

Software Manual



Pulse Sequencer Software Japan TELEC DFS Signal Generation

V 3.3.6

2010. 6. 15 ローデ・シュワルツ・ジャパン Rohde & Schwarz Japan





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ROHDE&SCHWARZ

1. はじめに Introduction

世界的に、2 つの周波数バンド 5.25 - 5.35 GHz, 5.47 - 5.725 GHz は、様々なレーダシステム に使用され、免許不要の WLAN (IEEE802.11a)デバイスに許可されています。この周波数バン ド再利用の要件は DFS (Dynamic Frequency Selection)と呼ばれます。

DFSを要求するシステムは、レーダシステムに干渉することを回避できる必要があります。 要件とテストパターンを定義する異なるスタンダードが世界的に存在します。

- US: FCC06-96
- EU: ETSI EN 301 893 (5 GHz), ETSI EN 302 502 (5.8 GHz)
- Japan: TELEC-T403

R&S パルスシーケンサ ソフトウェアを使用することで、DFS レーダテスト信号用の複雑なパルス パターンを簡単に発生することができます。

このマニュアルは、TELEC スタンダードの要件に対処します。R&S K6 パルスシーケンサ ソフト ウェアオプション付き R&S ベクトルシグナルジェネレータ(VSG)を使用して、どのようにテスト信 号を生成できるかを説明します。

R&S パルスシーケンサ ソフトウェアは、DFS スタンダード用に予め定義されたプロジェクトファイ ル付きスタンドアローン PC ベースソフトウェアです。要求された全ての波形を簡単に生成できま す。

Worldwide, the two frequency bands 5.25 - 5.35 GHz and 5.47 - 5.725 GHz are used by various radar systems and in addition, are allocated to unlicensed WLAN devices. A requirement arising from this frequency band reuse is a method called DFS which stands for Dynamic Frequency Selection.

A system that requires DFS needs to be capable of avoiding interfering with radar systems. Different standards documents exist worldwide that define requirements and test patterns.

- US: FCC06-96
- EU: ETSI EN 301 893 (5 GHz), ETSI EN 302 502 (5.8 GHz)
- Japan: TELEC-T403

The R&S Pulse Sequencer software allows the easy generation of complex pulses and pulse patterns for DFS radar test signals.

This manual deals with the requirements set in the TELEC standard. It describes how the test signals can be generated using a R&S Vector Signal Generator (VSG) with the R&S K6 Pulse Sequencer Software option.

The R&S Pulse Sequencer Software comes as a stand alone PC based software with preconfigured project files for DFS and other standards. It simplifies the generation of all required waveforms.



2. VSG オプション VSG Options

| <u>SMU200A</u> SMU-B106 SMU-B9, B10 or B11 SMU-B13 SMU-K6 | Vector Signal Generator 100 kHz to 6 GHz Baseband Generator with ARB 128 MS, 64 MS, 16 MS Baseband Main Module Pulse Sequencer License |
|---|--|
| SMATE200A | Vector Signal Generator |
| SMATE-B106 | 100 kHz to 6 GHz |
| SMATE-B9, B10 or B1 | 1 |
| | Baseband Generator with ARB 128 MS, 64 MS, 16 MS |
| SMATE-B13 | Baseband Main Module |
| SMATE-K6 | Pulse Sequencer License |
| SMJ100A | Vector Signal Generator |
| SMJ-B106 | 100 kHz to 6 GHz |
| SMJ-B9, B10, B11, B5 | 0 or B51 |
| | Baseband Generator with ARB 128 MS, 64 MS, 16 MS |
| SMU-B13 | Baseband Main Module |
| SMU-K6 | Pulse Sequencer License |
| SMBV100A | Vector Signal Generator |
| SMBV-B106 | 9 kHz to 6 GHz |
| SMBV-B10, B50 or B5 | 1 |
| | Baseband Generator with ARB 32 MS |
| | |
| SMBV-B92 | Removable HDD |
| | SMU200A SMU-B106 SMU-B9, B10 or B11 SMU-B13 SMU-K6 SMATE200A SMATE-B106 SMATE-B9, B10 or B1 SMATE-B13 SMATE-K6 SMJ-B106 SMJ-B106 SMU-B13 SMU-B13 SMU-B106 SMU-B13 SMU-B106 SMBV-B106 SMBV-B106 SMBV-B106 SMBV-B106 SMBV-B106 |



3. 文献 Literature

- TELEC-T403: W53/W56 Radio System Conformance Testing, V 9.3, December 1st, 2009
- NTIA (National Telecommunications And Information Administration) DFS information <u>http://ntiacsd.ntia.doc.gov/dfs/</u>
- DFS Signal Generation Manual http://www2.rohde-schwarz.com/file/DFS Manual.pdf
- R&S Pulse Sequencer Software Manual
 <u>http://www2.rohde-schwarz.com/file/Pulse_Sequencer.pdf</u>
- R&S SMU200A Operating Manual <u>http://www2.rohde-schwarz.com/file/SMU200A Operating Manual e.pdf</u>
- R&S SMATE200A Operating Manual <u>http://www2.rohde-schwarz.com/file/SMATE200A_Operating_Manual_e.pdf</u>
- R&S SMJ100A Operating Manual <u>http://www2.rohde-schwarz.com/file/SMJ100A Operating Manual e.pdf</u>
- R&S SMBV100A Operating Manual http://www2.rohde-schwarz.com/file/SMBV100A Operating.pdf
- Application Note 1MA127: Overview of Tests on Radar Systems and Components <u>http://www2.rohde-</u> <u>schwarz.com/en/service_and_support/Downloads/download_search/?searchtype=1&d</u> ownloadtype=all&download_b=1&type=20&downid=4805



4. 発生する波形サイズ Generated Waveforms Size

VSG 要件は、主に発生する波形サイズに依存します。種々の DFS テスト信号用波形サイズをリ ストします。波形サイズは、ARB サンプリングレートにもとづき、メガサンプル(MS)で表され、必 要最大数です。

The VSG requirements mainly depend on the size of the generated waveforms. The table below lists typical waveform sizes for the different DFS test signals. The listed waveform sizes are the maximum number that needs to be expected based on a given ARB sampling rate and provided in mega-samples (MS).

| Radar Type for Test Signal | Waveform Size | Sampling Rate |
|------------------------------|---------------|---------------|
| W53 Static Type 1 | 0.8 MS | 20 MHz |
| W53 Static Type 2 | 2 MS | 20 MHz |
| W56 Static Type 1 | 0.8 MS | 20 MHz |
| W56 Static Type 2 | 0.8 MS | 20 MHz |
| W56 Static Type 3 | 2 MS | 20 MHz |
| W56 Varied Type 4 | 8 MS | 20 MHz |
| W56 Varied Type 5 | 9 MS | 20 MHz |
| W56 Varied Type 6 | 8 MS | 20 MHz |
| W56 FM chirp Type 1 | 4 MS | 20 MHz |
| W56 Frequency Hopping Type 1 | 0.6 MS | 100 MHz |

5. VSG への接続 Connecting to the VSG

パルスシーケンサ ソフトウェアのインストール後の最初のステップは、VSG 接続を確立することです。VSG 接続は、波形および RF リストファイルの生成に必要です。 PC と VSG 間のリモートコントロール接続は、LAN あるいは GPIB インタフェースです。

The first step after a fresh installation of the Pulse Sequencer Software is to configure the VSG connection. The VSG connection is required for the creation of Waveforms and RF List files.

The remote control connection between PC and VSG is LAN or GPIB interface.

| 💠 R&S K6 Pulse Sequencer | 8 - 2 |
|---|-------|
| <u>Eile Create Project Instrument Options H</u> elp | |
| Project Trapsfer 00 | |

• Instrument \rightarrow Manager







- TCP/IP ホスト名や IP アドレス、あるいは GPIB アドレスを指定 Define TCP/IP Host name or IP address, or GPIB address.
- Add Manually
- ・ ダーゲット VSG を選択するためにダブルクリック
 Double click to select the target VSG.
- リモート接続が確立されると、Device Information が表示されます。
 The established remote connection displays Device Information.





6. DFS プロジェクトファイルのロード Loading a DFS Project File

パルス・シーケンサ ソフトウェアは、種々の DFS スタンダード用の予め定義されたプロジェクト・ファイルを含んでいます。

プロジェクトファイルは、パルス定義、レーダテスト信号、およびスタンダードで要求される周波数 ホッピングリストを全て含んでいます。

プロジェクト・ファイルを直接編集できませんが、それらは、様々なテスト信号の生成のためにパ ルスシーケンサ ソフトウェアを設定します。必要に応じて設定変更し、異なるファイル名でプロジ ェクトファイルをセーブできます。

The Pulse Sequencer software contains predefined project files for the different DFS standards.

The project files contain all pulse definitions, radar test signals, and frequency hopping lists that are required by the standard.

The project files cannot be edited directly but they configure the Pulse Sequencer Software for the generation of the various test signals. It is possible for the user to alter settings as needed and save the modified project file under a different name.

| RttS K6 Pulse Sequencer | |
|---|--|
| <u>Eile C</u> reate <u>P</u> roject <u>I</u> nstrument <u>O</u> ptions <u>H</u> elp | |
| Project Transfer 00 | |

• File → Load Project

| Load Project Fil | e | | | 6 | X |
|---|---|--|--------------|---------------------------|----------------|
| Directory History: C:¥ Look in: | Program Files¥Rol | nde-Schwarz¥K6 Pulse Se | quencer V3.3 | ¥Projects¥DFS ← 🗈 💣 💷+ | Ī |
| My Recent Documents Desktop My Documents My Documents | ETSI-301-89: ETSI-301-89: ETSI-302-50: FCC0696-Tyj FCC0696-Tyj FCC0696-Tyj FCC0696-Tyj FCC0696-Tyj FCC0696-Tyj Japan-TELEC Japan-TELEC Japan-TELEC | 3-V141.prj 3-V151.prj 2-V121.prj pe5-4.prj pe5-Sequencer.prj pe6.prj -T403.prj -T403-Chirp.prj -T403-Type6.prj | | | |
| My Network Places | File <u>n</u> ame: Files of <u>type</u> : | Japan-TELEC-T403.prj *.prj | | • | Load Cancel |



適切なファイルを選択
 Select the appropriate file. → Load

TELECJapan-TELEC-T403.prj:TELEC-T403
W53 waveforms
W56 static type waveforms
W56 varied type waveformsJapan-TELEC-T403-Chirp.prj:TELEC-T403
W56 FM chirp type waveformsJapan-TELEC-T403-Type6.prj:TELEC-T403
W56 Frequency hopping type waveform and RF listsFCC
FCC0696-Type6.prj:FCC 06-97

FCC 06-97 including NTIA RF hop lists



7. 固定パルス波形の生成 Creating the Static Type Waveforms

| Radar Type | Pulse Width | PRF | PRI | Pulses per | Burst |
|-----------------|-------------|------|---------|------------|------------|
| (W53) | [us] | [Hz] | [us] | Burst | Repetition |
| | | | | | Interval |
| | | | | | [S] |
| Static Type 1 | 1 | 700 | 1,428 | 18 | 15 |
| Static Type 2 | 2.5 | 260 | 3,846 | 18 | 15 |
| | | | | | |
| Radar Type | Pulse Width | PRF | PRI | Pulses per | Burst |
| (W56) | [us] | [Hz] | [us] | Burst | Repetition |
| | | | | | Interval |
| | | | | | [s] |
| Static Type 1 | 0.5 | 720 | 1,389 | 18 | 15 |
| Static Type 2 | 1 | 700 | 1,428 | 18 | 15 |
| Otatia Tura a 2 | 0 | 050 | 4 0 0 0 | 40 | 4.5 |

Test Waveforms

テストを始める前に全ての信号を生成することが賢明です。

It is advisable to create all signals before starting the tests.



- File → Load Project
- 'Japan-TELEC-T403.prj'を選択
 Select 'Japan-TELEC-T403.prj'. → Load
- 'Multi Segment Waveform'ブランチ下の'W53 Static 1, 2', 'W56 Static 1, 2, 3'の1つを選択

Select one of 'W53 Static 1, 2', 'W56 Static 1, 2, 3' under the 'Multi Segment Waveform' branch.

- (Last Seg. 'Back 1st', Trigger Mode 'Armed Retrigger')
- Start MSW build process

次のステップが自動的に実行されます。

- 1. 波形を生成し、VSG (内部 HDD)へ転送
- 2. マルチセグメント波形ファイルに波形を構築
- 3. 設定に準じて、マルチセグメント波形で ARB をスタート

The following steps is performed automatically.

- 1. Create the individual waveforms and transfer to the VSG (internal HDD)
- 2. Assemble waveforms to Multi Segment Waveform file
- 3. Start ARB with Multi Segment Waveform and configure according to settings



| 💠 R&S K6 Pulse Sequencer (Jap | an-TEL | EC-T403.pr | j) | | | | | |
|--|--------|----------------|------------------------------------|---------|---------|-------------|----------------------|-----------------|
| Eile Create Project Instrument | Option | s <u>H</u> elp | | | | | | |
| Project TELEC-T403 | Multi | Segment | Transfer Log | | | | | |
| Date 9.6.2011 Venion 4.0 | | Name | W53 Static 1 | | | | | |
| 1- 💀 🦄 🥏 🔺 🔻 | | Comment | Static pattern using MSW Sequencer | | | | | |
| 🗐 Pulse Library 🖉 | _ | | 1 | | | | | - |
| - 🗐 Sequence Library - 🗐 Multi Segment Waveform | 3. | | Target Name W53 Type1 | | | | % 🕄 | |
| W53 Static 1 | No | Rep | Sequence | Samples | Tstart | Tstop | Mode | Sequencer 🛩 |
| W56 Static 1 | | | 1 W/53 Static 1 | 560000 | 0,00 | . 28000.00 | Clock Pate | item = |
| W56 Static 2 | 1 | 6304 | 0 T> (blank filler) | 4750 | 2000.00 | 15000000.00 | CIUCK PARE | User - |
| W56 Var 4 | () | | | | | | MHZ. | 20.000000 |
| 1 W56 Var 5 | i i | | | | | | Level | Unchanged 🔻 |
| | | | | | | - | BB Path | Path A 🔻 |
| E I Plug-in | | | | | | | Last Seg. | Back 1st 🔻 |
| | | | | | | | Trigger Mode | med Retrigger 👻 |
| | | | | | | | Ext. Trigger Mode | Next = |
| | | | | | | | Trigger Source | Internal = |
| | | | | | | | Next Segment | |
| | | | | | | | Defay [samples] | 0.00 |
| | | | | | | | | Apply |
| | | | | | | | | Trigger |
| | | | | | | | L | Duery Seg. |
| ط ال | - | | | | | | - | 1 |
| | | | Done | | | | | |

1 burst repetition interval 15 s 長の波形ファイルが生成されます。

The waveform file of one burst repetition interval 15 s length is created.



8. 可変パルス波形の生成 Creating the Varied Type Waveforms

Test Waveforms

| Radar Type | Pulse Width | PRF | PRI | Pulses per | Burst |
|---------------|--------------|---------------|--------------|------------|------------|
| (W56) | [us] | [Hz] | [us] | Burst | Repetition |
| | randomly | randomly | randomly | randomly | Interval |
| | (1 us steps) | | (1 us steps) | (step 1) | [s] |
| Varied Type 4 | 1 ~ 5 | 4,347 ~ 6,667 | 150 ~ 230 | 23 ~ 29 | 15 |
| Varied Type 5 | 6 ~ 10 | 2,000 ~ 5,000 | 200 ~ 500 | 16 ~ 18 | 15 |
| Varied Type 6 | 11 ~ 20 | 2,000 ~ 5,000 | 200 ~ 500 | 12 ~ 16 | 15 |

テストを始める前に全ての信号を生成することが賢明です。

It is advisable to create all signals before starting the tests.

| 💠 RttS K6 Pulse Sequencer | 8 | |
|---|---|--|
| Eile Create Project Instrument Options Help | | |
| Project Transfer 00 | | |

- File \rightarrow Load Project
- 'Japan-TELEC-T403.prj'を選択 Select 'Japan-TELEC-T403.prj'. → Load
- 'Multi Segment Waveform'ブランチ下の'W56 Var 4, 5, 6'の1つを選択 Select one of 'W56 Var 4, 5, 6' under the 'Multi Segment Waveform' branch.
- Last Seg. 'Back 1st', (Trigger Mode 'Armed Retrigger')
- Start MSW build process

次のステップが自動的に実行されます。

- 1. 波形を生成し、VSG (内部 HDD)へ転送
- 2. マルチセグメント波形ファイルに波形を構築
- 3. 設定に準じて、マルチセグメント波形で ARB をスタート

The following steps is performed automatically.

- 1. Create the individual waveforms and transfer to the VSG (internal HDD)
- 2. Assemble waveforms to Multi Segment Waveform file
- 3. Start ARB with Multi Segment Waveform and configure according to settings



| ile <u>C</u> reate Project Instrument | Options | Help | | | | | | | | | |
|---------------------------------------|---------|---------|---|---------|-------------|-------------|----------------|-----------------|--|--|--|
| Project TELEC-T403 | Multi S | legment | Transfer Log | | | | | | | | |
| Author Rohde & Schwarz | - | | | | | | | | | | |
| enion 4.0 | | Name | | | | | | | | | |
| | | Comment | 30 variable patterns using MSW Sequence | | <u>ل</u> ا | | | | | | |
| 😸 Pulse Library 🖉 | | | 1. | | | | | - | | | |
| Sequence Library | | | Target Name | | | | A | | | | |
| Multi Segment Waveform | - 🛃 | | 📐 💙 VV56 Type4 | | | | Ma 😡 👘 | | | | |
| W53 Static 1 | No | Rep | Sequence | Samples | Tstart | Tstop | Hada | Samanent 🚽 | | | |
| W56 Static 1 | 0 | | 1 W56 Var 4 | 200000 | 0.00 | 10000.00 | MOGE C | Sequencer • | | | |
| W56 Static 2 | 1 | 6996 | T>I (blank filer) | 5000 | 10000.00 | 15000000 00 | Clock Rafe | User = | | | |
| W56 Static 3 | 2 | | 1 W56 Var 4 | 200000 | 15000000.00 | 15010000-00 | MHz. | 20.000000 | | | |
| 1 W56 Var 5 | 3 | 6996 | T>I (blank filer) | 5000 | 15010000.00 | 30000000 00 | Level | Unchanged 👻 | | | |
| | 4 | | 1 W56 Var 4 | 200000 | 30000000.00 | 30010000.00 | BB Path | Path A 🔻 | | | |
| RF List | 5 | 5996 | T>] (blank filer) | 5000 | 20010000.00 | 45000000.00 | Last Sea | Back 1st | | | |
| Plug-in | 6 | | 1 W56 Var 4 | 200000 | 45000000.00 | 45010000.00 | Link origi | | | | |
| | 7 | 6996 | T>] (blank filer) | 5000 | 45010000.00 | 60000000.00 | | | | | |
| | - 21 | | 1 W/56 Var 4 | 200000 | 60000000.00 | 60010000.00 | Trigger Mode | med Retrigger 🔻 | | | |
| | e. | 5996 | T> (blank filler) | 5000 | 60010000.00 | 7500000.00 | Ext. Trigger | Next = | | | |
| | 10 | | 1 W56 Var 4 | 200000 | 75000000.00 | 75010000.00 | Trigger Source | Internal = | | | |
| | 11 | 5906 | 0 T>] (blank filer) | 5000 | 75010000.00 | 90000000.00 | | | | | |
| | 12 | i | 1 W56 Var 4 | 200000 | 90000000.00 | 90010000.00 | Next Segment | E 0 | | | |
| | 13 | 5996 | 0 T> (blank tiler) | 5000 | 90010000.00 | 05000000.00 | Defay[samples] | 0.00 | | | |
| | 1.54 | | 1 W56 Var 4 | 200000 | 05000000:00 | 05010000.00 | | Arrow 1 | | | |
| | 15 | 5996 | © T> (blank filler) | 5000 | 05010000.00 | 20000000.00 | | - Abbiy | | | |
| | 16 | | 1 W56 Var 4 | 200000 | 20000000.00 | 20010000.00 | | Trigger | | | |
| | 17 | 5996 | T> (blank filer) | 5000 | 20010000.00 | 35000000.00 | 4 | Duery Seg. | | | |

30 burst repetition interval 7 min 30 s 長の波形ファイルが生成されます。 この Multi Segment Waveforms は要求される 30 のランダムバーストを含んでいます。 バースト波形は、パルス幅、PRI およびパルス数のランダム変数を使用します。ゆえに、'Start MSW build process'の実行ごとに、異なるランダムパラメータを組み立てます。

The waveform file of one burst repetition interval 7 min 30 s length is created. This Multi Segment Waveforms contain the required 30 random bursts. The burst waveforms use random variations of the pulse width, the pulse repetition interval and the number of pulses. Therefore, each executing of 'Start MSW build process' assembles a different random parameter.



9. FM チャープ波形の生成 Creating the FM Chirp Type Waveforms

Test Waveforms

| Radar | Pulse Width | Chirp | PRF | PRI | Pulses | Bursts |
|----------|--------------|-----------|----------|----------|-----------|----------|
| Туре | [us] | Deviation | [Hz] | [us] | per Burst | randomly |
| (W56) | randomly | [MHz] | randomly | randomly | randomly | (step 1) |
| | (1 us steps) | Randomly | | (1 us | (step 1) | |
| | | (1 MHz | | steps) | | |
| | | steps) | | | | |
| FM Chirp | 50 ~ 100 | 5~20 | 500 ~ | 1,000 ~ | 1~3 | 15 |
| Type 1 | | | 1,000 | 2,000 | | |



テストを始める前に全ての信号を生成することが賢明です。

It is advisable to create all signals before starting the tests.



- File → Load Project
- 'Japan-TELEC-T403-Chirp.prj'を選択 Select 'Japan-TELEC-T403-Chirp.prj'. → Load
- 'Multi Segment Waveform'ブランチ下の使用するバースト数エントリの1つを選択 Select an used number of bursts entry under the 'Multi Segment Waveform' branch.
- (Last Seg. 'Blank', Trigger Mode 'Armed Retrigger')
- Start MSW build process

次のステップが自動的に実行されます。

- 1. 波形を生成し、VSG (内部 HDD)へ転送
- 2. マルチセグメント波形ファイルに波形を構築
- 3. 設定に準じて、マルチセグメント波形で ARB をスタート



The following steps is performed automatically.

- 1. Create the individual waveforms and transfer to the VSG (internal HDD)
- 2. Assemble waveforms to Multi Segment Waveform file
- 3. Start ARB with Multi Segment Waveform and configure according to settings

| ther Robde & Schwarz | Multi | segment | Transfer Log | | | | | |
|------------------------|-------|---------------|---|---------|-------------|-------------|---------------------|---------------|
| ate 9.6.2011 | | Name | TELEC-T403-W56-08 | | | | | |
| alon 4.0 | | Comment | 8 random burds in a MSW for use with Sen | nancer | | | | - |
| 💀 🖄 🍠 🔺 💎 | | | The file name determins the trial number. | | | | | |
| 🚽 Pulse Library 🖉 🛁 | | | | | | | | |
| Sequence Library | | | Target Name | | | | A. (A) | |
| Multi Segment Waveform | - 📑 | | TELEC-T403-W56-08- | TRIAL-1 | | | Ma 😡 🛛 | |
| TELEC-T403-W56-08 | No | Rep | Sequence | Samples | Tstart | Tstop | HINDA | Semiencei 🔻 |
| TELEC-T403-W56-10 | .0 | rand(0,1493,1 |) 1ms Blank | 20000 | 0.00 | 555000.00 | Clack Pate | |
| TELEC-T403-W56-11 | 1 | 1 | W56 Chirp - 1,2,3 | 140000 | 555000.00 | 562000,00 | CIUCK Palle | 0.5et |
| TELEC-T403-W56-13 | 2 | 35000 | T> (blank filer) | . 536. | 562000.00 | 1500000.00 | MHZ. | 20.000000 |
| TELEC-T403-W56-14 | 3 | rand(0,1493,1 |) 1ms Blank | 20000 | 1600000.00 | 2412000.00 | Level | Unchanged T |
| TELEC-T403-W56-16 | 4 | 1 | W56 Chirp - 1,2,3 | 140000 | 2412000.00 | 2419000.00 | BB Path | Path A 🔻 |
| TELEC-T403-W56-17 | 6 | -2075(| T> (blank filler) | 560 | 2419000.00 | 3000000.00 | Last Seg. | Blank 🔻 |
| TELEC-T403-W56-18 | () G | rand(0,1493,1 |) 1ms Blank | 20000 | 3000000.00 | 3060000.00 | | |
| TELEC-T403-W56-20 | 7 | 1 | 10/56 Chirp - 1,2,3 | 140000 | 3050000.00 | 3067000.00 | 20 | |
| RF List | - 2 | 45150 | T> (blank filler) | 625 | 3067000.00 | 4500000.00 | Trigger Mode | med Retrigger |
| Plug-in | 1 | rand(0,1493,1 |) 1ms Blank | 20000 | 4500000.00 | 5375000.00 | Ext. Ingger Mode | Next |
| | 10 | 1 | W56 Chirp - 1,2,3 | 140000 | 6375000.00 | 5382000.00 | Trigger Source | Internal - |
| | - 11 | 24000 | T> (blank filer) | 515 | 5392000.00 | 6000000.00 | Next Seminant | 4 0 |
| | 12 | rand(0,1493,1 |) 1ms Blank | 20000 | 6000000,00 | 5418000.00 | men se graam | 1 1 |
| | 13 | 1 | W56 Chirp - 1,2,3 | 140000 | 6418000.00 | 6425000.00 | Delay[samples] | 3 1000.00 |
| | . 14 | 34400 | T> (blank filer) | 625 | 6425000.00 | 7500000.00 | | Apply |
| | 15 | rand(0,1493,1 |) 1ms Blank | 20000 | 7500000.00 | \$633000.00 | | Trigger |
| | 16 | | W/56 Chirp - 1,2,3 | 140000 | \$633000,00 | \$640000.00 | | Turary Sea |
| | - 17 | 12500 | T> (blank tiler) | 676 | 1540000.00 | 9000000.00 | | samely self. |

各トライアルごとに、全期間 12 s のシングル Multi-Segment 波形が生成されます。 プロジェクトは、8 ~ 20 バーストの波形種別を含んでいます。これらの波形はトライアル 1 ~ 13 を 表わします。それ以上のトライアルでは、'Target Name'に、既存の Multi-Segment 波形種別を

まわします。それ以上のドライアルでは、Target Name に、既存の Multi-Segment 波形種別 コピーし、トライアル番号を変更し、容易に生成することができます。

ファイル名の一部としてトライアル番号接尾語を提供することが確実です:

• TELEC-T403-W56-<バースト数>-TRIAL-<トライアル番号>

For each trial, a single Multi-Segment waveform for a total duration of 12 s is created. The project contains waveform descriptions between 8 and 20 bursts. These waveforms represent the trials 1 through 13. Further trials can easily be created by copying an existing Multi-Segment waveform description and changing the trial number in the target name.

It must be ensured that a valid trial number suffix is provided as part of the file name:

TELEC-T403-W56-<bursts>-TRIAL-<number>



| 💠 R&S K6 Pulse Sequencer (Jap | an-TELEC-T403-CI | irp.prj) | |
|---|------------------|--|-------------|
| Eile Create Project Instrument | Options Help | | |
| Project TELEC T403 Chirp Author: Rohde & Schwarz | Multi Segment | Transfer Log | |
| Date 11.4.2011 Version 4.0 | Name | TELEC-T403-W56-08 | |
| 1 | Comment | 8 random bursts in a MSW for use with Sequencer The file name determins the trial number. | 20 |
| Pulse Library | | Tarriet Manua | |
| Sequence Library Multi Segment Waveform | - 📑 📑 🖓 | TELEC-T403-W56-08-TRIAL-14 Start MSW build process | |
| TELEC-T403-W56-08 TELEC-T403-W56-09 | No Rep | Sequence Samples Tstart Tstop | Sequencer 🕶 |



10. 周波数ホッピング波形の生成 Creating the Frequency Hopping Type Waveforms



テストを始める前に全ての信号とRF ホップリストを生成することが賢明です。

It is advisable to create all signals and RF hop lists before starting the tests.



Res K6 Pulse Sequencer
 Elle <u>Oreate</u> Project Instrument <u>Options</u> Help
 Project
 Transfer
 Log

- File → Load Project
- 'Japan-TELEC-T403-Type6.prj'を選択 Select 'Japan-TELEC-T403-Chirp.prj'. → Load
- 'Multi Segment Waveform'ブランチ下の'TELEC-T403-T6'を選択
 Select the 'TELEC-T403-T6' under the 'Multi Segment Waveform' branch.
- (Last Seg. 'Blank', Trigger Mode 'Armed Retrigger')
- Start MSW build process

次のステップが自動的に実行されます。

- 1. 波形を生成し、VSG (内部 HDD)へ転送
- 2. マルチセグメント波形ファイルに波形を構築
- 3. 設定に準じて、マルチセグメント波形で ARB をスタート

The following steps is performed automatically.

- 1. Create the individual waveforms and transfer to the VSG (internal HDD)
- 2. Assemble waveforms to Multi Segment Waveform file
- 3. Start ARB with Multi Segment Waveform and configure according to settings

| 💠 R&S K6 Pulse Sequencer (Jap | an-TEL | EC-T403-Ty | /pe6.prj) | | | | | |
|---|---------|----------------|--|---------|-----------|-----------|-----------------|--------------------|
| Eile Create Project Instrument | Option: | s <u>H</u> elp | | | | | | |
| Project TELEC-T403 Author Rohde & Schwarz | Multi | Segment | Transfer Log | | | | | |
| Date 9.6.2011 Version 4.0 | | Name | TELEC-T403-T6 All 100 burds as Multi Segment Waveform | | | | | - |
| A 🕶 🗋 🥏 🔺 🔻 | | | | | | | | |
| B Pulse Library | - | | | | | | | |
| - 😸 Sequence Library 🖃 🍔 Multi Segment Waveform | 3, | | Target Name TELEC-T403-W56-Hop | 9 | | | 6 😳 | |
| TELEC-T403-T6 TELEC-T403-T6-simulat | No | Rep | Sequence | Samples | Tstart | Tstop | Mode | Sequencer 👻 |
| 😑 🍘 RF List | .0 | 10 | 10 T6 - any | 299700 | 0,00 | 299700.00 | Clock Rate | User = |
| Random Hop List | 1 | | 1 T6 - end | 15000 | 299700.00 | 302700.00 | MHz | 100.000000 |
| 🕀 🎆 Plug-in | | | | | <u> </u> | | | 100.000000 |
| | | | | | | | Level | Unchanged T |
| | | | | | | | BB Path | Path A 💌 |
| | | | | | | | Last Seg. | Blank 🔻 |
| | | | | | | | Trigger Mode | med Retrigger 💌 |
| | | | | | | | Ext. Trigger | Next = |
| | | | | | | | Mode | |
| | | | | | | | ingger Source | internar - |
| | | | | | | | Next Segment | <u> </u> |
| | | | | | | | Delay [samples] | 0.00 |
| | | | | | | | | Apply |
| | _ | | | | | | | Trigger |
| | | | | | | ر ا | | Duery Seg. |
| الد الــــــــــــــــــــــــــــــــــ | - | | | | | | 5 | |
| 1 contract of the second se | | | Done | | | | | |

1 burst 0.3 s 長の固定パルス波形ファイルが生成されます。

波形は固定パルスであり、生成は全トライアルのために一度だけ要します。代わりに、この波形は、トライアルごとに使用される様々な周波数リストを利用します。



ランダムホップリストにてトライアル 1 ~ 40 用リストファイルを生成する代わりに、NTIA ホップリストを生成することが賢明です。

NTIA (National Telecommunications and Information Administration)は、次のリンク下の RF ホップリスト例を提供します。

http://ntiacsd.ntia.doc.gov/dfs/

の'HopFreqInRlanBW.txt'ファイル

これらの 40 リストは、FCC0696-Type6 プロジェクトファイル内の NTIA リスト 1 ~ 40 として利用可能です。

RF List エディタは、周波数とレベルのペアの RF List を含んでいるテーブルです。Limits は、 Min – Max 範囲内に入るアイテムをマークできます。これらのアイテムはリスト内で緑にマークさ れます。

The static pulse waveform file of one burst 0.3 s length is created.

The waveform is static and the generation is only required once for all trials. Instead, this waveform makes use of various frequency lists that are used for the different trials.

It is advisable to create the NTIA hop lists, instead of a random hop list creating the list files for trials 1 through 40.

The NTIA (National Telecommunications And Information Administration) provides example RF hop lists under the following link:

http://ntiacsd.ntia.doc.gov/dfs/

under the file 'HopFreqInRlanBW.txt'.

The contents of these 40 lists is available as the NTIA List 1 through 40 in the FCC0696-Type6 project file.

The RF List editor provides a table that contains the frequency and level pairs of the RF List. Limits can be set to mark items that fall within the limit range. These items are marked green in the list.

| | | 1 | Remote List File FCC0696-Random.lsw |
|----------|-----------------|------------|--|
| Entry | Frequency [GHz] | Level [dBn | n] |
| 1 | 5.300000 | 0.00 | |
| 2 | 5.474000 | 0.00 | |
| 3 | 5.304000 | 0.00 | |
| 4 | 5.676000 | 0.00 | |
| 5 | 5.336000 | 0.00 | |
| 6 | 5.373000 | 0.00 | |
| 7 | 5.711000 | 0.00 | |
| <u>a</u> | 5.597000 | 0.00 | |
| ä. | E 700000 | 0.00 | |



1

NTIA ホップリストにてトライアル 1 ~ 40 用リストファイルを生成する場合

For the NTIA hop lists creating the list files for trials 1 through 40

| 💠 R&S K6 Pulse Sequencer | | | | | | | | | 8 | |
|--|---|--|--|--------------------|------|---|--|----------|--------------------|------|
| <u>File Create Project Instrument</u> | <u>O</u> ptions | <u>H</u> elp | | | | | | | | |
| Project | Transfe | r log l | | | | | | | | |
| File → Load Pr 'FCC0696-Typ Select 'FCC069 RF List 下の'N Select one of 'I □ Activate Level Min [-**.* 所望の出力レベ Enter the desir Level 'Fill' | roject e6.prj 96-Ty TIA Li NTIA I ** dBn *ノレ dBr マーロ | 'を選択 pe6.prj'. → st 1 ~ 40'の List 1 ~ 40' n] 3m を入力 tput level d | Load)1 つをテ under F Bm. | 選択 RF List | | | | | | |
| | | | | | | | | | | |
| - Sond DI | E lict t | o instrumo | ot | | | | | | | |
| | r list t | | i i t | | | | | | | |
| | | n na haanawa | | | | | | | | |
| File Create Project Instrument | Ontions | Helo | | | | | | | | |
| Project FCC 15:407 / FCC 08-96A | RF List | Transfer Log | | | | | | | | |
| Author Rohde & Schwarz | | Transfer Log | | | | | | | | |
| Date 12.4.2010 | | Name NTIA List | 1 | | | | | | | |
| Version 4.0 | C | ommerit Data extracte | d from file HopFre | qinRlan8W.td | | | | | 1 | |
| A- 🗣 🖞 🏈 🔺 💙 | | | | | | | | | - | |
| 🕘 Pulse Library 🔶 | | | | | | | | | 0.00 | |
| - 😸 Sequence Library | 1.00 | | | Remote List File | | | | <u> </u> | Activate | 0 |
| 🖃 🍔 Multi Segment Waveform | - 🛃 - E | A 🗸 🗸 | 🧯 💕 | FCC0696-NTIA-1.Isw | | | 9 | Ma 📰 | Path A 🔻 | 69 |
| FCC0696-T6 | Paters | - | Lumiter | | U | | | | | |
| FCC0696-T6-sim | Entry | Frequency [GHZ] | Level fab | ml | | | Set Length | 5 | 1 | |
| RF LISI | 1 | 5.506000 | -62.00 | | | | | | | |
| NTIA LIST 1 | 4 | 5.555000 | -62.00 | | | Dwe | ell Time | 3 | 100.0 | 1115 |
| NTIA List 2 | - | 5.673000 | -62.00 | | | | | | | |
| NTIA List 3 | #-2 | 5.265000 | -62.00 | | Fr | equency | 7. | Level | | |
| NTIA LISE 4 | | 5.362000 | -62.00 | | | oto E | All Camp - | Made | All San | |
| KIA List 6 | - | 5.327000 | -02.00 | | 5.00 | Jule | All Same • | mode | PM 5140 | 1e • |
| NTIA List 7 | <u></u> | 5.380000 | -02.00 | | M | in: | 0.000000 | Min | -62.000 | 0000 |
| NTIA LISE8 | - | 5.335000 | -62.00 | | 14 | аж | 0.000000 | Мах | 0.000 | 000 |
| NTIA List 10 | 100 | 5.307000 | -62.00 | | S | ер | 0.001000 | Step | 0.001 | 000 |
| NTIA List 11 | | 5.718000 | 62.00 | | | | | | | |
| NTIA LIST 12 | 17 | 5.379000 | 62.00 | | | | Fill | | Fill | |
| NTIA List 14 | 11.0 | 0.570000 | -02.00 | | 1212 | 11 | | | | |
| | 11 | 5.426000 | 62.00 | | | and the second se | | | | |
| NTIA List 15 | 12 | 5 426000 | -62.00 | | En | nns | | | | |
| TIA List 15 | 13 | 5.426000 5.529000 5.432000 | -62.00 -62.00 | | M | nas | 5.592500 | | -62.000 | 1000 |
| NTIA List 15 NTIA List 16 NTIA List 17 NTIA List 18 | 13 74 15 | 5.426000 5.529000 5.432000 5.573000 | -62.00 -62.00 -62.00 | | M | nns | 5.592500 | | -62.000 | 000 |
| NTIA List 15 NTIA List 16 NTIA List 17 NTIA List 17 NTIA List 18 NTIA List 19 | 13 7.4 15 16 | 5 426000 5 529000 5 432000 5 573000 5 625000 | -62.00 -62.00 -62.00 -62.00 | | M M | nits n ax | 5.592500 5.607500 | | -62.000 -62.000 | 000 |
| NTIA List 15 NTIA List 16 NTIA List 17 NTIA List 17 NTIA List 18 NTIA List 19 NTIA List 20 | 13 7.4 15 16 17 | 5.426000 5.529000 5.432000 5.573000 5.625000 5.344000 | -62.00 -62.00 -62.00 -62.00 -62.00 | | M | nits n nx | \$ 5.592500 \$ 5.607500 | | -62.000 -62.000 | 000 |
| NTIA List 15 NTIA List 16 NTIA List 17 NTIA List 17 NTIA List 19 NTIA List 20 NTIA List 21 NTIA List 21 NTIA List 22 | 13 74 15 16 17 18 | 5.426000 5.529000 5.432000 5.573000 5.625000 5.344000 5.465000 | -62.00 -62.00 -62.00 -62.00 -62.00 -62.00 -62.00 | | M | nits n nx | \$5.592500 \$5.607500 | | -62.000 -62.000 | 000 |



ランダムホップリストにてトライアル1~40 用リストファイルを生成する場合

For random hop lists creating the list files for trials 1 through 40

- 'Random Hop List' under RF List
- Frequency 'Fill' ランダム 100 周波数ホップリストが定義されます。 The random 100 frequencies hop list is defined.
- Level Min [-**.** dBm] 所望の出カレベル dBm を入力 Enter the desired output level dBm.
- Level 'Fill'
- 'Remote List File'
 トライアル番号接尾語を加えます。
 Add the trial number suffix.

ファイル名の一部としてトライアル番号接尾語を提供することが確実です:

• TELEC-T403-Random-<トライアル番号>

It must be ensured that a valid trial number suffix is provided as part of the file name:

• TELEC-T403-Random-<trial number>

Send RF list to instrument

| 💠 R&S K6 Pulse Sequencer (Japa | in-TELEC | -T403-Type6.prj) | | | | | 😸 🔲 🖂 🔀 |
|--|----------|-------------------------------------|-----------------------------|-------------------------|---------|---------------|-----------------|
| Eile Create Project Instrument | Options | Help | | | | | |
| Project TELEC-T403 | RF List | Transfer Log | | | | | |
| Author Rohde & Schwarz Date 9.6.2011 Version 4.0 | C | Name Random Formment List with rand | top List om frequencies. | | | | |
| JL-4# -] 🤛 🔺 🔻 | | | | | | | . <u>160</u> |
| 😸 Pulse Library 🧧 | 1 | | | | | | |
| - 🗐 Sequence Library | | | - | Remote List File | | | Activate |
| 🖃 鬪 Multi Segment Waveform | <u> </u> | A 🔻 | 🤳 🗳 | TELEC-T403-Random-1.lsw | | 9 | Path A 🔻 💔 |
| TELEC-T403-T6 TELEC-T403-T6-simulat | Entry | Frequency [GHz] | Level [dBn | a 🛛 | 1 | | |
| RF List | 1 | 5.300000 | -62.00 | | | Set Length | 100 |
| Random Hop List | 2 | 5.474000 | -62.00 | | D | well Time | 3 100.0 ms |
| 🕀 🍘 Plug-in | 3 | 5.304000 | -62.00 | | | inco rario | |
| | 4 | 5.676000 | -62.00 | | | | 1 |
| | 5 | 5.336000 | -62.00 | | Frequer | юу | Level |
| | 0 | 5:373000 | -62.00 | | Mode | Unique Rand 🔻 | Mode All Same 🔻 |
| | 7 | 5.711000 | -62.00 | | 1.50 | 5 250000 | Min 4,62,000000 |
| | 1 | 6 597000 | -62.00 | | Panti - | 5.20000 | 11xx 0.000000 |
| | | 5.720000 | -62.00 | | INTOX | 5.724000 | max 0.000000 |
| | 18 | 5.267000 | -62.00 | | Step | 0.001000 | Step 3 0.001000 |
| | 11. | 5.399000 | -62.00 | | | Fill | Fill |
| | 12 | 5.433000 | -62.00 | | | | |
| | 10 | 5.504000 | -62.00 | | Limits | | |
| | 14 | 5.591000 | -62.00 | | Later V | | |
| | 15 | 5.678000 | -62.00 | | Min | 5.592500 | -62,000000 |
| | 16 | 5.675000 | -62.00 | | Max | 5.607500 | 5 -62,000000 |
| | 17 | 5.419000 | -62.00 | | | | 4 |
| | 18 | 5.611000 | -62.00 | | | | |
| | 19 | 5.636000 | -62.00 | | | | |
| 41 3 ^[2] | | | | | | | |



11. トライアルの実施 Conducting the Trials

本章は、DFS テストをどのように手動で実行するか説明します。波形、Multi Segment 波形、あ るいは RF ホッピングリストが、既に VSG(内部 HDD)に転送されていることを前提とします。 操作プロシジャは、[Preset]後のデフォルト設定(下記スクリーン)から説明します。ただし、周波数 ホッピングトライアルを除く全てのトライアルでは、既に[Freq]と[Level]を設定する必要があります。

This chapter describes how the DFS tests are executed manually. It is assumed that the waveforms, Multi Segment Waveforms, or RF hopping lists are already transferred to the VSG (internal HDD).

Operation procedure is described from the default setting after [Preset] (the following screen). However, [FREQ] and [LEVEL] must be set in all the trials except frequency hopping trials.



ROHDE&SCHWARZ

DFS テスト中のレベルまたは周波数変更において、特別な注意をする必要のある VSG 特有の機能の詳細を説明します。

これは、SMJ100A、SMU200A、SMATE200A だけに関連します。SMBV100A は、RF 信号をALC 中 50 dB 抑圧します。

テスト中に、単一 DFS テスト信号を送り、DUT のレスポンスを観察し、検出成功で新たなチャネ ル周波数へ変更することが要求されます。これは、レーダ信号がこの周波数上で検出された場 合、DUT がチャネルをブラックリストするに違いないからです。

ベースバンドモードが、'Execute Trigger'ボタンによるマニュアルトリガに設定される場合、ベースバンドがトリガ待ちで、レベルまたは周波数が変更されるとき、VSGは、正確なレベルにするために内部校正信号を発生します。この校正信号は、瞬間に、設定周波数とレベルでRF出力にも現われます。

DFS テストの場合には、DUT はこの校正信号をレーダパターンとして解釈し、利用可能チャネル ヘホップするかもしれません。

この校正信号を抑圧するために、VSG には、設定 RF レベルの 40 dB 以下まで RF 出力を低減 する機能があります。DUT の検出しきい値以下の十分なレベルです。デフォルトでは、この機能 は無効であり、レベル抑圧を有効にすることは、VSG の RF ブロックから Automatic Level Control ダイアログ内で設定できます。

This paragraph contains detailed information about specific VSG functions that need to be paid special attention for changing Level or Frequency during DFS testing. This is only relevant for the SMJ100A, SMU200A and SMATE200A. The SMBV100A suppresses the RF signal during its ALC by 50 dB.

During manual testing, it is mostly required to send a single DFS test signal, observe the response of the DUT and in case of successful detection change to a new channel frequency. This is because the DUT must blacklist the channel if radar signals were detected on this frequency.

If the baseband mode is set to a manual trigger that is issued via 'Execute Trigger' button, in a mode where the baseband is waiting for a trigger event and the level or frequency is changed, the VSG generates an internal CAL signal for correct leveling. This CAL signal also appears at the RF output for a short period of time and with the set frequency and level.

In case of DFS testing, this CAL signal could be interpreted by the DUT as a radar pattern and cause another hop to the next available channel.

In order to suppress this CAL signal, the VSG offer an function that reduces the RF output by 40 dB below the set RF level. This should lead to a level well below the detection threshold of the DUT. By default, this function is disabled and enabling the level suppression can be done in the Automatic Level Control dialog from the VSG RF block.





| | —Automatic Level Control | |
|--------------|--------------------------|---|
| State | Auto | - |
| | Search Once | |
| Protect RF O | utput | ~ |

内部アッテネータの一時的変更は、内部レベルセンサに軽度の作用があるので、この機能を有効にすることは、わずかにレベル確度を低下させます。これがデフォルトでこの機能が無効である理由です。作用はわずかなので、DFS テストではレベル確度の低下を無視できます。

Enabling this function slightly decreases the level accuracy because the temporary change of the internal attenuator has minor effects on the internal level sensor. This is the reason why this function is disabled by default. Since the effect is minor, the degradation of level accuracy can be ignored for DFS testing.



12. 固定パルスの実施 Conducting the Static Type



Load Waveform





- Next Segment Mode 'Sequencer'
- Next Segment Mode Sequencing List

| • | Seq | luencing | List |
|---|-----|----------|------|
| | | | |

| uenci | ing List | W53 Ty | pe1 | | Assigned to I | Multi Seg. | Waveform | W53 Type1 |
|-------|----------|--------|-------------------|----------------------|---------------|-------------|----------|-----------|
| | | | | Sequencing Play List | } | ni : | N 195 | |
| ld# | State | Seg.# | Waveform | Rep. Cycles | Next | Go To | Info | |
| 0 | On | 0 | W53 Type1-seg1.wv | া | Next Id# | | Info | |
| 1 | On | 1 | W53 Type1-seg2.wv | 63 040 | Next Id# | | info | |
| | | | | | | | | |
| | Append | | Delete | Shift I | d# | Up | | Down |
| | Append | | Delete | Shift | d# | Up 1 [63 | 3040] | Down |

Load Sequencing List



| Select Sequencing List | | |
|--|----------------------------|--------------|
| R | cent files | |
| TELEC-T403-W56-11-TRIAL-4 TELEC-T403-W56-12-TRIAL-5 TELEC-T403-W56-13-TRIAL-6 TELEC-T403-W56-13-TRIAL-6 TELEC-T403-W56-15-TRIAL-8 TELEC-T403-W56-16-TRIAL-9 TELEC-T403-W56-16-TRIAL-9 TELEC-T403-W56-18-TRIAL-10 TELEC-T403-W56-19-TRIAL-110 TELEC-T403-W56-19-TRIAL-12 TELEC-T403-W56-20-TRIAL-13 W53 Type1 W53 Type2 W56 Type3 W56 Type4 | | |
| W56 Type4 W56 Type5 W56 Type6 | File Managerd: (DATA)/1 | telec-t403 → |
| W53 Type1 ~ 2 or W53 Type 1 [,] [ESC] Sequencing List を閉じる Exit Sequencing List Trigger/Marker | - 3 → Select | |
| Arbitrary Waveform Modulation A: Trigge | r/Marker/Clock | |
| т | igger In | |
| Mode | Armed Retrig | jger |
| Execute Trigger | | Stopped |
| | | 245 |
| Source | Internal | |

•

Trigger In Mode ⁻Armea [ESC] Trigger/Marker を閉じる Exit Trigger/Marker







波形の変更には、上記の全てのステップを繰り返す必要はありません。Multi Segment 波形とシ ーケンサリストをリロードすることで十分です。

For changing a waveform, it is not required to repeat all of the above steps. It is sufficient to reload the Multi-Segment waveform along with the sequencer list.



Execute Trigger



13. 可変パルスの実施 Conducting the Varied Type



Load Waveform



| | Recent files |
|-----------------|------------------------|
| ec-t403 | |
| - TELEC-T403-W5 | 56-20-TRIAL-13-seg56 🔺 |
| TELEC-T403-WS | 56-20-TRIAL-13-seg57 |
| TELEC-T403-W5 | 56-20-TRIAL-13-seg58 |
| - TELEC-T403-WS | 56-20-TRIAL-13-seg59 |
| - TELEC-T403-WS | 56-20-TRIAL-13-seg6 |
| TELEC-T403-WS | 56-20-TRIAL-13-seg60 |
| - TELEC-T403-W | 56-20-TRIAL-13-seg7 |
| - TELEC-T403-WS | 56-20-TRIAL-13-seg8 |
| TELEC-T403-W | 56-20-TRIAL-13-seg9 |
| TELEC-T403-WS | 56-20-TRIAL-13 |
| - W53 Type1 | |
| W53 Type2 | |
| W56 Type1 | |
| - W56 Type2 | |
| W56 Type3 | |
| W56 Type4 | |
| W56 Type5 | |
| W56 Type6 | - |
| | File |
| ect | Manager |

- W56 Type 4 ~ 6 → Select
 Next Segment Mode 'Sequencer'
 Sequencing List

•

| encin | g List 🛛 | W56 Typ | e4 | 102 - S. 41 | 1 | Assigned to | Multi Seg. V | Vaveforn | W56 Type4 | |
|-----------|----------|---------|----------------------|-------------|------------------|---------------|--------------|----------|------------|------|
| | (| | (| Sequen | cing Play List – | | | | | |
| ld# | State | Seg.# | Waveform | | Rep. Cycles | Next | Go To | info | | |
| 0 | On | 0 | W56 Type4-seg1.w∨ | | া | Next Id# | | Info | | |
| 1 | On | 1 | W56 Type4-seg2.wv | | 59 960 | Next Id# | | Info | | |
| 2 | On | 2 | W56 Type4-seg3.wv | | া | Next Id# | | Info | | |
| 3 | On | 3 | W56 Type4-seg4.wv | | 59 960 | Next Id# | | Info | | |
| 4 | On | 4 | W56 Type4-seg5.wv | | ्न | Next Id# | | Info | | |
| 5 | On | 5 | W56 Type4-seg6.wv | | 59 960 | Next Id# | | Info | | |
| 6 | On | 6 | W56 Type4-seg7.wv | | া | Next Id# | | Info | | |
| 7 | On | 7 | W56 Type4-seg8.wv | | 59 960 | Next Id# | | Info | | |
| 8 | On | 8 | W56 Type4-seg9.wv | | া | Next Id# | | Info | | |
| 9 | On | 9 | W56 Type4-seg10.wv | | 59 960 | Next Id# | | Info | | |
| 10 | On | 10 | W56 Type4-seg11.wv | | া | Next Id# | | Info | | |
| 11 | On | 11 | W56 Type4-seg12.wv | | 59 960 | Next Id# | | Info | | |
| 12 | On | 12 | W56 Type4-seg13.wv | | া | Next Id# | | Info | | |
| 1 martine | | 12 | | | | 247 - 2787411 | | 1.00 | | |
| Aj | opend | | Delete | | Shift Id | # | Up | | Down | |
| 11 | 1 [5996 | 0] 2[| 1] 3 [59960] 4 [1] 5 | 5 [59960] | 6 [1] 7 [5996 | 0] 8[1] | 9 [59960] | 10 [1] | 11 [59960] | 12[1 |
| | | 0.00 | | | | | | | | |
| 1 | lew | . 1 | | | Load | Sa | ve Sequ. | 1 | Save | |

Load Sequencing List



| 拱 Select Sequencing List | | |
|-------------------------------|-------------------------|------------------------|
| | Recent files | |
| d:/telec-t403 | | |
| TELEC-T403-W56-11- | TRIAL-4 | |
| - TELEC-T403-W56-12- | TRIAL-5 | |
| | TRIAL-6 | |
| TELEC-T403-W56-14- | TRIAL-7 | |
| TELEC-T403-W56-15- | TRIAL-8 | |
| - TELEC-T403-W56-16- | TRIAL-9 | |
| | TRIAL-10 | |
| TELEC-T403-W56-18- | TRIAL-11 | |
| TELEC-T403-W56-19- | TRIAL-12 | |
| - TELEC-T403-W56-20- | TRIAL-13 | |
| - W53 Type1 | | |
| - W53 Type2 | | |
| W56 Type1 | | |
| - W56 Type2 | | |
| - W56 Type3 | | |
| W56 Type4 | | |
| ··· W56 Type5 | | |
| W56 Type6 | - | |
| Select | File Manager | |
| | | d: (DATA)/telec-t403 → |
| W53 Type 4 ~ 6 → Select | t | |
| FSCI | | |
| Sequencing List を閉じる | | |
| Exit Sequencing List | | |
| Frigger/Marker | | |
| | As Tringer Marker (*1e) | |
| arbitrary waverorm modulation | A. Trigger Marker Clo | ch e |
| | Trigger in- | |
| ode | | Armed Retrigger |
| Execute Trigger | | Stopped< |
| | | |
| ource | | Internal |

- ٠ •
- Trigger In Mode 'Armed Retrigger' [ESC] Trigger/Marker を閉じる Exit Trigger/Marker



ARB 'On' •





波形の変更には、上記の全てのステップを繰り返す必要はありません。Multi Segment 波形とシ ーケンサリストをリロードすることで十分です。

For changing a waveform, it is not required to repeat all of the above steps. It is sufficient to reload the Multi-Segment waveform along with the sequencer list.



• Execute Trigger



14. FM チャープパルスの実施 Conducting the FM Chirp Type



Load Waveform





TELEC-T403-W56-08 ~ 20-TRIAL-1 ~ * → Select

- Next Segment Mode 'Sequencer' •
- Sequencing List

| | | | 4 | Sequen | cing Play List— | | <i>14</i> | w | |
|-----|-------|-------|---------------------------------|-----------------|-----------------|------------------------|-----------|--------|------------------|
| ld# | State | Seg.# | Waveform | | Rep. Cycles | Next | Go To | info | |
| 0 | On | 0 | TELEC-T403-W56-08-T | RIAL-1-seg1.wv | 120 | Next Id# | | Info | |
| 1 | On | 1 | TELEC-T403-W56-08-T | RIAL-1-seg2.wv | 1 | Next Id# | | Info | |
| 2 | On | 2 | TELEC-T403-W56-08-T | RIAL-1-seg3.wv | 43 936 | Next Id# | | Info | |
| 3 | On | 3 | TELEC-T403-W56-08-T | RIAL-1-seg4.wv | 286 | Next Id# | | Info | |
| 4 | On | 4 | TELEC-T403-W56-08-T | RIAL-1-seg5.wv | 1 | Next Id# | | Info | |
| 5 | On | 5 | TELEC-T403-W56-08-T | RIAL-1-seg6.wv | 44 375 | Next Id# | | Info | |
| 6 | On | 6 | TELEC-T403-W56-08-T | RIAL-1-seg7.wv | 1 078 | Next Id# | | Info | |
| 7 | On | 7 | TELEC-T403-W56-08-T | RIAL-1-seg8.wv | 1 | Next Id# | | Info | |
| 8 | On | 8 | TELEC-T403-W56-08-T | RIAL-1-seg9.wv | 13 280 | Next Id# | | Info | |
| 9 | On | 9 | TELEC-T403-W56-08-T | RIAL-1-seg10.wv | 1 136 | Next Id# | | Info | |
| 10 | On | 10 | TELEC-T403-W56-08-T | RIAL-1-seg11.wv | <u>)</u> | Next Id# | - | Info | |
| 11 | On | 11 | TELEC-T403-W56-08-T | RIAL-1-seg12.wv | 13 600 | Next Id# | | Info | |
| 12 | On | 12 | TELEC-T403-W56-08-T | RIAL-1-seg13.wv | 1 0 3 9 | Next Id# | | Info | |
| A | ppend | | Delete | | Shift Id | # | Up | | Down |
| 20] | 1 [1] | 2 [43 | <mark>936]</mark> 3 [286] 4 [1] | 5 [44375] 6 [| 1078] 7 [1] | <mark>8 [13280]</mark> | 9 [1136] | 10 [1] | 11 [13600] 12 [1 |
| | | | | | | | | | |

Load Sequencing List •



| 📰 Select Sequencing List 🔤 🗆 🔯 | |
|---|------------------------|
| Recent files | |
| d:/telec-t403 | |
| 📉 d: (DATA) | |
| 🖶 🔍 FCC-0696 🥂 🛒 | |
| 🗄 🖏 telec-t403 | |
| | |
| | |
| | |
| TELEC-T403-W56-10-TRIAL-3 | |
| TELEC-T403-W56-11-TRIAL-4 | |
| TELEC-T403-W56-12-TRIAL-5 | |
| - TELEC-T403-W56-13-TRIAL-6 | |
| - TELEC-T403-W56-14-TRIAL-7 | |
| - TELEC-T403-W56-15-TRIAL-8 | |
| TELEC-T403-W56-16-TRIAL-9 | |
| - TELEC-T403-W56-17-TRIAL-10 | |
| TELEC-T403-W56-18-TRIAL-11 | |
| TELEC-T403-W56-19-TRIAL-12 | |
| TELEC-T403-W56-20-TRIAL-13 | |
| - W53 Type1 | |
| File | |
| Select Manager | |
| | d: (DATA)/telec-t403 → |
| 「ELEC-T403-W56-08 ~ 20-TRIAL-1 ~ * → | Select |
| FSCI | |
| Sequencing Listを閉じる | |
| -xit Sequencing List | |
| List Frigger/Marker | |
| Arbitrary Waveform Modulation A: Trigger Marker Clo | ck |
| Triager In | |
| rigger m | [|
| ode | Armed Retrigger |
| | |
| Execute Trigger | Stopped |
| Execute Trigger | Stopped< |

- Trigger In Mode 'Armed Retrigger' •
- •
- [ESC] Trigger/Marker を閉じる Exit Trigger/Marker







波形の変更には、上記の全てのステップを繰り返す必要はありません。Multi Segment 波形とシ ーケンサリストをリロードすることで十分です。

For changing a waveform, it is not required to repeat all of the above steps. It is sufficient to reload the Multi-Segment waveform along with the sequencer list.



• Execute Trigger



15. 周波数ホッピングパルスの実施 Conducting the Frequency Hopping Type

バーストごとに波形ファイルから、次のホップに RF リストを切替える始めで、トリガパルスを発生します。 Marker 2 出力を Instr. Trigger 入力に接続します。

RFリストの外部トリガで、オペレーションモードを'Extern Step'に設定します。さらに、'Blank RF Output'を、最初のパルスの欠損回避するために無効にします。

'Blank RF Output'設定は、SMJ100A、SMU200A、SMATE200A だけに関連します。 SMBV100A はバーストの最初のパルスの欠損回避できません。

Each burst from the waveform file initiates a trigger pulse at the beginning that switches the RF list from a hop to the next one. The Marker 2 output is connected with the Instr. Trigger input.

For the external triggering of the RF list, the operation mode must be set to 'Extern Step'. In addition the check box 'Blank RF Output' must be disabled to avoid the truncation of the very first pulse.

Setting the 'Blank RF Output' is only relevant for the SMJ100A, SMU200A and SMATE200A. The SMBV100A cannot avoid the truncation of the first pulse from the burst.









- \frown config \rightarrow List Mode
- Mode 'Extern Step'
- Blank RF Output (Default ON) 'Off' (□ On)

| State | Off |
|---------------|---------------|
| Mode | Extern Step 👱 |
| Dwell Time | 10.000 ms 💌 |
| Current Index | |

VSGは、周波数変更で、内部シンセサイザを再調整するので、ある程度の時間を必要とすること を、特に注意しなければなりません。デフォルトでは、この間、不確定信号からデバイスを保護す るために、VSGはRF出力を抑えます。新たな周波数が規定確度に収まると、信号は再びアク ティブになります。安全のために、ブランク時間は付加マージンを含みます。

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DFS テストでは、VSG で使われるデフォルトブランク時間がわずかに長く、バーストの最初のパルスが欠損します。この用途で、VSG スペック内に収める難しい要求ではなく、短縮時間で周波数がチャネル帯域幅内に収まるため、ブランク時間の短縮が可能です。

Special care must be taken since changing the frequency requires the VSG to readjust the internal synthesizer and this takes a small amount of time. By default, the VSG suppresses any RF output during this time period to protect devices from an undefined or unwanted signal. The signal is activated again, once the new frequency has settled to the specified accuracy. For safety, an additional margin is added to the blanking time. For the DFS testing, the default blanking time used by the VSG is slightly too long and the first pulse from the burst will be truncated. Shorter blanking times are sufficient because the frequency will settle well within the channel bandwidth at a much shorter time and the tough requirement to reach the VSG specification limits is not required in this case.



Load Waveform





TELEC-T403-W56-Hop → Select

- Next Segment Mode 'Sequencer'
- Sequencing List

•

| ienci | ing List | TELEC. | T403-W56-Hop | -Somoncing Diav List | Assigned to N | lulti Seg. ¹ | Waveform | TELEC-T403-W56 |
|-------|----------|--------|----------------------------|----------------------|---------------|-------------------------|----------|----------------|
| ld# | State | Seg.# | Waveform | Rep. Cycles | Next | Go To | Info | |
| 0 | On | 0 | TELEC-T403-W56-Hop-seg1.wv | 100 | Next Id# | 1 | Info | |
| 1 | On | 1 | TELEC-T403-W56-Hop-seg2.wv | 1 | Blank | | info | |
| | | | | | | | | |
| | Append | | Delete | Shift | ld# | Up | | Down |
| j. | Append | | Delete | Shift | ld# | Up 1[1 |]+BI | Down |

Load Sequencing List





- Trigger In Mode 'Armed Retrigger'
- [ESC]

Trigger/Marker を閉じる Exit Trigger/Marker



- \longrightarrow config \rightarrow Automatic Level Control
- Protect RF Output '∅'

ROHDE&SCHWARZ



• List Mode Data → Select List







• Execute Trigger

•



次のトライアルのために新たな RF リストをリロード

Reloading a new RF list for the next trial



- config \rightarrow List Mode
- List Mode State 'Off'
- List Mode Data → Select List
- Learn List Mode Data
- List Mode 'On'

•



• Execute Trigger

'Learn List Mode Data'は、RF'ON'と適切なベースバンドセットアップで実行されなければなりま せん。ラーニングシーケンス中に VSG が内部測定を実行するからです。ラーニング測定値は、 設定した周波数、レベル、およびベースバンドモードにだけ関連します。これらのパラメータのうち 1 つでも変更すると、ラーニング測定値が無効になります。

The list learning must be done with the RF signal enabled and the baseband properly setup. This is required because the VSG performs internal measurement during the learning sequence. The learned values are only valid for the set frequency, level and baseband mode. Changing one of these parameters makes the learned values invalid.



16. テスト信号の確認 Checking the Test Signals

Static Type



• Burst Interval





• 18 Pulses per Burst (W53 Static Type 1)

| Spectrum 🌺 | |
|--|--|
| RefLevel -10.00 dBm CRBW 40 MHz | |
| ● Att 0 dB ● SWT 30 ms VBW 40 MHz | |
| SGL TRG: VID | |
| O 1AP Cirw | |
| | D1[1] 0.00 dB |
| M1 D1 | 1.42800 ms |
| -20 dBm 7 | M1[1] -20.01 dBm |
| | |
| -30 dBm | |
| | |
| -40-dBm-TRG -40.000 dBm | |
| | |
| 50 d9m | |
| -30 (1811) | |
| | |
| 60 dBm - bellevin a set of the set with the set with the set with a set of the set of th | والمستعمل فراج فراج ومعرفا والمعاد ومراجع والمنافعة والمراجع والمتحاط والمحاط والمراجع والمراجع والمحاص والمتعاد والمتحاط والمراجع |
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| le de la collecte de la collecte de la contribution de trivite | and the termine of the second seco |
| na a tha bhaile a llian ta mar i shini na shi bhaile an ta bhaile a tha bhaile a tha bhaile a bhaile a bhaile | |
| | |
| CF 5.0 GHz 10001 | pts 3.0 ms/ |
| | Ready 03.06.2011 |



• Pulse Width (W53 Static Type 1)





Varied Type (W56 Varied Type 4)



• Burst Interval

| Spectrum 🌺 | | | | |
|--|--|---|----|---------------------------------|
| Ref Level -10.00 dBm | RBW 40 MHz | | | |
| oAtt OdBoSWT 2 | 20 s VBW 40 MHz | | | |
| SGL TRG: VID | | | | , |
| o 1AP Clrw | r r | | | |
| | | D1[1] | | -0.01 dB |
| -20 dBm | | M1[1] | D1 | -20.03 dBm |
| | | 240 L 04 | Î | 0.00000 s |
| -30-d8m-TRG -30.000 d8m | | | | |
| | | | | |
| -40 dBm | | | | |
| | | | | |
| -50 d8m | | | | |
| -50 dbm | | | | |
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| | | | | |
| | | | | |
| CF 5.0 GHz | 1000 | 1 pts | | 2.0 s/ |
| t di | | Ready | | 03.06.2011 |









• 1 ~ 5 us Pulse Width (W56 Varied Type 4)





FM Chirp Type



• 10 Bursts

| Spectrum | | | | | | |
|-------------------------------|-----------------|-----------------------------------|-------|----------------------------|----------------|---------------------|
| Ref Level -10.00 c | iBm i | RBW 40 MHz | | | | |
| SGL U | I GB 😇 SWI 12 S | VBW 40 MHz | | | | |
| 01AP Clrw | | 155. II | | | | |
| | | | | | | |
| -20 dBm | | | | | | |
| -30 dBm | | | | | _ | |
| -40 dBm | | | | | | |
| | | | | | | |
| -50 dBm | | | | | | |
| AD AD AS AS AN AREA SHOWING A | | stores data a bat new last direct | | hall to be seen a short of | endets Jon See | testin et contra de |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| CF 5.0 GHz | | 1000 | 1 pts | | | 1.2 s/ |
| | | | Re | ady 📒 | 14 | 18:08:45 |



• 1 ~ 3 Pulses per Burst

| Spectrum | | | | | | | | |
|----------------------------------|-------------------------------|----------------------------|------------------------|-------------------|----------------------------|-----------------------|-----------------------|-----------------------|
| Ref Level | -10.00 dBm | e RBW | 40 MHz | | | | | |
| 🗢 Att | 0 dB 💿 SWT 10 | Oms VBW | 40 MHz | | | | | |
| SGL TRG: VI | D | | | | | | | |
| 01AP View 💿 | 2AP View 💿 3AP Clrw | | | | | | | |
| | | | | | | | | |
| 00 d0m | | | | | | | | |
| -20 aBm- | | ſ | | | | | | |
| | | | | | | | | |
| | RG -30.000 dBm | | | | | | | |
| | | | | | | | | |
| -40 dBm | | | | | | | | |
| | | | | | | | | |
| -50 dBm | | | | | | | | |
| | | | | | | | | |
| -60 dBm | | | | tra tra | | | | |
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| | | | | | | | | |
| | | | | | | | | |
| | | | 10001-0 | | | | | 1.0 ms/ |
| GF 3.0 GHZ | T | | 10001 b | | and he a | | (ANO) 0 | 3.06.2011 |
| | | | | R | eady [| | | 18:21:00 |





• FM Chirp 5 ~ 20 MHz Deviation, 50 ~ 100 us Pulse Width



Frequency Hopping Type



• 0.3 s burst within 40 MHz IF filter





• 30 hops within 40 MHz IF filter

| Spectrum | Real-Time S | pectrum 🛞 | Spectrur | n 2 🛛 🔊 | | |
|------------------------|--|-----------------------|-----------|--------------------------------|----------------------------------|--|
| Ref Level -10. | 00 dBm | RBW 40 | MHz | | | |
| 😑 Att | 0 dB 😑 SWT 9 | 0 ms VBW 40 | MHz | | | |
| TRG: VID | | | | | | |
| O1AP Clrw | | | | | | |
| -20 dBm | | | | | | |
| | | | | | | |
| | | | | | | |
| -40 dBm | | | | | | |
| - RO | -50.000 dBm | dullation . | | | | |
| A CARLEN AND A CARLEND | and the second | | | towethe full the second shadow | deski hanga kini aitalik kikadat | eterini ya ditini dan kani ka ya di kini k |
| | | | | | | |
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| | a) | | | | | |
| | hu attal militati ar | ale kulli don dhar ad | | The shift of the second | السرابان السالي م | d An Million Hillindin i |
| CF 5.5 GHz | | | 10001 pts | | | 9.0 ms/ |
| | | | l l w | ait for Trigger | | 03.06.2011 |



• 9 Pulses per Hop

| Spectrum 👋 Real-Time Spectrum | 8 | |
|---|---|-------------------|
| Ref Level -10.00 dBm © RBW | 40 MHz | |
| Att UdB SWI 3 ms VBW TRG:VID | 40 MHz | |
| • 1AP Clrw | | |
| | | |
| -20 dBm | | |
| | | |
| -30 dBm | | - |
| -40 dBm | | |
| -+o dbiii | | |
| -50 dBm TRG -50.000 dBm | | - |
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| CE 5 5 GHz | 10001 pts | |
| | | 3.06.2011 |



• 1 us Pulse Width





• Hopping





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