



Accredited testing-laboratory

DAR registration number: DAT-P-176/94-D1

**Federal Motor Transport Authority (KBA)
DAR registration number: KBA-P 00070-97**

Recognized by the Federal Communications Commission

Anechoic chamber registration no.: 90462 (FCC)

Anechoic chamber registration no.: 3463A-1 (IC)

Certification ID: DE 0001

Accreditation ID: DE 0002

Accredited Bluetooth® Test Facility (BQTF)

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Test report no. : 1-0644-01-04/08-PP
Type identification : BeoCom 5
Applicant : Bang & Olufsen a/s
FCC ID : BV5BEOCOM5
IC Certification No : 3775A-BEOCOM5
Test standards : FCC Part 15, subpart D
Industry Canada RSS-213, Issue 2

Table of contents

1	General information	4
1.1	Notes	4
1.2	Testing laboratory	5
1.3	Details of applicant	5
1.4	Application details	5
2	Test standard/s:	6
3	Technical tests	7
3.1	Details of manufacturer	7
3.1.1	Test Item	7
3.2	Description of the tested Device	8
3.3	Test Environment	8
3.4	Other Comments	8
4	Statement of Compliance	9
4.1	Summary of Measurement Results	9
5	Measurements and results	10
5.1	Power Line Conducted Emissions	10
5.2	Coordination with fixed microwave	15
5.3	Digital Modulation Techniques	15
5.4	Labeling Requirements	15
5.5	Antenna Requirements	16
5.6	Channel Frequencies	16
5.7	Automatic Discontinuation of Transmission	17
5.8	Peak Power Output	18
5.9	Emission Bandwidth B	22
5.10	Power Spectral Density	26
5.11	In-Band Unwanted Emissions, Conducted	29
5.12	Out-of-Band Emissions, Conducted	32
5.13	Carrier Frequency Stability	36
5.14	Frame Repetition Stability	37
5.15	Frame Repetition Stability	37
5.16	Monitoring Threshold, Least Interfered Channel	39
5.17	Threshold Monitoring Bandwidth	41
5.18	Reaction Time and Monitoring Interval	42
5.19	Time and Spectrum Window Access Procedure	44
5.20	Acknowledgements and Transmission duration	45
5.21	Dual Access Criteria Check	47
5.22	Alternative monitoring interval	51
5.23	Spurious Emissions (Radiated)	51
5.24	Receiver Spurious Emissions	53
6	Test Setups	56
6.1	Frequency Measurements	56
6.2	Timing Measurements	56
6.3	Conducted Emission Test	56
6.4	Radiated Emission Test	57
6.5	Power Line Conducted Emissions Test	57
6.6	Monitoring Tests	58
7	Used Test Equipment	59

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Test report no.: 1-0644-01-04/08-PP

8	Photographs of the Test Set-up.....	60
9	Photographs of the EUT	62

1 General information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 3.1.1. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.

Test laboratory manager:

2009-06-16

Marco Lenjoint



Date

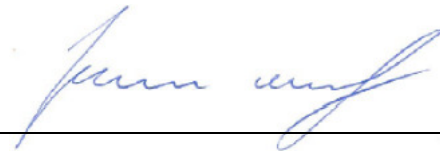
Name

Signature

Technical responsibility for area of testing:

2009-06-16

Joachim Wolf



Date

Name

Signature

CETECOM ICT Services GmbH

Test report no.: 1-0644-01-04/08-PP

1.2 Testing laboratory

CETECOM ICT Services GmbH

Untertürkheimer Straße 6 - 10

66117 Saarbrücken

Germany

Phone: + 49 681 5 98 - 0

Fax: + 49 681 5 98 - 9075

e-mail: info@ICT.cetecom.de

Internet: http://www.cetecom-ict.de

State of accreditation: The test laboratory (area of testing) is accredited according to
DIN EN ISO/IEC 17025
DAR registration number: DAT-P-176/94-D1

Accredited by: Federal Motor Transport Authority (KBA)
DAR registration number: KBA-P 00070-97

Testing location, if different from CETECOM ICT Services GmbH:

Name :
Street :
Town :
Country :
Phone :
Fax :

1.3 Details of applicant

Name:	Bang & Olufsen a/s
Street:	Peter Bangs Vej 15
Town:	7600 Struer
Country:	Denmark
Telephone:	+45 96 84 44 00
Fax:	+45 97 84 12 50
Contact:	Jesper Flyvholm
E-mail:	jfy@bang-olufsen.dk
Telephone:	+45 96 84 47 82

1.4 Application details

Date of receipt of order:	2009-05-28
Date of receipt of test item:	2009-06-02
Date of start test:	2009-06-02
Date of end test:	2009-06-16
Persons(s) who have been present during the test:	/

2 Test standard/s:

FCC Part 15, subpart D

Industry Canada RSS-213, Issue 2

Isochronous UPCS Device 1920 – 1930 MHz

**2 GHz Licence-exempt Personal
Communication Service Devices (LE-PCS)**

3 Technical tests

3.1 Details of manufacturer

Name:	Bang & Olufsen a/s
Street:	Peter Bangs Vej 15
Town:	7600 Struer
Country:	Denmark

3.1.1 Test Item

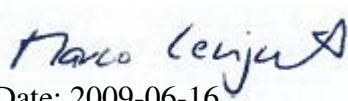
Kind of test item	: UPCS Portable part
Type identification	: BeoCom 5
S/N serial number	: Prototype sample
HW hardware status	: 3.0
SW software status	: 3.2
Tested to Radio Standards Specification (RSS) No.:	RSS-213 Issue 2
Open Area Test Site Industry Canada Number	: IC 3463A-1
Frequency Band [MHz]	: 1920 – 1930
Frequency Range (or fixed frequency)	: 1921.536 – 1928.448 MHz
Type of Modulation	: Digital (Gaussian Frequency Shift Keying)
Number of channels	: 5 RF Channels, 5x12 = 60 TDMA Duplex Channels
Antenna information	: 2 permanently attached antennas, no ext. connector
RF Power [W] (max)	: Conducted: 19.9 dBm, 97.7 mW Rad. EIRP: 18.6 dBm, 72.4 mW
Occupied Bandwidth (99% BW)	: 1.38MHz
Emission Designator (TRC-43)	: 1M38F1E
Receiver Spurious (worst case)	: -68 dBm
Transmitter Spurious (worst case)	: -32 dBm
Power Supply	: DC 3.7 V LIPOLY battery, Desktop charger
Temperature Range	: 0 °C to 40 °C

FCC ID: BV5BEOCOM5

IC: 3775A-BEOCOM5

ATTESTATION: I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned departmental standard(s), and that the radio equipment identified in this application has been subject to all applicable test conditions specified in the departmental standards and all of the requirements of the standards have been met.

Signature:



Date: 2009-06-16

Test engineer: Marco Lenjoint

3.2 Description of the tested Device

3.3 Test Environment

Description	Shortcut	Unit	Value
Nominal Temperature	T _{nom}	°C	21 - 24
Nominal Humidity	H _{nom}	%	30 -50
Nominal Power Source	V _{nom}	V	3.7 V DC

3.4 Other Comments

4 Statement of Compliance

4.1 Summary of Measurement Results

- No deviations from the technical specifications were ascertained**
 There were deviations from the technical specifications ascertained

CFR 47 Part 15 UPCS

Name of test	FCC CFR 47 Paragraph	IC RSS-213 Paragraph	Verdict
Coordination with fixed microwave	15.307(b)	N/A	Complies
Digital Modulation Techniques	15.319(b)	6.1	Complies
Labeling requirements	15.19(a)(3)	RSS-GEN 5.2	Complies
Antenna requirements	15.317, 15.203	4.1(e)	Complies
Power Line Conducted Emission	15.107(a), 15.207(a)	6.3 RSS_GEN 7.2.2	Complies
Emission Bandwidth	15.323(a)	6.4	Complies
In-band Emission	15.323(d)	6.7.2	Complies
Out-of-band Emissions	15.323(d)	6.7.1	Complies
Peak Transmit Power	15.319(c)(e), 15.31(e)	6.5	Complies
Power Spectral Density	15.319(d)	4.3.2.1	Complies
Automatic discontinuation of transmission	15.319(f)	4.3.4(a)	Complies
Carrier frequency stability	15.323(f)	6.2	Complies
Frame repetition stability	15.323(e)	4.3.4(c)	Complies
Frame period and jitter	15.323(e)	4.3.4(c)	Complies
Monitoring threshold, Least interfered channel	15.323(c)(2);(5); (9)	4.3.4(b)	Complies
Monitoring of intended transmit window and maximum reaction time	15.323(c)(1)	4.3.4	Complies
Threshold monitoring bandwidth	15.323(c)(7)	4.3.4	Complies
Reaction time and monitoring interval	15.323(c)(1);(5); (7)	4.3.4	Complies
Access criteria test interval	15.323(c)(4);(6)	4.3.4	N/A ¹
Access criteria functional test	15.323(c)(4);(6)	4.3.4	N/A ¹
Acknowledgments	15.323(c)(4)	4.3.4	Complies
Transmission duration	15.323(c)(3)	4.3.4	Complies
Dual access criteria	15.323(c)(10)	4.3.4	Complies
Alternative monitoring interval	15.323(c)(10);(11)	4.3.4	N/A ²
Spurious Emissions (Antenna Conducted)	15.323(d)	6.7.1	Complies ³
Spurious Emissions (Radiated)	15.319(g), 15.109(a), 15,209(a)	4.3.3 RSS-GEN 7.2.3	Complies ⁴
Receiver Spurious Emissions	N/A	6.8	Complies

¹ Only applicable for EUT that can initiate a communication link

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

³ The tested equipment has integrated antennas only

⁴ Only requirement FCC 15.109 for unintentional radiators was tested radiated

5 Measurements and results

5.1 Power Line Conducted Emissions

Measurement Procedure:

ANSI C63.4-2003 using 50 μ H/50 ohms LISN.

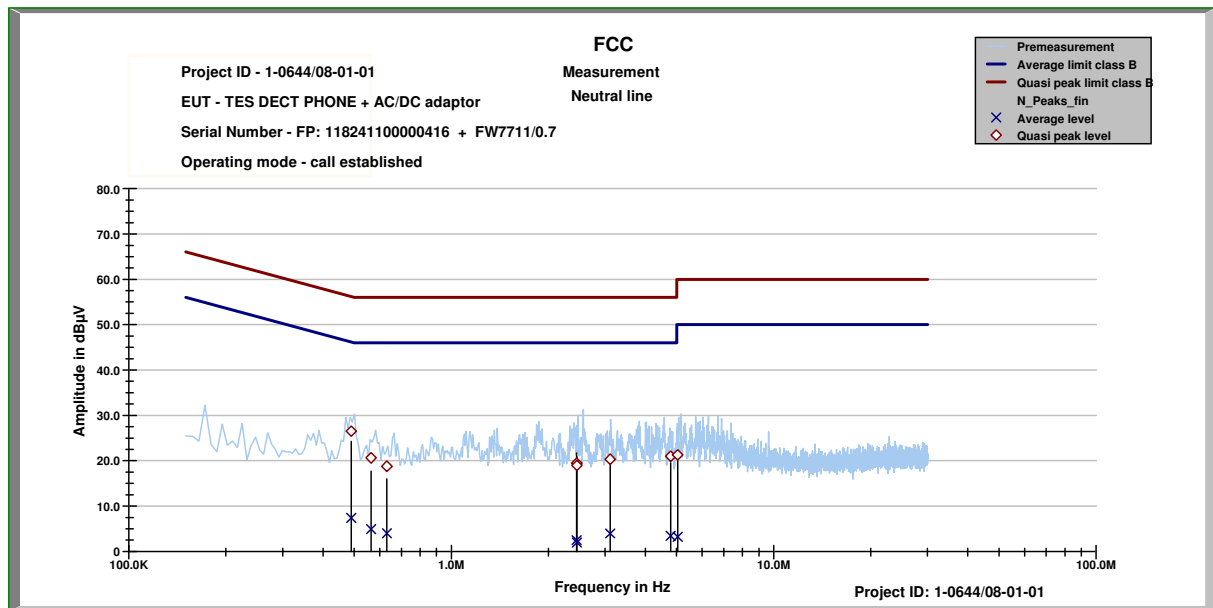
Test Result: Pass

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

Highest measured value (L1 and N):

All values were below the Average Limit even when measured with the Peak Detector.

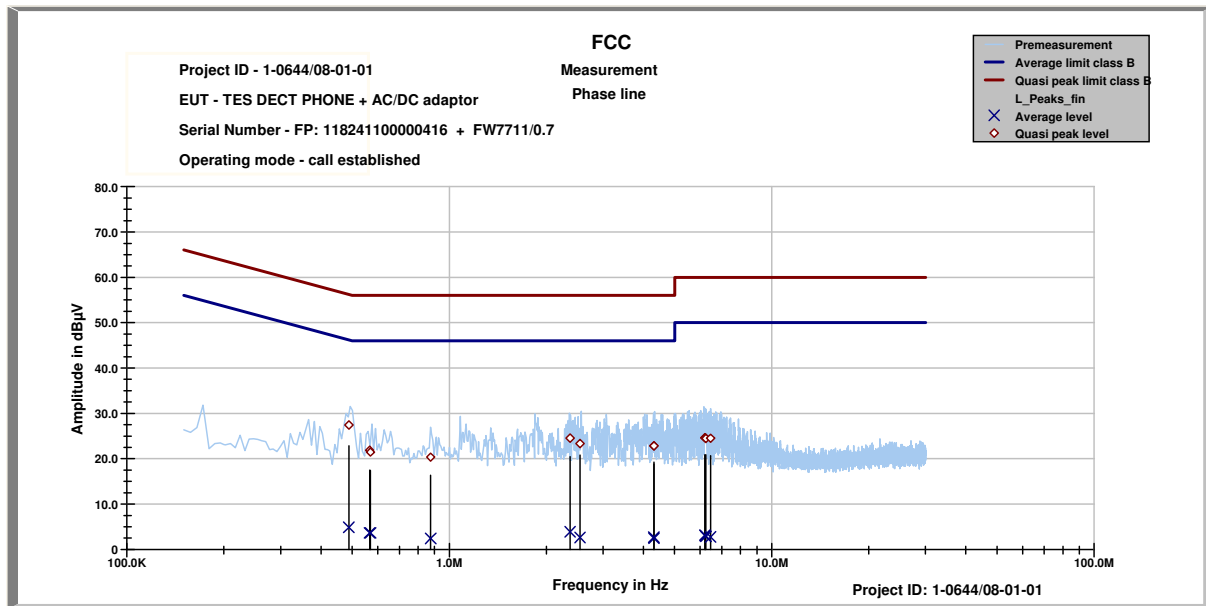
Requirement: FCC 15.207 (a)



Speaker Phone, idle mode, neutral line

11:09:19 AM, Friday, June 05, 2009

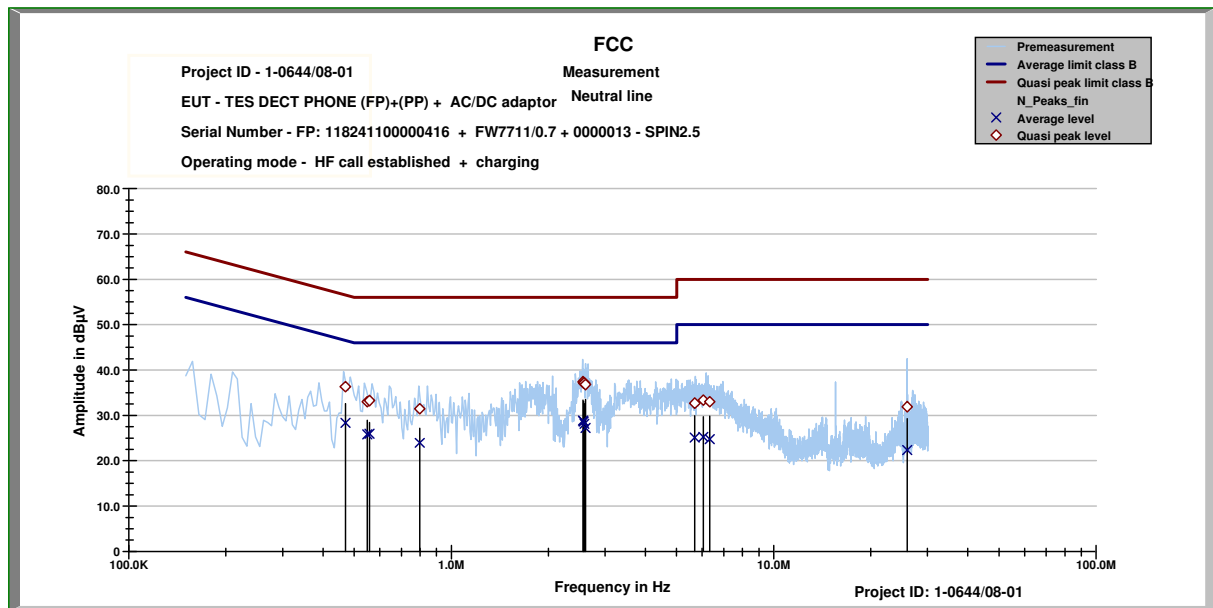
Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
□				
MHz	dBµV	dBµV	dBµV	dBµV
0.48939	26.49	29.69	7.40	38.90
0.56372	20.63	35.37	4.90	41.10
0.63147	18.77	37.23	3.97	42.03
2.4483	19.46	36.54	2.48	43.52
2.451	18.97	37.03	1.96	44.04
3.1087	20.31	35.69	3.94	42.06
4.7903	20.97	35.03	3.43	42.57
5.0337	21.27	38.73	3.22	46.78



Speaker Phone, idle mode, phase line

11:09:19 AM, Friday, June 05, 2009

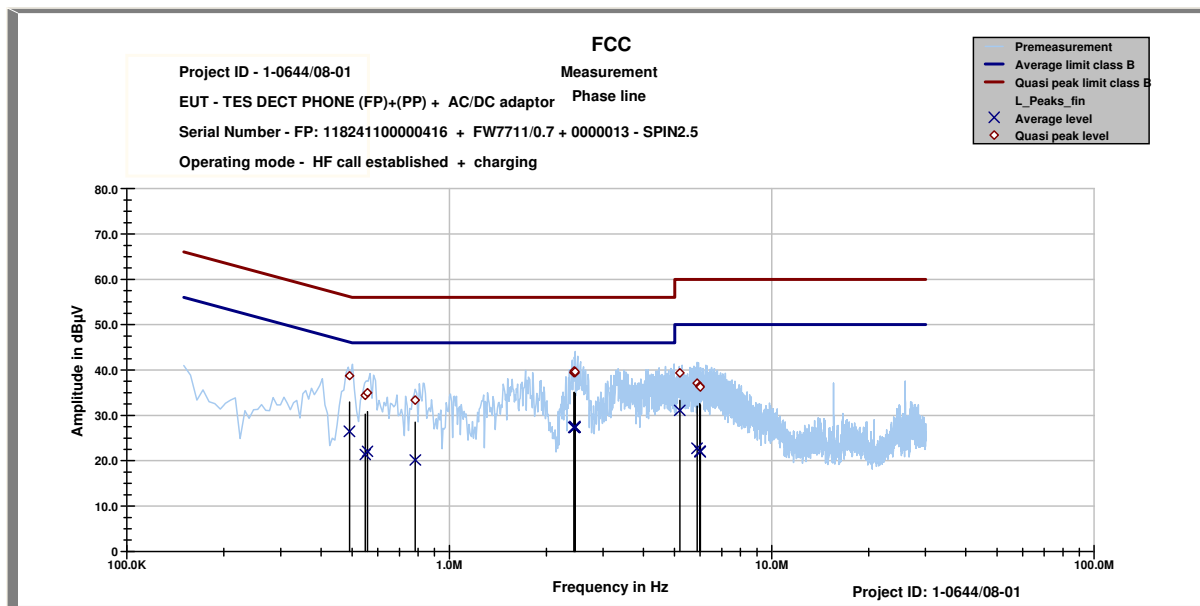
Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
□				
MHz	dBµV	dBµV	dBµV	dBµV
0.48806	27.41	28.79	4.84	41.50
0.56584	21.83	34.17	3.61	42.39
0.56981	21.44	34.56	3.63	42.37
0.87544	20.33	35.67	2.40	43.60
2.3698	24.55	31.45	3.86	42.14
2.544	23.32	32.68	2.62	43.38
4.3076	22.82	33.18	2.69	43.31
4.312	22.80	33.20	2.42	43.58
6.2039	24.62	35.38	3.12	46.88
6.2132	24.62	35.38	3.02	46.98
6.2503	24.44	35.56	2.86	47.14
6.4582	24.51	35.49	2.75	47.25



Speaker Phone and Portable Part, TX mode, neutral line

11:35:07 AM, Friday, June 05, 2009

Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
□				
MHz	dBµV	dBµV	dBµV	dBµV
0.46938	36.31	20.21	28.34	18.54
0.54859	33.00	23.00	25.78	20.22
0.55737	33.26	22.74	25.96	20.04
0.79774	31.43	24.57	23.93	22.07
2.5632	37.41	18.59	28.84	17.16
2.5752	37.10	18.90	28.60	17.40
2.587	37.14	18.86	28.15	17.85
2.6052	36.79	19.21	27.21	18.79
5.6902	32.66	27.34	25.10	24.90
6.0474	33.36	26.64	25.21	24.79
6.3317	33.00	27.00	24.71	25.29
25.93	31.89	28.11	22.30	27.70



Speaker Phone and Portable Part, TX mode, phase line

11:35:07 AM, Friday, June 05, 2009

Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
□				
MHz	dBµV	dBµV	dBµV	dBµV
0.49019	38.73	17.43	26.46	19.82
0.54842	34.40	21.60	21.34	24.66
0.55732	35.01	20.99	22.06	23.94
0.78431	33.34	22.66	20.16	25.84
2.4329	39.39	16.61	27.36	18.64
2.441	39.78	16.22	27.29	18.71
2.4516	39.38	16.62	27.53	18.47
2.4537	39.64	16.36	27.35	18.65
5.1859	39.33	20.67	31.08	18.92
5.865	37.10	22.90	22.75	27.25
5.9794	36.46	23.54	22.09	27.91
5.9998	36.25	23.75	21.96	28.04

5.2 Coordination with fixed microwave

The affidavit from UTAM, Inc. is included in the documentation supplied by the applicant:

Yes

No

Requirement: FCC 15.307 (b):

Each application for certification of equipment operating under the provisions of this Subpart must be accompanied by an affidavit from UTAM, Inc. certifying that the applicant is a participating member of UTAM, Inc. In the event a grantee fails to fulfill the obligations attendant to participation in UTAM, Inc., the commission may invoke administrative sanctions as necessary to preclude continued marketing and installation of devices covered by the grant of certification, including but not limited to revoking certification.

5.3 Digital Modulation Techniques

The tested equipment is based on DECT technology, the only difference is that the channel allocation is modified to operate in the 1920-1930 MHz band.

The EUT use 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.

5.4 Labeling Requirements

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

Requirement: 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.

5.5 Antenna Requirements

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.

Requirements: FCC 15.203, 14.204. 15.317

5.6 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(d), (g)

Within 1920-1930 MHz band for isochronous devices.

5.7 Automatic Discontinuation of Transmission

Does the EUT transmit control and Signaling Information?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Type of EUT:	<input checked="" type="checkbox"/> Initiating device	<input type="checkbox"/> 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	EUT switched Off	C	Pass
3	Hook-On by companion device	N/A	N/A
4	Hook-On by EUT	C	Pass
5	Power removed from companion device	A	Pass
6	Companion device switched Off	N/A	N/A

- 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 (the EUT does not have an on/off switch and can not perform Hook-On)

Requirement: 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 or repetitive code used by certain digital modulation technologies to complete frame or burst intervals.

5.8 Peak Power Output

Measurement Procedure:

ANSI C63.17, clause 6.1.2.

Test Results: Pass

Measurement Data:

Maximum Conducted Output Power

Channel No.	Frequency (MHz)	Maximum Conducted Output Power (dBm)	Maximum Radiated Output Power (dBm)	Maximum Antenna Gain (dBi)
4	1921.536	19.9	18.6	-1.3
2	1924.992	19.9	/	/
0	1928.448	19.7	18.1	-1.6

Limit:

Conducted: $100 \mu\text{W} \times \text{SQRT}(B)$ where B is the measured Emission Bandwidth in Hz

FCC 15.319(c)(e): 21.6 dBm (146 mW)

RSS-213, Issue 2: 20.7 dBm (117 mW)

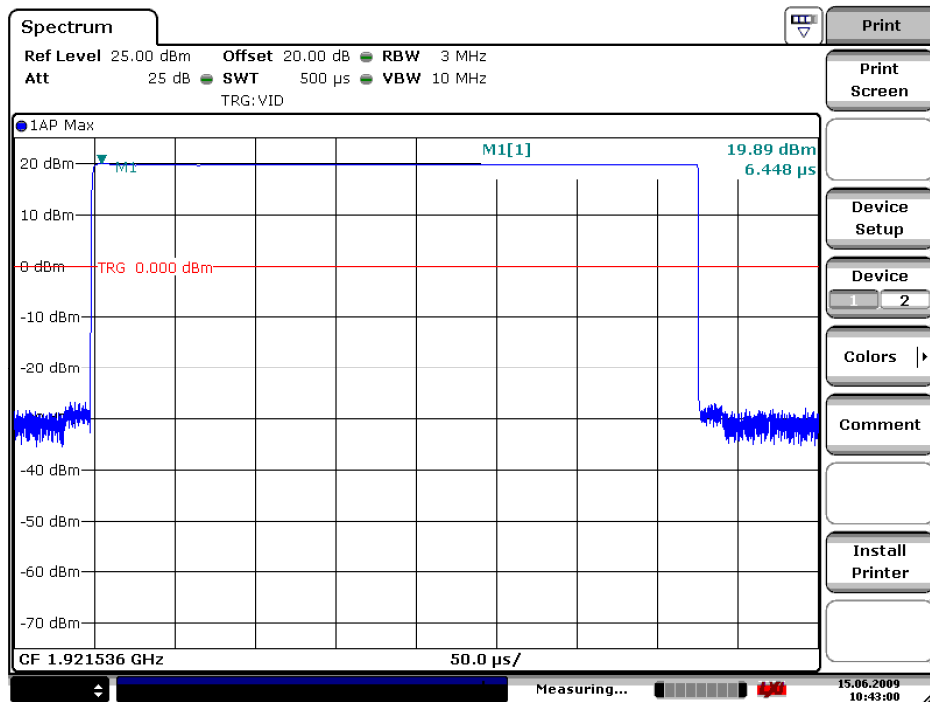
The antenna gain is below 3 dBi.

Requirements: FCC 15.319(f). RSS-213, Issue 2

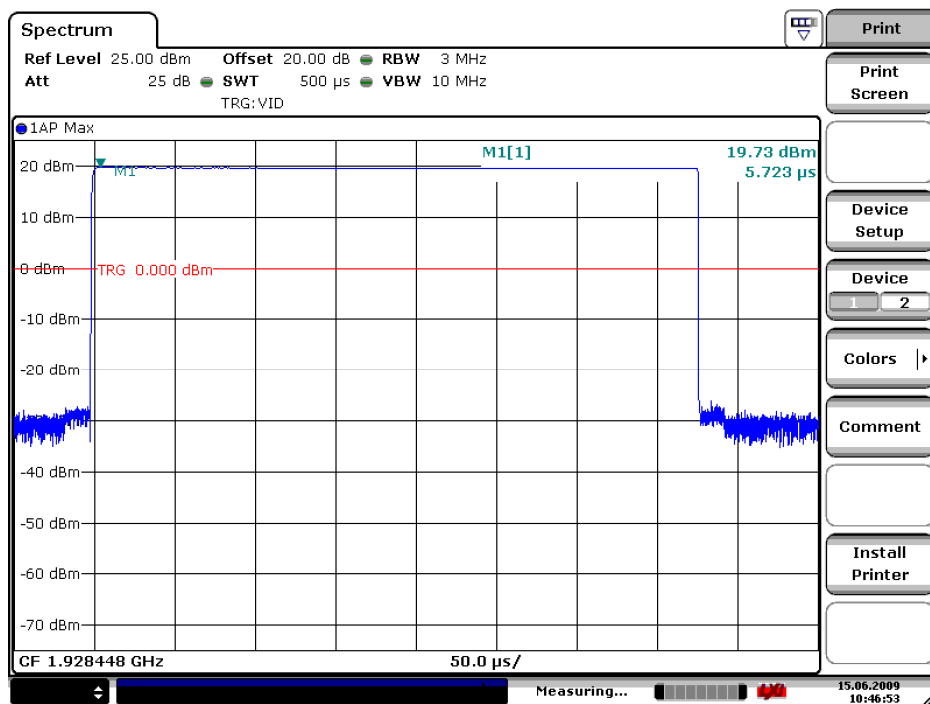
Peak transmit power shall not exceed 100 microwatts multiplied by the square root of the emission bandwidth in Hertz.

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

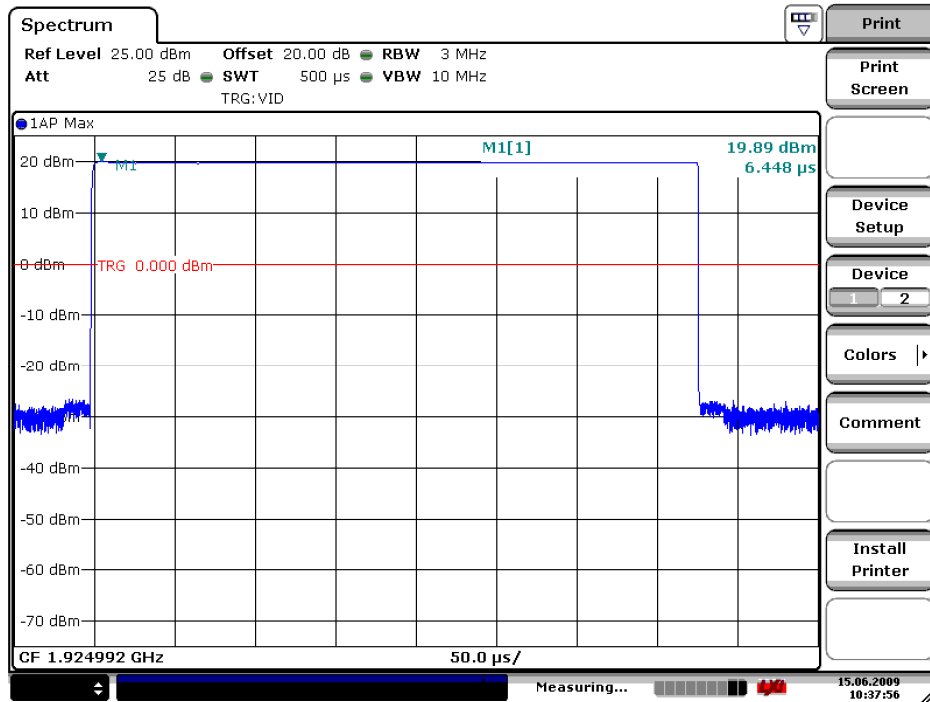
Conducted Peak Output Power



Lower Channel

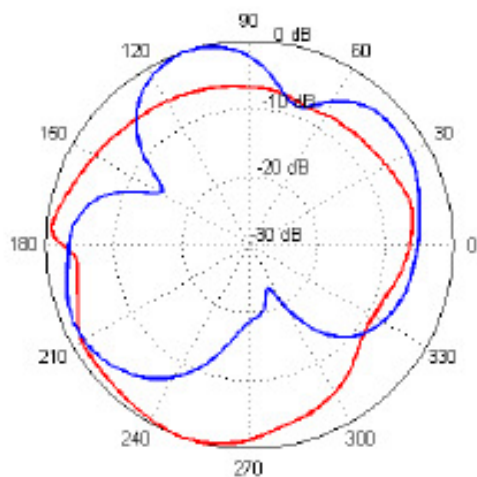


Upper Channel



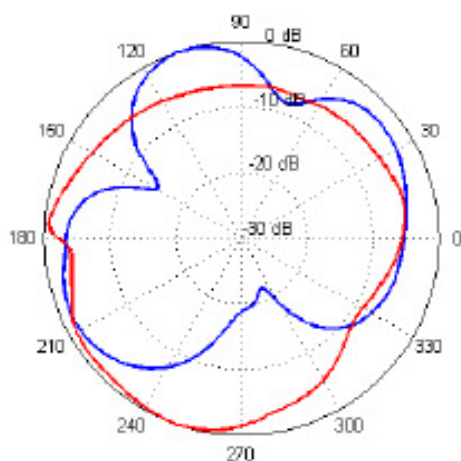
Middle Channel

Radiation patterns of antenna 1



(c) yz-plane, C_ϕ (blau, $G_{\max} \Rightarrow 1.35$ dBi),
 C_ψ (red, $G_{\max} \Rightarrow 14.07$ dBi)

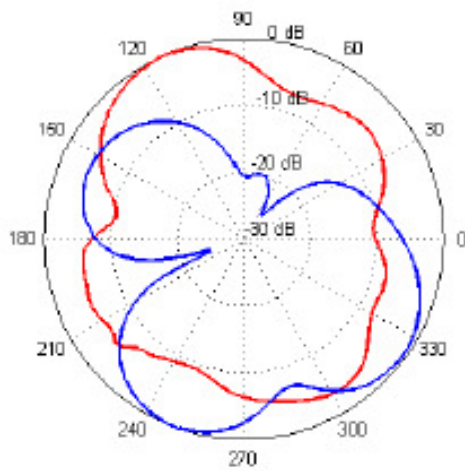
Lower Channel



(c) yz-plane, C_ϕ (blau, $G_{\max} \Rightarrow 1.67$ dBi),
 C_ψ (red, $G_{\max} \Rightarrow 14.51$ dBi)

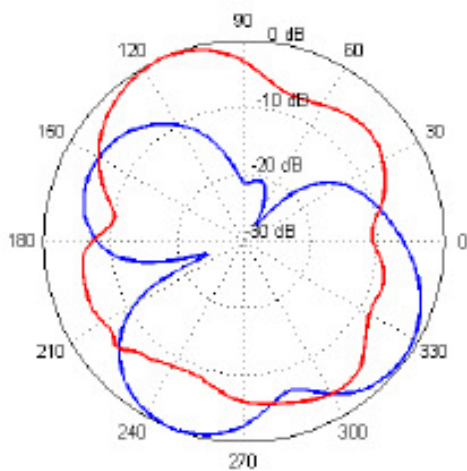
Upper Channel

Radiation patterns of antenna 2



(c) yz-plane, C_θ (blau, $G_{\max} = 2.26$ dBi),
 C_ϕ (red, $G_{\max} = -12.63$ dBi)

Lower Channel



(c) yz-plane, C_θ (blau, $G_{\max} = 2.55$ dBi),
 C_ϕ (red, $G_{\max} = -12.91$ dBi)

Upper Channel

5.9 Emission Bandwidth B

Measurement Procedure:

ANSI C63.17, clause 6.1.3.

Test Results: Pass

Measurement Data:

Channel No.	Frequency (MHz)	26 dB Bandwidth B (kHz)
4	1921.536	1893
0	1928.448	2121

Channel No.	Frequency (MHz)	20 dB Bandwidth B (kHz)
2	1924.992	1379

Channel No.	Frequency (MHz)	6 dB Bandwidth B (kHz)
4	1921.536	N/A
0	1928.448	N/A

Channel No.	Frequency (MHz)	12 dB Bandwidth B (kHz)
4	1921.536	N/A
0	1928.448	N/A

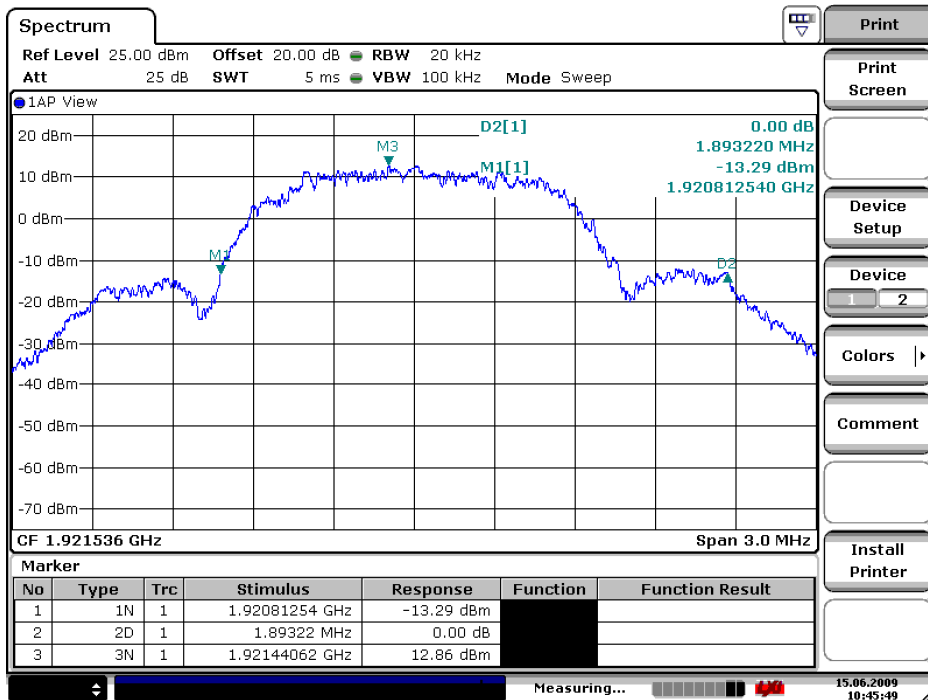
Requirement: FCC 15.323(a)

The 26 dB Bandwidth B shall be larger than 50 kHz and less than 2.5 MHz.

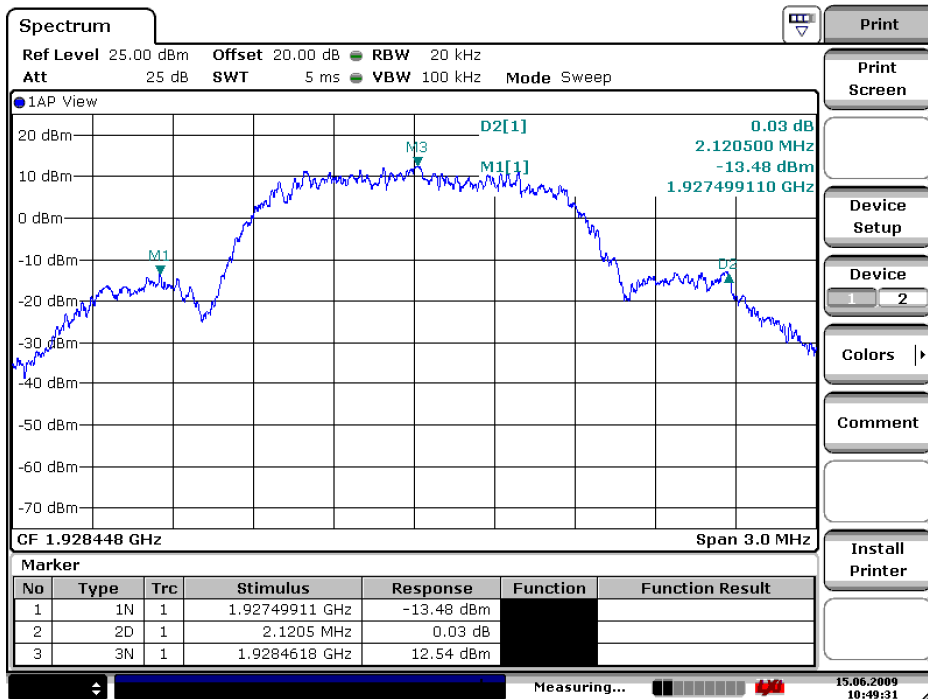
Requirement: RSS-213 Issue 2, clause 6.4

The 20 dB Bandwidth B shall be larger than 50 kHz and less than 2.5 MHz.

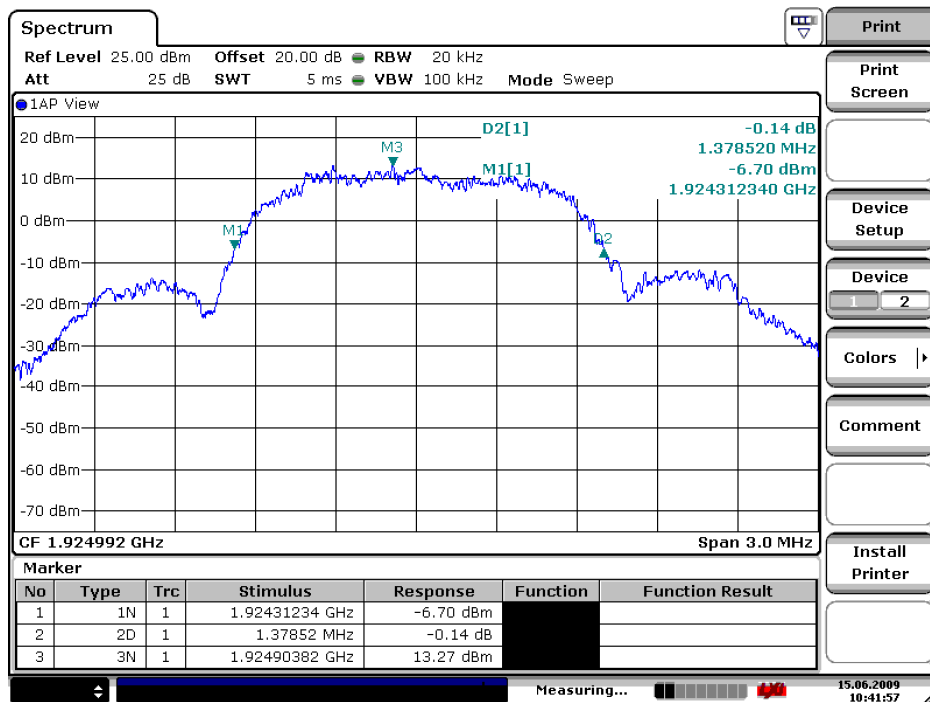
No requirement for 6 dB and 12 dB Bandwidth. These values are only used for testing Monitoring Bandwidth if the Simple Compliance test fails (ANSI C63.17, clause 7.4).



Emission Bandwidth B, Lower Channel



Emission Bandwidth B, Upper Channel



20 dB Bandwidth B, Middle Channel

5.10 Power Spectral Density

Measurement Procedure:

ANSI C63.17, clause 6.1.5.

Test Results: Pass

Measurement Data:

Channel No.	Frequency (MHz)	Power Spectral Density (mW/3kHz)
4	1921.441	0.30
0	1928.462	0.58

Averaged over 100 sweeps.

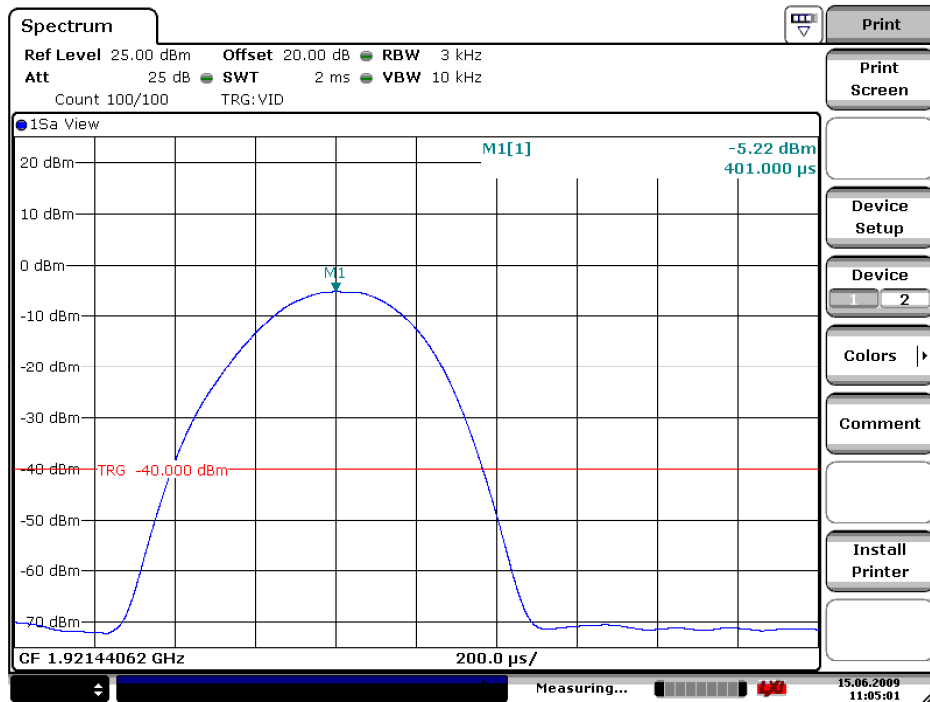
Requirement: FCC 15.319(d)

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:

Frequency of the maximum level was recorded under chapter 5.9.



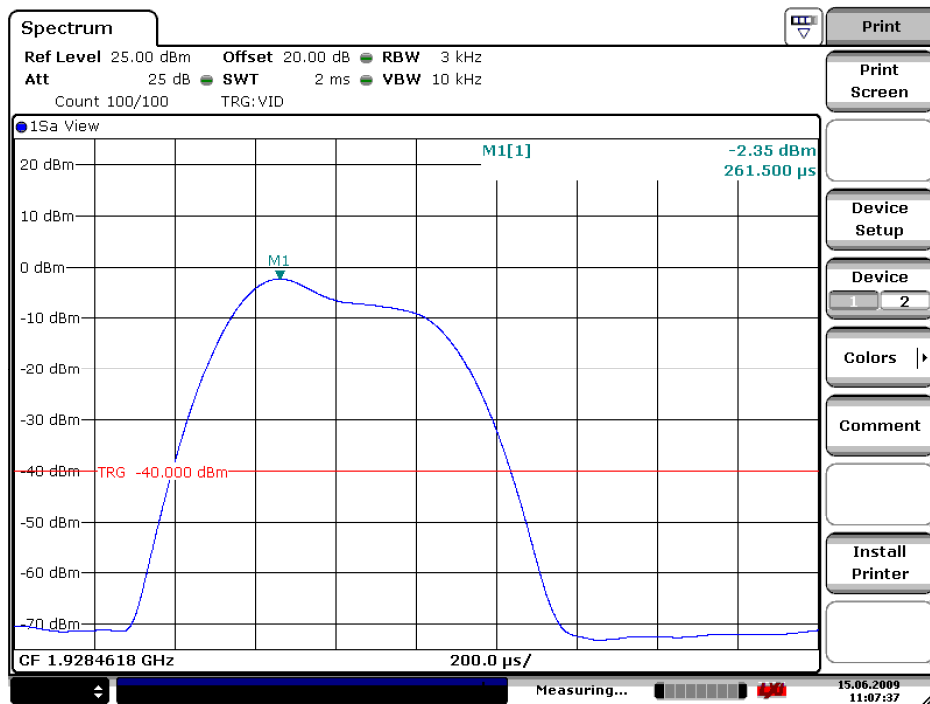
Averaged, 100 Sweeps

Average pulse power [dBm]	-5.22
Average pulse power [mW]	0.30

Power Spectral Density

Upper Channel:

Frequency of the maximum level was recorded under chapter 5.9.



Averaged, 100 Sweeps

Average pulse power [dBm]	-2.35
Average pulse power [mW]	0.58

5.11 In-Band Unwanted Emissions, Conducted

Measurement Procedure:

ANSI C63.17, clause 6.1.6.1.

Test Results: Pass

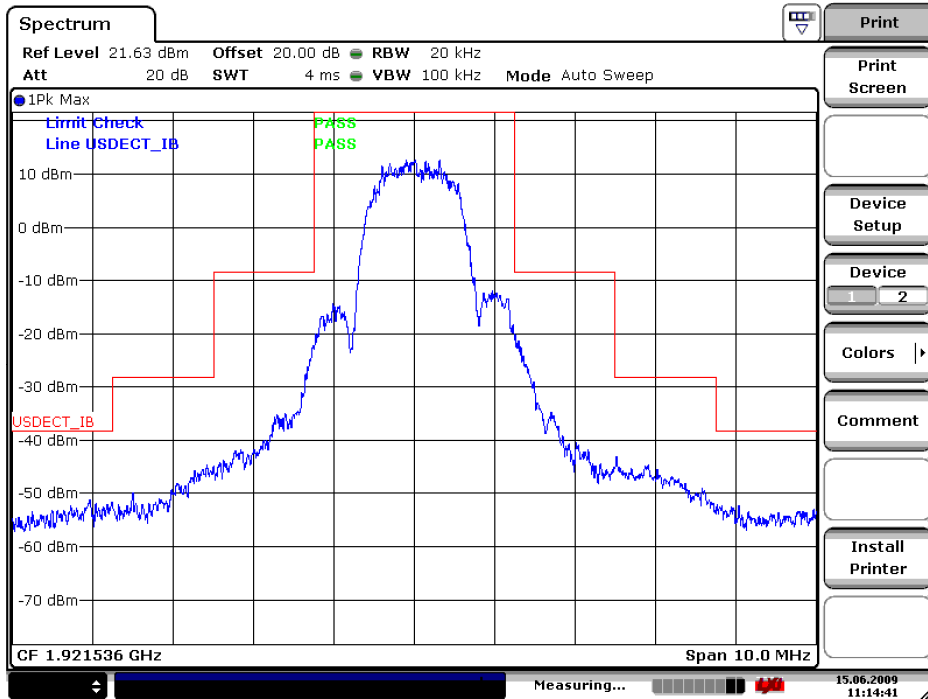
Measurement Data:

See plots.

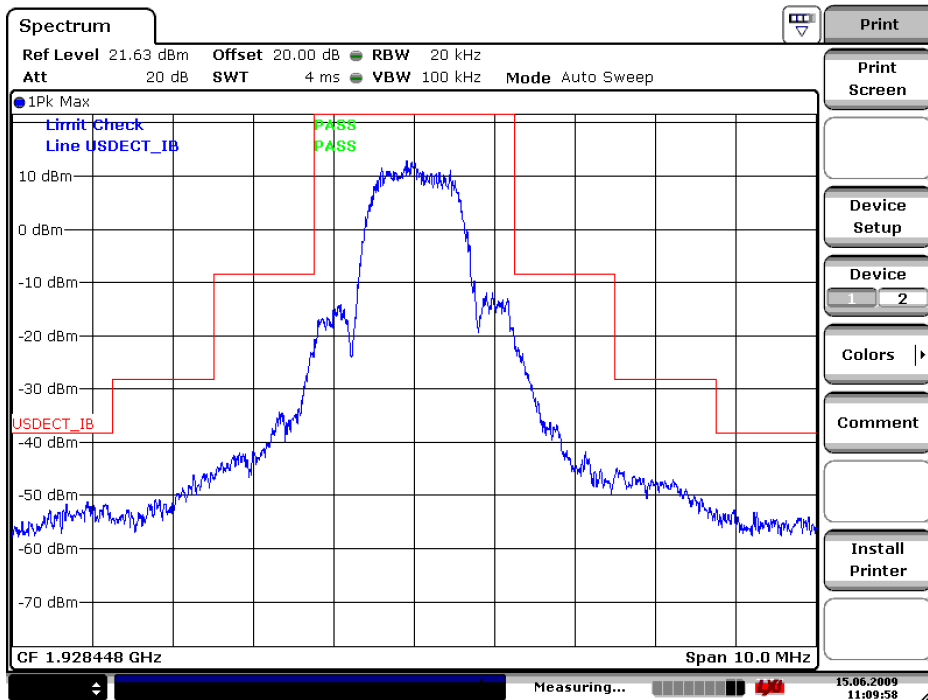
Requirement: FCC 15.323(d)

$B < f_2 \leq B$:	less than or equal to 30 dB below max. permitted peak power level
$2B < f_2 \leq 3B$:	less than or equal to 50 dB below max. permitted peak power level
$3B < f_2 \leq \text{UPCS Band Edge}$:	less than or equal to 60 dB below max. permitted peak power level

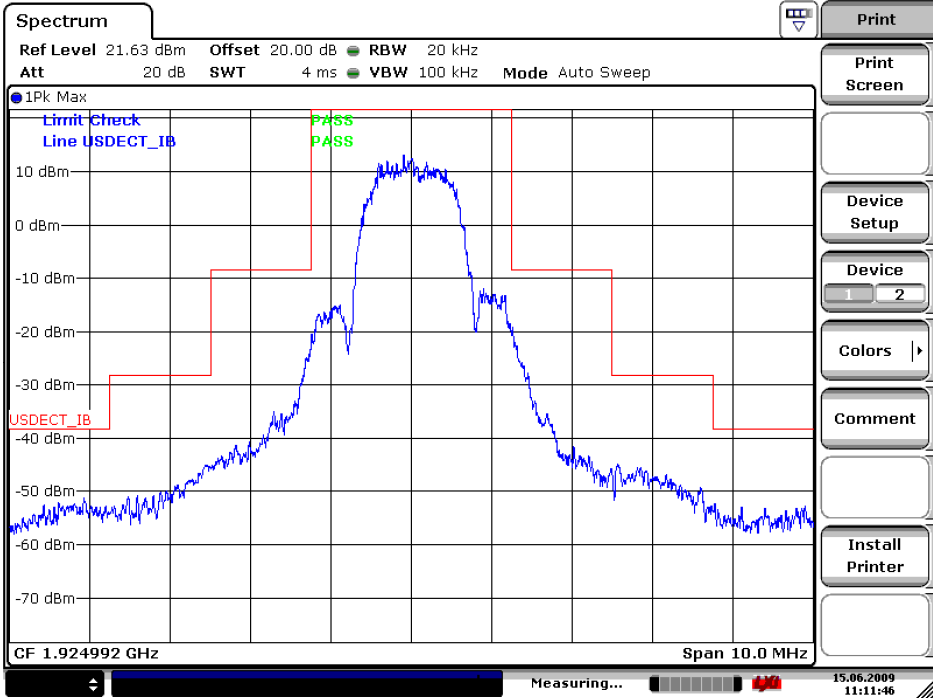
In-Band Unwanted Emissions, Conducted



Lower Channel



Upper Channel



Middle Channel

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

5.12 Out-of-Band Emissions, Conducted

Measurement Procedure:

ANSI C63.17, clause 6.1.6.2.

Test Results: Pass

Measurement Data:

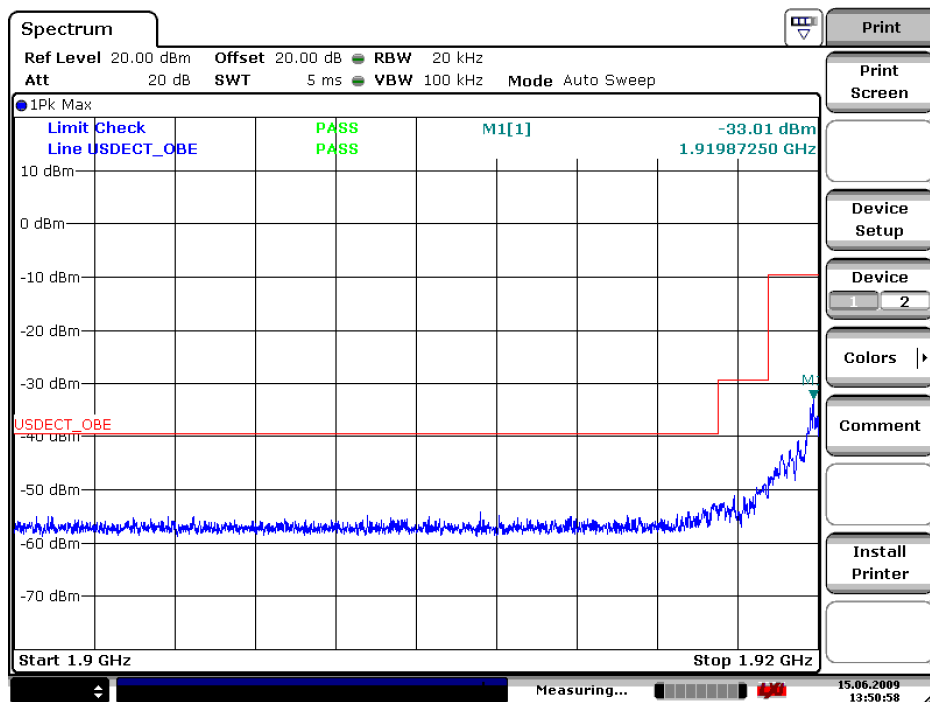
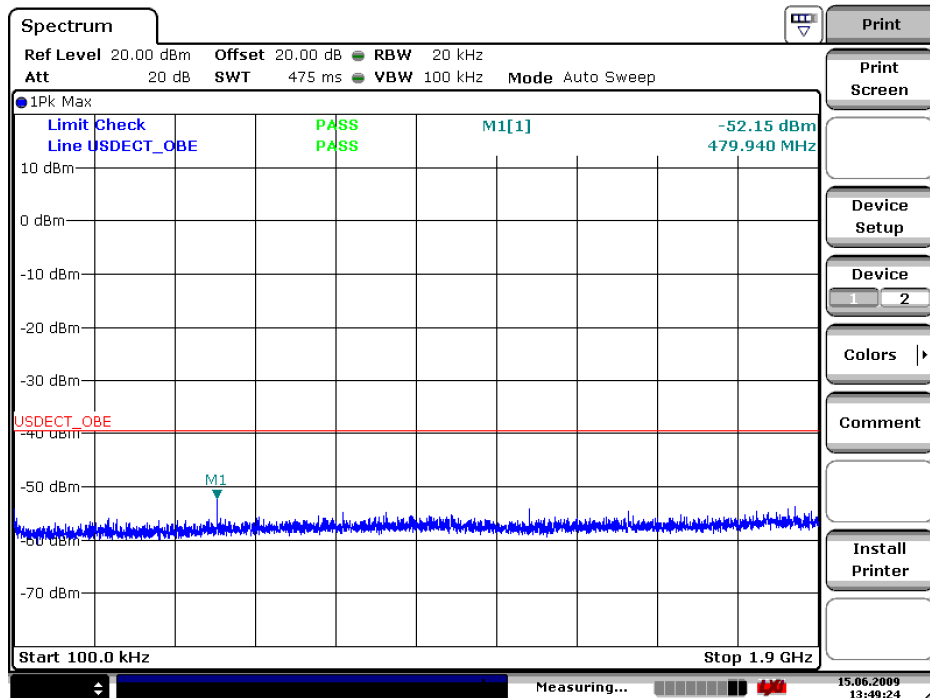
See plots.

Requirement: FCC 15.323(d)

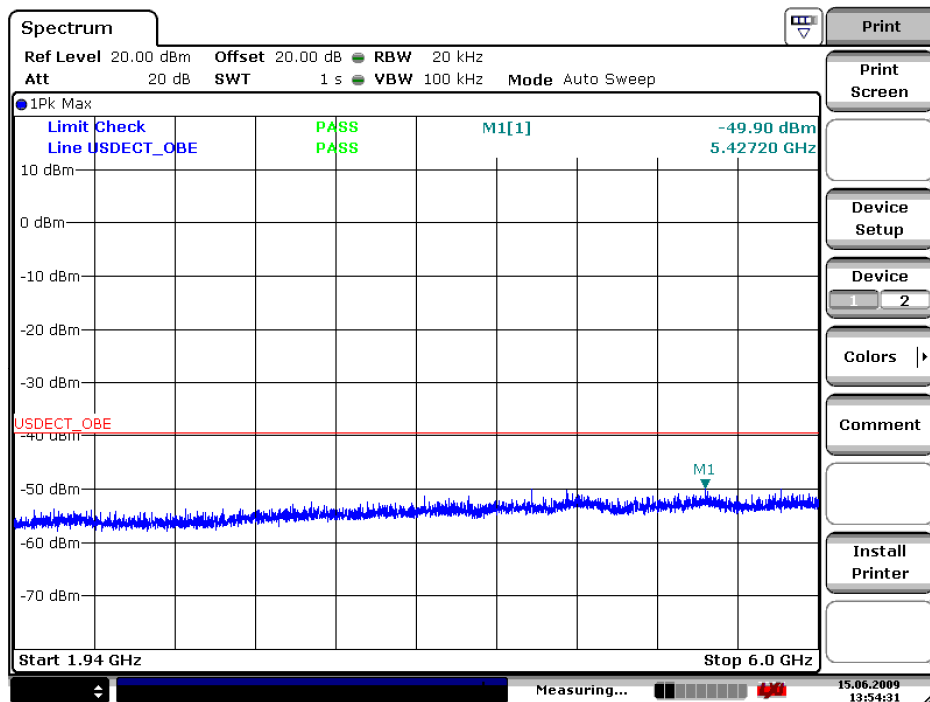
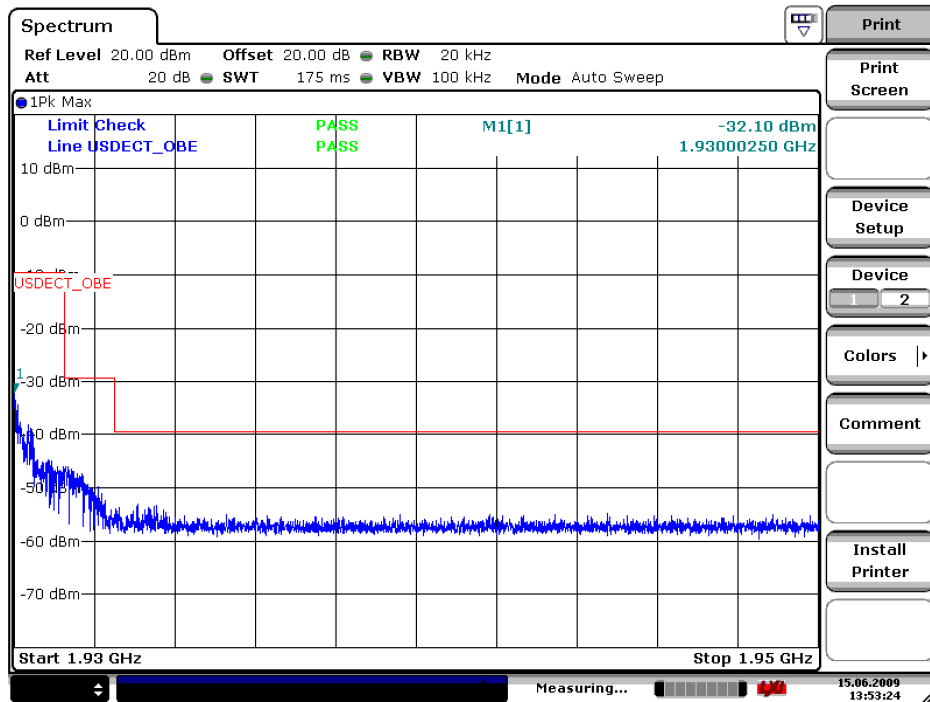
$f \leq 1.25$ MHz outside UPCS band:	≤ -9.5 dBm
1.25 MHz $\leq f \leq 2.5$ MHz outside UPCS band:	≤ -29.5 dBm
$f \geq 2.5$ MHz outside UPCS band:	≤ -39.5 dBm

Out-of-Band Unwanted Emissions, Conducted

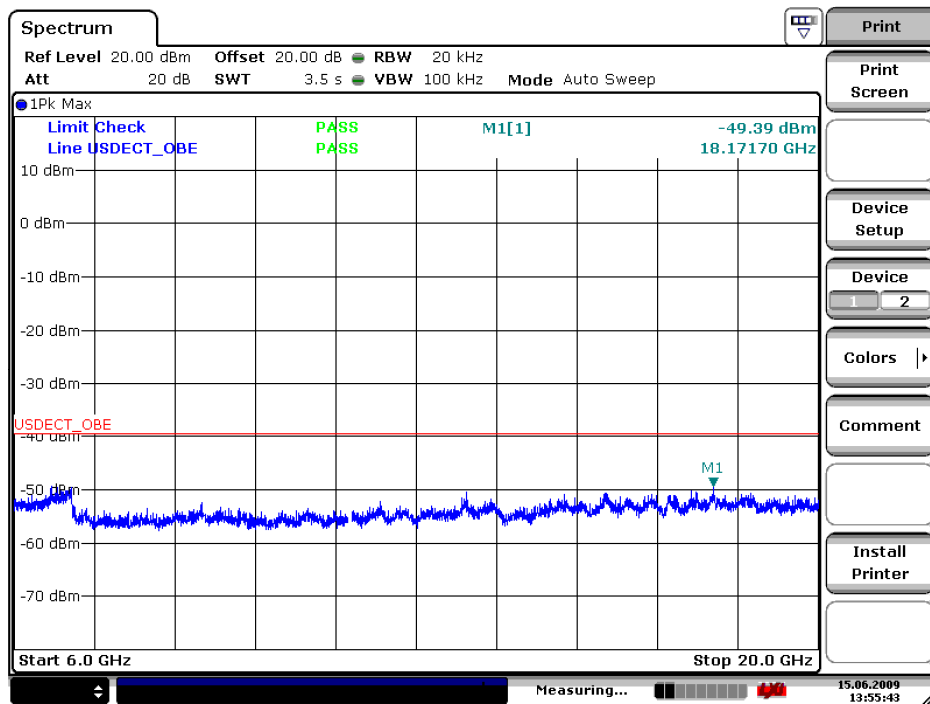
Lower and Upper Channel:



Out-of-Band Unwanted Emissions, Conducted



Out-of-Band Unwanted Emissions, Conducted



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

5.13 Carrier Frequency Stability

Measurement Procedure:

ANSI C63.17, clause 6.2.1.

Test Results: Pass

Measurement Data:

The Frequency Stability is measured with the CMD65. The CMD65 was logged by a computer programmed to get the new readings as fast as possible (about 3 readings per second) over the noted time period or 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 also with the CMD65.

Carrier Frequency Stability over Time at Nominal Temperature

Average Mean Carrier Frequency (MHz)	Max. Diff. (kHz)	Min. Diff. (kHz)	Max Dev. (ppm)	Limit (ppm)
1925.008081	+21.13	+11.02	+2.63	±10

Deviation ppm = ((Max.Diff. – Mean.Diff.) / Mean Carrier Freq.) x 10⁶

Deviation (ppm) is calculated from 3000 readings with the CMD65.

Carrier Frequency Stability over Power Supply at Nominal Temperature

Voltage	Measured Carrier Frequency (MHz)	Difference (kHz)	Deviation (ppm)	Limit (ppm)
Vnom	/	/	/	±10
85 % Vnom	/	/	/	
115 % Vnom	/	/	/	

Deviation ppm = ((Mean – Measured frequency) / Mean) x 10⁶

Carrier Frequency Stability over Temperature

Temperature	Measured Carrier Frequency (MHz)	Difference (kHz)	Deviation (ppm)	Limit (ppm)
T = +20°C	1925.028	Ref.	Ref.	±10
T = 0°C	1925.036	+8.0	+4.2	
T = +40°C	1925.020	-8.0	-4.2	

Deviation ppm = ((Mean – Measured frequency) / Mean) x 10⁶

5.14 Frame Repetition Stability

Measurement Procedure:

ANSI C63.17, clause 6.2.2.

Test Results: Pass

Measurement Data:

The Frame Repetition Stability is measured with the CMD65. The Frame Repetition Stability is 3 times the standard deviation.

Carrier Frequency (MHz)	Mean (Hz)	Standard Deviation (ppm)	Frame Repetition Stability (ppm)
1924.992	99.999999904	0.84	2.51

Limit:

Frame Repetition Stability	±10 ppm (TDMA)
----------------------------	----------------

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

5.15 Frame Period and Jitter

Measurement Procedure:

ANSI C63.17, clause 6.2.3.

Test Results: Pass

Measurement Data:

The Frame Repetition Stability is measured with the CMD65

Carrier Frequency (MHz)	Frame Period (ms)	Max Jitter (µs)	3xStandard Deviation of Jitter (µs)
1924.992	10.000	0.812	0.295

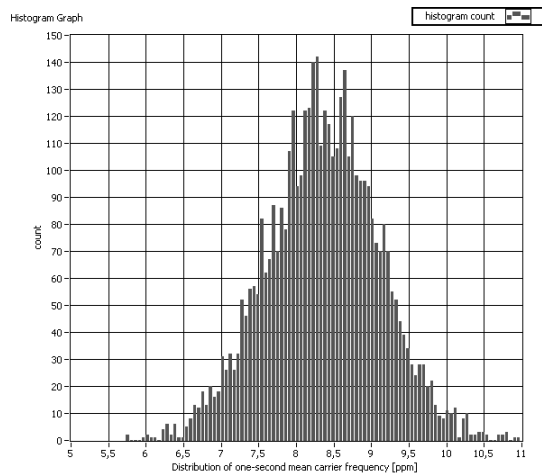
Max Jitter = $(1/(\text{Frame Period} + \text{Pk-Pk})/2) - (1/\text{Frame Period})$, when Pk-Pk and Frame Period are in Hz.

$3x\text{St.Dev. Jitter} = 3x(1/(\text{Frame Period} + \text{St.Dev})) - (1/\text{St.Dev}) \times 10^6$

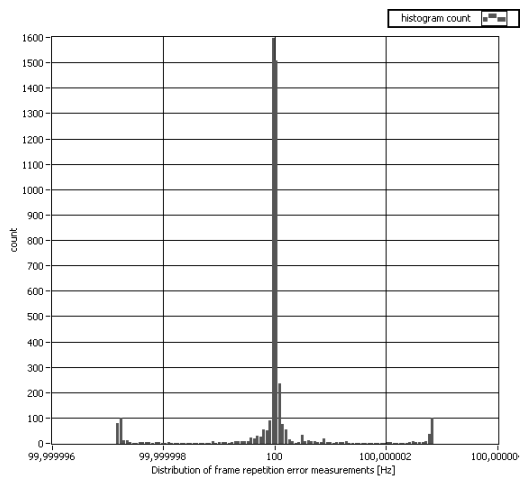
Limit:

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

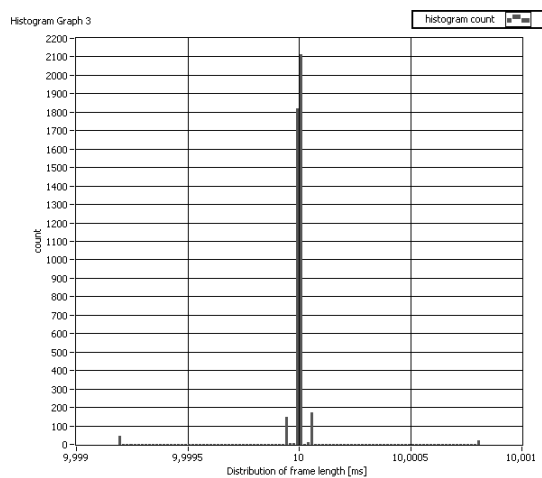
Ref. FCC 15.323(e). ANSI C63.17, clause 6.2.3.



Histogram of Carrier Frequency Stability



Histogram of Frame Repetition Stability



Histogram of Frame Period and Jitter

5.16 Monitoring Threshold, Least Interfered Channel

Monitoring Threshold limits:

Lower Threshold:

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

Upper Threshold:

$$T_U = 15 \log B - 184 + 50 - P_{EUT} \quad (\text{dBm})$$

B is measured Emission Bandwidth in Hz

P_{EUT} is measured Transmitter Power in dBm

Calculated values:

Lower Threshold	-79.0 dBm
Upper Threshold	-59.0 dBm

The Lower Threshold is applicable for systems which have defined less than 40 duplex system access channels. The Upper Threshold is applicable for systems with more than 40 duplex systems access channels and that implements the Least Interfered Channel Procedure (LIC).

Measurement Procedure:

The Upper Threshold is found by the procedure defined in ANSI C63.17 clause 7.3.1 or 7.3.2.

Least Interfered Channel Procedure NOT used:	
Lower Threshold	N/A
Least Interfered Channel Procedure used:	
Upper Threshold	-56.3 dBm

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

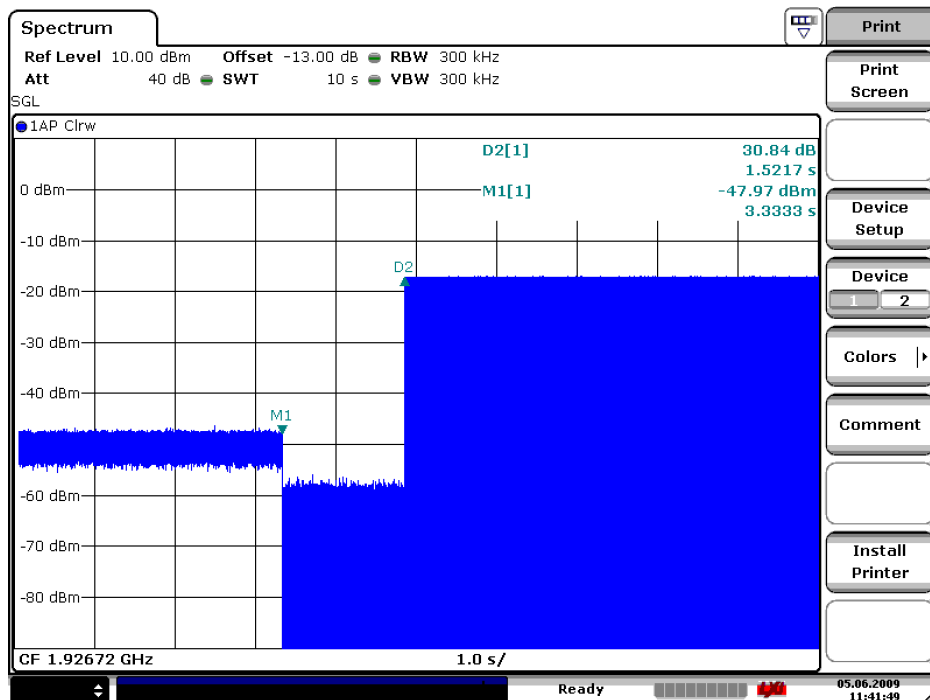
ANSI C63.17 clause 7.3.3 ref.	Observation	Verdict
b) $f_1 T_L + 13 \text{ dB}, f_2 T_L + 6 \text{ dB}$	Transmission always on f_2	Pass
c) $f_1 T_L + 6 \text{ dB}, f_2 T_L + 13 \text{ dB}$	Transmission always on f_1	Pass
d) $f_1 T_L + 7 \text{ dB}, f_2 T_L$	Transmission always on f_2	Pass
e) $f_1 T_L, f_2 \text{ at } T_L + 7 \text{ dB}$	Transmission always on f_1	Pass

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

ANSI C63.17 clause 7.3.4 ref.	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:

Lower Threshold + 6 dB margin	-73.0 dBm
Upper Threshold + 6 dB margin	-53.0 dBm



7.3.4 Selected Channel Confirmation, connection 1.5 s after interferer removed

5.17 Threshold Monitoring Bandwidth

This test is only required if a dedicated monitoring receiver is used. If the test is not carried out the manufacturer shall declare and provide 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	No transmissions	Pass
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 -6dB and -12 dB points if the Simple Compliance Test fails.

Comment: The Simple Compliance Test was performed with the level $T_U + U_M + 10$ dB to check that the EUT did not transmit at all.

The tested EUT uses the same receiver for monitoring and communication, this test is therefore not required. However the test was performed nonetheless and the test is passed.

Limits: FCC 15.323(c)(7):

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

5.18 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 a single carrier frequency.

Time-synchronized pulsed interference was then applied on the carrier at pulsed levels TU + UM to check that the EUT does not transmit. The level was raised 6 dB for part d) with 35 μ s pulses.

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

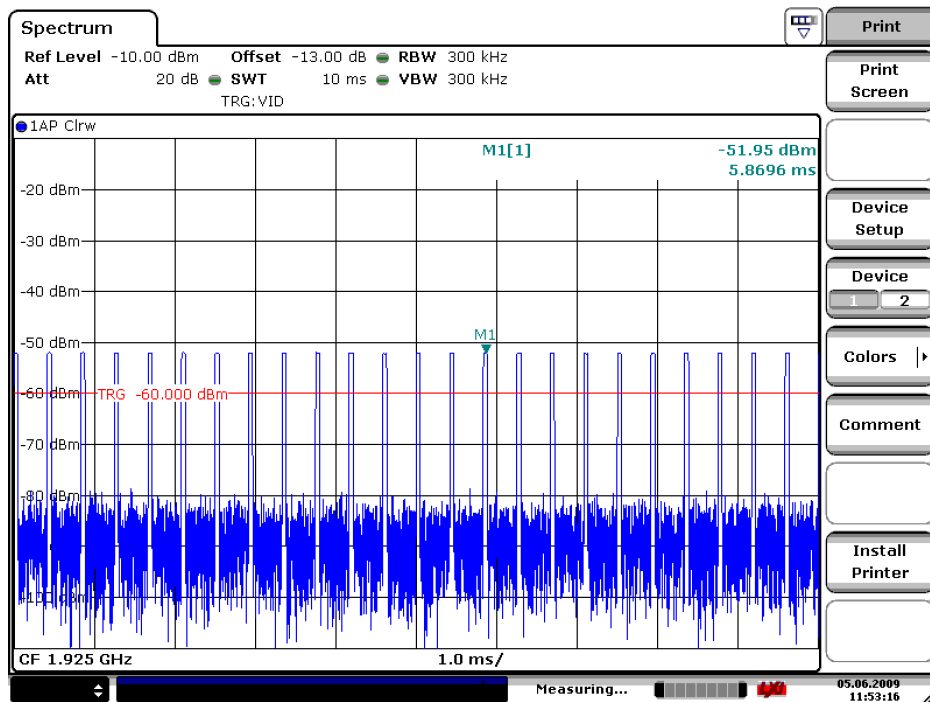
Pulse Width, ref. to ANSI C63.17 clause 7.5	Observation	Verdict
c) > largest of 50 μ s and $50 \cdot \text{SQRT}(1.25/B)$	No transmissions	Pass
d) > largest of 35 μ s and $35 \cdot \text{SQRT}(1.25/B)$ and with interference level raised 6 dB	No transmissions	Pass

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

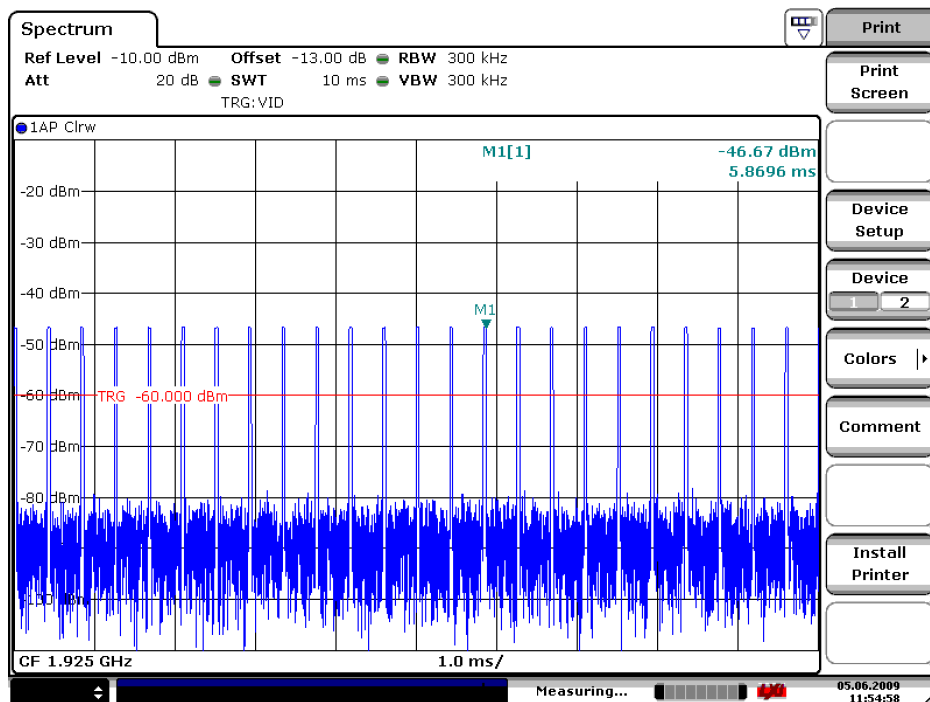
Limits: FCC 15.323(c)(1), (5) and (7)

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 microseconds.

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 microseconds.



50 μ s Pulses



35 μ s Pulses

5.19 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 signaling 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 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 interference free time slot when interference is introduced on the time slot in use	N/A	N/A

If FCC 15.323(c)(6) option 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 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 acknowledgement, at which the time 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.

5.20 Acknowledgements and Transmission duration

Measurement Procedure:

Acknowledgments: ANSI C63.17, clause 8.2.1

Transmission Duration: ANSI C63.17, clause 8.2.2

During the test **Initial transmission without acknowledgments** 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 acknowledgments** is performed by cutting-off the signal from the companion device by a RF switch 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:

Acknowledgments

Test ref. to ANSI C63.17 clause 8.2.1	Observation	Verdict
a) Initial transmission without acknowledgments	0.7s	Pass
c) Transmission time after loss of acknowledgments	5.1s	Pass

Transmission Duration

Test ref. to ANSI C63.17 clause 8.2.2	Observation	Verdict
b) Transmission duration on same time and frequency window	30min	Pass

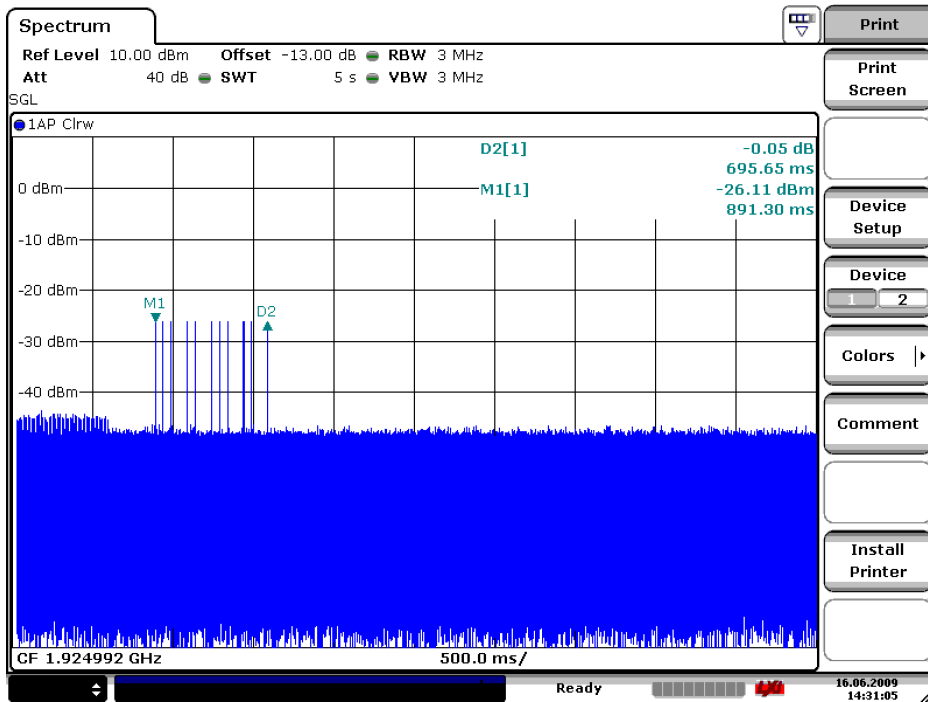
Comment: /

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

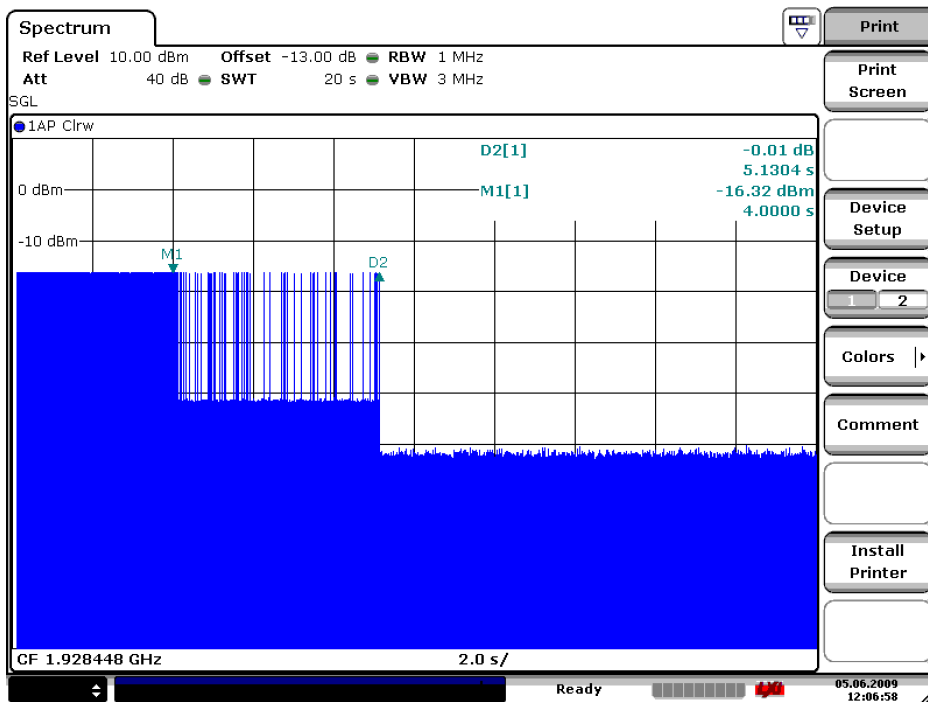
Occupation of the same combined time and spectrum windows by a device or group of cooperating devices continuously over a period of time longer than 8 hours is not permitted without repeating the access criteria.

Once access to specific combined time and spectrum windows is obtained an 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 acknowledgement, at which the time access criteria must be repeated.



8.2.1a) Initial Transmission Time without Acknowledgments



8.2.1c) Transmission Time after Loss of Acknowledgments

5.21 Dual Access Criteria Check

Measurement Procedure:

EUTs that do not implement the Upper Threshold: ANSI C62.17, clause 8.3.1

EUTs that implement the Upper Threshold: ANSI C62.17, 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 implement the Upper Threshold:

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 the EUT can set up a communication link.	N/A	N/A
c) d) No transmission on interference-free receive time/spectrum window. All transmit slots blocked	N/A	N/A
e) f) No transmission on interference-free transmit time/spectrum window. All transmit slots blocked	N/A	N/A

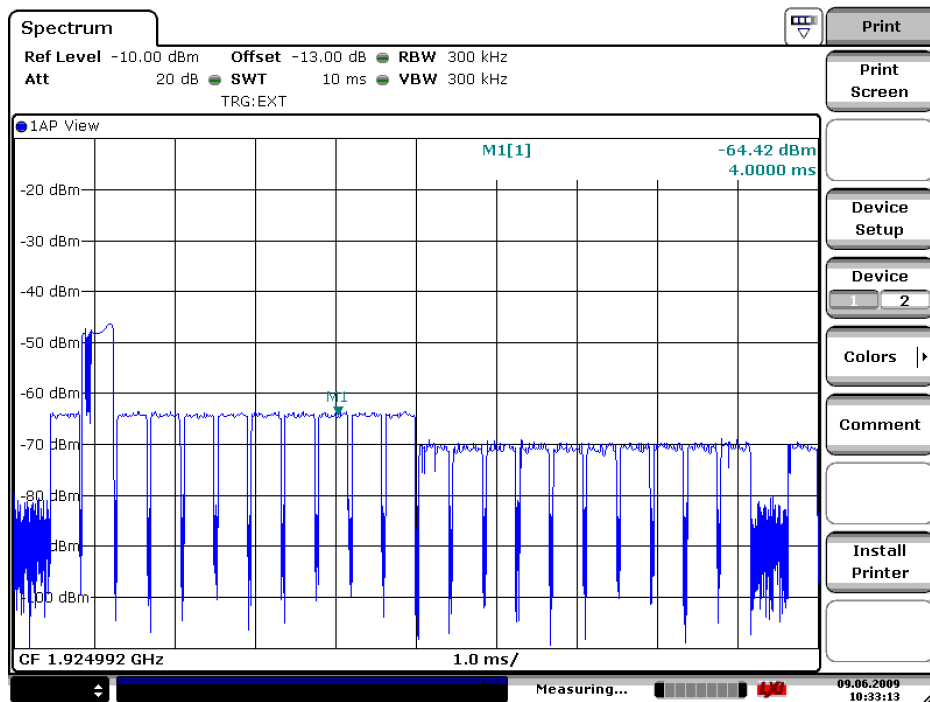
EUTs that implement the Upper Threshold:

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 the EUT can set up a communication link.	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
g) Transmission not possible on any time/spectrum window.	No connection possible	Pass

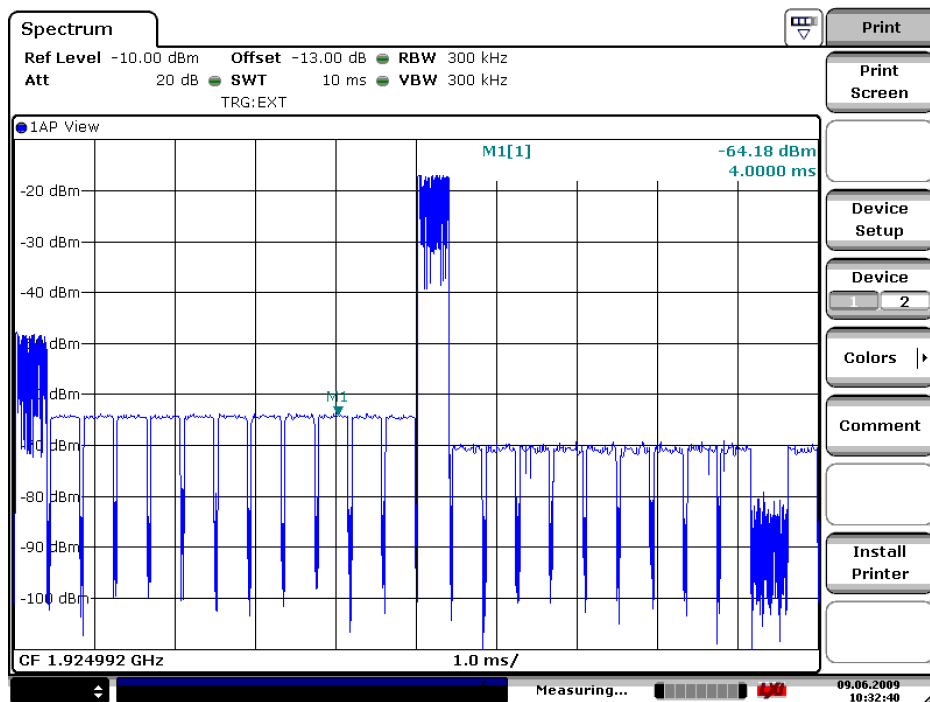
Comment: See plots.

Limits: FCC 15.323(c)(10)

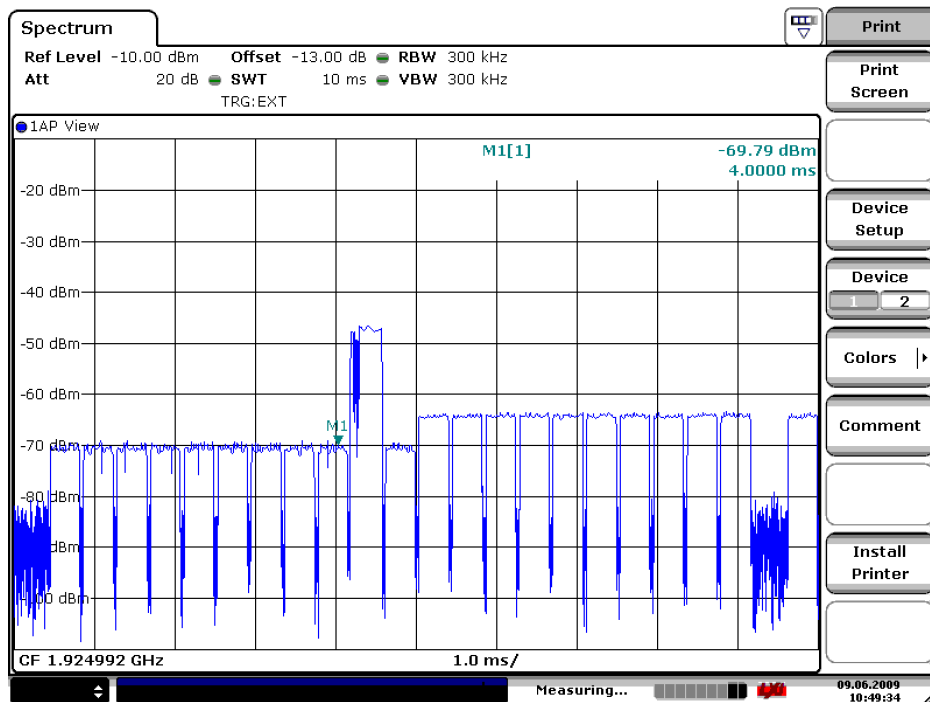
An initiating device may attempt to establish a duplex connection by monitoring both, its intended transmit and receive time and spectrum windows. If both the intended transmit and receive time and spectrum windows meet the access criteria, then the initiating device can initiate a transmission in the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



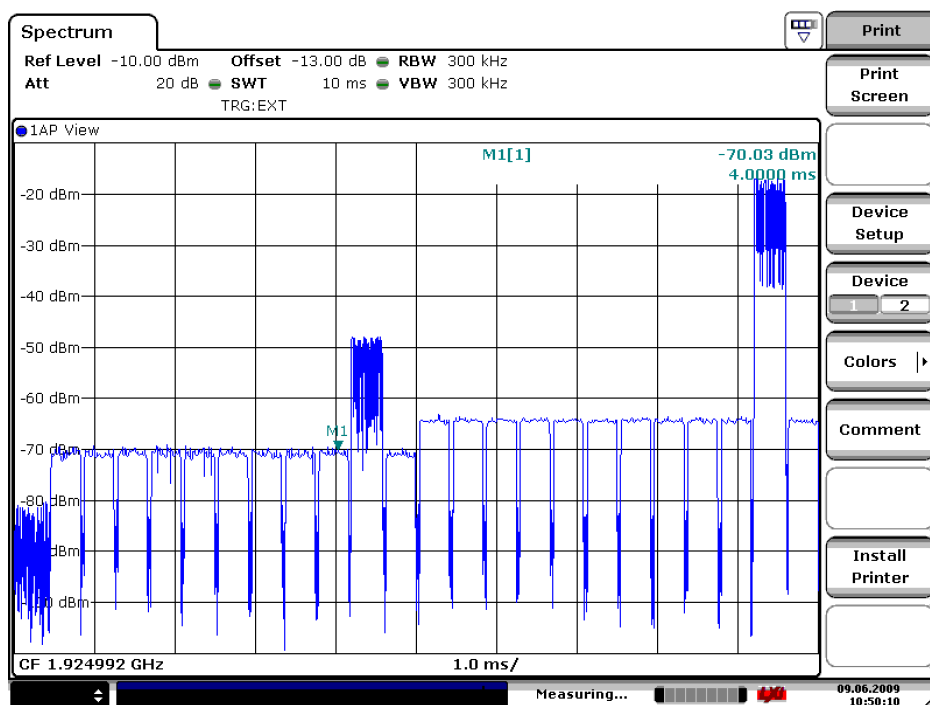
8.3.2c) EUT Transmits on Interference Free RECEIVE Slot, BEFORE



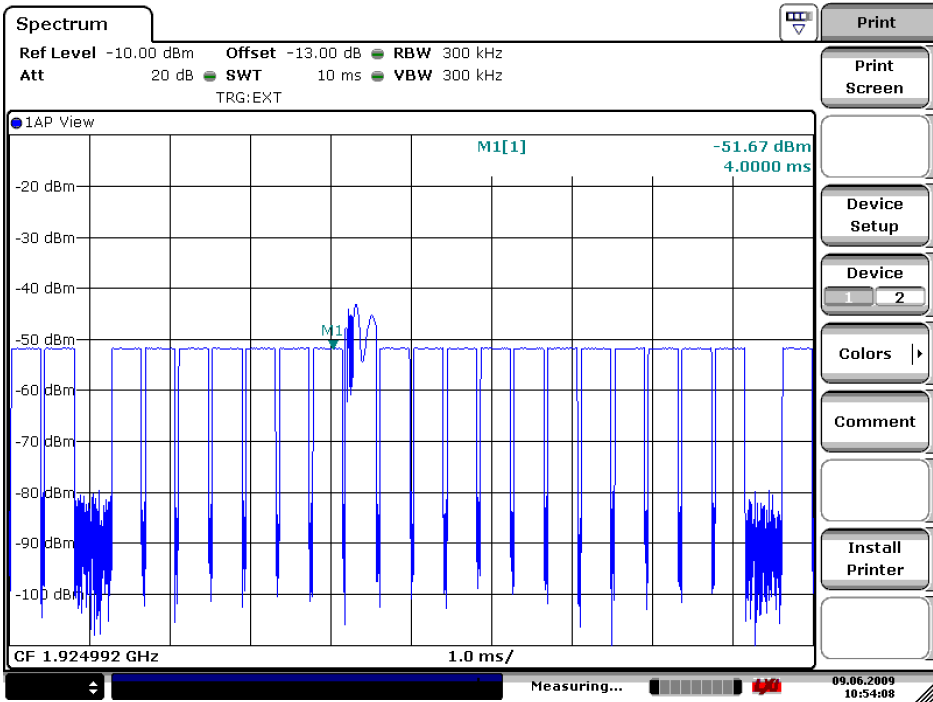
8.3.2c) EUT Transmits on Interference Free RECEIVE Slot, AFTER



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



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



8.3.2g) No Connection

5.22 Alternative monitoring interval

Test procedure described in ANSI C63.17, clause 8.4.

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

Test Result:

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

5.23 Spurious Emissions (Radiated)

Measurement Procedure:

FCC 15.209, FCC 15.109

Test Result:

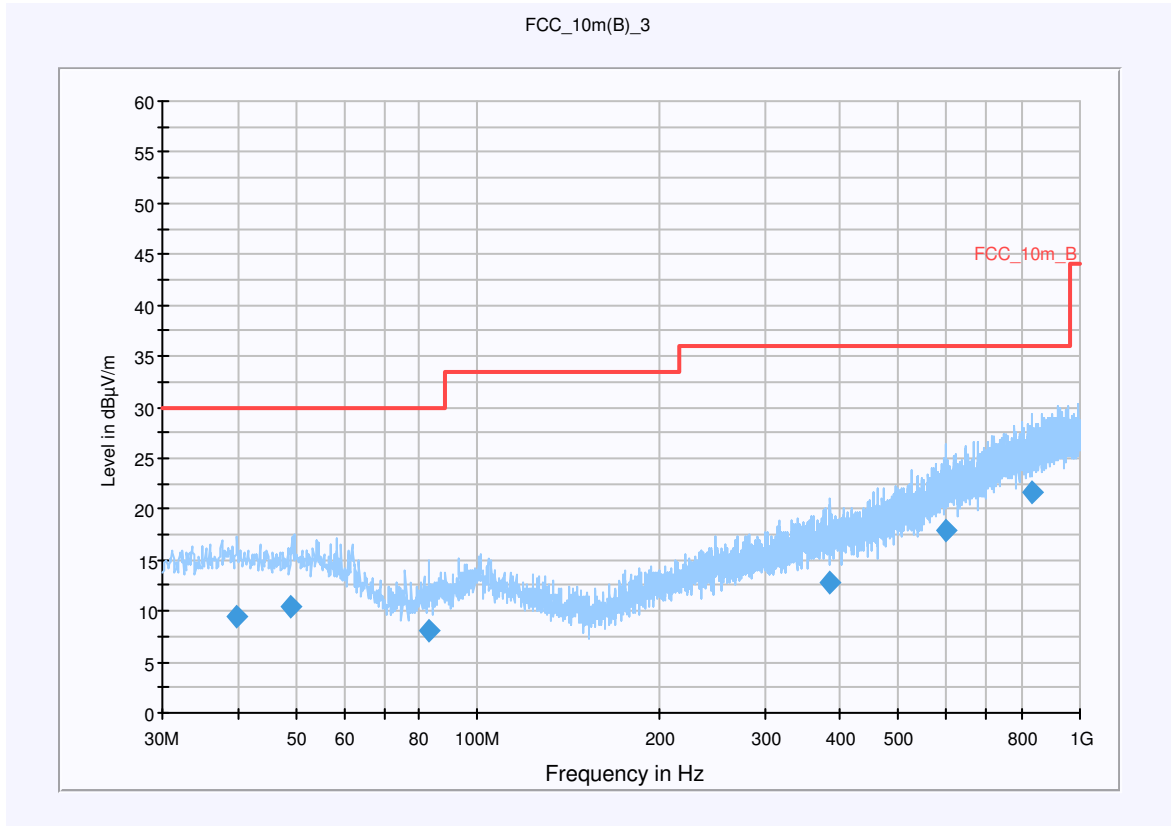
Tests for intentional radiators according to FCC 15.209 are not required when Out-of-Band Emission was tested conducted with a pass result.

Measurement Data:

See plots.

Requirement: FCC 15.109(b)

30 – 88 MHz:	90 μ V/m
88 – 216 MHz:	150 μ V/m
216 – 960 MHz:	210 μ V/m
960 – 1000 MHz:	300 μ V/m



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
39.807050	9.5	15000.000	120.000	155.0	V	24.0	13.6	20.5	30.0	
48.888850	10.4	15000.000	120.000	98.0	V	49.0	13.5	19.6	30.0	
83.041600	8.1	15000.000	120.000	185.0	V	137.0	9.9	21.9	30.0	
385.434300	12.8	15000.000	120.000	172.0	V	133.0	17.1	23.2	36.0	
598.849350	18.0	15000.000	120.000	220.0	V	144.0	21.4	18.0	36.0	
830.152500	21.7	15000.000	120.000	98.0	H	246.0	24.8	14.3	36.0	

The radiated spurious emission of the unintentional radiator is below the indicated limit.

5.24 Receiver Spurious Emissions

Measurement Procedure:

Industry Canada RSS-213 paragraph 6.8 and RSS-GEN paragraphs 4.8 and 6.

Test results:

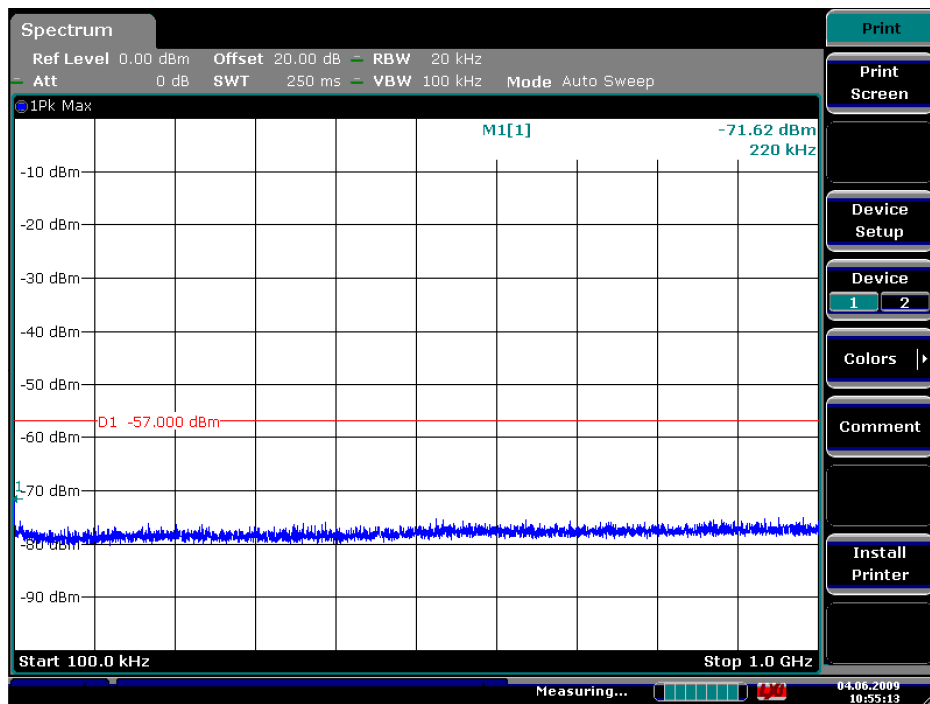
Frequency MHz	Carrier No.	Measured Value Conducted dBm	Conducted Limit dBm	Margin dB
30 - 1000	all	-71.6	-57	14.6
> 1000	all	-68.8	-53	15.8

Requirements: RSS-GEN Issue 2, clause 6

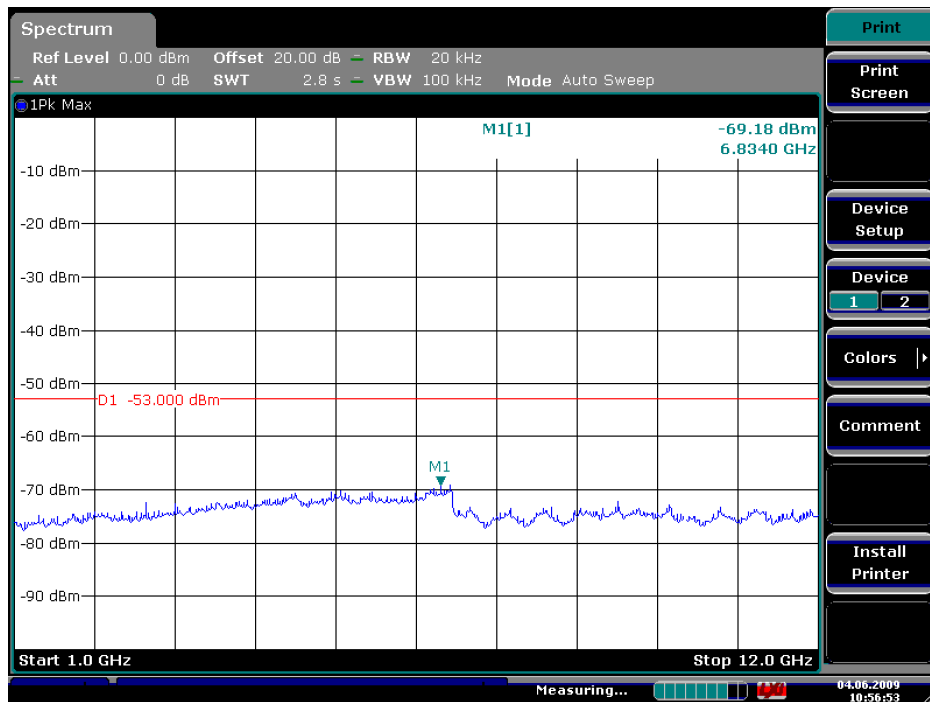
The measurement can be performed either radiated or conducted.

When measured conducted: No spurious signals appearing at the antenna terminals shall exceed 2 nW per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nW above 1 GHz.

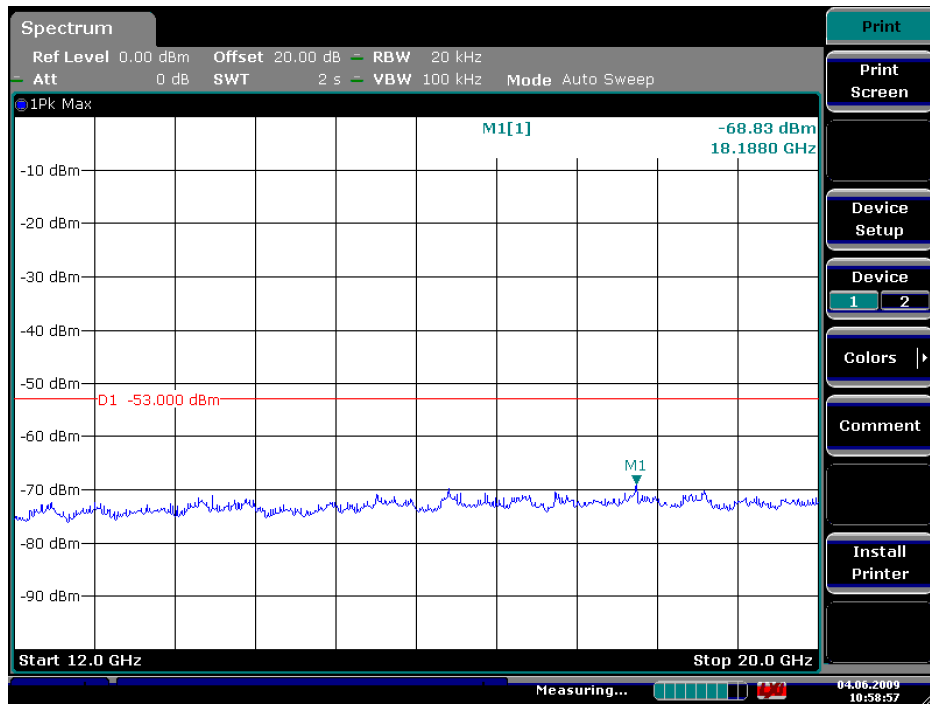
When measured radiated: See table 1 in RSS-GEN Issue2, clause 6.



Receiver Spurious Emissions, Conducted, 100 kHz – 1 GHz



Receiver Spurious Emissions, Conducted, 1 GHz – 12 GHz

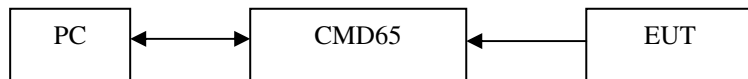


Receiver Spurious Emissions, Conducted, 12 GHz – 20 GHz

6 Test Setups

6.1 Frequency Measurements

Test Set-up 1:

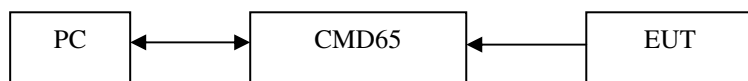


This setup is used for measuring Carrier Frequency Stability at nominal and extreme temperatures.

For long term Frequency Stability, the EUT was in loopback-mode and was controlled with the CMD65, the modulation pattern was set to 01010101....

6.2 Timing Measurements

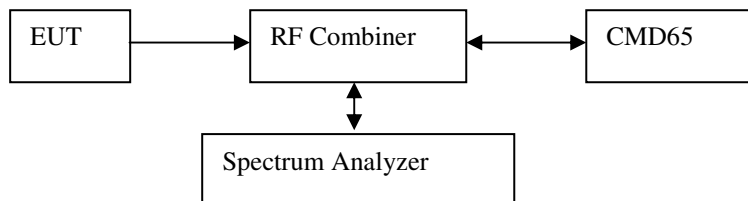
Test Set-up 2:



This setup is used for measuring Frame Repetition Stability, Frame Period and Jitter.

6.3 Conducted Emission Test

Test Set-up 3:



This setup is used for all conducted emission tests.

The EUT was in loopback-mode and was controlled with the CMD65, the modulation pattern was set to Pseudo-Random bit sequence to simulate normal speech.

6.4 Radiated Emission Test

Test Set-up 4:

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 20 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform with specifications ANSI C63.2-1987 clause 15 and ANSI C63.4-2003 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63-4-2003 clause 4.2.

Antennas are conform with ANSI C63.2-1996 item 15.

9 kHz - 150 MHz: Quasi Peak measurement, 200 Hz Bandwidth, passive loop antenna.

150 kHz - 30 MHz: Quasi Peak measurement, 9 kHz Bandwidth, passive loop antenna.

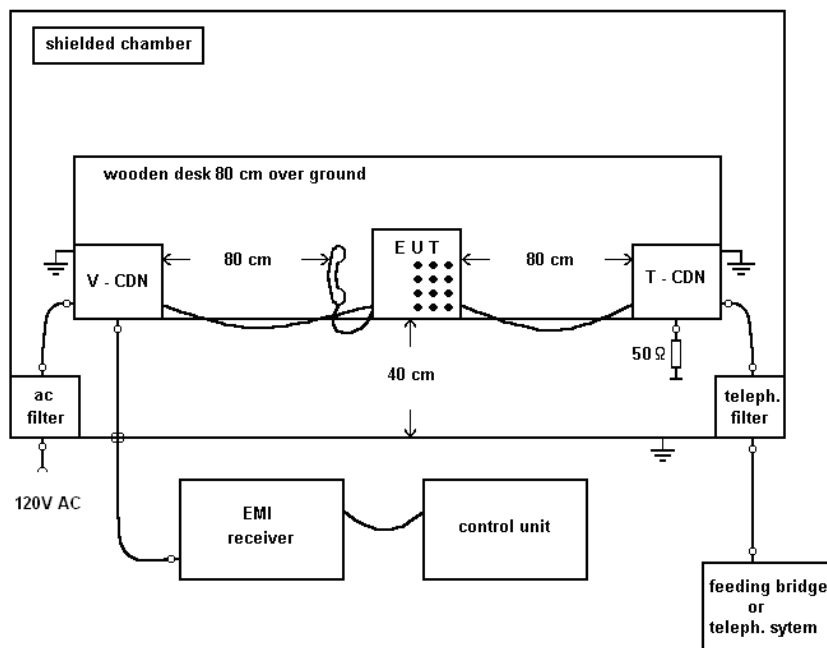
30 MHz - 200 MHz: Quasi Peak measurement, 120 KHz Bandwidth, bilog antenna

200MHz - 1GHz: Quasi Peak measurement, 120 KHz Bandwidth, bilog antenna

1GHz: Average, RBW 1MHz, VBW 10 MHz, waveguide horn

6.5 Power Line Conducted Emissions Test

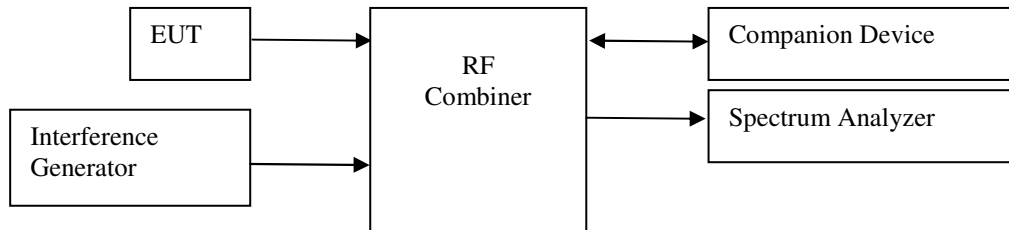
Test Set-up 5:



principle set up: conducted emission at ac power line

6.6 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 generator to the EUT is measured with a power meter before the testing is started.

A clock signal is used to synchronize the Interference 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 clock signal will come from the Companion Device.

7 Used Test Equipment

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
<u>Radiated Emission</u>					
F-1	Control Computer	F+W		FW0502032	300003303
F-2	Trilog antenna	Schwarzbeck	VULB 9163	9163-295	---
F-3a	Amplifier	Veritech Microwave Inc.	0518C-138	- / -	- / -
F-4b	Switch	HP	3488A	- / -	300000368
F-5	EMI Test receiver	R&S	ESCI	100083	300003312
F-6	Turntable Controller	EMCO	1061 3M	1218	300000661
F-7	Tower Controller	EMCO	1051 Controller	1262	300000625
F-8	Tower	EMCO	1051 Tower	1262	300000625
F-9	EMI Test receiver	R&S	ESU	- / -	300003555
<u>Power Line Conducted Emission</u>					
I-1	Spectrum Analyzer	Agilent	E4440A	MY48250080	300003812
I-2	RF Preselector	Agilent	N9039A	MY48260003	300003825
I-3	Signal Generator	Agilent	N5183A	MY47420220	300003813
I-4	Relay Matrix	R&S	PSU	890167/024	300001168
I-5	Computer	Medion	- / -	- / -	300002898
I-6	Software	ETC Lindgren	Tile!	- / -	- / -
I-7	AC power supply	Grundig	RT 5A	- / -	300001263
I-8	Two Line V-Network	R&S	ESH3-Z5	- / -	300001210
<u>Conducted</u>					
1	Spectrum Analyzer	R&S	FSV30	100763	- / -
2	Signal Generator	R&S	SMU200A	101633	300003496
3	Oscilloscope	Tektronix	DPO 7254	B022702	300003573
4	Oscilloscope	Tektronix	DPO 4034	C020330	300003740
5	Counter	Philips	PM 6654C	316568/002	- / -
6	Signaling Unit	R&S	CMD 65	825486/005	300000103
7	Combiner	R&S	1025.3400.02	- / -	- / -
80	Combiner	Suhner	4901.19A	- / -	- / -
9	Combiner	Weinschel	1515	KW438	- / -
10	Step Attenuator	R&S	DPSP	860898/005	- / -
11	Detector	Hewlett Packard	HP 8473C	03690	- / -
12	Attenuator	Narda	4779-50	9101	- / -
13	Attenuator	Narda	4779-30	9305	- / -
14	Attenuator	Narda	4779-20	9310	- / -
15	Control PC	F+W	/	FW0712052	300003735

8 Photographs of the Test Set-up

Photo 1: Power Line Conducted Emission Test

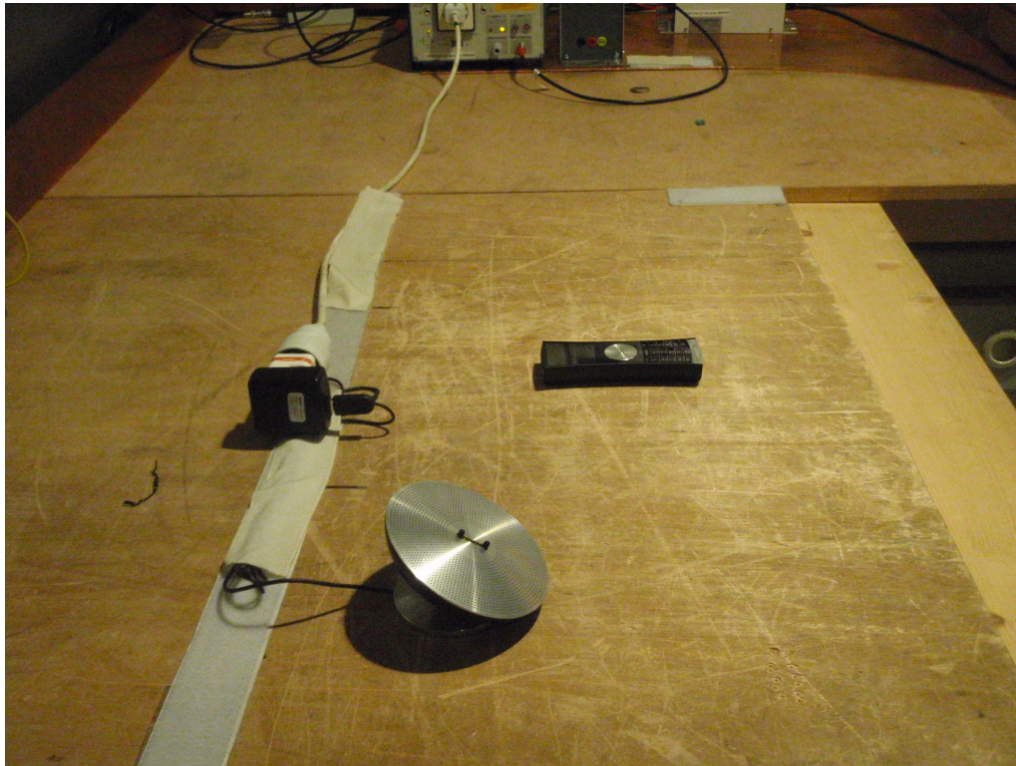


Photo 2: Power Line Conducted Emission Test

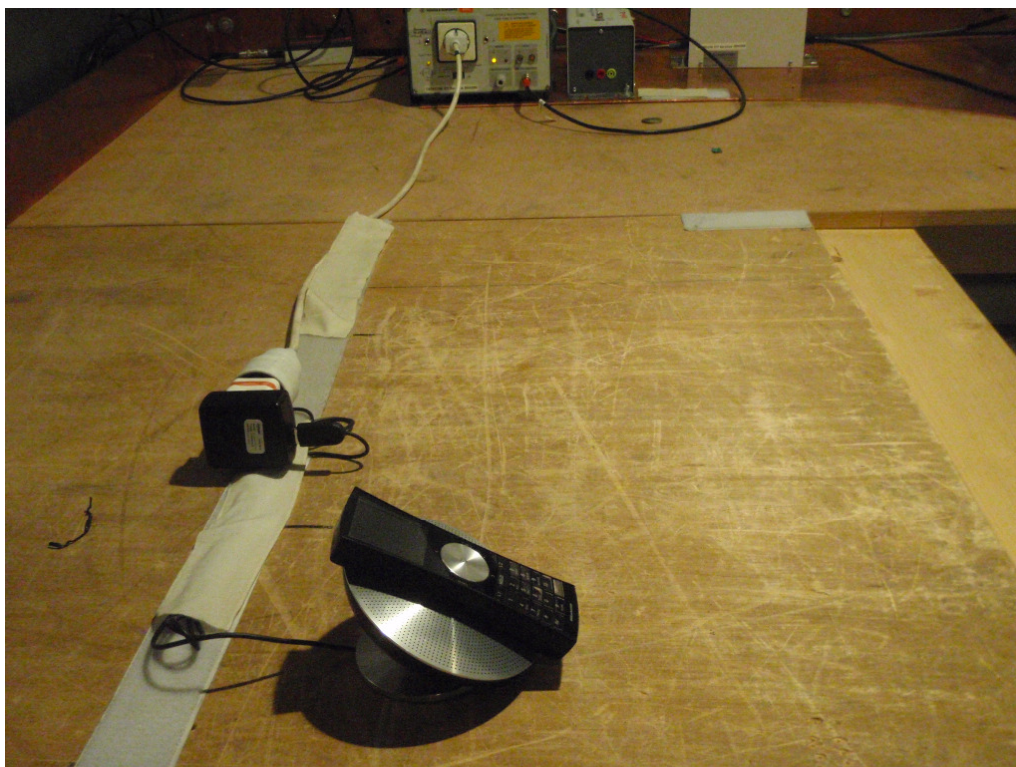
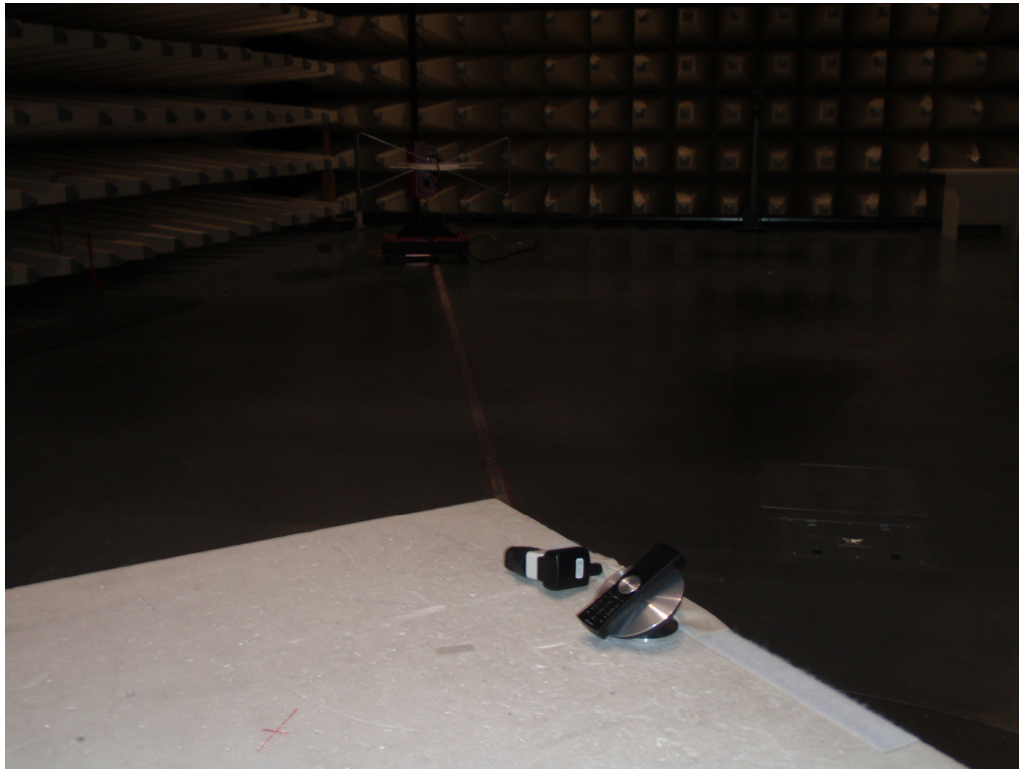


Photo 3: Radiated Emission



9 Photographs of the EUT

Photo 1:



Photo 2:



Photo 3:

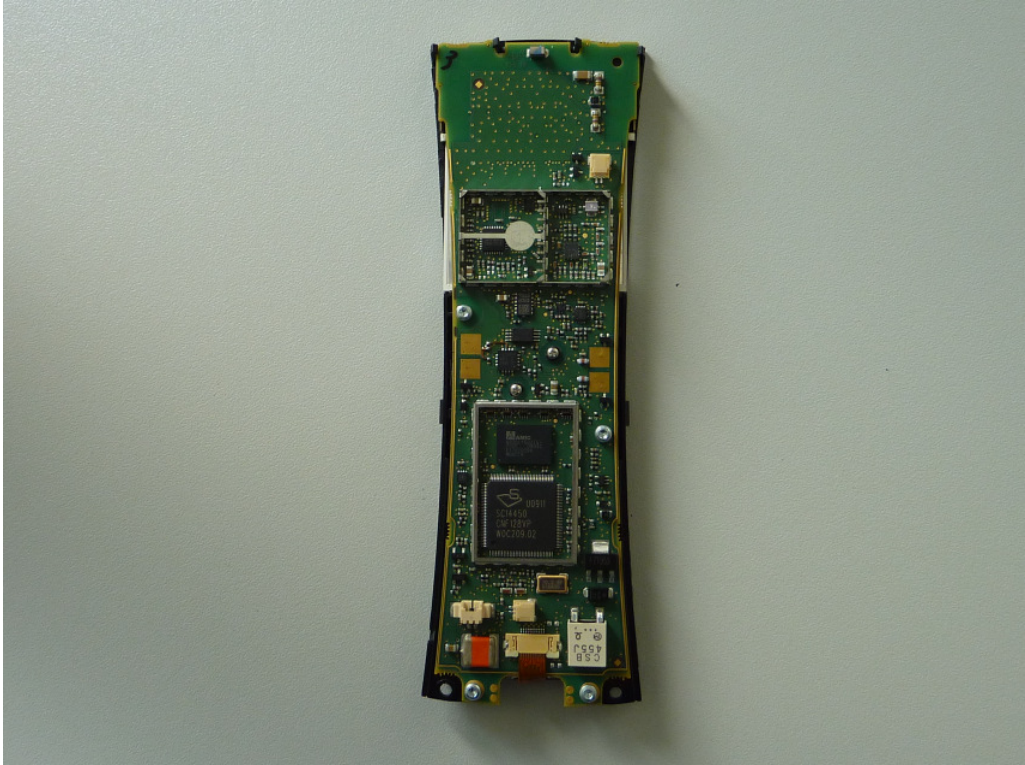


Photo 4:

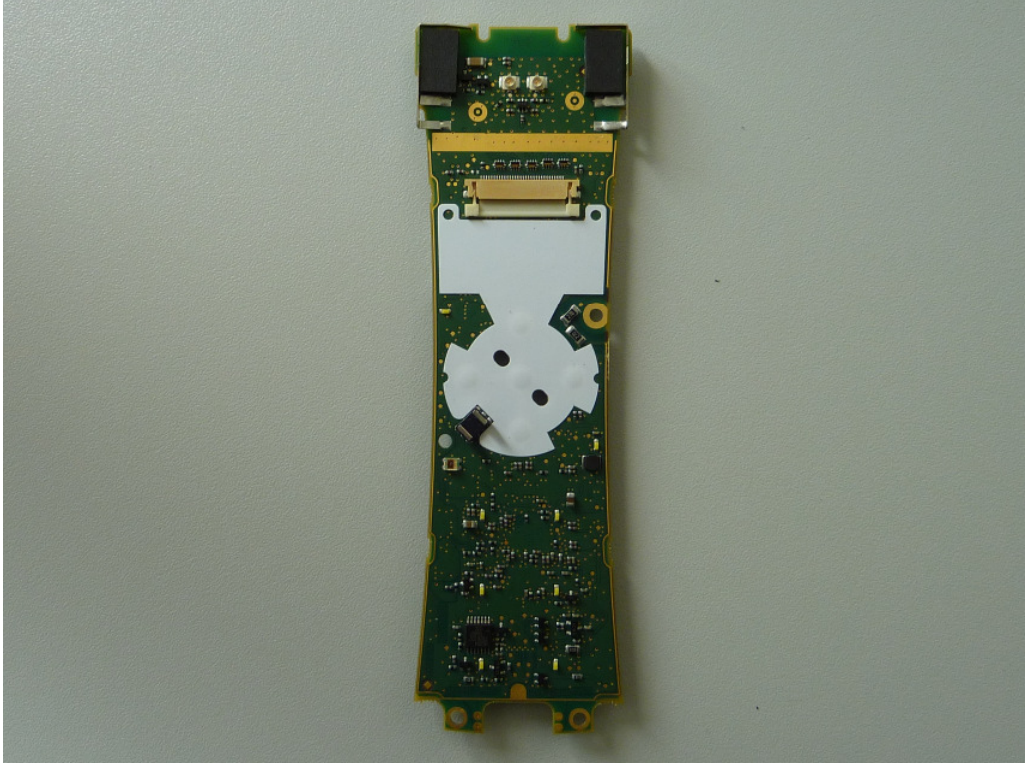


Photo 5:

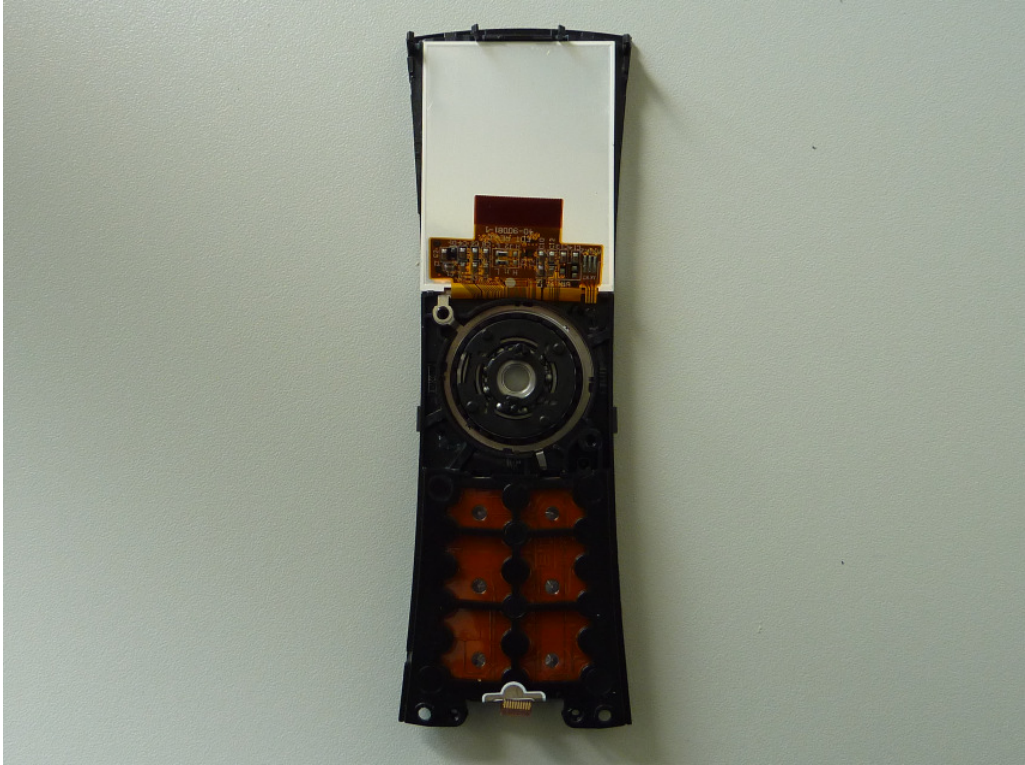


Photo 6:



Photo 7:

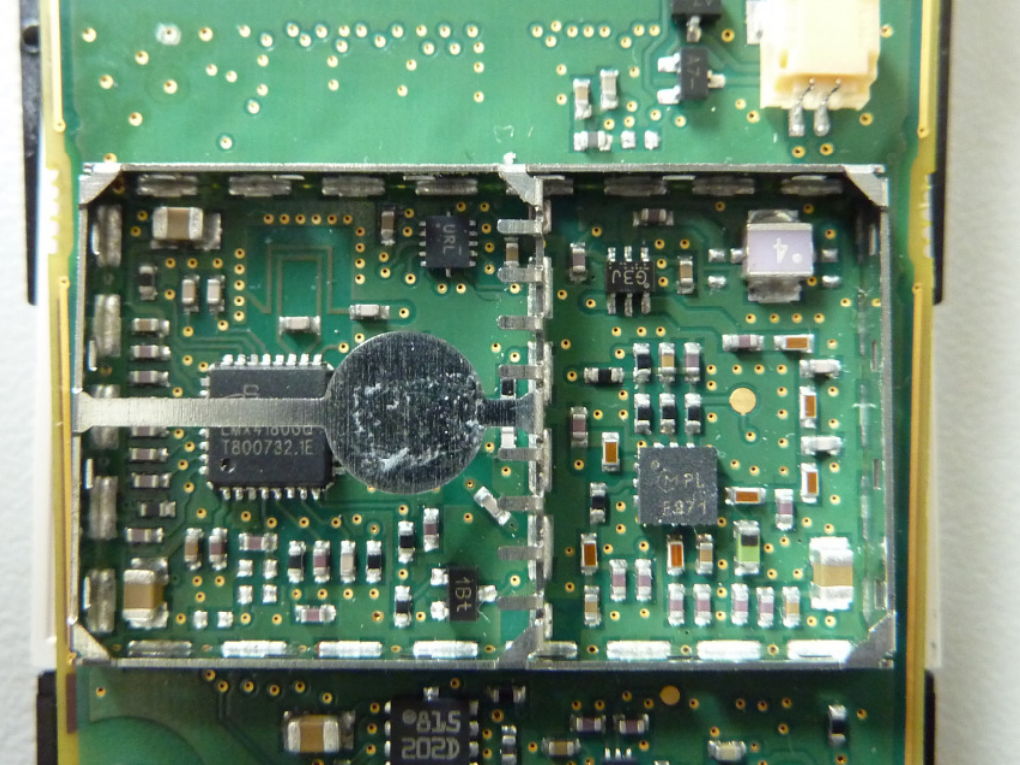


Photo 8:



Photo 9:



Photo 10:



Photo 11:

