TEST REPORT For FCC

Test Report No.	: TK-FR10051
Date of Issue	: 12/21/2010
FCC ID	: O25PZ-S100
Description of Product	: FM Transceiver
Model No.	: PZ-S100
Applicant	: Unimo Technology Co.,Ltd 626 Dangjeong-Dong Gunpo-S Gyeonggi-Do 435-030 KOREA
Manufacturer	: Unimo Technology Co.,Ltd 626 Dangjeong-Dong Gunpo-S Gyeonggi-Do 435-030 KOREA
Standards	: FCC Part 2,90
Test Date	: 12/15/2010 - 12/21/2010
Test Results	: ☒ PASS ☐ FAIL

The test results relate only to the items tested.

Tested by:
Kyu-Chul Shin
Test Engineer
Date:12/21/2010

Reviewed by:
KT Kang
Technical Manager
Date: 12/21/2010

THRU-KES CO.,LTD.
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TABLE OF CONTENTS

1.0 General Product Description

EUT Type	:	FM Transceiver
FCC Rule Part(s)	:	§2; §90
Model name	:	PZ-S100
Serial number	:	Identical prototype
Tx Freq. Range	:	12.5KHz: 150.8125 MHz ~ 173.9875MHz 25KHz : 150.8250 MHz ~ 173.9750MHz
Channel Space Bandwidth		12.5KHz , 25kHz
Type of Modulation	:	11K0F3E , 16K0F3E
Frequency Tolerance:	:	± 0.00025 % (2.5ppm)
RF Output Power	:	2W / 5W
Power Source	:	Li-ion Battery (DC 7.5V)
Antenna type	:	Whip antenna

1.1 Tested Frequency

-12.5KHz

	LOW	MID	HIGH
Frequency (MHz)	150.8125	162.4000	173.9875

-25KHz

	LOW	MID	HIGH
Frequency (MHz)	150.8250	162.4000	173.9750

1.3 Model Differences

1.4 Device Modifications

The following modifications were necessary for compliance:
Not applicable

1.5 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
E U T	Unimo Technology Co., Ltd.	PZ-S100	-

1.6 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

1.7 Test Facility

The measurement facility is located at 477-6, Hager-Ri, Yoju-Up, Yoju-Gun Kyunggi-Do,469-803, Korea. Tel: +82-31-883-5092/Fax: +82-31-883-5169. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.8 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
USA	**FCC**	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	343818
KOREA	**KCC**	EMI (10 meter Open Area Test Site and two conducted sites) Radio(3 & 10 meter Open Area Test Sites and one conducted site)	KR100
Canada	**IC**	3 & 10 meter Open Area Test Sites and one conducted site	4769B-1

2.0 Summary of tests

FCC Part Section(s)	Parameter	Status (note 1)
2.1046(a)	Carrier Output Power(Conducted)	C
2.1051	Unwanted Emissions (Transmitter Conducted)	C
2.1053(a)	Field Strength of Spurious Radiation	C
2.1049(c) (1)	Emission Masks(Occupied Bandwidth)	C
90.214	Transient Frequency Behavior	C
2.1047(a)	Audio Frequency Response	C
2.1047(b)	Modulation Limiting	C
2.1055(a) (1)	Frequency Stability(Temperature Variation)	C
2.1055(a) (1)	Frequency Stability(Voltage Variation)	C
2.202(g)	Necessary Bandwidth and Emission Bandwidth	C

The sample was tested according to the following specification:
FCC Rules and Regulations, Volume Ⅱ: Part2, Sub-part J, Sections 2.947, 2.1033(c) 2.1046, 2.1047, 2.1079, 2.1051,2.1053,2.1055,2.1057 and part 90

3 Transmitter requirements

3.1 Carrier Output Power(Conducted)

Definition:

- The carrier power output for a transmitter for this service is the available at the output Terminals of the transmitter when the output terminals are connected to the standard transmitter load

Specification : 47CFR2.1046 (a)

Test method : ANSI/TIA-603-C

Test Setup Layout

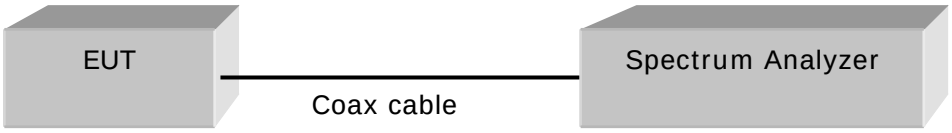


Figure 1 : Measurement setup for the carrier frequency seperation

Test Data

-12.5KHz

TEST CONDITIONS	Carrier power(W)		
Power lever(W)	150.8125MHz	162.4000MHz	173.9875MHz
2	1.89	1.83	1.88
5	4.74	4.94	4.99

-25KHz

TEST CONDITIONS	Carrier power(W)		
Power lever(W)	150.8250MHz	162.4000MHz	173.9750MHz
2	1.90	1.82	1.88
5	4.82	4.98	4.99

3.2 Unwanted Emissions (Transmitter Conducted)

Definition:

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

Specification : 47CFR2.1051

Test method : ANSI/TIA-603-C

Test Setup Layout

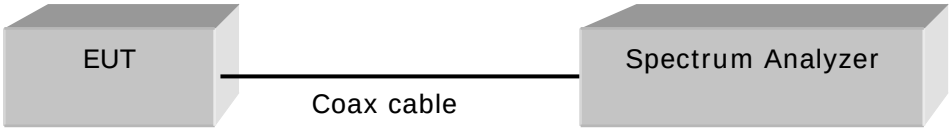


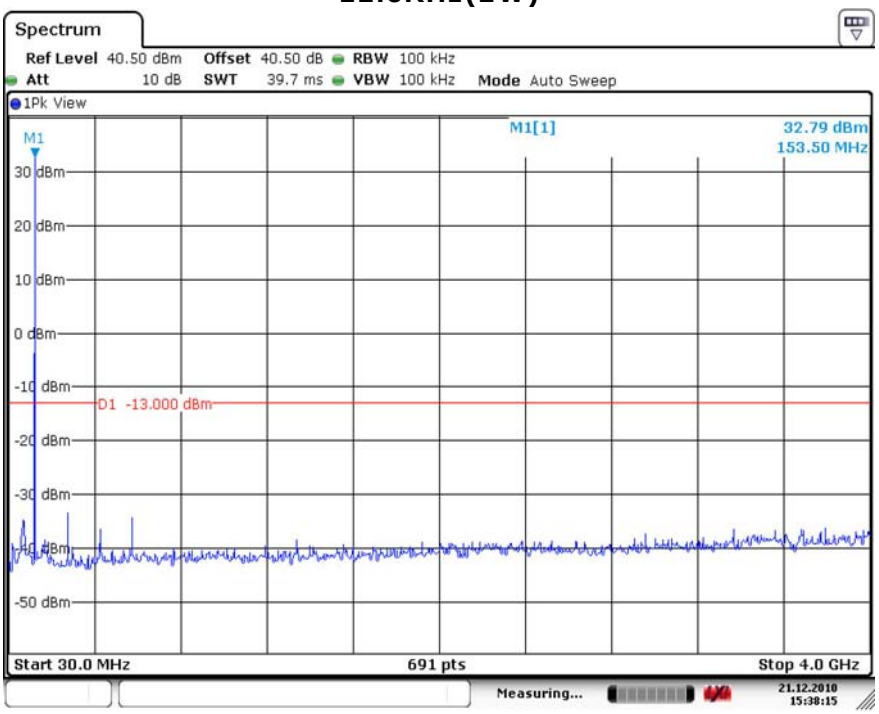
Figure 1 : Measurement setup for the carrier frequency seperation

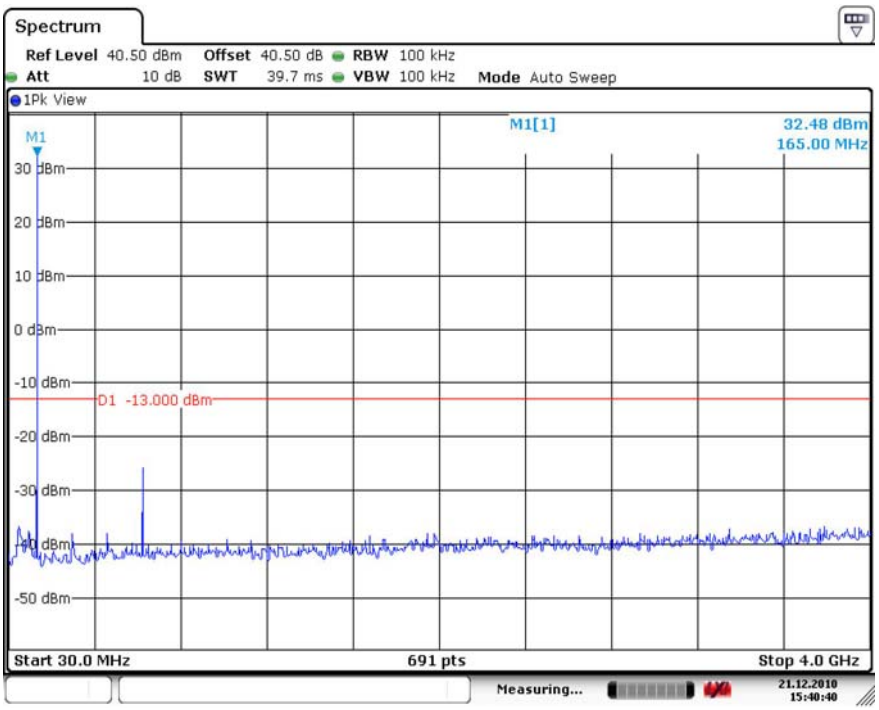
LIMIT

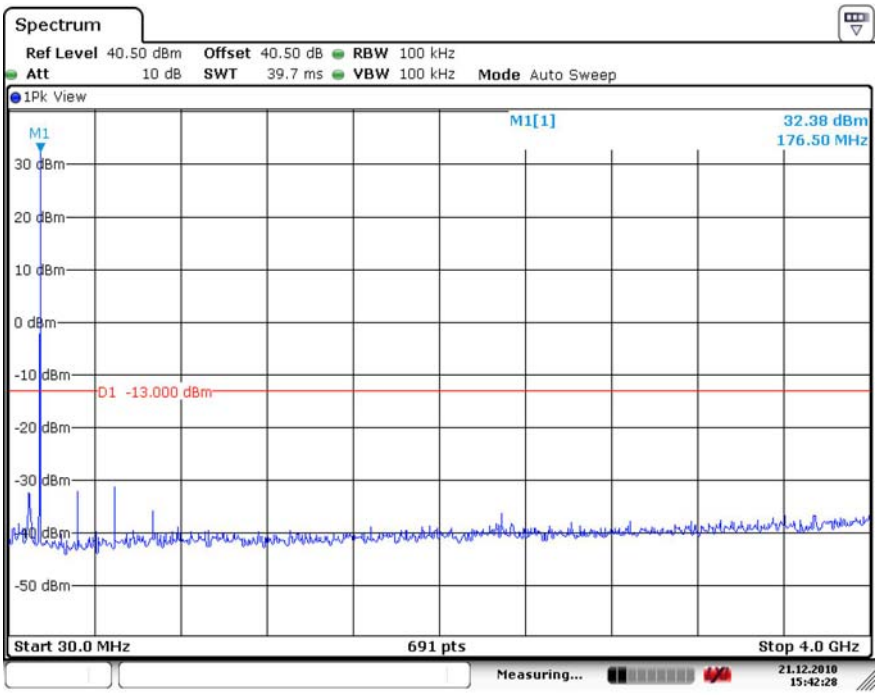
=43+10log(P)dBc (or -13dBm)

See next pages for actual measured spectrum plots.

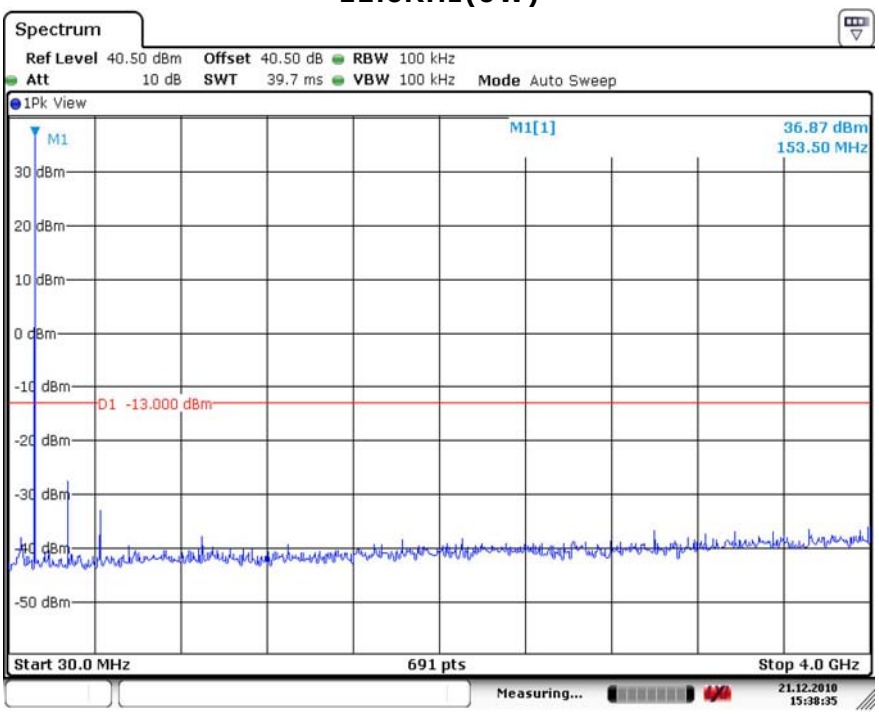
Unwanted Emissions
12.5KHz(2W)

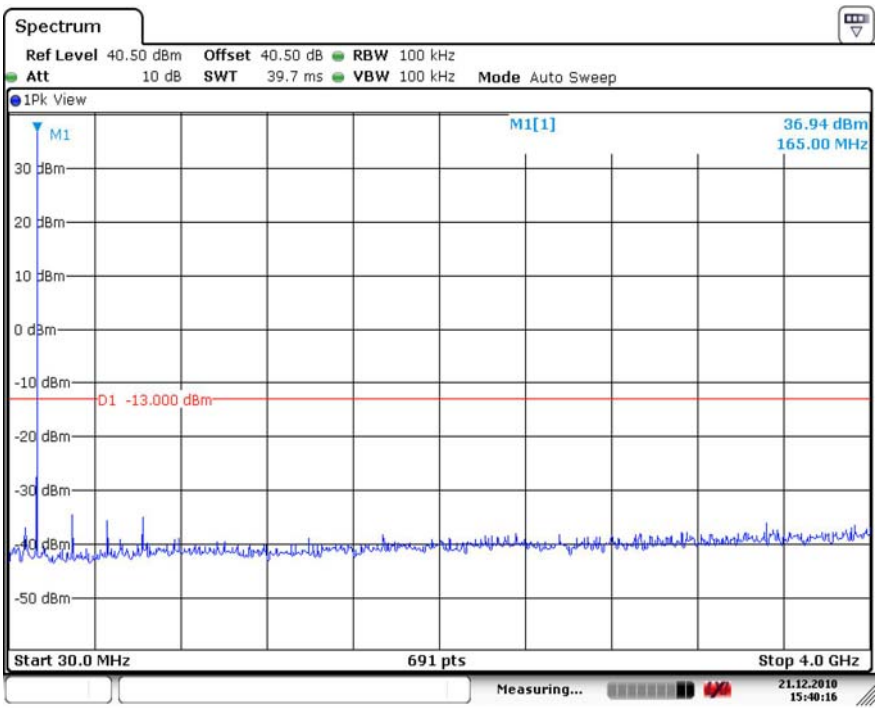


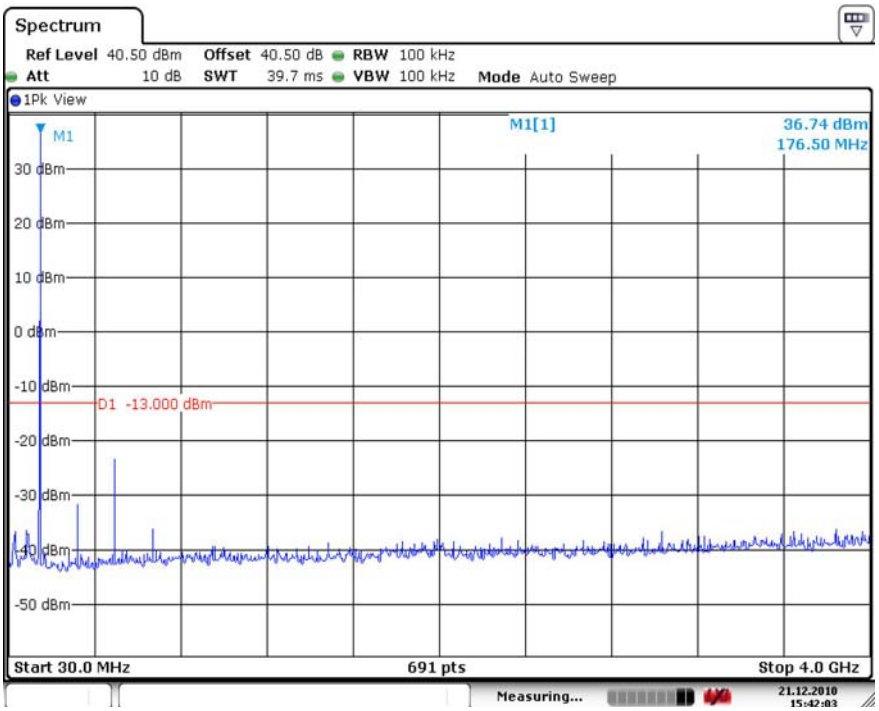




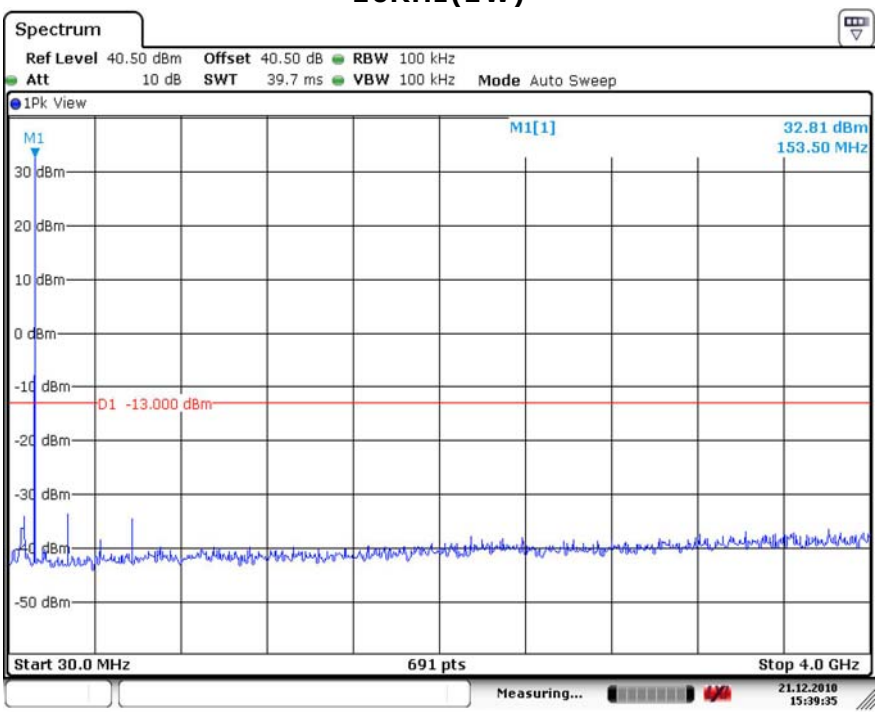
Unwanted Emissions
12.5KHz(5W)

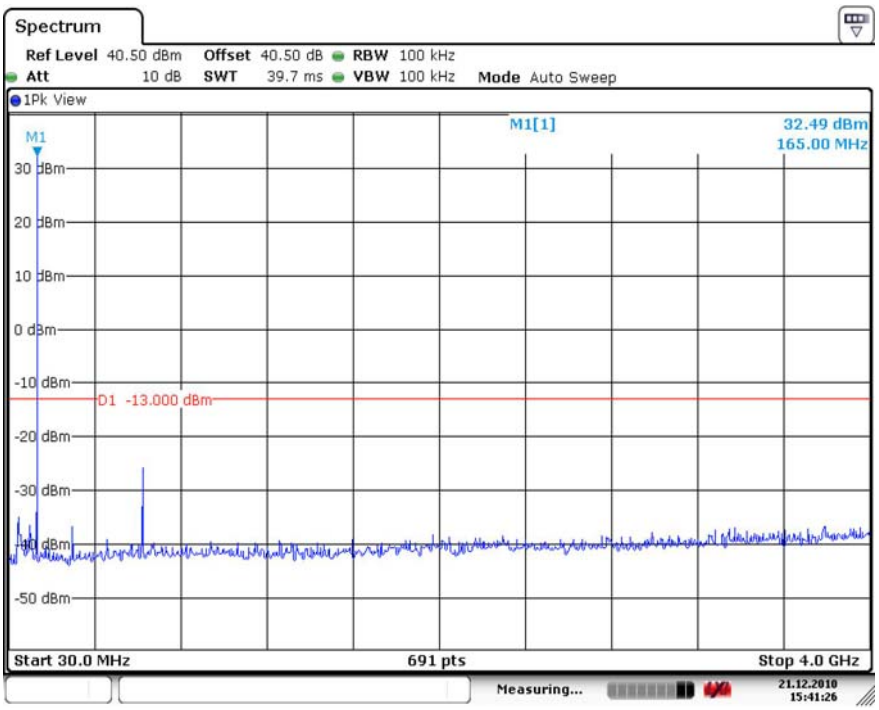


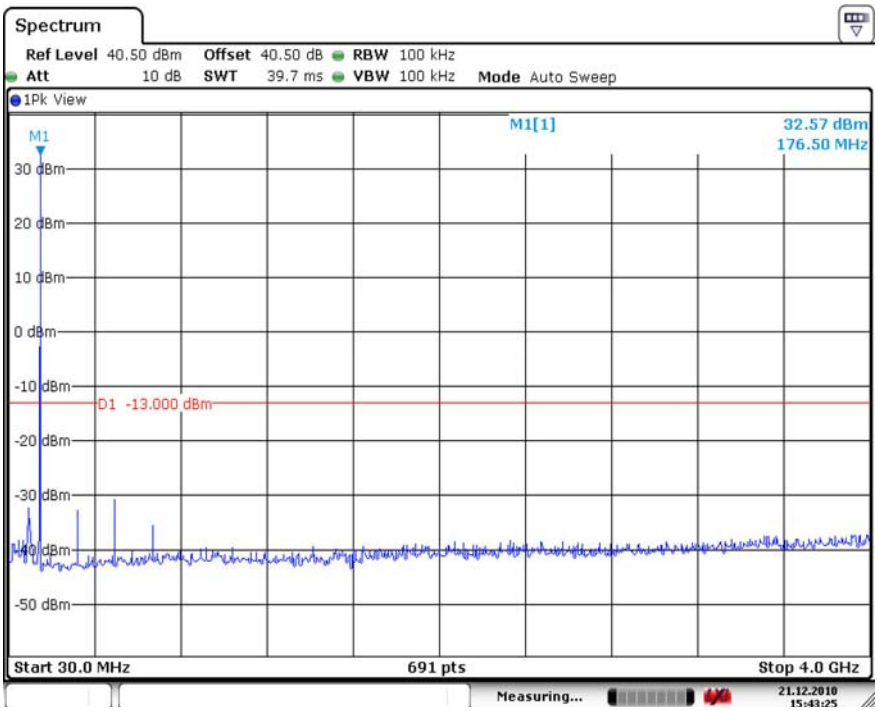




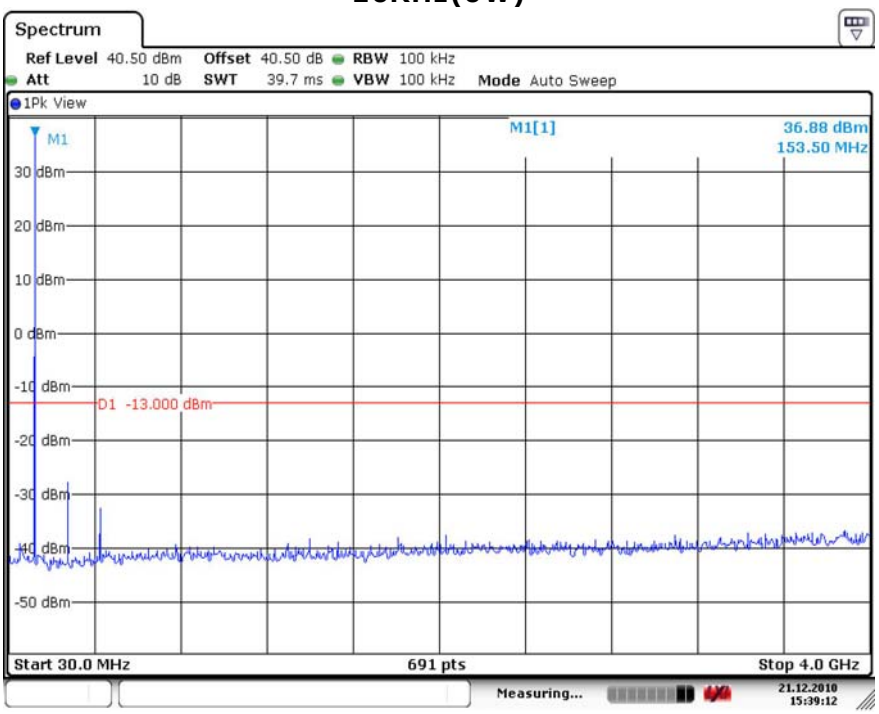
Unwanted Emissions
25KHz(2W)

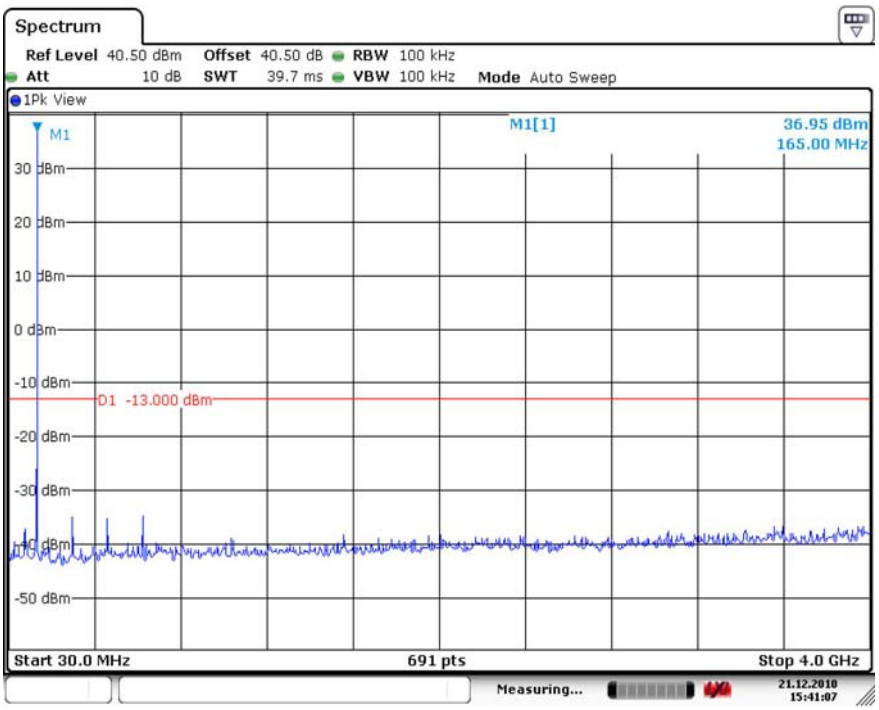


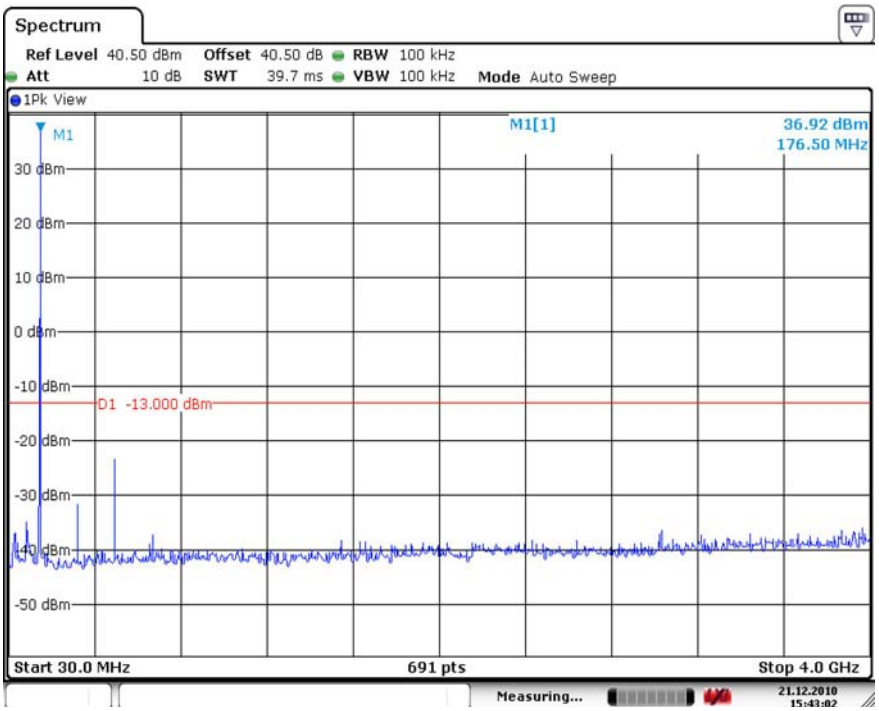




Unwanted Emissions
25KHz(5W)







3.3 Field Strength of Spurious Radiation

Definition:

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

Specification : 47CFR2.1053 , 90.210

Test method : ANSI/TIA-603-C

Measurement Procedure:

- The test sample was set up at a distance of three meters from the test instrument. Valid spurious signal were determined by switching the power on and off
- In the field, the test sample was placed on a wooden turntable above ground at three meters away from the search antenna
- The cables were oriented in order to obtain the maximum response. At each emission frequency, the turntable was rotated and the search antennas were raised and lowered vertically
- The emission was observed with both a vertically polarized and a horizontally polarized search antenna and the worst case was used.
- The field strength of each emission within 20dB of the limit was recorded and corrected with the appropriate cable and transducer factors.
- From the lowest frequency generated in the EUT and to at least the 10^{th} harmonic of the carrier frequency, or 40GHz, whichever is lower.
- The worst case for all channels is shown

LIMIT

= 43+10log(P)dBc(or -13dBm)

Measurement Data : Attached for Worst Case

Channel Spacing : 25KHz
-Test result :Low Frequency
P=36.83dBm = 4.82 W

Frequency (MHz)	Pol	Reading (dBm)	ERP measured (dBm)	Limit (dBc)
301.648	v	-29.24	-26.89	49.83
452.475	v	-35.71	-30.83	49.83

Test result : mid Frequency
P=36.97dBm = 4.98 W

Frequency (MHz)	Pol	Reading (dBm)	ERP measured (dBm)	Limit (dBc)
324.796	v	-37.57	-33.25	49.97
487.205	v	-37.13	-33.03	49.97
649.604	v	-37.09	-32.84	49.97

Test result : High Frequency
P=36.98dBm = 4.99 W

Frequency (MHz)	Pol	Reading (dBm)	ERP measured (dBm)	Limit (dBc)
347.971	v	-35.82	-30.20	49.98
521.960	v	-26.74	-22.87	49.98
695.940	v	-38.41	-34.64	49.98

3.4 Emission Masks(Occupied Bandwidth)

Definition:

- The term transmitter Sideband Spectrum denotes the energy produced at a discrete frequency separation from the carrier up to the test bandwidth due to all sources of unwanted noise within transmitter in a modulated condition.

Specification : 47CFR2.1053 , 90.210

Test method : ANSI/TIA-603-C

Measurement Procedure:

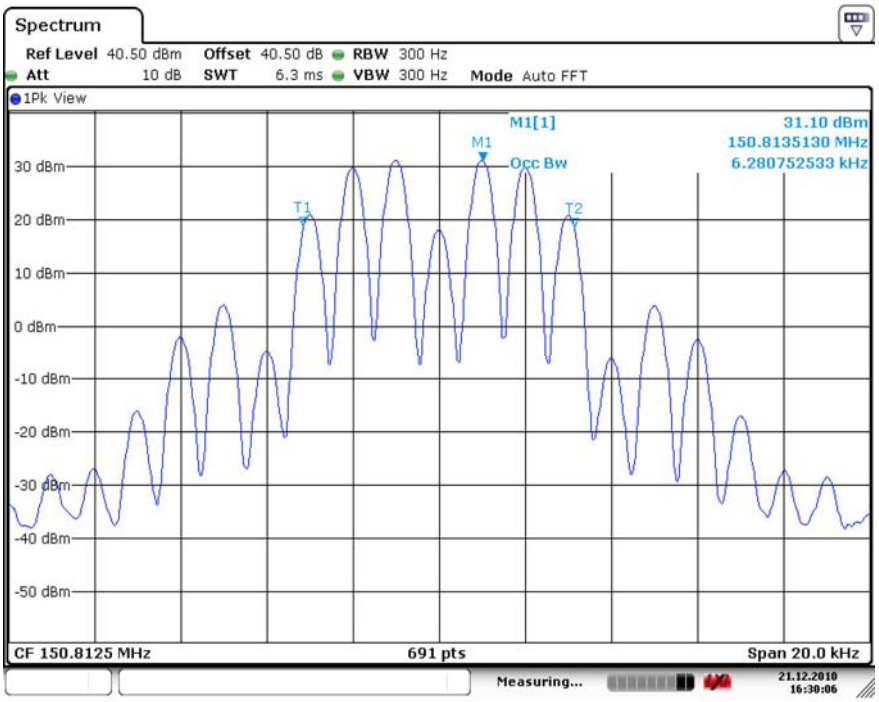
- The EUT and test equipment were set up as shown on the following page, with the Spectrum Analyzer connected.
- For EUT supporting audio modulation, the audio signal generator was adjusted to the frequency of maximum response and with output level set for ±2.5 / ±1.25KHz deviation(or 50% modulation). With level constant, the signal level was increased 16dB
- For EUT supporting digital modulation, the digital modulation mode was operate its maximum extent.
- The Occupied Bandwidth measured with the Spectrum Analyzer controls set as shown on the test results

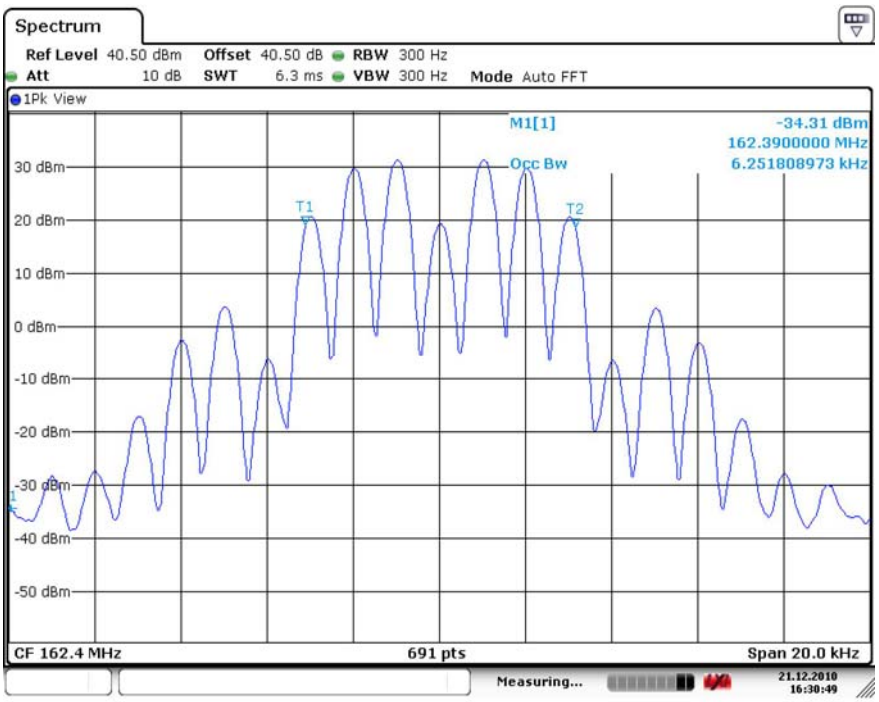
Test Data

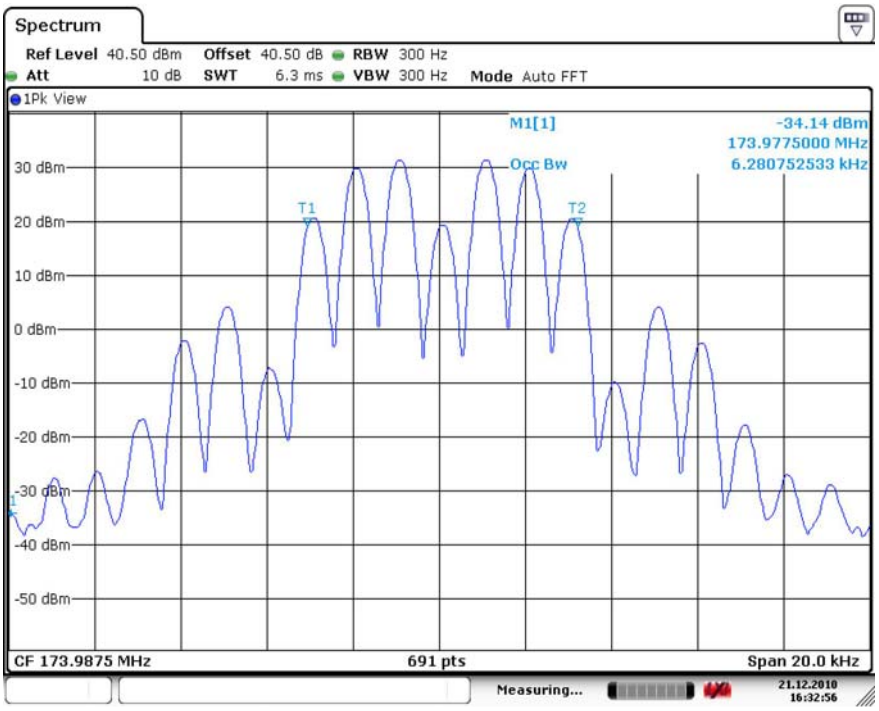
Frequency (MHz)	Channel Spacing (KHz)	Modulation	Measured 99% OBW at Maximum Freq. Deviation (KHz)	Maximum Authorized Bandwidth (KHz)
150.8125	12.5	FM with 1.25KHz sine wave signal	6.28	11.25
162.4000	12.5	FM with 1.25KHz sine wave signal	6.25	11.25
173.9875	12.5	FM with 1.25KHz sine wave signal	6.28	11.25
150.8250	25	FM with 2.5KHz sine wave signal	10.30	20.0
162.4000	25	FM with 2.5KHz sine wave signal	10.27	20.0
173.9750	25	FM with 2.5KHz sine wave signal	10.33	20.0

See next pages for actual measured spectrum plots.

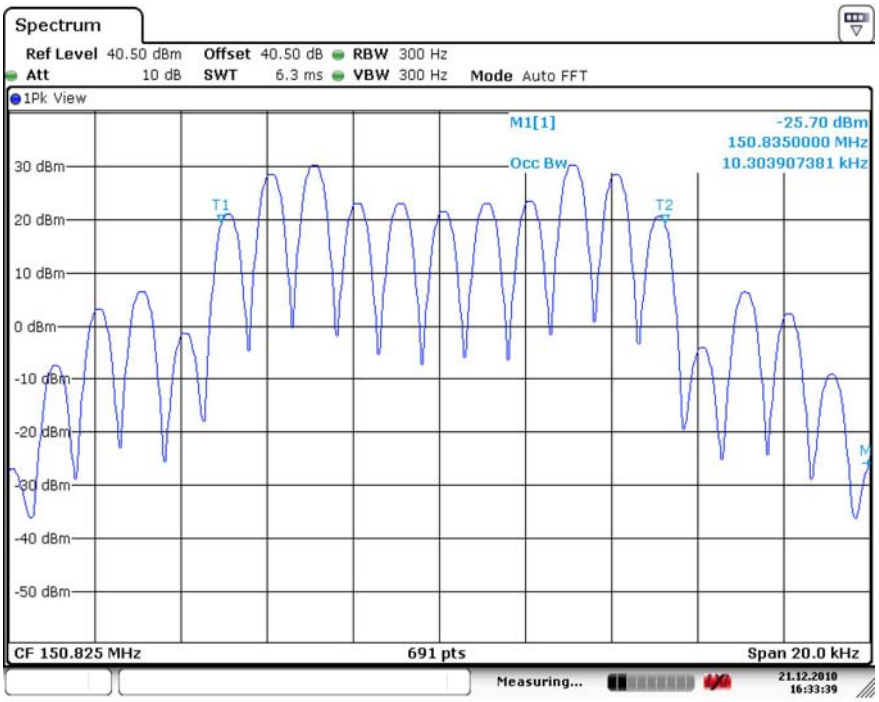
Occupied Bandwidth
12.5KHz

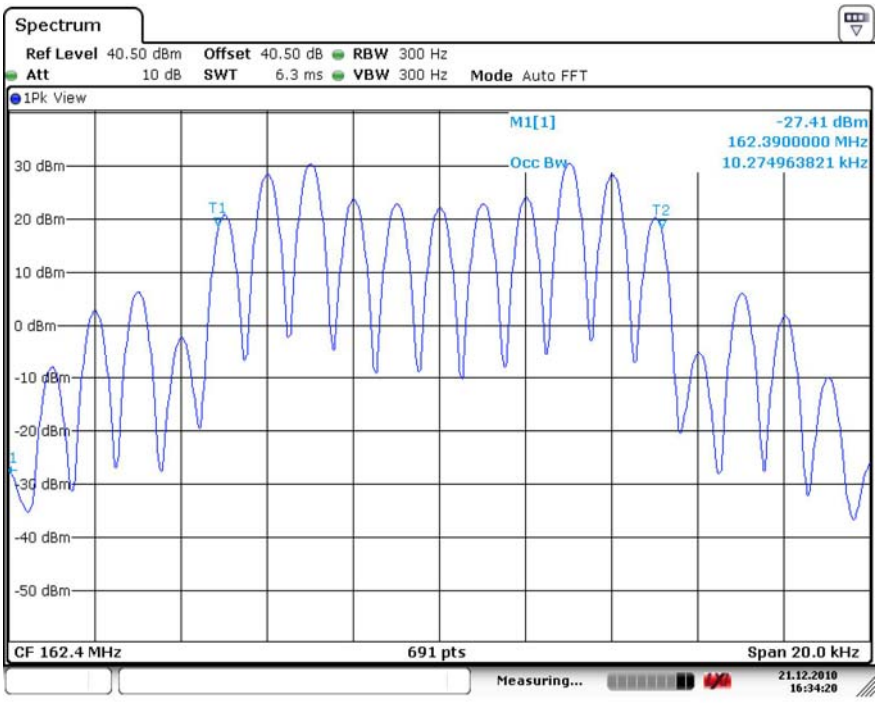


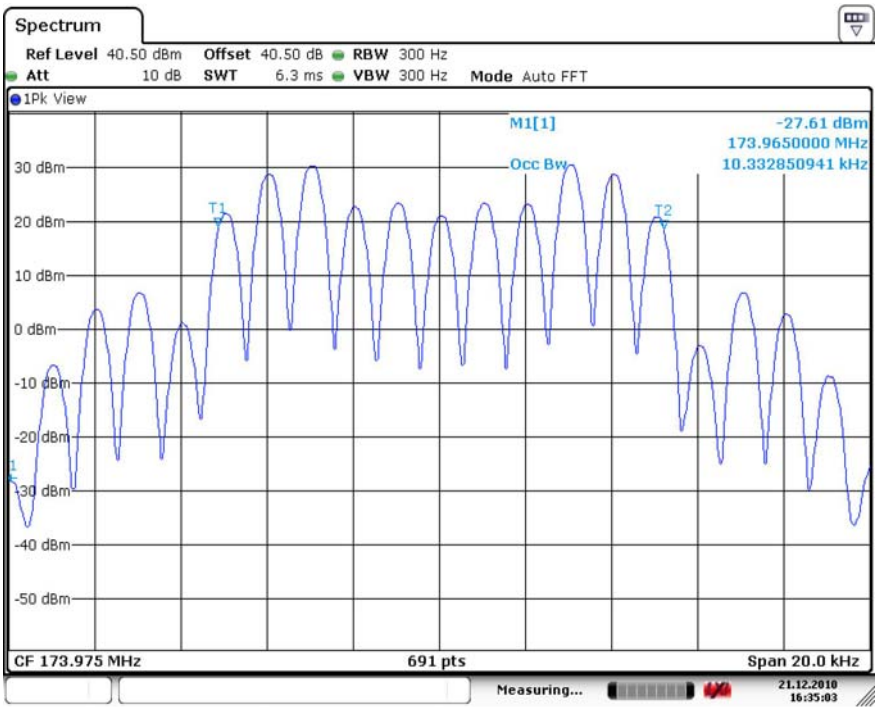




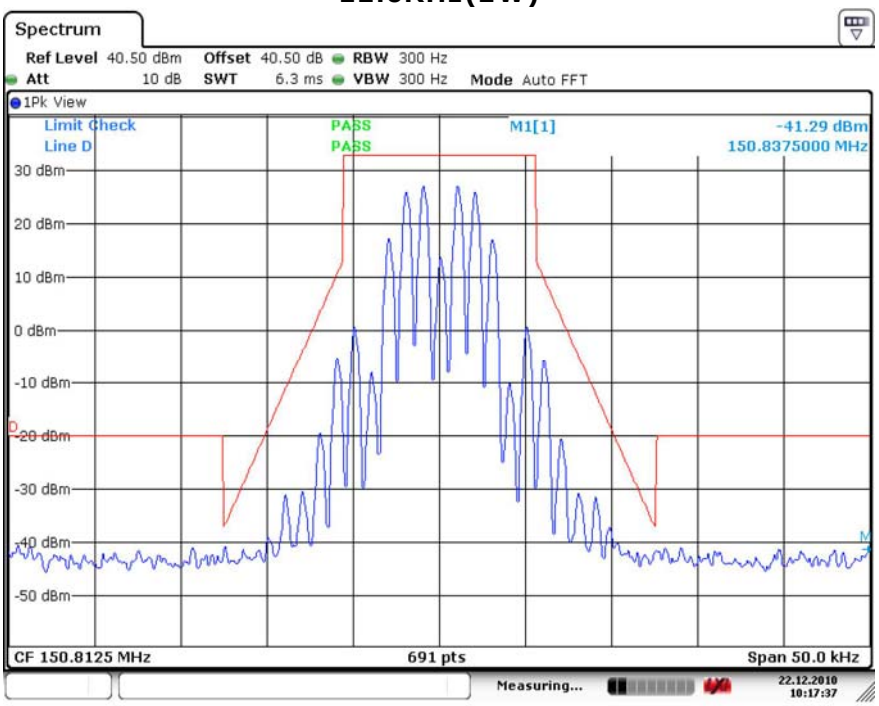
Occupied Bandwidth
25KHz

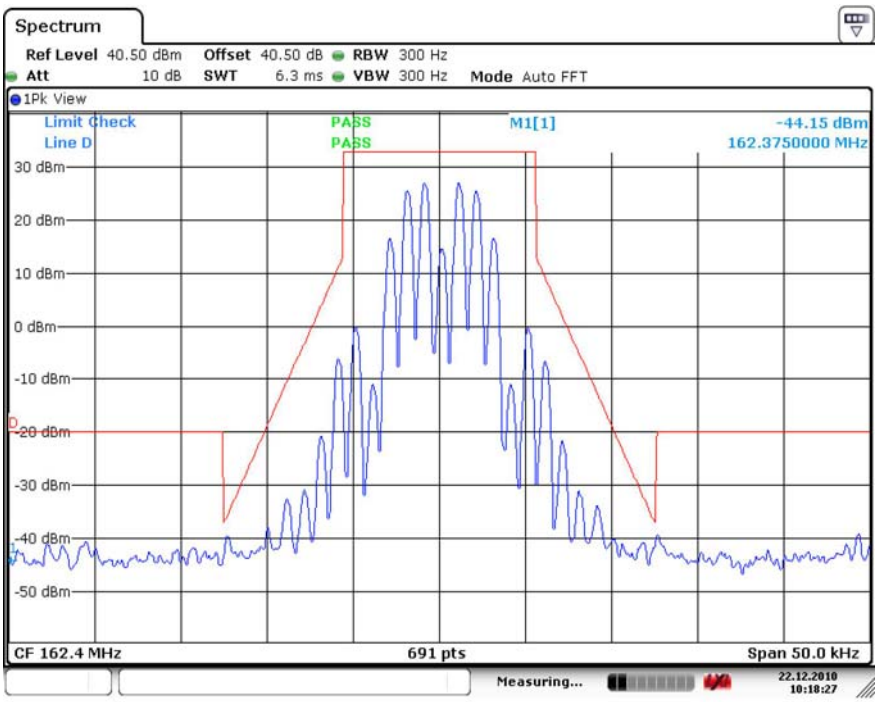


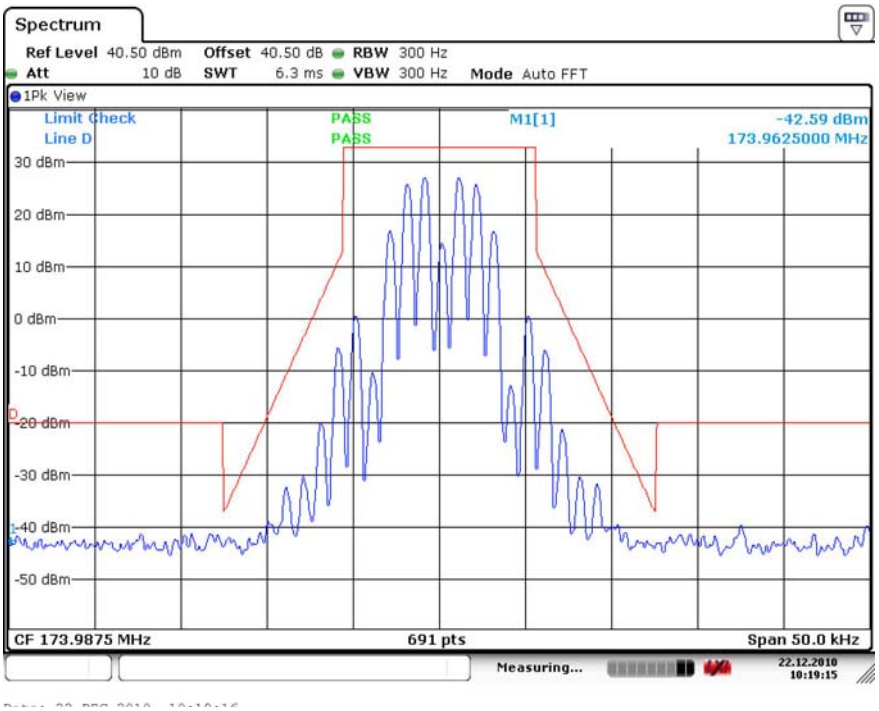




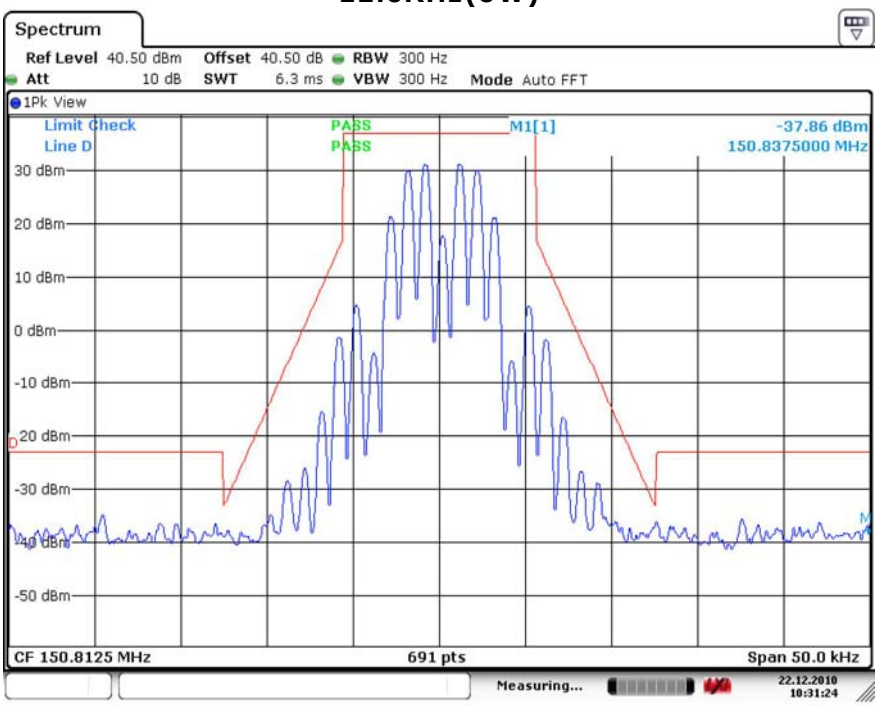
Emission Masks D
12.5KHz(2W)

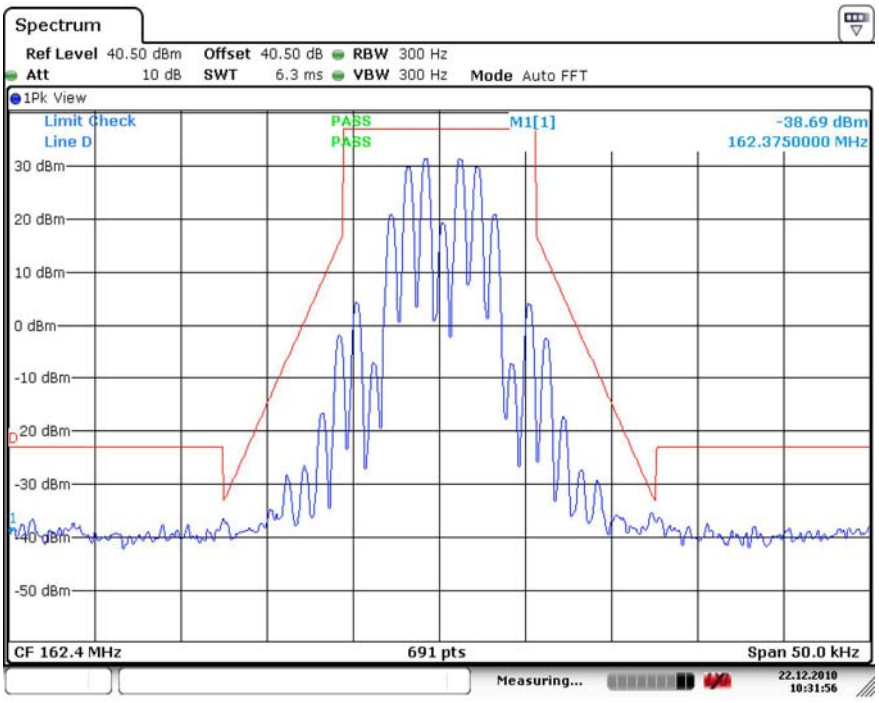


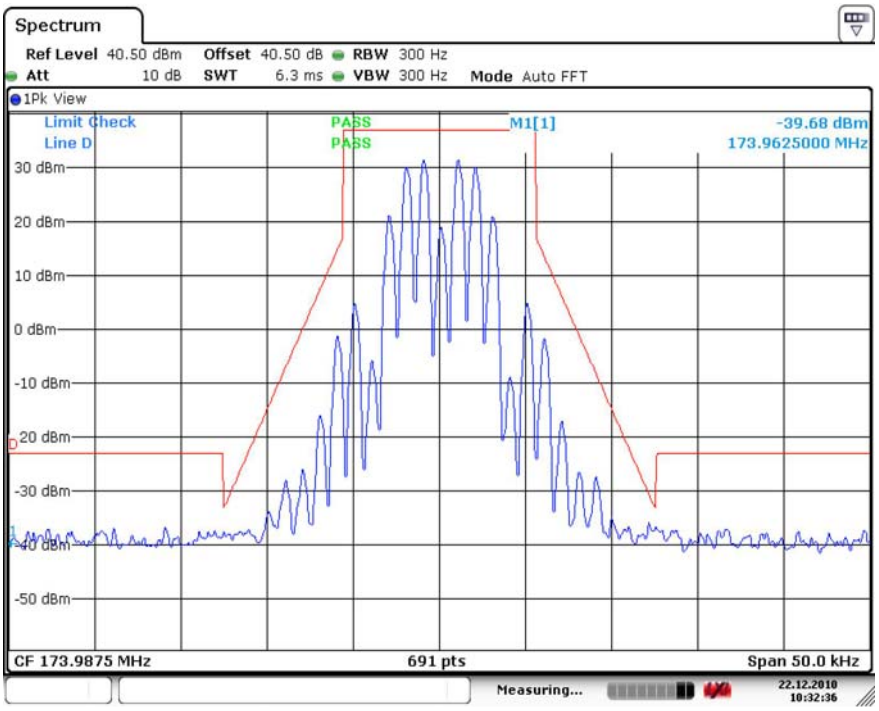




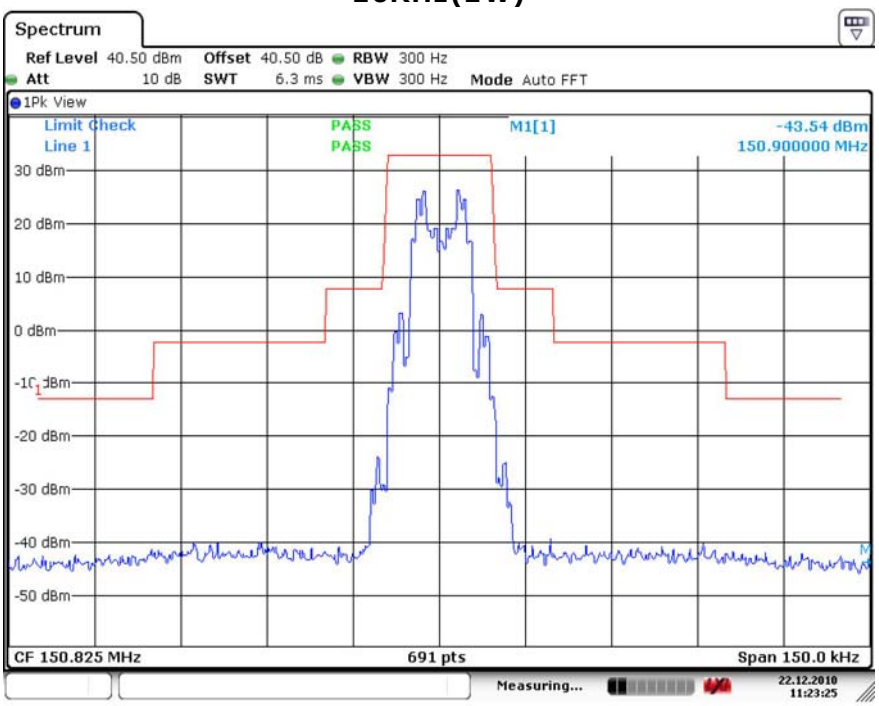
Emission Masks D
12.5KHz(5W)

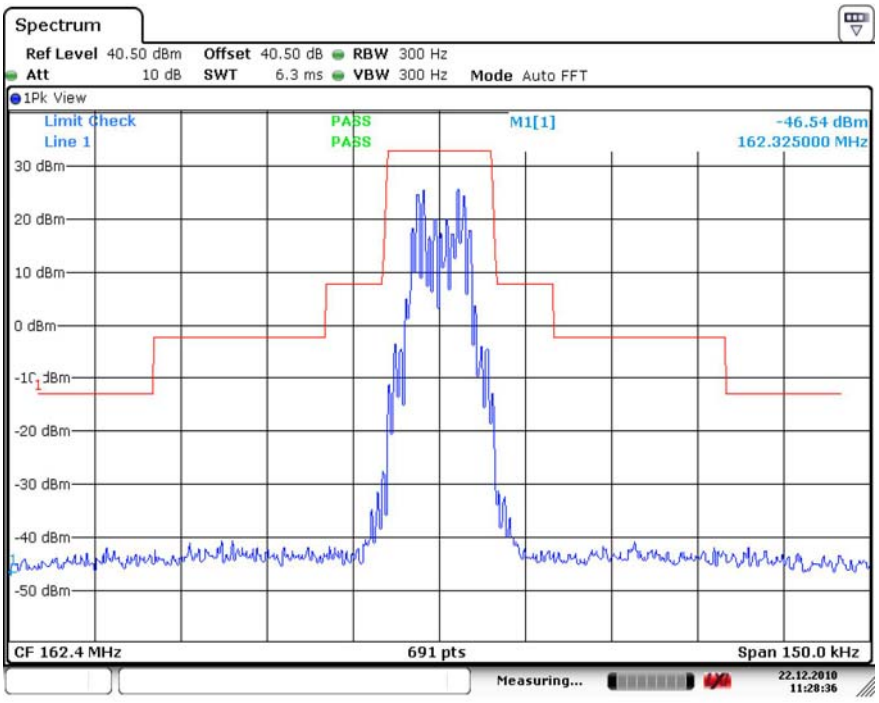


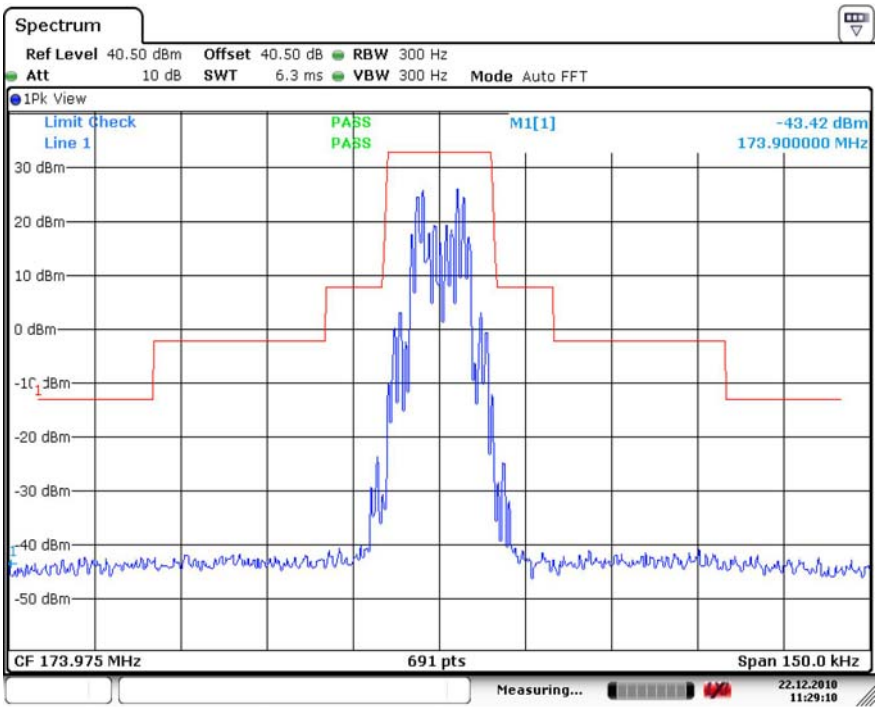




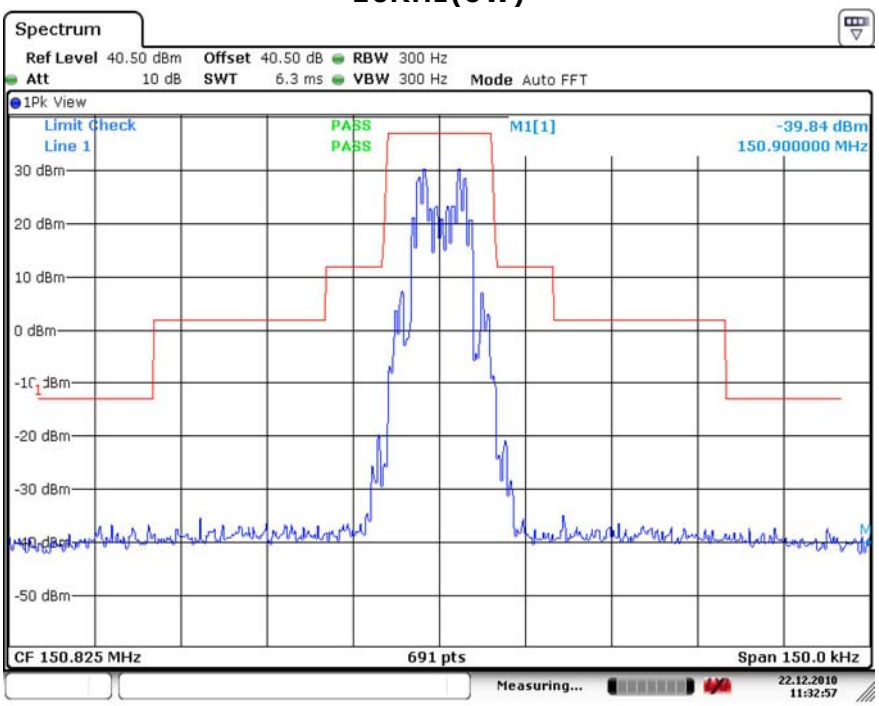
Emission Masks B
25KHz(2W)

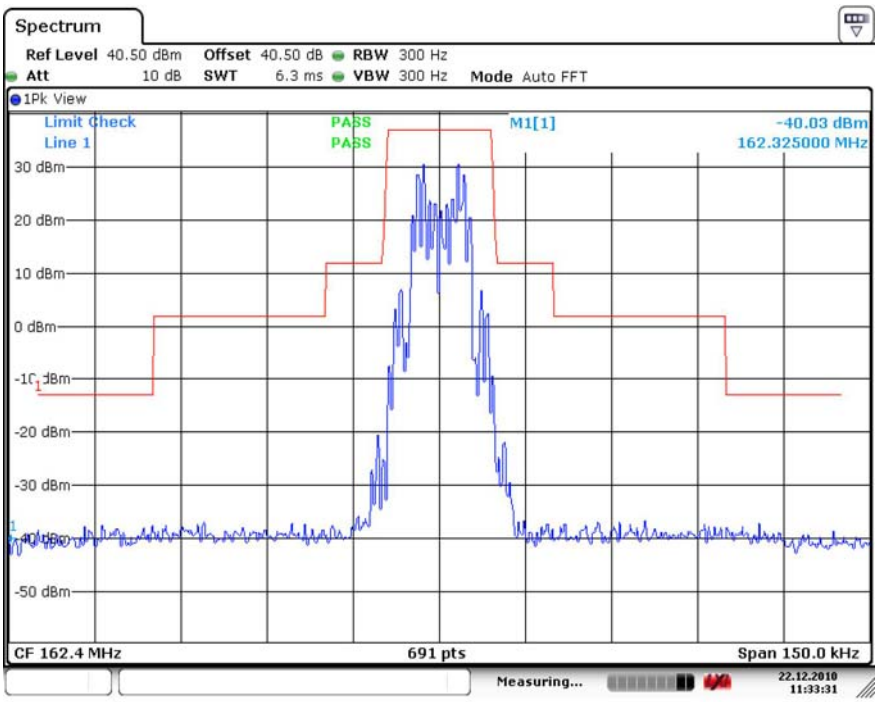


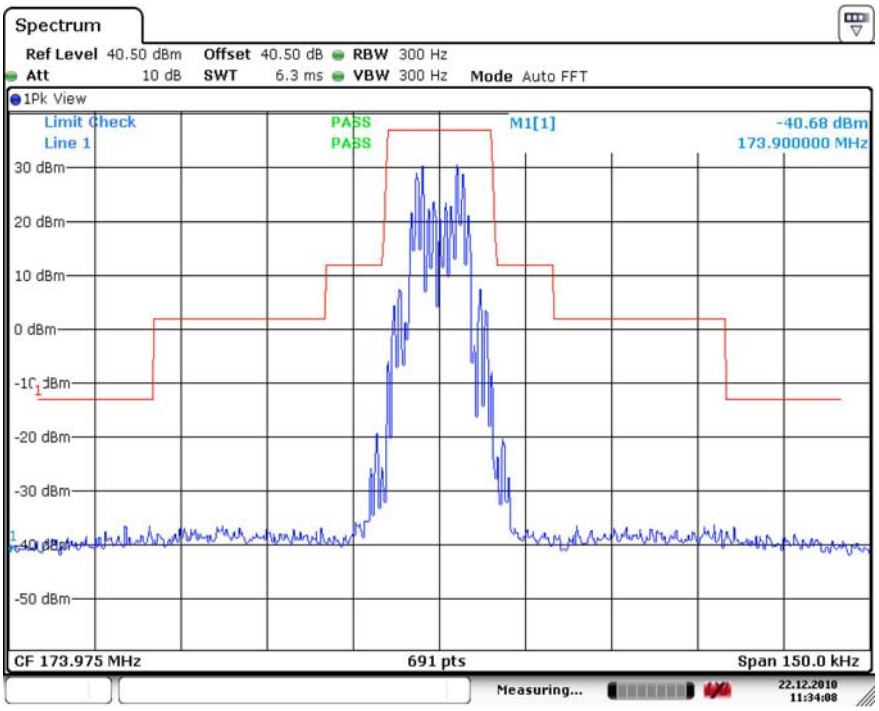




Emission Masks B
25KHz(5W)







3.5 Transient Frequency Behavior

Definition:

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

Specification : 47CFR90.214

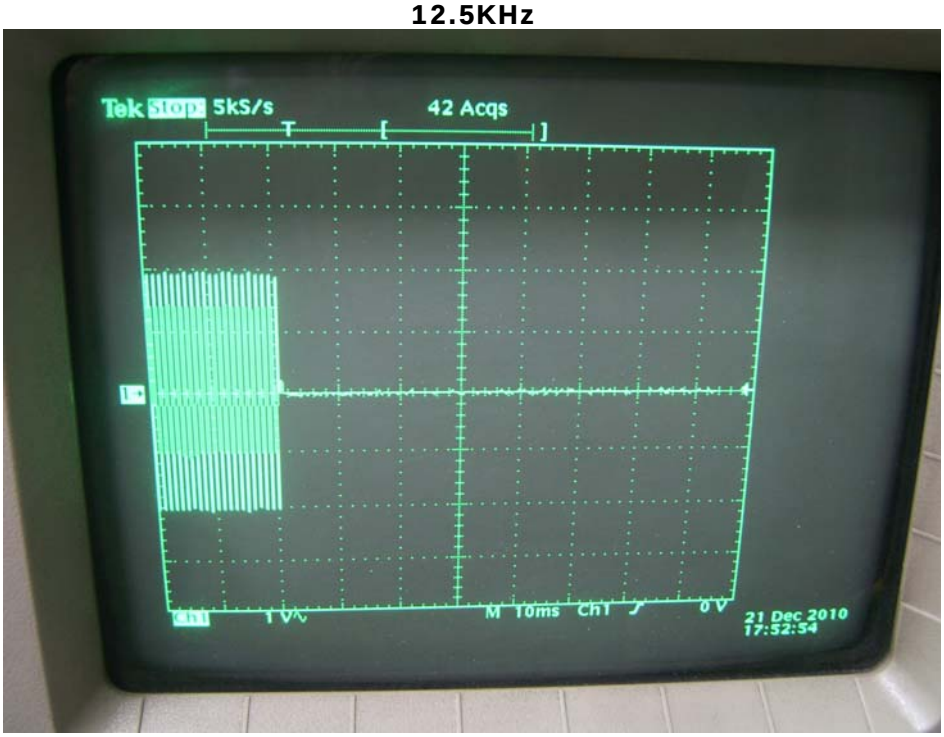
Test method : ANSI/TIA/EIA-603-C-2004

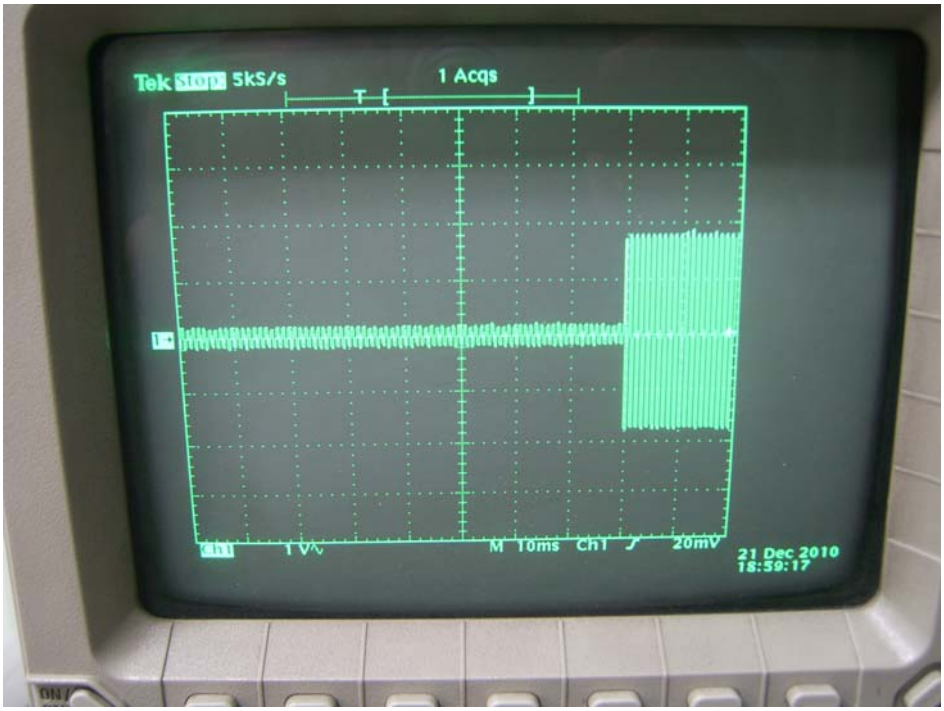
Measurement Procedure:

- The EUT was set up as shown on the attached page, following TIA/EIA-603 step a, b, and c as a guide.
- The transmitter was turned on.
- Sufficient attenuation was provided so that the transmitter carrier level measured at the output of the combiner was 40dB below the maximum input level of the test receiver. This level was recorded as step f.
- The transmitter was turned off.
- An RF signal generator(1)modulated with a 1KHz tone at either 25,12.5,or6.25KHz deviation, and set to the same frequency as the assigned transmitter frequency, (2)was adjusted to a lever. -20dB below the level recorded for step f, as measured at the output of the combiner. This level was then fixed for the remainder of the test and is recorded at step h.
- The oscilloscope was set up using TIA/EIA-603 steps j and k as a guide, and to either 10ms/div(UHF) of 5ms/div(VHF)
- The 30dB attenuator was removed, the transmitter was turned on, and the level of the output of the combiner was recorded as step 1.
- The carrier on-time as referenced in TIA/EIA-603 steps m,n,and o was captured and plotted. The carrier off-time as referenced in TIA/EIA-603 steps p,q,r, and s was captured and plotted.
- For EUT supporting audio modulation, the audio signal generator was adjusted to the frequency of maximum response and with output level set for ±2.5 / ±1.25KHz deviation (or 50% modulation). With level constant, the signal level was increased 16dB.
- For EUT supporting digital modulation, the digital modulation mode was operated to its maximum extent.
- The Occupied Bandwidth was measured with the Spectrum Analyzer controls set as shown on the test results.

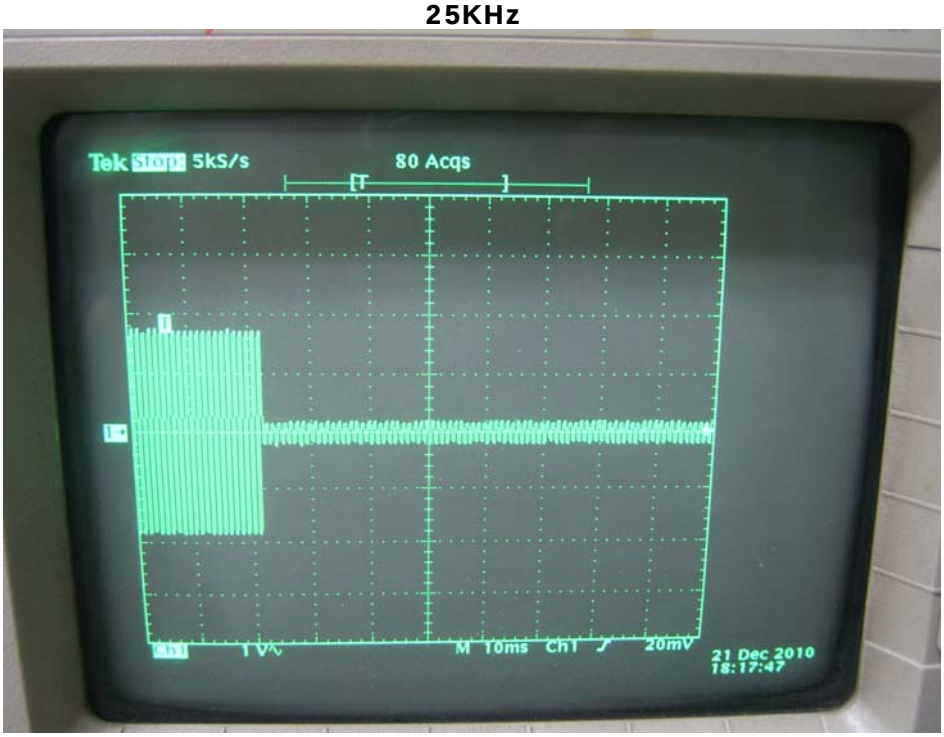
See next pages for actual measured spectrum plots.

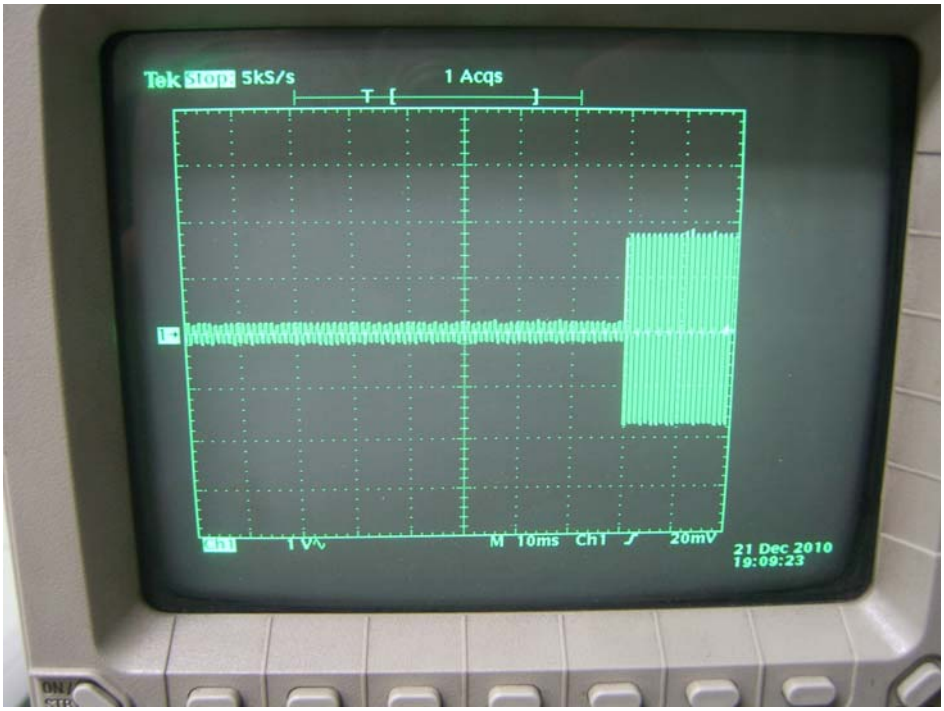
Transient Frequency Behavior
12.5KHz





Transient Frequency Behavior
25KHz





3.6 Audio Low Pass Filter(Voice Input)

Definition:

The Audio Low Pass Filter Response is The Frequency Response of the post limiter low pass filter circuit above 3000Hz

Specification : 47CFR2.1047(a)

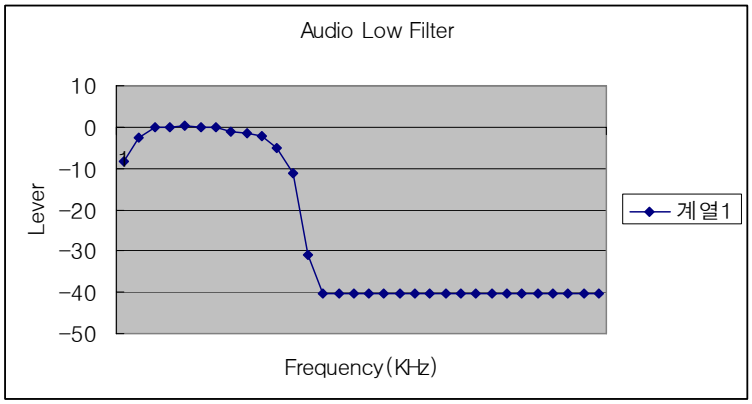
Test method : ANSI/TIA/EIA-603-C-2004

Measurement Procedure:

- The EUT and test equipment were set up such that the audio input was connected at the input to the modulation limiter, and the modulated stage
- The audio output was connected at the output to the modulated stage

Test Data

Audio Frequency Response					
Freq.,KHz	**Level,dB**	**Freq.,KHz**	**Level,dB**	**Freq.,KHz**	**Level,dB**
0.3	-8.34	**4.5**	-40.26	**25.0**	-40.26
0.4	-2.48	**5.0**	-40.26	**30.0**	-40.26
0.5	0.03	**6.0**	-40.26	**35.0**	-40.26
0.6	0.04	**7.0**	-40.26	**40.0**	-40.26
0.7	0.32	**8.0**	-40.26	**45.0**	-40.26
0.8	0.03	**9.0**	-40.26	**50.0**	-40.26
1.0	0	**10.0**	-40.26		
1.5	-1.17	**12.0**	-40.26		
2.0	-1.36	**14.0**	-40.26		
2.5	-2.34	**16.0**	-40.26		
3.0	-5.07	**18.0**	-40.26		
3.5	-11.19	**20.0**	-40.26		
4.0	-31.12	**22.0**	-40.26		



3.7 Audio Frequency Response

Definition:

- The Audio frequency response is the degree of closeness to which the frequency Deviation of the transmitter follows a prescribed characteristic

Specification : 47CFR2.1047(a)

Test method : ANSI/TIA/EIA-603-C-2004

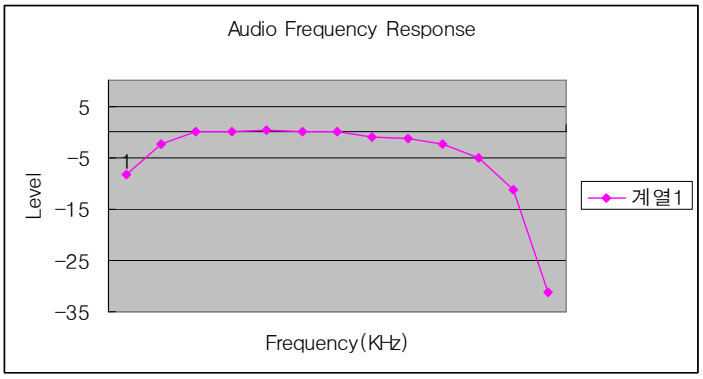
Measurement Procedure:

- The audio signal input was adjusted to obtain 20% modulation at 1KHz, and this point was taken as the 0dB reference level
- With input levels held constant and below limiting at all frequencies, the audio signal generator was varied from 300Hz to 30KHz
- The response in dB relative to 1KHz was then measured, using the Modulation Analyzer

Test Data

Operating Frequency : 162.4000MHz

Audio Frequency Response	
Freq.,KHz	**Level,dB**
0.3	-8.34
0.4	-2.48
0.5	0.03
0.6	0.04
0.7	0.32
0.8	0.03
1.0	0
1.5	-1.17
2.0	-1.36
2.5	-2.34
3.0	-5.07
3.5	-11.19
4.0	-31.12



3.8 Modulation Limiting

Definition:

- Modulation limiting refers to the transmitter circuits ability to limit the transmitter from producing deviations due to modulation in excess of a rated system deviation

Specification : 47CFR2.1047(b)

Test method : ANSI/TIA/EIA-603-C-2004

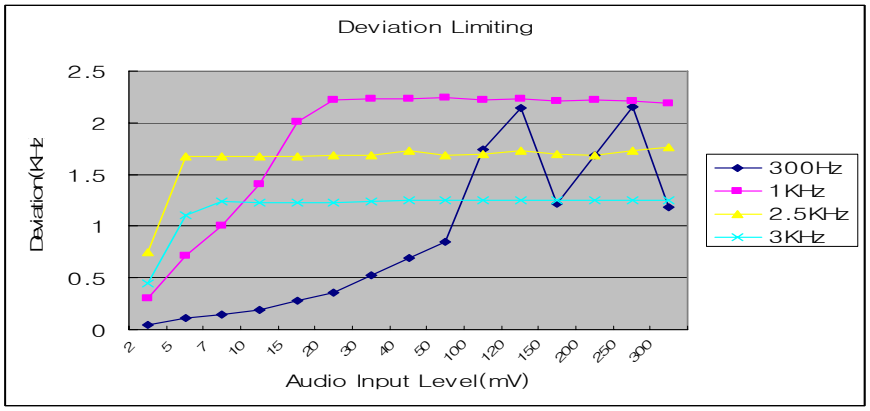
Measurement Procedure:

- The signal generator was connected to the input of the EUT as for "Frequency Response of the Modulating Circuit"
- The modulation response was measured for each of three frequencies (one of which was the frequency of maximum response), and the input voltage was varied and was observed on an Modulation Analyzer
- The input level was varied from 30% modulation(±1.5KHz deviation) to at least 20dB higher than the saturation point

Test Data

Operating Frequency : 162.4000MHz
Channel Spacing : 12.5KHz

Input Level (mV)	FM Deviation in KHz at Indicated Modulating Frequency			
	300Hz	1KHz	2.5KHz	3KHz
2	0.05	0.30	0.75	0.45
5	0.11	0.71	1.67	1.10
7	0.14	1.00	1.67	1.24
10	0.19	1.41	1.67	1.23
15	0.28	2.01	1.67	1.23
20	0.36	2.22	1.69	1.23
30	0.53	2.23	1.69	1.24
40	0.69	2.23	1.73	1.25
50	0.85	2.24	1.69	1.25
100	1.74	2.22	1.70	1.25
120	2.14	2.23	1.73	1.25
150	1.22	2.21	1.70	1.25
200	1.69	2.22	1.69	1.25
250	2.15	2.21	1.73	1.25
300	1.18	2.19	1.76	1.25



3.9 Frequency Stability

Definition:

- Modulation limiting refers to the transmitter circuits ability to limit the transmitter from producing deviations due to modulation in excess of a rated system deviation

Specification : 47CFR2.1055

Test method : ANSI/TIA/EIA-603-C-2004

Measurement Procedure:

- The frequency stability of the transmitter is measured by:
  a) Temperature: The temperature is varied from -30℃ to +60℃ using an environmental chamber.
  b) Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.
- Specification- The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.00025(±2.5ppm) of the center frequency.
- Time Period and Procedure:
  1. The carrier frequency of the transmitter and the individual oscillators is measured at room temperature (25℃ to 27℃ to provide a reference).
  2. The equipment is subjected to an overnight "soak" at -30℃ without power applied.
  3. After the overnight "soak" at 30℃(usually 14-16 hours), the equipment is turned on in a "standby" condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter and the individual oscillators is made within a three minute interval after applying power to the transmitter.
  4. Frequency measurements are made at 10℃ interval up to room temperature. At least a period of one and one half-hour is provided to allow stabilization of the equipment at each temperature level.
  5. Again the transmitter carrier frequency and the individual oscillators is measured at room temperature to begin measurement of the upper temperature levels.
  6. Frequency measurements are at 10 intervals starting at -30℃ up to +60℃ allowing at least two hours at each temperature for stabilization. In all measurements the frequency is measured within three minutes after re-applying power to the transmitter.
  7. The artificial load is mounted external to the temperature chamber. NOTE: The EUT is tested down to the battery endpoint.

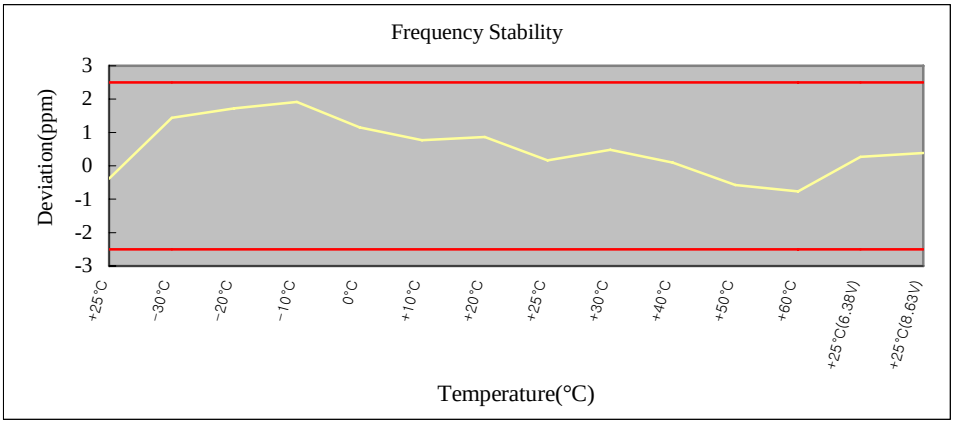
Test Data

Operating Frequency : 150.8125 MHz

Reference Voltage : 7.5 VDC Channel Spacing : 12.5 KHz

Deviation Limit : ±0.00025% or 2.5ppm

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQ (Hz)	Deviation (%)
100%	7.5	+25(Ref)	150.812442	-0.000038
100%		-30	150.812717	0.000144
100%		-20	150.812760	0.000172
100%		-10	150.812789	0.000192
100%		0	150.812674	0.000115
100%		+10	150.812616	0.000077
100%		+20	150.812630	0.000086
100%		+25	150.812524	0.000016
100%		+30	150.812572	0.000048
100%		+40	150.812514	0.000009
100%		+50	150.812413	-0.000058
100%		+60	150.812384	-0.000077
85%	6.38	+25	150.812541	0.000027
115%	8.63	+25	150.812558	0.000038



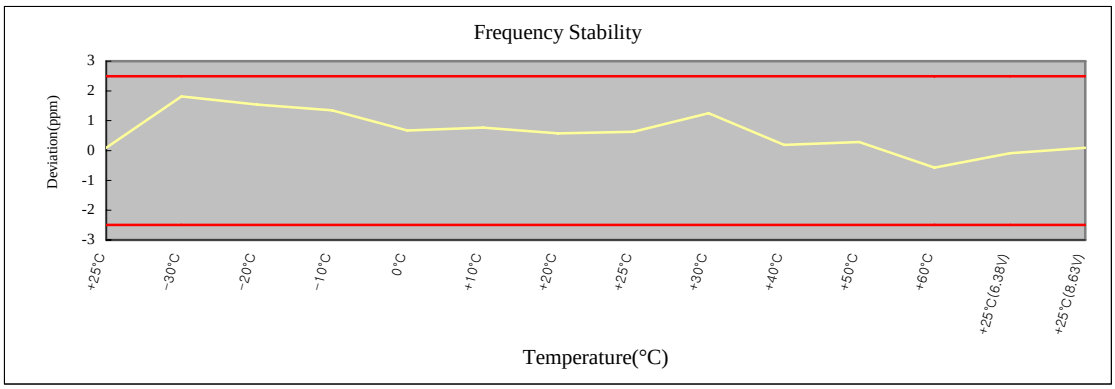
Test Data

Operating Frequency : 150.825 MHz

Reference Voltage : 7.5 VDC Channel Spacing : 25 KHz

Deviation Limit : ±0.00025% or 2.5ppm

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQ (Hz)	Deviation (%)
100%	7.5	+25(Ref)	150.825014	0.000009
100%		-30	150.825275	0.000182
100%		-20	150.825232	0.000154
100%		-10	150.825203	0.000135
100%		0	150.825101	0.000067
100%		+10	150.825116	0.000077
100%		+20	150.825087	0.000058
100%		+25	150.825095	-0.002685
100%		+30	150.825188	0.000125
100%		+40	150.825029	0.000019
100%		+50	150.825043	0.000029
100%		+60	150.824913	-0.000058
85%	6.38	+25	150.824986	-0.000009
115%	8.63	+25	150.825014	0.000009



2.1.2 3.7 Type of Emission

Specification : 47CFR2.1055

MODULATION = 16K0F3E

NECESSARY BANDWIDTH CALCULATION:

MAXIMUM MODULATION (M), kHz = 3

MAXIMUM DEVIATION (D), kHz = 5

CONSTANT FACTOR (K) = 1

NECESSARY BANDWIDTH (BN), kHz = (2 * M) + (2 * D * K)

= 16

MODULATION = 11K0F3E

NECESSARY BANDWIDTH CALCULATION:

MAXIMUM MODULATION (M), kHz = 3

MAXIMUM DEVIATION (D), kHz = 2.5

CONSTANT FACTOR (K) = 1

NECESSARY BANDWIDTH (BN), kHz = (2 * M) + (2 * D * K)

= 11

APPENDIX A – Test Equipment Used For Tests

c	Description	Manufacturer	Model No.	Serial No.	Due Cal.
1	Test Receiver	Rohde & Schwarz	ESHS 10	862970/018	2011.05.06
2	Test Receiver	Rohde & Schwarz	ESVS 10	826008/014	2011.05.06
3	Spectrum Analyzer	Hewlett Packard	8566B	2311A02394	2011.05.06
4	Spectrum Analyzer	Rohde & Schwarz	FSV30	100736	2011.12.01
5	Modulation Analyzer	Hewlett Packard	8901B	3438A05094	2011.05.06
6	Audio analyzer	Hewlett Packard	8903B	3011A12915	2011.05.06
7	Preamplifer	Hewlett Packard	8447F	2805A02570	2011.05.06
8	Preamplifer	A.H. Systems	PAM-0118	164	2011.05.06
9	Signal Generator	Hewlett Packard	8673D	2708A00448	2011.05.06
10	Power Meter	Hewlett Packard	437B	312U24787	2011.05.06
11	Power Sensor	Hewlett Packard	8482B	3318A06943	2011.05.06
12	Loop Antenna	Rohde & Schwarz	HFH2-Z2.335.4711.52	826532/006	2011.02.06
13	Dipole Antenna	Rohde & Schwarz	VHAP	574	2011.07.07
14	Dipole Antenna	Rohde & Schwarz	VHAP	575	2011.07.17
15	Dipole Antenna	Rohde & Schwarz	UHAP	545	2011.07.17
16	Dipole Antenna	Rohde & Schwarz	UHAP	546	2011.07.07
17	Biconical Antenna	Eaton Corp.	94455-1	0977	2011.07.03
18	Biconical Antenna	EMCO	3104C	9111-2468	2011.07.03
19	Log Periodic Antenna	EMCO	3146	2051	2011.06.05
20	Log Periodic Antenna	EMCO	3146	8901-2320	2011.07.03
21	Horn Antenna	A.H. Systems	SAS-571	414	2011.03.16
22	Waveform Generator	Hewlett Packard	33120A	US34001190	2011.05.06
23	Digital Oscilloscope	Tektronix	TDS 340A	B012287	2011.05.06
24	Dummy Load	Bird Electronics	8251	11511	2011.05.06