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PREFACE

Pakistan Meteorological Department (PMD) has been recording the intensity and magnitude of earthquakes since 1951, at seismic Observatory Quetta. In the beginning, the instruments namely Sprinter were being used. Later on, the Sprenter instruments were replaced by WWSSN as part of global seismic network till 2006. After 2006, the digital seismic monitoring equipments known as GURALP system were installed across Pakistan including Quetta, Islamabad, Peshawar, Lahore, Zhob, Turbat, Gilgit. Since then, the GURALP Instruments are regularly being used to record the earthquake events across the country and the neighboring countries.

Earthquake activity in Pakistan is mainly concentrated in the north and western sections of the country, along the conjunctions of Indian plate with the Iranian and Afghan micro-plates. The Chaman Fault runs along Pakistan's western frontier with Afghanistan from Kalat, in the northern Makran range, past Quetta and then on to Kabul, Afghanistan. A fault also runs along the Makran coast and is believed to be of the same nature as the West Coast fault along the coast of Maharashtra, An active subduction zone exists off the Makran coast.

This zone forms the boundary between the Arabian and the Iranian micro-plate, where the former subducts or dives beneath the latter. Thrust zones run along the Kirthar, Sulaiman and Salt ranges. There are four faults in and around Karachi and other parts of deltaic Indus, and Makran coast. The first is the Allah Bund fault that passes through Shahbunder, Jah, Pakistan Steel Mills, and runs through eastern parts of the city and ends near Cape Monz record depicts that fault, in fact, has caused extensive damage in the past many centuries in the deltaic areas. The destruction of Bhanbhor in the 13th century and damage to Shahbunder in 1896 were caused by this fault. The other one emanates from the Rann of Kutchh. The third one is the Pubb fault which ends into Arabian sea near Makran coast and the last one is located in the lower Dadu district near Surajani and falls in the vicinity of Karachi. Tsunamis or tidal waves have also affected the coast of Pakistan. The worst case was in 1945 when an earthquake of magnitude 8 struck the Makran coast, generating Tsunami washing away the town of Gwadar, waves as high as 12 meters.

The 1935 Quetta earthquake occurred on 31 May between 2:33 am and 3:40 am at Quetta, Balochistan. The earthquake had a magnitude of 7.7 and more than 30,000, people died from the impact. This ranked as the deadliest earthquake that hit South Asia until the October 08, 2005 Kashmir earthquake that devastated most parts of Kashmir and adjoining areas with death toll of more than 70,000 and millions homeless.

Pakistan Meteorological Department
Regional Meteorological & Geophysical Centre, Quetta
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Particulars of Stations

Sr. No.	Station	Symbol	Latitude °N	Longitude °E	Height (a. s. l.) in meters	Equipment Installed	Remarks
01.	QUETTA(Brewery)	Que	30.1887	66.9497	1721	Analog D.S.E.	Long period. Short period
02.	QUETTA (RSMC) (Sheikhmanda)	Que	30.2333	66.9833	1640	D.S.E.	Broadband
03.	KARACHI (NSMC)	Khi	24.9167	67.1333	38	D.S.E.	Broadband
04.	ISLAMABAD NSMC (Backup)	Isb	33.6800	73.0600	543	D.S.E.	Short period
05.	KHUZDAR	Khz	27.7833	66.6012	1248	D.S.E.	Broadband
06.	ZHOB	Zhb	31.3375	69.4511	1421	D.S.E.	Broadband
07.	TURBAT	Tur	25.9833	63.0166	141	D.S.E.	Broadband
08.	PESHAWAR (RSMC)	Psh	34.0200	71.5600	392	D.S.E. D.S.E.	Broadband. Short period
09.	LAHORE	Lhr	31.5500	74.3300	210	Analog D.S.E.	Short period Short period
10.	BALAKOT	Blk	34.5333	73.3333	995	D.S.E.	Broadband
11.	CHITRAL	Cht	35.8833	71.7833	1498	D.S.E.	Broadband
12.	UMERKOT	Umk	25.3333	69.7166	33	D.S.E.	Broadband
13.	MUZAFFARABAD	Muz	34.3646	73.4938	1169	D.S.E.	Broadband
14.	BAHAWALNAGAR	Bng	29.9500	73.2500	161	D.S.E.	Broadband

Abbreviations:

H	=	Origin Time.
ep, es & ex	=	emergence of primary-wave and emergence of shear wave and Unidentified wave
Mb	=	Body wave magnitude on Richter scale.
Mw	=	USGS magnitude on Richter scale.
H, M, S	=	Hours, Minute and Second in GMT.
Ipc	=	impulsive phase compression.
Ipd	=	impulsive phase dilatation.
N.S.M.C	=	National Seismic Monitoring Centre.
R.S.M.C	=	Regional Seismic Monitoring Centre.
D.S.E	=	Digital Seismic Equipment.

SUMMARY

The Seismic Monitoring Network of Pakistan Meteorological Department is working round the clock to record and monitor seismic activities all over the world, especially Pakistan, the South-Asia and neighboring countries.

In the month of May 2019, total numbers of events recorded by PMD Seismic network were 71. The frequency analysis based on magnitude of events depicts that 06 events were Minor (03-3.9), 25 events were of mild magnitude (04-4.9). The network also recorded 27 events of moderate magnitude (05-5.9) and 12 events of severe magnitude (06-6.9). 01 events of violent were reported by PMD Seismic network in the month of May, 2019 as depicted in the Figure 1.

Figure 1: Frequency Analysis of the Magnitude of the Seismic Events Recorded by PMD Seismic Network

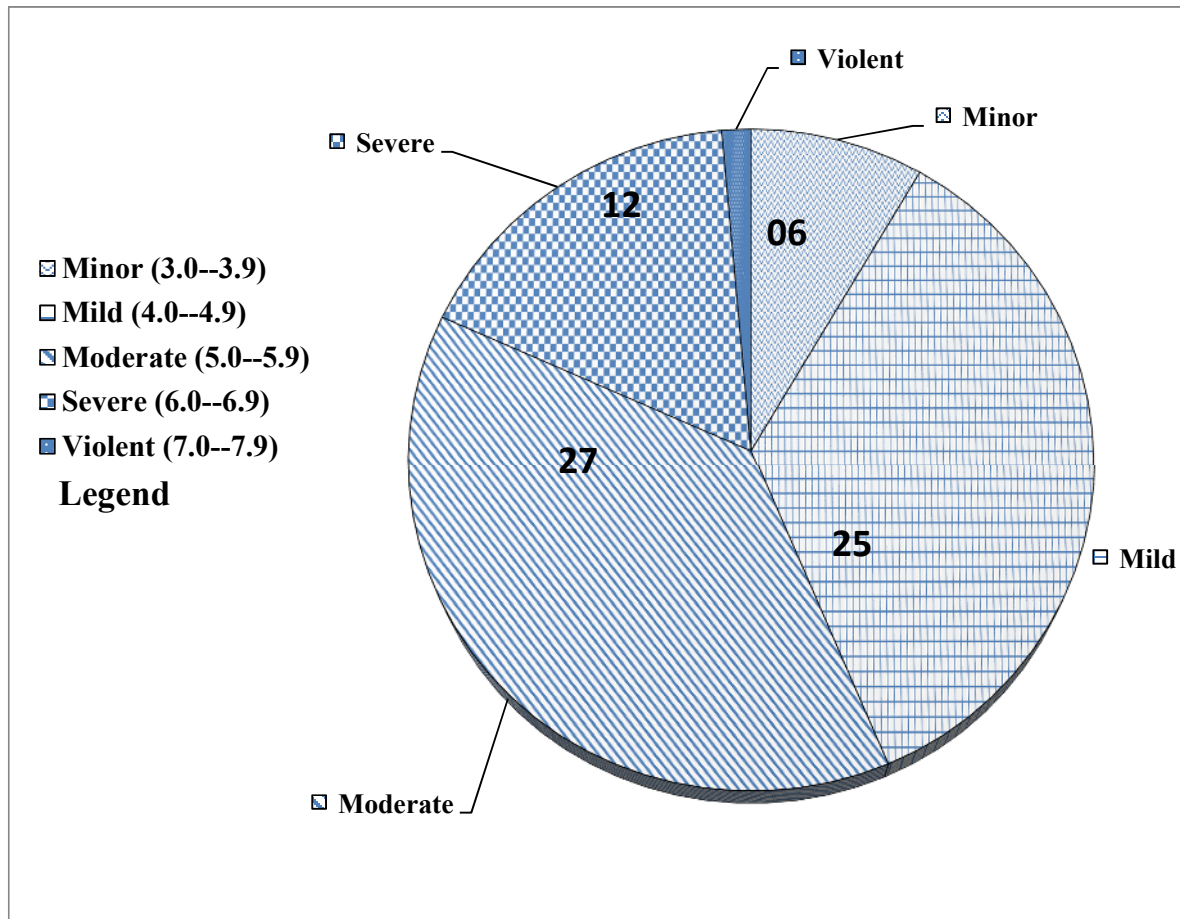


Figure01: shows the number of events recorded during the month of May, 2019 for different categories of severity.

FOCAL DEPTH

The frequency analysis based on focal depth of Seismic events for the month of May, 2019 was carried out. In the month of June, 2019 PMD Seismic network recorded totally 30 numbers of Major Seismic events.

The analysis depicts that the frequency of Shallow focal depth (0-70 km) seismic events was maximum with 24 numbers. Shallow focal depth earthquakes are also known as crustal earthquakes.

The Intermediate focal depth (70-300 km) seismic events were 03 numbers and 03 number of deep focal depth (>700 km) seismic events recorded by PMD Seismic network. Deep focal depth earthquakes also known as Intra-Plate earthquakes.

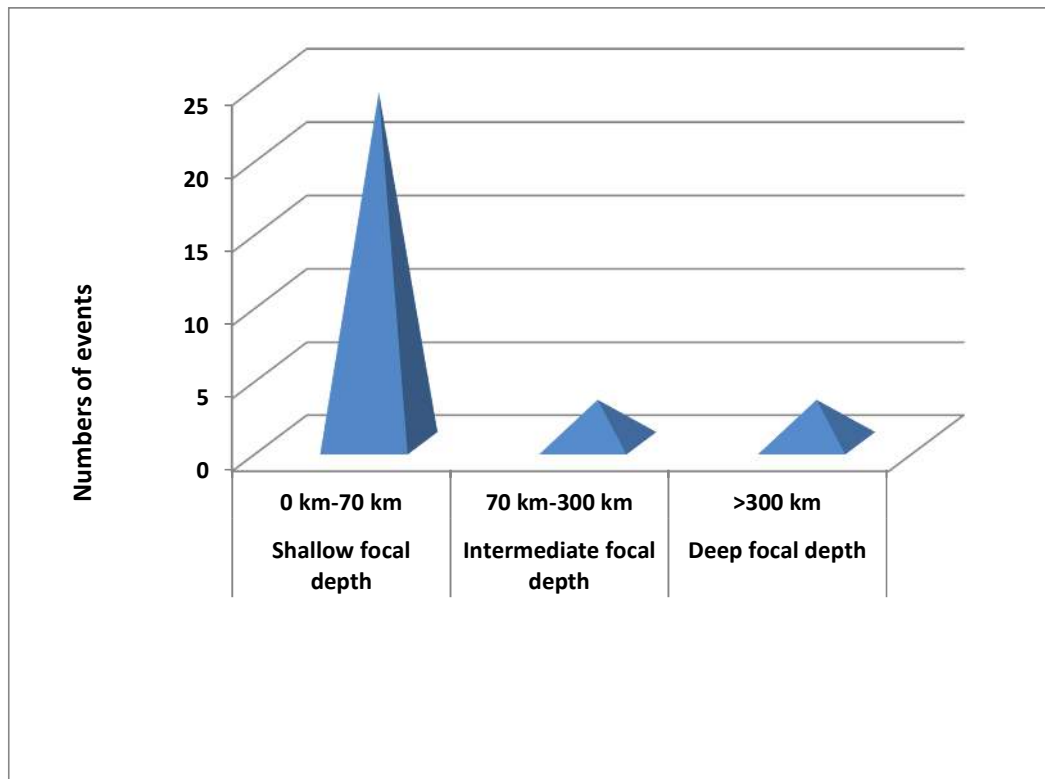


Figure2: Frequency analysis of major earthquakes based on focal depth during the month of May, 2019.

May 2019					Major Shocks			
Date	Station	Phase	H:M:S	Depth	Magnitude	Lat	Long	Country
3	Qta	ep es	- -	25 Km	-	6.9 ° S	160 ° E	Solomon Islands
	Isb	-	7:25:46		6			
	Pwr	ep es	7:38:38 7:49:32		6.1			
	Lhr	ep es	- 7:38:28		6.1			
	Usgs	-	7:25:31		6.2			
4	Qta	ep es	- -	10 Km	-	12.39 ° N	121 ° E	Mindoro, Philippines
	Isb	-	1:05:10		5.5			
	Pwr	ep es	1:14:02 1:21:11		5.7			
	Lhr	ep es	1:13:40 -		5.8			
	Usgs	-	1:05:10		5.6			
4	Qta	ep es	- -	91 Km	-	26.12 ° N	95.74 ° E	Myanmar-India Border Region
	Isb	-	11:03:52		5.4			
	Pwr	ep es	11:08:52 11:12:45		5.1			
	Lhr	ep es	11:08:21 -		5.4			
	Usgs	-	11:04:01		5.1			
4	Qta	ep es	- -	43 Km	-	43.26 ° N	146.5 ° E	Kuril Islands
	Isb	-	16:40:21		5.6			
	Pwr	ep es	16:50:09 16:58:01		5.1			
	Lhr	ep es	16:50:06 -		5.6			
	Usgs	-	16:40:25		5.1			
4	Qta	ep es	- -	349 Km	-	1.98 ° N	123.7 ° E	Minahassa Peninsula, Sulawesi
	Isb	-	21:02:11		5.4			
	Pwr	ep es	21:11:30 21:19:01		5.7			
	Lhr	ep es	21:11:08 -		5.4			
	Usgs	-	21:02:12		5.6			

May 2019					Major Shocks			
Date	Station	Phase	H:M:S	Depth	Magnitude	Lat	Long	Country
5	Qta	ep es	- -	137 Km	-	6.29 ° S	145.8 ° E	New Guinea, Papua New Guinea
	Isb	-	8:42:50		5.4			
	Pwr	ep es	8:54:48 9:04:41		5.2			
	Lhr	ep es	8:54:32 -		5.4			
	Usgs	-	8:42:49		5			
5	Qta	ep es	- -	312 Km	-	6.04 ° S	128.8 ° E	Banda Sea
	Isb	-	9:40:04		5.4			
	Pwr	ep es	9:50:25 9:58:46		5			
	Lhr	ep es	9:50:04 -		5.4			
	Usgs	-	9:40:03		5			
6	Qta	ep es	- -	45 Km	-	18.57 ° N	121.1 ° E	Luzon, Philippines
	Isb	-	2:48:47		5.5			
	Pwr	ep es	2:56:58 3:03:37		5.5			
	Lhr	ep es	2:56:46 -		5.5			
	Usgs	-	2:48:42		5.5			
6	Qta	ep es	- -	25 Km	-	5.35 ° S	102.1 ° E	Southern Sumatra, Indonesia
	Isb	-	8:20:13		5.2			
	Pwr	ep es	8:29:02 8:36:00		5.3			
	Lhr	ep es	8:28:36 -		5.2			
	Usgs	-	8:20:20		5.1			
6	Qta	ep es	- -	10 Km	-	3.26 ° S	12.24 ° W	North of Ascension Island
	Isb	-	13:23:09		5.2			
	Pwr	ep es	13:35:49 13:46:21		5.4			
	Lhr	ep es	13:36:06 -		5.2			
	Usgs	-	13:23:09		5.4			

May 2019					Major Shocks			
Date	Station	Phase	H:M:S	Depth	Magnitude	Lat	Long	Country
9	Qta	ep es	- -	10 Km	-	31.77 ° N	131.8 ° E	Kyushu, Japan
	Isb	-	22:43:21		5.6			
	Pwr	ep es	22:52:16 22:59:25		5.6			
	Lhr	ep es	22:52:02 -		5.5			
	Usgs	-	22:43:21		5.6			
10	Qta	ep es	- -	54 Km	-	31.83 ° N	131.7 ° E	Kyushu, Japan
	Isb	-	0:07:32		5.2			
	Pwr	ep es	0:16:29 0:23:35		5.1			
	Lhr	ep es	0:19:49 -		5.2			
	Usgs	-	0:07:39		5			
11	Qta	ep es	- -	10 Km	-	34.83 ° N	45.71 ° E	Iran-Iraq Border Region
	Isb	-	10:29:00		5.4			
	Pwr	ep es	10:33:48 10:37:41		5.3			
	Lhr	ep es	10:34:16 -		5.4			
	Usgs	-	10:28:59		5			
12	Qta	ep es	- -	10 Km	-	19.37 ° N	121 ° E	Philippine Island Region
	Isb	-	8:59:51		5.2			
	Pwr	ep es	9:08:18 9:15:05		5.4			
	Lhr	ep es	9:07:57 -		5.2			
	Usgs	-	8:59:52		5.3			
13	Qta	ep es	- -	10 Km	-	79.33 ° N	124 ° E	East of Severnaya Zemlya
	Isb	-	0:43:34		5			
	Pwr	ep es	0:52:30 0:59:41		5.4			
	Lhr	ep es	0:52:50 -		5			
	Usgs	-	0:43:33		5.3			

May 2019					Major Shocks			
Date	Station	Phase	H:M:S	Depth	Magnitude	Lat	Long	Country
13	Qta	ep es	- -	35 Km	-	6.4 ° S	150.8 ° E	New Britain Region, P.N.G
	Isb	-	12:54:24		5.2			
	Pwr	ep es	13:06:53 13:17:18		5.3			
	Lhr	ep es	13:04:39 -		5.3			
	Usgs	-	12:54:25		5.3			
14	Qta	ep es	- -	25 Km	-	4.16 ° S	152.5 ° E	New Britain Region, P.N.G
	Isb	-	12:58:24		7.3			
	Pwr	ep es	13:10:59 13:21:28		7.5			
	Lhr	ep es	13:10:46 -		7.3			
	Usgs	-	12:58:28		7.5			
14	Qta	ep es	- -	55 Km	-	43.84 ° N	148 ° E	East of Kuril Islands
	Isb	-	20:55:49		5.4			
	Pwr	ep es	21:05:19 21:13:17		5.7			
	Lhr	ep es	21:05:14 -		5.4			
	Usgs	-	20:55:28		5.4			
15	Qta	ep es	- -	42 Km	-	29.76 ° N	130.6 ° E	Ryukyu Islands, Japan
	Isb	-	5:24:38		5.4			
	Pwr	ep es	5:33:20 5:40:25		5.4			
	Lhr	ep es	5:33:08 -		5.4			
	Usgs	-	5:24:32		5.6			
16	Qta	ep es	- -	29 Km	-	5.19 ° S	152.5 ° E	New Britain Region, P.N.G
	Isb	-	1:23:56		5.6			
	Pwr	ep es	1:36:34 1:47:03		5.7			
	Lhr	ep es	1:36:21 -		5.6			
	Usgs	-	1:23:59		5.7			

May 2019					Major Shocks			
Date	Station	Phase	H:M:S	Depth	Magnitude	Lat	Long	Country
17	Qta	ep es	- -	31 Km	-	4.57 ° S	153 ° E	New Britain Region, P.N.G
	Isb	-	22:37:46		5.8			
	Pwr	ep es	22:50:23 23:00:47		6			
	Lhr	ep es	22:50:11 -		5.7			
	Usgs	-	22:37:48		5.9			
18	Qta	ep es	- -	10 Km	-	9.47 ° S	108.6 ° E	South of Java, Indonesia
	Isb	-	1:51:29		5.8			
	Pwr	ep es	2:01:04 2:08:50		5.6			
	Lhr	ep es	2:00:40 -		5.8			
	Usgs	-	1:51:29		5.5			
19	Qta	ep es	- -	10 Km	-	10.21 ° S	119.2 ° E	Sumba Region, Indonesia
	Isb	-	6:16:07		5			
	Pwr	ep es	6:26:34 6:35:01		5.1			
	Lhr	ep es	6:26:13 -		5			
	Usgs	-	6:16:07		5			
21	Qta	ep es	- -	42 Km	-	0.62 ° N	122.4 ° E	Minahassa Peninsula, Sulawesi
	Isb	-	18:42:49		5			
	Pwr	ep es	18:52:32 19:00:22		5.1			
	Lhr	ep es	18:52:15 -		5			
	Usgs	-	18:42:44		5			
22	Qta	ep es	- -	34 Km	-	13.82 ° N	92.92 ° E	Andaman Islands, India Region
	Isb	-	0:39:33		5.7			
	Pwr	ep es	0:45:24 0:50:04		5.6			
	Lhr	ep es	0:44:53 -		5.7			
	Usgs	-	0:39:35		5.6			

May 2019					Major Shocks			
Date	Station	Phase	H:M:S	Depth	Magnitude	Lat	Long	Country
23	Qta	ep es	- -	31 Km	-	51.43 ° N	178.3 ° W	Andreanof Islands, Aleutian Islands
	Isb	-	8:45:26		6			
	Pwr	ep es	8:56:58 9:06:32		6.1			
	Lhr	ep es	8:57:01 -		6			
	Usgs	-	8:45:18		6			
25	Qta	ep es	- -	38 Km	-	35.25 ° N	140.1 ° E	Near East Coast of Honshu, Japan
	Isb	-	6:20:43		5.3			
	Pwr	ep es	6:30:19 6:38:01		5			
	Lhr	ep es	6:30:09 -		5.3			
	Usgs	-	6:20:47		5			
27	Qta	ep es	- -	58 Km	-	59.04 ° N	152.6 ° W	Southern Alaska
	Isb	-	9:52:18		5.7			
	Pwr	ep es	10:04:24 10:14:18		5.7			
	Lhr	ep es	10:04:33 -		5.7			
	Usgs	-	9:52:21		5.8			
27	Qta	ep es	- -	72 Km	-	59.04 ° N	152.9 ° E	New Britain Region, P.N.G
	Isb	-	10:14:13		5.2			
	Pwr	ep es	10:26:39 10:36:52		5.3			
	Lhr	ep es	10:26:38 -		5.2			
	Usgs	-	10:14:21		5			
31	Qta	ep es	- -	578 Km	-	7.22 ° S	117.5 ° E	Bali Sea
	Isb	-	6:27:54		5.1			
	Pwr	ep es	6:47:02 6:54:25		5.4			
	Lhr	ep es	6:46:40 -		5.3			
	Usgs	-	6:37:53		5.2			

May 2019		Minor Shocks		
Date	Station	Phase	H:M:S	Magnitude
1	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	10:45:16 10:45:53	4.4
4	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	5:53:58 5:54:08	4.6
8	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	8:57:19 5:58:59	4.2
10	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	6:41:43 6:22:02	3.8
12	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	17:31:06 17:32:09	4.5
13	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	19:52:59 19:53:48	4
26	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	1:48:14 1:50:50	4.7
26	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	2:12:44 2:15:19	4.8
26	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	2:14:18 0:00:00	4.7

May 2019			Minor Shocks	
Date	Station	Phase	H:M:S	Magnitude
26	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	9:07:56 9:08:31	4.2
27	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	14:23:58 14:24:28	4.4
27	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	23:26:08 23:26:43	4.2
27	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	23:28:44 0:00:00	4.2
28	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	0:30:50 0:31:23	4.2
28	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	14:31:48 14:32:07	3.7
29	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	14:31:48 14:32:07	3.7
29	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	0:00:00 0:00:00	-
30	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	6:44:51 6:45:25	4.2
30	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	6:46:15 0:00:00	4.2
30	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	14:40:50 14:41:26	4
30	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	14:41:05 0:00:00	3.9
31	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	16:02:46 16:03:41	4.6
31	Qta	ep	0:00:00	-
		es	0:00:00	
	Pwr	ep es	16:07:44 0:00:00	4.6