Application For
Title 47 FCC Part 2, Subpart J, and FCC Part 90, Subpart I Certification
and
ANSI/TIA-603-C-2004, Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

Kyodo West
KG506-40E25K
465 -500 MHz Transmitter

FCC ID: IOJKG50640E

UST Project No: 11-0209
October 10, 2011

3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
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Testing Tomorrow's Technology

I certify that I am authorized to sign for the Test Agency and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

UNITED STATES TECHNOLOGIES, INC. (Agent Responsible For Test):

By: _____

Name: George Yang

Title: Laboratory Manager- Test Engineer

Date: October 10, 2011

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Testing Tomorrow's Technology

MEASUREMENT/TECHNICAL REPORT

This report concerns (check one): Original grant_X
Class II change_____

Equipment type: **Transceiver**

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes_____ No_X

If yes, defer until:_____
date

__N.A.__ agrees to notify the Commission by__N.A.__
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

US Tech
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

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1 General Information

1.1 Product Description

The KG506 series radio is designed to be used with an external control system. It consists of a rugged cast aluminum mobile housing containing a receiver, transmitter, power amplifier and a logic control board. The radio operates over the 465 to 500 MHz band without any field tuning. The power output is adjustable up to 30 W output and is rated for continuous duty at 25 W. It is capable of operation in simplex, duplex or repeater modes. There is space inside the housing for a mobile type duplexer. Alternately, an external duplexer or separate antennas may be used. The TX output connector is a UHF female and the RX input is a BNC female.

The external control system must provide volume control, channel select (optional), and connections for PTT, TX audio in and RX audio out.

1.2 Related Submittal(s)/Grant(s)

There are no related submittals or grants associated with this project.

2 Test and Measurements

2.1 Configuration of Tested System

A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious emissions measurements are shown in Figure 2. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions.

2.2 Characterization of Tested System

The sample used for testing was received by US Tech on September 27, 2011 in good condition.

2.3 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. Conducted and digital device testing was performed at US Tech's OATS measurement facility. This site has been fully described and registered by the FCC under Registration Number 91037. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number IC2982.

2.4 Test Equipment

Table 2 describes test equipment used to evaluate this product.

2.5 Modifications to Equipment under Test (EUT)

No modifications were made by US Tech to bring the EUT into compliance with the FCC limits for the transmitter portion of the EUT.

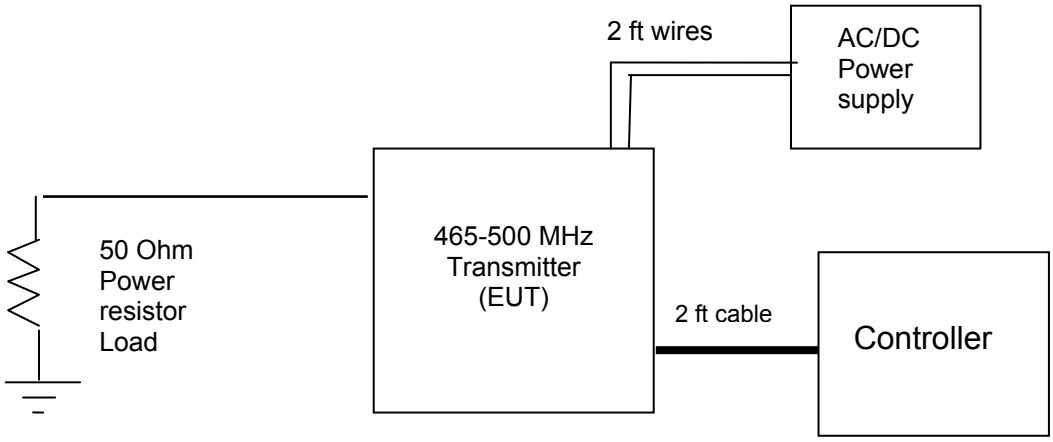


Figure 1 - Test Configuration

Figure 2 - Photograph of Spurious Radiation Test Setup, (Front View)

Figure 3 - Photograph of Spurious Radiation Test Setup, Rear View

Table 1 - EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
EUT Kyodo West	465-500 MHz Transmitter	None	IOJKG50640E	2’
ASTRODYNE (Power supply)	S-150-13.5	None	--	4’
Control box Kyodo West	--	--	--	2’

Table 2 - Test Instruments

EQUIPMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8566B	HEWLETT-PACKARD	2410A00109	10/29/10
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	10/18/2010
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT-PACKARD	2944A06291	9/7/10 Extended 90 days
BICONICAL ANTENNA	3110B	EMCO	9306-1708	04/29/11
LOG PERIODIC 100 MHz to 1000 MHz	3146	EMCO	3110-3236	1/22/10 2 Year
HORN ANTENNA	3115	EMCO	9107-3723	08/10/11
HORN ANTENNA	SAS-571	A. H. SYSTEMS	605	02/09/2010 2yr.
PREAMP	8449B	HEWLETT PACKARD	3008A00480	10/21/10
SIGNAL GENERATOR	8672A	HEWLETT-PACKARD	1733A00389	N/A
Graphical Multi-Meter	867B	FLUKE	DM7060268	02/23/11
Temperature Chamber	SM16/DR45 00A	Thermotron/ Honeywell	17095	03/14/2011
CALCULATION PROGRAM	N/A	N/A	Ver. 6.0	N/A
Modulation Analyzer	8091B	HP/ Agilent	3749A06049	01/08/2011

Note: The calibration interval of the above test instruments is 12 months and all calibrations are traceable to NIST/USA.

2.6 Antenna Description

Radio antenna connectors are UHF female for the transmitter and BNC female for the receiver. Any quality mobile or base station antenna(s) may be used.

2.7 RF Power Output (FCC Section 2.1046, 90.205)

The transmitter (EUT) was programmed to continuously generate maximum power. RF output power was measured by connecting the output of the transmitter directly to the input of a calibrated spectrum analyzer through a power attenuator whose loss had been measured and was entered into the spectrum analyzer as offset. The spectrum analyzer was set for an impedance of 50 Ω with the RBW set greater than the 6 dB bandwidth of the EUT, and the VBW ≥ RBW. This measurement was done at Low Channel, Mid Channel and High Channel frequencies.

2.7.1 ERP Requirements

The maximum allowable station effective radiated power (ERP) is dependent upon the stations HAAT (the height above the average terrain) and required service area. This product operates at frequencies from 465 MHZ to 500 MHz at ERP of 30 watts. Please refer to FCC 47 CFR 90.205 for specification details.

Table 3 - RF Output Effective Radiated Power (ERP)

Frequency of Fundamental (MHz)	ERP Measurement (dBm)*	ERP Measurement (Watts)*	FCC Limit (Watts)
465.07	44.4	27.5	Part 90.205
482.87	44.4	27.5	Part 90.205
499.88	44.6	28.8	Part 90.205

Test Date: September 28, 2011

Tester Signature: Keyvan Muvahhid **Name: Keyvan Muvahhid**

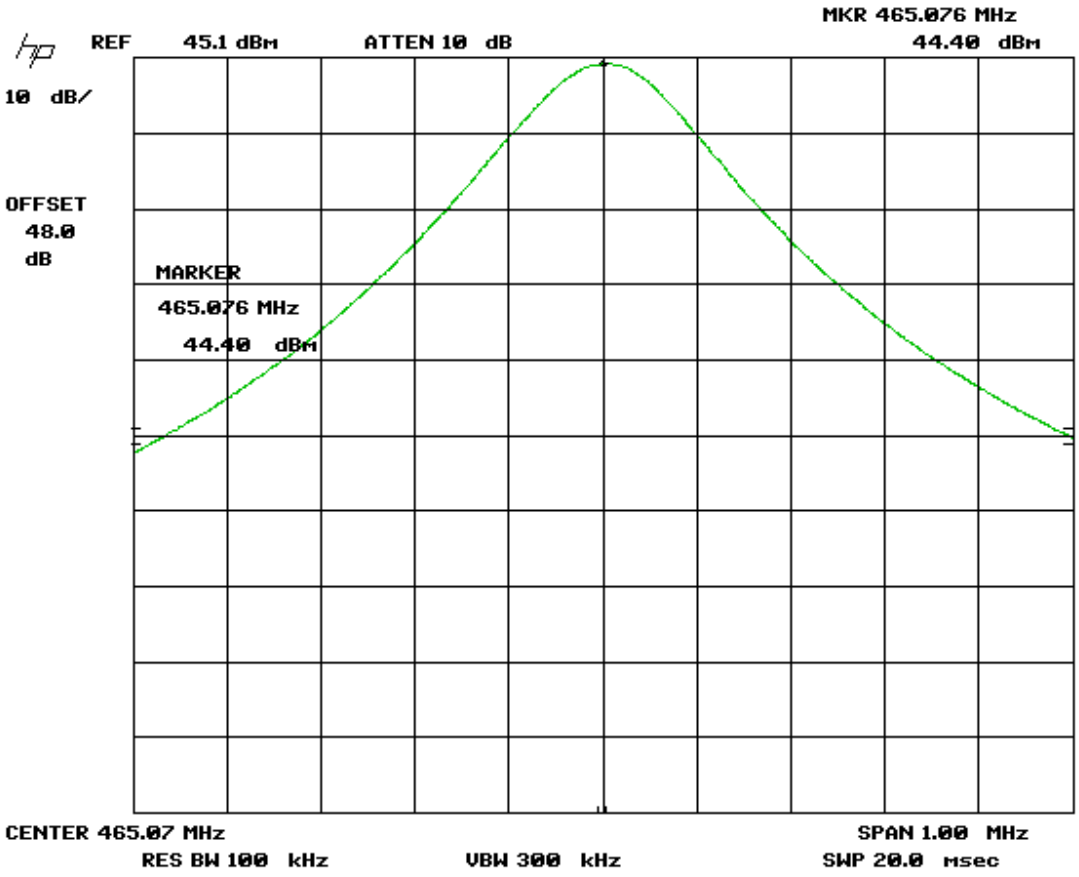


Figure 4 - Plot of Low band Output

Note: Attenuators and cable loss are added to spectrum analyzer.

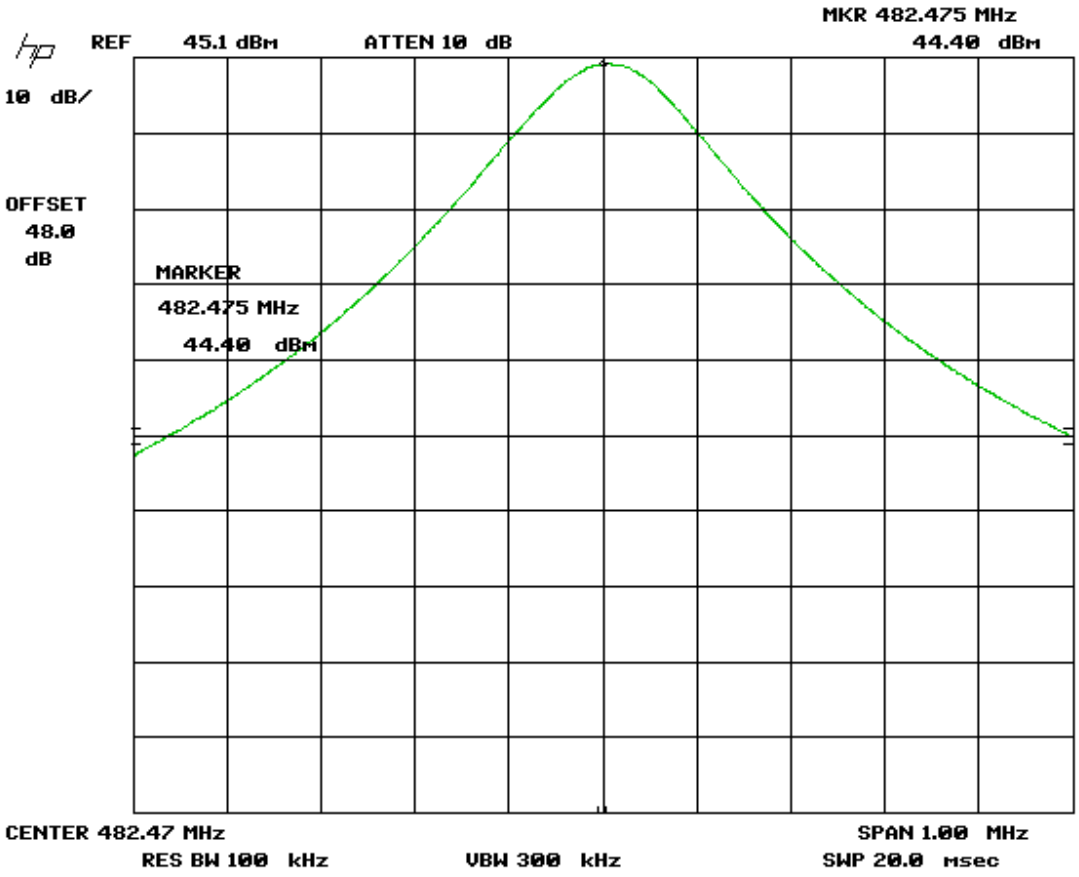


Figure 5 - Plot of Mid Band Output

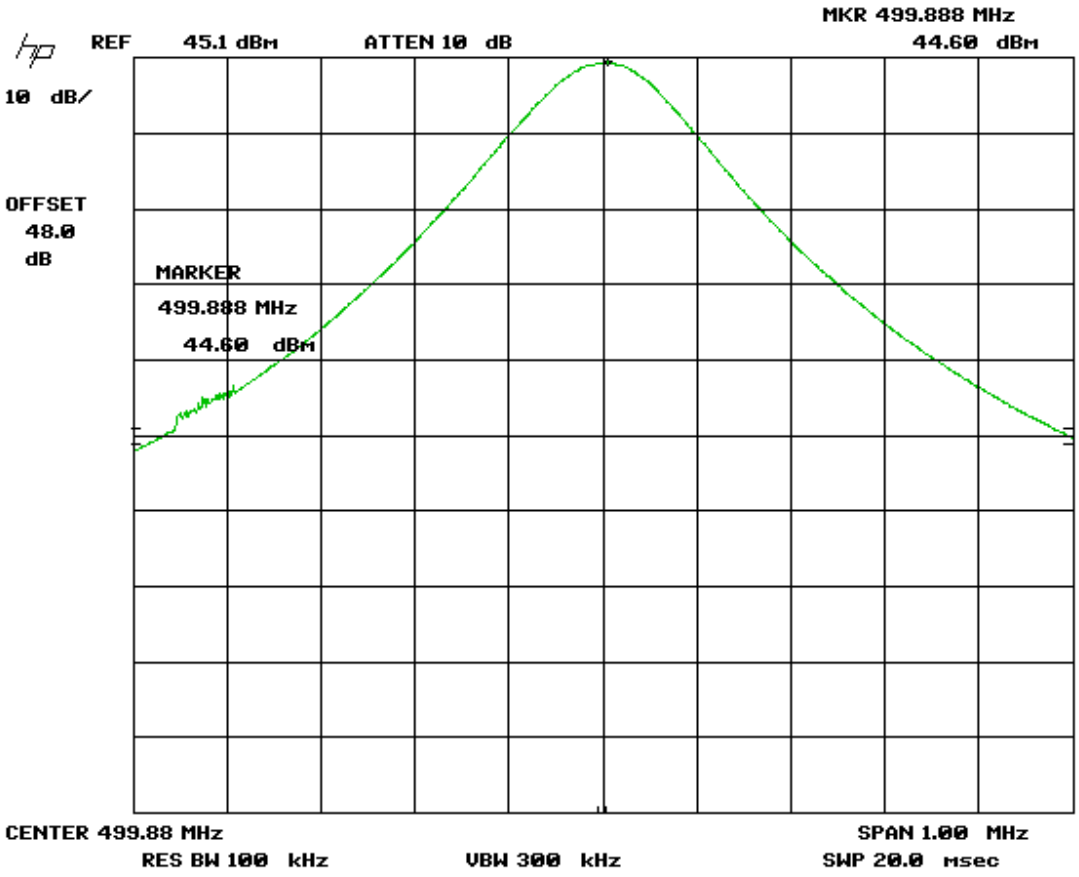


Figure 6 - Plot of High Band Output

2.8 Audio Frequency Response (2.1047(a) & 90.242(b) (8))

The rated audio input signal was applied to the input of the audio low-pass filter (or of all modulation stages) using an audio source. This input signal level and its corresponding frequency deviation were then measured and recorded using a Modulation Analyzer. Tests were repeated at different audio signal frequencies from 0 to 50 KHz.

2.8.1 Audio Frequency Requirements

§ **2.1047(a):** Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted.

2.8.2 Audio Frequency Test Results

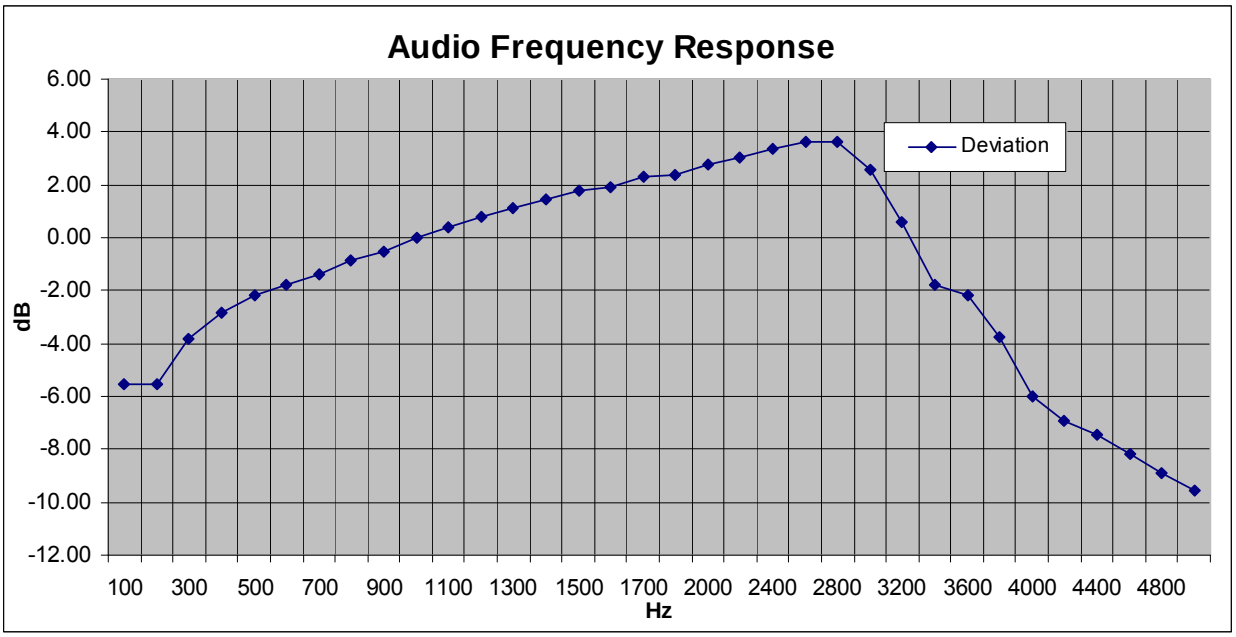


Figure 7 - Plot of the Audio Frequency Response

Table 4 - Data of the Audio Frequency Response

Frequency (Hz)	Measured deviation KHz	Response Relative to 1KHz level (dB)
100	0.153	-5.56
200	0.154	-5.53
300	0.227	-3.84
400	0.285	-2.86
500	0.333	-2.18
600	0.365	-1.78
700	0.402	-1.36
800	0.450	-0.87
900	0.484	-0.56
1000	0.550	0.00
1100	0.607	0.43
1200	0.660	0.79
1300	0.715	1.14
1400	0.773	1.48
1500	0.833	1.80
1600	0.860	1.94
1700	0.930	2.28
1800	0.955	2.40
2000	1.040	2.77
2200	1.113	3.06
2400	1.192	3.36
2600	1.266	3.62
2800	1.274	3.65
3000	0.998	2.59
3200	0.627	0.57
3400	0.364	-1.79
3600	0.335	-2.15
3800	0.233	-3.73
4000	0.138	-6.00
4200	0.112	-6.91
4400	0.099	-7.45
4600	0.084	-8.16
4800	0.071	-8.89
5000	0.061	-9.55

Test Date: October 3, 2011

Tester Signature:  **Name: Keyvan Muvahhid**

2.9 Modulation Limiting (2.1047(b) & 90.210)

The carrier frequency deviation was measured with the tone input signal level varied from 0 Vp to audio input rating level plus 16 dB at frequencies 0.3,1.0, and 3.0 KHz. The maximum deviation was recorded at each test condition. The limits and data for FM Voice Modulation follow.

2.9.1 Modulation Limiting Requirements

§ **2.1047(b):** Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed. Recommended frequency deviation characteristics are given below.

- 2.5 KHz for 12.5 KHz Channel Spacing System

Table 5 - Modulation Limiting Test Data

Audio Input mV	Test Data (300Hz)	Test Data (1KHz)	Test Data (3KHz)
0.01	0.153	0.141	0.154
0.20	0.184	0.345	0.53
0.40	0.233	0.565	0.929
0.60	0.284	0.801	1.23
0.80	0.332	1.025	1.313
1.00	0.390	1.244	1.341
1.20	0.440	1.445	1.361
1.40	0.483	1.691	1.368
1.60	0.540	1.87	1.373
1.80	0.589	1.96	1.383
2	0.644	2.06	1.387

All deviations were less than 2.5 KHz.

Test Date: October 3, 2011

Tester Signature:  **Name: Keyvan Muvahhid**

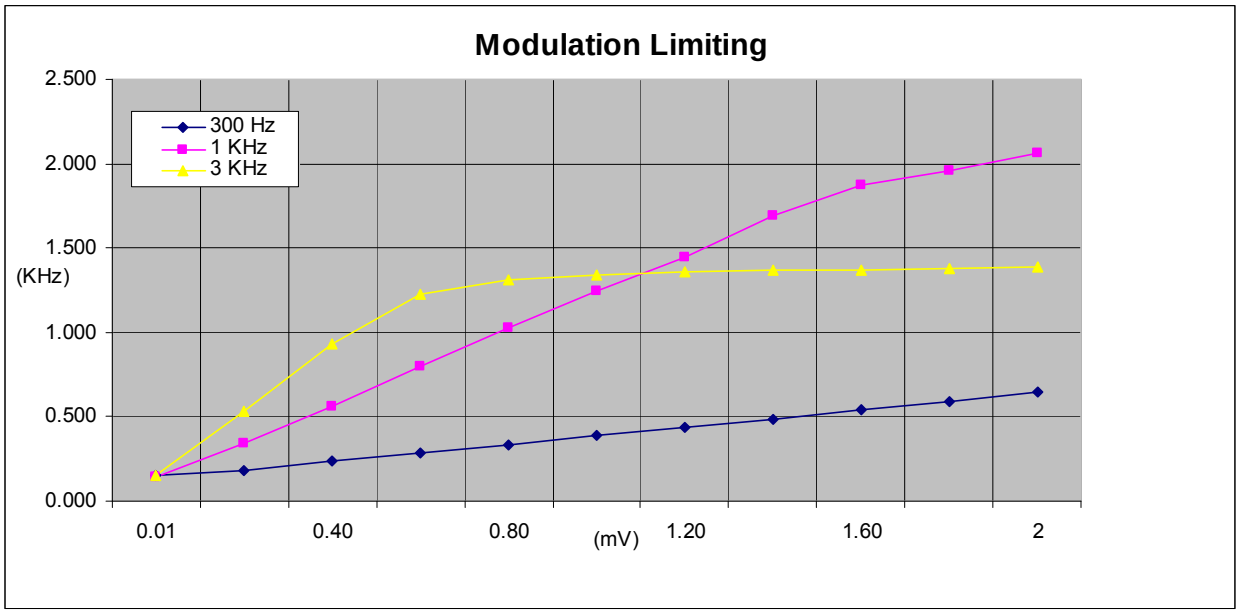


Figure 8 - Modulation Limiting Graph

2.10 Occupied Bandwidth (FCC Section 2.1049, 90.209, 90.210)

The transmitter was modulated by a 2.5 KHz tone signal at an input level 16 dB greater than that required to produce 50% modulation (e.g.: +2.5 KHz peak deviation at 1 KHz modulating frequency). The input level was established at the frequency of maximum response of the audio modulating circuit.

The occupied bandwidth of the fundamental was measured using a spectrum analyzer, as shown in Figures 9 through 11.

2.11 Mask D per FCC Part 90.210

(1) On any frequency from the center of the authorized bandwidth $f_0$to 5.625 kHz removed from f_0: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 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 + 10 log (P_{watt}) dB or 70 dB, whichever is the lesser attenuation.

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two to three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emissions mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (m) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, then an alternate procedure may be used provided prior Commission approval is obtained.

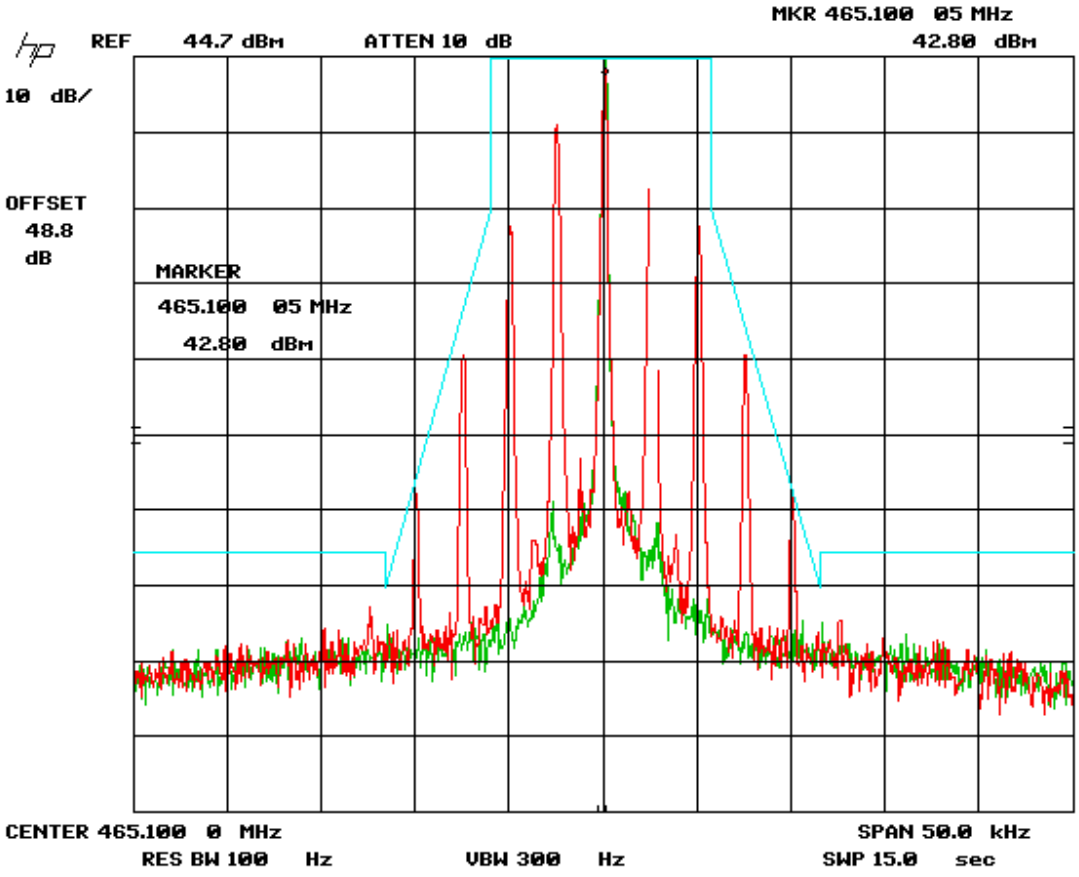


Figure 9 - Occupied Bandwidth of Transmitter Tuned to 465.1 MHz

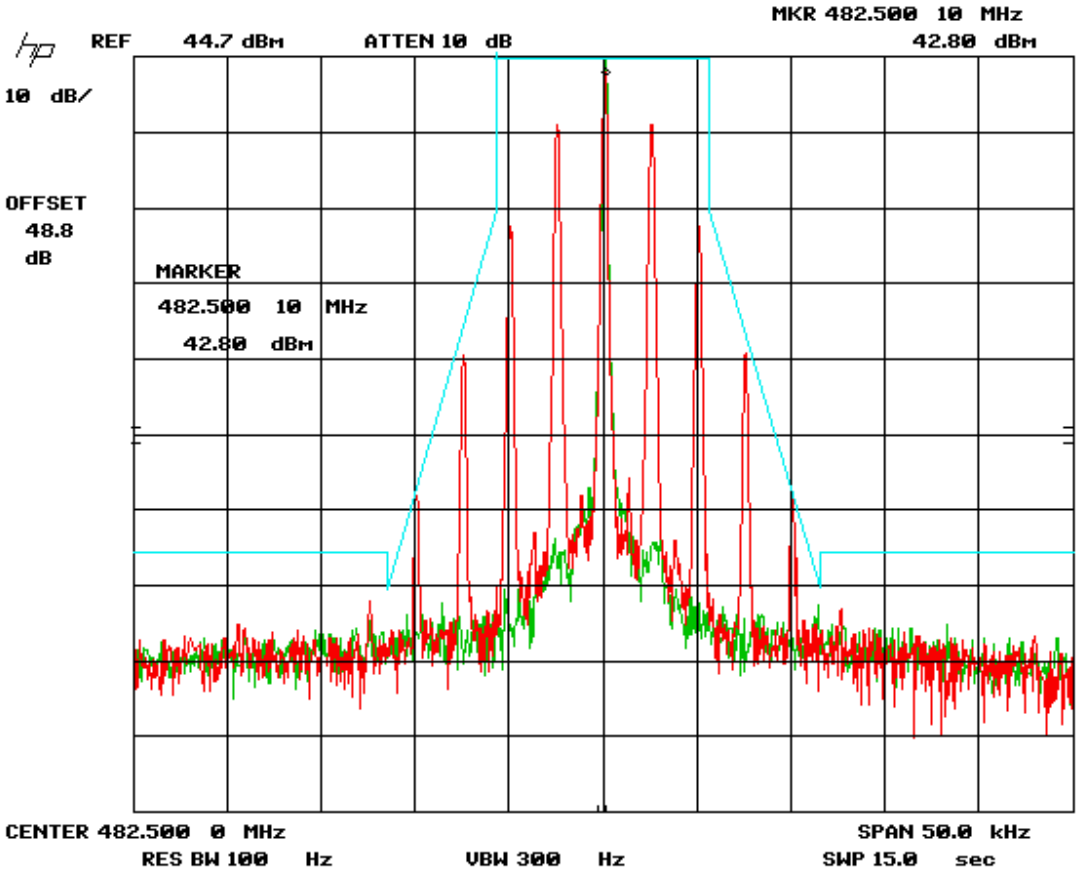


Figure 10 - Occupied Bandwidth of Transmitter Tuned to 482.5 MHz

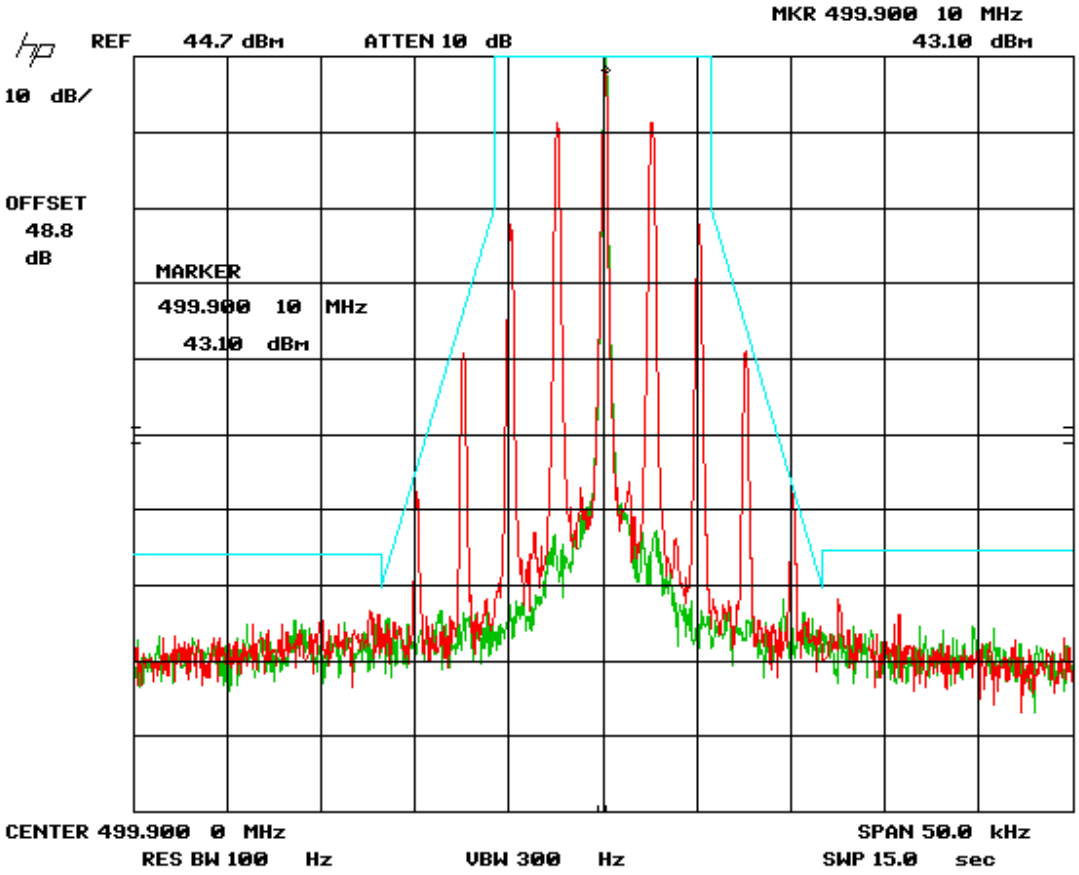


Figure 11 - Occupied Bandwidth of Transmitter Tuned to 499.9 MHz

2.12 Spurious Emissions at Antenna Terminals (FCC 2.1051, 2.1057, 90.210)

Spurious emissions in the frequency range 30 MHz – 5 GHz have been measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable and attenuator (whose loss was entered in the spectrum analyzer as offset) to the antenna output terminals. The spectrum analyzer was set for a 50 Ω impedance with the RBW = 100 kHz and VBW> RBW.

2.11.1 Spurious Emissions Limits

At least 50 + 10 log (P_{watt}) dB or 70 dB, whichever is the lesser attenuation.

2.11.2 Test data

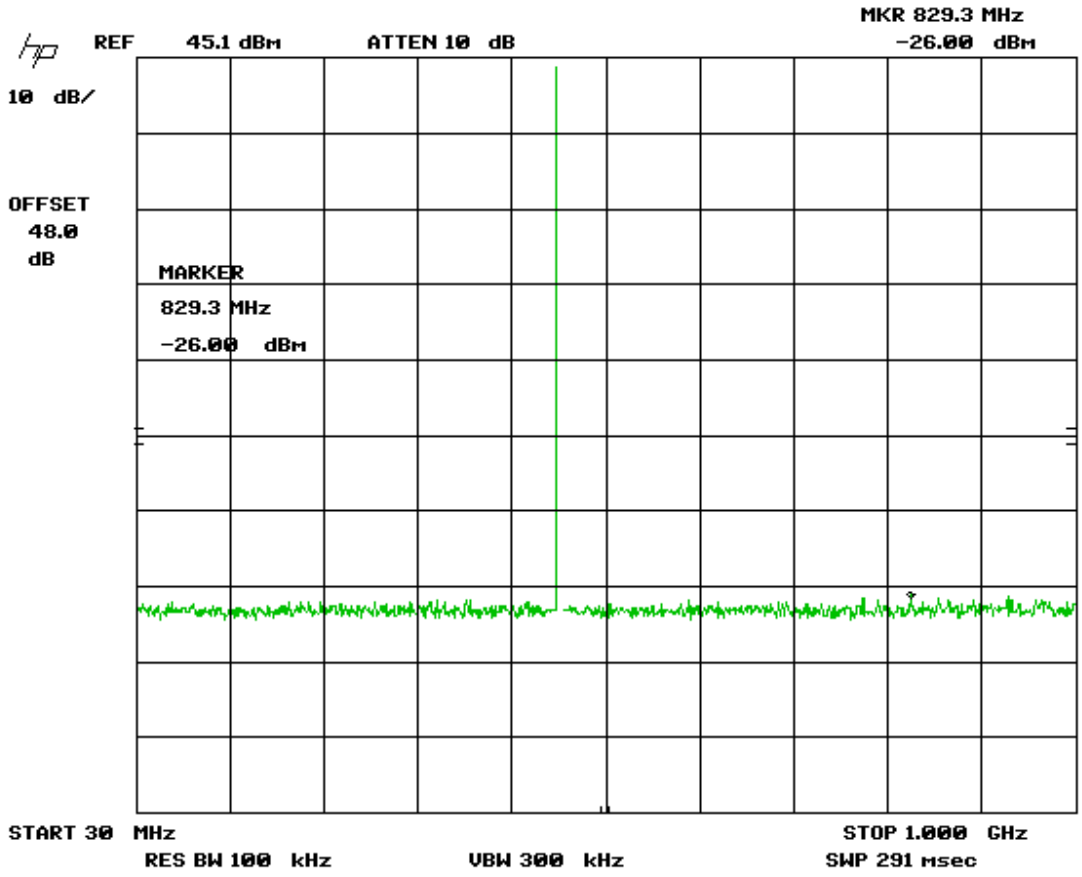


Figure 12 - Antenna Conducted Spurious Emissions

Attenuation = 45.1 dBm -(-26 dBm) = 71.1 > Limit = 50 + 10 log (P_{watt}) = 64.8 dB

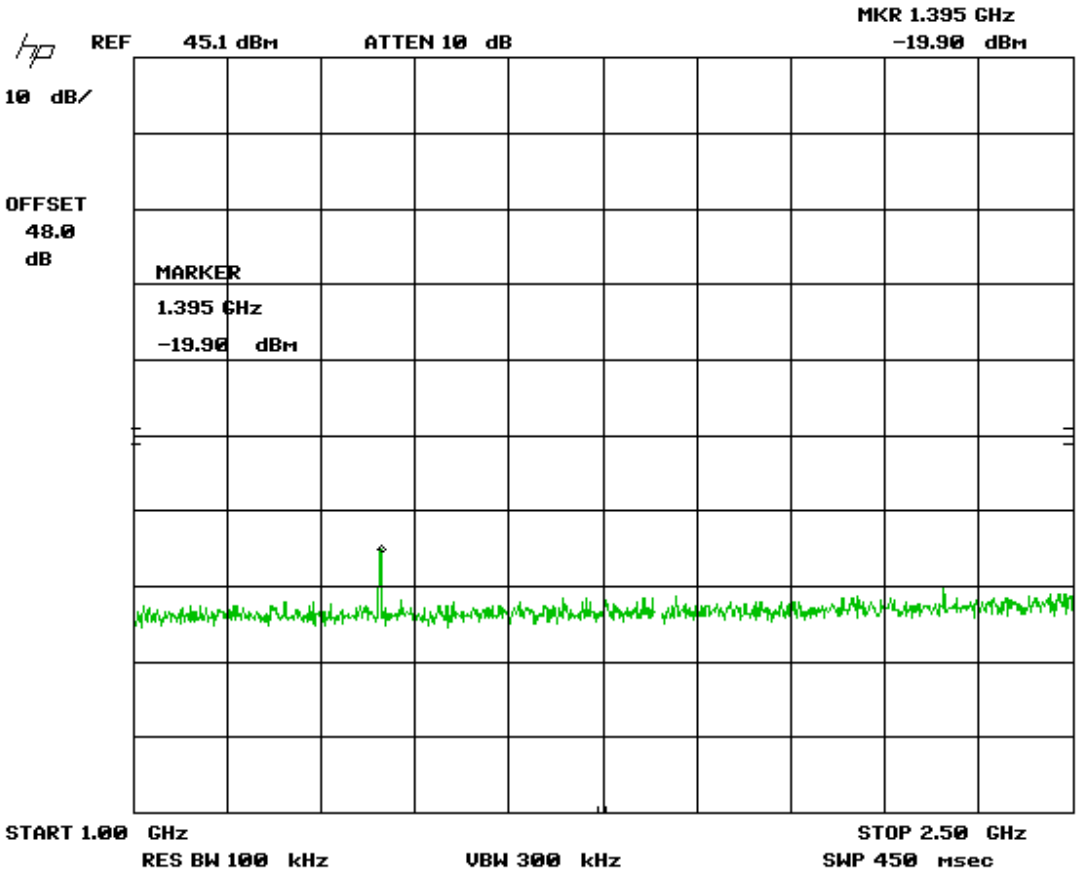


Figure 13 - Antenna Conducted Spurious Emissions

Attenuation = 45.1 dBm -(-19.9 dBm) = 65 > Limit = 50 + 10 log (P_{watt}) = 64.8 dB

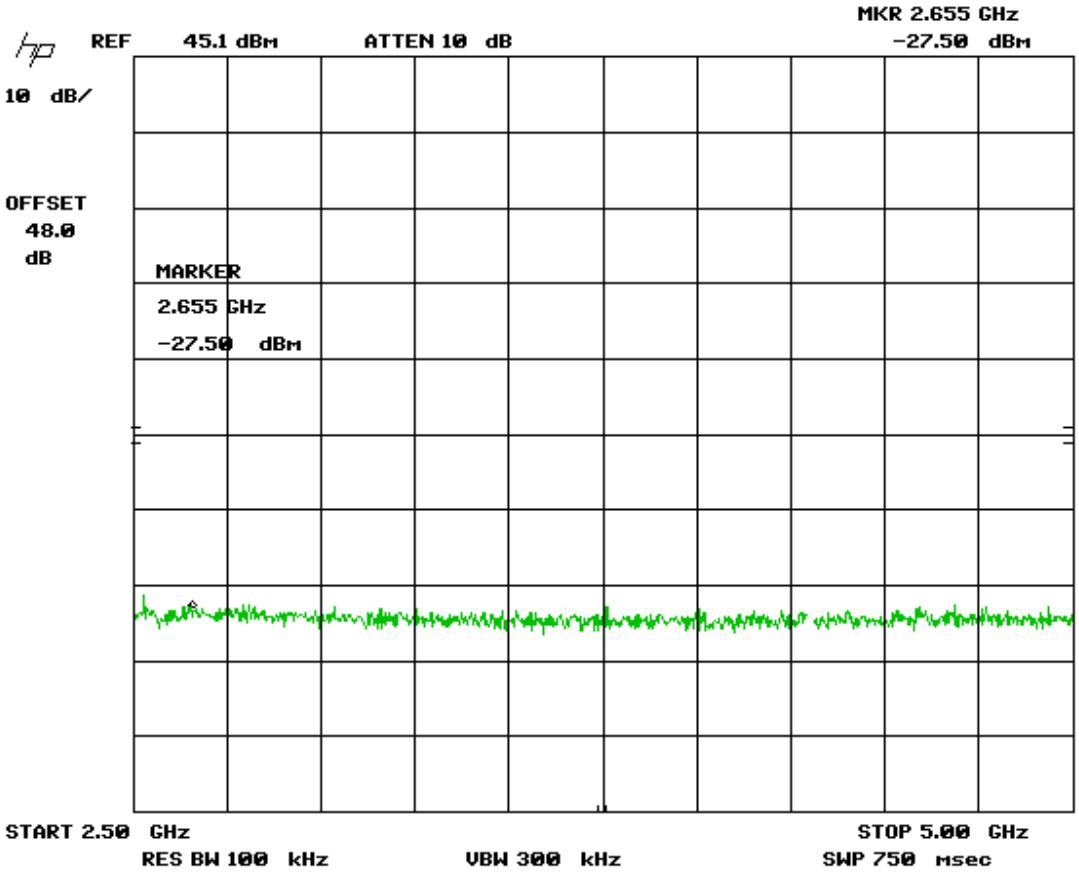


Figure 14 - Antenna Conducted Spurious Emissions

Attenuation = 45.1 dBm -(-27.5 dBm) = 72.6 > Limit = 50 + 10 log (P_{watt}) = 64.8 dB

2.13 Frequency Stability (FCC 2.1055, 90.213(a))

The EUT RF output was measured as its input bias voltages were changed from 4.5 VDC to 5.0 VDC and to 5.5 VDC while the temperature was varied from -30ºC to +50 ºC. Each soak period was 10 minutes. The EUT frequency stability versus temperature and DC bias variation was within the FCC 2.1055 requirements. Frequency change was less than 1 ppm (part per million).

2.13.1 Frequency Stability Requirements

Over the temperature range of -30 ºC to +50 ºC, for fixed and based stations operating in the frequency range of 421-512 MHz with channel bandwidth of 12.5 KHz, transmitters used must have a minimum frequency stability of 1.5 ppm. For mobile products the limit is 2.5 KHz.

2.13.2 Frequency Stability Test Data

Table 6 - Transmitter Frequency Stability

Center Frequency:	468.100372
Full Power Level:	30 W
Frequency Tolerance Limit:	2.0 ppm
Max. Frequency Tolerance Measured:	0.2 ppm
Measured Input Voltage:	13.6 V
Measured Input Current:	7.0 A

Table 7 - Frequency Stability Measurement at Nominal Voltage

Temperature (degrees C)	Measured Frequency (MHz)	Deviation (ppm)
-30	468.100460	0.2
-20	468.100472	0.2
-10	468.100497	0.3
0	468.100460	0.2
10	468.100410	0.1
20	468.100372	0.0
30	468.100285	-0.2
40	468.100272	-0.2
50	468.100347	-0.1

Table 8 - Frequency Stability Measurement at 85% of Nominal Voltage

Temperature (degrees C)	Measured Frequency (MHz)	Deviation (ppm)
-30	468.100452	0.2
-20	468.100460	0.2
-10	468.100482	0.2
0	468.100472	0.2
10	468.100452	0.2
20	468.100410	0.1
30	468.100382	0.0
40	468.100252	-0.3
50	468.100272	-0.2

Table 9 - Frequency Stability Measurement at 115% of Nominal Voltage

Temperature (degrees C)	Measured Frequency (MHz)	Deviation (ppm)
-30	468.100482	0.2
-20	468.100492	0.3
-10	468.100505	0.3
0	468.100472	0.2
10	468.100452	0.2
20	468.100440	0.1
30	468.100372	0.0
40	468.100372	0.0
50	468.100385	0.0

2.14 Field Strength of Spurious Radiation (FCC Section 2.1053, 2.1057, 90.210)

Spurious emissions were evaluated from 30 MHz to 5 GHz at a distance of 3 meters from the EUT.

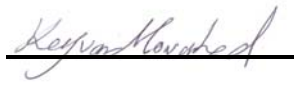
The EUT was placed on an open area test site and the spurious emissions tested with the EUT antenna terminated with a 50 Ohm load. Measurements for 30 to 1000 MHz were made with the analyzer's bandwidth at 10 kHz and video bandwidth set to 300 kHz.

The EUT's emissions were recreated with a signal generator and transmit antenna and the power was measured and recorded by the substitution method. Measurements above 1 GHz were made with the analyzer's resolution bandwidth set to 1 MHz.

Table 10 - Field Strength of Spurious Radiation

Frequency	Maximum RX Reading (Units A)	Recreated Reading During Substitution (Using Same Units A) - Ideally 0	Difference Column A - B	TX Gain (dBi)	TX Gain Relative to Dipole (dB)	RF Power into TX antenna (Corrected (dBm) (SG Value-CL)	RF Power into substitution TX antenna corrected by TX Gain Relative to Dipole (dBm)	Limit (dBm)	Margin Below Limit (dB)
The following applies information from test as performed									
999.98	44.3	45	-0.7	6.7	4.56	-48.89	-45.03	-20	25.03
930.183	54.1	54.3	-0.2	5.9	3.76	-48.57	-45.01	-20	25.01
965.003	49.3	49.8	-0.5	4.04	1.9	-48.65	-47.25	-20	27.25
2790.63	51.07	53.83	-2.76	10.09	7.95	-55.24	-50.05	-20	30.05
4185	50.12	50.79	-0.67	10.558	8.418	-54.74	-46.992	-20	26.992
3255	48.22	49.76	-1.54	9.362	7.222	-56.1	-50.418	-20	30.418
4650	48.36	47.04	1.32	11.134	8.994	-58.38	-48.066	-20	28.066
1447.5	61.67	61.99	-0.32	7.665	5.525	-51.92	-46.715	-20	26.715
4824.93	52.39	53.34	-0.95	10.873	8.733	-45.14	-37.357	-20	17.357
1499.73	65.2	65.85	-0.65	7.665	5.525	-46.99	-42.115	-20	22.115
4499.07	48.83	49.81	-0.98	11.027	8.887	-49.83	-41.923	-20	21.923
2499.4	59.24	59.34	-0.1	9.614	7.474	-44.91	-37.536	-20	17.536
2325.45	77.07	77.6	-0.53	9.35	7.21	-31.72	-25.04	-20	5.04
1395.33	57.77	57.9	-0.13	8.266	6.126	-48.93	-42.934	-20	22.934
1860.4	56.38	56.98	-0.6	9.35	7.21	-48.1	-41.49	-20	21.49
2412.23	62.04	62.58	-0.54	8.715	6.575	-42.16	-36.125	-20	16.125
2894.98	54.04	54.56	-0.52	9.665	7.525	-49.29	-42.285	-20	22.285
3377.45	47.67	47.91	-0.24	9.9	7.76	-56.76	-49.24	-20	29.24
1999.58	56.58	57.59	-1.01	8.028	5.888	-49.54	-44.662	-20	24.662
2999.28	55.62	55.2	0.42	9.53	7.39	-52.2	-44.39	-20	24.39
3499.28	54.76	54.98	-0.22	10.68	8.54	-51.8	-43.48	-20	23.48

Test Date: October 4, 2011

Tester Signature:  **Name: Keyvan Muvahhid**

2.15 Transient Frequency Behavior (90.214)

2.15.1 Transient Frequency Behavior Requirements

For transient frequency behavior for equipment designed to operate on 12.5 kHz channels:

Time intervals	Maximum frequency difference	421 to 512 MHz
T1	±12.5 kHz	10.0 ms
T2	±6.25 kHz	25.0 ms
T3	±12.5 kHz	10.0 ms

1. ton is the instant when a 1 KHz test signal is completely suppressed, including any capture time due to phasing.
T1 is the time period immediately following ton.
T2 is the time period immediately following t1.
T3 is the time period from the instant when the transmitter is turned off until toff.
toff is the instant when the 1 KHz test signal starts to rise.
2. During the time from the end of t2 to the beginning of t3, the frequency difference must not exceed the limits specified in § 90.213.
3. Difference between the actual transmitter frequency and the assigned transmitter frequency.
4. If the transmitter carrier output power rating is 50 Watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

2.15.2 Transient Frequency Behavior Test Data

Transient Frequency Behavior
Carrier Frequency: 465.1 MHz
Channel Spacing: 12.5 KHz
Power: 30 W
Description: Switch on condition t_{on}, t_1, and t_2

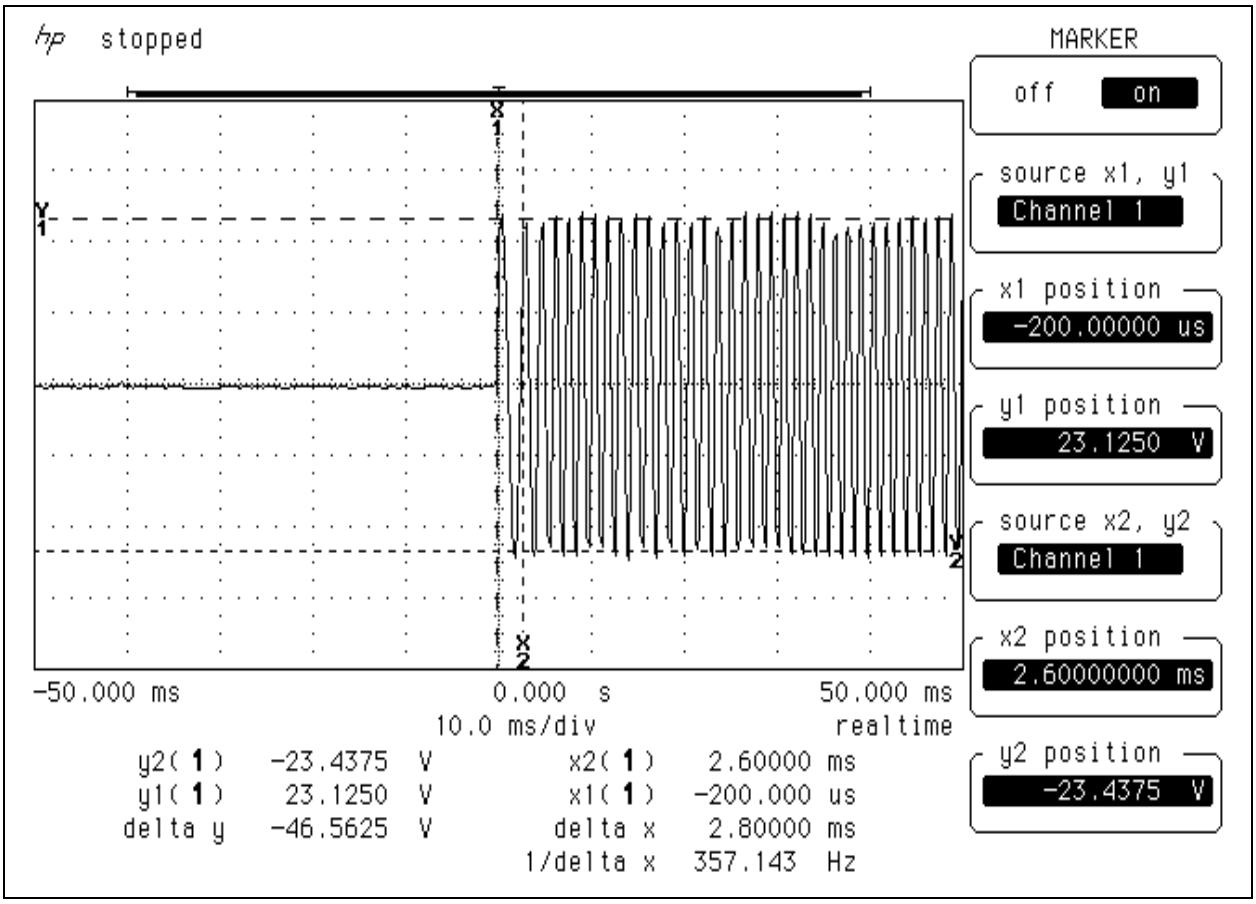


Figure 15 - Transient Frequency Behavior (On)

Carrier Frequency: 465.1 MHz
Channel Spacing: 12.5 KHz
Power: 30 W
Description: Switch off condition t_3, t_{off}

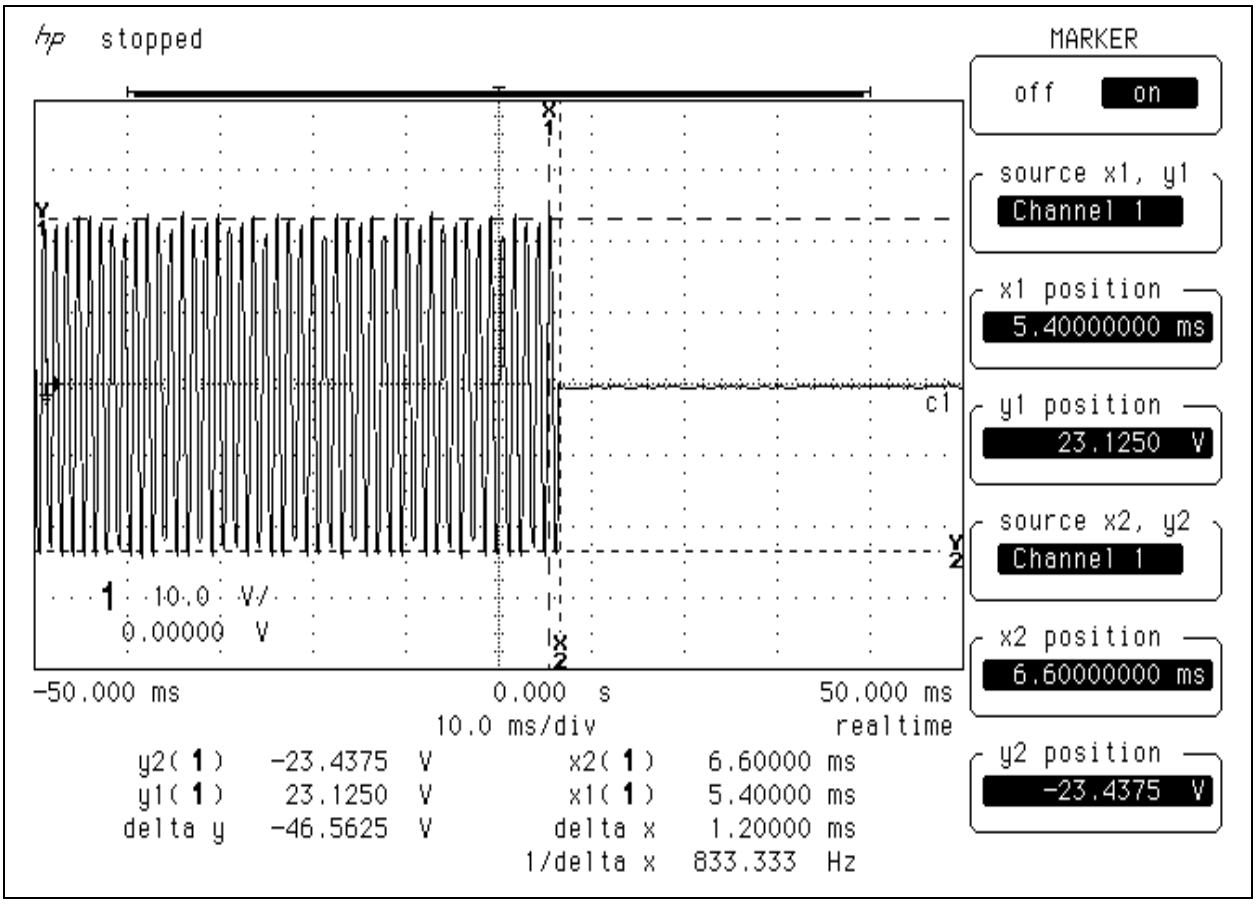


Figure 16 - Transient Frequency Behavior (Off)

2.16 RF Exposure Requirements (1.1310 & 2.1091)

5.5.1. Limits

§ **1.1310:** The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

2.16.1 Maximum Public Exposure to RF (MPE)

The maximum exposure level to the public from the RF power of the EUT shall not exceed the following:

Occupational/Controlled Exposure, $\mathbf{S}_{\mathbf{controlled}}$ [mW/cm^2] =450/300=
1.50 mW/cm^2= $15W/m^2$

General population/Uncontrolled Exposure, $\mathbf{S}_{\mathbf{uncontrolled}}$ [mW/cm^2] =450/1500=
0.3 mW/cm^2= $3W/m^2$

Therefore, for: Gain Antenna= 0 dBi

Peak Power (Watts) = 28.8 (from Table 3 of Test Report)
Gain of Transmit Antenna = 0 dB_i = 1,

$\mathbf{r}_{\mathbf{controlled}} = \sqrt{}(PG/ 4\pi S)= 28.8(1)/4*\pi*15= 0.39$ m= 39 cm

$\mathbf{r}_{\mathbf{uncontrolled}} = \sqrt{}(PG/ 4\pi S)= 28.8(1)/4*\pi*3= 0.87$ m= 87 cm

2.17 Emission Designation

For FM Voice Modulation:

Channel Spacing = 12.5 KHz, D = 2.5 KHz max, K = 1, M = 3 KHz
Bn = 2M + 2DK = 2(3) + 2(2.5) (1) = **11 KHz**
Emission designation: 11K0F3E

2.18 Measurement Uncertainty

The measurement uncertainties given were calculated using the method detailed in CISPR 16-4. A coverage factor of k=2 was used to give a level of confidence of approximately 95%.

2.18.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ±2.8 dB.

2.18.2 Radiated Emissions Measurement Uncertainty

For a measurement distance of 3 m the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is ±5.3 dB. This value includes all elements of measurement.

The measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is ±5.1 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ±5.1 dB.