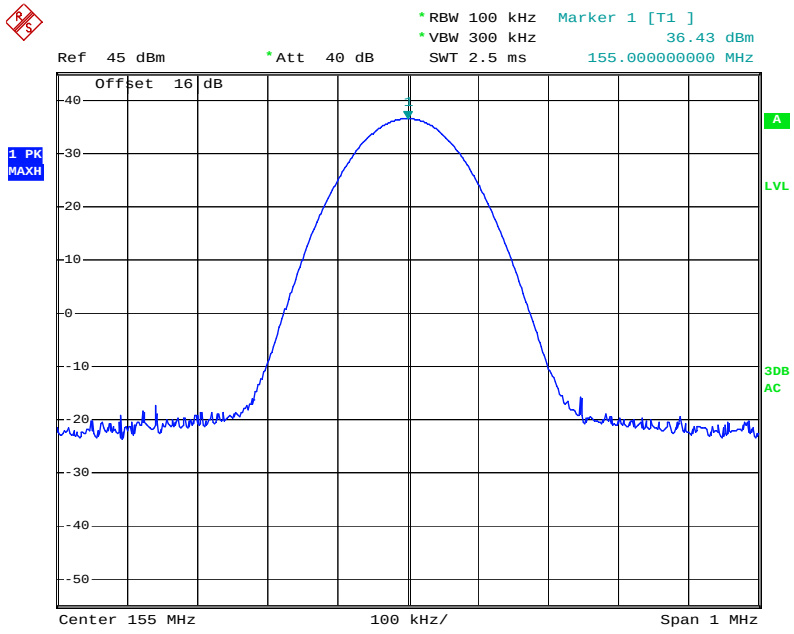
## High Channel, 25 kHz Channel Spacing

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# FCC §2.1047 & §90.207 - MODULATION CHARACTERISTIC

## Applicable Standard

FCC§2.1047 & §90.207:

(a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. for equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.

(b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

## Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| HP | Modulation Analyzer | 8901B | 3438A05208 | 2010-04-11 | 2011-04-11 |
| NANYAN | Audio Generator | NY2201 | 019829 | 2009-12-23 | 2010-12-23 |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

## Test Procedure

Test Method: TIA/EIA-603 2.2.3

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 °C |
| **Relative Humidity:** | 56% |
| **ATM Pressure:** | 100.1 kPa |

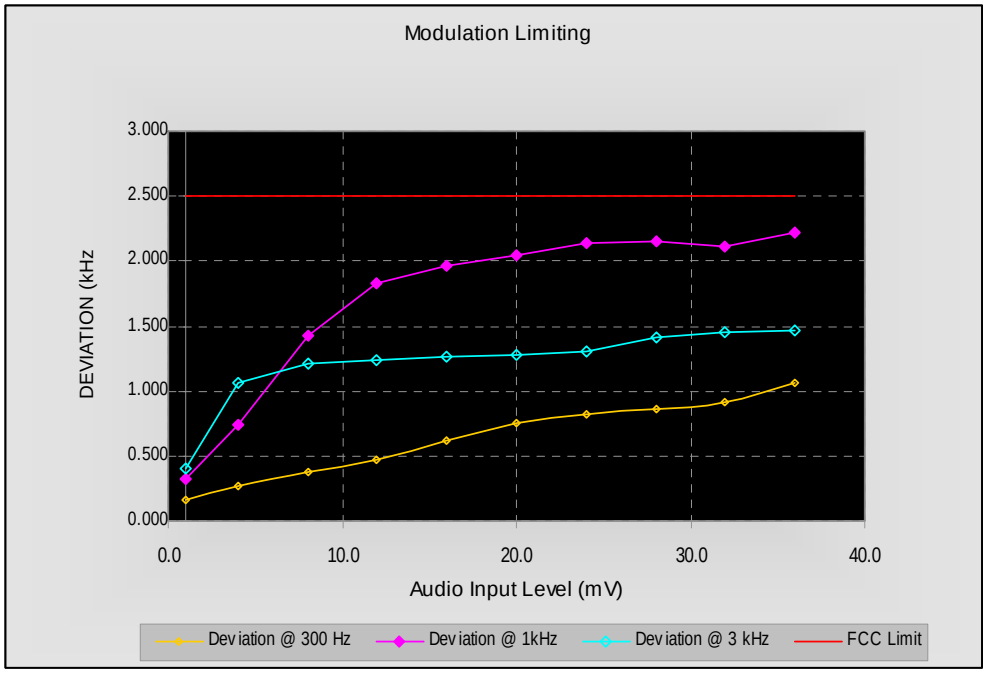
*The testing was performed by Allan An on 2010-11-20.*

*Test Mode: Transmitting*

## MODULATION LIMITING

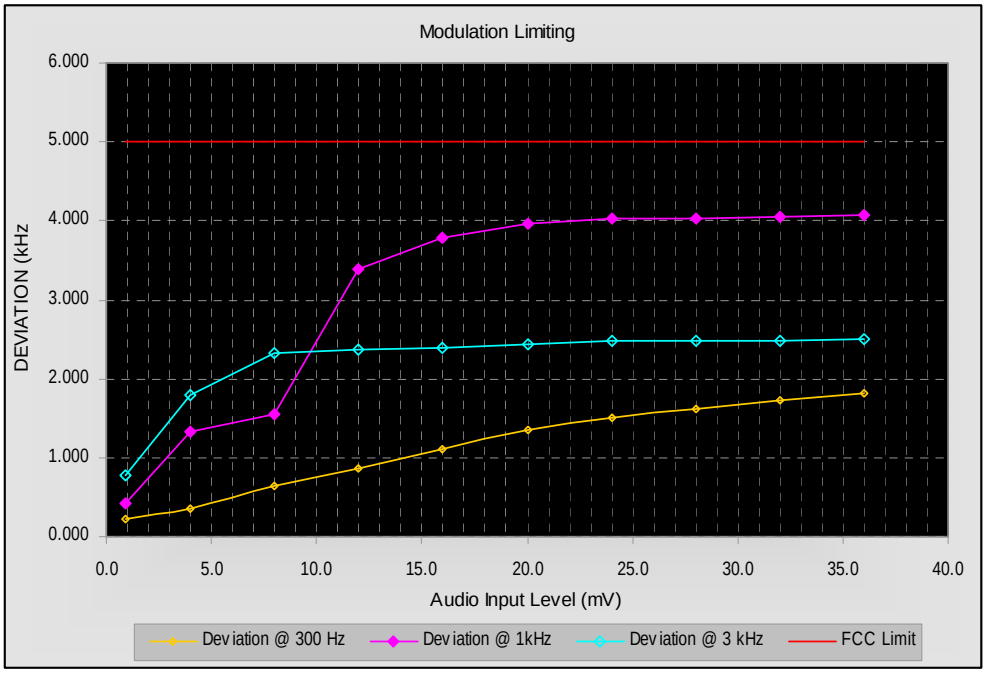
Carrier Frequency: 155 MHz, Channel Separation=12.5 kHz

| Audio Input Level [mV] | Frequency Deviation (kHz) | | | FCC Limit [kHz] |
|---|---|---|---|---|
| | @ 300 Hz | @ 1kHz | @ 3 kHz | |
| 1.0 | 0.167 | 0.327 | 0.397 | 2.5 |
| 4.0 | 0.273 | 0.746 | 1.065 | 2.5 |
| 8.0 | 0.376 | 1.423 | 1.213 | 2.5 |
| 12.0 | 0.476 | 1.827 | 1.237 | 2.5 |
| 16.0 | 0.621 | 1.968 | 1.264 | 2.5 |
| 20.0 | 0.751 | 2.041 | 1.280 | 2.5 |
| 24.0 | 0.818 | 2.137 | 1.303 | 2.5 |
| 28.0 | 0.857 | 2.156 | 1.413 | 2.5 |
| 32.0 | 0.913 | 2.113 | 1.447 | 2.5 |
| 36.0 | 1.068 | 2.223 | 1.472 | 2.5 |



Carrier Frequency: 155 MHz, Channel Separation=25.0 kHz

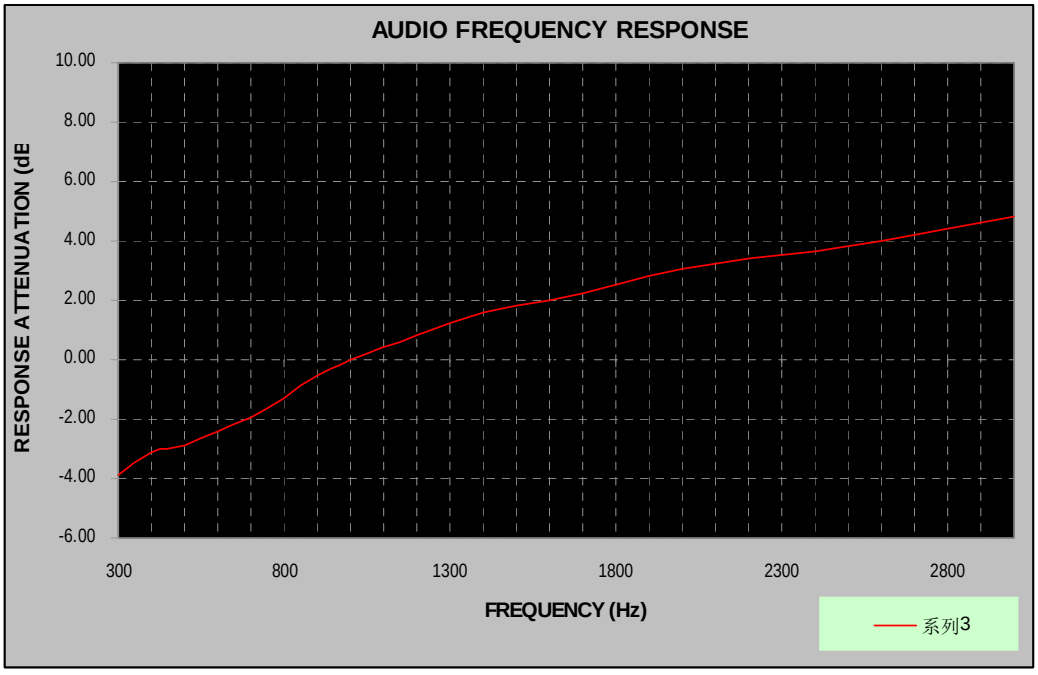
| Audio Input Level [mV] | Frequency Deviation (kHz) | | | FCC Limit [kHz] |
|---|---|---|---|---|
| | @ 300 Hz | @ 1kHz | @ 3 kHz | |
| 1.0 | 0.223 | 0.428 | 0.768 | 5.0 |
| 4.0 | 0.347 | 1.325 | 1.789 | 5.0 |
| 8.0 | 0.635 | 1.553 | 2.335 | 5.0 |
| 12.0 | 0.863 | 3.385 | 2.359 | 5.0 |
| 16.0 | 1.107 | 3.777 | 2.399 | 5.0 |
| 20.0 | 1.347 | 3.958 | 2.436 | 5.0 |
| 24.0 | 1.512 | 4.027 | 2.475 | 5.0 |
| 28.0 | 1.621 | 4.036 | 2.479 | 5.0 |
| 32.0 | 1.726 | 4.052 | 2.483 | 5.0 |
| 36.0 | 1.826 | 4.069 | 2.493 | 5.0 |



## Audio Frequency Response

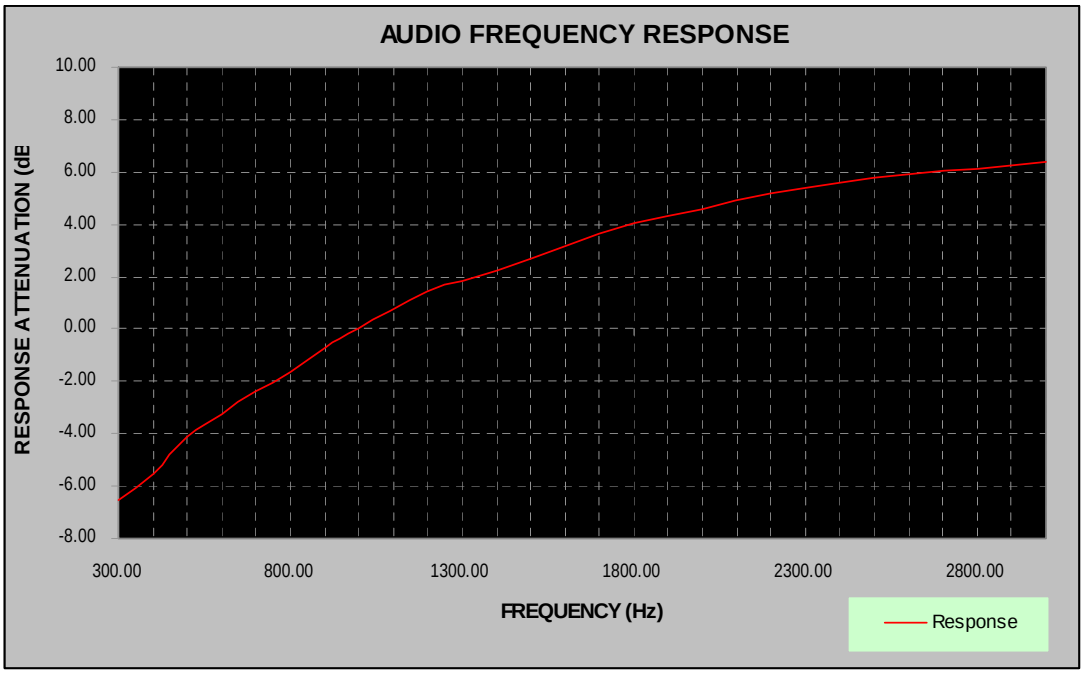
Carrier Frequency: 155 MHz, Channel Separation=12.5 kHz

| Audio Frequency (Hz) | Response Attenuation (dB) |
|---|---|
| 300 | -3.88 |
| 400 | -3.10 |
| 500 | -2.85 |
| 600 | -2.38 |
| 700 | -1.94 |
| 800 | -1.31 |
| 900 | -0.54 |
| 1000 | 0.00 |
| 1200 | 0.83 |
| 1400 | 1.58 |
| 1600 | 2.01 |
| 1800 | 2.54 |
| 2000 | 3.05 |
| 2200 | 3.41 |
| 2400 | 3.64 |
| 2600 | 3.97 |
| 2800 | 4.40 |
| 3000 | 4.81 |



Carrier Frequency: 155 MHz, Channel Separation=25.0 kHz

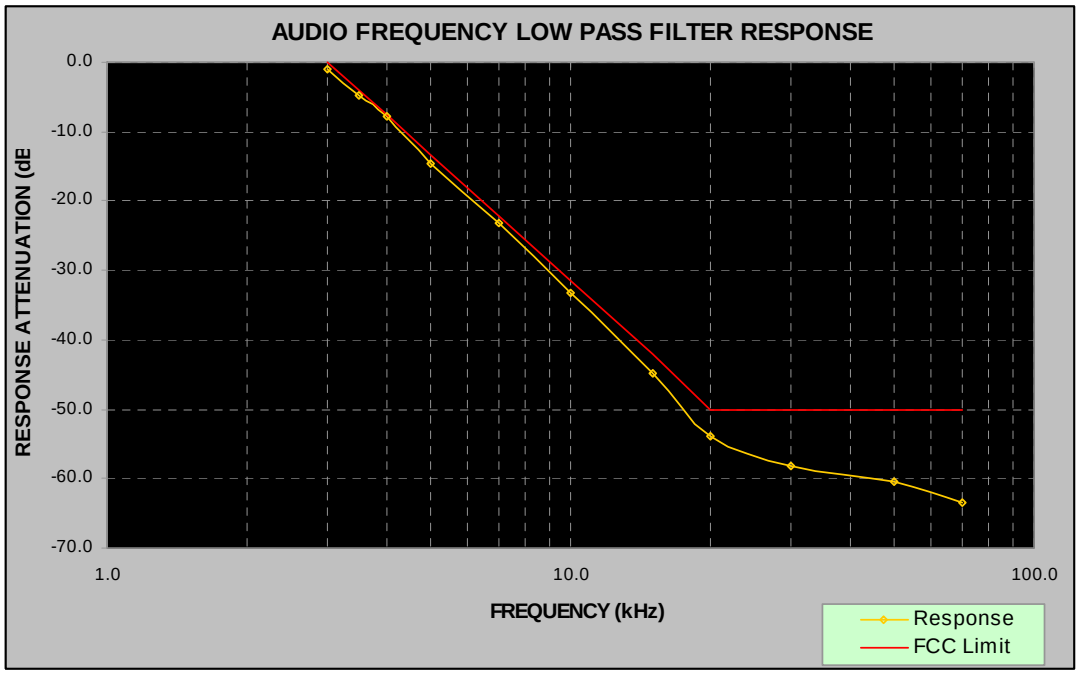
| Audio Frequency (Hz) | Response Attenuation (dB) |
|---|---|
| 300 | -6.56 |
| 400 | -5.51 |
| 500 | -4.15 |
| 600 | -3.22 |
| 700 | -2.38 |
| 800 | -1.62 |
| 900 | -0.72 |
| 1000 | 0.00 |
| 1200 | 1.44 |
| 1400 | 2.21 |
| 1600 | 3.17 |
| 1800 | 4.03 |
| 2000 | 4.61 |
| 2200 | 5.15 |
| 2400 | 5.58 |
| 2600 | 5.89 |
| 2800 | 6.11 |
| 3000 | 6.36 |



## Audio Frequency Low Pass Filter Response

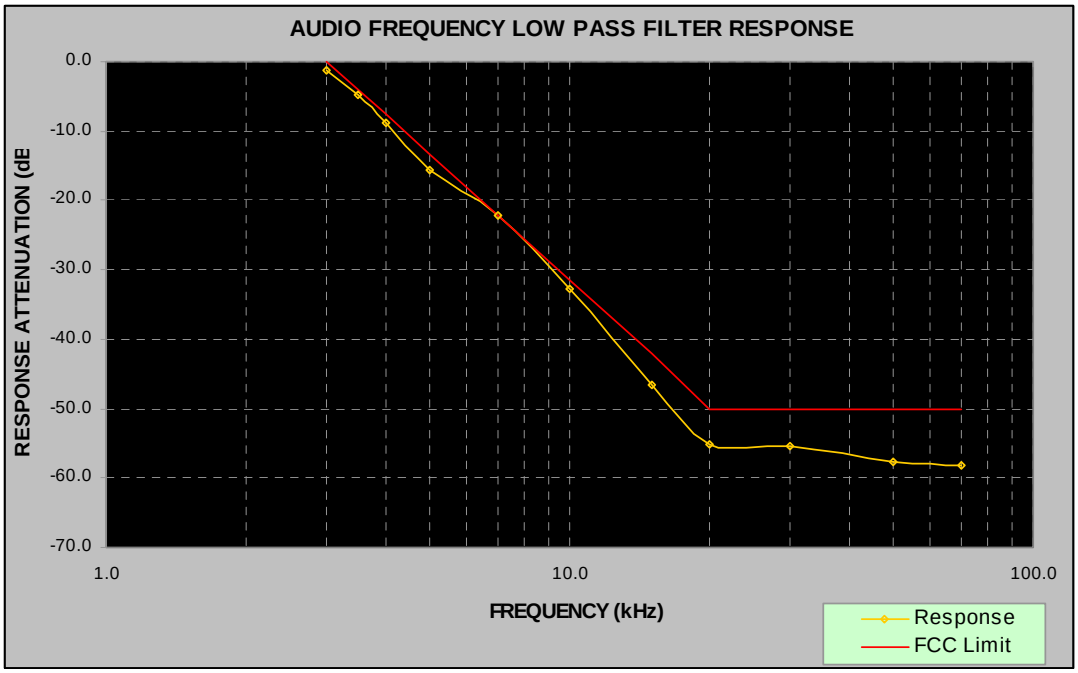
Carrier Frequency: 155 MHz, Channel Separation=12.5 kHz

| Audio Frequency (kHz) | Response Attenuation (dB) | FCC Limit (dB) |
|---|---|---|
| 3.0 | -1.1 | 0.0 |
| 3.5 | -4.7 | -4.0 |
| 4.0 | -7.8 | -7.5 |
| 5.0 | -14.7 | -13.3 |
| 7.0 | -23.2 | -22.1 |
| 10.0 | -33.3 | -31.4 |
| 15.0 | -44.8 | -42.0 |
| 20.0 | -53.9 | -50.0 |
| 30.0 | -58.2 | -50.0 |
| 50.0 | -60.4 | -50.0 |
| 70.0 | -63.5 | -50.0 |



Carrier Frequency: 155 MHz, Channel Separation=25.0 kHz

| Audio Frequency (kHz) | Response Attenuation (dB) | FCC Limit (dB) |
|---|---|---|
| 3.0 | -1.3 | 0.0 |
| 3.5 | -4.8 | -4.0 |
| 4.0 | -8.7 | -7.5 |
| 5.0 | -15.6 | -13.3 |
| 7.0 | -22.2 | -22.1 |
| 10.0 | -32.7 | -31.4 |
| 15.0 | -46.7 | -42.0 |
| 20.0 | -55.2 | -50.0 |
| 30.0 | -55.4 | -50.0 |
| 50.0 | -57.6 | -50.0 |
| 70.0 | -58.2 | -50.0 |



# FCC §2.1049, §90.209 & §90.210 – OCCUPIED BANDWIDTH & EMISSION MASK

## Applicable Standard

FCC §2.1049, §90.209 and §90.210

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

1) For any frequency removed from the center of the authorized bandwidth $f_0$ to 5.625 kHz removed from $f_0$, 0dB.

2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 ($f_d$ –2.88 kHz) dB.

3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 12.5 kHz at least:

50+10logP=50+10log(1.574)=51.97 dB

Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

1) For any frequency removed from the center of the assigned channel 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 center of the assigned channel by more than 100 percent up to and including 250 percent, at least 35 dB.

3) On any frequency removed from the center of the assigned channel by more than 250 percent at least:

43+10logP=43+10log(1.622)=45.10 dB

The resolution bandwidth was 300 Hz or greater for measuring up to 250 kHz from the edge of the authorized frequency segment, and 30 kHz or greater for measuring more than 250 kHz from the authorized frequency segment.

## Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| Rohde & Schwarz | EMI Test Receiver | ESCI | 100035 | 2009-11-24 | 2010-11-24 |
| HP | Modulation Analyzer | 8901B | 3438A05208 | 2010-03-03 | 2011-03-02 |
| NANYAN | Audio Generator | NY2201 | 019829 | 2009-12-23 | 2010-12-23 |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

## 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 300 Hz and the spectrum was recorded in the frequency band ±50 kHz from the carrier frequency.

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 °C |
| **Relative Humidity:** | 56% |
| **ATM Pressure:** | 100.1 kPa |

*The testing was performed by Allan An on 2010-11-20.*

### Emission Designator

According to CFR47 § 2.201 & § 2.202, Bn=2M + 2DK

1) 155 MHz, Channel spacing =12.5 kHz

Bn=2M + 2DK

*Where* M = 3000, *D* = 2.5 kHz, K = 1

Bn =2*(3000) + 2*(2500) = 11 kHz

Emission Designator: 11K0F3E

2) 155 MHz, Channel spacing =25 kHz

Bn=2M + 2DK

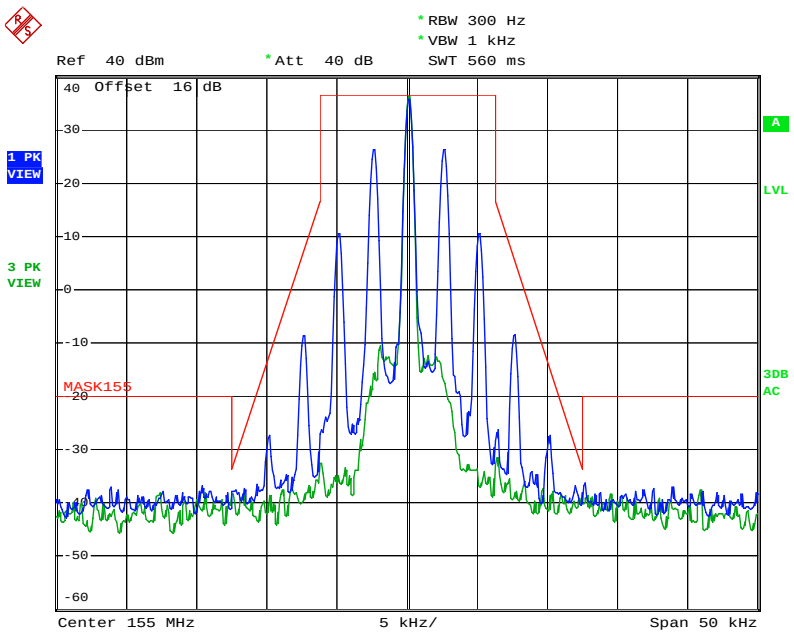
*Where* M = 3000, *D* = 5.0 kHz, K = 1

Bn =2*(3000) + 2*(5000) = 16 kHz

Emission Designator: 16K0F3E

Please refer to the emission mask hereinafter plots.

## Emission Mask D, 12.5 kHz Channel Spacing (Middle Channel)

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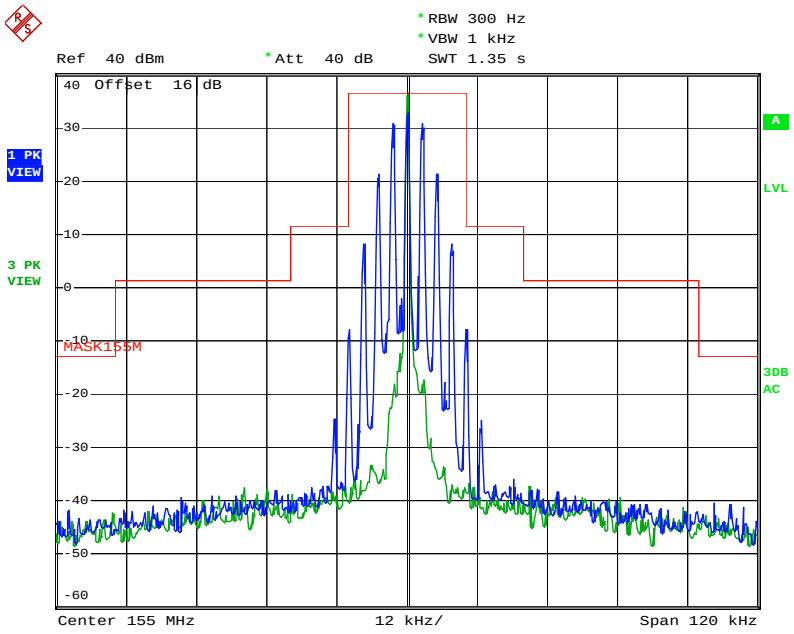
## Emission Mask B, 25.0 kHz Channel Spacing (Middle Channel)

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# FCC §2.1051 & §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

## Applicable Standard

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

1) For any frequency removed from the center of the authorized bandwidth $f_0$ to 5.625 kHz removed from $f_0$, 0 dB.

2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 ($f_d$ –2.88 kHz) dB.

3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 12.5 kHz at least:

50+10logP=50+10log (P) dB

Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

1) For any frequency removed from the center of the assigned channel 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 center of the assigned channel by more than 100 percent up to and including 250 percent, at least 35 dB.

3) On any frequency removed from the center of the assigned channel by more than 250 percent at least:

43+10logP=43+10log (P) dB

The resolution bandwidth was 300 Hz or greater for measuring up to 250 kHz from the edge of the authorized frequency segment, and 30 kHz or greater for measuring more than 250 kHz from the authorized frequency segment.

## Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| Rohde & Schwarz | Spectrum Analyzer | FSEM30 | 849720/019 | 2010-07-08 | 2011-07-08 |
| Rohde & Schwarz | EMI Test Receiver | ESCI | 100035 | 2009-11-24 | 2010-11-24 |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

## Test Procedure

The RF output of the Two-way radio was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10$^{th}$ harmonic.

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 °C |
| **Relative Humidity:** | 56% |
| **ATM Pressure:** | 100.1 kPa |

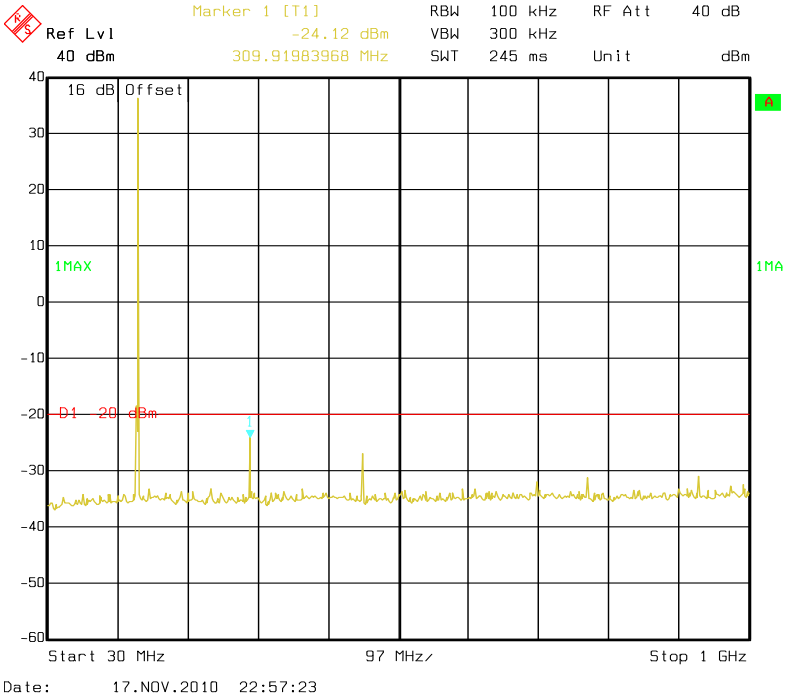
*The testing was performed by Allan An on 2010-11-17.*

*Test Mode: Transmitting*

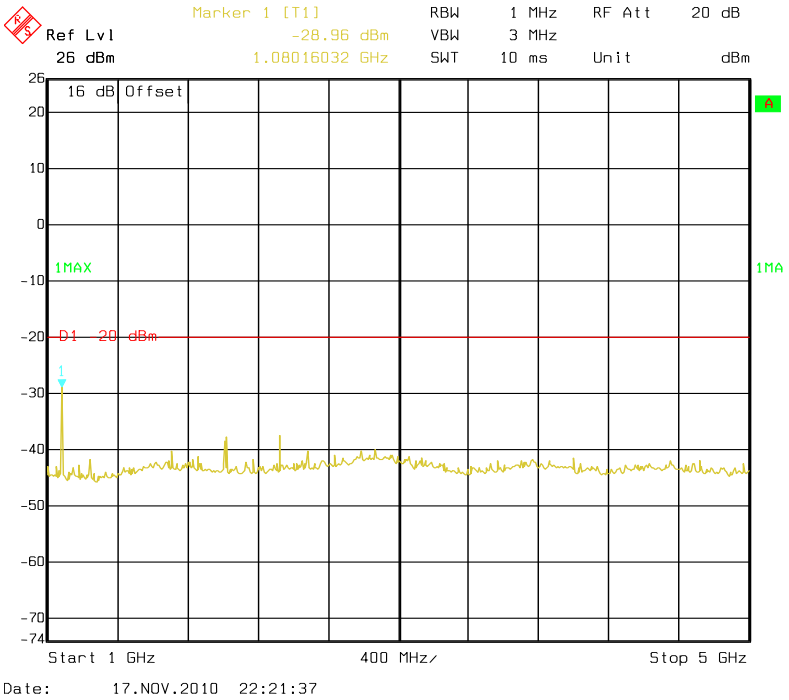
Please refer to the followingplots.

## 12.5 kHz Channel Spacing, (Middle Channel)

### 30 MHz - 1000 MHz

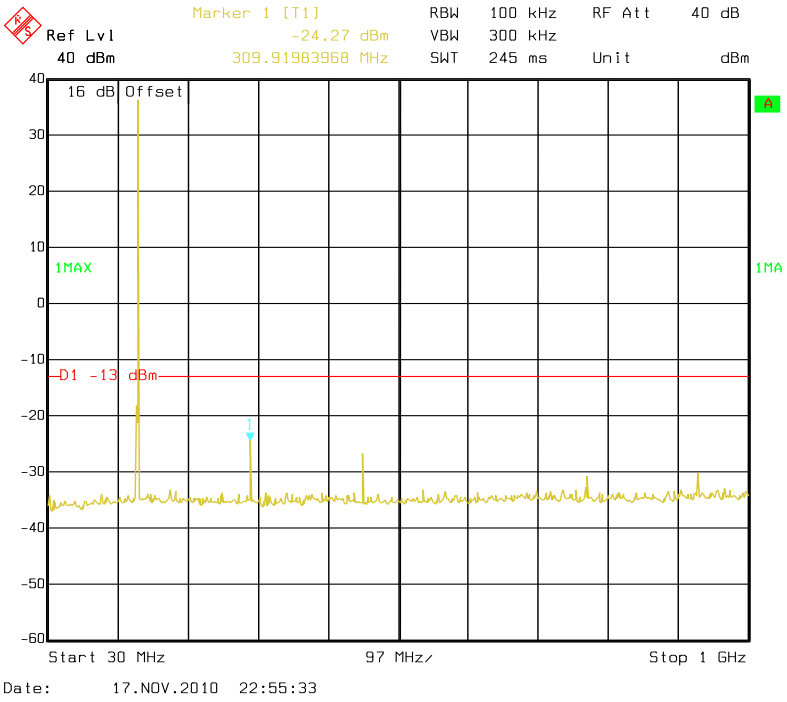



### 1-5 GHz

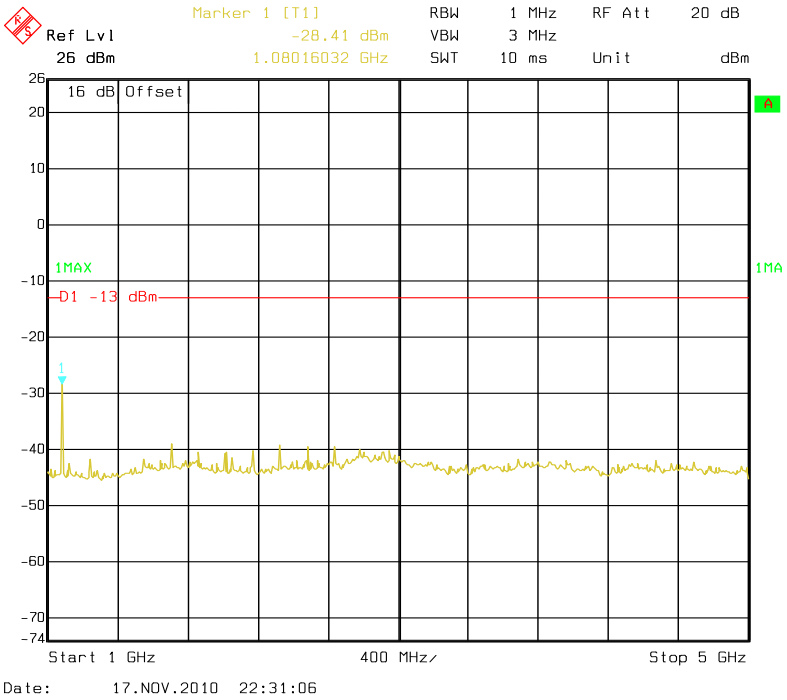


## 25.0 kHz Channel Spacing, (Middle Channel)

### 30 MHz - 1000 MHz




### 1-5 GHz



# FCC §2.1053 & §90.210 - RADIATED SPURIOUS EMISSIONS

## Applicable Standard

FCC §2.1053 and §90.210

## Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| Sunol Sciences | Horn Antenna | DRH-118 | A052604 | 2010-05-05 | 2011-05-04 |
| Sunol Sciences | Broadband Antenna | JB1 | A040904-1 | 2010-03-11 | 2011-03-11 |
| Sunol Sciences | Bilog Antenna | JB1 | A040904-2 | 2010-05-05 | 2011-05-04 |
| Rohde & Schwarz | Spectrum Analyzer | FSEM30 | 849720/019 | 2010-07-08 | 2011-07-08 |
| HP | Signal Generator | HP8657A | 2849U00982 | 2010-10-28 | 2011-10-27 |
| A.H. System | Horn Antenna | SAS-200/571 | 135 | 2010-05-17 | 2011-05-17 |
| HP | Synthesized Sweeper | 8341B | 2624A00116 | 2010-03-03 | 2011-03-02 |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

## Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT .The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to teeth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB =10 1g (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in dB =43+10 $\text{Log}_{10}$ (power out in Watts)
Spurious attenuation limit in dB =50+10 $\text{Log}_{10}$ (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.

## Test Results Summary

**1.76 dB** at **310 MHz** in the **Vertical** polarization for 12.5 kHz channel spacing

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 °C |
| **Relative Humidity:** | 56% |
| **ATM Pressure:** | 100.1 kPa |

*The testing was performed by Allan An on 2010-11-18.*

*Test Mode: Transmitting*

| Indicated | | Table Angle (Degree) | Test Antenna | | Substituted | | | | | Absolute Level (dBm) | FCC Part 90 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Freq. (MHz) | Receiver Reading (dBµV) | | Height (m) | Polar (H/V) | Freq. (MHz) | Level (dBm) | Ant. Polar (H/V) | Ant. Gain Cord. (dB) | Cable Loss (dB) | | Limit (dBm) | Margin (dB) |
| Middle channel 155 MHz （12.5 kHz spacing） | | | | | | | | | | | | |
| 310 | 71.62 | 140 | 1.1 | V | 310 | -21.4 | V | 0 | 0.36 | -21.76 | -20 | 1.76* |
| 465 | 67.65 | 133 | 1.1 | V | 465 | -26.3 | V | 0 | 0.46 | -26.76 | -20 | 6.76 |
| 1085 | 73.91 | 0 | 1.0 | V | 1085 | -32.9 | V | 5.9 | 0.76 | -27.76 | -20 | 7.76 |
| 310 | 63.50 | 45 | 1.3 | H | 310 | -29.5 | H | 0 | 0.36 | -29.86 | -20 | 9.86 |
| 1085 | 71.79 | 110 | 1.4 | H | 1085 | -34.8 | H | 5.9 | 0.76 | -30.07 | -20 | 10.07 |
| 775 | 63.32 | 135 | 1.0 | V | 775 | -31.7 | V | 0 | 0.65 | -32.35 | -20 | 12.35 |
| 775 | 59.98 | 78 | 1.4 | H | 775 | -35.1 | H | 0 | 0.65 | -35.75 | -20 | 15.75 |
| 465 | 55.92 | 52 | 1.3 | H | 465 | -38.1 | H | 0 | 0.46 | -38.56 | -20 | 18.56 |
| Middle channel 435.025MHz（25 kHz Spacing） | | | | | | | | | | | | |
| 310 | 71.81 | 133 | 1.0 | V | 310 | -21.1 | V | 0 | 0.36 | -21.46 | -13 | 8.46 |
| 465 | 69.48 | 125 | 1.1 | V | 465 | -24.5 | V | 0 | 0.46 | -24.96 | -13 | 11.96 |
| 1085 | 74.18 | 0 | 1.0 | V | 1085 | -32.8 | V | 5.9 | 0.76 | -27.66 | -13 | 14.66 |
| 310 | 64.90 | 117 | 1.5 | H | 310 | -28.1 | H | 0 | 0.36 | -28.46 | -13 | 15.46 |
| 775 | 65.88 | 115 | 1.0 | V | 775 | -29.1 | V | 0 | 0.65 | -29.75 | -13 | 16.75 |
| 1085 | 69.56 | 53 | 1.1 | H | 1085 | -37.1 | H | 5.9 | 0.76 | -32.30 | -13 | 19.30 |
| 775 | 59.72 | 120 | 1.6 | H | 775 | -35.3 | H | 0 | 0.65 | -35.95 | -13 | 22.95 |
| 465 | 56.01 | 110 | 1.6 | H | 465 | -37.9 | H | 0 | 0.46 | -38.36 | -13 | 25.36 |

*With measurement uncertainty!

# FCC §2.1055 & §90.213- FREQUENCY STABILITY

## Applicable Standard

FCC §2.1055& §90.213

## Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| WUHUAN | Temperature & Humidity Chamber | HTP205 | 20021115 | 2010-06-04 | 2011-06-03 |
| Hewlett-Packard | Frequency Counter | 5342A | 2317A08289 | 2010-04-22 | 2011-04-22 |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

## Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to an f Spectrum Analyzer via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

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

The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 °C |
| **Relative Humidity:** | 56% |
| **ATM Pressure:** | 100.1 kPa |

*The testing was performed by Allan An on 2010-11-20.*

*Test Mode: Transmitting*

**For 12.5 kHz Channel Spacing**

| Reference Frequency: 155 MHz, Limit: 2.5 ppm | | | |
|---|---|---|---|
| **Test Environment** | | **Frequency Measure with Time Elapsed** | |
| **Temperature ($^{O}$C)** | **Power Supplied ($V_{DC}$)** | **Measured Frequency (MHz)** | **Frequency Error (ppm)** |
| Frequency Stability versus Input Temperature | | | |
| 50 | 7.5 | 155.000175 | 1.129032 |
| 40 | 7.5 | 155.000158 | 1.019355 |
| 30 | 7.5 | 155.000175 | 1.129032 |
| 20 | 7.5 | 155.000154 | 0.993548 |
| 10 | 7.5 | 155.000181 | 1.167742 |
| 0 | 7.5 | 155.000167 | 1.077419 |
| -10 | 7.5 | 155.000179 | 1.154839 |
| -20 | 7.5 | 155.000182 | 1.174194 |
| Frequency Stability versus Input Voltage | | | |
| 20 | 6.5 | 155.000191 | 1.232258 |

**For 25.0 kHz Channel Spacing**

| Reference Frequency: 155 MHz, Limit: 5.0 ppm | | | |
|---|---|---|---|
| **Test Environment** | | **Frequency Measure with Time Elapsed** | |
| **Temperature ($^{O}$C)** | **Power Supplied ($V_{DC}$)** | **Measured Frequency (MHz)** | **Frequency Error (ppm)** |
| Frequency Stability versus Input Temperature | | | |
| 50 | 7.5 | 155.000182 | 1.174194 |
| 40 | 7.5 | 155.000167 | 1.077419 |
| 30 | 7.5 | 155.000161 | 1.038710 |
| 20 | 7.5 | 155.000158 | 1.019355 |
| 10 | 7.5 | 155.000178 | 1.148387 |
| 0 | 7.5 | 155.000159 | 1.025806 |
| -10 | 7.5 | 155.000182 | 1.174194 |
| -20 | 7.5 | 155.000152 | 0.980645 |
| Frequency Stability versus Input Voltage | | | |
| 20 | 6.5 | 155.000189 | 1.219355 |

# FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

## Applicable Standard

FCC §90.214

## Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| TEKTRONIX | Digital Phosphor Oscilloscope | TDS 7104 | B020518 | 2010-03-03 | 2011-03-02 |
| HP | Modulation Analyzer | 8901B | 3438A05208 | 2010-03-03 | 2011-03-02 |
| HP | Signal Generator | HP8657A | 2849U00982 | 2010-10-28 | 2011-10-27 |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

## Test Procedure

TIA/EIA-603 2.2.19

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 °C |
| **Relative Humidity:** | 56% |
| **ATM Pressure:** | 100.1 kPa |

*The testing was performed by Allan An on 2010-11-20.*

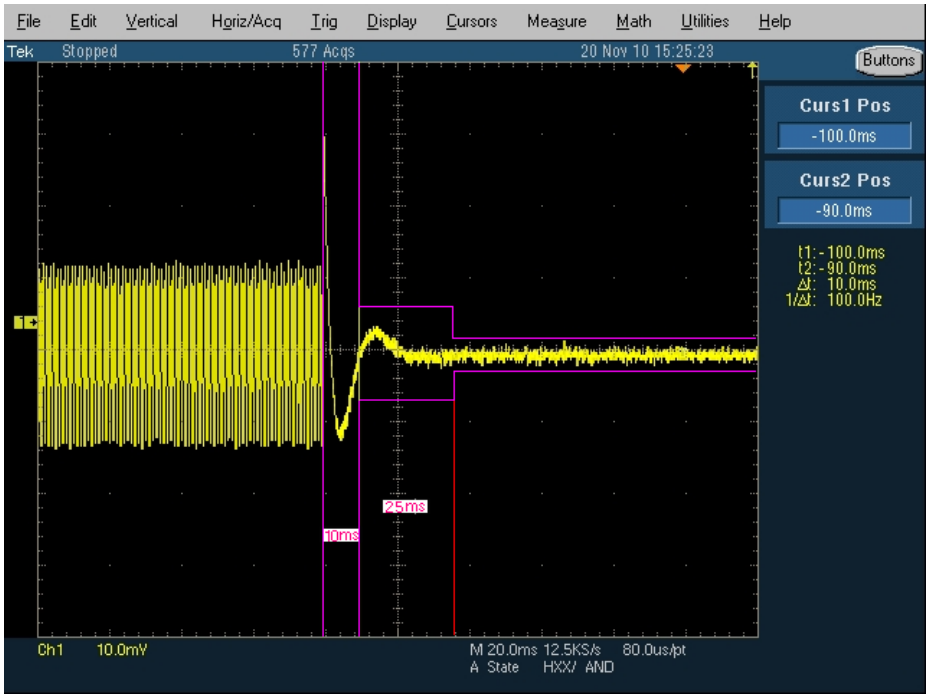
*Test Mode: Transmitting*

| Channel Spacing | Operation Frequency (MHz) | Channel Separation (kHz) | Transient Period (ms) | Transient Frequency | Result |
|---|---|---|---|---|---|
| 12.5 kHz | 155 | 12.5 | < 10 | +/-12.5 kHz | Pass |
| | | | < 25 | +/-6.25 kHz | |
| | | | < 10 | +/-12.5 kHz | |

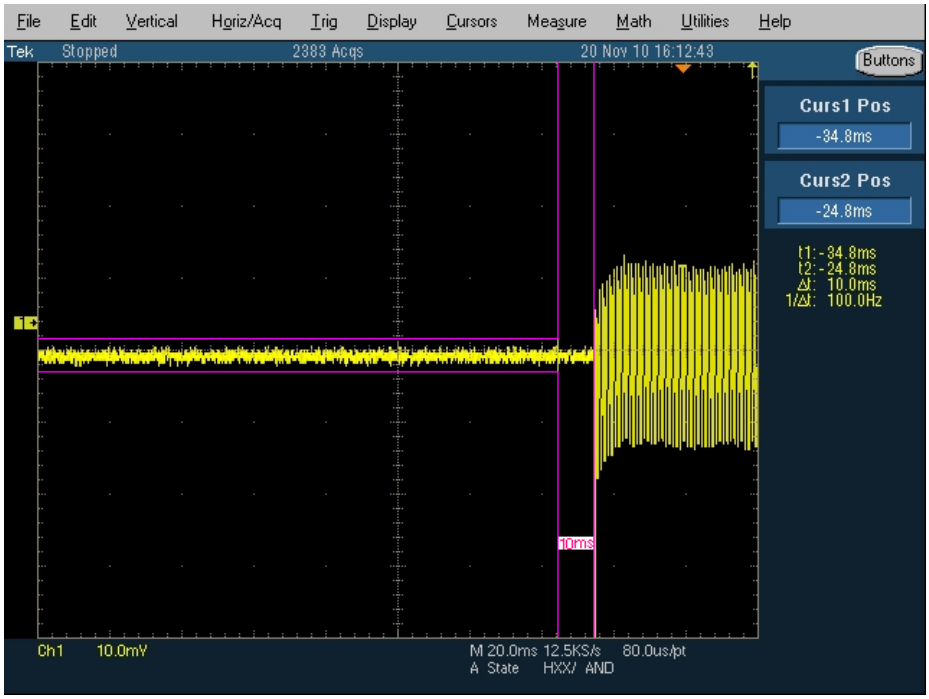
| Channel Spacing | Operation Frequency (MHz) | Channel Separation (kHz) | Transient Period (ms) | Transient Frequency | Result |
|---|---|---|---|---|---|
| 25 kHz | 155 | 25 | < 10 | +/-25.0 kHz | Pass |
| | | | < 25 | +/-12.5 kHz | |
| | | | < 10 | +/-25.0kHz | |

Please refer to the followingplots.

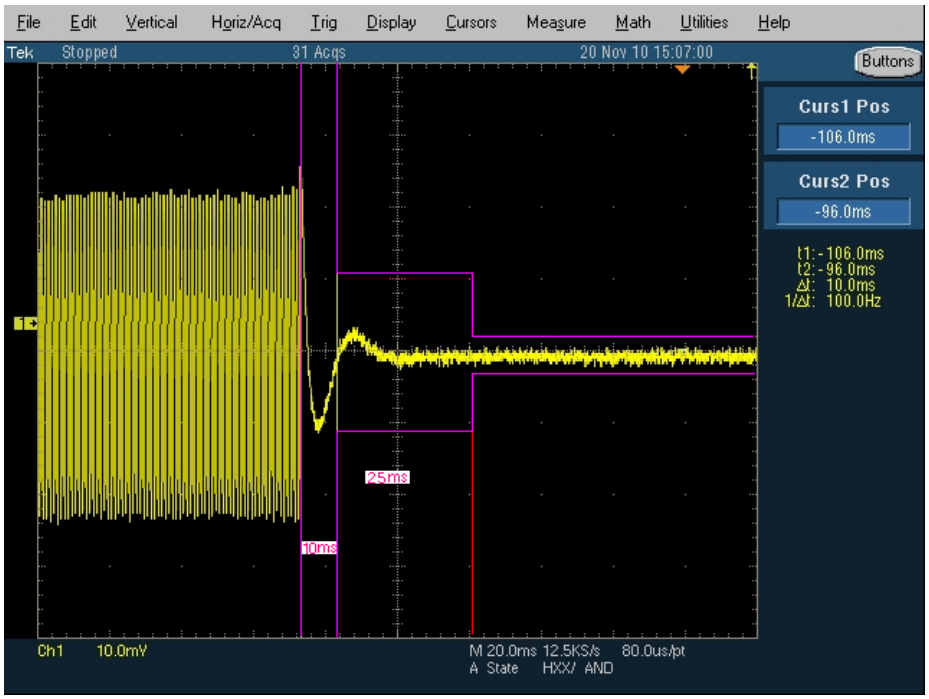
**Turn on (12.5 kHz Channel Spacing)**



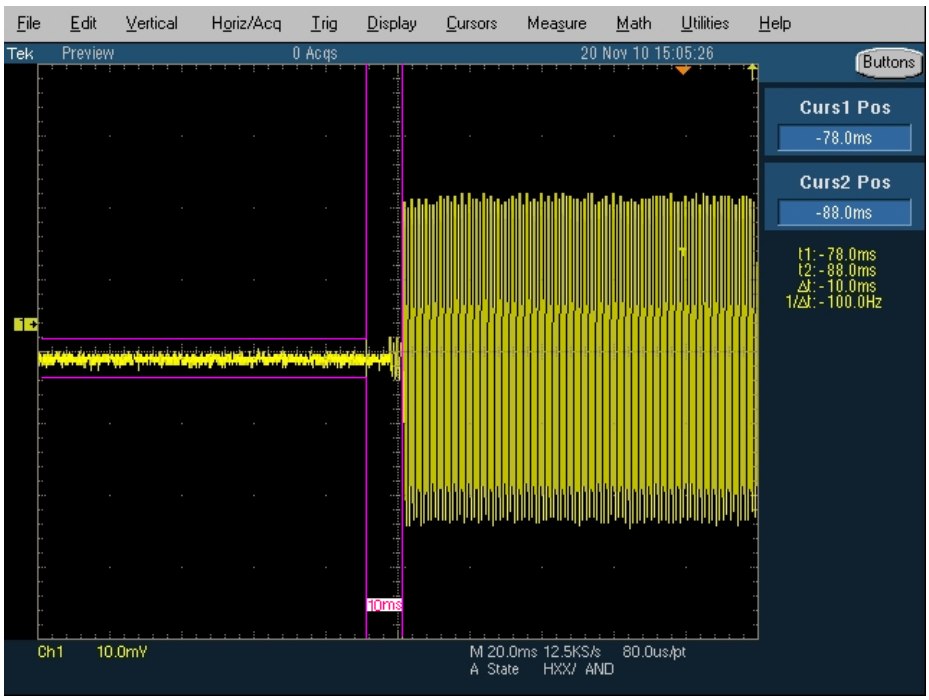

**Turn off (12.5 kHz Cahnnel Spacing)**



**Turn on (25 kHz Channel Spacing)**




**Turn off (25 kHz Channel Spacing)**




******* End of Report *******