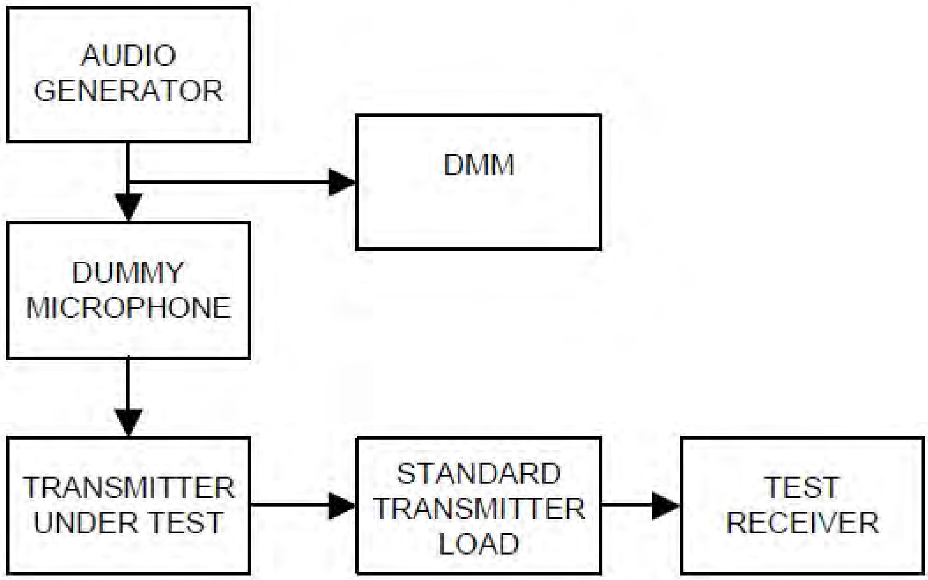
7.5Audio Frequency Response / Audio Low Pass Filter Response

▣Definition

The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic.

▣ TEST CONFIGURATION



▣TEST PROCEDURE

According to 2.2.6 in TIA-603-D Standard.

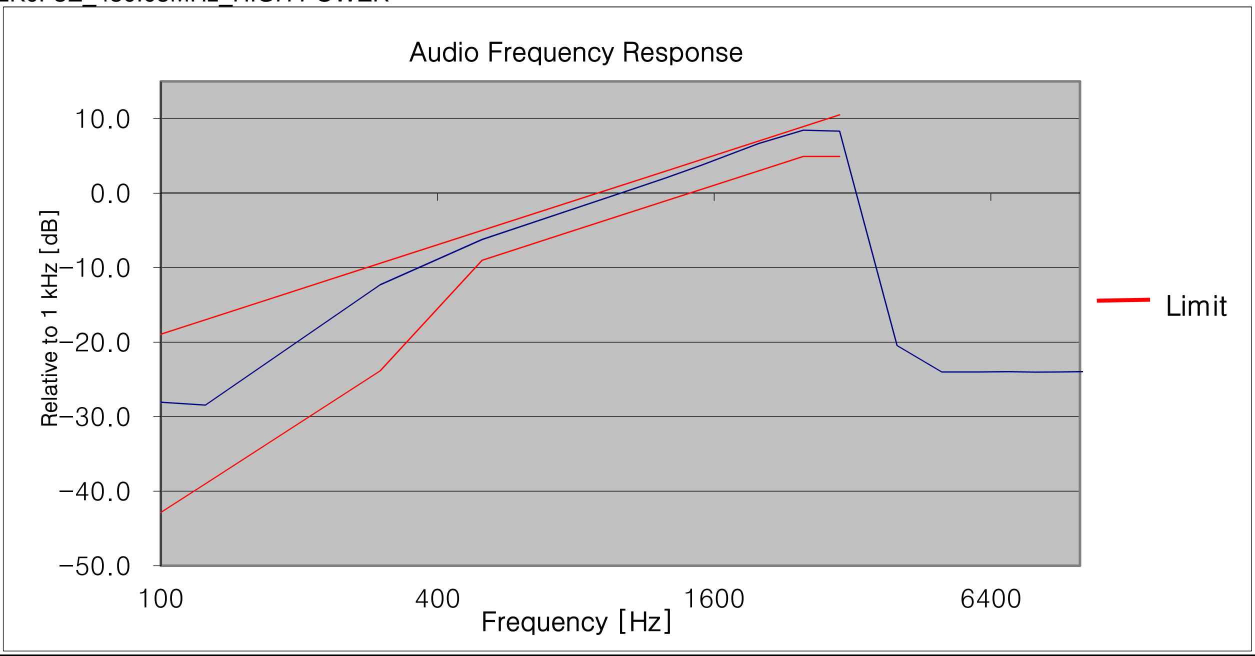
a) Connect the equipment as illustrated.
b) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤ 50 Hz to ≥ 15,000 Hz. Turn the de-emphasis function off.
c) Set the DMM to measure rms voltage.
d) Adjust the transmitter per the manufacturer's procedure for full rated system deviation.
e) Apply a 1000 Hz tone and adjust the audio frequency generator to produce 20% of the rated system deviation.
f) Set the test receiver to measure rms deviation and record the deviation reading.
g) Record the DMM reading as $V_{REF.}$
h) Set the audio frequency generator to the desired test frequency between 300 Hz and 3000 Hz.
i) Vary the audio frequency generator output level until the deviation reading that was recorded in step f) is obtained.
j) Record the DMM reading as $V_{FREQ.}$
k) Calculate the audio frequency response at the present frequency as:
   audio frequency response = 20 * $\log_{10}(V_{FREQ}/V_{REF})$
l) Repeat steps h) through k) for all the desired test frequencies.

*Note : Audio Filter of the above result is substituted with the same structure as Audio Frequency Response.
On the transmission condition below 3kHz, Transceiver shows pre-emphasis condition of transmission function.
On the transmission condition above 3kHz, Transceiver shows Audio Low Pass Filter.

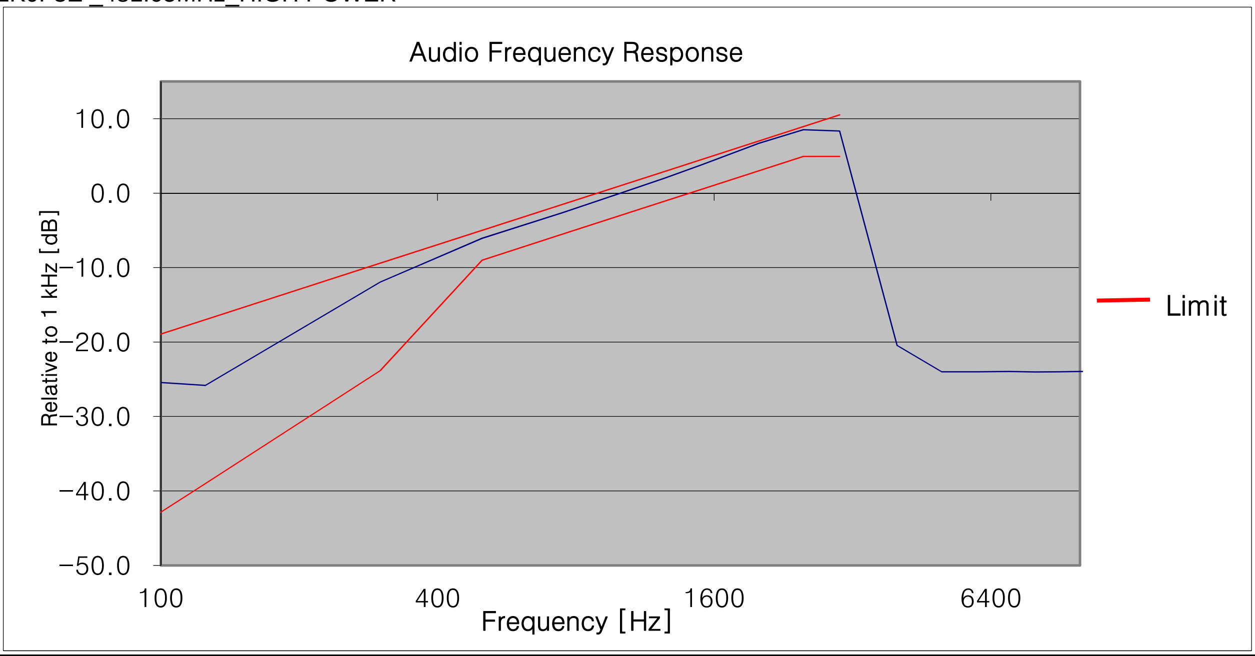
▣TEST RESULTS

11K0F3E

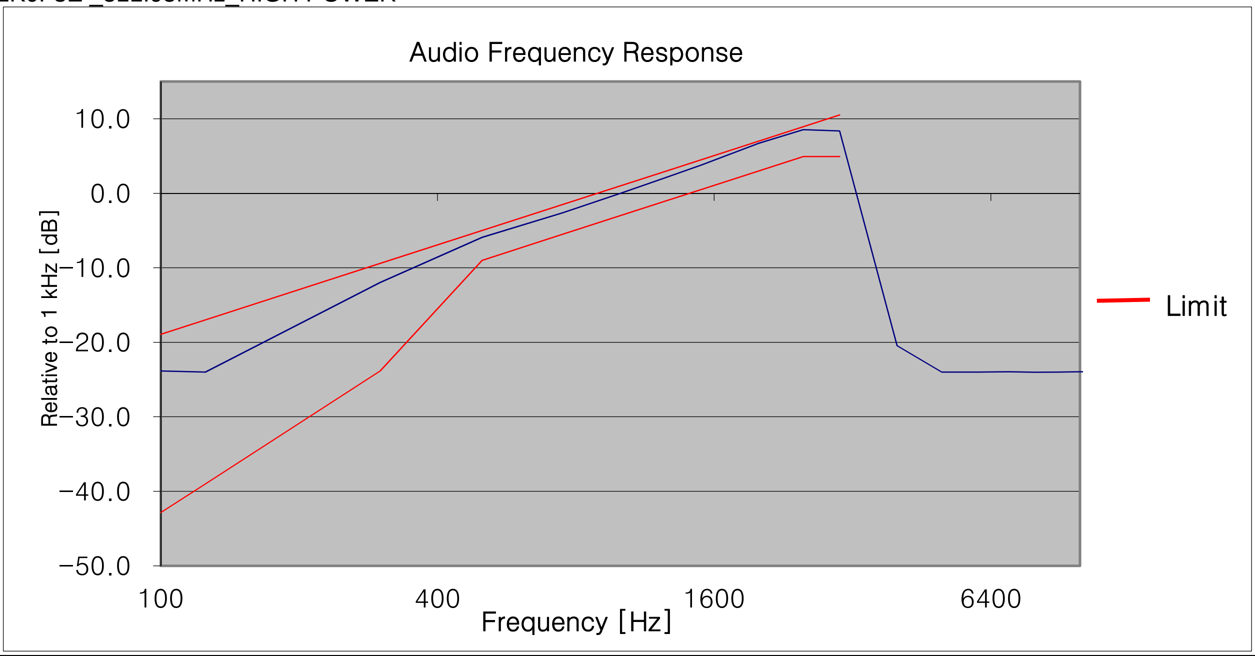
11K0F3E_450.05MHz_HIGH POWER



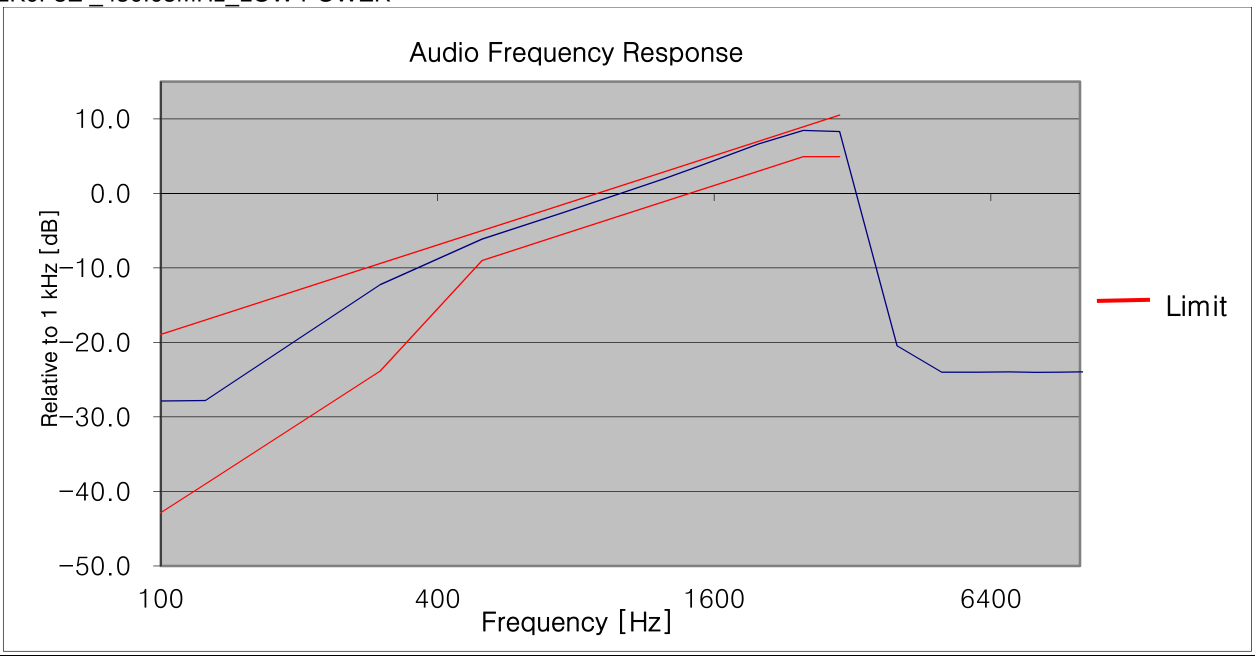
11K0F3E _481.05MHz_HIGH POWER



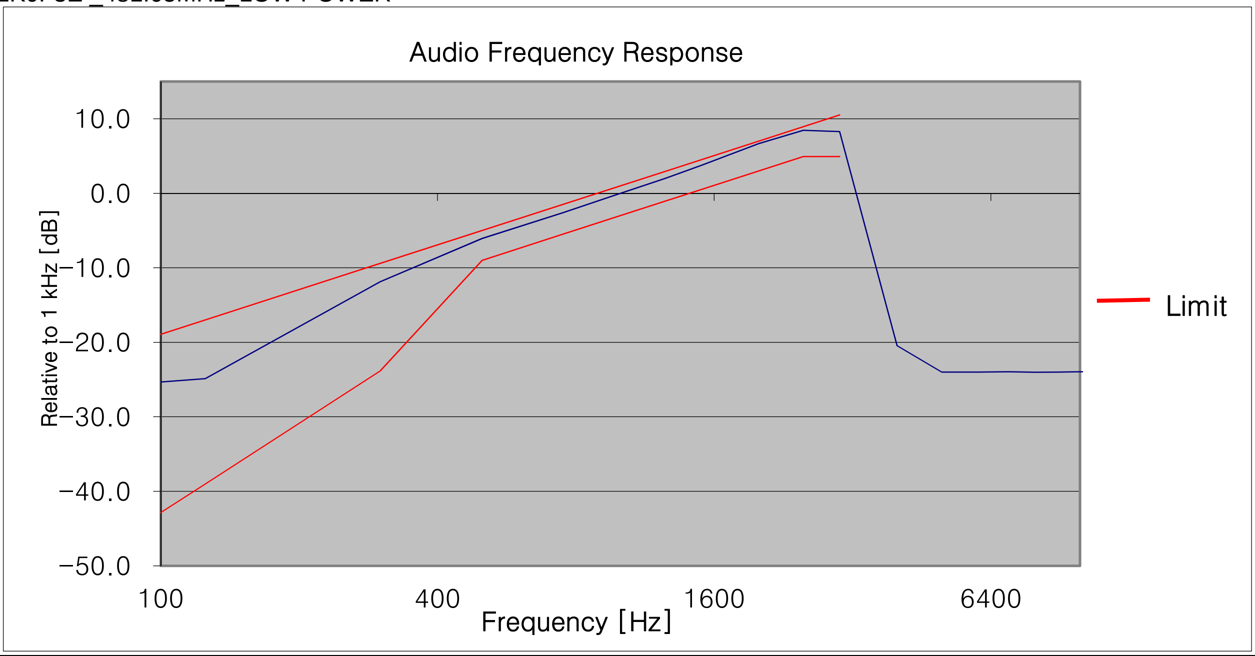
11K0F3E _511.95MHz_HIGH POWER



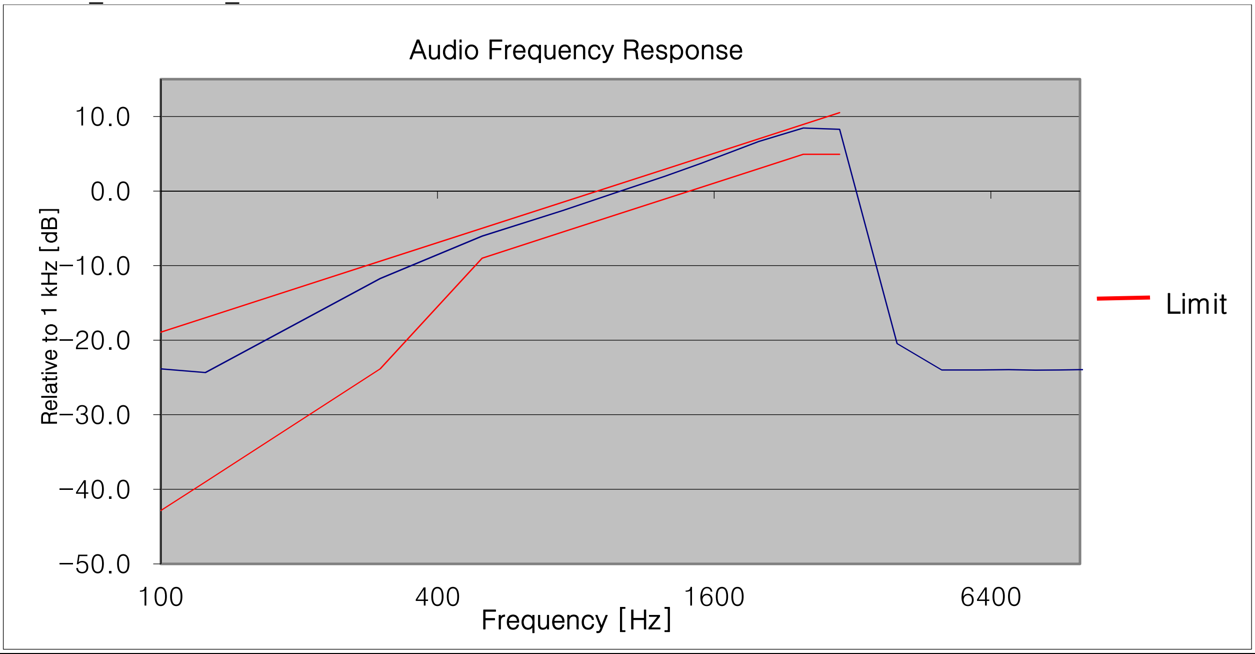
11K0F3E _450.05MHz_LOW POWER



11K0F3E _481.05MHz_LOW POWER

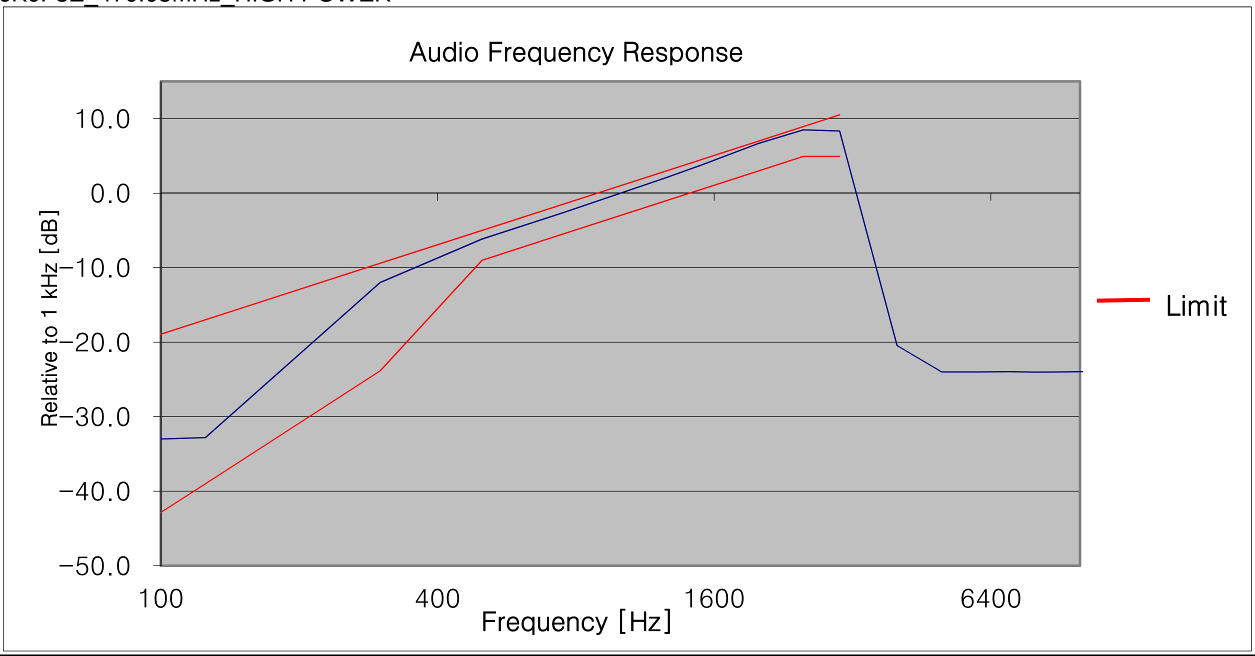


11K0F3E _511.95MHz_LOW POWER

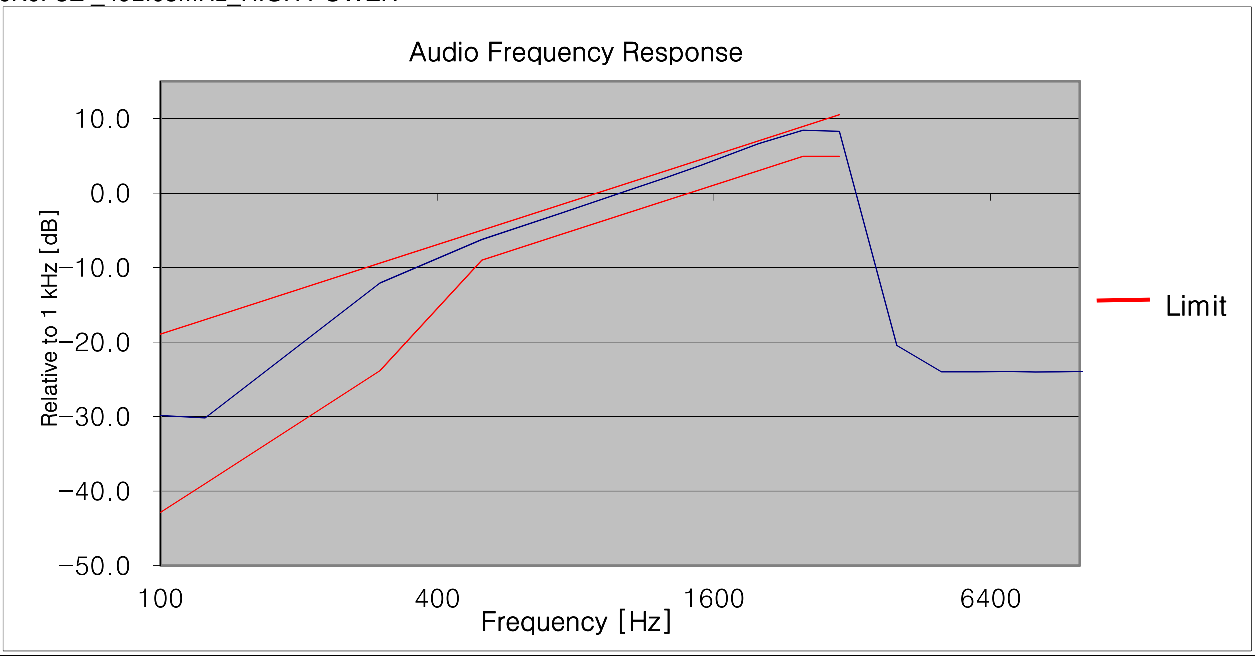


16K0F3E

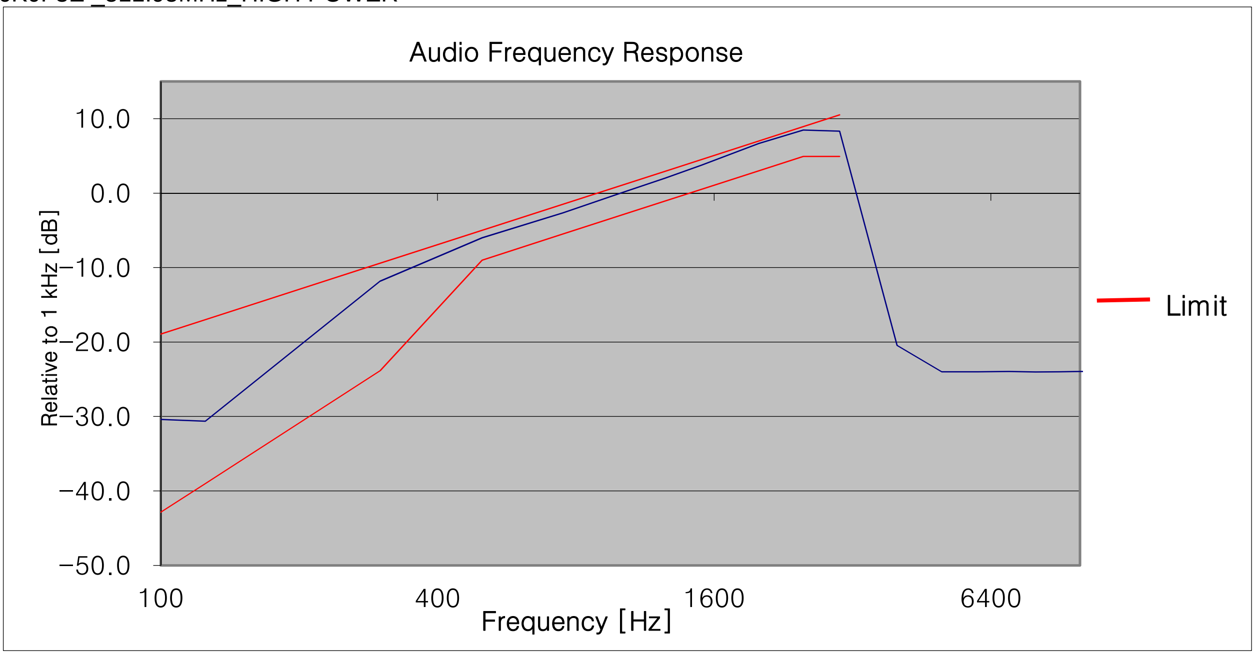
16K0F3E_470.05MHz_HIGH POWER



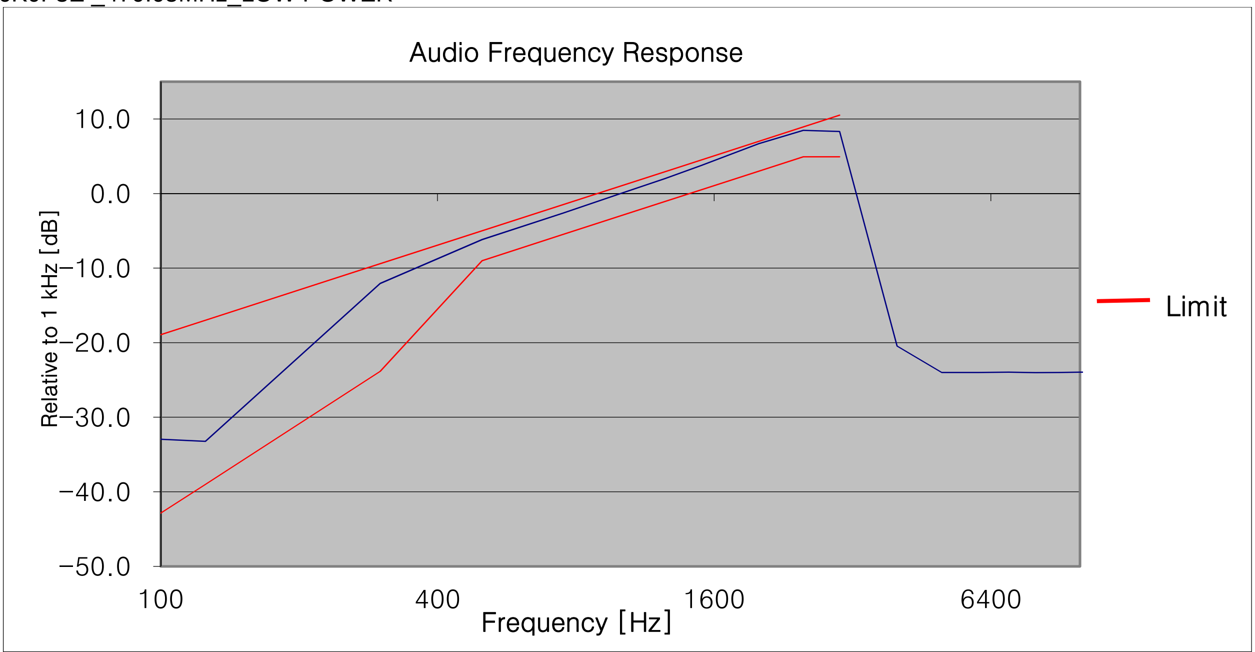
16K0F3E _491.05MHz_HIGH POWER



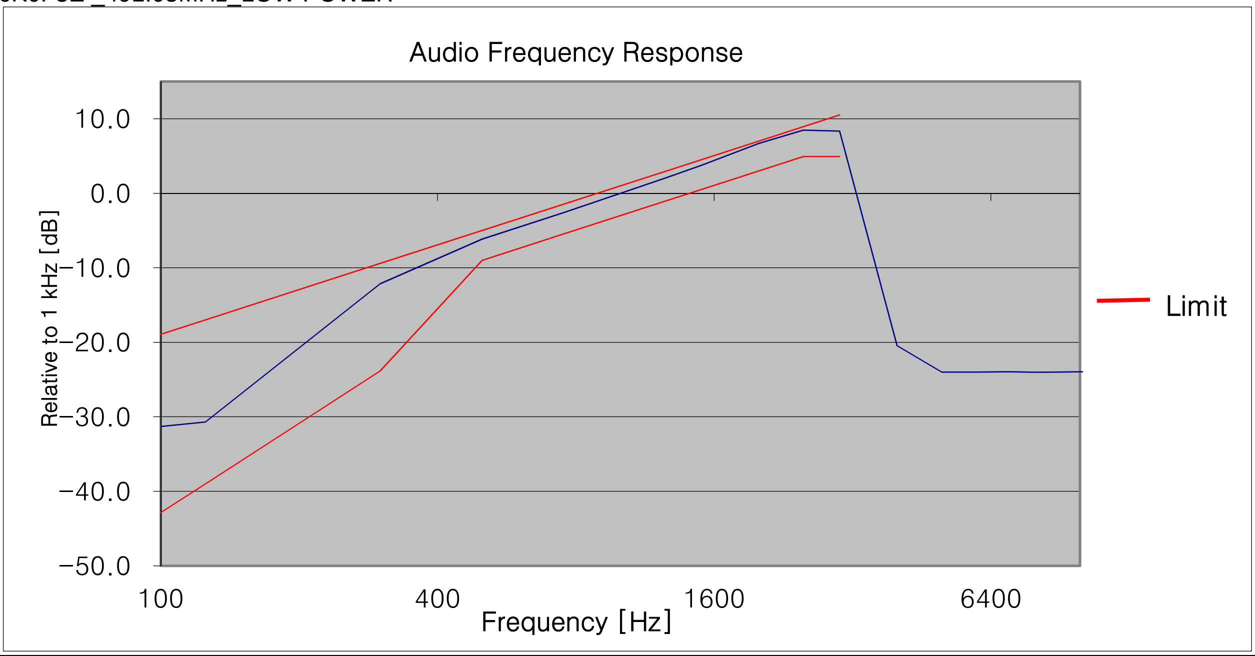
16K0F3E _511.95MHz_HIGH POWER



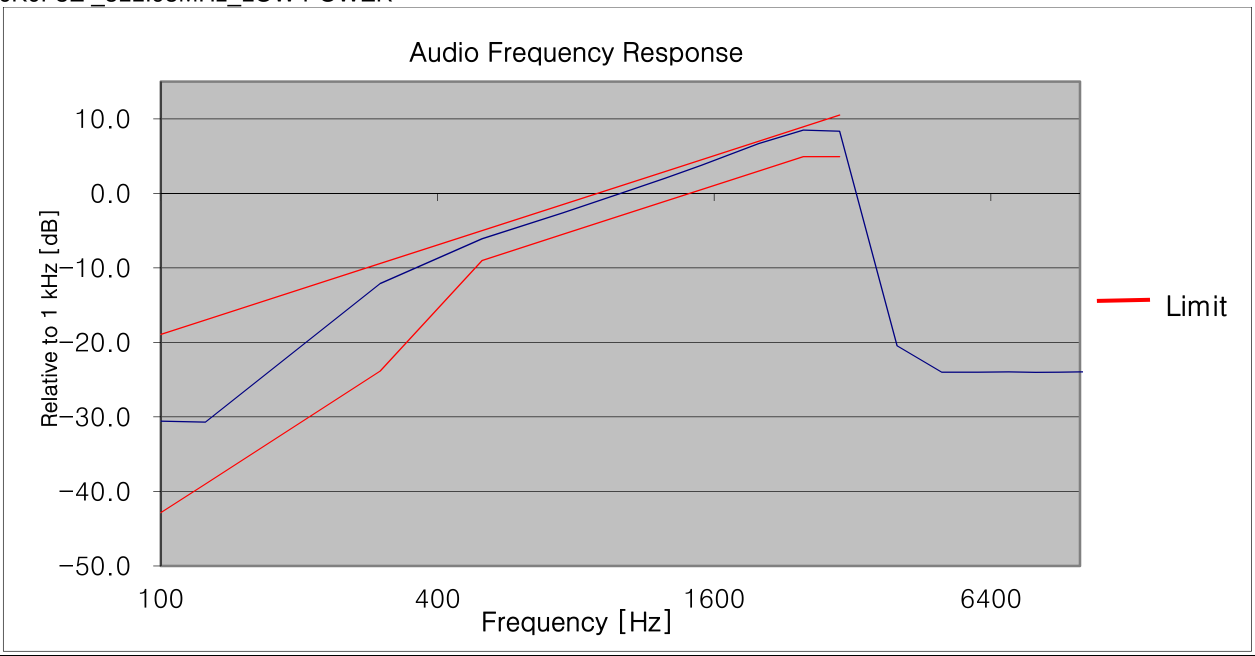
16K0F3E _470.05MHz_LOW POWER



16K0F3E _491.05MHz_LOW POWER



16K0F3E _511.95MHz_LOW POWER

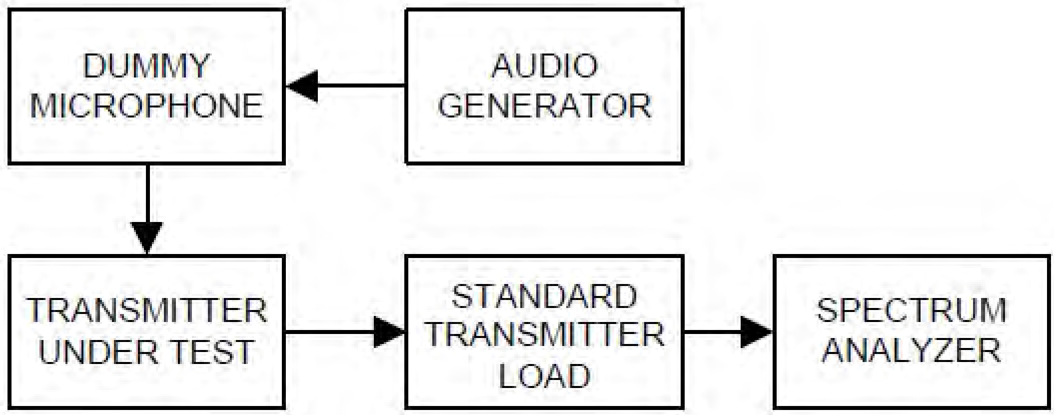


7.6 Emission Mask

▣Definition

The transmitter Emission Mask denotes the sideband power produced at a discrete frequency separation from the carrier up to the test bandwidth (see 1.3.4.4) due to all sources of unwanted noise within the transmitter in a modulated condition.

▣ TEST CONFIGURATION



▣TEST PROCEDURE

According to 2.2.11 in TIA-603-D Standard.

a) Connect the equipment as illustrated. Use the table to determine the spectrum analyzer resolution bandwidth:

Spectrum Analyzer Resolution Bandwidth

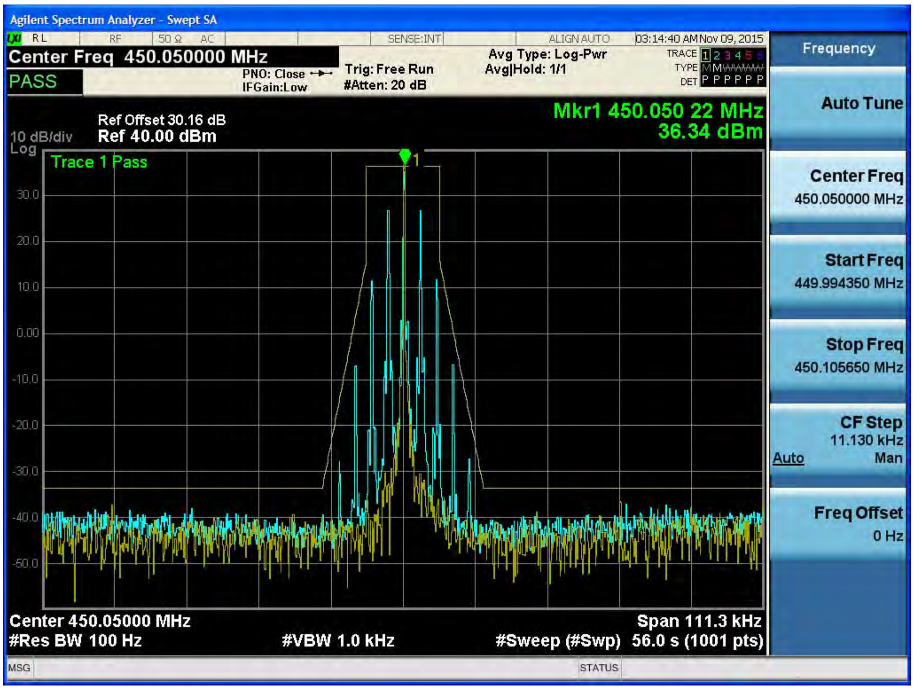
Frequency Band (MHz)	Mask for Equipment with Audio Low Pass Filter	Mask for Equipment without Low Pass Filter	Spectrum Analyzer Resolution Bandwidth (Hz)
25-50	B	C	300
72-76	B	C	300
138-174	NTIA	NTIA	300
150-174	B	C	300
150-174	D or E	D or E	100
406-420	NTIA	NTIA	300
421-512	B	C	300
421-512	D or E	D or E	100
806-821/851-866	B or EA	G or EA	300
821-824/866-869	B	H	300
896-901/935-940	I	J	300

b) Adjust the spectrum analyzer for the following settings:
   1) Resolution Bandwidth per the above table
   2) Video Bandwidth at least 10 times the resolution bandwidth.
   3) Sweep Speed slow enough to maintain measurement calibration.
   4) Detector Mode = Positive Peak.
   5) Span that will allow proper viewing of the test bandwidth (see 1.3.4.4).
c) Set the center frequency of the spectrum analyzer to the assigned transmitter frequency. Key the transmitter, and set the level of the unmodulated carrier to a full scale reference line. This is the 0 dB reference for the measurement.
d) Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation. The input level shall be established at the frequency of maximum response of the audio modulating circuit. Transmitters employing digital modulation techniques that bypass the limiter and the audio low-pass filter shall be modulated as specified by the manufacturer.
e) Record the resulting spectrum analyzer presentation of the emission level with an on-line recording device or in a photograph. It is recommended that the emission limit (as given in 3.2.11) be drawn on the plotted graph or photograph. The spectrum analyzer presentation is the sideband spectrum.

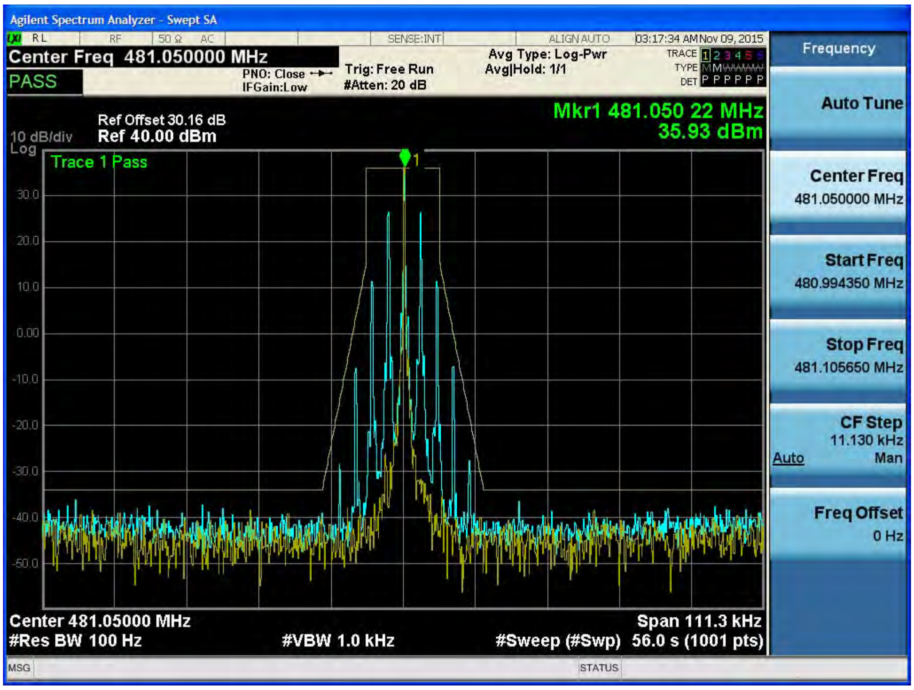
▣TEST RESULTS

11K0F3E

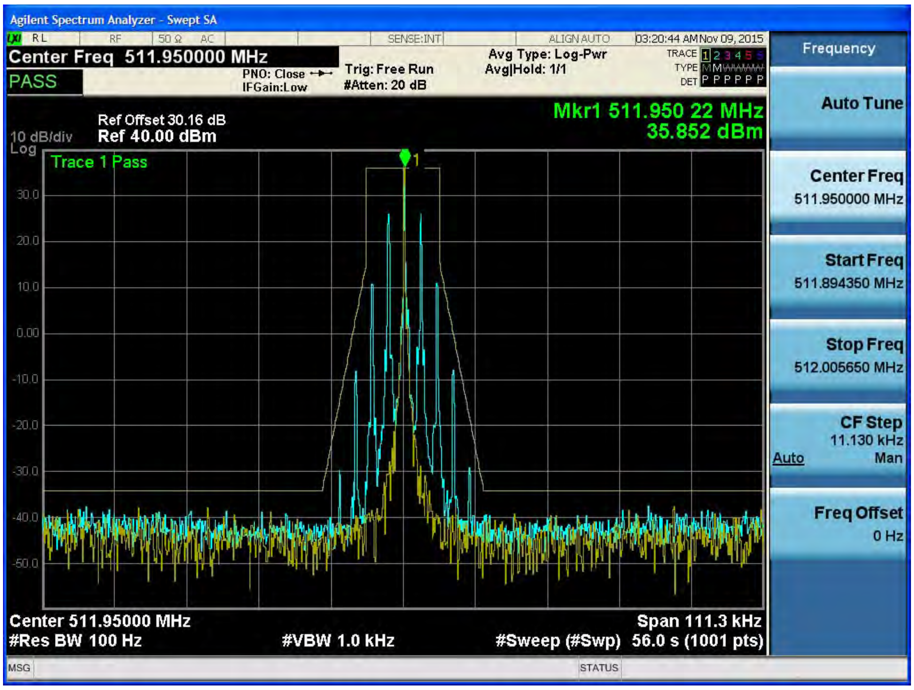
HIGH POWER_11K0F3E _450.05 MHz_Low



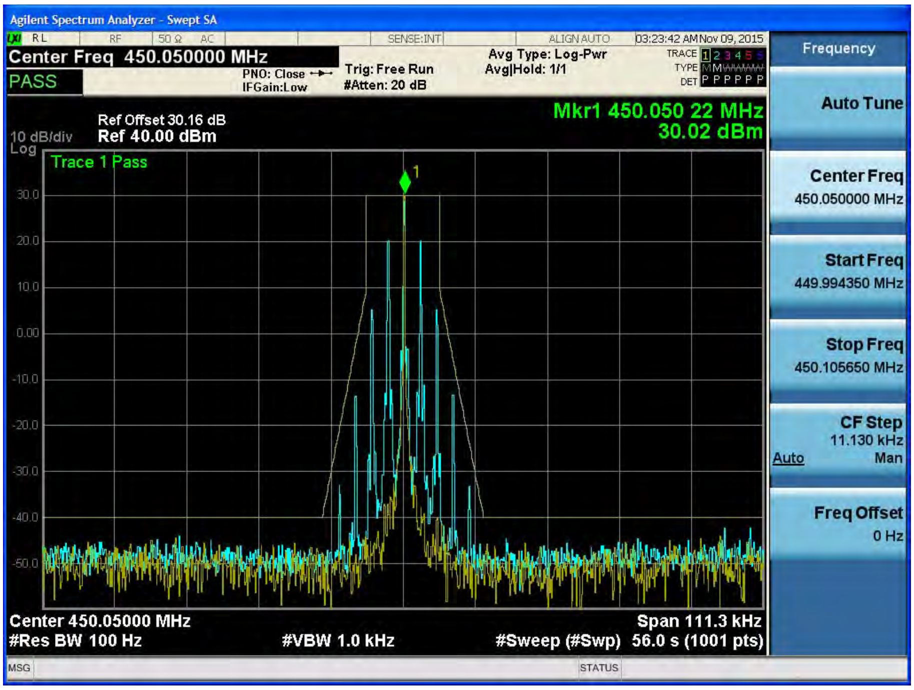
HIGH POWER_11K0F3E _481.05 MHz_Middle



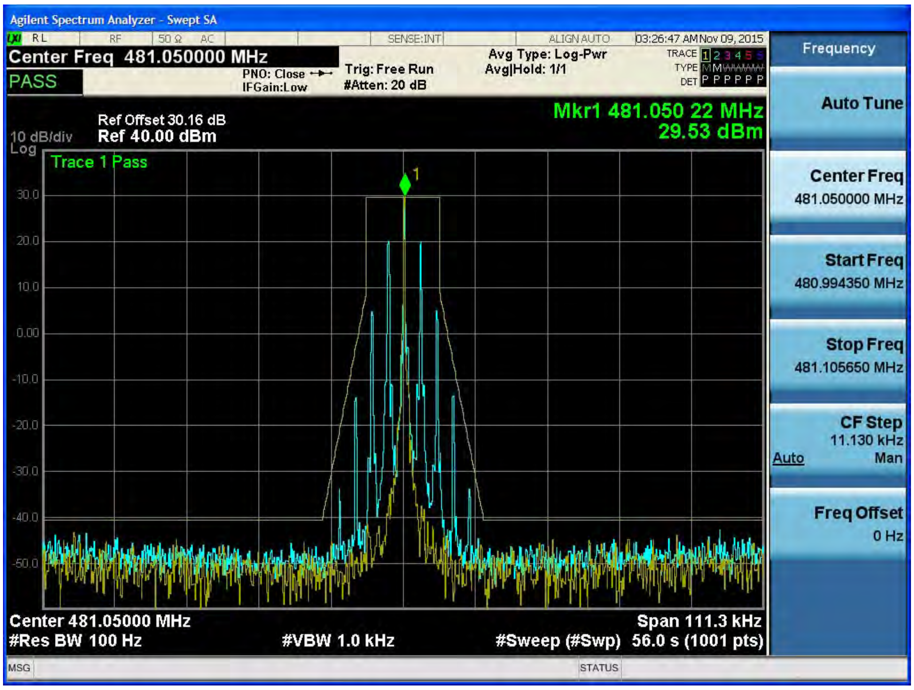
HIGH POWER_11K0F3E _511.95 MHz_High



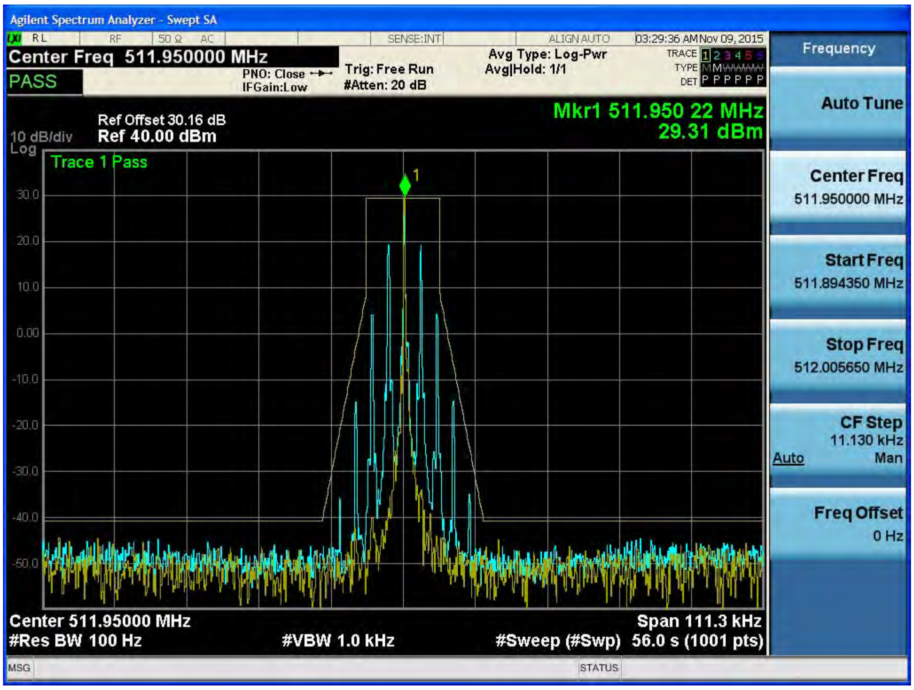
LOW POWER_11K0F3E _450.05 MHz_Low



LOW POWER_11K0F3E _481.05 MHz_Middle

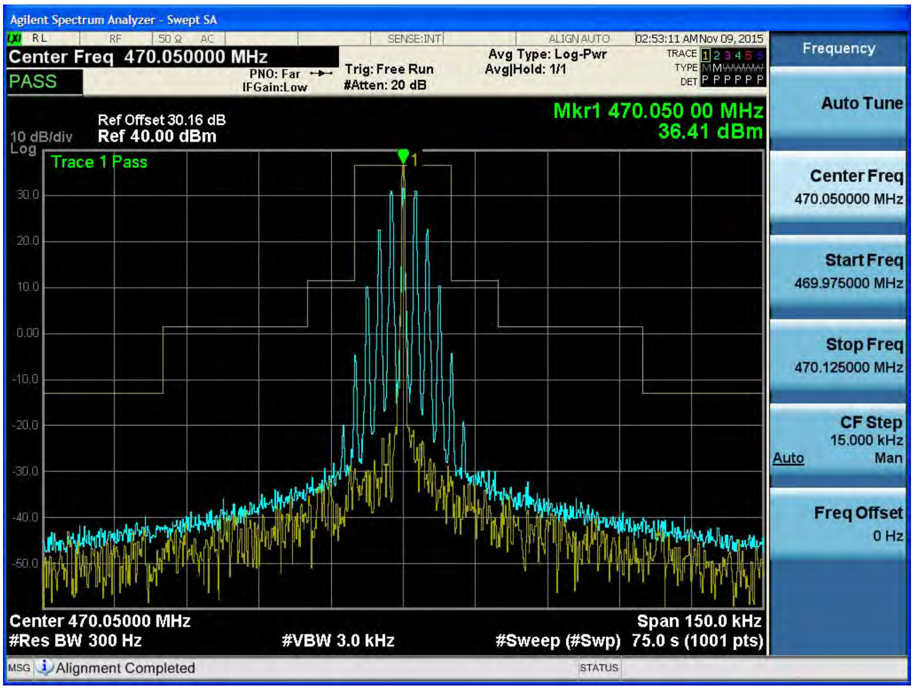


LOW POWER_11K0F3E _511.95 MHz_High

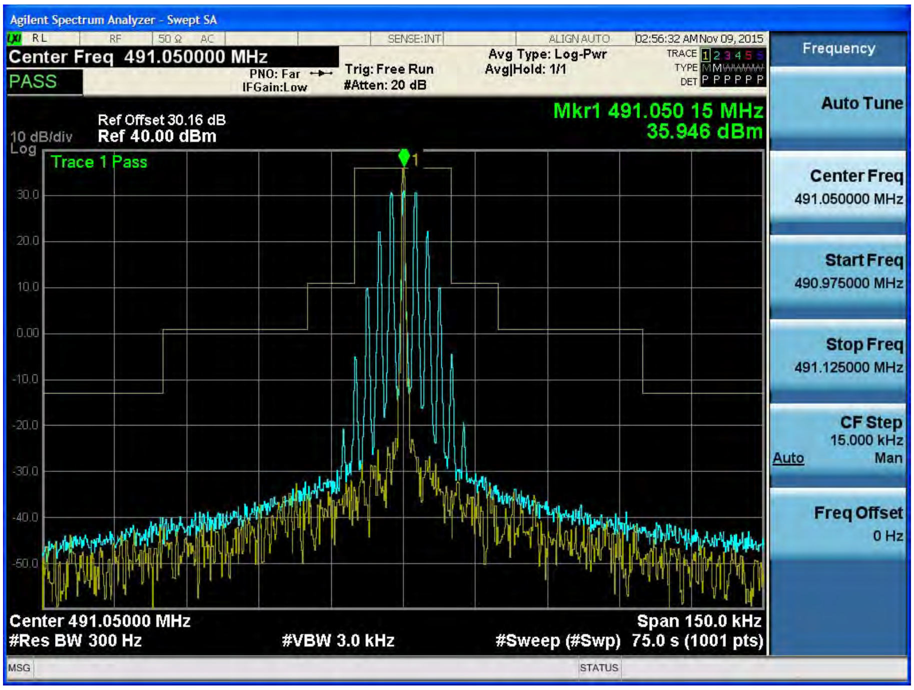


16K0F3E

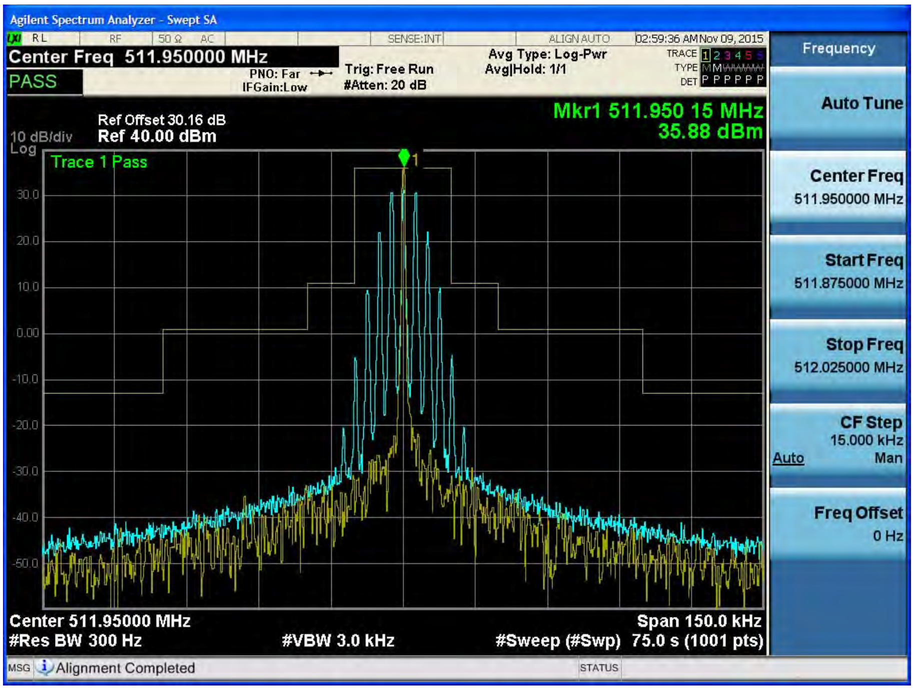
HIGH POWER_16K0F3E _470.05 MHz_Low



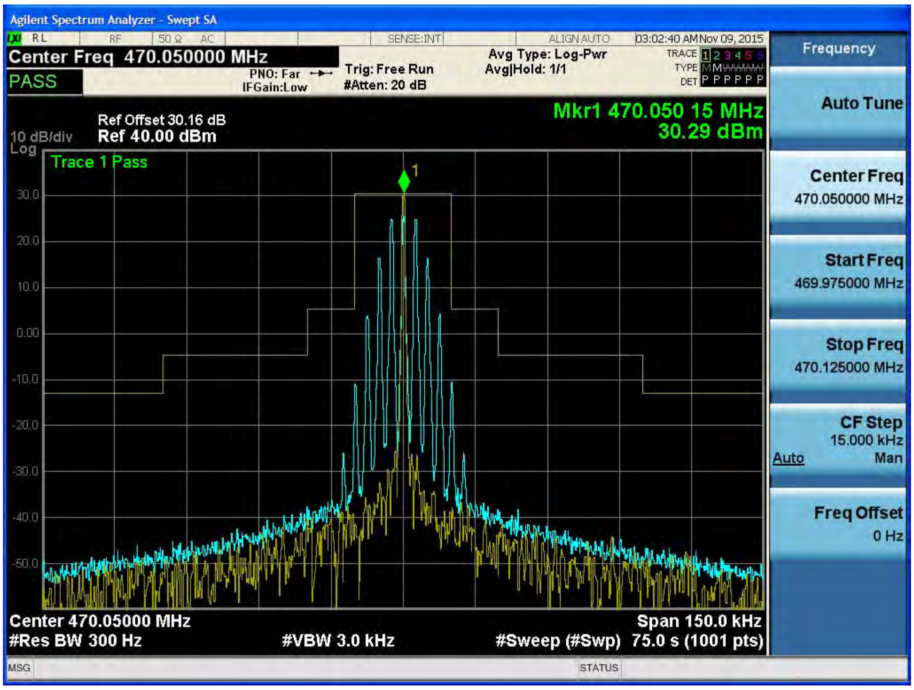
HIGH POWER_16K0F3E _491.05 MHz_Middle



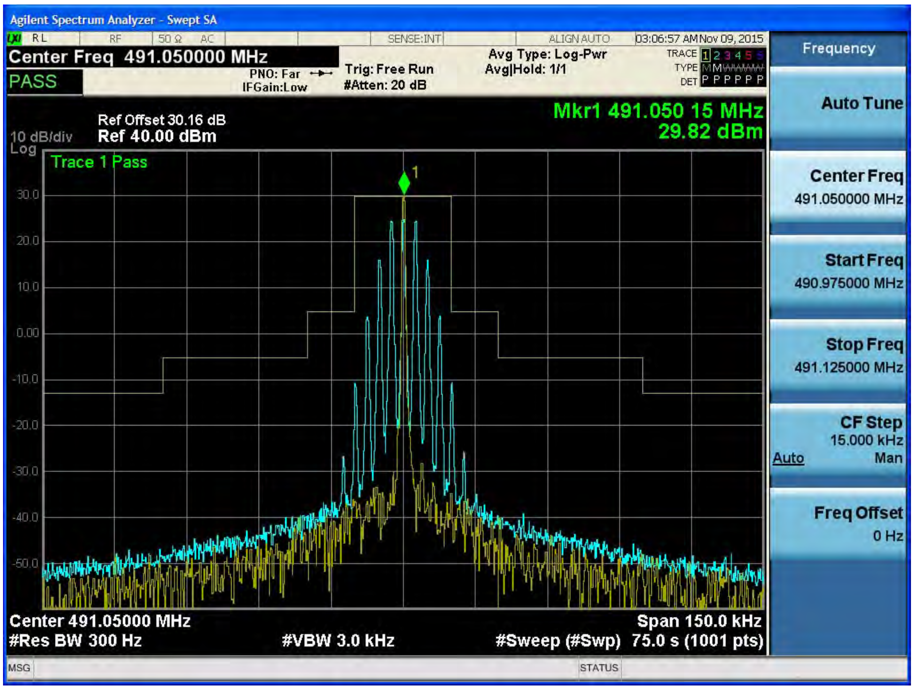
HIGH POWER_16K0F3E _511.95 MHz_High



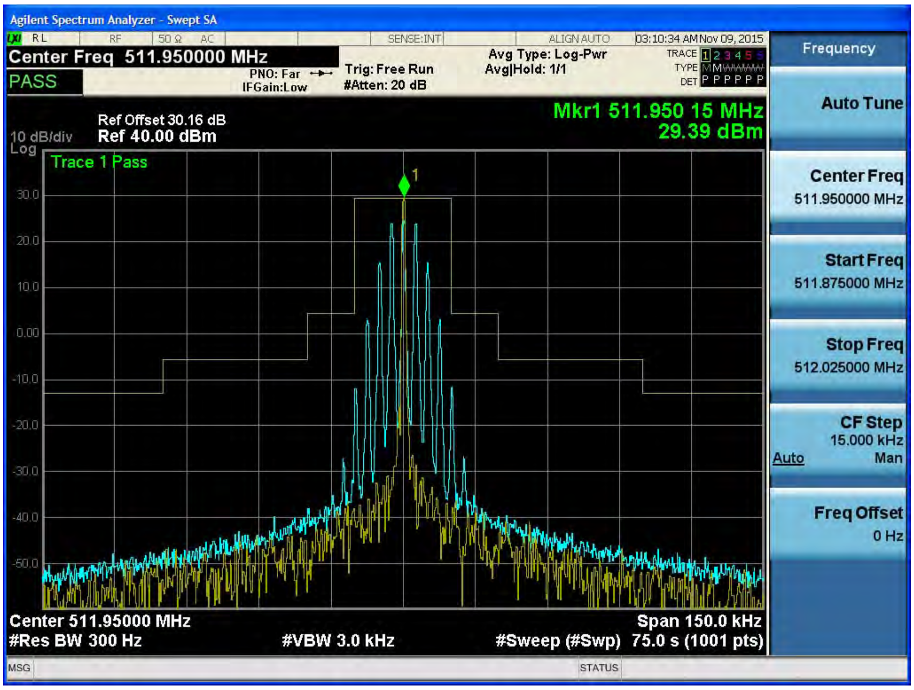
LOW POWER_16K0F3E _470.05 MHz_Low



LOW POWER_16K0F3E _491.05 MHz_Middle

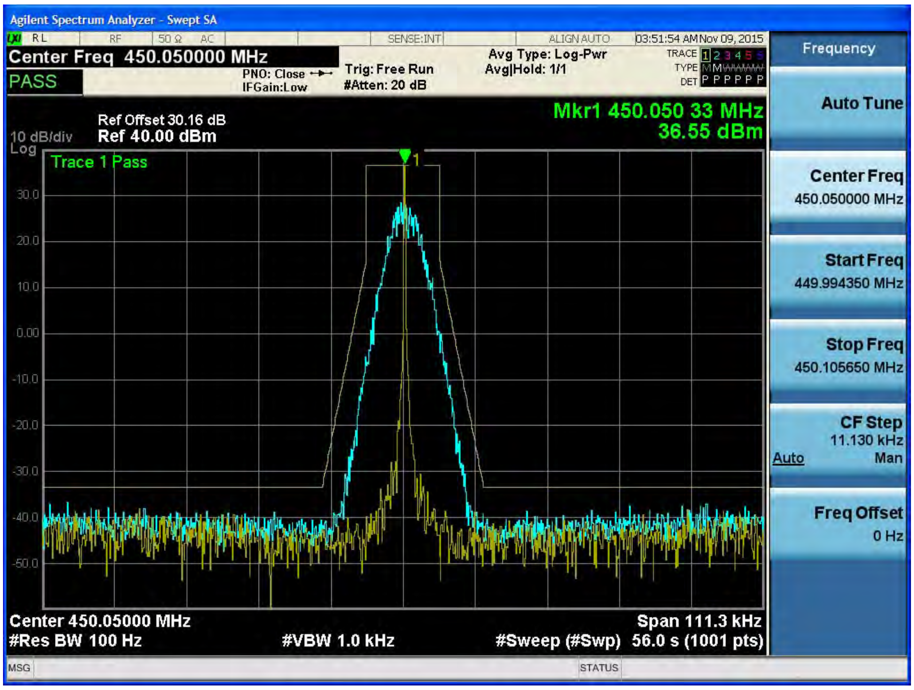


LOW POWER_16K0F3E _511.95 MHz_High

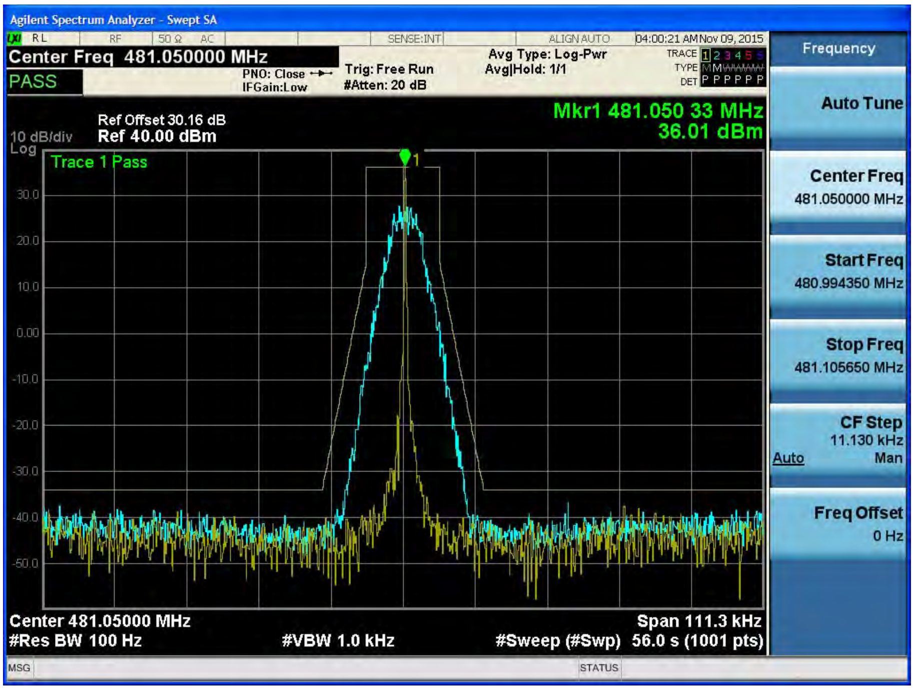


7K60FXD, 7K60FXE

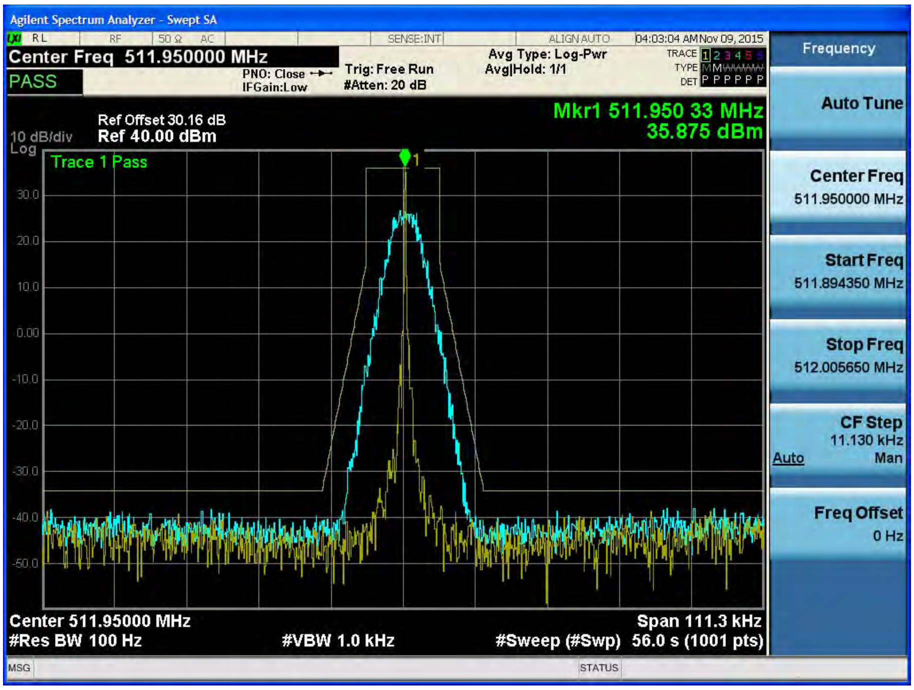
HIGH POWER_7K60FXD, 7K60FXE _450.05 MHz_Low



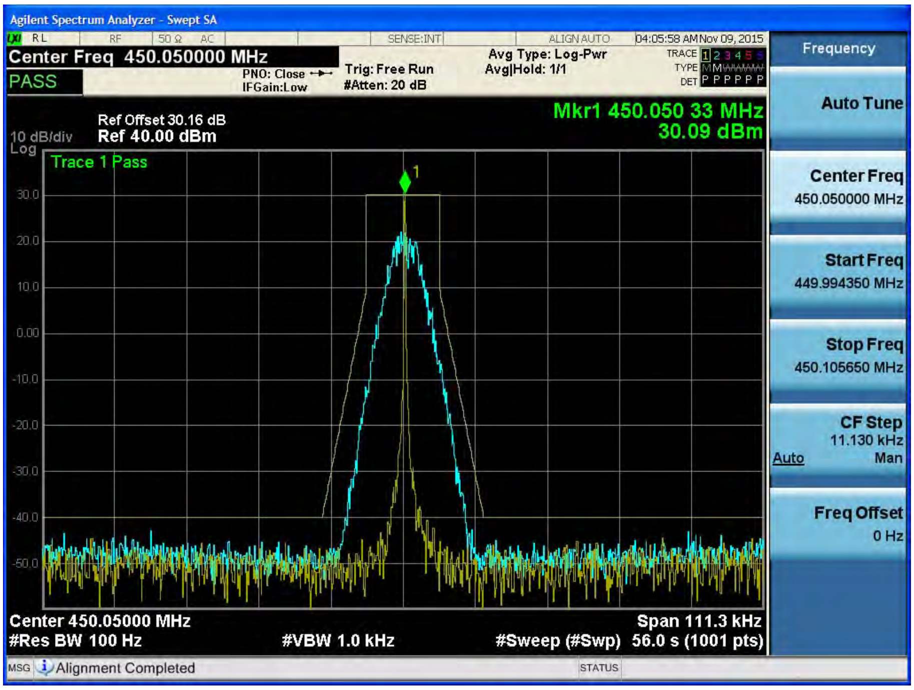
HIGH POWER_7K60FXD, 7K60FXE _481.05 MHz_Middle



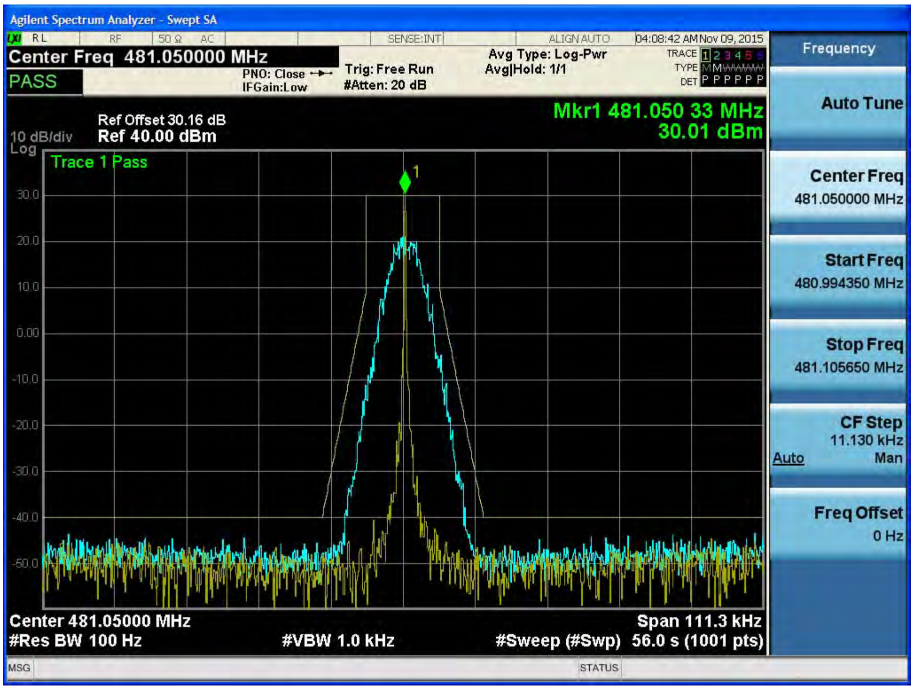
HIGH POWER_7K60FXD, 7K60FXE _511.95 MHz_High



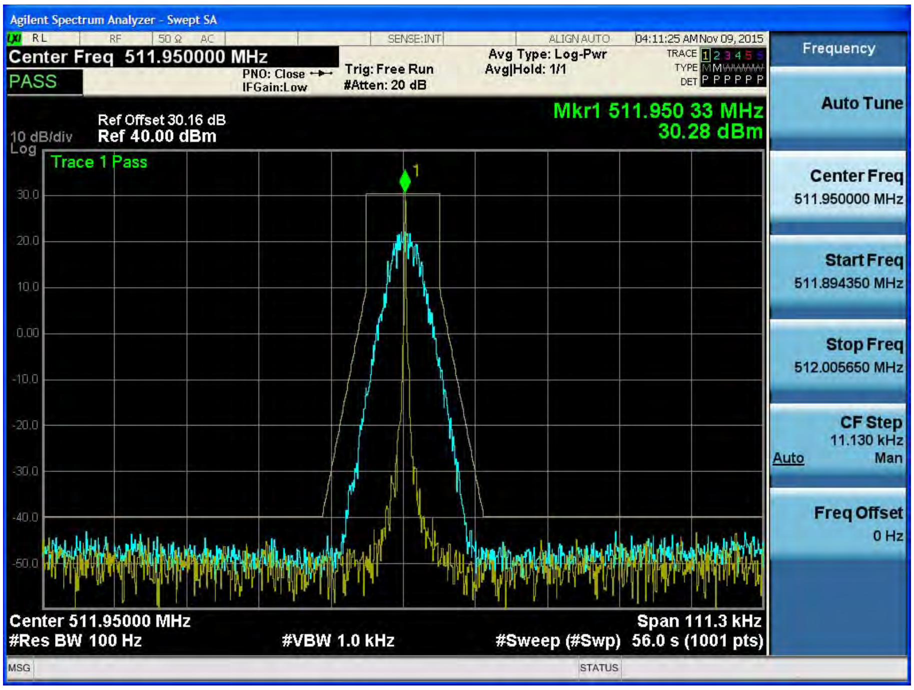
LOW POWER_7K60FXD, 7K60FXE _450.05 MHz_Low



LOW POWER_7K60FXD, 7K60FXE _481.05 MHz_Middle



LOW POWER_7K60FXD, 7K60FXE _511.95 MHz_High



7.7 Transient Frequency Behavior

▣Definition

Transient frequency behavior is a measure of the difference, as a function in time, of the actual transmitter frequency to the assigned transmitter frequency when the transmitted RF output power is switched on or off.

▣ TEST CONFIGURATION

▣TEST PROCEDURE

According to 2.2.19 in TIA-603-D Standard.

a) Connect the equipment as illustrated.

b) Connect the output of the standard transmitter load to the RF power meter.
Supply sufficient attenuation via the RF attenuator to provide a level that is approximately 40 dB below the maximum allowable input to the modulation domain analyzer.

c) Unkey the transmitter.

d) Disconnect the RF power meter and connect the modulation domain analyzer in its place.
Set the envelope trigger of the modulation domain analyzer to the minimum level that will trigger when the transmitter is keyed.

e) Reduce the attenuation of the RF attenuator so that the input to the modulation domain analyzer is increased by 30 dB when the transmitter is keyed.

f) Set the modulation domain analyzer to trigger on the rising edge of the waveform in order to capture a single-shot turn-on of the transmitter signal.

g) Adjust the display of the modulation domain analyzer for proper viewing of the transmitter transient behavior. Set the timebase reference to the left for observing the transmitter turn-on transient.

h) Key the transmitter.

i) Observe the stored display of the modulation domain analyzer.
The signal trace shall be maintained within the allowable limits during the periods t_1 and t_2, and shall also remain within limits following t_2.

j) Adjust the modulation domain analyzer to trigger on the falling edge of the transmitter waveform in order to capture a single-shot turn-off transient of the transmitter signal.

k) Adjust the display of the modulation domain analyzer for proper viewing of the transmitter transient behavior. Set the timebase reference to the right for observing the transmitter turn-off transient.

l) Unkey the transmitter.

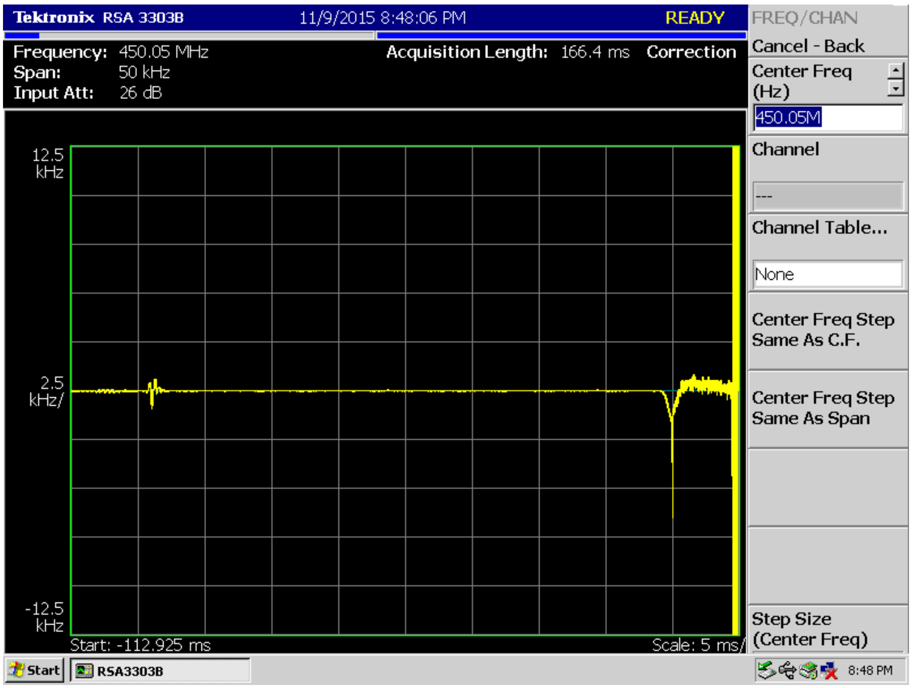
m) Observe the stored display of the modulation domain analyzer. The signal trace shall be maintained within the allowable limits during the period t_3.

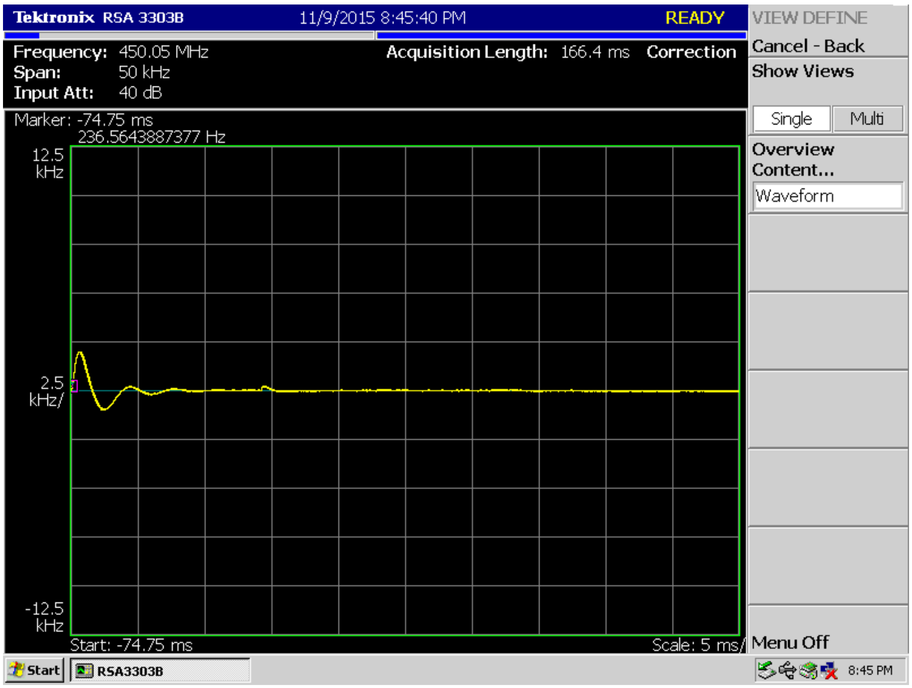
*Note :Digital test is no provision to configure the device with un-modulated carrier, hence test was performed with digital modulation on.

▣TEST RESULTS

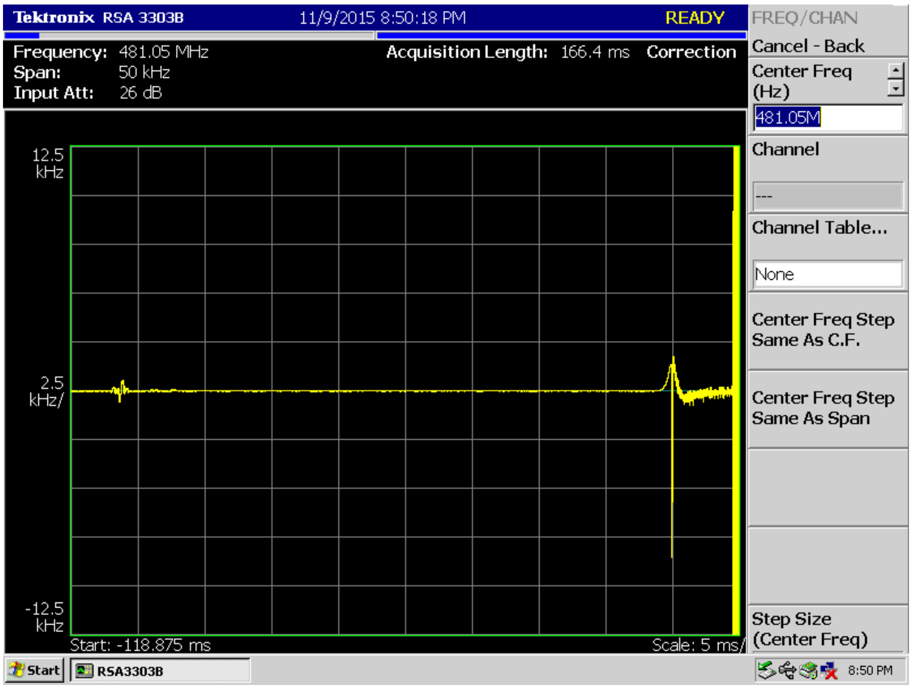
11K0F3E

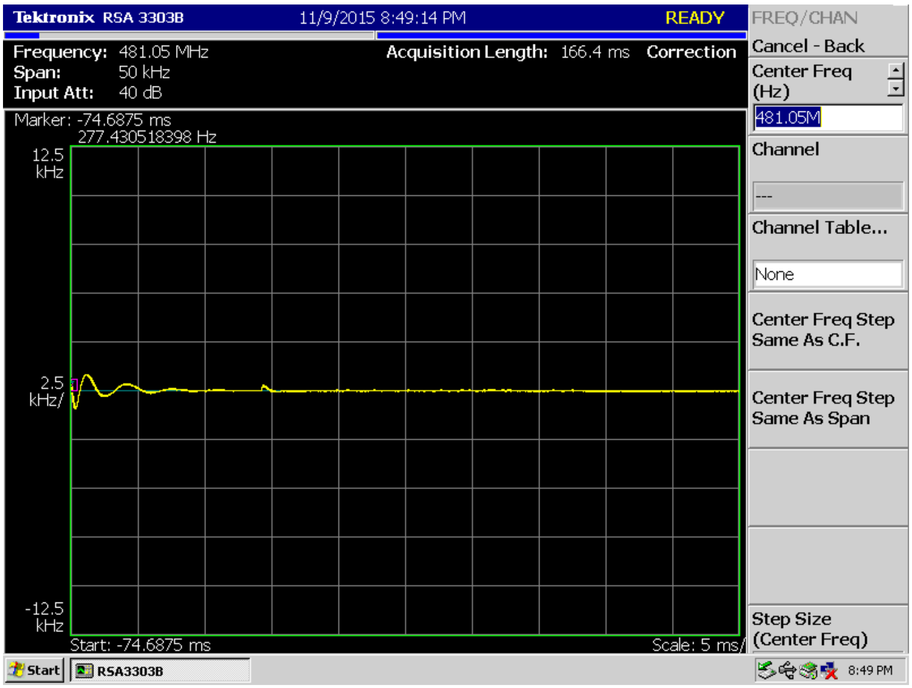
HIGH POWER_11K0F3E _450.05 MHz_Low



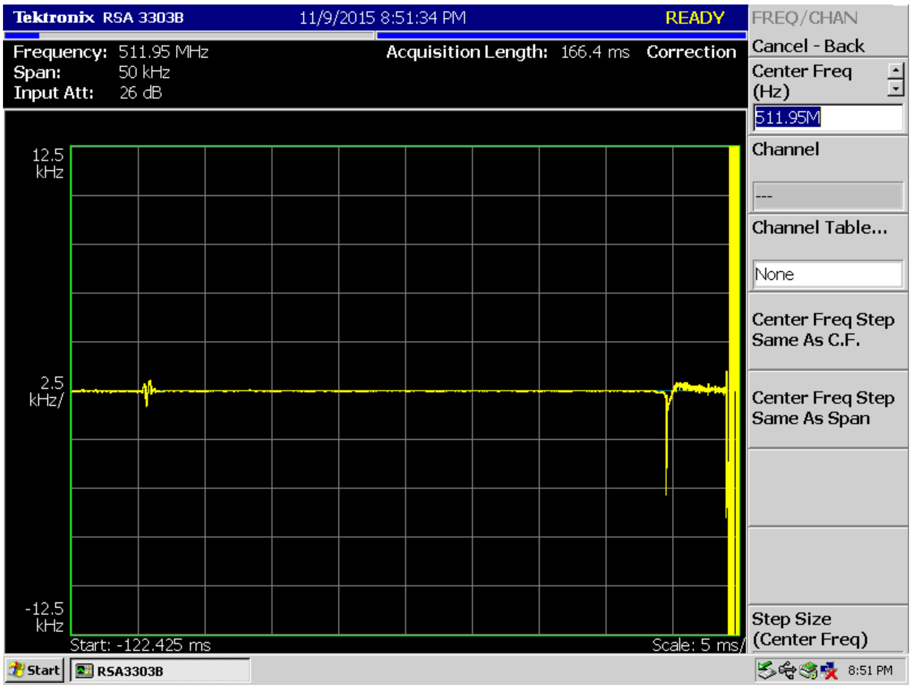


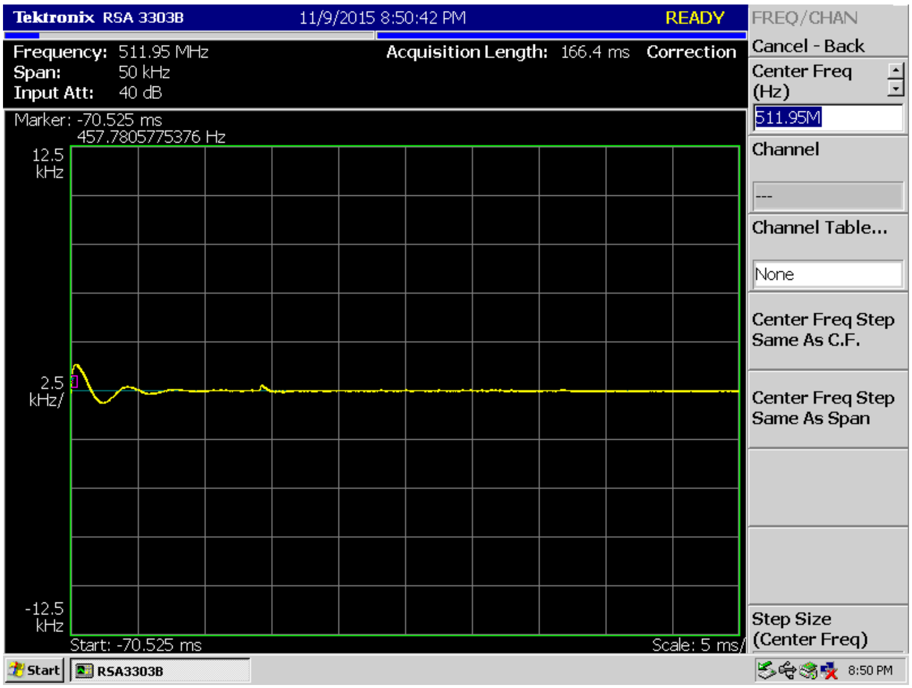
HIGH POWER_11K0F3E _481.05 MHz_Middle



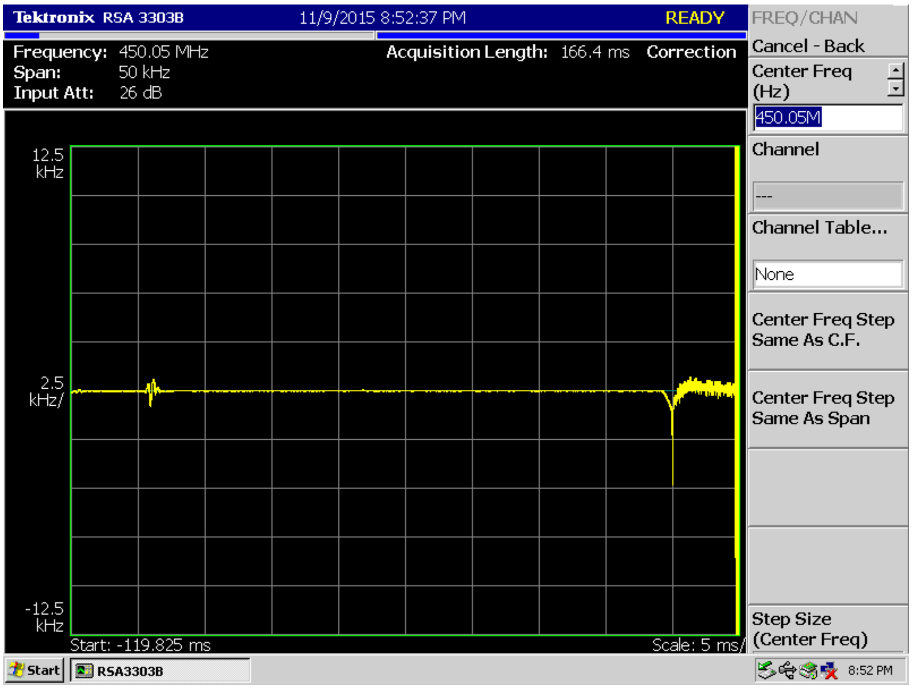


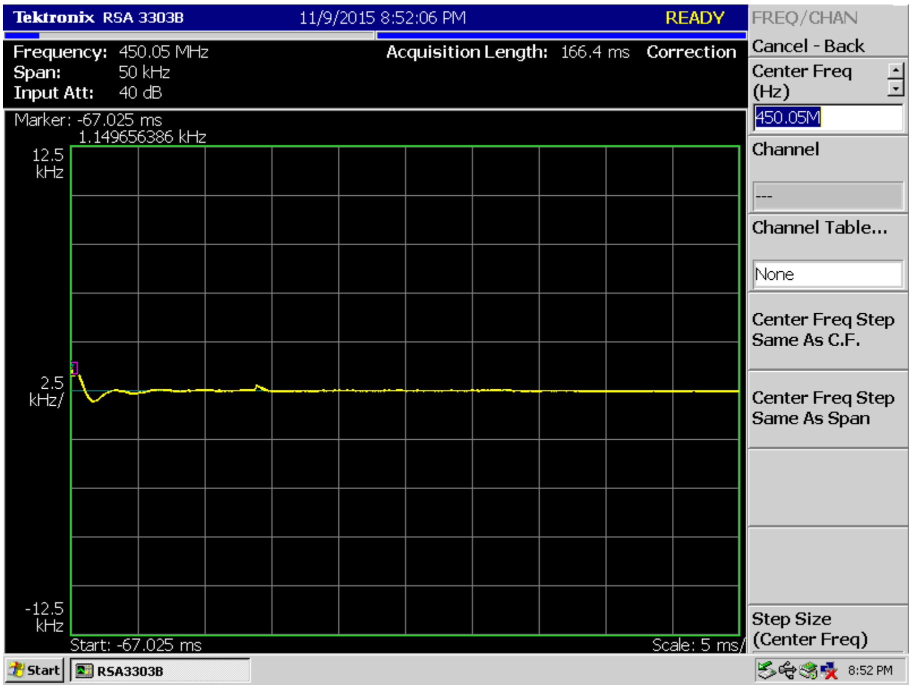
HIGH POWER_11K0F3E _511.95 MHz_High



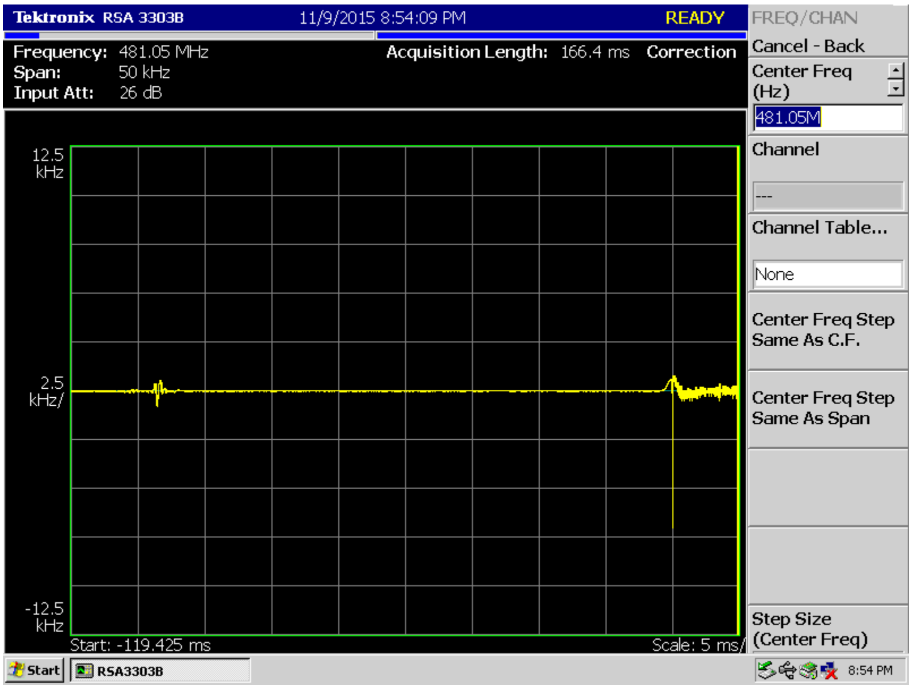


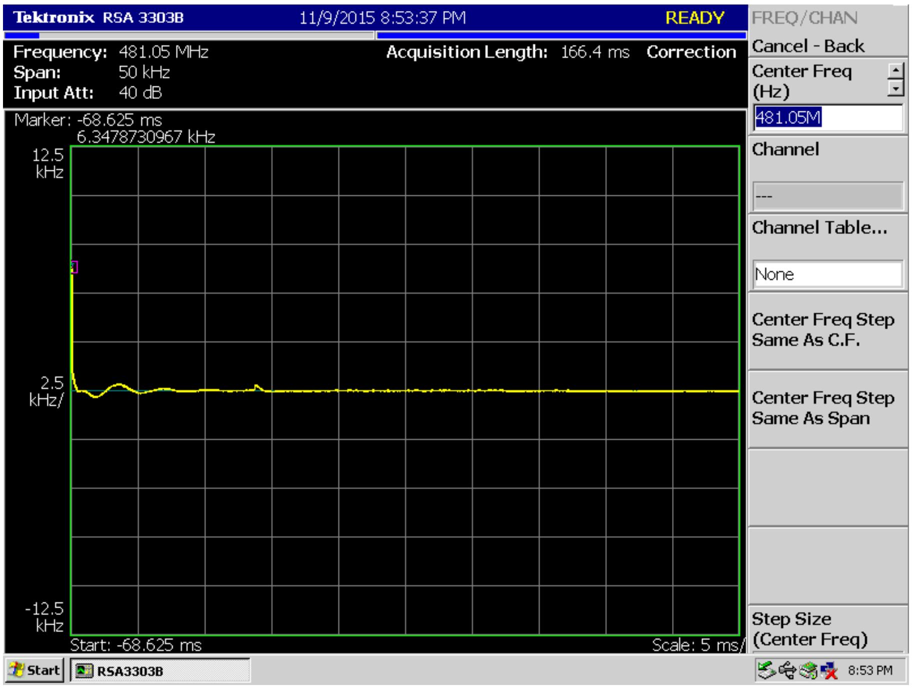
LOW POWER_11K0F3E _450.05 MHz_Low



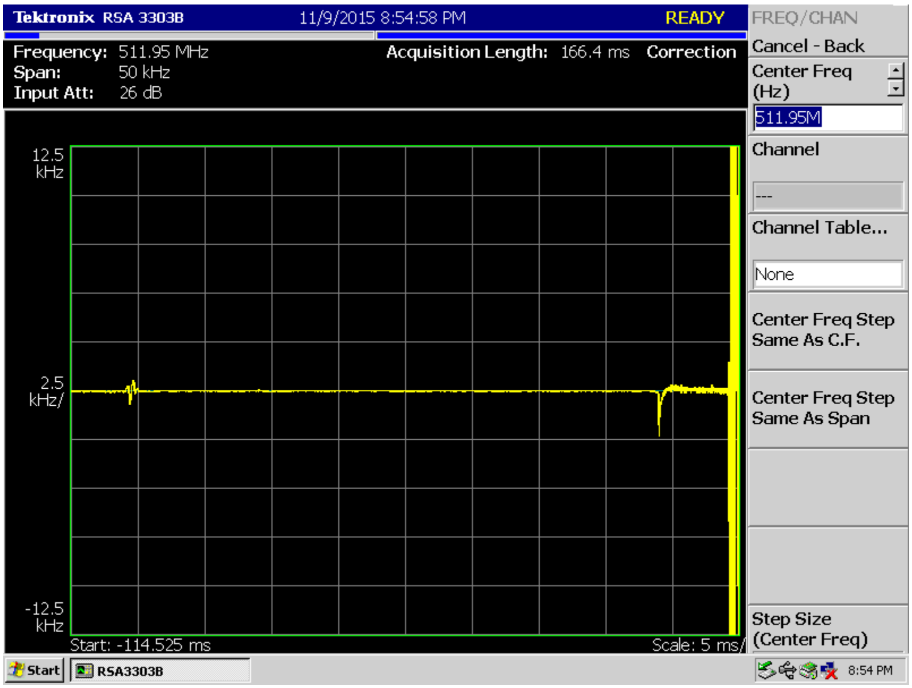


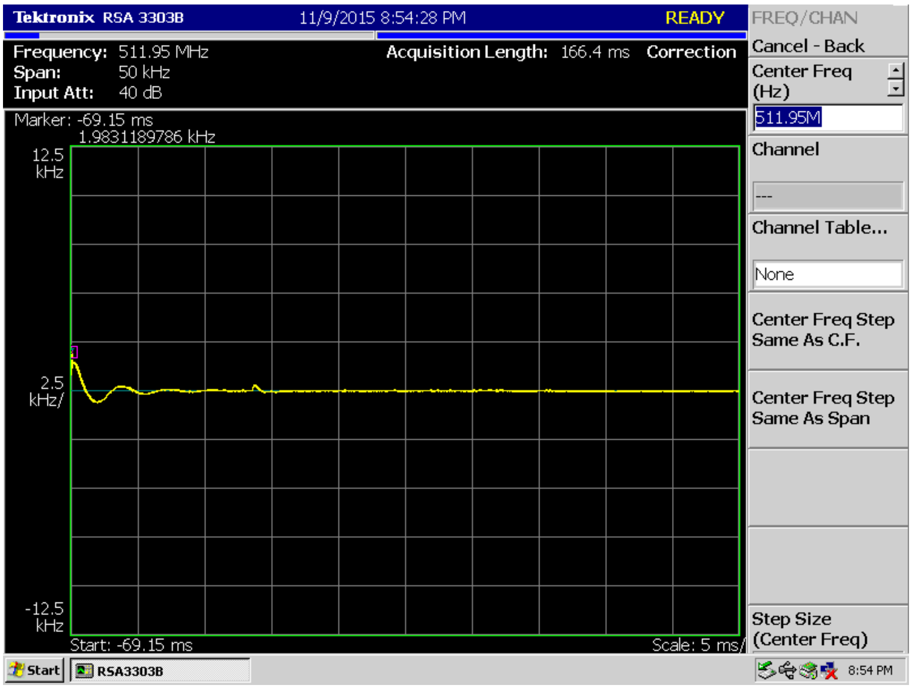
LOW POWER_11K0F3E _481.05 MHz_Middle





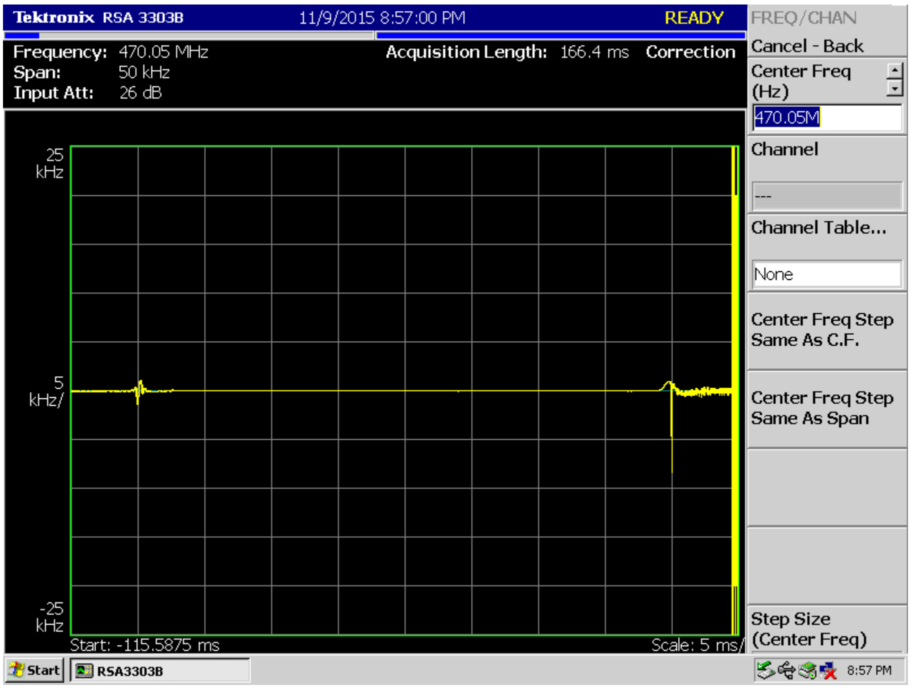
LOW POWER_11K0F3E _511.95 MHz_High

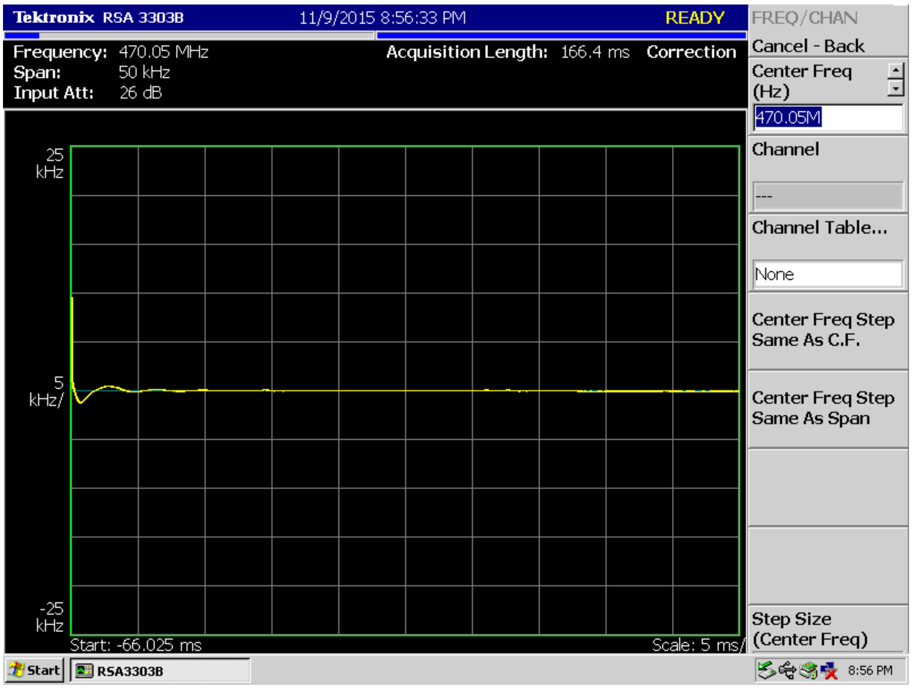




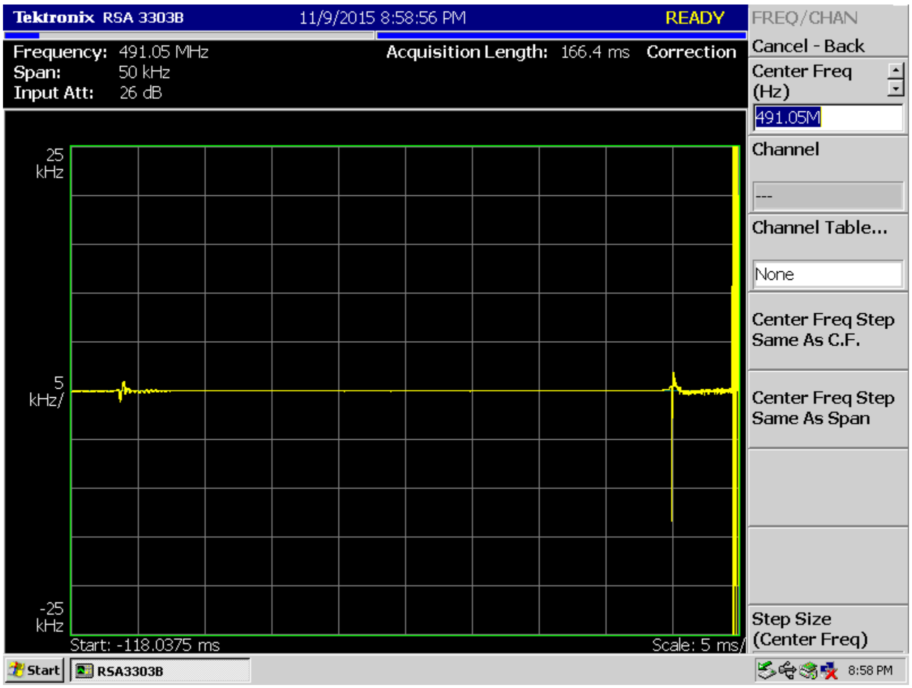
16K0F3E

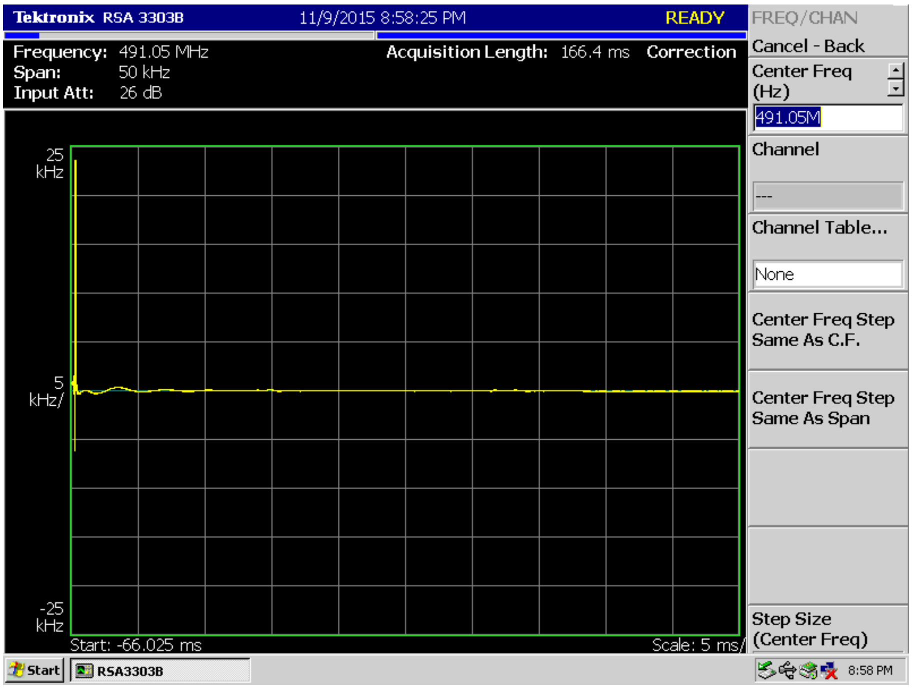
HIGH POWER_16K0F3E _470.05 MHz_Low



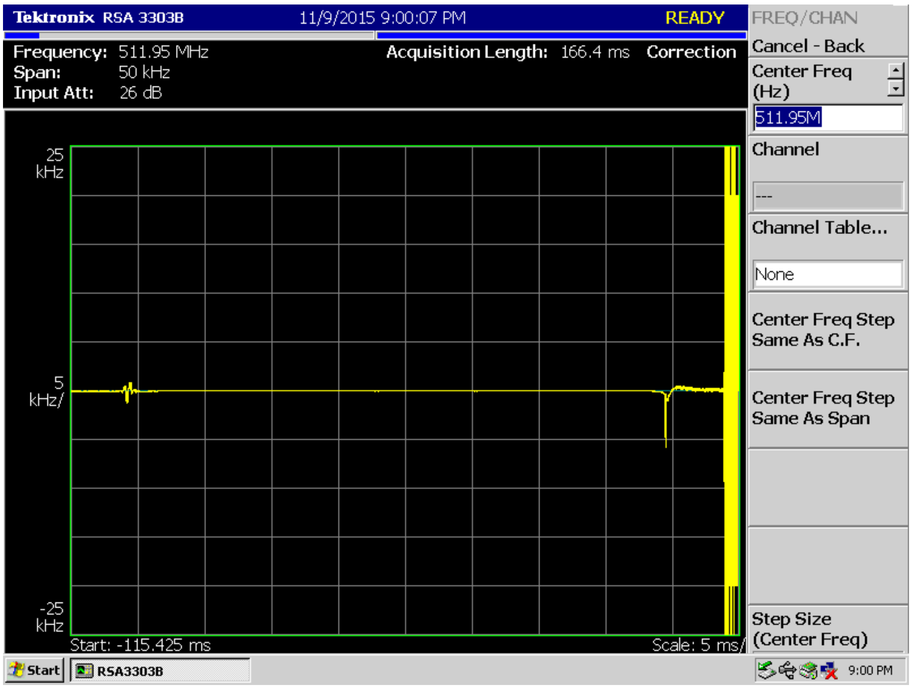


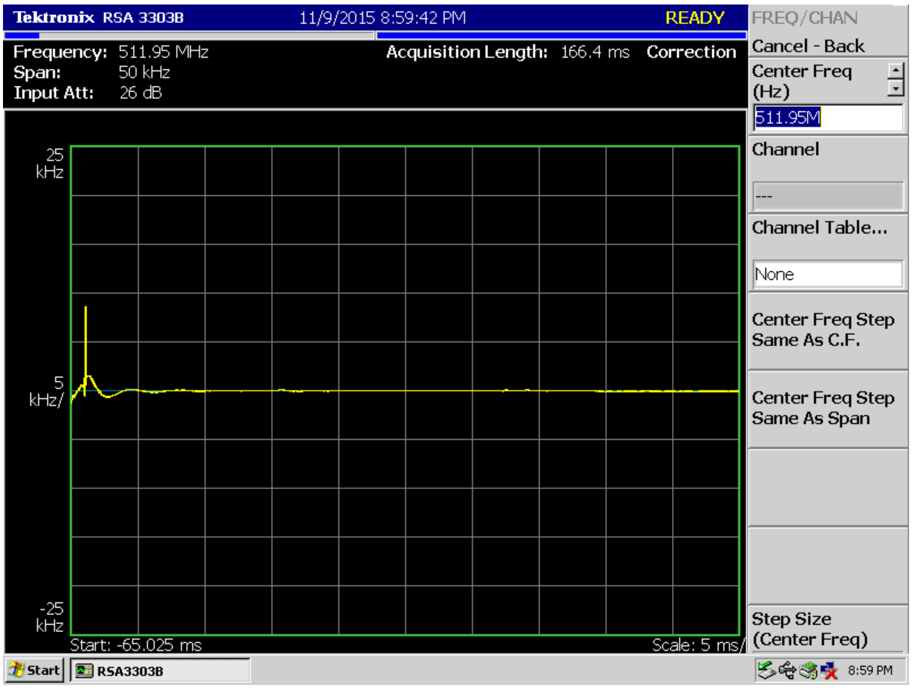
HIGH POWER_16K0F3E _491.05 MHz_Middle



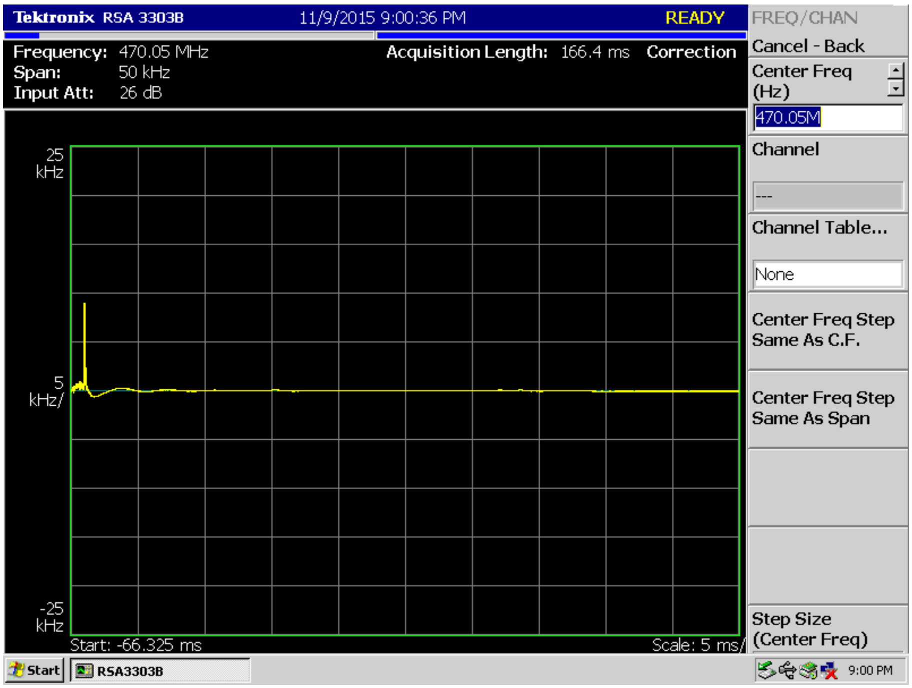


HIGH POWER_16K0F3E _511.95 MHz_High

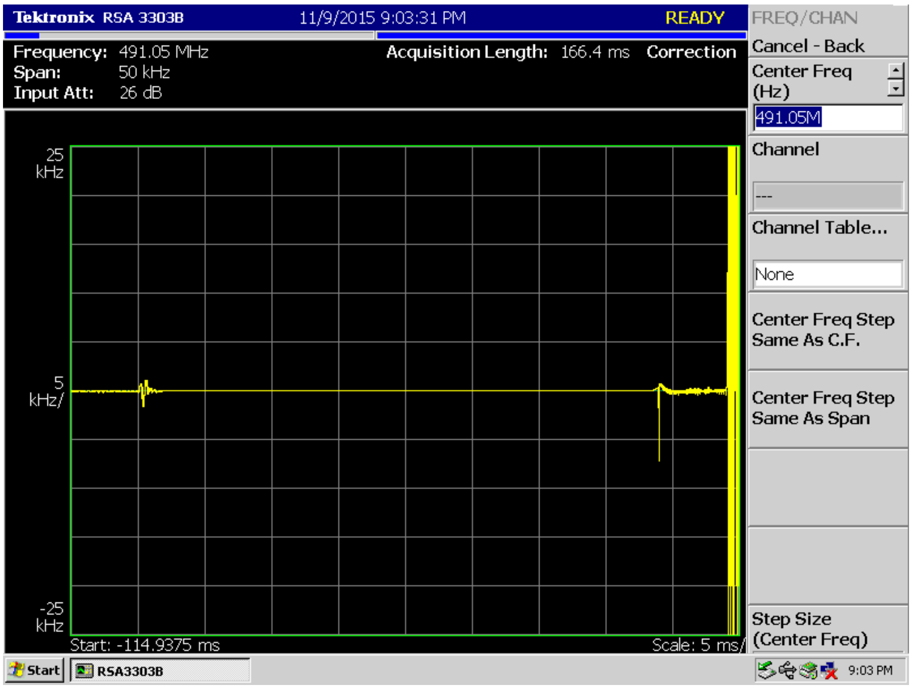


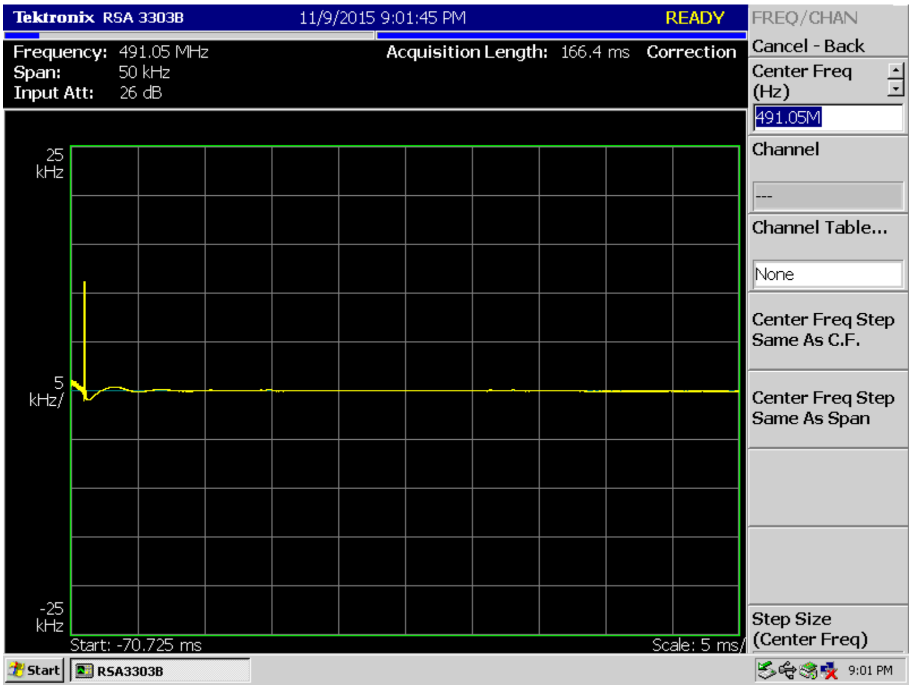


LOW POWER_16K0F3E _470.05 MHz_Low

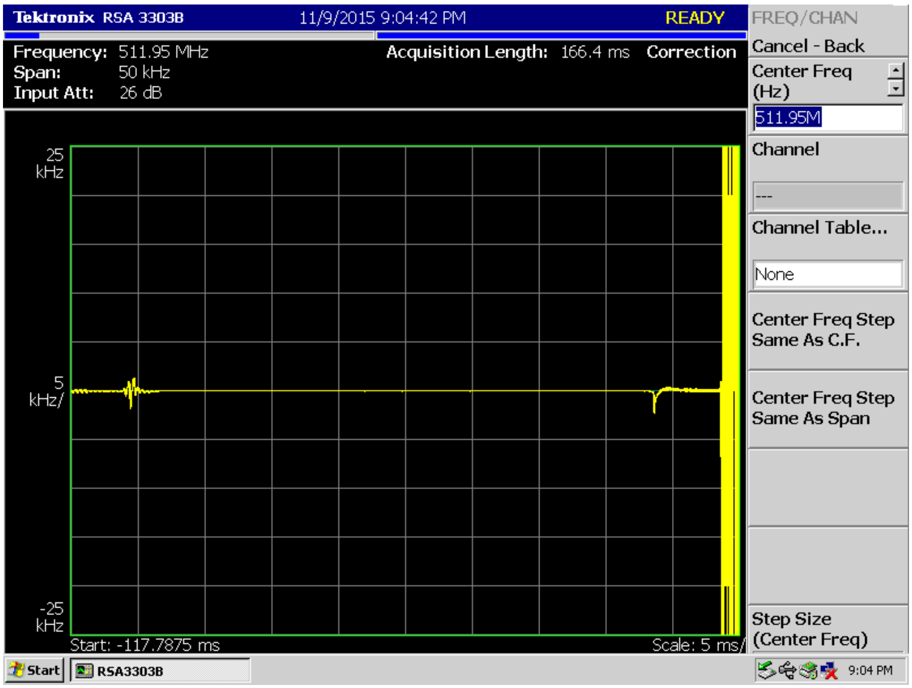


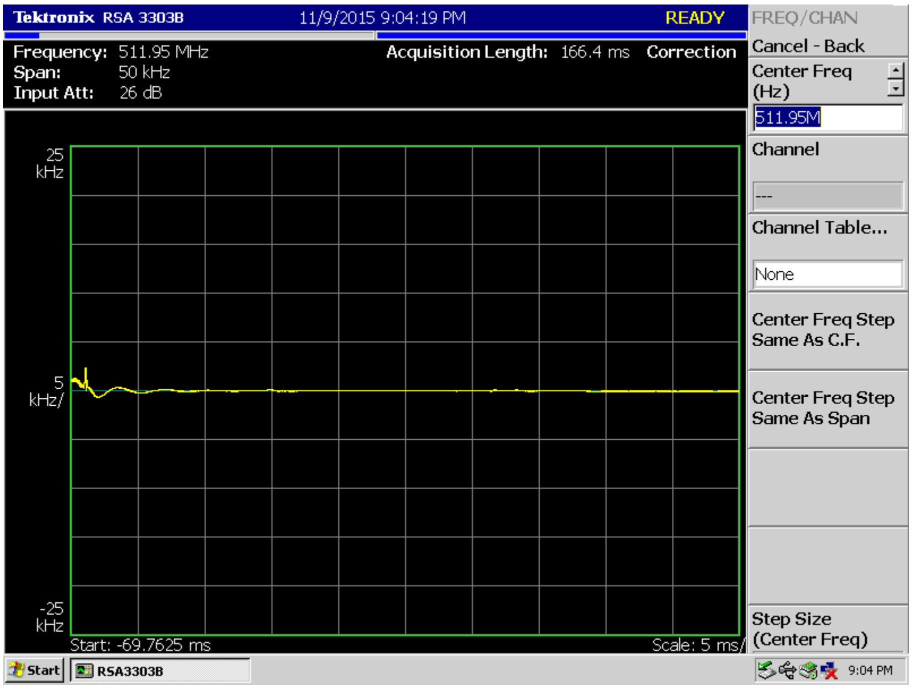
LOW POWER_16K0F3E _491.05 MHz_Middle





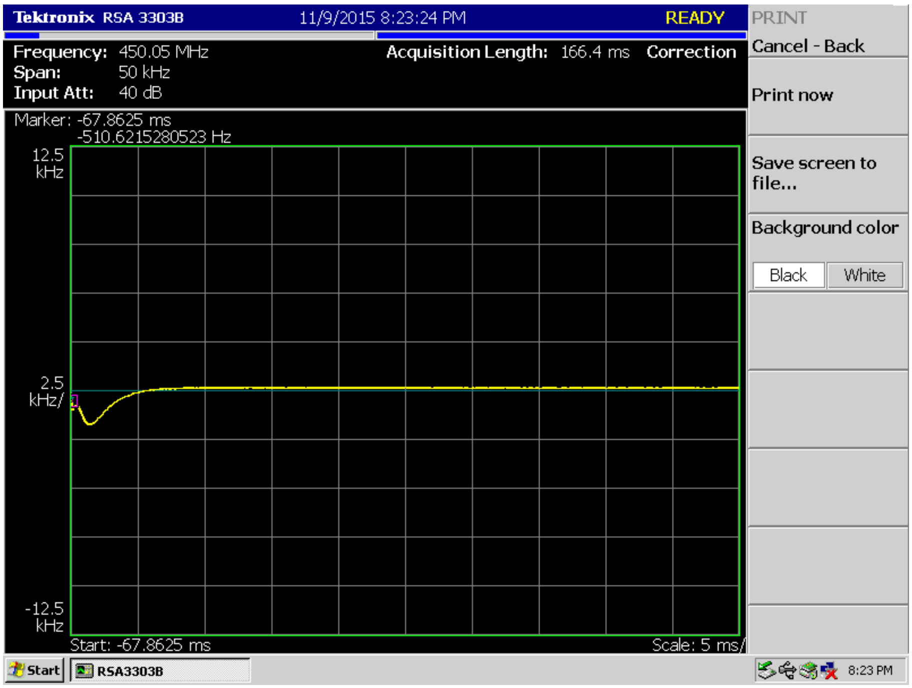
LOW POWER_16K0F3E _511.95 MHz_High



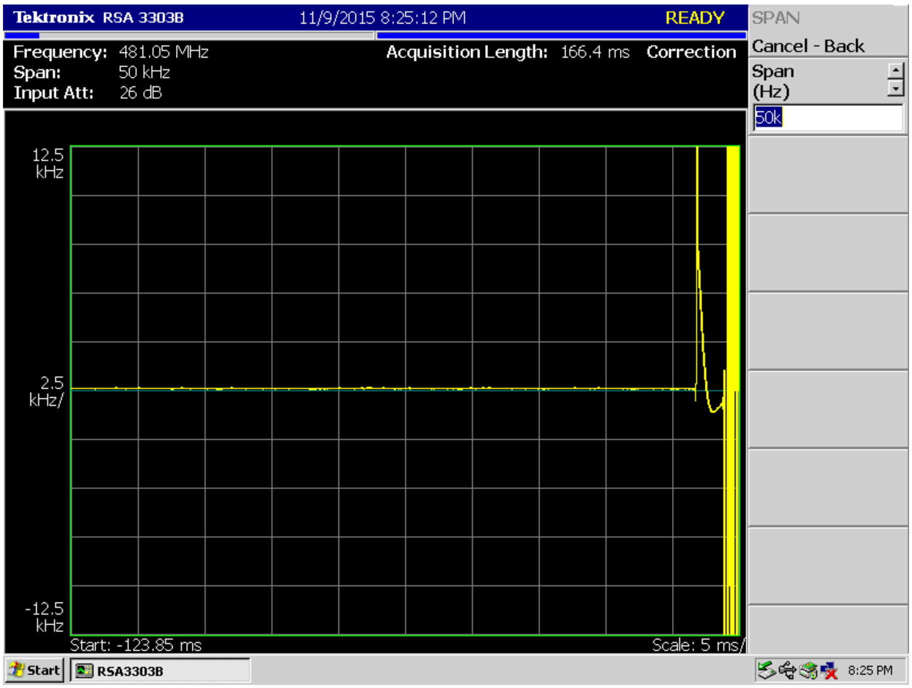


7K60FXD, 7K60FXE

HIGH POWER_7K60FXD, 7K60FXE _450.05 MHz_Low

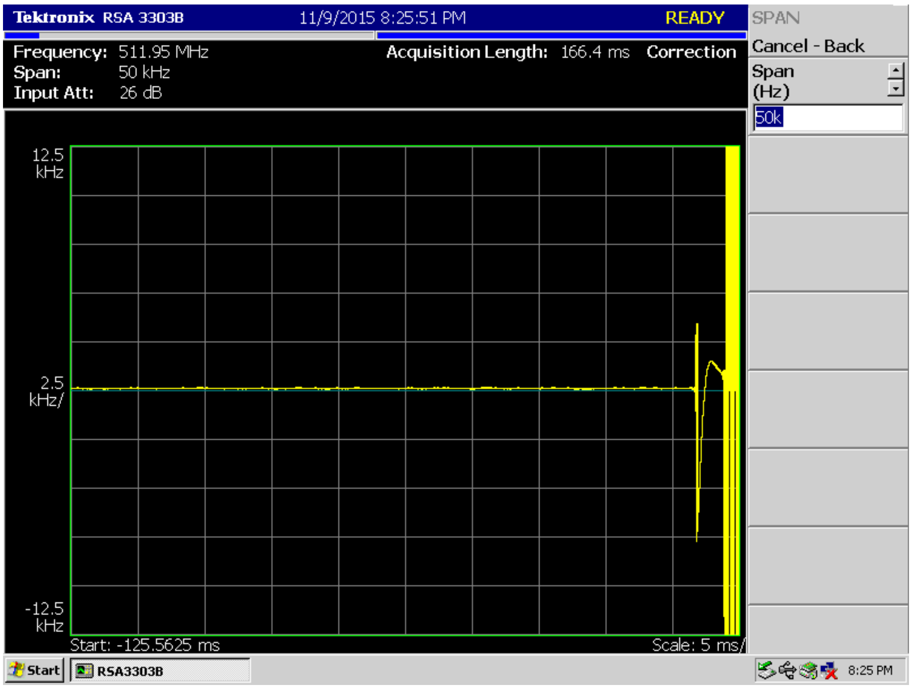


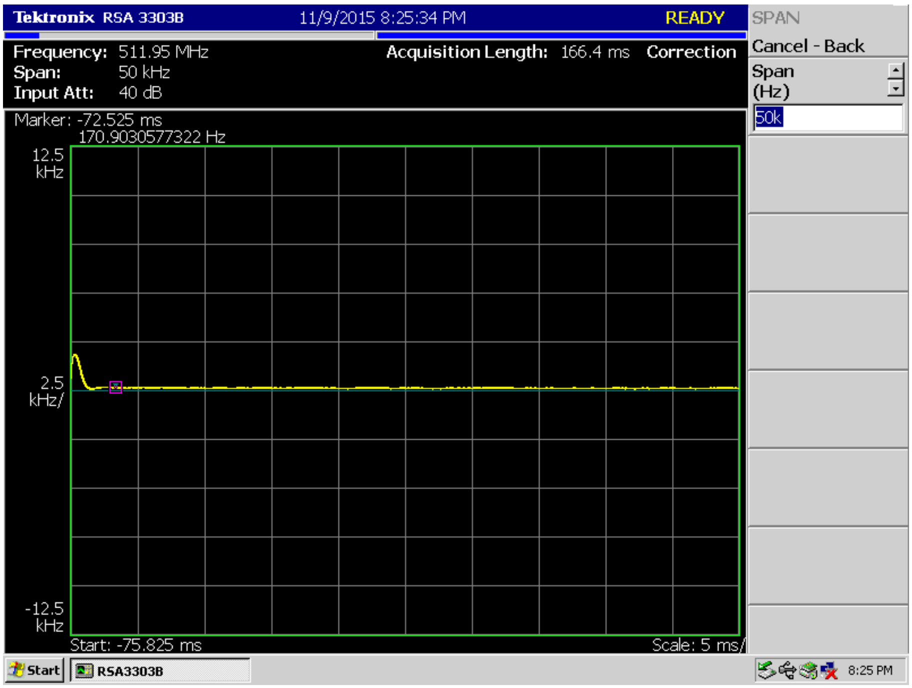
HIGH POWER_7K60FXD, 7K60FXE _481.05 MHz_Middle



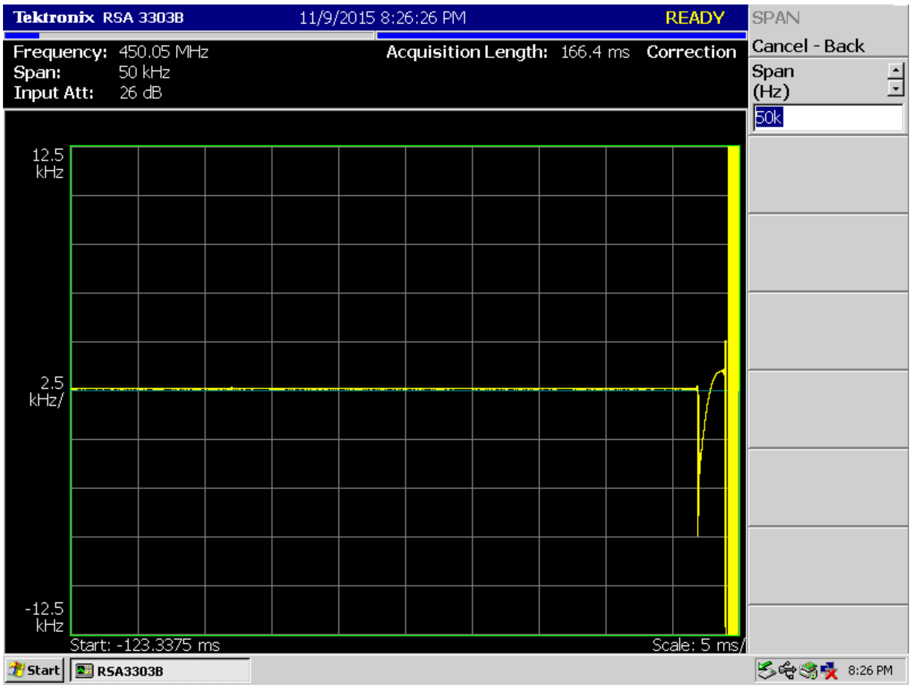
Note :If the transmitter carrier output power rating is 6 watts orless, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

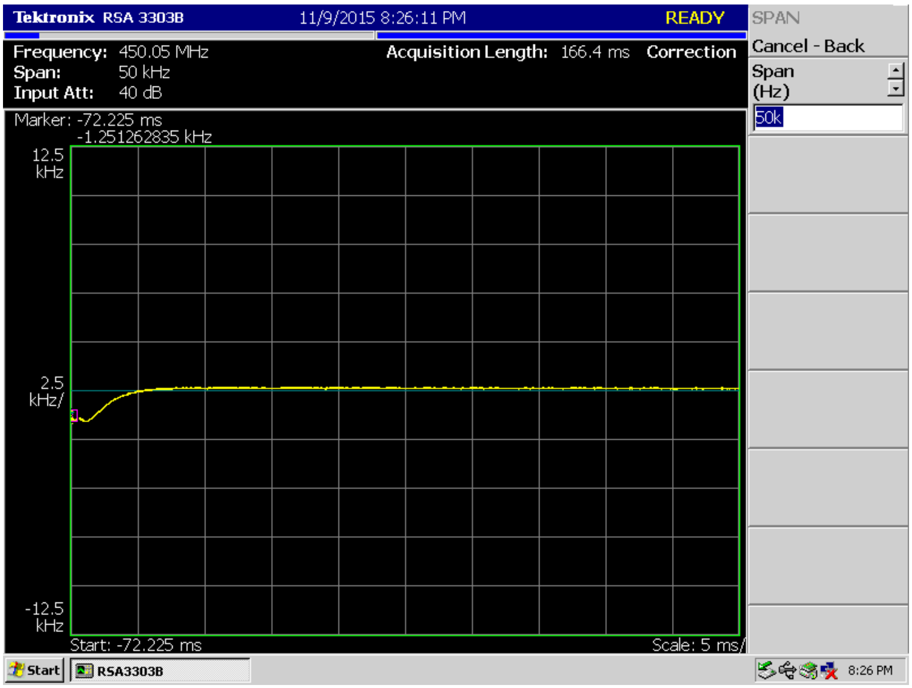
HIGH POWER_7K60FXD, 7K60FXE _511.95 MHz_High



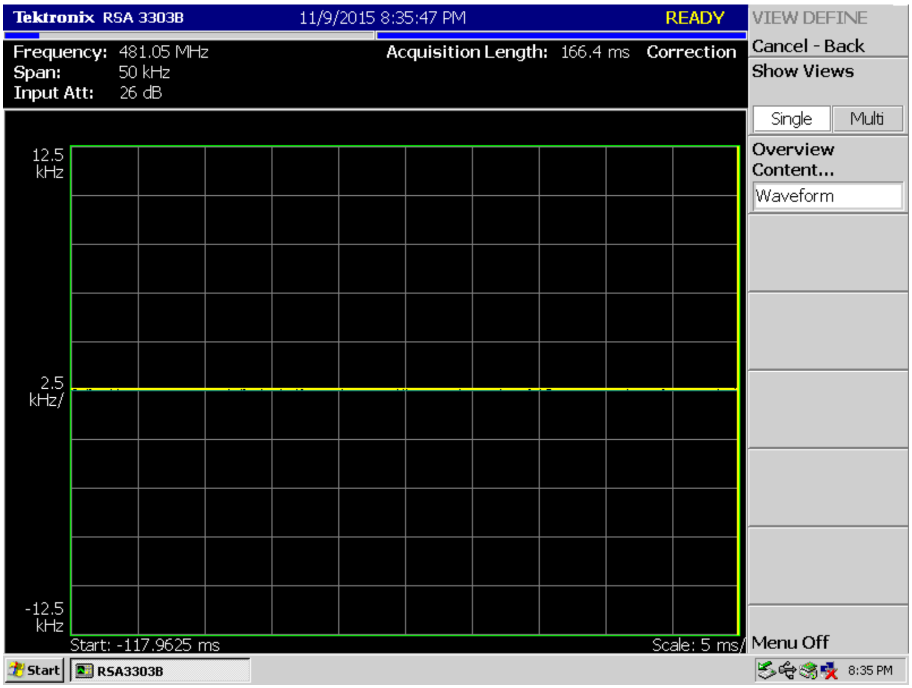


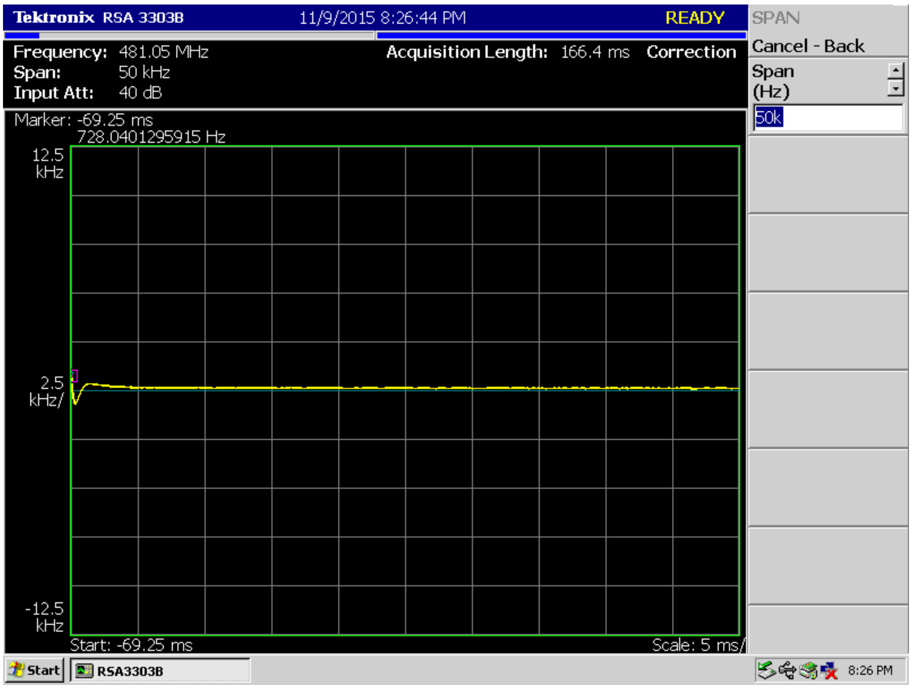
LOW POWER_7K60FXD, 7K60FXE _450.05 MHz_Low



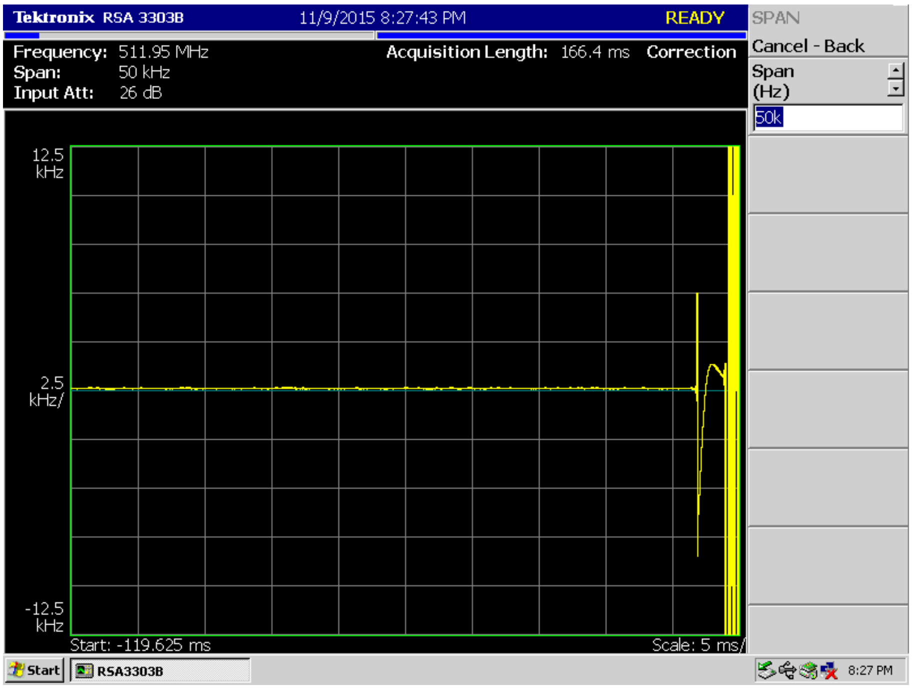


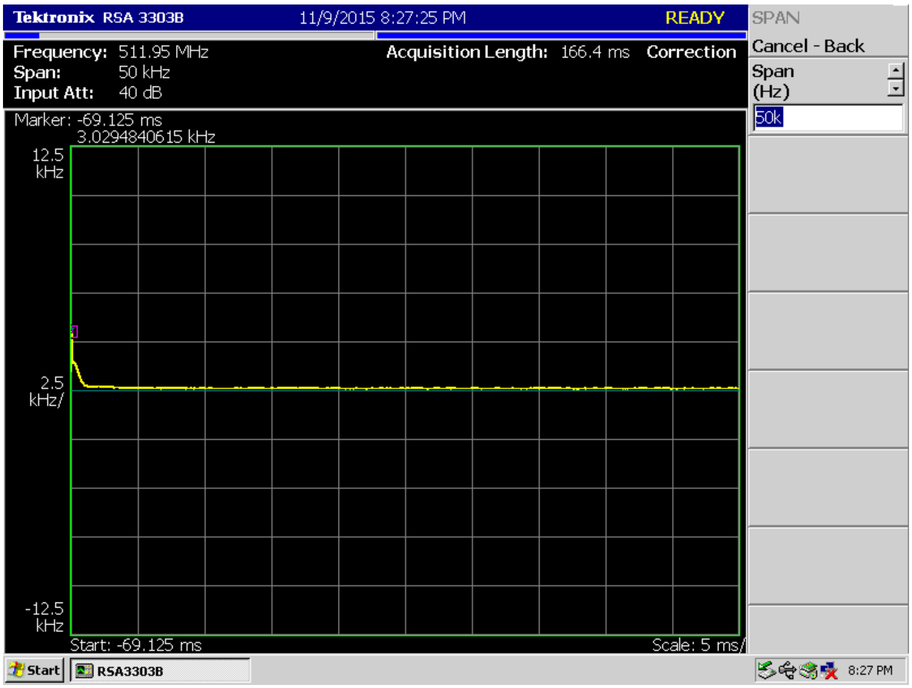
LOW POWER_7K60FXD, 7K60FXE _481.05 MHz_Middle





LOW POWER_7K60FXD, 7K60FXE _511.95 MHz_High



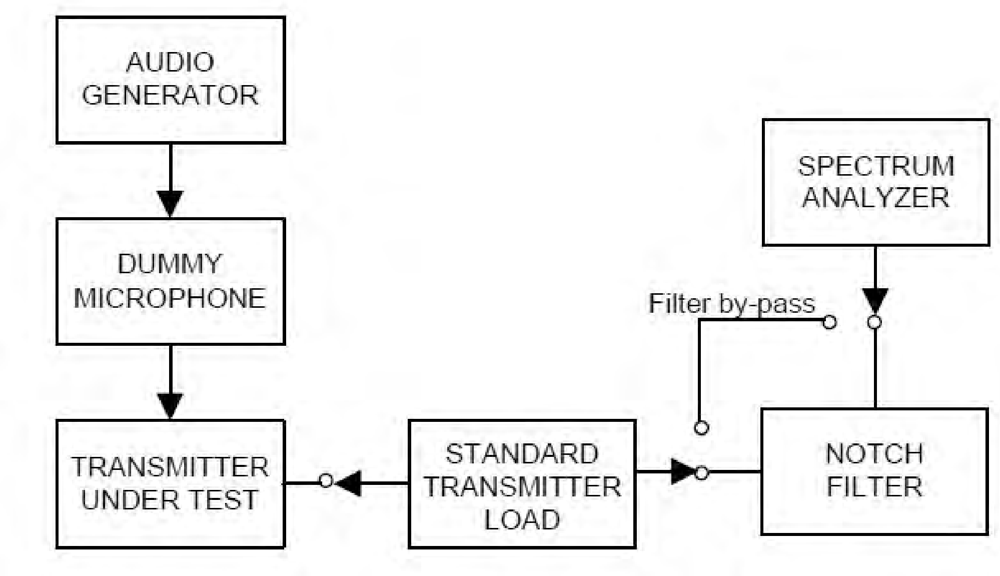


7.8 Unwanted Emissions : Conducted Spurious Emission

▣Definition

Conducted spurious emissions are emissions at the antenna terminals on a frequency or frequencies that are outside a band sufficient to ensure transmission of information of required quality for the class of communication desired.

▣ TEST CONFIGURATION



▣TEST PROCEDURE

According to 2.2.13 in TIA-603-D Standard.

e) Connect the equipment as illustrated, with the notch filter by-passed.

f) Set the center frequency of the spectrum analyzer to the assigned transmitter frequency, key the transmitter, and set the level of the carrier to the full scale reference line.

g) Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation. The input level shall be established at the frequency of maximum response of the audio modulation circuit.

h) Adjust the spectrum analyzer for the following settings:

1) Resolution Bandwidth = 10 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.

2) Video Bandwidth ≥3 times the resolution bandwidth.

3) Sweep Speed ≤2000 Hz per second.

4) Detector Mode = mean or average power.

e) Adjust the center frequency of the spectrum analyzer for incremental coverage of the range from:

1) The lowest radio frequency generated in the equipment to the carrier frequency minus the test bandwidth (see 1.3.4.4).

2) The carrier frequency plus the test bandwidth to a frequency less than 2 times the carrier

frequency.

f) Record the frequencies and levels of spurious emissions from step e).

g) Insert the notch filter.

h) Adjust the spectrum analyzer for the following settings:

1) Resolution Bandwidth = 10 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.

2) Video Bandwidth ≥3 times the resolution bandwidth.

3) Sweep Speed ≤2000 Hz per second.

4) Detector Mode = mean or average power.

i) Key the transmitter. Adjust the center frequency of the spectrum analyzer for incremental coverage of the range from a frequency equal to 2 times the carrier frequency and to the tenth harmonic of the carrier frequency.

▣TEST RESULTS

11K0F3E

Frequency (MHz)	Channel	Power Mode	Spurious Frequency (MHz)	Correct Level (dBm)	Emission Level (dBc)	Limit (dBc)	Margin (dB)
450.05	Low	High Power	0.01	-44.918	-81.250	-56.332	24.918
			0.16	-48.082	-84.414	-56.332	28.082
			900.09	-40.684	-77.016	-56.332	20.684
			5329.98	-35.568	-71.900	-56.332	15.568
481.05	Middle		0.01	-46.134	-82.170	-56.036	26.134
			0.15	-46.839	-82.875	-56.036	26.839
			962.17	-48.172	-84.208	-56.036	28.172
			5342.98	-35.018	-71.054	-56.036	15.018
511.95	High		0.01	-45.406	-81.317	-55.911	25.406
			0.16	-48.899	-84.810	-55.911	28.899
			867.11	-49.492	-85.403	-55.911	29.492
			5340.48	-35.350	-71.261	-55.911	15.350
450.05	Low	Low Power	0.01	-47.100	-77.347	-50.247	27.100
			0.16	-48.166	-78.413	-50.247	28.166
			900.09	-43.365	-73.612	-50.247	23.365
			5451.49	-34.646	-64.893	-50.247	14.646
481.05	Middle		0.01	-44.058	-73.975	-49.917	24.058
			0.15	-47.102	-77.019	-49.917	27.102
			314.21	-49.198	-79.115	-49.917	29.198
			5488.50	-35.051	-64.968	-49.917	15.051
511.95	High		0.01	-45.925	-75.197	-49.272	25.925
			0.15	-47.977	-77.249	-49.272	27.977
			806.97	-48.478	-77.750	-49.272	28.478
			5346.98	-35.410	-64.682	-49.272	15.410

16K0F3E

Frequency (MHz)	Channel	Power Mode	Spurious Frequency (MHz)	Correct Level (dBm)	Emission Level (dBc)	Limit (dBc)	Margin (dB)
470.05	Low	High Power	0.01	-48.208	-84.673	-49.465	35.208
			0.15	-48.880	-85.345	-49.465	35.880
			939.86	-46.655	-83.120	-49.465	33.655
			5474.50	-34.552	-71.017	-49.465	21.552
491.05	Middle		0.01	-47.302	-83.293	-48.991	34.302
			0.15	-48.810	-84.801	-48.991	35.810
			982.54	-47.069	-83.060	-48.991	34.069
			5406.99	-34.419	-70.410	-48.991	21.419
511.95	High		0.01	-43.457	-79.461	-49.004	30.457
			0.16	-47.916	-83.920	-49.004	34.916
			928.22	-49.128	-85.132	-49.004	36.128
			5433.49	-34.308	-70.312	-49.004	21.308
470.05	Low	Low Power	0.01	-47.448	-77.795	-43.347	34.448
			0.15	-48.069	-78.416	-43.347	35.069
			908.82	-49.385	-79.732	-43.347	36.385
			4673.41	-35.303	-65.650	-43.347	22.303
491.05	Middle		0.01	-45.203	-75.139	-42.936	32.203
			0.15	-49.495	-79.431	-42.936	36.495
			982.54	-47.209	-77.145	-42.936	34.209
			5385.49	-35.651	-65.587	-42.936	22.651
511.95	High		0.01	-46.653	-76.102	-42.449	33.653
			0.16	-49.852	-79.301	-42.449	36.852
			807.94	-49.934	-79.383	-42.449	36.934
			5487.00	-35.085	-64.534	-42.449	22.085

7K60FXD, 7K60FXE

Frequency (MHz)	Channel	Power Mode	Spurious Frequency (MHz)	Correct Level (dBm)	Emission Level (dBc)	Limit (dBc)	Margin (dB)
450.05	Low	High Power	0.01	-46.775	-83.451	-56.676	26.775
			0.16	-48.475	-85.151	-56.676	28.475
			900.09	-40.817	-77.493	-56.676	20.817
			5443.99	-33.991	-70.667	-56.676	13.991
481.05	Middle		0.01	-46.809	-82.834	-56.025	26.809
			0.17	-46.614	-82.639	-56.025	26.614
			962.17	-48.631	-84.656	-56.025	28.631
			5372.99	-35.076	-71.101	-56.025	15.076
511.95	High		0.01	-45.923	-81.779	-55.856	25.923
			0.18	-48.863	-84.719	-55.856	28.863
			746.83	-49.691	-85.547	-55.856	29.691
			5325.48	-35.609	-71.465	-55.856	15.609
450.05	Low	Low Power	0.01	-46.938	-77.152	-50.214	26.938
			0.16	-50.075	-80.289	-50.214	30.075
			900.09	-43.677	-73.891	-50.214	23.677
			5463.50	-35.685	-65.899	-50.214	15.685
481.05	Middle		0.01	-46.125	-76.160	-50.035	26.125
			0.15	-47.187	-77.222	-50.035	27.187
			906.88	-50.191	-80.226	-50.035	30.191
			5440.99	-35.428	-65.463	-50.035	15.428
511.95	High		0.01	-47.286	-77.674	-50.388	27.286
			0.15	-49.258	-79.646	-50.388	29.258
			743.92	-50.100	-80.488	-50.388	30.100
			5464.00	-34.490	-64.878	-50.388	14.490

▣TEST RESULTS

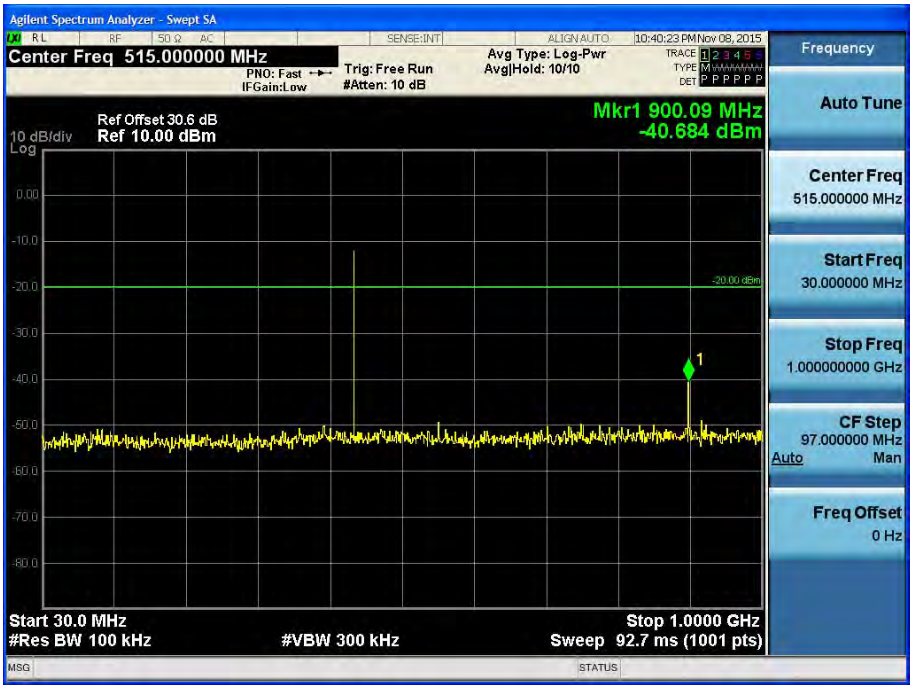
11K0F3E

HIGH POWER_11K0F3E _450.05 MHz_Low

(9 kHz ~ 150 kHz)

(150 kHz ~ 30 MHz)

(30 MHz ~ 1 GHz)

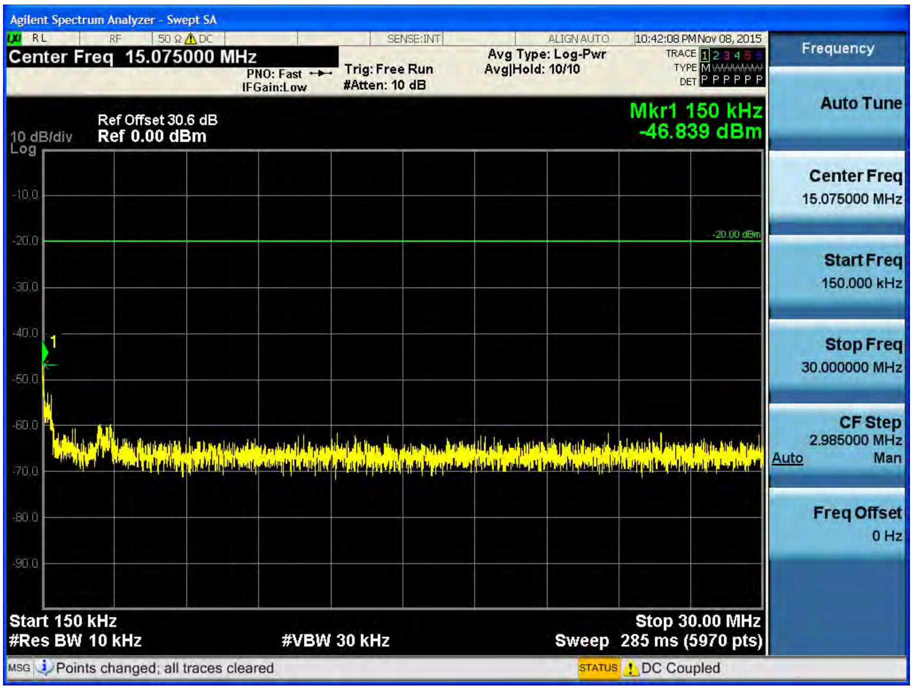


(1 GHz ~ 5.5 GHz)

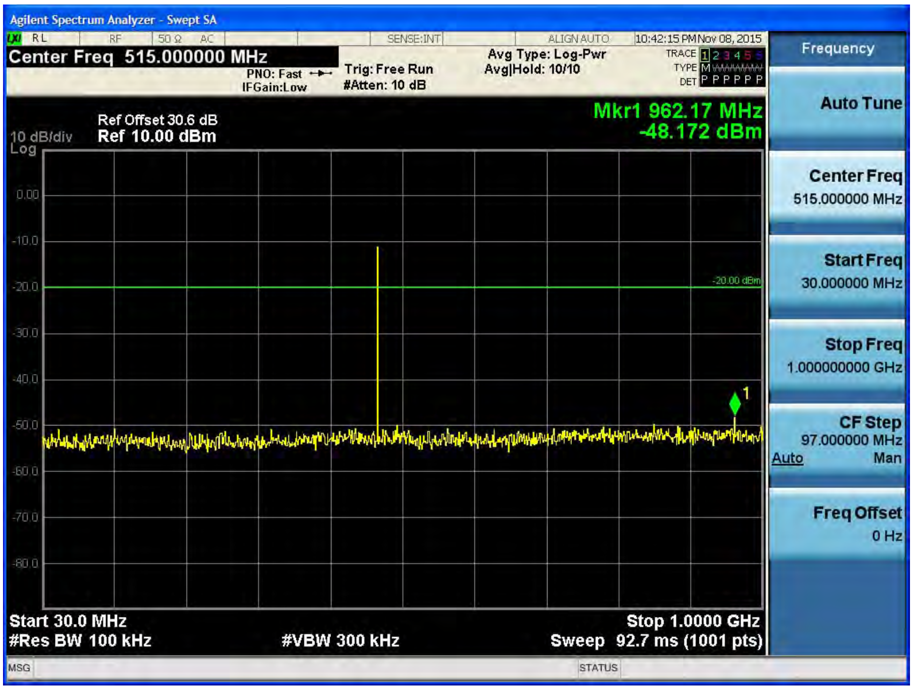
HIGH POWER_11K0F3E _481.05 MHz_Middle

(9 kHz ~ 150 kHz)

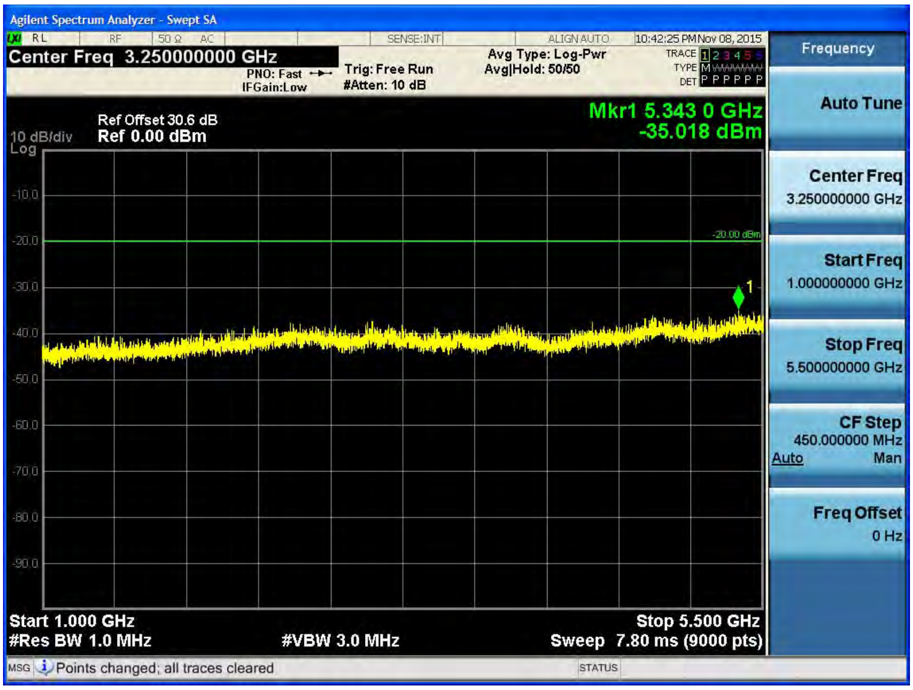
(150 kHz ~ 30 MHz)



(30 MHz ~ 1 GHz)



(1 GHz ~ 5.5 GHz)



HIGH POWER_11K0F3E _511.95 MHz_High

(9 kHz ~ 150 kHz)

(150 kHz ~ 30 MHz)

(30 MHz ~ 1 GHz)

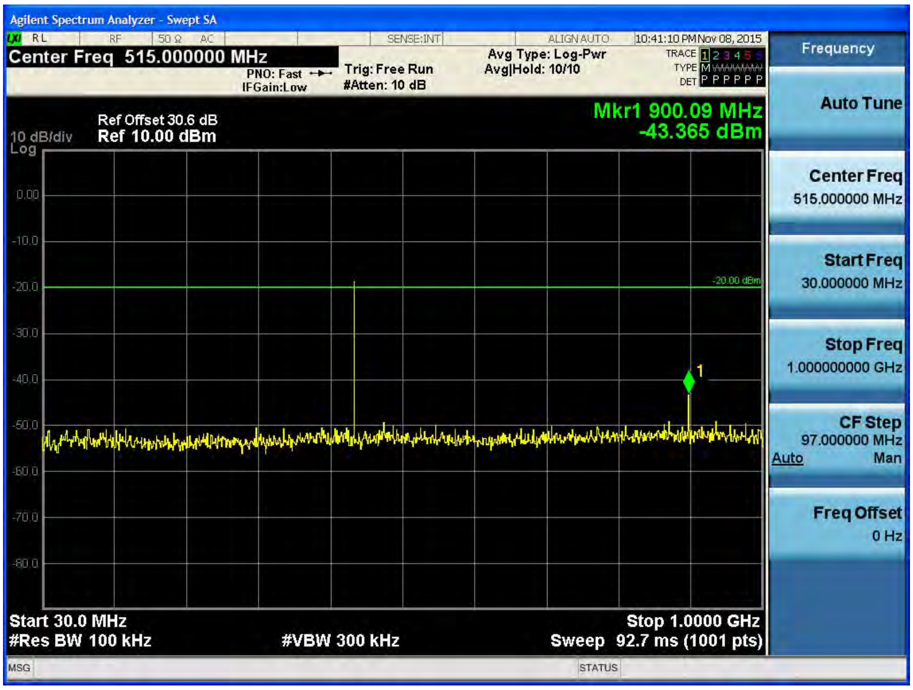
(1 GHz ~ 5.5 GHz)

LOW POWER_11K0F3E _450.05 MHz_Low

(9 kHz ~ 150 kHz)

(150 kHz ~ 30 MHz)

(30 MHz ~ 1 GHz)

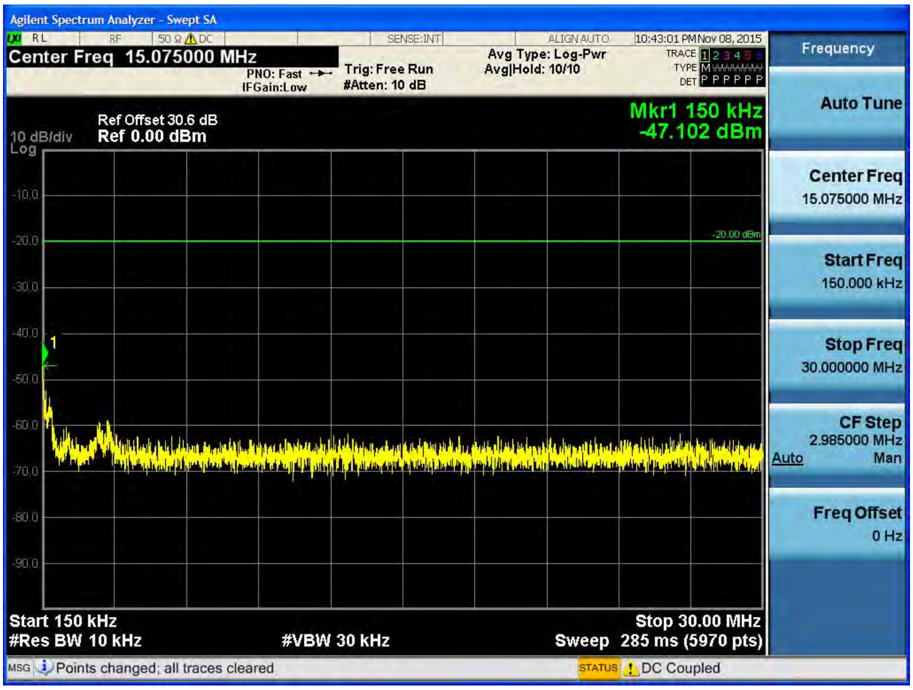


(1 GHz ~ 5.5 GHz)

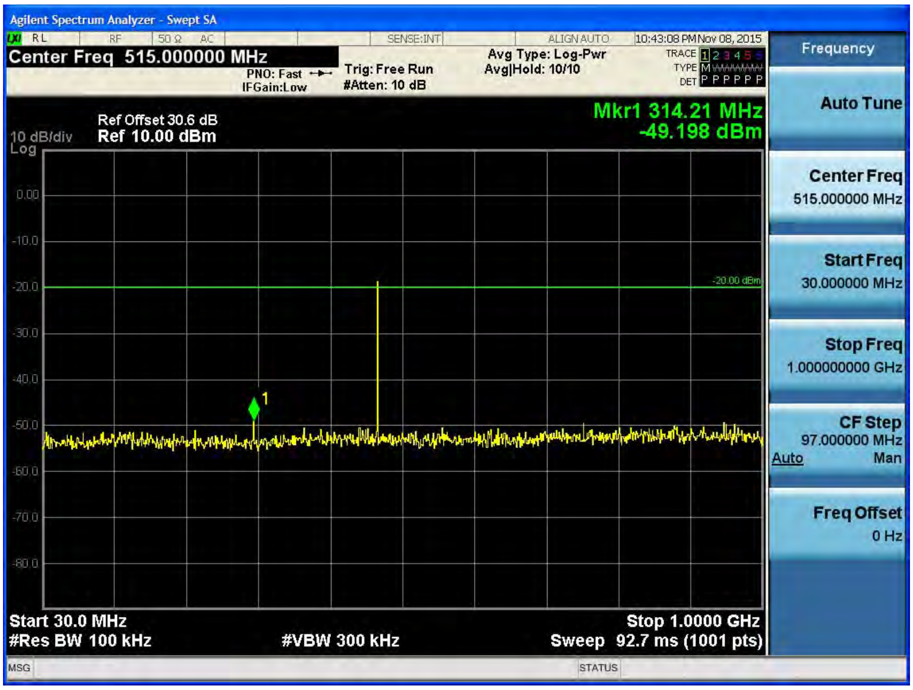
LOW POWER_11K0F3E _481.05 MHz_Middle

(9 kHz ~ 150 kHz)

(150 kHz ~ 30 MHz)



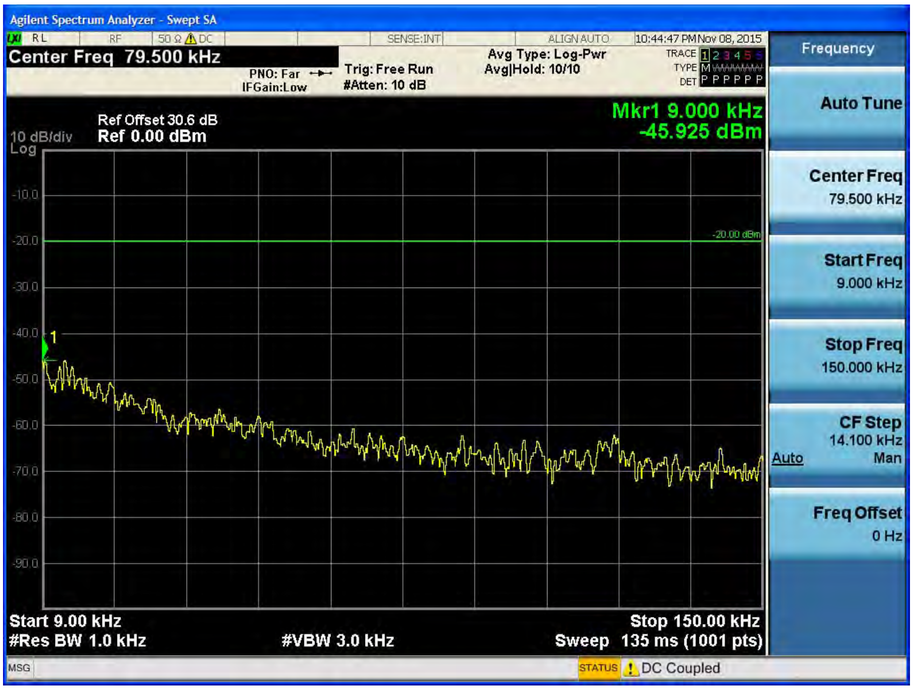
(30 MHz ~ 1 GHz)



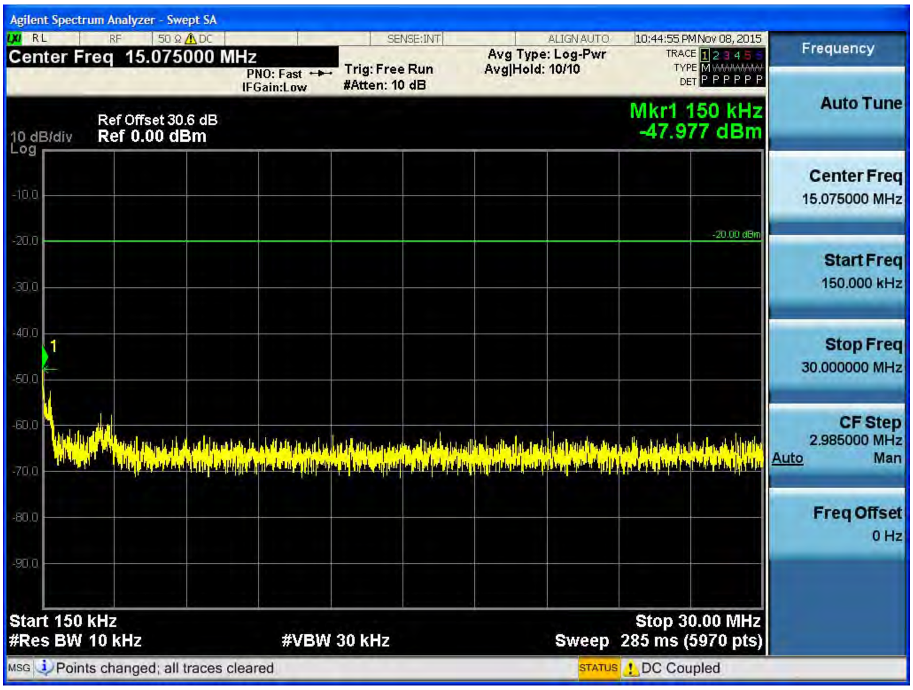
(1 GHz ~ 5.5 GHz)

LOW POWER_11K0F3E _511.95 MHz_High

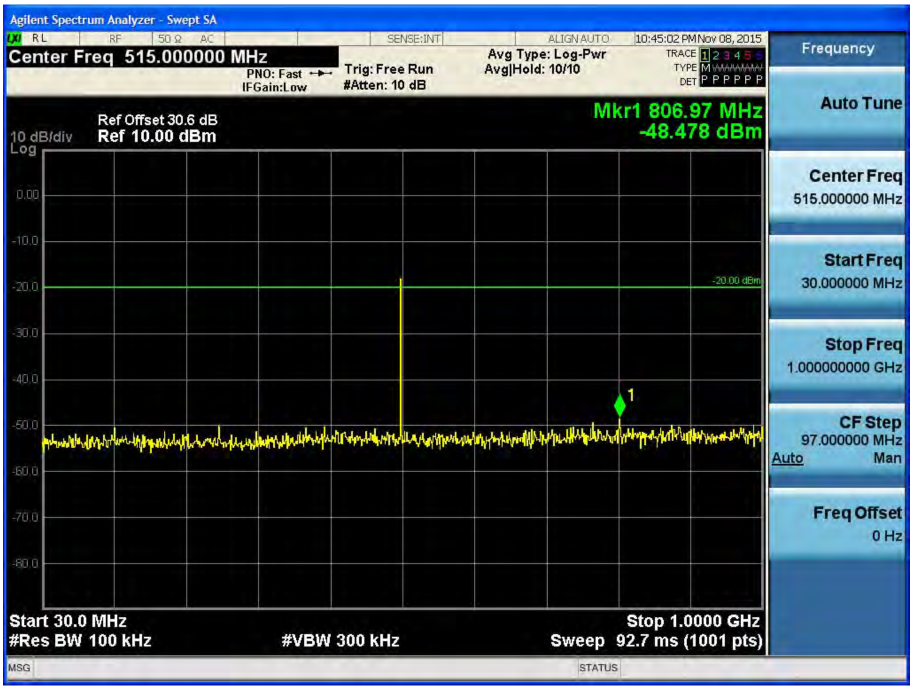
(9 kHz ~ 150 kHz)



(150 kHz ~ 30 MHz)



(30 MHz ~ 1 GHz)



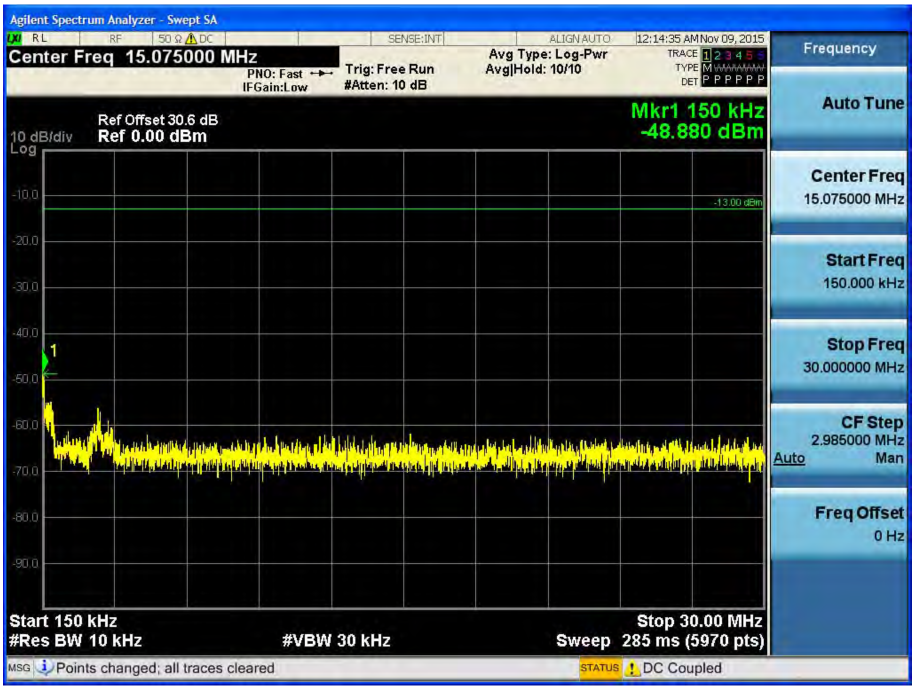
(1 GHz ~ 5.5 GHz)

16K0F3E

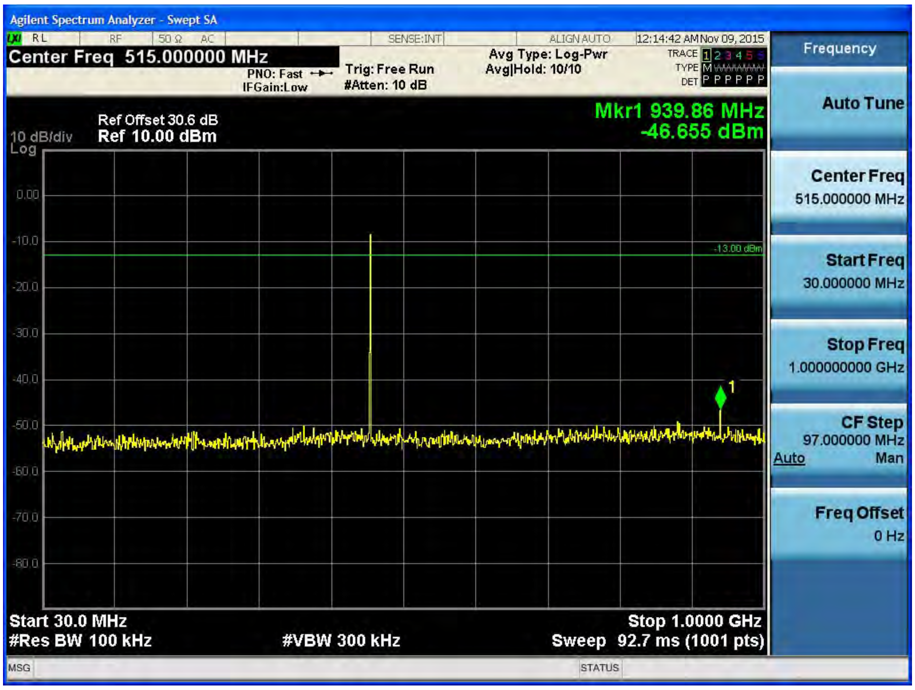
HIGH POWER_16K0F3E _470.05 MHz_Low

(9 kHz ~ 150 kHz)

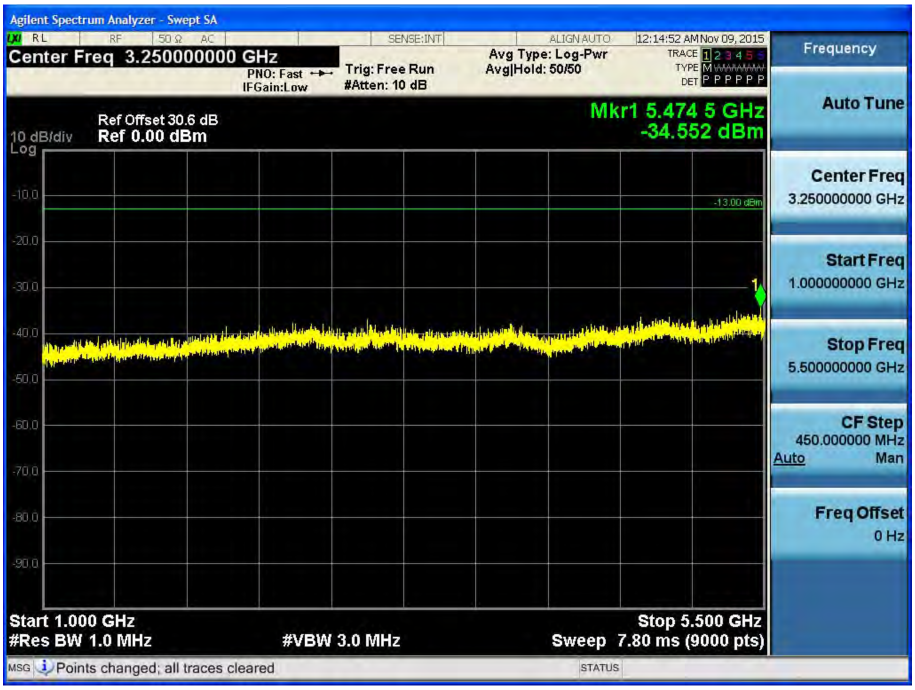
(150 kHz ~ 30 MHz)



(30 MHz ~ 1 GHz)



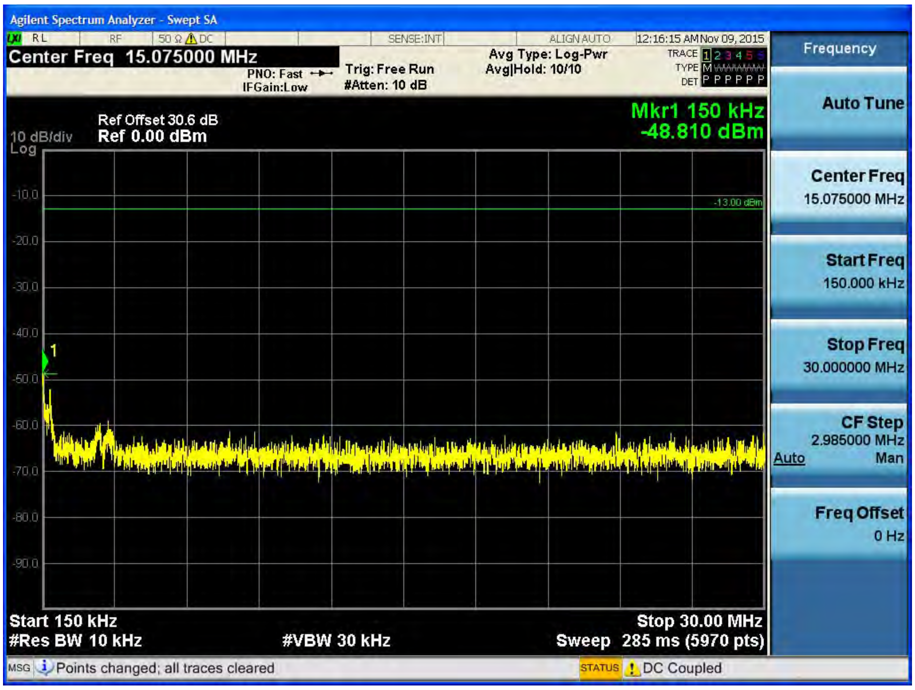
(1 GHz ~ 5.5 GHz)



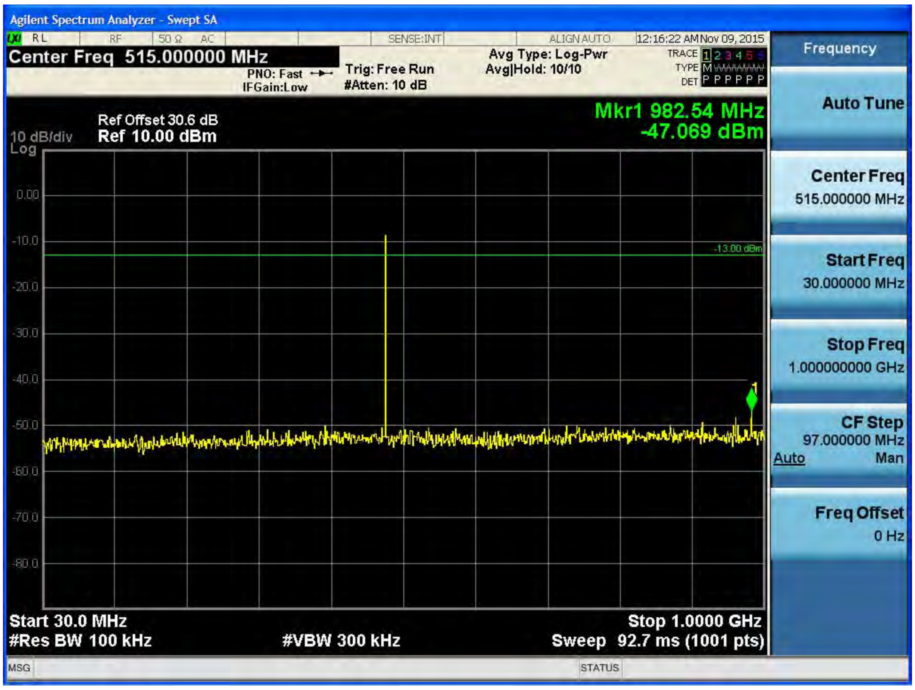
HIGH POWER_16K0F3E _491.05 MHz_Middle

(9 kHz ~ 150 kHz)

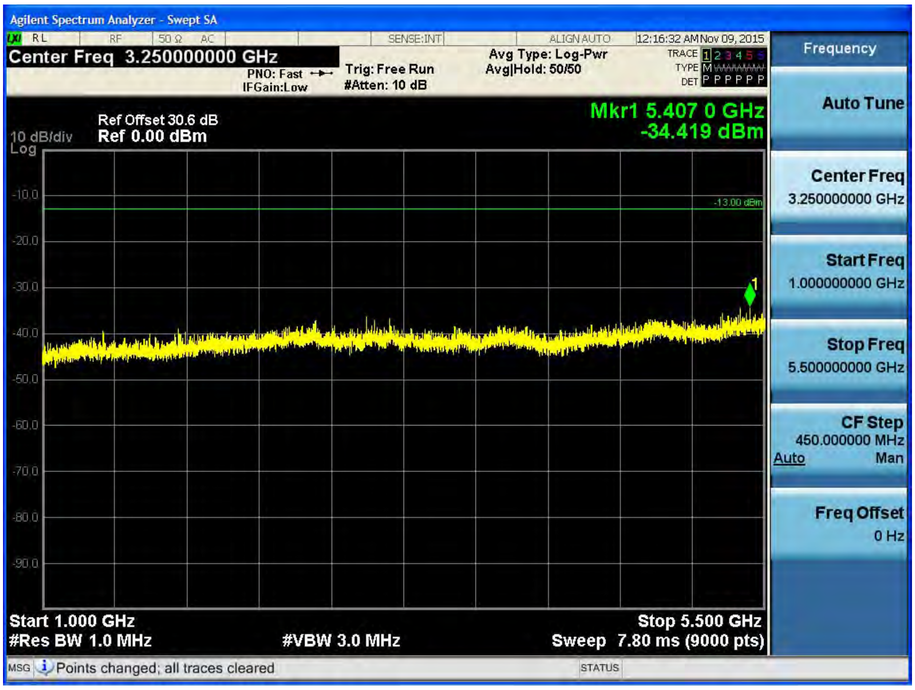
(150 kHz ~ 30 MHz)



(30 MHz ~ 1 GHz)



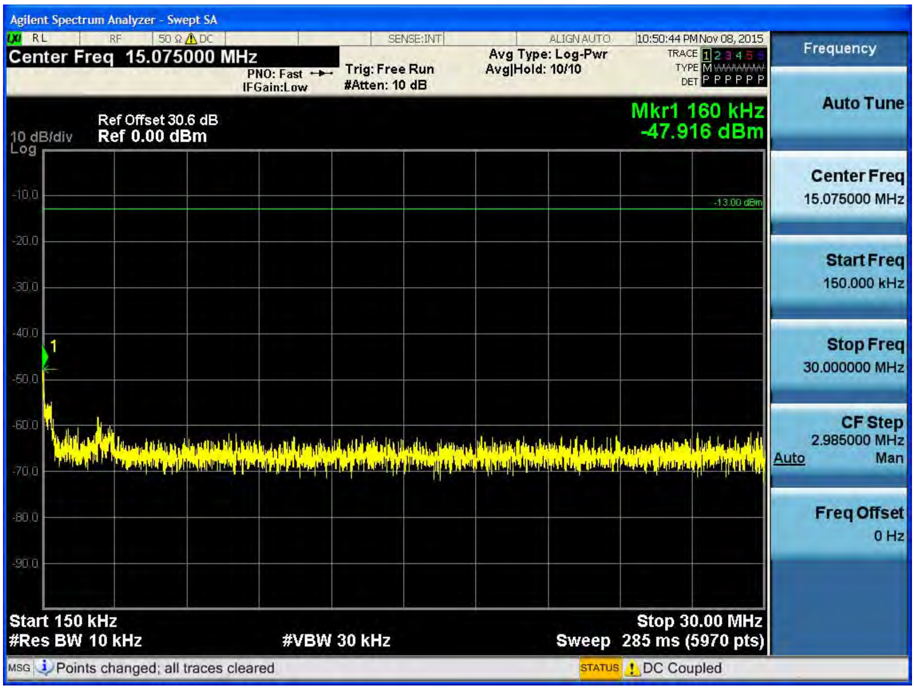
(1 GHz ~ 5.5 GHz)



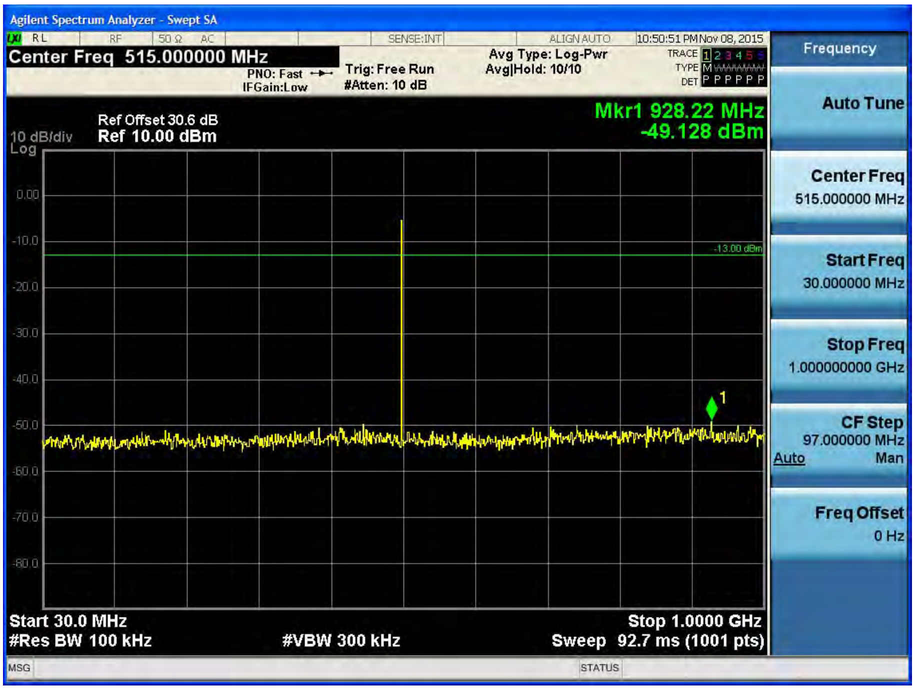
HIGH POWER_16K0F3E _511.95 MHz_High

(9 kHz ~ 150 kHz)

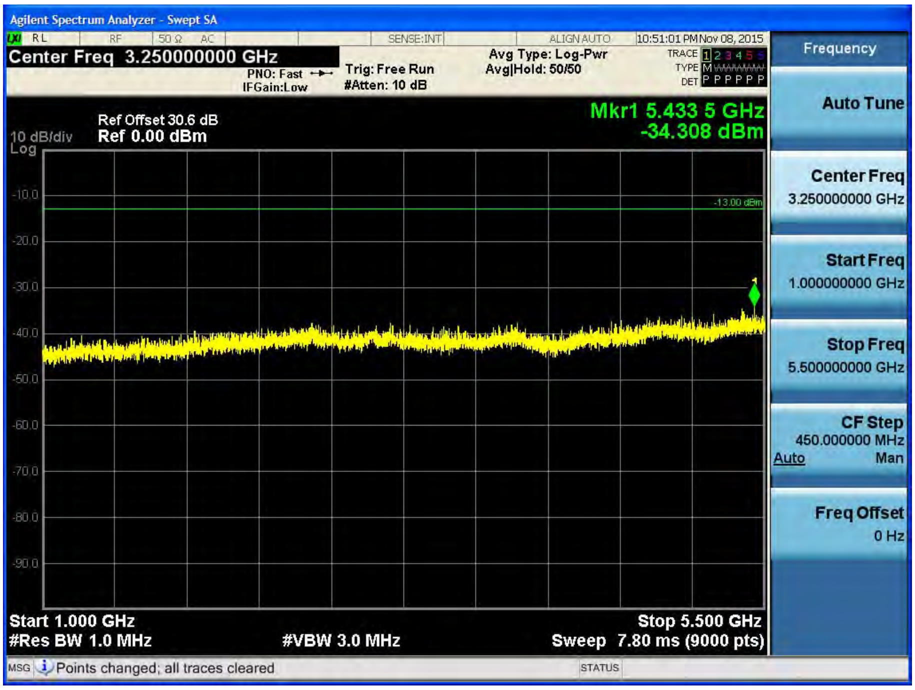
(150 kHz ~ 30 MHz)



(30 MHz ~ 1 GHz)



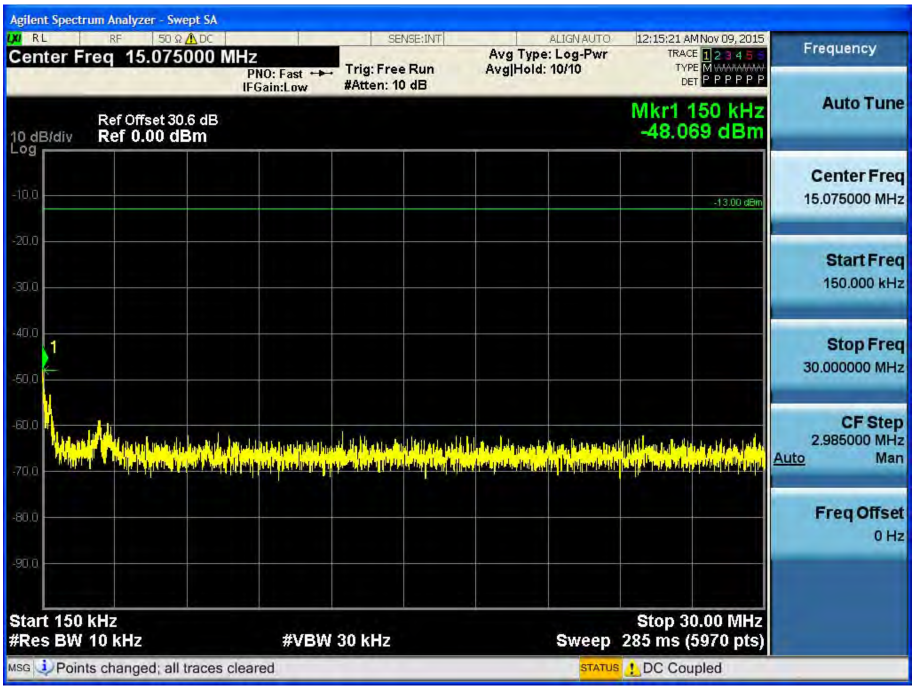
(1 GHz ~ 5.5 GHz)



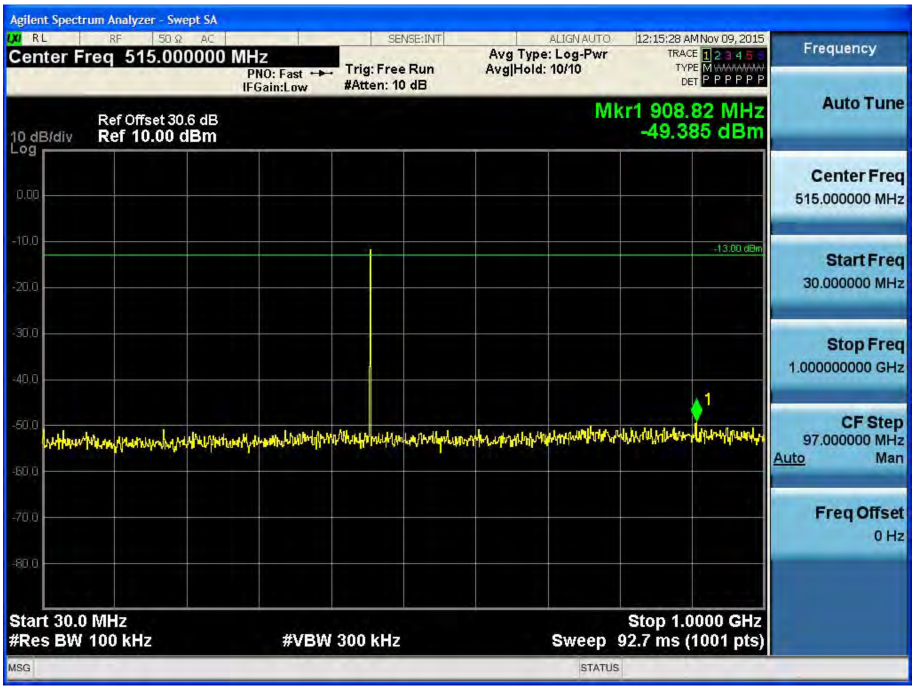
LOW POWER_16K0F3E _470.05 MHz_Low

(9 kHz ~ 150 kHz)

(150 kHz ~ 30 MHz)



(30 MHz ~ 1 GHz)

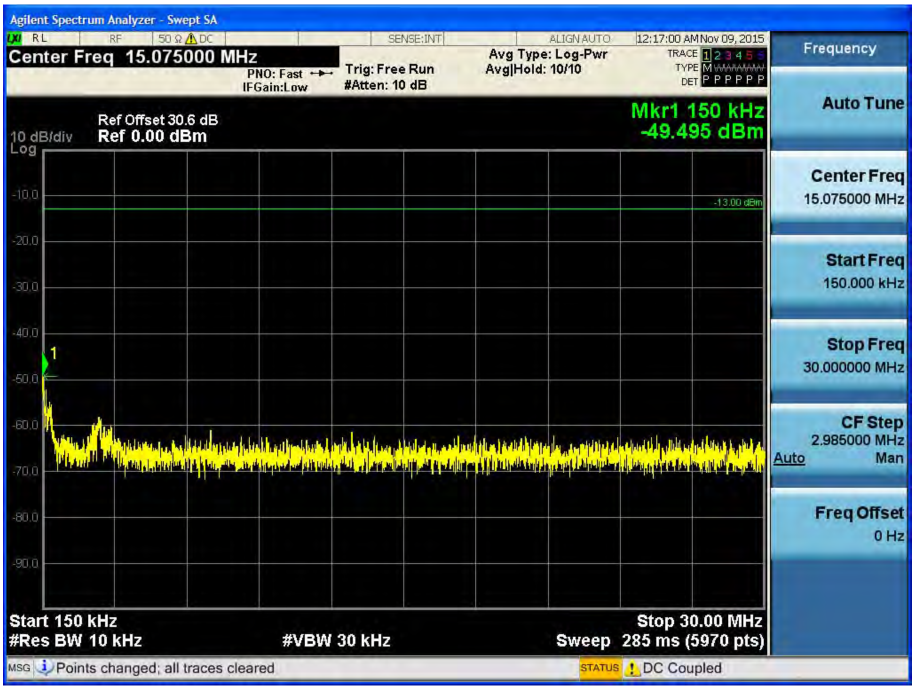


(1 GHz ~ 5.5 GHz)

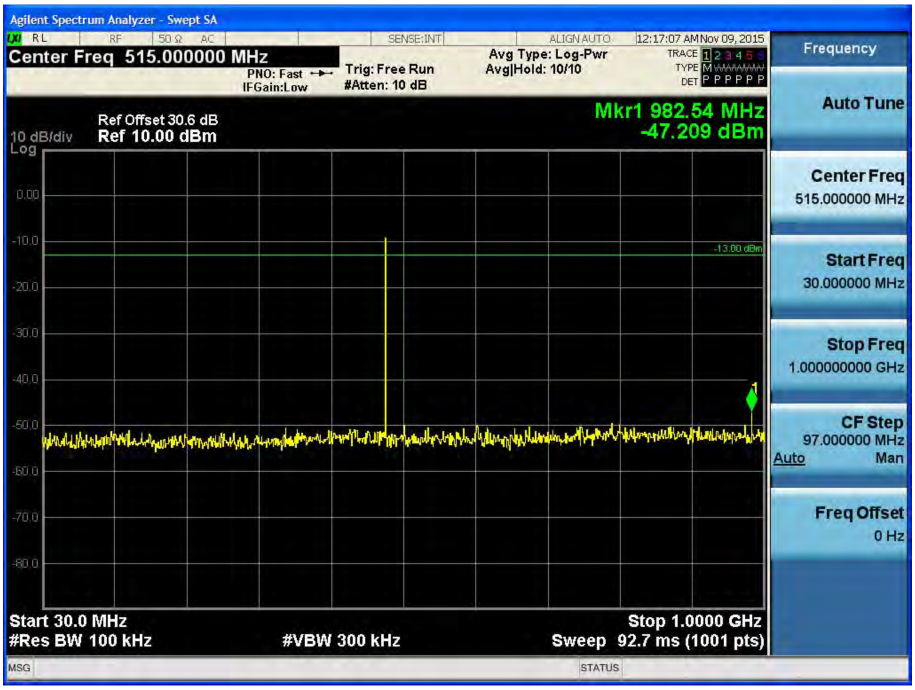
LOW POWER_16K0F3E _491.05 MHz_Middle

(9 kHz ~ 150 kHz)

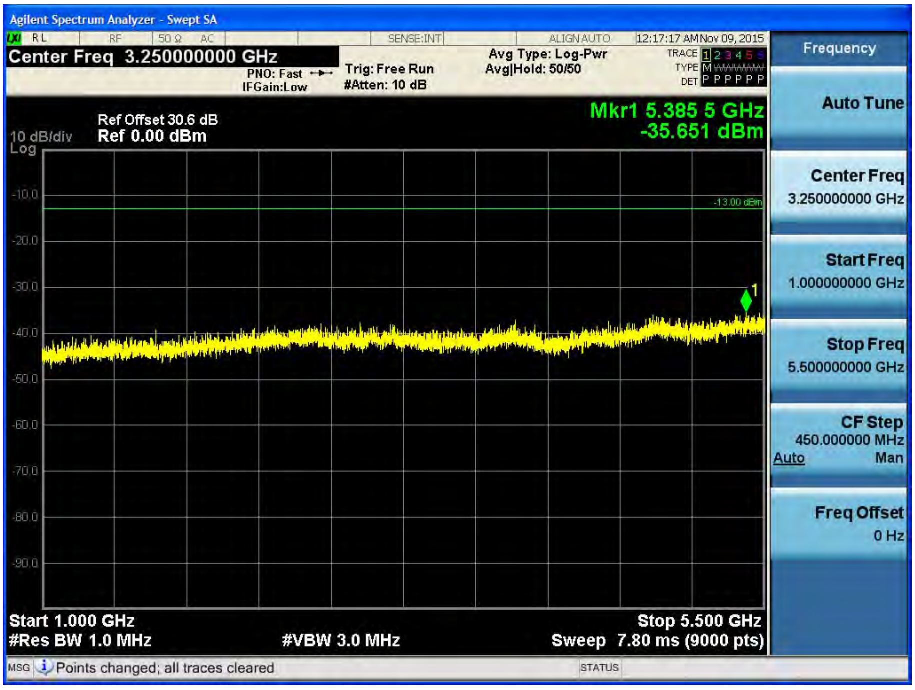
(150 kHz ~ 30 MHz)



(30 MHz ~ 1 GHz)



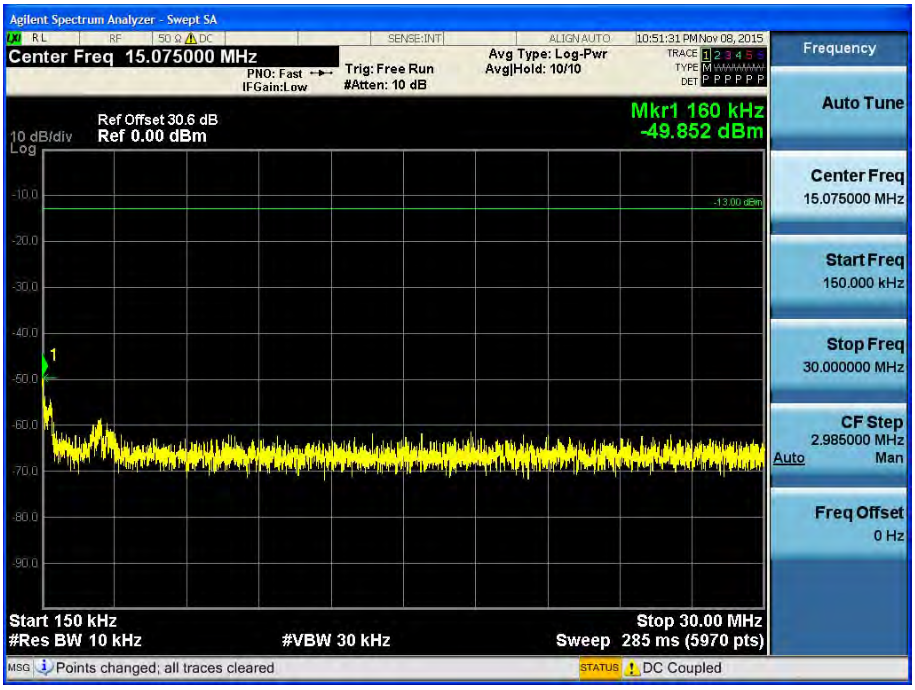
(1 GHz ~ 5.5 GHz)



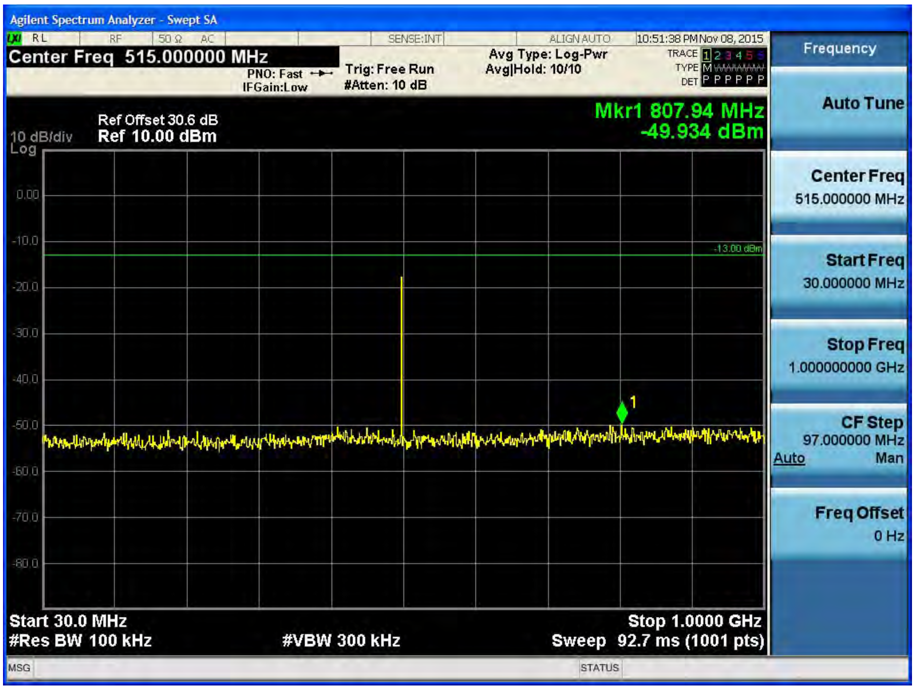
LOW POWER_16K0F3E _511.95 MHz_High

(9 kHz ~ 150 kHz)

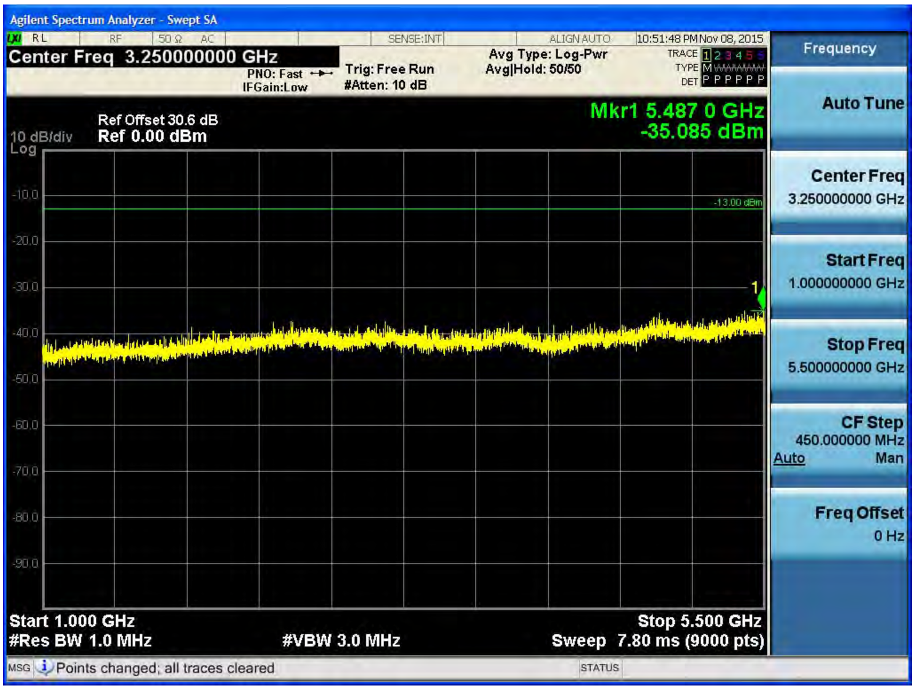
(150 kHz ~ 30 MHz)



(30 MHz ~ 1 GHz)



(1 GHz ~ 5.5 GHz)

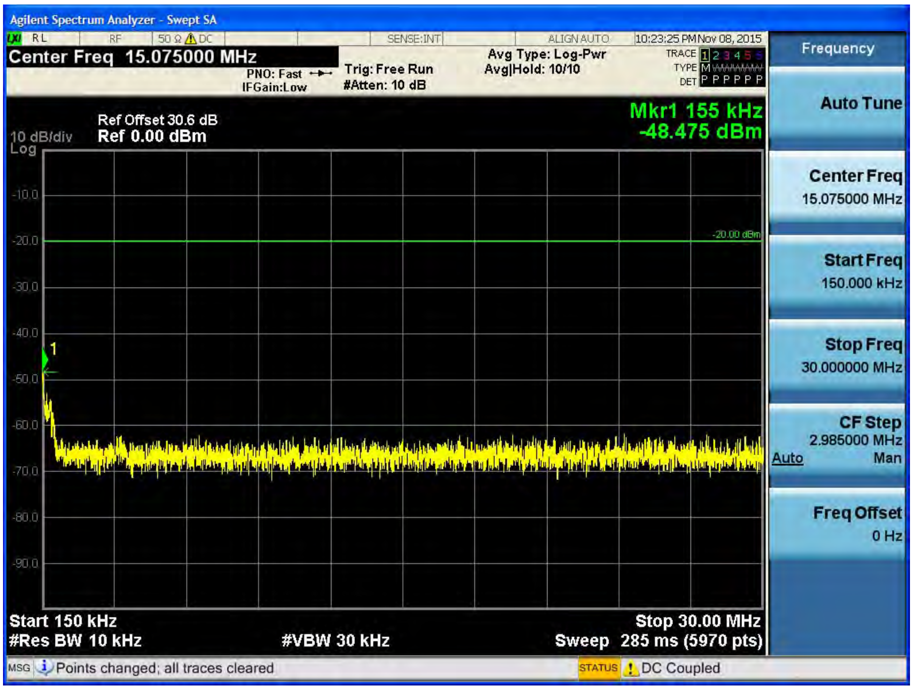


7K60FXD, 7K60FXE

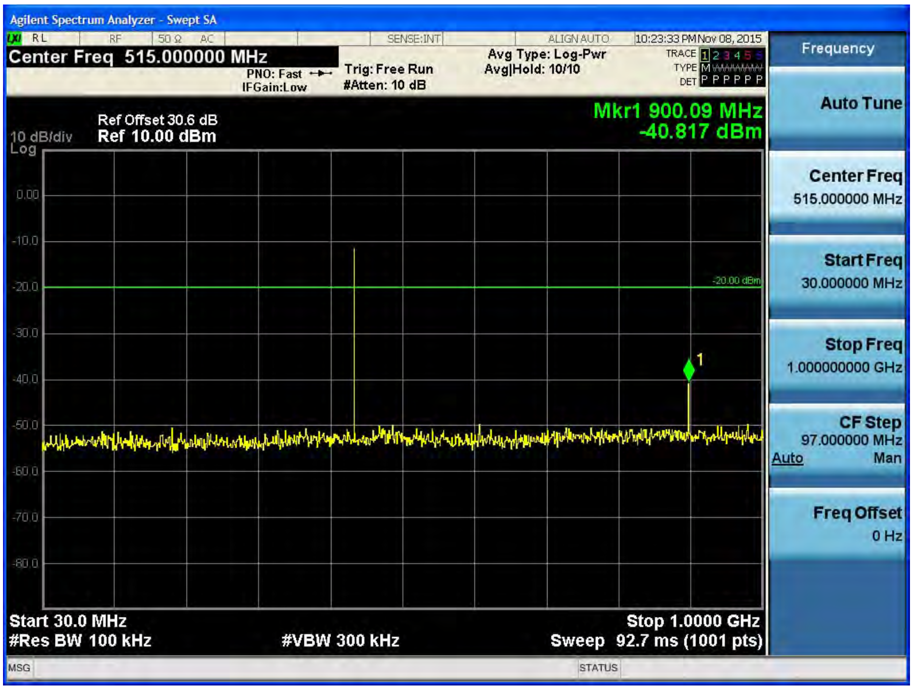
HIGH POWER_7K60FXD, 7K60FXE _450.05 MHz_Low

(9 kHz ~ 150 kHz)

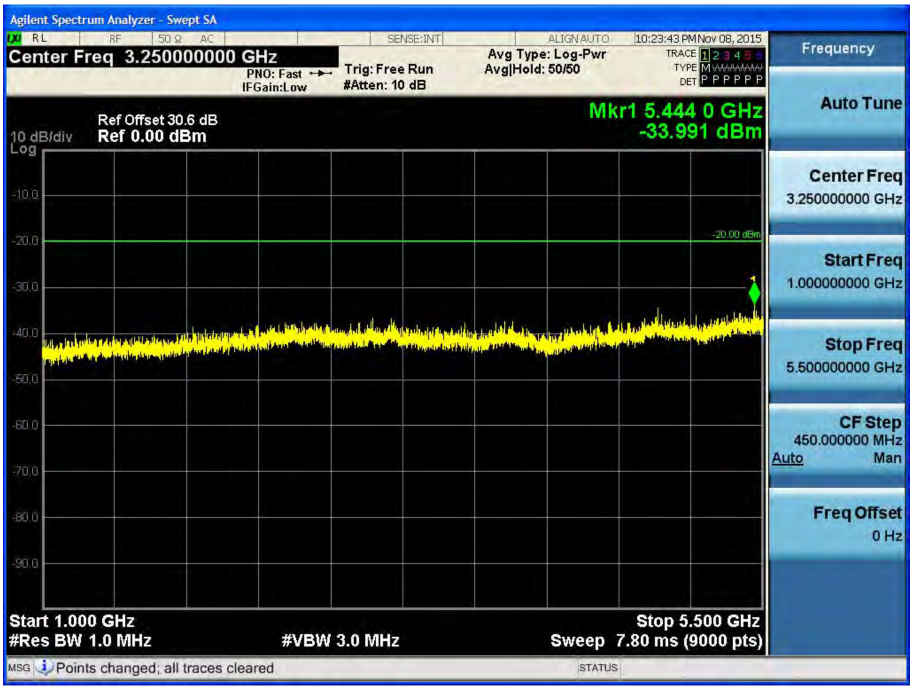
(150 kHz ~ 30 MHz)



(30 MHz ~ 1 GHz)



(1 GHz ~ 5.5 GHz)

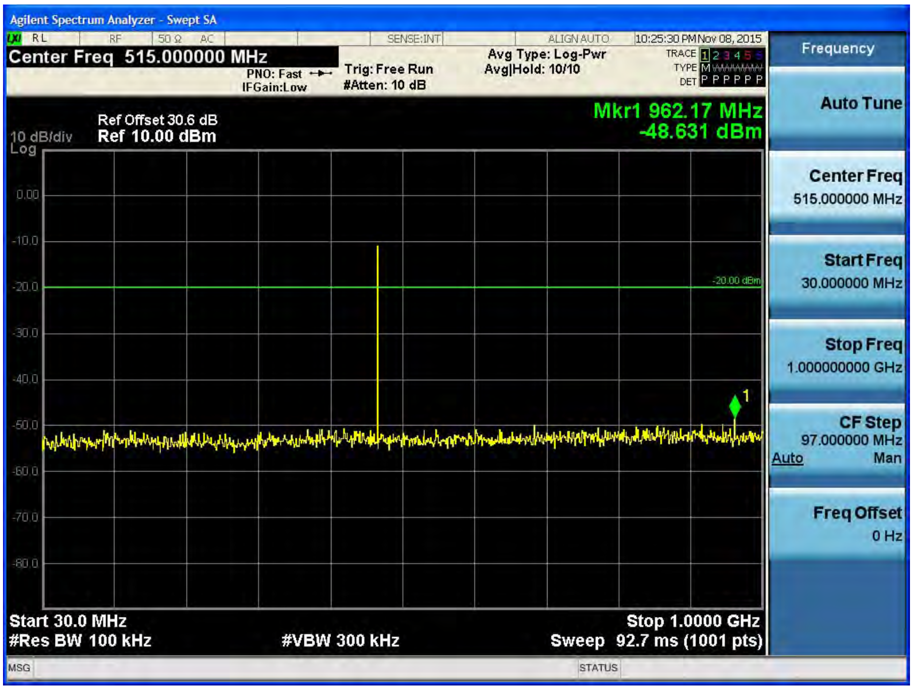


HIGH POWER_7K60FXD, 7K60FXE _481.05 MHz_Middle

(9 kHz ~ 150 kHz)

(150 kHz ~ 30 MHz)

(30 MHz ~ 1 GHz)

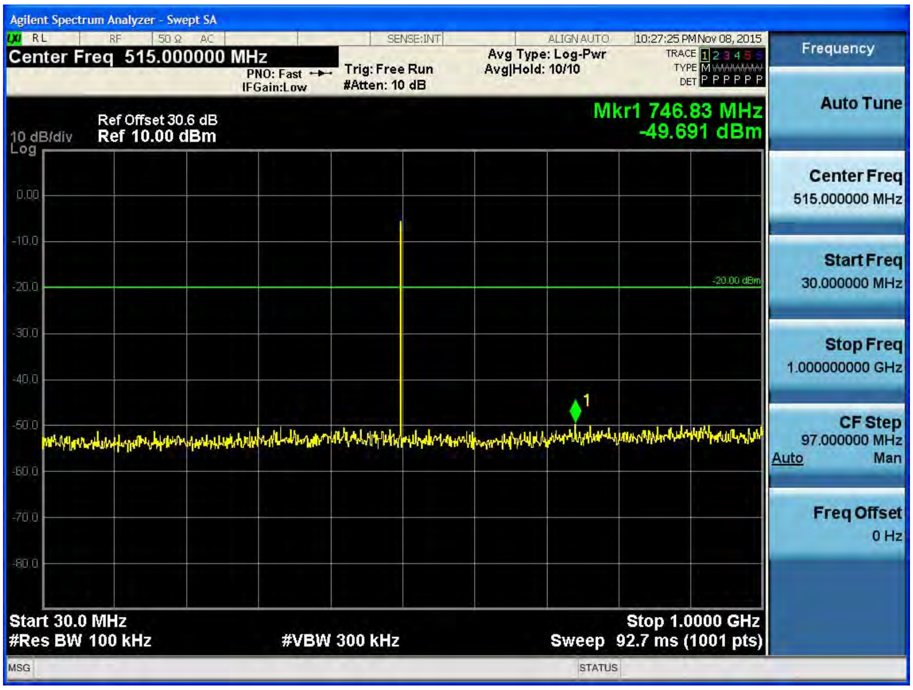


(1 GHz ~ 5.5 GHz)

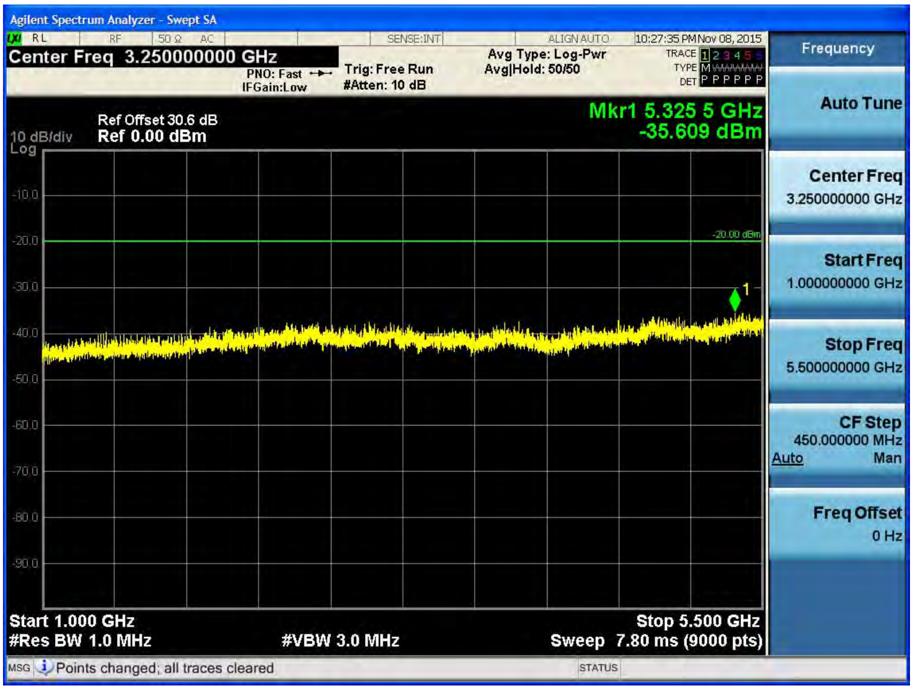
HIGH POWER_7K60FXD, 7K60FXE _511.95 MHz_High
(9 kHz ~ 150 kHz)

(150 kHz ~ 30 MHz)

(30 MHz ~ 1 GHz)



(1 GHz ~ 5.5 GHz)

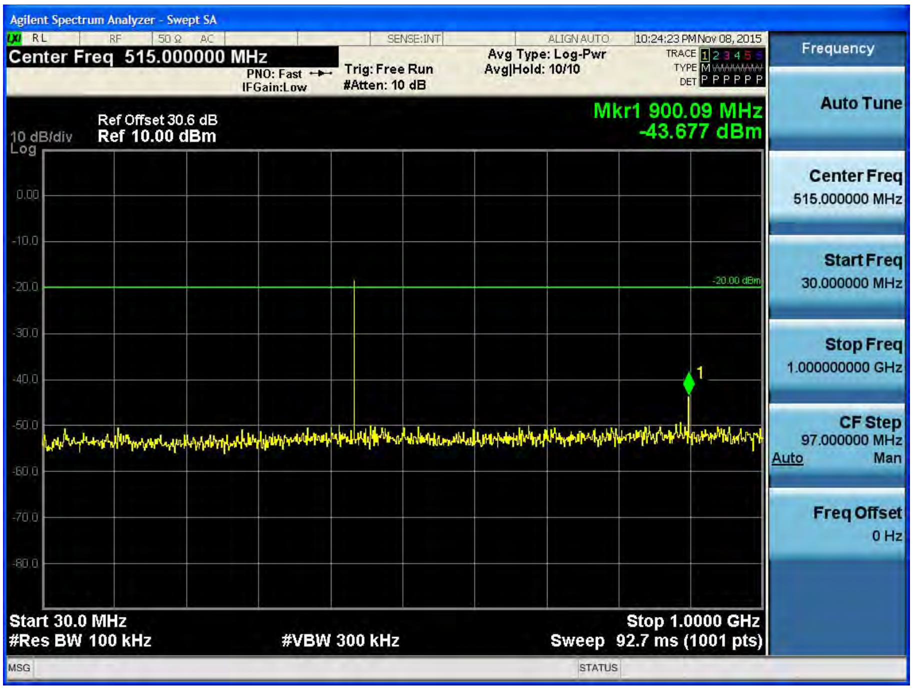


LOW POWER_7K60FXD, 7K60FXE _450.05 MHz_Low

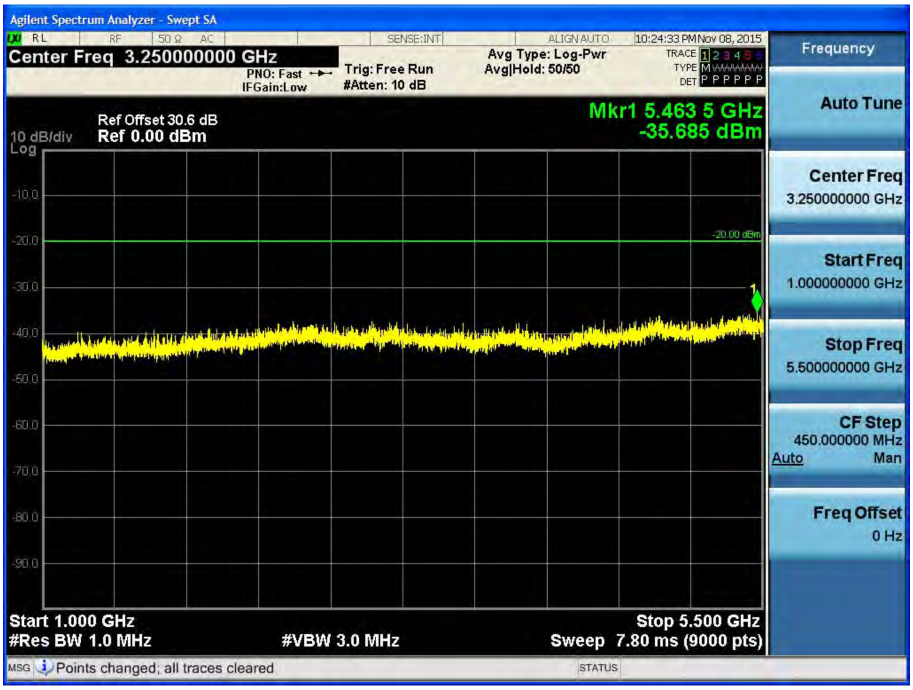
(9 kHz ~ 150 kHz)

(150 kHz ~ 30 MHz)

(30 MHz ~ 1 GHz)



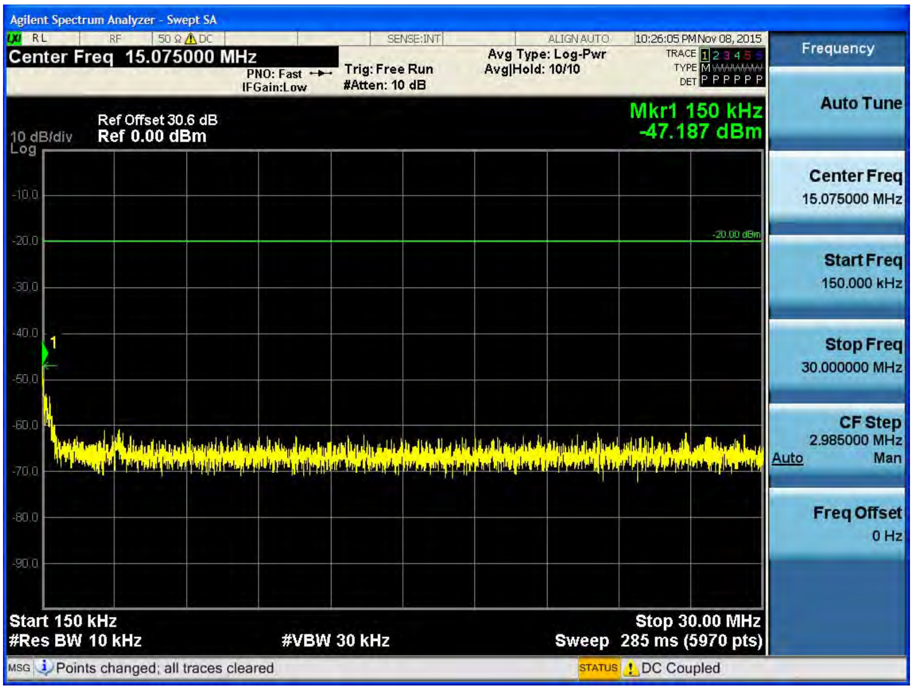
(1 GHz ~ 5.5 GHz)



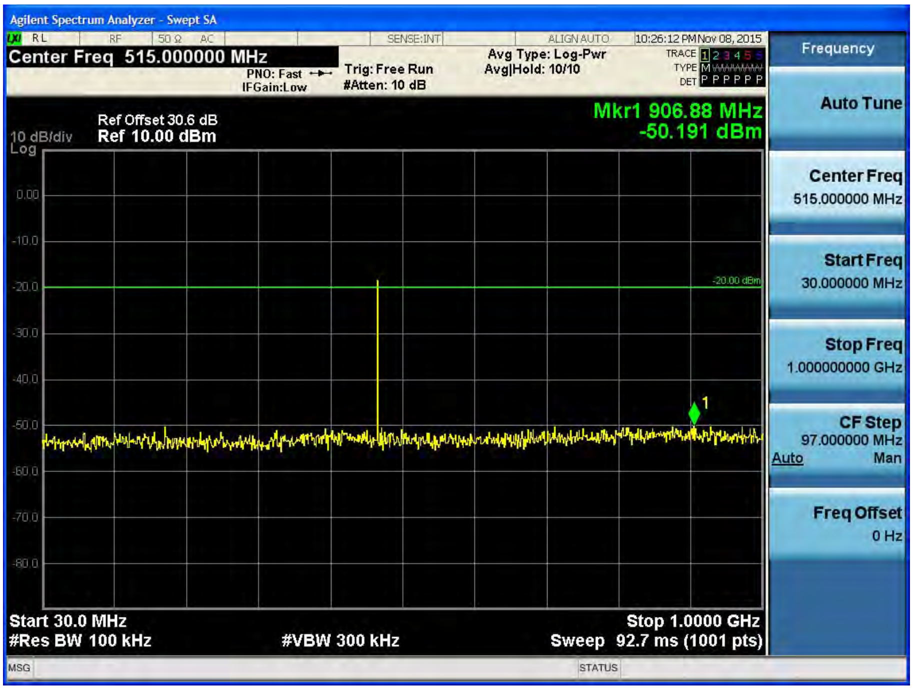
LOW POWER_7K60FXD, 7K60FXE _481.05 MHz_Middle

(9 kHz ~ 150 kHz)

(150 kHz ~ 30 MHz)



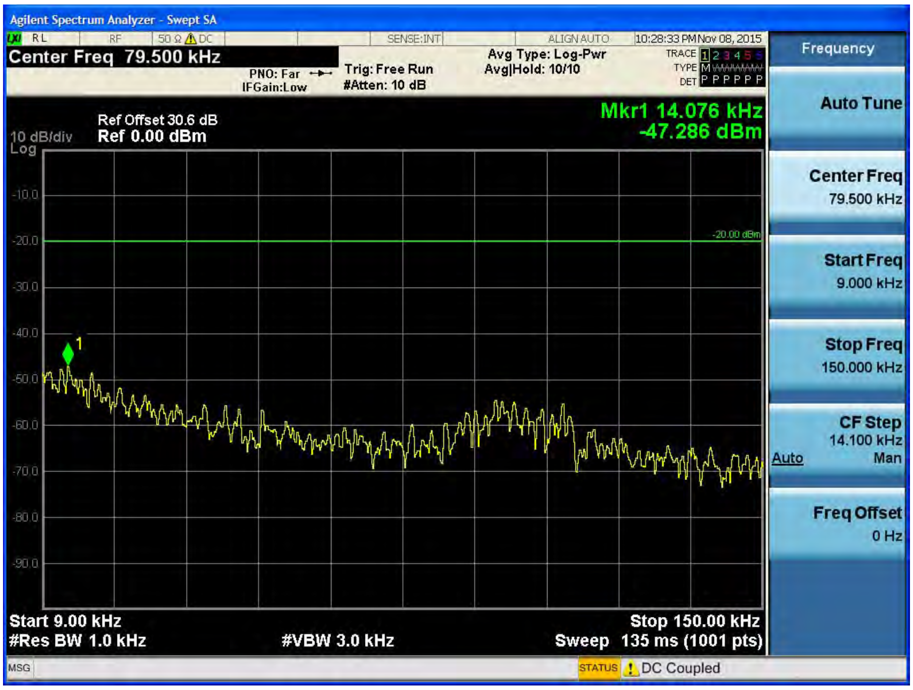
(30 MHz ~ 1 GHz)



(1 GHz ~ 5.5 GHz)

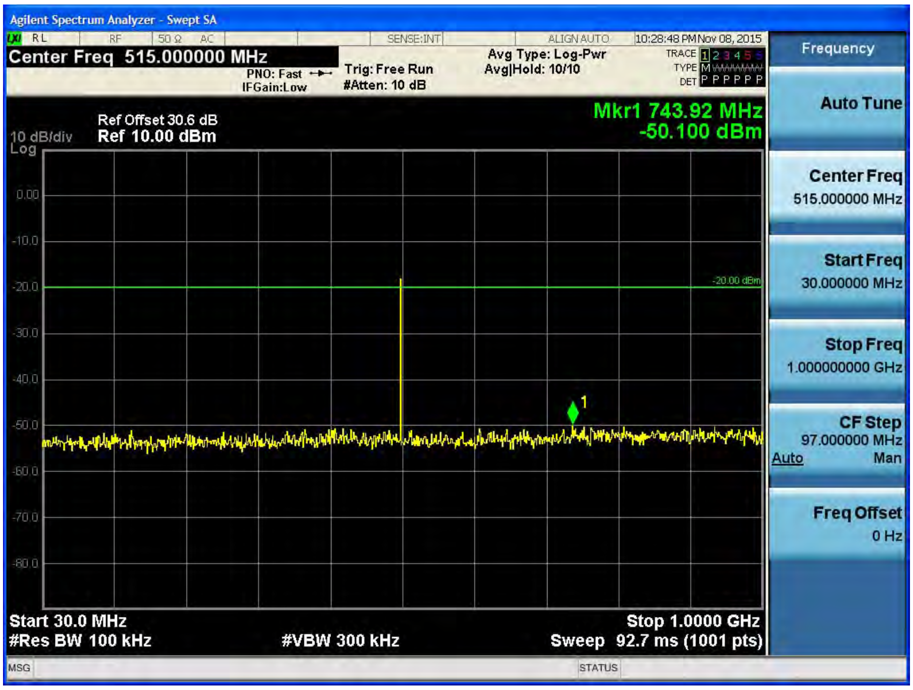
LOW POWER_7K60FXD, 7K60FXE _511.95 MHz_High

(9 kHz ~ 150 kHz)

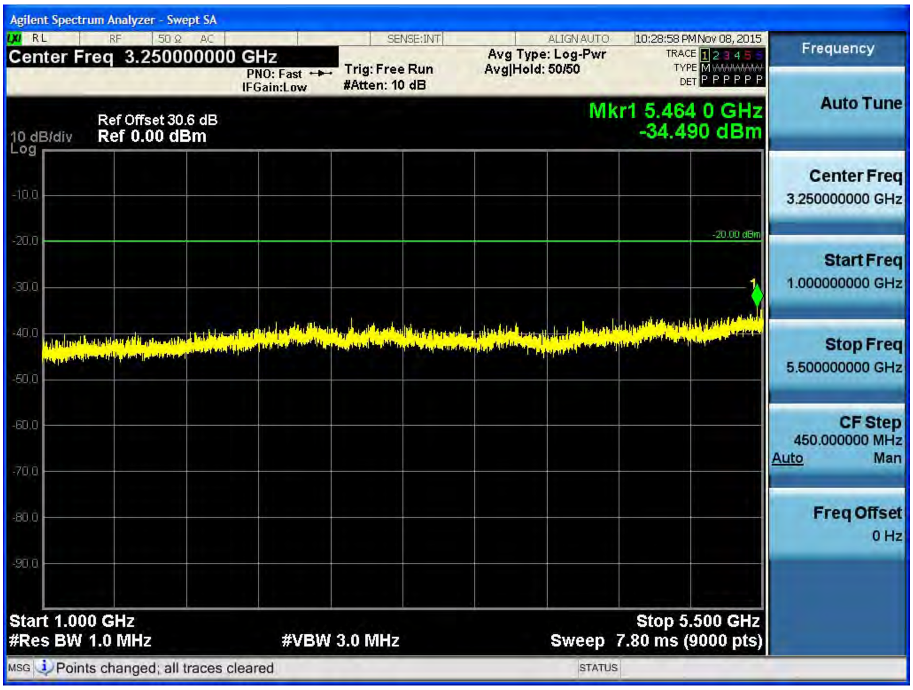


(150 kHz ~ 30 MHz)

(30 MHz ~ 1 GHz)



(1 GHz ~ 5.5 GHz)



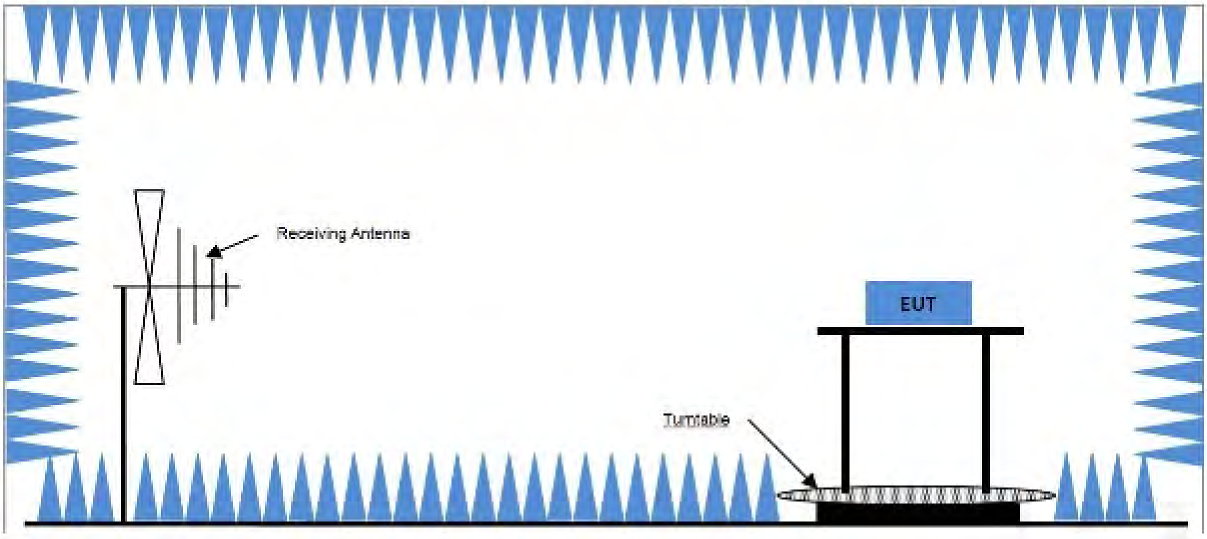
7.9Unwanted Emissions : Radiated SpuriousEmission

▣Definition

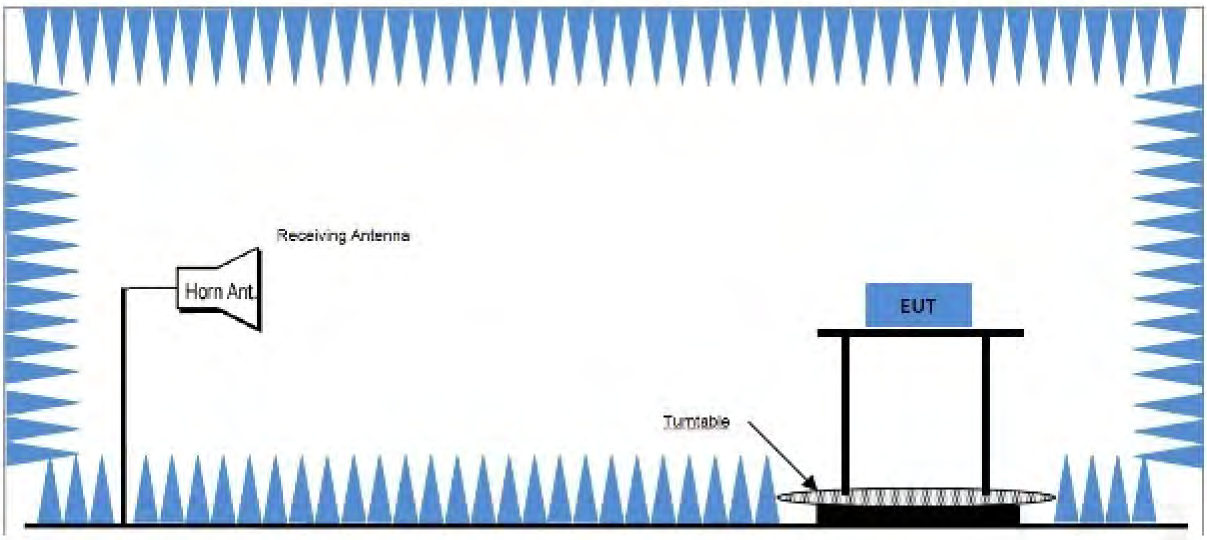
Radiated spurious emissions are emissions from the equipment when transmitting into a non-radiating load on a frequency or frequencies that are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communications desired.

▣ TEST CONFIGURATION

Below 30 MHz



Above 1 GHz



TEST PROCEDURE USED

According to 2.2.12 in TIA-603-D Standard.

a) Connect the equipment as illustrated.

b) Adjust the spectrum analyzer for the following settings:

1) Resolution Bandwidth = 10 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1GHz.
2) Video Bandwidth = 300 kHz for spurious emissions below 1 GHz, and 3 MHz for spurious emissions above 1 GHz.
3) Sweep Speed slow enough to maintain measurement calibration.
4) Detector Mode = Positive Peak.

c) Place the transmitter to be tested on the turntable in the standard test site, or an FCC listed site compliant with ANSI C63.4-2001 clause 5.4. The transmitter is transmitting into a nonradiating load that is placed on the turntable. The RF cable to this load should be of minimum length. For transmitters with integral antennas, the tests are to be run with the unit operating into the integral antenna.

d) For each spurious measurement the test antenna should be adjusted to the correct length for the frequency involved. This length may be determined from a calibration ruler supplied with the equipment. Measurements shall be made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier, except for the region close to the carrier equal to±the test bandwidth (see 1.3.4.4).

e) Key the transmitter.

f) For each spurious frequency, raise and lower the test antenna from 1 m to 4 m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Then the turntable should be rotated 360°to determine the maximum reading.
Repeat this procedure to obtain the highest possible reading. Record this maximum reading.

g) Repeat step f) for each spurious frequency with the test antenna polarized vertically.

h) Reconnect the equipment as illustrated.

i) Keep the spectrum analyzer adjusted as in step b).

j) Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At the lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground.

k) Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.

l) Repeat step k) with both antennas vertically polarized for each spurious frequency.

m) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps k) and l) by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula:

Pd(dBm) = *Pg*(dBm) – *cable loss* (dB) + *antenna gain* (dB)

where:

*Pd*is the dipole equivalent power and

*Pg*is the generator output power into the substitution antenna.

n) The *Pd*levels record in step m) are the absolute levels of radiated spurious emissions in dBm. The radiated spurious emissions in dB can be calculated by the following:

Radiated spurious emissions (dB) =

10*$\log_{10}$(TX power in watts/0.001)- *the levels in step m)*

▣LIMIT

Frequency Band (MHz)	Channel bandwidth (kHz)	Limit (dBm)
450.05 – 511.95	12.5	-20
470.05 – 511.95	25	-13

▣Operating Mode

EUT Type	Modulation	Battery	Test frequency (MHz)	Antenna
Stand alone	11K0F3E 7K60FXD, 7K60FXE	KNB-45L KNB-69L KNB-29N KNB-53N	450.05	KRA-42M
				KRA-23M
				KRA-27M
			481.05	KRA-42M, M2
				KRA-23M, M2
				KRA-27M, M2
			511.95	KRA-42M2
				KRA-23M2
				KRA27M2
	16K0F3E	KNB-45L KNB-69L KNB-29N KNB-53N	470.05	KRA-42M
				KRA-23M
				KRA-27M
			491.05	KRA-42M2
				KRA-23M2
				KRA27M2
			511.95	KRA-42M2
				KRA-23M2
				KRA27M2

Note

1. It is permissible to use other antennas provided they can be referenced to a dipole.
2. Worst case is red mark.

▣**TEST RESULTS**

<u>11K0F3E</u>

Frequency [MHz] F1 : 450.05 Battery : KNB-29N, Antenna : KRA-27M						
Frequency (MHz)	**Reading [dBm]**	**Factor (dB)**	**Pol.**	**Result (dBm)**	**Limit (dBm)**	**Margin (dB)**
450.05	6.81	27.18	Y-V	33.99	-	-
900.1	-	-	-	-	-20	-
1350.15	-52.78	-4.2	Y-V	-56.98	-20	36.98
1800.2	-41.33	-4.31	Y-V	-45.64	-20	25.64
2250.25	-48.39	1.69	Y-H	-46.7	-20	26.7
2700.3	-54.67	1.02	Y-V	-53.65	-20	33.65
3150.35	-	-	-	-	-20	-
3600.4	-	-	-	-	-20	-
4050.45	-60.47	6.38	Y-V	-54.09	-20	34.09
4500.5	-58.7	7.67	Y-V	-51.03	-20	31.03

*Note :

1. Limit = P_{dBm} – (50+10 log (P_{watt})) = -20 dBm

Frequency [MHz] F1 : 481.05 Battery : KNB-29N, Antenna : KRA-27M						
Frequency (MHz)	**Reading [dBm]**	**Factor (dB)**	**Pol.**	**Result (dBm)**	**Limit (dBm)**	**Margin (dB)**
481.05	7.96	27.25	Y-V	35.21	-	-
962.1	-88.47	33.36	Y-V	-55.11	-20	35.11
1443.15	-46.86	-4.04	X-V	-50.9	-20	30.9
1924.2	-44.04	-3.2	X-V	-47.24	-20	27.24
2405.25	-34.61	0.75	Y-V	-33.86	-20	13.86
2886.3	-49.6	2.26	Y-V	-47.34	-20	27.34
3367.35	-43.37	2.47	X-V	-40.9	-20	20.9
3848.4	-53.16	5.67	Y-V	-47.49	-20	27.49
4329.45	-	-	-	-	-20	-
4810.5	-	-	-	-	-20	-

*Note :

1. Limit = P_{dBm} – (50+10 log (P_{watt})) = -20 dBm

Frequency [MHz] F1 : 511.95 Battery : KNB-29N, Antenna : KRA-27M2						
Frequency (MHz)	**Reading [dBm]**	**Factor (dB)**	**Pol.**	**Result (dBm)**	**Limit (dBm)**	**Margin (dB)**
511.95	8.65	27.26	X-H	35.91	-	-
1023.9	-46.85	-6.6	Y-V	-53.45	-20	33.45
1535.85	-27.25	-3.96	Z-H	-31.21	-20	11.21
2047.8	-40.63	-1.33	Z-H	-41.96	-20	21.96
2559.75	-35.6	0.54	Z-H	-35.06	-20	15.06
3071.7	-46.31	2.9	Y-V	-43.41	-20	23.41
3583.65	-38.2	4.48	Z-H	-33.72	-20	13.72
4095.6	-48.22	5.97	X-V	-42.25	-20	22.25
4607.55	-43.31	8.1	Z-H	-35.21	-20	15.21
5119.5	-45.53	10.55	Y-H	-37.98	-20	14.98

*Note :

1. Limit = P_{dBm} – (50+10 log (P_{watt})) = -20 dBm

16K0F3E

Frequency [MHz] F1 : 470.05 Battery : KNB-29N, Antenna : KRA-27M						
Frequency (MHz)	**Reading [dBm]**	**Factor (dB)**	**Pol.**	**Result (dBm)**	**Limit (dBm)**	**Margin (dB)**
470.05	8.36	27.21	Y-V	35.57	-	-
940.1	-88.86	33.69	Z-H	-55.17	-13	42.17
1410.15	-	-	-	-	-13	-
1880.2	-41.16	-2.91	Z-H	-44.07	-13	31.07
2350.25	-33.19	0.89	Z-H	-32.3	-13	19.3
2820.3	-45.95	2.26	Z-H	-43.69	-13	30.69
3290.35	-46.8	2.7	Z-V	-44.1	-13	31.1
3760.4	-	-	-	-	-13	-
4230.45	-	-	-	-	-13	-
4700.5	-	-	-	-	-13	-

*Note :

1. Limit = P_{dBm} – (43+10 log (P_{watt})) = -13dBm

Frequency [MHz] F1 : 491.05 Battery : KNB-29N, Antenna : KRA-27M2						
Frequency (MHz)	**Reading [dBm]**	**Factor (dB)**	**Pol.**	**Result (dBm)**	**Limit (dBm)**	**Margin (dB)**
491.05	8.18	27.27	Y-V	35.45	-	-
982.1	-89.32	33.78	Y-V	-55.54	-13	42.54
1473.15	-40.45	-4	Z-H	-44.45	-13	31.45
1964.2	-39.43	-3.2	Z-H	-42.63	-13	29.63
2455.25	-38.36	0.43	Z-H	-37.93	-13	24.93
2946.3	-46.92	2.54	Z-H	-44.38	-13	31.38
3437.35	-42.28	3.13	Z-H	-39.15	-13	26.15
3928.4	-	-	-	-	-13	-
4419.45	-47.02	7.18	Z-H	-39.84	-13	26.84
4910.5	-	-	-	-	-13	-

*Note :

1. Limit = P_{dBm} – (43+10 log (P_{watt})) = -13dBm

Frequency [MHz] F1 : 511.95 Battery : KNB-29N, Antenna : KRA-27M2						
Frequency (MHz)	**Reading [dBm]**	**Factor (dB)**	**Pol.**	**Result (dBm)**	**Limit (dBm)**	**Margin (dB)**
511.95	8.14	27.26	X-H	35.4	-	-
1023.9	-47.47	-6.6	Z-H	-54.07	-13	41.07
1535.85	-27.64	-3.96	Z-H	-31.6	-13	18.6
2047.8	-41.58	-1.33	Z-H	-42.91	-13	29.91
2559.75	-36.06	0.54	Z-H	-35.52	-13	22.52
3071.7	-47.44	2.9	Z-H	-44.54	-13	32.54
3583.65	-38.49	4.48	Z-H	-34.01	-13	21.01
4095.6	-	-	-	-	-13	
4607.55	-42.89	8.1	Z-H	-34.79	-13	21.79
5119.5	-46.04	10.55	Z-H	-35.49	-13	22.49

*Note :

1. Limit = P_{dBm} – (43+10 log (P_{watt})) = -13dBm

7.10Necessary Bandwidth Calculations

Modulation = 16K0F3E	
Maximum Modulation (M), kHz	3
Maximum Deviation (D), kHz	5
Constant Factor (K)	1
Necessary Bandwidth (BN), kHz	(2xM)+(2xDxK)
Necessary Bandwidth (BN), kHz	16.0

Modulation = 11K0F3E	
Maximum Modulation (M), kHz	3
Maximum Deviation (D), kHz	2.5
Constant Factor (K)	1
Necessary Bandwidth (BN), kHz	(2xM)+(2xDxK)
Necessary Bandwidth (BN), kHz	11.0

Modulation = 7K60FXD, 7K60FXE	
Digital information rate (R), bps	9600
Maximum Deviation (D), kHz	3.391
Signaling States (S)	4
Constant Factor (K)	0.516
Necessary Bandwidth (BN), kHz	$(R/\log_2 S)+2DK$
Necessary Bandwidth (BN), kHz	7.60

8. LIST OF TEST EQUIPMENT

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Calibration Due	Serial No.
Agilent	N9020A/ SIGNAL ANALYZER	06/30/2015	Annual	06/30/2016	MY51110085
Agilent	N1911A/Power Meter	07/09/2015	Annual	07/09/2016	MY45100523
Agilent	N1921A /POWER SENSOR	07/09/2015	Annual	07/09/2016	MY45241059
Hewlett Packard	8903B/Audio Analyzer	12/16/2014	Annual	12/16/2015	3413A13913
Hewlett Packard	8901B/Modulation Analyzer	04/21/2015	Annual	04/21/2016	2406A00169
Tektronix	RSA3303B/Real Time Spectrum Analyzer	09/21/2015	Annual	09/21/2016	B010208
Agilent	8498A/30 dB Attenuator	10/28/2015	Annual	10/28/2016	51162
EAGLE	220NFNM/Tuneable Notch Filter	10/14/2015	Annual	10/14/2016	H00564-7
EAGLE	220NFNM/Tuneable Notch Filter	10/14/2015	Annual	10/14/2016	H00564-8
EAGLE	230NFNM/Tuneable Notch Filter	10/14/2015	Annual	10/14/2016	H00564-9
Korea Engineering	KR-1005L / Temperature Chamber	10/27/2015	Annual	10/27/2016	KRAC05063-3CH
CERNEX	AMPLIFIER_CBLU1183540B	05/21/2015	Annual	05/21/2016	25540
Wainwright	WHKX1.0/15G-12SS	08/12/2015	Annual	08/12/2016	42
Schwarzbeck	UHAP/ Dipole Antenna	03/23/2015	Biennial	03/23/2017	557
Schwarzbeck	UHAP/ Dipole Antenna	03/23/2015	Biennial	03/23/2017	558
Schwarzbeck	BBHA 9120D/ Horn Antenna	09/01/2014	Biennial	09/01/2016	147
Schwarzbeck	BBHA 9120D/ Horn Antenna	05/15/2015	Biennial	05/15/2017	1299
ROHDE&SCHWARZ	FSV40-N/Spectrum Analyzer	09/23/2015	Annual	09/23/2016	101068-SZ
Inn-co GmbH	CT 0800/Turn table	N/A	N/A	N/A	AS2000P/034/9740305
Inn-co GmbH	DE 3260/Ant. Mast	N/A	N/A	N/A	DE3260/005/7860504/L
Schwarzbeck	VULB 9160/ TRILOG Antenna	10/10/2014	Biennial	10/10/2016	3368