DFS Radar Pattern
MX370073A / MX370073B

Vector Signal Generator
MG3710A

DFS Radar Pattern MX370073A (to be discontinued in May 2019)
DFS Radar Pattern MX370073B

Installing the DFS Radar Pattern MX370073A/MX370073B option in the Vector Signal Generator MG3710A supports output of FCC 06-96 (Released: June 30, 2006), FCC 13-22 (Released: February 20, 2013) and Japan MIC (Reference: TELEC-T403 (V12.1)) DFS test signals. Output of complex combinations of pulse, chirp and hopping signals required to support the DFS tests is made easy just by selecting combination files supplied with the MX370073A.
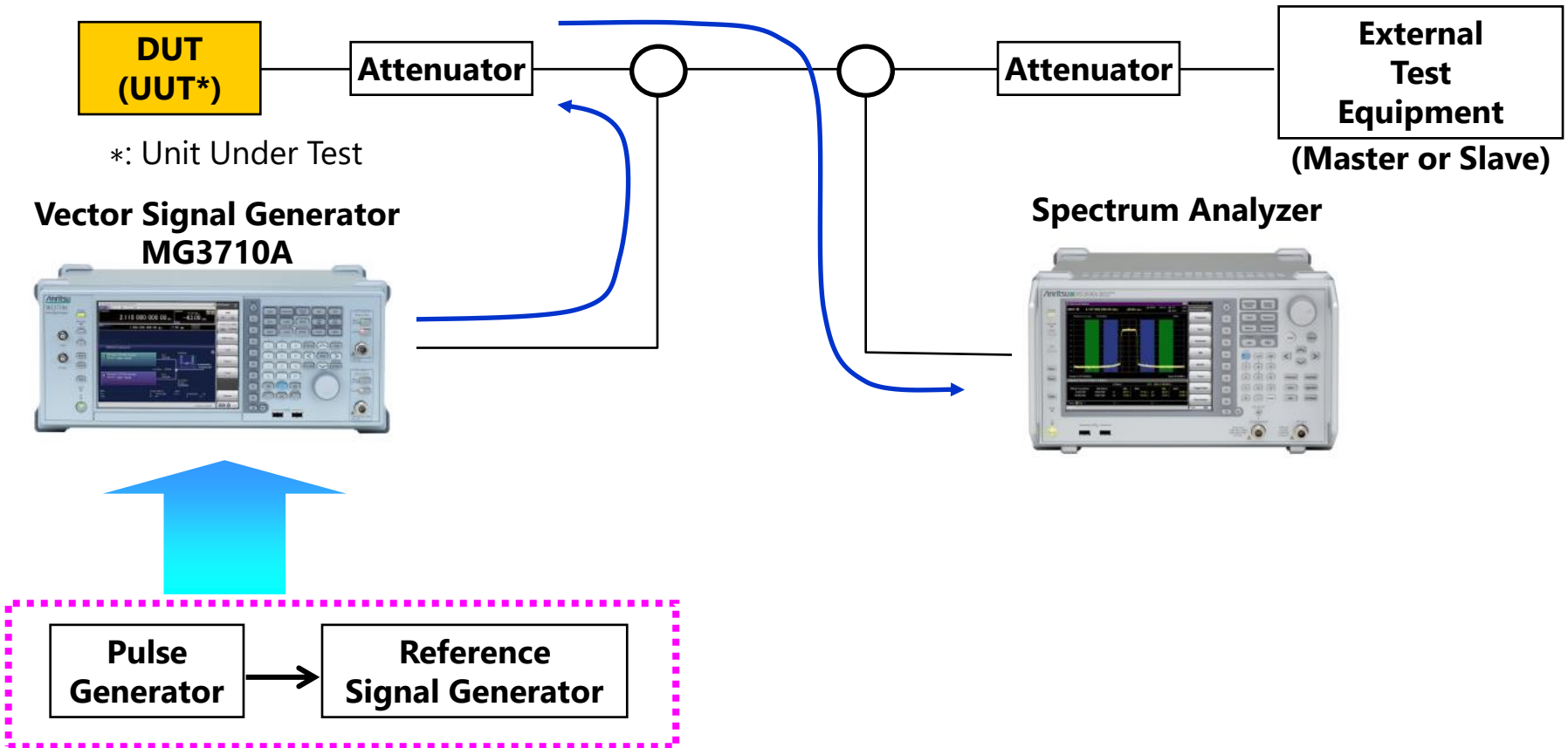
DFS Radar Pattern

MG3710A

Install

The main unit requires a license.

✓ *The MX370073A and MX370073B support both FCC and Japan MIC (TELEC) Standards.*

✓ *One MG3710A supports pulse, chirp and hopping signals.*

✓ *External PC not required. Simply selecting prepared waveform pattern outputs various signals using MG3710A built-in Sequence function.*

✓ *The MX370073B supports 5.3 GHz band solid-state radar waveform patterns* under consideration for addition to Japan MIC Standard.*

*:Waveform patterns created based on information published in November 2018 by Ministry of Internal Affairs and Communications (5 GHz band WLAN test group).

Anritsu envision : ensure

DFS Test Setup (Example)

DUT
(UUT*)

*: Unit Under Test

Attenuator

Attenuator

External
Test
Equipment

(Master or Slave)

Vector Signal Generator
MG3710A

Spectrum Analyzer

Pulse
Generator → Reference
Signal Generator

◆ *One MG3710A supports pulse, chirp and hopping signals.*
◆ *PC not required.*

Difference between MX370073A and MX370073B

✓: Supported

Model	Vector Signal Generator		Note
	MG3710A	MG3700A (discontinued)	
MX370073A (to be discontinued in May 2019)	✓	✓	
MX370073B	✓		• Only for MG3710A • Includes all waveform patterns offered by MX370073A • Includes 5.3 GHz band solid-state radar waveform patterns* now under consideration for addition to Japan MIC Standard

Anritsu envision:ensure

Sequence Function and Combination File

Sequence Function

This standard function switches and outputs multiple waveform patterns continuously.

Standards-compliant test signals can be created by combining complex patterns of pulse, chirp, hopping, and null signal waveforms.

Clicking "Sequence Restart" on the right starts output of the DFS test signal according to the standards.

Combination File:

Users can output pulse, chirp and hopping signals for DFS tests easily just by selecting a combination file with this sequence information.

Sequence function:
[Mode] > (Page2) [F7: Sequence Mode]

Sequence Function Display

Switches and outputs multiple waveform patterns continuously.

Anritsu envision : ensure

DFS Radar Pattern List
(MX370073A / MX370073B)

DFS Radar Pattern List (MX370073A/MX370073B)

◆ Simple output just by selecting combination file.
◆ Supports 40 variable signal types - 20 times each for main test and retest.
  Selecting in order supports tests with random conditions

For FCC Standard

Supported software: MX370073A, MX370073B

Test No.			Package	Combination File Name	Note	File Size [MB]
Short Pulse Radar		Type 0	RadarType0	ShortPulse0	Fixed Pulse Radar Signals. 1 pattern.	791 (All MX370073B)
		Type 1	RadarType1	Test A: ShortPulse1A-01 ~ ShortPulse1A-23	Variable Pulse Radar Signals. 23 patterns each.	
				Test B: ShortPulse1B-01 ~ ShortPulse1B-15	Variable Pulse Radar Signals. 15 patterns each.	
		Type 2	RadarType2	ShortPulse2-01 to ShortPulse2-40	Variable Pulse Radar Signals. 40 patterns each.	
		Type 3	RadarType3	ShortPulse3-01 to ShortPulse3-40		
		Type 4	RadarType4	ShortPulse4-01 to ShortPulse4-40		
Long Pulse Radar		Type 5	RadarType5	LongPulse-01 to LongPulse-40	Variable Charp Radar Signals. 40 patterns each.	
Frequency Hopping Radar		Type 6	RadarType6_20M	Hopping_20M-01 to Hopping_20M-40	Frequency Hopping Radar Signals. 40 patterns each. For 20 MHz/ch.	
			RadarType6_40M	Hopping_40M-01 to Hopping_40M-40	Frequency Hopping Radar Signals. 40 patterns each. For 40 MHz/ch.	
			RadarType6_80M	Hopping_80M-01 to Hopping_80M-40	Frequency Hopping Radar Signals. 40 patterns each. For 80 MHz/ch.	
			RadarType6_160M*	Hopping_160M-01 to Hopping_160M-40	Frequency Hopping Radar Signals. 40 patterns each. For 160 MHz/ch.	

Anritsu envision:ensure

*Available only for MG3710A

DFS Radar Pattern List (MX370073A/MX370073B)

◆ Simple output just by selecting combination file.
◆ Supports 40 variable signal types - 20 times each for main test and retest.
  Selecting order supports tests with random conditions.

For Japan MIC Standard (Reference: TELEC-T403)
  Supported software: MX370073A, MX370073B

Test No. (TELEC-T403)		Package	Combination File Name	Note	File Size [MB]
Appended Table 1	Type 1	DFS_behhyoudai1gou-1_2	behhyou_dai1gou-1	Fixed Pulse Radar Signals 1 pattern each	791 (All MX370073B)
	Type 2		behhyou_dai1gou-2		
Appended Table 2	Type 1	DFS_behhyoudai2gou-1_2_3	behhyou_dai2gou-1	Fixed Pulse Radar Signals 1 pattern each	
	Type 2		behhyou_dai2gou-2		
	Type 3		behhyou_dai2gou-3		
	Type 4	DFS_behhyoudai2gou-4	behhyou2-4-1 to behhyou2-4-40	Variable Pulse Radar Signals 40 patterns each	
	Type 5	DFS_behhyoudai2gou-5	behhyou2-5-1 to behhyou2-5-40		
	Type 6	DFS_behhyoudai2gou-6	behhyou2-6-1 to behhyou2-6-40		
Appended Table 3	Type 1	DFS_behhyoudai3gou	behhyou3-1 to behhyou3-40	Variable Chirp Radar Signals 40 patterns each	
Appended Table 4	Type 1	DFS_behhyoudai4gou	behhyou4-01 to behhyou4-40	Frequency Hopping Radar Signals 40 patterns each For DUT 20 MHz detection bandwidth	
		DFS_behhyoudai4gou_40M	behhyou4-01_40M ~ behhyou4-40_40M	Frequency Hopping Radar Signals 40 patterns each For DUT 40 MHz detection bandwidth	
		DFS_behhyoudai4gou_80M	behhyou4-01_80M ~ behhyou4-40_80M	Frequency Hopping Radar Signals 40 patterns each For DUT 80 MHz detection bandwidth	
		DFS_behhyoudai4gou_160M*	behhyou4-01_160M ~ behhyou4-40_160M	Frequency Hopping Radar Signals 40 patterns each For DUT 160 MHz detection bandwidth	

Anritsu envision : ensure

*Available only for MG3710A

DFS Radar Pattern List (MX370073A/MX370073B)

For Japan MIC Standard (signal additions under investigation)
Supported software: MX370073B

Test No.	Package	Combination File Name	Note	File Size [MB]
None	W53_DFS_Radar_Pattern	n01_variable_W53 to n07_variable_W53 n08_chirp_W53 to n20_chirp_W53	• Twenty 5.3 GHz band solid-state radar waveform patterns • Based on specifications (at November 2018) published by Ministry of Internal Affairs and Communications (5 GHz band WLAN test group)	791 (ALL MX370073B)

✓ These waveform patterns are not included currently in the standard (at December 2018). They are the candidates expected to be adopted by the Ministry of Internal Affairs and Communications.

✓ Waveform patterns created based on information published in November 2018 by Ministry of Internal Affairs and Communications (5 GHz band WLAN test group).

DFS Test Signals
for FCC and Japan MIC Standards

DFS Test Signals for FCC 06-96 and FCC 13-22 (1/4)

Supported software: MX370073A, MX370073B

Test Objects

Test Items	Radar Type	Chapter Number
Short Pulse Radar	0	6.1
	1	6.1
	2	6.1
	3	6.1
	4	6.1
Long Pulse Radar	5	6.2
Frequency Hopping Radar	6	6.3 (20 MHz)[1]
		6.3 (40 MHz)[2]
		6.3 (80 MHz)[3]
		6.3 (160 MHz)[4]

*1: Frequency Hopping Bandwidth = 20 MHz
*2: Frequency Hopping Bandwidth = 40 MHz
*3: Frequency Hopping Bandwidth = 80 MHz
*4: Frequency Hopping Bandwidth = 160 MHz (Available only for the MG3710A.).

Anritsu envision : ensure

DFS Test Signals for FCC 06-96 and FCC 13-22 (2/4)

Supported software: MX370073A, MX370073B

Short Pulse Radar

Used for combining randomly extracted combinations of pulse width, pulse repetition frequency and continuous pulse count at each repetition cycle

Radar Type	Pulse Width (W) [µs]	Pulse Repetition Interval (PRI) [µs]	Pulse Per Burst for each PRI (PPB)
0	1	1428	18
1	1	518 to 3066 (1 µs step)	18 to 102 (1 step)
2	1 to 5 (1 µs step)	150 to 230 (1 µs step)	23 to 29 (1 step)
3	6 to 10 (1 µs step)	200 to 500 (1 µs step)	16 to 18 (1 step)
4	11 to 20 (1 µs step)	200 to 500 (1 µs step)	12 to 16 (1 step)

*See slides 16 and 18 for signal images.

PRI: Pulse Repetition Interval

Anritsu envision : ensure

DFS Test Signals for FCC 06-96 and FCC 13-22 (3/4)

Supported software: MX370073A, MX370073B

Long Pulse Radar: Chirp Signal

Used for combining randomly extracted combinations of pulse width, chirp width, pulse repetition frequency, continuous pulse count and burst count at each repetition cycle. However, the chirp frequency band is within the occupied frequency band.

Radar Type	Pulse Width (W) [µs]	Pulse Repetition Interval (PRI) [µs]	Pulse Per Burst for each PRI (PPB)
5	50 to 100 (1 µs step)	1000 to 2000 (1 µs step)	1 to 3 (1 step)

*See slides 19 and 20 for signal images.

PRI: Pulse Repetition Interval

Anritsu envision : ensure

Supported software: MX370073A, MX370073B

Frequency Hopping Radar

Hopping is performed at each 0.333 kHz hopping time interval. The hopping frequency can be selected randomly from 475 waves at 1 MHz intervals between 5250 and 5724 MHz. The 9 pulses in every burst are at the same frequency. However, the pulse pattern for the 20 or 40 MHz frequency band detected by the Rx module within the frequency hopping band is output as the test signal.

Radar Type	Pulse Width (W) [µs]	Pulse Repetition Interval (PRI) [µs]	Pulse Per Burst for each Hopping
6	1	333	9

*See slides 21 and 22 for signal images.

PRI: Pulse Repetition Interval

DFS Test Signals for Japan MIC Standard   (1/8)

Reference: TELEC-T403
Supported software: MX370073A, MX370073B

Test Objects

Test Items	Frequency	Test signal	Test No.
Carrier Sense (2)	5.3 GHz	Fixed Pulse Radar Signals	Table No. 1 Type. 1
			Table No. 1 Type. 2
Carrier Sense (3)	5.6 GHz	Fixed Pulse Radar Signals	Table No. 2 Type. 1
			Table No .2 Type. 2
			Table No. 2 Type. 3
		Variable Pulse Radar Signals	Table No. 2 Type. 4
			Table No. 2 Type. 5
			Table No. 2 Type. 6
		Chirp Radar Signals	Table No. 3 Type. 1
		Frequency Hopping Radar Signals	Table No. 4 Type. 1 (20 MHz)[*1]
			Table No. 4 Type. 1 (40 MHz)[*2]
			Table No. 4 Type. 1 (80 MHz)[*3]
			Table No. 4 Type. 1 (160 MHz)[*4]

*1: Frequency Hopping Bandwidth = 20 MHz
*2: Frequency Hopping Bandwidth = 40 MHz
*3: Frequency Hopping Bandwidth = 80 MHz
*4: Frequency Hopping Bandwidth = 160 MHz (Available only for the MG3710A.).

/Anritsu envision : ensure

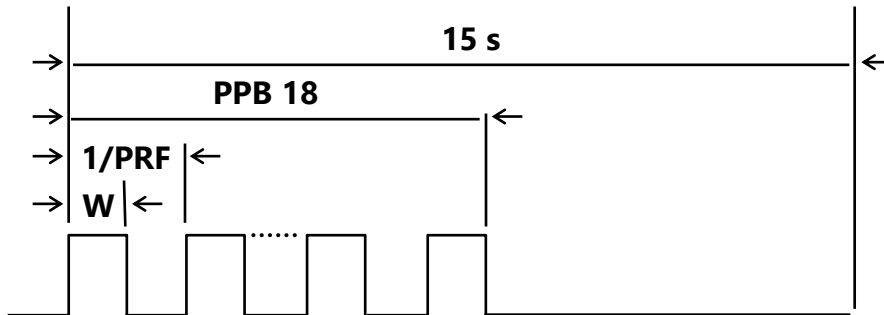# DFS Test Signals for Japan MIC Standard　　(2/8)

Reference: TELEC-T403
Supported software: MX370073A, MX370073B

Fixed Pulse Radar Signals: (Table No.1 Type.1, 2)
Fixed Pulse Radar Signals: (Table No.2 Type.1, 2, 3)

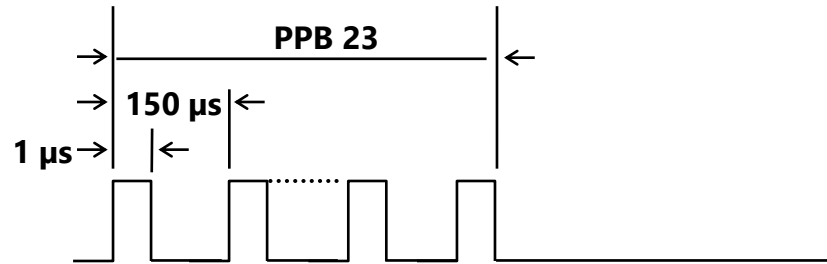| Test No.		Pulse Width (W) [μs]	Pulse Repetition Frequency (PRF) [Hz]	Pulse Per Burst for each PRF (PPB)	Repetition Interval [s]
Table No1	Type. 1	1	700	18	15
	Type. 2	2.5	260	18	15
Table No.2	Type. 1	0.5	720	18	15
	Type. 2	1	700	18	15
	Type. 3	2	250	18	15

Anritsu envision:ensure

Reference: TELEC-T403
Supported software: MX370073A, MX370073B

Variable Pulse Radar Signals: (Table No. 2 Type. 4, 5, 6)

Used for combining randomly extracted combinations of pulse width, pulse repetition frequency and continuous pulse count at each repetition cycle

Test No.		Pulse Width (W) [μs]	Pulse Repetition Frequency (PRF) [Hz]	Pulse Per Burst for each PRF (PPB)	Repetition Interval [s]
Table No. 2	Type. 4	1 to 5 (1 μs step)	4347 to 6667 (1 Hz step)	23 to 29 (1 step)	15
	Type. 5	6 to 10 (1 μs step)	2000 to 5000 (1 Hz step)	16 to 18 (1 step)	15
	Type .6	11 to 20 (1 μs step)	2000 to 5000 (1 Hz step)	12 to 16 (1 step)	15

PRF: Pulse Repetition Frequency

Anritsu envision : ensure

Reference: TELEC-T403
Supported software: MX370073A, MX370073B

Variable Pulse Radar Signals: (Table No. 2 Type 4, 5, 6)
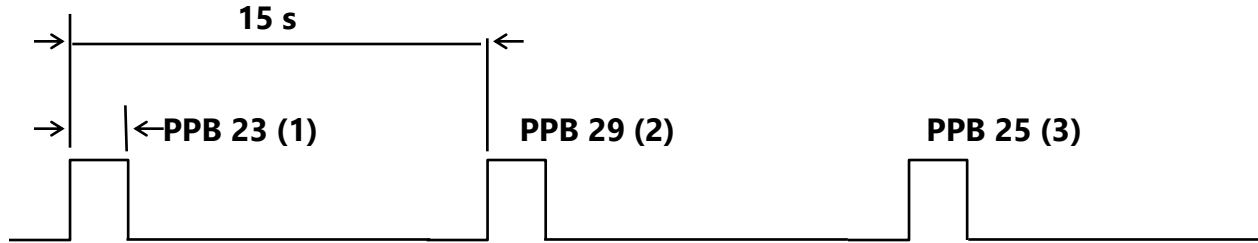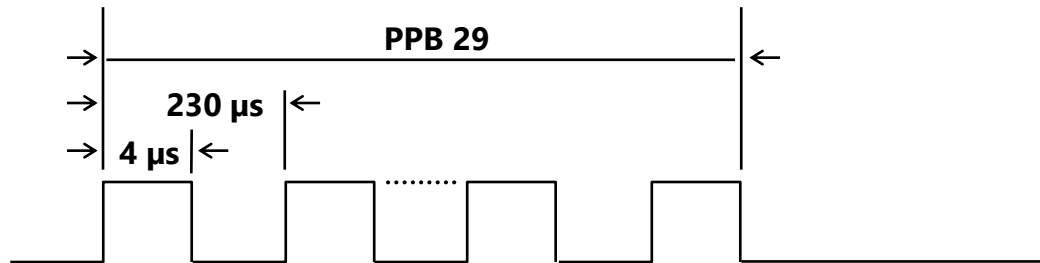
Reference: TELEC-T403
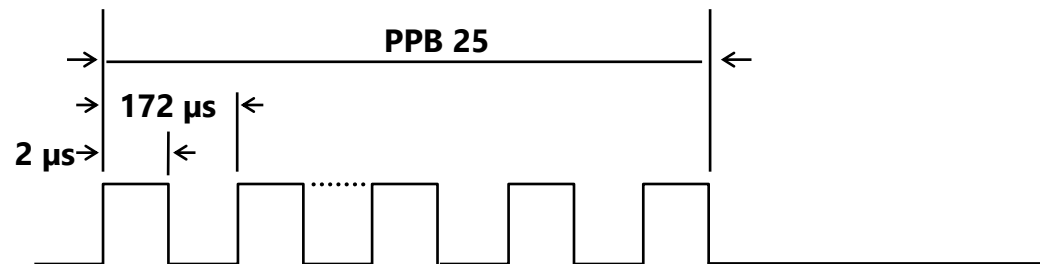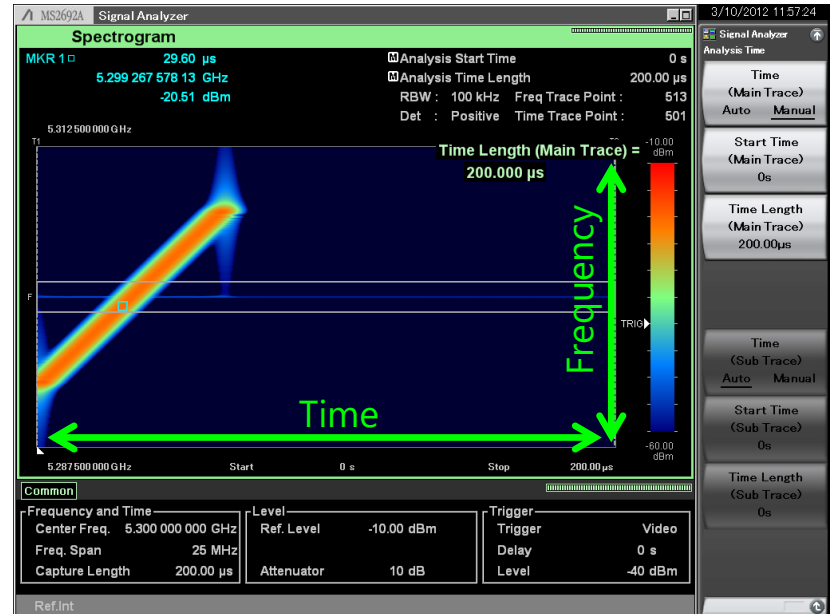Supported software: MX370073A, MX370073B

Chirp Radar Signals: (Table No. 3)

Used for combining randomly extracted combinations of pulse width, chirp width, pulse repetition frequency, continuous pulse count and burst count at each repetition cycle. However, the chirp frequency band is within the occupied frequency band.

Example for chirp signal (zoomed-in)

Test No.		Pulse Width (W) [μs]	Pulse Repetition Frequency (PRF) [Hz]	Pulse Per Burst for each PRF (PPB)	Repetition Interval [s]
Table No. 3	Type. 1	50 to 100 (1 μs step)	500 to 1000 (1 Hz step)	1 to 3 (1 step)	12

PRF: Pulse Repetition Frequency

Anritsu envision : ensure

19

Reference: TELEC-T403
Supported software: MX370073A, MX370073B
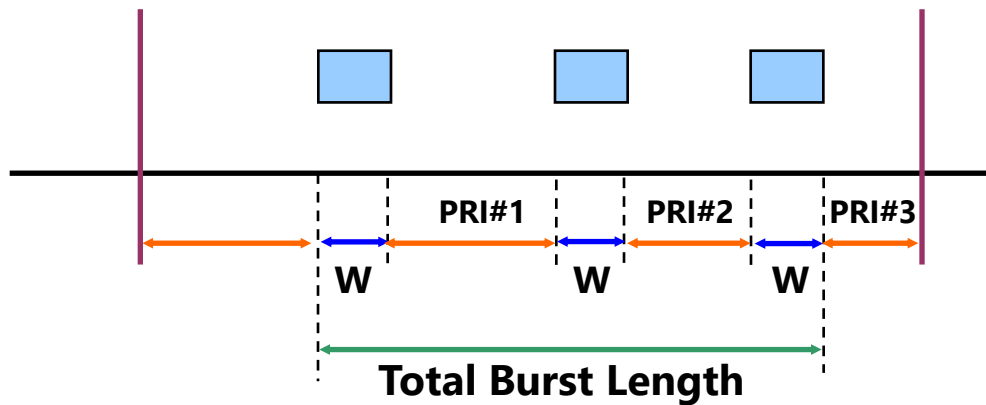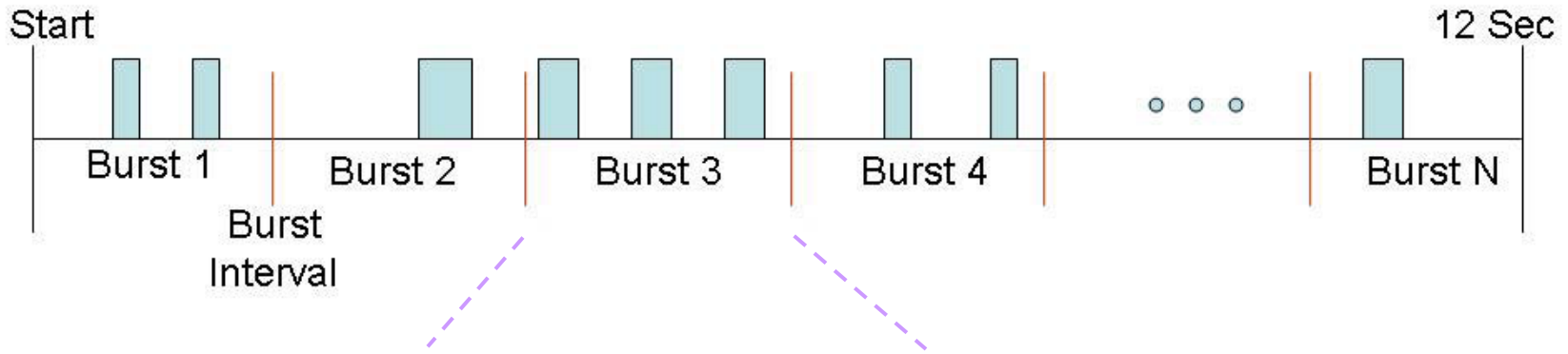
Chirp Radar Signals: (Table No. 3)

W: Pulse Width
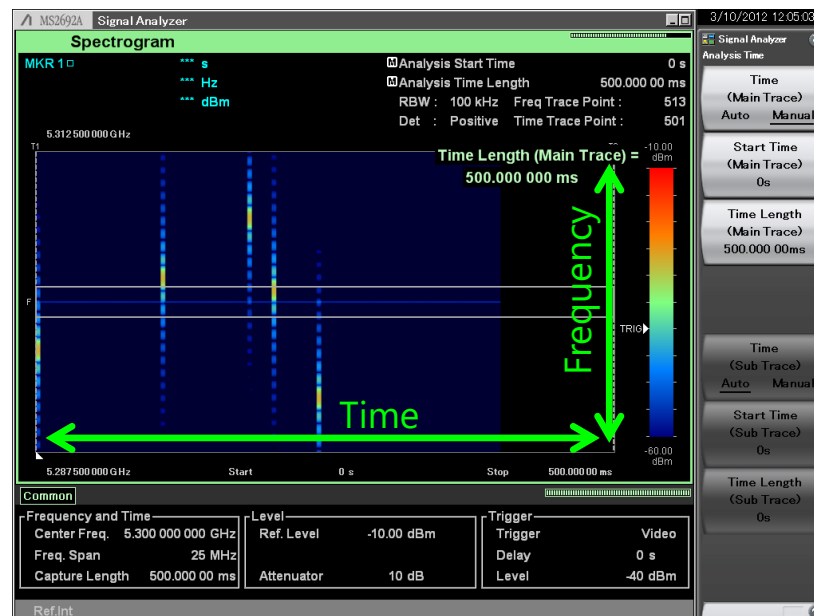
PRI: Pulse Repetition Interval

DFS Test Signals for Japan MIC Standard (7/8)

Reference: TELEC-T403
Supported software: MX370073A, MX370073B

Frequency Hopping Radar Signals: (Table No. 4)

Hopping is performed at each 3 ms hopping time interval. The hopping frequency can be selected randomly from 475 waves at 1 MHz intervals between 5250 and 5724 MHz. The 9 pulses output every 3 ms are at the same frequency. However, the pulse pattern for the 20, 40, 80 or 160 MHz frequency band detected by the Rx module within the frequency hopping band is output as the test signal.

Example for hopping signal (zoomed-in)

Test No.		Pulse Width (W) [µs]	Pulse Repetition Frequency (PRF) [Hz]	Pulse Per Hopping for each PRF (PPB)	Repetition Interval [s]
Table No. 4	Type. 1	1	3,000	9	10

PRF: Pulse Repetition Frequency

Anritsu envision : ensure
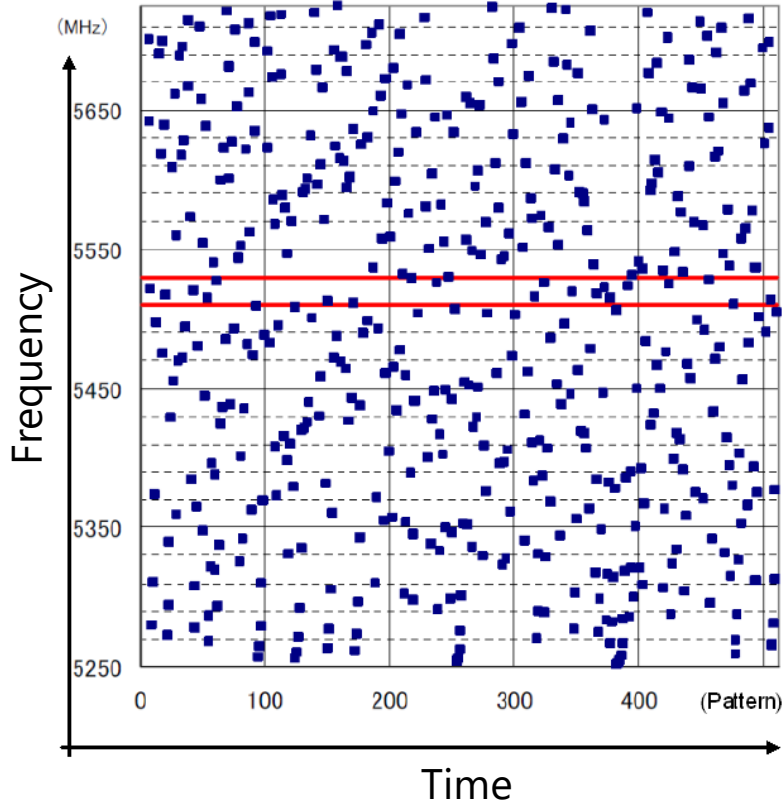
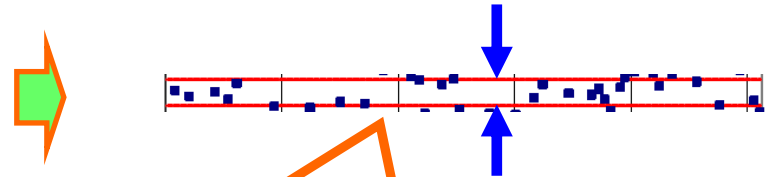# DFS Test Signals for Japan MIC Standard   (8/8)

Reference: TELEC-T403

Supported software: MX370073A, MX370073B

Frequency Hopping Radar Signals: (Table No. 4)

Bandwidth:
20 MHz, 40 MHz, 80 MHz, 160 MHz

The signal generator outputs any in-band pulse but no out-of-band pulse. The DUT performs carrier sensing when a pulse within the detection band is detected.

DFS Test Signals for Japan MIC Standard (signal additions under investigation) (1/2)

Supported software: MX370073B

Test Objects

Test Items	Frequency	Test signals	Test No.
Carrier Sense	5.3 GHz	• Twenty 5.3 GHz band solid-state radar waveform patterns • Based on specifications (at November 2018) published by Ministry of Internal Affairs and Communications (5 GHz band WLAN test group).	None

✓ These waveform patterns are not included currently in the standard (at December 2018). They are the candidates expected to be adopted by the Ministry of Internal Affairs and Communications.

✓ Waveform patterns created based on information published in November 2018 by Ministry of Internal Affairs and Communications (5 GHz band WLAN test group).

DFS Test Signals for Japan MIC Standard (signal additions under investigation) (2/2)

Supported software: MX370073B

No.	Short Pulse (μs)	Blank 1 (μs)	Long Pulse (μs)	Blank 2 (μs)	α*1	γ*2	B*3	Pulse Repetition Frequency (PRF) [Hz]	Continuous Pulse Count	Repetition Interval [s]
1	2.5	0	0	3028	–	–	–	330	10	15.0
2	1	0	0	1063	–	–	–	940	27	15.0
3	1	0	0	1329	–	–	–	752	21	15.0
4	2	0	0	3844	–	–	–	260	10	15.0
5	2	0	0	2379	–	–	–	420	15	15.0
6	1	0	0	892	–	–	–	1120	32	15.0
7	1	0	0	1189	–	–	–	840	24	15.0
8	1	72	64	825	0	1.48	1.2	1040	28	15.0
9	1	72	64	1065	0	1.48	1.2	832	23	15.0
10	1	108	100	2291	0	1.48	1.67	400	20	15.0
11	1	108	100	2916	0	1.48	1.67	320	30	15.0
12	1	72	64	2762	0.45	1.48	2	345	10	15.0
13	1	40	32	1031	0.45	1.48	2	906	26	15.0
14	1	40	32	1252	0.45	1.48	2	755	22	15.0
15	0.5	20	20	585	0.1	1.48	2	1600	10	15.0
16	0.5	20	20	585	0.89	1.48	2	1600	10	15.0
17	5	200	200	2928	0.1	1.48	1	300	10	15.0
18	5	200	200	2928	0.89	1.48	1	300	10	15.0
19	15	400	400	4185	0.1	1.48	1	200	15	15.0
20	15	400	400	4185	0.89	1.48	1	200	15	15.0
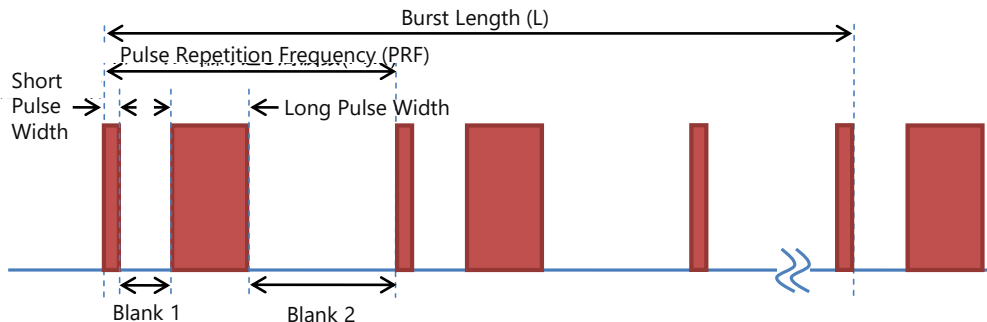
*1: Variable determining ratio of Linear and Non-linear frequency components
*2: Variable determining curvature of non-linear components
*3: Frequency sweep width

Anritsu envision : ensure

[Supplement] What is DFS: Dynamic Frequency Selection?

Japan MIC Standard (Reference: TELEC-T403) specifies use of frequency bands from 5.3 GHz (5.26/5.28/5.30/5.32 GHz) and 5.6 GHz (5.50/5.52/5.54/5.56/5.58/5.60/5.62/5.64/5.66/5.68/5.70 GHz) for the WLAN 5 GHz band. Since these are the same frequency bands as used by meteorological radar[Note] and marine radar, these pulse signals are obliged to use Dynamic Frequency Selection (DFS) technology.

FCC 06-96 requires the same tests for 5.25 to 5.35 GHz and 5.47 to 5.725 GHz.

Note: Weather radar locates precipitation by transmitting pulse bursts every second. Interference from wireless LAN can be mistaken for precipitation. Therefore, use DFS to confirm the absence of weather radar before starting operation.

/Anritsu envision : ensure