Test Report

FM DECT SYSTEM

Manufacturer:

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4905 Tilghman St., Suite 120
Allentown, PA 18104
United States

By

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TYPE CERTIFICATION TEST REPORT

FM DECT Vehicle Unit USA
Model Number *X10-723-002-035*

TABLE OF CONTENTS

LIST of TABLES

LIST of FIGURES

List of Abbreviations

B –	emission bandwidth
BS –	Base Station
CW –	continuous wave
dBi –	dB referenced to isotropic antenna gain
EUT –	Equipment Under Test
LIC –	Least Interfered Channel
M_L –	upper interference threshold
M_U –	upper interference threshold
n.a. –	not applicable
ppm -	parts per million
PSD -	power spectral density
rf –	radio frequency
RBW –	resolution bandwidth
TDMA –	time division multiple access
T_U –	Upper Threshold
T_L –	Lower Threshold
U_M –	measurement uncertainty
VU -	Vehicle Unit

1. EUT Description

The Equipment Under Test (EUT) is the **FM DECT Vehicle Unit USA**.

Specific test requirements for this device include the following:

47 CFR 15.249	Fundamental Transmit Power
47 CFR 15.249	Spurious Radiated Power
15.205 & 15.209	
47 CFR 15.231	Occupied Bandwidth
47 CFR 15.203	Antenna Requirement
47 CFR 15.207	Conducted Emissions

The system tested consisted of the following:

Manufacturer & Model	**FCC ID #**	**Description**
FM DECT Vehicle Unit	**SD9X10723002035**	**Vehicle Unit USA**

2. Testing Summary

The **FM DECT VU** was tested and found to be in compliance with FCC Part 15, Subpart D (UPCS).

The following table details the test and evaluation results:

General Requirements				
Requirement	**FCC Part**	**Test Procedure** (Section numbers refer to ANSI C63.17 unless otherwise noted)	**Result**	**Detailed Results**
Radiated Out of Band Emissions	**15.309 (b) & FCC Part 15 Subpart B, 15.109**		**PASS**	**Separate Attachment**
Labeling Requirements	**15.311 & 15.19(a)(3)**		**PASS**	**Separate Attachment**
Conducted Emissions	**15.315 & 15.207 15.309 (b) & 15.107**	**ANSI C63.4**	**n.a.**	**n.a.**
Antenna Requirements	**15.317 & 15.203**	**Declaration**	**Attestation**	**5.1**
Use digital modulation	**15.319 (b)**	**6.1.4**	**Attestation**	**5.2**

Requirement	FCC Part	Test Procedure (Section numbers refer to ANSI C63.17 unless otherwise noted)	Result	Detailed Results
Peak transmit power	15.303(f) & 15.319 (c)	6.1.2	PASS	5.3
Power spectral density	15.319 (d) & 15.107	6.1.5	PASS	5.4
Power adjustment for antenna gain	15.319 (e)	4	Attestation	5.5
Automatically discontinue transmission	15.319 (f)		PASS	5.6
Spurious emissions	15.319 (g) & 15.209	6.1.6	PASS	5.7
RF Exposure	15.319 (i) & 1.1307(b), 2.1091 and 2.1093	ANSI/IEEE C95.1	Attestation	5.8

Isochronous Requirements				
Emission Bandwidth	15.303(c) & 15.323 (a)	6.1.3	PASS	5.9
Listen before talk	15.323 (c)	7	Attestation	5.10
Monitoring time	15.323 (c)(1)	7.3.4	PASS	5.11
Monitoring threshold	15.323 (c)(2)	7.3.1	PASS	5.12
Maximum transmit time	15.323 (c)(3)	8.2.2	PASS	5.13
System acknowledgement	15.323 (c)(4)	8.1.1 & 8.1.2	PASS	5.14
Least Interfered Channel	15.323 (c)(5.1)	7.3.2 & 7.3.3	PASS	5.15
Channel confirmation	15.323 (c)(5.2)	7.3.3 & 7.3.4	Attestation	5.16
Power measurement resolution	15.323 (c)(5.3)	7.3.3	PASS	5.17
Segment occupancy	15.323 (c)(5.4)	Declaration	Attestation	5.18

Requirement	FCC Part	Test Procedure (Section numbers refer to ANSI C63.17 unless otherwise noted)	Result	Detailed Results
Random waiting	15.323 (c)(6)	8.1.3	Attestation	5.19
Monitoring bandwidth	15.323 (c)(7.1)	7.4	Attestation	5.20
Monitoring reaction time	15.323 (c)(7.2)	7.5	PASS	5.21
Monitoring antenna	15.323 (c)(8)	4	Attestation	5.22
Monitoring threshold relaxation	15.323 (c)(9)	4	PASS	5.23
Duplex system LBT	15.323 (c)(10)	8.3	PASS	5.24
Alternate monitoring interval	15.323 (c)(11)	8.4	PASS	5.25
Fair access	15.323 (c)(12)	Declaration	Attestation	5.26
Out of band emissions	15.323 (d)	6.1.6	PASS	5.7
Frame period	15.323 (e)	6.2.2 & 6.2.3	PASS	5.27
Frequency stability	15.323 (f)	6.2.1	PASS	5.28

Table 1: Testing Summary for VU

3. Test Facilities

3.1. Siemens AG Test Laboratory

Most of the tests, except for **Radiated Out of Band Emissions and RF Exposure SAR Testing of Vehicle Unit** are performed by the Siemens AG Test Laboratory.

Address:
Siemens AG
Frankenstr. 2
46395 Bocholt
Germany

Contact: Juergen Lepping
Tel.: +49 2871 91-2284
Fax. : +49 2871 91-2329
E-Mail: juergen.lepping@siemens.com

3.2. Recognized FCC Test Facility

CETECOM, a recognized FCC test facility, has performed the tests **Radiated Out of Band Emissions and RF Exposure SAR Testing of Vehicle Unit.**

CETECOM ICT Services GmbH
Untertürkheimerstr. 6-10
66117 Saarbrücken
Germany
Tel: +49 681598 0
Fax: +49 681598 8775

3.3. Test Equipment at Siemens AG Test Laboratory

No.	Test Equipment	Manufacturer	Model No.
1	Programmable Power Supply	Hameg	HM 8142
2	RF Signal Generator	Rohde & Schwarz	SMIQ 03B
3	RF Spectrum Analyzer	Rohde & Schwarz	FSIQ 7
4	DECT Digital Communication Tester	Rohde & Schwarz	CMD 60
5	Oscilloscope	Tektronix	TDS 714 L
6	Arbitrary Waveform Generator	Hewlett Packard	33120A
7	RF Combiner	Huber & Suhner	4901.19.A
8	Terminations and Connectors	Huber & Suhner	
9	Frequency Counter	Fluke	PM 6685
10	DECT Protocol Tester	TIS	
11	Personal Computer	Fujitsu Siemens	Scenic 800
12	Anechoic Chamber		
13	Spectrum Analyzer	Hewlett Packard	8593A

Table 2: List of Test Equipment

3.4. Test Conditions

Unless otherwise stated the normal operating conditions for the VU are:

Condition	Value
Power Supply	20V DC Power Supply
Temperature	25°C
Relative Humidity Content	20…….75%
Air Pressure	86…….103kPa

Table 3: Test Conditions

4. Technical Specification

The technical specifications of this device are summarized below:

Specification	Value
Operating Standard	DECT
Operating Mode	TDMA
Frame Period	10ms
Time Slot Length	416.67μs
Slots per Frame	24 slots / 12 RX, 12 TX
Slot Structure	12 active duplex pairs per frame
Bit Rate	1.152MHz
Bit Period	868.1ns
Number of Frequency Channels	5
Frequency Band	1920 – 1930 MHz
Peak Transmission Power	18dBm nominal
Emission Bandwidth	1.5MHz nominal
Gaussian Frequency Shift Keying	B*T = 0.5 nominal
Deviation	400KHz nominal
Speech Codec	32kBit/s ADPCM
Receiver Sensitivity	-93dBm for BER of 1exp-3

Table 4: List of Specifications

Frequency Channel	Frequency
CH1	1921.536MHz
CH2	1923.264MHz
CH3	1924.992MHZ
CH4	1926.720MHz
CH5	1928.448MHz

Table 5: List of Frequency Channels

5. Detailed Test Procedures and Results

5.1. Antenna Requirements

5.1.1. Test Criteria

47CFR15.203 Antenna requirement.
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

5.1.2. Procedure

Attestation of manufacturer supported by photos and/or description of the antenna to allow visual confirmation.

5.1.3. Attestation

The VU uses an external attachable antenna.

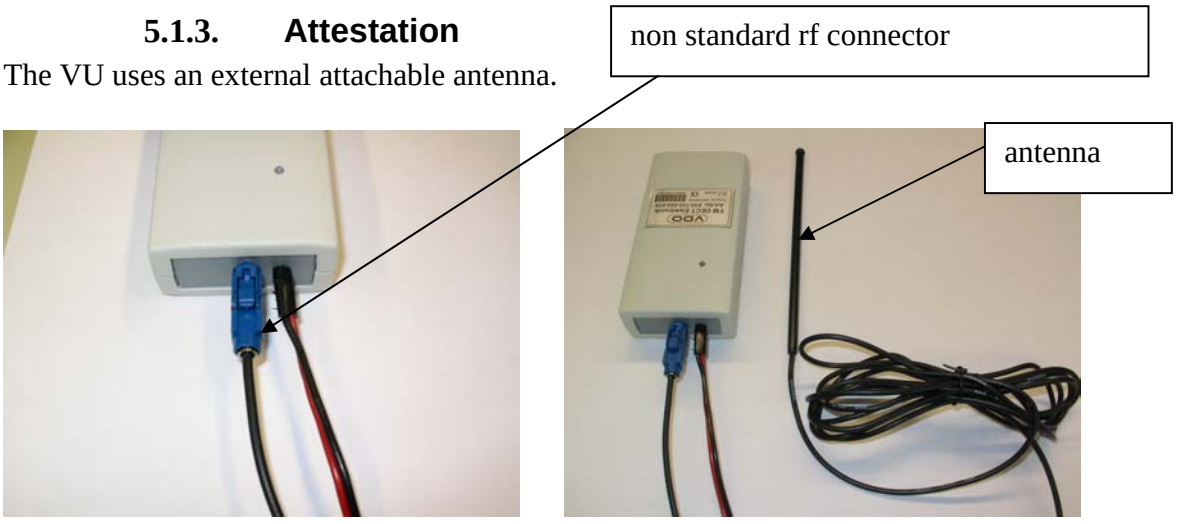

Figure 1: VU Antenna

The VU is supplied by a non standard rf connector and thus excludes the use of a standard antenna with a standard rf connector. Thus this criterium is met.

5.2. Use digital modulation

5.2.1. Test Criteria

Section 15.319 General technical requirements.
(b) All transmissions must use only digital modulation techniques.

5.2.2. Procedure

Attestation of manufacturer supported by reference to relevant DECT specifications.

5.2.3. Attestation

This device is compliant with the DECT standards described in European Standards EN 300 175-2 and EN 300 175-3. DECT transmissions are MC/TDMA/TDD (Multi carrier / Time Division Multiple Access / Time Division Duplex) using Digital GFSK modulation.

For further details see operational description or relevant portions of the DECT standards.

5.3. Peak transmit power

5.3.1. Test Criteria

Section 15.319 General technical requirements.
(c) Peak transmit power shall not exceed 100 microwatts multiplied by the square root of the emission bandwidth in hertz. Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

5.3.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 6.1.2, which provides the test methodology for this provision. The EUT is controlled from a personal computer and set into continuous transmission mode.

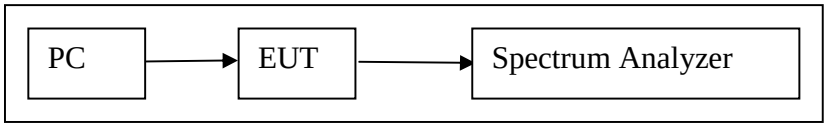

Figure 2: Test Setup for Peak Transmit Power Measurement

The spectrum analyzer is setup according to ANSI C63.17 Clause 6.1.2:

Centre Frequency	CH1, CH3, CH5
RBW	10MHz
VBW	10MHz
Trigger	Video
Span	zero
Detection	Peak Detection
Sweep Rate	1ms
Amplitude Scale	Log
Peak Hold	On

Table 6: Spectrum Analyzer Settings for Peak Transmit Power Measurement

The peak transmit power of the VU is measured at 25°C and frequency channel CH1, CH3 and CH5.

The maximum allowable peak transmit power is described in ANSI C63.17 Clause 4.3.1.

The antenna gain of the VU antenna is < 3dBi.
Therefore: $P_{limit} = P_{max}$

The emission bandwidth = 1.4MHz and therefore:
P_{max} = 5 log B – 10dBm
= 5 log (1.4exp6) – 10dBm
= 20.7dBm
The maximum allowable peak transmit power is 20.7dBm.

5.3.3. Test Results

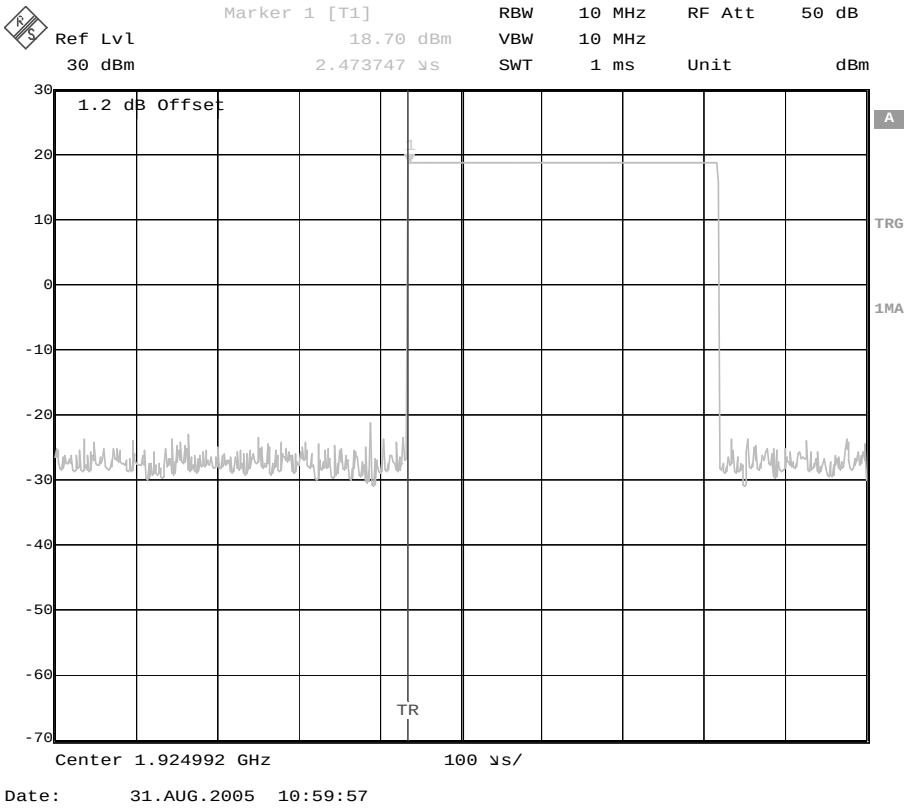

Figure 3: Peak Transmit Power of VU at CH3

The following results are measured:

Peask Transmit Power	Measurement	Result
CH1	18.6dBm	Pass
CH3	18.6dBm	Pass
CH5	18.6dBm	Pass

Table 7: Measured Peak Transmit Power of VU

Result: Pass

5.4. Power Spectral Density

5.4.1. Test Criteria

§ 15.319 General technical requirements.
(d) Power spectral density shall not exceed 3 milliwatts in any 3 kHz bandwidth as measured with a spectrum analyzer having a resolution bandwidth of 3 kHz.

5.4.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 6.1.5, which provides the test methodology for this provision. The EUT is controlled from a personal computer and set into continuous transmission mode.

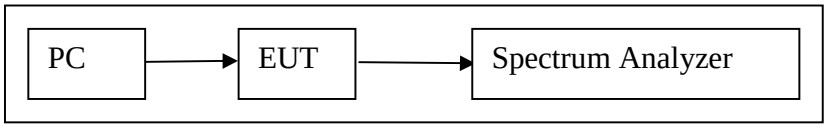

Figure 4: Test Setup for Power Spectral Density

The spectrum analyzer is setup according to ANSI C63.17 Clause 6.1.5:

Centre Frequency	CH1, CH3, CH5
RBW	3KHz
VBW	3KHz
Trigger	Free Run
Span	10KHz
Detection	Peak Detection
Sweep Rate	20ms
Amplitude Scale	Log
Peak Hold	On

Table 8: Spectrum Analyzer Settings for Power Spectral Density Measurement

The power spectral density of the VU is measured at 25°C and frequency channel CH1, CH3 and CH5.

According to Part 15.319 (d) the maximum allowable Power Spectral Density is 3mW
PSD_{limit} = 3mW = 4,8dBm

5.4.3. Test Results

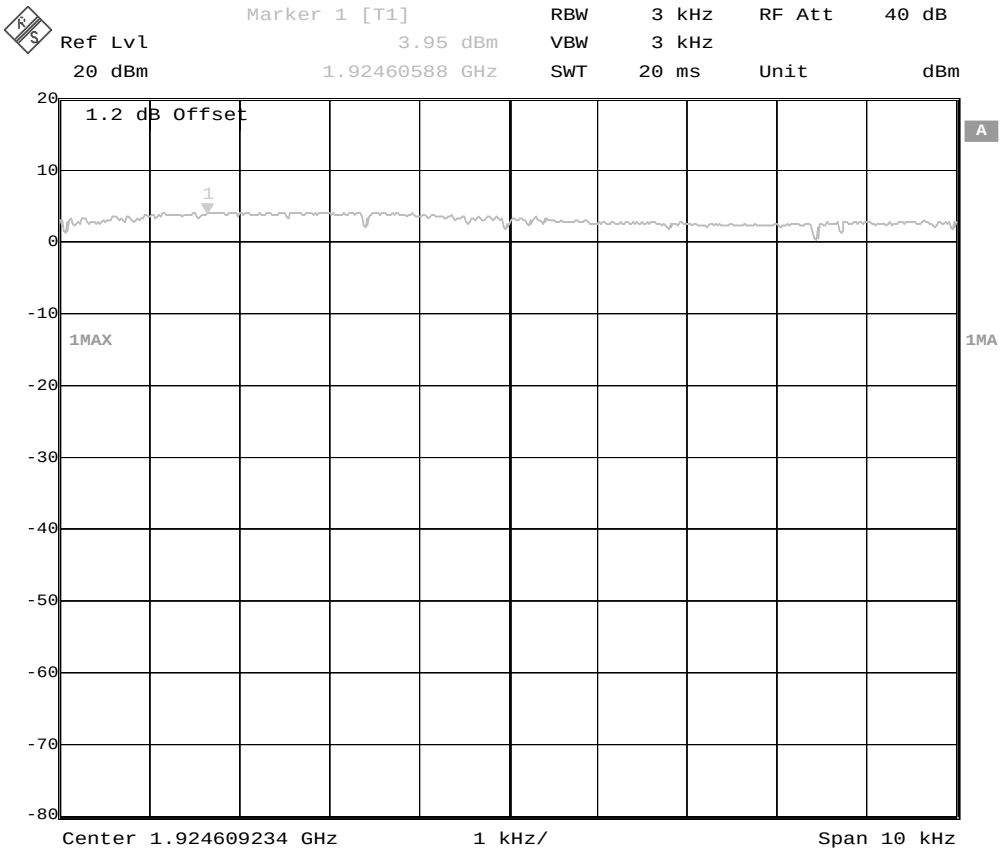

Figure 5: Power Spectral Density of VU at CH3

The following results are measured:

Power Spectral Density	Measurement	Result
CH1	2.1mW/3KHz	Pass
CH3	2.5mW/3KHz	Pass
CH5	2.6mW/3KHz	Pass

Table 9: Measured Power Spectral Density of VU

Result: Pass

5.5. Power adjustment for antenna gain

5.5.1. Test Criteria

§ 15.319 General technical requirements.
(e) The peak transmit power shall be reduced by the amount in decibels that the maximum directional gain of the antenna exceeds 3 dBi.

5.5.2. Test Procedure

The antenna gain of the VU is measured in an anechoic room.

5.5.3. Test Results

The antenna together with its cable is measured in an anechoic room.

Figure 6: Antenna Measurement of VU

A SMA connector is mounted on the antenna cable for measurement.

VU Antenna

	Vertical	Horizontal
Min.	-20.6 dB	-26.1 dB
Max.	-8.4 dB	-5.0 dB

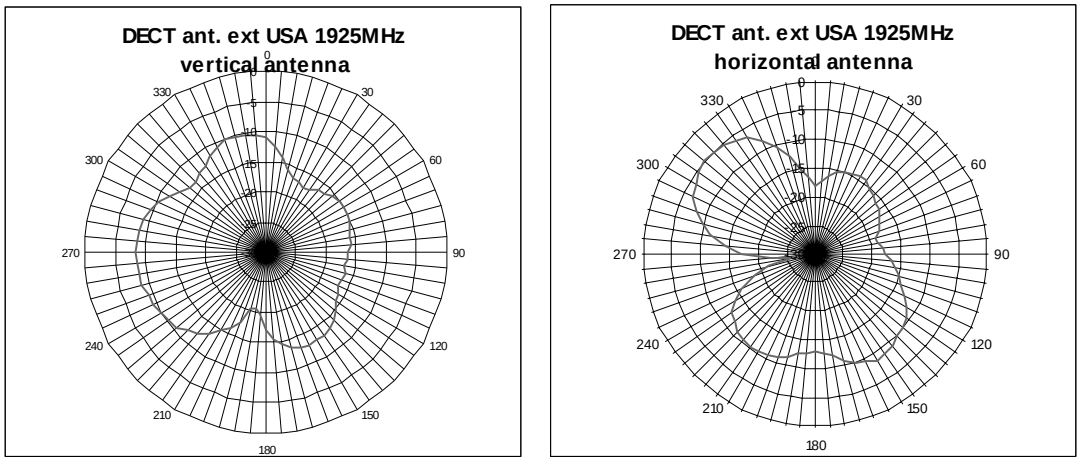

Figure 7: Antenna Diagram of VU Antenna

The antenna measurements are summarized below:

	VU Antenna
Max Vert. Gain	-8.4dBi
Max Hor. Gain	-5dBi

Table 10: Test Result of VU Antenna Measurement

Result: The maximum antenna gain < 3dBi.

5.6. Automatically discontinue transmission

5.6.1. Test Criteria

Section 15.319 General technical requirements.
(f) The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude transmission of control and signaling information or use of repetitive codes used by certain digital technologies to complete frame or burst intervals.

5.6.2. Test Procedure

Attestation of manufacturer supported by test results. The statement shall include a description of how the EUT operates when there is no data to transmit. This may be met by reference to relevant portions of the DECT standards. The supporting testing is as follows:

The following tests are performed after a connection is first established between the EUT and its companion device.

	Test	Reaction at EUT	Result
1	Remove Power from companion device.	A/B/C	Pass/Fail
2	Switch off the companion device.	A/B/C	Pass/Fail
3	Terminate call at the companion device.	A/B/C	Pass/Fail
4	Switch off the EUT.	A/B/C	Pass/Fail
5	Terminate call at the EUT.	A/B/C	Pass/Fail

Table 11: Test Procedure for Transmission Interruption

A – Connection is terminated and transmission ceases.
B – Connection is terminated but the EUT transmits control or signaling information
C – Connection is terminated but the companion device transmits control or signaling information

5.6.3. Test Result

The following testing is performed to further confirm compliance with this provision :

#	Test	Reaction at EUT	Result
1	Remove Power from companion device.	A	PASS
2	Switch off the companion device.	A	PASS
3	Terminate call at the companion device.	A	PASS
4	Switch off the EUT.	A	PASS
5	Terminate call at the EUT.	A	PASS

Table 12: Test Results for Transmission Interruption of VU

This device meets the requirement for automatic discontinuous operation. Its compliance with the DECT standards assures that transmissions are stopped when data is not available. See:

- ETSI EN 300 173-3, chapter 11.5.1: RFPI handshake
- ETSI EN 301 406, chapter 4.5.10.3: Channel release

Result: PASS

5.7. Spurious emissions & Out of Band Emissions

5.7.1. Test Criteria

5.7.1.1. Out of Band Emissions

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.
(d)(1) Emissions shall be attenuated below a reference power of 112 milliwatts as follows: 30 dB between the band edge and 1.25 MHz above or below the band; 50 dB between 1.25 and 2.5 MHz above or below the band; and 60 dB at 2.5 MHz or greater above or below the band.

5.7.1.2. Spurious and In Band Unwanted Emissions

(d)(2) Emissions inside the band must comply with the following emission mask: In the bands between 1B and 2B measured from the center of the emission bandwidth, the total power emitted by the device shall be at least 30 dB below the transmit power permitted for that device; in the bands between 2B and 3B measured from the center of the emission bandwidth, the total power emitted by an intentional radiator shall be at least 50 dB below the transmit power permitted for that radiator; in the bands between 3B and the band edge, the total power emitted by an intentional radiator in the measurement bandwidth shall be at least 60 dB below the transmit power permitted for that radiator. "B" is defined as the emission bandwidth of the device in hertz. Compliance with the emission limits is based on the use of measurement instrumentation employing peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

5.7.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 6.1.6, which provides the test methodology for this provision.[1]

This test procedure for the spurious in-band and out-of-band emissions evaluates the frequency range 1905MHz to 1945MHz. The whole frequency range 9KHz up to 25GHz is supplied in a separate document.

The EUT is controlled from a personal computer and set into continuous transmission mode.

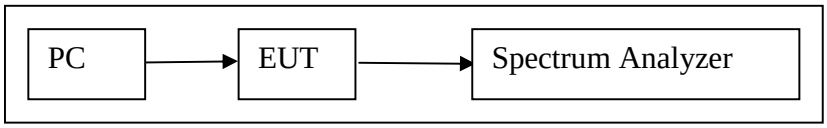

Figure 8: Test Setup for Spurious Emission Measurement

The spectrum analyzer is setup according to ANSI C63.17 Clause 6.1.6:

Centre Frequency	CH1, CH3, CH5
RBW	20KHz
VBW	100KHz
Trigger	Free Run
Span	20MHz in-band, 40MHz out-of-band
Detection	Peak Detection
Sweep Rate	auto
Amplitude Scale	Log
Peak Hold	On

Table 13: Spectrum Analyzer Setting for Spurious Emission Measurement

The spurious emission of the VU is measured at 25°C and frequency channels CH1, CH3 and CH5.

The following limits apply:

	Out of Band Emissions	**Spurious and In Band Unwanted Emissions**
B	1.4 MHz	1.4 MHz
Peak Power	20.5dBm	20.7dBm
-30dB	Band Edge - 1.25MHz	1.4 – 2.8MHz
-50dB	1.25 – 2.5MHz	2.8 – 4.2MHz
-60dB	> 2.5MHz	> 4.2MHz

Table 14: Table of Limits for VU

[1] Where these limits are more stringent than 47 CFR 15, Subpart C,§15.209, the limits of 47 CFR 15, Subpart C,§15.209 take precedence as indicated in 47 CFR 15, Subpart D, §15.319 (g).

5.7.3. Test Results

5.7.3.1. Out of Band Emissions

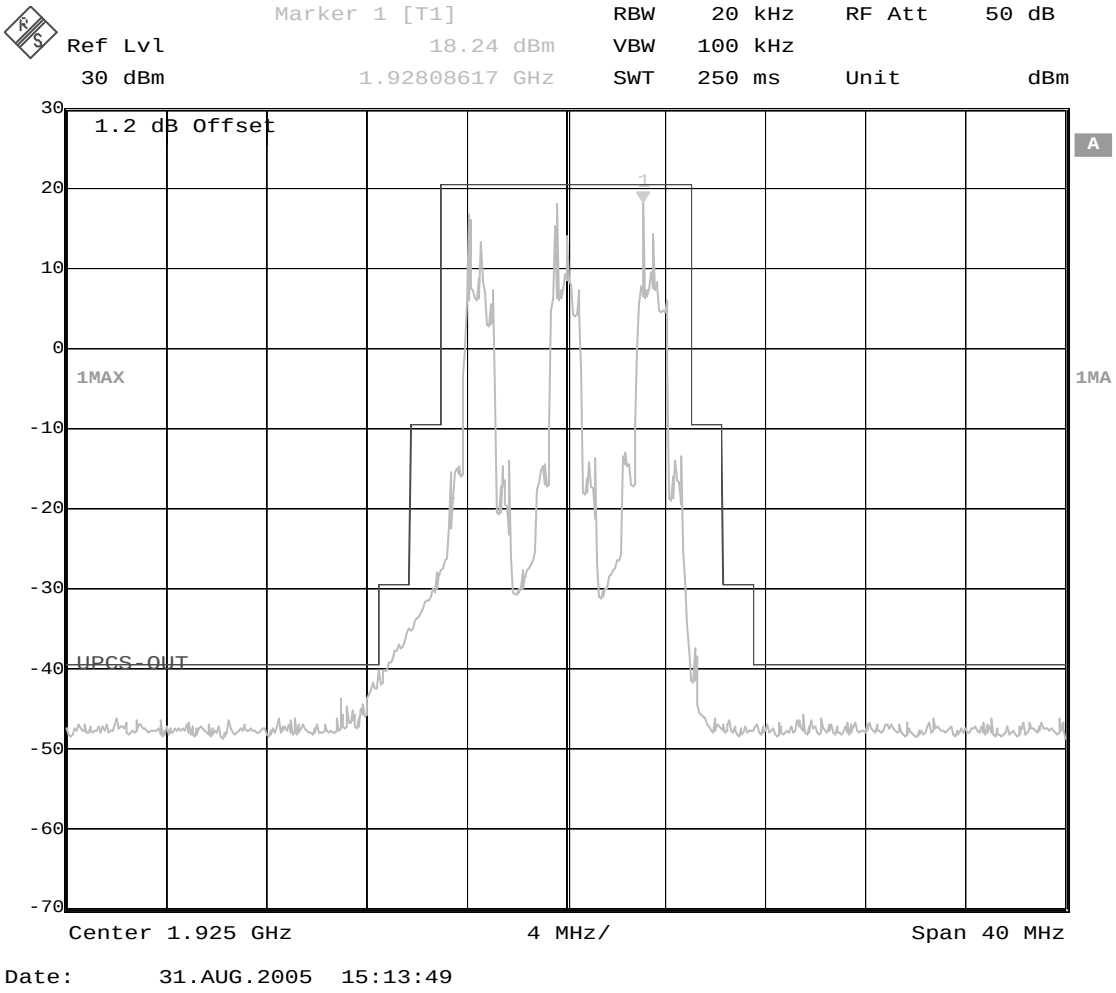

Figure 9: Out-of-Band Emission of VU at CH1, CH3, CH5

The VU spurious out-of-band transmission level is below the indicated limit.

Result: Pass

5.7.3.2. Spurious and In Band Unwanted Emissions

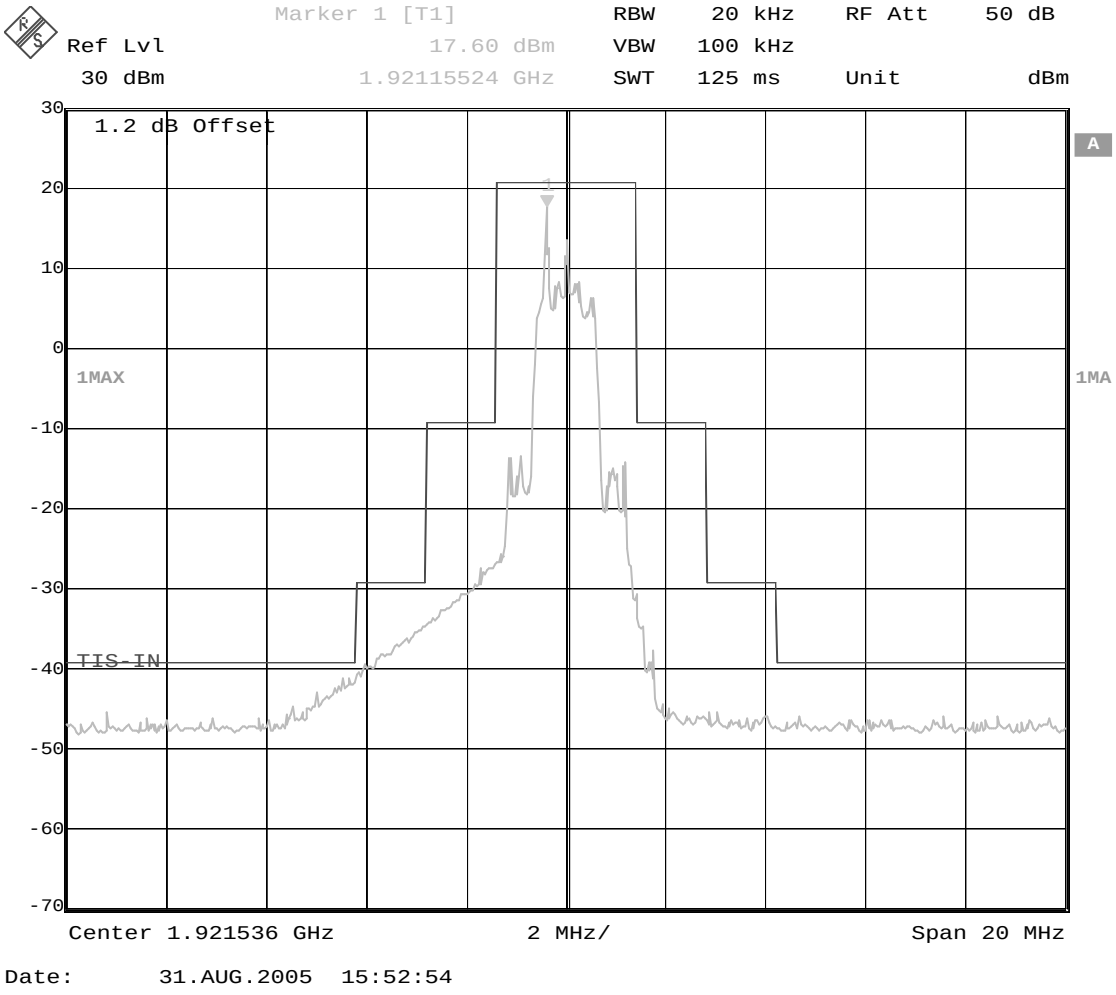

Figure 10: In-Band Spurious Emission of VU at CH1

The VU spurious in-band transmission level is below the indicated limit.

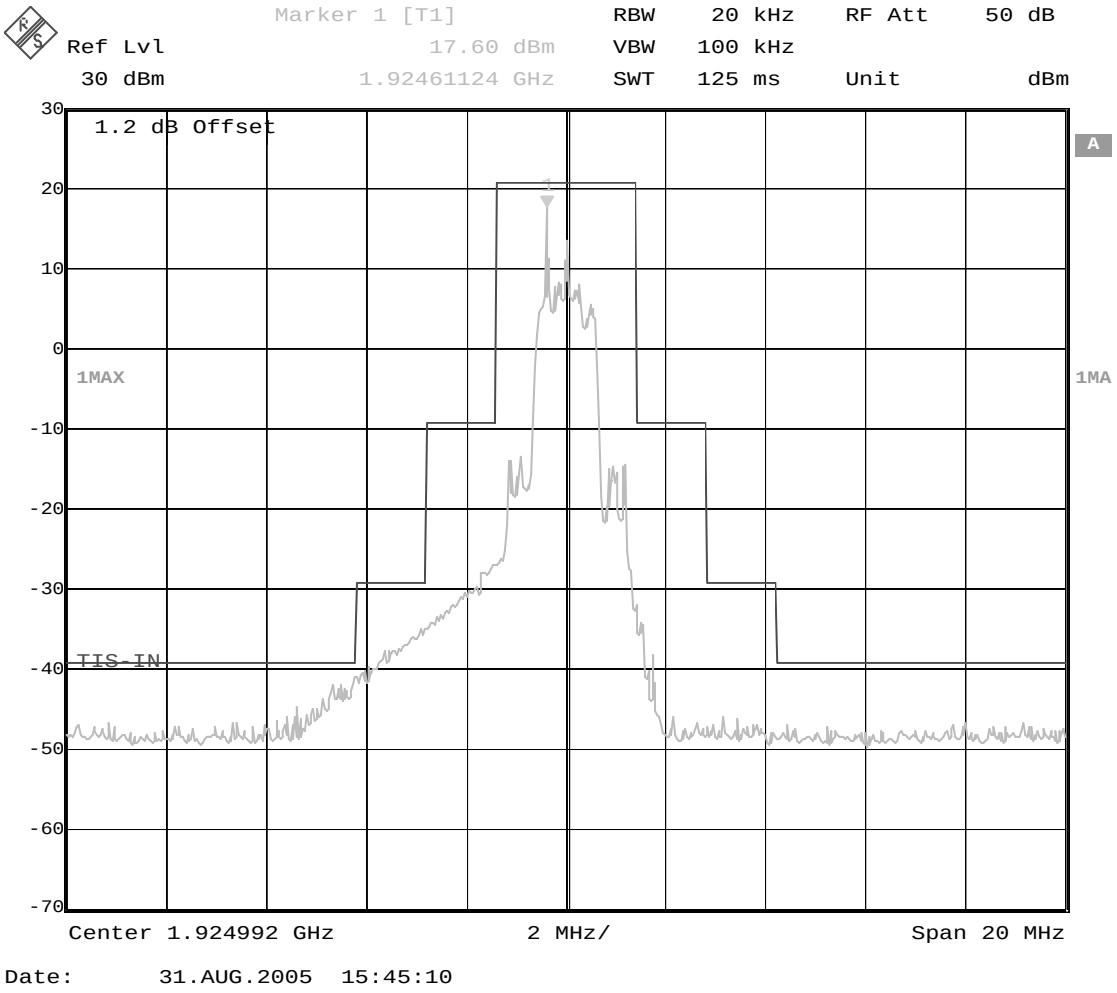

Figure 11: In-Band Spurious Emission of VU at CH3

The VU spurious in-band transmission level is below the indicated limit.

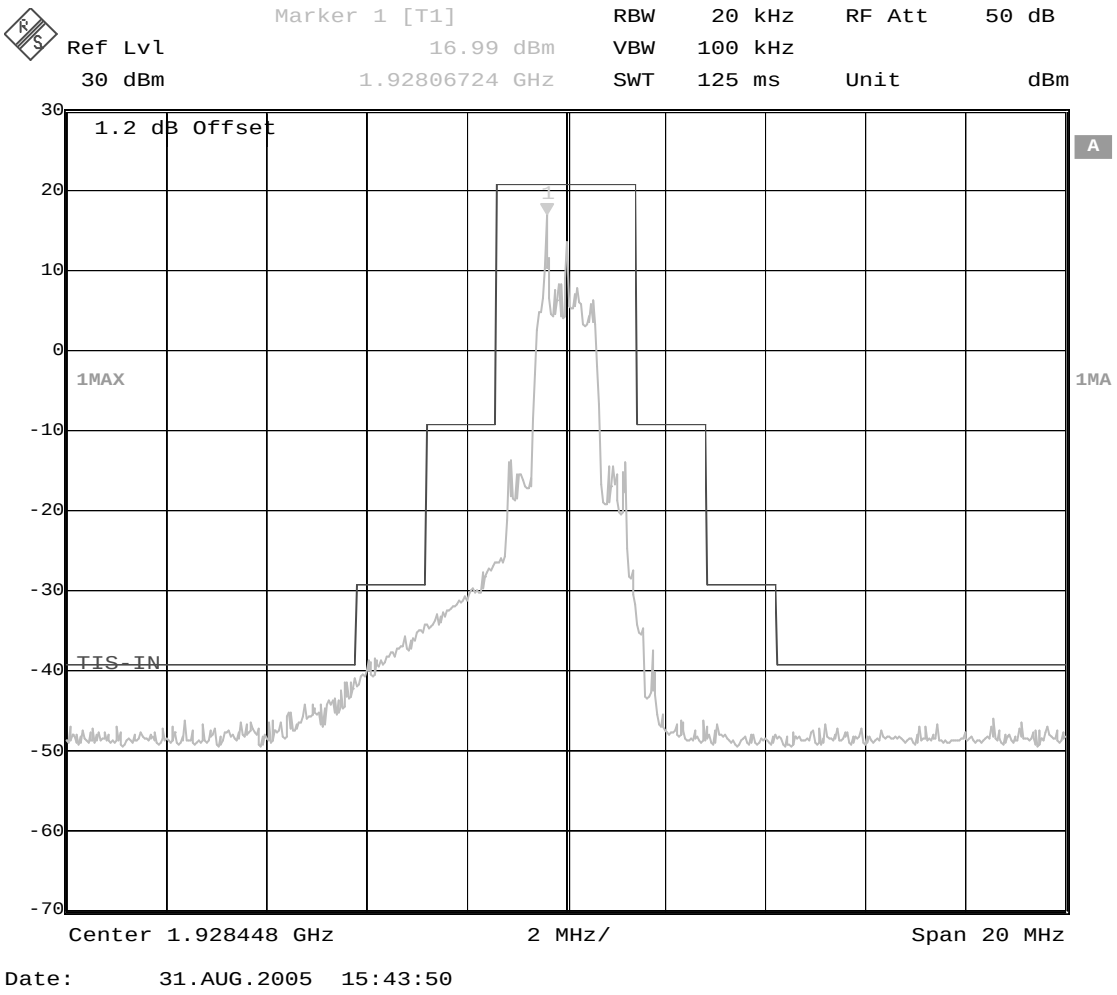

Figure 12: In-Band Spurious Emission of VU at CH5

The VU spurious in-band transmission level is below the indicated limit.

Result: Pass

5.8. RF Exposure

5.8.1. Test Criteria

§ 15.319 General Technical Requirements
(i)Unlicensed PCS devices are subject to the radiofrequency radiation exposure requirements specified in §§ 1.1307(b), 2.1091 and 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a ‘‘general population/uncontrolled’’ environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

5.8.2. Procedure

The manufacturer supplies an attestation.

5.8.3. Attestation

According to 47 CFR §2.1091 the VU is a mobile device. The VU is mounted in a vehicle and is used in such a way that a separation distance of at least 20 centimeters is maintained between the transmitter's radiating structures and the body of the user or nearby persons. The VU ERP is less than 3W and therefore the VU is categorically excluded from routine environmental evaluation for RF exposure.

However the SAR of the VU is measured and supplied in a separate report.

5.9. Emission Bandwidth

5.9.1. Test Criteria

§ 15.303 Definitions.
(c) Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.
(a) Operation shall be contained within the 1920-1930 MHz band. The emission bandwidth shall be less then 2.5 MHz. The power level shall be as specified in §15.319(c), but in no event shall the emission bandwidth be less than 50 kHz.

5.9.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 6.1.3, which provides the test methodology for this provision.

The EUT is controlled from a personal computer and set into continuous transmission mode.

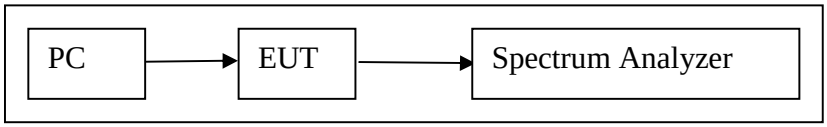

Figure 13: Test Setup for Emission Bandwidth Measurement

The spectrum analyzer is setup according to ANSI C63.17 Clause 6.1.3:

Centre Frequency	CH1, CH3, CH5
RBW	20KHz
VBW	100KHz
Trigger	Free Run
Span	5MHz
Detection	Peak Detection
Sweep Rate	auto
Amplitude Scale	Log
Peak Hold	On

Table 15: Spectrum Analyzer Settings for Emission Bandwidth Measurement

The emission bandwidth of the VU is measured at 25°C and frequency channel CH1, CH3 and CH5.

According to Part 15.323 (a) the maximum allowable emission bandwidth is 2.5MHz.

5.9.3. Test Results

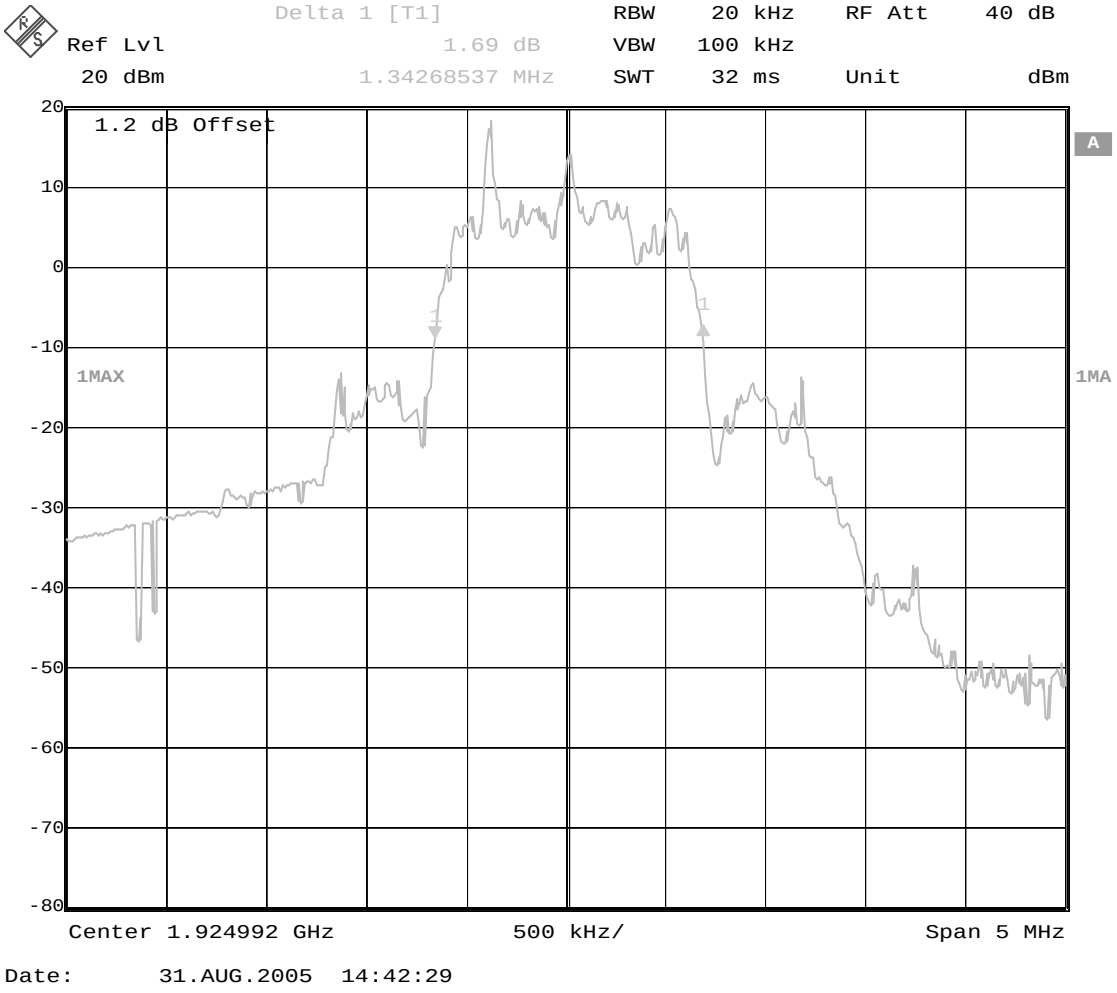

Figure 14: Emission Bandwidth Measurement of VU at CH3

The following results are measured:

Emission Bandwidth	Measurement	Result
CH1	1.4MHz	Pass
CH3	1.3MHz	Pass
CH5	1.4MHz	Pass

Table 16: Measured Emission Bandwidth of VU

Result: Pass

5.10. Listen Before Talk

5.10.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

5.10.2. Procedure

This requirement is split up into separate requirements which are covered by section 5.8 and sections 5.11 – 5.28.

5.10.3. Attestation

This requirement is met by section 5.8 and sections 5.11 – 5.28.

5.11. Monitoring Time

5.11.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(1) Immediately prior to initiating transmission, devices must monitor the combined time and spectrum windows in which they intend to transmit for a period of at least 10 milliseconds for systems designed to use a 10 milliseconds or shorter frame period or at least 20 milliseconds for systems designed to use a 20 milliseconds frame period.

5.11.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 7.3.4, which provides the test methodology for this provision.

The following test setup is used:

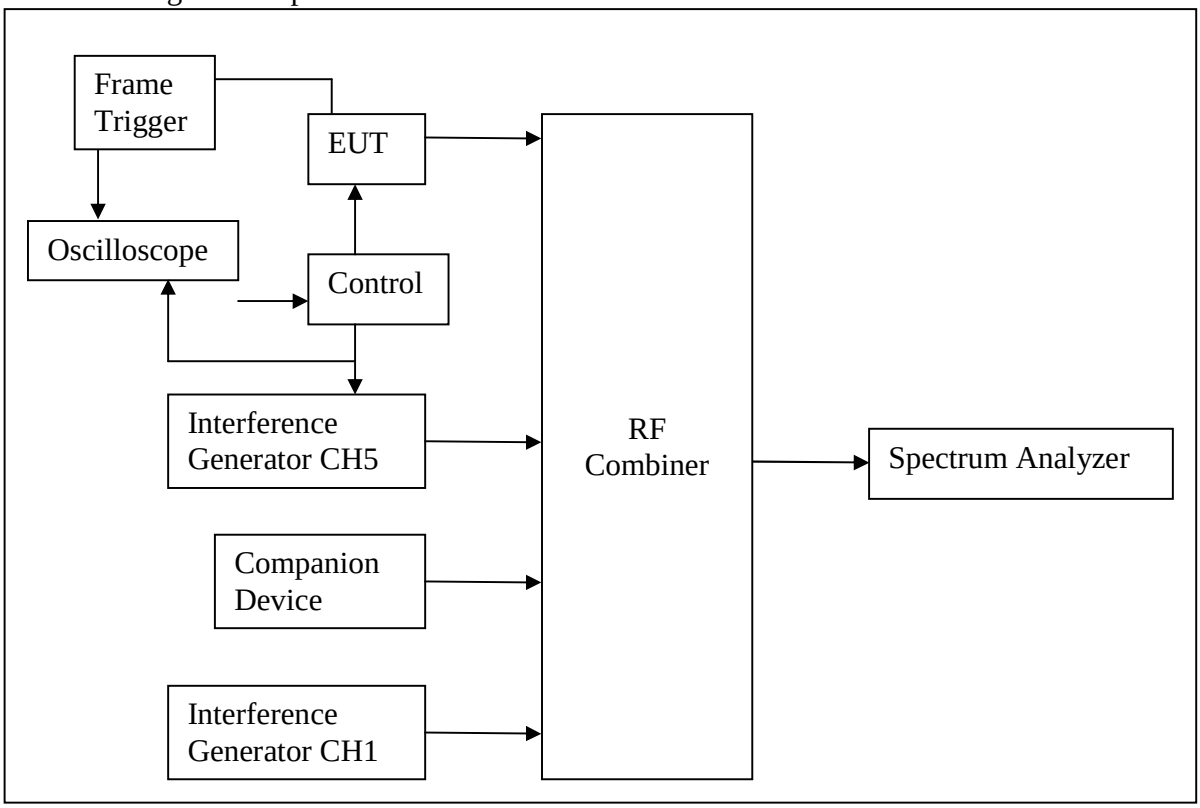

Figure 15: Test Setup for Monitoring Time of VU

The following test procedure is applied:

ANSI C63.17	**Description**
Clause 7.3.4 (a)	Restrict transmission to CH1 and CH5 only. Set CW interference on CH5 to -61dBm (T_U+1dB). VU and BS are synchronized on CH1.
Clause 7.3.4 (b)	Initiate a communication link between the VU and BS and verify that the link is on CH1. Terminate the link.
Clause 7.3.4 (c)	Apply CW interference on CH1 to -61dBm (T_U+1dB).
Clause 7.3.4 (d)	Remove interference from CH5 and immediately initiate a communication link, which should change frequency to CH5 within 20ms.

Table 17: Test Procedure for Monitoring Time of VU

The oscilloscope display is showing the CH5 rf disable signal and the frame sync signal from the VU. As soon as the frame sync signal appears a communication link should be setup on CH5. The communication link frequency is seen on the spectrum analyzer.

5.11.3. Test Results

The oscilloscope display is shown below:

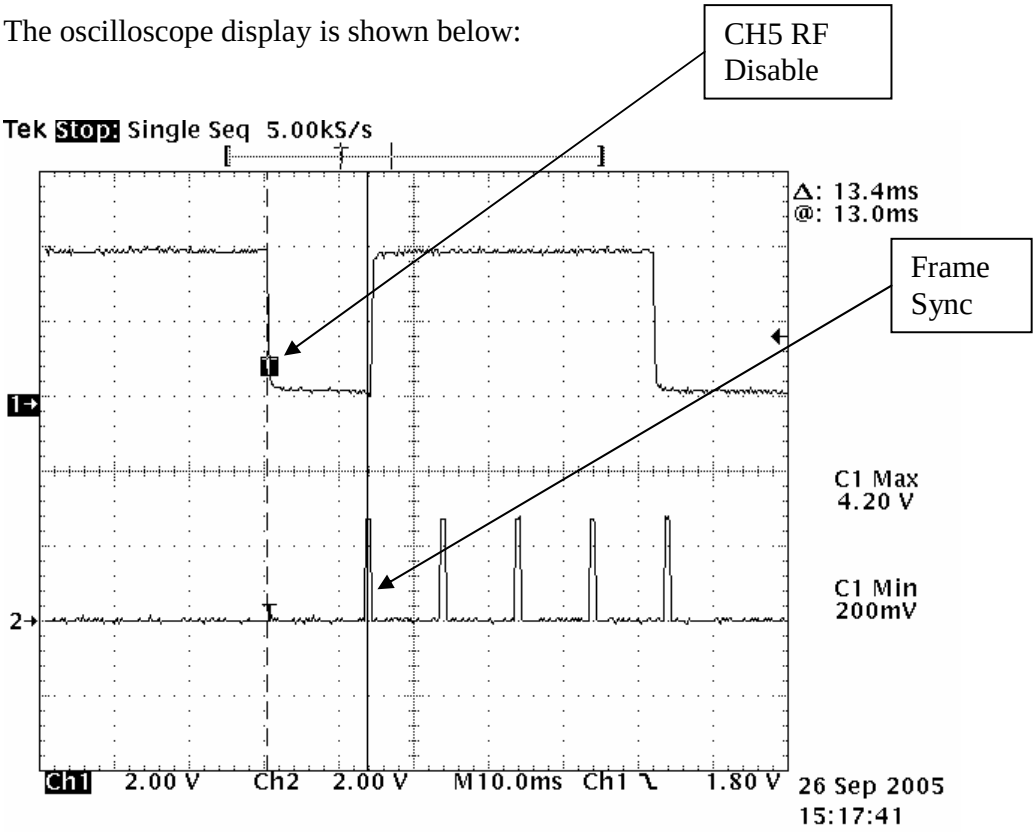

Figure 16: RF Disable and Frame Sync for Monitoring Time on VU

The following test results are obtained:

ANSI C63.17	Description	Result
Clause 7.3.4 (a)	Transmission is restricted to CH1 and CH5 only. CW Interference on CH5 to a level of -61dBm. VU and BS are synchronized on CH1.	Pass
Clause 7.3.4 (b)	Communication link between the VU and BS on CH1. Terminate the link.	Pass
Clause 7.3.4 (c)	Apply interference on CH1 at a level of -61dBm.	Pass
Clause 7.3.4 (d)	Remove interference from CH5 and immediately initiate a communication link. 19.2ms after rf disable the frame sync signal appears, indicating communication link setup on CH5.	Pass

Table 18: Test Procedure for Monitoring Time on VU

Result: Pass

5.12. Monitoring Threshold

5.12.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(2) The monitoring threshold must not be more than 30 dB above the thermal noise power for a bandwidth equivalent to the emission bandwidth used by the device.

5.12.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 7.3.1, which provides the test methodology for this provision. The Clause states that the lower threshold is for devices that do not use the LIC procedure.

The equation for the lower monitoring threshold is given in ANSI C63.17 Clause 4.3.4.

$T_L \leq (-174 + 10\log B + M_L + P_{max} - P_{EUT})$ dBm

B = 1.4MHz
M_L = 30dB
$P_{max} = P_{EUT}$

T_L = -82.5dBm

5.12.3. Test Results

The FM DECT System utilizes a LIC procedure and transmits on the least interfered channel.

The rf sensitivity of the product for a BER of 1.10exp-3 is measured at -93dBm. The LIC procedure will be applied starting at -93dBm input power.

Result: Pass

5.13. Maximum Transmit Time

5.13.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(3) If no signal above the threshold level is detected, transmission may commence and continue with the same emission bandwidth in the monitored time and spectrum windows without further monitoring. However, occupation of the same combined time and spectrum windows by a device or group of cooperating devices continuously over a period of time longer than 8 hours is not permitted without repeating the access criteria.

5.13.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 8.2.2, which provides the test methodology for this provision.

A communication link is established between BS and VU in an anechoic room to prevent influence from other transmissions.

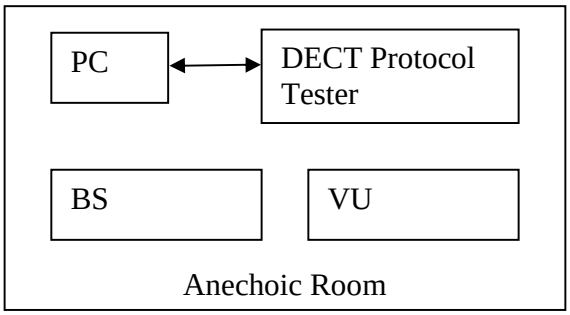

Figure 17: Test Setup for Maximum Transmit Time Measurement

According to FCC Part 15.323 (c) (3), the access criteria have to be verified at least every 8 hours. The following test is performed:

ANSIC 63.17	**Description**
Clause 8.2.2 (a)	Initiate a communication link between BS and VU.
Clause 8.2.2 (b)	Monitor the communication channel. This link is monitored by a DECT protocol tester in an anechoic room to ensure no other DECT influence except for the existing communication link.

Table 19: Measurement Procedure for Maximum Transmit Time

5.13.3. Test Results

	Absolute Time	**Time Difference**	**Result**
Initiate setup	08h04		n.a.
New Channel Access	09h01		n.a.
New Channel Access	10h01	1h00	Pass
New Channel Access	11h02	1h01	Pass
New Channel Access	12h00	0h58	Pass
New Channel Access	13h01	1h01	Pass
New Channel Access	14h02	1h01	Pass

Table 20: Result of Maximum Transmit Time Measurement

The access criteria are verified every hour. During this procedure the channel is changed.

Result: Pass

5.14. System Acknowledgement

5.14.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.
(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:
(4) Once access to specific combined time and spectrum windows is obtained an acknowledgment from a system participant must be received by the initiating transmitter within one second or transmission must cease. Periodic acknowledgments must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signaling information may transmit continuously for 30 seconds without receiving an acknowledgment, at which time the access criteria must be repeated.

5.14.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 8.2.1., which provides the test methodology for this provision.

The following test setup is used:

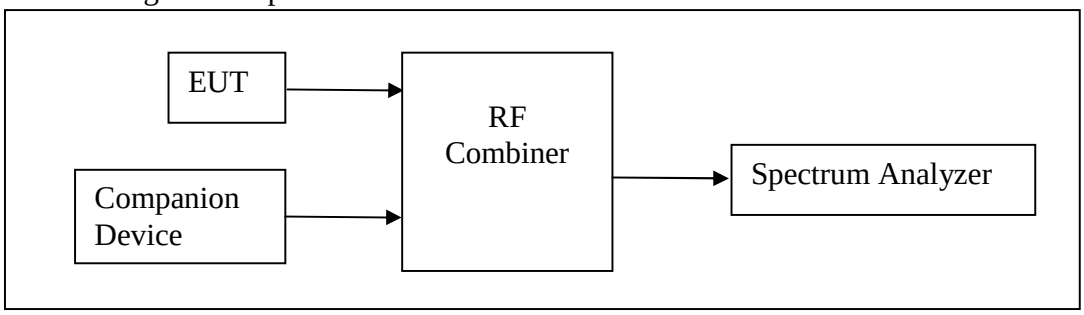

Figure 18: Test Setup for System Acknowledgement of VU

The VU is synchronized to the BS through the rf combiner.

The following tests are performed:

ANSI C63.17	Description
Clause 8.2.1 (a)	The frequency channel is restricted to CH3 and the BS transmits control signals on CH3 and a communication link can be build up.
Clause 8.2.1 (b)	Disable the receiver of the BS and verify initiating a communication link. Verify that the VU stops transmitting within 1s after initiation.
Clause 8.2.1 (c)	Enable the receiver of the BS and verify that a communication link can be build up.
Clause 8.2.1 (d)	With a communication link existing, turn off the BS and verify that the VU terminates transmission within 30s.

Table 21: Test Procedure for System Acknowledgement of VU

5.14.3. Test Result

The following results are obtained:

ANSI C63.17	Description	Result
Clause 8.2.1 (a)	The frequency channel on BS and VU is restricted to CH3.	Pass
Clause 8.2.1 (b)	The VU terminates transmission immediately < 100ms.	Pass
Clause 8.2.1 (c)	Communication link is build up.	Pass
Clause 8.2.1 (d)	The VU terminates transmission within 5s.	Pass

Table 22: Measurement Results of System Acknowledgement Tests of VU

Result: Pass

5.15. Least Interfered Channel

5.15.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(5) If access to spectrum is not available as determined by the above, and a minimum of 40 duplex system access channels are defined for the system, the time and spectrum windows with the lowest power level below a monitoring threshold of 50 dB above the thermal noise power determined for the emission bandwidth may be accessed.

5.15.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 7.3.2. & 7.3.3, which provides the test methodology for this provision.

The current product offers 12 duplex channels per frequency channel and therefore 12x5=60 duplex channels in total. Hence Part 15.323 (c) (5) applies.

The equation for the upper monitoring threshold is given in ANSI C63.17 Clause 4.3.3.

$T_U \leq (-174 + 10\log B + M_U + P_{max} - P_{EUT})$ dBm

B = 1.4MHz
M_U = 50dB
$P_{max} = P_{EUT}$

T_U = -62.5dBm

5.15.2.1. Upper Threshold

Testing to ANSI C63.17 draft ballot 3.0 Clause 7.3.2 (a), which provides the test methodology for this provision.

The following test setup is used:

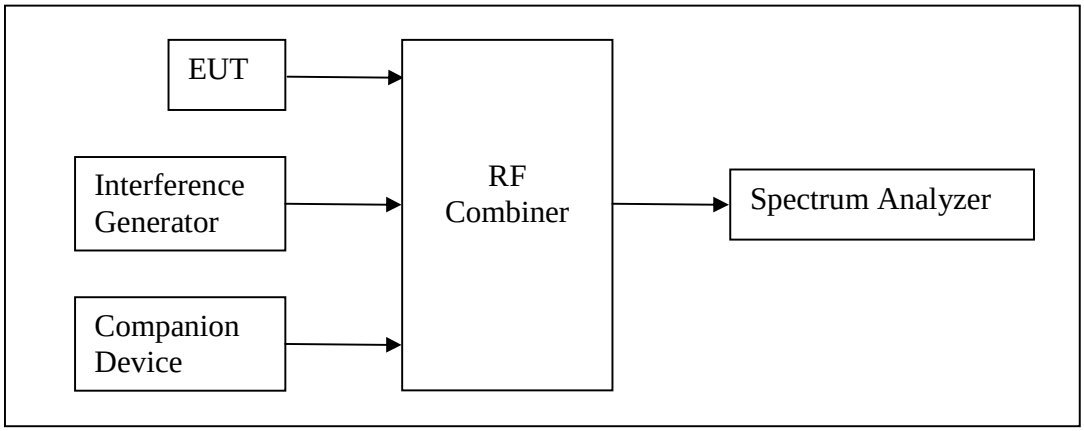

Figure 19: Test Setup for Upper Threshold Measurement of VU

The following test procedure is applied:

ANSI C63.17	**Description**
Clause 7.3.2 (a)	The VU is forced to operate on frequency channel CH3 only. The BS is set to transmit its control signals at frequency channel CH3. BS and VU are synchronized on CH3. Apply CW interference at CH3 to a level of -52dBm (T_U +10dB). A communication link is initiated, forcing the VU to transmit on CH3. Lower interference level until the communication link can be set up on CH3. Verify the communication link on spectrum analyzer.

Table 23: Test Procedure for Upper Threshold Measurement of VU

5.15.2.2. LIC Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 7.3.3, which provides the test methodology for this provision.

The following test setup is used:

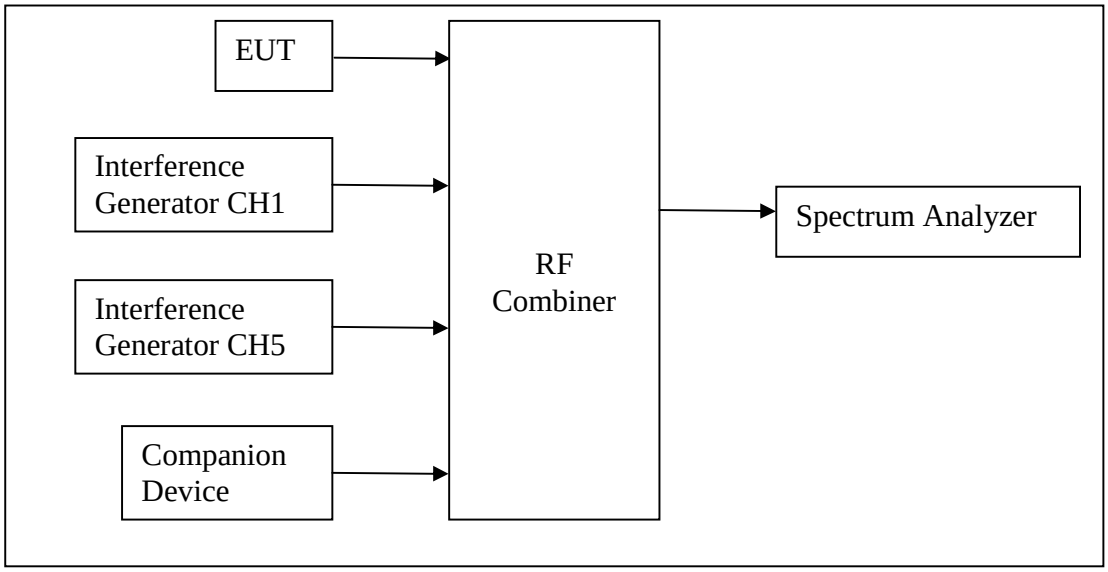

Figure 20: Test Setup for LIC Measurement of VU

The following test procedure is applied:

ANSI C63.17	**Description**
Clause 7.3.3 (a)	The EUT is restricted to transmit on either CH1 or CH5.
Clause 7.3.3. (b)	Apply interference on CH1 at level -75dBm (T_L + 7dB). Apply interference on CH5 at level -82dBm (T_L). Setup link between BS and VU 5 x and verify TX on CH5.
Clause 7.3.3. (c)	Apply interference on CH1 at level -82dBm (T_L). Apply interference on CH5 at level -75dBm (T_L + 7dB). Setup link between BS and VU 5 x and verify TX on CH1.
Clause 7.3.3. (d)	Apply interference on CH1 at level -81dBm (T_L + 1dB). Apply interference on CH5 at level -88dBm (T_L - 6dB). Setup link between BS and VU 5 x and verify TX on CH5.
Clause 7.3.3. (e)	Apply interference on CH1 at level -88dBm (T_L - 6dB). Apply interference on CH5 at level -81dBm (T_L + 1dB). Setup link between BS and VU 5 x and verify TX on CH1.

Table 24: Test Procedure for LIC Measurement of VU

Verify the communication link on the spectrum analyzer.

5.15.3. Test Results

5.15.3.1. Upper Threshold

The VU is activated and a communication link is setup.

Interference Signal	Communication Link Setup on CH3	Result
< -60dBm	YES	Pass
> -60dBm	NO	Pass

Table 25: Upper Threshold Measurement on VU

Result: Pass

5.15.3.2. LIC Procedure

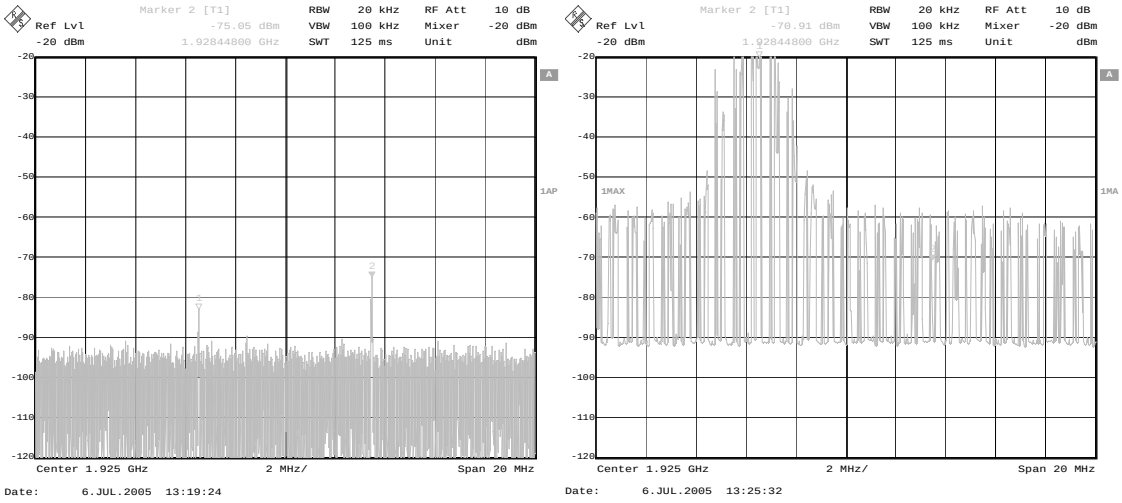

Figure 21: Spectrum Analyzer Display for LIC Procedure on VU

The spectrum analyzer display on the left shows the two interference sources at CH1 and CH5. Interference source at CH1 is at -82dBm (T_L) and CH5 is at -75dBm (T_L + 7dB). The spectrum analyzer display on the right shows the VU accessing CH1 (LIC).
The following test results are measured:

ANSI C63.17	Description	Result
Clause 7.3.3. (a)	The VU is restricted to CH1 or CH5.	Pass
Clause 7.3.3. (b)	5 x CH5 link setup	Pass
Clause 7.3.3. (c)	5 x CH1 link setup	Pass
Clause 7.3.3. (c)	5 x CH5 link setup	Pass
Clause 7.3.3. (d)	5 x CH1 link setup	Pass

Table 26: LIC Procedure Measurement on VU

Result: Pass

5.16. Channel Confirmation

5.16.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(5) A device utilizing the provisions of this paragraph must have monitored all access channels defined for its system within the last 10 seconds and must verify, within the 20 milliseconds (40 milliseconds for devices designed to use a 20 milliseconds frame period) immediately preceding actual channel access that the detected power of the selected time and spectrum windows is no higher than the previously detected value.

5.16.2. Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 7.3.3 & 7.3.4, which provides the test methodology for this provision.

5.16.3. Attestation

This test was performed in section 5.11 and 5.15.

5.17. Power Measurement Resolution

5.17.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(5) The power measurement resolution for this comparison must be accurate to within 6 dB.

5.17.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 7.3.3, which provides the test methodology for this provision.

5.17.3. Test Results

This procedure was tested in section 5.15. The power measurement resolution is accurate to within 1dB.

Result: PASS

5.18. Segment Occupancy

5.18.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(5) No device or group of cooperating devices located within 1 meter of each other shall occupy more than three 1.25 MHz channels during any frame period.

5.18.2. Procedure

Attestation of manufacturer supported by reference to relevant DECT specifications.

5.18.3. Attestation

This device is compliant with the DECT standards described in European Standards EN 300 175-2 and EN 300 175-3. DECT transmissions are MC/TDMA/TDD (Multi carrier / Time Division Multiple Access / Time Division Duplex) using Digital GFSK modulation.

During any frame period cooperating devices will not occupy more than one channel bandwidth (~ 2MHz emission bandwidth)

For further details see operational description or relevant portions of the DECT standards.

5.19. Random Waiting

5.19.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(6) If the selected combined time and spectrum windows are unavailable, the device may either monitor and select different windows or seek to use the same windows after waiting an amount of time, randomly chosen from a uniform random distribution between 10 and 150 milliseconds, commencing when the channel becomes available.

5.19.2. Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 8.1.3, which provides the test methodology for this provision.

5.19.3. Attestation

The option 15.323(c) (6) is not implemented by this product.

5.20. Monitoring Bandwidth

5.20.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(7) The monitoring system bandwidth must be equal to or greater than the emission bandwidth of the intended transmission and have a maximum reaction time less than 50xSQRT (1.25/ emission bandwidth in MHz) microseconds for signals at the applicable threshold level but shall not be required to be less than 50 microseconds.

5.20.2. Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 7.4, which provides the test methodology for this provision.

5.20.3. Attestation

The VU uses a transceiver with the following block diagram.

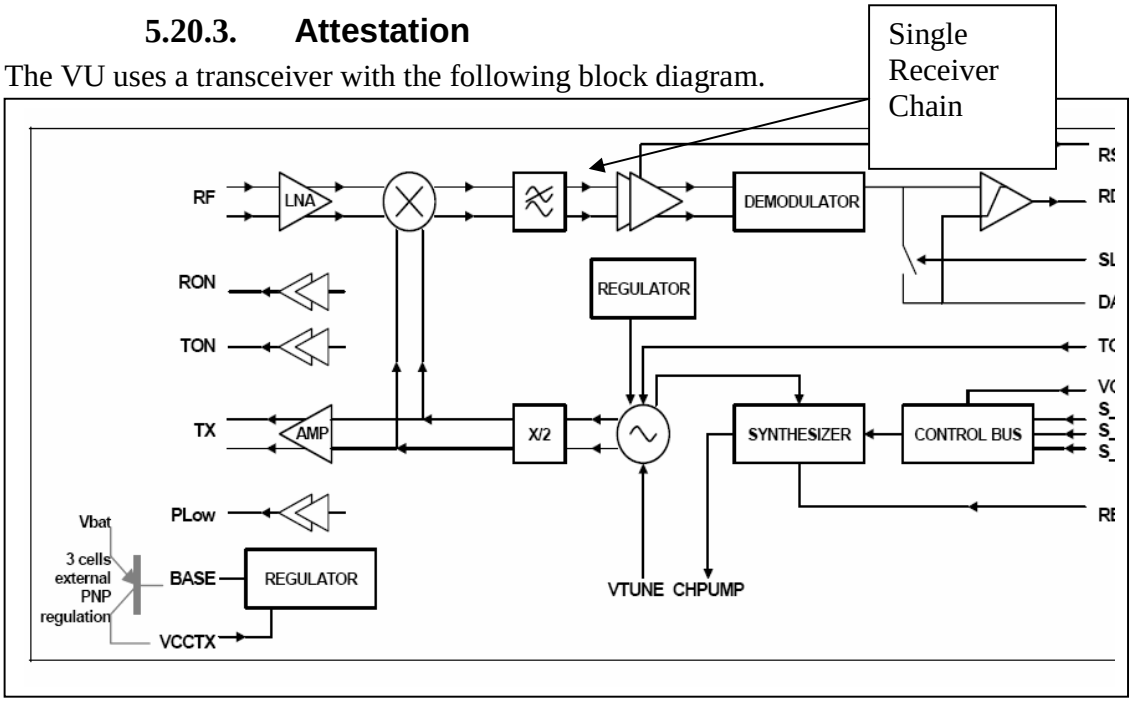

Figure 22: Transceiver Block Diagram

The monitoring feature is realized by the actual receiver and therefore the receiver bandwidth equals the monitoring bandwidth.

5.21. Monitoring Reaction Time

5.21.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(7) If a signal is detected that is 6 dB or more above the applicable threshold level, the maximum reaction time shall be 35xSQRT (1.25/emission bandwidth in MHz) microseconds but shall not be required to be less than 35 microseconds.

5.21.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 7.5, which provides the test methodology for this provision.

The following test setup is used:

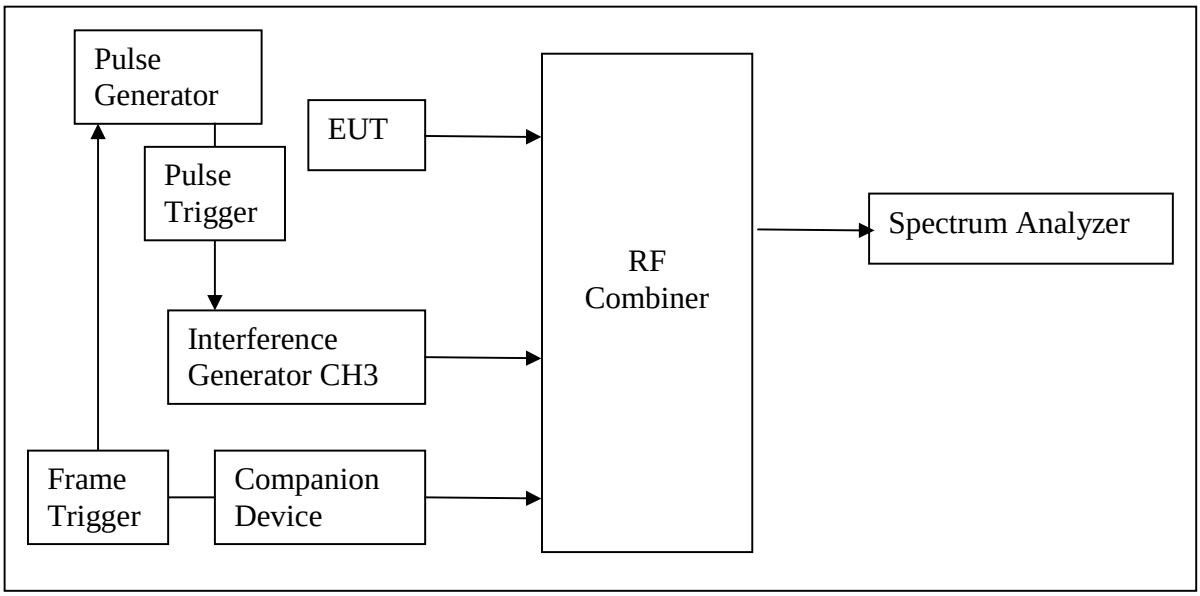

Figure 23: Test Setup for Monitoring Reaction Time of VU

The following test procedure is applied:

ANSI C63.17	Description
Clause 7.5 (a)	The EUT is restricted to transmit on CH3 only. The BS is transmitting control signals on CH3. VU and BS are synchronized.
Clause 7.5 (b)	Apply synchronized CW pulsed interference on CH3. The BS frame sync signal serves as input trigger to a pulse generator, which generates the 35µs pulses within each slot. The CW interference generator on CH3 is set to-62dBm (T_U).
Clause 7.5 (c)	The 50µs requirement is not verified as it is not required by the FCC.
Clause 7.5 (d)	Initiate a communication link from the VU and verify that no connection is setup with a pulse width of 35µs and interference level of -56dBm (T_U + 6dB).

Table 27: Test Procedure for Monitoring Reaction Time of VU

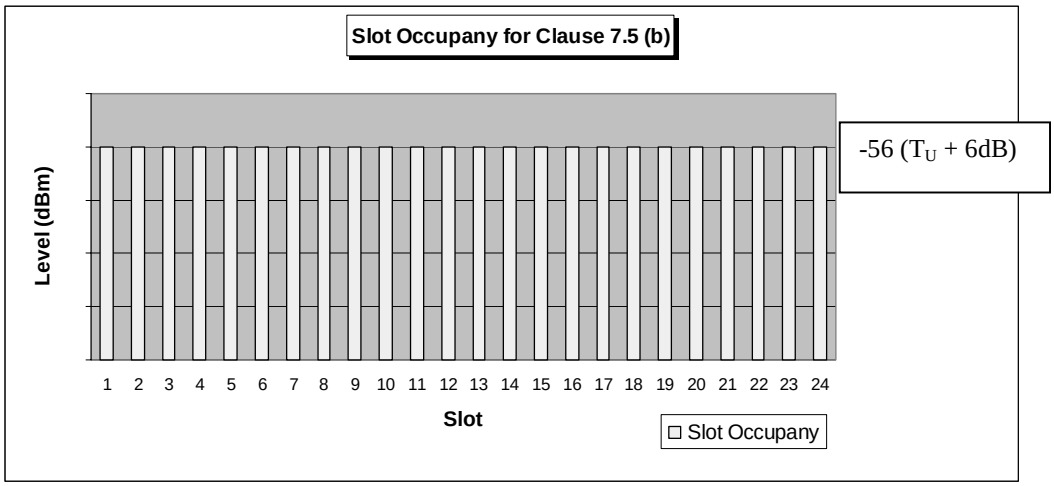

Figure 24: Slot Occupancy for Monitoring Reaction Time on VU

5.21.3. Test Results

The following test results are obtained:

ANSI C63.17	Description	Result
Clause 7.5 (a)	The EUT is restricted to transmit on CH3 only. VU and BS are synchronized on CH1.	Pass
Clause 7.5 (b)	Synchronized pulsed CW interference is applied on CH3.	Pass
Clause 7.5 (c)	The 50µs requirement is not verified.	n.a.
Clause 7.5 (d)	No communication link can be setup.	Pass

Table 28: Test Procedure for Monitoring Reaction Time of VU

Result: Pass

5.22. Monitoring Antenna

5.22.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(8) The monitoring system shall use the same antenna used for transmission, or an antenna that yields equivalent reception at that location.

5.22.2. Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 4, which provides the test methodology for this provision.

5.22.3. Attestation

The VU uses an external attached antenna.

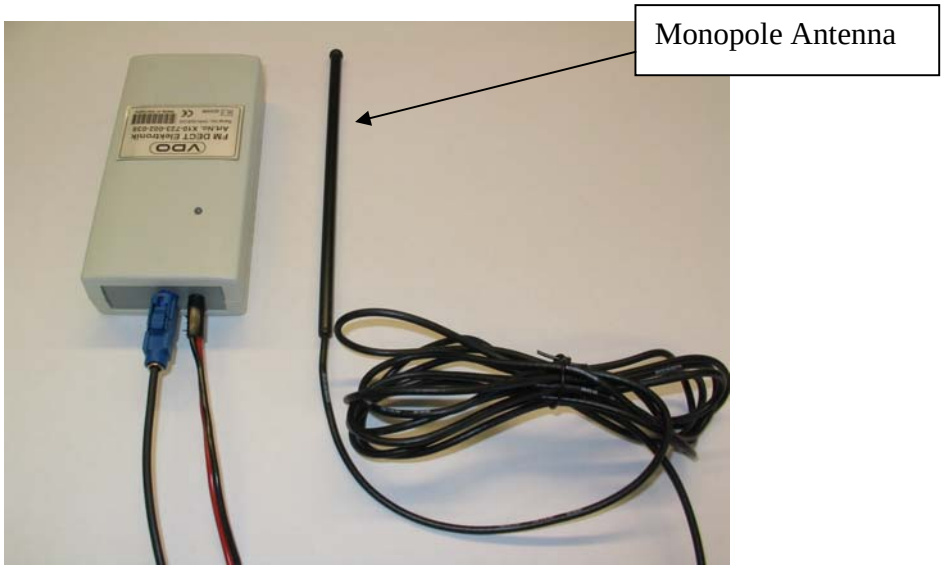

Figure 25: VU Antenna

The VU uses a single external attached antenna for transmission and monitoring. A TDMA system is realized according to the DECT standard. Channel monitoring and transmission is done through the same antenna.

5.23. Monitoring Threshold Relaxation

5.23.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(9) Devices that have a power output lower than the maximum permitted under this subpart may increase their monitoring detection threshold by one decibel for each one decibel that the transmitter power is below the maximum permitted.

5.23.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 4, which provides the test methodology for this provision.

5.23.3. Test Results

The monitoring threshold of this product is not linked to the output power level.

Description	Value
Permitted Upper Monitoring Threshold	-62.5dBm + 6dB
Measured Upper Monitoring Threshold	-60dBm
Permitted Peak Transmitter Power	20.7dBm
Measured Peak Transmitter Power	18.7dBm

Table 29: Monitoring Threshold Relaxation for VU

The upper threshold of the VU may be increased with up to 2dB.

Result: Pass

5.24. Duplex System LBT

5.24.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(10) An initiating device may attempt to establish a duplex connection by monitoring both its intended transmit and receive time and spectrum windows. If both the intended transmit and receive time and spectrum windows meet the access criteria, then the initiating device can initiate a transmission in the intended transmit time and spectrum window. If the power detected by the responding device can be decoded as a duplex connection signal from the initiating device, then the responding device may immediately begin transmitting on the receive time and spectrum window monitored by the initiating device.

5.24.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 8.3.2, which provides the test methodology for this provision. The VU is the initiating device and the BS is the companion device.

For this procedure each slot within a DECT frame ruster is setup with a different interference level. Each DECT frame consists out of 24 slots, the first 12 are RX slots and slots 13-24 are TX slots. Only the even slots are active which results in 6 active RX slots and 6 active TX slots. The following test procedure is applied:

ANSI C63.17	Description
Clause 8.3.2 (a)	The BS and the VU are synchronized.
Clause 8.3.2 (b)	Restrict the BS and VU to operate on CH3 only. Verify that a communication link can be setup on CH3. Terminate the connection.
Clause 8.3.2 (c)	Apply pulsed CW interference as shown for Clause 8.3.2 (c).
Clause 8.3.2 (d)	Initiate a communication link from the VU and verify that slot 1 is active for RX and slot 13 for TX. Terminate the connection.
Clause 8.3.2 (e)	Apply pulsed CW interference as shown for Clause 8.3.2 (e).
Clause 8.3.2 (f)	Initiate a communication link from the VU and verify that slot 11 is active for RX and slot 23 for TX. Terminate connection.
Clause 8.3.2 (g)	Apply interference as shown for Clause 8.3.2 (f). No connection should be possible.

Table 30: Test Procedure for Duplex System LBT of VU

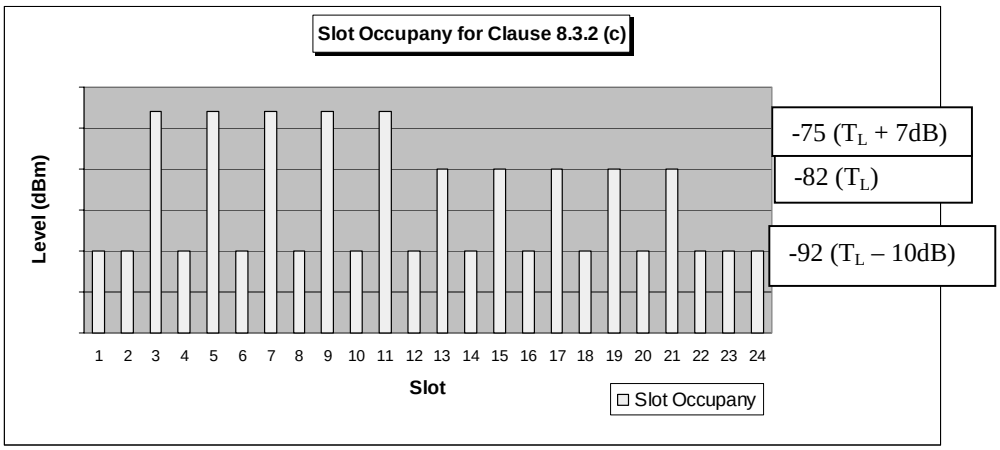

Figure 26: Slot Occupancy for Clause 8.3.2 (c)

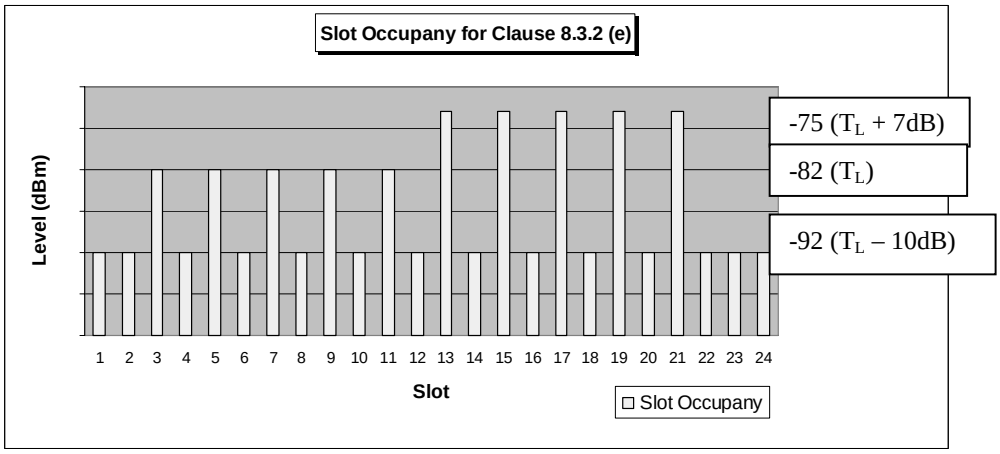

Figure 27: Slot Occupancy for Clause 8.3.2 (e)

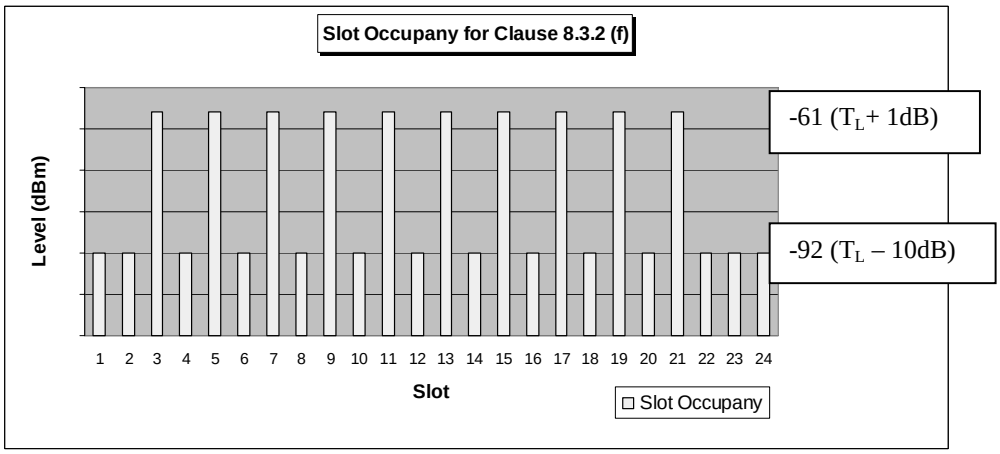

Figure 28: Slot Occupancy for Clause 8.3.2 (f)

The following test setup is used:

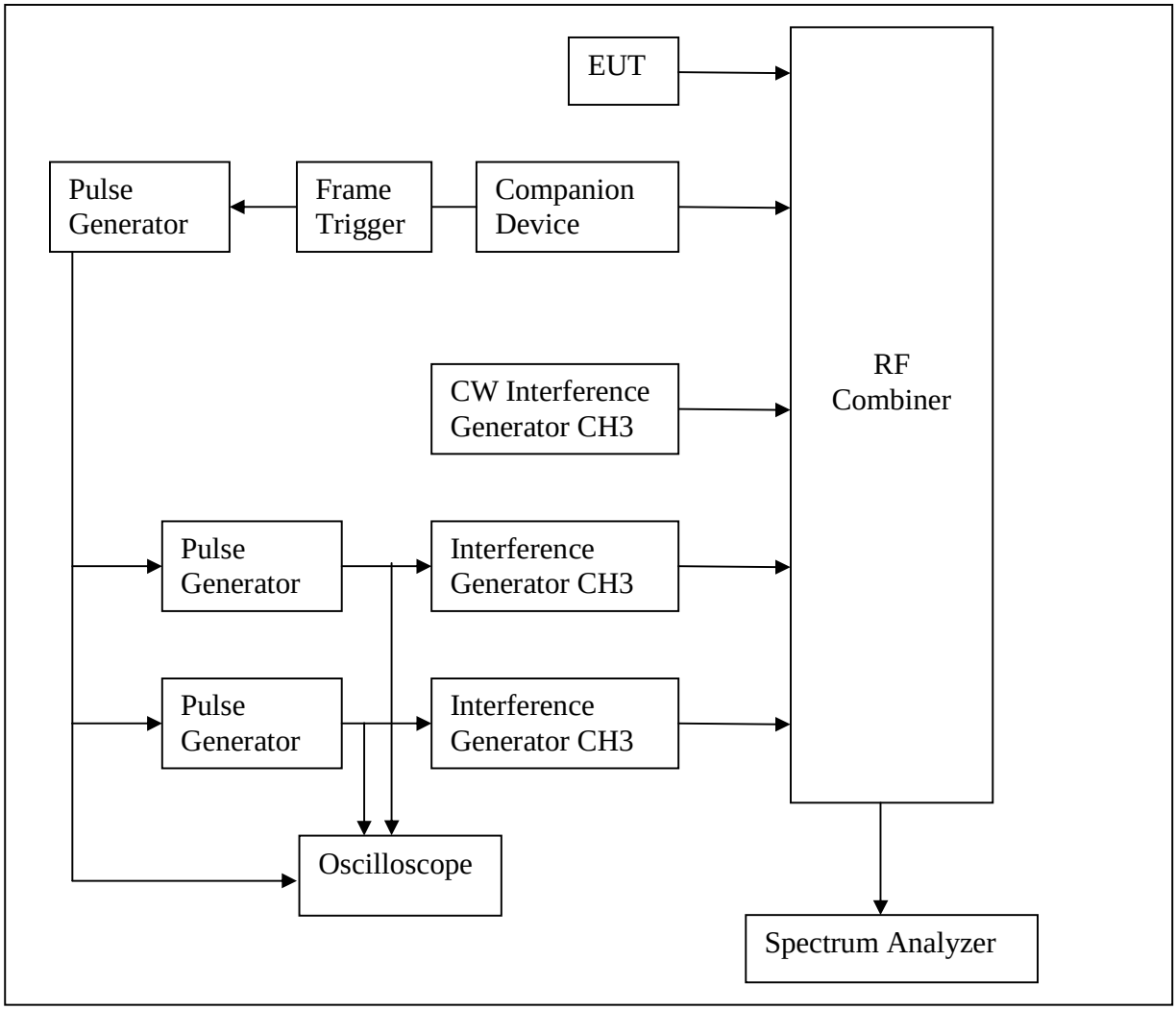

Figure 29: Test Setup for Duplex System LBT of VU

In the available service menu of the VU an indication shows on which slot a link is setup.

5.24.3. Test Results

The following test results are obtained:

ANSI C63.17	Description	Result
Clause 8.3.2 (a)	The patch loss is calibrated.	Pass
Clause 8.3.2 (b)	The frequency channel is restricted to CH3 only. A communication link can be setup on CH3. The connection is terminated.	Pass
Clause 8.3.2 (c)	Apply interference as shown for Clause 8.3.2 (c).	Pass
Clause 8.3.2 (d)	A communication link is setup on slot 1 RX and slot 13 TX. The connection is terminated.	Pass
Clause 8.3.2 (e)	Apply interference as shown for Clause 8.3.2 (e).	Pass
Clause 8.3.2 (f)	A communication link is setup on slot 11 RX and slot 23 TX. The connection is terminated.	Pass
Clause 8.3.2 (g)	Apply interference as shown for Clause 8.3.2 (f). No connection is possible.	Pass

Table 31: Test Procedure for Duplex System LBT of VU

Result: Pass

5.25. Alternate Monitoring Interval

5.25.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(11) An initiating device that is prevented from monitoring during its intended transmit window due to monitoring system blocking from the transmissions of a co-located (within one meter) transmitter of the same system, may monitor the portions of the time and spectrum windows in which they intend to receive over a period of at least 10 milliseconds. The monitored time and spectrum window must total at least 50 percent of the 10 millisecond frame interval and the monitored spectrum must be within the 1.25 MHz frequency channel(s) already occupied by that device or co-located co-operating devices. If the access criteria is met for the intended receive time and spectrum window under the above conditions, then transmission in the intended transmit window by the initiating device may commence.

5.25.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 8.4, which provides the test methodology for this provision. The VU is the initiating device and the BS is the companion device.

The following test procedure is applied:

ANSI C63.17	Description
Clause 8.4 (a)	The patch Loss is calibrated such that the power level between VU and BS is at -30dBm.
Clause 8.4 (b)	Restrict the BS and VU to operate on frequency channel CH3 only. Verify that a communication link can be setup on CH3. Terminate the connection.
Clause 8.4(c)	Apply interference as shown for Clause 8.4 (c). The interference generator applies a pulsed FSK, a DECT equivalent, signal.
Clause 8.4 (d)	Initiate a communication link from the VU and verify that no connection can be setup. In the available service menu of the VU an indication shows on which slot a link is setup.

Table 32: Test Procedure for Alternate Monitoring Interval of VU

The following test setup is used:

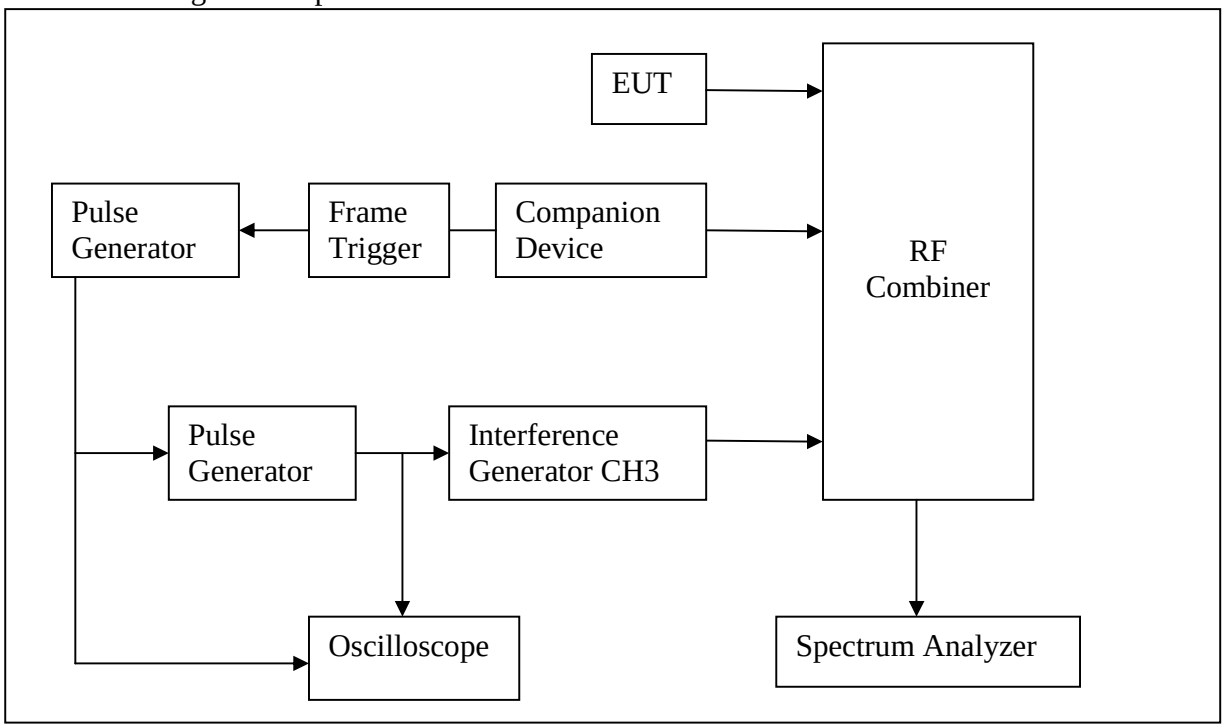

Figure 30: Test Setup for Alternate Monitoring Interval of VU

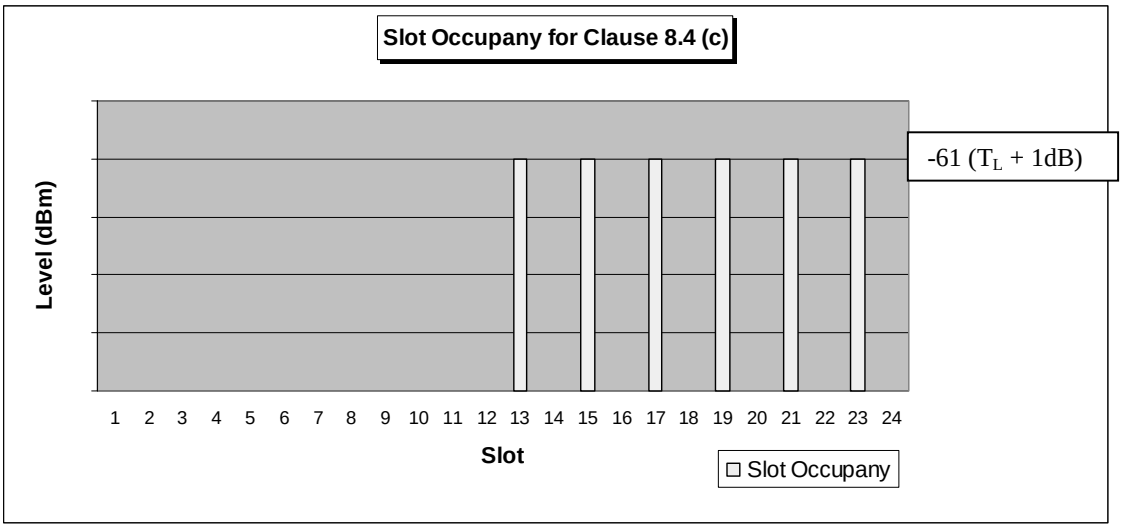

Figure 31: Slot Occupancy for Clause 8.4 (c)

5.25.3. Test Results

The following test results are obtained:

ANSI C63.17	Description	Result
Clause 8.4 (a)	The setup is calibrated	Pass
Clause 8.4 (b)	The communication link is restricted to CH3 only. A communication link is setup on CH3. The connection is terminated.	Pass
Clause 8.4(c)	Apply interference as shown for Clause 8.4 (c).	Pass
Clause 8.4 (d)	No connection is setup.	Pass

Table 33: Test Procedure for Alternate Monitoring Interval of VU

Result: Pass

5.26. Fair Access

5.26.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(12) The provisions of (c)(10) or (c)(11) of this section shall not be used to extend the range of spectrum occupied over space or time for the purpose of denying fair access to spectrum to other devices.

5.26.2. Procedure

The manufacturer supplies an attestation.

5.26.3. Attestation

This device does not use any mechanisms as provided by Part 15.323(c)(10) or (c)(11) to deny fair access to spectrum to other devices.

5.27. Frame Period

5.27.1. Test Criteria

5.27.1.1. Frame Repetition Stability

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.
(e) The frame period (a set of consecutive time slots in which the position of each time slot can be identified by reference to a synchronizing source) of an intentional radiator operating in these sub-bands shall be 20 milliseconds or 10 milliseconds/X where X is a positive whole number. Each device that implements time division for the purposes of maintaining a duplex connection on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 50 parts per million (ppm). Each device which further divides access in time in order to support multiple communication links on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 10 ppm.

5.27.1.2. Timing Jitter

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.
The jitter (time-related, abrupt, spurious variations in the duration of the frame interval) introduced at the two ends of such a communication link shall not exceed 25 microseconds for any two consecutive transmissions. Transmissions shall be continuous in every time and spectrum window during the frame period defined for the device.

5.27.2. Test Procedure

5.27.2.1. Frame-Repetition Stability

Testing to ANSI C63.17 draft ballot 3.0 Clause 6.2.2, which provides the test methodology for this provision.

The EUT is controlled from a personal computer and set into continuous transmission mode. The Spectrum Analyzer is acting as a video detector, by using zero span, and the video output of the spectrum analyzer is monitored by a frequency counter.

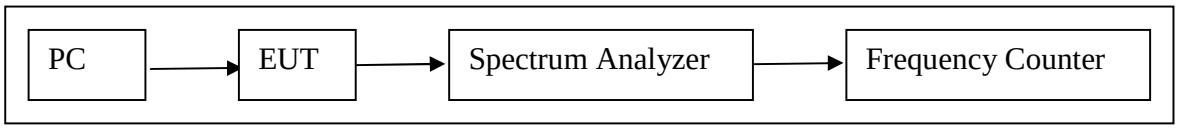

Figure 32: Test Setup for Frame-Repetition Stability Measurement

The spectrum analyzer is setup according to ANSI C63.17 Clause 6.2.2:

Centre Frequency	CH3
RBW	10MHz
VBW	10MHz
Trigger	Video
Span	Zero
Detection	Peak Detection
Sweep Rate	2ms
Amplitude Scale	Log
Peak Hold	Off

Table 34: Spectrum Analyzer Settings for Frame-Repetition Measurement

The FM DECT System uses TDMA and a frame period of 10ms.

The frequency counter is gated every 10s and measurements are recorded over 1hour.

The test is performed at 25°C with the EUT set to frequency Channel CH3.

According to ANSI C63.17 Clause 6.2.2, 3 x the standard deviation of the frame-repetition stability should be smaller than 10ppm.

5.27.2.2. Timing Jitter

Testing to ANSI C63.17 draft ballot 3.0 Clause 6.2.3, which provides the test methodology for this provision.

The EUT is controlled from a personal computer and set into continuous transmission mode. The Spectrum Analyzer is acting as a video detector, by using zero span, and the video output of the spectrum analyzer is monitored by a frequency counter.

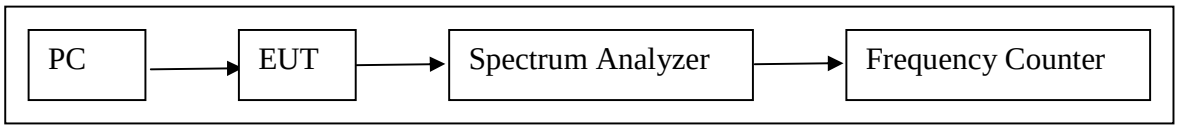

Figure 33: Test Setup for Timing Jittert Measurement

The spectrum analyzer is setup according to ANSI C63.17 Clause 6.2.3:

Centre Frequency	CH3
RBW	10MHz
VBW	10MHz
Trigger	Video
Span	Zero
Detection	Peak Detection
Sweep Rate	2ms
Amplitude Scale	Log
Peak Hold	Off

Table 35: Spectrum Analyzer Settings for Timing Jitter Measurement

The frequency counter is gated every 10s and measurements are recorded over 1hour.

The test is performed at 25°C with the EUT set to frequency Channel CH3.

According to ANSI C63.17 Clause 6.2.3, the timing jitter should be smaller than 25μs.

5.27.3. Test Results

5.27.3.1. Frame-Repetition Stability

The mean, standard deviation and 3 x SD as the frame-repetition stability is calculated.

Mean Frame Repetition	Standard Deviation	Frame Repetition Stability	Result
99.999 849Hz	0.000 000 8Hz	0.03 ppm	Pass

Table 36: Frame-Repetition Stability Measurement

Result: Pass

5.27.3.2. Timing Jitter

The following timing jitter was recorded:

Mean Period	Timing Jitter	Result
10.000 014ms	0.000 5µs	Pass

Table 37: Timing Jitter Measurement

Result: Pass

5.28. Frequency Stability

5.28.1. Test Criteria

§ 15.323 Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band.
(f) The frequency stability of the carrier frequency of the intentional radiator shall be maintained within +/-10 ppm over 1 hour or the interval between channel access monitoring, whichever is shorter. The frequency stability shall be maintained over a temperature variation of -20° to +50 °C at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20 °C. For equipment that is capable only of operating from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage

5.28.2. Test Procedure

Testing to ANSI C63.17 draft ballot 3.0 Clause 6.2.1, which provides the test methodology for this provision.

The EUT is controlled from a personal computer and set into continuous transmission mode.

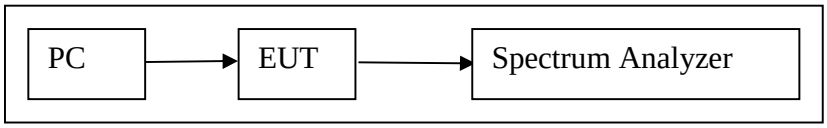

Figure 34: Test Setup for Frequency Stability Measurement

The spectrum analyzer is setup according to ANSI C63.17 Clause 6.2.1:

Centre Frequency	CH3
Mode	Vector Analyzer – DECT Demodulation
Trigger	Video
Symbol Rate	1.152MHz
BT	0.5
Reference Filter	Gaussian

Table 38: Spectrum Analyzer Settings for Frequency Stability Measurement

The frequency stability of the VU is measured at frequency channel CH3.

A +/-10ppm frequency shift is allowed at 1924.992Hz.
Frequency Shift = 10/1exp6 * 1925exp6
= 19.25KHz

5.28.3. Test Results

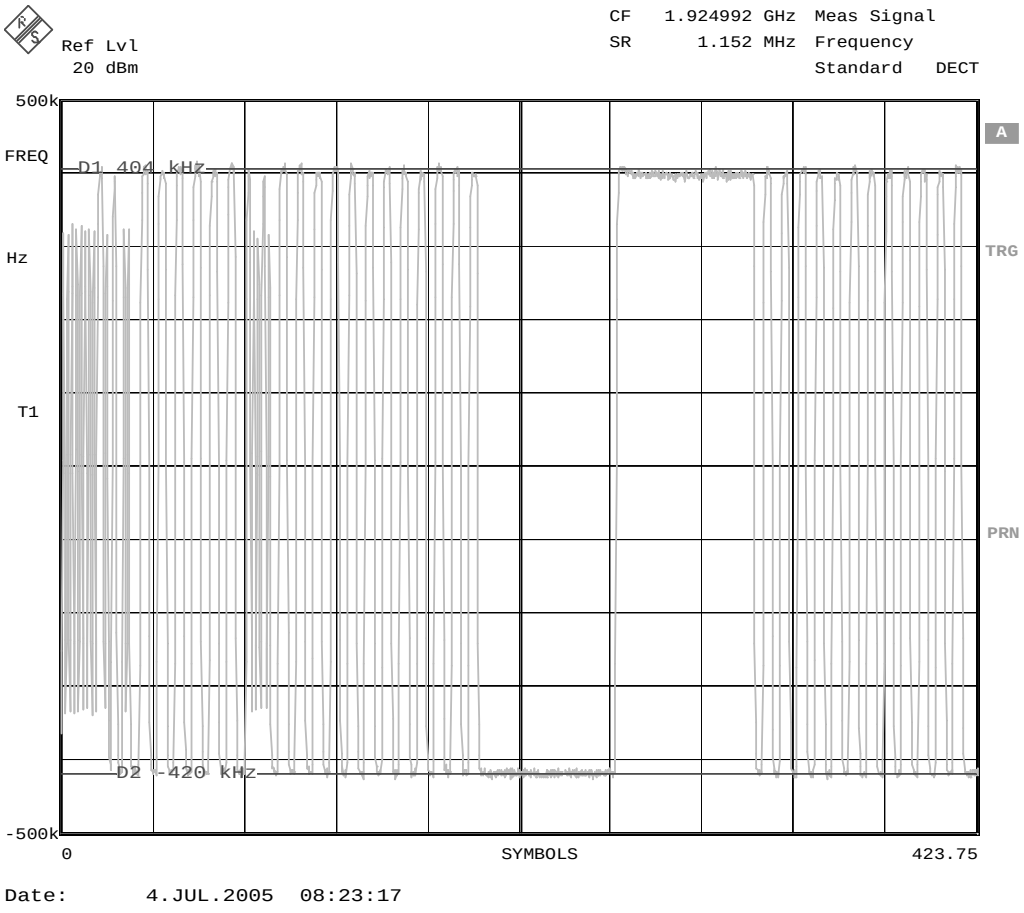

Figure 35: Spectrum Analyzer Display for Frequency Stability Measurement of VU

The following Frequency Offset was measured:

+20°C 85-115% Supply		**-20°C Normal Supply**		**+50°C Normal Supply**		**Result**
KHz	**ppm**	**KHz**	**ppm**	**KHz**	**ppm**	
+8	+4	+1	+0.5	+17	+8.8	Pass

Table 39: Results of Frequency Stability of VU

Result: Pass