FCC TEST REPORT

Report No: STS1412052F01

Issued for

TIETONG Electronics(Group)

No.13 zihua Street Jiangnan Hi-tech Industrial area Licheng District
QuanZhou City Fujian Province

Product Name:	Portable Digital Radio
Brand Name:	TIETONG
Model No.:	T928
Series Model:	T906,T908,T916,T828,T816,TT-820, TT-810
FCC ID:	2AD7HT928
Test Standard:	FCC Part 90 Rules

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TEST RESULT CERTIFICATION

Applicant's name	TIETONG Electronics(Group)
Address	No.13 zihua Street Jiangnan Hi-tech Industrial area Licheng District QuanZhou City Fujian Province
Manufacture's Name	TIETONG Electronics(Group)
Address	No.13 zihua Street Jiangnan Hi-tech Industrial area Licheng District QuanZhou City Fujian Province
Product description	
Product name	Portable Digital Radio
Band name	TIETONG
Model and/or type reference	T928, T906,T908,T916,T828,T816,TT-820,TT-810
Standards	FCC Part 90 Rules
Test procedure	ANSI C 63.4: 2014; TIA/EIA 603 and FCC CFR 47 Rules of 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057.

This device described above has been tested by STS, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test	
Date of performance of tests	01 Jan. 2015 ~09 Jan . 2015
Date of Issue	10 Jan . 2015
Test Result	Pass

Testing Engineer : (Tony Liu)

Technical Manager : (Vita Li)

Authorized Signatory : (Bovey Yang)

Table of Contents Page

Table of Contents Page

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

Emission			
Standard	Item	Result	Remarks
§90.210	Radiated Receive And Out-Of-Band Spurious Emission Measurement	PASS	
§90.205	Maximum Transmitter Power	PASS	
§90.207	Modulation Characteristic	PASS	
§90.242	Audio Low Pass Filter Response	PASS	
§90.209	Occupied Bandwidth	PASS	
§90.210	Emission Mask	PASS	
§90.213	Frequency Tolerance	PASS	
§90.214	Transient Frequency Behavior	PASS	

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

1.1 TEST FACILITY

Shenzhen STS Test Services Co., Ltd.
Add.: 1/F, Building 2, Zhuoke Science Park, Chongqing Road, Fuyong, Baoan District, Shenzhen, China.
FCC Registration No.: 842334; IC Registration No.: 12108A-1

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ± U，where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2，providing a level of confidence of approximately 95 %。

No.	Item	Uncertainty
1	RF power,conducted	±0.70dB
2	Spurious emissions,conducted	±1.19dB
3	Spurious emissions,radiated((>1G)	±2.83dB
4	Spurious emissions,radiated(<1G)	±3.01dB
5	Temperature	±0.5℃
6	Humidity	±2%

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Product:	Portable Digital Radio	
Brand Name:	TIETONG	
Model Number:	T928	
Series Model Name:	T906,T908,T916,T828,T816,TT-820, TT-810	
Series Model Difference description:	Only difference in mode name	
Emission Bandwidth:	9.318KHz	
Adapter:	Input:AC 120V/50Hz 0.5A output DC 12V/1A	
Power Supply	DC 7.4V,2000mA by battery	
Operation Frequency Range	Frequency Range: 400~ 470MHz	
Maximum/Minimun Transmitter Power:	4W(35.76dBm)/1W(29.16dBm)	
Channel Separation:	12.5KHz	
Emission Designator:	F3E (Analog)/FXW/FXD(Digital)	
Support data rate:	9.6kbps	
Modulation type:	FM for Analog Voice	
	4FSK for Digital Voice/Digital Data	
	4FSK for Digital Data	
	Analog	F3E for 12.5KHz Channel Separation
	Digital	FXW/ FXD for 12.5KHz Channel Separation
		/
Frequency Tolerance	1.203ppm	
Temperature Range:	-30℃-50℃	
Test frequency list	See Note 5	
Software version number	T928V01	
Hardware version number	T928V02	

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. Note: The product has the same digital working characters when operating in both two digitized voice/data mode. So only one set of test results for digital modulation modes are provided in this test report.
3. Please refer to Appendix B for the photographs of the EUT. For more details, please refer to the User's manual of the EUT.
4. Table for Filed Antenna

Ant	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	N/A	External Antenna	NA	1.0	Antenna

The EUT antenna is integral Antenna. no antenna other than that furnished by the responsible party shall be used with the device.

5. Test frequency list

Modulation Type	Channel Separation	Test Frequency (MHz)
4FSK(Digital)/FM(Analog)	12.5KHz	406.100
		435.325
		469.975

Note:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test,please see the above listed frequency for testing.

2.2 EUT OPERATION MODE

The EUT has been tested under typical operating condition and The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements..

EUToperation mode no.	Description of operation mode	Additional information
Op 1	4FSK+BW12.5kHz+TX	The equipment is set with 4FSK modulation and 12.5kHz bandwidth at maximum rated power for transmitter,powered and Digital Voice/Digital Data
Op 2	4FSK+BW12.5kHz+TX	The equipment is set with 4FSK modulation and 12.5kHz bandwidth at maximum rated power for transmitter,powered and Digital Data
Op 3	4FSK+BW12.5kHz+TX	The equipment is set with 4FSK modulation and 12.5kHz bandwidth at minimum rated power for transmitter,powered and Digital Voice/Digital Data
Op 4	4FSK+BW12.5kHz+TX	The equipment is set with 4FSK modulation and 12.5kHz bandwidth at minimum rated power for transmitter,powered and Digital Data
Op5	FM+BW12.5kHz+TX	The equipment is set with FM modulation and 12.5kHz bandwidth at maximum rated power for transmitter,powered and Voice
Op6	FM+BW12.5kHz+TX	The equipment is set with FM modulation and 12.5kHz bandwidth at minimum rated power for transmitter,powered and Voice

2.3 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

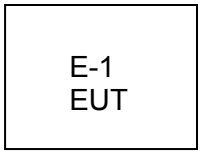
Pretest Mode	Description
Mode 1	Low Channel
Mode 2	Middle Channel
Mode 3	High Channel
Mode 4	Link Mode

For Radiated Emission	
Final Test Mode	Description
Mode 1	Low Channel
Mode 2	Middle Channel
Mode 3	High Channel
Mode 4	Link Mode

Note:

(1) Due to the different configuration and test, in this list only some worse mode. The worst test data of the worse modeis reported by this report.

2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



2.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Portable Digital Radio	N/A	T928	N/A	EUT

Note:

(1) The support equipment was authorized by Declaration of Confirmation.
(2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
(3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

2.6 EQUIPMENTS LIST FOR ALL TEST ITEMS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
Universal Radio Communication Tester	R&S	CMU200	112012	2014.10.25	2015.10.24
Bilog Antenna	TESEQ	CBL6111D	34678	2014.10.25	2015.10.24
Temperature& humidity test chamber	GZGONGWEN	GDS-250	080821	2014.10.25	2015.10.24
Modulation Analyzer	HP	8920B	3104A03367	2014.07.16	2015.07.15
Signal Generator	R&S	SMT02	A0304261	2014.07.16	2015.07.15
Digital Oscilloscope	Tektronix	TDS1012B	C062149	2014.10.27	2015.10.26
Test Cable	N/A	R-01	N/A	2014.10.25	2015.10.24
Test Cable	N/A	R-02	N/A	2014.10.25	2015.10.24
EMI Test Receiver	R&S	ESCI	101427	2014.10.25	2015.10.24
Antenna Mast	EM	SC100_1	N/A	N/A	N/A
Turn Table	EM	SC100	060531	N/A	N/A
50Ω Switch	Anritsu Corp	MP59B	6200983705	2014.07.06	2015.07.05
Spectrum Analyzer	Aglient	E4407B	MY50140340	2014.10.25	2015.10.24
Horn Antenna	Schwarbeck	BBHA 9120D	9120D-963	2014.10.25	2015.10.24
Pre-Amplifier	DASY 5	NO.WL-42W	9638	2014.10.25	2015.10.24
LISN	R&S	ENV216	101242	2014.10.25	2015.10.24
Temperature & Humitidy Chamber	Mieo	HH660	N/A	2014.10.27	2015.10.26
Conduction Cable	EM	C01	N/A	2014.10.25	2015.10.24
Rf Communication Test Set	HP	8920A	3813A10206	2014.11.1	2015.10.31
High-Pass Filter	Anritsu	MP526B	6220875256	2014.11.1	2015.10.31
Attenuator	HP	215-05-20	DC-3G	2014.10.27	2015.10.26

3. EMISSION TEST

3.1 RADIATED RECEIVE AND OUT-OF-BAND SPURIOUS EMISSION

3.1.1 RADIATED RECEIVE EMISSION LIMITS

According to the TIA/EIA 603 D test method, and according to Section 90.210, the power of each unwanted emission shall be less than Transmitted Power as specified below for transmitters designed to operate with 12.5 kHz channel bandwidth

3.1.2 OUT-OF-BAND SPURIOUS EMISSION MEASUREMENT LIMITS

a. §90.210

According to Section 90.210, the power of each unwanted emission shall be less than Transmitted Power as specified below for transmitters designed to operate with 12.5 KHz channel bandwidth:
(1).On any frequency removed from the center of the authorized bandwidth fo to 5.625 KHz removed from fo: Zero dB
(2).On any frequency removed from the center of the authorized bandwidth by a displacement Frequency (fd in KHz) fo of more than 5.625 KHz but no more than 12.5 KHz: At least 7.27(fd-2.88 KHz) dB
(3).On any frequency removed from the center of the authorized bandwidth by a displacement Frequency (fd in KHz) fo of more than 12.5KHz: At least 50+10 log(P) dB or 70 dB, which ever is lesser attenuation.
Limit:
At least 50+10 log (P) =50+10log(4)=56(dBc) (For UHF)
Limit:
At least 50+10 log (P) =50+10log(1)=50(dBc) (For UHF)
Note: In general, the worse case attenuation requirement shown above was applied.
Calculation: Limit (dBm) =EL-50-10log10 (TP)
Notes:
EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is 35.76 dBm.
Limit (dBm) =35.76-50-10log10(4) = -14.24dBm

3.1.3 TEST PROCEDURE

a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
b. The EUT was placed on the top of a rotating table 1 meters above the ground at a 3 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment or of the substitution antenna shall be 1 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. On a test site, the EUT shall be placed on a turntable and in the position closest to the normal use as declared by the user.
e. 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.
f. 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.
g The test antenna shall be raised and lowered through the specified range of height until the measuring receiver detects a maximum signal level.
h The test antenna shall be raised and lowered again through the specified range of height until the measuring receiver detects a maximum signal level.

i 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.

j 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.

Note:

Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

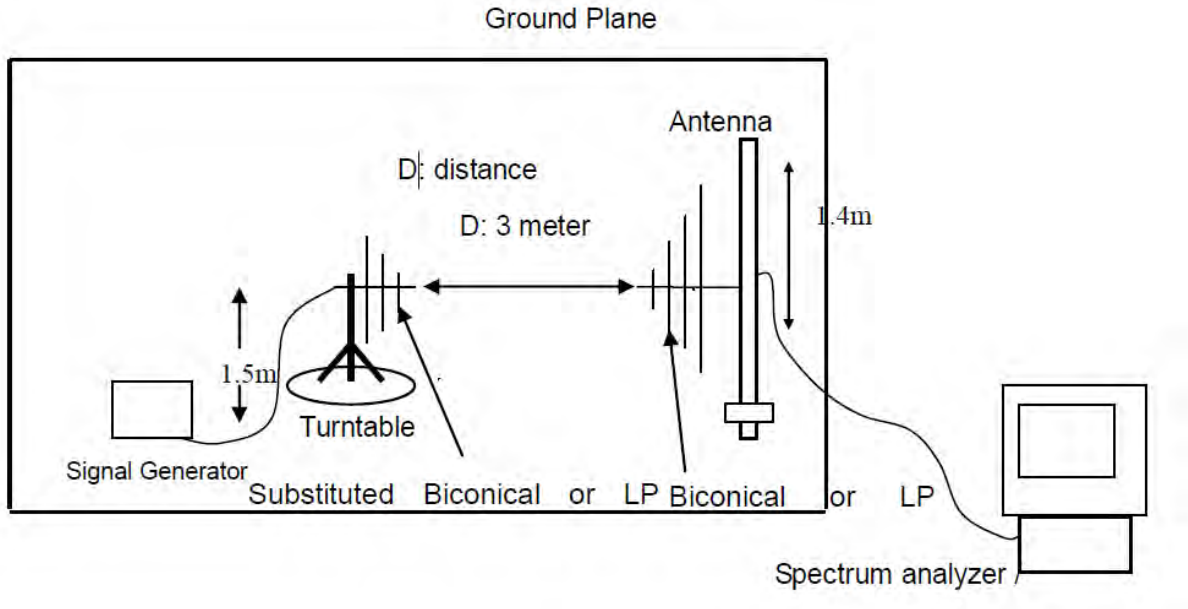
3.1.4 DEVIATION FROM TEST STANDARD

No deviation

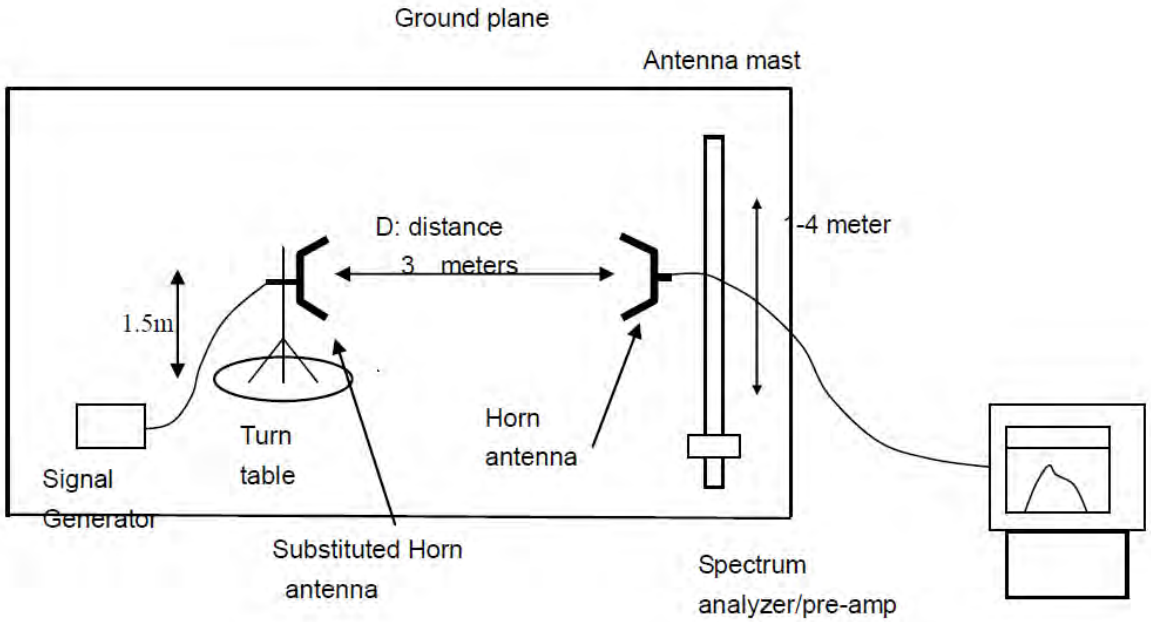
3.1.5 TEST SETUP BLOCK DIAGRAM

SUBSTITUTION METHOD: (Radiated Emissions)

（A）Radiated Emission Test-Up Frequency Above 30MHz



（B）Radiated Emission Test-Up Frequency Above 1GHz



3.1.6 RADIATED RECEIVE EMISSION TEST RESULTS Below 30MHz

EUT：	Portable Digital Radio	Model Name. ：	T928
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Polarization：	---
Test Voltage ：	DC 12V from Adapter AC 120V/60Hz		
Test Mode ：	Mode 4		

Remark:We tested and recorded All Op, recorded worst case at Op 1.

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

NOTE:
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits(dBuv) + distance extrapolation factor

3.1.7 OUT-OF-BAND SPURIOUS TEST RESULTS ABOVE 30MHz

EUT：	Portable Digital Radio	Model Name. ：	T928
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Polarization：	---
Test Voltage ：	DC 12V from Adapter AC 120V/60Hz		
Test Mode ：	Mode 1/2/3		

Remark:We tested and recorded All Op, recorded worst case at Op 1 and Op 5 .

Measurement Result for 12.5 KHz Channel Separation@ 406.1MHz - Op 1				
Emission Frequency (MHz)	Ant. Polarity(H/V)	Measurement Result Below carrier(dBc)	Limit	Result(P/F)
406.1	V	0		Pass
812.2	V	66.73(-29.73dBm)	56	Pass
1218.3	V	75.42(-38.42dBm)	56	Pass
1624.4	V	78.32	56	Pass
2030.5	V	81.73	56	Pass
2436.6	V	85.54	56	Pass
2842.7	V	88.81	56	Pass
3248.8	V	88.44	56	Pass
3654.9	V	90.35	56	Pass
4061	V	90.32	56	Pass

Measurement Result for 12.5 KHz Channel Separation@ 406.1MHz - Op 5				
Emission Frequency (MHz)	Ant. Polarity(H/V)	Measurement Result Below carrier(dBc)	Limit	Result(P/F)
406.1	V	0		Pass
812.2	V	66.71(-29.73dBm)	56	Pass
1218.3	V	75.39(-38.42dBm)	56	Pass
1624.4	V	78.21	56	Pass
2030.5	V	81.62	56	Pass
2436.6	V	85.43	56	Pass
2842.7	V	88.74	56	Pass
3248.8	V	88.35	56	Pass
3654.9	V	90.34	56	Pass
4061	V	90.44	56	Pass

Measurement Result for 12.5 KHz Channel Separation@ 435.325MHz - Op 1				
Emission Frequency (MHz)	Ant. Polarity(H/V)	Measurement Result Below carrier(dBc)	Limit	Result(P/F)
435.325	V	0		Pass
870.650	V	72.34(-35.34dBm)	56	Pass
1305.975	V	77.52	56	Pass
1741.300	V	79.34	56	Pass
2176.625	V	80.37	56	Pass
2611.950	V	83.13	56	Pass
3047.275	V	89.35	56	Pass
3482.600	V	90.14	56	Pass
3917.925	V	90.56	56	Pass
4353.250	V	91.15	56	Pass

Measurement Result for 12.5 KHz Channel Separation@ 435.325MHz - Op 5				
Emission Frequency (MHz)	Ant. Polarity(H/V)	Measurement Result Below carrier(dBc)	Limit	Result(P/F)
435.325	V	0		Pass
870.650	V	72.31(-35.34dBm)	56	Pass
1305.975	V	77.47	56	Pass
1741.300	V	79.26	56	Pass
2176.625	V	80.32	56	Pass
2611.950	V	83.06	56	Pass
3047.275	V	89.27	56	Pass
3482.600	V	90.13	56	Pass
3917.925	V	90.45	56	Pass
4353.250	V	91.11	56	Pass

Measurement Result for 12.5 KHz Channel Separation@ 469.975MHz - Op 1				
Emission Frequency (MHz)	Ant. Polarity(H/V)	Measurement Result Below carrier(dBc)	Limit	Result(P/F)
469.975	V	0		Pass
939.950	V	72.27(-35.27dBm)	56	Pass
1409.925	V	75.63	56	Pass
1879.900	V	80.56	56	Pass
2349.875	V	83.42	56	Pass
2819.850	V	89.75	56	Pass
3289.825	V	90.27	56	Pass
3759.800	V	91.33	56	Pass
4229.775	V	91.72	56	Pass
4699.750	V	92.16	56	Pass

Measurement Result for 12.5 KHz Channel Separation@ 469.975MHz - Op 5				
Emission Frequency (MHz)	Ant. Polarity(H/V)	Measurement Result Below carrier(dBc)	Limit	Result(P/F)
469.975	V	0		Pass
939.950	V	72.24(-35.27dBm)	56	Pass
1409.925	V	75.53	56	Pass
1879.900	V	80.52	56	Pass
2349.875	V	83.35	56	Pass
2819.850	V	89.65	56	Pass
3289.825	V	90.22	56	Pass
3759.800	V	91.28	56	Pass
4229.775	V	91.67	56	Pass
4699.750	V	92.11	56	Pass

Notes: Emissions from 30 MHz ten harmonic scan record the worst mode

3.2 EMISSION MASK PLOT

- Emission mask acc to §90.210

a. - The detailed procedure employed for Emission Mask measurements are specified as following:

- The transmitter shall be modulated by a 2.5 KHz audio signal,

- The level of the audio signal employed is 16 dB greater than that necessary to produce 50% of

b. rated system deviation. Rated system deviation is 2.5 KHz (12.5 KHz channel spacing channel spacing) .

Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

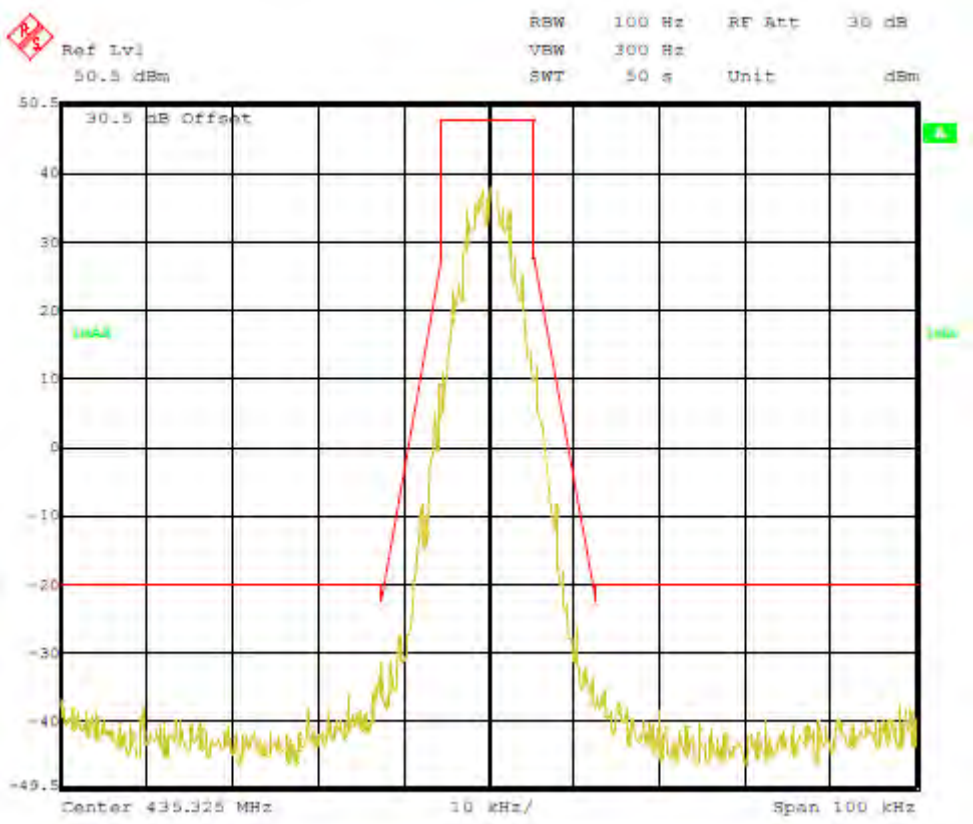
(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(f_d−2.88 kHz) dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

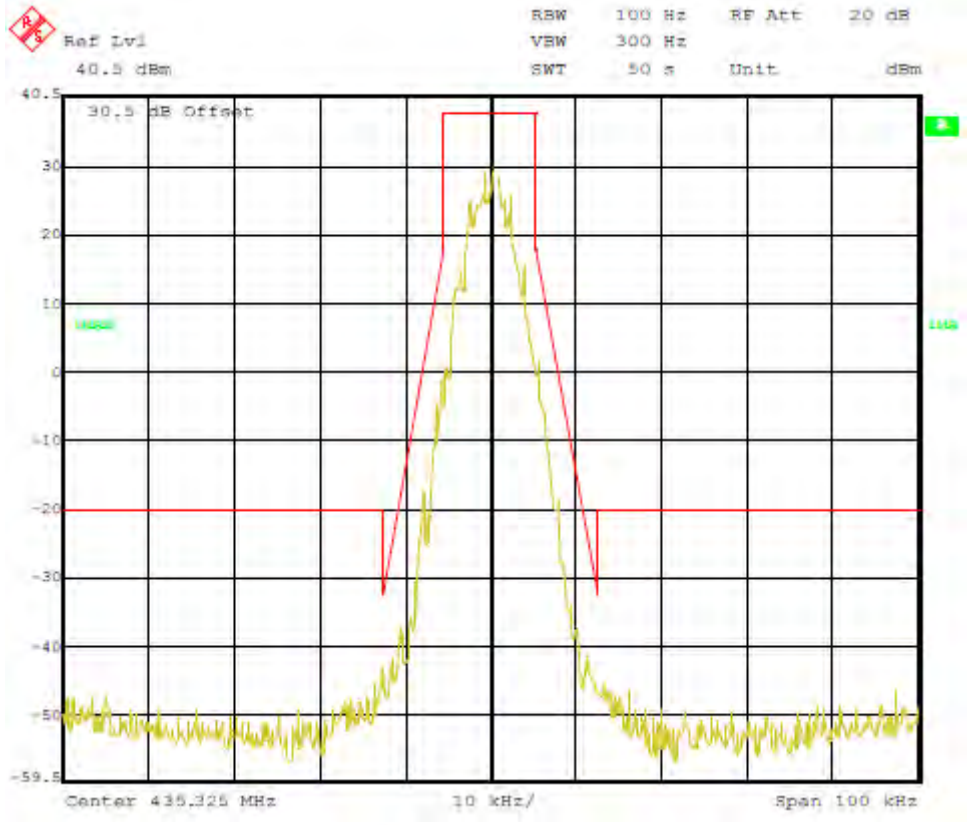
(3) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask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

Remark 1:We tested and recorded Op1- Op4, recorded worst case at Op 1 and Op 3 .

4FSK(Digital)The Worst Emission Mask for 12.5 KHz channel Separation (Op 1)

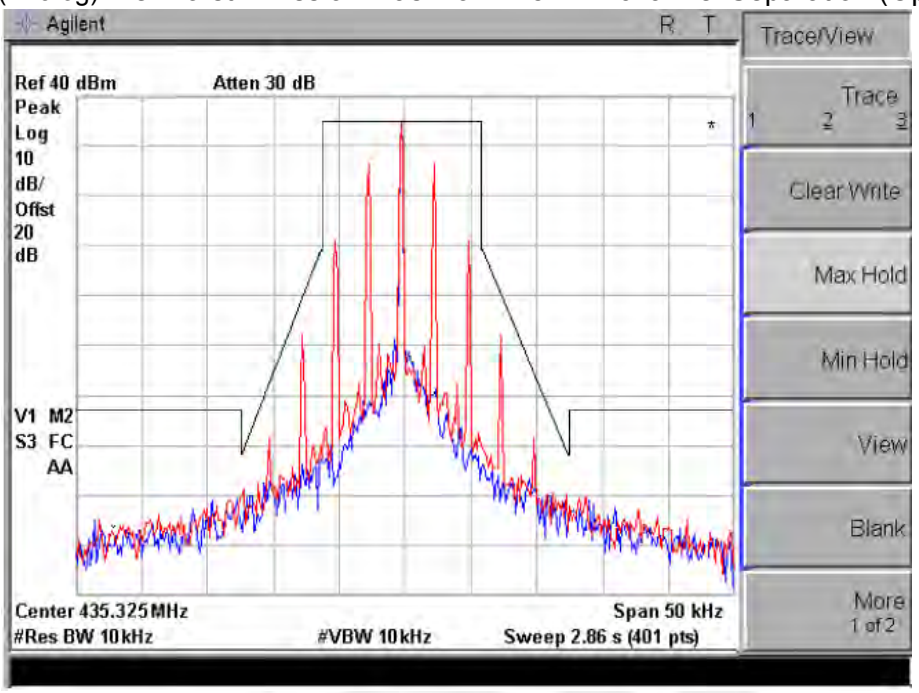


4FSK(Digital)The Worst Emission Mask for 12.5 KHz channel Separation (Op 3)

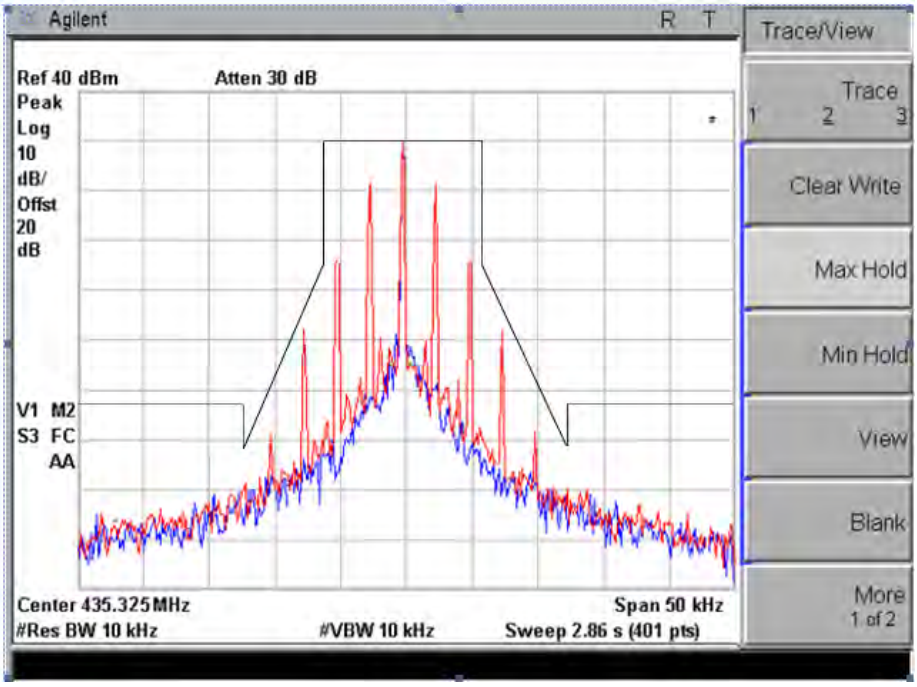


Remark 2:We tested and recorded Op 5 and Op 6 .

FM (Analog)The Worst Emission Mask for 12.5 KHz channel Separation (Op 5)



FM (Analog)The Worst Emission Mask for 12.5 KHz channel Separation (Op 6)



4. FREQUENCY TOLERANCE

4.1 DESCRIPTION OF SUPPORT UNITS

a. According to FCC Part 2 Section 2.1055(a)(1), the frequency stability shall be measured with variation of ambient temperature from –30℃ to +50℃ centigrade.

b. 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 manufacturer.

c. According to FCC Part 90 Section 90.213, the frequency tolerance must be maintained within §90.213 requires for mobile stations 2.5ppm (12.5 kHz)

4.2 MEASUREMENT PROCEDURE

4.2.1 FREQUENCY STABILITY VERSUS ENVIRONMENTAL TEMPERATURE

a. Setup the configuration per figure 1 for frequencies measurement inside an environment chamber, Install new battery in the EUT.

b. Turn on EUT and set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1 KHz and Video Resolution Bandwidth to 1 KHz and Frequency Span to 50KHz.Record this frequency as reference frequency.

c. Set the temperature of chamber to 50℃. 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.

d. Repeat step 2 with a 10℃ decreased per stage until the lowest temperature -30℃ is measured, record all measured frequencies on each temperature step.

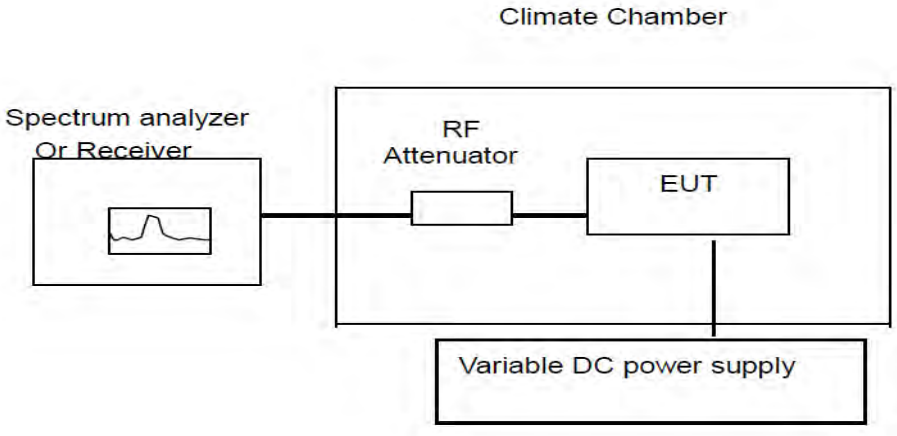
4.2.2 FREQUENCY STABILITY VERSUS INPUT VOLTAGE

a. Setup the configuration per figure 1 for frequencies measured at temperature if it is within 15℃ to 25℃. Otherwise, an environment chamber set for a temperature of 20℃ shall be used. The EUT shall be powered by DC 7.4V

b. Set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1 KHz and Video Resolution Bandwidth to 1 KHz. Record this frequency as reference frequency.

c. Set the temperature of chamber to 50℃. 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.

4.3 TEST SETUP BLOCK DIAGRAM



4.4 TEST RESULT

(1) Frequency stability versus input voltage (Supply nominal voltage is DC 7.4V)

Remark:We tested and recorded All Op, middle channel record bad situation in the Op - 1.

FOR UHF BAND TEST RESULT -PASS

Middle Channel @ 12.5 KHz Channel Separation -Op 1			
Reference Frequency:	435.325 MHz	Result	Limit (2.5ppm)
Envionment Temperature	Power Supply	Frequency Deviation	
(℃)	(V)	(MHz)	ppm
50	DC 7.4V	435.325514	1.180727
40	DC 7.4V	435.325474	1.088842
30	DC 7.4V	435.325335	0.769540
20	DC 7.4V	435.325379	0.870614
10	DC 7.4V	435.325326	0.748866
0	DC 7.4V	435.325341	0.783323
-10	DC 7.4V	435.325359	0.824671
-20	DC 7.4V	435.325365	0.838454
-30	DC 7.4V	435.325377	0.866020

(2) Frequency stability versus input voltage (Battery Fully Charged voltage is DC 8.51V/+10%)

Remark:We tested and recorded All Op, middle channel record bad situation in the Op - 1.

Middle Channel @ 12.5 KHz Channel Separation -Op 1			
Reference Frequency:	435.325 MHz	Result	Limit (2.5ppm)
Envionment Temperature	Power Supply	Frequency Deviation	
(℃)	(V)	(MHz)	ppm
50	DC 8.51V	435.325524	1.203698
40	DC 8.51V	435.325453	1.040602
30	DC 8.51V	435.325323	0.741974
20	DC 8.51V	435.325365	0.838454
10	DC 8.51V	435.325323	0.741974
0	DC 8.51V	435.325245	0.562798
-10	DC 8.51V	435.325324	0.744272
-20	DC 8.51V	435.325364	0.836157
-30	DC 8.51V	435.325324	0.744272

(3) Frequency stability versus input voltage (Battery Half Charged voltage is DC 6.29V/-10%)

Remark:We tested and recorded All Op, middle channel record bad situation in the Op - 1.

Middle Channel @ 12.5 KHz Channel Separation - Op 1			
Reference Frequency:	435.325 MHz	Result	Limit (2.5ppm)
Envionment Temperature	Power Supply	Frequency Deviation	
(℃)	(V)	(MHz)	ppm
50	DC 6.29V	435.325523	1.201401
40	DC 6.29V	435.325451	1.036008
30	DC 6.29V	435.325324	0.744272
20	DC 6.29V	435.325363	0.833860
10	DC 6.29V	435.325322	0.739677
0	DC 6.29V	435.325246	0.565095
-10	DC 6.29V	435.325323	0.741974
-20	DC 6.29V	435.325362	0.831563
-30	DC 6.29V	435.325322	0.739677

(4) Frequency stability versus input voltage (Battery Announced ultimate voltage of manufacturers DC 5.78V)

Remark:We tested and recorded All Op, middle channel record bad situation in the Op - 1.

Middle Channel @ 12.5 KHz Channel Separation - Op 1			
Reference Frequency:	435.325 MHz	Result	Limit (2.5ppm)
Envionment Temperature	Power Supply	Frequency Deviation	
(℃)	(V)	(MHz)	ppm
50	DC 5.78V	435.325523	1.201401
40	DC 5.78V	435.325451	1.036008
30	DC 5.78V	435.325324	0.744272
20	DC 5.78V	435.325363	0.833860
10	DC 5.78V	435.325322	0.739677
0	DC 5.78V	435.325246	0.565095
-10	DC 5.78V	435.325323	0.741974
-20	DC 5.78V	435.325362	0.831563
-30	DC 5.78V	435.325322	0.739677

5. EMISSION BANDWIDTH

5.1 PROVISIONS APPLICABLE

a. According to FCC Part 90 Section 90.209: The authorized bandwidth shall be 11.25 KHz for 12.5 KHz.

5.2 MEASUREMENT PROCEDURE

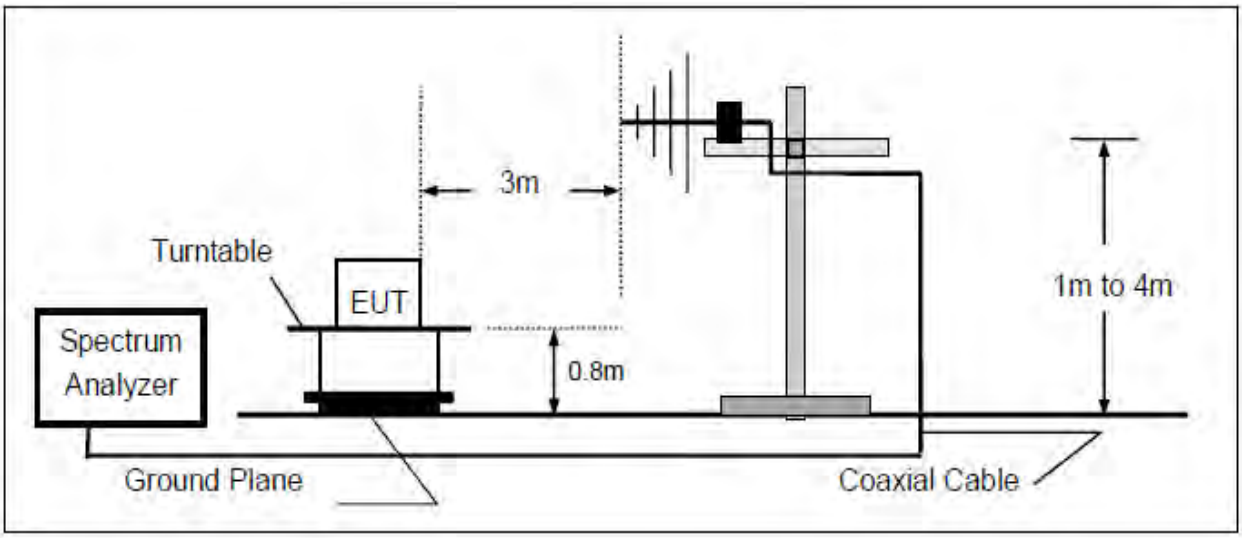
a. The EUT was placed on a turn table which is 0.8m above ground plane.

b. The EUT was modulated by 3.0 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) .

c. Set SPA Center Frequency = fundamental frequency, RBW=VBW= 300 Hz, Span =50 KHz.

d. Set SPA Max hold. Mark peak, -26 dB.

5.3 TEST SETUP BLOCK DIAGRAM

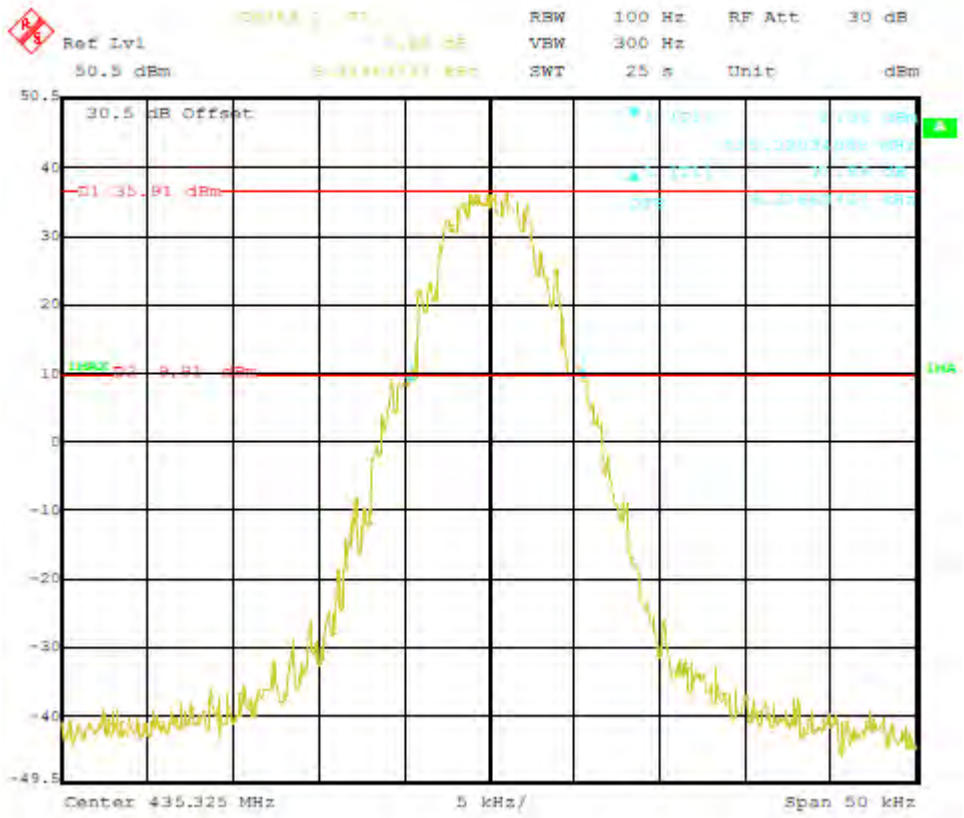


5.4 MEASUREMENT RESULT:

Remark:We tested and recorded All Op, recorded worst case at Op 1 and Op 3 .

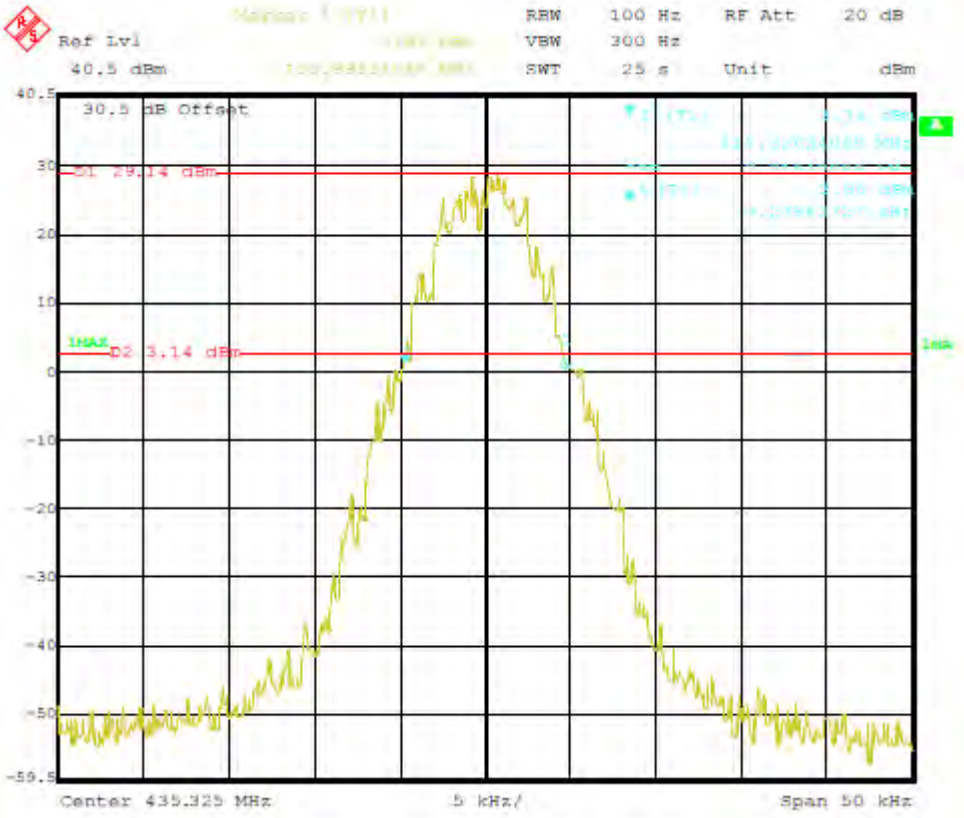
26 dB Bandwidth Measurement Result For UHF Band - Op 1			
Operating Frequency	12.5 KHz Channel Separation		
	Test Data	Limits	Result
406.100MHz	9.252KHz	11.25	Pass
435.325MHz	9.318KHz	11.25	Pass
469.975MHz	9.293KHz	11.25	Pass

4FSK(Digital) Occupied bandwidth of Middle Channel (Maximum) - Op 1



26 dB Bandwidth Measurement Result For UHF Band - Op 3			
Operating Frequency	12.5 KHz Channel Separation		
	Test Data	Limits	Result
406.100MHz	9.231KHz	11.25	Pass
435.325MHz	9.278KHz	11.25	Pass
469.975MHz	9.276KHz	11.25	Pass

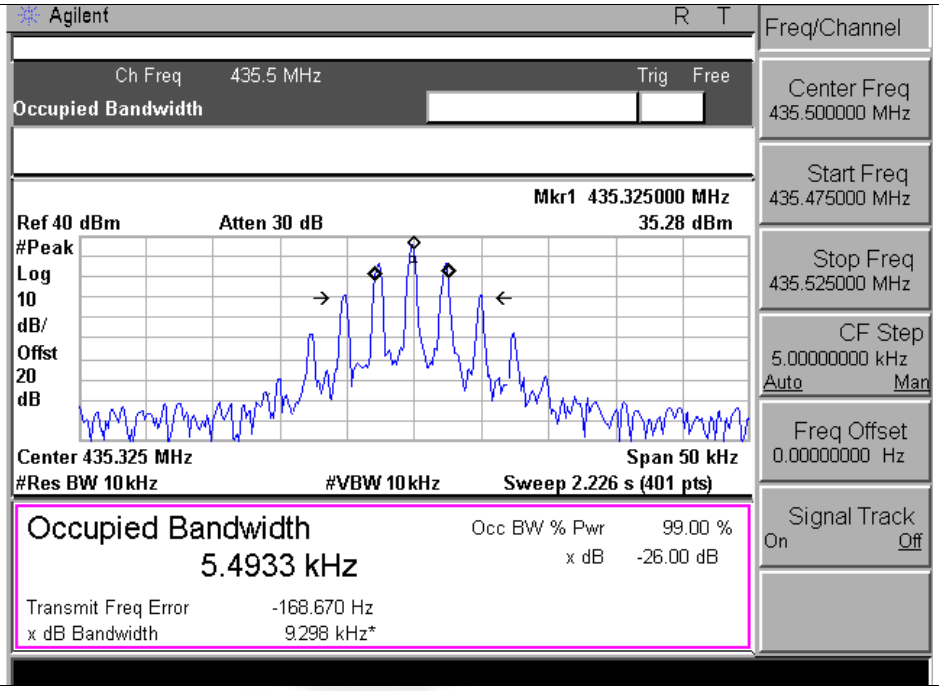
4FSK(Digital) Occupied bandwidth of Middle Channel (Maximum) - Op 3



Remark:We tested and recorded Op 5 and Op 6 .

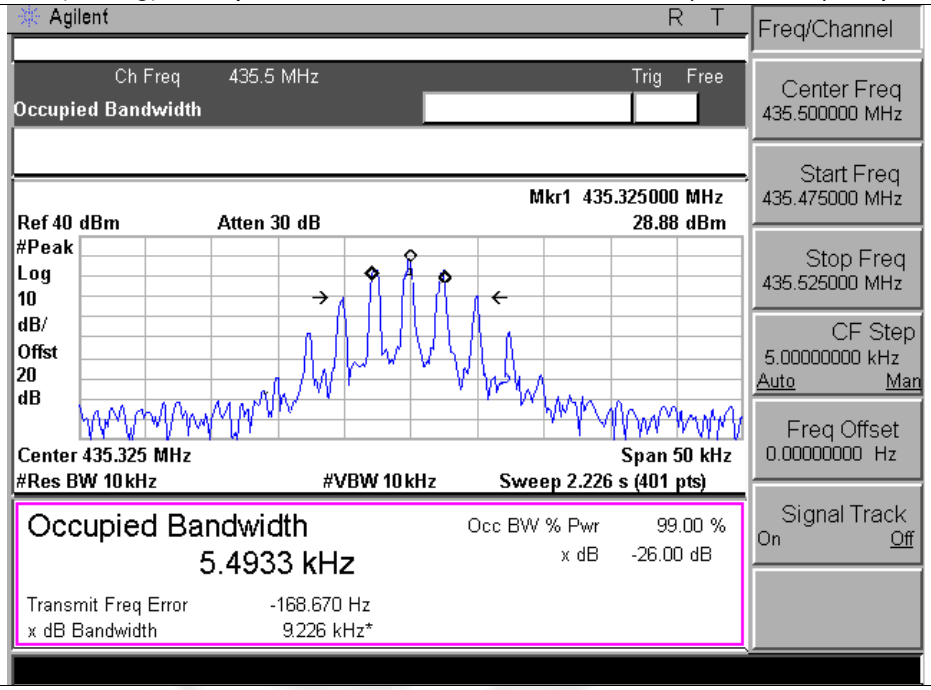
26 dB Bandwidth Measurement Result For UHF Band - Op 5			
Operating Frequency	12.5 KHz Channel Separation		
	Test Data	Limits	Result
406.100MHz	9.254KHz	11.25	Pass
435.325MHz	9.298KHz	11.25	Pass
469.975MHz	9.213KHz	11.25	Pass

FM (Analog) Occupied bandwidth of Middle Channel (Maximum) - Op 5



26 dB Bandwidth Measurement Result For UHF Band - Op 6			
Operating Frequency	12.5 KHz Channel Separation		
	Test Data	Limits	Result
406.100MHz	9.234KHz	11.25	Pass
435.325MHz	9.226KHz	11.25	Pass
469.975MHz	9.242KHz	11.25	Pass

FM (Analog) Occupied bandwidth of Middle Channel (Maximum) - Op 6



6. MODULATION CHARACTERISTICS

6.1 PROVISIONS APPLICABLE

a. According to CFR 47 section 2.1047(a), for Voice Modulation Communication Equipment, the frequency response of the audio modulation circuit over a range of 100 to 5000Hz shall be measured.

6.2 PROVISIONS APPLICABLE

6.2.1 MODULATION LIMIT

a. Configure the EUT as shown in figure 1, adjust the audio input for 60% of rated system deviation at 1KHz 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.

b. Repeat step 1 with input frequency changing to 300, 1000, 1500 and 3000Hz in sequence.

6.2.2 Audio Frequency Response

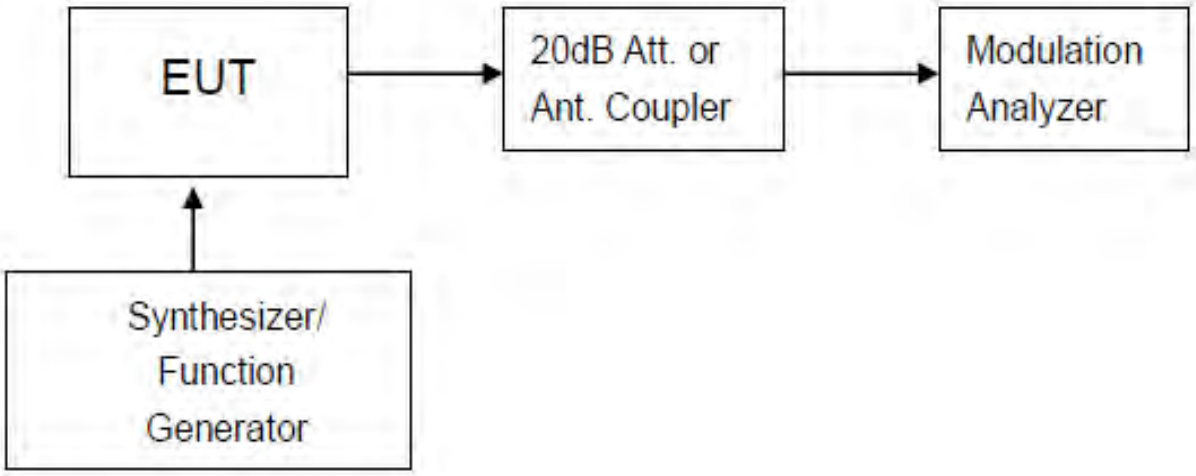
a. Configure the EUT as shown in figure 1..

b. Adjust the audio input for 20% of rated system deviation at 1 KHz using this level as a reference (0 dB).

c. Vary the Audio frequency from 100 Hz to 10 KHz and record the frequency deviation.

d. Audio Frequency Response = 20log10 (Deviation of test frequency/Deviation of 1 KHz reference).

6.3 TEST SETUP BLOCK DIAGRAM



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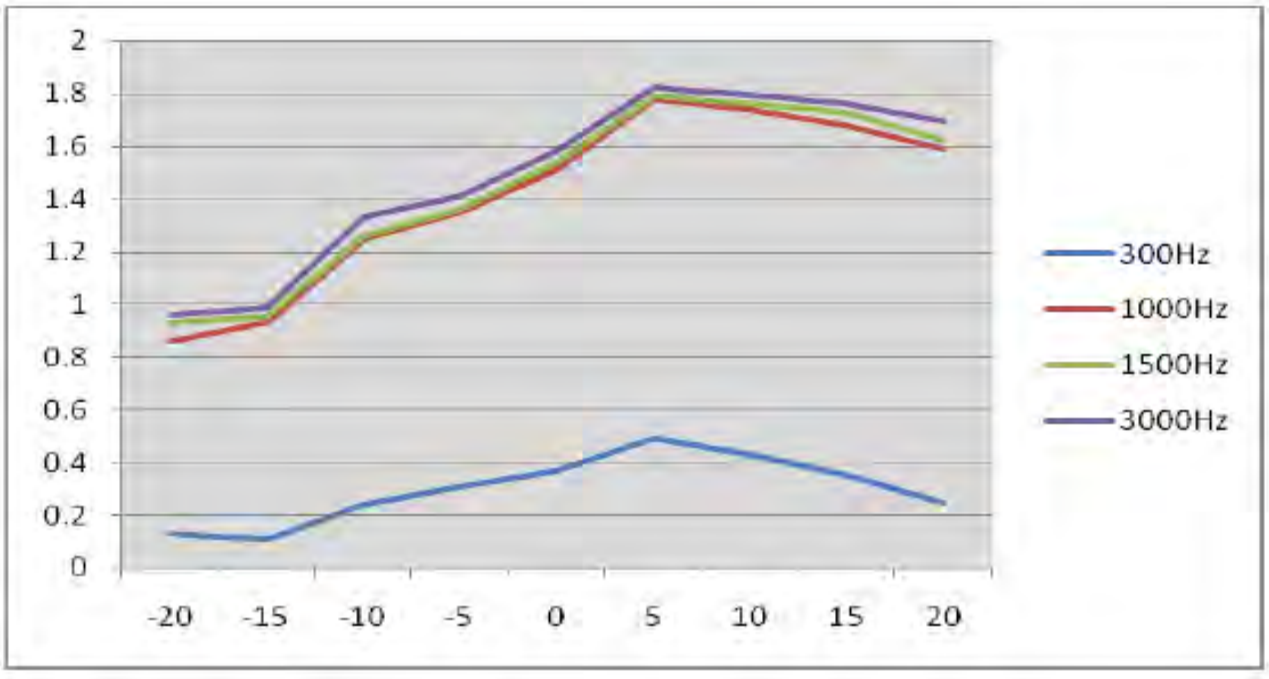
Modulation Characteristic Measurement Configuration

6.4 MEASUREMENT RESULT

a. Modulation Limit:

Remark:We tested and recorded Op 5 to Op 6, recorded worst case at Op 5.

Middle Channel @ 12.5 KHz Channel Separations for UHF Band -Op 5				
Modulation Level (dB)	Peak Freq. Deviation At 300 Hz	Peak Freq. Deviation At 1000 Hz	Peak Freq. Deviation At 1500 Hz	Peak Freq. Deviation At 3000 Hz
-20	0.14	0.84	0.92	0.95
-15	0.16	0.93	0.94	0.98
-10	0.23	1.25	1.26	1.33
-5	0.33	1.35	1.37	1.44
0	0.36	1.50	1.54	1.59
5	0.45	1.77	1.77	1.81
10	0.42	1.73	1.76	1.79
15	0.35	1.68	1.72	1.75
20	0.25	1.60	1.63	1.68

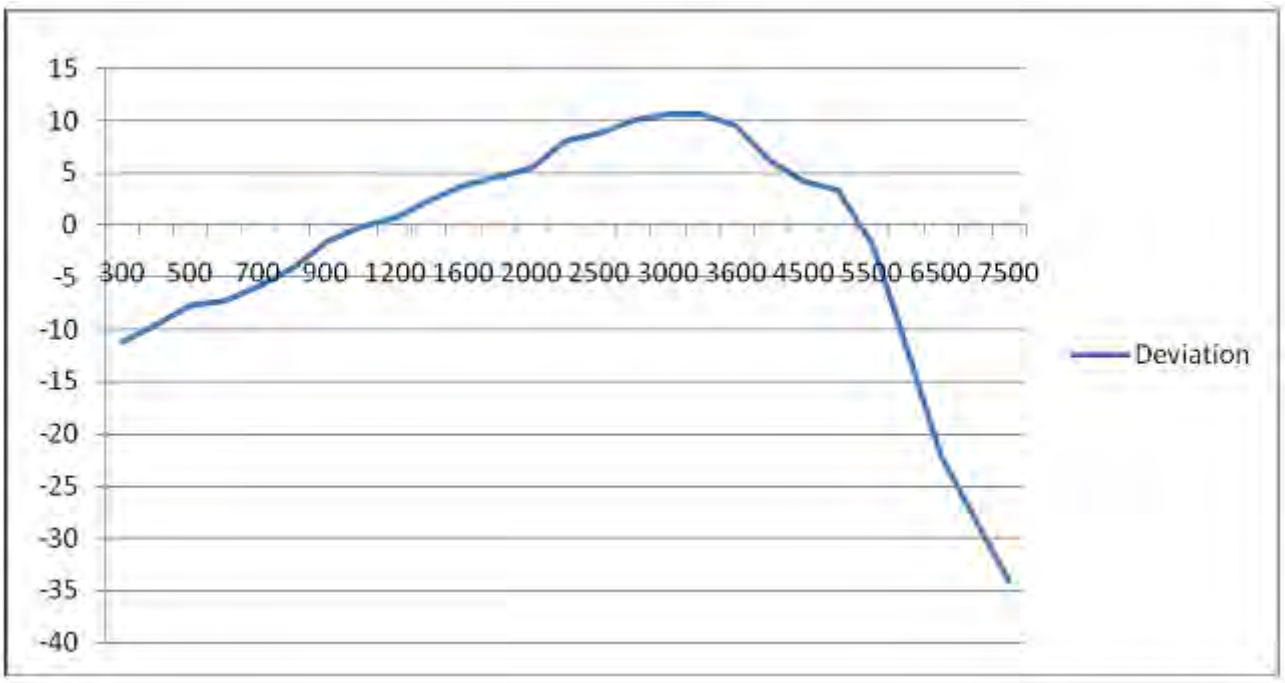


b. Audio Frequency Response:

12.5 KHz Middle Channel Separations for UHF Band -Op 5		
Frequency (Hz)	Deviation (KHz)	Audio Frequency Response(dB)
100	--	--
200	--	--
300	0.14	-11.228843
400	0.17	-9.5424251
500	0.21	-7.7070176
600	0.22	-7.3029499
700	0.26	-5.8519366
800	0.32	-4.048404
900	0.43	-1.4820344
1000	0.50	-0.1720034
1200	0.55	0.65585027
1400	0.67	2.37009253
1600	0.79	3.8011383
1800	0.87	4.63898153
2000	0.96	5.49402114
2400	1.30	8.12746352
2500	1.41	8.83297873
2800	1.62	10.0388968
3000	1.74	10.6595814
3200	1.73	10.6095185
3600	1.54	9.59901089
4000	1.04	6.18926326
4500	0.824	4.16714071
5000	0.75	3.34982175
5500	0.41	-1.8957264
6000	0.13	-11.872536
6500	0.04	-22.110204
7000	0.02	-28.130804
7500	0.01	-34.151404
9000	--	--
10000	--	--
14000	--	---

18000	--	--
20000	--	--
30000	--	--

Frequency Response of Middle Channel



7. AUDIO LOW PASS FILTER RESPONSE

7.1 PROVISIONS APPLICABLE

7.1.1 LIMITS

a. 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. 90.242(b)(8): Recommended audio filter attenuation characteristics are given below:

Audio band	Minimum Attenuation Rel. to 1 KHz Attenuation
3 –20 KHz	60 $\log_{10}$(f/3) dB where f is in KHz
20 – 30 KHz	50dB

7.2 METHOD OF MEASUREMENTS

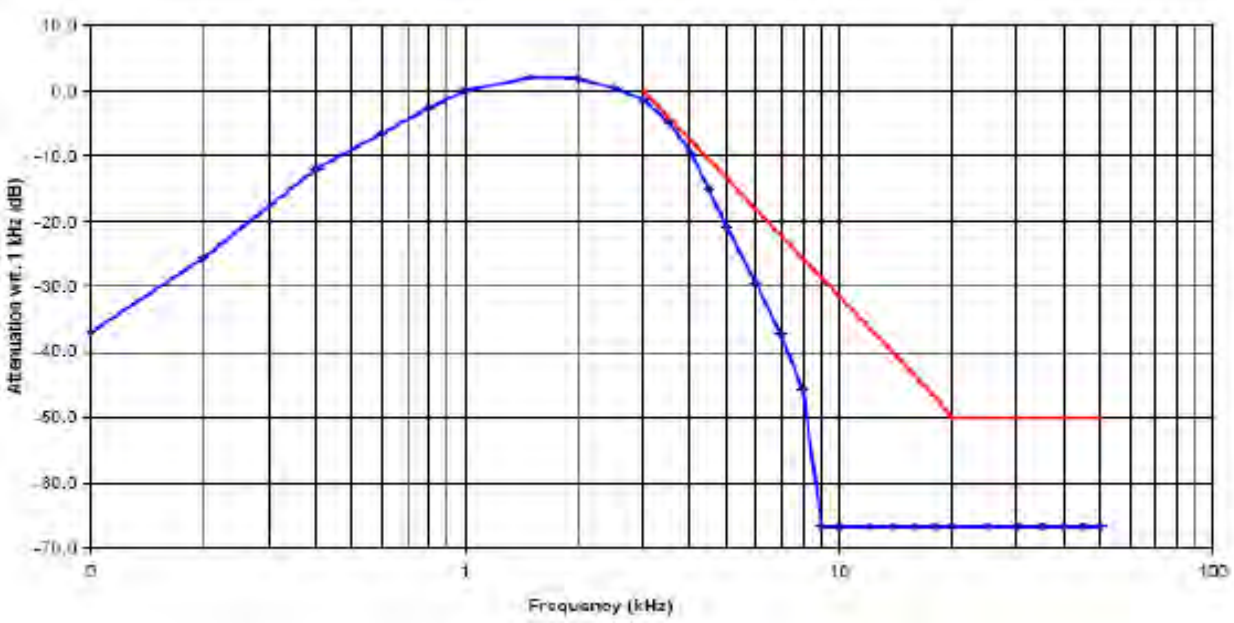
a. The rated audio input signal was applied to the input of the audio low-pass filter (or of all modulation stages) using an audio oscillator, this input signal level and its corresponding output signal were then measured and recorded using the FFT Digital Spectrum Analyzer. Tests were repeated at different audio signal frequencies from 0 to 50 KHz.

7.3 TEST DATA

Remark:We tested and recorded Op 5 to Op 6, recorded worst case at Op 5.

12.5 KHz Channel Spacing, F3E, Frequency of All Modulation States - Op 5					
Frequency (KHz)	Audio In (dBV)	Audio out (dBV)	Attenuation (Out_In) dB	Attenuation Rel.to 3 KHz	Recommended Attenuation （dB)
0.1	-75.79	-30.25	45.6	-36.7	
0.2	-75.79	-18.35	57.1	-25.5	
0.4	-75.79	-5.27	70.4	-12.0	
0.6	-75.79	0.24	76.1	-6.4	
0.8	-75.79	4.08	79.7	-2.6	
1.0	-75.79	6.67	82.6	0.0	
1.5	-75.79	8.74	84.3	2.1	
2.0	-75.79	8.54	84.4	1.9	
2.5	-75.79	7.12	82.9	0.5	
3.0	-75.79	5.33	81.2	-1.4	0
3.5	-75.79	2.02	77.8	-4.3	-4
4.0	-75.79	-2.62	73.2	-9.7	-7
4.5	-75.79	-8.41	67.5	-15.3	-11
5.0	-75.79	-14.05	61.7	-21.5	-13
6.0	-75.79	-22.68	53.2	-29.4	-18
7.0	-75.79	-30.62	45.4	-37.5	-22
8.0	-75.79	-38.95	36.7	-45.5	-26
9.0	-75.79	-60	-15.8	-66.7	-29
10.0	-75.79	-60	-15.8	-66.7	-31
12.0	-75.79	-60	-15.8	-66.7	-36
14.0	-75.79	-60	-15.8	-66.7	-40
16.0	-75.79	-60	-15.8	-66.7	-44
18.0	-75.79	-60	-15.8	-66.7	-47
20.0	-75.79	-60	-15.8	-66.7	-50
25.0	-75.79	-60	-15.8	-66.7	-50
30.0	-75.79	-60	-15.8	-66.7	-50
35.0	-75.79	-60	-15.8	-66.7	-50
40.0	-75.79	-60	-15.8	-66.7	-50
45.0	-75.79	-60	-15.8	-66.7	-50
50.0	-75.79	-60	-15.8	-66.7	-50

Note: Due to the difficulty of measuring the Frequency Response of the internal low-pass filter, the Frequency Response of All Modulation States is performed to show the roll-off at 3 KHz in comparison with the recommended audio filter attenuation.


10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Attenuation wrt. 1 kHz (dB)
0
1
10
100
Frequency (kHz)

8. TRANSMITTER FREQUENCY BEHAVIOR

8.1 PROVISIONS APPLICABLE

§90.214 Transient frequency behavior.

Time intervals[1][2]	Maximum frequency difference[3]	All equipment	
		150 to 174 MHz	421 to 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t_1[4]	±25.0 kHz	5.0 ms	10.0 ms
t_2	±12.5 kHz	20.0 ms	25.0 ms
t_3[4]	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
t_1[4]	±12.5 kHz	5.0 ms	10.0 ms
t_2	±6.25 kHz	20.0 ms	25.0 ms
t_3[4]	±12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
t_1[4]	±6.25 kHz	5.0 ms	10.0 ms
t_2	±3.125 kHz	20.0 ms	25.0 ms
t_3[4]	±6.25 kHz	5.0 ms	10.0 ms

[1] t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

t_1 is the time period immediately following t_{on}.

t_2 is the time period immediately following t_1.

t_3 is the time period from the instant when the transmitter is turned off until t_{off}.

t_{off} is the instant when the 1 kHz test signal starts to rise.

[2] During the time from the end of t_2 to the beginning of t_3, the frequency difference must not exceed the limits specified in §90.213.

[3] Difference between the actual transmitter frequency and the assigned transmitter frequency.

[4] If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

8.2 TEST METHOD

TIA/EIA-603 2.2.19

8.3 DESCRIBE LIMIT LINE OF RANSMITTER FREQUENCY BEHAVIOR

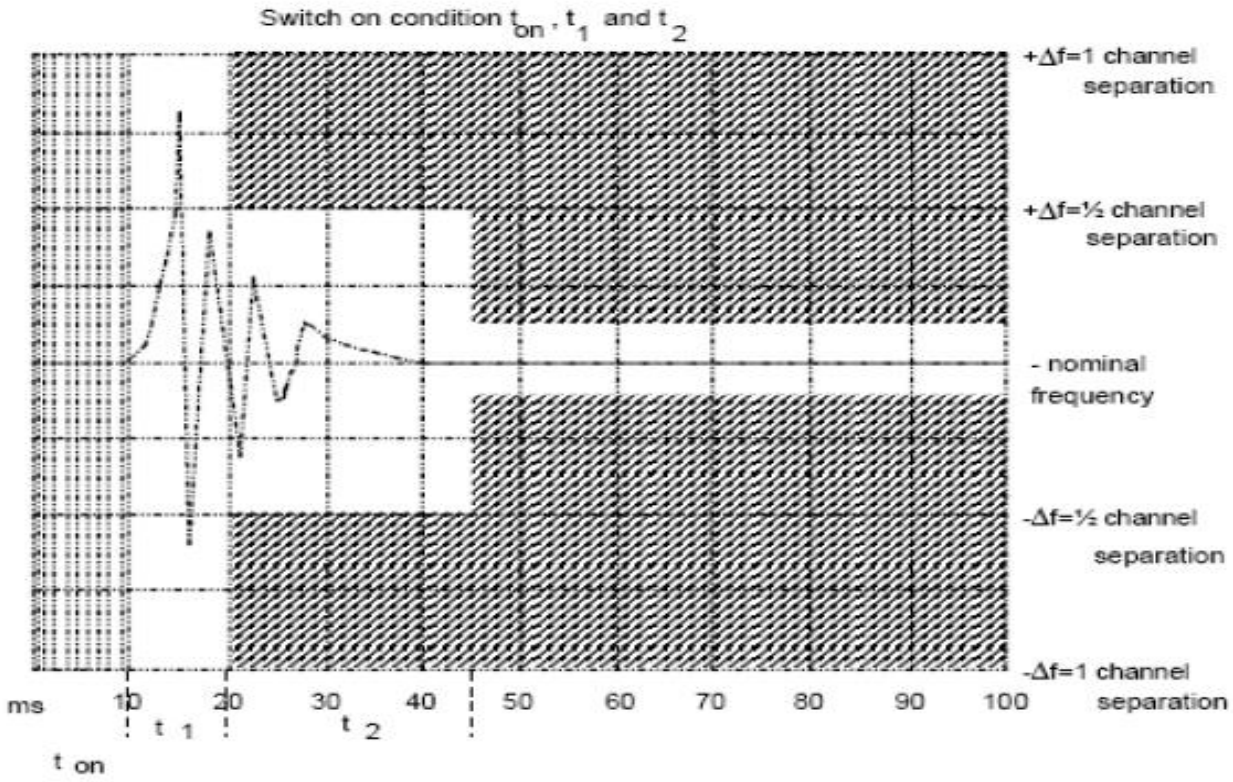
TIA/EIA-603 2.2.19

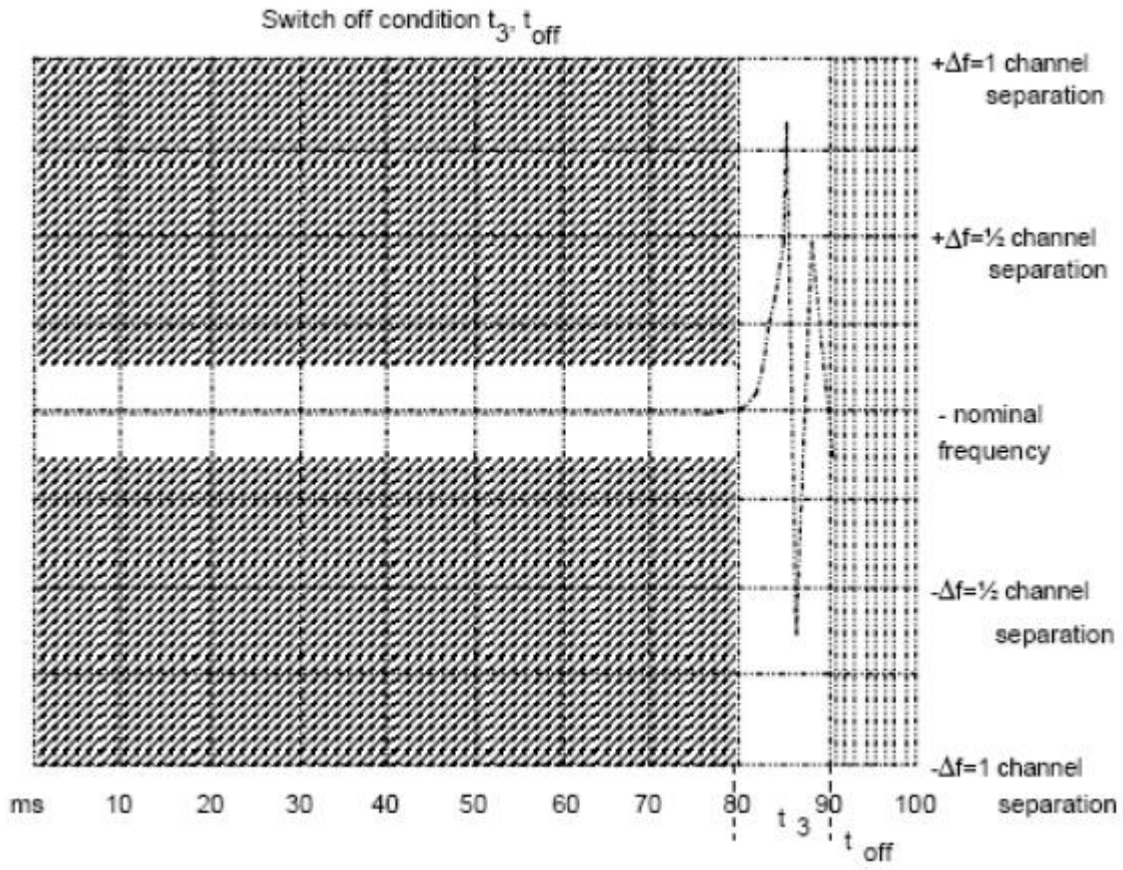
Ton: the switch-on instant ton of a transmitter is defined by the condition when the output power, measured at the antenna terminal, exceeds 0,1 % of the full output power (-30 dbc).

T1: period of time starting at ton and finishing according to above 11.1

T2: period of time starting at the end of t1 and finishing according to above 11.1 toff: switch-off instant defined by the condition when the output power falls below 0,1 % of the full output power (-30 dBc).

T3: period of time that finishing at toff and starting according to above 11.1


Switch on condition t_{on}, t_1 and t_2
+Δf=1 channel separation
+Δf=½ channel separation
- nominal frequency
-Δf=½ channel separation
-Δf=1 channel separation
ms
10
20
30
40
50
60
70
80
90
100
t_1
t_2
t_{on}

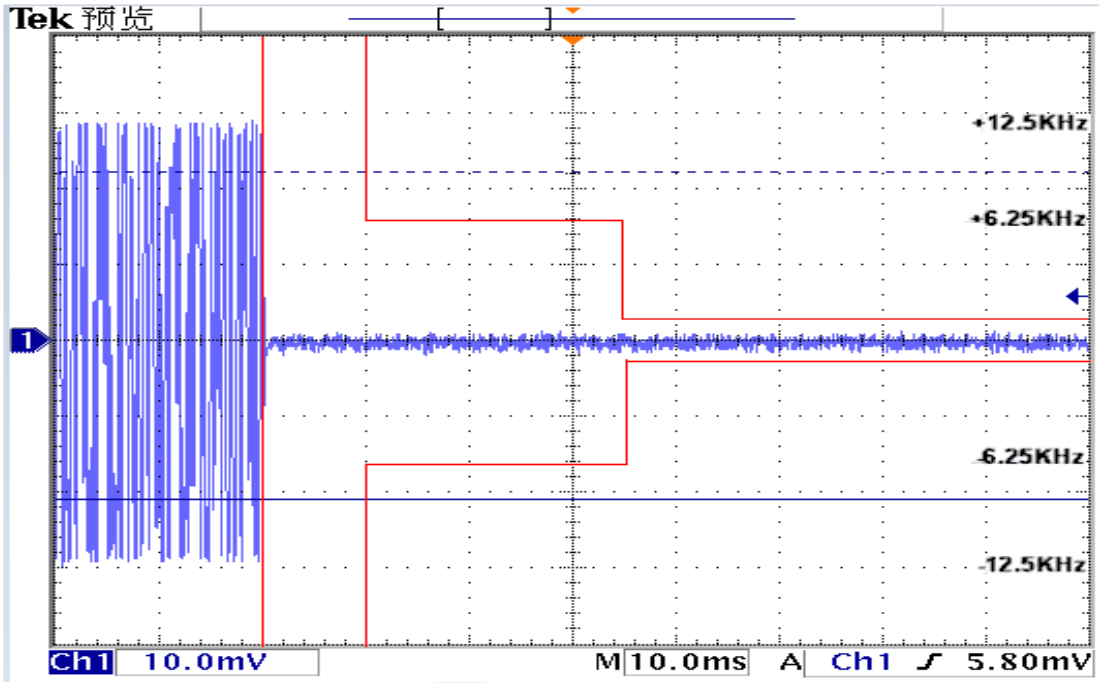

Switch off condition t_3, t_{off}
+Δf=1 channel separation
+Δf=½ channel separation
- nominal frequency
-Δf=½ channel separation
-Δf=1 channel separation
ms
10
20
30
40
50
60
70
80
90
100
t_3
t_{off}

8.4 MEASURE RESULT

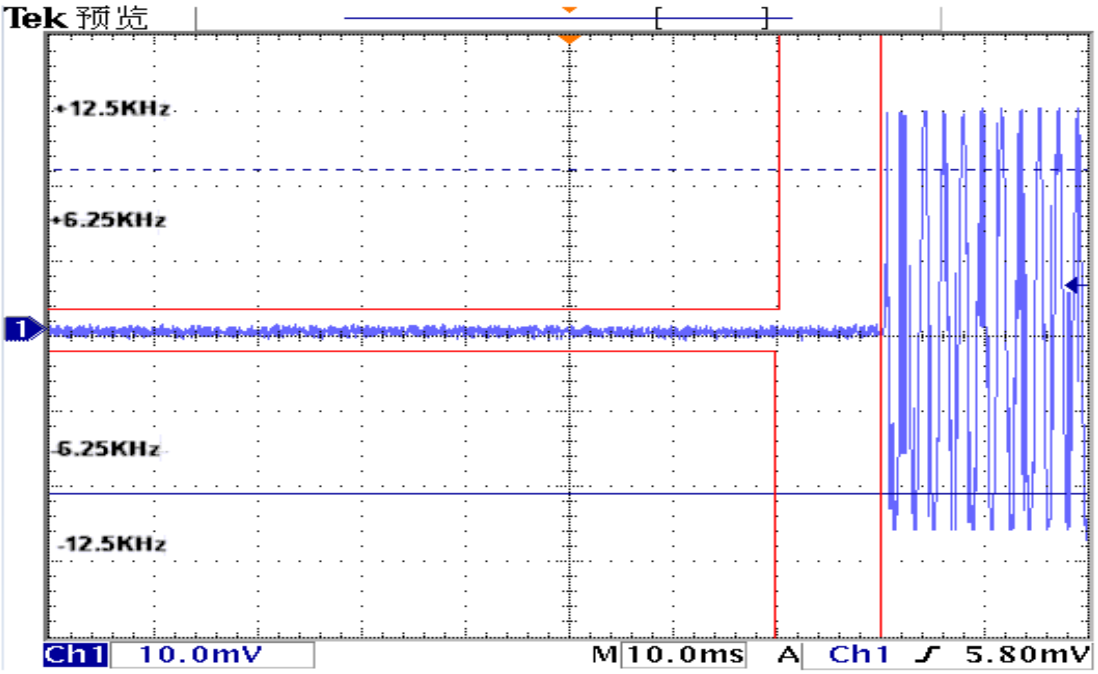
Remark:We tested and recorded All Op, recorded worst case at Op 1.

FOR UHF BAND

Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation--Off to On



Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation--On to Off



9. MAXIMUMN TRANSMITTER POWER (CONDUCTED OUTPUT POWER)

9.1 PROVISIONS APPLICABLE

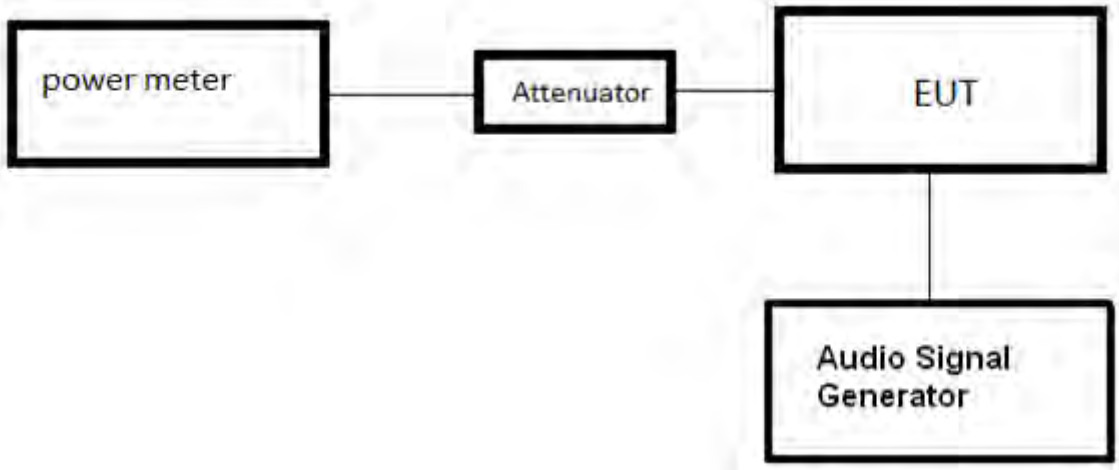
Per Fcc §2.1046 And §90.205: Maximum Erp Is Dependent Upon The Station'S Antenna Haat And Required Service Area.

9.2 TEST PROCEDURE

The Rf Output Of Two-Way Radio Was Connected To A Power Meter Through An Appropriate Attenuator. The Transmitter Shall Be Modulated By A 2.5 Khz 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)

Measure and record the transmitter output power, the use of measurement to capture the real peak of transmitting equipment test.

9.3 TEST CONFIGURATION



9.4 TEST RESULT
The maximum Conducted Power (CP) is

Remark:We tested and recorded All Op.

4W(36.02dBm) for 12.5 KHz Channel Separation for UHF -OP1

Conducted Power Measurement Results		
Channel Separation	**Channel**	**Measurement Result (dBm)**
12.5KHz	Bottom(406.100MHz)	35.54
	Middle(435.325MHz)	**35.76**
	Top (469.975MHz)	35.72

4W(36.02dBm) for 12.5 KHz Channel Separation for UHF –OP2

Conducted Power Measurement Results		
Channel Separation	**Channel**	**Measurement Result (dBm)**
12.5KHz	Bottom(406.100MHz)	35.34
	Middle(435.325MHz)	**35.45**
	Top (469.975MHz)	35.35

1W(30.00dBm) for 12.5 KHz Channel Separation for UHF –OP3

Conducted Power Measurement Results		
Channel Separation	**Channel**	**Measurement Result (dBm)**
12.5KHz	Bottom(406.100MHz)	29.56
	Middle(435.325MHz)	**29.63**
	Top (469.975MHz)	29.53

1W(30.00dBm) for 12.5 KHz Channel Separation for UHF –OP4

Conducted Power Measurement Results		
Channel Separation	**Channel**	**Measurement Result (dBm)**
12.5KHz	Bottom(406.100MHz)	29.17
	Middle(435.325MHz)	**29.24**
	Top (469.975MHz)	29.16

4W(36.02dBm) for 12.5 KHz Channel Separation for UHF –OP5

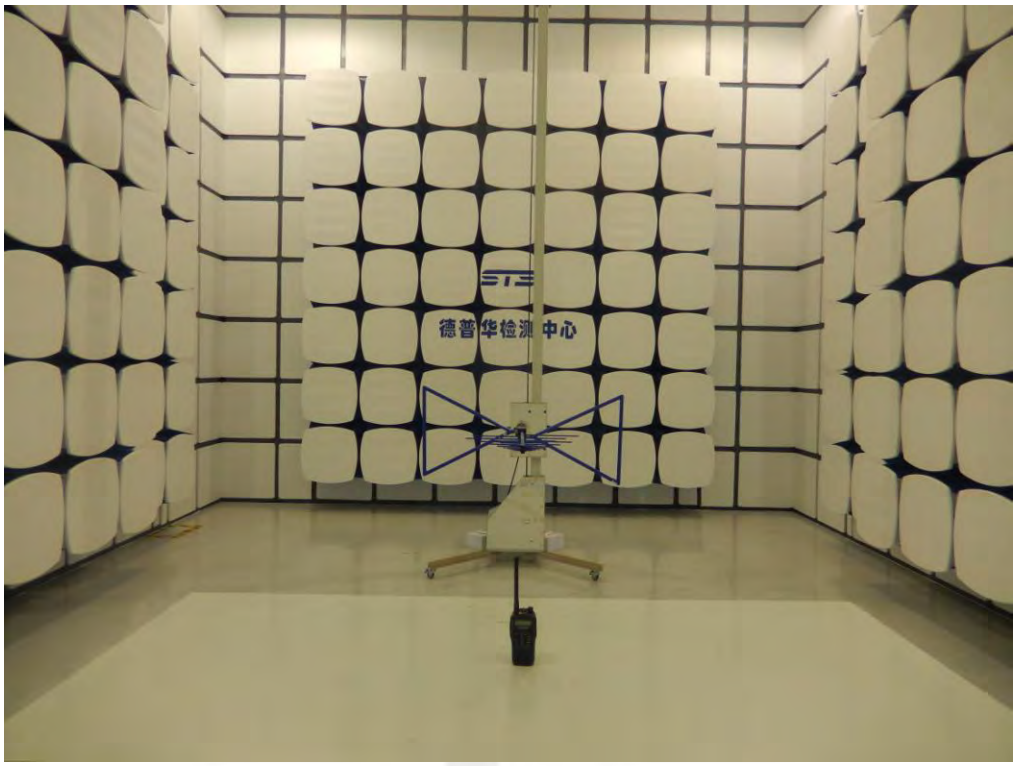
Conducted Power Measurement Results		
Channel Separation	**Channel**	**Measurement Result (dBm)**
12.5KHz	Bottom(406.100MHz)	35.21
	Middle(435.325MHz)	**35.43**
	Top (469.975MHz)	35.14

1W(30.00dBm) for 12.5 KHz Channel Separation for UHF –OP6

Conducted Power Measurement Results		
Channel Separation	**Channel**	**Measurement Result (dBm)**
12.5KHz	Bottom(406.100MHz)	29.21
	Middle(435.325MHz)	**29.25**
	Top (469.975MHz)	29.17

PHOTOS OF TEST SETUP

Radiated Measurement Photos
30MHz- 1GHz



Above 1GHz