

Quarterly Report on Frequency Spectrum Monitoring

(July - September 2025)



Bhutan InfoComm and Media Authority
Royal Government of Bhutan

September 2025

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1. Background

Spectrum monitoring is the practice of maintaining and monitoring the network or devices that use Radio Frequency (RF) signals and frequencies. Due to the growing demands on the radio frequency spectrum, it is critical that spectrum monitoring is consistently carried out and also keep track with advanced techniques in radio communication technology. Spectrum monitoring is carried out mainly to ensure that technical parameters and standards or guidelines for radiocommunication systems are adhered to by the users. In addition spectrum monitoring assists in promoting the efficient utilization of the radio frequency spectrum.

Spectrum Monitoring is closely associated with inspection and compliance that enables the identification and measurement of spectrum usage, interference sources, the verification of proper technical and operation characteristics of radiated signals, and detection and identification of illegal transmitters. The Monitoring further supports the overall spectrum management effort by providing general measurement of channel and band usage, including the channel availability and measure of spectrum occupancy.

The Bhutan InfoComm and Media Authority conducts fixed and mobile spectrum monitoring to ensure that spectrum use complies with the National Radio Rules and Regulations. The monitoring can detect, identify and resolve the unauthorized transmission or interference, verify technical and operational parameters, and to monitor occupancy and field strength.

2. Monitoring

To ensure effective and proper utilization of spectrum, to control unauthorized transmission and to ensure compliance of equipment and stations with the the National Radio Rules and Regulation, the Authority has monitored the fixed and mobile spectrum from July to September, 2025 in following places;

Sl. No	Monitored Places	Monitored Frequency
1.	Thimphu (Fixed Spectrum Monitoring)	4G Frequencies 2300-2390 MHz
2.	Thimphu (Fixed Spectrum Monitoring)	2G Frequencies 900-990 MHz
3.	Thimphu (Fixed Spectrum Monitoring)	3G Frequencies 860-890 MHz
4.	Tsirang (Fixed Spectrum Monitoring remotely)	Short Wave Frequency from 9 MHz to 11 MHz

5.	Tsirang (Fixed Spectrum Monitoring Remotely)	Short Wave Frequency from 11 MHz to 12 MHz
6.	Tsirang (Fixed Spectrum Monitoring Remotely)	Short Wave Frequency from 13 MHz to 15 MHz

3. Objective of Spectrum Monitoring

The main objective of the Spectrum measurement monitoring is:

- a. To ensure the authorized spectrum for proper application in conformity with the licensing terms and conditions.
- b. To survey and inspect radio communication systems.
- c. To ensure compliance of transmitters and stations with the National Radio Rules and Regulations.
- d. To detect and identify unauthorized transmission.
- e. To determine the spectrum occupancy, field strength and assessment of channel availability which will be useful for proper spectrum planning and management.

4. Details of the Equipment used for Fixed and Mobile Spectrum Monitoring

The details of existing Spectrum monitoring equipment of the Authority are as mentioned below:

a. Fixed Spectrum Monitoring

Equipment Make/Model: LS Telecom FMU308w

Type of the Antenna: HF/VHF/UHF/SHF omni-directional antenna

Monitoring Receiver: FMU supports frequency range from 9kHz to 8GHz

Calibration details: Calibrated on 15-02-2023 and valid up to 2 to 3 years

b. Mobile Spectrum Monitoring

Equipment Make/Model: Narda SignalShark 3310

Type of the Antenna: HF/VHF/UHF/SHF directional antennas

Spectrum Analyzer/Receiver: Frequency range for the receiver is from 8KHz to 8GHz

Calibration details: Calibrated on 23-01-2023 and valid up to 2 to 3 years

5. Methodology

The Spectrum measurement monitoring was carried out as mentioned below;

a. Fixed Spectrum Monitoring

The fixed spectrum monitoring was done with the Fixed Monitoring equipment and LS Observer software for the transmission frequency signals. The Fixed Monitoring equipment is fixed to a particular location and the monitoring is usually done through the scanning of the frequency and obtaining its transmission and reception characteristics.

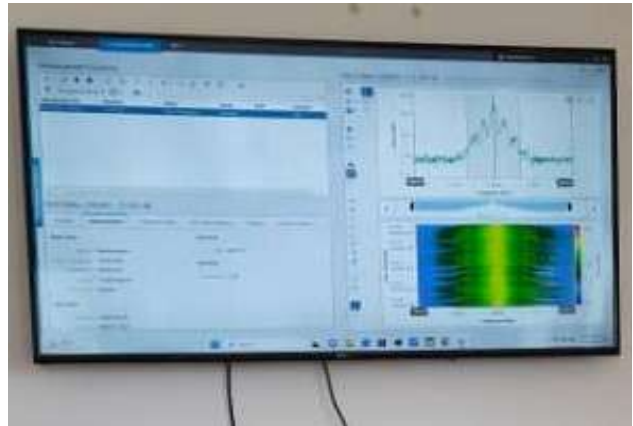


Figure 1: Fixed Spectrum Monitoring

b. Mobile Spectrum Monitoring

The Mobile Spectrum Monitoring was carried out using the DF monitoring equipment which was mounted in the roof of the car. These vehicles are passenger cars used to carry equipment and antennas. The antenna array used for DF and monitoring is mounted in an unobtrusive roof-top carrier mounted directly to the luggage rack on the roof of the car. The monitoring and DF equipment is mounted in the luggage area at the rear of the car.



Figure 2: Mobile Spectrum Monitoring

6. Findings

i. Fixed Spectrum Monitoring in Thimphu

a. Spectrum Occupancy Monitoring for 4G 2300 transmitters

1. The team has carried out the fixed Spectrum Monitoring for 4G transmitter frequencies ranging from 2300 MHz to 2390 MHz.
2. During the monitoring in Thimphu, we have found out that following frequency are actively operating and occupied the band;

Sl.	Frequency Range	Spectrum Occupancy	Remark
1	2300-2310 MHz	Not occupied	Channel is free
2.	2320 MHz	Occupied band is 38%	These Frequencies are actively operated by BTL.
3	2330 MHz	Occupied band is 41%	These Frequencies are actively operated by BTL.
4	2340 MHz	Occupied band is 42%	These Frequencies are actively operated by BTL.
5.	2350 MHz	Occupied band is 39%	These Frequencies are actively operated by BTL.
6.	2360 MHz	Not Occupied	Operation is inactive
7.	2370 MHz	Not Occupied	Operation is inactive.
8.	2380 MHz	Not Occupied	Operation is inactive.

59	2390 MHz	Not Occupied	Operation is active
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3. The details of the spectrum occupancy result are attached in **annexure 1**.
4. No illegal operations were detected so far in the 4G TDD transmitter.
5. There is no out of band transmission from 4G transmitters. The detailed findings are attached **annexure 1**.
6. The channel are free in 1800- 1810 Mhz and 1890 MHz-1899 MHz

b. Spectrum Occupancy Monitoring for GSM 900 band (2G)

1. The team have carried out the fixed Spectrum Monitoring for GSM band (2G) transmitter frequencies ranging from 900 MHz to 990 MHz.
2. During the monitoring in Thimphu, we have found out that following frequency are actively operating and occupied the band;

Sl.	Frequency Range	Spectrum Occupancy	Remark
1	900- 943.38 MHz	No occupancy	Channels are free
2.	935-945 MHz	Occupied band is 51-100%	It is a down link Frequencies and actively operated by BTL.
4.	946.88-954.38 MHz	Occupied band is 1-100%	It is a down link Frequencies and actively operated by TIPL.
5.	956.00-990.00 MHz	Not Occupied	Channel is free

3. The details of the spectrum occupancy result are attached in **annexure 2**.
4. No illegal operations were detected so far in GSM 900 band (2G).
5. There is no out of band transmission from the GSM 900 transmitters. The detailed findings are attached **annexure 2**.
6. The channels are free in 956-990 MHz.

c. Spectrum Occupancy Monitoring for 3G transmitters

1. The team has carried out the fixed Spectrum Monitoring for 3G transmitter frequencies ranging from 860MHz to 899 MHz.
2. During the monitoring in Thimphu, we have found out that following frequency are actively operating and occupied the band;

Sl.	Frequency Range	Spectrum Occupancy	Remark
1	860- 868 MHz	Not occupied	Channel is free
2.	869.00 MHz	Occupied band is 10%	It is a down link Frequencies and actively operated by TIPL.
3.	872.50 MHz	Occupied band is 20%	It is a down link Frequencies and actively operated by TIPL.
4.	877.50 MHz	Occupied Band is 44%	It is a down link Frequencies and actively operated by TIPL.
5.	882.50 MHz	Occupied Band is 57%	It is a down link Frequencies and actively operated by BTL.
6.	887.50 MHz	Occupied Band is 64%	It is a down link Frequencies and actively operated by BTL.
7.	890-899 MHz	Not Occupied	Channel is free

3. The details of the spectrum occupancy result are attached in **annexure 3**.
4. No illegal operations were detected so far in the 3G transmitter.
5. There is no out of band transmission from 3G transmitters. The detailed findings are attached **annexure 3**.
6. The channels are free in 860-868 MHz and 890 MHz-899 MHz

ii. Tsirang Fixed Spectrum Monitoring Remotely

1. Short Wave Frequency from 9 MHz to 11.7 MHz

- a. The team has carried out the Fixed Spectrum Monitoring for BTS transmitter frequencies ranging from 9 MHz to 11.7 MHz short wave frequency.
- b. During the monitoring, we have found out that following frequencies are actively operating and occupying the band and also done with the audio listing monitoring for each occupied band.
- c. The details of the Spectrum Monitoring result is attached in **Annexure 4**

Sl.	Frequency Range	Spectrum Occupancy	Remark
1	9.490 MHz	Active/Occupied	Operating by China/Tibetan

2.	9.530 MHz	Active/Occupied	Operating by China BC
3.	9.560 MHz	Active/Occupied	Operating by China BC
4.	9.580 MHz	Active/Occupied	Operating by Tibetan BC
5.	9.599 MHz	Active/Occupied	Operating by China BC
6.	9.610 MHz	Active/Occupied	Operating by China BC
7	9.629 MHz	Active/Occupied	Operating by China BC
9	11.610MHz	Active/Occupied	Operating by China BC
10	11.659 MHz	Active/Occupied	Operating by China BC
11	11.669 MHz	Active/Occupied	Operating by China BC
12	11.695 MHz	Active/Occupied	Operating by China BC
13	11.770 MHz	Active/Occupied	Operating by China BC
14	11.785 MHz	Active/Occupied	Operating by China BC
15	11.788 MHz	Active/Occupied	Operating by China BC

2. Short Wave Frequency from 11.7 MHz to 12 MHz

- a. The team has carried out the Fixed Spectrum Monitoring for short Wave transmitter frequencies ranging from 11.7 MHz to 12 MHz MHz.
- b. During the monitoring, we have found out that following frequencies are actively operating and occupying the band and also done with the audio listing monitoring for each occupied band.
- c. The result of Fixed Spectrum Monitoring of Tsirang are as shown in the table below;

Sl.	Frequency Range	Spectrum Occupancy	Remark
1	11.709 MHz	Active/Occupied	Operating by China
2.	11.730 MHz	Active/Occupied	Operating by China BC
3.	11.760 MHz	Active/Occupied	Operating by China BC
4.	11.769 MHz	Active/Occupied	Operating by Tibetan BC
5.	11.784 MHz	Active/Occupied	Operating by China BC

6.	11.849 MHz	Active/Occupied	Operating by China BC
7	11.860 MHz	Active/Occupied	Operating by China BC
9	11.874 MHz	Active/Occupied	Operating by China BC
10	11.892 MHz	Active/Occupied	Operating by China BC
11	11.914 MHz	Active/Occupied	Operating by China BC
12	11950 MHz	Active/Occupied	Operating by China BC
13	12.055 MHz	Active/Occupied	Operating by China BC

d. The details of the Spectrum Monitoring result is attached in **Annexure 5**

3. Short Wave Frequency from 13 MHz to 15.8 MHz

- The team has carried out the Fixed Spectrum Monitoring for short Wave transmitter frequencies ranging from 13 MHz to 15.8 MHz.
- During the monitoring, we have found out that following frequencies are actively operating and occupying the band and also done with the audio listing monitoring for each occupied band.
- The result of Fixed Spectrum Monitoring of Tsirang are as shown in the table below;

Sl.	Frequency Range	Spectrum Occupancy	Remark
Sl.	Frequency Range	Spectrum Occupancy	Remark
1	13.663 MHz	Active/Occupied	BC China
2.	13.669MHz	Active/Occupied	BC China
3.	13.700 MHz	Active/Occupied	BC China
4.	13.729 MHz	Active/Occupied	BC China
5.	13.787 MHz	Active/Occupied	BC China
6.	13.811 MHz	Active/Occupied	BC China
7	13.860 MHz	Active/Occupied	BC China
9	14.919 MHz	Active/Occupied	BC China
10	14.958 MHz	Active/Occupied	By China

11.	14.980 MHz	Active/Occupied	BC China
12	15.000 MHz	Active/Occupied	BC China
13	15.202 Mhz	Active/Occupied	BC China
14	15.230 MHz	Active/Occupied	BC China
15	15.310 MHz	Active/Occupied	BC Britain
16	15.349 MHz	Active/Occupied	BC China
17	15.760 MHz	Active/Occupied	BC China
18	15.800 MHz	Active/Occupied	BC China

4. The details of the Spectrum Monitoring result is attached in **Annexure 6**

7. Follow up

i. The Authority has to maintain the database for any spectrum signal detected during the monitoring from the outside country.

ii. The authority will continue monitoring the spectrum occupancy for 2G, 3G, 4G and 5G in different places.

iii. The Authority will compare the fixed and mobile spectrum monitoring result with the frequency assigning database to see whether they are operating illegally or not.

vi. The authority will continue monitoring the Fixed Spectrum Monitoring in Thimphu and Tsirang.

v. The Authority has to practise more and periodically (once in a month or two) on DF Monitoring system to find out the accurate bearing and to get more familiar with the DF monitoring system.

iv. The authority will keep the record of external radio signal and transmission location which was obtained from the DF monitoring result.

Annexure 1

The following are the details of the system generated spectrum occupancy report monitoring for 4G 2300 band (4G) transmitter frequencies ranging from 2300 MHz to 2390 MHz.

Measurement

Name: 4G TDD

Receiver Settings

Mode: Frequency Range **Freq. Range:** 2.30 GHz - 2.39 GHz

RBW: 25.00 kHz

Step Width: 24.73 kHz

Start Time: 7/31/2025 9:10:00 AM

Stop Time: 7/31/2025 9:45:00 AM

Duration: 35 Minutes 0 Second

Channel Name	Main Frequency	Bandwidth	Occupancy [%]		
			Max	Avg	Min
S1	2.31 GHz	10.00 MHz	0	0	0
S2	2.32 GHz	10.00 MHz	34	32	30
S3	2.33 GHz	10.00 MHz	31	29	25
S4	2.34 GHz	10.00 MHz	42	38	35
S5	2.35 GHz	10.00 MHz	35	33	31
S6	2.36 GHz	10.00 MHz	0	0	0
S7	2.37 GHz	10.00 MHz	0	0	0
S8	2.38 GHz	10.00 MHz	0	0	0
S9	2.39 GHz	10.00 MHz	0	0	0

Annexure 2

The following are the details of the system generated spectrum occupancy report monitoring for 2G frequency range 900-990 MHz from the fixed monitoring equipment.

Measurement

Name: 2G August 25
Mode: Frequency Range
Freq. Range: 900.00 MHz - 990.00 MHz
RBW: 50.00 kHz
Step Width: 48.83 kHz
Start Time: 8/29/2025 8:30:00 AM
Stop Time: 8/29/2025 8:45:00 AM
Duration: 15 Minutes 0 Second

Receiver Settings

Channel Name	Main Frequency	Band width	Occupancy [%]		
			Max	Avg	Min
S1	900.63 MHz	1.25 MHz	0	0	0
S2	901.88 MHz	1.25 MHz	0	0	0
S3	903.13 MHz	1.25 MHz	0	0	0
S4	904.38 MHz	1.25 MHz	0	0	0
S5	905.63 MHz	1.25 MHz	0	0	0
S6	906.88 MHz	1.25 MHz	0	0	0
S7	908.13 MHz	1.25 MHz	0	0	0
S8	909.38 MHz	1.25 MHz	0	0	0
S9	910.63 MHz	1.25 MHz	0	0	0
S10	911.88 MHz	1.25 MHz	0	0	0
S11	913.13 MHz	1.25 MHz	0	0	0
S12	914.38 MHz	1.25 MHz	0	0	0

S13	915.63 MHz	1.25 MHz	0	0	0
S14	916.88 MHz	1.25 MHz	0	0	0
S15	918.13 MHz	1.25 MHz	0	0	0
S16	919.38 MHz	1.25 MHz	0	0	0
S17	920.63 MHz	1.25 MHz	0	0	0
S18	921.88 MHz	1.25 MHz	0	0	0
S19	923.13 MHz	1.25 MHz	0	0	0
S20	924.38 MHz	1.25 MHz	0	0	0
S21	925.63 MHz	1.25 MHz	0	0	0
S22	926.88 MHz	1.25 MHz	0	0	0
S23	928.13 MHz	1.25 MHz	0	0	0
S24	929.38 MHz	1.25 MHz	0	0	0
S25	930.63 MHz	1.25 MHz	0	0	0
S26	931.88 MHz	1.25 MHz	0	0	0
S27	933.13 MHz	1.25 MHz	0	0	0
S28	934.38 MHz	1.25 MHz	0	0	0
S29	935.63 MHz	1.25 MHz	100	100	100
S30	936.88 MHz	1.25 MHz	100	100	100
S31	938.13 MHz	1.25 MHz	77	71	61
S32	939.38 MHz	1.25 MHz	8	7	6

S33	940.63 MHz	1.25 MHz	8	7	7
S34	941.88 MHz	1.25 MHz	11	10	9
S35	943.13 MHz	1.25 MHz	28	26	24
S36	944.38 MHz	1.25 MHz	52	42	35
S37	945.63 MHz	1.25 MHz	55	51	45
S38	946.88 MHz	1.25 MHz	97	97	97
S39	948.13 MHz	1.25 MHz	100	100	100
S40	949.38 MHz	1.25 MHz	100	100	100
S41	950.63 MHz	1.25 MHz	1	1	0
S42	951.88 MHz	1.25 MHz	2	1	1
S43	953.13 MHz	1.25 MHz	2	1	0
S44	954.38 MHz	1.25 MHz	1	1	0
S45	955.63 MHz	1.25 MHz	0	0	0
S46	956.88 MHz	1.25 MHz	0	0	0
S47	958.13 MHz	1.25 MHz	0	0	0
S48	959.38 MHz	1.25 MHz	0	0	0
S49	960.63 MHz	1.25 MHz	0	0	0
S50	961.88 MHz	1.25 MHz	0	0	0
S51	963.13 MHz	1.25 MHz	0	0	0
S52	964.38 MHz	1.25 MHz	0	0	0
S53	965.63 MHz	1.25 MHz	0	0	0
S54	966.88 MHz	1.25 MHz	0	0	0

S55	968.13 MHz	1.25 MHz	0	0	0
S56	969.38 MHz	1.25 MHz	0	0	0
S57	970.63 MHz	1.25 MHz	0	0	0
S58	971.88 MHz	1.25 MHz	0	0	0
S59	973.13 MHz	1.25 MHz	0	0	0
S60	974.38 MHz	1.25 MHz	0	0	0
S61	975.63 MHz	1.25 MHz	0	0	0
S62	976.88 MHz	1.25 MHz	0	0	0

S63	978.13 MHz	1.25 MHz	0	0	0
S64	979.38 MHz	1.25 MHz	0	0	0
S65	980.63 MHz	1.25 MHz	0	0	0
S66	981.88 MHz	1.25 MHz	0	0	0
S67	983.13 MHz	1.25 MHz	0	0	0
S68	984.38 MHz	1.25 MHz	0	0	0
S69	985.63 MHz	1.25 MHz	0	0	0
S70	986.88 MHz	1.25 MHz	0	0	0
S71	988.13 MHz	1.25 MHz	0	0	0
S72	989.38 MHz	1.25 MHz	0	0	0

Annexure 3

The following are the details of the system generated spectrum occupancy report monitoring for 3G frequency range 860 MHz to 890 MHz from the fixed monitoring equipment.

Measurement

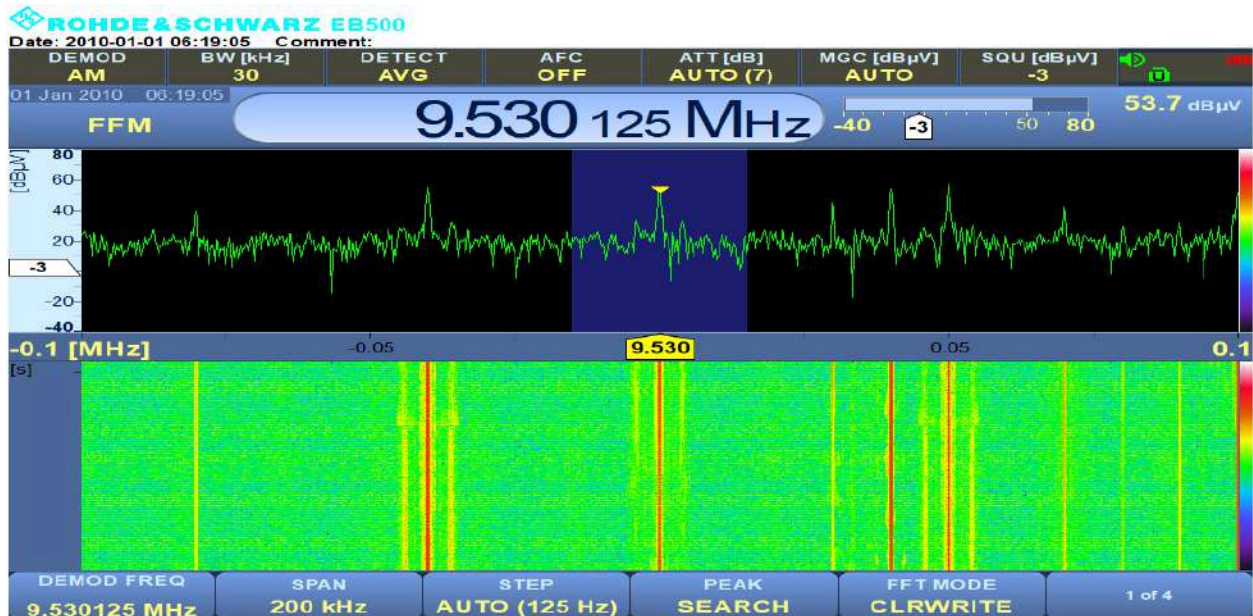
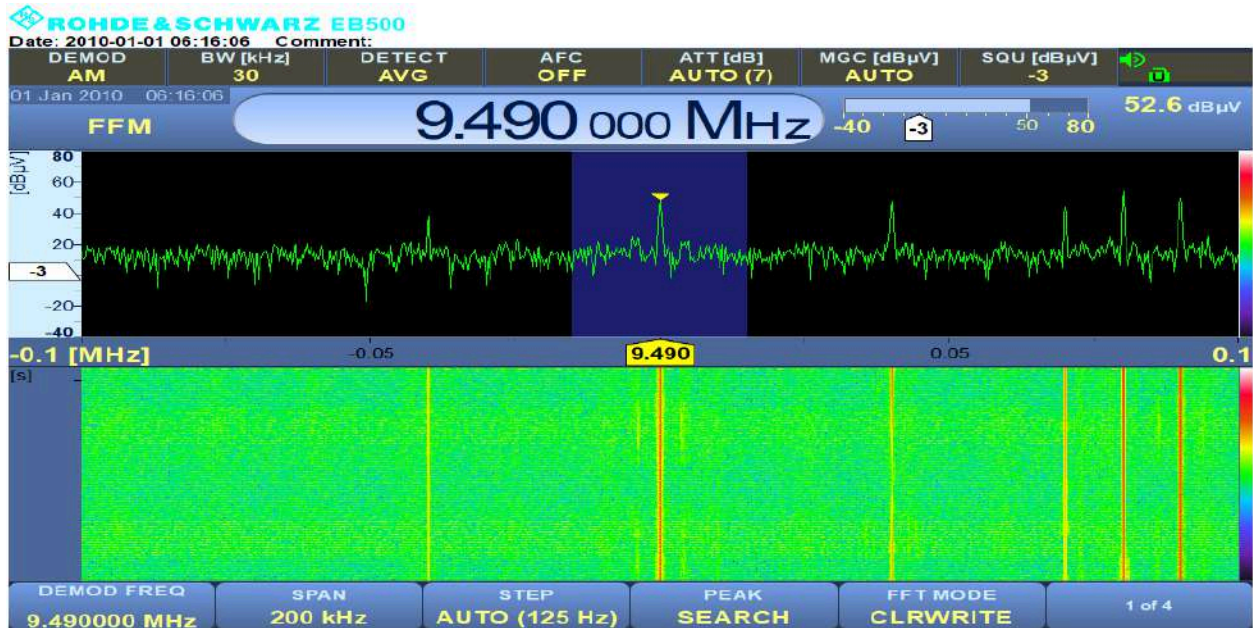
Name: UMTS 3G September 25
Mode: Frequency Range
Freq. Range: 860.00 MHz - 899.00 MHz
RBW: 25.00 kHz
Step Width: 24.73 kHz
Start Time: 9/19/2025 8:50:00 AM
Stop Time: 9/19/2025 10:20:00 AM
Duration: 1 Hour 30 Minutes 0 Second

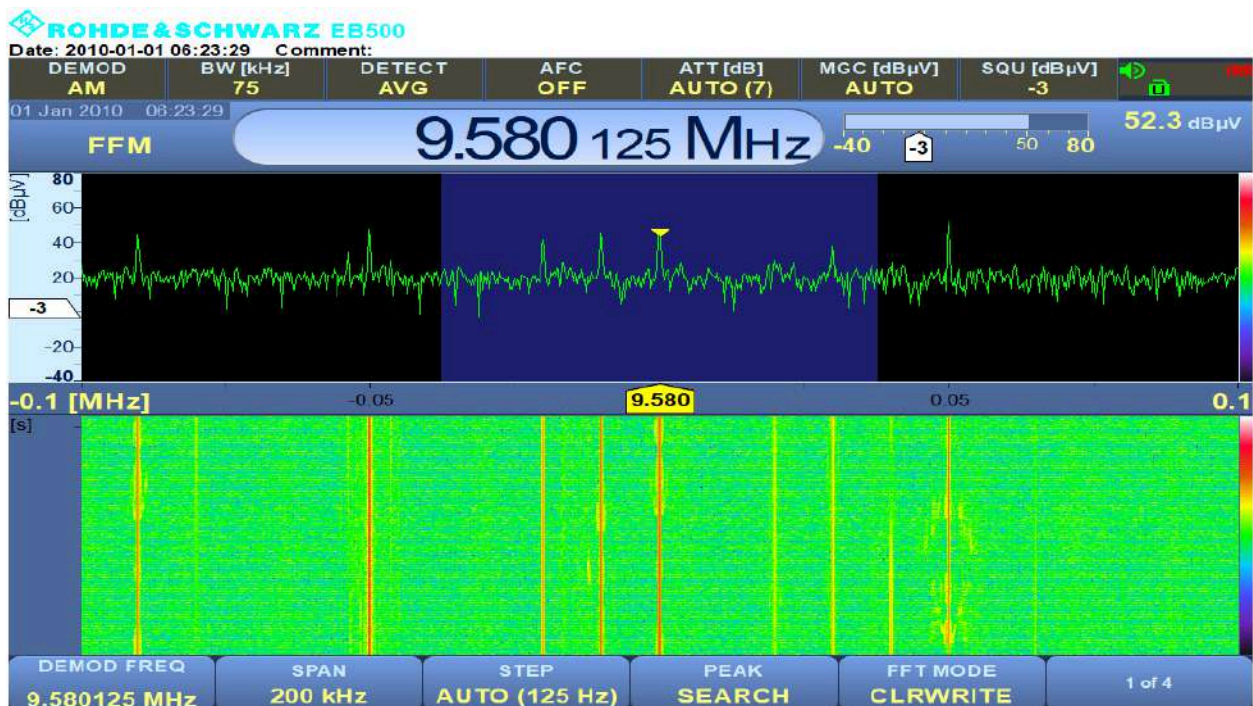
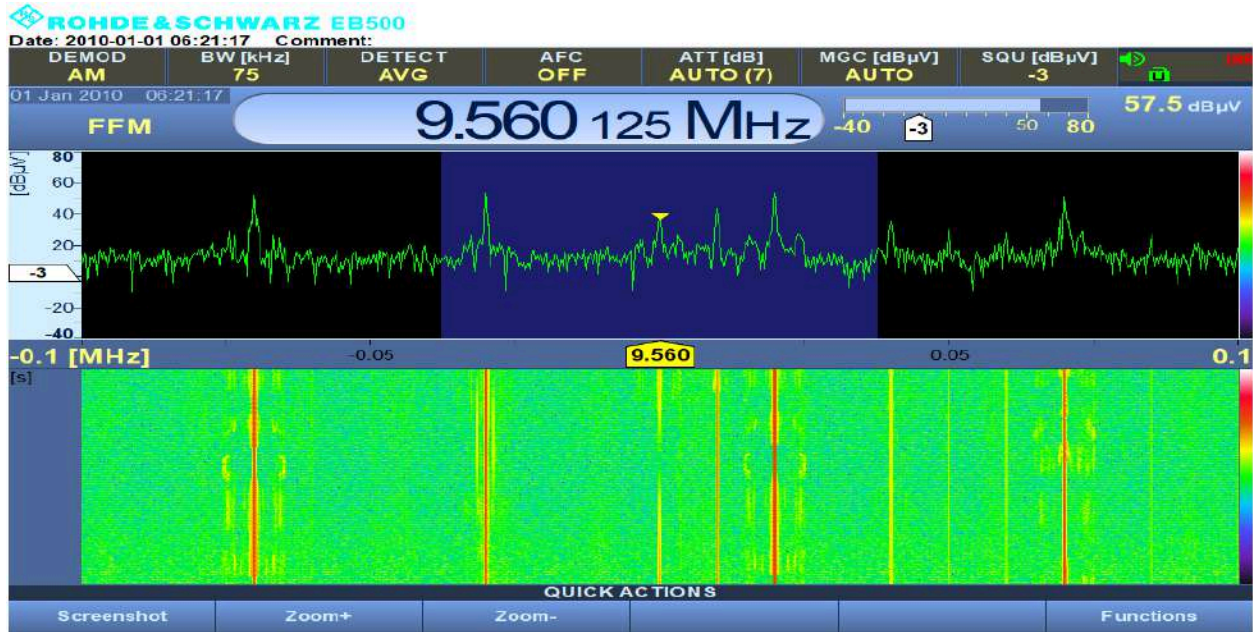
Receiver Settings

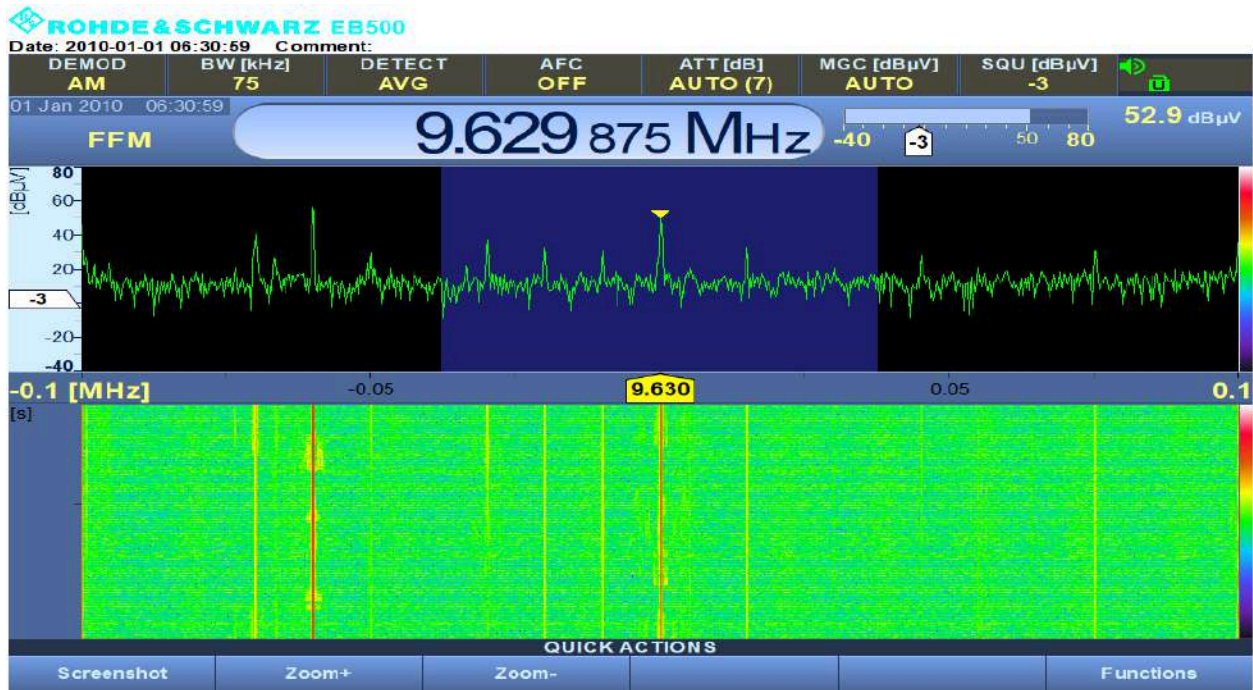
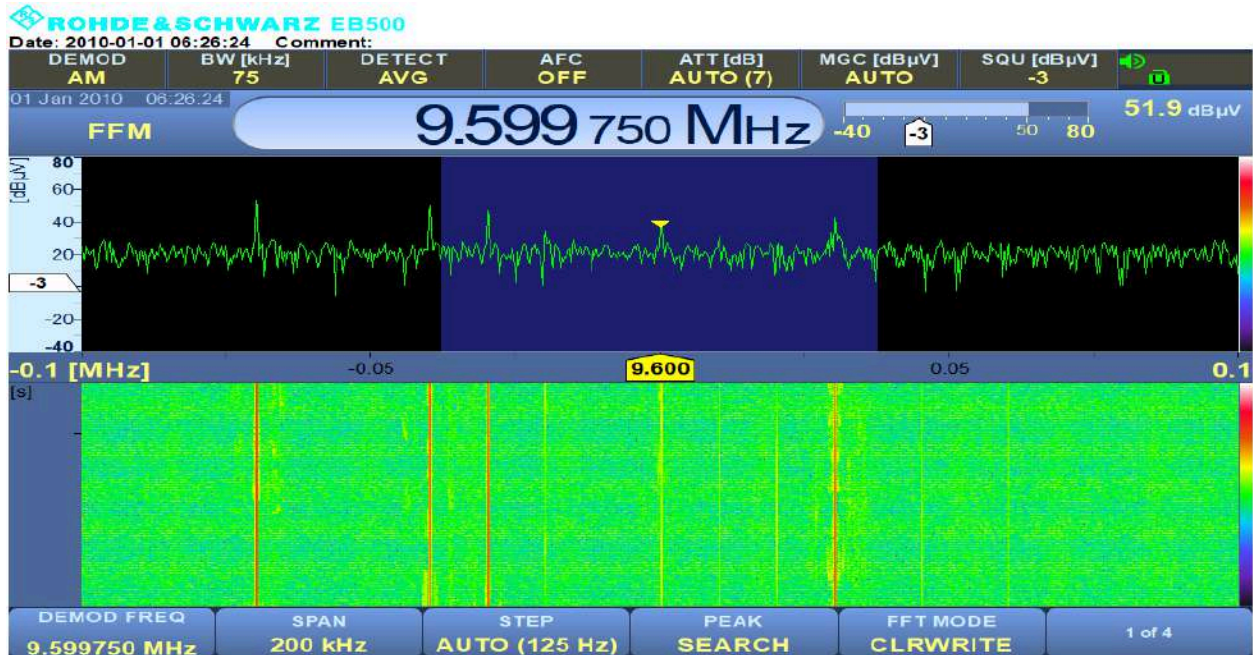
Channel Name	Main Frequency	Band width	Occupancy [%]		
			Max	Avg	Min
S1	868.50 MHz	5.00 MHz	95	93	89
S2	873.50 MHz	5.00 MHz	95	94	91
S3	878.50 MHz	5.00 MHz	100	100	100
S4	883.50 MHz	5.00 MHz	100	100	100
S5	888.50 MHz	5.00 MHz	100	100	100
S6	893.50 MHz	5.00 MHz	0	0	0

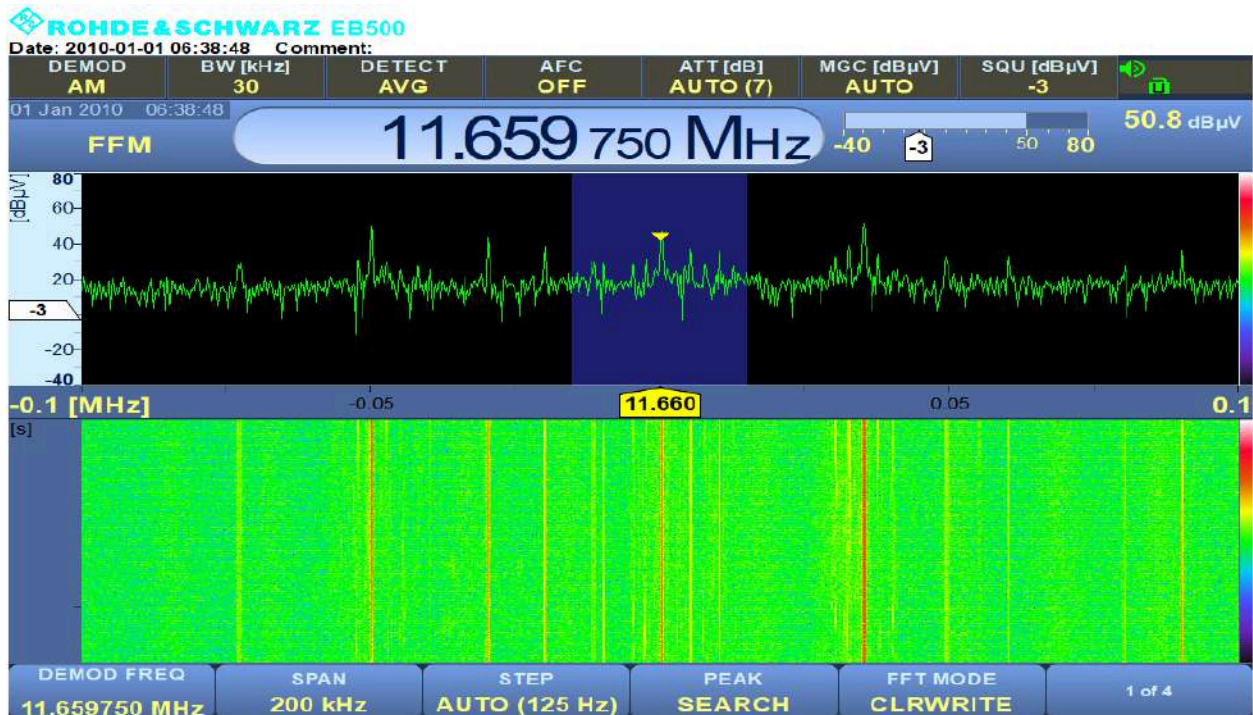
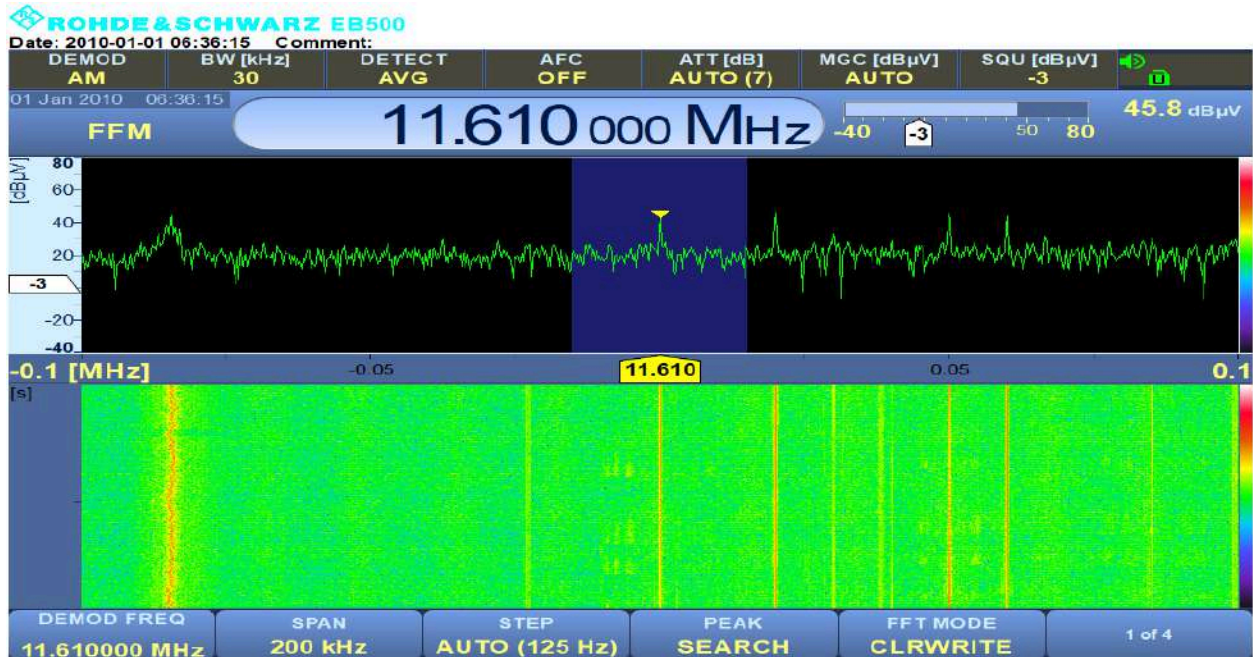
Annexures 4

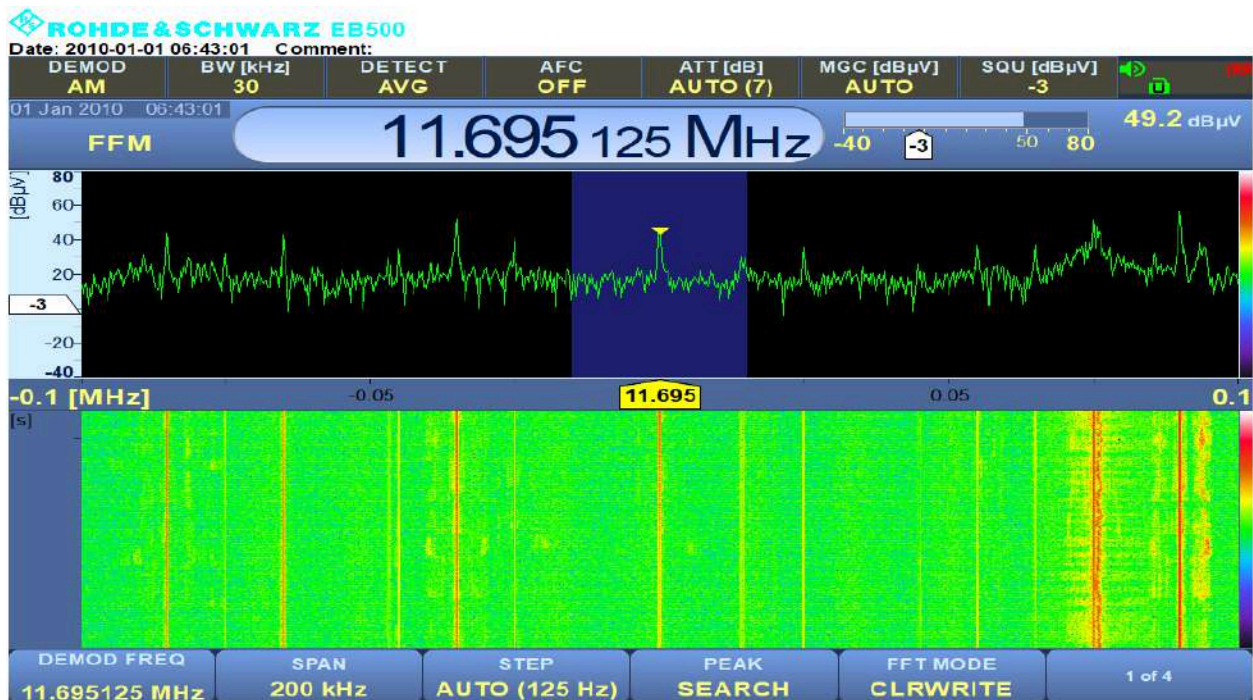
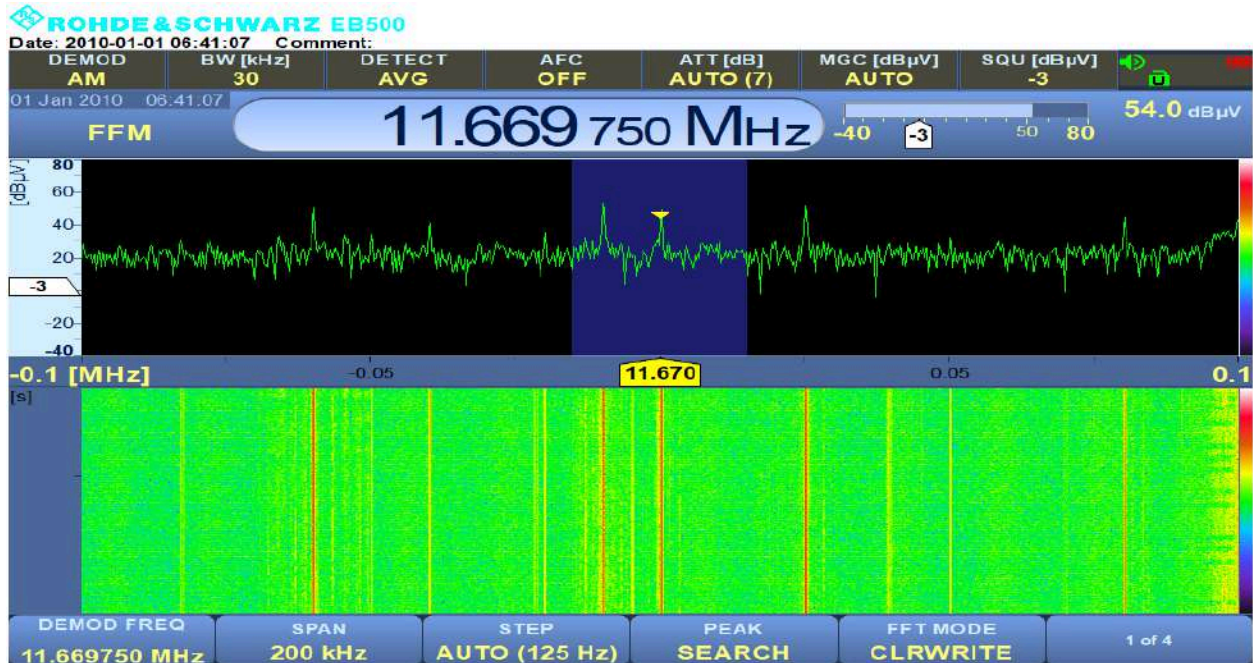
The following shows the signal detected during the Fixed Spectrum Monitoring in Tsirang for Short Wave Frequency monitoring from 9 MHz to 12 MHz

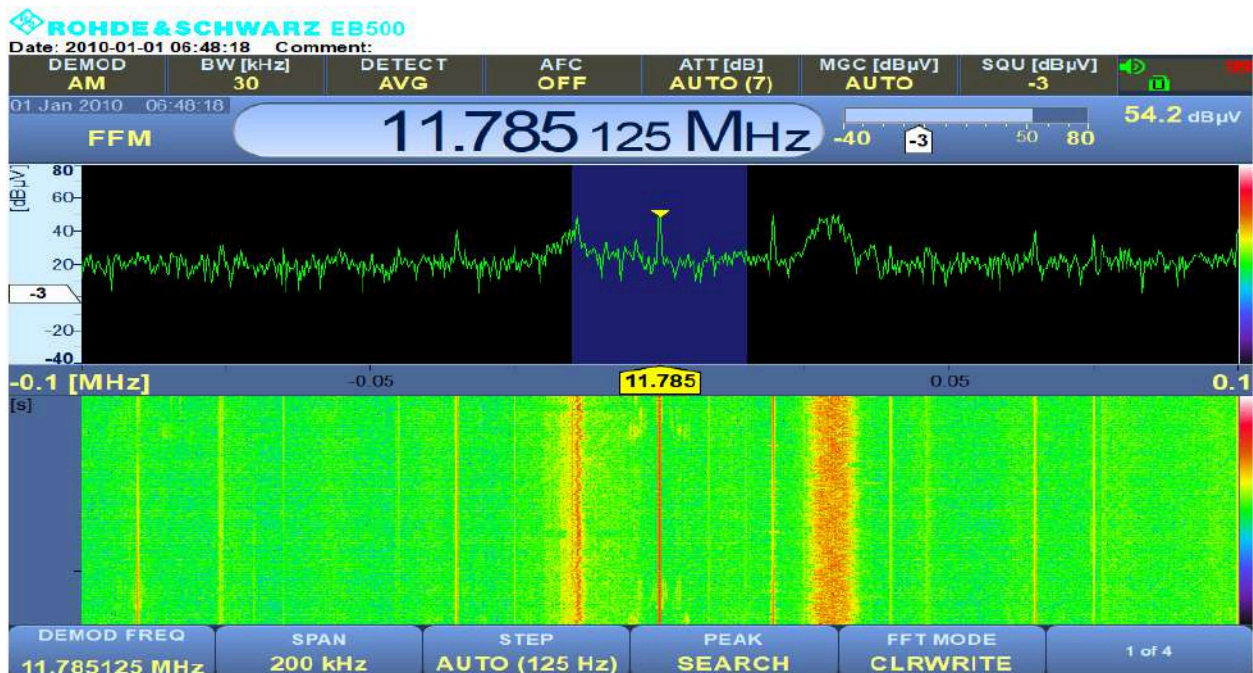
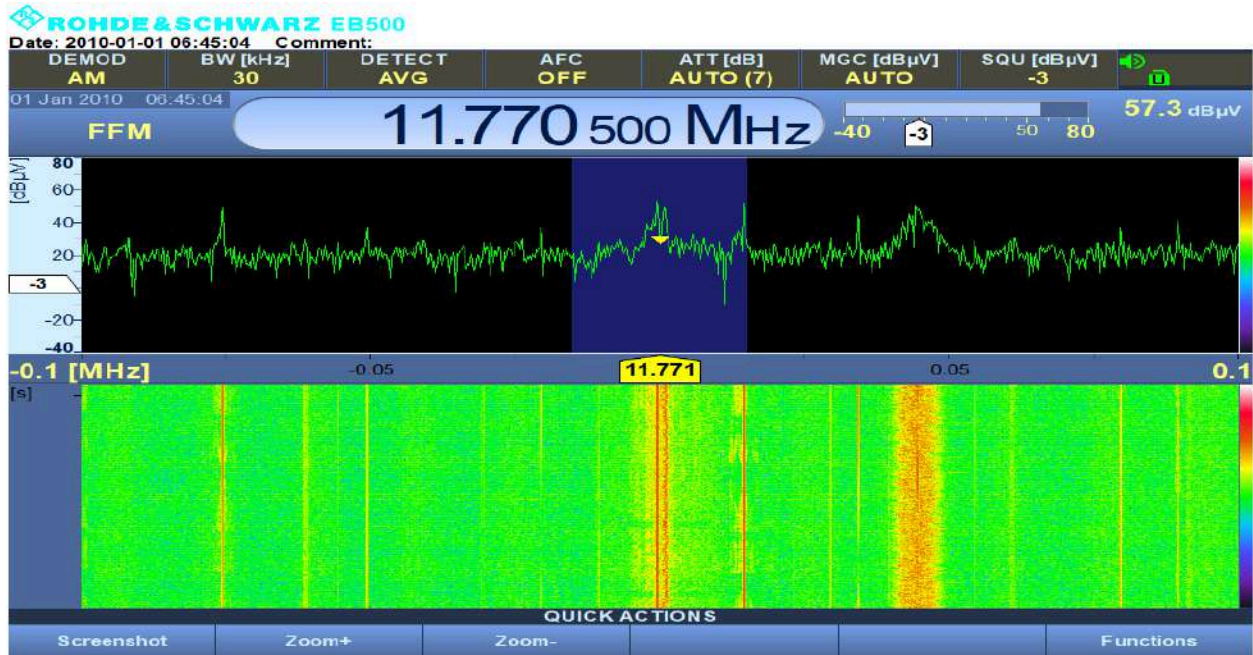


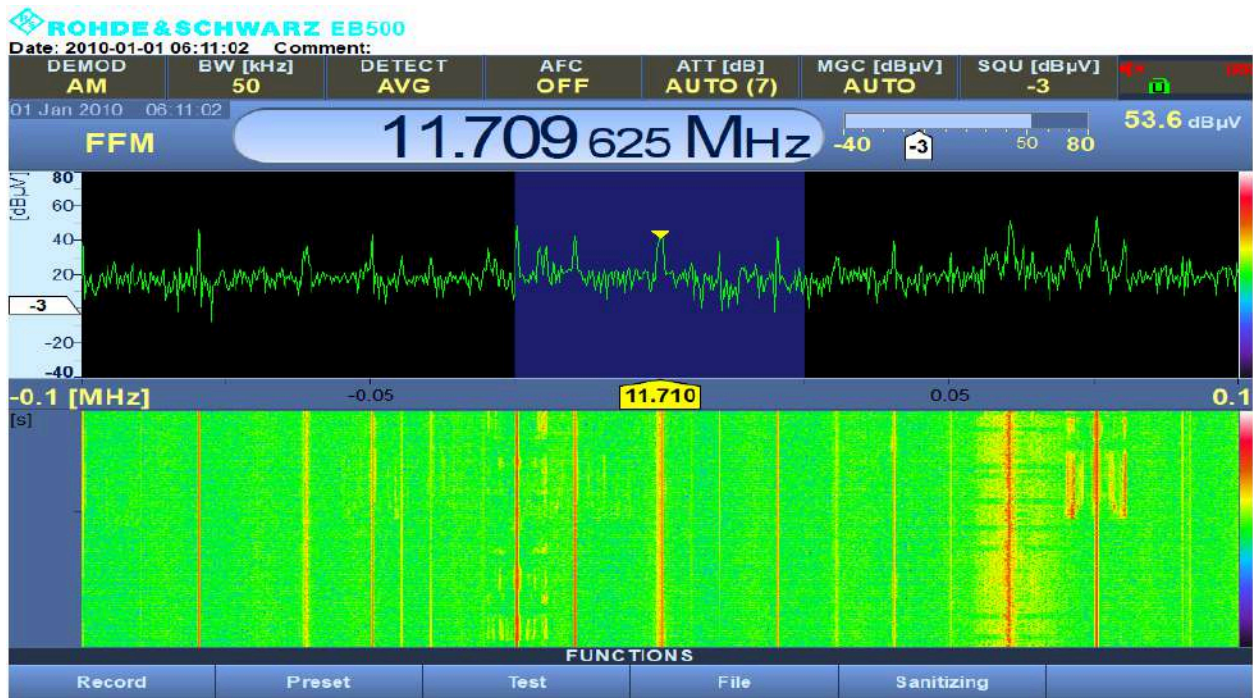
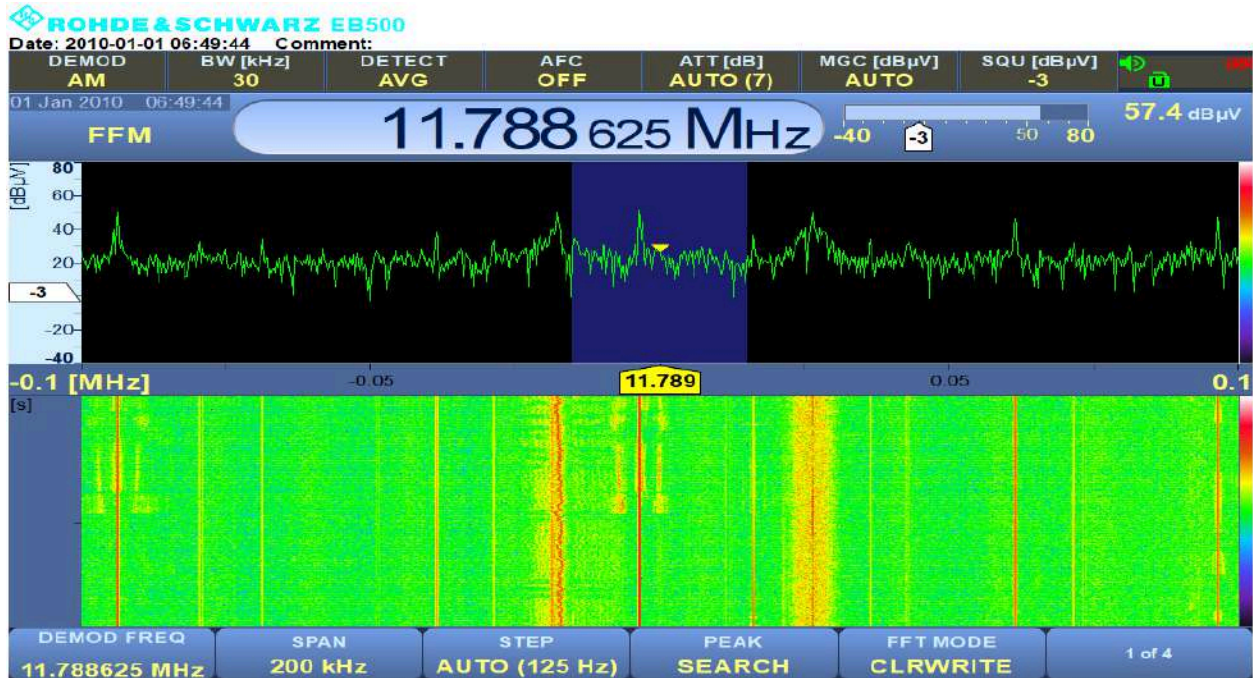


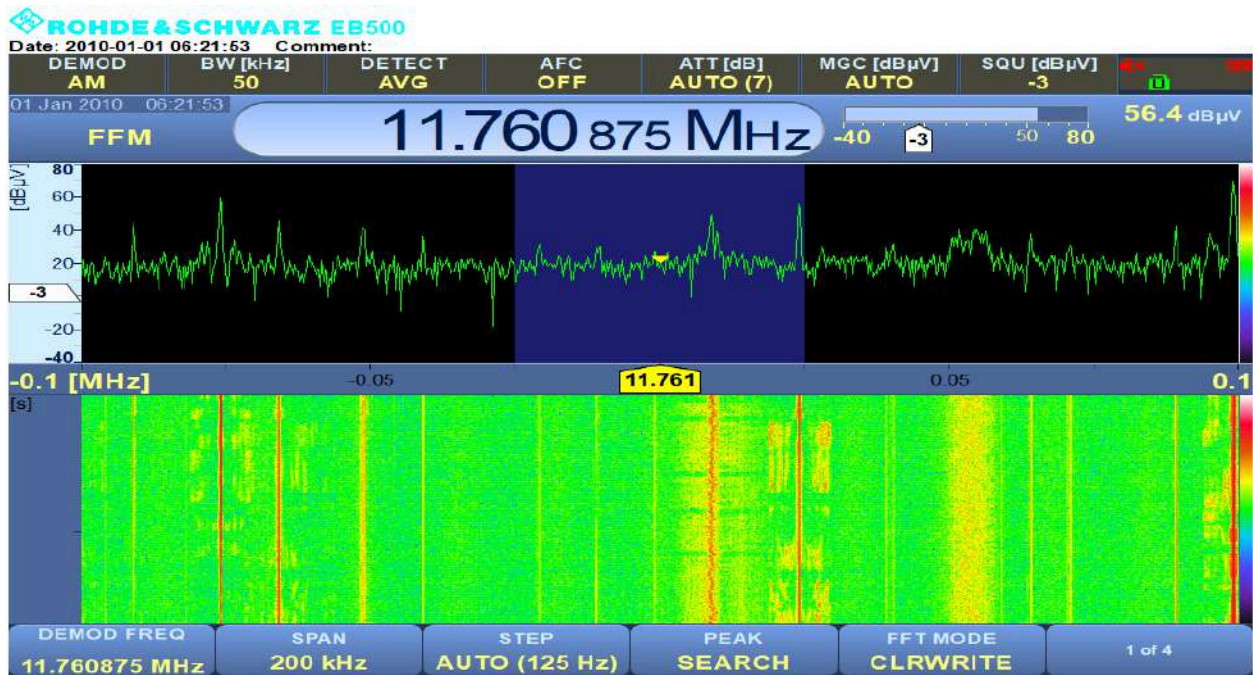
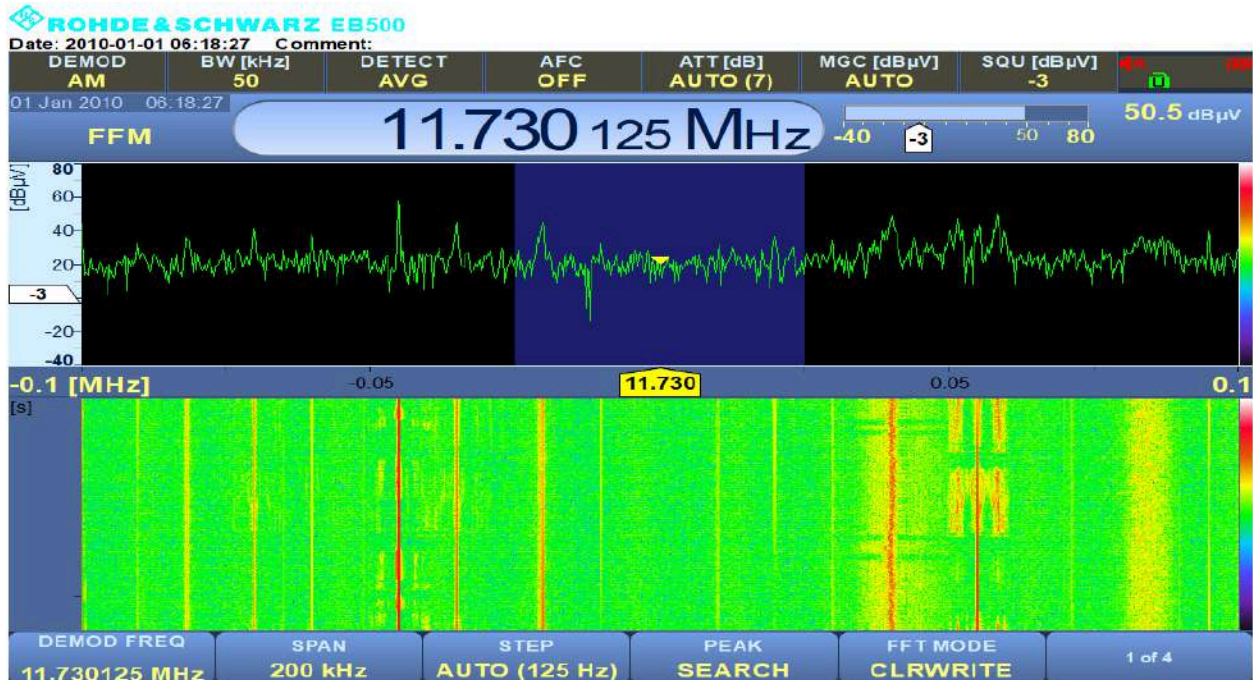


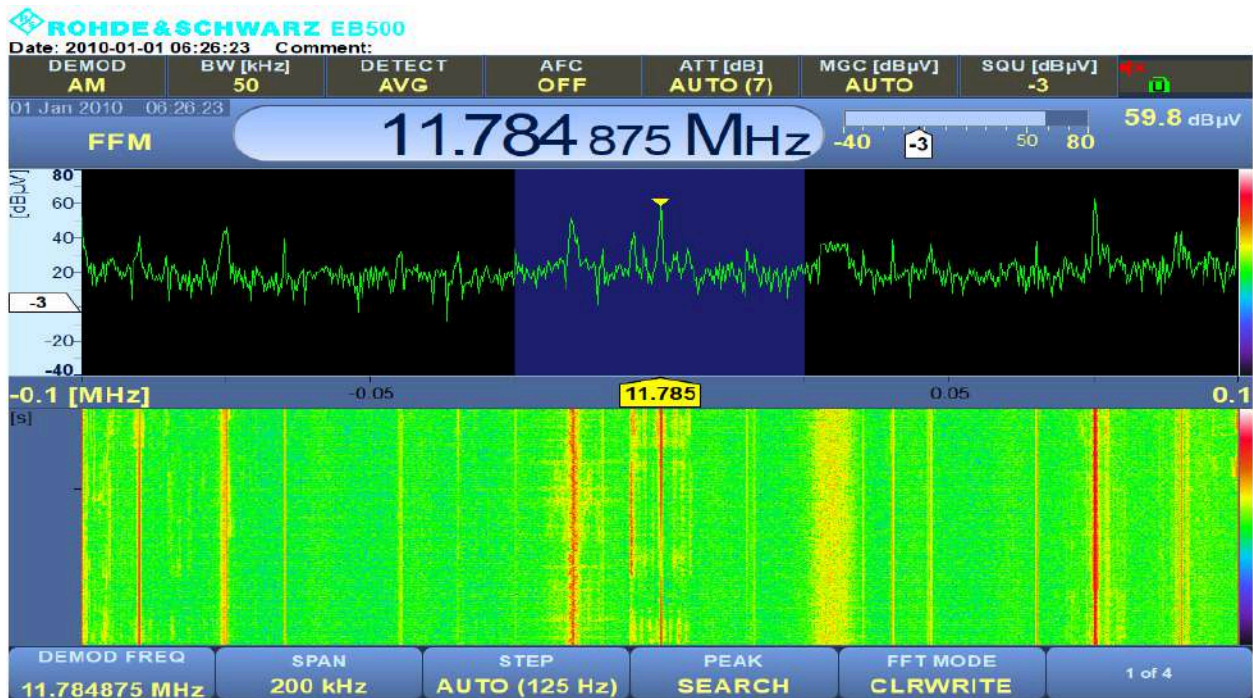
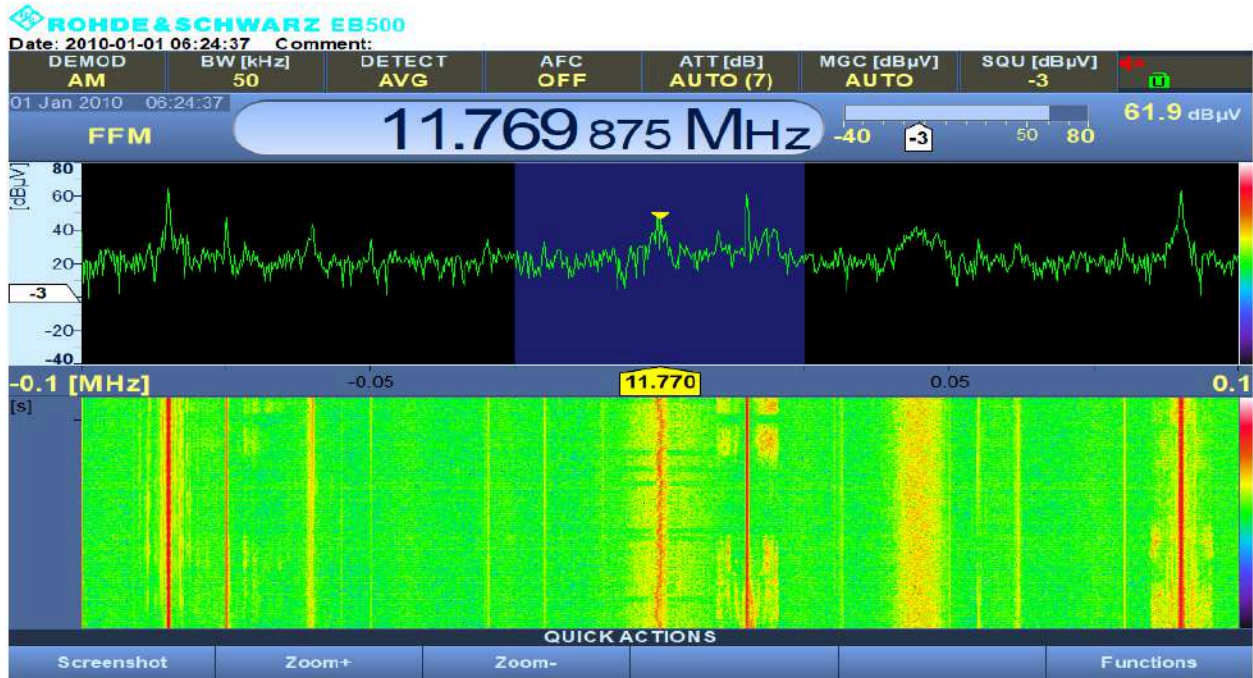


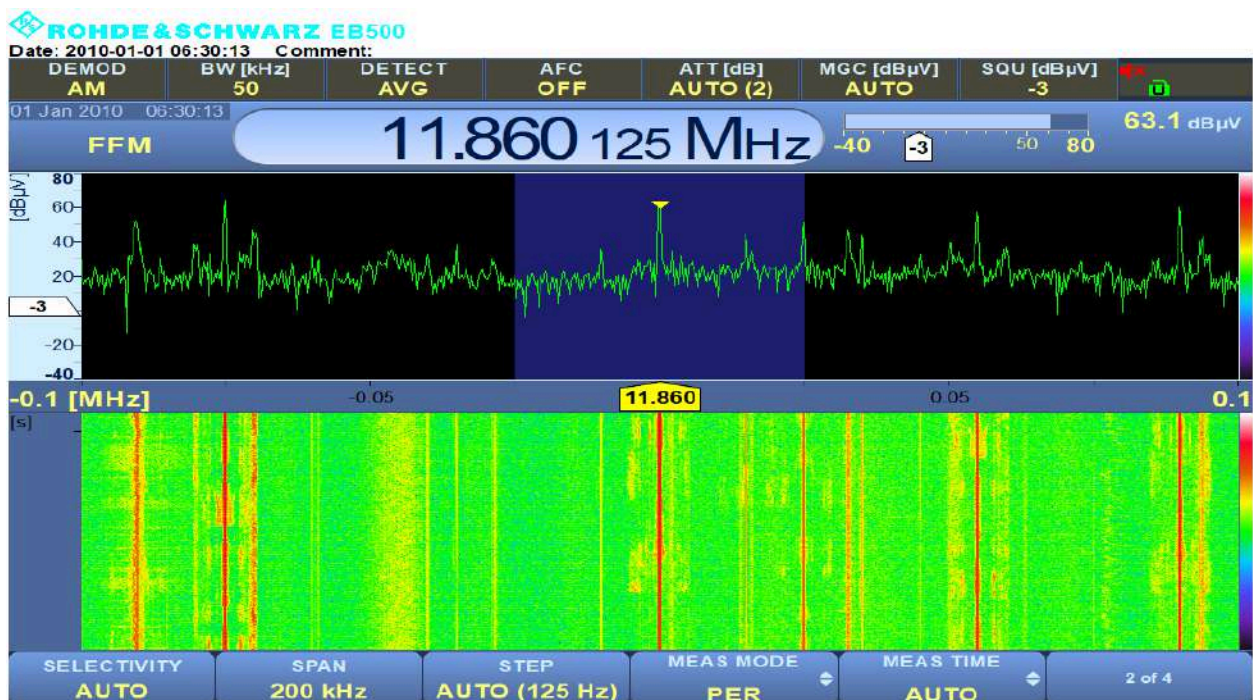
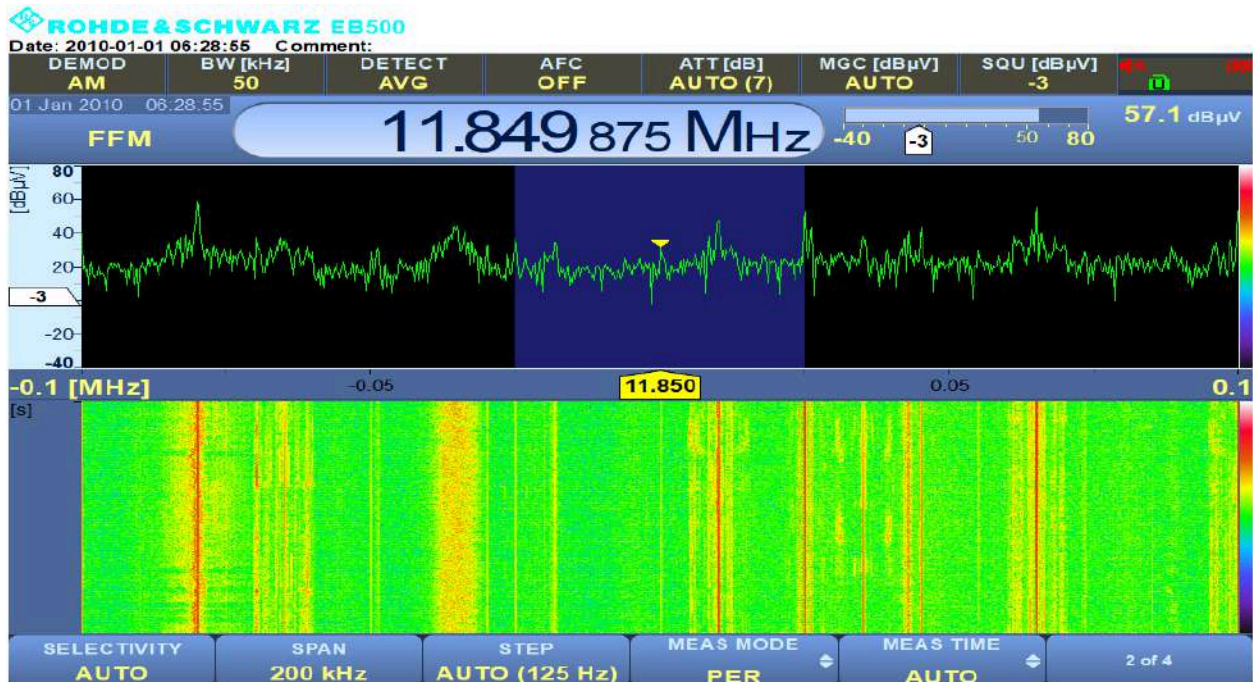


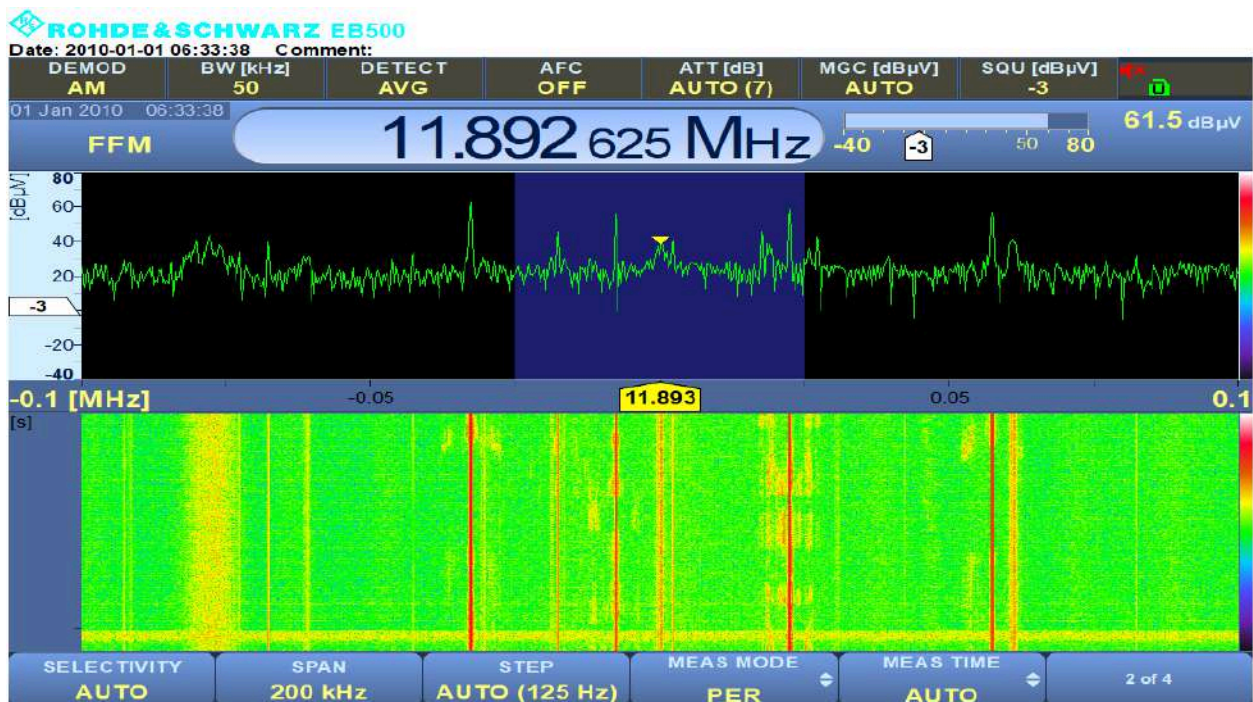
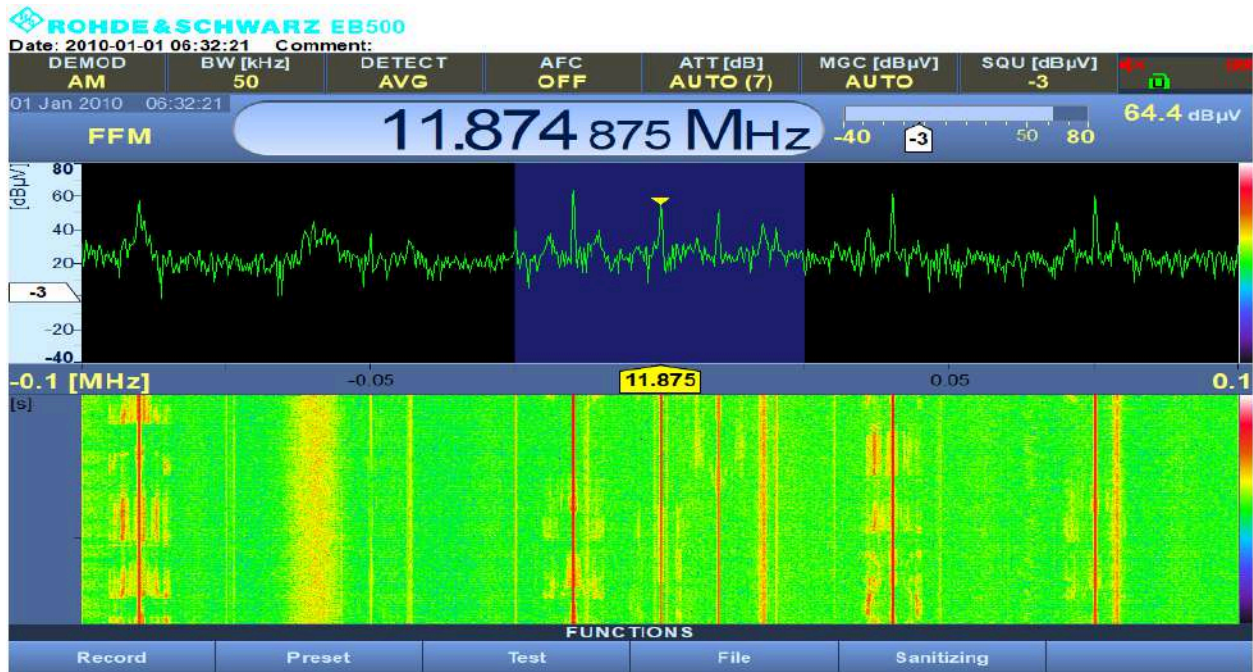


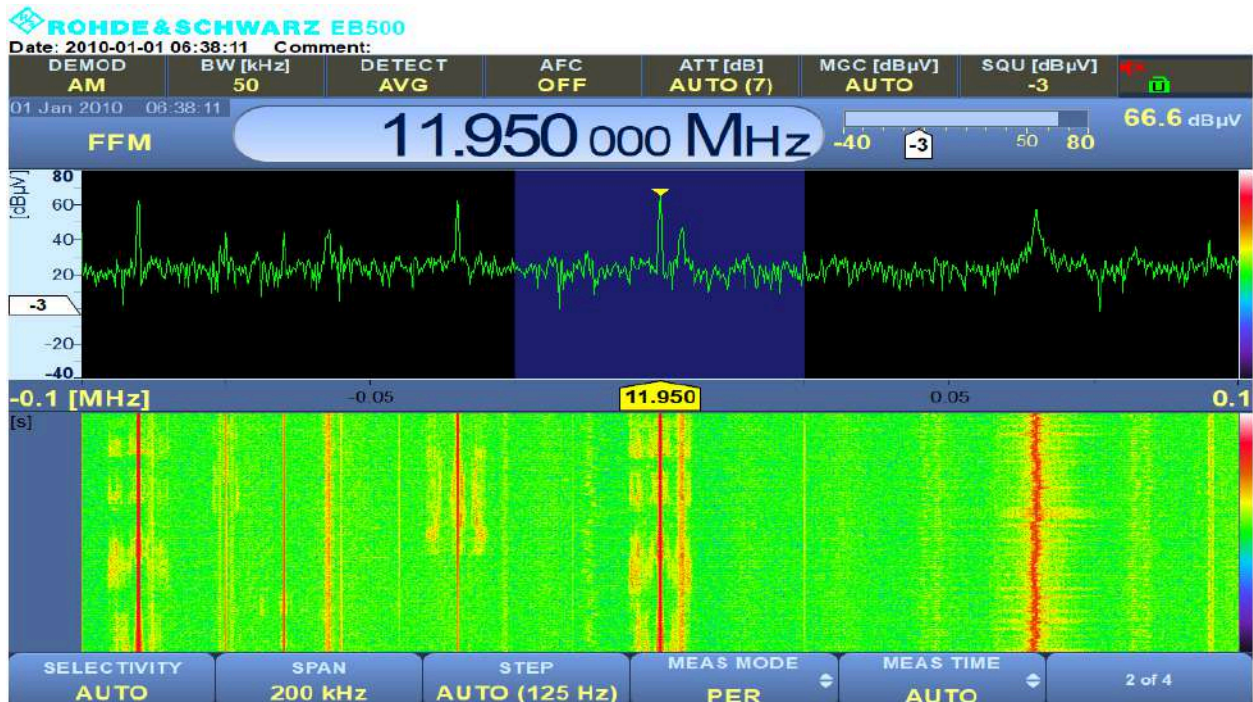
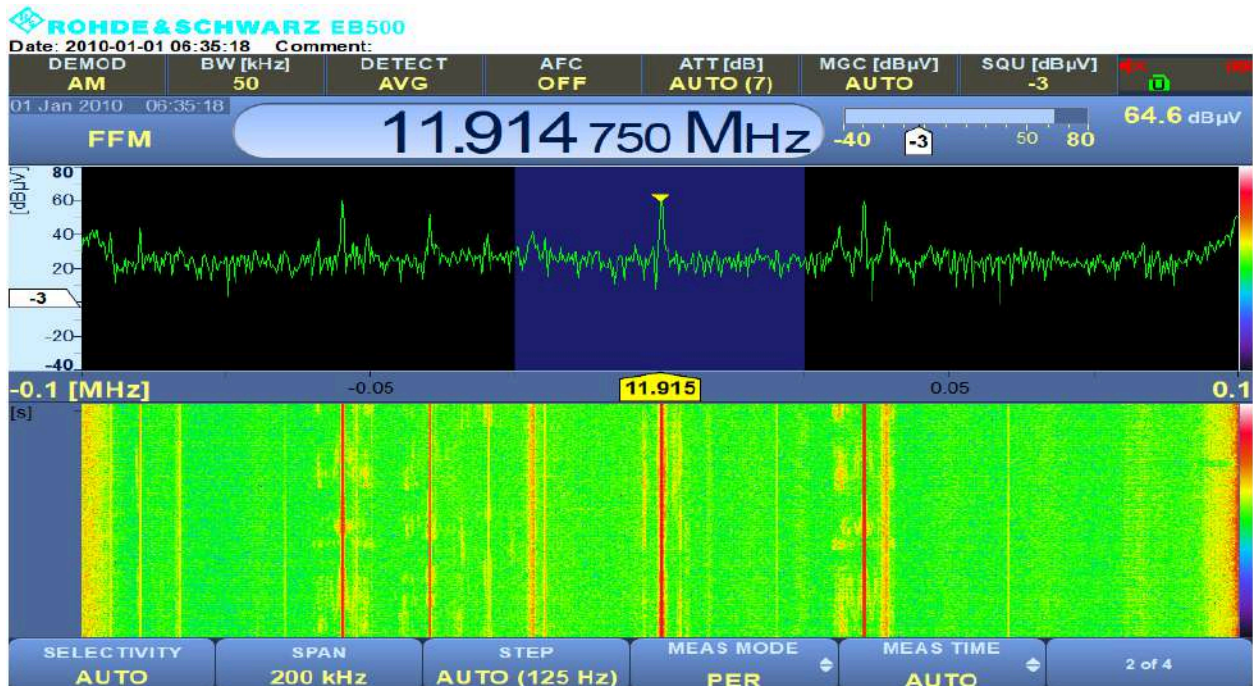








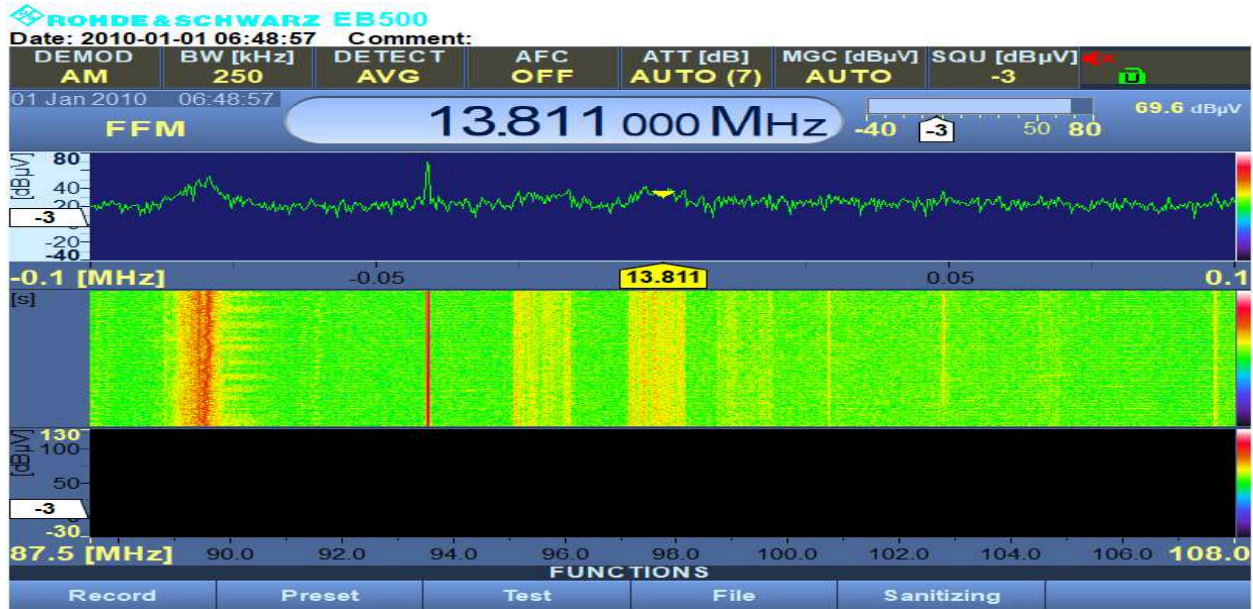




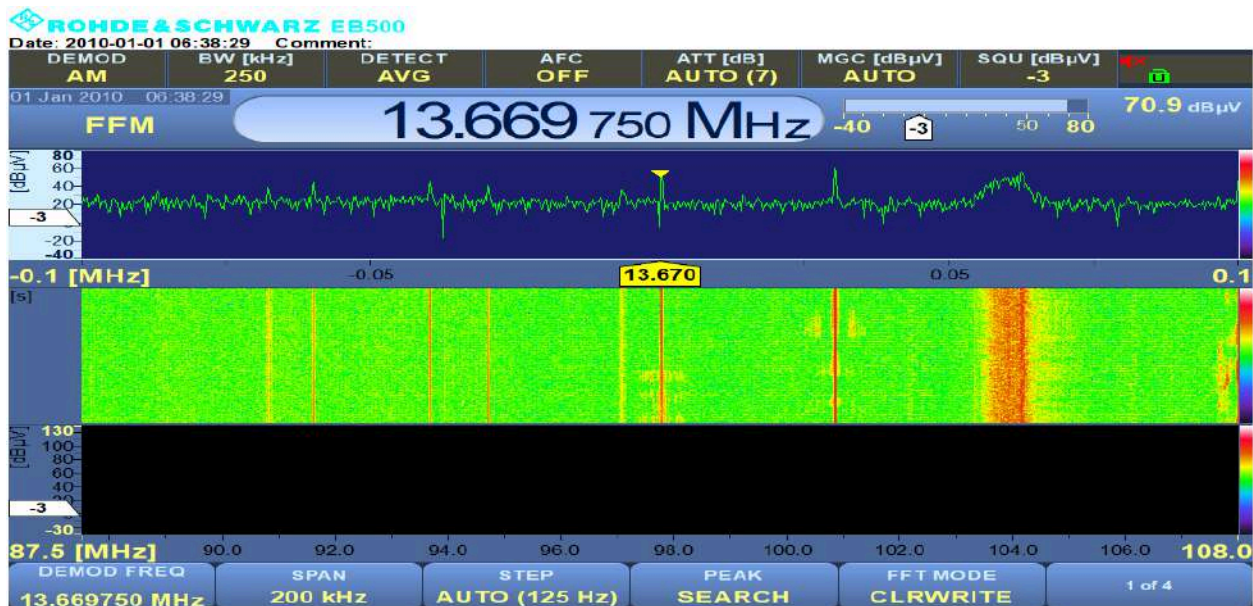
Annexures 5

The following shows the signal detected during the Fixed Spectrum Monitoring in Tsirang for Short Wave frequencies from 13 MHz to 15 MHz

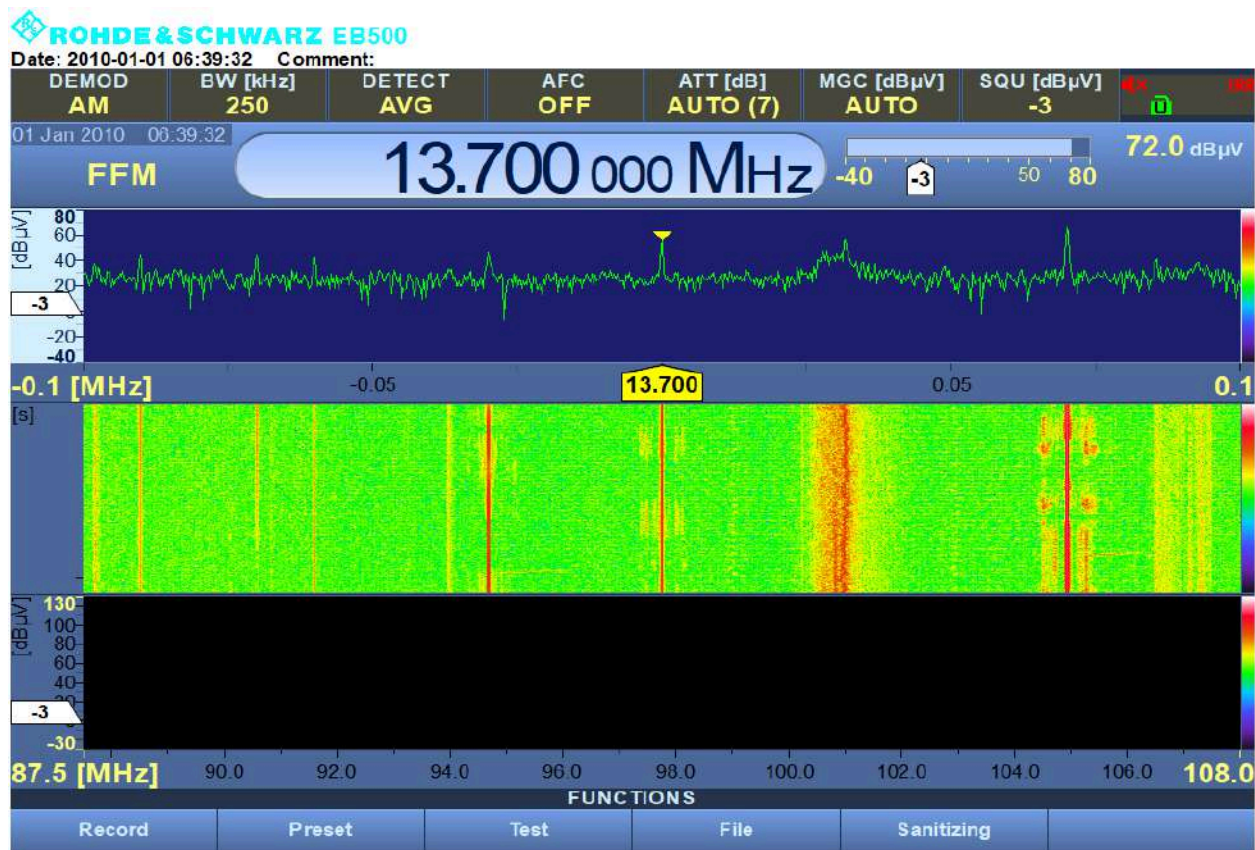
BC China



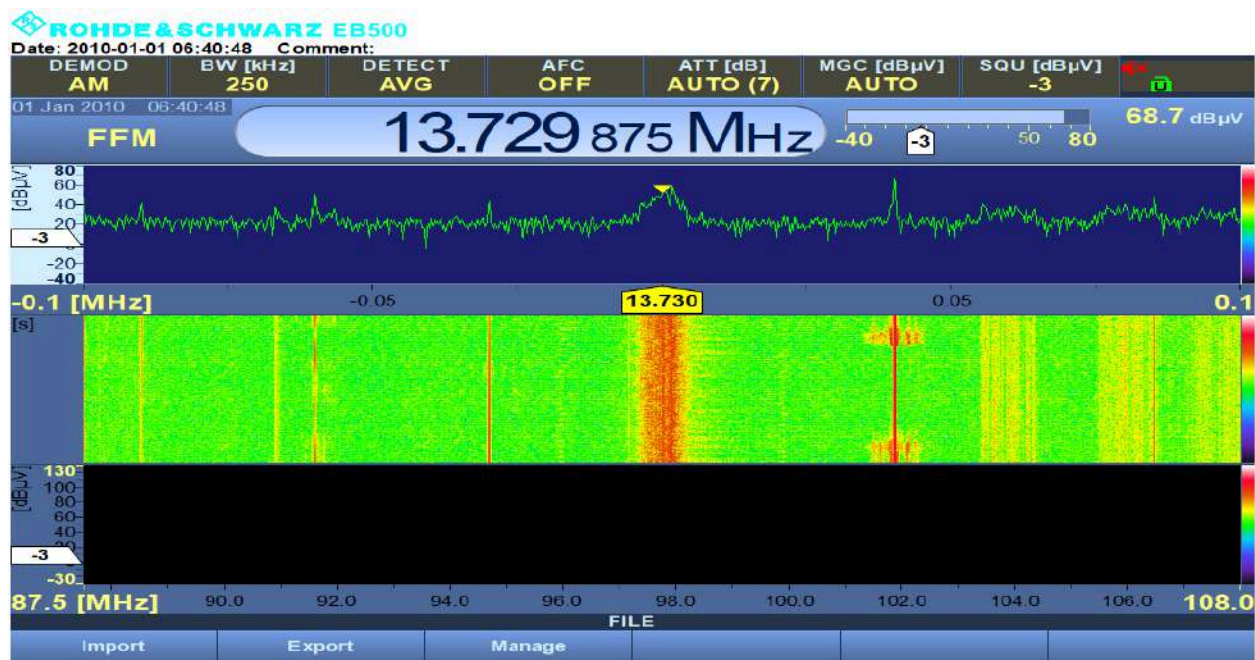
BC China



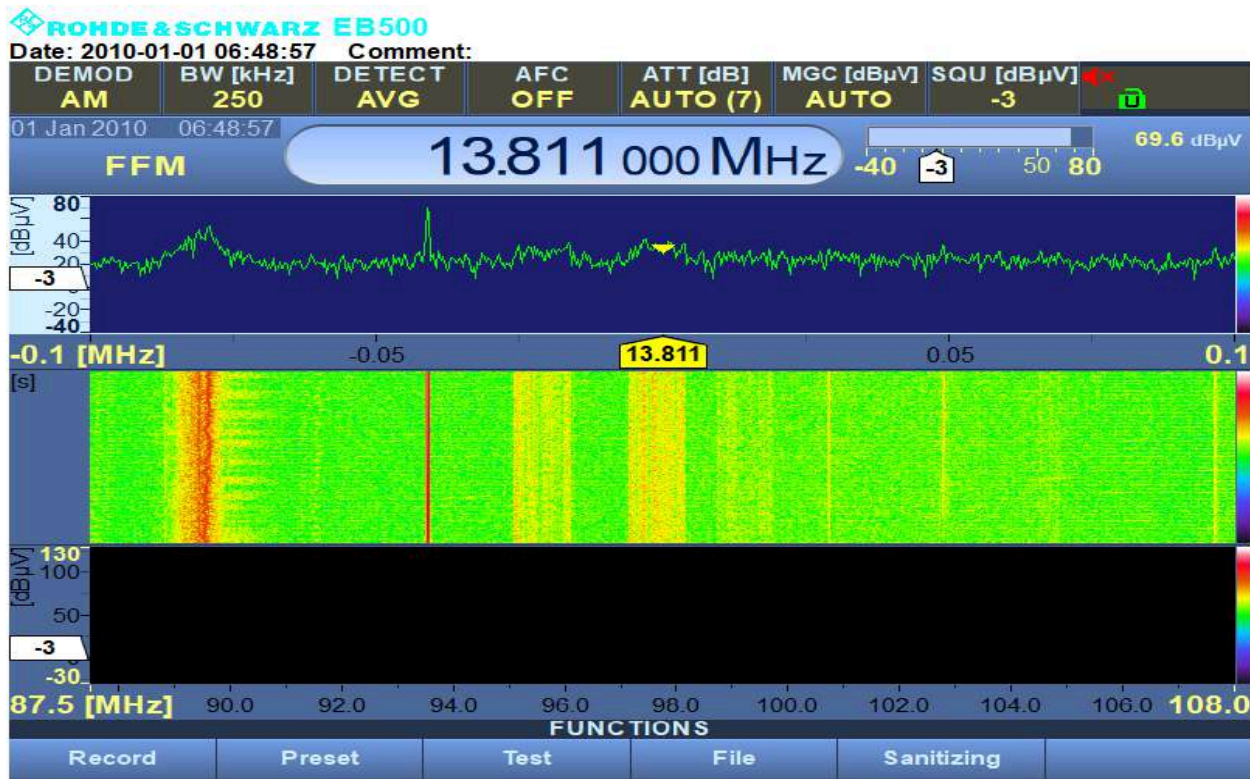
BC China



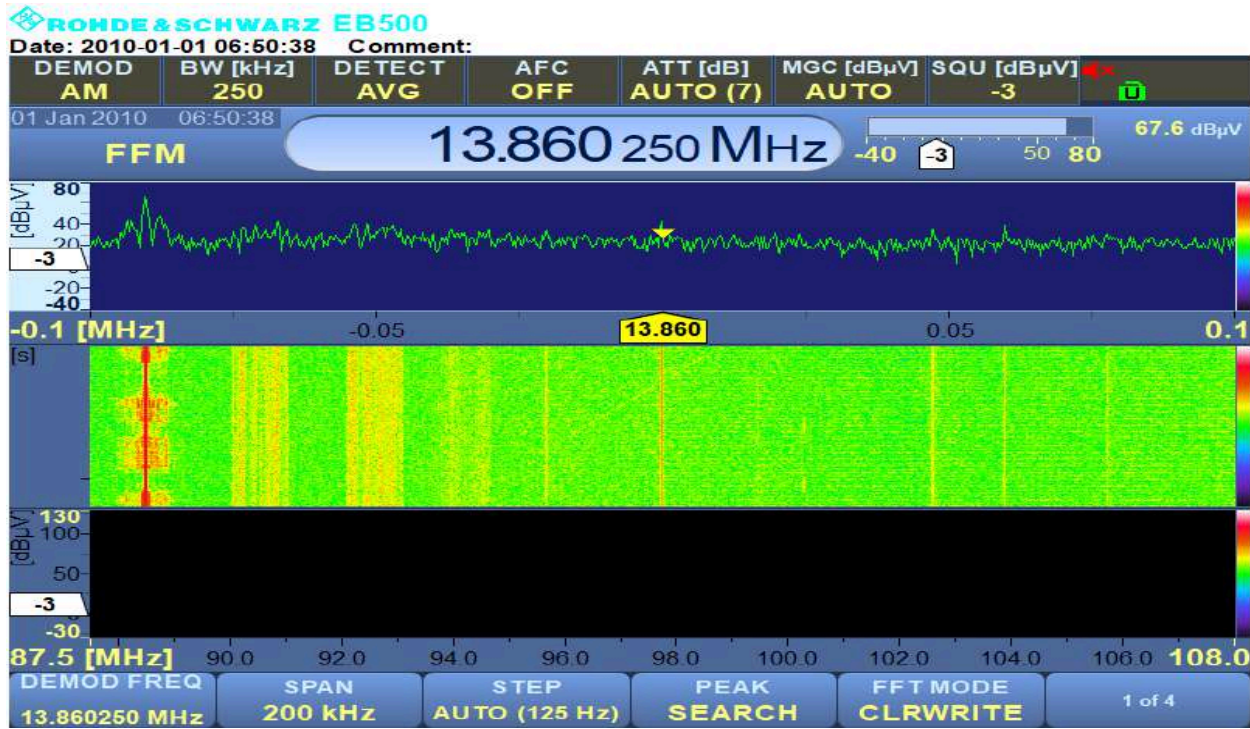
BC China



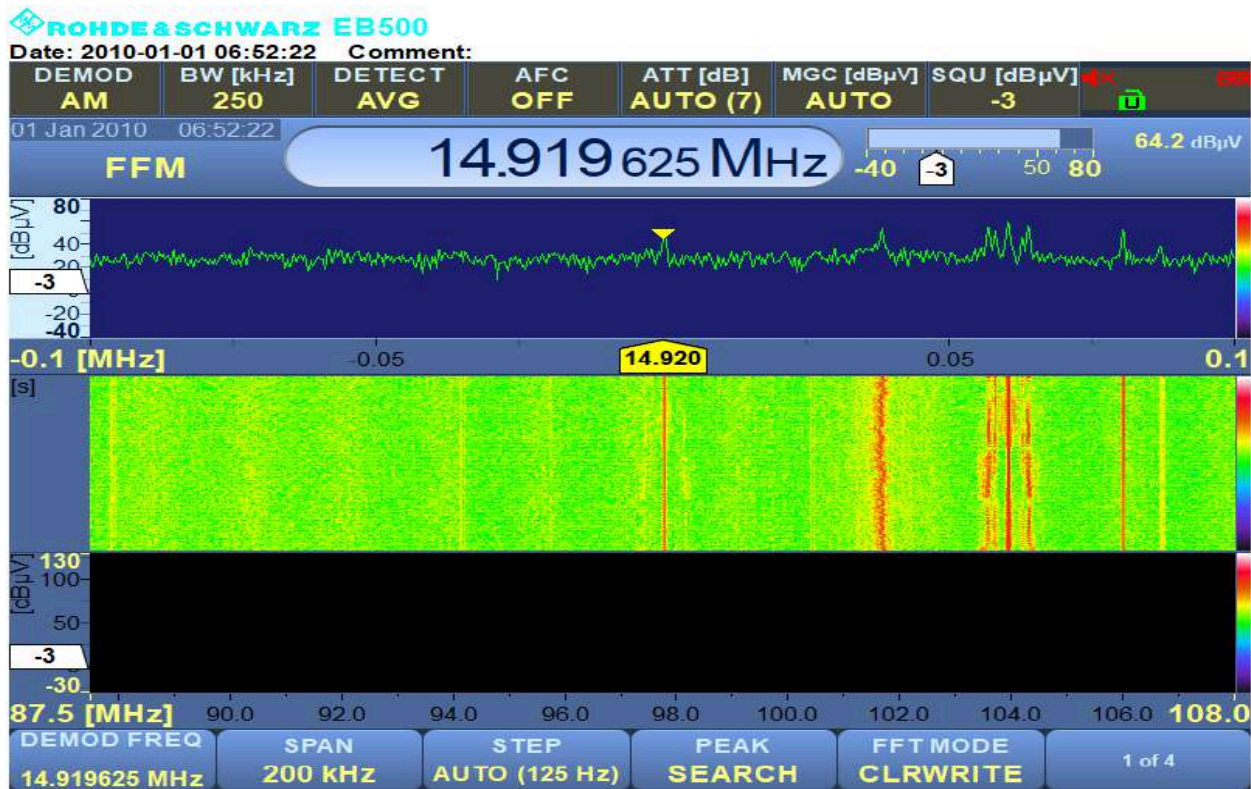
BC China



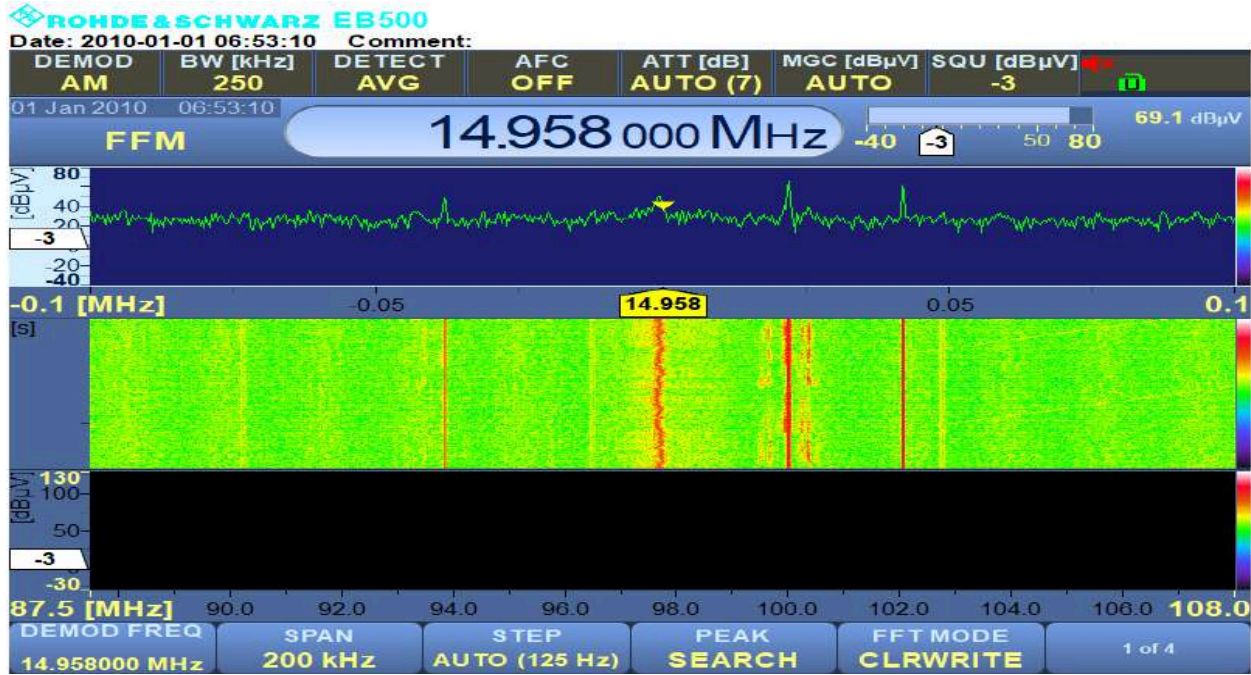
BC China



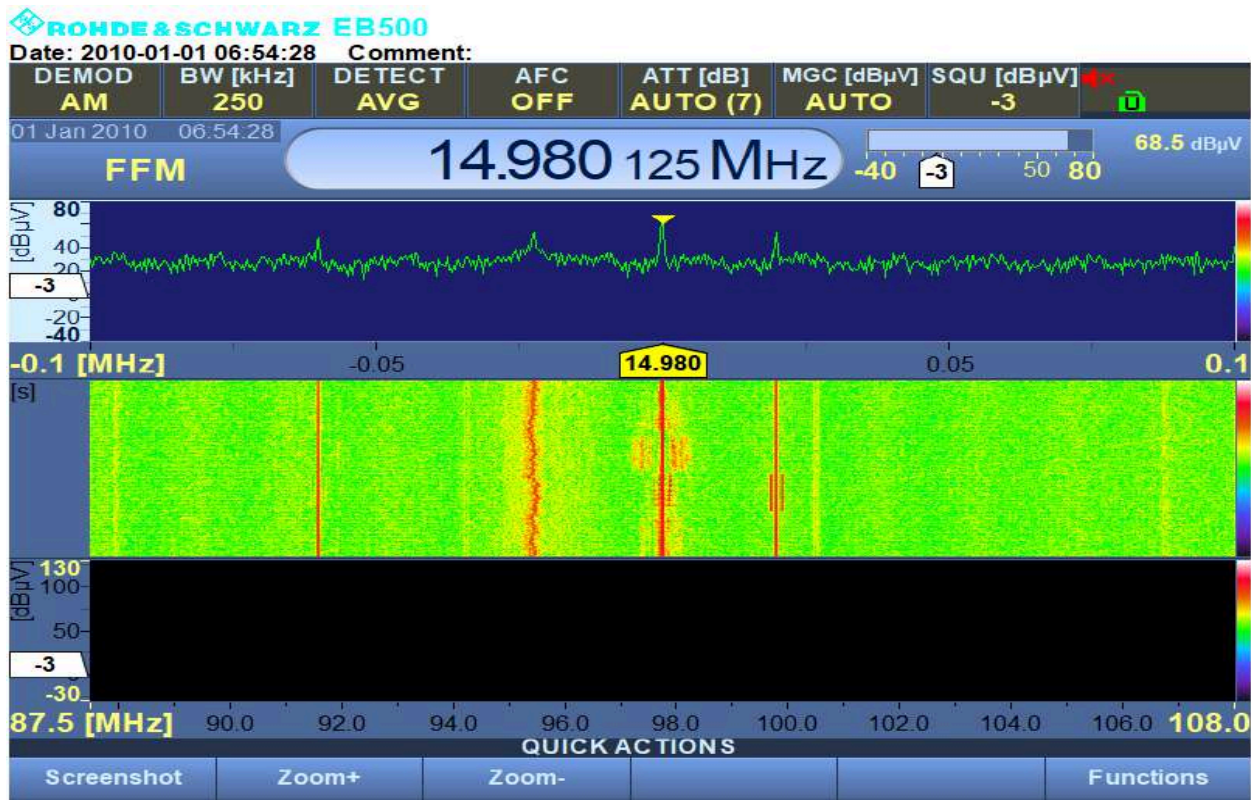
BC China



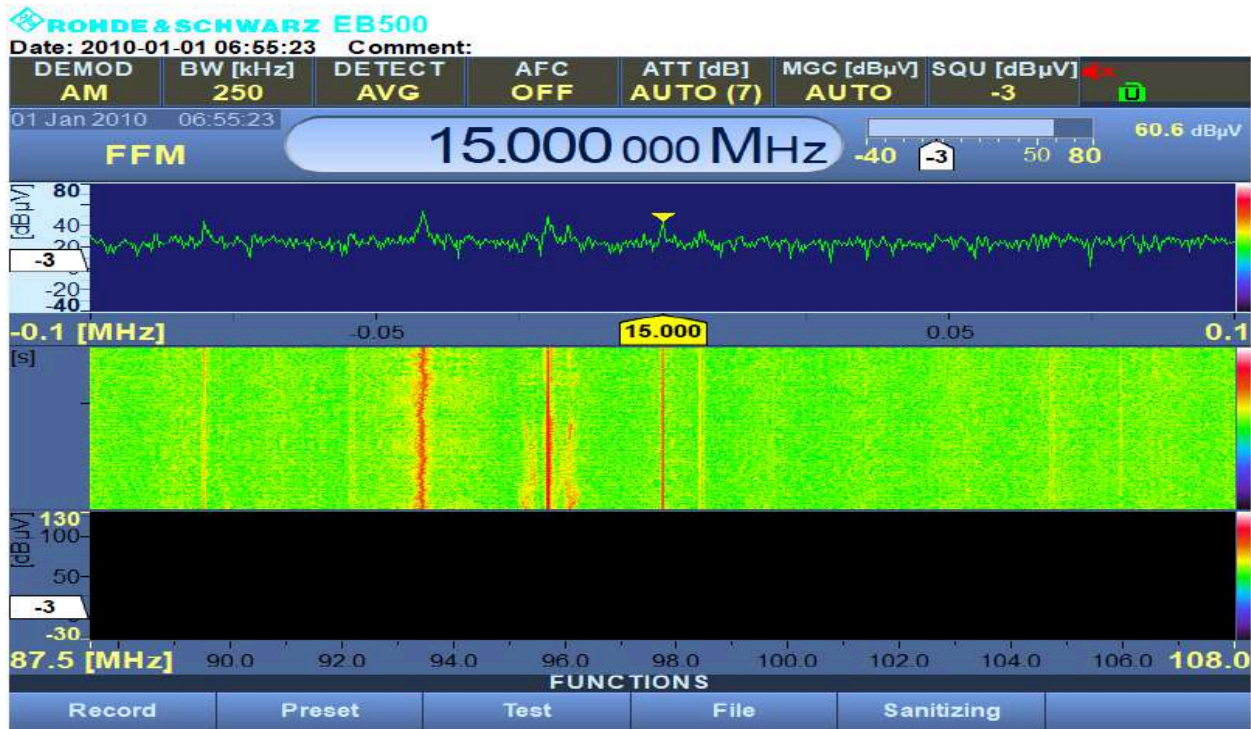
BC China



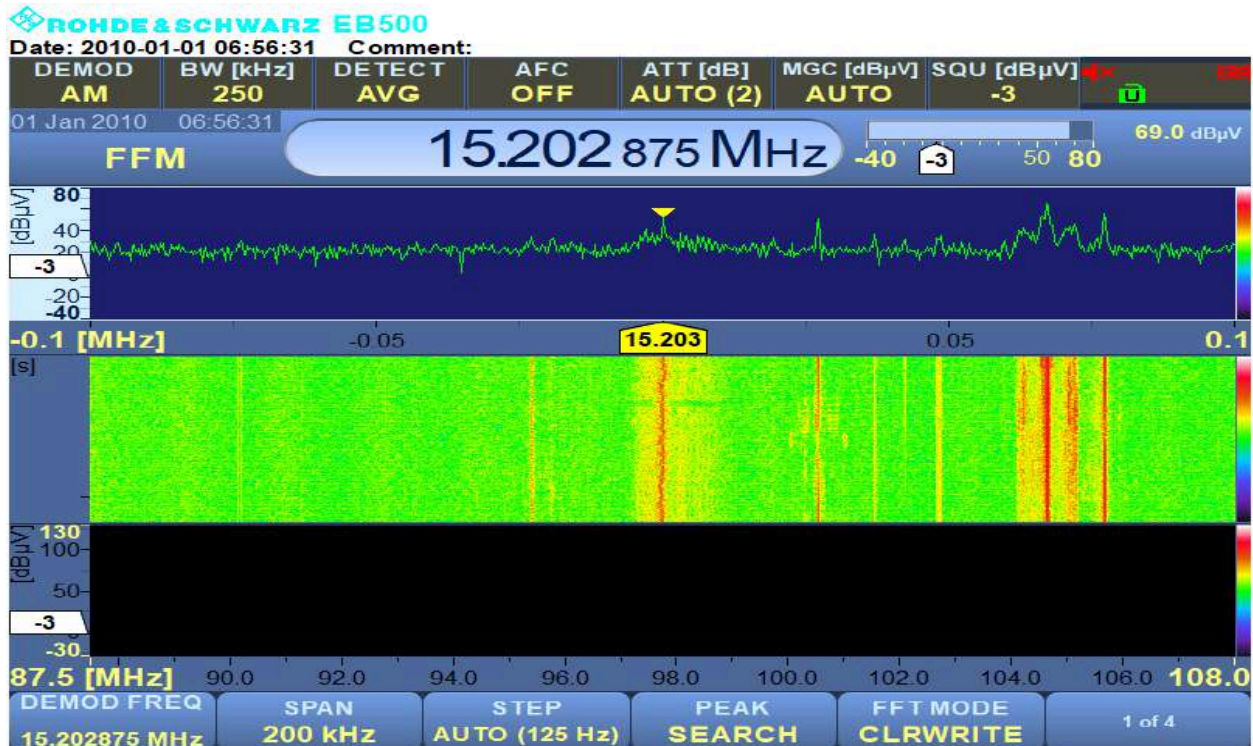
BC China



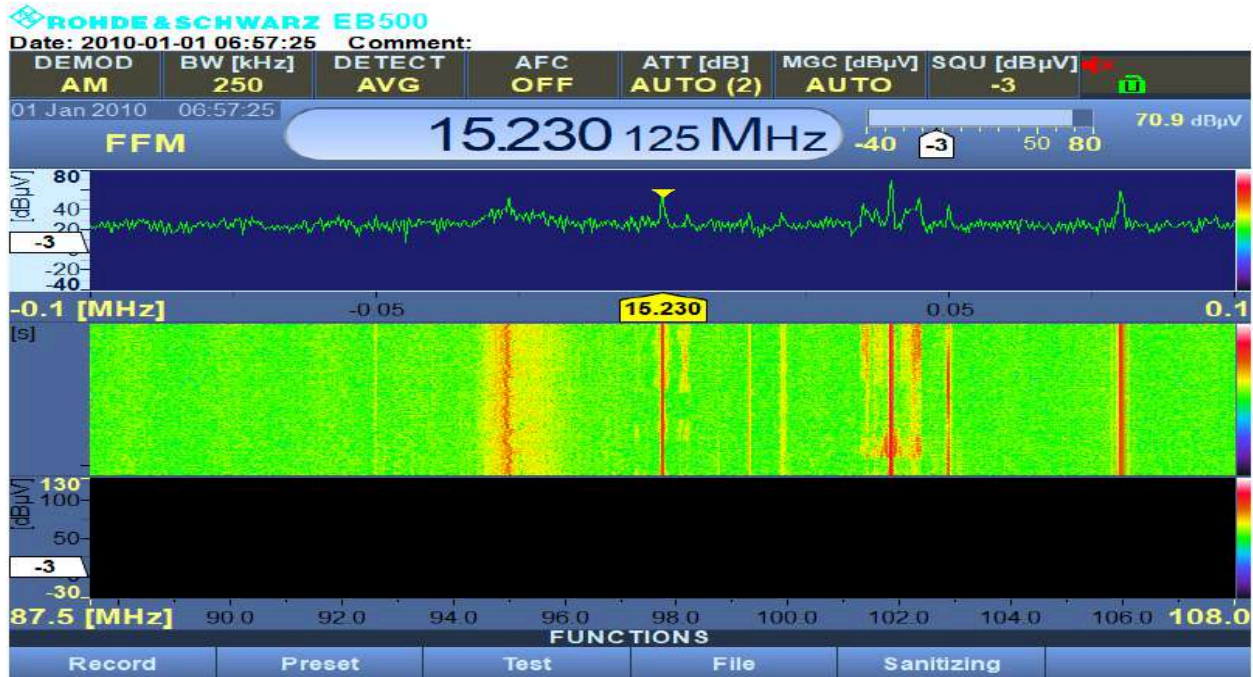
BC China



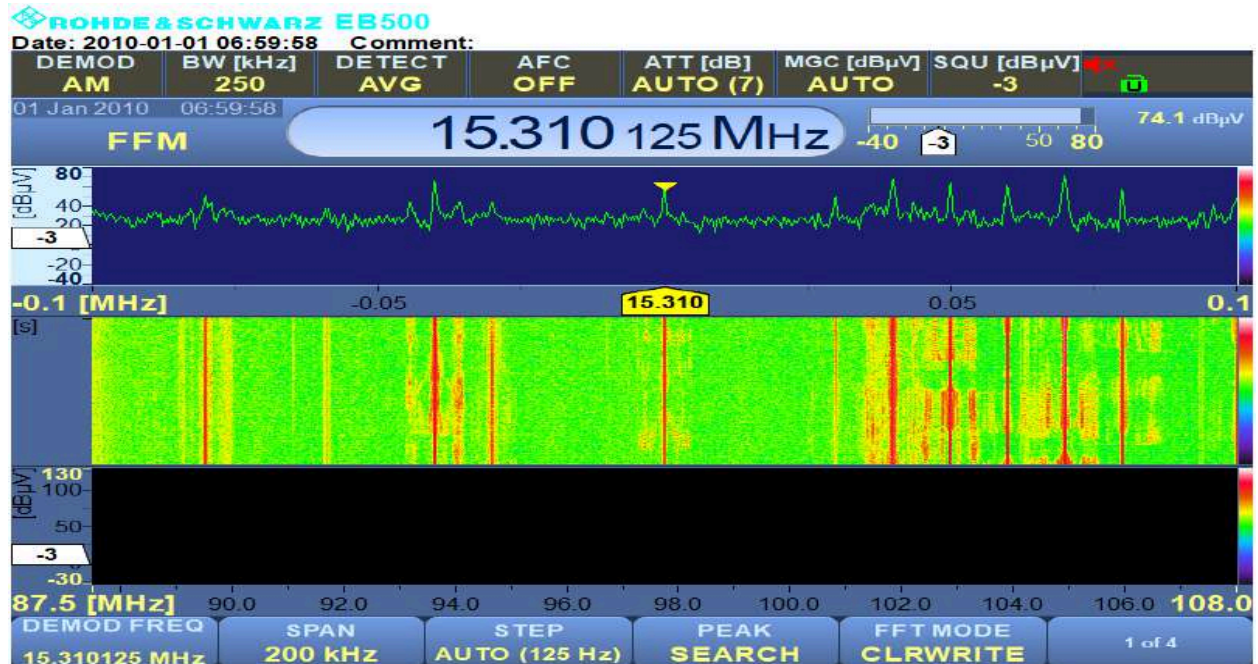
BC China



BC China



BBC UK



BC China

