



Dynamic Frequency Selection

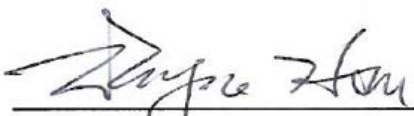
Test Report

Equipment : 802.11abgn, USB module
Brand Name : SparkLAN
Model No. : WUBR-508N
Applicant : SparkLAN Communications, Inc.
Manufacturer : 8F., No. 257, Sec. 2, Tiding Blvd., Neihu District,
Taipei City 11493, Taiwan
Test Standard(s) : EN 301 893 V1.6.1 (2011-11)
Test Freq. Range : 5250~5350 MHz / 5470~5725 MHz
Submission Type : Original Equipment
Operating Mode : Slave

The product sample received on Apr. 10, 2012 and completely tested on Apr. 19, 2012.
We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in EN 301 893 V1.6.1 (2011-11) and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:


Wayne Hsu / Assistant Manager



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
EY232843	Rev. 01		May 10, 2012

**1. SUMMARY OF THE TEST RESULT**

Applied Standard: ETSI EN 301 893 V1.6.1 (2011-11)			
Part	Appendix	Description of Test	Result
2	5.3.8	Dynamic Frequency Selection	Complies



2. DYNAMIC FREQUENCY SELECTION MEASUREMENT

2.1. Product Specification Table

Specification Items	Description
Data Modulation Data Rate (Mbps)	OFDM for IEEE 802.11a (BPSK / QPSK / 16QAM / 64QAM) (6/9/12/18/24/36/48/54) See the below table for IEEE 802.11n
DFS Function	5260~5320 MHz ; 5500~5700 MHz
Operating Mode	Client (without radar detection function)
Communication Mode	IP based system
Power-on cycle	NA (No Channel Availability Check Function)
MAC Address	00:0E:8E:63:89:35
Software Version	Ver 3.2.4.0

IEEE 802.11n Modulation Scheme

MCS	Spatial	Modulation	Coding Rate	Data rate(Mbps)			
Index	Streams	Type	Type	20 MHz channel		40 MHz channel	
				800nsGI	400nsGI	800nsGI	400nsGI
0	1	BPSK	1/2	6.5	7.2	13.5	15
1	1	QPSK	1/2	13	14.4	27	30
2	1	QPSK	3/4	19.5	21.7	40.5	45
3	1	16-QAM	1/2	26	28.9	54	60
4	1	16-QAM	3/4	39	43.3	81	90
5	1	64-QAM	2/3	52	57.8	108	120
6	1	64-QAM	3/4	58.5	65	121.5	135
7	1	64-QAM	5/6	65	72.2	135	150
8	2	BPSK	1/2	13	14.4	27	30
9	2	QPSK	1/2	26	28.8	54	60
10	2	QPSK	3/4	39	43.4	81	90
11	2	16-QAM	1/2	52	57.8	108	120
12	2	16-QAM	3/4	78	86.6	162	180
13	2	64-QAM	2/3	104	115.6	216	240
14	2	64-QAM	3/4	117	130	243	270
15	2	64-QAM	5/6	130	144.4	270	300

Symbol	Explanation
NSS	Number of spatial streams
R	Code rate
NBPSC	Number of coded bits per single carrier
NCBPS	Number of coded bits per symbol
NDBPS	Number of data bits per symbol
GI	guard interval



2.2. Table for DFS Band Carrier Frequencies

DFS Band Carrier Frequencies

Frequency Band	Channel No.	Frequency
5250~5350 MHz Band 2	52	5260 MHz
	56	5280 MHz
	60	5300 MHz
	64	5320 MHz

Frequency Band	Channel No.	Frequency
5470~5725 MHz Band 3	100	5500 MHz
	104	5520 MHz
	108	5540 MHz
	112	5560 MHz
	116	5580 MHz
	120	5600 MHz
	124	5620 MHz
	132	5660 MHz
	136	5680 MHz
	140	5700 MHz

2.3. Supporting Units

Support Unit	Brand	Model No.	Serial No.	Software Version
Notebook PC	DELL	Latitude E5510	N/A	Win 7 Pro SP1
Notebook PC	HP Compaq	Presario B1251TU	N/A	Win XP Pro SP3
Access Point	3Com	WL-605	FCC ID: O9C-WL605	WP741_normal_v18.WW

2.4. Test Facility

Test Site No.	Test Site Location
DFS01-HY	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: 886-3-327-3456 FAX: 886-3-327-0973

3. DYNAMIC FREQUENCY SELECTION MEASUREMENT

3.1. EUT Operating Mode

EUT Operating Mode	Master	Slave, without radar detection function	Slave, with radar detection function
	☐	☒	☐

3.2. Applicability of DFS requirements

DFS is required for RLAN devices in the frequency ranges 5250 MHz to 5350 MHz and 5470 MHz to 5725 MHz. Radar detection is not required in the frequency range 5150 MHz to 5250 MHz.

Applicability of DFS requirements

Requirement	DFS Operational mode		
	Master	Slave without radar detection (see table D.2)	Slave with radar detection (see table D.2)
Channel Availability Check	√	Not required	√ (note2)
Off-Channel CAC (note 1)	√	Not required	√ (note2)
In-Service Monitoring	√	Not required	√
Channel Shutdown	√	√	√
Non-Occupancy Period	√	Not required	√
Uniform Spreading	√	Not required	Not required

NOTE 1: Where implemented by the manufacturer.

NOTE 2: A slave with radar detection is not required to perform a CAC or Off-Channel CAC at initial use of the channel but only after the slave has detected a radar signal on a channel by In-Service Monitoring.

DFS requirement values

Parameter	Value
Channel Availability Check Time	60 seconds (see note 1)
Maximum Off-Channel CAC Time	4 hours (see note 2)
Channel Move Time	10 seconds
Channel Closing Transmission Time	1 second.
Non-occupancy period	Minimum 30 minutes

Note 1: For channels whose nominal bandwidth falls completely or partly within the band 5600-5650 MHz, the Channel Availability Check Time shall be 10 minutes. Note 2: For channels whose nominal bandwidth falls completely or partly within the band 5600-5650 MHz, the Maximum Off-Channel CAC Time shall be 24 hours.

Radar Detection Threshold

EIRP Spectral Density (dBm/MHz)	Value (see notes 1 and 2)
10	-62 dBm

NOTE 1: This is the level at the input of the receiver of a RLAN device with a maximum EIRP density of 10 dBm/MHz and assuming a 0 dBi receive antenna. For devices employing different EIRP spectral density and/or a different receive antenna gain G (dBi) the DFS threshold level at the receiver input follows the following relationship:

DFS Detection Threshold (dBm) = -62 + 10 · EIRP Spectral Density (dBm/MHz) + G (dBi), however the DFS threshold level shall not be lower than -64 dBm assuming a 0 dBi receive antenna gain.

NOTE 2: Slave devices with a maximum EIRP of less than 23 dBm do not have to implement radar detection.

The radar Detection Threshold, lowest antenna gain is the parameter of Interference radar DFS detection threshold, The Interference **Detection Threshold** is worse -64dBm.

DFS Radar Signal Parameter

Radar test signal # (note 1 to 3)	Pulse width W [μ s]		Pulse repetition frequency PRF (PPS)		Number of different PRFs	Pulses per burst for each PRF (PPB) (note 5)
	Min	Max	Min	Max		
1	0.5	5	200	1000	1	10 (note 6)
2	0.5	15	200	1600	1	15 (note 6)
3	0.5	15	2 300	4000	1	25
4	20	30	2 000	4000	1	20
5	0.5	2	300	400	2/3	10 (note 6)
6	0.5	2	400	1200	2/3	15 (note 6)
Reference	1	1	700	700	1	18

NOTE 1: Radar test signals 1 to 4 are constant PRF based signals. See figure D.1. These radar test signals are intended to simulate also radars using a packet based Staggered PRF. See figure D.2.

NOTE 2: Radar test signal 4 is a modulated radar test signal. The modulation to be used is a chirp modulation with a ± 2.5 MHz frequency deviation which is described below.

NOTE 3: Radar test signals 5 and 6 are single pulse based Staggered PRF radar test signals using 2 or 3 different PRF values. For radar test signal 5, the difference between the PRF values chosen shall be between 20 and 50 pps. For radar test signal 6, the difference between the PRF values chosen shall be between 80 and 400 pps. See figure D.3

NOTE 4: Apart for the Off-Channel CAC testing, the radar test signals above shall only contain a single burst of pulses. See figure D.1, D.2 and D.3. For the Off-Channel CAC testing, repetitive bursts shall be used for the total duration of the test. See figure D.4.

NOTE 5: The total number of pulses in a burst is equal to the number of pulses for a single PRF multiplied by the number of different PRFs used.

NOTE 6: For the CAC and Off-Channel CAC requirements, the minimum number of pulses (for each PRF) for any of the radar test signals to be detected in the band 5600 to 5650 MHz shall be 18.

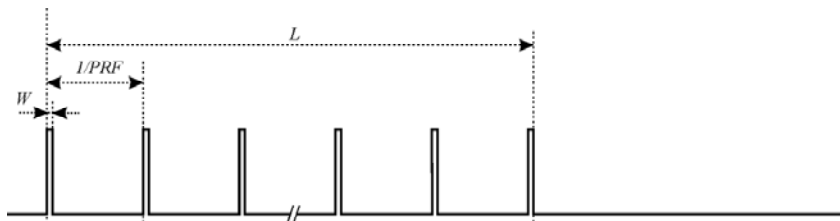


Figure D.1: General structure of a single burst / constant PRF based radar test signal

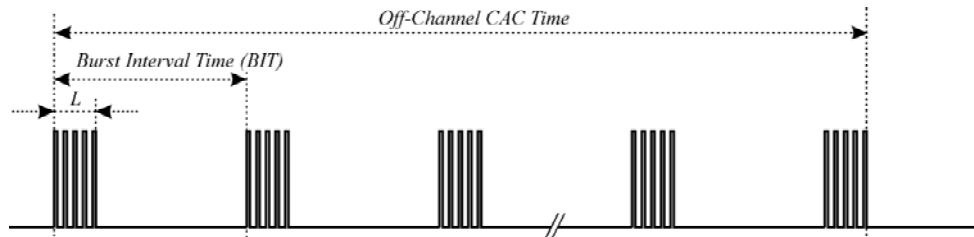


Figure D.2: General structure of a multiple burst / constant PRF based radar test signal

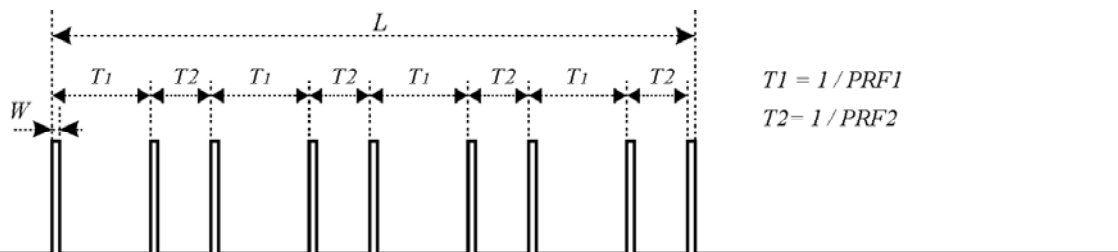


Figure D.3: General structure of a single burst / single pulse based staggered PRF radar test signal

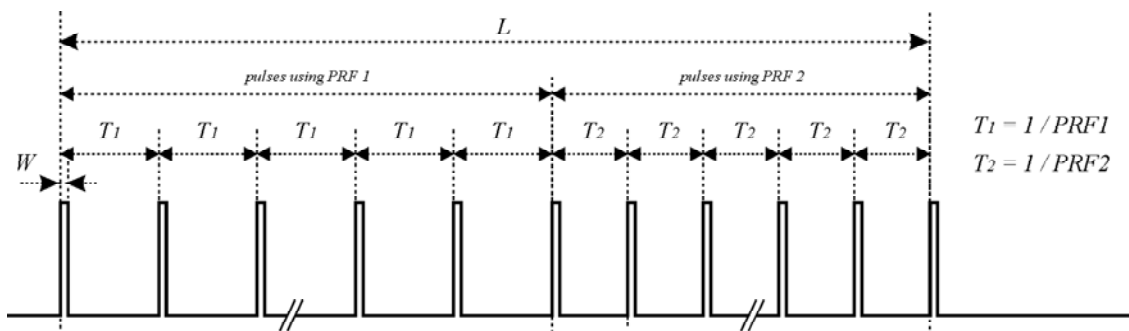


Figure D.4: General structure of a single burst / packet based staggered PRF radar test signal

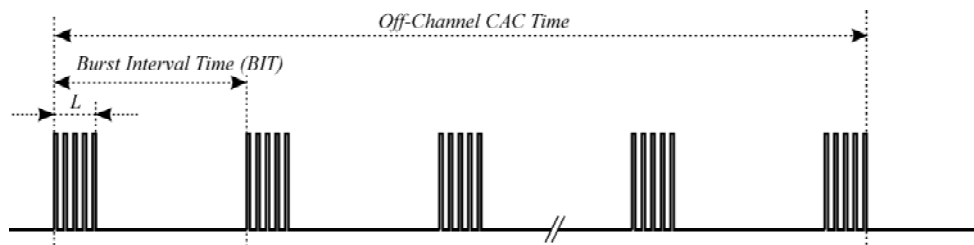


Figure D.5: General structure of a multiple burst / packet based staggered PRF based radar test signal



Dynamic Frequency Selection (DFS) radar detection probability (%)

Parameter	Detection Probability (Pd)	
	Channels whose nominal bandwidth falls partly or completely within the 5600 – 5650 MHz band	Other channels
CAC, Off-Channel CAC	99.99 %	60 %
In-Service Monitoring	60 %	60 %
NOTE: Pd gives the probability of detection per simulated radar burst and represents a minimum level of detection performance under defined conditions. Therefore Pd does not represent the overall detection probability for any particular radar under real life conditions.		

Off-Channel CAC for Minimum number of burst detections for channels within the 5600-5650 MHz band

Off-Channel CAC Time (Minutes)	Number of Bursts generated assuming a BIT of 10 minutes	Minimum Number of burst detections
60	6	5
90	9	6
160	16	7
320	32	8
1440	144	9

3.3. Test Procedures

Channel Shutdown

The steps below define the procedure to verify the Channel Shutdown process and to determine the Channel Closing Transmission Time, the Channel Move Time.

a) When the EUT is a slave device (with or without a Radar Interference Detection function), the EUT shall associate with a master device.

In both cases, it is assumed that the channel selection mechanism for the *Uniform Spreading* requirement is disabled in the master.

a) The EUT shall transmit a test transmission sequence in accordance transmitter minimum activity ratio of 30 % measured over an interval of 100 ms on the selected channel Chr.

b) At a certain time T_0 , a single burst test signal is generated on Chr using the reference DFS test signal defined in table D.3 and at a level of up to 10 dB above the Radar Detection Threshold level on the selected channel. T_1 denotes the end of the radar burst.

c) The transmissions of the EUT following instant T_1 on the selected channel shall be observed for a period greater than or equal to the Channel Move Time limit. The aggregate duration (Channel Closing Transmission Time) of all transmissions from the EUT during the Channel Move Time shall be compared to the limit.

NOTE: The aggregate duration of all transmissions of the EUT does not include quiet periods in between transmissions of the EUT.

d) T_2 denotes the instant when the EUT has ceased all transmissions on the channel. The time difference between T_1 and T_2 shall be measured. This value (Channel Move Time) shall be noted and compared with the limit.

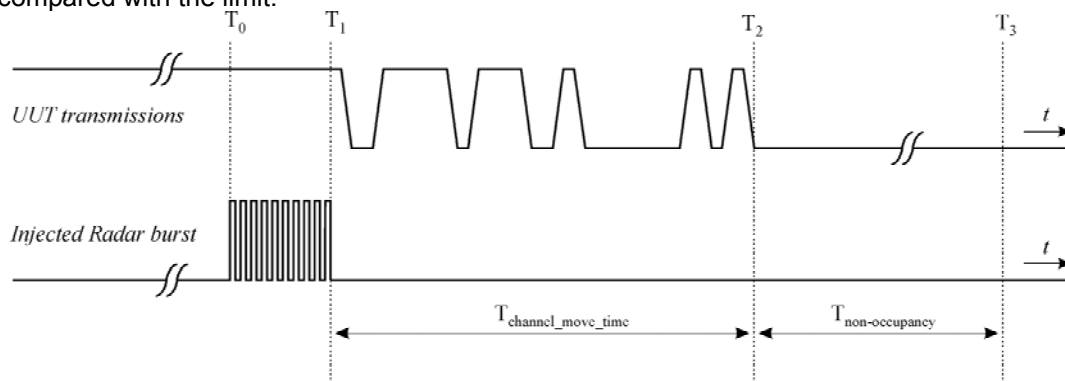
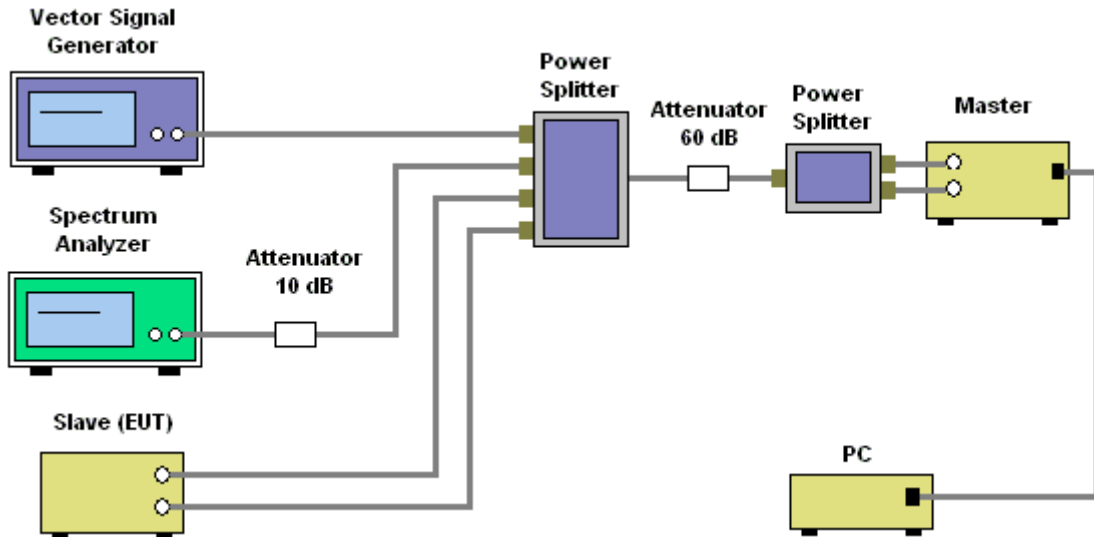


Figure 1: Channel Closing Transmission Time, Channel Move Time

3.4. Test Setup Diagram

Slave without Radar Detection Conducted Measurement



3.5. Test Deviation

There is no deviation with the original standard.

3.6. EUT Operation during Test

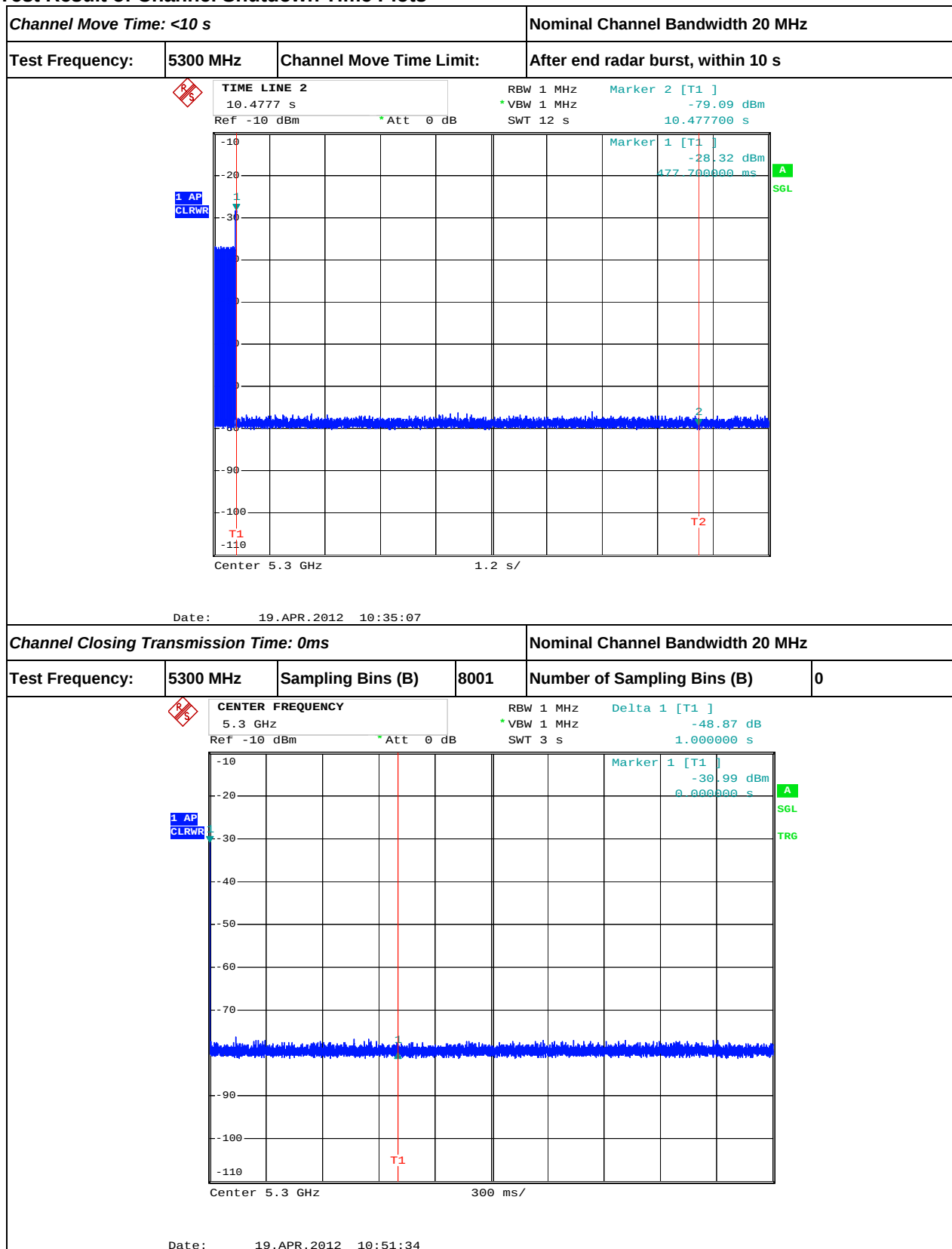
EUT transmitter minimum activity ratio of 30 % measured over an interval of 100 ms.

Channel Shutdown

Test Conditions (see clause EN 301 893, clause 5.3.8.1):			
Nominal Channel Bandwidth 20 MHz			
Antenna gain: 5.97 dBi (see EN 301 893, clause 5.3.8.2.1, paragraph 3)			
Power Density: 6.75 dBm/MHz			
Radar Detection Threshold level: (-62dBm+10dB)			
Duty Cycle: 32.71%	Test results		
Rel. Humidity: 62%	Radar Test Signal (#)	Channel Closing Transmission Time (ms)	Channel Move Time (s)
Ambient Temp.: 24.8°C			
Test Frequency:			
5300 MHz (20MHz)			
5500 MHz (20MHz)	Reference	0	0
5620 MHz (20MHz)	Reference	0	0
5310 MHz (40MHz)	Reference	34.50	0.0750
5510 MHz (40MHz)	Reference	42.00	0.1025
5630 MHz (40MHz)	Reference	52.50	0.1020
Measurement uncertainty: [n.a.]			



Test Result of Channel Shutdown Time Plots

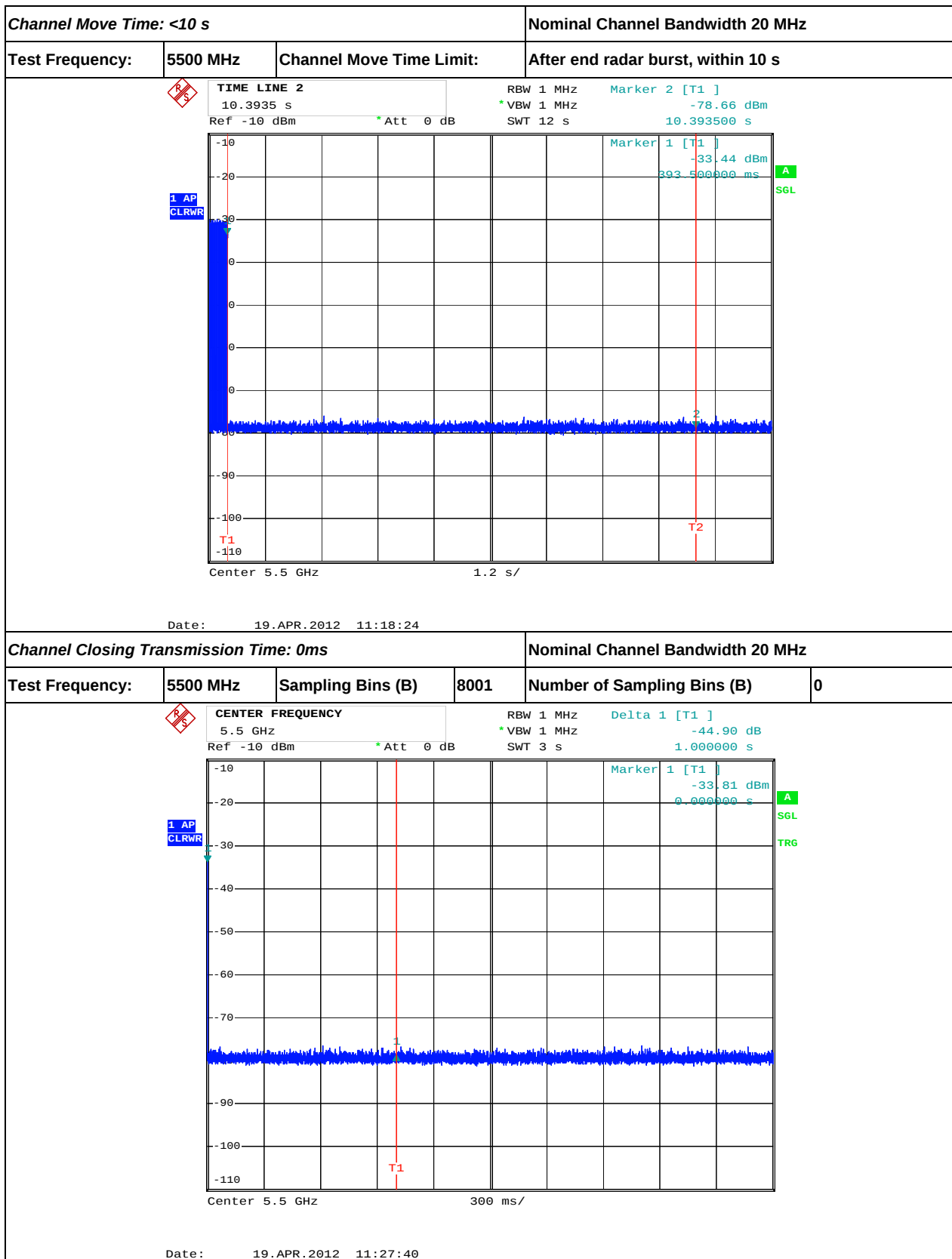




DFS-CCTT.vi

 **DFS Channel Close Transmission Time (v1.0.35)**  

VISA session GPIB0::21:	Marker 1 (sec) 0.4777	Set Points (501) 8001	Space Time of Point 0.0015	No. of Pulse 0
FSP & FSL	Marker 2 (sec) 10.4777	Set Sweep Time 12	Mark 1 Point 319	Close TX Time 0
	Total Trace of Points 8001	Threshold (dBm) -70	Mark 2 Point 6986	Trace Data 0 -79.2286

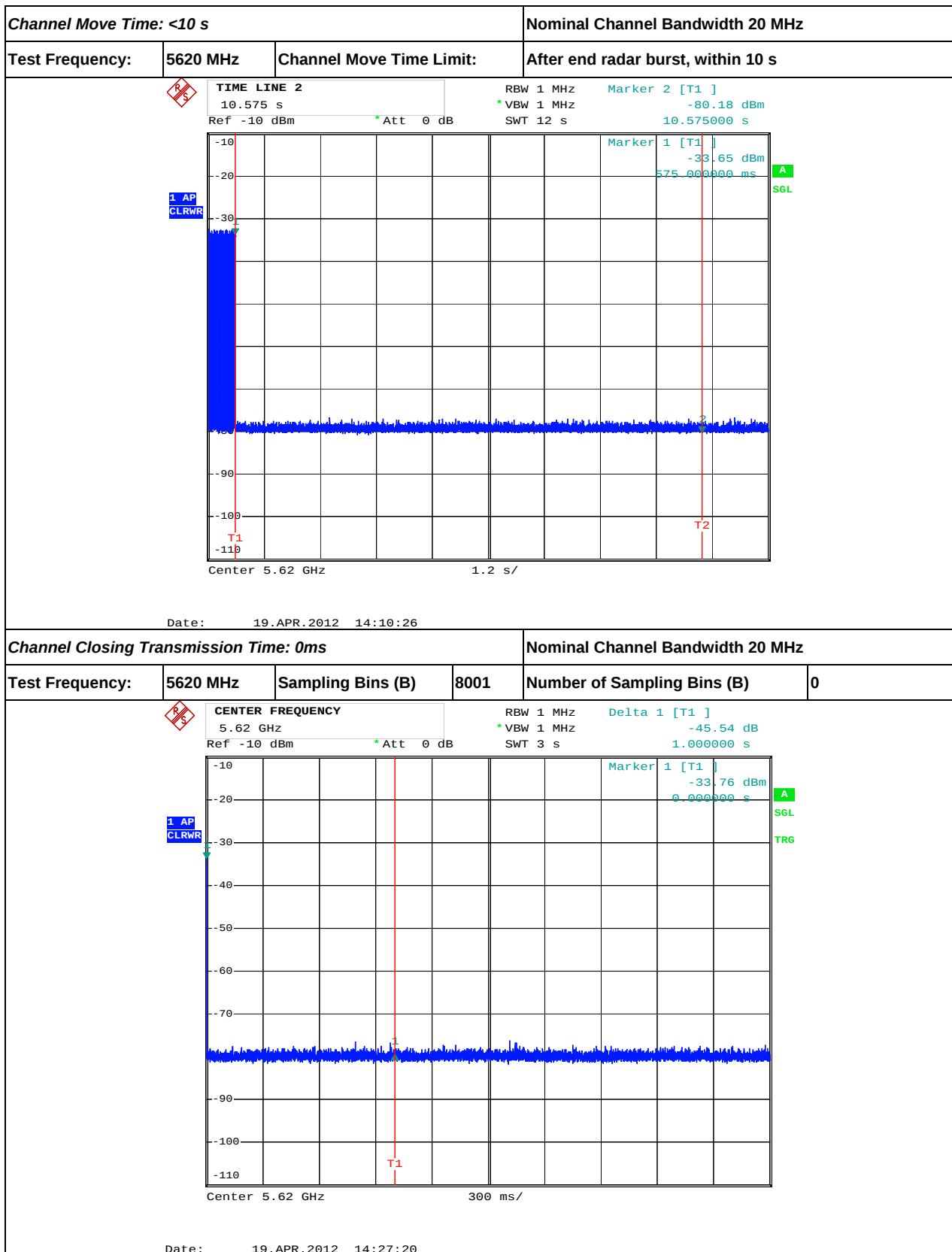




DFS-CCTT.vi

 **DFS Channel Close Transmission Time (v1.0.35)**  

VISA session GPIB0::21:	Marker 1 (sec) 0.3935	Set Points (501) 8001	Space Time of Point 0.0015	No. of Pulse 0
FSP & FSL	Marker 2 (sec) 10.3935	Set Sweep Time 12	Mark 1 Point 263	Close TX Time 0
	Total Trace of Points 8001	Threshold (dBm) -70	Mark 2 Point 6930	Trace Data 0 -30.1800

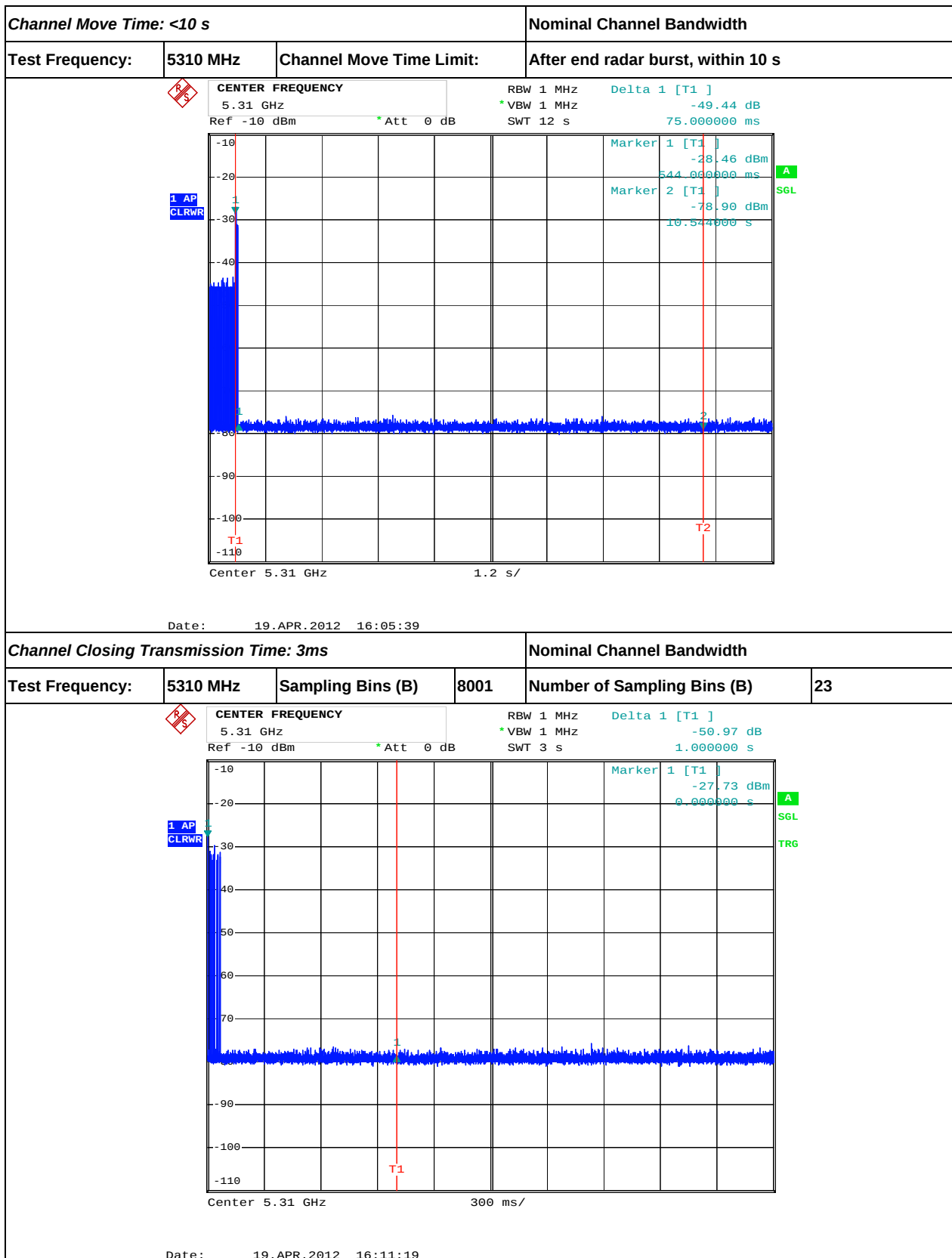




DFS-CCTT.vi

 **DFS Channel Close Transmission Time (v1.0.35)**  

VISA session GPIB0::21:	Marker 1 (sec) 0.575	Set Points (501) 8001	Space Time of Point 0.0015	No. of Pulse 0
FSP & FSL	Marker 2 (sec) 10.575	Set Sweep Time 12	Mark 1 Point 384	Close TX Time 0
	Total Trace of Points 8001	Threshold (dBm) -70	Mark 2 Point 7051	Trace Data 0 -79.5147

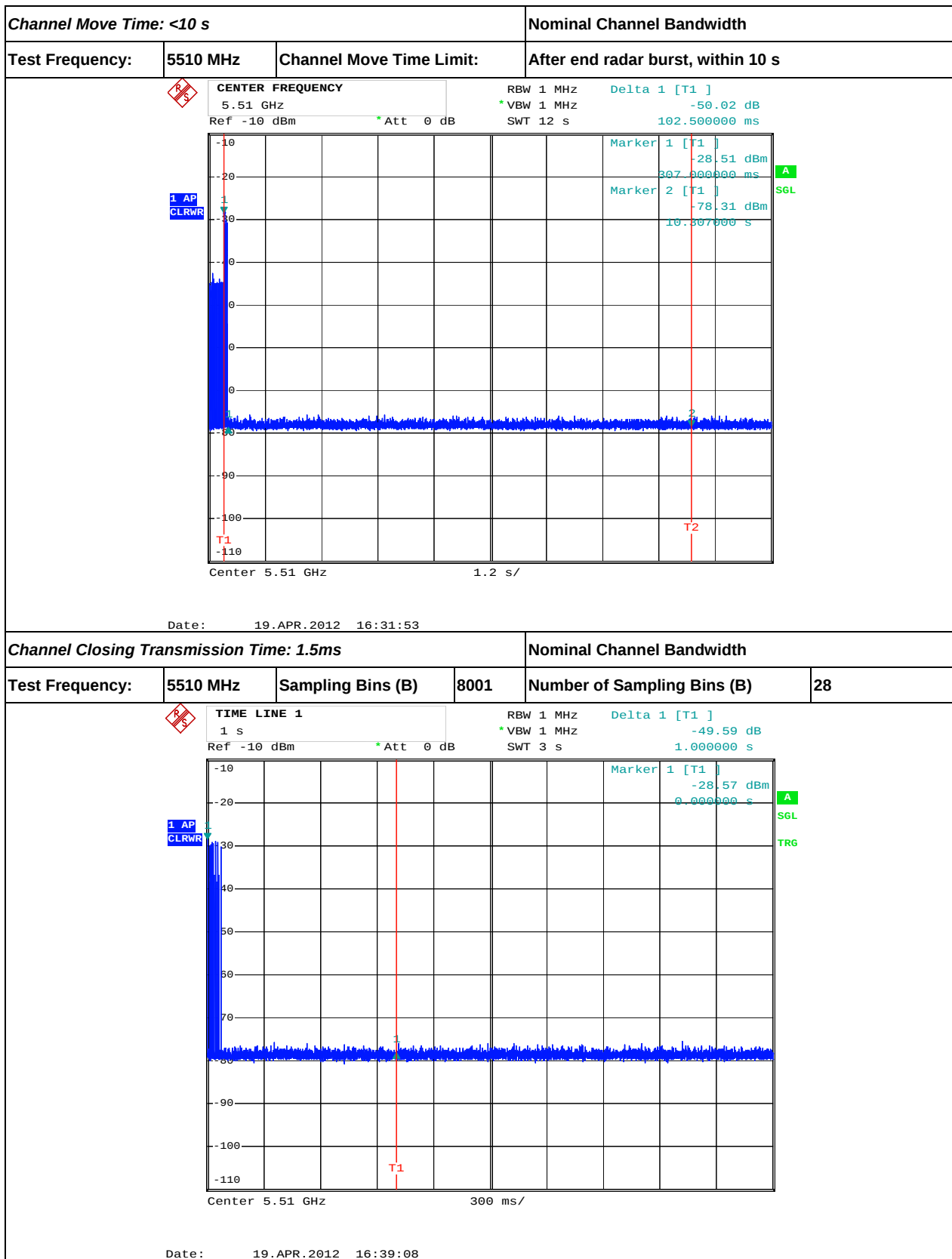




DFS-CCTT.vi

 **DFS Channel Close Transmission Time (v1.0.35)**  

VISA session GPIB0::21:	Marker 1 (sec) 0.544	Set Points (501) 8001	Space Time of Point 0.0015	No. of Pulse 23
FSP & FSL	Marker 2 (sec) 10.544	Set Sweep Time 12	Mark 1 Point 364	Close TX Time 0.0345
	Total Trace of Points 8001	Threshold (dBm) -70	Mark 2 Point 7030	Trace Data 0 -78.2274

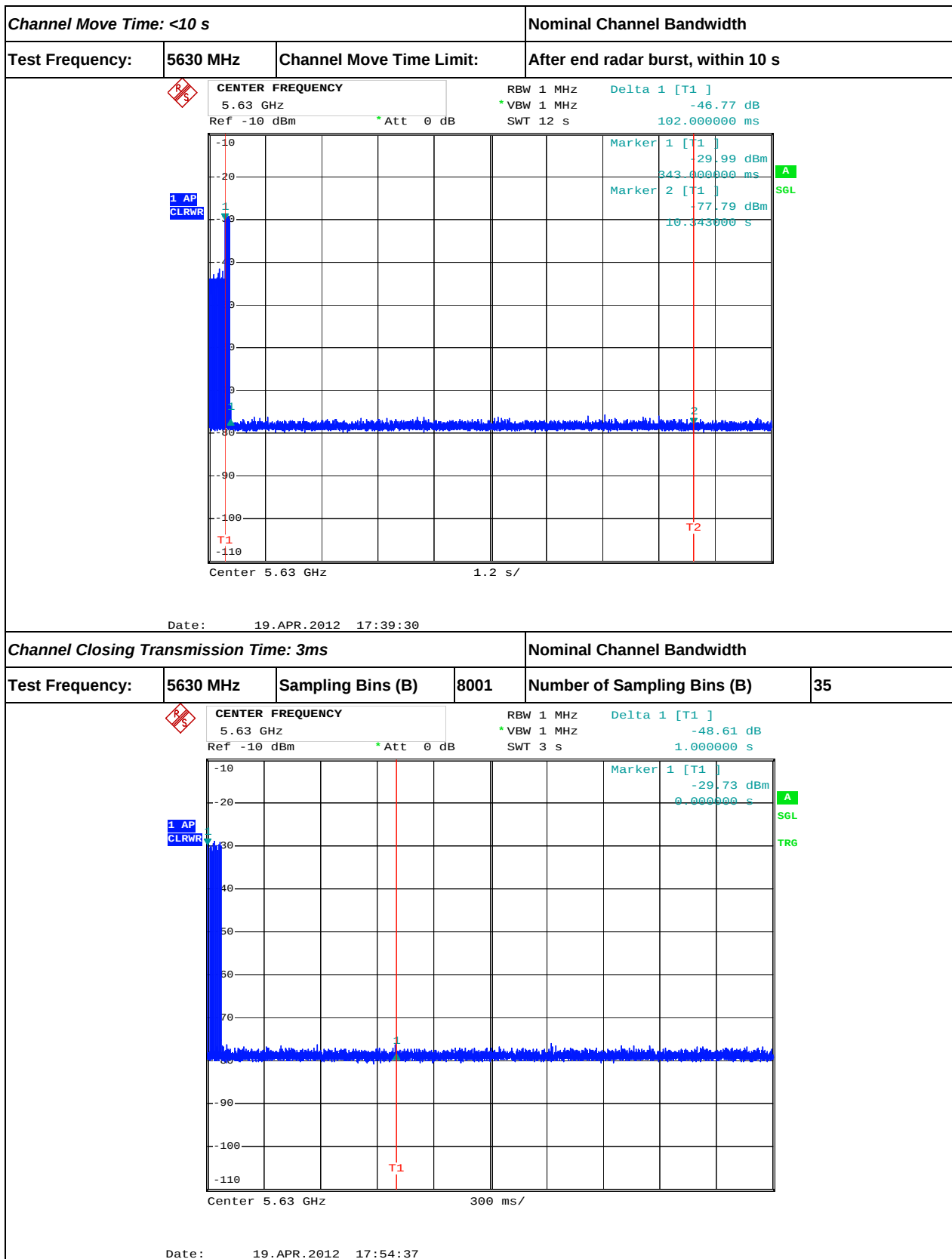




DFS-CCTT.vi

 **DFS Channel Close Transmission Time (v1.0.35)**  

VISA session GPIB0::21:	Marker 1 (sec) 0.307	Set Points (501) 8001	Space Time of Point 0.0015	No. of Pulse 28
FSP & FSL	Marker 2 (sec) 10.307	Set Sweep Time 12	Mark 1 Point 206	Close TX Time 0.042
	Total Trace of Points 8001	Threshold (dBm) -70	Mark 2 Point 6872	Trace Data 0 -78.3700





DFS-CCTT.vi

 **DFS Channel Close Transmission Time (v1.0.35)**  

VISA session GPIB0::21:	Marker 1 (sec) 0.343	Set Points (501) 8001	Space Time of Point 0.0015	No. of Pulse 35
FSP & FSL	Marker 2 (sec) 10.343	Set Sweep Time 12	Mark 1 Point 230	Close TX Time 0.0525
	Total Trace of Points 8001	Threshold (dBm) -70	Mark 2 Point 6896	Trace Data 0 -44.0870



4. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Spectrum Analyzer	R&S	FSP 7	100643	9kHz ~ 7GHz	Aug. 23, 2011	Conducted (TH01-HY)
Vector Signal Generator	R&S	SMU200A	102098	100kHz ~ 6GHz	Oct. 05, 2011	Conducted (TH01-HY)
RF Cable-3m	HUBER+SUHNER	SUCOFLEX_104	302338	1 ~ 26.5GHz	Jan. 01, 2012	Conducted (TH01-HY)
RF Cable-10m	HUBER+SUHNER	SUCOFLEX_104	302345	1 ~ 26.5GHz	Jan. 01, 2012	Conducted (TH01-HY)
Horn Antenna	ETS-LINDGREN	3117	00091920	1 ~ 18GHz	Nov. 15, 2011	Conducted (TH01-HY)
Horn Antenna	COM-POWER	AH-118	711064	1 ~ 18GHz	Jul. 27, 2011	Conducted (TH01-HY)

Note: Calibration Interval of instruments listed above is one year.



Appendix A. Test Photos

1. Photographs of DFS Test Configuration

FRONT VIEW

