

FCC AND IC CERTIFICATION TEST REPORT

FOR

Applicant	:	Altis Technology (Hong Kong) Ltd.
Address	:	711, Lu Plaza, 2 Wing Yip Street, Kwun Tong, Hong Kong
Equipment under Test	:	GMRS/FRS Walkie Talkie Two-way Radio
Model No	:	FS300/ FS300-2/ FS300-3/ FS300-4
Trade Mark	:	Cobra
FCC ID	:	2AHJMFSCJJ
IC	:	21854-FSCJJ
Manufacturer	:	Altis Technology (Hong Kong) Ltd.
Address	:	711, Lu Plaza, 2 Wing Yip Street, Kwun Tong, Hong Kong

Issued By: Dongguan Dongdian Testing Service Co., Ltd.

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REPORT

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TEST REPORT DECLARE

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Trade Mark	:	Cobra
Manufacturer	:	Altis Technology (Hong Kong) Ltd.
Address	:	711, Lu Plaza, 2 Wing Yip Street, Kwun Tong, Hong Kong

Test Standard Used: FCC Rules and Regulations Part 95; FCC Rules and Regulations Part 2; FCC Rules and Regulations Part 15B; RSS-210 issue 8:2010

Test procedure used: TIA-603-D:2010; ANSI C63.10:2013, ANSI C63.4:2014,

We Declare:

The equipment described above is tested by Dongguan Dongdian Testing Service Co., Ltd and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and Dongguan Dongdian Testing Service Co., Ltd is assumed of full responsibility for the accuracy and completeness of these tests.

After test and evaluation, our opinion is that the equipment provided for test compliance with the requirement of the above FCC and IC standards.

Report No:	DDT-R17Q0307-14E2		
Date of Test:	Mar. 12, 2017 ~ Mar. 21, 2017	Date of Report:	Mar. 22, 2017

Prepared By:



Leo Liu/RF Engineer

Approved By:



Kevin Ho/RF Manager

Note: This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Dongguan Dongdian Testing Service Co., Ltd.

1. Summary of test results

Description of Test Item	Standard	Results
Maximum Transmitter Power	FCC Part 95.639 RSS-210 A6.1.4 RSS-210 A6.2.4	PASS
Modulation Characteristics	FCC Part 2.1047, FCC Part 95.637 RSS-210 A6.1.2 RSS-210 A6.2.2	PASS
Occupied Bandwidth and Emission Mask	FCC Part 2.1049, FCC Part 95.633, FCC Part 95.635 RSS-210 A6.1.3 RSS-210 A6.2.3 RSS-210 A6.1.5 RSS-210 A6.2.5	PASS
Radiated Spurious Emission	FCC Part 95.635 RSS-210 A6.1.5 RSS-201 A6.2.5	PASS
Frequency Stability	FCC Part 2.1055, FCC Part 95.621 FCC Part 95.626 RSS-210 A6.1.6 RSS-201 A6.2.6	PASS

2. General test information

2.1. Description of EUT

EUT* Name	:	GMRS/FRS Walkie Talkie Two-way Radio
Model No	:	FS300/ FS300-2/ FS300-3/ FS300-4
Difference of model number	:	This device have 4 models, and the difference of each models are cabinet color, sales country and accessories, all the other characteristic like circuit, PCB layout, RF power are exactly same, and FS300 was used for test.
EUT function description	:	Please reference user manual of this device
Power supply	:	DC 3.7V battery
Operation frequency range	:	462.55MHz-462.7250MHz / 467.5625MHz-467.7125MHz
Modulation type	:	FM
Max Tx deviation	:	2.5KHz
Emission type	:	F3E
Antenna Type	:	Integral
Date of Receipt	:	Mar. 11, 2017
Sample Type	:	Series production

Note1: EUT is the ab. of equipment under test.

2.2. Accessories of EUT

Description of Accessories	Manufacturer	Model number or Type	Other
USB cable	/	/	Length: 0.8m

2.3. Channel Information

CH #	FREQ (MHz)	TYPE	CH #	FREQ (MHz)	TYPE
1	462.5625	GMRS	12	467.6625	FRS
2	462.5875	GMRS	13	467.6875	FRS
3	462.6125	GMRS	14	467.7125	FRS
4	462.6375	GMRS	15	462.55	GMRS
5	462.6625	GMRS	16	462.575	GMRS
6	462.6875	GMRS	17	462.6	GMRS
7	462.7125	GMRS	18	462.625	GMRS
8	467.5625	FRS	19	462.65	GMRS
9	467.5875	FRS	20	462.675	GMRS
10	467.6125	FRS	21	462.7	GMRS
11	467.6375	FRS	22	462.725	GMRS

2.4. Block diagram of EUT configuration for test

For Radiated emissions test, the block diagram of EUT configuration as blowe:

EUT

2.5. Deviations of test standard

No Deviation.

2.6. Test environment conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature range:	21-25°C
Humidity range:	40-75%
Pressure range:	86-106kPa

2.7. Test laboratory

Dongguan Dongdian Testing Service Co., Ltd

Add: No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan City, Guangdong Province, China, 523808 Tel: +86-0769-22891499 <http://www.dgddt.com>

FCC Registration Number: 270092 Industry Canada site registration number: 10288A-1

2.8. Measurement uncertainty

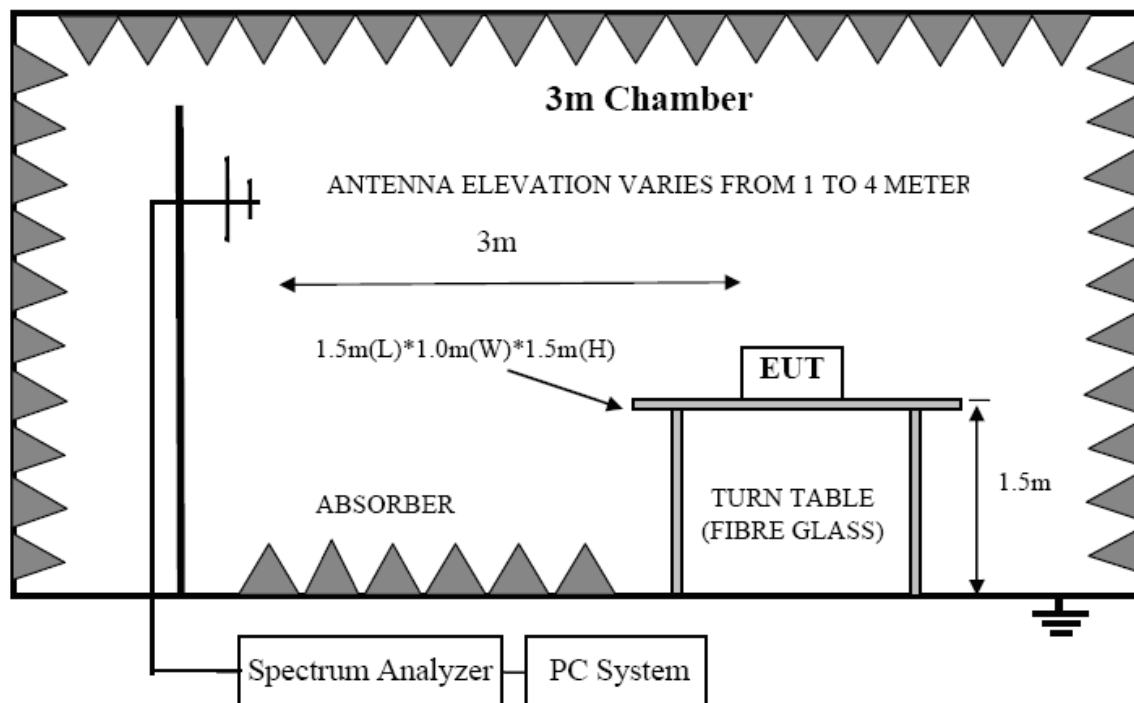
Test Item	Uncertainty
Bandwidth	1.1%
Peak Output Power(Conducted)(Spectrum analyzer)	0.86dB(10 MHz ≤ f < 3.6GHz);
	1.38dB(3.6GHz ≤ f < 8GHz)
Peak Output Power(Conducted)(Power Sensor)	0.74dB
Dwell Time	0.6%
Conducted spurious emissions	0.86dB(10 MHz ≤ f < 3.6GHz);
	1.40dB(3.6GHz ≤ f < 8GHz)
	1.66dB(8GHz ≤ f < 22GHz)
Uncertainty for radio frequency (RBW<20KHz)	3×10 ⁻⁸
Temperature	0.4°C
Humidity	2%
Uncertainty for Radiation Emission test (30MHz-1GHz)	4.70 dB (Antenna Polarize: V)
	4.84 dB (Antenna Polarize: H)
Uncertainty for Radiation Emission test (1GHz-18GHz)	4.10dB(1-6GHz)
	4.40dB (6GHz-18Gz)
Uncertainty for Power line conduction emission test	3.32dB (150KHz-30MHz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

3. Equipment used during test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
RF Connected Test					
Spectrum analyzer	R&S	FSU26	1166.1660.26	Oct. 16, 2016	1 Year
Vector Signal Generator	Agilent	E8267D	MY52098743	Oct. 20, 2016	1 Year
Vector Signal Generator	Agilent	N5182A	MY48180737	Jul. 05, 2016	1 Year
Power Sensor	Agilent	U2021XA	MY55150010	Apr. 18, 2016	1 Year
Power Sensor	Agilent	U2021XA	MY55150011	Apr. 19, 2016	1 Year
DC Power Source	MATRIS	MPS-3005L-3	D813058W	Oct. 24, 2016	1 Year
Attenuator	Mini-Circuits	BW-S10W2	101109	Aug. 18, 2016	1 Year
RF Cable	Micable	C10-01-01-1	100309	Aug. 18, 2016	1 Year
Test Software	JS Tonscend	JS1120-2	Ver.2.5	N/A	N/A
USB Data acquisition	Agilent	U2531A	TW55043503	N/A	N/A
Auto control Unit	JS Tonscend	JS0806-2	158060010	N/A	N/A
Radiated Emission Test					
EMI Test Receiver	R&S	ESU8	100316	Oct. 16, 2016	1 Year
Spectrum analyzer	R&S	FSU26	1166.1660.26	Oct. 16, 2016	1 Year
Trilog Broadband Antenna	Schwarzbeck	VULB9163	9163-462	Oct. 27, 2016	1 Year
Active Loop antenna	Schwarzbeck	FMZB-1519	1519-038	Oct. 16, 2016	1 Year
Double Ridged Horn Antenna	R&S	HF907	100276	Oct. 12, 2016	1 Year
Pre-amplifier	A.H.	PAM-0118	360	Oct. 16, 2016	1 Year
RF Cable	HUBSER	CP-X2	W11.03	Oct. 16, 2016	1 Year
RF Cable	HUBSER	CP-X1	W12.02	Oct. 16, 2016	1 Year
MI Cable	HUBSER	C10-01-01-1M	1091629	Oct. 16, 2016	1 Year
Test software	Audix	E3	V 6.11111b	/	/
Power Line Conducted Emissions Test					
Test Receiver	R&S	ESU8	100316	Oct. 16, 2016	1 Year
LISN 1	R&S	ENV216	101109	Oct. 16, 2016	1 Year
LISN 2	R&S	ESH2-Z5	100309	Oct. 16, 2016	1 Year
Pulse Limiter	R&S	ESH3-Z2	101242	Oct. 16, 2016	1 Year
CE Cable 1	HUBSER	ESU8/RF2	W10.01	Oct. 16, 2016	1 Year
Test software	Audix	E3	V 6.11111b	/	/

4. Maximum Transmitter Power

4.1. Block diagram of test setup



4.2. Limits

According to FCC Part 95.639:.

No FRS unit, under any condition of modulation, shall exceed 0.500 W effective radiated power (ERP)

No GMRS channel, under any condition of modulation, shall exceed:

- (1) 50W Carrier power (average TP during one modulated RF cycle) when transmitting emissions type A1D, F1D, G1D, A3E, F3E, or G3E.
- (2) 50W peak envelope TP when transmitting emission type H1D, J1D, R1D, H3E, J3E or R3E.

According to RSS-210 A6.1.4:

For FRS transmitter the maximum permissible transmitter output power under any operating conditions is 0.5 W effective radiated power (e.r.p.). The radio shall be equipped with an integral antenna.

According to RSS-210 A6.2.4:

A GMRS transmitter may transmit with a maximum power of 2 W e.r.p.

4.3. Test Procedure

- (1) On a test site, the EUT shall be placed at 1.5m height on a wooden turntable, and in the position closest to normal use as declared by the applicant.
- (2) The test antenna shall be oriented initially for vertical polarization located 3m from EUT to correspond

to the frequency of the transmitter.

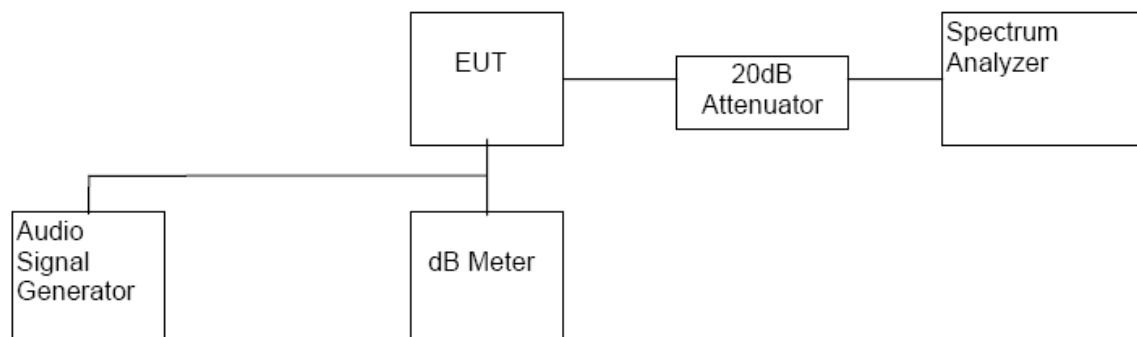
- (3) The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
- (4) The transmitter shall be switched on , if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- (5) The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
- (6) The transmitter shall then be rotated through 360° in the horizontal plane, until a maximum signal level is detected by the measuring receiver.
- (7) The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
- (8) The maximum signal level detected by the measuring receiver shall be noted.
- (9) The transmitter shall be replaced by a tuned dipole (substitution antenna).
- (10) The substitution antenna shall be oriented for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
- (11) The substitution antenna shall be connected to a calibrated signal generator.
- (12) If necessary , the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- (13) The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver
- (14) The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
- (15) The input signal to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
- (16) The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
- (17) The measure of the ERP is the larger of the two levels recorded, at the input to the substitution antenna, corrected the gain of the substitution antenna if necessary.

4.4. Test Result

CH #	Frequency	Type	Result(ERP)		FCC Limit	FCC Margin	RSS-210 Limit	RSS-210 Margin
	(MHz)		dBm	(W)	(W)	(W)	(W)	(W)
1	462.5625	GMRS	27.68	0.586	50	49.414	2	1.414
2	462.5875	GMRS	27.65	0.582	50	49.418	2	1.418
3	462.6125	GMRS	27.66	0.583	50	49.417	2	1.417
4	462.6375	GMRS	27.66	0.583	50	49.417	2	1.417
5	462.6625	GMRS	27.68	0.586	50	49.414	2	1.414
6	462.6875	GMRS	27.63	0.579	50	49.421	2	1.421
7	462.7125	GMRS	27.65	0.582	50	49.418	2	1.418
8	467.5625	FRS	26.85	0.484	0.5	0.016	0.5	0.016
9	467.5875	FRS	26.86	0.485	0.5	0.015	0.5	0.015
10	467.6125	FRS	26.84	0.483	0.5	0.017	0.5	0.017
11	467.6375	FRS	26.84	0.483	0.5	0.017	0.5	0.017
12	467.6625	FRS	26.87	0.486	0.5	0.014	0.5	0.014
13	467.6875	FRS	26.83	0.482	0.5	0.018	0.5	0.018
14	467.7125	FRS	26.85	0.484	0.5	0.016	0.5	0.016
15	462.55	GMRS	27.67	0.585	50	49.415	2	1.415
16	462.575	GMRS	27.65	0.582	50	49.418	2	1.418
17	462.6	GMRS	27.65	0.582	50	49.418	2	1.418
18	462.625	GMRS	27.66	0.583	50	49.417	2	1.417
19	462.65	GMRS	27.68	0.586	50	49.414	2	1.414
20	462.675	GMRS	27.65	0.582	50	49.418	2	1.418
21	462.7	GMRS	27.67	0.585	50	49.415	2	1.415
22	462.725	GMRS	27.66	0.583	50	49.417	2	1.417
Conclusion:Pass								
Test Date : Mar. 19, 2017					Test Engineer : Toby Ren			

5. Occupied bandwidth and emission mask

5.1. Block diagram of test setup



5.2. Limits

According to FCC 95.633 & RSS-210 A6.1.3, A6.2.3:

For GMRS: 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.

For FRS: the authorized bandwidth for emission type F3E or F2D is 12.5 KHz

According to FCC 95.635 & RSS-210 A6.1.5, A6.2.5:

At least 25dB (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.

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.

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

5.3. Test Procedure

- (1). Configure EUT and assistant system according clause 4.2
- (2). The EUT was modulated by 2.5 KHz Sine wave audio signal, The level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation. Rated system deviation is 2.5 kHz (12.5 kHz channel spacing).
- (3). Set SPA Center Frequency = fundamental frequency, RBW=VBW= 300 Hz, Span =20 KHz.
- (4). Measure the -20 dB bandwidth of modulated signal.

5.4. Test Result

Occupied Bandwidth:

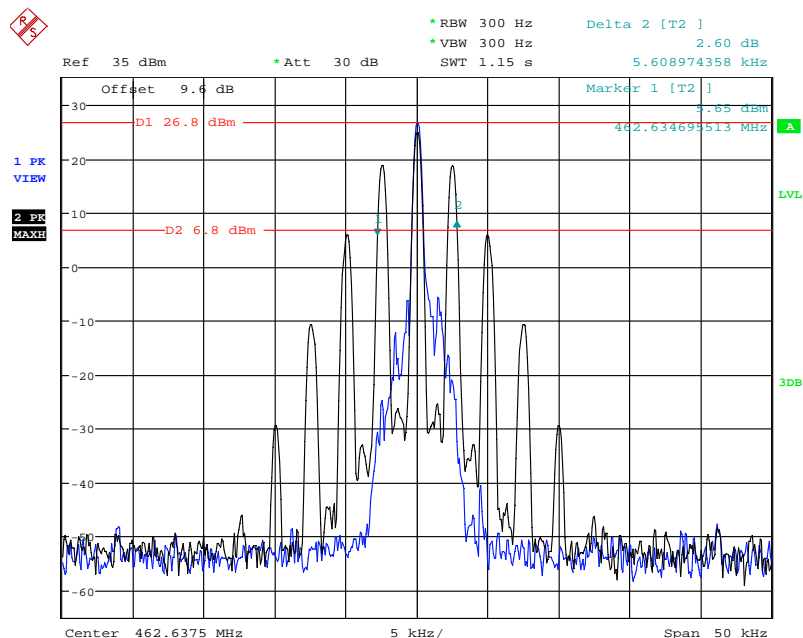
CH	Freq (MHz)	Type	Occupied Bandwidth	Limit
CH4	462.6375	GMRS	5.61KHz	20KHz
CH11	467.6375	FRS	5.61KHz	12.5KHz
Conclusion:PASS				
Test Date : Mar. 21, 2017			Test Engineer : Toby Ren	

Emission mask:

CH	Freq (MHz)	Type	Emission mask result
CH4	462.6375	GMRS	PASS
CH11	467.6375	FRS	PASS
Test Date : Mar. 21, 2017			Test Engineer : Toby Ren

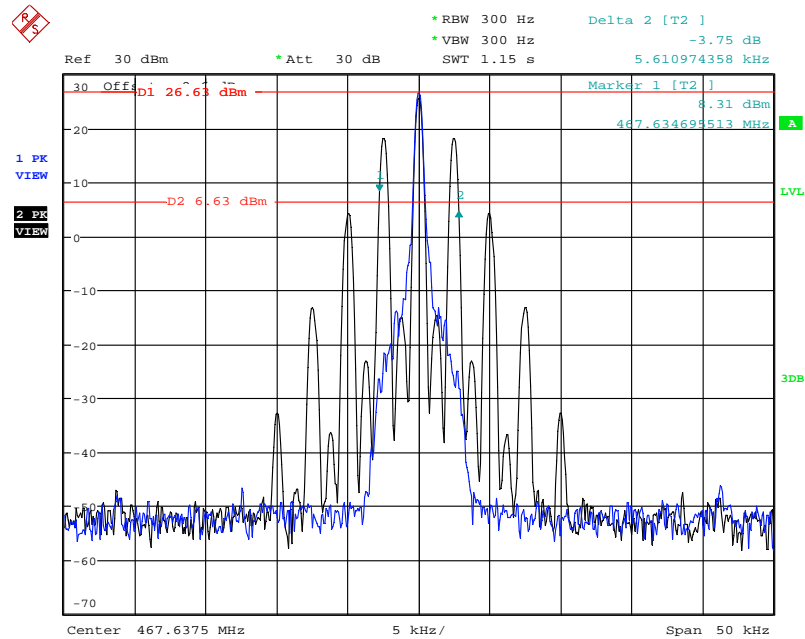
5.5. Original test data

Occupied Bandwidth CH4:



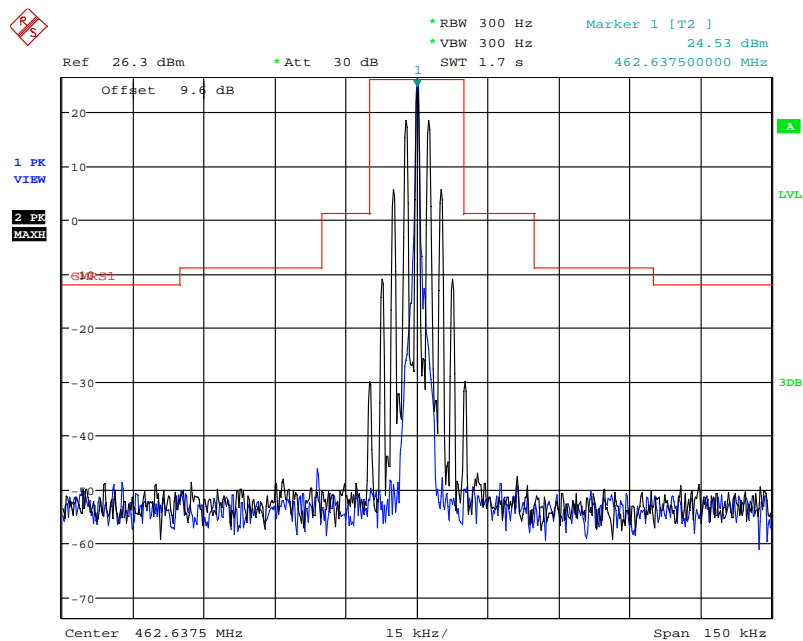
Date: 21.MAR.2017 10:52:27

Occupied Bandwidth CH11:



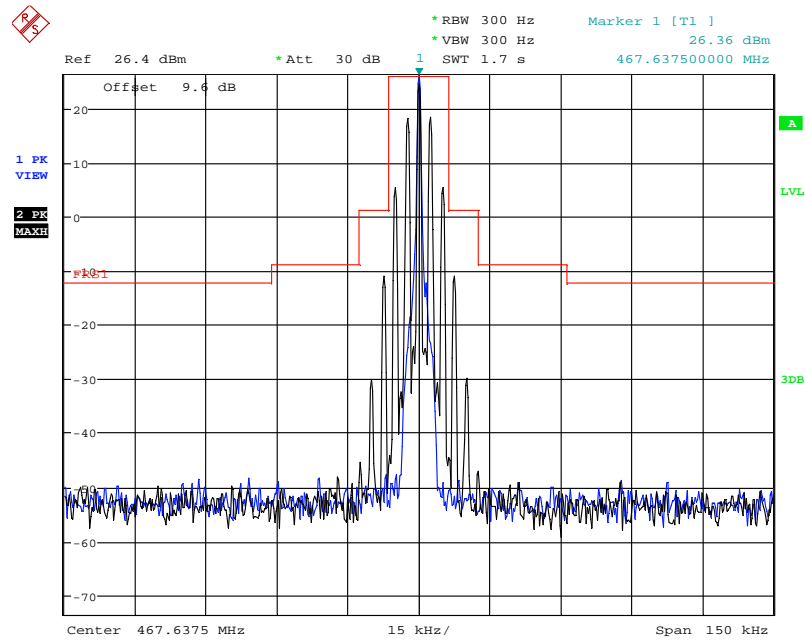
Date: 21.MAR.2017 11:05:39

Emission mask CH 4



Date: 21.MAR.2017 10:56:32

Emission mask CH11



Date: 21.MAR.2017 11:01:37

6. Modulation Characteristics

6.1. Block diagram of test setup

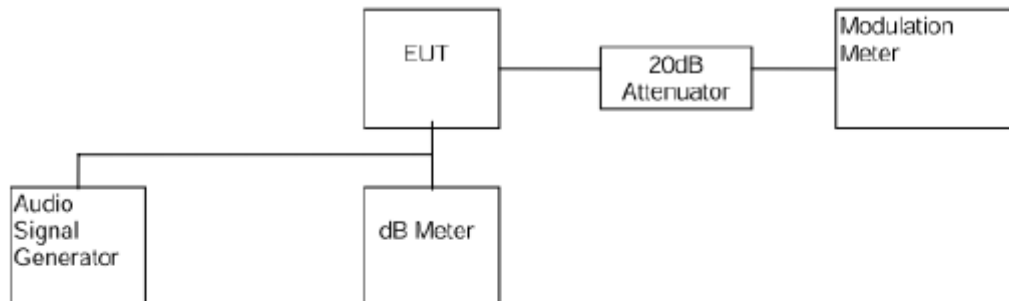


Figure 1

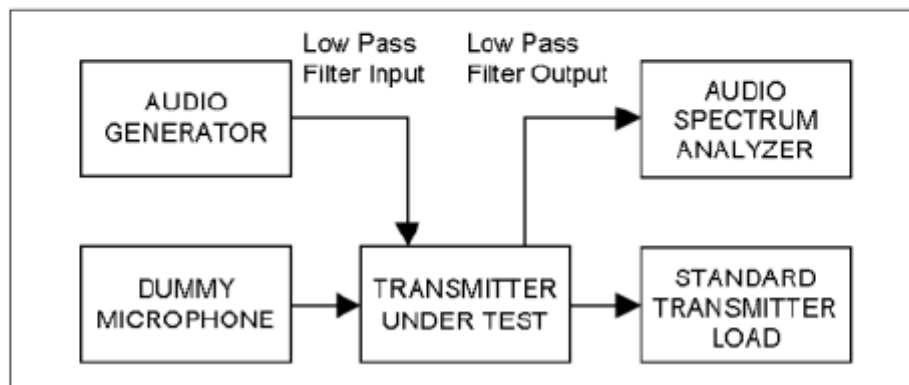


Figure 2

6.2. Limits

According to FCC 95.637:

(a) A GMRS transmitter that transmits emission types F1D, G1D, or G3E must not exceed a peak frequency deviation of plus or minus 5 kHz. A GMRS transmitter that transmits emission type F3E must not exceed a peak frequency deviation of plus or minus 5 kHz. 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 .

(b) 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 $60 \log_{10} (f/3)$ 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.

According to FCC 2.1047:

(a) 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.

(b) Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

6.3. Test Procedure**Frequency deviation:**

(1). Configure the EUT as shown in figure 1, adjust the audio input for 60% of rated system deviation at 1 KHz using this level as a reference (0dB) and vary the input level from -20 to +20dB.

Record the frequency deviation obtained as a function of the input level.

(2). Repeat step (1) with input frequency changing to 300Hz, 500Hz, 1Kz, 1.5KHz, 2KHz and 3KHz in sequence.

Audio Frequency Response:

(1). Configure the EUT as shown in figure 1.

(2). Apply a 1000 Hz tone and adjust the audio frequency generator to produce 20% of the rated system deviation.

(3). Vary the Audio frequency from 100 Hz to 5 KHz and record the frequency deviation.

(4). The peak frequency deviation must not exceed $\pm 2.5\text{KHz}$.

Audio Low Pass Filter Response:

(1) Connect the equipment in figure 2.

(2) Connect the audio frequency generator as close as possible the input of the post limiter low pass filter within the transmitter under test.

(3) Connect the audio spectrum analyzer to the output of the post limiter low pass filter within the transmitter under test.

(4) Apply a 1000 Hz tone from the audio frequency generator and adjust the level per manufacturer's specifications.

(5) Record the dB level of the 1000 Hz spectral line on the audio spectrum analyzer as LEV1 .

(6) Set the audio frequency generator to the desired test frequency between 3000 Hz and the upper low pass filter limit.

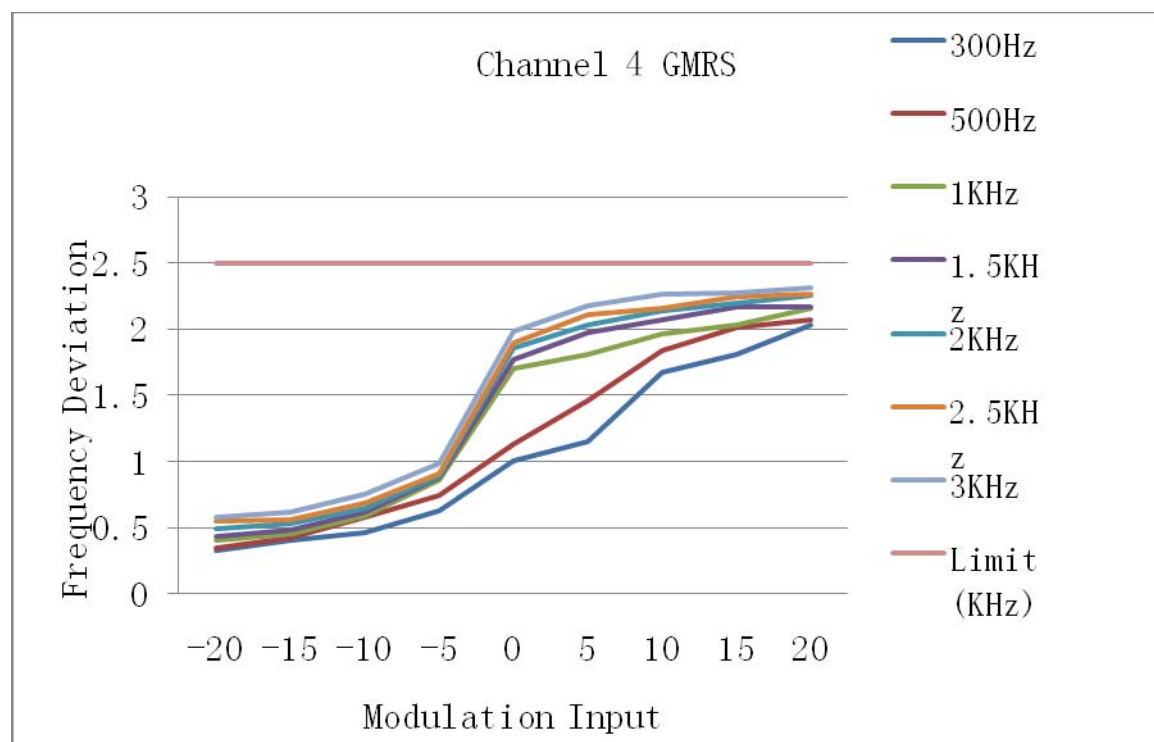
(7) Record audio spectrum analyzer levels, at the test frequency in step (6).

(8) Record the dB level on the audio spectrum analyzer as LEV2 . Method of Measurement for Transmitters .

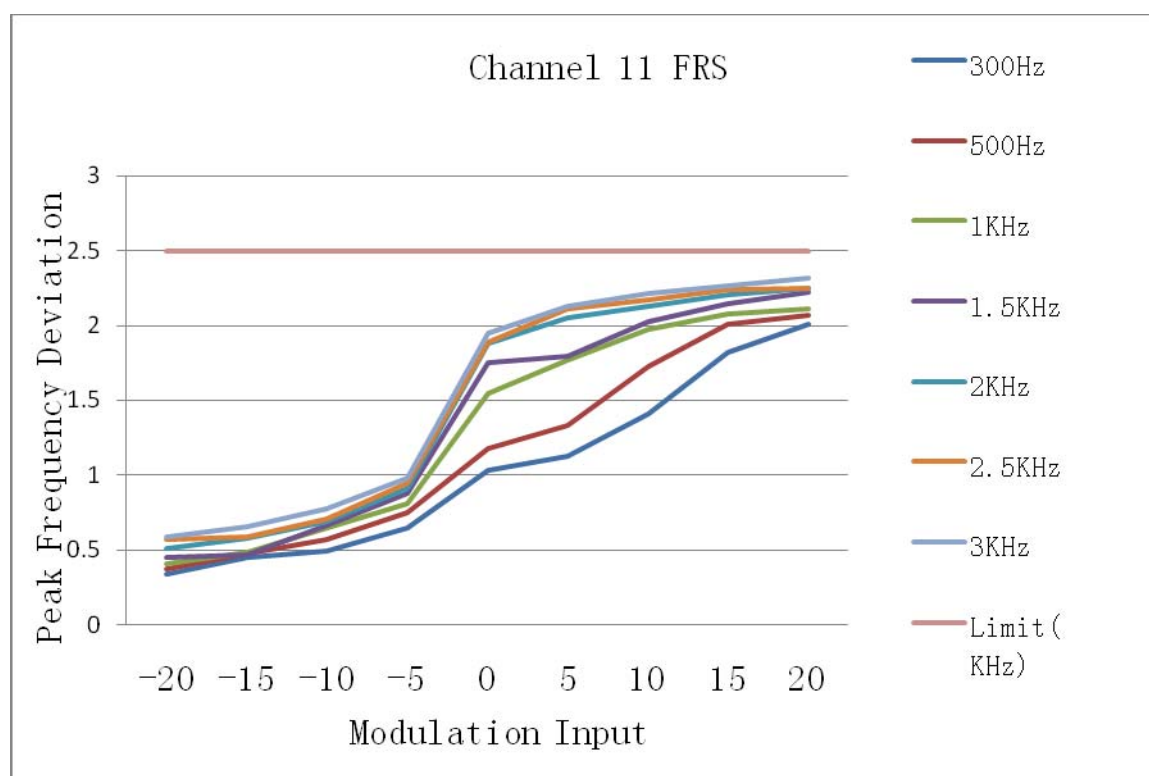
6.4. Test Result

Frequency deviation:

Channel 4: 462.6375MHz, GMRS								
Modulation Input(dB)	Peak Frequency Deviation (KHz)							Limit (KHz)
	300Hz	500Hz	1KHz	1.5KHz	2KHz	2.5KHz	3KHz	
-20	0.33	0.35	0.41	0.43	0.49	0.55	0.58	2.5
-15	0.41	0.43	0.46	0.48	0.53	0.56	0.62	2.5
-10	0.47	0.58	0.59	0.61	0.64	0.69	0.75	2.5
-5	0.63	0.75	0.86	0.88	0.89	0.91	0.99	2.5
0	1.01	1.13	1.71	1.77	1.85	1.89	1.98	2.5
5	1.15	1.46	1.81	1.98	2.03	2.11	2.17	2.5
10	1.67	1.84	1.97	2.07	2.13	2.15	2.26	2.5
15	1.81	2.01	2.03	2.17	2.19	2.24	2.27	2.5
20	2.03	2.07	2.16	2.17	2.25	2.26	2.31	2.5
Conclusion: PASS								
Test Date : Mar. 21, 2017					Test Engineer : Toby Ren			

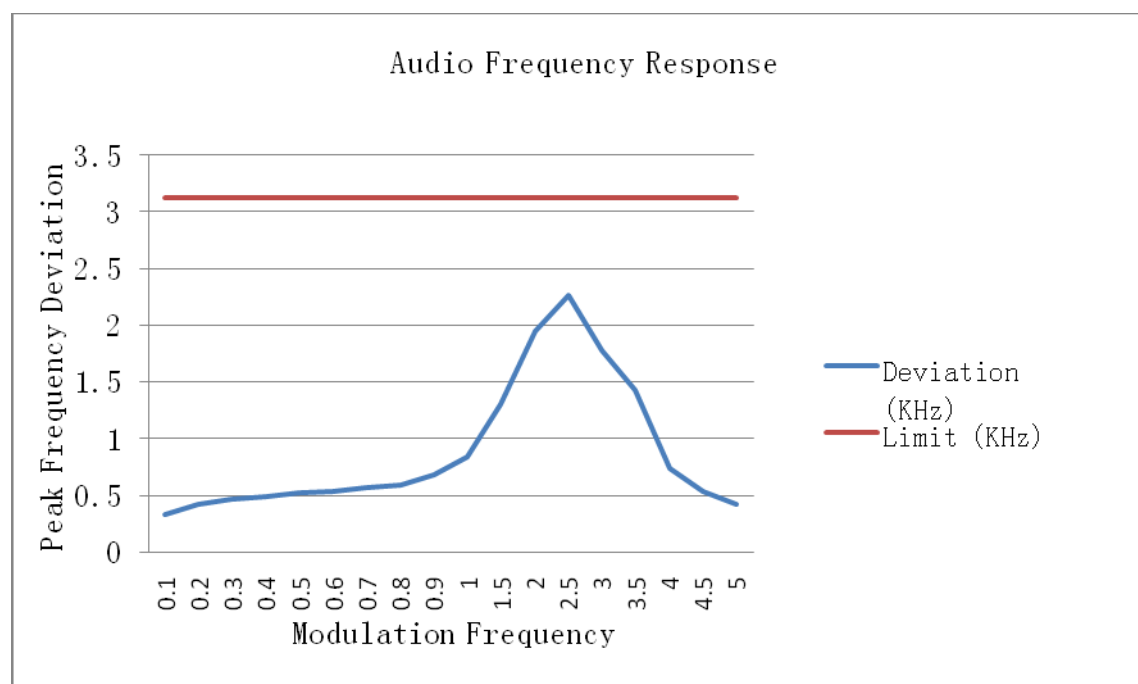


Channel 11: 467.6375MHz, FRS								
Modulation Input(dB)	Peak Frequency Deviation (KHz)							Limit (KHz)
	300Hz	500Hz	1KHz	1.5KHz	2KHz	2.5KHz	3KHz	
-20	0.34	0.37	0.41	0.45	0.51	0.57	0.59	2.5
-15	0.45	0.47	0.49	0.47	0.58	0.59	0.66	2.5
-10	0.49	0.57	0.65	0.66	0.69	0.71	0.78	2.5
-5	0.65	0.75	0.81	0.88	0.91	0.95	0.98	2.5
0	1.03	1.18	1.55	1.75	1.88	1.89	1.95	2.5
5	1.13	1.33	1.77	1.79	2.05	2.11	2.13	2.5
10	1.41	1.73	1.97	2.02	2.13	2.17	2.22	2.5
15	1.82	2.01	2.08	2.14	2.21	2.24	2.27	2.5
20	2.01	2.07	2.11	2.22	2.25	2.25	2.32	2.5
Conclusion: PASS								
Test Date : Mar. 21, 2017					Test Engineer : Toby Ren			



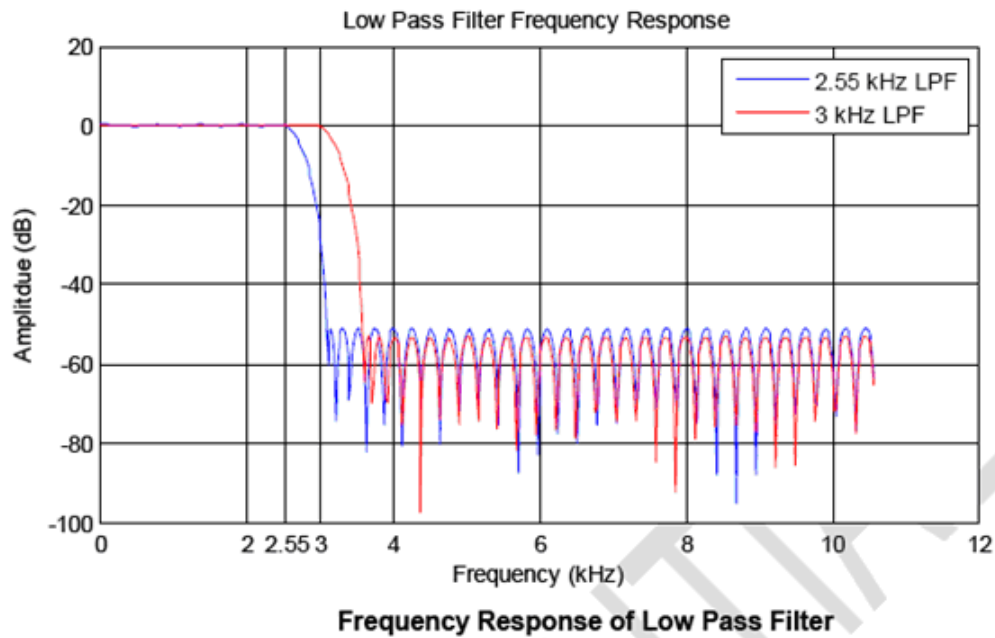
Audio Frequency Response

Channel 11: 467.6375MHz, FRS		
Modulation Frequency(Hz)	Deviation (KHz)	Limit (KHz)
100	0.33	3.125
200	0.42	3.125
300	0.47	3.125
400	0.49	3.125
500	0.52	3.125
600	0.53	3.125
700	0.57	3.125
800	0.59	3.125
900	0.68	3.125
1000	0.84	3.125
1500	1.31	3.125
2000	1.95	3.125
2500	2.27	3.125
3000	1.78	3.125
3500	1.43	3.125
4000	0.74	3.125
4500	0.53	3.125
5000	0.42	3.125
Conclusion:PASS		
Test Date : Mar. 21, 2017		Test Engineer : Toby Ren



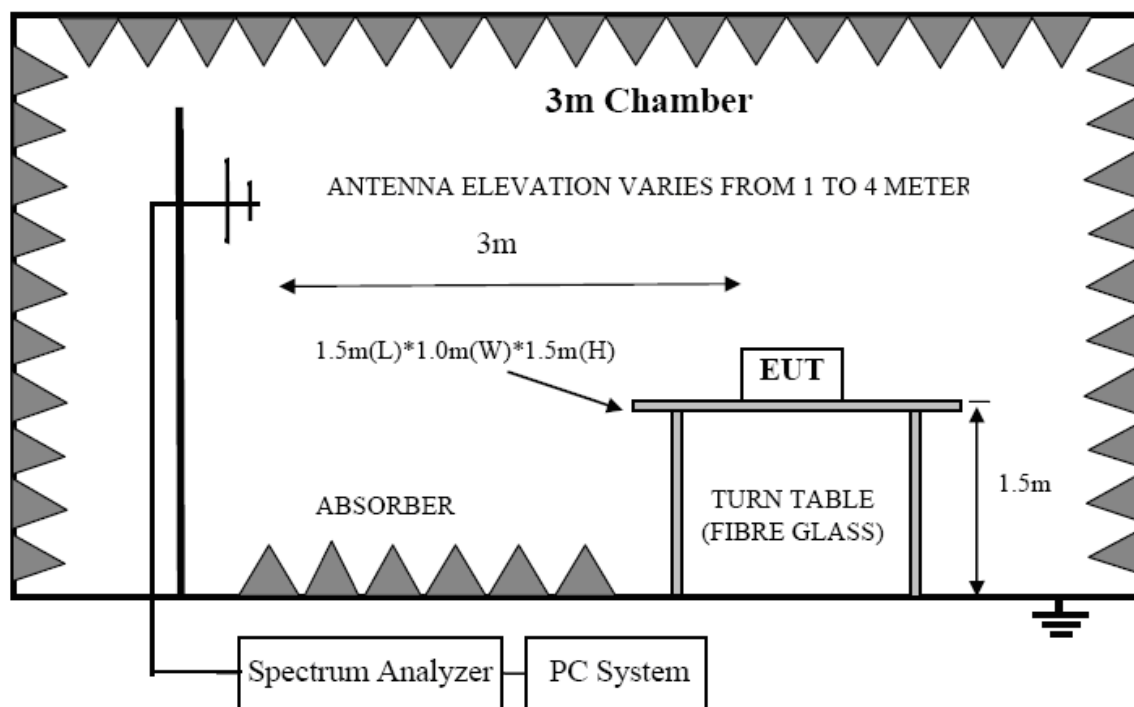
Audio Low Pass Filter Response

For this device the Audio Low Pass Filter was integrated in chip U301(EL3280), and it's impossible to measure the response of Audio Low Pass Filter. According technical spec of U301, the Audio Low Pass Filter Response curve as below, and comply this FCC and IC requirements.



7. Radiated Spurious Emission

7.1. Block diagram of test setup



7.2. Limit

The unwanted emission should be attenuated below TP by at least $43 + 10\log(\text{Transmit Power})$ dB and unwanted emissions falling within the restricted bands of RSS-Gen shall be attenuated to the limits provided in this section or to the general field strength limits shown in RSS-Gen, whichever are less stringent.

7.3. Test Procedure

- (1) On a test site, the EUT shall be placed on a 1.5m turntable and in the position closest to the normal use as declared by the user.
- (2) The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the transmitter.
- (3) The output of the antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- (4) The transmitter shall be switched on; if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
- (5) The test antenna shall be raised and lowered through the specified range of height until the measuring receiver detects a maximum signal level.

- (6)The transmitter shall than be rotated through 360°in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- (7)The test antenna shall be raised and lowered again through the specified range of height until the measuring receiver detects a maximum signal level.
- (8)The maximum signal level detected by the measuring receiver shall be noted.
- (9)The measurement shall be repeated with the test antenna set to horizontal polarization.
- (10) Replace the antenna with a proper Antenna (substitution antenna).
- (11) The substitution antenna shall be oriented for vertical polarization and, if necessary, the length of the substitution antenna shall be adjusted to correspond to the frequency of transmitting.
- (12) The substitution antenna shall be connected to a calibrated signal generator.
- (13) If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- (14) The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
- (15) The input signal to substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
- (16) The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
- (17) The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.
- (18) Frequency from lowest frequency (21.72MHz) into 10th harmonic(5GHz) was was measured.

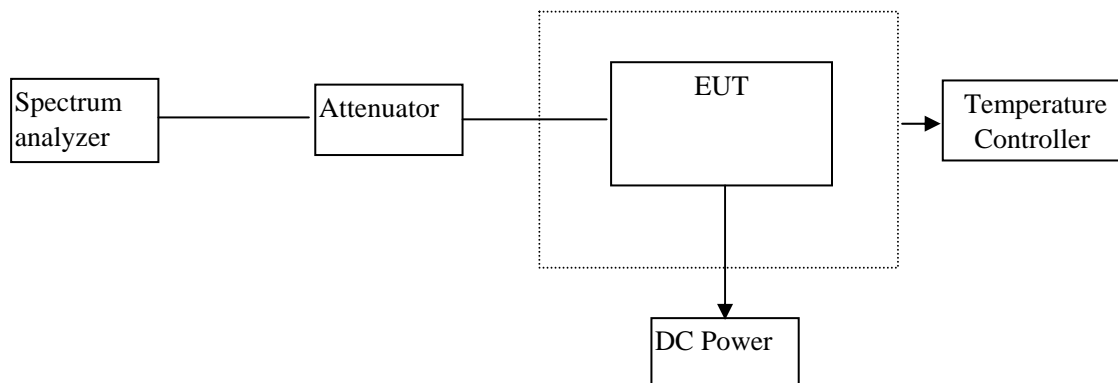
7.4. Test result

Test Mode: GMRS mode continue transmitting Channel 4, Frequency= 462.6375MHz, with earphone and power adapter 2.(Note 1)					
Channle Maximum Power:27.66dBm (0.583W)					
Frequency (MHz)	Antenna polarization	Result (dBm)	Limit(Note 2) (dBm)	Margin (dB)	Conclusion
496.57	H	-60.20	-13	-47.20	PASS
926.28	H	-34.54	-13	-21.54	PASS
1385.00	H	-23.12	-13	-10.12	PASS
1847.00	H	-25.79	-13	-12.79	PASS
2309.00	H	-38.34	-13	-25.34	PASS
616.02	V	-61.24	-13	-48.24	PASS
926.28	V	-28.41	-13	-15.41	PASS
1385.00	V	-21.71	-13	-8.71	PASS
1847.00	V	-23.93	-13	-10.93	PASS
2309.00	V	-38.41	-13	-25.41	PASS
Note 1: According explorer test, this configuration have worst emission.					
Note 2:Limit= 27.66dBm- (43+10log(Transmit Power)) = -13dBm					
Test Date : Mar. 21, 2017			Test Engineer : Toby Ren		

Test Mode: FRS mode continue transmitting Channel 11, Frequency= 467.6375MHz, with earphone and power adapter 2.(Note 1)					
Channle Maximum Power:26.84dBm (0.483W)					
Frequency (MHz)	Antenna polarization	Result (dBm)	Limit(Note 2) (dBm)	Margin (dB)	Conclusion
647.89	H	-61.05	-13	-48.05	PASS
935.98	H	-32.85	-13	-19.85	PASS
1399.00	H	-24.80	-13	-11.80	PASS
1868.00	H	-28.74	-13	-15.74	PASS
2337.00	H	-36.00	-13	-23.00	PASS
694.45	V	-60.87	-13	-47.87	PASS
935.98	V	-26.72	-13	-13.72	PASS
1399.00	V	-25.97	-13	-12.97	PASS
1868.00	V	-28.61	-13	-15.61	PASS
2337.00	V	-40.90	-13	-27.90	PASS
Note 1: According explorer test, this configuration have worst emission.					
Note 2:Limit= 26.84dBm- (43+10log(Transmit Power)) = -13dBm					
Test Date : Mar. 21, 2017			Test Engineer : Toby Ren		

8. Frequency Stability

8.1. Block diagram of test setup



8.2. Limits

According to FCC 95.621

(b) Each GMRS transmitter for mobile station, small base station and control station operation must be maintained within a frequency tolerance of 0.0005%. Each GMRS transmitter for base station (except small base), mobile relay station or fixed station operation must be maintained within a frequency tolerance of 0.00025%.

According to FCC 95.627

(b) Each FRS unit must be maintained within a frequency tolerance of 0.000 25%.

According to RSS-210 A6.1.6

FRS Devices: Carrier frequency tolerance shall be better than ± 5 ppm

According to RSS-210 A6.2.6

GMRS Devices: Carrier frequency tolerance shall be better than ± 5 ppm

8.3. Test Procedure

Frequency stability versus environmental temperature:

- (1). Setup the configuration per figure 1 for frequencies measurement inside an environment chamber, Install new battery in the EUT.
- (2). Turn on EUT and set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1KHz and Video Resolution Bandwidth to 1KHz and Frequency Span to 50KHz. Record this frequency as reference frequency.
- (3). Set the temperature of chamber to 50°C. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
- (4). Repeat step 2 with a 10°C decreased per stage until the lowest temperature -30°C is measured, record all measured frequencies on each temperature step.

Frequency stability versus input voltage:

- (1). Setup the configuration per figure 1 for frequencies measured at temperature if it is within 15°C to 25°C. Otherwise, an environment chamber set for a temperature of 20°C shall be used. The EUT shall be powered by DC 3.7 V
- (2). Set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1 KHz and Video Resolution Bandwidth to 1KHz. Record this frequency as reference frequency.
- (3). Supply the EUT primary voltage at the operating end point which is specified by manufacturer and record the frequency.

8.4. Test result

Frequency Tolerance							
CH #	Frequency (MHz)	TYPE	Result			FCC limit	RSS-210 limit
			Measured (MHz)	Tolerance (%)	Tolerance (ppm)	%	ppm
1	462.5625	GMRS	462.5625	0	0	0.0005%	±5
2	462.5875	GMRS	462.5875	0	0	0.0005%	±5
3	462.6125	GMRS	462.6126	0.000022	0.22	0.0005%	±5
4	462.6375	GMRS	462.6375	0	0	0.0005%	±5
5	462.6625	GMRS	462.6625	0	0	0.0005%	±5
6	462.6875	GMRS	462.6878	0.000065	0.65	0.0005%	±5
7	462.7125	GMRS	462.7123	-0.000043	-0.43	0.0005%	±5
8	467.5625	FRS	467.5625	0	0	0.00025%	±5
9	467.5875	FRS	467.5873	-0.000043	-0.43	0.00025%	±5
10	467.6125	FRS	467.6123	-0.000043	-0.43	0.00025%	±5
11	467.6375	FRS	467.6372	-0.000065	-0.65	0.00025%	±5
12	467.6625	FRS	467.6625	0	0	0.00025%	±5
13	467.6875	FRS	467.6875	0	0	0.00025%	±5
14	467.7125	FRS	467.7127	0.000043	0.43	0.00025%	±5
15	462.55	GMRS	462.55	0	0	0.0005%	±5
16	462.575	GMRS	462.575	0	0	0.0005%	±5
17	462.6	GMRS	462.6	0	0	0.0005%	±5
18	462.625	GMRS	462.625	0	0	0.0005%	±5
19	462.65	GMRS	462.65	0	0	0.0005%	±5
20	462.675	GMRS	462.676	0	0	0.0005%	±5
21	462.7	GMRS	462.7	0	0	0.0005%	±5
22	462.725	GMRS	462.726	0	0	0.0005%	±5
Conclusion:PASS							
Test Date : Mar. 21, 2017				Test Engineer : Toby Ren			

Frequency Deviation With Temperature Variation						
GMRS Channel 4						
Temperature (°C)	Frequency (MHz)	Result			FCC limit	RSS-210 limit
		Measured (MHz)	Tolerance (%)	Tolerance (ppm)	%	ppm
-30	462.6375	462.6377	0.000043	0.43	0.0005%	±5
-20	462.6375	462.6373	-0.000043	-0.43	0.0005%	±5
-10	462.6375	462.6378	0.000065	0.65	0.0005%	±5
0	462.6375	462.6376	0.000022	0.22	0.0005%	±5
10	462.6375	462.6375	0	0	0.0005%	±5
20	462.6375	462.6376	0.000022	0.22	0.0005%	±5
30	462.6375	462.6375	0	0	0.0005%	±5
40	462.6375	462.6375	0	0	0.0005%	±5
50	462.6375	462.6377	0.000043	0.43	0.0005%	±5
FRS Channel 11						
-30	467.6375	467.6378	0.000064	0.64	0.00025%	±5
-20	467.6375	467.6377	0.000043	0.43	0.00025%	±5
-10	467.6375	467.6375	0	0	0.00025%	±5
0	467.6375	467.6374	-0.000021	-0.21	0.00025%	±5
10	467.6375	467.6375	0	0	0.00025%	±5
20	467.6375	467.6377	0.000043	0.43	0.00025%	±5
30	467.6375	467.6374	-0.000021	-0.21	0.00025%	±5
40	467.6375	467.6376	0.000021	0.21	0.00025%	±5
50	467.6375	467.6378	0.000064	0.64	0.00025%	±5
Conclusion:PASS						
Test Date : Mar. 21, 2017				Test Engineer : Toby Ren		

Frequency Deviation With Voltage Variation						
GMRS Channel 4						
Voltage(V)	Frequency (MHz)	Result			FCC limit	RSS-210 limit
		Measured (MHz)	Tolerance (%)	Tolerance (ppm)	%	ppm
4.5	462.6375	462.6378	0.000065	0.65	0.0005%	±5
4.2	462.6375	462.6373	-0.000043	-0.43	0.0005%	±5
4.0	462.6375	462.6375	0	0	0.0005%	±5
3.7	462.6375	462.6375	0	0	0.0005%	±5
3.4	462.6375	462.6378	0.000065	0.65	0.0005%	±5
3.2	462.6375	462.6373	-0.000043	-0.43	0.0005%	±5
3.0	462.6375	462.6376	0.000022	0.22	0.0005%	±5
FRS Channel 11						
4.5	467.6375	467.6378	0.000064	0.64	0.00025%	±5
4.2	467.6375	467.6374	-0.000021	-0.21	0.00025%	±5
4.0	467.6375	467.6375	0	0	0.00025%	±5
3.7	467.6375	467.6372	-0.000065	-0.65	0.00025%	±5
3.4	467.6375	467.6374	-0.000021	-0.21	0.00025%	±5
3.2	467.6375	467.6374	-0.000021	-0.21	0.00025%	±5
3.0	467.6375	467.6373	-0.000043	-0.43	0.00025%	±5
Conclusion:PASS						
Test Date : Mar. 21, 2017				Test Engineer : Toby Ren		