

IEEE802.15.4g MR-FSK Measurement Solution

MS2830A
Signal Analyzer

IEEE802.15.4g MR-FSK Measurement Solution

IEEE Std 802.15.4g™ - 2012

**Physical Layer (PHY) Specifications for Low-Data-Rate,
Wireless, Smart Metering Utility Networks**

Version 1.0

May 2013

Anritsu Corporation

*References:

- IEEE Std 802.15.4g - 2012
- IEEE Std 802.15.4 - 2011

[For details, refer to each reference.](#)

IEEE802.15.4g MR-FSK PHY Measurements

These materials explain the PHY layer measurements supported by IEEE802.15.4g **MR-FSK**.

Sub-clauses in IEEE 802.15.4g		MS2830A	MG3740A	
18.1 MR-FSK PHY specification				
18.1.2.3	Modulation Quality	✓		*1
18.1.2.3.1	Frequency Deviation Tolerance	✓		*1
18.1.2.3.2	Zero crossing tolerance	✓		*1
18.1.5.3	Radio frequency tolerance	✓		*1
18.1.5.4	Channel Switch Time	N.A.		
18.1.5.5	Transmitter symbol rate	✓		*1
18.1.5.6	Transmit spectral mask	✓		
18.1.5.9 / 8.2.1	Tx-to-Rx turnaround time	N.A.		
18.1.5.10 / 8.2.2	Rx-to-Tx turnaround time	✓		*2
18.1.5.11	Transmit Power	✓		
18.1.5.7	Receiver sensitivity	✓		*2
18.1.5.8	Receiver interference rejection	✓	✓	*2, *3
18.1.5.12	Receiver maximum Input Level of Desired Signal	✓		*2

or

Sub-clauses in IEEE 802.15.4g		MG3710A		
18.1.5.7	Receiver sensitivity	✓		*4
18.1.5.8	Receiver interference rejection	✓	✓	*4
18.1.5.12	Receiver maximum Input Level of Desired Signal	✓		*4

*4 Baseband Addition Function:

The MG3710A can add two different signals and output them from the RFx1 port.

The frequency (recommended range: ± 60 MHz) and level (CN: ± 80 dB) can also be set at the screen.

MS2830A
Signal Analyzer



+

*1: MX269017A
Vector Modulation Analysis
Software

+

*2: MS2830A-020/021
Vector Signal Generator
Option
MX269902A
TDMA IQproducer

+

*3: MG3740A
Analog Signal Generator

MG3710A

Vector Signal Generator



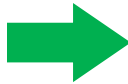
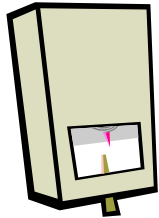
+

MX370102A
TDMA IQproducer

[Anritsu] IEEE802.15.4g PHY Measurement Solution

Tx Evaluation

Unit, Module *



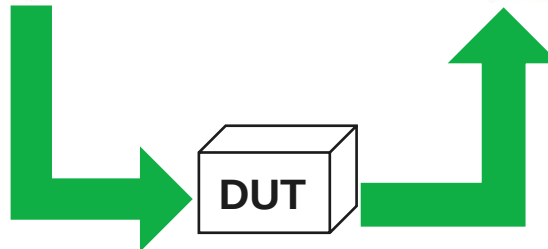
MS2830A
Signal Analyzer



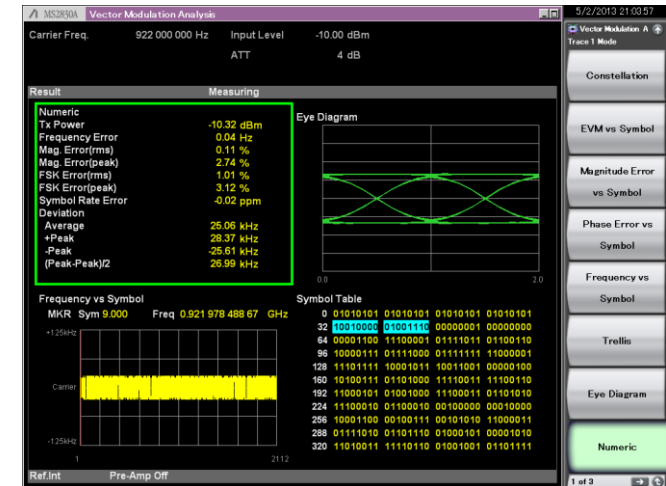
MS2830A
Signal Analyzer



Reference Signal:
Opt-020/021
Vector Signal Generator
Option
+
MX269902A
TDMA IQproducer



MX269017A
Vector Modulation Analysis Software



Modulation Methods

- 2FSK, 4FSK, O-QPSK, etc.

Measurements

- Frequency Deviation Error (RMS)
- Zero Crossing Offset
- Frequency Error, etc.

[Anritsu] IEEE802.15.4g PHY Measurement Solution

Rx Evaluation

MG3740A
Analog Signal Generator



Interference Signal
(CW)

MS2830A
Signal Analyzer



Wanted Signal
(Modulated
Signal)

+ MX370102A
TDMA IQproducer

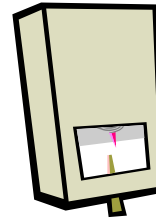
MG3710A
Vector Signal Generator



Desired signal
&
Interfere signal

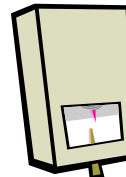
Modulated Signal Output for Rx:
Opt-020/021 Vector Signal Generator
+
MX269902A TDMA IQproducer

Unit, Module *

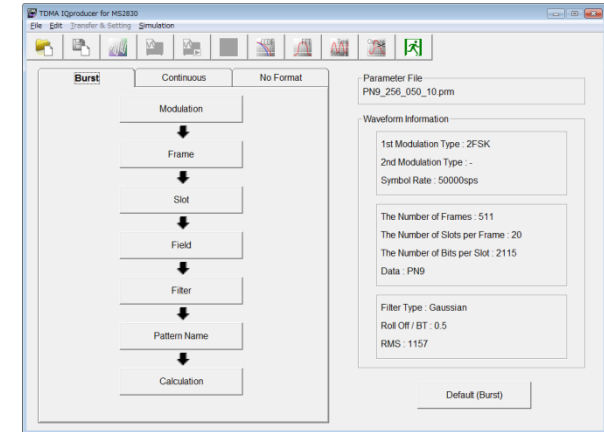


- * Output on Test Mode
- Data Whitening = Disable
- PHR/PSDU = Uncoded
- Mode switch = Disable

Unit, Module *



MX269902A/MX370102A
TDMA IQproducer



Modulation Methods
- 2FSK, 4FSK, O-QPSK, etc.

- Data Whitening = Not supported
- PHR/PSDU Coding = Not supported
- Mode switch = Not supported

4 Baseband Addition Function:

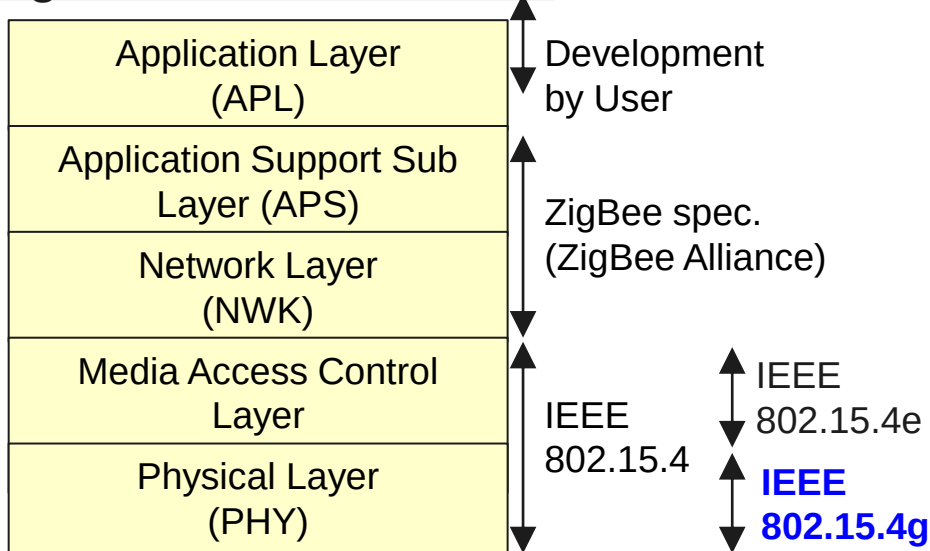
The MG3710A can add two different signals and output them from the RFx1 port.

The frequency (recommended range: ± 60 MHz) and level (CN: ± 80 dB) can also be set at the screen.

► Modulation

Refer to IEEE802.15.4g MR-FSK for these materials.

ZigBee and IEEE802.15.4



Modulation

IEEE802.15.4

O-QPSK

GFSK

BPSK

ASK

CSS

UWB

IEEE802.15.4g

MR-O-QPSK

MR-FSK

MR-OFDM

O-QPSK (Offset quadrature phase-shift keying)
BPSK (Binary phase-shift keying)
ASK (Amplitude shift keying)
CSS (Chirp spread spectrum)
UWB (Ultra-wide band)
GFSK (Gaussian frequency-shift keying)
MR (Multi-Rate and Multi-Regional)
FSK (Frequency shift keying)
OFDM (Orthogonal frequency division multiplexing)

(Note)

ZigBee uses the IEEE802.15.4 regulation for PHY/MAC. The ZigBee Alliance has established specifications for layers higher than the Network layer. Usually, the layers are collectively called ZigBee. However, IEEE802.15.4 describes many modulation methods for the PHY layer for the PHY/MAC standards. On the other hand IEEE802.15.4g specifies three modulation methods. IEEE802.15.4g is a standard provided mainly for SUN (Smart metering Utility Network) applications.

► Frequency Range, Bit Rate

The following table lists the frequency bands and bit rates for each modulation method. MR-FSK has two standards: **Filtered 2FSK** and **Filtered 4FSK**. However, smart-meter, etc., tend to use the internationally agreed **920-MHz band**.

Frequency Band [MHz]	Bit rate [kbps] @ Modulation				
	Filtered 2FSK	Filtered 4FSK	O-QPSK	OFDM	
169.400 - 169.475	2.4 / 4.8	9.6	---	---	(Europe)
450 - 470	4.8	9.6	---	---	(US FCC Part 22/90)
470 - 510	50 / 100	200	6.25 - 50	*1	(China)
779 - 787	50 / 100	200	31.25 - 500	*1	(China)
863 - 870	50 / 100	200	---	*1	(Europe)
868 - 870	---	---	6.25 - 50	---	(Europe)
896 - 901	10 / 20 / 40	---	---	---	(US FCC Part 90)
901 - 902	10 / 20 / 40	---	---	---	(US FCC Part 24)
902 - 928	50 / 150 / 200	---	31.25 - 500	*1	(US)
917.0 - 923.5	50 / 150 / 200	---	31.25 - 500	*1	(Korea)
920 - 928	50 / 100 / 200	400	6.25 - 50	*1	(Japan)
928 - 960	10 / 20 / 40	---	---	---	(US, non-contiguous)
950 - 958	50 / 100 / 200	400	6.25 - 50	*1	(Japan)
1427 - 1518	10 / 20 / 40	---	---	---	(US and Canada, non-contiguous)
2400.0 - 2483.5	50 / 150 / 200	---	31.25 - 500	*1	

*1: As defined in 18.3 (IEEE802.15.4g)

► Modulation Index, Channel Spacing

The following table lists the modulation method, index, and channel spacing for each bit rate.

Bit rate	Symbol Rate	Modulation	Mod. Index	Channel spacing
2.4 kbps	2.4 kbps	Filtered 2FSK	2.0	12.5 kHz
4.8 kbps	4.8 kbps		0.5	
			1.0	
10 kbps	10 kbps		0.5	
20 kbps	20 kbps		0.5	
40 kbps	40 kbps		0.5	
50 kbps	50 kbps		1.0	200 kHz
100 kbps	100 kbps		1.0	400 kHz
150 kbps	150 kbps		0.5	
200 kbps	200 kbps		0.5	600 kHz
		1.0		
9.6 kbps	4.8 kbps	Filtered 4FSK	0.33	12.5 kHz
200 kbps	100 kbps		0.3	400 kHz
400 kbps	200 kbps		0.3	600 kHz

► Packet Format 1/3

PPDU Format for MR-FSK (without mode switch)

SHR		PHR	PHY Payload
Preamble	SFD	*1	PSDU

*1: Mode Switch, FCS Type, Data Whitening, Frame Length

Preamble

Modulation	Bit String	Repetition No. [Octets]
2FSK	0101 0101(bin)/55(hex)	4 to 1000
4FSK	0111 0111 0111 0111(bin)/7777(hex)	4 to 1000

SFD (Start-of-frame delimiter)

2FSK	SFD Value for Coded (PHR + PSDU) (b0–b15)	SFD Value for Uncoded (PHR + PSDU) (b0–b15)
phyMRFSKSFD = 0	0110 1111 0100 1110(bin)/6F4E(hex)	1001 0000 0100 1110(bin)/904E(hex)
phyMRFSKSFD = 1	0110 0011 0010 1101(bin)/632D(hex)	0111 1010 0000 1110(bin)/7A0E(hex)

4FSK	SFD Value for Coded (PHR + PSDU) (b0–b15)	SFD Value for Uncoded (PHR + PSDU) (b0–b15)
phyMRFSKSFD = 0	0111 1101 1111 1111 0111 0101 1111 1101(bin) 7DFF75FD(hex)	1101 0111 0101 0101 0111 0101 1111 1101(bin) D75575FD(hex)
phyMRFSKSFD = 1	0111 1101 0101 1111 0101 1101 1111 0111(bin) 7D5F5DF7(hex)	0111 1111 1101 1101 0101 0101 1111 1101(bin) 7FDD55FD(hex)

► Packet Format 2/3

PPDU Format for MR-FSK (without mode switch)

SHR		PHR	PHY Payload
Preamble	SFD	*1	PSDU

*1: Mode Switch, FCS Type, Data Whitening, Frame Length

PHR (PHY Header)

Bit String Index	0	1–2	3	4	5–15
Bit mapping	MS	R1–R0	FCS	DW	L10–L0
Field Name	Mode Switch	Reserved	FCS Type	Data Whitening	Frame Length

MS, DW

0	Disable
1	Enable

FCS

Value	Transmitted FCS Length
0	4 octets
1	2 octets

Frame Length

e.g.

7 octets 000 0000 0111

256 octets 001 0000 0000

512 octets 010 0000 0000

► Packet Format 3/3

PPDU Format for MR-FSK (without mode switch)

Example

Modulation: Filtered 2FSK, DW = Disable, FEC = Disable, Interleaving = Disable

Frame Length = 7 octets, Payload = all 1

SHR		PHR	PHY Payload
Preamble	SFD		PSDU
55 55 55 55	90 4E	00 07	FF FF FF FF FF FF FF (hex)

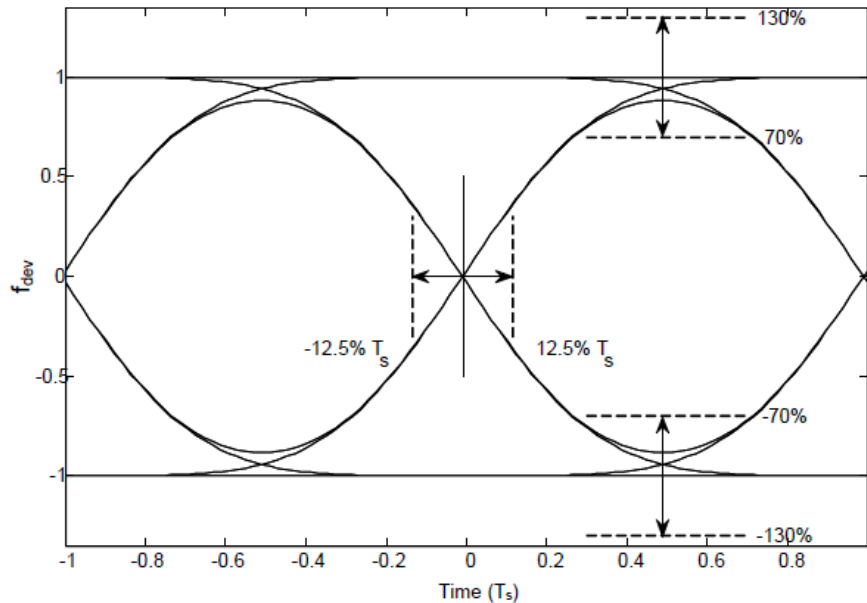
- Preamble: 2FSK, 4 octets
0101 0101 0101 0101 0101 0101 0101 0101(bin) / 55 55 55 55(hex)
- SFD: phyMRFSKSFD = 0, SFD value for uncoded
1001 0000 0100 1110(bin) / 90 4E(hex)
- PHR: MS = Disable, FCS = 4 octets, DW = Disable, Frame Length = 7 octets
0000 0000 0000 0111(bin) / 00 07(hex)
- PSDU:
1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111(bin) / FF FF FF FF FF FF FF(hex)

Tx Evaluation

18.1.2.3 Modulation Quality 1/2

18.1.2.3.1 Frequency Deviation Tolerance

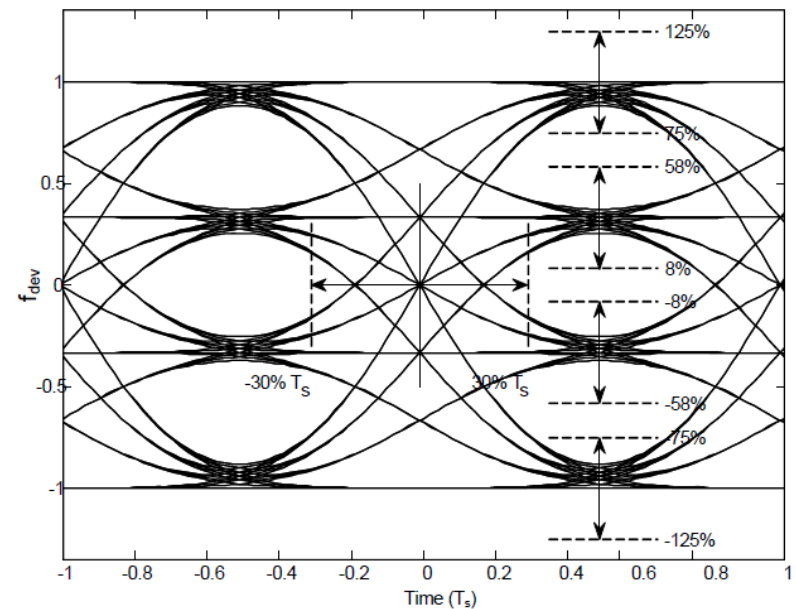
18.1.2.3.2 Zero Crossing Tolerance



2FSK Expected Values:

Deviation: $70\% < f < 130\%$

Zero Crossing Offset: $\leq \pm 12.5\%$



4FSK Expected Values:

Deviation: $75\% < f < 125\%$

Zero Crossing Offset: $\leq \pm 30\%$

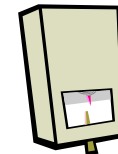
Rx Evaluation

18.1.2.3 Modulation Quality 2/2

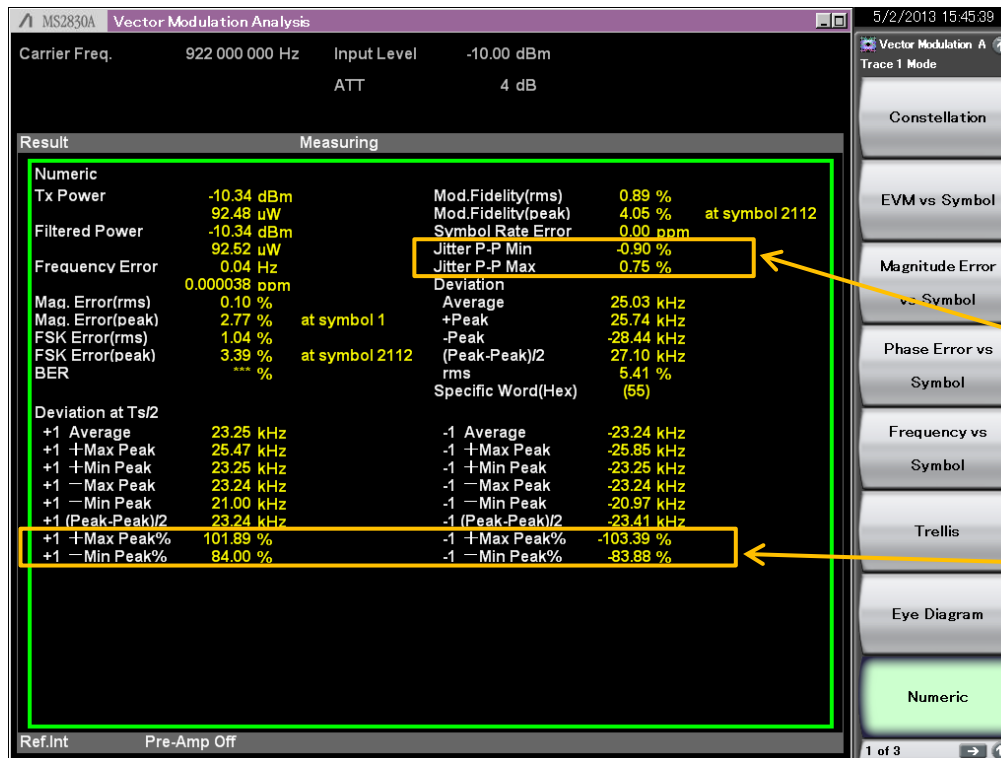
18.1.2.3.1 Frequency Deviation Tolerance

18.1.2.3.2 Zero Crossing Tolerance

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Unit, Module



Zero Crossing Offset: $\leq \pm 12.5\%$

Jitter P-P Min	-0.90 %
Jitter P-P Max	0.75 %

Deviation: $70\% < f < 130\%$

+1 +Max Peak%	101.89 %
+1 -Min Peak%	84.00 %

-1 +Max Peak%	-103.39 %
-1 -Min Peak%	-83.88 %

2FSK Measurement Example: MS2830A + MX269017A

Tx Evaluation

18.1.5.3 Radio Frequency Tolerance 1/2

Expected Value: $T \leq \min\left(\frac{T_0 \times R \times h \times F_0}{R_0 \times h_0 \times F}, 50 \text{ ppm}\right)$

[Note] IEEE802.15.4g: T_F Equation

R: symbol rate [ksps]
h: modulation index
F: carrier frequency [MHz]
R0: 50 [ksps]
h0: 1
F0: 915 [MHz]
T0: 30 ppm/40ppm (2.4-GHz band)

e.g.)

R 50 ksps
h 1
F 922 MHz

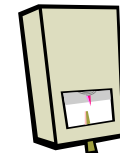
$$T \leq \frac{30 \times 50 \times 1 \times 915}{50 \times 1 \times 922}$$

$$T \leq 29.77 \text{ ppm}$$

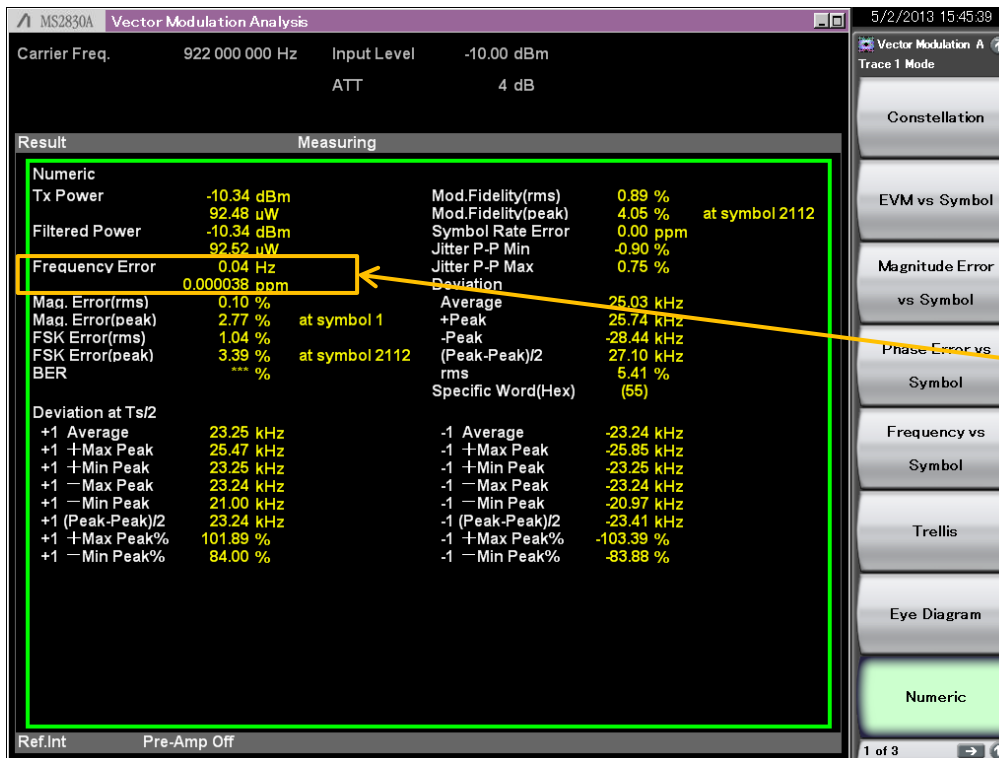
Tx Evaluation

18.1.5.3 Radio Frequency Tolerance 2/2

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Signal Analyzer



Unit, Module



Radio Frequency Tolerance
e.g.) $T \leq 29.77$ ppm

Frequency Error 0.04 Hz
0.000038 ppm

2FSK Measurement Example: MS2830A + MX269017A

Tx Evaluation

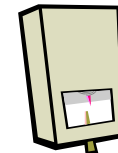
18.1.5.5 Transmitter Symbol Rate

Expected Value:

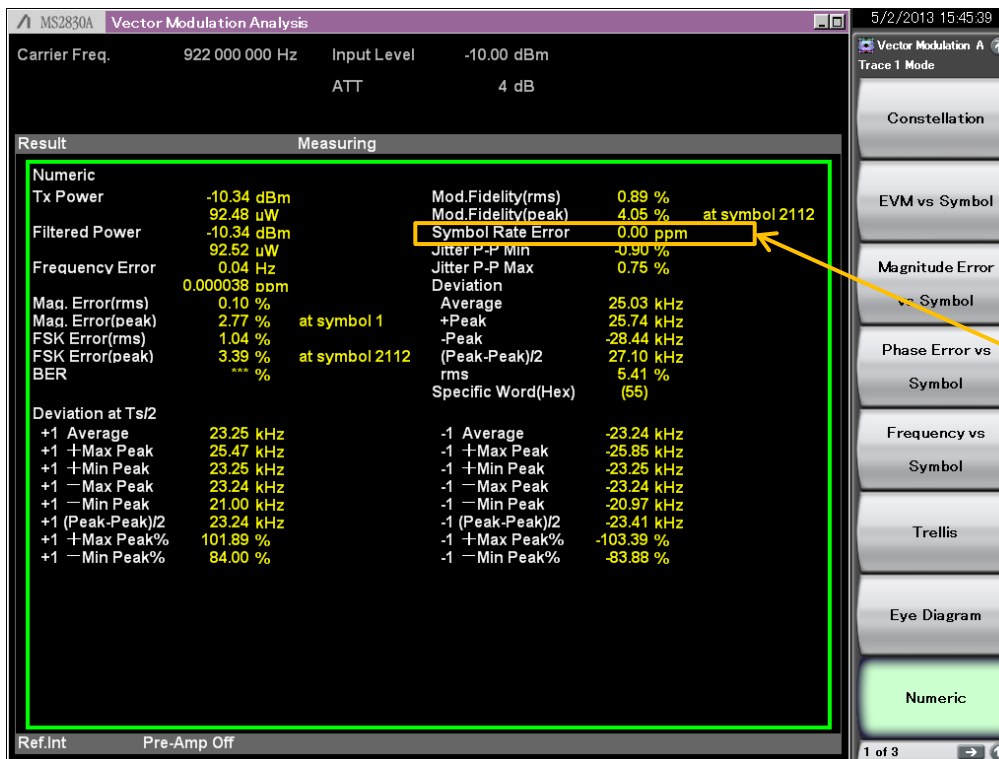
Transmitter Symbol Rate Tolerance $\leq \pm 300$ ppm

Peak Transmitter Symbol Rate Jitter $\leq \pm 40$ ppm

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Signal Analyzer



Unit, Module



Transmitter Symbol Rate Tolerance
 $\leq \pm 300$ ppm

Symbol Rate Error 0.00 ppm

2FSK Measurement Example: MS2830A + MX269017A

Tx Evaluation

18.1.5.6 Transmit Spectral Mask

Expected Values: (Adjacent Channel Leakage Power Ratio)

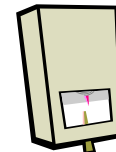
Channel Width: $1.5 \times R$, at Offset Frequency M_1 , M_2

M_1 : < -25 dBc, M_2 : < -35 dBc



2FSK Measurement Example: MS2830A

MS2830A
Signal Analyzer



Unit, Module

* Refer to items 18.1.5.6 of IEEE802.15.4g for the M_1 and M_2 calculation method (next page).

M_1 : < -25 dBc

M_2 : < -35 dBc

	dBc / dBm			dBc / dBm	
L1	-45.08 (	-58.77)	U1	-44.35 (	-58.04)
L2	-56.58 (	-70.27)	U2	-56.16 (	-69.85)

Tx Evaluation

18.1.5.6 Transmit Spectral Mask

[Note] IEEE802.15.4g: M_1 M_2 Calculation Method

18.1.5.6 Transmit spectral mask

The transmit spectral content is the ratio of the total transmitted out-of-channel power to the total transmitted in-channel power in a given integration bandwidth.

The integration bandwidth shall be equal to $1.5 \times R$, where R is the symbol rate, expressed in units of hertz.

Integration bandwidth of 1.5 times symbol rate

Out-of-channel power shall be measured at two offset frequencies relative to the carrier frequency. The offset frequencies M_1 and M_2 are defined as follows:

$$M_1 = 1.5 \times R \times (1 + h)$$

$$M_2 = 3 \times R \times (1 + h)$$

where h is the modulation index for 2-level modulation and three times the modulation index for 4-level modulation. **For 2FSK, h = modulation index. For 4FSK, h = modulation index x 3**

The transmit spectral content at M_1 and M_2 shall be less than -25 dB and -35 dB, respectively.

Same as expected value of previous page

The modulated signal shall use a PN data pattern of 511 bits or longer.

Modulation signal must use PN data pattern of ≥ 511 bits

The spectrum analyzer settings for this measurement shall be as follows: the resolution bandwidth is 1 kHz, the video bandwidth is 1 kHz or greater, and the detector is RMS.

VBW ≥ 1 kHz

RMS detector

RBW = 1 kHz

e.g.)

R 50 ksps

h 1

$$M_1 = 1.5 \times 50k \times (1+1) \\ = 150 \text{ kHz}$$

$$M_2 = 3 \times 50k \times (1+1) \\ = 300 \text{ kHz}$$

* VBW cannot be set for RMS detector with MS2830A, but since VBW = OFF = ∞ the conditions on the left (≥ 1 kHz) are met.

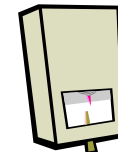
Tx Evaluation

18.1.5.11 Transmitter Power

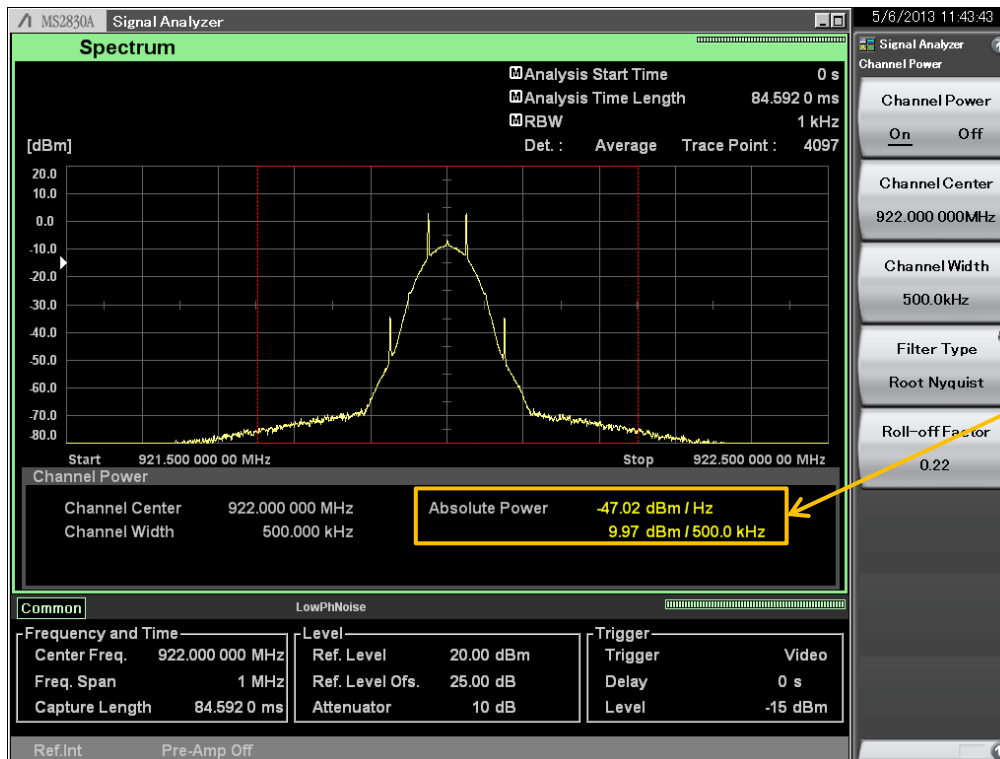
Expected Value:

$-3 \text{ dBm} < \text{power} < (\text{National Standard})$

MS2830A
Signal Analyzer



Unit, Module



Absolute Power -47.02 dBm / Hz
9.97 dBm / 500.0 kHz

Absolute Power 19.865 nW / Hz
9.9320 mW / Hz / 500.0 kHz

Switched Display Units
dBm, dBuV, dBmV,
W, dBuV(emf), dBuV/m

2FSK Measurement Example: MS2830A

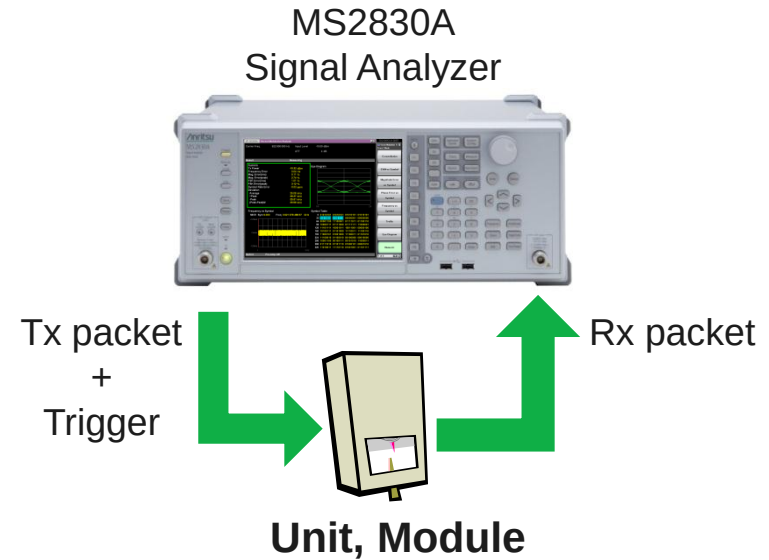
Tx Evaluation

18.1.5.10 Rx-to-Tx Turnaround Time

Expected Value:
< 12 symbols

(Example of Procedure)

1. SG sends packets to DUT and outputs trigger for SPA at trailing edge of Tx packet.
2. DUT starts sending packets (Tx) after completing receiving (Rx) of packets from SG.
3. SPA confirms Power vs Time from SG trigger until DUT sending (Tx) and measures time from Rx packet trailing edge until Tx packet rising edge.



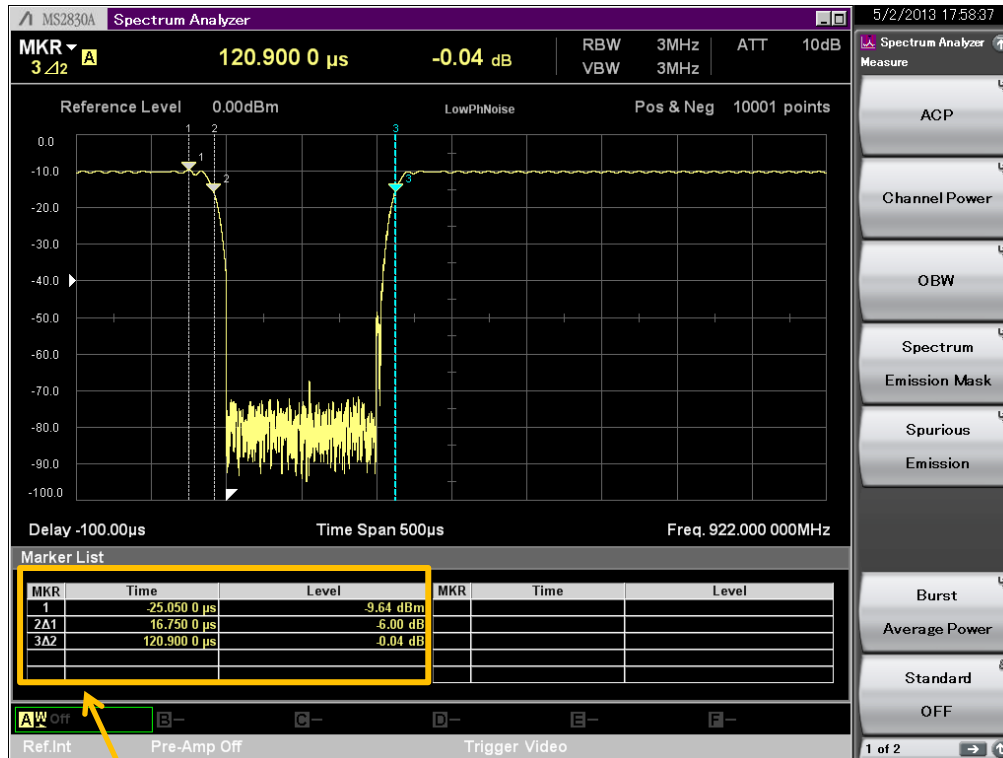
Tx Evaluation

18.1.5.10 Rx-to-Tx Turnaround Time

Measurement Example using MS2830A

Method using Marker List Function

1. Press [Peak Search] at Marker1 to move to peak point on screen.
2. Press [Relative to 1] at Marker2 and move the marker manually to the position 6 dB below Marker1 corresponding to the trailing edge of the Rx packet.
3. Press [Relative to 2] at Marker3 and move the marker manually to the position with the same level as Marker2 corresponding to the Tx packet rising edge.
4. [3 delta 2] here is the measurement time.



*Measurement image (not actually measured DUT results)

MKR	Time	Level
1	-25.050 0 μs	-9.64 dBm
2A1	16.750 0 μs	-6.00 dB
3A2	120.900 0 μs	-0.04 dB

Expected value:
< 12 symbols

e.g.) 50 kbps:
12 symbols = 240 μs

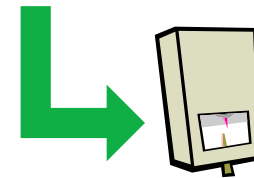
Rx Evaluation

18.1.5.7 Receiver Sensitivity

Expected Value: < S

$$S = \left(S_0 + 10 \log \left[\frac{R}{R_0} \right] \right) \text{ dBm}$$

- PSDU Length = 20 octets
- PER 1%
- Power measured at antenna terminals
- No interference



Unit, Module

[Note] IEEE802.15.4g: S Equation

S₀: – 91 (without FEC)
R₀: 50 [kbps]
R: bit rate [kbps]

e.g.)
R 50 kbps

$$\begin{aligned} S &= -91 + 10 \log \frac{50}{50} \\ &= -91 + 0 \\ &= -91 \end{aligned}$$

Rx Evaluation

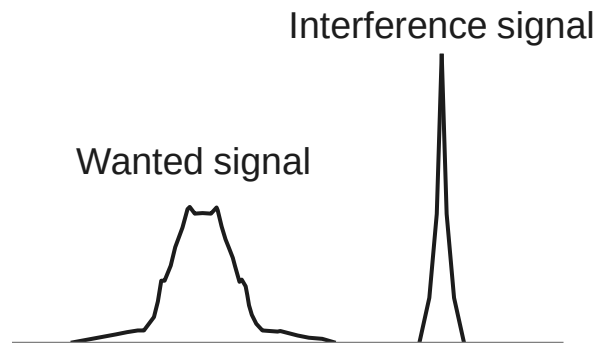
18.1.5.8 Receiver Interference Rejection

Expected Value:

Adjacent Channel Rejection: ≥ 0 dB

Alternate Channel Rejection: ≥ 30 dB

- PSDU Length = 20 octets
- PER 1%
- Power measured at antenna terminals

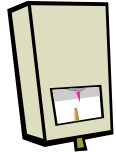


- Wanted signal level = "Receiver sensitivity level" + 3 dB
- Interference signal: Unmodulated carrier
More than one removed from wanted signal carrier
- Only one interfering signal at one time

MG3710A
Vector Signal Generator



Desired signal
&
Interfere signal



Unit, Module

Baseband Addition Function:

The MG3710A can add two different signals and output them from the RFx1 port.

The frequency (recommended range: ± 60 MHz) and level (CN: ± 80 dB) can also be set at the screen.

Note:

The interference wave must be at least 1 carrier from the wanted wave. For example, the 915-MHz band has a 26-MHz band) but two signals can be output from one RF port using the MG3710A baseband addition function (± 60 MHz). Although the baseband addition function can be added to the MG3740A, since the frequency offset range is ± 8 MHz, it must be used within this range.

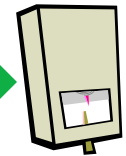
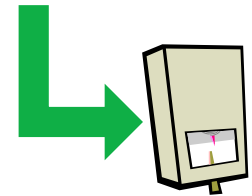
Rx Evaluation

18.1.5.12 Receiver maximum input level of desired signal

Expected Value: ≥ -20 dBm

- PSDU Length = 20 octets
- PER 1%
- Power measured at antenna terminals
- No interference

MS2830A
Signal Analyzer



Unit, Module

Appendix

Method for Generating Waveform Patterns using TDMA IQproducer

Using TDMA IQproducer to Generate Waveform Pattern 1/7

Sample Pattern Conditions

e.g.)

Modulation Method : Filtered 2FSK
Modulation Index : 1
Filter : Gaussian (BT = 0.5)
Data Rate : 50 kbps (= 50 ksps)
Payload : PN9

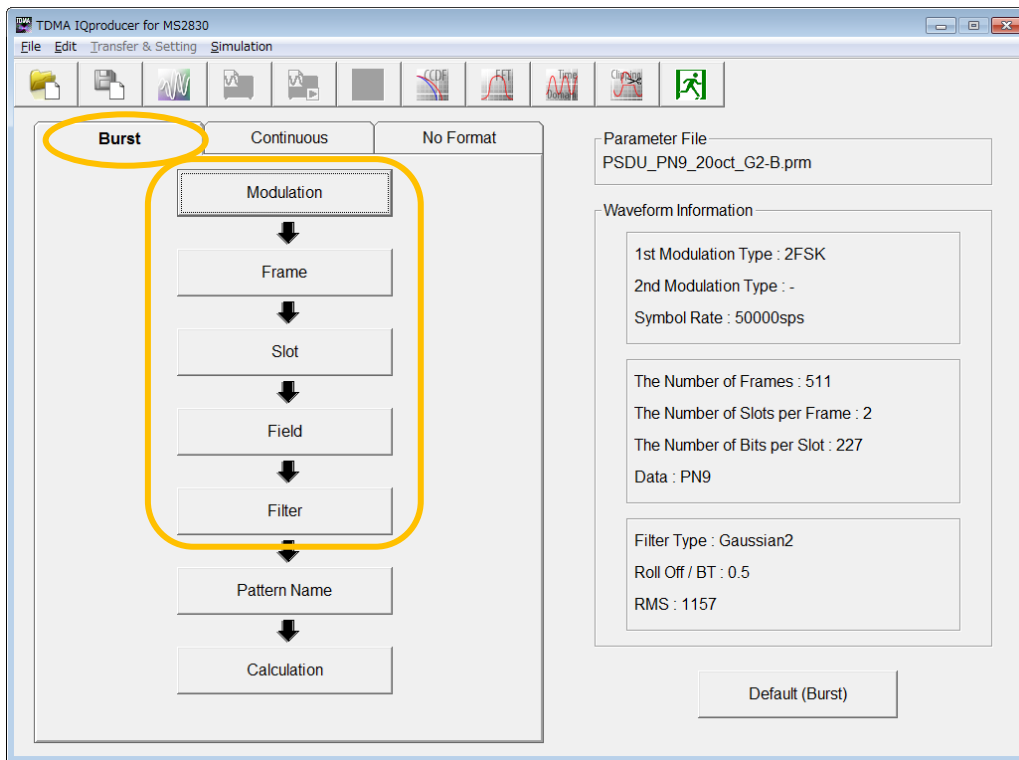
Preamble Length : 4 octets 55 55 55 55 (hex)
SFD : phyMRFSKSFD = 0, Uncoded 904E (hex)

Mode Switch : Disable
FCS Type : 4 octets
Data Whitening : Disable
Frame Length : 20 octets

Bit string index	0	1–2	3	4	5–15
Bit mapping	MS	R1–R0	FCS	DW	L10–L0
Field name	Mode Switch	Reserved	FCS Type	Data Whitening	Frame Length
	0	00	0	0	000 0001 0100
					00 14 (hex)

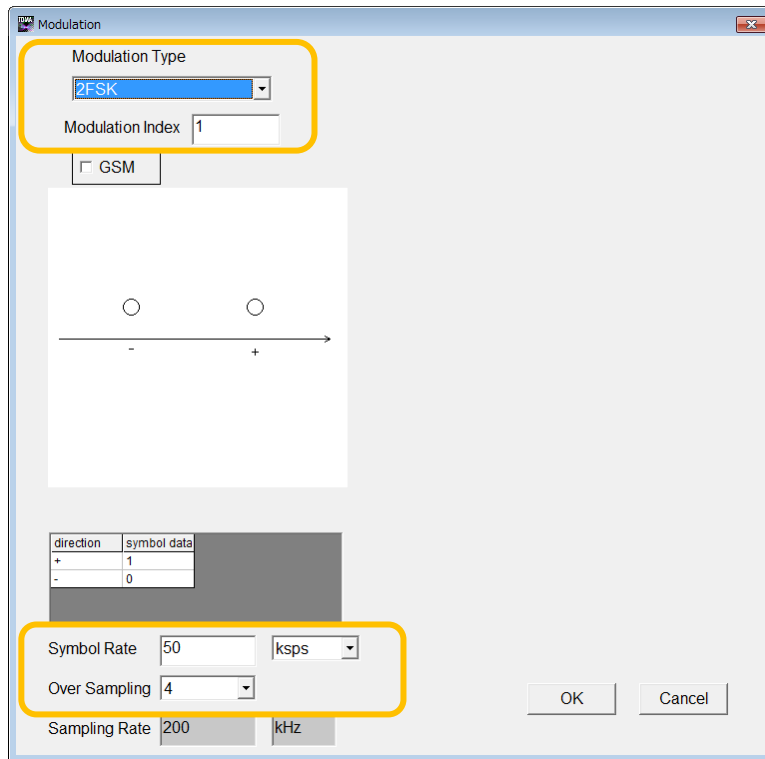
Using TDMA IQproducer to Generate Waveform Pattern 2/7

- ❑ Start TDMA IQproducer.
- ❑ Select [Burst] to generate burst signals.
- ❑ Set the parameters in the following sequence.
[Modulation] > [Frame] > [Slot] > [Field] > [Filter]
- ❑ First, click [Modulation] and then proceed to the next page.



Using TDMA IQproducer to Generate Waveform Pattern 3/7

- Set the following at the [Modulation] tab.
[Modulation Type], [Modulation Index], [Symbol Rate]
- Select anything for Over Sampling (recommended value: 4)



e.g.)

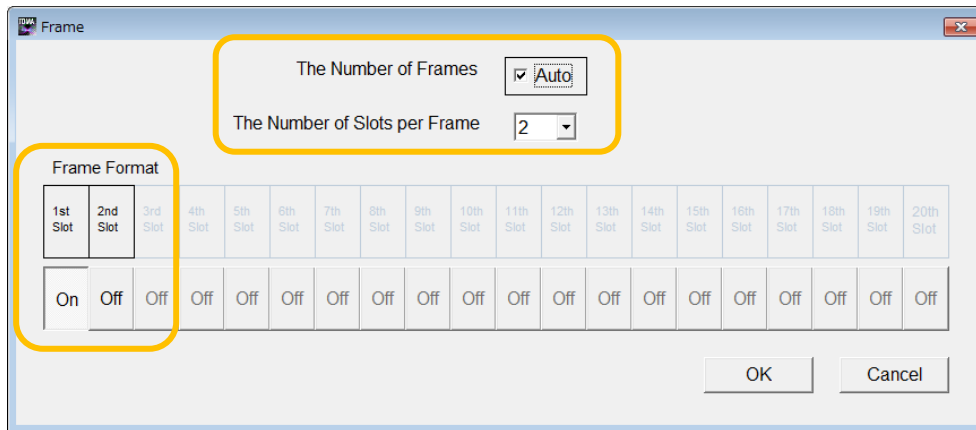
Modulation Method : Filtered 2FSK

Modulation Index : 1

Data Rate : 50 kbps (= 50 ksps)

Using TDMA IQproducer to Generate Waveform Pattern 4/7

- ❑ Set the following at the [Frame] tab.
 - Total number of frames: (The Number of Frames)
 - Slot number in 1 frame and On/Off: (The Number of Slots per Frame)
- ❑ The Number of Frames:
 - At [Auto], the number of frame is calculated automatically. In this case, when using PN9 data, [511] is set automatically for repeating PN9 = 511 bit (required for BER test).
 - Since PN9 repeating is not required for PER evaluation, uncheck [Auto] and set The Number of Frames to [1] to minimize the file size.
- ❑ The Number of Slots per Frame:
 - The following diagram shows an example when the slots in the frame are set to 1st Slot=On, 2nd Slot=Off, producing a signal with an On/Off ratio of 50%. Up to 20 slots can be set in one frame.



At BER Measurement

The Number of Frames ☒ Auto

At PER Measurement

The Number of Frames ☐ Auto 1

Using TDMA IQproducer to Generate Waveform Pattern 5/7

- Set the number of bits allocated within a slot at the [Slot] tab.

SHR		PHR		PHY payload	
Preamble	SFD			PSDU	

Slot Format

R	F	F	F	D	C	R	G
1	32	16	16	128	32	1	1

1st Field	Guard	0	bit
2nd Field	Ramp	1	bit
3rd Field	Fixed	32	bit
4th Field	Fixed	16	bit
5th Field	Fixed	16	bit
6th Field	Data	128	bit
7th Field	Data	0	bit
8th Field	CRC	32	bit
9th Field	Fixed	0	bit
10th Field	Fixed	0	bit
11th Field	Fixed	0	bit
12th Field	Fixed	0	bit
13th Field	Fixed	0	bit
14th Field	Fixed	0	bit
15th Field	Fixed	0	bit
16th Field	Fixed	0	bit
17th Field	Fixed	0	bit
18th Field	Fixed	0	bit
19th Field	Fixed	0	bit
20th Field	Fixed	0	bit
21st Field	Fixed	0	bit
22nd Field	Fixed	0	bit
23rd Field	Ramp	1	bit
24th Field	Guard	1	bit

Apply OK Cancel

e.g.)

Attach 1 bit before and after Ramp and 1 bit at the end of Guard.

PSDU 20 octets (160 bits) is divided into Data (128 bits) and CRC (32 bits).

Preamble and SFD are both Fixed.

Using TDMA IQproducer to Generate Waveform Pattern 6/7

- Set each of the parameters allocated at the [Slot] tab using the [Field] tab.

SHR		PHR		PHY payload	
Preamble	SFD			PSDU	

Field

Slot Format: Slot1

R	F	F	F	D	C	R	G
1	32	16	16	128	32	1	1

Data Field

PN9

☒ Data Field has a continuity between the fields in the adjacent slots.

☐ Data Field has a continuity between the fields in the same number slots.

CRC Field

☒ Ones Complement

Initial Content of the Register

☐ ALL1 ☒ ALL0

1st Field Ramp 1 bit

2nd Field Fixed 32 bit 55555555 (Hex)

3rd Field Fixed 16 bit 904E (Hex)

4th Field Fixed 16 bit 0014 (Hex)

5th Field Data 128 bit 128 Computing Range (Bit)

6th Field CRC 32 bit

7th Field Ramp 1 bit

8th Field Guard 1 bit

OK Cancel

e.g.)

Select [PN9] at the Data Field (PSDU).

Put a checkmark for CRC as shown in the figure.

e.g.)

Preamble Length : 55 55 55 55 (hex)

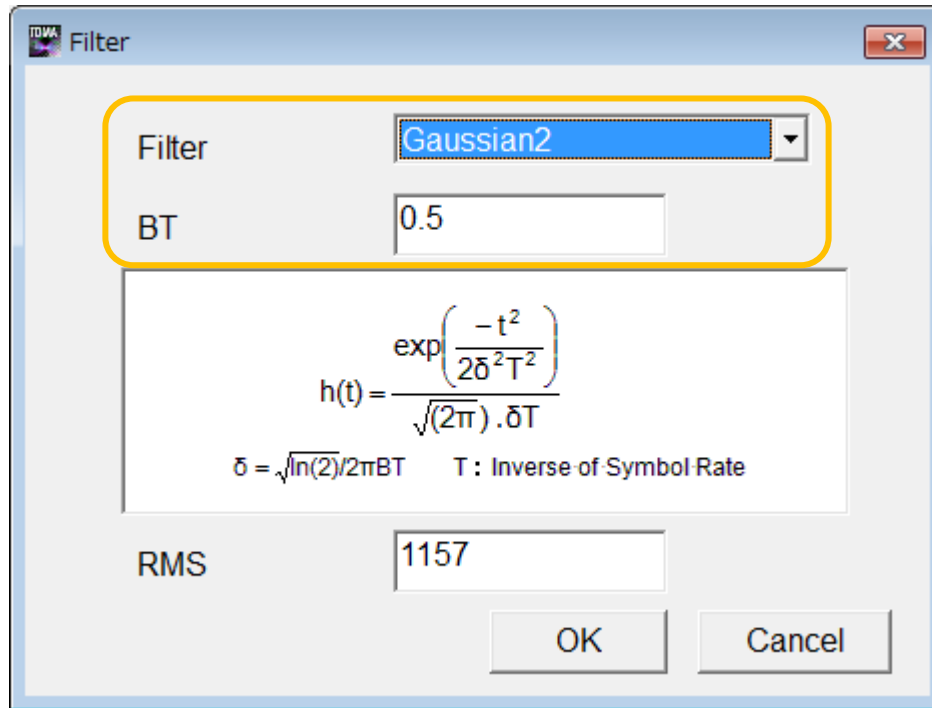
SFD : 904E (hex)

PHR : 0014 (hex)

CRC sets the target Data bit count.
(e.g. 128 bits).

Using TDMA IQproducer to Generate Waveform Pattern 7/7

- ☐ Set the filter at the [Filter] tab.
- ☐ Basically, set the RMS default.



e.g.

Filter: Gaussian (BT = 0.5)

Ordering Information

Model	Name	Note	
MS2830A	Signal Analyzer	Required	
MS2830A-040	3.6 GHz Signal Analyzer	Select any	
MS2830A-041	6 GHz Signal Analyzer		
MS2830A-006	Analysis Bandwidth 10 MHz	Required by MX269017A	
MX269017A	Vector Modulation Analysis Software	For modulation analysis	
MS2830A-020	3.6 GHz Vector Signal Generator	For modulation signal output (for desired signal)	a b
MS2830A-022	Low Power Extension for Vector Signal Generator	Required by sensitivity test	a b
MS2830A-027	ARB Memory Upgrade 256 MSa for Vector Signal Generator	Recommended when using a lot of patterns	a b
MX269902A	TDMA Iqproducer	Required for modulation signal generation	a b

Model	Name	Note	
MG3740A	Analog Signal Generator	Required	b c
MG3740A-032	1stRF 100 kHz to 2.7 GHz	CW output (for interfere signal)	b c
MG3740A-020	Digital Modulation	For modulation signal output (for desired signal)	c
MG3740A-048	Combination of Baseband Signal for 1stRF	Outout two signals by one-RFport	c
MX370102A	TDMA Iqproducer	Required for modulation signal generation	c

Model	Name	Note	
MG3710A	Vecror Signal Generarot	Required	d
MG3740A-032	1stRF 100 kHz to 2.7 GHz	For modulation signal output (for desired signal)	d
MG3740A-048	Combination of Baseband Signal for 1stRF	Outout two signals by one-RFport	d
MX370102A	TDMA IQproducer	Required for modulation signal generation	d

Note: The above table lists the minimum configuration. Select the reference oscillator and power extensions as necessary.

Rx Test Configuration Example a to d

a: [Wanted waveform \(MS2830A-020\) only](#)

[\[Recommended\]](#)

b: Wanted waveform (MS2830A-020) + interference waveform (MG3740A) ... Requires external coupler

c: Wanted waveform + interference waveform (MG3740A + Baseband Addition) ... Frequency Offset ± 8 MHz

d: [Wanted waveform + interference waveform \(MG3710A + Baseband Addition\) ... Frequency Offset \$\pm 60\$ MHz](#) [\[Recommended\]](#)

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