#### APPLICATION NOTE

# Analyzing UXM IQ captures with the SJ001A WaveJudge Wireless Analyzer Toolset

Import, Decode and Troubleshoot UXM IQ Captures

## Insightful Wireless Analysis to Diagnose and Adjudicate Root Cause of Problems

Troubleshooting functional and interoperability issues in 5G is not easy. We need to determine what Protocol messages were sent, relative to what PHY events occurred, and the timing of those messages and events. With Sanjole Solutions, Keysight can address new use cases moving forward.

This Application Note describes the process to import, decode and troubleshoot UXM IQ captures. This is really useful to complement the capabilities of Keysight Network Emulation Solutions, and to adjudicate disputes created when multiple vendors' products and analysis logs are contradictory, causing undue delays and increasing engineering expenses.

This paper demonstrates how to analyze UXM 5G IQ captures using the Keysight WaveJudge Wireless Analyzer Toolset

# S S

#### **Testing 5G**

requires diagnosing the root causes of problems between layers, which often takes hours, days or even weeks.

#### The SJ001A WaveJudge Wireless Analyzer Toolset

provides visibility into protocol and physical layer interaction in wireless transmissions, with the ability to record and review the conditions when performance is optimal and compare when the results are less than expected.



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# **Preliminary Steps**

1. Run WaveJudge (this step has to be done once only). The shortcut should be available on the desktop.



Figure 1. WaveJudge Icon, available on the desktop

2. If there is an error message observed about the license during WaveJudge launching, please check the following information:



Figure 2. License Request Process

It may be also required to change the settings the first time that WaveJudge is opened under your profile. If so, click on OK and make sure that Cell is configured as below. Click on Apply to apply the changes. If you have already the default setting, you can just use it.

A. Configure 5G NR as scenario (Please perform this if you don't have a following setting)

Configure Test	
Configure Test	Configure Test Scenario Standard 5G NR
Set up Capture	3 <ul> <li>Single base station (one cell)  <ul> <li>Two cells</li> </ul> </li> <li>Start custom test scenario</li> </ul>

Figure 3. Configure 5G NR Test Scenario

B. Click on Add Cell  $\rightarrow$  5G NR Cell

Configure Test Scenario	3GPP LTE Cell	
Single base station (one cell)	5G NR Cell Add 5GTF Cell to test co	onfigur
Start custom test scenario	Add UL/DL 5GTF Cell 5	-C
	Add Rx Port	JI/div iel ?? :
Go to 5G Card/Carrier Configuration	WiFi/WiGig Cell	
Exclude Transport Payload in IntelliJudge capturepy	Transmitter Mobile WiMAX Cell	
	Fixed WiMAX Cell	Frequ

Figure 4. Add 5G NR Cell

C. Configure 5G NR cell with any valid configuration. Do not need to take care of the 5GNR configuration right now.



Figure 5. Configure 5G NR cell

# How to Load an IQ Capture onto WaveJudge

1. Perform an IQ capture (either using TAP or L1 Capture tool) with the info to be analyzed.

2. Convert that IQ capture files to WaveJudge format. For that, you can use an iq2sanjole converter program or Matlab (e.g. fid = fopen(\'y1\_DL1.iq\');  $x = fread(fid, inf, \int16\', 0, \int16\')$ .

Instructions to use this are simple. You can type convertiq.exe –help to get more details about the input/output allowed parameters. This tool allows converting .IQ files to Sanjole format, VSA format, or IQ format (if you desire to cut the capture, making it shorter or capturing only a part of the entire capture).

C:\WINDOWS\system32\cmd.exe						
Microsoft Windows [Version Copyright <c> 2009 Microsof</c>	6.1.7601] t Corporation. All rights reserved.					
C:\Users\rubegarc>cd C:\Users\rubegarc\Documents\5GNR\5GNR_L1Capture\IQ2Sanjole converter\v2.0						
C:\Users\rubegarc\Documents Convert a UXM IQ file into	\5GNR\5GNR_L1Capture\IQ2Sanjole converter\v2.0>convertiq.exe —help VSA or SanJole text file					
You can use this tool to co You can use it to perform a of the capture that you wil You can even generate a new IQ swapped or which contain	nvert a UXM IQ capture into a USA or SanJole text file. nd IQ swap. You can also use it to select a section l convert (i.e. by providing a start and a length). UXM IQ capture file (normally one that has been s only part of the original input file samples)					
Note that this program need	s pcre64.dll (from https://nim-lang.org/download/dlls.zip) to run.					
Usage: convertiq [to FORMAT 	-o OUTFILE -n ANTENNAS -s START -1 LENGTHfs=FREQ] [iqswap] <iqfiles></iqfiles>					
Options:						
to=FORMAT -oout=FILENAME -nnum-antennas=NUM iqswap -sstart=START	Target output format (sanjole, vsa or iq) [Default: sanjole] Output filename (defaults to iqfile1 plus ".txt") The number of antennas (defaults to the number of input files) Swap the I and Q The start position for the conversion in samples or ms. To specify a number of samples simply provide an integer value. To specify a time in miliseconds append "us" to the value (e.g. 125us) To specify miliseconds append "ms" and for seconds append "s" You can use a negative file to _add_ some zero samples to the beginning of the capture.					
-1length=LENGTH	Use this to skip (or add) initial samples or miliseconds [default: 0] The maximum length of the converted file in samples or ms To specify a number of samples simply provide an integer value. To specify a time in miliseconds append "us" to the value (e.g. 125us) To specify miliseconds append "ms" and for seconds append "s" Use this to limit the size of the output file. Bu default the companying more till the sed of the file					
fs=SAMPLING_FREQ	Sampling frequency of the input capture in Hz [default: 153.6e6] Note that this is only used to calculate the number of samples given a start or length in time (i.e. us, ms or s). That is, this is not used to do any kind of resampling of the input file.					
C:\Users\rubegarc\Documents	\5GNR\5GNR_L1Capture\IQ2Sanjole converter\v2.0>					

Figure 6. Convert IQ help details

Example:

IQ Captures named as  $\rightarrow$  y1\_DL1.iq, y2\_DL1.iq

Command to execute: convertiq.exe --to sanjole -o capture.txt -s 0 y1\_DL1.iq y2\_DL1.iq

This command will generate a capture.txt file that can be opened by WaveJudge software. This file structure is 8 columns. The first four columns belong to 1st antenna port, and the other four columns belong to the 2nd antenna port.

- First column: I numerical values of 1st antenna port.
- Second column: Q numerical values of 1st antenna port.
- Third column: I numerical values of 2nd antenna port.
- Fourth column: Q numerical values of 2nd antenna port.

		_			_		_		-
862137	-2041		-13:	28		0		0	ſ
862138	3337		292	5		0		0	
862139	4135		406	D		0		0	
862140	793 -:	25:	19	0	1	0			
862141	-2592		-20	87		0		0	
862142	340 3	54	0	0					
862143	4151		-193	35		0		0	
862144	-2719		112	0		0			
862145	-3077		3324	4		0		0	
862146	4026		195	3		0		0	
862147	953 1	168	3	0		0			
862148	-2454		866	0		0			
862149	-2427		136	7		0		0	

Figure 7. Capture.txt columns format

3. Open WaveJudge and click on File  $\rightarrow$  Import  $\rightarrow$  I/Q Samples from text file.

🚏 Wa	veJudge - [capture1.txt]			
File	Edit View Actions Tools Window Help			
	New Test Configuration	Ctrl+N ge	Cipher¶ <i>Judge</i>	GPS: 🔲 1J: LTE 🔲 📳
: 🚰	Open	Ctrl+O pce	ss interval:	0 ms 👉 📥 📩
	Open Combined IntelliJudge/VSA Capture			WaveJ
	Open Multiple IntelliJudge Capture Files	е	Start T	i Port D Error Checkin
	Load IntelliJudge LTE MAC Settings			
	Save Current Capture	Ctrl+S		
	Save Test Configuration Ctrl+:	Shift+S		
1	Save WaveJudge Capture			
	Save WaveJudge Capture Selection As			
	Save IntelliJudge Capture			
	Save IntelliJudge Capture Selection As			
	Save Combined IntelliJudge/WaveJudge Capture			
-	Save Multiple IntelliJudge Captures			
	Load Bookmarks			
	Save Bookmarks	Ctrl+B		
	Capture Information			
-	Import	•	I/Q Samples (	from text file
8	Export	•	I/Q Sample Ir	mport with Options
	Exit		WiFi PCAP	

Figure 8. Selecting the .txt file

Select the .txt file generated in step #2 and wait until it is imported completely.

Import I/Q Samp	ples	×
	Importing I/Q samples from E:\USERS\Documents\SanJo\capture1.txt	
•	Please wait	
Elapsed: 00:00:02	2 360000 / 2457600 Remaining: 00:00 Total: 00:01	):13 0:16
	Cancel	

Figure 9. Importing the .txt file

4. Once imported, click on the Reprocess button.

👬 W	aveJudo	je - [cap	ture1.txt]					
File	e Edit	View	Actions	Tools	Window	Help		
: 🔛	2.		) 💕 🔒	🈓 🗓	Captu	ure nn	Repeat	001 IntelliJud
Sto	oped at O	ms / 107	ms				8 😵 🙎	🗲 🔹 🚺 Pr
Type	Cell 2: DL	on RX 1					[	Reprocess

Figure 10. Reprocessing (after importing)

5. Once completed, you should be able to see the signal on WaveJudge (at least, on time domain).

6. Start to configure the **5G NR parameters and/or Scheduling elements** to properly decode the signal. If it already exists, you may load an existing WaveJudge configuration file and apply it to the current I/Q capture. This will make the analysis easier and faster.

To do this:

- a. In WaveJudge, File  $\rightarrow$  Open
- b. Select the WaveJudge Configuration file.

脊 WaveJu	udge - [capture1.txt]	Open WaveJudge/IntellJudge Capture or Configuration File  San De San					
File E	Edit View Actions Tools	Organize  New Folder					
	en	🖃 🚖 Favorites	Name *	Date modified	Туре		
	Desktop	Desktop     Downloads	capture decoded using l1analyzer captura1_PDSCH.def	4/2/2018 4:27 PM 4/3/2018 12:18 AM	File folder DEF File		
		Recent Places	captura1_PDSCH	4/3/2018 12:18 AM	WaveJudge Configuration		
	e 🧊 Libraries 🕀 🖻 Documents		Test_PDSCH	4/2/2018 5:10 PM	WaveJudge File		

Figure 11. Opening and selecting an existing WaveJudge configuration file

# **PRACH Analysis**

## Parameters



Figure 12. PRACH Analysis Parameters

## WaveJudge Verification

1. Time domain power  $\rightarrow$  OK

For	mat	Nseq	Тср	Tseq	T <sub>GP</sub>	Use case
А	1	2	288 • T <sub>S</sub>	2048 • T <sub>S</sub>	0 • T <sub>s</sub>	Small cell

 $T_s = \frac{1}{8 \cdot 30720}$  ms for 120 kHz subcarrier spacing

**PRACH Format A1** =  $288 \cdot T_{s+} 2 \cdot 2048 \cdot T_{s+} 0 \cdot T_{s} \approx 18 \ \mu s$ 



Figure 13. PRACH in time domain

2. Mapping location  $\rightarrow$  OK (2 OFDM symbols (1st and 2nd) in Format A1)



Figure 14. PRACH mapping location

3. Number of subcarriers  $\rightarrow$  OK

144 subcarriers = 12 PRBs.



Figure 15. PRACH subcarriers

#### 4. Cell ID = $0 \rightarrow OK$

	Cell 1: DL on RX 1		***					
Slot List					80			
	■ [0]			slot 0				
				slot 1				
	. [2]		<u> </u>	slot 2				
Name	Start Ti Port Dire	ection Cell ID	Error Checking	# Bytes	Frame N	EVM	Code	N Reso
PRACH	0006.00 1 U	0			0	00.00	1	

Figure 16. Cell ID in PRACH

# SSB Analysis

## Parameters

% General Parameters							
fO	= 0;	% RF frequency in Hz (set to 0 to skip ph	ase pre-compensation)				
n_cell_id	= 28;	% Cell ID	[0 : 1007]				
sfn	= 0;	% System frame number	[0 1023]				
n_hf	= 0;	<pre>% Half-frame number</pre>	[0, 1]				
mu	= 3;	% Subcarrier scaling (2 ^ mu) * 15 kHz	[0, 1, 3]				
n_fft	= 1024;	% FFT size	[512 : 4096] n_fft * (2 ^ mu) * 15 kHz = 122.88 Msps				
k_0	= 0;	% Subcarrier offset in OFDM signal transm	uission [-6, 0, +6]				
n_rb	= 66;	% Number of resource blocks	[20 : 275] n_rb * 12 * (2 ^ mu) * 15 kHz <= 100 MHz				
n_bwp_start	= 0;	% Bandwidth part start [0:274].					
dc_notch	= false;	% DC notch					
n_ant	= 2;	% Number of antennas	[1 : 2]				
periodicity	= 20;	% Periodicity of generated signal (in ms	) [5, 10, 15, 20]				
% SSB Paramete	rs						
mu_ssb	= 3;	% Subcarrier scaling for SSB (2 ^ mu) * 1	5 kHz [0, 1, 3, 4]				
n_fft_ssb	= 1024;	% FFT size for SSB	[512 : 4096] n_fft * (2 ^ mu) * 15 kHz = 122.88 Msps				
k_0_ssb	= 0;	% Subcarrier offset in OFDM signal transm	ussion for SSB [-6, 0, +6]				
n_rb_ssb	= 66;	% Number of resource blocks for SSB	[20 : 275] n_rb_ssb * 12 * (2 ^ mu_ssb) * 15 kHz <= 100 MHz				
pss_gain	= 1;	<pre>% Gain for PSS</pre>	<pre>(&lt; 2.0) - linear maginitude</pre>				
sss_gain	= 1;	% Gain for PSS	<pre>(&lt; 2.0) - linear maginitude</pre>				
pbch_tbs	= 24;	% Number of bits for PBCH					
pbch_payload	<pre>= zeros(1, pbch_tbs)</pre>	;% High layer payload for PBCH (must be 24	bits)				
pbch_trch_en	= true;	% Enables channel encoding	[true, false]				
pbch_data_gain	1 = 1;	% Gain for PBCH data	<pre>(&lt; 2.0) - linear maginitude</pre>				
pbch_dmrs_gain	( = 1;	% Gain for PBCH DMRS	<pre>(&lt; 2.0) - linear maginitude</pre>				
ssb_1	= 64;	% Number of SSB in a SSB Burst Set	<pre>(&lt;= 30 kHz: 4 or 8; 120 kHz: 64)</pre>				
ssb_map30	= 0;	% Mapping alternative for SSB at 30 kHz	[0, 1]				
ssb_re	= 0;	% First RE of SSB	[0 : (n_rb_ssb - 20) * 12]				
ssb_p1_id	= [1 1];	% P1 index for 2 antennas for all SSBs	(index starts at 0)				
ssb_p2_id	<pre>= ones([1 64]);</pre>	<pre>% P2 index for all SSBs in a SSB Burst Se</pre>	t (index starts at 0)				

Figure 17. General and SSB Parameters

## WaveJudge Verification

5. Time domain power  $\rightarrow$  OK



Figure 18. SSB Time Domain Power

### 6. Mapping location $\rightarrow$ OK



Figure 19. SSB Mapping Location

7. Number of subcarriers  $\rightarrow$  OK

240 subcarriers = 20 PRBs



Figure 20. Number of Subcarriers

8. Cell ID =  $28 \rightarrow OK$ 

Cell 1: DL on RX 1

[0]	Frame 0, CellID=28	٠
🗉 Slot List	Count: 80	
⊡ [0]	slot 0	
🖂 Assignment	Count: 5	
⊡ [0]	PSS	

Figure 21. Cell ID in SSB

9. SSB Burst composition  $\rightarrow$  OK

![](_page_16_Figure_0.jpeg)

Figure 22. SSB Burst Composition

10. Periodicity (20 ms)  $\rightarrow$  OK

![](_page_17_Figure_0.jpeg)

Figure 23. SSB 20 ms periodicity

11. Error checking  $\rightarrow$  OK

Cell 1: DL on RX 1						WaveJu	dge	
□ [0]	Frame 0, CellID=28		Name	Start Time	Port	Direction	Error Chec	ŧ
<ul> <li>Slot List</li> </ul>	Count: 80		Slot	0000.00	1			
□ [0]	slot 0		PBCH	0004.99	1	D	ПК	3
🗆 Assignment	Count: 5		PBCH	0004.99	1	D	OK	3
□ [0]	PSS		PSS	0004.00	1	D D	on	Ŭ
KOffs	-24	- 11	222	0004.99	1	D D		
. [1]	SSS	- 11	Clas	0004.00	1	0		
□ [2]	PBCH	- 11	DDCU	0004.33	1	D	OF	
Modu	I QPSK	- 11		0005.12	1	0		2
Block	0	- 11	L DCC	0005.12	1	0	UK	3
TB Si	32	- 11	P55	0005.12	1	U		
⊞ [3]	PDCCH	- 11	555	0005.12	1	D		
± [4]	PBCH	- 11	Slot	0005.12	1	_		
⊞ [1]	slot 1	- 11	PBCH	0005.24	1	D	UK	3
	slot 2	- 11	PBCH	0005.24	1	D	ок	3
<u>⊞</u> [3]	slot 3	- 11	PSS	0005.24	1	D		
<u>⊞ [4]</u>	slot 4	- 11	SSS	0005.24	1	D		
E [5]	slot 5	- 11	Slot	0005.24	1			
<u>ш</u> (6)	slot 6	- 11	PBCH	0005.37	1	D	OK	3
<u>⊞ [/]</u>	slot /	- 11	PBCH	0005.37	1	D	OK	3
⊞ [8]	slot 8	- 11	PSS	0005.37	1	D		
E [9]	slot 9	- 11	SSS	0005.37	1	D		
<u>⊞</u> [10]	slot TU	- 11	Slot	0005.37	1			
<u>⊞ [11]</u>	slot 11	-11	PBCH	0005.49	1	D	OK	3
	slot 12	- 11	РВСН	0005.49	1	D	ОК	3
E [13]	SIDE 1.3	- 11	PSS	0005 49	1	D		
	slot 14	- 11	SSS	0005.49	1	- D		
	slot 16	- 11	Slot	0005.49	1	5		
	slot 10	- 11	PRCH	0005.62	1	n	0K	2
E [17]	slot 17	- 11	DDCU	0005.02	1	D D	OK	2
E [10]	slot 19	- 11	Dec	0005.02		D	UK	3
E [10]	slot 10	- 11	666	0005.62		D		
E [20]	slot 20		000	0003.62	1	U		
E [27]	slot 21		I SIOC	0005.62	-		or	
E [23]	slot 22		PBCH	0005.74	-	D	UK	3
E [24]	slot 24		PBCH	0005.74	1	U	UK	3
€ (25)	slot 25		PSS	0005.74	1	U		
	slot 26		SSS	0005.74	1	D		
	slot 27		Slot	0005.74	1			
	slot 28		PBCH	0005.87	1	D	OK	3
⊞ [29]	slot 29		PBCH	0005.87	1	D	OK	3
E (30)	slot 30		PSS	0005.87	1	D		
	1.4.01	-	ISSS	0005 87	1	D		

Figure 24. SSB Error Checking

#### 12. EVM and constellation $\rightarrow$ OK

![](_page_18_Figure_1.jpeg)

Figure 25. PSS EVM and Constellation

![](_page_18_Figure_3.jpeg)

Figure 26. SSS EVM and Constellation

![](_page_18_Figure_5.jpeg)

Figure 27. PBCH EVM and Constellation

#### 13. Spectral power (RB Offset) $\rightarrow$ OK

![](_page_19_Figure_1.jpeg)

Figure 28. SSB Spectral Power

## VSA Verification

![](_page_19_Figure_4.jpeg)

Figure 29. SSB VSA Verification

## PDCCH+PDSCH Analysis

#### Parameters

- PDCCH parameters (kma missed)
- CCE Start = 0
- CCE Length = 1
- TB Size = 56
- RNTI = 1
- Data n ID = 28
- DMRS n ID = 30
- Symbol Length = 1
- PDSCH parameters (extracted from.kma)

```
%% This is an example of a PDSCH configuration file
%% SIGNAL TYPE
standard = 'nr' % Only supported standard is NR
signal_type = 'PDSCH'
SE LOG MODE
mode_interactive = true
                                                            % If false then the console is closed inmediately
SS CAPTURE FILES
y0_file = 'C:\LocalTemp\TestTBPDSCH\y5_DL1.iq'
y1_file = 'C:\LocalTemp\TestTBPDSCH\y6_DL1.iq'
                                                                                           % File containing samples for antenna 0 at Fs_capt
% File containing samples for antenna at Fs_capt
                                                               & Sampling frequency of the capture expressed in samples per second
Fs_capt = 122.88e6
% Slot info
% Slot info
ns = 52 % Slot number within a frame
sample_offset = 798720 % offset to start cutting the slot (at Fs_capt)
cfo = 0 % CFO to apply in Hz
soft_en = true % Soft decoding enable [true:
llr_fix = false % Indicates if fixed-point representation for
snr_value = %0 % SNR
                                                                                                                               [true: soft-decoding, false: hard-decoding]
                                                               % Indicates if fixed-point representation for LLR is used
% General Parameters
n_cell_id = 28
mu = 3
                                                           % Cell ID
                                                                                                                                          [0 : 1007]
[0, 1, 3]
                                                               % Cell ID [0 : 1007]
§ Subcarrier scaling (2 ^ mu) * 15 kHz [0, 1, 3]
% RF frequency in Hz (set to 0 if no pre-compensation is needed)
fO
                 = 1024
= 66
= 0
                                                               % KF Irequency in n2 (set to 0 if no pre-compensation is needed)
% FFT size
% Number of resource blocks
% l1 : 275] BW = n_fft * (2 ^ mu) * 15 kHz
% Subcarrier offset in OFDM signal reception [-6, 0, +6]
% Bandwidth part start [0:274].
n_fft
n_rb
k_0
n_bwp_start = 0
dc_notch = false
                                                              & DC notch
n_rnti = 1 % UE RNTI
n_id = 28 % PDSCH N_ID for scrambling
                                                                 % Number of antennas
% Number of PDSCH layers
% IMCS for PDSCH
n_ant
n_layers
                    = 1
= 1
                                                                                                                                          [1, 2]
[1, 2]
                                                                                                                                         (0 : 27) if 256QAM is enabled; (0 : 28) otherwise
                                  - 0
imcs
                                                               % IMCS for PDSCH
% Enables 256QAM
% PDSCH N OH parameter
% First PDSCH PRB
% Last PDSCH PRB
% First PDSCH symbol
% Last PDSCH symbol
% First DMRS OFDM symbol
% First DMRS OFDM symbol
% Select between simples
 en_256gam
                                 = false
                                 = 0
n oh prb
                                                                % PDSCH N_OH parameter
% First PDSCH PRB [0 : (n_rb - 1)]
% Last PDSCH PRB [0 : (n_rb - 1)]
% First PDSCH symbol ([0 : 3] for mapping type Å, [0 : 12] for mapping type B)
% Last PDSCH symbol ([1 : 3] for mapping type Å, [0 : 12] for mapping type B)
% First DRSS OFDW symbol ([2, 3]: Mapping type Å; 0: Mapping type B)
% Select between single and double-symbol DMRS (1: Single-symbol; 2: Double-symbol)
% DMRS additional positions [0 : 3]
% DMRS type
first_prb
last_prb
                                 = 65
                              = 1
= 11
= 2
first_symb
last_symb
dmrs_10
dmrs_len
dmrs_add_pos
                                   = 1
                                   = 0
dmrs_type
dmrs_boosting
                                   = 1
= 0
= 0
                                                                 % DMRS type
% Boosting applied to DMRS
                                                                                                                                          [1, 2]
                                                                                                                                            (dB)
                                                                 % DMRS NSCID
% N_ID to use for DMRS
                                                                                                                                          10 : 11
dmrs n scid
                                                                   [0 : 1]

* N_ID to use for DMRS [0 : 65535]

* Antenna port indexes used for DMRS p = 1000 + X

* Number of DMRS CDM groups without data

* Enable PTRS

* Parameter - ----
 dmrs_n_id
                                  = 28
dmrs p
                                   = 0
dmrs_cdm_no_data = 1
ptrs_en = false
                                                                  % Parameter L_PTRS
% Parameter K_PTRS
% Parameter DL-PTRS-RE-offset
ptrs 1
                                  = 1
                                                                                                                                                                                                      [1, 2, 4]
ptrs_k
                                                                                                                                                                                                      [2, 4]
[0 : 3]
ptrs_re_offset
                                 = 0
                                    - 0
                                                                   % Association between PT-RS port and DMRS port dmrs_p(ptrs_p)
ptrs_p
```

Figure 30. PDSCH Parameters

## WaveJudge Verification

1. Time domain power  $\rightarrow$  OK

![](_page_21_Figure_2.jpeg)

Figure 31. PDCCH+PDSCH Time Domain Power

![](_page_21_Figure_4.jpeg)

2. Mapping location and number of subcarriers  $\rightarrow$  OK

Figure 32. PDCCH+PDSCH Mapping Location

#### 3. Cell ID = $28 \rightarrow OK$

[0]	Frame 6, CellID=28	
🖬 Slot List	Count: 80	
□ [0]	slot 0	
<ul> <li>Assignment List</li> </ul>	Count: 4	
<b>⊞</b> [0]	PSS	
<b>⊞</b> [1]	SSS	
<b>⊞</b> [2]	PBCH	
<b>⊞</b> [3]	PBCH	

Figure 33. PDCCH+PDSCH Cell ID

4.- Error checking  $\rightarrow$  OK

□ [52]	slot 52	Name	Start Ti	Port	D	Error
Assignment List	Count: 2	Slot	0013.63	2		
□ [0]	PDCCH	Slot	0013.75	2		
CCE Start	0	Slot	0013.88	2		
CCE Length	1	Slot	0014.00	2		
TB Size	56	Slot	0014.13	2		
BNTI	1	Slot	0014.25	2		
Data n ID	28	Slot	0014 38	2		
DMRS n ID	30	Slot	0014 50	2		
Symbol Length	1	Slot	0014.63	2		
⊡ [1]	PDSCH	Slot	0014.05	2		
⊞ CodeWords	Count: 1	Slot	0014.70	2		
BNTI	1	SIOC	0014.00	2		
Symbol Start	1	SIDE	0015.00	2		
Symbol Stop	11	Slot	0015.13	2		
RB start	0	Slot	0015.25	2		
RB Length	66	Slot	0015.38	2		
DMRS-config-type	1	Slot	0015.50	2		
DMRS-typeA-pos	2	Slot	0015.63	2		
DMRS-add-pos	0	Slot	0015.75	2		
Antenna Port Config	0	Slot	0015.88	2		
Transmission Scheme	SingleAntennaPort	Slot	0016.00	2		
Mapping Type	A	Slot	0016.13	2		
n SCID	0	Slot	0016.25	2		
Data n ID	Use N Cell ID	Slot	0016.38	2		
DMRS n ID	Use N Cell ID	PDCCH	0016.50	2	D	ОК
DMRS Duration	SingleSymbol	PDSCH	0016 50	2	D	ОК
L PTRS	1	Slot	0016 50	2	-	U.L.
K PTRS	2	elat	0010.00	2		

Figure 34. PDCCH+PDSCH Error Checking

5. EVM and constellation  $\rightarrow$  OK

		WaveJudge Messages List	Rel Amplitude UI Constellation: Cell 1 DL All			
Name	Start Ti., Port D., Error Ch	necking #Bytes Frame N., EVM	1 Code N Reso Power Tir			
Slot	0013.63 2	6		0.9		
Slot	0013.75 2	6		0.8		
Slot	0013.88 2	6		07		
Slot	0014.00 2	6		0.1		
Slot	0014.13 2	6			0 0 0 0 0 0	
Slot	0014.25 2	6		0.5		
Slot	0014.38 2	6		0.4		
Slot	0014.50 2	6		0.3		
Slot	0014.63 2	6		0.2		
Slot	0014.75 2	6				
Slot	0014.88 2	6		0.1		
Slot	0015.00 2	6		•	V	
Slot	0015.13 2	6		-0.1 - O		
Slot	0015.25 2	6		-0.2		
Slot	0015.38 2	6		-0.3		
Slot	0015.50 2	6		-04		
Slot	0015.63 2	6		-0.4		
Slot	0015.75 2	6		-0.5		
Slot	0015.88 2	6		-0.6		
Slot	0016.00 2	6		-0.7		
Slot	0016.13 2	6		-0.8		
Slot	0016.25 2	6		.0.9		
Slot	0016.38 2	6		-0.0		
PDCCH	0016.50 2 D OK	7 6 -80.34		-0.8 -0.6	-0.4 -0.2 0 0.2 0.4 0.6 0.8	
PDSCH	0016.50 2 D OK	261 6 -73.55	66		0.2 UI/div Rel Amplitude UI	
Slot	0016.50 2	6			Summary: BX 1 Al	
Slot	0016.63 2	6		Carrier Freq Err: 0	.000 kHz = 0.000 ppm	
71.4	0010 75 0	-		Carrier Freq Err: 0	.000 kHz = 0.000 ppm	

Figure 35. PDCCH+PDSCH EVM and Constellation

![](_page_23_Figure_2.jpeg)

6. Spectral power (RB Offset)  $\rightarrow$  OK

Figure 36. PDCCH+PDSCH Spectral Power

# Troubleshooting

1. If the following error message appears during WaveJudge launching, click on OK and operate as usual. Root cause of this problem has not been identified yet.

![](_page_24_Picture_2.jpeg)

Figure 37. Error Message during WaveJudge Launch

2. The following steps describe how to face errors shown in below figure:

Name	Start Ti	Port	D	Error Checking	# Bytes	Frame N	EVM	Code
Slot	0000.00	2				6		
PBCH	0010.00	2	D	OK	3	6	-69.44	
PBCH	0010.00	2	D	OK	3	6	-67.97	
PSS	0010.00	2	D			6	-72.35	
SSS	0010.00	2	D			6	-71.19	
BCCH-RRC	0010.00		D	Data Underflow	3			
BCCH-RRC	0010.00		D	Data Underflow	3			
Slot	0010.00	2				6		
PBCH	0010.13	2	D	OK	3	6	-68.95	
PBCH	0010.13	2	D	OK	3	6	-69.02	
PSS	0010.13	2	D			6	-00.49	
SSS	0010.13	2	D			6	-00.49	
BCCH-RRC	0010.13		D	Data Underflow	3			
BCCH-RRC	0010.13		D	Data Underflow	3			
Slot	0010.13	2				6		
PBCH	0010.25	2	D	OK	3	6	-69.37	
PBCH	0010.25	2	D	OK	3	6	-69.62	
PSS	0010.25	2	D			6	-72.35	
SSS	0010.25	2	D			6	-71.15	
BCCH-RRC	0010.25		D	Data Underflow	3			
BCCH-RRC	0010.25		D	Data Underflow	3			

Figure 38. Data Underflow Errors

Disable RRC messages doing:

2. Right click over Message List area -> Click on Chart Properties

![](_page_25_Picture_2.jpeg)

Figure 39. Disabling RRC Messages - Chart Properties

#### Disable RRC, NAS, IP, & Other

![](_page_25_Picture_5.jpeg)

Figure 40. Disabling RRC Messages - Disabling Options

Name	Start Ti	Port	D	Error Checking	# Bytes	Frame N	EVM Co
Slot	0000.00	2		^		6	
РВСН	0010.00	2	D	OK	3	6	-69.44
РВСН	0010.00	2	D	OK	3	6	-67.97
PSS	0010.00	2	D			6	-72.35
SSS	0010.00	2	D			6	-71.19
Slot	0010.00	2				6	
PBCH	0010.13	2	D	OK	3	6	-68.95
PBCH	0010.13	2	D	OK	3	6	-69.02
PSS	0010.13	2	D			6	-00.49
SSS	0010.13	2	D			6	-00.49
Slot	0010.13	2				6	
PBCH	0010.25	2	D	OK	3	6	-69.37
PBCH	0010.25	2	D	OK	3	6	-69.62
PSS	0010.25	2	D			6	-72.35
SSS	0010.25	2	D			6	-71.15
Slot	0010.25	2				6	
PBCH	0010.38	2	D	OK	3	6	-69.40
PBCH	0010.38	2	D	OK	3	6	-69.21
PSS	0010.38	2	D			6	-00.49
SSS	0010.38	2	D			6	-00.49

3. After the previous steps the View should look like the figure below:

Figure 41. View after correcting the errors

# Sanjole Wireless Analyzers

Sanjole Wireless Analyzers are industry-leading over-the-air communication sniffers, trusted as undisputed "source of truth" to find anomalies, uncover issues and quickly identify root cause in complex wireless systems.

With the addition of the Sanjole solutions, Keysight portfolio enhances its capabilities to provide industry-leading, end-to-end 5G solutions across the entire wireless ecosystem. Sanjole's software offerings will enhance Keysight's 5G solutions for modem, chipset, and radio access network (RAN) customers. Together, Keysight and Sanjole will be able to provide communications standards-validated interoperability testing, enable fast debugging, and accelerate time to deployment for customers.

To learn more about Sanjole Wireless Analyzers, please visit www.keysight.com/find/sanjole.

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![](_page_27_Picture_6.jpeg)