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| DCPC Requirements Discussionby Peter Woolner |
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| NOAANational Environmental Satellite, Data, and Information Service |  |
| Contract DG133E-07-CQ-0030 |
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# Suggested Content for DCPC Transmissions

* Features I assume are mandatory, in addition to RF parameters:
	+ DCPC link must be able to work with any DCP – just add a receiver
	+ Ground security is to be provided in a similar way as for DADDS
	+ Require G/T of -26 dB/K (3 dBi antenna)
	+ Use same addresses as DCPs but transmit without BCH coding
* Features I recommend be included but need work on details:
	+ Ability to send a wide variety of commands
		- Simple: Turn-off, Reset, Run diagnostics, etc.
		- Complex: Change many parameters: Address, Channel, Timing, Interval, Content, etc.
		- Very large: Allow for extensive re-programming over DCPC link
	+ Make all DCPC transmissions as secure as possible
	+ Send commands with different levels of priority
	+ Include a time calibration mark (need to decide accuracy, reference point, etc.)
	+ Provide a “Stay Awake” list at standard intervals
	+ Notify DCPs in advance when a leap second is to occur
	+ Include ability to expand for future needs – items not known now
	+ Are there any other items users want to have or that vendors want to offer?
* Everyone is encouraged to consider these lists and
	+ Suggest additional items with examples of extreme events (How large is “very large”?)

##### Other Decisions Needed for Basic Formatting

* Is the message transmission is to be continuous or not?
	+ At 350 bps it will take about 58.749 seconds for 11 frames
		- Transmit nominally 1.251 seconds without data modulation each minute?
			* Provides ability to adjust (e.g. leap seconds, CDA antenna transfers, etc.)
		- Adjust the encoded data rate to 342.66667 bps so 11 frames take exactly 1 minute?
			* Signal will be as stable as possible
* What needs to go in the 446 bytes that are available?
	+ Some number of commands, each with a specific address
		- Could be an individual or group address
		- Needs to include a form of authentication
	+ Should command length be fixed or variable?
	+ Include a time hack?
	+ Include leap second notification?
	+ A fixed length header to identify the content of the rest of the frame
* Assignment of precedence
	+ Are some commands more important than others?
	+ Need to define precedence or send in strict order of arrival
* Stay awake list – I consider this important but this will limit the command rate (cph)
	+ I recommend a 10:1 Sleep/Wake ratio for receivers as a minimum

Stay Awake List Problem

* How many separate commands should be planned for one hour?
	+ e.g. 10 commands per frame x 5 frames per minute x 60 minutes per hour = **3000** cph
* How long will it take to send 3000 addresses so all other DCPs can go back to sleep
	+ If only 22 bits used to send address plus group/individual identifier:
		- 22 bits x 3000 addresses / 3504 bits in frame = 18.84 frames
		- At 5 frames per minute 19 frames will take 3 minutes 48 seconds
		- Sleep/Awake ratio = (60 - 3.8) / 3.8 = **14.8:1** (approx)
* Is sending many concatenated addresses acceptable?
* Is sending addresses without BCH acceptable?
* System could send 21,900 short commands per hour but this would limit it to 3000 cph
	+ I suggest this be considered an acceptable rate

# RF Parameters for the DCPC Link (p/o GOES-R Requirements)

Uplink Frequency: 2032.825 MHz or 2032.775 MHz

Uplink EIRP 76 dBmi

Uplink Polarization: Linear N-S

Uplink C/No 67 dB/Hz

Downlink Frequency: 468.825 MHz or 468.775 MHz

Peak Satellite EIRP: 47.0 dBmi

Downlink Polarization: RHCP

Satellite Axial ratio: 1.0 dB

Ground Axial Ratio: 6.0 dB

Required C/No 38.0 dB/Hz

Modulation: OQPSK and DSSS

Modulation Coding: NRZ-M

FEC Coding: RS(255,223) I=2 interleaved RS codewords per frame

Coded Data Rate: 350 bps (with RS code bits and 32 bit Frame Header)

DSSS Chip Rate: 22.225 kHz

DSSS Chip Codes: (TBD)

PN Code Length: 127

Shaping Filter: SRRC with α = 1.0

Frame Sync Marker: 1ACFFC1D

Total Frame Length: 514 bytes (4112 bits)

OQPSK = Offset Quadrature Phase Shift Keyed

DSSS = Direct Sequence Spread Spectrum

SRRC = Square Root Raised Cosine