



Report No.: 030560 rev.03 \_ US  
FCC ID: OMDMSF0001  
Client: Listen Technologies Corporation

023



NVLAP LAB CODE: 200413-0

August 11, 2003

## Test Record

Product Verification  
According to FCC Part 95 Subparts E,G

for

**LISTEN TECHNOLOGIES CORPORATION**

**MODEL: MSF0001**

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## Revision History

Revision	Date	Description of Changes	Author
0.1	11 Aug 2003	Initial document	V.Shapiro/L.Kogan
0.2	26 Sept.2003	Revised pages 14-16,18,20,22,31,43:	L.Kogan
0.3	06 Nov.2003	Revised pages:16,19-22,42-54	L.Kogan

## Introduction – Test Plan

This report describes the results of all measurements made on an Low Power Radio Service (LPRS) portable transmitter which falls under the class of intentional radiator by the FCC Part 95 Rules and Regulations.

This EUT is designated:

**Wireless Audio FM Transmitter/Receiver for personal use.**

Model :

**MSF0001**

The **EUT** is designed and manufactured by **Listen Technologies Corporation**.

The EUT was tested in full compliance with the FCC Regulations using the methods of FCC Part 95 and Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”. The results of the testing indicate that the MSF0001 met the Part 95 limits and requirements.

## 1.0 CERTIFICATION OF TEST DATA

### Verification statement.

The data, data evaluation and equipment configuration represented herein are a true and accurate representation of the test sample (EUT), and characteristics and measurements obtained as of the dates and the times of the test under the conditions specified and to the methods of FCC Part 95 “Personal radio Services” and Part 2 “Frequency Allocations and radio Treaty Matters; General Rules and regulations”

The test results provided with this report, indicate that the equipment tested:

**WIRELESS AUDIO FM TRANSMITTER/RECEIVER FOR PERSONAL USE.**  
**MODEL : MSF0001** is compliant with the following Rules and Regulations with modifications of the design:

- A. 47 Code of Federal Regulations, Part 95, Subpart E and G
- B. 47 Code of Federal Regulations, Part 2
- C. 47 Code of Federal Regulations, Part 15.109

Tests performed by:

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E-mail:emc@jmr.com

## **2.0 GENERAL INFORMATION**

### **2.1 Client Information**

Company Name: Listen Technologies Corporation  
Contact: Russell Gentner  
Company Address: 8535 South 700 West, Suite A  
Sandy, UT 84070  
Phone: (801) 233-8992

### **2.2 Administrative Data**

Device tested: Wireless Audio FM Transmitter/Receiver for personal use  
Model: MSF0001  
Equipment category: LPRS  
Accessories: N/A  
Expository Statement: This device is intended for personal use and in public facilities  
Purpose of test: Compliance to FCC Rules and Regulations, Part 95, Subparts E and G and Part 15.109  
Date of test: 07/31/2003 – 11/06/2003  
Place of the test: JMR Electronics, Inc.  
Compliance Engineering Laboratory  
20400 Plummer Street  
Chatsworth, CA 91311  
Phone: (818) 993-4801

### **3.0 Description of Equipment Under Test (EUT)**

#### **3.1 Brief Description of the EUT**

The EUT, Microfield MSF0001, is the Low Power radio Service (LPRS) FM Transmitter/Receiver with RF transmitting frequency range of 216.0125 MHz – 216.9875 MHz . The EUT receives audio on three frequency bands :

- 1) 72.0250 MHz – 75.9750 MHz for FM Receiver, 57 channels;
- 2) 216.0125 MHz – 216.9875 MHz for FM Receiver, 62 channels;
- 3) Multiple Infrared (IR) Channels

The EUT was design to aid children and adults with hearing impairments by receiving audio transmissions (for personal use and in public settings as required by the ADA) and re-transmitting them directly to the individual's hearing aid. Several hearing aid manufacturer's provide such receivers as an accessory to their products."

The EUT was configured as an independent module, standalone device and was tested with standard Microphone and Speaker connected. The modulation frequency was provided by external Test Oscillator HP 651B.

**Operating frequencies :** 216.0125 – 216.9875 MHz .

**Clock frequencies :** 4MHz, 48MHz.

**Power Supply :** External Power AC Adapter : Sino-American, Model A41208D,  
Input : 120 VAC 60Hz, Output : 12 VDC, 300 mA

#### **3.2 Test Run**

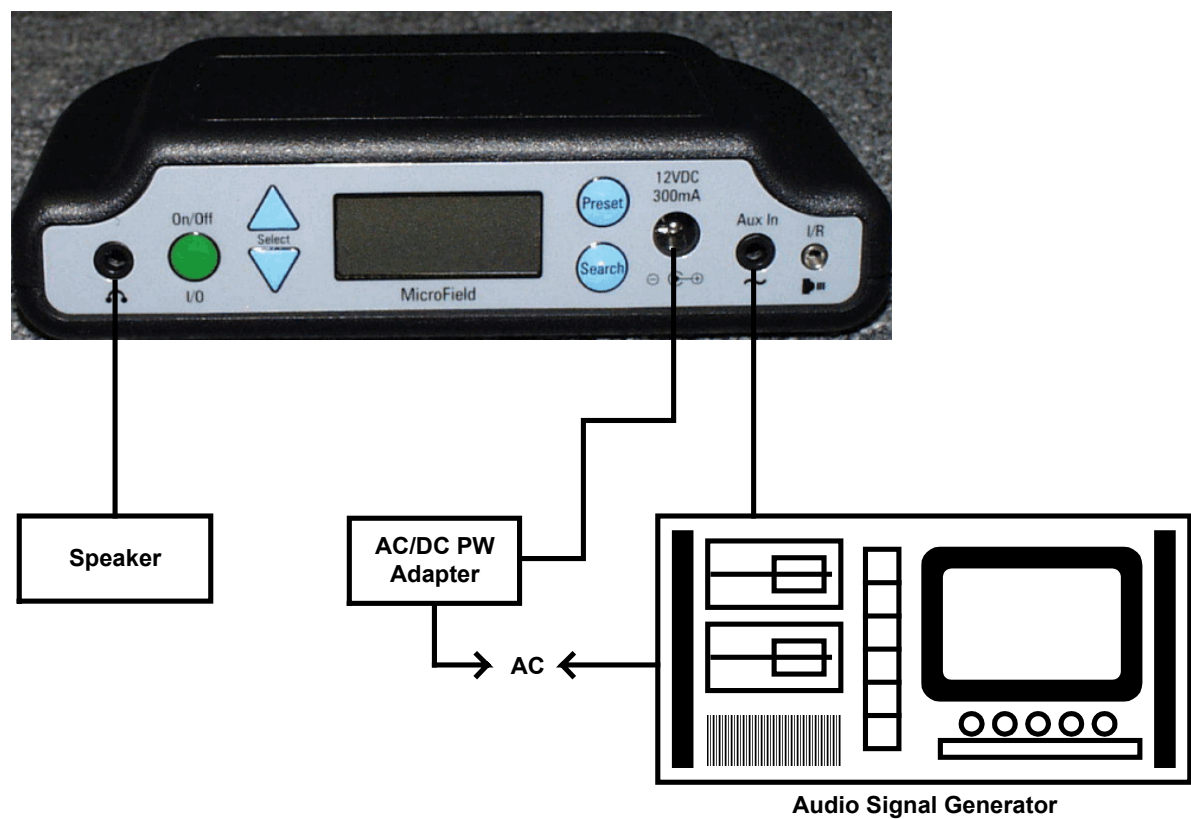
- 1) The EUT was connected through AC Power adapter to AC 110 VAC lines;
- 2) Standard Microphone and Speaker devices were connected to the appropriate input/output of the EUT;
- 3) Test Oscillator HP 651B had been connected to the Aux In input when it was necessary.

For test purposes the following channels were selected for measurements :

- 1) three channels – Channel 1 / 216.0125 MHz, Channel 61 / 216.5125 MHz and Channel 80 / 216.9875 for FM LPRS Transmitter;
- 2) one channel – 9E / 72.9250 MHz for FM Receiver in frequency range of 72-76 MHz;
- 3) one channel – 61 / 216.5125 MHz for FM Receiver in frequency range of 216-217 MHz;
- 4) one channel – 94 / 2.3 MHz for IR Receiver.

Each channel had generated/received its frequency continuously for the duration of the testing. The above mentioned set-up allowed the article to perform sufficiently for the test purposes and required time.

### 3.3 Block Diagram of the Test Setup



### 3.4 Support Equipment List:

No	Equipment	Model	S/N (last 6)	Notes
1	HP Test Oscillator	651B	1230A08435	
2	IFR Communication Analyser	1500A		
3	Standard Microphone	N/A	N/A	
4	Standard Speaker	N/A	N/A	

### 3.5 Cabling Configuration

#### Power Cords:

Unit	The EUT, nondetachable AC Adapter Power cable
MFG	Sino-American
Shielded	No
Length	2.0 m

Unit	HP 651B Test Oscillator
MFG	Standard
Shielded	No
Length	2 m

Unit	Communication Analyzer 1500A
MFG	Standard
Shielded	No
Length	2 m

#### I / O Cables External:

Connection	Mic input of the EUT
Cable	Generic microphone cable
Shielded?	No
Connector	Mic jack
Length	1 m

Connection	AUX In of the EUT
Cable	Generic Speaker cable
Shielded?	No
Connector	Speaker jack
Length	0.3 m

Connection	AUX In of the EUT to Out, 50 Ohm of the HP 651B
Cable	Generic 50 Ohm RF cable
Shielded?	Yes
Connector	BNC, Jack
Length	0.3 m



**Photos of the EUT**



**EUT: MSF0001 with AC-DC A41208D Power Adapter  
Front View**



**EUT: MSF0001 FM Transmitter/Receiver**  
**Front View**





**EUT: MSF0001 FM Transmitter/Receiver**  
**Bottom View**

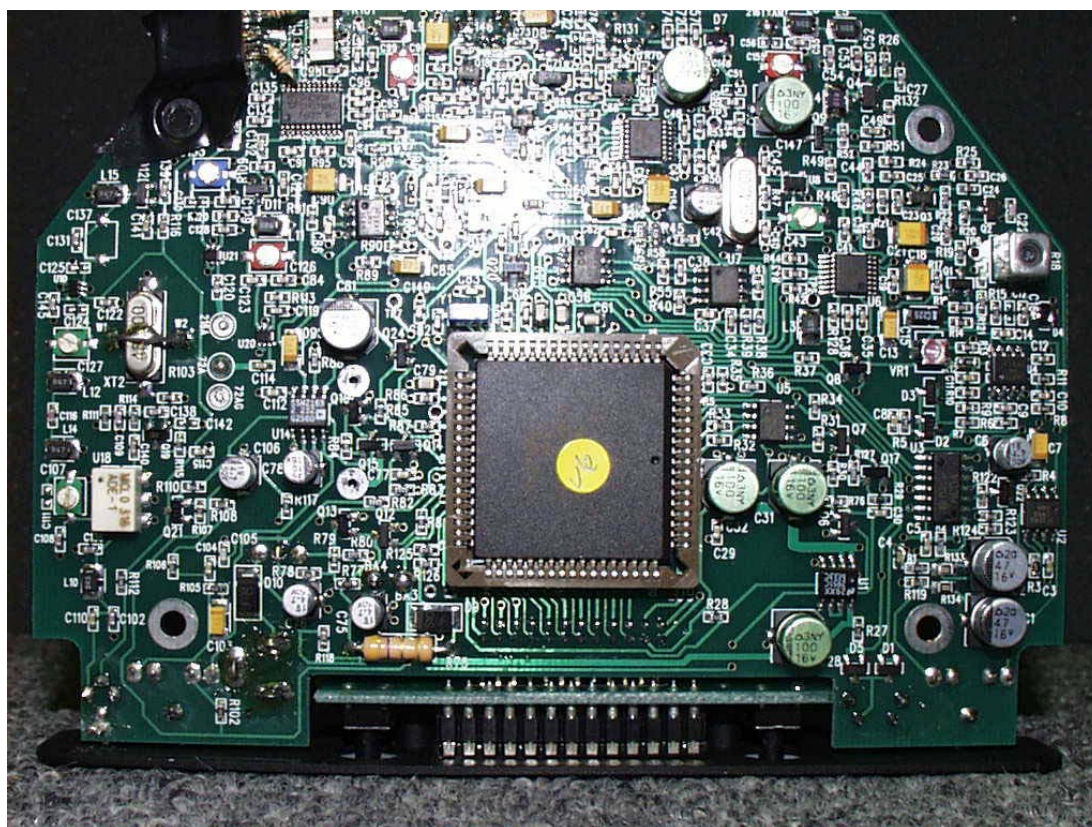


**EUT: MSF0001 FM , Power Adapter  
Front View**





**EUT: MSF0001 FM Transmitter/Receiver**  
**Solder side view without cover**



**EUT: MSF0001 FM Transmitter/Receiver  
PCB Component side view**

### 3.7 EUT Modifications

N/A

### 3.8 Photographs of EUT Modifications

N/A

#### 4.0 Test equipment used

Device	Model No.	Serial No.	Last Cal.	Next Cal
Cable 1	8214	CBL-006	06/21/03	06/21/04
Analyzer	HP85462A	3325A00120	04/11/03	04/11/04
Cable 2	8268	CBL-002	06/21/03	06/21/04
Preselector	HP85460A	3330A00117	04/11/03	04/11/04
Qpeak Adapter	HP85462 Internal	Internal	04/11/03	04/11/04
Pre-Amplifier	None			
Tower 1	EMCO 1050	9310-1786	N/A	N/A
Turntable 1	EMCO 1060	9409-1753	N/A	N/A
Bilog Antenna	CBL6112B	2604	08/08/02	08/08/03
DRG Horn Antenna	SAS-200/571	175	10/18/02	10/18/03
Log-Periodic Antenna	CBL6111	11167	11/01/02	11/01/03
Cable1	RG-214/U	CBL-001	06/21/03	06/21/04
Shielded Semi-Anechoic Chamber	RANTEC	N/A	02/11/03	02/11/04
Communication's Analyzer	IFR 1500A		07/01/03	07/01/04
16 Channel Thermocouple Monitor	SR630	34202	12/16/02	12/16/03
Temperature's Oven	Ingoco Ovens	5966B	N/A	N/a
Sorensen DC Power Supply	DCS80-13E	9916B1012	07/07/03	07/07/04
Temperature and Humidity Recorder	Dickson TH8-24C	5097755	09/16/03	09/16/05

## 5.0 RF Power Output

Type of Test : RF Power Output  
FCC Part 95 : Subclause 95.639 (e)  
FCC Part 2 : Subclause 2.1046

**Limit : The maximum transmitter output power authorized for LPRS is 100 mW that equals 20 dBm**

The test facility consists of a shielded semi-anechoic chamber with attached shielded control room. The semi-anechoic chamber is approximately 18 feet wide by 28 feet long by 19 feet high. A hybrid absorber combines high performance anechoic polyurethane foam with a ferrite tile base to achieve high levels of absorption and power dissipation capability.

The EUT had been placed at the 0.8 m height on the non-conducting table. Transmitter had been turned ON without modulation and worked at the frequencies of the selected 1, 61 and 80 channels.

All data was obtained via a HP 85876A EMI measurement software package using an HP 85462A Receiver which is compliant to CISPR 16. RF Power Level of the EUT was installed to maximum value equal “25”. The EUT was configured in various geometric patterns to find the geometric configuration and EUT attitude that produced the largest RF power.

After determination of the maximum emissions configuration the distance of the EUT to the scanning antenna was set to 3 meters.

**At each Channel 1, 61, and 80 RF Power Output had been measured. Then Effective Radiated power of each channel’s frequency had been determined by a substitution measurement. For substitution method of ERP measurement the CBL6111 antenna with RG-214/U, 26’ length cable and HP 8648A Signal generator were used.**

The equation for ERP determination is

$$\text{ERP} = P + \text{Gain} - L - 2.14 \quad \text{where}$$

**P** is a reading of the power delivered from calibrated HP8648A signal generator to the substitution antenna ;

**Gain** is the antenna gain (dBi) of the substitution antenna at the measured frequency ;

**2.14 dBi** - ideal dipole gain

**L** is the losses of the RG-214/U cable at the measured frequency.



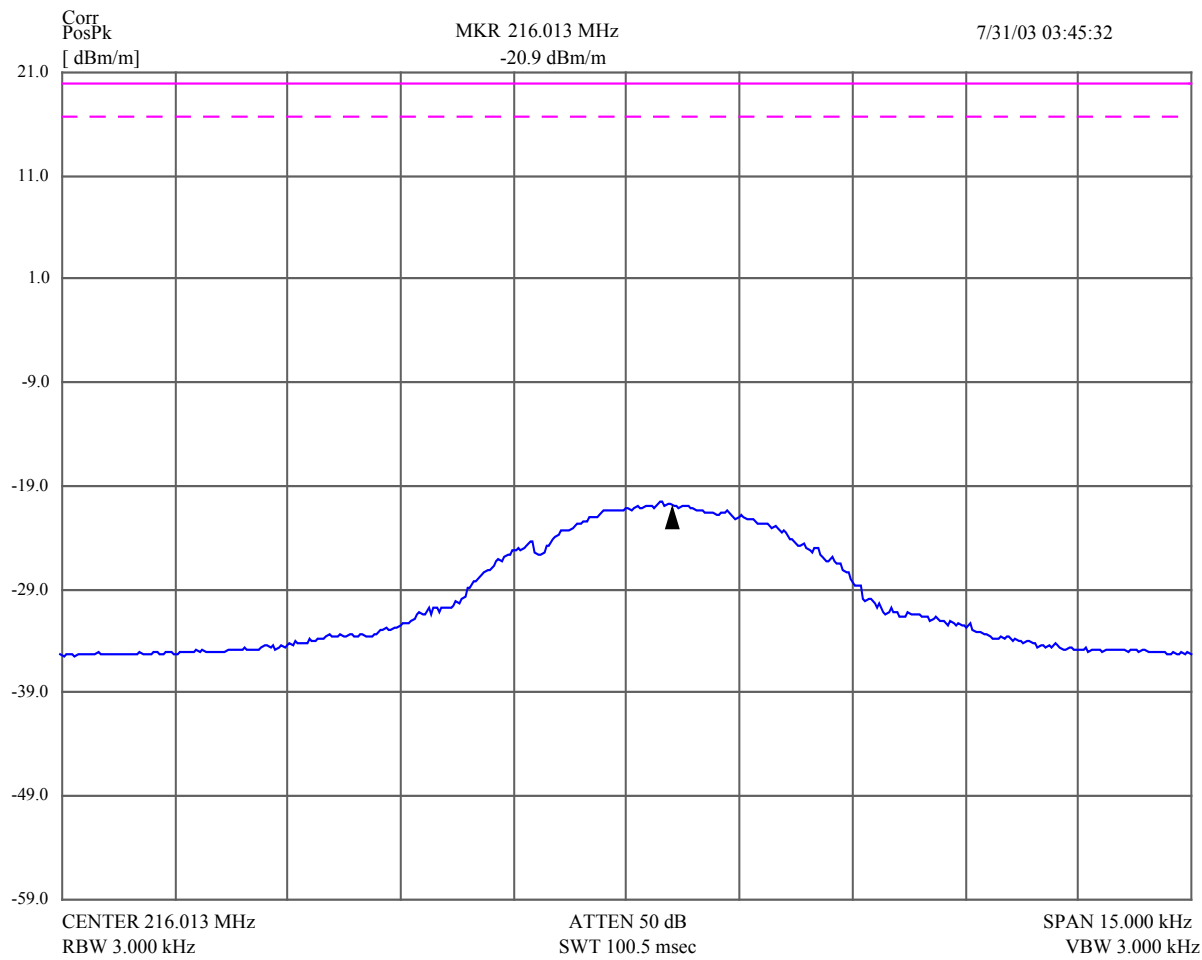
Below are the Peak and ERP measurements/calculation of the highest value RF Power output at the frequencies of the selected channels.

5.1. Channel 1

Peak value data

Frequency MHz	Peak dBm	Peak Limit dBm	DelLim - Peak dB	Status
216.013104	-20.9	20.0	- 40.9	PASS

Receiver graph of RF Power output at 3 m



The following are the result of the calculated ERP based on the actual HP8648A Signal generator readings at the transmitter channel's 1 frequency to produce the same peak field strength readings as above graph

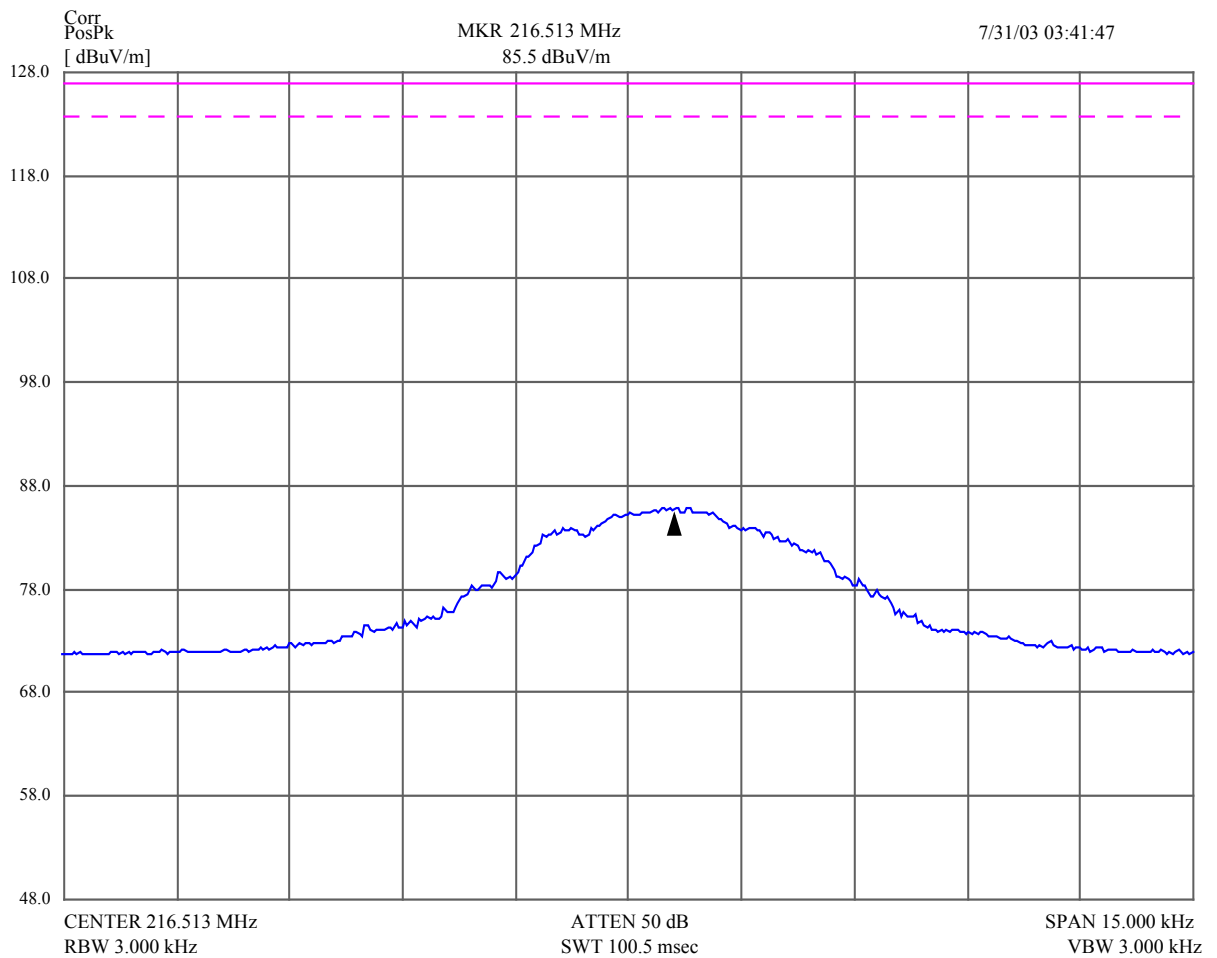
Frequency MHz	Peak dBm	P – HP8648A Reading dBm	Antenna gain dBi	Cable Losses dB	ERP Value dBm
216.012496	-20.8	-17.2	6.1	1.41	-14.65

## 5.2. Channel 61

### Peak value data

Frequency MHz	Peak dBm	Peak Limit dBm	DelLim - Peak dB	Status
216.513104	-21.35	20.0	-41.35	PASS

### Receiver graph of RF Power output at 3 m



The following are the result of the calculated ERP based on the actual HP8648A Signal generator readings at the transmitter channel's 61 frequency to produce the same peak field strength readings as above graph

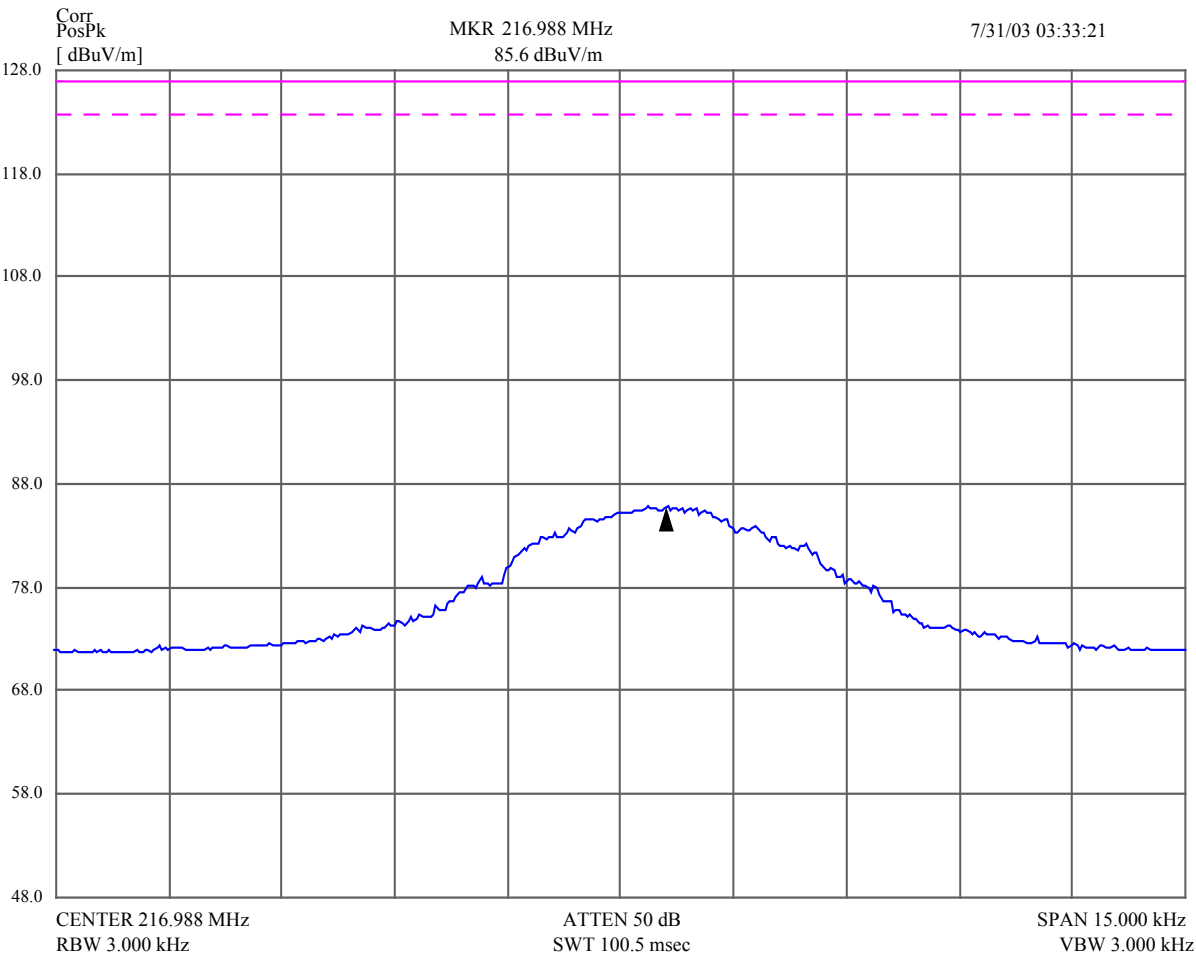
Frequency	Peak	P – HP8648A Reading	Antenna gain	Cable Losses	ERP Value
MHz	dBm	dBm	dBi	dB	dBm
216.513104	-21.3	-17.6	6.1	1.407	-15.05

### 5.3. Channel 80

#### Peak value data

Frequency MHz	Peak dBm	Peak Limit dBm	DelLim - Peak dB	Status
216.988144	-21.9	20.0	-41.9	PASS

#### Receiver graph of RF Power output at 3 m



The following are the result of the calculated ERP based on the actual HP8648A Signal generator readings at the transmitter channel's 80 frequency to produce the same peak field strength readings as above graph

Frequency	Peak	P – HP8648A Reading	Antenna gain	Cable Losses	ERP Value
MHz	dBm	dBm	dB	dB	dBm
216.988000	-21.8	-17.6	6.1	1.41	-15.05

## 6.0 Unwanted radiation

Type of Test : Unwanted radiation  
FCC Part 95 : Subclause 95.635 (c) (1)  
FCC Part 2 : Subclause 2.1046

**Limit :** Emissions for LPRS transmitters operating on standard band channels (25kHz) shall be attenuated below the unmodulated carrier in according the following :

- 1) emissions 12.5 kHz to 22.5 kHz away from the channel center frequency : at least 30 dB;
- 2) emissions more than 22.5 kHz away from the channel center frequency : at least 33 dB.

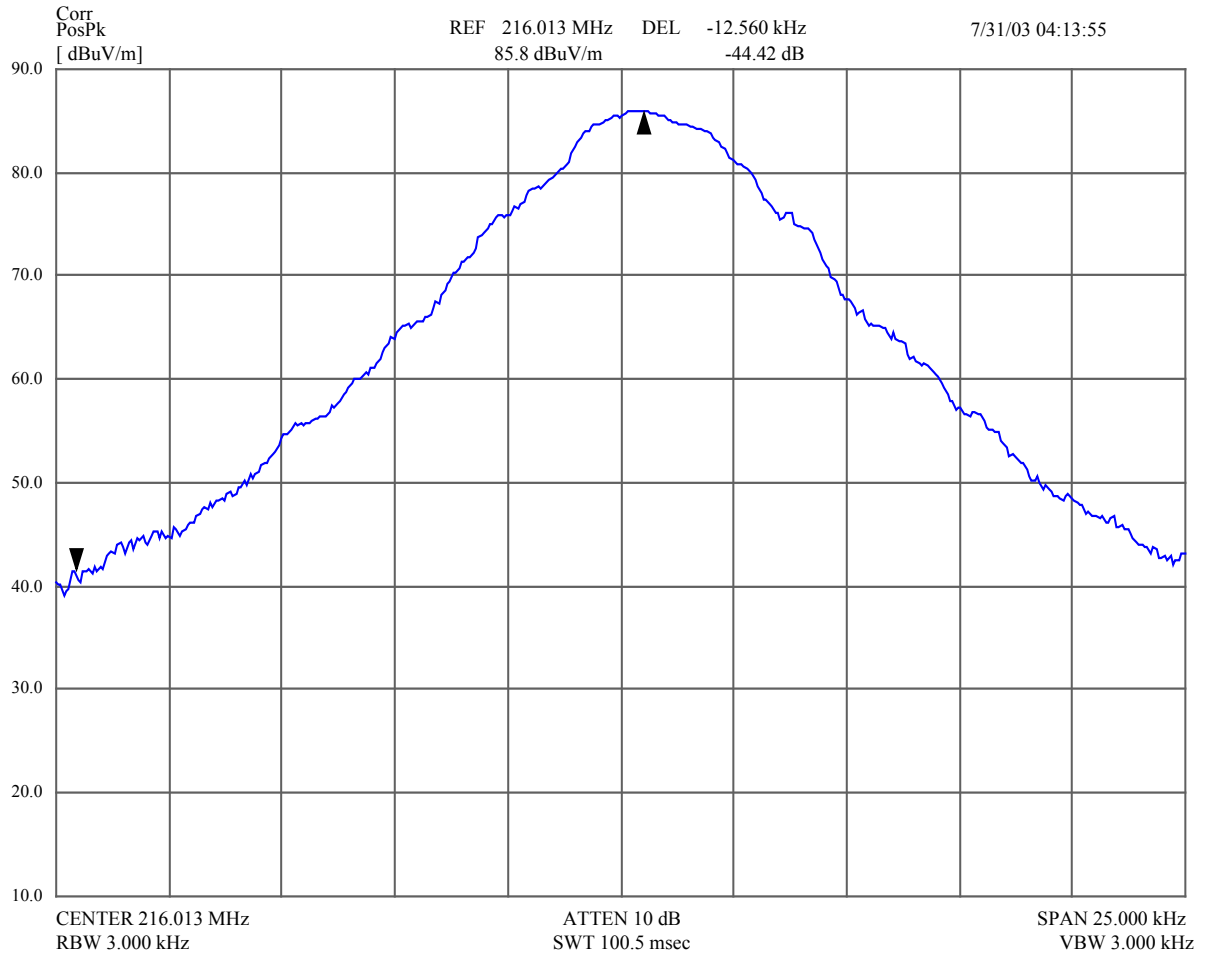
Below is the Peak measurements of the emission value UNWANTED RADIATION signals observed at the frequency carrier of the selected channels.

### 6.1 Channel 1

#### Emission values of the unwanted frequencies

Frequency MHz	Peak dBuV/m	Peak Carrier dBuV/m	Limit attenuation dB	Pk carrier- Pk dB	Status	Comment
216.000432	41.43	85.85	30	44.42	PASS	-(12.5...22.5) kHz
215.999980	41.42	85.85	33	44.43	PASS	> -22.5 kHz

Receiver graph of unwanted radiation



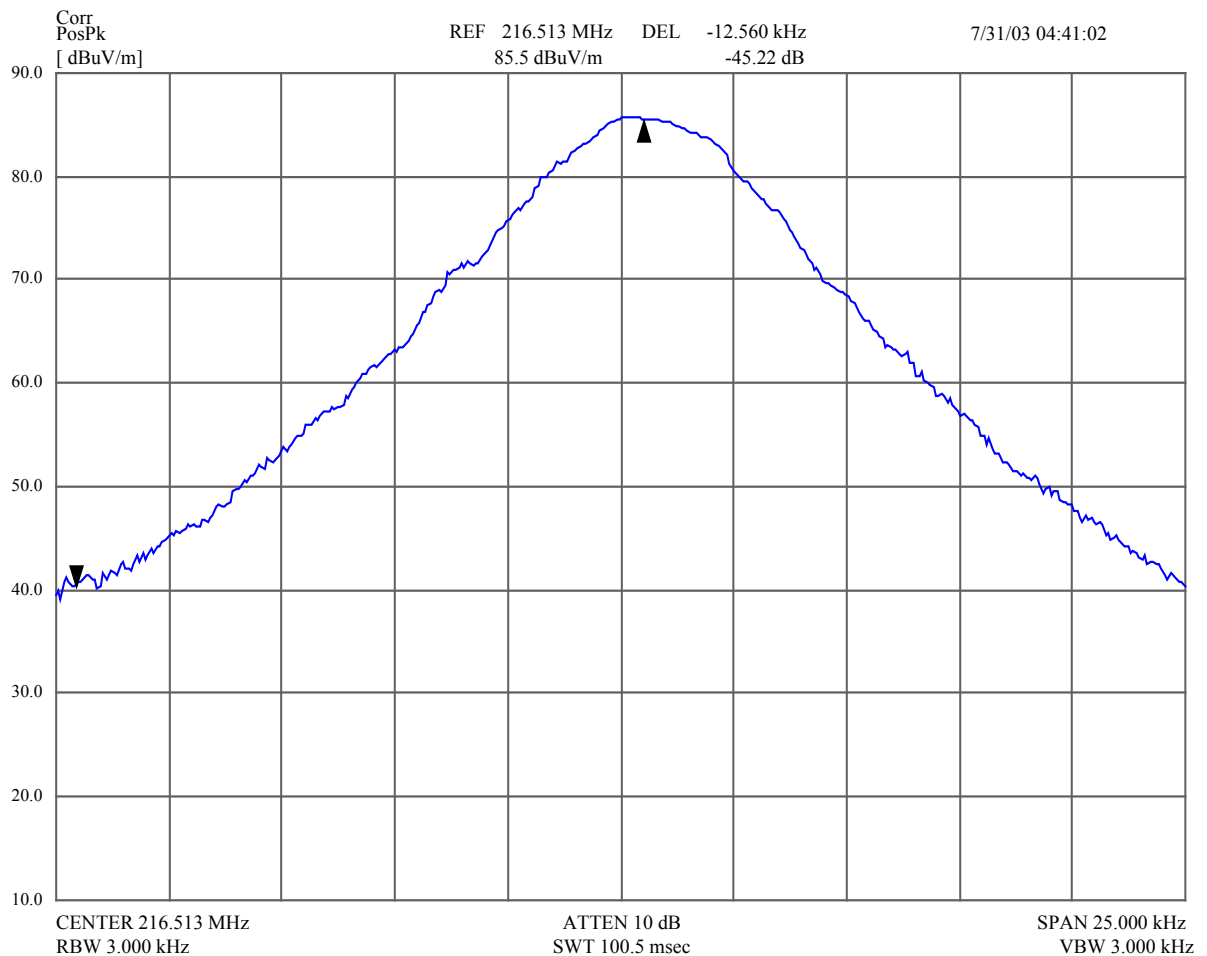


## 6.2 Channel 61

### Emission values of the unwanted frequencies

Frequency MHz	Peak dBuV/m	Peak Carrier dBuV/m	Limit attenuation dB	Pk carrier- Pk dB	Status	Comment
216.500432	40.25	85.47	30	45.22	PASS	-(12.5...22.5) kHz
215.499980	41.24	85.47	33	45.23	PASS	> -22.5 kHz

### Receiver graph of unwanted radiation

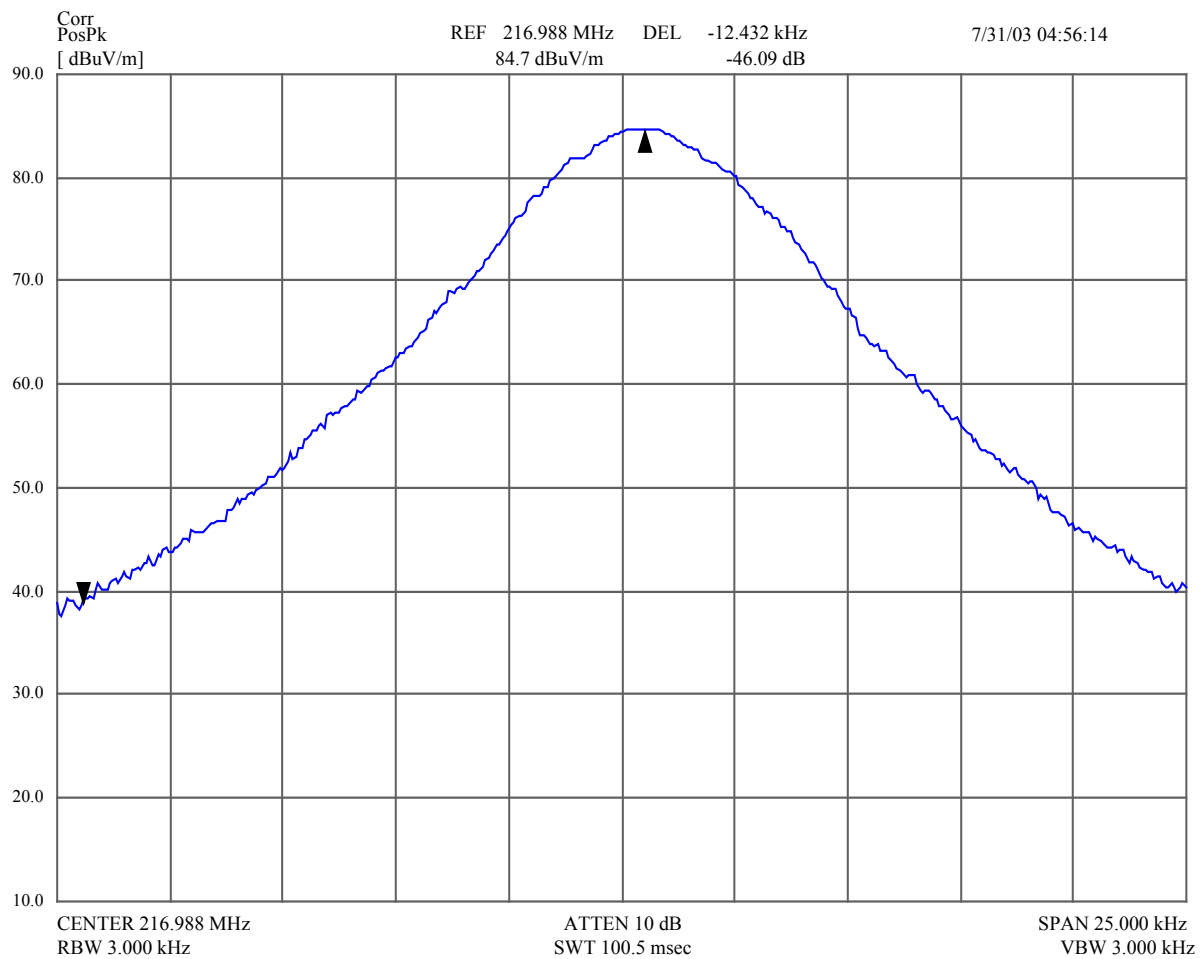


### 6.3 Channel 80

#### Emission values of the unwanted frequencies

Frequency MHz	Peak dBuV/m	Peak Carrier dBuV/m	Limit attenuation dB	Pk carrier- Pk dB	Status	Comment
216.975568	38.56	84.63	30	46.07	PASS	-(12.5...22.5) kHz
215.974999	38.55	84.63	33	46.07	PASS	> -22.5 kHz

#### Receiver graph of unwanted radiation



## 7.0 Occupied channel bandwidth

Type of Test : Occupied Channel bandwidth  
**FCC Part 95 :** Subclause 95.633 (d) (2)  
**FCC Part 2 :** Subclause 2.1049 © (1)

The channel Bandwidth (BW) is defined as the minimum declared bandwidth +/- 12.5 kHz, within which the transmitter's necessary bandwidth can be contained.

The BW value was defined using The First Carrier Null procedure :

1. The Transmitter was adjusted to work at the selected channels -1, 61 and 80. All measurements were conducted by the HP 85462A Spectrum Analyzer;
2. The test Signal generator HP651B was connected to the Aux audio input of the EUT with amplitude equals 150 mV rms. This value had been defined by **Limiting Threshold measured (see below, an audio input level versus a modulation frequency) ;**
3. Then the modulation frequency at test Signal Generator had been adjusted to the certain value **Fmod** at which the First carrier Null was achieved ;
4. The Channel BW was calculated by the following equation :

$$BW = +/- [ (Fmod \times M ) ( kHz)$$

Where :

**Fmod** = the certain frequency of the Signal Generator at which the First Carrier Null was achieved ;

**M** = Modulation index equal 2.4 for the First Carrier null ;

## 7.1 Test Results

### 7.1.1 Limiting Threshold

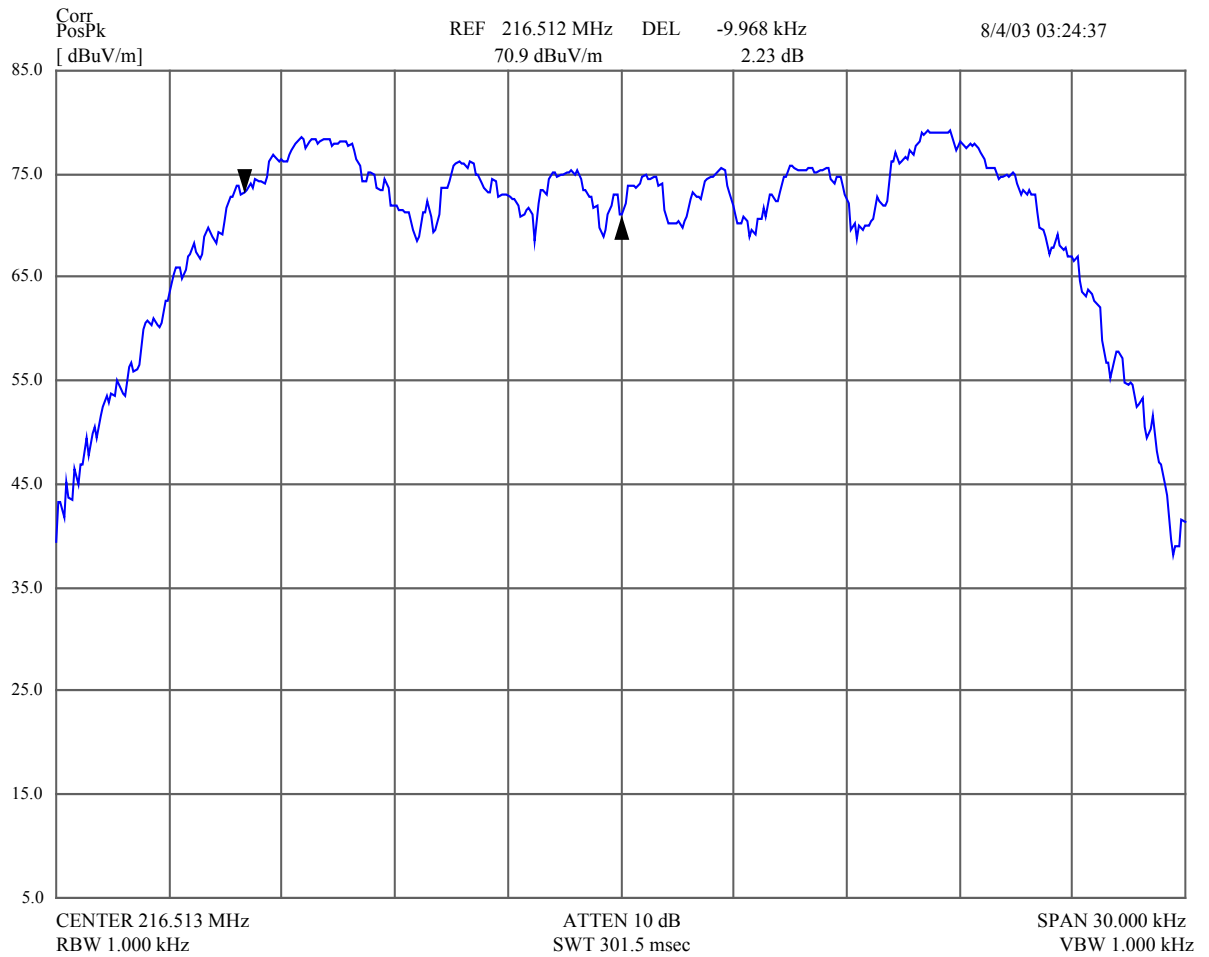
The Limiting Threshold was tested and defined with Channel 61. The Limiting Threshold is defined as the minimum audio input level at which the slope of the audio input/output transfer curve is greater or equal to 4:1. **The EUT don't support the audio output so the limiting threshold was defined by the curve "of the modulation limiting data which is the deviation as a function of audio input level".** The modulation frequency of the Signal generator had been installed at 1kHz, 2 kHz, 3 kHz, 4kHz and 5kHz..

Measurements were conducted by HP 85462A Spectrum Analyzer with RBW=1 and 3 kHz and Span=30 kHz installed.

1) Fmod = 1 kHz

The modulation Amplitude mV, rms	Frequency at level 99% of F peak carrier MHz	Frequency of carrier mHz	Transmitter Deviation kHz
10	216.511376	216.512496	1.120
20	216.508000	216.512496	4.496
<b>30</b>	<b>216.503424</b>	<b>216.512496</b>	<b>9.072</b>
40	216.503424	216.512496	9.072
50	216.503424	216.512496	9.072
60	216.503424	216.512496	9.072
70	216.503424	216.512496	9.072
80	216.503424	216.512496	9.072
90	216.503424	216.512496	9.072
100	216.503424	216.512496	9.072
110	216.503424	216.512496	9.072
120	216.503424	216.512496	9.072
130	216.503424	216.512496	9.072
140	216.503424	216.512496	9.072
150	216.503424	216.512496	9.072

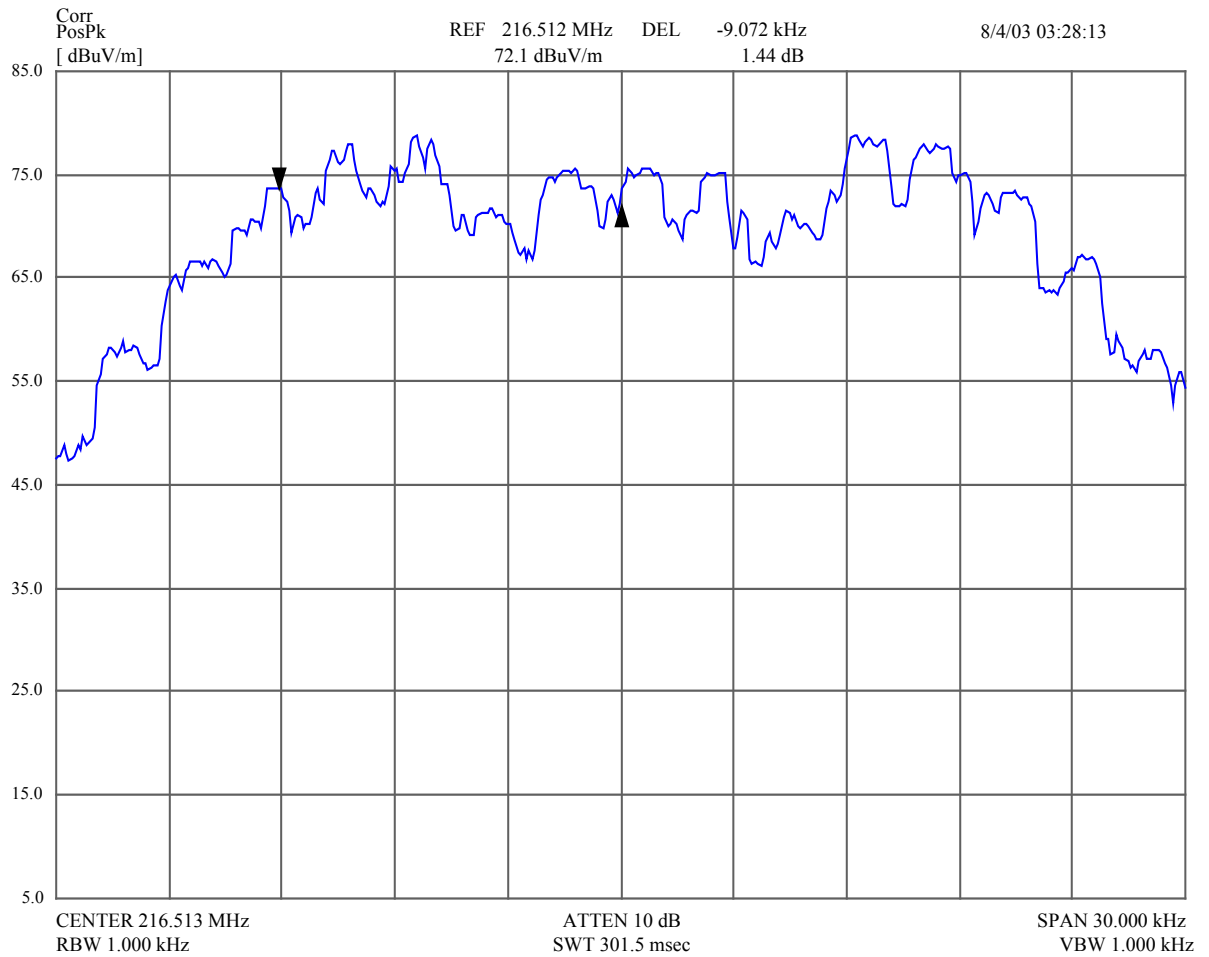
Receiver graph at Fmod = 1 kHz and 100 mV audio input level



2) Fmod = 2 kHz

The modulation Amplitude mV, rms	Frequency at level 99% of F peak carrier MHz	Frequency of carrier MHz	Transmitter Deviation kHz
10	216.511520	216.512496	0.976
20	216.508752	216.512496	3.744
<b>30</b>	<b>216.504400</b>	<b>216.512496</b>	<b>8.096</b>
40	216.504400	216.512496	8.096
50	216.504400	216.512496	8.096
60	216.504400	216.512496	8.096
70	216.504400	216.512496	8.096
80	216.504400	216.512496	8.096
90	216.504400	216.512496	8.096
100	216.504400	216.512496	8.096
110	216.504400	216.512496	8.096
120	216.504400	216.512496	8.096
130	216.504400	216.512496	8.096
140	216.504400	216.512496	8.096
150	216.504400	216.512496	8.096

**Receiver graph at Fmod = 2 kHz and 100 mV audio input level**

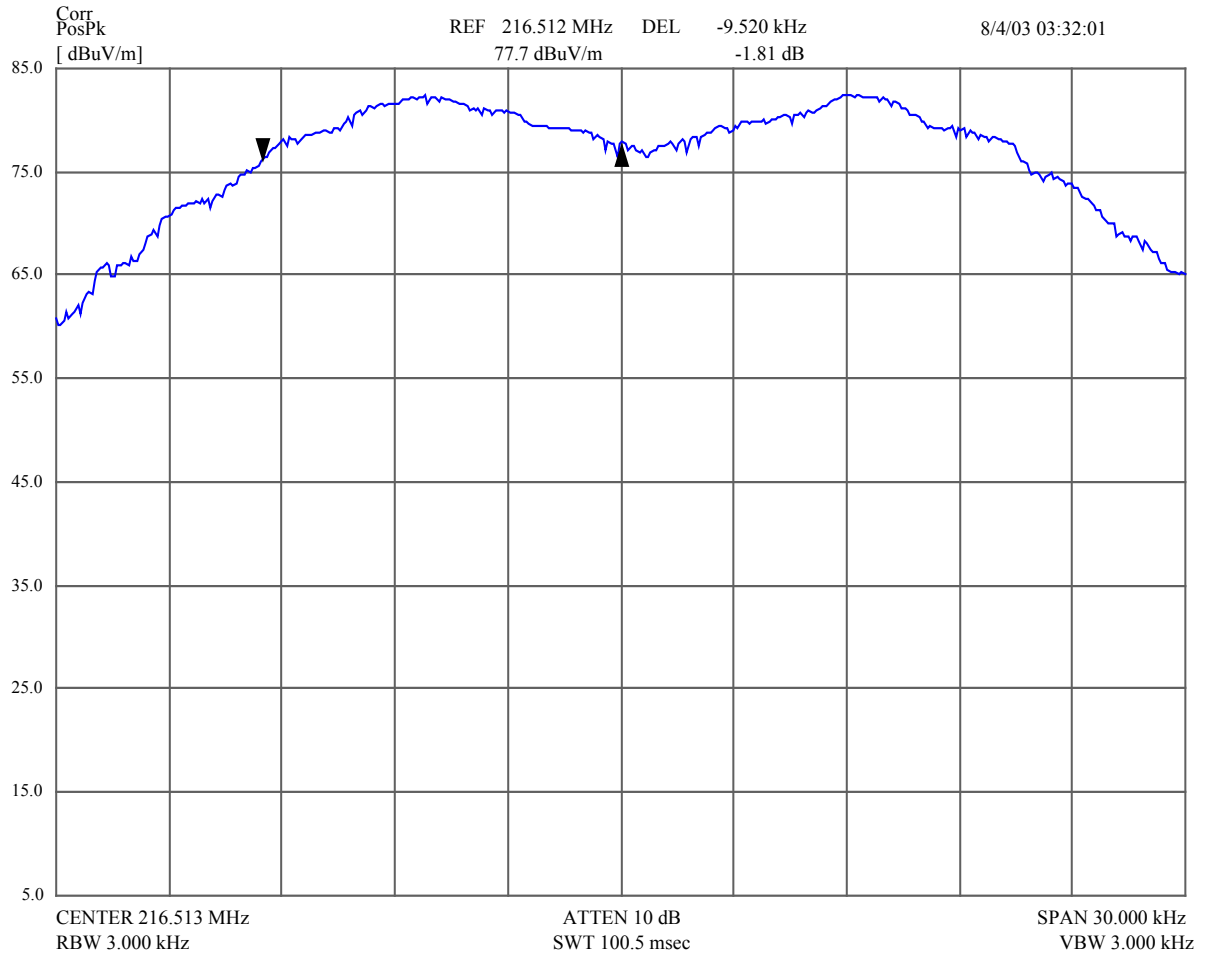


**3) Fmod = 3 kHz**

The modulation Amplitude mV, rms	Frequency at level 99% of F peak carrier MHz	Frequency of carrier MHz	Transmitter ½ of Deviation kHz
10	216.511456	216.512496	1.040
20	216.508832	216.512496	3.664
<b>30</b>	<b>216.504096</b>	<b>216.512496</b>	<b>8.400</b>
40	216.504096	216.512496	8.400
50	216.504096	216.512496	8.400
60	216.504096	216.512496	8.400
70	216.504096	216.512496	8.400
80	216.504096	216.512496	8.400
90	216.504096	216.512496	8.400
100	216.504096	216.512496	8.400
110	216.504096	216.512496	8.400
120	216.504096	216.512496	8.400
130	216.504096	216.512496	8.400
140	216.504096	216.512496	8.400
150	216.504096	216.512496	8.400



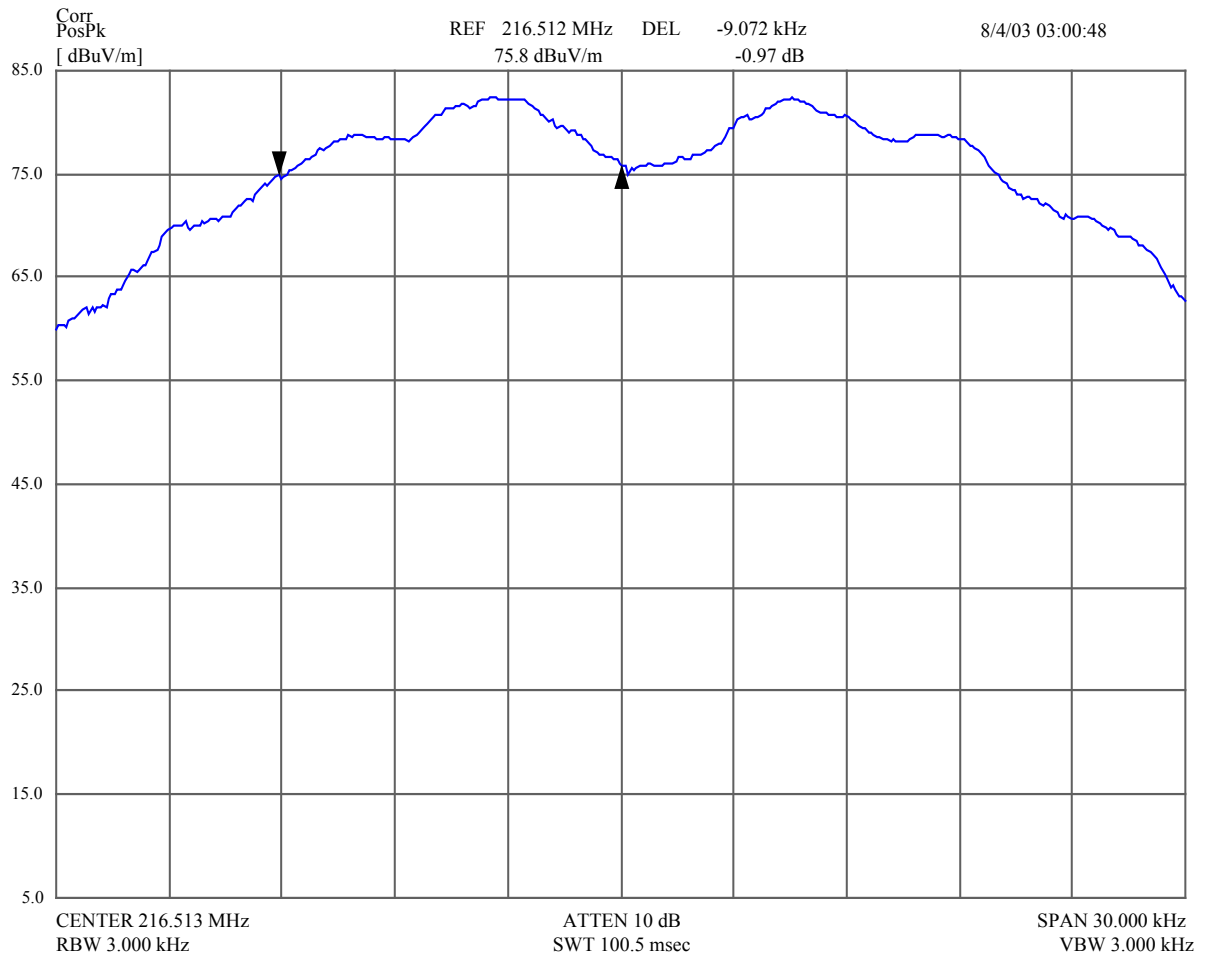
Receiver graph at Fmod = 3 kHz and 100 mV audio input level



4) Fmod = 4 kHz

The modulation Amplitude mV, rms	Frequency at level 99% of F peak carrier MHz	Frequency of carrier mHz	Transmitter ½ of Deviation kHz
10	216.511968	216.512496	0.528
20	216.508448	216.512496	4.048
<b>30</b>	<b>216.504480</b>	<b>216.512496</b>	<b>8.016</b>
40	216.504480	216.512496	8.016
50	216.504480	216.512496	8.016
60	216.504480	216.512496	8.016
70	216.504480	216.512496	8.016
80	216.504480	216.512496	8.016
90	216.504480	216.512496	8.016
100	216.504480	216.512496	8.016
110	216.504480	216.512496	8.016
120	216.504480	216.512496	8.016
130	216.504480	216.512496	8.016
140	216.504480	216.512496	8.016
150	216.504480	216.512496	8.016

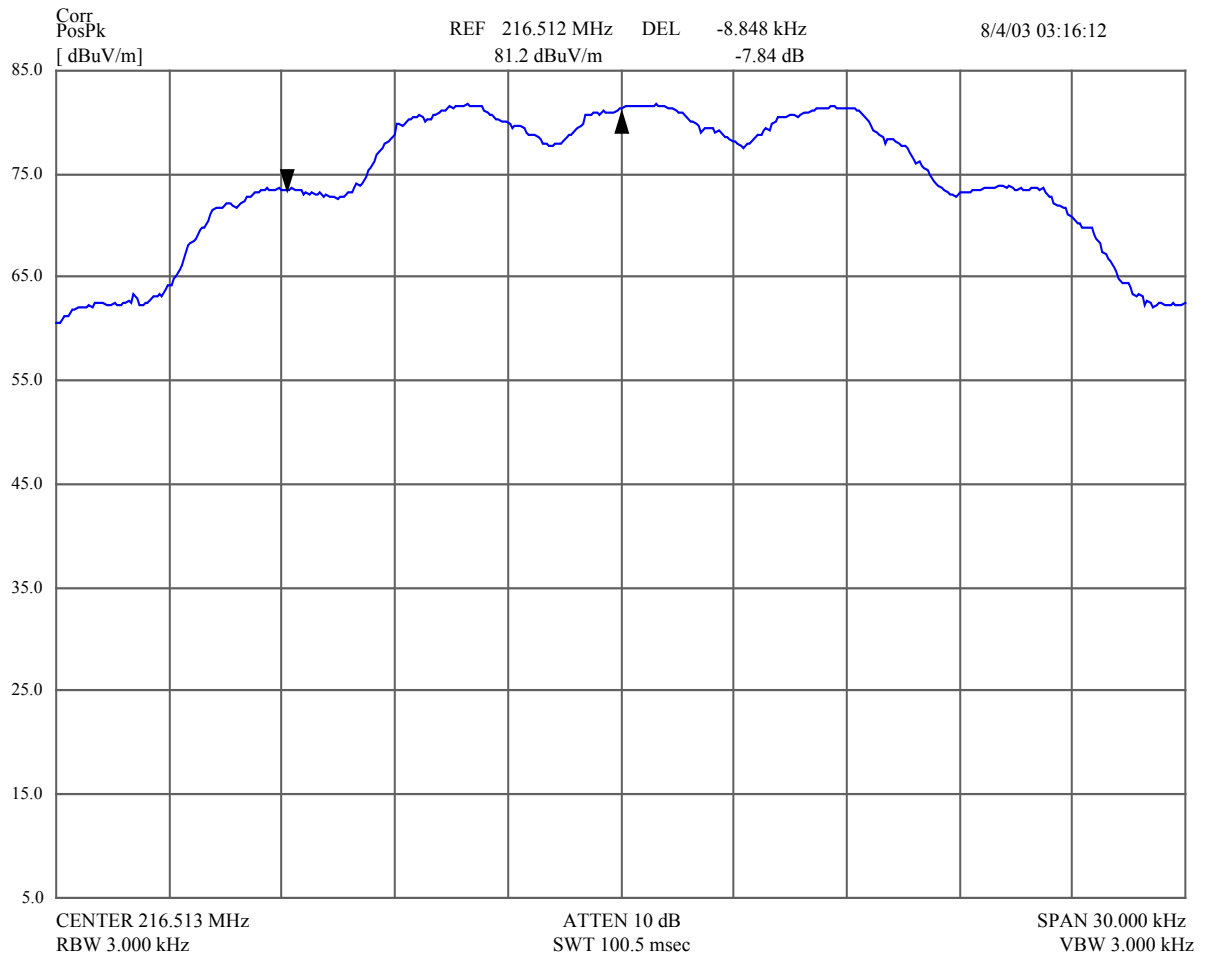
Receiver graph at Fmod = 4 kHz and 100 mV audio input level



**5) Fmod = 5 kHz**

<b>The modulation Amplitude mV, rms</b>	<b>Frequency at level 99% of F peak carrier MHz</b>	<b>Frequency of carrier mHz</b>	<b>Transmitter ½ of Deviation kHz</b>
10	216.511008	216.512496	1.448
20	216.507168	216.512496	5.328
<b>30</b>	<b>216.505560</b>	<b>216.512496</b>	<b>6.936</b>
40	216.503808	216.512496	8.688
50	216.503808	216.512496	8.688
60	216.503808	216.512496	8.688
70	216.503808	216.512496	8.688
80	216.503808	216.512496	8.688
90	216.503808	216.512496	8.688
100	216.503808	216.512496	8.688
110	216.503808	216.512496	8.688
120	216.503808	216.512496	8.688
130	216.503808	216.512496	8.688
140	216.503808	216.512496	8.688
150	216.503808	216.512496	8.688

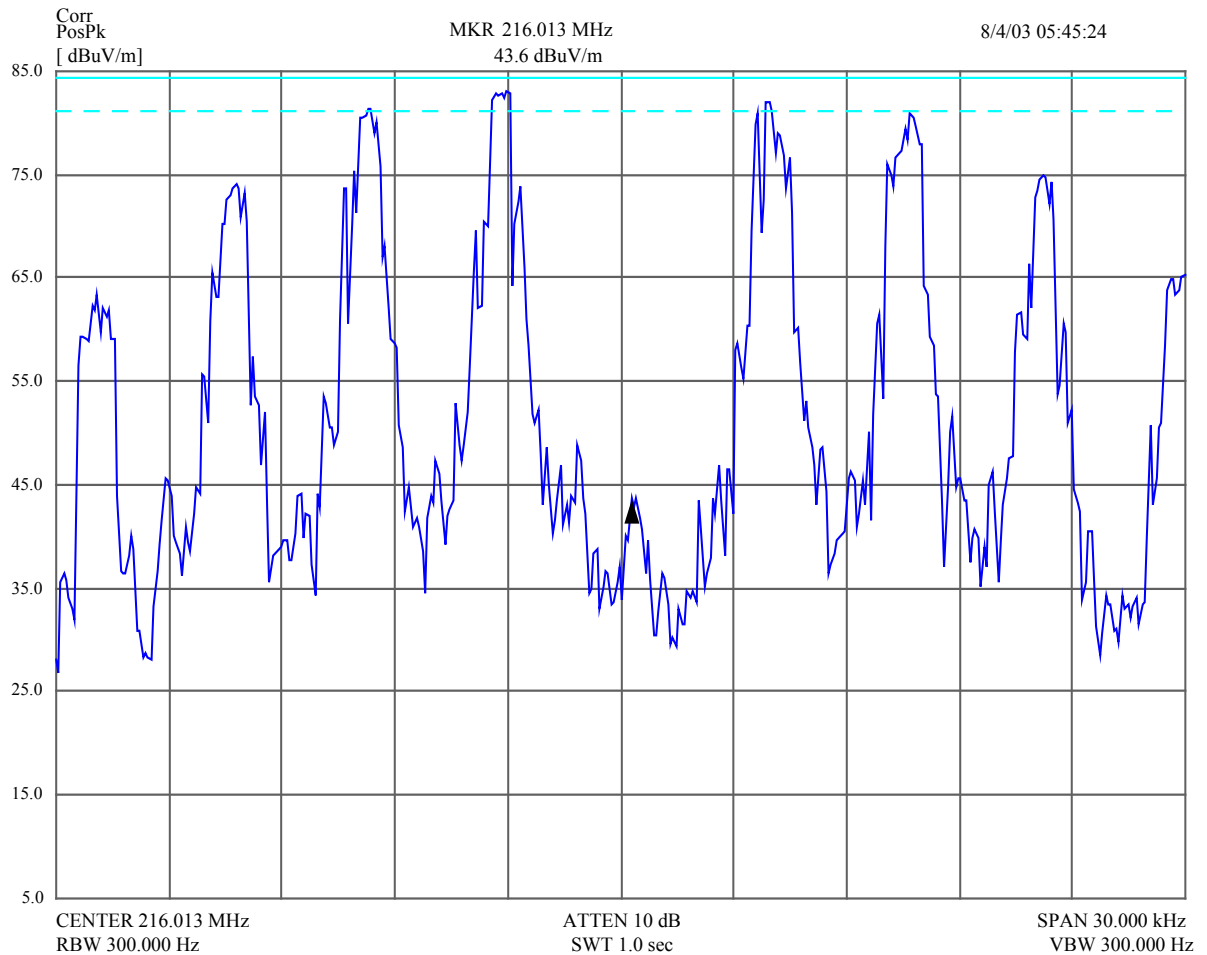
**Receiver graph at Fmod = 5 kHz and 100 mV audio input level**



- 5) Data depicted above (7.1.1) show that we can take 25 mV as the Limiting Threshold amplitude of audio input and according to Subclause 2.1049 we should use this input level increased by 16 dB as the modulation input level at **Fmod = 2500 Hz** to define all characteristics of the EUT – it comes to **150 mV** value.

## 7.1.2 BW, Channel 1

Below are the Receiver Spectrum at the First Carrier Null , at 150 mV audio input amplitude :

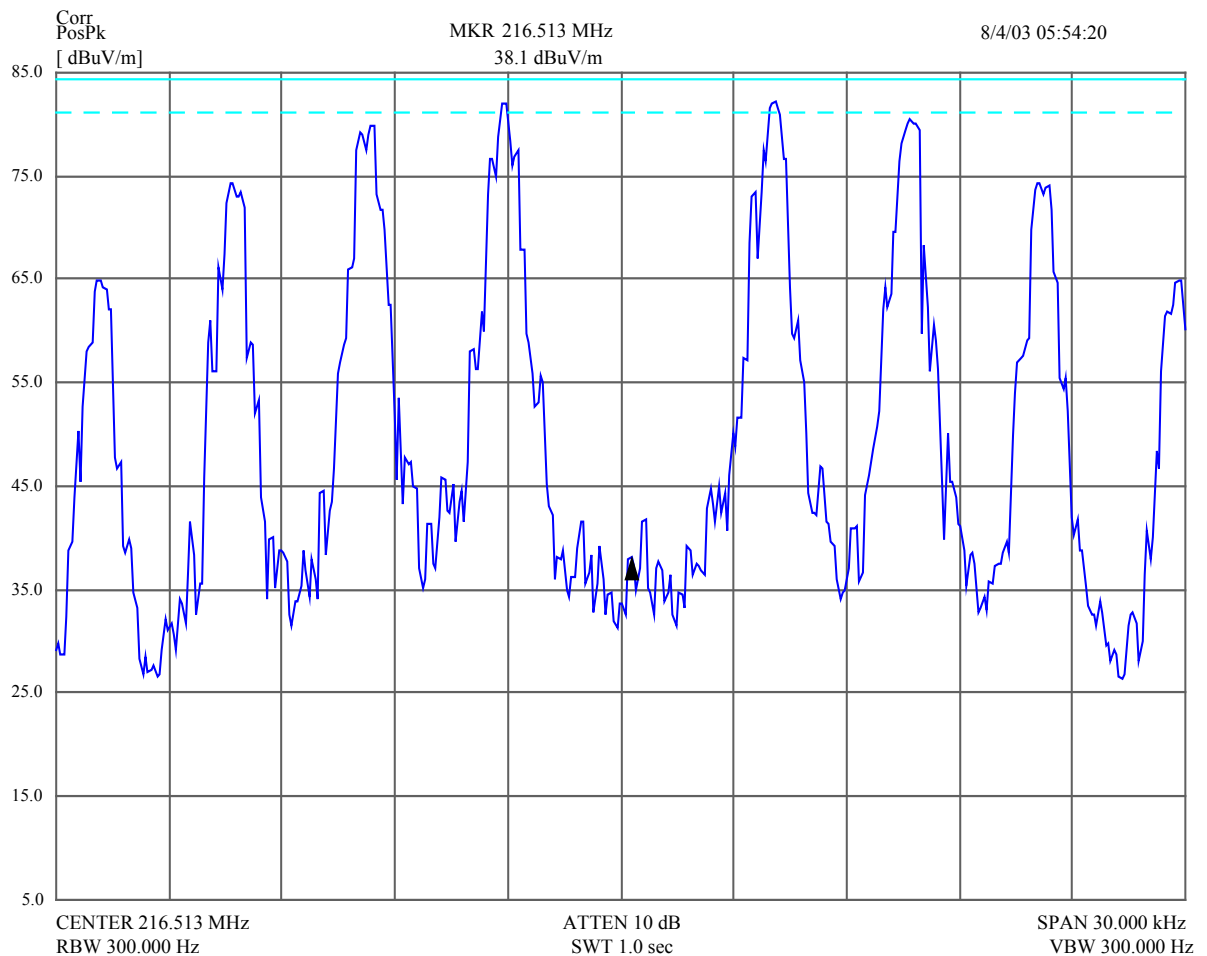


The First Carrier Null was achieved at  $F_{mod} = 3.61$  kHz.  
Channel Bandwidth calculated with the First Carrier Null procedure is

$$BW = \pm (F_{mod} \times M) = 3.61 \times 2 = \pm 7.22 \text{ kHz}$$

### 7.1.3 BW, Channel 61

Below are the Receiver Spectrum at the First Carrier Null, at 150 mV audio input amplitude :

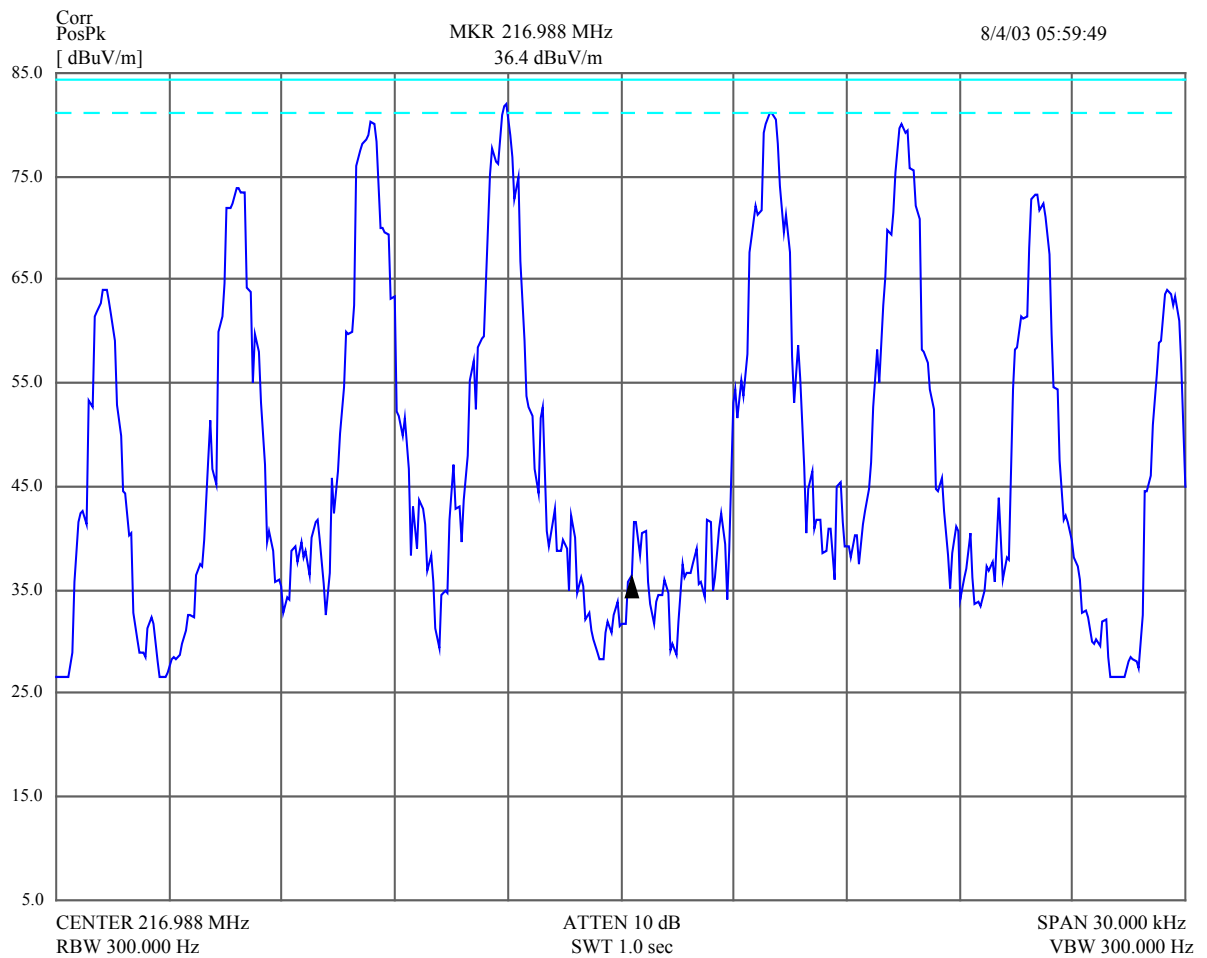


The First Carrier Null was achieved at  $F_{mod} = 3.63$  kHz.  
 Channel Bandwidth calculated with the First Carrier Null procedure is

$$BW = \pm (F_{mod} \times M) = 3.61 \times 2 = \pm 7.26 \text{ kHz}$$

#### 7.1.4 BW, Channel 80

Below are the Receiver Spectrum at the First Carrier Null , at 150 mV audio input amplitude :



The First Carrier Null was achieved at Fmod = 3.59 kHz.  
Channel Bandwidth calculated with the First Carrier Null procedure is

$$BW = +/- [ (Fmod \times M) ] = 3.59 \times 2 = +/- 7.18 \text{ kHz}$$



## 8.0 Field strength of spurious radiation

Type of Test : Field strength of spurious radiation  
FCC Part 2 : Subclause 2.1053 (a) (b)  
FCC Part 2 : Subclause 2.1057 (a) (1))

### Limit value :

ERP of transmitter spurious emission should not exceed the value of -13 dBm.

## 8.1 Spurious emissions (radiation) had been measured with the following procedure :

The EMC radiated test facility consists of a shielded semi-anechoic chamber with attached shielded control room. The semi-anechoic chamber is approximately 18 feet wide by 28 feet long by 19 feet high. A hybrid absorber combines high performance anechoic polyurethane foam with a ferrite tile base to achieve high levels of absorption and power dissipation capability.

The test site is designed according to the ANSI 63.4 -2000 requirements and the anechoic treatment of the chamber is sufficient to achieve the requirements of CISPR 22 and ANSI C63.4. The test site description along with the site attenuation data has been filed with the FCC and a letter of compliance with the requirements of Section 2.948 of the FCC Rules was issued on August 20, 1998 by the FCC.

The EUT had been placed at the 0.8 m height on the non-conducting table. Transmitter had been turned ON with modulation at  $F_{mod} = 2500$  Hz, 150 mV amplitude and worked at the frequencies of the selected 1, 61 and 80 channels.

All data was obtained via an HP 85876A EMI measurement software package using an HP 85462A Receiver which is compliant to CISPR 16. RF Power Level of the EUT was installed to maximum value equal "25". The EUT was configured in various geometric patterns to find the geometric configuration and EUT attitude that produced the largest RF power of a field strength spurious radiation.

After determination of the maximum emissions configuration the distance of the EUT to the scanning antenna was set to 3 meters. Radiated emissions were then monitored from the EUT over a frequency range of 30 MHz to 2000 MHz in horizontal polarization with the scanning antenna repeatedly moving from 1 to 4 meters in elevation while the turntable rotated through a 360 degree arc. This procedure was then repeated in vertical polarization to confirm the strongest signals and polarization orientation.

Radiation of spurious frequencies had been measured by the test equipment over the frequency range 30 MHz to 2000 MHz excluding a 216 MHz band of frequencies centered on the channel on which the transmitter is intended to operate.

At each Channel 1, then 61, then 80 RF Field strength of all spurious emissions had been measured. Then Effective Radiated power of each spurious frequency defined had been determined by a substitution measurement. For substitution method of ERP measurement the CBL6111 or SAS 200/571 Horn antennas, RG-214/U, 26' length cable and HP 8648A Signal generator were used.

The equation for ERP determination is

$$\text{ERP} = \text{P} + \text{Gain} - \text{L} - 2.14 \quad \text{where}$$

- P** is a reading of the power delivered from calibrated HP8648A signal generator to the substitution antenna ;
- Gain** is the antenna factor of the substitution antenna at the measured frequency ;
- L** is the losses of the RG-214/U cable at the measured frequency.
- 2.14 dBi** is ideal dipole gain

Below is a results with a spectrum traces of the magnitude of all the signals throughout the band and ERP measurements/calculation of all spurious frequencies may be seen below.

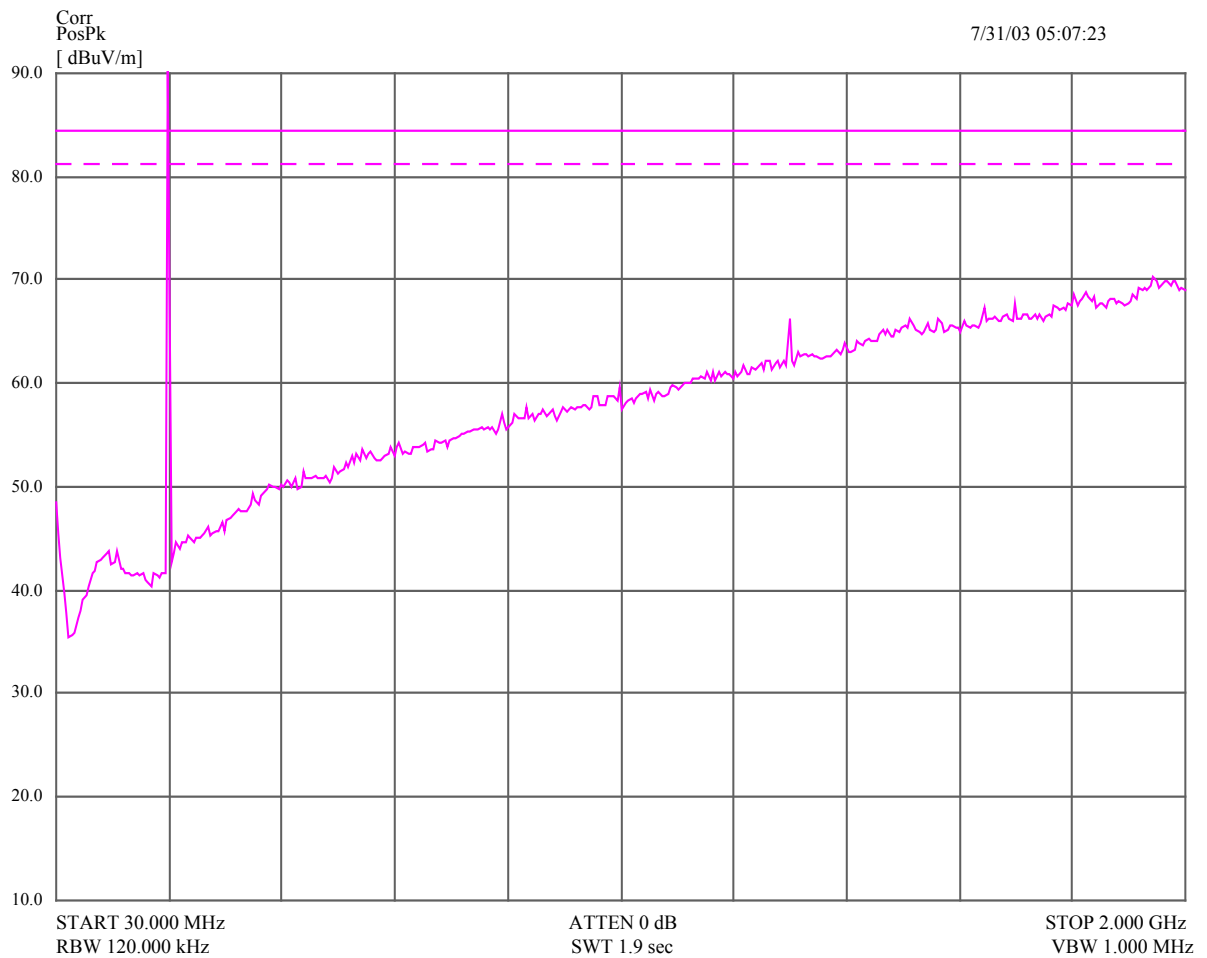
## 8.2 Test results

### Transmitter 216 MHz – 217 MHz

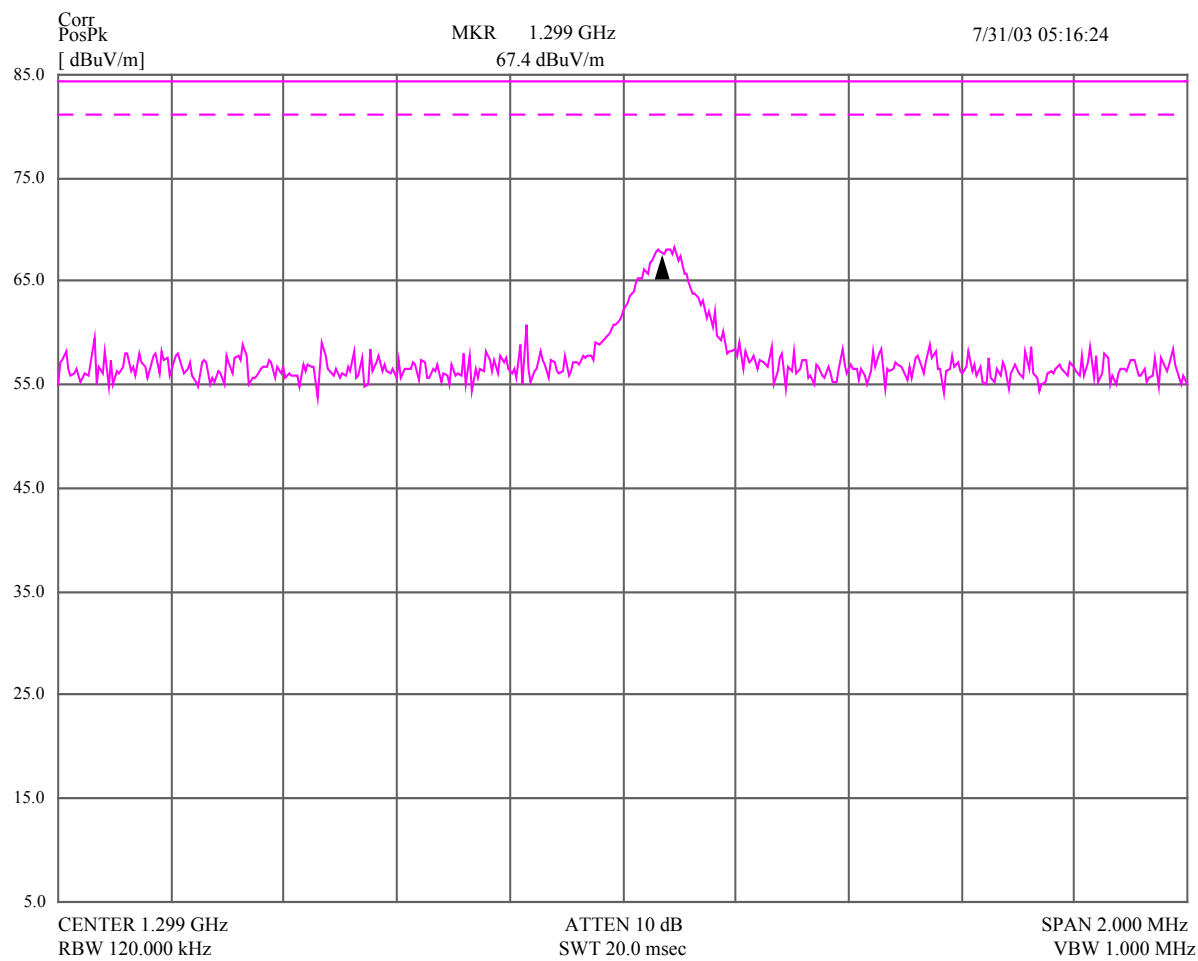
#### Channel 61 is turned ON

In this graph the magnitude of the largest signal is plotted for the configuration that produced the largest signal at 3m distance between the EUT and receiving antenna. **The largest signal (above the limit ) that you can see in this graph is the operating frequency on which transmitter works.**

### Spectrum graph from 30 MHz to 2000 MHz



Spectrum graph and data of the spurious emission at frequency F = 1299 MHz



Frequency MHz	Peak dBuV/m	Peak Lmt dBuV/m	DelLim-Pk dB	Angle deg	Hgt cm	Status
1299.079936	67.48	84.46	-16.98	276	100	PASS

The following is the result of the calculated ERP based on the actual HP8648A Signal generator readings at the spurious frequency 1299 MHz to produce the same peak field strength readings as above graph

Frequency	Peak	P – HP8648A Reading	Gain Antenna	Cable Losses	Limit Value	ERP Value	Status
MHz	dBm	dBm	dBi	dB	dBm	dBm	
1299.079936	-39.52	-52.9	11.9	3.36	-13.0	-46.5	PASS

### 8.3 Test results

**Receiver 216 MHz – 217 MHz, Channel 22,  
Transmitter 216 MHz – 217 MHz is turned Off**

**Test Specifications**

Specification: ANSI C63.4: 2000  
Title: American National Standard for Methods of  
Measurement of Radio-Noise Emissions from  
Low-Voltage Electrical and Electronic  
Equipment in the Range of 9 kHz to 40 GHz.  
Specification: FCC 47 CFR, Part 15.109, class B: 2003  
Title: Code of Federal Regulations,  
Telecommunication  
Specification: JMR Work Procedure W090-5206  
Title: Radiated Emission Test

**Radiated Emissions Test Results**

Measurements expanded uncertainty equals 3.26 dB with 95% confidence level.  
Room Ambient Temperature: 20°C±1°C  
Relative Humidity: 57%±5%

Below are the Quasi-Peak and Avg. readings of the highest value signals observed  
throughout the 30 MHz to 2300 MHz frequency range.

Frequency MHz	QP dBuV/m	QP Lmt dBuV/m	DelLim-QP dB	Pol	Hgt cm	Angle deg	Status
226.840000	43.42	46.00	-2.58	Horz	168	352	PASS
226.848992	40.15	46.00	-5.85	Vert	95	252	PASS

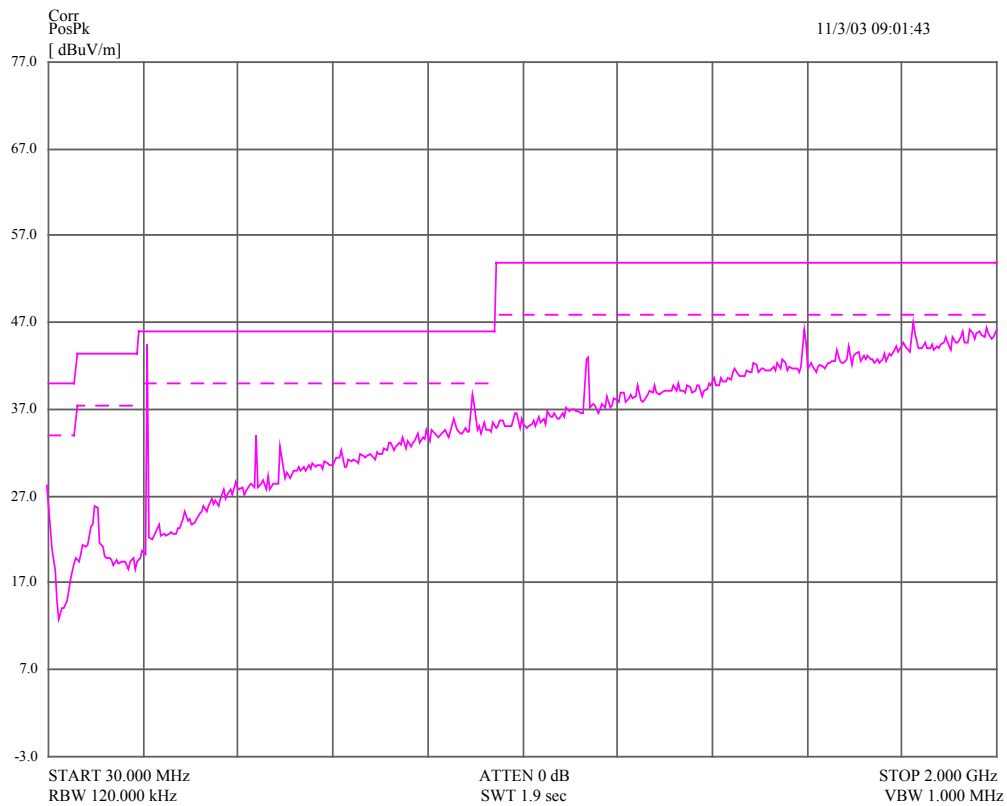
Frequency MHz	Avg dBuV/m	Avg Lmt dBuV/m	DelLim-Avg dB	Pol	Hgt cm	Angle deg	Status
1134.192000	39.23	54.00	-14.77	Horz	144	283	PASS
1361.026944	43.84	54.00	-10.16	Vert	96	261	PASS
1587.864960	47.84	54.00	-6.16	Horz	95	40	PASS
1814.700032	44.75	54.00	-9.25	Horz	112	51	PASS
2268.189952	36.45	54.00	-17.55	Horz	165	194	PASS

A horizontal and vertical polarization spectrum traces of the magnitude of all the signals

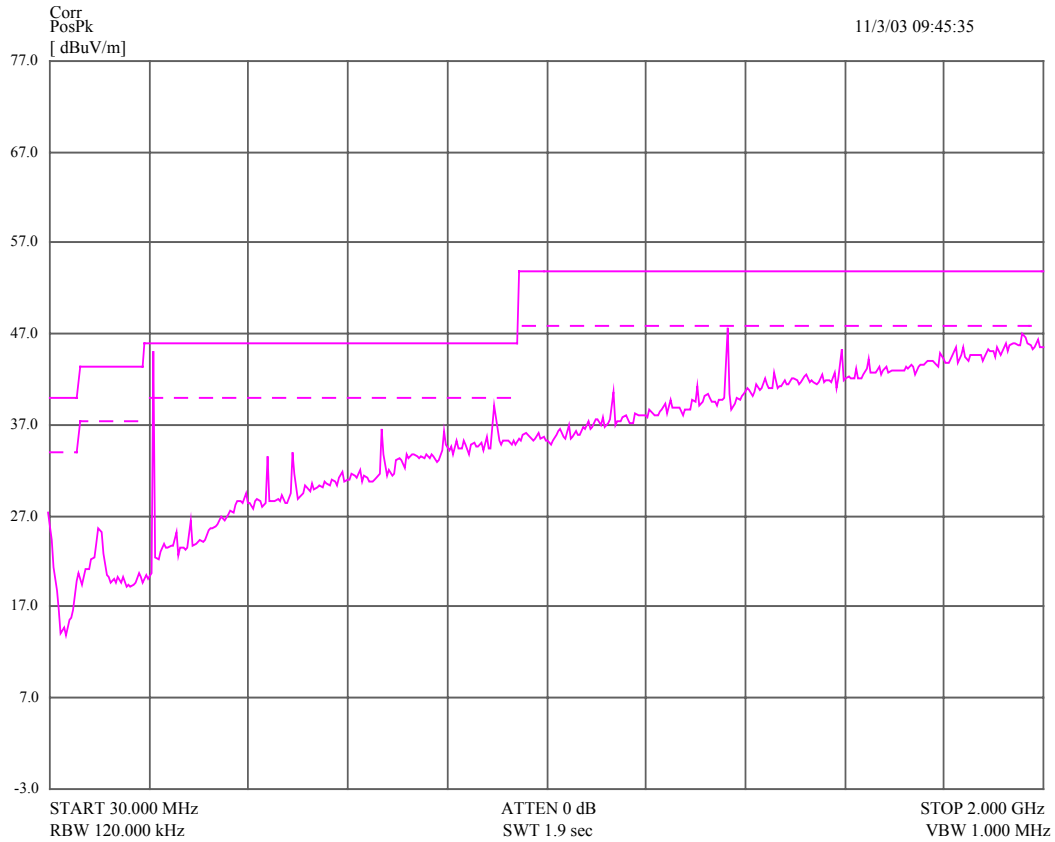
throughout the band may be seen below. In this graph the magnitude of the largest signal is plotted for the configuration that produced the largest signal.

### Spectrum graph from 30 MHz to 2300 MHz

#### horizontal polarization



#### vertical polarization



## 8.4 Test results



**Receiver 72 MHz – 76 MHz, Channel 9E,  
Transmitter 216 MHz – 217 MHz is turned Off**

**Test Specifications**

Specification: ANSI C63.4: 2000  
Title: American National Standard for Methods of  
Measurement of Radio-Noise Emissions from  
Low-Voltage Electrical and Electronic  
Equipment in the Range of 9 kHz to 40 GHz.  
Specification: FCC 47 CFR, Part 15.109, class B: 2003  
Title: Code of Federal Regulations,  
Telecommunication  
Specification: JMR Work Procedure W090-5206  
Title: Radiated Emission Test

**Radiated Emissions Test Results**

Measurements expanded uncertainty equals 3.26 dB with 95% confidence level.  
Room Ambient Temperature: 20°C±1°C  
Relative Humidity: 57%±5%

Below are the Quasi-Peak and Avg. readings of the highest value signals observed  
throughout the 30 MHz to 1000 MHz frequency range.

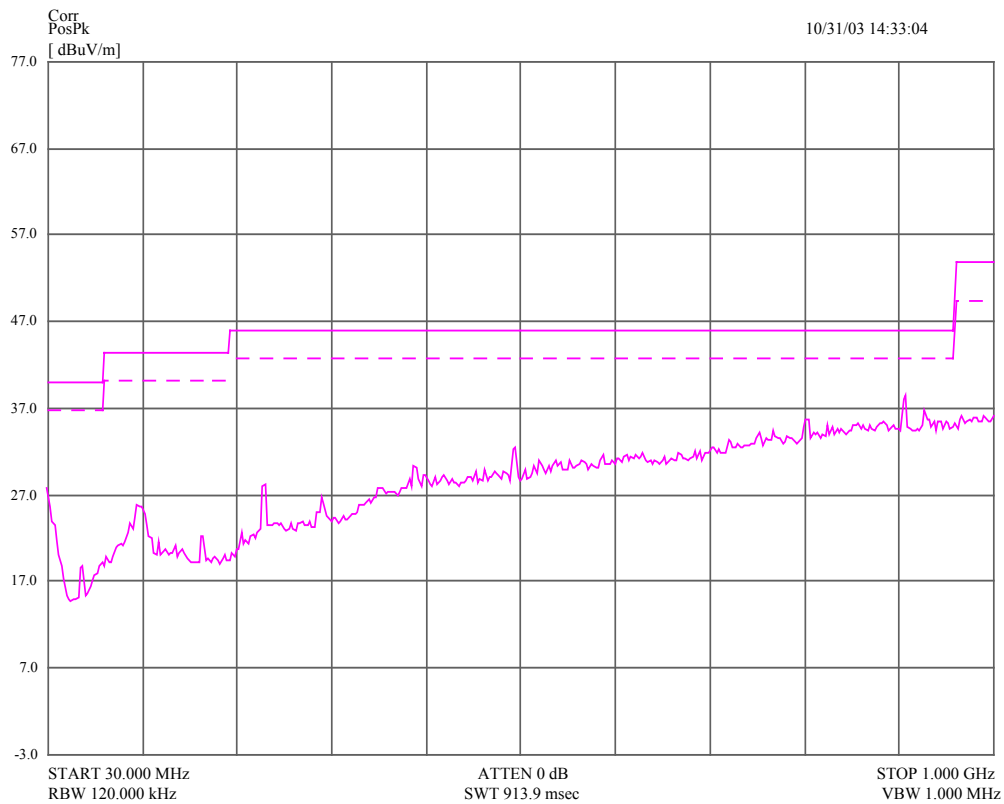
Frequency MHz	QP dBuV/m	QP Lmt dBuV/m	DelLim-QP dB	Pol	Hgt cm	Angle deg	Status
61.376000	19.25	40.00	-20.75	Vert	95	18	PASS
119.918000	22.85	43.50	-20.65	Vert	168	42	PASS
123.498000	21.69	43.50	-21.81	Horz	132	183	PASS
245.500000	24.33	46.00	-21.67	Horz	148	17	PASS
501.179008	27.11	46.00	-18.89	Horz	137	131	PASS

A horizontal and vertical polarization spectrum traces of the magnitude of all the signals

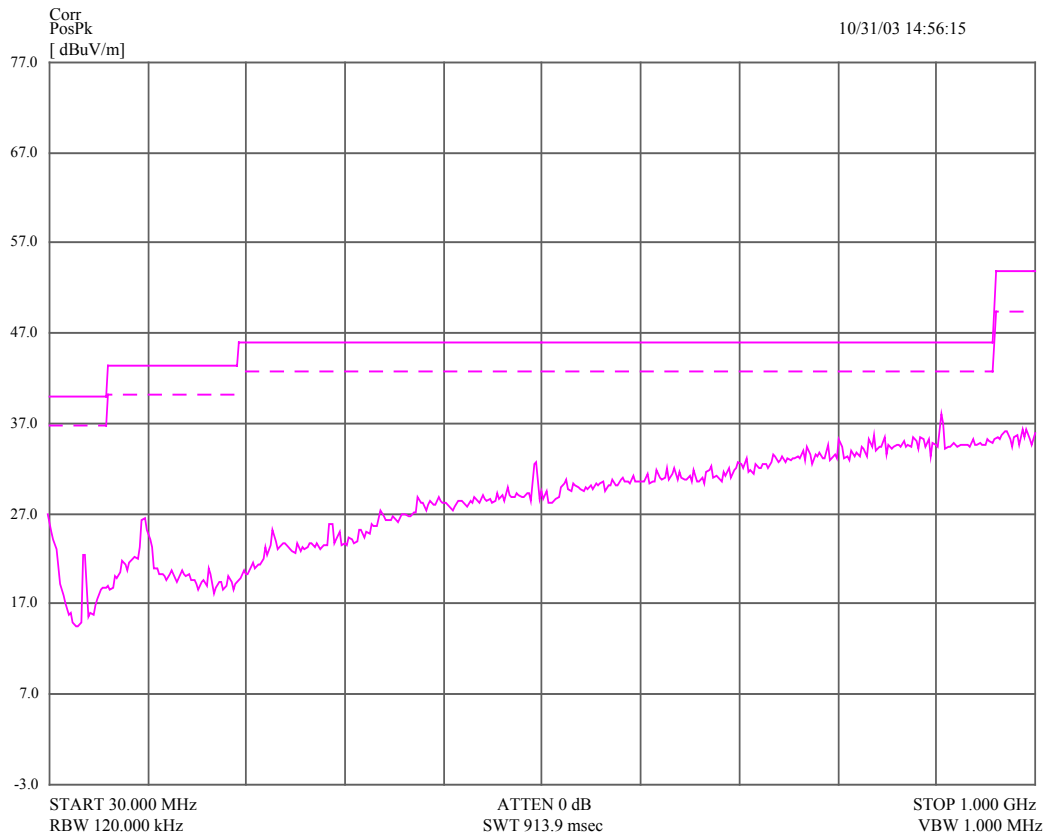
throughout the band may be seen below. In this graph the magnitude of the largest signal is plotted for the configuration that produced the largest signal.

### Spectrum graph from 30 MHz to 1000 MHz

#### horizontal polarization



vertical polarization

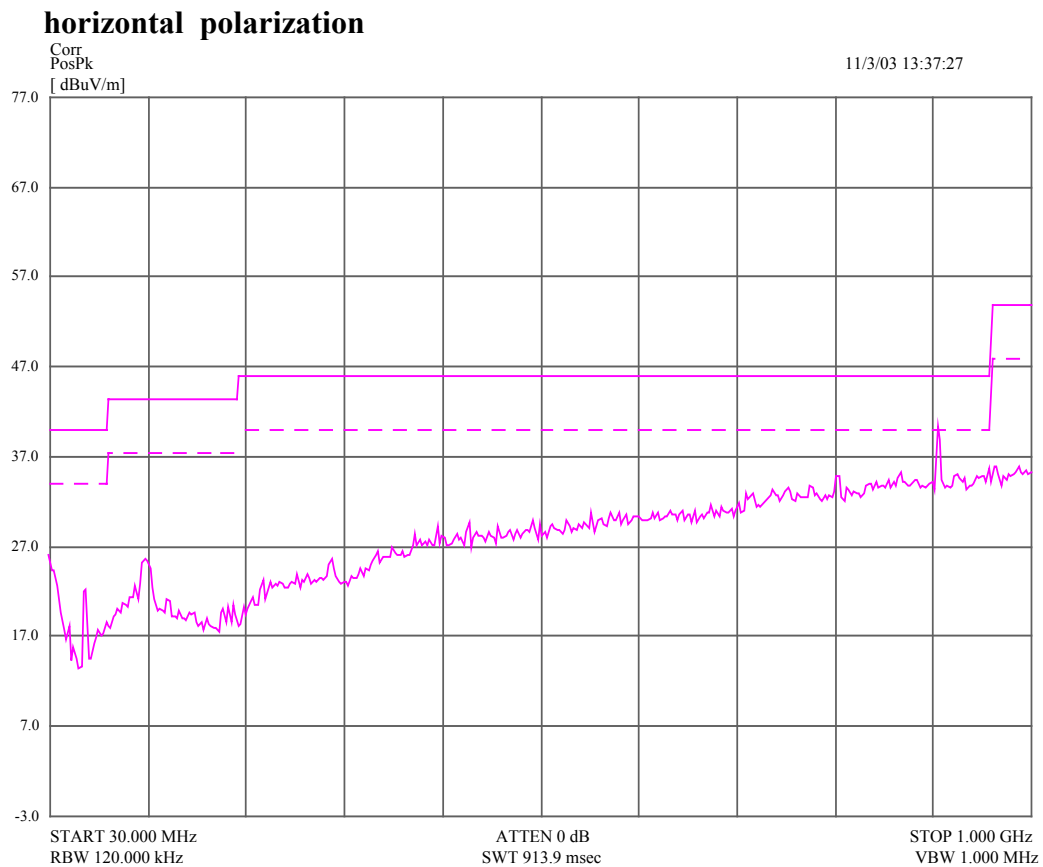


## 8.5 Test results

### IR Multiple channels Receiver , Channel 94, Transmitter 216 MHz – 217 MHz is turned Off

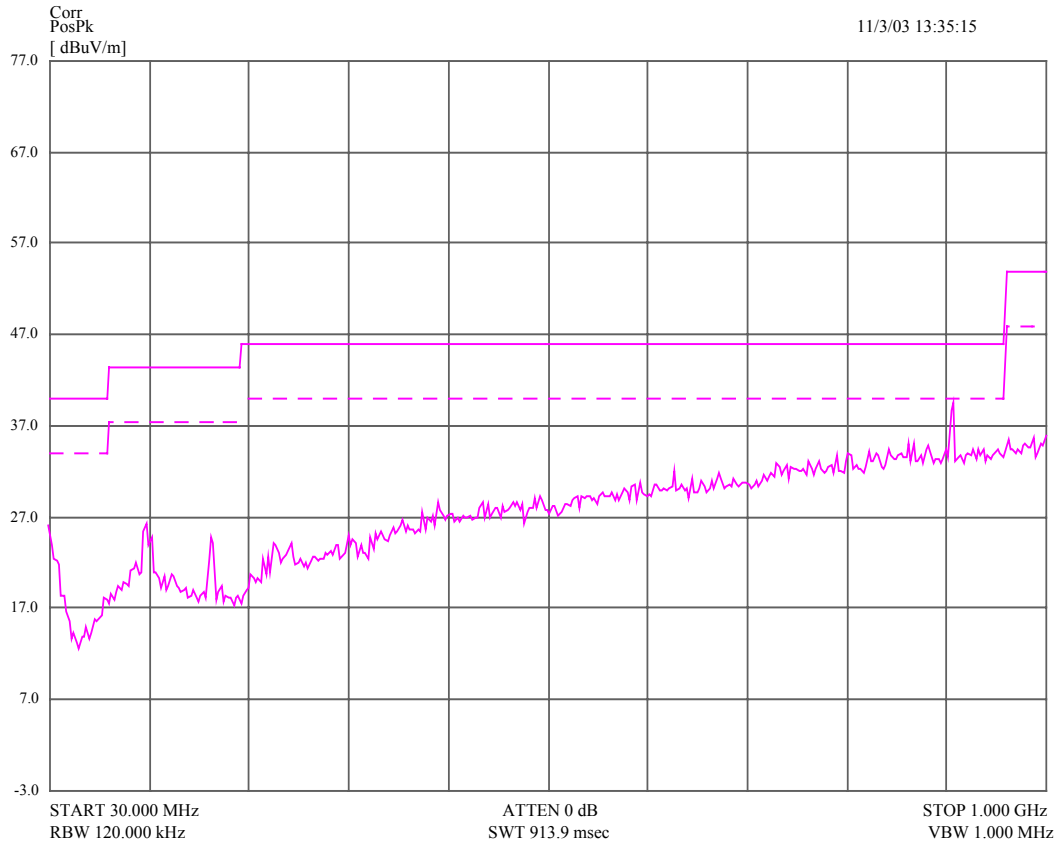
In this graph the magnitude of the largest signal is plotted for the configuration that produced the largest signal at 3m distance between the EUT and receiving antenna.

### Spectrum graph from 30 MHz to 1000 MHz



The test results are depicted by the spectrum graph above show that there is no data of spurious emission to measure

Vertical polarization



## 9.0 Frequency stability

Type of Test : Frequency stability  
FCC Part 95 : Subclause 95.629 (c ) (2)  
**FCC Part 2 : Subclause 2.1055 (a) (1)**  
**FCC Part 2 : Subclause 2.1055 (d) (1))**

**Limit requirement : LPRS transmitters operating on standard band channels must be maintained within a frequency stability of 50 parts per million.**

The **FREQUENCY STABILITY TEST** was done :

- 1) with variation of ambient temperature from -30° to +50° centigrade ;
  - 2) with variation primary supply voltage from 85 to 115 percent of the nominal AC and DC value
- for the selected standard channel 61.

Room Ambient Temperature: 21°C±1°C.

Relative Humidity: 47%±5%.

The thermocouple was installed on the enclosure of the EUT. Variation of ambient temperature was performed by Temperature's Ingogo Oven. The Carrier frequency was measured by HP85462A Spectrum Analyzer.

Variation of primary power supply was performed by BEHLMAN's Power Test Station. Variation of DC power supply was performed by SORENSEN's power supply.

### 9.1. Variation of ambient temperature

**Channel 61 , Fcarrier (Fc) = 216.5125 MHz**

Temperature Measured ° C	Frequency measured Fm MHz	Frequency tolerance $\Delta F = F_m - F_c$ kHz	Frequency Stability Limit, Flim KHz	Status
-30	216.514592	2.09	10.83	PASS
-20	216.514400	2.15	10.83	PASS
-10	216.514352	2.10	10.83	PASS
0	216.514208	1.96	10.83	PASS
10	216.513696	1.45	10.83	PASS
20	216.512928	0.68	10.83	PASS
30	216.512576	0.33	10.83	PASS
40	216.511872	-0.38	10.83	PASS
50	216.511328	-0.92	10.83	PASS

**9.3. Variation of primary supply voltage**  
**Channel 61 , Fcarrier (Fc) = 216.5125 MHz**

Primary AC supply Voltage  V	Frequency measured Fm MHz	Frequency tolerance $\Delta F = F_m - F_c$ kHz	Frequency stability Limit, Flim +/-kHz	Status
93.5	216.513104	0.854	10.83	PASS
110	216.513104	0.854	10.83	PASS
126.5	216.513104	0.854	10.83	PASS

Primary DC supply Voltage  V	Frequency measured Fm MHz	Frequency tolerance $\Delta F = F_m - F_c$ kHz	Frequency stability Limit, Flim +/-kHz	Status
10.2	216.513104	0.854	10.83	PASS
12	216.513104	0.854	10.83	PASS
13.8	216.513104	0.854	10.83	PASS

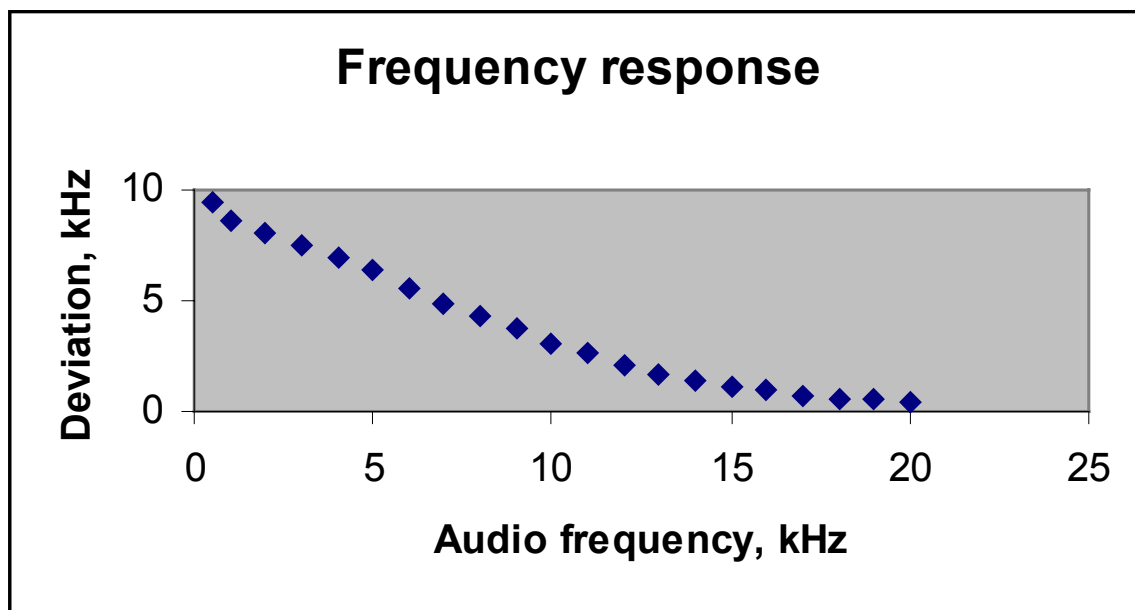
## 10.0 Frequency response

Type of Test : Audio frequency response  
FCC Part 95 : Subclause 95.633 (d ) (2)  
FCC Part 2 : Subclause 2.1047 (a)

Below is a data and spectrum graph showing the frequency response of the audio modulating circuit of the EUT over a range of 0.5 kHz to 20 kHz measured with the IFR 1500A Communication Analyzer.

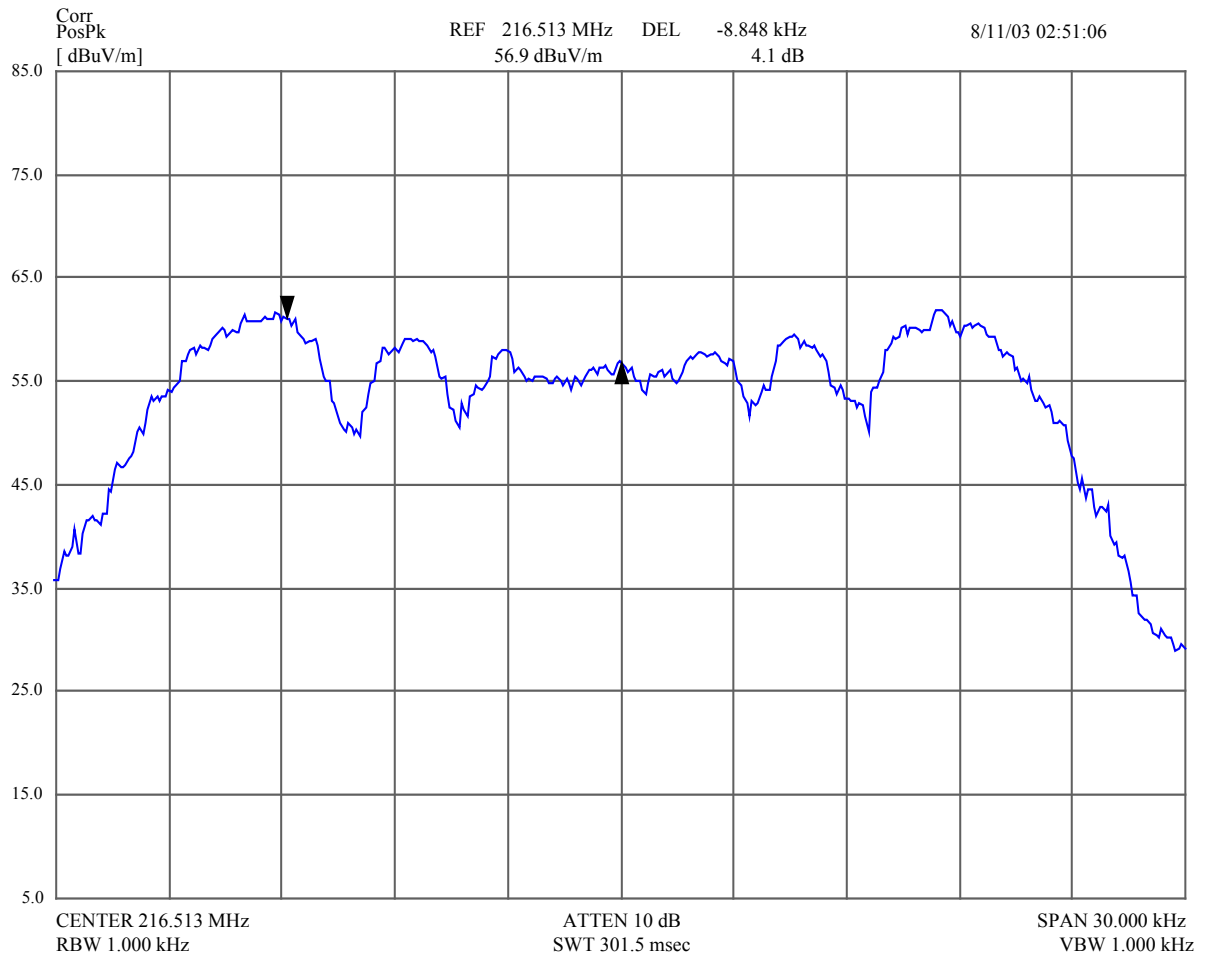
Audio frequency kHz	Deviation +/- kHz
0.5	9.42
1.0	8.65
2.0	8.04
3.0	7.52
<b>4.0</b>	<b>6.95</b>
5.0	6.34
6.0	5.49
7.0	4.91
8.0	4.30
9.0	3.72
10.0	3.12
11.0	2.60
12.0	2.13
13.0	1.73
14.0	1.40
15.0	1.12
16.0	0.91
17.0	0.73
18.0	0.61
19.0	0.51
20.0	0.42



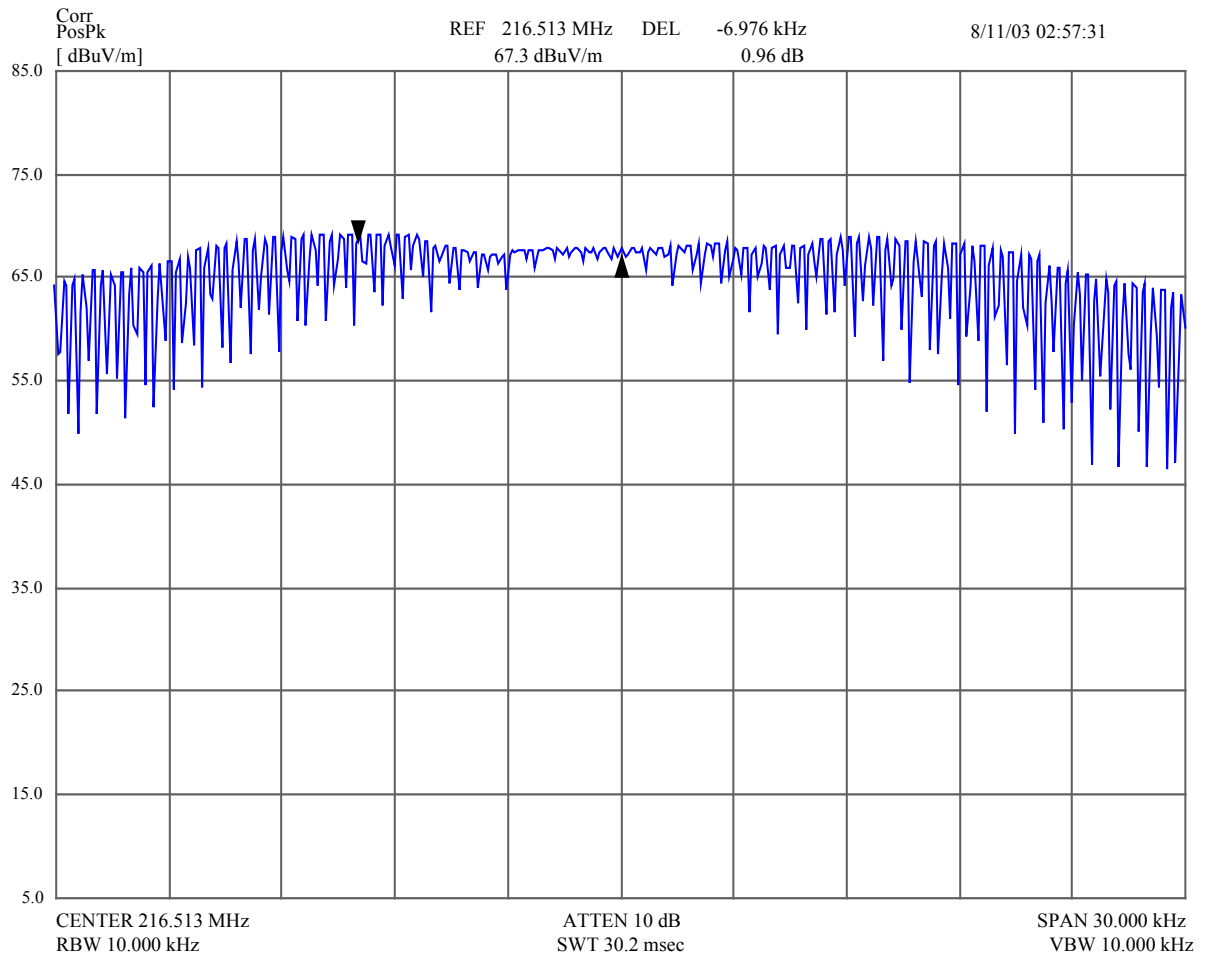


Audio modulation frequency 4.0 kHz should be accepted as the Maximum modulation frequency.

Below is the spectrum graph, Fmod = 1 kHz



Below is the spectrum graph,  
Fmod = 4.0 kHz that is the maximum modulation frequency



## **11.0 FCC Designation of emission for the EUT**

**Type of Test :** Necessary bandwidth  
**FCC Part 2 :** Subclause 2.202 (a)

**$B_n = 2M + 2DK$  , where**

B<sub>n</sub> - Necessary bandwidth in hertz;

M - Maximum modulation frequency in hertz;

D - Peak frequency deviation;

K - An overall numerical factor that equal 1 for FM Sound Broadcasting

**For the EUT :**

M = 4000 Hz

D = 9420 Hz

**Necessary bandwidth calculated B<sub>n</sub> is**

$$B_n = 2 \times 4000 + 2 \times 9420 \times 1 = 26840 \text{ Hz}$$

**Designation of emission is 26K8F3E**

## **12.0 FCC Labeling requirements**

**Type of Test :** Labeling requirements  
**FCC Part 95 :** Subclause 95.1017  
**FCC Part 95 :** Subclause 95.1015

**1. Each LPRS transmitting device shall bear the following statement in a conspicuous location on the device :**

“This device may not interfere with TV reception or federal government radar, and must accept any interference received, including interference that may cause undesired operation.”

**2. Manufacturers of LPRS transmitters used for auditory assistance, health care assistance and law enforcement tracking purposes must include with each transmitting device the following statement :**

“This transmitter is authorized by rule under the Low Power Radio Service (47 C.F.R. Part 95) and must not cause harmful interference to TV reception or United States Navy SPASUR installations. You don’t need a FCC license to operate this transmitter. This transmitter may only be used to provide : auditory assistance to persons who require language translation, or person in educational settings; health care services to ill. Two-way voice communications and all other types of uses not mentioned above are expressly prohibited”