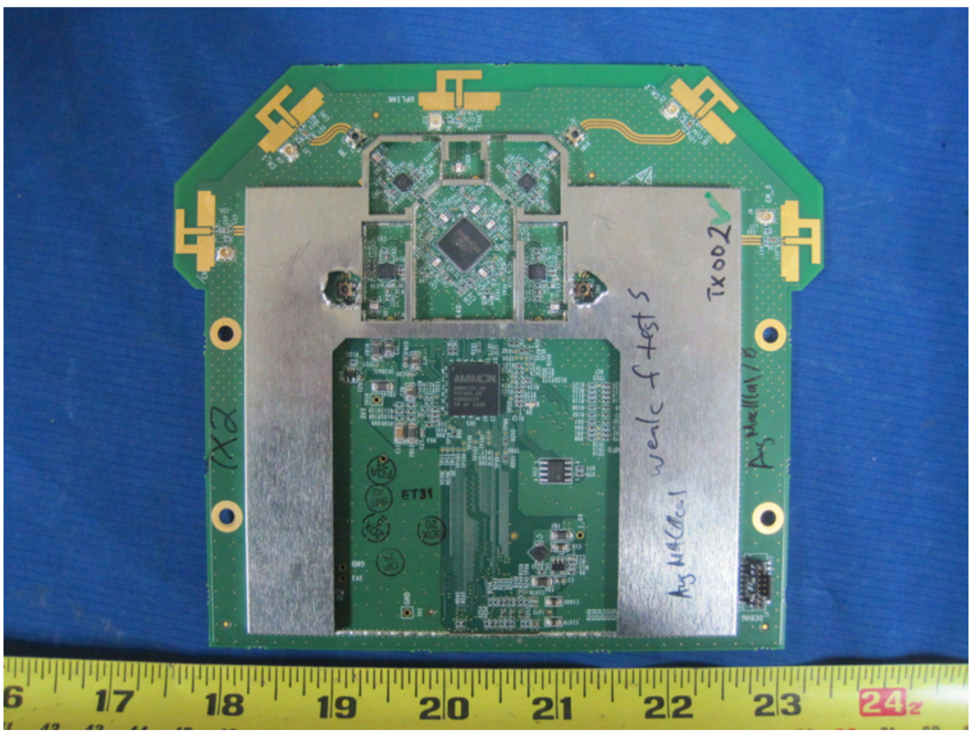
STRYKER ENDOSCOPY

SYNK TRANSMITTER

Model: P23368

Jan 13th, 2013
Report No.: SL12011902-STR-001_ SYNK_Transmitter(DFS Client)
(This report supersedes NONE)



Modifications made to the product : None

This Test Report is Issued Under the Authority of:	
Choon Sian Ooi Compliance Engineer	David Zhang Compliance Engineer

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RF Test Report
To: FCC15.407h DFS Test Report

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Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC , RF/Wireless , Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless , Telecom
Taiwan	BSMI , NCC , NIST	EMC, RF, Telecom , Safety
Hong Kong	OFTA , NIST	RF/Wireless ,Telecom
Australia	NATA, NIST	EMC, RF, Telecom , Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF , Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC , RF/Wireless, Telecom
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Accreditations for Product Certifications

Country	Accreditation Body	Scope
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Canada	IC FCB , NIST	EMC , RF , Telecom
Singapore	iDA, NIST	EMC , RF , Telecom
EU	NB	EMC & R&TTE Directive
Japan	MIC (RCB 208)	RF , Telecom
HongKong	OFTA (US002)	RF , Telecom

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1 Executive Summary & EUT information

The purpose of this test programme was to demonstrate compliance of the Stryker Endoscopy, SYNK TRANSMITTER, against the current Stipulated Standards. The SYNK TRANSMITTER has demonstrated compliance with the FCC15.407h, FCC 06-96, and IC RSS210 Issue 8: 2010.

Applicant & EUT Information

Applicant Information

Applicant / Client	**Stryker Endoscopy** **5900 Optical Court, San Jose, California 95138 U.S.A**
Manufacturer1	**Stryker Endoscopy** **5900 Optical Court, San Jose, California 95138 U.S.A**

EUT Information

EUT Description	:	**SYNK TRANSMITTER**
Model Name	:	**P23368**
Serial No	:	**N/A**
Input Power	:	**100-240VAC, 50-60Hz**
Frequency	:	**5180~5320MHz, 5500~5700MHz, 5745-5825MHz**
Modulation	:	**OFDM**
Classification Per Stipulated Test Standard	:	**UNII Device**

2 TECHNICAL DETAILS

Laboratory performing the tests	**SIEMIC Laboratories 775 Montague Expressway Milpitas, CA, 95035**
Date of EUT received	**Sep 10th, 2012**
Dates of test (from – to)	**Oct 18th , 2012 – Jan 7th , 2013**
Equipment Category	**UNII**
Standard applied	**See page 2**
FCC ID:	**SSH-SYNKTX**
IC ID:	**4919C-SYNKTX**

EUT Test Mode Evaluation

EUT Major Function List

Functions	Description
Fn#1	Wireless communication

EUT Test Mode List

RF Test Modes	Description	Test Configuration
RF_Test Mode	TTE test software	Continues Tx

5150~5350MHz		5470~5725MHz	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	5180	9	5500
2	5200	10	5520
3	5220	11	5540
4	5240	12	5560
5	5260	13	5580
6	5280	14	5660
7	5300	15	5680
8	5320	16	5700

5725~5825MHz			
Channel	Frequency (MHz)		
17	5745		
18	5765		
19	5785		
20	5805		
21	5825		

Supporting Equipment & Cabling

Supporting equipment used with the EUT

Equipment Description	Model	Serial No.	Manufacturer
PC Laptop / HP	N/A	N/A	HP
Multimedia Generator	ODSG-02C	N/A	Spider
SYNK Receiver	P23366	N/A	Stryker Endoscopy
WISE 26" HDTV Display	VHW261I0620	N/A	Stryker Endoscopy
DFS Master (FCC ID: SSH-SYNKRX)	P23366	N/A	Stryker Endoscopy

Details of cables between EUT and Supporting Equipment

Connection Start		Connection Stop		Length / shielding Info	
From	I/O Port	To	I/O Port	Length(m)	Shielding
PC Laptop / HP	Serial	EUT	Serial	0.5	N/A
Multimedia Generator	Serial	EUT	Serial	0.5	N/A
SYNK Receiver	RF	EUT	RF	0.5	N/A
WISE 26" HDTV Display	DVI	SYNK Receiver	DVI	0.5	N/A

Test Software Information

Test Item	Software	Description
DFS	TTE test software	Set the EUT to different modulation and channel

3 TEST SUMMARY

The product was tested in accordance with the following specifications.
All Testing has been performed according to below product classification:

UNII Device

Test Results Summary

Test Standard		Description	Pass / Fail
47 CFR Part 15 Subpart E	RSS 210 Issue 8		
15.407 (h)(2)(b)(iii)	RSS210(A9.3)	Dynamic Frequency Selection (DFS)	Pass
ANSI C63.4: 2009 PS: All measurement uncertainties are not taken into consideration for all presented test result.			

*The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual.

4 MEASUREMENTS, EXAMINATION AND DERIVED RESULTS

4.1 Dynamic Frequency Selection (DFS)

4.1.1 Test Procedure and Setup

Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	**Value (see note)**
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 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.	

DFS Response requirement values

Parameter	**Value**
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 80% of the 99% power bandwidth See Note 3.
Note 1: The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows: • For the Short pulse radar Test Signals this instant is the end of the *Burst*. • For the Frequency Hopping radar Test Signal, this instant is the end of the last radar *Burst* generated. • For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission. Note 2: The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required facilitating *Channel* changes (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. Note 3: During the *U-NII Detection Bandwidth* detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.	

Radar Test Waveforms

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms

1. Short Pulse Radar Test Waveforms

Rada r Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Trials
1	1	1428	18	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

2. Long Pulse Radar Test Waveform

Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per *Burst*	Number of *Bursts*	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-20 00	1-3	8-20	80%	30

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse radar test signal. If more than 30 waveforms are used for the Long Pulse radar test signal, then each additional waveform must also be unique and not repeated from the previous waveforms.

Each waveform is defined as follows:

1) The transmission period for the Long Pulse Radar test signal is 12 seconds. 2) There are a total of 8 to 20 Bursts in the 12 second period, with the number of Bursts being randomly chosen. This number is Burst_Count. 3) Each Burst consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each Burst within the 12 second sequence may have a different number of pulses.

4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a Burst will have the same pulse width. Pulses in different Bursts may have different pulse widths.

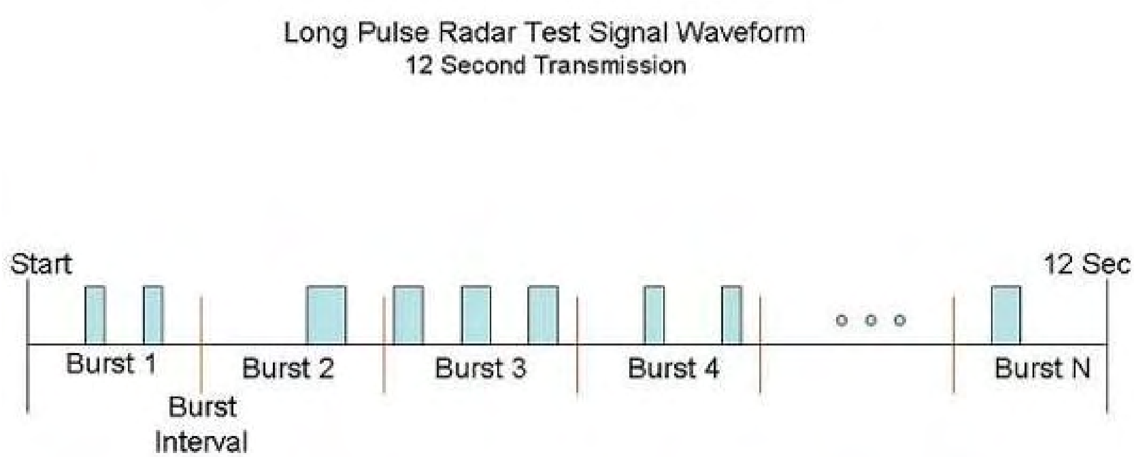
5) Each pulse has a linear FM chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a Burst will have the same chirp width. Pulses in different Bursts may have different chirp widths. The chirp is centered on the pulse. For example, with a radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.

6) If more than one pulse is present in a Burst, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a Burst, the time between the first and second pulses is chosen independently of the time between the second and third pulses.

7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to Burst_Count. Each interval is of length (12,000,000 / Burst_Count) microseconds. Each interval contains one Burst. The start time for the Burst, relative to the beginning of the interval, is between 1 and [(12,000,000 / Burst_Count) – (Total Burst Length) + (One Random PRI Interval)] microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The s9tart time for each Burst is chosen independently.

A representative example of a Long Pulse radar test waveform:

1) The total test signal length is 12 seconds. 2) 8 Bursts are randomly generated for the Burst Count. 3) Burst 1 has 2 randomly generated pulses. 4) The pulse width (for both pulses) is randomly selected to be 75 microseconds. 5) The PRI is randomly selected to be at 1213 microseconds. 6) Bursts 2 through 8 are generated using steps 3 – 5. 7) Each Burst is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, Burst 1 is randomly generated (1 to 1,500,000 minus the total Burst 1 length + 1 random PRI interval) at the 325,001 microsecond step. Bursts 2 through 8 randomly fall in successive 1,500,000 microsecond intervals (i.e. Burst 2 falls in the 1,500,001 – 3,000,000 microsecond range).



3. Frequency Hopping Radar Type

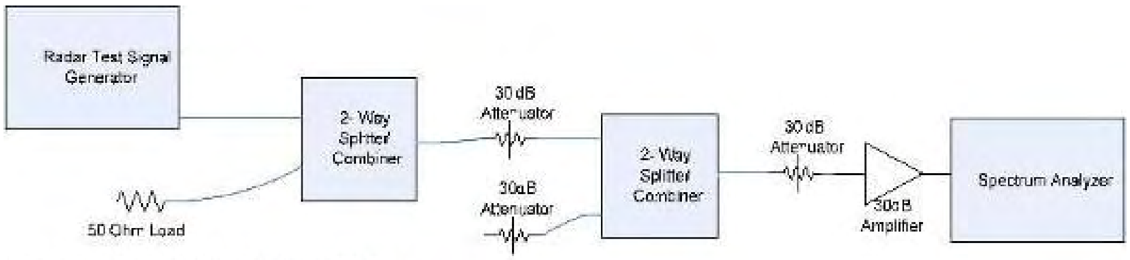
Radar Type	Pulse Width (μsec)	PRI (μsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	9	.333	300	70%	30

For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected 1 from the hopping sequence defined by the following algorithm:

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

4.1.2 Radar Waveform Calibration

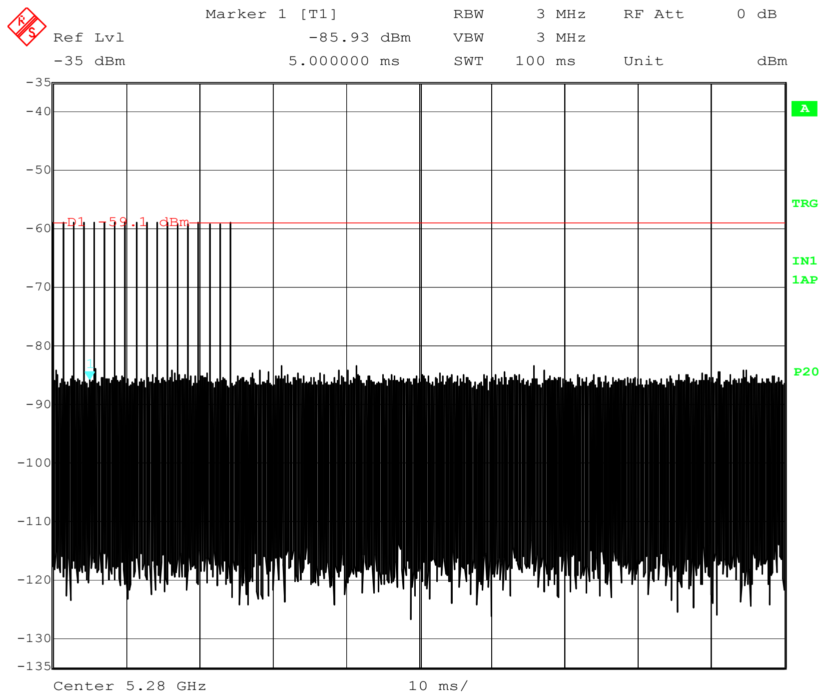
The following equipment setup was used to calibrate the conducted Radar Waveform. A spectrum analyzer was used to establish the test signal level for each radar type. During this process there were no transmissions by either the Master or Client Device. The spectrum analyzer was switched to the zero span (Time Domain) mode at the frequency of the Radar Waveform generator. Peak detection was utilized. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) were set to 3 MHz.



Conducted Calibration Setup

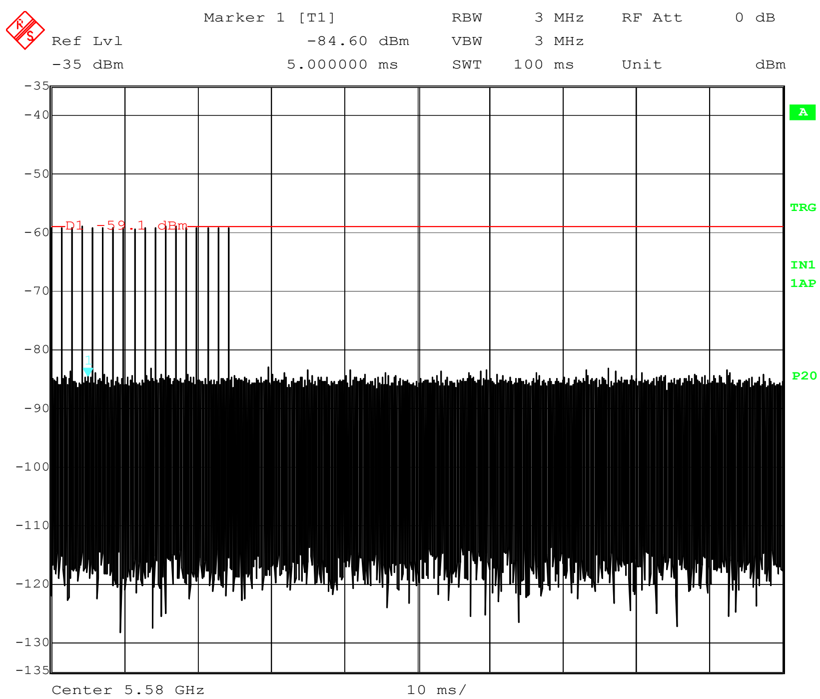
5250MHz to 5350MHz bands

Radar Type 1



5470MHz to 5725MHz band

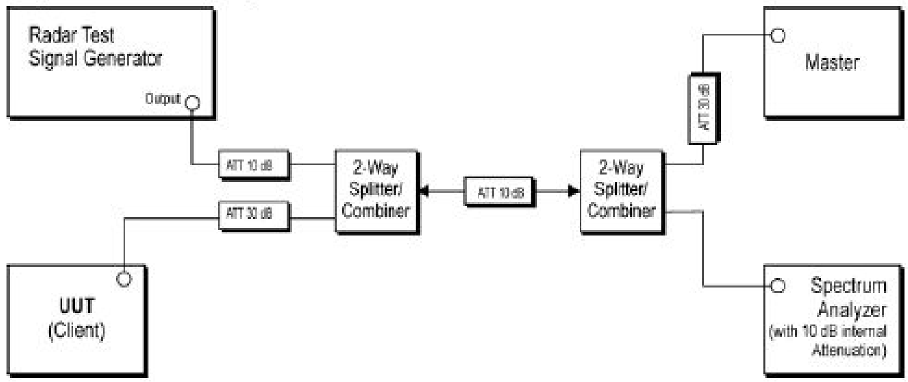
Radar Type 1



4.1.3 Test Setup

Test Setup Block Diagram

7.2.2 Setup for Client with injection at the Master



The radio was set at the center channel frequency of tested Channel.
A FCC DFS Master device (FCC ID: SSH-SYNKRX) was used to link with DFS client device.

For the frequency bands 5470MHz to 5725MHz and 5250MHz to 5350MHz the master device provides, on aggregate, uniform loading of the spectrum across all devices by selecting an operating channel among the available channels using a random algorithm.

Antenna gain of 1.9 dBi ;

Radar receive signal level=-62dBm + minimum antenna gain +1dB

=-59.1dBm

4.1.4 DFS Test Results

In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period

These tests define how the following DFS parameters are verified during In-Service Monitoring; Channel Closing Transmission Time, Channel Move Time, and Non-Occupancy Period.

The steps below define the procedure to determine the above mentioned parameters when a radar Burst with a level equal to the DFS Detection Threshold + 1dB (--59 dBm) is generated on the Operating Channel of the U-NII device.

UUT operating as a Client Device will associate with the (Master) at Mid Channel. DFS testing while the system is performing a FTP file transfer of a Zebra proprietary 50MB label file representing the biggest label file a customer could send over WIFI to the printers. The data rates will be adjusted to allow for the highest channel loading possible in theory by the system, up to a maximum loading of 22%. The 22% is based on the expected channel loading of a typical 802.11n radio link while running an FTP for transfer of the label file. The 50MB file was set to continuously transferring after transfer duration 60seconds end as lopping process.

At time T0 the Radar Waveform generator sends a Burst of pulses for each of the radar types at -59 dBm.

Observe the transmissions of the UUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the UUT during the observation time (Channel Move Time). Compare the Channel Move Time and Channel Closing Transmission Time results to the limits defined in the DFS Response requirement values table.

Channel Closing Transmission Time- Measurement

A type 1 waveform was introduced to the EUT and the Spectrum Analyzer sweep time was set to 1s for monitoring and capturing the plot. A LabView program was created to collect trace data and capturing the plot. The program will calculate the channel closing time base on the spectrum analyzer result. The result will be calculated base on FCC procedure.

C= N*Dwell

C is the closing time, N is the number of spectrum analyzer sampling bins showing a U-NII transmission and dwell is the dwell time per bin.

Dwell= S/B

Where Dwell is the dwell time per spectrum analyzer sampling bin, S is the sweep time and B is the number 0f spectrum analyzer sampling bins.

Radar (Type 1)

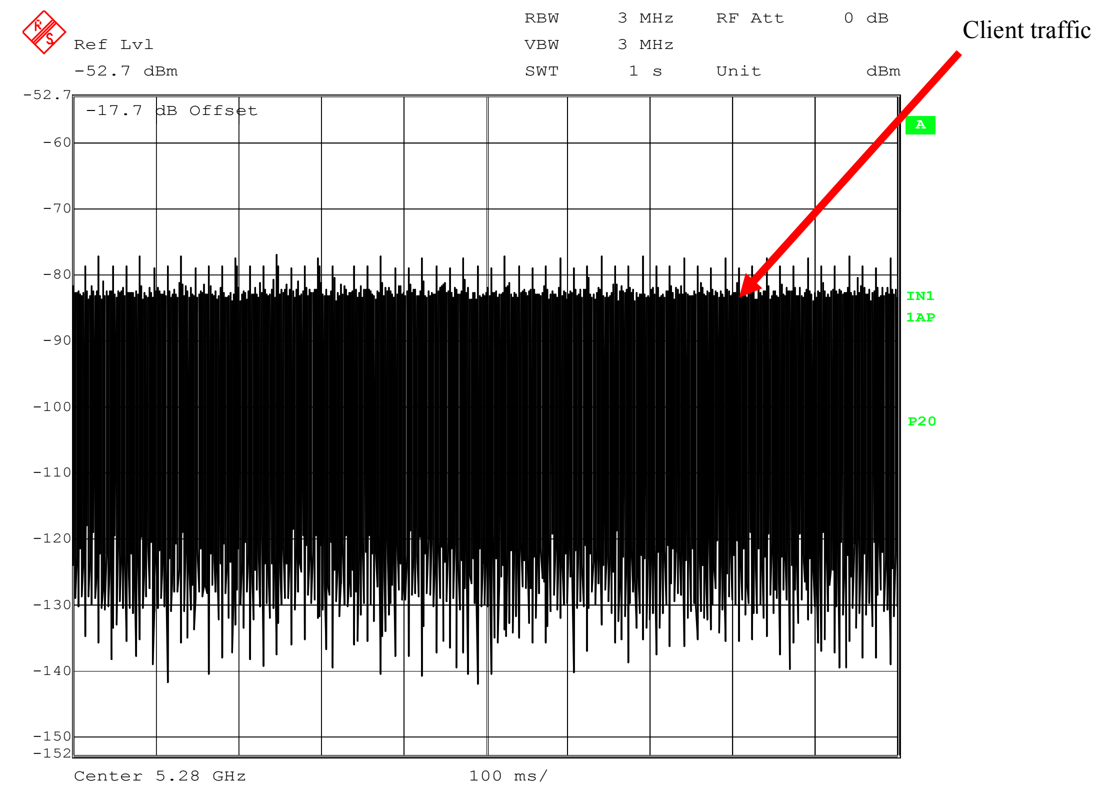
Frequency Band	Test Item	Requirement	Result
5250MHz to 5350MHz	Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See **Notes 1** and **2**.	Pass
	Channel Move Time	10 seconds	Pass
	Non-Occupancy Period	30 minutes	Pass
5470MHz to 5725MHz	Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See **Notes 1** and **2**.	Pass
	Channel Move Time	10 seconds	Pass
	Non-Occupancy Period	30 minutes	Pass

Note 1: The instant that the Channel Move Time and the Channel Closing Transmission Time begins is as follows:

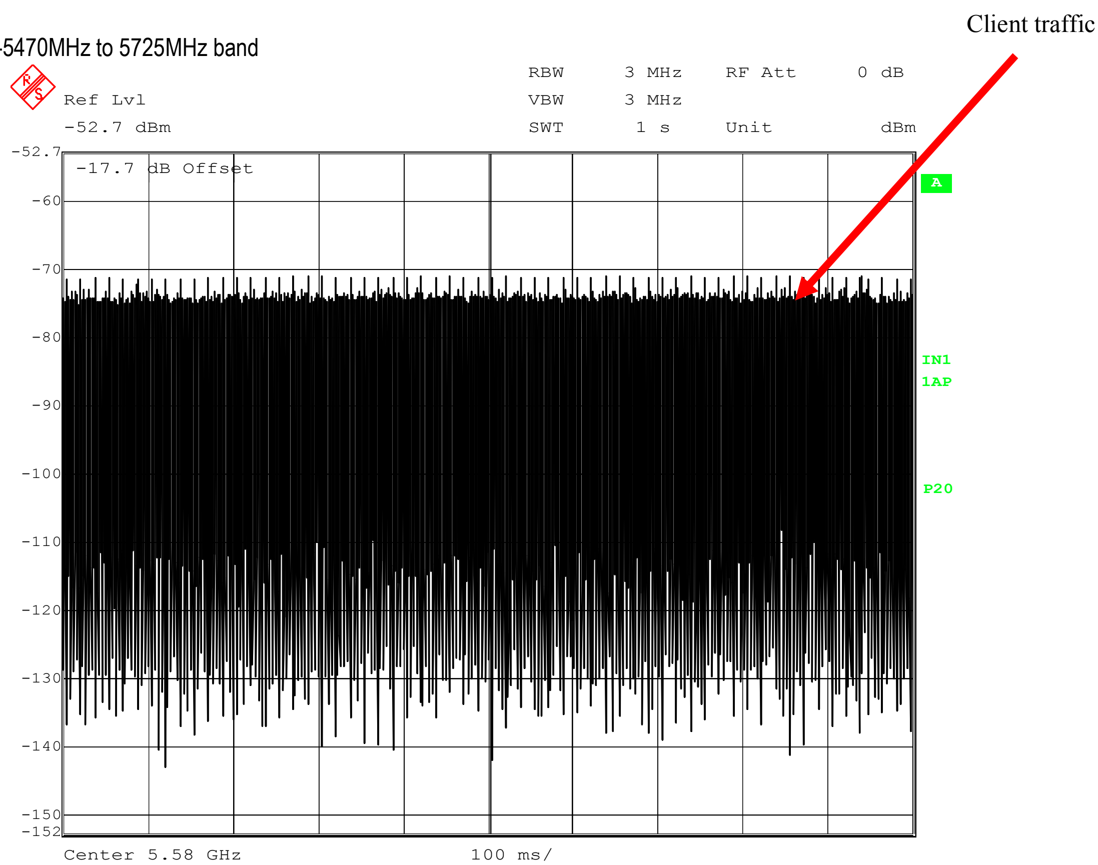
- For the Short Pulse Radar Test Signals this instant is the end of the Burst.
- For the Frequency Hopping radar Test Signal, this instant is the end of the last radar Burst generated.
- For the Long Pulse Radar Test Signal this instant is the end of the 12 second period defining the Radar Waveform.

Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between

Client traffic -5250MHz to 5350MHz band

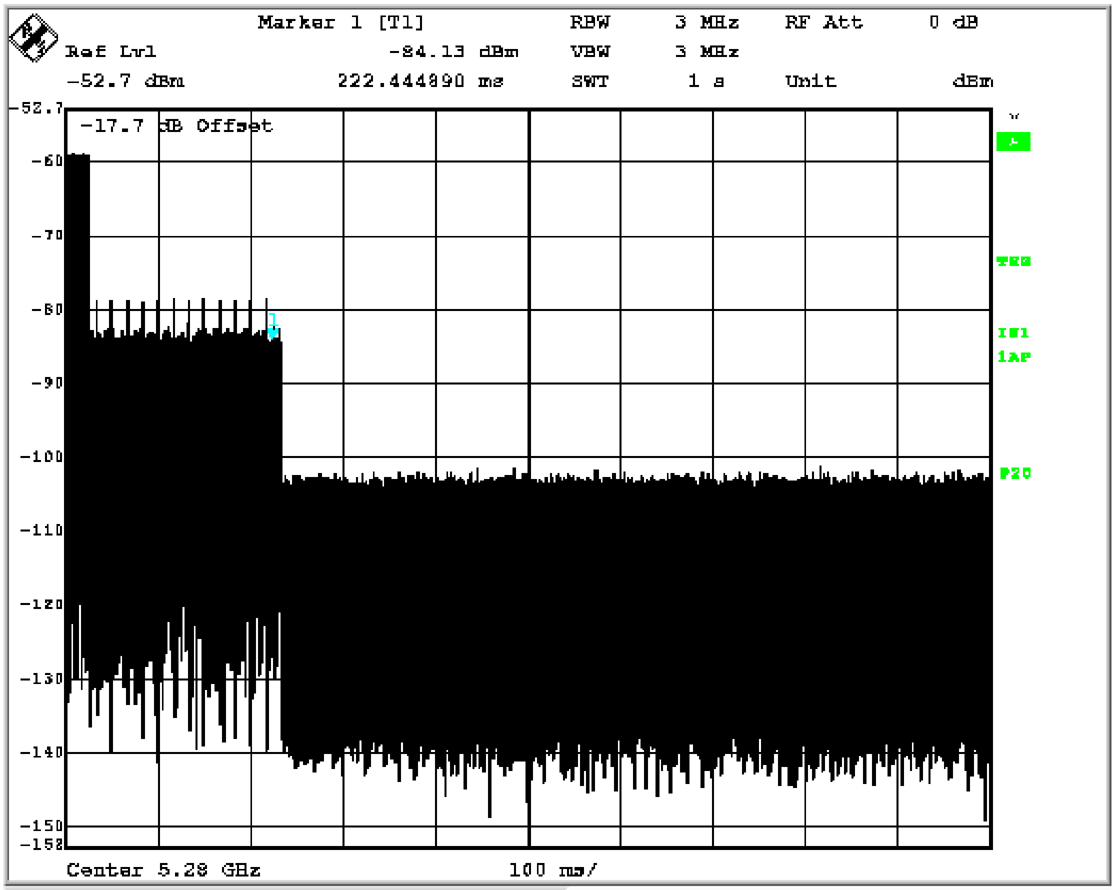


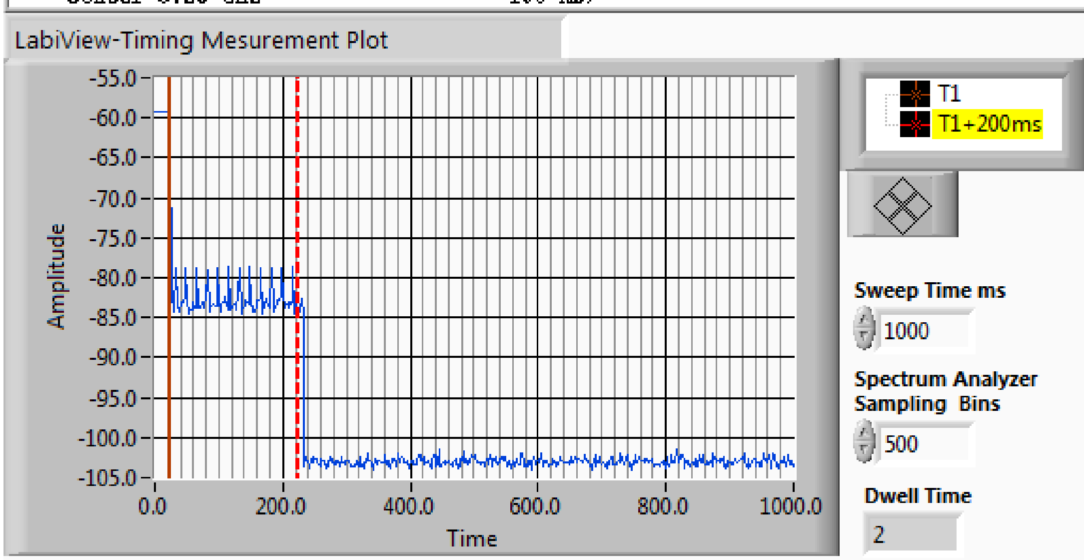
Client traffic -5470MHz to 5725MHz band



Channel Closing Transmission Time for Type 1 Radar -20MHz channel

Test Result-5250MHz to 5350MHz band



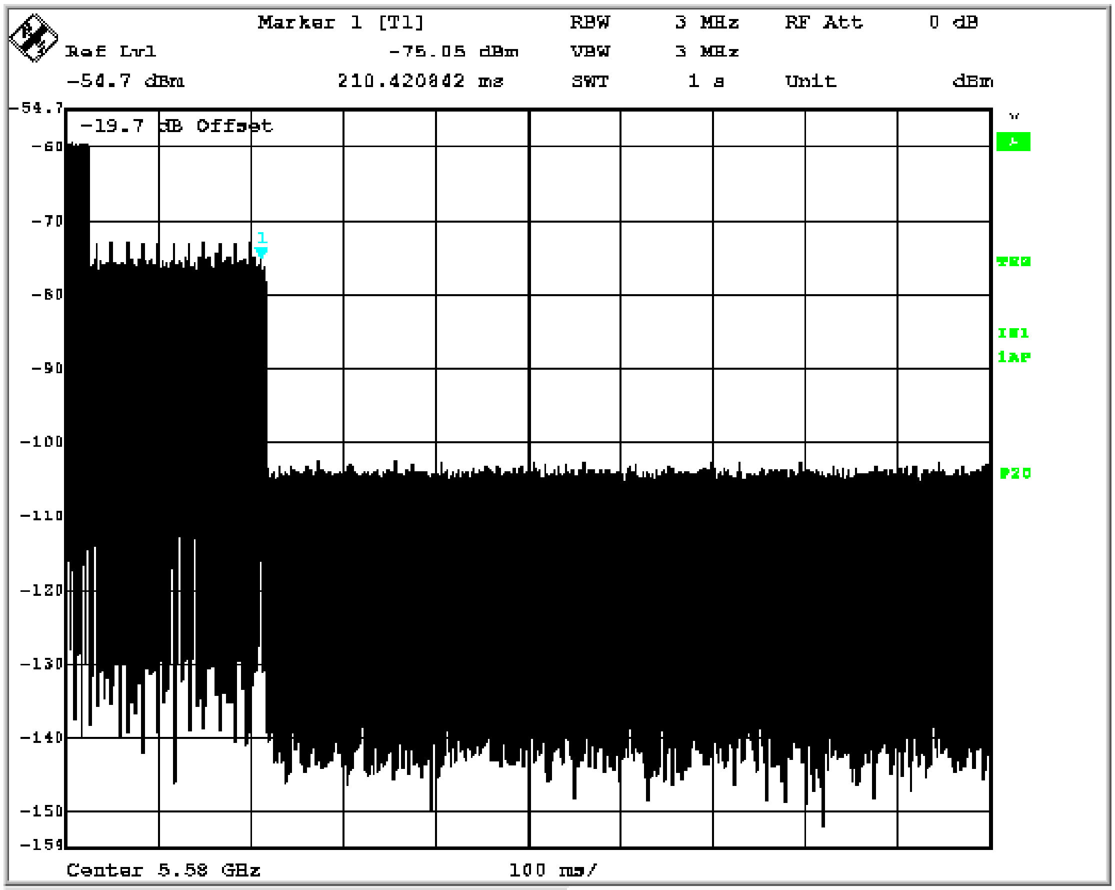


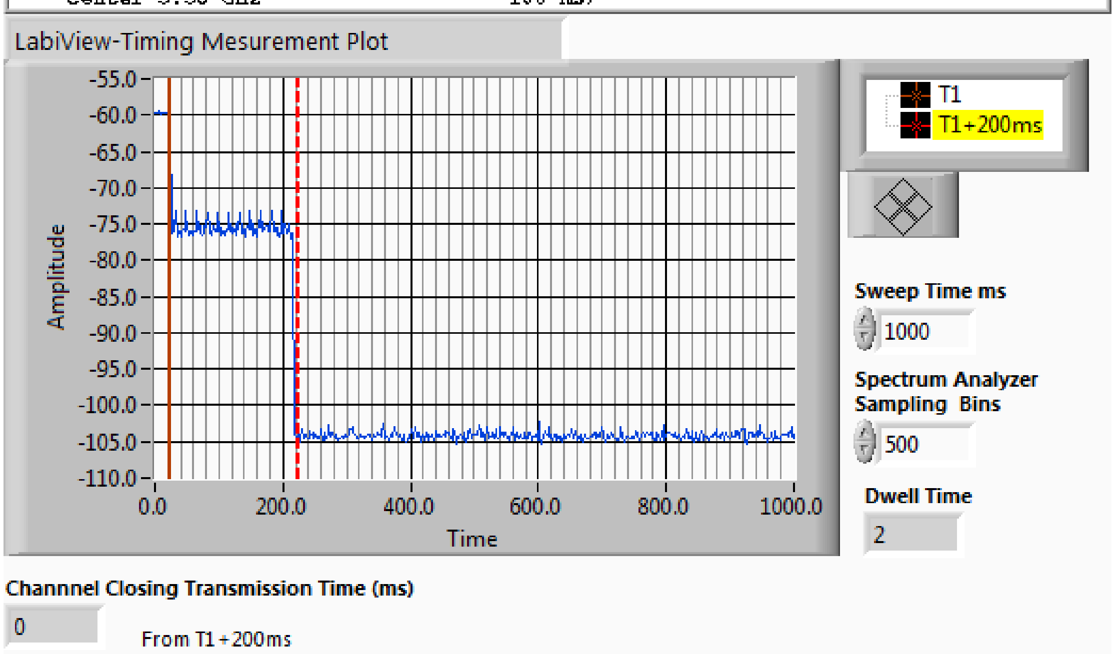
Channnel Closing Transmission Time (ms)

8

From T1+200ms

Test Result-5470MHz to 5725MHz band

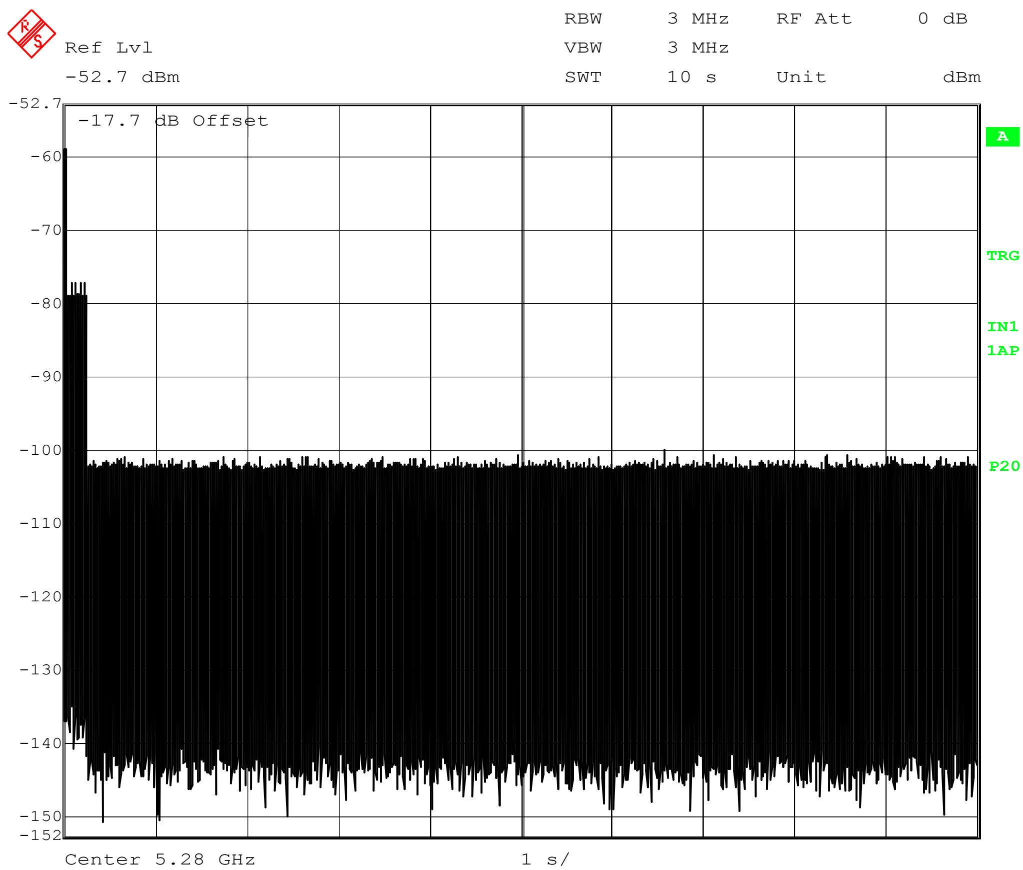




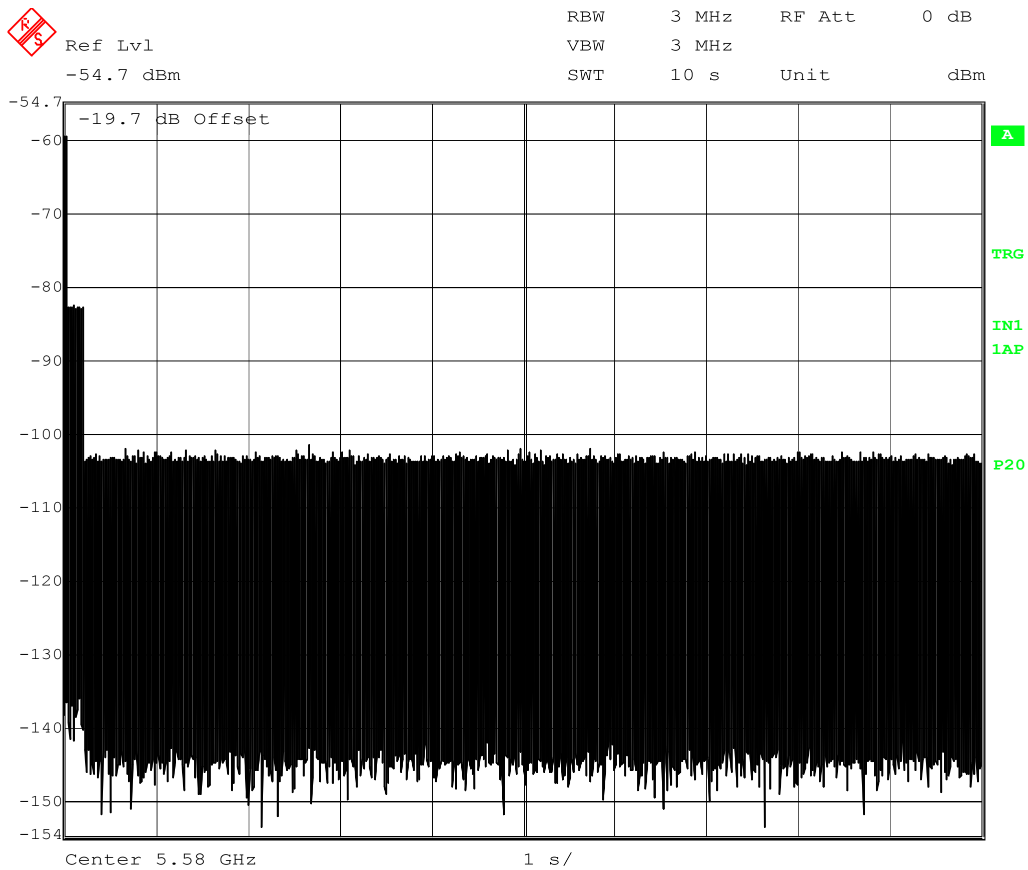
Additionally, a redundant conventional spectrum analyzer screen capture plot is provided for verification purpose.

Channel Closing Transmission Time and Channel Move Time Radar Type 1- 20MHz channel

Test Result-5250MHz to 5350MHz band



Test Result-5470MHz to 5725MHz band



Non-occupancy period -20MHz channel

Test Result-5250MHz to 5350MHz band