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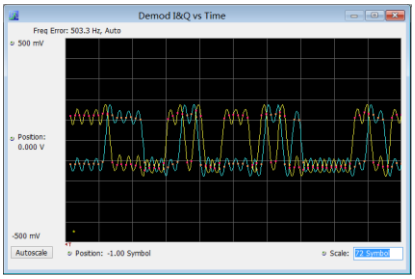
3: Digital Mod in function keys, Demo GMSK in second function keys.

3: Digital Mod in function keys, 72 I&Q Step Count 72 in second function keys.

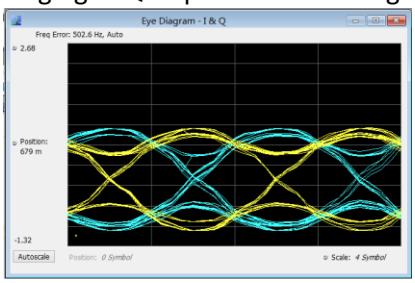
Status block will be:

Start Freq	1.5GHz	Stop Freq	1.5GHz	Step Freq	-
Amplitude	0dBm	Repeat Time	10ms	Duration Time	-
Mode	Single Freq w/o Pulse Mod			Symbol Rate	100.00KHz

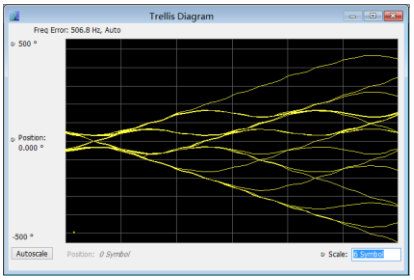
GMSK data rate will be 100KHz/b, changing I&Q step count will change GMSK data rate.



Demod I&Q vs Time from RSA306



Eye Diagram from RSA306



Trellis Diagram from RSA306

3.8 FSK signal Output

1: Mode in function keys, Single Freq w/o Pulse Mod in second function keys.

2: Frequency in function keys, 1GHz Start Freq 1 GHz in second function keys.

3: Amplitude in function keys, 0dBm Output Level 0 dBm in second function keys.

4: I&Q Sel in function keys, Internal in second function keys.

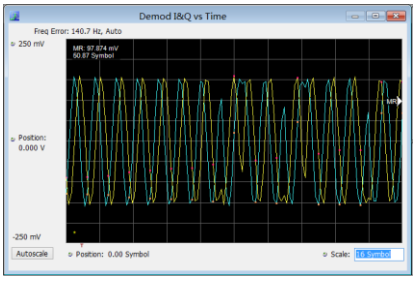
5: Digital Mod in function keys, Demo FSK in second function keys.

6: Digital Mod in function keys, 50 I&Q Step Count 50 in second function keys.

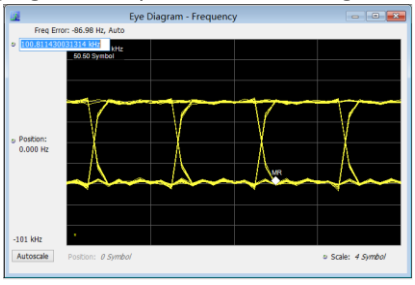
Status block will be:

Start Freq	1GHz	Stop Freq	1GHz	Step Freq	-
Amplitude	0dBm	Repeat Time	10ms	Duration Time	-
Mode	Single Freq w/o Pulse Mod			Symbol Rate	40.00KHz

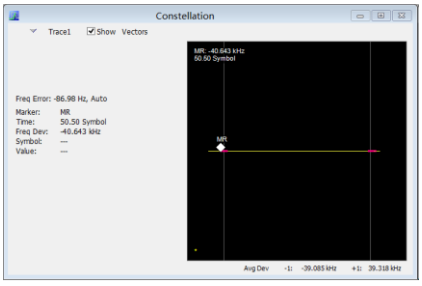
FSK data rate will be 40KHz/b, changing I&Q step count will change FSK data rate.



Demod I&Q vs Time from RSA306



Eye Diagram from RSA306



Constellation Diagram from RSA306

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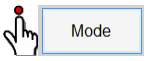
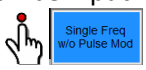
3.9 Digital Modulation with I&Q Engine

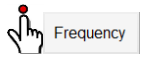
Working on I&Q file， most of all digital modulation can be generated, save the I&Q file into Digital modulation sub folder, click the 

， I&Q file can be input. The 4FSK file is example in following section.

1: 

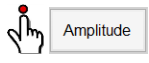
in function keys, 

in second function keys.

2: 

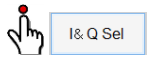
in function keys, 1GHz 

in second function keys.

3: 

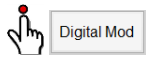
in function keys, 0dBm 

in second function keys.

4: 

in function keys, 

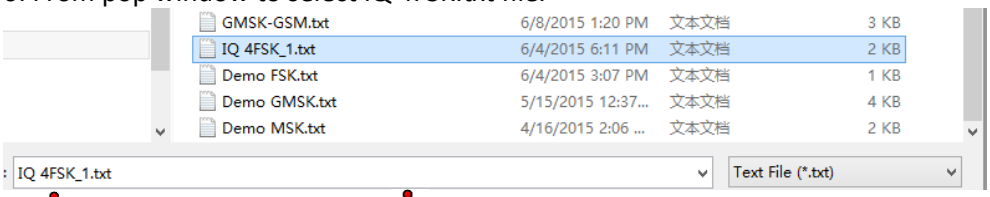
in second function keys.

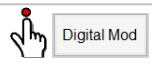
5: 

in function keys, 

in second function keys.

6: From pop window to select IQ 4FSK.txt file.



7: 

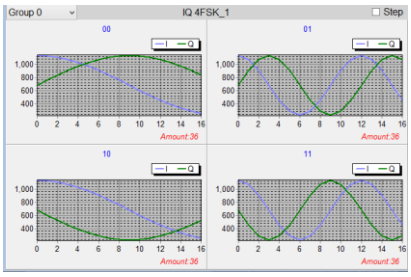
in function keys, 50 

in second function keys.

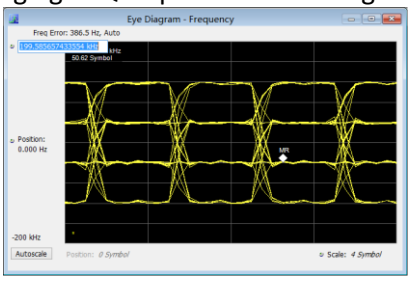
Status block will be:

Start Freq	1GHz	Stop Freq	1GHz	Step Freq	-
Amplitude	0dBm	Repeat Time	10ms	Duration Time	-
Mode	Single Freq w/o Pulse Mod			Symbol Rate	40.00KHz

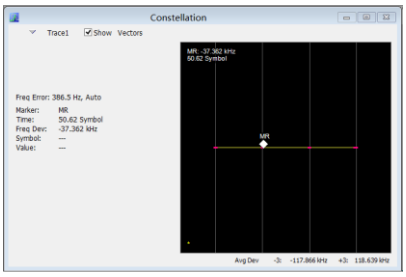
4FSK data rate will be 40KHz/b, changing I&Q step count will change 4FSK data rate.



I&Q pattern from TSG

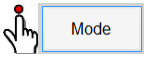


Eye Diagram from RSA306



Constellation Diagram from RSA306

3.10 QPSK Signal output

1: 

in function keys, 

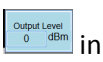
in second function keys.

2: 

in function keys, 1GHz 

in second function keys.

3: 

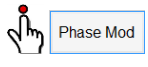
in function keys, 0dBm 

in second function keys.

4: 

in function keys, 

in second function keys.

5: 

in function keys, 

in second function keys.

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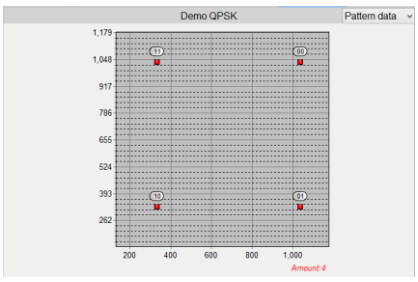
6: Phase Mod in function keys, 72 I& Q Step Count 72 in second function keys.

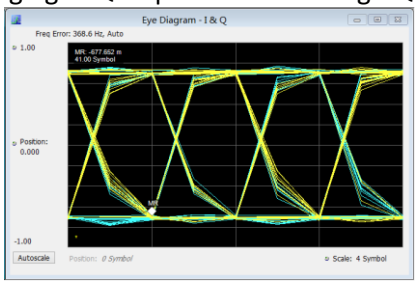
Status block will be:

Start Freq	1GHz	Stop Freq	1GHz	Step Freq	-
Amplitude	0dBm	Repeat Time	10ms	Duration Time	-
Mode	Single Freq w/o Pulse Mod			Symbol Rate	1.00MHz

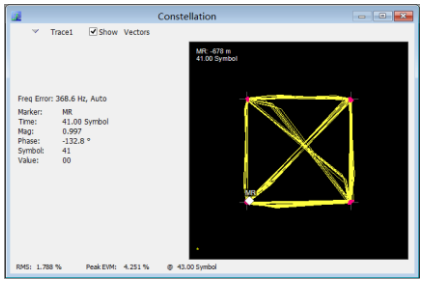
QPSK data rate will be 4MHz/b, changing I&Q step count will change QPSK data rate.



Constellation Diagram from TSG



Eye Diagram from RSA306



Constellation Diagram from RSA306

3.11 8PSK Signal output

1: Mode in function keys, Single Freq w/o Pulse Mod in second function keys.

2: Frequency in function keys, 1GHz Start Freq 1 GHz in second function keys.

3: Amplitude in function keys, 0dBm Output Level 0 dBm in second function keys.

4: I& Q Sel in function keys, Internal in second function keys.

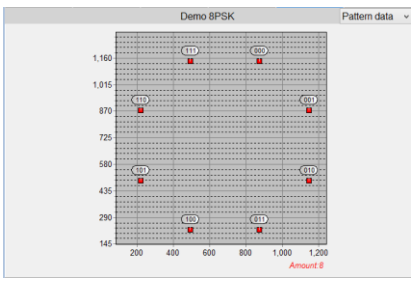
5: Phase Mod in function keys, Demo 8PSK in second function keys.

6: Phase Mod in function keys, 72 I& Q Step Count 72 in second function keys.

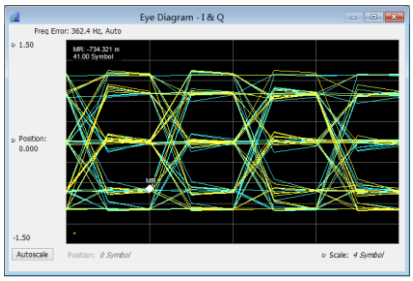
Status block will be:

Start Freq	1GHz	Stop Freq	1GHz	Step Freq	-
Amplitude	0dBm	Repeat Time	10ms	Duration Time	-
Mode	Single Freq w/o Pulse Mod			Symbol Rate	1.00MHz

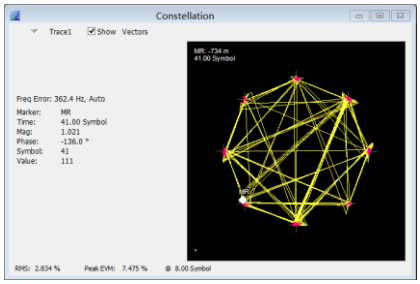
8PSK data rate will be 8MHz/b, changing I&Q step count will change QPSK data rate.



Constellation Diagram from TSG



Eye Diagram from RSA306



Constellation Diagram from RSA306

3.12 16QAM Signal output

1: Mode in function keys, Single Freq w/o Pulse Mod in second function keys.

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2: Frequency in function keys, 1GHz Start Freq 1 GHz in second function keys.

3: Amplitude in function keys, 0dBm Output Level 0 dBm in second function keys.

4: I& Q Sel in function keys, Internal in second function keys.

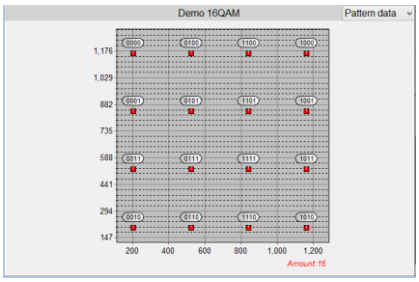
5: Phase Mod in function keys, Demo 16QAM in second function keys.

6: Phase Mod in function keys, 72 I& Q Step Count 72 in second function keys.

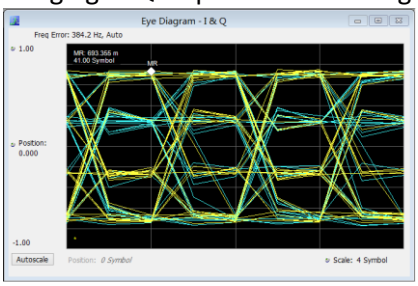
Status block will be:

Start Freq	1GHz	Stop Freq	1GHz	Step Freq	-
Amplitude	0dBm	Repeat Time	10ms	Duration Time	-
Mode	Single Freq w/o Pulse Mod			Symbol Rate	1.00MHz

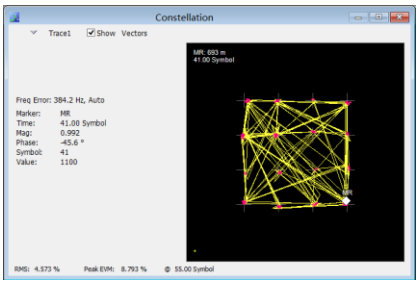
16QAM data rate will be 16MHz/b, changing I&Q step count will change QPSK data rate.



Constellation Diagram from TSG



Eye Diagram from RSA306



Constellation Diagram from RSA306

3.13 Phase Modulation with I&Q Engine

Working on I&Q file， most of all phase modulation can be generated, save the I&Q file into phase modulation sub folder, click the Load File ， I&Q file can be input. The 64QAM file is example in following section.

1: Mode in function keys, Single Freq w/o Pulse Mod in second function keys.

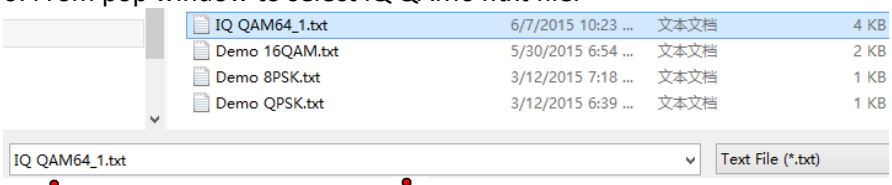
2: Frequency in function keys, 1GHz Start Freq 1 GHz in second function keys.

3: Amplitude in function keys, 0dBm Output Level 0 dBm in second function keys.

4: I& Q Sel in function keys, Internal in second function keys.

5: Phase Mod in function keys, Load File in second function keys.

6: From pop window to select IQ QAM64.txt file.



6: Phase Mod in function keys, 72 I& Q Step Count 72 in second function keys.

Status block will be:

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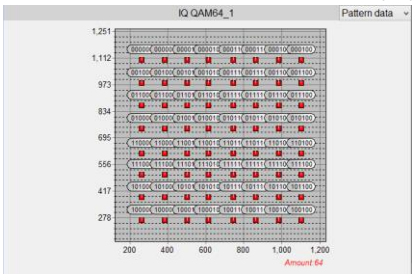
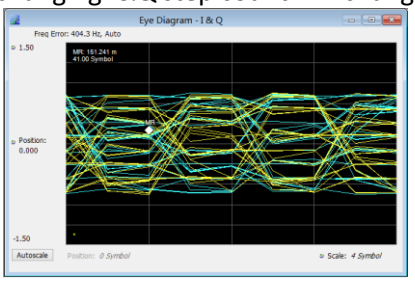
Start Freq	1GHz	Stop Freq	1GHz	Step Freq	-
Amplitude	0dBm	Repeat Time	10ms	Duration Time	-
Mode	Single Freq w/o Pulse Mod			Symbol Rate	1.00MHz

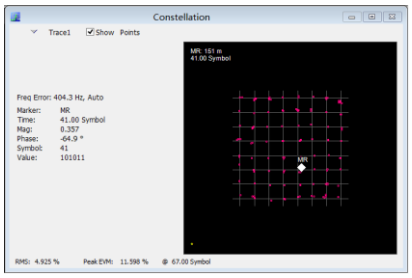
64QAM data rate will be 64MHz/b, changing I&Q step count will change QPSK data rate.



Constellation Diagram from TSG



Eye Diagram from RSA306



Constellation Diagram from RSA306

3.14 Frequency Sweeping without Pulse Modulation

1: Mode in function keys, Freq Sweeping w/o Pulse Mod in second function keys.

2: Frequency in function keys, 0.98GHz Start Freq 0.98 GHz, 1.02GHz Stop Freq 1.02 GHz, 1MHz Step Freq 1 MHz

1MHz Scan Poins 41, Send to dongle in second function keys.

3: Amplitude in function keys, 0dBm Output Level 0 dBm in second function keys.

4: Pulse Mod in function keys, 100ms Pulse Period 100 ms, Send to dongle, commands will send to dongle.

If sweeping signal need to add I&Q modulation, go into the next step.

4: I& Q Sel in function keys, Internal in second function keys.

5: Phase Mod in function keys, Demo 16QAM in second function keys.

6: Phase Mod in function keys, 72 I& Q Step Count 72 in second function keys.

Status block will be:

Start Freq	0.98GHz	Stop Freq	1.02GHz	Step Freq	1MHz
Amplitude	0dBm	Repeat Time	100ms	Duration Time	-
Mode	Freq Sweeping w/o Pulse Mod			Symbol Rate	1.00MHz

Following image will be shown the sweeping signal without Pulse modulation.

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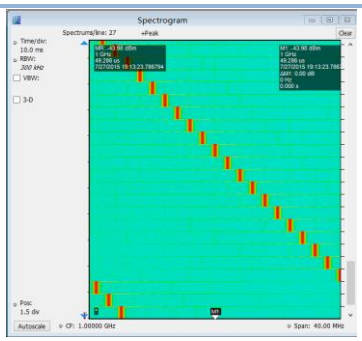
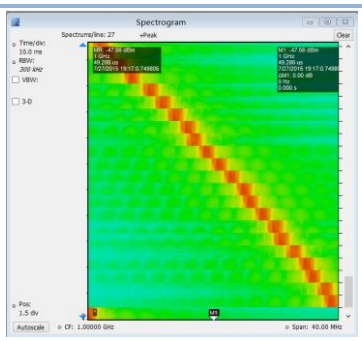
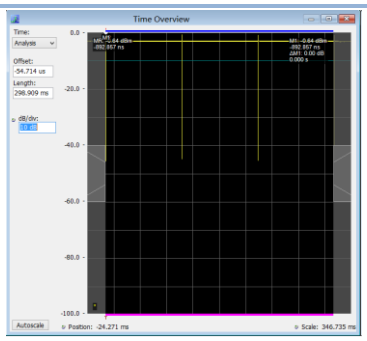


Sweeping signal without I@Q Mod



Sweeping signal with I@Q Mod



Sweeping timing from RSA306

3.15 Frequency Sweeping with Pulse Modulation

1: Mode in function keys, Freq Sweeping with Pulse Mod in second function keys.

2: Frequency in function keys, 0.98GHz Start Freq 0.98 GHz, 1.02GHz Stop Freq 1.02 GHz, 1MHz Step Freq 1 MHz

1MHz Scan Poins 41, Send to dongle in second function keys.

3: Amplitude in function keys, 0dBm Output Level 0 dBm in second function keys.

4: Pulse Mod in function keys, 100ms Pulse Period 100 ms, 2ms Pulse Width 2 ms in second function keys.

After all setting, Send to dongle, commands will send to dongle.

If sweeping signal need to add I&Q modulation, go into the next step.

5: I& Q Sel in function keys, Internal in second function keys.

6: Phase Mod in function keys, Demo 16QAM in second function keys.

7: Phase Mod in function keys, 72 I& Q Step Count 72 in second function keys.

Status block will be:

Start Freq	0.98GHz	Stop Freq	1.02GHz	Step Freq	1MHz
Amplitude	0dBm	Repeat Time	100ms	Duration Time	2ms
Mode	Freq Sweeping with Pulse Mod			Symbol Rate	1.00MHz

Following image will be shown the sweeping signal with Pulse modulation

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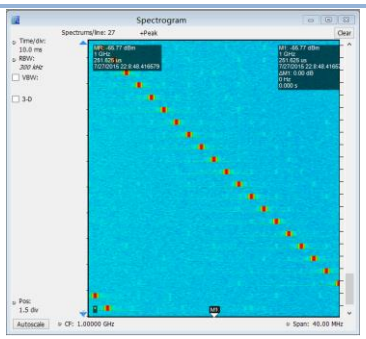
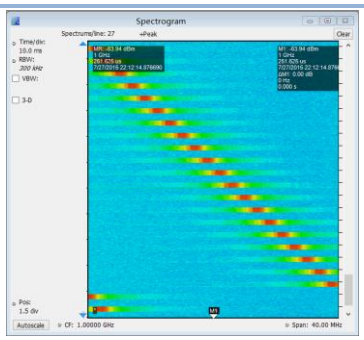
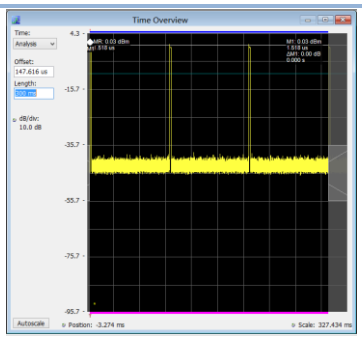


Sweeping signal without I@Q Mod



Sweeping signal with I@Q Mod



Sweeping timing from RSA306

3.16 Frequency hopping without Pulse Modulation

1: Mode in function keys, Freq Hopping w/o Pulse Mod in second function keys.

2: Hopping in function keys, Demo 1 in second function keys.

3: Amplitude in function keys, 0dBm Output Level 0 dBm in second function keys.

4: Pulse Mod in function keys, 100ms Pulse Period 100 ms, Send to dongle ,commands will send to dongle.

If sweeping signal need to add I&Q modulation, go into the next step.

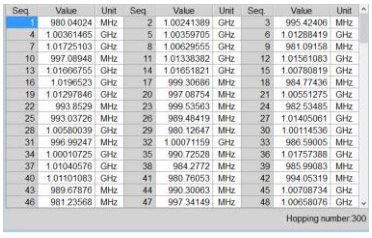
4: I& Q Sel in function keys, Internal in second function keys.

5: Phase Mod in function keys, Demo 16QAM in second function keys.

6: Phase Mod in function keys, 72 I& Q Step Count 72 in second function keys.

Status block and hopping table will be:

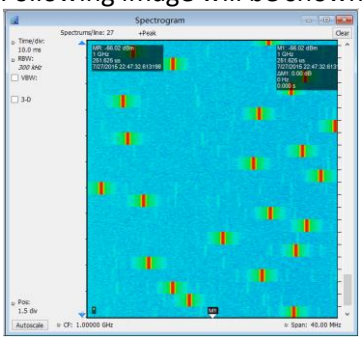
Start Freq	-	Stop Freq	-	Step Freq	-
Amplitude	0dBm	Repeat Time	100ms	Duration Time	-
Mode	Freq Hopping w/o Pulse Mod			Symbol Rate	1.00MHz



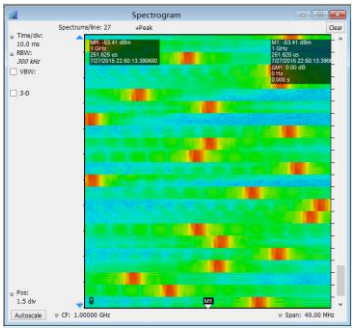
Seq	Value	Unit	Seq	Value	Unit	Seq	Value	Unit
1	980.04024	MHz	2	1.00241389	GHz	3	995.42406	MHz
4	1.00361465	GHz	5	1.00359705	GHz	6	1.01288419	GHz
7	1.01725103	GHz	8	1.00629555	GHz	9	981.09158	MHz
10	997.08948	MHz	11	1.01338382	GHz	12	1.01561083	GHz
13	1.01666755	GHz	14	1.01651821	GHz	15	1.00780819	GHz
16	1.0196523	GHz	17	999.30686	MHz	18	984.77436	MHz
19	1.01297846	GHz	20	997.08754	MHz	21	1.00551275	GHz
22	993.8529	MHz	23	999.53563	MHz	24	982.53485	MHz
25	993.03726	MHz	26	989.48419	MHz	27	1.01405061	GHz
28	1.00580039	GHz	29	980.12647	MHz	30	1.00114536	GHz
31	996.99247	MHz	32	1.00071159	GHz	33	986.59005	MHz
34	1.00010725	GHz	35	990.72528	MHz	36	1.01757388	GHz
37	1.01040576	GHz	38	984.2772	MHz	39	985.99083	MHz
40	1.01101083	GHz	41	980.76053	MHz	42	994.05319	MHz
43	989.67876	MHz	44	990.30063	MHz	45	1.00708734	GHz
46	981.23568	MHz	47	997.34149	MHz	48	1.00658076	GHz

Hopping number:300

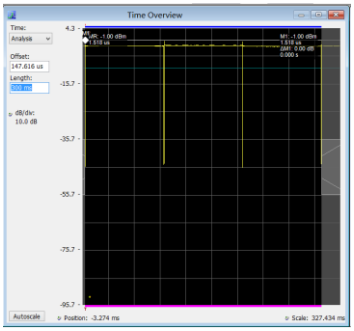
Following image will be shown the hopping signal without Pulse modulation



Hopping signal without I@Q Mod



Hopping signal with I@Q Mod



Hopping timing from RSA306

3.17 Frequency Hopping with Pulse Modulation

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1: Mode in function keys, Freq Hopping with Pulse Mod in second function keys.

2: Hopping in function keys, Demo 1 in second function keys.

3: Amplitude in function keys, 0dBm Output Level 0 dBm in second function keys.

4: Pulse Mod in function keys, 100ms Pulse Period 100 ms, 2ms Pulse Width 2 ms in second function keys.

After all setting, Send to dongle, commands will send to dongle.

If sweeping signal need to add I&Q modulation, go into the next step.

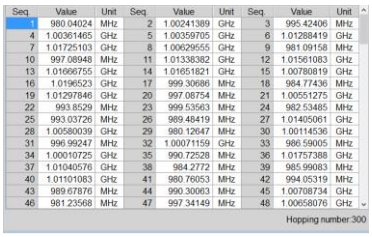
5: I& Q Sel in function keys, Internal in second function keys.

6: Phase Mod in function keys, Demo 16QAM in second function keys.

7: Phase Mod in function keys, 72 I& Q Step Count 72 in second function keys.

Status block and hopping table will be:

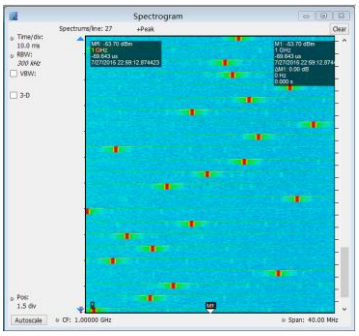
Start Freq	-	Stop Freq	-	Step Freq	-
Amplitude	0dBm	Repeat Time	100ms	Duration Time	2ms
Mode	Freq Hopping with Pulse Mod			Symbol Rate	1.00MHz



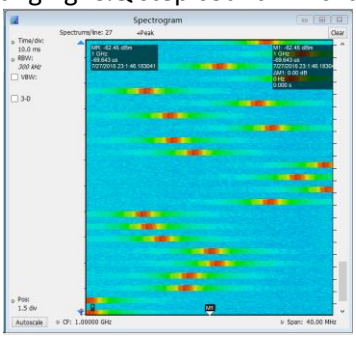
Seq	Value	Unit	Seq	Value	Unit	Seq	Value	Unit
1	980.04024	MHz	2	1.00241389	GHz	3	995.42406	MHz
4	1.00361465	GHz	5	1.00359705	GHz	6	1.01288419	GHz
7	1.01725103	GHz	8	1.00629555	GHz	9	981.09158	MHz
10	997.08948	MHz	11	1.01338382	GHz	12	1.01561083	GHz
13	1.01666755	GHz	14	1.01651821	GHz	15	1.00780819	GHz
16	1.0196523	GHz	17	999.30686	MHz	18	984.77436	MHz
19	1.01297846	GHz	20	997.08754	MHz	21	1.00551275	GHz
22	993.8529	MHz	23	999.53563	MHz	24	982.53485	MHz
25	993.03726	MHz	26	989.48419	MHz	27	1.01405061	GHz
28	1.00580039	GHz	29	980.12647	MHz	30	1.00114536	GHz
31	996.99247	MHz	32	1.00071159	GHz	33	986.59005	MHz
34	1.00010725	GHz	35	990.72528	MHz	36	1.01757388	GHz
37	1.01040576	GHz	38	984.2772	MHz	39	985.99083	MHz
40	1.01101083	GHz	41	980.76053	MHz	42	994.05319	MHz
43	989.67876	MHz	44	990.30063	MHz	45	1.00708734	GHz
46	981.23568	MHz	47	997.34149	MHz	48	1.00658076	GHz

Hopping number:300

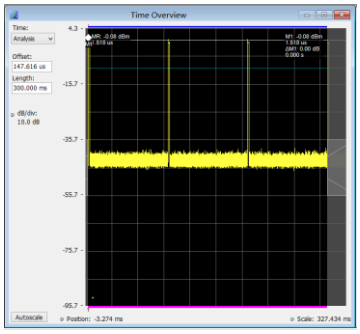
16QAM data rate will be 16MHz/b, changing I&Q step count will change QPSK data rate.



Hopping signal without I@Q Mod



Hopping signal with I@Q Mod



Hopping timing from RSA306

3.18 S11/S21 measurement with spectrum analyzer

The S11/S21 key is reserved for multi device measurement, it is not ready now. Such as working with RF power meter or spectrum analyzer. But it need to setup synchronize with spectrum analyzer when it is scanning.

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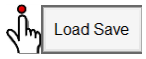
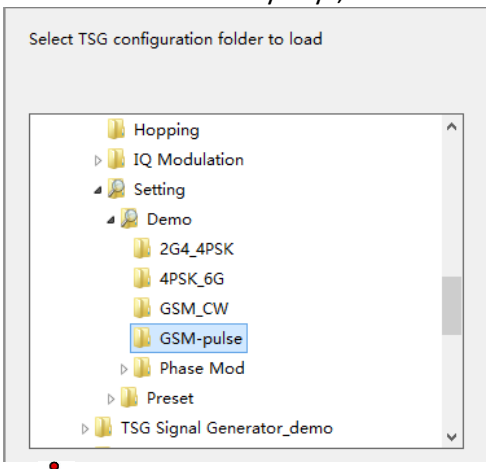
3.19 Example for GSM signal output

1: 

in utility keys, 

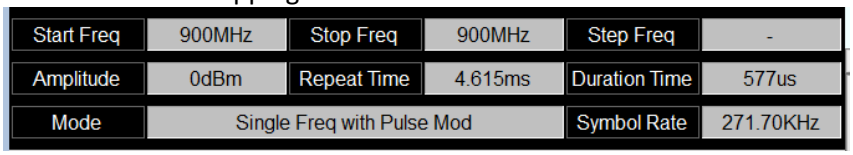
in second function keys.



2: 

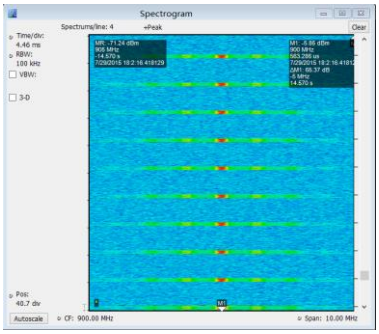
in TSG configuration folder and open this file.

Status block and hopping table will be:

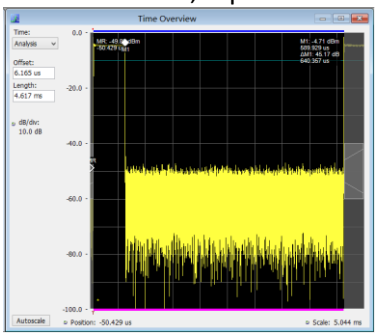


Start Freq	900MHz	Stop Freq	900MHz	Step Freq	-
Amplitude	0dBm	Repeat Time	4.615ms	Duration Time	577us
Mode	Single Freq with Pulse Mod			Symbol Rate	271.70KHz

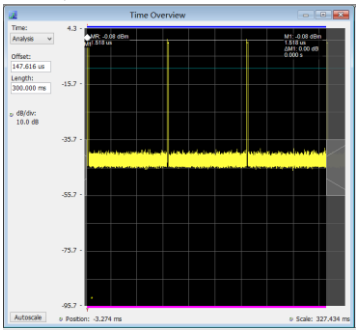
GSM data rate will be 271Kb with GMSK modulation, repeat time will be 4.6ms, duration time will be 577us.



GSM signal with I@Q Mod



One slot of GSM signal



three pulse of GSM signal

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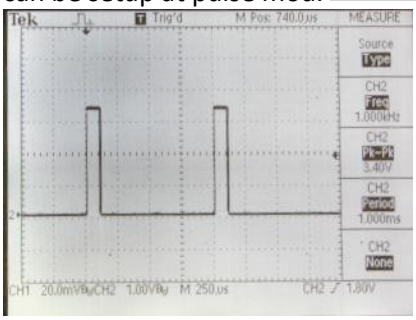
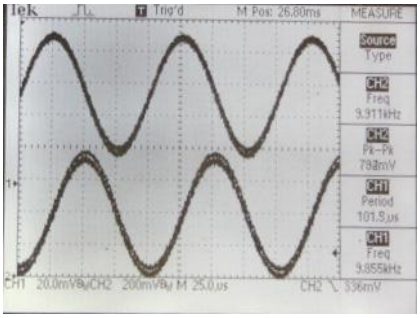
3.20 Pulse modulation signal output

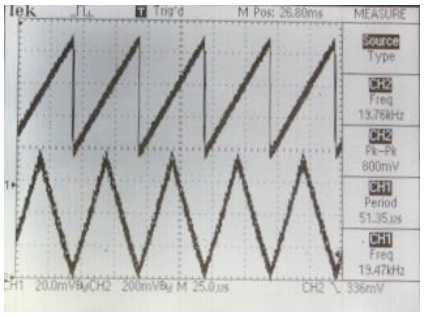
The Pulse signal output port can generate pulse signal, when mode setup to xxx with pulse mod. The parameter of pulse can be setup at pulse mod. Pulse Mod, following will be pulse signal output measured by scope.

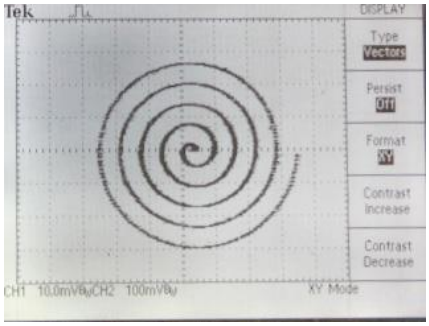


3.21 SIN/Triangle/Spiral waveform signal output

VSG6G1/VSG2G1/TSG4G1 also can output low frequency signal, using I&Q raw data file, I&Q port can output any kind of low frequency signal, the demo setting will be sin waveform, triangle waveform, and spiral waveform, output waveform will be shown at following:







You can output a lot different waveform by define I&Q raw data file, it is more like arbitrary signal generator.
The frequency can be setup I*Q step count to fine turn. The total sampling length are also impact with output frequency.
The frequency=72MHz/(step count*sampling length).

3.22 Clock selection

Internal clock reference will be 12MHz, and Main processor will be working at 72MHz, maximum the I&Q symbol rate will be 2.4MHz (when I*Q step count set at 30).
When clock select at internal, it is also the default setting, clock port will be output 12MHz reference clock.
When clock select at external, it needs to input 10MHz reference clock at clock port, the clock level need to be larger than 5dBm.
Internal clock reference will be 12MHz, and Main processor will be work at 72MHz, maximum the I&Q symbol rate will be 2.4MHz (when I*Q step count set at 30).
When clock select at internal, it is also default setting, clock port will output 12MHz reference clock.
When clock select at external, it need input 10MHz reference clock at clock port, the clock level need to be larger than 5dBm.

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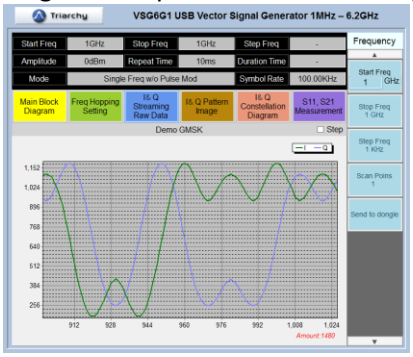
3.23 I&Q Selection

I&Q port selection will have three choice:
1: None: it will turn off any I&Q modulation, only CW signal will be output.
2: Internal: internal I&Q waveform will connect to modulation IC.
3: External/Fast: External setup will need I&Q signal input from I&Q port, it can generate very fast modulation, the signal bandwidth can be setup to 500MHz. Fast setup will be reserved for high speed I&Q data generator option. It is an accessory of VSG6G1, it can generate up to 100MHz data rate modulation signal.

3.24 Hardcopy Operation

Click the hardcopy, the image of setup can be store within jpg file. File can be found at document folder.



4 I&Q Engine

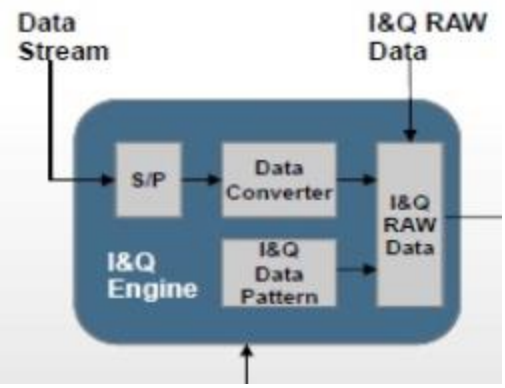
4.1 I&Q Engine principle

What is I&Q engine?

I&Q engine is to generate I&Q raw data based on input data stream and modulation. I&Q raw data will send to DAC to generate I&Q waveform which will be needed for I&Q modulator.

So that data stream will be input, and I&Q raw data will be output conditional upon the type of modulation.

The block diagram of I&Q engine will be follow:



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First, data stream will be go into S/P block, which is series to parallel section, most of modulation need this S/P section to setup I&Q mapping.

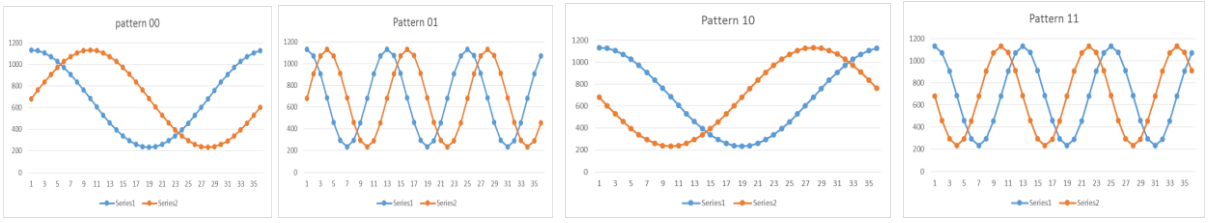
After S/P section, the parallel data may be need to do certain types of process, such as Gray code conversion, this section will be Data converter.

The parallel data will be mapping with I&Q data pattern to generate I&Q raw data. The mapping pattern is depend on the modulation, a lot of text book will discuss I&Q data pattern. Studying the data pattern can be generated a lot of different kind of modulation.

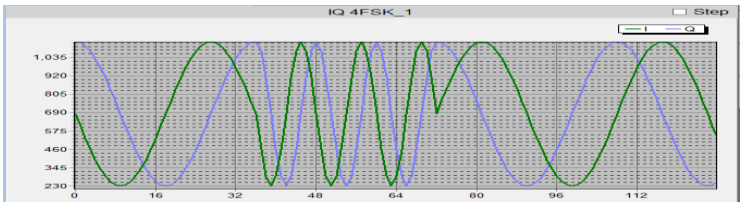
For example, 4FSK generator:

1: convert series data into 2 bits parallel data,

2: generate 4 I&Q pattern with 36 samples, which related to F1, F2, F3, F4.



3: mapping the I&Q pattern based on the input data stream, then generate the raw I&Q data.



4.2 I&Q file configuration

There are two kind of I&Q file which can be used by TSG program:
1: I&Q raw data file, which is only two rows of I&Q raw data. I&Q raw data will sent to DAC to generate I&Q waveform.
2: Data stream file, which will input to I&Q engine to generate I&Q raw data file.

4.21 I&Q raw data file

I&Q raw data file format is very simple, only two row of data with comma in txt file, first data is Q data, second data is I data.
I&Q data will be DAC input, the DAC will be 12 bit with 3.3V range, and DAC setup range will be 0~1.1V, reference bias will be 0.55V.
So that DAC input range will be 0~1365 (4095/3), the reference bias of DAC will be 683.
Following data shows the PM file and data waveform:

684,233
494,275

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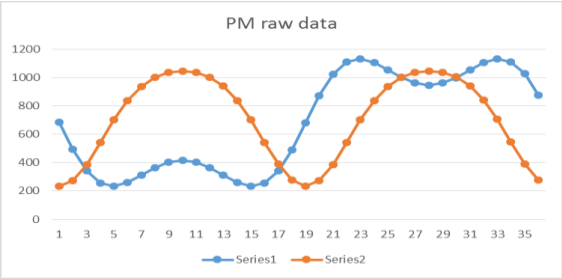
343,388
255,543
233,702
260,838
312,938
365,1002
404,1036
417,1046
404,1036
366,1002
313,939
261,839
233,703
255,544
342,390
492,276
682,233
872,275
1023,388
1111,543
1133,702
1105,838
1053,938
1000,1002
961,1037
947,1047
961,1037
999,1004
1052,941



The modulation frequency will be 72MHz/(step count*I&Q sample amount)
If step count=200, and I&Q sample amount=36, modulation frequency will be 10MHz.

Any analog modulation and low frequency signal can be generated by I&Q raw data file. Define the I&Q raw data by math formula. you can generate any kind of waveform, the working method of I&Q raw data file is same as Arbitrary Signal Generator, it have two channels to generate signal.

I&Q raw data will also can be generated by I&Q engine with or without I&Q channel shift.

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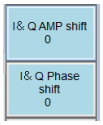
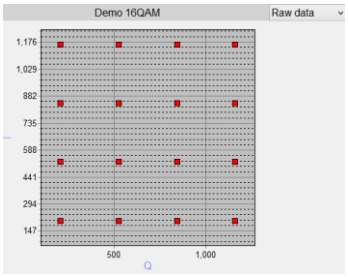
Click the system in the utility keys, you will find I&Q AMP shift and I&Q Phase shift in the second function keys.

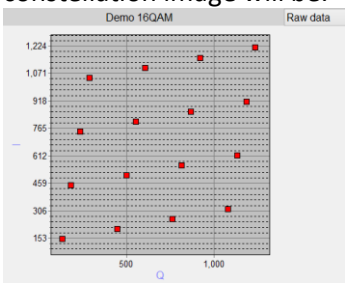


The default value for shift is 0. If you use default value, I&Q raw data file generated from I&Q engine will be not shift.

For example, input data stream file of Demo 16QAM.txt 5/30/2015 6:54 ... into the I&Q engine, output will be raw data file Demo 16QAM_rawdata.txt 8/17/2015 3:17 ... . The constellation image will be:



If change I&Q AMP shift to 5 and I&Q Phase shift to 10, output will be raw data file Demo 16QAM_rawdata_A5_P10.txt 8/17/2015 3:17 ... . The constellation image will be:



The I&Q amp and phase shift will be used for compensation of I&Q unbalance. When VSG6G1 is working on the band 2, I&Q channel will generate unbalance due to the Mixer stage. You have to use function of I&Q amp and phase shift to improve the EVM parameter.

I&Q AMP shift will be amplitude shift of I&Q channel with unit in percentage.
I&Q Phase shift will be phase shift of I&Q channel with unit in degree.

4.22 Data stream file

Data stream file will be include input data, I&Q pattern and some settings.
When you open the data stream file, you will find four section:
1: Data input
2: S/P setting
3: converter setting
4: I&Q pattern data
the file format will be shown at following:

```
Binary_IN, 1, 0001101111010100000110111101010011111111100000000010100101C
S/P_mode, 4, 3
Code_converter, 1
PatternI_000, 683, 762, 838, 910, 977, 1037, 1088, 1129, 1159, 1177
PatternQ_000, 1183, 1177, 1158, 1128, 1087, 1036, 977, 910, 837, 761
PatternI_001, 183, 189, 208, 238, 279, 330, 390, 456, 529, 605
PatternQ_001, 684, 762, 838, 911, 977, 1037, 1088, 1129, 1159, 1177
PatternI_010, 682, 604, 527, 455, 388, 329, 278, 237, 207, 189
PatternQ_010, 183, 189, 208, 238, 279, 330, 390, 457, 529, 606
PatternI_011, 1183, 1177, 1158, 1128, 1087, 1036, 976, 909, 836, 760
PatternQ_011, 681, 603, 527, 455, 388, 328, 278, 237, 207, 189
PatternI_100, 682, 760, 836, 909, 976, 1036, 1087, 1128, 1158, 1177
PatternQ_100, 183, 189, 207, 237, 278, 328, 388, 455, 527, 603
PatternI_101, 1183, 1177, 1159, 1129, 1088, 1037, 977, 910, 838, 762
PatternQ_101, 683, 761, 837, 910, 977, 1036, 1087, 1128, 1158, 1177
```

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Data input:
One parameter (M), one data stream will be setup in following format:
Binary_IN, M, binary data stream
M is one bit, it is FSK mode.
M=1, it is MSK/GMSK , modulation index is 0.5
M=2~15, it will be FSK/GFSK mode, modulation index is 0.5*M
Total I&Q buffer will be 4Kb, so that the Maximum length of data will be 4Kb/M
When binary data will total length of binary input. P will be parallel length of modulation.

S/P setting:
Two parameter (X,Y) will be setup in following format:
S/P_mode,X,Y
Y will be length of parallel data in bit.
X will be setup S/P mode.
X=1, Bypass mode, for all kind of binary modulation such as FSK, PSK and ASK.
X=2, Group mode, series to parallel conversion with group mode.
If input data is : 1100101011101000,

Y=4, date in parallel will be 1100 1010 1110 1000

I,Q data in parallel will be: 1100

1010

1110

1000

X=3, interleave mode, series to parallel conversion with interleave mode.
If input data is : 1100101011101000,

Y=4, date in parallel will be 1(11) 1(21) 0(31) 0(41) 1(12) 0 (22) 1(32) 0(42) 1(13) 1(23) 1(33) 0(43)

1(14) 0(24)0(34) 0(44)

I,Q data in parallel will be: 1111

1010

0110

0000

X=4, MSK mode. It is special setup for MSK, GMSK, FSK, GFSK, OQPSK, SFSK..

Converter setting:

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One parameter (**Z**) will be setup in following format:
Code convertor, **Z**
Z will be setup converter mode.

Z=1, Bypass mode, it means converter will do nothing, just pass through.

Z=2, Gray code mode, do gray code calculation: **G(N) = (B(n)/2) XOR B(n)**

Z=3, GMSK filter, if you want to generate GMSK modulation, select it.

I&Q pattern data:

The I&Q pattern data format will be:

PatternI_number,dataI1, dataI2, dataI3, dataI4, dataI5, dataI6, dataI7, dataI8, dataI9, dataI10

PatternQ_number,dataQ1, dataQ2, dataQ3, dataQ4, dataQ5, dataQ6, dataQ7, dataQ8, dataQ9, dataQ10will

Number length will be parameter X, parallel data length. If X=4, total I&Q pattern will be 16 set.

DataIn and DataQn, will be pattern data, n will be pattern amount in length.

I&Q pattern will be defined by modulation, analyze the modulation, then you can get I&Q pattern.

The following will be partial of I&Q pattern:

PatternI_00000,683,762,838,910,977,1037,1088,1129,1159,1177

PatternQ_00000,1183,1177,1158,1128,1087,1036,977,910,837,761

PatternI_00001,183,189,208,238,279,330,390,457,529,606

PatternQ_00001,684,762,838,911,977,1037,1088,1129,1159,1177

PatternI_00010,682,604,527,455,388,329,278,237,207,189

PatternQ_00010,183,189,208,238,279,330,390,456,529,605

PatternI_00011,1183,1177,1158,1128,1087,1036,976,909,836,760

PatternQ_00011,681,603,527,455,388,328,278,237,207,189