

Quarterly Report on Frequency Spectrum Monitoring

(October - December 2023)



འབྲུག་བཅད་དོན་བརྒྱུད་འབྲེལ་དང་བཅད་བརྒྱུད་དབང་འཛིན།

Bhutan InfoComm and Media Authority
Royal Government of Bhutan

December 2023

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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 October to December, 2023 in following places;

Sl. No	Monitored Places	Monitored Frequency
1.	Samtse (Mobile Spectrum Monitoring)	3G UMTS (TICL)
1.	Tsirang (Canceled RadioCommunication Apparatus License Monitoring / Spectrum Occupancy)	VHF and UHF Frequency
2.	Sarpang(Canceled RadioCommunication Apparatus License Monitoring and Spectrum Occupancy)	VHF and UHF Frequency
3.	Samdrup Jongkhar (Canceled RadioCommunication Apparatus License Monitoring and Spectrum Occupancy)	VHF and UHF Frequency

4.	Thimphu (Fixed Spectrum Monitoring)	VHF frequency range from 136 MHz-142 MHz Band
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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.

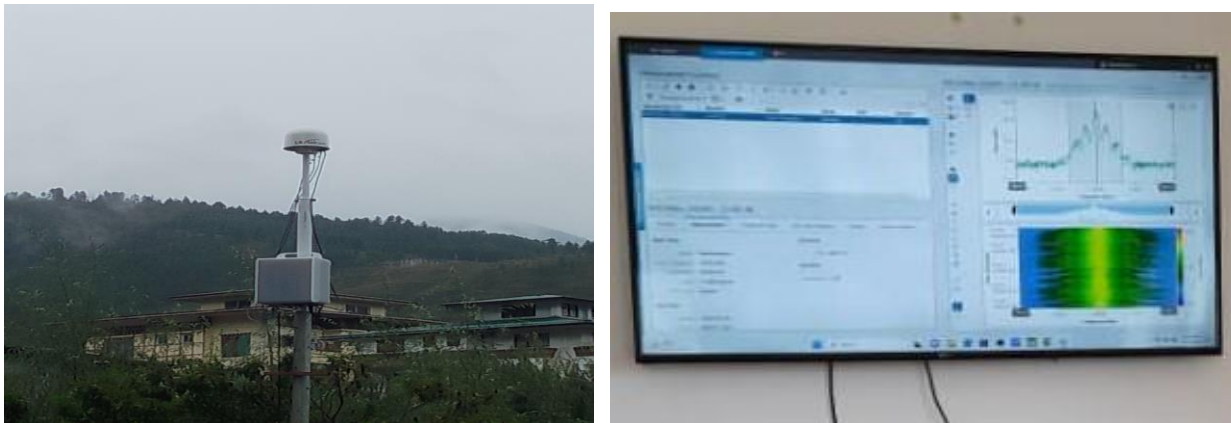


Figure 1: Fixed Spectrum Monitoring

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. Mobile Spectrum Monitoring in Samtse

1. There was presence of the signal interference detection and UMTS (3G) network of TICL was strongly interfered by the external radio interference as shown in the **Annexure 1**.
2. The source of interference was not from our country. The interfering signals are from the border areas.
3. Bandwidth occupied of radio signal interference is between 8.5MHz to 9.8MHz
4. The detailed monitoring activities carried out at Site/location are mentioned below:

a. Samtse Town

The monitoring team carried out the DF monitoring by keeping two receiver at different location, one in Samtse town and another in Khando Thang while doing the triangulation, we could able to detect the location of interfering transmitter at **Longitude (26.73742), Latitude (89.03709)** near **Telipara Tea Garden** as shown below:

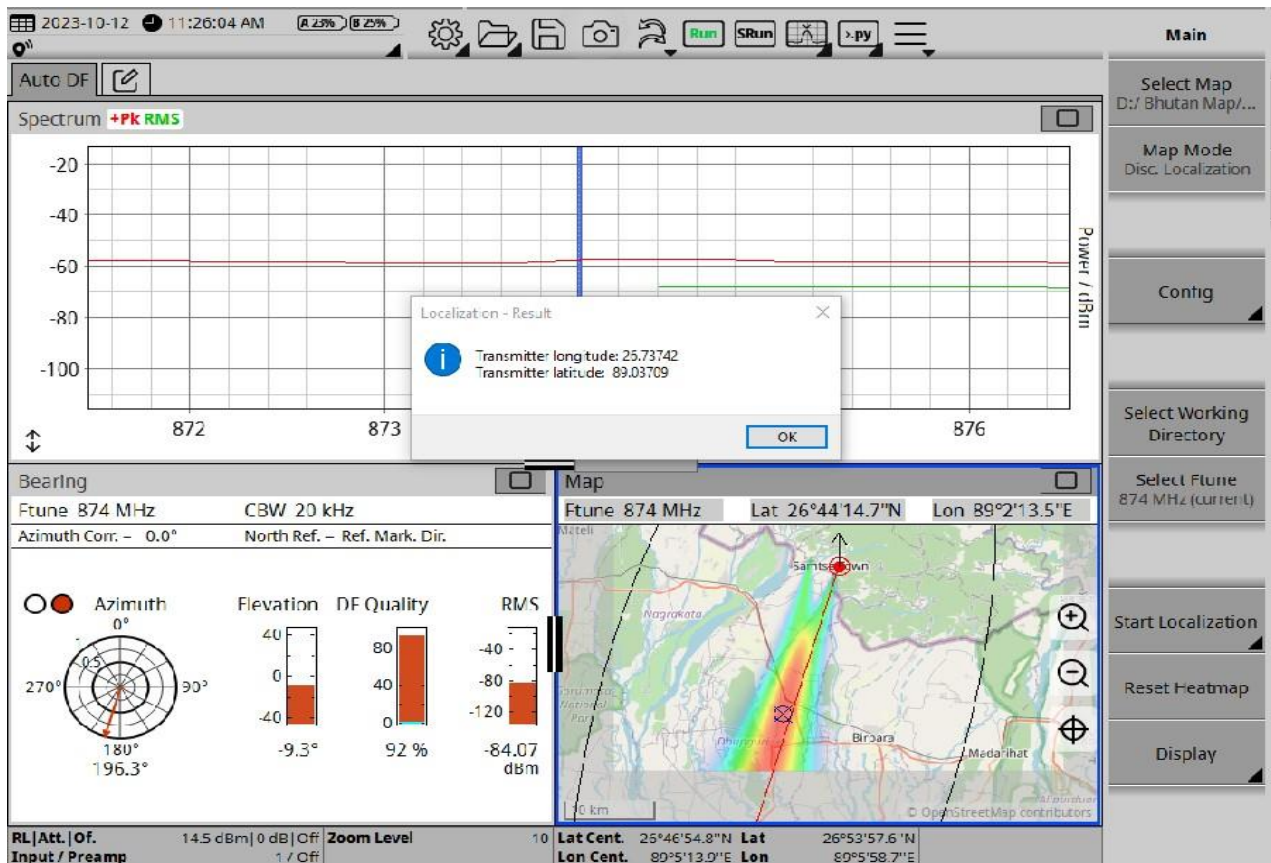


Figure 3: Localization Result

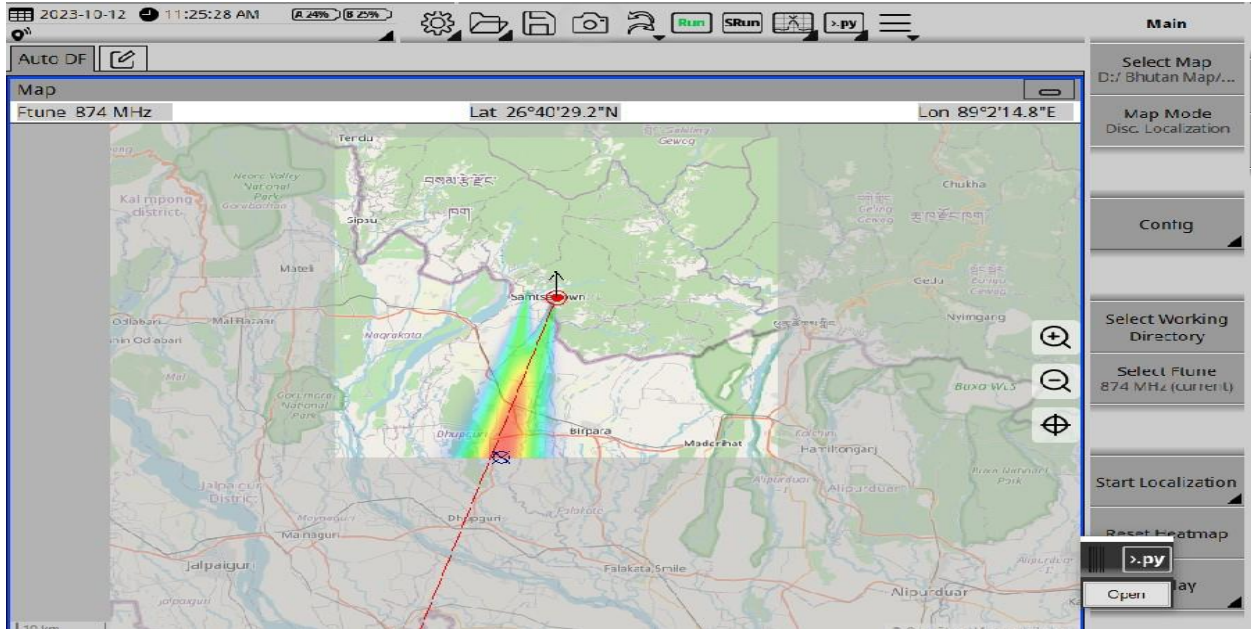


Figure 4: Showing Triangulation Map

b. Norbugang

The monitoring team carried out the DF monitoring by keeping the two receiver at different location, one in Norbugang Highway Road and another in Norbugang village top while doing the triangulation, we could able to detect the location of interfering transmitter at **Longitude (26.9019), Latitude (89.03168)** near **Lal Jhamela Basti Primary School** as shown below:

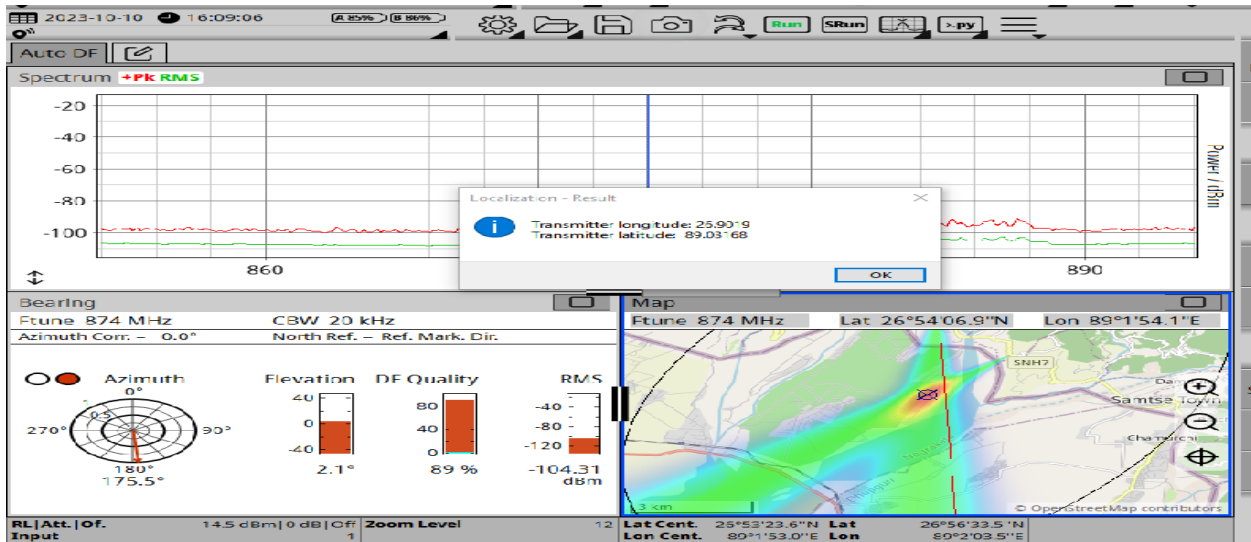


Figure 3: Localization Result

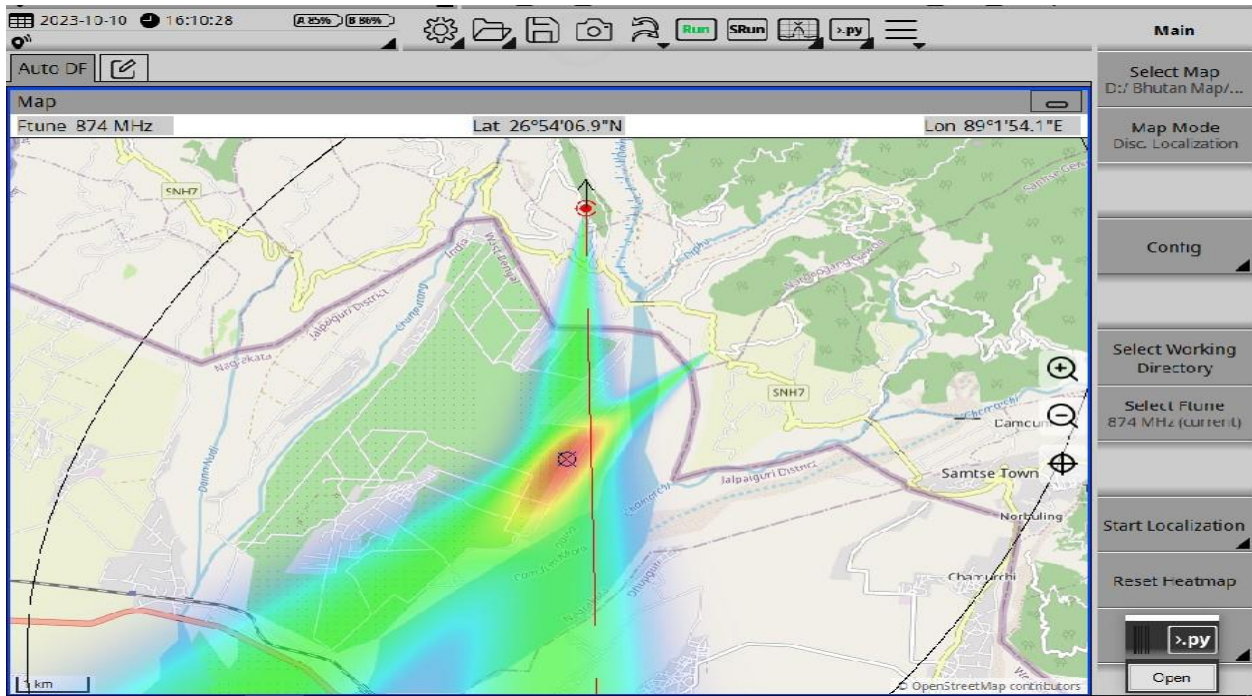


Figure 4: Showing Triangulation Map

c. Tendu

The monitoring team carried out the DF monitoring by keeping the two receiver at different location, one in Tendu and another in Bara while doing the triangulation, we could able to detect the location of interfering transmitter at **Longitude (27.1064), Latitude (88.85084)** near **Lower Godak SSK** as shown below:

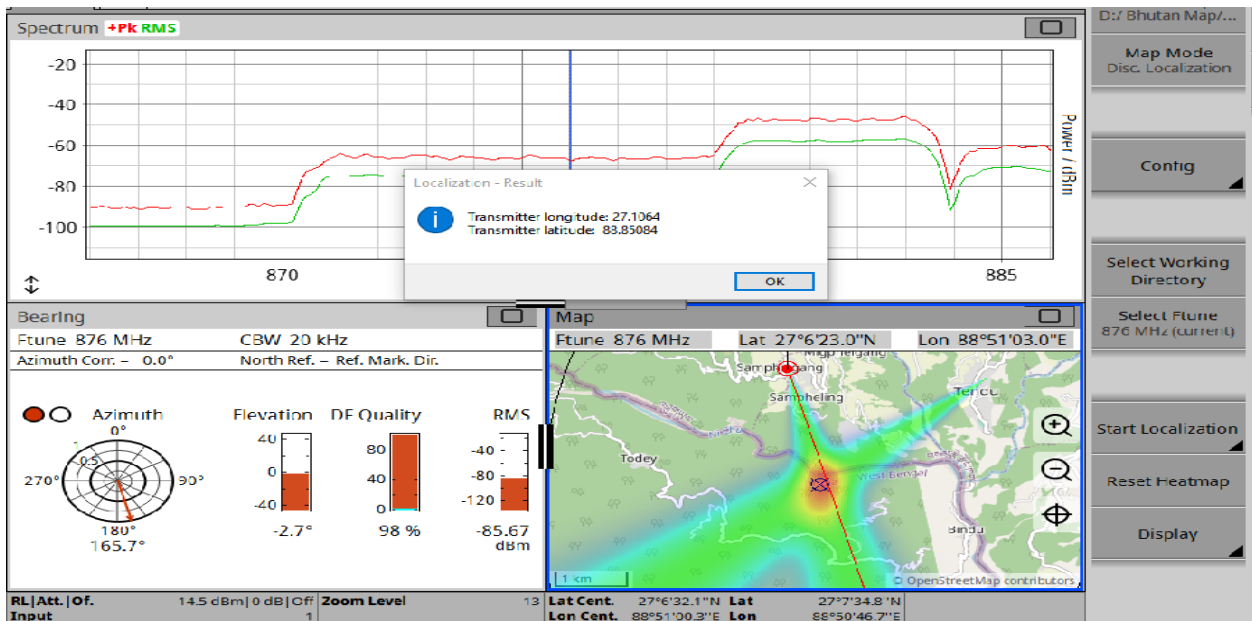


Figure 5: Localization Result

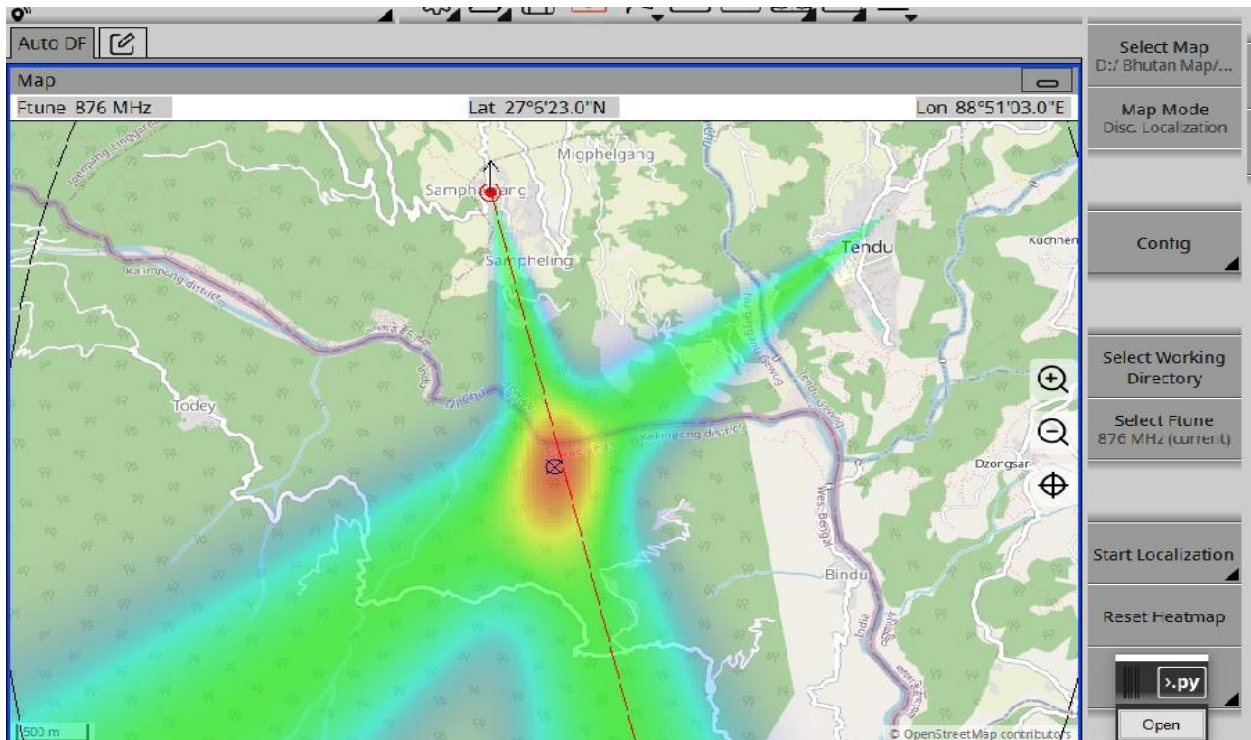


Figure 6: Showing Triangulation Map

5. The detailed monitoring result are shown in the table below

District	3G NodeB Name	Uplink	Down link	Findings	Remark
Samtse	Samtse Town	824-834 MHz(TICL)	869-879 MHz(TICL)	Signal Radio interference is detected (Scanned for Frequencies using spectrum analyzer and DF Monitoring equipment)	Source of interference is detected and the location of the interfering transmitter is Longitude (26.73742), Latitude (89.03709)
	Norbugang	824-834 MHz(TICL)	869-879 MHz(TICL)	Signal Radio interference is detected (Scanned for Frequencies using spectrum analyzer and DF Monitoring equipment)	Source of interference is detected and the location of the interfering transmitter is Longitude (26.9019), Latitude (89.03168)
	Tendu	824-834 MHz(TICL)	824-834 MHz(TICL)	Signal Radio interference is detected (Scanned for	Source of interference is detected and the location

				Frequencies using spectrum analyzer and DF Monitoring equipment)	of the interfering transmitter is Longitude (27.1064), Latitude (88.85084)
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6. During the course of investigation, there was signal interference in UMTS network of TICL and it is confirmed through our spectrum monitoring using a spectrum analyzer and DF (Direction Finding) equipment.

7. It is concluded that the source of interference is not from Bhutan as the respective transmitters in 850MHz were shut down completely in Samtse Dzongkhag. The source of radio interference that the UMTS network of TICL in Samtse has experienced is from border areas.

8. During the Spectrum DF (Direction Finding) monitoring, we have detected the location of the source of the interference transmitter and its showing the signal from the border areas.

9. Since the signal is constant it is probably from Cellular tower only if it is military they will never use the constant frequencies they use hop frequency to prevent for the detection.

ii. Canceled Radio Communication Apparatus Licensed Monitoring

The Authority had monitored the canceled Radio license in Three Dzongkhag as mentioned below and detailed monitoring results are attached in **Annexure 2**.

1. Tsirang Dzongkhag

SL	License Name	Licensee No	Area of operation	Expiry date	Frequency	Remarks
1	KEC International	502000262	Tsirang	16.2.2018	144 MHz	Not in use
2	Lakey Tharchen Construction	502000376	Tsirang	29.7.2019	138.975 MHz	Not in use

2. Sarpang Dzongkhag

SL	Name of Licence	Licensee No	Area of operation	Expiry date	Frequency	Remarks
1	National Centre of Aquaculture	502000914	sarpang	21.3.21	168.150 MHz	Not in use
2	Dai Nippon Construction	502000256	Gelephu	12.10.21	141.175 MHz	Not in use
3	Gaki Pelbar construction	502000281	Gelephu	4.11.19	163.75 MHz	Not in use
4.	Dzong Construction	502000352	Sarpang	2.3.22	141.925 MHz	Not in use
5	Central Regional Hospital	502000469	Gelephu	20.11.21	138.200 MHz	Not in use
6	Norbu Construction	502000391	Gelephu	1.3.20	161.45 MHz	Not in use
7	Begogang Stone Quarry	502000436	Gelephu	1.1.21	462 MHz	Not in use

3. Samdrup Jongkhar

S L	Name of Licence	Licensee No	Area of operation	Expiry date	Frequency	Remarks
1	Serthi Gewog	502000457	Samdrup Jongkhar	25.6.21	165.6 MHz	Not in use
2	SD Eastern Bhutan Ferro Silicon	502000087	Samdrup Jongkhar	22.6.21	143.400 MHz	Not in use
3	Thromde	502000212	Samdrup Jongkhar	4.8.21	138.900 MHz	Not in use

4	Arong Regional Mithun breeding	502000386	Arong area	18.3.21	138.825 MHz	Not in use
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iii. Spectrum Occupancy Monitoring in Tsirang, Sarpang and Samdrup Jongkhar

The power emission and frequency used of the 2G, 3G, 4G and 5G transmitter monitored in Tsirang, Sarpang and Samdrup Jongkhar are as mentioned below and are all within the permissible limits.

a. Samdrup Jongkhar

SL	Name of Operator	Frequency Band	Signal Strength dBm	Location
1	Bhutan Telecom	700 MHz	-72.38	Samdrup Jongkhar
2	Bhutan Telecom	1800	-57.17	Samdrup Jongkhar
3	Tashicell	1800	-85.06	Samdrup Jongkhar
4	Tashicell	3 GHz	-77.73	Samdrup Jongkhar
5	Bhutan Telecom	2300 MHz	-61.04	Samdrup Jongkhar
6	Bhutan Telecom	850 MHz	-67.64	Samdrup Jongkhar
7	Bhutan Telecom	900 MHz	-66.02	Samdrup Jongkhar
8	Tashicell	900 MHz	-76.73	Samdrup Jongkhar

b. Sarpang

SL	Name of Operator	Frequency Band	Signal Strength	Location
1	Tashicell	900 MHz	-68.74	Sarpang
2	Bhutan Telecom	900 MHz	-80.83	Sarpang
3	Bhutan Telecom	1800 MHz	-58.85	Sarpang
4	Tashicell	700 MHz	-83.46	Sarpang
5	Bhutan Telecom	2300 MHz	-97.76	Sarpang
6	Tashicell	2300 MHz	-96.91	Sarpang

c. Tsirang

SL	Name of Operator	Frequency Band	Signal Strength	Location
1	Bhutan Telecom	900 MHz	-37.08	Tsirang
2	Bhutan Telecom	700 MHz	-66.63	Tsirang
3	Bhutan Telecom	850 MHz	-69.58	Tsirang
4	Bhutan Telecom	1800 MHz	-42.67	Tsirang
5	Tashicell	900 MHz	-65.36	Tsirang
6	Bhutan Telecom	3 GHz	-76.35	Tsirang
7	Tashicell	1800 MHz	-68.52	Tsirang

There is no out of band transmission from the 2G, 3G, 4G and 5G transmitters of both the operators. The detailed findings record are attached in **annexure 3**

iv. Fixed Spectrum Monitoring in Thimphu

1. The team have carried out the fixed Spectrum Monitoring for VHF transmitter frequencies ranging from 136 MHz to 140 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	136.01 MHz-136.09 MHz	Free	
2.	136.24 MHz-136.39 MHz	Occupied the frequency	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
3.	136.24 MHz-136.39 MHz	Free	
4.	136.41 MHz-136.54 MHz	Occupied the Frequency	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
5.	136.58 MHz-136.69 MHz	Free	
6.	136.71 MHz-136.81 MHz	Occupied the Frequency	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
7	136.89 MHz-136.99 MHz	Free	
8	137.01 MHz-137.19 MHz	Occupied the Frequency	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
9	137.21 MHz-137.29 MHz	Free	
10	137.31 MHz-137.51 MHz	Occupied the Frequency	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
11	137.53 MHz-137.61 MHz	Free	
12	137.64 MHz-137.81 MHz	Occupied the frequency	We need to do the Audio

			listening whether it is occupied or noise generated from the receiver.
13	137.84 MHz-137.94 MHz	Free	
14	137.96 MHz-138.14 MHz	Occupied the frequency	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
15	138.16 MHz-138.14 MHz	Free	
16	138.16 MHz-138.24 MHz	Occupied the frequency	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
17	138.26 MHz-138.46 MHz	No occupancy	
18	138.49 MHz-138.56 MHz	Occupied the frequency	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
19	138.59 MHz-138.86 MHz	No Occupancy	
20	138.89 MHz-139.09 MHz	Occupied the Frequency	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
21	139.91 MHz-139.96 MHz	Occupied the frequency	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
22	139.99 Mhz-140.21 MHz	free	
23	140.24 MHz	Occupied	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
24	140.26 MHz	free	
26	140.6 MHz	Occupied	We need to do the Audio listening whether it is

			occupied or noise generated from the receiver.
27	140.29 MHz-140.54 MHz	free	
28	140.36 MHz-140.61 MHz	Occupied	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
29	140.64 MHz-140..84 MHz	free	
30	140.86 MHz-140.94 MHz	Occupied	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
31	140.96 MHz-141.14 MHz	free	
32	141.16 MHz-141.24 MHz	Occupied	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
33	141.26 MHz-141.46MHz	free	
34	141.49 MHz-141.56 MHz	occupied	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
35	141.59 MHz-141.76 MHz	free	
36	141.79 MHz-141.86 MHz	Occupied	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
37	141.89 MHz-142.09 MHz	Occupied	We need to do the Audio listening whether it is occupied or noise generated from the receiver.
5 MHz band measurement completed			

3. The details of the Spectrum Occupancy result is attached in Annexure 3.

4. We need to do the monitoring for Audio listening whether it is occupied or noise generated from the receiver.

7. Follow up

- i. Authority will continue monitoring the canceled RadioCommunication license in different places although illegal users were not found in recent monitoring in Tsirang, Sarpang and Samdrup Jongkhar.

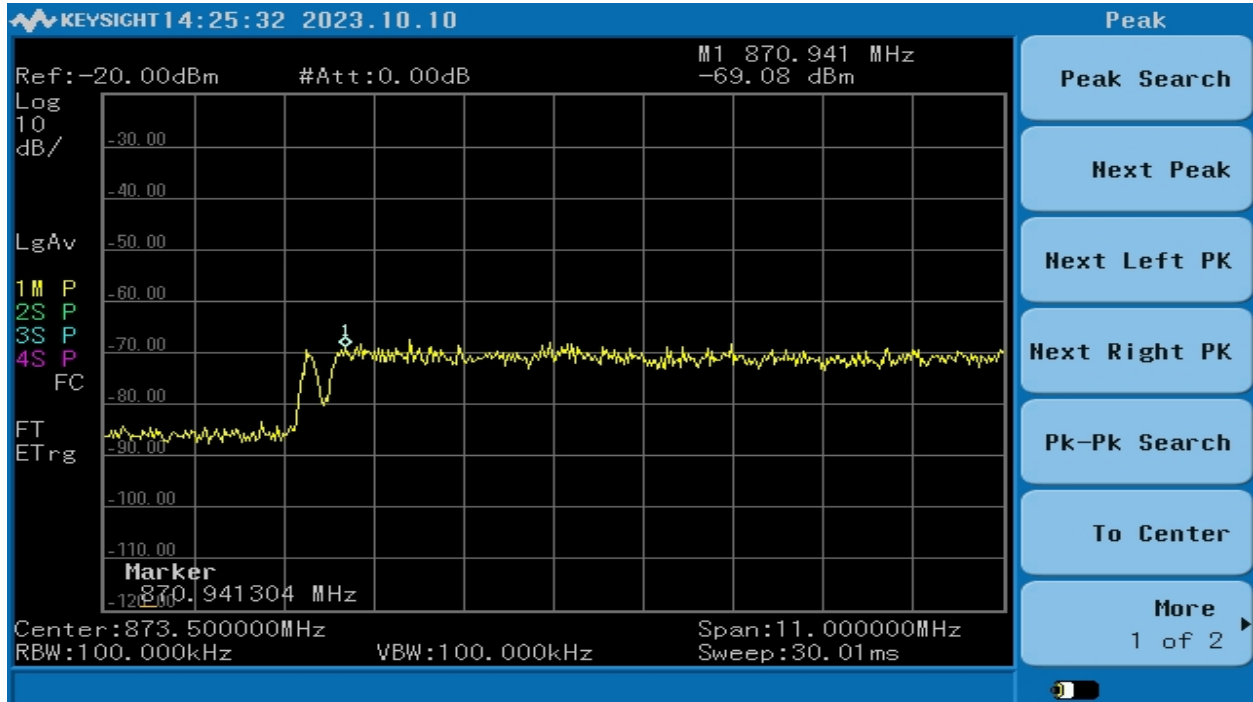
- ii. We need to do the Audio listening of the occupied channel while doing the selected frequency from band 136 MHz to 142 MHz to find out if it is really occupied or not.

- iii. Authority will continue monitoring the spectrum occupancy for 2G, 3G, 4G and 5G in different places.

- iv. The Authority may have to request and carry out the cross border frequency coordination discussion with the Radio Frequency Spectrum regulator of India for UMTS 3G network issues in Samtse.

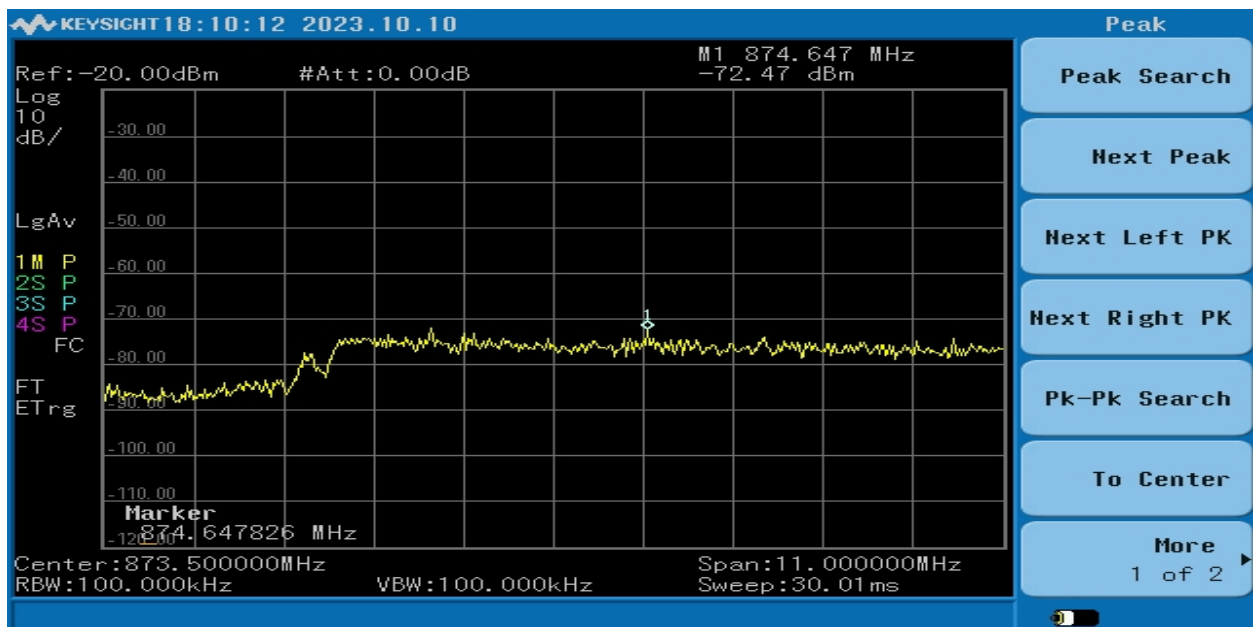
Annexure 1

The external signal interference is detected at band 850 in TICL



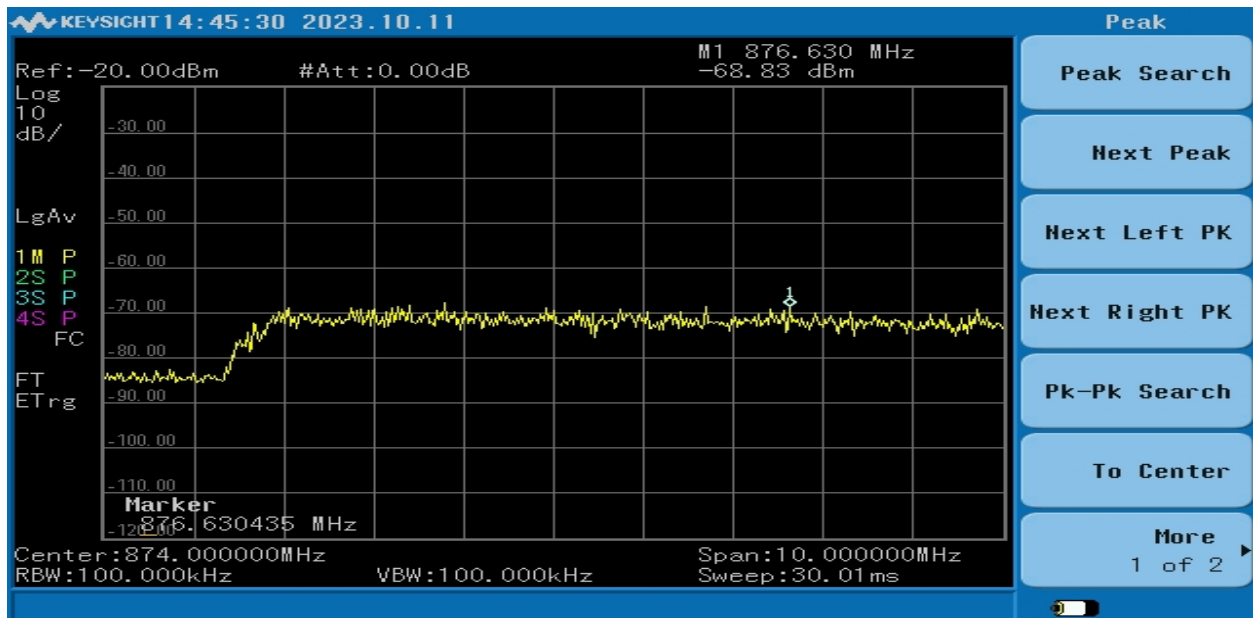
Area: Samtse Town

Power: -69.08 dBm

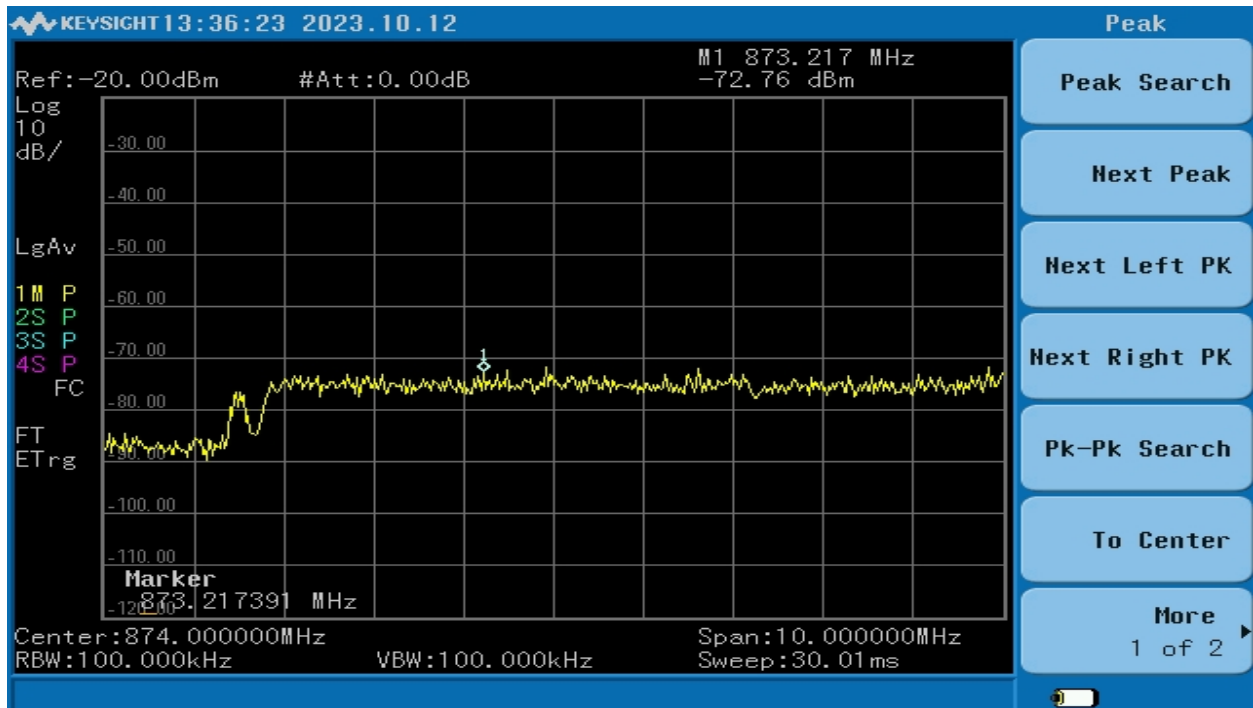


Area: Norbugang

Power: -72.47dBm



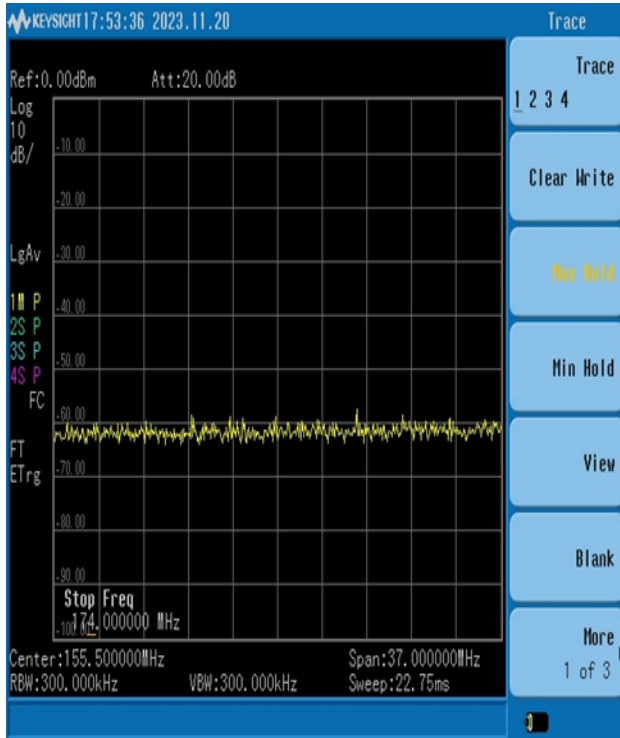
Area: Bara
Power: -68.83 dBm



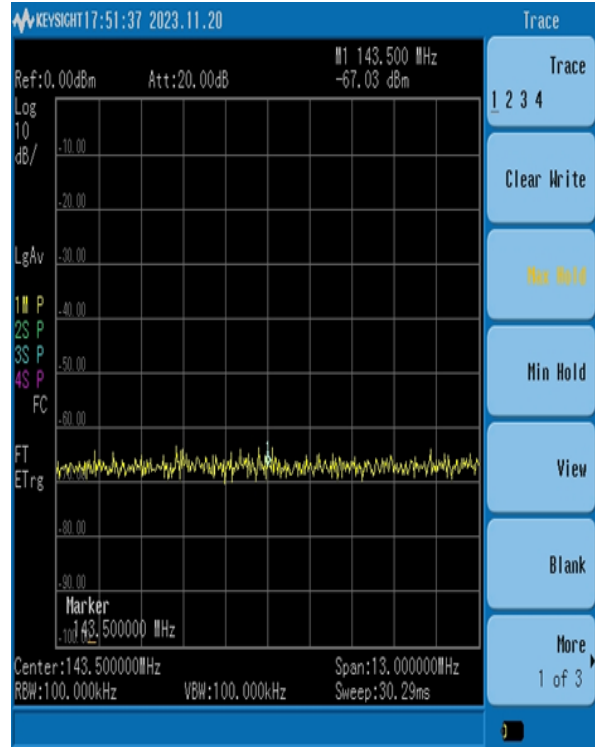
Area: Samtse Khandothag
Power: -72.76 dBm

Annexure 2

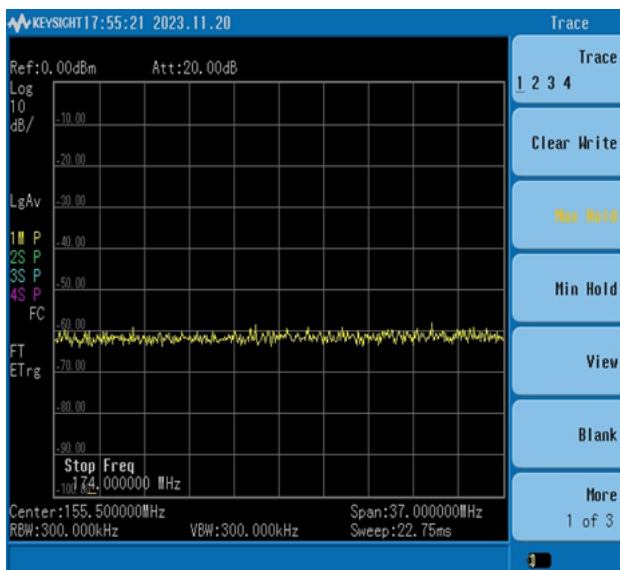
The figures showing the monitoring records from the Spectrum Analyzer for Spectrum apparatus canceled licenses all with particular spectrum frequency and area of operation.



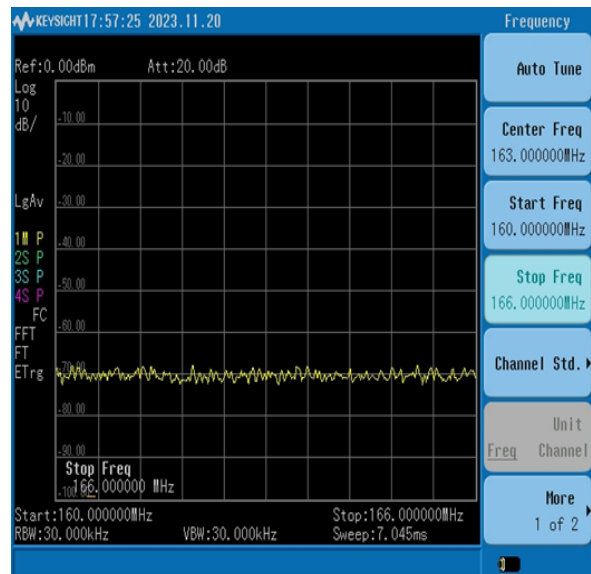
Name: Serthi Gewog (S/J)



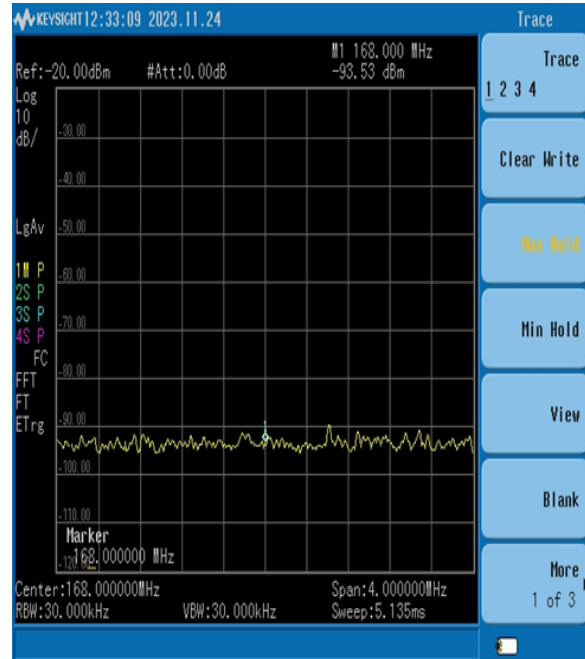
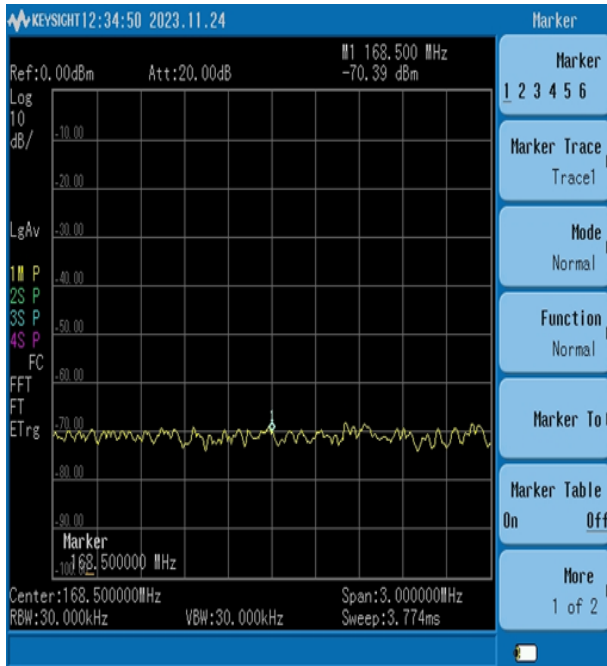
Name: SD Eastern Bhutan Ferro Silicon(S/J)



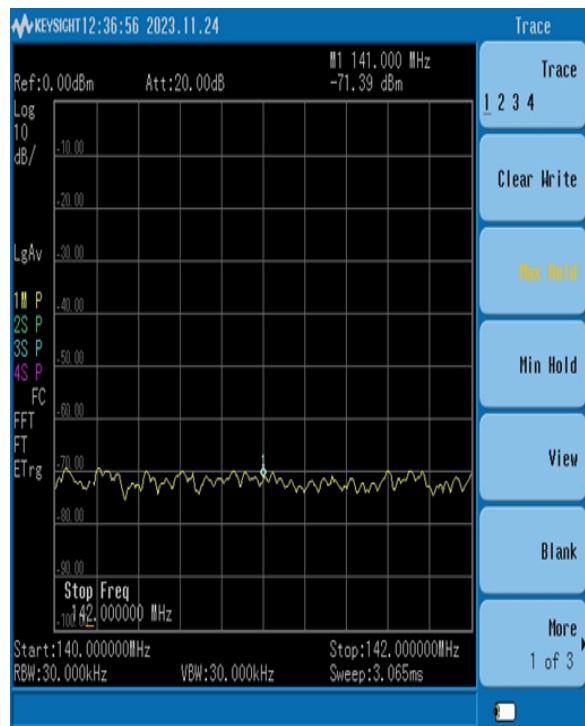
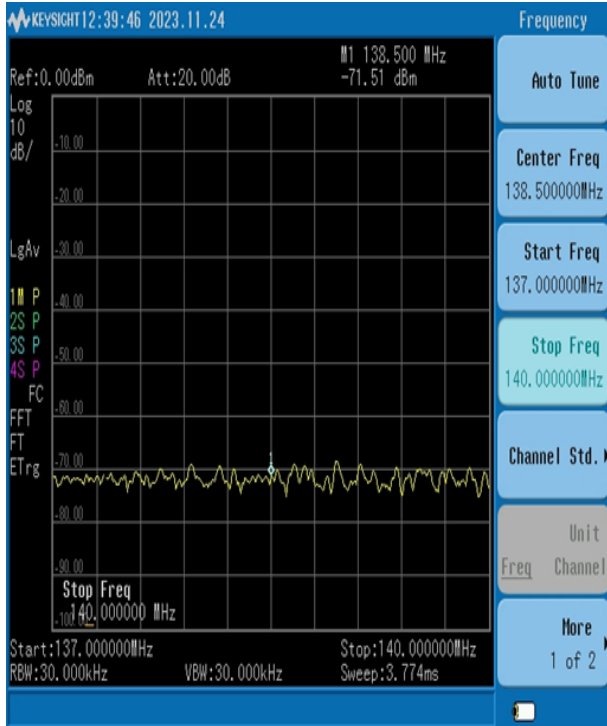
Name: S/J Thromde(S/J)



Name: Among Regional Mithun breeding(S/J)

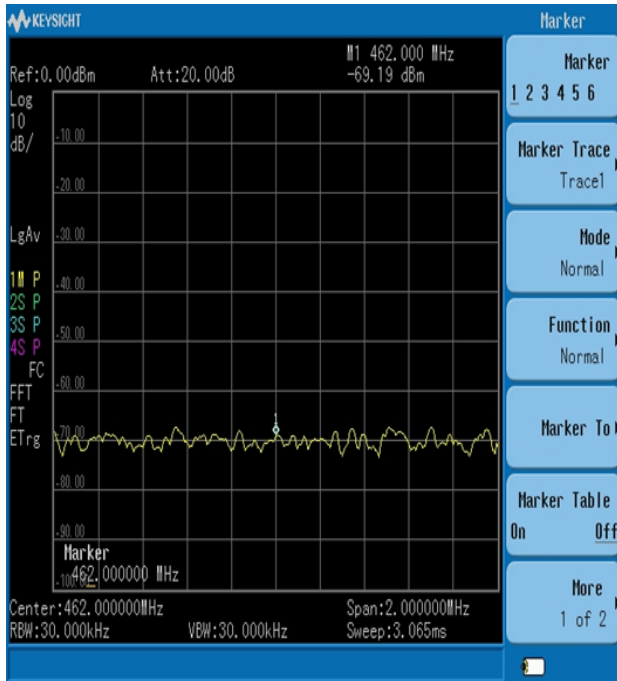


Name: National Centre of Aquaculture(Sarpang) Name: Dai Nippon Construction(Sarpang)

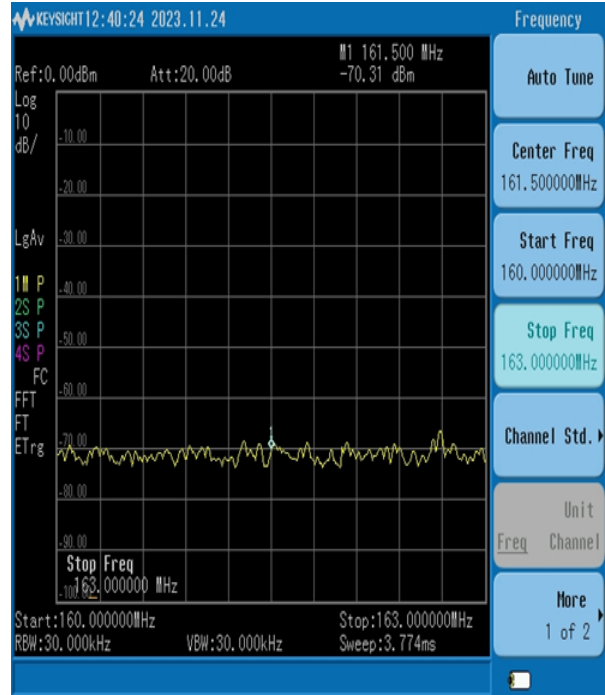


Name: Gaki Pelbar construction(Sarpang)

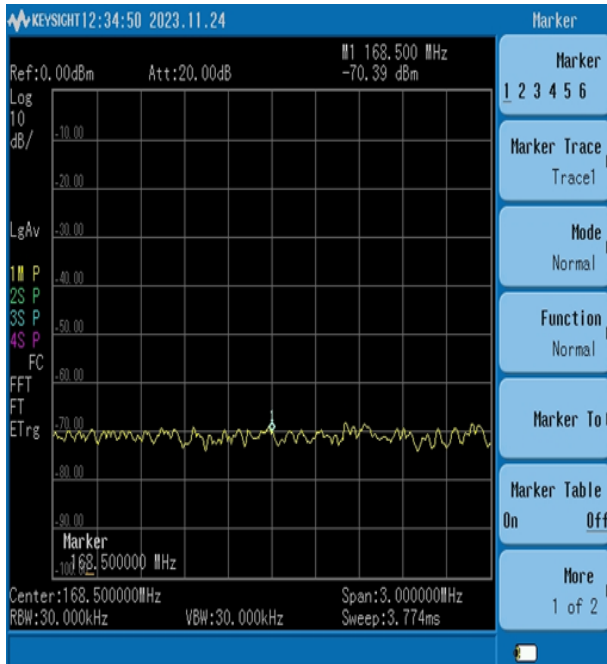
Name: Dzong Construction(Sarpang)



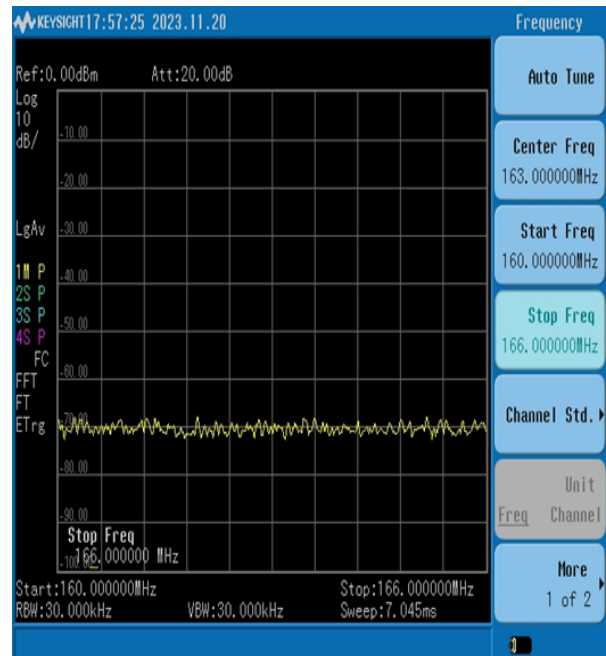
Name: Central Regional Hospital(Sarpang)



Name: Norbu Construction(Sarpang)



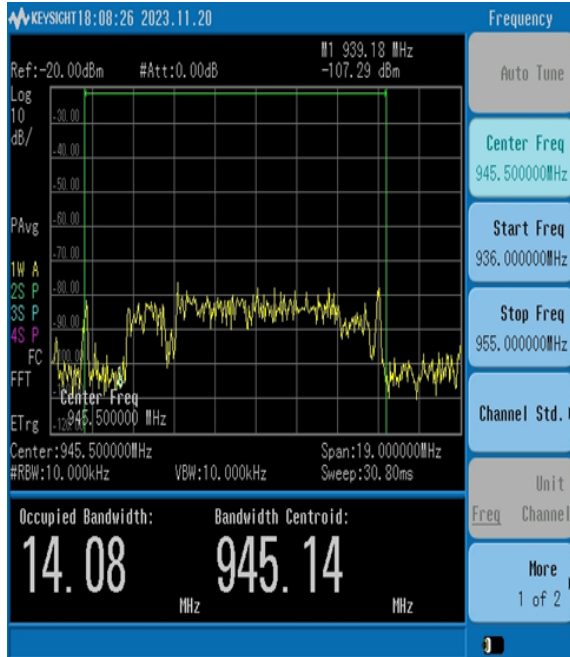
Name: KEC International(Tsirang)



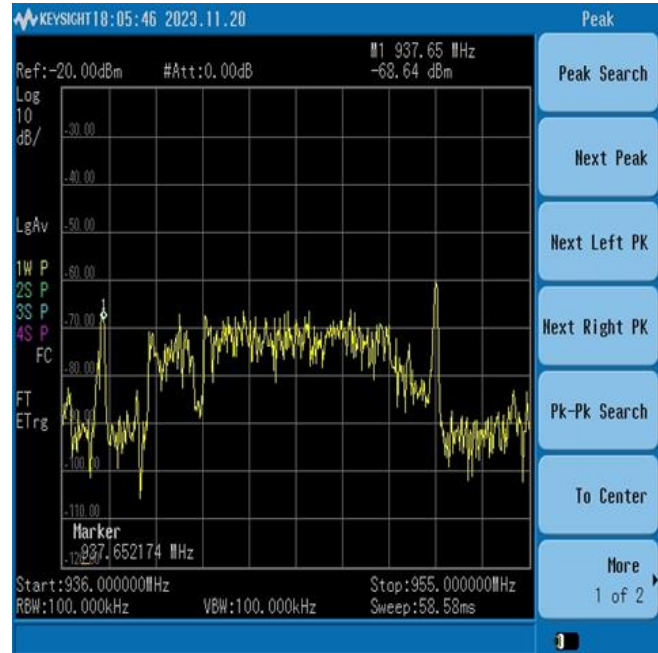
Name: Lakey Tharchen Construction(Tsirang)

Annexure 3

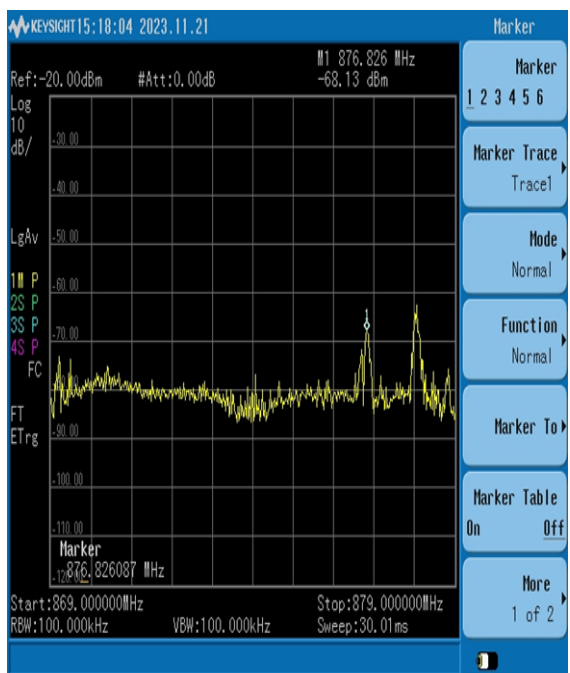
The figures show the monitoring records from the Spectrum Analyzer for Spectrum Occupancy monitoring with particular spectrum frequency and monitoring location.



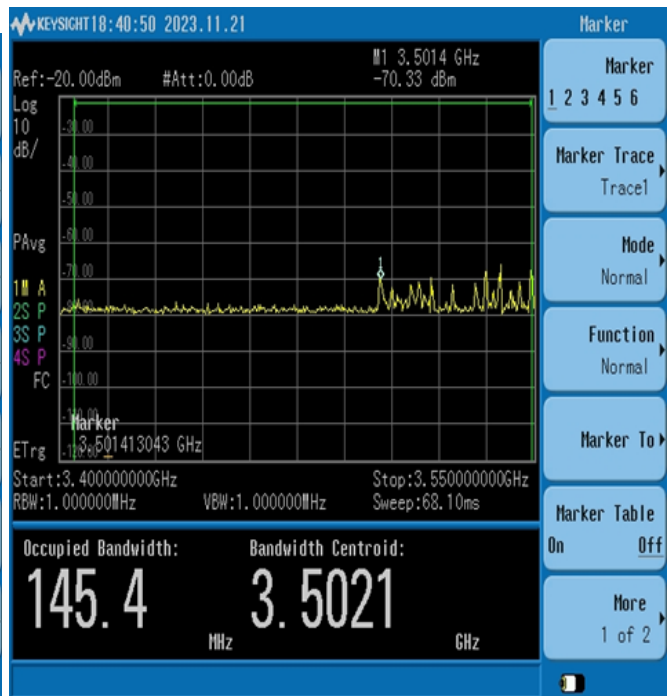
GSM 900 MHz band (SJ)



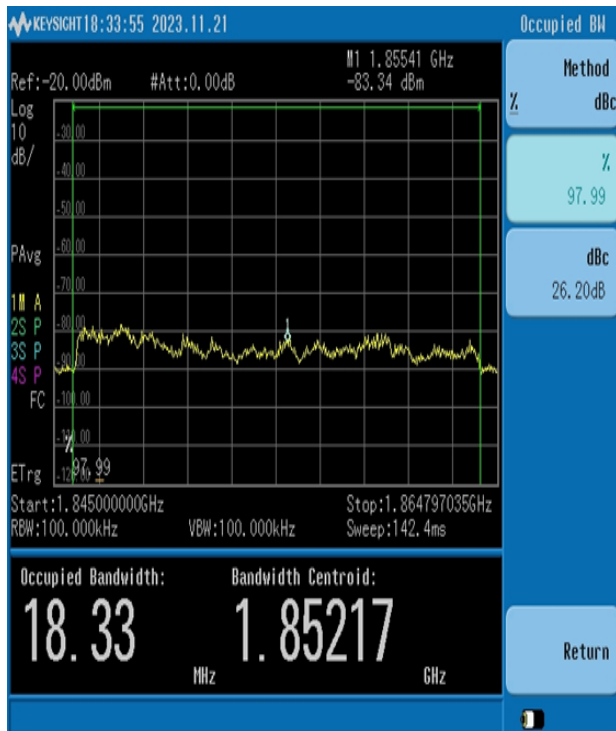
GSM 900 MHz band (SJ)



GSM 850 MHz SJ



5G, 3GHz SJ



GSM spectrum Monitoring 1800 MHz SJ



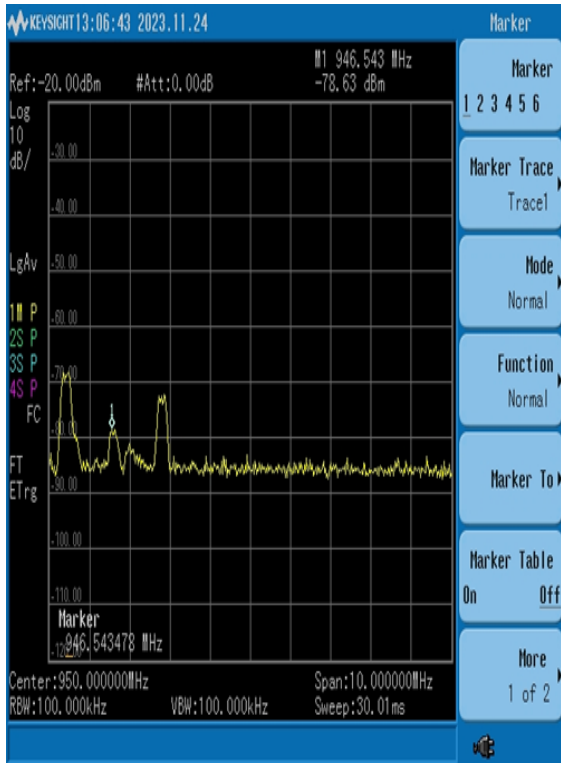
700 MHz Spectrum Monitoring SJ



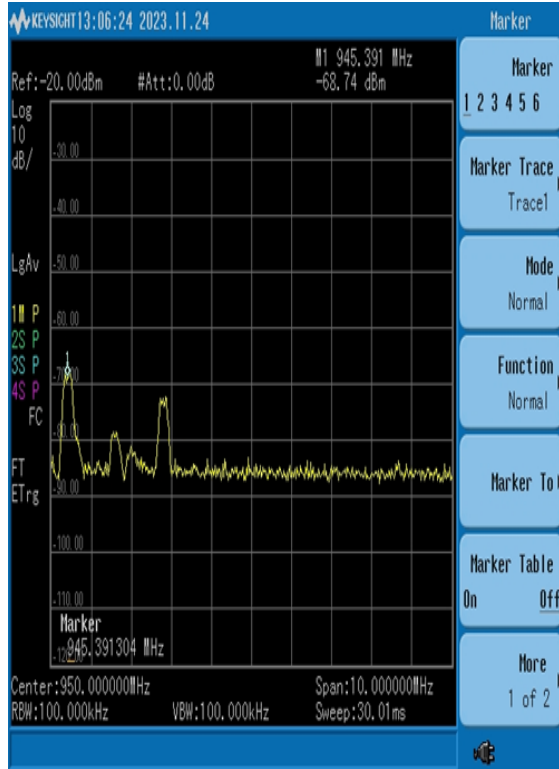
2300 MHz spectrum Monitoring SJ



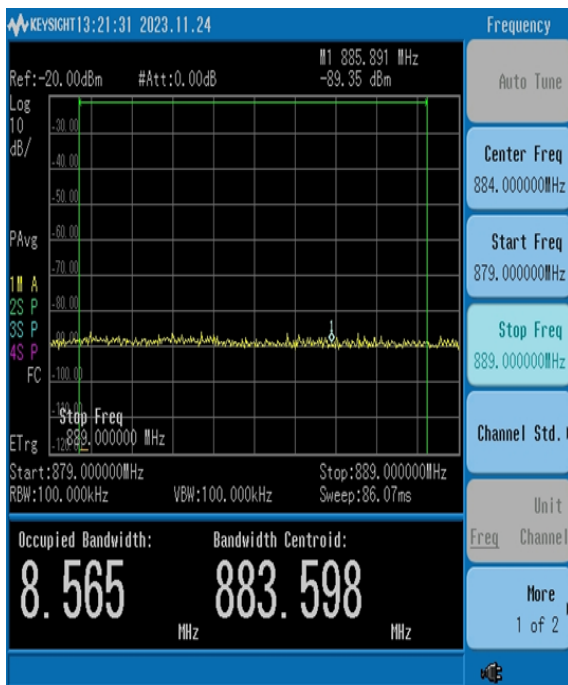
1800 MHz Spectrum Monitoring SJ



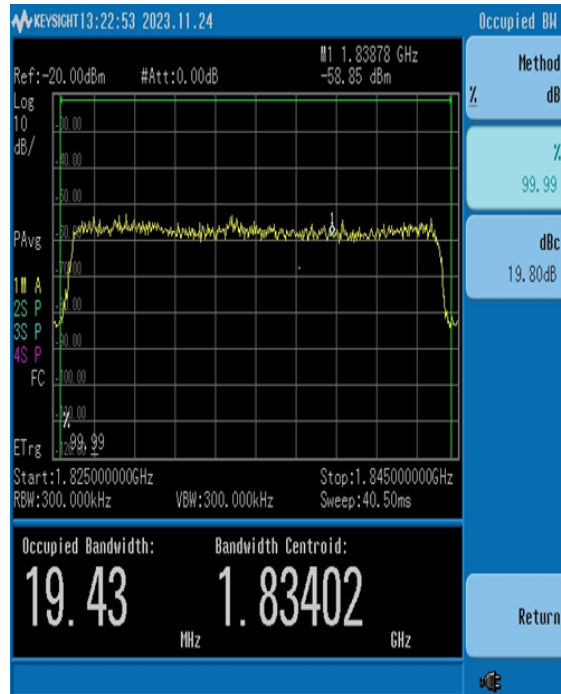
GSM 900 spectrum monitoring Sarpang



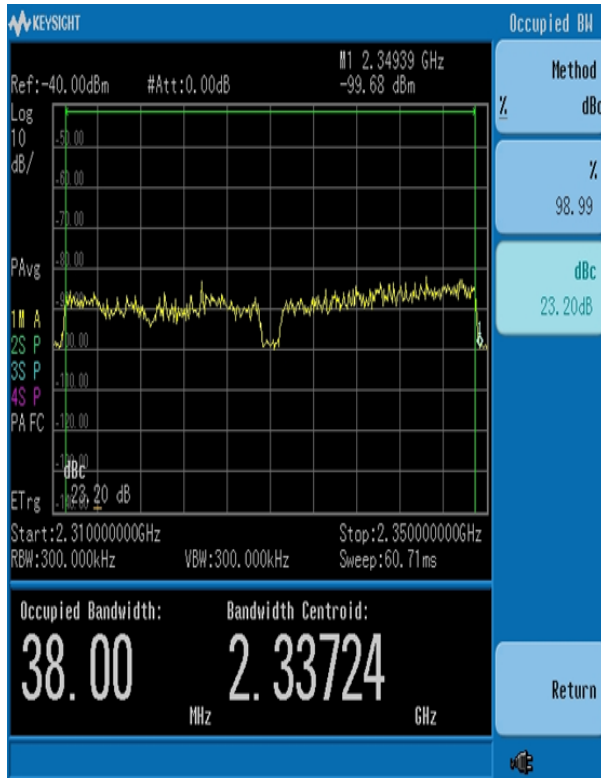
GSM 900 spectrum monitoring Sarpang



700 Mhz Spectrum Monitoring Sarpang



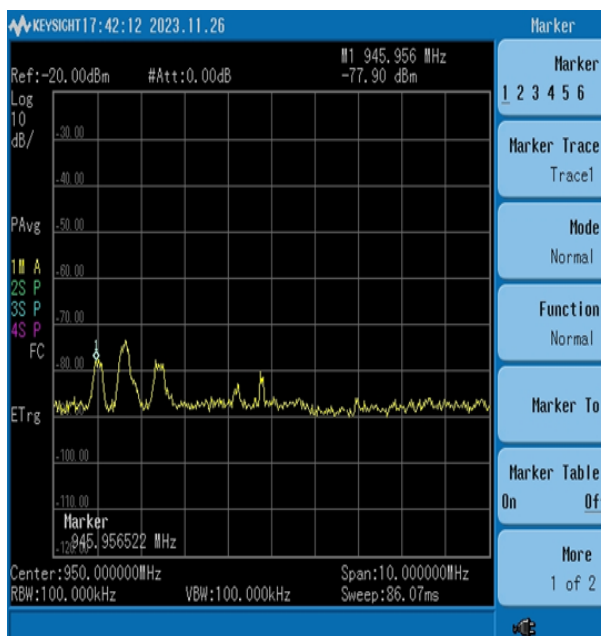
GSM 1800 MHz Spectrum Monitoring Sarpang



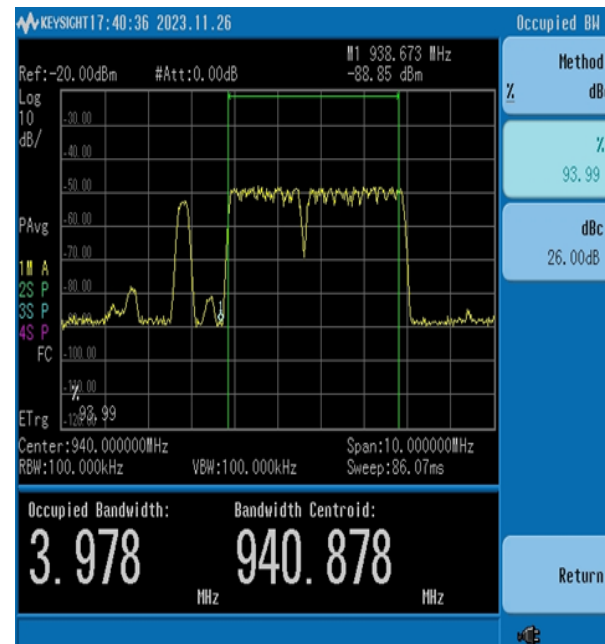
2300MHz Spectrum Monitoring Sarpang



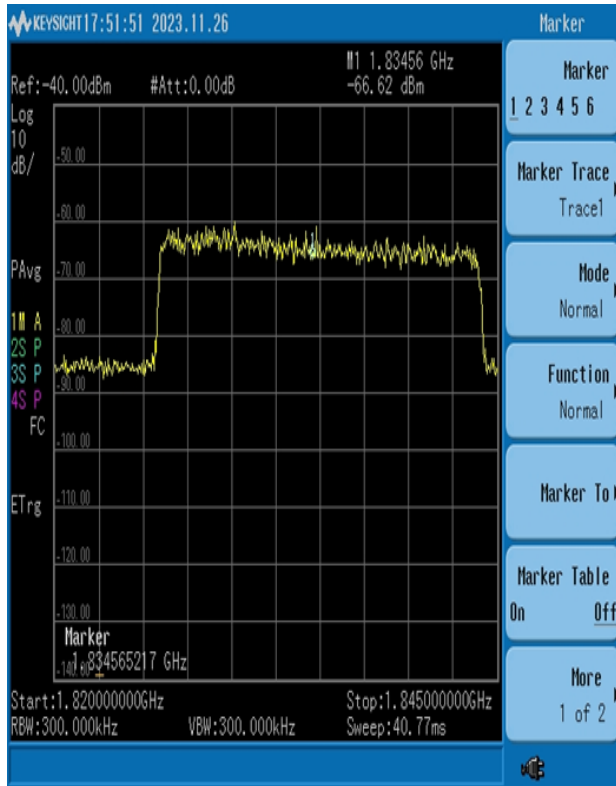
1800 Mhz Spectrum Monitoring Sarpang



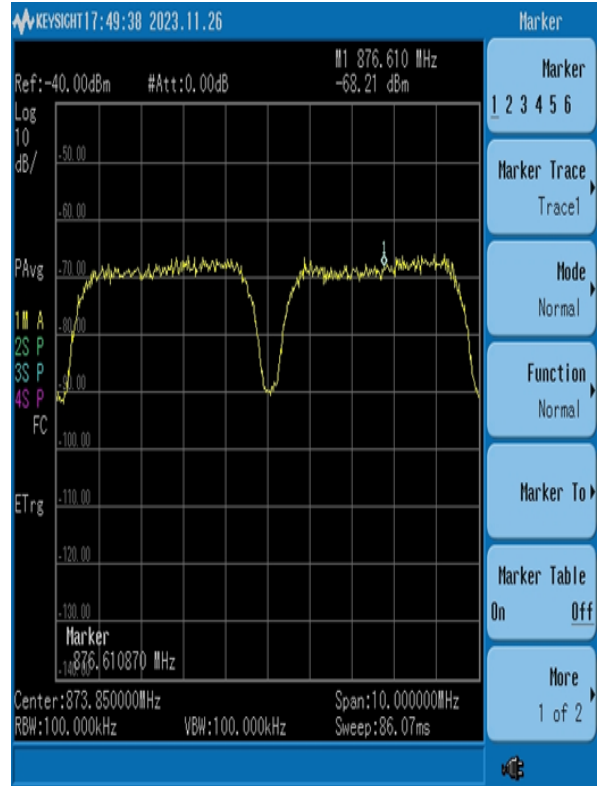
GSM 900 Spectrum Monitoring Tsirang



GSM 900 Spectrum Monitoring Tsirang



1800 MHz Spectrum Monitoring Tsirang



850 MHz Spectrum Monitoring Tsirang

Annexures 4

The following are the details of the system generated spectrum occupancy report monitoring for VHF frequency from the fixed monitoring equipment.

Monitoring Station

Data

Name: FMU308w_100305
Latitude: 89.6242752075195 °
Longitude: 27.4747543334961 °
Receiver: LS-RX-08-T

Type: FCO 5
Time Interval: 5 min
Channel Sets: VHF Monitoring

Measurement Settings

Receiver

Name: Re-VHF Monitoring
Mode: Frequency Range
Freq. Range: 136.00 MHz - 142.00 MHz
RBW: 12.50 kHz
Step Width: 12.44 kHz
Start Time: 12/7/2023 4:45:00 AM
Stop Time: 12/7/2023 7:40:00 AM
Duration: 2 Hours 55 Minutes 0 Second

Attenuation: 0 dB

Channel Name	Main Frequency	Bandwidth	Max	Occupancy [%] Avg	Min
S1	136.01 MHz	25.00 kHz	0	0	0

S2	136.04 MHz	25.00 kHz	0	0	0
S3	136.06 MHz	25.00 kHz	0	0	0
S4	136.09 MHz	25.00 kHz	0	0	0
S5	136.11 MHz	25.00 kHz	0	0	0
S6	136.14 MHz	25.00 kHz	1	0	0
S7	136.16 MHz	25.00 kHz	8	1	0
S8	136.19 MHz	25.00 kHz	11	1	0
S9	136.21 MHz	25.00 kHz	2	0	0
S10	136.24 MHz	25.00 kHz	0	0	0
S11	136.26 MHz	25.00 kHz	0	0	0
S12	136.29 MHz	25.00 kHz	0	0	0
S13	136.31 MHz	25.00 kHz	0	0	0
S14	136.34 MHz	25.00 kHz	0	0	0
S15	136.36 MHz	25.00 kHz	0	0	0
S16	136.39 MHz	25.00 kHz	0	0	0
S17	136.41 MHz	25.00 kHz	2	0	0
S18	136.44 MHz	25.00 kHz	10	1	0
S19	136.46 MHz	25.00 kHz	35	5	0

S20	136.49 MHz	25.00 kHz	54	8	0
S21	136.51 MHz	25.00 kHz	48	5	0
S22	136.54 MHz	25.00 kHz	11	0	0
S23	136.56 MHz	25.00 kHz	0	0	0
S24	136.59 MHz	25.00 kHz	0	0	0
S25	136.61 MHz	25.00 kHz	0	0	0
S26	136.64 MHz	25.00 kHz	0	0	0
S27	136.66 MHz	25.00 kHz	0	0	0
S28	136.69 MHz	25.00 kHz	0	0	0
S29	136.71 MHz	25.00 kHz	1	0	0
S30	136.74 MHz	25.00 kHz	22	6	0
S31	136.76 MHz	25.00 kHz	48	10	0

Channel Name	Main Frequency	Bandwidth	Max	Occupancy	
				[%] Avg	Min
S32	136.79 MHz	25.00 kHz	74	16	0
S33	136.81 MHz	25.00 kHz	75	15	0
S34	136.84 MHz	25.00 kHz	68	5	0
S35	136.86 MHz	25.00 kHz	10	0	0

S36	136.89 MHz	25.00 kHz	0	0	0
S37	136.91 MHz	25.00 kHz	0	0	0
S38	136.94 MHz	25.00 kHz	0	0	0
S39	136.96 MHz	25.00 kHz	0	0	0
S40	136.99 MHz	25.00 kHz	0	0	0
S41	137.01 MHz	25.00 kHz	1	0	0
S42	137.04 MHz	25.00 kHz	18	6	0
S43	137.06 MHz	25.00 kHz	52	19	1
S44	137.09 MHz	25.00 kHz	76	19	1
S45	137.11 MHz	25.00 kHz	82	21	1
S46	137.14 MHz	25.00 kHz	76	15	0
S47	137.16 MHz	25.00 kHz	68	4	0
S48	137.19 MHz	25.00 kHz	3	0	0
S49	137.21 MHz	25.00 kHz	0	0	0
S50	137.24 MHz	25.00 kHz	0	0	0
S51	137.26 MHz	25.00 kHz	0	0	0
S52	137.29 MHz	25.00 kHz	0	0	0
S53	137.31 MHz	25.00 kHz	1	0	0

S54	137.34 MHz	25.00 kHz	4	1	0
S55	137.36 MHz	25.00 kHz	43	16	0
S56	137.39 MHz	25.00 kHz	66	21	1
S57	137.41 MHz	25.00 kHz	78	20	1
S58	137.44 MHz	25.00 kHz	83	20	2
S59	137.46 MHz	25.00 kHz	73	10	0
S60	137.49 MHz	25.00 kHz	38	2	0
S61	137.51 MHz	25.00 kHz	1	0	0
S62	137.54 MHz	25.00 kHz	0	0	0

Channel Name	Main Frequency	Bandwidth	Occupancy		
			Max	[%] Avg	Min
S63	137.56 MHz	25.00 kHz	0	0	0
S64	137.59 MHz	25.00 kHz	0	0	0
S65	137.61 MHz	25.00 kHz	0	0	0
S66	137.64 MHz	25.00 kHz	1	0	0
S67	137.66 MHz	25.00 kHz	9	3	0
S68	137.69 MHz	25.00 kHz	49	20	0

S69	137.71 MHz	25.00 kHz	72	18	1
S70	137.74 MHz	25.00 kHz	79	21	0
S71	137.76 MHz	25.00 kHz	84	19	1
S72	137.79 MHz	25.00 kHz	69	6	0
S73	137.81 MHz	25.00 kHz	12	0	0
S74	137.84 MHz	25.00 kHz	0	0	0
S75	137.86 MHz	25.00 kHz	0	0	0
S76	137.89 MHz	25.00 kHz	0	0	0
S77	137.91 MHz	25.00 kHz	0	0	0
S78	137.94 MHz	25.00 kHz	0	0	0
S79	137.96 MHz	25.00 kHz	1	0	0
S80	137.99 MHz	25.00 kHz	26	10	0
S81	138.01 MHz	25.00 kHz	56	25	0
S82	138.04 MHz	25.00 kHz	74	18	1
S83	138.06 MHz	25.00 kHz	81	23	0
S84	138.09 MHz	25.00 kHz	82	16	1
S85	138.11 MHz	25.00 kHz	61	4	0
S86	138.14 MHz	25.00 kHz	2	0	0

S87	138.16 MHz	25.00 kHz	0	0	0
S88	138.19 MHz	25.00 kHz	0	0	0
S89	138.21 MHz	25.00 kHz	0	0	0
S90	138.24 MHz	25.00 kHz	0	0	0
S91	138.26 MHz	25.00 kHz	1	0	0
S92	138.29 MHz	25.00 kHz	3	1	0
S93	138.31 MHz	25.00 kHz	51	19	0

Channel Name	Main Frequency	Bandwidth	Max	Occupancy [%] Avg	Min
S94	138.34 MHz	25.00 kHz	59	24	0
S95	138.36 MHz	25.00 kHz	77	19	0
S96	138.39 MHz	25.00 kHz	83	22	2
S97	138.41 MHz	25.00 kHz	79	12	0
S98	138.44 MHz	25.00 kHz	44	2	0
S99	138.46 MHz	25.00 kHz	1	0	0
S100	138.49 MHz	25.00 kHz	0	0	0
S101	138.51 MHz	25.00 kHz	0	0	0
S102	138.54 MHz	25.00 kHz	0	0	0

S103	138.56 MHz	25.00 kHz	0	0	0
S104	138.59 MHz	25.00 kHz	1	0	0
S105	138.61 MHz	25.00 kHz	35	13	0
S106	138.64 MHz	25.00 kHz	58	25	0
S107	138.66 MHz	25.00 kHz	77	19	0
S108	138.69 MHz	25.00 kHz	81	23	1
S109	138.71 MHz	25.00 kHz	82	15	0
S110	138.74 MHz	25.00 kHz	66	4	0
S111	138.76 MHz	25.00 kHz	2	0	0
S112	138.79 MHz	25.00 kHz	0	0	0
S113	138.81 MHz	25.00 kHz	0	0	0
S114	138.84 MHz	25.00 kHz	0	0	0
S115	138.86 MHz	25.00 kHz	0	0	0
S116	138.89 MHz	25.00 kHz	1	0	0
S117	138.91 MHz	25.00 kHz	4	1	0
S118	138.94 MHz	25.00 kHz	56	22	0
S119	138.96 MHz	25.00 kHz	71	24	1
S120	138.99 MHz	25.00 kHz	82	21	1

S121	139.01 MHz	25.00 kHz	82	22	3
S122	139.04 MHz	25.00 kHz	80	11	0
S123	139.06 MHz	25.00 kHz	45	2	0
S124	139.09 MHz	25.00 kHz	1	0	0

Channel Name	Main Frequency	Bandwidth	Max	Occupancy [%] Avg	Min
S125	139.11 MHz	25.00 kHz	0	0	0
S126	139.14 MHz	25.00 kHz	0	0	0
S127	139.16 MHz	25.00 kHz	0	0	0
S128	139.19 MHz	25.00 kHz	1	0	0
S129	139.21 MHz	25.00 kHz	2	0	0
S130	139.24 MHz	25.00 kHz	15	5	0
S131	139.26 MHz	25.00 kHz	58	26	1
S132	139.29 MHz	25.00 kHz	78	21	1
S133	139.31 MHz	25.00 kHz	81	23	0
S134	139.34 MHz	25.00 kHz	84	20	2
S135	139.36 MHz	25.00 kHz	77	7	0

S136	139.39 MHz	25.00 kHz	20	1	0
S137	139.41 MHz	25.00 kHz	1	0	0
S138	139.44 MHz	25.00 kHz	0	0	0
S139	139.46 MHz	25.00 kHz	0	0	0
S140	139.49 MHz	25.00 kHz	0	0	0
S141	139.51 MHz	25.00 kHz	1	0	0
S142	139.54 MHz	25.00 kHz	4	1	0
S143	139.56 MHz	25.00 kHz	38	15	0
S144	139.59 MHz	25.00 kHz	63	31	1
S145	139.61 MHz	25.00 kHz	80	21	2
S146	139.64 MHz	25.00 kHz	85	25	1
S147	139.66 MHz	25.00 kHz	81	18	1
S148	139.69 MHz	25.00 kHz	74	5	0
S149	139.71 MHz	25.00 kHz	7	0	0
S150	139.74 MHz	25.00 kHz	1	0	0
S151	139.76 MHz	25.00 kHz	0	0	0
S152	139.79 MHz	25.00 kHz	0	0	0
S153	139.81 MHz	25.00 kHz	0	0	0

S154	139.84 MHz	25.00 kHz	2	0	0
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S155	139.86 MHz	25.00 kHz	8	2	0
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Channel Name	Main Frequency	Bandwidth	Max	Occupancy [%] Avg	Min
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S156	139.89 MHz	25.00 kHz	63	27	0
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S157	139.91 MHz	25.00 kHz	69	31	1
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S158	139.94 MHz	25.00 kHz	82	23	1
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S159	139.96 MHz	25.00 kHz	86	24	3
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S160	139.99 MHz	25.00 kHz	80	14	0
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S161	140.01 MHz	25.00 kHz	55	3	0
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S162	140.04 MHz	25.00 kHz	3	0	0
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S163	140.06 MHz	25.00 kHz	1	0	0
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S164	140.09 MHz	25.00 kHz	1	0	0
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S165	140.11 MHz	25.00 kHz	0	0	0
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S166	140.14 MHz	25.00 kHz	1	0	0
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S167	140.16 MHz	25.00 kHz	3	1	0
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S168	140.19 MHz	25.00 kHz	20	7	0
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S169	140.21 MHz	25.00 kHz	70	31	0
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S170	140.24 MHz	25.00 kHz	79	26	1
S171	140.26 MHz	25.00 kHz	84	26	0
S172	140.29 MHz	25.00 kHz	87	23	3
S173	140.31 MHz	25.00 kHz	79	10	0
S174	140.34 MHz	25.00 kHz	28	1	0
S175	140.36 MHz	25.00 kHz	1	0	0
S176	140.39 MHz	25.00 kHz	1	0	0
S177	140.41 MHz	25.00 kHz	1	0	0
S178	140.44 MHz	25.00 kHz	0	0	0
S179	140.46 MHz	25.00 kHz	1	0	0
S180	140.49 MHz	25.00 kHz	4	1	0
S181	140.51 MHz	25.00 kHz	41	17	0
S182	140.54 MHz	25.00 kHz	70	35	0
S183	140.56 MHz	25.00 kHz	81	25	1
S184	140.59 MHz	25.00 kHz	87	28	1
S185	140.61 MHz	25.00 kHz	87	21	2
S186	140.64 MHz	25.00 kHz	77	7	0

Channel Name	Main Frequency	Bandwidth	Occupancy		
			Max	[%] Avg	Min
S187	140.66 MHz	25.00 kHz	12	1	0
S188	140.69 MHz	25.00 kHz	1	0	0
S189	140.71 MHz	25.00 kHz	1	0	0
S190	140.74 MHz	25.00 kHz	1	0	0
S191	140.76 MHz	25.00 kHz	0	0	0
S192	140.79 MHz	25.00 kHz	2	1	0
S193	140.81 MHz	25.00 kHz	8	2	0
S194	140.84 MHz	25.00 kHz	62	28	0
S195	140.86 MHz	25.00 kHz	72	35	2
S196	140.89 MHz	25.00 kHz	86	25	2
S197	140.91 MHz	25.00 kHz	87	28	5
S198	140.94 MHz	25.00 kHz	85	17	1
S199	140.96 MHz	25.00 kHz	73	5	0
S200	140.99 MHz	25.00 kHz	6	1	0
S201	141.01 MHz	25.00 kHz	1	0	0
S202	141.04 MHz	25.00 kHz	1	0	0

S203	141.06 MHz	25.00 kHz	1	0	0
S204	141.09 MHz	25.00 kHz	1	0	0
S205	141.11 MHz	25.00 kHz	4	1	0
S206	141.14 MHz	25.00 kHz	18	6	0
S207	141.16 MHz	25.00 kHz	70	31	1
S208	141.19 MHz	25.00 kHz	83	37	4
S209	141.21 MHz	25.00 kHz	87	29	4
S210	141.24 MHz	25.00 kHz	86	21	2
S211	141.26 MHz	25.00 kHz	82	7	0
S212	141.29 MHz	25.00 kHz	16	1	0
S213	141.31 MHz	25.00 kHz	2	0	0
S214	141.34 MHz	25.00 kHz	1	0	0
S215	141.36 MHz	25.00 kHz	1	0	0
S216	141.39 MHz	25.00 kHz	1	0	0
S217	141.41 MHz	25.00 kHz	4	1	0

Channel Name	Main Frequency	Bandwidth	Max	Occupancy [%] Avg	Min
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S218	141.44 MHz	25.00 kHz	15	4	0
S219	141.46 MHz	25.00 kHz	65	30	0
S220	141.49 MHz	25.00 kHz	77	34	3
S221	141.51 MHz	25.00 kHz	86	27	2
S222	141.54 MHz	25.00 kHz	87	28	5
S223	141.56 MHz	25.00 kHz	86	16	1
S224	141.59 MHz	25.00 kHz	71	5	0
S225	141.61 MHz	25.00 kHz	9	1	0
S226	141.64 MHz	25.00 kHz	1	0	0
S227	141.66 MHz	25.00 kHz	1	0	0
S228	141.69 MHz	25.00 kHz	1	0	0
S229	141.71 MHz	25.00 kHz	2	0	0
S230	141.74 MHz	25.00 kHz	5	1	0
S231	141.76 MHz	25.00 kHz	30	10	0
S232	141.79 MHz	25.00 kHz	69	35	1
S233	141.81 MHz	25.00 kHz	83	29	4
S234	141.84 MHz	25.00 kHz	86	28	2
S235	141.86 MHz	25.00 kHz	89	25	3

S236	141.89 MHz	25.00 kHz	83	11	0
S237	141.91 MHz	25.00 kHz	46	3	0
S238	141.94 MHz	25.00 kHz	5	1	0
S239	141.96 MHz	25.00 kHz	1	0	0
S240	141.99 MHz	25.00 kHz	1	0	0
S241	142.01 MHz	25.00 kHz	1	0	0
S242	142.04 MHz	25.00 kHz	2	1	0
S243	142.06 MHz	25.00 kHz	8	2	0
S244	142.09 MHz	25.00 kHz	53	21	0
S245	142.11 MHz	25.00 kHz	72	38	2
S246	142.14 MHz	25.00 kHz	84	27	3
S247	142.16 MHz	25.00 kHz	88	29	2
S248	142.19 MHz	25.00 kHz	88	22	2