

4.6. Frequency Stability Test

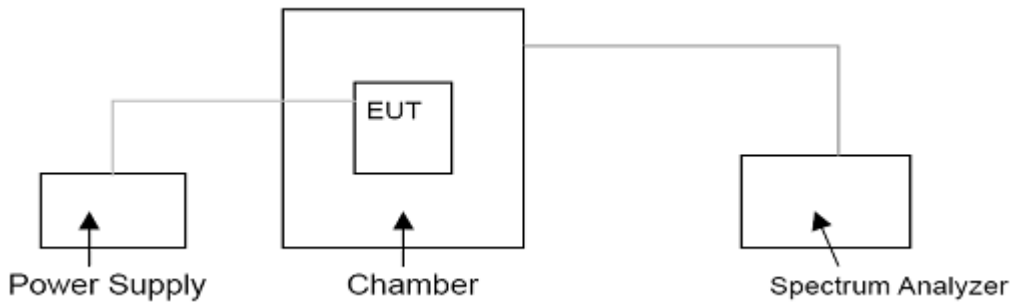
TEST APPLICABLE

- 1 According to FCC Part 2 Section 2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30°C to +60°C centigrade.
- 2 According to FCC Part 2 Section 2.1055 (a) (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 85 to 115 percent of the nominal value.
- 4 According to §90.213, the frequency stability limit is 1.5 ppm for 12.5KHz channel separation

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 ESI 26. 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 CONFIGURATION



TEST 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 RESULTS

Remark: We tested Op 1 to Op 8, recorded worst case at Op 1, Op 2, Op 5 and Op 6

Operation Mode	Channel Separation	Test conditions		Frequency error (ppm)		
		Voltage(V)	Temp(°C)	450.5	488.5	526.5
Op 1	12.5KHz	120	-30	1.02	1.02	0.99
			-20	0.98	0.95	0.96
			-10	0.85	0.87	0.87
			0	0.75	0.84	0.77
			10	0.77	0.76	0.72
			20	0.76	0.69	0.65
			30	0.72	0.66	0.70
			40	0.85	0.79	0.74
			50	0.86	0.82	0.65
		102 (85% Rated)	20	0.78	0.75	0.65
138(115% Rated)	20	0.79	0.79	0.87		
Limit		1.5 ppm				
Test Results		PASS				

Operation Mode	Channel Separation	Test conditions		Frequency error (ppm)		
		Voltage(V)	Temp(°C)	450.5	488.5	526.5
Op 2	12.5KHz	13.6	-30	1.02	1.02	1.01
			-20	0.89	0.99	0.98
			-10	0.78	0.81	0.78
			0	0.80	0.87	0.77
			10	0.78	0.75	0.79
			20	0.74	0.73	0.75
			30	0.75	0.81	0.80
			40	0.81	0.78	0.77
			50	0.85	0.79	0.81
		11.56 (85% Rated)	20	0.75	0.81	0.77
15.64(115% Rated)	20	0.79	0.85	0.79		
Limit		1.5 ppm				
Test Results		PASS				

Operation Mode	Channel Separation	Test conditions		Frequency error (ppm)		
		Voltage(V)	Temp(°C)	450.5	488.5	526.5
Op 5	12.5KHz	120	-30	1.02	1.01	1.01
			-20	0.87	0.88	0.82
			-10	0.84	0.85	0.84
			0	0.79	0.80	0.79
			10	0.85	0.84	0.83
			20	0.76	0.75	0.75
			30	0.78	0.77	0.77
			40	0.81	0.80	0.80
			50	0.79	0.75	0.76
		102 (85% Rated)	20	0.77	0.76	0.75
138(115% Rated)	20	0.77	0.77	0.76		
Limit		1.5 ppm				
Test Results		PASS				

Operation Mode	Channel Separation	Test conditions		Frequency error (ppm)		
		Voltage(V)	Temp(°C)	450.5	488.5	526.5
Op 6	12.5KHz	13.6	-30	1.01	1.02	1.01
			-20	0.90	0.90	0.89
			-10	0.85	0.84	0.86
			0	0.80	0.82	0.81
			10	0.82	0.85	0.82
			20	0.77	0.76	0.79
			30	0.79	0.76	0.77
			40	0.80	0.81	0.79
			50	0.78	0.79	0.78
		11.56 (85% Rated)	20	0.78	0.77	0.77
		15.64(115% Rated)	20	0.77	0.77	0.77
Limit			1.5 ppm			
Test Results			PASS			

4.7. 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.

Per RSS-119 Section 5.4 and 5.4.1: The output power shall be within ±1.0 dB of the manufacturer’s rated power. Typical transmitter output powers are 110 watts for base and/or fixed stations (paging transmitters excepted), and 30 watts for mobile stations. Higher powers may be certified, but it should be noted that mobile stations are normally only licensed up to 30 watts. See the SRSP relevant to the operating frequency for equipment power limits.

TEST PROCEDURE

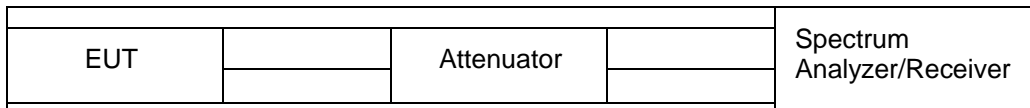
Measurements shall be made to establish the radio frequency power delivered by the transmitter the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted below:

If the power output is adjustable, measurements shall be made for the highest and lowest power levels.

The EUT connect to the Receiver through 20 dB attenuator.

Measurement with Spectrum Analyzer FSP40 conducted, external power supply with 13.60 V or AC 120V/60Hz stabilized supply voltage.

TEST CONFIGURATION



The EUT was directly connected to a RF Communication Test set by a 20 dB attenuator

TEST RESULTS

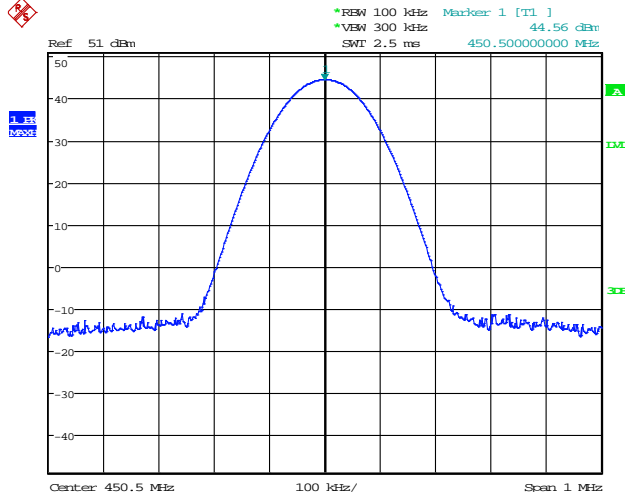
Modulation Type	Channel Sparation	Operation Mode	Test Channel	Test Frequency (MHz)	Test Results (dBm)
Analog/FM	12.5KHz	Op 1	Lowest CH	450.5	44.56
			Middle CH	488.5	44.70
			Highest CH	526.5	44.36
		Op 2	Lowest CH	450.5	44.60
			Middle CH	488.5	44.64
			Highest CH	526.5	44.33
		Op 3	Lowest CH	450.5	30.61
			Middle CH	488.5	30.35
			Highest CH	526.5	30.16
		Op 4	Lowest CH	450.5	30.48
			Middle CH	488.5	30.39
			Highest CH	526.5	30.20
Digital/4FSK	12.5KHz	Op 5	Lowest CH	450.5	44.45
			Middle CH	488.5	44.65
			Highest CH	526.5	44.31
		Op 6	Lowest CH	450.5	44.39
			Middle CH	488.5	44.67
			Highest CH	526.5	44.32
		Op 7	Lowest CH	450.5	30.38
			Middle CH	488.5	30.17
			Highest CH	526.5	30.24
		Op 8	Lowest CH	450.5	30.29
			Middle CH	488.5	30.28
			Highest CH	526.5	30.28
Limit	The limit is dependent upon the station’s antenna HAAT and required service area.				
Test Results	PASS				

Modulation Type

FM

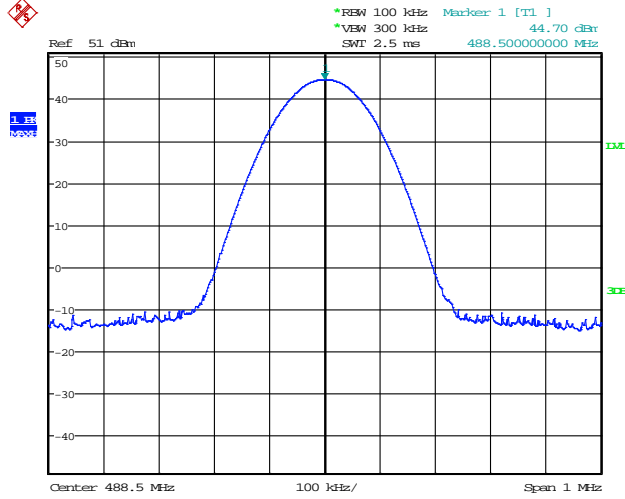
Test mode:

OP1



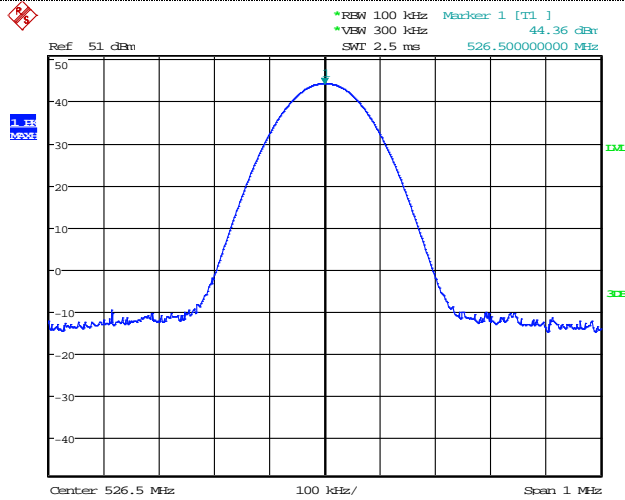
Date: 23.MAY.2014 17:31:57

Lowest CH



Date: 29.MAY.2014 09:57:44

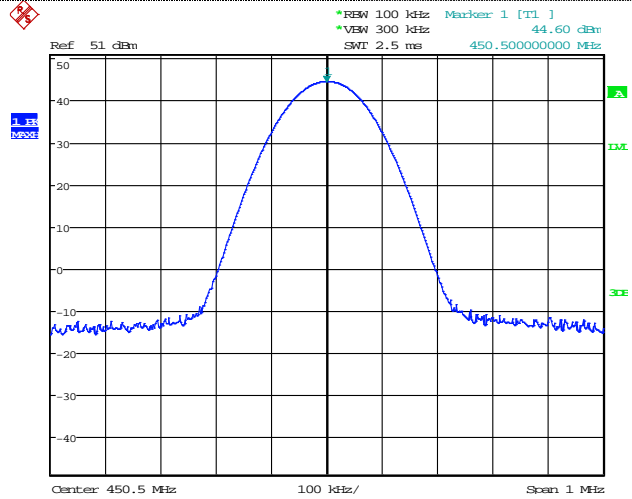
Middle CH



Date: 29.MAY.2014 10:02:13

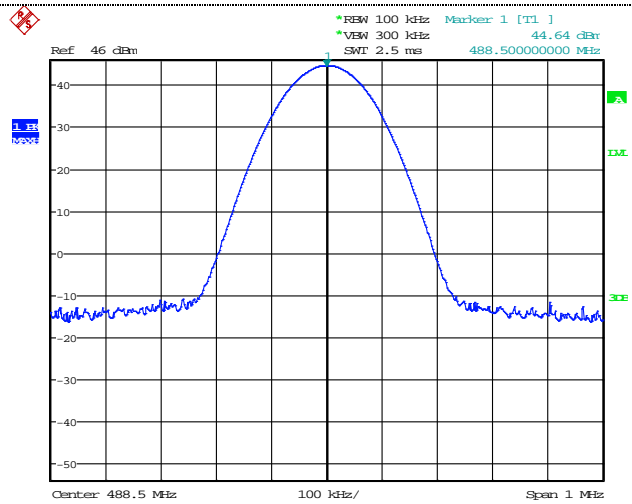
Highest CH

Modulation Type	FM	Test mode:	OP2
-----------------	----	------------	-----



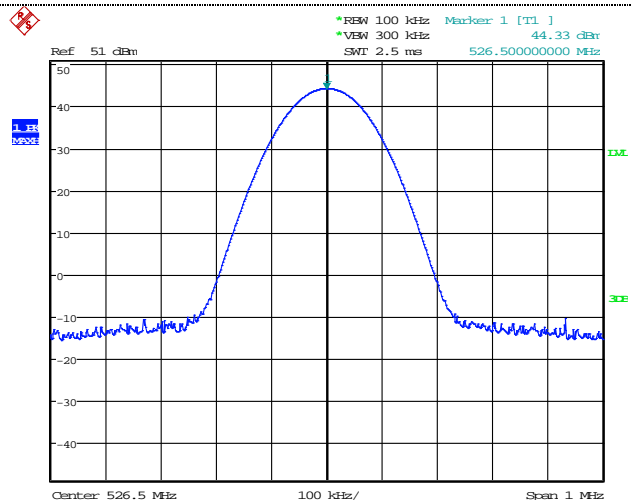
Date: 23.MAY.2014 17:31:37

Lowest CH



Date: 29.MAY.2014 11:16:54

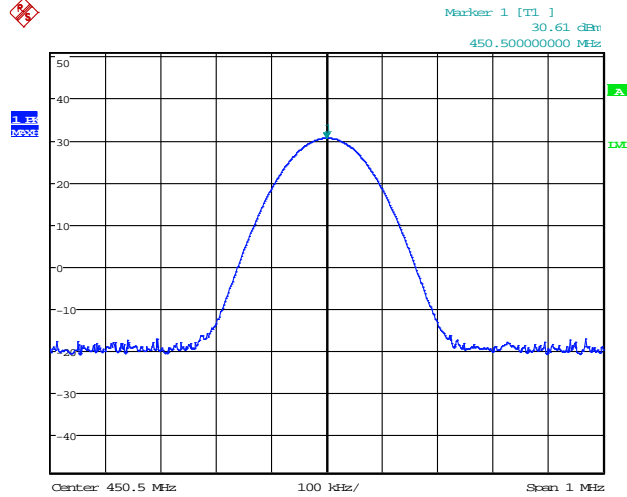
Middle CH



Date: 29.MAY.2014 10:02:21

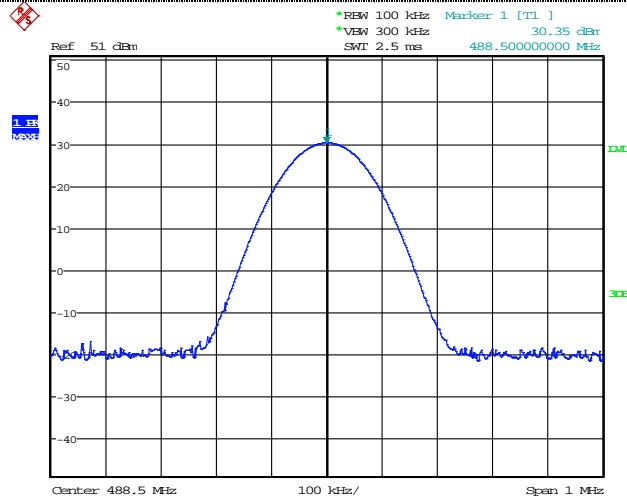
Highest CH

Modulation Type	FM	Test mode:	OP3
-----------------	----	------------	-----



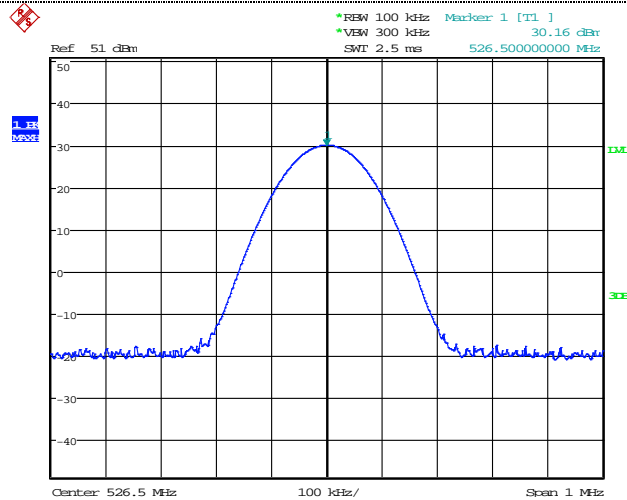
Date: 5.JUN.2014 19:52:39

Lowest CH



Date: 29.MAY.2014 09:59:13

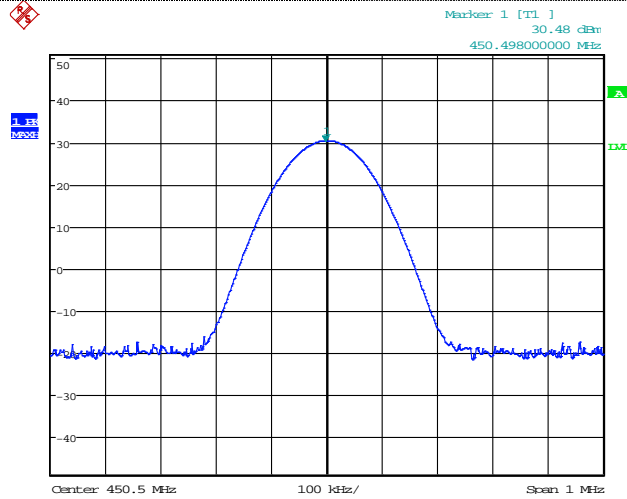
Middle CH



Date: 29.MAY.2014 10:00:57

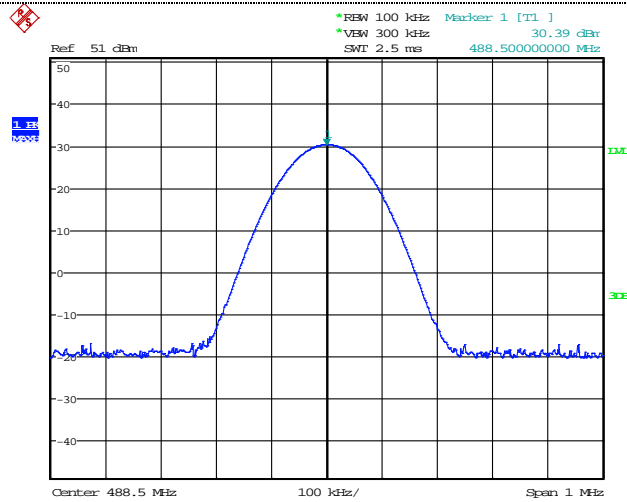
Highest CH

Modulation Type	FM	Test mode:	OP4
-----------------	----	------------	-----



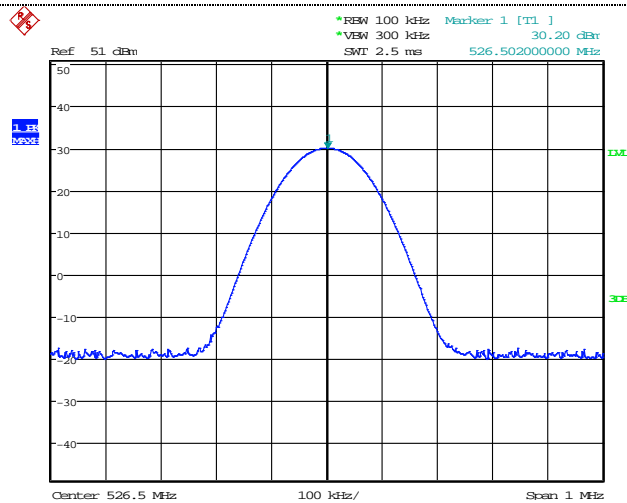
Date: 5.JUN.2014 19:52:51

Lowest CH



Date: 29.MAY.2014 09:59:23

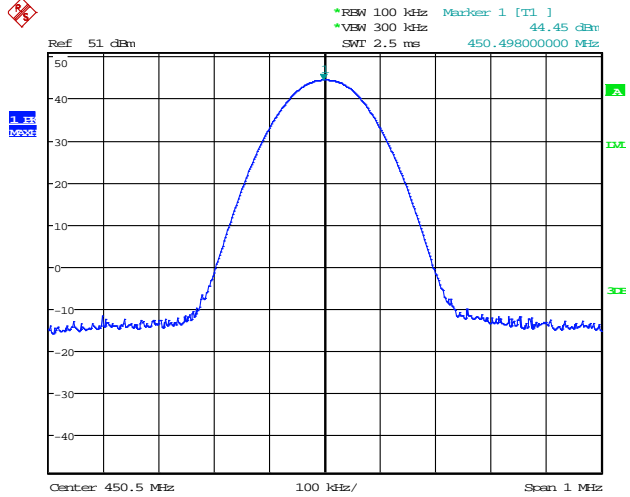
Middle CH



Date: 29.MAY.2014 10:00:43

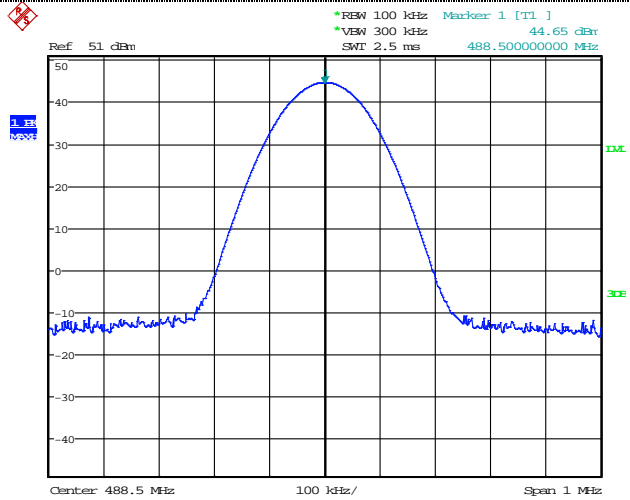
Highest CH

Modulation Type	4FSK	Test mode:	OP5
-----------------	------	------------	-----



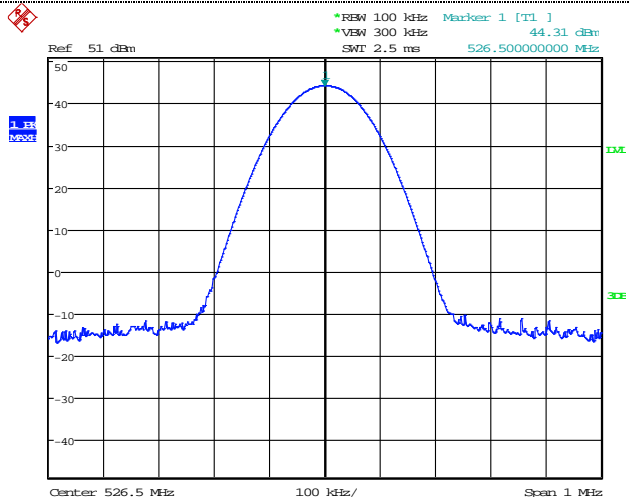
Date: 23.MAY.2014 17:43:04

Lowest CH



Date: 29.MAY.2014 09:58:26

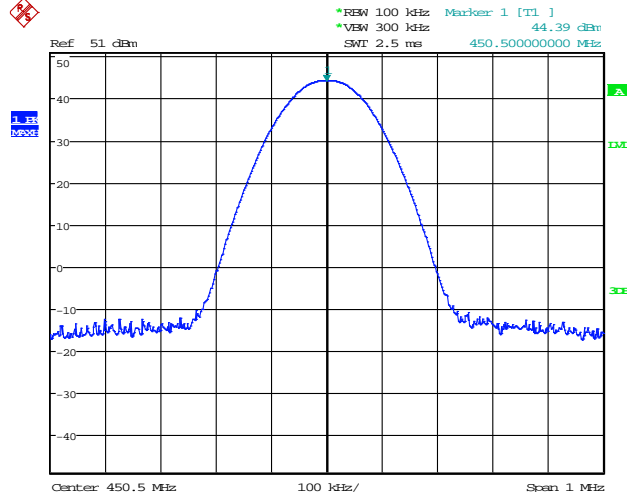
Middle CH



Date: 29.MAY.2014 10:02:28

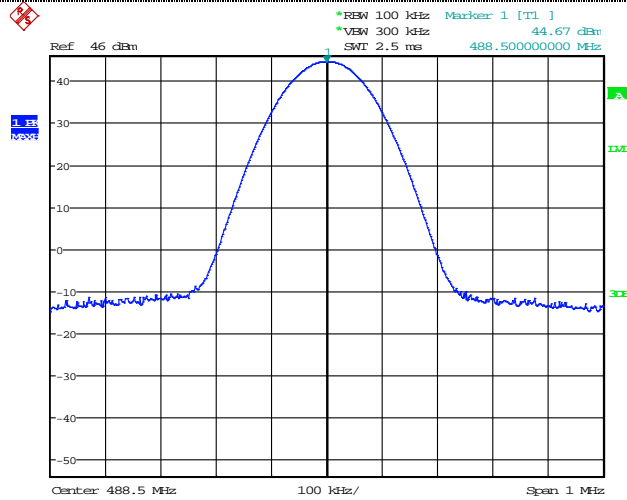
Highest CH

Modulation Type	4FSK	Test mode:	OP6
-----------------	------	------------	-----



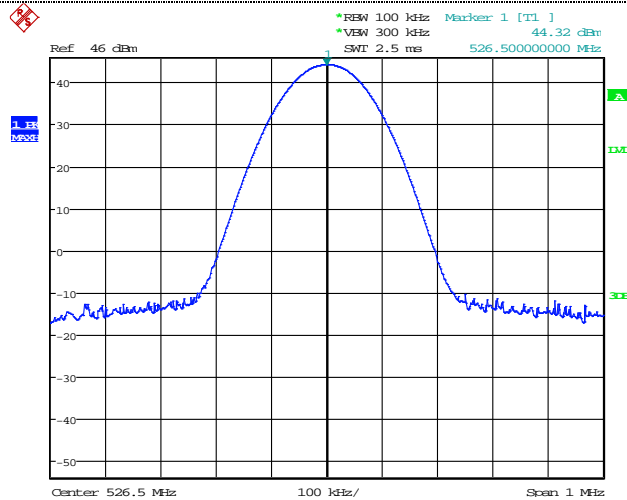
Date: 23.MAY.2014 17:43:15

Lowest CH



Date: 29.MAY.2014 11:16:22

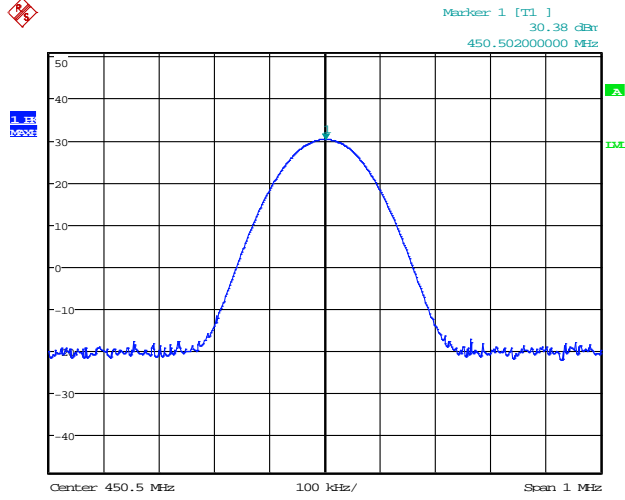
Middle CH



Date: 29.MAY.2014 11:20:37

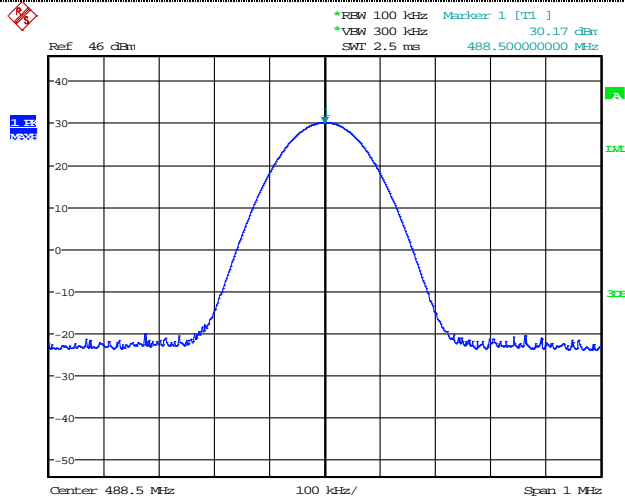
Highest CH

Modulation Type	4FSK	Test mode:	OP7
-----------------	------	------------	-----



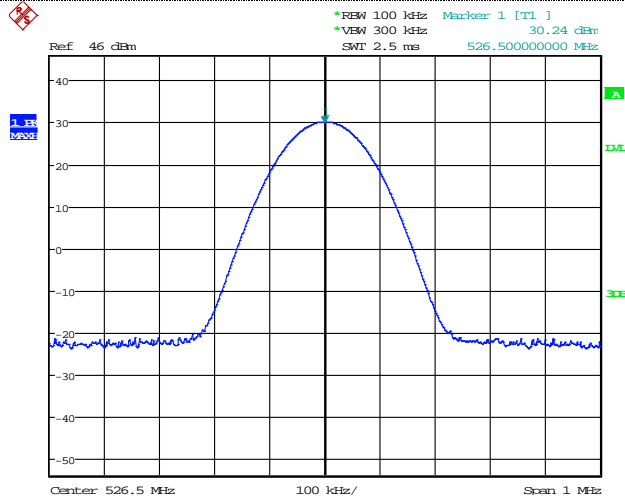
Date: 5.JUN.2014 19:53:06

Lowest CH



Date: 29.MAY.2014 11:17:24

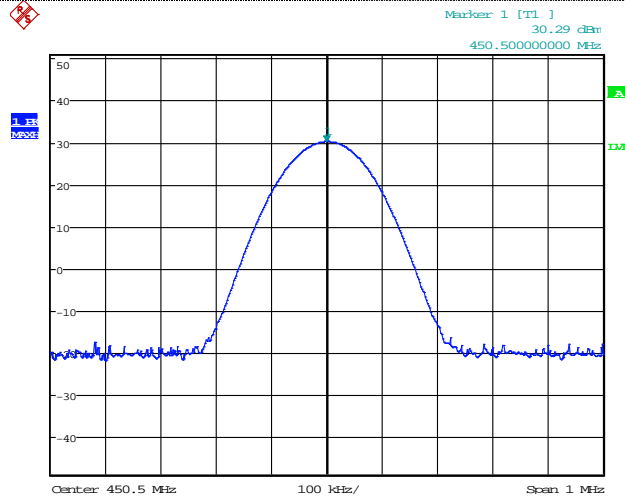
Middle CH



Date: 29.MAY.2014 11:22:16

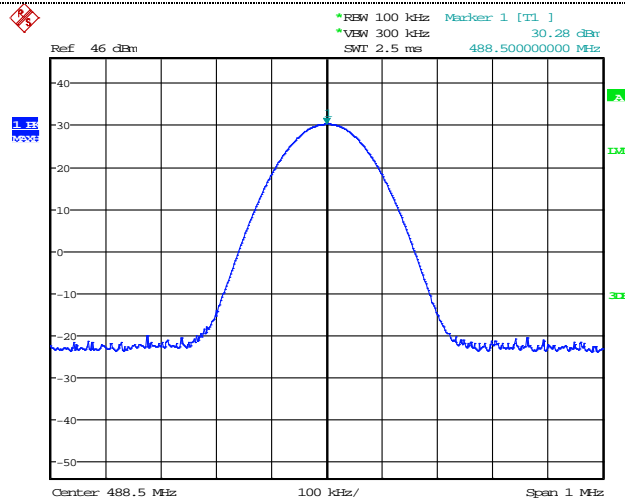
Highest CH

Modulation Type	4FSK	Test mode:	OP8
-----------------	------	------------	-----



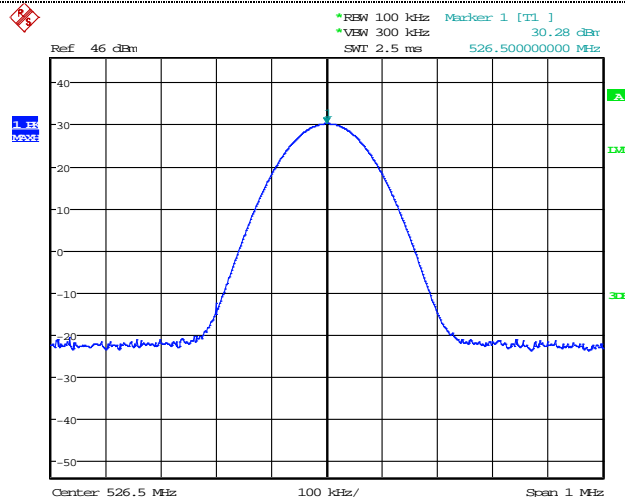
Date: 5.JUN.2014 19:53:19

Lowest CH



Date: 29.MAY.2014 11:17:29

Middle CH



Date: 29.MAY.2014 11:22:28

Highest CH

4.8. Transmitter Frequency Behavior

TEST APPLICABLE

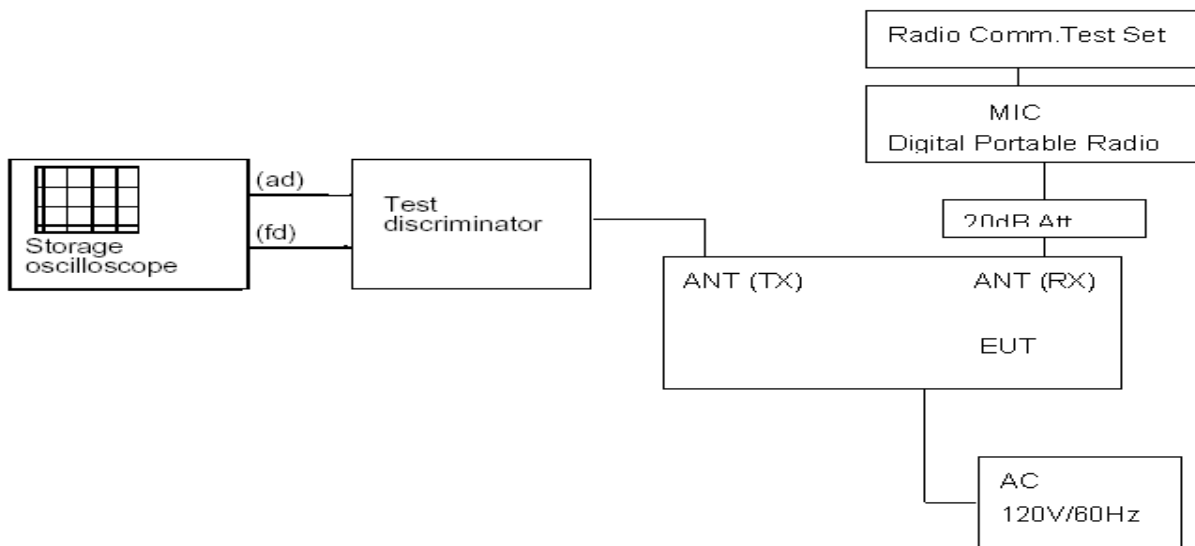
Section 90.214

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.
 t₁ is the time period immediately following t_{on}.
 t₂ is the time period immediately following t₁.
 t₃ 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 t₂ to the beginning of t₃, 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

According to TIA/EIA-603 2.2.19 requirement. As for the product different from PTT, we use test steps as follows:

- Use Digital portable radio which manufactured by Victel Global Communications Corporation Limited which uses same protocol as the DUT connect to RX antenna by 20Att in order to avoid damaging DUT;
- Connect DUT into Test discriminator and Storage Oscilloscope and keep DUT stats ON;

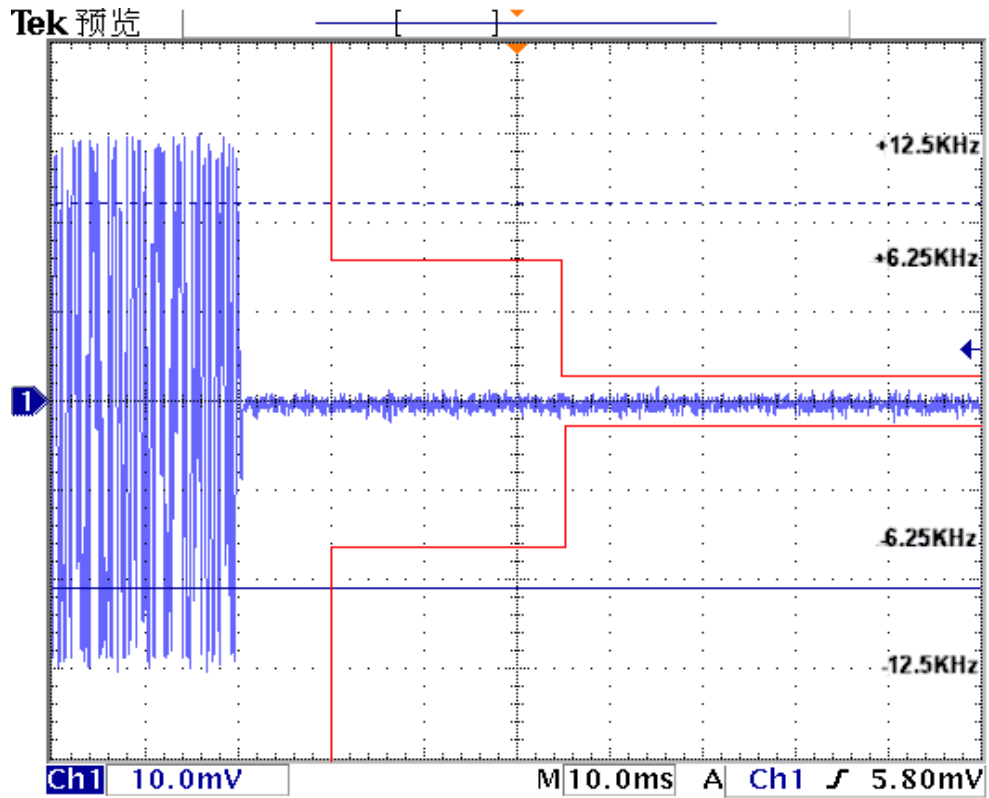
3. Inut 1KHz signal into digital portable radio;
4. Set the modulation domain analyzer to trigger on the rising edge of the waveform in order to capture a single-shot turn-on of the transmitter signals;
5. Keep the digital protable radio in OFF state and Key the PTT of digital portable radio;
6. Observe the stored oscilloscope of modulation domain analyzer.The signal trace shall be maintained within the allowable limits during the periods t_1 and t_2 ,and shall also remain within limits following t_2 ;
7. Adjust the modulation domain anzlyzer to trigger on the falling edge of the transmitter waveform in order to capture a single-shot turn-off transmitter of the transmitter signal.
8. Keep the digital portable radio in ON state and Unkey the PTT of digital portable radio;
9. Observe the stored oscilloscope of modulation domain analyzer.The signal trace shall be maintained within the allowable limits during the period t_3 .

TEST RESULTS

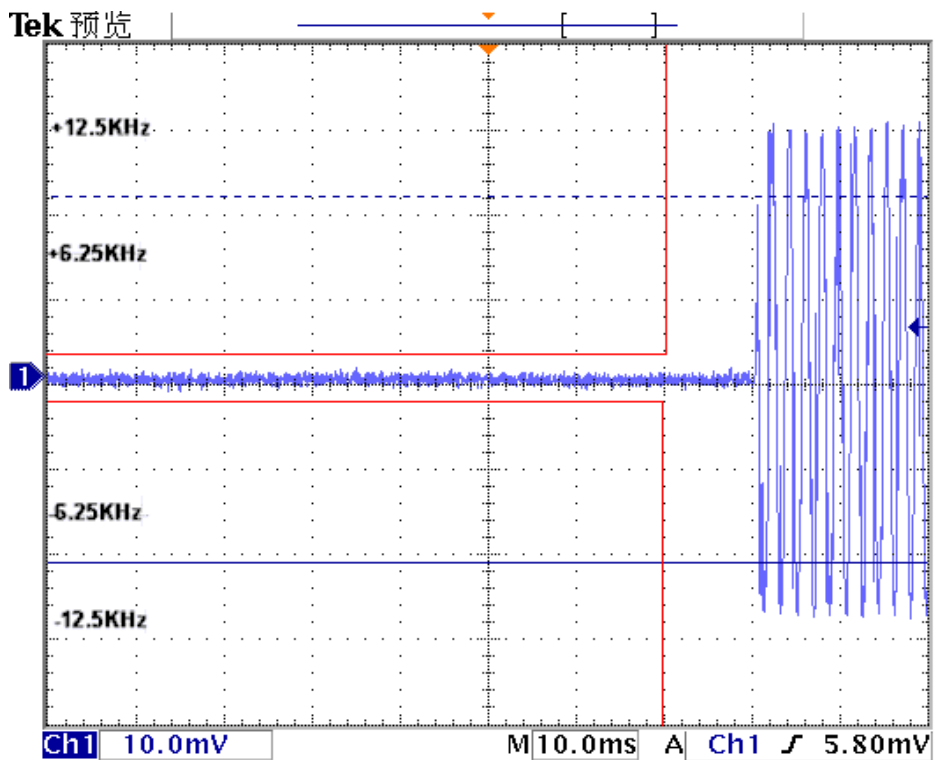
Please refer to the following plots.

Modulation Type: FM

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

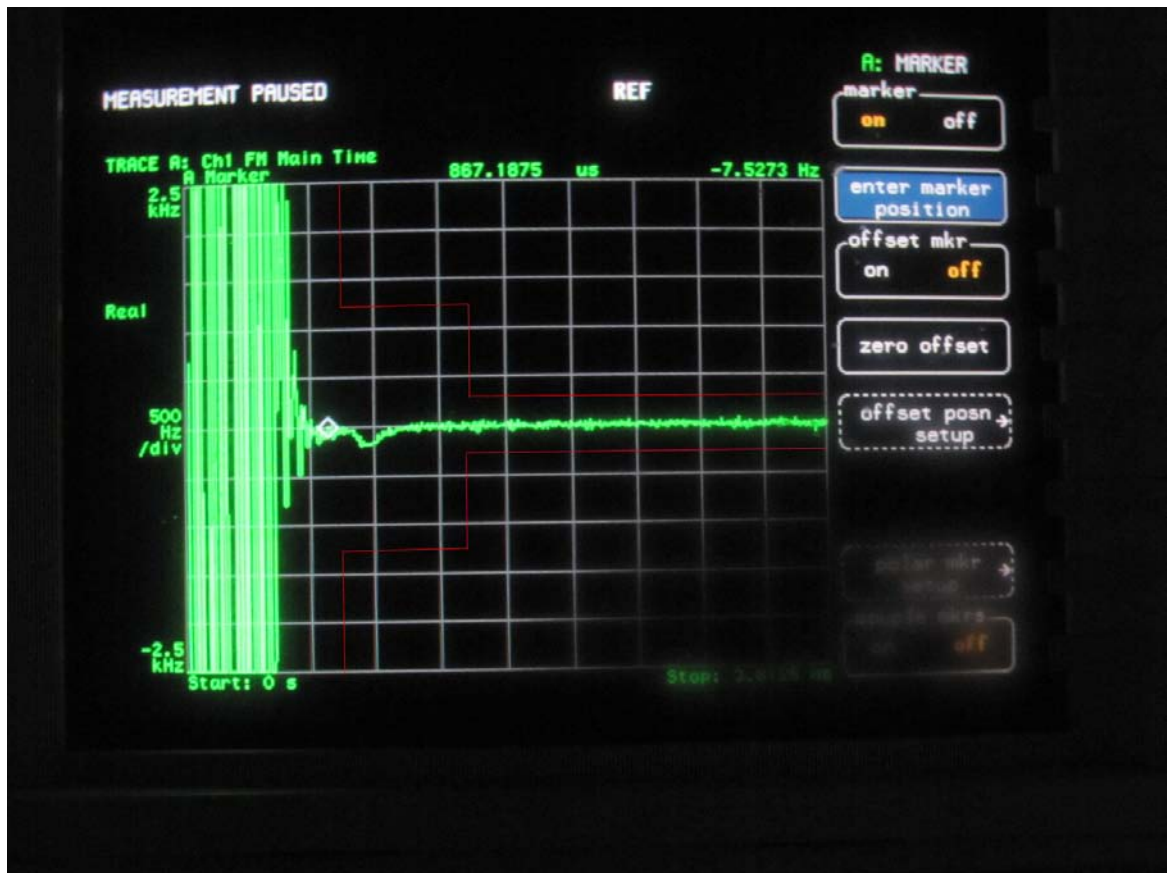


Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation-----On – Off

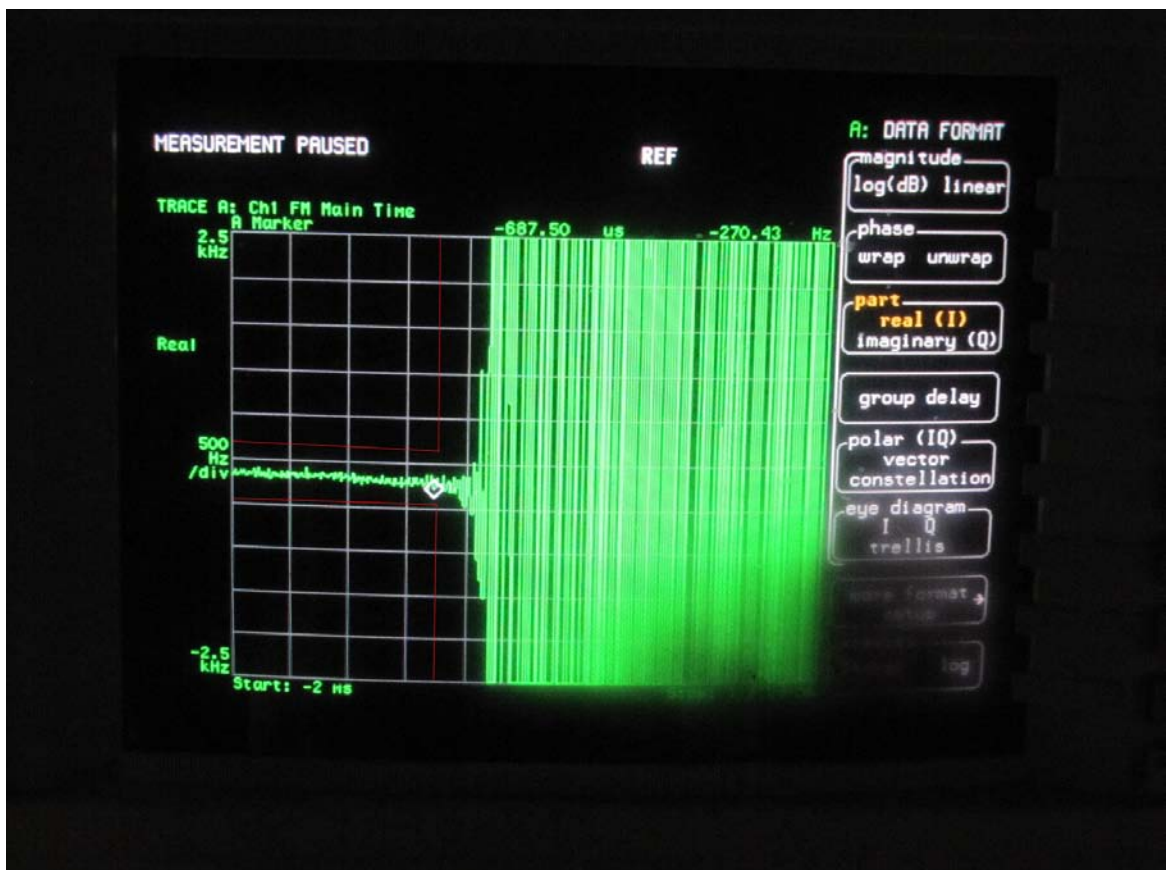


Modulation Type: 4FSK

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



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



5. Test Setup Photos of the EUT



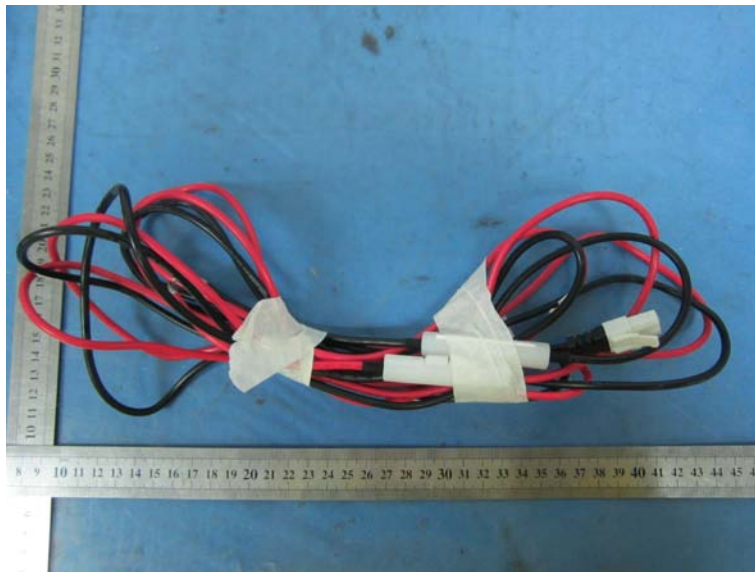


6. External and Internal Photos of the EUT

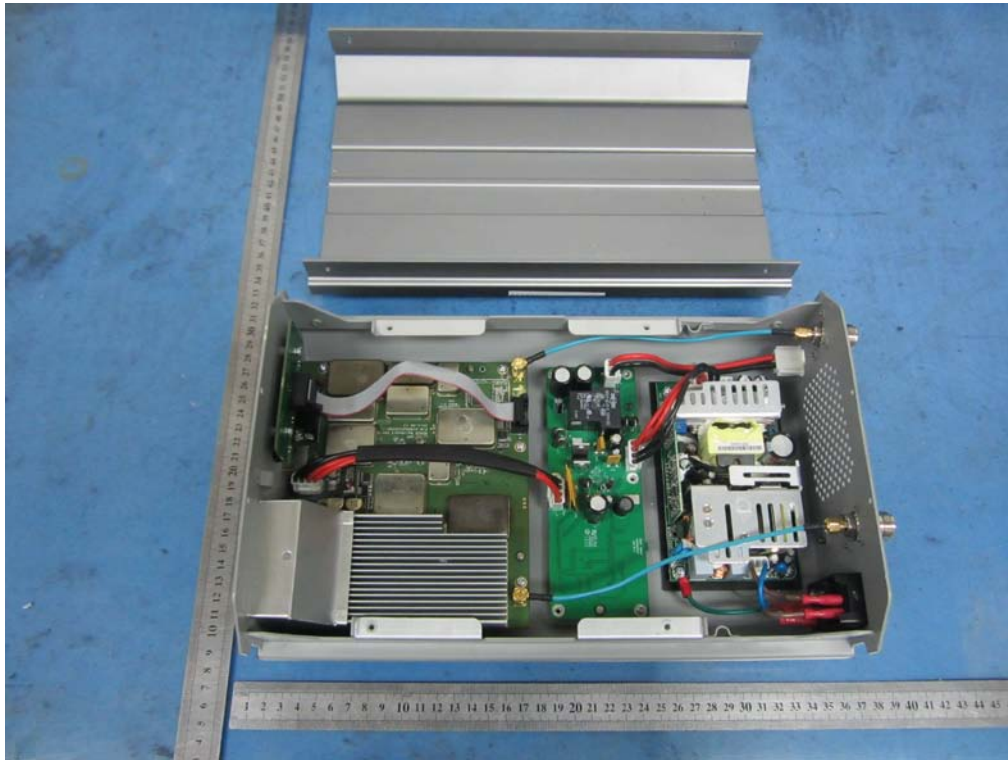
External photos of the EUT



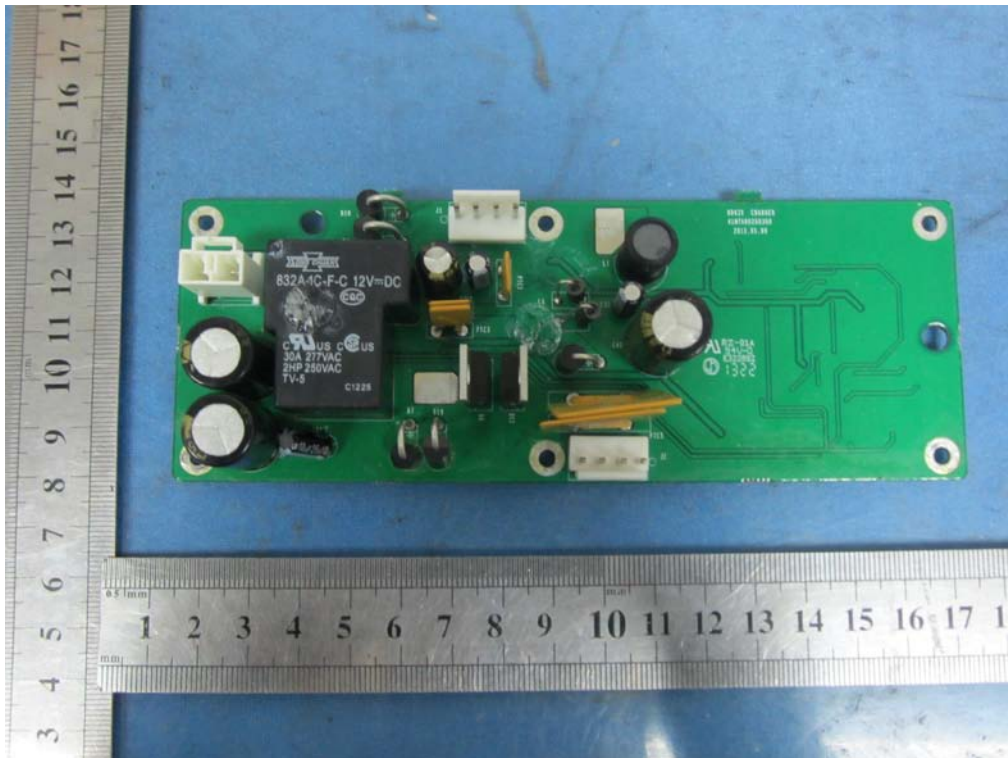
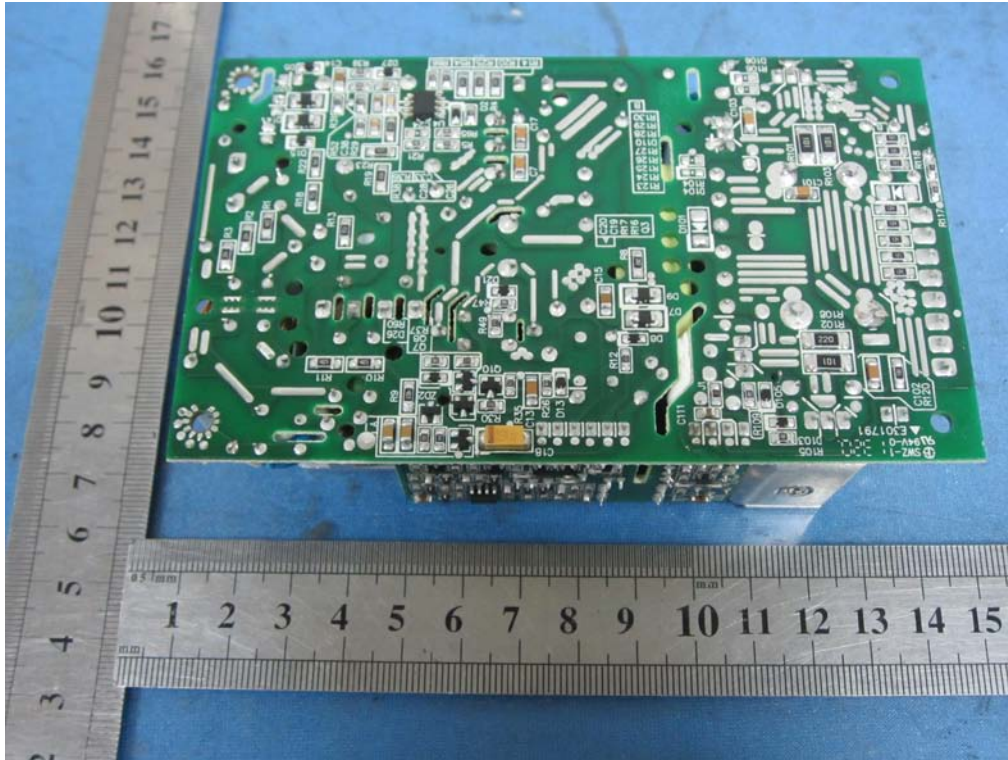


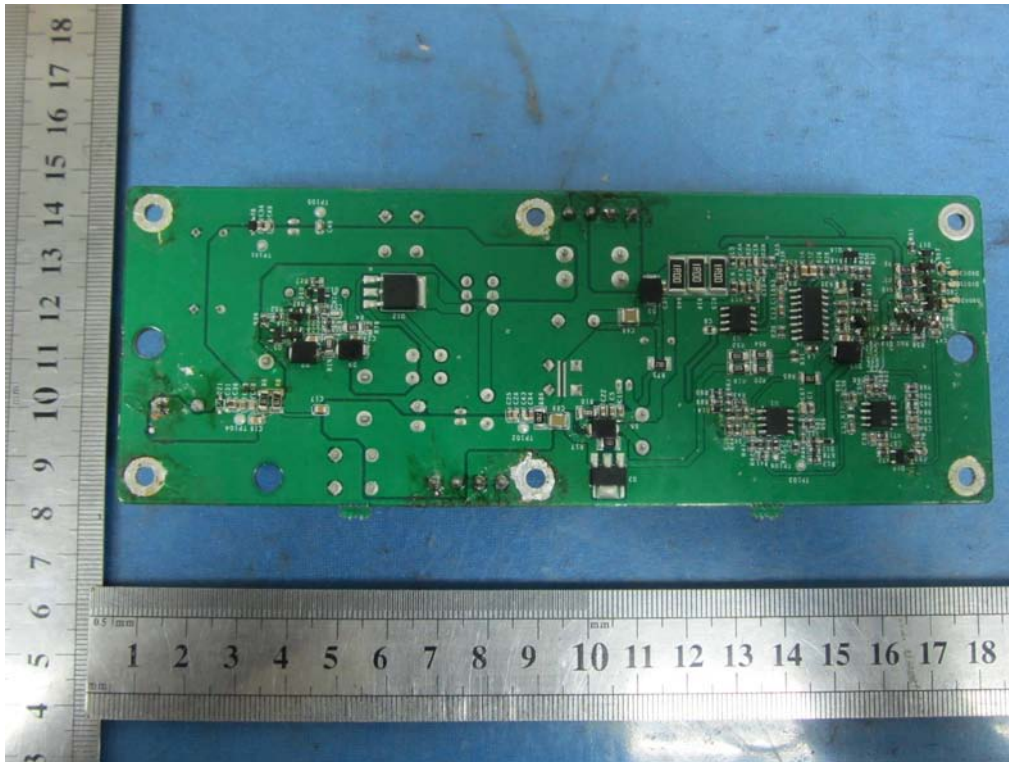


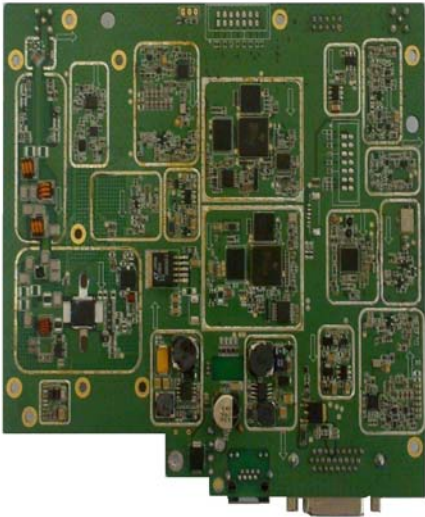
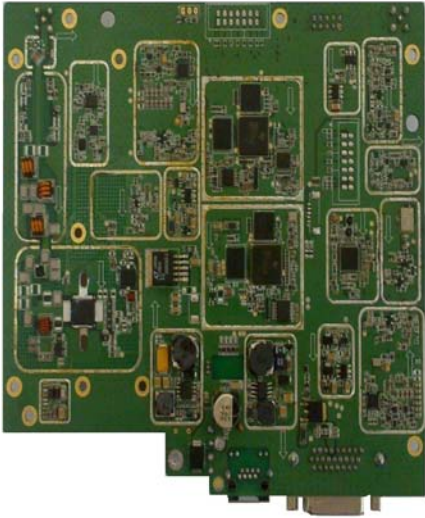
Internal photos of the EUT

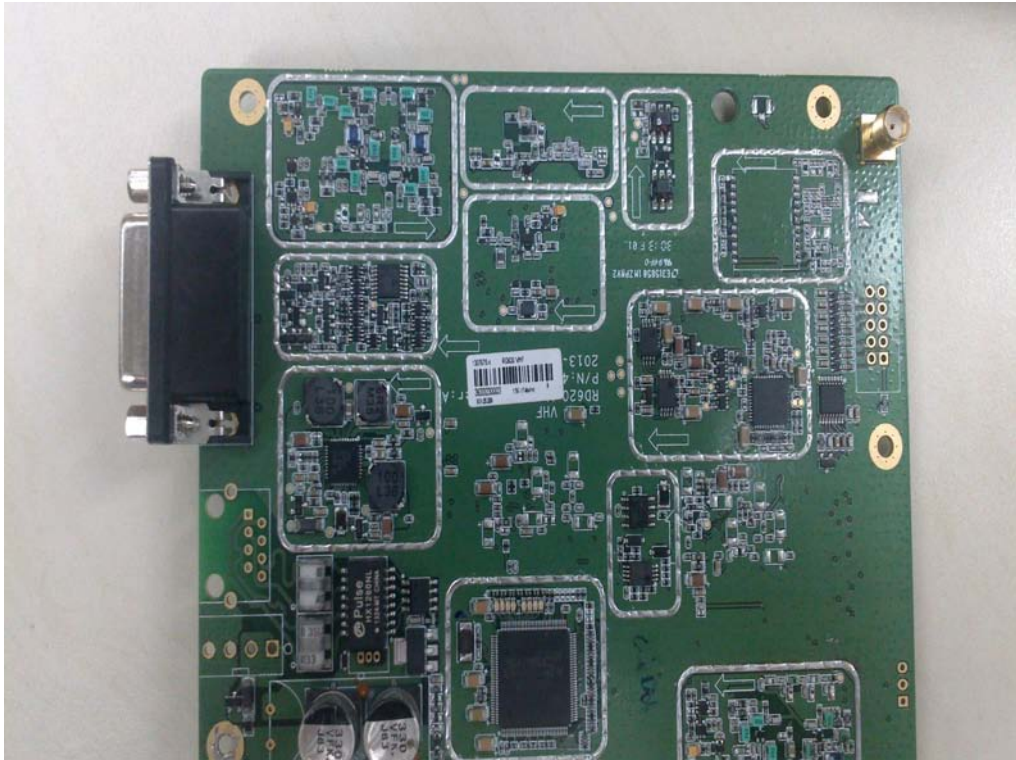


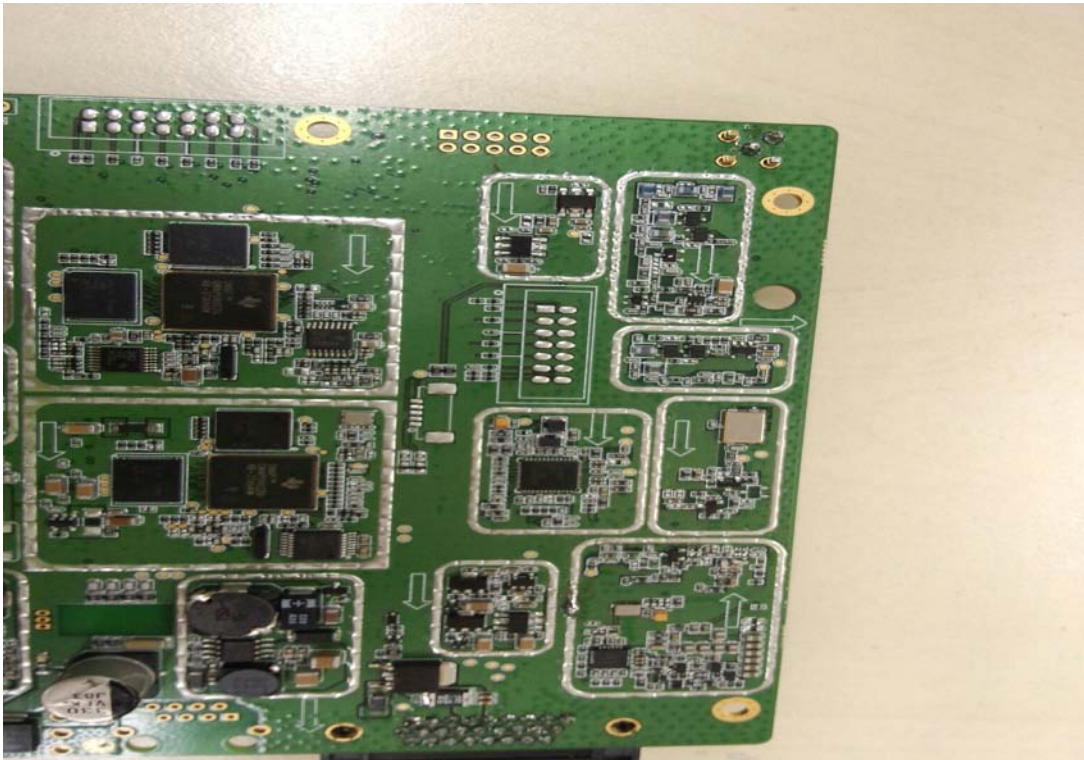
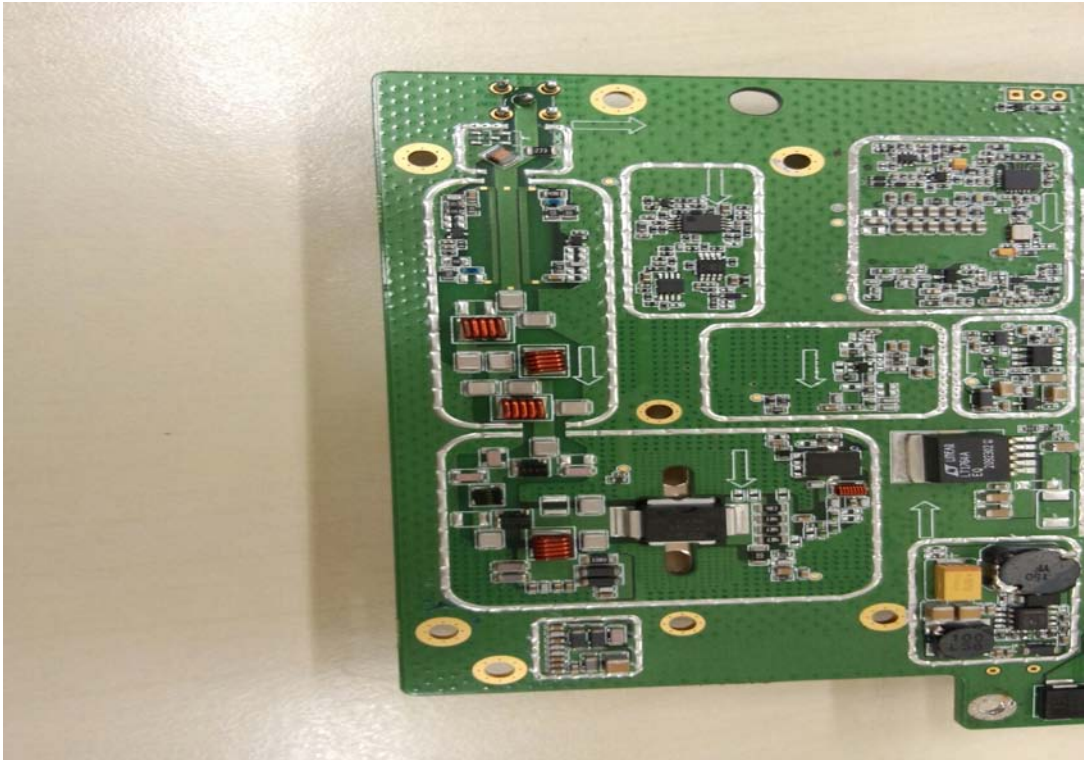












.....End of Report.....