TEST REPORT

OF

FCC Part 90, Part 2

FCC ID : R72IM101

Equipment Under Test	:	Private Land Mobile Radio for Vehicle(VHF)
Model No.	:	IM101
Serial No.	:	N/A
Applicant	:	E-Tech Co., Ltd.
Manufacturer	:	E-Tech Co., Ltd.
Date of Test(s)	:	2007-01-15~ 2007-01-31
Date of Issue	:	2007-02-02

In the configuration tested, the EUT complied with the standards specified above.

Tested By: **Date** **2007-02-02**

Feel Jeong

Approved By **Date** **2007-02-02**

Albert Lim

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Appendix A. Photo of Radiated Spurious Emissions Test

Appendix B. Photos of the EUT

1. General Information

1-1. Testing Laboratory

SGS Testing Korea Co., Ltd.
Wireless Div. 2F, 18-34, Sanbon-dong, Gunpo-city, Gyeonggi-do, Korea 435-040
www.electrolab.kr.sgs.com
Telephone : +82 +31 428 5740
FAX : +82 +31 427 2371

1-2. Details of Applicant

Applicant : E-Tech Co., Ltd.
Address : #403-901, Techno Park Complex, 193, Yakdae-dong, Wonmi-gu, Bucheon-city, Kyunggi-do, 420-734, Korea
Contact Person : Jong-woon Kim
Phone No. : 82-32-328-0611
Fax No. : 82-32-328-0612

1-3 Description of EUT

Kind of Product	Private Land Mobile Radio for Vehicle(VHF)
Model Name	IM101
Serial Number	N/A
Power Supply	DC 13.6 V
Frequency Range	136 MHz ~ 174 MHz
Transmit Power	5W(Low), 40 W(High)
Modulation Technique	FM
Number of Channels	255 Channels
Operating Conditions	-30 ~ 60 deg C
Antenna Type	External Antenna

1-4 Details of modification

-N/A

1-5. Test Equipment List

EQUIPMENT	MANUFACTURER	MODEL	CAL DUE.
Signal Generator	Agilent	E4438C	May 2007
Spectrum Analyzer	Agilent	E4440A	May 2007
Audio Analyzer	H.P.	8903B	Dec.2007
Modulation Analyzer	H.P.	8901B	Dec.2007
DC Power Supply	Agilent	6674A	May 2007
Tem/Hum Chamber	Han-Gil	HGTP-4050	Oct.2007
Power Sensor	Agilent	E9327A	May 2007
Power Meter	Agilent	4416A	May 2007
Attenuator	Weincshel	AZ3096	Dec.2007
Preamplifier	Agilent	8449B	May 2007
Preamplifier	Agilent	8447F	Jun.2007
Dipole Antenna	VHAP/UHAP	975/958	Jun. 2007
Horn Antenna	Electro-Metrics	RGA-60	Dec. 2007
Horn Antenna	SCHWARZBECK	BBHA9120D(0600)	Jul. 2007
Signal Generator	R&S	SMR 20	Dec.2007
Ultra Broadband Antenna	R&S	HL562	Sep.2007
Biconical Antenna	Schwarzbeck ME	VUSA 9117	Nov.2007
Turn Table	INN-CO	CT 0800	N.C.R
Antenna Mast	INN-CO	MA 2000	N.C.R
Turn Device	INN-CO	FSM 230-M	N.C.R
Controller	INN-CO	CO 2000	N.C.R
Anechoic Chamber	SY Corporation	L x W x H 9.6 x 6.4 x 6.4	Aug. 2007

1.6 Summary of Test Results

Description of Test	FCC Rule	Result
Output Power Conducted	2.1046(a), 90.205	Complied
Radiated Spurious Emissions	2.1053(a), 90.210	Complied
Conducted Spurious Emissions	2.1051, 90.210	Complied
Audio Frequency Response	2.1047(a)	Complied
Audio Low Pass Filter Frequency Response	2.1047(a)	Complied
Modulation Limiting	2.1047(b)	Complied
Occupied Bandwidth	2.1049, 90.210	Complied
Frequency Stability	90.213, 2.1055	Complied
Transient Frequency Behaviour of the Transmitter	90.214	Complied

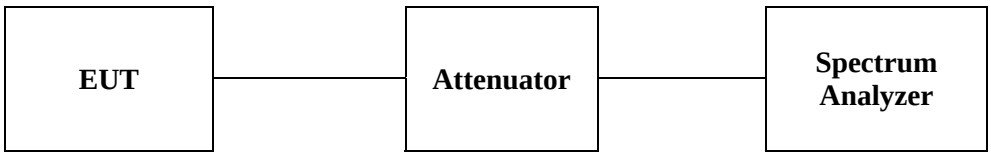
2. Output Power Conducted : FCC 2.1046(a), FCC90.205

2.1. Limit

According to §90.205(r), the output power shall not exceed by more than 20 percent either the out-put power

2.2. Test Procedure

1. The conducted RF output power is the available power at the output terminals of the transmitter when the output terminals are corrected to the standard transmitter load.
2. The test sample is feeding a 50 ohm coaxial attenuator which is connected to a spectrum analyzer.
3. The power output at the transmitter antenna port is determined by adding the value of the attenuator to the spectrum analyzer reading.
4. The test are performed at the frequencies(low, middle, high channels of the EUT operating band) and full rated power levels of the transmitter.



2.3. Test results

Ambient temperature : 23 ℃ Relative humidity : 51 %

Power Level [W]	Frequency [MHz]	Channel Spacing [kHz]	RF Output Power [W]	Nominal DC Voltage [V]
5	136.000	12.5	5.02	13.6
	155.000	12.5	4.97	13.6
	174.000	12.5	5.14	13.6
40	136.000	12.5	40.79	13.6
	155.000	12.5	39.60	13.6
	174.000	12.5	40.35	13.6

The supply voltage to the transmitter was set to 13.6 volts DC. The RF output power was measured with the indicated current applied into the final RF amplifying device.

RF Power Output 5 W, Frequency 155.000 MHz

Measured DC Current: 1.90 A

RF Power Output 40 W, Frequency 155.000 MHz

Measured DC Current: 6.45 A

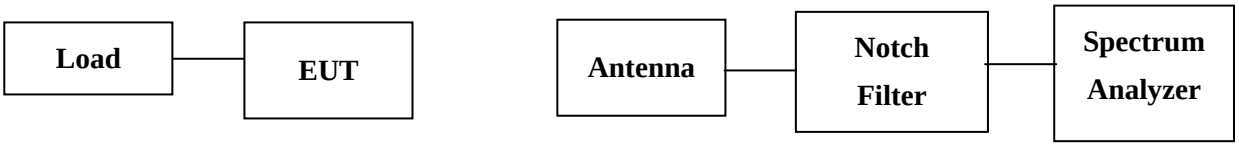
3. Radiated Spurious Emissions : FCC 2.1053(a), FCC90.210

3.1. Limit

According to §90.210, For 25 kHz channel : Spurious attenuated in dB= 43+ 10log (Power output in watts) Alternatively, an equivalent absolute level of -13 dBm is taken. For 12.5 kHz channel : Spurious attenuated in dB= 50+ 10log(Power output in watts) Alternatively, an equivalent absolute level of -20 dBm is taken.

3.2. Test Procedure

1 Radiated spurious emissions are emissions from the EUT when transmitting in non-radiating load on frequencies outside the operating band.
2. In order to suppress inter-modulation products in the spectrum analyzer a notch filter is used, if applicable.
3. The equipment is adjusted to obtain peak reading of received signal wherever they occur in the Spectrum by: rotating the transmitter under test, adjusting the antenna height.
4. The testing procedure is repeated for both horizontal and vertical polarization of the receiving antenna.
5. Relative signal strength is indicated on the spectrum analyzer connected to the receiving antenna. To obtain actual radiated signal strength for each spurious and harmonic frequency observed, a standard signal generator with calibrated output is connected to a dipole antenna adjusted to that particular frequency.
6. This dipole antenna is substituted for the transmitter under test.
7. The signal generator is adjusted in output level until a reading identical to that obtained with the actual transmitter is observed on the spectrum analyzer.
8. Signal strength is then read and recorded directly from the generator.



3.3. Test results

Ambient temperature : 23 ℃ Relative humidity : 60 %

TX FREQ= 136.000 MHz Low Power Setting Channel Spacing: 12.5 kHz

Frequency [MHz]	Polarization	Max. Power Value [dBm]	Specification Limit [dBm]	Margin [dB]
272.000	V	<-30	-20	>10
408.000	V	<-30	-20	>10
544.000	V	<-30	-20	>10
680.000	H	<-30	-20	>10
816.000	V	<-30	-20	>10
952.000	V	<-30	-20	>10
1088.000	V	<-30	-20	>10
1224.000	V	<-30	-20	>10
1360.000	H	<-30	-20	>10

TX FREQ = 136.000 MHz High Power Setting Channel Spacing: 12.5 kHz

Frequency [MHz]	Polarization	Max. Power Value [dBm]	Specification Limit [dBm]	Margin [dB]
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544.000	V	<-30	-20	>10
680.000	H	<-30	-20	>10
816.000	V	<-30	-20	>10
952.000	V	<-30	-20	>10
1088.000	V	<-30	-20	>10
1224.000	V	<-30	-20	>10
1360.000	V	<-30	-20	>10

TX FREQ = 136.000 MHz Low Power Setting Channel Spacing: 25 kHz

Frequency [MHz]	Polarization	Max. Power Value [dBm]	Specification Limit [dBm]	Margin [dB]
272.000	V	<-30	-13	>17
408.000	V	<-30	-13	>17
544.000	V	<-30	-13	>17
680.000	H	<-30	-13	>17
816.000	V	<-30	-13	>17
952.000	V	<-30	-13	>17
1088.000	V	<-30	-13	>17
1224.000	V	<-30	-13	>17
1360.000	V	<-30	-13	>17

TX FREQ = 136.000 MHz High Power Setting Channel Spacing: 25 kHz

Frequency [MHz]	Polarization	Max. Power Value [dBm]	Specification Limit [dBm]	Margin [dB]
272.000	V	<-30	-13	>17
408.000	V	<-30	-13	>17
544.000	V	<-30	-13	>17
680.000	H	<-30	-13	>17
816.000	V	<-30	-13	>17
952.000	V	<-30	-13	>17
1088.000	V	<-30	-13	>17
1224.000	V	<-30	-13	>17
1360.000	V	<-30	-13	>17

TX FREQ = 155.000 MHz Low Power Setting Channel Spacing: 12.5 kHz

Frequency [MHz]	Polarization	Max. Power Value [dBm]	Specification Limit [dBm]	Margin [dB]
310.000	V	<-30	-20	>10
465.000	V	<-30	-20	>10
620.000	H	<-30	-20	>10
775.000	V	<-30	-20	>10
930.000	V	<-30	-20	>10
1085.000	V	<-30	-20	>10
1240.000	V	<-30	-20	>10
1395.000	H	<-30	-20	>10
1550.000	V	<-30	-20	>10

TX FREQ = 155.000 MHz High Power Setting Channel Spacing: 12.5 kHz

Frequency [MHz]	Polarization	Max. Power Value [dBm]	Specification Limit [dBm]	Margin [dB]
310.000	V	<-30	-20	>10
465.000	V	<-30	-20	>10
620.000	H	<-30	-20	>10
775.000	H	<-30	-20	>10
930.000	V	<-30	-20	>10
1085.000	H	<-30	-20	>10
1240.000	V	<-30	-20	>10
1395.000	H	<-30	-20	>10
1550.000	H	<-30	-20	>10

TX FREQ = 155.000 MHz Low Power Setting Channel Spacing: 25 kHz

Frequency [MHz]	Polarization	Max. Power Value [dBm]	Specification Limit [dBm]	Margin [dB]
310.000	V	<-30	-13	>17
465.000	V	<-30	-13	>17
620.000	H	<-30	-13	>17
775.000	V	<-30	-13	>17
930.000	V	<-30	-13	>17
1085.000	V	<-30	-13	>17
1240.000	V	<-30	-13	>17
1395.000	V	<-30	-13	>17
1550.000	V	<-30	-13	>17

TX FREQ = 155.000 MHz High Power Setting Channel Spacing: 25 kHz

Frequency [MHz]	Polarization	Max. Power Value [dBm]	Specification Limit [dBm]	Margin [dB]
310.000	V	<-30	-13	>17
465.000	V	<-30	-13	>17
620.000	H	<-30	-13	>17
775.000	V	<-30	-13	>17
930.000	V	<-30	-13	>17
1085.000	V	<-30	-13	>17
1240.000	V	<-30	-13	>17
1395.000	V	<-30	-13	>17
1550.000	V	<-30	-13	>17

TX FREQ = 174.000 MHz Low Power Setting Channel Spacing: 12.5 kHz

Frequency [MHz]	Polarization	Max. Power Value [dBm]	Specification Limit [dBm]	Margin [dB]
348.000	V	<-30	-20	>10
522.000	H	<-30	-20	>10
696.000	V	<-30	-20	>10
870.000	V	<-30	-20	>10
1044.000	V	<-30	-20	>10
1218.000	V	<-30	-20	>10
1392.000	H	<-30	-20	>10
1566.000	V	<-30	-20	>10
1740.000	H	<-30	-20	>10

TX FREQ = 174.000 MHz High Power Setting Channel Spacing: 12.5 kHz

Frequency [MHz]	Polarization	Max. Power Value [dBm]	Specification Limit [dBm]	Margin [dB]
348.000	V	<-30	-20	>10
522.000	V	<-30	-20	>10
696.000	V	<-30	-20	>10
870.000	H	<-30	-20	>10
1044.000	H	<-30	-20	>10
1218.000	V	<-30	-20	>10
1392.000	H	<-30	-20	>10
1566.000	H	<-30	-20	>10
1740.000	H	<-30	-20	>10

TX FREQ = 174.000 MHz Low Power Setting Channel Spacing: 25 kHz

Frequency [MHz]	Polarization	Max. Power Value [dBm]	Specification Limit [dBm]	Margin [dB]
348.000	V	<-30	-13	>17
522.000	H	<-30	-13	>17
696.000	H	<-30	-13	>17
870.000	V	<-30	-13	>17
1044.000	V	<-30	-13	>17
1218.000	V	<-30	-13	>17
1392.000	H	<-30	-13	>17
1566.000	V	<-30	-13	>17
1740.000	V	<-30	-13	>17

TX FREQ = 174.000 MHz High Power Setting Channel Spacing: 25 kHz

Frequency [MHz]	Polarization	Max. Power Value [dBm]	Specification Limit [dBm]	Margin [dB]
348.000	V	<-30	-13	>17
522.000	V	<-30	-13	>17
696.000	V	<-30	-13	>17
870.000	H	<-30	-13	>17
1044.000	V	<-30	-13	>17
1218.000	V	<-30	-13	>17
1392.000	H	<-30	-13	>17
1566.000	V	<-30	-13	>17
1740.000	V	<-30	-13	>17

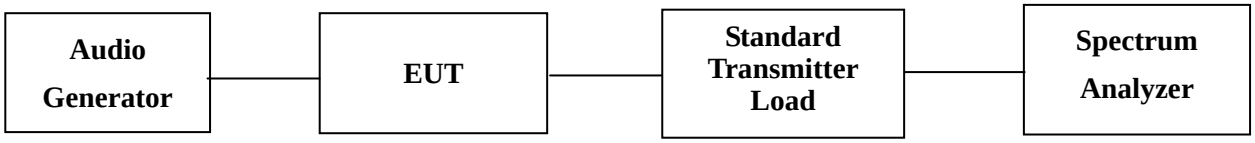
4. Conducted Spurious Emissions : FCC 2.1051, FCC90.210

4.1. Limit

According to §90.210, For 25 kHz channel : Spurious attenuated in dB= 43+ 10log(Power output in watts) Alternatively, an equivalent absolute level of -13 dBm is taken. For 12.5 kHz channel : Spurious attenuated in dB= 50+ 10log(Power output in watts) Alternatively, an equivalent absolute level of -20 dBm is taken

4.2. Test Procedure

1. Conducted spurious emissions are emissions at the antenna terminal on frequencies outside the operating band. The test is performed according the principle below using a computer controlled test set-up.
2. The transmitter is modulated with 2500Hz sine wave at an input level 16dB greater than that necessary to produce 50% of rated system deviation.

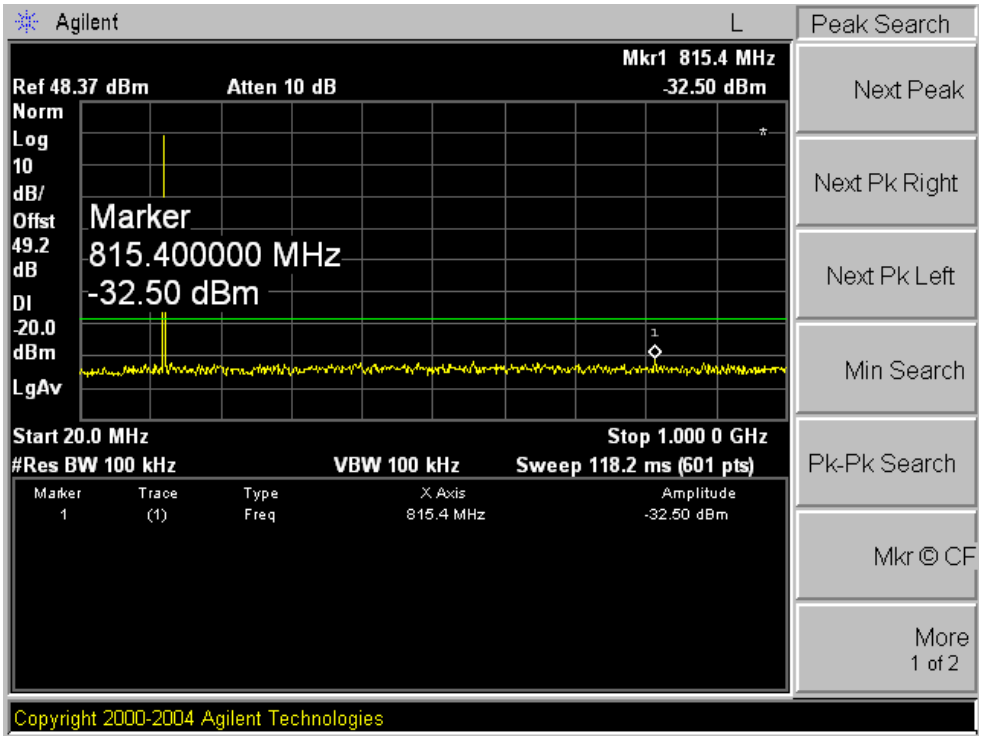


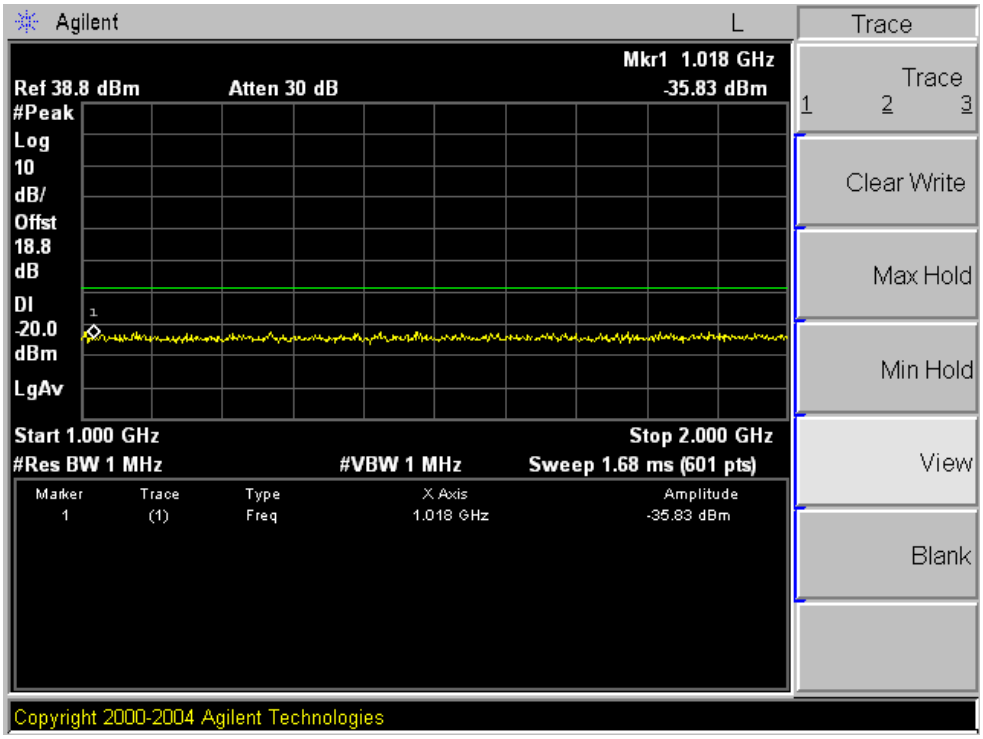
4.3. Test Results

Ambient temperature : 23 ℃ Relative humidity : 51 %

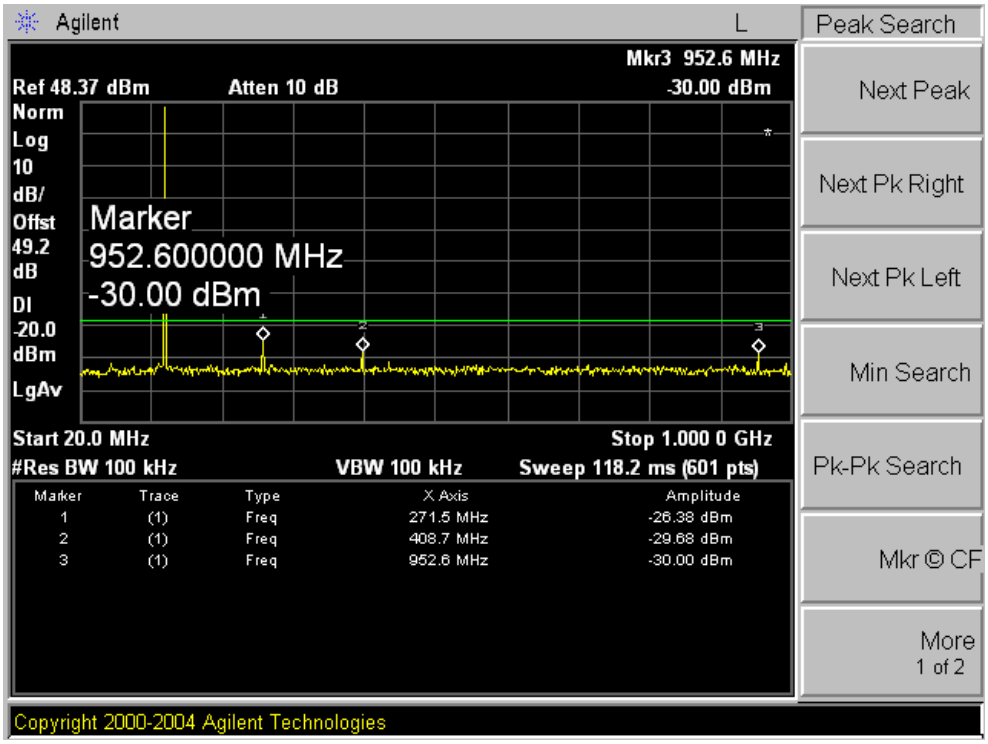
Please refer to the following plots.

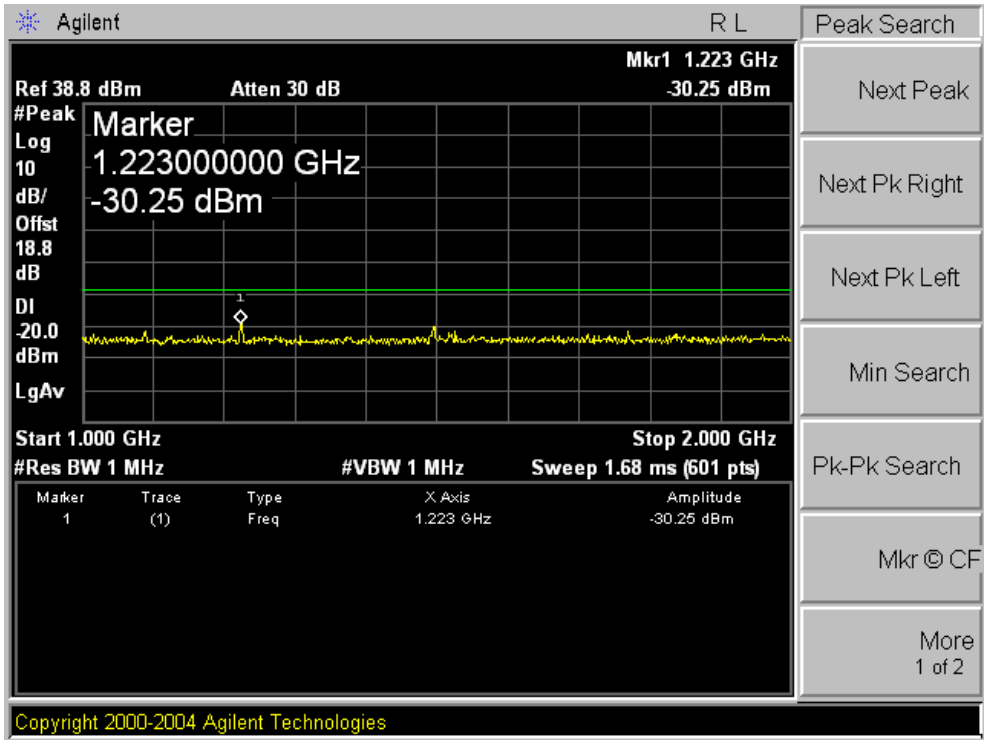
TX FREQ= 136.000 MHz **Low Power Setting** **Channel Spacing: 12.5 kHz**



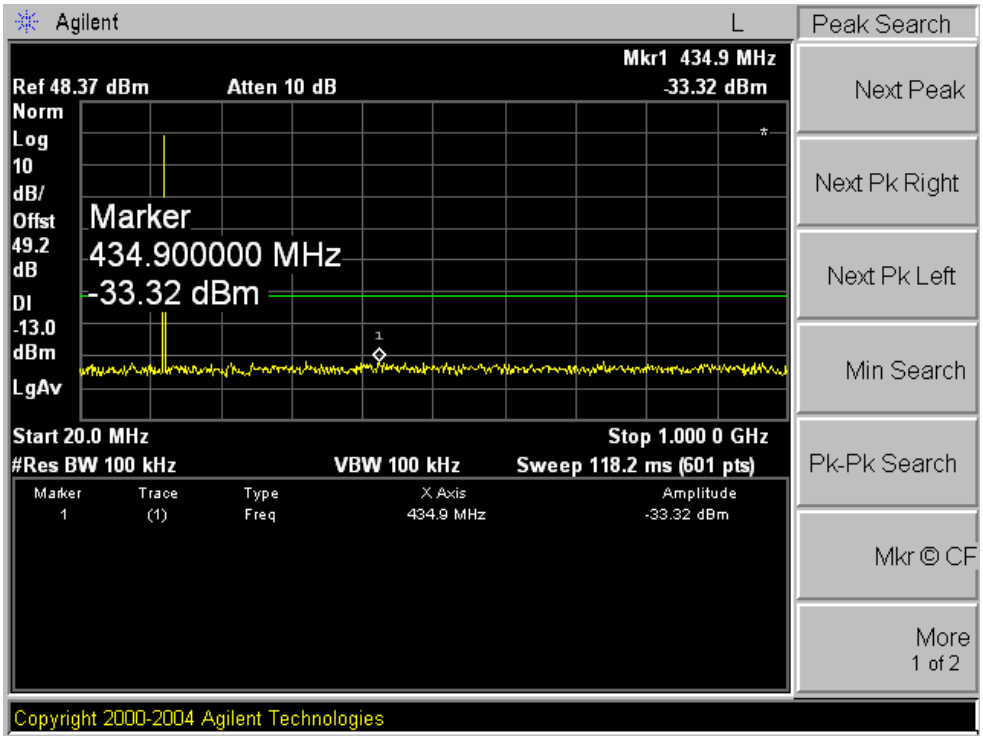


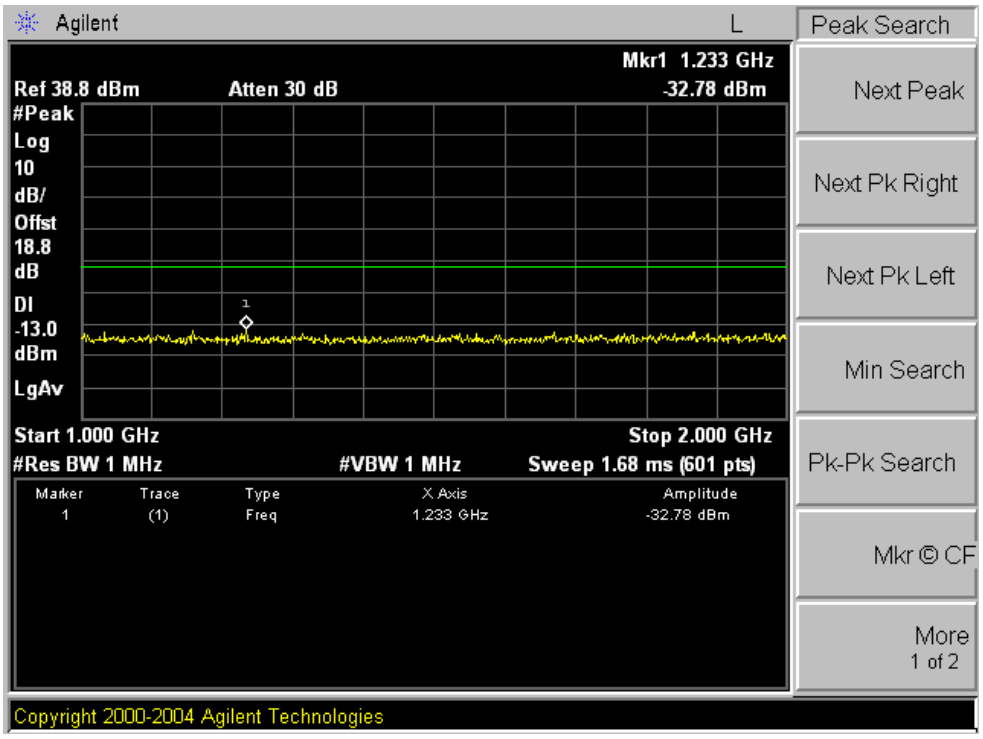
TX FREQ = 136.000 MHz **High Power Setting** **Channel Spacing: 12.5 kHz**



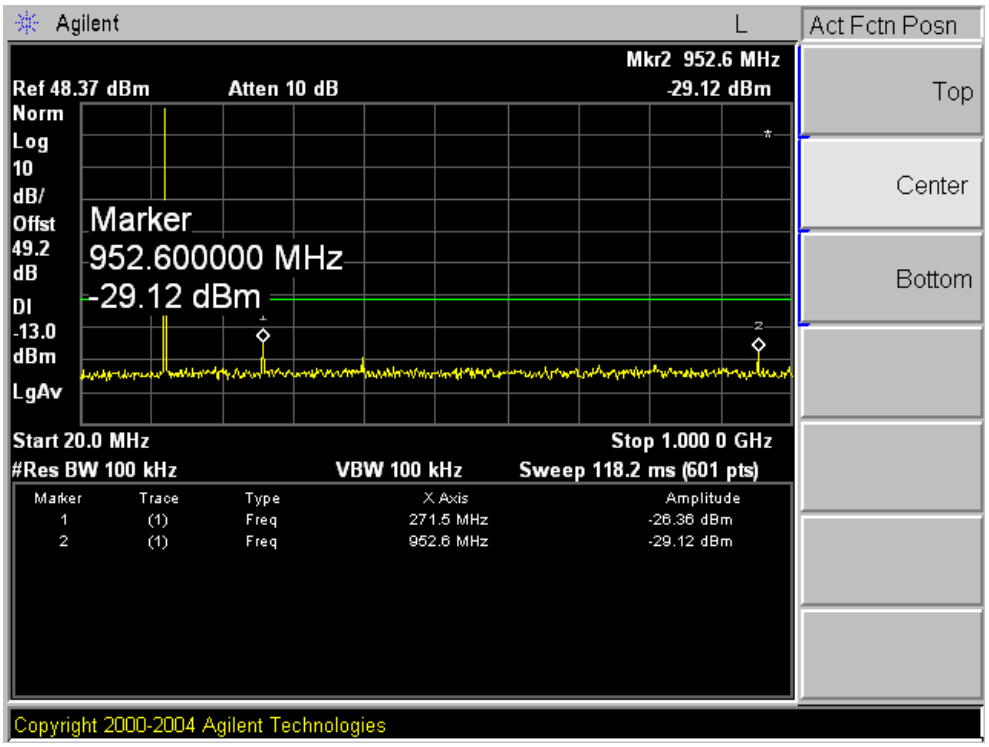


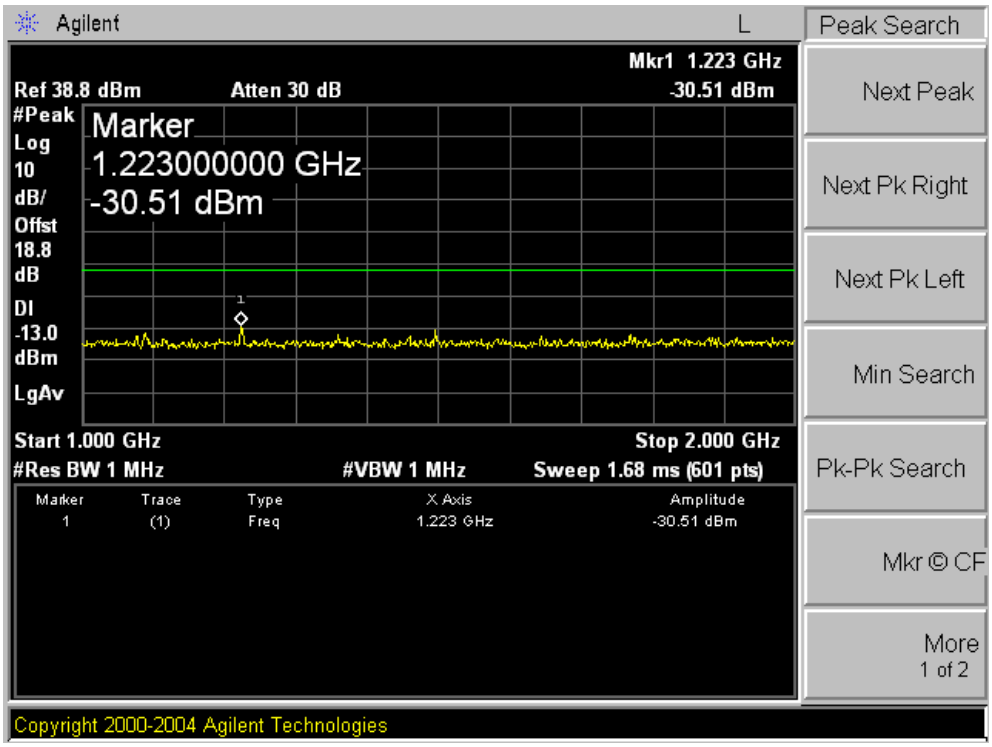
TX FREQ = 136.000 MHz **Low Power Setting** **Channel Spacing: 25 kHz**



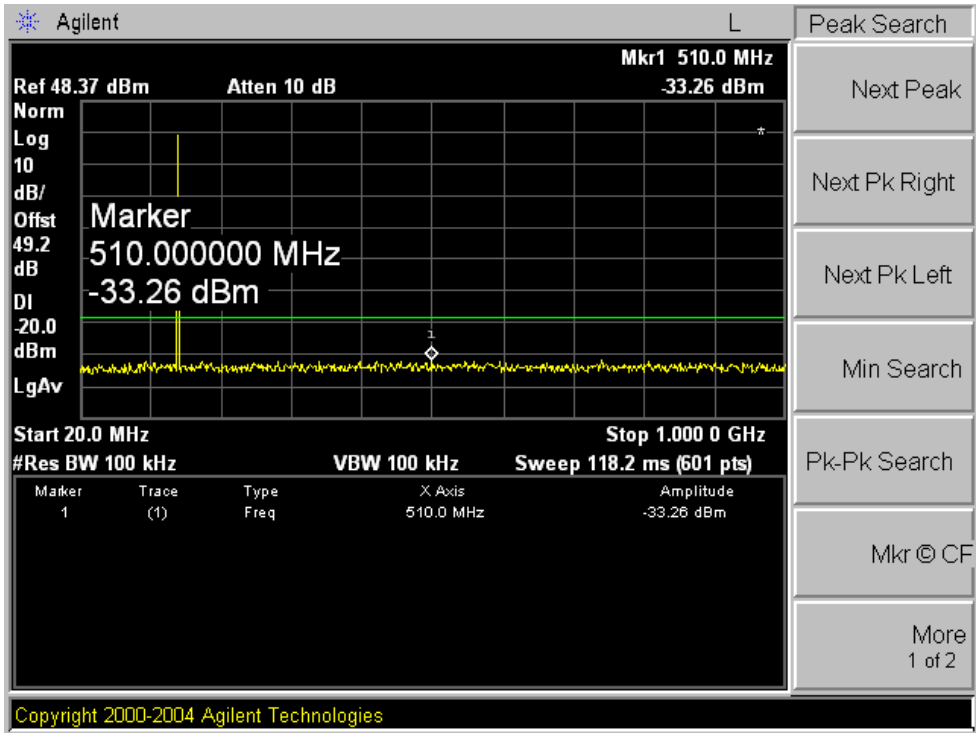


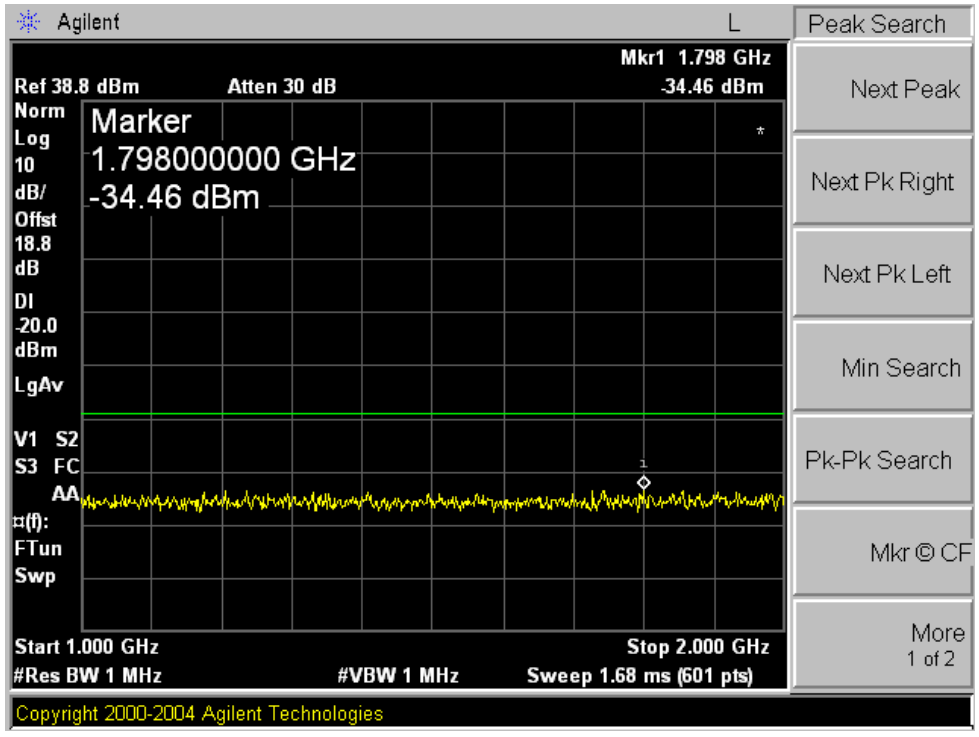
TX FREQ = 136.000 MHz **High Power Setting** **Channel Spacing: 25 kHz**



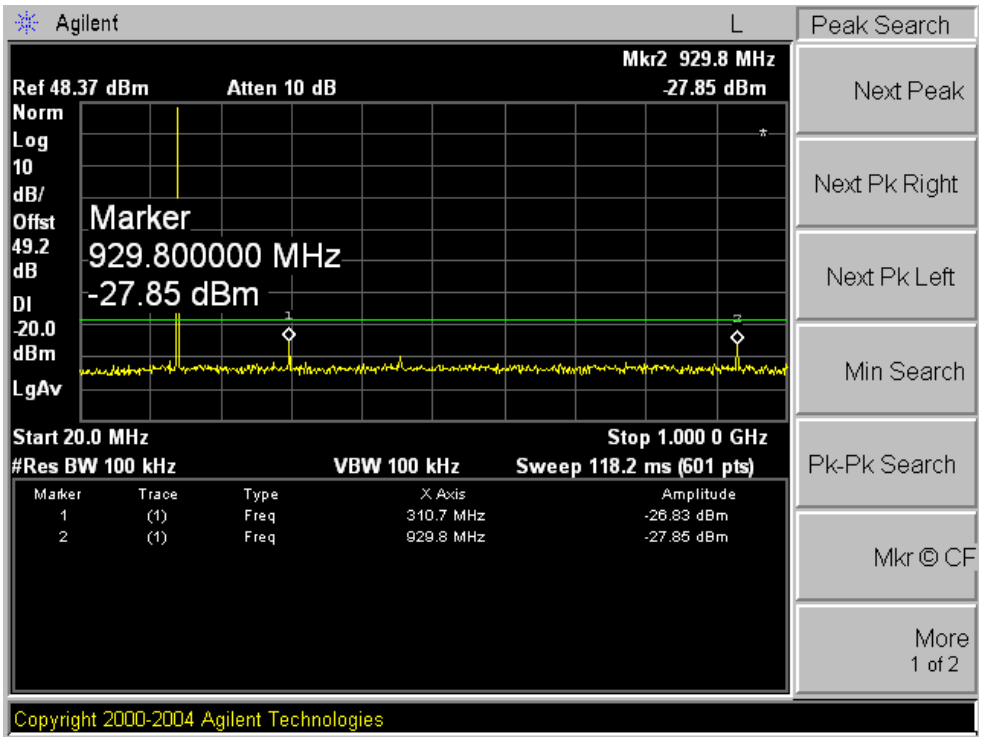


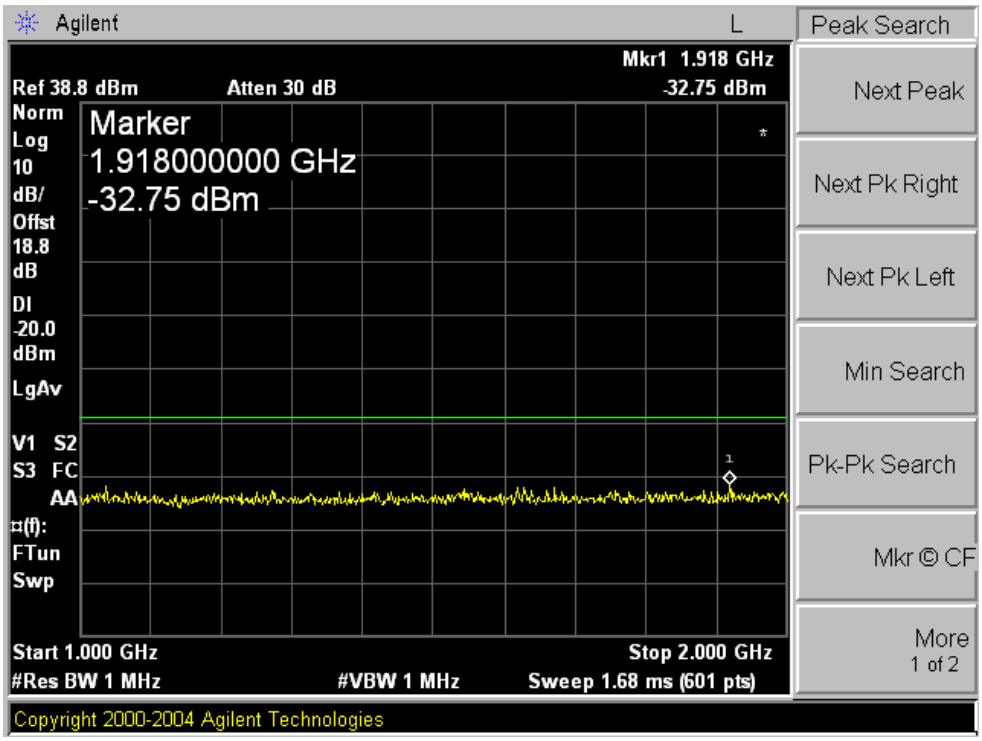
TX FREQ = 155.000 MHz **Low Power Setting** **Channel Spacing: 12.5 kHz**



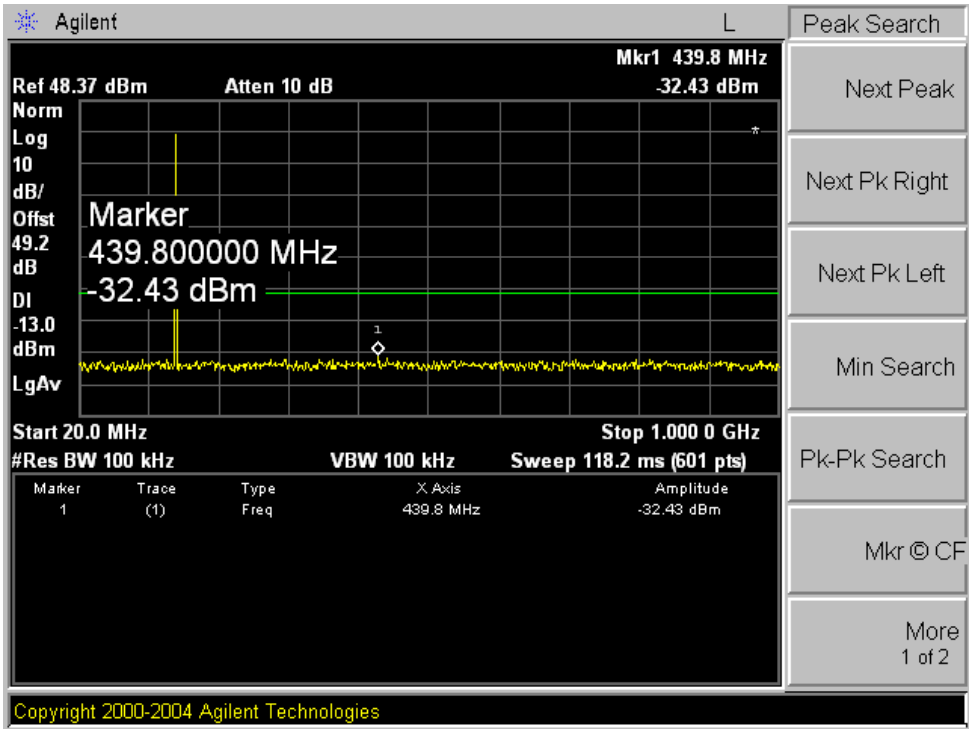


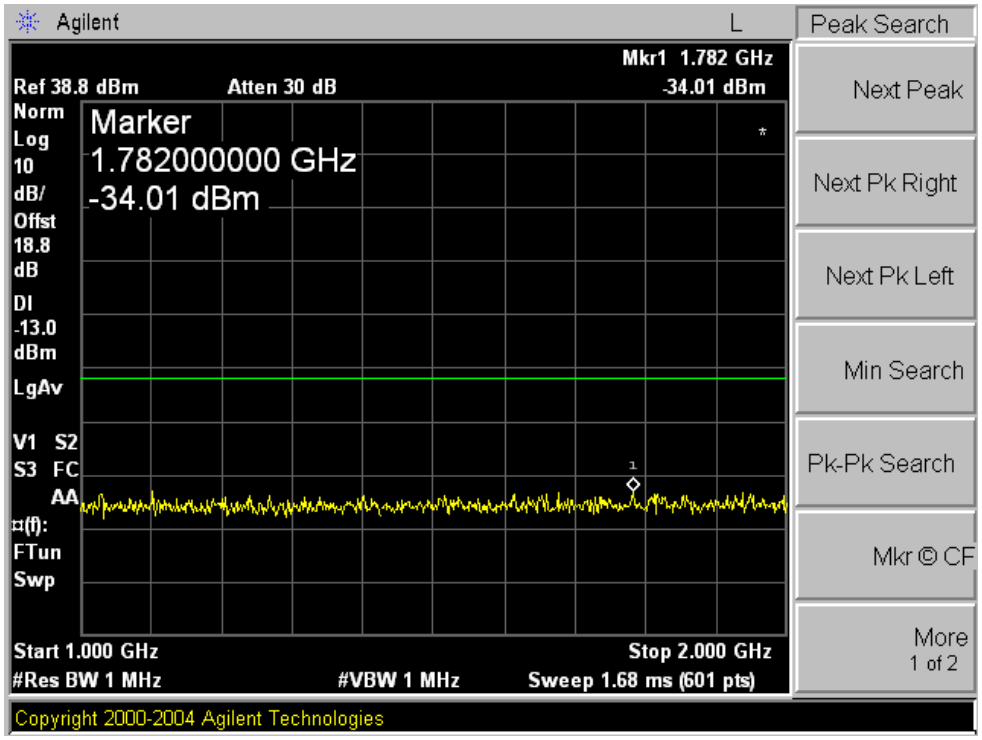
TX FREQ = 155.000 MHz **High Power Setting** **Channel Spacing: 12.5 kHz**



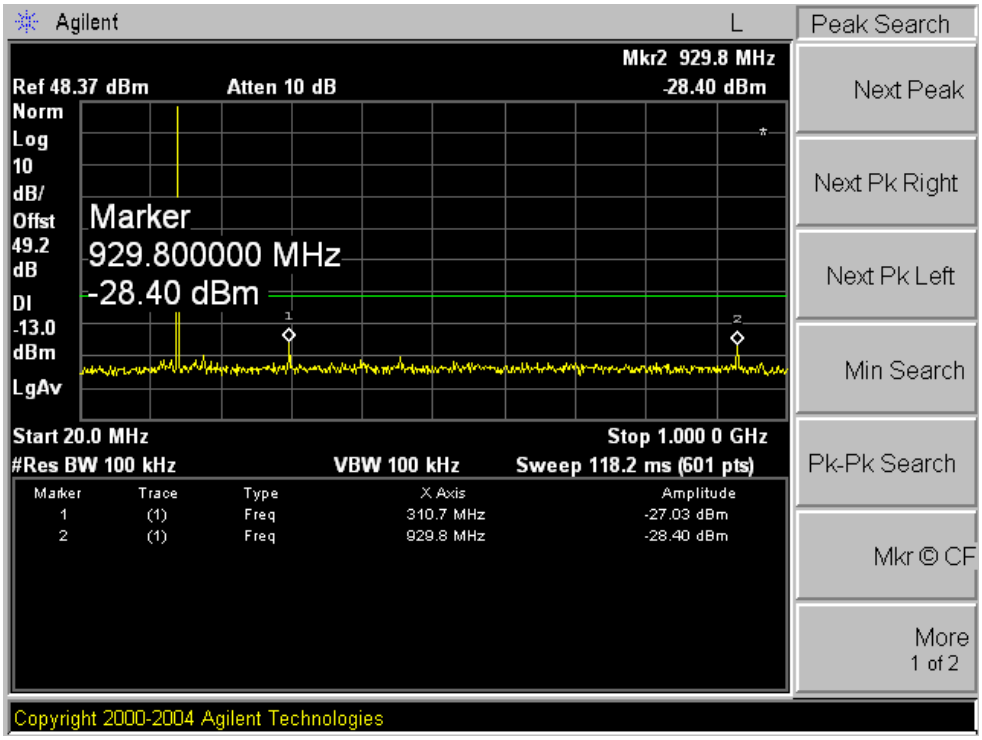


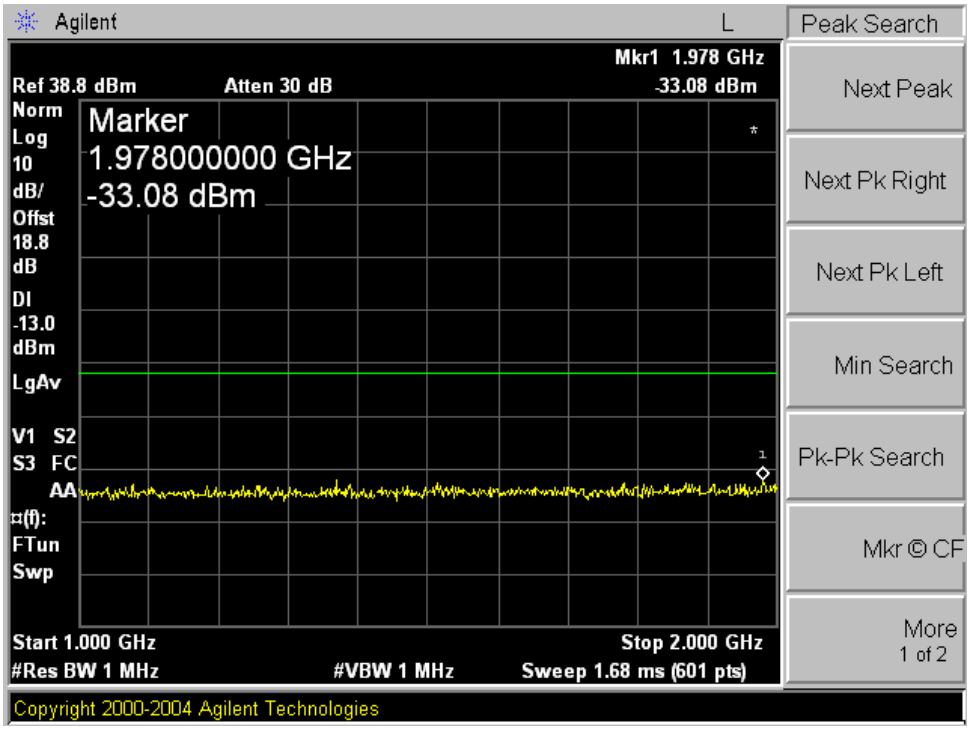
TX FREQ = 155.000 MHz **Low Power Setting** **Channel Spacing: 25 kHz**



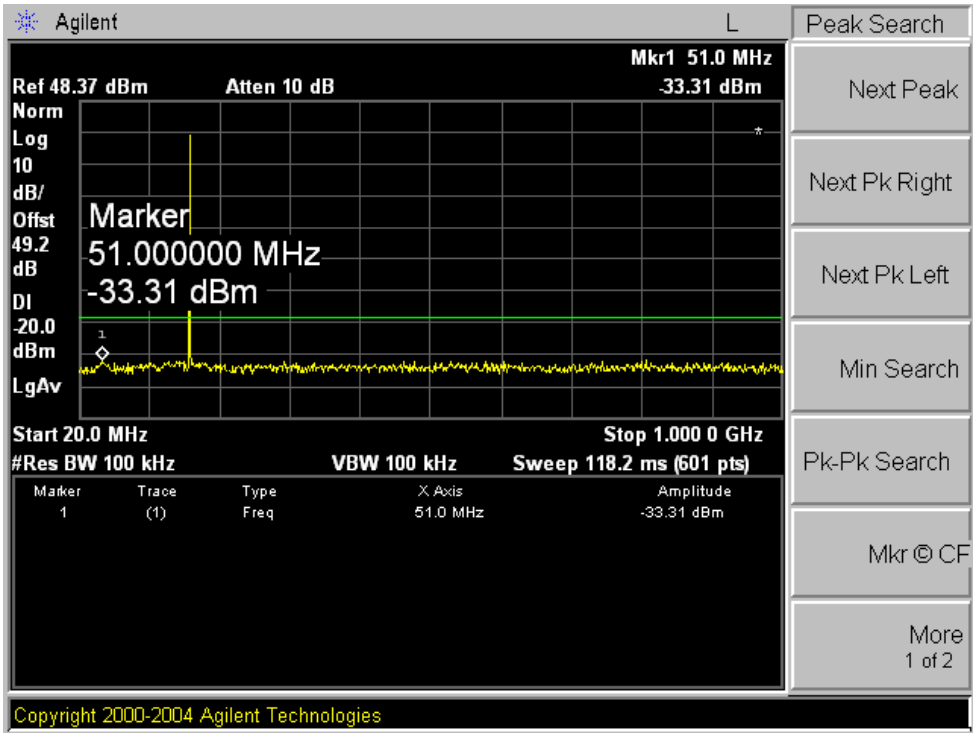


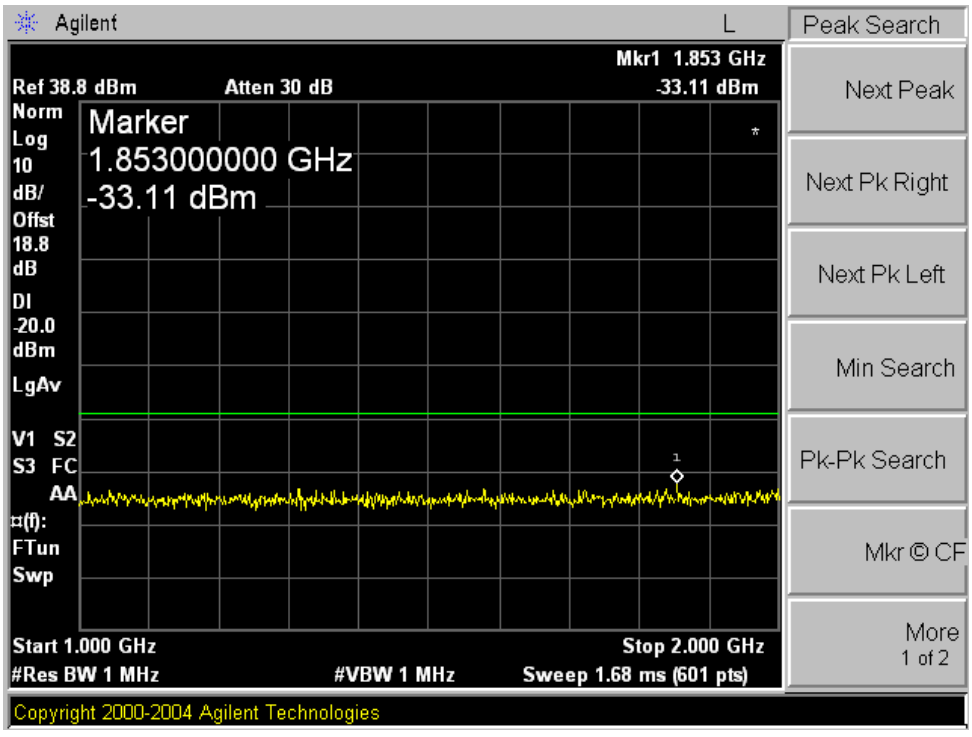
TX FREQ = 155.000 MHz **High Power Setting** **Channel Spacing: 25 kHz**



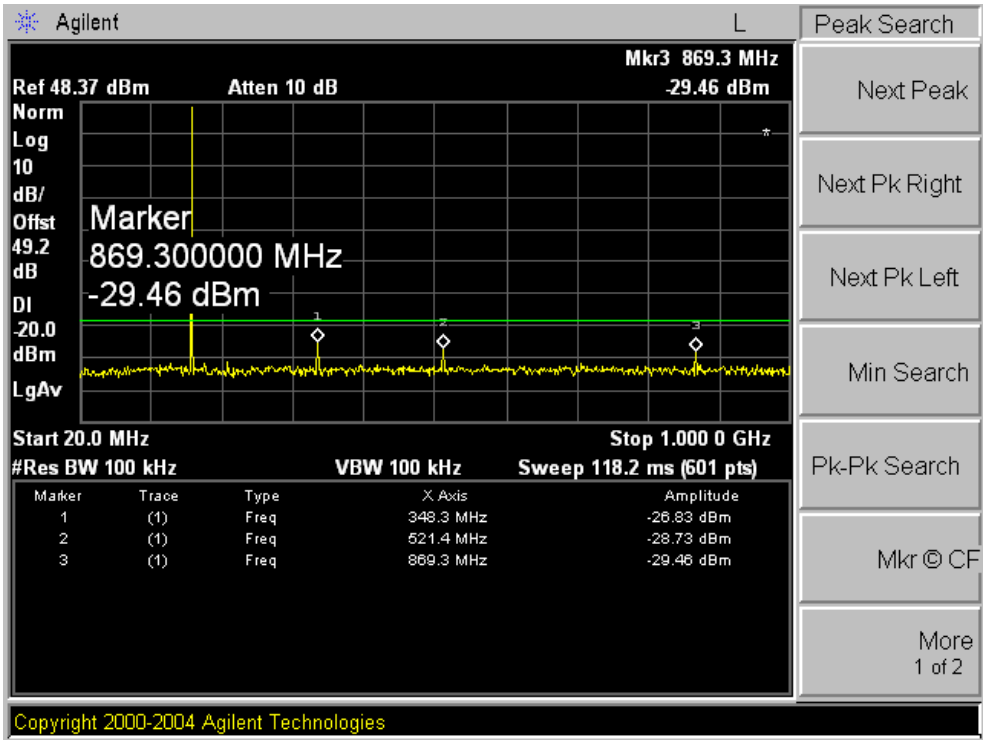


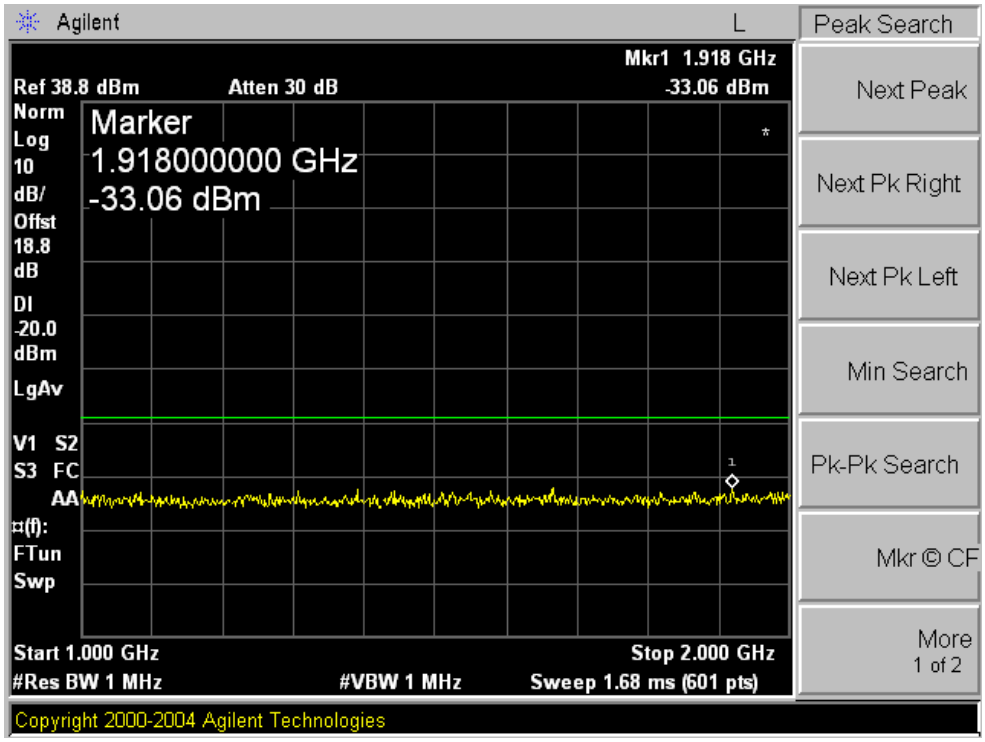
TX FREQ = 174.000 MHz **Low Power Setting** **Channel Spacing: 12.5 kHz**



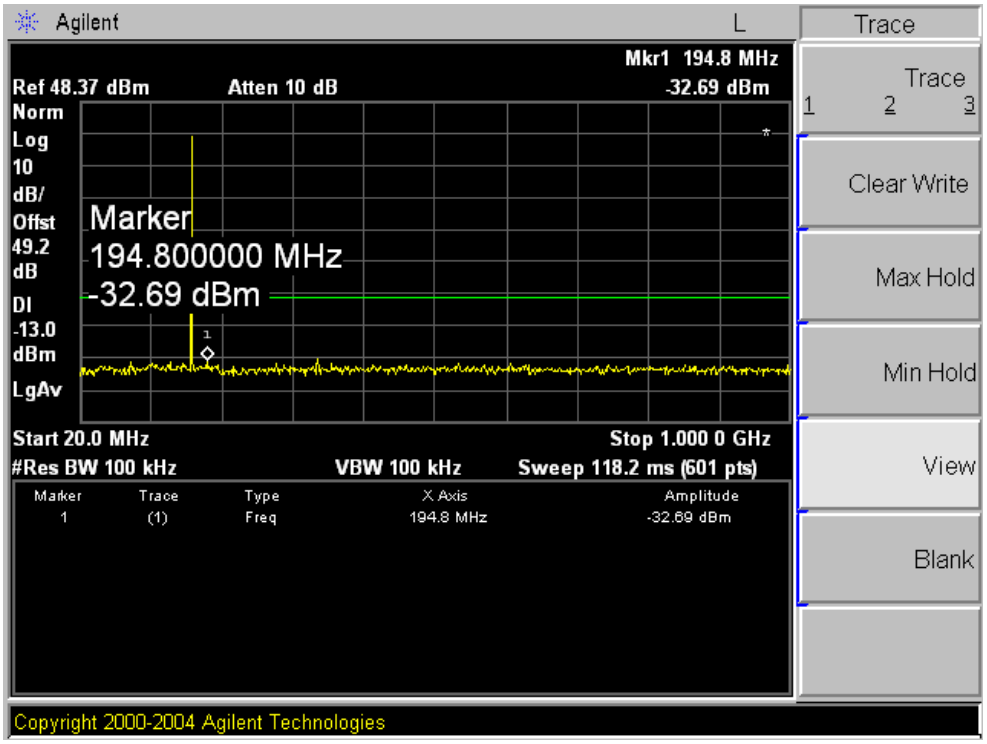


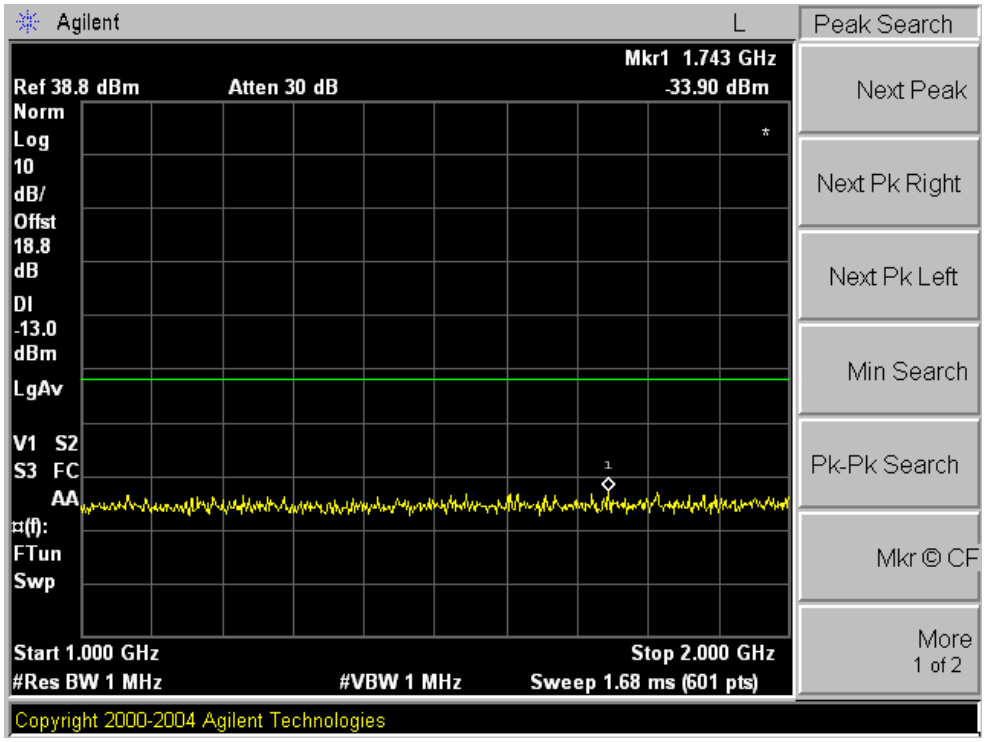
TX FREQ =174.000 MHz **High Power Setting** **Channel Spacing: 12.5 kHz**



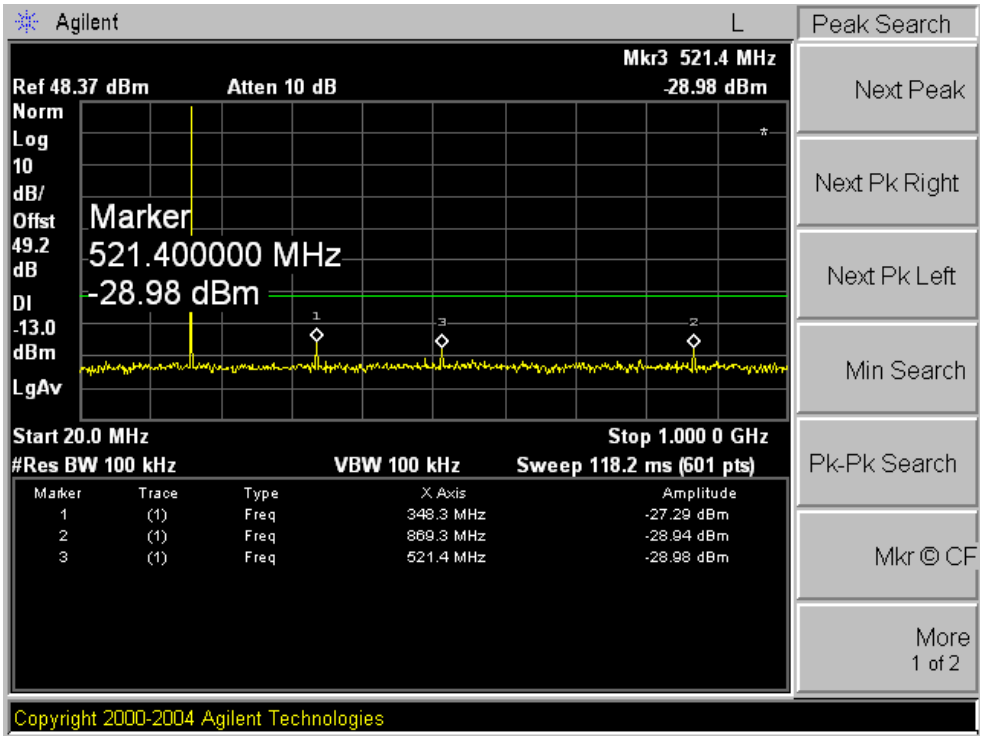


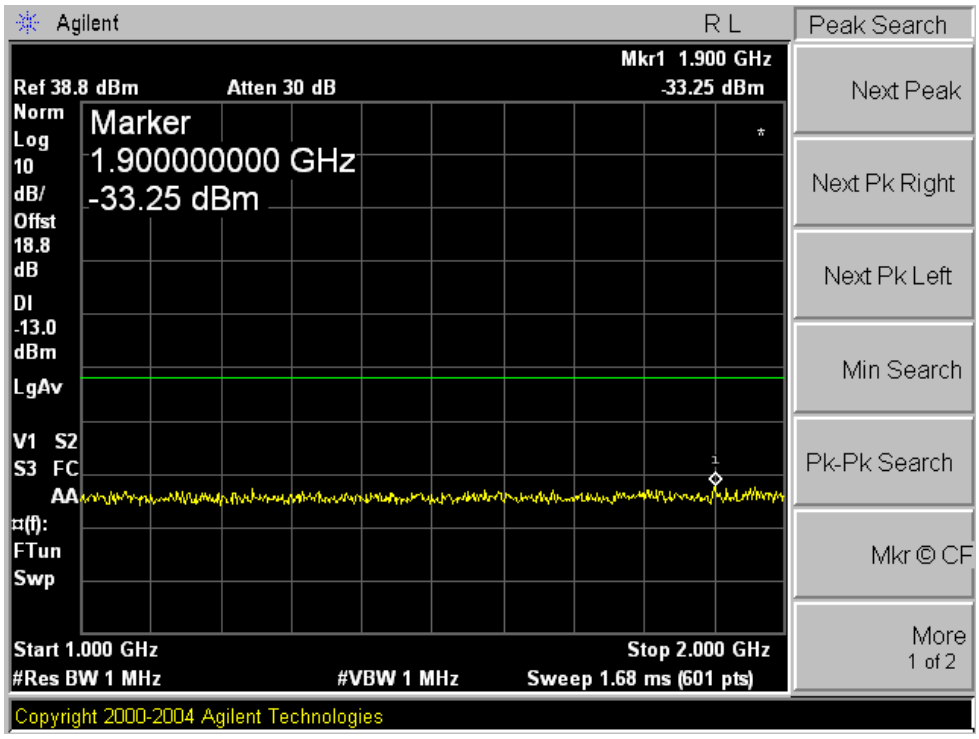
TX FREQ = 174.000 MHz **Low Power Setting** **Channel Spacing: 25 kHz**





TX FREQ = 174.000 MHz **High Power Setting** **Channel Spacing: 25 kHz**





5. Audio Frequency Response : FCC 2.1.047(a)

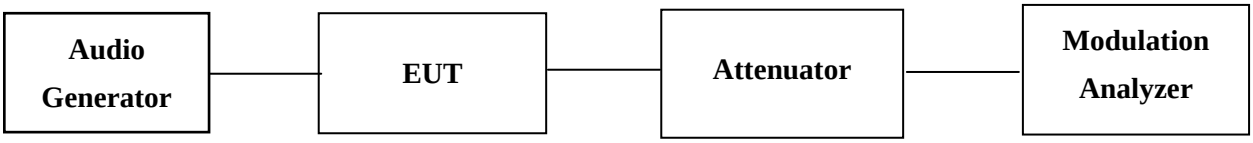
5.1. Limit

Minimum Standard - The audio frequency response shall not vary more than +1 or -3 dB from 300 to 3000 Hz as referenced to 1000 Hz level (with the exception of a permissible 6 dB/octave roll off from 2500 to 3000 Hz).

5.2. Test Procedure

1. The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic.
2. The frequency response of the audio modulation part is adjusted to get 20% of the rated system deviation.
3. The deviations obtained over the frequency range from 100Hz to 5000Hz are recorded and compared with the reference deviation as follows:

$$\text{Audio Frequency Response} = 20\log [DEV_{Freq} / DEV_{ref}]$$



5.3. Test Results

Ambient temperature : 23 ℃ Relative humidity : 51 %

Operating Frequency : 155.000 MHz

Channel : Middle

Nominal DC Voltage: 13.6 Vdc

Audio frequency [Hz]	Channel spacing 12.5 kHz		Channel spacing 25 kHz	
	Measured Deviation [kHz]	Calculated Response [dB]	Measured Deviation [kHz]	Calculated Response [dB]
100	0.03	-24.44	0.04	-27.96
200	0.07	-17.08	0.11	-19.17
300	0.09	-14.89	0.15	-16.48
400	0.13	-11.70	0.23	-12.77
500	0.17	-9.37	0.33	-9.63
600	0.23	-6.74	0.43	-7.33
700	0.29	-4.73	0.56	-5.04
800	0.38	-2.38	0.70	-3.10
900	0.43	-1.31	0.84	-1.51
1000	0.50	0.00	1.00	0.00
2000	1.18	7.46	2.29	7.20
2500	1.28	8.16	2.47	7.85
3000	1.50	9.54	3.00	9.54
4000	0.03	-24.44	0.04	-27.96
5000	0.03	-24.44	0.04	-27.96

6. Audio Low Pass Filter Frequency Response: FCC 2.1047(a)

6.1. Limit

According EIA/TIA 603, a) For equipment operating on 20, 25 or 30 kHz channel spacing in the 25 MHz to174 MHz range: At frequencies from 3000 Hz through 15,000 Hz the attenuation shall be greater than the attenuation at 1000 Hz by at least: 40 $\log_{10}$(f / 3000) dB

b) For equipment operating with 25 kHz spacing channels between 406 and 512 MHz through 896 MHz, and between 929 MHz through 930 MHz:

At frequencies from 3000 Hz through 20,000 Hz, the attenuation shall be greater than the attenuation at 1000 Hz by at least: 60 $\log_{10}$(f / 3000) dB where: f is the audio frequency in Hz.

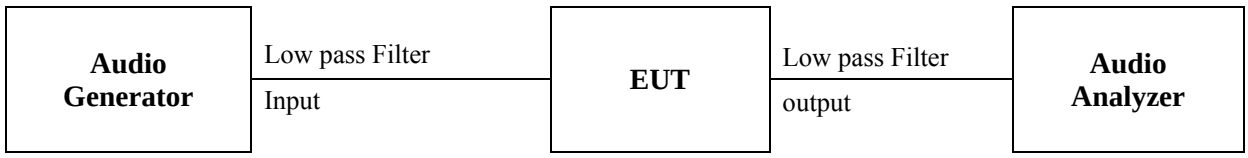
At frequencies above 20,000 Hz the attenuation shall be greater than the attenuation at 1000 Hz by at least: 50 dB.

c) For equipment operating on channels between 896 MHz through 901 MHz, between 935 MHz through 940 MHz, and 12.5 or 15 kHz spaced channels in the frequency range 138-174 MHz and 406-512 MHz.

At frequencies from 3000 Hz through 20,000 Hz the attenuation shall be greater than the attenuation at 1000 Hz by at least: 100 $\log_{10}$ (f / 3000) dB where: f is the audio frequency in Hz.

6.2. Test Procedure

1. Connect the audio frequency generator as close as possible the input of the post limiter low pass filter within the transmitter under test.
2. Connect the audio spectrum analyzer to the output of the post limiter low pass filter within the transmitter under test.
3. Apply a 1000 Hz tone from the audio frequency generator and adjust the level per manufacturer's specifications.
4. Record the dB level of the 1000 Hz spectral line on the audio spectrum analyzer as LEV_{REF} .
5. Set the audio frequency generator to the desired test frequency between 3000 Hz and the upper low pass filter limit.
6. Record audio spectrum analyzer levels, at the test frequency in step 5).
7. Record the dB level on the audio spectrum analyzer as LEV_{FREQ}
8. Calculate the audio frequency response at the test frequency as: low pass frequency response = LEV_{FREQ} – LEV_{REF}
9. Repeat steps 7) through 8) for all the desired test frequencies.



6.3. Test Results

Ambient temperature : 23 ℃ Relative humidity : 51 %

Operating Frequency : 155.000 MHz

Channel : Middle

Nominal DC Voltage: 13.6 Vdc

Audio frequency [kHz]	Channel spacing 12.5 kHz	Channel spacing 25 kHz
	Response [dB]	Response [dB]
1	0	0
2	1.59	1.63
3	3.49	3.58
4	-49.86	-48.73
5	-58.13	<-60
6	-52.48	-48.35
7	<-60	<-60
8	<-60	<-60
9	<-60	<-60
10	<-60	<-60
20	<-80	<-80

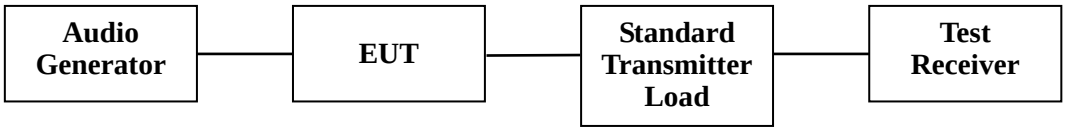
7. Modulation Limiting: FCC 2.1047(b)

7.1. Limit

Minimum Standard - The transmitter modulation must not exceed rated system deviation at any frequency input or reasonable change in input level.

7.2. Test Procedure

1. Modulation limiting is the transmitter circuit's ability to limit the transmitter from producing deviations in excess of rated system deviation.
2. The modulation response is measured at certain modulation frequencies, related to 1000Hz reference signal.
3. The basic setting is 60% of full rated deviation which will be increased the audio generator level from –20 dB to 20 dB in nine steps.
4. Tests are performed for positive and negative modulation.



7.3. Test Results

Ambient temperature : 23 ℃ Relative humidity : 51 %

Operating Frequency : 155.000 MHz

Channel : Middle

Nominal DC Voltage: 13.6 Vdc

12.5 kHz channel spacing

Audio input level Relative [dB]	Positive peak deviation [kHz]			Negative peak deviation [kHz]		
	300 Hz	1000 Hz	3000 Hz	300 Hz	1000 Hz	3000 Hz
-20	0.05	0.19	0.75	0.05	0.18	0.76
-15	0.07	0.30	1.30	0.08	0.30	1.33
-10	0.11	0.51	1.54	0.11	0.52	1.56
-5	0.18	0.91	1.57	0.18	0.91	1.58
0	0.29	1.50	1.57	0.29	1.50	1.59
5	0.46	1.65	1.57	0.49	1.71	1.59
10	0.77	1.64	1.57	0.81	1.68	1.58
15	1.22	1.65	1.57	1.31	1.70	1.58
20	1.61	1.64	1.56	1.63	1.71	1.58

25 kHz channel spacing

Audio input level Relative [dB]	Positive peak deviation [kHz]			Negative peak deviation [kHz]		
	300 Hz	1000 Hz	3000 Hz	300 Hz	1000 Hz	3000 Hz
-20	0.09	0.34	1.47	0.08	0.33	1.50
-15	0.12	0.58	2.61	0.11	0.58	2.65
-10	0.18	0.99	3.12	0.17	1.01	3.16
-5	0.29	1.78	3.19	0.28	1.79	3.22
0	0.49	3.00	3.20	0.49	3.00	3.24
5	0.82	3.38	3.19	0.87	3.49	3.25
10	1.46	3.32	3.19	1.51	3.42	3.22
15	2.36	3.35	3.18	2.51	3.45	3.22
20	3.17	3.31	3.18	3.21	3.47	3.21

8. Occupied Bandwidth: FCC 2.1049, FCC 90.210

8.1. Limit

According to §90.210, Emission Mask B – 25 kHz channel bandwidth. For Transmitters that are equipped with an audio low-pass filter. Measured Data:(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than100 percent of the authorized bandwidth : At least 25 dB.(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth : At least 35 dB.(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth : At least 43+10 log10(P) dB.

Emission Mask D - 12.5 kHz channel bandwidth. For Transmitters that designed to operate with 12.5kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows: Measured Data:(1) On any frequency from the center of the authorized bandwidth fo to 5.625kHz removed from fo : Zero dB.(2)On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5kHz. At least 7.27 (fd - 2.88kHz) dB.(3)On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5kHz: At least 50+10 log10(P) dB or 70 dB, whichever is the lesser attenuation.

8.2. Test Procedure

1. The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.
2. The transmitter is modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.
3. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

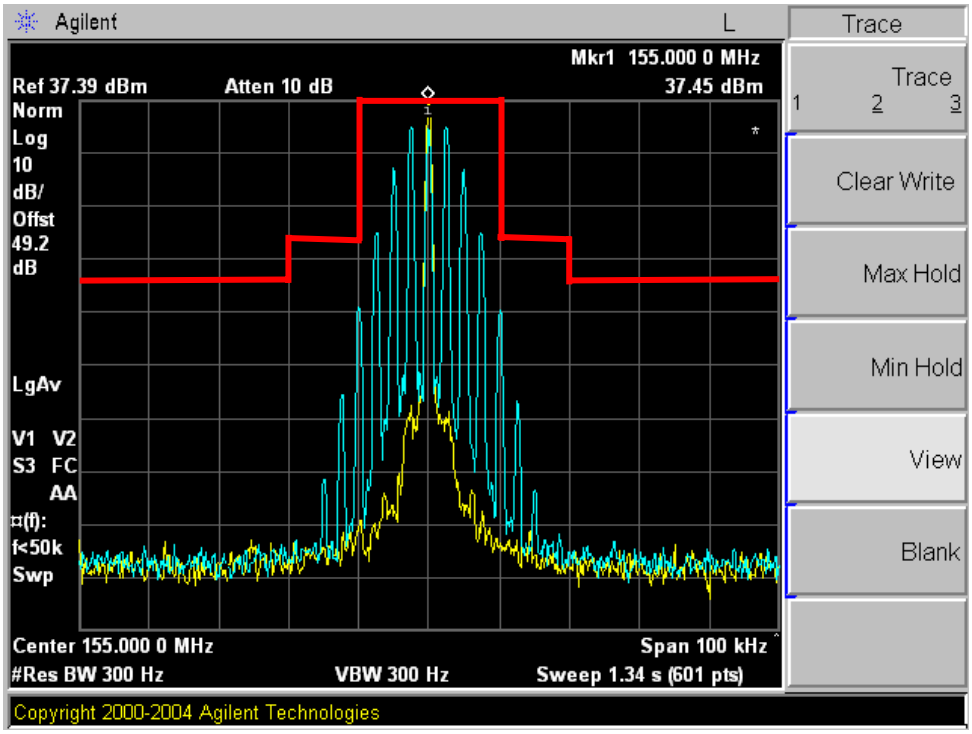
8.3. Test Results

Ambient temperature : 23 ℃ Relative humidity : 51 %

Operating Frequency : 155.000 MHz

Channel : Middle Nominal DC Voltage: 13.6 Vdc

MASK B CHANNEL SPACING = 25 kHz

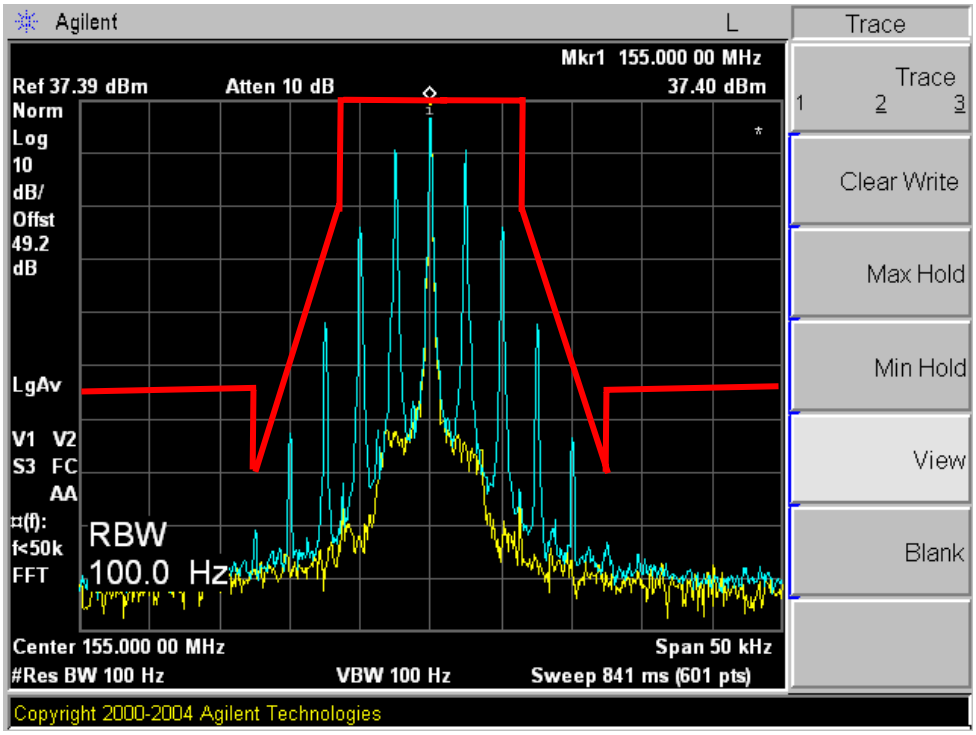


Limits: Are determined by used emission mask.

Operating Frequency : 155.000 MHz

Channel : Middle Nominal DC Voltage: 13.6 Vdc

MASK D CHANNEL SPACING = 12.5 kHz



Limits: Are determined by used emission mask.

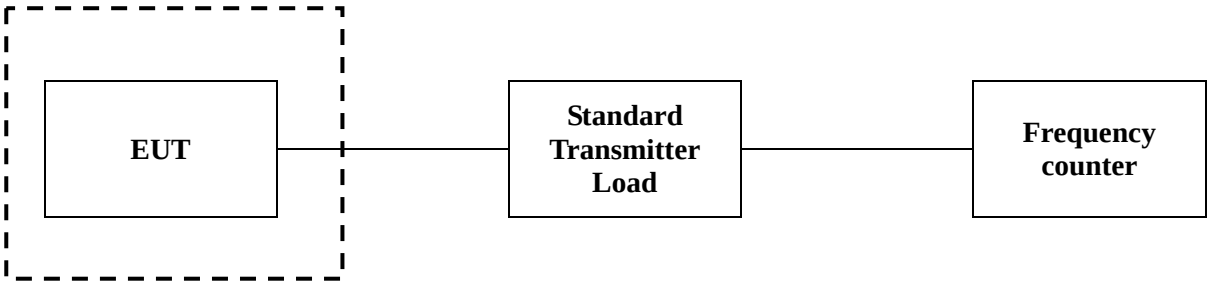
9. Frequency Stability: FCC 90.213, FCC2.1055

9.1. Limit

According to §90.213, Temperature - Frequency Stability of +/- 2.5 ppm(channel spacing 12.5 kHz), +/- 5 ppm(channel spacing 25 kHz), from -30 to +60 degrees centigrade.

9.2. Test Procedure

1. The carrier frequency is the stability of the transmitter to maintain an assigned carrier frequency.
2. The frequency stability is measured with variation of ambient temperature from -30℃to+60℃.



Climatic chamber

9.3. Test Results

Ambient temperature : 20 ℃ Relative humidity : 51 %

Channel spacing :12.5 kHz , Frequency:155.000 MHz

Voltage [%]	Voltage [V]	Temperature [deg C]	Measured Frequency [Hz]	Frequency Error [ppm]
100%	13.6	-30	154999961	-0.252
100%	13.6	-20	154999955	-0.290
100%	13.6	-10	154999969	-0.200
100%	13.6	0	154999989	-0.071
100%	13.6	+ 10	155000009	+ 0.058
100%	13.6	+ 20	155000025	+ 0.161
100%	13.6	+ 30	155000019	+ 0.123
100%	13.6	+ 40	155000013	+ 0.084
100%	13.6	+ 50	155000007	+ 0.045
100%	13.6	+ 60	155000006	+ 0.039
85%	11.56	+ 20	155000037	+ 0.239
115%	15.64	+ 20	155000014	+ 0.090

Channel spacing : 25 kHz , Frequency:155.000 MHz

Voltage [%]	Voltage [V]	Temperature [deg C]	Measured Frequency [Hz]	Frequency Error [ppm]
100%	13.6	-30	154999966	-0.219
100%	13.6	-20	154999951	-0.316
100%	13.6	-10	154999975	-0.161
100%	13.6	0	154999985	-0.097
100%	13.6	+ 10	155000011	+ 0.071
100%	13.6	+ 20	155000029	+ 0.187
100%	13.6	+ 30	155000026	+ 0.168
100%	13.6	+ 40	155000021	+ 0.135
100%	13.6	+ 50	155000015	+ 0.097
100%	13.6	+ 60	155000012	+ 0.077
85%	11.56	+ 20	155000040	+ 0.258
115%	15.64	+ 20	155000015	+ 0.097

10. Transient Frequency Behaviour of the Transmitter : FCC 90.214

10.1. Limits:

Time intervals [1, 2]	Maximum Frequency Difference [3]	All equipment	
		150 to 174 MHz	421 to 512 MHz
Transient Frequency Behaviour for Equipment Designed to Operate on 25 kHz Channel			
t_1 [4] ----------	±25.0 kHz	5.0 ms	10.0 ms
t_2 ----------	±12.5 kHz	20.0 ms	25.0 ms
t_3 [4] ----------	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channel			
t_1 [4] ----------	±12.5 kHz	5.0 ms	10.0 ms
t_2 ----------	±6.25 kHz	20.0 ms	25.0 ms
t_3 [4] ----------	±12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behaviour for Equipment Designed to Operate on 6.25 kHz Channel			
t_1 [4] ----------	±6.25 kHz	5.0 ms	10.0 ms
t_2 ----------	±3.125 kHz	20.0 ms	25.0 ms
t_3 [4] ----------	±6.25 kHz	5.0 ms	10.0 ms

[1] $_{on}$ is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

t_1 is the time period immediately following t_{on}.

t_2 is the time period immediately following t_1.

t_3 is the time period from the instant when the transmitter is turned off until t_{off}.

t_{off} is the instant when the 1kHz test signal starts to rise.

[2] During the time from the end of t_2 to the beginning of t_3, the frequency difference must not exceed the limits specified in §90.213.

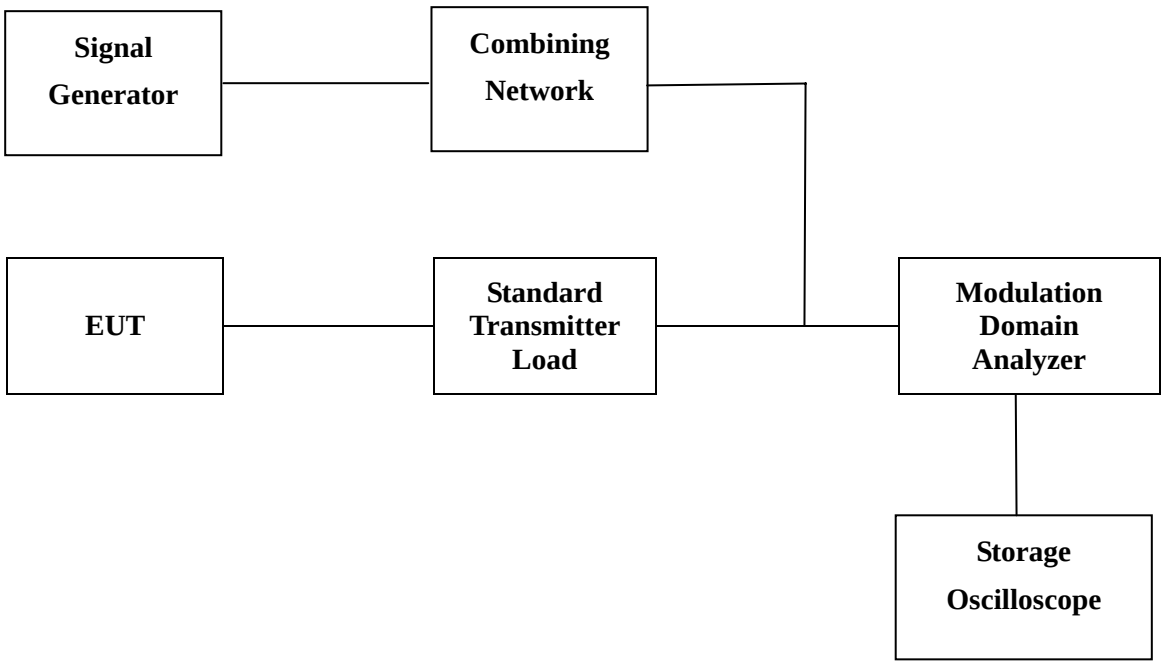
[3] Difference between the actual transmitter frequency and the assigned transmitter frequency .

[4] If the transmitter carrier output power rating is 6watts or less, the frequency difference during this time may exceed the maximum frequency difference for this period.

10.2. Test Procedure

1. Set the test receiver to measure FM deviation with the audio bandwidth set at ≤50 Hz to ≥15,000 Hz, and tune the RF frequency to the transmitter assigned frequency.
2. Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at ±25 kHz deviation and set its output level to -100dBm.
3. Key the transmitter.
4. Supply sufficient attenuation via the RF attenuator to provide an input level to the test receiver that is 40 dB below the test receiver maximum allowed input power when the transmitter is operating at its rated power level.
5. Unkey the transmitter.
6. Adjust the RF level of the signal generator to provide RF power into the RF power meter equal to the level This signal generator RF level shall be maintained throughout the rest of the measurement.
7. Connect the output of the RF combiner network to the input of the Modulation analyzer.
8. Set the horizontal sweep rate on the storage oscilloscope to 10 milliseconds per division and adjust the display to continuously view the 1000 Hz tone. Adjust the vertical amplitude control of the oscilloscope to display the 1000 Hz at ±4 divisions vertically centered on the display.
9. Key the transmitter and observe the stored display. once the modulation Analyzer demodulator has been captured by the transmitter power, the display will show the frequency difference from the assigned frequency to the actual transmitter frequency versus time. The instant when the 1 kHz test signal is completely suppressed (including any capture time due to phasing) is considered to be t_{on} . The trace should be maintained within the allowed divisions during the period t1 and t2 . See the figure in the appropriate standards section.
10. During the time from the end of t2 to the beginning of t3 the frequency difference should not exceed the limits set by the FCC in 47 CFR 90.214 and outlined in 3.2.2. The allowed limit is equal to the transmitter frequency times its FCC frequency tolerance times ±4 display divisions divided by 25 kHz.
11. Key the transmitter and observe the stored display. The trace should be maintained within the allowed divisions after the end of t2 and remain within it until the end of the trace. See the figure in the appropriate standards sections.
12. To test the transient frequency behavior during the period t3 the transmitter shall be keyed.

13. Adjust the oscilloscope trigger controls so it will trigger on a decreasing magnitude from the Modulation analyzer, at 1 division from the right side of the display, when the transmitter is turned off. Set the controls to store the display. The moment when the 1 kHz test signal starts to rise is considered to provide to t_{off}.
14. The transmitter shall be unkeyed.
15. Observe the display. The trace should remain within the allowed divisions during period t3. See the figures in the appropriate standards section.



10.3. Test Results

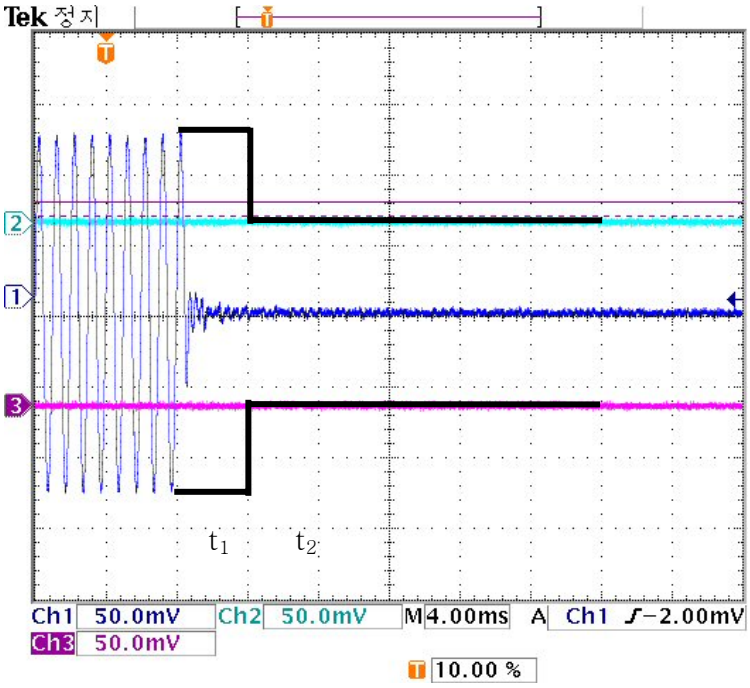
Ambient temperature : 23 ℃ Relative humidity : 51 %

Please refer to the following plots.

Plot

Ch 1 Narrow

Switching from OFF to ON (t_1 & t_2)



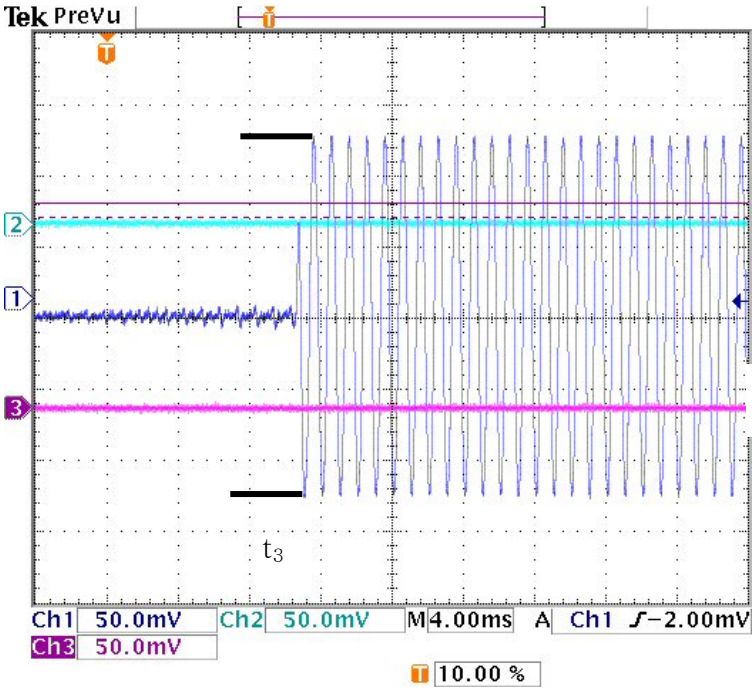
Channel separation

1/2 Channel separation

1/2 Channel separation

Channel separation

Switching from ON to OFF (t_3)



Channel separation

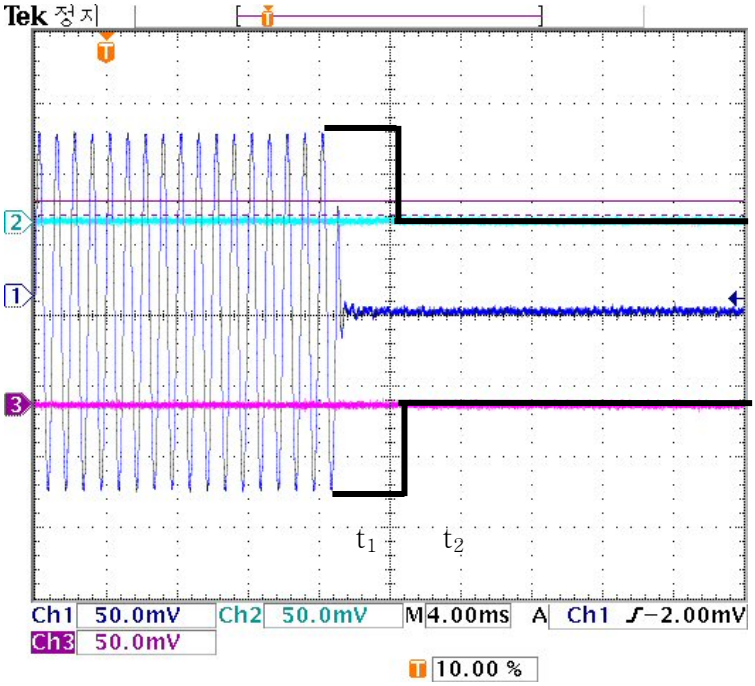
1/2 Channel separation

1/2 Channel separation

Channel separation

Ch 3 Narrow

Switching from OFF to ON (t_1 & t_2)



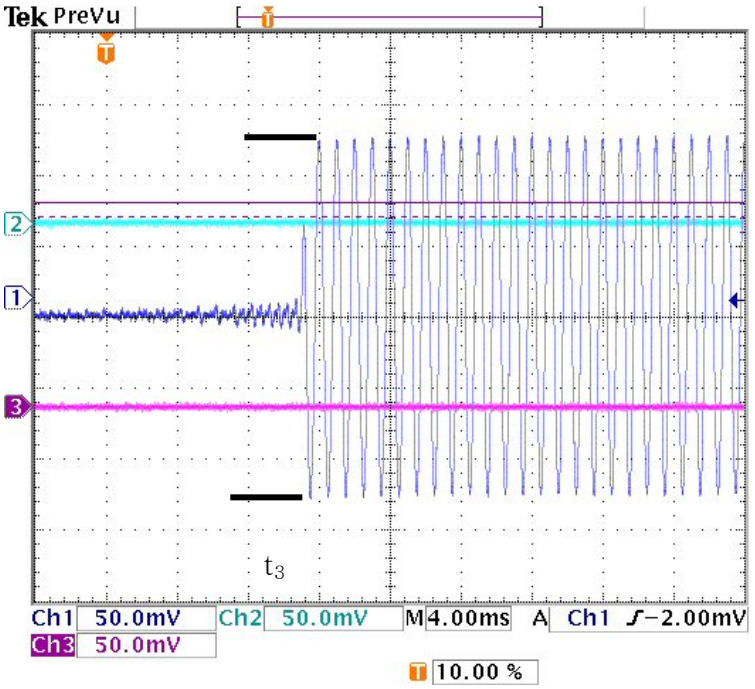
Channel separation

1/2 Channel separation

1/2 Channel separation

Channel separation

Switching from ON to OFF (t_3)



Channel separation

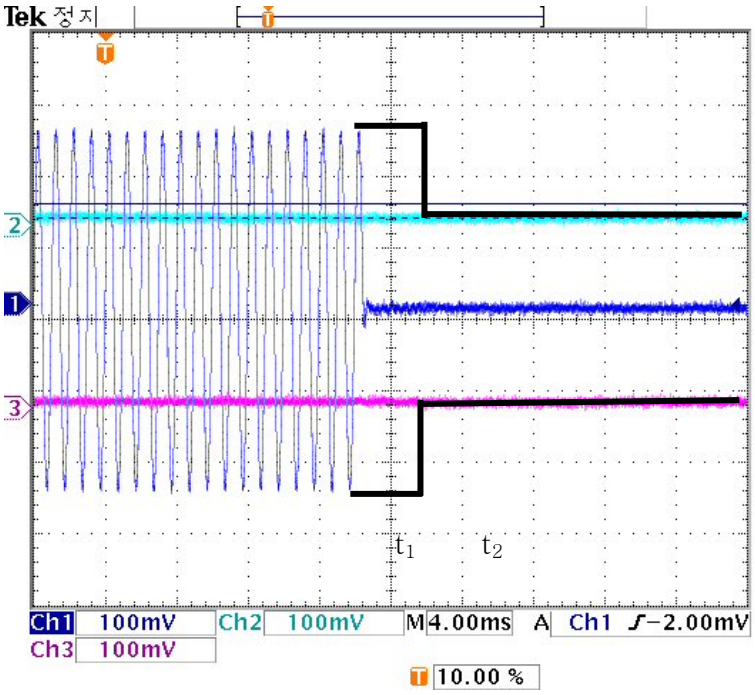
1/2 Channel separation

1/2 Channel separation

Channel separation

Ch 1 Wide

Switching from OFF to ON (t_1 & t_2)



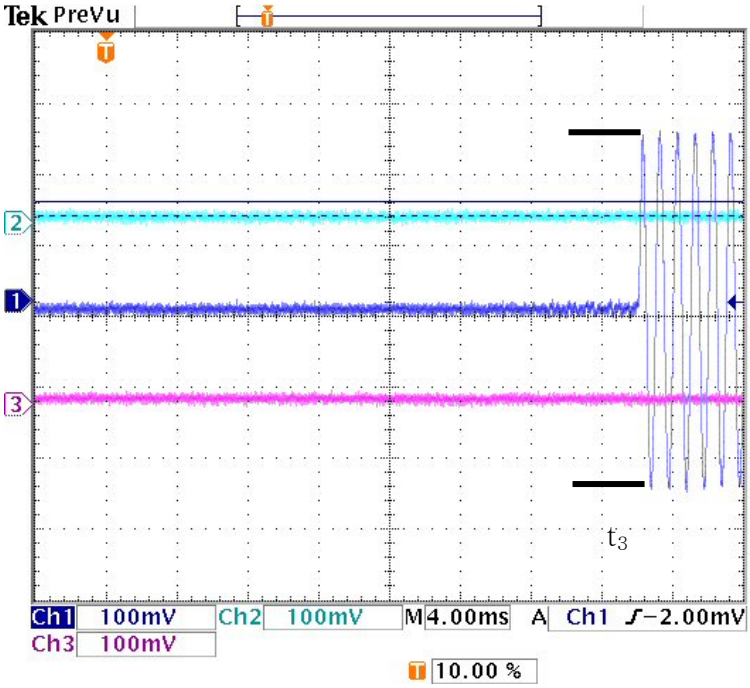
Channel separation

1/2 Channel separation

1/2 Channel separation

Channel separation

Switching from ON to OFF (t_3)



Channel separation

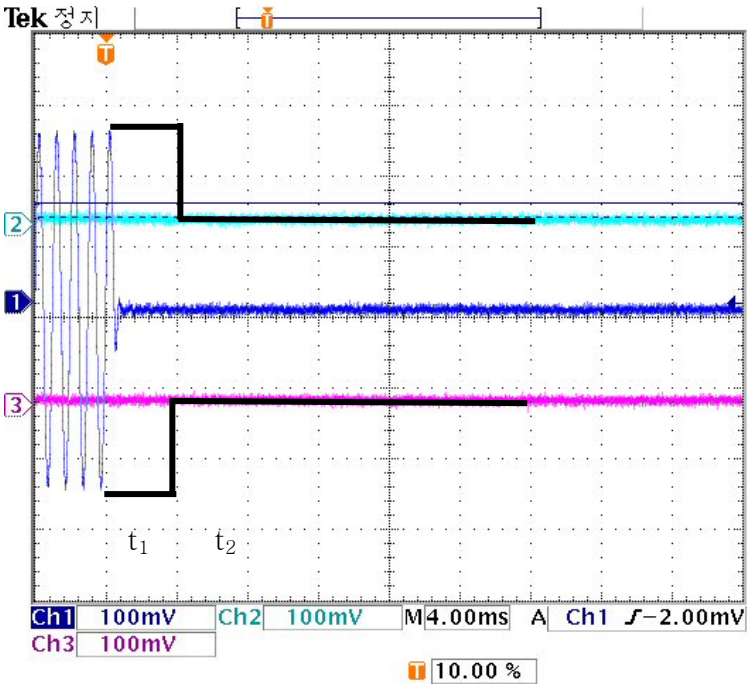
1/2 Channel separation

1/2 Channel separation

Channel separation

Ch 3 Wide

Switching from OFF to ON (t_1 & t_2)



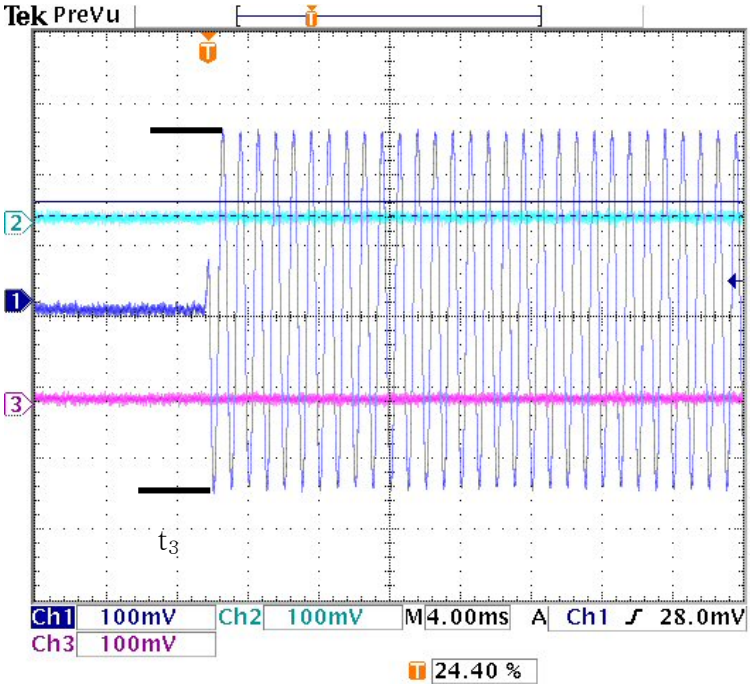
Channel separation

1/2 Channel separation

1/2 Channel separation

Channel separation

Switching from ON to OFF (t_3)



Channel separation

1/2 Channel separation

1/2 Channel separation

Channel separation

Appendix A. Photo of Radiated Spurious Emission Test