

Test Report

Product	DECT Wireless Relay Station	
Name and address of the applicant	Panasonic Corporation of North America	
Name and address of the manufacturer	Panasonic System Networks Co., Ltd. 1-62, 4-chome, Minoshima, Hakata-ku Fukuoka 812-8531, Japan	
Model	KX-HNZ108 / KX-HNH200	
Rating	120V AC (AC Adaptor Model PNLV226)	
Trademark	Panasonic	
Serial number	/	
Additional information	DECT 6.0, WRS	
Tested according to	FCC Part 15, subpart D Isochronous UPCS Device, 1920 – 1930 MHz Industry Canada RSS 213, Issue 3 2 GHz License-Exempt Personal Communications Services (LE-PCS) Devices	
Order number	324587	
Tested in period	2017.01.24	
Issue date	2017.02.06	
Name and address of the testing laboratory	 FCC No: 994405 IC OATS: 2040D-1 Instituttveien 6 Kjeller, Norway TEL: +47 22 96 03 30 FAX: +47 22 96 05 50	
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1 INFORMATION

1.1 Tested Item

Name :	Panasonic
Model name :	KX-HNZ108 / KX-HNH200
FCC ID :	ACJ96NKX-HNZ108
Industry Canada ID :	216A-KXHHN200
Serial number :	/
Hardware identity and/or version:	PNLB1754xx
Software identity and/or version :	SW313
Tested to IC Radio Standard (RSS) :	RSS-213 Issue 3, RSS-GEN Issue 4
Test Site IC Reg. Number :	IC 2040D-1
Frequency Range :	1921.536 – 1928.448 MHz
Number of Channels :	5 RF Channels, 5x12 = 60 TDMA Duplex Channels
Type of Modulation :	Digital (Gaussian Frequency Shift Keying)
Conducted Output Power :	71.6 mW (Peak)
Antenna Connector :	None
Number of Antennas :	2
Antenna Diversity Supported :	Yes
Desktop Charger :	N/A
Power Supply :	AC Adaptor Model PNLV226
Interface :	None
Companion Devices for Monitoring Tests :	Base Station: KX-HNB600 (FCC ID: ACJ96NKX-HNB600) Portable Device: KX-HNS101 (FCC ID: ACJ96NKX-HNS101)*

* The Portable Device used for the monitoring tests, was operating in a mode where the connection was manually activated and kept until manually released.

1.2 Description of Tested Device

The EUT is a DECT Wireless Relay Station (WRS) and is a responding device as described in ANSI C63.17 and it is designed to operate together with a DECT Handset, which is the initiating device.

The WRS works by retransmitting the data from the Handset to the Base Station in the next DECT frame, and vice versa with the response from the Base Station to the Handset. The WRS has its own unique ID and will only work with Base Stations it has previously been registered to.

The WRS will not transmit at all if it does not see the Base Station it has been registered to.

The WRS decodes the signal it receives and retransmits only the data, the RF signal transmitted from the WRS is on a different timeslot and is completely independent of the input signal received by the WRS, except that it is on the same RF Carrier and contains the same data.

1.3 Test Environment

Temperature:	20 – 23 °C
Relative humidity:	30 – 50 %
Normal test voltage:	120 V AC

The values are the limit registered during the test period.

1.4 Test Engineer(s)

Frode Sveinsen

1.5 Other Comments

The Monitoring and Time and Spectrum Window Access tests were performed with Test Set-Up 6 (Ref. clause 5). A clock signal from the companion device was used to synchronize the Pulse Pattern Generator and the Spectrum Analyzer to the start of the DECT time window. The EUT was limited by administrative commands to operate on only two frequency carriers. For the tests where the EUT was required to operate on only one frequency carrier, one carrier was blocked by applying a CW interfering signal from RF Generator 3. The Pulse Pattern Generator was used to apply time synchronized interference to time windows where this was required.

Since the EUT was programmed to operate on only two RF carriers, it was only necessary with two RF generators for the monitoring tests, however a third generator was applied for the tests that required specific time slots to be blocked.

This EUT supports Least Interfered Channel procedure (LIC), the Monitoring and Time and Spectrum Window Access tests were conducted as specified for EUTs that support LIC procedure.

All tests were performed in conducted mode with a temporary antenna connector.

This report covers only Monitoring tests, all other tests are covered by the original test report for this device, Nemko test report no. 312149-1.

Monitoring tests were re-tested because software has been modified to comply with the new rules, i.e. this version does no longer use Upper Limit and the EUT will always transmit if a base station is found.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC CFR47 Part 15D for Isochronous UPCS Devices and Industry Canada RSS-213 Issue 3 / RSS-GEN Issue 4 / RSP-100 Issue 11.

All tests were conducted in accordance with ANSI C63.4-2014 and ANSI C63.17-2013. Antenna Gain tests were made in a 3m fully-anechoic chamber.

A description of the test facility is on file with the FCC and Industry Canada.

- | | |
|----------------------------------------------------------------|-----------------------------------------------------|
| <input type="checkbox"/> New Submission | <input checked="" type="checkbox"/> Production Unit |
| <input checked="" type="checkbox"/> Class II Permissive Change | <input type="checkbox"/> Pre-production Unit |
| PUB Equipment Code | <input type="checkbox"/> Family Listing |



THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

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2.2 Test Summary

Name of test	FCC CFR 47 Paragraph #	IC RSS-213 Paragraph #	Verdict
Power Line Conducted Emission	15.107(a) 15.207(a)	5.4 RSS-GEN 8.8	N/T ¹
Digital Modulation Techniques	15.319(b)	5.1	N/T ¹
Labeling requirements	15.19(a)(3)	RSP-100 3.1	N/T ¹
Antenna Requirement	15.317, 15.203	RSS-GEN 8.3	N/T ¹
Channel Frequencies	15.303	5.1	N/T ¹
Automatic discontinuation of transmission	15.319(f)	5.2 (4)	N/T ¹
Emission Bandwidth	15.323(a)	5.5 RSS-GEN 6.6	N/T ¹
In-band emissions	15.323(d)	5.8.2	N/T ¹
Out-of-band emissions	15.323(d)	5.8.1	N/T ¹
Peak Transmit Power and Antenna Gain	15.319(c)(e), 15.31(e)	5.6 RSS-GEN 8.3	N/T ¹
Power Spectral Density	15.319(d)	5.7	N/T ¹
Carrier frequency stability	15.323(f)	5.3	N/T ¹
Frame repetition stability	15.323(e)	5.2 (13)	N/T ¹
Frame period and jitter	15.323(e)	5.2 (13)	N/T ¹
Monitoring threshold, Least interfered channel	15.323(c)(2)(5)(9)	5.2 (2)(5)(9)	Complies
Monitoring of intended transmit window and maximum reaction time	15.323(c)(1)	5.2 (1)	Complies
Threshold monitoring bandwidth	15.323(c)(7)	5.2 (7)	Complies
Reaction time and monitoring interval	15.323(c)(1)(5)(7)	5.2 (1)(5)(7)	Complies
Access criteria test interval	15.323(c)(4)(6)	5.2 (4)(6)	Complies
Access Criteria functional test	15.323(c)(4)(6)	5.2 (4)(6)	Complies
Acknowledgements	15.323(c)(4)	5.2 (4)	Complies
Transmission duration	15.323(c)(3)	5.2 (3)	Complies
Dual access criteria	15.323(c)(10)	5.2 (10)	Complies
Alterative monitoring interval	15.323(c)(11)(12)	5.2 (11)(12)	N/A ²
Spurious Emissions (Radiated)	15.319(g) 15.109(a) 15.209(a)	RSS-GEN 8.9	N/A ³

¹ Covered by Nemko test report no. 312149-1

² The client declares that the tested equipment does not implement this provision

³ Not required if the Conducted Out-of-Band Emissions test is Passed

3 TEST RESULTS

3.1 Monitoring Threshold, Least Interfered Channel

Monitoring Threshold Limits:

Lower Threshold:

$$T_L = 15 \log B - 184 + 30 - P_{EUT} \quad (\text{dBm})$$

Upper Threshold:

$$T_U = T_L + 20 \quad (\text{dBm})$$

B is measured Emission Bandwidth in Hz
P_{EUT} is measured Transmitter Power in dBm

Calculated values:

	FCC 15.323, RSS-213, Issue 3
Lower Threshold	-80.3 dBm

Least Interfered Channel Procedure (LIC) may only be used by systems with more than 20 duplex system access channels. Systems with less than 20 duplex system access channels are not allowed to transmit when interferer level is above Lower Threshold.

Measurement Procedure:

Least Interfered Channel Procedure NOT used:	
Lower Threshold	N/A The EUT uses LIC procedure

Least Interfered Channel (LIC) Procedure Test, FCC 15.323(b), (c)(2) and (c)(5)

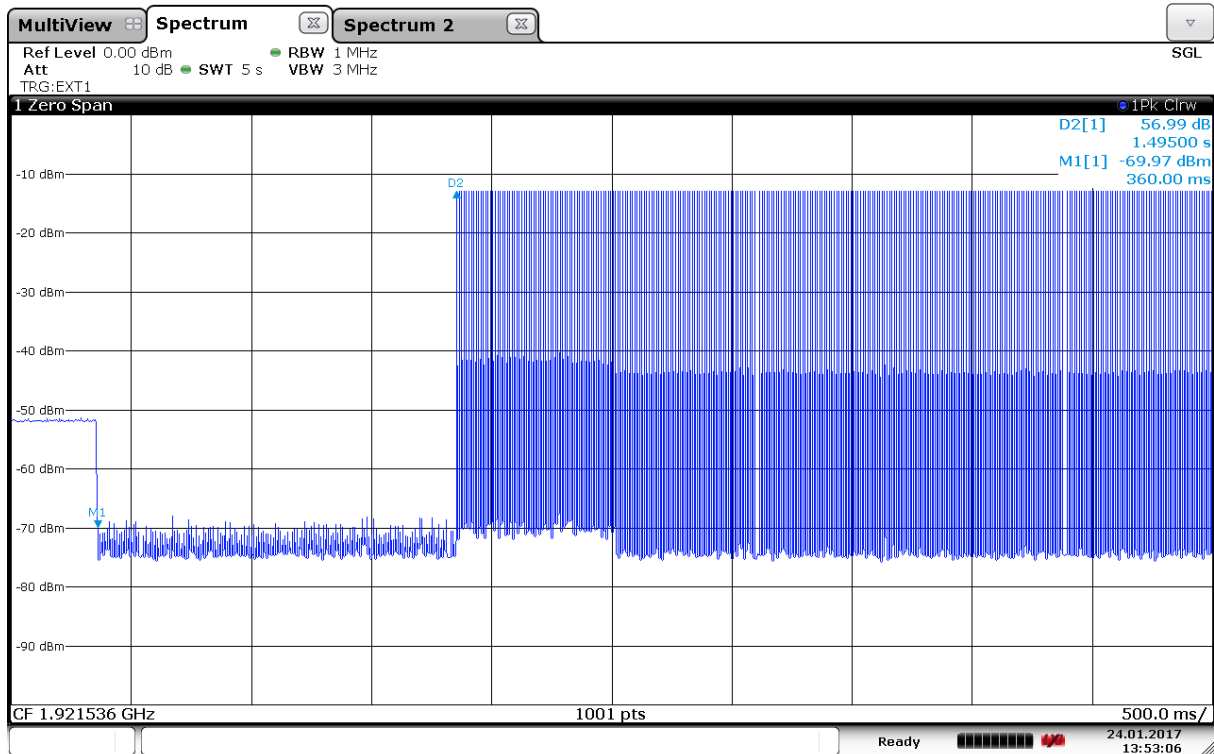
ANSI C63.17 clause 7.3.2 ref.	Observation	Verdict
b) f_1 at $T_L + U_M + 7$ dB, f_2 at $T_L + U_M$	Transmission always on f_2	Pass
c) f_1 at $T_L + U_M$, f_2 at $T_L + U_M + 7$ dB	Transmission always on f_1	Pass
d) f_1 at $T_L + U_M + 1$ dB, f_2 at $T_L + U_M - 6$ dB	Transmission always on f_2	Pass
e) f_1 at $T_L + U_M - 6$ dB, f_2 at $T_L + U_M + 1$ dB	Transmission always on f_1	Pass

Selected Channel Confirmation, FCC 15.323(c)(1) and (5)

ANSI C63.17 clause 7.3.3	Observation	Verdict
b) Shall not transmit on f_1	EUT transmits on f_2	Pass
d) Shall not transmit on f_2	EUT transmits on f_1	Pass

Limits:

	FCC 15.323, RSS-213, Issue 3
Lower Threshold + 6 dB margin	-74.3 dBm



7.3.4 Selected Channel Confirmation, Connection 1.5s After Interferer Removed

3.2 Threshold Monitoring Bandwidth

This test is only required if a dedicated monitoring receiver is used. However, if the test is not carried out the manufacturer shall declare and provide proper evidence that the monitoring is made through the radio receiver used for communication.

Measurement Procedure:

Simple Compliance Test, ANSI C63.17, clause 7.4.1

More Detailed Test, ANSI C63.17, clause 7.4.2

The test is passed if **either** the Simple Compliance Test or the More Detailed test is passed.

During this test the spectrum analyzer is observed visually to see if the EUT transmits or not.

Test Results:

Test performed	Observation	Verdict
Simple Compliance test, at $\pm 30\%$ of B	N/A	N/A
More Detailed Test, at -6 dB points	N/A	N/A
More Detailed Test, at -12 dB points	N/A	N/A

The more detailed test must be pass at both the -6 and -12 dB points if the Simple Compliance test fails.

Comment: The manufacturer declares that the tested EUT uses the same receiver for monitoring and communication, this test is therefore not required.

Limits, FCC 15.323(c)(7):

The monitoring system bandwidth must be equal to or greater than the emission bandwidth of the intended transmission.

3.3 Reaction Time and Monitoring Interval

Measurement Procedure

ANSI C63.17, clause 7.5

Test results:

By administrative commands and out-of-operating region interference, the EUT is restricted to operate on two RF carrier frequencies.

A CW interferer signal at a level T_L is applied on f_1 and time-synchronized pulsed interference at a level $T_L + U_M$ dB is applied on f_2 . The level on f_2 was raised 6 dB for part d) with 35 μ s pulses.

The pulses are synchronized with the EUT timeslots and applied centered within all timeslots.

For both tests the test is passed if the EUT transmits on f_1 .

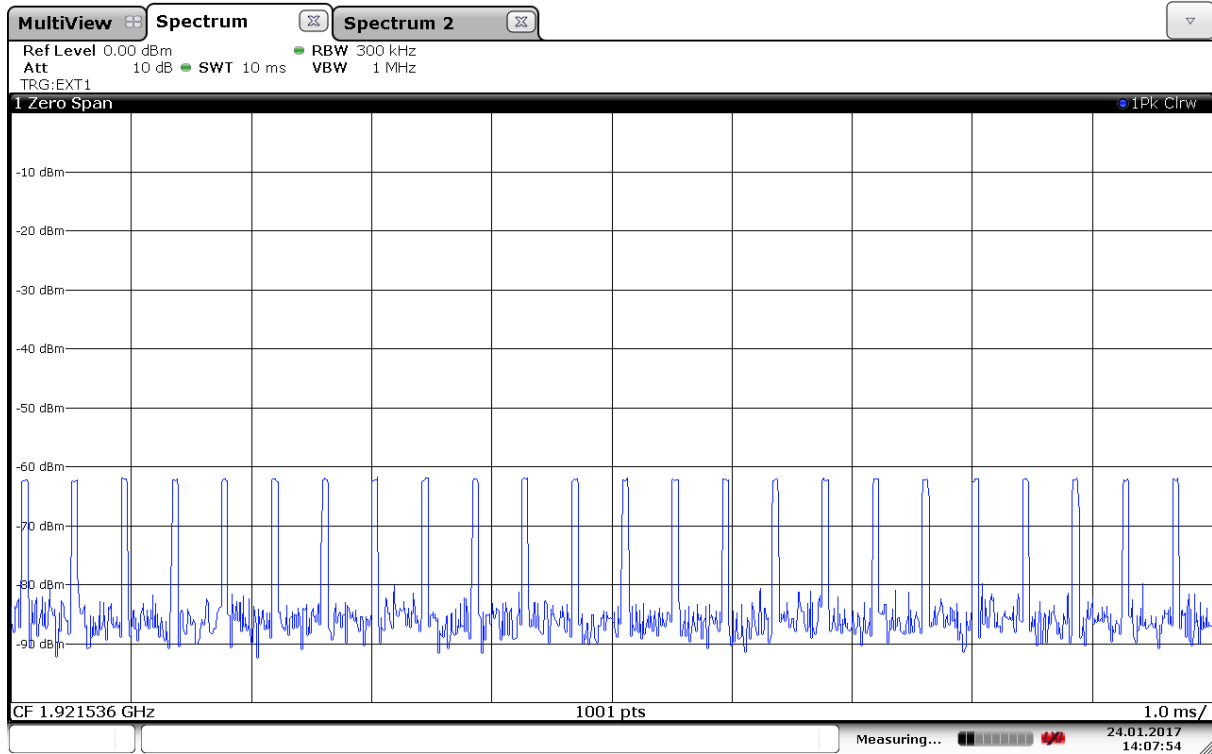
Pulse Width, ref. to ANSI C63.17 clause 7.5	Observation	Verdict
c) > largest of 50 μ s and $50 \cdot \text{SQRT}(1.25/B)$	EUT transmits on f_1	Pass
d) > largest of 35 μ s and $35 \cdot \text{SQRT}(1.25/B)$, and with interference level raised 6 dB	EUT transmits on f_1	Pass

Comment: Since B is larger than 1.25 MHz the test was performed with pulse lengths of 50 μ s and 35 μ s.

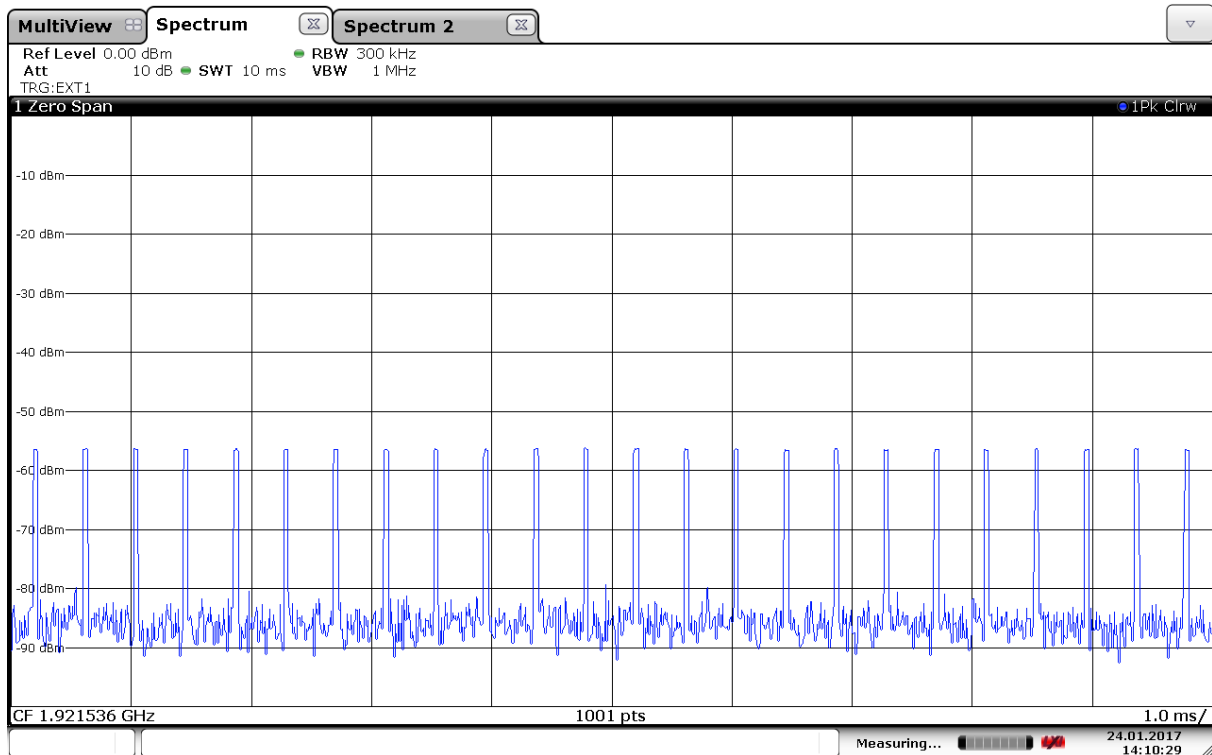
Limits, FCC 15.323(c)(1), (5) and (7)

The maximum reaction time must be less than $50 \cdot \text{SQRT}(1.25/\text{emission bandwidth in MHz})$ microseconds for signals at the applicable threshold level but shall not be required to be less than 50 μ s.

If a signal is detected that is 6 dB or more above the applicable threshold level, the maximum reaction time shall be $35 \cdot \text{SQRT}(1.25/\text{emission bandwidth in MHz})$ microseconds but shall not be required to be less than 35 μ s.



50 μ s Pulses



35 μ s Pulses

3.4 Time and Spectrum Window Access Procedure

This requirement is only for EUTs which transmit unacknowledged control and signaling information.

Measurement Procedure:

Timing for EUTs using control and signaling channel type transmissions: ANSI C63.17, clause 8.1

Test results:

Access Criteria, ref. to ANSI C63.17 clause 8.1.1	Observation	Verdict
b) Check that the EUT transmits on the interference free time-slot	EUT transmits on the interference free time-slot	Pass
b) The EUT must terminate or pause in its repetitive transmission of the control and signalling channel on the open channel to repeat the access criteria not less frequently than every 30 s	Transmission paused every 1.28 s	Pass

If FCC 15.323(c)(6) option, **If Random Waiting Interval is NOT implemented**

Access Criteria, ref. to ANSI C63.17 clause 8.1.2	Observation	Verdict
b) Check that the EUT changes to an interference-free slot when interference is introduced on the time slot in use	EUT changes to the interference-free time-slot, and stays there	Pass

If FCC 15.323(c)(6) option, **Only if Random Waiting Interval is implemented**

Access Criteria, ref. to ANSI C63.17 clause 8.1.3	Observation	Verdict
b-d) Check that the EUT uses random waiting interval before continuing transmission on an interfered time slot	N/A	N/A

Comment: The tested EUT does not support the Random Waiting Interval option.

Limits:

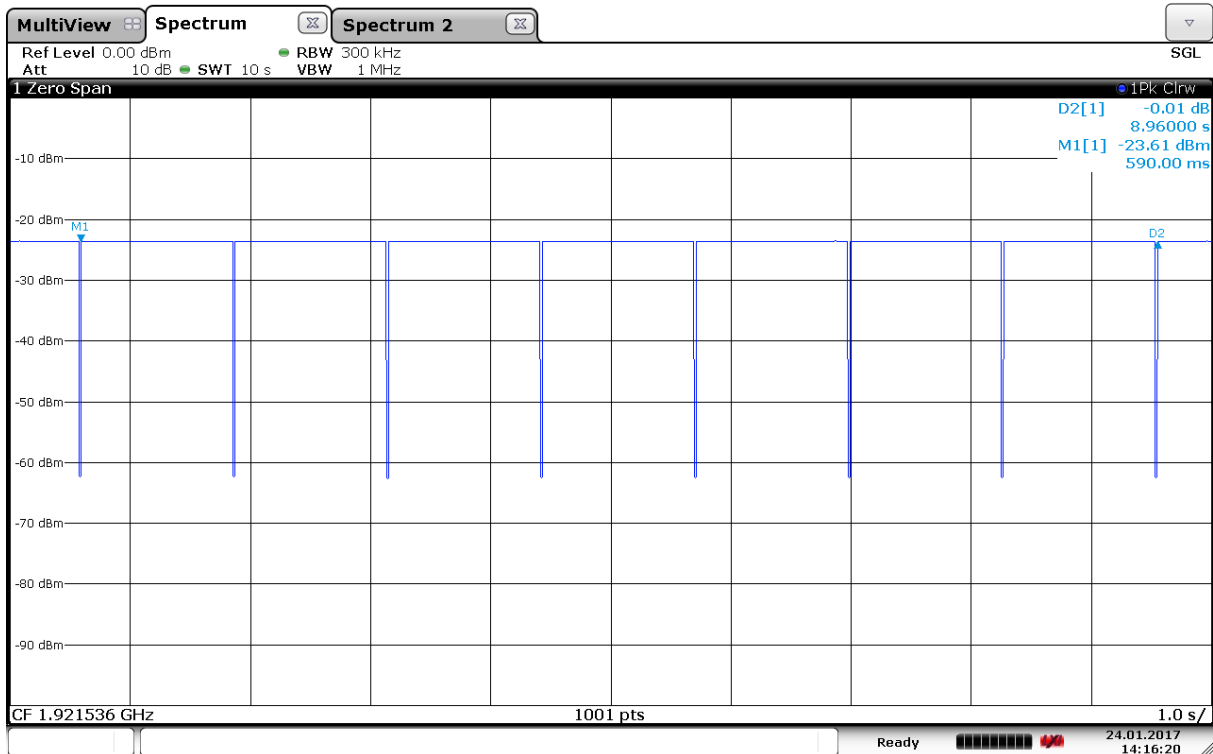
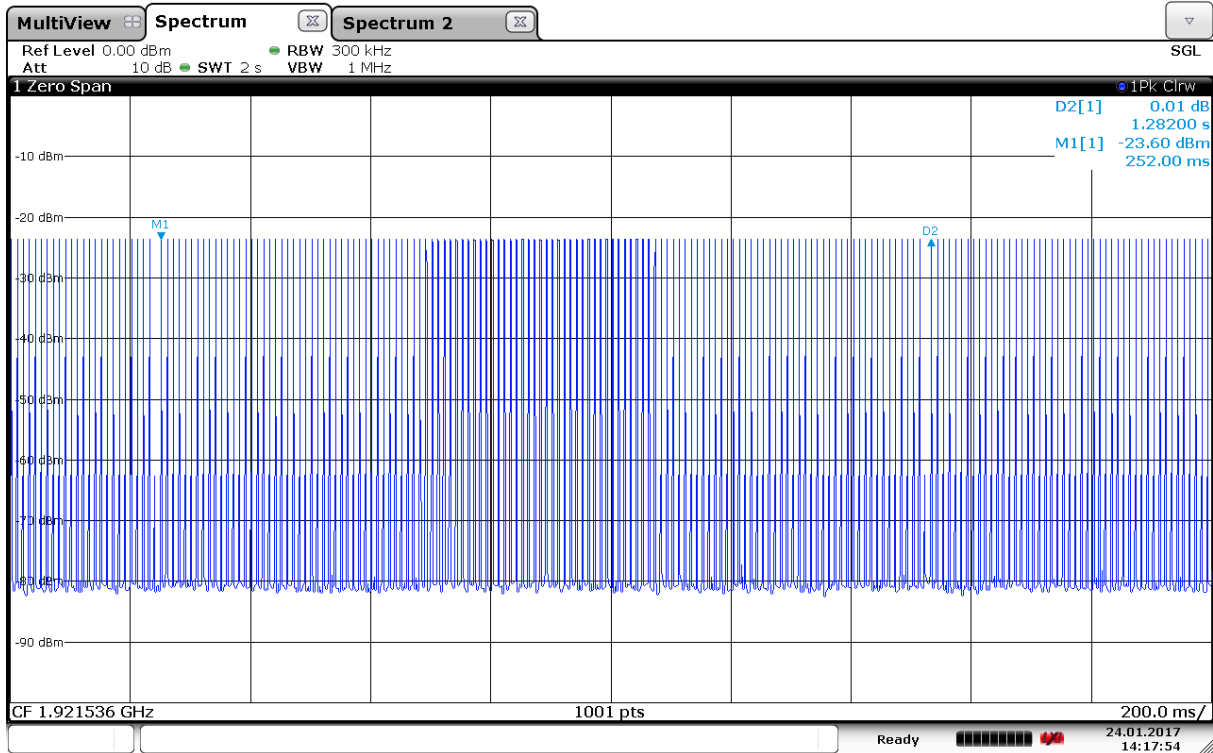
FCC 15.323(c)(4):

Once access to specific combined time and spectrum windows is obtained an acknowledgement from a system participant must be received by the initiating transmitter within one second or transmission must cease. Periodic acknowledgements 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 acknowledgement, at which time the access criteria must be repeated.

FCC 15.323(c)(6):

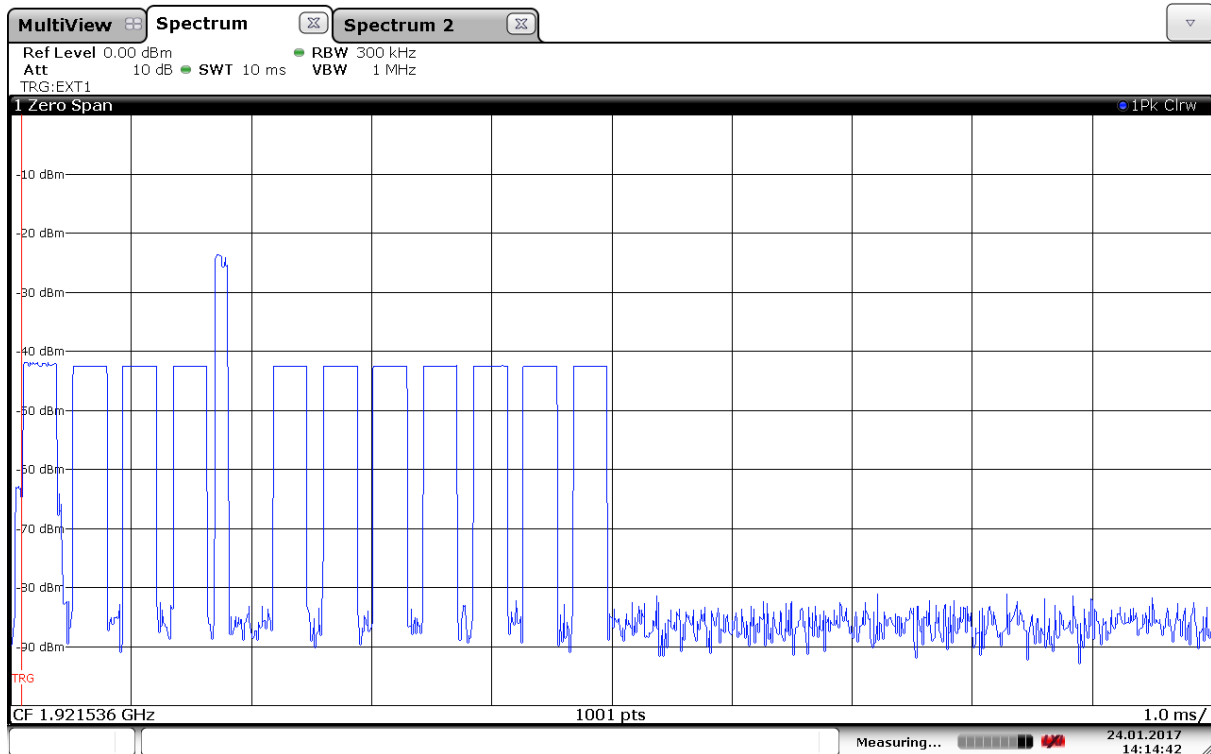
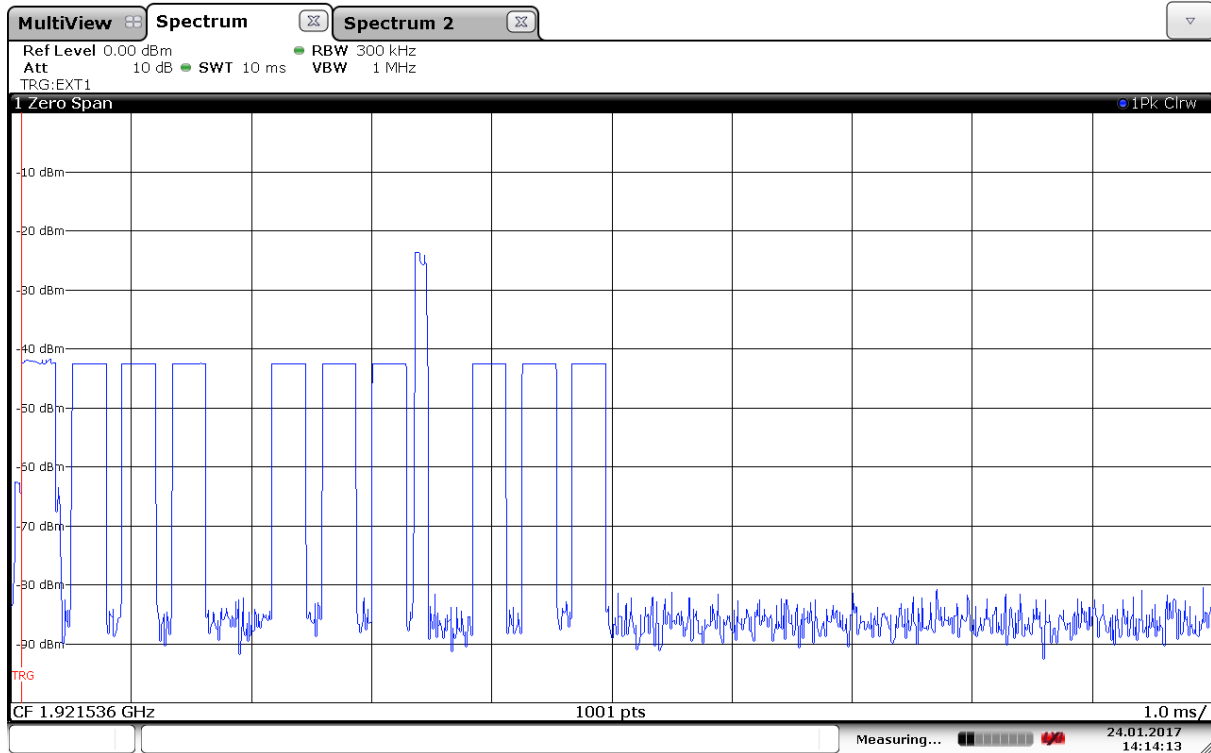
If the selected combined time and spectrum windows are unavailable, the device may either monitor and select different windows or seek to use the same windows after waiting an amount of time, randomly chosen from a uniform random distribution between 10 and 150 milliseconds, commencing when the channel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

Access Criteria Check



8.1.1 Access Criteria check Interval

Access Criteria Check



8.1.2 Functional test, Before and after

3.5 Acknowledgements and Transmission Duration

Measurement Procedure:

Acknowledgements: ANSI C63.17, clause 8.2.1

Transmission Duration: ANSI C63.17, clause 8.2.2

During the test **Initial transmission without acknowledgements** the signal from the EUT to the companion device is blocked by circulators in addition to the tunable attenuator.

The test **Transmission time after loss of acknowledgements** is performed by cutting-off the signal from the companion device by a RF switch and measuring the time until the EUT stops transmitting.

The **Transmission Duration** test is performed by monitoring the slot in use and measuring the time until the EUT changes to a different slot.

Test Results:

Acknowledgements

Test ref. to ANSI C63.17 clause 8.2.1	Observation	Verdict
a) Initial transmission without acknowledgements	Not applicable for EUT that transmits control and signaling information	N/A
c) Transmission time after loss of acknowledgements	6 sec	Pass

Transmission Duration

Test ref. to ANSI C63.17 clause 8.2.2	Observation	Verdict
b) Transmission duration on same time and frequency window	Only for initiating device that controls which time slot is used	N/A

Comment: /

Limits, FCC 15.323(c)(3) and (4)

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.

Once access to specific combined time and spectrum windows is obtained an acknowledgement from a system participant must be received by the initiating transmitter within one second or transmission must cease.

Periodic acknowledgements 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 acknowledgement, at which time the access criteria must be repeated.

3.6 Dual Access Criteria Check

Measurement Procedure:

EUTs that does not implement the LIC procedure: ANSI C63.17, clause 8.3.1

EUTs that implement the LIC procedure: ANSI C63.17, clause 8.3.2

This test is required for equipment that uses the access criteria in FCC 15.323(c)(10).

Test Results:

EUTs that do NOT implements the LIC procedure:

Test ref. to ANSI C63.17 clause 8.3.1	Observation	Verdict
b) EUT is restricted to a single carrier f_i for TDMA systems. The Test is Pass if EUT can transmit	N/A	N/A
c) d) Interference at level $T_L + U_M$ on all timeslots except one receive slot where interference is at least 10 dB below T_L	N/A	N/A
e) f) Interference at level $T_L + U_M$ on all timeslots except one transmit slot where interference is at least 10 dB below T_L	N/A	N/A

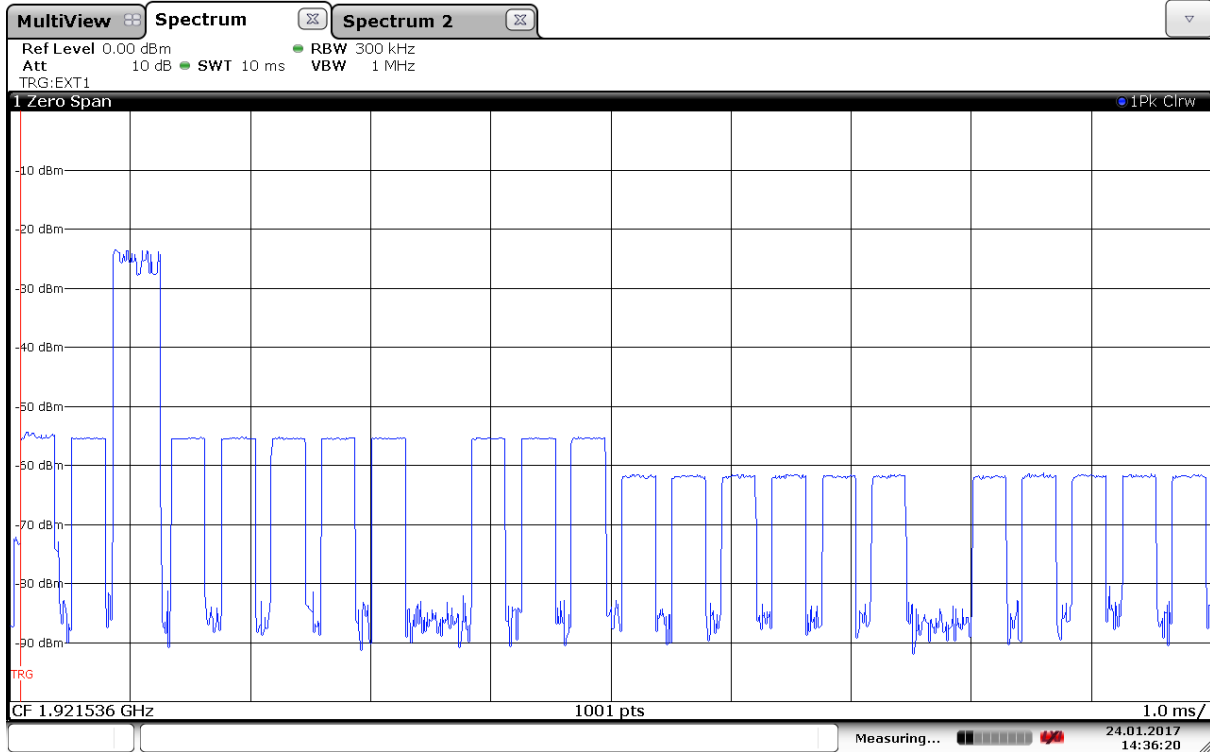
EUTs that implements the LIC procedure:

Test ref. to ANSI C63.17 clause 8.3.2	Observation	Verdict
b) EUT is restricted to a single carrier f_i for TDMA systems. The Test is Pass if EUT can transmit	EUT can transmit	Pass
c) d) Transmission on interference-free receive time/spectrum window	EUT transmits on interference free receive slot	Pass
e) f) Transmission on interference-free transmit time/spectrum window	EUT transmits on interference free transmit slot	Pass

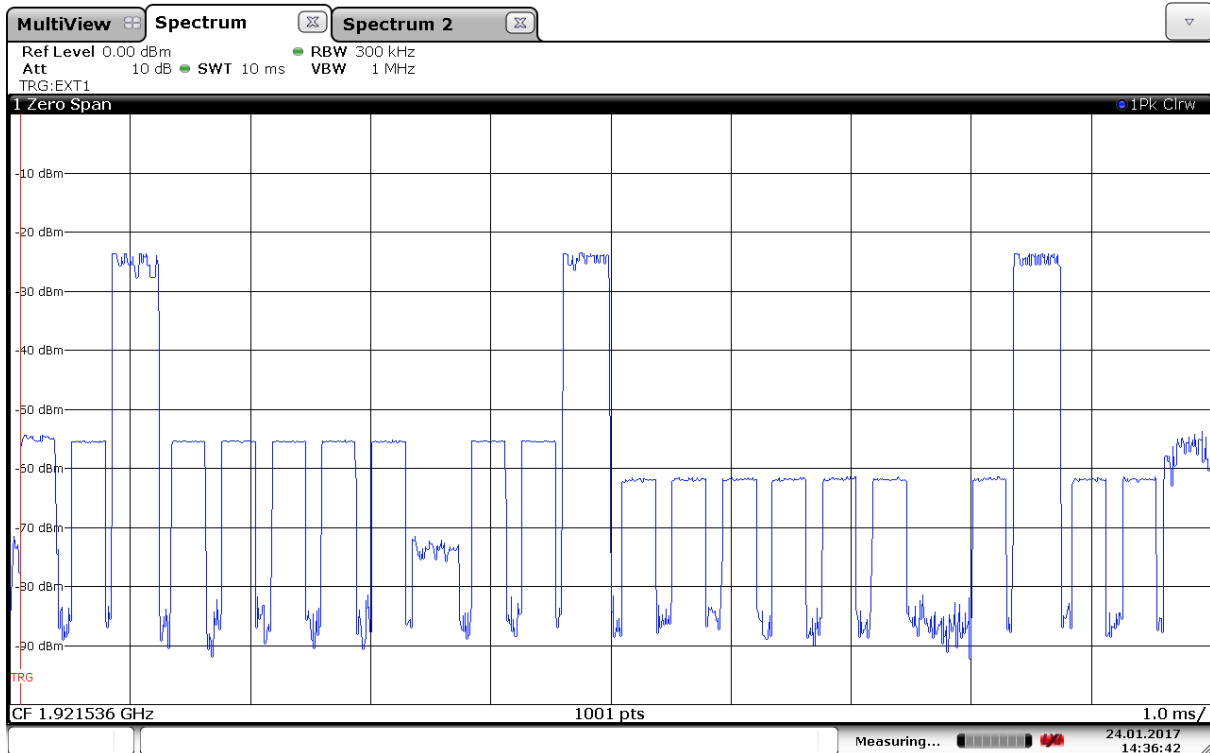
Comment: See plots.

Limits, FCC 15.323(c)(10)

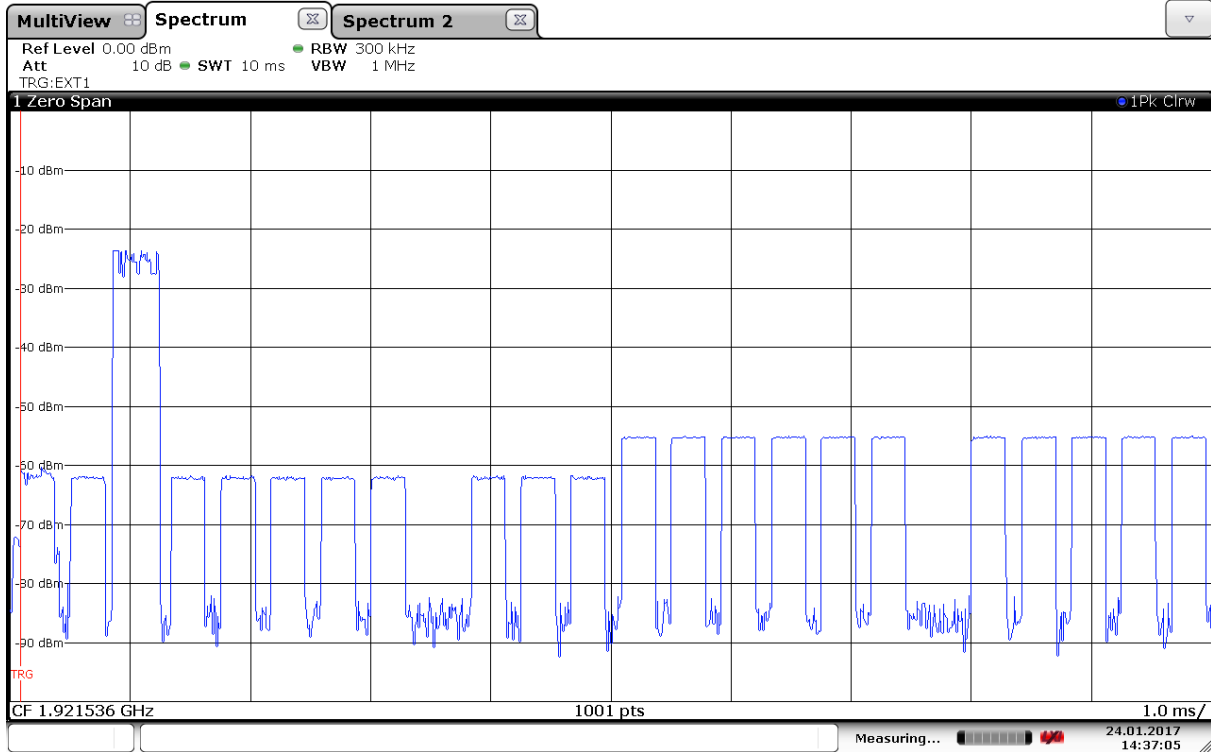
An initiating device may attempt to establish a duplex connection by monitoring both its intended transmit and receive time and spectrum windows. If both the intended transmit and receive time and spectrum windows meet the access criteria, then the initiating device can initiate a transmission in the 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.



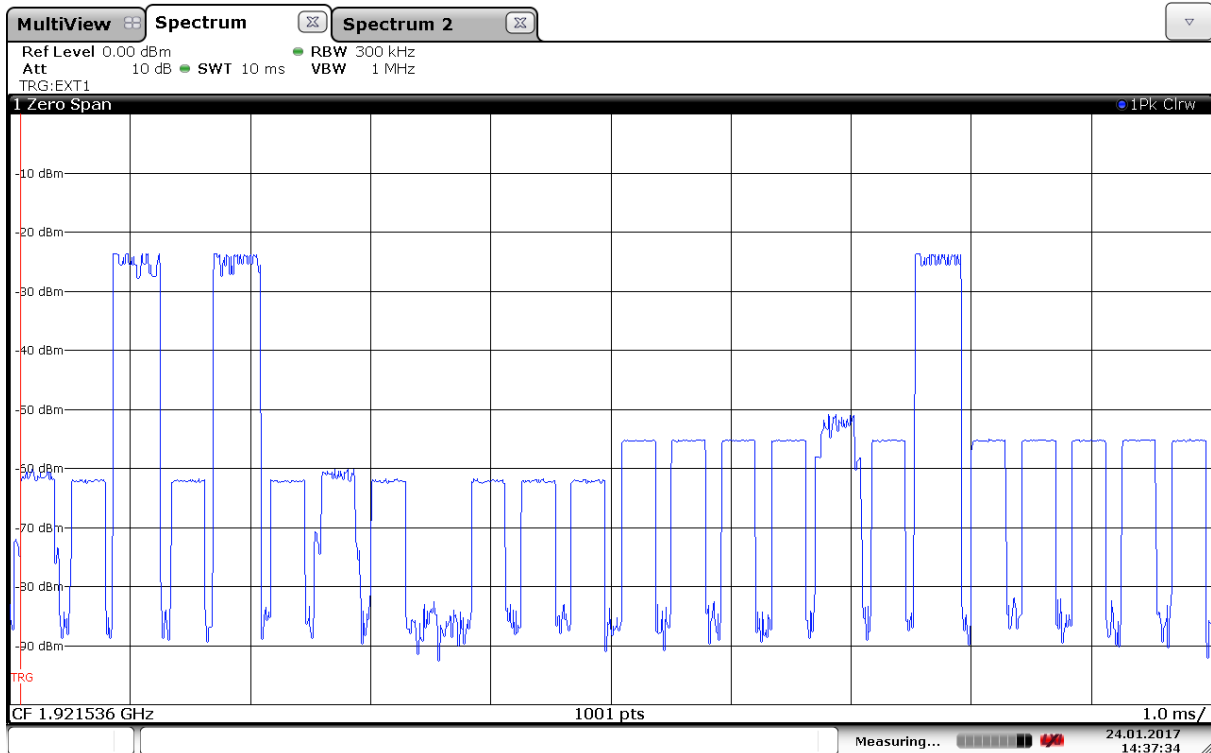
8.3.2c) EUT Transmits on Interference Free RECEIVE Slot, BEFORE



8.3.2c) EUT Transmits on Interference Free RECEIVE Slot, AFTER



8.3.2e) EUT Transmits on Interference Free TRANSMIT Slot, BEFORE



8.3.2e) EUT Transmits on Interference Free TRANSMIT Slot, AFTER

3.7 Alternative Monitoring Interval

Test procedure described in ANSI C63.17 clause 8.4.

This test is required if the EUT implements the provisions of FCC 15.323(c)(11).

Test result:

Not Tested. The tested EUT does not implement this provision. See manufacturers' declaration.

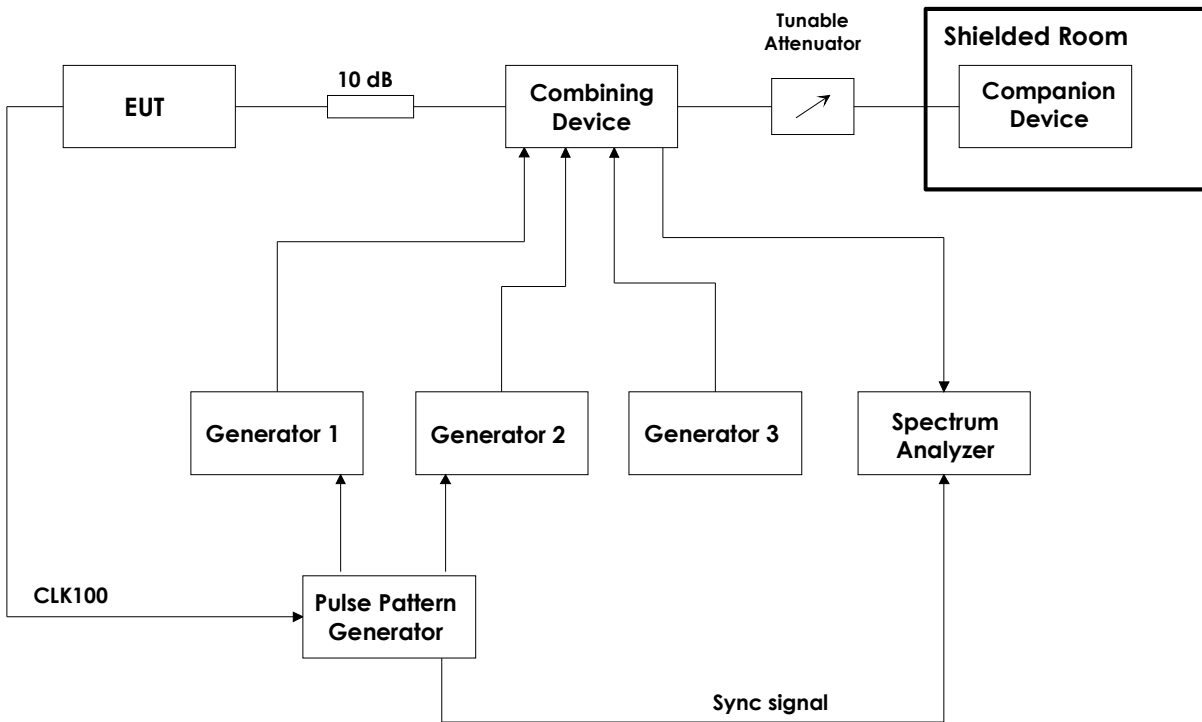
4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted (RBW < 100 kHz)	< 3.6 GHz	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	Frequency	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Timing and Jitter Measurements		±2.0 ns
Frame Timing Measurements		±1.4 ppm
Receiver Blocking Levels		±1.0 dB
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 Test Setups

5.1 Monitoring Tests



Test equipment: 1, 2, 3, 4, 6, 9, 10, 11, 12, 13, 14, 15, 19, 23, 24, 25, 26

Test Set-Up 6

This test setup is used for all Monitoring and Time and Spectrum Access Procedure tests. The path loss from the signal generators to the EUT is measured with a power meter before the testing is started.

The CLK100 is used to synchronize the Pulse-/ Pattern generator to the start of the DECT frame, this signal always comes from the base station. If the EUT is a DECT Portable Part (i.e. a handset) the CLK100 signal will come from the Companion Device.

The sync signal to the Spectrum Analyzer is the CLK100 signal that is regenerated in the Pulse-/ Pattern Generator, this is used to synchronize the Spectrum Analyzer to the DECT frame when in zero span. The Pulse-/ Pattern Generator is used for tests that require time synchronized pulses or blocking of specific time slots.

6 Test Equipment Used

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Testhouse.

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW26	Spectrum Analyzer	Rohde & Schwarz	LR 1640	2017.01	2019.01
2	SME03	Signal generator	Rohde & Schwarz	LR 1238	2015.05	2017.05
3	SMIQ03B	Signal generator	Rohde & Schwarz	LR 1516	2015.05	2017.05
4	SMHU52	Signal generator	Rohde & Schwarz	LR 1240	Cal b4 use	
6	81104A	Pulse-/ Pattern Generator	Agilent	LR 1502	2015.05	2017.05
7	6810.17A	Attenuator	Suhner	LR 1187	2015.02	2017.02
9	6810.17B	Attenuator	Suhner	LR 1669	Cal b4 use	
10	745-69	Step Attenuator	Narda	LR 1442	N/A	
11	WE 1506A	Power Splitter	Weinchel	LR 244	Cal b4 use	
12	WE 1506A	Power Splitter	Weinchel	LR 245	Cal b4 use	
13	H-9	Hybrid	Anzac	LR 86	Cal b4 use	
14	H-9	Hybrid	Anzac	LR 257	Cal b4 use	
15	S212DS	RF Switch	Narda	LR 1244	N/A	
18	6812B	AC Power Source	Agilent	LR 1515	Cal b4 use	
19	Model 87 V	Multimeter	Fluke	LR 1597	2016.10	2018.10
20	87H35-1	Circulator	Racal-MESL	s.no.: 140	N/A	
21	87H35-1	Circulator	Racal-MESL	s.no.: 141	N/A	
22	87H35-1	Circulator	Racal-MESL	s.no.: 142	N/A	
23	U2000A	Average Power Sensor	Agilent	LR 1523	2015.10	2017.10

Revision history

Version	Date	Comment	Sign
1.0	2017.02.03	First edition	FS