

08/01/20

Lumistar Data Processing System (LDPS)

TMoIP Application - DQM

This is a supplement to the TMoIP Device application to describe the DQM mode (Data Quality Metrics). This is a special mode to accommodate receivers that have the capability to add the DQM data to the PCM bit stream.

What is DQM

For the best description of what the DQM is, you should contact Mr. Terry Hill at Quasonix. Below is my take on his explanation.

Data Quality Metrics is inserted into the PCM bit stream. The metrics are a 48 bit structure added every user configurable number of bits in the PCM bit stream by the receiver that received the original PCM bit stream. This encapsulation structure consists of

- 16 bit frame sync pattern (0xFAC4)
- 16 bit ID and reserved word (must be 0 currently)
- 16 bit Data Quality Metric

The Data Quality Metric is the key part inserted by the receiver. A value of 0 to 65535 representing the confidence of the receiver bit sync that it could determine the definition of the bit to be a 1 or a 0. It is described as the BEP (bit error probability), where the higher the BEP, the lower the DQM, and the less confidence the receiver could determine the difference between a 1 and a 0. The DQM is converted to the Q, a range between 0 and 12 where 12 is the best, corresponding to the BEP ranging from 0.5 to 1.0e-12.

The encapsulation is inserted at a user defined interval of bits (interval of bytes by this application). This insertion does add overhead to the system on the network as well as on the frame sync and encapsulation breakout. Some folks will need the encapsulation at a fairly high rate, others not so often. Much depends on your test and the terrain your test is in, relative to tracking antenna placement....and a whole bunch of other factors. You'll learn as you go. The default is every 4096 bits, put in the 48 bit encapsulation data.

How the receivers determine this is beyond me, but I know there are a few receivers out there that have some confidence weighting scheme of one sort or another. This one is being proposed to the RCC for inclusion into the 2018 IRIG specification. If

it becomes a standard, then the receivers can work interchangeably with decoms and best source selectors out in the world.

Why Use DQM

Depending on your receiver configuration and usage of the receiver, there are a few reasons why the DQM would be enabled.

- The combiner output is not trustworthy (incorrectly configured or antenna placement, etc.). The user could select to use channel 1 or channel 2 or the combiner output, depending on his confidence in the combiner, and the value of the DQM.
- Best source selector. Feed the DQM to a best source selector and it can use the Q to determine which source to collect data from. This is especially handy when you have antennas that cannot cover the entire mission and the data source selection criteria can be made with the Q.
- Post test processing. Post test, when analyzing all your data, if you have the Q, you can weight your data selection from the source with the best Q, if you have different sources for the same data.

It Will Be A While

It will most probably be a little while before all the vendors of receivers get this implemented, as well as the vendors of the decomp cards.

For the decomp cards, as you can see from the above, the receiver inserts 48 extra bits, every y bits of PCM data. This can cause a bit of havoc with a frame sync if it isn't accounted for. A hardware frame sync is going to require a firmware modification most likely, as well as the API modification, and then the integrators of the hardware to the software folks will need to change things as well. As you may well know, this usually happens over-night.

This application is a software frame-sync and decomp. It can handle the DQM mode now, including archiving the DQM with every minor frame of data. (It's in the header words. Upper nibble of first status word is the Q, and bit 15 of the 5th status word indicates if DQM is enabled or not.) The Q can be used now in post-test analysis of the data archived. As this becomes more and more available with various receiver folks and ranges, it is a really simple task to make the DQM information available externally to a simple best source or hand-off selector, or a piece of hardware that can time align the DQM info in real time (say at 50 kHz) for super best source selectors.

Testing DQM Mode

This could be a daunting task, if you don't have all the equipment around, like a receiver, a transmitter, an airplane..simple things like that. All you can do is hope the receiver folks filled that DQM data in correctly. That doesn't do much, however, if you want to check out your hardware decom, or this software decom.

Lumistar has a solution for that as well. The TDynaSim.exe encoder application has this same DQM mode. If enabled, it will insert the encapsulated DQM data every x bytes, with a slider control to vary the DQM value. At least this way, you can determine if your soft decom can handle it, or if your best source or hand-off application does as it is supposed to, depending on the Q. The encapsulation information is only inserted into the PCM stream of bits going out the UDP port (if enabled) and it is archived, if enabled. If you have a hardware simulator attached, that does NOT get the encapsulation (for now...let's see where this goes).

//-----

TMoIP Device Usage of DOM

If you look at the decom setup window, you'll see two items to set up relating to DQM, in the lower right (Rate/Mem/Mode box)

- DQM Mode – Enable/Disable the DQM mode
- DQM Payload Bytes – The number of bytes between DQM encapsulation of 48 bits, if DQM Mode is enabled.

NOTE – These fields cannot be edited unless 'Allow DQM Mode' is checked in the System-Options.

If the DQM is enabled, then on the top next to the Frame State LEDs another little status window will display

- DQM – The data quality metric inserted into the PCM bit stream
- BEP – The calculated bit error probability based on the DQM
- Q – The calculated quality of the data based on the BEP
- DQM Bar – This gauge ranges from 0 to 65535 and follows the DQM. The color of the bar changes with the value of the DQM. You can set these colors in the System – Options of this application.



These two items **MUST** match what the receiver is doing.

If the receiver is putting out DQM data, but you don't have it enabled, you'll still get a frame lock and good data, because this frame sync doesn't have a Verify or Check mode. If the FSP is not there after the last frame, then it starts searching for the FSP again. Your data will not be trustworthy, however, depending on where the DQM data is actually inserted.

If you have enabled the DQM mode, and the receiver is not putting the DQM data out, you will not get ANY data, because it is assumed that no data is coming in if it can't find the DQM frame sync pattern. You'll get an indication of this when you see your Major and Minor Frame LEDs turn black.

On the Major Frame Dump window, on the top right in the Analysis Info box, the DQM Q has an LED that follows the color you've selected in the application options.

TMoIP - Stream 1 FPI Data											
Setup Info				Status Info				Analysis Info			
Cwl	16	Sfld Word	3	FPI	16	Data Valid	YES	Minor Fr Rate	244.2	Frames Lost	0x00000000
Wpt	512	Sfld Msb	3			Drdy Counter	0x0008EFED	Major Fr Rate	15.3	Reset	DQM Q
Num Sf	16	Sfld Start	0			Time	194:23:07:19.983219	FPI Rate	15.3		

Hex	T1	T2	T3	T4	S1	1	2	3	4	5	6
0	9461	0723	9819	1932	E001	FE6B	2840	0001	0004	0005	0006
1	9461	0723	9819	1932	E002	FE6B	2840	0002	0004	0005	0006
2	9461	0723	9819	1932	E003	FE6B	2840	0003	0004	0005	0006
3	9461	0723	9819	1932	E004	FE6B	2840	0004	0004	0005	0006
4	9461	0723	9819	1932	E005	FE6B	2840	0005	0004	0005	0006
5	9461	0723	9819	1932	E006	FE6B	2840	0006	0004	0005	0006
6	9461	0723	9819	1932	E007	FE6B	2840	0007	0004	0005	0006
7	9461	0723	9819	1932	E008	FE6B	2840	0008	0004	0005	0006
8	9461	0723	9819	1932	E009	FE6B	2840	0009	0004	0005	0006
9	9461	0723	9819	1932	E00A	FE6B	2840	000A	0004	0005	0006
10	9461	0723	9819	1932	E00B	FE6B	2840	000B	0004	0005	0006
11	9461	0723	9819	1932	E00C	FE6B	2840	000C	0004	0005	0006
12	9461	0723	9819	1932	E00D	FE6B	2840	000D	0004	0005	0006
13	9461	0723	9819	1932	E00E	FE6B	2840	000E	0004	0005	0006
14	9461	0723	9819	1932	E00F	FE6B	2840	000F	0004	0005	0006
15	9461	0723	9819	1932	E000	FE6B	2840	0000	0004	0005	0006

If you have the Analysis page opened (from the Major Frame Dump window), the DQM information is displayed there as well.

PCM Analysis Info Stream 1 [X]

Frame Info	CWL	16	FPI	16
	WPF	512		
	Num SF	16	Processed Count	1120

Analysis Info Elapsed Time (secs) 4.72

Frame Time	194:23:09:38.655273	DQM	32768
Minor Fr Rate (Hz)	260.2	BEP	1.0E-6
Data Density (%)	25.1	Q	6
Frames Lost	0		

[Analysis Reset]

CRC Type

- None
- CRC-16
- CRC-32



2.00
0.00
-1.00

Save To File Clear Log Logging Fr Lock

[Navigation icons]