

## FCC PART 90

## TEST REPORT

For

### Shenzhen Friendcom Technology Development Co., Ltd.

6/F, 17 Building, Guangqian Industrial Park, Longzhu Road, Xili Town, Nanshan,  
Shenzhen, China

**FCC ID: UU3FC302U2D**

<b>Report Type:</b> Original Report	<b>Product Type:</b> FC-302 Data Radio
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<b>Report Number:</b> RSZ151030001-00	
<b>Report Date:</b> 2015-11-19	
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**Note:** This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

## **TABLE OF CONTENTS**

<b>GENERAL INFORMATION.....</b>	<b>4</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....	4
OBJECTIVE .....	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY .....	4
TEST FACILITY .....	4
<b>SYSTEM TEST CONFIGURATION.....</b>	<b>5</b>
DESCRIPTION OF TEST CONFIGURATION .....	5
EUT EXERCISE SOFTWARE .....	5
EQUIPMENT MODIFICATIONS .....	5
SUPPORT EQUIPMENT LIST AND DETAILS .....	5
EXTERNAL I/O CABLE.....	5
BLOCK DIAGRAM OF TEST SETUP .....	6
<b>SUMMARY OF TEST RESULTS .....</b>	<b>7</b>
<b>FCC §15.247 (i) &amp; §1.1307 (b) (1) &amp; §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE).....</b>	<b>8</b>
APPLICABLE STANDARD .....	8
RESULT .....	8
<b>FCC §2.1046 &amp; §90.205 - RF Output Power .....</b>	<b>9</b>
APPLICABLE STANDARD .....	9
TEST PROCEDURE .....	9
TEST EQUIPMENT LIST AND DETAILS.....	9
TEST DATA .....	9
<b>FCC §2.1047 &amp; §90.207 - MODULATION CHARACTERISTIC .....</b>	<b>11</b>
APPLICABLE STANDARD .....	11
TEST EQUIPMENT LIST AND DETAILS.....	11
TEST PROCEDURE .....	11
TEST DATA .....	11
<b>FCC §2.1049 &amp; §90.209 &amp; §90.210 – OCCUPIED BANDWIDTH &amp; EMISSION MASK .....</b>	<b>19</b>
APPLICABLE STANDARD .....	19
TEST EQUIPMENT LIST AND DETAILS.....	20
TEST PROCEDURE .....	20
TEST DATA .....	21
<b>FCC §2.1051 &amp; §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS .....</b>	<b>28</b>
APPLICABLE STANDARD .....	28
TEST EQUIPMENT LIST AND DETAILS.....	29
TEST PROCEDURE .....	29
TEST DATA .....	29
<b>FCC §2.1053 &amp; §90.210 - RADIATED SPURIOUS EMISSIONS .....</b>	<b>33</b>
APPLICABLE STANDARD .....	33
TEST EQUIPMENT LIST AND DETAILS.....	33
TEST PROCEDURE .....	33
TEST DATA .....	34
<b>FCC §2.1055 &amp; §90.213- FREQUENCY STABILITY.....</b>	<b>36</b>

APPLICABLE STANDARD .....36

TEST EQUIPMENT LIST AND DETAILS.....36

TEST PROCEDURE .....36

TEST DATA .....36

**FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR.....38**

APPLICABLE STANDARD .....38

TEST EQUIPMENT LIST AND DETAILS.....38

TEST PROCEDURE .....38

TEST DATA .....39

## GENERAL INFORMATION

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### Product Description for Equipment under Test (EUT)

The *Shenzhen Friendcom Technology Development Co., Ltd.*'s product, model number: *FC-302 U2 (FCC ID: UU3FC302U2D)* or the "EUT" in this report was a *FC-302 Data Radio*, which was measured approximately: 117 mm (L) × 63 mm (W) × 32 mm (H), rated input voltage: DC 12 V.

*\* All measurement and test data in this report was gathered from production sample serial number: 1506957 (Assigned by Applicant). The EUT supplied by the applicant was received on 2015-10-30.*

### Objective

This test report is prepared on behalf of *Shenzhen Friendcom Technology Development Co., Ltd.* in accordance with Part 2 and Part 90 of the Federal Communication Commissions rules.

### Related Submittal(s)/Grant(s)

No related submittal(s).

### 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 63.4-2014.

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.

Measurement uncertainty with radiated emission is 5.91 dB for 30MHz-1GHz and 4.92 dB for above 1GHz, 1.95dB for conducted measurement.

### 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 October 31, 2013. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

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.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

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

### EUT Exercise Software

1. FC-302 QuickSet En v0.1.11.exe
2. ComMonitor.exe

### Equipment Modifications

No modification was made to the EUT tested.

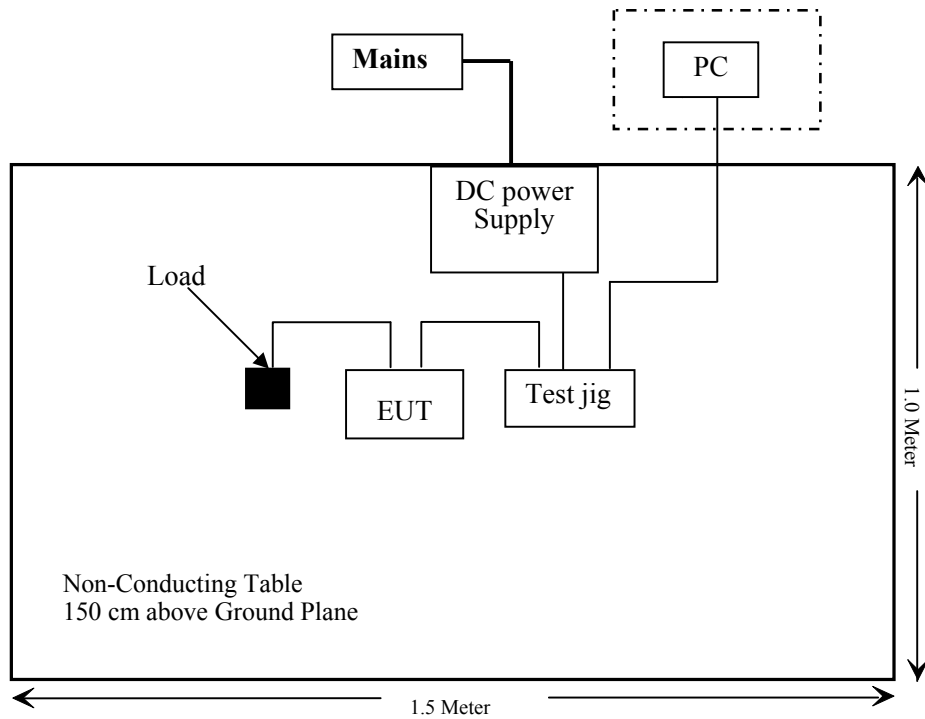
### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
GWINSTEK	DC Power Supply	GPS-3030DD	N/A
N/A	50 ohm Load	N/A	N/A
Friendcom	Test jig	FC-302-SetBoard V2	N/A

### External I/O Cable

Cable Description	Length (m)	From/Port	To
Un-shielding Detachable AC Power Cable	1.5	DC Power Supply	Mains
Un-shielding Detachable DC Power Cable	1.2	DC Power Supply	Test jig
Un-shielding Detachable RF Cable	0.5	EUT	Load
Un-shielding Detachable RSS 232Cable	0.3	EUT	Test jig
Un-shielding Detachable RS232-to-USB Cable	1.5	Test jig	PC

## Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Results
§1.1307 (b) (1)& §2.1091	Maximum Permissible Exposure(MPE)	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

## FCC §15.247 (i) & §1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

### Applicable Standard

According to subpart 15.247 (i) and subpart 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (Minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	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

### Result

#### Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm<sup>2</sup>)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Frequency (MHz)	Antenna Gain		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
	(dBi)	(numeric)	(dBm)	(mW)			
470.0125	5.0	3.16	37.5	5623.4	100	0.14	0.31

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 100cm from nearby persons.

### Result: Compliance



## FCC §2.1046 & §90.205 - RF Output Power

### Applicable Standard

FCC §2.1046 and §90.205

### Test Procedure

Conducted RF Output Power:

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

Spectrum Analyzer Setting:

R B/W	Video B/W
100 kHz	300 kHz

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2015-08-22	2016-08-22
HP Agilent	RF Communication test set	8920A	3325U00859	2015-06-03	2016-06-03

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

Temperature:	24 °C
Relative Humidity:	49 %
ATM Pressure:	101.0 kPa

*The testing was performed by Candy Li on 2015-11-09.*

*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following table.

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	Output Power (dBm)	Output Power (W)	Result
Analog	6.25	450.0125	High	32.83	1.92	Pass
		470.0125		32.72	1.87	Pass
		489.9875		33.14	2.06	Pass
		450.0125	Low	29.68	0.93	Pass
		470.0125		30.17	1.04	Pass
		489.9875		29.92	0.98	Pass
	12.5	450.0125	High	36.81	4.80	Pass
		470.0125		36.90	4.90	Pass
		489.9875		36.97	4.98	Pass
		450.0125	Low	29.85	0.97	Pass
		470.0125		29.98	1.00	Pass
		489.9875		29.91	0.98	Pass
Digital-GMSK	12.5	450.0125	High	37.09	5.12	Pass
		470.0125		37.31	5.38	Pass
		489.9875		37.13	5.16	Pass
		450.0125	Low	30.04	1.01	Pass
		470.0125		30.23	1.05	Pass
		489.9875		30.11	1.03	Pass

**Note:**

For 6.25 kHz:

The rated high power is 2W. The limit of the high output power is 1.6W-2.4W.

The rated low power is 1W. The limit of the low output power is 0.8W-1.2W.

For 12.5 kHz:

The rated high power is 5W. The limit of the high output power is 4.0W-6.0W.

The rated low power is 1W. The limit of the low output power is 0.8W-1.2W.

**FCC §2.1047 & §90.207 - MODULATION CHARACTERISTIC****Applicable Standard**

FCC§2.1047and §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
HP	RF Communication Test Set	8920A	3438A05201	2015-06-14	2016-06-13
LEADER	MILLIVOLTMETER	LMV-181A	6041126	2015-06-09	2016-06-09

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

**Test Procedure**

Test Method: TIA/EIA-603 2.2.3

**Test Data****Environmental Conditions**

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	49 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Candy Li on 2015-11-09.*

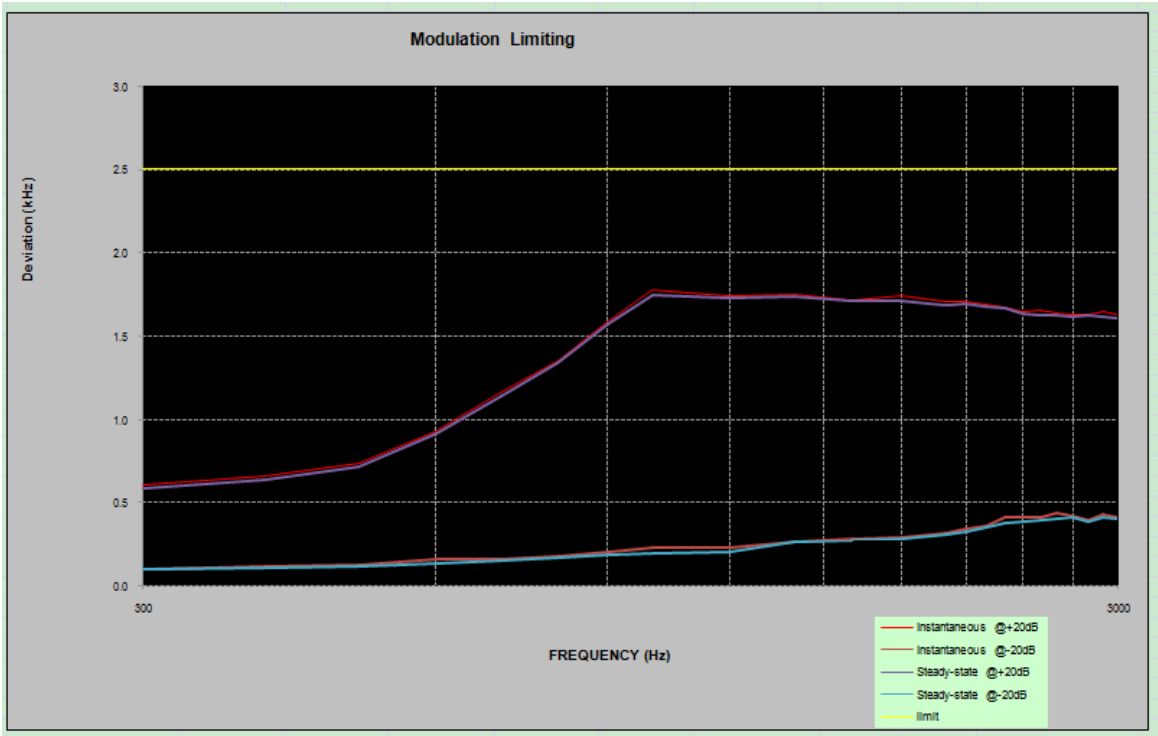
*Test Mode: Transmitting*

**Result:** Compliance.

**Analog Modulation:****MODULATION LIMITING**

Carrier Frequency: 470.0125 MHz, Middle Channel Separation=12.5 kHz

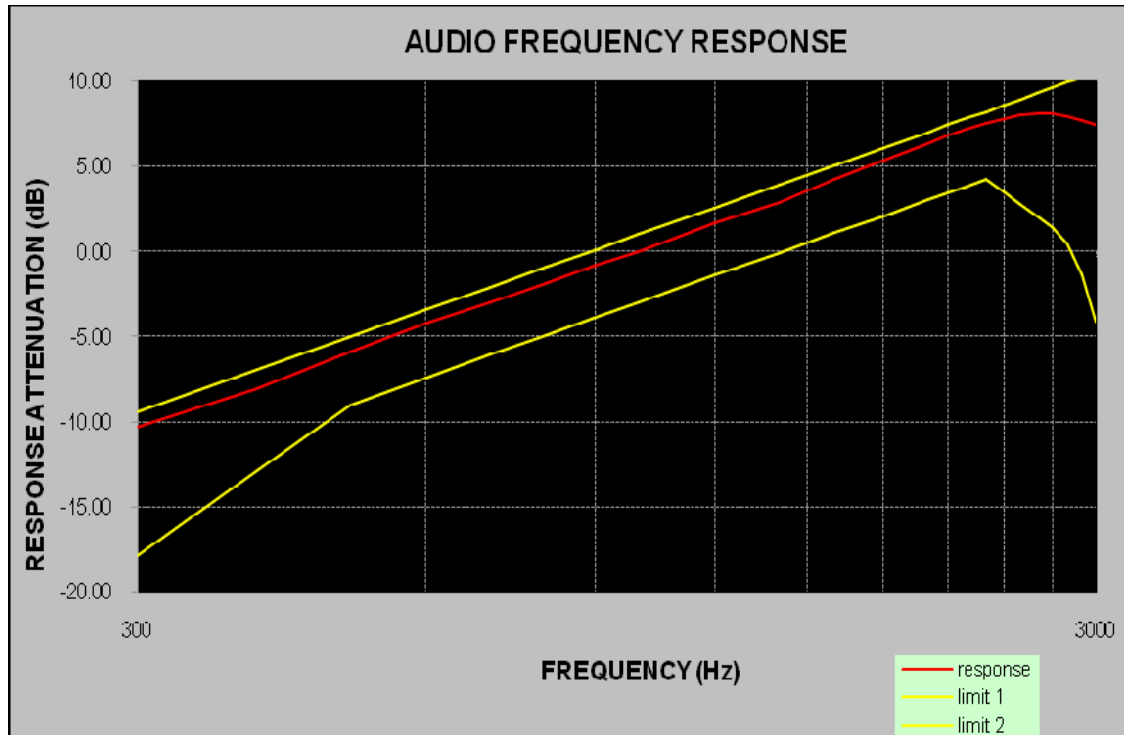
Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	0.602	0.101	0.586	0.097	2.500
400	0.662	0.114	0.639	0.104	2.500
500	0.738	0.124	0.715	0.116	2.500
600	0.923	0.160	0.915	0.137	2.500
700	1.157	0.162	1.137	0.155	2.500
800	1.351	0.180	1.339	0.172	2.500
900	1.589	0.203	1.572	0.188	2.500
1000	1.777	0.229	1.743	0.196	2.500
1200	1.740	0.227	1.726	0.205	2.500
1400	1.752	0.267	1.735	0.263	2.500
1600	1.715	0.278	1.709	0.272	2.500
1800	1.744	0.288	1.711	0.284	2.500
2000	1.708	0.318	1.687	0.308	2.500
2100	1.702	0.346	1.692	0.326	2.500
2200	1.690	0.355	1.675	0.349	2.500
2300	1.673	0.408	1.664	0.374	2.500
2400	1.645	0.408	1.635	0.381	2.500
2500	1.656	0.408	1.628	0.396	2.500
2600	1.636	0.435	1.626	0.401	2.500
2700	1.626	0.422	1.619	0.413	2.500
2800	1.630	0.392	1.623	0.387	2.500
2900	1.648	0.428	1.617	0.411	2.500
3000	1.626	0.414	1.604	0.406	2.500



**Audio Frequency Response**

Carrier Frequency: 470.0125 MHz, Channel Separation=12.5 kHz

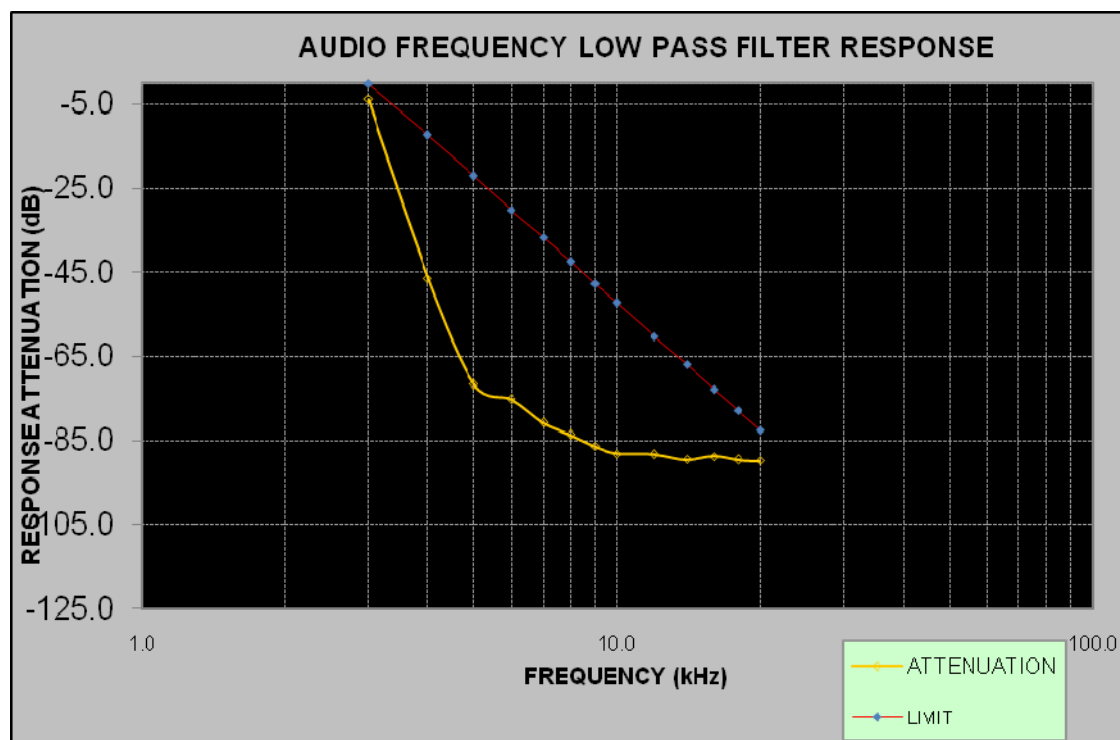
Audio Frequency (Hz)	Response Attenuation (dB)
300	-10.34
400	-8.09
500	-5.92
600	-4.24
700	-2.97
800	-1.89
900	-0.82
1000	0.00
1200	1.68
1400	2.89
1600	4.25
1800	5.33
2000	6.35
2100	6.78
2200	7.20
2300	7.51
2400	7.80
2500	8.03
2600	8.13
2700	8.07
2800	7.94
2900	7.68
3000	7.47



**Audio Frequency Response Low Pass Filter**

Carrier Frequency: 470.0125 MHz, Channel Separation=12.5 kHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	/	/
3.0	-3.9	0.0
4.0	-46.5	-12.5
5.0	-71.7	-22.2
6.0	-75.2	-30.1
7.0	-80.8	-36.8
8.0	-83.6	-42.6
9.0	-86.4	-47.7
10.0	-88.1	-52.3
12.0	-88.3	-60.2
14.0	-89.5	-66.9
16.0	-88.7	-72.7
18.0	-89.6	-77.8
20.0	-89.8	-82.5

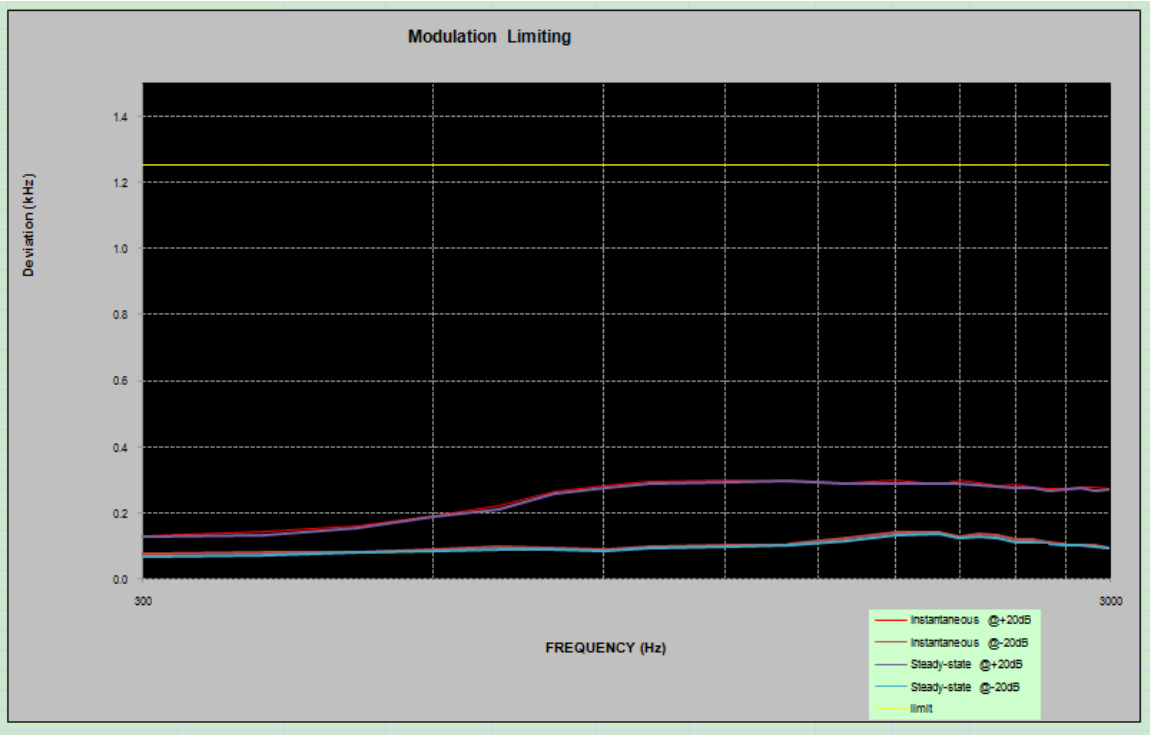




**MODULATION LIMITING**

Carrier Frequency: 470.0125 MHz, Middle Channel Separation=6.25 kHz

Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	0.128	0.076	0.126	0.069	1.250
400	0.144	0.079	0.133	0.072	1.250
500	0.160	0.082	0.152	0.078	1.250
600	0.189	0.090	0.188	0.085	1.250
700	0.222	0.097	0.212	0.088	1.250
800	0.263	0.092	0.259	0.089	1.250
900	0.280	0.089	0.273	0.086	1.250
1000	0.293	0.098	0.286	0.093	1.250
1200	0.297	0.102	0.293	0.098	1.250
1400	0.296	0.107	0.295	0.102	1.250
1600	0.291	0.125	0.290	0.115	1.250
1800	0.300	0.141	0.288	0.134	1.250
2000	0.287	0.142	0.286	0.138	1.250
2100	0.300	0.129	0.289	0.124	1.250
2200	0.290	0.137	0.283	0.128	1.250
2300	0.283	0.130	0.280	0.123	1.250
2400	0.285	0.121	0.274	0.112	1.250
2500	0.279	0.119	0.275	0.110	1.250
2600	0.271	0.110	0.266	0.105	1.250
2700	0.271	0.105	0.271	0.102	1.250
2800	0.277	0.106	0.273	0.102	1.250
2900	0.275	0.103	0.266	0.098	1.250
3000	0.271	0.095	0.270	0.094	1.250



## **FCC §2.1049 & §90.209 & §90.210 – OCCUPIED BANDWIDTH & EMISSION MASK**

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### **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  $7.27(f_d - 2.88 \text{ kHz})$  dB.
- 3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 12.5 kHz: At least  $50 + 10 \log(P)$  dB or 70 dB, whichever is the lesser attenuation.

Emission Mask E—6.25 kHz or less channel bandwidth equipment. For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- 1) On any frequency from the center of the authorized bandwidth  $f_0$  to 3.0 kHz removed from  $f_0$ : Zero dB.
- 2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least  $30 + 16.67(f_d - 3 \text{ kHz})$  or  $55 + 10 \log(P)$  or 65 dB, whichever is the lesser attenuation.
- 3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least  $55 + 10 \log(P)$  or 65 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

**Test Equipment List and Details**

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2015-08-22	2016-08-22
HP	RF Communication Test Set	8920A	3438A05201	2015-06-14	2016-06-13
Rohde & Schwarz	EMI Test Receiver	ESR	1316.3003K0 3-101746-zn	2015-06-13	2016-06-13

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

**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 100 Hz and the spectrum was recorded in the frequency band  $\pm 50$  kHz from the carrier frequency.

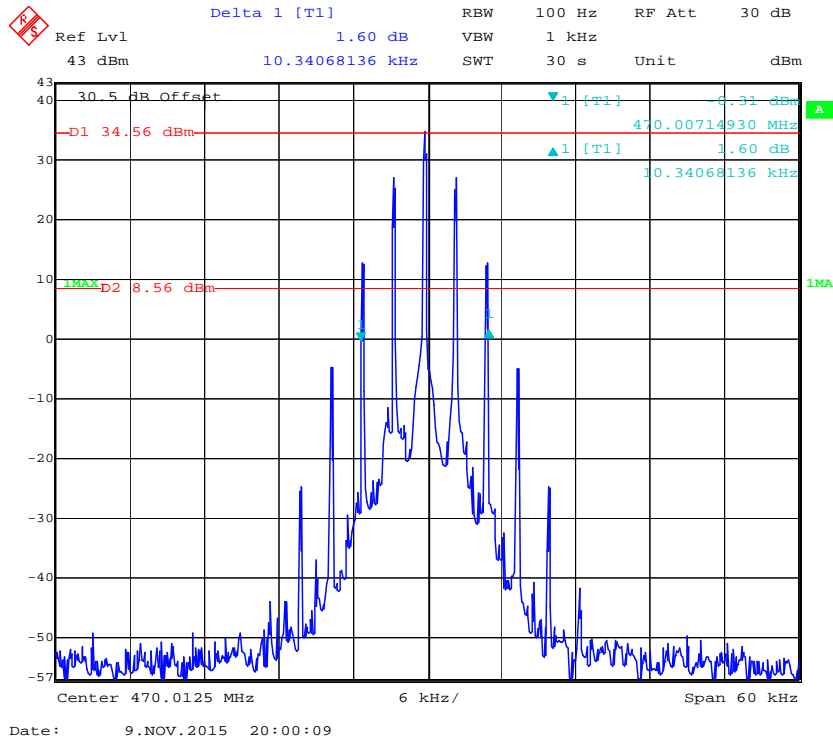
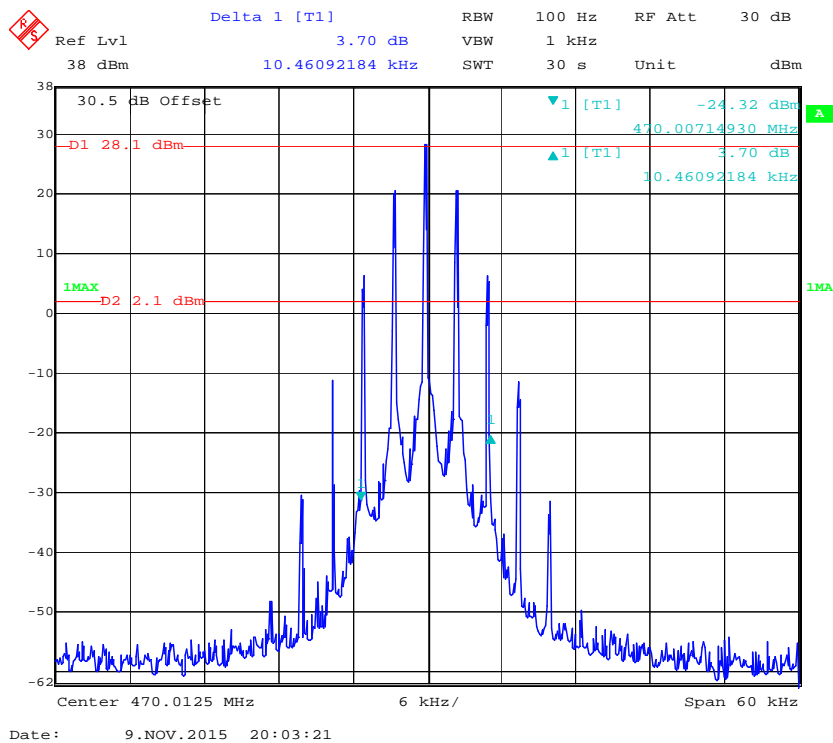
**Test Data****Environmental Conditions**

<b>Temperature:</b>	24~25 °C
<b>Relative Humidity:</b>	45~55 %
<b>ATM Pressure:</b>	100.1~101.0 kPa

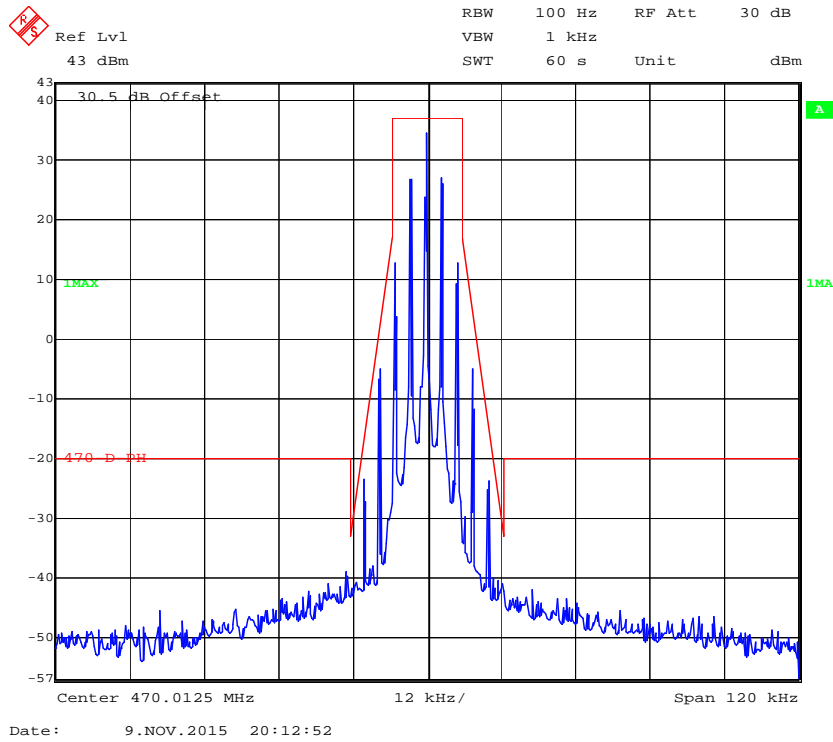
*The testing was performed by Candy Li on 2015-11-09 and 2015-11-10.*

*Test Mode: Transmitting*

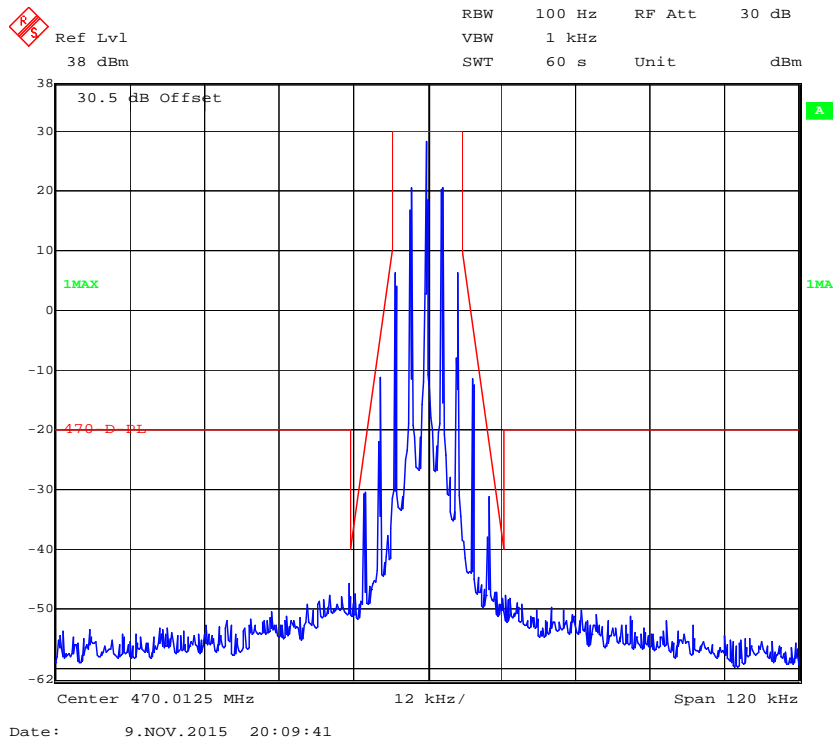
<b>Modulation</b>	<b>Frequency (MHz)</b>	<b>Channel space (kHz)</b>	<b>Power Level</b>	<b>26 dB Emissions Bandwidth (kHz)</b>
Analog	470.0125	12.5	High	10.34
			Low	10.46
		6.25	High	5.11
			Low	5.17
Digital-GMSK	470.0125	12.5	High	9.86
			Low	9.38

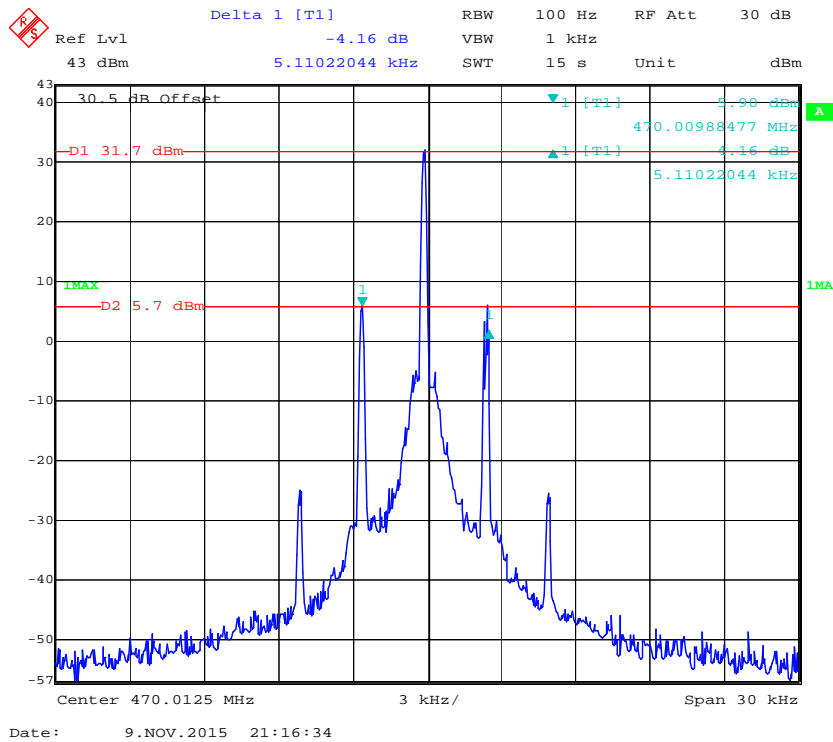
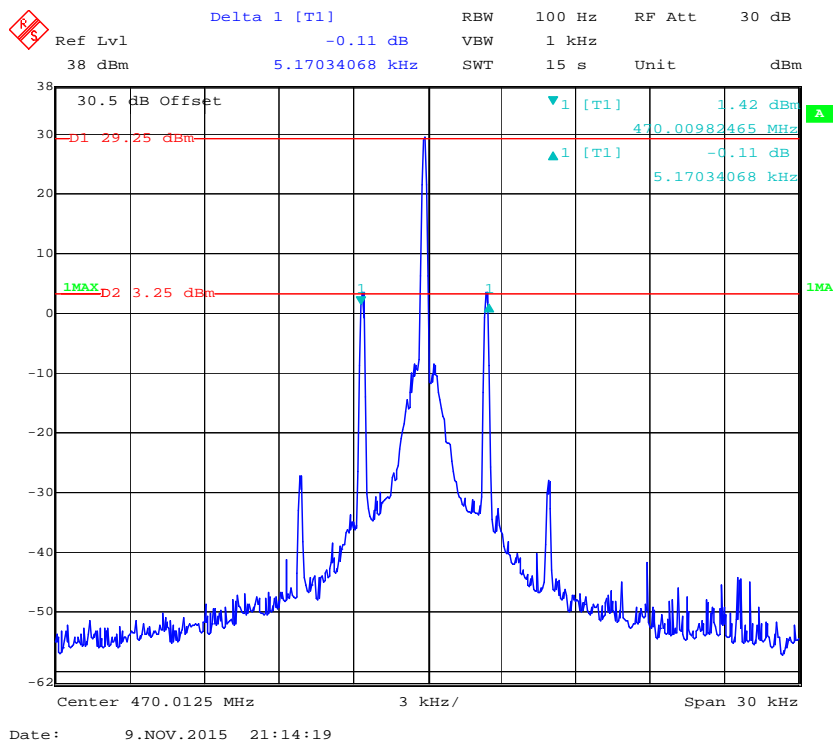
**Analog Modulation:****26 dB Emissions Bandwidth 12.5 kHz, 470.0125 MHz (High Power)****26 dB Emissions Bandwidth 12.5 kHz, 470.0125 MHz (Low Power)**

### Emission Mask D with High Power 12.5 kHz, 470.0125 MHz



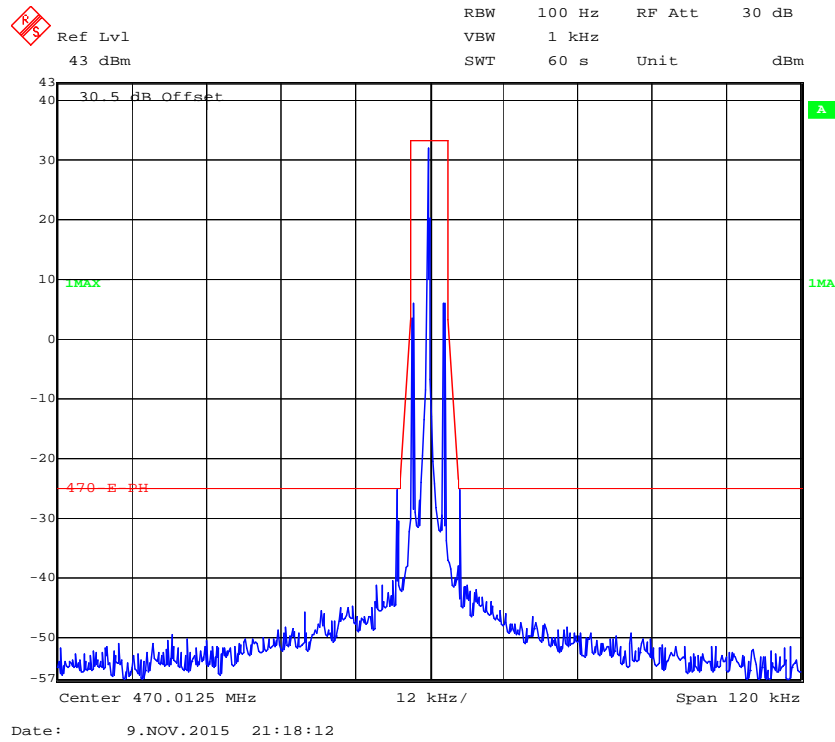
### Emission Mask D with Low Power 12.5 kHz, 470.0125 MHz



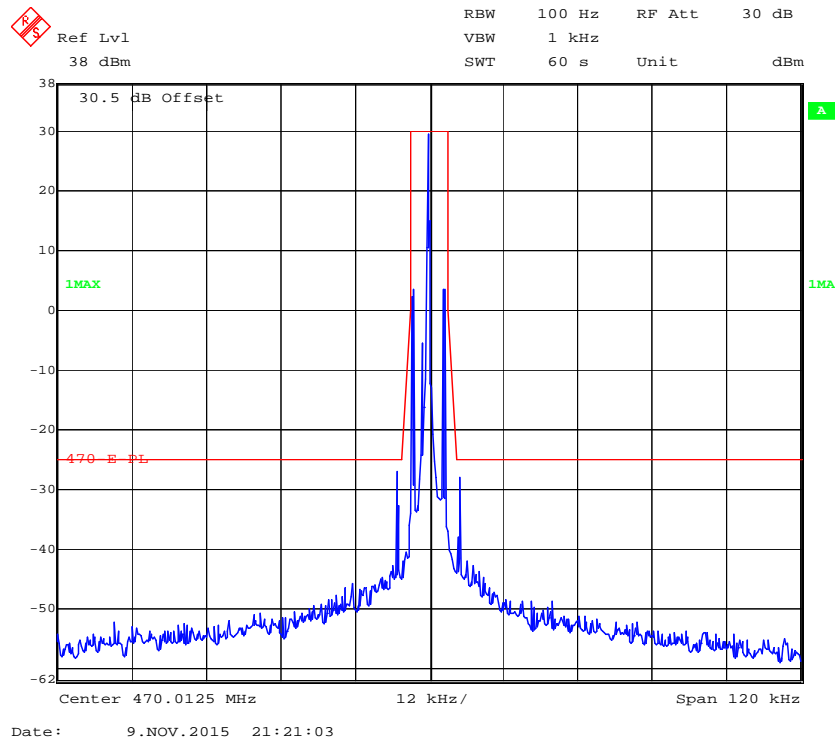
**26 dB Emissions Bandwidth 6.25 kHz, 470.0125 MHz (High Power)****26 dB Emissions Bandwidth 6.25 kHz, 470.0125 MHz (Low Power)**

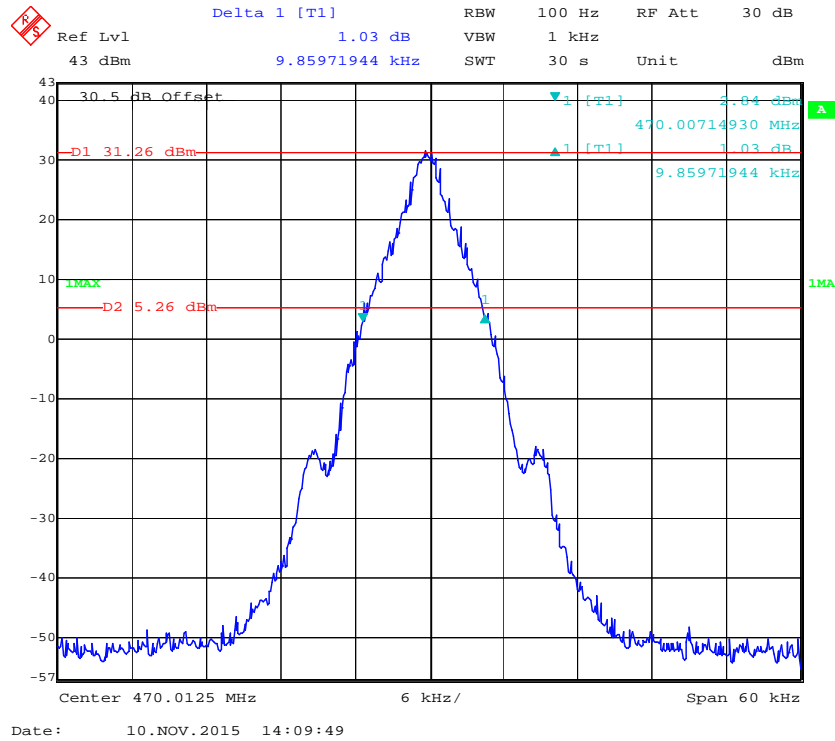
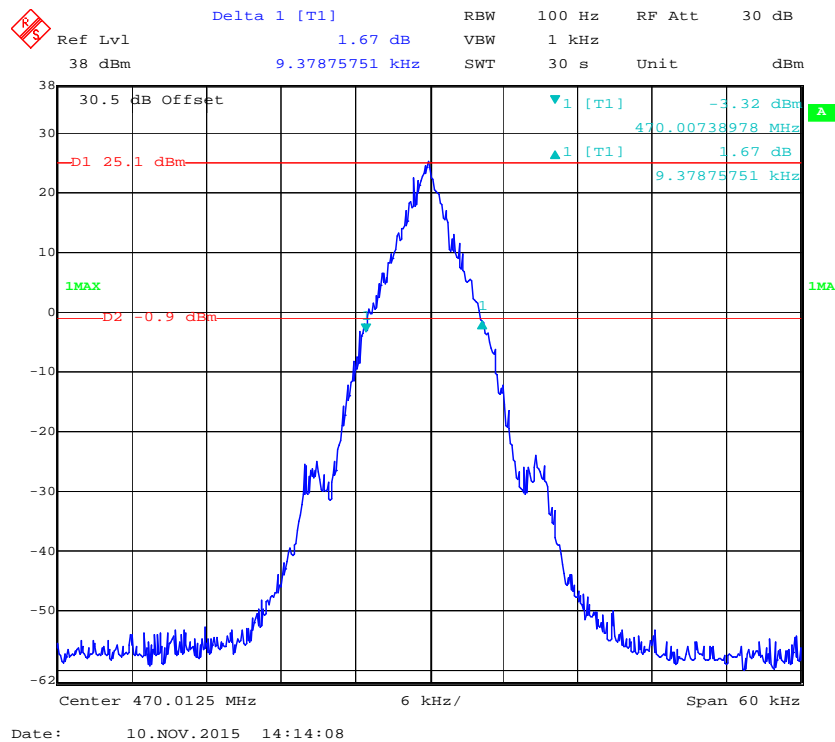


### Emission Mask E with High Power 6.25 kHz, 470.0125 MHz

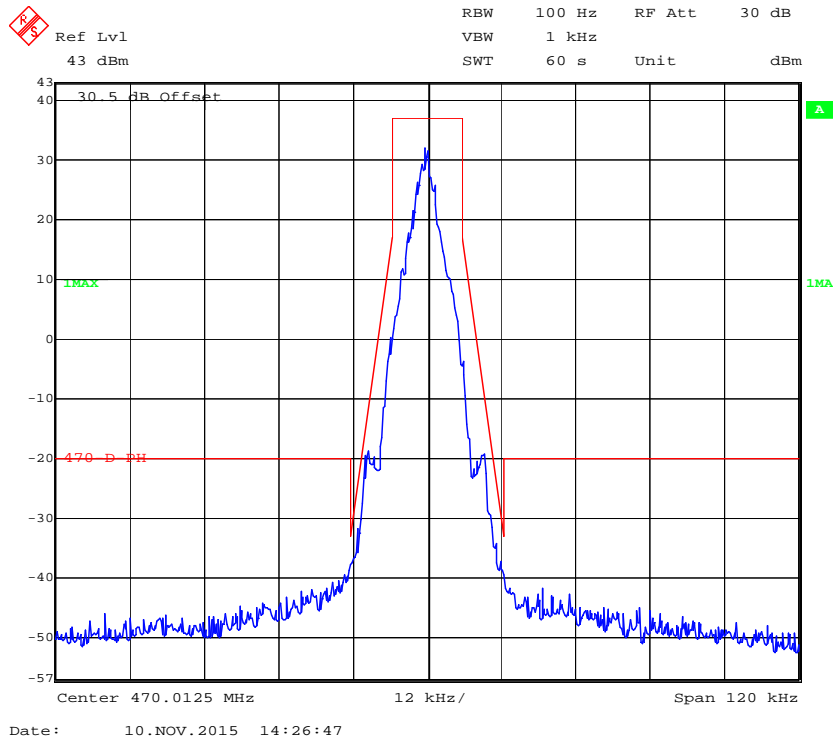


### Emission Mask E with Low Power 6.25 kHz, 470.0125 MHz

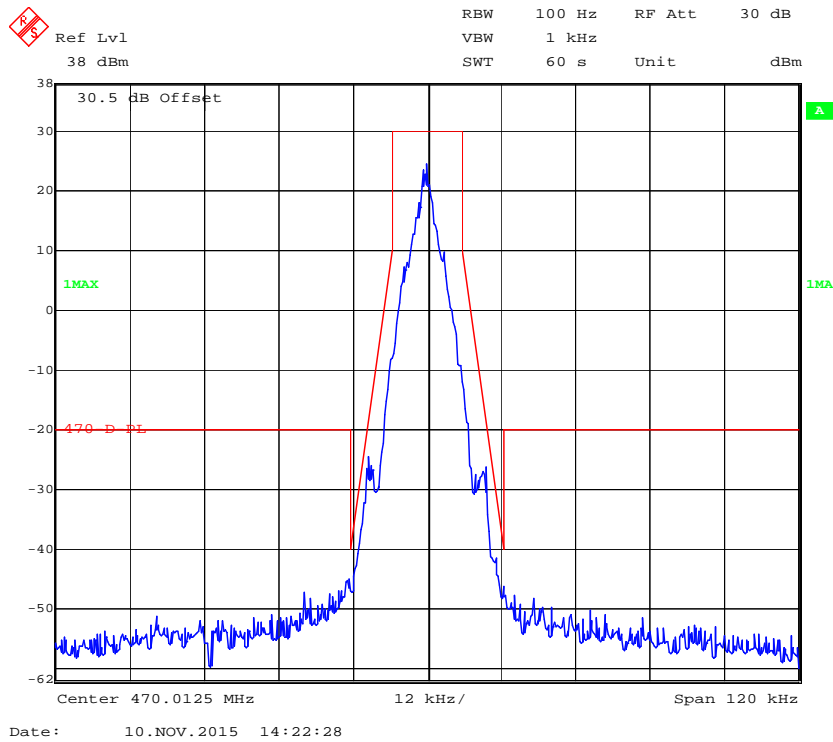


**Digital Modulation:****26 dB Emissions Bandwidth 12.5 kHz, 470.0125 MHz GMSK (High Power)****26 dB Emissions Bandwidth 12.5 kHz, 470.0125 MHz GMSK (Low Power)**

### Emission Mask D with High Power 12.5 kHz, 470.0125 MHz (GMSK)



### Emission Mask D with Low Power 12.5 kHz, 470.0125 MHz (GMSK)



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

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**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  $50 + 10 \log (P)$  dB or 70 dB, whichever is the lesser attenuation.

Emission Mask E—6.25 kHz or less channel bandwidth equipment. For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- 1) On any frequency from the center of the authorized bandwidth  $f_0$  to 3.0 kHz removed from  $f_0$ : Zero dB.
- 2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least  $30 + 16.67(f_d - 3 \text{ kHz})$  or  $55 + 10 \log (P)$  or 65 dB, whichever is the lesser attenuation.
- 3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least  $55 + 10 \log (P)$  or 65 dB, whichever is the lesser attenuation.
- 4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

**Test Equipment List and Details**

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2015-08-22	2016-08-22

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

**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 100 kHz for below 1GHz, and 1MHz for above 1GHz. sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.

**Test Data****Environmental Conditions**

Temperature:	24 °C
Relative Humidity:	49 %
ATM Pressure:	101.0 kPa

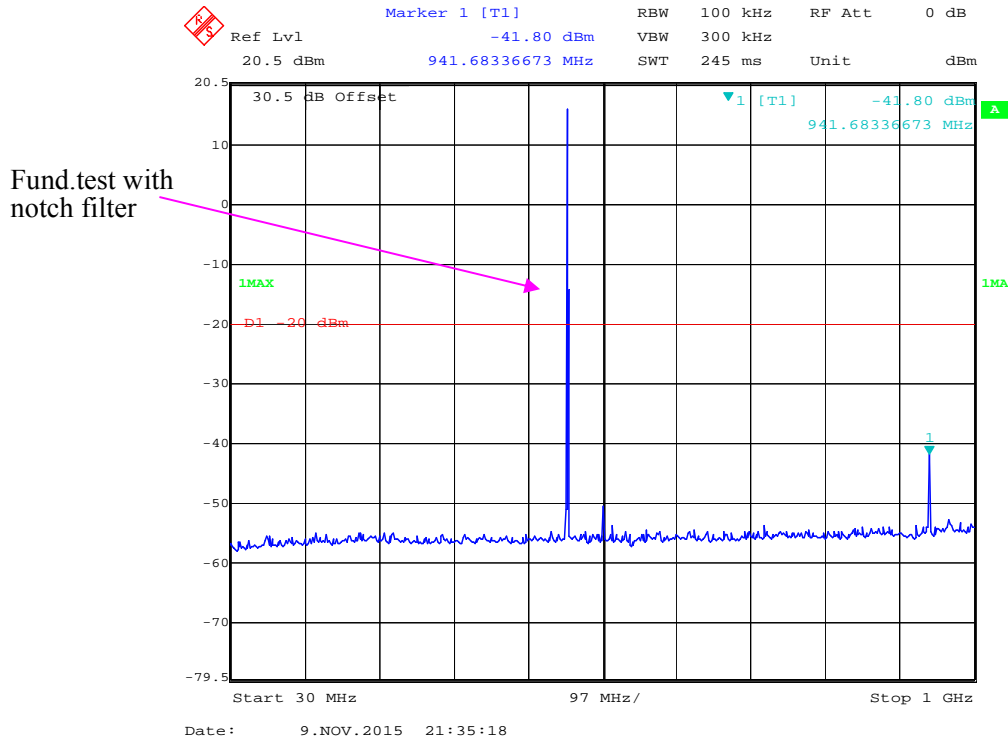
*The testing was performed by Candy Li on 2015-11-09.*

*Test Mode: Transmitting*

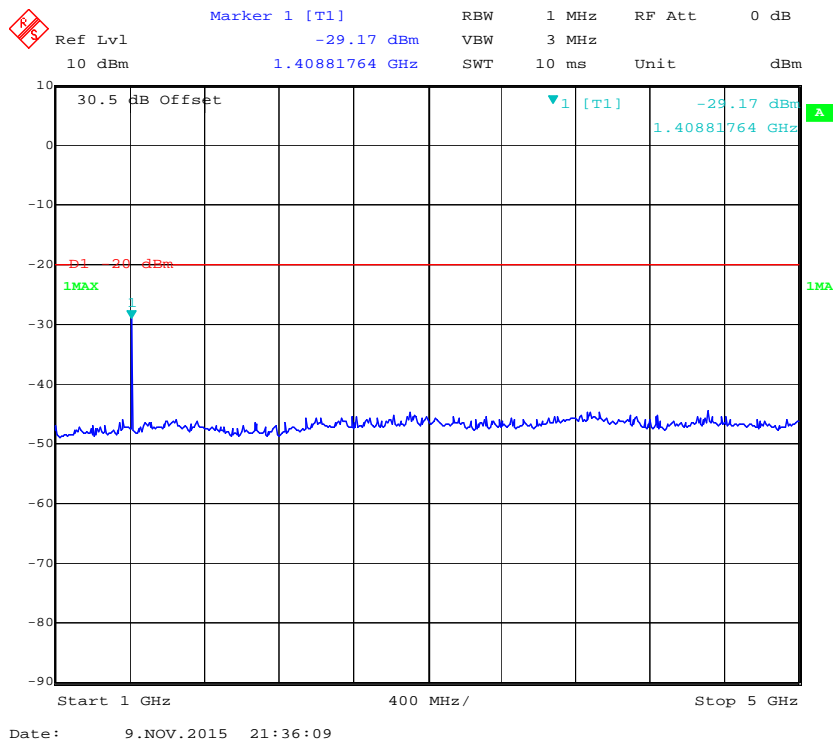
Please refer to the following plots.

**Analog Modulation:**

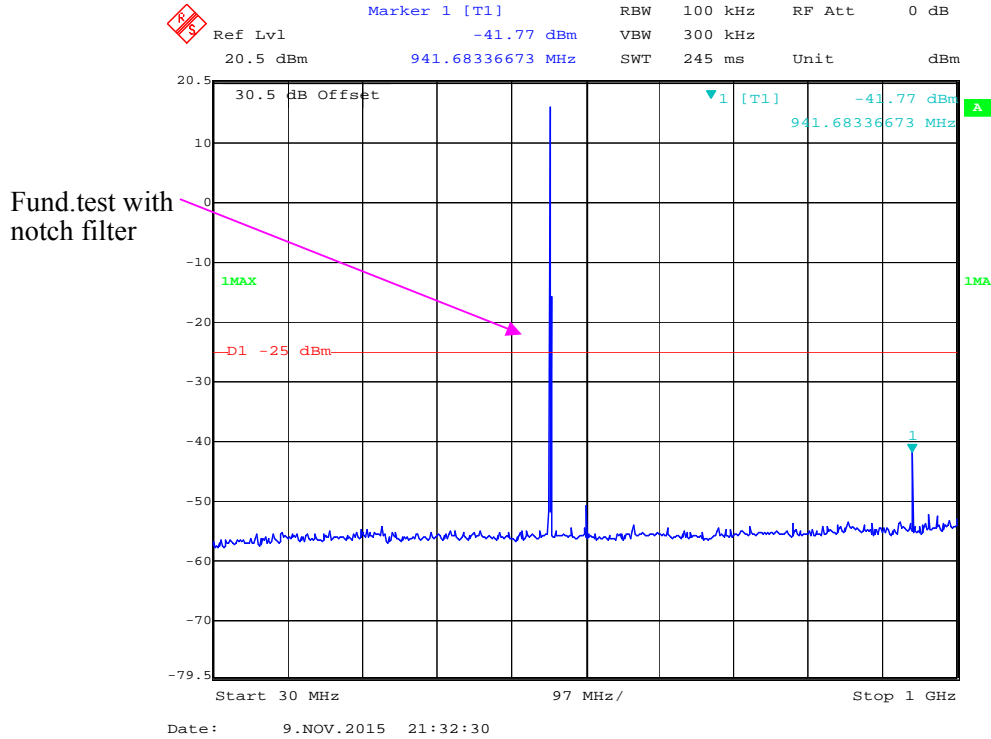
**30 MHz – 1 GHz, Spacing Channel 12.5 kHz, 470.0125 MHz**



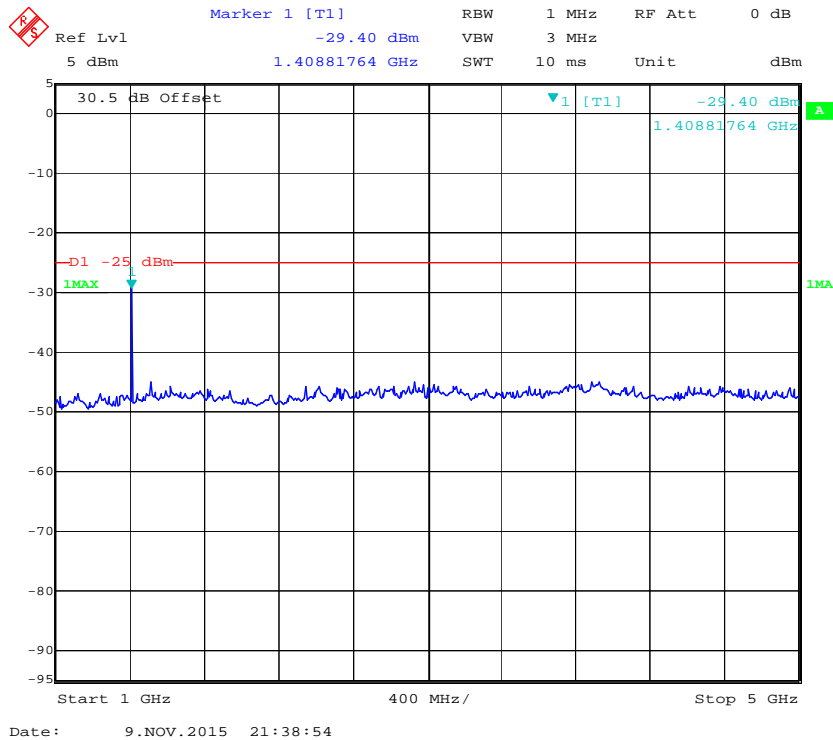
**1 GHz – 5GHz, Spacing Channel 12.5 kHz, 470.0125 MHz**

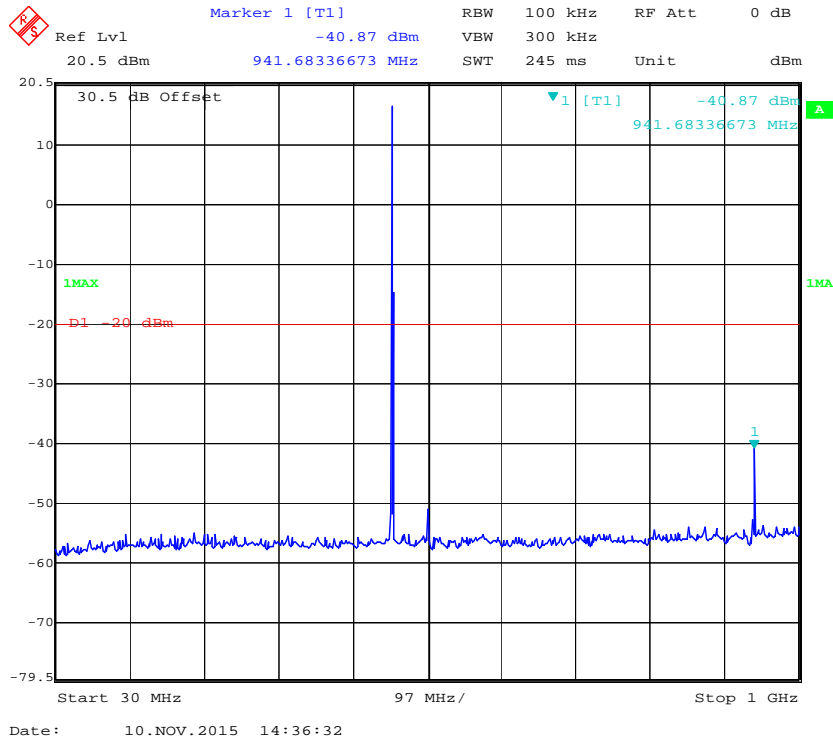
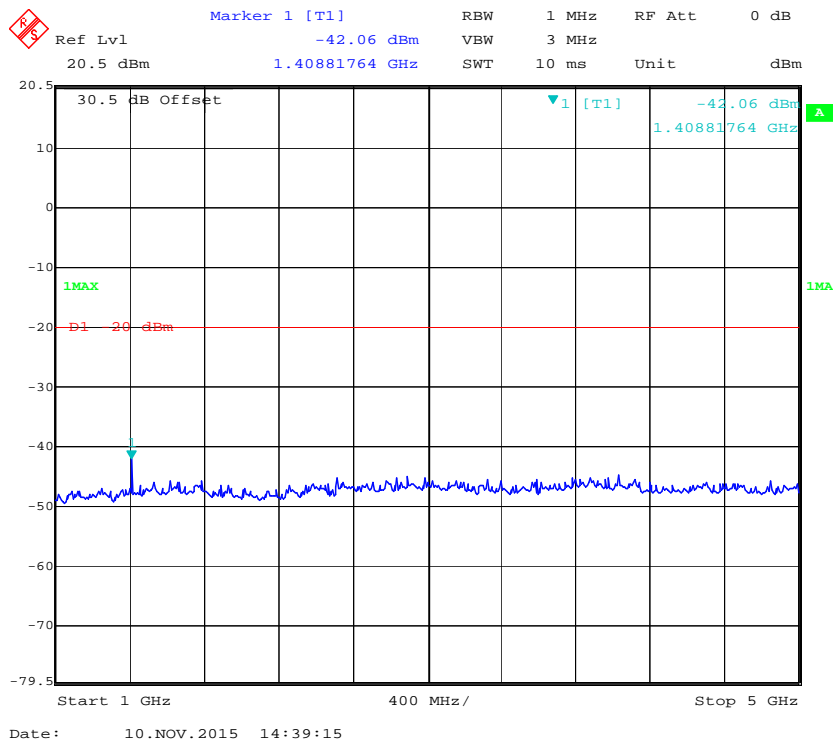


### 30 MHz – 1 GHz, Spacing Channel 6.25 kHz, 470.0125 MHz



### 1 GHz – 5GHz, Spacing Channel 6.25 kHz, 470.0125 MHz



**Digital Modulation:****30 MHz – 1 GHz, Spacing Channel 12.5 kHz, 470.0125 MHz (GMSK)****1 GHz – 5GHz, Spacing Channel 12.5 kHz, 470.0125 MHz (GMSK)**



## FCC §2.1053 & §90.210 - RADIATED SPURIOUS EMISSIONS

### Applicable Standard

FCC §2.1053 and §90.210

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2015-11-03	2016-11-03
HP	Amplifier	8447E	1937A01046	2015-05-06	2016-05-05
Sunol Sciences	Broadband Antenna	JB3	A111513	2014-06-18	2017-06-17
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2015-08-22	2016-08-22
Sunol Sciences	Horn Antenna	DRH-118	A052304	2013-12-01	2016-11-30
HP	Synthesized Sweeper	8341B	2624A00116	2015-06-03	2016-06-03
Mini-Circuits	Amplifier	ZVA-183-S+	5969001149	2015-04-23	2016-04-22
A.H. System	Horn Antenna	SAS-200/571	135	2015-02-11	2016-02-10
COM POWER	Dipole Antenna	AD-100	041000	NCR	NCR

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

### 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 =  $10 \lg(\text{TXpwr in Watts}/0.001)$  - the absolute level

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

Spurious attenuation limit in dB =  $55 + 10 \lg_{10}(\text{power out in Watts})$  for EUT with a 6.25 kHz channel bandwidth.

**Test Data****Environmental Conditions**

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	49 %
<b>ATM Pressure:</b>	101.0 kPa

The testing was performed by Candy Li on 2015-11-09.

Test Mode: Transmitting

**30 MHz – 5 GHz:**

Frequency (MHz)	Receiver Reading (dBμV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	FCC Part 90	
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
Analog Modulation 470.0125MHz, Channel Spacing 12.5kHz										
119.24	44.05	141	1.8	H	-52.9	0.26	0	-53.16	-20	33.16
119.24	44.82	32	1.4	V	-52.2	0.27	0	-52.47	-20	32.47
262.80	46.88	103	1.7	H	-50.1	0.32	0	-50.42	-20	30.42
262.80	41.08	175	2.1	V	-55.9	0.32	0	-56.22	-20	36.22
940.03	57.59	152	1.4	H	-39.4	0.70	0	-40.10	-20	20.10
940.03	50.22	111	2.3	V	-46.8	0.70	0	-47.50	-20	27.50
1410.04	47.05	71	1.6	H	-50.8	1.23	6.40	-45.63	-20	25.63
1410.04	53.23	308	1.3	V	-44.6	1.23	6.40	-39.43	-20	19.43
Analog Modulation 470.0125MHz, Channel Spacing 6.25kHz										
262.80	46.61	15	2.0	H	-50.4	0.32	0	-50.72	-25	25.72
262.80	39.83	282	1.6	V	-57.2	0.32	0	-57.52	-25	32.52
940.03	55.40	162	2.2	H	-41.6	0.70	0	-42.30	-25	17.30
940.03	47.29	224	1.3	V	-49.7	0.70	0	-50.40	-25	25.40
1410.04	47.18	351	2.0	H	-50.7	1.23	6.40	-45.53	-25	20.53
1410.04	51.33	282	1.6	V	-46.5	1.23	6.40	-41.33	-25	16.33

Frequency (MHz)	Receiver Reading (dBμV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	FCC Part 90	
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
Digital Modulation 470.0125MHz, Channel Spacing 12.5kHz (GMSK)										
262.80	47.38	264	1.1	H	-49.6	0.32	0	-49.92	-20	29.92
262.80	42.81	99	1.5	V	-54.2	0.32	0	-54.52	-20	34.52
433.52	45.29	304	2.2	H	-51.7	0.44	0	-52.14	-20	32.14
433.52	41.95	176	1.8	V	-55.0	0.44	0	-55.44	-20	35.44
940.03	57.82	50	1.3	H	-39.2	0.70	0	-39.90	-20	19.90
940.03	49.55	285	1.7	V	-47.4	0.70	0	-48.10	-20	28.10
1410.04	50.94	216	2.2	H	-46.9	1.23	6.40	-41.73	-20	21.73
1410.04	49.15	339	1.8	V	-48.7	1.23	6.40	-43.53	-20	23.53

**Note:**

Absolute Level = SG Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

,

**FCC §2.1055 & §90.213- FREQUENCY STABILITY****Applicable Standard**

FCC §2.1055 and §90.213

**Test Equipment List and Details**

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Hewlett-Packard	Frequency Counter	5343A	2232A00827	2013-05-09	2016-05-08
ESPEC	Temperature & Humidity Chamber	EL-10KA	09107726	2015-11-01	2016-11-01
Long Wei	DC Power Supply	TPR-6420D	398363	NCR	NCR

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

**Test Procedure**

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC 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 DC 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.

**Test Data****Environmental Conditions**

Temperature:	24 °C
Relative Humidity:	49 %
ATM Pressure:	101.0 kPa

*The testing was performed by Candy Li on 2015-11-09.*

*Test Mode: Transmitting*

Reference Frequency: 470.0125MHz, Limit: $\pm 2.5$ ppm, 12.5 kHz			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (°C)	Power Supplied (V <sub>DC</sub> )	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	12.0	470.012393	-0.228
40	12.0	470.012395	-0.223
30	12.0	470.012412	-0.187
20	12.0	470.012405	-0.202
10	12.0	470.012389	-0.236
0	12.0	470.012396	-0.221
-10	12.0	470.012401	-0.211
-20	12.0	470.012392	-0.230
-30	12.0	470.012389	-0.236
Frequency Stability versus Input Voltage			
20	10.2	470.012402	-0.209
20	13.8	470.012415	-0.181

Reference Frequency: 470.0125MHz, Limit: $\pm 1.0$ ppm, 6.25 kHz			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (°C)	Power Supplied (V <sub>DC</sub> )	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	12.0	470.012418	-0.174
40	12.0	470.012378	-0.260
30	12.0	470.012419	-0.172
20	12.0	470.012421	-0.168
10	12.0	470.012410	-0.191
0	12.0	470.012402	-0.209
-10	12.0	470.012394	-0.226
-20	12.0	470.012418	-0.174
-30	12.0	470.012415	-0.181
Frequency Stability versus Input Voltage			
20	10.2	470.012411	-0.189
20	13.8	470.012408	-0.196

## 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

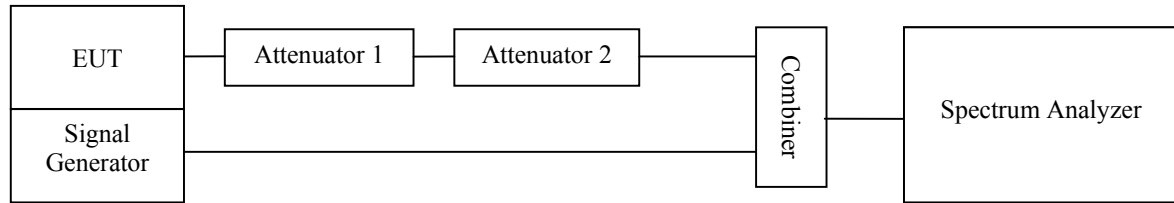
Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSIQ26	837405/023	2015-08-22	2016-08-22
HP	RF Communication Test Set	8920A	3438A05201	2015-06-14	2016-06-13

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

### Test Procedure

- Connect the EUT and test equipment as shown on the following block diagram.
- Set the Spectrum Analyzer to measure FM deviation, and tune the RF frequency to the transmitter assigned frequency.
- Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at  $\pm 12.5$  kHz deviation and set its output level to -100dBm.
- Turn on the transmitter.
- 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  $P_0$ .
- Turn off the transmitter.
- 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.
- Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30 dB when the transmitter is turned on.
- Adjust the vertical amplitude control of the spectrum analyzer to display the 1000 Hz at  $\pm 4$  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 "trigger offset" to -10ms for turn on and -15ms for turn off.
- 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:	24 °C
Relative Humidity:	45 %
ATM Pressure:	101.0 kPa

The testing was performed by Candy Li on 2015-11-09.

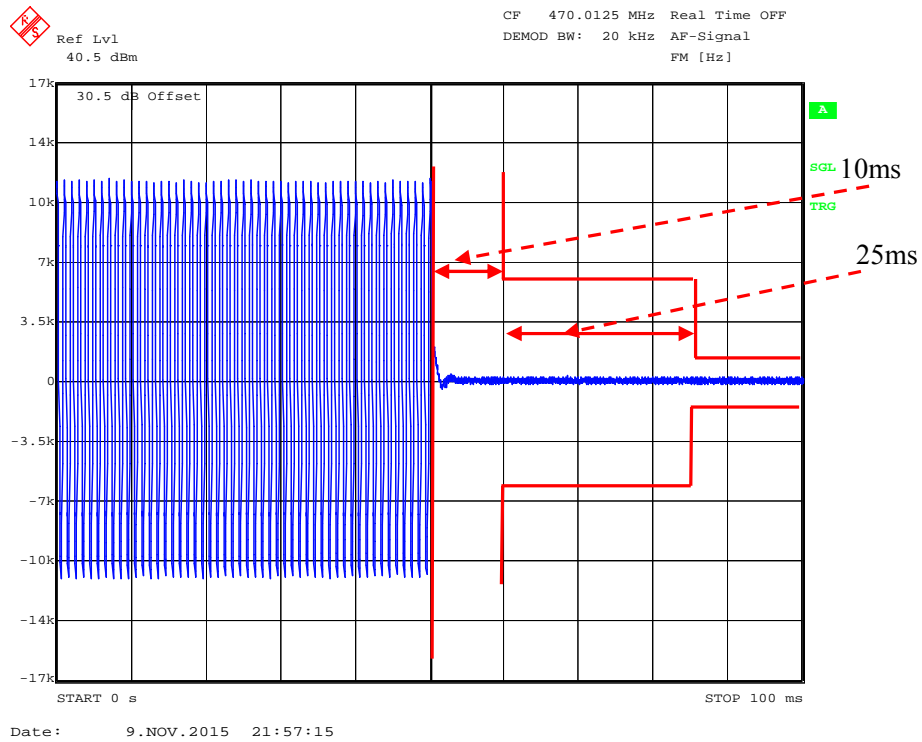
Test Mode: Transmitting

Channel Separation (kHz)	Transient Period (ms)	Transient Frequency	Result
6.25	10 (t1)	<+/-6.25 kHz	Pass
	25 (t2)	<+/-3.125 kHz	
	10 (t3)	<+/-6.25 kHz	
12.5	10 (t1)	<+/-12.5 kHz	
	25 (t2)	<+/-6.25 kHz	
	10 (t3)	<+/-12.5 kHz	

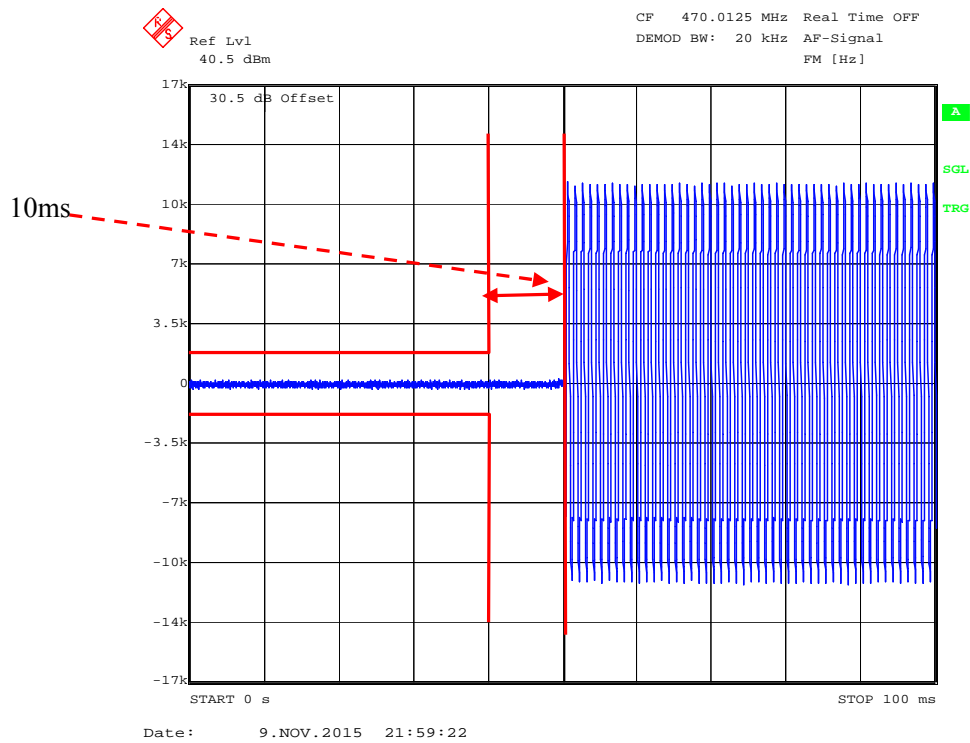
Please refer to the following plots.

# Channel Spacing 12.5 kHz

## Turn on



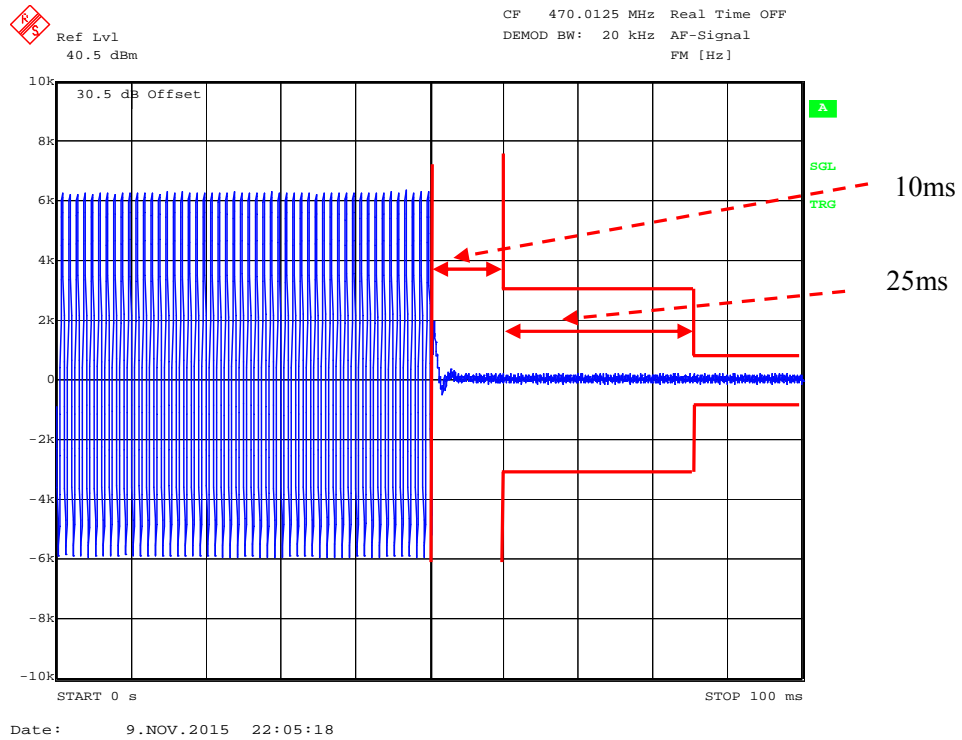
## Turn off



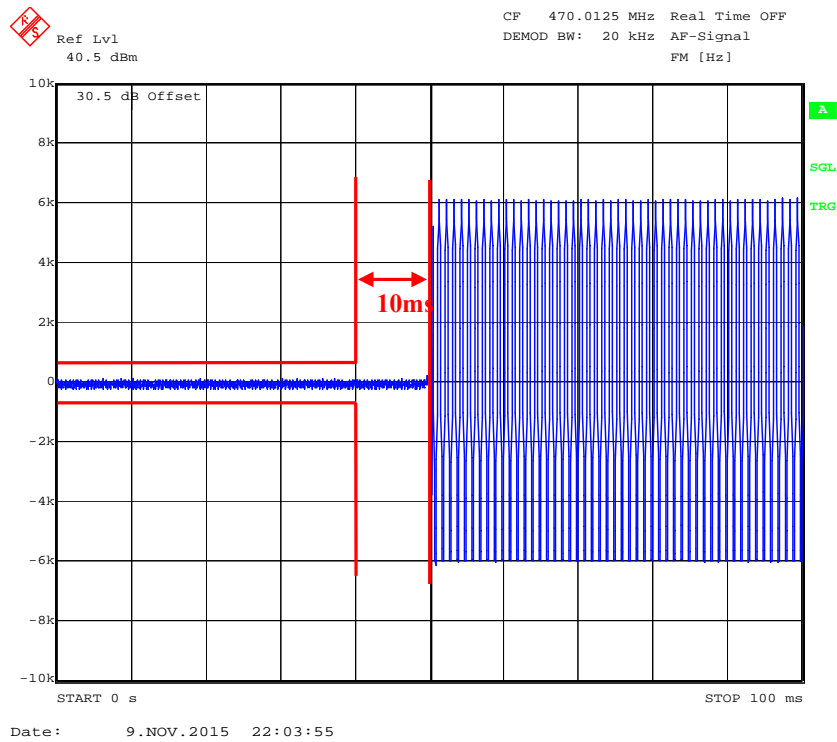


# Channel Spacing 6.25 kHz

## Turn on



## Turn off



\*\*\*\*\* END OF REPORT \*\*\*\*\*