

# NorDig-Unified\_Test\_Plan\_ver\_2.6.0 – DVB-T/DVB-T2 PART

## 1 Introduction

This document summarizes Silicon Labs understanding of current test plan and the needs of further clarification or update from NorDig when comparing latest test plan requirements with related NorDig unified requirements.

## 2 DVB-T

### 2.1 Task 3:29 Synchronization for varying echo power level in SFN

Expected results refer to table 3.18 of NorDig Unified requirements ver2.6.

**Expected result:**

The IRD shall maintain the SFN synchronisation when the amplitude of the echo signal varies in a function of time. The required C/N shall not exceed the specified value in table 3.18.

This is a typo as

- DVB-T maximum required C/N for QEF with dynamically varying echo power levels using DVB-T is in table 3.19 (page 59 of NorDig 2.6 Unified requirements)

Note that this corresponds to table 3.18 of NorDig Unified ver3.0 (page 63).

Silicon Labs recommends to update table number and mention that table belongs to NorDig Unified ver2.6.

### 2.2 Task 3:32 C/(N+I) Performance in SFN outside the guard interval

Expected results refer to tables 3.22 and table 3.23 of NorDig Unified requirements ver2.6.

<i>Test Case</i>	<b>Task 3:32 Performance: C/(N+I) Performance in SFN outside the guard interval</b>
<i>Section</i>	NorDig Unified 3.4.10.11
<i>Requirement</i>	For echoes outside the guard interval, for 8MHz DVB-T signal, QEF reception shall be possible with echo levels up the values defined in Table 3.22 For echoes outside the guard interval, for 7MHz DVB-T signal, QEF reception shall be possible with echo levels up the values defined in Table 3.23

This is a typo as

- QEF reception for echoes outside the guard interval, for 8MHz DVB-T signal is in table 3.21 (page 61 of NorDig 2.6 Unified requirements)
- QEF reception for echoes outside the guard interval, for 7MHz DVB-T signal is in table 3.22 (page 61 of NorDig 2.6 Unified requirements)

Note that expected results shall also be updated:

**Expected result:**

All the echo attenuation values shall be equal or lower compared to NorDig Unified values in tables 3.20 and 3.21.

Note that this corresponds to tables 3.20 and 3.21 of NorDig Unified ver3.0 (page 65).

Silicon Labs recommends to update table number and mention that table belongs to NorDig Unified ver2.6.

### 3 DVB-T2

#### 3.1 Task 3:50 Verification of Signal Strength Indicator (SSI)

Although using same Pref and same SSI formula, there are some discrepancies between SSImin/SSImax requirements of Task 3:50 compared to task 3:13 (DVB-T SSI).

8k 64QAM R2/3 G1/8 8MHz, P <sub>reference</sub> =-80dBm, f=666MHz					32KE, 256QAMR, PP4, R3/5, G19/256, 8MHz, P <sub>reference</sub> =-80dBm, f=666MHz				
P <sub>input level</sub> [dBm]	SSI [%]	SSI <sub>min</sub> [%]	SSI <sub>max</sub> [%]	NOK or OK	P <sub>input level</sub> [dBm]	SSI [%]	SSI <sub>min</sub> [%]	SSI <sub>max</sub> [%]	NOK or OK
-40		99	100		-40		99	100	
-50		92	100		-50		92	100	
-60		70	93		-60		70	93	
-70		30	70		-70		30	70	
-80		7	30		-80		5	38	
-95		0	5		-95		0	5	

For -85dBm, SSI=2/3\*10=6.66.

For -75dBm, SSI=4\*5+10=30

Silicon Labs recommends to apply 64QAM 2/3 SSImin/SSImax requirements for DVB-T2 mode 32ke 256QAM rotated 3/5 19/256 PP4.

SSImin/SSImax requirements for DVB-T2 mode with Pref=-76dBm are incorrect :

32KE, 256QAMR, PP2, R3/4, G1/8, 8MHz, P <sub>reference</sub> =-76dBm, f=666MHz					freq Mhz		
P <sub>input level</sub> [dBm]	SSI [%]	SSI <sub>min</sub> [%]	SSI <sub>max</sub> [%]	NOK or OK	Level	SSI Min	SSI Max
-40		96	100		-40	96	100
-50		86	100		-50	86	99
-60		54	93		-60	54	91
-70		14	70		-70	14	54
-80		3	38		-80	4	14
-95		0	5		-95	0	2

For -43dBm (-50+7dB error), SSI=2/3\*13+90=98.66. Note that for -57dBm (-50-7dB error), SSI is correct (86).

For -55dBm (-60+5dB error), SSI=2/3\*1+90=90.66. Note that for -65dBm (-60-5dB error), SSI is correct (54).

For -65dBm (-70+5dB error), SSI= 4\*11+10=54. Note that for -75dBm (-70-5dB error), SSI is correct (14).

For -75dBm (-80+5dB error), SSI= 4\*1+10=14.

For -85dBm (-80-5dB error), SSI= 2/3\*6=4.

For -88dBm (-95+7dB error), SSI=2/3\*3=2

Silicon Labs recommends to update SSImin/SSImax requirements for DVB-T2 mode 32ke 256QAM rotated 3/4 1/8 PP2.

#### 3.2 Task 3:54 Input/Output Data Formats

Purpose of this task is to check requirement to support TS bit rates <= 72Mbit/s.

<b>Test Case</b>	<b>Task 3:54 DVB-T2: Input/Output Data Formats</b>
<b>Section</b>	NorDig Unified 3.4.9
<b>Requirement</b>	The NorDig IRD-T2 shall be able to support TS bit rates ≤ 72 Mbit/s.

Expected results assume no NDP (Null Packet Deletion) which limits bit rate to 50.3Mbit/s and does not allow to test TS bit rates up to 72 Mbit/s.

**Expected result:**

DVB-T2 front end is able to deliver transport streams up to bit rate supported by the DVB-T2 mode (approx 50Mbit/s).

To test 72Mbit/s requirements, Silicon Labs recommends to enabled NPD and use 72Mbit/s MPEG TS stream. Note that such DVB-T2 settings are already deployed in countries like South Africa.

### 3.3 Task 3:56 C/N Performance on Gaussian channel

Requirements refer to table 2.3 (PP2) and table 2.6(PP7).

<i>Test Case</i>	<b>Task 3:56 DVB-T2: Performance: C/N performance on Gaussian channel</b>
<i>Section</i>	NorDig Unified 3.4.10.3
<i>Requirement</i>	The NorDig IRD shall have at least the QEF performance for the C/N ratios given in, <u>table 2.3 (PP2) and Table 2.6 (PP7)</u> Maximum required C/N for profiles 1 and 2.

This is a typo as

- PP2 requirements are in table **2.4** (page 69 of NorDig 2.6 test plan)
- PP7 requirements are in table **2.7** (page 72 of NorDig 2.6 test plan).

Typo shall also be corrected in expected results:

**Expected result:**

The required C/N for quasi error free reception in Gaussian channel is less than specified in Table 2.6  
 If 1.7MHz signal BW is supported, the required C/N for quasi error free reception in Gaussian channel is less than specified in Table 2.3.

### 3.4 Task 3:57 C/N Performance on 0dB echo channel

Requirements refer to table 2.3 (PP2) and table 2.4(PP4).

<i>Test Case</i>	<b>Task 3:57 DVB-T2: Performance: C/N performance on 0dB echo channel</b>
<i>Section</i>	NorDig Unified 3.4.10.3
<i>Requirement</i>	The NorDig IRD shall have at least the QEF performance for the C/N ratios given in, <u>Table 2.3 (PP2) and Table 2.4 (PP4)</u> Maximum required C/N for profiles 1 and 2.

This is a typo as

- PP2 requirements are in table **2.4** (page 69 of NorDig 2.6 test plan)
- PP4 requirements are in table **2.5** (page 70 of NorDig 2.6 test plan).

Typo shall also be corrected in expected results:

**Expected result:**

The required C/N for quasi error free reception in 0 dB echo channel is less than specified in Table 2.3 and Table 2.4 except for DVB-T2 mode 32KE 256QAM R3/4

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If 1.7MHz signal BW is supported, the required C/N for quasi error free reception in Gaussian channel is less than specified in Table 2.3.

Note that DVB-T2 pilot pattern tested are PP2, PP4, PP6 and PP7. Therefore, Silicon Labs recommends to refer to C/N requirements given in table 2.4(PP2), table 2.5(PP4), table 2.6 (PP6) and table 2.7(PP7) of NorDig test plan.

### 3.5 Task 3:58 Minimum receiver signal input levels on Gaussian channel

Expected results refer to table 2.7 (PP2) and table 2.10(PP7).

**Expected result:**

Sensitivity shall be equal or better for all measured frequencies (channels) and for all DVB-T2 modes and signal bandwidths as specified in Table 2.10  
 If signal bandwidth 1.7MHz is supported, the sensitivity shall be equal or better for measured frequency and for DVB-T2 mode as specified in Table 2.7.

This is a typo as

- PP2 sensitivity requirements are in table **2.8** (page 73 of NorDig 2.6 test plan)
- PP7 sensitivity requirements are in table **2.11** (page 76 of NorDig 2.6 test plan)

### 3.6 Task 3:59 Minimum IRD signal input levels on 0dB echo channel

Expected results refer to table 2.7 (PP2), table 2.8, table 2.9 and table 2.10(PP7) and table 2.6 for 1.7MHz (PP2).  
**Expected result:**

Required minimum signal level shall be equal or lower in dBm than specified in Table 2.8, Table 2.9 and Table 2.10 at measured frequencies, DVB-T2 modes and signal bandwidths for an echo delays.  
 If signal bandwidth 1.7MHz is supported, the required minimum signal level shall be equal or lower in dBm than specified in table 2.6 at measured frequency and for DVB-T2 mode.

This is a typo as

- PP2 sensitivity requirements are in table 2.8 (page 73 of NorDig 2.6 test plan)
- PP4 sensitivity requirements are in table 2.9 (page 74 of NorDig 2.6 test plan)
- PP6 sensitivity requirements are in table 2.10 (page 75 of NorDig 2.6 test plan)
- PP7 sensitivity requirements are in table 2.11 (page 76 of NorDig 2.6 test plan)

### 3.7 Task 3:60 Receiver noise figure on gaussian channel

Test refers to NF table 3.12 and Gaussian tasks 3:59 and 3:57.

<b>Requirement</b>	The NorDig IRD shall have a noise figure (NF) for supported frequency ranges equal or better than the values specified in Table 3.12.
<b>IRD Profile(s)</b>	Basic, IRD, DVB-T2
<b>Test procedure</b>	<p><b>Purpose of test:</b> To calculate the noise figure of the receiver for gaussian channel.</p> <p><b>Equipment:</b> No equipment needed.</p> <p><b>Test procedure for evaluation of the receiver noise figure:</b></p> <p>Determine the minimum carrier levels <math>C_{min}</math> for the gaussian channel measured in Task 3:59 (DVB-T2: Performance - Minimum IRD Signal Input Levels on Gaussian channel).</p> <p>Determine the required <math>C/N_{min}</math> for the gaussian channel measured in Task 3:57 (DVB-T2: Performance - C/N performance on Gaussian channel).</p> <p>Calculate the noise figure NF[dB] for the supported frequencies using the formulas</p> <p>For 8MHz extended DVB-T2 signal: <math>NF[dB] = N + 105.1dBm = C_{min} - C/N_{min} + 105.1dBm</math></p> <p>For 8MHz normal DVB-T2 signal: <math>NF[dB] = N + 105.2dBm = C_{min} - C/N_{min} + 105.2dBm</math></p> <p>For 7MHz normal DVB-T2 signal: <math>NF[dB] = N + 105.7dBm = C_{min} - C/N_{min} + 105.7dBm</math></p> <p>For 1.7MHz normal DVB-T2 signal: <math>NF[dB] = N + 112.1dBm = C_{min} - C/N_{min} + 105.7dBm</math></p> <p><b>Expected result:</b> The noise figure is less than or equal to table 3.12.</p>

This is a typo as

- NF requirements are in table 3.13 (page 52 of NorDig Unified requirements 2.6)
- Gaussian C/N is task 3:56 (page 194 of NorDig 2.6 test plan)
- Gaussian sensitivity is task 3:58 (page 198 of NorDig 2.6 test plan)

### 3.8 Task 3:60 Receiver Noise figure on Gaussian channel

Expected results refer to table 2.7 (PP2), table 2.8, table 2.9 and table 2.10(PP7) and table 2.6 for 1.7MHz (PP2).

**Expected result:**

Required minimum signal level shall be equal or lower in dBm than specified in Table 2.8, Table 2.9 and Table 2.10 measured frequencies, DVB-T2 modes and signal bandwidths for all echo delays.  
If signal bandwidth 1.7MHz is supported, the required minimum signal level shall be equal or lower in dBm than specified in table 2.6 measured frequency and for DVB-T2 mode.

This is a typo as

- PP2 sensitivity requirements are in table 2.8 (page 73 of NorDig 2.6 test plan)
- PP4 sensitivity requirements are in table 2.9 (page 74 of NorDig 2.6 test plan)
- PP6 sensitivity requirements are in table 2.10 (page 75 of NorDig 2.6 test plan)
- PP7 sensitivity requirements are in table 2.11 (page 76 of NorDig 2.6 test plan)

### 3.9 Task 3:66 Synchronization for varying echo power level in SFN

Expected results refer to table 3.19 of NorDig Unified requirements ver2.6.

**Expected result:**

The IRD shall maintain the SFN synchronisation when the amplitude of the echo signal varies as a function of time. The required C/N shall not exceed the specified value in table 3.19.

This is a typo as

- DVB-T2 maximum required C/N for QEF with dynamically varying echo power levels using DVB-T2 is in table 3.20 (page 59 of NorDig 2.6 Unified requirements)

Note that this corresponds to table 3.19 of NorDig Unified ver3.0 (page 63).

Silicon Labs recommends to update table number and mention that table belongs to NorDig Unified ver2.6.

### 3.10 Task 3:67 C/(N+I) Performance in SFN for more than one echo

Expected results refer to table 2.3 (PP2) and table 2.4(PP4):

**Expected result:**

The IRD shall synchronize in all combinations defined in measurement record and the required C/N value shall not exceed the required C/N defined for profile 2: 0dB echo in table 2.3 (PP2) and table 2.4 (PP4).

This is a typo as

- PP2 requirements are in table 2.4 (page 69 of NorDig 2.6 test plan)
- PP4 requirements are in table 2.5 (page 70 of NorDig 2.6 test plan).

### 3.11 Task 3:68 C/(N+I) Performance in SFN inside the guard interval

Expected results refer to table 2.3 (PP2) and table 2.4(PP4):

**Expected result:**

The IRD shall synchronize in all echo attenuation and delay combinations except the longest values according to below:

32K extended, 256QAM, PP4, R=2/3,  $\Delta/T_U=1/16$ , 8MHz: -220 $\mu$ s and 220 $\mu$ s  
32K extended, 256QAM, PP4, R=3/5,  $\Delta/T_U=19/256$ , 8MHz: -266 $\mu$ s and 266 $\mu$ s  
32K extended, 256QAM, PP2, R=3/4,  $\Delta/T_U=1/8$ , 8MHz: -448 $\mu$ s and 448 $\mu$ s  
32K normal, 256QAM, PP4, R=2/3,  $\Delta/T_U=19/256$ , 7MHz: -304 $\mu$ s and +304 $\mu$ s  
32K normal, 256QAM, PP2, R=3/4,  $\Delta/T_U=1/8$ , 7MHz: -500 $\mu$ s and +500 $\mu$ s

The required C/N value for 0dB echo shall not be higher than defined in table 2.3 (PP2) and table 2.4 (PP4).

This is a typo as

- PP2 requirements are in table 2.4 (page 69 of NorDig 2.6 test plan)
- PP4 requirements are in table 2.5 (page 70 of NorDig 2.6 test plan).

### 3.12 Task 3:69 C/(N+I) Performance in SFN outside the guard interval

Expected results refer to tables 3.24 and table 3.25 of NorDig Unified requirements ver2.6.

<i>Test Case</i>	<b>Task 3:69 DVB-T2: Performance: C/(N+I) Performance in SFN outside the guard interval</b>
<i>Section</i>	NorDig Unified 3.4.10.11
<i>Requirement</i>	For echoes outside the guard interval, for 8 MHz DVB-T2 signal, QEF reception shall be possible with echo levels up to the values defined in Table 3.24. For echoes outside the guard interval, for 7 MHz DVB-T2 signal, QEF reception shall be possible with echo levels up to the values defined in Table 3.25.

This is a typo as

- QEF reception for echoes outside the guard interval, for 8MHz DVB-T2 signal is in table 3.23 (page 61 of NorDig 2.6 Unified requirements)
- QEF reception for echoes outside the guard interval, for 7MHz DVB-T2 signal is in table 3.24 (page 62 of NorDig 2.6 Unified requirements)

Note that expected results shall also be updated:

**Expected result:**

All the echo attenuation values shall be equal or lower compared to NorDig Unified values in table 3.2 and 3.23.

Note that this corresponds to tables 3.22 and 3.23 of NorDig Unified ver3.0 (pages 65 and 66).

Silicon Labs recommends to update table number and mention that table belongs to NorDig Unified ver2.6.