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

FCC ID: UU3FC302VD

Report Type:	**Product Type:**
Original Report	FC-302V Data Radio

Test Engineer:	Rocky Kang
Report Number:	RSZ160629003-00
Report Date:	2016-07-19
Reviewed By:	Bell Hu RF Engineer
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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.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Shenzhen Friendcom Technology Development Co., Ltd.*'s product, model number: *FC-302VD (FCC ID: UU3FC302VD)* or the "EUT" in this report was a *FC-302V Data Radio,* which was measured approximately: 117 mm (L) x 63 mm (W) x 32 mm (H), rated with input voltage: DC 12.0 V rechargeable battery.

** All measurement and test data in this report was gathered from production sample serial number: 1602630 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2016-06-29.*

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)

N/A

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 5.81 dB for 30MHz-1GHz.and 4.88 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.

Equipment Modifications

No modification was made to the EUT tested.

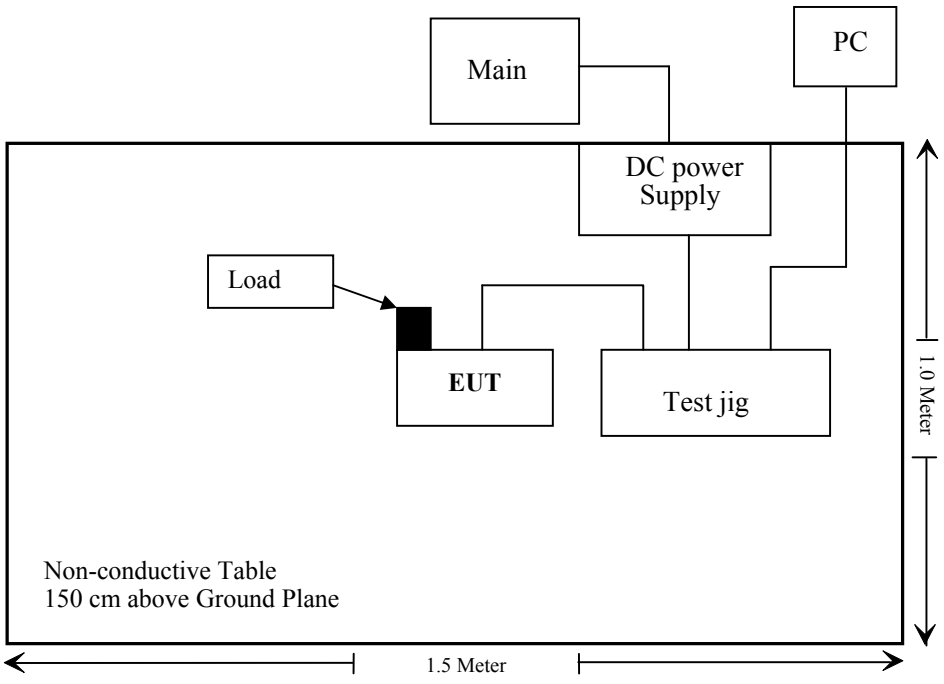
Support Equipment List and Details

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-Set Board 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 RSS 232 Cable	0.3	EUT	Test jig
Shielding Detachable RSS232-to-USB-Cable	1.5	Test jig	PC

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§ 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 §1.1307 & §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

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (Minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

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

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/cm2)
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)

For worst case:

Frequency (MHz)	Target power (dBm)	Target power (mW)	Antenna Gain		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
			(dBi)	(numeric)			
136-174	37.50	5623.41	9	7.94	150	0.16	0.2

The maximum antenna gain is 9.0 dBi

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 150cm 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	8386001028	2016-04-14	2017-04-14
HP Agilent	RF Communication test set	8920A	3325U00859	2016-05-07	2017-05-07
Ducommun technologies	RF Cable	RG-214	3	2016-05-06	2017-05-06
JFW	30dB Attenuator	50FH-030-100 RF	170006716507	2016-06-12	2017-06-12

*** 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:	23 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Rocky Kang on 2016-07-14.

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	136.025	High	32.87	1.94	Pass
			Low	29.84	0.96	Pass
	6.25	155.750	High	32.61	1.82	Pass
			Low	29.87	0.97	Pass
	6.25	173.975	High	32.98	1.99	Pass
			Low	30.33	1.08	Pass
	12.5	136.025	High	37.16	5.20	Pass
			Low	29.95	0.99	Pass
	12.5	155.750	High	36.89	4.89	Pass
			Low	29.74	0.94	Pass
	12.5	173.975	High	37.34	5.42	Pass
			Low	30.33	1.08	Pass
Digital	12.5	136.025	High	36.94	4.94	Pass
			Low	29.83	0.96	Pass
	12.5	155.750	High	36.86	4.85	Pass
			Low	29.85	0.97	Pass
	12.5	173.975	High	36.88	4.88	Pass
			Low	29.79	0.95	Pass

For 12.5 KHz: The rated high power is 5W.
The rated low power is 1W.
For 6.25 KHz: The rated high power is 2W.
The rated low power is 1W.

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 Procedure

Test Method: TIA -603-D 2.2.3

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	RF Communication Test Set	8920A	3438A05201	2016-06-14	2017-06-13
LEADER	MILLIVOLTMETER	LMV-181A	6041126	2016-07-02	2017-07-01
Ducommun technologies	RF Cable	RG-214	3	2016-05-06	2017-05-06
JFW	30dB Attenuator	50FH-030-100 RF	170006716507	2016-06-12	2017-06-12

*** 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:	23 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Rocky Kang on 2016-07-16.

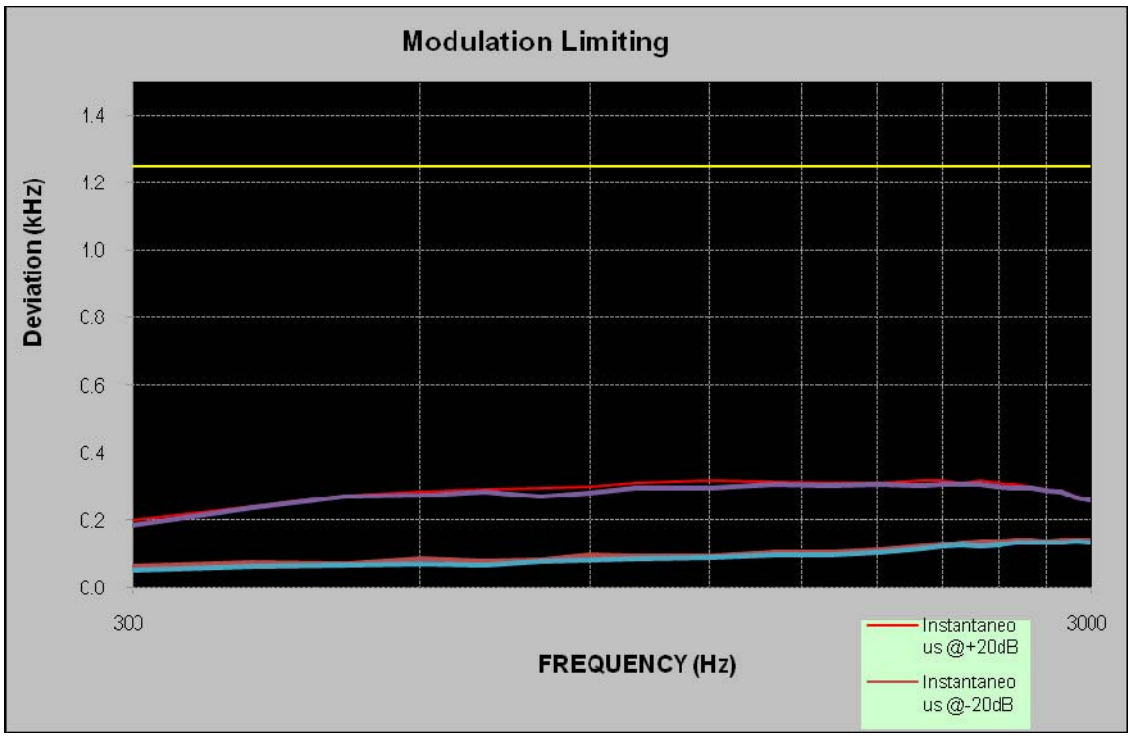
Test Mode: Transmitting

Result: Compliance.

Analog Modulation:

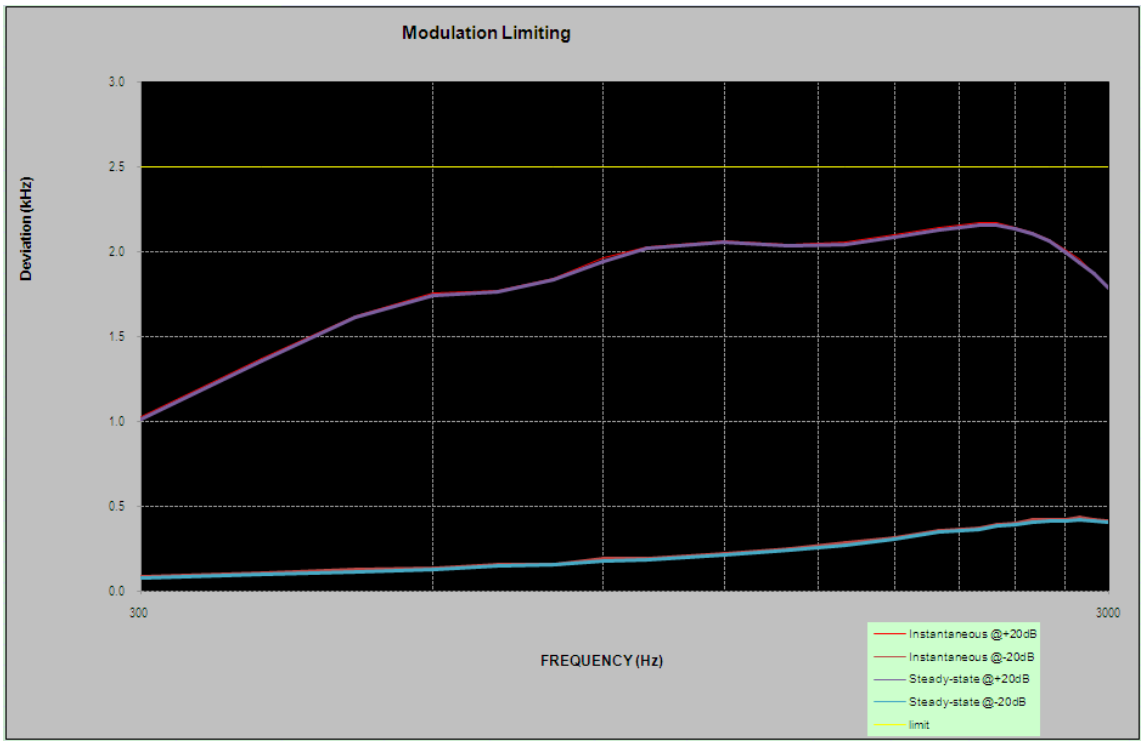
Carrier Frequency: 155.75 MHz, Channel Separation=6.25 kHz

Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	300	0.198	0.061	0.186	1.25
400	400	0.241	0.073	0.235	1.25
500	500	0.275	0.070	0.268	1.25
600	600	0.283	0.084	0.272	1.25
700	700	0.292	0.079	0.283	1.25
800	800	0.295	0.083	0.271	1.25
900	900	0.301	0.095	0.279	1.25
1000	1000	0.311	0.091	0.295	1.25
1200	1200	0.317	0.094	0.296	1.25
1400	1400	0.315	0.105	0.305	1.25
1600	1600	0.312	0.102	0.302	1.25
1800	1800	0.311	0.112	0.305	1.25
2000	2000	0.317	0.121	0.303	1.25
2100	2100	0.316	0.127	0.308	1.25
2200	2200	0.312	0.134	0.305	1.25
2300	2300	0.318	0.135	0.305	1.25
2400	2400	0.311	0.138	0.298	1.25
2500	2500	0.308	0.140	0.295	1.25
2600	2600	0.301	0.141	0.296	1.25
2700	2700	0.290	0.138	0.288	1.25
2800	2800	0.289	0.141	0.285	1.25
2900	2900	0.271	0.142	0.267	1.25
3000	3000	0.261	0.142	0.257	1.25


Modulation Limiting
Deviation (kHz)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
300
3000
FREQUENCY (Hz)
Instantaneous @+20dB
Instantaneous @-20dB

Carrier Frequency: 155.75 MHz, Channel Separation=12.5 kHz

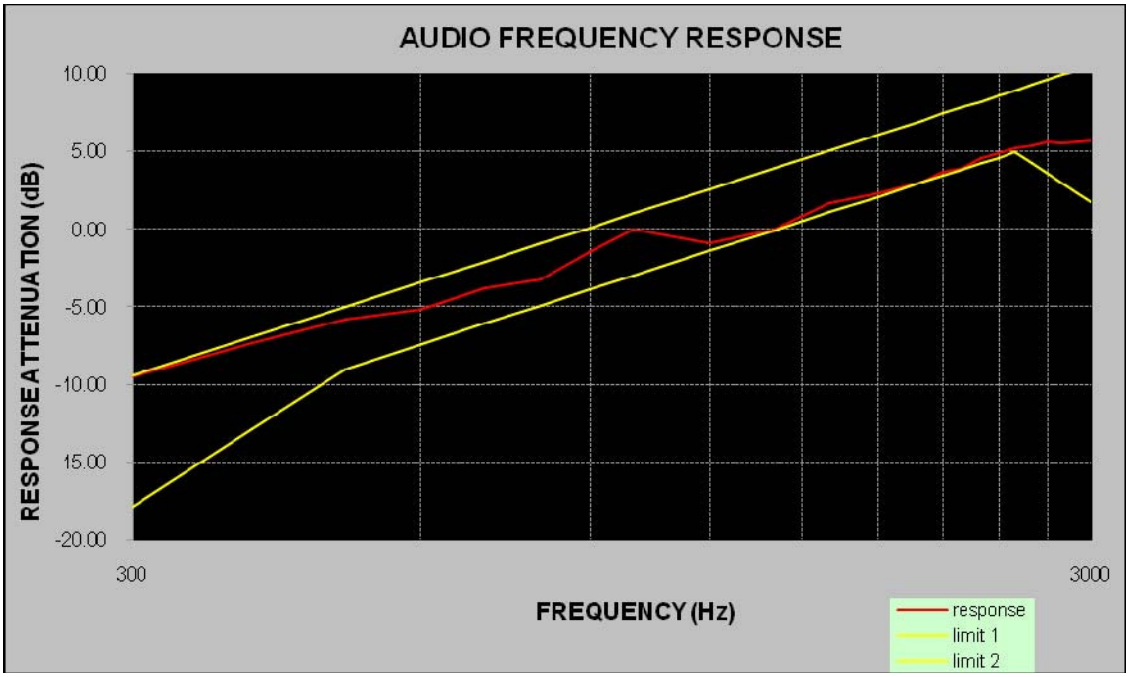
Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	1.026	0.084	1.015	0.076	2.5
400	1.370	0.107	1.356	0.098	2.5
500	1.624	0.128	1.616	0.115	2.5
600	1.759	0.138	1.743	0.131	2.5
700	1.773	0.155	1.765	0.148	2.5
800	1.843	0.161	1.834	0.155	2.5
900	1.964	0.191	1.945	0.177	2.5
1000	2.027	0.192	2.019	0.185	2.5
1200	2.064	0.225	2.055	0.213	2.5
1400	2.041	0.250	2.032	0.243	2.5
1600	2.055	0.286	2.042	0.275	2.5
1800	2.098	0.316	2.085	0.306	2.5
2000	2.142	0.356	2.131	0.348	2.5
2100	2.156	0.362	2.145	0.356	2.5
2200	2.171	0.372	2.153	0.368	2.5
2300	2.167	0.395	2.154	0.383	2.5
2400	2.145	0.401	2.133	0.395	2.5
2500	2.112	0.419	2.105	0.408	2.5
2600	2.071	0.420	2.064	0.415	2.5
2700	2.012	0.425	2.002	0.416	2.5
2800	1.953	0.434	1.935	0.425	2.5
2900	1.872	0.425	1.868	0.414	2.5
3000	1.793	0.411	1.783	0.405	2.5


Modulation Limiting
Deviation (kHz)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
300
3000
FREQUENCY (Hz)
Instantaneous @+20dB
Instantaneous @-20dB
Steady-state @+20dB
Steady-state @-20dB
limit

Audio Frequency Response

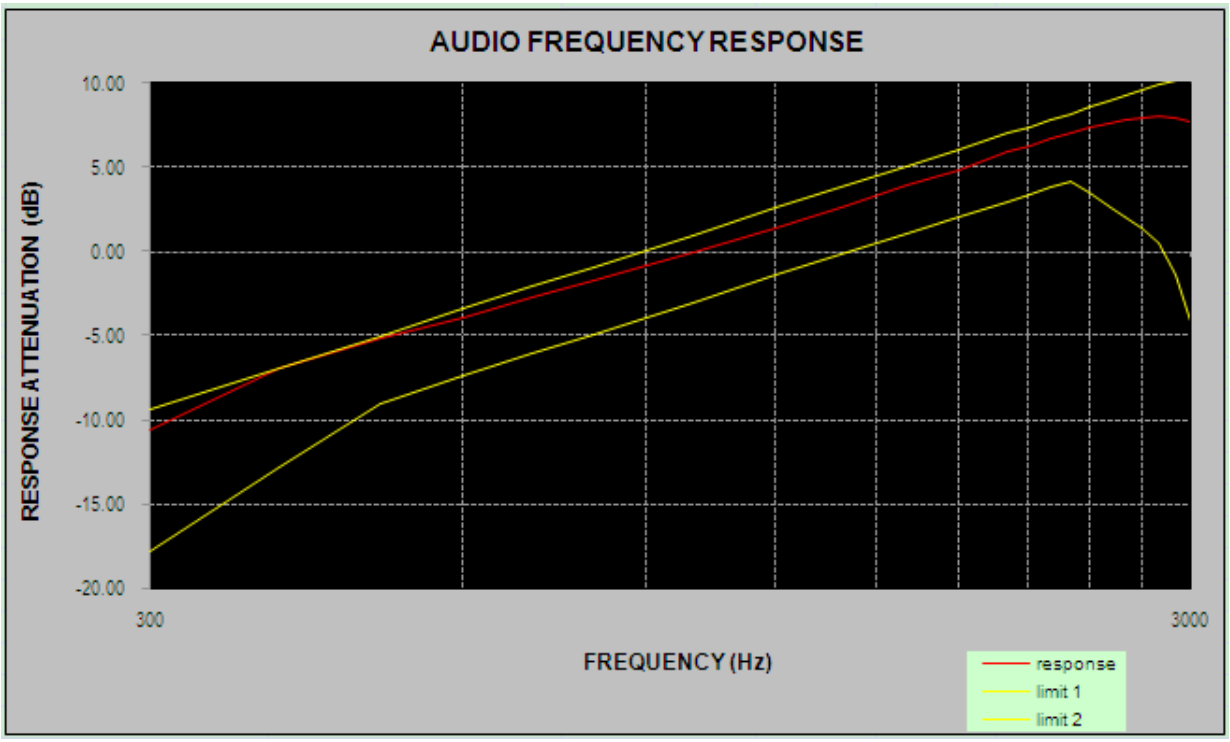
Carrier Frequency: 155.75 MHz, Channel Separation=6.25 kHz

Audio Frequency (Hz)	Response Attenuation (dB)
300	-9.47
400	-7.37
500	-5.81
600	-5.16
700	-3.77
800	-3.25
900	-1.43
1000	0.00
1200	-0.92
1400	0.00
1600	1.64
1800	2.28
2000	3.07
2100	3.68
2200	3.91
2300	4.55
2400	4.87
2500	5.16
2600	5.33
2700	5.58
2800	5.56
2900	5.58
3000	5.68


AUDIO FREQUENCY RESPONSE
10.00
5.00
0.00
-5.00
-10.00
15.00
-20.00
RESPONSE ATTENUATION (dB)
300
3000
FREQUENCY (Hz)
response
limit 1
limit 2

Carrier Frequency: 155.75 MHz, Channel Separation=12.5 kHz

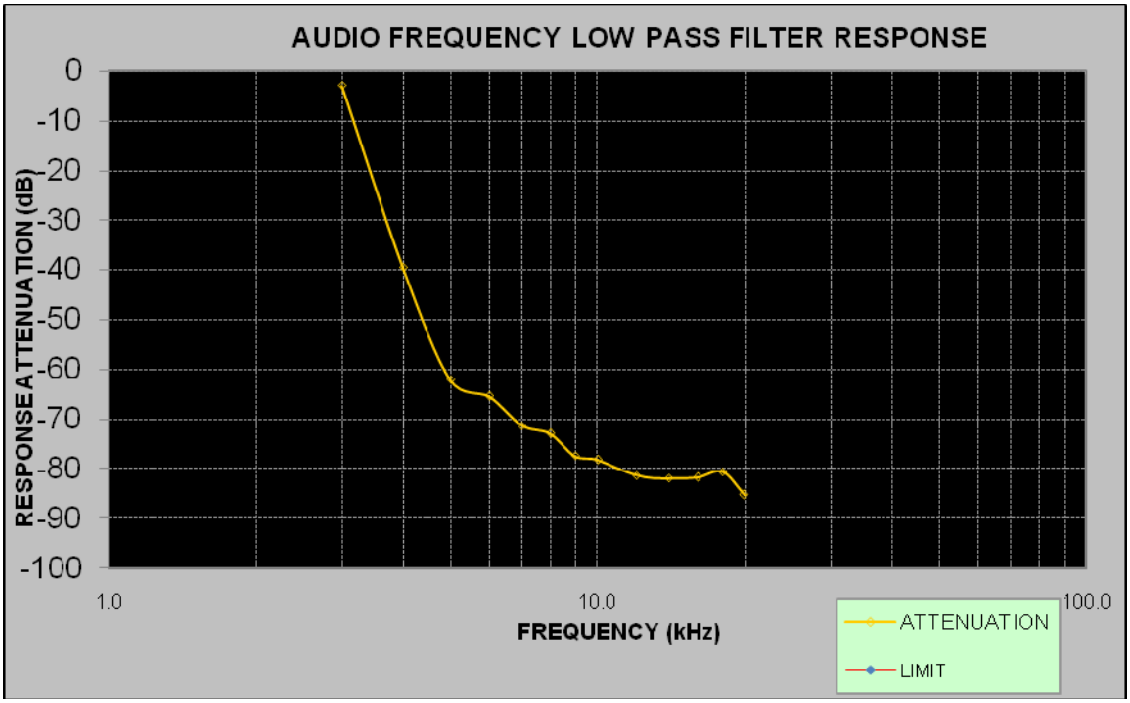
Audio Frequency (Hz)	Response Attenuation (dB)
300	-10.63
400	-6.94
500	-5.13
600	-3.99
700	-2.73
800	-1.68
900	-0.82
1000	0.00
1200	1.38
1400	2.77
1600	3.96
1800	4.87
2000	5.90
2100	6.30
2200	6.71
2300	7.05
2400	7.41
2500	7.59
2600	7.86
2700	7.99
2800	8.00
2900	7.92
3000	7.78


AUDIO FREQUENCY RESPONSE
RESPONSE ATTENUATION (dB)
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
300
3000
FREQUENCY (Hz)
response
limit 1
limit 2

Audio Frequency Response Low Pass Filter

Carrier Frequency: 155.75 MHz, Channel Separation=6.25 kHz

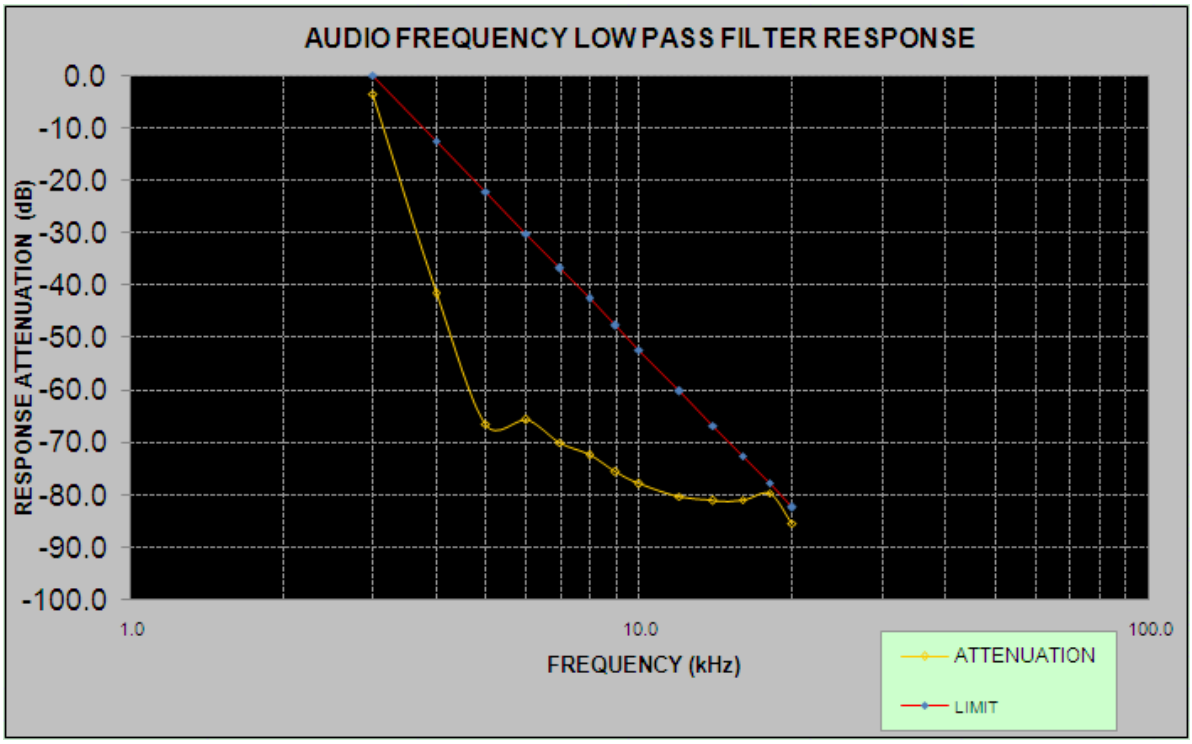
Audio Frequency (kHz)	Response Attenuation (dB)	Result
1.0	/	Compliance
3.0	-2.9	
4.0	-39.5	
5.0	-62.1	
6.0	-65.4	
7.0	-71.3	
8.0	-72.9	
9.0	-77.4	
10.0	-78.2	
12.0	-81.3	
14.0	-81.9	
16.0	-81.7	
18.0	-80.6	
20.0	-85.2	



Audio Frequency Response Low Pass Filter

Carrier Frequency: 155.75 MHz, Channel Separation=12.5 kHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	/	/
3.0	-3.5	0.0
4.0	-41.6	-12.5
5.0	-66.5	-22.2
6.0	-65.7	-30.1
7.0	-70.1	-36.8
8.0	-72.5	-42.6
9.0	-75.7	-47.7
10.0	-77.9	-52.3
12.0	-80.3	-60.2
14.0	-81.2	-66.9
16.0	-81.1	-72.7
18.0	-79.8	-77.8
20.0	-85.5	-82.5



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

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

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 ±50 kHz from the carrier frequency.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2016-04-14	2017-04-14
HP	RF Communication Test Set	8920A	3325U00859	2016-05-07	2017-05-07
Ducommun technologies	RF Cable	RG-214	3	2016-05-06	2017-05-06
JFW	30dB Attenuator	50FH-030-100 RF	170006716507	2016-06-12	2017-06-12

*** 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:	22~24 ℃
Relative Humidity:	48~52 %
ATM Pressure:	100~101.0 kPa

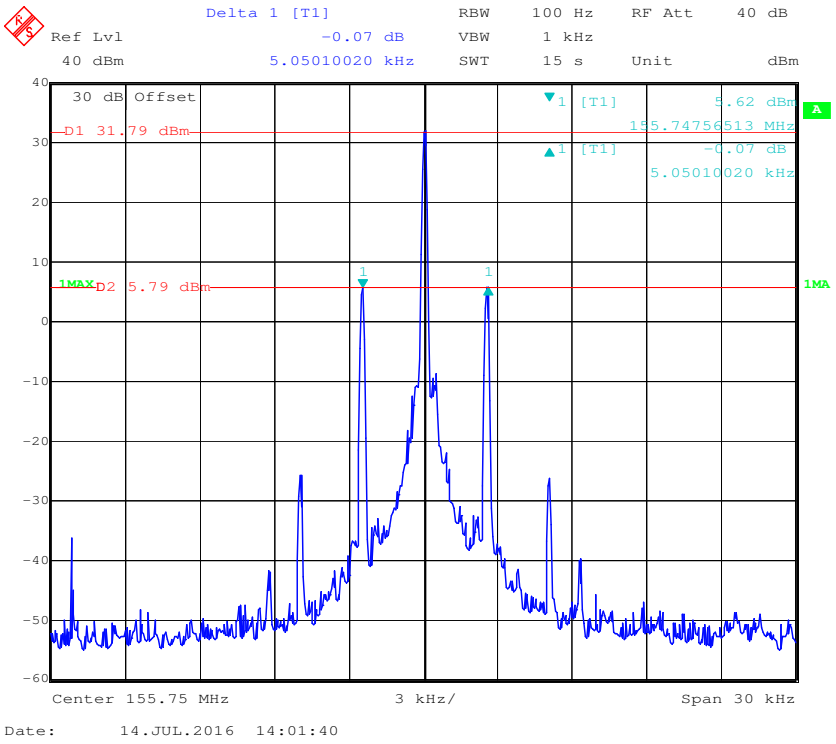
The testing was performed by Rocky Kang on 2016-07-14 and 2016-07-16.

Test Mode: Transmitting

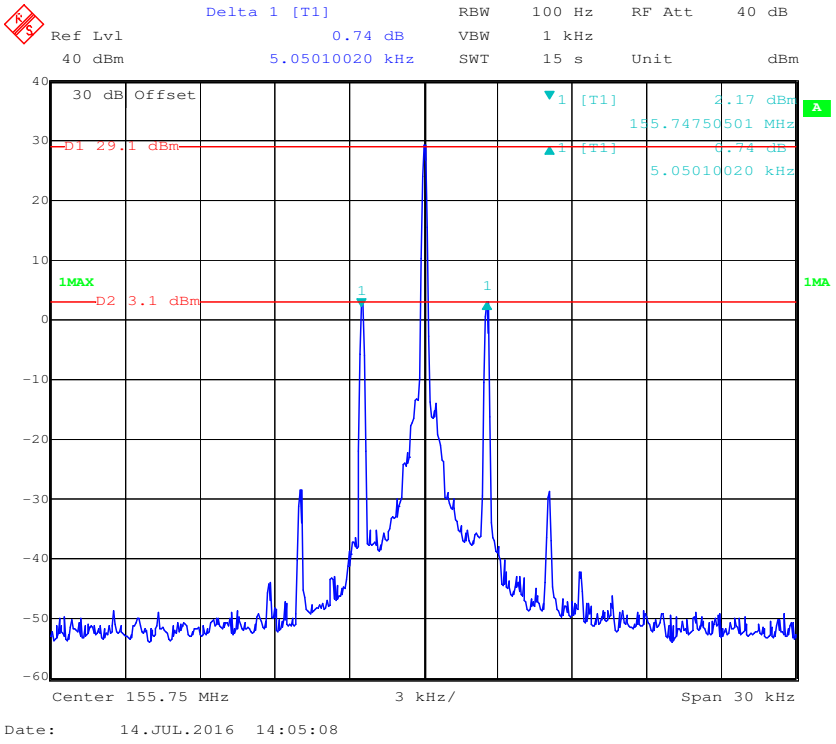
Modulation	Frequency (MHz)	Channel space (kHz)	Power Level	26 dB Emissions Bandwidth (kHz)
Analog	155.75	6.25	High	5.05
			Low	5.05
	155.75	12.5	High	10.22
			Low	10.22
Digital	155.75	12.5	High	7.21
			Low	7.21

Analog Modulation:

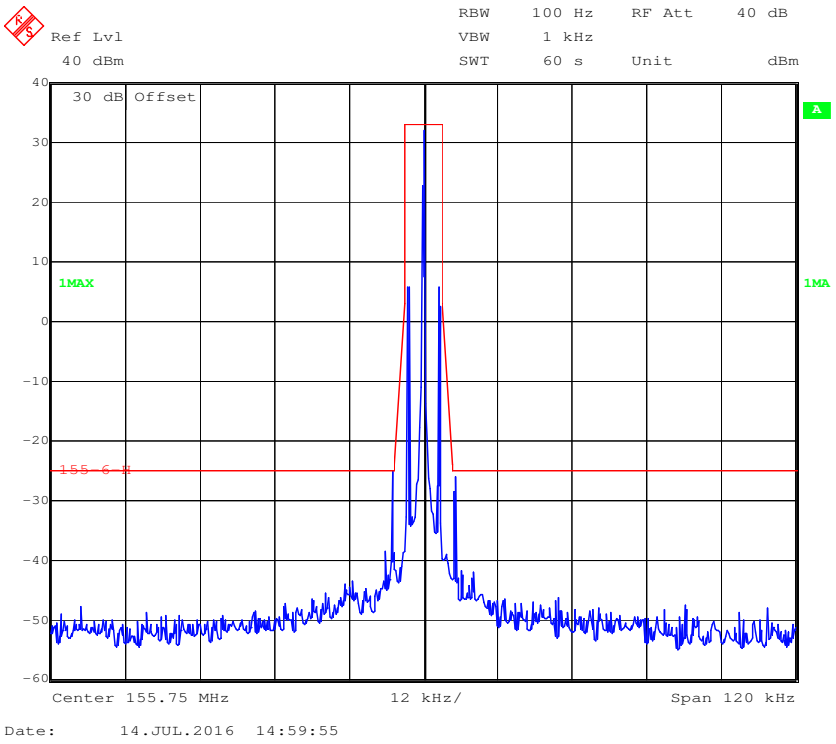
26 dB Emissions Bandwidth 6.25 kHz, 155.75 MHz (High Power)



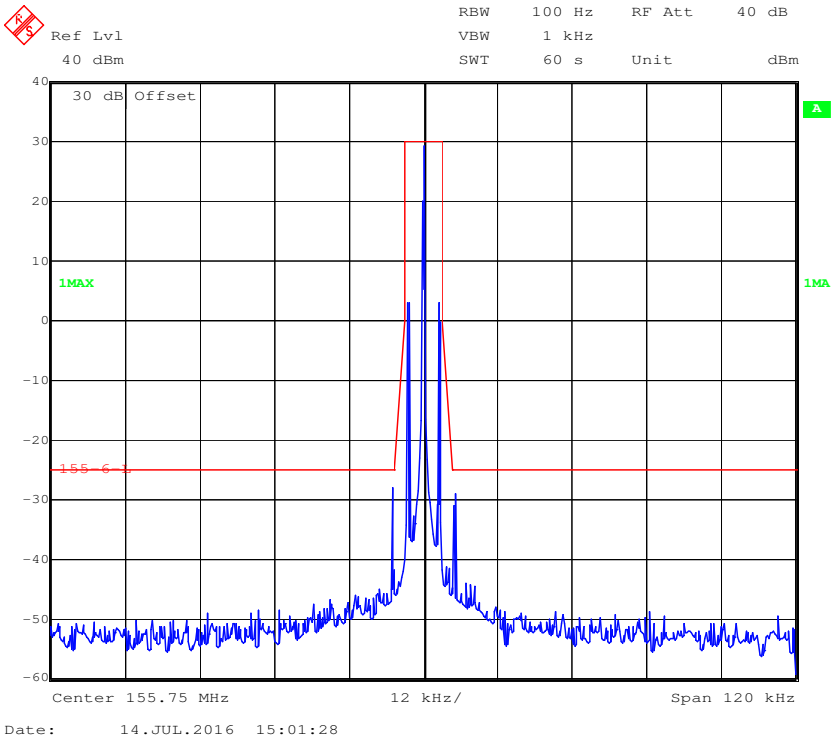
26 dB Emissions Bandwidth 6.25 kHz, 155.75 MHz (Low Power)



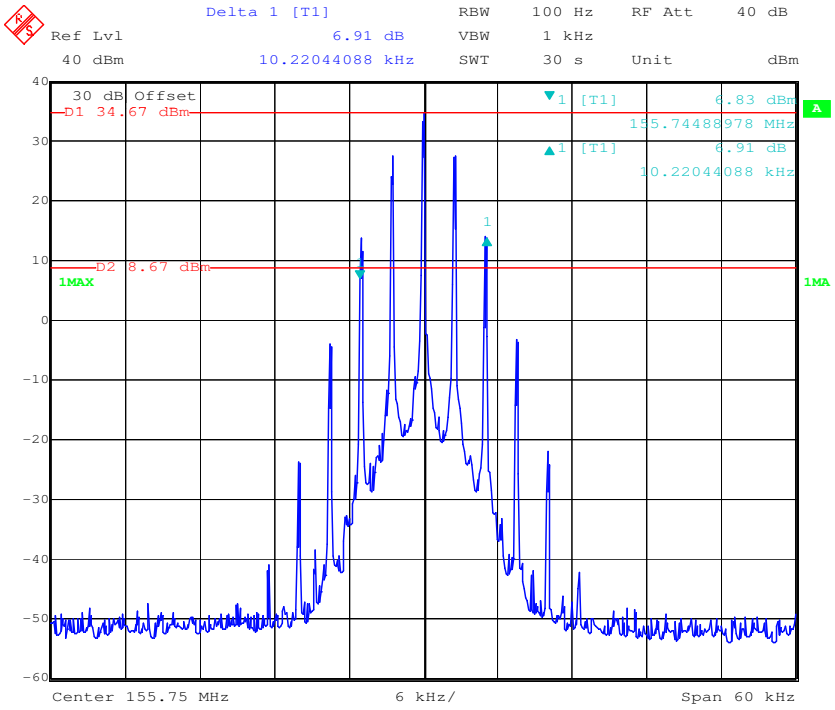
Emission Mask E with High Power 6.25 kHz, 155.75 MHz



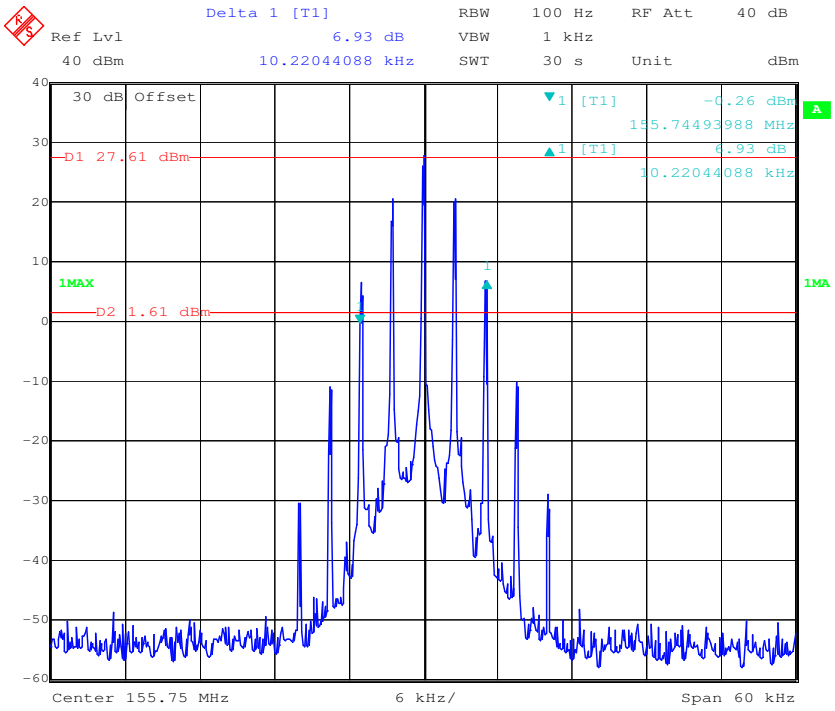
Emission Mask E with Low Power 6.25 kHz, 155.75 MHz



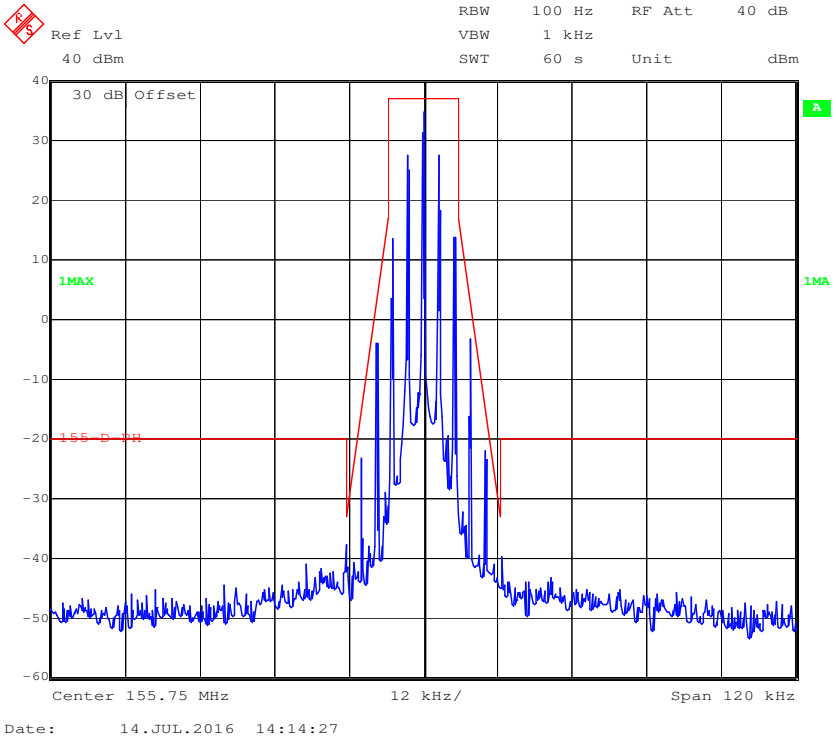
26 dB Emissions Bandwidth 12.5 kHz, 155.75 MHz (High Power)



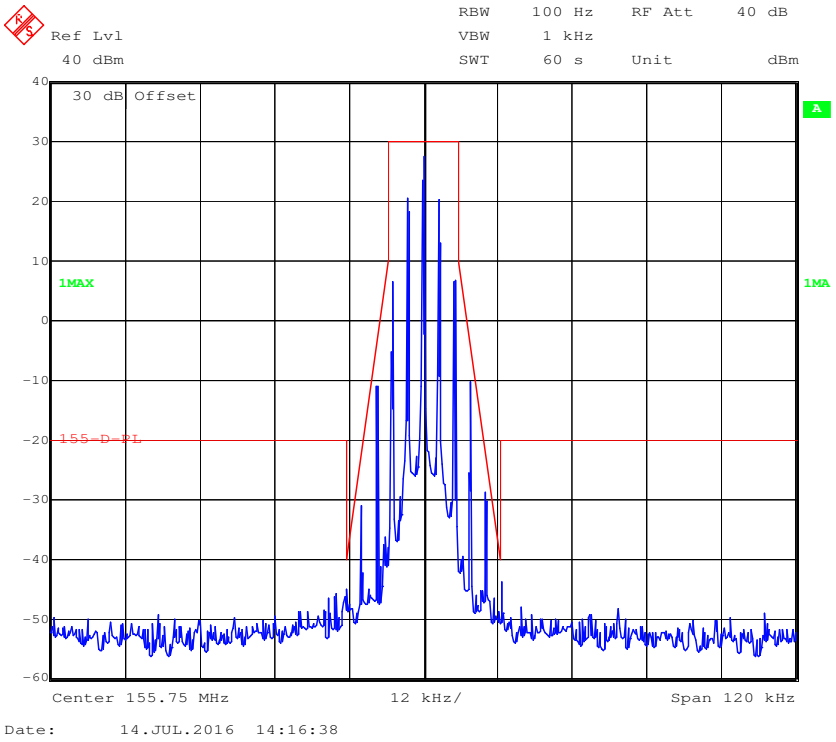
26 dB Emissions Bandwidth 12.5 kHz, 155.75 MHz (Low Power)



Emission Mask D with High Power 12.5 kHz, 155.75 MHz

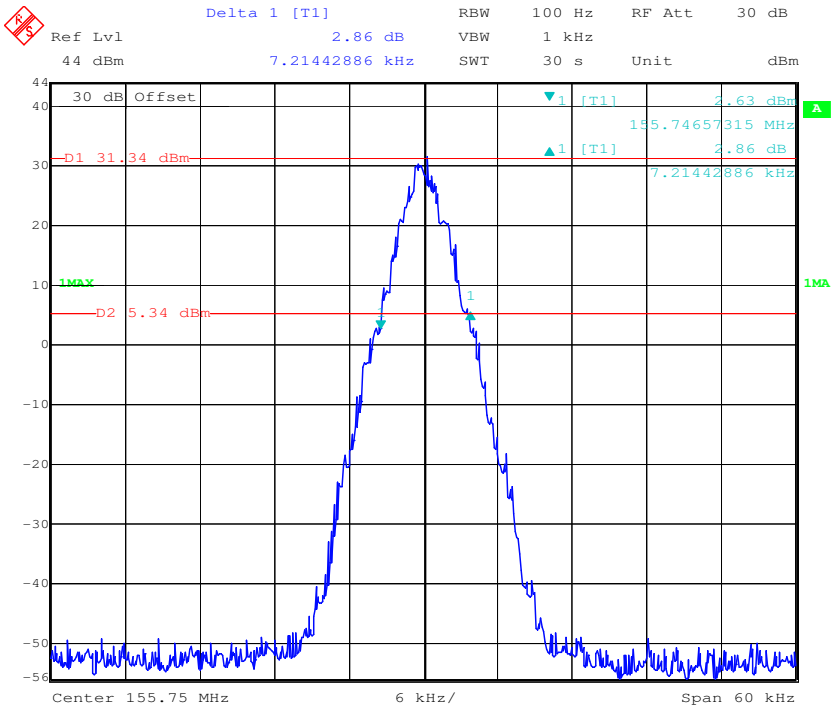


Emission Mask D with Low Power 12.5 kHz, 155.75 MHz

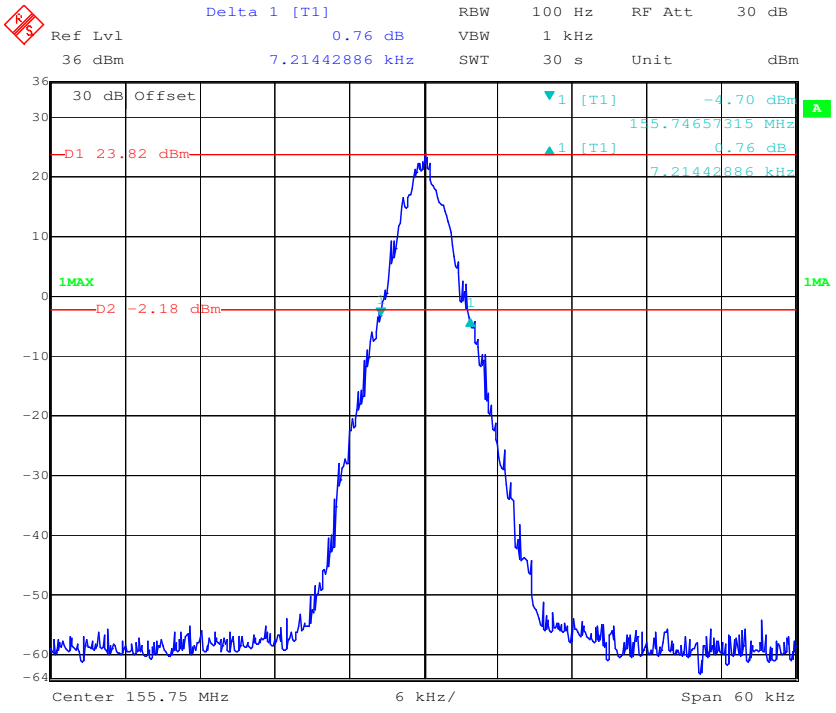


Digital Modulation:

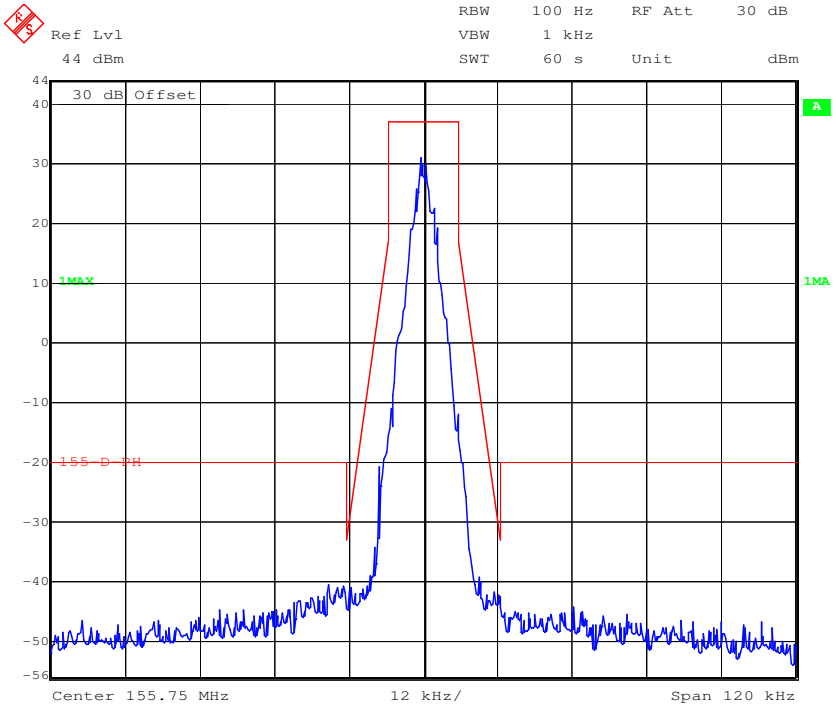
26 dB Emissions Bandwidth 12.5 kHz, 155.75 MHz (High Power)



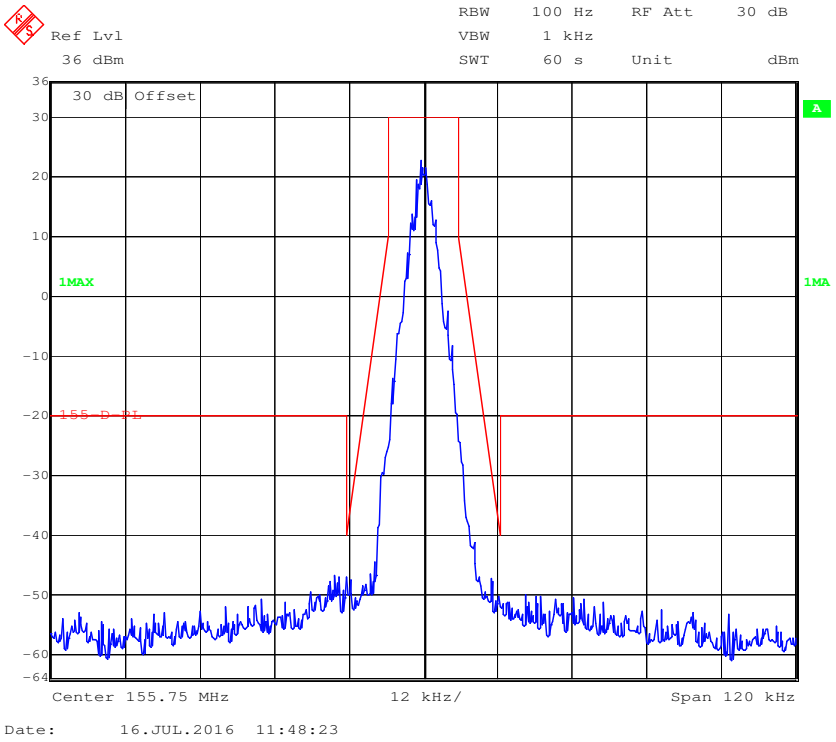
26 dB Emissions Bandwidth 12.5 kHz, 155.75 MHz (Low Power)



Emission Mask D with High Power 12.5 kHz, 155.75 MHz



Emission Mask D with Low Power 12.5 kHz, 155.75 MHz



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

4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

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 kHz) or 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.
(2) 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 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 10th harmonic.

Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2016-04-14	2017-04-14
Ducommun technologies	RF Cable	RG-214	3	2016-05-06	2017-05-06
JFW	30dB Attenuator	50FH-030-100 RF	170006716507	2016-06-12	2017-06-12

*** 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:	22~23 ℃
Relative Humidity:	48~52 %
ATM Pressure:	100.0~101.0 kPa

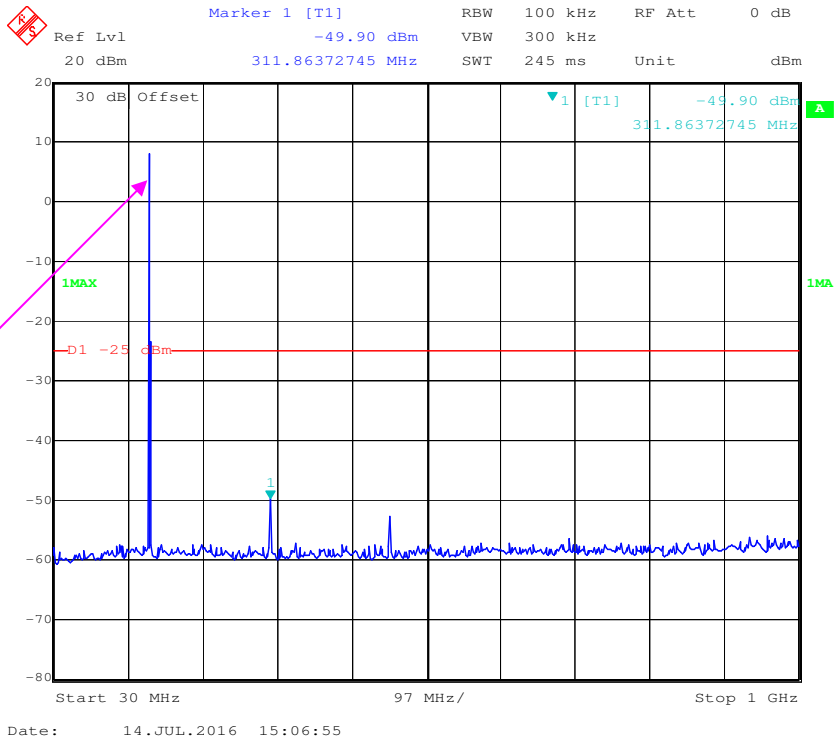
The testing was performed by Rocky Kang on 2016-07-14 and 2016-07-18.

Test Mode: Transmitting

Please refer to the following plots.

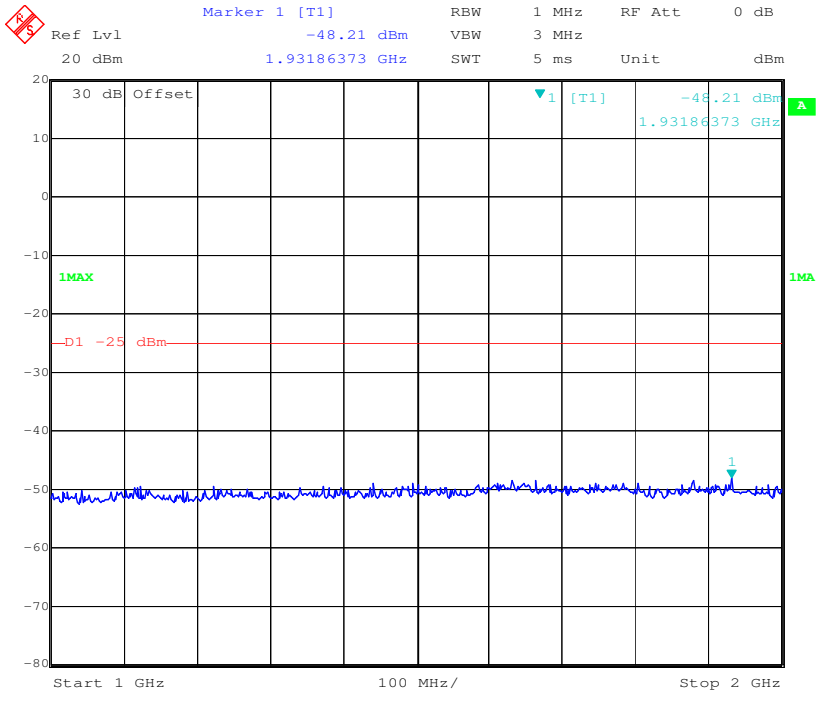
Analog Modulation:

30 MHz – 1 GHz, Spacing Channel 6.25 kHz, 155.75 MHz

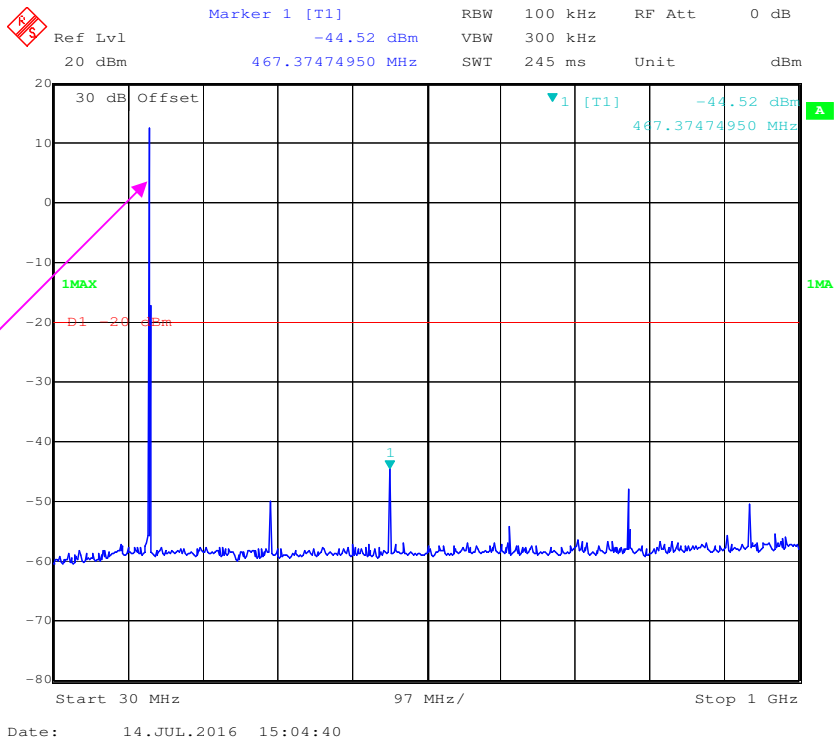


Fund.test with notch filter

1 GHz – 2GHz, Spacing Channel 6.25 kHz, 155.75 MHz

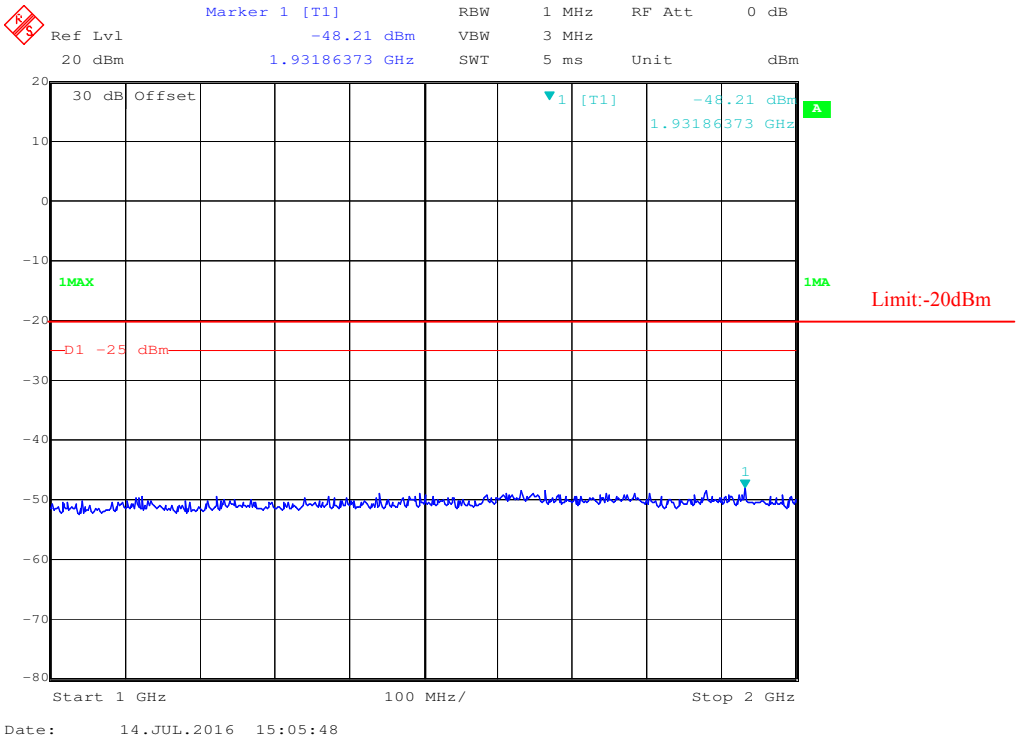


30 MHz – 1 GHz, Spacing Channel 12.5 kHz, 155.75 MHz



Fund.test with notch filter

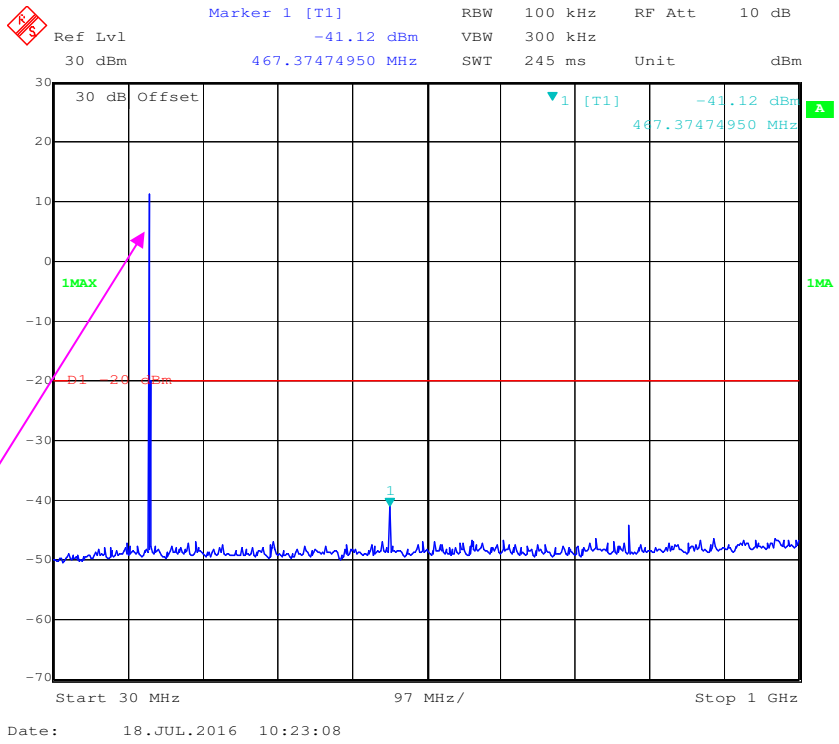
1 GHz – 2GHz, Spacing Channel 12.5 kHz, 155.75 MHz



Limit:-20dBm

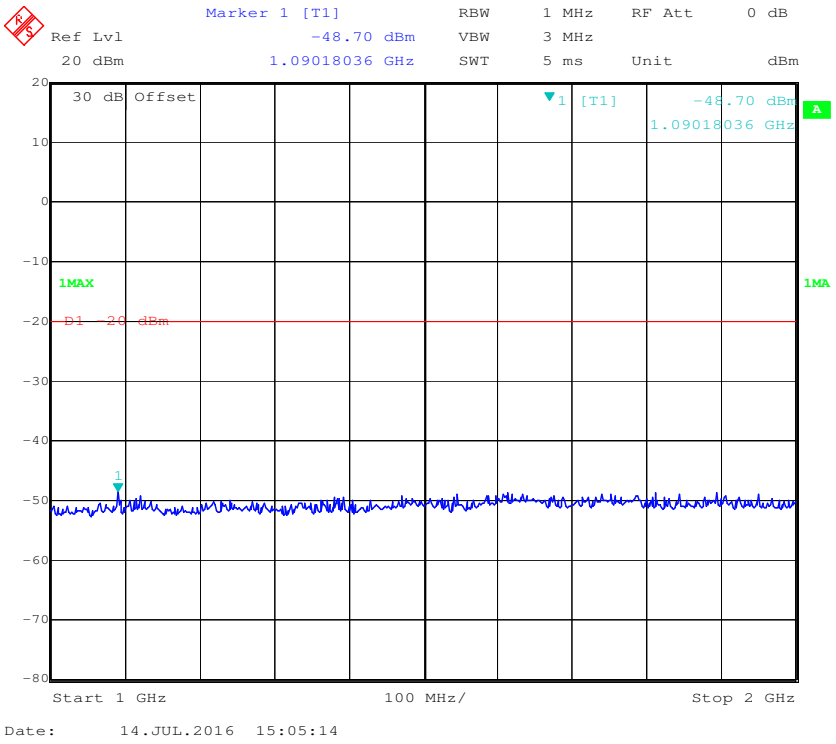
Digital Modulation:

30 MHz – 1 GHz, Spacing Channel 12.5 kHz, 155.75 MHz



Fund.test with notch filter

1 GHz – 2GHz, Spacing Channel 12.5 kHz, 155.75 MHz



FCC §2.1053 & §90.210 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053 and §90.210

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2015-12-15	2016-12-14
HP	Amplifier	HP8447E	1937A01046	2016-05-06	2017-05-05
Sunol Sciences	Bi-log Antenna	JB1	A040904-2	2014-12-07	2017-12-06
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2016-04-14	2017-04-14
Sunol Sciences	Horn Antenna	DRH-118	A052604	2014-12-29	2017-12-28
HP	Synthesized Sweeper	HP 8341B	2624A00116	2016-07-02	2017-07-01
Mini	Amplifier	ZVA-183-S+	5969001149	2016-04-23	2017-04-22
A.H. System	Horn Antenna	SAS-200/571	135	2015-08-18	2018-08-17
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2015-10-22	2016-10-22
Ducommun technologies	RF Cable	104PEA	218124002	2015-10-22	2016-10-22
Ducommun technologies	RF Cable	RG-214	1	2016-05-06	2017-05-06
Ducommun technologies	RF Cable	RG-214	2	2016-05-06	2017-05-06
COM POWER	Dipole Antenna	AD-100	041000	2015-08-18	2016-08-18

*** 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:	23 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Rocky Kang on 2016-07-15.

Test Mode: Transmitting

30 MHz – 2 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 155.75MHz 6.25kHz										
311.5	40.70	218	1.4	H	-56.3	0.36	0	-56.66	-25	31.66
311.5	38.02	312	2.4	V	-59.0	0.36	0	-59.36	-25	34.36
1401.75	51.51	116	1.6	H	-56.9	1.20	6.40	-51.70	-25	26.70
1401.75	49.73	69	2.1	V	-58.7	1.20	6.40	-53.50	-25	28.50
Analog Modulation 155.75MHz, Channel Spacing 12.5k										
311.5	38.98	244	1.5	H	-58.0	0.36	0	-58.36	-20	38.36
311.5	36.42	117	1.2	V	-60.6	0.36	0	-60.96	-20	40.96
1246.00	48.63	338	1.3	H	-58.5	1.50	6.20	-53.80	-20	33.80
1246.00	49.58	355	2.0	V	-58.8	1.50	6.20	-54.10	-20	34.10
Digital Modulation 155.75MHz, Channel Spacing 12.5k										
311.5	37.48	220	2.3	H	-59.5	0.36	0	-59.86	-20	39.86
311.5	35.55	354	1.5	V	-61.5	0.36	0	-61.86	-20	41.86
1246	46.58	173	1.5	H	-60.6	1.5	6.2	-60.60	-20	40.60
1246	47.13	101	2.2	V	-61.3	1.5	6.2	-61.30	-20	41.30

Note:
Absolute Level = SG Level - Cable loss + Antenna Gain
Margin = Limit- Absolute Level

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FCC §2.1055 & §90.213- FREQUENCY STABILITY

Applicable Standard

FCC §2.1055 and §90.213

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 Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Hewlett-Packard	Frequency Counter	5343A	2232A00827	2016-05-09	2019-05-08
ESPEC	Temperature & Humidity Chamber	EL-10KA	09107726	2015-11-01	2016-10-31
Ducommun technologies	RF Cable	RG-214	3	2016-05-06	2017-05-06
JFW	30dB Attenuator	50FH-030-100 RF	170006716507	2016-06-12	2017-06-12
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 Data

Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Rocky Kang on 2016-07-14.

Test Mode: Transmitting

For Analog Modulation

Reference Frequency: 155.75 MHz, Limit: ±5.0 ppm, 12.5 kHz			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Power Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	12.0	155.749993	-0.044
40	12.0	155.749982	-0.114
30	12.0	155.749996	-0.027
20	12.0	155.749998	-0.014
10	12.0	155.749999	-0.007
0	12.0	155.749980	-0.126
-10	12.0	155.749989	-0.070
-20	12.0	155.749982	-0.119
-30	12.0	155.749995	-0.032
Frequency Stability versus Input Voltage			
20	9.5	155.749989	-0.070

For Digital Modulation

Reference Frequency: 155.75 MHz, Limit: ±5.0 ppm, 12.5 kHz			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (℃)	Power Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
50	12.0	155.749983	-0.112
40	12.0	155.749983	-0.108
30	12.0	155.749989	-0.071
20	12.0	155.749994	-0.037
10	12.0	155.749988	-0.077
0	12.0	155.749993	-0.045
-10	12.0	155.749986	-0.091
-20	12.0	155.749985	-0.094
-30	12.0	155.749983	-0.107
Frequency Stability versus Input Voltage			
20	9.5	155.749985	-0.094

FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

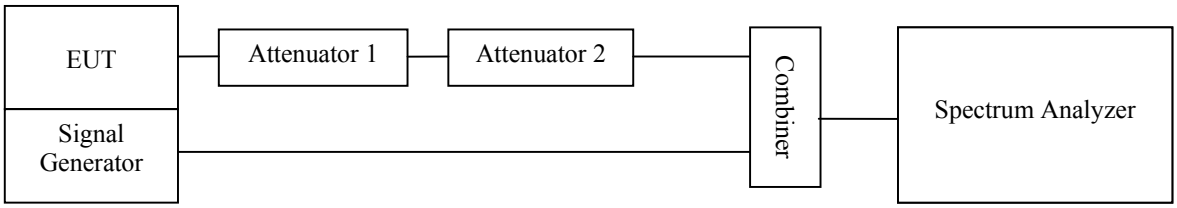
Applicable Standard

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

Test 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 Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2016-04-14	2017-04-14
HP	RF Communication Test Set	8920A	3325U00859	2016-05-07	2017-06-02
Ducommun technologies	RF Cable	RG-214	3	2016-06-15	2017-05-07
JFW	30dB Attenuator	50FH-030-100 RF	170006716507	2016-06-12	2017-06-12

*** 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:	23 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Rocky Kang on 2016-07-16.

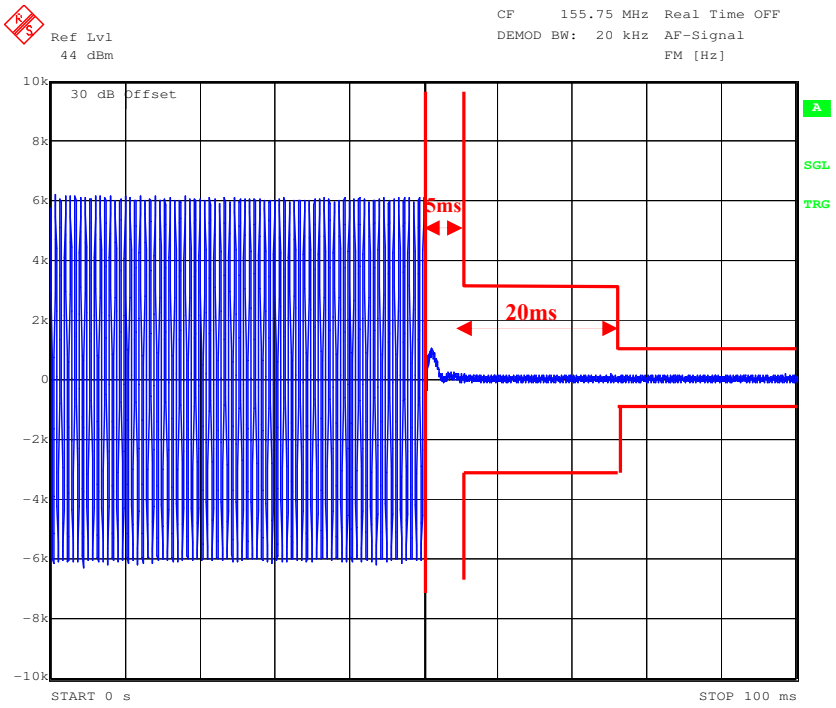
Test Mode: Transmitting

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	
6.25	5 (t1)	<+/-6.25 kHz	
	20(t2)	<+/-3.125 kHz	
	5 (t3)	<+/-6.25 kHz	

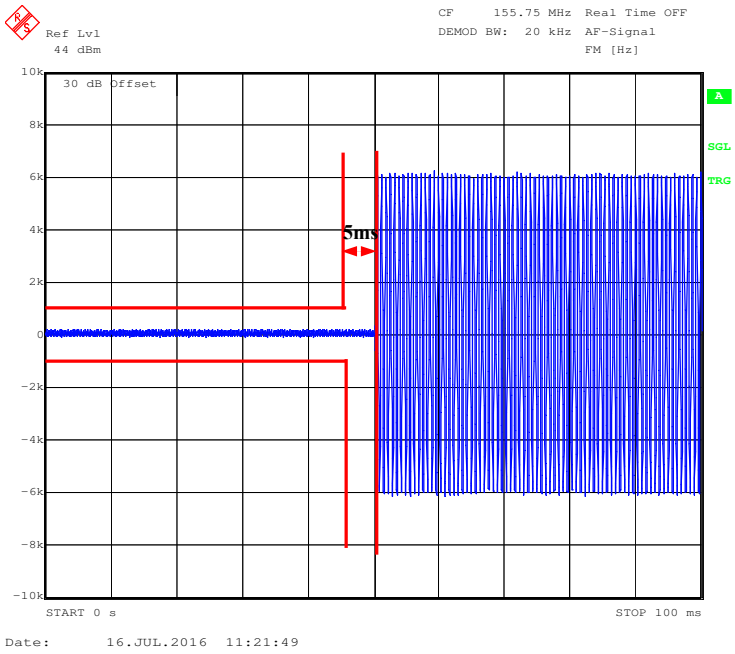
Please refer to the following plots.

Channel Spacing 6.25 kHz

Turn on

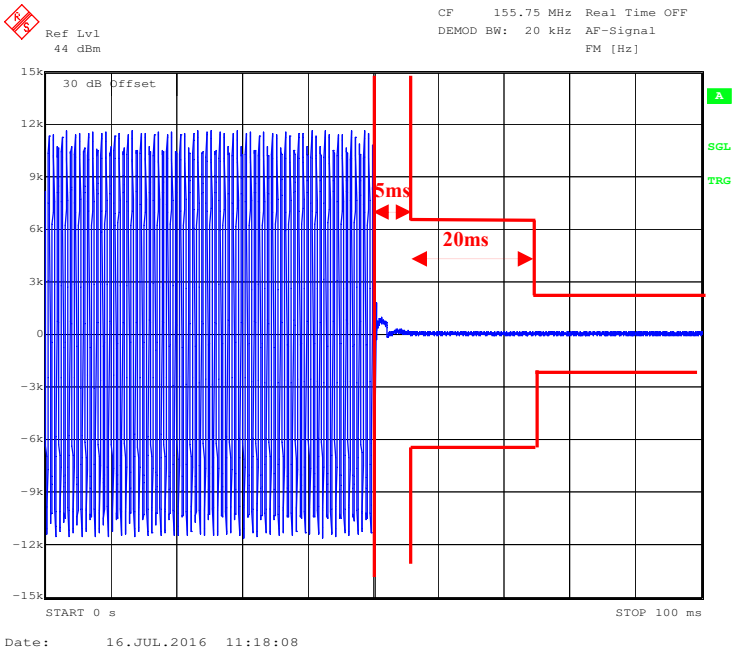


Turn off

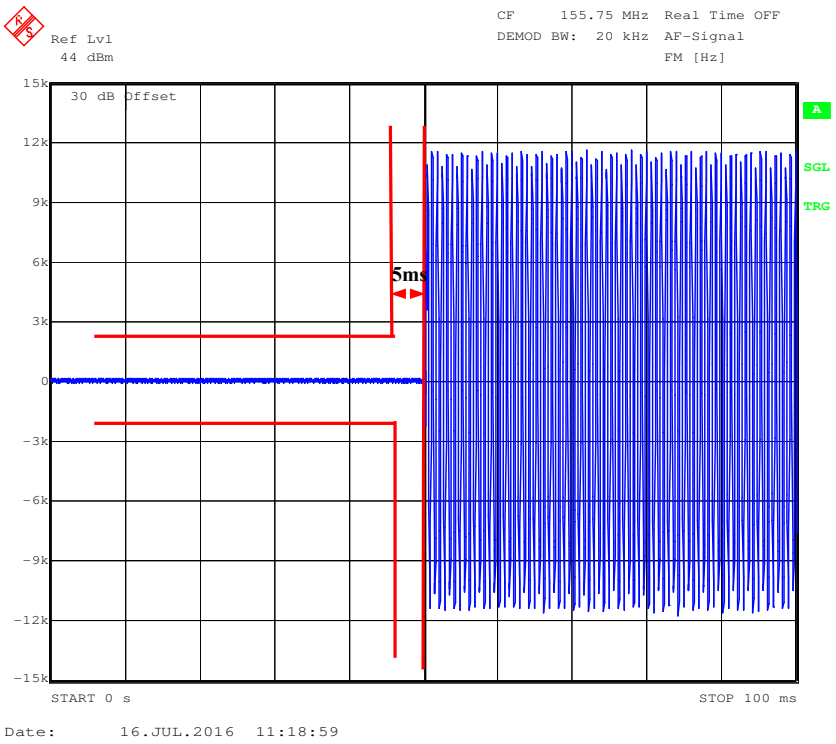


Channel Spacing 12.5 kHz

Turn on



Turn off



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