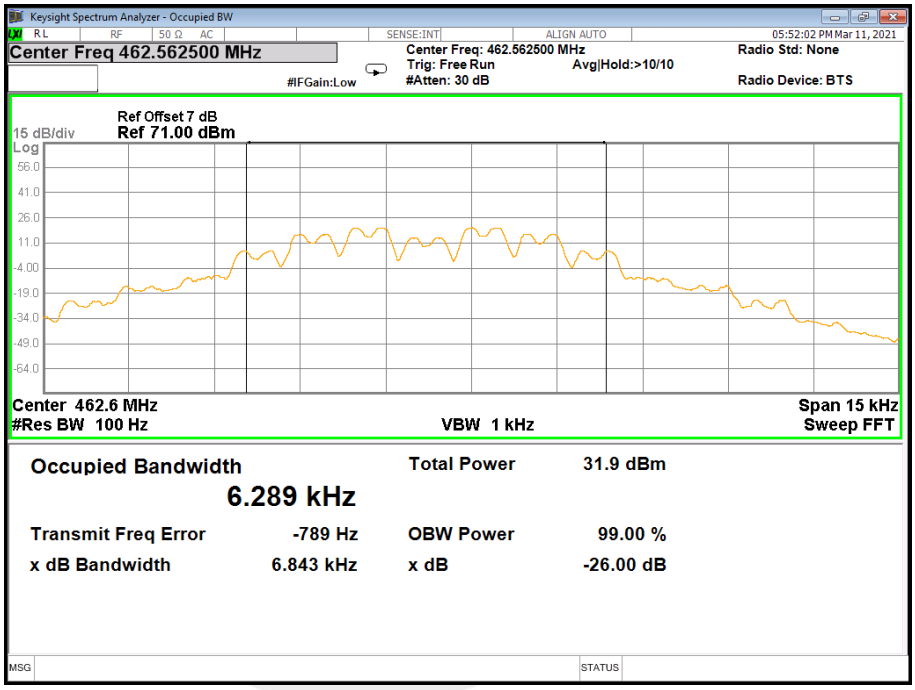
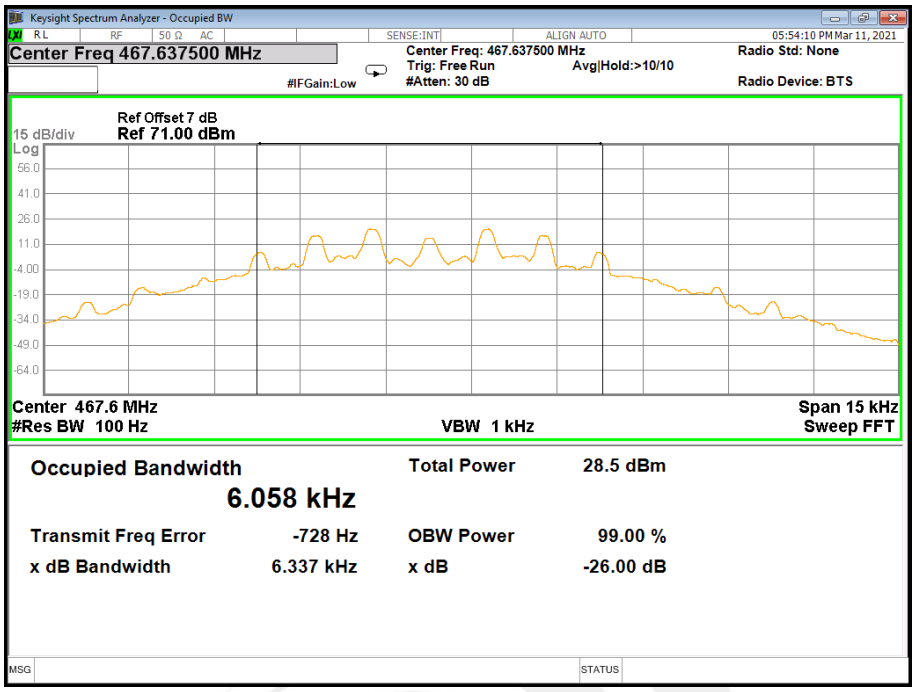
5.5 TEST RESULTS

Operation Mode	Test Channel	Occupied Bandwidth(KHz)		Limit(kHz)	Result
		99%	26dB		
FRS	1	6.289	6.843	≤12.5	Pass
	11	6.058	6.337	≤12.5	Pass
	22	6.039	6.31	≤12.5	Pass

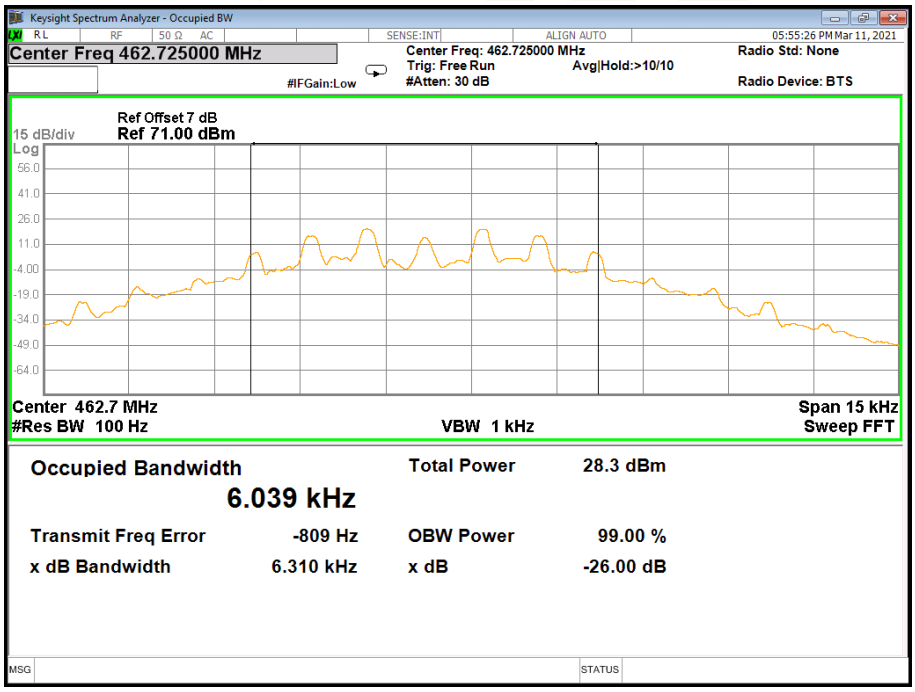
CH01



CH11


Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
05:54:10 PM Mar 11, 2021
Center Freq 467.637500 MHz
#IFGain:Low
Center Freq: 467.637500 MHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 7 dB
15 dB/div
Ref 71.00 dBm
Log
56.0
41.0
26.0
11.0
-4.00
-19.0
-34.0
-49.0
-64.0
Center 467.6 MHz
#Res BW 100 Hz
VBW 1 kHz
Span 15 kHz
Sweep FFT
Occupied Bandwidth
6.058 kHz
Total Power 28.5 dBm
Transmit Freq Error -728 Hz
OBW Power 99.00 %
x dB Bandwidth 6.337 kHz
x dB -26.00 dB
MSG
STATUS

CH22


Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
05:55:26 PM Mar 11, 2021
Center Freq 462.725000 MHz
#IFGain:Low
Center Freq: 462.725000 MHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 7 dB
15 dB/div
Ref 71.00 dBm
Log
56.0
41.0
26.0
11.0
-4.00
-19.0
-34.0
-49.0
-64.0
Center 462.7 MHz
#Res BW 100 Hz
VBW 1 kHz
Span 15 kHz
Sweep FFT
Occupied Bandwidth
6.039 kHz
Total Power 28.3 dBm
Transmit Freq Error -809 Hz
OBW Power 99.00 %
x dB Bandwidth 6.310 kHz
x dB -26.00 dB
MSG
STATUS

6. TRANSMITTER OUTPUT POWER AND EFFECTIVE RADIATED POWER (E.R.P)

6.1 LIMIT

FRS:

Each FRS transmitter type must be designed such that the effective radiated power (ERP) on channels 8 through 14 does not exceed 0.5 Watts and the ERP on channels 1 through 7 and 15 through 22 does not exceed 2.0 Watts.

The maximum permissible transmitted e.r.p. of the equipment under any operating conditions shall not exceed 0.5 W for channels 8-14 and 2 W for other channels.

6.2 TEST PROCEDURE

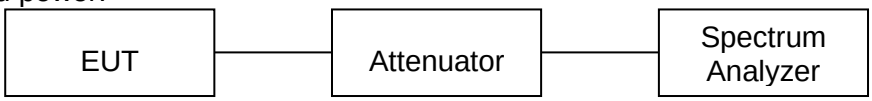
The procedure of conducted power is as follows:
Measurements shall be made to establish the radio frequency power delivered by the transmitter the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, 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 30 dB attenuator.

The procedure of effective radiated power is as follows:

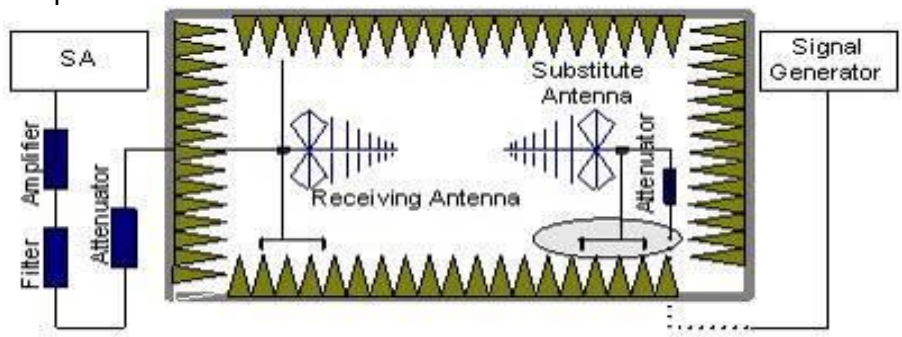
1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1. 0 m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels were measured with peak detector.
2. 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.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test.Set Test Receiver or Spectrum RBW=1MHz,VBW=3MHz for above 1GHz and BW=100kHz,VBW=300kHz for 30MHz to 1GHz, And the maximum value of the receiver should be recorded as (Pr).
4. The EUT shall be 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 thesubstitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). 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.
5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test.
   The measurement results are obtained as described below:
   Power(EIRP)=P_{Mea}- P_{Ag} - P_{cl} + G_a
   We used signal generator which signal level can up to 33dBm,so we not used power Amplifier for substituation test; The measurement results are amend as described below:
   Power(EIRP)=P_{Mea}- P_{cl} +G_a
6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power
7. ERP can be calculated from EIRP by subtracting the gain of the dipole,
   ERP=Reading - Cable loss + Antenna Gain - 2.15

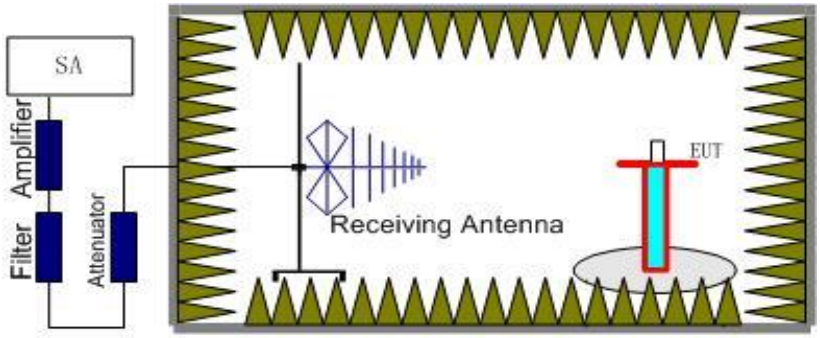
6.3 TEST SETUP

Conducted power:



Effective radiated power:





6.4 TEST RESULTS

Conducted Power:

Operation Mode	Test Channel	Test Frequency(MHz)	Test Results (dBm)	Test Results (W)	Limit (W)	Result
FRS	1	462.5625	24.08	0.26	2	Pass
	11	467.6375	24.72	0.30	0.5	Pass
	22	462.7250	24.88	0.31	2	Pass

Effective radiated power:

Operation Mode	Test Channel	Test Frequency (MHz)	Reading (dBm)	Cable Loss (dB)	Antenna Gain (dBi)	ERP (dBm)	ERP (W)	Limit (W)	Polarity	Result
FRS	1	462.5625	21.72	1.49	6.00	24.08	0.26	2	V	Pass
			21.67	1.49	6.00	24.03	0.25	2	H	Pass
	11	467.6375	22.36	1.49	6.00	24.72	0.30	0.5	V	Pass
			22.23	1.49	6.00	24.59	0.29	0.5	H	Pass
	22	462.7250	22.46	1.49	6.00	24.82	0.30	2	V	Pass
			22.63	1.49	6.00	24.99	0.32	2	H	Pass
Note:ERP=Reading - Cable loss + Antenna Gain - 2.15										

7. EMISSION MASK

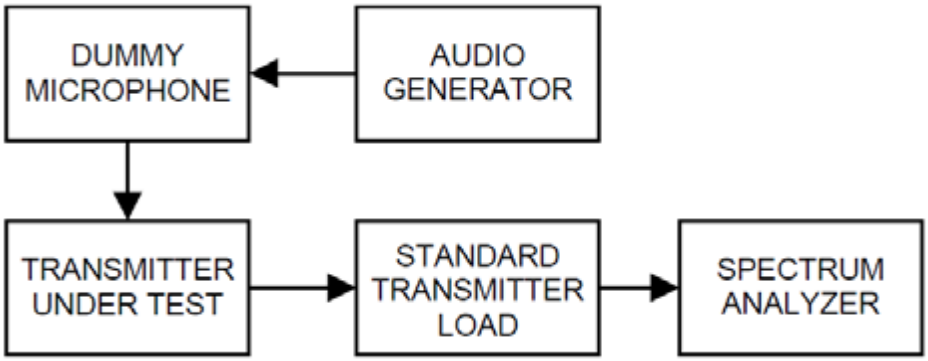
7.1 LIMIT

FRS:
a. 25 dB, measured with a bandwidth of 300 Hz, in the band 6.25 kHz to 12.5 kHz removed from the channel centre frequency;
b. 35 dB, measured with a bandwidth of 300 Hz, in the band 12.5 kHz to 31.25 kHz removed from the channel centre frequency; and
c. 43 dB + 10 $\log_{10}$ (transmitter power in watts) dB, measured with a bandwidth of 30 kHz for frequencies beyond 31.25 kHz removed from the channel centre frequency.

7.2 TEST PROCEDURE

1. The EUT was connected to the spectrum analyzer through sufficent attenuation.
2. Set EUT as digital data mode.
3. Set SPA Center Frequency=fundamental frequency, RBW=300Hz, VBW=3KHz, span =120KHz.

7.3 TEST SETUP

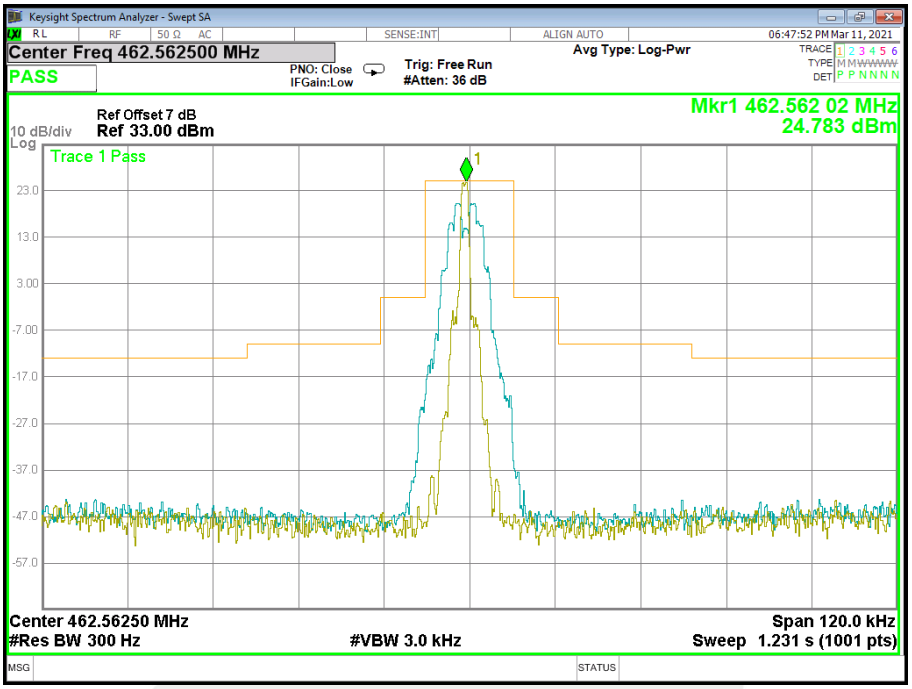


7.4 EUT OPERATION CONDITIONS

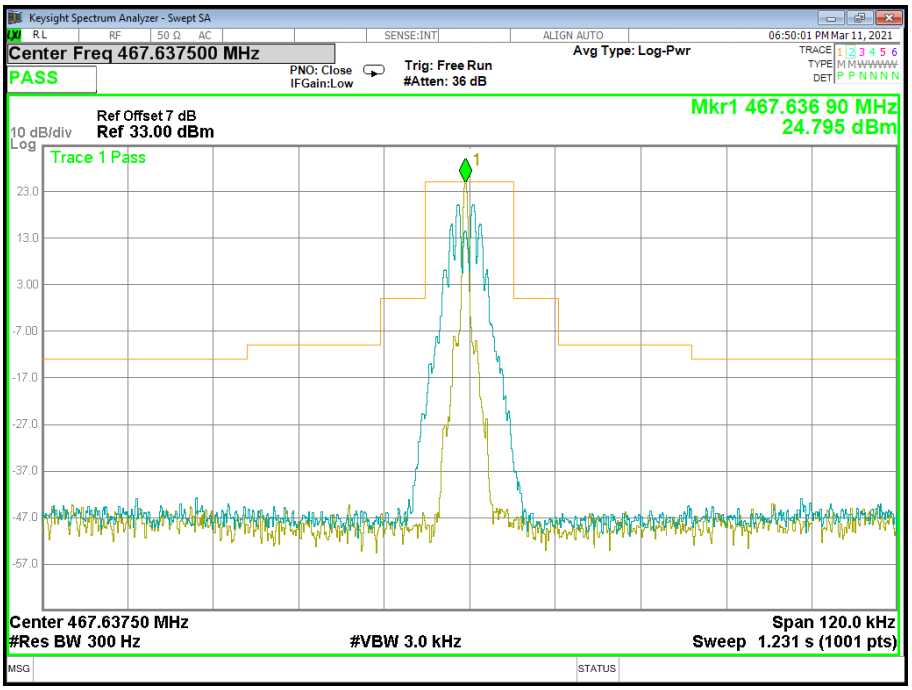
TX mode.

7.5 TEST RESULT

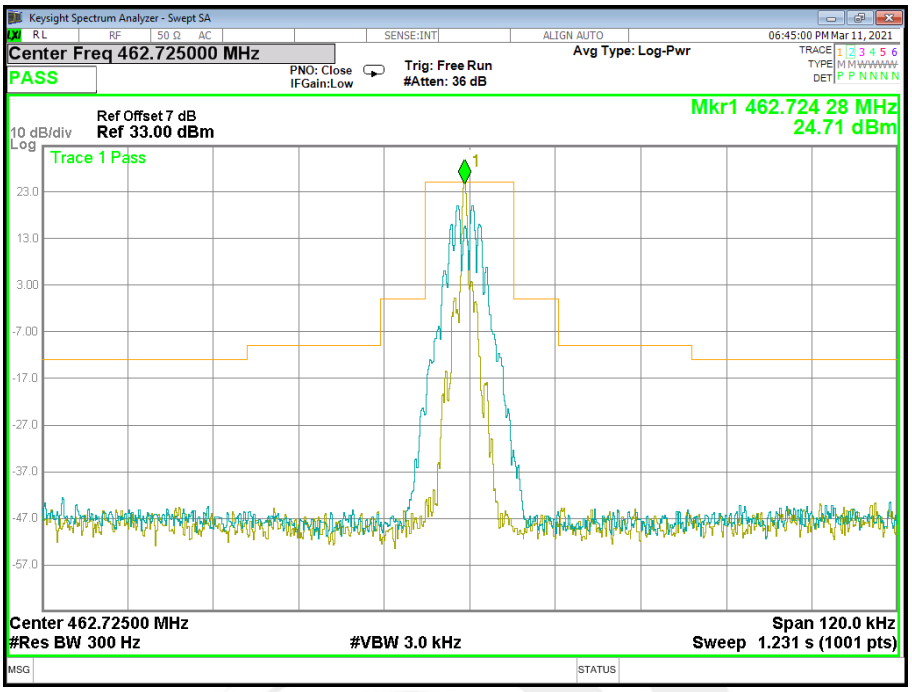
CH01



CH11



CH22


Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
06:45:00 PM Mar 11, 2021
Center Freq 462.725000 MHz
PASS
PNO: Close
IFGain:Low
Trig: Free Run
#Atten: 36 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE M M W W W W
DET P P N N N N
Mkr1 462.724 28 MHz
24.71 dBm
Ref Offset 7 dB
10 dB/div
Log
Ref 33.00 dBm
Trace 1 Pass
23.0
13.0
3.00
-7.00
-17.0
-27.0
-37.0
-47.0
-57.0
Center 462.72500 MHz
#Res BW 300 Hz
#VBW 3.0 kHz
Span 120.0 kHz
Sweep 1.231 s (1001 pts)
MSG
STATUS

8. FREQUENCY STABILITY

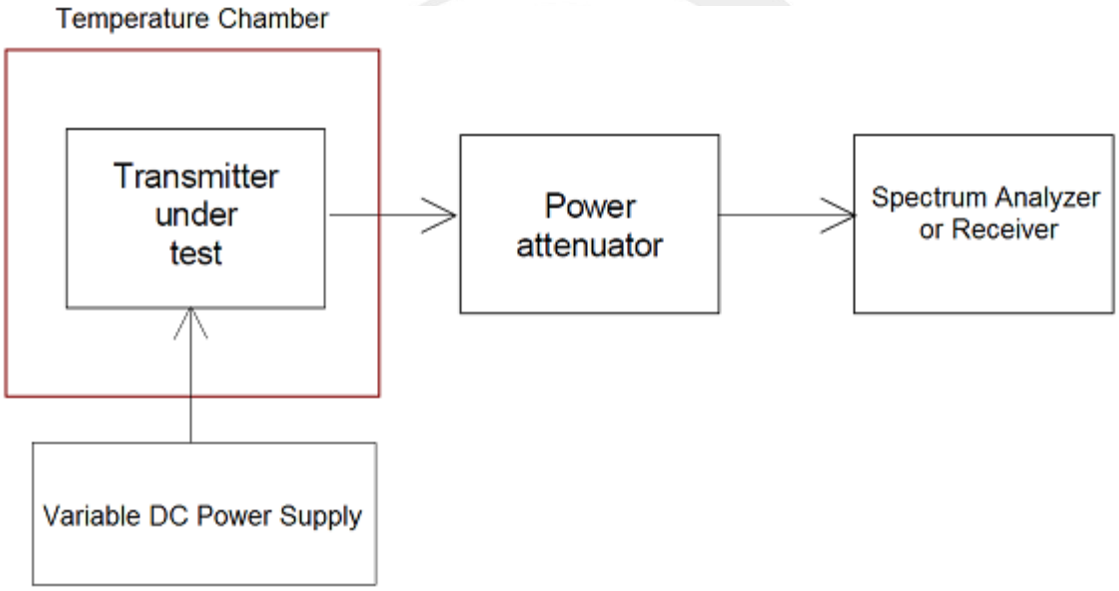
8.1 LIMIT

The carrier frequency stability shall not exceed ±2.5 ppm.

8.2 TEST PROCEDURE

1. The frequency stability shall be measured with variation of ambient temperature from -30℃ to +50℃
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 manufacture.
3. Vary primary supply voltage from 3.15V to 4.26V.
4. 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

8.3 TEST SETUP



8.4 EUT OPERATION CONDITIONS

TX mode.

8.5 TEST RESULT

FRS_Channl 01(462.5625MHz)						
Voltage	Temperature (°C)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Frequency error (ppm)	Limit	Result
Normal Voltage	-30	462.5625	462.5626	0.2162	±2.5ppm	Pass
	-20	462.5625	462.5626	0.2162		
	-10	462.5625	462.5629	0.8647		
	0	462.5625	462.5626	0.2162		
	10	462.5625	462.5627	0.4324		
	20	462.5625	462.5629	0.8647		
	30	462.5625	462.5631	1.2971		
	40	462.5625	462.5625	0.0000		
	50	462.5625	462.5628	0.6486		
Maximum Voltage	20	462.5625	462.5630	1.0809		
BEP	20	462.5625	462.5627	0.4324		

FRS_Channl 11(467.6375MHz)						
Voltage	Temperature (°C)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Frequency error (ppm)	Limit	Result
Normal Voltage	-30	467.6375	467.6375	0.0000	±2.5ppm	Pass
	-20	467.6375	467.6379	0.8554		
	-10	467.6375	467.6377	0.4277		
	0	467.6375	467.6378	0.6415		
	10	467.6375	467.6379	0.8554		
	20	467.6375	467.6379	0.8554		
	30	467.6375	467.6375	0.0000		
	40	467.6375	467.6380	1.0692		
	50	467.6375	467.6376	0.2138		
Maximum Voltage	20	467.6375	467.6378	0.6415		
BEP	20	467.6375	467.6375	0.0000		

FRS_Channl 22(462.7250MHz)						
Voltage	Temperature (°C)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Frequency error (ppm)	Limit	Result
Normal Voltage	-30	462.7250	462.7250	0.0000	±2.5ppm	Pass
	-20	462.7250	462.7255	1.0806		
	-10	462.7250	462.7255	1.0806		
	0	462.7250	462.7256	1.2967		
	10	462.7250	462.7252	0.4322		
	20	462.7250	462.7250	0.0000		
	30	462.7250	462.7255	1.0806		
	40	462.7250	462.7254	0.8644		
	50	462.7250	462.7252	0.4322		
Maximum Voltage	20	462.7250	462.7254	0.8644		
BEP	20	462.7250	462.7250	0.0000		

9. MODULATION LIMIT

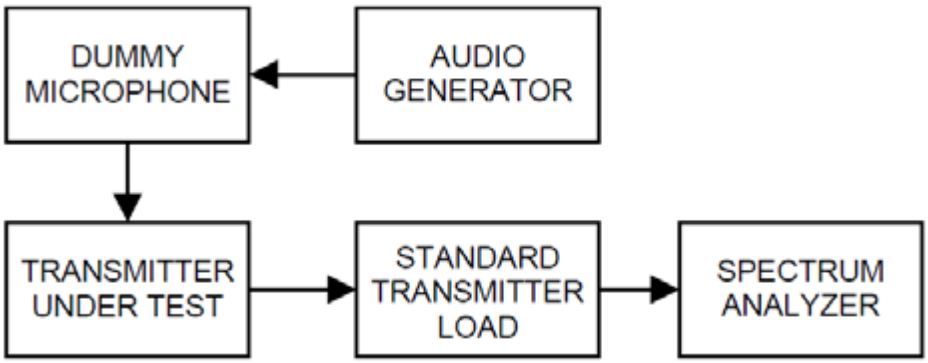
9.1 LIMIT

FRS:
Each FRS transmitter type must be designed such that the peak frequency deviation does not exceed 2.5 kHz, and the highest audio frequency contributing substantially to modulation must not exceed 3.125 kHz.

9.2 TEST PROCEDURE

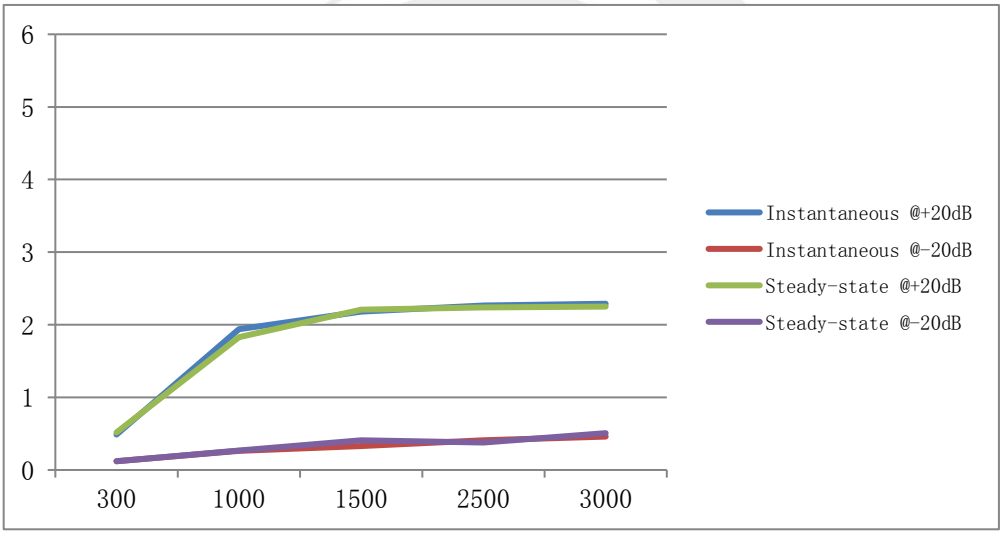
1. Connect the equipment as illustrated.
2. Adjust the transmitter per the manufacturer's procedure for full rated system deviation
3. Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤0.25 Hz to ≥15,000 Hz. Turn the de-emphasis function off
4. Apply a 1000 Hz modulating signal to the transmitter from the audio frequency generator, and adjust the level to obtain 60% of full rated system deviation, this level is as a reference (0dB) and vary the input lev el from –20 to +20dB.
5. Measure both the instantaneous and steady-state deviation at and after the time of increasing the audio input level
6. Repeat step 4-5 with input frequency changing to 300Hz, 1004Hz, 1500Hz and 2500Hz in sequence.

9.3 TEST SETUP

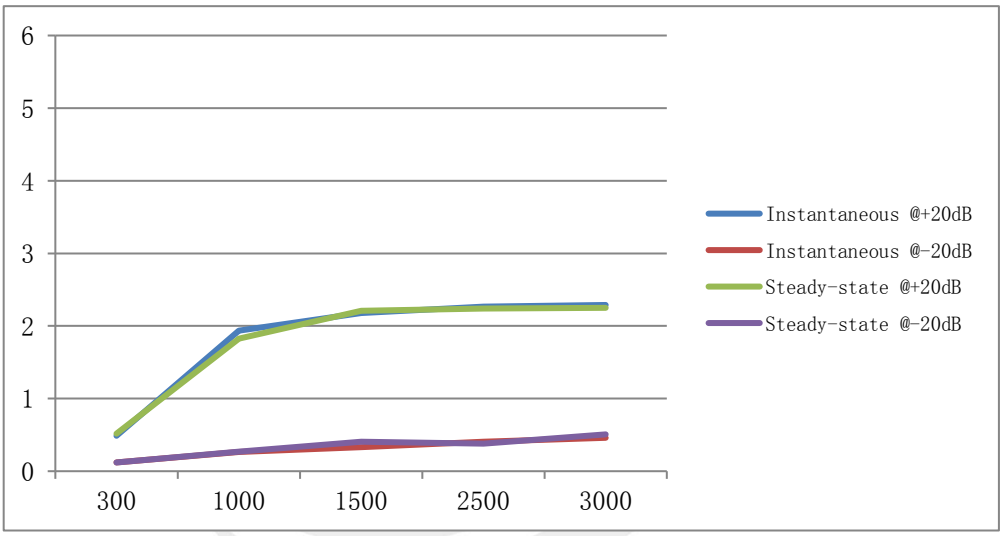


9.4 TEST RESULT

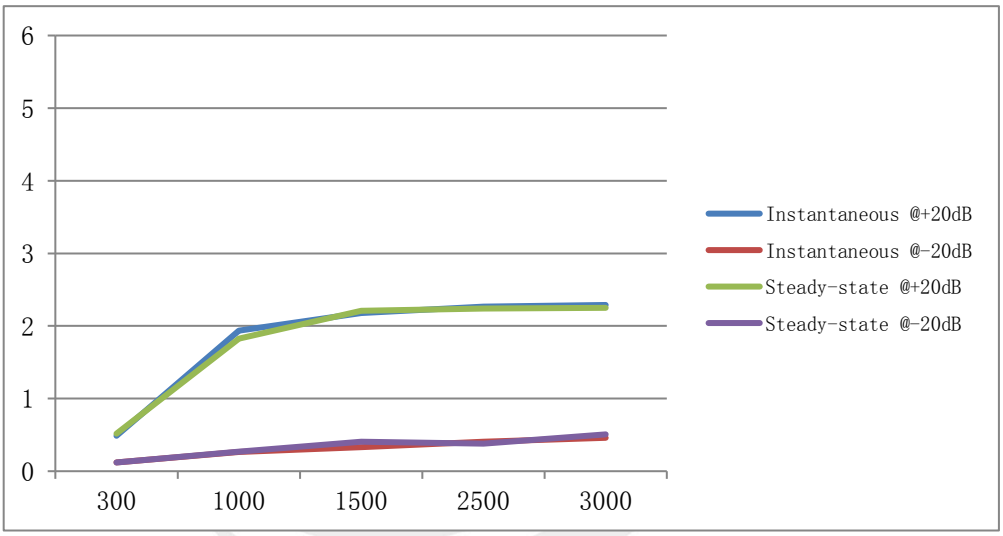
FRS_Channl 1(462.5625MHz)						
Audio Frequency (Hz)	Instantaneous		Steady-state		Limit (kHz)	Result
	Deviation (@+20dB) (kHz)	Deviation (@-20dB) (kHz)	Deviation (@+20dB) (kHz)	Deviation (@-20dB) (kHz)		
300	0.44	0.142	0.499	0.148	±2.5	Pass
1000	1.984	0.287	1.823	0.282		
1500	2.161	0.341	2.276	0.391		
2500	2.243	0.356	2.222	0.378		
3000	2.336	0.46	2.246	0.472		



FRS_Channl 11(467.6375MHz)						
Audio Frequency (Hz)	Instantaneous		Steady-state		Limit (kHz)	Result
	Deviation (@+20dB) (kHz)	Deviation (@-20dB) (kHz)	Deviation (@+20dB) (kHz)	Deviation (@-20dB) (kHz)		
300	0.488	0.121	0.517	0.12	±2.5	Pass
1000	1.937	0.263	1.827	0.268		
1500	2.179	0.329	2.207	0.407		
2500	2.265	0.408	2.238	0.379		
3000	2.289	0.46	2.25	0.507		



FRS_Channl 22(462.7250MHz)						
Audio Frequency (Hz)	Instantaneous		Steady-state		Limit (kHz)	Result
	Deviation (@+20dB) (kHz)	Deviation (@-20dB) (kHz)	Deviation (@+20dB) (kHz)	Deviation (@-20dB) (kHz)		
300	0.536	0.104	0.629	0.075	±2.5	Pass
1000	1.883	0.201	1.899	0.221		
1500	2.152	0.368	2.011	0.389		
2500	2.162	0.413	2.127	0.405		
3000	2.153	0.402	2.095	0.409		



10. AUDIO FREQUENCY FILTER

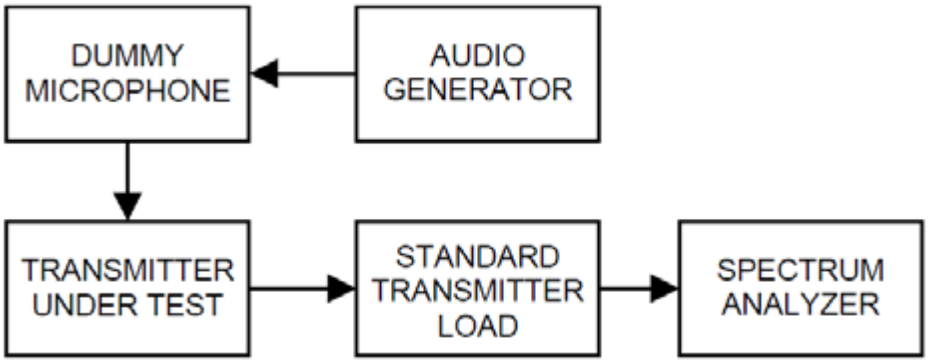
10.1 LIMIT

Frequency, f (kHz)	Attenuation Greater Than the Attenuation at 1 kHz (dB)
3 ≤ f ≤ 20	60 $\log_{10}$(f/3)
f > 20	50

10.2 TEST PROCEDURE

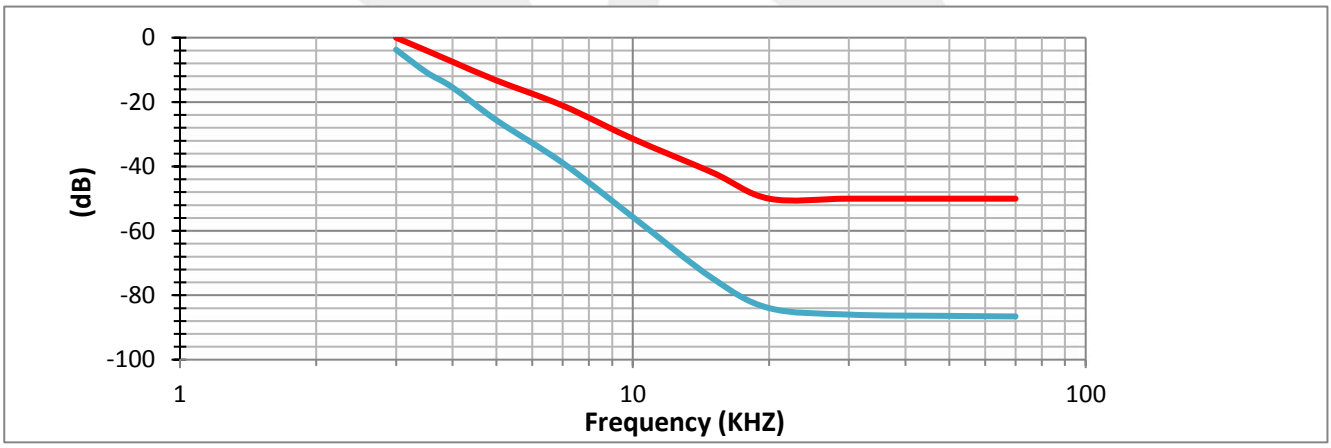
1. Configure the EUT as shown in figure
2. Apply a 1000 Hz tone from the audio signal generator and adjust the level per manufacturer's specifications. Record the dB level of the 1000 Hz tone as LEV_{REF}.
3. Set the audio signal generator to the desired test frequency between 3000 Hz and the upper low pass filter limit. Record the dB level at the test frequency as LEV_{FREQ}
4. Calculate the audio frequency response at the test frequency as:
low pass filter response = LEV_{FREQ} - LEV_{REF}

10.3 TEST SETUP

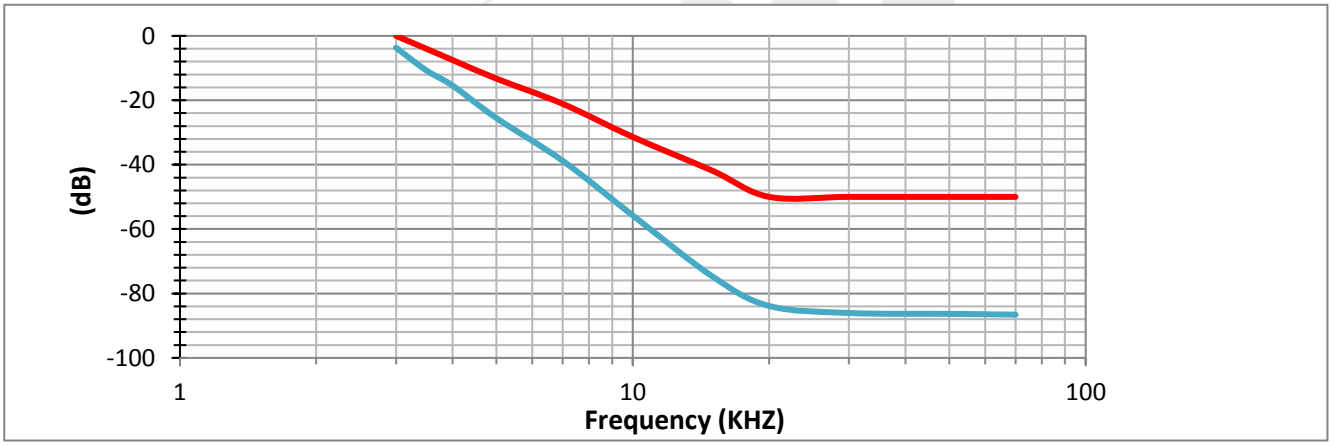


10.4 TEST RESULT

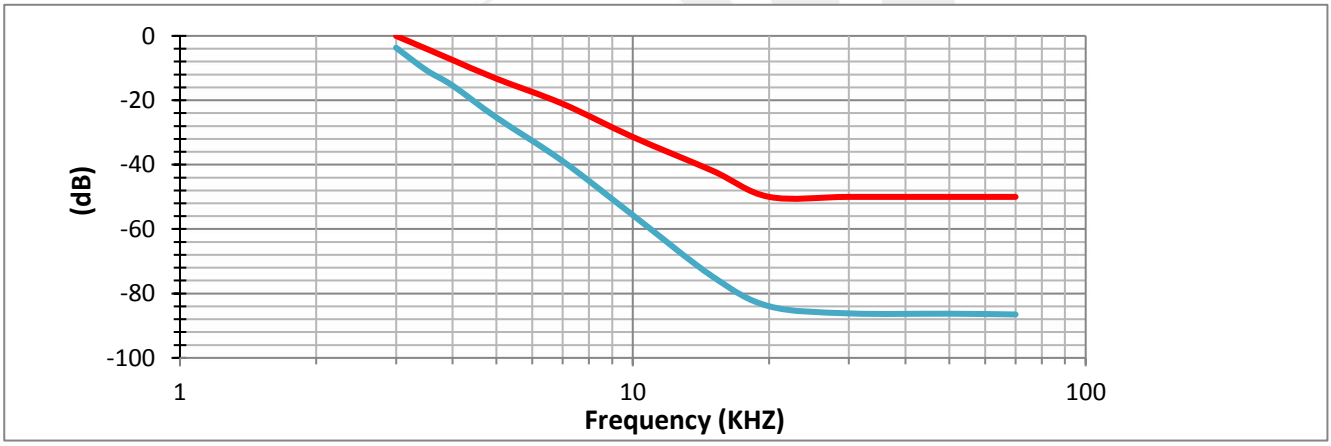
FRS_Channl 01(462.5625MHz)			
Audio Frequency(KHz)	Limit	Response Attenuation(dB)	Result
3	0	-3.74	PASS
3.5	-4	-10.74	
4	-7.5	-15.47	
5	-13.3	-25.67	
7	-21.1	-38.90	
10	-31.4	-55.70	
15	-41.9	-74.77	
20	-50	-83.99	
30	-50	-86.00	
50	-50	-86.41	
70	-50	-86.58	



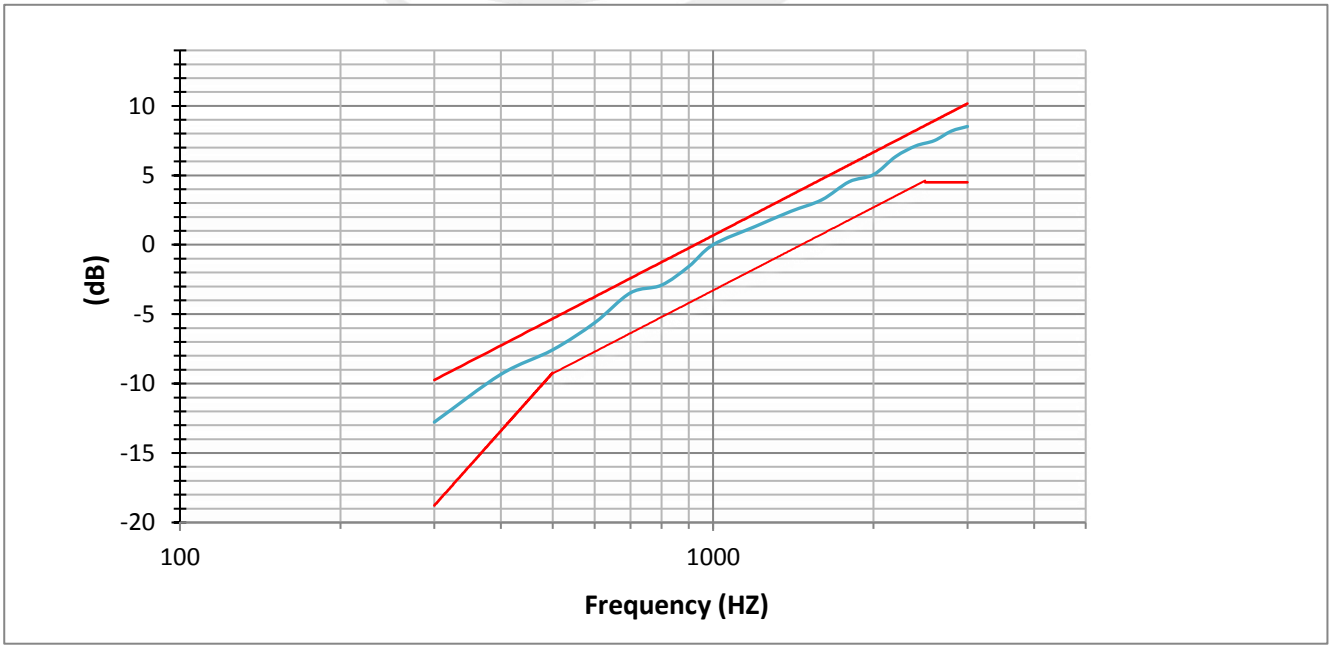
FRS_Channl 11(467.6375MHz)			
Audio Frequency(KHz)	Limit	Response Attenuation(dB)	Result
3	0	-3.69	PASS
3.5	-4	-10.73	
4	-7.5	-15.45	
5	-13.3	-25.56	
7	-21.1	-38.80	
10	-31.4	-55.78	
15	-41.9	-74.75	
20	-50	-83.87	
30	-50	-86.05	
50	-50	-86.33	
70	-50	-86.57	



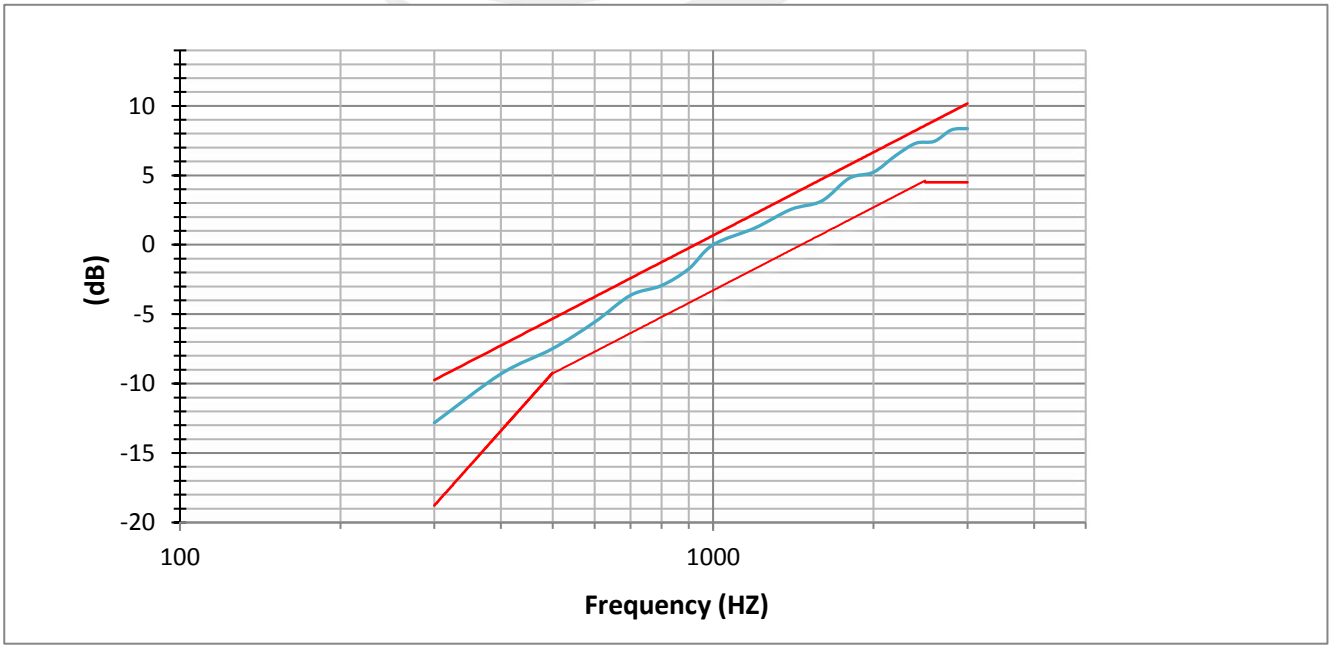
FRS_Channl 22(462.7250MHz)			
Audio Frequency(KHz)	Limit	Response Attenuation(dB)	Result
3	0	-3.68	PASS
3.5	-4	-10.67	
4	-7.5	-15.44	
5	-13.3	-25.37	
7	-21.1	-38.92	
10	-31.4	-55.67	
15	-41.9	-74.74	
20	-50	-83.97	
30	-50	-86.18	
50	-50	-86.28	
70	-50	-86.51	



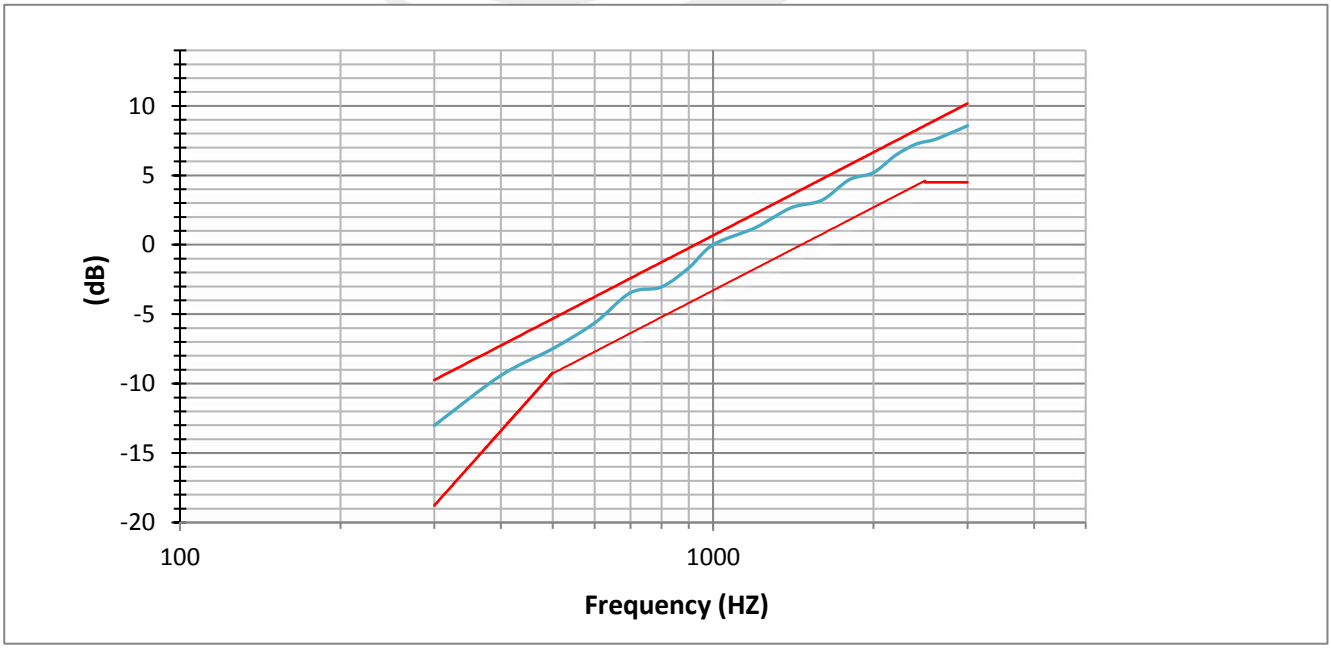
FRS_Channl 01(462.5625MHz)		
Audio Frequency(Hz)	Audio Frequency Response(dB)	Result
300	-12.77	PASS
400	-9.33	
500	-7.57	
600	-5.61	
700	-3.46	
800	-2.91	
900	-1.57	
1000	0.00	
1200	1.32	
1400	2.41	
1600	3.24	
1800	4.54	
2000	5.05	
2200	6.35	
2400	7.12	
2600	7.5	
2800	8.19	
3000	8.52	



FRS_Channl 11(467.6375MHz)		
Audio Frequency(Hz)	Audio Frequency Response(dB)	Result
300	-12.82	PASS
400	-9.30	
500	-7.48	
600	-5.56	
700	-3.64	
800	-2.94	
900	-1.74	
1000	0.00	
1200	1.22	
1400	2.55	
1600	3.16	
1800	4.79	
2000	5.23	
2200	6.42	
2400	7.31	
2600	7.45	
2800	8.27	
3000	8.37	



FRS_Channl 22(462.7250MHz)		
Audio Frequency(Hz)	Audio Frequency Response(dB)	Result
300	-13.01	PASS
400	-9.41	
500	-7.49	
600	-5.62	
700	-3.45	
800	-3.04	
900	-1.67	
1000	0.00	
1200	1.23	
1400	2.66	
1600	3.21	
1800	4.68	
2000	5.20	
2200	6.45	
2400	7.24	
2600	7.57	
2800	8.07	
3000	8.57	



11. CONDUCTED EMISSION MEASUREMENT

11.1 POWER LINE CONDUCTED EMISSION LIMITS

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table.

FREQUENCY (MHz)	Conducted Emissionlimit (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

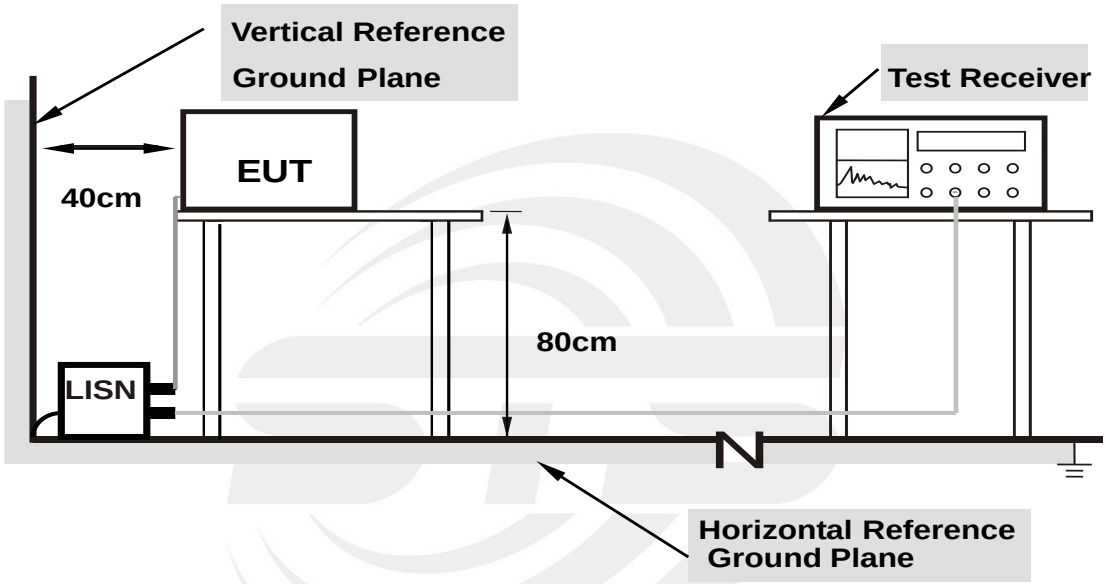
The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

11.2 TEST PROCEDURE

a. The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN is at least 80 cm from the nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

11.3 TEST SETUP



Note: 1. Support units were connected to second LISN.

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes support units.

11.4 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

11.5 TEST RESULT

Temperature:	N/A	Relative Humidity:	N/A
Test Voltage:	N/A	Phase:	L/N
Test Mode:	N/A		

Note: EUT is only power by battery, So it is not applicable for this test.

APPENDIX 1- PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

※※※※※END OF THE REPORT※※※※※