FCC PART 90 SUBPART C TEST REPORT

FCC PART 90

Report Reference No.....:	**HK2005110897-E**	
FCC ID.....:	**2AJTU-K1**	
Compiled by (position+printed name+signature)..:	Testing Engineer Gary Qian	Gary Qian
Supervised by (position+printed name+signature)..:	Technical Manager Eden Hu	Eden Hu
Approved by (position+printed name+signature)..:	Authorized Signatory Jason Zhou	Jason Zhou
Date of issue.....:	May.19, 2020	
Representative Laboratory Name.:	Shenzhen HUAK Testing Technology Co., Ltd.	
Address .....:	1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China	
Testing Laboratory Name.....:	Shenzhen HUAK Testing Technology Co., Ltd.	
Address .....:	1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China	
Applicant's name.....:	**South Surveying & Mapping Technology Co., Ltd.**	
Address .....:	No.39, Sicheng Road, Tianhe District, Guangzhou, China	
Test specification.....**:**		
Standard .....:	**FCC Part 90/FCC Part 2**	
TRF Originator.....:	Shenzhen HUAK Testing Technology Co., Ltd.	

Shenzhen HUAK Testing Technology Co., Ltd. All rights reserved.
This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen HUAK Testing Technology Co., Ltd. as copyright owner and source of the material. Shenzhen HUAK Testing Technology Co., Ltd. takess no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

Test item description .....:	GNSS RECEIVER
Trade Mark .....:	SOUTH, KOLIDA, SANDING, RUIDE, TIANYU
Manufacturer.....:	**Guangzhou South Satellite Navigation Instrument Co., Ltd.**
Model/Type reference.....:	K1
Listed Models .....:	K1 PRO, K20s, K20s IMU, K5 UFO, K5 IMU, K6, K6s, C6, R93i, T7, G1, G6, G1 plus, P30, inno7, G7
Modulation Type .....:	GMSK
Operation Frequency.....:	From 460.125MHz to 467.625MHz
Rating .....:	DC 7.4V from battery or DC 12V from adapter
Hardware version .....:	V2.0
Software version .....:	V2.0
Result.....:	**PASS**

TEST REPORT

Test Report No. :	HK2005110897-E	May.19, 2020 Date of issue

Equipment under Test	:	GNSS RECEIVER
Model /Type	:	K1
Listed Models	:	K1 PRO, K20s, K20s IMU, K5 UFO, K5 IMU, K6, K6s, C6, R93i, T7, G1, G6, G1 plus, P30, inno7, G7
Applicant	:	**South Surveying & Mapping Technology Co., Ltd.**
Address	:	No.39, Sicheng Road, Tianhe District, Guangzhou, China
Manufacturer	:	**Guangzhou South Satellite Navigation Instrument Co., Ltd.**
Address	:	Area A Layer 6, Area A Layer 5, Area A Layer 4, No.39, Sicheng Road, Tianhe District, Guangzhou, China

Test Result:	**PASS**

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.

Contents

1 SUMMARY 4

1.1 TEST STANDARDS 4
1.2 Test Description 4
1.3 Test Facility 5
1.4 Statement of the measurement uncertainty 5

2 GENERAL INFORMATION 6

2.1 Environmental conditions 6
2.2 General Description of EUT 6
2.3 Description of Test Modes and Test Frequency 6
2.4 Measurement Instruments List 7
2.5 Related Submittal(s) / Grant(s) 7
2.6 Modifications 7

3 TEST CONDITIONS AND RESULTS 8

3.1 Maximum Transmitter Power 8
3.2 Occupied Bandwidth and Emission Mask 10
3.3 Modulation Characteristic 13
3.4 Frequency Stability 14
3.5 Transmitter Frequency Behavior 16
3.6 Transmitter Radiated Spurious Emission 18
3.7 Spurious Emission on Antenna Port 21

4 TEST SETUP PHOTOS OF THE EUT 26

5 EXTERNAL AND INTERNAL PHOTOS OF THE EUT 27

1 SUMMARY

1.1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 90 :2017: PRIVATE LAND MOBILE RADIO SERVICES.

TIA/EIA 603 D:June 2010: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

FCC Part 2: FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS

1.2 Test Description

Test specification clause	Test case	Verdict
FCC Part 90.205	Maximum Transmitter Power	PASS
FCC Part2.1047	Modulation Characteristic	PASS
FCC Part 90.209	Occupied Bandwidth	PASS
FCC Part 90.210	Emission Mask	PASS
FCC Part 90.213	Frequency Stability	PASS
FCC Part 90.214	Transmitter Frequency Behavior	PASS
FCC Part 90.210	Transmitter Radiated Spurious Emssion	PASS
FCC Part 90.210	Spurious Emssion On Antenna Port	PASS

1.3 Test Facility

1.3.1 Address of the test laboratory

Shenzhen HUAK Testing Technology Co., Ltd.
1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China

1.4 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 CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the Shenzhen HUAK Testing Technology 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 HUAK Testing Technology Co., Ltd. is reported

Test Items	Measurement Uncertainty	Notes
Frequency error	25 Hz	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Adjacent and alternate channel power Conducted	1.20 dB	(1)
Conducted spurious emission 9KHz-12.75 GHz	1.60 dB	(1)
Radiated spurious emission 9KHz-12.75 GHz	2.20 dB	(1)
Intermodulation attenuation	1.00 dB	(1)
Maximum useable receiver sensitivity	2.80 dB	(1)
Co-channel rejection	2.80 dB	(1)
Adjacent channel selectivity	2.80 dB	(1)
Spurious response rejection	2.80 dB	(1)
Intermodulation response rejection	2.80 dB	(1)
Blocking or desensitization	2.80 dB	(1)

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

2 GENERAL INFORMATION

2.1 Environmental conditions

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

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

2.2 General Description of EUT

Name of EUT	GNSS RECEIVER
Model Number	K1
List Models	K1 PRO, K20s, K20s IMU, K5 UFO, K5 IMU, K6, K6s, C6, R93i, T7, G1, G6, G1 plus, P30, inno7, G7
Difference descrption	All model's the function, software and electric circuit are the same, only with a product color and model named different. Test sample model: K1.
Power Supply	DC 7.4V from battery or DC 12V from adapter
Frequency Range	From 460.125MHz to 467.625MHz
Rate Power	12W/25W
Modulation Type	GMSK
Channel Separation	12.5KHz/25KHz
Antenna Type	External antenna

Note 1: For more details, please refer to the user's manual of the EUT.

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	Condition	
	GMSK		TX	RX
1	☒	12.5KHz	☒	
2	☒	12.5KHz		☒
3	☒	25KHz	☒	
4	☒	25KHz		☒

Test frequency list:

Modulation Type	Test Channel	Channel Separation	Test Frequency (MHz)
GMSK	Ch1	12.5KHz	460.125
	Ch8		463.625
	Ch16		467.625
	Ch1	25KHz	460.125
	Ch8		463.625
	Ch16		467.625

.

2.4 Measurement Instruments List

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	Spectrum analyzer	Agilent	N9020A	HKE-048	2019/12/26	2020/12/25
2	Signal generator	Agilent	N5182A	HKE-029	2019/12/26	2020/12/25
3	Signal generator	Agilent	83630A	HKE-028	2019/12/26	2020/12/25
4	RF automatic control unit	Tonscend	JS0806-2	HKE-060	2019/12/26	2020/12/25
5	Power Sensor	Agilent	E9300A	HKE-086	2019/12/26	2020/12/25
6	Spectrum analyzer	R&S	FSP40	HKE-025	2019/12/26	2020/12/25
7	Wireless Communication Test Set	R&S	CMU200	HKE-026	2019/12/26	2020/12/25
8	Wireless Communication Test Set	R&S	CMW500	HKE-027	2019/12/26	2020/12/25
9	RF automatic control unit	Tonscend	JS0806-2	HKE-060	2019/12/26	2020/12/25
10	Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	2019/12/26	2020/12/25
11	Horn antenna	Schwarzbeck	9120D	HKE-013	2019/12/26	2020/12/25
12	Receiver	R&S	ESCI 7	HKE-010	2019/12/26	2020/12/25
13	Position controller	Taiwan MF	MF7802	HKE-011	2019/12/26	2020/12/25
14	Preamplifier	EMCI	EMC051845SE	HKE-015	2019/12/26	2020/12/25
15	Preamplifier	Agilent	83051A	HKE-016	2019/12/26	2020/12/25
16	High pass filter unit	Tonscend	JS0806-F	HKE-055	2019/12/26	2020/12/25
17	Spectrum analyzer	Agilent	N9020A	HKE-048	2019/12/26	2020/12/25

The calibration interval is 1 year.

2.5 Related Submittal(s) / Grant(s)

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

2.6 Modifications

No modifications were implemented to meet testing criteria.

3 TEST CONDITIONS AND RESULTS

3.1 Maximum Transmitter Power

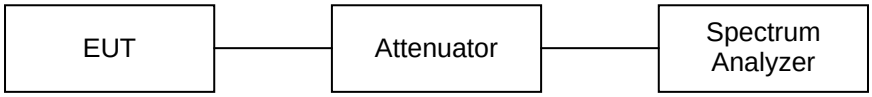
TEST APPLICABLE

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

Measurements shall be made to establish the radio frequency power delivered by the transmitter the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted bellow:
If the power output is adjustable, measurements shall be made for the highest and lowest power levels.
The EUT connect to the Spectrum Analyzer through 20 dB attenuator.

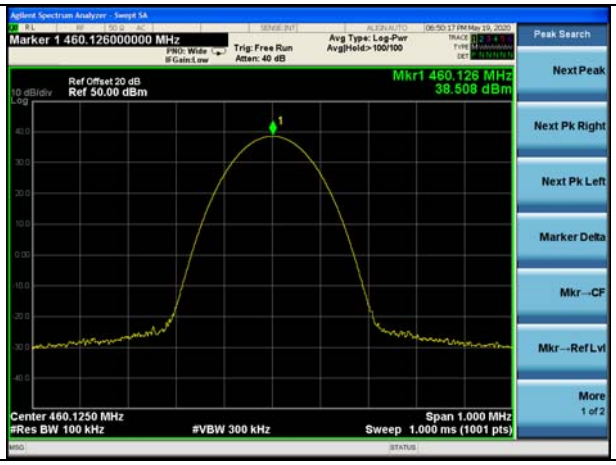
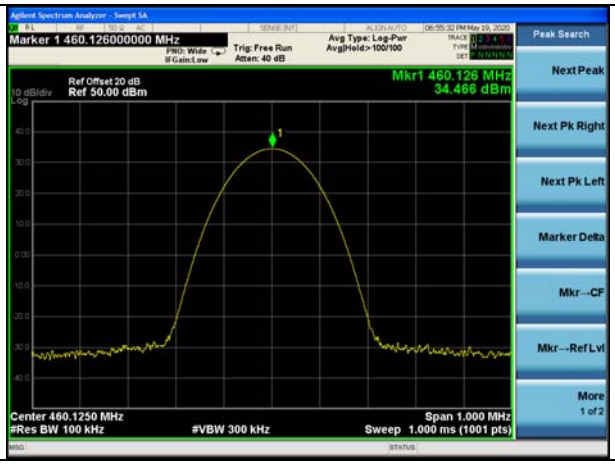
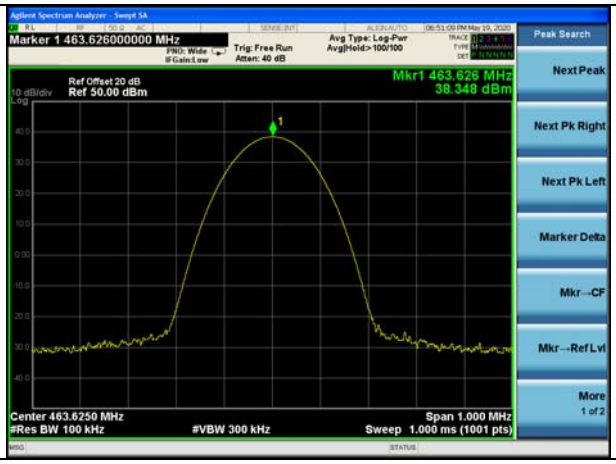
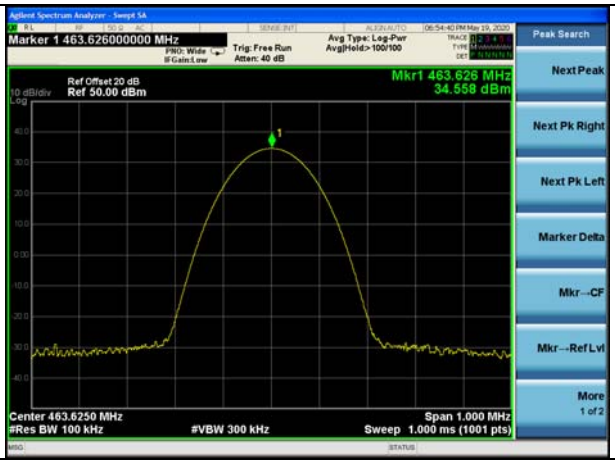
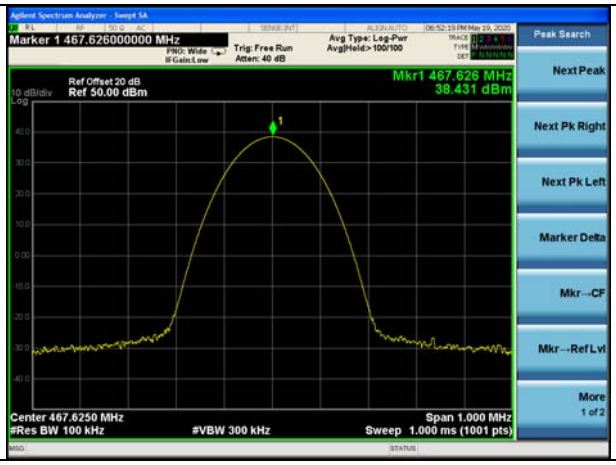
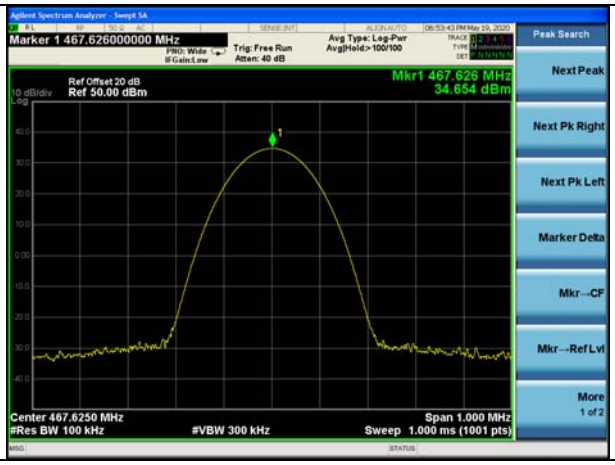
TEST CONFIGURATION



TEST RESULTS

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Test Results (dBm)	Limit(W)	Test result
GMSK	12.5KHz	Ch1	460.125	38.508	500	Pass
		Ch8	463.625	38.348		
		Ch16	467.625	38.431		
GMSK	25KHz	Ch1	460.125	34.466		
		Ch8	463.625	34.558		
		Ch16	467.625	34.654		
Limit	The limit is dependent upon the station's antenna HAAT and required service area.					

Remark:
1. The station's antenna high (HAAT) is 15m and the service area radius is 15Km;
2. All the test modes completed for test. only the worst result was reported as bellow:

12.5 KHz	25 KHz
	
CH1	*CH1*
	
CH8	*CH8*
	
CH16	*CH16*

3.2 Occupied Bandwidth and Emission Mask

TEST APPLICABLE

(a) Occupied Bandwidth: The EUT was connected to the audio signal generator and the spectrum analyzer via the main RF connector, and through an appropriate attenuator. The EUT was controlled to transmit its maximum power. Then the bandwidth of 99% power can be measured by the spectrum analyzer.

(b) 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.

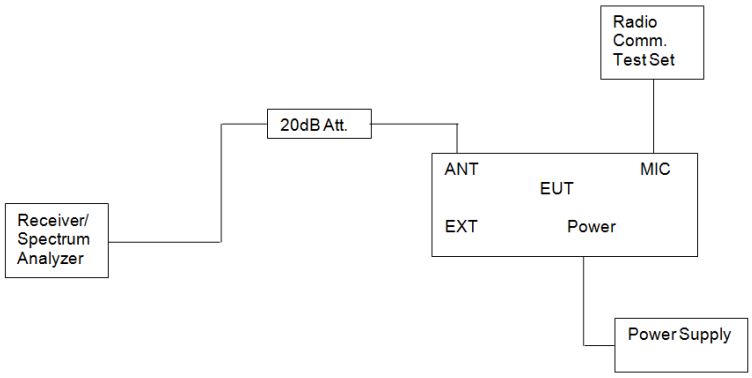
(c) Emission Mask D, 12.5 kHz channel bandwidth equipment: For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(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 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, RBW=300Hz, VBW= 1 KHz, span =50 KHz for channel bandwidth 12.5 KHz and 100 KHz for channel bandwidth 25 KHz..

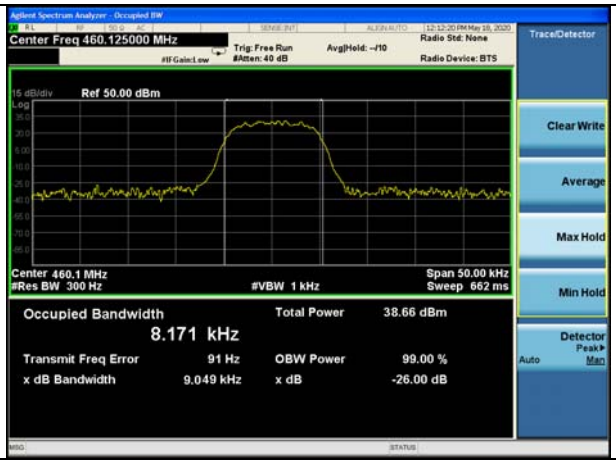
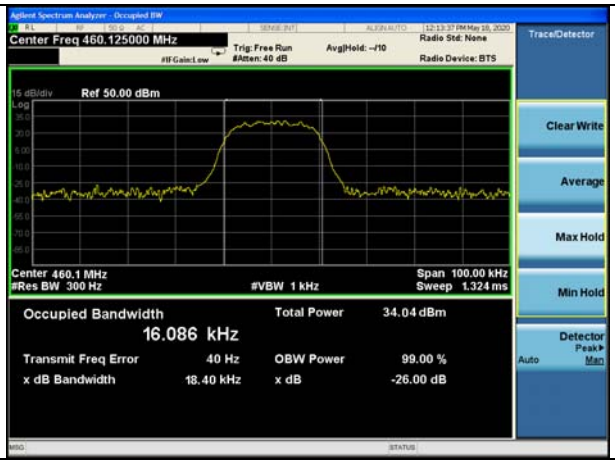
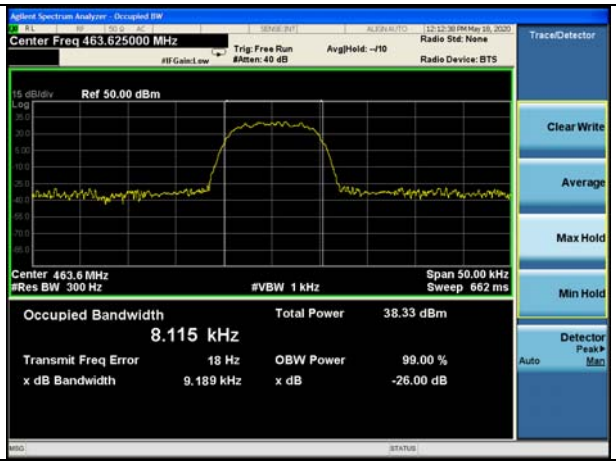
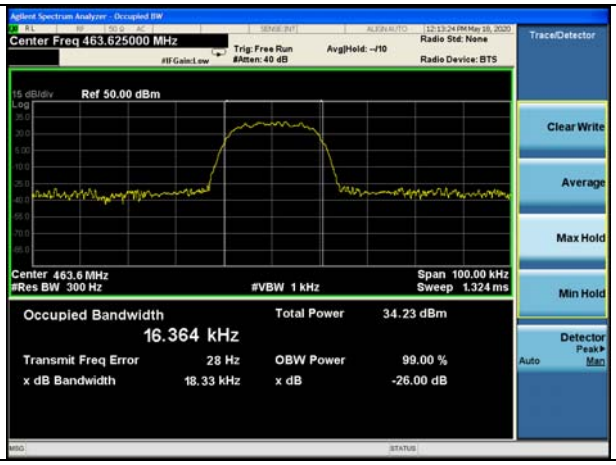
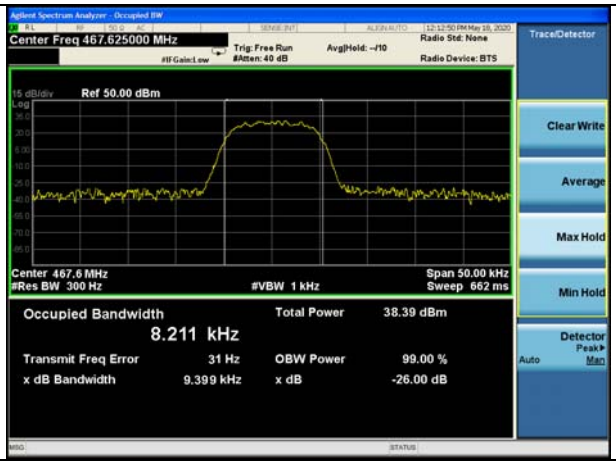
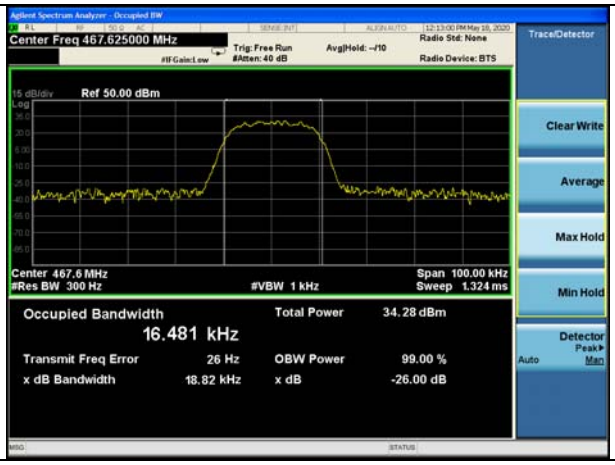
3 Set SPA Max hold. Mark peak, Set 99% Occupied Bandwidth and 26dB Occupied Bandwidth.

TEST RESULTS

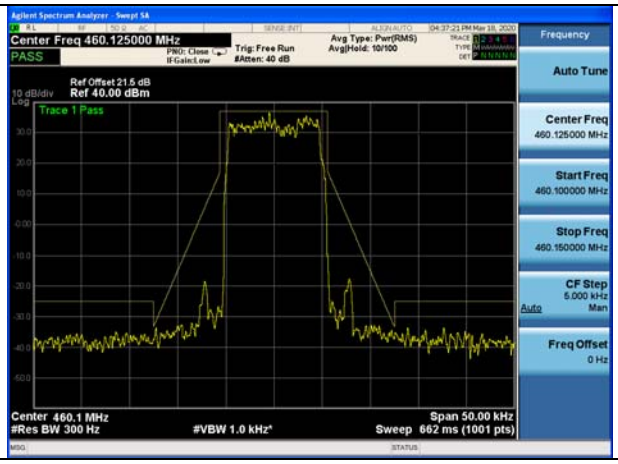
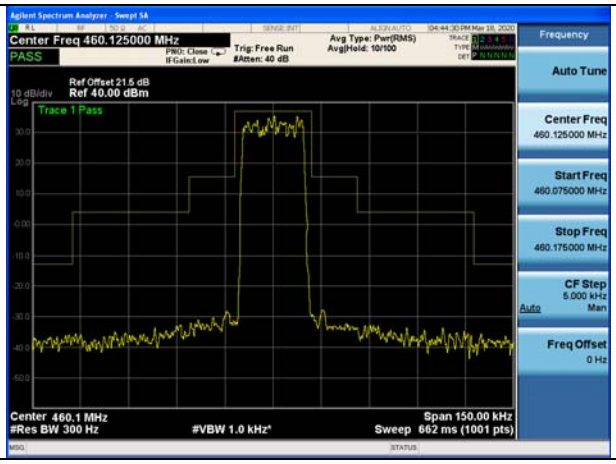
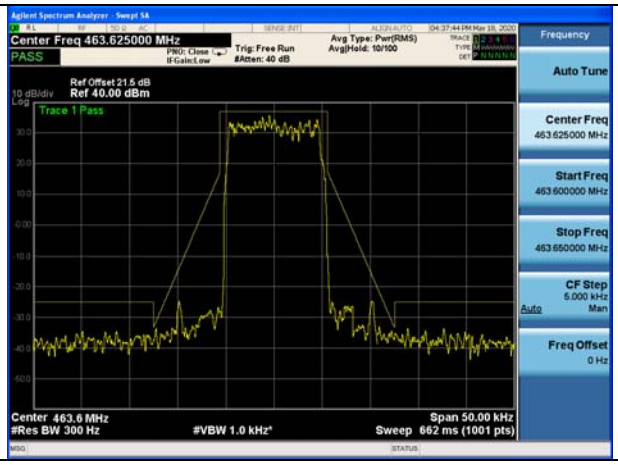
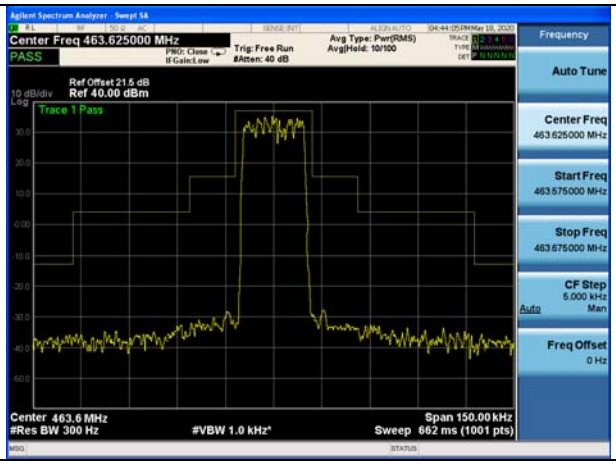
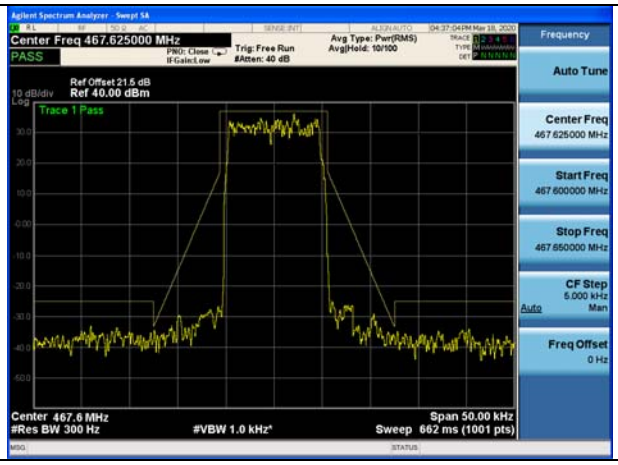
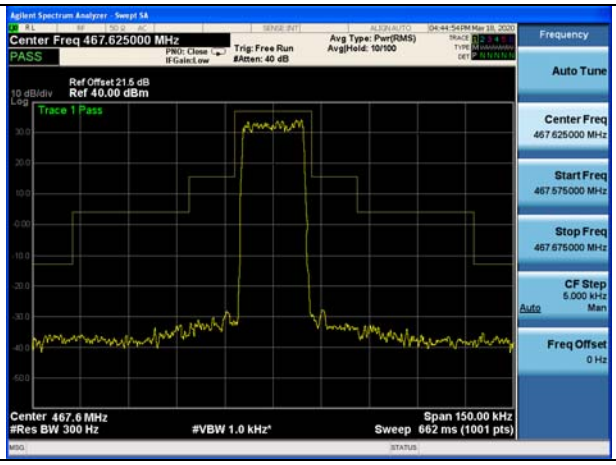
PASS, All the test modes completed for test. only the worst result was reported.

Occupied Bandwidth:

Modulation	Channel Separation	Channel	99% OBW (kHz)	26dB bandwidth (kHz)	Limit (KHz)
GMSK	12.5 KHz	CH1	8.171	9.049	11.25
		CH8	8.115	9.189	
		CH16	8.211	9.399	
GMSK	25 KHz	CH1	16.086	18.40	20
		CH8	16.364	18.33	
		CH16	16.481	18.82	

12.5 KHz	25 KHz
	
CH1	*CH1*
	
CH8	*CH8*
	
CH16	*CH16*

Emission Mask:

12.5 KHz	25 KHz
	
CH1	*CH1*
	
CH8	*CH8*
	
CH16	*CH16*

3.3 Modulation Characteristic

TEST APPLICABLE

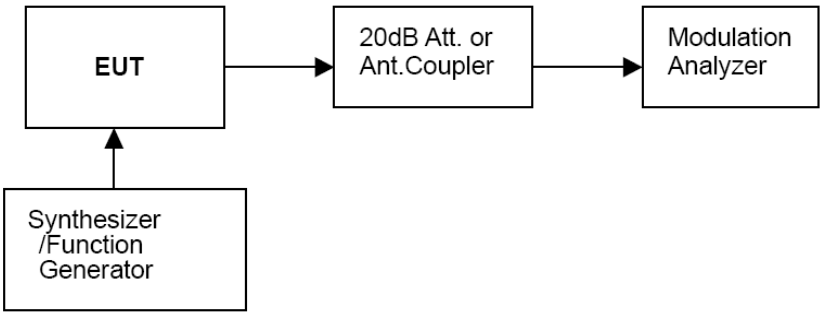
According to CFR47 section 2.1047(a), Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.
Recommended frequency deviation characteristics are given below:

1. 1.25 kHz for 6.25 kHz Channel Spacing System
2. 2.5 KHz for 12.5 kHz Channel Spacing System
3. 5 kHz for 25 kHz Channel Spacing System

TEST PROCEDURE

Modulation Limit
For Audio Transmitter: The carrier frequency deviation was measured with the tone input signal level varied from 0 Vp to audio input rating level plus 16 dB at frequencies 0.1, 0.5, 1.0, 3.0 and 5.0 kHz. The maximum deviation was recorded at each test condition.
For Data Transmitter with Maximum Frequency Deviation set by Factory: The EUT was set at maximum frequency deviation, and its peak frequency deviation was then measured using EUT's internal random data source.

TEST CONFIGURATION



TEST RESULTS

Modulation Limit:
Data Modulation Limiting for 12.5 kHz Channel Spacing Operation

Operating Mode	Data Rate	Peak Frequency Deviation (KHz)
GMSK	9.6 kbps random data	1.56

Data Modulation Limiting for 25 kHz Channel Spacing Operation

Operating Mode	Data Rate	Peak Frequency Deviation (KHz)
GMSK	19.2 kbps random data	2.24

3.4 Frequency Stability

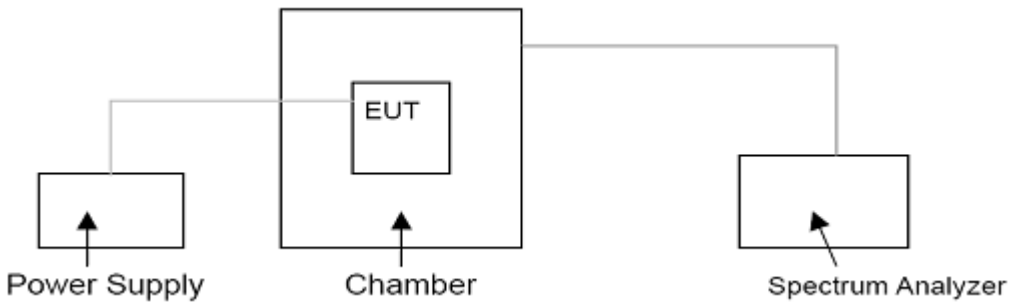
LIMITS

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

Frequency Range (MHz)	Channel Bandwidth (KHz)	Frequency Tolerance (ppm)		
		Fixed and Base Stations	Mobile Stations	
			> 2 W	≤ 2 W
150-174 MHz	6.25	1.0	2.0	2.0
	12.5	2.5	5.0	5.0
	25	5.0	5.0	50.0*
421-512 MHz	6.25	0.5	1.0	1.0
	12.5	1.5	2.5	2.5
	25	2.5	5.0	5.0

- Stations operating in the 154.45 to 154.49 MHz or the 173.2 to 173.4 MHz bands must have a frequency stability of 5 ppm.
- Paging transmitters operating on paging-only frequencies must operate with frequency stability of 5 ppm in the 150-174 MHz band and 2.5 ppm in the 421-512 MHz band.

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

Channel Separation: 12.5KHz

Test conditions		Frequency error (ppm)			Limit (ppm)	Result
Voltage(V)	Temp(℃)	460.125	463.625	467.625		
7.40	-30	1.02	1.11	1.17	2.5	Pass
	-20	0.86	0.82	0.91		
	-10	0.93	0.54	1.01		
	0	0.50	0.76	0.86		
	10	0.54	0.80	0.84		
	20	0.63	0.78	0.89		
	30	0.69	1.07	0.80		
	40	0.84	0.86	1.00		
	50	0.71	0.87	0.96		
6.29(85% Rated)	20	0.57	0.84	0.56		
8.51(115% Rated)	20	0.16	0.75	0.48		

Channel Separation: 25KHz

Test conditions		Frequency error (ppm)			Limit (ppm)	Result
Voltage(V)	Temp(℃)	460.125	463.625	467.625		
7.40	-30	2.01	2.10	2.18	5	Pass
	-20	1.81	1.86	1.97		
	-10	2.00	1.55	1.98		
	0	1.55	1.73	1.92		
	10	1.49	1.70	1.78		
	20	1.57	1.74	1.96		
	30	1.65	2.05	1.83		
	40	1.85	1.82	2.00		
	50	1.76	1.88	1.96		
6.29(85% Rated)	20	1.52	1.90	1.63		
8.51(115% Rated)	20	1.36	1.81	1.76		

3.5 Transmitter Frequency Behavior

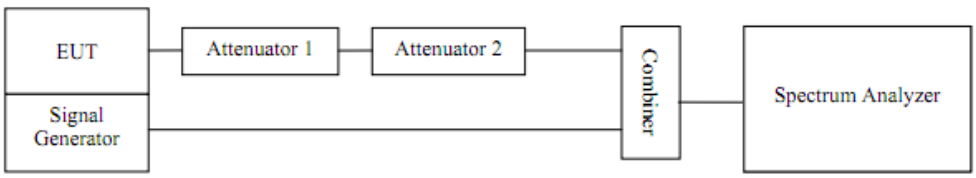
TEST APPLICABLE

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

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.

TEST CONFIGURATION



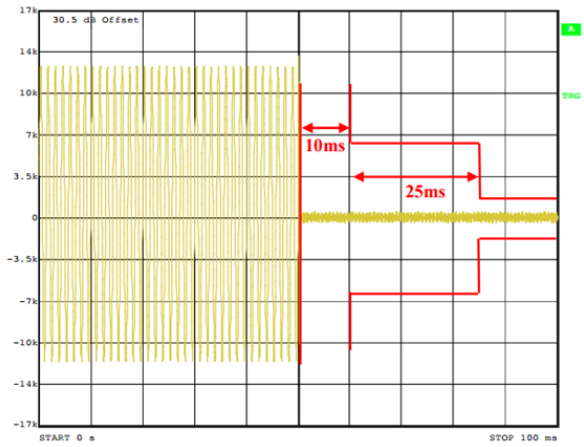
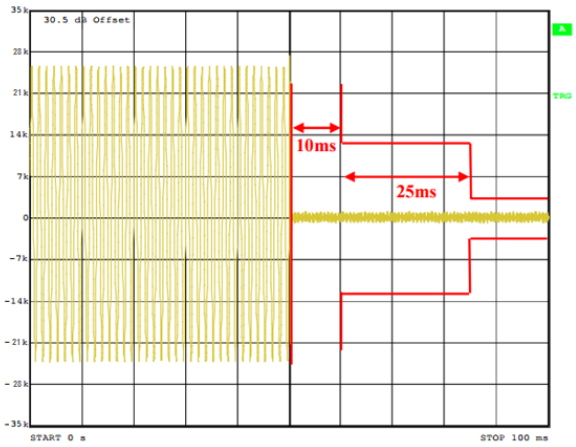
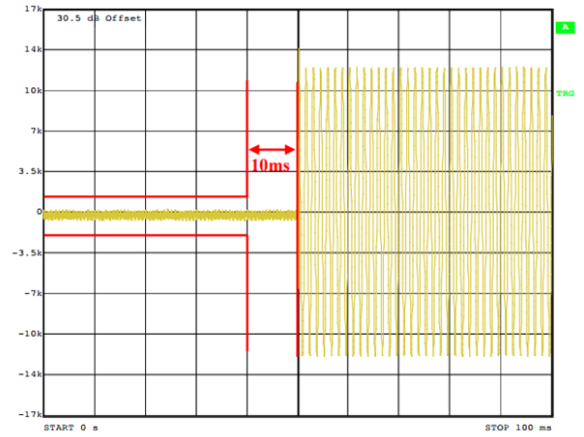
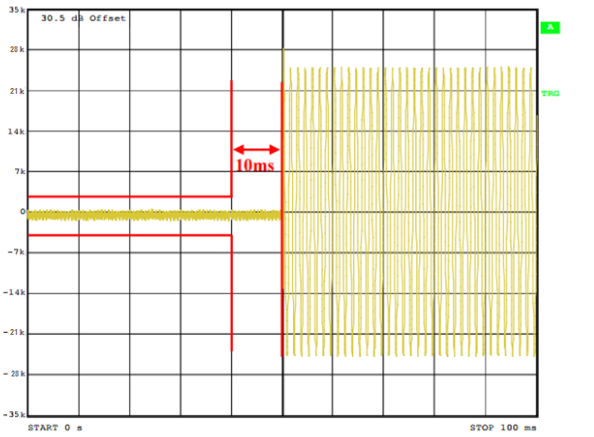
TEST PROCEDURE

1. Connect the EUT and test equipment as shown in the test configuration.
2. Set Spectrum Analyzer to measure FM deviation, and tune the RF frequency to transmitter assigned frequency.
3. 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.
4. Turn on the transmitter.
5. 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.
6. Turn off the transmitter.
7. 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.
8. 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

PASS, All the test modes completed for test. only the worst result was reported.

Transmitter Frequency Behavior	
12.5 KHz	25 KHz
	
12.5 KHz Channel Separation------Off – On	25 KHz Channel Separation------Off – On
	
12.5 KHz Channel Separation------On – Off	25 KHz Channel Separation------On – Off

3.6 Transmitter Radiated Spurious Emission

Limit

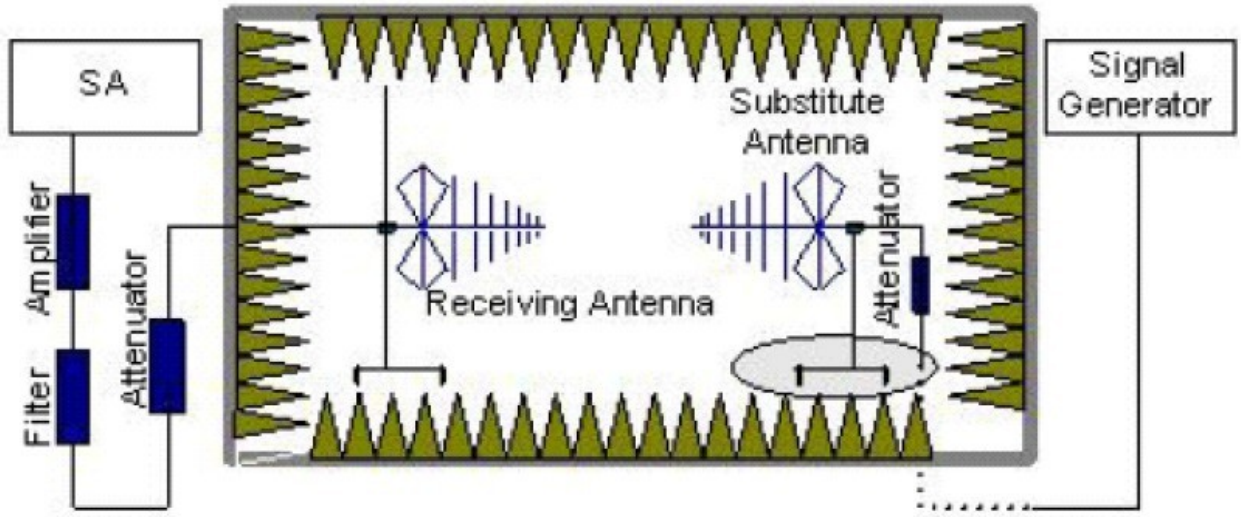
According to the TIA/EIA 603 test method, and according to Section 90.210, the power of each unwanted emission shall be less than Transmitted Power as specified below for transmitters designed to operate with 12.5 KHz channel bandwidth:

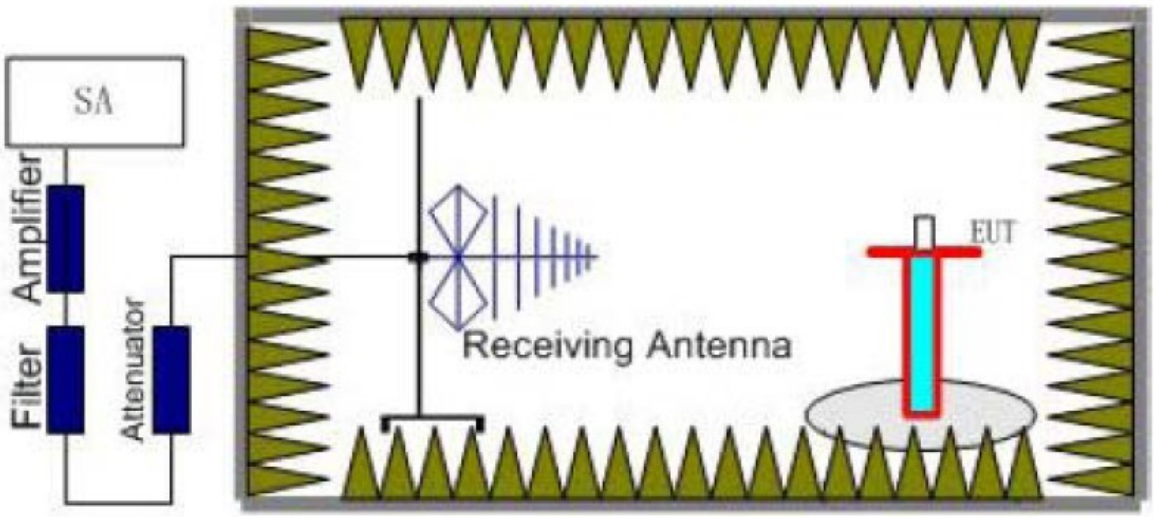
1 On any frequency removed from the center of the authorized bandwidth f_0 to 5.625 KHz removed from f_0: Zero dB
2 On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) f_0 of more than 5.625 KHz but no more than 12.5 KHz: At least 7.27dB
3 On 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+10log (P) dB.

TEST CONFIGURATION





TEST PROCEDURE

a. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. 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 -2.15dBi.
g. Test site anechoic chamber refer to ANSI C63.

TEST RESULTS

Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency;

worst spurious emissions recorded as below:

Channel Separation:12.5KHz

Test Frequency (MHz)	Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Distance (m)	G_a Antenna Gain(dBi)	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Pol.
460.125	920.250	-33.24	3.54	3.00	12.87	-23.91	-20	3.91	V
	1380.375	-40.13	4.21	3.00	15.48	-28.86	-20	8.86	V
	2300.625	-42.98	4.52	3.00	17.32	-30.18	-20	10.18	V
	920.250	-33.28	3.54	3.00	12.87	-23.95	-20	3.95	H
	1380.375	-39.85	4.21	3.00	15.48	-28.58	-20	8.58	H
	2300.625	-43.16	4.52	3.00	17.32	-30.36	-20	10.36	H
463.625	927.250	-32.07	3.88	3.00	12.98	-22.74	-20	2.74	V
	1390.375	-39.53	4.35	3.00	15.51	-28.26	-20	8.26	V
	2318.125	-43.64	4.76	3.00	17.44	-30.84	-20	10.84	V
	927.250	-31.71	3.88	3.00	12.98	-22.38	-20	2.38	H
	1390.375	-39.69	4.35	3.00	15.51	-28.42	-20	8.42	H
	2318.125	-44.04	4.76	3.00	17.44	-31.24	-20	11.24	H
467.625	935.250	-33.47	3.95	3.00	13.11	-24.14	-20	4.14	V
	1402.875	-40.66	4.55	3.00	15.65	-29.39	-20	9.39	V
	2338.125	-41.77	4.79	3.00	17.58	-28.97	-20	8.97	V
	935.250	-33.52	3.95	3.00	13.11	-24.19	-20	4.19	H
	1402.875	-40.30	4.55	3.00	15.65	-29.03	-20	9.03	H
	2338.125	-41.70	4.79	3.00	17.58	-28.90	-20	8.90	H

Channel Separation:25KHz

Test Frequency (MHz)	Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	Distance (m)	G_a Antenna Gain(dBi)	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Pol.
460.125	920.250	-32.91	3.54	3	12.87	-23.58	-13	10.58	V
	1380.375	-39.85	4.21	3	15.48	-28.58	-13	15.58	V
	2300.625	-42.96	4.52	3	17.32	-30.16	-13	17.16	V
	920.250	-33.25	3.54	3	12.87	-23.92	-13	10.92	H
	1380.375	-39.76	4.21	3	15.48	-28.49	-13	15.49	H
	2300.625	-43.23	4.52	3	17.32	-30.43	-13	17.43	H
463.625	927.250	-32.15	3.54	3	12.87	-22.82	-13	9.82	V
	1390.375	-39.51	4.21	3	15.48	-28.24	-13	15.24	V
	2318.125	-43.64	4.52	3	17.32	-30.84	-13	17.84	V
	927.250	-32.15	3.54	3	12.87	-22.82	-13	9.82	H
	1390.375	-39.22	4.21	3	15.48	-27.95	-13	14.95	H
	2318.125	-43.64	4.52	3	17.32	-30.84	-13	17.84	H
467.625	935.250	-33.76	3.54	3	12.87	-24.43	-13	11.43	V
	1402.875	-40.25	4.21	3	15.48	-28.98	-13	15.98	V
	2338.125	-41.77	4.52	3	17.32	-28.97	-13	15.97	V
	935.250	-33.69	3.54	3	12.87	-24.36	-13	11.36	H
	1402.875	-40.60	4.21	3	15.48	-29.33	-13	16.33	H
	2338.125	-41.95	4.52	3	17.32	-29.15	-13	16.15	H

Remark:

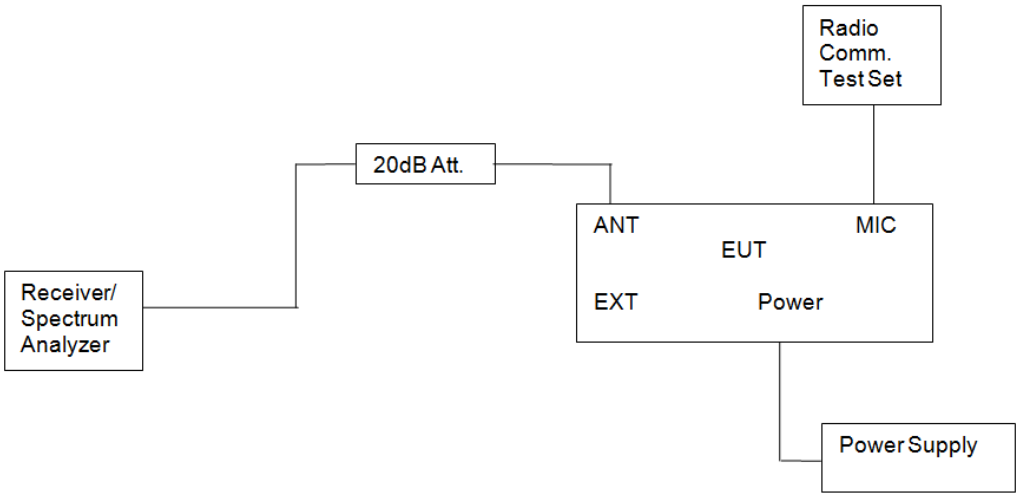
1. *EIRP=P_{Mea}(dBm)-P_{cl}(dB) +G_a(dBi)*
2. *-- Means other points for values lower than limits and not recorded.*
3. *Margin = Limit – EIRP*

3.7 Spurious Emission on Antenna Port

Limit

The same as Section 3.7

TEST CONFIGURATION



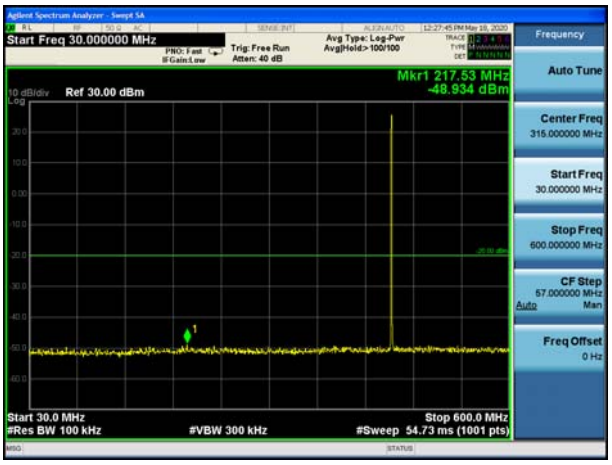
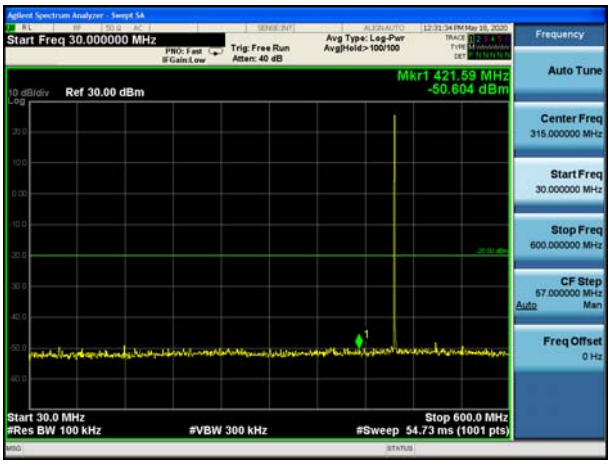
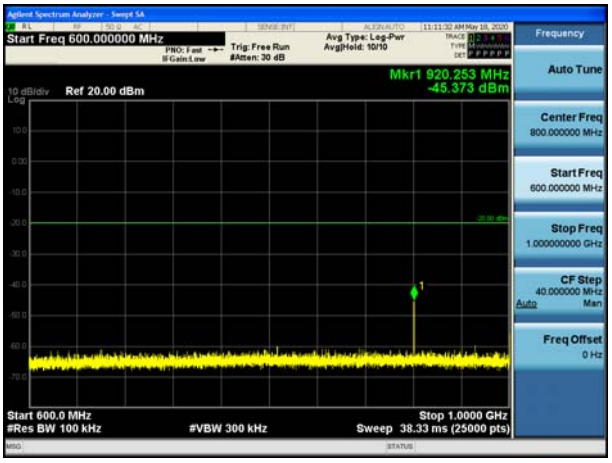
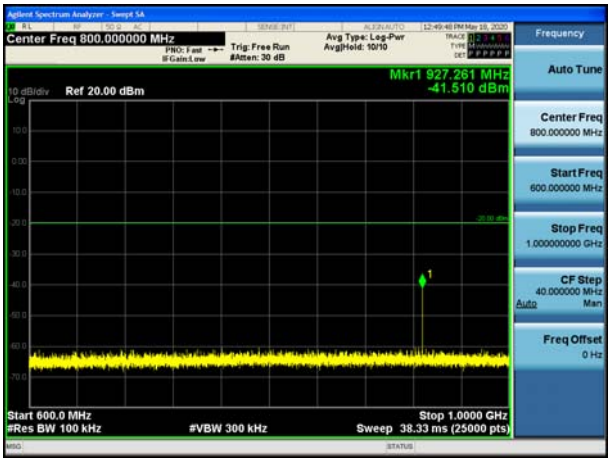
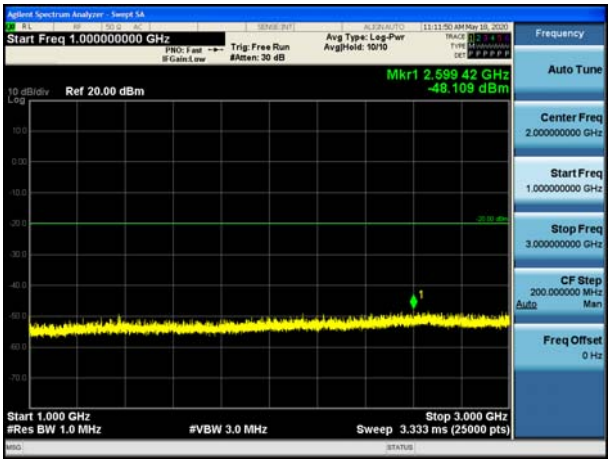
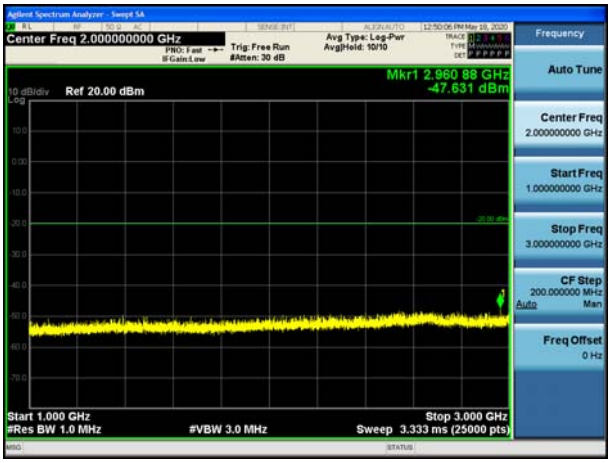
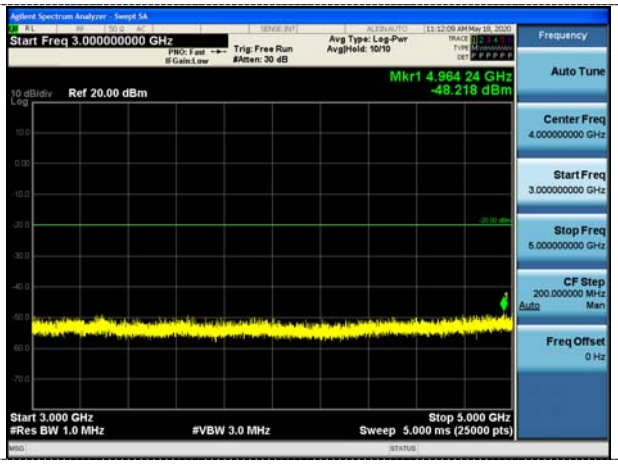
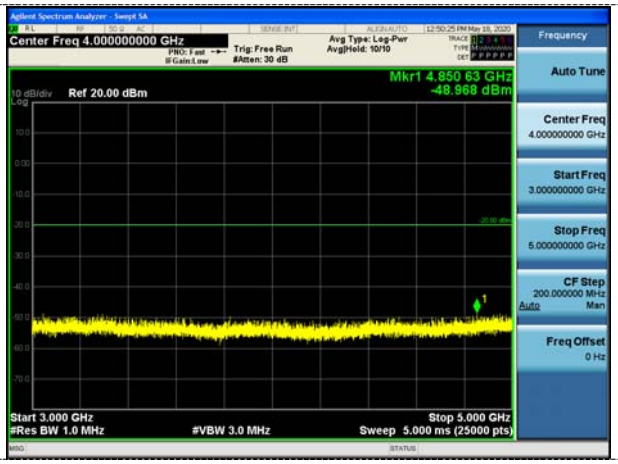
TEST PROCEDURE

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 10 kHz/1MHz. 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 10 kHz, VBW 30 kHz in the frequency band 30MHz to 1GHz,while set RBW=1MHz.VBW=3MHz from the 1GHz to 10th Harmonic.

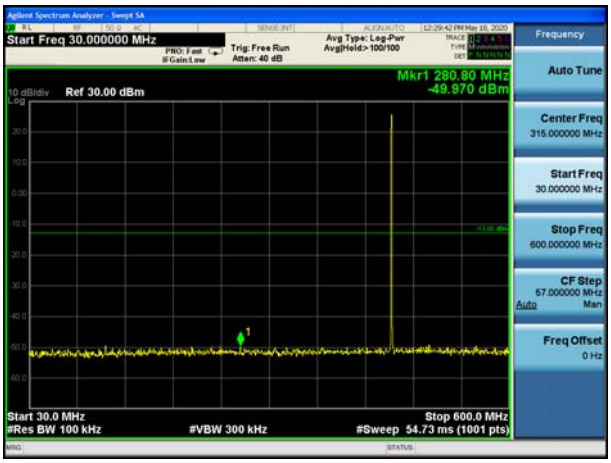
TEST RESULTS

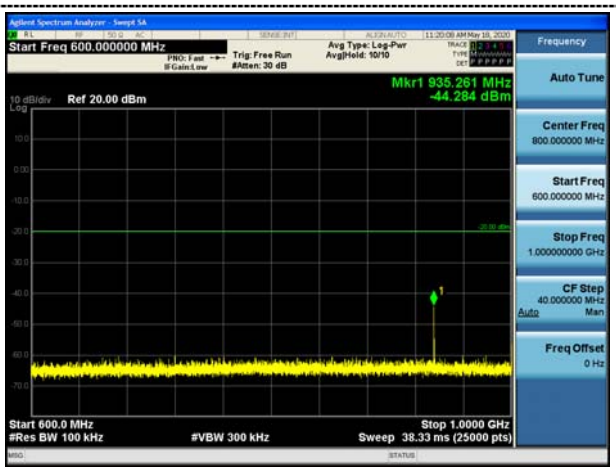
PASS, All the test modes completed for test. only the worst result was reported.

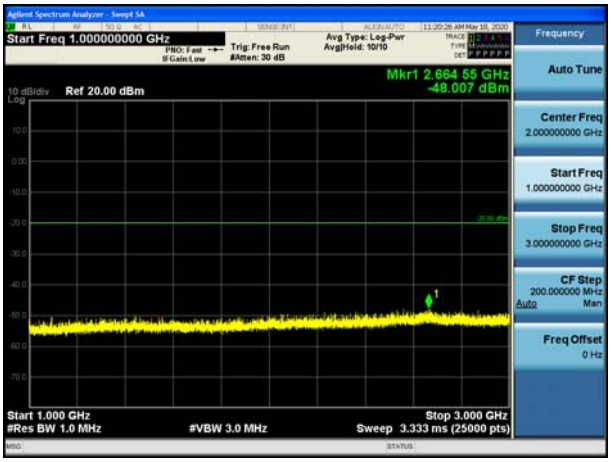
12.5kHz

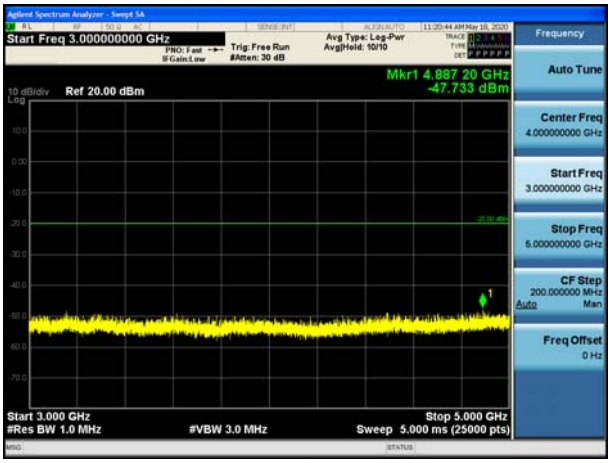
CH1	CH8
	
	
	
	

CH16


Agilent Spectrum Analyzer - Swept SA
Start Freq 30.000000 MHz
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 280.80 MHz
-49.970 dBm
10 dB/div Ref 30.00 dBm
Start 30.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 600.0 MHz
#Sweep 54.73 ms (1001 pts)
Frequency
Auto Tune
Center Freq 315.000000 MHz
Start Freq 30.000000 MHz
Stop Freq 600.000000 MHz
CF Step 57.000000 MHz
Freq Offset 0 Hz

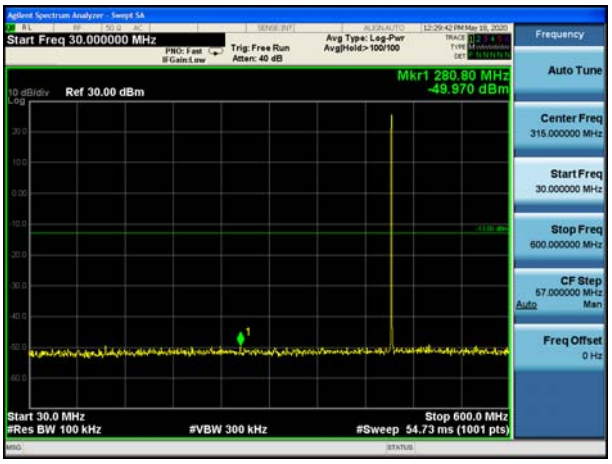

Agilent Spectrum Analyzer - Swept SA
Start Freq 600.000000 MHz
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Mkr1 935.261 MHz
-44.284 dBm
10 dB/div Ref 20.00 dBm
Start 600.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 38.33 ms (25000 pts)
Frequency
Auto Tune
Center Freq 800.000000 MHz
Start Freq 600.000000 MHz
Stop Freq 1.000000000 GHz
CF Step 40.000000 MHz
Freq Offset 0 Hz


Agilent Spectrum Analyzer - Swept SA
Start Freq 1.000000000 GHz
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Mkr1 2.664 55 GHz
-48.007 dBm
10 dB/div Ref 20.00 dBm
Start 1.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 3.000 GHz
Sweep 3.333 ms (25000 pts)
Frequency
Auto Tune
Center Freq 2.000000000 GHz
Start Freq 1.000000000 GHz
Stop Freq 3.000000000 GHz
CF Step 200.000000 MHz
Freq Offset 0 Hz

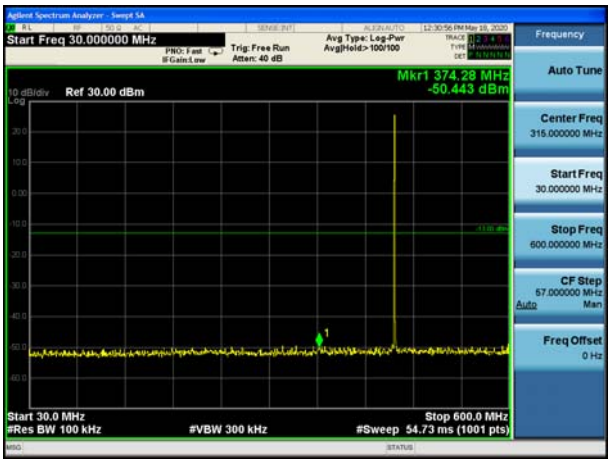

Agilent Spectrum Analyzer - Swept SA
Start Freq 3.000000000 GHz
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Mkr1 4.887 20 GHz
-47.733 dBm
10 dB/div Ref 20.00 dBm
Start 3.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 5.000 GHz
Sweep 5.000 ms (25000 pts)
Frequency
Auto Tune
Center Freq 4.000000000 GHz
Start Freq 3.000000000 GHz
Stop Freq 5.000000000 GHz
CF Step 200.000000 MHz
Freq Offset 0 Hz

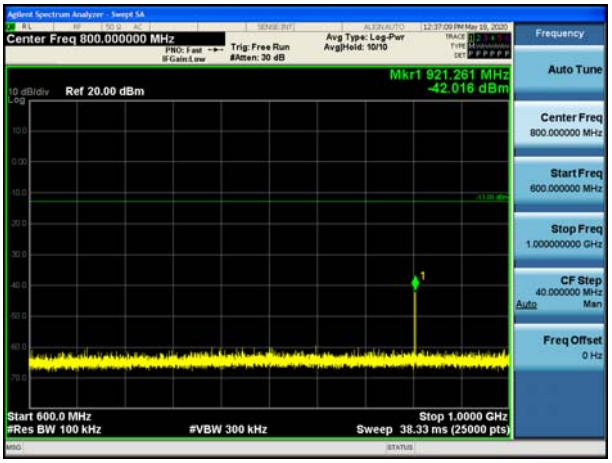
25kHz

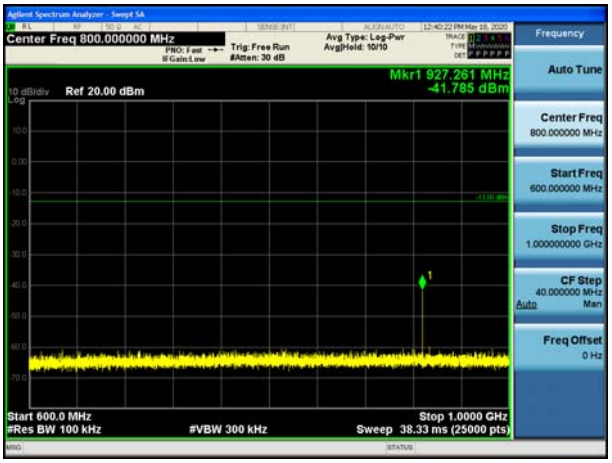
CH1

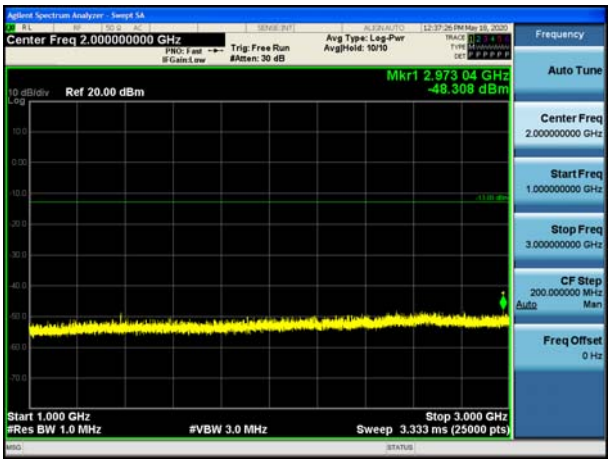


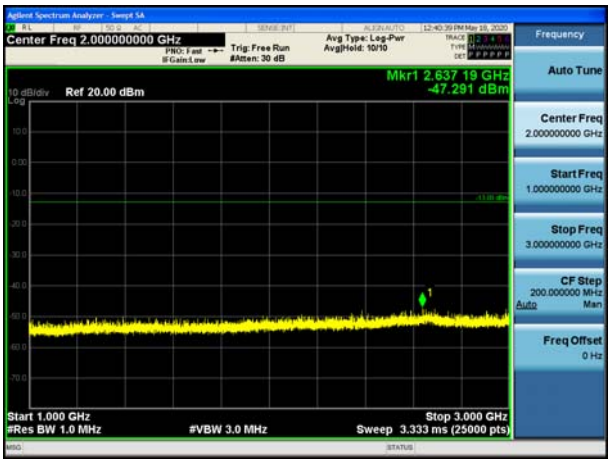
CH8

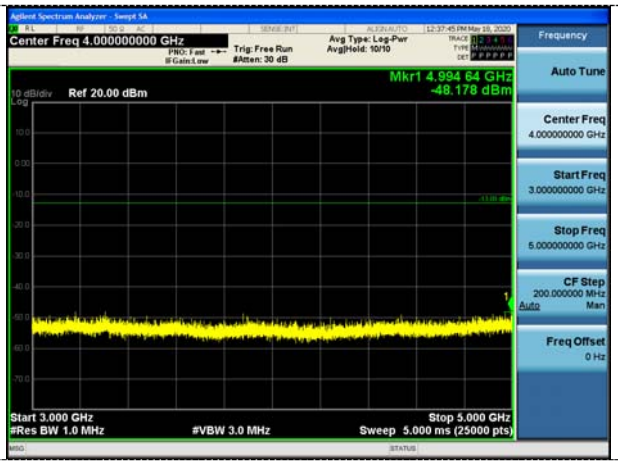


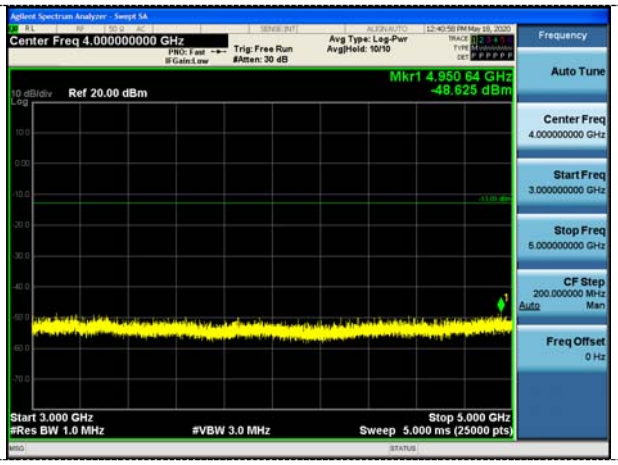




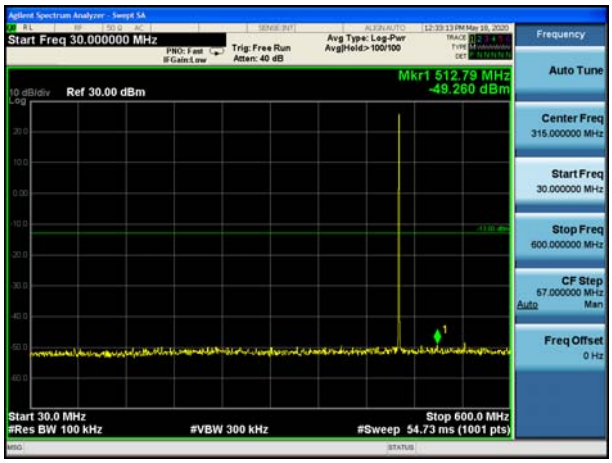


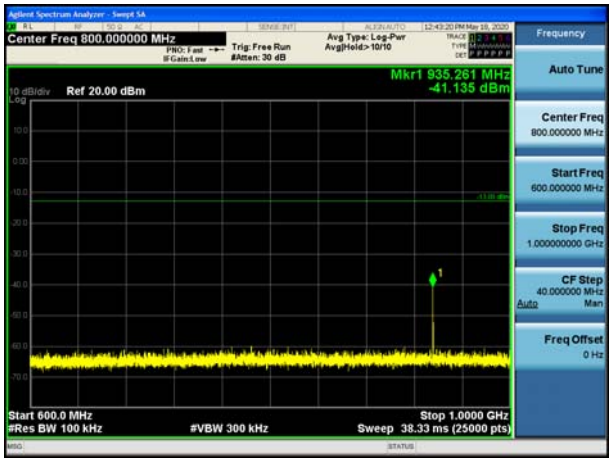


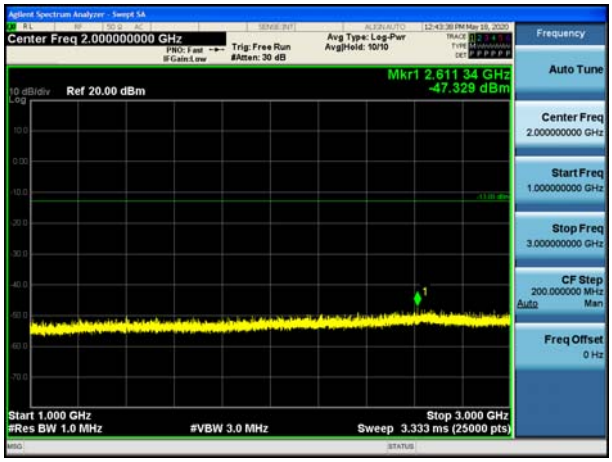


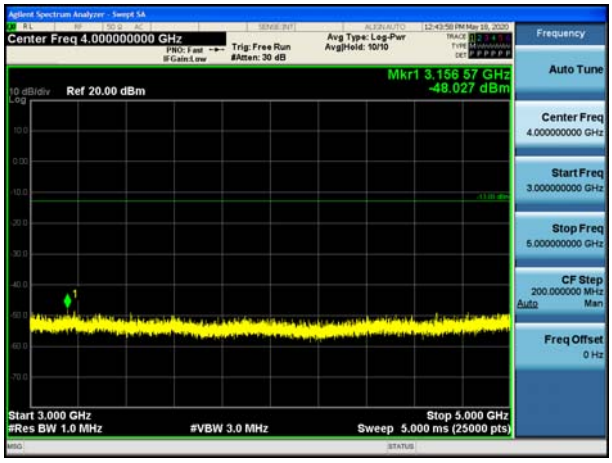


CH16

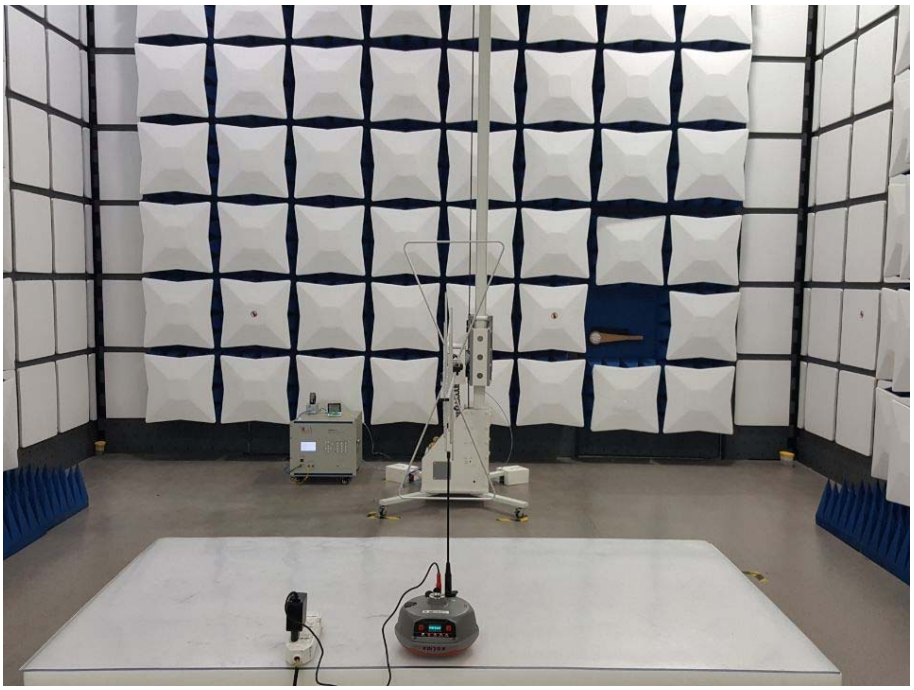

Agilent Spectrum Analyzer - Swept SA
Start Freq 30.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:39:13 PM May 18, 2020
Mkr1 512.79 MHz
-49.260 dBm
10 dB/div
Ref 30.00 dBm
Start 30.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 600.0 MHz
#Sweep 54.73 ms (1001 pts)
Frequency
Auto Tune
Center Freq
315.000000 MHz
Start Freq
30.000000 MHz
Stop Freq
600.000000 MHz
CF Step
57.000000 MHz
Auto
Man
Freq Offset
0 Hz

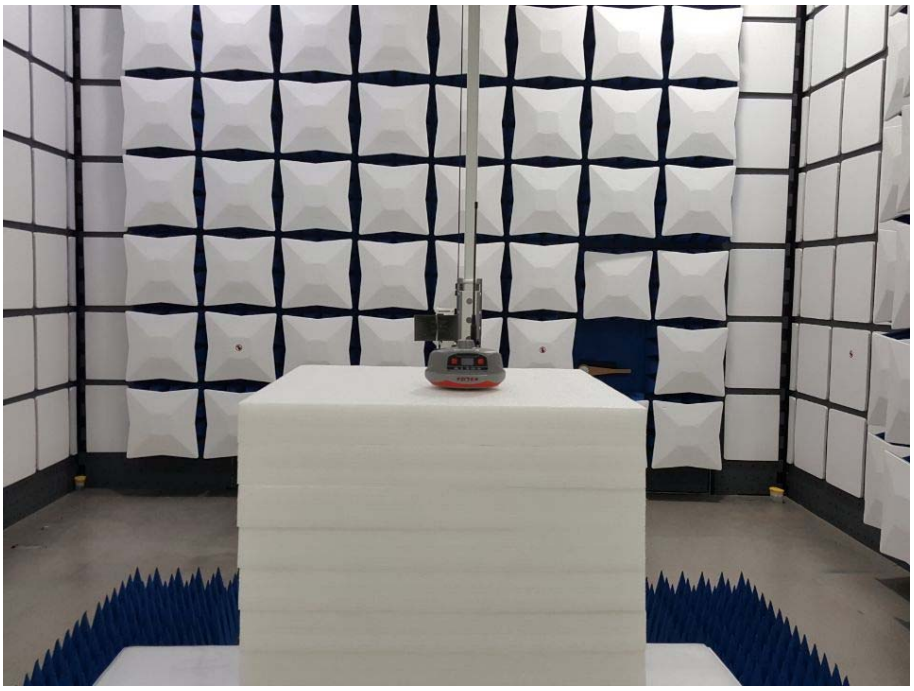

Agilent Spectrum Analyzer - Swept SA
Center Freq 800.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
12:43:20 PM May 18, 2020
Mkr1 935.261 MHz
-41.135 dBm
10 dB/div
Ref 20.00 dBm
Start 600.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 38.33 ms (25000 pts)
Frequency
Auto Tune
Center Freq
800.000000 MHz
Start Freq
600.000000 MHz
Stop Freq
1.000000000 GHz
CF Step
40.000000 MHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
12:43:38 PM May 18, 2020
Mkr1 2.611 34 GHz
-47.329 dBm
10 dB/div
Ref 20.00 dBm
Start 1.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 3.000 GHz
Sweep 3.333 ms (25000 pts)
Frequency
Auto Tune
Center Freq
2.000000000 GHz
Start Freq
1.000000000 GHz
Stop Freq
3.000000000 GHz
CF Step
200.000000 MHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 4.000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
12:43:58 PM May 18, 2020
Mkr1 3.156 57 GHz
-48.027 dBm
10 dB/div
Ref 20.00 dBm
Start 3.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 5.000 GHz
Sweep 5.000 ms (25000 pts)
Frequency
Auto Tune
Center Freq
4.000000000 GHz
Start Freq
3.000000000 GHz
Stop Freq
5.000000000 GHz
CF Step
200.000000 MHz
Auto
Man
Freq Offset
0 Hz

4 Test Setup Photos of the EUT





5 External and Internal Photos of the EUT

Reference to the test report No. 18220WC00039601.

********** End of Report **********