FCC ID TEST REPORT

for

PMR 446 with Bluetooth

Model: X2 Slim

FCC ID: 2ACTIX2SLIM

Prepared for: Vigor Sports, Inc.
16310 Arthur Street Cerritos, CA 90703, USA

Prepared by: Shenzhen TCT Testing Technology Co.,Ltd
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Report Number: TCT140430015F2-2
Date of Test: July 04-July 17, 2014
Date of Report: July 17, 2014

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1.0 General Details

1.1 Test Lab Details

Name :	Shenzhen Tongce Testing Lab
Address:	1F, Leinuo Watch Building, Fuyong Town, Baoan Dist, Shenzhen, China
Telephone:	13410377511
Fax:	--

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

FCC Registration Number: 572331

Shenzhen TCT Testing Technology Co., Ltd., Shenzhen EMC Laboratory: Shenzhen Tongce Testing Lab

The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

Registration Number: 572331

Industry Canada (IC)

The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

Registration Number IC: 10668A-1

1.2 Applicant Details

Applicant:	Vigor Sports, Inc.
Address:	16310 Arthur Street Cerritos, CA 90703, USA
Telephone:	562 407 2184
Fax:	562 802 3151

Manufacturer:	AIRTECH I & C., Ltd.
Address:	21, Namdong-daero 370beon-gil, Namdong-gu, Incheon 405-846, Korea
Telephone:	--
Fax:	--

1.3 Description of EUT

Product:	PMR 446 with Bluetooth
Model No.:	X2 Slim
Additional Model No.:	N.A.
Brand Name	N.A.
Power supply:	DC 3.7V via Battery or DC 5V via Adapter Adapter Information: Model: FY0500500 Input: AC 100-240V, 50-60Hz Output: DC 5V, 0.5A
Modulation Type:	FM for GMRS and FRS, GFSK for Bluetooth
Max Tx deviation	25KHz for GMRS and FRS, 2MHz for Bluetooth
Emission type:	F3E
Operation Frequency:	Bluetooth : 2 402 MHz ~ 2 480 MHz GMRS : 462.55 MHz ~ 462.725 MHz FRS : 462.5625 MHz ~ 462.7125 MHz ; 467.5625MHz ~ 467.7125MHz
Number of Channel:	Bluetooth : 40 GMRS : 8 FRS : 14
Antenna Designation:	Bluetooth: An internal antenna and the maximum antenna gain is -1.95dBi. GMRS(FRS): An helical antenna and the maximum antenna gain is -3.22dBi.

1.4 Statement

1.5 Test Engineer

The sample tested by 

Printed name: Jack Kang

2.0 Test equipments and Associated Equipment used during the test.

2.1 Test Equipments

Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
ESPI Test Receiver	ROHDE&SCHWARZ	ESPI 3	100379	July 2, 2014	July 1, 2015
Spectrum Analyzer	ROHDE&SCHWARZ	FSEM	848597/001	July 2, 2014	July 1, 2015
Pre-amplifier	Teseq	LNA6900	--	July 3, 2014	July 2, 2015
Pre-amplifier	Agilent	8447D	83153007374	July 3, 2014	July 2, 2015
Pre-amplifier	Agilent	8449B	3008A01738	July 3, 2014	July 2, 2015
Loop antenna	A.R.A.	PLA-1030/B	1029	July 3, 2014	July 2, 2015
Ultra Broadband ANT	ROHDE&SCHWARZ	HL562	100157	July 3, 2014	July 2, 2015
Horn Antenna	ETS LINDGREN	3117	--	July 3, 2014	July 2, 2015
Horn Antenna	ETS LINDGREN	3160	--	July 3, 2014	July 2, 2015
EMI Test Receiver	R&S	ESCS30	100139	July 2, 2014	July 1, 2015
LISN	AFJ	LS16C	16010222119	July 2, 2014	July 1, 2015
Signal Generator	HP	83650B	3614A00276	July 2, 2014	July 1, 2015
RF Communications Test Set	HP	8920A	3438A05338	July 2, 2014	July 1, 2015
Function Generator	Agilent	33220A	MY43004878	July 2, 2014	July 1, 2015
Spectrum Analyzer	Agilent	E4446A	US44300386	July 3, 2014	July 2, 2015
DC Power Supply	BK Precision	1621A	D185052265	July 2, 2014	July 1, 2015
MXA	Agilent	N9010A	MY/SG/US5340	May 12, 2014	May 11, 2015

2.2 AE used during the test

Equipment type	Manufacturer	Model
N/A		
N/A		
N/A		
N/A		

3.0 Technical Details

3.1 Summary of test results

The EUT has been tested according to the following specifications

Requirement	CFR 47 Section	Result
Modulation Characteristics	**§ 2.1047, §95.637**	**PASS**
Field Strength of Spurious Radiation	**§ 2.1053, §95.635**	**PASS**
RF Output Power	**§ 2.1046, §95.639**	**PASS**
Occupied Bandwidth & Emission Mask	**§ 2.1049, §95.633, §95.635**	**PASS**
Spurious Emissions at Antenna Terminals	**§ 2.1051, §95.635**	**PASS**
Frequency stability	**§ 2.1055, § 95.621, §95.626**	**PASS**
RF Exposure	**§ 2.1093**	**PASS**

3.2 Test Standards

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 parts:

Part 95A: General Mobile Radio Service (GMRS)

Part 95B: Family Radio Service (FRS)

Applicable Standards: TIA 603-C,

4.0 EUT Modification

No modification by Shenzhen TCT Testing Technology Co., Ltd

5.0 Measurement Uncertainty（95% confidence levels, k=2)

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase centre variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR16-4-2:2003, The Treatment of Uncertainty in EMC Measurements, the values ranging from +2.0 dB for Conducted Emissions tests and +4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at TCT Lab.

Note: 1) The EUT is a portable device, and measurements were conducted in all three axis (X, Y, Z), and the worst case (X axis) was submitted only.

6.0 Power Line Conducted Emission Test

Not applicable

7.0 RF Exposure Information

7.1 Applicable Standards

FCC §2.1093

7.2 Result

This is a portable device which requires SAR testing; refer to the separate SAR report No.: 14702R-HP-US-P03V01 for detailed results

8.0 RF Output Power

8.1 Applicable Standard

According to FCC §2.1046, and §95.639,

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

50 Watt (47dBm) Carrier power (average TP during one unmodulated RF cycle) when transmitting emission type A1D, F1D, G1D, A3E, F3E or G3E.

50 Watt (47dBm) peak envelope TP when transmitting emission type H1D, J1D, R1D, H3E, J3E or R3E.

(d) No FRS unit, under any condition of modulation, shall exceed 0.500 Watt (27dBm) effective radiated power (ERP).

8.2 Test specification:

Environmental conditions: Temperature 23° C Humidity: 51% Atmospheric pressure: 103kPa

8.3 Test Equipment List and Details

8.4 Test Procedure

TIA-603-C clause 2.2.17.2

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation

8.5 Test Result PASS

Conducted Output Power:

Channel	Frequency (MHz)	Conducted Output Power (Watt)	Limit (Watt)
FRS			
1	462.5625	0.22	0.5
2	462.5875	0.21	
3	462.6125	0.23	
4	462.6375	0.22	
5	462.6625	0.22	
6	462.6875	0.24	
7	462.7125	0.22	

GMRS			
8	462.5750	1.45	2
9	**462.6250**	**1.46**	
10	462.6750	1.42	
11	462.5500	1.41	
12	462.6000	1.43	
13	462.6500	1.45	
14	462.7000	1.42	
15	462.7250	1.43	
FRS			
16	**467.5625**	**0.45**	0.5
17	467.5875	0.43	
18	467.6125	0.42	
19	467.6375	0.43	
20	467.6625	0.42	
21	467.6875	0.42	
22	467.7125	0.43	

Therefore all applicable requirements were tested to the two channels, the 9th for GMRS and the 16th for FRS. The field strength of spurious emission was measured in three orthogonal EUT positions(x-axis, y-axis and z-axis). Worst case is z-axis.

ERP:

No	Freq (MHz)	S.G level + Amp. (dBm)	Antenna Factor	Cable loss(dB)	Antenna Polarity	Result (dBm)	Part 95A/B Limit (dBm)	Margin (dB)	Remark
GMRS CH-9									
	462.6250	32.14	-1.32	0.6	H	30.22	47	-16.78	PK
	462.6250	31.06	-1.32	0.6	V	29.14	47	-17.86	PK
FRS CH-16									
	467.5625	28.44	-1.21	0.6	H	26.63	27	-0.37	PK
	467.5625	27.61	-1.21	0.6	V	25.80	27	-1.20	PK

9.0 Modulation Characteristics

9.1 Applicable Standard

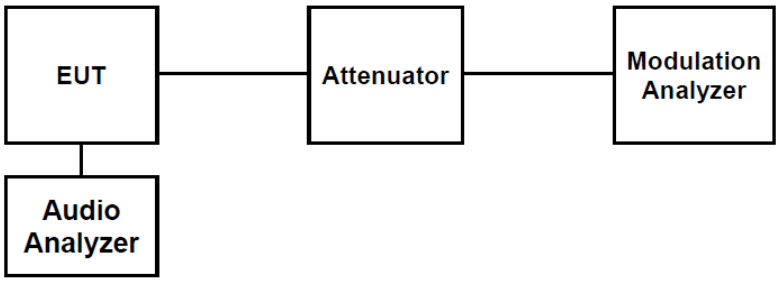
FCC §2.1047(d) and §95.637.

(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 over modulation. 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.

9.2 Test Procedure

1. Set up the test equipment in the following configuration :



2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Modulation Analyzer.

3. Connect the microphone of EUT to the Audio Analyzer.

Frequency Deviation

1. Standard test modulation is a 1000 Hz input signal at a level that produces 60 % of full rated system deviation.

2. Change a input level from -25 dB to 25 dB as 5 dB scale and record the frequency deviation.

3. Generate audio signal 300 Hz and 3 kHz.

4. Repeat Step 2 respectively.

Audio Frequency Response

1. Standard test modulation is a 1000 Hz input signal at a level that produces 20 % of full rated system deviation.

2. Generate audio signal from 100 Hz to 5 kHz and record the frequency deviation.

3. Calculate and record the audio frequency response at the present frequency as :

audio frequency response = 20 log (DEVFreq./DEVRef.)

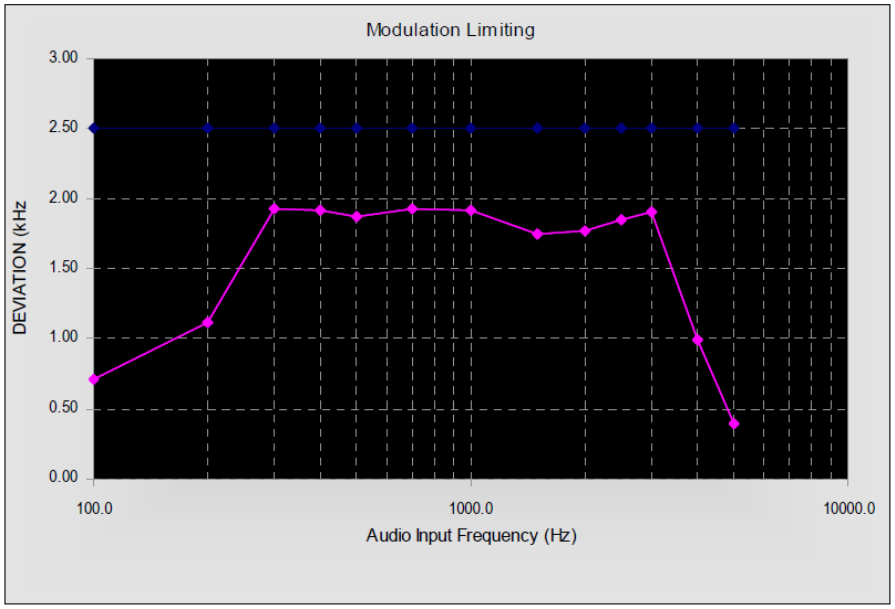
TIA-603-C section 2.2.3, 2.2.6

9.3 Test Result

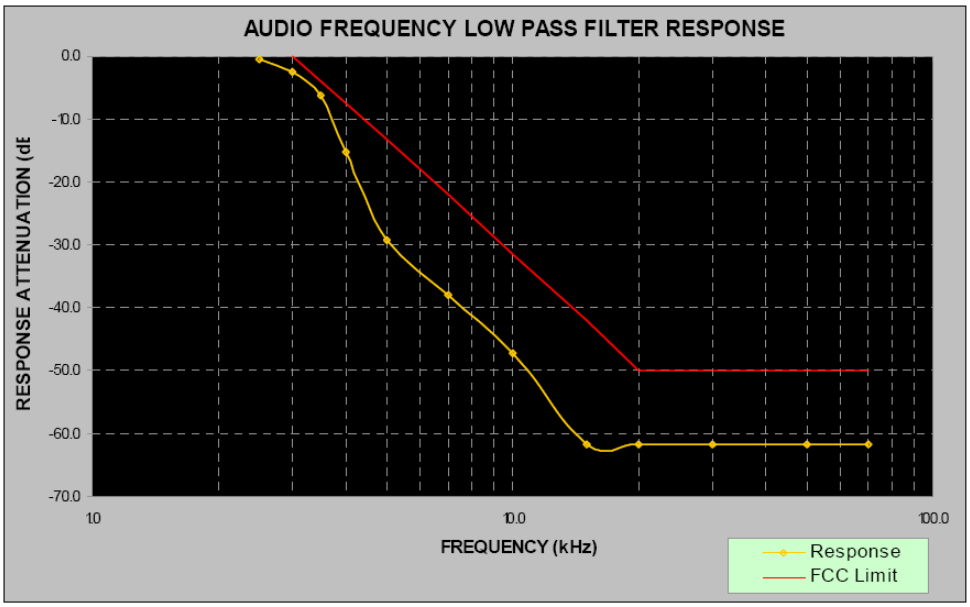
Please refer to the plots.

GMRS

Frequency Deviation

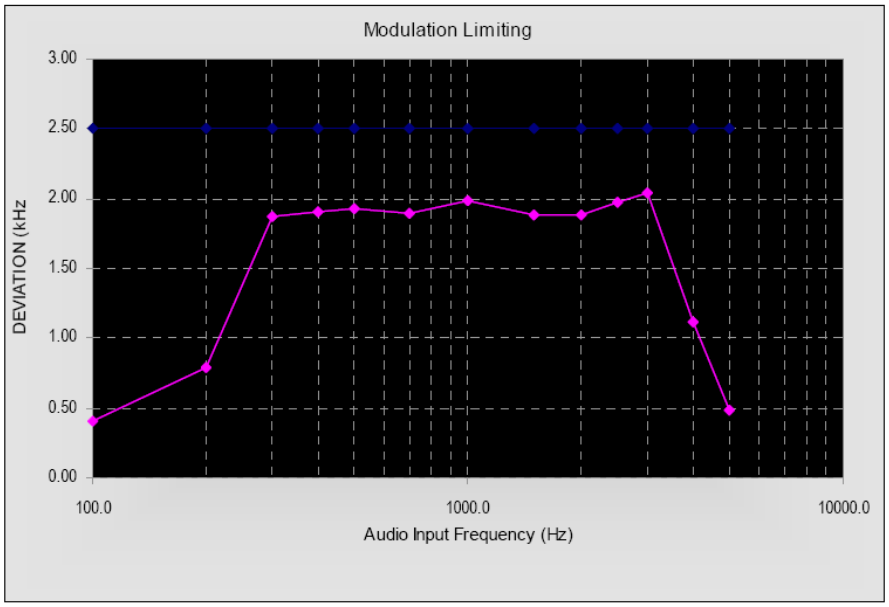


Frequency Response of Audio Low Pass Filter

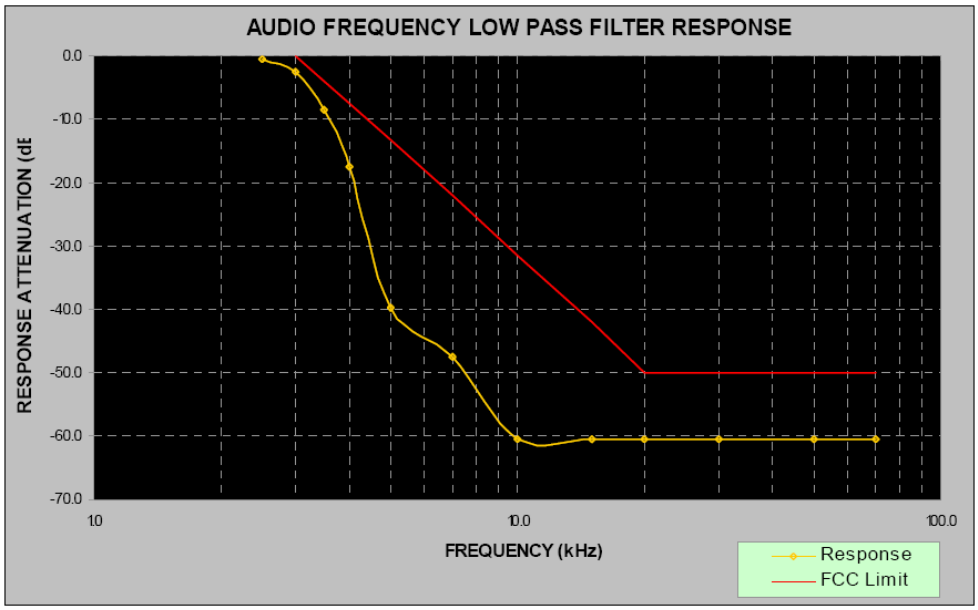


FRS

Frequency Deviation



Frequency Response of Audio Low Pass Filter



10.0 Occupied Bandwidth & Emission Mask

10.1 Applicable Standards

FCC §2.1049 and §95.633 (a) (c).

(a) 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.

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

Transmitter	Emission type	Applicable paragraphs (b)
GMRS	A1D, A3E, F1D, G1D, F3E, G3E with filtering	(1), (3), (7).
	A1D, A3E, F1D, G1D, F3E, G3E without filtering	(5), (6), (7).
	H1D, J1D, R1D, H3E, J3E, R3E	(2), (4), (7).
FRS	F3E with filtering	(1), (3), (7).

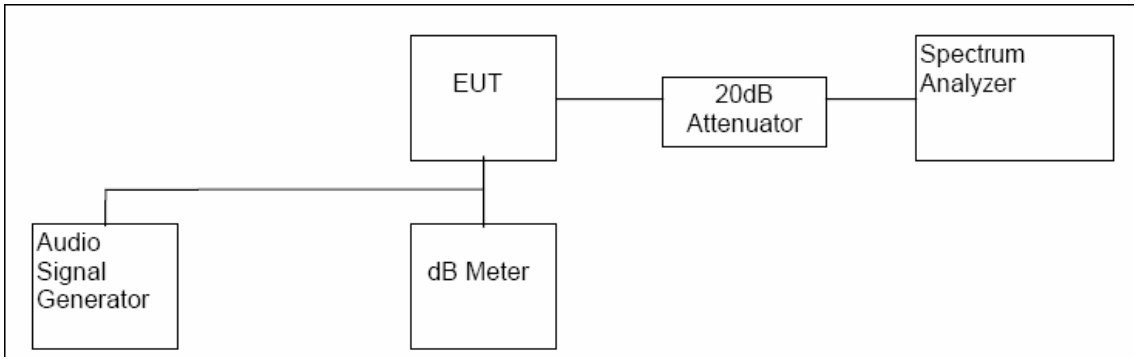
(1) At least 25 dB (decibels) on any frequency removed from the centre of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.

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

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

10.2 Test Procedure

(1). Configure EUT and assistant system as following:



(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.

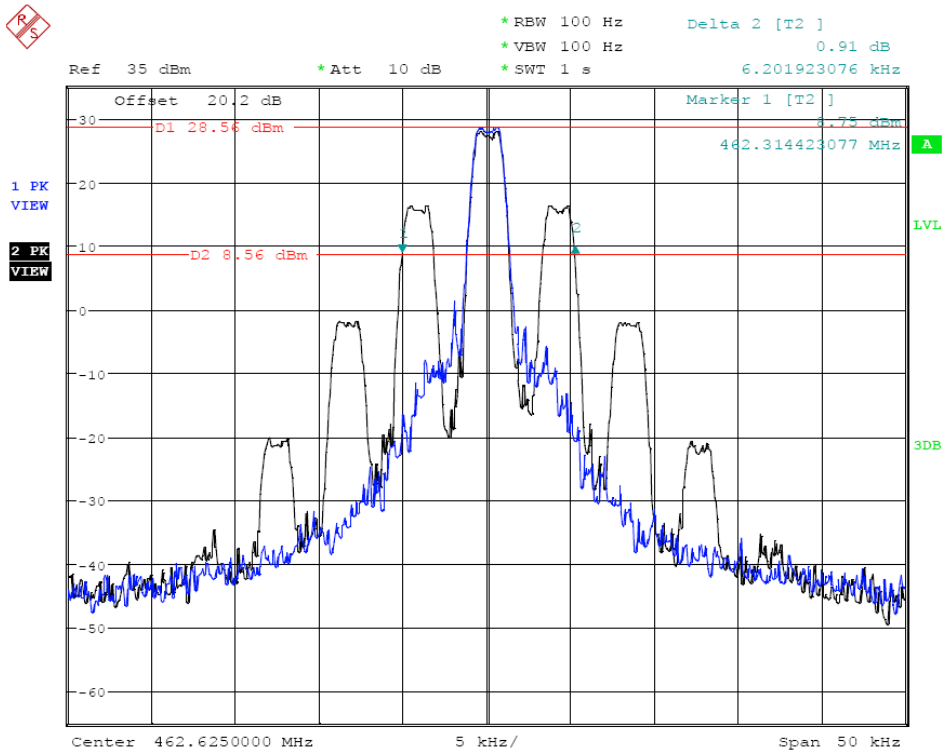
(4). Measure the -20 dB bandwidth of modulated signal.

10.3 Test Results

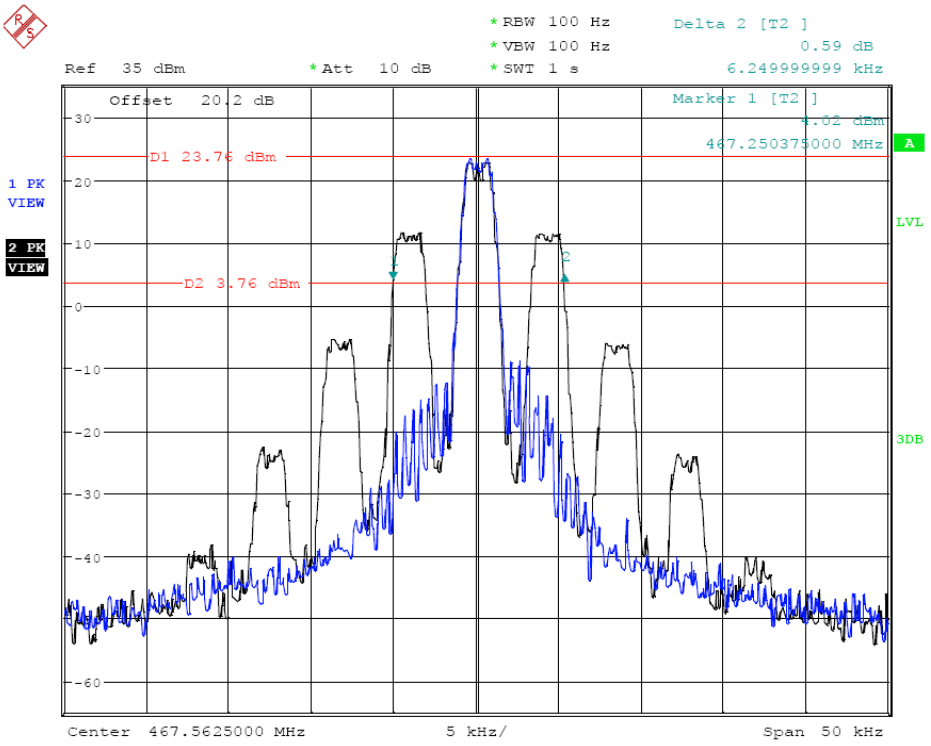
Please refer to the following plots.

Occupied Bandwidth

GMRS:CH9

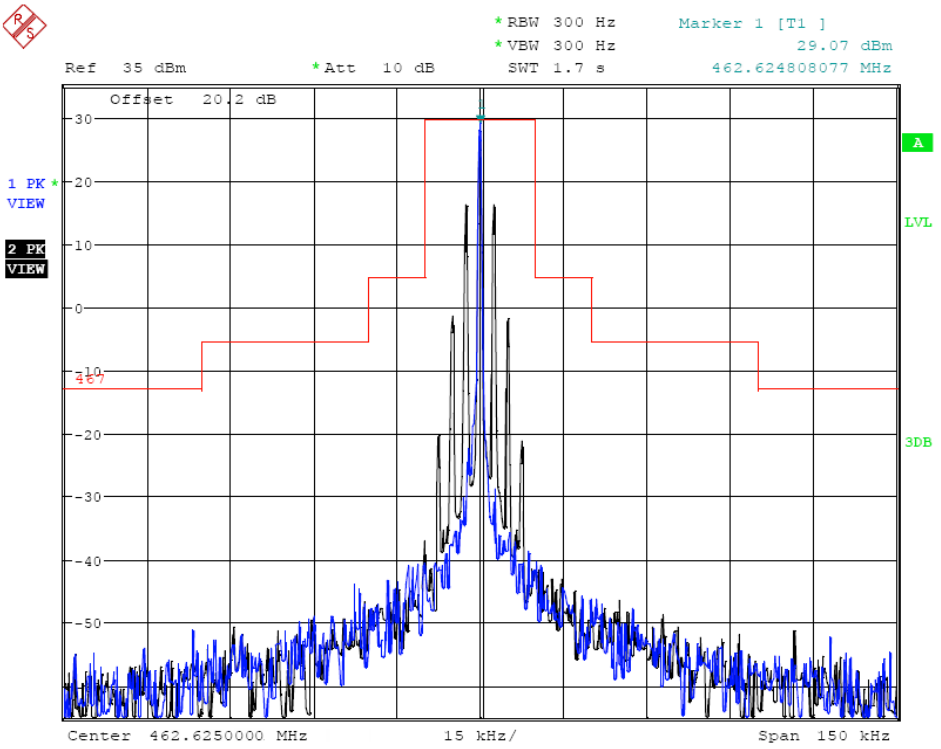


FRS:CH16

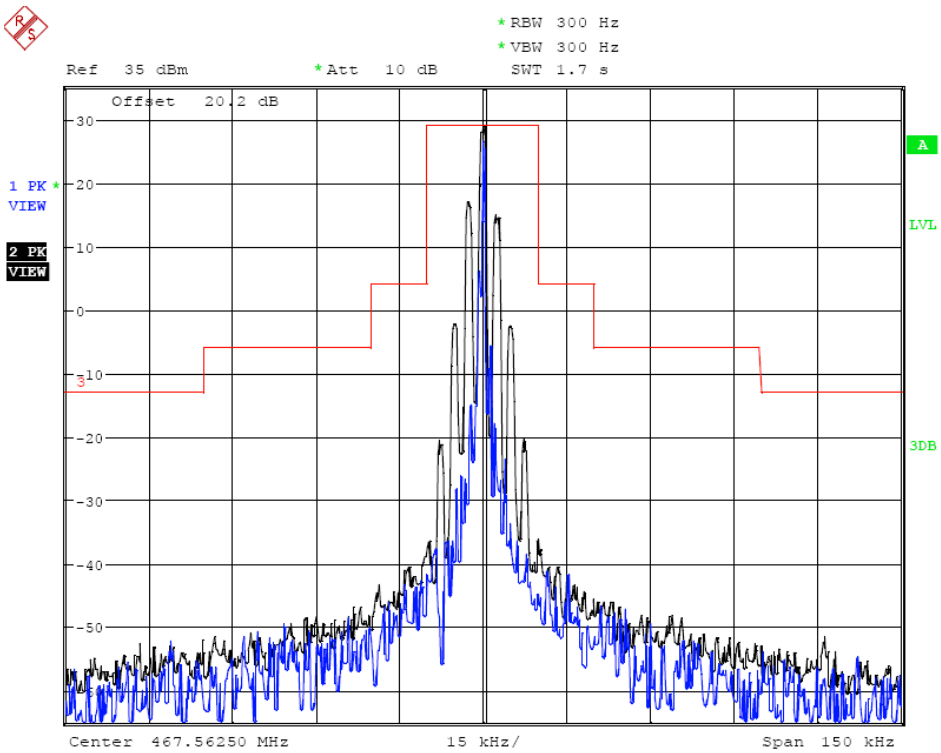


Emission Mask

GMRS:CH9



FRS:CH16



11.0 Spurious Emissions at Antenna Terminals

11.1 Applicable Standards

FCC §2.1051 and §95.635.

Transmitter	Emission type	Applicable paragraphs (b)
GMRS	A1D, A3E, F1D, G1D, F3E, G3E with filtering	(1), (3), (7).
	A1D, A3E, F1D, G1D, F3E, G3E without filtering	(5), (6), (7).
	H1D, J1D, R1D, H3E, J3E, R3E	(2), (4), (7).
FRS	F3E with filtering	(1), (3), (7).

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

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

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

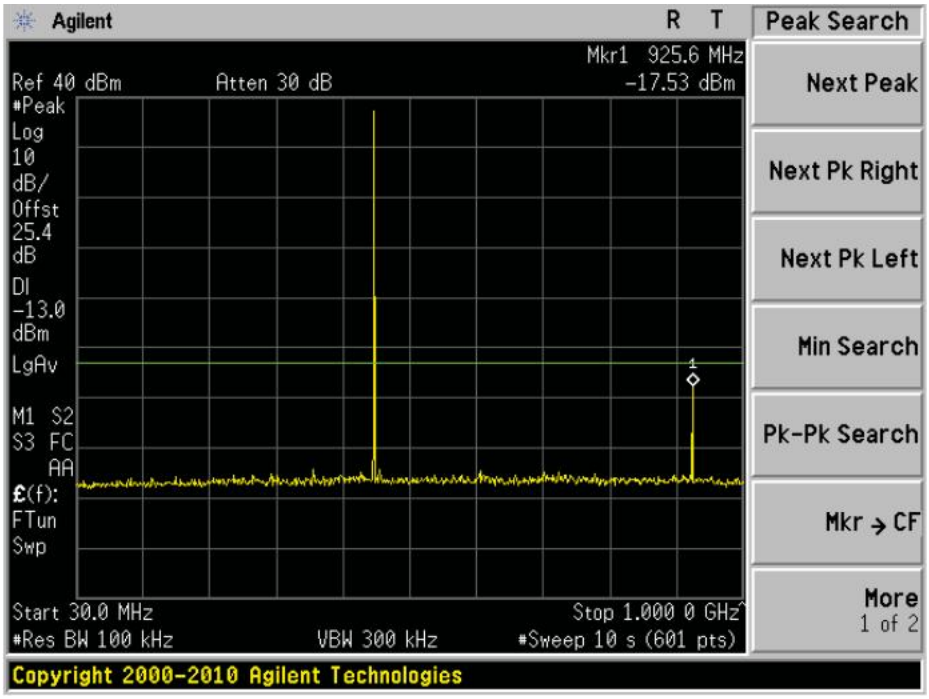
11.2 Test Procedure

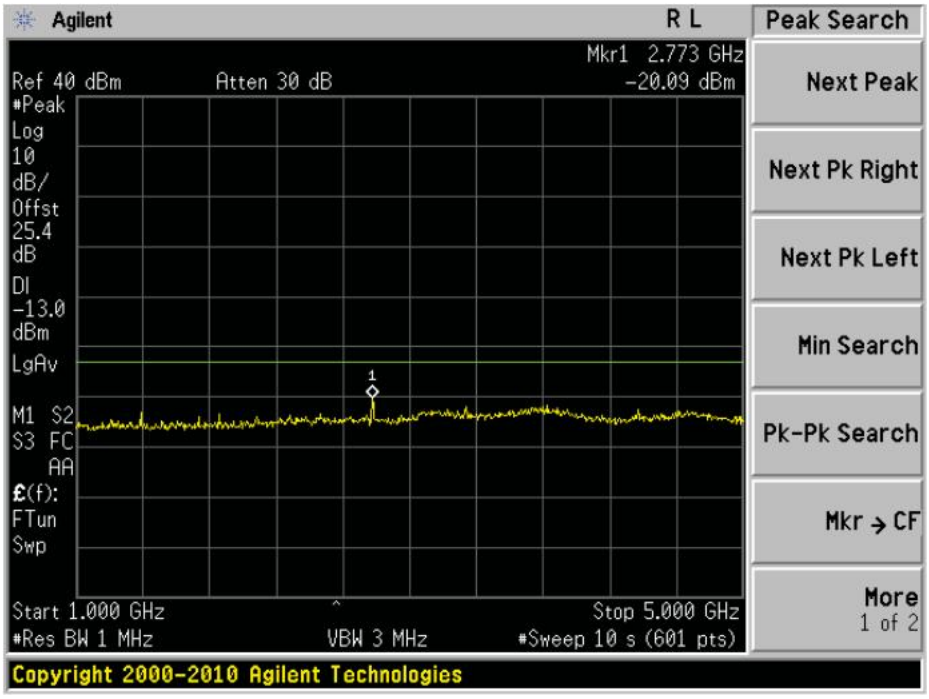
TIA 603-C Clause 2.2.13

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation.

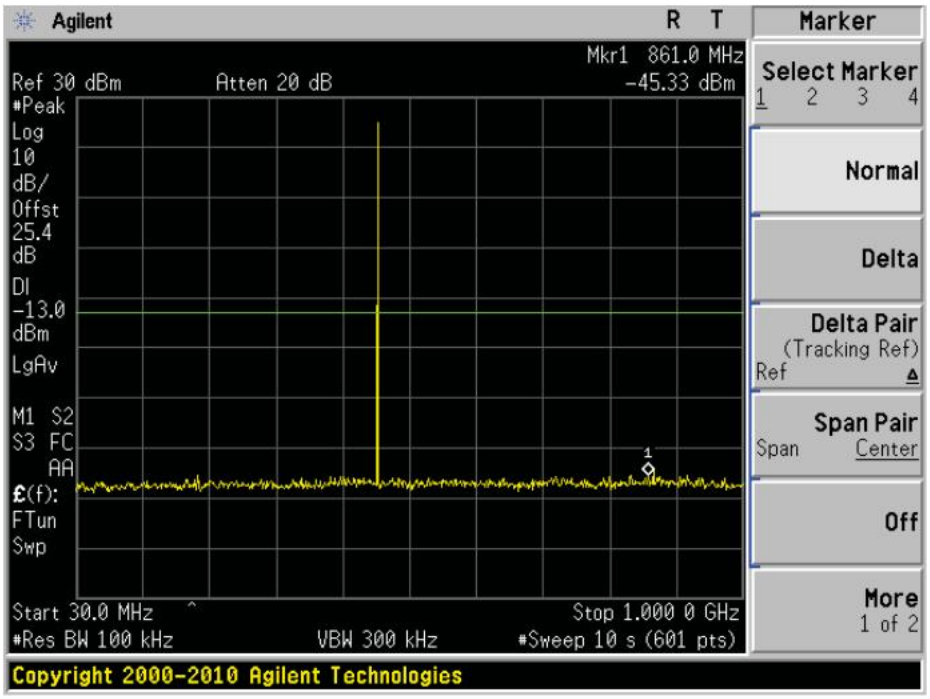
11.3 Test Result : PASS

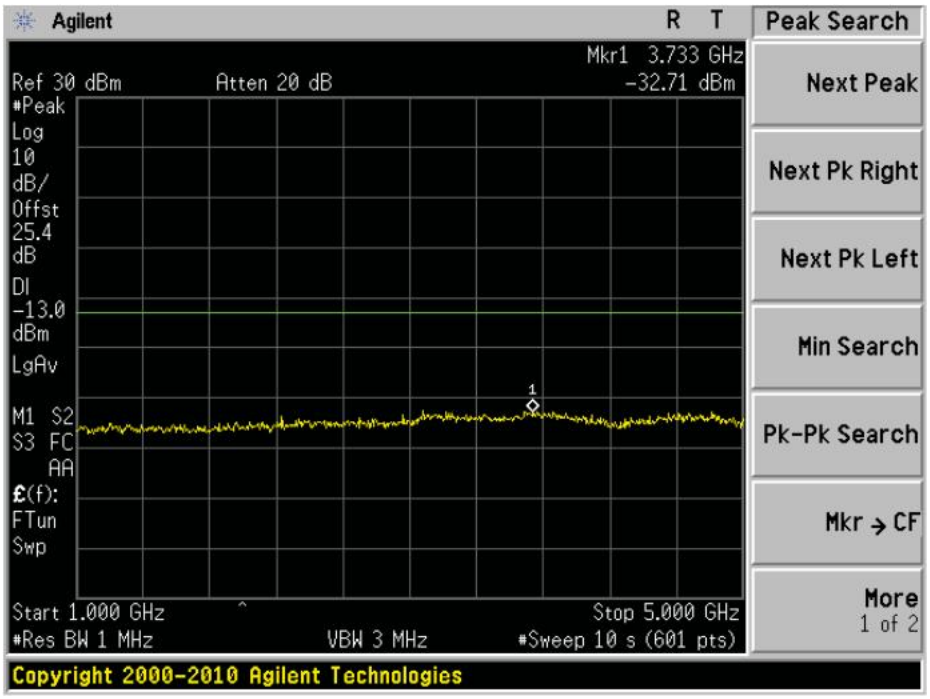
GMRS CH9


Agilent
R T
Peak Search
Mkr1 925.6 MHz
Ref 40 dBm
Atten 30 dB
-17.53 dBm
#Peak
Log
10
dB/
Offst
25.4
dB
Dl
-13.0
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Start 30.0 MHz
#Res BW 100 kHz
VBW 300 kHz
Stop 1.000 0 GHz
#Sweep 10 s (601 pts)
Copyright 2000-2010 Agilent Technologies


Agilent
R L
Peak Search
Mkr1 2.773 GHz
Ref 40 dBm
Atten 30 dB
-20.09 dBm
#Peak
Log
10
dB/
Offst
25.4
dB
Dl
-13.0
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Start 1.000 GHz
#Res BW 1 MHz
VBW 3 MHz
Stop 5.000 GHz
#Sweep 10 s (601 pts)
Copyright 2000-2010 Agilent Technologies

FRS CH16


Agilent
R T
Marker
Mkr1 861.0 MHz
-45.33 dBm
Ref 30 dBm
Atten 20 dB
#Peak
Log
10
dB/
Offst
25.4
dB
Dl
-13.0
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Start 30.0 MHz
#Res BW 100 kHz
VBW 300 kHz
Stop 1.000 0 GHz
#Sweep 10 s (601 pts)
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref
Span Pair
Span Center
Off
More
1 of 2
Copyright 2000-2010 Agilent Technologies


Agilent
R T
Peak Search
Mkr1 3.733 GHz
-32.71 dBm
Ref 30 dBm
Atten 20 dB
#Peak
Log
10
dB/
Offst
25.4
dB
Dl
-13.0
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Start 1.000 GHz
#Res BW 1 MHz
VBW 3 MHz
Stop 5.000 GHz
#Sweep 10 s (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Copyright 2000-2010 Agilent Technologies

12.0 Spurious Radiated Emissions

12.1 Spurious Radiated Emissions

FCC §2.1051 and §95.635.

Transmitter	Emission type	Applicable paragraphs (b)
GMRS	A1D, A3E, F1D, G1D, F3E, G3E with filtering	(1), (3), (7).
	A1D, A3E, F1D, G1D, F3E, G3E without filtering	(5), (6), (7).
	H1D, J1D, R1D, H3E, J3E, R3E	(2), (4), (7).
FRS	F3E with filtering	(1), (3), (7).

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

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

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

12.2 Test Procedure

TIA/EIA 603-C Clause 2.2.12

The transmitter was placed on a 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 frequency range up to tenth harmonic of the fundamental frequency was investigated.

The EUT Removed and replaced with a 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 log (TXpwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log10 (power out in Watts)

12.5 Test result:

Test Mode：GMRS mode continue transmitting Channel 9, Frequency= 462.6250MHz, with earphone					
Frequency (MHz)	Reading(dB μ V)				Conclusion
	Antenna polarization	Result (dBm)	Limit(Note 2) (dBm)	Margin (dB)	
153.650	H	-29.23	-13	-16.23	PASS
925.250	H	-22.24		-9.24	
1387.875	H	-26.84		-13.84	
153.650	V	-18.83		-5.83	
925.250	V	-17.05		-4.05	
1387.875	V	-21.51		-8.51	
Note 1: According explorer test, this configuration have worst emission. Note 2:Limit= 30.04dBm- (43+10log(Transmit Power)) = -13dBm					

Test Mode： FRS mode continue transmitting Channel 16, Frequency= 467.5625MHz, with earphone					
Frequency (MHz)	Reading(dB μ V)				Conclusion
	Antenna polarization	Result (dBm)	Limit(Note 2) (dBm)	Margin (dB)	
126.57	H	-29.75	-13	-16.75	PASS
935.125	H	-21.35		-8.35	
1402.6875	H	-28.84		-15.84	
126.57	V	-28.57		-15.57	
935.125	V	-15.14		-2.14	
1402.6875	V	-22.53		-9.53	
Note 1: According explorer test, this configuration have worst emission. Note 2:Limit= 30.04dBm- (43+10log(Transmit Power)) = -13dBm					

13.0 Frequency Stability

13.1 Applicable Standard

FCC §2.1055, §95.621 (b), §95.627 (b)

§ 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%.

§ 95.626 (b) Each FRS unit must be maintained within a frequency tolerance of 0.00025%.

13.2 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. 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 frequency counter.

Frequency Stability vs. Voltage:

An external variable DC power supply was connected to the EUT, The voltage was set to 115%, 100%, and 85% of the nominal operating input voltage, and the frequency output was recorded from the frequency counter.

13.2 Test conclusion

PASS

13.3 Test result

See next page

GMRS, CH 9

Reference Frequency 462.6250 MHz, Limit : 0.0005% or 5 PPM			
Environment Conditions		Frequency Measure with Time Elapsed	
Temperature (OC)	Power supplied (Vdc)	Measured Frequency (MHz)	Error (PPM)
Frequency Stability vs. Temperature			
50	3.7	462.62512	0.259389354
40	3.7	462.62524	0.518778708
30	3.7	462.62555	1.188867873
20	3.7	462.62522	0.475547149
10	3.7	462.62512	0.259389354
0	3.7	462.62525	0.540394488
-10	3.7	462.62522	0.475547149
-20	3.7	462.62511	0.237773575
-30	3.7	462.62515	0.324236693
Frequency Stability vs. Voltage			
20	4.20	462.62524	0.518778708
20	3.15	462.62523	0.497162929

FRS, CH 16

Reference Frequency 467.5625 MHz, Limit : 0.0005% or 5 PPM			
Environment Conditions		Frequency Measure with Time Elapsed	
50	3.7	467.56224	-0.562086205
40	3.7	467.56251	0.021618700
30	3.7	467.56225	-0.540467504
20	3.7	467.56236	-0.302661802
10	3.7	467.56245	-0.108093501
0	3.7	467.56235	-0.324280503
-10	3.7	467.56233	-0.367517903
-20	3.7	467.56225	-0.540467504
-30	3.7	467.56238	-0.259424402
Frequency Stability vs. Voltage			
20	4.20	467.56235	-0.324280503
20	3.15	467.56232	-0.389136603

END OF REPORT