

TEST REPORT

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 443-390, Korea
TEL: 82 70 5008 1021
FAX: 82 505 299 8311

Report No.: KCTL15-FR0071(1)

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KCTL
<http://www.kctl.co.kr>

1. Applicant

Name: E-TECH Co., Ltd.
Address: #403-901, 655, Pyeongcheon-ro, Wonmi-gu, Bucheon-si,
Gyeonggi-do, Korea

2. Sample Description:

FCC ID: R72NEW400
Type of equipment: FM Handheld Transceiver (UHF)
Basic Model: NEW400

3. Date of Test:

November 2 ~ November 10, 2015
April 5 ~ April 15, 2016

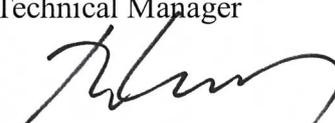
4. Test method used:

FCC Part 2 Subpart J,
FCC Part 90 Subpart I

5. Test Results

Test Item: Refer to page 8
Result: Refer to page 9 ~ page 105
Measurement Uncertainty: Refer to page 8

This result shown in this report refer only to the sample(s) tested unless otherwise stated.

Affirmation	<p>Tested by</p>  <p>Name: MYEONG HWA, JANG</p>	<p>Technical Manager</p>  <p>Name: MIN GI, SON</p>
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2016. 04. 18

KCTL Inc. Testing Laboratory

History of Issued Test Report

Issued date:.	Report Number	History
November 24, 2015	KCTL15-FR0071	Issued the original test teport
April 18, 2016	KCTL15-FR0071(1)	Added and tested more test mode

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1. Client information

Applicant: E-TECH Co., Ltd.
Address: #403-901, 655, Pyeongcheon-ro, Wonmi-gu, Bucheon-si, Gyeonggi-do, Korea
Telephone number: +82-32-328-3184
Facsimile number: +82-32-328-3186
Contact person: Jae-Hyun Kim / pico76@etech2004.co.kr

Manufacturer: E-TECH Co., Ltd.
Address: #403-901, 655, Pyeongcheon-ro, Wonmi-gu, Bucheon-si, Gyeonggi-do, Korea

2. Laboratory information

Address

KCTL Inc.

65 Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea

Telephone Number: 82-70-5008-1016 Facsimile Number: 82-505-299-8311

Certificate

KOLAS No.: KT231

FCC Site Designation No.: KR0040

FCC Site Registration No.: 687132

VCCI Site Registration No.: R-3327, G-198, C-3706, T-1849

IC Site Registration No.:8035A-2

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant:	E-TECH Co., Ltd.
Address of Applicant	#403-901, 655, Pyeongcheon-ro, Wonmi-gu, Bucheon-si, Gyeonggi-do, Korea
Manufacturer	E-TECH Co., Ltd.
Address of Manufacturer	#403-901, 655, Pyeongcheon-ro, Wonmi-gu, Bucheon-si, Gyeonggi-do, Korea
Type of equipment	FM Handheld Transceiver (UHF)
Basic Model	NEW400
Serial number	N/A

3.2 General description

Frequency Range	406.10 MHz ~ 512.00 MHz
Type of Modulation	12.5BW, 6.25BW
Number of Channels	32 ch
Type of Antenna	Helical Antenna
Transmit Power	1 W / 4 W
Power supply	DC 7.4 V
H/W Version	1.0
S/W version	1.0
Test SW Version	N/A
RF power setting in TEST SW	N/A

Note : The above EUT information was declared by the manufacturer.

3.3 Test frequency

	Frequency
Low frequency	406.10 MHz
Middle frequency	459.00 MHz
High frequency	512.00 MHz

3.4 Test Voltage

Mode	Voltage
Norminal voltage	DC 7.4 V

4. Summary of test results

4.1 Standards & results

FCC Rule Reference	Parameter	Report Section	Test Result
2.1046(a), 90.205	Output Power Conducted	5.1	C
90.213, 2.1055	Frequency Stability	5.2	C
2.1047(b)	Modulation Limiting	5.3	C
2.1047(a)	Audio Frequency Response	5.4	C
2.1047(a)	Audio Low Pass Filter Frequency Response	5.5	C
2.1049, 90.210	Occupied Bandwidth	5.6	C
90.214	Transient Frequency Behaviour of the Transmitter	5.7	C
2.1051, 90.210	Conducted Spurious Emission	5.8	C
2.1053(a), 90.210	Radiated Spurious Emission	5.9	C
Note: C = complies NC = Not complies NT = Not tested NA = Not Applicable			

* The general test methods used to test this device is TIA-603-D.

4.2 Uncertainty

Measurement Item	Expanded Uncertainty $U = kUc (k = 2)$	
Conducted RF power	1.30 dB	
Conducted Spurious Emissions	1.52 dB	
Radiated Spurious Emissions	30 MHz ~ 300 MHz:	+ 4.94 dB, - 5.06 dB
		+ 4.93 dB, - 5.05 dB
	300 MHz ~ 1 000 MHz:	+ 4.97 dB, - 5.08 dB
		+ 4.84 dB, - 4.96 dB
1 GHz ~ 25 GHz:	+ 6.03 dB, - 6.05 dB	
Conducted Emissions	9 kHz ~ 150 kHz:	3.75 dB
	150 kHz ~ 30 MHz:	3.36 dB

5. Test results

5.1 Output Power Conducted

5.1.1 Regulation

According to §90.205, (r) All other frequency bands. Requested transmitter power will be considered and authorized on a case by case basis.

(s) The output power shall not exceed by more than 20 percent either the output power shown in the Radio Equipment List [available in accordance with §90.203(a)(1)] for transmitters included in this list or when not so listed, the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

5.1.2 Measurement 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.

5.1.3 Test Result

- Complied

* 12.5BW

-Target Power 1W

Channel	Frequency [MHz]	Result [dBm]	Result [W]	Limit [W]	Margin [W]	Current [A]
Lowest	406.10	30.03	1.01	1.20	0.19	0.81
Middle	459.00	30.66	1.16	1.20	0.04	0.58
Highest	512.00	30.24	1.06	1.20	0.14	0.60

-Target Power 4W

Channel	Frequency [MHz]	Result [dBm]	Result [W]	Limit [W]	Margin [W]	Current [A]
Lowest	406.10	36.03	4.01	4.80	0.79	1.56
Middle	459.00	36.26	4.23	4.80	0.57	1.10
Highest	512.00	36.18	4.14	4.80	0.66	1.34

* 6.25BW

-Target Power 1W

Channel	Frequency [MHz]	Result [dBm]	Result [W]	Limit [W]	Margin [W]	Current [A]
Lowest	406.10	30.20	1.05	1.20	0.15	0.80
Middle	459.00	30.54	1.13	1.20	0.07	0.57
Highest	512.00	30.13	1.03	1.20	0.17	0.59

-Target Power 4W

Channel	Frequency [MHz]	Result [dBm]	Result [W]	Limit [W]	Margin [W]	Current [A]
Lowest	406.10	35.97	3.95	4.80	0.85	1.52
Middle	459.00	35.85	3.85	4.80	0.95	1.09
Highest	512.00	35.41	3.48	4.80	1.32	1.24

-NOTE:

1. We took the insertion loss of the cable loss into consideration within the measuring instrument.

5.2 Frequency Stability

5.2.1 Regulation

According to §90.213, in the 150-174 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

In the 150-174 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth or designed to operate on a frequency specifically designated for itinerant use or designed for low-power operation of two watts or less, must have a frequency stability of 5.0 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 2.0 ppm.

In the 421-512 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 1.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 0.5 ppm.

In the 421-512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

5.2.2 Measurement 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°C to +60°C.

5.2.3 Test Result

- Complied

* 12.5BW

-Target Power_1W_406.10 MHz

Voltage [%]	Power [V _{DC}]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [ppm]
100	7.4	-30	406 099 832	-168	-0.414
		-20	406 099 813	-187	-0.460
		-10	406 099 877	-123	-0.303
		0	406 099 889	-111	-0.273
		10	406 100 103	103	0.254
		20	406 100 137	137	0.337
		30	406 100 046	46	0.113
		40	406 099 999	-1	-0.002
		50	406 099 919	-81	-0.199
		60	406 099 906	-94	-0.231
		Normal	406 100 051	51	0.126
85	6.29	Normal	406 100 044	44	0.108
115	8.51	Normal	406 100 037	37	0.091

-Target Power_1W_459.00 MHz

Voltage [%]	Power [V _{DC}]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [ppm]
100	7.4	-30	458 999 816	-184	-0.401
		-20	458 999 786	-214	-0.466
		-10	458 999 859	-141	-0.307
		0	458 999 886	-114	-0.248
		10	459 000 110	110	0.240
		20	459 000 156	156	0.340
		30	459 000 060	60	0.131
		40	458 999 952	-48	-0.105
		50	458 999 912	-88	-0.192
		60	458 999 898	-102	-0.222
		Normal	459 000 024	24	0.052
85	6.29	Normal	459 000 020	20	0.044
115	8.51	Normal	459 000 022	22	0.048

-Target Power_1W_512.00 MHz

Voltage [%]	Power [V _{DC}]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [ppm]
100	7.4	-30	511 999 814	-186	-0.363
		-20	511 999 756	-244	-0.477
		-10	511 999 837	-163	-0.318
		0	511 999 885	-115	-0.225
		10	512 000 109	109	0.213
		20	512 000 175	175	0.342
		30	512 000 082	82	0.160
		40	511 999 985	-15	-0.029
		50	511 999 906	-94	-0.184
		60	511 999 888	-112	-0.219
		Normal	512 000 028	28	0.055
85	6.29	Normal	512 000 031	31	0.061
115	8.51	Normal	512 000 039	39	0.076

-Target Power_4W_406.10 MHz

Voltage [%]	Power [V _{DC}]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [ppm]
100	7.4	-30	406 099 917	-83	-0.204
		-20	406 099 814	-186	-0.458
		-10	406 099 850	-150	-0.369
		0	406 099 941	-59	-0.145
		10	406 100 026	26	0.064
		20	406 100 132	132	0.325
		30	406 100 088	88	0.217
		40	406 099 998	-2	-0.005
		50	406 099 933	-67	-0.165
		60	406 099 916	-84	-0.207
		Normal	406 100 060	60	0.148
85	6.29	Normal	406 100 062	62	0.153
115	8.51	Normal	406 100 067	67	0.165

-Target Power_4W_459.00 MHz

Voltage [%]	Power [V _{DC}]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [ppm]
100	7.4	-30	458 999 881	-119	-0.259
		-20	458 999 782	-218	-0.475
		-10	458 999 841	-159	-0.346
		0	458 999 920	-80	-0.174
		10	459 000 052	52	0.113
		20	459 000 153	153	0.333
		30	459 000 092	92	0.200
		40	458 999 973	-27	-0.059
		50	458 999 920	-80	-0.174
		60	458 999 902	-98	-0.214
		Normal	459 000 049	49	0.107
85	6.29	Normal	459 000 052	52	0.113
115	8.51	Normal	459 000 060	60	0.131

-Target Power_4W_512.00 MHz

Voltage [%]	Power [V _{DC}]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [ppm]
100	7.4	-30	511 999 842	-158	-0.309
		-20	511 999 754	-246	-0.480
		-10	511 999 829	-171	-0.334
		0	511 999 894	-106	-0.207
		10	512 000 088	88	0.172
		20	512 000 174	174	0.340
		30	512 000 092	92	0.180
		40	511 999 979	-21	-0.041
		50	511 999 908	-92	-0.180
		60	511 999 889	-111	-0.217
		Normal	512 000 043	43	0.084
85	6.29	Normal	512 000 046	46	0.090
115	8.51	Normal	512 000 051	51	0.100

* 6.25BW

-Target Power_1W_406.10 MHz

Voltage [%]	Power [V _{DC}]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [ppm]
100	7.4	-30	406 099 536	-464	-1.143
		-20	406 099 613	-387	-0.953
		-10	406 099 661	-339	-0.835
		0	406 099 670	-330	-0.813
		10	406 099 845	-155	-0.382
		20	406 099 887	-113	-0.278
		30	406 099 806	-194	-0.478
		40	406 099 726	-274	-0.675
		50	406 099 666	-334	-0.822
		60	406 099 646	-354	-0.872
		Normal	406 099 840	-160	-0.394
85	6.29	Normal	406 099 831	-169	-0.416
115	8.51	Normal	406 099 824	-176	-0.433

-Target Power_1W_459.00 MHz

Voltage [%]	Power [V _{DC}]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [ppm]
100	7.4	-30	458 999 486	-514	-1.120
		-20	458 999 580	-420	-0.915
		-10	458 999 582	-418	-0.911
		0	458 999 701	-299	-0.651
		10	458 999 779	-221	-0.481
		20	458 999 855	-145	-0.316
		30	458 999 806	-194	-0.423
		40	458 999 664	-336	-0.732
		50	458 999 629	-371	-0.808
		60	458 999 619	-381	-0.830
		Normal	458 999 729	-271	-0.590
85	6.29	Normal	458 999 728	-272	-0.593
115	8.51	Normal	458 999 729	-271	-0.590

-Target Power_1W_512.00 MHz

Voltage [%]	Power [V _{DC}]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [ppm]
100	7.4	-30	511 999 464	-536	-1.047
		-20	511 999 548	-452	-0.883
		-10	511 999 507	-493	-0.963
		0	511 999 712	-288	-0.563
		10	511 999 693	-307	-0.600
		20	511 999 819	-181	-0.354
		30	511 999 812	-188	-0.367
		40	511 999 609	-391	-0.764
		50	511 999 597	-403	-0.787
		60	511 999 594	-406	-0.793
		Normal	511 999 684	-316	-0.617
85	6.29	Normal	511 999 680	-320	-0.625
115	8.51	Normal	511 999 680	-320	-0.625

-Target Power_4W_406.10 MHz

Voltage [%]	Power [V _{DC}]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [ppm]
100	7.4	-30	406 099 534	-466	-1.148
		-20	406 099 579	-421	-1.037
		-10	406 099 686	-314	-0.773
		0	406 099 637	-363	-0.894
		10	406 099 858	-142	-0.350
		20	406 099 886	-114	-0.281
		30	406 099 797	-203	-0.500
		40	406 099 747	-253	-0.623
		50	406 099 665	-335	-0.825
		60	406 099 638	-362	-0.891
		Normal	406 099 832	-168	-0.414
85	6.29	Normal	406 099 796	-204	-0.502
115	8.51	Normal	406 099 785	-215	-0.529

-Target Power_4W_459.00 MHz

Voltage [%]	Power [V _{DC}]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [ppm]
100	7.4	-30	458 999 453	-547	-1.192
		-20	458 999 573	-427	-0.930
		-10	458 999 596	-404	-0.880
		0	458 999 668	-332	-0.723
		10	458 999 807	-193	-0.420
		20	458 999 863	-137	-0.298
		30	458 999 794	-206	-0.449
		40	458 999 674	-326	-0.710
		50	458 999 625	-375	-0.817
		60	458 999 608	-392	-0.854
		Normal	458 999 726	-274	-0.597
85	6.29	Normal	458 999 723	-277	-0.603
115	8.51	Normal	458 999 723	-277	-0.603

-Target Power_4W_512.00 MHz

Voltage [%]	Power [V _{DC}]	Temp. [°C]	Reading Frequency [Hz]	Frequency Error [Hz]	Frequency Error [ppm]
100	7.4	-30	511 999 478	-522	-1.020
		-20	511 999 536	-464	-0.906
		-10	511 999 518	-482	-0.941
		0	511 999 690	-310	-0.605
		10	511 999 720	-280	-0.547
		20	511 999 826	-174	-0.340
		30	511 999 804	-196	-0.383
		40	511 999 618	-382	-0.746
		50	511 999 595	-405	-0.791
		60	511 999 583	-417	-0.814
		Normal	511 999 674	-326	-0.637
85	6.29	Normal	511 999 669	-331	-0.646
115	8.51	Normal	511 999 668	-332	-0.648

5.3 Modulation Limiting

5.3.1 Regulation

According to TIA-603-D, the instantaneous peak and steady state deviations shall not exceed rated system deviation at any audio frequency or change in level, as specified in the method of measurement.

5.3.2 Measurement 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 1000 Hz 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.

5.3.3 Test Result

- Complied

* 12.5BW

-Target Power_1W_406.10 MHz

Audio input level relative [dB]	Positive peak deviation [kHz]			Negative peak deviation [kHz]			Limit [kHz]
	300 [Hz]	1 000 [Hz]	3 000 [Hz]	300 [Hz]	1 000 [Hz]	3 000 [Hz]	
-20	0.097	0.228	0.328	0.115	0.240	0.338	2.5
-15	0.123	0.343	0.527	0.127	0.354	0.533	
-10	0.147	0.531	0.852	0.153	0.552	0.860	
-5	0.197	0.884	1.471	0.209	0.893	1.468	
0	0.301	1.525	1.673	0.304	1.516	1.668	
5	0.471	2.058	1.667	0.481	2.060	1.669	
10	0.786	1.970	1.661	0.785	1.990	1.657	
15	1.335	1.942	1.666	1.350	1.975	1.656	
20	2.207	1.935	1.663	2.228	1.946	1.665	

-Target Power_1W_459.00 MHz

Audio input level relative [dB]	Positive peak deviation [kHz]			Negative peak deviation [kHz]			Limit [kHz]
	300 [Hz]	1 000 [Hz]	3 000 [Hz]	300 [Hz]	1 000 [Hz]	3 000 [Hz]	
-20	0.084	0.206	0.311	0.087	0.208	0.315	2.5
-15	0.101	0.323	0.504	0.097	0.312	0.504	
-10	0.128	0.524	0.877	0.133	0.536	0.864	
-5	0.190	0.887	1.499	0.183	0.885	1.488	
0	0.277	1.535	1.652	0.279	1.529	1.644	
5	0.451	2.019	1.648	0.460	2.021	1.642	
10	0.763	1.935	1.645	0.761	1.945	1.636	
15	1.318	1.905	1.643	1.312	1.914	1.632	
20	2.130	1.913	1.638	2.140	1.911	1.624	

-Target Power_1W_512.00 MHz

Audio input level relative [dB]	Positive peak deviation [kHz]			Negative peak deviation [kHz]			Limit [kHz]
	300 [Hz]	1 000 [Hz]	3 000 [Hz]	300 [Hz]	1 000 [Hz]	3 000 [Hz]	
-20	0.075	0.209	0.308	0.088	0.224	0.303	2.5
-15	0.088	0.310	0.497	0.091	0.308	0.500	
-10	0.124	0.528	0.863	0.121	0.518	0.862	
-5	0.169	0.878	1.494	0.168	0.884	1.482	
0	0.259	1.546	1.662	0.259	1.532	1.653	
5	0.438	2.021	1.672	0.427	2.049	1.646	
10	0.722	1.946	1.657	0.728	1.948	1.650	
15	1.253	1.919	1.641	1.247	1.927	1.627	
20	2.049	1.913	1.648	2.062	1.914	1.633	

-Target Power_4W_406.10 MHz

Audio input level relative [dB]	Positive peak deviation [klz]			Negative peak deviation [klz]			Limit [klz]
	300 [Hz]	1 000 [Hz]	3 000 [Hz]	300 [Hz]	1 000 [Hz]	3 000 [Hz]	
-20	0.104	0.228	0.329	0.111	0.233	0.347	2.5
-15	0.112	0.336	0.695	0.130	0.347	0.528	
-10	0.146	0.534	0.859	0.153	0.554	0.864	
-5	0.205	0.889	1.472	0.216	0.897	1.474	
0	0.294	1.524	1.669	0.307	1.528	1.669	
5	0.474	2.046	1.663	0.478	2.057	1.664	
10	0.786	1.966	1.663	0.801	1.987	1.657	
15	1.361	1.937	1.659	1.348	1.953	1.658	
20	2.196	1.952	1.662	2.216	1.948	1.655	

-Target Power_4W_459.00 MHz

Audio input level relative [dB]	Positive peak deviation [klz]			Negative peak deviation [klz]			Limit [klz]
	300 [Hz]	1 000 [Hz]	3 000 [Hz]	300 [Hz]	1 000 [Hz]	3 000 [Hz]	
-20	0.084	0.266	0.321	0.086	0.206	0.316	2.5
-15	0.110	0.316	0.508	0.097	0.312	0.508	
-10	0.134	0.533	0.858	0.133	0.521	0.857	
-5	0.073	0.908	1.477	0.074	0.877	1.472	
0	0.280	1.517	1.628	0.283	1.516	1.627	
5	0.450	2.000	1.632	0.458	1.993	1.627	
10	0.758	1.924	1.629	0.755	1.926	1.621	
15	1.299	1.906	1.644	1.300	1.919	1.638	
20	2.129	1.901	1.632	2.138	1.904	1.629	

-Target Power_4W_512.00 MHz

Audio input level relative [dB]	Positive peak deviation [klz]			Negative peak deviation [klz]			Limit [klz]
	300 [Hz]	1 000 [Hz]	3 000 [Hz]	300 [Hz]	1 000 [Hz]	3 000 [Hz]	
-20	0.069	0.204	0.303	0.078	0.193	0.307	2.5
-15	0.093	0.311	0.488	0.085	0.310	0.492	
-10	0.123	0.516	0.857	0.119	0.517	0.849	
-5	0.165	0.881	1.476	0.174	0.876	1.467	
0	0.259	1.535	1.638	0.264	1.530	1.625	
5	0.434	2.003	1.640	0.423	2.010	1.620	
10	0.719	1.933	1.633	0.728	1.943	1.623	
15	1.248	1.906	1.638	1.238	1.910	1.624	
20	2.035	1.908	1.631	2.045	1.898	1.623	

* 6.25BW

-Target Power_1W_406.10 MHz

Audio input level relative [dB]	Positive peak deviation [klz]			Negative peak deviation [klz]			Limit [klz]
	300 [Hz]	1 000 [Hz]	3 000 [Hz]	300 [Hz]	1 000 [Hz]	3 000 [Hz]	
-20	0.084	0.134	0.186	0.096	0.144	0.200	1.25
-15	0.093	0.194	0.284	0.107	0.201	0.287	
-10	0.111	0.291	0.445	0.118	0.292	0.453	
-5	0.125	0.458	0.745	0.137	0.461	0.755	
0	0.184	0.761	0.772	0.191	0.774	0.768	
5	0.258	0.938	0.768	0.269	0.957	0.771	
10	0.395	0.896	0.760	0.401	0.916	0.764	
15	0.647	0.890	0.764	0.664	0.902	0.774	
20	1.009	0.905	0.768	1.018	0.896	0.767	

-Target Power_1W_459.00 MHz

Audio input level relative [dB]	Positive peak deviation [klz]			Negative peak deviation [klz]			Limit [klz]
	300 [Hz]	1 000 [Hz]	3 000 [Hz]	300 [Hz]	1 000 [Hz]	3 000 [Hz]	
-20	0.072	0.129	0.183	0.073	0.127	0.178	1.25
-15	0.079	0.172	0.270	0.078	0.178	0.267	
-10	0.092	0.280	0.440	0.090	0.274	0.436	
-5	0.114	0.451	0.734	0.114	0.451	0.739	
0	0.156	0.756	0.743	0.157	0.758	0.738	
5	0.235	0.904	0.742	0.233	0.906	0.740	
10	0.376	0.869	0.744	0.372	0.875	0.735	
15	0.633	0.864	0.740	0.631	0.869	0.736	
20	0.958	0.863	0.743	0.975	0.866	0.738	

-Target Power_1W_512.00 MHz

Audio input level relative [dB]	Positive peak deviation [klz]			Negative peak deviation [klz]			Limit [klz]
	300 [Hz]	1 000 [Hz]	3 000 [Hz]	300 [Hz]	1 000 [Hz]	3 000 [Hz]	
-20	0.070	0.118	0.175	0.062	0.119	0.171	1.25
-15	0.068	0.177	0.269	0.070	0.172	0.272	
-10	0.080	0.272	0.445	0.079	0.268	0.440	
-5	0.101	0.450	0.745	0.101	0.448	0.740	
0	0.140	0.767	0.747	0.148	0.762	0.743	
5	0.219	0.923	0.755	0.225	0.917	0.743	
10	0.360	0.883	0.750	0.352	0.889	0.751	
15	0.603	0.874	0.751	0.605	0.872	0.745	
20	0.935	0.866	0.748	0.939	0.873	0.743	

-Target Power 4W 406.10 MHz

Audio input level relative [dB]	Positive peak deviation [klz]			Negative peak deviation [klz]			Limit [klz]
	300 [Hz]	1 000 [Hz]	3 000 [Hz]	300 [Hz]	1 000 [Hz]	3 000 [Hz]	
-20	0.084	0.146	0.195	0.093	0.142	0.192	1.25
-15	0.085	0.196	0.287	0.096	0.191	0.291	
-10	0.110	0.293	0.447	0.106	0.305	0.446	
-5	0.138	0.465	0.740	0.134	0.458	0.746	
0	0.184	0.758	0.763	0.187	0.768	0.767	
5	0.256	0.939	0.761	0.266	0.944	0.770	
10	0.405	0.905	0.772	0.398	0.902	0.761	
15	0.646	0.887	0.766	0.657	0.896	0.764	
20	1.010	0.883	0.764	1.010	0.882	0.754	

-Target Power 4W 459.00 MHz

Audio input level relative [dB]	Positive peak deviation [klz]			Negative peak deviation [klz]			Limit [klz]
	300 [Hz]	1 000 [Hz]	3 000 [Hz]	300 [Hz]	1 000 [Hz]	3 000 [Hz]	
-20	0.072	0.126	0.174	0.067	0.127	0.177	1.25
-15	0.079	0.180	0.275	0.078	0.180	0.269	
-10	0.090	0.283	0.435	0.120	0.280	0.441	
-5	0.117	0.450	0.740	0.107	0.451	0.735	
0	0.168	0.755	0.742	0.157	0.763	0.741	
5	0.241	0.924	0.741	0.239	0.910	0.737	
10	0.382	0.873	0.747	0.386	0.880	0.741	
15	0.641	0.872	0.745	0.638	0.872	0.745	
20	0.964	0.873	0.741	0.968	0.875	0.740	

-Target Power 4W 512.00 MHz

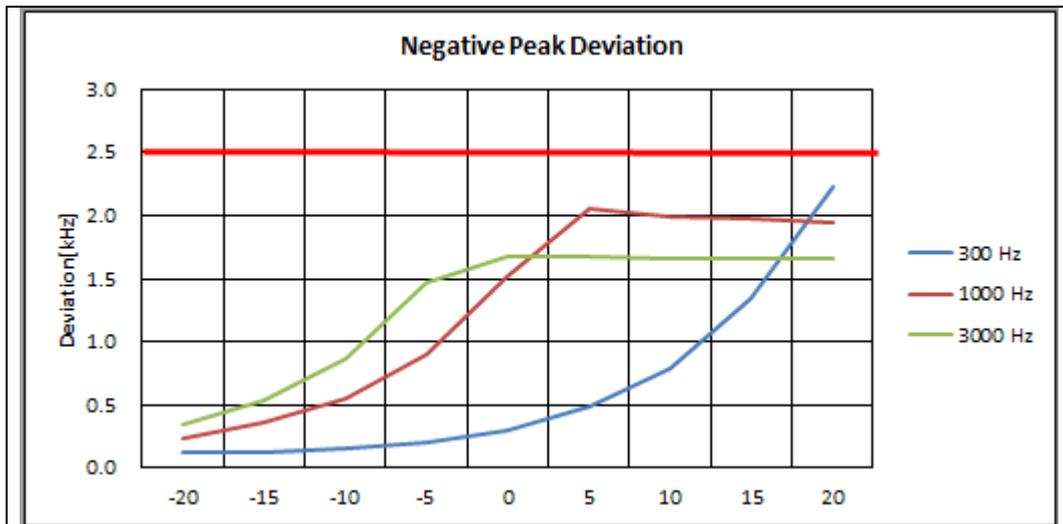
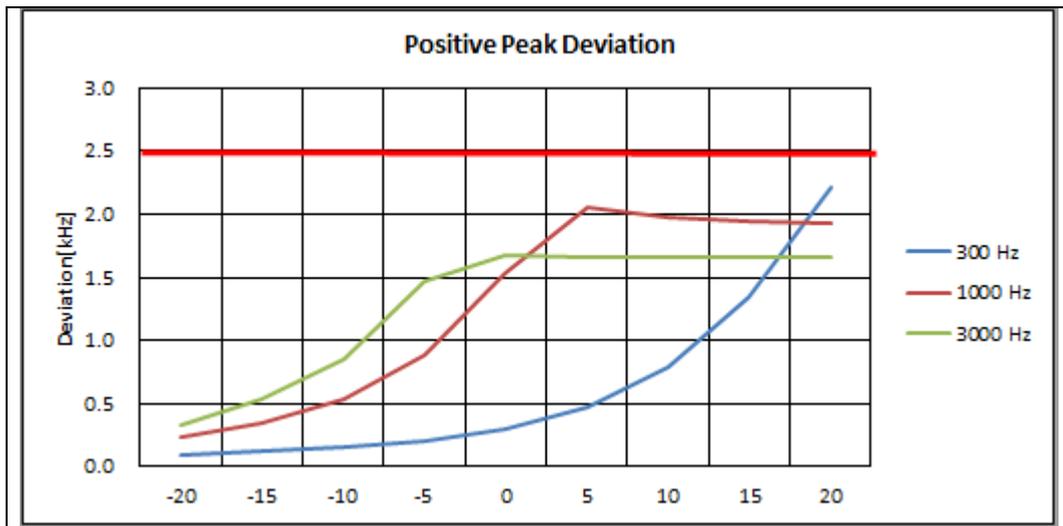
Audio input level relative [dB]	Positive peak deviation [klz]			Negative peak deviation [klz]			Limit [klz]
	300 [Hz]	1 000 [Hz]	3 000 [Hz]	300 [Hz]	1 000 [Hz]	3 000 [Hz]	
-20	0.057	0.116	0.171	0.060	0.118	0.167	1.25
-15	0.064	0.172	0.266	0.064	0.178	0.265	
-10	0.083	0.272	0.439	0.083	0.274	0.442	
-5	0.103	0.444	0.745	0.104	0.440	0.738	
0	0.149	0.762	0.748	0.141	0.760	0.744	
5	0.225	0.916	0.752	0.227	0.911	0.745	
10	0.361	0.879	0.745	0.362	0.878	0.742	
15	0.602	0.866	0.744	0.600	0.870	0.742	
20	0.928	0.865	0.742	0.937	0.869	0.739	

5.3.4 Test Plot

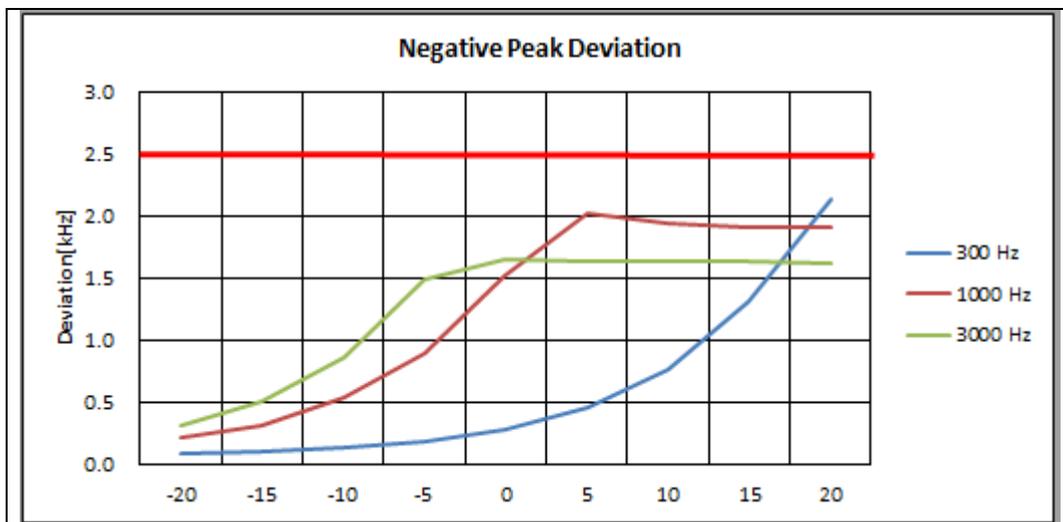
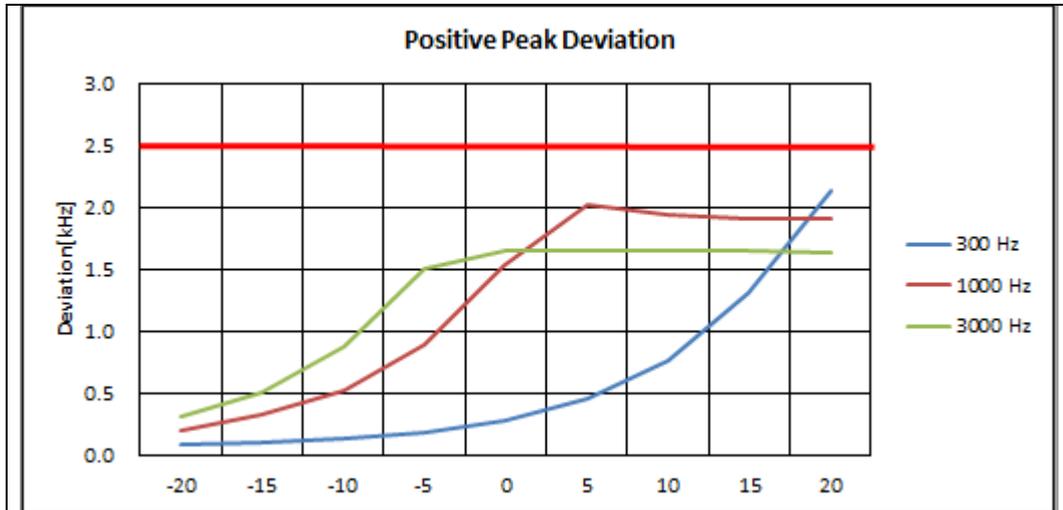
Figure 1. Plot of the Modulation Limiting

* 12.5BW

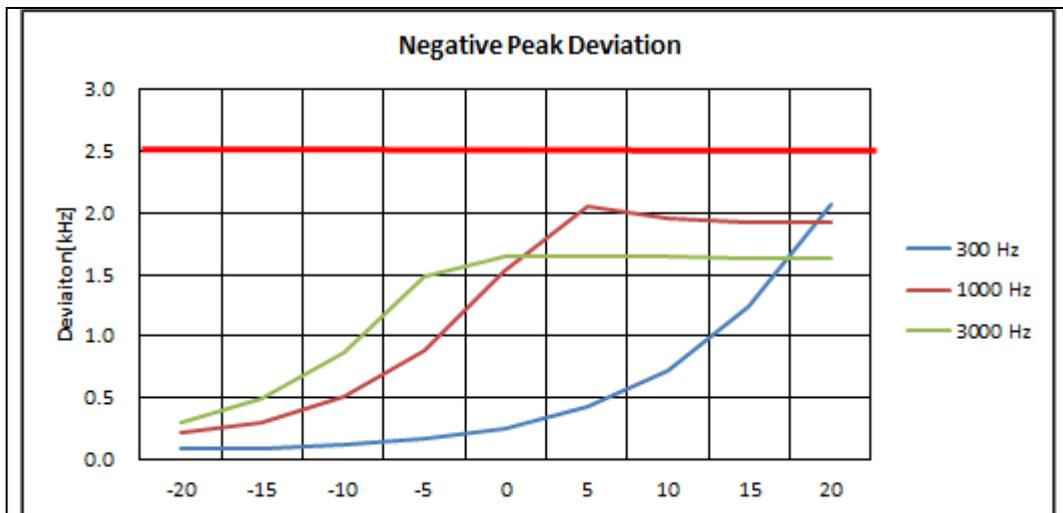
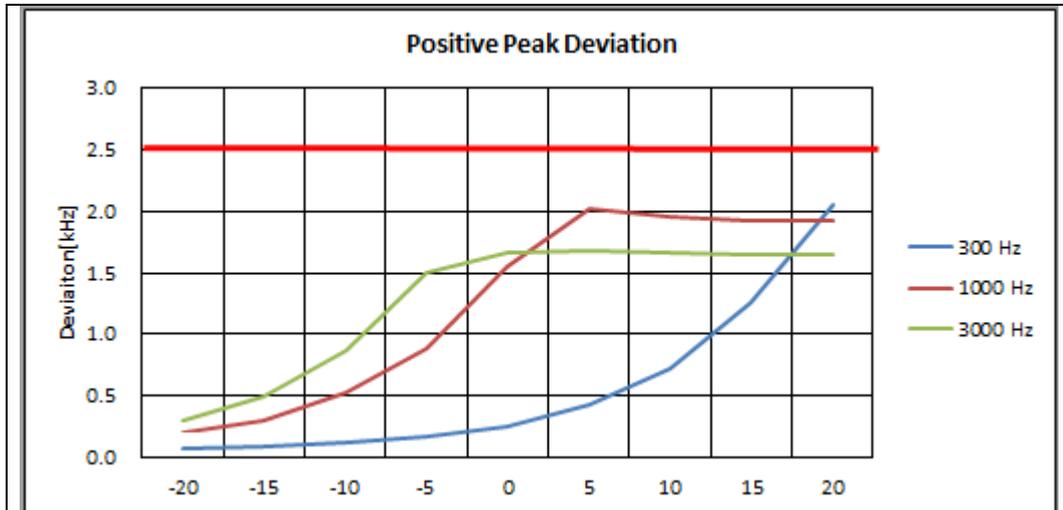
-Target Power_1W_406.10 MHz



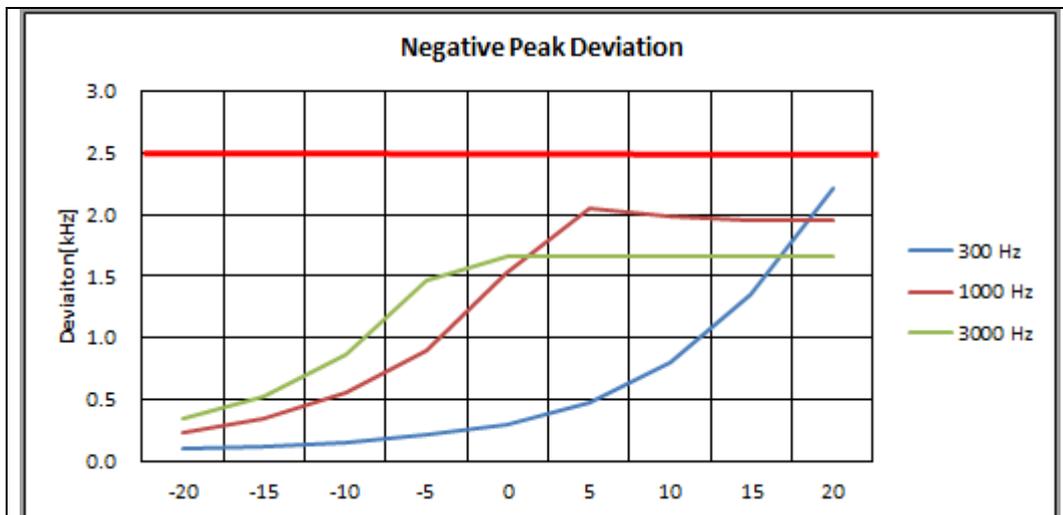
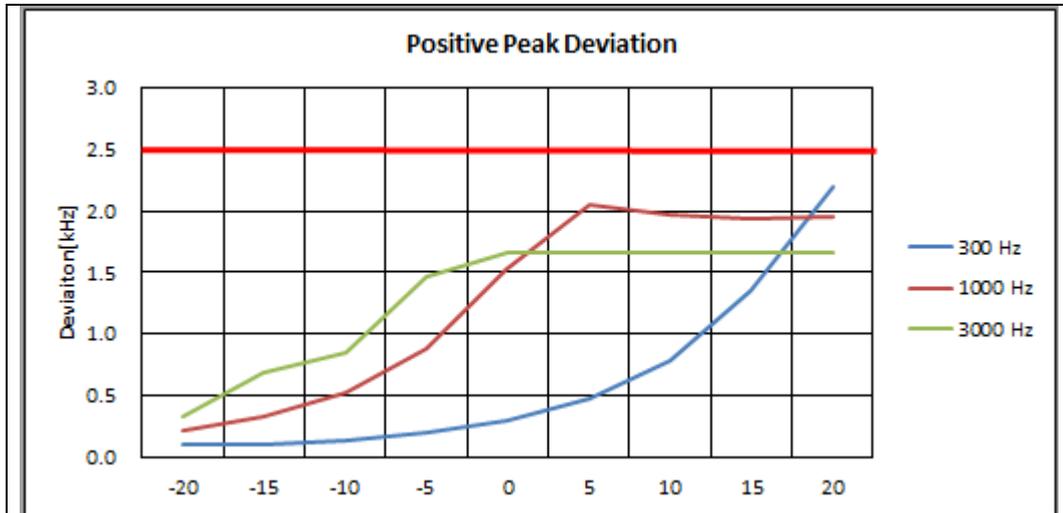
-Target Power_1W_459.00 MHz



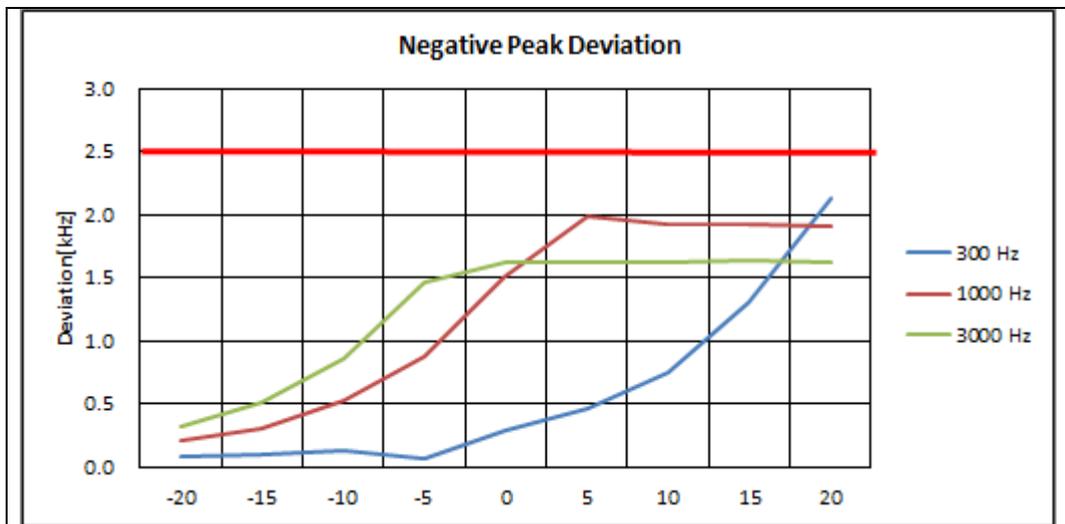
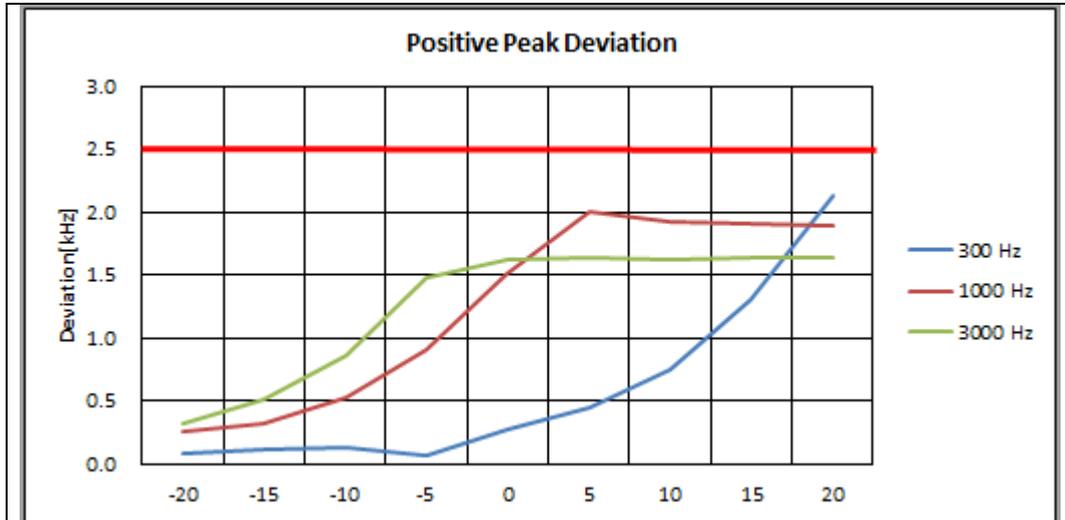
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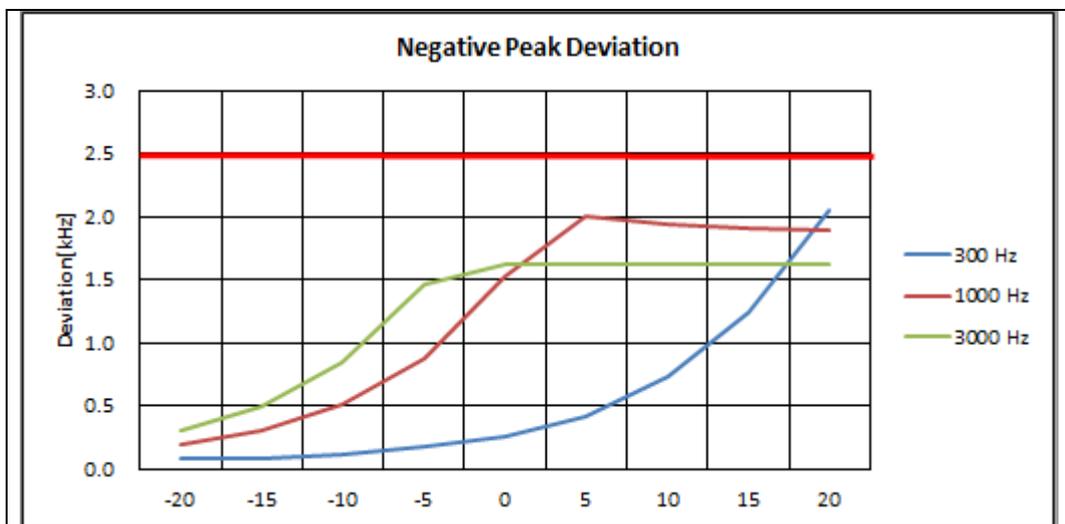
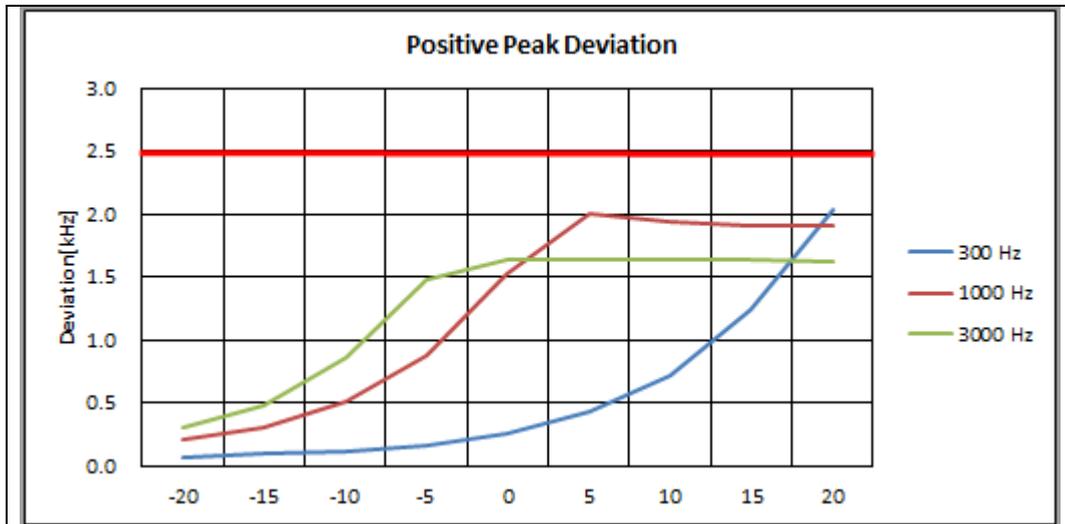
-Target Power_4W_406.10 MHz



-Target Power_4W_459.00 MHz

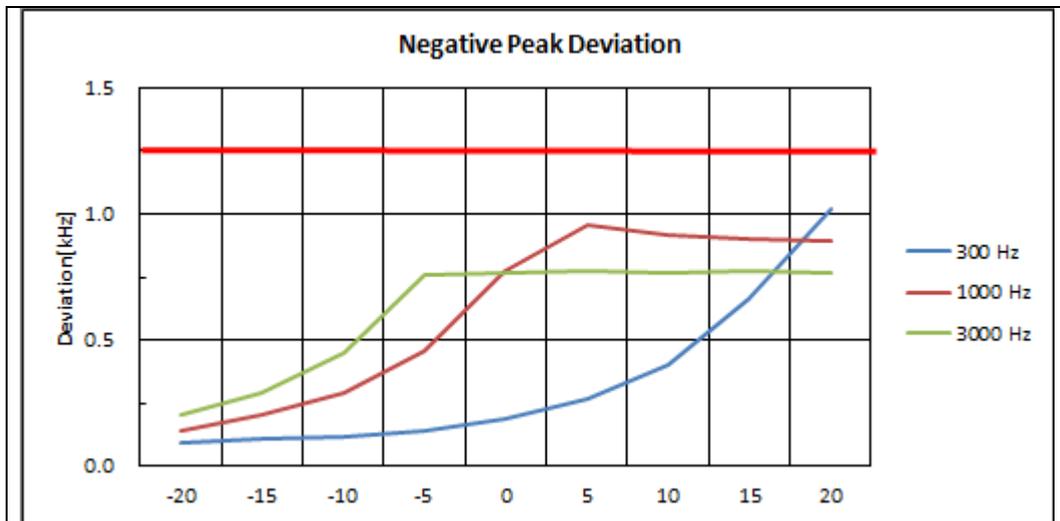
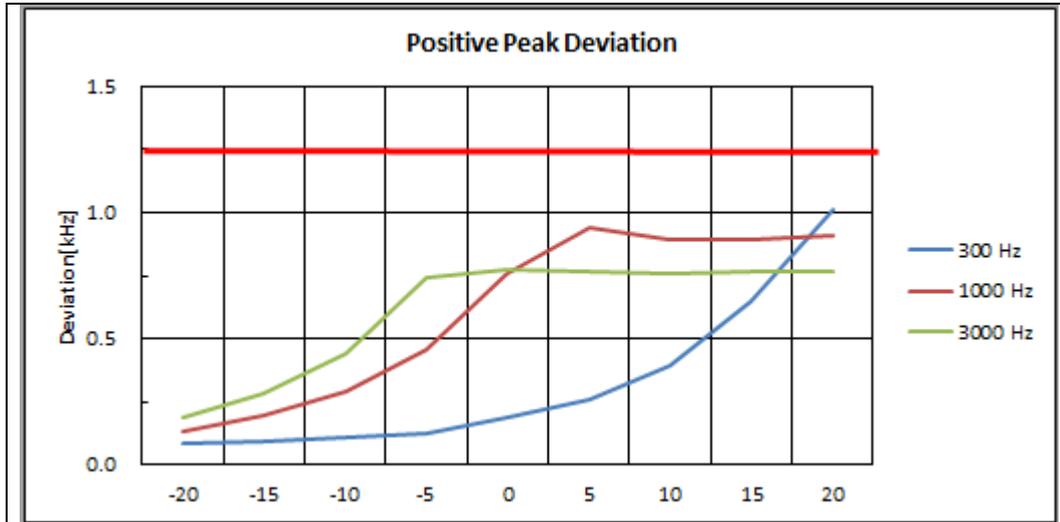


-Target Power_4W_512.00 MHz

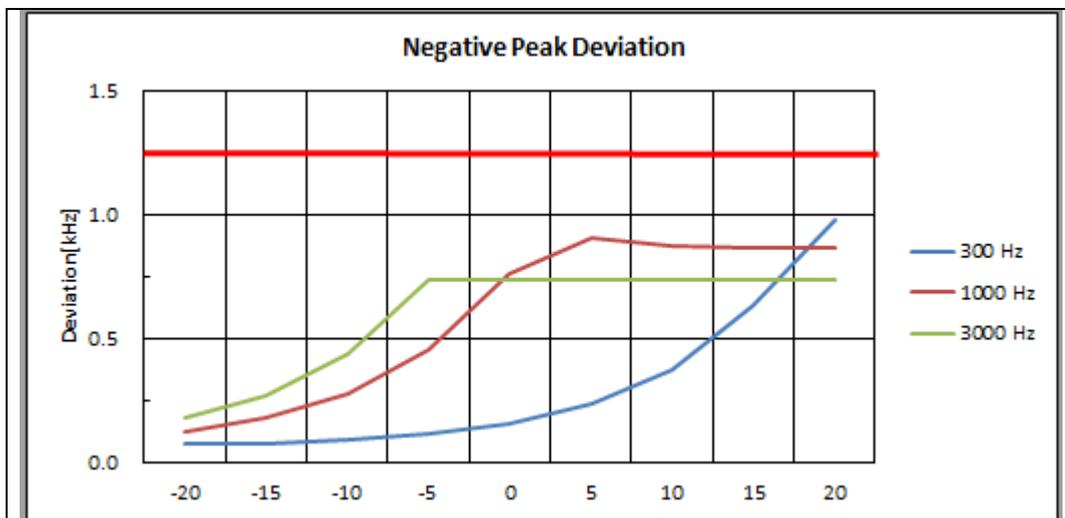
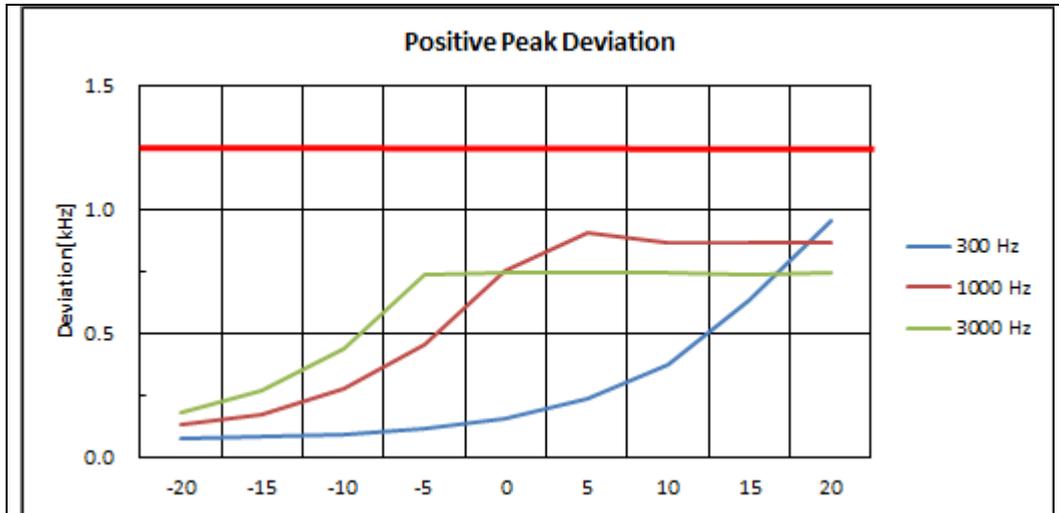


* 6.25BW

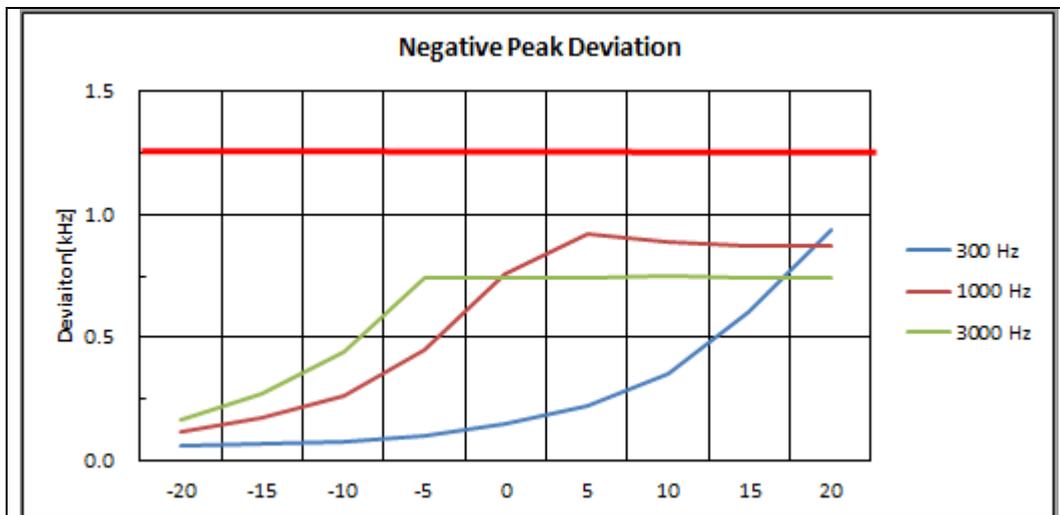
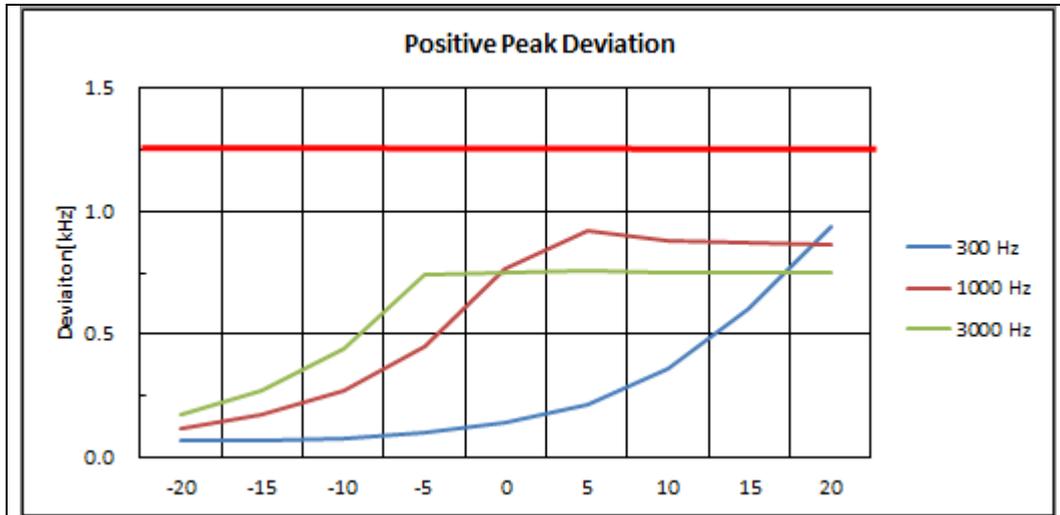
-Target Power_1W_406.10 MHz



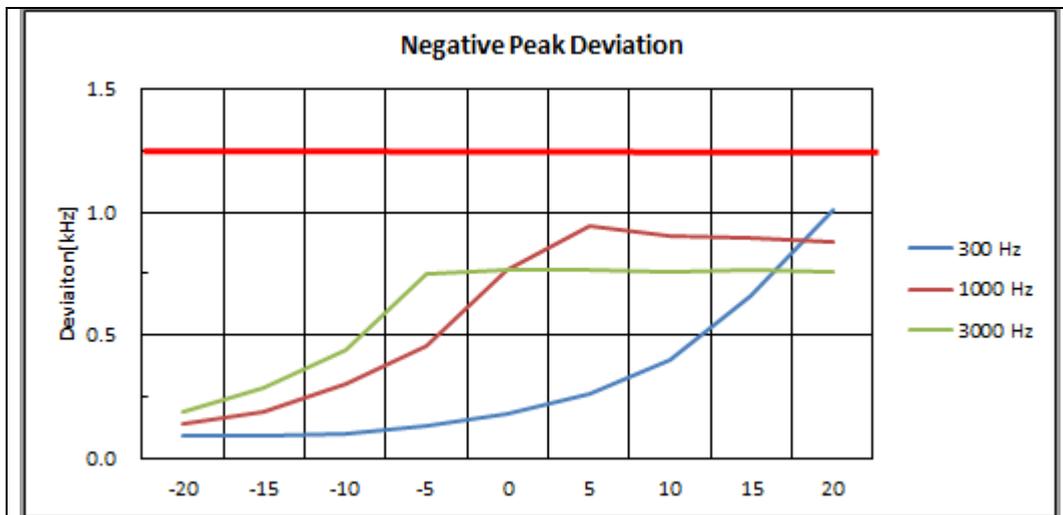
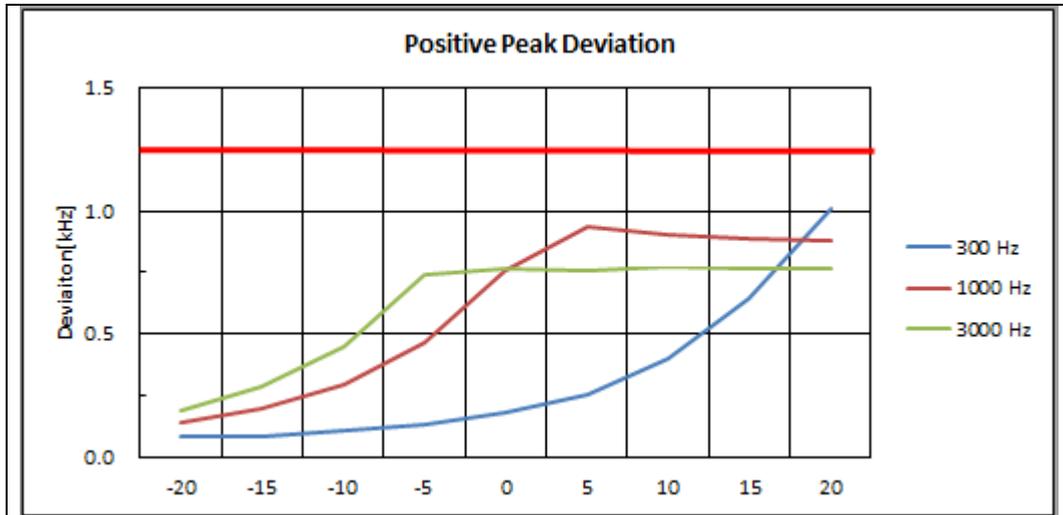
-Target Power_1W_459.00 MHz



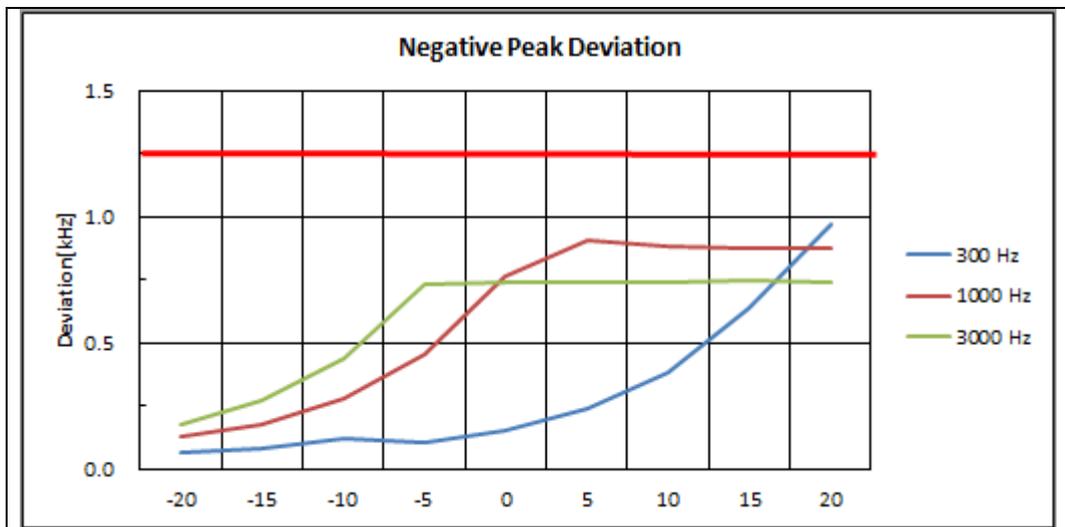
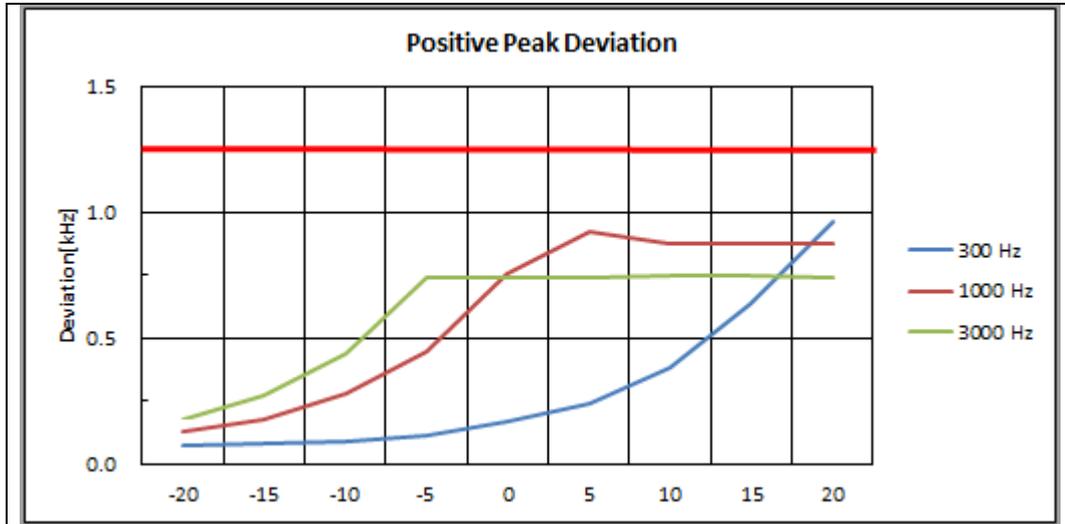
-Target Power_1W_512.00 MHz



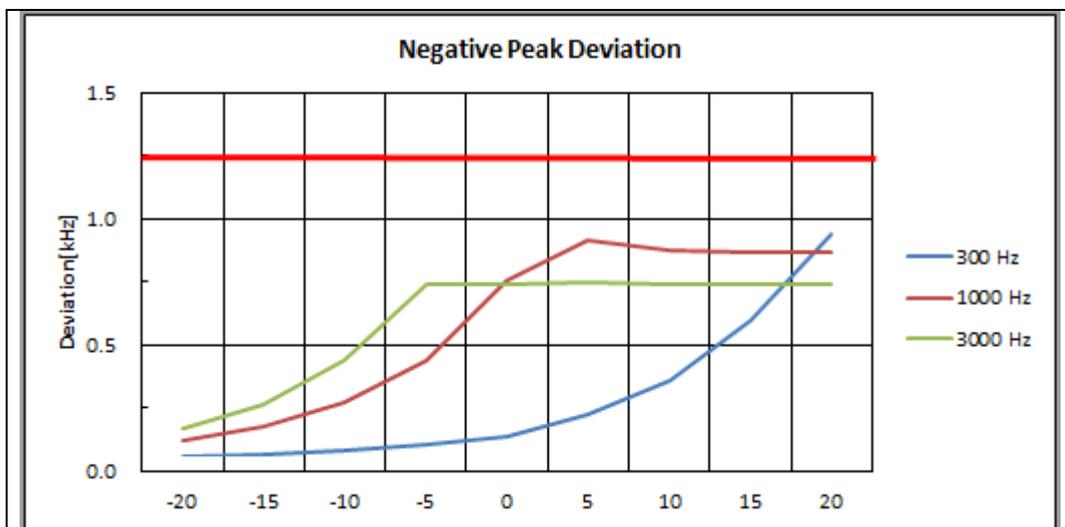
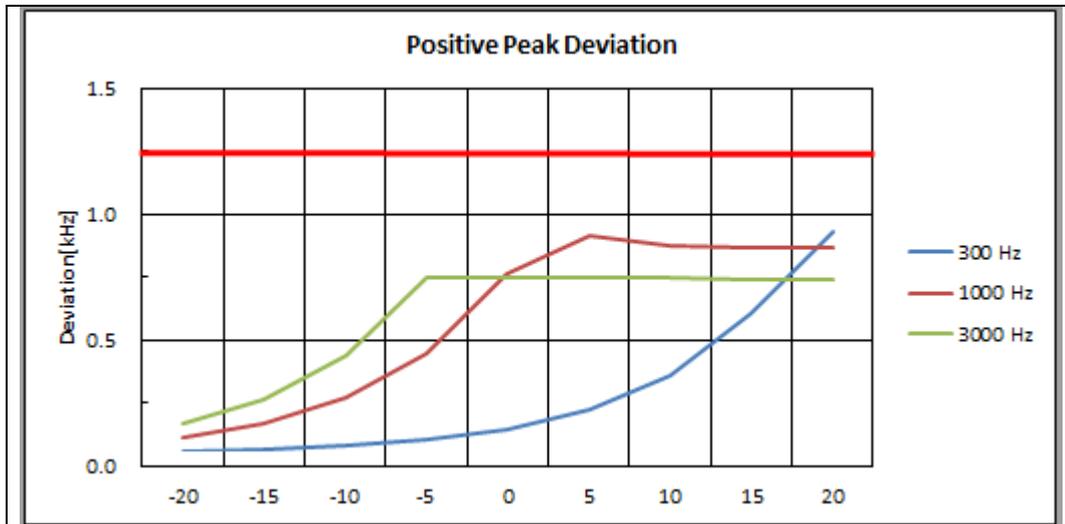
-Target Power_4W_406.10 MHz



-Target Power_4W_459.00 MHz



-Target Power_4W_512.00 MHz



5.4 Audio Frequency Response

5.4.1 Regulation

According to TIA-603-D, the audio frequency response from 300 Hz to 3000 Hz shall not vary more than +1 dB or -3 dB from a true 6 dB per octave pre-emphasis characteristics as referenced to the 1000 Hz level. The exception is from 500 Hz to 300 Hz, where additional 6 dB per octave rolloff is allowed.

5.4.2 Measurement 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 100 Hz to 5000 Hz are recorded and compared with the reference deviation as follows:

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

5.4.3 Test Result

- Complied

* 12.5BW

-Target Power_1W_406.10 MHz

Audio Frequency [Hz]	Measured Deviation [kHz]	Calculated Response [dB]
100	0.08	-15.84
200	0.09	-15.63
300	0.13	-11.81
400	0.20	-8.37
500	0.23	-6.83
600	0.29	-4.94
700	0.34	-3.59
800	0.39	-2.33
900	0.45	-1.10
1 000	0.51	0.00
1 500	0.79	3.69
2 000	1.04	6.15
2 500	1.15	6.96
3 000	0.84	4.24
4 000	0.09	-15.43
5 000	0.08	-15.94

-Target Power_1W_459.00 MHz

Audio Frequency [Hz]	Measured Deviation [kHz]	Calculated Response [dB]
100	0.07	-16.65
200	0.07	-17.51
300	0.13	-12.09
400	0.17	-9.47
500	0.23	-6.91
600	0.28	-5.12
700	0.33	-3.61
800	0.39	-2.21
900	0.45	-1.01
1 000	0.50	0.00
1 500	0.78	3.85
2 000	1.06	6.44
2 500	1.15	7.15
3 000	0.84	4.47
4 000	0.07	-17.25
5 000	0.07	-16.76

-Target Power_1W_512.00 MHz

Audio Frequency [Hz]	Measured Deviation [kHz]	Calculated Response [dB]
100	0.06	-18.38
200	0.06	-18.24
300	0.12	-12.57
400	0.17	-9.53
500	0.22	-7.31
600	0.27	-5.42
700	0.33	-3.85
800	0.38	-2.49
900	0.44	-1.21
1 000	0.51	0.00
1 500	0.79	3.87
2 000	1.05	6.37
2 500	1.16	7.18
3 000	0.84	4.42
4 000	0.06	-18.10
5 000	0.06	-18.67

-Target Power_4W_406.10 MHz

Audio Frequency [Hz]	Measured Deviation [kHz]	Calculated Response [dB]
100	0.08	-15.68
200	0.09	-15.58
300	0.15	-10.53
400	0.20	-8.28
500	0.25	-6.35
600	0.28	-5.10
700	0.34	-3.51
800	0.40	-2.19
900	0.45	-1.10
1 000	0.51	0.00
1 500	0.79	3.82
2 000	1.05	6.26
2 500	1.15	7.02
3 000	0.84	4.32
4 000	0.09	-14.71
5 000	0.09	-15.28

-Target Power 4W_459.00 MHz

Audio Frequency [Hz]	Measured Deviation [kHz]	Calculated Response [dB]
100	0.08	-15.79
200	0.07	-17.42
300	0.12	-12.20
400	0.18	-9.11
500	0.23	-6.98
600	0.28	-5.18
700	0.33	-3.72
800	0.40	-2.07
900	0.45	-0.98
1 000	0.51	0.00
1 500	0.79	3.86
2 000	1.05	6.33
2 500	1.15	7.17
3 000	0.83	4.33
4 000	0.07	-16.68
5 000	0.07	-16.68

-Target Power 4W_512.00 MHz

Audio Frequency [Hz]	Measured Deviation [kHz]	Calculated Response [dB]
100	0.06	-19.17
200	0.06	-18.87
300	0.12	-12.77
400	0.17	-9.63
500	0.22	-7.41
600	0.27	-5.38
700	0.33	-3.82
800	0.38	-2.56
900	0.45	-1.17
1 000	0.51	0.00
1 500	0.79	3.80
2 000	1.06	6.36
2 500	1.15	7.10
3 000	0.84	4.30
4 000	0.07	-17.48
5 000	0.06	-18.72

* 6.25BW

-Target Power_1W_406.10 MHz

Audio Frequency [Hz]	Measured Deviation [kHz]	Calculated Response [dB]
100	0.08	-10.46
200	0.08	-10.24
300	0.09	-9.51
400	0.11	-7.32
500	0.14	-5.69
600	0.15	-4.66
700	0.18	-3.00
800	0.19	-2.63
900	0.22	-1.29
1 000	0.26	0.00
1 500	0.36	2.80
2 000	0.48	5.36
2 500	0.52	6.05
3 000	0.39	3.61
4 000	0.08	-10.02
5 000	0.08	-10.80

-Target Power_1W_459.00 MHz

Audio Frequency [Hz]	Measured Deviation [kHz]	Calculated Response [dB]
100	0.06	-12.74
200	0.06	-12.18
300	0.08	-10.46
400	0.10	-8.39
500	0.13	-6.16
600	0.17	-3.90
700	0.19	-2.96
800	0.20	-2.24
900	0.24	-0.80
1 000	0.26	0.00
1 500	0.38	3.25
2 000	0.51	5.78
2 500	0.54	6.41
3 000	0.40	3.83
4 000	0.06	-12.88
5 000	0.06	-13.34

-Target Power_1W_512.00 MHz

Audio Frequency [Hz]	Measured Deviation [kHz]	Calculated Response [dB]
100	0.06	-13.06
200	0.06	-12.61
300	0.07	-10.64
400	0.09	-8.85
500	0.12	-6.37
600	0.14	-5.04
700	0.17	-3.32
800	0.20	-2.05
900	0.22	-1.14
1 000	0.25	0.00
1 500	0.37	3.43
2 000	0.50	6.02
2 500	0.54	6.68
3 000	0.40	4.06
4 000	0.06	-13.06
5 000	0.05	-13.71

-Target Power_4W_406.10 MHz

Audio Frequency [Hz]	Measured Deviation [kHz]	Calculated Response [dB]
100	0.07	-10.95
200	0.08	-9.95
300	0.08	-9.85
400	0.12	-7.12
500	0.14	-5.66
600	0.16	-4.36
700	0.18	-3.08
800	0.20	-2.18
900	0.24	-0.73
1 000	0.26	0.00
1 500	0.36	2.89
2 000	0.47	5.16
2 500	0.52	6.02
3 000	0.39	3.44
4 000	0.08	-10.06
5 000	0.07	-11.19

-Target Power 4W_459.00 MHz

Audio Frequency [Hz]	Measured Deviation [kHz]	Calculated Response [dB]
100	0.06	-12.42
200	0.07	-11.48
300	0.08	-10.07
400	0.10	-7.96
500	0.13	-6.12
600	0.15	-4.49
700	0.17	-3.37
800	0.20	-2.29
900	0.24	-0.60
1 000	0.26	0.00
1 500	0.38	3.56
2 000	0.50	5.87
2 500	0.56	6.82
3 000	0.40	4.00
4 000	0.06	-12.14
5 000	0.06	-12.28

-Target Power 4W_512.00 MHz

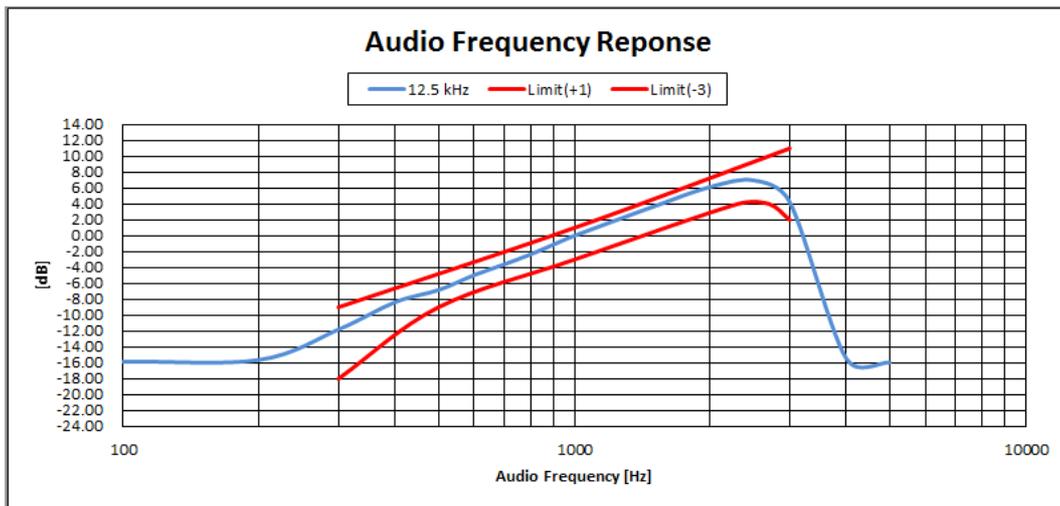
Audio Frequency [Hz]	Measured Deviation [kHz]	Calculated Response [dB]
100	0.05	-14.44
200	0.06	-12.79
300	0.07	-11.41
400	0.09	-8.60
500	0.12	-6.77
600	0.14	-5.02
700	0.17	-3.50
800	0.20	-2.22
900	0.23	-0.90
1 000	0.25	0.00
1 500	0.38	3.53
2 000	0.50	5.85
2 500	0.55	6.70
3 000	0.40	4.02
4 000	0.05	-13.58
5 000	0.05	-13.91

5.4.4 Test Plot

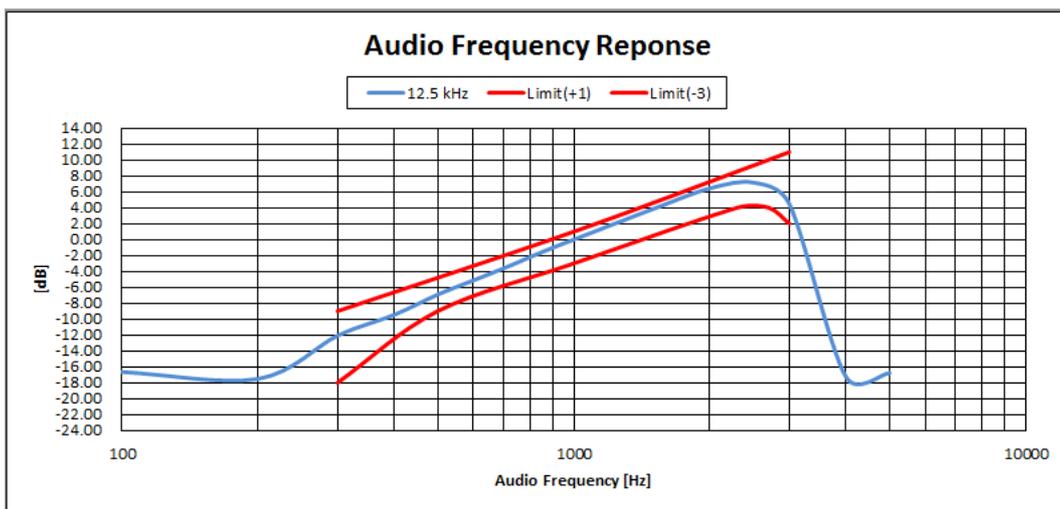
- Complied

* 12.5BW

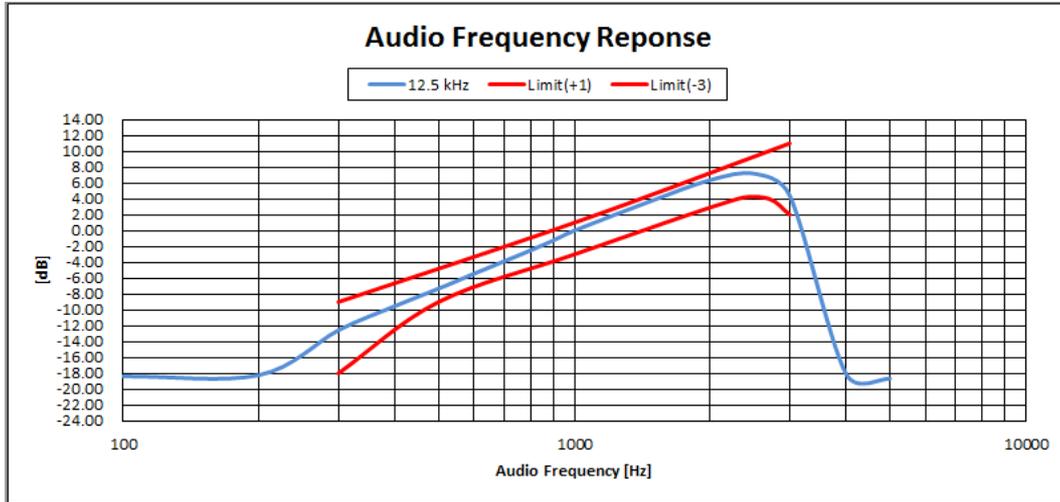
-Target Power_1W_406.10 MHz



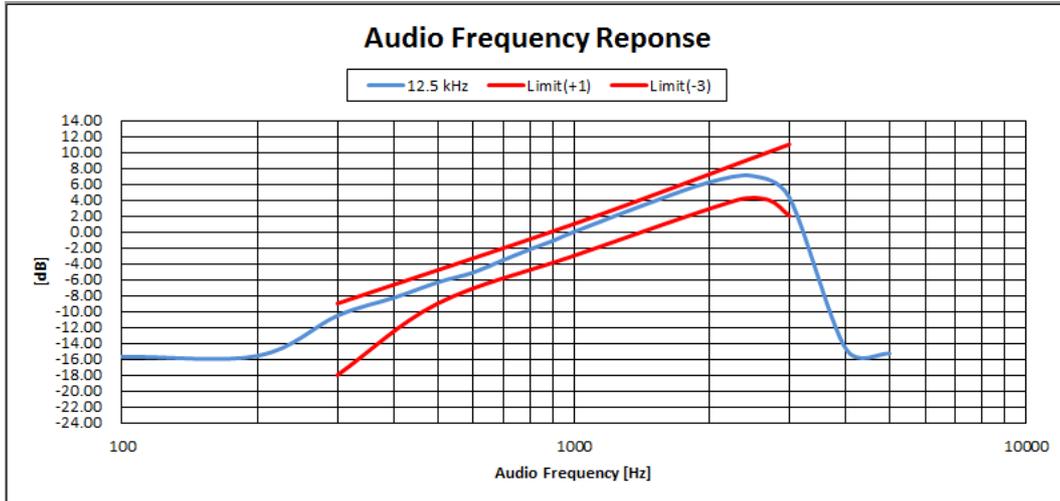
-Target Power_1W_459.00 MHz



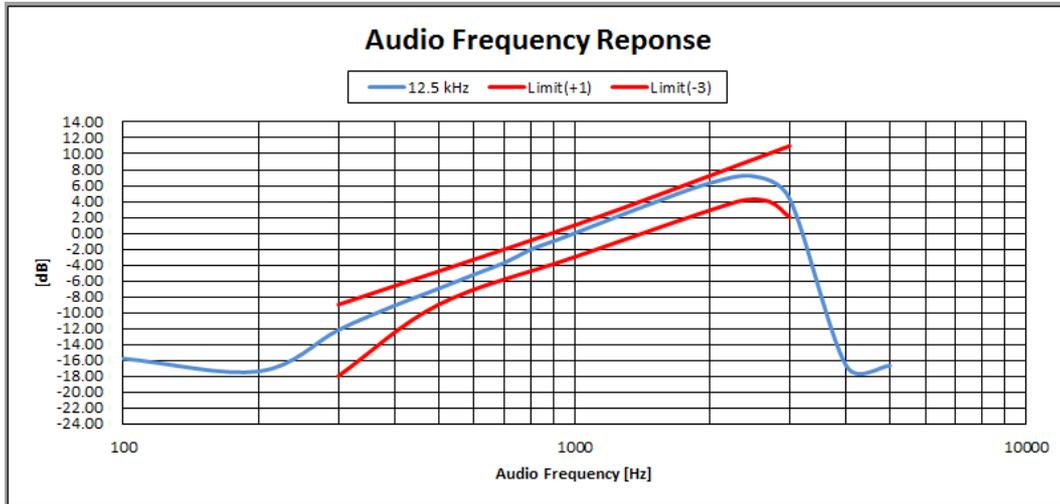
-Target Power_1W_512.00 MHz



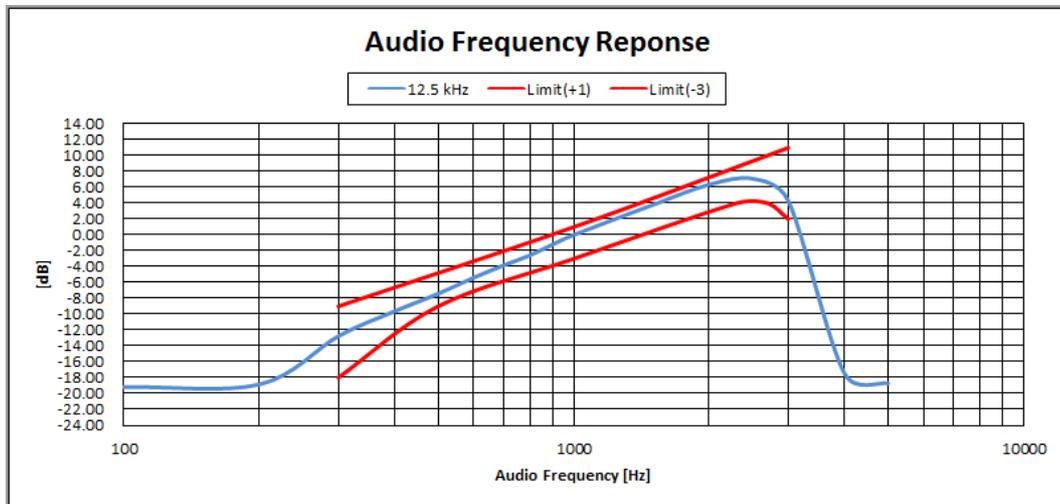
-Target Power_4W_406.10 MHz



-Target Power_4W_459.00 MHz

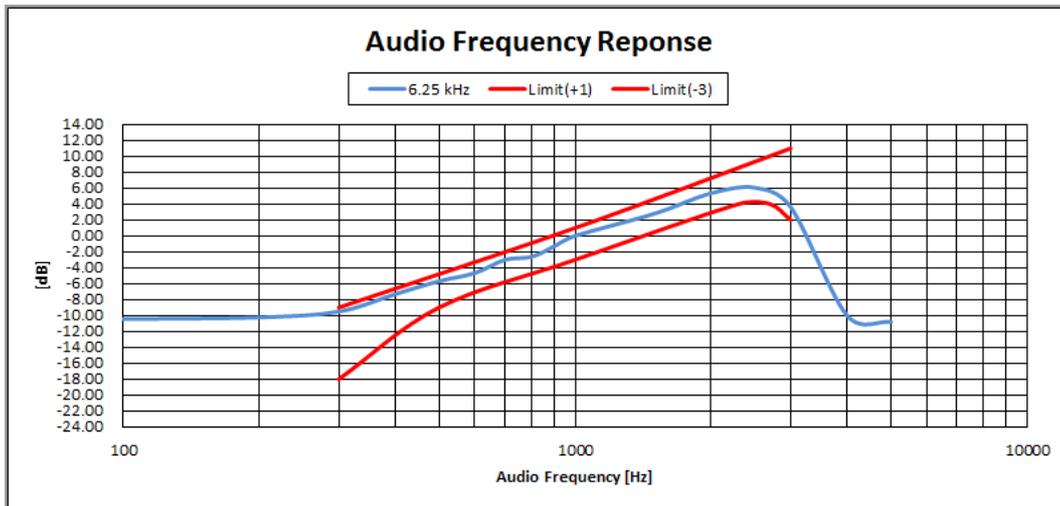


-Target Power_4W_512.00 MHz

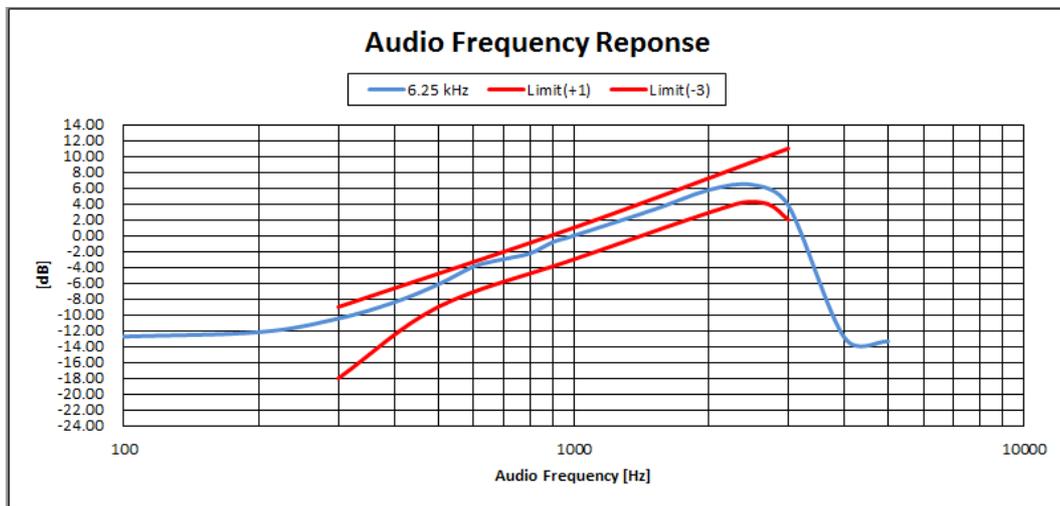


* 6.25BW

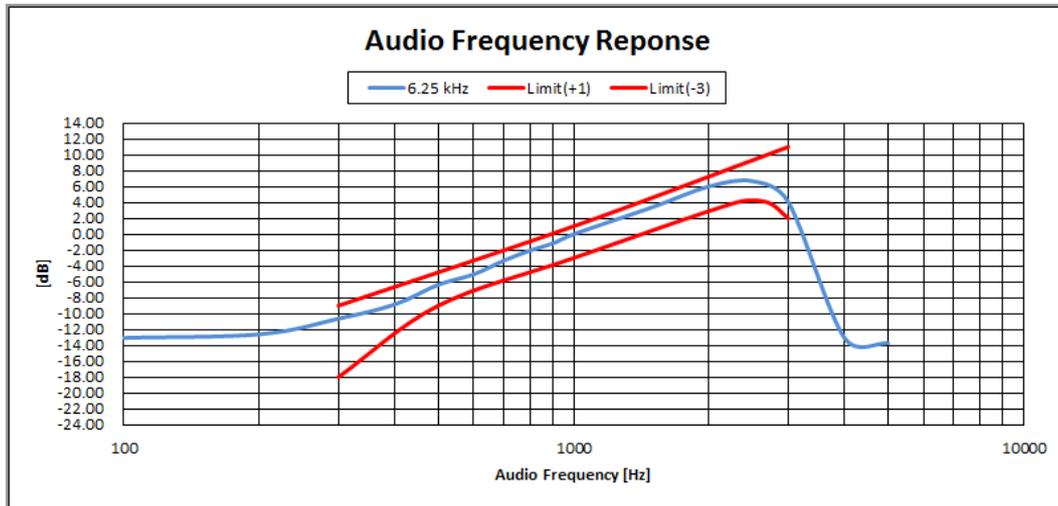
-Target Power_1W_406.10 MHz



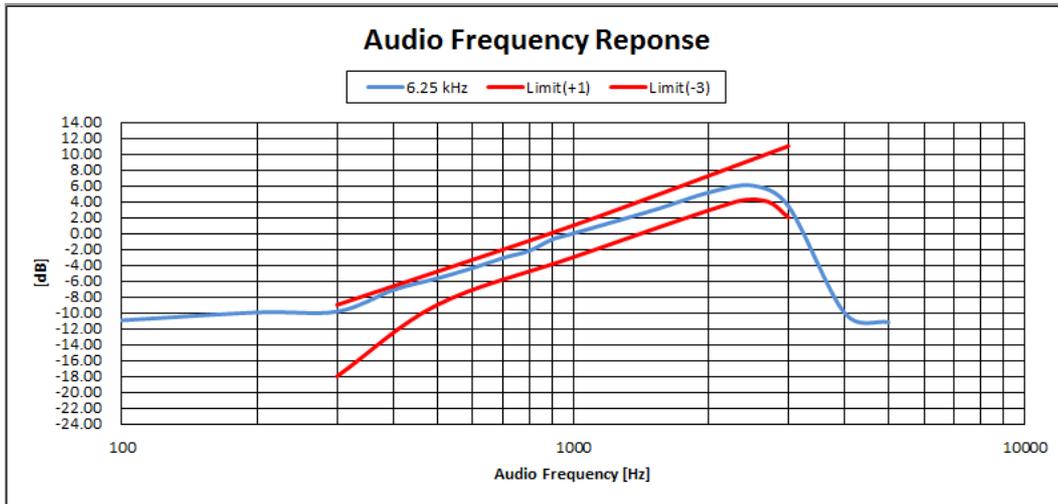
-Target Power_1W_459.00 MHz



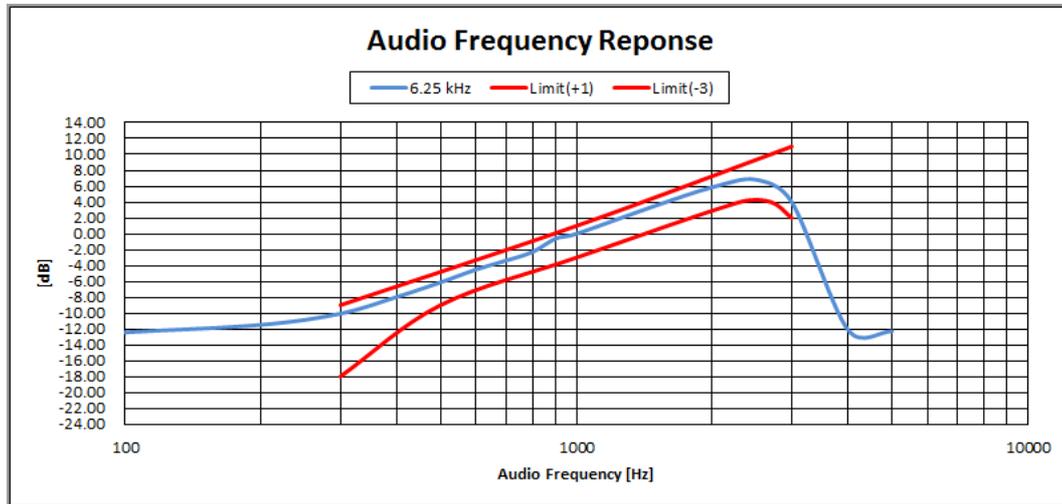
-Target Power_1W_512.00 MHz



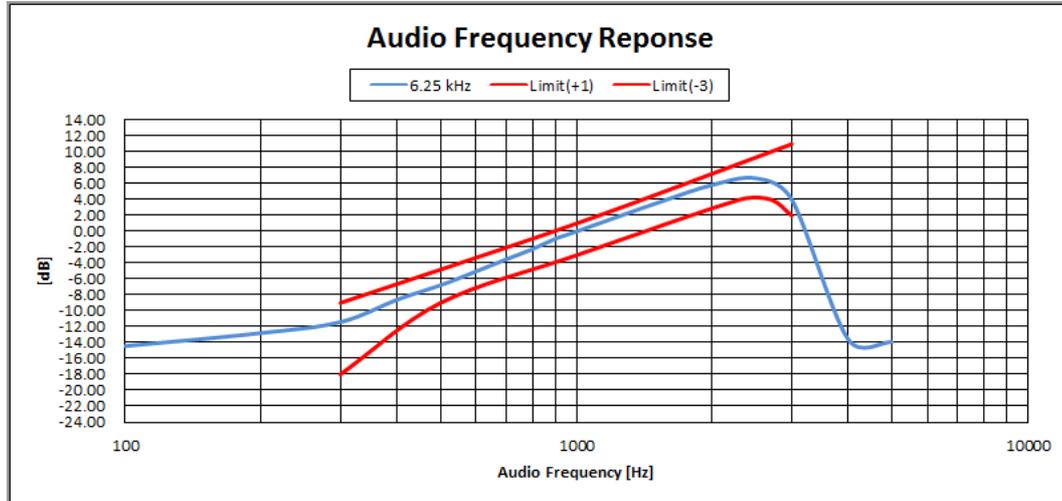
-Target Power_4W_406.10 MHz



-Target Power_4W_459.00 MHz



-Target Power_4W_512.00 MHz



5.5 Audio Low Pass Filter Frequency Response

5.5.1 Regulation

According to TIA-603-D, 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.

5.5.2 Measurement 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.

5.5.3 Test Result

- Complied

* 12.5BW

-Target Power_1W_406.10 MHz

Audio Frequency [kHz]	Calculated Response [dB]	Limit [dB]
1	0.0	0.0
2	-3.3	0.0
3	-5.8	0.0
4	-15.5	-12.5
5	-33.4	-22.2
6	-38.5	-30.1
7	-38.9	-36.8
8	<-50	-42.6
9	<-50	-47.7
10	<-55	-52.3
20	<-85	-82.4

-Target Power_1W_459.00 MHz

Audio Frequency [kHz]	Calculated Response [dB]	Limit [dB]
1	0.0	0.0
2	-3.2	0.0
3	-5.9	0.0
4	-15.6	-12.5
5	-33.6	-22.2
6	-39.0	-30.1
7	-39.7	-36.8
8	<-50	-42.6
9	<-50	-47.7
10	<-55	-52.3
20	<-85	-82.4

-Target Power_1W_512.00 MHz

Audio Frequency [kHz]	Calculated Response [dB]	Limit [dB]
1	0.0	0.0
2	-3.2	0.0
3	-5.8	0.0
4	-15.5	-12.5
5	-33.3	-22.2
6	-38.6	-30.1
7	-39.1	-36.8
8	<-50	-42.6
9	<-50	-47.7
10	<-55	-52.3
20	<-85	-82.4

-Target Power_4W_406.10 MHz

Audio Frequency [kHz]	Calculated Response [dB]	Limit [dB]
1	0.0	0.0
2	-3.2	0.0
3	-5.9	0.0
4	-15.3	-12.5
5	-33.2	-22.2
6	-43.2	-30.1
7	-44.6	-36.8
8	<-50	-42.6
9	<-50	-47.7
10	<-55	-52.3
20	<-85	-82.4

-Target Power_4W_459.00 MHz

Audio Frequency [kHz]	Calculated Response [dB]	Limit [dB]
1	0.0	0.0
2	-3.3	0.0
3	-5.9	0.0
4	-15.7	-12.5
5	-34.5	-22.2
6	-43.3	-30.1
7	-45.1	-36.8
8	<-50	-42.6
9	<-50	-47.7
10	<-55	-52.3
20	<-85	-82.4

-Target Power_4W_512.00 MHz

Audio Frequency [kHz]	Calculated Response [dB]	Limit [dB]
1	0.0	0.0
2	-3.3	0.0
3	-5.8	0.0
4	-15.5	-12.5
5	-33.4	-22.2
6	-43.2	-30.1
7	-44.6	-36.8
8	<-50	-42.6
9	<-50	-47.7
10	<-55	-52.3
20	<-85	-82.4

* 6.25BW

-Target Power_1W_406.10 MHz

Audio Frequency [kHz]	Calculated Response [dB]	Limit [dB]
1	0.0	0.0
2	-2.5	0.0
3	-5.8	0.0
4	-15.6	-12.5
5	-34.0	-22.2
6	-40.8	-30.1
7	-41.5	-36.8
8	<-50	-42.6
9	<-50	-47.7
10	<-55	-52.3
20	<-85	-82.4

-Target Power_1W_459.00 MHz

Audio Frequency [kHz]	Calculated Response [dB]	Limit [dB]
1	0.0	0.0
2	-2.4	0.0
3	-5.7	0.0
4	-15.5	-12.5
5	-33.6	-22.2
6	-39.3	-30.1
7	-39.8	-36.8
8	<-50	-42.6
9	<-50	-47.7
10	<-55	-52.3
20	<-85	-82.4

-Target Power_1W_512.00 MHz

Audio Frequency [kHz]	Calculated Response [dB]	Limit [dB]
1	0.0	0.0
2	-2.4	0.0
3	-5.7	0.0
4	-15.6	-12.5
5	-33.6	-22.2
6	-38.7	-30.1
7	-39.4	-36.8
8	<-50	-42.6
9	<-50	-47.7
10	<-55	-52.3
20	<-85	-82.4

-Target Power_4W_406.10 MHz

Audio Frequency [kHz]	Calculated Response [dB]	Limit [dB]
1	0.0	0.0
2	-2.5	0.0
3	-5.8	0.0
4	-15.7	-12.5
5	-34.5	-22.2
6	-43.7	-30.1
7	-45.1	-36.8
8	<-50	-42.6
9	<-50	-47.7
10	<-55	-52.3
20	<-85	-82.4

-Target Power_4W_459.00 MHz

Audio Frequency [kHz]	Calculated Response [dB]	Limit [dB]
1	0.0	0.0
2	-2.4	0.0
3	-5.7	0.0
4	-15.4	-12.5
5	-34.3	-22.2
6	-43.4	-30.1
7	-44.7	-36.8
8	<-50	-42.6
9	<-50	-47.7
10	<-55	-52.3
20	<-85	-82.4

-Target Power_4W_512.00 MHz

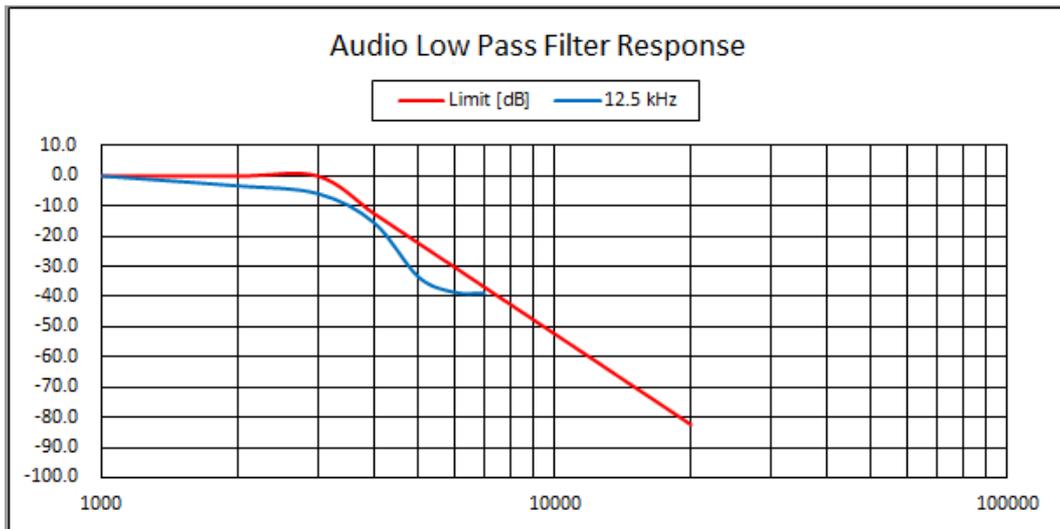
Audio Frequency [kHz]	Calculated Response [dB]	Limit [dB]
1	0.0	0.0
2	-2.4	0.0
3	-5.7	0.0
4	-15.6	-12.5
5	-33.4	-22.2
6	-43.4	-30.1
7	-44.8	-36.8
8	<-50	-42.6
9	<-50	-47.7
10	<-55	-52.3
20	<-85	-82.4

5.5.4 Test Plots

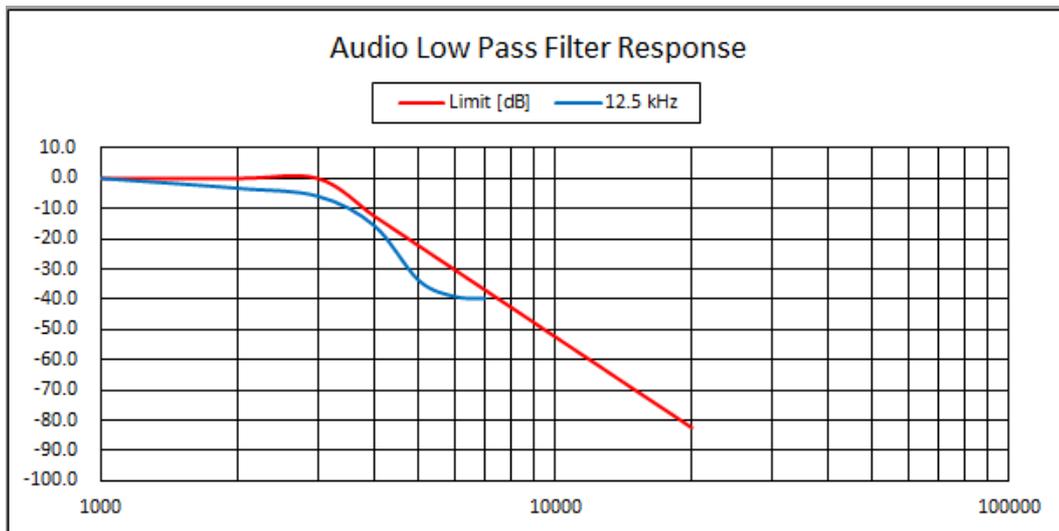
- Complied

* 12.5BW

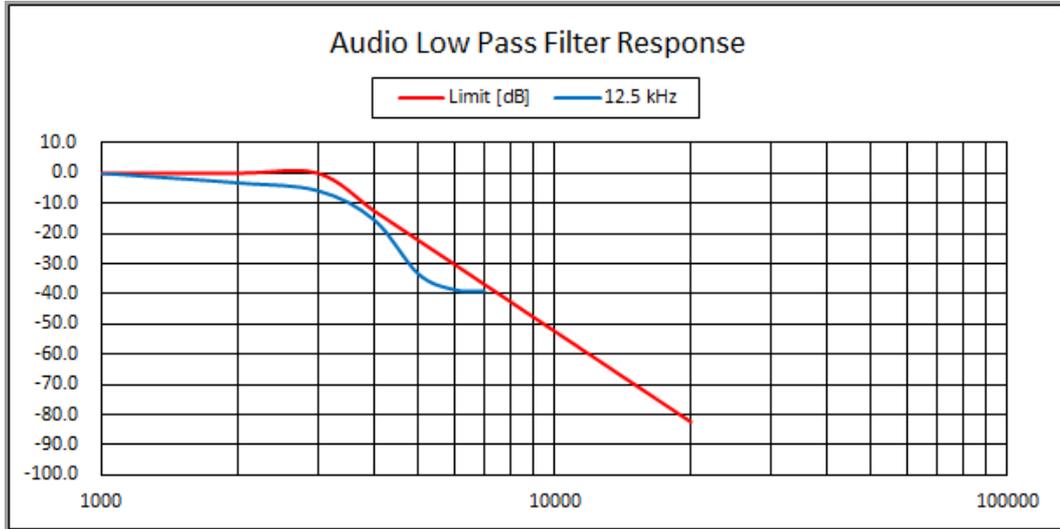
-Target Power_1W_406.10 MHz



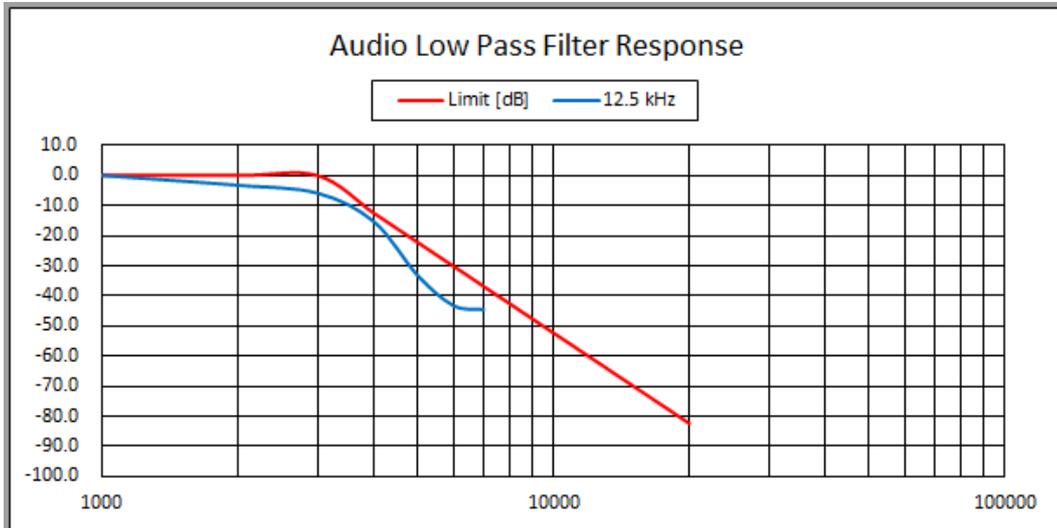
-Target Power_1W_459.00 MHz



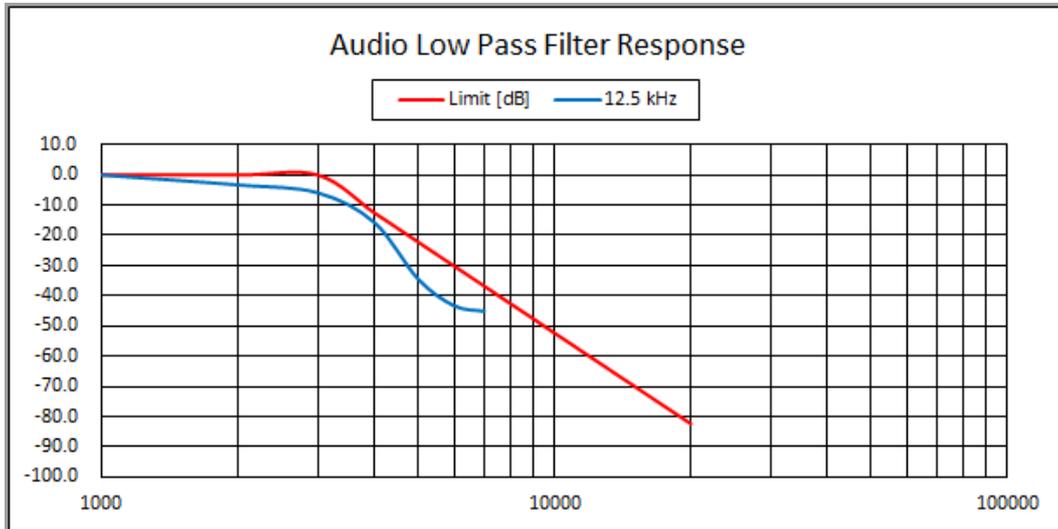
-Target Power_1W_512.00 MHz



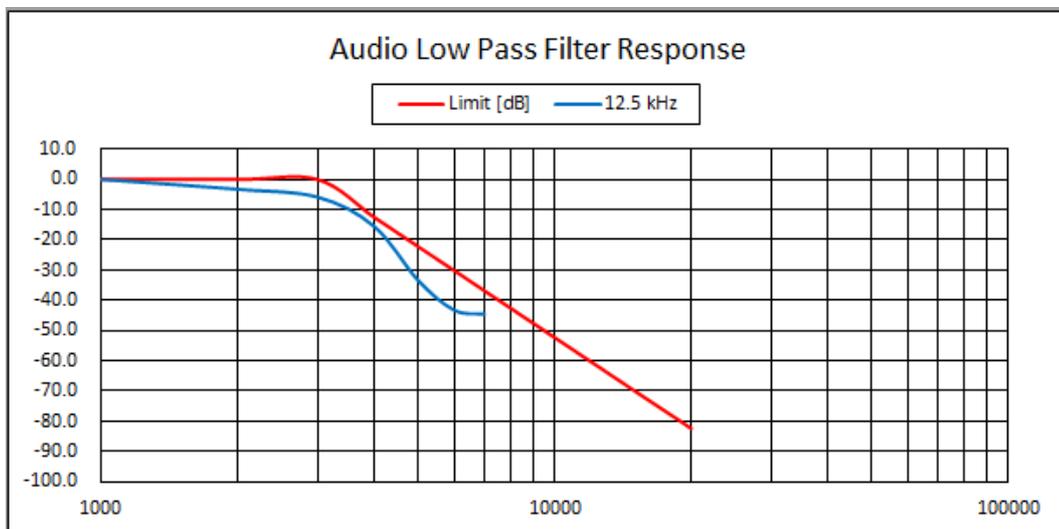
-Target Power_4W_406.10 MHz



-Target Power_4W_459.00 MHz

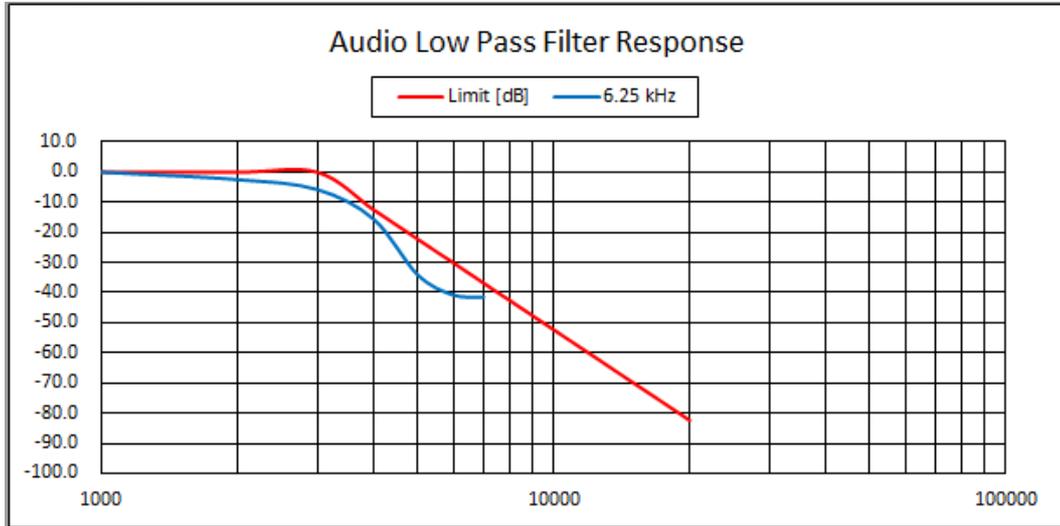


-Target Power_4W_512.00 MHz

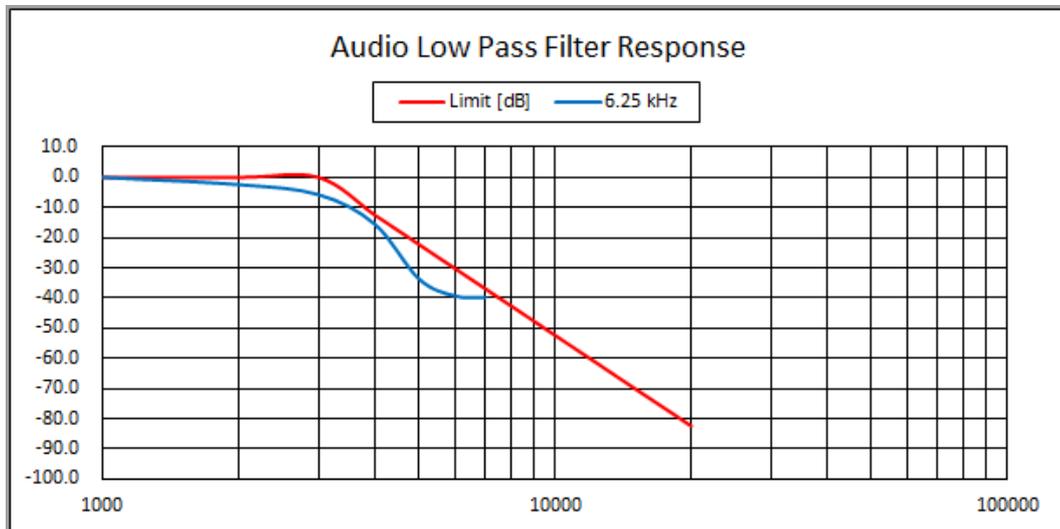


* 6.25BW

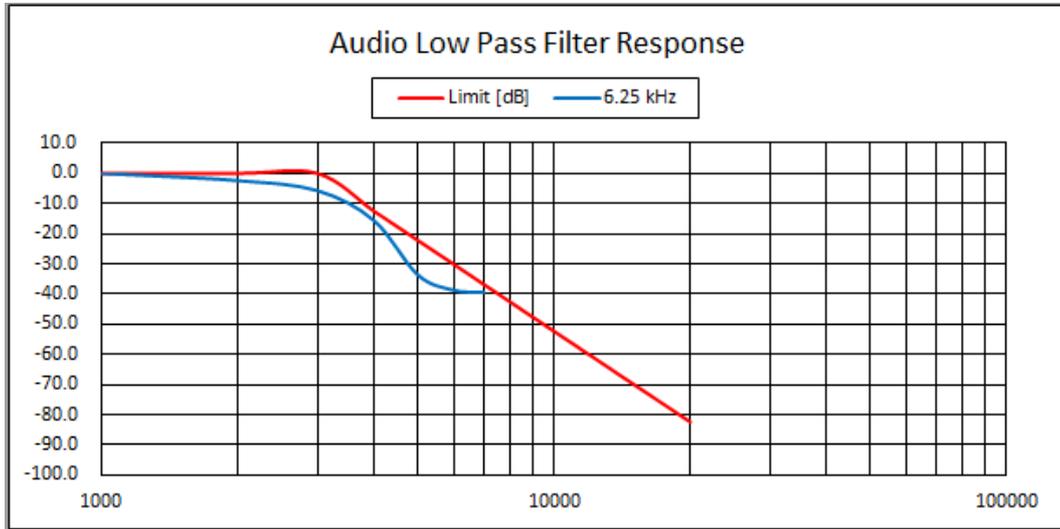
-Target Power_1W_406.10 MHz



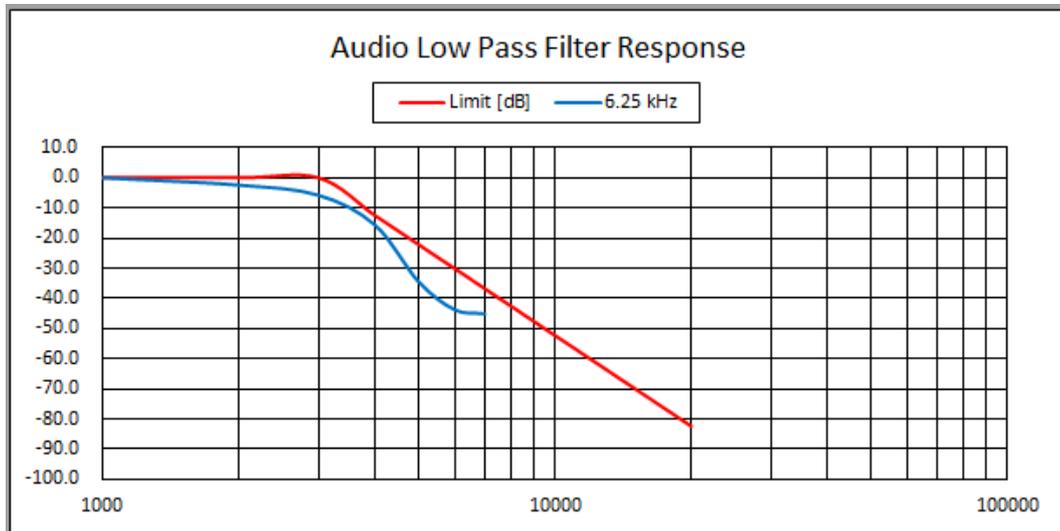
-Target Power_1W_459.00 MHz



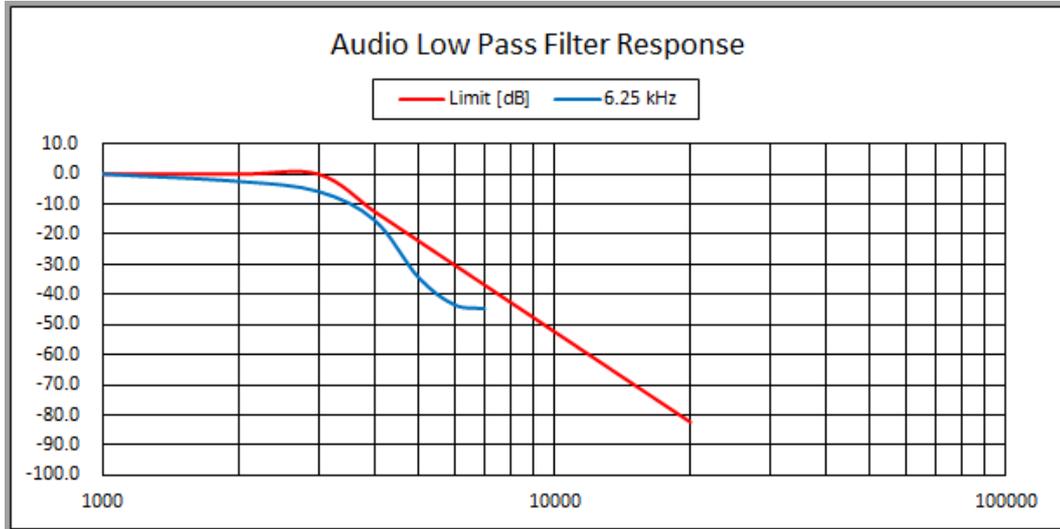
-Target Power_1W_512.00 MHz



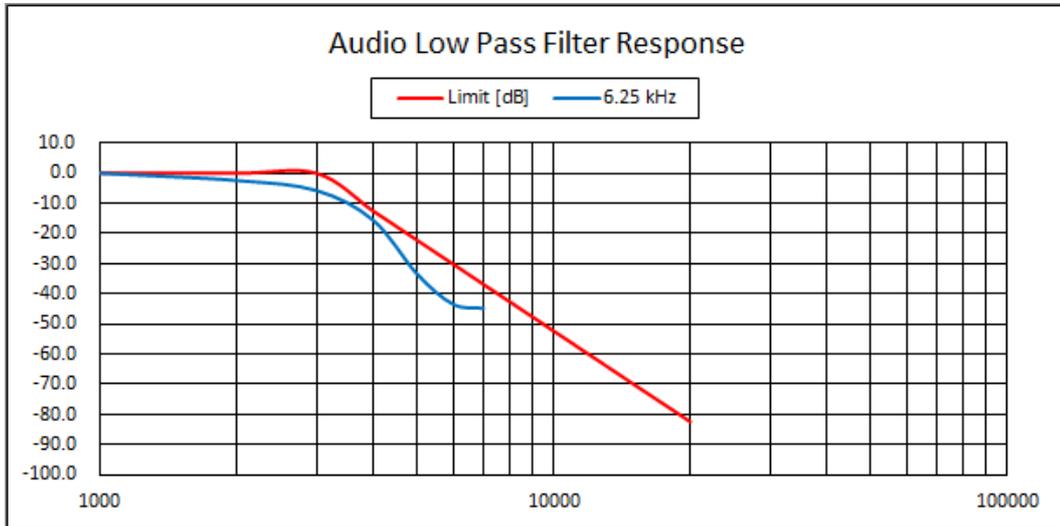
-Target Power_4W_406.10 MHz



-Target Power_4W_459.00 MHz



-Target Power_4W_512.00 MHz



5.6 Occupied Bandwidth

5.6.1 Regulation

According to §90.210(d), Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (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 $7.27(f_d - 2.88 \text{ kHz})$ 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 $50 + 10 \log(P)$ 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 or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission 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 (o) 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, an alternate procedure may be used provided prior Commission approval is obtained.

5.6.2 Measurement 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.

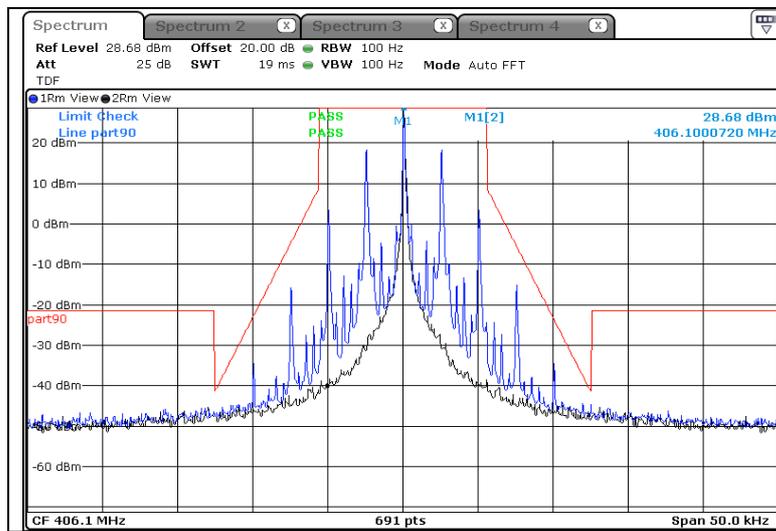
5.6.3 Test Result

- Complied

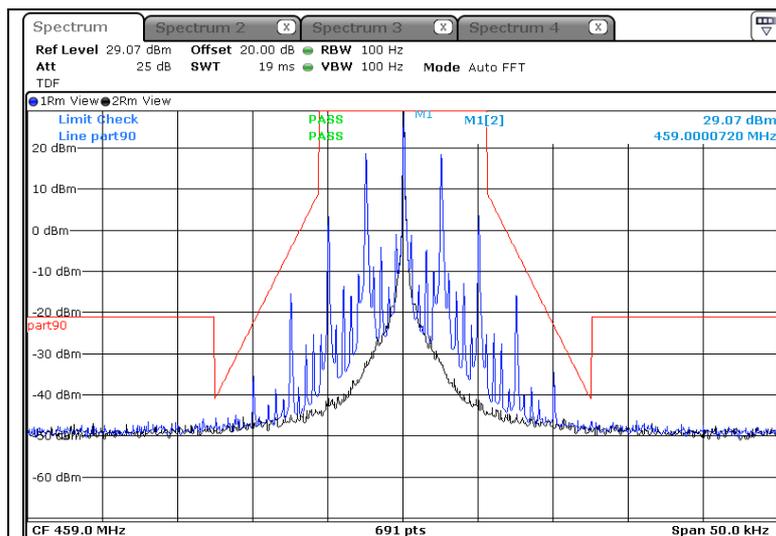
Figure 4. plot of Occupied Bandwidth

* 12.5BW

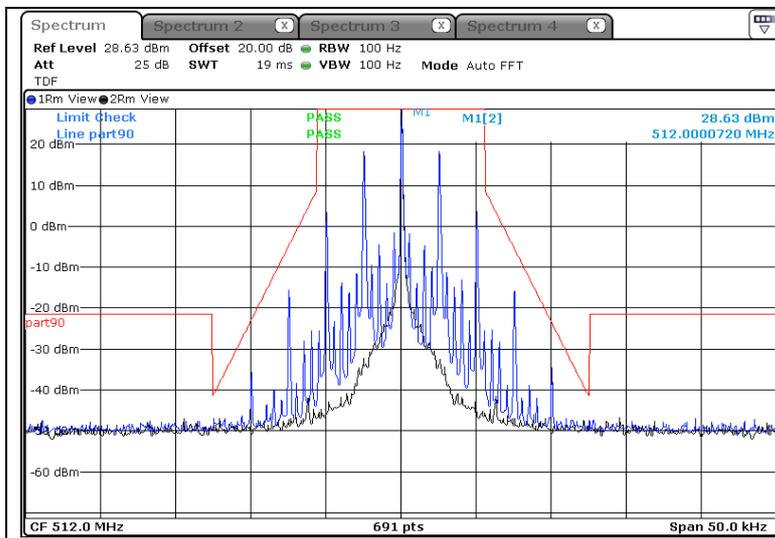
-Target Power_1W_406.10 MHz



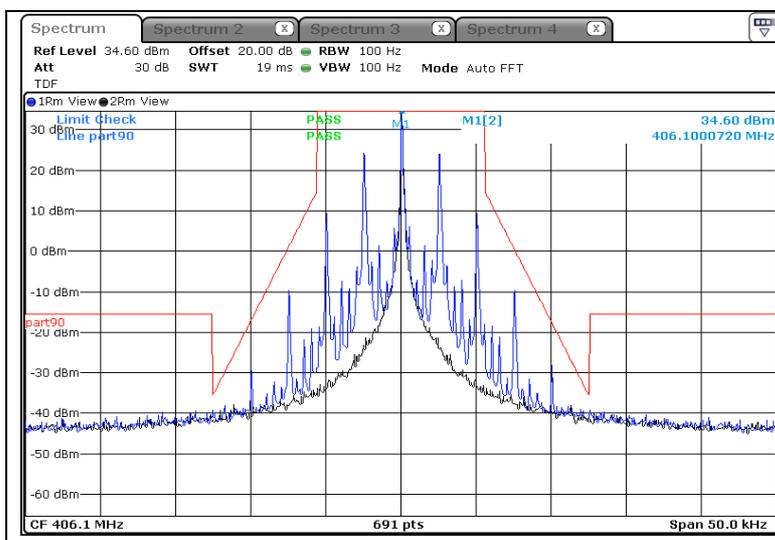
-Target Power_1W_459.00 MHz



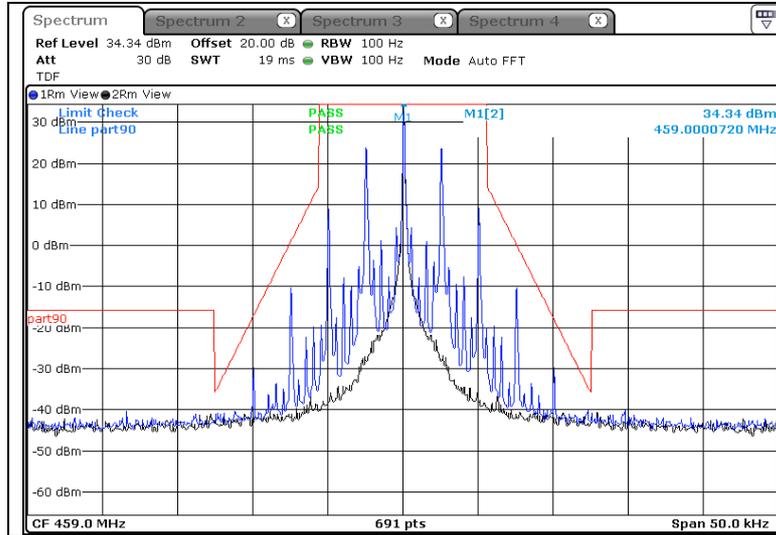
-Target Power_1W_512.00 MHz



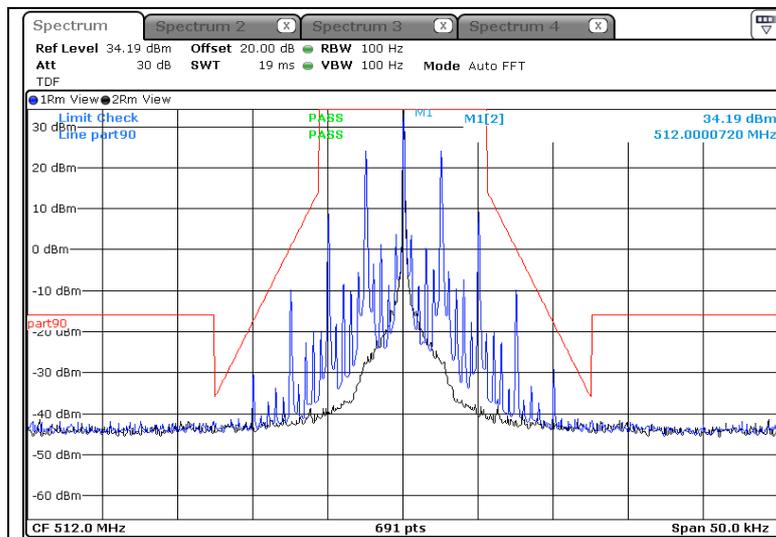
-Target Power_4W_406.10 MHz



-Target Power_4W_459.00 MHz

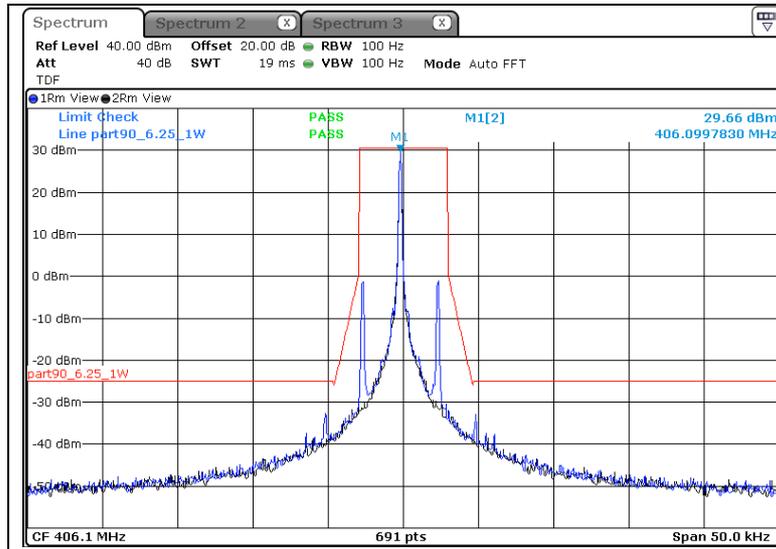


-Target Power_4W_512.00 MHz

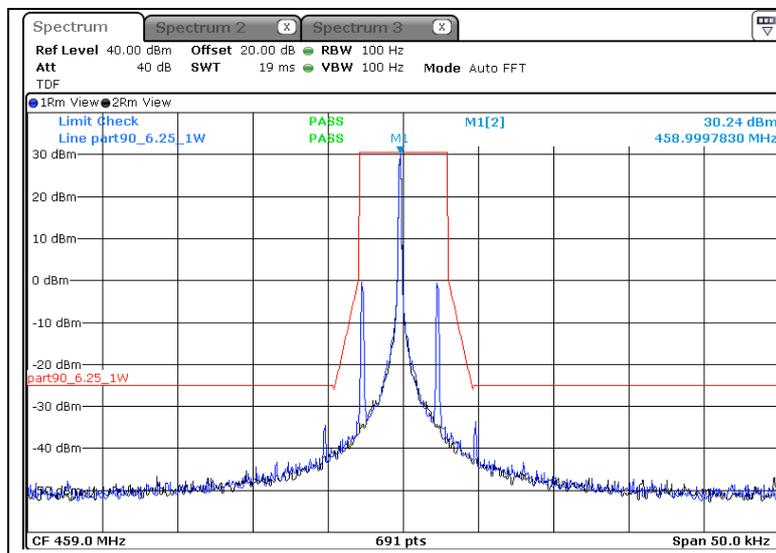


* 6.25BW

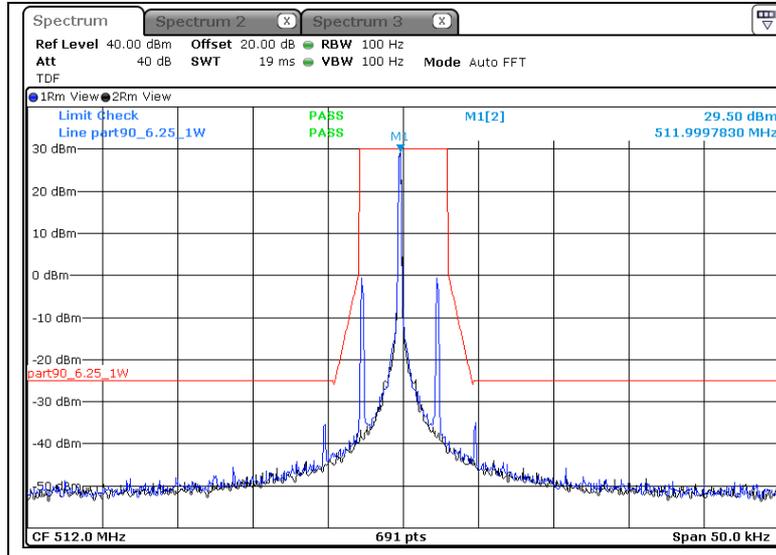
-Target Power_1W_406.10 MHz



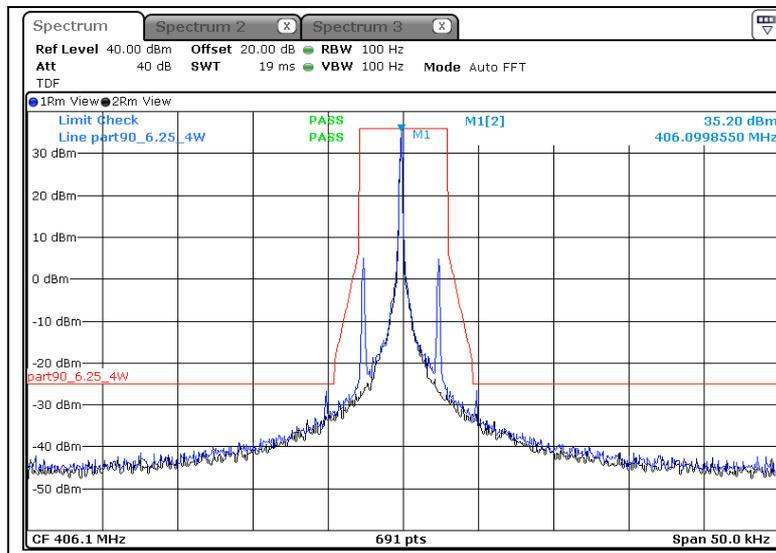
-Target Power_1W_459.00 MHz



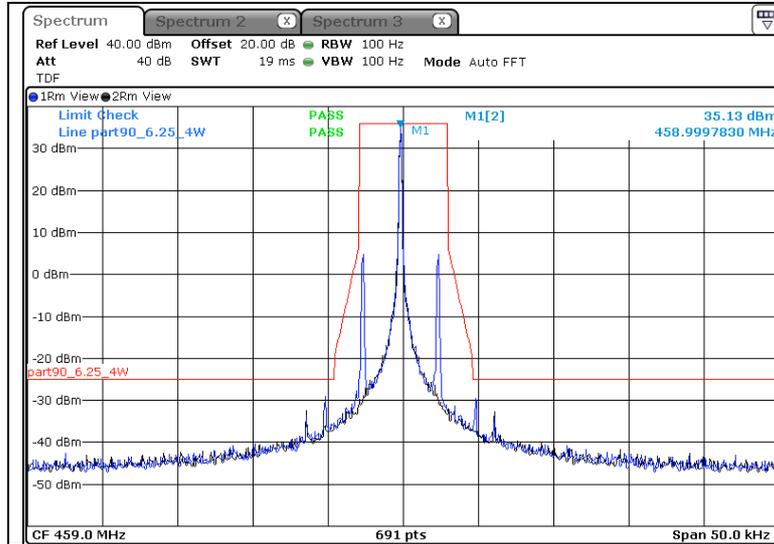
-Target Power_1W_512.00 MHz



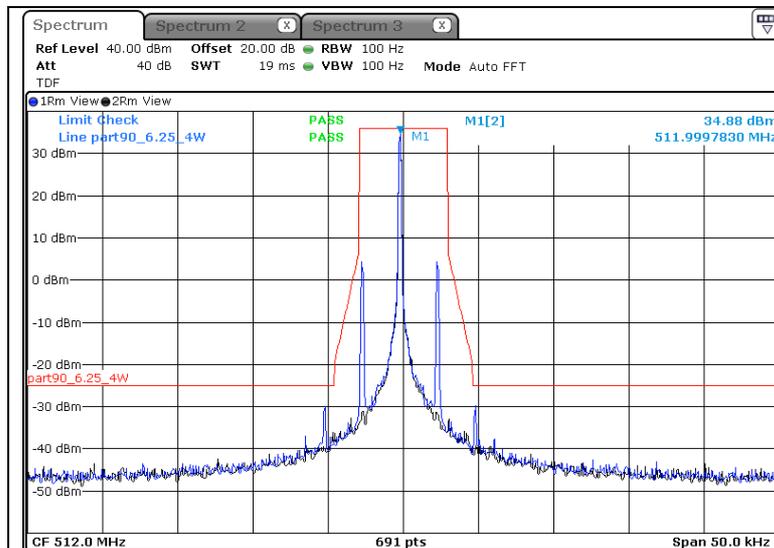
-Target Power_4W_406.10 MHz



-Target Power_4W_459.00 MHz



-Target Power_4W_512.00 MHz



5.7 Transient Frequency Behaviour of the Transmitter

5.7.1 Regulation

According to §90.214, Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time intervals ^{1 2}	Maximum frequency difference ³	All equipment	
		150 to 174 MHz	421 to 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
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 Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
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 Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
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 t_{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 1 kHz 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 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

5.7.2 Measurement Procedure

1. Set the test receiver to measure FM deviation with the audio bandwidth set at ≤ 50 Hz to $\geq 15,000$ 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 -100 dBm.
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 ton . 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 toff .
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.

5.7.3 Test Result

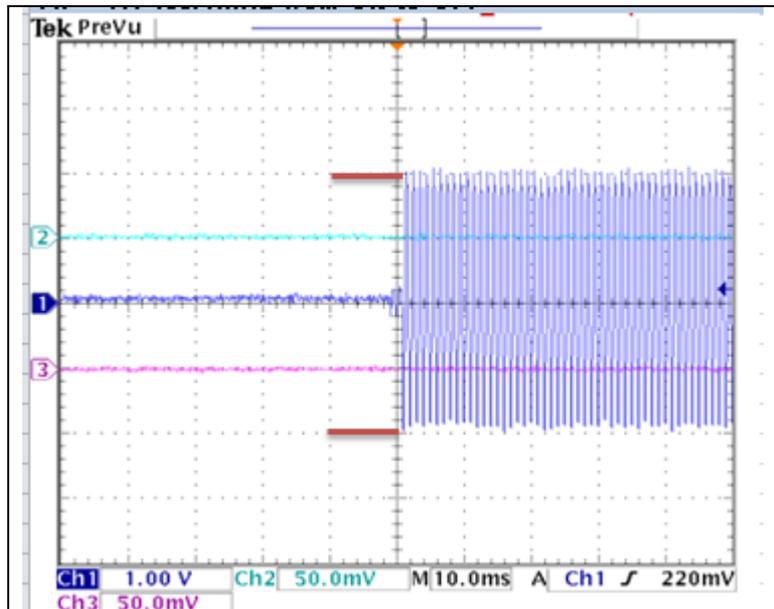
- Complied

Figure 4. plot of Transient Frequency Behaviour of the Transmitter

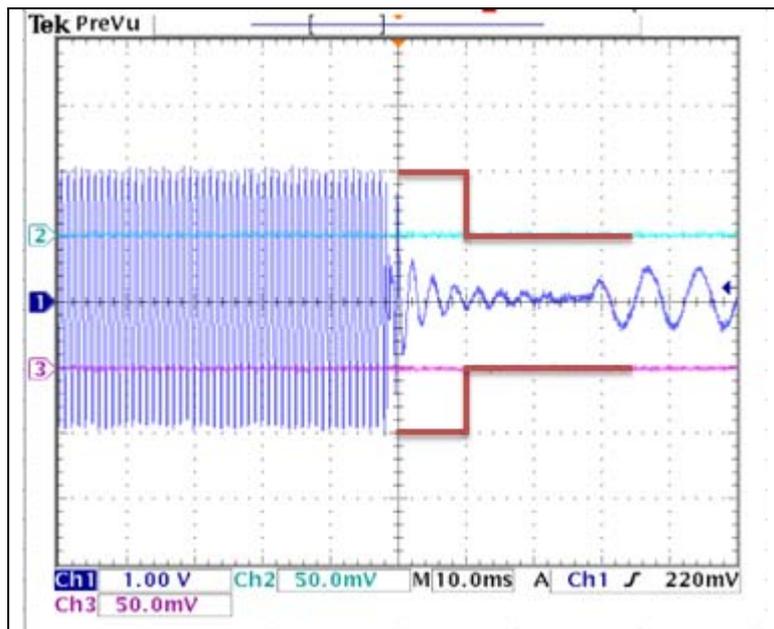
* 12.5BW

-Target Power_1W_406.10 MHz

-On to Off

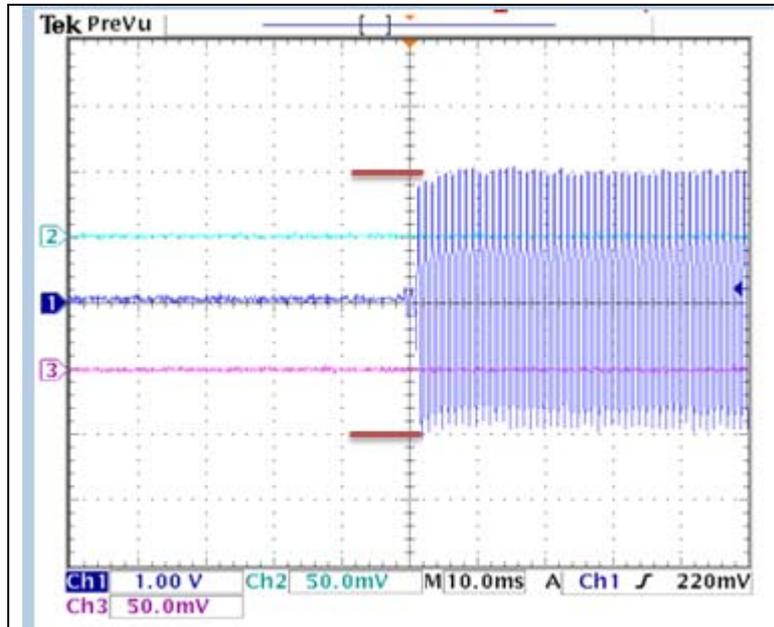


-Off to On

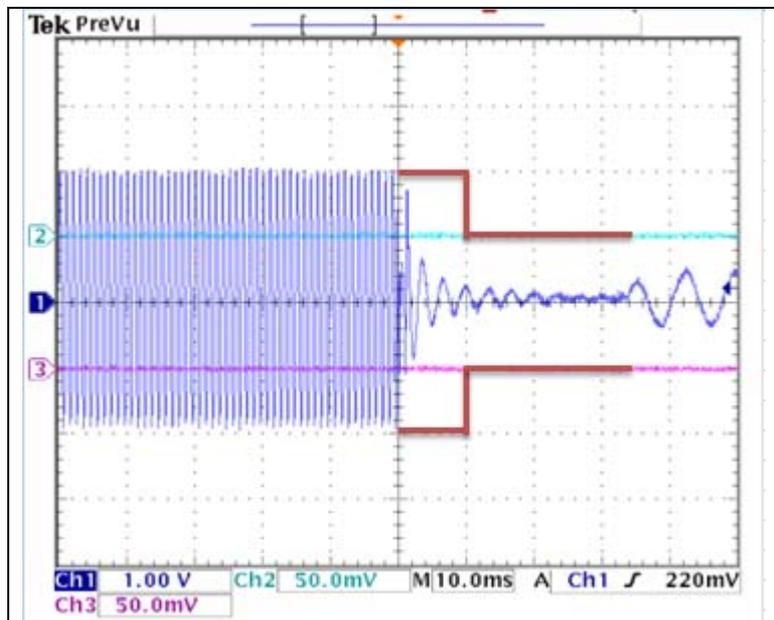


-Target Power_1W_459.00 MHz

-On to Off

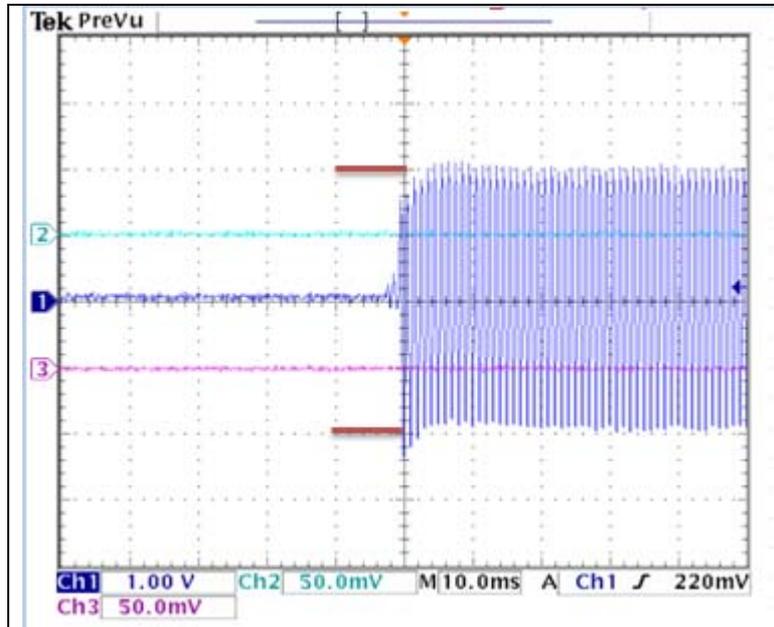


-Off to On

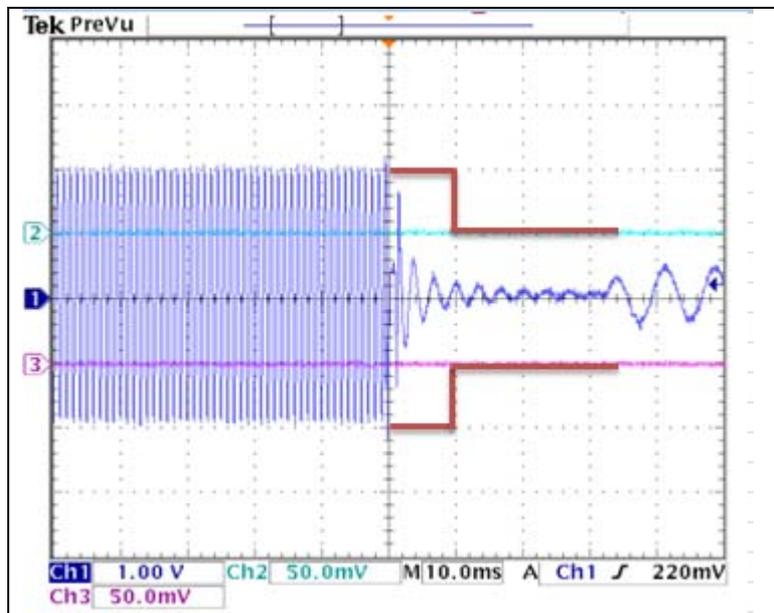


-Target Power_1W_512.00 MHz

-On to Off

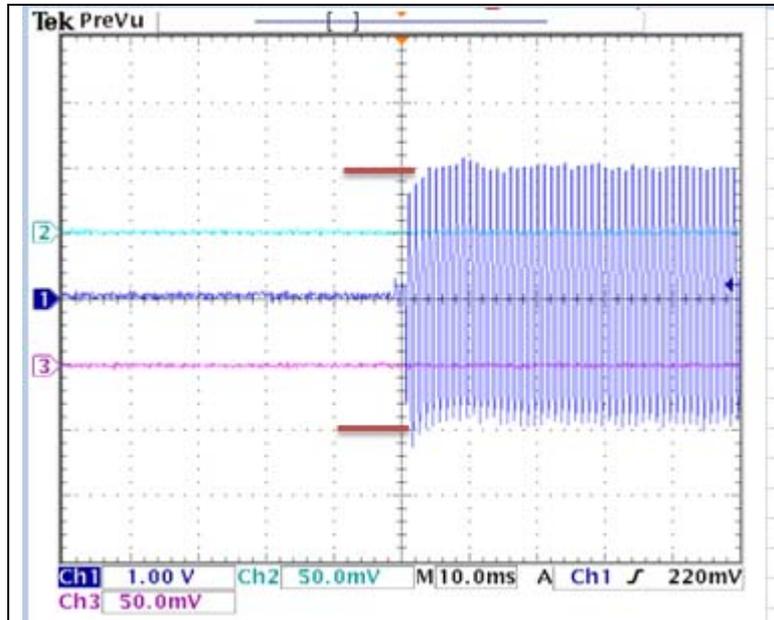


-Off to On

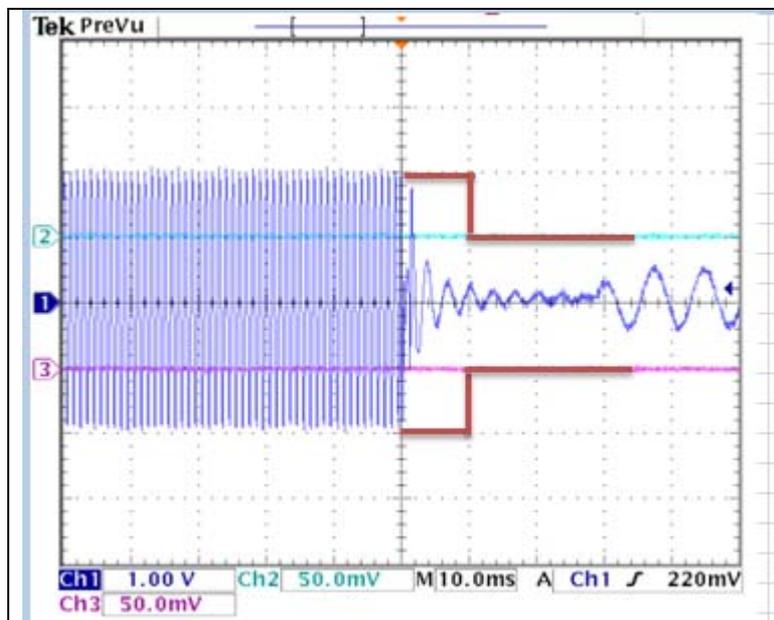


-Target Power_4W_406.10 MHz

-On to Off

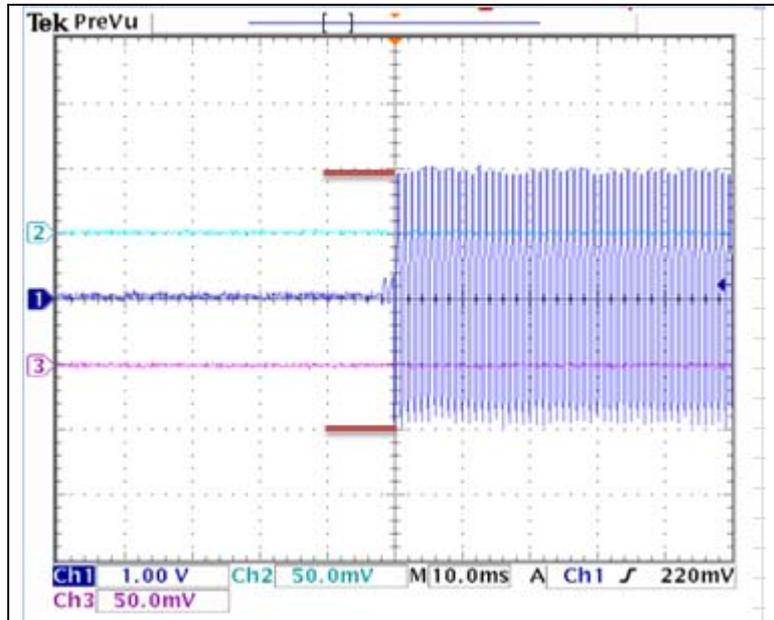


-Off to On

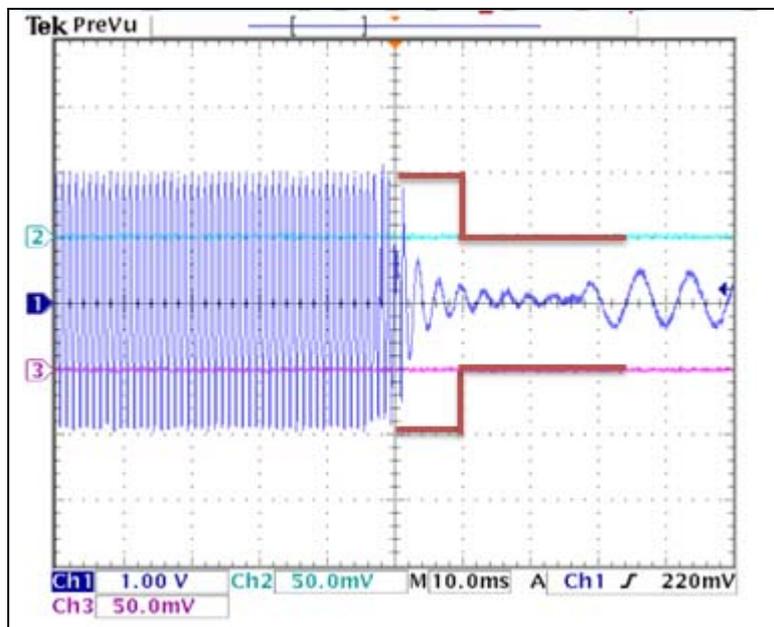


-Target Power_4W_459.00 MHz

-On to Off

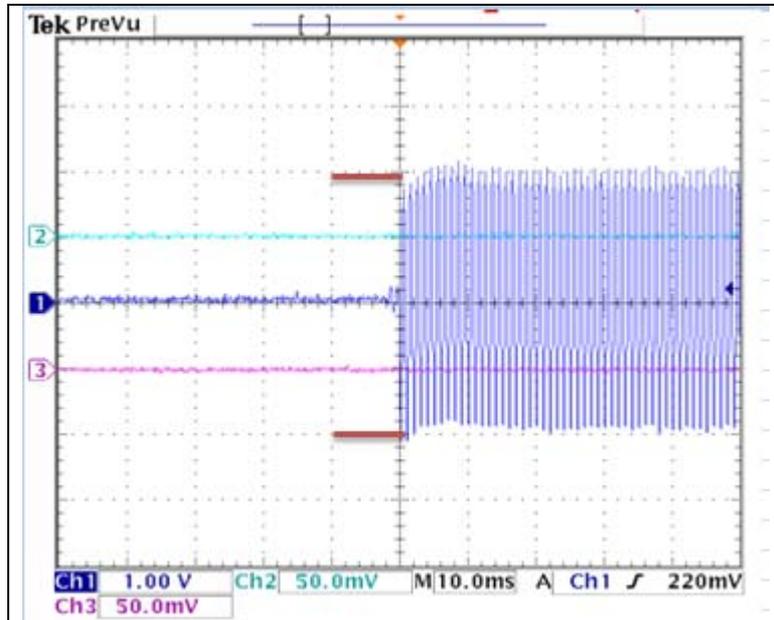


-Off to On

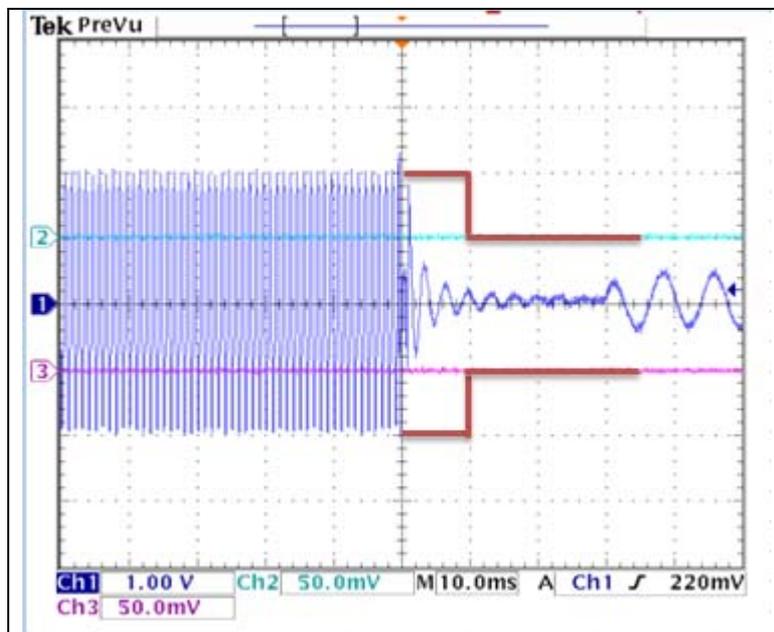


-Target Power_4W_512.00 MHz

-On to Off



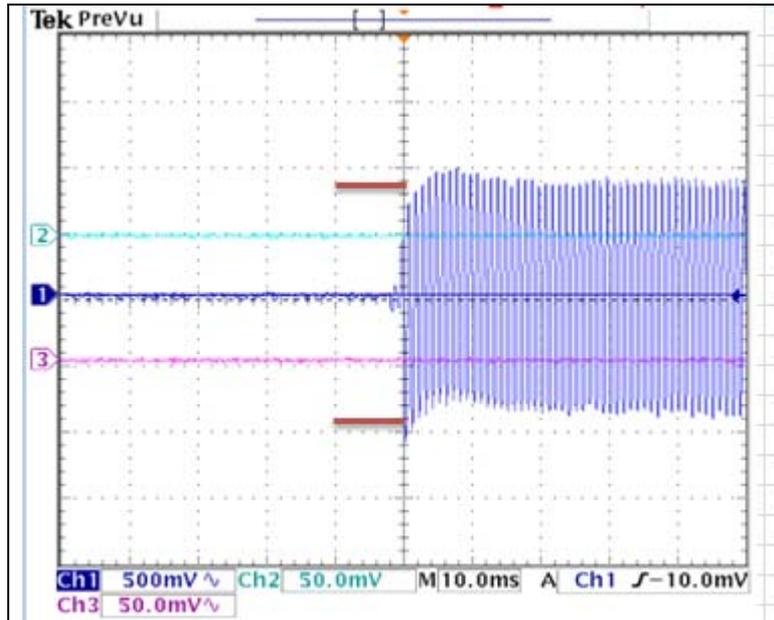
-Off to On



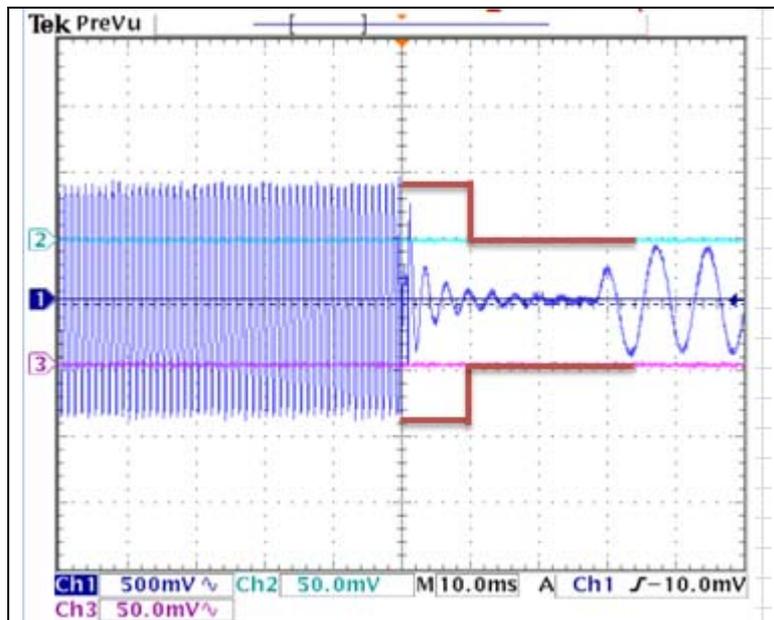
* 6.25BW

-Target Power_1W_406.10 MHz

-On to Off

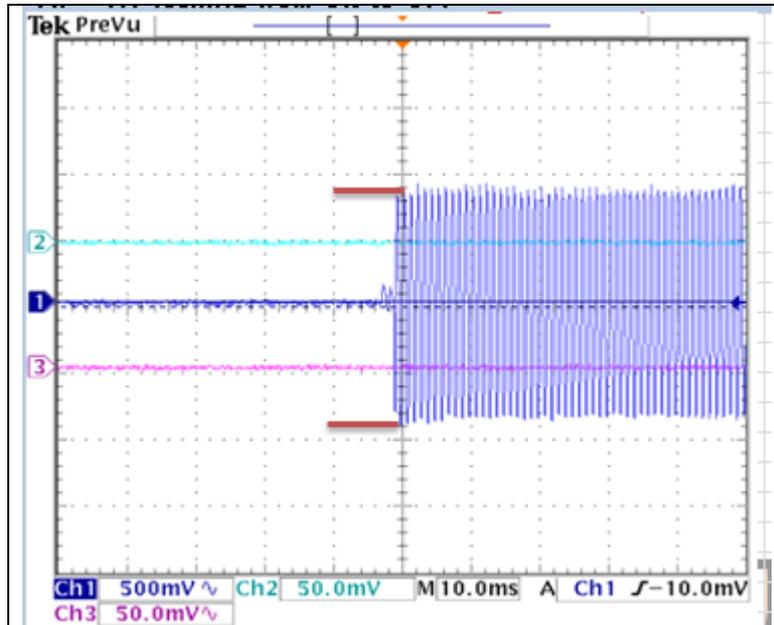


-Off to On

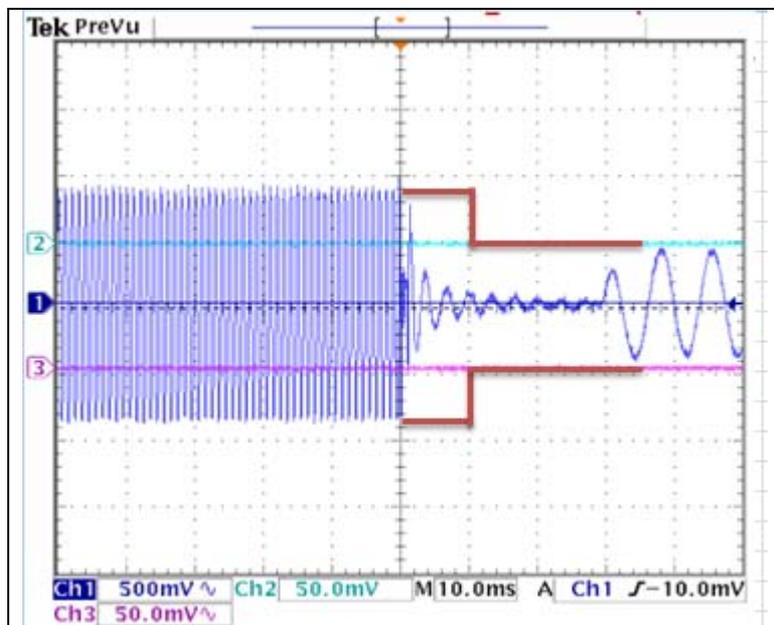


-Target Power_1W_459.00 MHz

-On to Off

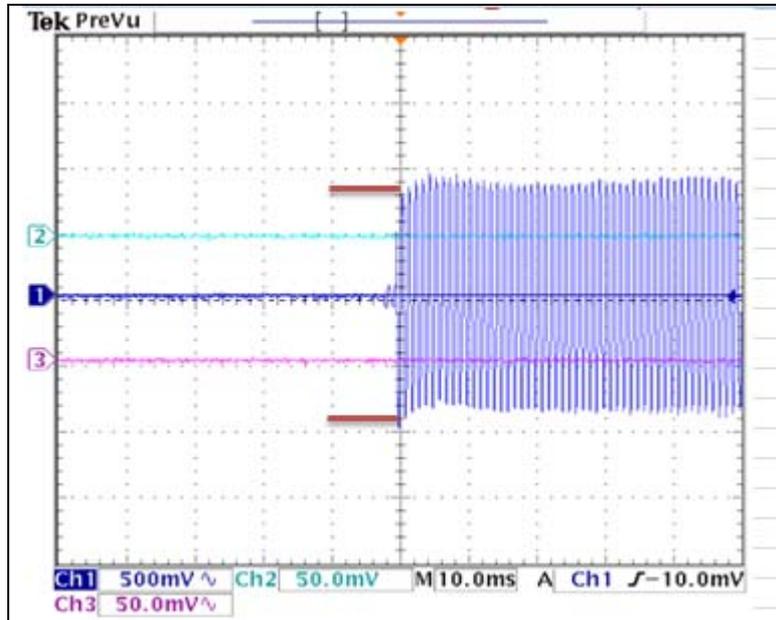


-Off to On

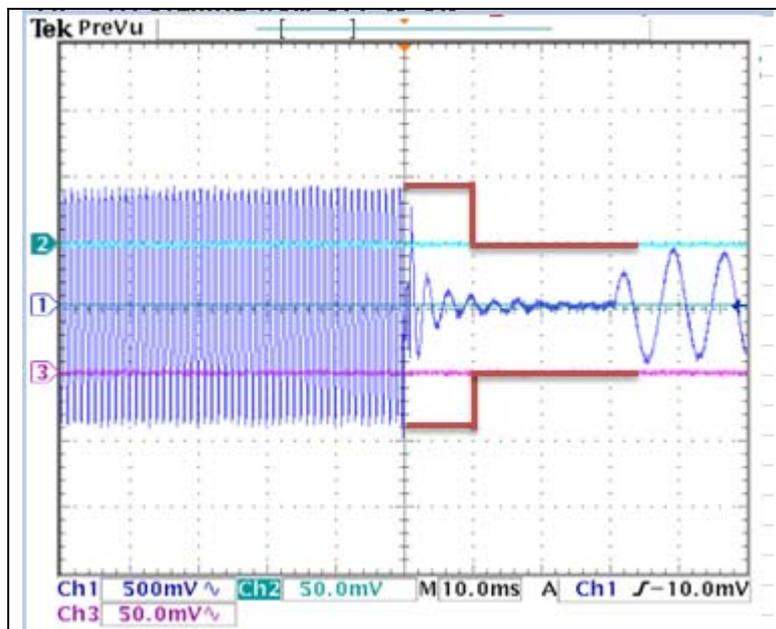


-Target Power_1W_512.00 MHz

-On to Off

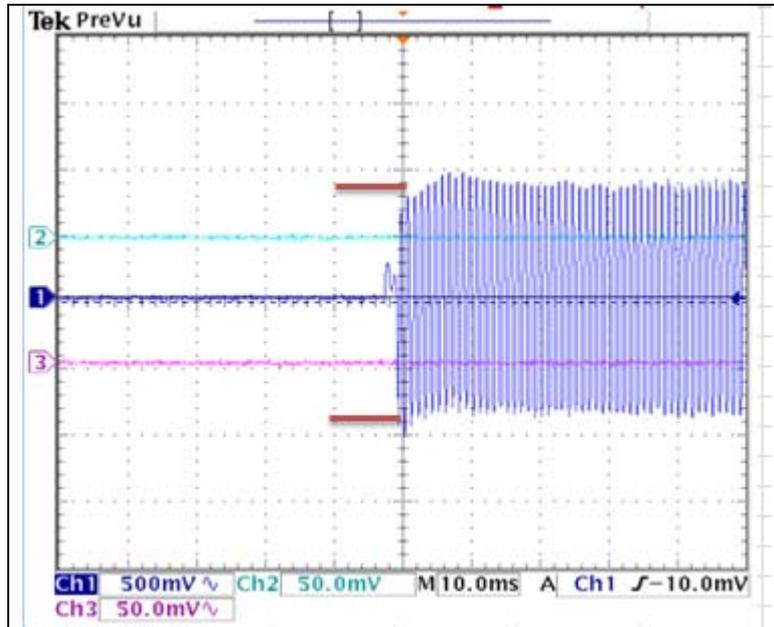


-Off to On

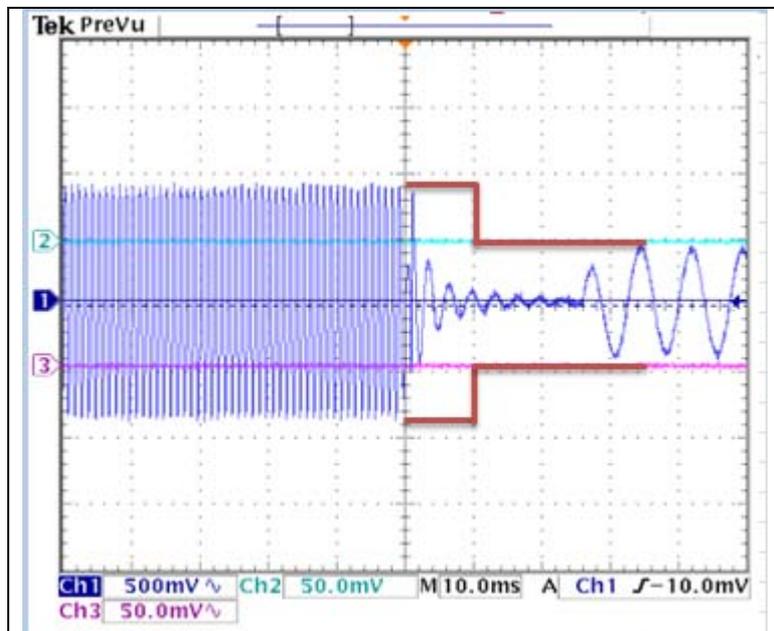


-Target Power_4W_406.10 MHz

-On to Off

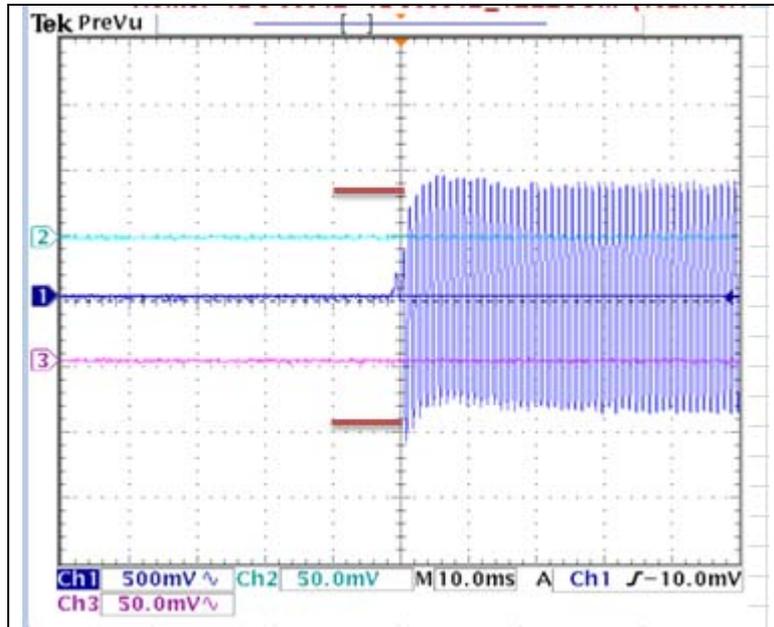


-Off to On

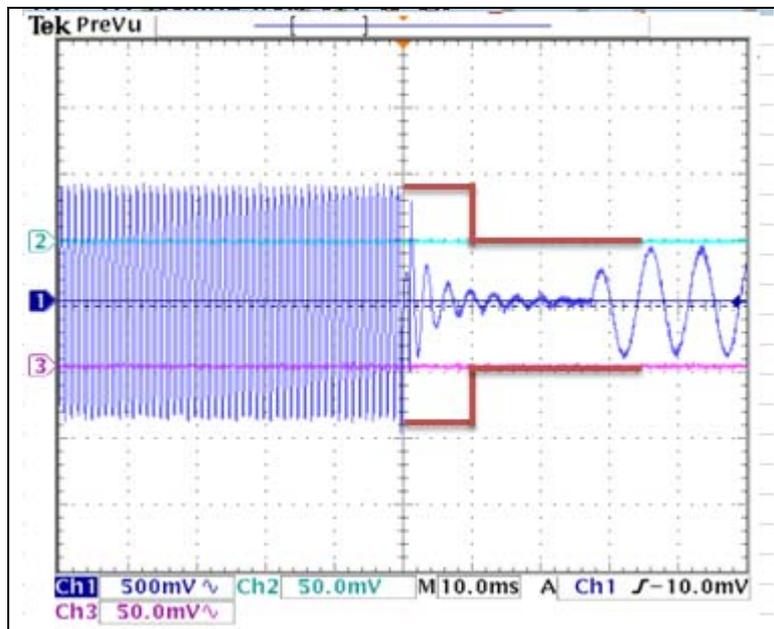


-Target Power_4W_459.00 MHz

-On to Off

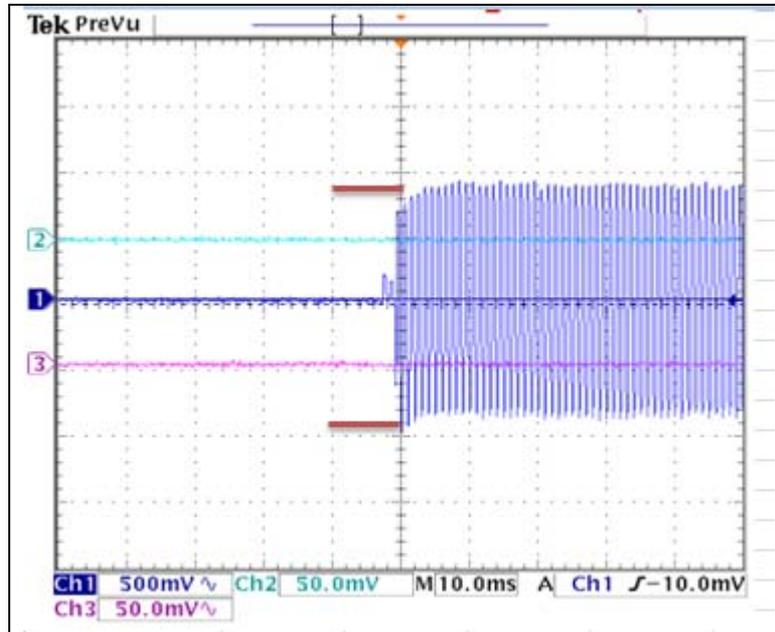


-Off to On

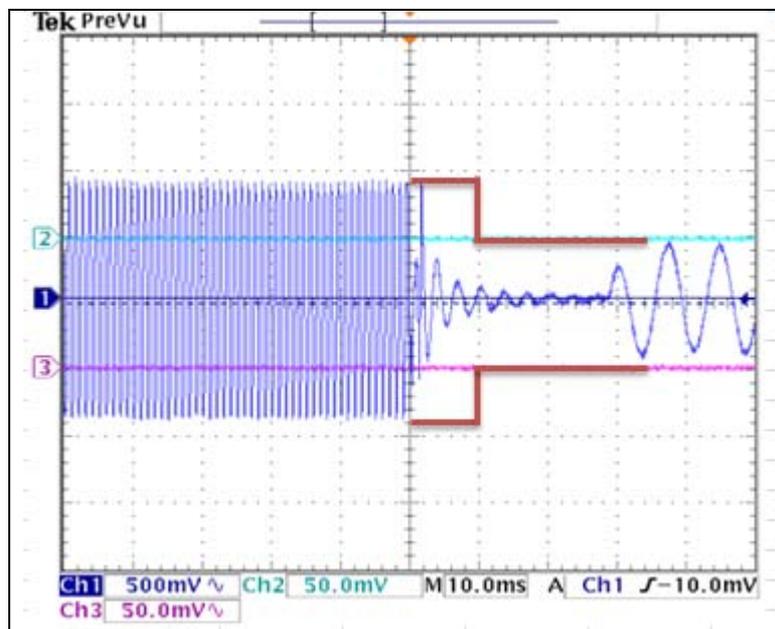


-Target Power_4W_512.00 MHz

-On to Off



-Off to On



5.8 Conducted Spurious Emission

5.8.1 Regulation

According to §90.210, 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.

5.7.2 Measurement 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 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation.

5.8.3 Test Result

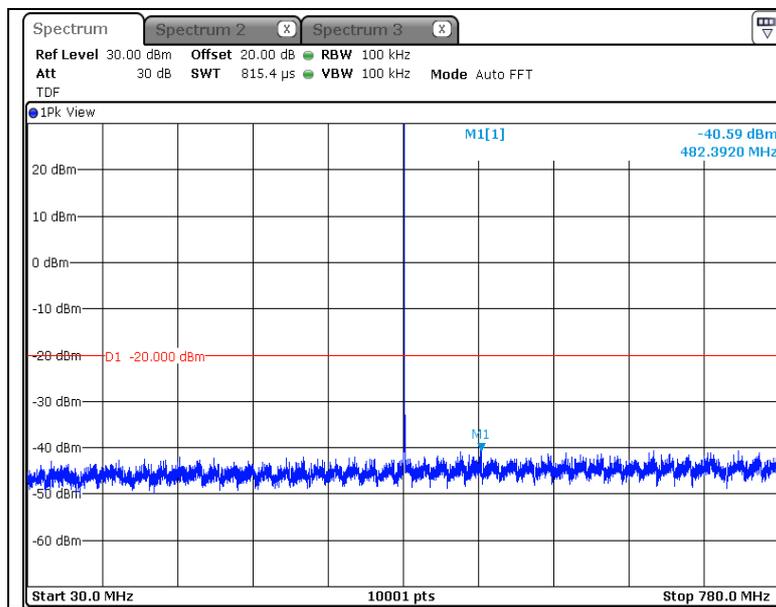
- Complied

Figure 4. plot of Conducted Spurious Emission

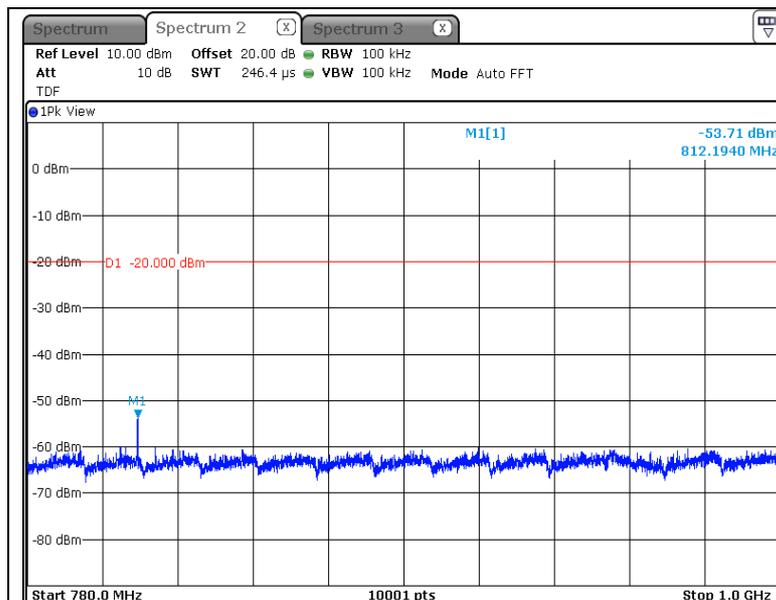
* 12.5BW

-Target Power_1W_406.10 MHz

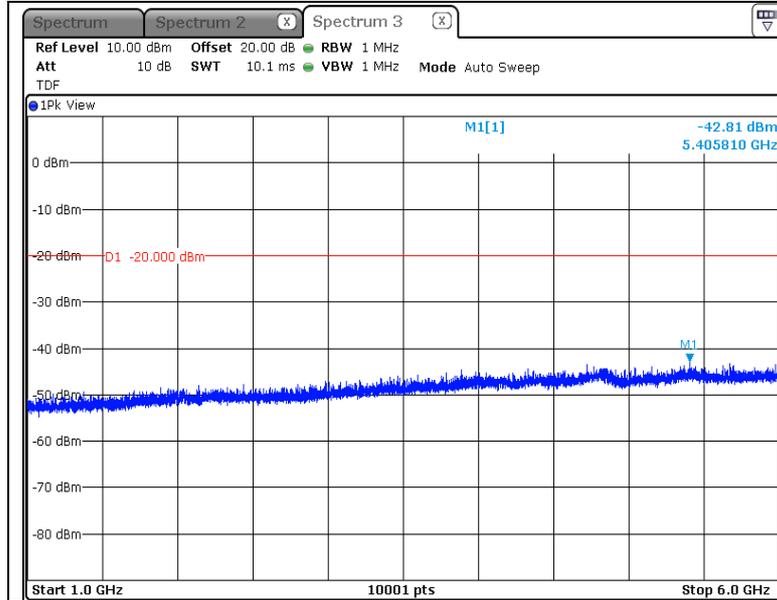
-30 MHz ~ 780 MHz



-780 MHz ~ 1 GHz

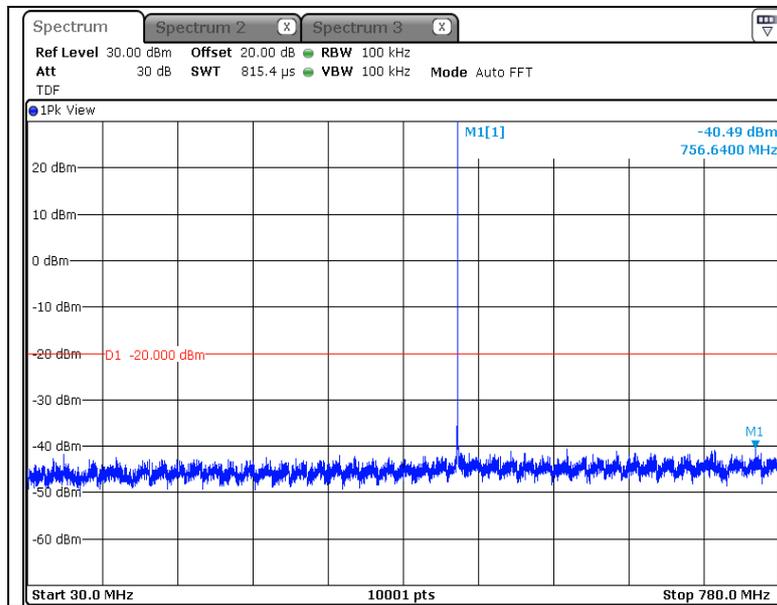


-1 GHz ~ 6 GHz

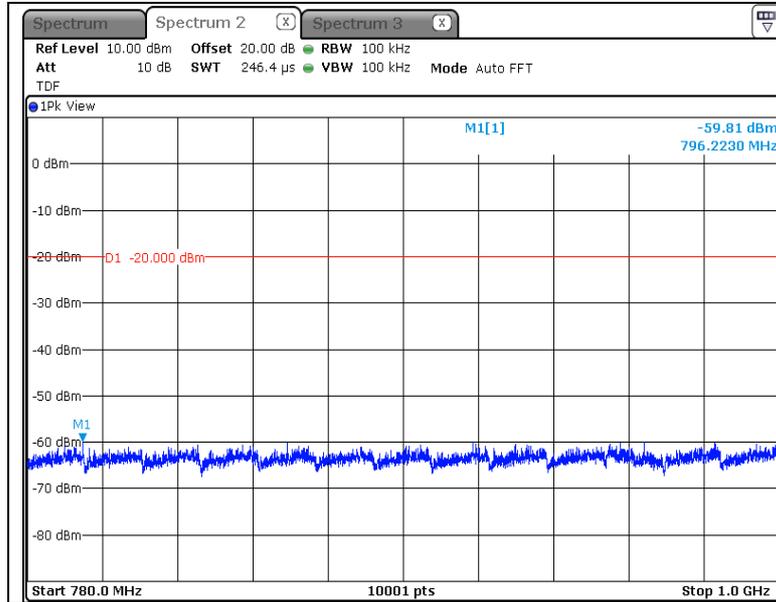


-Target Power_1W_459.00 MHz

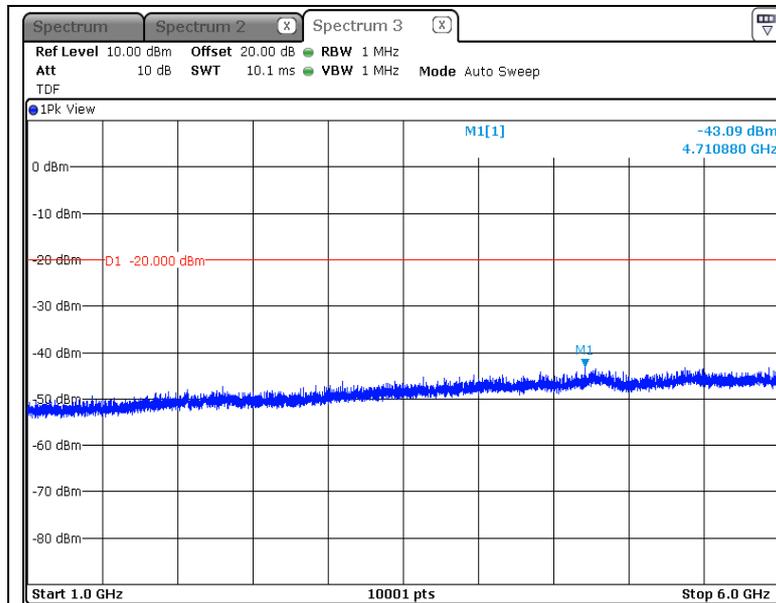
-30 MHz ~ 780 MHz



-780 MHz ~ 1 GHz

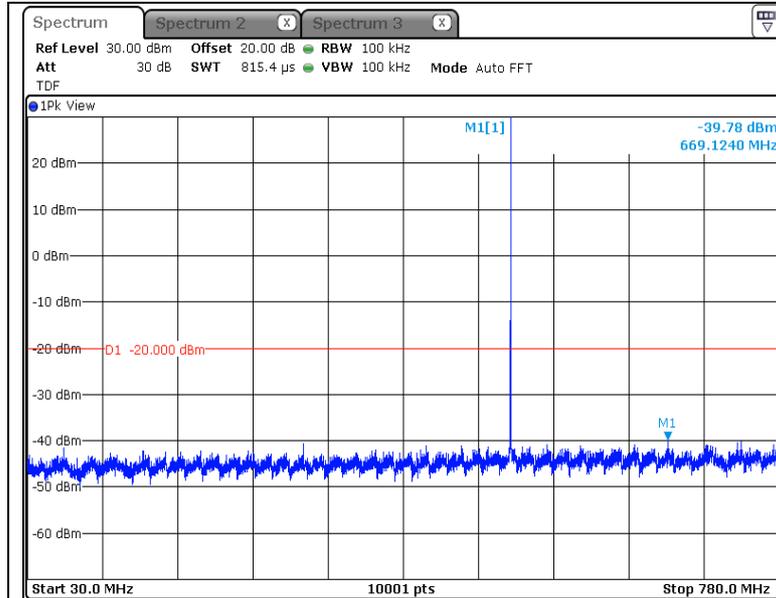


-1 GHz ~ 6 GHz

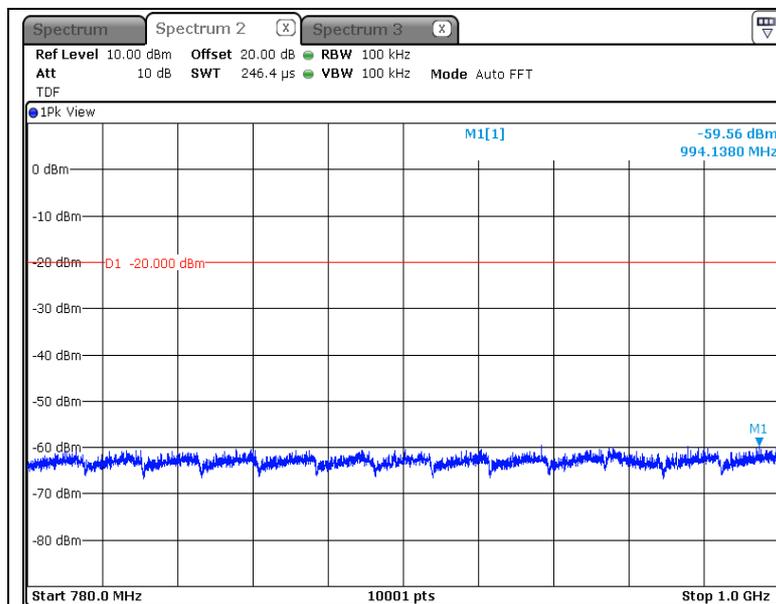


-Target Power_1W_512.00 MHz

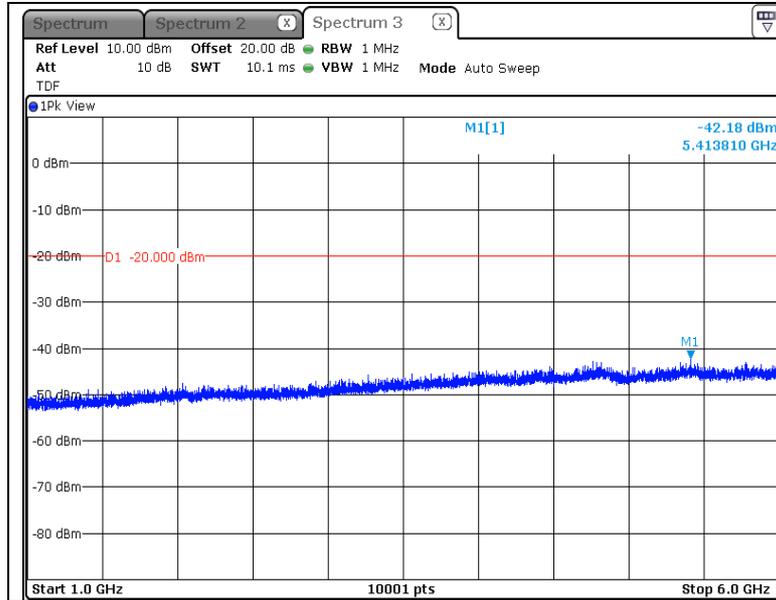
-30 MHz ~ 780 MHz



-780 MHz ~ 1 GHz

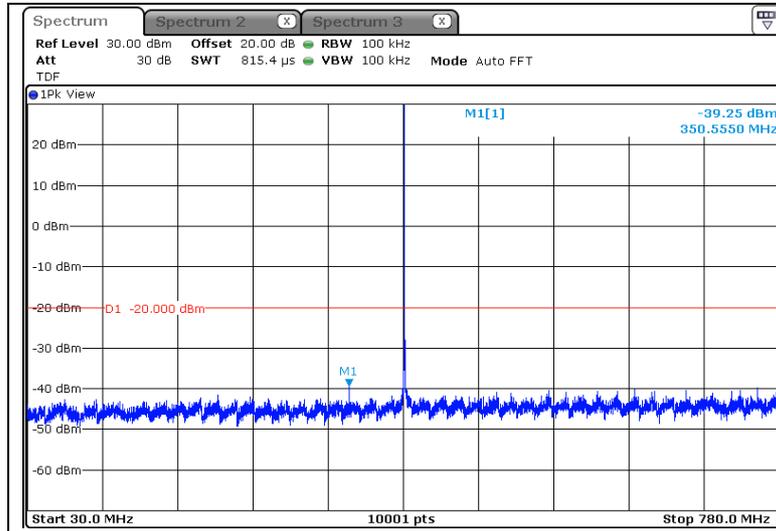


-1 GHz ~ 6 GHz

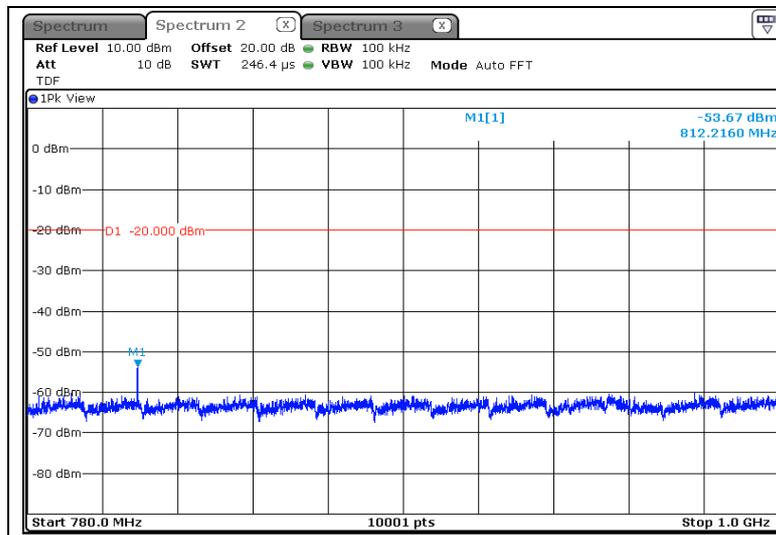


-Target Power_4W_406.10 MHz

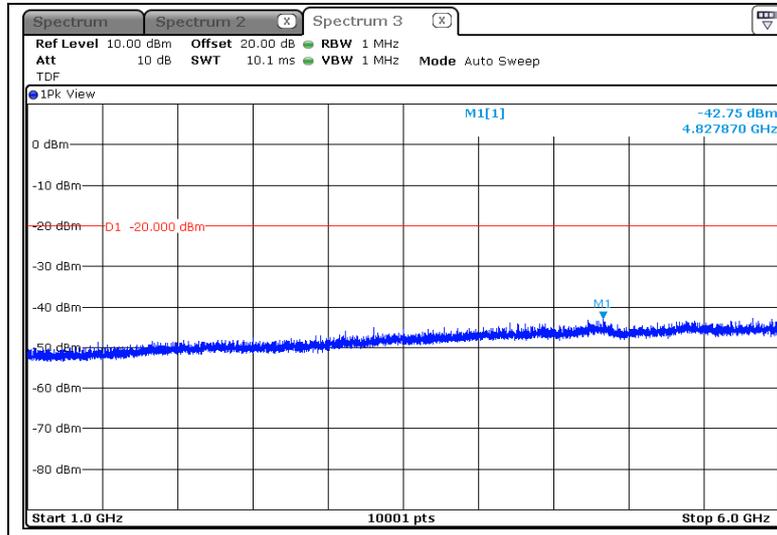
-30 MHz ~ 780 MHz



-780 MHz ~ 1 GHz

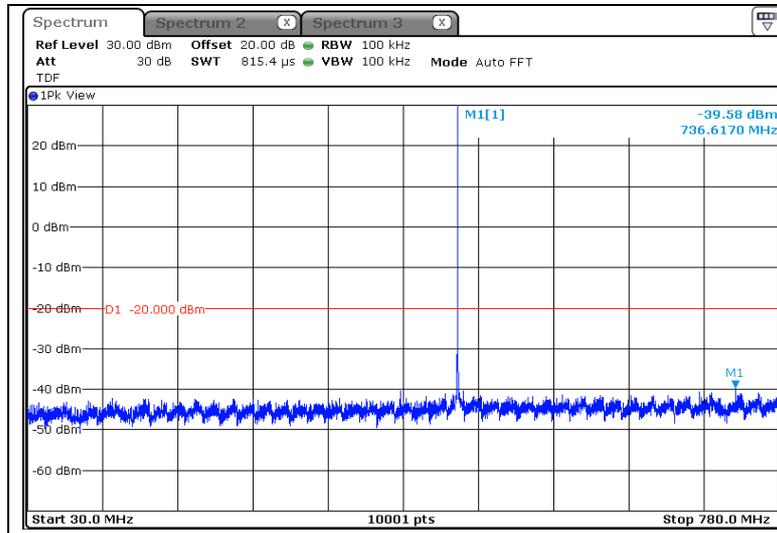


-1 GHz ~ 6 GHz

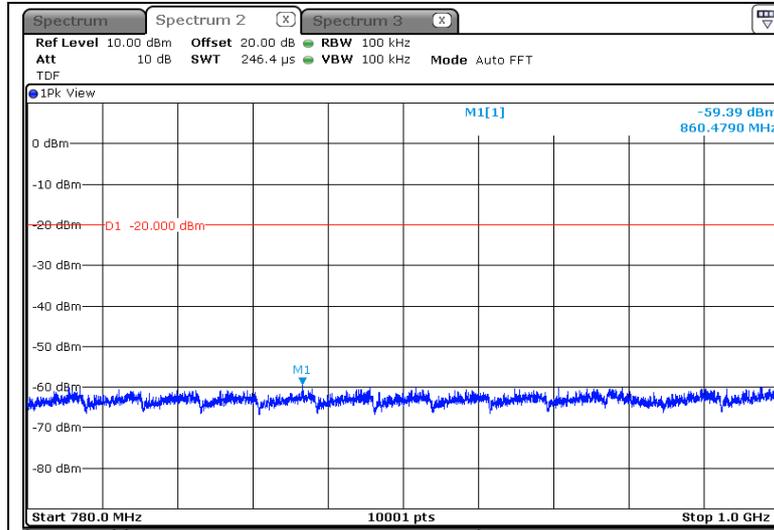


-Target Power_4W_459.00 MHz

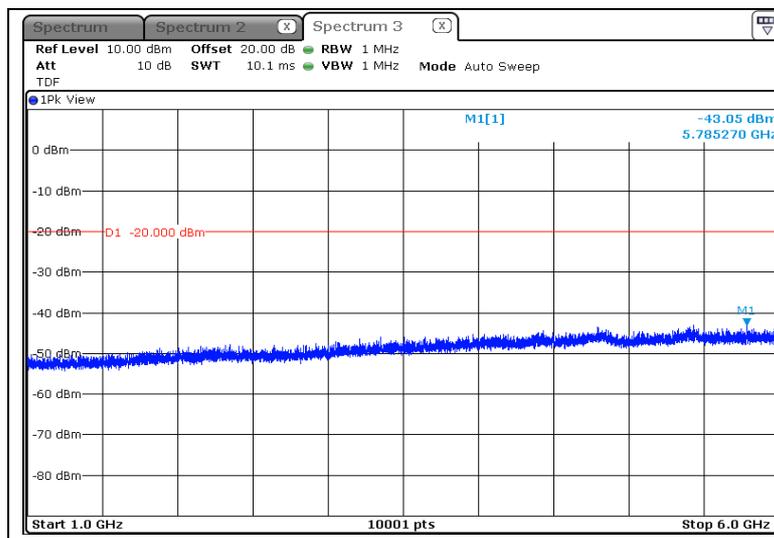
-30 MHz ~ 780 MHz



-780 MHz ~ 1 GHz

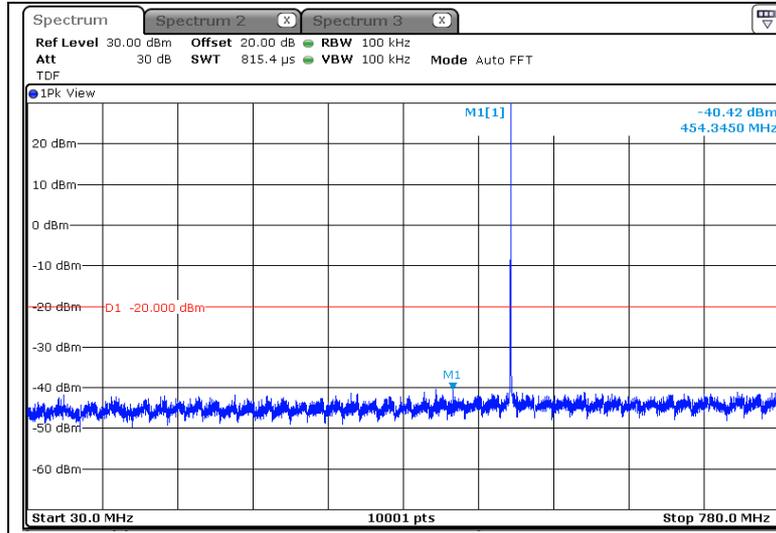


-1 GHz ~ 6 GHz

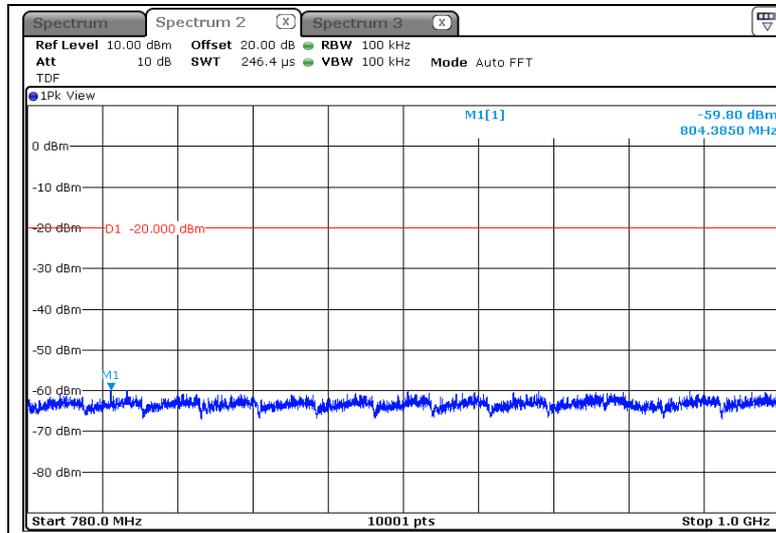


-Target Power_4W_512.00 MHz

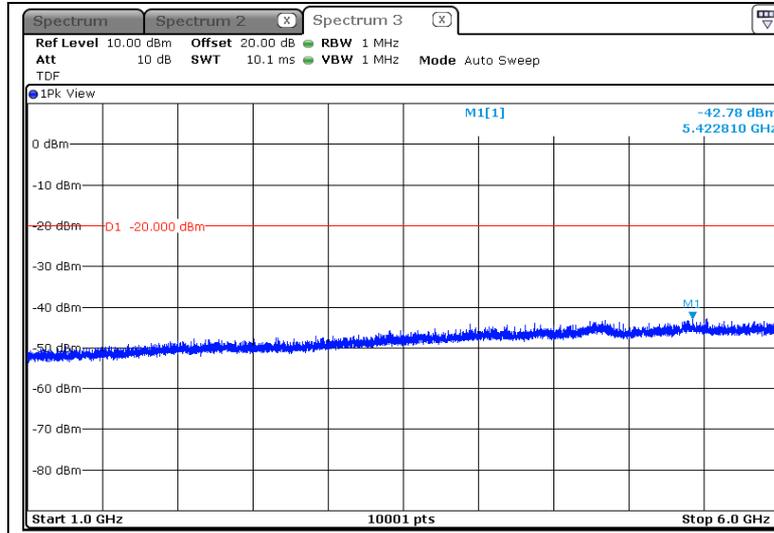
-30 MHz ~ 780 MHz



-780 MHz ~ 1 GHz



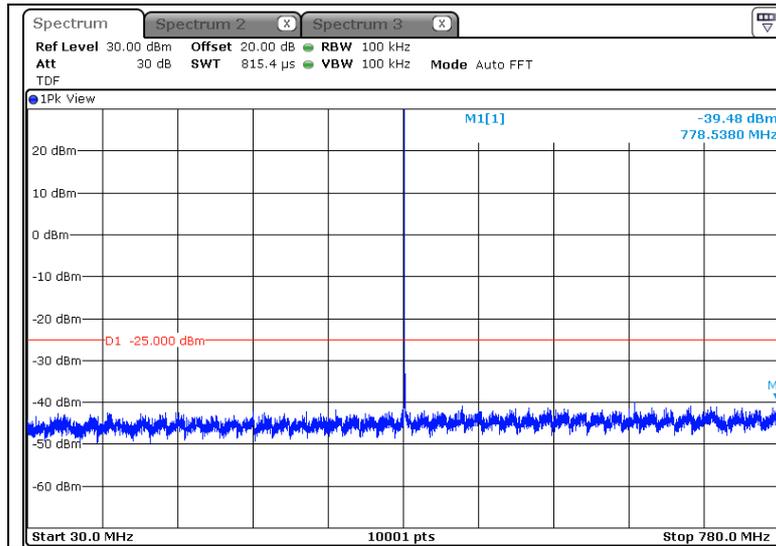
-1 GHz ~ 6 GHz



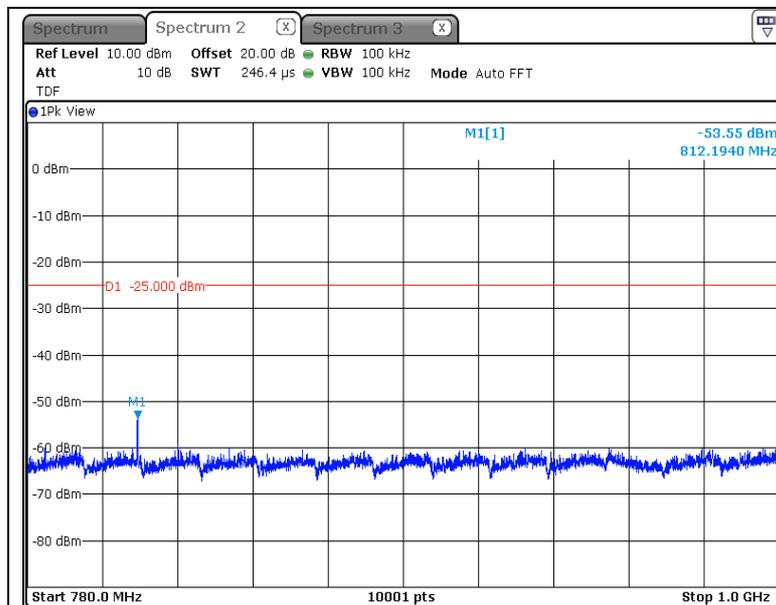
* 6.25BW

-Target Power_1W_406.10 MHz

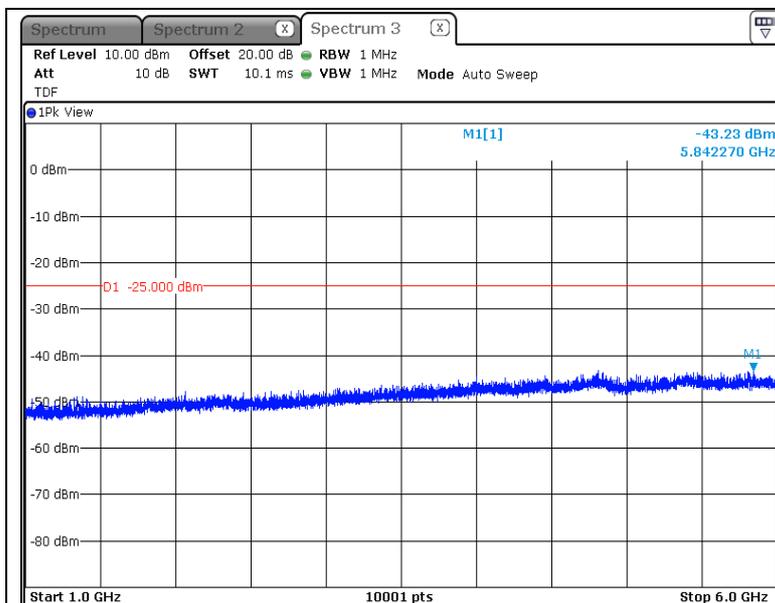
-30 MHz ~ 780 MHz



-780 MHz ~ 1 GHz

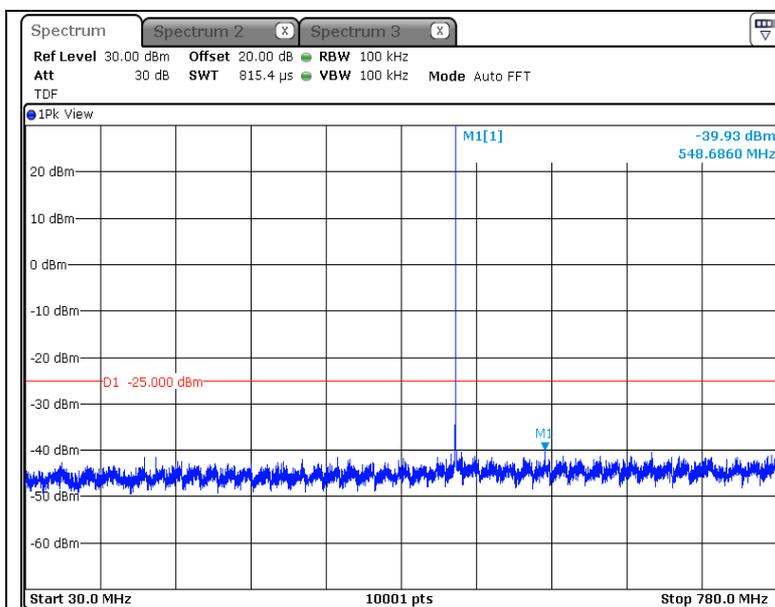


-1 GHz ~ 6 GHz

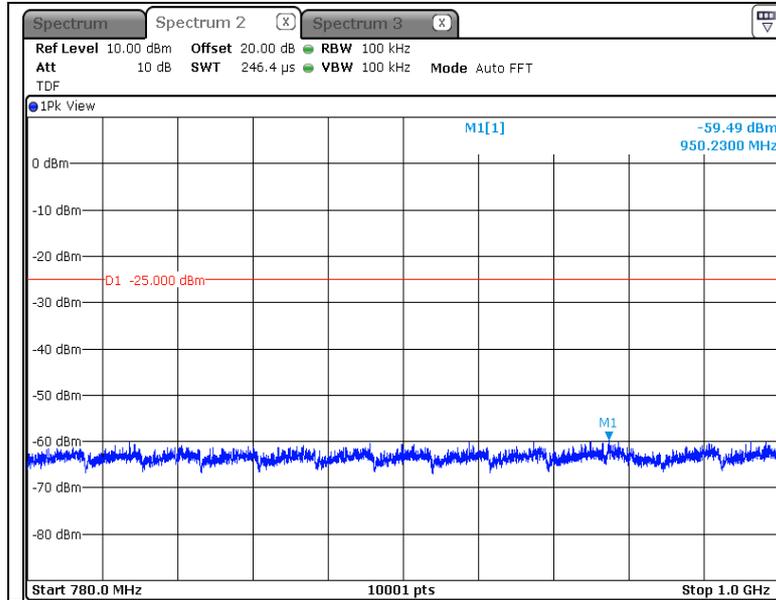


-Target Power_1W_459.00 MHz

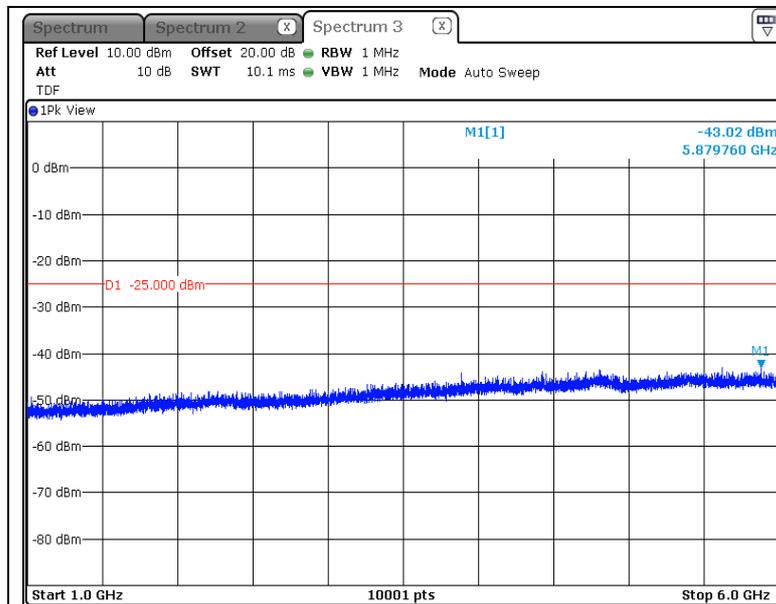
-30 MHz ~ 780 MHz



-780 MHz ~ 1 GHz

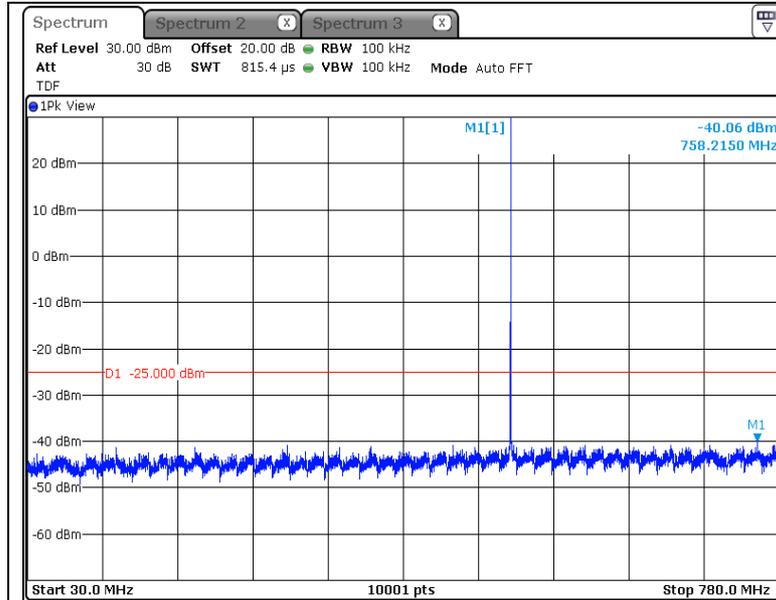


-1 GHz ~ 6 GHz

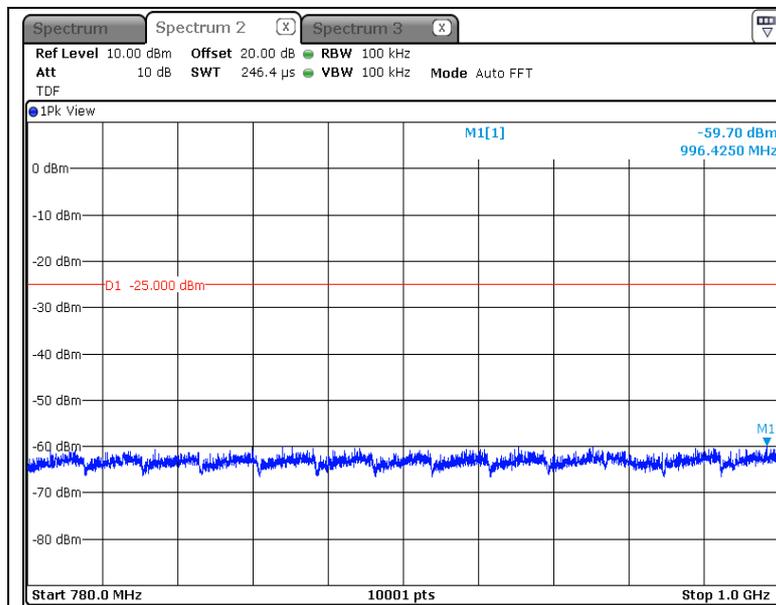


-Target Power_1W_512.00 MHz

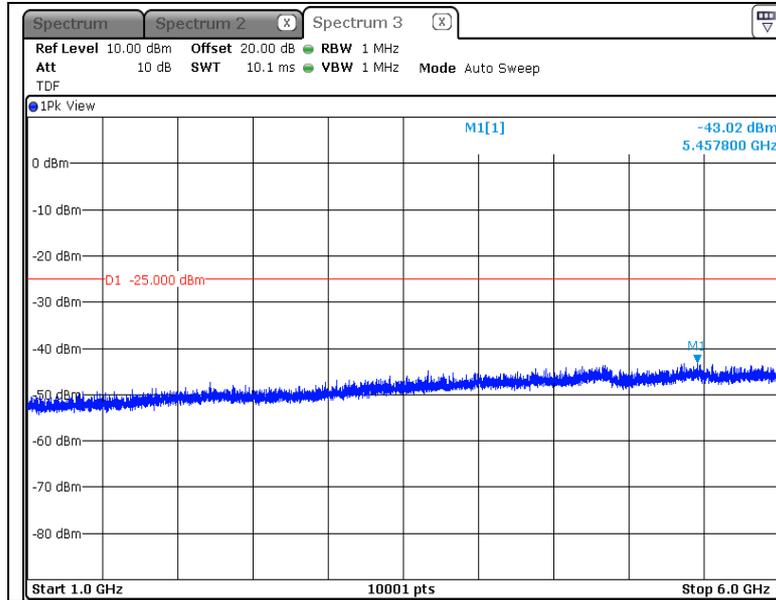
-30 MHz ~ 780 MHz



-780 MHz ~ 1 GHz

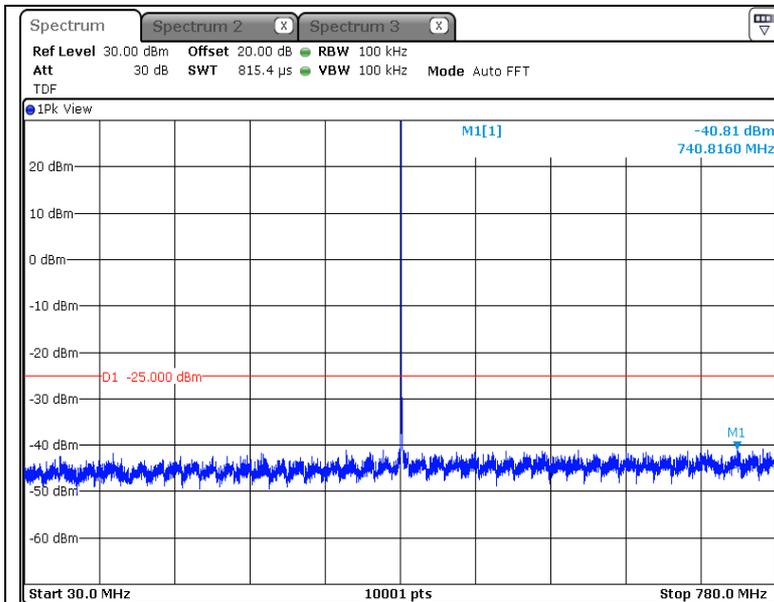


-1 GHz ~ 6 GHz

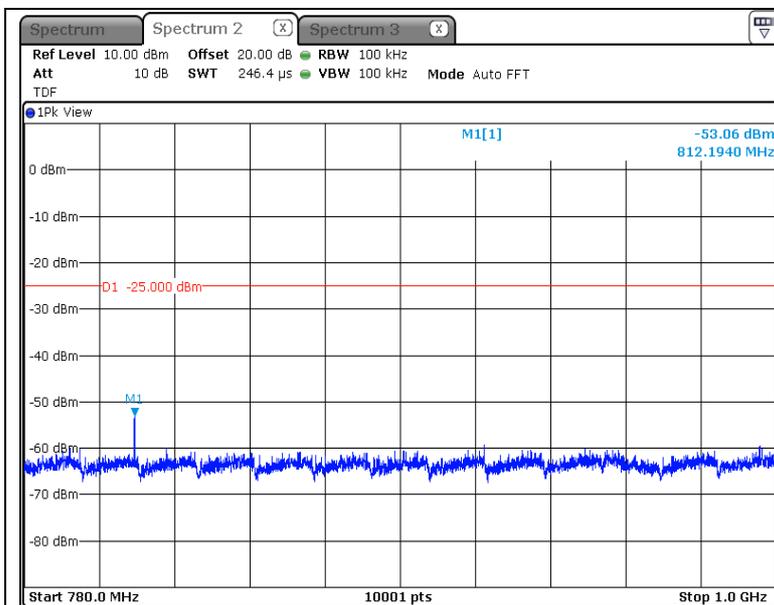


-Target Power_4W_406.10 MHz

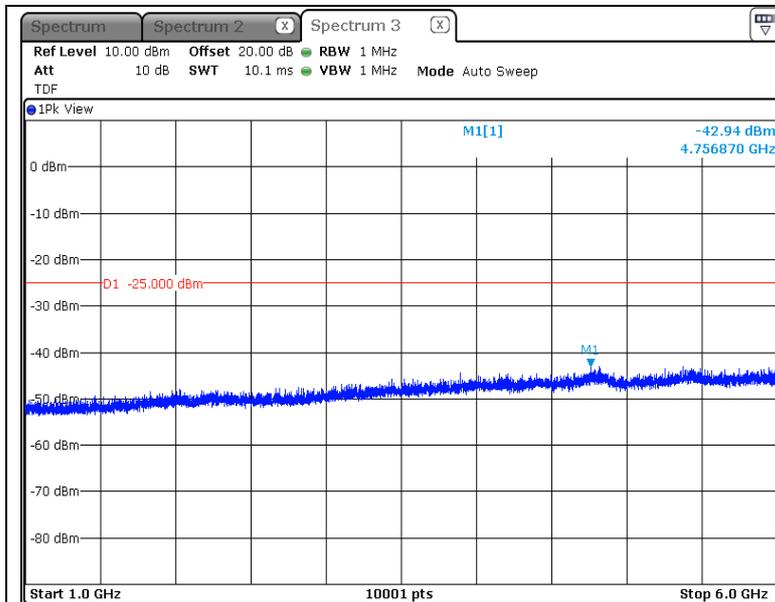
-30 MHz ~ 780 MHz



-780 MHz ~ 1 GHz

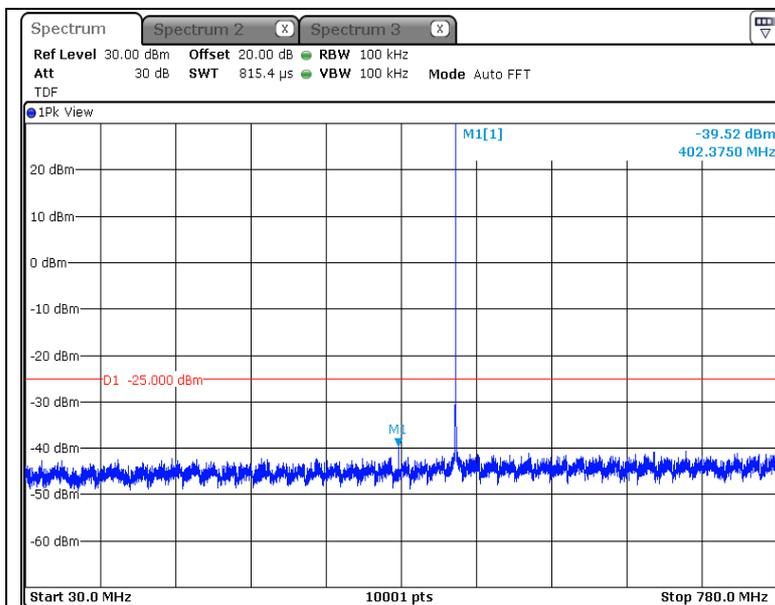


-1 GHz ~ 6 GHz

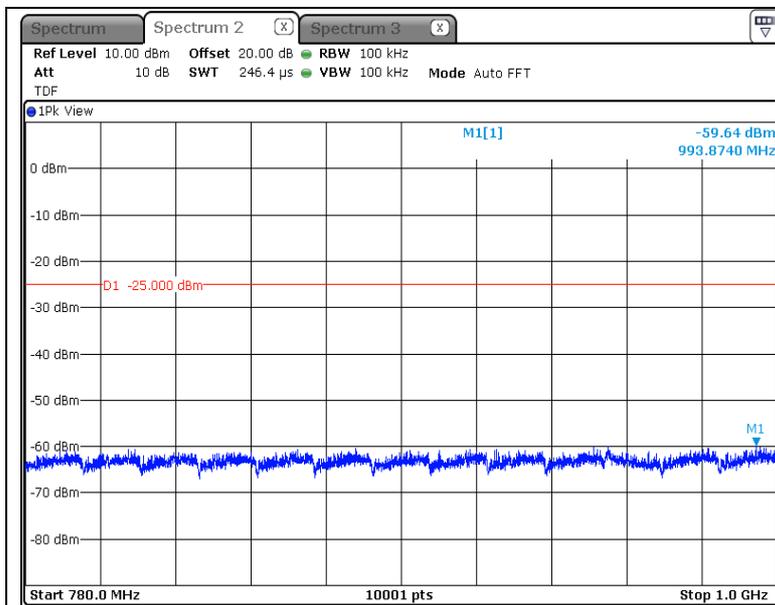


-Target Power_4W_459.00 MHz

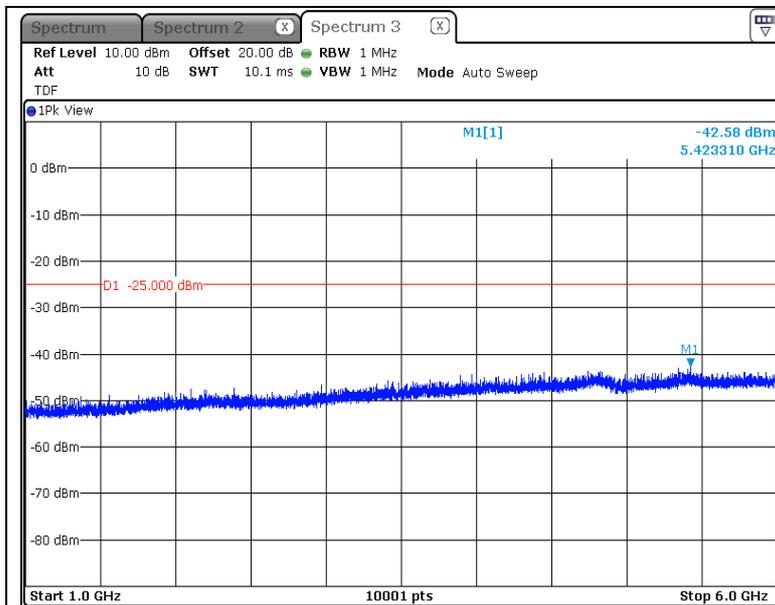
-30 MHz ~ 780 MHz



-780 MHz ~ 1 GHz

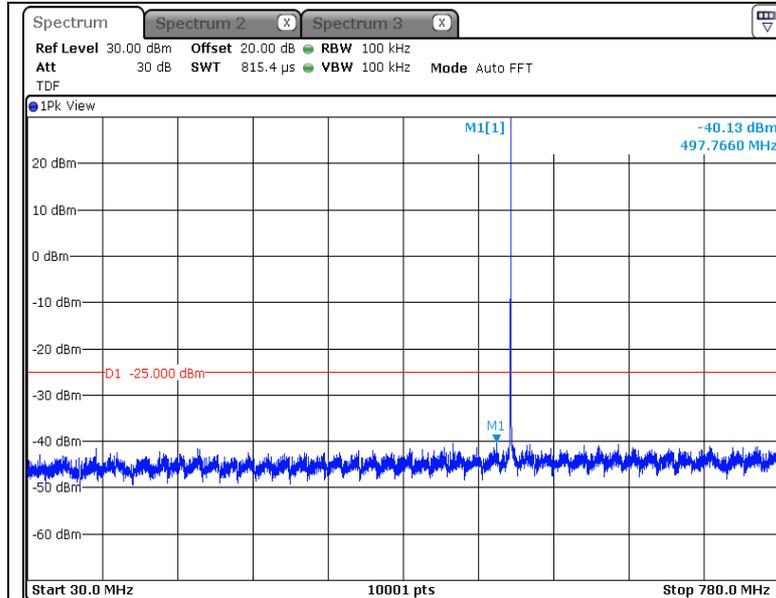


-1 GHz ~ 6 GHz

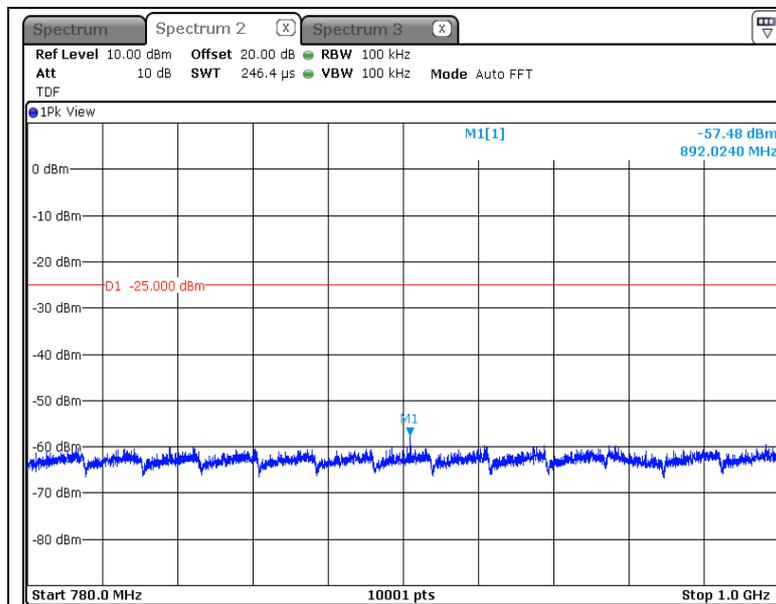


-Target Power_4W_512.00 MHz

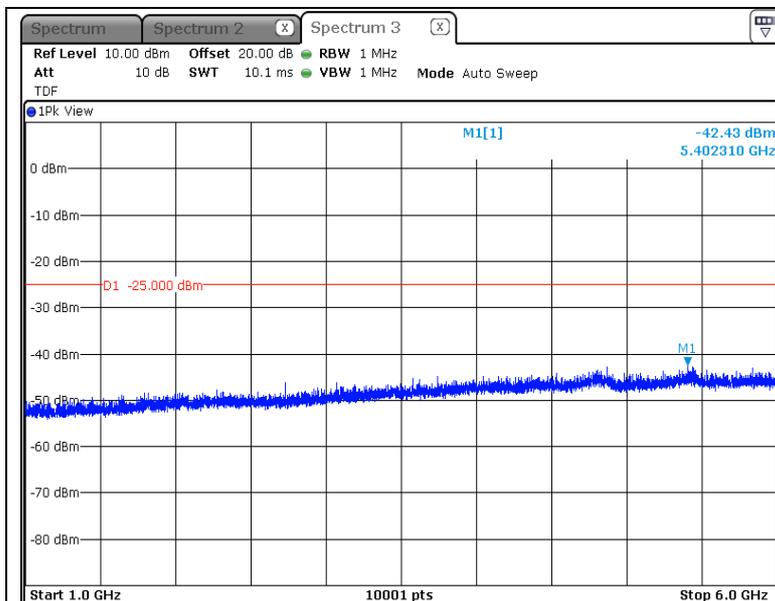
-30 MHz ~ 780 MHz



-780 MHz ~ 1 GHz



-1 GHz ~ 6 GHz



5.9 Radiated Spurious Emission

5.9.1 Regulation

According to §90.210, 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.

5.9.2 Measurement 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 preliminary and final radiated measurements were performed to determine the frequency producing the maximum emissions in at a 3 m anechoic chamber. The EUT was tested at a distance 3 meters.
4. The EUT was placed on the top of the 1.5-meter height. To find the maximum emission levels, the EUT was tested x,y and z – 3 axis each and the turntable was rotated 360 °.
5. The testing procedure is repeated for both horizontal and vertical polarization of the receiving antenna.
6. It mentioned only worst case data at this report.

5.9.3 Test Result

- Complied

* 12.5BW

-Target Power_1W_406.10 Mhz

Frequency [Mhz]	PoI [H/V]	Reading [dB(mW)]	Space Loss [dB]	Level [dB(mW)]	Limit [dB(mW)]	Margin [dB]
812.20	H	-47.80	8.20	-39.60	-20.00	19.60
1 218.53	V	-50.30	6.70	-43.60	-20.00	23.60
1 624.47	V	-44.70	7.10	-37.60	-20.00	17.60
2 030.40	V	-41.80	12.40	-29.40	-20.00	9.40
2 436.33	V	-49.10	12.90	-36.20	-20.00	16.20
2 842.88	V	-64.30	13.70	-50.60	-20.00	30.60
3 248.81	V	-67.20	16.20	-51.00	-20.00	31.00

-Target Power_1W_459.00 Mhz

Frequency [Mhz]	PoI [H/V]	Reading [dB(mW)]	Space Loss [dB]	Level [dB(mW)]	Limit [dB(mW)]	Margin [dB]
918.00	H	-56.30	10.40	-45.90	-20.00	25.90
1 377.24	V	-37.50	9.00	-28.50	-20.00	8.50
1 836.28	V	-45.20	7.90	-37.30	-20.00	17.30
2 294.71	V	-41.70	12.40	-29.30	-20.00	9.30
3 212.80	V	-65.60	16.20	-49.40	-20.00	29.40

-Target Power_1W_512.00 Mhz

Frequency [Mhz]	PoI [H/V]	Reading [dB(mW)]	Space Loss [dB]	Level [dB(mW)]	Limit [dB(mW)]	Margin [dB]
927.94	H	-70.80	10.70	-60.10	-20.00	40.10
1 023.81	H	-52.20	4.80	-47.40	-20.00	27.40
1 535.95	V	-40.10	7.70	-32.40	-20.00	12.40
2 048.10	V	-41.00	13.10	-27.90	-20.00	7.90
2 559.64	V	-56.20	12.60	-43.60	-20.00	23.60
3 072.40	V	-61.00	14.20	-46.80	-20.00	26.80
3 583.93	V	-66.60	16.50	-50.10	-20.00	30.10

-Target Power_4W_406.10 MHz

Frequency [MHz]	Pol [H/V]	Reading [dB(mW)]	Space Loss [dB]	Level [dB(mW)]	Limit [dB(mW)]	Margin [dB]
812.20	H	-46.40	8.20	-38.20	-20.00	18.20
1 218.53	V	-50.40	6.70	-43.70	-20.00	23.70
1 624.47	V	-41.40	7.10	-34.30	-20.00	14.30
2 030.40	V	-41.40	12.40	-29.00	-20.00	9.00
2 436.33	V	-45.40	12.90	-32.50	-20.00	12.50
2 842.88	V	-62.60	13.70	-48.90	-20.00	28.90
3 248.81	V	-65.40	16.20	-49.20	-20.00	29.20
3 654.74	H	-68.20	16.60	-51.60	-20.00	31.60

-Target Power_4W_459.00 MHz

Frequency [MHz]	Pol [H/V]	Reading [dB(mW)]	Space Loss [dB]	Level [dB(mW)]	Limit [dB(mW)]	Margin [dB]
918.00	V	-49.10	9.70	-39.40	-20.00	19.40
1 377.24	V	-35.20	9.00	-26.20	-20.00	6.20
1 835.67	V	-46.60	7.90	-38.70	-20.00	18.70
2 294.71	V	-46.20	12.40	-33.80	-20.00	13.80
2 753.75	H	-68.40	13.60	-54.80	-20.00	34.80
3 212.80	V	-65.70	16.20	-49.50	-20.00	29.50
3 671.84	H	-65.70	16.70	-49.00	-20.00	29.00

-Target Power_4W_512.00 MHz

Frequency [MHz]	Pol [H/V]	Reading [dB(mW)]	Space Loss [dB]	Level [dB(mW)]	Limit [dB(mW)]	Margin [dB]
952.68	H	-72.00	11.70	-60.30	-20.00	40.30
1 023.81	V	-54.30	4.90	-49.40	-20.00	29.40
1 535.95	V	-40.10	7.70	-32.40	-20.00	12.40
2 048.10	V	-36.10	13.10	-23.00	-20.00	3.00
2 560.25	V	-45.00	12.60	-32.40	-20.00	12.40
3 072.40	V	-62.20	14.20	-48.00	-20.00	28.00
3 583.93	H	-63.70	16.50	-47.20	-20.00	27.20
4 096.08	H	-65.70	18.50	-47.20	-20.00	27.20
4 608.23	H	-66.20	21.50	-44.70	-20.00	24.70
5 119.77	V	-66.10	20.50	-45.60	-20.00	25.60

* 6.25BW

-Target Power_1W_406.10 MHz

Frequency [MHz]	PoI [H/V]	Reading [dB(mW)]	Space Loss [dB]	Level [dB(mW)]	Limit [dB(mW)]	Margin [dB]
812.20	H	-47.70	8.20	-39.50	-25.00	14.50
1 218.53	V	-50.60	6.70	-43.90	-25.00	18.90
1 624.47	V	-44.70	7.10	-37.60	-25.00	12.60
2 030.40	V	-41.10	12.40	-28.70	-25.00	3.70
2 436.33	V	-49.50	12.90	-36.60	-25.00	11.60
2 842.27	V	-65.20	13.70	-51.50	-25.00	26.50
3 248.81	V	-66.20	16.20	-50.00	-25.00	25.00

-Target Power_1W_459.00 MHz

Frequency [MHz]	PoI [H/V]	Reading [dB(mW)]	Space Loss [dB]	Level [dB(mW)]	Limit [dB(mW)]	Margin [dB]
918.00	V	-56.30	9.70	-46.60	-25.00	21.60
1 377.24	V	-37.80	9.00	-28.80	-25.00	3.80
1 836.28	V	-46.40	7.90	-38.50	-25.00	13.50
2 294.71	V	-42.80	12.40	-30.40	-25.00	5.40
3 213.41	V	-66.20	16.20	-50.00	-25.00	25.00

-Target Power_1W_512.00 MHz

Frequency [MHz]	PoI [H/V]	Reading [dB(mW)]	Space Loss [dB]	Level [dB(mW)]	Limit [dB(mW)]	Margin [dB]
951.71	H	-71.90	11.70	-60.20	-25.00	35.20
1 023.81	H	-53.20	4.80	-48.40	-25.00	23.40
1 535.95	V	-42.50	7.70	-34.80	-25.00	9.80
2 048.10	H	-49.60	12.30	-37.30	-25.00	12.30
2 559.64	H	-57.20	12.70	-44.50	-25.00	19.50
3 072.40	H	-61.80	14.40	-47.40	-25.00	22.40
3 583.93	V	-66.20	16.50	-49.70	-25.00	24.70

-Target Power_4W_406.10 Mhz

Frequency [Mhz]	Pol [H/V]	Reading [dB(mW)]	Space Loss [dB]	Level [dB(mW)]	Limit [dB(mW)]	Margin [dB]
812.20	H	-47.70	8.20	-39.50	-25.00	14.50
1 217.92	V	-51.80	6.70	-45.10	-25.00	20.10
1 624.47	V	-42.20	7.10	-35.10	-25.00	10.10
2 030.40	V	-41.50	12.40	-29.10	-25.00	4.10
2 436.33	V	-47.70	12.90	-34.80	-25.00	9.80
2 842.88	V	-64.60	13.70	-50.90	-25.00	25.90
3 248.81	V	-65.80	16.20	-49.60	-25.00	24.60
3 654.74	V	-69.20	16.70	-52.50	-25.00	27.50

-Target Power_4W_459.00 Mhz

Frequency [Mhz]	Pol [H/V]	Reading [dB(mW)]	Space Loss [dB]	Level [dB(mW)]	Limit [dB(mW)]	Margin [dB]
918.00	V	-49.70	9.70	-40.00	-25.00	15.00
1 377.24	V	-47.10	9.00	-38.10	-25.00	13.10
1 835.67	V	-60.00	7.90	-52.10	-25.00	27.10
2 294.71	V	-59.50	12.40	-47.10	-25.00	22.10
2 753.75	H	-59.60	13.60	-46.00	-25.00	21.00
3 212.80	H	-63.70	16.30	-47.40	-25.00	22.40
3 671.84	V	-64.50	16.80	-47.70	-25.00	22.70

-Target Power_4W_512.00 Mhz

Frequency [Mhz]	Pol [H/V]	Reading [dB(mW)]	Space Loss [dB]	Level [dB(mW)]	Limit [dB(mW)]	Margin [dB]
950.63	H	-71.70	11.70	-60.00	-20.00	40.00
1 023.81	V	-55.20	4.90	-50.30	-25.00	25.30
1 535.95	H	-37.90	7.70	-30.20	-25.00	5.20
2 048.10	V	-42.80	13.10	-29.70	-25.00	4.70
2 559.64	V	-56.30	12.60	-43.70	-25.00	18.70
3 071.79	H	-64.20	14.40	-49.80	-25.00	24.80
3 583.93	V	-58.10	16.50	-41.60	-25.00	16.60
4 096.08	V	-65.60	18.50	-47.10	-25.00	22.10
4 608.23	V	-61.70	21.60	-40.10	-25.00	15.10
5 119.77	V	-65.80	20.50	-45.30	-25.00	20.30

6. Test equipment used for test

	Description	Manufacturer	Model No.	Serial No.	Next Cal Date.
■	DC power supply	AGILENT	E3632A	MY40004791	16.07.15
■	Constant temp & Humid chamber	ESPEC CORP.	SH-641	92004765	16.07.17
■	Attenuator	BIRD	50-A-MFN-20	403002	16.10.08
■	Signal generator	R&S	SMR40	100007	16.06.15
■	Spectrum Analyzer	R&S	FSV30	100732	16.07.21
■	Highpass Filter	Mini-Circuits	NHP-800+	v uu16801113	16.07.15
■	Audio analyzer	HP	8903B	3729A18248	16.10.13
■	Modulation analyzer	HP	8901B	3538A05527	16.10.13
■	Wideband power sensor	R&S	NRP-Z81	102398	17.02.11
■	Digital Phosphor Oscilloscope	Tektronix	TDS3012	B027160	16.01.06
■	Bilog Antenna	Teseq GmbH	CBL 6143A	35039	16.07.10
■	Horn antenna	ETS.lindgren	3115	62589	16.11.12
■	Amplifier	SONOMA INSTRUMENT	317	321041	17.03.05
■	Broadband Preamplifier	SCHWARZBECK	BBV9718	216	16.11.11
■	Attenuator	Weinschel ENGINEERING	10	AJ1239	16.07.15
■	RF Selector	TOYO Corporation	NS5800	1003-010	-
■	Band Selector	TOYO Corporation	NS5800	1003-135	-
■	Band Selector	TOYO Corporation	NS5800	1003-320	-
■	Antenna Master	MATURO	EAS 1.5	042/8941211	-
■	Antenna Master	MATURO	EAS 1.5	043/8941211	-
■	Turn Table	MATURO	TT 0.8 PF	041/8941211	-
■	Turn Devices	MATURO	TD 1.5-2 kg	039/8941211	-