

# FCC PART 90

## EMI MEASUREMENT AND TEST REPORT

For

### Alltronic Tech. Mftg.Limited

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Village Road, Shau Kei Wan, Hong Kong.

**Model No: LD-500**

**FCC ID: UPNLD500**

<b>This Report Concerns:</b> <input checked="" type="checkbox"/> Original Report	<b>Equipment Type:</b> Professional Radio
<b>Test Engineer:</b> Paul Tan	
<b>Report No.:</b> BTR06092601-1	
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**Note:** This test report is specially limited to the above client company and product model. It may not be duplicated without prior written consent of BEST Test Service(Shenzhen) Co., Ltd. This report **must not** be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

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## GENERAL INFORMATION

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

The *Alltronics Tech. Mftg. Limited.* 's Model: LD-500 or the "EUT" as referred to in this report is a Professional Radio, which measures approximately 60mmL x 50mmW x 265mmH, powered by DC 7.2V battery.

The EUT operates at 400MHz-470MHz with maximum power of 36.10dBm (4.07W), have two kinds of antenna, one is measure approximately D=15mm x 145 mmH, another is measure approximately D=15mm x 82 mmH

*\*The test data gathered are from production sample serial number 060918743 provided by the manufacturer.*

### Objective

This report is prepared on behalf of *Alltronic Tech. Mftg.Limited.* in accordance with Part 90 Subpart A, and Subpart I of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC Part 2 and Part 90 rules

### Related Grant/Submission

No Related Submittals.

### 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/EIA 603 -C and ANSI 63.4-2003, American National Standard for Method of Measurement of Radio -Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

### Test Facility

All measurement facilities used to collect the data are located at Huatongwei Building , Keji Rd, 12 S, high-Tech Park, Nanshan District, Shenzhen, China.

The sites are constructed in conformance with the requirements of ANSI C63.7/634 and CISPR 22, The site was accredited by FCC(662850), A2LA( 2243.01) and CNAL (L1225)

All emissions measurement was performed at Shenzhen Huatongwei International Inspect. Co., Ltd.

**Test Equipment List**

Manufacturer	Description	Model	Serial Number	Cal. Date	Cal. Due.Date
ESPEC	Climate Chamber	EL-10KV	05107008	2006-01-30	2007-01-30
Rohde&Schwarz	EMI Test RECEIVER	ESIB26	100009	2005-11-05	2006-11-05
HP	Modulation Analyzer	8901B	3104A03367	2006-07-08	2007-07-08
Rohde&Schwarz	Audio Generator	SMT03	100059	2006-02-01	2007-02-01
ROHDE & SCHWARZ	Ultra-Broadband Antenna	HL562	100015	2005-11-16	2006-11-16
ROHDE & SCHWARZ	EMI TEST RECEIVER	ESI 26	100009	2005-11-16	2006-11-16
ROHDE & SCHWARZ	RF TEST PANEL	TS / RSP	335015/ 0017	N/A	N/A
ETS	TURNTABLE	2088	2149	N/A	N/A
ETS	ANTENNA MAST	2075	2346	N/A	N/A
ROHDE & SCHWARZ	EMI TEST SOFTWARE	ES-K1 V1.71	NA	N/A	N/A
SUNOL SCIENCE	Horn Antenna	DRH-118	A052605	2005-11-16	2006-11-16
SUNOL SCIENCE	Horn Antenna	DRH-118	A052607	2005-11-16	2006-11-16
Tektronix	Storage Oscilloscope	TDS3052	B017447	2006-06-26	2007-06-26
HP	Communication Tester	HP8920B	US35010135	2006-06-01	2007-06-01

\* **Statement of Traceability:** All calibration has been performed using suitable standards traceable to NIM China.

## **SYSTEM TEST CONFIGURATION**

### **Justification**

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

### **EUT Test Configuration**

The EUT was powered and fully operated by pushing PTT (Push To Talk) button and then change the channel to Low, Middle, and High by selecting the channel knob on the EUT.

The EUT was Lie/ Stand/Side On the test table , and stand is the worst mode, and the worst mode' s data was included in this report.

### **Equipment Modifications**

BEST Test Service (Shenzhen) Co., Ltd has not done any modification to the EUT.

**SUMMARY OF TEST RESULT**

FCC Rules	Description of Test	Test Result
2.1046 90.205	RF Output Power	Complied
2.1047 90.207	Modulation Characteristics	Complied
2.1049 90.209	Occupied Bandwidth	Complied
2.1051 90.210	Spurious Emission at Antenna Port	Complied
2.1053 90.210	Radiated Spurious Emission	Complied
2.1055 90.213	Frequency Stability	Complied
90.214	Transient Frequency Behavior	Complied

## CONDUCTED OUTPUT POWER

### Applicable Standard

Per FCC §2.1046, §90.205 and §90.309: the maximum transmitter output power depends on HAAT and service area radius.

### Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuator.

### Test Results

Channel	Frequency	Output Power in dBm	Output Power in W
25KHz			
Low	400.025	36.03	4.01
Middle	435.025	36.08	4.06
High	469.975	36.02	4.00
12.5KHz			
Low	400.0125	36.04	4.02
Middle	435.0125	36.10	4.07
High	469.9875	36.07	4.05

## MODULATION CHARACTERISTICS

### Applicable Standard

Per FCC § 2.1047, § 90.207,

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.

### Test Procedure

#### A, Modulation Limit

- 1) Configure the EUT as shown in figure 1, adjust the audio input for 60% of rated system deviation at 1KHz using this level as a reference (0dB) and vary the input level from -20 to +20dB. Record the frequency deviation obtained as a function of the input level.
- 2) Repeat step 1 with input frequency changing to 300 and 2500Hz in sequence.

#### B, Audio Frequency Response

- 1). Configure the EUT as shown in figure 1
- 2). Adjust the audio input for 20% of rated system deviation at 1 KHz using this level as a reference (0dB).
- 3). Vary the Audio frequency from 100 Hz to 10 KHz and record the frequency deviation.
- 4) Audio Frequency Response = $20\log_{10}(\text{Deviation of test frequency}/\text{Deviation of 1 KHz reference})$ .

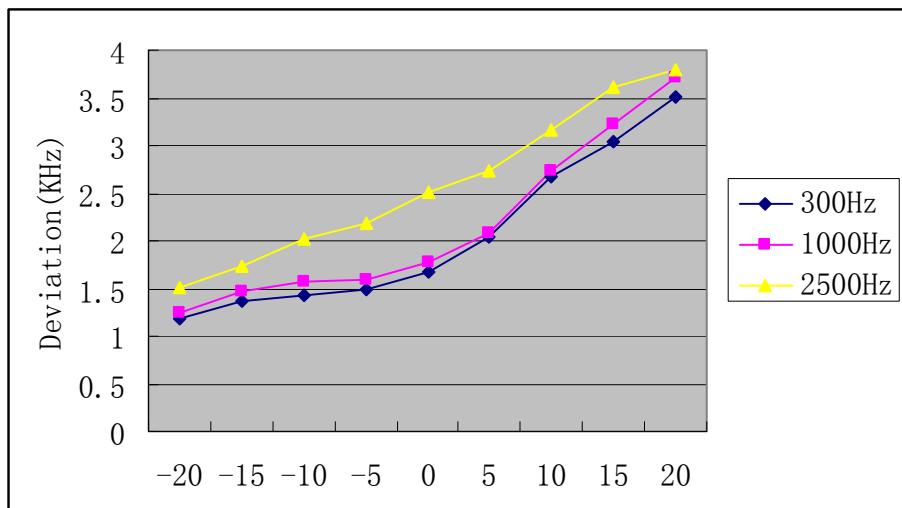
### Test Results:

Environmental Conditions	
Temperature:	25 °C
Relative Humidity:	60%
ATM Pressure:	1016

#### (a) Modulation Limit

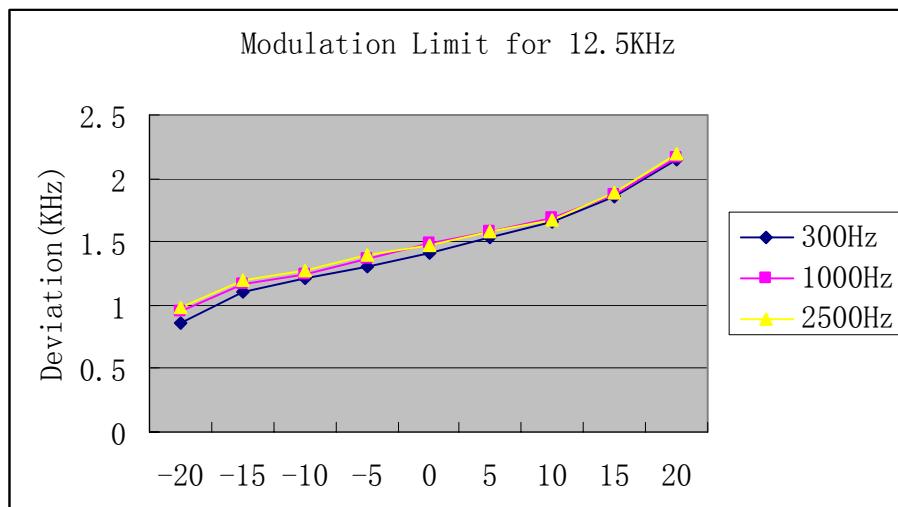
##### 25 KHz Channel Separation

Audio Input	300Hz Deviation (KHz)	1KHz Deviation (KHz)	2.5KHz Deviation (KHz)
-20. 0	1. 18	1. 24	1. 52
-15. 0	1. 37	1. 46	1. 74
-10. 0	1. 42	1. 58	2. 03
-5. 0	1. 49	1. 60	2. 18
0. 0	1. 67	1. 78	2. 51
5. 0	2. 04	2. 09	2. 73
10. 0	2. 67	2. 73	3. 16
15. 0	3. 05	3. 22	3. 62
20. 0	3. 51	3. 71	3. 79

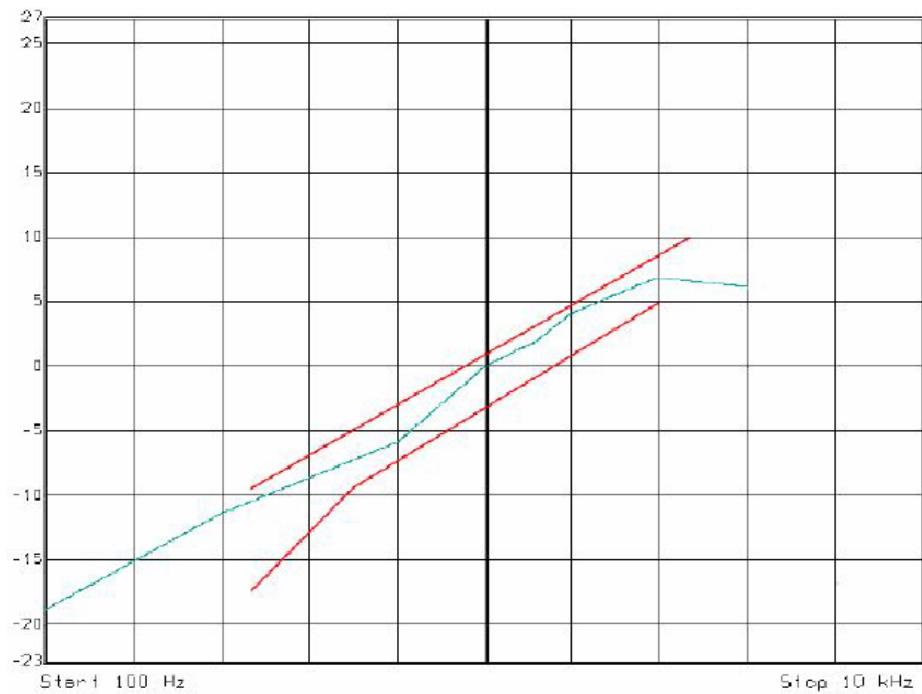


## 12.5 KHz Channel Separations

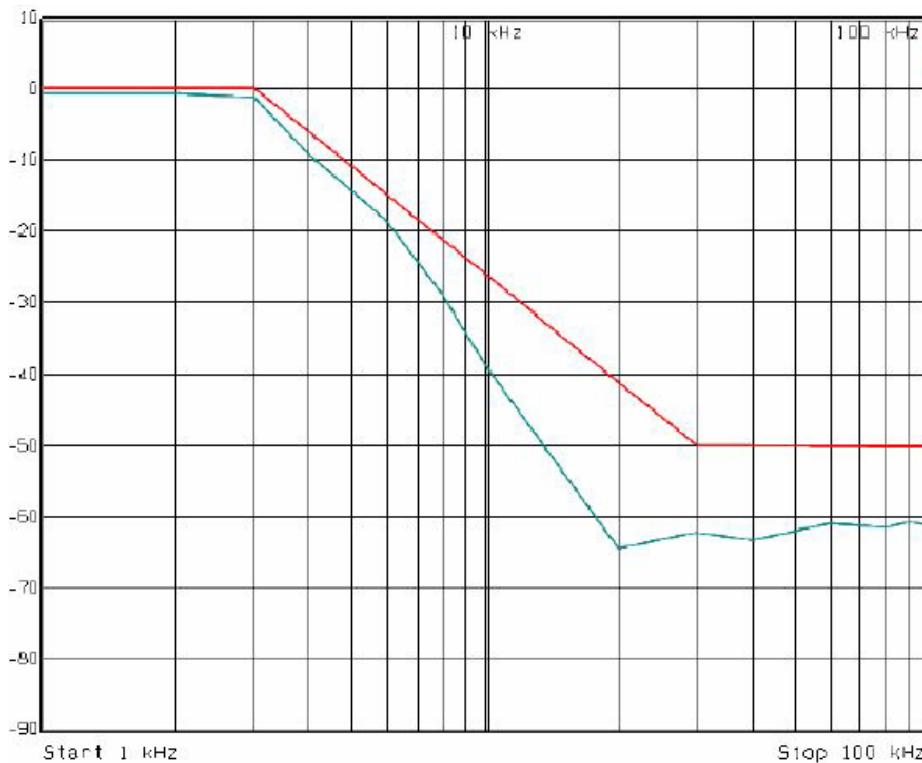
Audio Input	300Hz Deviation (KHz)	1KHz Deviation (KHz)	2.5 KHz Deviation (KHz)
-20.0	0.86	0.95	0.98
-15.0	1.11	1.17	1.19
-10.0	1.21	1.25	1.28
-5.0	1.30	1.37	1.40
0.0	1.41	1.49	1.48
5.0	1.53	1.58	1.58
10.0	1.66	1.69	1.67
15.0	1.85	1.87	1.88
20.0	2.15	2.16	2.20



## (b) Audio Frequency Response:



Audio Low Pass Filter Response



## **OCCUPIED BANDWIDTH OF EMISSION**

### **Provision Applicable**

Per FCC §2.1049, §90.209(b)(5), and §90.210 (b), the authorized bandwidth is 20kHz for operating band within 25-50 MHz.

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.

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.

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

$43 + 10 \log(P) \text{ dB}$

### **Test Procedure**

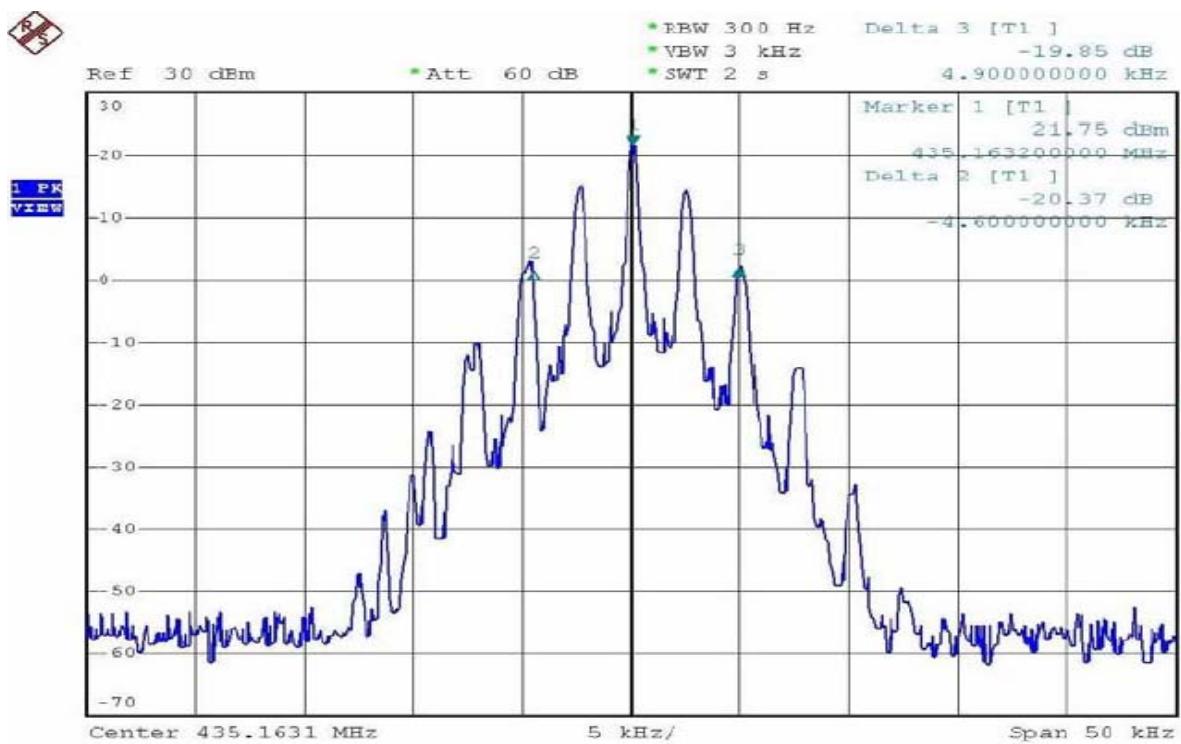
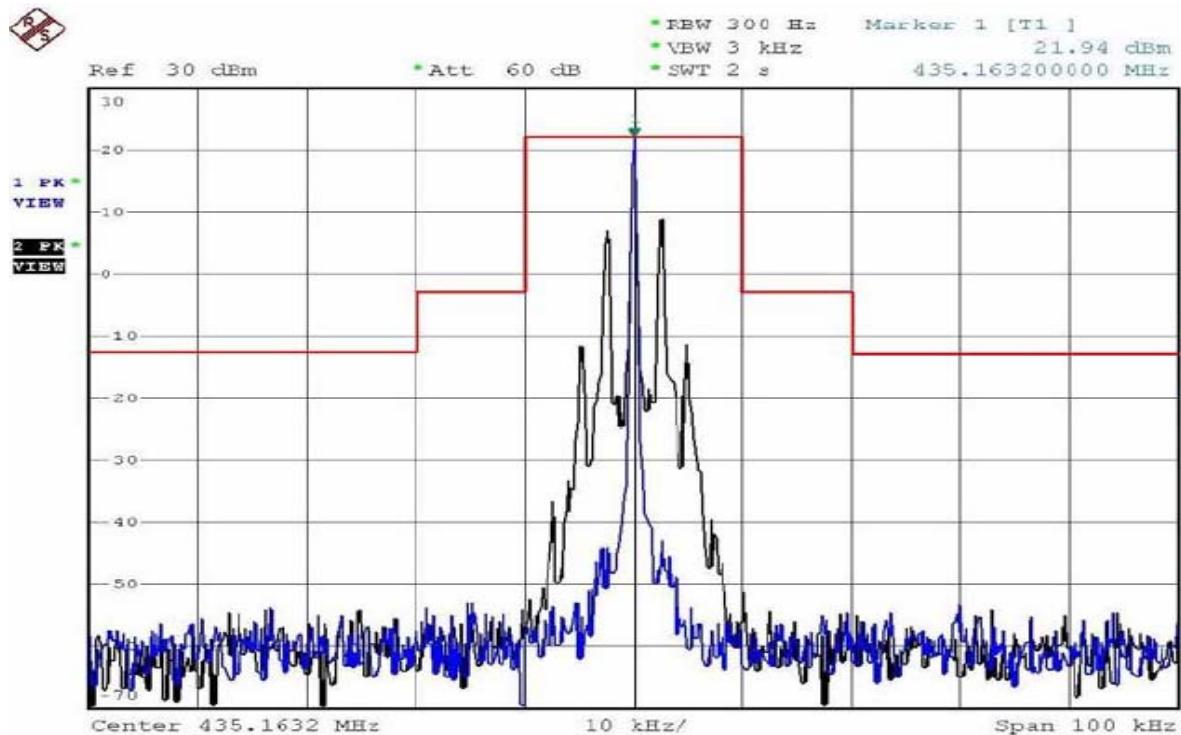
The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation. The RBW of the spectrum analyzer was set at 300Hz, and the spectrum was recorded in  $\pm$  50KHz from the carrier Frequency.

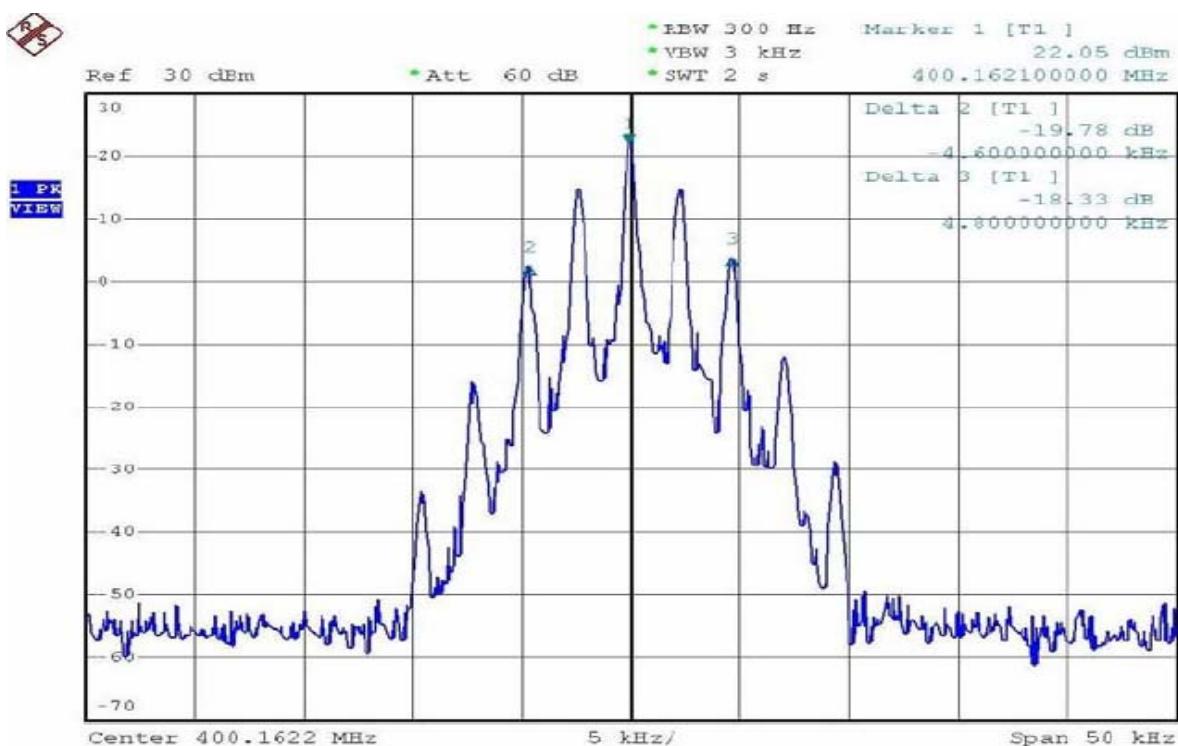
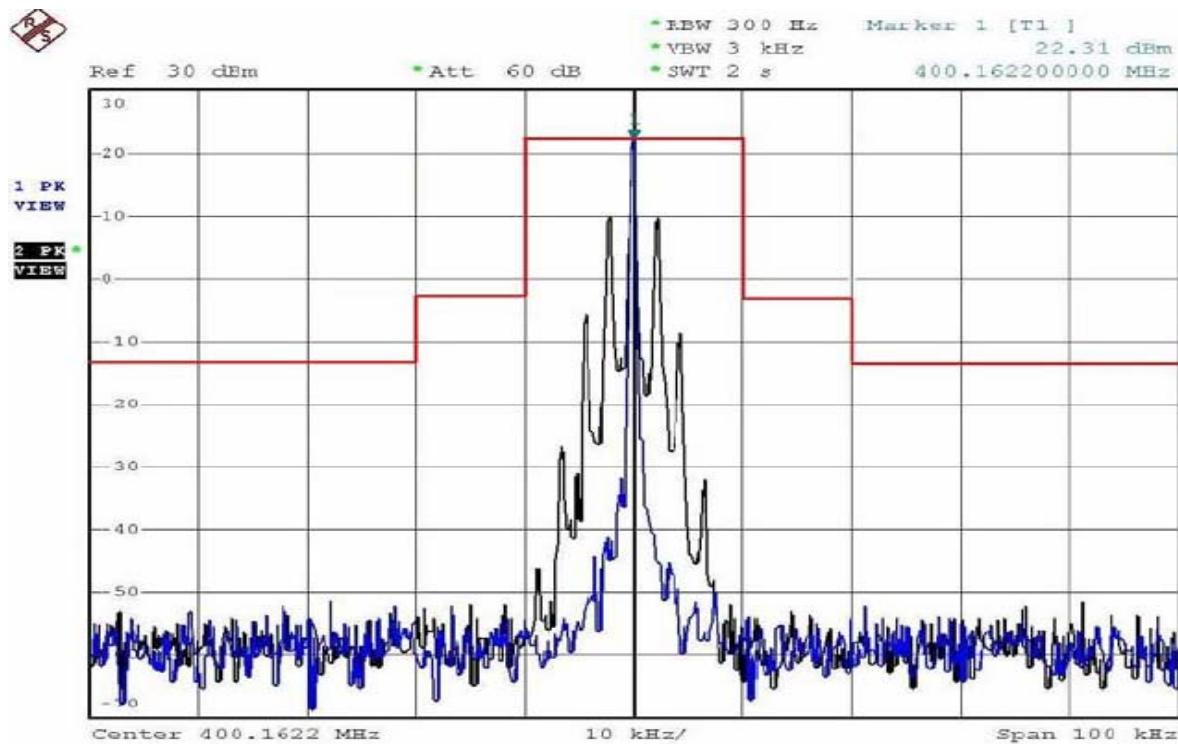
### **Test Results**

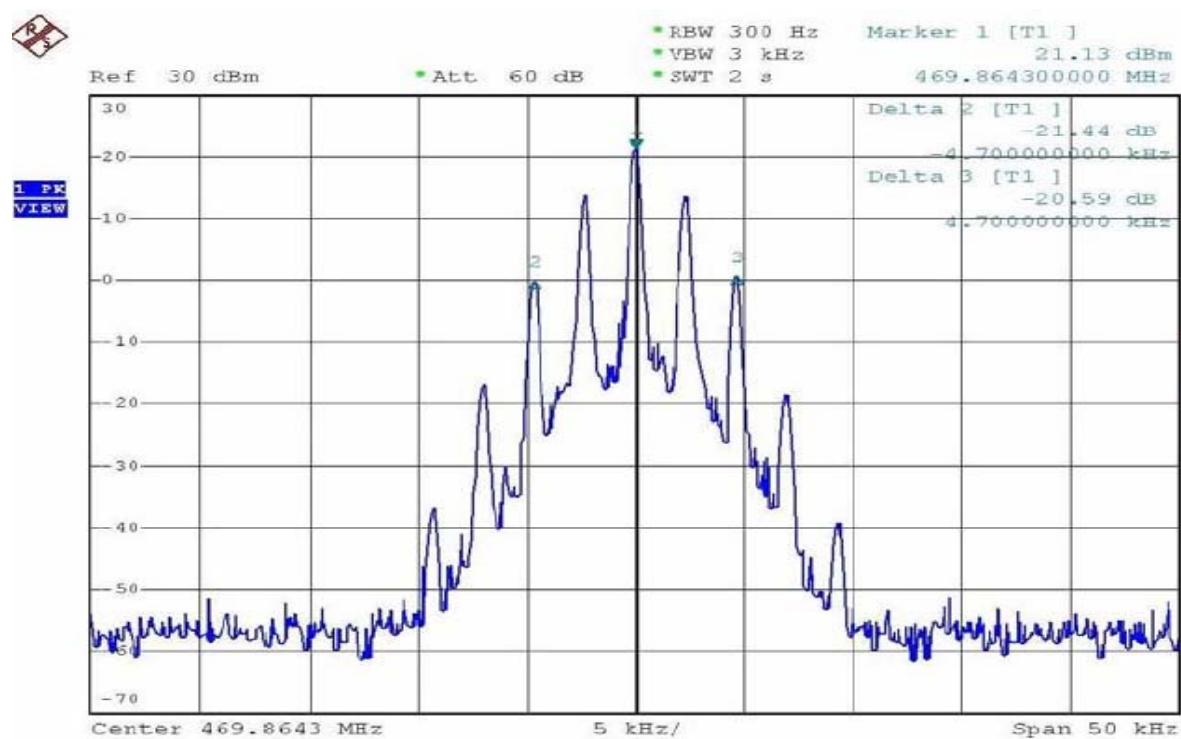
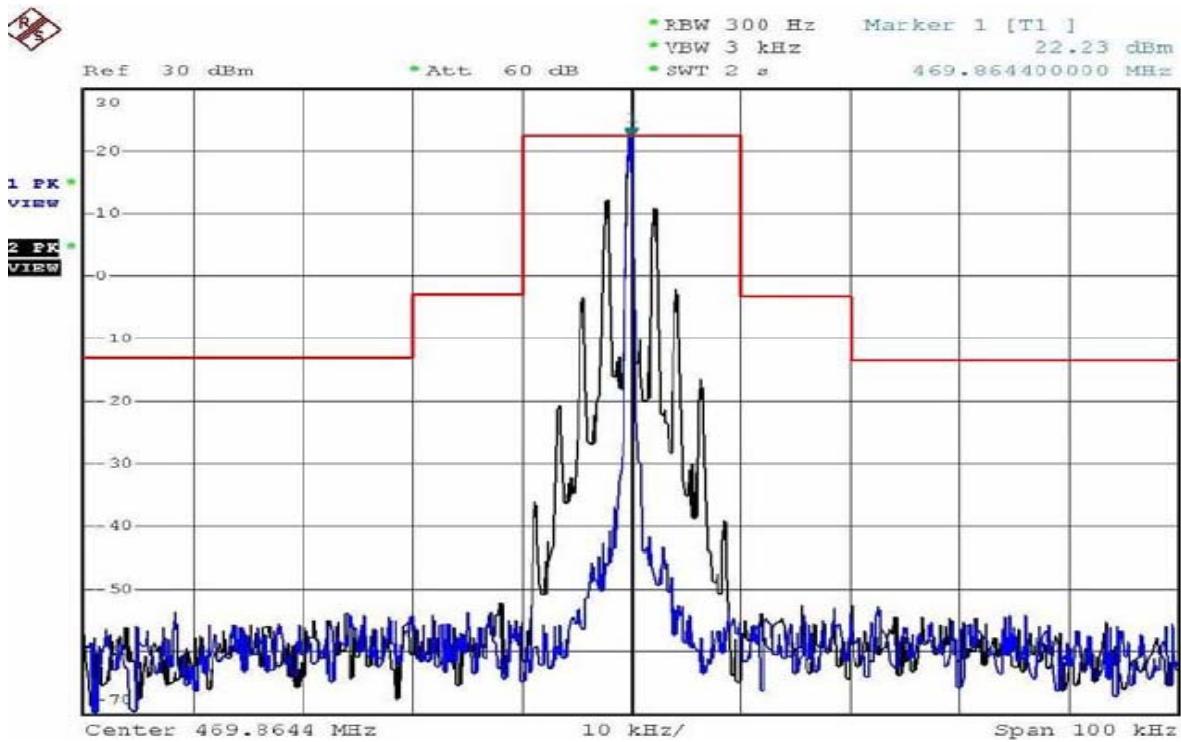
Test Result: Pass

Please refer the following curve and plots.

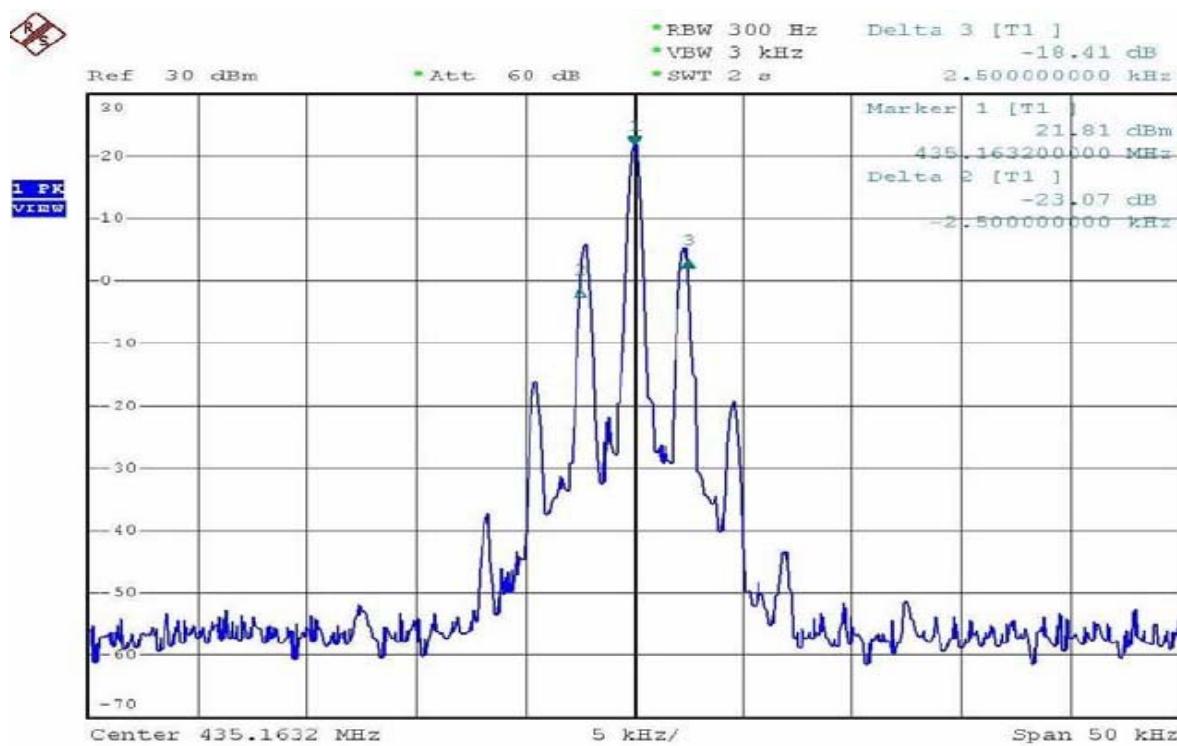
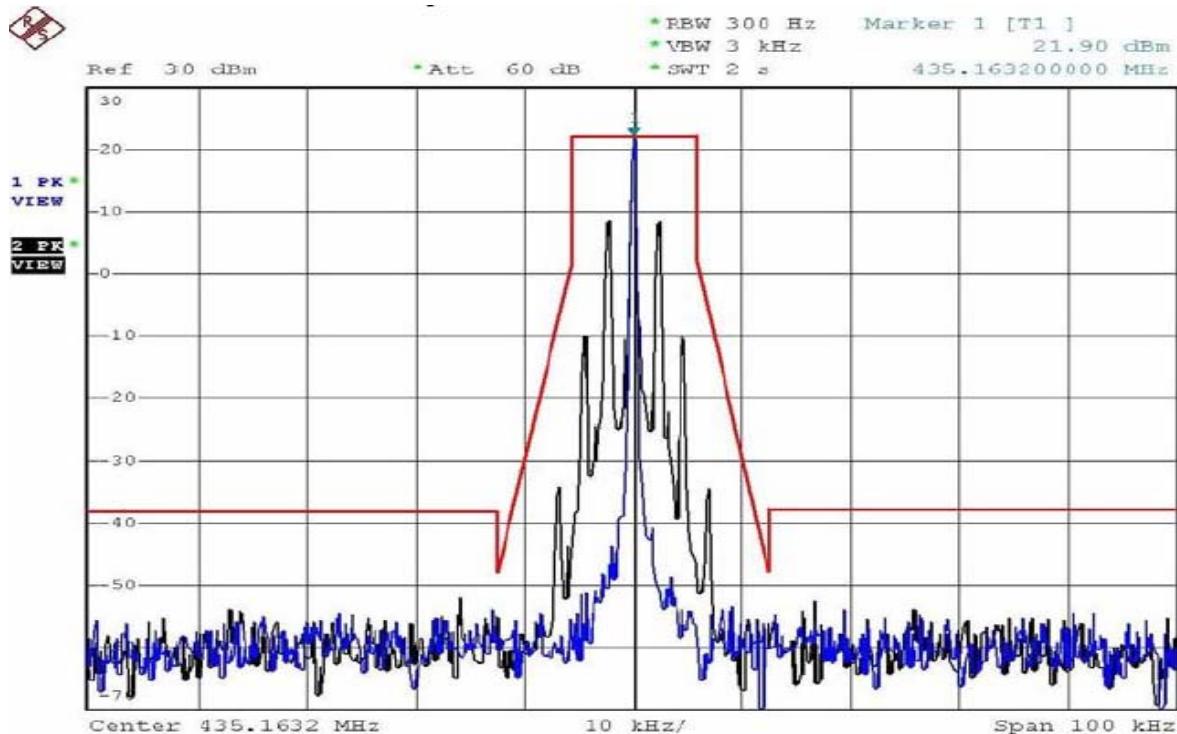
## 25KHz Channel Separation

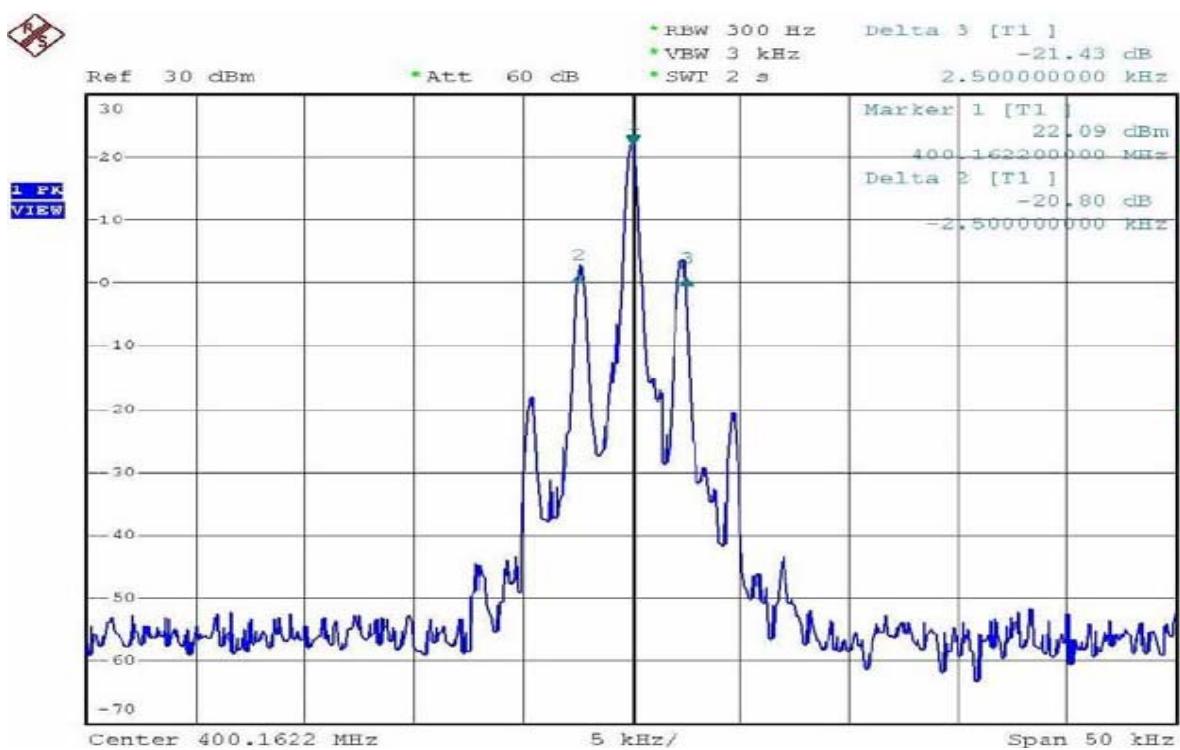
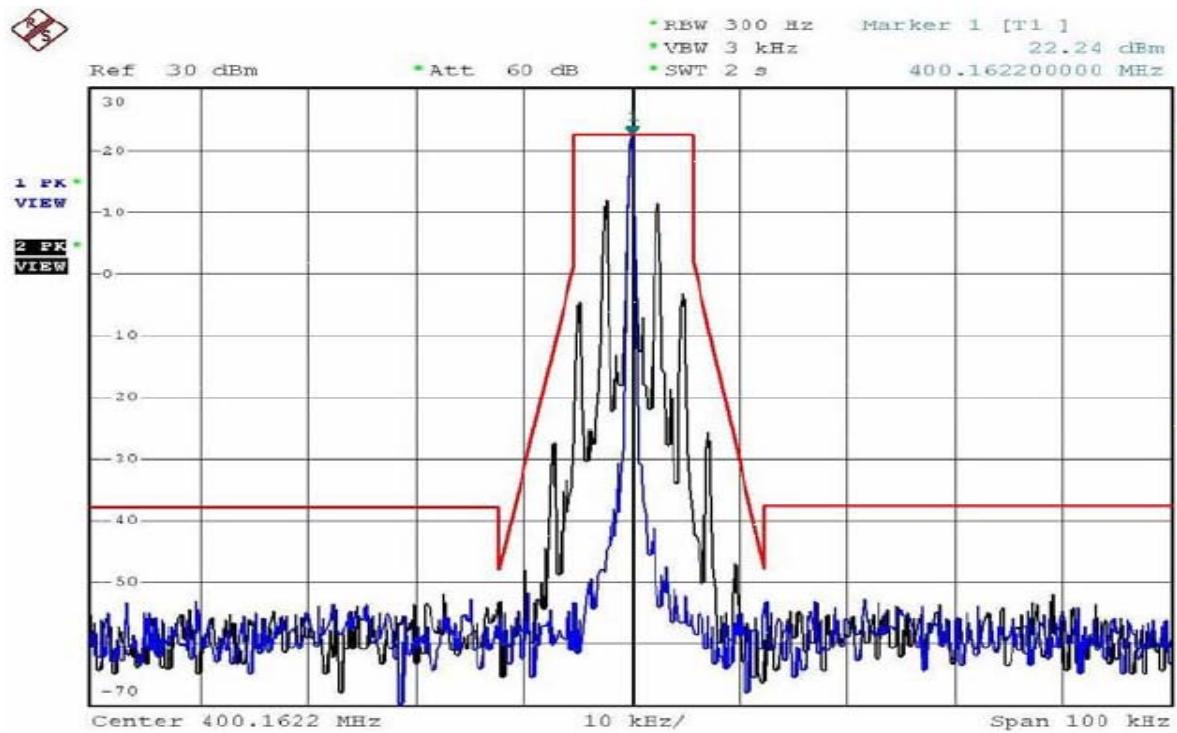


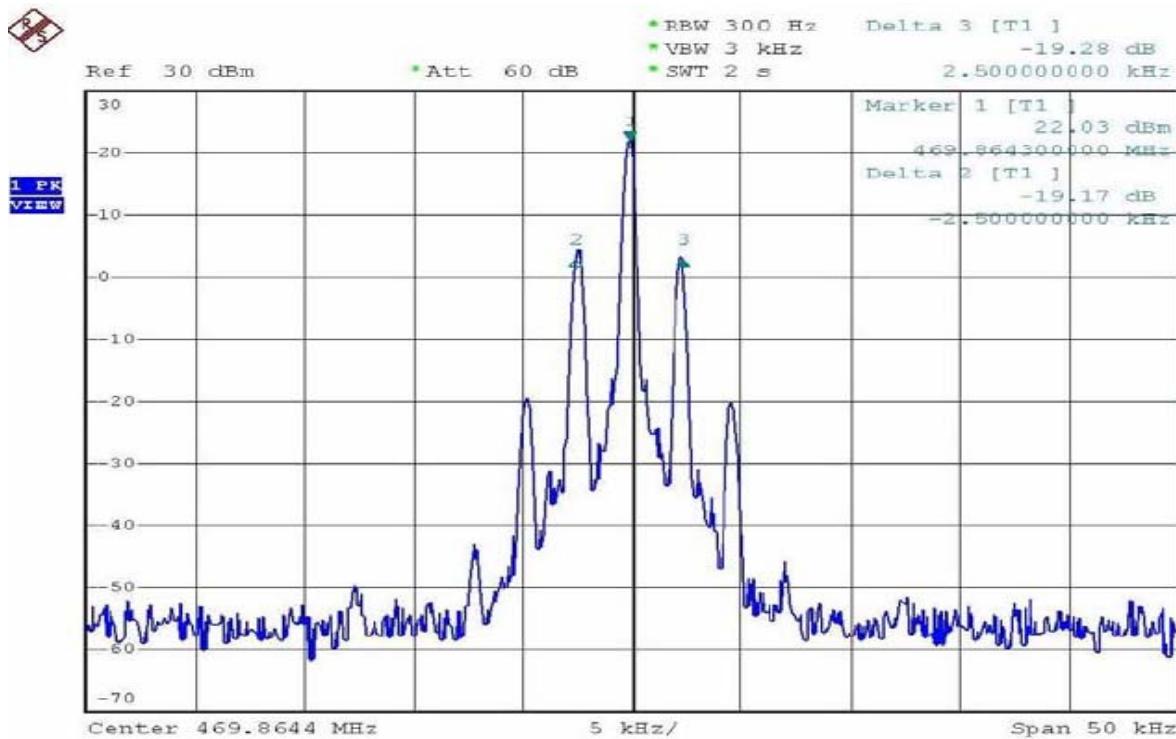
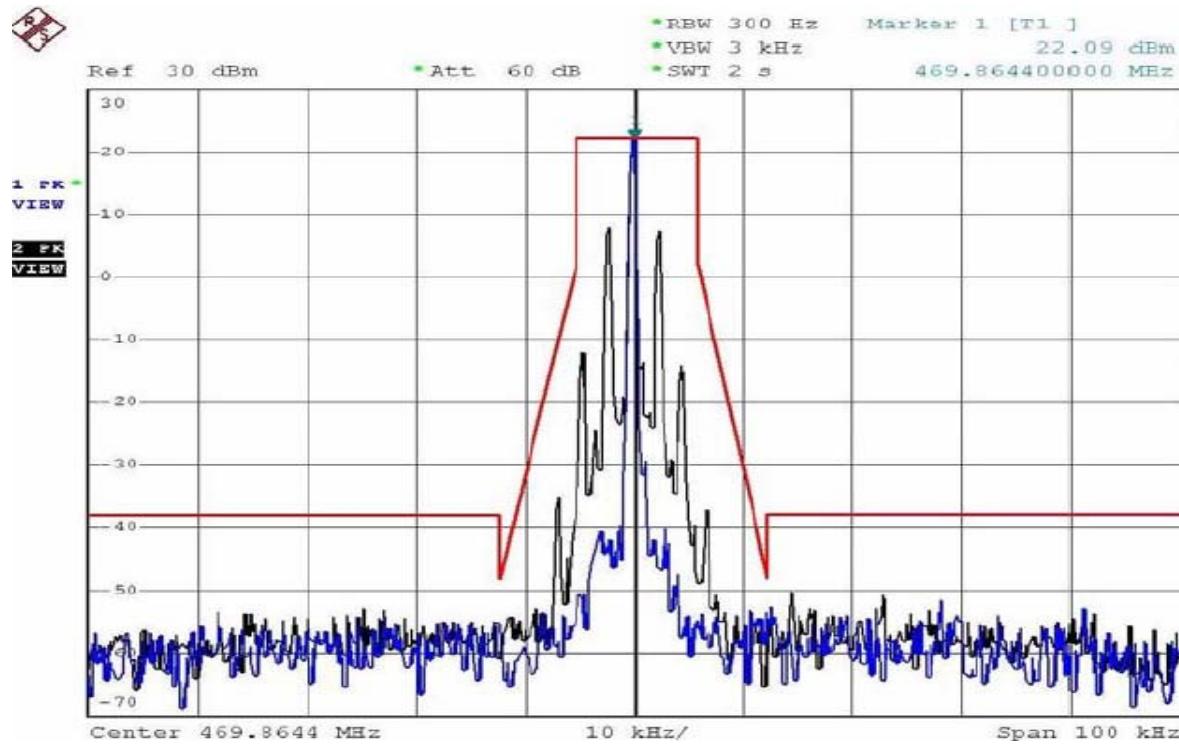




## 12.5KHz Channel Separation







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## RADIATED SPURIOUS EMISSION

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### Provision Applicable

Per FCC §2.1051 and FCC §90.210(b)

For 25 KHz channel separation, on any frequency removed from the center of the assigned channel by more than 250 percent at least:  $43 + 10 \log(P) \text{ dB}$

For 12.5 KHz Channel Separation, 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:  $50 + 10 \log(P) \text{ dB}$

### 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 tenth 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 =  $10 \lg(\text{TXpwr in Watts}/0.001)$  – the absolute level

Spurious attenuation limit in dB =  $43 + 10 \log_{10}(\text{power out in Watts})$

### Test Result

All spurious emission is more than 20dB below the limit, so the test data were omitted.

EUT					Generator					Standard		
Indicated		Table	Test Antenna		Substitution		Substitution	Correction Factor		Absolute level	FCC Part 90	
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Polar	Antenna	Cable	dBm	Limit	Margin
25KHz Channel Separation High Channel Primary scan 30 - 5000 MHz, Transmitting												
/	/	/	/	/	/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/	/	/	/	/	/
25KHz Channel Separation Middle Channel Primary scan 30 - 5000 MHz, Transmitting												
/	/	/	/	/	/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/	/	/	/	/	/
25KHz Channel Separation Low Channel Primary scan 30 - 5000 MHz, Transmitting												
/	/	/	/	/	/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/	/	/	/	/	/
12.5KHz Channel Separation High Channel Primary scan 30 - 5000 MHz, Transmitting												
/	/	/	/	/	/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/	/	/	/	/	/
12.5KHz Channel Separation Middle Channel Primary scan 30 - 5000 MHz, Transmitting												
/	/	/	/	/	/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/	/	/	/	/	/
12.5KHz Channel Separation Low Channel Primary scan 30 - 5000 MHz, Transmitting												
/	/	/	/	/	/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/	/	/	/	/	/

**Result:** Pass

## SPURIOUS EMISSION AT ANTENNA TERMINAL

### Standard Applicable

Per FCC §2.1051 and FCC §90.210(b)

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

$43 + 10 \log (P) \text{ dB}$

### Measurement Procedure

The RF output of the transceiver 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<sup>th</sup> harmonic.

### Test Result

Spurious Emission At Antenna Port		Limit (dBm)
Frequency (MHz)	Level (dBm)	
25KHz Channel Separation, Low Channel		
800.050	-44.6	-13
1200.075	-43.5	-13
1600.100	-48.6	-13
2000.125	-52.2	-13
2400.150	-58.1	-13
25KHz Channel Separation, Middle Channel		
870.050	-45.9	-13
1350.075	-44.6	-13
1740.100	-47.9	-13
2175.125	-52.0	-13
2610.15	-57.1	-13
25KHz Channel Separation, High Channel		
939.950	-46.3	-13
1409.925	-46.0	-13
1879.900	-49.6	-13
2349.875	-53.7	-13
2819.850	-58.8	-13

Spurious Emission At Antenna Port		Limit (dBm)
Frequency (MHz)	Level (dBm)	
12.5KHz Channel Separation, Low Channel		
800.025	-45.7	-20
1200.0375	-42.9	-20
1600.050	-48.2	-20
2000.0625	-53.3	-20
2400.075	-57.6	-20
12.5KHz Channel Separation, Middle Channel		
870.025	-45.2	-20
1350.0375	-44.4	-20
1740.050	-47.1	-20
2175.0625	-52.5	-20
2610.075	-56.8	-20
12.5KHz Channel Separation, High Channel		
939.975	-46.8	-20
1409.9625	-45.6	-20
1879.950	-48.9	-20
2349.9375	-53.1	-20
2819.925	-58.0	-20

## FREQUENCY STABILITY MEASUREMENT

### Provision Applicable

According to §90.213, for operating band within 421-512MHz and output power > 2 watts, the frequency stability limit is 2.5 ppm.

According to FCC Part 2 Section 2.1055 (a)(2), for battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacturer.

### Test Procedure

#### Frequency stability versus environmental temperature

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

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

#### Frequency Stability versus Input Voltage

At room temperature ( $25 \pm 1^\circ\text{C}$ ), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for end, 100% and 85% of the nominal operating input voltage.

### Test Results

#### Frequency Stability versus Input Voltage, Battery operation end point voltage is 6.0 V

For 25 KHz Channel Separation

Test Condition	Frequency Measured (MHz)	Frequency Error (ppm)	Limit (ppm)
Temperature ( $^\circ\text{C}$ )			
25	400.024981	-0.046	$\pm 5.0$
25	435.024980	-0.046	$\pm 5.0$
25	469.974979	-0.045	$\pm 5.0$

For 12.5 KHz Channel Separation

Test Condition	Frequency Measured (MHz)	Frequency Error (ppm)	Limit (ppm)
Temperature ( $^\circ\text{C}$ )			
25	400.012472	-0.07	$\pm 2.5$
25	435.012479	-0.05	$\pm 2.5$
25	469.987468	-0.07	$\pm 2.5$

**Frequency stability versus environmental temperature**

Low Channel  
25KHz Channel Separation

<b>Test Condition</b>		Frequency Measured (MHz)	Frequency Error (ppm)	Limit (ppm)
Temperature (°C)	Voltage (V)			
50	7.2	400.024980	-0.046	±5.0
40	7.2	400.024976	-0.055	±5.0
30	7.2	400.024981	-0.044	±5.0
20	7.2	400.024986	-0.032	±5.0
10	7.2	400.024982	-0.041	±5.0
0	7.2	400.024984	-0.037	±5.0
-10	7.2	400.024984	-0.037	±5.0
-20	7.2	400.024983	-0.039	±5.0
-30	7.2	400.024982	-0.041	±5.0

12.5KHz Channel Separation

<b>Test Condition</b>		Frequency Measured (MHz)	Frequency Error (ppm)	Limit (ppm)
Temperature (°C)	Voltage (V)			
50	7.2	400.012478	-0.05	±2.5
40	7.2	400.012469	-0.08	±2.5
30	7.2	400.012472	-0.07	±2.5
20	7.2	400.012472	-0.07	±2.5
10	7.2	400.012473	-0.07	±2.5
0	7.2	400.012473	-0.07	±2.5
-10	7.2	400.012474	-0.06	±2.5
-20	7.2	400.012472	-0.07	±2.5
-30	7.2	400.012473	-0.07	±2.5

Middle Channel:  
25KHz Channel Separation

Test Condition		Frequency Measured (MHz)	Frequency Error (ppm)	Limit (ppm)
Temperature (°C)	Voltage (V)			
50	7.2	435.024978	-0.051	±5.0
40	7.2	435.024979	-0.048	±5.0
30	7.2	435.024981	-0.044	±5.0
20	7.2	435.024980	-0.046	±5.0
10	7.2	435.024981	-0.044	±5.0
0	7.2	435.024978	-0.051	±5.0
-10	7.2	435.024979	-0.048	±5.0
-20	7.2	435.024983	-0.039	±5.0
-30	7.2	435.024981	-0.044	±5.0

12.5KHz Channel Separation

Test Condition		Frequency Measured (MHz)	Frequency Error (ppm)	Limit (ppm)
Temperature (°C)	Voltage (V)			
50	7.2	435.012478	-0.05	±2.5
40	7.2	435.012479	-0.05	±2.5
30	7.2	435.012479	-0.05	±2.5
20	7.2	435.012477	-0.05	±2.5
10	7.2	435.012474	-0.06	±2.5
0	7.2	435.012474	-0.06	±2.5
-10	7.2	435.012473	-0.06	±2.5
-20	7.2	435.012474	-0.06	±2.5
-30	7.2	435.012474	-0.06	±2.5

High Channel  
25KHz Channel Separation

Test Condition		Frequency Measured (MHz)	Frequency Error (ppm)	Limit (ppm)
Temperature (°C)	Voltage (V)			
50	7.2	469.974979	-0.045	±5.0
40	7.2	469.974980	-0.047	±5.0
30	7.2	469.974978	-0.047	±5.0
20	7.2	469.974976	-0.051	±5.0
10	7.2	469.974978	-0.047	±5.0
0	7.2	469.974977	-0.049	±5.0
-10	7.2	469.974979	-0.045	±5.0
-20	7.2	469.974979	-0.045	±5.0
-30	7.2	469.974978	-0.047	±5.0

12.5KHz Channel Separation

Test Condition		Frequency Measured (MHz)	Frequency Error (ppm)	Limit (ppm)
Temperature (°C)	Voltage (V)			
50	7.2	469.987468	-0.07	±2.5
40	7.2	469.987469	-0.07	±2.5
30	7.2	469.987468	-0.07	±2.5
20	7.2	469.987467	-0.07	±2.5
10	7.2	469.987468	-0.07	±2.5
0	7.2	469.987467	-0.07	±2.5
-10	7.2	469.987469	-0.07	±2.5
-20	7.2	469.987468	-0.07	±2.5
-30	7.2	469.987468	-0.07	±2.5

## TRANSIENT FREQUENCY BEHAVIOUR OF THE TRANSMITTER

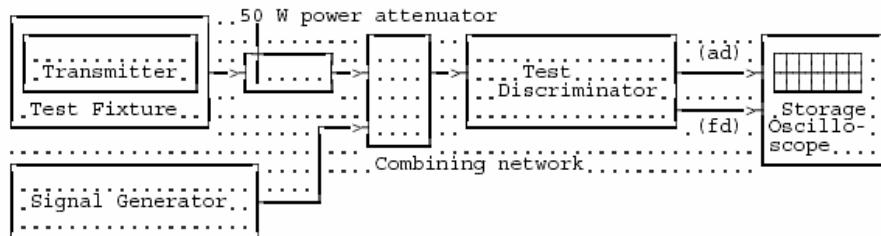
### Standard Applicable

The transient periods are given in following table:

Frequency Range	30 MHz to 300 MHz	Above 300 MHz to 500 MHz	Above 500 MHz to 1000MHz
$t_1(\text{ms})$	5.0	10.0	20.0
$t_2(\text{ms})$	20.0	25.0	50.0
$t_3(\text{ms})$	5.0	10.0	10.0

### Test Measurement

The transmitter shall be placed in the test fixture and the measurement shown in following figure shall be used.



Two signals shall be connected to the test discriminator via a combining network.

The transmitter output from the test fixture shall be connected a to a  $50 \Omega$  power antenuator.

The output of the power attenuator shall be connected to the test discriminator via one input of the combining network.

A test signal generator shall be connected to the second input of the combining network.

The test signal shall be adjusted to the nominal frequency of the transmitter.

The test signal shall be modulated by a frequency of 1 kHz with a deviation equal to  $\pm$  the value of the relevant channel separation.

**The test signal level shall be adjusted to correspond to 0.1% of the power of the transmitter under test measured at the input of the test discriminator. This level shall be maintained throughout the measurement.**

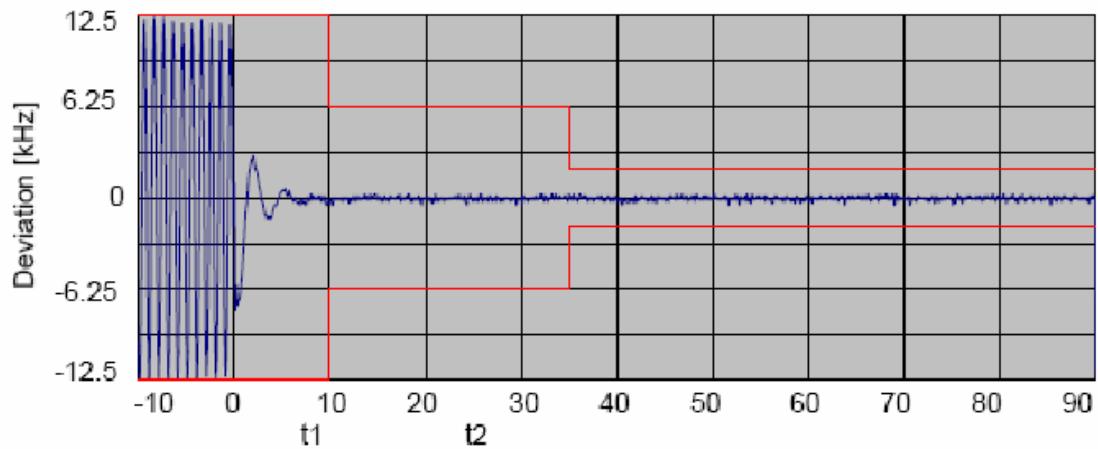
The amplitude difference (ad) and the frequency difference (fd) output of the test discriminator shall be connected to a storage oscilloscope.

### Test Results

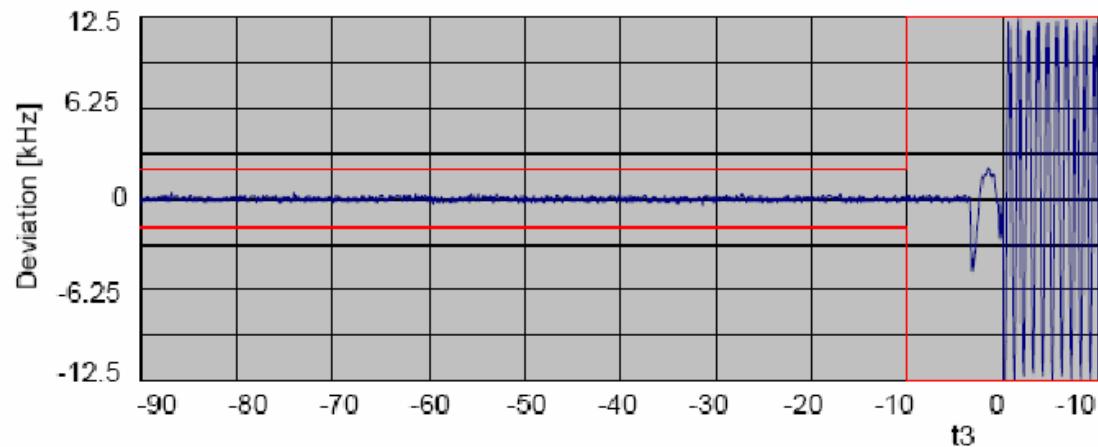
PASS

Please refer to the following plots.

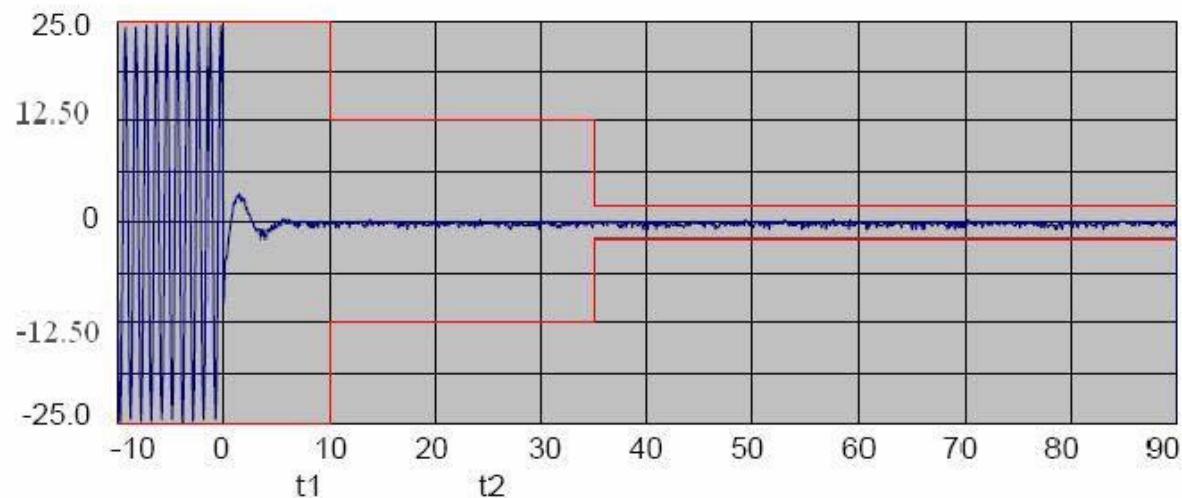
## Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation-----Off – On



## Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation-----On - Off



## Transmitter Frequency Behaviour @ 25 KHz Channel Separation-----Off – On



## Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation-----On – Off

