

Report on the Radio Testing

For

SmarDTV (UK) Limited

on

Project N63

Report no. TRA-029575-02-45-07C

2nd December 2016

RF929

Report Number: TRA-029575-02-45-07C
Issue: C

REPORT ON THE RADIO TESTING OF A
SmarDTV (UK) Limited
Project N63
WITH RESPECT TO SPECIFICATION
DFS requirements of FCC 47CFR15E

TEST DATE: 16/08/2016 to 03/10/2016

Written by: A Longley

A Longley
Radio Test Engineer

Approved by:

J Charters
Department Manager - Radio

Date: 2nd December 2016

Disclaimers:

- [1] THIS DOCUMENT MAY BE REPRODUCED ONLY IN ITS ENTIRETY AND WITHOUT CHANGE
[2] THE RESULTS CONTAINED IN THIS DOCUMENT RELATE ONLY TO THE ITEM(S) TESTED

RF929

1 Revision Record

<i>Issue Number</i>	<i>Issue Date</i>	<i>Revision History</i>
A	20 th October 2016	Original
B	15 th November 2016	Added note in about TPC
C	2 nd December 2016	EUT name change

2 Summary

TEST REPORT NUMBER:	TRA-029575-02-45-07C
WORKS ORDER NUMBER	TRA-029575-02
PURPOSE OF TEST:	Testing of radio frequency equipment per the relevant authorization procedure of chapter 47 of CFR (code of federal regulations) Part 2, subpart J.
TEST SPECIFICATION:	47CFR15.407(h)
EQUIPMENT UNDER TEST (EUT):	Project N63
FCC IDENTIFIER:	DKN-AVBX1
ISED CERTIFICATION NUMBER:	1707A-AVBX1
EUT SERIAL NUMBER:	E411006C00066D (Master), E411006C00012D (Client)
MANUFACTURER/AGENT: ADDRESS:	SmarDTV (UK) Limited Beckside Design Centre Millennium Business Park Station Rd Steeton Keighley West Yorkshire BD20 6QW United Kingdom
CLIENT CONTACT:	Chris Wordley ☎ 01535 659000 ✉ chris.wordley@smardtv.com
ORDER NUMBER:	POR01251
TEST DATE:	16/08/2016 to 03/10/2016
TESTED BY:	A Longley Element

2.1 Test Summary

Test Method and Description	Requirement Clause	Applicable to this equipment	Result / Note
	47CFR15		
TPC and DFS	15.407(h)	☒	Pass
U-NII detection bandwidth	15.407(h)(2)	☒	Pass
CAC	15.407(h)(2)(ii)	☒	Pass
In-service monitoring	15.407(h)(2)(iii) & 15.407(h)(2)(iv)	☒	Pass
Statistical performance check	-	☒	Pass

Note s:

The results contained in this report relate only to the items tested, in the condition at time of test, and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set-up and exercised using the configurations, modes of operation and arrangements defined in this report only. Any modifications made are identified in Section 8 of this report.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 5.2 of this test report (Deviations from Test Standards).

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4 Introduction

This report TRA-029575-02-45-07C presents the results of the Radio testing on a SmarDTV (UK) Limited, Project N63 to specification 47CFR15 Radio Frequency Devices.

The testing was carried out for SmarDTV (UK) Limited by Element, at the address(es) detailed below.

☒	Element Hull Unit E South Orbital Trading Park Hedon Road Hull HU9 1NJ UK	☐	Element Skelmersdale Unit 1 Pendle Place Skelmersdale West Lancashire WN8 9PN UK
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This report details the configuration of the equipment, the test methods used and any relevant modifications where appropriate.

FCC Site Listing:

The test laboratory is accredited for the above sites under the US-EU MRA, Designation number UK0009.

ISED Registration Number(s):

Element Skelmersdale	3930B
Element Hull	3483A

The test site requirements of ANSI C63.4-2014 are met up to 1GHz.

The test site SVSWR requirements of CISPR 16-1-4:2010 are met over the frequency range 1 GHz to 18 GHz.

5 Test Specifications

5.1 Normative References

- FCC 47 CFR Ch. I – Part 15 – Radio Frequency Devices.
- FCC KDB Publication 905462 D02 v01r02 – Compliance measurement procedures for unlicensed-national information infrastructure devices operating in the 5250-5350 MHz and 5470-5725 MHz bands incorporating dynamic frequency selection.

5.2 Deviations from Test Standards

There were no deviations from the test standard.

6 Glossary of Terms

§	denotes a section reference from the standard, not this document
AC	Alternating Current
ANSI	American National Standards Institute
BW	bandwidth
C	Celsius
CAC	Channel Availability Check
CFR	Code of Federal Regulations
CW	Continuous Wave
dB	decibel
dBm	dB relative to 1 milliwatt
DC	Direct Current
DFS	Dynamic Frequency Selection
DSSS	Direct Sequence Spread Spectrum
EIRP	Equivalent Isotropically Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
Hz	hertz
IC	Industry Canada (now ISED)
ISED	Innovation, Science and Economic Development Canada
ITU	International Telecommunication Union
LBT	Listen Before Talk
LE-LAN	Licence-Exempt Local Area Network
m	metre
max	maximum
MIMO	Multiple Input and Multiple Output
min	minimum
MRA	Mutual Recognition Agreement
N/A	Not Applicable
PCB	Printed Circuit Board
PDF	Portable Document Format
Pt-mpt	Point-to-multipoint
Pt-pt	Point-to-point
PSD	Power Spectral Density
RF	Radio Frequency
RH	Relative Humidity
RMS	Root Mean Square
Rx	receiver
s	second
SVSWR	Site Voltage Standing Wave Ratio
TPC	Transmitter Power Control
Tx	transmitter
UKAS	United Kingdom Accreditation Service
U-NII	Unlicensed-National Information Infrastructure
V	volt
W	watt
Ω	ohm

7 Equipment Under Test

7.1 EUT Identification

- Name: Project N63
- Serial Number: E411006C00066D (Master), E411006C00012D (Client)
- Model Number: S60
- Software Revision: Not Applicable
- Build Level / Revision Number: Not Applicable

7.2 System Equipment

Equipment listed below forms part of the overall test setup and is required for equipment functionality and/or monitoring during testing. The compliance levels achieved in this report relate only to the EUT and not items given in the following list.

A second N63 unit was connected as a Client device during testing, both units were controlled by a Laptop.

7.3 EUT Mode of Operation

7.3.1 Where channel loading is required

The mode of operation for tests was as follows...

Script files load_stbap.sh and START_TRAFFIC.sh contained parameters for data block sizes and distribution to give a channel loading of >17% (channel loading measurements indicated between 19% and 20% for all bandwidths, each bandwidth tested had a different set of parameters set by the script files). The EUT was associated with the Client device during testing.

The files and settings were supplied by the client by email on 27/09/2016, all tests reported here that required channel loading were performed after this date.

7.3.2 Where channel loading is not required

The mode of operation for tests was as follows...

The EUT was associated with the Client device during testing, where necessary the Master was set to indicate when a radar pulse had been successfully detected.

7.4 EUT Radio Frequency Parameters

7.4.1 General

Frequency of operation:	5180 to 5825 MHz
Modulation type(s):	802.11a/n/ac
Occupied channel bandwidth(s):	20MHz, 40MHz and 80MHz
Channel spacing:	By bandwidth
Warning against use of alternative antennas in user manual (yes/no):	Yes
Nominal Supply Voltage:	12V dc from power supply
Location of notice for license exempt use:	Label / user manual / both.
Method of prevention of use on non-US frequencies:	Frequency list programmed into EUT, see also Software Security.

7.4.2 Antennas

Type:	PCB
Frequency range:	5150 to 5850 MHz
Impedance:	50 Ω
Gain:	U-NII-2A: 4.2 dBi at channel tested U-NII-2C: 3.5 dBi at channel tested
Polarisation:	Linear
Connector type:	UFL
Length:	18mm
Mounting:	Fixed within EUT enclosure

7.4.3 Product specific declarations

Multiple antenna configuration(s), e.g. MIMO:	4 antennas mounted orthogonally within EUT enclosure
Fixed pt-pt operations (yes/no):	No
Software security description:	Detailed in file "Software Security Description S60.pdf" stored in Element job folder
TDWR interference information in users manual (yes/no):	Yes

DFS Parameters:	
Highest and lowest EIRP:	U-NII-2A 91.15 mW U-NII-2C 95.29 mW
Antenna used for testing:	All 4 antennas were connected to the DFS test set using a suitable combiner
Antenna port impedance:	50 ohms
Channel loading / test file:	START_TRAFFIC.sh
TPC description:	See Note 1
System architectures, data rates, U-NII channel bandwidths:	20MHz : 1.1M L:65000 40MHZ : 2.3M L:60000 80MHz : 5M L:60000
Power up cycle time:	To start of CAC: 20.8s To command prompt: 25.5s
Clients: Radar detection Master U-NII Device FCC ID	The Client module is reported separately

Note 1: 47CFR15.407 (h) (1); A Transmitter Power Control mechanism is not required for systems with an e.i.r.p of less than 500 mW. For e.i.r.p. values see Element test report TRA-029575-02-45-08C.

7.5 EUT Description

The EUT is a Multimedia Transcoder containing a dual band Wi-Fi router with Bluetooth. The radios are contained in two separate modules. The module covered by this report is a DFS Master device.

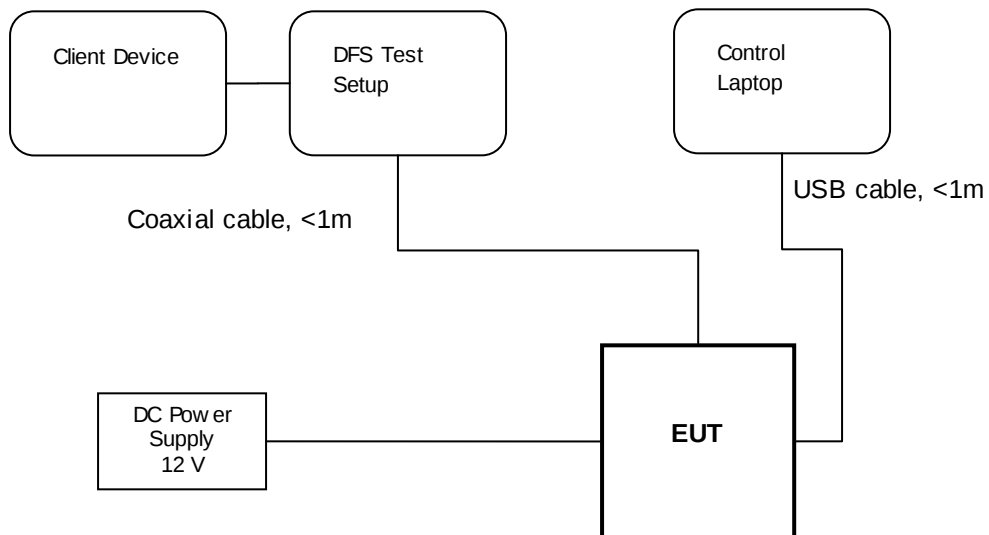
8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup

9.1 Block Diagram

The following diagram shows basic EUT interconnections with cable type and cable lengths identified:



9.2 General Set-up Photograph

The following photograph shows basic EUT set-up:

Photographs are withheld in accordance with client's FCC confidentiality request.

10 General Technical Parameters

10.1 Normal Conditions

The E U T was tested under the normal environmental conditions of the test laboratory, except where otherwise stated. The normal power source applied was approx. 12 V dc from the adaptor.

10.2 Varying Test Conditions

No varying test conditions were used during these tests.

11 Dynamic Frequency Selection (DFS)

11.1 General

An U-NII network will employ a Dynamic Frequency Selection (DFS) function to detect interference from radar systems (radar detection) and to avoid co-channel operation with these systems.

Within the context of the operation of the DFS function, a U-NII device will operate in either Master Mode or Client Mode. U-NII devices operating in Client Mode can only operate in a network controlled by a U-NII device operating in Master Mode.

11.2 Test Parameters

Test Location:	Element Hull
Test Chamber:	Lab 4
Test Standard and Clause:	KDB 905462 D02, Clause 7.8
EUT Tested Channel Bandwidths:	20 MHz, 40 MHz & 80 MHz
EUT Test Channel Loading:	Duty cycle >17%
EUT Output Power Setting:	Max.
EUT Tested Modes:	Master
Deviations From Standard:	None

Environmental Conditions (Normal Environment)

Temperature: 23 °C	Usually: +15 °C to +35 °C
Humidity: 45 %RH	Usually: 20%RH to 75%RH

Test Limits

Refer to individual tests for applicable tables, as defined below.

Table 3: Interference threshold values

<i>Maximum Transmit Power</i>	<i>Value (see notes 1, 2 and 3)</i>
EIRP $\geq$ 200 mW	-64 dBm
EIRP $<$ 200 mW and PSD $<$ 10 dBm/MHz	-62 dBm
EIRP $<$ 200 mW that do not meet the PSD requirement	-64 dBm
NOTE 1:	This is the level at the input of the receiver assuming a 0 dBi receive antenna.
NOTE 2:	Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.
NOTE 2:	EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.

Table 4: DFS requirement values

<i>Parameter</i>	<i>Value</i>
Non-Occupancy Period	Min. 30 minutes
Channel Availability Check Time	60 s
Channel Move Time	10 s (see note 1).
Channel Closing Transmission Time	200 ms + an aggregate of 60 ms over remaining 10 s period (see notes 1 & 2).
U-NII Detection Bandwidth	Min. 100 % of the U-NII 99% transmission power bandwidth (see note 3).
Maximum Off-Channel CAC Time	4 hours (see note 2)
NOTE 1:	<i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.
NOTE 2:	The <i>Channel Closing Transmission Time</i> is comprised of 200 ms starting at the beginning of the <i>Channel Move Time</i> plus any additional intermittent control signals required to facilitate a channel move (an aggregate of 60 ms) during the remainder of the 10 s period. The aggregate duration of control signals will not count quiet periods in-between transmissions.
NOTE 3:	During the <i>U-NII Detection Bandwidth</i> detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 %. Measurements are performed with no data traffic.

Table 5: Short pulse radar test signals

<i>Radar type</i>	<i>Pulse width (μs)</i>	<i>PRI (μs)</i>	<i>Number of pulses</i>	<i>Min. % of successful detection</i>	<i>Min. number of trials</i>
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a Test B: 15 unique PRI values randomly selected within the range of 518-3066 μs, with a minimum increment of 1 μs, excluding PRI values selected in Test A	Roundup: $1/360 \times 19.10^6 / \text{PRI}$	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120
NOTE 1: Short pulse radar type 0 should be used for detection bandwidth test, channel move time and channel closing time tests.					

Table 5a: Pulse repetition intervals for test A

<i>Pulse repetition frequency number</i>	<i>Pulse repetition frequency (pulses / s)</i>	<i>Pulse repetition interval (μs)</i>
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066

Table 6: Long pulse radar test signal

<i>Radar type</i>	<i>Pulse width (μs)</i>	<i>Chirp width (MHz)</i>	<i>PRI (μs)</i>	<i>Number of pulses per burst</i>	<i>Number of bursts</i>	<i>Min. % of successful detection</i>	<i>Min. number of trials</i>
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

Table 7: Frequency hopping radar test signal

<i>Radar type</i>	<i>Pulse width (μs)</i>	<i>PRI (μs)</i>	<i>Pulses per hop</i>	<i>Hopping rate (kHz)</i>	<i>Hopping sequence length (ms)</i>	<i>Min. % of successful detection</i>	<i>Min. number of trials</i>
6	1	333	9	0.333	300	70%	30

11.3 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure i, the wanted signal (Gen A) was set to establish a reliable link (approx. 10 dB above receiver threshold). The interfering signal (Gen B) was then introduced at the specified Radar Detection Threshold level, plus 1dB.

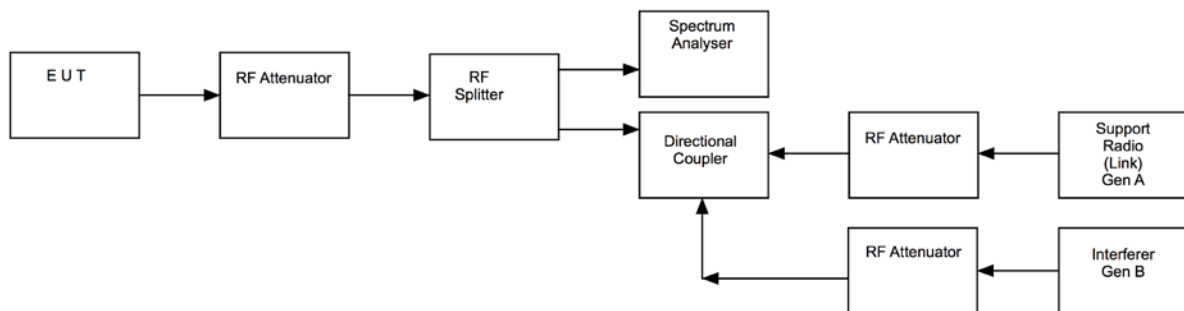
[1] Conducted method

Received power was measured at the antenna port. For multiple port devices, equal splitting was employed to ensure the same level was received at each antenna port.

[2] Radiated method

Received power was measured at the centre of the EUT.

Figure i Test Setup



EUT and setup photos are withheld due to confidentiality request.

11.4 Calibration

Antenna Gain

The test generator level setting was adjusted to take account of the worst case antenna gain for the frequencies tested in each band.

For U-NII-2A the antenna gain as specified by the client was: 4.2 dBi

For U-NII-2C the antenna gain as specified by the client was: 3.5 dBi

DFS Radar Waveforms

The RF attenuator nearest the EUT was set to provide sufficient attenuation not to overload the analyser whilst the EUT was at maximum power. The RF attenuator nearest the support radio was then set by increasing to the point where the EUT could no longer receive the signal (receiver threshold), then backing off 10dB. The RF attenuator nearest the signal generator was then set to provide sufficient isolation between the generator and the support radio.

The interferer (Gen B) was set to the centre of the test channel, Ch_r , in CW mode. The EUT was replaced with the spectrum analyser, whilst the analyser was replaced with a 50 ohm load. The level of the generator was adjusted to find the appropriate DFS threshold +1dB, adjusted for min. antenna gain (see above), measured on the spectrum analyser. The analyser and EUT were then returned to position and an offset added to the analyser to read the same level as measured at the EUT.

Each radar signal required was then observed on the spectrum analyser in a 3MHz RBW with peak detector.

12 U-NII Detection Bandwidth

12.1 Definition

99% power bandwidth.

The 99% Power Bandwidth is the bandwidth of the fundamental signal that contains 99% of the transmitted power of that signal, it may be determined using a spectrum analyser with an Occupied Bandwidth measurement function. Determination of the 99% power bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth between 1% and 5% of the bandwidth of the device under test.

12.2 Additional Test Parameters

EUT Test Channels, Ch_r.

Mid low band / Mid high band

EUT Operating Channels / Bandwidths:
(all bandwidths must be tested)

20 MHz, 40 MHz & 80 MHz

Test Limits

A U-NII device operating with any part of its 99% power bandwidth in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems.

The device must sense for radar signals at 100 percent of its 99% power bandwidth.

12.3 Test Method

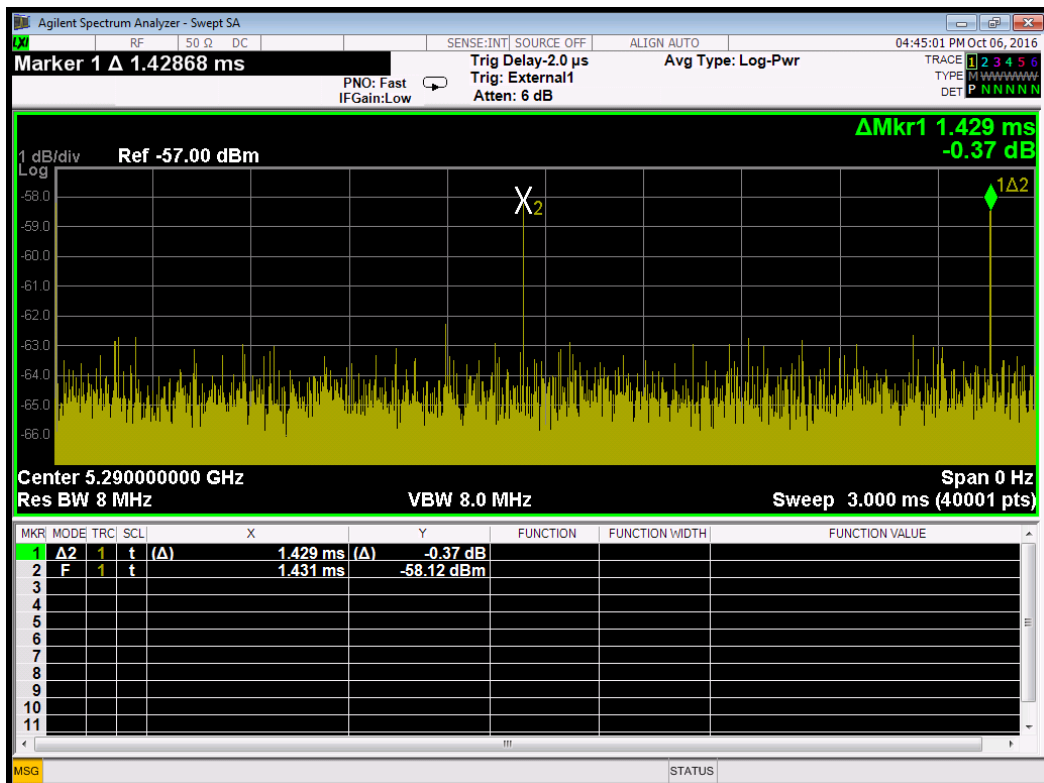
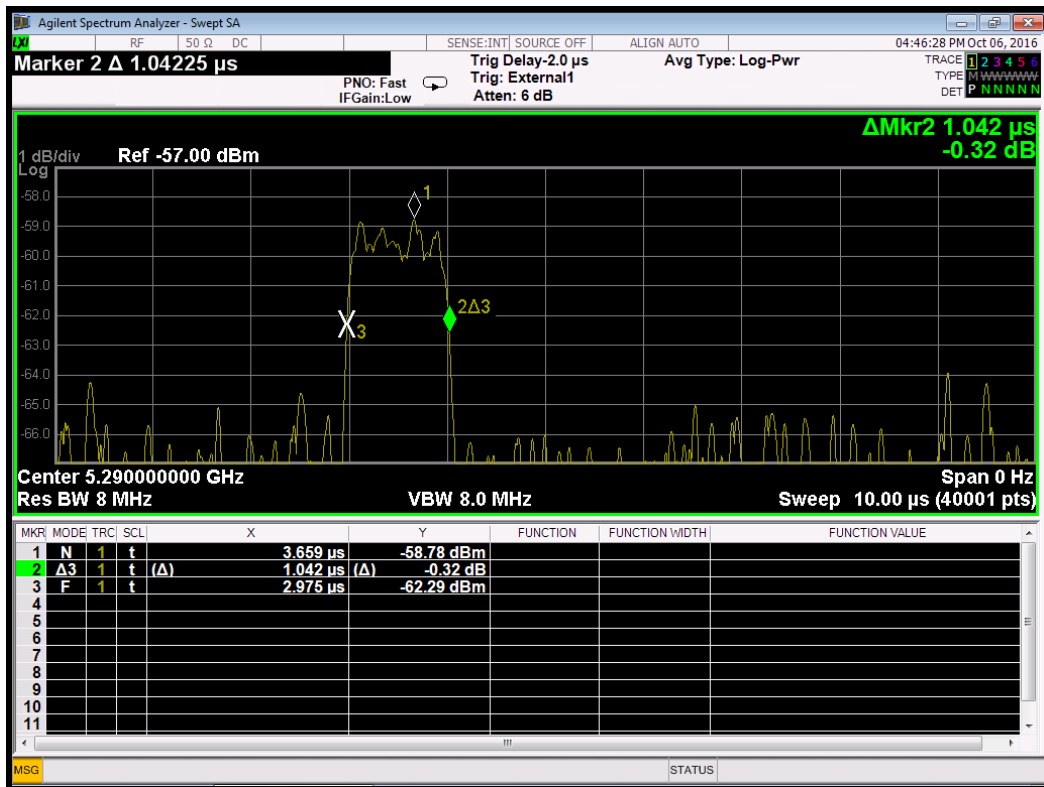
The EUT was switched on without an associated client/master and no traffic and set to channel, Ch_r. The interferer (Gen B) was set to the same frequency, Ch_r, and radar test signal # 0, of table 5 (at the threshold level). The interferer was present for one burst only and the EUT was observed for radar detections. The test signal and observations were repeated a further 9 times as recorded in the results.

This test was repeated in 5 MHz, then 1 MHz, increments of the interferer to find the upper and lower points where the detection rate fell below the requirement.

12.4 Test Equipment

<i>Equipment Description</i>	<i>Manufacturer</i>	<i>Equipment Type</i>	<i>Element No</i>	<i>Last Cal Calibration</i>	<i>Calibration Period</i>	<i>Due For Calibration</i>
DFS Test System	Aeroflex	PXI-1042	REF2152	05/07/2016	12	05/07/2017
Spectrum Analyser	Agilent	N9030A	REF2167	13/10/2015	12	13/10/2016

12.5 Test Results



EUT Channel: 5300 MHz; Bandwidth: 20 MHz;			
Radar test signal #0; Interference level: -58.8 dBm			
Test Frequency (MHz)	Number of bursts	Number detected	Requirement
Ch _r	10	10	90%
Ch _r + 5	10	10	90%
Ch _r + 10	10	10	90%
Ch _r + 11	10	0	90%
Ch _r - 5	10	10	90%
Ch _r - 10	10	10	90%
Ch _r - 11	10	0	90%

F_H (MHz)	F_L (MHz)	U-NII Detection Bandwidth (MHz)	99% Power bandwidth (MHz)	Result
5310	5290	20	18.005	PASS

EUT Channel: 5310 MHz; Bandwidth: 40 MHz;			
Radar test signal #0; Interference level: -58.8 dBm			
Test Frequency (MHz)	Number of bursts	Number detected	Requirement
Ch _r	10	10	90%
Ch _r + 5	10	10	90%
Ch _r + 10	10	10	90%
Ch _r +15	10	10	90%
Ch _r + 20	10	10	90%
Ch _r + 21	10	0	90%
Ch _r - 5	10	10	90%
Ch _r - 10	10	10	90%
Ch _r - 15	10	10	90%
Ch _r - 20	10	10	90%
Ch _r - 21	10	0	90%

F_H (MHz)	F_L (MHz)	U-NII Detection Bandwidth (MHz)	99% Power bandwidth (MHz)	Result
5330	5290	40	36.395	PASS

EUT Channel: 5290 MHz; Bandwidth: 80 MHz;			
Radar test signal #0; Interference level: -58.8 dBm			
Test Frequency (MHz)	Number of bursts	Number detected	Requirement
Ch _r	10	10	90%
Ch _r + 5	10	10	90%
Ch _r + 10	10	10	90%
Ch _r + 15	10	10	90%
Ch _r + 20	10	10	90%
Ch _r + 25	10	10	90%
Ch _r + 30	10	10	90%
Ch _r + 35	10	10	90%
Ch _r + 40	10	10	90%
Ch _r + 41	10	0	90%
Ch _r - 5	10	10	90%
Ch _r - 10	10	10	90%
Ch _r - 15	10	10	90%
Ch _r - 20	10	10	90%
Ch _r - 25	10	10	90%
Ch _r - 30	10	10	90%
Ch _r - 35	10	10	90%
Ch _r - 40	10	0	90%
Ch _r - 39	10	10	90%

F_H (MHz)	F_L (MHz)	U-NII Detection Bandwidth (MHz)	99% Power bandwidth (MHz)	Result
5330	5251	79	76.022	PASS

EUT Channel: 5560 MHz; Bandwidth: 20 MHz;			
Radar test signal #0; Interference level: -59.5 dBm			
Test Frequency (MHz)	Number of bursts	Number detected	Requirement
Ch _r	10	10	90%
Ch _r + 5	10	10	90%
Ch _r + 10	10	10	90%
Ch _r + 11	10	0	90%
Ch _r - 5	10	10	90%
Ch _r - 10	10	10	90%
Ch _r - 11	10	0	90%

F_H (MHz)	F_L (MHz)	U-NII Detection Bandwidth (MHz)	99% Power bandwidth (MHz)	Result
5570	5550	20	17.992	PASS

EUT Channel: 5550 MHz; Bandwidth: 40 MHz;			
Radar test signal #0; Interference level: -59.5 dBm			
Test Frequency (MHz)	Number of bursts	Number detected	Requirement
Ch _r	10	10	90%
Ch _r + 5	10	10	90%
Ch _r + 10	10	10	90%
Ch _r + 15	10	10	90%
Ch _r + 20	10	10	90%
Ch _r + 21	10	0	90%
Ch _r - 5	10	10	90%
Ch _r - 10	10	10	90%
Ch _r - 15	10	10	90%
Ch _r - 20	10	10	90%
Ch _r - 21	10	0	90%

F_H (MHz)	F_L (MHz)	U-NII Detection Bandwidth (MHz)	99% Power bandwidth (MHz)	Result
5570	5530	40	36.358	PASS

EUT Channel: 5530 MHz; Bandwidth: 80 MHz;			
Radar test signal #0; Interference level: -59.5 dBm			
Test Frequency (MHz)	Number of bursts	Number detected	Requirement
Ch _r	10	10	90%
Ch _r + 5	10	10	90%
Ch _r + 10	10	10	90%
Ch _r + 15	10	10	90%
Ch _r + 20	10	10	90%
Ch _r + 25	10	10	90%
Ch _r + 30	10	10	90%
Ch _r + 35	10	10	90%
Ch _r + 40	10	10	90%
Ch _r + 41	10	0	90%
Ch _r - 5	10	10	90%
Ch _r - 10	10	10	90%
Ch _r - 15	10	10	90%
Ch _r - 20	10	10	90%
Ch _r - 25	10	10	90%
Ch _r - 30	10	10	90%
Ch _r - 35	10	10	90%
Ch _r - 40	10	1	90%
Ch _r - 39	10	10	90%

F_H (MHz)	F_L (MHz)	U-NII Detection Bandwidth (MHz)	99% Power bandwidth (MHz)	Result
5570	5491	79	76.123	PASS

13 Channel Availability Check

13.1 Definition

The *Channel Availability Check (CAC)* is defined as a mechanism by which an U-NII device checks channels for the presence of radar signals. This mechanism is used for identifying *Available Channels*.

There shall be no transmissions by the U-NII device on the channels being checked during the initial CAC process.

If no radars have been detected on a channel, then that channel becomes an *Available Channel*.

13.2 Additional Test Parameters

EUT Channels At Switch On: Channels 58 (UNII-2A) & 106 (UNII-2C)

EUT CAC Channel Bandwidths: 80MHz

Test Limits

The U-NII device may start using the channel if no radar signal with a power level greater than the interference threshold values (listed in table 3) is detected within 60 seconds.

13.3 Test Method

[1] Length of CAC.

The EUT channel was selected, then switched off. The spectrum analyser was set to time domain (zero span) with sufficient bandwidth to capture all intentional emissions from the EUT. The EUT was then switched on and the analyser Element synchronised to the moment when the power-up sequence was completed. The length of the CAC is the time difference between the completion of the power-up sequence and the initiation of transmission on the selected channel.

[2] Radar detection.

The interferer (Gen B) was set to one of the signal types of table 5 at the reference level of table 3, increased by 1dB and muted. The EUT channel was selected, then switched off. The spectrum analyser was set to time domain (zero span) with sufficient bandwidth to capture all intentional emissions from the EUT. The EUT was then switched on and upon completion of the power-up sequence, the interferer (Gen B) was unmuted for a single burst. The spectrum analyser was monitored to ensure no transmissions occurred.

The test was repeated, but with a delay of approx. 57s prior to unmuting the interferer.

During testing the CAC time measurements were manually initiated at the point in the EUT boot sequence where the CAC test was started, marked by the message "Firmware init done".

13.4 Test Equipment

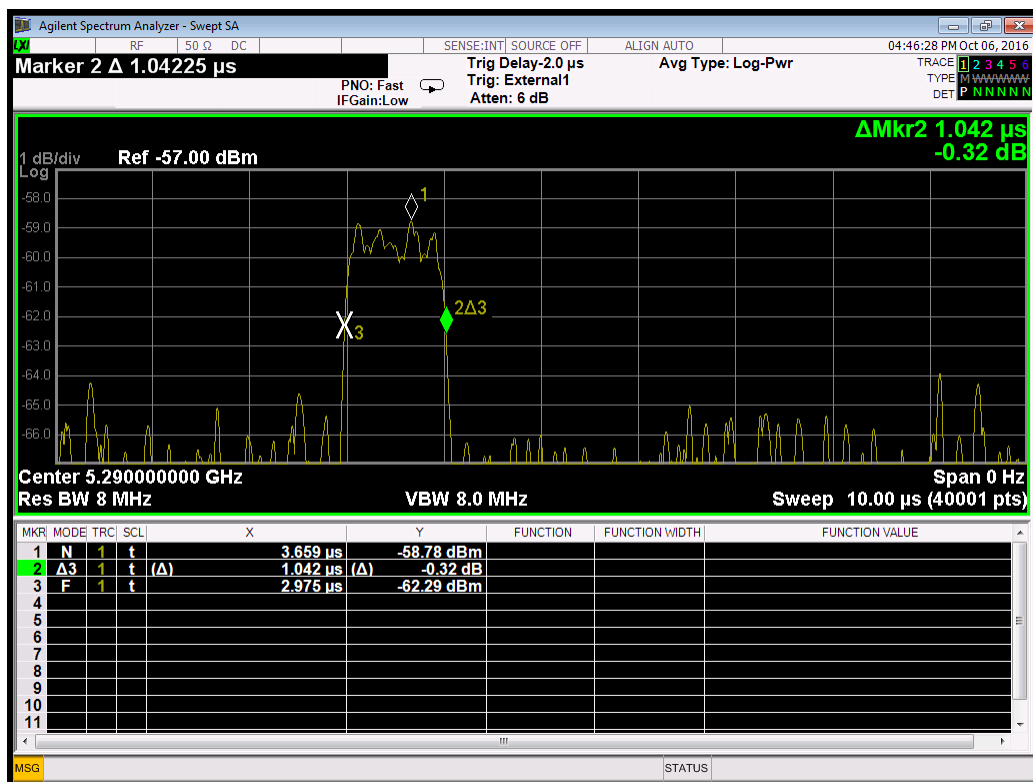
<i>Equipment Description</i>	<i>Manufacturer</i>	<i>Equipment Type</i>	<i>Element No</i>	<i>Last Cal Calibration</i>	<i>Calibration Period</i>	<i>Due For Calibration</i>
DFS Test System	Aeroflex	PXI-1042	REF2152	05/07/2016	12	05/07/2017
Spectrum Analyser	Agilent	N9030A	REF2167	13/10/2015	12	13/10/2016

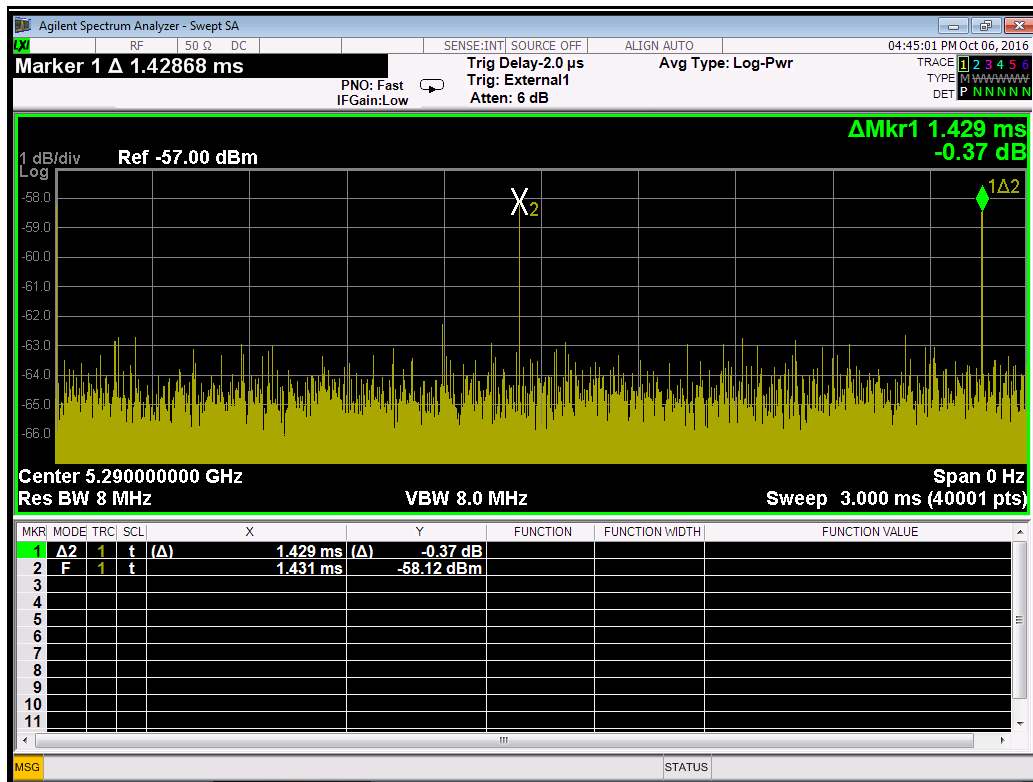
13.5 Test Results

[1] Length of CAC

Channel Bandwidth: 80 MHz					
Channel (MHz)	Completion of power-up sequence (s)	Start of transmission (s)	CAC length (s)	EUT transmissions during CAC	Result
5290	0	61.9	60	None	PASS
5530	0	61.6	60	None	PASS

[2] Radar detection





Channel: 5290 MHz; Bandwidth: 80 MHz; Interference level: -58.8 dBm				
Time of injection (s)	Radar test signal #	Pulse width (μs)	PRI (μs)	EUT transmits (Yes/No)
T1 + 03	0	1.042	1429	No
T1 + 57	0	1.042	1429	No



Channel: 5530 MHz; Bandwidth: 80 MHz; Interference level: -59.5 dBm				
Time of injection (s)	Radar test signal #	Pulse width (μs)	PRI (μs)	EUT transmits (Yes/No)
T1 + 03	0	1.042	1429	No
T1 + 57	0	1.042	1429	No



14 In-Service Monitoring

14.1 Definition

14.1.1 Channel Closing

The *Channel Closing* is defined as the process initiated by the U-NII device on an *Operating Channel* after a radar signal has been detected during the *In-Service Monitoring* on that channel.

The master device shall instruct all associated slave devices to stop transmitting on this channel, which they shall do within the *Channel Move Time*.

Slave devices with a Radar Interference Detection function, shall stop their own transmissions on an *Operating Channel* within the *Channel Move Time* upon detecting a radar signal within this channel.

The aggregate duration of all transmissions of the U-NII device on this channel during the *Channel Move Time* shall be limited to the *Channel Closing Transmission Time*. The aggregate duration of all transmissions shall not include quiet periods in-between transmissions.

For equipment having simultaneous transmissions on multiple (adjacent or non-adjacent) operating channels, only the channel(s) containing the frequency on which radar was detected is subject to the *Channel Closing* requirement. The equipment is allowed to continue transmissions on other *Operating Channels*.

14.1.2 Non-Occupancy Period

The *Non-Occupancy Period* is defined as the time during which the U-NII device shall not make any transmissions on a channel after a radar signal was detected on that channel.

For equipment having simultaneous transmissions on multiple (adjacent or non-adjacent) operating channels, only the channel(s) containing the frequency on which radar was detected is subject to the *Non-Occupancy Period* requirement. The equipment is allowed to continue transmissions on other *Operating Channels*.

After the *Non-Occupancy Period*, the channel needs to be identified again as an *Available Channel* before the U-NII device may start transmitting again on this channel.

14.2 Additional Test Parameters

EUT Test Channels, Ch _r .	Mid low band / Mid high band
EUT Operating Channels / Bandwidths:	Ch58/80MHz & Ch106/80MHz
Master Uniform Spreading:	Disabled

Test Limits

The *Channel Move Time* shall not exceed the limit defined in table 4.

The *Channel Closing Transmission Time* shall not exceed the limit defined in table 4.

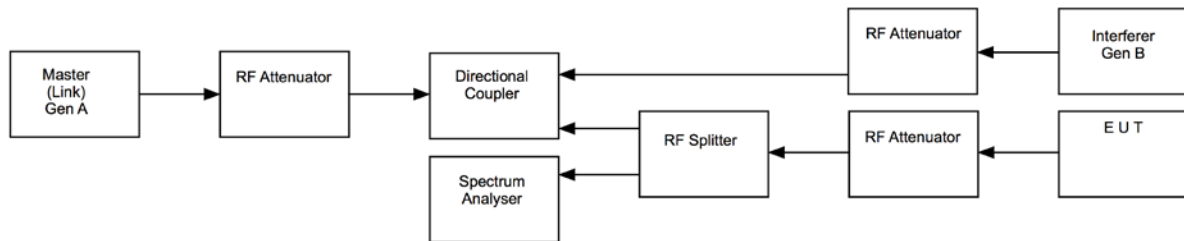
The *Non-Occupancy Period* shall not be less than the value defined in table 4.

14.3 Test Method

The EUT channel for both data and control signals, Ch_r, was selected, then transmissions to the paired device commenced. The interferer (Gen B) was set to the same frequency, Ch_r, and a radar test signal of table 5 (to appear at the Master at the threshold level + 1dB) then muted. The spectrum analyser was set to time domain (zero span) with sufficient bandwidth to capture all intentional emissions from the EUT. The analyser was then synchronised to the switching of the interferer – the interferer (Gen B) level was unmuted for a single burst. Transmissions from the EUT continued to be observed for a further 30 min.

Note, the set-up of figure ii was required to test slave mode, where the master is not the EUT.

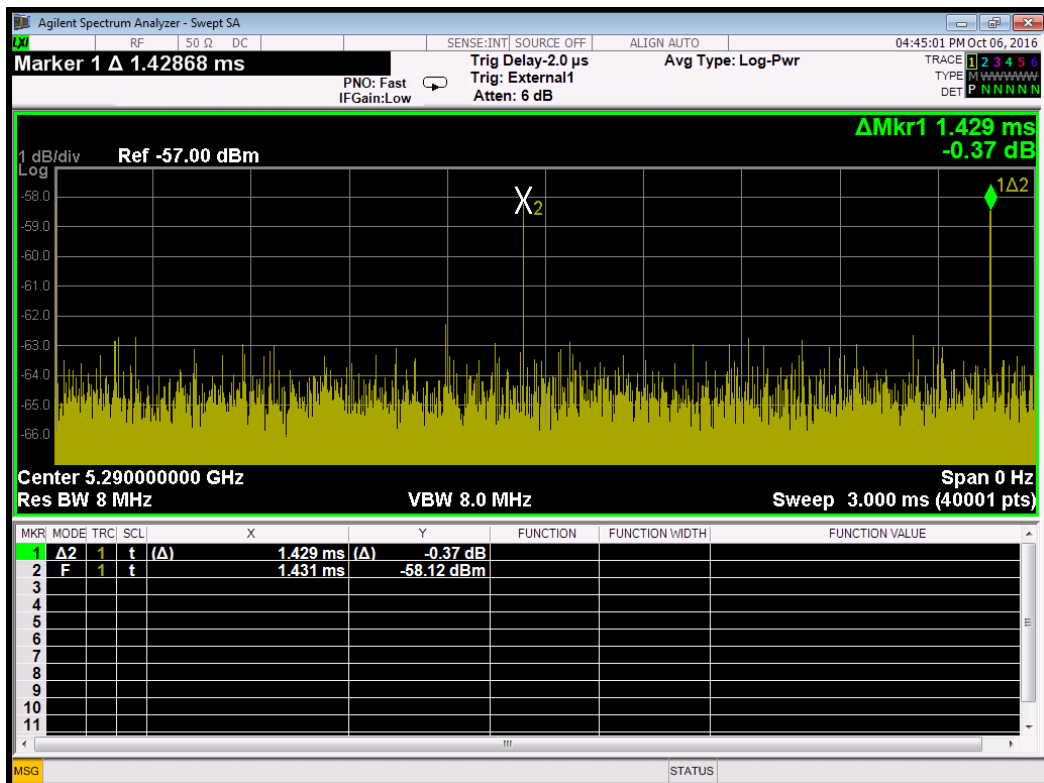
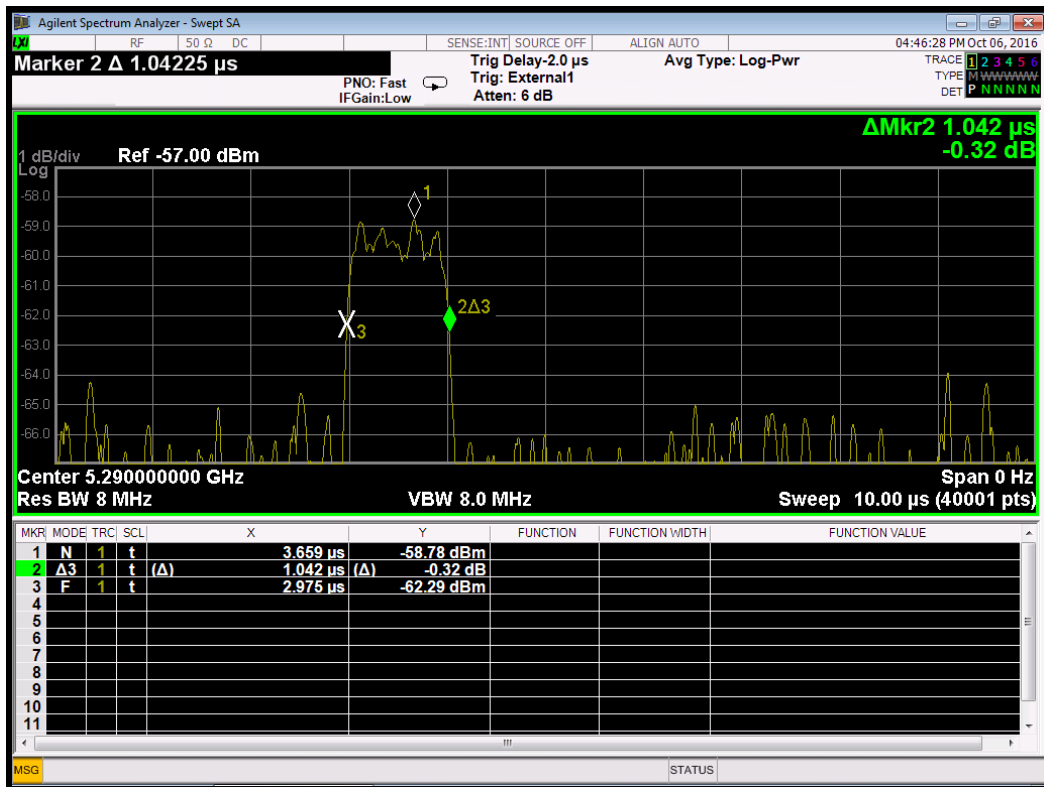
Figure ii Test Setup



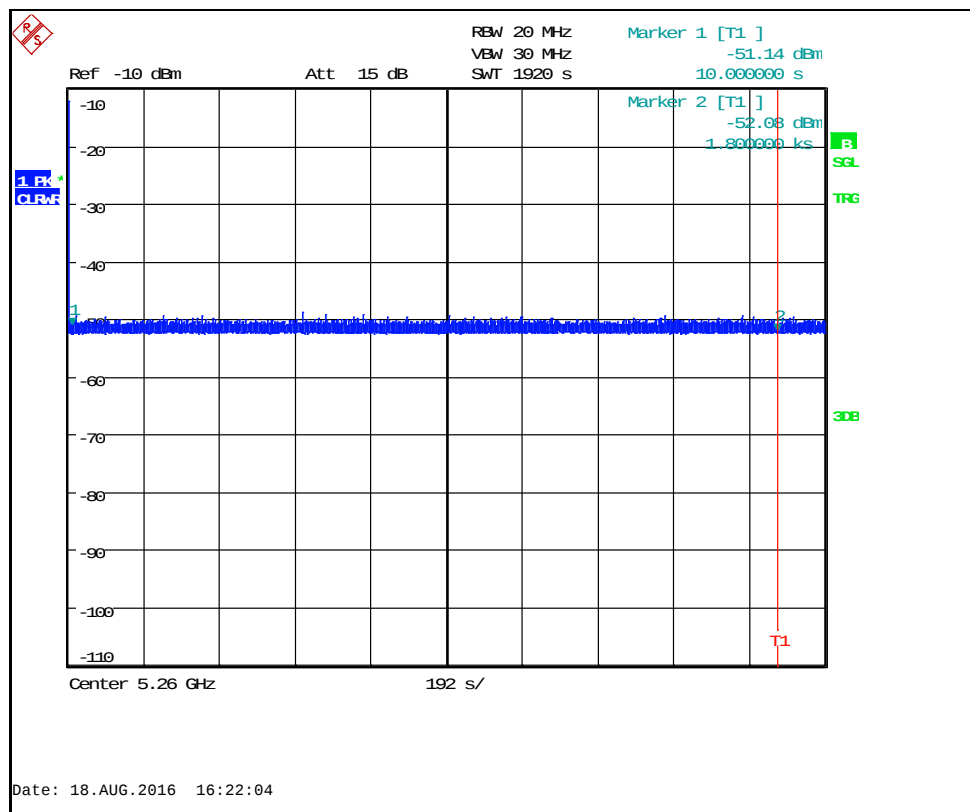
14.4 Test Equipment

<i>Equipment Description</i>	<i>Manufacturer</i>	<i>Equipment Type</i>	<i>Element No</i>	<i>Last Cal Calibration</i>	<i>Calibration Period</i>	<i>Due For Calibration</i>
DFS Test System	Aeroflex	PXI-1042	REF2152	05/07/2016	12	05/07/2017
Spectrum Analyser	Agilent	N9030A	REF2167	13/10/2015	12	13/10/2016

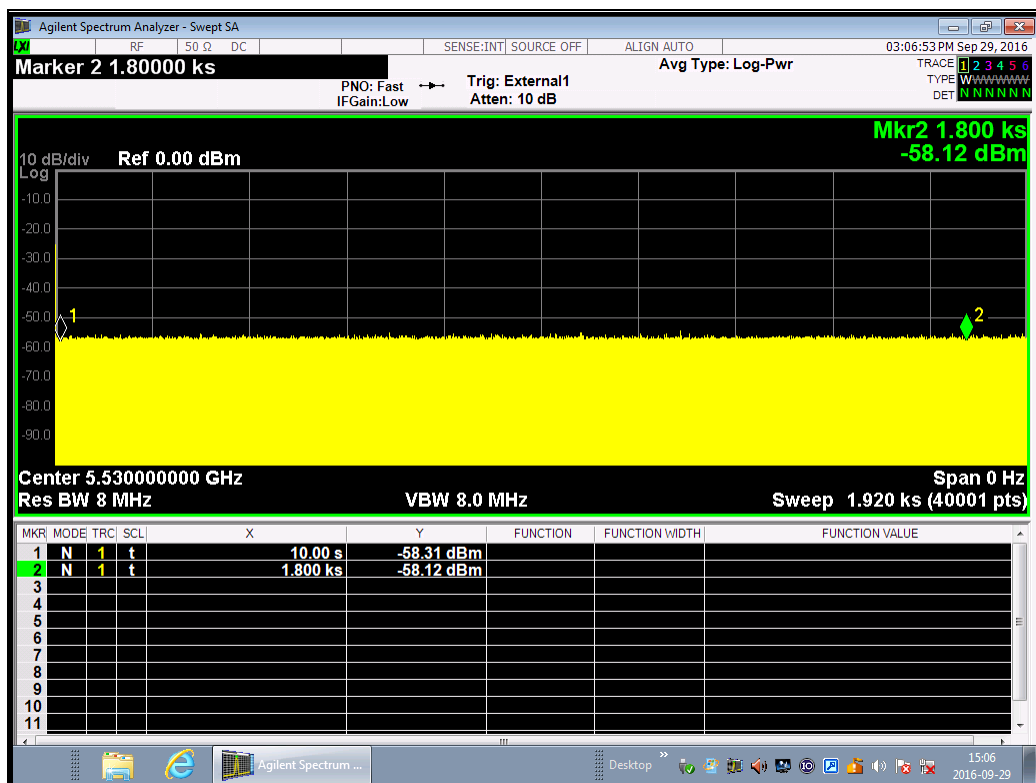
14.5 Test Results



Bandwidth: 80 MHz					
Channel (MHz)	Interference level (dBm)	Channel move time (s)	Channel Closing Transmission Time (ms)	Transmissions during non-occupancy period	Result
5290	-58.8	0.073833	15.575	None	PASS



Bandwidth: 80 MHz					
Channel (MHz)	Interference level (dBm)	Channel move time (s)	Channel Closing Transmission Time (ms)	Transmissions during non-occupancy period	Result
5530	-59.5	0.065999	17.594	None	PASS



15 Statistical Performance Check

15.1 Definition

The *In-Service Monitoring* is defined as the process by which a U-NII device monitors each *Operating Channel* for the presence of radar signals.

15.2 Additional Test Parameters

EUT Test Channels, Ch_r : Mid low band / Mid high band
 EUT Operating Channels / Bandwidths: 20 MHz, 40 MHz & 80 MHz

Test Limits

The *In-Service Monitoring* shall be used to monitor each *Operating Channel*.

The *In-Service-Monitoring* shall start immediately after the U-NII device has started transmissions on a channel.

During the *In-Service Monitoring*, the U-NII device shall be capable of detecting any of the radar test signals that fall within the ranges given by tables 5-7 with a level above the *Radar Detection Threshold* defined in table 3.

The minimum required detection probability associated with a given radar test signal is defined in tables 5-7.

15.3 Test Method

The EUT channel for both data and control signals, Ch_r , was selected, then transmissions to the paired device commenced. The interferer (Gen B) was set to the same frequency, Ch_r , and a radar test signal of table 5-7 (to appear at the Master at the threshold level + 1dB). The interferer was present for one burst only and the EUT was observed for radar detections.

Frequencies selected for statistical performance check should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel centre frequency

15.4 Test Equipment

Equipment Description	Manufacturer	Equipment Type	Element No	Last Cal Calibration	Calibration Period	Due For Calibration
DFS Test System	Aeroflex	PXI-1042	REF2152	05/07/2016	12	05/07/2017
Spectrum Analyser	Agilent	N9030A	REF2167	13/10/2015	12	13/10/2016

15.5 Test Results

Summary U-NII-2A 20MHz channels				
Radar Type	Number of trials	% successful	Limit (%)	Result
1	30	83.33	60	PASS
2	30	83.33	60	PASS
3	30	76.67	60	PASS
4	30	86.67	60	PASS
1-4	N/A	82.50	80	PASS
5	30	86.67	80	PASS
6	30	96.67	70	PASS

Summary U-NII-2A 40MHz channels				
Radar Type	Number of trials	% successful	Limit (%)	Result
1	30	100.00	60	PASS
2	30	73.33	60	PASS
3	30	80.00	60	PASS
4	30	76.67	60	PASS
1-4	N/A	82.50	80	PASS
5	30	96.67	80	PASS
6	30	100.00	70	PASS

Summary U-NII-2A 80MHz channels				
Radar Type	Number of trials	% successful	Limit (%)	Result
1	30	100.00	60	PASS
2	30	73.33	60	PASS
3	30	73.33	60	PASS
4	30	80.00	60	PASS
1-4	N/A	81.67	80	PASS
5	30	83.33	80	PASS
6	30	100.00	70	PASS

Pulse 1 U-NII-2A			
Interference level: -58.8 dBm			
Test #	Channel 5300 MHz BW 20 MHz Detected (Y/N)	Channel 5310 MHz BW 40 MHz Detected (Y/N)	Channel 5290 MHz BW 80 MHz Detected (Y/N)
1	Y	Y	Y
2	N	Y	Y
3	Y	Y	Y
4	Y	Y	Y
5	Y	Y	Y
6	Y	Y	Y
7	Y	Y	Y
8	N	Y	Y
9	Y	Y	Y
10	Y	Y	Y
11	Y	Y	Y
12	N	Y	Y
13	N	Y	Y
14	Y	Y	Y
15	Y	Y	Y
16	Y	Y	Y
17	Y	Y	Y
18	Y	Y	Y
19	Y	Y	Y
20	Y	Y	Y
21	N	Y	Y
22	Y	Y	Y
23	Y	Y	Y
24	Y	Y	Y
25	Y	Y	Y
26	Y	Y	Y
27	Y	Y	Y
28	Y	Y	Y
29	Y	Y	Y
30	Y	Y	Y
Total	25	30	30

Pulse 2 U-NII-2A			
Interference level: -58.8 dBm			
Test #	Channel 5300 MHz BW 20 MHz Detected (Y/N)	Channel 5310 MHz BW 40 MHz Detected (Y/N)	Channel 5290 MHz BW 80 MHz Detected (Y/N)
1	N	N	N
2	Y	N	Y
3	Y	N	Y
4	Y	Y	Y
5	N	Y	N
6	Y	Y	N
7	Y	Y	Y
8	Y	Y	Y
9	Y	Y	Y
10	N	N	Y
11	Y	N	Y
12	Y	Y	N
13	Y	Y	N
14	Y	Y	Y
15	Y	Y	Y
16	Y	Y	N
17	Y	Y	N
18	Y	Y	Y
19	N	Y	Y
20	Y	N	Y
21	N	Y	Y
22	Y	Y	Y
23	Y	Y	Y
24	Y	N	Y
25	Y	Y	Y
26	Y	Y	Y
27	Y	Y	Y
28	Y	N	Y
29	Y	Y	N
30	Y	Y	Y
Total	25	22	22

Pulse 3 U-NII-2A			
Interference level: -58.8 dBm			
Test #	Channel 5300 MHz BW 20 MHz Detected (Y/N)	Channel 5310 MHz BW 40 MHz Detected (Y/N)	Channel 5290 MHz BW 80 MHz Detected (Y/N)
1	N	N	N
2	N	Y	N
3	N	Y	Y
4	N	Y	N
5	Y	Y	Y
6	Y	Y	Y
7	Y	Y	N
8	Y	Y	Y
9	Y	Y	N
10	Y	N	Y
11	Y	Y	Y
12	Y	Y	N
13	Y	N	Y
14	Y	Y	Y
15	Y	Y	Y
16	Y	N	Y
17	Y	Y	Y
18	Y	Y	Y
19	Y	Y	Y
20	N	Y	Y
21	Y	N	Y
22	N	Y	Y
23	Y	N	Y
24	Y	Y	Y
25	Y	Y	Y
26	Y	Y	Y
27	Y	Y	N
28	N	Y	Y
29	Y	Y	Y
30	Y	Y	N
Total	23	24	22

Pulse 4 U-NII-2A			
Interference level: -58.8 dBm			
Test #	Channel 5300 MHz BW 20 MHz Detected (Y/N)	Channel 5310 MHz BW 40 MHz Detected (Y/N)	Channel 5290 MHz BW 80 MHz Detected (Y/N)
1	N	N	N
2	Y	Y	Y
3	Y	Y	N
4	Y	Y	Y
5	Y	Y	Y
6	N	Y	N
7	Y	Y	Y
8	Y	Y	Y
9	Y	Y	Y
10	N	Y	Y
11	Y	Y	Y
12	Y	Y	Y
13	Y	Y	Y
14	Y	Y	Y
15	Y	N	Y
16	Y	N	Y
17	Y	N	Y
18	Y	Y	Y
19	Y	Y	Y
20	Y	Y	Y
21	Y	Y	N
22	Y	Y	N
23	Y	Y	Y
24	N	Y	Y
25	Y	Y	Y
26	Y	Y	Y
27	Y	N	N
28	Y	Y	Y
29	Y	N	Y
30	Y	N	Y
Total	26	23	24

Pulse 5 U-NII-2A			
Interference level: -58.8 dBm			
Test #	Channel 5300 MHz BW 20 MHz Detected (Y/N)	Channel 5310 MHz BW 40 MHz Detected (Y/N)	Channel 5290 MHz BW 80 MHz Detected (Y/N)
1	N	Y	Y
2	Y	Y	Y
3	N	Y	Y
4	Y	Y	Y
5	Y	Y	Y
6	Y	Y	Y
7	Y	Y	N
8	Y	Y	Y
9	Y	Y	Y
10	Y	Y	Y
11	Y	Y	Y
12	Y	Y	Y
13	Y	Y	Y
14	Y	Y	Y
15	Y	Y	Y
16	Y	Y	Y
17	Y	Y	Y
18	Y	Y	N
19	Y	Y	N
20	Y	Y	Y
21	Y	Y	Y
22	N	Y	Y
23	Y	Y	Y
24	Y	Y	Y
25	N	Y	N
26	Y	Y	Y
27	Y	Y	Y
28	Y	Y	Y
29	Y	Y	N
30	Y	N	Y
Total	26	29	25

Pulse 6 U-NII-2A			
Interference level: -58.8 dBm			
Test #	Channel 5300 MHz BW 20 MHz Detected (Y/N)	Channel 5310 MHz BW 40 MHz Detected (Y/N)	Channel 5290 MHz BW 80 MHz Detected (Y/N)
1	Y	Y	Y
2	Y	Y	Y
3	Y	Y	Y
4	Y	Y	Y
5	Y	Y	Y
6	Y	Y	Y
7	Y	Y	Y
8	Y	Y	Y
9	Y	Y	Y
10	Y	Y	Y
11	Y	Y	Y
12	Y	Y	Y
13	Y	Y	Y
14	Y	Y	Y
15	Y	Y	Y
16	Y	Y	Y
17	Y	Y	Y
18	Y	Y	Y
19	Y	Y	Y
20	Y	Y	Y
21	Y	Y	Y
22	Y	Y	Y
23	Y	Y	Y
24	N	Y	Y
25	Y	Y	Y
26	Y	Y	Y
27	Y	Y	Y
28	Y	Y	Y
29	Y	Y	Y
30	Y	Y	Y
Total	29	30	30

Summary U-NII-2C 20MHz channels				
Radar Type	Number of trials	% successful	Limit (%)	Result
1	30	90.00	60	PASS
2	30	76.67	60	PASS
3	30	83.33	60	PASS
4	30	96.67	60	PASS
1-4	N/A	85.00	80	PASS
5	30	83.33	80	PASS
6	30	100.00	70	PASS

Summary U-NII-2C 40MHz channels				
Radar Type	Number of trials	% successful	Limit (%)	Result
1	30	96.67	60	PASS
2	30	80.00	60	PASS
3	30	83.33	60	PASS
4	30	96.67	60	PASS
1-4	N/A	89.17	80	PASS
5	30	93.33	80	PASS
6	30	100.00	70	PASS

Summary U-NII-2C 80MHz channels				
Radar Type	Number of trials	% successful	Limit (%)	Result
1	30	100.00	60	PASS
2	30	76.67	60	PASS
3	30	66.67	60	PASS
4	30	86.67	60	PASS
1-4	N/A	82.50	80	PASS
5	30	96.67	80	PASS
6	30	100.00	70	PASS

Pulse 1 U-NII-2C			
Interference level: -59.5 dBm			
Test #	Channel 5560 MHz BW 20 MHz Detected (Y/N)	Channel 5550 MHz BW 40 MHz Detected (Y/N)	Channel 5530 MHz BW 80 MHz Detected (Y/N)
1	Y	Y	Y
2	Y	Y	Y
3	Y	Y	Y
4	Y	Y	Y
5	N	Y	Y
6	Y	Y	Y
7	Y	Y	Y
8	N	N	Y
9	Y	Y	Y
10	Y	Y	Y
11	Y	Y	Y
12	Y	Y	Y
13	Y	Y	Y
14	Y	Y	Y
15	Y	Y	Y
16	Y	Y	Y
17	Y	Y	Y
18	Y	Y	Y
19	Y	Y	Y
20	Y	Y	Y
21	Y	Y	Y
22	Y	Y	Y
23	Y	Y	Y
24	Y	Y	Y
25	Y	Y	Y
26	N	Y	Y
27	Y	Y	Y
28	Y	Y	Y
29	Y	Y	Y
30	Y	Y	Y
Total	27	29	30

Pulse 2 U-NII-2C			
Interference level: -59.5 dBm			
Test #	Channel 5560 MHz BW 20 MHz Detected (Y/N)	Channel 5550 MHz BW 40 MHz Detected (Y/N)	Channel 5530 MHz BW 80 MHz Detected (Y/N)
1	Y	N	Y
2	Y	N	Y
3	N	Y	Y
4	Y	N	Y
5	N	Y	N
6	Y	N	N
7	Y	Y	Y
8	N	Y	N
9	N	Y	Y
10	Y	Y	Y
11	N	Y	Y
12	Y	Y	N
13	Y	Y	Y
14	Y	N	Y
15	Y	Y	Y
16	Y	Y	Y
17	Y	Y	Y
18	Y	Y	Y
19	Y	Y	N
20	Y	N	N
21	N	Y	N
22	N	Y	Y
23	N	Y	Y
24	Y	Y	Y
25	Y	Y	Y
26	Y	Y	Y
27	Y	Y	Y
28	Y	Y	Y
29	Y	Y	Y
30	N	Y	Y
Total	21	24	23

Pulse 3 U-NII-2C			
Interference level: -59.5 dBm			
Test #	Channel 5560 MHz BW 20 MHz Detected (Y/N)	Channel 5550 MHz BW 40 MHz Detected (Y/N)	Channel 5530 MHz BW 80 MHz Detected (Y/N)
1	N	N	N
2	Y	Y	N
3	Y	Y	Y
4	N	Y	N
5	Y	N	N
6	Y	Y	Y
7	Y	Y	Y
8	Y	Y	N
9	Y	Y	Y
10	Y	Y	Y
11	Y	Y	Y
12	Y	Y	Y
13	Y	Y	Y
14	Y	Y	N
15	Y	Y	Y
16	N	Y	N
17	N	Y	Y
18	N	N	Y
19	Y	Y	Y
20	Y	Y	N
21	Y	N	Y
22	Y	Y	Y
23	Y	N	Y
24	Y	Y	N
25	Y	N	Y
26	Y	Y	Y
27	Y	Y	Y
28	Y	Y	N
29	Y	Y	Y
30	Y	Y	Y
Total	25	25	20

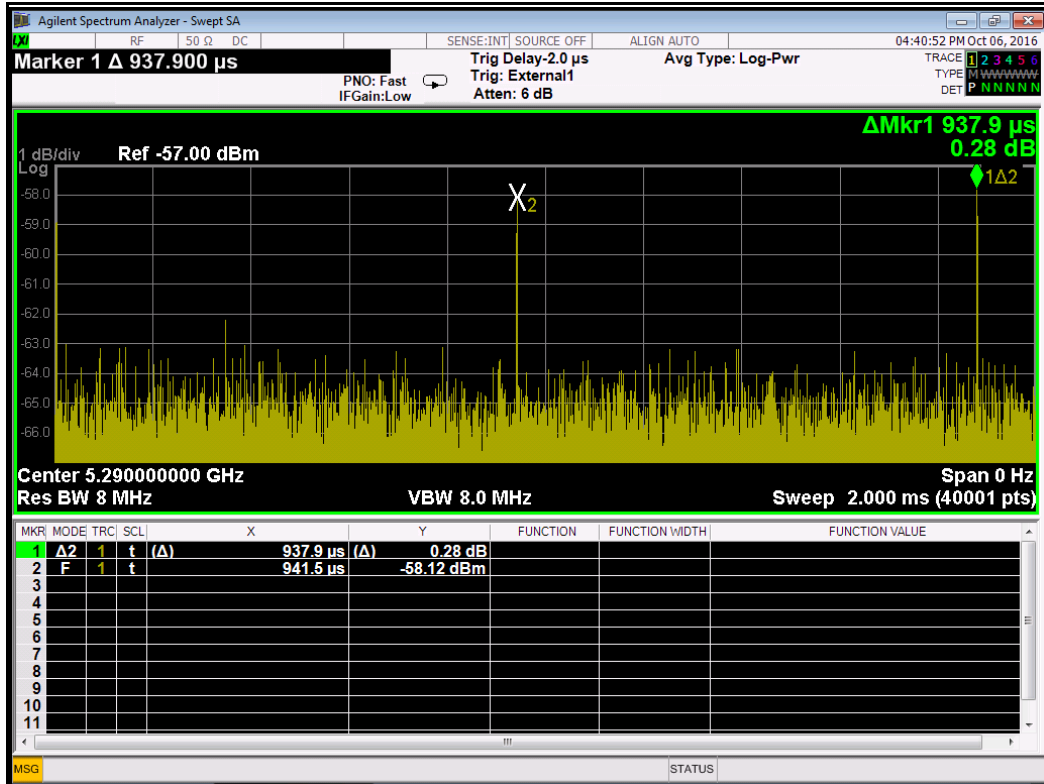
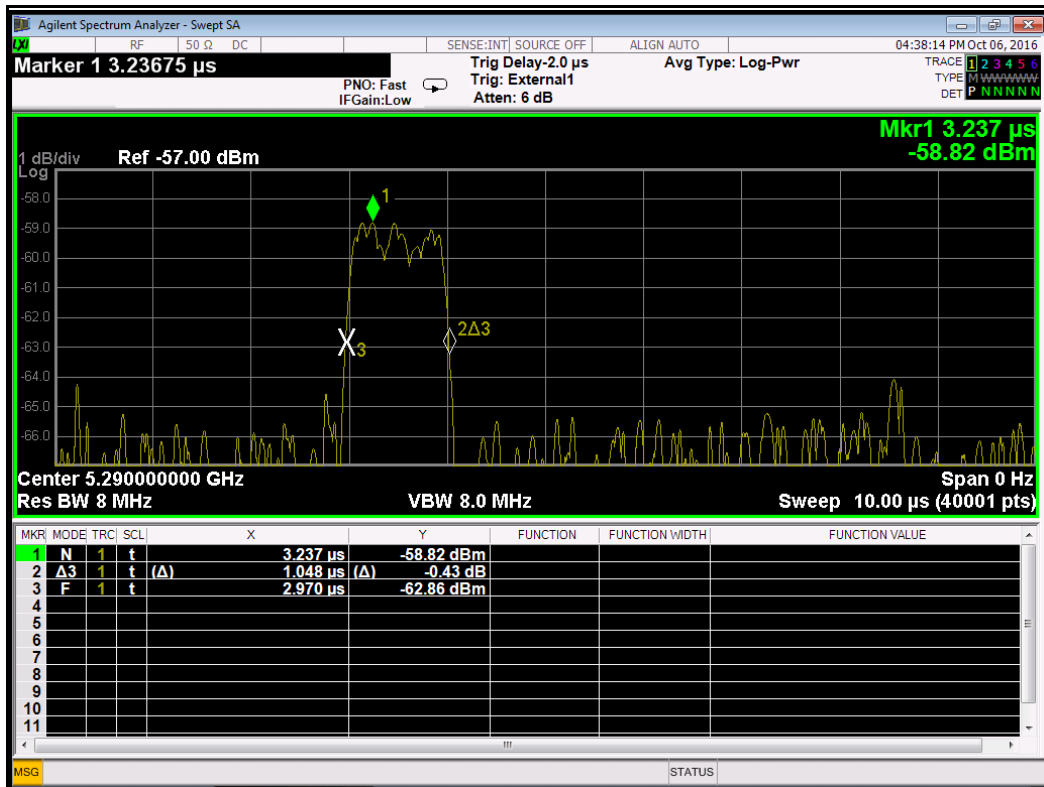
Pulse 4 U-NII-2C			
Interference level: -59.5 dBm			
Test #	Channel 5560 MHz BW 20 MHz Detected (Y/N)	Channel 5550 MHz BW 40 MHz Detected (Y/N)	Channel 5530 MHz BW 80 MHz Detected (Y/N)
1	Y	Y	N
2	Y	Y	Y
3	Y	Y	Y
4	Y	Y	Y
5	Y	Y	Y
6	Y	Y	Y
7	Y	Y	Y
8	Y	Y	Y
9	N	Y	Y
10	Y	Y	N
11	Y	Y	Y
12	Y	Y	Y
13	Y	N	Y
14	Y	Y	Y
15	Y	Y	N
16	Y	Y	Y
17	Y	Y	Y
18	Y	Y	Y
19	Y	Y	Y
20	Y	Y	Y
21	Y	Y	Y
22	Y	Y	Y
23	Y	Y	Y
24	Y	Y	Y
25	Y	Y	Y
26	Y	Y	N
27	Y	Y	Y
28	Y	Y	Y
29	Y	Y	Y
30	Y	Y	Y
Total	29	29	26

Pulse 5 U-NII-2C			
Interference level: -59.5 dBm			
Test #	Channel 5560 MHz BW 20 MHz Detected (Y/N)	Channel 5550 MHz BW 40 MHz Detected (Y/N)	Channel 5530 MHz BW 80 MHz Detected (Y/N)
1	Y	Y	Y
2	Y	Y	Y
3	Y	Y	Y
4	N	Y	Y
5	Y	Y	Y
6	Y	Y	Y
7	Y	Y	Y
8	Y	Y	Y
9	Y	Y	Y
10	Y	Y	Y
11	Y	Y	Y
12	N	N	N
13	N	Y	Y
14	Y	Y	Y
15	Y	Y	Y
16	Y	Y	Y
17	Y	Y	Y
18	Y	Y	Y
19	N	Y	Y
20	Y	Y	Y
21	Y	Y	Y
22	N	Y	Y
23	Y	Y	Y
24	Y	Y	Y
25	Y	Y	Y
26	Y	Y	Y
27	Y	Y	Y
28	Y	Y	Y
29	Y	Y	Y
30	Y	N	Y
Total	25	28	29

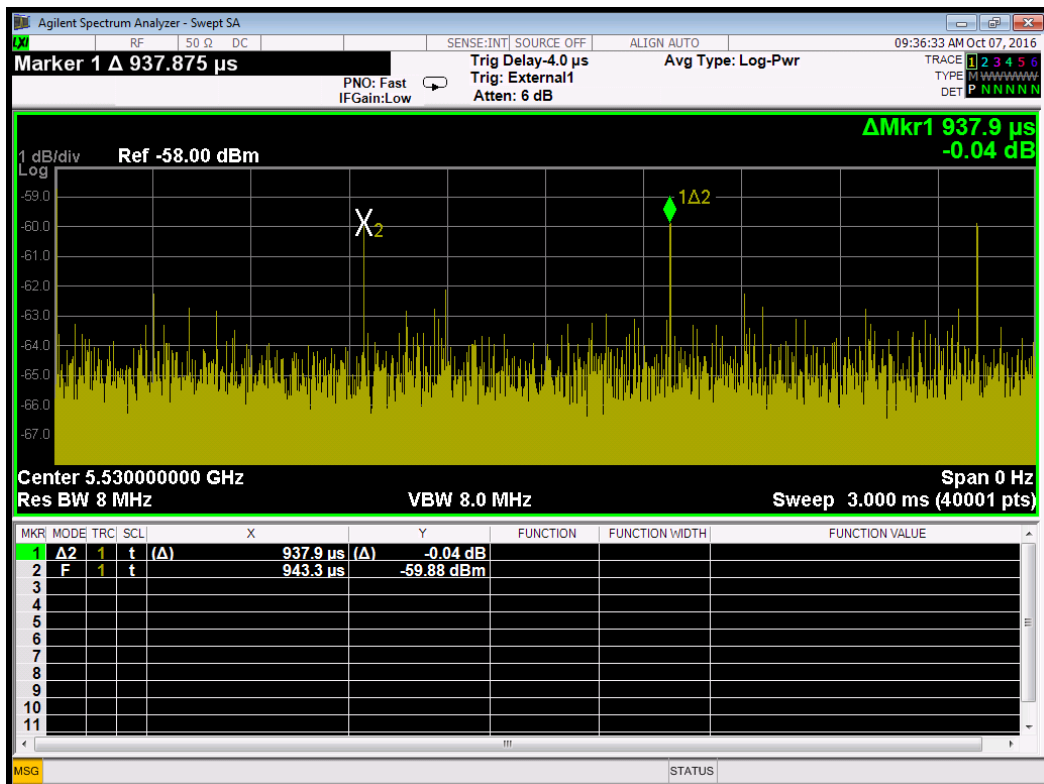
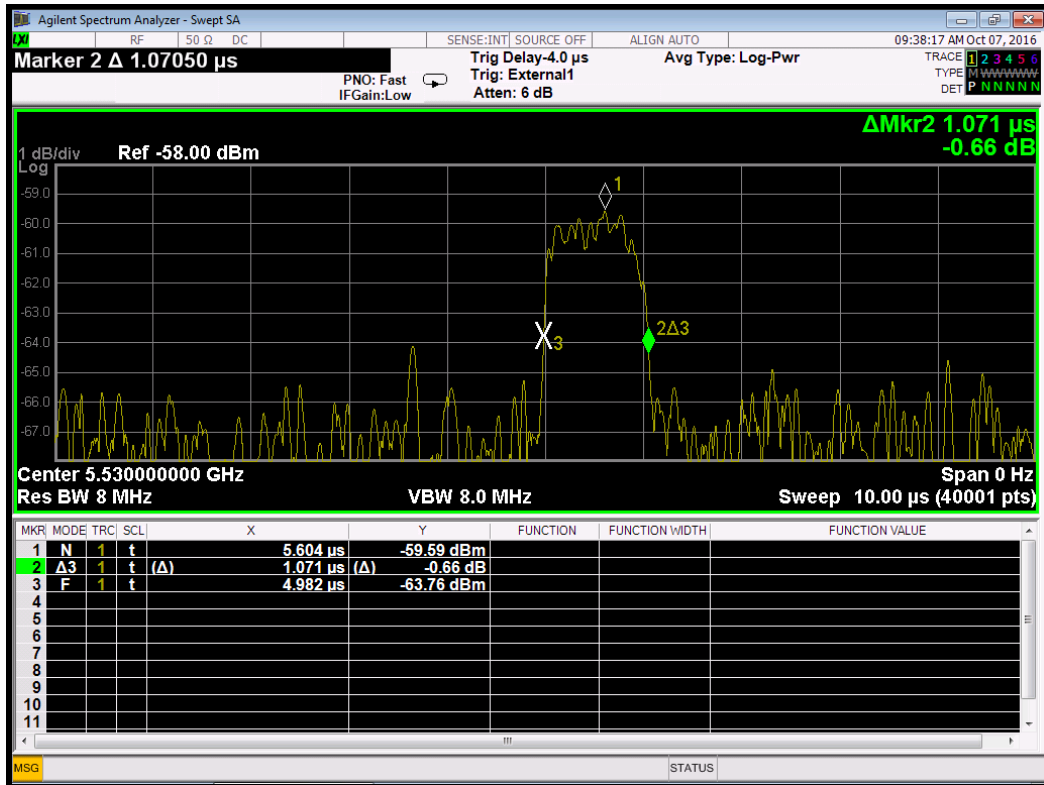
Pulse 6 U-NII-2C			
Interference level: -59.5 dBm			
Test #	Channel 5560 MHz BW 20 MHz Detected (Y/N)	Channel 5550 MHz BW 40 MHz Detected (Y/N)	Channel 5530 MHz BW 80 MHz Detected (Y/N)
1	Y	Y	Y
2	Y	Y	Y
3	Y	Y	Y
4	Y	Y	Y
5	Y	Y	Y
6	Y	Y	Y
7	Y	Y	Y
8	Y	Y	Y
9	Y	Y	Y
10	Y	Y	Y
11	Y	Y	Y
12	Y	Y	Y
13	Y	Y	Y
14	Y	Y	Y
15	Y	Y	Y
16	Y	Y	Y
17	Y	Y	Y
18	Y	Y	Y
19	Y	Y	Y
20	Y	Y	Y
21	Y	Y	Y
22	Y	Y	Y
23	Y	Y	Y
24	Y	Y	Y
25	Y	Y	Y
26	Y	Y	Y
27	Y	Y	Y
28	Y	Y	Y
29	Y	Y	Y
30	Y	Y	Y
Total	30	30	30

15.6 Test Pulse Parameters

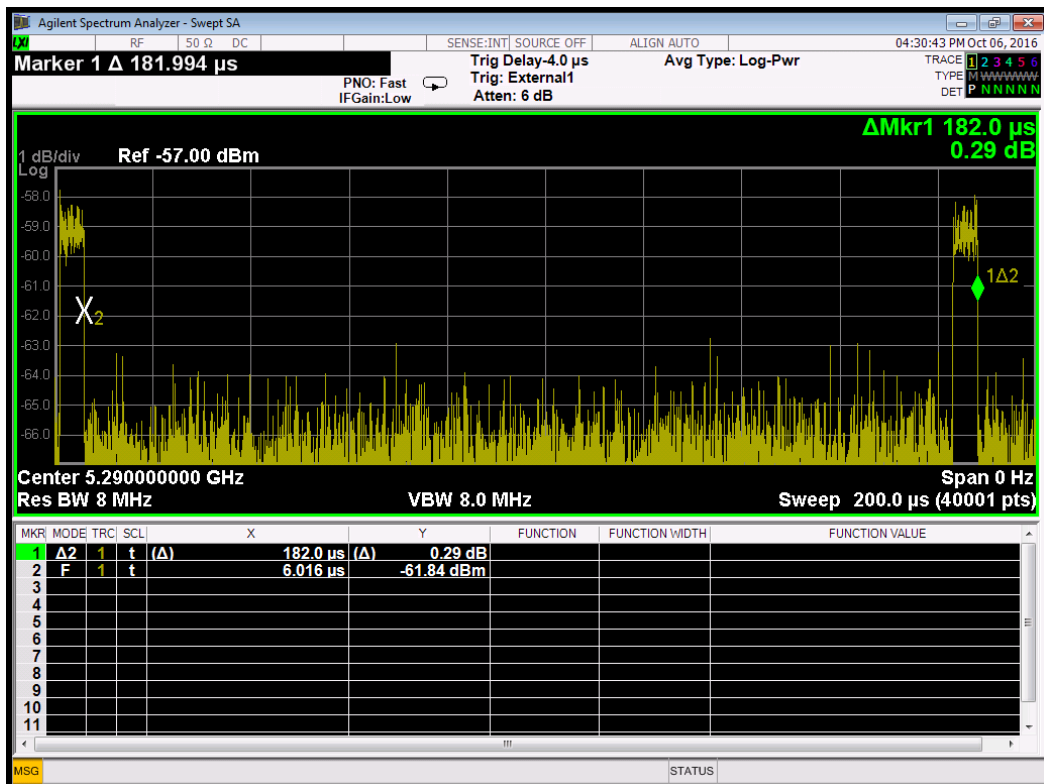
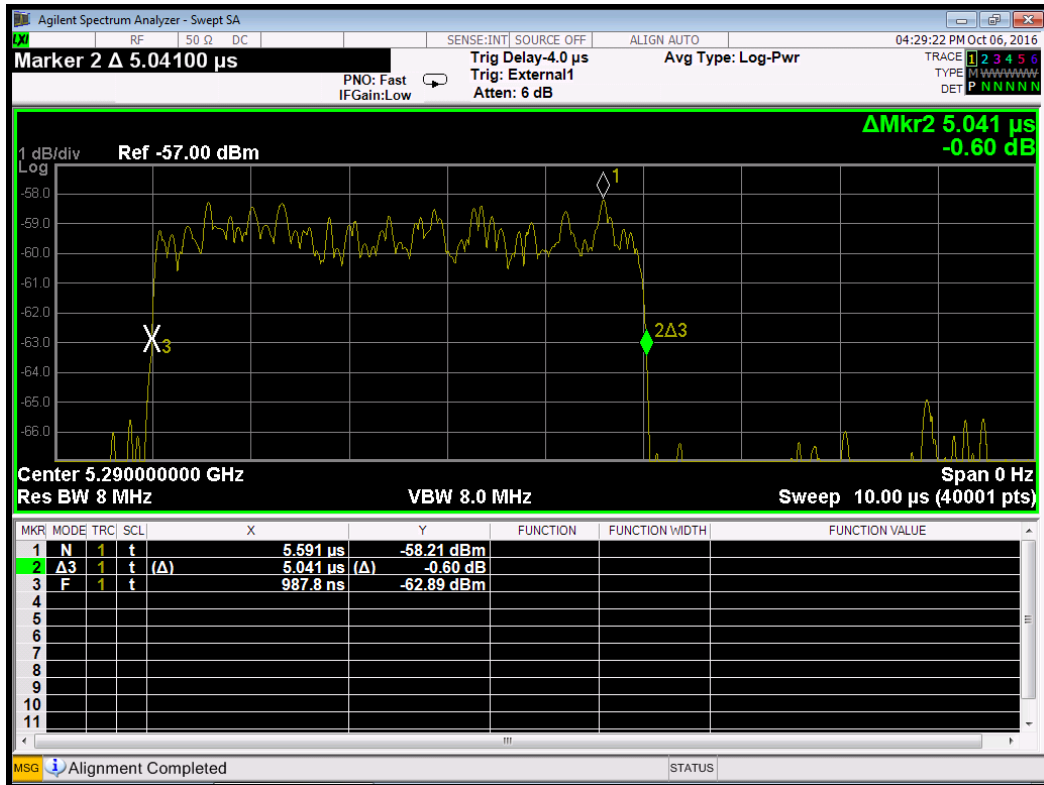
Type 1 Pulse U-NII-2A



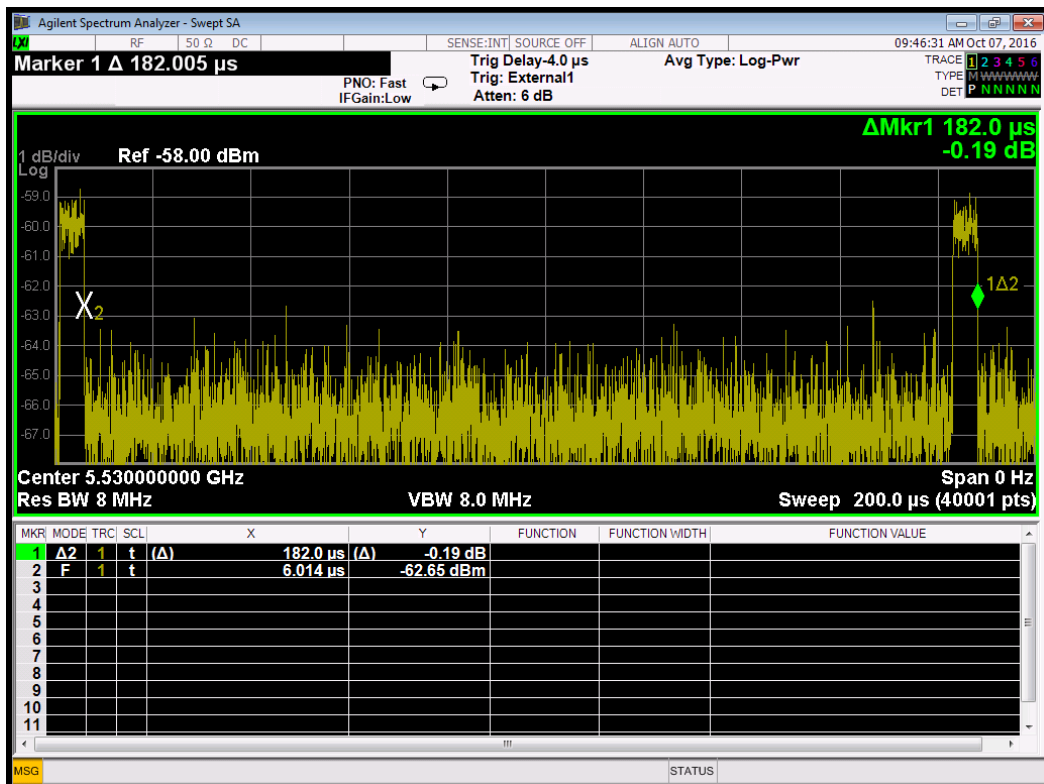
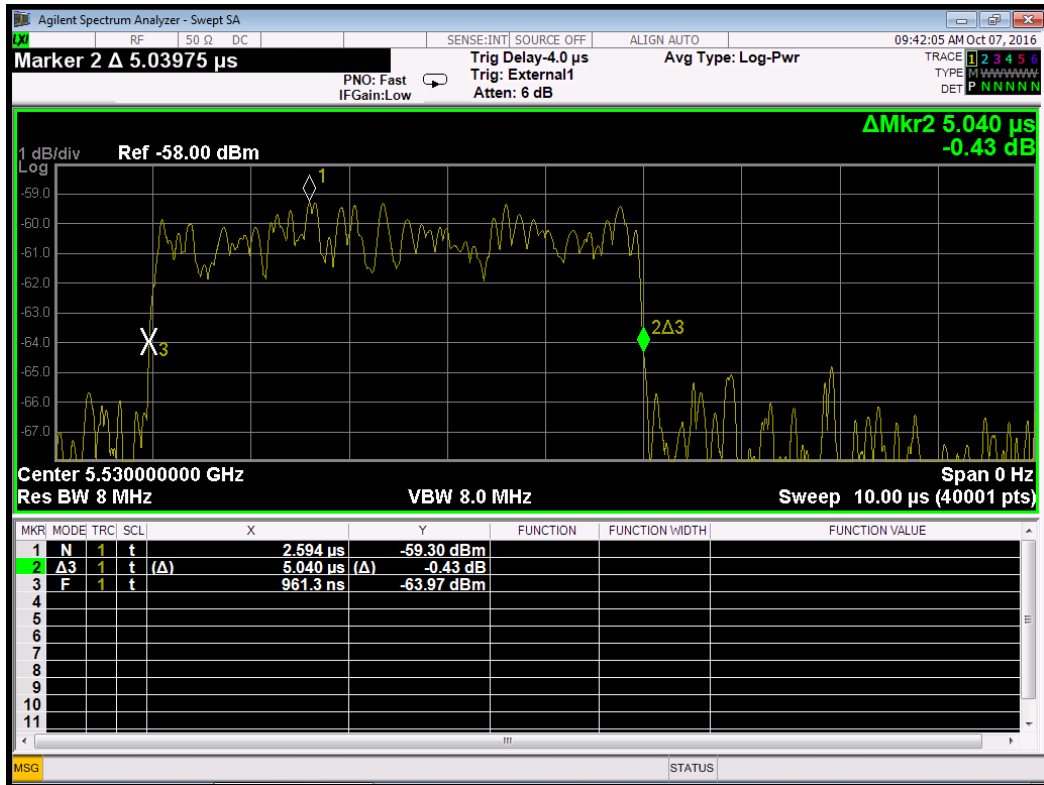
Type 1 Pulse U-NII-2C



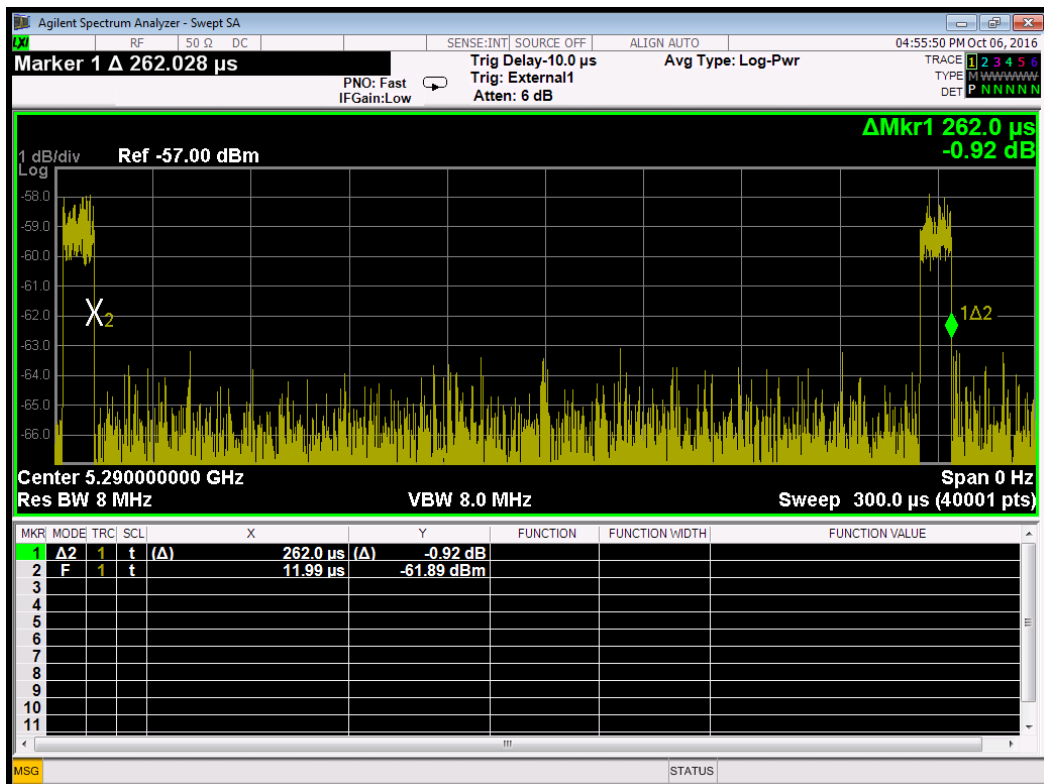
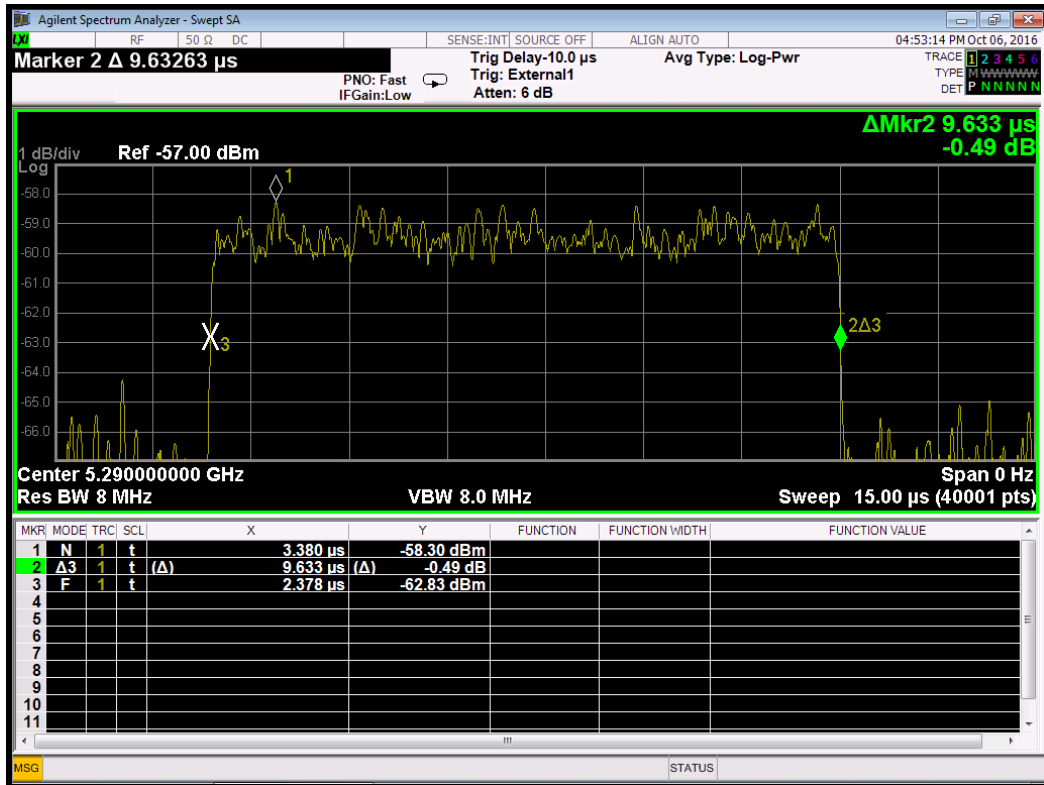
Type 2 Pulse U-NII-2A



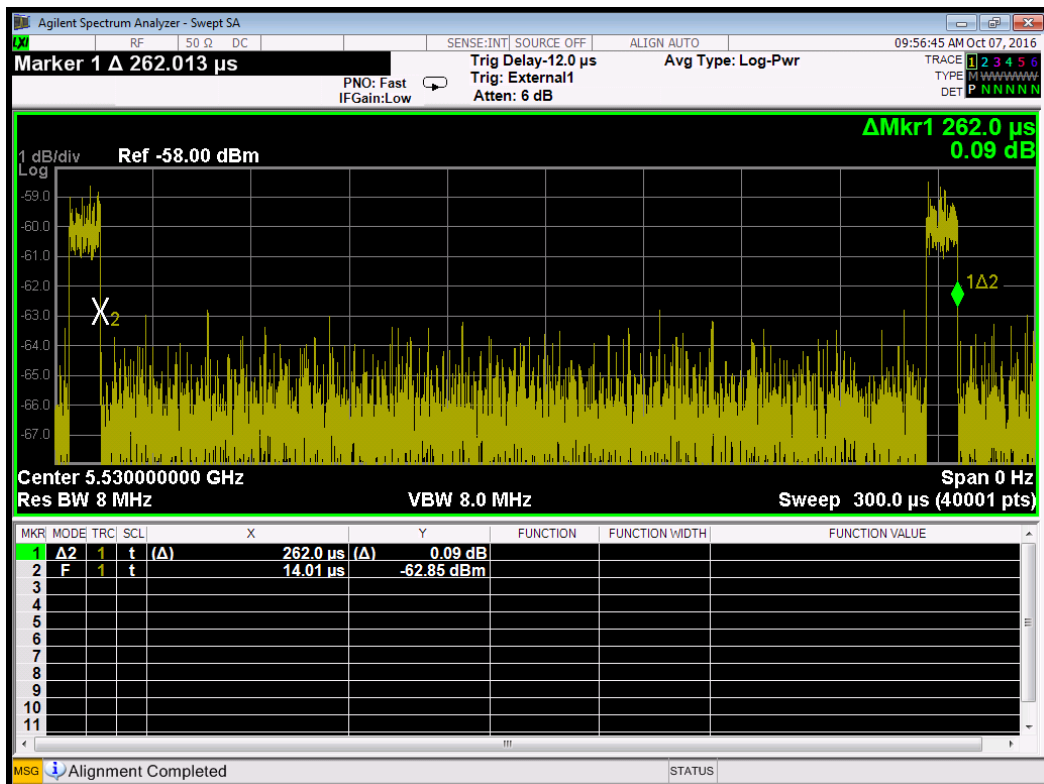
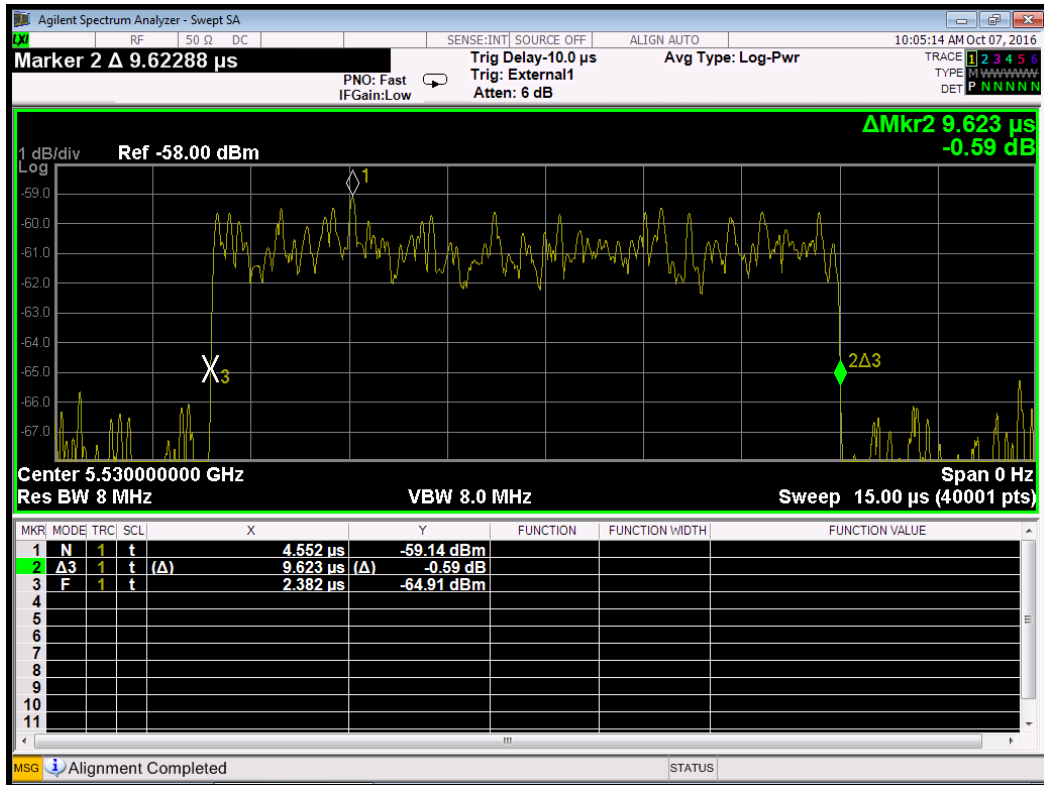
Type 2 Pulse U-NII-2C



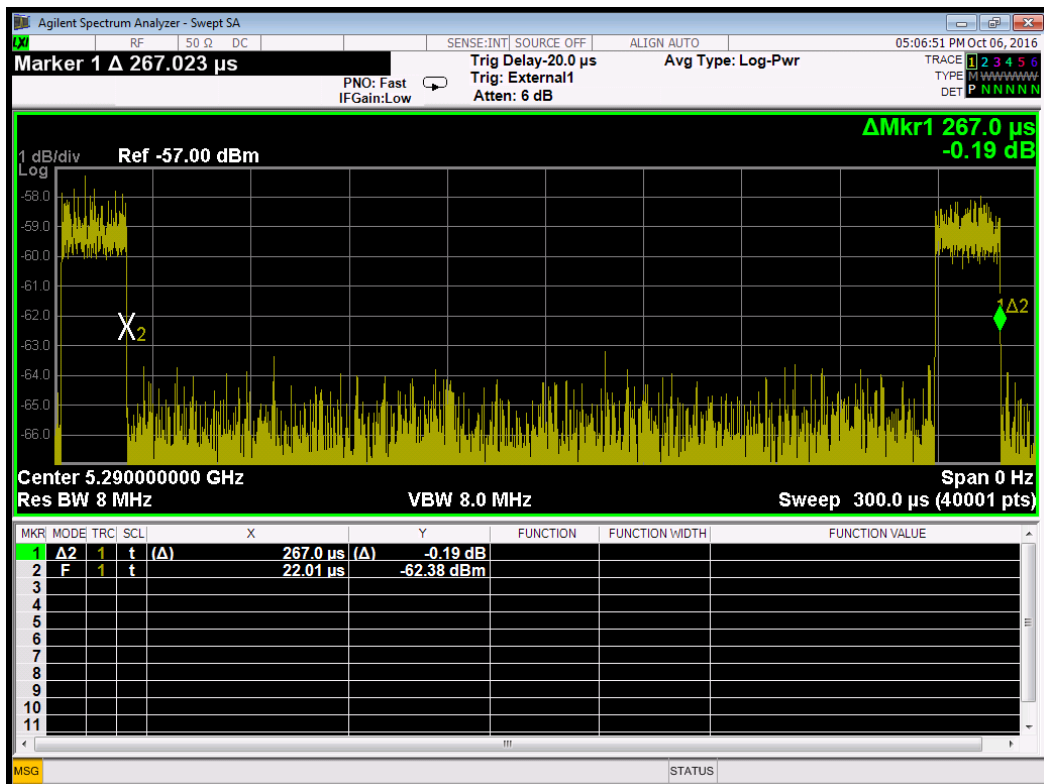
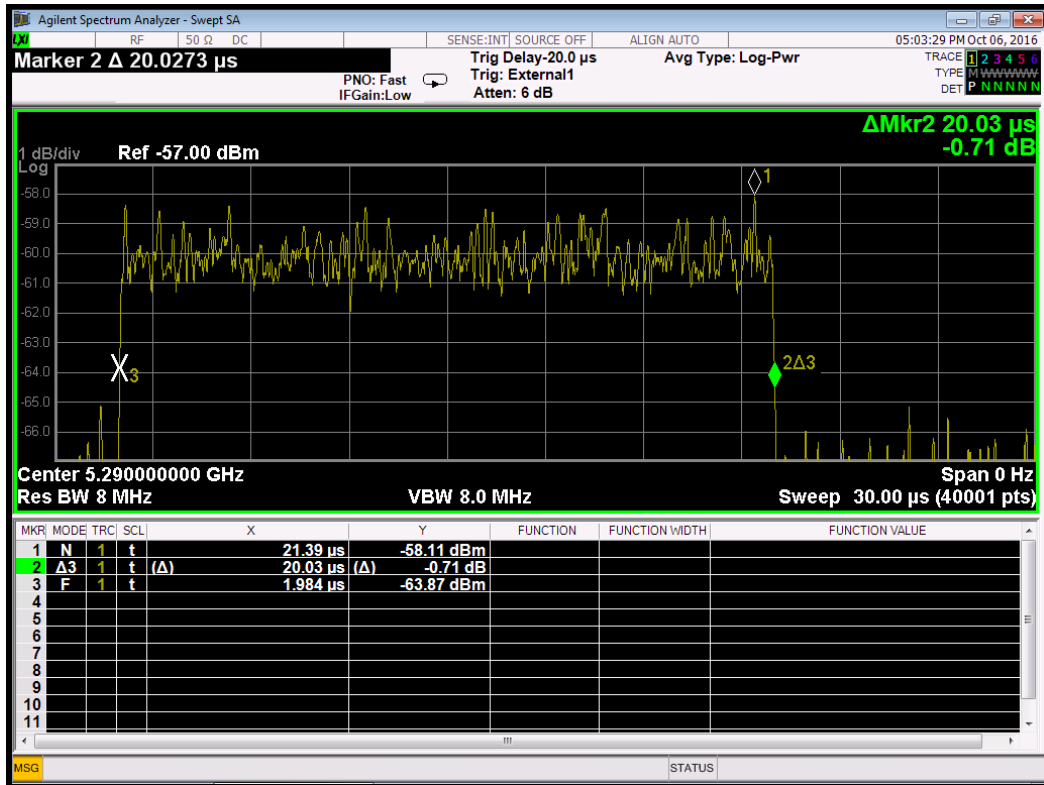
Type 3 Pulse U-NII-2A



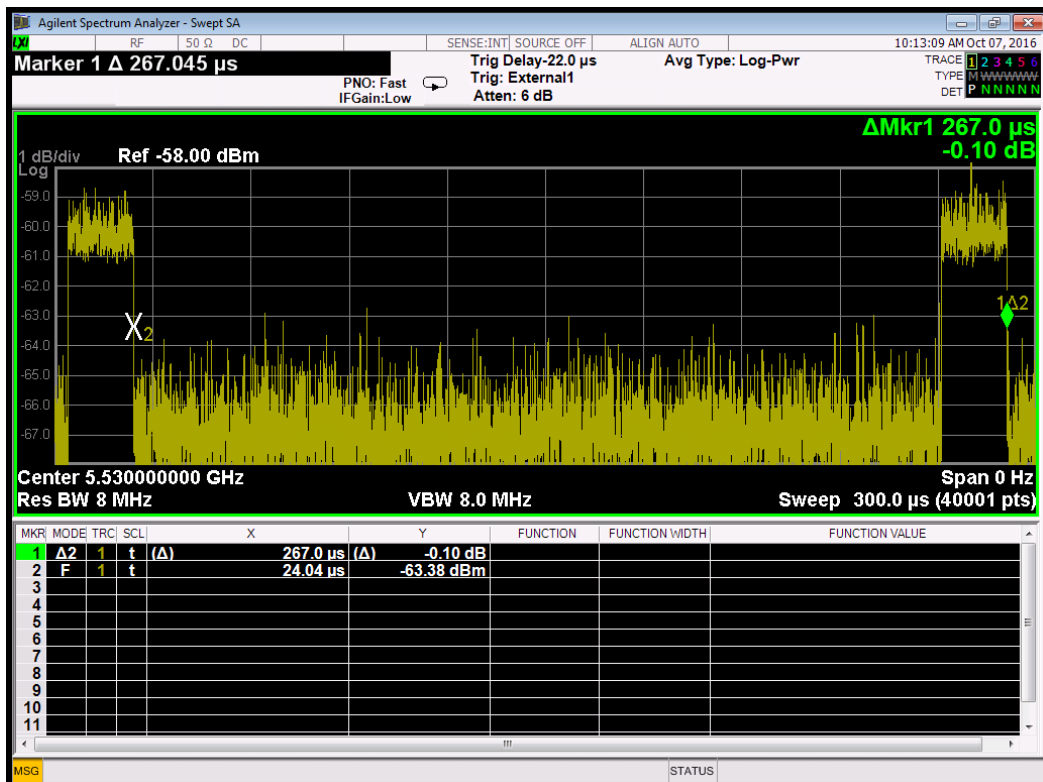
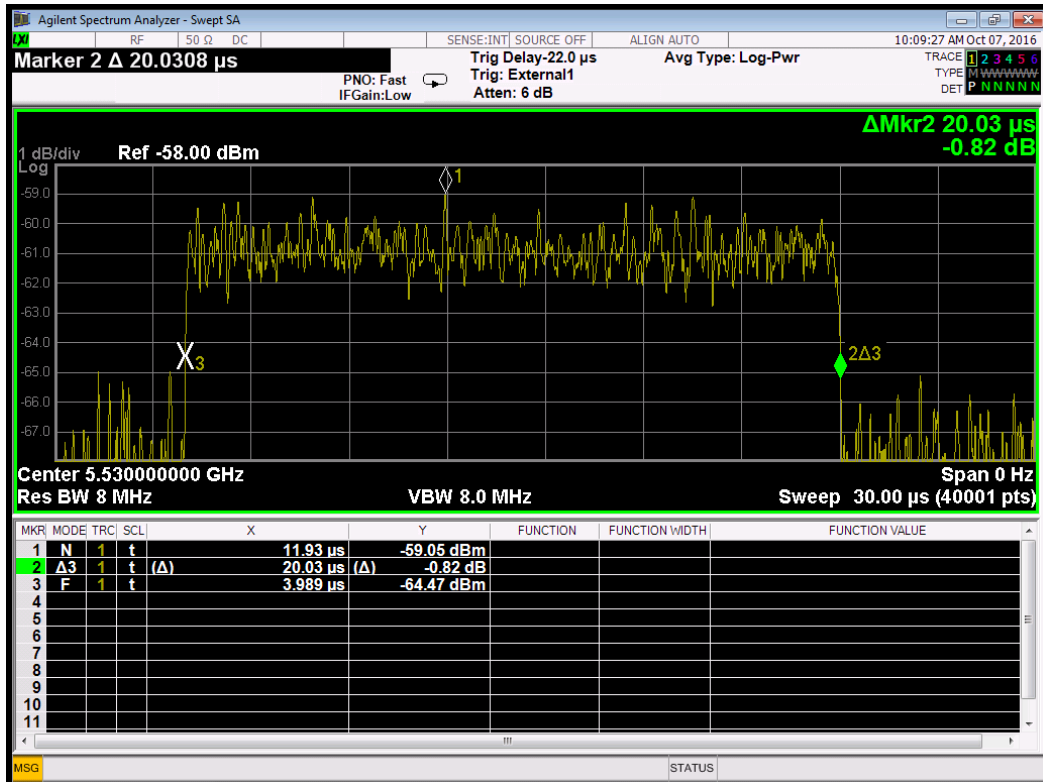
Type 3 Pulse U-NII-2C



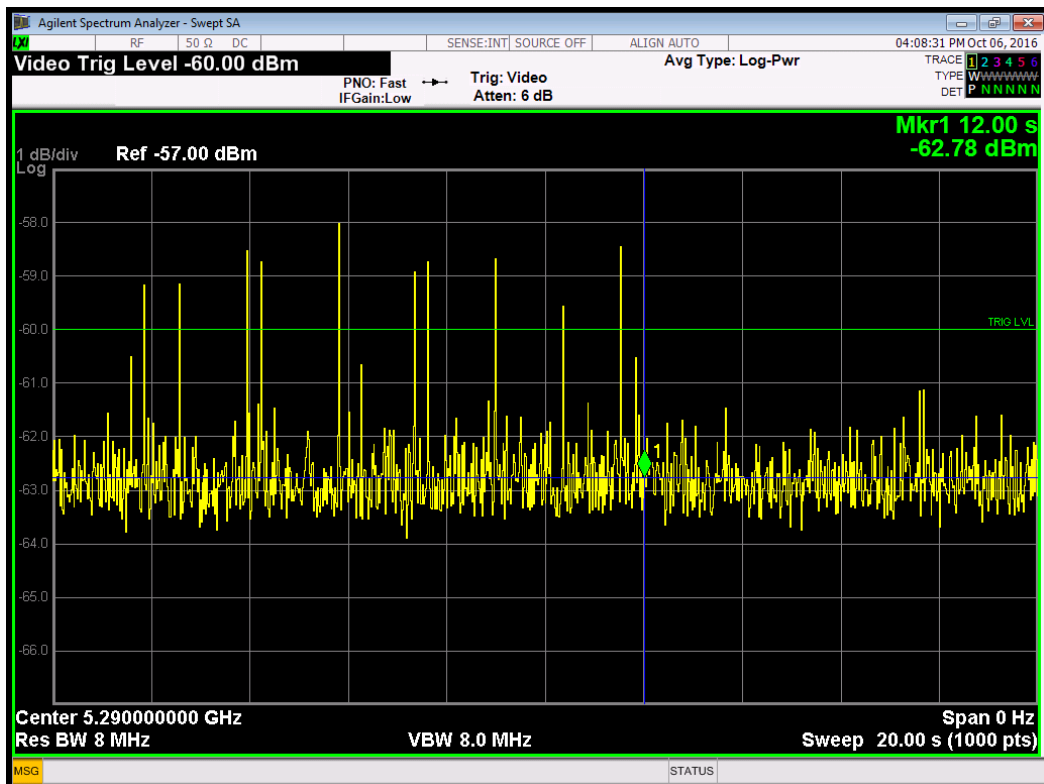
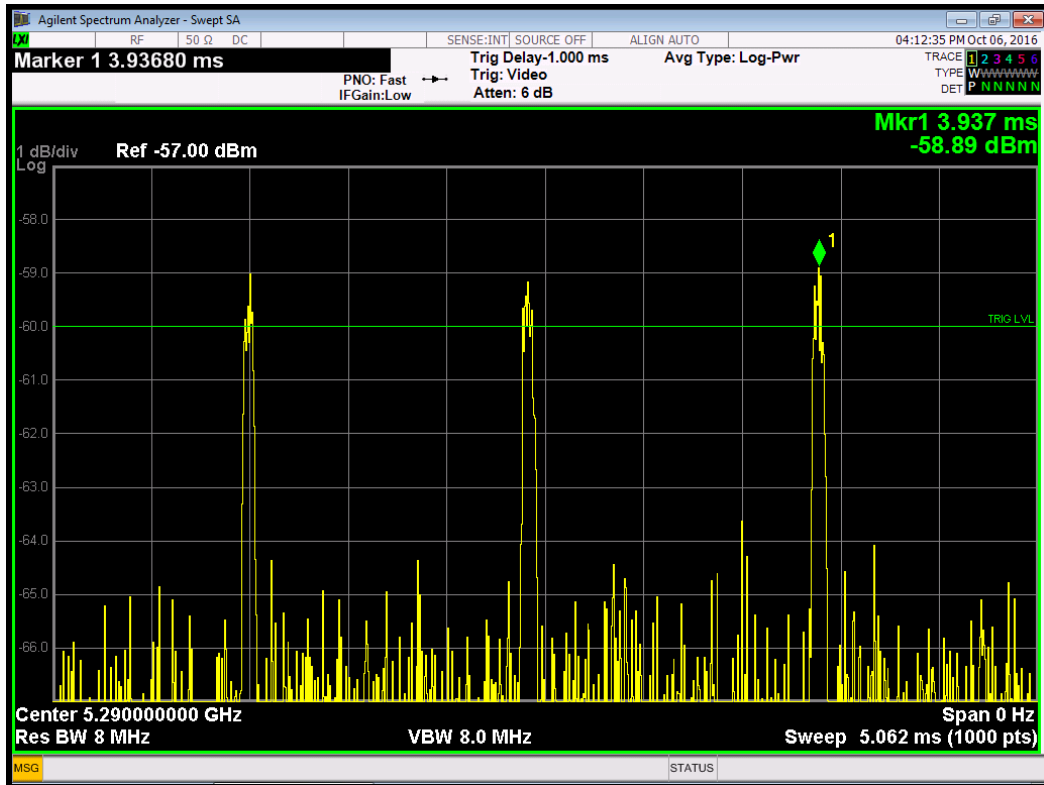
Type 4 Pulse U-NII-2A



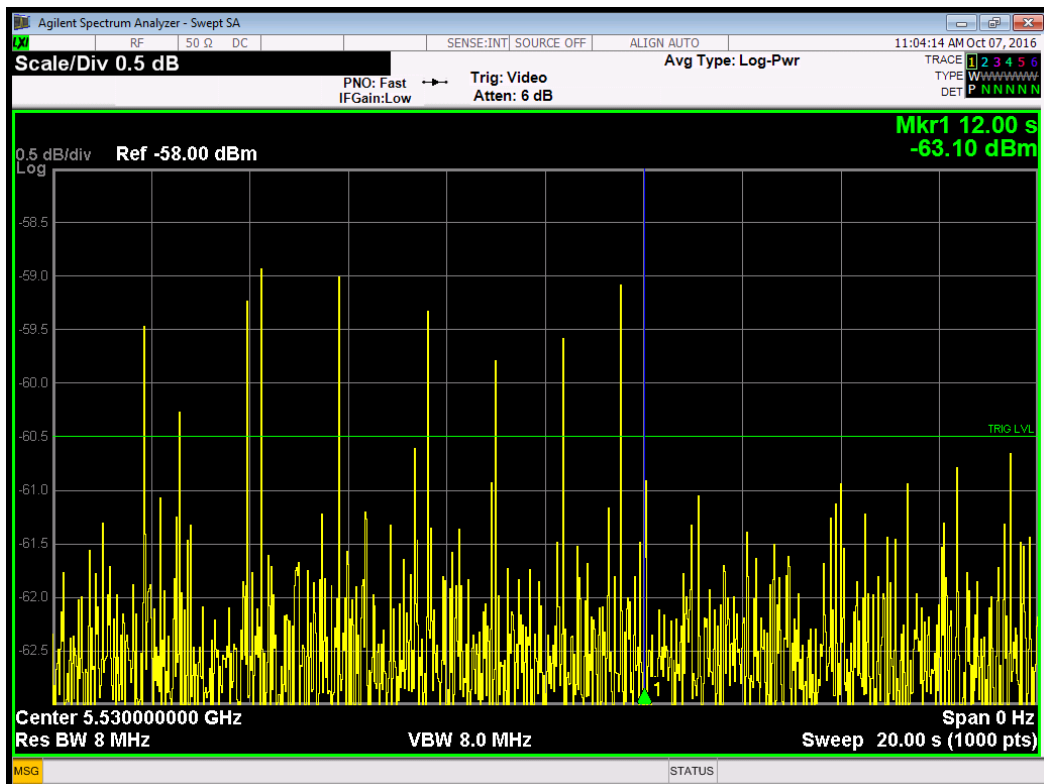
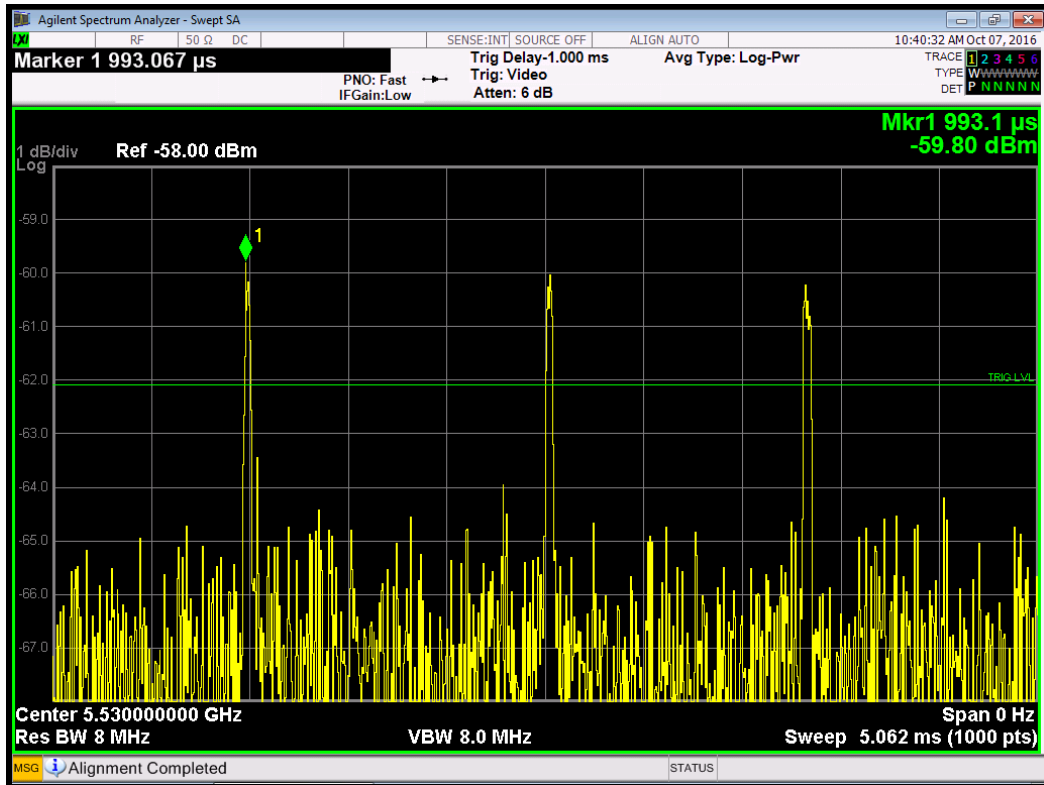
Type 4 Pulse U-NII-2C



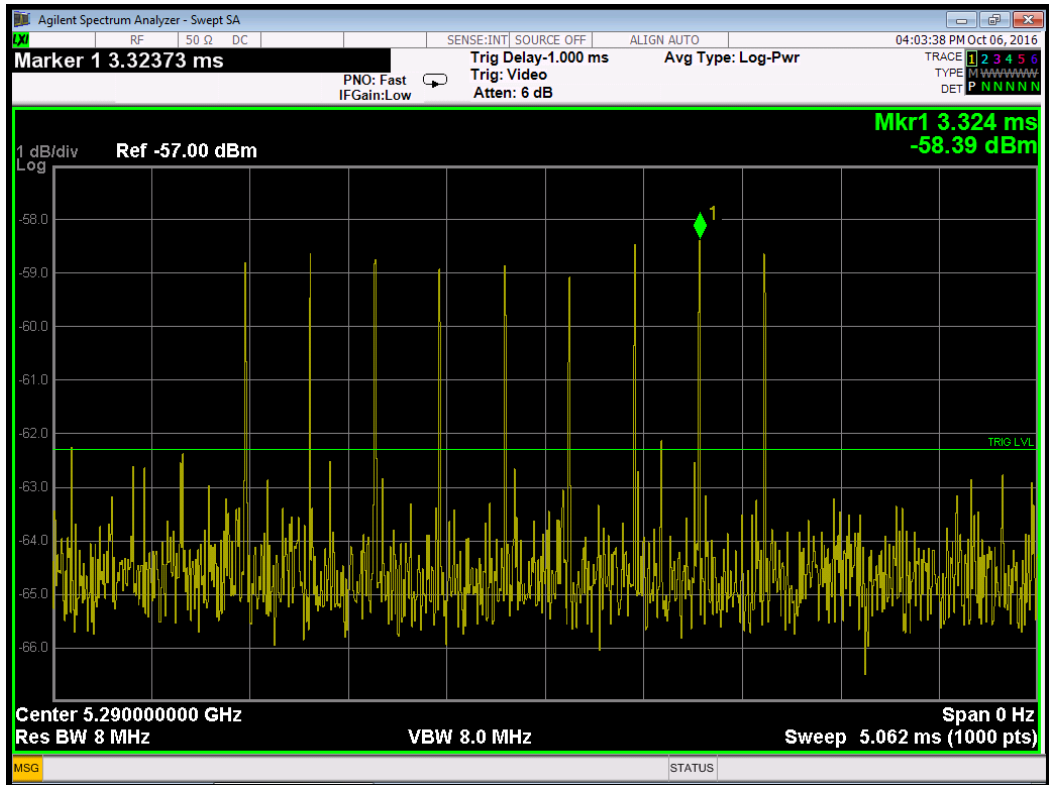
Type 5 Pulse U-NII-2A



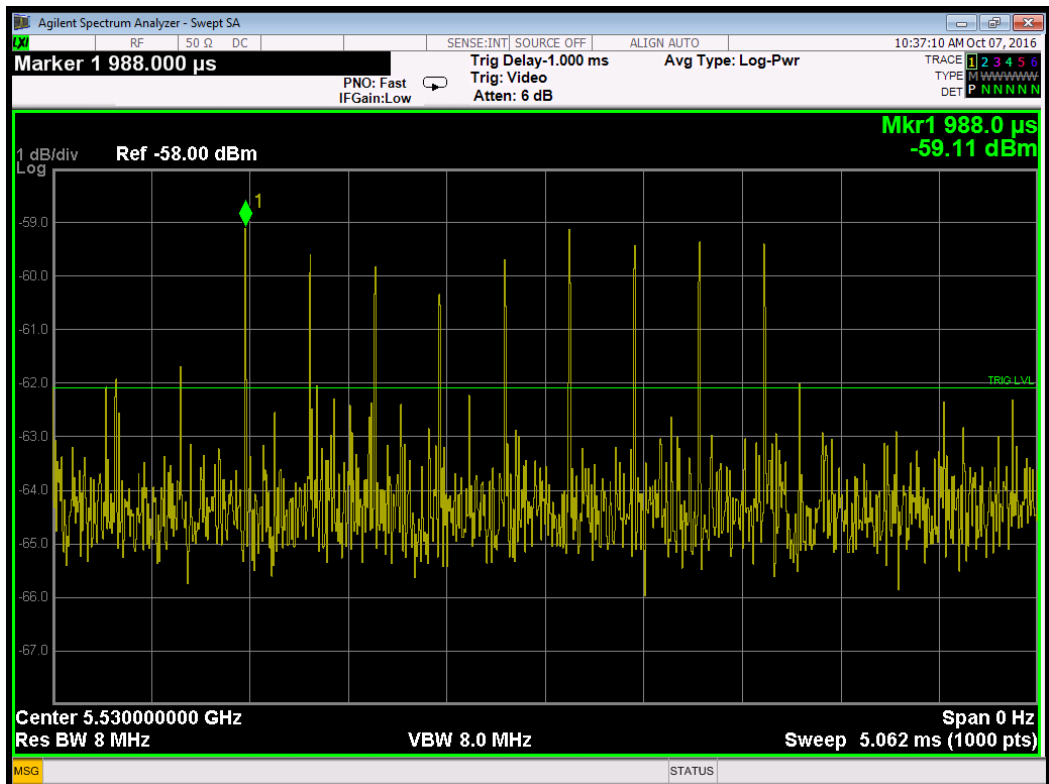
Type 5 Pulse U-NII-2C



Type 6 Pulse U-NII-2A



Type 6 Pulse U-NII-2C



Radar Type	Pulse Width (us)	PRF (Hz)	PRI	# Pulses
Type 0	1	700	1428	18
Type 1	1	1355	738	72
Type 1	1	1672	598	89
Type 1	1	1859	538	99
Type 1	1	1792	558	95
Type 1	1	1285	778	68
Type 1	1	1066	938	57
Type 1	1	1618	618	86
Type 1	1	1139	878	61
Type 1	1	1433	698	76
Type 1	1	1166	858	62
Type 1	1	1520	658	81
Type 1	1	1931	518	102
Type 1	1	1193	838	63
Type 1	1	1567	638	83
Type 1	1	1114	898	59
Type 1	1	1170	855	62
Type 1	1	507	1971	27
Type 1	1	539	1856	29
Type 1	1	472	2117	25
Type 1	1	648	1543	35
Type 1	1	883	1133	47
Type 1	1	338	2958	18
Type 1	1	522	1917	28
Type 1	1	358	2794	19
Type 1	1	365	2741	20
Type 1	1	531	1882	29
Type 1	1	1101	908	59
Type 1	1	464	2154	25
Type 1	1	381	2628	21
Type 1	1	348	2870	19
Type 2	4.5	6452	155	29
Type 2	3.2	6061	165	23
Type 2	5	5495	182	26
Type 2	2	5556	180	26
Type 2	4.3	6667	150	23
Type 2	4.5	5747	174	23
Type 2	1.2	4902	204	27
Type 2	3.4	4717	212	25
Type 2	1.4	5848	171	23
Type 2	1.8	6452	155	23
Type 2	1.4	5587	179	24
Type 2	4.2	5682	176	29
Type 2	2.5	4808	208	27
Type 2	1.2	6211	161	24
Type 2	5	5556	180	23
Type 2	3.8	6173	162	26
Type 2	4	4348	230	24

Type 2	1.3	5102	196	24
Type 2	2	5848	171	25
Type 2	3.1	5376	186	29
Type 2	1.2	4695	213	25
Type 2	3	6173	162	23
Type 2	2.3	6579	152	27
Type 2	2	5291	189	27
Type 2	2.6	6667	150	26
Type 2	3	5000	200	25
Type 2	2.2	5464	183	23
Type 2	2.9	5405	185	23
Type 2	4.4	6623	151	28
Type 2	1.2	5181	193	23
Type 3	8.3	2179	459	16
Type 3	9	2012	497	17
Type 3	9.4	2890	346	16
Type 3	6	3247	308	16
Type 3	9.5	2874	348	17
Type 3	8.6	2451	408	17
Type 3	8.5	2353	425	17
Type 3	9.6	3817	262	16
Type 3	9.3	2639	379	17
Type 3	7	2519	397	16
Type 3	6.9	3571	280	17
Type 3	8.5	2475	404	17
Type 3	7.2	2513	398	16
Type 3	6.7	2519	397	16
Type 3	6.7	3436	291	16
Type 3	10	2604	384	18
Type 3	8.3	3906	256	16
Type 3	6.9	3003	333	18
Type 3	7.7	2445	409	17
Type 3	6.9	2092	478	17
Type 3	6	2667	375	18
Type 3	6.3	2299	435	16
Type 3	8.5	3650	274	18
Type 3	9.5	3344	299	16
Type 3	8.2	2985	335	16
Type 3	8	2421	413	18
Type 3	10	2232	448	18
Type 3	7.6	2451	408	17
Type 3	9.3	5000	200	18
Type 3	8.9	3876	258	18
Type 4	19.8	4484	223	15
Type 4	16.7	4032	248	12
Type 4	13.7	4405	227	14
Type 4	19.7	3247	308	13
Type 4	12.2	2451	408	16
Type 4	13.6	2457	407	16

Type 6	1	3000	333.3	900
Type 6	1	3000	333.3	900
Type 6	1	3000	333.3	900
Type 6	1	3000	333.3	900
Type 6	1	3000	333.3	900

DFS Parameters Types 1 to 4 and 6

The Yellow highlighted rows indicate the pulses measured for the pulse parameter plots presented here. For type 5 pulses Burst 029 was recorded.

The following pages present the pulse parameters for the type 5 pulses used for testing:

Burst Number 000

Burst Number 000								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	1	7	595284	89	0	0	404627	1000000
2	3	7	493811	64	1370	1408	503219	1000000
3	3	7	137352	51	1667	1771	859057	1000000
4	3	7	123476	51	1370	1103	873898	1000000
5	3	7	307140	89	1119	1642	689832	1000000
6	1	7	802955	59	0	0	196986	1000000
7	2	7	59921	100	1676	0	938203	1000000
8	1	7	504142	50	0	0	495808	1000000
9	1	7	458367	52	0	0	541581	1000000
10	3	7	43126	91	1804	1117	953680	1000000
11	3	7	130084	60	1903	1898	865935	1000000
12	2	7	846552	68	1440	0	151872	1000000
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 001

Burst Number 001								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	6	453317	79	1886	0	544639	1000000
2	2	6	483539	72	1578	0	514739	1000000
3	3	6	697415	75	1645	1771	298944	1000000
4	3	6	563131	66	1748	1596	433327	1000000
5	3	6	737966	67	1162	1514	259157	1000000
6	2	6	195186	76	1269	0	803393	1000000
7	1	6	248410	65	0	0	751525	1000000
8	2	6	249223	97	1647	0	748936	1000000
9	2	6	600395	96	1264	0	398149	1000000
10	3	6	392846	61	1099	1349	604523	1000000
11	2	6	262354	54	1312	0	736226	1000000
12	1	6	692729	91	0	0	307180	1000000
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 002

Burst Number 002								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	1	20	597733	99	0	0	108050	705882
2	3	20	86008	93	1468	1843	616284	705882
3	1	20	132313	80	0	0	573489	705882
4	2	20	71706	50	1742	0	632334	705882
5	2	20	319040	53	1346	0	385390	705882
6	1	20	359164	79	0	0	346639	705882
7	1	20	132340	91	0	0	573451	705882
8	1	20	107846	66	0	0	597970	705882
9	1	20	167602	98	0	0	538182	705882
10	2	20	580145	77	1453	0	124130	705882
11	3	20	561647	70	1784	1003	141238	705882
12	2	20	394511	94	1895	0	309288	705882
13	1	20	376263	92	0	0	329527	705882
14	1	20	573441	63	0	0	132378	705882
15	1	20	169315	71	0	0	536496	705882
16	2	20	554303	68	1527	0	149916	705882
17	1	20	463551	80	0	0	242251	705882
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 003

Burst Number 003								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	1	17	394875	64	0	0	695970	1090909
2	2	17	1054809	51	1437	0	34561	1090909
3	1	17	244658	52	0	0	846199	1090909
4	1	17	430508	83	0	0	660318	1090909
5	3	17	391513	76	1548	1522	696098	1090909
6	2	17	294251	51	1838	0	794718	1090909
7	3	17	176565	92	1272	1798	910998	1090909
8	1	17	409817	100	0	0	680992	1090909
9	1	17	605315	71	0	0	485523	1090909
10	3	17	695173	92	1602	1106	392752	1090909
11	3	17	831949	52	1273	1883	255648	1090909
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 004

Burst Number 004								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	6	44422	62	1600	0	553854	600000
2	1	6	141806	71	0	0	458123	600000
3	1	6	536352	61	0	0	63587	600000
4	3	6	82127	75	1463	1144	515041	600000
5	1	6	206786	87	0	0	393127	600000
6	3	6	305226	99	1809	1000	291668	600000
7	3	6	333991	92	1333	1867	262533	600000
8	2	6	302131	85	1870	0	295829	600000
9	3	6	298787	87	1691	1549	297712	600000
10	1	6	567587	91	0	0	32322	600000
11	1	6	200582	71	0	0	399347	600000
12	3	6	250707	52	1137	1609	346391	600000
13	2	6	352904	86	1500	0	245424	600000
14	1	6	108236	99	0	0	491665	600000
15	2	6	148147	87	1696	0	449983	600000
16	3	6	311743	74	1603	1317	285115	600000
17	3	6	263002	63	1594	1740	333475	600000
18	2	6	312791	92	1493	0	285532	600000
19	3	6	311484	98	1395	1667	285160	600000
20	3	6	535367	82	1683	1457	61247	600000

Burst Number 005

Burst Number 005								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	6	349370	71	1805	0	280261	631578
2	1	6	453218	95	0	0	178265	631578
3	3	6	15374	54	1421	1290	613331	631578
4	3	6	538679	52	1743	1481	89519	631578
5	3	6	42143	58	1836	942	586483	631578
6	2	6	455063	51	1637	0	174776	631578
7	1	6	385402	99	0	0	246077	631578
8	3	6	257425	97	1682	1402	370778	631578
9	2	6	156165	93	1688	0	473539	631578
10	1	6	67809	81	0	0	563688	631578
11	3	6	294272	72	1178	1530	334382	631578
12	3	6	571210	74	951	1030	58165	631578
13	2	6	70477	87	1911	0	559016	631578
14	1	6	536029	52	0	0	95497	631578
15	3	6	186182	78	1594	1676	441892	631578
16	1	6	356911	77	0	0	274590	631578
17	2	6	593578	70	1404	0	36456	631578
18	3	6	493915	81	1748	1470	134202	631578
19	1	6	73771	82	0	0	557725	631578
20	0	0	0	0	0	0	0	0

Burst Number 006

Burst Number 006								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	3	8	59759	88	1851	1418	859784	923076
2	2	8	274451	52	1449	0	647072	923076
3	1	8	860385	91	0	0	62600	923076
4	2	8	325398	79	1859	0	595661	923076
5	2	8	33940	66	1642	0	887362	923076
6	3	8	324609	78	1922	1005	595306	923076
7	1	8	171060	87	0	0	751929	923076
8	1	8	617190	90	0	0	305796	923076
9	3	8	849268	71	1576	1728	70291	923076
10	3	8	481330	90	956	1080	439440	923076
11	1	8	180154	55	0	0	742867	923076
12	1	8	210915	91	0	0	712070	923076
13	1	8	399709	81	0	0	523286	923076
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 007

Burst Number 007								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	9	131492	69	1207	0	467163	600000
2	3	9	383382	93	1059	1674	213606	600000
3	3	9	524998	64	1444	1546	71820	600000
4	2	9	8345	87	1696	0	589785	600000
5	2	9	322174	80	1200	0	276466	600000
6	2	9	481082	96	1350	0	117376	600000
7	3	9	341381	77	992	1406	255990	600000
8	3	9	21606	93	1274	1426	575415	600000
9	2	9	575087	79	1095	0	23660	600000
10	2	9	398329	64	1464	0	200079	600000
11	3	9	185982	80	1505	1175	411098	600000
12	2	9	535802	73	1527	0	62525	600000
13	2	9	522592	51	1820	0	75486	600000
14	2	9	542202	89	1857	0	55763	600000
15	2	9	171022	85	1074	0	427734	600000
16	2	9	215880	83	1160	0	382794	600000
17	2	9	502658	68	1135	0	96071	600000
18	2	9	6299	98	902	0	592603	600000
19	3	9	413961	59	1791	1159	182912	600000
20	1	9	10482	79	0	0	589439	600000

Burst Number 008

Burst Number 008								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	19	97165	67	1582	0	501119	600000
2	1	19	137458	91	0	0	462451	600000
3	1	19	349446	50	0	0	250504	600000
4	2	19	561606	69	1153	0	37103	600000
5	2	19	78667	95	1745	0	519398	600000
6	1	19	191029	88	0	0	408883	600000
7	2	19	15156	51	1809	0	582933	600000
8	1	19	436007	97	0	0	163896	600000
9	1	19	73512	70	0	0	526418	600000
10	1	19	376948	66	0	0	222986	600000
11	1	19	427222	95	0	0	172683	600000
12	1	19	239027	67	0	0	360906	600000
13	2	19	249877	76	1859	0	348112	600000
14	2	19	544999	73	1891	0	52964	600000
15	3	19	451318	90	1292	1353	145767	600000
16	1	19	63010	78	0	0	536912	600000
17	1	19	82227	90	0	0	517683	600000
18	3	19	370261	94	1408	1747	226302	600000
19	2	19	355717	61	1005	0	243156	600000
20	3	19	466826	72	1110	1458	130390	600000

Burst Number 009

Burst Number 009								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	3	7	350123	73	1531	1144	278561	631578
2	1	7	537357	50	0	0	94171	631578
3	2	7	243214	50	1629	0	386635	631578
4	1	7	33262	53	0	0	598263	631578
5	2	7	320069	97	1075	0	310240	631578
6	2	7	197910	55	1628	0	431930	631578
7	3	7	82425	71	1331	1298	546311	631578
8	2	7	416574	81	1772	0	213070	631578
9	3	7	452696	53	1717	1591	175415	631578
10	2	7	546714	79	1556	0	83150	631578
11	2	7	491740	71	1534	0	138162	631578
12	3	7	547735	99	1431	1629	80486	631578
13	1	7	172954	68	0	0	458556	631578
14	2	7	92394	52	1060	0	538020	631578
15	2	7	528272	90	1064	0	102062	631578
16	3	7	11101	71	1726	1092	617446	631578
17	2	7	257400	52	1242	0	372832	631578
18	3	7	407946	68	1524	1806	220098	631578
19	2	7	111652	63	1646	0	518154	631578
20	0	0	0	0	0	0	0	0

Burst Number 010

Burst Number 010								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	3	12	394182	70	1489	1288	402831	800000
2	2	12	525055	77	942	0	273849	800000
3	2	12	339795	53	1716	0	458383	800000
4	3	12	352110	100	1131	1530	444929	800000
5	3	12	254363	67	1855	1169	542412	800000
6	1	12	612167	96	0	0	187737	800000
7	2	12	683409	85	1500	0	114921	800000
8	2	12	571103	73	1152	0	227599	800000
9	3	12	532770	74	1788	1364	263856	800000
10	2	12	508860	98	924	0	290020	800000
11	3	12	61487	89	1495	1077	735674	800000
12	2	12	213406	61	1566	0	584906	800000
13	2	12	481648	61	1457	0	316773	800000
14	1	12	362669	77	0	0	437254	800000
15	3	12	638225	100	1751	1334	158390	800000
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 011

Burst Number 011								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	14	760766	86	1712	0	737350	1500000
2	2	14	199359	59	1714	0	1298809	1500000
3	2	14	612073	95	1504	0	886233	1500000
4	1	14	898031	66	0	0	601903	1500000
5	1	14	539918	51	0	0	960031	1500000
6	1	14	80864	58	0	0	1419078	1500000
7	3	14	481670	60	1335	1334	1015481	1500000
8	3	14	880661	97	1546	998	616504	1500000
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 012

Burst Number 012								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	1	18	303918	52	0	0	362696	666666
2	1	18	570117	57	0	0	96492	666666
3	2	18	551860	75	1206	0	113450	666666
4	2	18	197827	50	1626	0	467113	666666
5	1	18	442603	56	0	0	224007	666666
6	3	18	366827	53	1519	1837	296324	666666
7	2	18	75595	76	1326	0	589593	666666
8	1	18	555603	60	0	0	111003	666666
9	2	18	507836	65	1246	0	157454	666666
10	2	18	95011	53	1227	0	570322	666666
11	1	18	336425	94	0	0	330147	666666
12	3	18	383728	84	1689	1082	279915	666666
13	2	18	567513	86	938	0	98043	666666
14	3	18	175193	99	1178	1415	488583	666666
15	3	18	581930	81	1412	1862	81219	666666
16	1	18	153094	91	0	0	513481	666666
17	2	18	204799	90	1435	0	460252	666666
18	1	18	150462	56	0	0	516148	666666
1	1	18	303918	52	0	0	362696	666666
2	1	18	570117	57	0	0	96492	666666

Burst Number 013

Burst Number 013								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	20	490214	97	1472	0	139698	631578
2	1	20	240919	89	0	0	390570	631578
3	3	20	222271	50	1345	974	406838	631578
4	1	20	17297	76	0	0	614205	631578
5	3	20	495003	75	1523	1380	133447	631578
6	1	20	527491	58	0	0	104029	631578
7	3	20	403182	78	936	1904	225322	631578
8	1	20	379417	57	0	0	252104	631578
9	3	20	211274	50	1772	1308	417074	631578
10	3	20	69858	74	1672	1763	558063	631578
11	1	20	408412	94	0	0	223072	631578
12	3	20	312669	94	1542	1185	315900	631578
13	2	20	485700	87	1433	0	144271	631578
14	1	20	286703	90	0	0	344785	631578
15	1	20	135301	94	0	0	496183	631578
16	1	20	467311	90	0	0	164177	631578
17	2	20	142068	93	1702	0	487622	631578
18	2	20	435679	60	1093	0	194686	631578
19	3	20	424821	50	1802	1568	203237	631578
20	0	0	0	0	0	0	0	0

Burst Number 014

Burst Number 014								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	1	9	825061	96	0	0	374843	1200000
2	2	9	910034	85	1059	0	288737	1200000
3	2	9	1122696	54	973	0	76223	1200000
4	1	9	276550	96	0	0	923354	1200000
5	1	9	656220	63	0	0	543717	1200000
6	1	9	410105	68	0	0	789827	1200000
7	1	9	668574	93	0	0	531333	1200000
8	2	9	966568	72	1053	0	232235	1200000
9	2	9	183190	87	1582	0	1015054	1200000
10	2	9	1099555	80	1074	0	99211	1200000
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 015

Burst Number 015								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	3	13	268963	54	1542	1852	327481	600000
2	3	13	148621	60	1356	1109	448734	600000
3	2	13	182153	89	1653	0	416016	600000
4	2	13	175039	65	1787	0	423044	600000
5	2	13	566236	68	1095	0	32533	600000
6	2	13	408086	67	1033	0	190747	600000
7	2	13	263441	94	1455	0	334916	600000
8	3	13	433613	65	1051	1680	163461	600000
9	3	13	82797	89	1347	1467	514122	600000
10	2	13	525057	55	1208	0	73625	600000
11	2	13	217766	94	1892	0	380154	600000
12	2	13	515632	54	1688	0	82572	600000
13	2	13	523728	80	1283	0	74829	600000
14	2	13	460248	63	1743	0	137883	600000
15	1	13	520526	66	0	0	79408	600000
16	3	13	595590	75	1072	1588	1525	600000
17	2	13	248955	82	1448	0	349433	600000
18	3	13	407133	60	1939	996	189752	600000
19	3	13	28509	100	1120	1596	568475	600000
20	1	13	419014	73	0	0	180913	600000

Burst Number 016

Burst Number 016								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	16	266758	69	1783	0	362899	631578
2	2	16	527057	82	1705	0	102652	631578
3	1	16	337506	62	0	0	294010	631578
4	2	16	622751	60	1157	0	7550	631578
5	3	16	78621	97	1456	1229	549981	631578
6	2	16	121558	80	1226	0	508634	631578
7	3	16	159710	63	1523	1010	469146	631578
8	1	16	19384	70	0	0	612124	631578
9	2	16	387974	71	1074	0	242388	631578
10	3	16	597662	60	952	1726	31058	631578
11	2	16	92975	99	1718	0	536687	631578
12	1	16	1920	90	0	0	629568	631578
13	3	16	234113	63	1303	1850	394123	631578
14	3	16	413789	67	1851	1008	214729	631578
15	2	16	449413	62	982	0	181059	631578
16	2	16	317202	50	1788	0	312488	631578
17	3	16	37036	89	983	1283	592009	631578
18	3	16	14608	77	1463	1097	614179	631578
19	2	16	313183	75	970	0	317275	631578
20	0	0	0	0	0	0	0	0

Burst Number 017

Burst Number 017								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	14	418211	100	1555	0	437176	857142
2	2	14	194897	93	973	0	661086	857142
3	2	14	651554	53	1556	0	203926	857142
4	3	14	834655	62	1716	1888	18697	857142
5	2	14	796944	78	933	0	59109	857142
6	2	14	318949	60	1586	0	536487	857142
7	3	14	499812	80	1245	1200	354645	857142
8	2	14	394979	55	1724	0	460329	857142
9	2	14	298829	80	1279	0	556874	857142
10	3	14	710454	96	1620	1749	143031	857142
11	3	14	799474	55	1724	1743	54036	857142
12	1	14	439080	85	0	0	417977	857142
13	2	14	557500	98	1363	0	298083	857142
14	1	14	8194	90	0	0	848858	857142
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 018

Burst Number 018								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	1	18	1262970	87	0	0	70276	1333333
2	3	18	372278	73	1428	1910	957498	1333333
3	3	18	1061671	59	1531	1570	268384	1333333
4	2	18	670116	65	1021	0	662066	1333333
5	1	18	792467	77	0	0	540789	1333333
6	1	18	105895	83	0	0	1227355	1333333
7	2	18	221733	53	1159	0	1110335	1333333
8	1	18	422990	91	0	0	910252	1333333
9	3	18	876617	67	1166	953	454396	1333333
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 019

Burst Number 019								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	3	19	308986	77	1534	1719	287530	600000
2	1	19	58576	53	0	0	541371	600000
3	3	19	337591	80	1225	1085	259859	600000
4	2	19	312197	79	1397	0	286248	600000
5	3	19	526796	81	1581	1274	70106	600000
6	1	19	398385	67	0	0	201548	600000
7	2	19	144204	79	1306	0	454332	600000
8	2	19	191785	89	1889	0	406148	600000
9	1	19	406832	81	0	0	193087	600000
10	3	19	12035	90	1427	1516	584752	600000
11	2	19	515231	59	1550	0	83101	600000
12	1	19	474086	62	0	0	125852	600000
13	1	19	426819	94	0	0	173087	600000
14	1	19	187312	52	0	0	412636	600000
15	2	19	165673	100	1191	0	432936	600000
16	1	19	283798	52	0	0	316150	600000
17	3	19	195419	93	1395	1733	401174	600000
18	3	19	330180	69	1833	1830	265950	600000
19	3	19	513619	63	939	1579	83674	600000
20	3	19	134083	82	1391	1429	462851	600000

Burst Number 020

Burst Number 020								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	7	616858	84	1463	0	48177	666666
2	1	7	420688	83	0	0	245895	666666
3	2	7	311724	82	1585	0	353193	666666
4	1	7	425401	67	0	0	241198	666666
5	3	7	577138	89	1445	1219	86597	666666
6	3	7	635124	66	1253	1923	28168	666666
7	1	7	454888	84	0	0	211694	666666
8	1	7	535571	83	0	0	131012	666666
9	2	7	342352	92	1598	0	322532	666666
10	2	7	266121	90	1188	0	399177	666666
11	3	7	602982	87	1183	1424	60816	666666
12	1	7	580334	91	0	0	86241	666666
13	1	7	661201	61	0	0	5404	666666
14	3	7	593621	97	1106	1258	70390	666666
15	3	7	583931	52	1644	1538	79397	666666
16	2	7	486582	99	1231	0	178655	666666
17	3	7	551282	52	1593	1390	112245	666666
18	1	7	336449	95	0	0	330122	666666
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 021

Burst Number 021								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	1	12	1088017	81	0	0	245235	1333333
2	2	12	235290	97	1056	0	1096793	1333333
3	2	12	1070873	73	1236	0	261078	1333333
4	3	12	907633	71	1397	1725	422365	1333333
5	2	12	692023	55	1634	0	639566	1333333
6	2	12	1037815	88	1853	0	293489	1333333
7	1	12	211987	50	0	0	1121296	1333333
8	2	12	125118	73	999	0	1207070	1333333
9	2	12	285022	91	1641	0	1046488	1333333
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 022

Burst Number 022								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	5	766569	89	1347	0	322815	1090909
2	3	5	1064313	75	945	1853	23573	1090909
3	2	5	161641	59	1587	0	927563	1090909
4	3	5	1058530	90	1726	1524	28859	1090909
5	2	5	375550	84	952	0	714239	1090909
6	3	5	421932	100	1649	1809	665219	1090909
7	1	5	62726	73	0	0	1028110	1090909
8	3	5	873572	62	1459	1604	214088	1090909
9	2	5	581096	62	1754	0	507935	1090909
10	1	5	929476	96	0	0	161337	1090909
11	1	5	1071535	69	0	0	19305	1090909
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 023

Burst Number 023								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	10	127924	65	1466	0	537146	666666
2	3	10	194143	92	1505	1888	468854	666666
3	3	10	76917	72	1884	984	586665	666666
4	3	10	611192	73	1848	1871	51536	666666
5	1	10	603543	74	0	0	63049	666666
6	2	10	292422	78	1720	0	372368	666666
7	1	10	122931	88	0	0	543647	666666
8	1	10	8018	77	0	0	658571	666666
9	3	10	614270	80	944	1833	49379	666666
10	3	10	455057	97	1321	1828	208169	666666
11	2	10	572150	75	1736	0	92630	666666
12	2	10	253909	57	1058	0	411585	666666
13	1	10	40040	72	0	0	626554	666666
14	2	10	568890	92	1367	0	96225	666666
15	3	10	556181	70	1248	1650	107377	666666
16	3	10	656691	51	1256	1379	7187	666666
17	2	10	362250	54	1839	0	302469	666666
18	1	10	336387	50	0	0	330229	666666
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 024

Burst Number 024								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	17	1122872	98	1654	0	75278	1200000
2	3	17	106971	99	1544	1704	1089484	1200000
3	1	17	371218	98	0	0	828684	1200000
4	3	17	563315	78	978	1880	633593	1200000
5	2	17	1067739	85	1001	0	131090	1200000
6	2	17	1044528	59	1322	0	154032	1200000
7	1	17	266963	52	0	0	932985	1200000
8	3	17	545555	55	1368	1501	651411	1200000
9	1	17	1085914	53	0	0	114033	1200000
10	1	17	427639	73	0	0	772288	1200000
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 025

Burst Number 025								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	3	8	477966	98	1112	1380	225130	705882
2	3	8	410916	76	1760	1512	291466	705882
3	2	8	638159	91	1024	0	66517	705882
4	3	8	667631	88	1283	977	35727	705882
5	3	8	473644	71	1896	1907	228222	705882
6	2	8	353487	93	1626	0	350583	705882
7	1	8	9385	87	0	0	696410	705882
8	1	8	629013	98	0	0	76771	705882
9	3	8	134548	76	1905	1828	567373	705882
10	1	8	272889	76	0	0	432917	705882
11	1	8	10249	76	0	0	695557	705882
12	3	8	101784	67	1065	1075	601757	705882
13	3	8	543796	69	1338	1756	158785	705882
14	1	8	377582	99	0	0	328201	705882
15	1	8	698360	92	0	0	7430	705882
16	1	8	597435	84	0	0	108363	705882
17	2	8	157505	57	1797	0	546466	705882
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 026

Burst Number 026								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	3	11	591988	73	1801	1571	904421	1500000
2	1	11	677077	86	0	0	822837	1500000
3	2	11	877372	83	1430	0	621032	1500000
4	2	11	931248	50	1846	0	566806	1500000
5	3	11	835814	56	1061	1816	661141	1500000
6	2	11	473192	91	1274	0	1025352	1500000
7	2	11	1430702	85	1317	0	67811	1500000
8	3	11	1121500	95	1022	1030	376163	1500000
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 027

Burst Number 027								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	11	738657	88	1341	0	259826	1000000
2	1	11	874603	76	0	0	125321	1000000
3	2	11	663660	65	1339	0	334871	1000000
4	3	11	723670	98	1853	1214	272969	1000000
5	1	11	835302	56	0	0	164642	1000000
6	2	11	327675	82	1427	0	670734	1000000
7	3	11	800218	66	1249	1431	196904	1000000
8	3	11	640554	70	1390	1541	356305	1000000
9	2	11	698366	55	1026	0	300498	1000000
10	2	11	569956	78	962	0	428926	1000000
11	2	11	835404	52	1860	0	162632	1000000
12	1	11	4651	73	0	0	995276	1000000
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 028

Burst Number 028								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	1	7	730696	100	0	0	69204	800000
2	1	7	7307	87	0	0	792606	800000
3	2	7	793673	77	1331	0	4842	800000
4	1	7	545065	53	0	0	254882	800000
5	3	7	344388	98	955	936	453427	800000
6	3	7	456643	61	965	1668	340541	800000
7	3	7	331925	88	1170	1368	465273	800000
8	1	7	690255	65	0	0	109680	800000
9	2	7	307465	63	1521	0	490888	800000
10	2	7	628567	85	1528	0	169735	800000
11	1	7	131419	82	0	0	668499	800000
12	3	7	563461	79	940	1419	233943	800000
13	1	7	626415	99	0	0	173486	800000
14	3	7	113174	51	1107	1263	684303	800000
15	1	7	95155	71	0	0	704774	800000
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

Burst Number 029

Burst Number 029								
Burst Segment	Number of Pulses	Chirp Width (MHz)	t1 (μs)	Pulse Width t2 (μs)	t3 (μs)	t4 (μs)	t5 (μs)	Total Segment Length (μs)
1	2	12	111708	50	1428	0	977673	1090909
2	1	12	889231	76	0	0	201602	1090909
3	1	12	515856	77	0	0	574976	1090909
4	2	12	818281	71	1573	0	270913	1090909
5	2	12	4171	93	1667	0	1084885	1090909
6	3	12	487621	63	1488	1259	600352	1090909
7	1	12	919038	66	0	0	171805	1090909
8	2	12	112873	98	1344	0	976496	1090909
9	1	12	378618	79	0	0	712212	1090909
10	1	12	684628	77	0	0	406204	1090909
11	3	12	743317	94	1344	1397	344569	1090909
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0

16 Measurement Uncertainty

Calculated Measurement Uncertainties

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence:

[1] DFS Parameters

Test type	Quantity	Quantity frequency range	Uncertainty
DFS Parameters	Amplitude	9kHz to 26.5GHz	±0.9 dB
	Time	9kHz to 26.5GHz	0.1%
	Frequency	9kHz to 26.5GHz	3.611kHz