



Shenzhen GUOREN Certification Technology Service Co., Ltd.

101#, Building K & Building T, The Second Industrial Zone, Jiazitang Community,
Fenghuang Street, Guangming District, Shenzhen, China

**TEST REPORT
FCC Part 90**

Report Reference No......: **GRCTR250801052-01**

FCC ID.....: **2AIJ4-FS-8200**

Compiled by

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Date of issue.....: Sep. 02, 2025

Testing Laboratory Name.....: **Shenzhen GUOREN Certification Technology Service Co., Ltd.**

Address.....: 101#, Building K & Building T, The Second Industrial Zone, Jiazitang
Community, Fenghuang Street, Guangming District, Shenzhen, China

Applicant's name.....: **Quanzhou HengLiDa Tel-Equipment Co.,Ltd.**

Address.....: 659 Xingpu, Xiamei Town, Nan'an City,Fujian Province,China

Test specification.....:

Standard.....: **FCC Part 90**

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Test item description.....: **Waterproof walkie-talkie**

Trade Mark.....: /

Manufacturer.....: **Quanzhou HengLiDa Tel-Equipment Co.,Ltd.**

Model/Type reference.....: FS-8200

Listed Models: /

Modulation: FM

Hardware version.....: V1.0

Software version: V1.0

Frequency..... 400-470MHz

Rating.....: DC 5V Powered by adapter
DC 3.7V By Li-ion rechargeable battery

Result.....: **PASS**



TEST REPORT

Equipment under Test : Waterproof walkie-talkie

Model /Type : FS-8200

Listed Models : /

Applicant : Quanzhou HengLiDa Tel-Equipment Co.,Ltd.

Address : 659 Xingpu, Xiamei Town, Nan'an City,Fujian Province,China

Manufacturer : Quanzhou HengLiDa Tel-Equipment Co.,Ltd.

Address : 659 Xingpu, Xiamei Town, Nan'an City,Fujian Province,China

Test result	Pass
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The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1 SUMMARY

1.1 TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules Part 90](#) : PERSONAL RADIO SERVICES

[ANSI/TIA-603-E-2016](#): Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

[FCC Part 2](#): FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

[ANSI C63.26-2015](#): IEEE/ANSI Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

1.2 Test Description

Test specification clause	Test case	Verdict
FCC Part 90.205	Maximum Transmitter Power	PASS
FCC Part 90.207	Modulation Characteristic	PASS
FCC Part 90.209	Occupied Bandwidth	PASS
FCC Part 90.210	Emission Mask	PASS
FCC Part 90.210	Transmitter Radiated Spurious Emission	PASS
FCC Part 90.210	Spurious Emission On Antenna Port	PASS
FCC Part 90.213	Frequency Stability	PASS
FCC Part 90.214	Transmitter Frequency Behavior	PASS

Remark: The measurement uncertainty is not included in the test result.

2 GENERAL INFORMATION

2.1 General Remarks

Date of receipt of test sample	:	Aug. 13, 2025
Testing commenced on	:	Aug. 13, 2025
Testing concluded on	:	Sep. 02, 2025

2.2 Product Description

Product Name:	Waterproof walkie-talkie
Model/Type reference:	FS-8200
Listed Models:	/
Power Supply	DC 5V Powered by adapter or DC 3.7V By Li-ion rechargeable battery
Adapter Information:	M/N:XTX-05010A Input:AC 100-240V 50/60Hz Output:DC 5V/1A
Testing sample ID:	GRCTR250801052-01-1#(Engineer sample) GRCTR250801052-01-2#(Normal sample)
Frequency Range	From 400MHz to 470MHz
Rate Power	High power 5W and Low power 2W
Modulation Type	FM
Channel Separation	12.5KHz
Antenna Type	External antenna
Antenna gain*(Supplied by the customer):	3.00dBi
Remark:*When the information provided by the customer was used to calculate test results, if the information provided by the customer is not accurate, shenzhen GUOREN Certification Technology Service Co., Ltd. does not assume any responsibility.	

2.3 Description of Test Modes and Test Frequency

The EUT has been tested under typical operating condition. As, test modes selected as below by the technical parameters of the EUT:

Operation Mode No.	Modulation	Channel Separation	Power level
	FM	12.5KHz	
Mode 1	☒	☒	High
Mode 2	☒	☒	Low

Test frequency list:

Modulation Type	Channel Separation	Test Frequency (MHz)
Analog/FM	12.5KHz	400.025 MHz
		435.000 MHz
		469.975 MHz

2.4 Equipment Under Test

Power supply system utilised

Power supply voltage	:	☐	230V / 50 Hz	☐	120V / 60Hz
		☐	12 V DC	☐	24 V DC
		☒	Other (specified in blank below)		

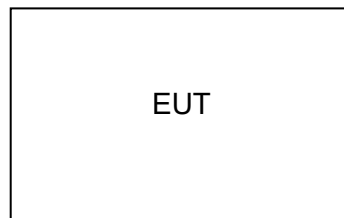
DC 3.7V By Li-ion rechargeable battery

2.5 Short description of the Equipment under Test (EUT)

This is a Waterproof walkie-talkie.

For more details, refer to the user's manual of the EUT.

2.6 Block Diagram of Test Setup



2.7 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with FCC Part 90 Rules.

2.8 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Address of the test laboratory

Shenzhen GUOREN Certification Technology Service Co., Ltd.

101#, Building K & Building T, The Second Industrial Zone, Jiazitang Community, Fenghuang Street, Guangming District, Shenzhen, China

3.2 Test Facility

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

FCC-Registration No.: 920798 Designation Number: CN1304

Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA-Lab Cert. No.: 6202.01

Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

ISED#: 27264 CAB identifier: CN0115

Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

CNAS-Lab Code: L15631

Shenzhen GUOREN Certification Technology Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories for the Competence of Testing and Calibration Laboratories.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

3.3 Environmental conditions

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

Normal Temperature	15-35 °C
Relative Humidity	30-60 %
Air Pressure	950-1050mbar

3.4 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen GUOREN Certification Technology Service Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen GUOREN Certification Technology Service Co., Ltd.:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.06 dB	(1)
Radiated Emission	1~18GHz	5.14 dB	(1)
Radiated Emission	18-40GHz	5.38 dB	(1)
Conducted Disturbance	0.15~30MHz	2.14 dB	(1)
Max output power	30MHz~18GHz	0.54 dB	(1)
Spectrum bandwidth	/	1.2%	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.5 Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	GRCTEE009	2024/09/19	2025/09/18
LISN	R&S	ENV216	GRCTEE010	2024/09/19	2025/09/18
EMI Test Receiver	R&S	ESPI	GRCTEE017	2024/09/19	2025/09/18
EMI Test Receiver	R&S	ESCI	GRCTEE008	2024/09/19	2025/09/18
Spectrum Analyzer	Agilent	N9020A	GRCTEE002	2024/09/19	2025/09/18
Spectrum Analyzer	R&S	FSP	GRCTEE003	2024/09/20	2025/09/19
Vector Signal generator	Agilent	N5181A	GRCTEE007	2024/09/19	2025/09/18
Analog Signal Generator	R&S	SML03	GRCTEE006	2024/09/19	2025/09/18
Climate Chamber	QIYA	LCD-9530	GRCTES016	2024/09/19	2025/09/18
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	GRCTEE018	2023/09/28	2026/09/27
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	GRCTEE081	2023/09/28	2026/09/27
Horn Antenna	Schwarzbeck	BBHA 9120D	GRCTEE019	2023/09/28	2026/09/27
Loop Antenna	Zhinan	ZN30900C	GRCTEE020	2023/10/15	2026/10/14
Horn Antenna	Beijing Hangwei Dayang	OBH100400	GRCTEE049	2023/09/28	2026/09/27
Amplifier	Schwarzbeck	BBV 9745	GRCTEE021	2024/09/19	2025/09/18
Amplifier	Schwarzbeck	BBV 9745	GRCTEE084	2024/09/19	2025/09/18
Amplifier	Taiwan chengyi	EMC051845B	GRCTEE022	2024/09/19	2025/09/18
Audio Analyzer	Rohde&Schwarz	UPL	GRCTEE086	2024/09/19	2025/09/18
Temperature/Humidity Meter	Huaguan	HG-308	GRCTES037	2024/09/19	2025/09/18

Directional coupler	NARDA	4226-10	GRCTEE004	2024/09/19	2025/09/18
High-Pass Filter	XingBo	XBLBQ-GTA18	GRCTEE053	2024/09/19	2025/09/18
High-Pass Filter	XingBo	XBLBQ-GTA27	GRCTEE054	2024/09/19	2025/09/18
RF COMMUNICATION TEST SET	HP	8921A	GRCTEE078	2024/09/19	2025/09/18
Automated filter bank	Tonscend	JS0806-F	GRCTEE055	2024/09/19	2025/09/18
Power Sensor	Agilent	U2021XA	GRCTEE070	2024/09/19	2025/09/18
EMI Test Software	ROHDE & SCHWARZ	ESK1-V1.71	GRCTEE060	N/A	N/A
EMI Test Software	Fera	EZ-EMC	GRCTEE061	N/A	N/A

4 TEST CONDITIONS AND RESULTS

4.1 Maximum Transmitter Power

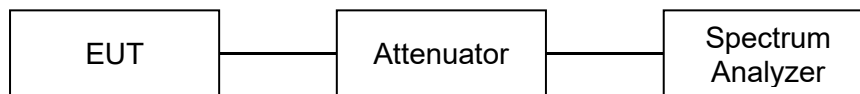
TEST APPLICABLE

Per FCC Part 2.1046 and Part 90.205: Maximum ERP is dependent upon the station's antenna HAAT and required service area.

TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The output was measured by spectrum analyzer with 100 KHz RBW and 300 KHz VBW.

TEST CONFIGURATION



TEST RESULTS

Modulation Type	Channel Separation (kHz)	Power Level	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Test result
Analog/FM	12.5KHz	High	400.025	36.399	4.36	Pass
			435.000	37.290	5.36	Pass
			469.975	37.564	5.71	Pass
		Low	400.025	33.034	2.01	Pass
			435.000	33.516	2.25	Pass
			469.975	33.431	2.20	Pass



Power_High 400.025MHz



Power_High 435.000MHz



Power_High 469.975MHz



Power_Low 400.025MHz



Power_Low 435.000MHz



Power_Low 469.975MHz

4.2 Occupied Bandwidth and Emission Mask

TEST APPLICABLE

Occupied Bandwidth: FCC Part 90.209, FCC Part 2.1049

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
Below 25 ²		
25-50	20	20
72-76	20	20
150-174	17.5	^{1 3} 20/11.25/6
216-220 ⁵	6.25	20/11.25/6
220-222	5	4
406-512 ²	¹ 6.25	¹³⁶ 20/11.25/6
806-809/851-854	12.5	20
809-824/854-869	25	⁶ 20
896-901/935-940	12.5	13.6
902-928 ⁴		
929-930	25	20
1427-1432 ⁵	12.5	12.5
³ 2450-2483.5 ²		
Above 2500 ²		

Emission Mask: FCC Part 90.210, FCC Part 2.1049

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25 ¹	A or B	A or C
25-50	B	C
72-76	B	C
150-174 ²	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512 ^{2 5}	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854 ⁶	B	H
809-824/854-869 ^{3 5}	B	G
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990 MHz	L or M	L or M
5850-5925 ⁴		
All other bands	B	C

Emission Mask B:

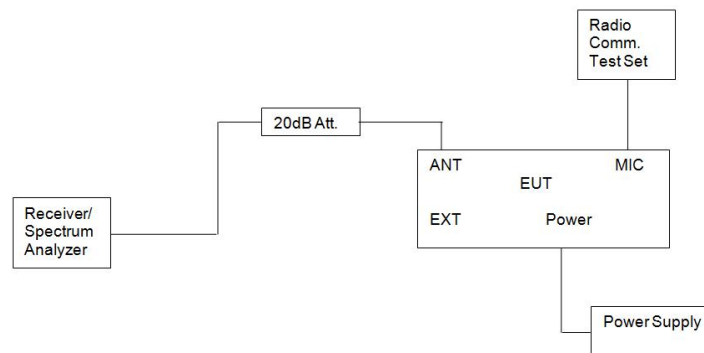
For transmitters that are equipped with an audio low-pass filter pursuant to §90.211(a), the power of any emission must be below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
- (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.

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:

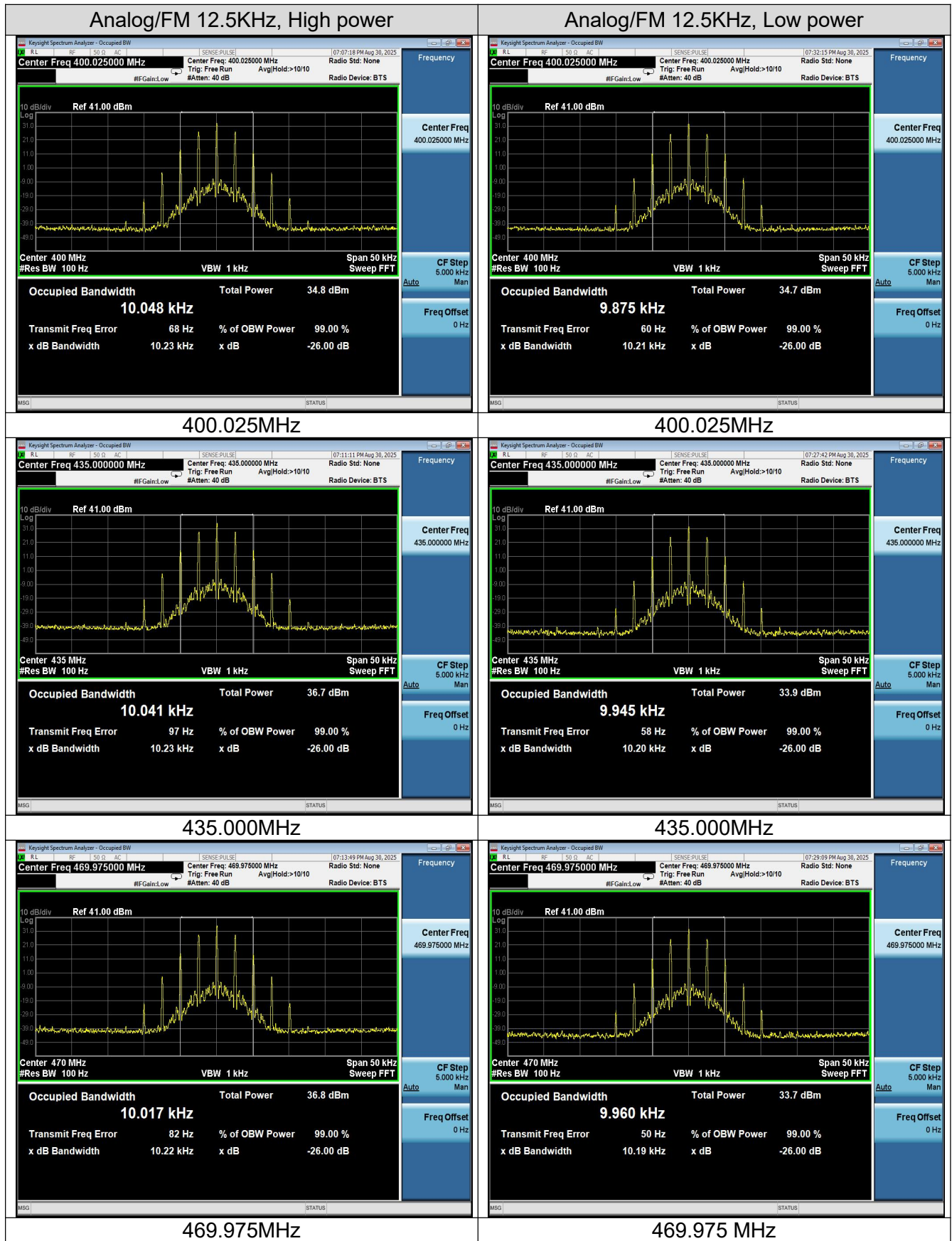
- (1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.

TEST CONFIGURATION**TEST PROCEDURE**

- 1 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) and 5 kHz (25 kHz channel spacing).
- 2 Set SPA Center Frequency = fundamental frequency, set RBW=100Hz, VBW= 1 KHz, span =50 KHz for 12.5KHz mode and RBW=300Hz, VBW= 3 KHz for 25KHz mode.
- 3 Set SPA Max hold. Mark peak, Set 99% Occupied Bandwidth and 26dB Occupied Bandwidth.

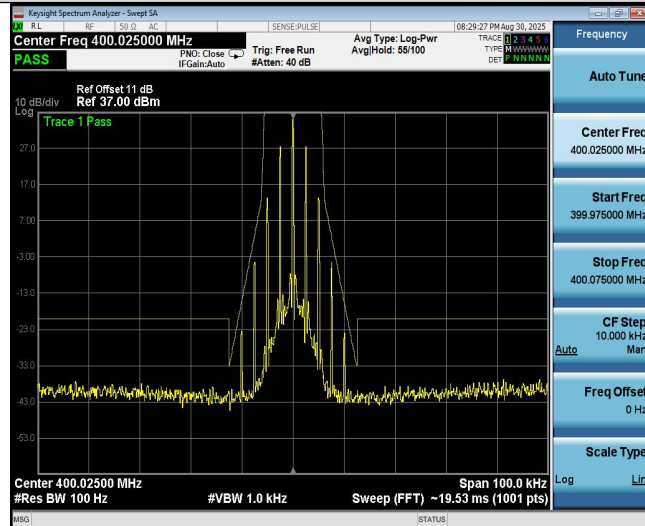
TEST RESULTS**Occupied Bandwidth:**

Modulation Type	Channel Separation (kHz)	Power Level	Frequency (MHz)	99% OBW (kHz)	26dB bandwidth (kHz)	Limit (KHz)	Test result
Analog/FM	12.5KHz	High	400.025	10.048	10.23	11.25	Pass
			435.000	10.041	10.23		Pass
			469.975	10.017	10.22		Pass
		Low	400.025	9.875	10.21		Pass
			435.000	9.945	10.20		Pass
			469.975	9.960	10.19		Pass



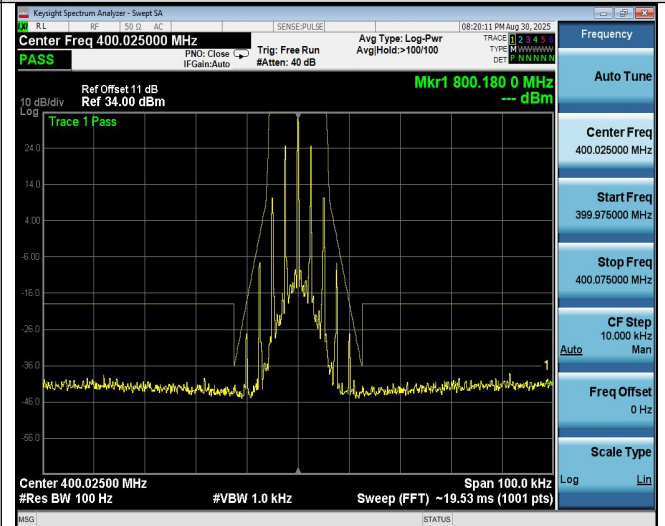
Emission Mask:

Analog/FM 12.5KHz, High power

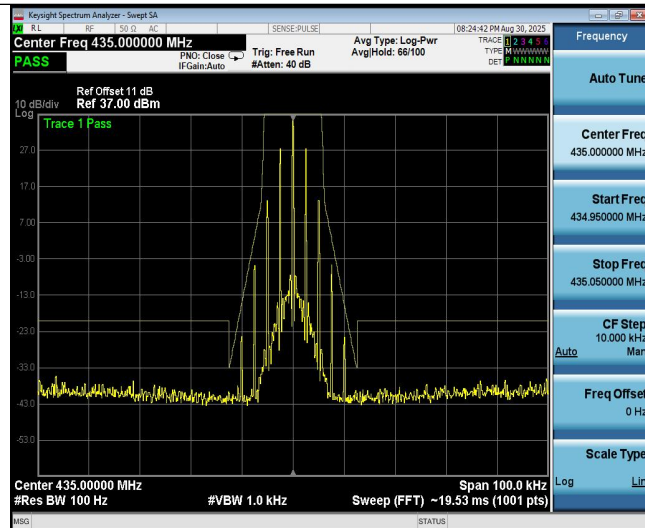


400.025MHz

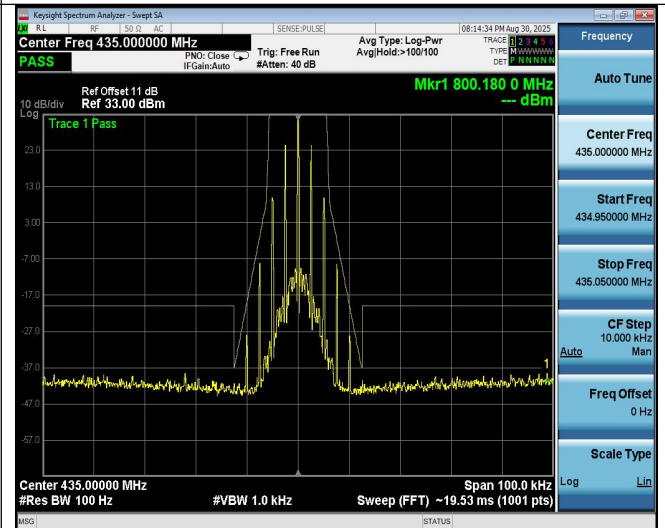
Analog/FM 12.5KHz, Low power



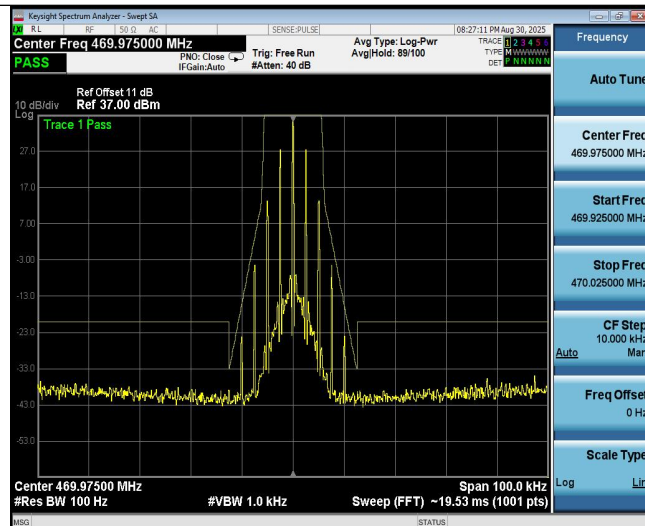
400.025MHz



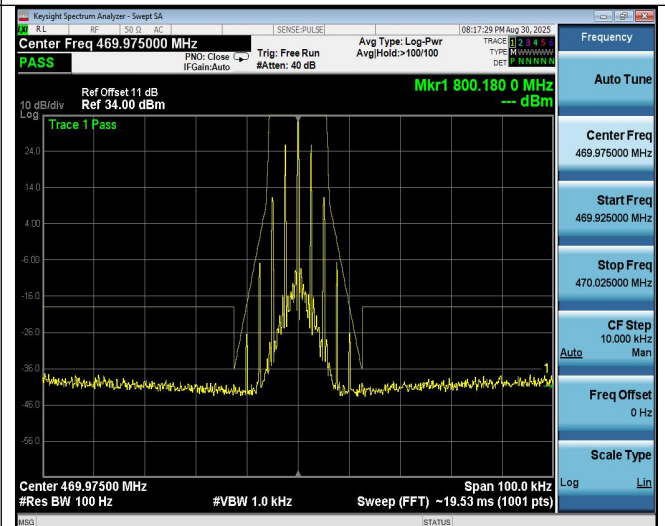
435.000MHz



435.000MHz



469.975MHz

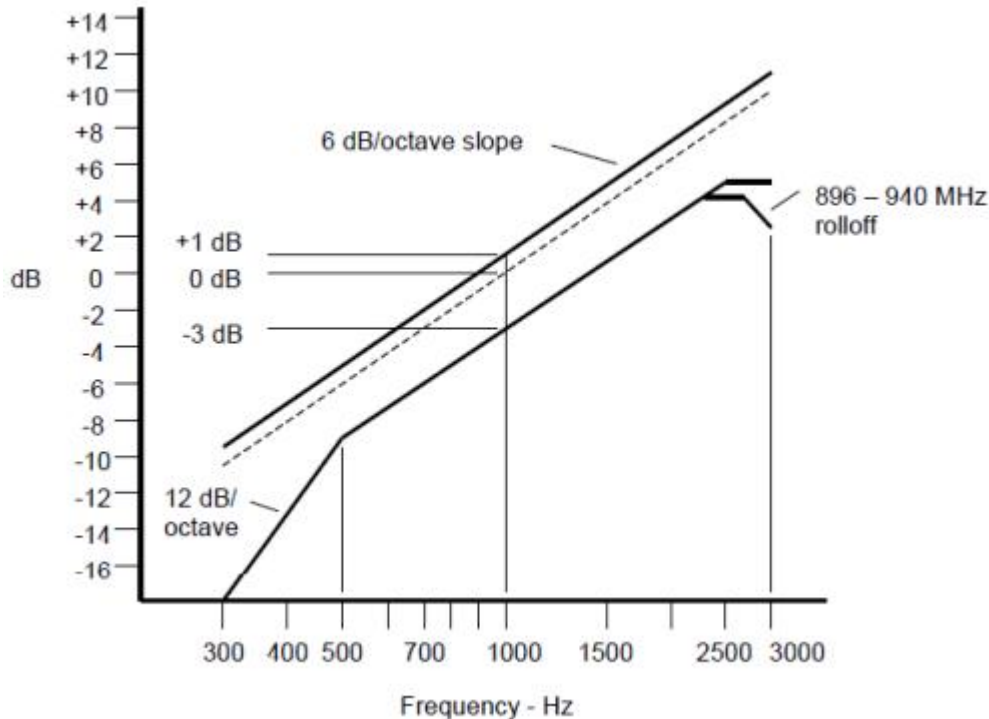


469.975 MHz

4.3 Modulation Characteristic

TEST APPLICABLE

According to CFR47 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. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.



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

TEST PROCEDURE

Modulation Limit

- 1 Configure the EUT as shown in TEST CONFIGURATION, 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 300, 1004, 1500 and 2500Hz in sequence.

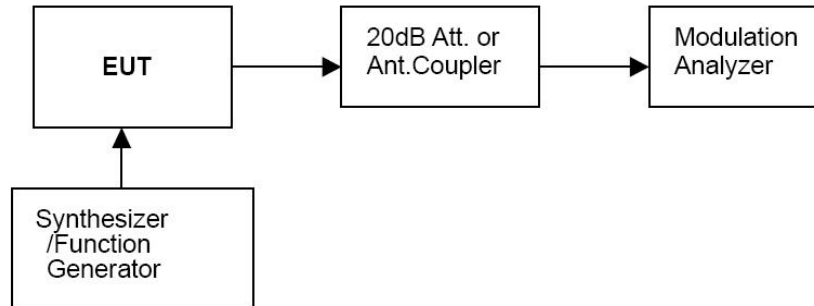
Audio Frequency Response

- 1 Configure the EUT as shown in TEST CONFIGURATION.
- 2 Adjust the audio input for 20% of rated system deviation at 1 KHz using this level as a reference (0dB).
- 3 Vary the Audio frequency from 100 Hz to 3 KHz and record the frequency deviation.
- 4 Audio Frequency Response = $20 \log_{10} (\text{Deviation of test frequency} / \text{Deviation of 1 KHz reference})$.

Audio Low Pass Filter Response

- 1 Connect the equipment as illustrated.
- 2 Connect the Audio Generator as close as possible the input of the post limiter low pass filter
- 3 within the transmitter under test.
- 4 Connect the RF Communications Test Set to the output of the post limiter low pass filter within
- 5 the transmitter under test.
- 6 Apply a 1000 Hz tone from the audio frequency generator and adjust the level per manufacturer's specifications.
- 7 Record the dB level of the 1000 Hz spectral line on the RF Communications Test Set as LEV_{REF} .

- 8 Set the audio frequency generator to the desired test frequency between 3000 Hz and the upper low pass filter limit.
- 9 Record RF Communications Test Set levels, at the test frequency in step 8)
- 10 Record the dB level on the RF Communications Test Set as LEV_{FREQ} .

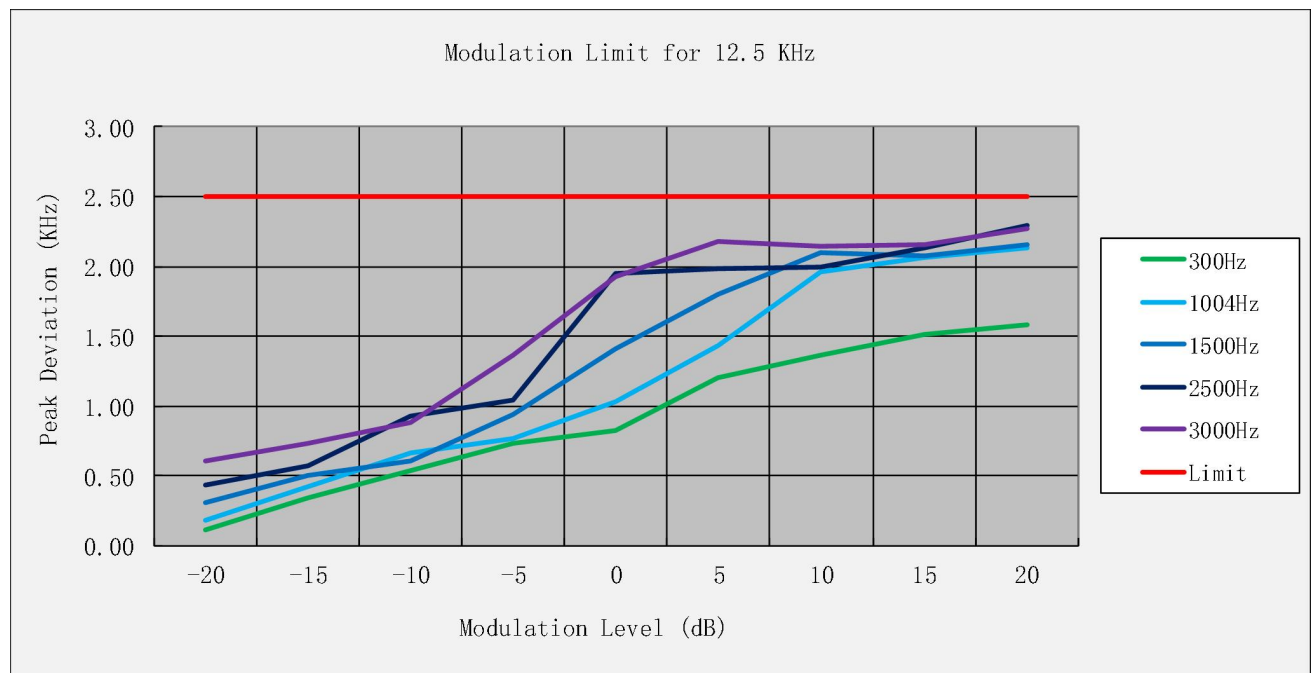
TEST CONFIGURATION

TEST RESULTS

Remark: Both test mode 1 and test mode 2 have been tested, only the worst case of test mode 1 middle channel recorded as below.

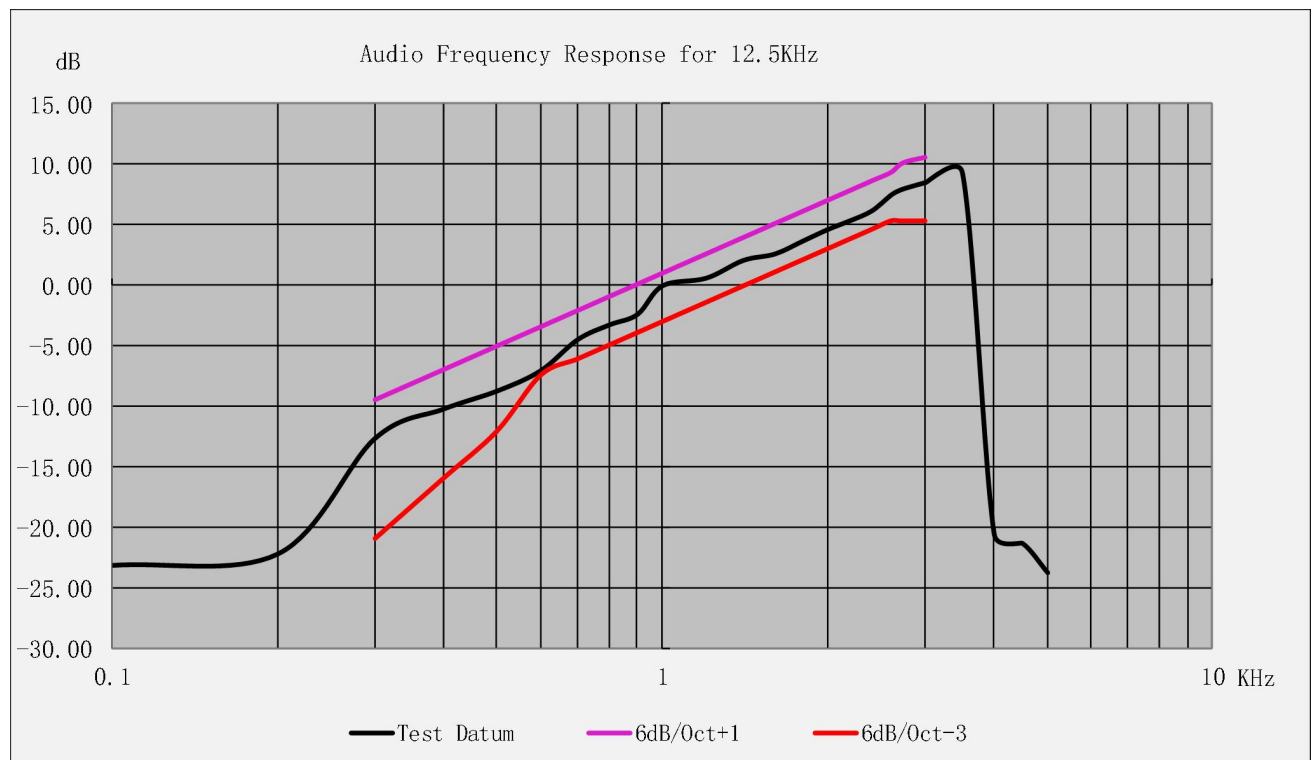
Modulation Limit:**12.5 KHz Channel Separation**

Modulation Level (dB)	Peak Freq. Deviation At 300 Hz (KHz)	Peak Freq. Deviation At 1004 Hz (KHz)	Peak Freq. Deviation At 1500 Hz (KHz)	Peak Freq. Deviation At 2500 Hz (KHz)
-20	0.12	0.18	0.31	0.44
-15	0.34	0.42	0.50	0.57
-10	0.54	0.67	0.61	0.93
-5	0.73	0.77	0.94	1.04
0	0.83	1.03	1.41	1.95
+5	1.21	1.43	1.80	1.98
+10	1.36	1.96	2.10	2.00
+15	1.51	2.07	2.08	2.13
+20	1.58	2.13	2.16	2.29



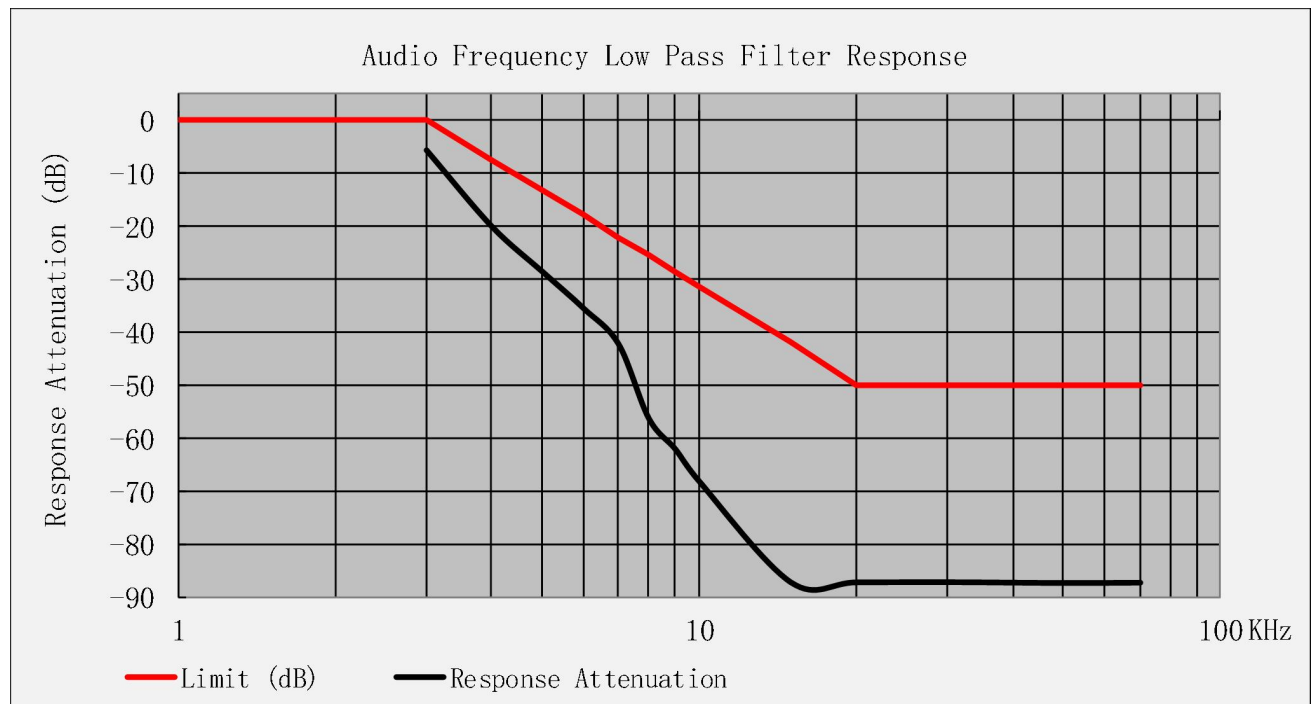
Audio Frequency Response:

Frequency (KHz)	Frequency Deviation (KHz)	1KHz Refenerce Deviation (KHz)	Audio Frequency Response (dB)
0.1	0.05	0.77	-23.10
0.2	0.06	0.77	-22.16
0.3	0.18	0.77	-12.63
0.4	0.24	0.77	-10.19
0.5	0.28	0.77	-8.71
0.6	0.34	0.77	-7.03
0.7	0.46	0.77	-4.47
0.8	0.53	0.77	-3.24
0.9	0.59	0.77	-2.37
1.0	0.77	0.77	0.00
1.2	0.83	0.77	0.62
1.4	0.98	0.77	2.08
1.6	1.04	0.77	2.62
1.8	1.18	0.77	3.70
2.0	1.32	0.77	4.66
2.2	1.43	0.77	5.40
2.4	1.57	0.77	6.19
2.6	1.82	0.77	7.49
2.7	1.91	0.77	7.89
2.8	1.96	0.77	8.13
3.0	2.05	0.77	8.51
3.5	2.25	0.77	9.31
4.0	0.07	0.77	-20.57
4.5	0.07	0.77	-21.28
5.0	0.05	0.77	-23.70



Audio Low Pass Filter Response

Audio Frequency (KHz)	Response Attenuation (dB)	Limit (dB)
3	0	-5.62
4	-7.5	-20.01
5	-13.31	-28.56
6	-18.06	-35.52
7	-22.08	-42.26
8	-25.56	-56.32
9	-28.63	-62.16
10	-31.37	-68.25
15	-41.94	-87.35
20	-50	-87.31
30	-50	-87.27
50	-50	-87.43
70	-50	-87.37



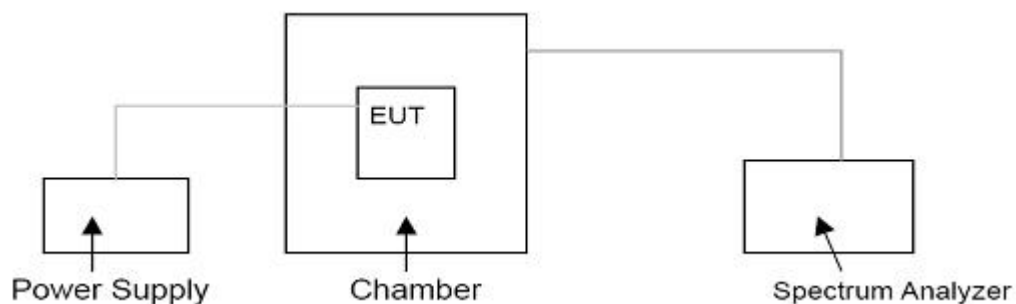
4.4 Frequency Stability

LIMITS

According to 90.213, Transmitters used must have minimum frequency stability as specified in the following table.

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	^{1 2 3} 100	100	200
25-50	20	20	50
72-76	5		50
150-174	^{5 11} 5	⁶ 5	^{4 6} 50
216-220	1.0		1.0
220-222 ¹²	0.1	1.5	1.5
421-512	^{7 11 14} 2.5	⁸ 5	⁸ 5
806-809	¹⁴ 1.0	1.5	1.5
809-824	¹⁴ 1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5
896-901	¹⁴ 0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928 ¹³	2.5	2.5	2.5
929-930	1.5		
935-940	0.1	1.5	1.5
1427-1435	⁹ 300	300	300
Above 2450 ¹⁰			

TEST CONFIGURATION



TEST PROCEDURE

The EUT was set in the climate chamber and connected to an external DC power supply. The RF output was directly connected to Spectrum Analyzer. The coupling loss of the additional cables was recorded and taken in account for all the measurements. After temperature stabilization (approx. 20 min for each stage), the frequency for the lower, the middle and the highest frequency range was recorded. For Frequency stability Vs. Voltage the EUT was connected to a DC power supply and the voltage was adjusted in the required ranges. The result was recorded.

TEST RESULTS

Remark: Both test mode 1 and test mode 2 have been tested, only the worst case of test mode 1 recorded as below.

Test conditions		Frequency error (ppm)			Limit (ppm)	Result
Voltage(V)	Temp(°C)	400.025	435.000	469.975		
3.7	-30	-0.56	0.55	-1.62	2.5	Pass
	-20	1.09	0.76	1.33		
	-10	-0.33	-0.86	-0.26		
	0	-0.38	-0.21	1.32		
	10	0.91	1.21	1.37		
	20	-1.99	1.85	-1.08		
	30	0.75	0.91	1.84		
	40	1.95	-1.67	-1.29		
	50	-1.42	1.32	1.89		
4.37 (85% Rated)	20	1.92	0.59	-0.08	2.5	Pass
3.23 (115% Rated)	20	-0.77	0.89	-1.42		

4.5 Transmitter Radiated Spurious Emission

Limit

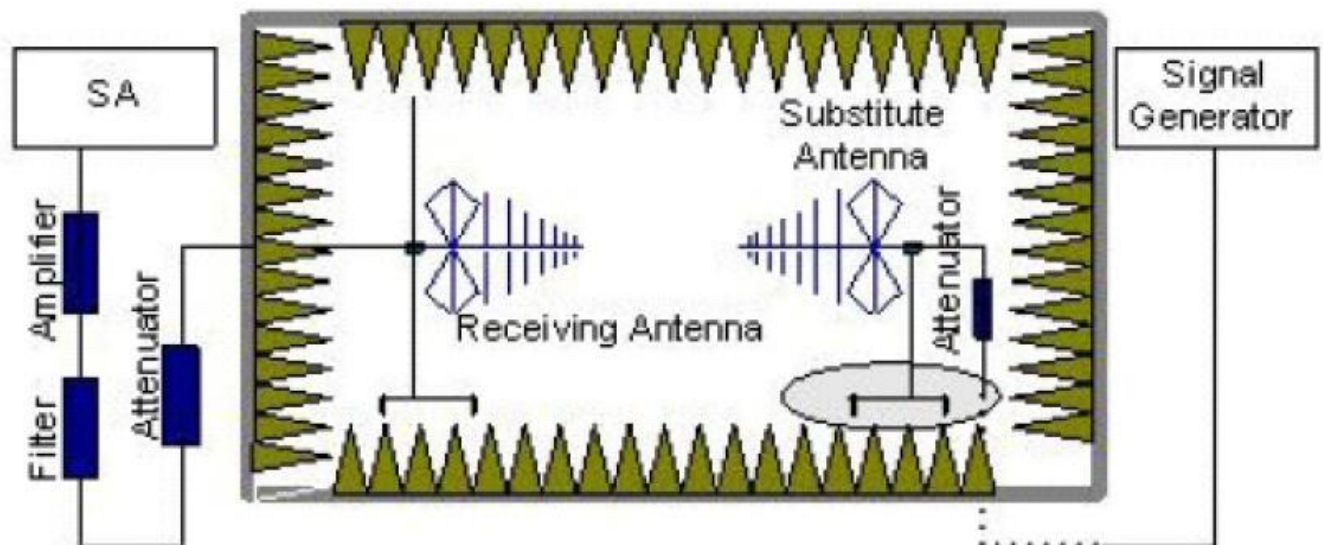
According to the TIA/EIA 603 test method, and according to Section 90.210, the power of each unwanted emission shall be less than Transmitted Power as specified below for transmitters designed to operate with 12.5 KHz channel bandwidth:

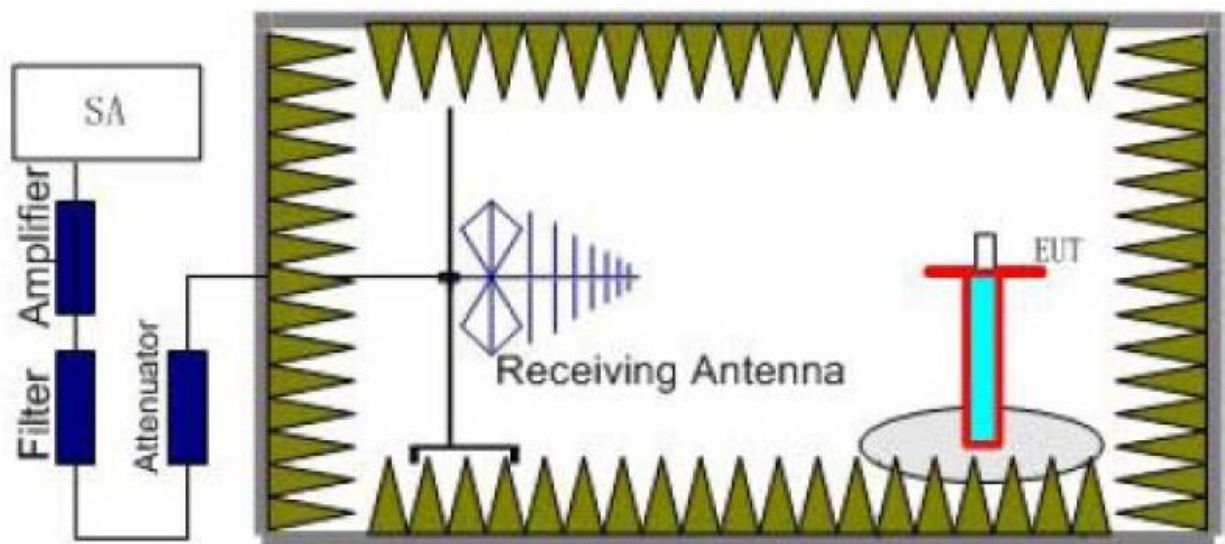
- 1 On any frequency removed from the center of the authorized bandwidth f_0 to 5.625 KHz removed from f_0 : Zero dB
- 2 On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) f_0 of more than 5.625 KHz but no more than 12.5 KHz: At least 7.27dB
- 3 On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) f_0 of more than 12.5 KHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is lesser attenuation.

For transmitters designed to transmit with 25 KHz channel separation and equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as following:

- 1 On any frequency removed from the assigned frequency by more than 50 percent, but no more than 100 percent of the authorized bandwidth: At least 25 dB.
- 2 On any frequency removed from the assigned frequency by more than 100 percent, but no more than 250 percent of the authorized bandwidth: At least 35 dB.
- 3 On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.

TEST CONFIGURATION





TEST PROCEDURE

- a. EUT was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.0m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all test transmit frequencies were measured with peak detector.
- b. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
- c. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum 100 kHz below 1GHz and 1MHz above 1GHz, Sweep from 30MHz to the 10th harmonic of the fundamental frequency; and recorded the level of the concerned spurious emission point as (P_r).
- d. The EUT then replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

The measurement results are obtained as described below:

$$\text{Power}_{(EIRP)} = P_{Mea} - P_{cl} + G_a$$

Where;

P_{Mea} is the recorded signal generator level

P_{cl} is the cable loss connect between instruments

G_a Substitution Antenna Gain

- e. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
- f. ERP can be calculated from EIRP by subtracting the gain of the dipole, $ERP = EIRP - 2.15\text{dBi}$.
- g. Test site anechoic chamber refer to ANSI C63.

TEST RESULTS

Remark:

1. Both test mode 1 and test mode 2 have been tested, only the worst case of test mode 1 recorded.
2. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency; and worst spurious emissions recorded as below:

Test frequency:400.025 MHz							
Frequency(MHz)	P _{Mea} (dBm)	G _a Antenna Gain(dBi)	P _{cl} (dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dBm)	Polarity
801.60	-32.14	6.10	2.51	-28.55	-20.00	-8.55	H
1201.40	-33.15	6.22	2.58	-29.51	-20.00	-9.51	H
1601.20	-39.71	8.96	2.93	-33.68	-20.00	-13.68	H
2001.70	-44.24	9.60	3.48	-38.12	-20.00	-18.12	H
--	--	--	--	--	--	--	H
801.60	-31.32	6.10	2.51	-27.73	-20.00	-7.73	V
1201.40	-32.76	6.22	2.58	-29.12	-20.00	-9.12	V
1601.20	-39.06	8.96	2.93	-33.03	-20.00	-13.03	V
2001.70	-43.71	9.60	3.48	-37.59	-20.00	-17.59	V
--	--	--	--	--	--	--	V
Test frequency:435.000 MHz							
Frequency(MHz)	P _{Mea} (dBm)	G _a Antenna Gain(dBi)	P _{cl} (dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dBm)	Polarity
870.25	-34.16	5.89	2.68	-30.95	-20.00	-10.95	H
1305.80	-31.09	6.92	2.76	-26.93	-20.00	-6.93	H
1740.45	-38.77	9.77	3.21	-32.21	-20.00	-12.21	H
2175.45	-45.72	9.68	3.62	-39.66	-20.00	-19.66	H
--	--	--	--	--	--	--	H
870.25	-33.46	5.89	2.68	-30.25	-20.00	-10.25	V
1305.80	-30.59	6.92	2.76	-26.43	-20.00	-6.43	V
1740.45	-38.46	9.77	3.21	-31.90	-20.00	-11.90	V
2175.45	-45.70	9.68	3.62	-39.64	-20.00	-19.64	V
Test frequency:469.975 MHz							
Frequency(MHz)	P _{Mea} (dBm)	G _a Antenna Gain(dBi)	P _{cl} (dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dBm)	Polarity
940.85	-31.60	5.97	2.86	-28.49	-20.00	-8.49	H
1410.50	-32.42	7.61	2.71	-27.52	-20.00	-7.52	H
1880.15	-37.74	9.95	3.14	-30.93	-20.00	-10.93	H
2350.70	-45.29	10.27	3.84	-38.86	-20.00	-18.86	H
--	--	--	--	--	--	--	H
940.85	-30.48	5.97	2.86	-27.37	-20.00	-7.37	V
1410.50	-31.87	7.61	2.71	-26.97	-20.00	-6.97	V
1880.15	-37.57	9.95	3.14	-30.76	-20.00	-10.76	V
2350.70	-44.34	10.27	3.84	-37.91	-20.00	-17.91	V

Remark:

1. $EIRP = P_{Mea}(dBm) - P_{cl}(dB) + G_a(dBi)$
2. -- Means other points for values lower than limits and not recorded.
3. $Margin = Limit - EIRP$

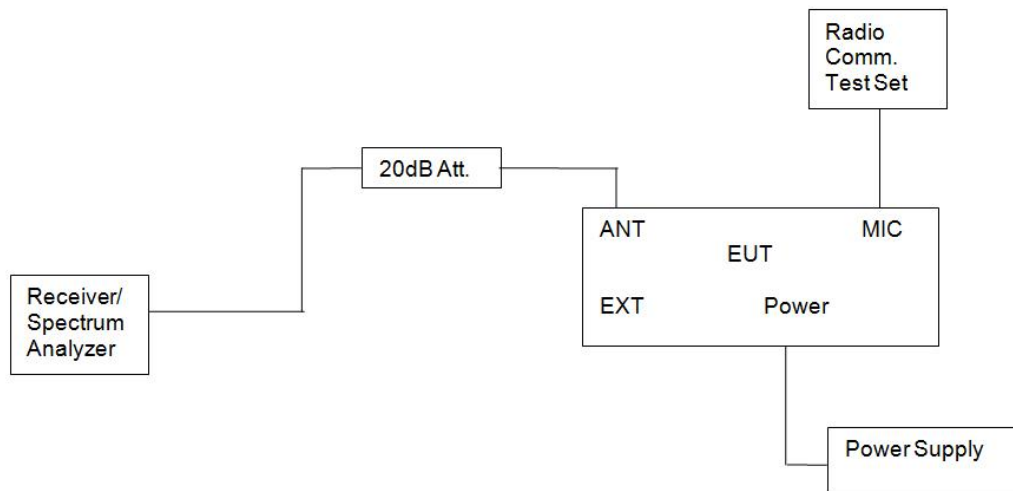
4.6 Spurious Emission on Antenna Port

Limit

FCC Part 90.210, FCC Part 2.1051

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.

TEST CONFIGURATION



TEST PROCEDURE

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set to 100 kHz. Sufficient scans were taken to show any out of band emission up to 10th. Harmonic for the lower and the highest frequency range. Set RBW 100 kHz, VBW 300 kHz in the frequency band 30MHz to 1GHz, while set RBW=1MHz.VBW=3MHz from the 1GHz to 10th Harmonic.

TEST RESULTS

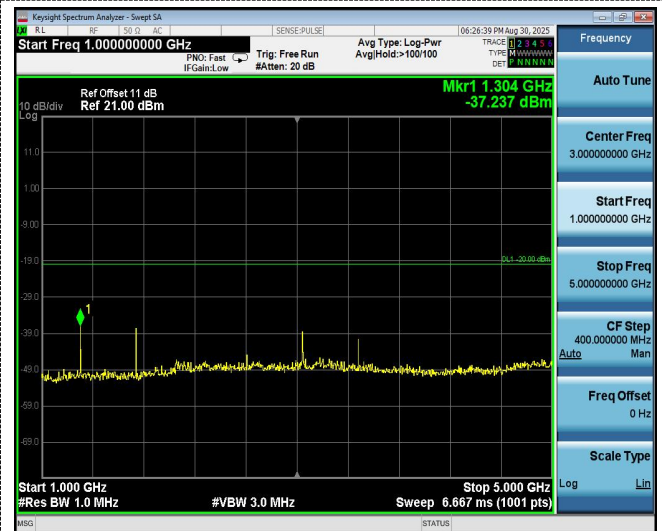
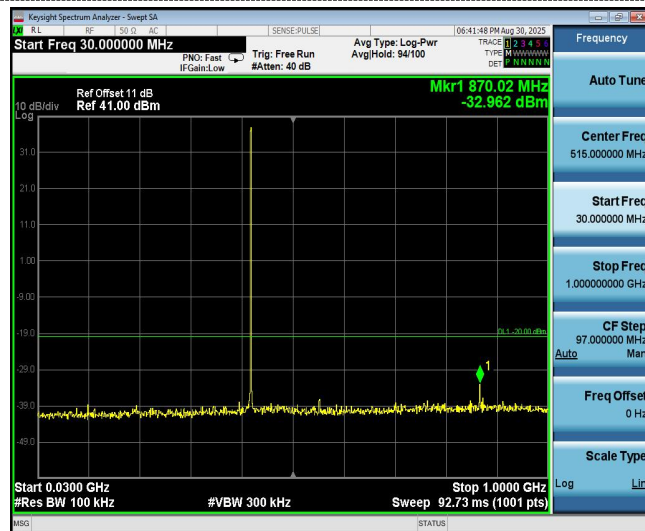
Remark:

1. Both test mode 1 and test mode 2 have been tested, only the worst case of test mode 1 recorded.
2. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency; and worst spurious emissions recorded as below:

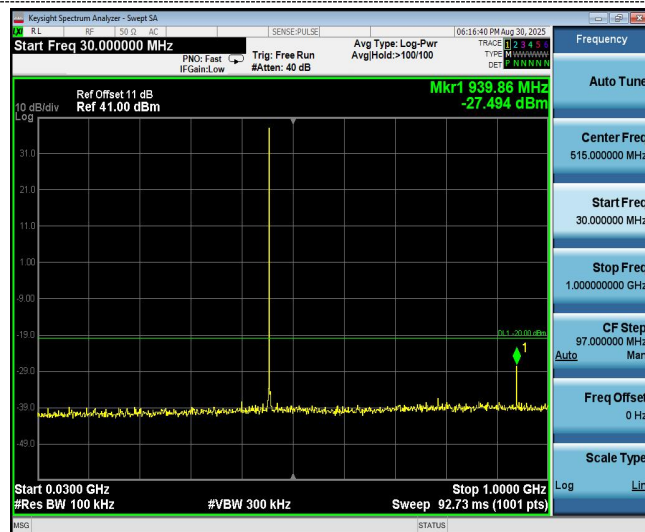
FM 12.5 KHz Channel Separation Test mode 1



400.025MHz



435.000MHz



469.975MHz

4.7 Transmitter Frequency Behavior

TEST APPLICABLE

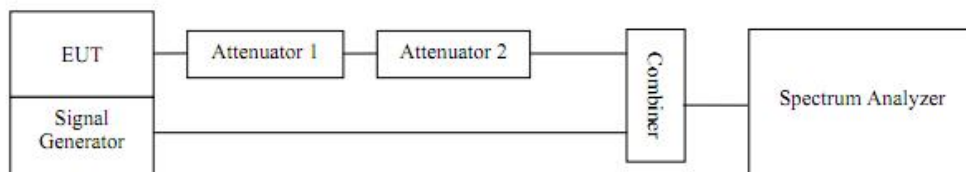
Section 90.214

Transient frequencies must be within the maximum frequency difference limits during the time intervals indicated:

Time intervals ^{1, 2}	Maximum frequency difference ³	All equipment	
		150 to 174 MHz	421 to 512MHz
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

- 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.
- 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.
- Difference between the actual transmitter frequency and the assigned transmitter frequency.
- 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.

TEST CONFIGURATION



TEST PROCEDURE

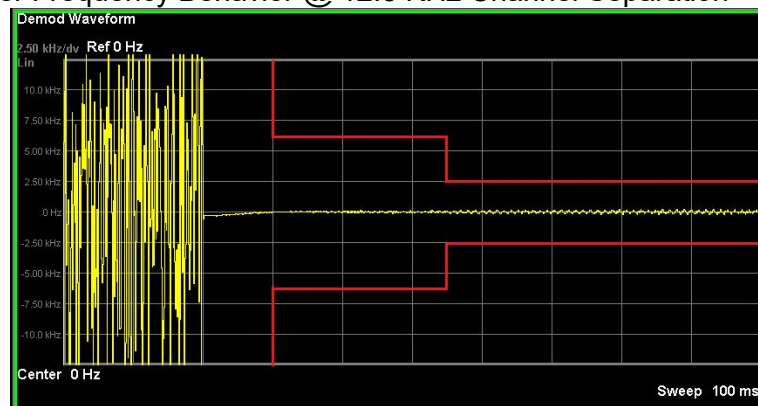
- Connect the EUT and test equipment as shown in the test configuration.
- Set Spectrum Analyzer to measure FM deviation, and tune the RF frequency to transmitter assigned frequency.
- Set the signal generator to the assigned transmitter frequency and modulate it with a 1KHz tone at ±12.5Khz deviation and set its output level to -100dBm.
- Turn on the transmitter.
- Supply sufficient attenuation via RF attenuator to provide an input level to the Spectrum Analyzer that is 40dB below the maximum allowed input power when the transmitter is operating at its rated power level. Note this power level on Spectrum Analyzer as P_0 .
- Turn off the transmitter.
- Adjust the RF level of the signal generator to provide RF power equal to P_0 . This signal generator RF level shall be maintained throughout the rest of the measurement.
- Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30dB when the transmitter is turned on.

9. Adjust the vertical amplitude control of the spectrum analyzer to display the 1000Hz at ± 4 divisions vertically centered on display. Set trigger mode of the Spectrum Analyzer to "Video", and tune the "trigger level" on suitable level. Then set the "trigger offset" to -10ms for turn on and -15ms for turn off.
10. Turn on the transmitter and the transient wave will be captured on the screen of Spectrum Analyzer. Observe the stored display. The instant when the 1 KHz test signal is completely suppressed is considered to be t_{on} . The trace should be maintained within the allowed divisions during the period t_1 and t_2 .
11. Then turn off the transmitter, and another transient wave will be captured on the screen of Spectrum Analyzer. The trace should be maintained within the allowed divisions during the period t_3 .

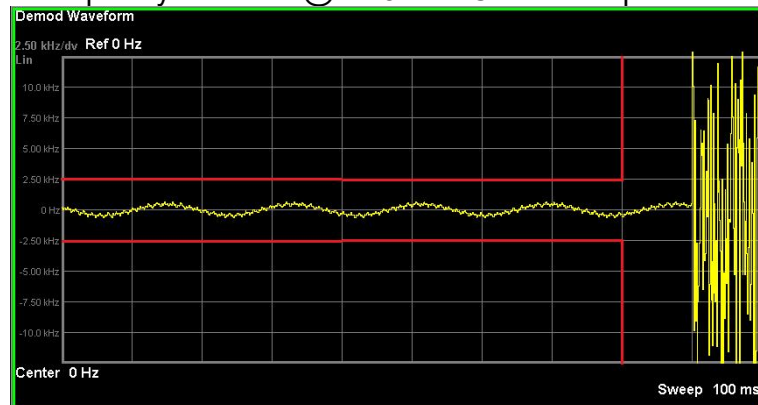
TEST RESULTS

Modulation Type: FM

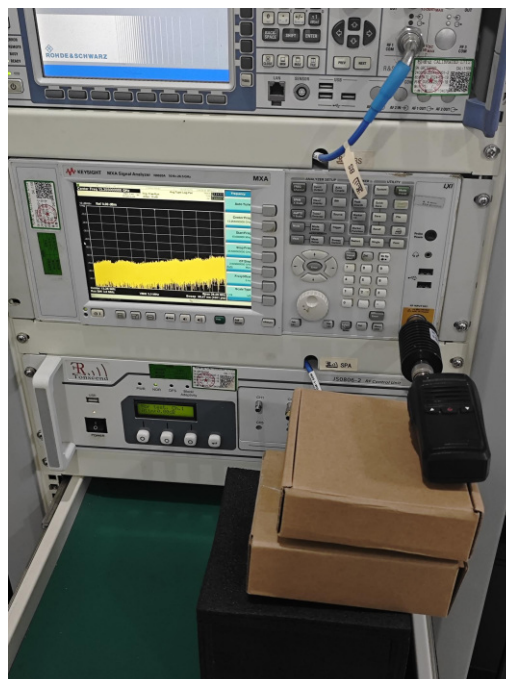
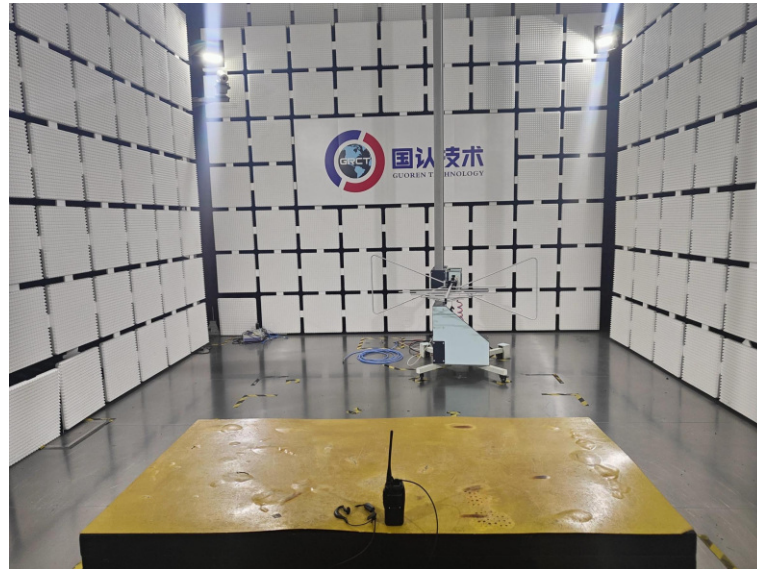
Transmitter Frequency Behavior @ 12.5 KHz Channel Separation-----Off – On



Transmitter Frequency Behavior @ 12.5 KHz Channel Separation-----On – Off



5 Test Setup Photos of the EUT



6 External and Internal Photos of the EUT

