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Test report

341229-2TRFWL

Date of issue: November 30, 2017

Applicant:

Panasonic Corporation of North America

Product:

DECT Handset

Model:

KX-TGEA61 KX-TGEA69C

FCC ID: IC Reg. Number:

ACJ96NKX-TGEA61 216A-KXTGEA69

Specifications:

- FCC 47 CFR Part 15, Subpart D

  Isochronous UPCS Device, 1920–1930 MHz

- RSS-213, Issue 3, March 2015

  2 GHz Licence-Exempt Personal Communications Services (LE-PCS) Devices

Test location

Company name	Nemko Canada Inc.
Address	303 River Road
City	Ottawa
Province	Ontario
Postal code	K1V 1H2
Country	Canada
Telephone	+1 613 737 9680
Facsimile	+1 613 737 9691
Toll free	+1 800 563 6336
Website	www.nemko.com
Site number	FCC: CA2040; IC: 2040A-4 (3 m semi anechoic chamber)

Tested by	Frode Sveinsen, Senior Wireless Engineer
Reviewed by	Andrey Adelberg, Senior Wireless/EMC Specialist
Date	November 30, 2017
Signature of reviewer	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

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1 INFORMATION

1.1 Applicant information

Name :	Panasonic Corporation of North America
Address:	Panasonic System Networks Co., Ltd. 1-62, 4-chome, Minoshima, Hakata-ku Fukuoka 812-8531, Japan

1.2 Tested Item

Name:	DECT Handset
Additional information:	DECT 6.0
Model name:	KX-TGEA61 (USA Model) KX-TGEA69 (Canada Model)
FCC ID:	ACJ96NKX-TGEA61
Industry Canada Registration Number:	216A-KXTGEA69C
Serial number:	/
Trademark:	PANASONIC
Hardware identity and/or version:	PNLB2730xx
Software identity and/or version:	SW200
Tested to ISED Radio Standard (RSS):	RSS-213 Issue 3; RSS-Gen Issue 4
Frequency Band:	1920–1930 MHz
Frequency Range:	1921.536–1928.448 MHz
Number of Channels:	5 RF Channels, 5 × 12 = 60 TDMA Duplex Channels
Type of Modulation:	Digital (Gaussian Frequency Shift Keying)
Conducted Output Power:	91.6 mW (Peak)
Antenna Connector:	None (Integral Antennas)
Number of Antennas:	1
Antenna Diversity Supported:	No
Power Supply:	Secondary Batteries (2x AAA cells, NiMH, 1.2V_{DC}, 550mAh)
Desktop Charger:	PNLC1079 with AC Adaptor PNLV233 (UC)
Interface:	None
Companion Device:	Wireless DECT Base KX-TGE670

1.3 Testing dates

Tested in period:	November 6, 2017 to November 9, 2017

1.4 Description of Tested Device

The EUT is a DECT Headset and is a Initiating device as described in ANSI C63.17 and is designed to operate together with a DECT Base Station, which is then the responding device.

The models KX-TGEA61 and KX-TGEA69 for USA and Canada respectively, are identical.

1.5 Test Conditions

Temperature:	**15–30 °C**
Relative humidity	**20–75 %**
Air pressure	**860–1060 mbar**
Normal test voltage	**120 V_{AC}**

All tests were performed with the EUT powered from the mains.

The values are the limit registered during the test period.

1.6 Test Engineer(s)

Frode Sveinsen

1.7 Digital Modulation Techniques

The EUT uses Multi Carrier / Time Division Multiple Access / Time Division Duplex and Digital GFSK modulation. For further details see the operational description provided by the applicant.

Requirement, FCC 15.319(b):

All transmissions must use only digital modulation techniques.

1.8 Labeling Requirements

See separate documents showing the label design and the placement of the label on the EUT.

Requirements FCC 15.19

The FCC Identifier shall be displayed on the label, and the device(s) shall bear the following statement in a conspicuous location on the device or in the user manual if the device is too small:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The label itself shall be of a permanent type, not a paper label, and shall last the lifetime of the equipment.

1.9 Antenna Requirement

Does the EUT have detachable antenna(s)?	**☐ YES**	**☒ NO**
If detachable, is the antenna connector(s) non-standard?	**☐ YES**	**☐ NO**
The tested equipment has only integral antennas. The conducted tests were performed on a sample with a temporary antenna connector.		

Requirement: FCC 15.203, 15.204, 15.317.

1.10 Channel Frequencies

UPCS CHANNEL	FREQUENCY (MHz)
Upper Band Edge	1930.000
0 (Highest)	1928.448
1	1926.720
2	1924.992
3	1923.264
4 (Lowest)	1921.536
Lower Band Edge	1920.000

Requirement: FCC 15.303

Within 1920–1930 MHz band for isochronous devices.

1.11 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.

The tested EUT supports both normal DECT slot length and DECT Long slot. Long slot is an extended DECT slot that allows a higher data rate for bit rates higher than 32 kbps.

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 except Power-Line Conducted Emissions were performed in conducted mode with a temporary antenna connector.

The Power-Line Conducted Emissions test was performed with all ports populated and operating.

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 15 Subpart D for Isochronous UPCS Devices and Industry Canada RSS-213 Issue 3 / RSS-Gen Issue 4 / RSP-100 Issue 11.

All tests were conducted is accordance with ANSI C63.4-2014 and ANSI C63.17-2013.

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

☒ New Submission	☒ Production Unit
☐ Class II Permissive Change	☐ Pre-production Unit
PUE Equipment Code	☐ 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”.

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	Complies
Digital Modulation Techniques	15.319(b)	5.1	Complies
Labeling requirements	15.19(a)(3)	RSP-100 3.1	Complies
Antenna Requirement	15.317, 15.203	RSS-GEN 8.3	Complies
Channel Frequencies	15.303	5.1	Complies
Automatic discontinuation of transmission	15.319(f)	5.2 (4)	Complies
Emission Bandwidth	15.323(a)	5.5 RSS-GEN 6.6	Complies
In-band emissions	15.323(d)	5.8.2	Complies
Out-of-band emissions	15.323(d)	5.8.1	Complies
Peak Transmit Power and Antenna Gain	15.319(c)(e), 15.31(e)	5.6 RSS-GEN 8.3	Complies
Power Spectral Density	15.319(d)	5.7	Complies
Carrier frequency stability	15.323(f)	5.3	Complies
Frame repetition stability	15.323(e)	5.2 (13)	Complies
Frame period and jitter	15.323(e)	5.2 (13)	Complies
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)	N/A[1]
Access Criteria functional test	15.323(c)(4)(6)	5.2 (4)(6)	N/A[1]
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] Only applies for equipment that transmits unacknowledged control and signaling information

[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 Power Line Conducted Emissions

FCC Part 15.207(a)

RSS-213 Clause 6.3, RSS-GEN Clause 8.8

Measurement procedure: **ANSI C63.4-2014 using 50 µH/50 ohms LISN.**

Test Results: **Complies**

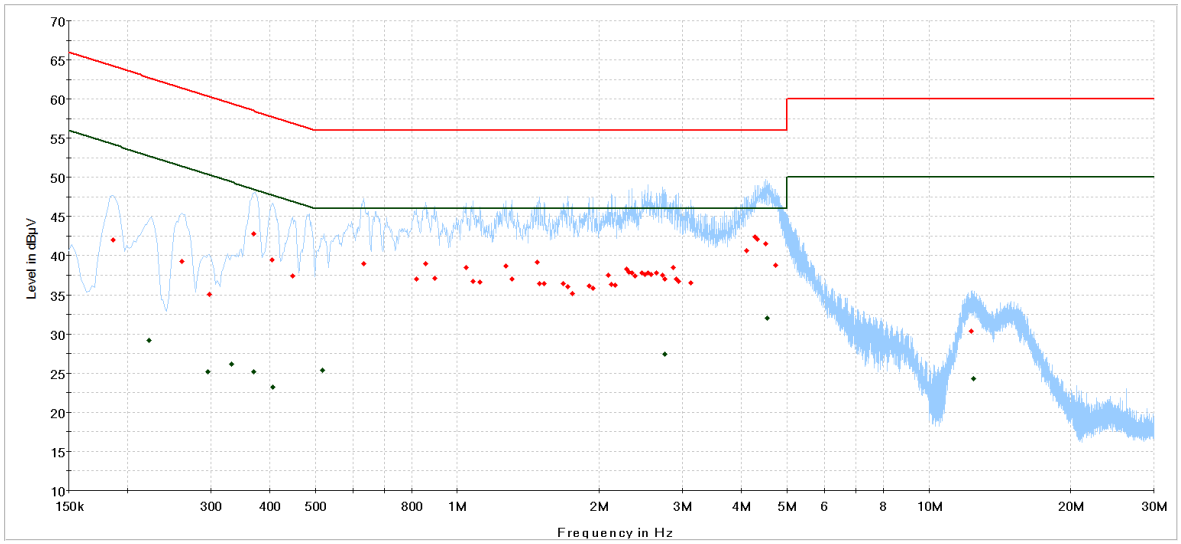
Measurement Data: **See attached graph, (Peak detector).**

Frequency (MHz)	Measured Value (dBµV)	Detector	Line	Limit (dBµV)	Margin (dB)
0.181500	35.81	Av	L1	54.42	18.61
0.197250	37.43	Av	L1	53.73	16.30
0.217500	41.65	Av	L1	52.91	11.26
0.289500	37.49	Av	L1	50.54	13.05
0.327750	37.00	Av	L1	49.51	12.51
0.363750	35.47	Av	L1	48.64	13.17
0.510000	36.23	Av	L1	46.00	9.77
0.728250	34.40	Av	L1	46.00	11.60
2.582250	30.77	Av	L1	46.00	15.23
4.506000	32.18	Av	L1	46.00	13.82
0.183750	43.96	QP	L1	64.31	20.35
0.366000	43.58	QP	L1	58.59	15.01
0.440250	40.61	QP	L1	57.06	16.45
0.478500	40.29	QP	L1	56.37	16.08
0.552750	41.91	QP	L1	56.00	14.09
0.588750	41.73	QP	L1	56.00	14.27
0.620250	40.37	QP	L1	56.00	15.63
0.660750	40.41	QP	L1	56.00	15.59
0.696750	40.47	QP	L1	56.00	15.53
0.773250	41.32	QP	L1	56.00	14.68
0.807000	41.87	QP	L1	56.00	14.13
0.849750	38.33	QP	L1	56.00	17.67
0.881250	40.87	QP	L1	56.00	15.13
0.917250	40.36	QP	L1	56.00	15.64
1.027500	41.78	QP	L1	56.00	14.22
1.065750	41.82	QP	L1	56.00	14.18
1.101750	40.40	QP	L1	56.00	15.60
1.248000	42.14	QP	L1	56.00	13.86
1.286250	42.18	QP	L1	56.00	13.82
1.322250	40.48	QP	L1	56.00	15.52
1.468500	42.71	QP	L1	56.00	13.29
1.506750	41.80	QP	L1	56.00	14.20

Frequency (MHz)	Measured Value (dBµV)	Detector	Line	Limit (dBµV)	Margin (dB)
1.542750	40.80	QP	L1	56.00	15.20
1.650750	41.04	QP	L1	56.00	14.96
1.689000	42.68	QP	L1	56.00	13.32
1.725000	41.67	QP	L1	56.00	14.33
1.763250	41.21	QP	L1	56.00	14.79
1.880250	37.64	QP	L1	56.00	18.36
1.916250	38.08	QP	L1	56.00	17.92
1.945500	41.32	QP	L1	56.00	14.68
2.100750	38.51	QP	L1	56.00	17.49
2.130000	42.89	QP	L1	56.00	13.11
2.166000	41.77	QP	L1	56.00	14.23
2.204250	42.24	QP	L1	56.00	13.76
2.240250	41.97	QP	L1	56.00	14.03
2.280750	40.51	QP	L1	56.00	15.49
2.314500	41.17	QP	L1	56.00	14.83
2.350500	40.83	QP	L1	56.00	15.17
2.386500	41.40	QP	L1	56.00	14.60
2.424750	42.31	QP	L1	56.00	13.69
2.472000	39.86	QP	L1	56.00	16.14
2.505750	40.45	QP	L1	56.00	15.55
2.571000	43.36	QP	L1	56.00	12.64
2.717250	42.22	QP	L1	56.00	13.78
2.937750	40.64	QP	L1	56.00	15.36
3.122250	39.72	QP	L1	56.00	16.28
3.489000	38.62	QP	L1	56.00	17.38
3.673500	38.47	QP	L1	56.00	17.53
3.855750	39.90	QP	L1	56.00	16.10
4.076250	41.07	QP	L1	56.00	14.93
4.296750	42.20	QP	L1	56.00	13.80
4.517250	43.15	QP	L1	56.00	12.85
12.526750	30.19	QP	L1	60.00	29.81

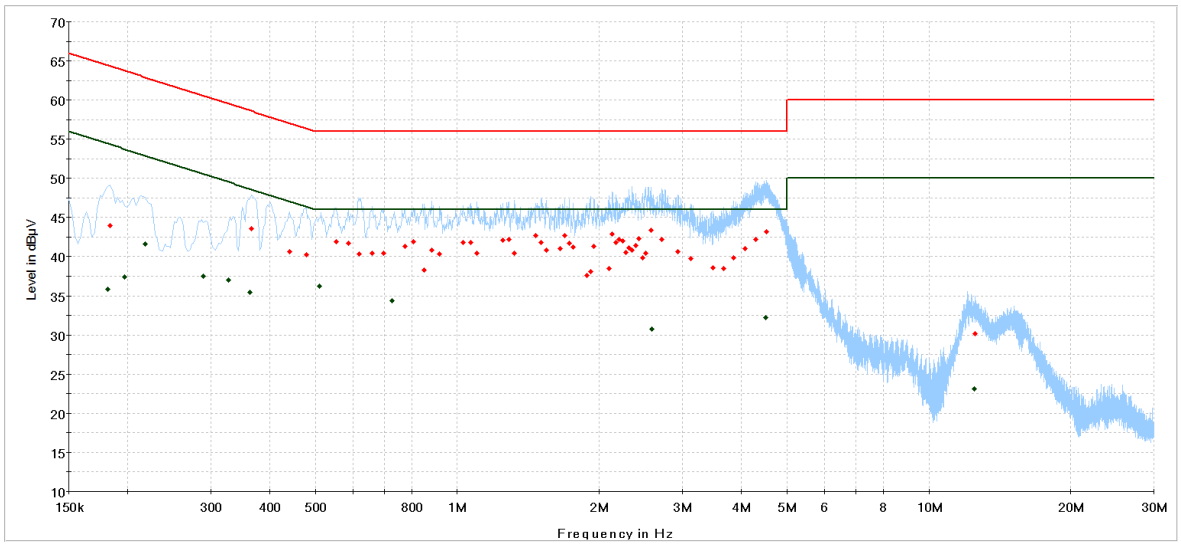
Frequency (MHz)	Measured Value (dBµV)	Detector	Line	Limit (dBµV)	Margin (dB)
0.222000	29.14	Av	N	52.74	23.60
0.296250	25.17	Av	N	50.35	25.18
0.332250	26.12	Av	N	49.40	23.27
0.370500	25.19	Av	N	48.49	23.30
0.406500	23.17	Av	N	47.72	24.55
0.516750	25.33	Av	N	46.00	20.67
2.757750	27.41	Av	N	46.00	18.59
4.539750	32.01	Av	N	46.00	13.99
12.423250	24.28	Av	N	50.00	25.72
0.186000	42.04	QP	N	64.21	22.17
0.260250	39.26	QP	N	61.42	22.16
0.298500	35.09	QP	N	60.28	25.19
0.370500	42.77	QP	N	58.49	15.72
0.404250	39.49	QP	N	57.77	18.28
0.447000	37.37	QP	N	56.93	19.56
0.633750	38.95	QP	N	56.00	17.05
0.820500	37.02	QP	N	56.00	18.98
0.856500	39.02	QP	N	56.00	16.98
0.894750	37.12	QP	N	56.00	18.88
1.043250	38.51	QP	N	56.00	17.49
1.081500	36.71	QP	N	56.00	19.29
1.117500	36.62	QP	N	56.00	19.38
1.266000	38.72	QP	N	56.00	17.28
1.304250	36.99	QP	N	56.00	19.01
1.475250	39.17	QP	N	56.00	16.83
1.495500	36.38	QP	N	56.00	19.62
1.527000	36.47	QP	N	56.00	19.53
1.677750	36.38	QP	N	56.00	19.62
1.713750	36.01	QP	N	56.00	19.99
1.752000	35.15	QP	N	56.00	20.85
1.900500	36.17	QP	N	56.00	19.83
1.938750	35.81	QP	N	56.00	20.19
2.087250	37.55	QP	N	56.00	18.45
2.123250	36.35	QP	N	56.00	19.65
2.161500	36.24	QP	N	56.00	19.76
2.285250	38.25	QP	N	56.00	17.75
2.310000	37.90	QP	N	56.00	18.10
2.348250	37.77	QP	N	56.00	18.23
2.384250	37.41	QP	N	56.00	18.59
2.460750	37.76	QP	N	56.00	18.24
2.496750	37.63	QP	N	56.00	18.37

Frequency (MHz)	Measured Value (dBµV)	Detector	Line	Limit (dBµV)	Margin (dB)
2.535000	37.78	QP	N	56.00	18.22
2.571000	37.63	QP	N	56.00	18.37
2.645250	37.79	QP	N	56.00	18.21
2.721750	37.51	QP	N	56.00	18.49
2.757750	37.05	QP	N	56.00	18.95
2.874750	38.44	QP	N	56.00	17.56
2.908500	37.04	QP	N	56.00	18.96
2.944500	36.72	QP	N	56.00	19.28
3.131250	36.56	QP	N	56.00	19.44
4.101000	40.66	QP	N	56.00	15.34
4.285500	42.40	QP	N	56.00	13.60
4.323750	42.14	QP	N	56.00	13.86
4.510500	41.54	QP	N	56.00	14.46
4.735500	38.81	QP	N	56.00	17.19
12.279250	30.33	QP	N	60.00	29.67



CE - TGEA 61 charging Neutral
Preview Result 1-PK+
CISPR 22 Mains Q-Peak Class B Limit
CISPR 22 Mains Average Class B Limit
Final_Result QPK
Final_Result CAV

120V 60Hz, Charging, Phase N



CE - TGEA 61 charging Phase
Preview Result 1-PK+
CISPR 22 Mains Q-Peak Class B Limit
CISPR 22 Mains Average Class B Limit
Final_Result QPK
Final_Result CAV

120V 60Hz, Charging, Phase L1

3.2 Automatic Discontinuation of Transmission

Does the EUT transmit Control and Signaling Information?	**☐ YES**	**☒ NO**
TYPE OF EUT :	**☒ INITIATING DEVICE**	**☐ RESPONDING DEVICE**

The following tests simulate the reaction of the EUT in case of either absence of information to transmit or operational failure after a connection with the companion device is established.

Number	Test	EUT Reaction	Verdict
1	Power removed from EUT	C	Pass
2	Switch Off EUT	C	Pass
3	Hook-On by EUT	C	Pass
4	Power Removed from Companion Device	A	Pass
5	Switch Off Companion Device	N/A	Pass
6	Hook-On by Companion Device	N/A	Pass

A - Connection breakdown, Cease of all transmissions
B - Connection breakdown, EUT transmits control and signaling information
C - Connection breakdown, Companion Device transmits control and signaling information
N/A - Not Applicable (Companion Device does not have On/Off switch and cannot perform Hook-On)

Requirements, FCC 15.319(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.

3.3 Peak Power Output

Test Method:

ANSI C63.17, clause 6.1.2.

Test Results: Complies

Measurement Data:

Maximum Conducted Output Power

Channel No.	Frequency (MHz)	Maximum Conducted Output Power (dBm)	Maximum Antenna Gain (dBi)	Maximum Radiated Output Power (dBm)
4	1921.536	19.50	0.0*	19.50
2	1924.992	19.62	0.0*	19.62
0	1928.448	19.59	0.0	19.59

*Antenna Gain is value declared by manufacturer

Limit:

Conducted: 100 µW x SQRT(*B*) where *B* is the measured Emission Bandwidth in Hz

FCC 15.319(c)(e) and RSS-213, Issue 3: 20.69 dBm (117 mW)

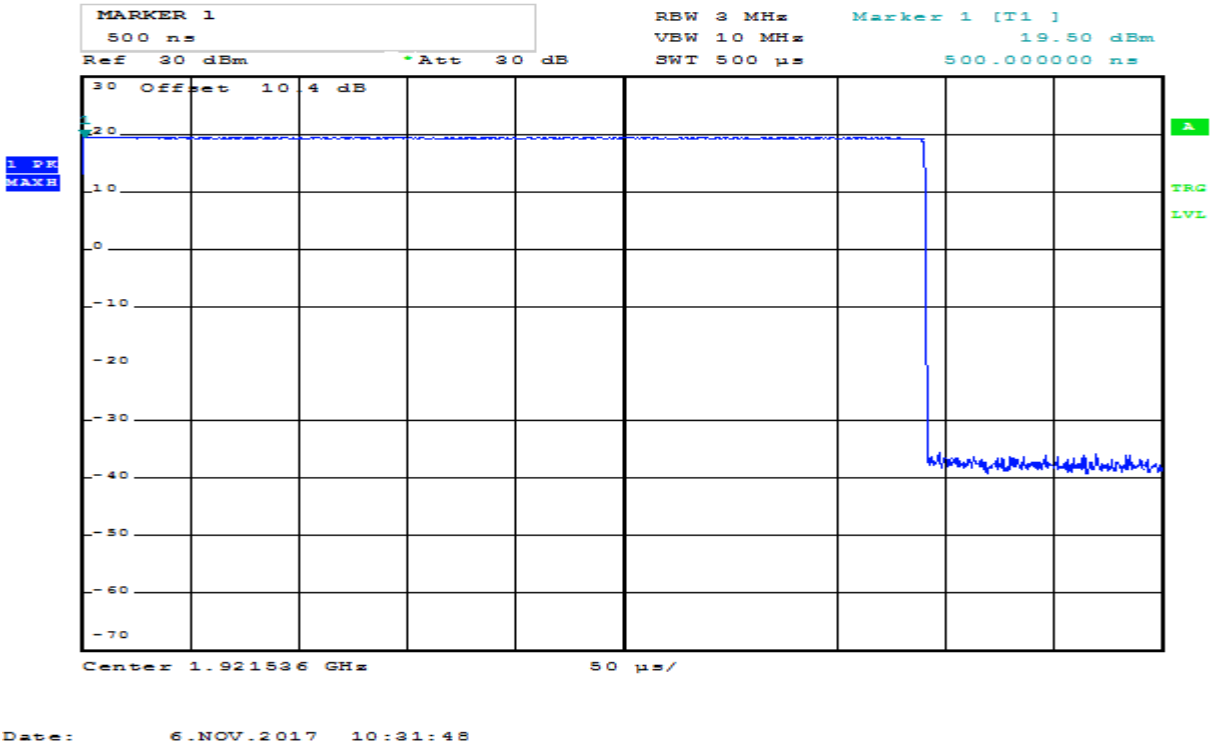
The antenna gain is below 3 dBi, no reduction in transmit power is necessary.

Requirements, FCC 15.319(c)(e); RSS-213, Issue 3; RSS-GEN, Issue 4

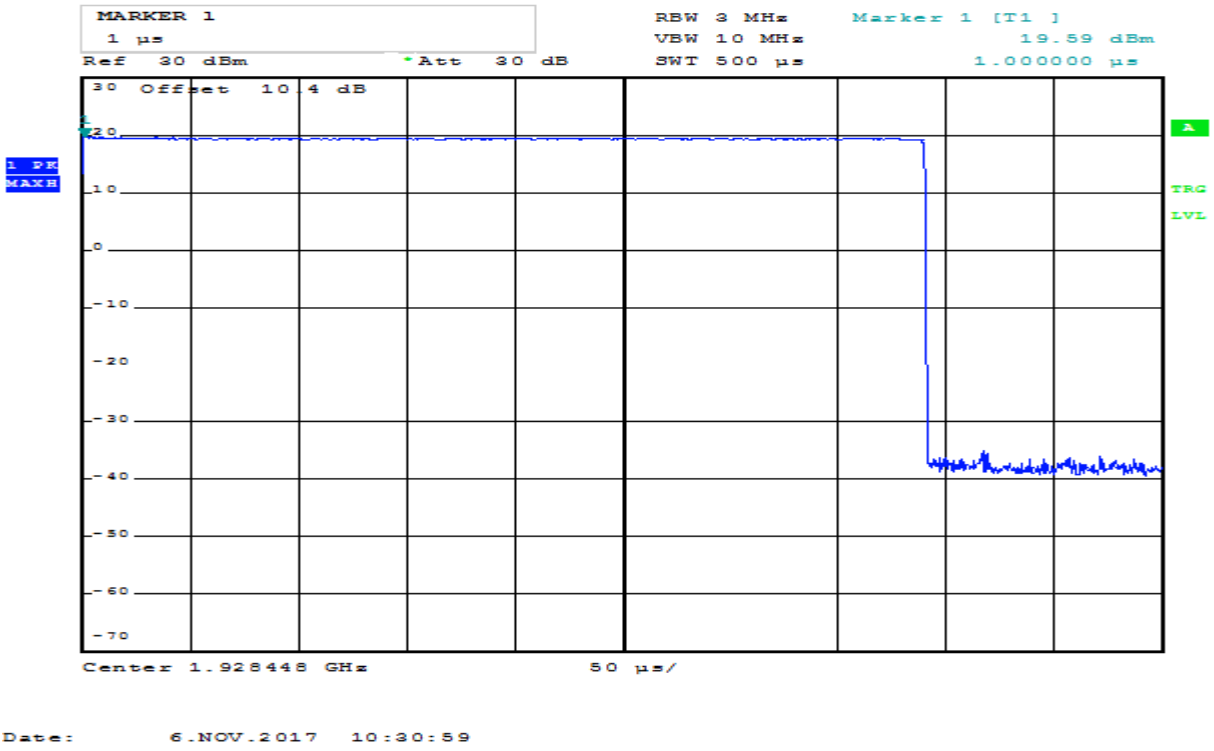
Peak transmit power shall not exceed 100 microwatts multiplied by the square root of the emission bandwidth in Hertz.

The peak transmit power shall be reduced by the amount in decibels that the maximum directional gain of the antenna exceeds 3 dBi.

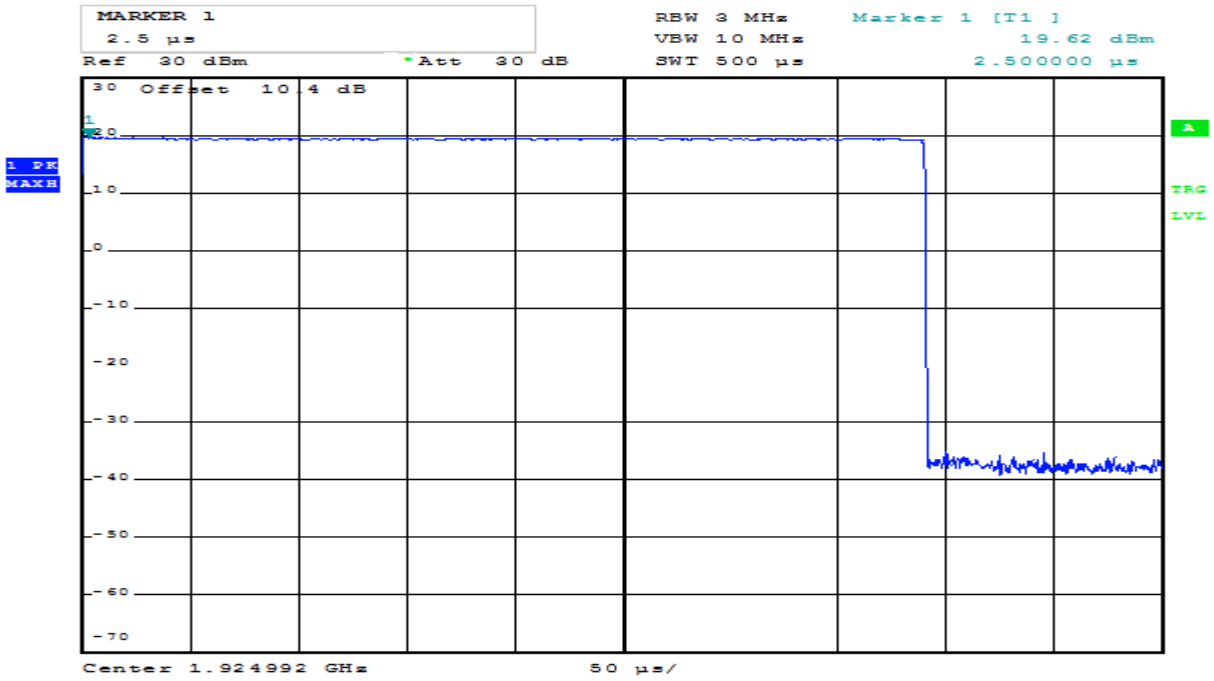
Conducted Peak Output Power



Lower Channel



Upper Channel



Middle Channel

3.4 Emission Bandwidth *B*

Test Method:

ANSI C63.17, clause 6.1.3.

Test Results: Complies

Measurement Data:

Channel No.	Frequency (MHz)	Emission Bandwidth *B* (MHz)
4	1921.536	1.37
0	1928.448	1.38

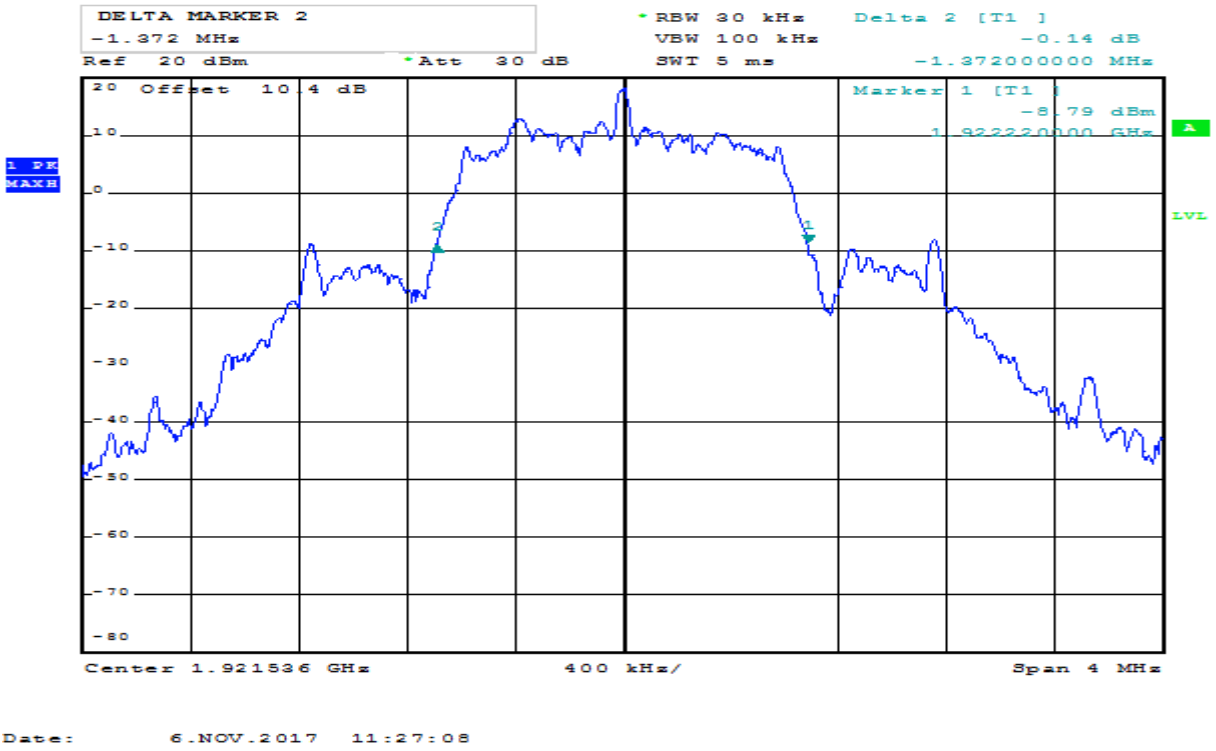
Channel No.	Frequency (MHz)	Occupied Bandwidth (MHz)
2	1924.992	1.23

Requirements, FCC 15.323(a), RSS-213 Issue 3, clause 5.5

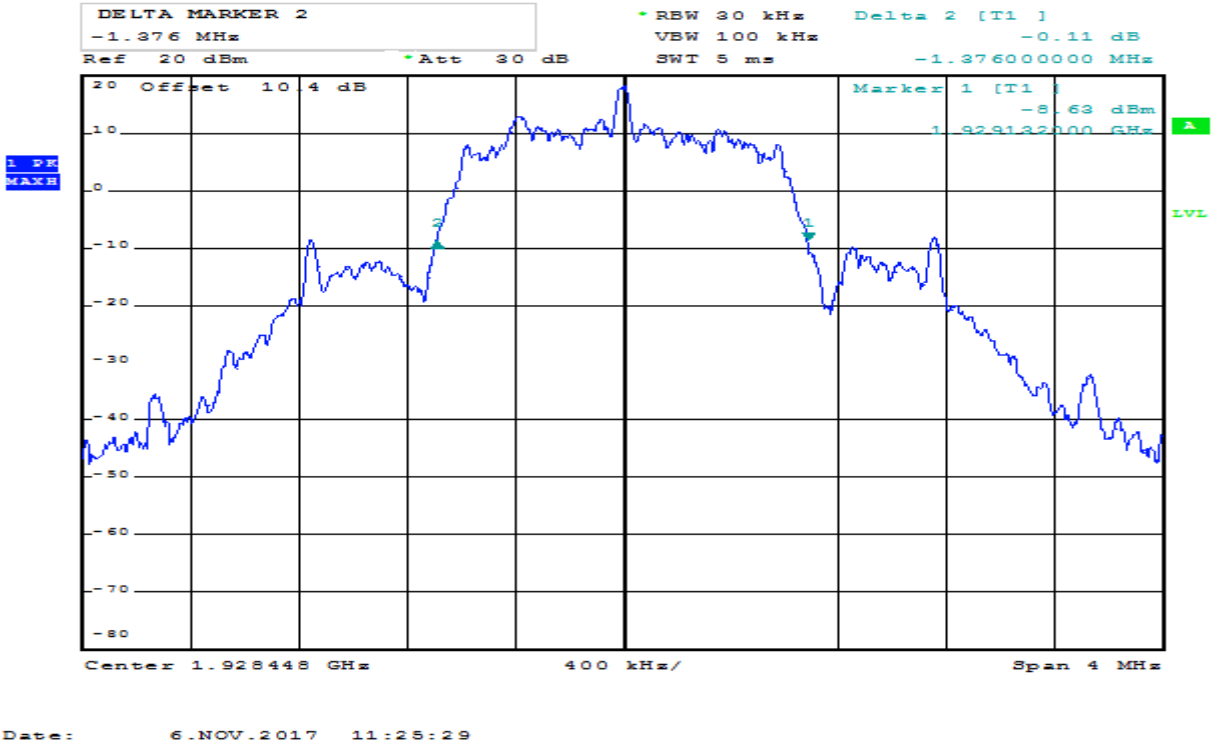
The Emission Bandwidth *B* shall be larger than 50 kHz and less than 2.5 MHz.

No requirements for 6 and 12 dB Bandwidth, these values are only used for testing Monitoring Bandwidth if the Simple Compliance test fails (ANSI C63.17, clause 7.4).

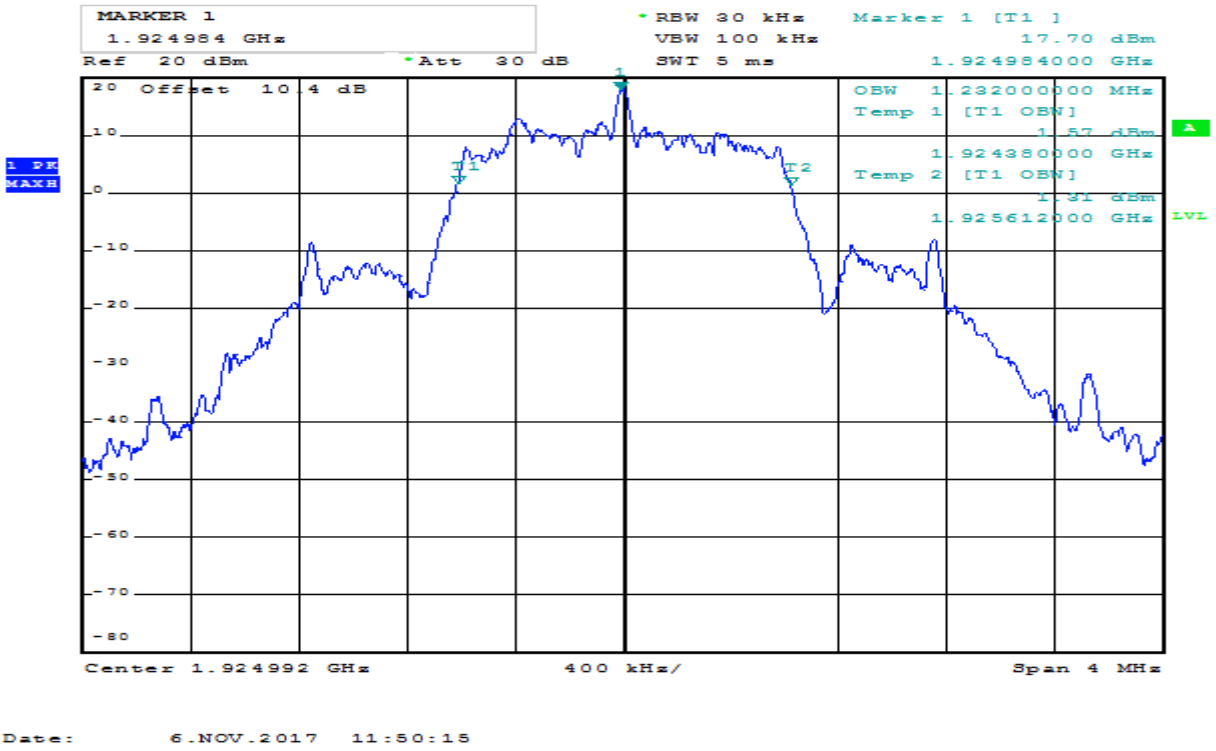
Occupied Bandwidth (99%) is measured according to RSS-GEN Issue 4, clause 6.6. This value is reported for information only.



Emission Bandwidth *B*, Lower Channel



Emission Bandwidth *B*, Upper Channel



99% Bandwidth, Middle Channel

3.5 Power Spectral Density

Test Method:

ANSI C63.17, clause 6.1.5.

Test Results: Complies

Measurement Data:

Channel No.	Frequency (MHz)	Power Spectral Density (dBm)
4	1921.536	4.2
0	1928.448	4.3

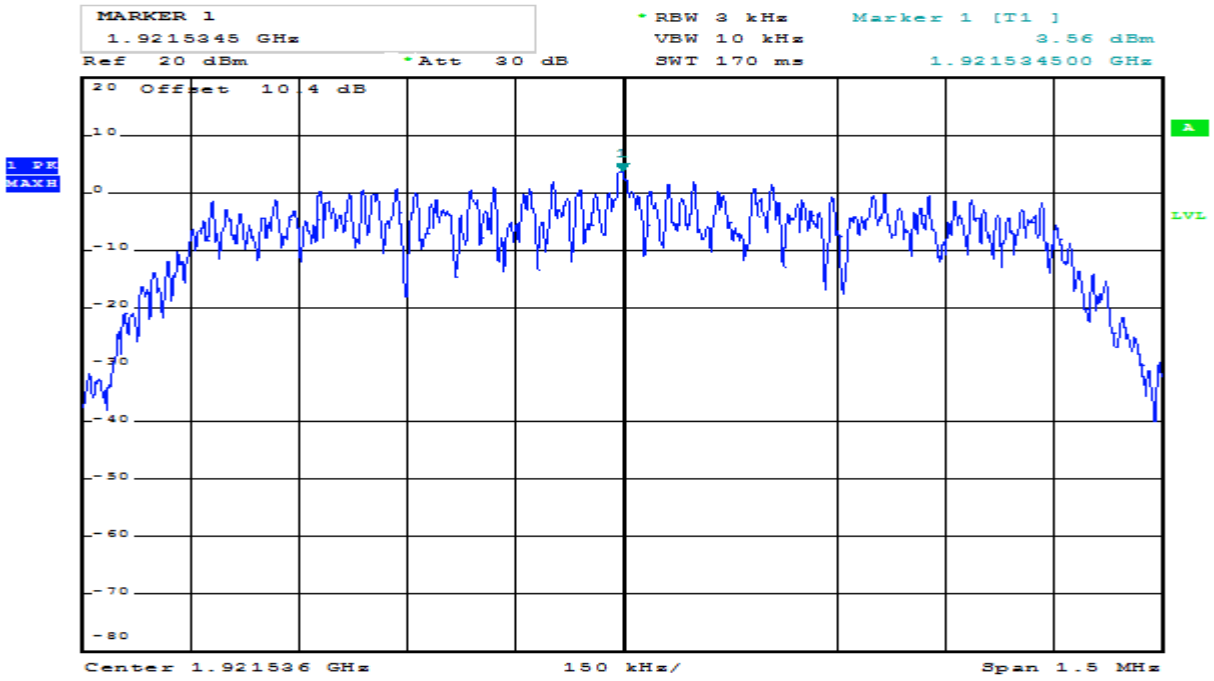
Averaged over 1000 sweeps.

Requirements, FCC 15.319(d)

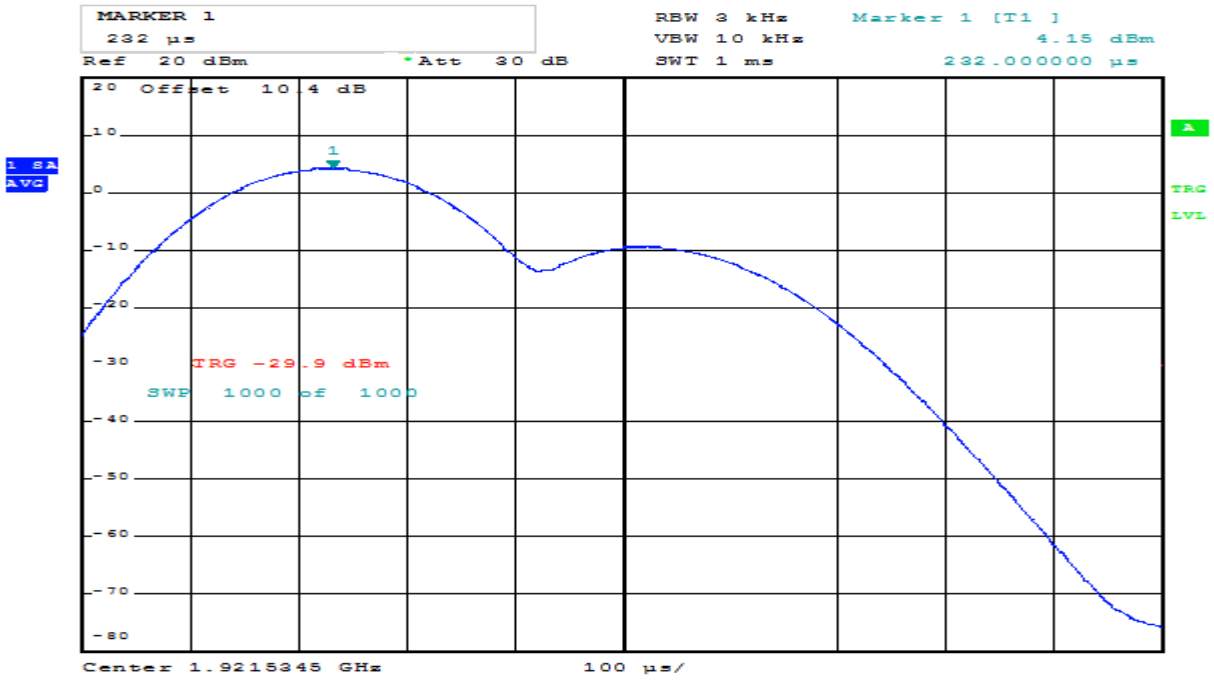
The Power Spectral Density shall be less than 3 mW (4.77 dBm) when averaged over at least 100 sweeps.

Power Spectral Density

Lower Channel:

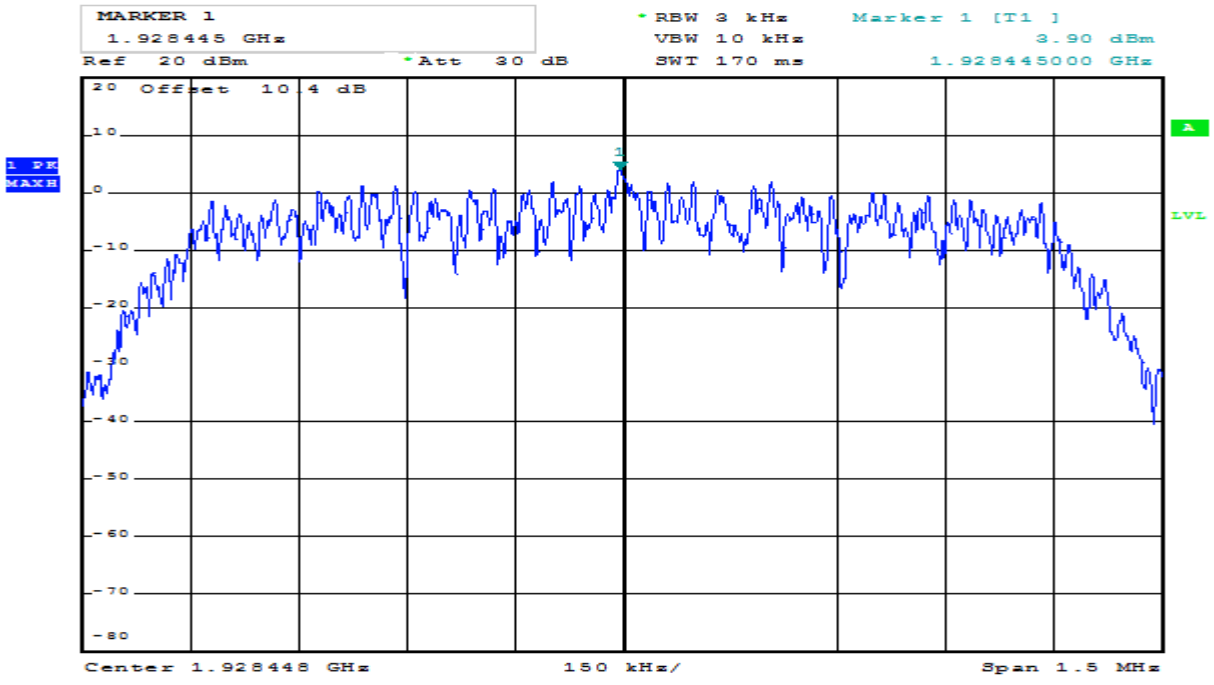


Overview



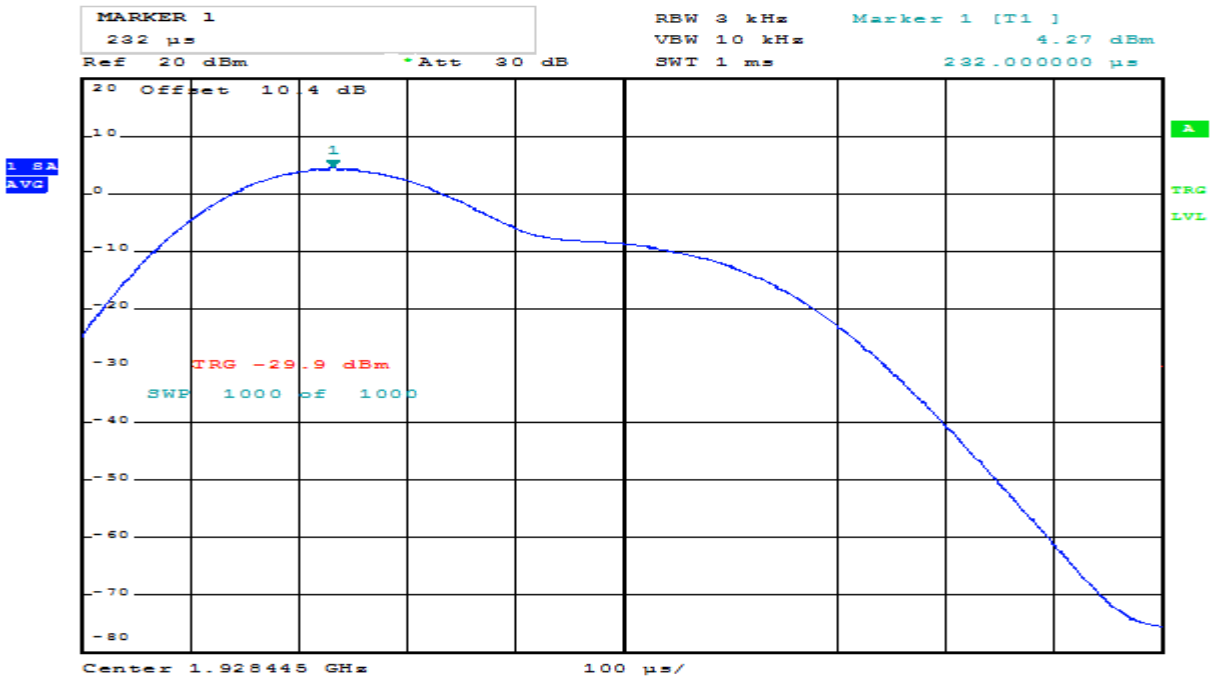
Averaged, 1000 Sweeps

Upper Channel:



Date: 6.NOV.2017 11:45:20

Overview



Date: 6.NOV.2017 11:46:54

Averaged, 1000 Sweeps

3.6 In-Band Unwanted Emissions, Conducted

Test Method:

ANSI C63.17, clause 6.1.6.1.

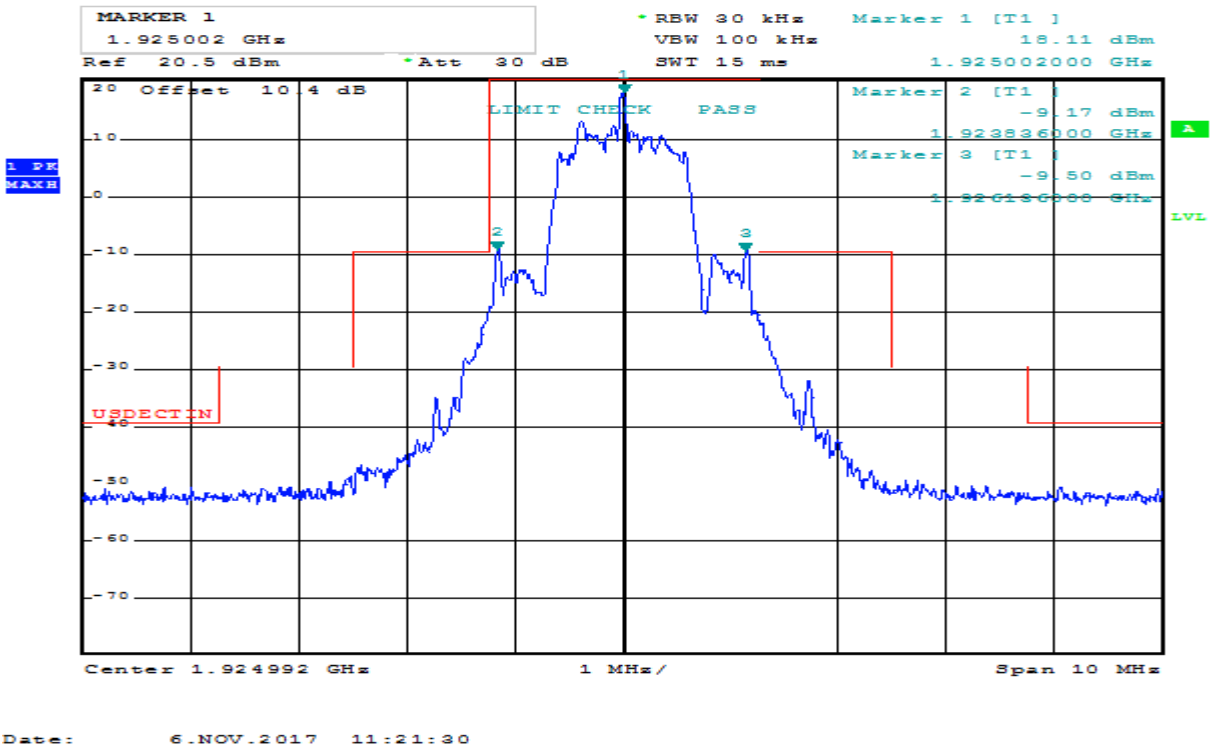
Test Results: Complies

Measurement Data:

See plots.

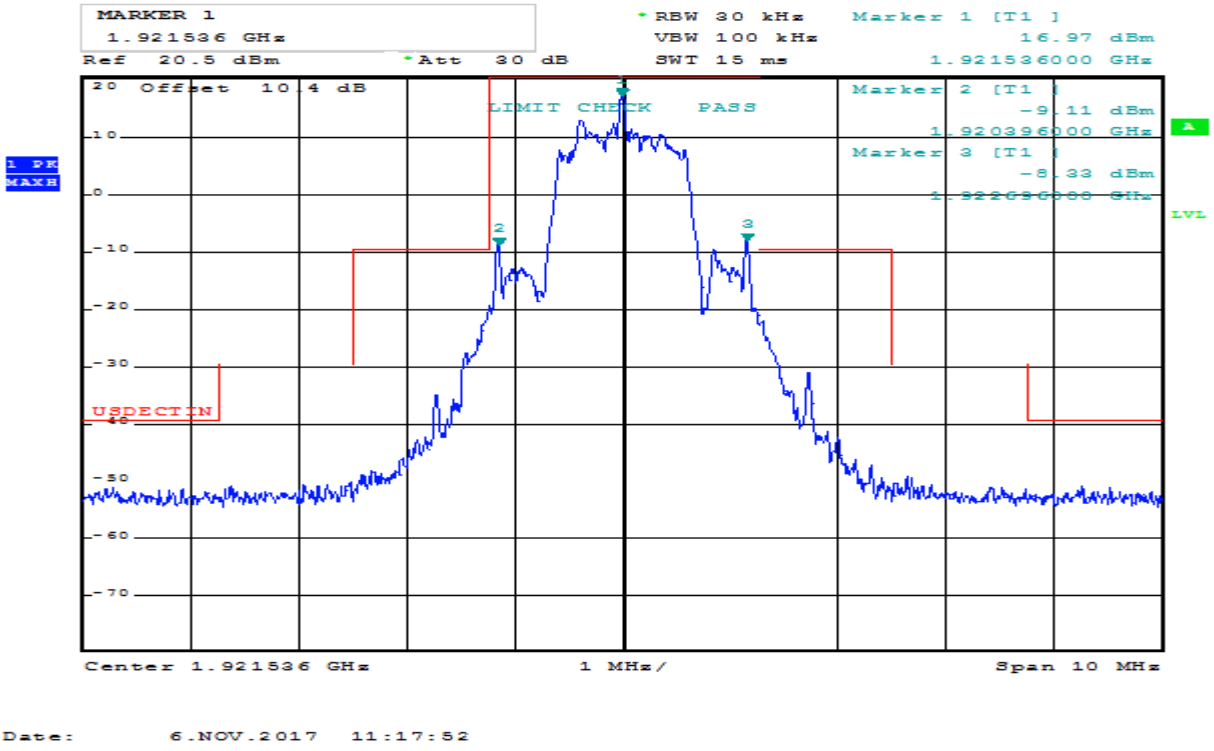
Requirements, FCC 15.323(d):

$B < f \leq 2B$: at least 30 dB below max. permitted peak power
$2B < f \leq 3B$: at least 50 dB below max. permitted peak power
$3B < f \leq$ UPCS Band Edge : at least 60 dB below max. permitted peak power

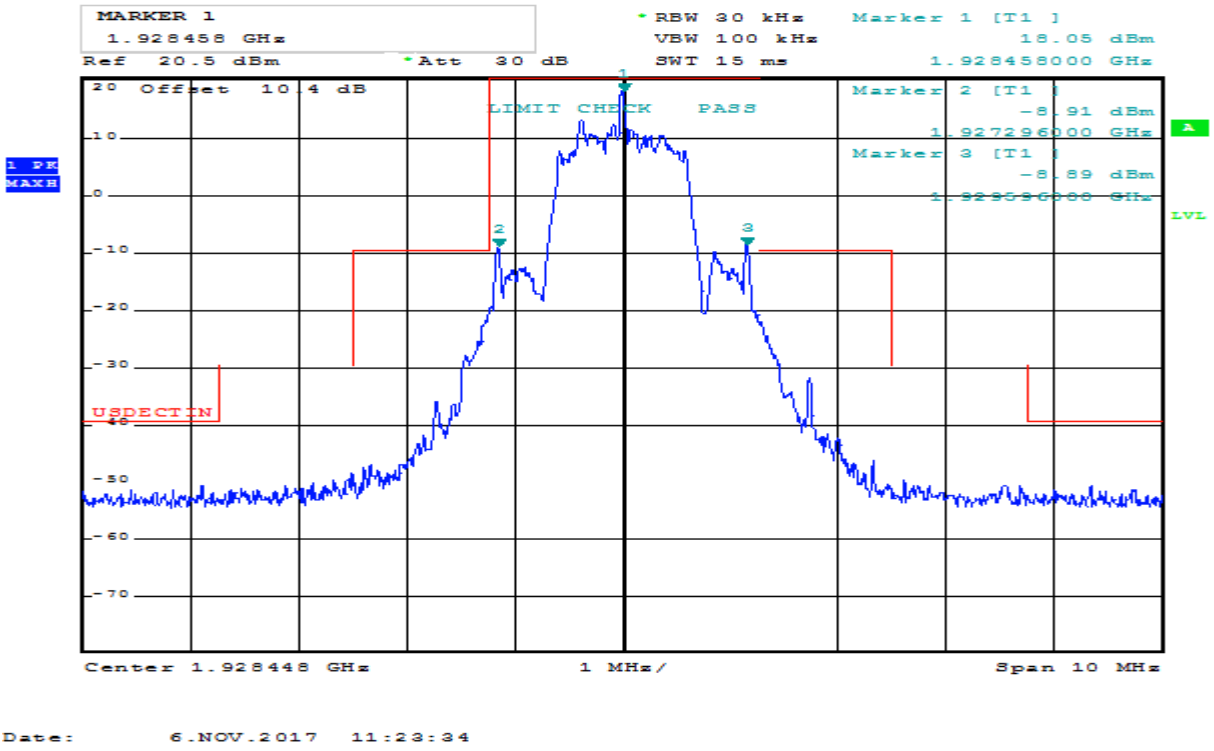


Middle Channel

In-Band Unwanted Emissions, Conducted



Lower Channel



Upper Channel

3.7 Out-of-band Emissions, Conducted

Test Method:

ANSI C63.17, clause 6.1.6.2.

Test Results: Complies

Measurement Data:

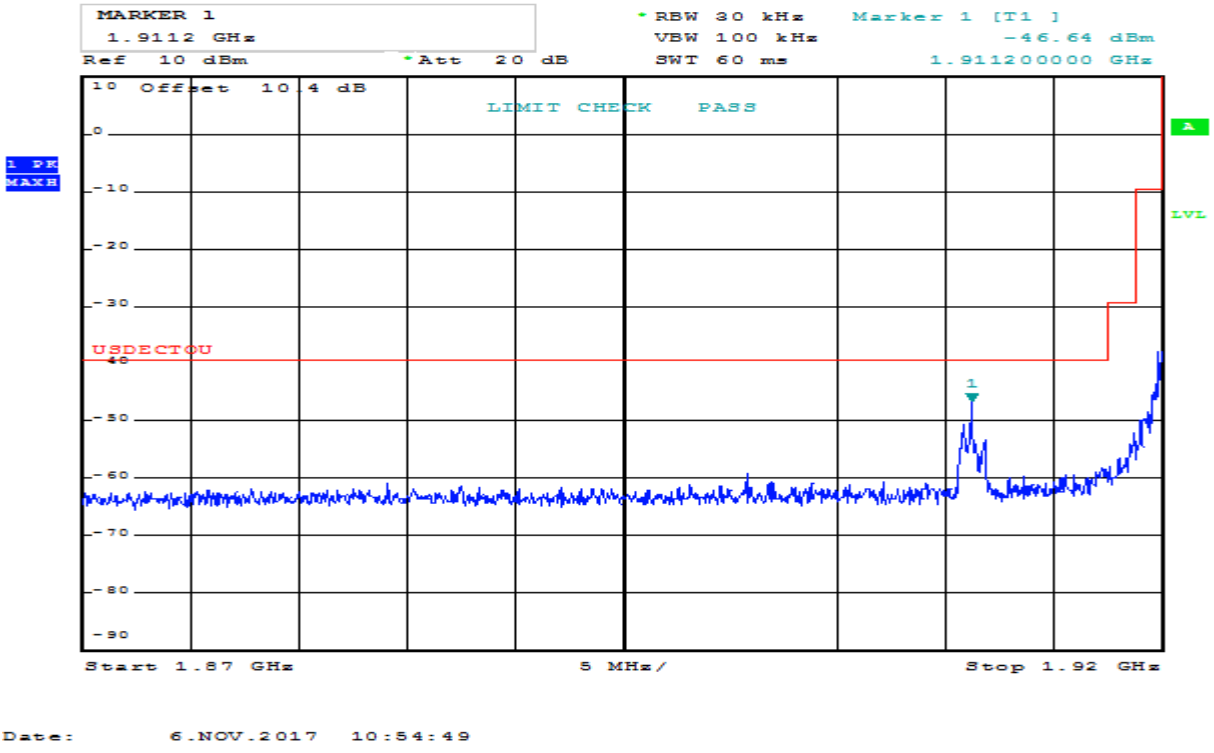
See plots.

Requirements, FCC 15.323(d):

$f \leq$ 1.25MHz outside UPCS band : ≤ -9.5dBm
1.25MHz ≤ $f \leq$ 2.5MHz outside UPCS band : ≤ -29.5 dBm
$f \geq$ 2.5MHz outside UPCS band : ≤ -39.5 dBm

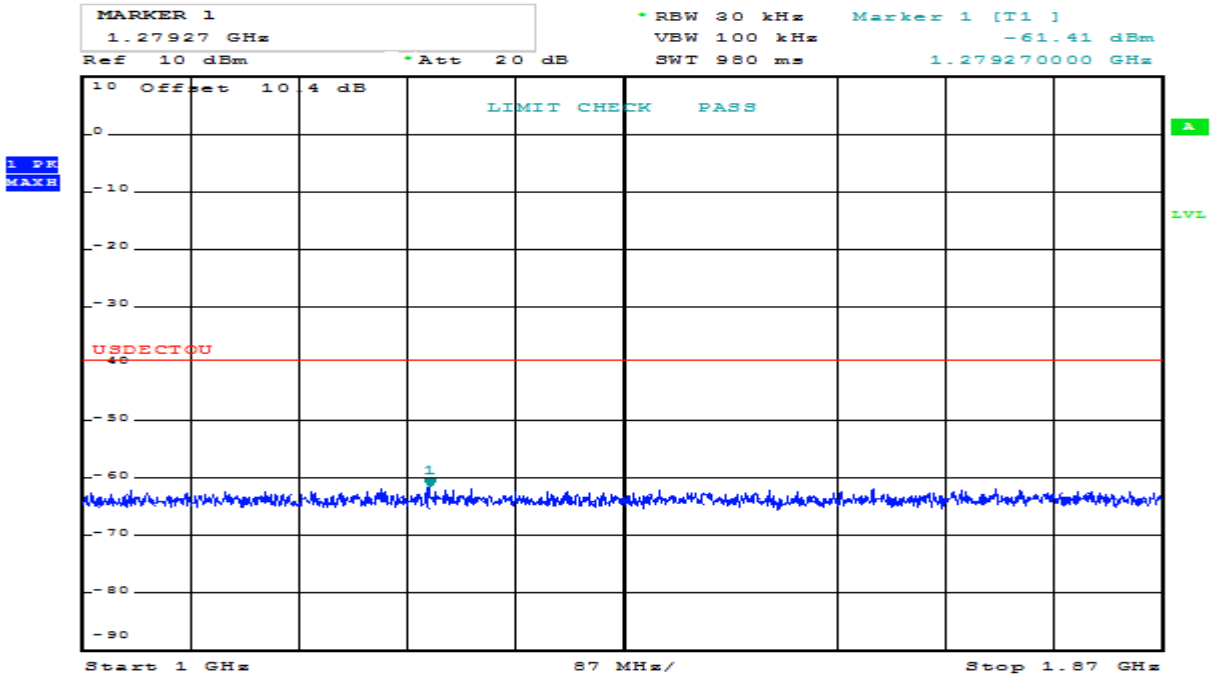
Out-of-Band Emissions, Conducted

Lower Channel:

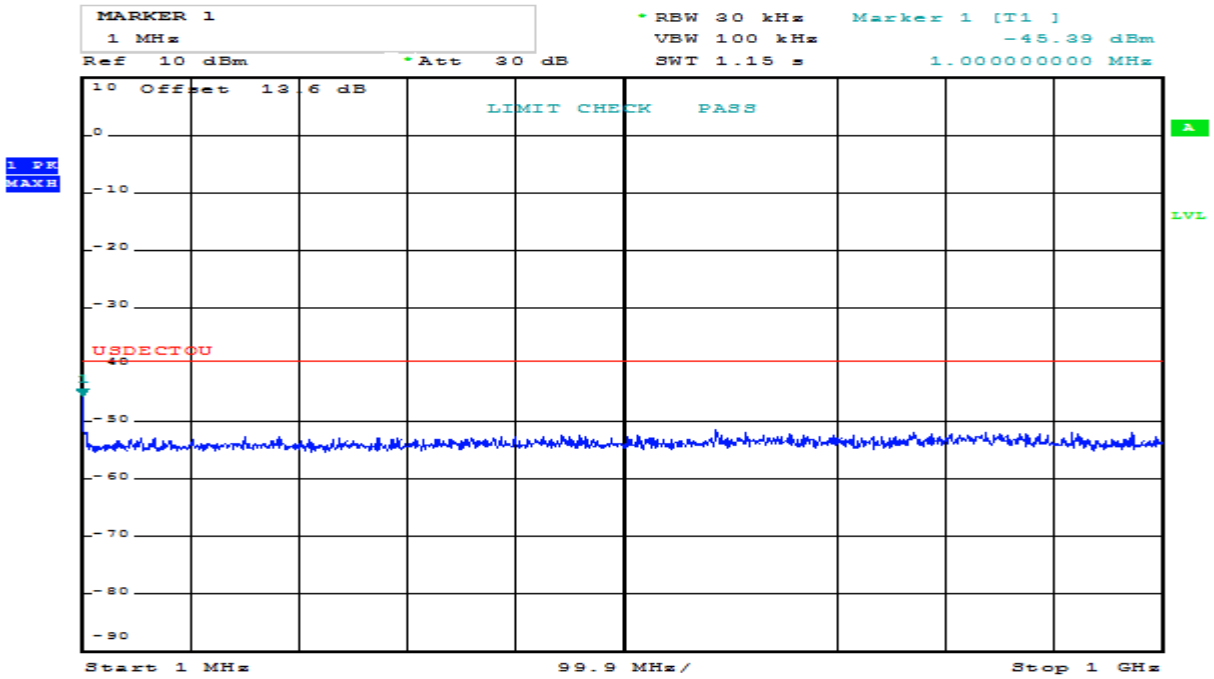


Out-of-Band Emissions, Conducted

Lower Channel:



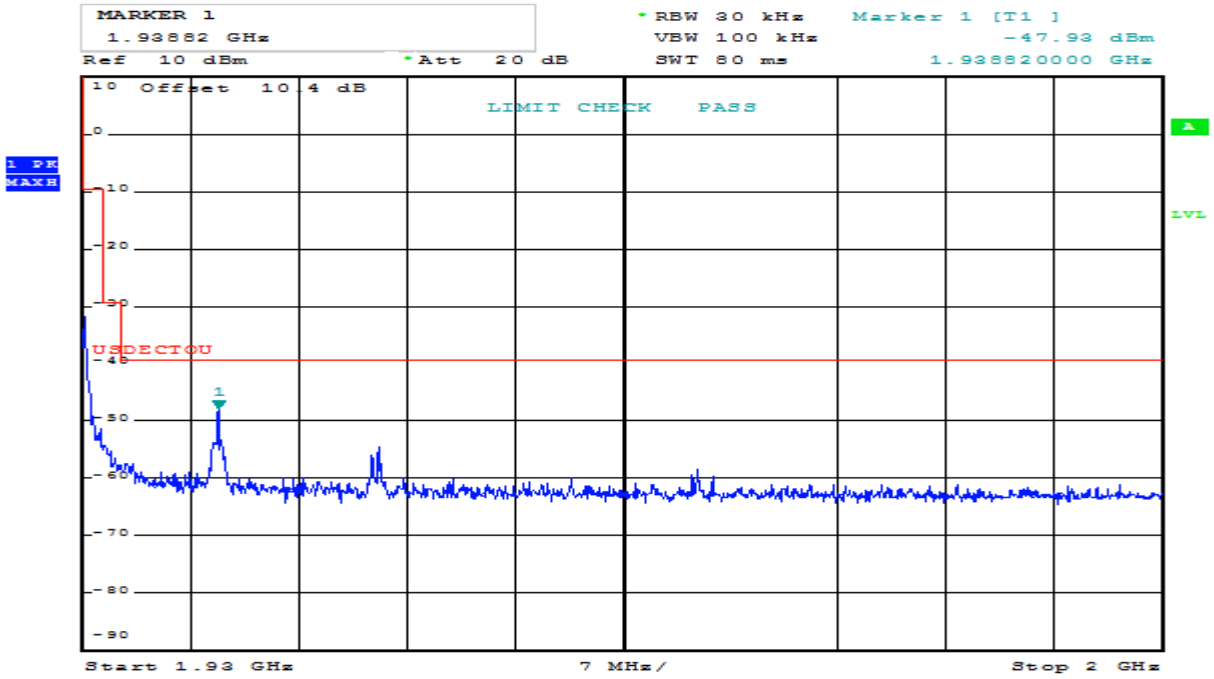
Date: 6.NOV.2017 10:58:58



Date: 6.NOV.2017 11:12:25

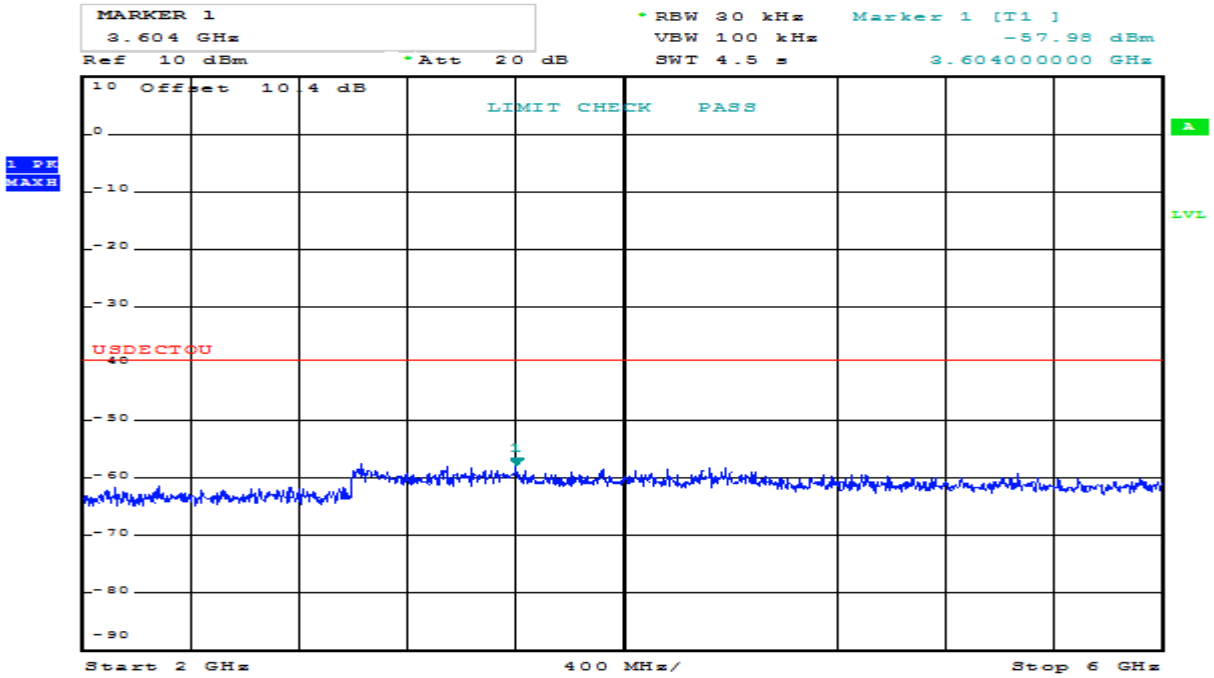
Out-of-Band Emissions, Conducted

Upper Channel:



Date: 6.NOV.2017 10:39:07

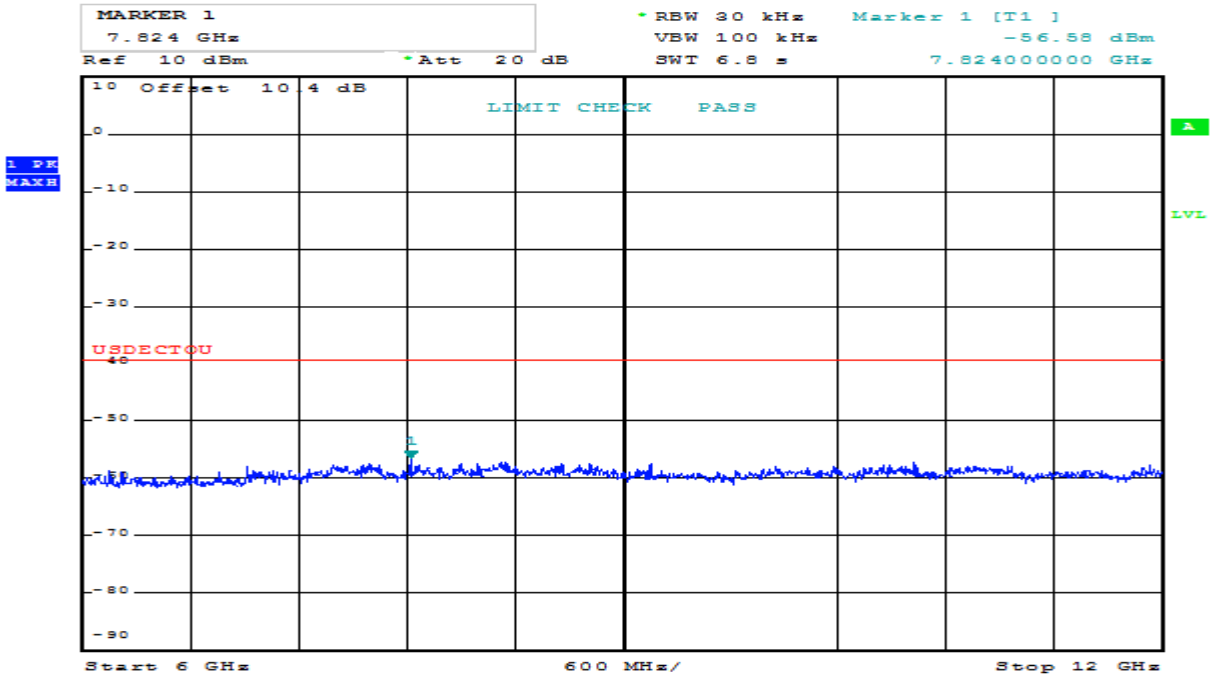
Mid Channel:



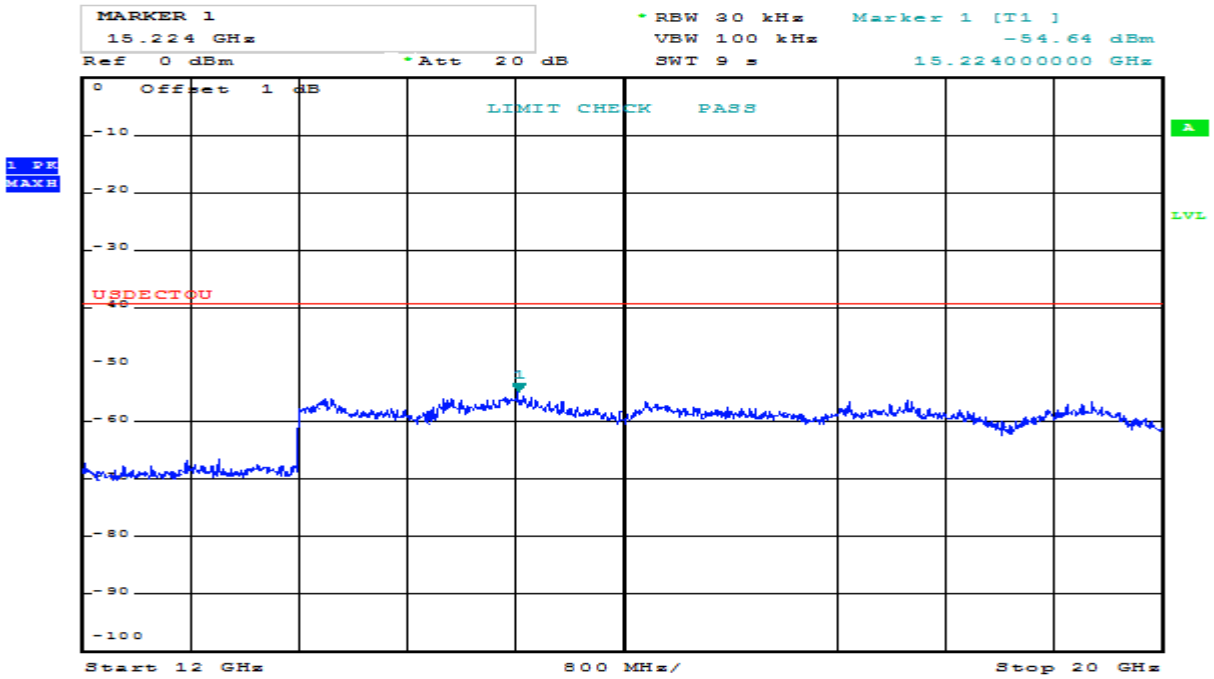
Date: 6.NOV.2017 10:35:42

Out-of-Band Emissions, Conducted

Mid Channel:



Date: 6.NOV.2017 10:44:12



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3.8 Carrier Frequency Stability

Test Method:

ANSI C63.17, clause 6.2.1.

Test Results: Complies

Measurement Data:

Long Term Frequency Stability is measured with the HP53310A Modulation Domain analyzer. The HP53310A is logged by a computer programmed to get new readings as fast as possible over the noted number of readings. The peak-to-peak difference was recorded and the mean value and deviation in ppm was calculated.

The Carrier Frequency Stability over Power Supply Voltage and over Temperature is measured with a Frequency Domain Analyzer in histogram mode.

Carrier Frequency Stability over Time at Nominal Temperature

Average Mean Carrier Frequency (MHz)	Max. Diff. (kHz)	Min. Diff. (kHz)	Max. Dev. (ppm)	Limit
1924.994031	3.005	0.247	-0.9	±10 ppm

Deviation ppm = ((Diff. - Mean Diff) / Mean Carrier Freq.) x 10^6

Deviation (ppm) is calculated from 3000 readings.

Frequency Stability over Power Supply Voltage at Nominal Temperature

Voltage	Measured Carrier Frequency (MHz)	Difference (kHz)	Deviation (ppm)	Limit
V_{nom}	/	0	0	±10 ppm
85% of V_{nom}	/	/	/	
115% of V_{nom}	/	/	/	

Deviation ppm = ((Mean – Measured Frequency) / Mean) x 10^6

This test does not apply for EUT that is powered from batteries.

Frequency Stability over Temperature

Temperature	Measured Carrier Frequency (MHz)	Difference (kHz)	Deviation (ppm)	Limit
T = +20 °C	1924.9965	0	0	±10 ppm
T = -20 °C	1924.9908	-5.7	-3.0	
T = +50 °C	1924.9851	-11.4	-5.9	

Deviation ppm = ((Mean – Measured Frequency) / Mean) x 10^6

3.9 Frame Repetition Stability

Test Method:

ANSI C63.17, clause 6.2.2.

Test Results: Complies

Measurement Data:

The envelope of the RF signal from the EUT is detected with a Crystal Detector and the mean and standard deviation of the frame repetition frequency is then gated over 100 frames and measured with a Frequency Domain Analyzer. The frame repetition stability is 3 times the standard deviation.

Carrier Frequency (MHz)	Mean (Hz)	Standard Deviation (µHz)	Frame Repetition Stability (ppm)
1924.992	100.000	0.054	0.029

Limit:

Frame Repetition Stability	±10 ppm (TDMA)

Ref. FCC 15.323(e), ANSI C63.17, clause 6.2.2

3.10 Frame Period and Jitter

Test Method:

ANSI C63.17, clause 6.2.3.

Test Results: Complies

Measurement Data:

The envelope of the RF signal from the EUT is detected with a Crystal Detector and the frame period and jitter is measured with a Frequency Domain Analyzer over at least 100.000 frames.

Carrier Frequency (MHz)	Frame Period (ms)	Max Jitter (µs)	3xStandard Deviation of Jitter (µs)
1924.992	10.000	-0.027	-0.022

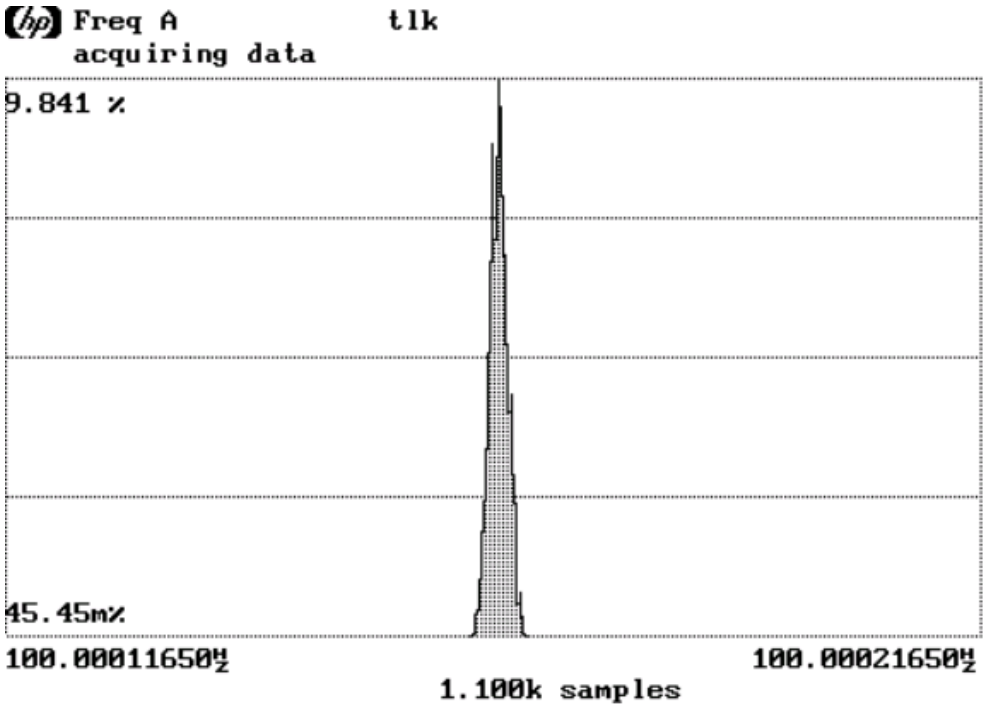
Max Jitter = (1/ (Frame period + Pk-Pk/2)) - (1/Frame Period), when Pk-Pk and Frame Period are in Hz

3xSt.Dev.Jitter = 3x (1/(Frame Period + St.Dev) – 1/St.Dev) x 10^6

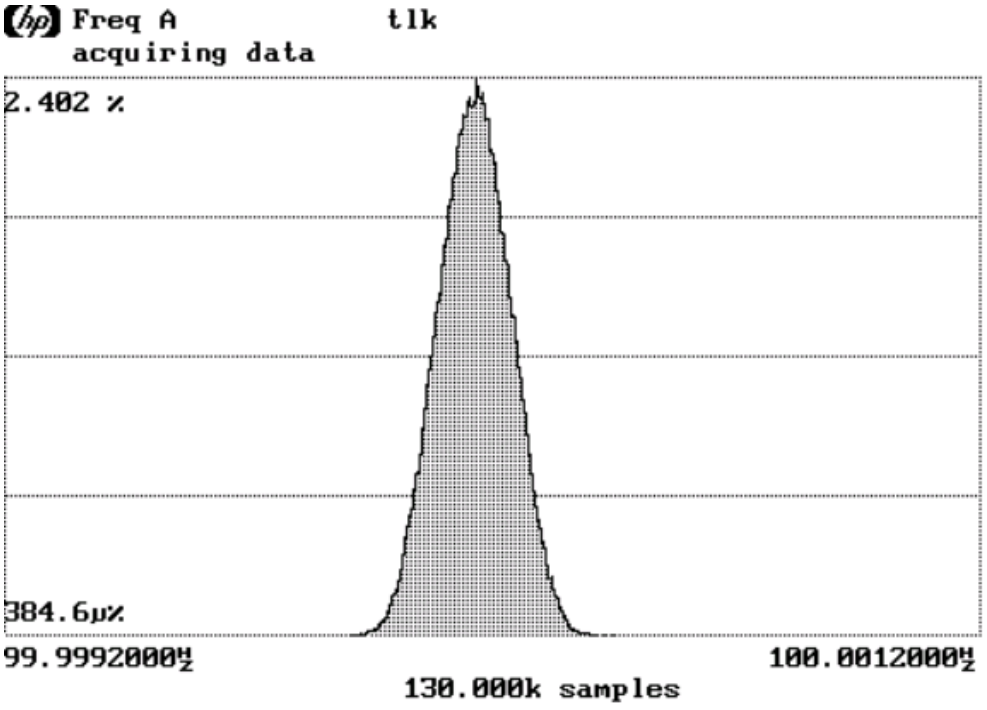
Limit:

Frame Period	20 or 10 ms
Max Jitter	25 µs
3 times St.Dev of Jitter	12.5 µs

Ref. FCC 15.323(e), ANSI C63.17, clause 6.2.3



Frame Repetition Stability, Gated over 100 Frames



Frame Period and Jitter

3.11 Monitoring Threshold, Least Interfered Channel

Monitoring Threshold Limits:

Lower Threshold:

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

Upper Threshold:

$T_U = T_L + 20$ (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	-81.5 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)

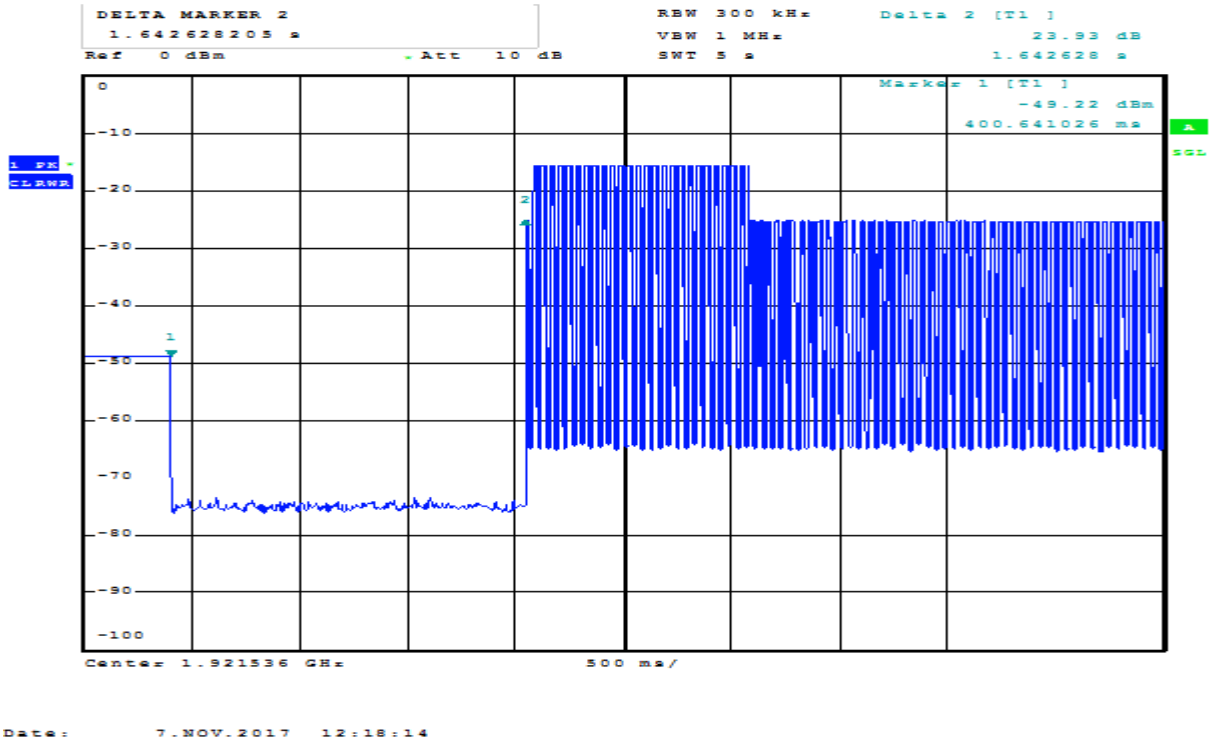
ANSI C63.17 clause 7.3.2 ref.	**Observation**	**Verdict**
b) f_1 at $T_L + U_M + 7$ dB, f_2 at $T_L + U_M$	Transmission always on f_2	**Pass**
c) f_1 at $T_L + U_M$, f_2 at $T_L + U_M + 7$ dB	Transmission always on f_1	**Pass**
d) f_1 at $T_L + U_M + 1$ dB, f_2 at $T_L + U_M - 6$ dB	Transmission always 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	-75.5 dBm



7.3.4 Selected Channel Confirmation, Connection 1.6s After Interferer Removed

3.12 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 ±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.

3.13 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 µs 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.

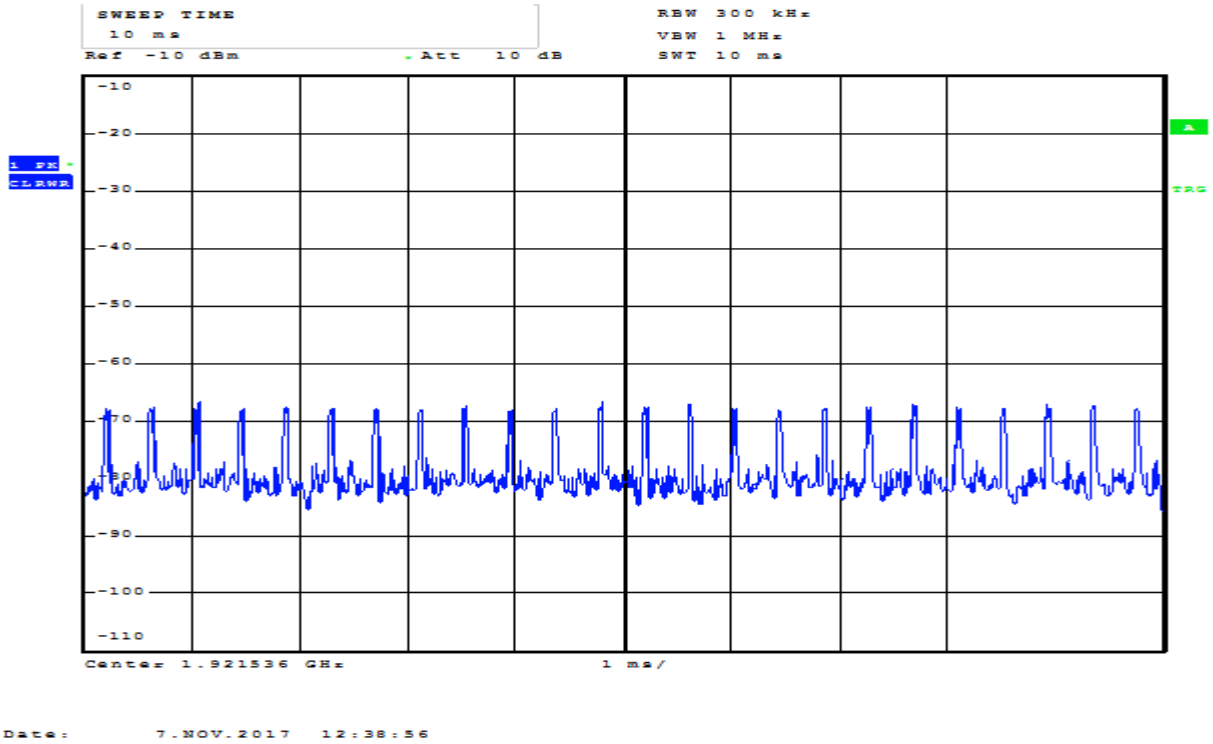
Pulse Width, ref. to ANSI C63.17 clause 7.5	Observation	Verdict
c) > largest of 50 µs and 50*SQRT(1.25/*B*)	EUT transmits on f_1	**Pass**
d) > largest of 35 µs and 35*SQRT(1.25/*B*), and with interference level raised 6 dB	EUT transmits on f_1	**Pass**

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

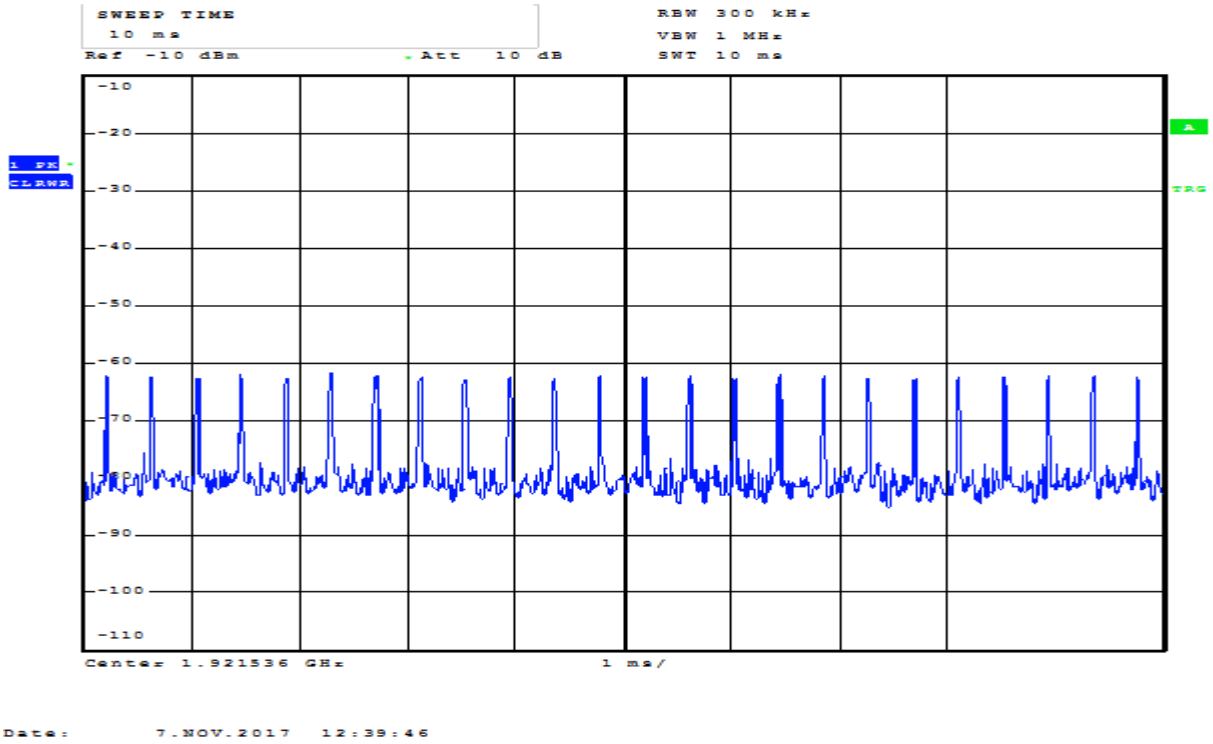
Limits, FCC 15.323(c)(1), (5) and (7)

The maximum reaction time must be 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 µs.

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 µs.



50 µs Pulses



35 µs Pulses

3.14 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	N/A	**N/A**
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	N/A	**N/A**

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	N/A	**N/A**

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 transmit unacknowledged control and signaling information.

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

3.15 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	0.5 ms	**Pass**
c) Transmission time after loss of acknowledgements	5.0 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	1.0 hours	**Pass**

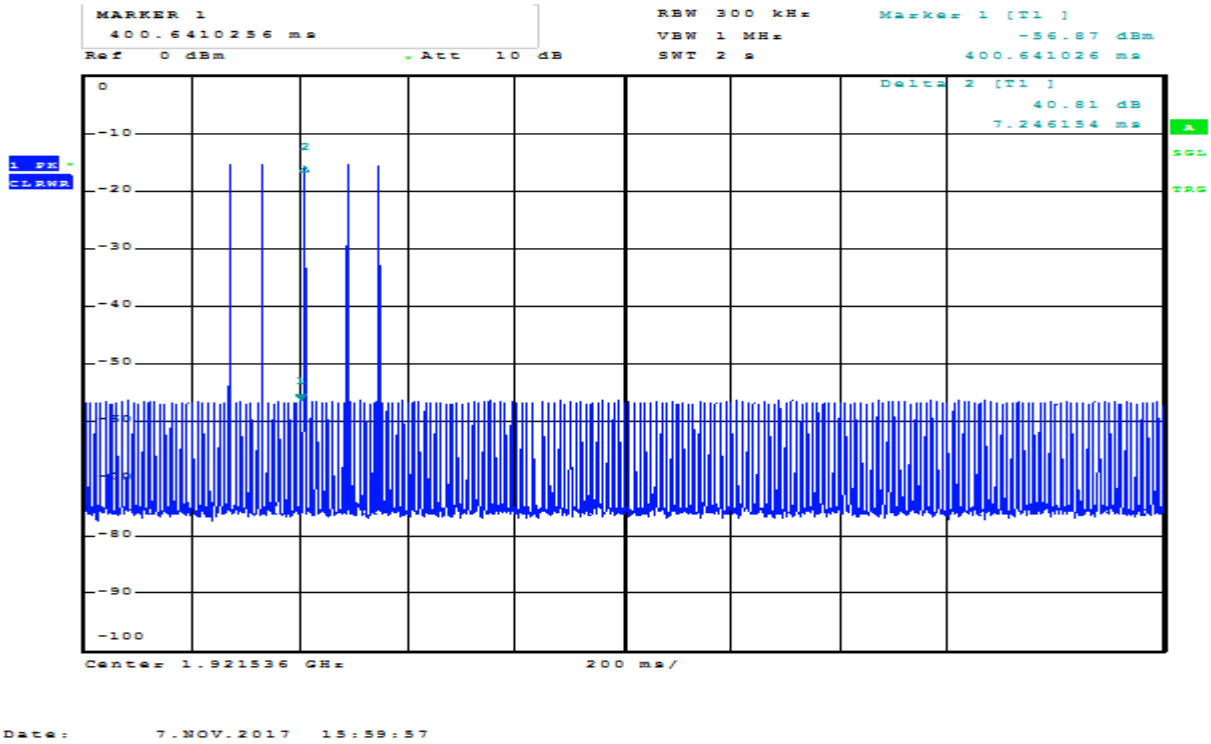
Comment: /

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

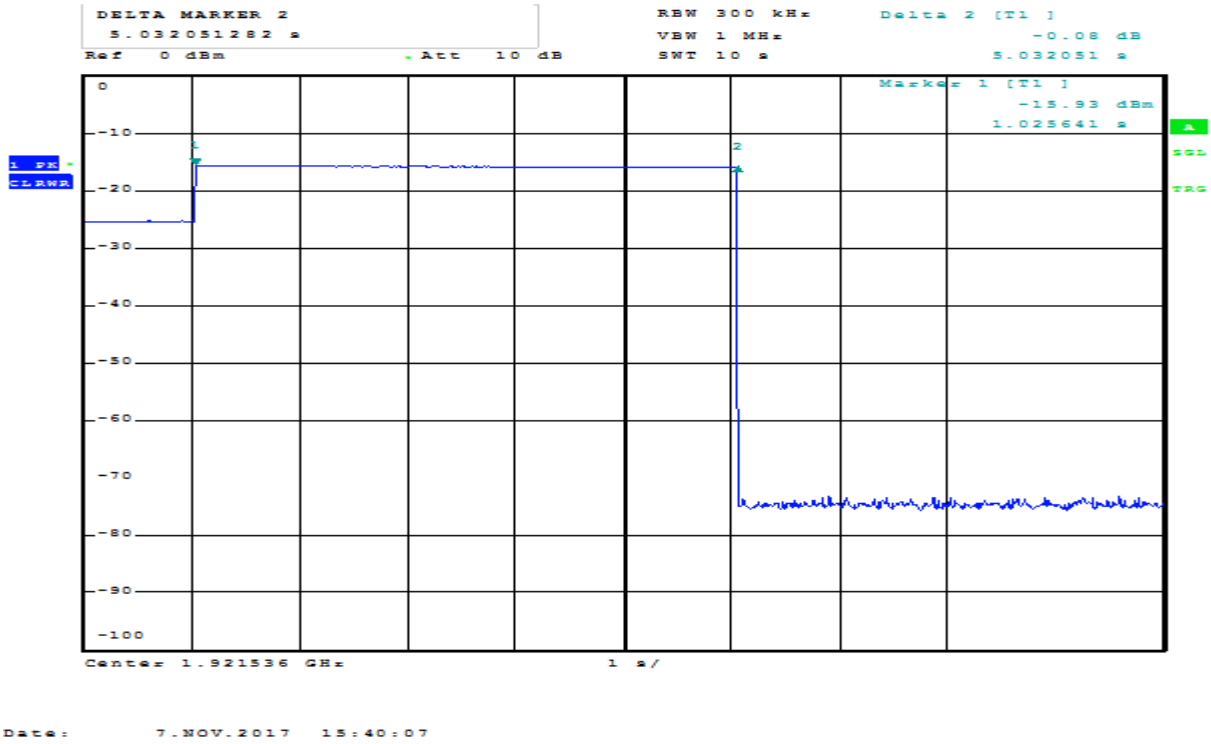
Occupation of the same combined time and spectrum windows by a device or group of cooperating devices continuously over a period of time longer than 8 hours is not permitted without repeating the access criteria.

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.



8.2.1a) Initial Transmission Without Acknowledgements



8.2.1c) Transmission Time After Loss of Acknowledgements

3.16 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_1 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**

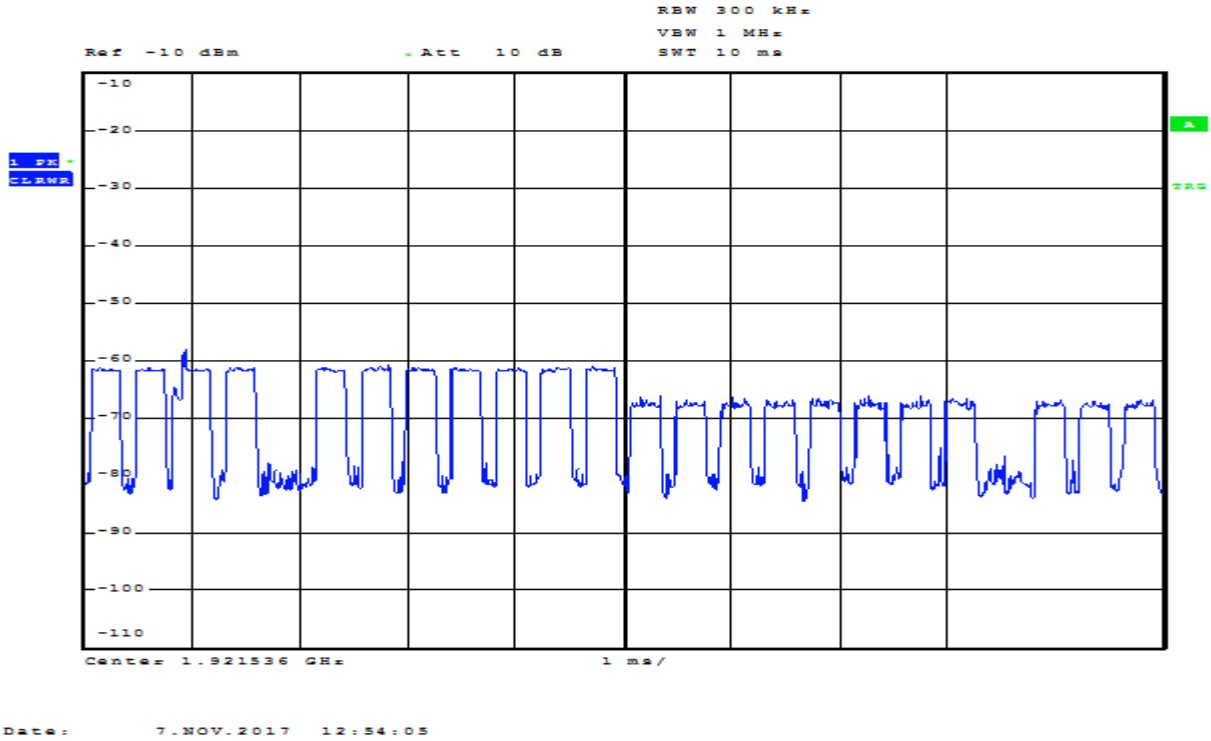
EUTs that implements the LIC procedure:

Test ref. to ANSI C63.17 clause 8.3.2	Observation	Verdict
b) EUT is restricted to a single carrier f_1 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**

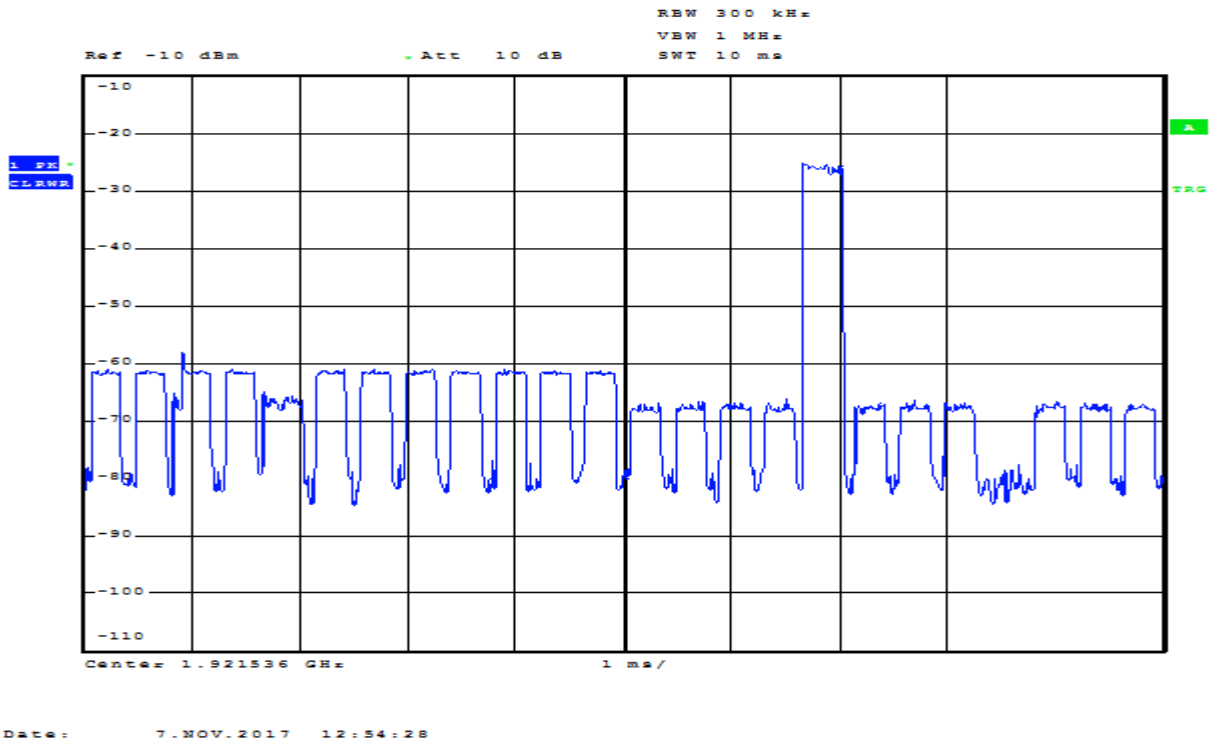
Comment: This test was performed with both Full Slot and Long slot. Both modes uses LIC procedure. See plots.

Limits, FCC 15.323(c)(10)

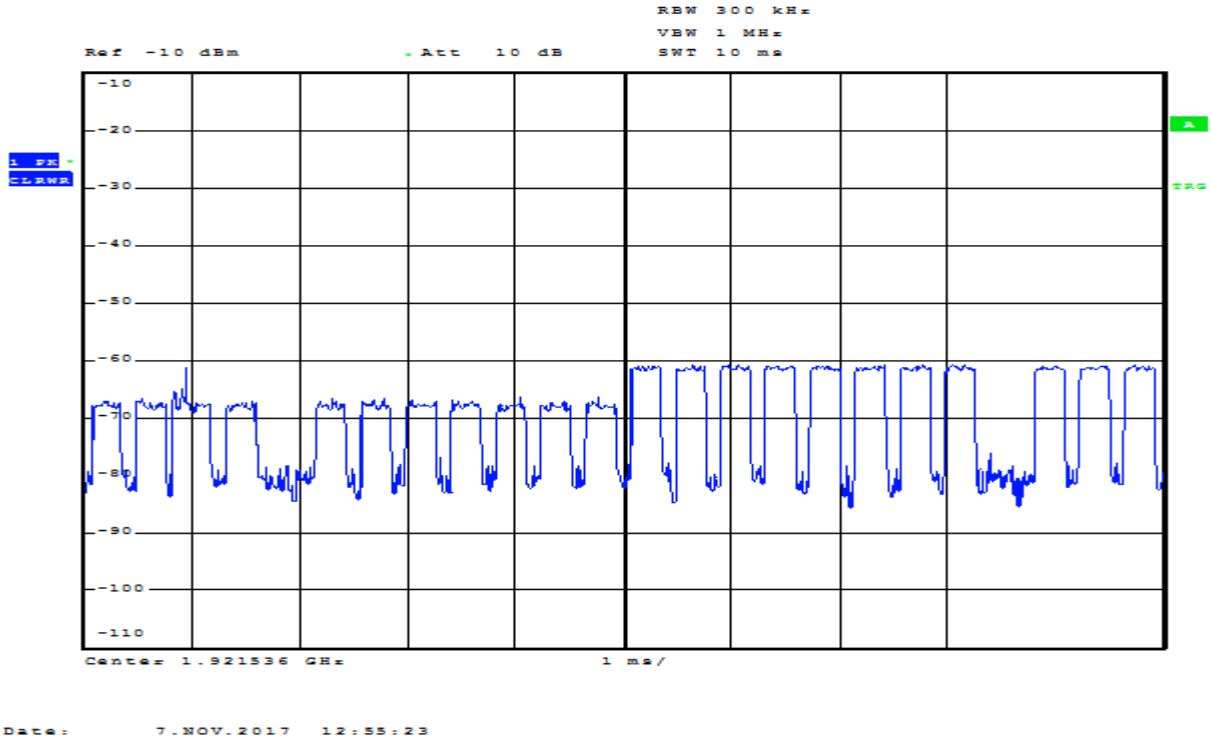
An initiating device may attempt to establish a duplex connection by monitoring both its intended transmit and receive time and spectrum windows. If both the intended transmit and receive time and spectrum windows meet the access criteria, then the initiating device can initiate a transmission in the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



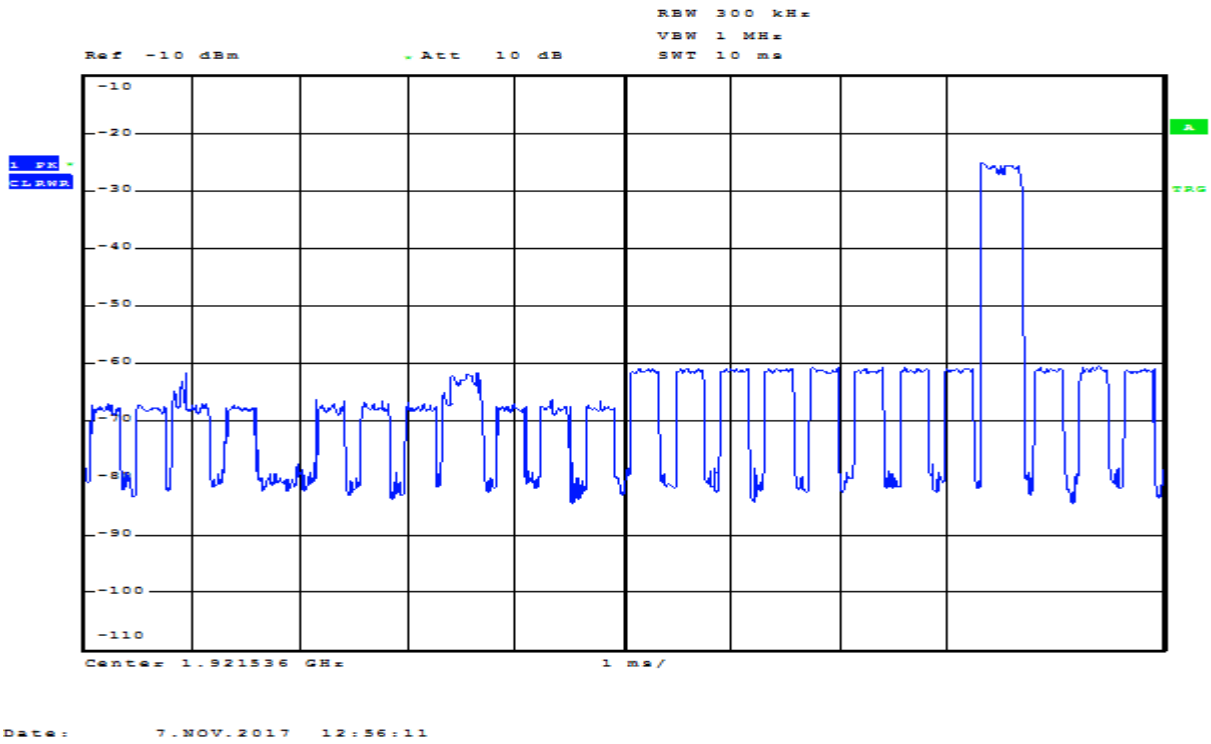
8.3.2c) EUT Transmits on Interference Free RECEIVE Slot, BEFORE, Full Slot



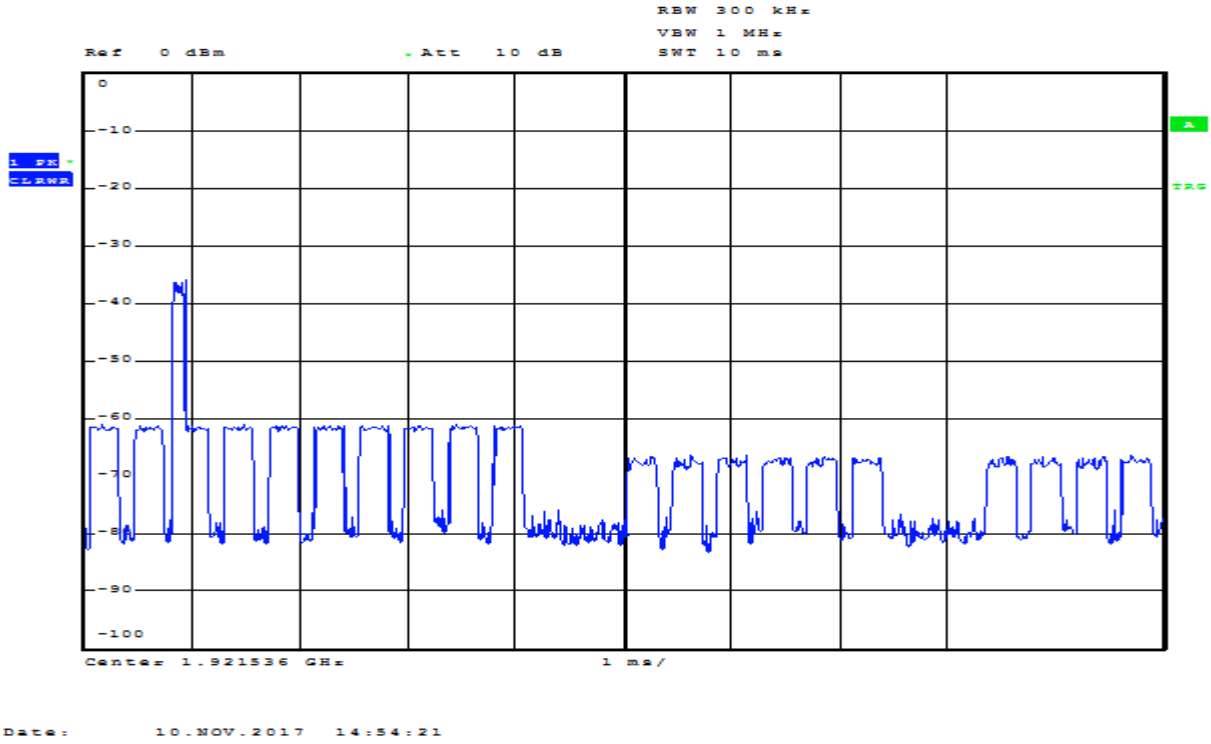
8.3.2d) EUT Transmits on Interference Free RECEIVE Slot, AFTER, Full Slot



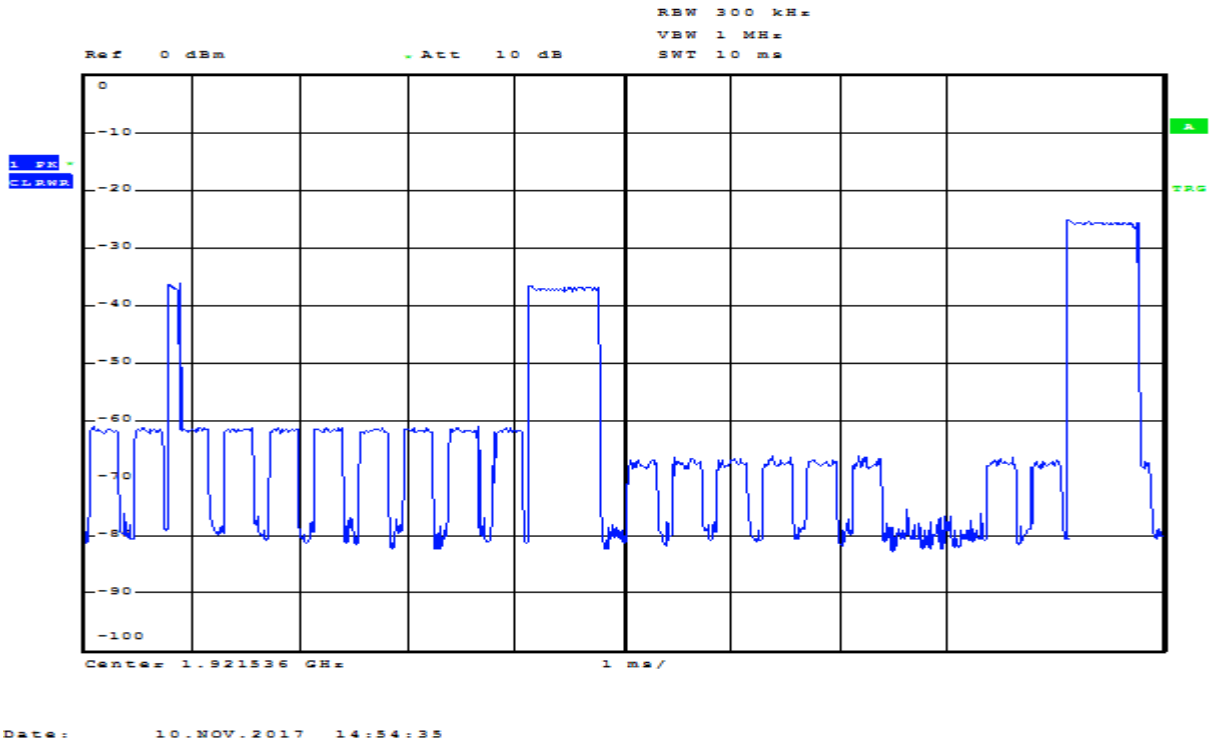
8.3.2e) EUT Transmits on Interference Free TRANSMIT Slot, BEFORE, Full Slot



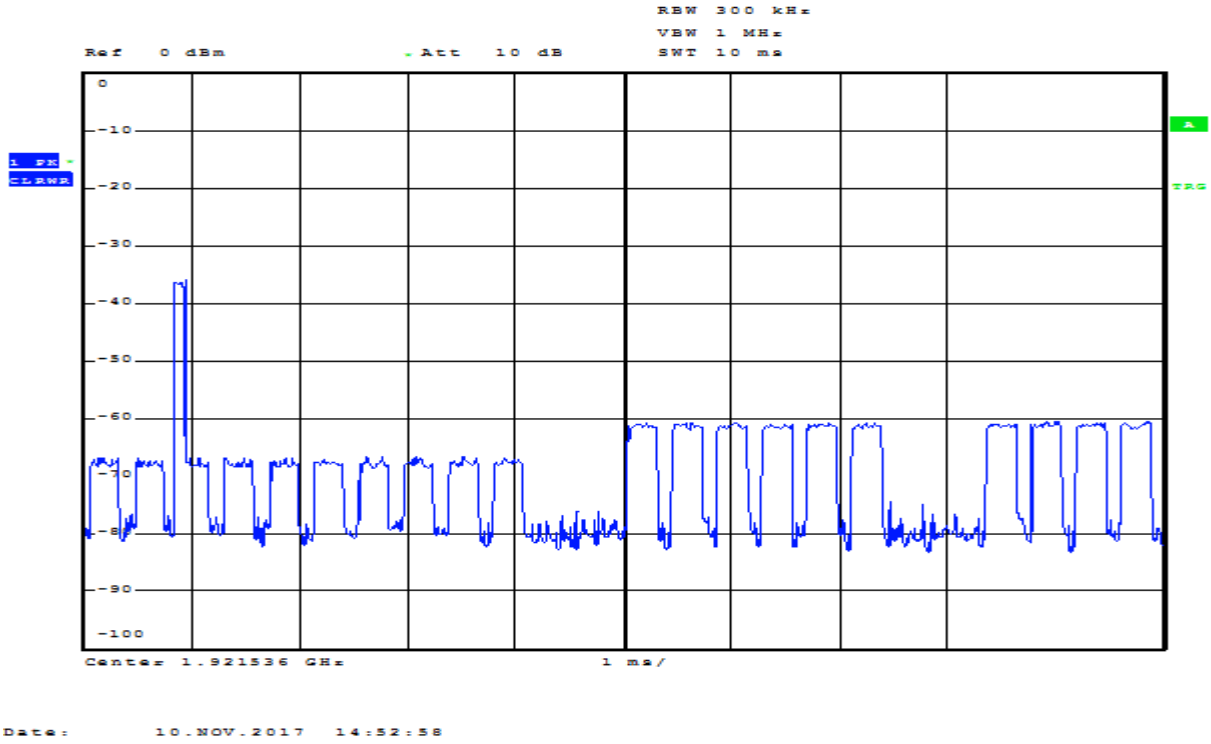
8.3.2f) EUT Transmits on Interference Free TRANSMIT Slot, AFTER, Full Slot



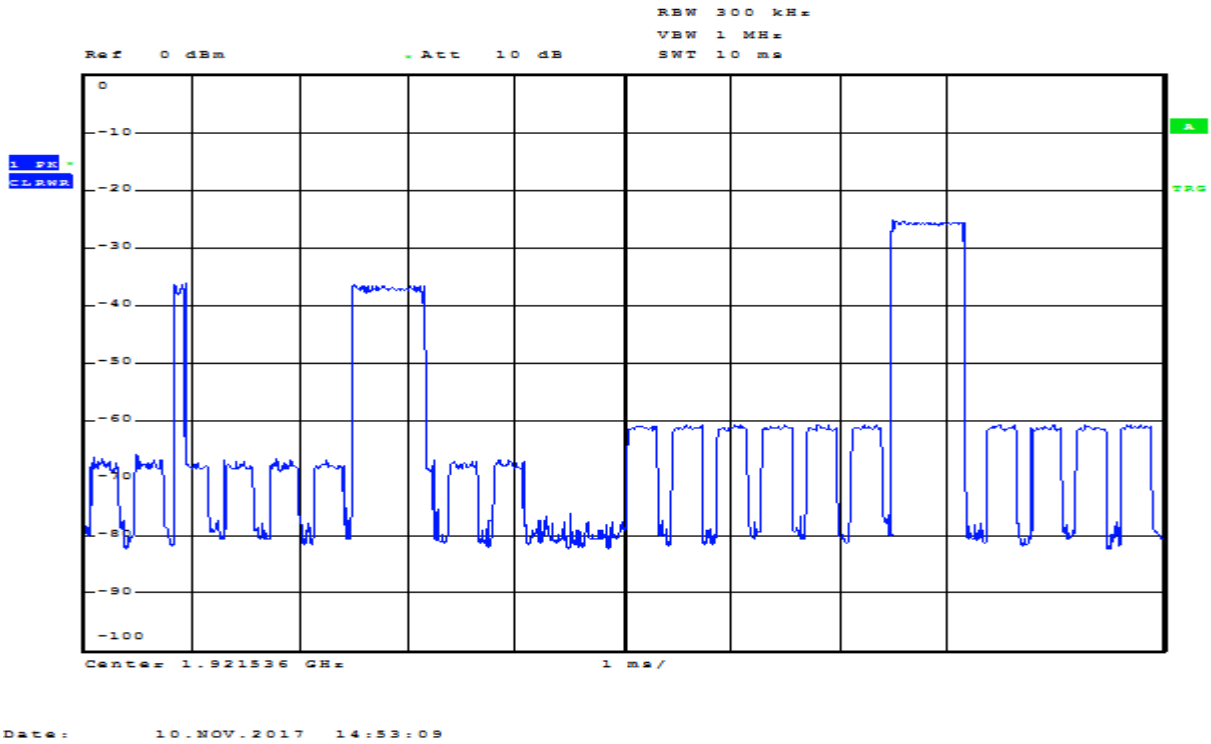
8.3.2c) EUT Transmits on Interference Free RECEIVE Slot, BEFORE, Long Slot



8.3.2d) EUT Transmits on Interference Free RECEIVE Slot, AFTER, Long Slot



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



8.3.2f) EUT Transmits on Interference Free TRANSMIT Slot, AFTER, Long Slot

3.17 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

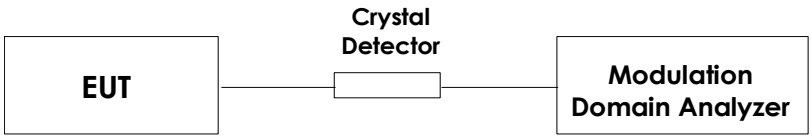
5 Test Setups

5.1 Frequency Measurements

Test Set-up 1

This setup is used for measuring Carrier frequency stability at normal and extreme temperatures.

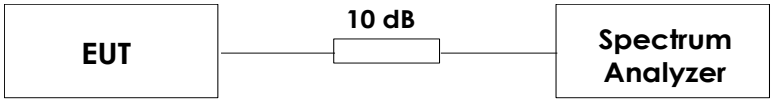
5.2 Timing Measurements



Test Set-up 2

This setup is used for measuring Frame repetition stability, Frame period and Jitter.

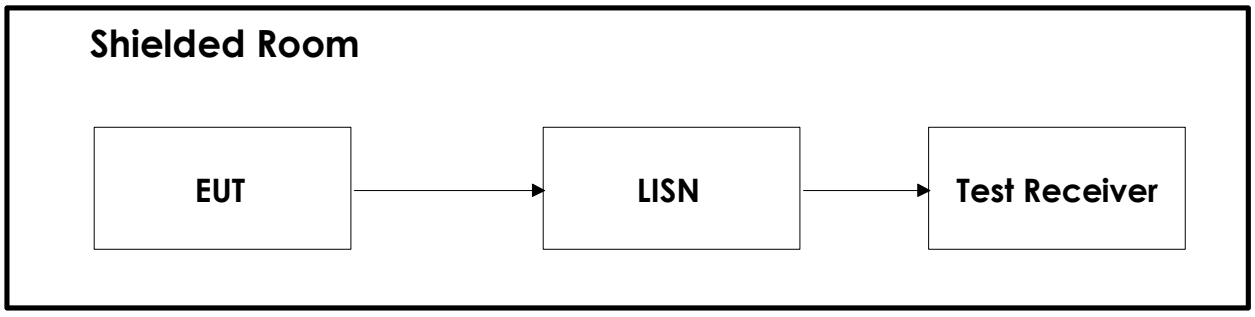
5.3 Conducted Emission Test



Test Set-up 3

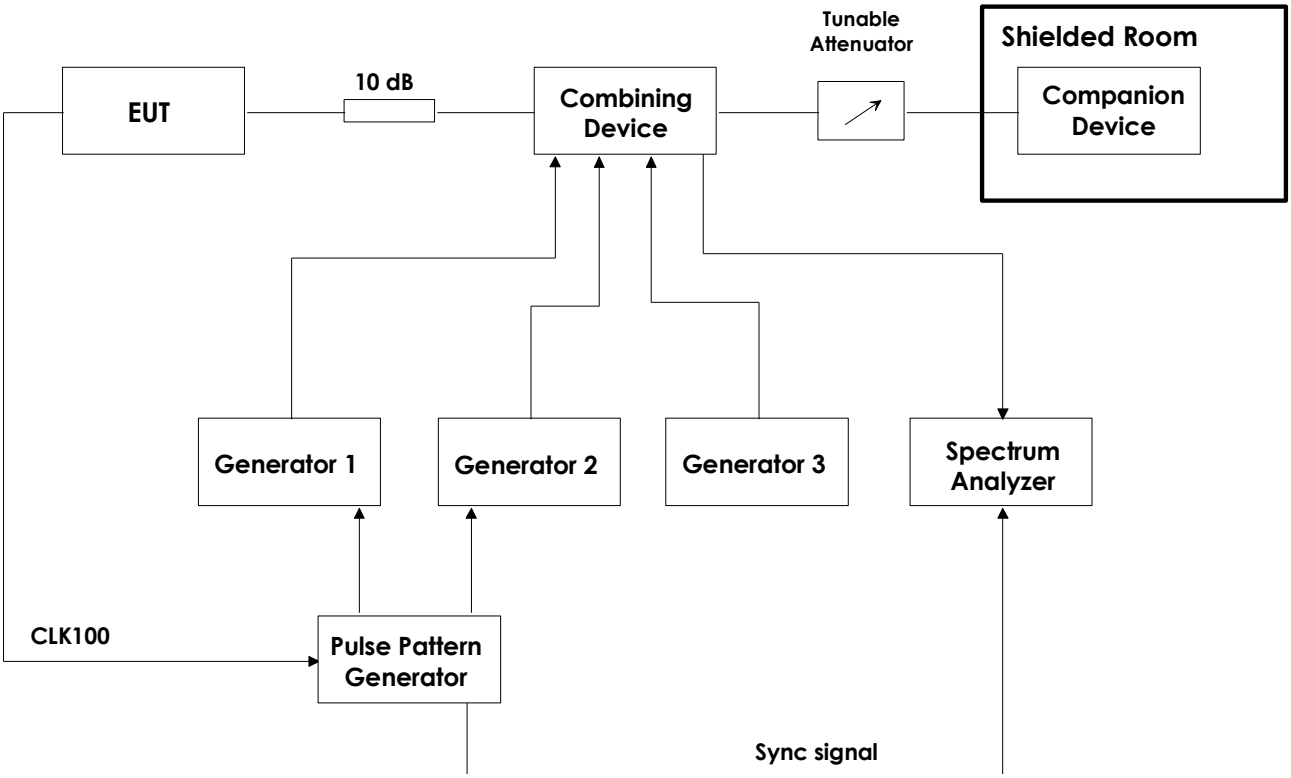
This setup is used for all conducted emission tests.

5.4 Power Line Conducted Emissions Test



Test Set-Up 5

5.5 Monitoring Tests



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	FSP30	Spectrum Analyzer	Rohde & Schwarz	LR 1551	2017.06	2019.06
2	SMIQ06B	Signal generator	Rohde & Schwarz	SN: 100481	2017.08	2018.08
3	SMIQ03E	Signal generator	Rohde & Schwarz	FA001269	2016.04	2018.04
4	SMR40	Signal generator	Rohde & Schwarz	FA001879	COU	
5	53310A	Modulation Domain Analyzer	Hewlett Packard	LR 1483	2016.01	2018.01
6	81110A	Pulse-/ Pattern Generator	Agilent	LR 1725	COU	
7	8470B	Crystal Detector	Hewlett Packard	LR 1207	N/A	
8	6810.17B	Attenuator	Suhner	LR 1669	COU	
9	745-69	Step Attenuator	Narda	LR 1442	N/A	
10	WE 1506A	Power Splitter	Weinchel	LR 244	COU	
11	WE 1506A	Power Splitter	Weinchel	LR 245	COU	
12	H-9	Hybrid	Anzac	LR 86	COU	
13	H-9	Hybrid	Anzac	LR 257	COU	
14	S212DS	RF Switch	Narda	LR 1244	N/A	
15	87H35-1	Circulator	Racal-MESL	s.no.: 140	N/A	
16	87H35-1	Circulator	Racal-MESL	s.no.: 141	N/A	
17	87H35-1	Circulator	Racal-MESL	s.no.: 142	N/A	
18	ESU26	Receiver/spectrum analyzer	Rohde & Schwarz	FA002043	2017.01	2018.01
19	ENV216	LISN	Rohde & Schwarz	FA002023	2017.05	2018.05
20	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	

Note: COU – calibrate on use; N/A – Not Applicable

The software listed below has been used for one or more tests.

No.	Manufacturer	Name	Version	Comment
1	Agilent	Intuitlink Data Capture	2.1.0	Screenshots from HP 53310A
2	Rohde & Schwarz	EMC 32	9.26.01	Software for EMC Measurements of Power-Line Conducted Tests

Revision history

Version	Date	Comment	Sign
1.0	2017.11.14	First edition	FS