ENGINEERING TEST REPORT

HF Transceiver
Model: IC-F8101
FCC ID: AFJ350000

Applicant:

ICOM Incorporated
1-1-32, Kamiminami, Hirano-ku
Osaka
Japan, 547-0003

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, Parts 2 and 90

UltraTech's File No.: ICOM-331F90

This Test report is Issued under the Authority of Tri M. Luu Vice President of Engineering UltraTech Group of Labs Date: June 11, 2013	
Report Prepared by: Dan Huynh Issued Date: June 11, 2013	Tested by: Wei Wu Test Dates: Apr 17 - May 27, 2013

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

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FCC	VCCI	Industry Canada Approved Test Facility	NVLAP	BSMI	Korea KCC-RRL
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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Parts 2 and 90
Title:	Code of Federal Regulations (CFR), Title 47 Telecommunication – Parts 2 and 90
Purpose of Test:	To obtain FCC Certification Authorization for Radio operating in the Frequency Band 1.6 - 30 MHz.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with TIA/EIA Standard TIA/EIA-603-D – Land Mobile FM or PM Communications Equipment Measurement and performance Standards.

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 2 and 90	2012	Code of Federal Regulations – Telecommunication
ANSI C63.4	2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/TIA-603-D	2010	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	Icom Incorporated
Address:	1-1-32, Kamiminami Hirano-ku, Osaka Japan, 547-0003
Contact Person:	Mr. Hideji Fujishima Phone #: +81 6 6794 7783 Fax #: +81 6 6794 7785 Email Address: world_support@icom.co.jp

MANUFACTURER	
Name:	Icom Incorporated
Address:	1-1-32, Kamiminami Hirano-ku, Osaka Japan, 547-0003
Contact Person:	Mr. Hideji Fujishima Phone #: +81 6 6794 7783 Fax #: +81 6 6794 7785 Email Address: world_support@icom.co.jp

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The applicant has supplied the following information (with the exception of the Date of Receipt).

Brand Name:	ICOM Incorporated
Product Name:	HF Transceiver
Model Name or Number:	IC-F8101
Serial Number:	00000001
Type of Equipment:	Licensed Non-Broadcast Station Transmitter
Power Supply Requirement:	13.8 Vdc nominal
Transmitting/Receiving Antenna Type:	Non-integral
Primary User Functions of EUT:	HF Transceiver

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Fixed/mobile
Intended Operating Environment:	Commercial, Industrial or Business
Power Supply Requirement:	13.8 Vdc nominal
RF Output Power Rating:	125, 50 and 10 Watts (J3E, A1A) 75, 50 and 10 Watts(J2B, F1B) 30, 12.5 and 3 Watts (A3E)
Operating Frequency Range:	1.6 - 30 MHz
RF Output Impedance:	50 Ω
Occupied Bandwidth (99%):	J3E: 2.16 kHz A1A: 0.200 kHz J2B: 0.862 kHz F1B: 1.022 kHz A3E: 5.411 kHz
Emission Designation:	2K80J3E, 100HA1A, 2K80J2B, 2K80F1B and 6K00A3E
Antenna Connector Type:	Female HF

2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Shielded/Non-shielded
1	DC Power Connector	1	4-pin connector, 2-wire	Non-shielded cable
2	Fan Connector	1	2-pin connector	Non-shielded cable
3	Speaker Jack	1	Mini jack	Shielded
4	Accessory Connector ATU	1	DB9	Shielded
5	Accessory Connector ACC	1	DB15	Shielded
6	USB Connector	1	USB	Shielded
7	Antenna Connector	1	UHF	Shielded
8	Ground Terminal	1	wire	Non-shielded cable

2.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	Controller (Front Panel)
Brand Name:	Icom Inc.
Model Name or Number:	RMK-6
Serial Number:	00000021

Ancillary Equipment # 2	
Description:	Cooling fans
Brand Name:	Icom Inc.
Model Name or Number:	CFU-F8100
Serial Number:	N/A

Ancillary Equipment # 3	
Description:	External speaker
Brand Name:	Icom Inc.
Model Name or Number:	SP-25
Serial Number:	N/A

Ancillary Equipment # 4	
Description:	Hand Microphone
Brand Name:	Icom Inc.
Model Name or Number:	HM-193
Serial Number:	N/A

Ancillary Equipment # 5	
Description:	Automatic Antenna Tuner
Brand Name:	Icom Inc.
Model Name or Number:	AT-140
Serial Number:	N/A

2.6. GENERAL TEST SETUP

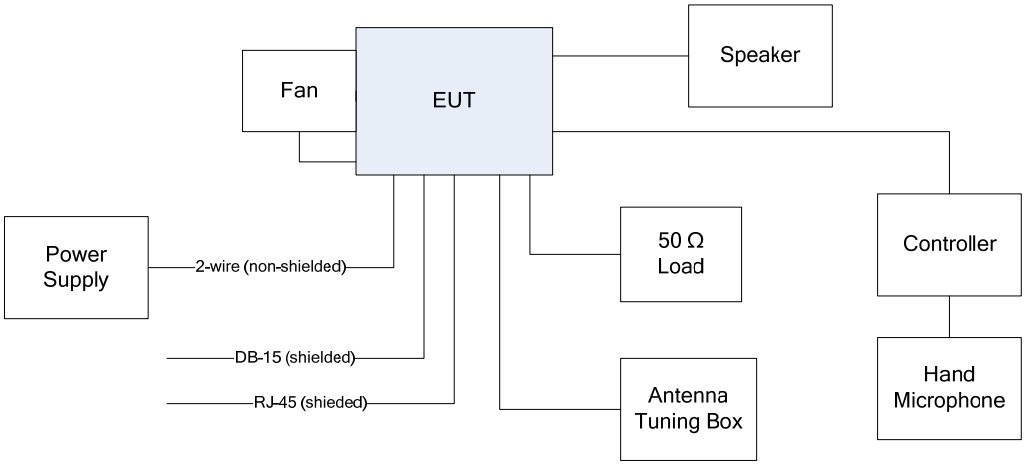


EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power Input Source:	13.8 Vdc nominal

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	N/A
Special Hardware Used:	N/A
Transmitter Test Antenna:	The EUT is tested with the antenna port terminated to a 50 Ohm RF Load.

Transmitter Test Signals	
Frequency Band(s):	1.6 - 30 MHz
Test Frequencies: (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	1.71, 17.45, 29.75 MHz

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2014-04-04.

4.2. APPLICABILITY & SUMMARY OF EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Applicability (Yes/No)
2.1046, 90.205	RF Power Output	Yes
2.1047(a) & 90.242(b)(8)	Modulation Characteristics - Audio Frequency Response	Not applicable to current standard. However, tests are conducted under FCC's recommendation.
2.1047(b) & 90.210	Modulation Characteristics - Modulation Limiting	Yes
2.1049, 90.209 & 90.210	Emission Limitation & Emission Mask	Yes
2.1051, 2.1057, 90.210	Spurious Emissions at Antenna Terminal	Yes
2.1053, 2.1057, 90.210	Field Strength of Spurious Emissions	Yes
2.1055, 90.213	Frequency Stability	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

4.3.1. DEVIATION OF STANDARD TEST PROCEDURES

None.

EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. RF POWER OUTPUT [§ 2.1046, 90.205]

5.1.1. Limits

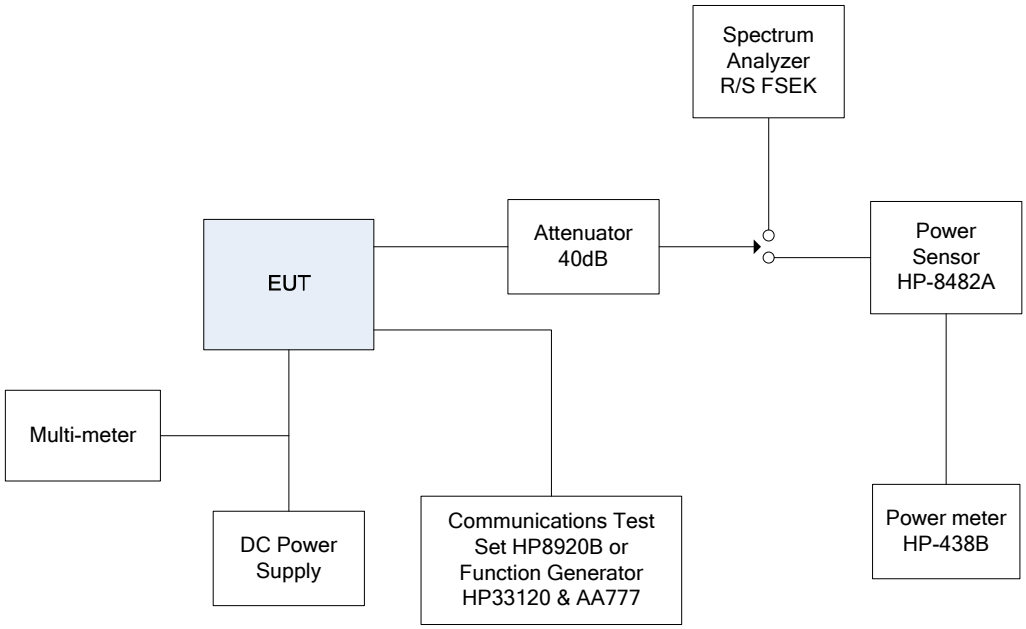
Please refer to FCC 47 CFR 90.205 for detalied limit specifications:

a) Below 25 MHz. For single sideband operations (J3E emission), the maximum transmitter peak envelope power is 1000 watts.
b) 25–50 MHz. The maximum transmitter output power is 300 watts.

5.1.2. Method of Measurements

Refer to Sections 8.1 (Conducted) and 8.2 (Radiated) of this report for measurement details

5.1.3. Test Arrangement



5.1.4. Test Data

Operating Mode: J3E					
Power Level	Frequency (MHz)	Measured Peak Power		Power Rating	
		(W)	(dBm)	(W)	(dBm)
High	1.710	147.23	51.68	125	50.97
	17.450	147.91	51.70	125	50.97
	29.750	143.22	51.56	125	50.97
Middle	1.710	63.24	48.01	50	46.99
	17.450	66.22	48.21	50	46.99
	29.750	62.37	47.95	50	46.99
Low	1.710	13.40	41.27	10	40.00
	17.450	13.90	41.43	10	40.00
	29.750	12.53	40.98	10	40.00

Operating Mode: A1A					
Power Level	Frequency (MHz)	Measured Peak Power		Power Rating	
		(W)	(dBm)	(W)	(dBm)
High	1.710	138.68	51.42	125	50.97
	17.450	140.93	51.49	125	50.97
	29.750	135.21	51.31	125	50.97
Middle	1.710	58.08	47.64	50	46.99
	17.450	59.57	47.75	50	46.99
	29.750	57.02	47.56	50	46.99
Low	1.710	11.97	40.78	10	40.00
	17.450	12.19	40.86	10	40.00
	29.750	11.43	40.58	10	40.00

Operating Mode: J2B					
Power Level	Frequency (MHz)	Measured Peak Power		Power Rating	
		(W)	(dBm)	(W)	(dBm)
High	1.710	87.50	49.42	75	48.75
	17.450	84.53	49.27	75	48.75
	29.750	80.35	49.05	75	48.75
Middle	1.710	58.08	47.64	50	46.99
	17.450	59.29	47.73	50	46.99
	29.750	54.33	47.35	50	46.99
Low	1.710	11.75	40.70	10	40.00
	17.450	11.91	40.76	10	40.00
	29.750	11.12	40.46	10	40.00

Operating Mode: F1B					
Power Level	Frequency (MHz)	Measured Peak Power		Power Rating	
		(W)	(dBm)	(W)	(dBm)
High	1.710	84.14	49.25	75	48.75
	17.450	83.56	49.22	75	48.75
	29.750	76.38	48.83	75	48.75
Middle	1.710	54.95	47.40	50	46.99
	17.450	56.10	47.49	50	46.99
	29.750	51.52	47.12	50	46.99
Low	1.710	10.86	40.36	10	40.00
	17.450	11.48	40.60	10	40.00
	29.750	10.33	40.14	10	40.00

Operating Mode: A3E					
Power Level	Frequency (MHz)	Measured Average Power		Power Rating	
		(W)	(dBm)	(W)	(dBm)
High	1.710	30.13	44.79	30	44.77
	17.450	31.19	44.94	30	44.77
	29.750	29.38	44.68	30	44.77
Middle	1.710	12.22	40.87	12.5	40.97
	17.450	12.91	41.11	12.5	40.97
	29.750	11.56	40.63	12.5	40.97
Low	1.710	2.75	34.40	3	34.77
	17.450	2.82	34.50	3	34.77
	29.750	3.20	35.05	3	34.77

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.2. AUDIO FREQUENCY RESPONSE [§ 2.1047(a) & 90.242(b)(8)]

5.2.1. Limits

§ **2.1047(a):** Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

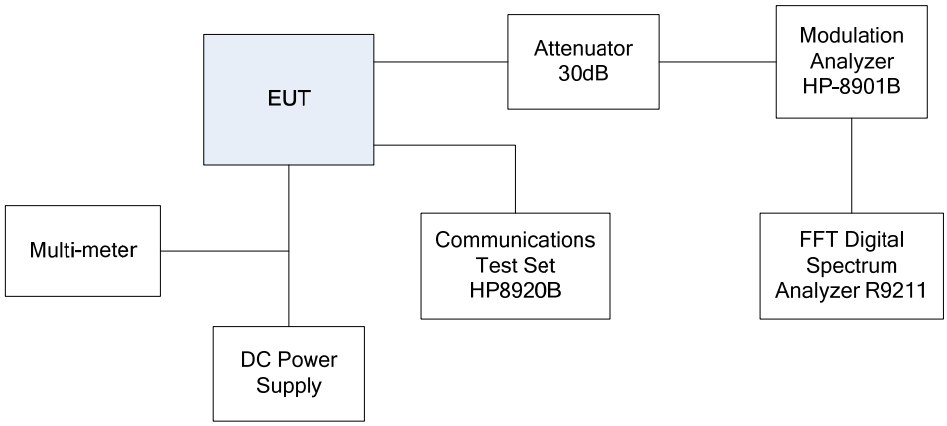
§ **90.242(b)(8):** Recommended audio filter attenuation characteristics are given below:

RF Band	Audio band	Minimum Attenuation Rel. to 1 kHz Attenuation
1.6 - 30 MHz	3 –20 KHz 20 – 30 KHz	60 $\log_{10}$(f/3) dB where f is in kHz 50dB

5.2.2. Method of Measurements

The rated audio input signal was applied to the input of the audio low-pass filter (or of all modulation stages) using an audio oscillator, this input signal level and its corresponding output signal were then measured and recorded using the FFT Digital Spectrum Analyzer. Tests were repeated at different audio signal frequencies from 0 to 50 KHz.

5.2.3. Test Arrangement



5.2.4. Test Data

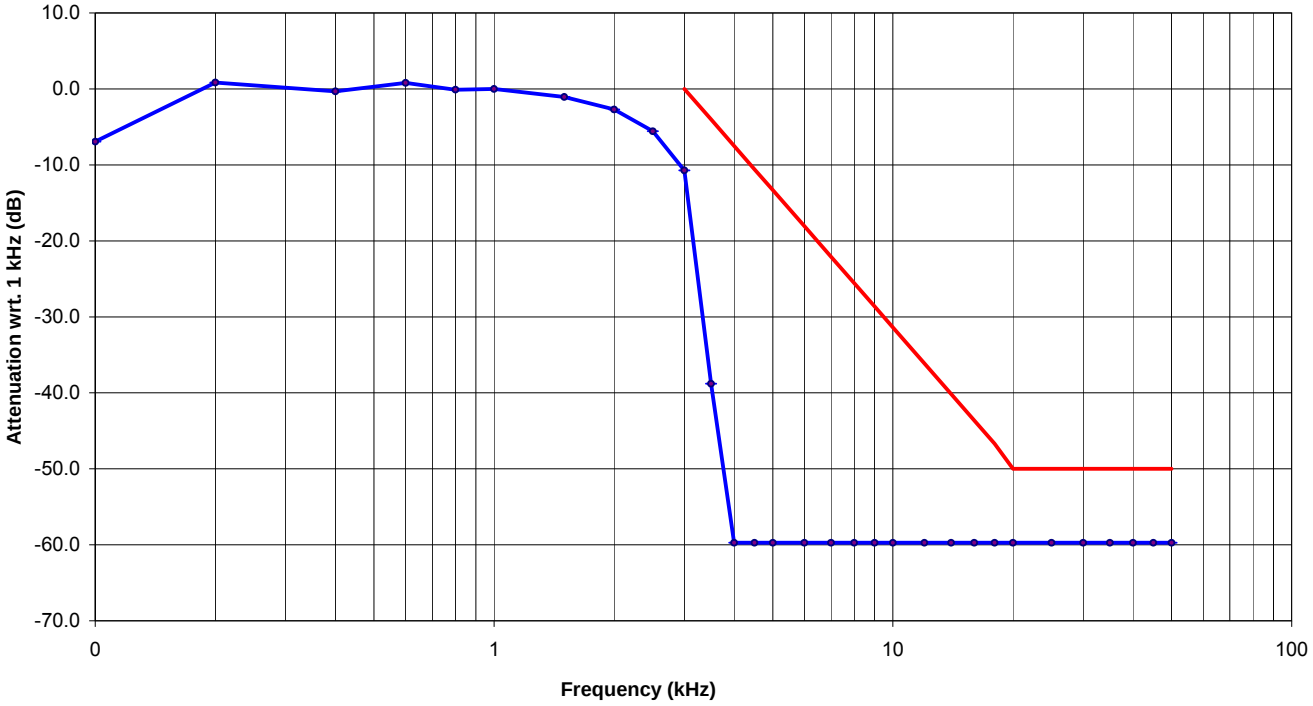
5.2.4.1. A3E - Audio Frequency Response of All Modulation States

Remark: Due to the difficulty of measuring the Frequency Response of the internal low-pass filter, the Frequency Response of All Modulation States is performed to show the roll-off at 3 kHz in comparison with the recommended audio filter attenuation.

Audio input level STD: 1 mV

Frequency (KHz)	Audio In (dBV)	Audio Out (dBV)	Attenuation (Out - In) (dB)	Attenuation Rel. to 1 KHz (dB)	Recommended Attenuation (dB)
0.1	-60.00	-17.21	42.8	-6.9	--
0.2	-60.00	-9.43	50.6	0.8	--
0.4	-60.00	-10.58	49.4	-0.3	--
0.6	-60.00	-9.47	50.5	0.8	--
0.8	-60.00	-10.36	49.6	-0.1	--
1.0	-60.00	-10.27	49.7	0.0	--
1.5	-60.00	-11.33	48.7	-1.1	--
2.0	-60.00	-12.98	47.0	-2.7	--
2.5	-60.00	-15.84	44.2	-5.6	--
3.0	-60.00	-20.98	39.0	-10.7	0
3.5	-60.00	-49.07	10.9	-38.8	-4
4.0	-60.00	-70.00	-10.0	-59.7	-7
4.5	-60.00	-70.00	-10.0	-59.7	-11
5.0	-60.00	-70.00	-10.0	-59.7	-13
6.0	-60.00	-70.00	-10.0	-59.7	-18
7.0	-60.00	-70.00	-10.0	-59.7	-22
8.0	-60.00	-70.00	-10.0	-59.7	-26
9.0	-60.00	-70.00	-10.0	-59.7	-29
10.0	-60.00	-70.00	-10.0	-59.7	-31
12.0	-60.00	-70.00	-10.0	-59.7	-36
14.0	-60.00	-70.00	-10.0	-59.7	-40
16.0	-60.00	-70.00	-10.0	-59.7	-44
18.0	-60.00	-70.00	-10.0	-59.7	-47
20.0	-60.00	-70.00	-10.0	-59.7	-50
25.0	-60.00	-70.00	-10.0	-59.7	-50
30.0	-60.00	-70.00	-10.0	-59.7	-50
35.0	-60.00	-70.00	-10.0	-59.7	-50
40.0	-60.00	-70.00	-10.0	-59.7	-50
45.0	-60.00	-70.00	-10.0	-59.7	-50
50.0	-60.00	-70.00	-10.0	-59.7	-50

A3E - Audio Frequency Response



5.3. MODULATION LIMITING [§ 2.1047 (b) & 90.210]

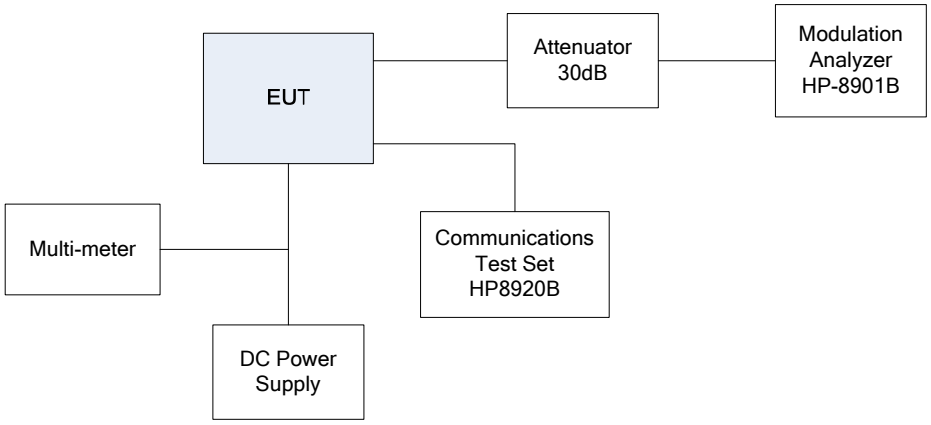
5.3.1. Limits

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

5.3.2. Method of Measurements

For Audio Transmitter: The carrier frequency deviation was measured with the tone input signal level varied from 0 Vp to audio input rating level plus 16 dB at frequencies 0.1, 0.5, 1.0, 3.0 and 5.0 kHz. The maximum deviation was recorded at each test condition.

5.3.3. Test Arrangement



5.3.4. Test Data

5.3.4.1. A3E - Modulation Limiting

Modulating Signal Level	Peak Modulation depth %					Maximum Limit
(mVrms)	0.1 kHz	0.5 kHz	1.0 kHz	3.0 kHz	5.0 kHz	%
1	24.38	55.30	51.30	20.42	12.50	100
2	45.90	85.50	85.60	32.79	12.50	100
4	52.40	85.50	85.60	38.22	12.45	100
6	54.10	85.50	85.60	37.49	12.40	100
8	51.90	85.50	85.60	37.49	12.40	100
10	51.90	85.50	85.60	37.49	12.39	100
15	51.90	85.50	85.60	37.49	7.42	100
20	51.90	85.50	85.60	37.49	5.41	100
25	51.90	85.50	85.60	37.49	4.39	100
30	51.90	85.50	85.60	37.49	3.56	100
35	51.90	85.50	85.60	37.49	3.18	100
40	51.90	85.50	85.60	37.49	2.87	100
45	51.90	85.50	85.60	37.49	2.56	100
50	51.90	85.50	85.60	37.49	2.24	100

Voice Signal Input Level	= STD MOD Level + 16 dB = 20*log(1 mVrms) + 16 dB = 16 dB(mVrms) = 6.31 mVrms	
Modulation Frequency (kHz	**Peak Depth (%)**	**Maximum Limit (%)**
0.1	51.90	100
0.2	86.10	100
0.4	86.10	100
0.6	86.70	100
0.8	86.80	100
1.0	85.80	100
1.2	81.70	100
1.4	81.00	100
1.6	78.80	100
1.8	76.80	100
2.0	74.00	100
2.5	59.40	100
3.0	37.70	100
3.5	4.45	100
4.0	5.02	100
4.5	5.83	100
5.0	12.44	100
6.0	13.38	100
7.0	12.94	100
8.0	12.73	100
9.0	13.11	100
10.0	12.93	100

5.3.4.2. J2B - Modulation Limiting

Input Audio Signal Level (mV)	Measured RF Ouput Power (dBm)	Measured RF Ouput Power (Watts)
1	8.05	0.01
2	11.92	0.02
5	20.38	0.11
10	25.84	0.38
15	28.91	0.78
20	32.97	1.98
30	34.40	2.75
40	36.64	4.61
50	38.69	7.40
60	39.82	9.59
70	41.14	13.00
80	41.93	15.60
90	42.57	18.07
100	43.25	21.13
200	47.40	54.95
300	48.93	78.16
400	49.05	80.35
500	49.42	87.50
600	49.42	87.50
700	49.42	87.50
824	49.42	87.50

5.3.4.3. J3E - Modulation Limiting

Input Audio Signal Level (mV)	Measured RF Ouput Power (dBm)	Measured RF Ouput Power (Watts)
0.5	43.24	21.09
1	48.32	67.92
2	51.60	144.54
4	51.62	145.21
6	51.64	145.88
8	51.64	145.88
10	51.68	147.23
15	51.64	145.88
20	51.68	147.23
50	51.68	147.23
100	51.68	147.23
200	51.68	147.23
300	51.68	147.23
400	51.68	147.23
500	51.68	147.23
600	51.68	147.23
700	51.68	147.23
800	51.68	147.23
900	51.68	147.23
1000	51.68	147.23

5.4. OCCUPIED BANDWIDTH & EMISSION MASK [§ 2.1049, 90.209 & 90.210]

5.4.1. Limits

§ 90.209 (b)

(1) For **A1A** or A1B emissions, the maximum authorized bandwidth is 0.25 kHz. The maximum authorized bandwidth for type **A3E** emission is 8 kHz.

(2) For operations below 25 MHz utilizing **J3E** emission, the bandwidth occupied by the emission shall not exceed 3000 Hz. The assigned frequency will be specified in the authorization. The authorized carrier frequency will be 1400 Hz lower in frequency than the assigned frequency. Only upper sideband emission may be used. In the case of regularly available double sideband radiotelephone channels, an assigned frequency for J3E emissions is available either 1600 Hz below or 1400 Hz above the double sideband radiotelephone assigned frequency.

(3) For all other types of emissions, the maximum authorized bandwidth shall not be more than that normally authorized for voice operations.

§ 90.210 Emission masks

Applicable Emission Masks

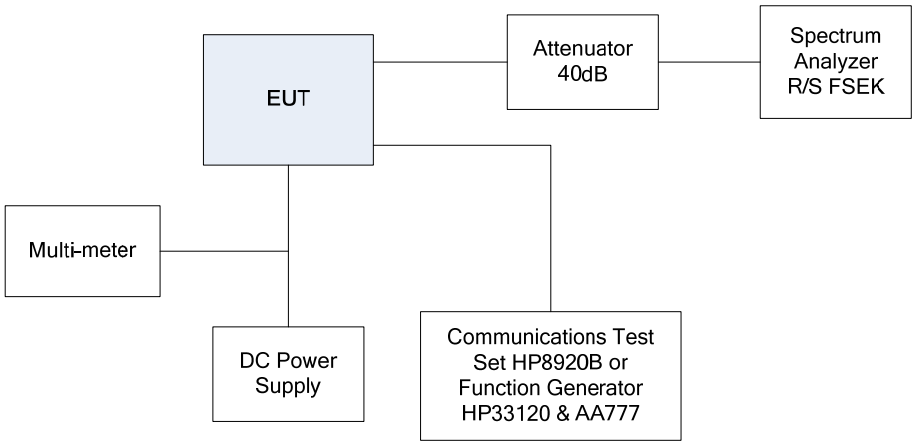
Frequency band (MHz)	Mask for equipment with Audio low pass filter	Mask for equipment without audio low pass filter
Below 25 [1]	A or B	A or C
25-50	B	C

[1] Equipment using single sideband J3E emission must the requirements of Emission Mask A. Equipment using other emissions must meet the requirements of Emission Mask B or C, as applicable.

5.4.2. Method of Measurements

Refer to 47 CFR 2.1049 for measurement details.

5.4.3. Test Arrangement



5.4.4. Test Data

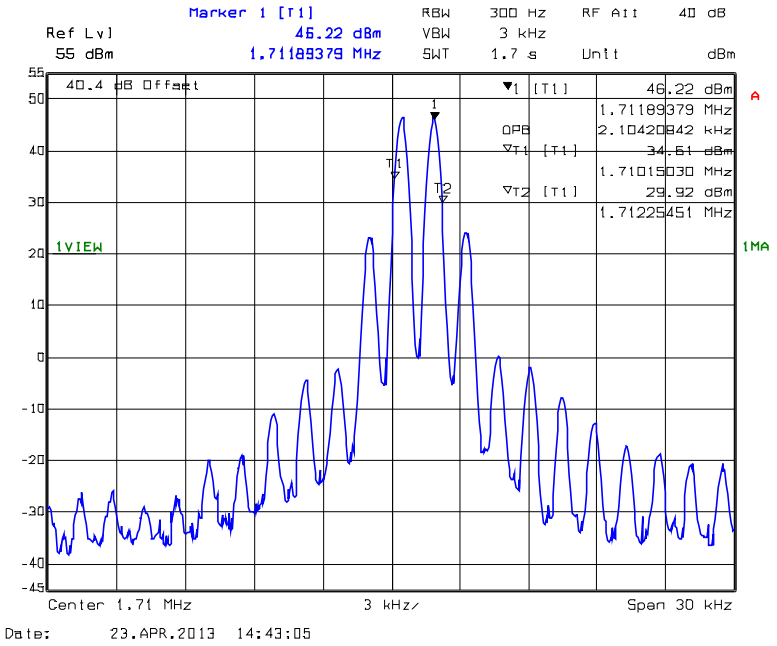
5.4.4.1. 99% Occupied Bandwidth

Emission Type	Frequency (MHz)	*Measured 99% OBW at Maximum Freq. Deviation (kHz)	Maximum Authorized Bandwidth (kHz)
J3E	1.71	2.10	3
	17.45	2.04	3
	29.75	2.16	3
A1A	1.71	0.188	0.25
	17.45	0.196	0.25
	29.75	0.200	0.25
J2B	1.71	0.862	3
	17.45	0.862	3
	29.75	0.862	3
F1B	1.71	0.992	3
	17.45	1.022	3
	29.75	0.992	3
A3E	1.71	5.411	8
	17.45	5.411	8
	29.75	5.411	8

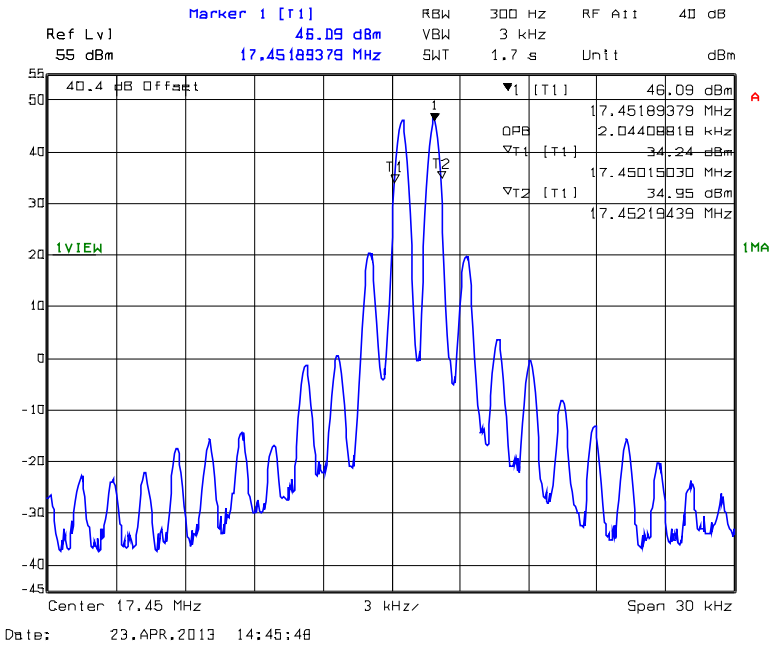
Note: 99% Occupied Bandwidth measurements were done using the built-in auto function of the analyzer.

See the following plots for detailed measurements.

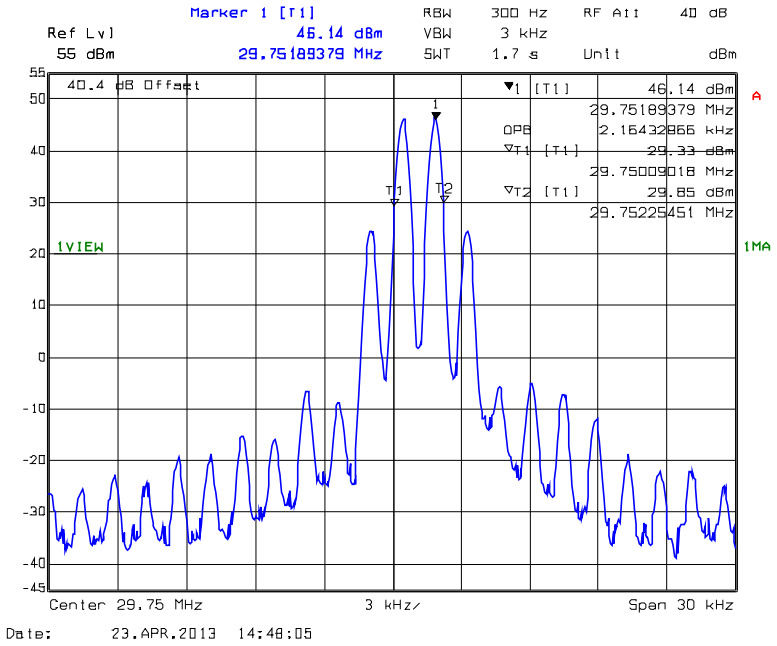
Plot 5.4.4.1.1. 99% Occupied Bandwidth, J3E, 1.71 MHz
Two tones at frequencies of 400 Hz and 1800 Hz



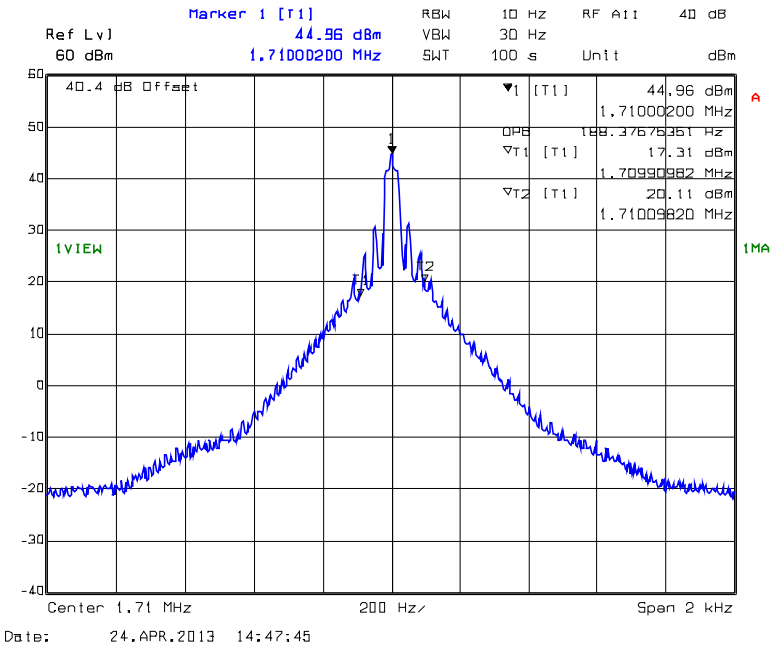
Plot 5.4.4.1.2. 99% Occupied Bandwidth, J3E, 17.45 MHz
Two tones at frequencies of 400 Hz and 1800 Hz



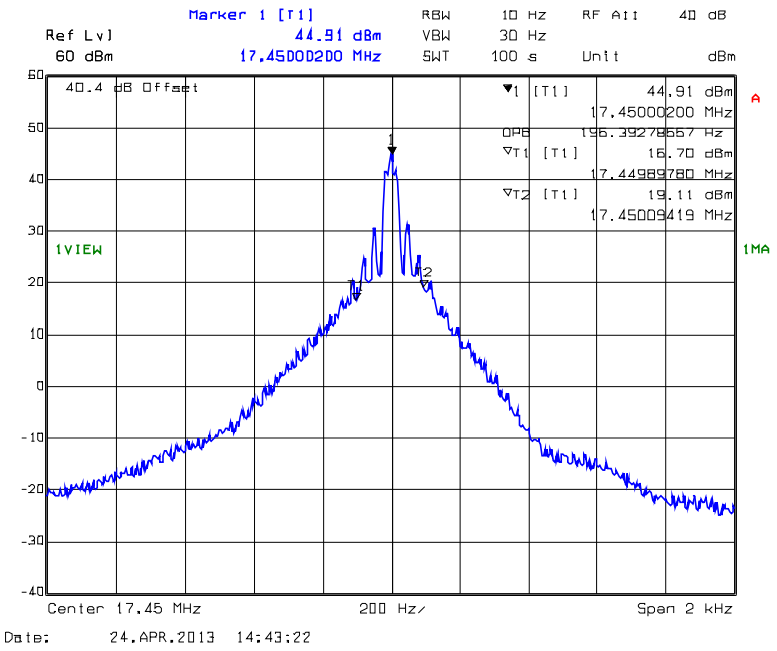
Plot 5.4.4.1.3. 99% Occupied Bandwidth, J3E, 29.75 MHz
Two tones at frequencies of 400 Hz and 1800 Hz



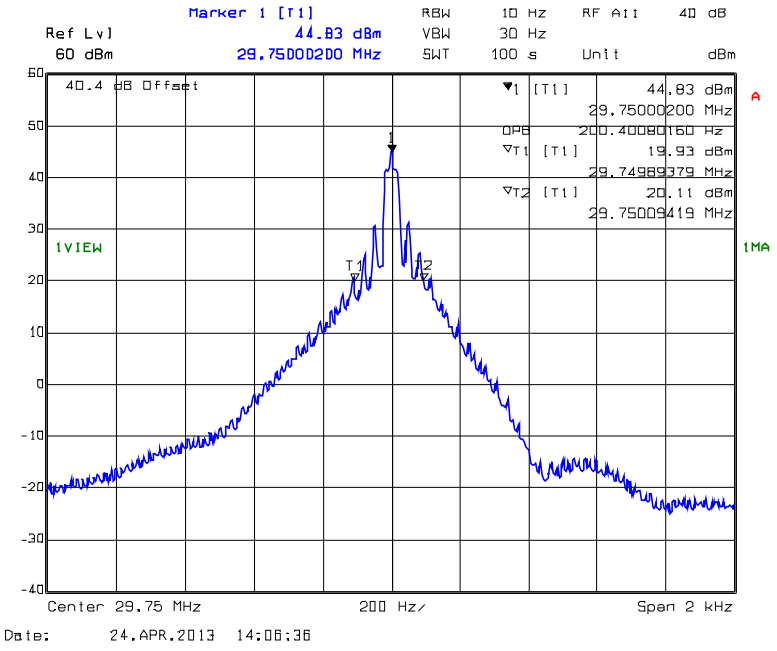
Plot 5.4.4.1.4. 99% Occupied Bandwidth, A1A, 1.71 MHz
16 dots / second



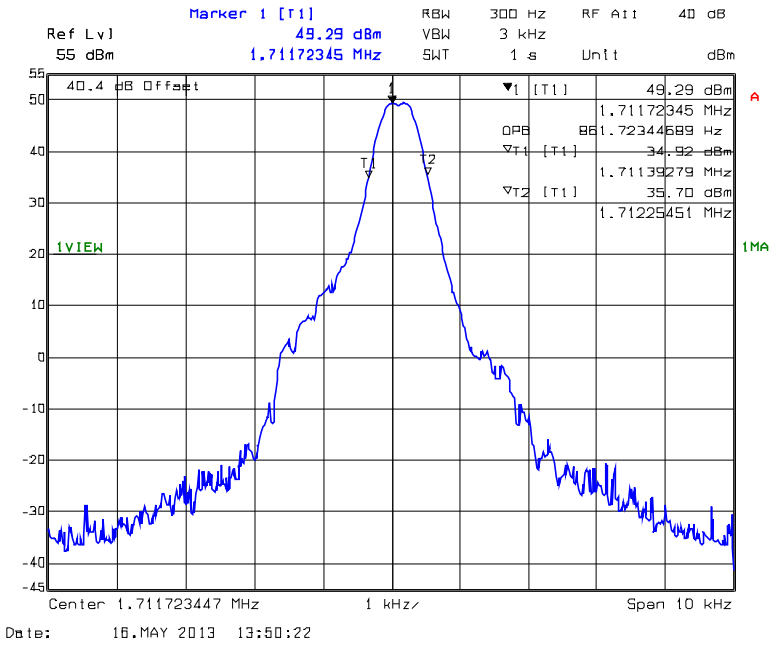
Plot 5.4.4.1.5. 99% Occupied Bandwidth, A1A, 17.45 MHz
16 dots / second



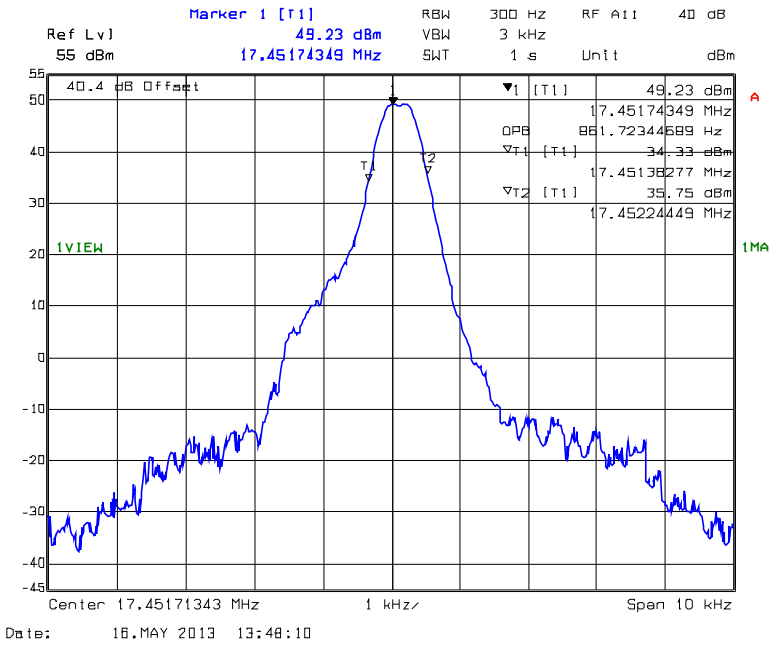
Plot 5.4.4.1.6. 99% Occupied Bandwidth, A1A, 29.75 MHz
16 dots / second



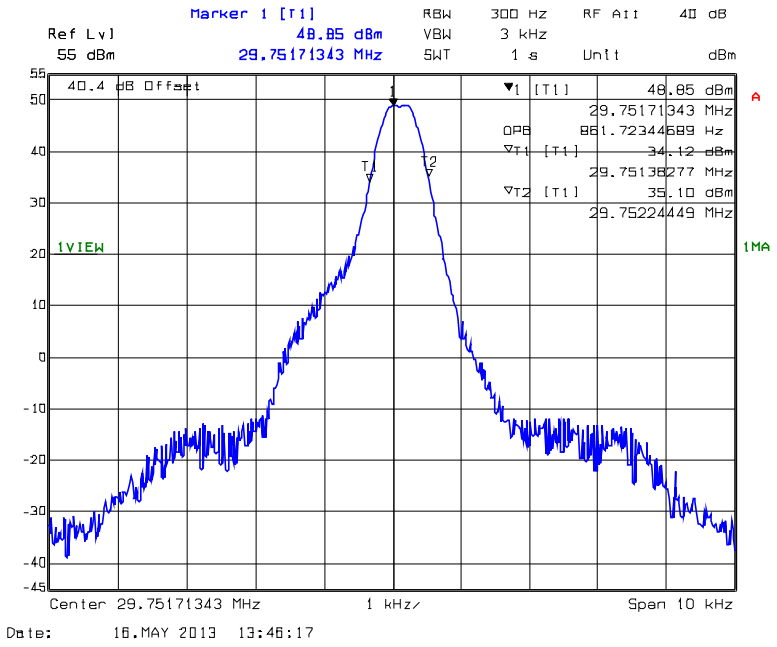
Plot 5.4.4.1.7. 99% Occupied Bandwidth, J2B (USBD1), 1.71 MHz
AFSK Tone Frequency: 1.7 kHz; Shift Frequency: 170 Hz; Shift Rate: 100



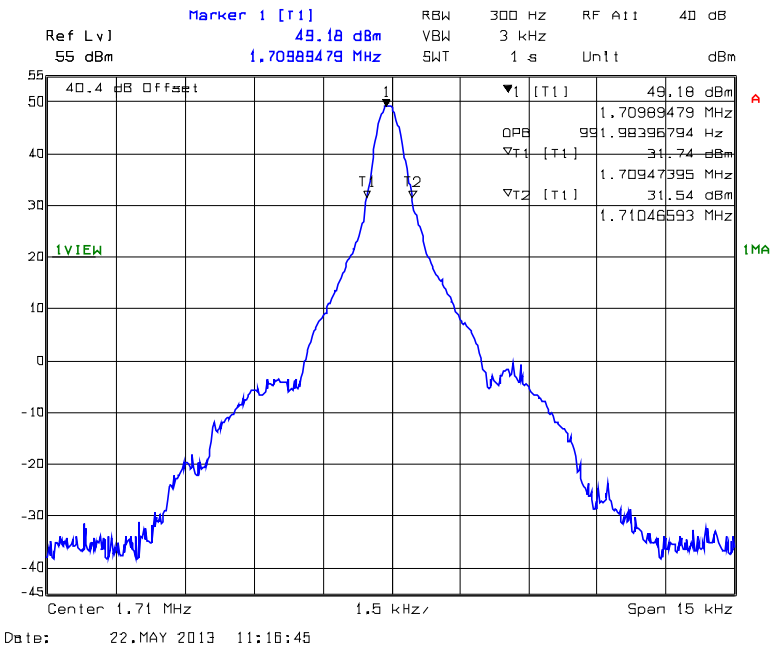
Plot 5.4.4.1.8. 99% Occupied Bandwidth, J2B (USBD1), 17.45 MHz
AFSK Tone Frequency: 1.7 kHz; Shift Frequency: 170 Hz; Shift Rate: 100



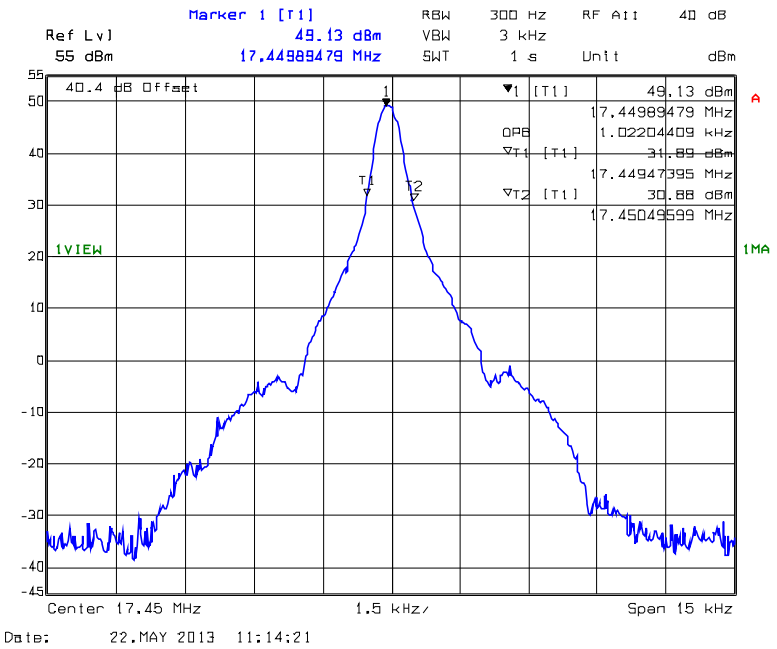
Plot 5.4.4.1.9. 99% Occupied Bandwidth, J2B (USBD1), 29.75 MHz
AFSK Tone Frequency: 1.7 kHz; Shift Frequency: 170 Hz; Shift Rate: 100



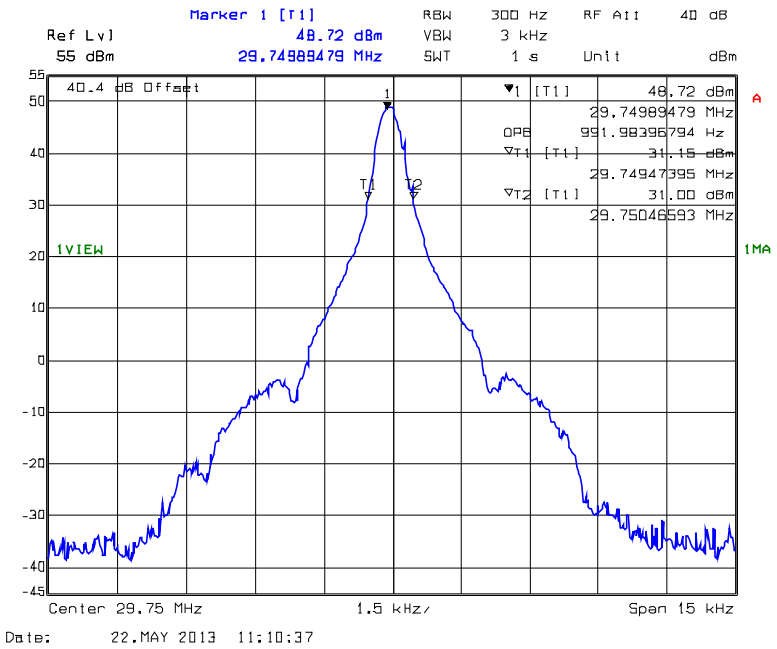
Plot 5.4.4.1.10. 99% Occupied Bandwidth, F1B (RTTY), 1.71 MHz
Shift Frequency 170 Hz; Shift Rate 100



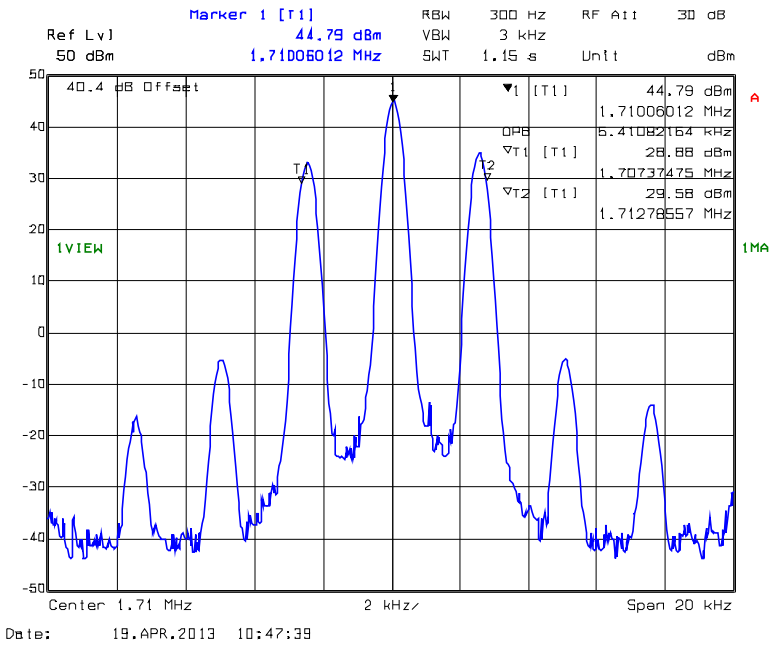
Plot 5.4.4.1.11. 99% Occupied Bandwidth, F1B (RTTY), 17.45 MHz
Shift Frequency 170 Hz; Shift Rate 100



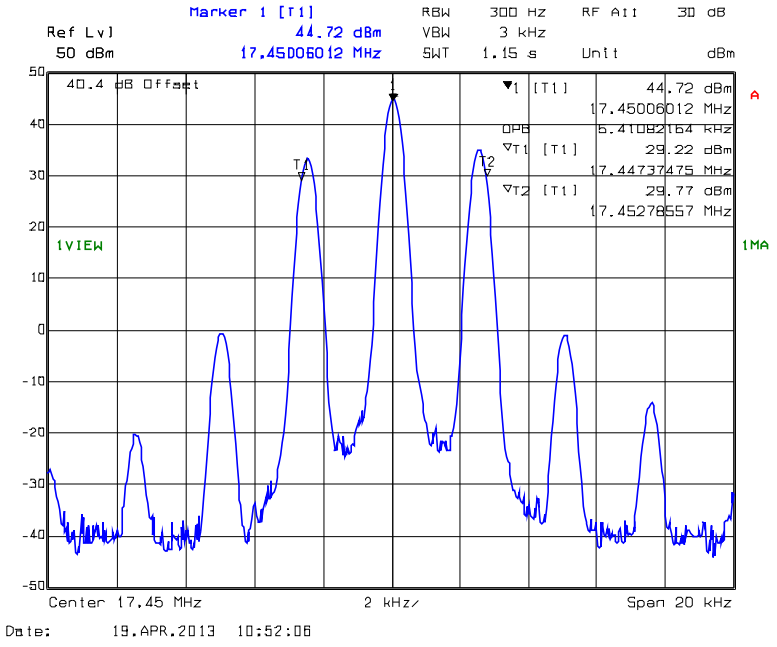
Plot 5.4.4.1.12. 99% Occupied Bandwidth, F1B (RTTY), 29.75 MHz
Shift Frequency 170 Hz; Shift Rate 100



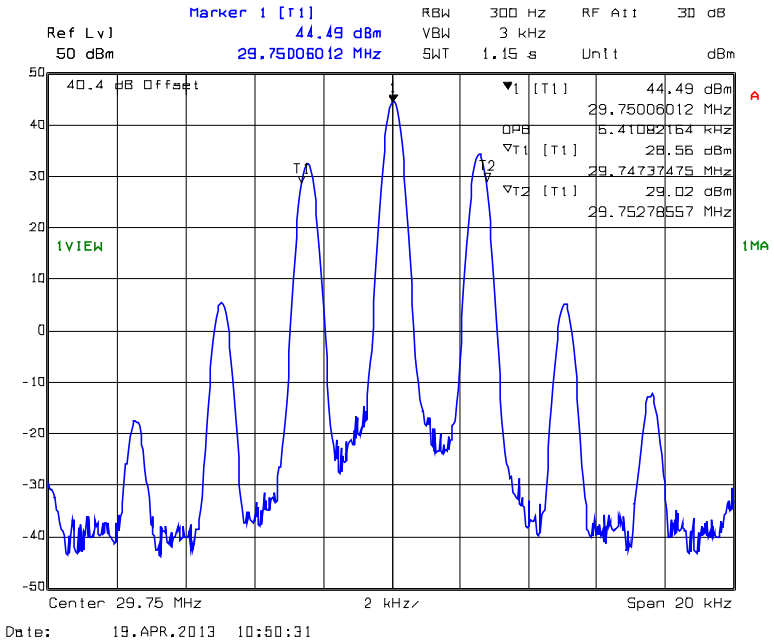
Plot 5.4.4.1.13. 99% Occupied Bandwidth, A3E, 1.71 MHz
2.5 kHz tone



Plot 5.4.4.1.14. 99% Occupied Bandwidth, A3E, 17.45 MHz
2.5 kHz tone

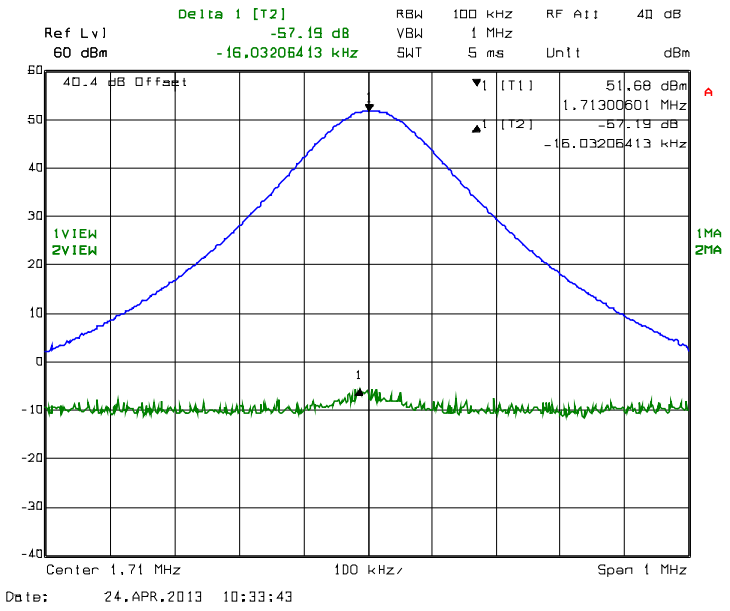


Plot 5.4.4.1.15. 99% Occupied Bandwidth, A3E, 29.75 MHz
2.5 kHz tone

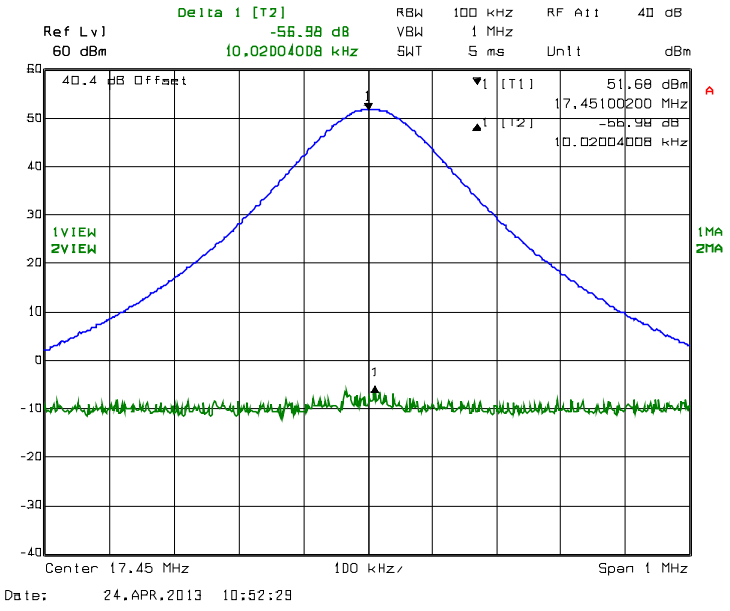


5.4.4.2. Emission Masks

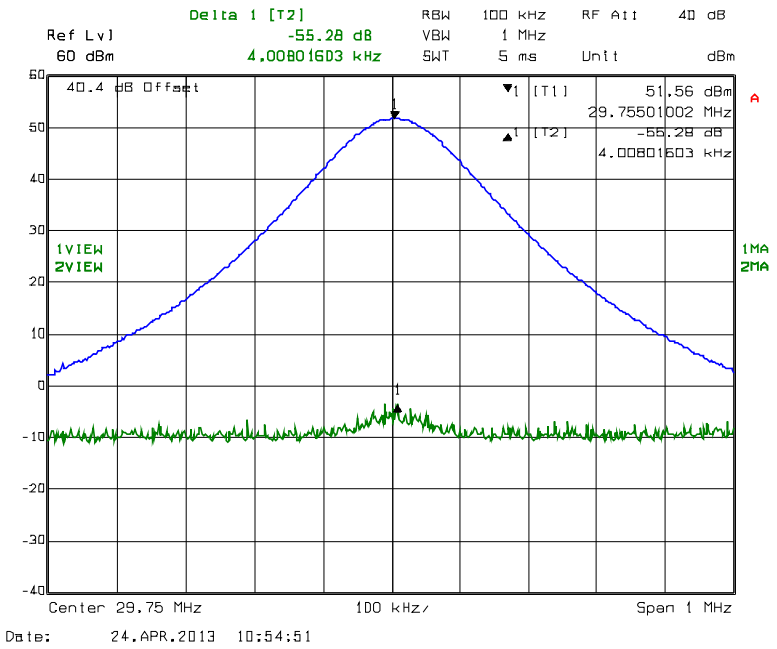
Plot 5.4.4.2.1. Emission Mask A – Suppressed Carrier, J3E, High Power, 1.71 MHz
Carrier is at least 40 dB below the peak envelope power



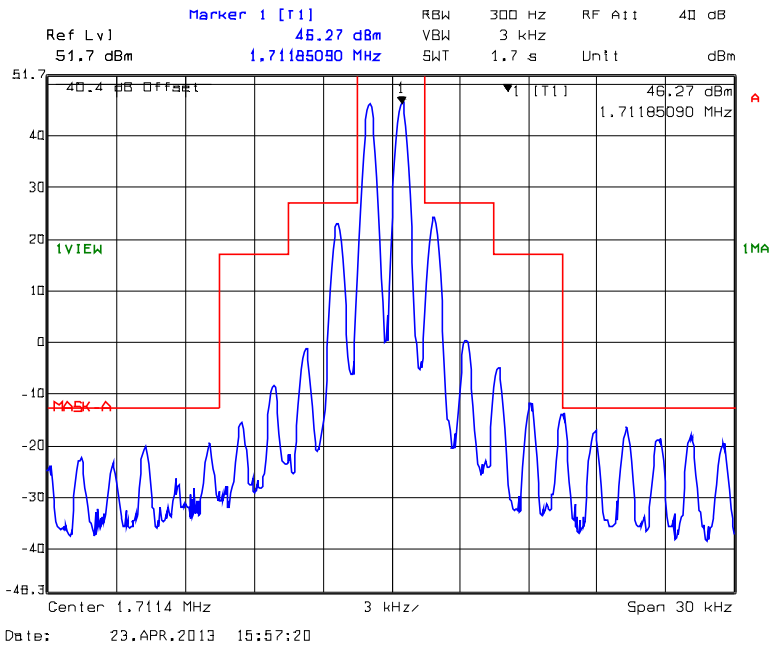
Plot 5.4.4.2.2. Emission Mask A – Suppressed Carrier, J3E, High Power, 17.45 MHz
Carrier is at least 40 dB below the peak envelope power



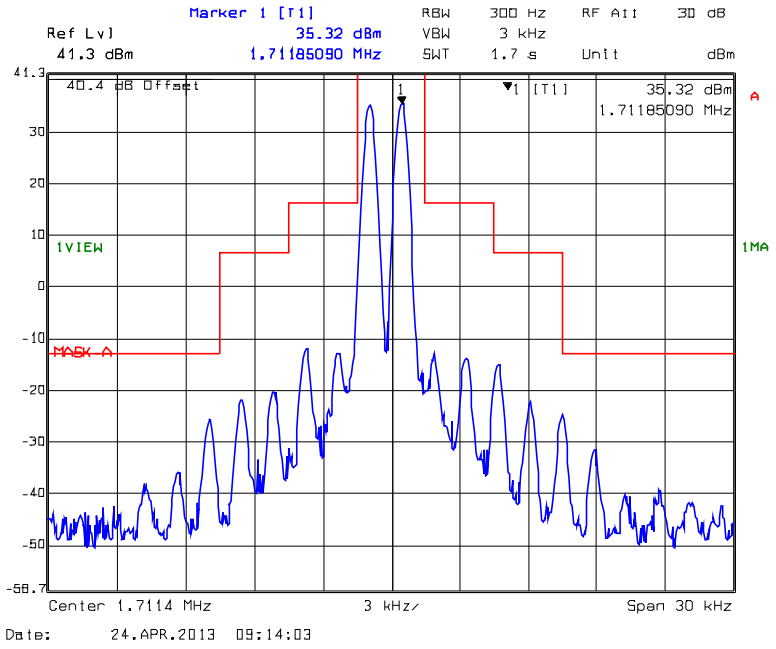
Plot 5.4.4.2.3. Emission Mask A – Suppressed Carrier, J3E, High Power, 29.75 MHz
Carrier is at least 40 dB below the peak envelope power



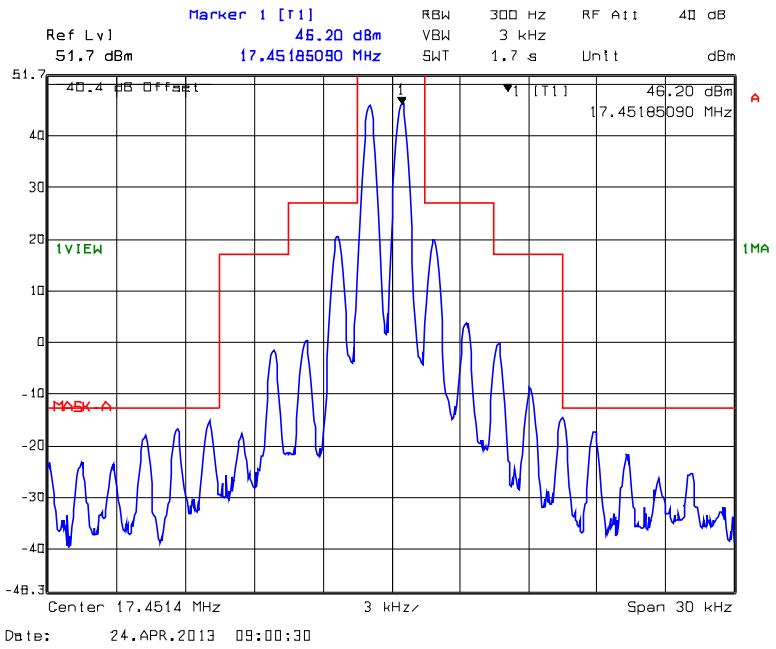
Plot 5.4.4.2.4. Emission Mask A, J3E, High Power, 1.71 MHz
Two tones at frequencies of 400 Hz and 1800 Hz



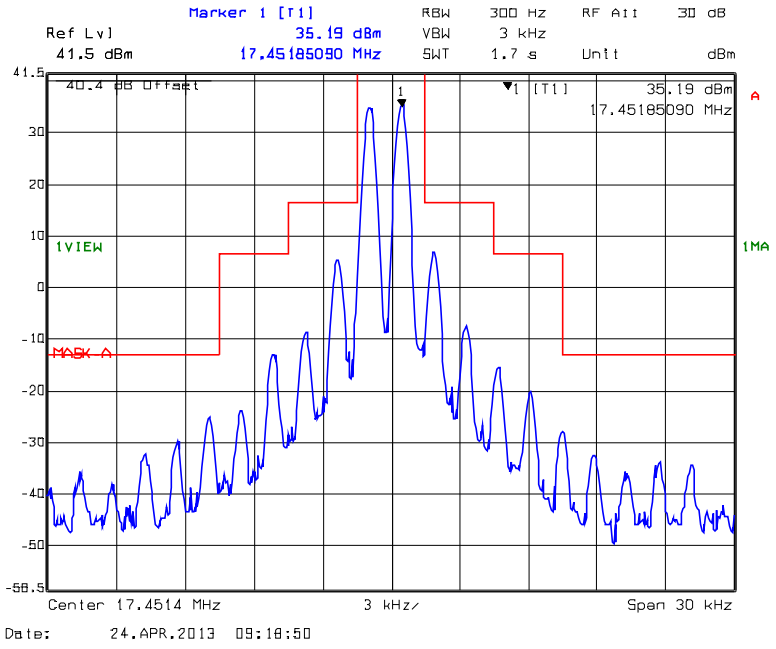
Plot 5.4.4.2.5. Emission Mask A, J3E, Low Power, 1.71 MHz
Two tones at frequencies of 400 Hz and 1800 Hz



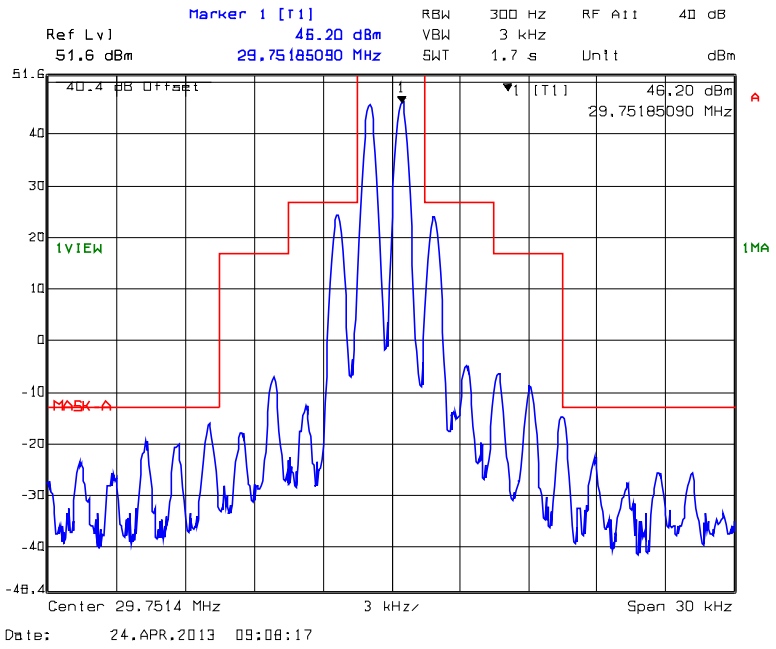
Plot 5.4.4.2.6. Emission Mask A, J3E, High Power, 17.45 MHz
Two tones at frequencies of 400 Hz and 1800 Hz



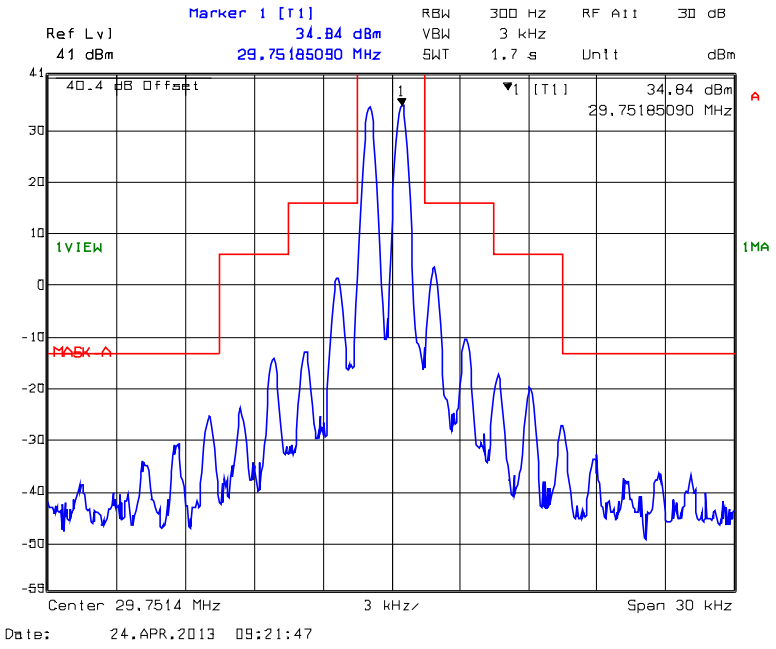
Plot 5.4.4.2.7. Emission Mask A, J3E, Low Power, 17.45 MHz
Two tones at frequencies of 400 Hz and 1800 Hz



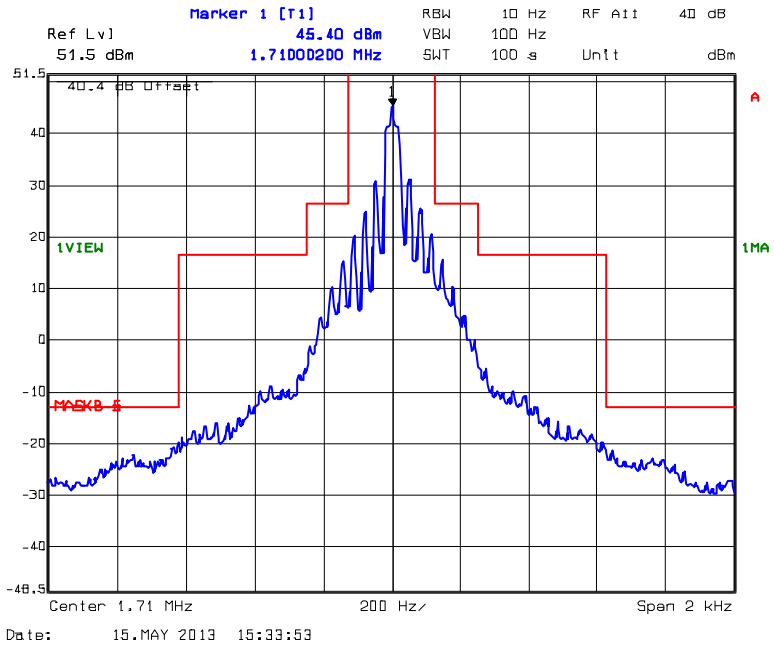
Plot 5.4.4.2.8. Emission Mask A, J3E, High Power, 29.75 MHz
Two tones at frequencies of 400 Hz and 1800 Hz



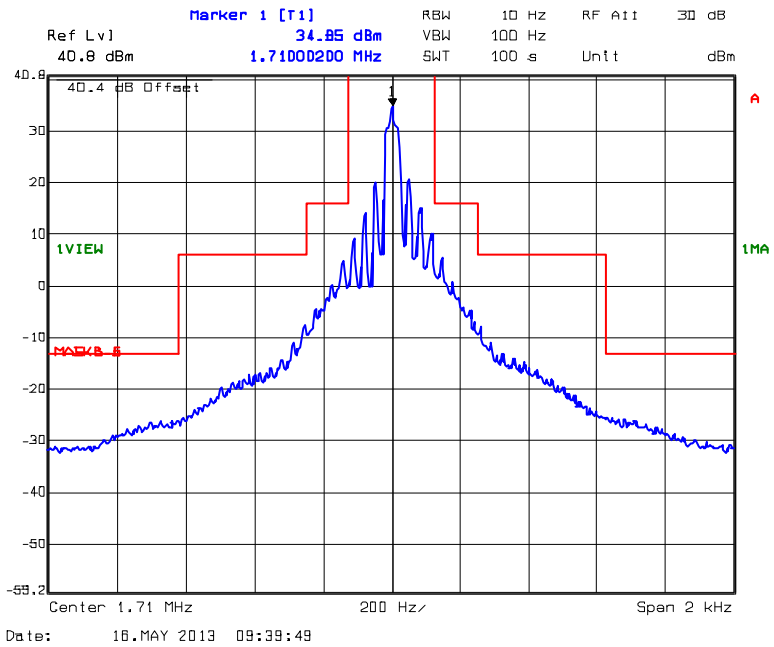
Plot 5.4.4.2.9. Emission Mask A, J3E, Low Power, 29.75 MHz
Two tones at frequencies of 400 Hz and 1800 Hz



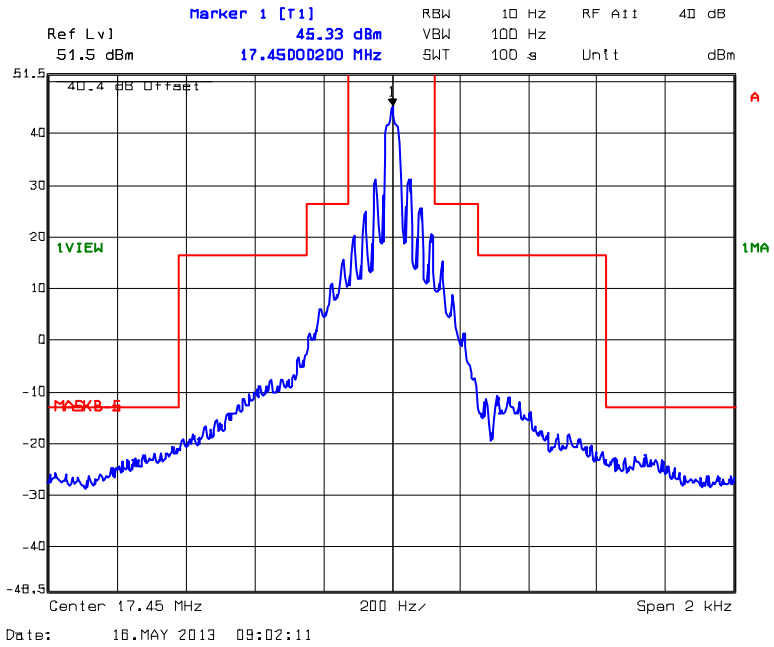
Plot 5.4.4.2.10. Emission Mask B, A1A, High Power, 1.71 MHz
16 dots / second



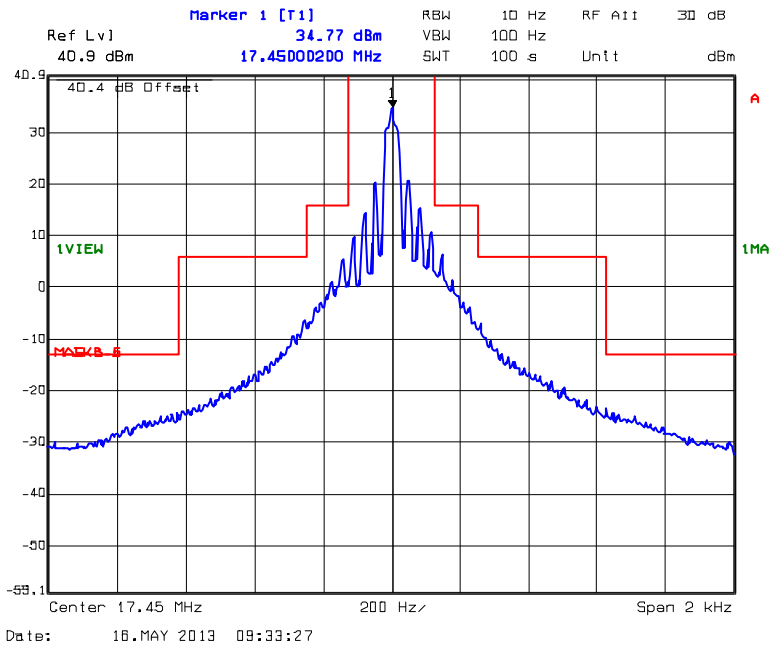
Plot 5.4.4.2.11. Emission Mask B, A1A, Low Power, 1.71 MHz
16 dots / second



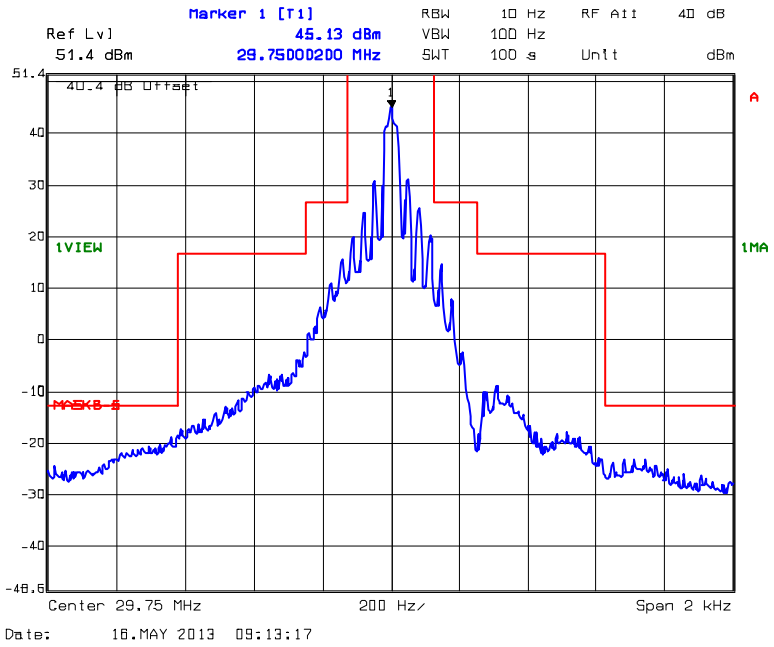
Plot 5.4.4.2.12. Emission Mask B, A1A, High Power, 17.45 MHz
16 dots / second



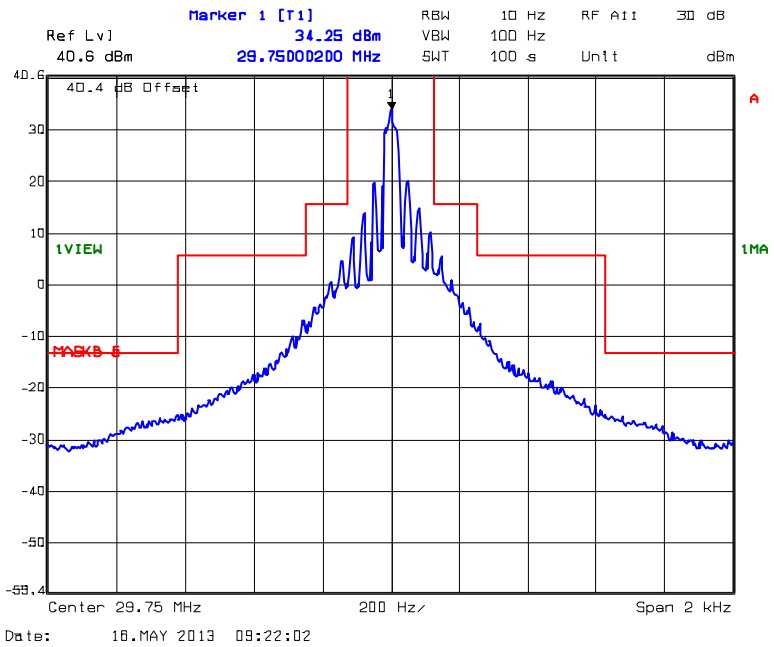
Plot 5.4.4.2.13. Emission Mask B, A1A, Low Power, 17.45 MHz
16 dots / second



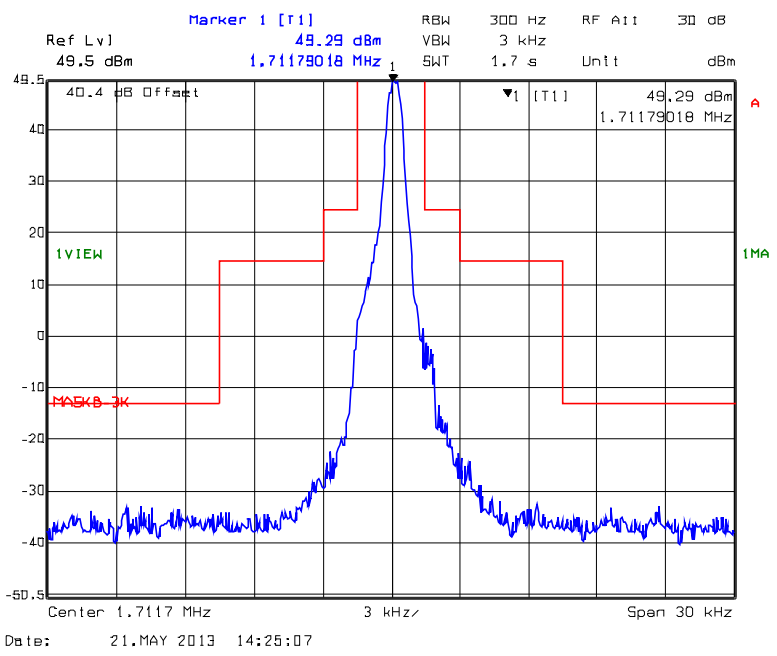
Plot 5.4.4.2.14. Emission Mask B, A1A, High Power, 29.75 MHz
16 dots / second



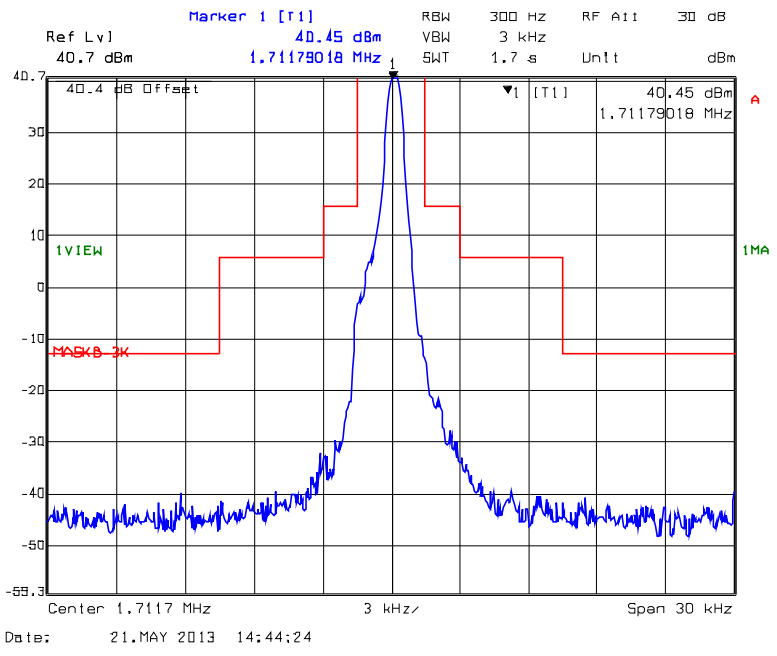
Plot 5.4.4.2.15. Emission Mask B, A1A, Low Power, 29.75 MHz
16 dots / second



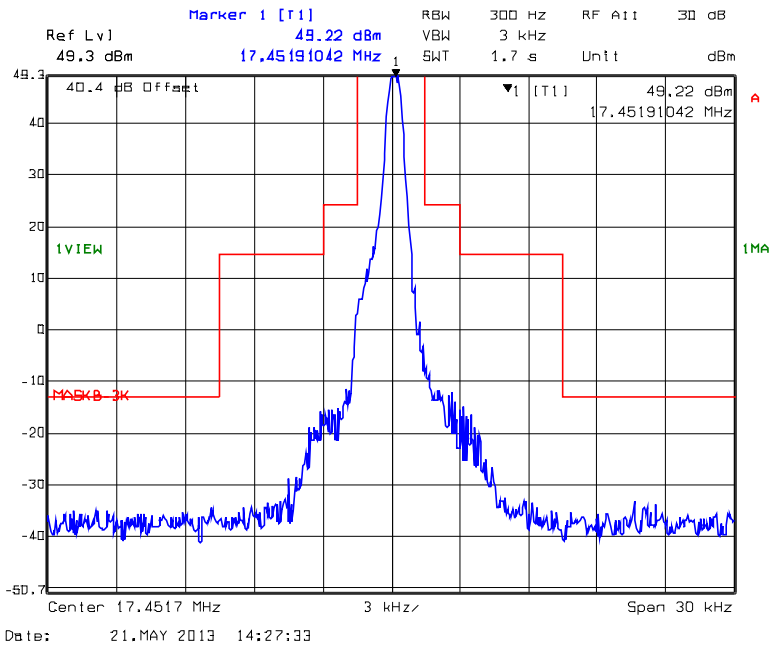
Plot 5.4.4.2.16. Emission Mask B, J2B, High Power, 1.71 MHz



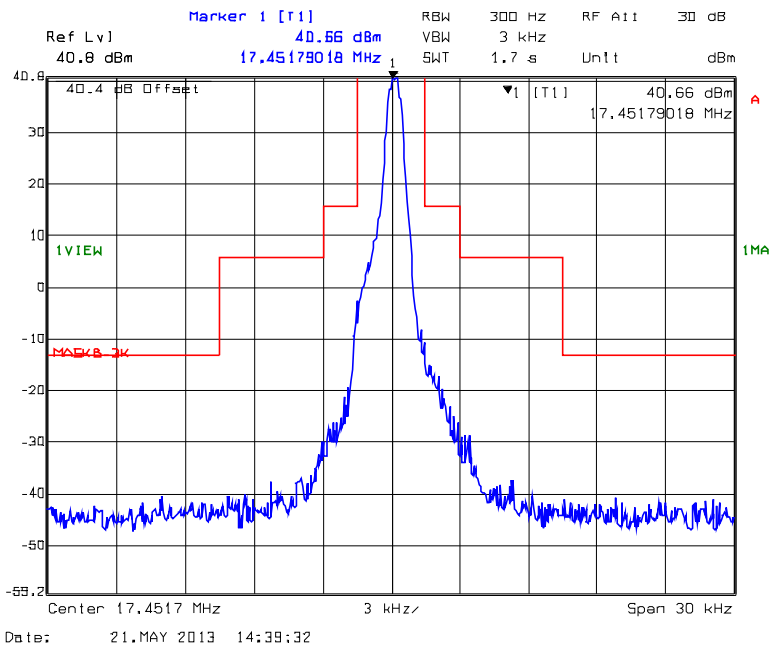
Plot 5.4.4.2.17. Emission Mask B, J2B, Low Power, 1.71 MHz



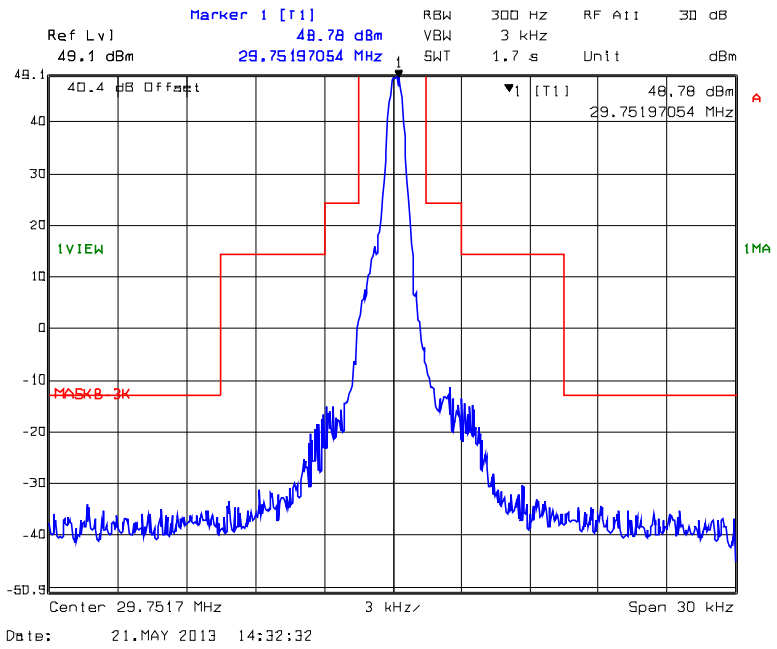
Plot 5.4.4.2.18. Emission Mask B, J2B, High Power, 17.45 MHz



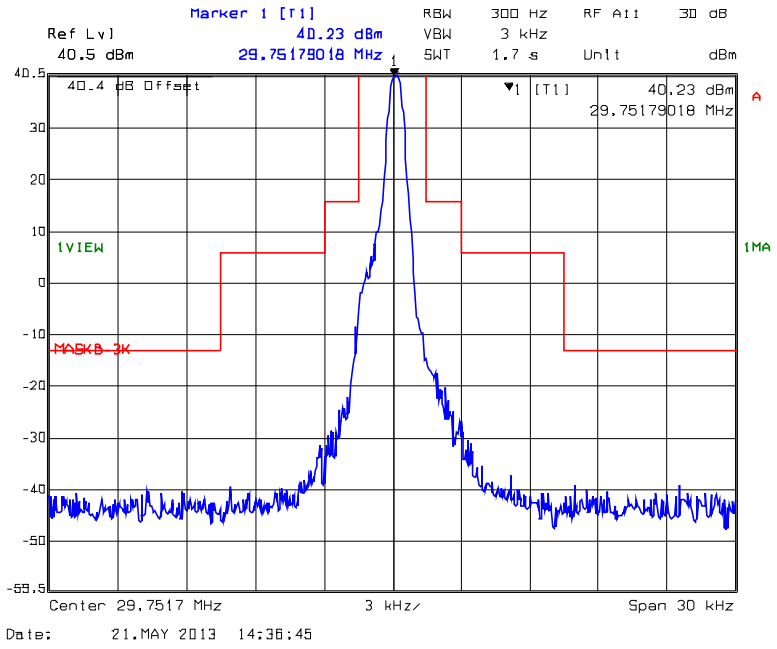
Plot 5.4.4.2.19. Emission Mask B, J2B, Low Power, 17.45 MHz



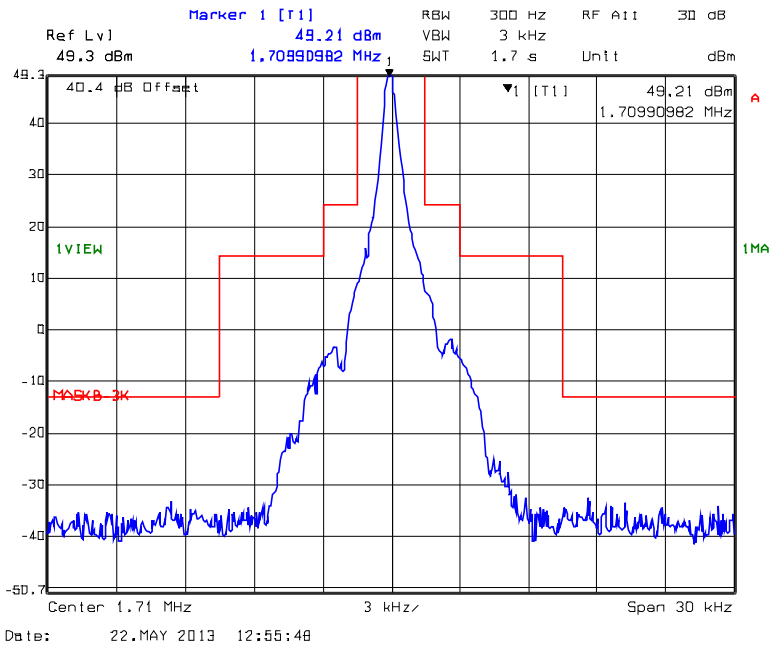
Plot 5.4.4.2.20. Emission Mask B, J2B, High Power, 29.75 MHz



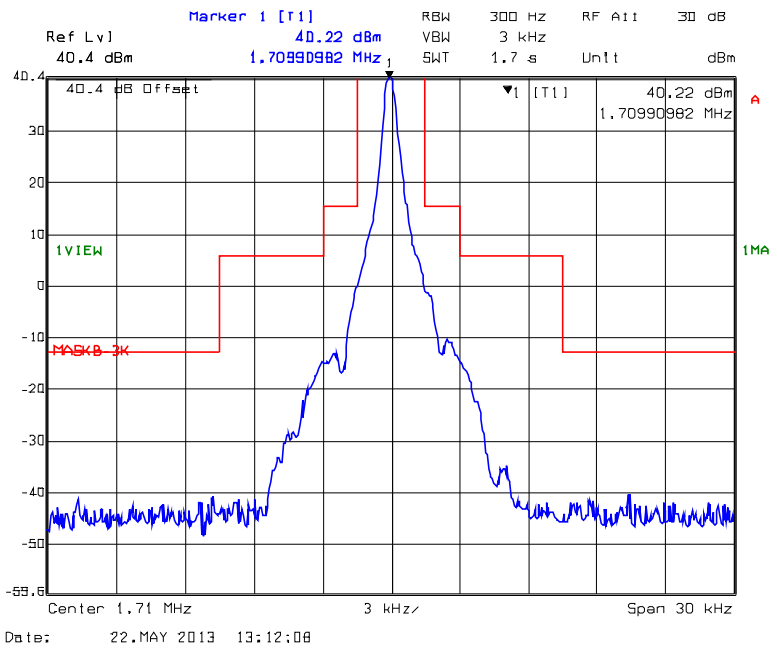
Plot 5.4.4.2.21. Emission Mask B, J2B, Low Power, 29.75 MHz



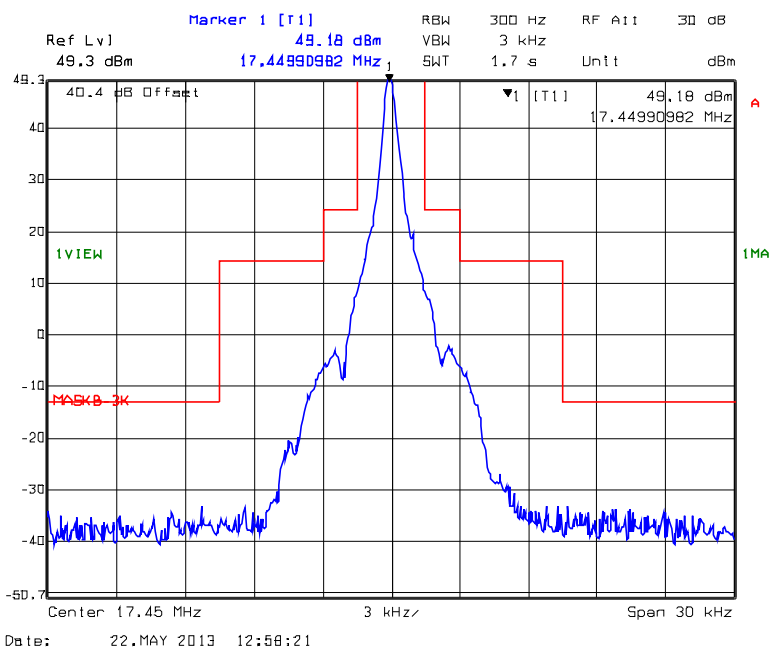
Plot 5.4.4.2.22. Emission Mask B, F1B, High Power, 1.71 MHz



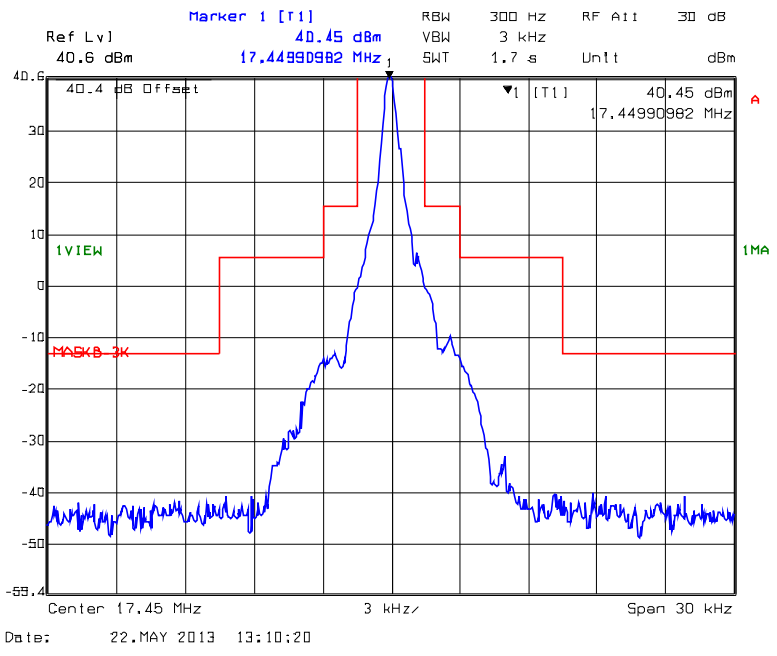
Plot 5.4.4.2.23. Emission Mask B, F1B, Low Power, 1.71 MHz



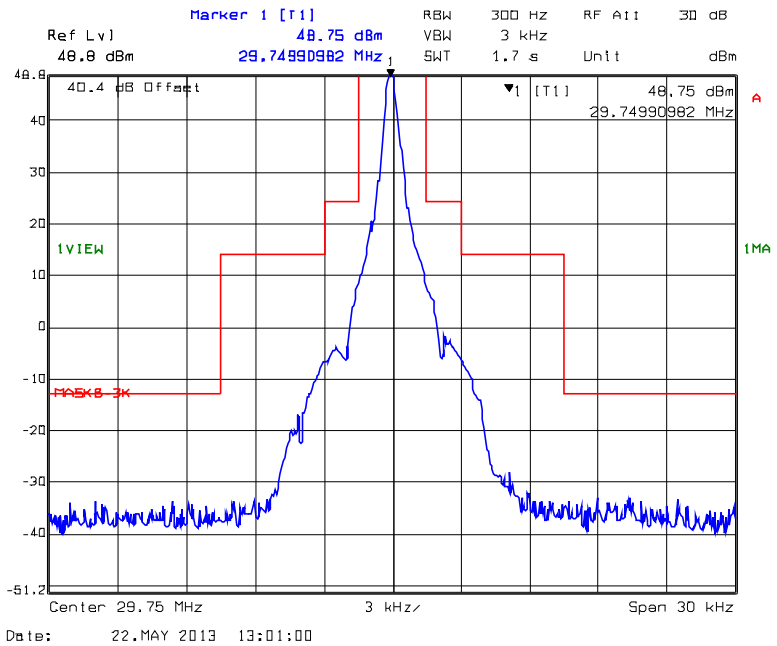
Plot 5.4.4.2.24. Emission Mask B, F1B, High Power, 17.45 MHz



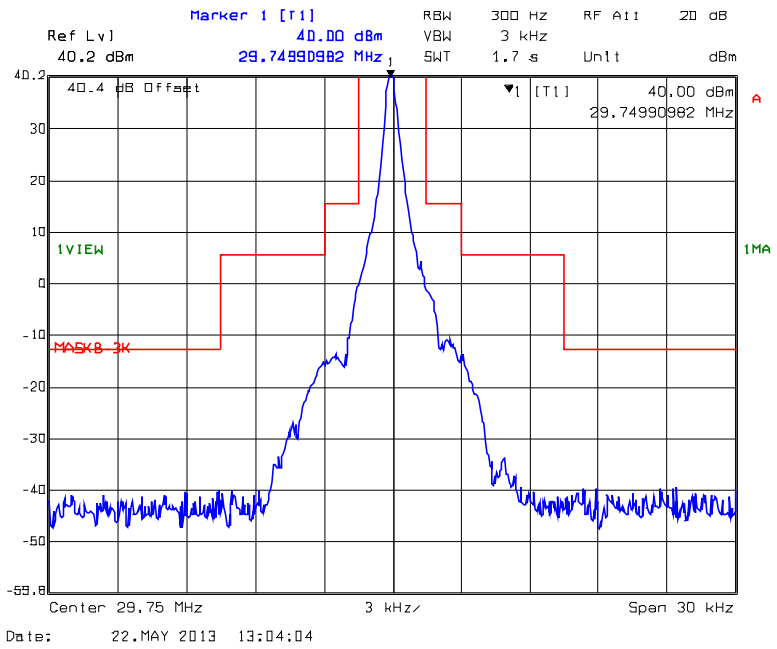
Plot 5.4.4.2.25. Emission Mask B, F1B, Low Power, 17.45 MHz



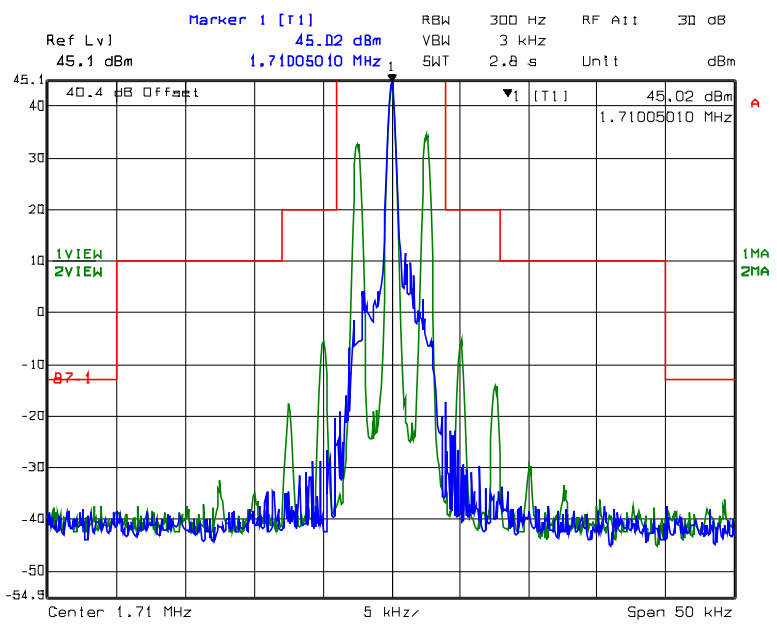
Plot 5.4.4.2.26. Emission Mask B, F1B, High Power, 29.75 MHz



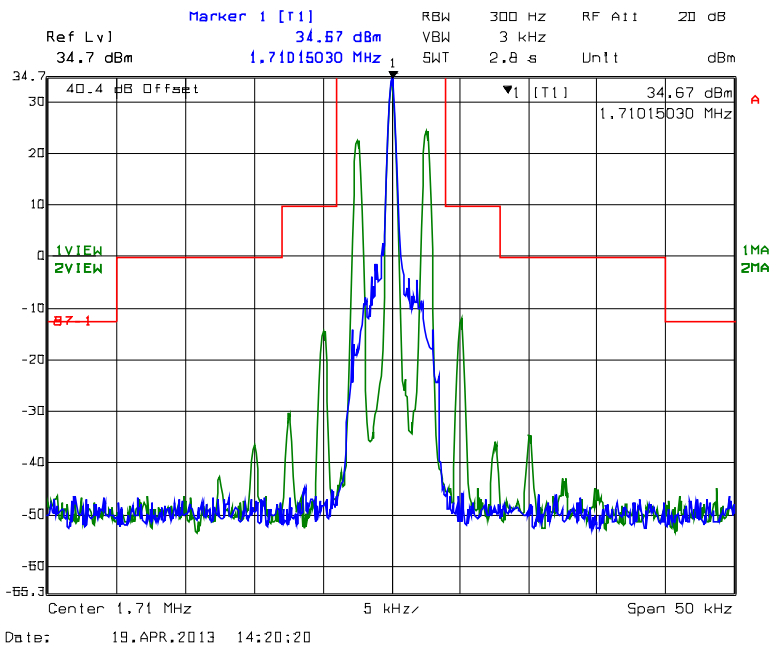
Plot 5.4.4.2.27. Emission Mask B, F1B, Low Power, 29.75 MHz



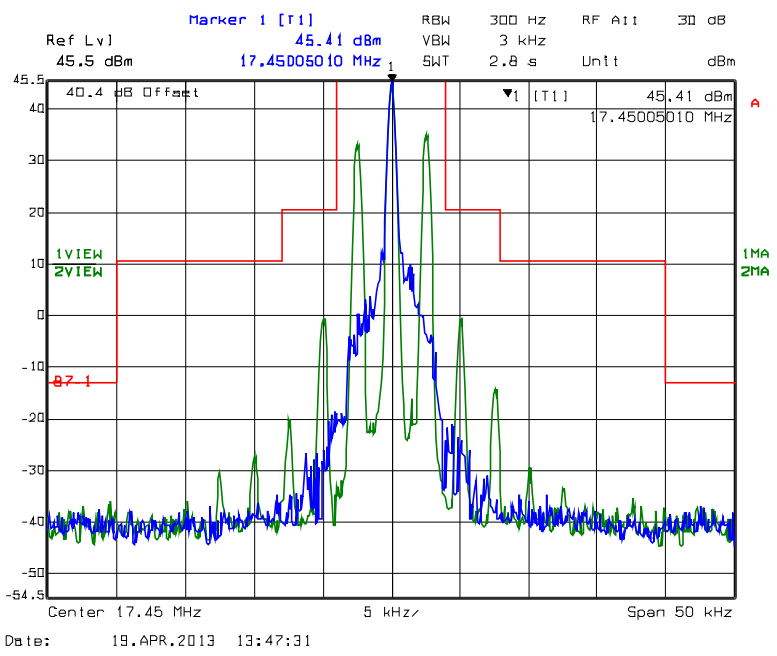
Plot 5.4.4.2.28. Emission Mask B, A3E, High Power, 1.71 MHz



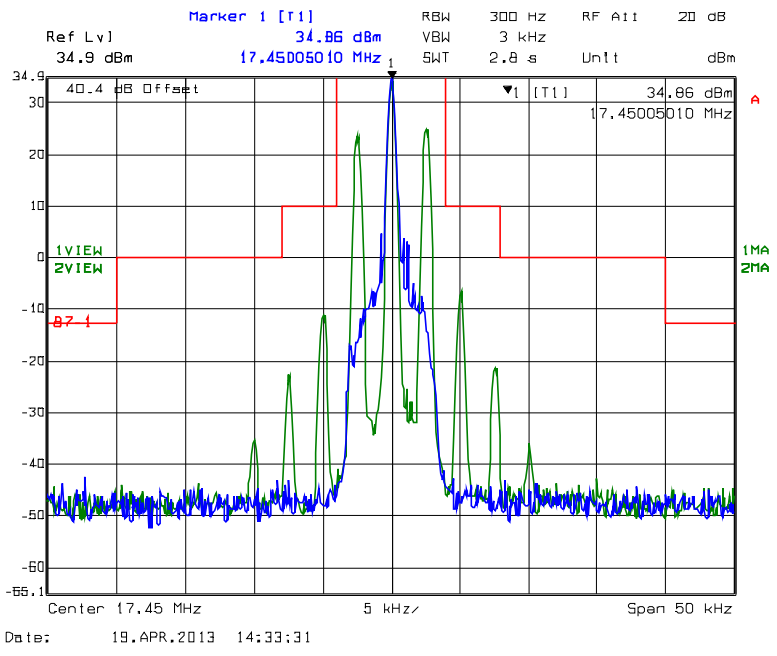
Plot 5.4.4.2.29. Emission Mask B, A3E, Low Power, 1.71 MHz



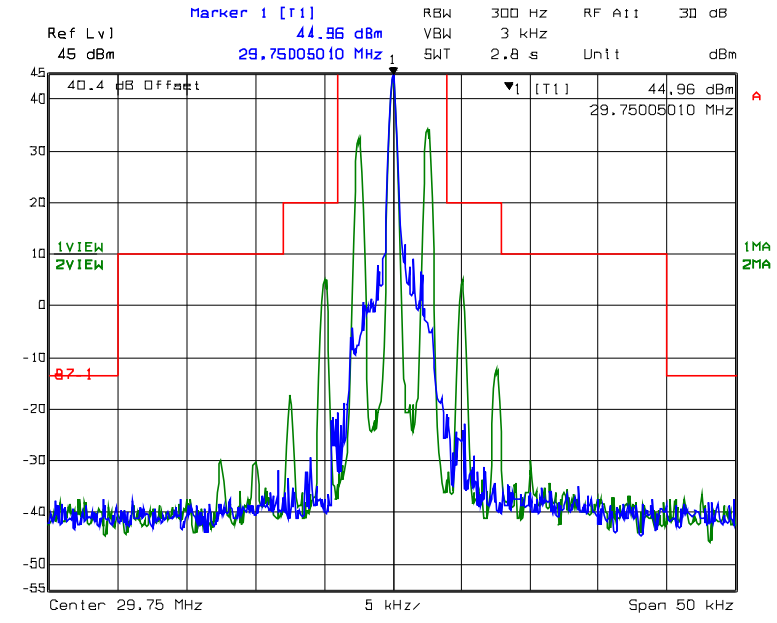
Plot 5.4.4.2.30. Emission Mask B, A3E, High Power, 17.45 MHz



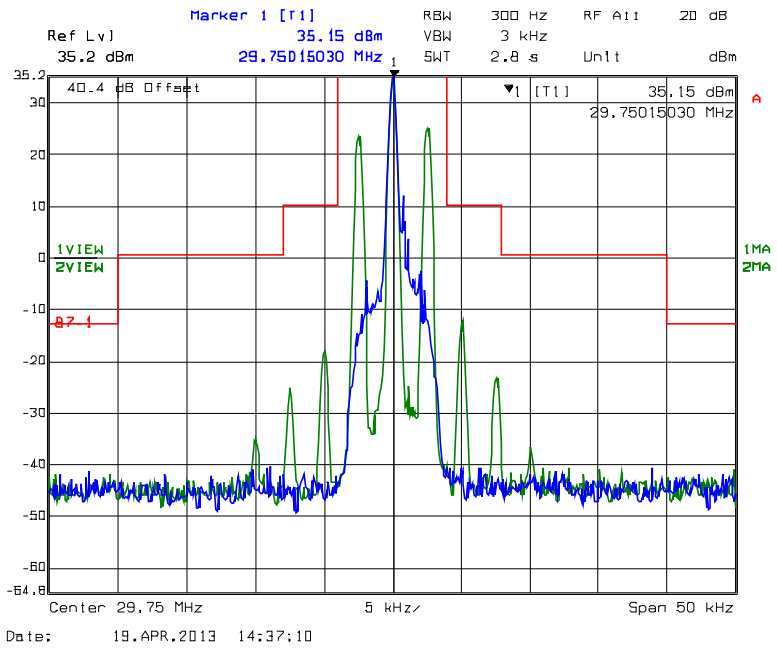
Plot 5.4.4.2.31. Emission Mask B, A3E, Low Power, 17.45 MHz



Plot 5.4.4.2.32. Emission Mask B, A3E, High Power, 29.75 MHz



Plot 5.4.4.2.33. Emission Mask B, A3E, Low Power, 29.75 MHz



5.5. TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS [§ 2.1051, 2.1057, 90.210]

5.5.1. Limits

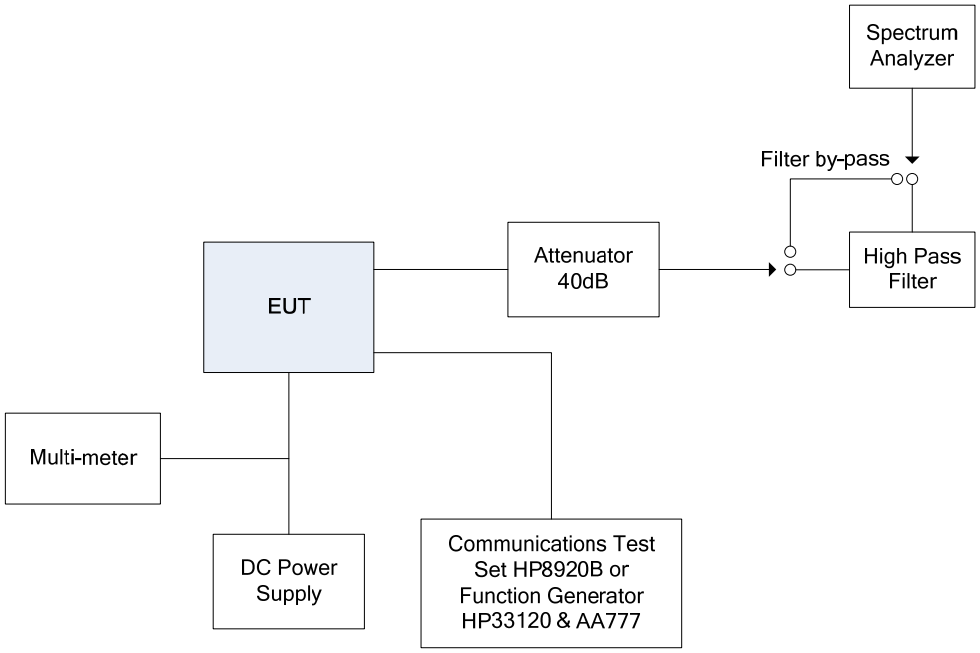
Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Attenuation Limit (dBc)
§ 90.210 (a) & (b)	At least 43 + 10 log (P) dB

5.5.2. Method of Measurements

Refer to 47 CFR Sections 2.1051 and 2.1057 for measurement details.

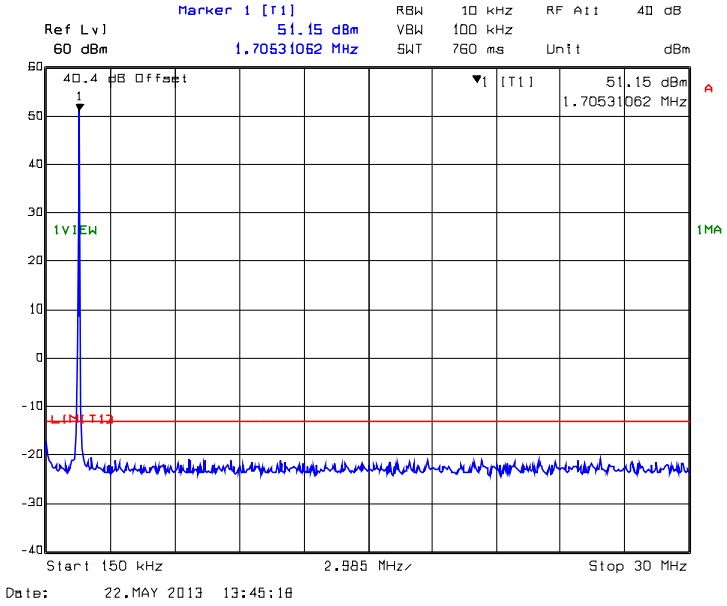
5.5.3. Test Arrangement



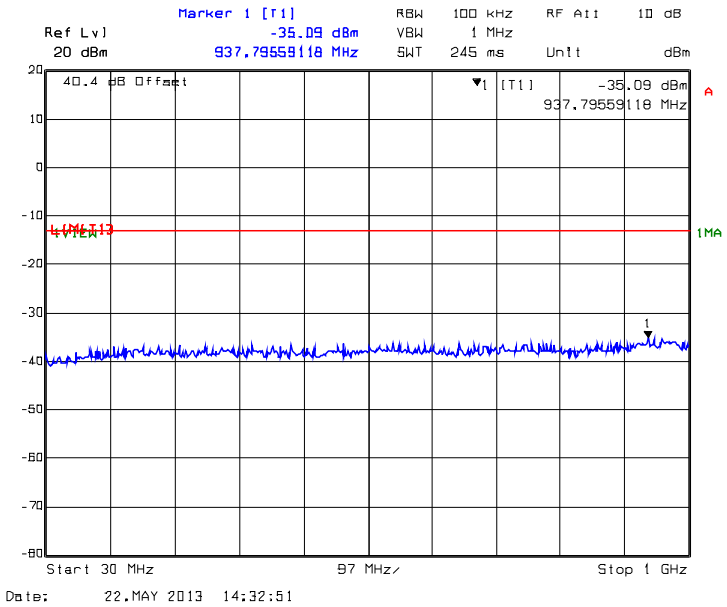
5.5.4. Test Data

Remark: Exploratory tests were conducted with modulations in the range of typical modes of operation to identify the worst-case modulation. The following test mode is the worst-case test configuration for the final measurement.

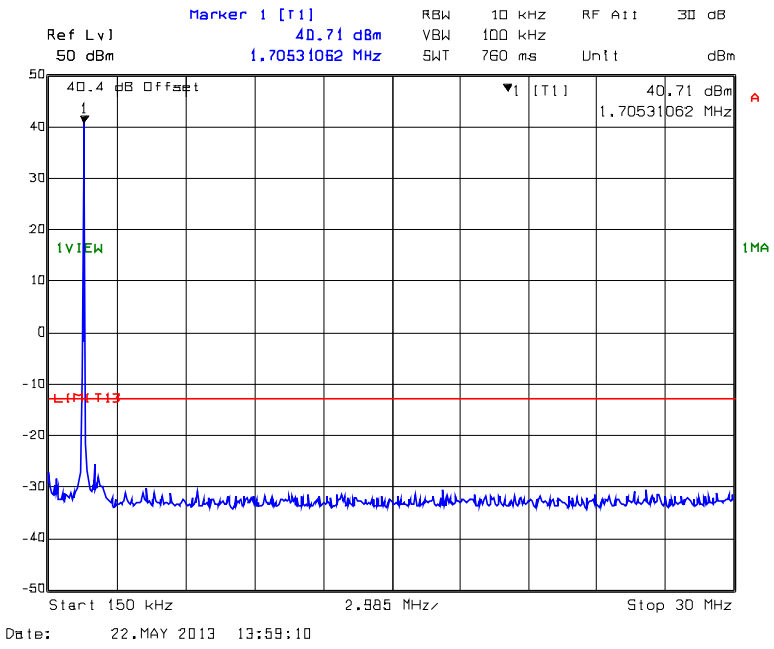
Plot 5.5.4.1. Conducted Transmitter Spurious Emissions, J3E, High Power, 1.71 MHz, 150 kHz - 30 MHz



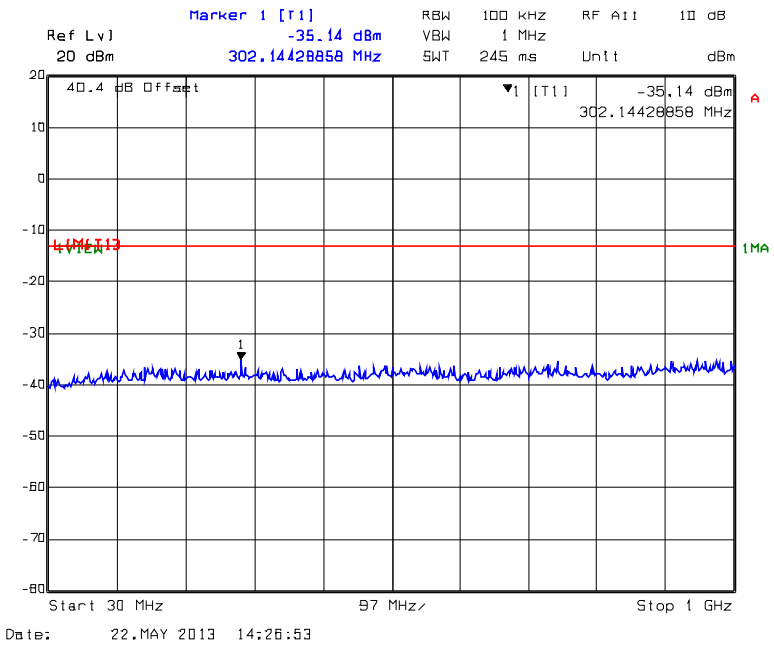
Plot 5.5.4.2. Conducted Transmitter Spurious Emissions, J3E, High Power, 1.71 MHz, 30 MHz - 1 GHz



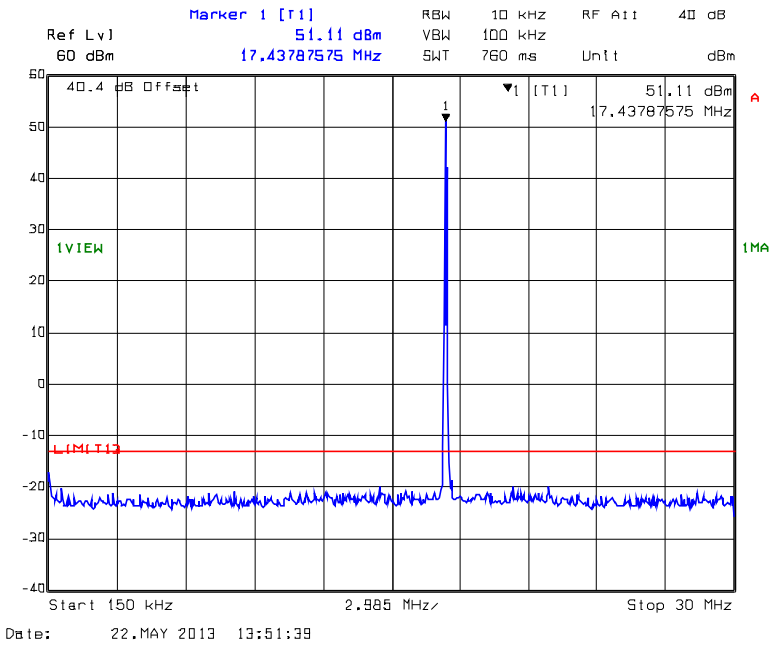
Plot 5.5.4.3. Conducted Transmitter Spurious Emissions, J3E, Low Power, 1.71 MHz, 150 kHz – 30 MHz



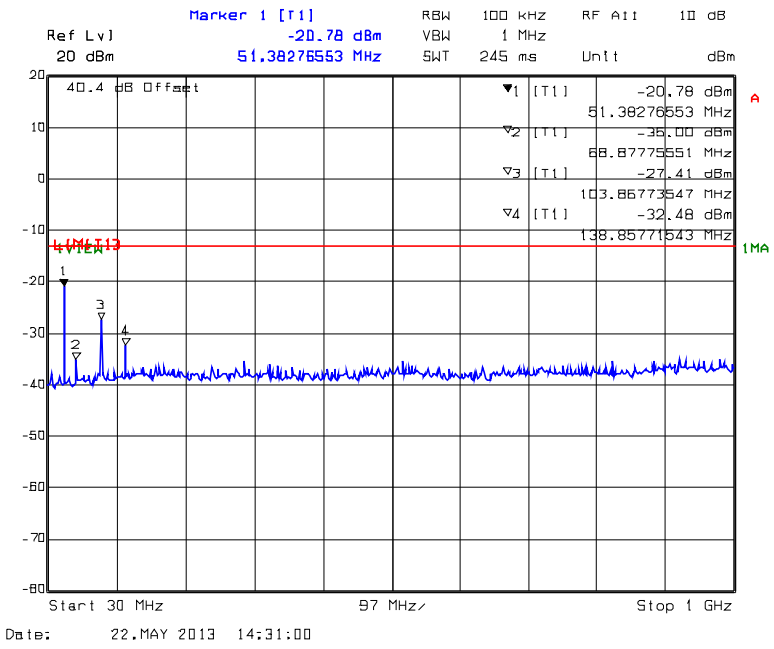
Plot 5.5.4.4. Conducted Transmitter Spurious Emissions, J3E, Low Power, 1.71 MHz, 30 MHz - 1 GHz



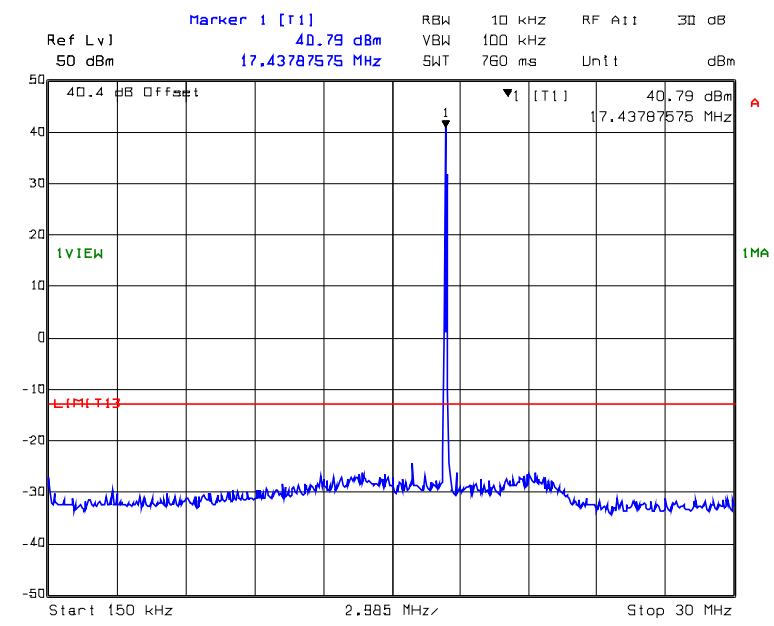
Plot 5.5.4.5. Conducted Transmitter Spurious Emissions, J3E, High Power, 17.45 MHz, 150 kHz - 30 MHz



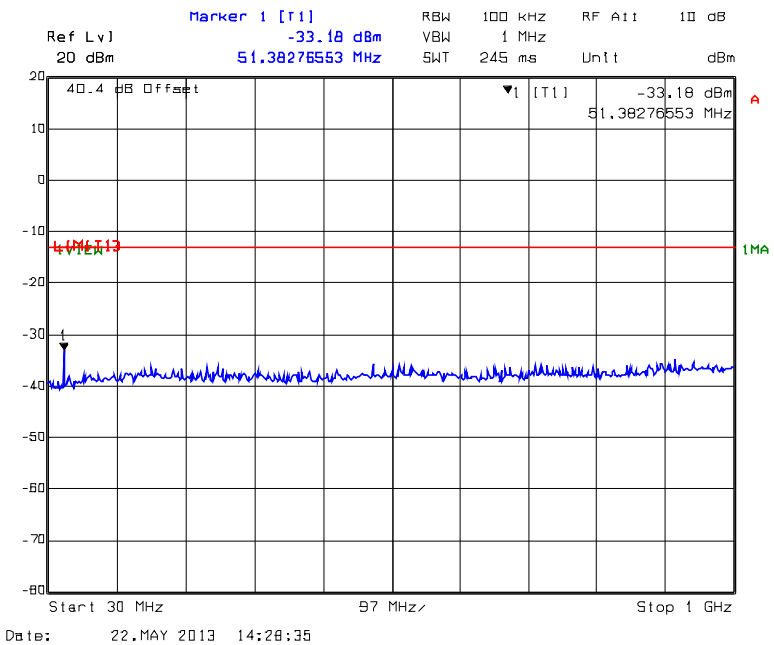
Plot 5.5.4.6. Conducted Transmitter Spurious Emissions, J3E, High Power, 17.45 MHz, 30 MHz - 1 GHz



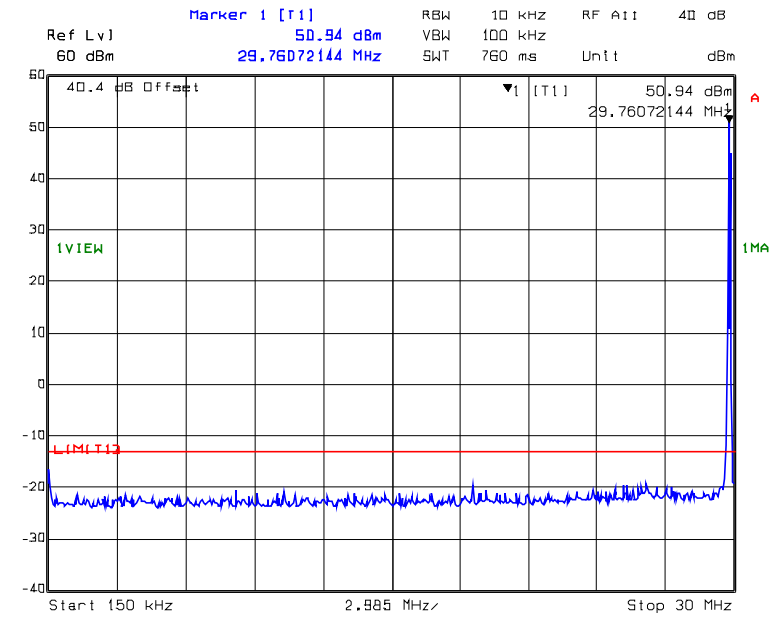
Plot 5.5.4.7. Conducted Transmitter Spurious Emissions, J3E, Low Power, 17.45 MHz, 150 kHz - 30 MHz



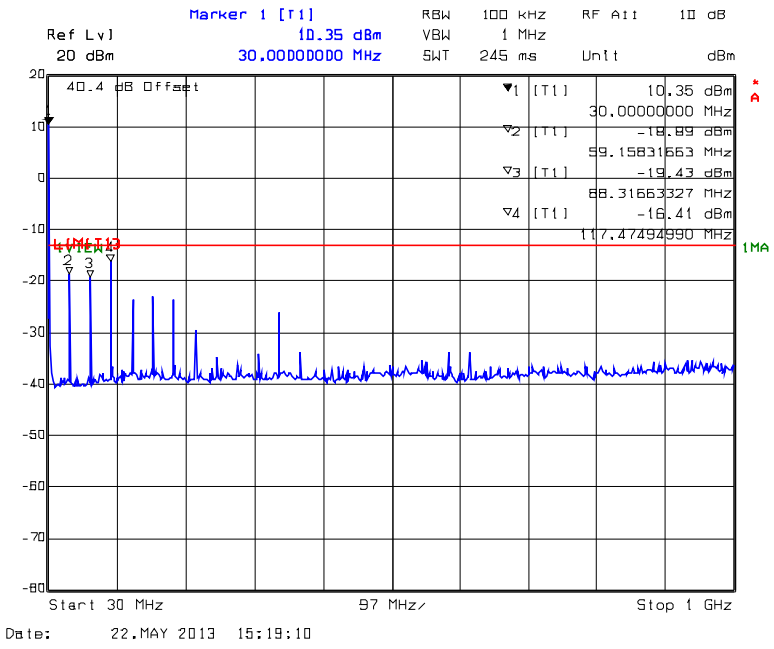
Plot 5.5.4.8. Conducted Transmitter Spurious Emissions, J3E, Low Power, 17.45 MHz, 30 MHz - 1 GHz



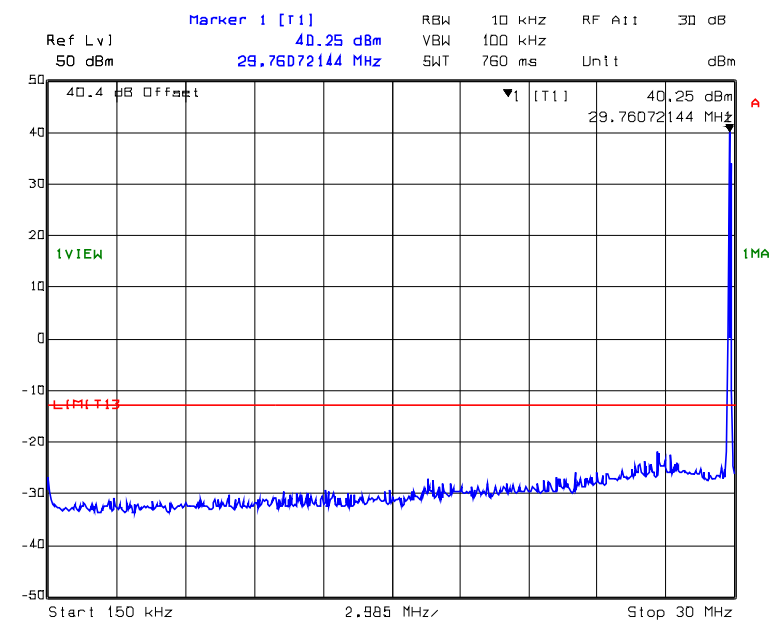
Plot 5.5.4.9. Conducted Transmitter Spurious Emissions, J3E, High Power, 29.75 MHz, 150 kHz - 30 MHz



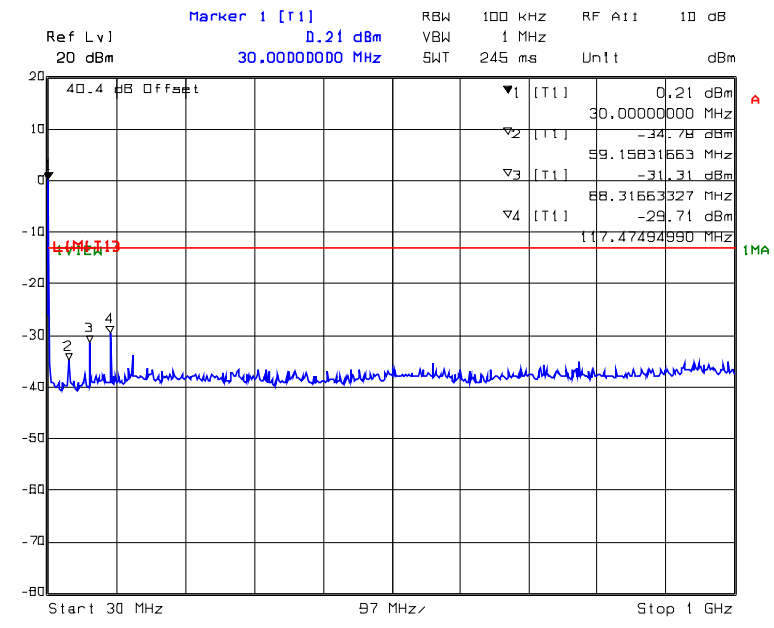
Plot 5.5.4.10. Conducted Transmitter Spurious Emissions, J3E, High Power, 29.75 MHz, 30 MHz - 1 GHz



Plot 5.5.4.11. Conducted Transmitter Spurious Emissions, J3E, Low Power, 29.75 MHz, 150 kHz - 30 MHz



Plot 5.5.4.12. Conducted Transmitter Spurious Emissions, J3E, Low Power, 29.75 MHz, 30 MHz - 1 GHz



5.6. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS [§ 2.1053, 2.1057, 90.210]

5.6.1. Limits

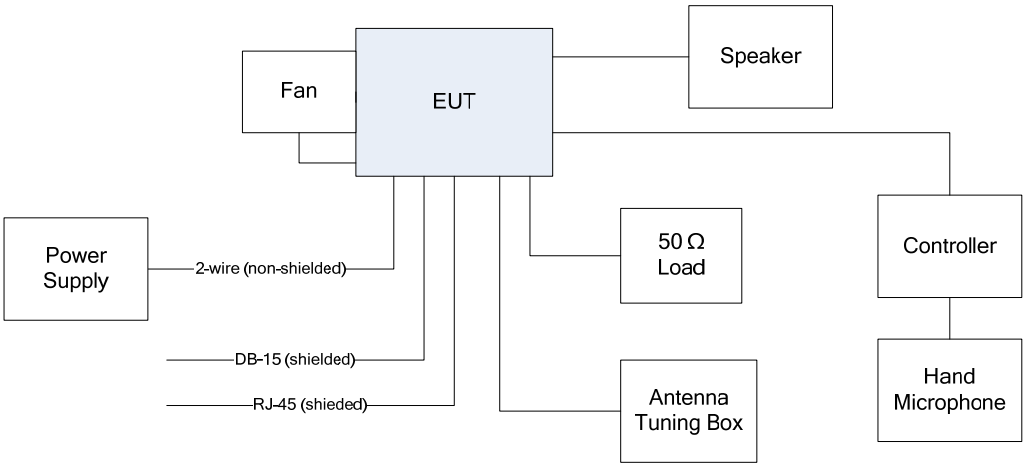
Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Attenuation Limit (dBc)
§ 90.210 (a) & (b)	At least 43 + 10 log (P) dB

5.6.2. Method of Measurements

The spurious/harmonic ERP measurements are conducted using substitution method specified in Section 8.2 of this report.

5.6.3. Test Arrangement



5.6.4. Test Data

Remarks:

- The emissions were scanned from 0.01 to 1000 MHz; all spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- The J3E emissions, set at maximum power, are chosen to be tested for worst case.

Test Frequency:	1.71 MHz
Test Frequency Range:	10 kHz - 1000 MHz
Power $_{conducted}$:	51.68 dBm
Limit:	-13 dBm

Frequency (MHz)	RF Peak Level @ 3m (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured (dBm)	Limit (dBm)	Margin (dB)
0.01 -1000	*	Peak	V/H	*	-13	*
* Spurious emissions are more than 20dB below the specified limit						

Test Frequency:	17.45 MHz
Test Frequency Range:	0.15 - 1000 MHz
Power $_{conducted}$:	51.70 dBm
Limit:	-13 dBm

Frequency (MHz)	RF Peak Level @ 3m (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured (dBm)	Limit (dBm)	Margin (dB)
0.15-1000	*	Peak	V/H	*	-13	*
* Spurious emissions are more than 20dB below the specified limit						

Test Frequency:	29.75 MHz
Test Frequency Range:	0.15 - 1000 MHz
Power $_{conducted}$:	51.56 dBm
Limit:	-13 dBm

Frequency (MHz)	RF Peak Level @ 3m (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured (dBm)	Limit (dBm)	Margin (dB)
0.15-1000	*	Peak	V/H	*	-13	*
* Spurious emissions are more than 20dB below the specified limit						

5.7. FREQUENCY STABILITY [§ 2.1055, 90.213]

5.7.1. Limits

§ 90.213 - Minimum Frequency Stability

Frequency range (MHz)	Minimum Frequency Stability (ppm)		
	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	[1,2,3] 100	100	200
25-50	20	20	50

[1] Fixed and base stations with over 200 watts transmitter power must have a frequency stability of 50 ppm except for equipment used in the Public Safety Pool where the frequency stability is 100 ppm.

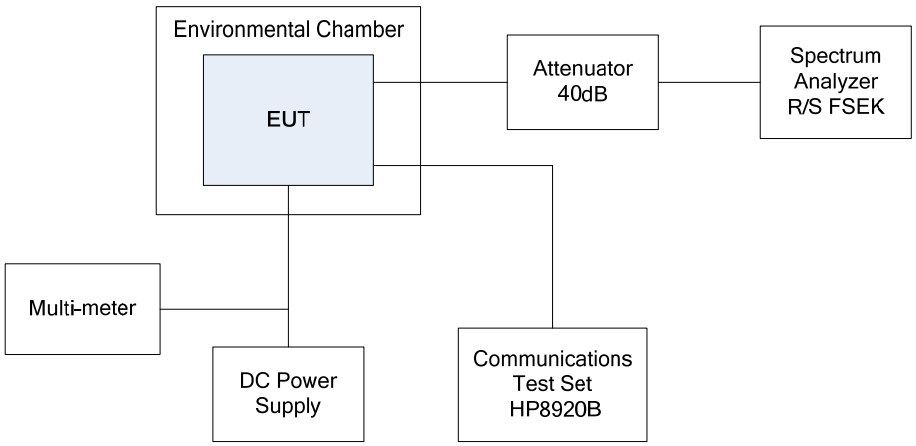
[2] For single sideband operations below 25 MHz, the carrier frequency must be maintained within 50 Hz of the authorized carrier frequency.

[3] Travelers information station transmitters operating from 530-1700 kHz and transmitters exceeding 200 watts peak envelope power used for disaster communications and long distance circuit operations pursuant to §§ 90.242 and 90.264 must maintain the carrier frequency to within 20 Hz of the authorized frequency.

5.7.2. Method of Measurements

Refer to 47 CFR 2.1055 for measurement details

5.7.3. Test Arrangement



5.7.4. Test Data

Test Frequency:	29.75 MHz
Full Power Level:	51.68 dBm
Frequency Tolerance Limit:	0.3 ppm or 9 Hz (manufacturer declaration)
Max. Frequency Tolerance Measured:	+8 Hz
Input Voltage Rating:	13.8 Vdc (nominal)

Ambient Temperature (^{o}C)	**Frequency Drift (Hz)**		
	Supply Voltage (Nominal) 13.8 Vdc	**Supply Voltage (85% of Nominla) 11.73 Vdc**	**Supply Voltage (115% of nominla) 15.87 Vdc**
-30	6	--	--
-20	8	--	--
-10	7	--	--
0	6	--	--
10	4	--	--
20	3	-1	3
30	3	--	--
40	3	--	--
50	3	--	--
60	3	--	--

5.8. RF EXPOSURE REQUIRMENTS [§§ 1.1310 & 2.1091]

The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation.

FCC 47 CFR § 1.1310:

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

5.8.1. Method of Measurements

Refer to Sections 1.1310, 2.1091

In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:

(1) Calculation that estimates the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits defined for free space.
(2) Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement
(3) Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits
(4) Any other RF exposure related issues that may affect MPE compliance

Calculation Method of RF Safety Distance:

$$S = \frac{P \cdot G}{4 \cdot \pi \cdot r^2} = \frac{EIRP}{4 \cdot \pi \cdot r^2}$$

Where: P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

5.8.2. RF Evaluation

EVALUATION OF RF EXPOSURE COMPLIANCE REQUIREMENTS	
RF Exposure Requirements	**Compliance with FCC Rules**
Minimum calculated separation distance between antenna and persons required: *12.9 **cm**	Manufacturer' instruction for separation distance between antenna and persons required: **80 cm**
Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement	Antenna installation and device operating instructions shall be provided to installers to maintain and ensure compliance with RF exposure requirements.
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	Refer to User's Manual for RF Exposure Information.
Any other RF exposure related issues that may affect MPE compliance	None.

*The minimum separation distance between the antenna and bodies of users are calculated using the following formula:

For General /Un-controlled Exposure operating in 1.6 -30 MHz:

S = 180/f^2 = 180 / 1.6^2 = 70.31 mW/cm^2 (worst case)
Maximum EIRP = 51.70 + 0 dBi = 51.70 dBm = 147911 mW (worst case)

(Minimum Safe Distance, r) = $\sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}} = \sqrt{\frac{147911}{4 \cdot \pi \cdot (70.31)}} \approx 12.9cm$

For Occupational/Controlled Exposure operating in 1.6 -30 MHz:

S = 100 mW/cm^2 (worst case)
Maximum EIRP = 51.70 + 0 dBi = 51.70 dBm = 147911 mW (worst case)

(Minimum Safe Distance, r) = $\sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}} = \sqrt{\frac{147911}{4 \cdot \pi \cdot (100)}} \approx 10.8cm$

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	R/S	FSEK	834157/005	9 KHz – 40 GHz	30 Jul 2013
Attenuator (40dB)	Aeroflex/Weinschel	53-40-34	MN917	DC-1 GHz	Cal. on use.
High Pass Filter	Mini Circuit	SHP 25	--	Cut off 25 MHz	Cal. on use.
Power Meter	Hewlett Packard	438A	3008A06729	100K--50G sensor dependent	25 Mar 2014
Power Sensor	Hewlett Packard	8482A	US37295944	100KHz-4.2GHZ	26 Feb 2014
Modulation Analyzer	Hewlett Packard	8901B	3226A04606	150KHz-1300MHz	29 Jan 2014
Combiner	Mini Circuit	ZFSC-3-4	15542	1MHz - 1GHz	Cal. on use.
Infinium Digital Oscilloscope	Hewlett-Packard	54801A	US38380192	DC-500M Hz 1G sampling	15 Jun 2013
Environmental Chamber	Envirotronics	SSH32C	11994847-S-11059	-60 to 177 °C	16 Apr 2014
RF Synthesized signal Generator	HP	8648C	3343U00391	100K-3200M Hz AM/ FM/ PM	03 Jan 2014
FFT Digital Spectrum Analyzer	Advantest	R9211E	8202336	10mHz--100KHz	25 Jan 2014
RF Communication Test Set	Hewlett Packard	8920B	US39064699	30MHz-1GHz	17 Jan 2014
Horn antenna	ETS-LINDGREN	3117	119425	1-18GHz	25 Apr 2014
Preamplifier	Hewlett Packard	8449B	3008A00769	1-26.5GHz	06 Aug 2013
Power supply	XANTREX	XKW 60-50	26509	0-60V 0-50A DC	Cal. on use.
Antenna	ETS	3148	1101	200-2000 MHz	22 Mar 2014
Attenuator	Aeroflex/Weinschel	24-20-34	BJ2364	DC-18 GHz	Cal. on use.
Frequency counter	EIP	545A	2683	10Hz-18 GHz	25 Mar 2014
Biconical Antenna	EMCO	93110B	9906-3319	20-200MHz	30 Mar 2014
Loop Antenna	EMCO	6502	9104-2611	10kHz-30MHz	26 Aug 2014
Tunable Band Reject Filter	K & L	3TFNF-30/76-N-N	36	28-300MHz	Cal. on use.
Function Generator	Hewlett Packard	33120A	US34011688	15MHz	02 Nov 2013

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.79**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.78**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 1.87**	**Under consideration**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 3.75**	**Under consideration**

EXHIBIT 8. MEASUREMENT METHODS

8.1. CONDUCTED POWER MEASUREMENTS

- The following shall be applied to the combination(s) of the radio device and its intended antenna(e).
- I f the RF level is user adjustable, all measurements shall be made with the highest power level available to the user for that combination.
- The following method of measurement shall apply to both conducted and radiated measurements.
- The radiated measurements are performed at the Ultratech Calibrated Open Field Test Site.
- The measurement shall be performed using normal operation of the equipment with modulation.

Test procedure shall be as follows:

Step 1: Duty Cycle measurements if the transmitter's transmission is transient

- Using a EMI Receiver with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal;
- The duty cycle of the transmitter, x = Tx on / (Tx on + Tx off) with 0<x<1, is measure and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal or more than 0.1.

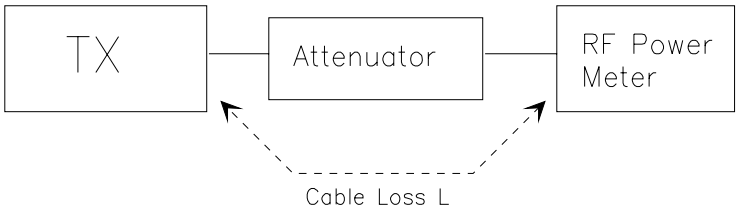
Step 2: Calculation of Average EIRP. See Figure 1

- The average output power of the transmitter shall be determined using a wideband, calibrated RF average power meter with the power sensor with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);
- The e.i.r.p. shall be calculated from the above measured power output "A", the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:

EIRP = A + G + 10log(1/x)

{X = 1 for continuous transmission => 10log(1/x) = 0 dB}

Figure 1.



8.2. RADIATED POWER MEASUREMENTS (ERP & EIRP) USING SUBSTITUTION METHOD

8.2.1. MAXIMIZING RF EMISSION LEVEL (E-FIELD)

(a) The measurements were performed with full rf output power and modulation.
(b) Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The BICONILOG antenna (20 MHz to 1 GHz) or HORN antenna (1 GHz to 18 GHz) was used for measuring.
(e) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBμV/m) = Reading (dBμV) + Total Correction Factor (dB/m)

(f) Set the EMI Receiver and #2 as follows:

Center Frequency:	test frequency
Resolution BW:	100 KHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(g) The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(h) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(i) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(j) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
(k) The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
(l) Repeat for all different test signal frequencies.

8.2.2. Measuring the EIRP of Spurious/Harmonic Emissions using Substitution Method

(a) Set the EMI Receiver (for measuring E-Field) and Receiver #2 (for measuring EIRP) as follows:

Center Frequency:	equal to the signal source
Resolution BW:	100 KHz
Video BW:	VBW > RBW
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(b) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

(c) Select the frequency and E-field levels obtained in the Section 8.2.1 for ERP/EIRP measurements.
(d) Substitute the EUT by a signal generator and one of the following transmitting antenna (substitution antenna):
- DIPOLE antenna for frequency from 0.15-1000 MHz or
- HORN antenna for frequency above 1 GHz }.

(e) Mount the transmitting antenna at 1.5 meter high from the ground plane.
(f) Use one of the following antenna as a receiving antenna:
- DIPOLE antenna for frequency from 0.15-1000 MHz or
- HORN antenna for frequency above 1 GHz }.

(g) If the DIPOLE antenna is used, tune it's elements to the frequency as specified in the calibration manual.
(h) Adjust both transmitting and receiving antenna in a VERTICAL polarization.
(i) Tune the EMI Receivers to the test frequency.
(j) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(k) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(l) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(m) Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
(n) Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:

P = P1 - L1 = (P2 + L2) – L1 = P3 + A + L2 - L1
EIRP = P + G1 = P3 + L2 - L1 + A + G1
ERP = EIRP – 2.15 dB
Total Correction factor in EMI Receiver # 2 = L2 – L1 + G1

Where:	P:	Actual RF Power fed into the substitution antenna port after corrected.
	P1:	Power output from the signal generator
	P2:	Power measured at attenuator A input
	P3:	Power reading on the Average Power Meter
	EIRP:	EIRP after correction
	ERP:	ERP after correction

(o) Adjust both transmitting and receiving antenna in a HORIZONTAL polarization, then repeat step (k) to (o)
(p) Repeat step (d) to (o) for different test frequency
(q) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(r) Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.

Figure 2

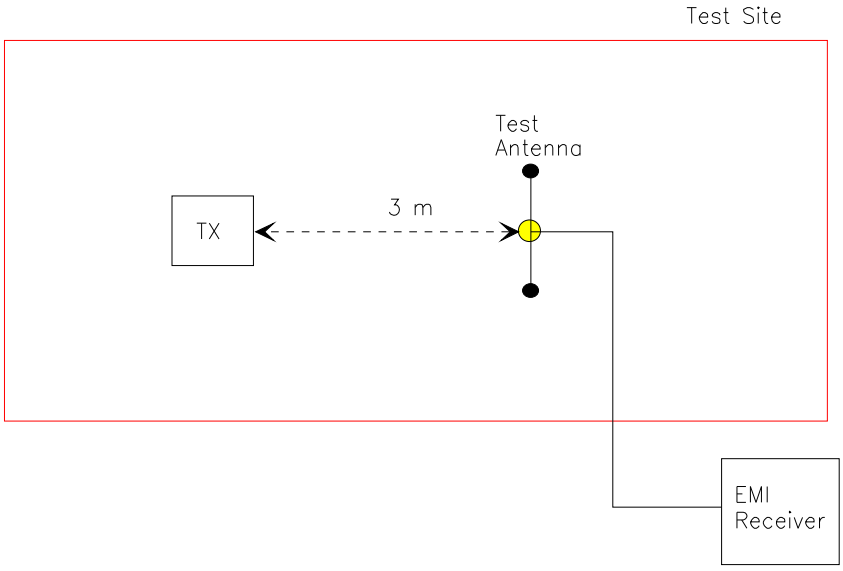
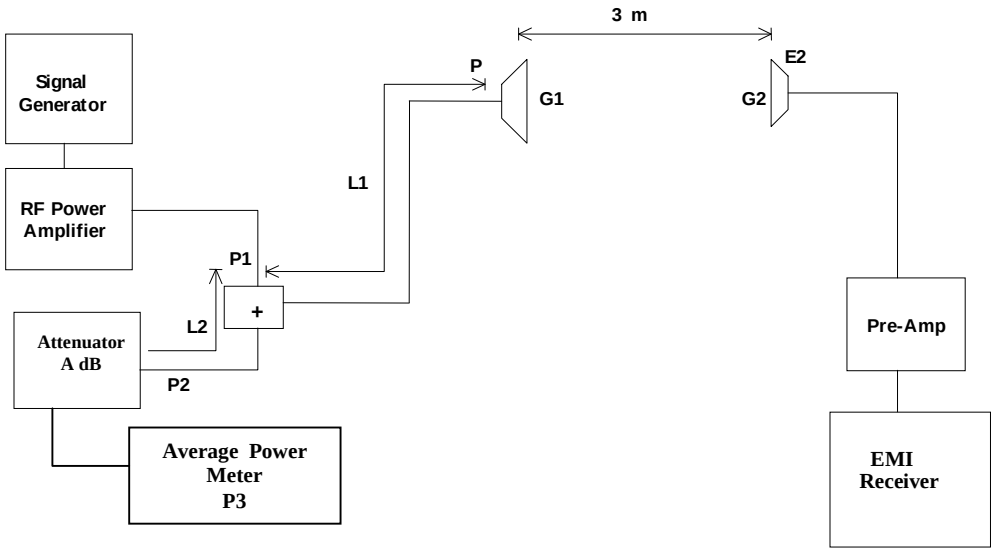


Figure 3



All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)