Lab Code: 200707-0

FCC PART 90

TEST REPORT

For

Hytera Communications Corporation Ltd.

HYT Tower, Hi-Tech Industrial Park North, Nanshan District, Shenzhen, China

FCC ID: YAMX1EVHF

Report Type:	**Product Type:**
Original Report	DMR Covert Radio

Test Engineer:	Eric Lee
Report Number:	R1DG120405004-00B
Report Date:	2012-04-25
Reviewed By:	Alvin Huang EMC Engineer
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Hytera Communications Corporation Ltd.'s* product, model number: *X1e VHF (FCC ID: YAMX1EVHF)* (the "EUT") in this report is a *DMR Covert Radio*, which was measured approximately 12.8 cm (L) x 6.0 cm (W) x 2.2 cm (H) (Exclude antenna), rated input voltage: DC 7.4 V Li-ion battery.

Specification:

Frequency rang: 136~174MHz
Channel spacing: 12.5 kHz
Modulation: FM/4FSK
Output power (conducted): 36.7 dBm

** All measurement and test data in this report was gathered from production sample serial number: 1204053 (Assigned by BACL, Shenzhen). The EUT was received on 2012-04-05.*

Objective

This test report is prepared on behalf of *Hytera Communications Corporation Ltd.* in accordance with Part 2, and Part 90 of the Federal Communication Commissions rules.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DSS submission with FCC ID: YAMX1EVHF.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA 603-D and ANSI 63.4-2009.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on December 06, 2010. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratories Corp. (Shenzhen) is an ISO/IEC 17025 accredited laboratory, and is accredited by National Voluntary Laboratory Accredited Program (Lab Code 200707-0).

The current scope of accreditations can be found at http://ts.nist.gov/Standards/scopes/2007070.htm.

SYSTEM TEST CONFIGURATION

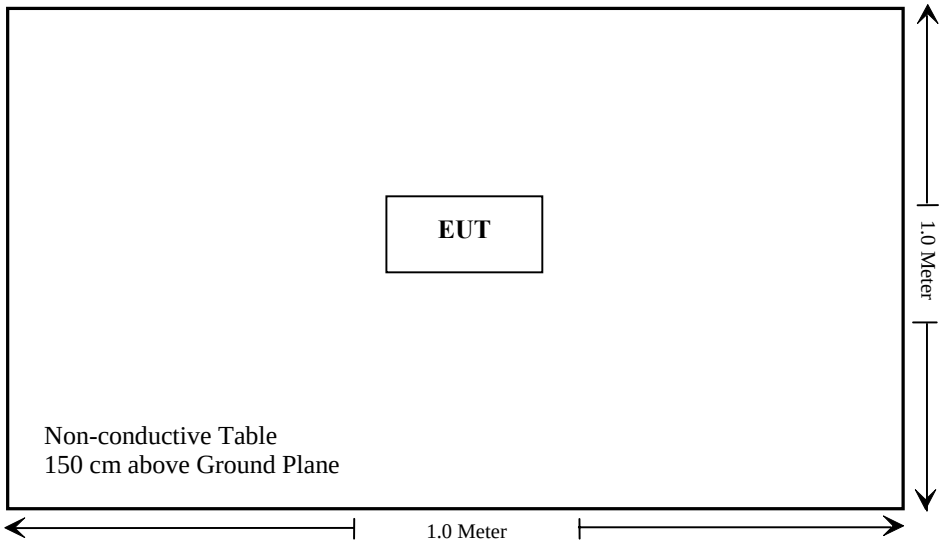
Description of Test Configuration

The system was configured for testing in a test mode which has been done in the factory.

Equipment Modifications

No modification was made to the EUT tested.

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1307 (b); §2.1093	RF Exposure	Compliance
§2.1046; §90.205	RF Output Power	Compliance
§2.1047; §90.207	Modulation Characteristic	Compliance
§2.1049; §90.209; §90.210	Occupied Bandwidth & Emission Mask	Compliance
§2.1051; §90.210	Spurious Emission at Antenna Terminal	Compliance
§2.1053; §90.210	Spurious Radiated Emissions	Compliance
§2.1055; §90.213	Frequency Stability	Compliance
§90.214	Transient Frequency Behavior	Compliance

Note: The uncertainty of any RF tests which use conducted method measurement is 0.96 dB.

The uncertainty of any radiation emissions measurement is 4.0 dB.

FCC §1.1307(b) & §2.1093 - RF EXPOSURE

Applicable Standard

According to RF Exposure Mobile and Portable Device Review and Approval Procedure date October 2005, for a PPT device with output power < 2 x 900 /f(GHz) (Low Threshold), SAR evaluation was not required for TCB Approval.

Result: The output power was 5.09 Watts and was smaller than the low threshold. Therefore, it was compliant. .

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FCC §2.1046 & §90.205- RF OUTPUT POWER

Applicable Standard

FCC §2.1046 and §90.205.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	101122	2011-11-17	2012-11-16

*** Statement of Tractability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Test Procedure

Conducted RF Output Power:

TIA-603-D section 2.2.1

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

Spectrum Analyzer setting:

RBW	***Video B/W***
100 kHz	*300 kHz*

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56%
ATM Pressure:	100.1 kPa

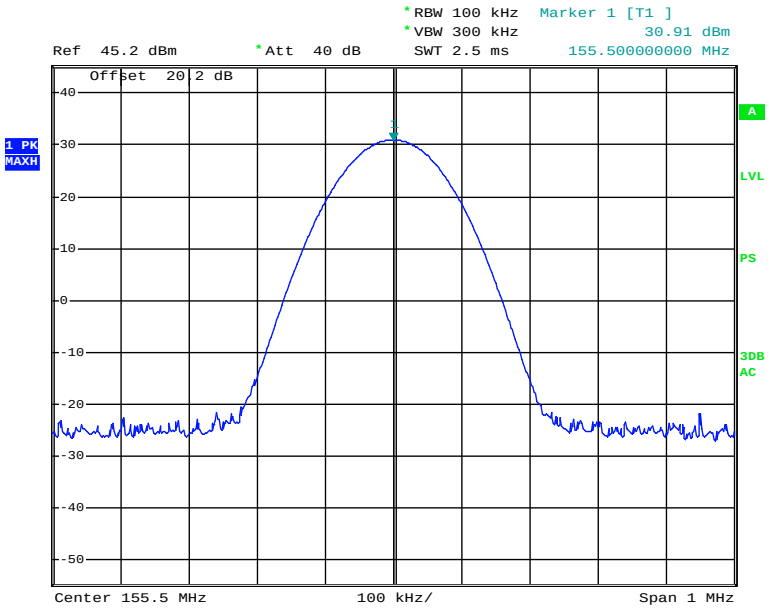
The testing was performed by Eric Lee on 2012-04-07.

Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

Mode	Frequency (MHz)	Output Power (dBm)	Output Power (Watt)	Comments
Analog Modulation	155.500	30.91	1.233	Low
	155.500	37.05	5.070	High
Digital Modulation	155.500	30.92	1.236	Low
	155.500	37.07	5.093	High

Analog Modulation - Low Power



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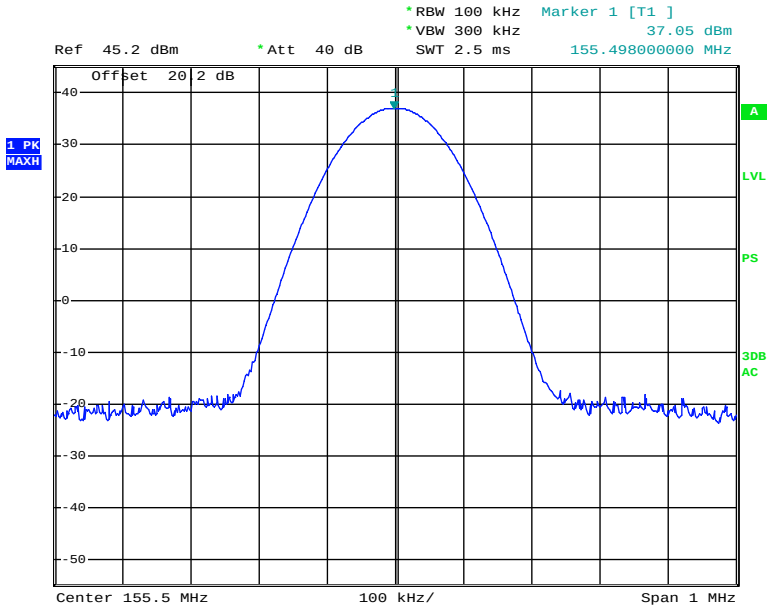
Analog Modulation – High Power



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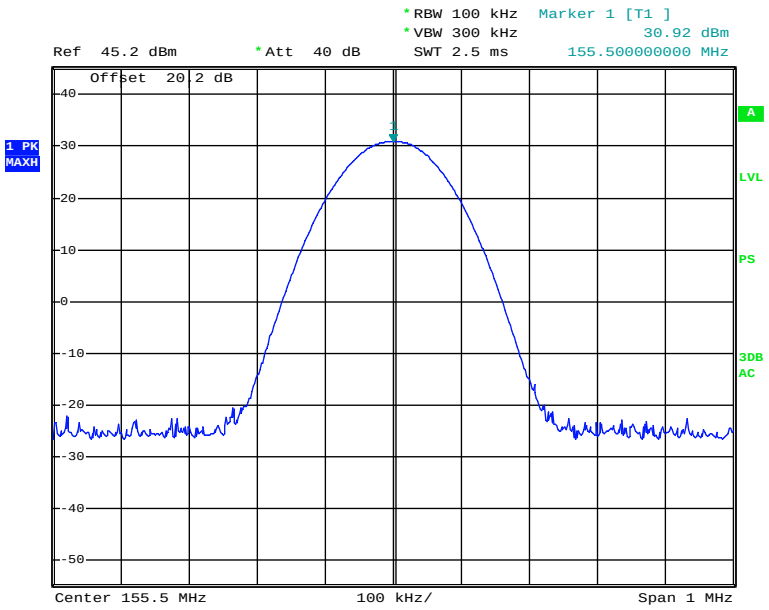
Digital Modulation – Low Power



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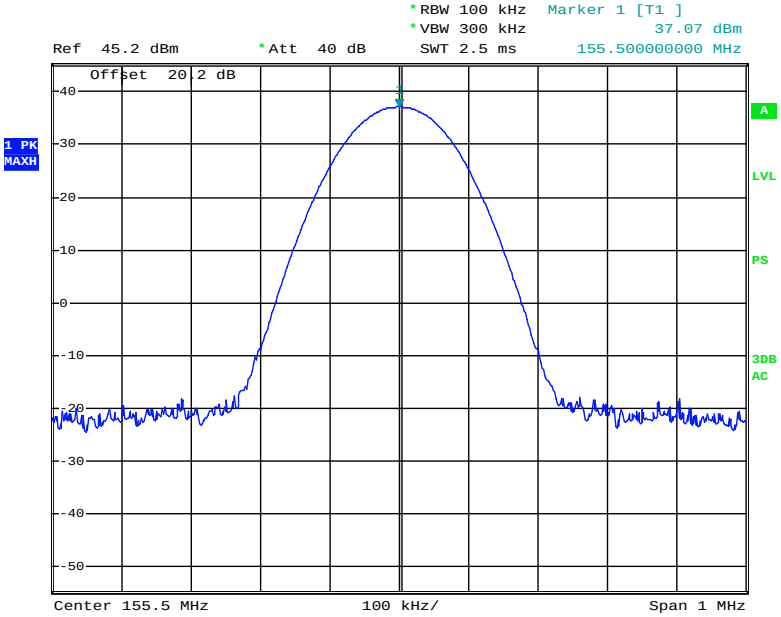
Digital Modulation – High Power



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FCC §2.1047 & §90.207 - MODULATION CHARACTERISTIC

Applicable Standard

FCC§2.1047 & §90.207:

(a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. for equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.

(b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
TEKTRONIX	Digital Phosphor Oscilloscope	TDS 7104	B020518	2012-04-11	2013-04-10
HP	Modulation Analyzer	8901B	3438A05208	2012-04-11	2013-04-11
HP	Signal Generator	HP8657A	2849U00982	2011-10-21	2012-10-20

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

Test Method: TIA/EIA-603 2.2.3

Test Data

Environmental Conditions

Temperature:	28 °C
Relative Humidity:	50%
ATM Pressure:	100.1 kPa

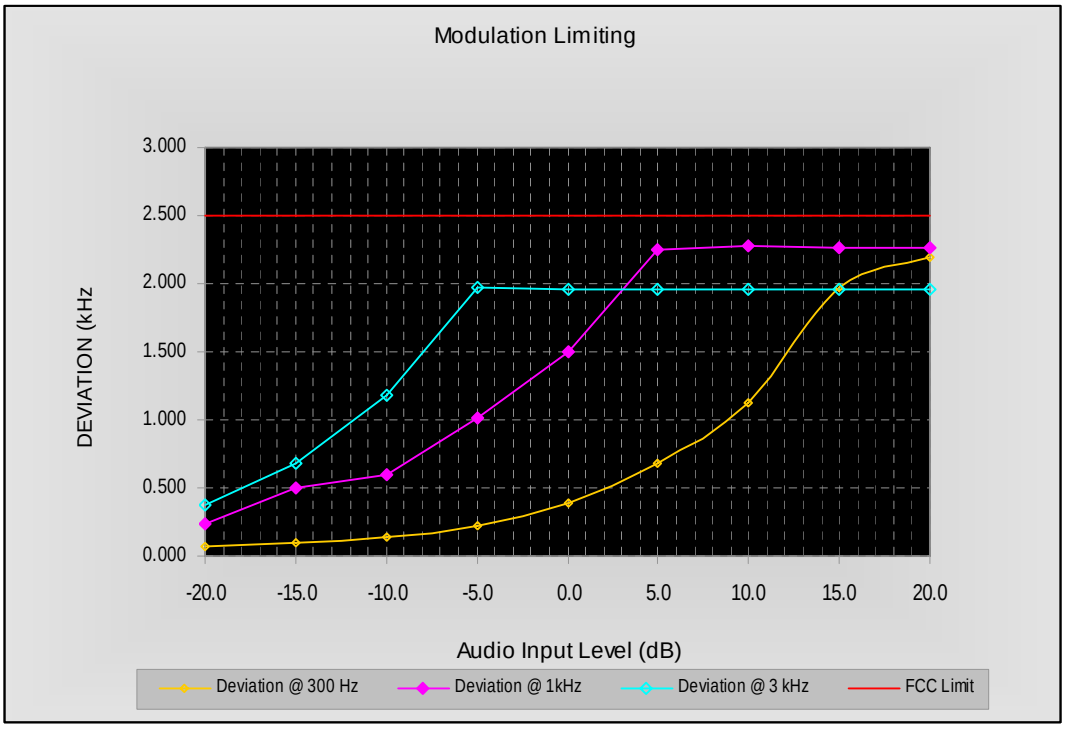
The testing was performed by Eric Lee on 2012-04-24.

Test Mode: Transmitting

MODULATION LIMITING

Carrier Frequency: 155.5 MHz, Channel Separation=12.5 kHz

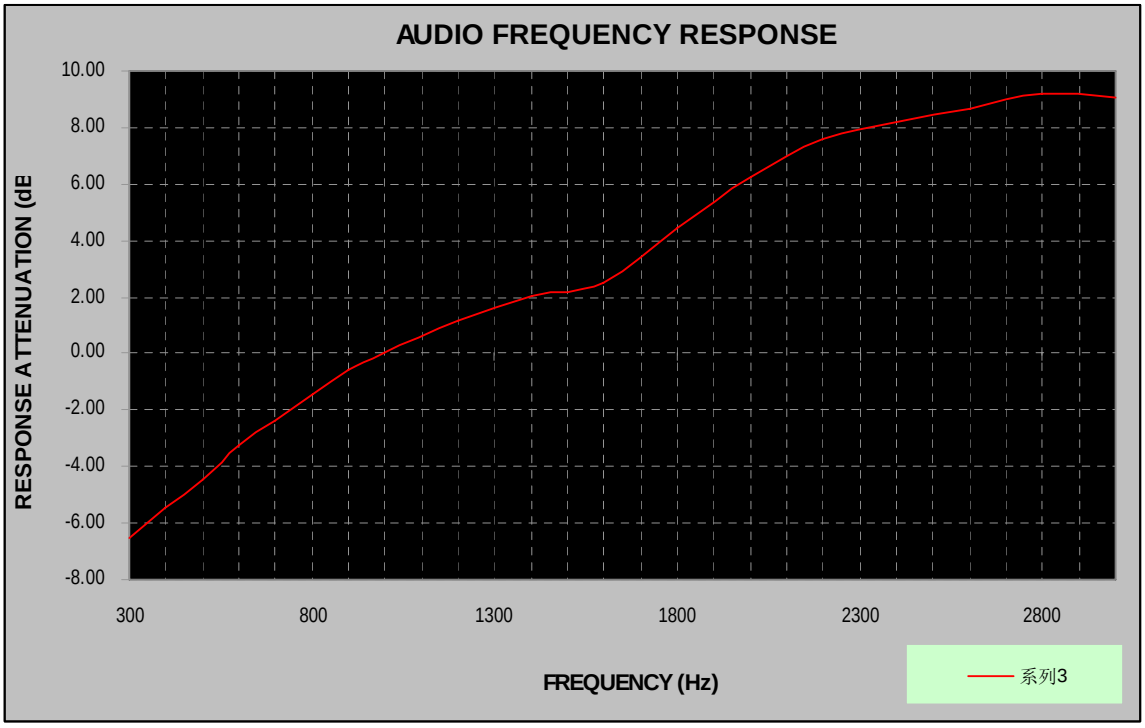
Audio Input Level [mV]	Frequency Deviation (kHz)			FCC Limit [kHz]
	@ 300 Hz	@ 1kHz	@ 3 kHz	
20.0	2.197	2.267	1.954	2.5
15.0	1.978	2.260	1.954	2.5
10.0	1.129	2.283	1.956	2.5
5.0	0.686	2.254	1.954	2.5
0.0	0.383	1.500	1.955	2.5
-5.0	0.223	1.018	1.970	2.5
-10.0	0.141	0.602	1.185	2.5
-15.0	0.093	0.504	0.674	2.5
-20.0	0.068	0.231	0.375	2.5



Audio Frequency Response

Carrier Frequency: 155.5 MHz, Channel Separation=12.5 kHz

Audio Frequency (Hz)	Response Attenuation (dB)
300	-6.56
400	-5.45
500	-4.47
600	-3.22
700	-2.41
800	-1.41
900	-0.57
1000	0.00
1200	1.20
1400	2.05
1600	2.53
1800	4.48
2000	6.26
2200	7.58
2400	8.19
2600	8.67
2800	9.16
3000	9.06



FCC §2.1049, §90.209 & §90.210 – OCCUPIED BANDWIDTH & EMISSION MASK

Applicable Standard

FCC §2.1049, §90.209 and §90.210

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) For any frequency removed from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0, 0dB.

2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 (f_d –2.88 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+10logP=50+10 log (1.574) = 51.97 dB

Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

1) For any frequency removed from the center of the assigned channel by more than 50 percent up to and including 100 percent of the authorized bandwidth, at least 25 dB.

2) On any frequency removed from the center of the assigned channel by more than 100 percent up to and including 250 percent, at least 35 dB.

3) On any frequency removed from the center of the assigned channel by more than 250 percent at least:

43+10logP=43+10log (1.622) = 45.10 dB

The resolution bandwidth was 300 Hz or greater for measuring up to 250 kHz from the edge of the authorized frequency segment, and 30 kHz or greater for measuring more than 250 kHz from the authorized frequency segment.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	101122	2011-11-17	2012-11-16

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the frequency band ±35 kHz from the carrier frequency.

Test Data

Environmental Conditions

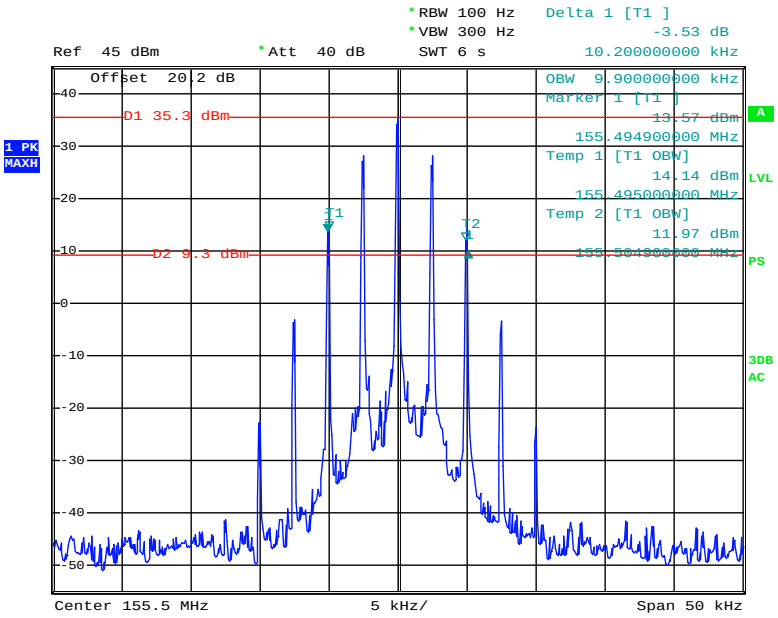
Temperature:	25 °C
Relative Humidity:	56%
ATM Pressure:	100.1 kPa

The testing was performed by Eric Lee on 2012-04-19.

Mode	99% Occupied Bandwidth (kHz)	26 dB Bandwidth (kHz)
Analog Modulation	9.90	10.20
Digital Modulation	7.00	9.70

Please refer to the emission mask hereinafter plots.

Analog Modulation: Occupied Bandwidth



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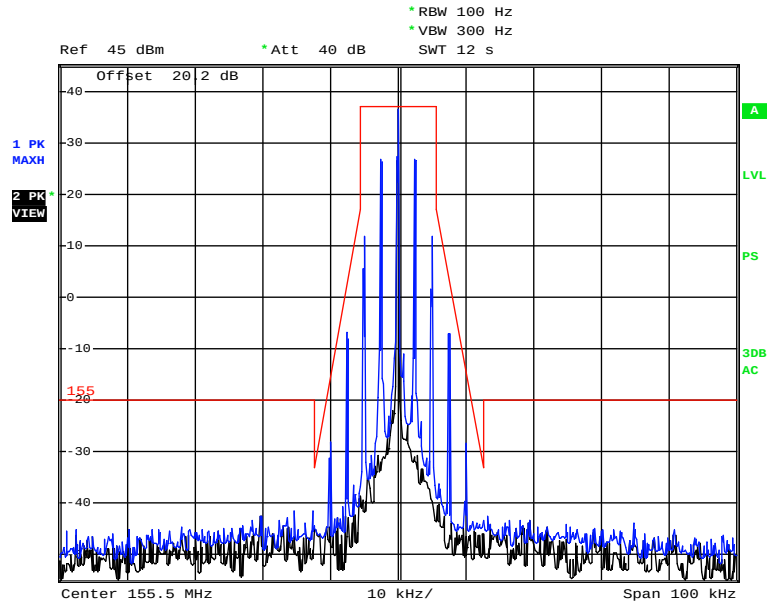
Analog: Emission Mask



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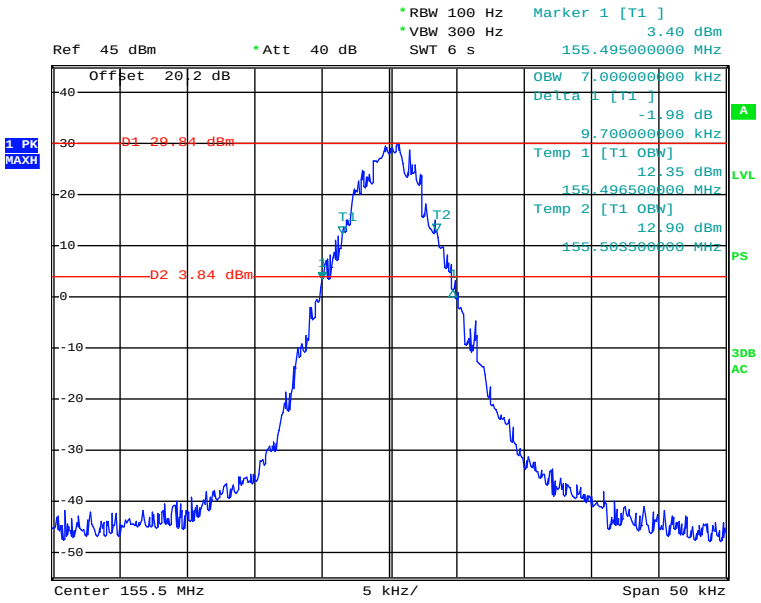
Digital Modulation: Occupied Bandwidth



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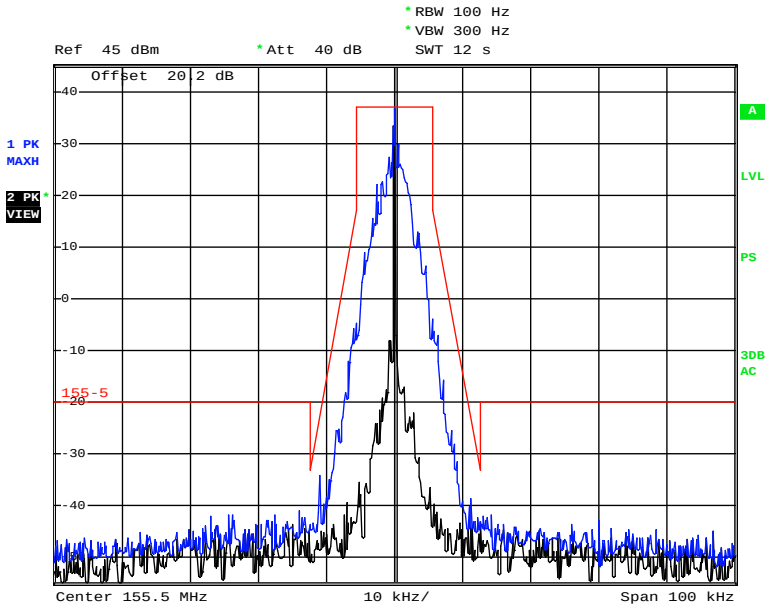
Digital Modulation: Emission Mask



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FCC §2.1051 & §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

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) For any frequency removed from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0, 0 dB.

2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 (f_d –2.88 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+10logP=50+10log (P) dB

Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

1) For any frequency removed from the center of the assigned channel by more than 50 percent up to and including 100 percent of the authorized bandwidth, at least 25 dB.

2) On any frequency removed from the center of the assigned channel by more than 100 percent up to and including 250 percent, at least 35 dB.

3) On any frequency removed from the center of the assigned channel by more than 250 percent at least:

43+10logP=43+10log (P) dB

The resolution bandwidth was 300 Hz or greater for measuring up to 250 kHz from the edge of the authorized frequency segment, and 30 kHz or greater for measuring more than 250 kHz from the authorized frequency segment.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	101122	2011-11-17	2012-11-16

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

Test Data

Environmental Conditions

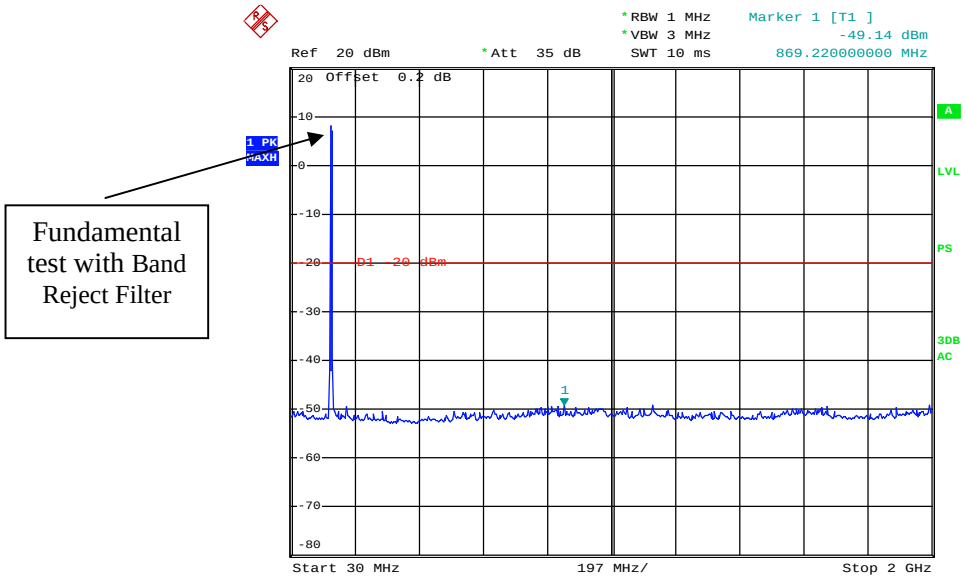
Temperature:	25 °C
Relative Humidity:	56%
ATM Pressure:	100.1 kPa

The testing was performed by Eric Lee on 2012-04-07.

Test Mode: Transmitting

Please refer to the following plots.

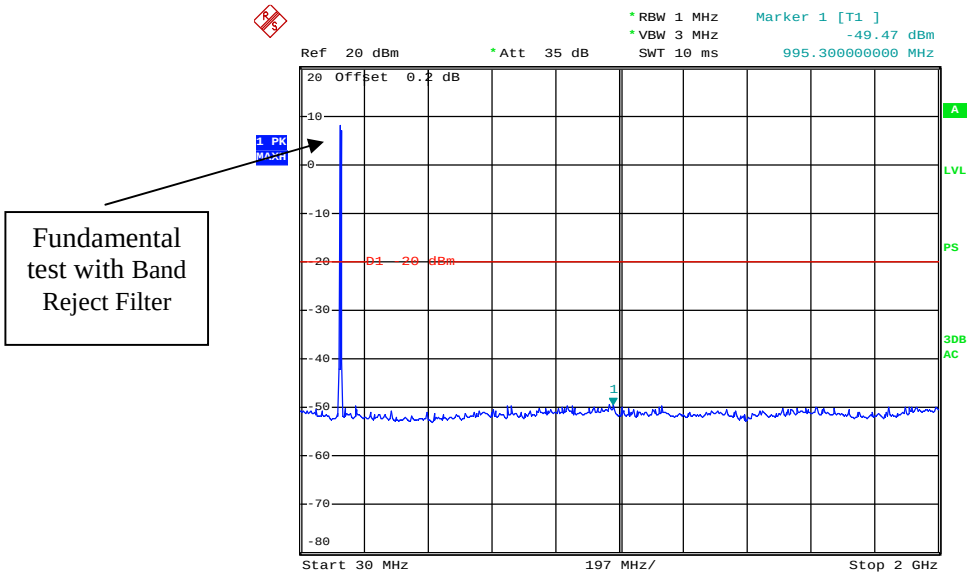
Analog Modulation: 30 MHz – 2 GHz



EUT

Date: 7.APR.2012 15:04:20

Digital Modulation: 30 MHz - 2 GHz



EUT

Date: 7.APR.2012 15:06:34

FCC §2.1053 & §90.210 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053 and §90.210

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Sunol Sciences	Horn Antenna	DRH-118	A052304	2011-12-01	2012-12-01
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2011-11-28	2012-11-27
Sunol Sciences	Bilog Antenna	JB1	A040904-2	2011-11-28	2012-11-27
Rohde & Schwarz	Signal Analyzer	FSIQ 26	609358	2011-07-08	2012-07-07
HP	Signal Generator	HP8657A	2849U00982	2011-10-21	2012-10-20
A.H. System	Horn Antenna	SAS-200/571	135	2012-02-11	2013-02-10
HP	Synthesized Sweeper	8341B	2624A00116	2012-04-11	2013-04-10

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT .The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to teeth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB =10 1g (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in dB =43+10 Log_{10} (power out in Watts)
Spurious attenuation limit in dB =50+10 Log_{10} (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56%
ATM Pressure:	100.1 kPa

The testing was performed by Eric Lee on 2012-04-24.

Test Mode: Transmitting

30MHz-2GHz:

Indicated		Table	Test Antenna		Substituted			Antenna Gain Correction (dB)	Cable Loss (dB)	Absolute Level (dBm)	FCC Part 90	
Frequency (MHz)	Reading (dBµV)	Angle Degree	Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Polar (H/V)				Limit (dBm)	Margin (dB)
Analog Modulation (155.5MHz)												
466.5	47.59	258	1.3	V	466.5	-49.41	V	0	0.48	-49.8	-20	29.8
311	43.87	312	1.7	V	311	-53.13	V	0	0.37	-53.5	-20	33.5
311	37.22	54	1.6	H	311	-59.78	H	0	0.37	-60.1	-20	40.1
466.5	28.35	182	1.4	H	466.5	-68.65	H	0	0.48	-69.1	-20	49.1
Digital Modulation (155.5MHz)												
311	48.44	49	1.5	V	311	-48.56	V	0	0.37	-48.9	-20	28.9
466.5	37.27	185	1.3	V	466.5	-59.73	V	0	0.48	-60.2	-20	40.2
311	32.24	172	1.4	H	311	-63.76	H	0	0.37	-64.1	-20	44.1
466.5	30.35	123	1.6	H	466.5	-66.65	H	0	0.48	-67.1	-20	47.1

FCC §2.1055 & §90.213- FREQUENCY STABILITY

Applicable Standard

FCC §2.1055 & §90.213

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Hewlett-Packard	Frequency Counter	5343A	2232A00827	2012-04-15	2013-04-14
WUHUAN	Temperature & Humidity Chamber	Typhoon 3.0	20021115	2011-06-04	2012-06-03

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external AC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The AC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56%
ATM Pressure:	100.1 kPa

The testing was performed by Eric Lee on 2012-04-24.

Test Mode: Transmitting

Reference Frequency: 155.5 MHz, Limit: ±1.5 ppm			
Test Environment		**Frequency Measure with Time Elapsed**	
Temperature (℃)	**Power Supplied (V_{DC})**	**Measured Frequency error (MHz)**	**Frequency Error (ppm)**
Frequency Stability versus Input Temperature			
50	7.4	155.5000062	0.040
40	7.4	155.5000071	0.046
30	7.4	155.5000056	0.036
20	7.4	155.5000022	0.014
10	7.4	155.5000048	0.031
0	7.4	155.5000039	0.025
-10	7.4	155.5000014	0.009
-20	7.4	155.5000043	0.028
-30	7.4	155.5000025	0.016
Frequency Stability versus Input Voltage			
20	7.14	155.5000076	0.049
20	8.51	155.5000037	0.024

FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

Applicable Standard

Regulations: FCC §90.214
Test method: ANSI/TIA-603-D 2010, section 2.2.19.3

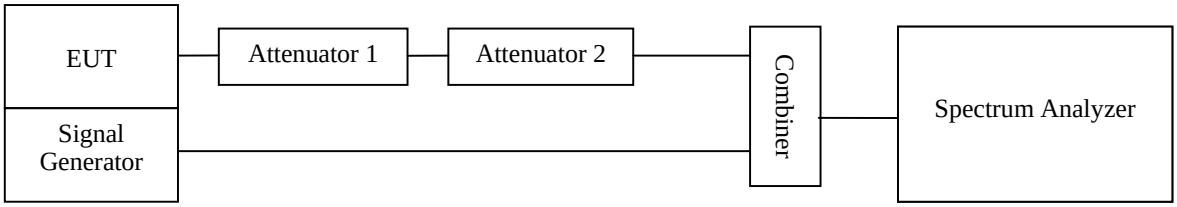
Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	101122	2011-11-17	2012-11-16
HP	Signal Generator	HP8657A	2849U00982	2011-10-21	2012-10-20

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

a) Connect the EUT and test equipment as shown on the following block diagram.
b) Set the Spectrum Analyzer to measure FM deviation, and tune the RF frequency to the transmitter assigned frequency.
c) Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at ±12.5 kHz deviation and set its output level to -100dBm.
d) Turn on the transmitter.
e) Supply sufficient attenuation via the RF attenuator to provide an input level to the Spectrum Analyzer that is 40 dB below the maximum allowed input power when the transmitter is operating at its rated power level. Note this power level on the Spectrum Analyzer as P_0.
f) Turn off the transmitter.
g) Adjust the RF level of the signal generator to provide RF power equal to P_0. This signal generator RF level shall be maintained throughout the rest of the measurement.
h) Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30 dB when the transmitter is turned on.
i) Adjust the vertical amplitude control of the spectrum analyzer to display the 1000 Hz at ±4 divisions vertically centered on the display. Set trigger mode of the Spectrum Analyzer to "Video", and tune the "trigger level" on suitable level. Then set the "tiger offset" to -10ms for turn on and -15ms for turn off.
j) Turn on the transmitter and the transient wave will be captured on the screen of Spectrum Analyzer. Observe the stored display. The instant when the 1 kHz test signal is completely suppressed is considered to be t_{on}. The trace should be maintained within the allowed divisions during the period t_1 and t_2.
k) Then turn off the transmitter, and another transient wave will be captured on the screen of Spectrum Analyzer. The trace should be maintained within the allowed divisions during the period t_3.



Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56%
ATM Pressure:	100.1 kPa

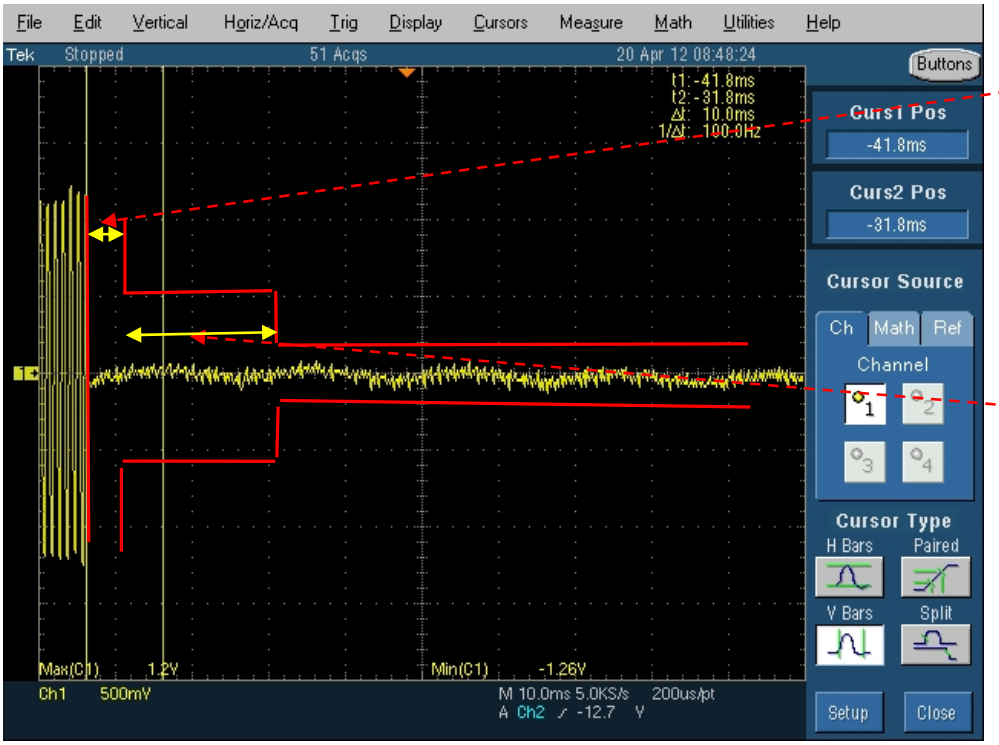
The testing was performed by Eric Lee on 2012-04-20.

Channel Separation (kHz)	Transient Period (ms)	Transient Frequency	Result
12.5	<5 (t1)	+/-12.5 kHz	Pass
	<20 (t2)	+/-6.25 kHz	
	<5 (t3)	+/-12.5 kHz	

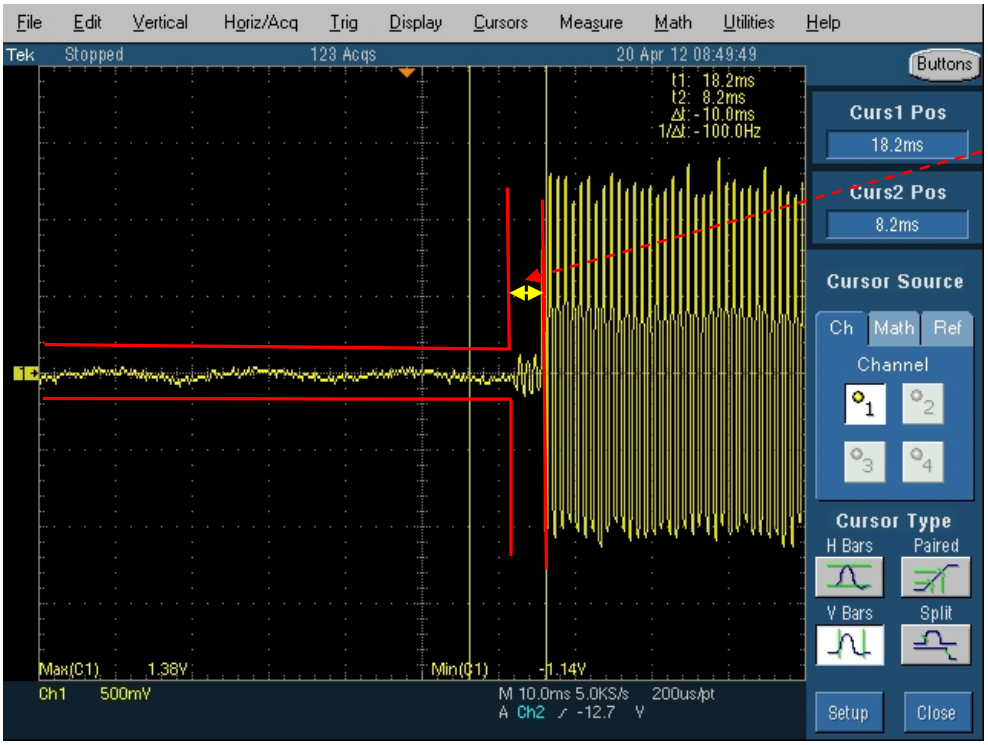
Please refer to the following plots.

Analog Modulation:

Turn on

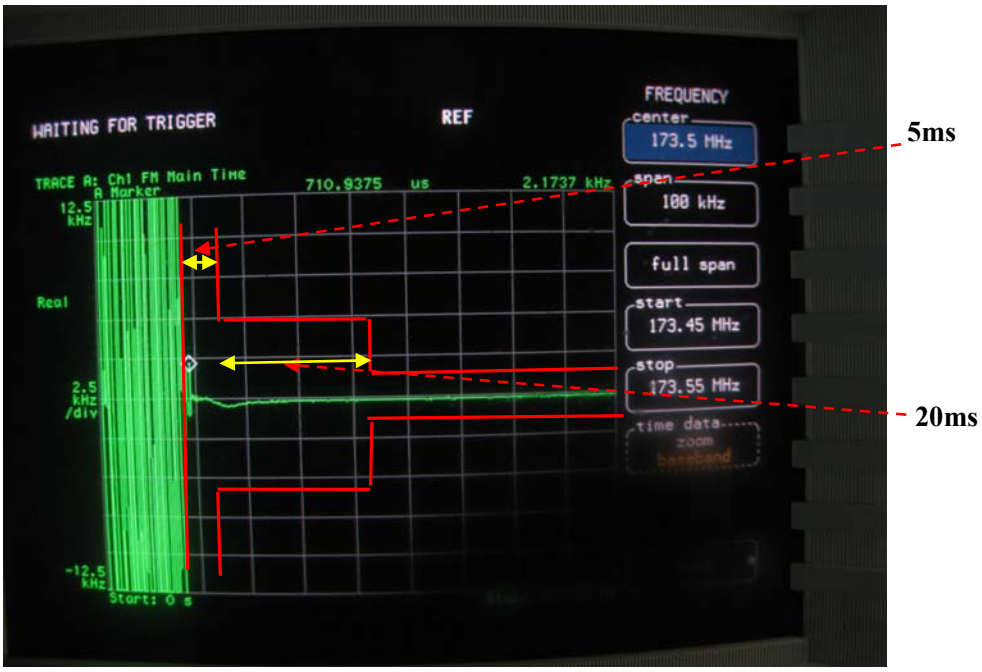


Turn off



Digital Modulation:

Turn on



Turn off

******* End of Report *******