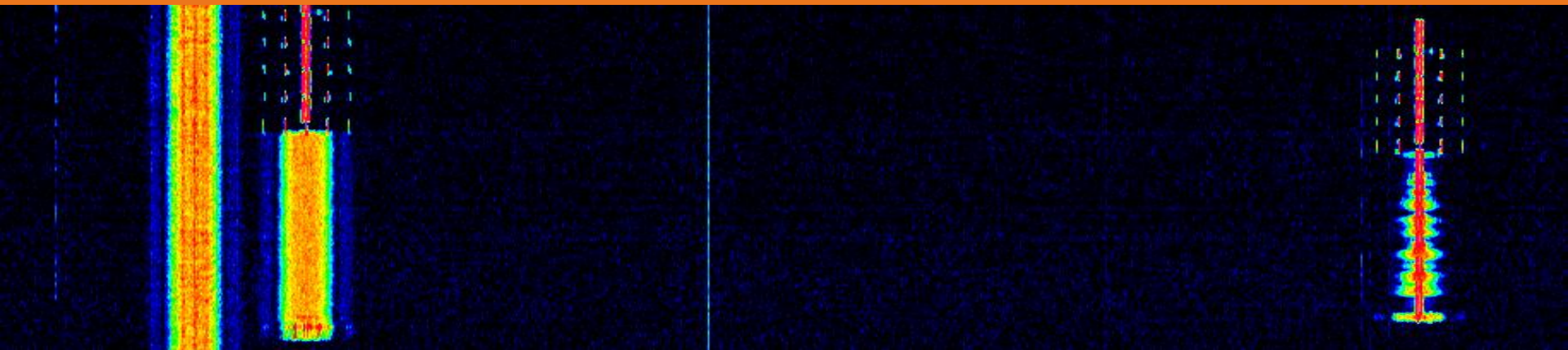


Tracking Edmonton's Trunked Radio System with GNU Radio

Clayton Caron



Trunked Radio

- Users share a pool of channels
- More efficient bandwidth allocation (solution to spectrum crowding)
- Often uses a dedicated control channel to manage communication
- Group call support via talkgroups (agencies, fleets, and subfleets)

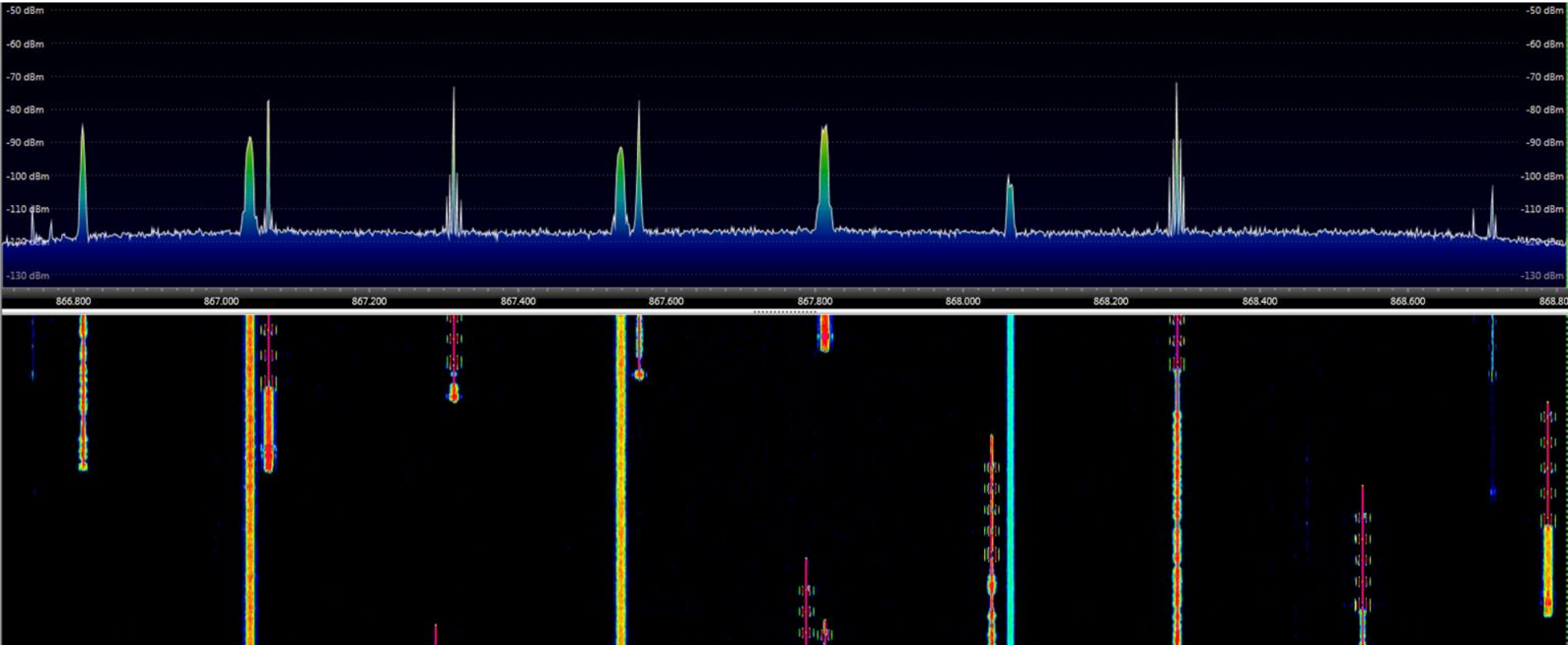
http://wiki.radioreference.com/index.php/Trunking_Basics

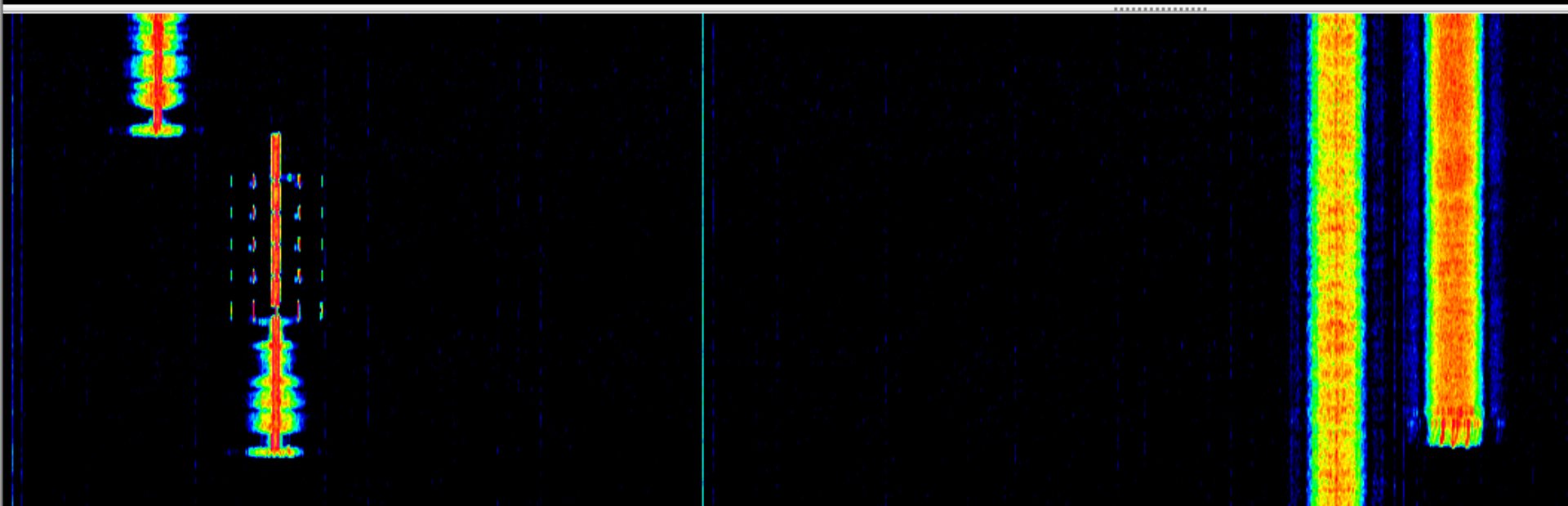
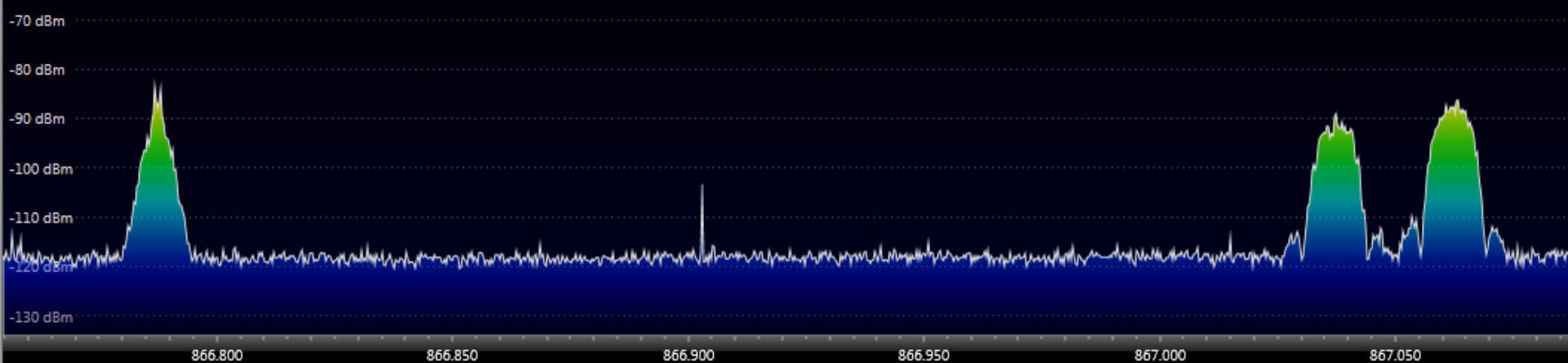
Edmonton Public Safety and Public Works

- Police, Fire, EMS, and others
- System Type: EDACS Standard
- System Voice: ProVoice and Analog
- 20 Channels
- Frequency ranges from 866.0375 MHz to 868.7875 MHz
- Outbound control channel swaps between 866.7875 MHz (Ch 4) and 867.0375 MHz (Ch 5)

<http://www.radioreference.com/apps/db/?sid=1328>

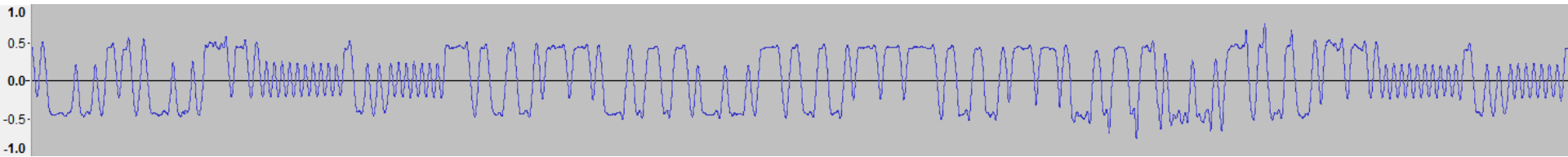
System radio activity...



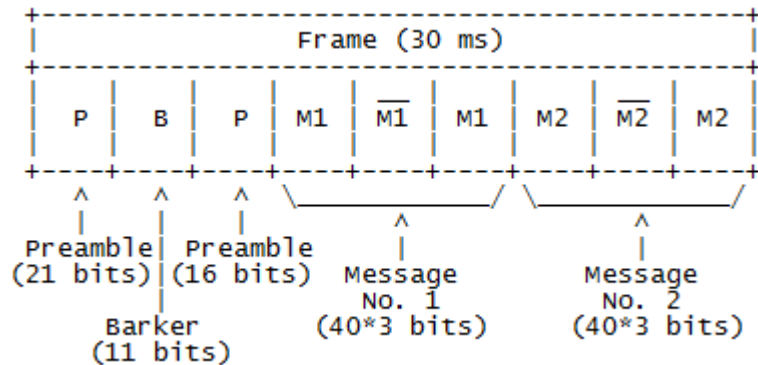


EDACS Control Channel

- Modulation: Gaussian Frequency-Shift Keying (GFSK) digital modulation
- Baud rate: 9600 bits per second
- Frame synchronization: 0101010101010101010101011100010010010101010101010101
or 0x555557125555



EDACS Control Channel Cont.



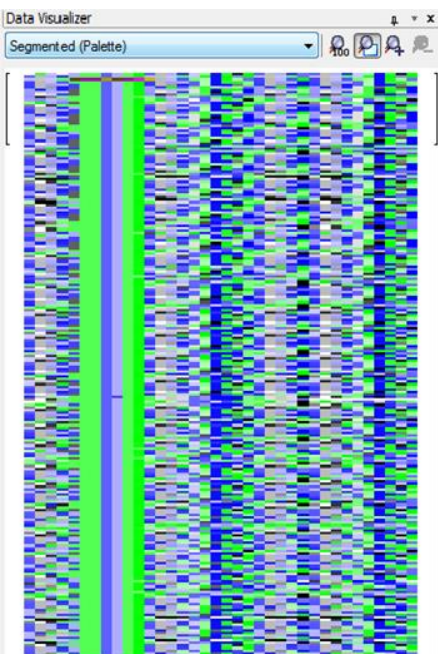
Message	
Bits	Function
0 - 7	Command bits
8 - 12	Logical channel number (LCN)
13 - 16	Status bits
17 - 19	Agency ID
20 - 23	Fleet ID
24 - 27	Subfleet ID
28 - 39	Error correction polynomial

---Talkgroup

www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2014-1998-PDF-E.pdf

<https://web.archive.org/web/20060429232951/http://users.netropolis.net/maverick/scanners/edacs.htm>

Control channel data...



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
00000000	0061	8702	9555	55C4	9555	7BC6	0995	E184	39F6	6A1E	7BC6	0995	E1BB	C													
00000036	C609	95E1	9555	55C4	9555	7B8E	0887	5484	71F7	78AB	7B8E	0887	54BB	8													
00000072	8E08	8754	9555	55C4	9555	7BD6	098D	CB44	29F6	7234	BBD6	098D	CB7B	I													
00000108	D609	8DCB	5555	55C4	9555	7BD8	099E	93C4	27F6	616C	3BD8	099E	93FB	I													
00000144	D809	9E93	D555	55C4	9555	7BDC	090D	EEC4	23F6	F211	3BDC	090D	EEFB	I													
00000180	DC09	0DEE	D555	55C4	9555	7B9F	DA6C	C844	6025	9337	BB9F	DA6C	C87B	S													
00000216	9FEA	9BE9	1555	55C4	9555	7BA0	0891	8E04	5FF7	6E71	FBA0	0891	8E3B	Z													
00000252	A008	918E	1555	55C4	9555	7BA2	0185	D704	5DFE	7A28	FBA2	0185	D73B	Z													
00000288	A201	85D7	1555	55C4	9555	7BA6	1C11	4444	59E3	EEBB	BBA6	1C11	447B	Z													
00000324	A61C	1144	5555	55C4	9555	533C	A98D	29AC	C356	72D6	533C	A98D	2996	S													
00000360	9CA9	8E9B	5555	55C4	9555	7F38	7697	B000	C789	684F	FF38	7697	B03F	S													
00000396	3876	97B0	1555	55C4	9555	7F59	0407	05C0	A6FB	F8FA	3F59	0407	05FF	1													
00000432	1000	1B52	5555	55C4	9555	7BC6	0995	E184	39F6	6A1E	7BC6	0995	E1BB	C													
00000468	C609	95E1	9555	55C4	9555	7BD8	099E	93C4	27F6	616C	3BD8	099E	93FB	I													
00000504	D809	9E93	D555	55C4	9555	7BDC	090D	EEC4	23F6	F211	3BDC	090D	EEFB	I													
00000540	DC09	0DEE	D555	55C4	9555	7B9F	DA6C	C844	6025	9337	BB9F	DA6C	C87B	S													
00000576	9FEA	9BE9	1555	55C4	9555	7BA0	0891	8E04	5FF7	6E71	FBA0	0891	8E3B	Z													
00000612	A008	918E	1555	55C4	9555	7BA2	0185	D704	5DFE	7A28	FBA2	0185	D73B	Z													
00000648	A201	85D7	1555	55C4	9555	7BE4	098D	3904	1BF6	72C6	FBE4	098D	393B	F													
00000684	E409	8D39	1555	55C4	9555	7BA6	1C11	4444	59E3	EEBB	BBA6	1C11	447B	Z													
00000720	A61C	1144	5555	55C4	9555	7F38	70EA	6940	C78F	1596	BF38	70EA	697F	S													
00000756	3870	EA69	5555	55C4	9555	7F59	0407	05C0	A6FB	F8FA	3F59	0407	05FF	1													
00000792	1000	1B52	5555	55C4	9555	7BC6	0995	E184	39F6	6A1E	7BC6	0995	E1BB	C													
00000828	C609	95E1	9555	55C4	9555	7BD8	099E	93C4	27F6	616C	3BD8	099E	93FB	I													
00000864	D809	9E93	D555	55C4	9555	7BDC	090D	EEC4	23F6	F211	3BDC	090D	EEFB	I													
00000900	DC09	0DEE	D555	55C4	9555	7B9F	DA6C	C844	6025	9337	BB9F	DA6C	C87B	S													
00000936	9FEA	9BE9	1555	55C4	9555	7BA2	0185	D704	5DFE	7A28	FBA2	0185	D73B	Z													
00000972	A201	85D7	1555	55C4	9555	7BE4	098D	3904	1BF6	72C6	FBE4	098D	393B	F													

Data Inspector

Data at offset 76:

int8	-107
uint8	149
int16	21909
uint16	21909
int32	-1001040491
uint32	3293926805
int64	-2991703425725147755
uint64	15455040647984403861
half float	89.3125
float	-853.33722
double	-4.0122379e+108
DATE	<invalid>
DOS date	21/12/2022
DOS time	10:44:42 AM
FILETIME	<invalid>
time_t	<invalid>
time64_t	<invalid>
binary	0101010101010101110001001001010101010101

Expression Calc

Signed 32 bit

1



GNU Radio

- Free & open-source software development toolkit
- Provides signal processing blocks for implementing software radio systems
 - Filters
 - Demodulators
 - Resamplers
 - Synchronizers
- Instrumentation and controls
 - Spectrum displays
 - Sliders
 - Buttons
- Blocks can be written in either C++ or Python

<http://gnuradio.org/about/>

Trunked Radio

Talkgroup: 0
Frequency List: [866.0375,...
Center Frequency: 867.413
Source Sample Rate: 4M
Sink Sample Rate: 48k
Track Analog: On
Track Digital: On
Tone Threshold: 150m
Noise Threshold: 5
Find Channel Numbers: On
Voice Threshold: 400m

General	Advanced	Documentation
ID	trunked_radio_0_0	
Talkgroup	0	
Frequency List	[866.0375, 866.2875, 866.5375, 866.7875, 867.0375]	
Center Frequency	867.4125	
Source Sample Rate	4000000	
Sink Sample Rate	48000	
Track Analog	On ▼	
Track Digital	On ▼	
Tone Threshold	slider_tone_threshold	
Noise Threshold	slider_noise_threshold	
Find Channel Numbers	On ▼	
Voice Threshold	0.4	

