FCC TEST REPORT

Product Name:	WIRELESS INTERCOM SYSTERM
Trade Mark:	TekeyTBox
Model No.:	TK-708
Report Number:	171028001RFC-1
Test Standards:	FCC 47 CFR Part 95 FCC 47 CFR Part 2
FCC ID:	2AN74-TK708
Test Result:	PASS
Date of Issue:	November 25, 2017

Prepared for:

Guangxi Qinzhou Hua Jun Trading Co., Ltd.
No. 40, West Lane, ShaWei, Qinzhou City, Guangxi Province, China

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
16/F, Block A, Building 6, Baoneng Science and Technology Park,
Qingxiang Road No.1, Longhua New District, Shenzhen, China
TEL: +86-755-2823 0888
FAX: +86-755-2823 0886

Tested by: Kevin Liang
Senior Engineer

Reviewed by: Jim Long
Senior Supervisor

Approved by: Billy Li
Technical Director

Date: November 25, 2017

UnionTrust Laboratories * Certified *

Version

Version No.	Date	Description
V1.0	November 25, 2017	Original

CONTENTS

1. GENERAL INFORMATION 4
   1.1 CLIENT INFORMATION 4
   1.2 EUT INFORMATION 4
      1.2.1 GENERAL DESCRIPTION OF EUT 4
      1.2.2 DESCRIPTION OF ACCESSORIES 4
   1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD 5
   1.4 EUT CHANNEL LIST 5
   1.5 DESCRIPTION OF SUPPORT UNITS 5
   1.6 TEST LOCATION 5
   1.7 TEST FACILITY 6
   1.8 DEVIATION FROM STANDARDS 6
   1.9 ABNORMALITIES FROM STANDARD CONDITIONS 6
   1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER 6
   1.11 MEASUREMENT UNCERTAINTY 6
2. TEST SUMMARY 7
3. EQUIPMENT LIST 8
4. TEST CONFIGURATION 9
   4.1 ENVIRONMENTAL CONDITIONS FOR TESTING 9
      4.1.1 NORMAL OR EXTREME TEST CONDITIONS 9
   4.2 TEST CHANNELS 9
   4.3 EUT TEST STATUS 9
   4.4 SYSTEM TEST CONFIGURATION 10
5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION 11
   5.1 REFERENCE DOCUMENTS FOR TESTING 11
   5.2 MAXIMUM TRANSMITTER POWER (EFFECTIVE RADIATED POWER) 11
   5.3 MODULATION LIMIT 13
   5.4 AUDIO FREQUENCY RESPONSE 14
   5.5 AUDIO LOW PASS FILTER RESPONSE 15
   5.6 FREQUENCY STABILITY 16
   5.7 EMISSION BANDWIDTH 17
   5.8 EMISSION MASK 20
   5.9 TRANSMITTER RADIATED SPURIOUS EMISSION 22

APPENDIX 1 PHOTOS OF TEST SETUP 35
APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS 35

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Guangxi Qinzhou Hua Jun Trading Co., Ltd.
Address of Applicant:	No. 40, West Lane, ShaWei, Qinzhou City, Guangxi Province, China
Manufacturer:	Guangxi Qinzhou Hua Jun Trading Co., Ltd.
Address of Manufacturer:	No. 40, West Lane, ShaWei, Qinzhou City, Guangxi Province, China

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	WIRELESS INTERCOM SYSTERM
Model No.:	TK-708
Add. Model No.:	N/A
Trade Mark:	TekeyTBox
DUT Stage:	Identical Prototype
Sample Received Date:	October 28, 2017
Sample Tested Date:	October 29, 2017 to November 17, 2017

1.2.2 Description of Accessories

Adapter	
Trade Mark:	KeZhen
Model No.:	KZ0501000
Input:	100-240 V~50/60 Hz 0.3 A Max
Output:	5.0 V ⎓ 1 A
AC Cable:	N/A
DC Cable:	1.87 Meter, Shielded with one ferrite

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Range:	GMRS/FRS:	462.5875 MHz to 462.7250 MHz
	FRS:	467.5625 MHz to 467.6125 MHz
Rated Output Power:	GMRS/FRS:	0.5W(27dBm)
Modulation Type:	GMRS/FRS:	FM
Emission Type:	GMRS/FRS:	F3E
Channel Separation:	GMRS/FRS:	12.5 KHz
Emission Designator:	GMRS/FRS:	5K44F3E
Maximum Transmitter Power (ERP):	GMRS/FRS:	14.4dBm
Number of Channels:	10	
Antenna Type:	External Antenna	
Normal Test Voltage:	120 Vac	
Extreme Test Voltage:	102 to 138 Vdc	
Extreme Test Temperature:	-30 °C to +55 °C	
Note 1: The EUT only supports voice communication.		

1.4 EUT CHANNEL LIST

Operation Frequency Each of Channel					
GMRS		**GMRS/FRS**		**FRS**	
Channel	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**
1	462.7250 MHz	2	462.5875 MHz	8	467.5625 MHz
--	--	3	462.6125 MHz	9	467.5875 MHz
--	--	4	462.6375 MHz	0	467.6125 MHz
--	--	5	462.6625 MHz	--	--
--	--	6	462.6875 MHz	--	--
--	--	7	462.7125 MHz	--	--

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested independently

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
-	-	-	-	-

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	SMA	0.30 Meter	UnionTrust

1.6 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China 518109
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

IC-Registration No.: 21600-1
The 3m Semi-anechoic chamber of Shenzhen UnionTrust Quality and Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 21600-1.

A2LA-Lab Certificate No.: 4312.01
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC Accredited Lab.
Designation Number: CN1194
Test Firm Registration Number: 259480

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Radiated Spurious emissions 30MHz-1GHz	±4.5 dB
2	Radiated Spurious emissions 1GHz-18GHz	±4.4 dB

2. TEST SUMMARY

FCC 47 CFR Part 95 Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Maximum Transmitter Power	FCC 47 CFR Part 95.639(a)&(d) FCC 47 CFR Part 2.1046(a)	ANSI/TIA-603-E-2016	PASS
Modulation Limit	FCC 47 CFR Part 95.637(a) FCC 47 CFR Part 2.1047(a)(b)	ANSI/TIA-603-E-2016	PASS
Audio Frequency Response	FCC 47 CFR Part 95.637(a) FCC 47 CFR Part 2.1047(a)	ANSI/TIA-603-E-2016	PASS
Audio Low Pass Filter Response	FCC 47 CFR Part 95.637(b)	ANSI/TIA-603-E-2016	PASS
Emission Bandwidth	FCC 47 CFR Part 95.633(a)&(c)	ANSI/TIA-603-E-2016	PASS
Emission Mask	FCC 47 CFR Part 95.635(b)(1)(3)(7)	ANSI/TIA-603-E-2016	PASS
Transmitter Radiated Spurious Emission	FCC 47 CFR Part 95.635(b)(7)	ANSI/TIA-603-E-2016	PASS
Spurious Emission On Antenna Port	FCC 47 CFR Part 95.635(b)(7)	ANSI/TIA-603-E-2016	N/A
Frequency Stability	FCC 47 CFR Part 95.626(b) FCC 47 CFR Part 2.1055 (a)(1)	ANSI/TIA-603-E-2016	PASS
Note: 1) N/A: In this whole report not application.			

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☑	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	N/A	Dec. 20, 2015	Dec. 19, 2018
☑	Receiver	R&S	ESIB26	100114	Dec. 22, 2016	Dec. 22, 2017
☐	Loop Antenna	ETS-LINDGREN	6502	00202525	Jun. 24, 2015	Jun. 23, 2018
☑	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Jul. 24, 2015	Jul. 23, 2018
☑	Preamplifier	HP	8447F	2805A02960	Dec. 22, 2016	Dec. 22, 2017
☑	Broadband Antenna (Pre-amplifier)	ETS-LINDGREN	3142E-PA	00201891	Dec. 30, 2016	Dec. 30, 2017
☑	Horn Antenna	ETS-LINDGREN	3117	00164202	Jul. 24, 2015	Jul. 23, 2018
☑	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	Dec. 30, 2016	Dec. 30, 2017
☐	Horn Antenna	ETS-LINDGREN	3116C	00200180	Jul. 28, 2015	Jul. 27, 2018
☐	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Jul. 29, 2015	Jul. 28, 2018
☑	MXG X-Series RF Vector Signal Generator	KEYSIGHT	N5182B	MY51350267	Jan. 08, 2016	Jan. 07, 2018
☑	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☑	Test Software	Audix	e3	Software Version: 9.160323		

Conducted RF test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☑	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Dec. 22, 2016	Dec. 22, 2017
☑	Receiver	R&S	ESR7	1316.3003K07 -101181-K3	Dec. 22, 2016	Dec. 22, 2017
☑	RF Communication Test set	HP	8920A	3438A05165	Nov. 2, 2017	Nov. 1, 2018

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Test Environment	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (Vac)	Relative Humidity (%)
TN/VN	+15 to +35	120	20 to 75
TL/VL	-30	102	20 to 75
TH/VL	+55	102	20 to 75
TL/VH	-30	138	20 to 75
TH/VH	+55	138	20 to 75

Remark:

1) The EUT just work in such extreme temperature of -30 °C to +55 °C and the extreme voltage of 102 V to 138 V, so here the EUT is tested in the temperature of -30 °C to +55 °C and the voltage of 102 V to 138 V.
2) VN: Normal Voltage; TN: Normal Temperature;
TL: Low Extreme Test Temperature; TH: High Extreme Test Temperature;
VL: Low Extreme Test Voltage; VH: High Extreme Test Voltage.

4.2 TEST CHANNELS

Operation Mode	Frequency Range	Test RF Channel Lists		
GMRS/FRS	462.5875 MHz to 462.7250 MHz	**Lowest**	**Middle**	**Highest**
		Channel 2	Channel 4	Channel 7
		462.5875 MHz	462.6375 MHz	462.7125 MHz
FRS	467.5625 MHz to 467.6125 MHz	**Lowest**	**Middle**	**Highest**
		Channel 8	Channel 9	Channel 0
		467.5625 MHz	467.5875 MHz	467.6125 MHz

4.3 EUT TEST STATUS

Mode	Description
GMRS/FRS	1. Keep the EUT in continuously transmitting with modulation or single carrier test single.

4.4 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by a 120Vac. Only the worst case data were recorded in this test report.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. Video bandwidth was 3 times greater than resolution bandwidth.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 30 MHz to the tenth harmonic of the highest fundamental frequency. The spurious emissions more than 20 dB below the permissible value are not reported.

5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2 Subpart J	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 95	Personal Radio Service
3	ANSI/TIA-603-E-2016	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

5.2 MAXIMUM TRANSMITTER POWER (EFFECTIVE RADIATED POWER)

Test Requirement: FCC 47 CFR Part 95.639(a)&(d)
FCC 47 CFR Part 2.1046(a)

Test Method: ANSI/TIA-603-E-2016, Section 2.2.17

Limit:

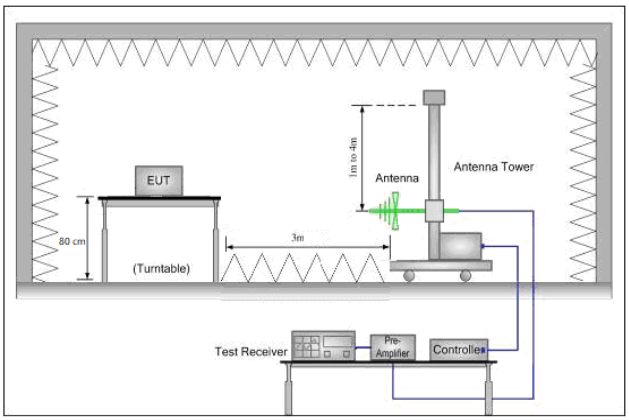
1. For GMRS transmitter, under any condition of modulation, transmits with no more than 5 watts ERP.
2. For FRS transmitter, under any condition of modulation, transmits with no more than 0.5 watts ERP.

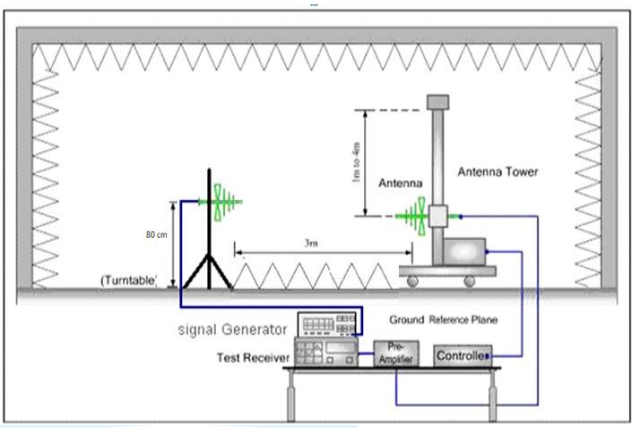
Test Procedure:

Test procedure as below:

1) EUT was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made. The radiated emission measurements of all transmit frequencies in all channels were measured with peak detector.
2) A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3) The EUT is then put into continuously transmitting mode at its maximum power level during the test.Set Test Receiver or Spectrum RBW=100kHz,VBW=300kHz for 30MHz to 1GHz, And the maximum value of the receiver should be recorded as (Pr).
4) The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5) A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test.
   The measurement results are obtained as described below: Power(EIRP)=PMea- PAg - Pcl - Ga
   The measurement results are amend as described below:
   Power(EIRP)=PMea- Pcl - Ga
6) This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7) ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.
8) Test the EUT in the lowest channel, the middle channel the Highest channel

Test Setup:





Instruments Used: Refer to section 3 for details

Test Mode: Unmodulated Transmitter mode

Test Results: Refer to APPENDIX A.

5.3 MODULATION LIMIT

Test Requirement: FCC 47 CFR Part 95.637(a)

Test Method: ANSI/TIA-603-E-2016, Section 2.2.3

Limit:

1. A GMRS transmitter that transmits emission types F1D, G1D, F3E or G3E must not exceed a peak frequency deviation of plus or minus 5 kHz.
2. A FRS unit that transmits emission type F3E must not exceed a peak frequency deviation of plus or minus 2.5 kHz, and the audio frequency response must not exceed 3.125 kHz.

Test Procedure:

a) Connect the equipment as illustrated.

b) Adjust the transmitter per the manufacturer's procedure for full rated system deviation.

c) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤0.25 Hz to ≥15,000 Hz. Turn the de-emphasis function off.

d) Apply a 1000 Hz modulating signal to the transmitter from the audio frequency generator, and adjust the level to obtain 60% of full rated system deviation.

e) Increase the level from the audio frequency generator by 20 dB in one step (rise time between the 10% and 90% points shall be 0.1 second maximum).

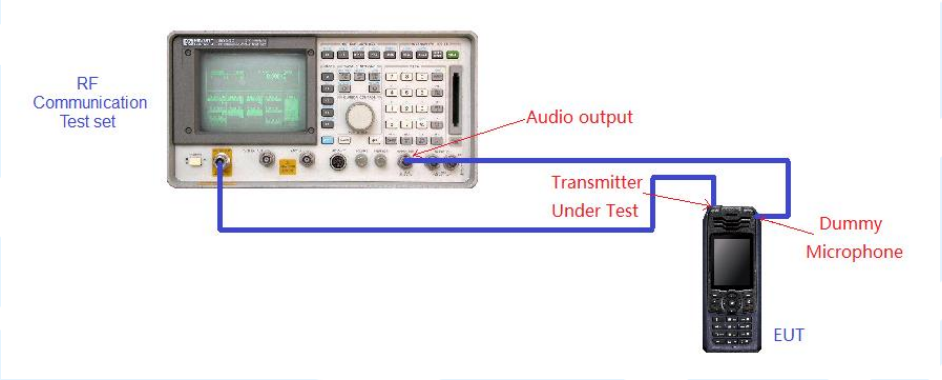
f) Measure both the instantaneous and steady-state deviation at and after the time of increasing the audio input level.

g) With the level from the audio frequency generator held constant at the level obtained in step e), slowly vary the audio frequency from 300 Hz to 3000 Hz and observe the steady-state deviation. Record the maximum deviation.

h) Set the test receiver to measure peak negative deviation and repeat steps d) through g).

i) The values recorded in steps g) and h) are the modulation limiting.

Test Setup:



Instruments Used: Refer to section 3 for details

Test Mode: Modulated Transmitter mode

Test Results: Refer to APPENDIX B.

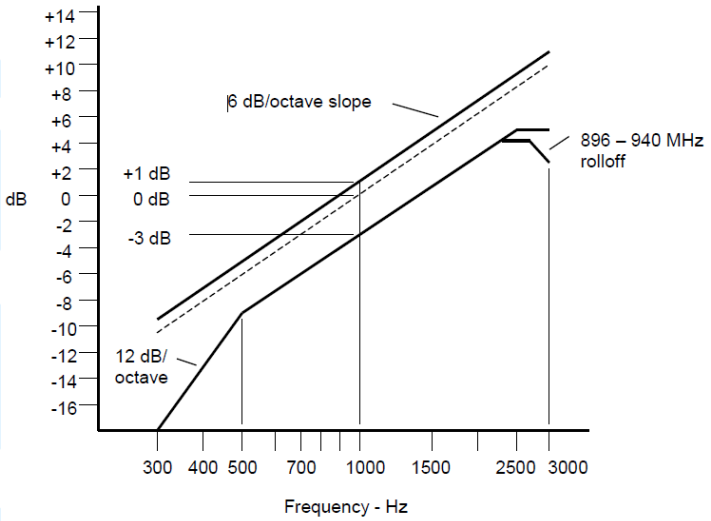
5.4 AUDIO FREQUENCY RESPONSE

Test Requirement: FCC 47 CFR Part 95.637(a)

Test Method: ANSI/TIA-603-E-2016, Section 2.2.6

Limit:

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

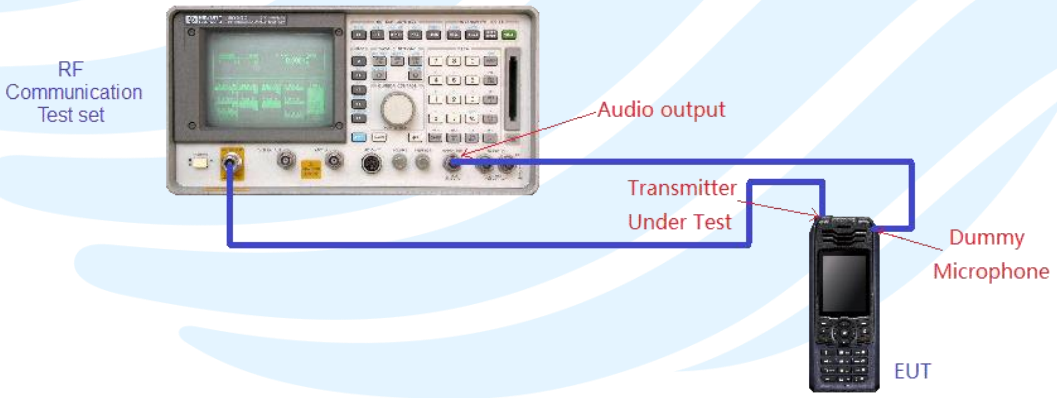


An additional 6 dB per octave attenuation is allowed from 2500 Hz to 3000 Hz in equipment operating in the 25 MHz to 869 MHz range.

Test Procedure:

1) Configure the EUT as shown in figure.
2) Adjust the audio input for 20% of rated system deviation at 1kHz using this level as a reference.
3) Vary the Audio frequency from 300Hz to 3 kHz and record the frequency deviation.
4) Audio Frequency Response =20log10 (V_{FREQ}/V_{REF}).

Test Setup:



Instruments Used: Refer to section 3 for details

Test Mode: Modulated Transmitter mode

Test Results: Refer to APPENDIX C

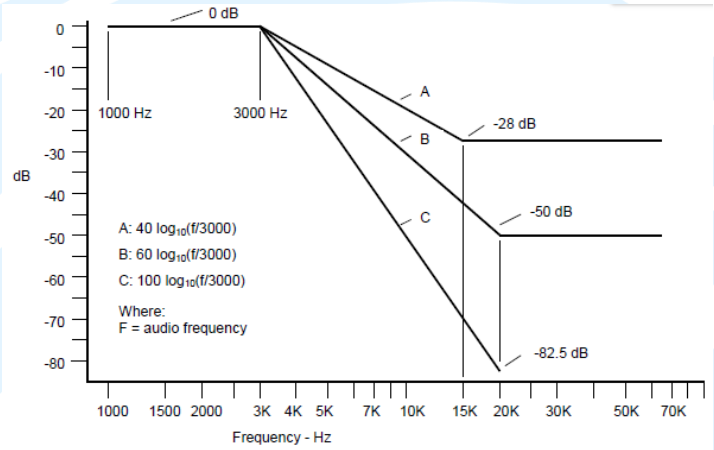
5.5 AUDIO LOW PASS FILTER RESPONSE

Test Requirement: FCC 47 CFR Part 95.637(b)

Test Method: ANSI/TIA-603-E-2016, Section 2.2.15

Limit:

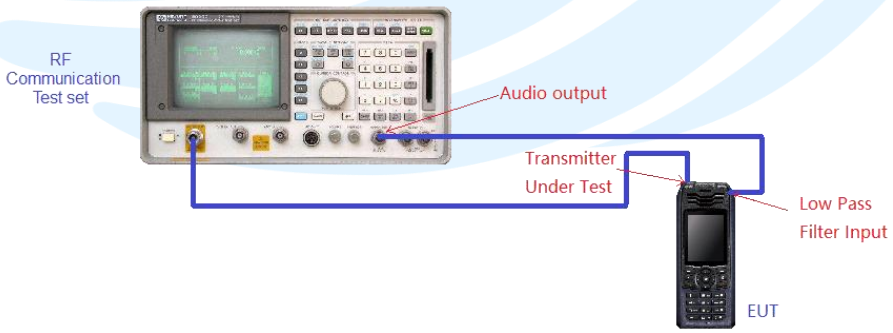
Each GMRS transmitter, except a mobile station transmitter with a power output of 2.5 W or less, must automatically prevent a greater than normal audio level from causing overmodulation. The transmitter also must include audio frequency low pass filtering, unless it complies with the applicable paragraphs of § 95.631 (without filtering.) The filter must be between the modulation limiter and the modulated stage of the transmitter. At any frequency (f in kHz) between 3 and 20 kHz, the filter must have an attenuation of at least 60 log10 (f/3) dB greater than the attenuation at 1 kHz. Above 20 kHz, it must have an attenuation of at least 50 dB greater than the attenuation at 1 kHz.



Test Procedure:

a) Connect the equipment as illustrated.
b) Connect the audio frequency generator as close as possible the input of the post limiter low pass filter within the transmitter under test.
c) Connect the audio spectrum analyzer to the output of the post limiter low pass filter within the transmitter under test.
d) Apply a 1000 Hz tone from the audio frequency generator and adjust the level per manufacturer's specifications.
e) Record the dB level of the 1000 Hz spectral line on the audio spectrum analyzer as LEV_{REF}.
f) Set the audio frequency generator to the desired test frequency between 3000 Hz and the upper low pass filter limit.
g) Record audio spectrum analyzer levels, at the test frequency in step f).
h) Record the dB level on the audio spectrum analyzer as LEV_{FREQ} .
i) Calculate the audio frequency response at the test frequency as:
low pass frequency response = LEV_{FREQ} - LE_{VREF}
j) Repeat steps f) through i) for all the desired test frequencies.

Test Setup:



Instruments Used: Refer to section 3 for details

Test Mode: Transmitter mode

Test Results: Refer to APPENDIX D

5.6 FREQUENCY STABILITY

Test Requirement: FCC 47 CFR Part 95.626(b)

Test Method: ANSI/TIA-603-E-2016, Section 2.2.2

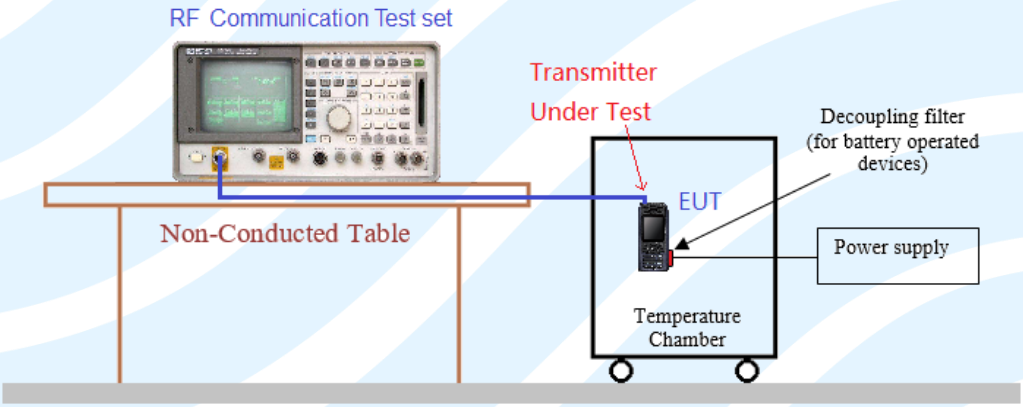
Limit:

Each FRS unit must be maintained within a frequency tolerance of 0.00025% (2.5 ppm).
Each GMRS unit must be maintained within a frequency tolerance of 0.0005% (5 ppm).

Test Procedure:

1. According to FCC Part 2 Section 2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30°C to +50°C centigrade.
2. According to FCC Part 2 Section 2.1055 (d) (2), for battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacture.
3. Vary primary supply voltage from 102 V to 138 V.
4. The EUT was set in the climate chamber and connected to an external DC power supply. The RF output was directly connected to Spectrum Analyzer or RF Communication Test set The coupling loss of the additional cables was recorded and taken in account for all the measurements. After temperature stabilization (approx. 20 min for each stage), the frequency for the lower, the middle and the highest frequency range was recorded. For Frequency stability Vs. Voltage the EUT was connected to a DC power supply and the voltage was adjusted in the required ranges. The result was recorded.

Test Setup:



Instruments Used: Refer to section 3 for details

Test Mode: Unmodulated Transmitter mode

Test Results: Refer to APPENDIX E

5.7 EMISSION BANDWIDTH

Test Requirement: FCC 47 CFR Part 95.633(a)&(c)

Test Method: ANSI/TIA-603-E-2016, Section 2.2.11

Limits:

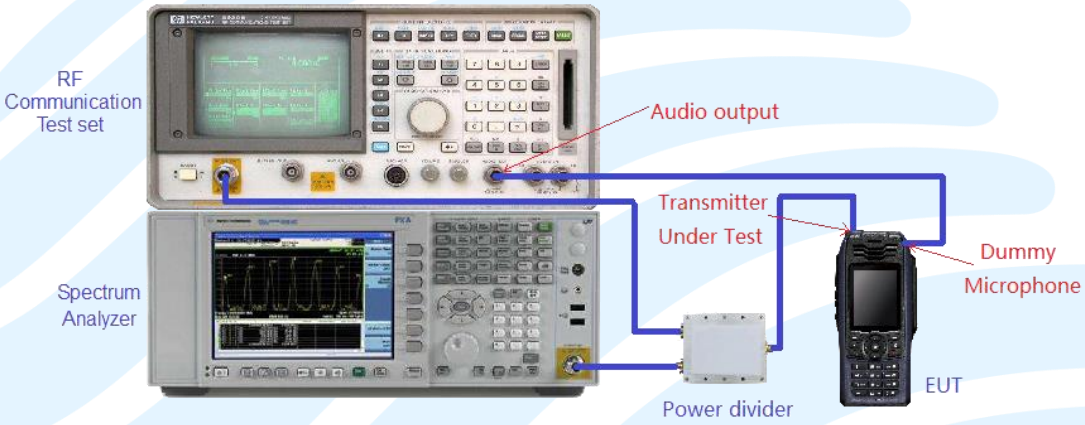
GMRS:

The authorized bandwidth (maximum permissible bandwidth of a transmission) for emission type H1D, J1D, R1D, H3E, J3E or R3E is 4 kHz. The authorized bandwidth for emission type A1D or A3E is 8 kHz. The authorized bandwidth for emission type F1D, G1D, F3E or G3E is 20 kHz.

FRS:

The authorized bandwidth for emission type F3E or F2D transmitted by a FRS unit is 12.5 kHz.

Test Setup:



Test Procedures:

1) The EUT was modulated by 2.5 kHz sine wave audio signal; the level of the audio signal employed is 16dB greater than that necessary to produce 50% of rated system deviation.
   Rated system deviation is 2.5kHz and 5kHz).
2) Spectrum set as follow:
   Centre frequency = fundamental frequency, span=50kHz,
   RBW=100Hz, VBW=300Hz, Sweep = auto, Detector function = peak, Trace = max hold
3) Set 99% Occupied Bandwidth and 26dB Occupied Bandwidth
4) Measure and record the results in the test report.

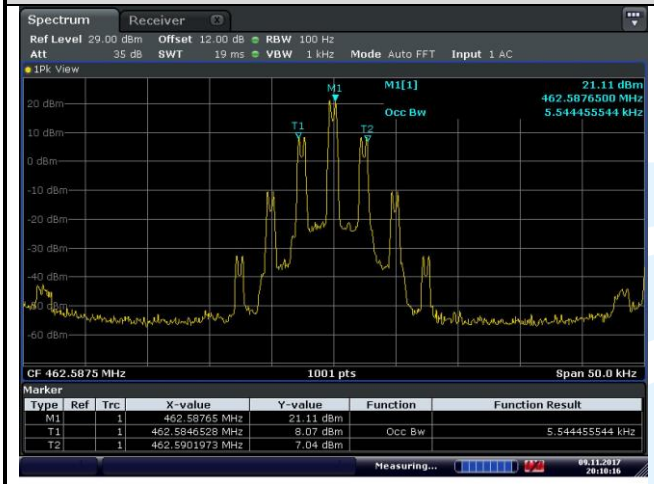
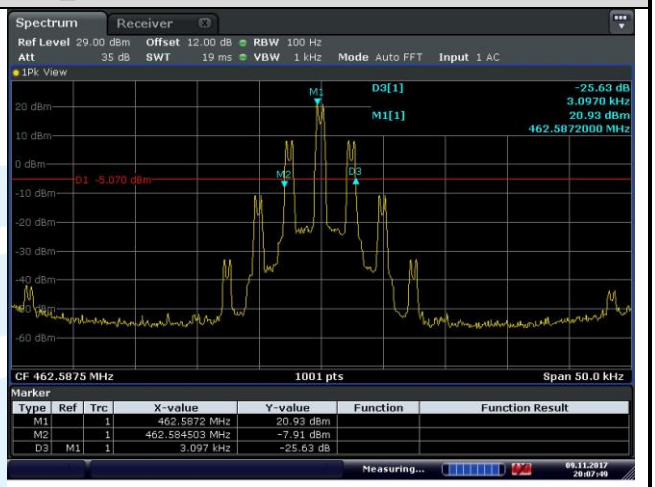
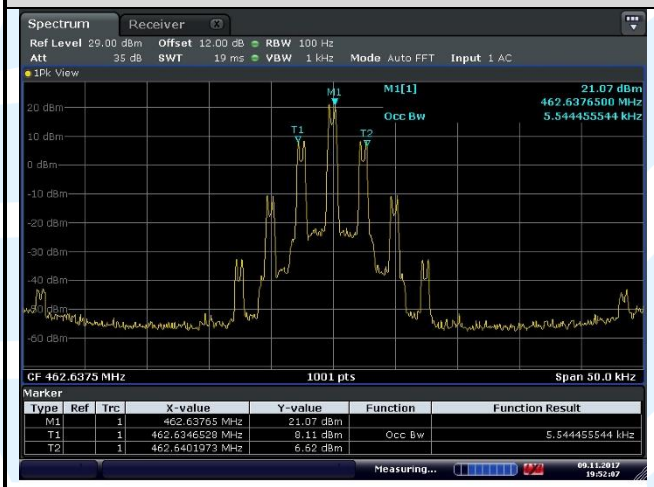
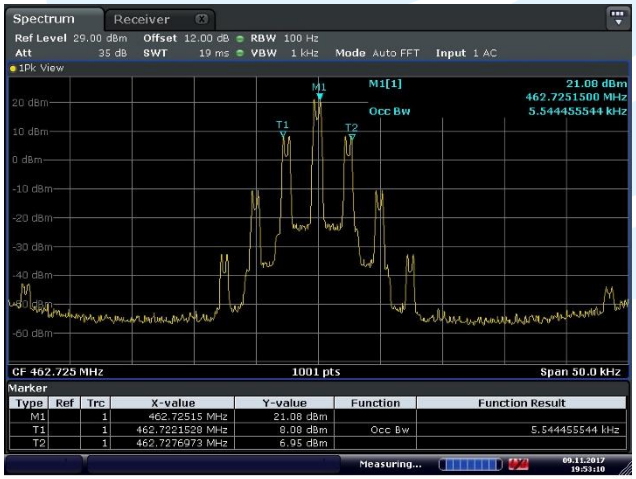
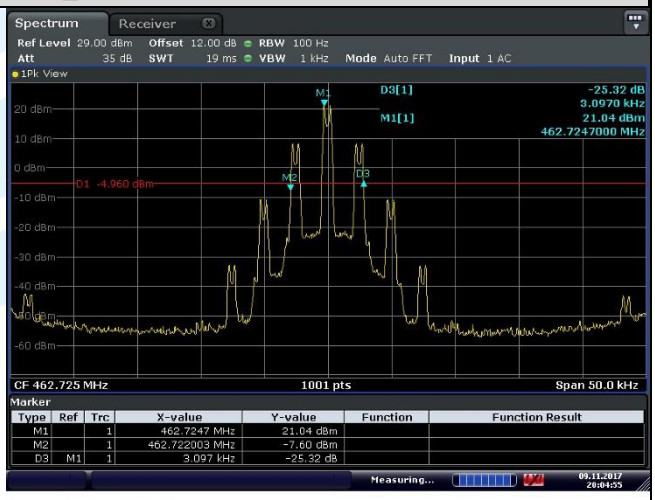
Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

Operation Mode	Channel	Frequency (MHz)	26 dB Bandwidth (KHz)	99% Bandwidth (KHz)	26 dB Bandwidth Limit	Pass / Fail
FRS	2	462.5875	3.097	5.544	≤ 12.5 kHz	Pass
	4	462.6375	3.097	5.544	≤ 12.5 kHz	Pass
	7	462.7125	3.097	5.544	≤ 12.5 kHz	Pass
	8	467.5625	2.647	5.544	≤ 12.5 kHz	Pass
	9	467.5875	3.097	5.544	≤ 12.5 kHz	Pass
	0	467.6125	2.647	5.544	≤ 12.5 kHz	Pass

The test plot as follows:

FRS	
99% Bandwidth	**26 dB Bandwidth**
Lowest Channel_CH2	
	
Middle Channel_CH4	
	
Highest Channel_CH7	
	

FRS

99% Bandwidth	26 dB Bandwidth

Lowest Channel_CH8

Middle Channel_CH9

Highest Channel_CH0

5.8 EMISSION MASK

Test Requirement: FCC 47 CFR Part 95.635(b)(1)(3)(7)

Test Method: ANSI/TIA-603-E-2016, Section 2.2.11

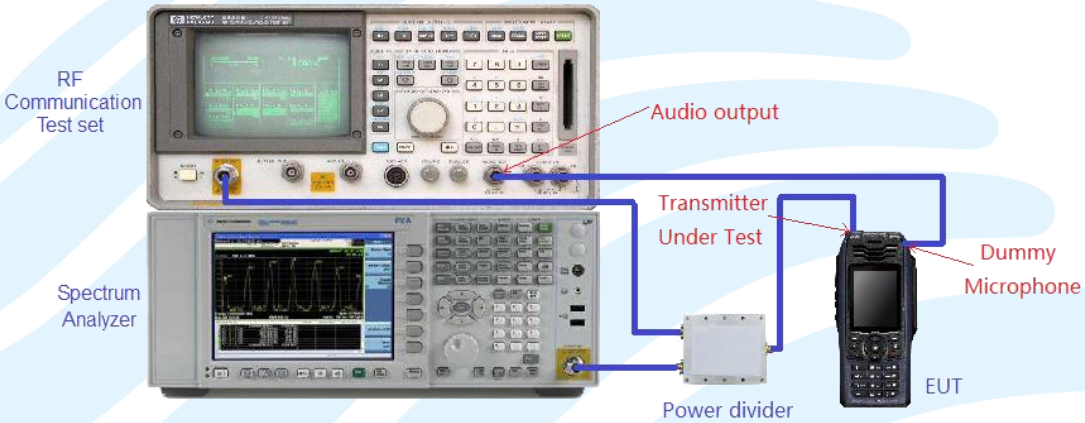
Limits:

(1) At least 25 dB (decibels) on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.

(2) At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.

(3) At least 43 + 10 log10 (T) dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

Test Setup:



Test Procedures:

5) Connect the equipment as illustrated.

6) Spectrum set as follow:
Centre frequency = fundamental frequency, span=125kHz for 12.5kHz channel spacing,
RBW=100Hz, VBW=1000Hz, Sweep = auto, Detector function = peak, Trace = max hold

7) Key the transmitter, and set the level of the unmodulated carrier to a full scale reference line. This is the 0dB reference for the measurement.
Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation (Rated system deviation is 2.5 kHz for 12.5kHz channel spacing).

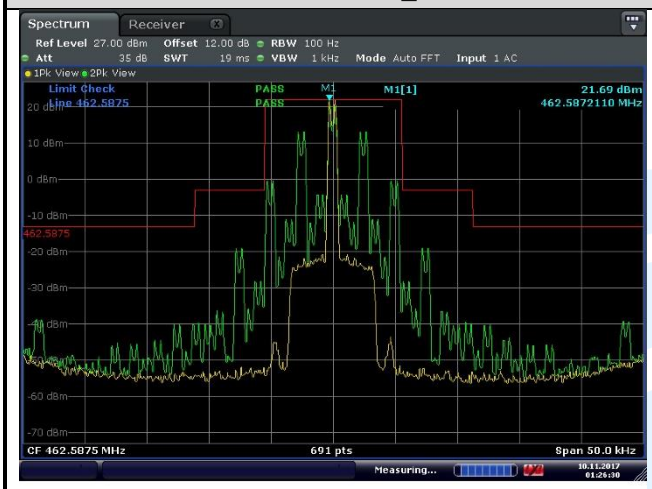
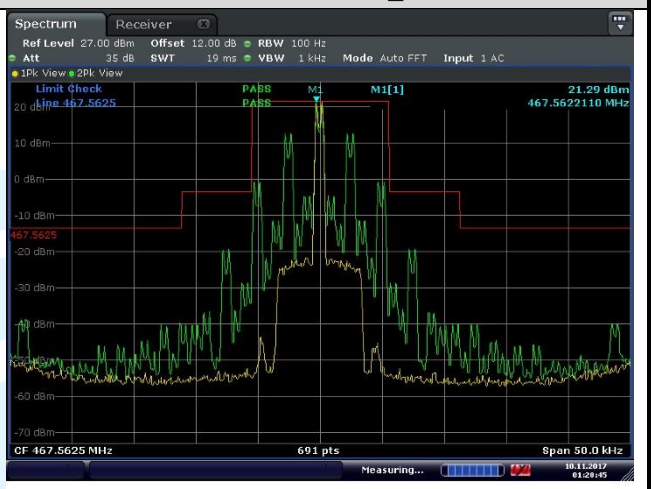
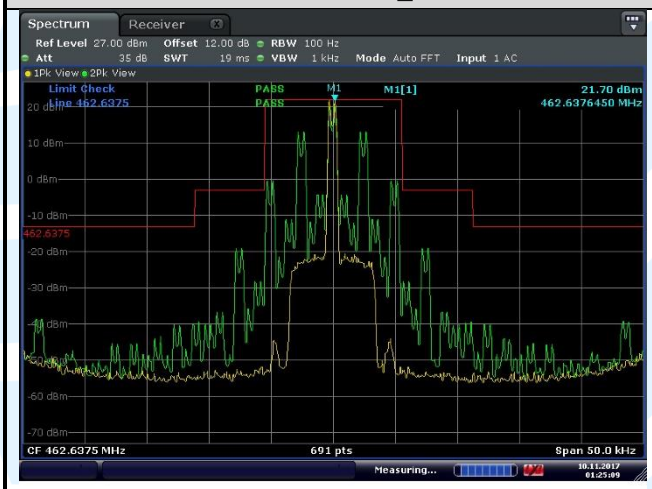
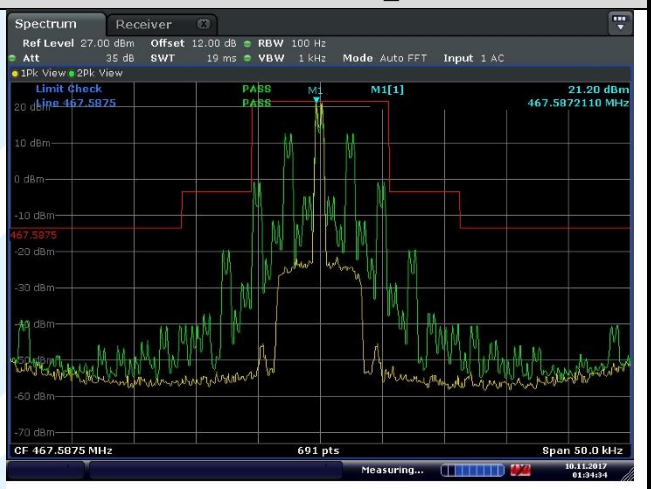
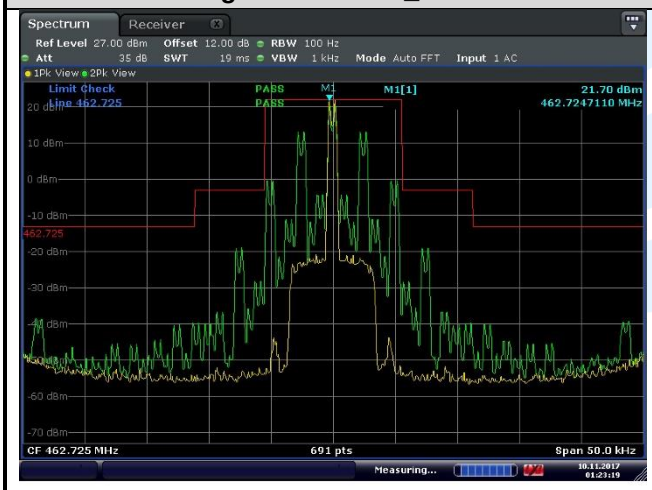
8) The input level shall be established at the frequency of maximum response of the audio modulating circuit. Transmitters employing digital modulation techniques that bypass the limiter and the audio low-pass filter shall be modulated as specified by the manufacturer

9) Measure and record the results in the test report.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

The test plot as follows:

GMRS/FRS	FRS
Lowest Channel_CH2	**Lowest Channel_CH8**
	
Middle Channel_CH4	**Middle Channel_CH9**
	
Highest Channel_CH7	**Highest Channel_CH0**
	

5.9 TRANSMITTER RADIATED SPURIOUS EMISSION

Test Requirement: FCC 47 CFR Part 95.635(b)(7)

Test Method: ANSI/TIA-603-E-2016, Section 2.2.12

Limit:

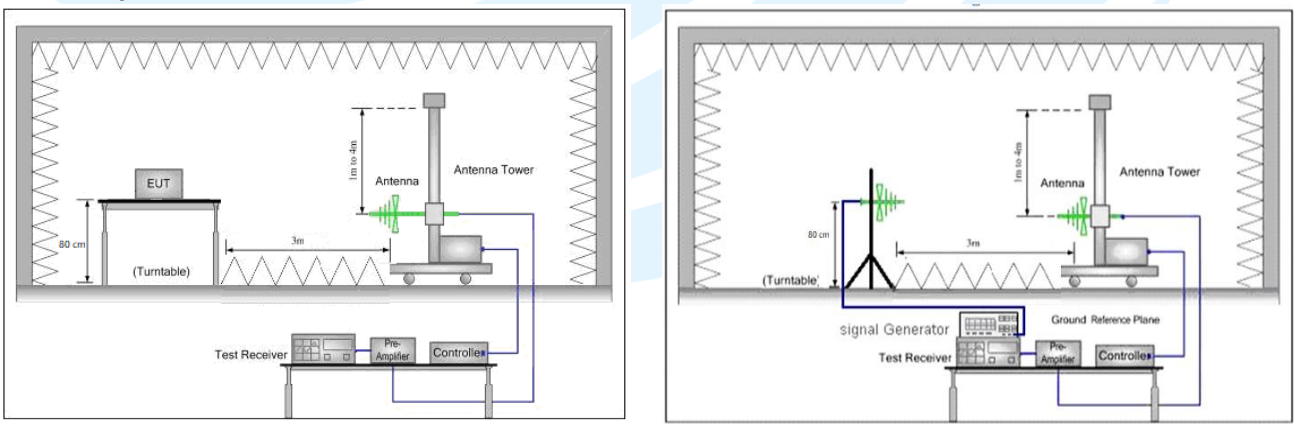
At least 43 + 10 log10 (T) dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

Test Procedure:

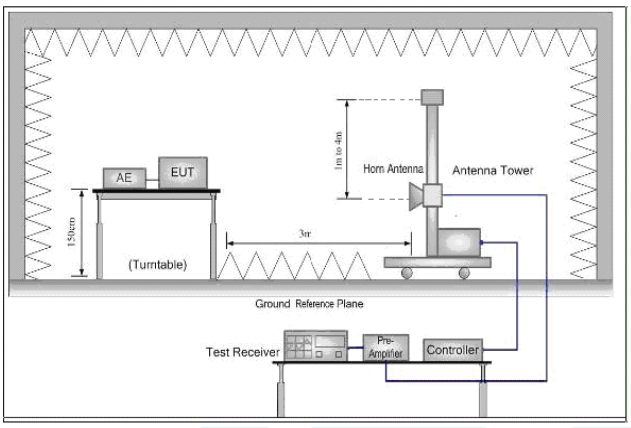
Test procedure as below:

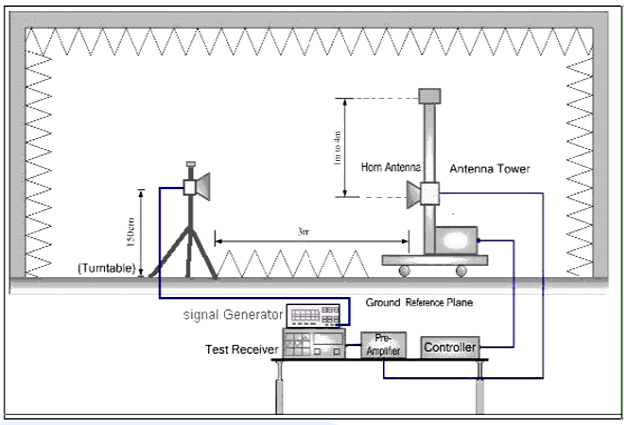
1) EUT was placed on a 0.8 or 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made. The radiated emission measurements of all transmit frequencies in all channels were measured with peak detector.
2) A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3) The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz for above 1GHz and RBW=100kHz,VBW=300kHz for 30MHz to 1GHz, And the maximum value of the receiver should be recorded as (Pr).
4) The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5) A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test.
   The measurement results are obtained as described below: Power(EIRP)=PMea- PAg - Pcl - Ga
   The measurement results are amend as described below:
   Power(EIRP)=PMea- Pcl - Ga
6) This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7) ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.
8) Test the EUT in the lowest channel, the middle channel the Highest channel

Test Setup:



ERP Test Setup





EIRP Test Setup

Instruments Used: Refer to section 3 for details

Test Mode: Unmodulated Transmitter mode

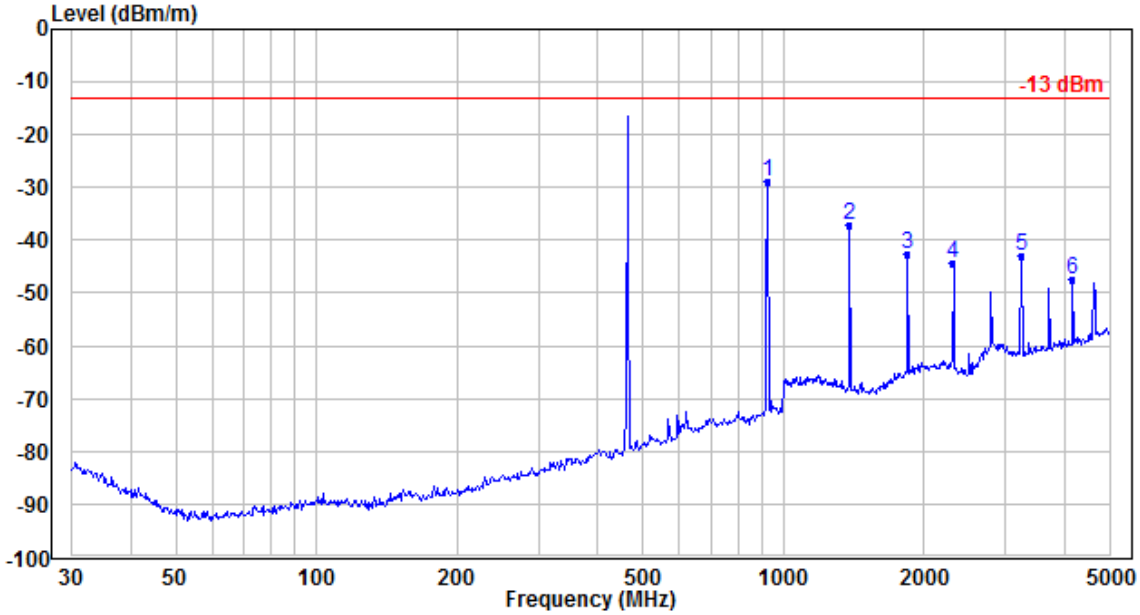
Test Results: Pass

The measurement data as follows:

Spurious emissions test data (30MHz to 5 GHz):

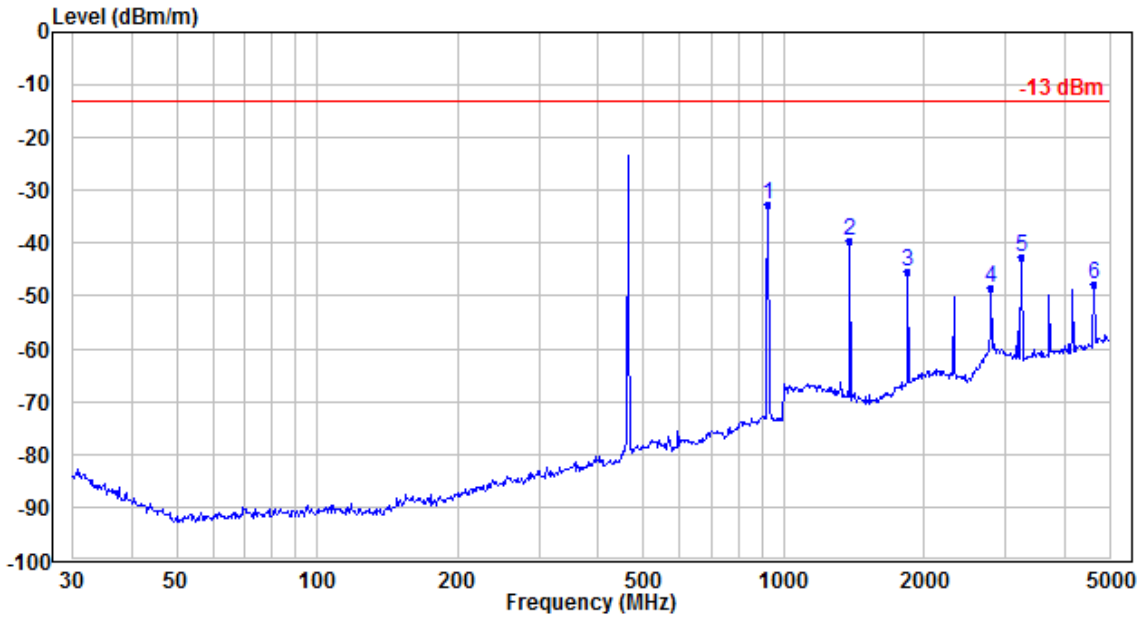
FRS Mode_ Lowest Channel_CH2

Horizontal



No.	Frequency (MHz)	Reading (dBm)	Correction factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	925.613	-38.70	9.70	-29.00	-13.00	16.00	Peak
2	1389.555	-32.42	-4.76	-37.18	-13.00	24.18	Peak
3	1851.576	-42.24	-0.33	-42.57	-13.00	29.57	Peak
4	2313.091	-44.95	0.51	-44.44	-13.00	31.44	Peak
5	3245.418	-46.09	3.06	-43.03	-13.00	30.03	Peak
6	4173.770	-52.31	4.87	-47.44	-13.00	34.44	Peak

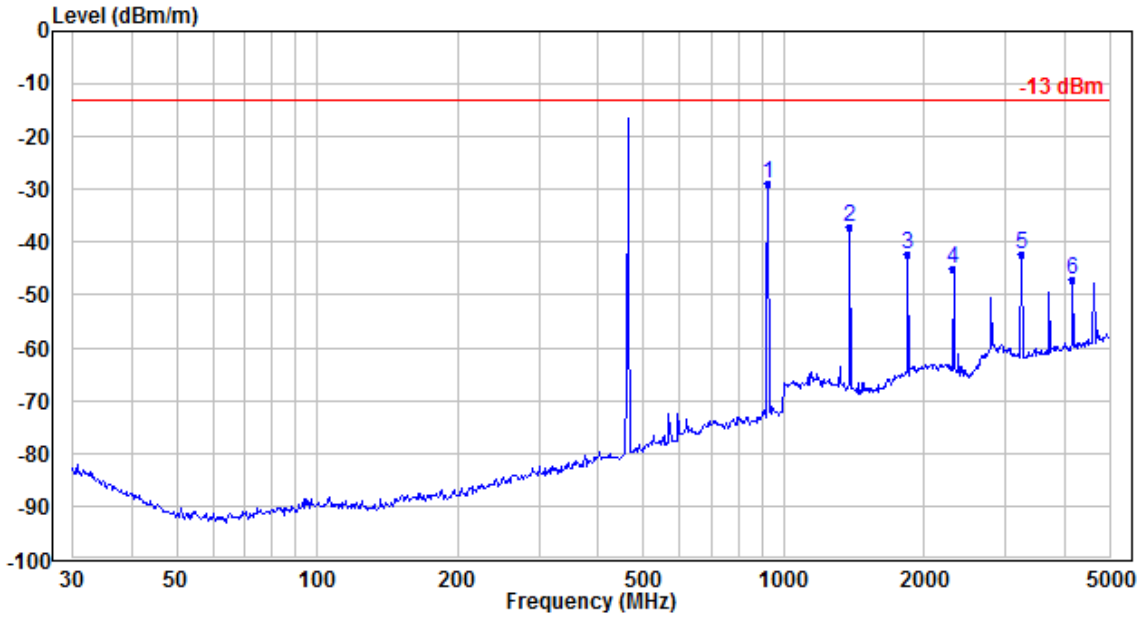
Vertical



No.	Frequency (MHz)	Reading (dBm)	Correction factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	925.613	-42.29	9.57	-32.72	-13.00	19.72	Peak
2	1385.080	-33.50	-5.86	-39.36	-13.00	26.36	Peak
3	1851.576	-43.69	-1.68	-45.37	-13.00	32.37	Peak
4	2779.938	-54.50	6.05	-48.45	-13.00	35.45	Peak
5	3234.967	-45.37	2.76	-42.61	-13.00	29.61	Peak
6	4627.562	-52.17	4.57	-47.60	-13.00	34.60	Peak

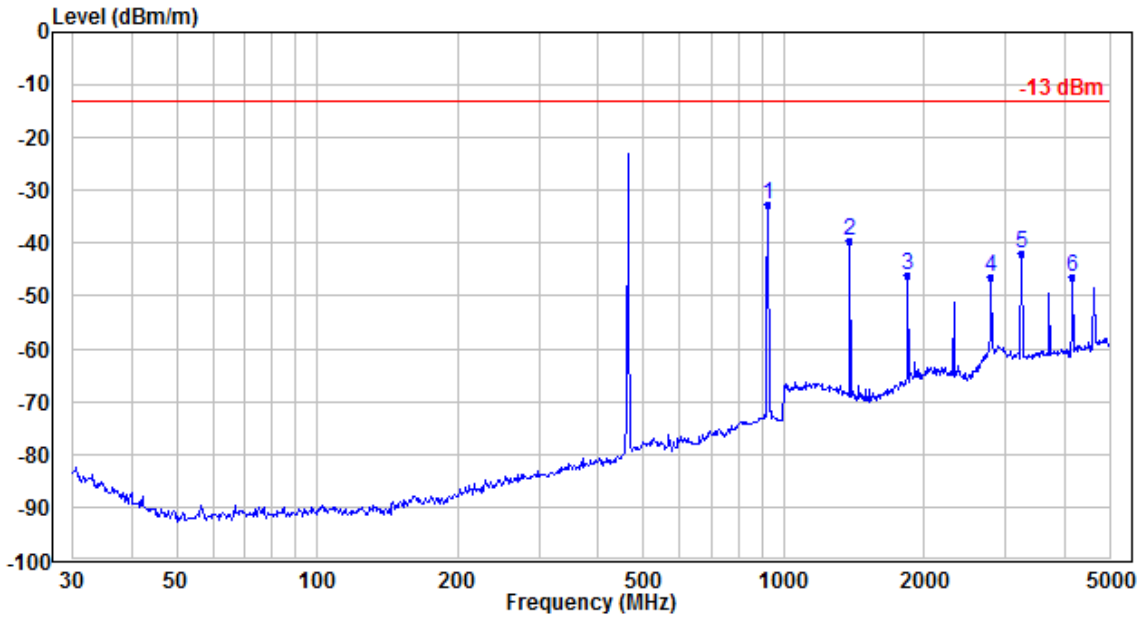
FRS Mode_ Middle Channel_CH4

Horizontal



No.	Frequency (MHz)	Reading (dBm)	Correction factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	925.613	-38.58	9.70	-28.88	-13.00	15.88	Peak
2	1385.080	-32.22	-4.75	-36.97	-13.00	23.97	Peak
3	1851.576	-41.86	-0.33	-42.19	-13.00	29.19	Peak
4	2313.091	-45.54	0.51	-45.03	-13.00	32.03	Peak
5	3245.418	-45.26	3.06	-42.20	-13.00	29.20	Peak
6	4173.770	-52.10	4.87	-47.23	-13.00	34.23	Peak

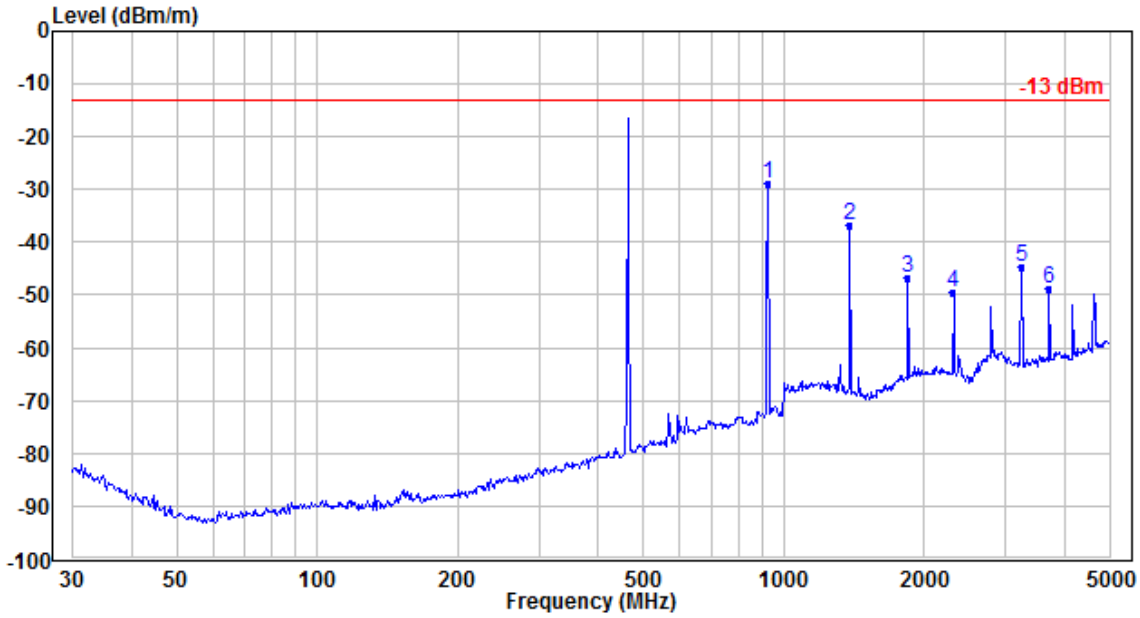
Vertical



No.	Frequency (MHz)	Reading (dBm)	Correction factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	925.613	-42.05	9.57	-32.48	-13.00	19.48	Peak
2	1389.555	-33.59	-5.87	-39.46	-13.00	26.46	Peak
3	1851.576	-44.37	-1.68	-46.05	-13.00	33.05	Peak
4	2779.938	-52.48	6.05	-46.43	-13.00	33.43	Peak
5	3245.418	-44.53	2.76	-41.77	-13.00	28.77	Peak
6	4173.770	-50.27	3.94	-46.33	-13.00	33.33	Peak

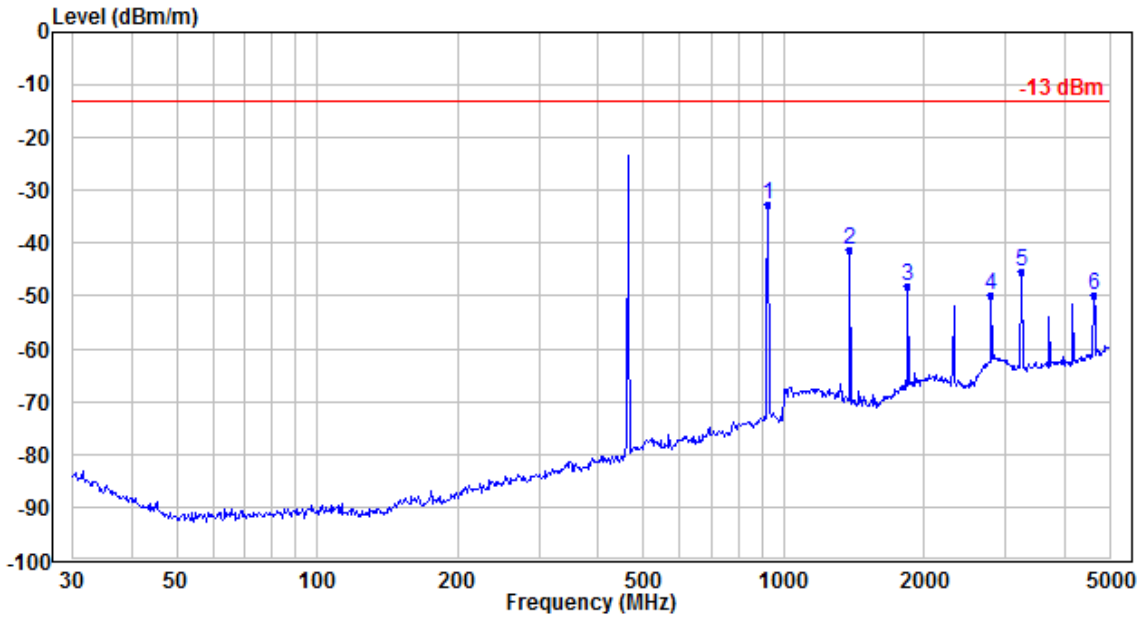
FRS Mode_ Highest Channel_CH7

Horizontal



No.	Frequency (MHz)	Reading (dBm)	Correction factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	925.613	-38.46	9.70	-28.76	-13.00	15.76	Peak
2	1389.555	-31.97	-4.76	-36.73	-13.00	23.73	Peak
3	1851.576	-46.26	-0.33	-46.59	-13.00	33.59	Peak
4	2313.091	-49.95	0.51	-49.44	-13.00	36.44	Peak
5	3245.418	-47.75	3.06	-44.69	-13.00	31.69	Peak
6	3704.256	-52.97	4.31	-48.66	-13.00	35.66	Peak

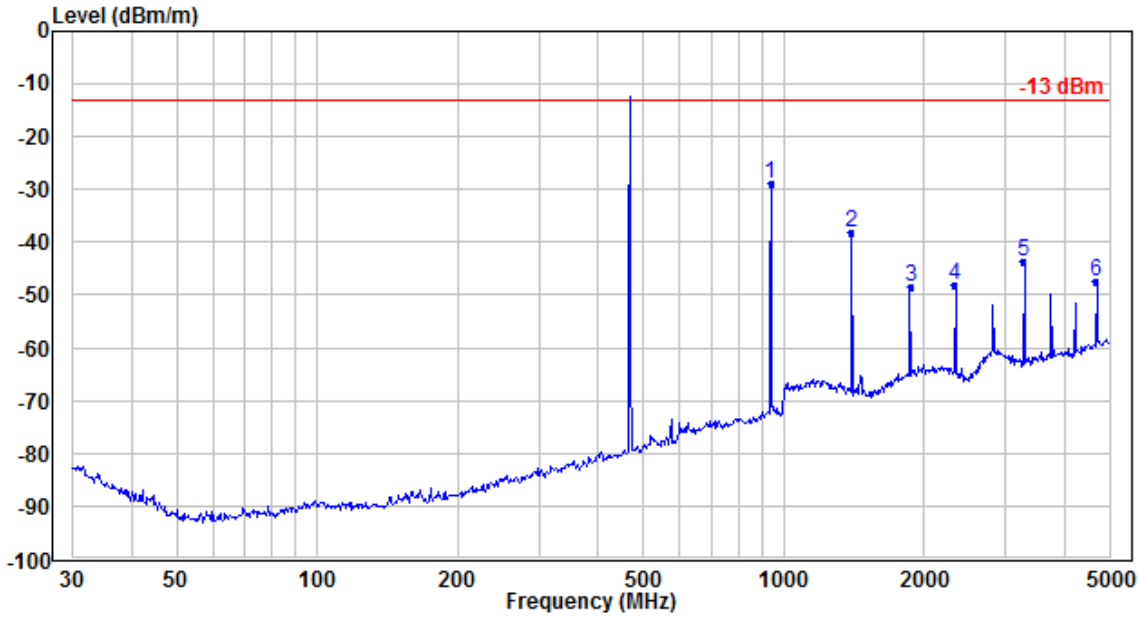
Vertical



No.	Frequency (MHz)	Reading (dBm)	Correction factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	925.613	-42.10	9.57	-32.53	-13.00	19.53	Peak
2	1385.080	-35.50	-5.86	-41.36	-13.00	28.36	Peak
3	1851.576	-46.40	-1.68	-48.08	-13.00	35.08	Peak
4	2779.938	-56.02	6.05	-49.97	-13.00	36.97	Peak
5	3245.418	-48.20	2.76	-45.44	-13.00	32.44	Peak
6	4627.562	-54.38	4.57	-49.81	-13.00	36.81	Peak

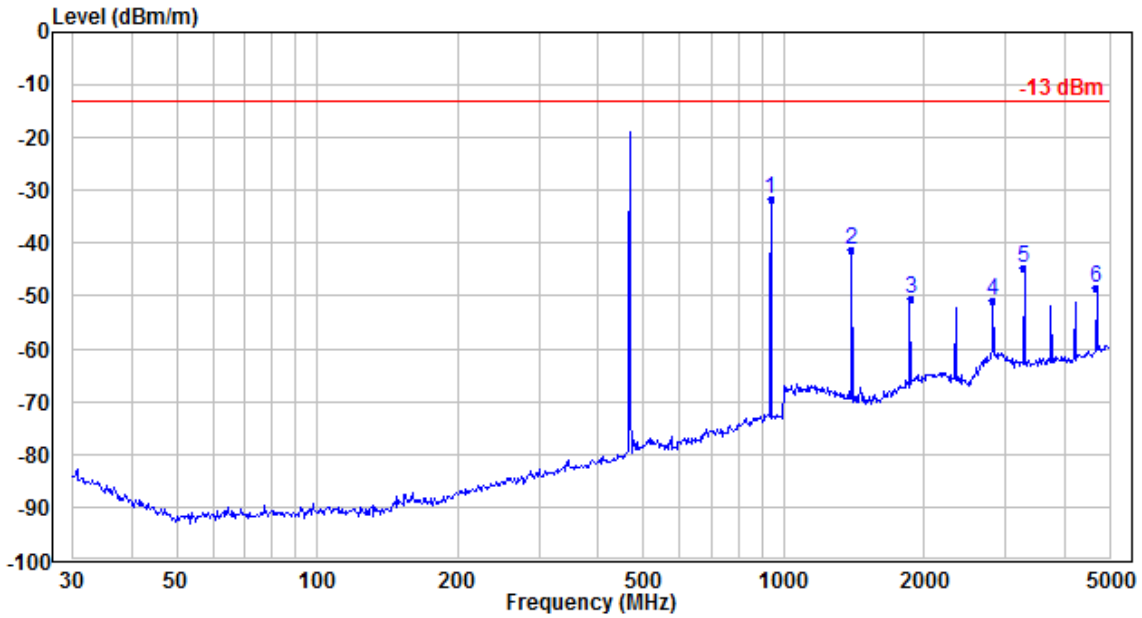
FRS Mode_ Lowest Channel_CH8

Horizontal



No.	Frequency (MHz)	Reading (dBm)	Correction factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	938.714	-39.35	10.38	-28.97	-13.00	15.97	Peak
2	1403.065	-33.18	-4.80	-37.98	-13.00	24.98	Peak
3	1869.579	-48.28	-0.11	-48.39	-13.00	35.39	Peak
4	2335.582	-48.32	0.37	-47.95	-13.00	34.95	Peak
5	3276.973	-46.81	3.14	-43.67	-13.00	30.67	Peak
6	4687.650	-53.11	5.74	-47.37	-13.00	34.37	Peak

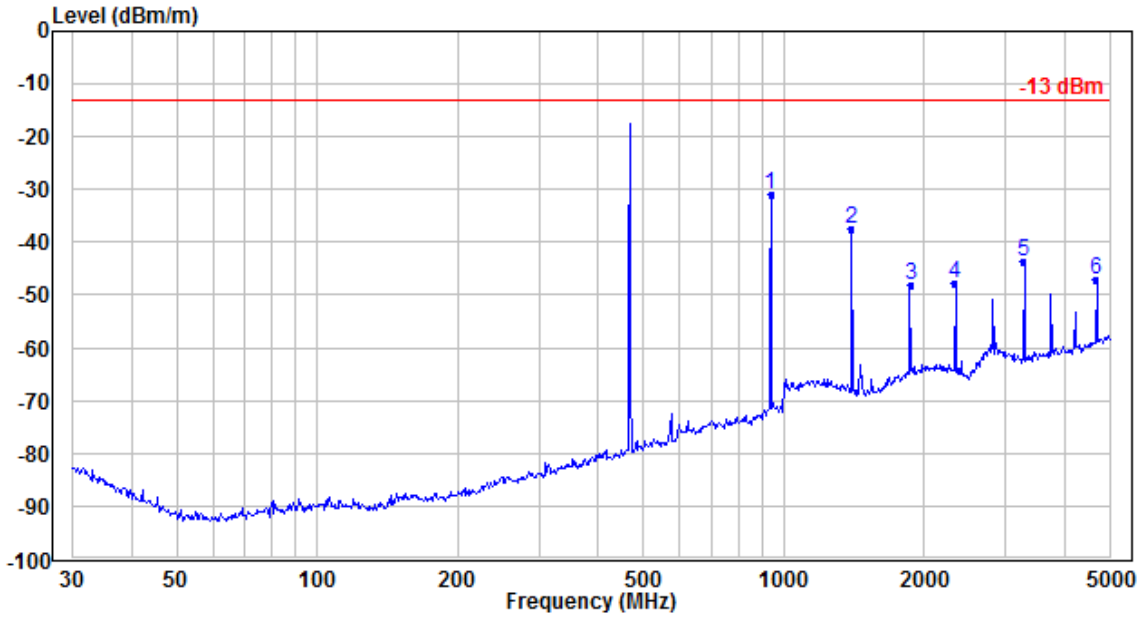
Vertical



No.	Frequency (MHz)	Reading (dBm)	Correction factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	938.714	-41.11	9.57	-31.54	-13.00	18.54	Peak
2	1403.065	-35.26	-5.92	-41.18	-13.00	28.18	Peak
3	1869.579	-49.19	-1.42	-50.61	-13.00	37.61	Peak
4	2806.967	-57.28	6.48	-50.80	-13.00	37.80	Peak
5	3276.973	-47.40	2.81	-44.59	-13.00	31.59	Peak
6	4687.650	-53.28	4.77	-48.51	-13.00	35.51	Peak

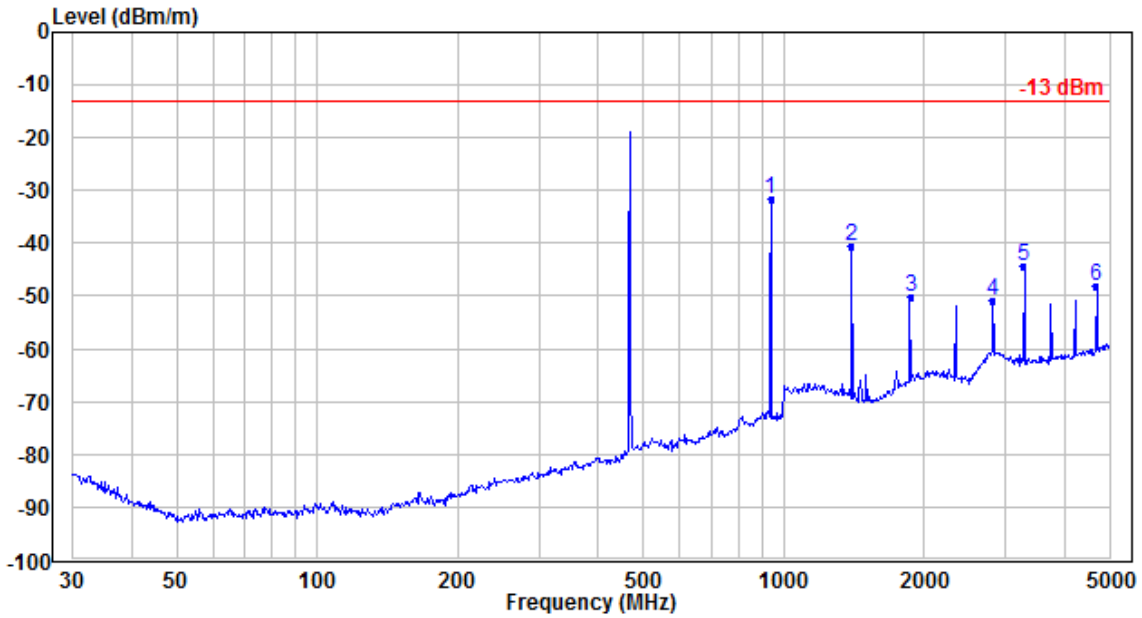
FRS Mode_ Middle Channel_CH9

Horizontal



No.	Frequency (MHz)	Reading (dBm)	Correction factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	938.714	-41.42	10.38	-31.04	-13.00	18.04	Peak
2	1403.065	-32.78	-4.80	-37.58	-13.00	24.58	Peak
3	1869.579	-47.89	-0.11	-48.00	-13.00	35.00	Peak
4	2335.582	-48.00	0.37	-47.63	-13.00	34.63	Peak
5	3276.973	-46.76	3.14	-43.62	-13.00	30.62	Peak
6	4687.650	-52.76	5.74	-47.02	-13.00	34.02	Peak

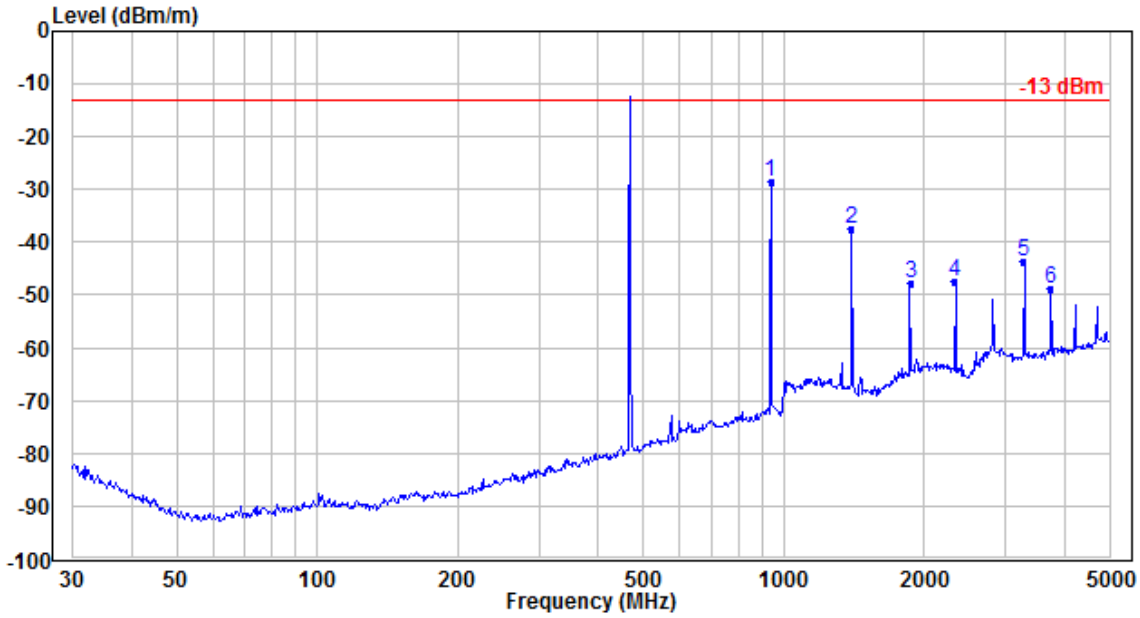
Vertical



No.	Frequency (MHz)	Reading (dBm)	Correction factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	938.714	-41.23	9.57	-31.66	-13.00	18.66	Peak
2	1403.065	-34.63	-5.92	-40.55	-13.00	27.55	Peak
3	1869.579	-48.66	-1.42	-50.08	-13.00	37.08	Peak
4	2806.967	-57.46	6.48	-50.98	-13.00	37.98	Peak
5	3276.973	-47.28	2.81	-44.47	-13.00	31.47	Peak
6	4687.650	-52.89	4.77	-48.12	-13.00	35.12	Peak

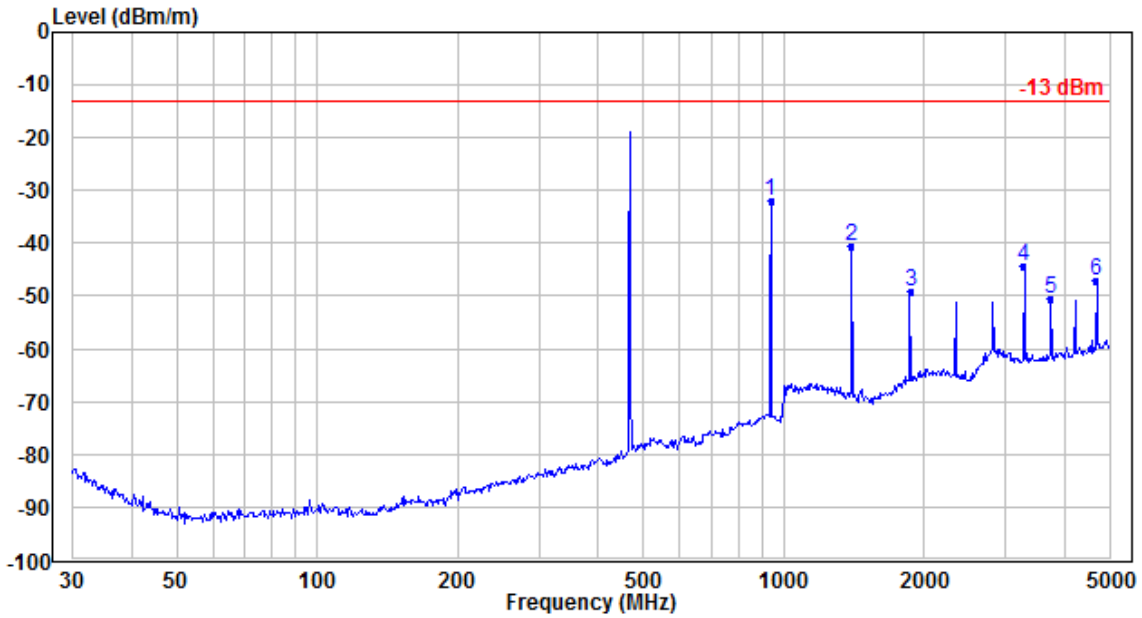
FRS Mode_ Highest Channel_CH0

Horizontal



No.	Frequency (MHz)	Reading (dBm)	Correction factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	938.714	-38.80	10.38	-28.42	-13.00	15.42	Peak
2	1403.065	-32.53	-4.80	-37.33	-13.00	24.33	Peak
3	1869.579	-47.65	-0.11	-47.76	-13.00	34.76	Peak
4	2335.582	-47.64	0.37	-47.27	-13.00	34.27	Peak
5	3276.973	-46.95	3.14	-43.81	-13.00	30.81	Peak
6	3740.273	-53.14	4.45	-48.69	-13.00	35.69	Peak

Vertical



No.	Frequency (MHz)	Reading (dBm)	Correction factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	938.714	-41.66	9.57	-32.09	-13.00	19.09	Peak
2	1403.065	-34.68	-5.92	-40.60	-13.00	27.60	Peak
3	1869.579	-47.89	-1.42	-49.31	-13.00	36.31	Peak
4	3276.973	-47.15	2.81	-44.34	-13.00	31.34	Peak
5	3740.273	-54.34	3.75	-50.59	-13.00	37.59	Peak
6	4687.650	-51.93	4.77	-47.16	-13.00	34.16	Peak

Remark:
1. Margin=Limit-Reading

APPENDIX 1 PHOTOS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

The test report is effective only with both signature and specialized stamp. The result(s) shown in this report refer only to the sample(s) tested. Without written approval of UnionTrust, this report can't be reproduced except in full.

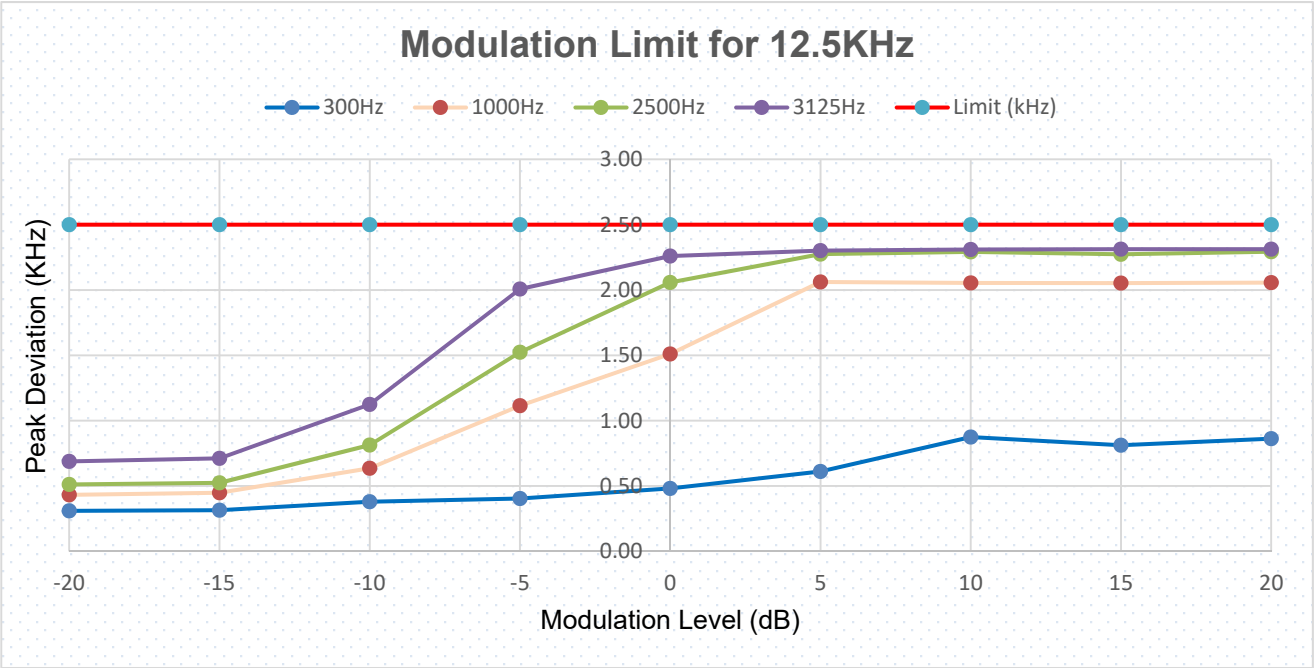
APPENDIX A
MAXIMUM TRANSMITTER POWER TEST DATA

Operation Mode	Channel	Frequency (MHz)	ERP (dBm)	ERP (W)	Limits (W)	Margin (W)	Pass/Fail
FRS	1	462.7250	14.18	0.0262	5.00	-4.9738	Pass
	4	462.6375	**14.31**	0.0270	5.00	-4.9730	Pass
	7	462.7125	14.18	0.0262	5.00	-4.9738	Pass
	8	467.5625	14.25	0.0266	0.50	-0.4734	Pass
	9	467.5875	14.32	0.0270	0.50	-0.4730	Pass
	0	467.6125	**14.40**	0.0275	0.50	-0.4725	Pass

APPENDIX B
MODULATION LIMIT TEST DATA

FRS: Channel 4						
Modulation Level (dB)	Peak frequency deviation (kHz)				Limit (kHz)	Pass / Fail
	300Hz	1000Hz	2500Hz	3125Hz		
-20	0.31	0.43	0.51	0.69	2.50	Pass
-15	0.32	0.45	0.53	0.71	2.50	Pass
-10	0.38	0.64	0.81	1.12	2.50	Pass
-5	0.41	1.12	1.52	2.01	2.50	Pass
0	0.48	1.51	2.06	2.26	2.50	Pass
5	0.61	2.06	2.27	2.30	2.50	Pass
10	0.88	2.05	2.29	2.31	2.50	Pass
15	0.81	2.05	2.27	2.31	2.50	Pass
20	0.86	2.06	2.29	2.31	2.50	Pass

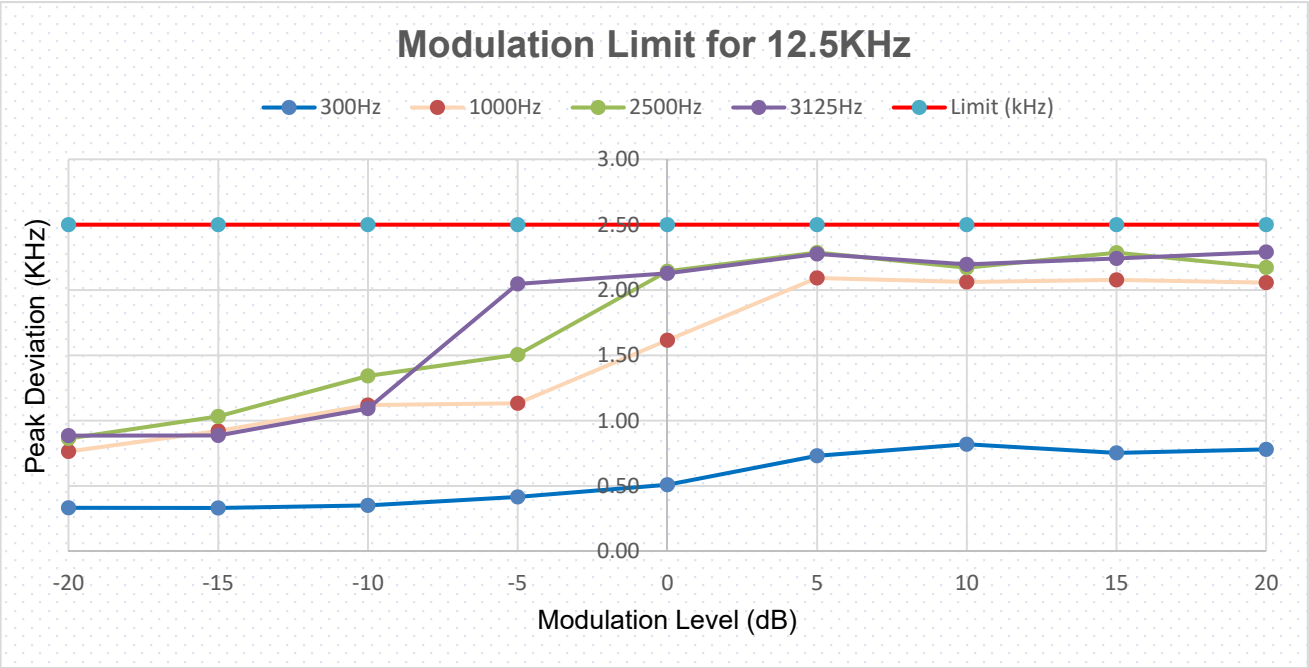
The test plot as follows:



APPENDIX B
MODULATION LIMIT TEST DATA

FRS: Channel 9						
Modulation Level (dB)	Peak frequency deviation (kHz)				Limit (kHz)	Pass / Fail
	300Hz	1000Hz	2500Hz	3125Hz		
-20	0.33	0.77	0.86	0.89	2.50	Pass
-15	0.33	0.92	1.03	0.89	2.50	Pass
-10	0.35	1.12	1.34	1.09	2.50	Pass
-5	0.42	1.13	1.51	2.05	2.50	Pass
0	0.51	1.62	2.14	2.13	2.50	Pass
5	0.73	2.09	2.29	2.28	2.50	Pass
10	0.82	2.06	2.17	2.20	2.50	Pass
15	0.75	2.08	2.29	2.24	2.50	Pass
20	0.78	2.06	2.17	2.29	2.50	Pass

The test plot as follows:

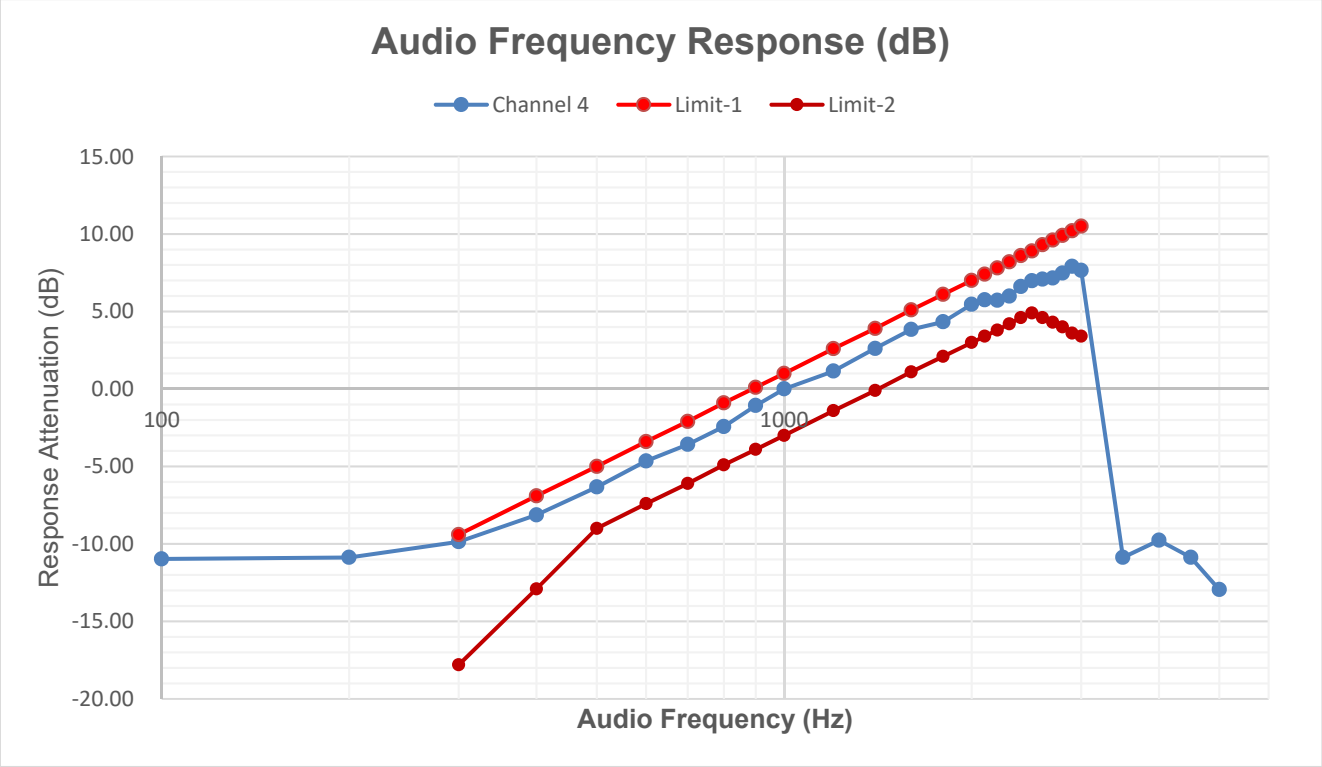


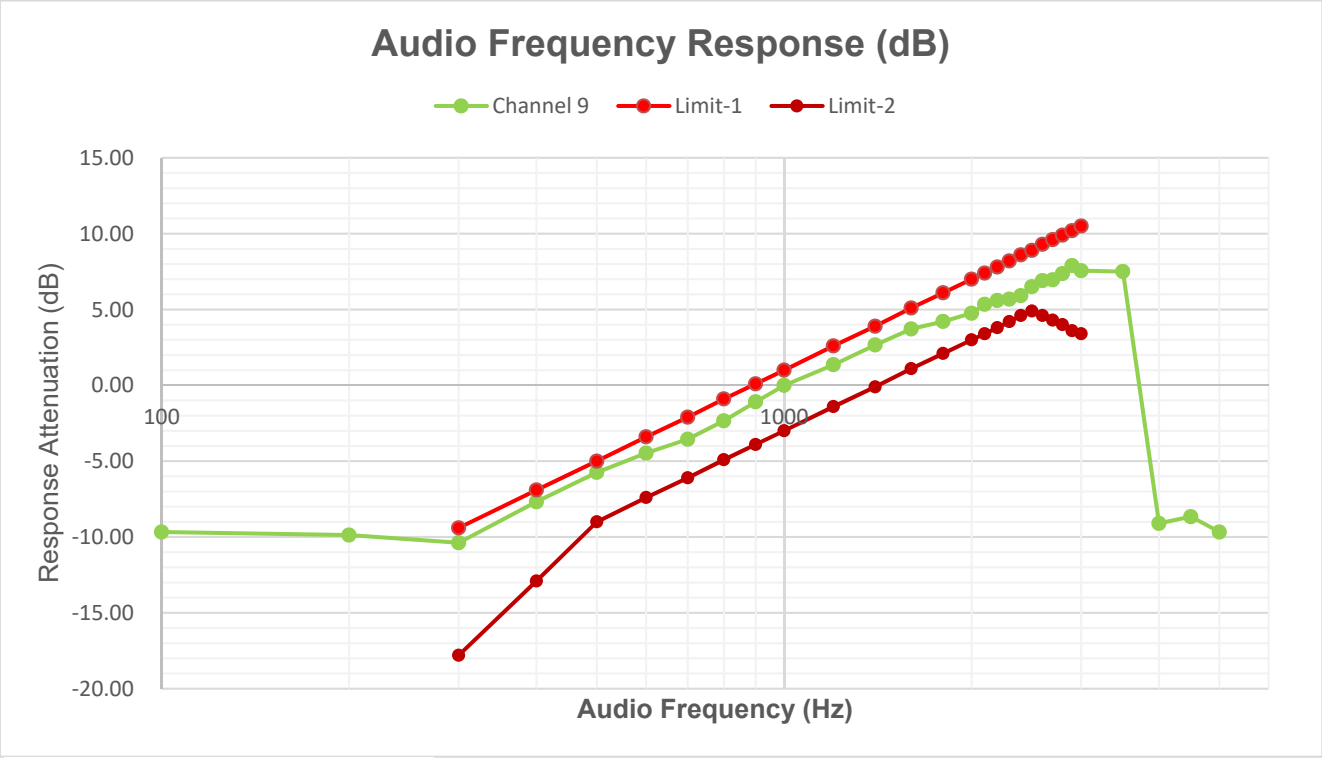
APPENDIX C
AUDIO FREQUENCY RESPONSE TEST DATA

Audio Frequency (Hz)	Frequency Deviation			Audio Frequency Response (dB)			Limit-1	Limit-2
	Channel 4	Channel 9	---	Channel 4	Channel 9	---		
100	0.09	0.09	---	-10.97	-9.67	---		
200	0.09	0.09	---	-10.87	-9.87	---		
300	0.10	0.08	---	-9.86	-10.38	---	-9.40	-17.80
400	0.12	0.11	---	-8.13	-7.68	---	-6.90	-12.90
500	0.15	0.14	---	-6.33	-5.74	---	-5.00	-9.00
600	0.18	0.16	---	-4.65	-4.47	---	-3.40	-7.40
700	0.21	0.18	---	-3.58	-3.55	---	-2.10	-6.10
800	0.24	0.21	---	-2.43	-2.34	---	-0.90	-4.90
900	0.28	0.24	---	-1.07	-1.09	---	0.10	-3.90
1000	0.31	0.27	---	0.00	0.00	---	1.00	-3.00
1200	0.36	0.32	---	1.15	1.36	---	2.60	-1.40
1400	0.42	0.37	---	2.61	2.66	---	3.90	-0.10
1600	0.48	0.42	---	3.84	3.72	---	5.10	1.10
1800	0.51	0.44	---	4.33	4.21	---	6.10	2.10
2000	0.58	0.47	---	5.46	4.75	---	7.00	3.00
2100	0.60	0.50	---	5.75	5.34	---	7.40	3.40
2200	0.60	0.52	---	5.72	5.59	---	7.80	3.80
2300	0.62	0.52	---	5.99	5.68	---	8.20	4.20
2400	0.67	0.54	---	6.60	5.91	---	8.60	4.60
2500	0.70	0.57	---	6.98	6.50	---	8.90	4.90
2600	0.70	0.60	---	7.08	6.90	---	9.30	4.60
2700	0.71	0.60	---	7.15	6.96	---	9.60	4.30
2800	0.74	0.63	---	7.47	7.37	---	9.90	4.00
2900	0.77	0.67	---	7.91	7.89	---	10.20	3.60
3000	0.75	0.65	---	7.65	7.56	---	10.50	3.40
3500	0.09	0.64	---	-10.87	7.50	---		
4000	0.10	0.10	---	-9.77	-9.10	---		
4500	0.09	0.10	---	-10.87	-8.66	---		
5000	0.07	0.09	---	-12.95	-9.67	---		
Pass/Fail	Pass							

APPENDIX C
AUDIO FREQUENCY RESPONSE TEST DATA

The test plot as follows:

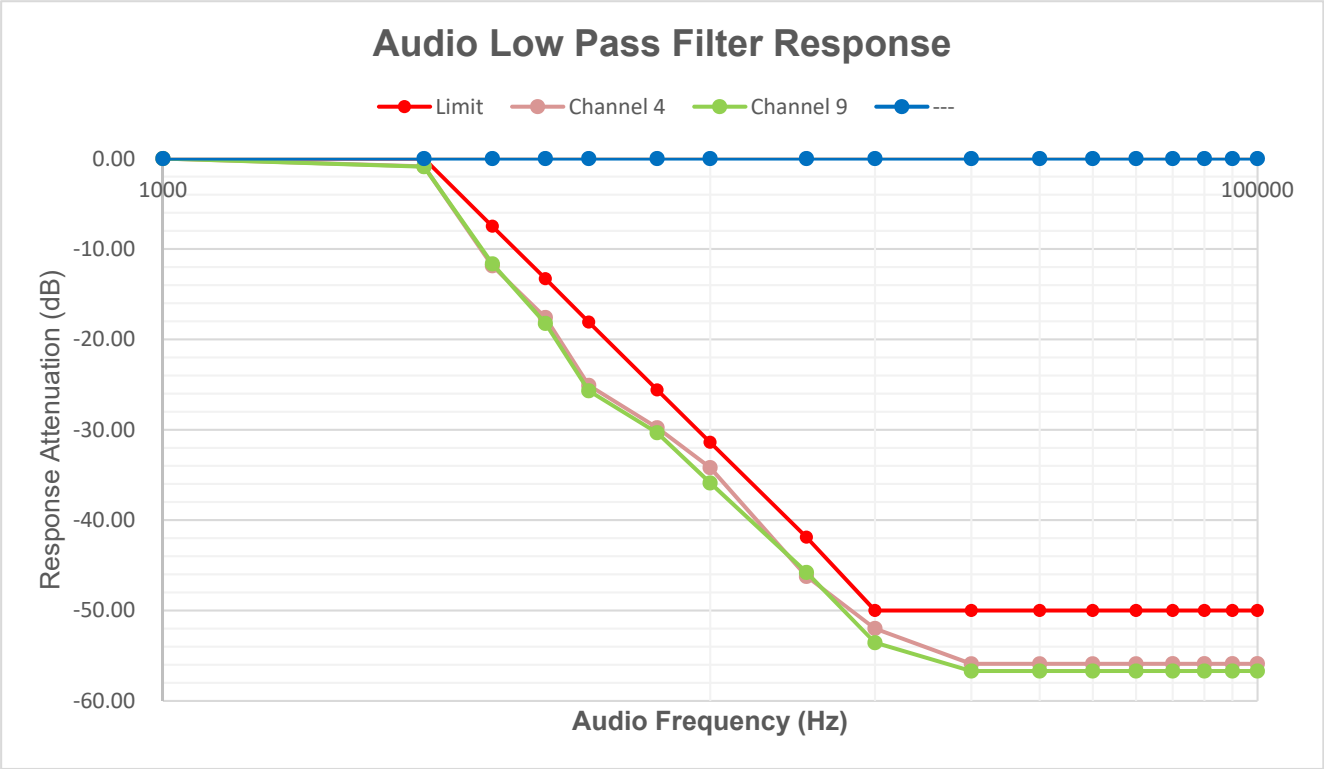




APPENDIX D
AUDIO LOW PASS FILTER RESPONSE TEST DATA

Audio Frequency (Hz)	Measured value (dB)			Response Attenuation (dB)			Limit	Pass/Fail
	Channel 4	Channel 9	---	Channel 4	Channel 9	---		
1000	-2.56	-2.87	---	0.00	0.00	---	0.00	Pass
3000	-3.43	-3.78	---	-0.87	-0.91	---	0.00	Pass
4000	-14.43	-14.52	---	-11.87	-11.65	---	-7.50	Pass
5000	-20.15	-21.12	---	-17.59	-18.25	---	-13.30	Pass
6000	-27.65	-28.56	---	-25.09	-25.69	---	-18.10	Pass
8000	-32.34	-33.21	---	-29.78	-30.34	---	-25.60	Pass
10000	-36.76	-38.76	---	-34.20	-35.89	---	-31.40	Pass
15000	-48.79	-48.66	---	-46.23	-45.79	---	-41.90	Pass
20000	-54.55	-56.43	---	-51.99	-53.56	---	-50.00	Pass
30000	-58.46	-59.56	---	-55.90	-56.69	---	-50.00	Pass
40000	-58.46	-59.56	---	-55.90	-56.69	---	-50.00	Pass
50000	-58.46	-59.56	---	-55.90	-56.69	---	-50.00	Pass
60000	-58.46	-59.56	---	-55.90	-56.69	---	-50.00	Pass
70000	-58.45	-59.56	---	-55.89	-56.69	---	-50.00	Pass
80000	-58.45	-59.56	---	-55.89	-56.69	---	-50.00	Pass
90000	-58.45	-59.56	---	-55.89	-56.69	---	-50.00	Pass
100000	-58.45	-59.56	---	-55.89	-56.69	---	-50.00	Pass

The test plot as follows:



APPENDIX E
FREQUENCY STABILITY TEST DATA

GMRS/FRS_ Channel 4 (462.637500 MHz)					
Temp. (°C)	Voltage	Measured Frequency (MHz)	Frequency Drift (ppm)	Limit (ppm)	Pass/Fail
50	VN	462.637420	-0.1729	2.5	Pass
40		462.637420	-0.1729	2.5	Pass
30		462.637430	-0.1513	2.5	Pass
20		462.637430	-0.1513	2.5	Pass
10		462.637430	-0.1513	2.5	Pass
0		462.637430	-0.1513	2.5	Pass
-10		462.637300	-0.4323	2.5	Pass
-20		462.637340	-0.3458	2.5	Pass
-30		462.637420	-0.1729	2.5	Pass
TN	VL	462.637430	-0.1513	2.5	Pass
	VH	462.637430	-0.1513	2.5	Pass

FRS_ Channel 9 (467.587500 MHz)					
Temp. (°C)	Voltage	Measured Frequency (MHz)	Frequency Drift (ppm)	Limit (ppm)	Pass/Fail
50	VN	467.587500	0.0000	2.5	Pass
40		467.587350	-0.3208	2.5	Pass
30		467.587430	-0.1497	2.5	Pass
20		467.587330	-0.3636	2.5	Pass
10		467.587330	-0.3636	2.5	Pass
0		467.587340	-0.3422	2.5	Pass
-10		467.587340	-0.3422	2.5	Pass
-20		467.587340	-0.3422	2.5	Pass
-30		467.587345	-0.3315	2.5	Pass
TN	VL	467.587330	-0.3636	2.5	Pass
	VH	467.587330	-0.3636	2.5	Pass