

**Test report no. : 69376-4**

**Item tested : BeoCom4 US Base**

**Type of equipment : Isochronous UPCS Device**

**FCC ID : BV5BEOCOM4BS**

**Client : Bang & Olufsen A/S**

**FCC Part 15, subpart D**  
Isochronous UPCS Device  
1920 - 1930 MHz

**Industry Canada RSS-213, Issue 2**  
2 GHz Licence-exempt Personal  
Communications Service Devices  
(LE-PCS)

**28 September 2006**

**Authorized by : ..... **

Egil Hauger  
Technical Verificator



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## 1 GENERAL INFORMATION

### 1.1 Testhouse Info

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Fax : +47 64 84 57 05  
E-mail: post@comlab.no  
FCC test firm registration # : 994405  
IC OATS registration # : 4443  
Total Number of Pages: 52

### 1.2 Client Information

Name : Bang & Olufsen Telecom A/S  
Address : Peter Bangs Vej 15, 7600 Struer, Denmark  
Telephone : +45 9684 1085

**Contact:**

Name : Jens Aksel Thomsen  
E-mail : jmt@bang-olufsen.dk

### 1.3 Manufacturer ( if other than client)

Name : Bang & Olufsen a/s  
Address : Peter Bangs Vej 15, 7600 Struer, Denmark  
**and:**  
Name : Bang & Olufsen S.R.O.  
Address : Koprivnice 742 21, Czech Republic



## 2 Test Information

### 2.1 Tested Item

Name :	Bang & Olufsen
FCC ID :	BV5BEOCOM4BS
Industry Canada ID :	3775A-BEOCOM4B
Model/version :	BeoCom 4 US
Serial number :	Conducted sample: Comlab 3 Radiated Sample s.n.: 19347804
Hardware identity and/or version:	G
Software identity and/or version :	2.1
Frequency Range :	1921.536 – 1928.448 MHz
Tunable Bands :	1
Number of Channels :	5 RF Channels, 5x12 = 60 TDMA Duplex Channels
Type of Modulation :	GFSK (Gaussian Frequency Shift Keying)
User Frequency Adjustment :	None
Rated Output Power :	110 mW Peak Power, 9.2 mW Time Averaged Power
Type of Power Supply :	AC Adaptor
Antenna Connector :	None
Antenna Diversity Supported :	Yes
Desktop Charger :	The charger is integrated in the base station

#### Description of Tested Device(s)

The tested equipment is a DECT base (Fixed Part) which complies with ETSI EN 300 175. The frequencies have been reprogrammed and the output power reduced to comply with the FCC requirements to an Isochronous UPCS device after FCC Part 15D.

The EUT is a responding device as described in ANSI C63.17 and is designed to operate together with a DECT Portable Part (i.e. a handset), which is then the initiating device.

#### Exposure Evaluation

The EUT is designed to be placed on a table. A test reports with the measured SAR values when used in body worn configuration is submitted with the application, the SAR values are also included in the user manual.

The EUT is exempted from RF Exposure Evaluation to Industry Canada SAR requirements since the output power is below the limit in RSS-102 Issue 2, clause 2.5.2.



## **2.2 Test Environment**

Temperature: 22 – 24 °C  
Relative humidity: 30 – 50 %  
Normal test voltage: 115 V AC

The values are the limit registered during the test period.

## **2.3 Test Period**

Item received date: 2006-07-11  
Test period : from 2006-07-12 to 2006-09-28

## **2.4 Test Engineers**

Frode Sveinsen / Tore Løvlien

## **2.5 Test Equipment**

See list of test equipment in clause 6.

## **2.6 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.

All tests except the Radiated Spurious Emissions, Radiated Power and the Power line conducted emissions tests were performed in conducted mode with a temporary antenna connector.

It was checked that 85% of the lowest and 115% of the operating voltage did not have any influence on the measurement results.

The Radiated Emissions tests were performed with all ports populated and operating.



### **3 TEST REPORT SUMMARY**

#### **3.1 General**

Manufacturer: Bang & Olufsen  
Model No.: BeoCom 4 US  
Serial No.: /

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, paragraph 15.323 for Isochronous UPCS Devices and Industry Canada RSS-213 Issue 2.

The conducted test methods have been in accordance with ANSI C63.17-2006 Draft 3.5 where applicable.

Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made in a 10m semi-anechoic chamber. A description of the test facility is on file with the FCC and Industry Canada.

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

**THIS TEST REPORT RELATES ONLY TO THE ITEM (S) TESTED.**

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



**TEST REPORT NO: 69376-4**

TESTED BY: Frode Sveinsen

Frode Sveinsen, Chief Engineer

**DATE: 28 September 2006**

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### 3.2 Test Summary

Name of test	FCC CFR 47 Paragraph #	IC RSS-213 Paragraph #	Verdict
Coordination with fixed microwave	15.307(b)	-	Complies
Digital Modulation Techniques	15.319(b)	6.1	Complies
Labelling requirements	15.19(a)(3)	RSS-GEN 5.2	Complies
Antenna Requirement	15.317, 15.203	4.1(e)	Complies
Power Line Conducted Emission	15.207(a)	6.3	Complies
Emission Bandwidth	15.323(a)	6.4	Complies
In-band emissions	15.323(d)	6.7.2	Complies
Out-of-band emissions	15.323(d)	6.7.1	Complies
Peak transmit Power	15.319(c), 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	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	Complies
Access Criteria functional test	15.323(c)(4);(6)	4.3.4	Complies
Acknowledgements	15.323(c)(4)	4.3.4	Complies
Transmission duration	15.323(c)(3)	4.3.4	N/A <sup>1</sup>
Dual access criteria	15.323(c)(10)	4.3.4	N/A <sup>1</sup>
Alternative monitoring interval	15.323(c)(10);(11)	4.3.4	N/A <sup>2</sup>
Spurious Emissions (Antenna Conducted)	15.323(d)	6.7.1	Complies <sup>3</sup>
Spurious Emissions (Radiated)	15.209	4.3.3	Complies
Receiver Spurious Emissions	/	6.8	Complies

<sup>1</sup> Only applies for equipment that can be initiating device.

<sup>2</sup> The client declares that the tested equipment does not implement this provision.

<sup>3</sup> The tested equipment has integral antennas only.



## 4 TEST RESULTS

### 4.1 Power Line Conducted Emissions

Para. No.: 15.207 (a)

Test Performed By: Tore Løvlien	Date of Test: 26 July 2006
---------------------------------	----------------------------

Measurement procedure: ANSI C63.4-2003 using 50  $\mu$ H/50 ohms LISN.

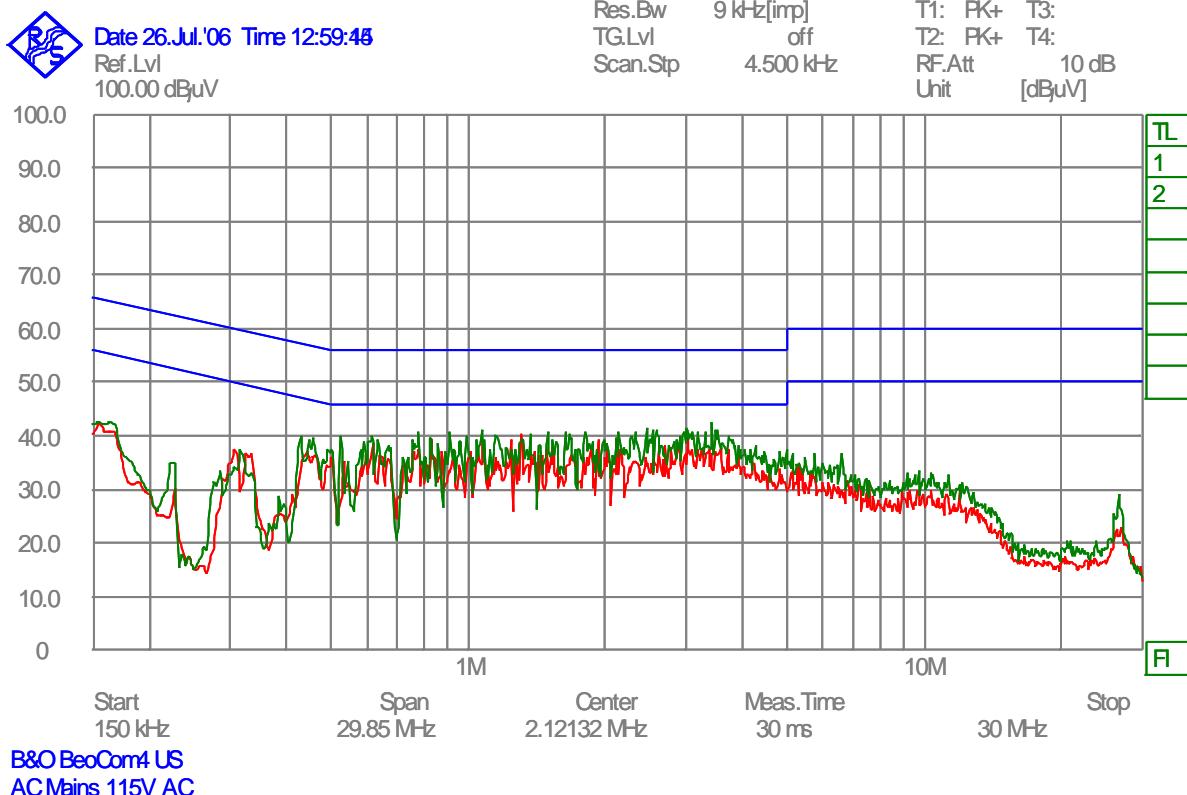
Test Results: Complies

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

#### Highest measured value (L1 and N):

All values are below the limit when measuring with Peak Detector.

Frequency	Detector	Measured value	Limit	Margin
KHz	Peak/QP/A V	dB $\mu$ V	dB $\mu$ V	dB
/	QP	/	/	/
/	AV	/	/	/

**Power Line Conducted Emissions, Phase L1 and N, Call Active, Peak Detector**



## 4.2 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 fulfil 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.

## 4.3 Digital Modulation Techniques

The tested equipment is based on DECT technology described in the ETSI standard EN 300175, the only difference is that the channel allocation is modified to operate in the 1920-1930 MHz band.

The EUT used 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.

## 4.4 Labelling 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.



#### 4.5 Antenna Requirement

Does the EUT have detachable antenna?

Yes  No

If detachable, is the antenna connector 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.**

#### 4.6 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.



#### 4.7 Automatic Discontinuation of Transmission

<b>The EUT transmits Control and Signalling Information?</b>	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
<b>TYPE OF EUT :</b>	<input type="checkbox"/> INITIATING DEVICE	<input checked="" 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 the EUT	A	Pass
2	EUT Switch Off	N/A	Pass
3	Hook-On by companion device	B	Pass
4	Hook-On by EUT	N/A	Pass
5	Power Removed from Companion Device	B	Pass
6	Companion Device Switch Off	B	Pass

A - Connection breakdown, Cease of all transmissions

B - Connection breakdown, EUT transmits control and signalling information

C - Connection breakdown, Companion Device transmits control and signalling information

N/A - Not Applicable (Hook-On and Power-Off is not possible on base)

#### 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 signalling information or use of repetitive codes used by certain digital technologies to complete frame or burst intervals.

## 4.8 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 Radiated Output Power (dBm)	Maximum Antenna Gain (dBi)
4	1921.536	20.4	21.3	+0.9
0	1928.448	20.2	21.0	+0.8

The EIRP is calculated from measured field strength by the formula in DA00-705.

For this test it was also checked that input voltage variation of 85 and 115% of nominal value did not have any effect on the measured output power, neither radiated nor conducted.

### Limit:

Conducted:  $100 \mu\text{W} \times \text{SQRT}(B) = 114 \text{ mW} = 20.6 \text{ dBm}$ , where  $B$  is measured emission bandwidth in Hz

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

### Rated antenna gain: 0 dBi

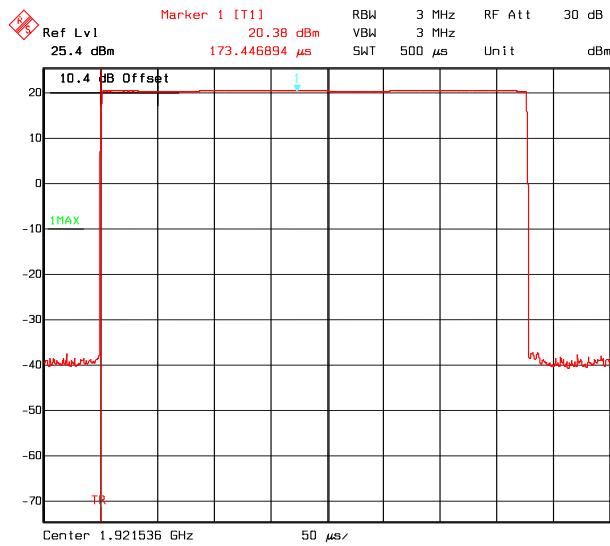
### Requirements, FCC 15.319(c)(f)

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.

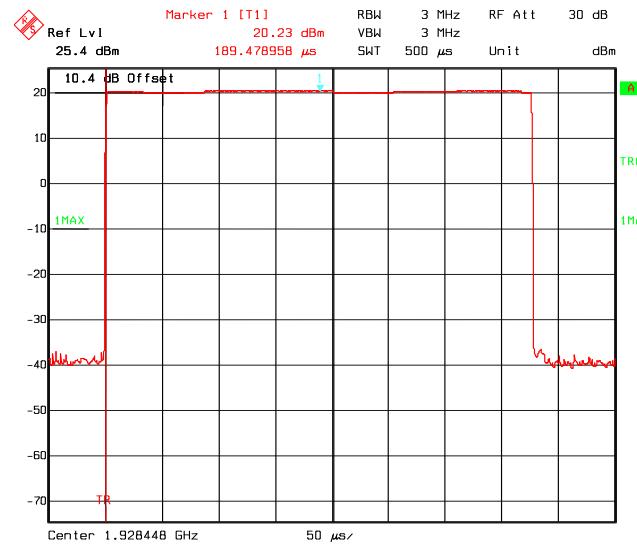


## Conducted Peak Output Power



Date: 12.JUL.2006 10:50:29

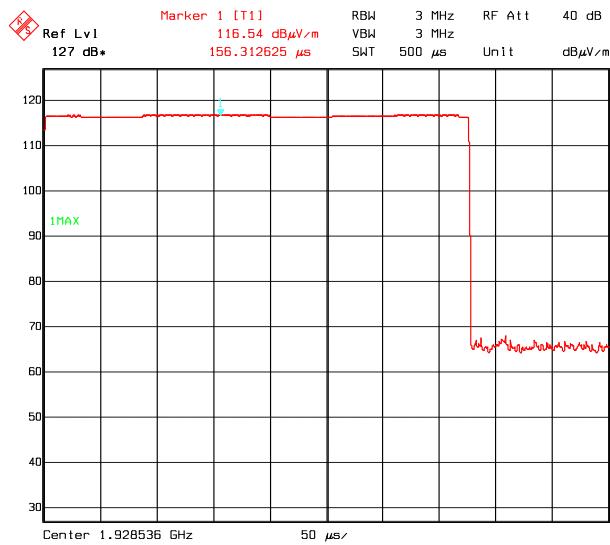
### Lower Channel



Date: 12.JUL.2006 10:30:12

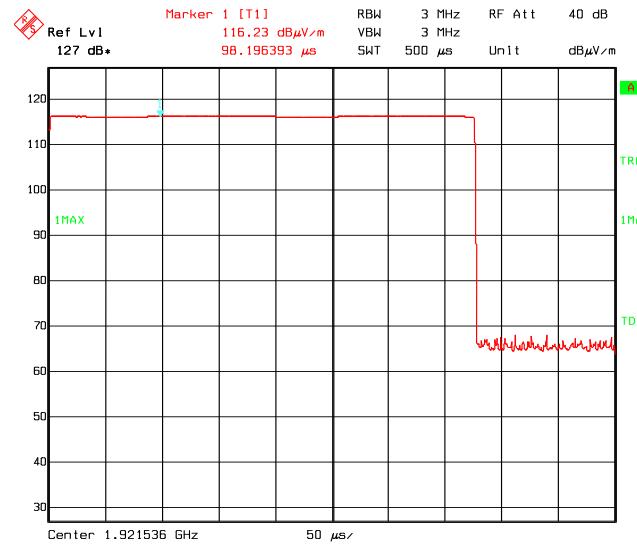
### Upper Channel

## Radiated Peak Output Power



Date: 14.JUL.2006 11:25:17

### Lower Channel (Max: Ant 1, VP)



Date: 14.JUL.2006 11:31:47

### Upper Channel (Max: Ant 1, VP)



## 4.9 Emission Bandwidth *B*

### Test Method:

ANSI C63.17 D3.5, clause 6.1.3.

### Test Results: Complies

### Measurement Data:

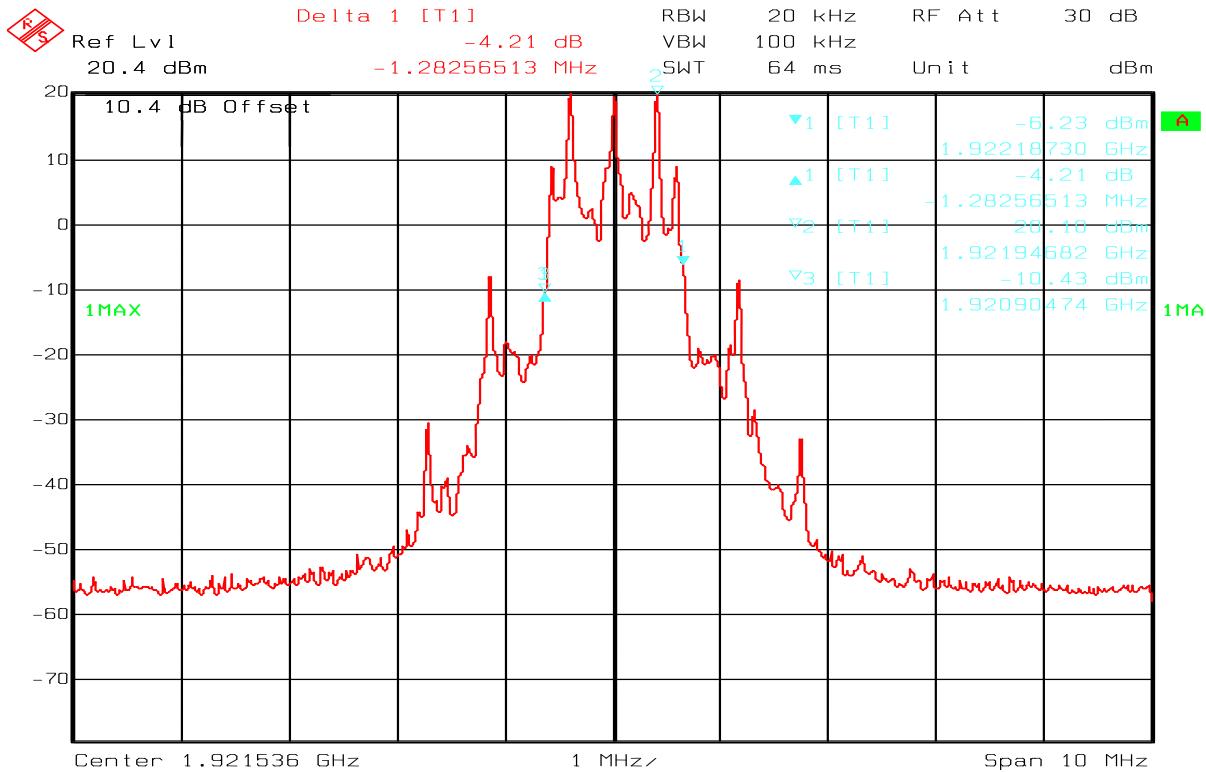
Channel No.	Frequency (MHz)	26 dB Bandwidth <i>B</i> (kHz)
4	1921.536	1282.6
2	1924.992	1302.6
0	1928.448	1302.6

Channel No.	Frequency (MHz)	6 dB Bandwidth (kHz)
4	1921.536	881.8
0	1928.448	901.8
Channel No.	Frequency (MHz)	12 dB Bandwidth (kHz)
4	1921.536	1202.4
0	1928.448	1202.4

### Requirements, FCC 15.323(a)

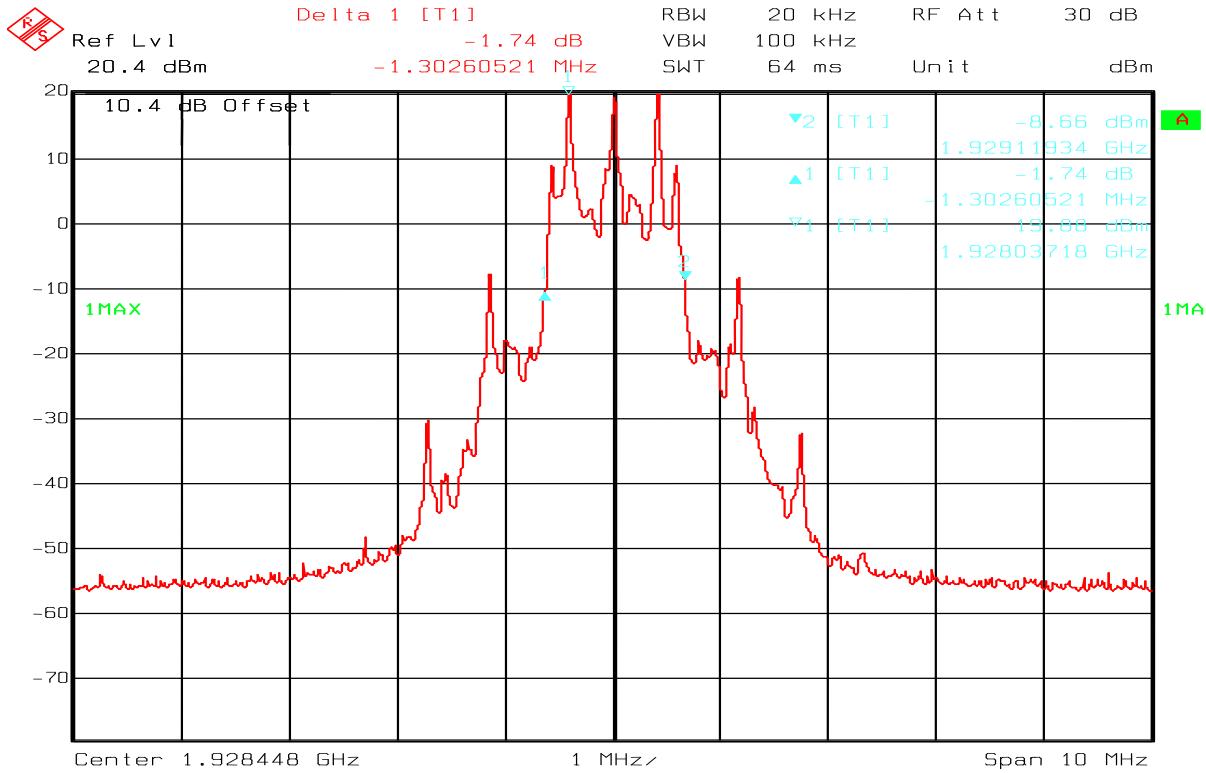
The 26 dB Bandwidth *B* shall be larger than 50 kHz and less than 2.5 MHz.

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 D3.5 clause 7.4).



Date: 12.JUL.2006 10:56:52

## Emission Bandwidth $B$ , Lower Channel



Date: 12.JUL.2006 11:11:53

### Emission Bandwidth $B$ , Upper Channel

## 4.10 Power Spectral Density

### Test Method:

ANSI C63.17, clause 6.1.5.

### Test Results: Complies

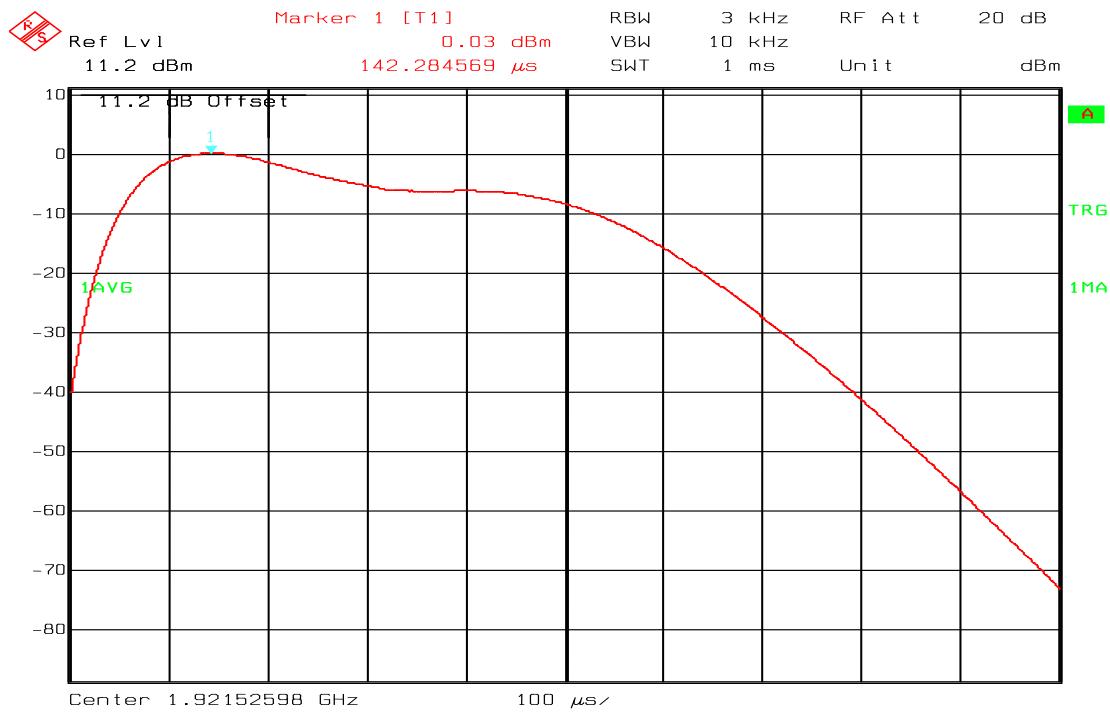
### Measurement Data:

Channel No.	Frequency (MHz)	Power Spectral Density (dBm)
4	1921.536	0.0
0	1928.448	1.7

Averaged over 100 sweeps.

### Requirements, FCC 15.319(d)

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

**Lower Channel:****Power Spectral Density, Averaged, 100 Sweeps****Upper Channel:****Power Spectral Density, Averaged, 100 Sweeps**

## 4.11 In-Band Unwanted Emissions, Conducted

### Test Method:

ANSI C63.17, clause 6.1.6.1.

### Test Results: Complies

### Measurement Data:

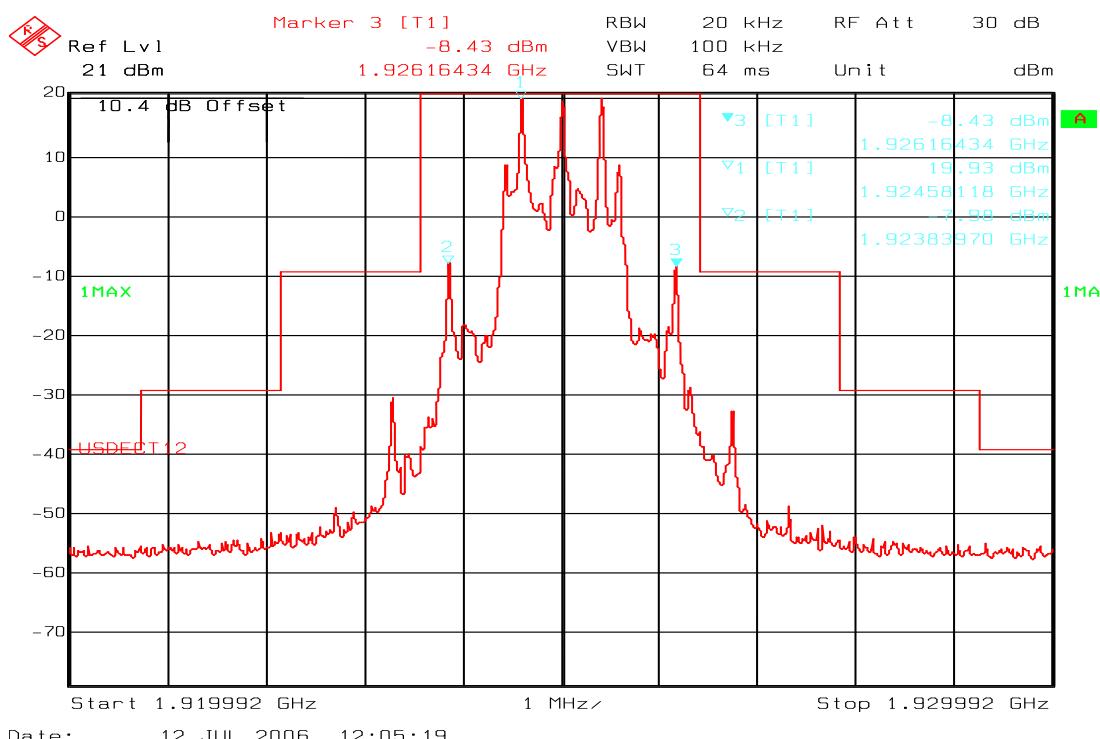
See plots.

### Requirements, FCC 15.323(d):

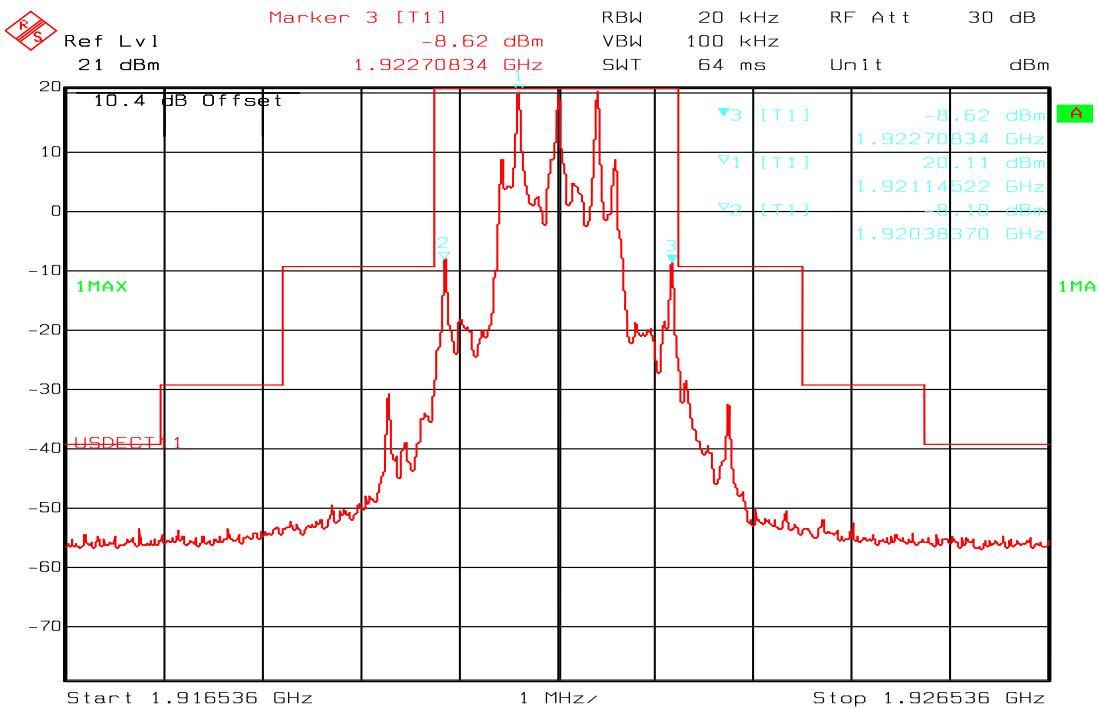
$B < f \leq 2B$ : less than or equal to 30 dB below max. permitted peak power level

$2B < f \leq 3B$ : less than or equal to 50 dB below max. permitted peak power level

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

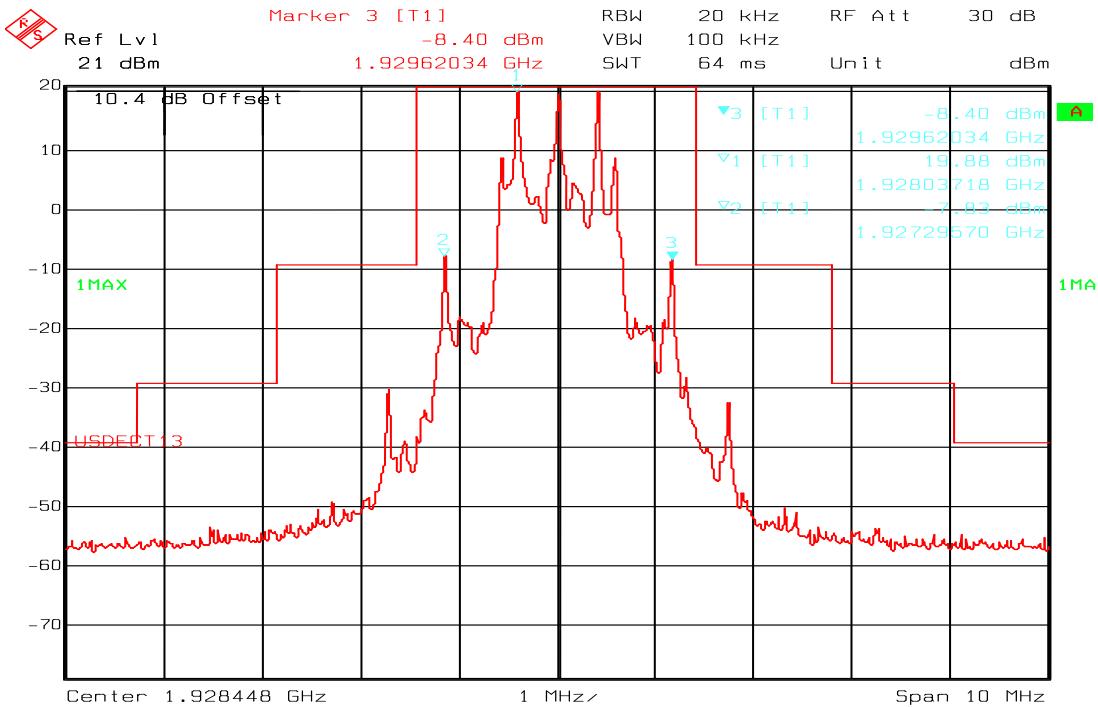


### Middle Channel



Date: 12.JUL.2006 12:26:56

## Lower Channel



Date: 12.JUL.2006 12:15:45

## Upper Channel



## 4.12 Out-of-band Emissions, Conducted

### Test Method:

ANSI C63.17, clause 6.1.6.2.

### Test Results: Complies

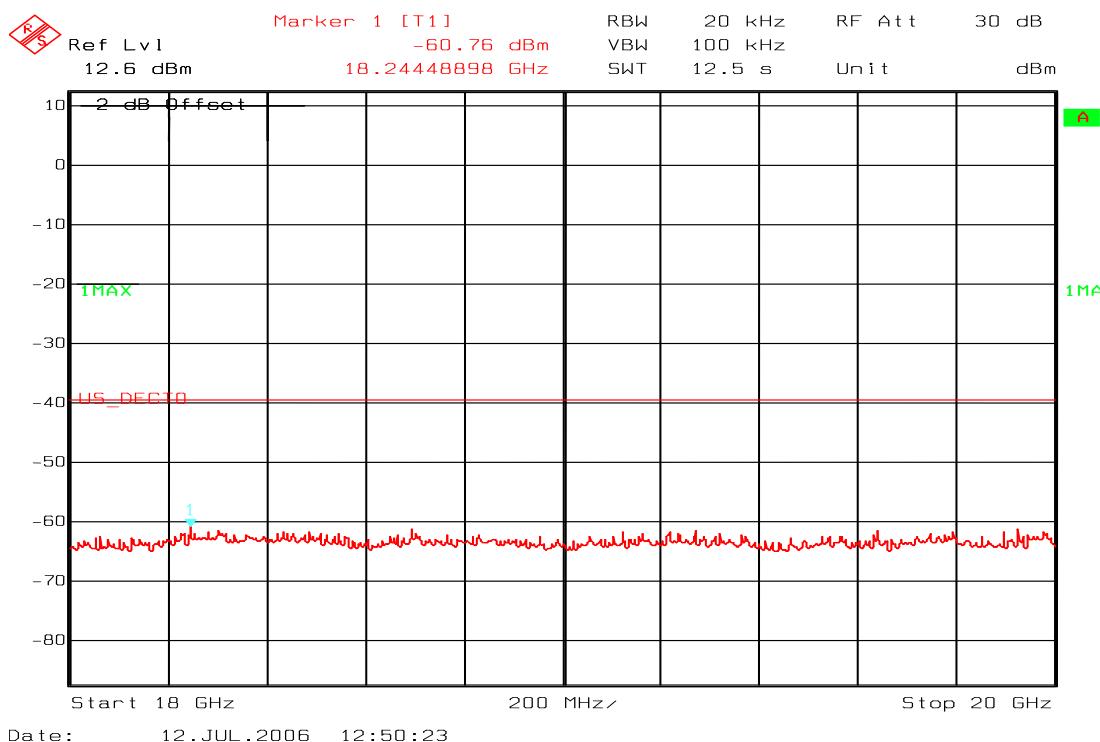
### Measurement Data:

See plots.

### Requirements, FCC 15.323(d):

$f \leq 1.25\text{MHz}$ outside UPSCS band :	$\leq -9.5\text{dBm}$
$1.25\text{MHz} \leq f \leq 2.5\text{MHz}$ outside UPSCS band :	$\leq -29.5\text{ dBm}$
$f \geq 2.5\text{MHz}$ outside UPSCS band :	$\leq -39.5\text{ dBm}$

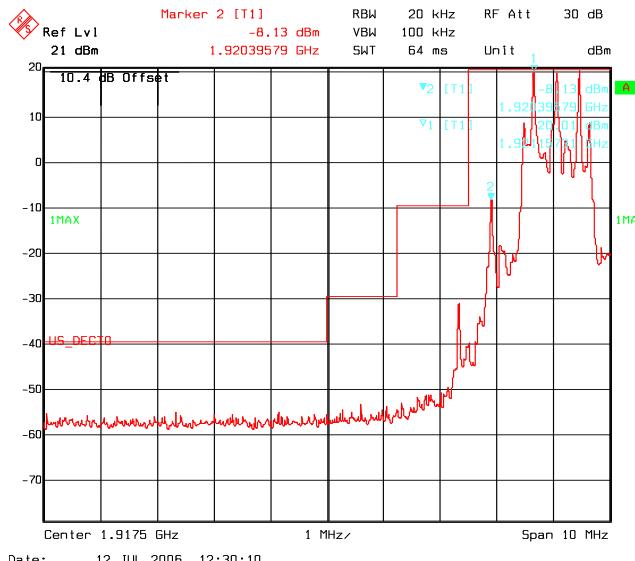
### Upper Channel:



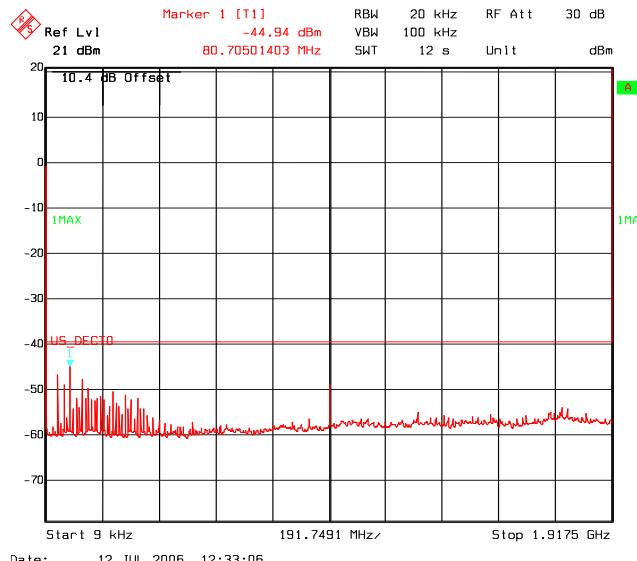


## Out-of-Band Emissions, Conducted

### Lower Channel:

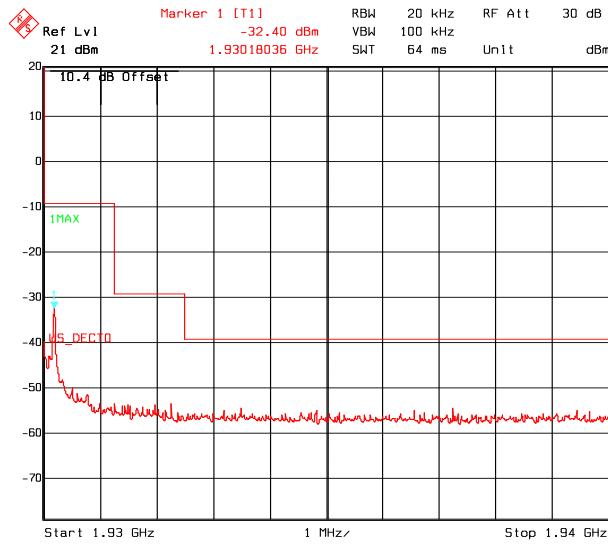


Date: 12.JUL.2006 12:30:10



Date: 12.JUL.2006 12:33:06

### Upper Channel:



Date: 12.JUL.2006 12:42:14



Date: 12.JUL.2006 12:48:50



## 4.13 Carrier Frequency Stability

**Test Method:**

ANSI C63.17, clause 6.2.1.

**Test Results: Complies****Measurement Data:**

The Carrier frequency stability is measured directly with a Frequency Domain Analyzer in histogram mode. Frequency Deviation in ppm is calculated.

**Frequency Stability over 1 hour of operation at Nominal Temperature**

Voltage	Measured Carrier Frequency (MHz)	Pk-Pk Difference (kHz)	Deviation ppm	Limit
115V AC	1924.936	23.4	6.1	10 ppm

Deviation ppm = ((Pk-Pk difference / 2) / Mean) x 10<sup>6</sup>

**Frequency Stability over Power Supply Voltage at Nominal Temperature**

Voltage	Measured Carrier Frequency (MHz)	Difference (kHz)	Deviation ppm	Limit
115V AC	1924.936332	0	0	10 ppm
98 V AC	1924.936502	0.2	0.1	
132 V AC	1924.936574	0.2	0.1	

Deviation ppm = ((Mean – Measured Frequency) / Mean) x 10<sup>6</sup>

**Frequency Stability over Temperature**

Temperature	Measured Carrier Frequency (MHz)	Difference (kHz)	Deviation ppm	Limit
T = +20 °C	1924.936332	0	0	10 ppm
T = -20 °C	1924.946223	9.9	5.1	
T = +50 °C	1924.921881	-14.5	-7.5	

Deviation ppm = ((Mean – Measured Frequency) / Mean) x 10<sup>6</sup>



## 4.14 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)	Frame Period Mean (Hz)	Frame Period Standard Deviation (Hz)	Frame Repetition Stability (ppm)
1924.992	99.999984	0.0000217	0.65

**Limit:**

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

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

## 4.15 Frame Period and Jitter

**Test Method:**

ANSI C63.17, clause 6.2.3.

**Test Results: Complies****Measurement Data:**

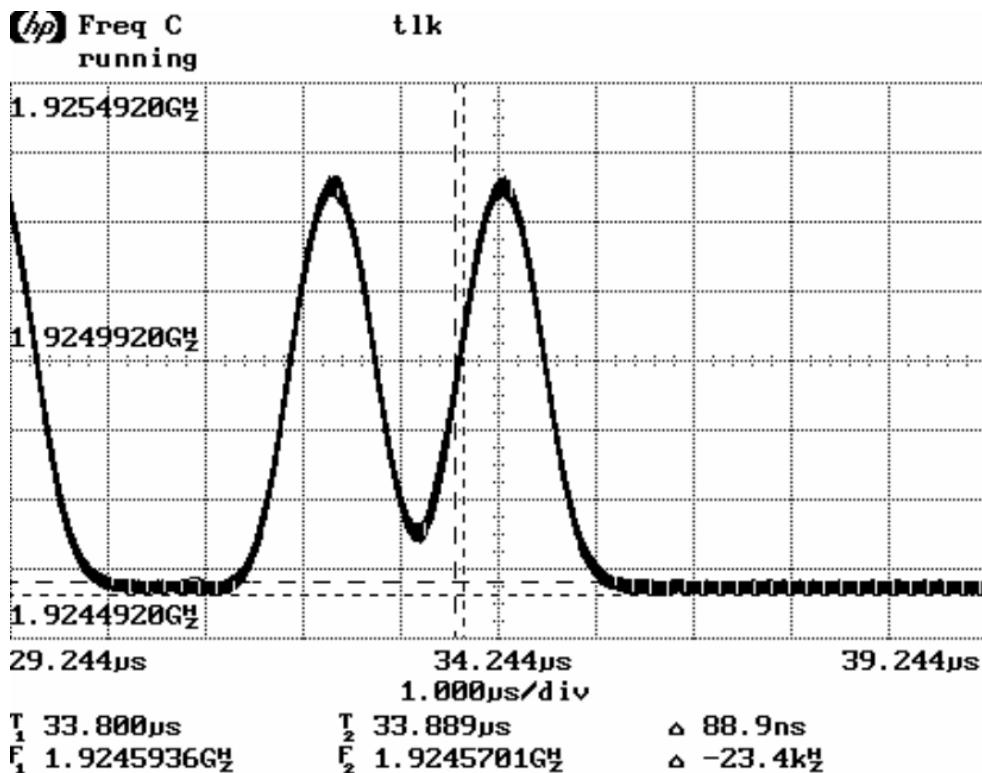
Carrier Frequency (MHz)	Frame Period (Hz)	Max Jitter (μs)	3xStandard Deviation of Jitter (μs)
1924.992	99.999984	0.0004455	0.0065

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

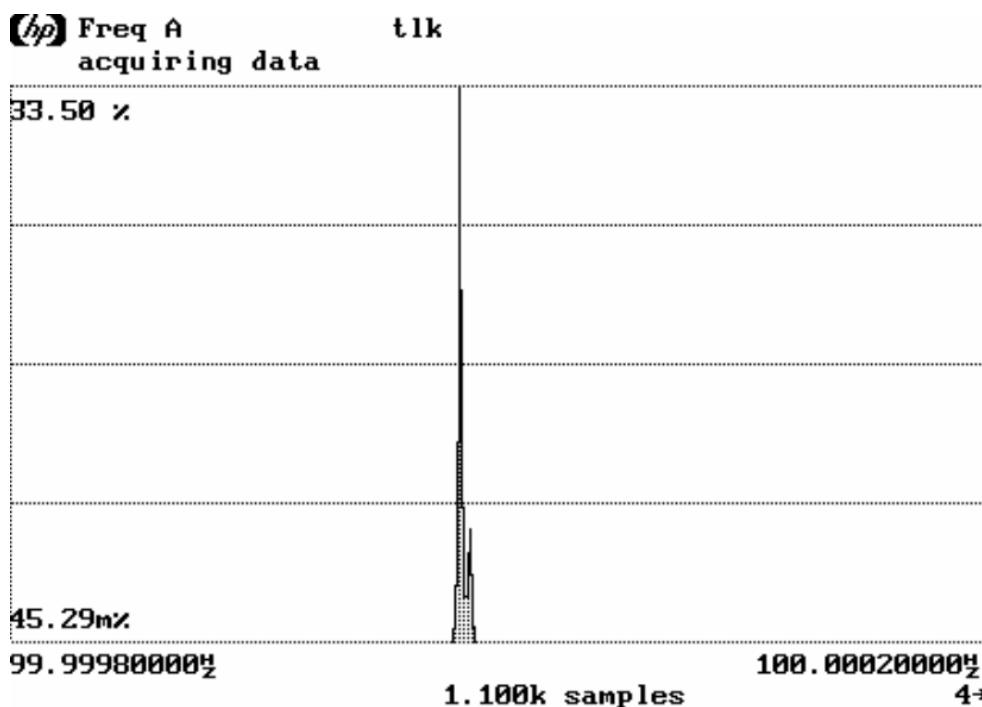
**Limit:**

Frame Period	20 or 10/x 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

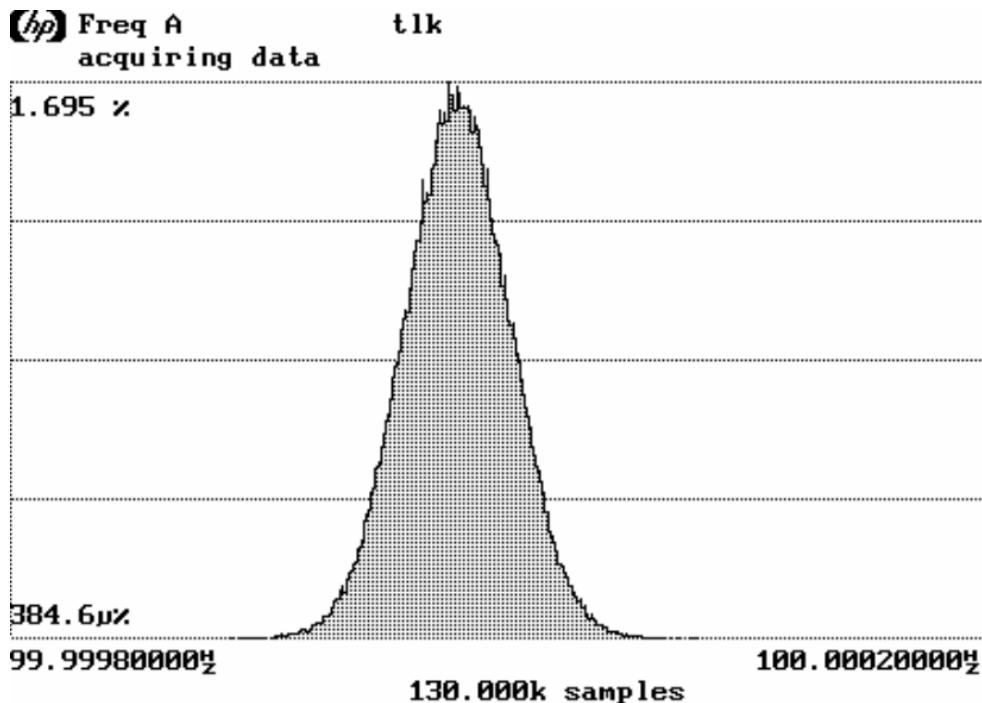


Long Term Carrier Frequency Stability



Pk-Pk 8.91μHz 1/Mean 10.000ms  
Max 99.99999065Hz Min 99.99998174Hz

Frame Repetition Stability, Gated over 100 Frames



Mean 99.99998359435Hz 1/Mean 10.000ms  
Pk-Pk 191.54  $\mu$ s Std Dev 21.66998  $\mu$ s

**Frame Period and Jitter**



## 4.16 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 is measured Transmitter Power in dBm

Calculated values:

Lower Threshold	-82.5 dBm
Upper Threshold	-62.5 dBm

The upper Threshold is applicable for systems which have defined a minimum of 40 duplex system access channels.

### Measurement Procedure:

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

<b>Least Interfered Channel</b>	
Lower Threshold	N/A
Upper Threshold	-61.5 dBm

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

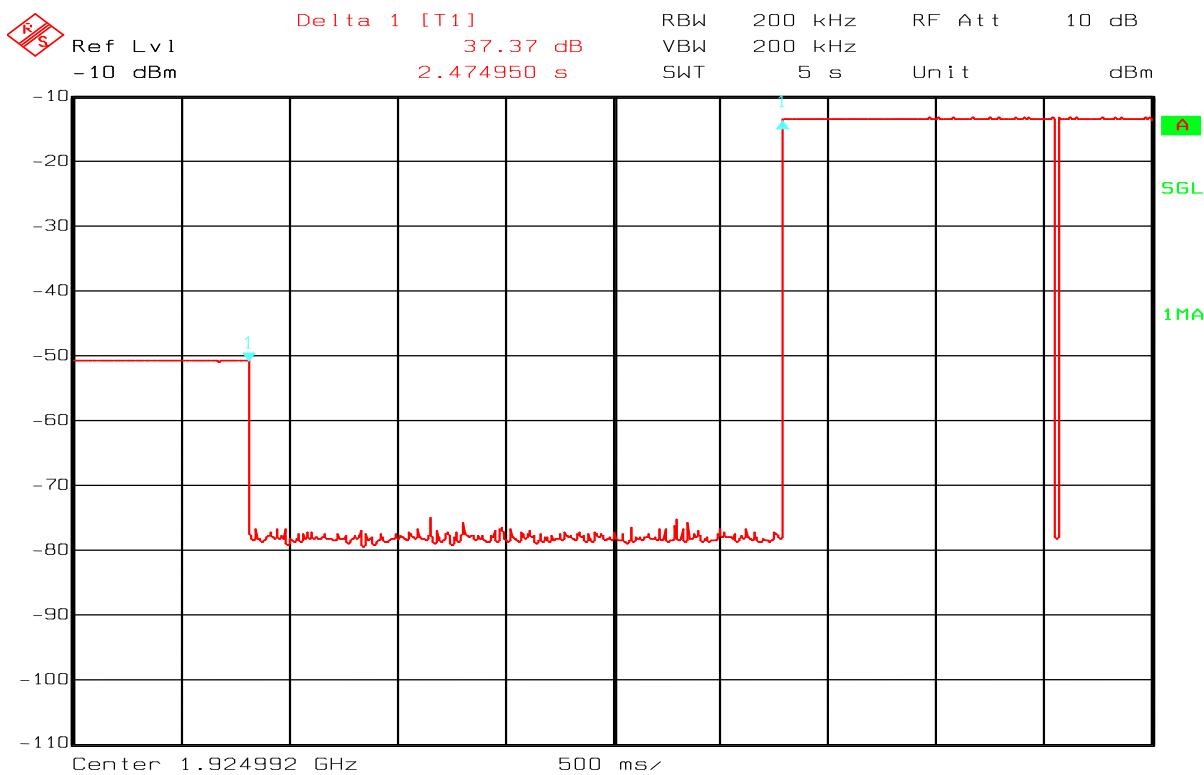
<b>ANSI C63.17 clause 7.3.3 ref.</b>	<b>Observation</b>	<b>Verdict</b>
b) $f_1 T_L + 13 \text{ dB}$ , $f_2$ at $T_L + 6 \text{ dB}$	Transmission always on $f_2$	Pass
c) $f_1 T_L + 6 \text{ dB}$ , $f_2$ at $T_L + 13 \text{ dB}$	Transmission always on $f_1$	Pass
d) $f_1 T_L + 7 \text{ dB}$ , $f_2$ at $T_L$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

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

<b>ANSI C63.17 clause 7.3.4</b>	<b>Observation</b>	<b>Verdict</b>
b) Shall <b>not</b> transmit on $f_1$	EUT transmits on $f_2$	Pass
d) Shall <b>not</b> transmit on $f_2$	EUT transmits on $f_1$	Pass

### Limits:

Lower Threshold + 6 dB margin	-76.5 dBm
Upper Threshold + 6 dB margin	-56.5 dBm



**7.3.4 d) EUT transmits on  $f_2$  2.5s after interferer is removed**

## 4.17 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 the Simple Compliance Test is passed or if 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 connection	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 -6 and -12 dB points if the Simple Compliance test fails.

**Comment:** The tested EUT uses the same receiver for monitoring and communication, this test is therefore not required. However, the test has been 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.



## 4.18 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 is then applied on the carrier at pulsed level  $T_U+6\text{dB}$  or  $T_L+6\text{dB}$ , as appropriate.

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

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

**Comment:** Since  $B$  is larger than 1.25 MHz the test was performed with pulse lengths of 50  $\mu\text{s}$  and 35  $\mu\text{s}$ .

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

The maximum reaction time must be less than  $50\sqrt{1.25/\text{emission bandwidth in MHz}}$  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  $35\sqrt{1.25/\text{emission bandwidth in MHz}}$  microseconds but shall not be required to be less than 35 microseconds.



#### 4.19 Time and Spectrum Window Access Procedure

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

##### Measurement Procedure:

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

##### Test results:

Access Criteria, ref. to ANSI C63.17 clause 8.1.1	Observation	Verdict
b) Check that the EUT transmits on the interference free time-slot	EUT transmits on the interference free time-slot	Pass
b) The Access Criteria must be repeated at least every 30 s.	Access Criteria is repeated every 1.3 sec. See plot.	

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

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

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

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

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

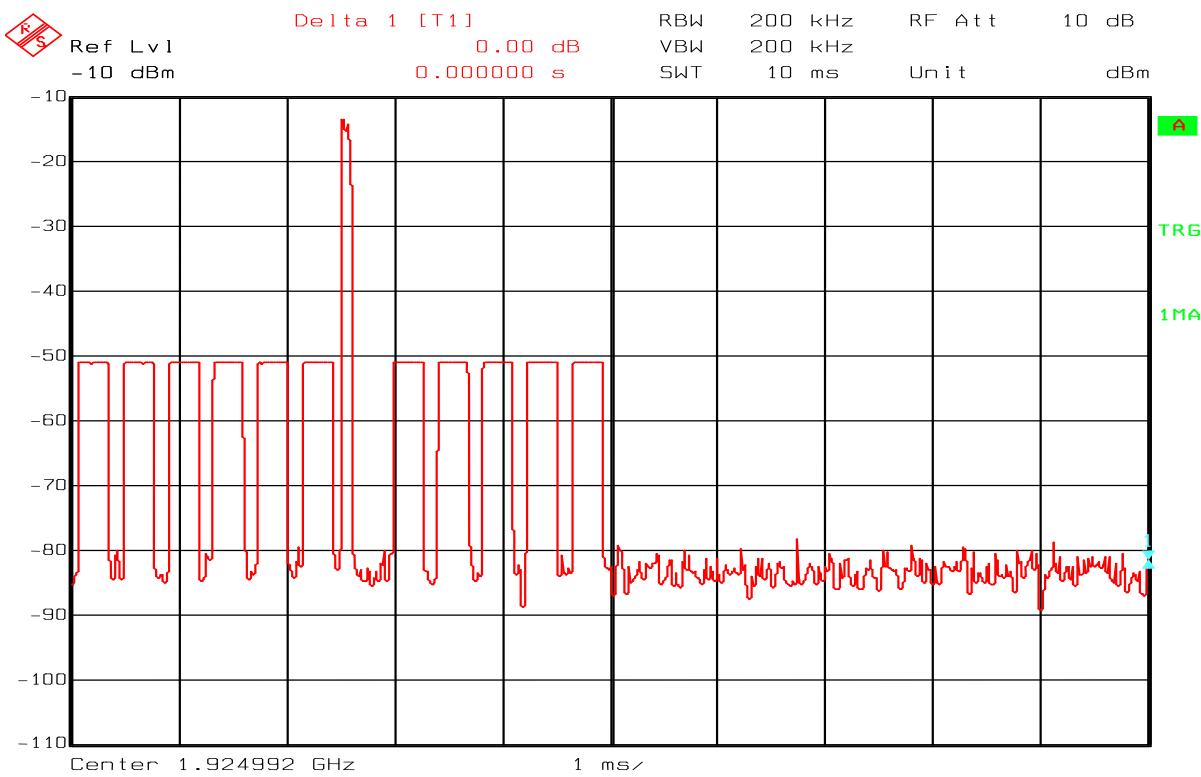
##### Limits:

##### FCC 15.323(c)(4):

Once access to specific combined time and spectrum windows is obtained an acknowledgement from a system participant must be received by the initiating transmitter within one second or transmission must cease. Periodic acknowledgements must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signalling information may transmit continuously for 30 seconds without receiving an acknowledgement, at which time the access criteria must be repeated.

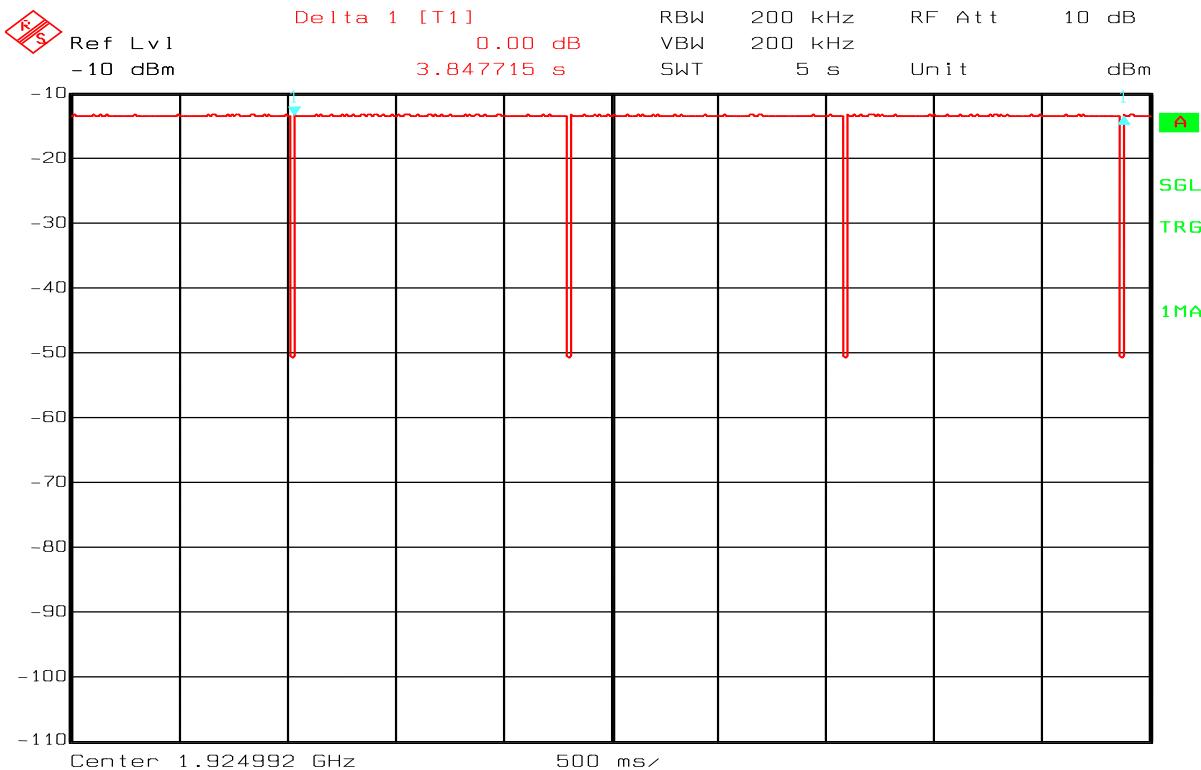
##### FCC 15.323(c)(6):

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



Date: 17.JUL.2006 16:27:54

### 8.1.1 b) Transmission on the Unblocked Timeslot



Date: 17.JUL.2006 16:29:49

### 8.1.1 b) Access Criteria Check Interval



## 4.20 Acknowledgements and Transmission Duration

### Measurement Procedure:

Acknowledgements: ANSI C63.17, clause 8.2.1

Transmission Duration: ANSI C63.17, clause 8.2.2

### Test Results:

#### Acknowledgements

Test ref. to ANSI C63.17 clause 8.2.1	Observation	Verdict
a) Initial transmission without acknowledgements	Only for initiating device.	N/A
c) transmission time after cease of acknowledgements	2.1 sec	Pass

#### Transmission Duration

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

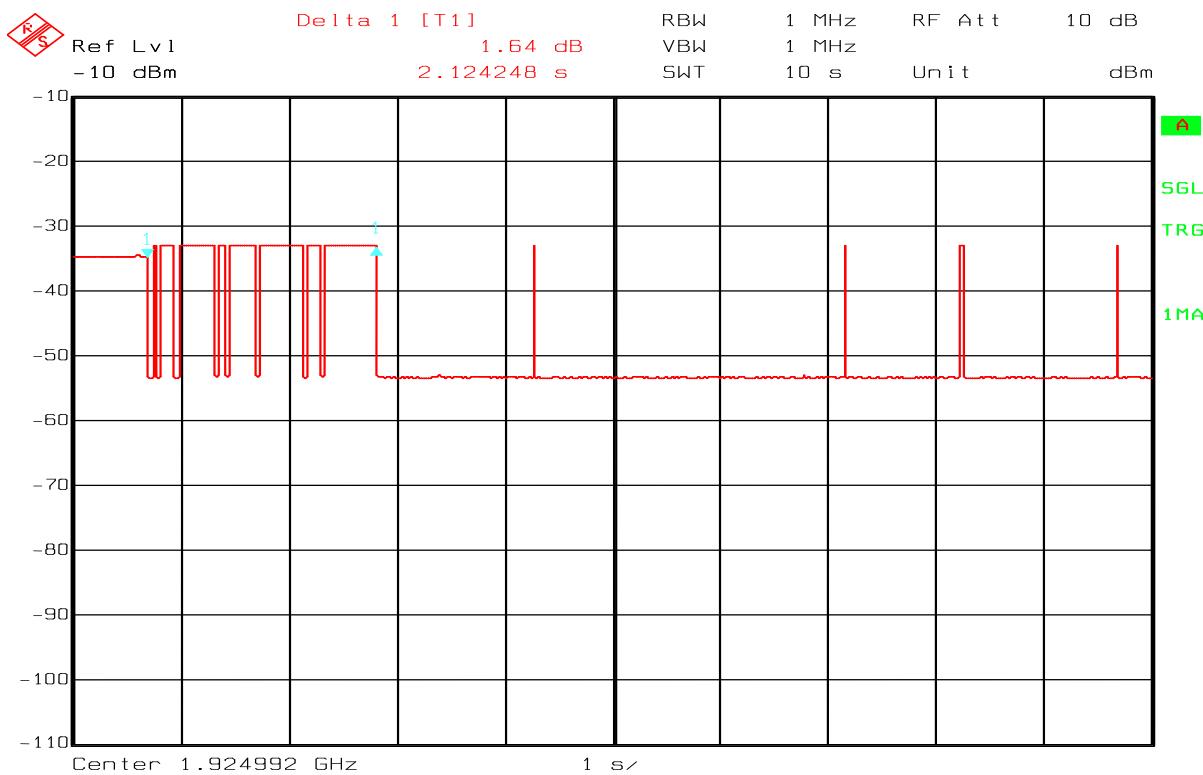
Comment: /

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

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

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

Periodic acknowledgements must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signalling information may transmit continuously for 30 seconds without receiving an acknowledgement, at which time the access criteria must be repeated.



Date: 17.JUL.2006 16:47:15

### 8.2.1 c) Transmission Time after cease of Acknowledgements

## 4.21 Dual Access Criteria Check

### Measurement Procedure:

EUTs that does not implement the Upper Threshold: ANSI C63.17, clause 8.3.1

EUTs that implement the Upper Threshold: 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 Implements the Upper Threshold:

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	N/A	N/A
c) d) Transmission on interference-free <b>receive</b> time/spectrum window	N/A	N/A
e) f) Transmission on interference-free <b>transmit</b> time/spectrum window	N/A	N/A
g) Transmission not possible on any time/spectrum window	N/A	N/A

Comment: This test is only for initiating device. Since channel selection is decided by the initiating device and not the responding device this test has not been performed on this EUT.

### 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.

## 4.22 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 is not initiating device, and the tested EUT does not implement this provision. See manufacturers' declaration.

## 4.23 Duty Cycle Correction Factor Calculation

The tested EUT is a DECT base station that can transmit on up to 2 single timeslot per 10ms DECT system frame.

Frame length: 10ms

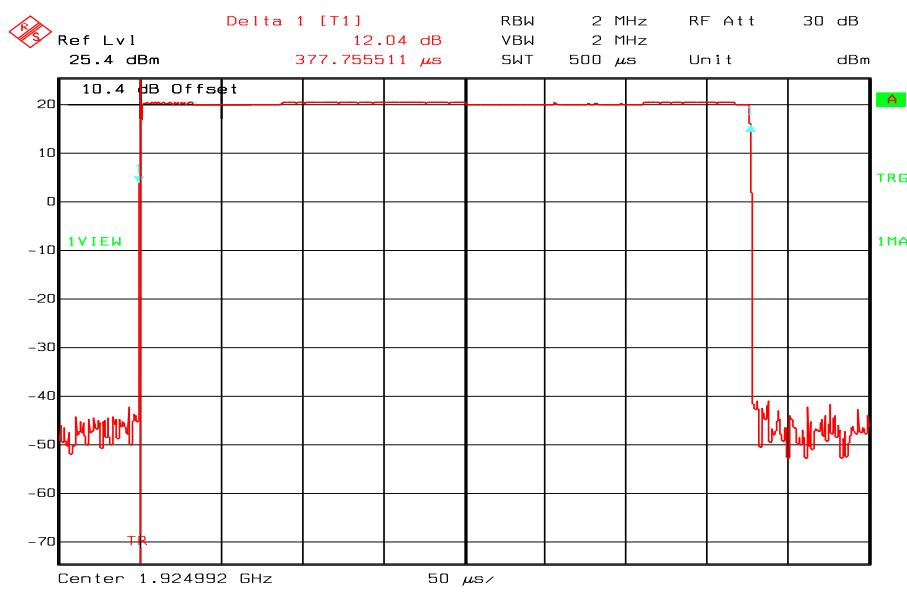
Slot length: 0.378ms

Calculation of DC Correction Factor:

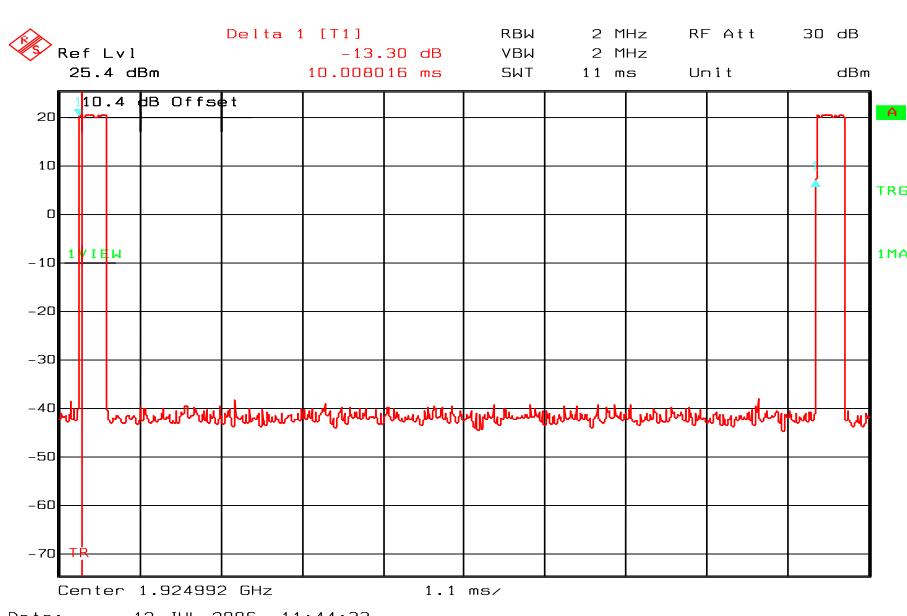
$$-20 \log (2 \times \text{slot length} / \text{Frame length}) = -20 \log (2 \times 0.378 / 10) = 22.4 \text{ dB}$$

**Duty Cycle Correction Factor : 20 dB**

Max allowed Duty Cycle Correction Factor is 20 dB



**Burst length**



**Frame length**



## 4.24 Spurious Emissions (Radiated)

### Measurement Procedure:

FCC 15.209

### Test Results:

#### Radiated emission 10 kHz-30 MHz.

Measuring distance 10 m, measured with Peak detector.

No component detected, see attached graph.

Limit is converted to 10 m using 40 dB/decade according to 15.31 (f) (2).

Transmitter Active, Speech Mode, Handset and Base together

#### Radiated Emissions 30 - 1000 MHz.

Detector: Quasi-Peak

Measuring distance 3 m.

The EUT were rotated 360 degrees and the antenna height varied between 1 and 4 m on all found frequencies.

Transmitter Active, Speech Mode, Handset and Base together

Frequency	RF channel	Distance correction factor	Field strength, 3m	Limit	Margin
MHz	/	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
124.4	/	0	33.4	43.5	10.1
960.75	/	0	40.7	54.0	13.3

#### Radiated Emissions 1 - 20 GHz

Detector: Peak

Measuring distance: 1.0 – 8.5 GHz: 3m  
8.5 – 20.0 GHz: 1m

The EUT was rotated, the antenna height varied and emissions were checked on highest and lowest channel.

Transmitter active

Frequency	RF channel	Distance correction factor	Field strength, 3m	Duty cycle correction factor	Limit	Margin
GHz	00 / 04	dB	dB $\mu$ V/m	dB	dB $\mu$ V/m	dB
3.84	04	0	55.0	20	54	19.0
5.76	04	0	55.0	20	54	19.0
All others	00 / 04	0 or 9.5	< 54	20	54	>20

**Important:** For the measurements performed at 1m (8.5 – 20 GHz) the distance correction factor is not included on the plot. This means that the readings on these plots are 9.5 dB higher than the actual value.

**Nemko Comlab**

13. Jul 06 10:24

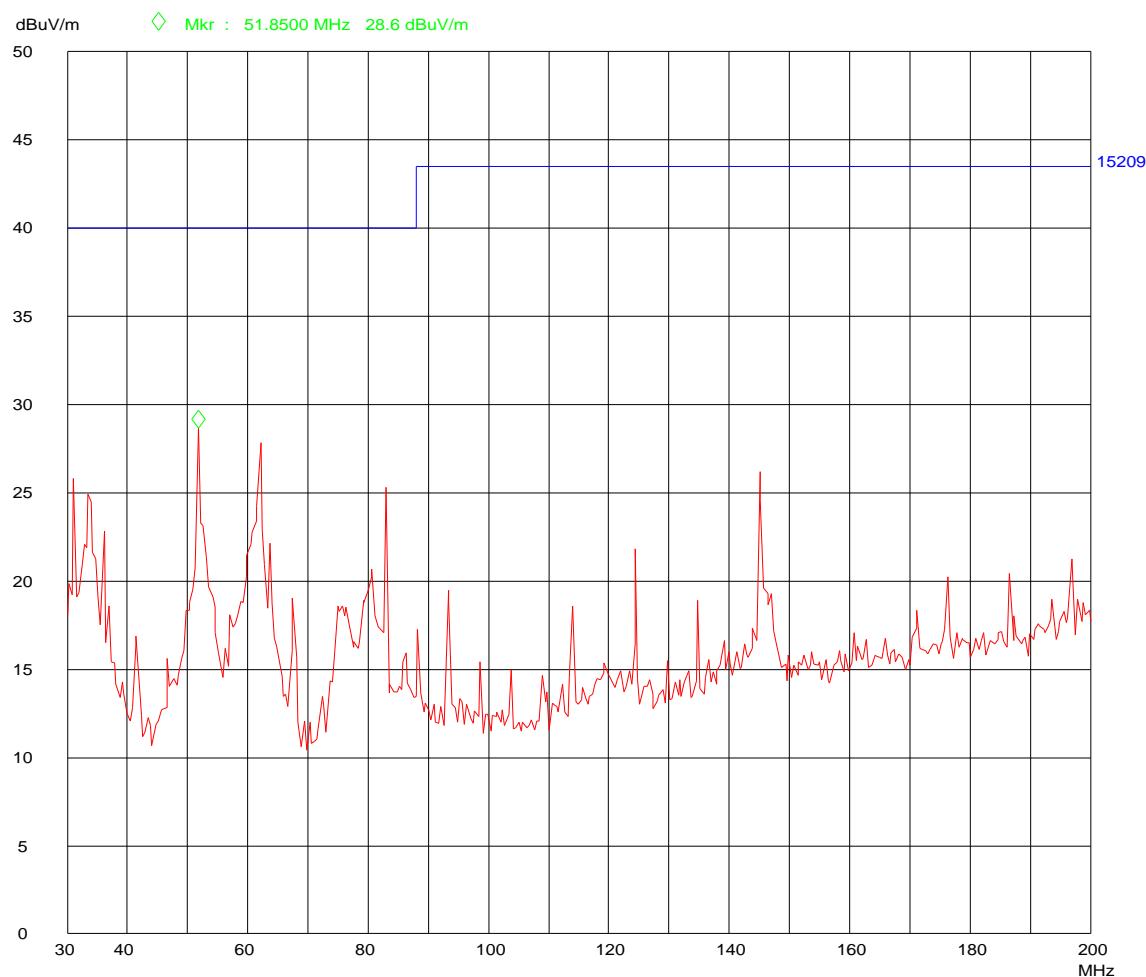
**Peak**

EUT: BeoCom4 UPCH  
 Manuf: Bang & Olufsen  
 Op Cond: 1m VP  
 Operator: FS  
 Test Spec: FCC 15.209, 3m  
 Comment: Handset and Base  
 Speech Mode

**Scan Settings (1 Range)**

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30M	200M	50k	120k	PK	50ms	AUTO	LN ON	60dB

Transducer No.	Start	Stop	Name
20	30M	200M	HK116


**Spurious Emissions 30 – 200 MHz, Peak Detector, Vertical Polarization**



## Nemko Comlab Peak

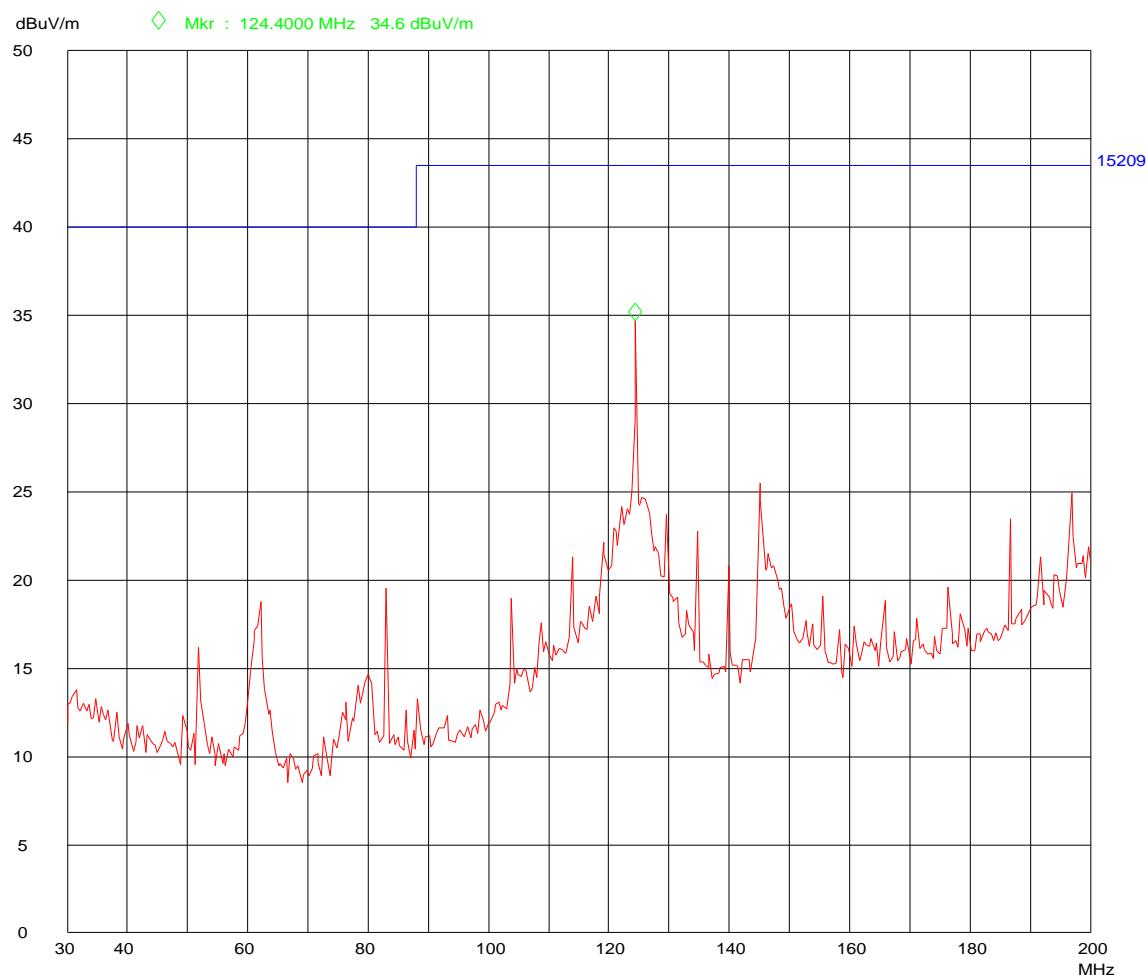
13. Jul 06 10:36

EUT: BeoCom4 UPCS  
Manuf: Bang & Olufsen  
Op Cond: 2m HP  
Operator: FS  
Test Spec: FCC 15.209, 3m  
Comment: Handset and Base  
Speech Mode

## Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30M	200M	50k	120k	PK	50ms	AUTO	LN ON	60dB

Transducer No.	Start	Stop	Name
20	30M	200M	HK116



**Spurious Emissions 30 – 200 MHz, Peak Detector, Horizontal Polarization**



## Nemko Comlab Peak

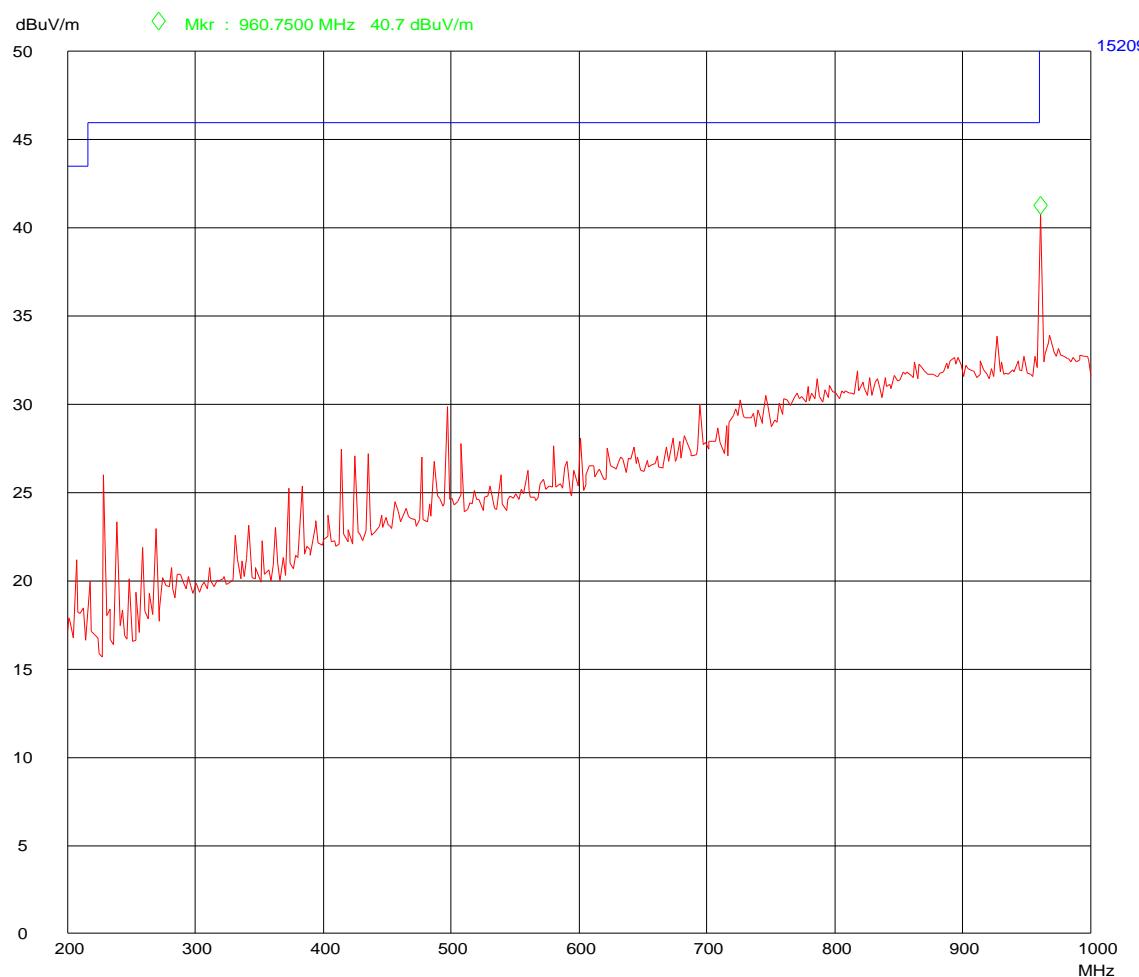
13. Jul 06 09:24

EUT: BeoCom4 UP-CS  
Manuf: Bang & Olufsen  
Op Cond: 1m VP  
Operator: FS  
Test Spec: FCC 15.209, 3m  
Comment: Handset and Base  
Speech Mode

### Scan Settings (1 Range)

----- Frequencies -----||----- Receiver Settings -----|  
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge  
200M 1000M 50k 120k PK 50ms AUTO LN ON 60dB

Transducer No. Start Stop Name  
21 200M 1000M HL223



**Spurious Emissions 200 - 1000 MHz, Peak Detector, Vertical Polarization**



## Nemko Comlab Peak

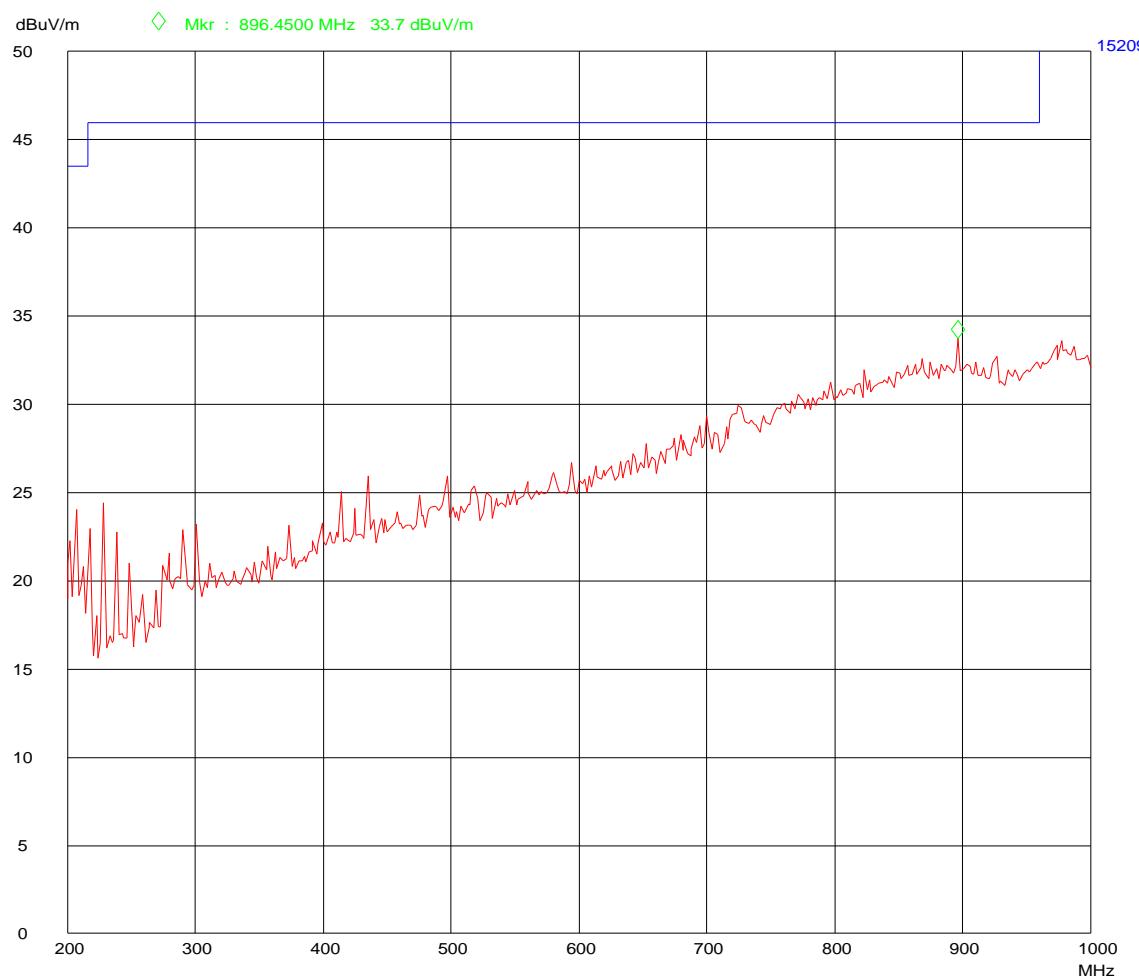
13. Jul 06 09:49

EUT: BeoCom4 UP-CS  
Manuf: Bang & Olufsen  
Op Cond: 2m HP  
Operator: FS  
Test Spec: FCC 15.209, 3m  
Comment: Handset and Base  
Speech Mode

## Scan Settings (1 Range)

----- Frequencies -----||----- Receiver Settings -----|  
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge  
200M 1000M 50k 120k PK 50ms AUTO LN ON 60dB

Transducer No. Start Stop Name  
21 200M 1000M HL223



### Spurious Emissions 200 - 1000 MHz, Peak Detector, Horizontal Polarization

**NEMKO COMLAB**  
**Peak**

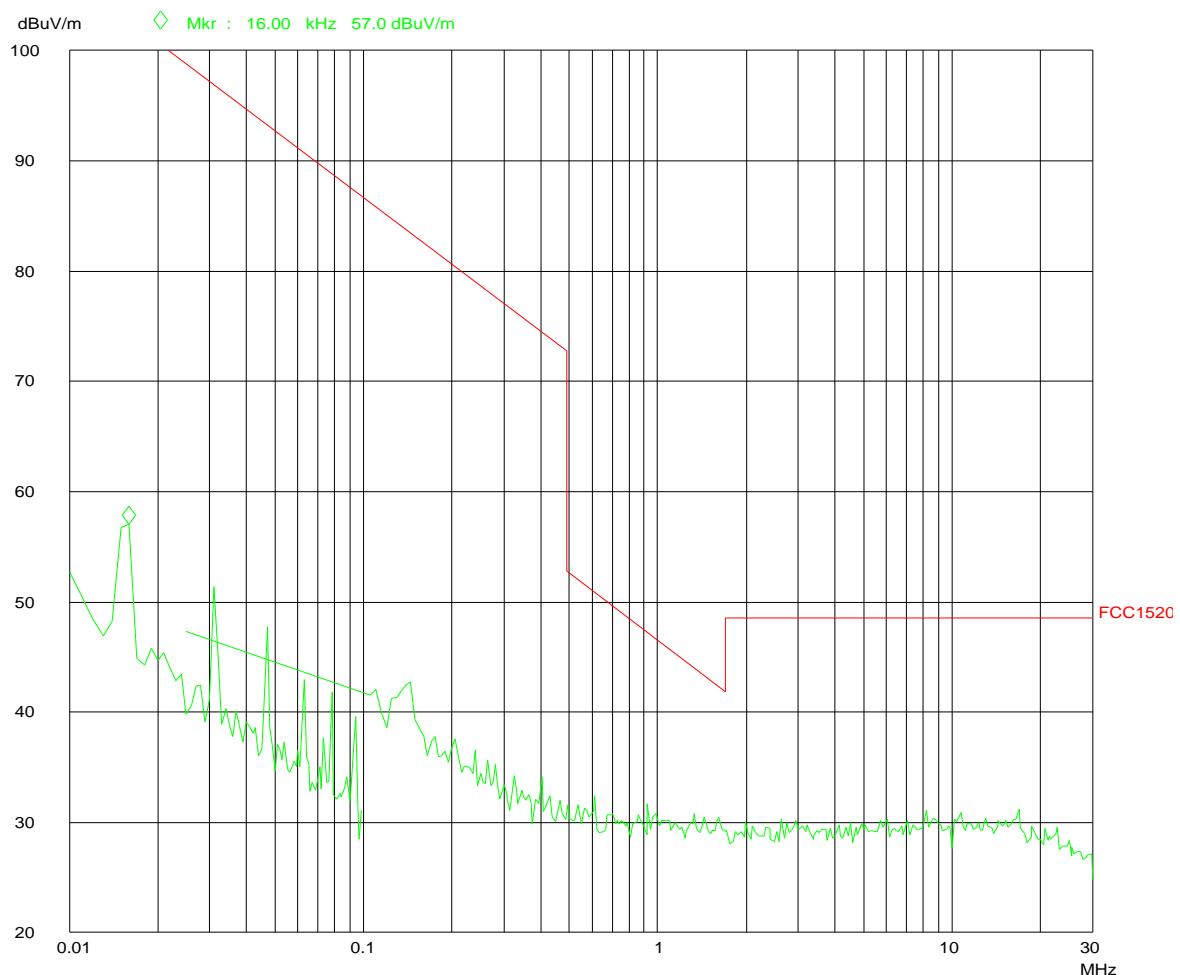
14. Jul 06 11:52

Operator: FS  
 Comment: Bang % Olfesen  
 BeoCom4, Base and Handset  
 FCC 15.209, 10m  
 Speech Mode

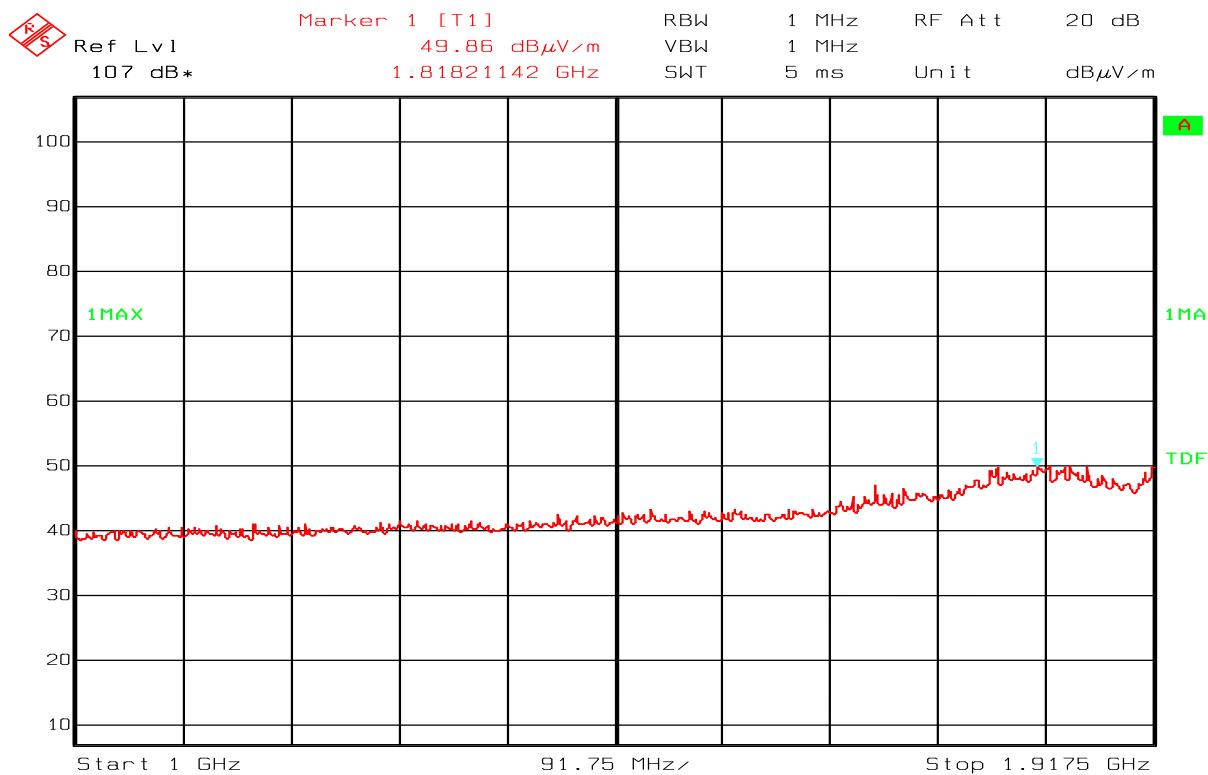
**Scan Settings (4 Ranges)**

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
10k	100k	1k	1k	PK	20ms	0dBLN	OFF	60dB
20k	20k	5k	9k	PK	20ms	AUTO	LN ON	60dB
20k	10M	5k	9k	PK	20ms	AUTO	LN OFF	60dB
10M	30M	5k	9k	PK	20ms	AUTO	LN OFF	60dB

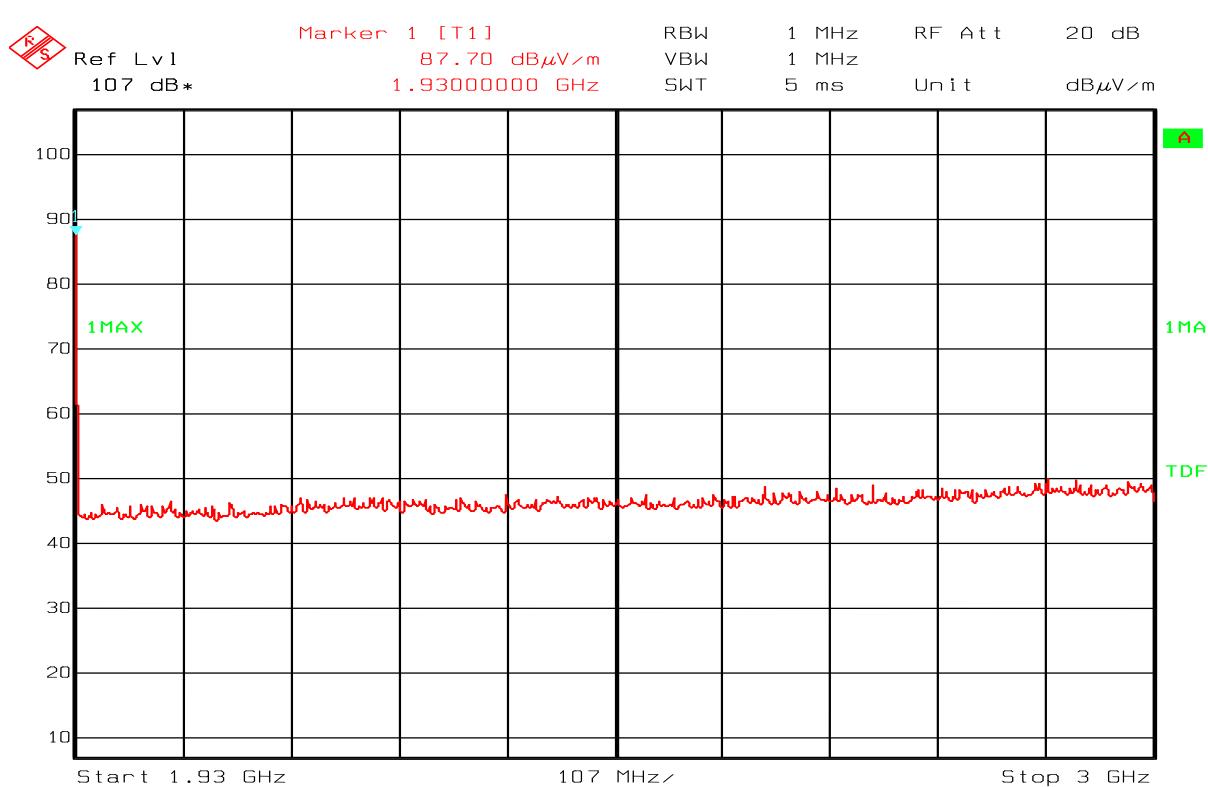
Transducer No. Start Stop Name  
 13 10k 30M HFH2Z2



**Spurious Emissions 0.010 - 30 MHz, Peak Detector**



### Spurious Emissions 1 – 1.9175 GHz



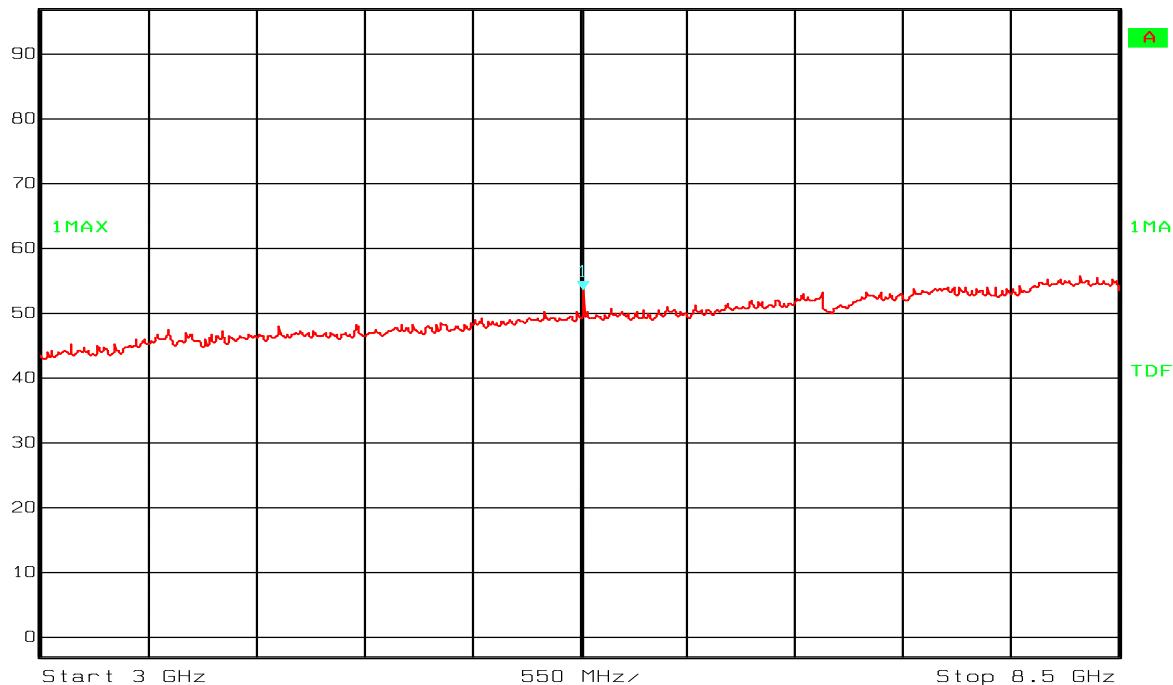
### Spurious Emissions 1.93 – 3 GHz



Ref Lvl  
97 dB\*

Marker 1 [T1]  
53.58 dB $\mu$ V/m  
5.76653307 GHz

RBW 1 MHz  
VBW 1 MHz  
SWT 32 ms  
RF Att Unit 0 dB  
dB $\mu$ V/m



Date: 14.JUL.2006 13:00:54

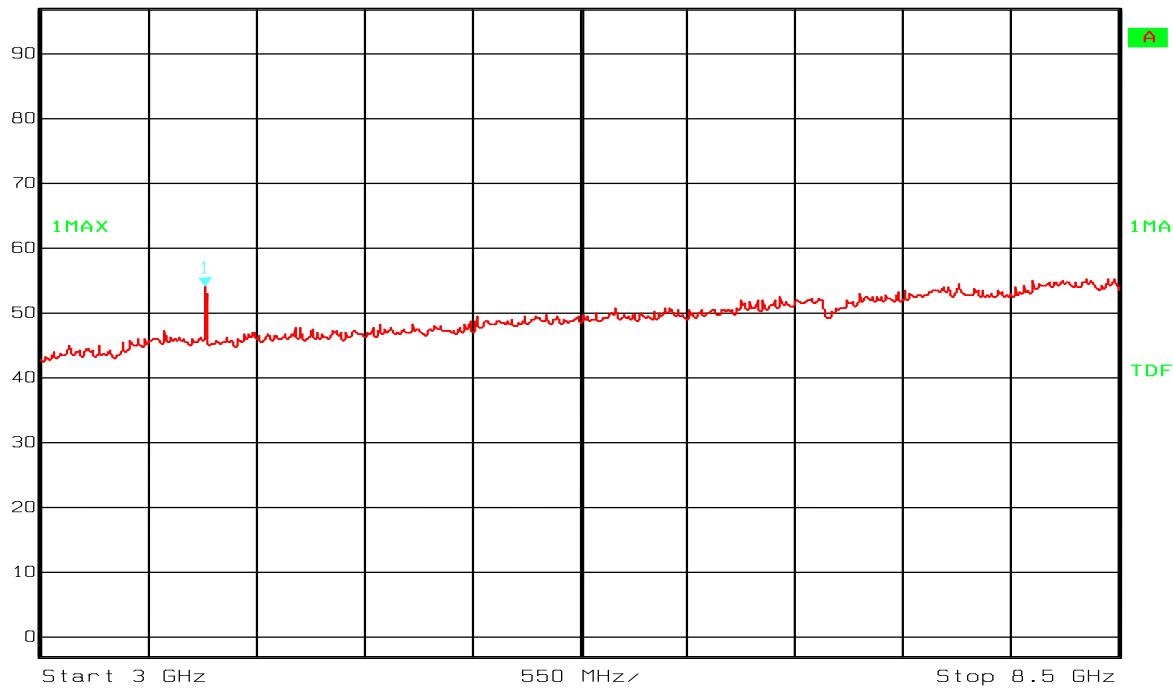
### Spurious Emissions 3 – 8.5 GHz, ch04, Ant 1



Ref Lvl  
97 dB\*

Marker 1 [T1]  
54.24 dB $\mu$ V/m  
3.83767535 GHz

RBW 1 MHz  
VBW 1 MHz  
SWT 32 ms  
RF Att Unit 0 dB  
dB $\mu$ V/m

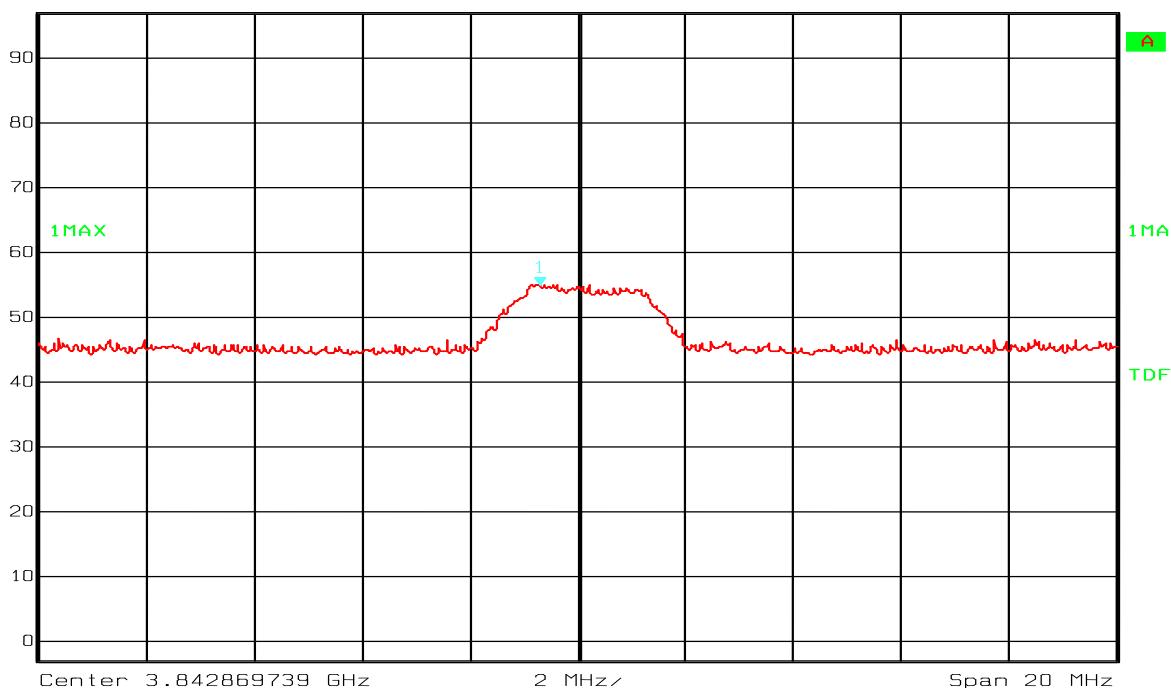


Date: 14.JUL.2006 13:17:51

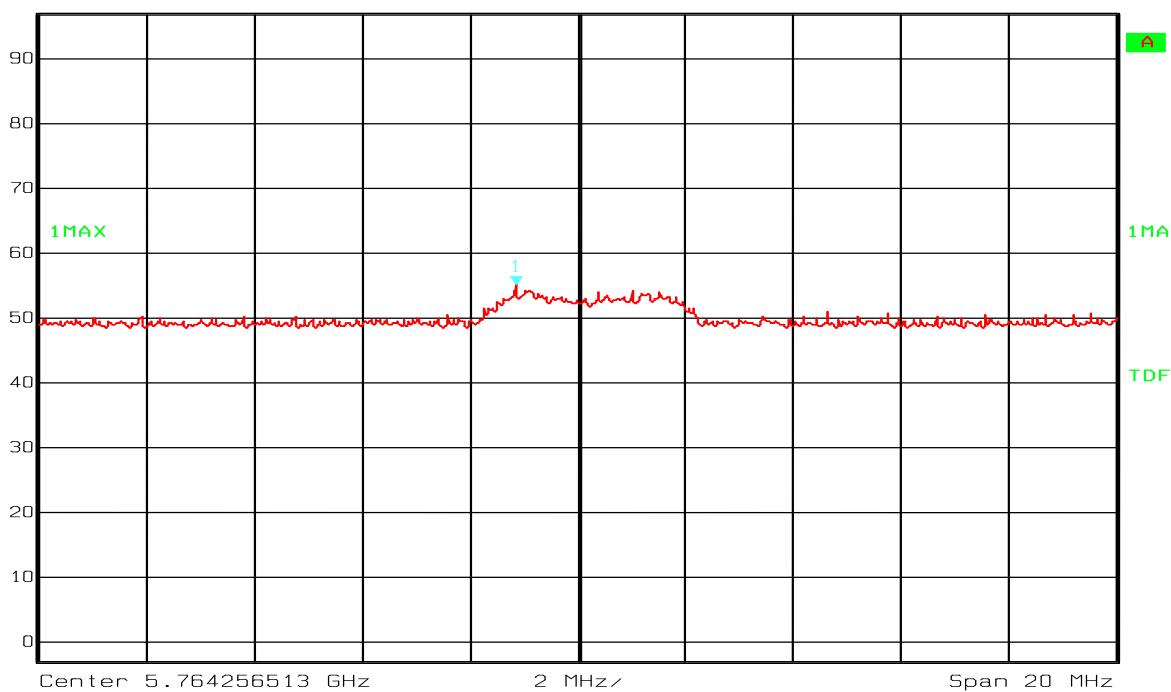
### Spurious Emissions 3 – 8.5 GHz, ch04, Ant 2

**Nemko**

**TEST REPORT**  
**FCC part 15D**  
Project no.: 69376  
FCC ID: BV5BECOM4BS

Ref Lvl  
97 dB\*Marker 1 [T1]  
54.99 dB $\mu$ V/m  
3.84216834 GHzRBW 1 MHz  
VBW 1 MHz  
SWT 5 ms  
Unit dB $\mu$ V/m

Date: 14.JUL.2006 13:22:23

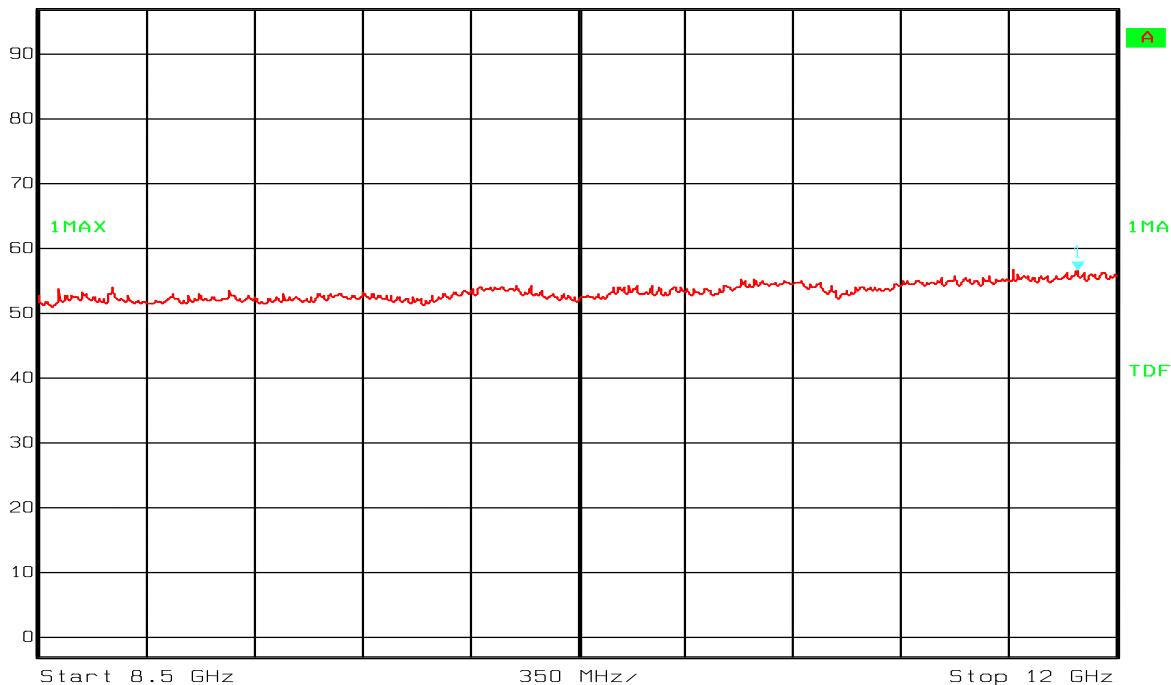
**Spurious Emissions 3.84 GHz (Second harmonic)**Ref Lvl  
97 dB\*Marker 1 [T1]  
55.03 dB $\mu$ V/m  
5.76311423 GHzRBW 1 MHz  
VBW 1 MHz  
SWT 5 ms  
Unit dB $\mu$ V/m

Date: 14.JUL.2006 13:12:04

**Spurious Emissions 5.76 GHz (Third harmonic)**

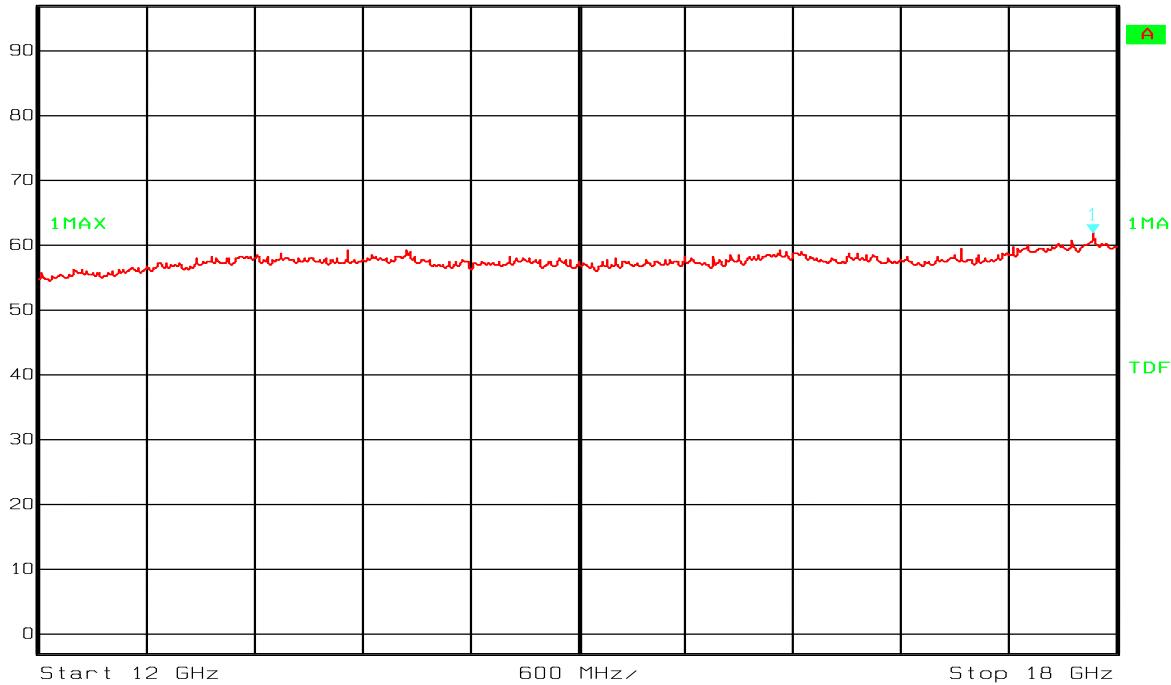
**Nemko**

**TEST REPORT**  
**FCC part 15D**  
Project no.: 69376  
FCC ID: BV5BECOM4BS

Ref Lvl  
97 dB\*Marker 1 [T1]  
56.70 dB $\mu$ V/m  
11.87374749 GHzRBW 1 MHz  
VBW 1 MHz  
SWT 20 ms  
RF Att Unit 0 dB  
dB $\mu$ V/m

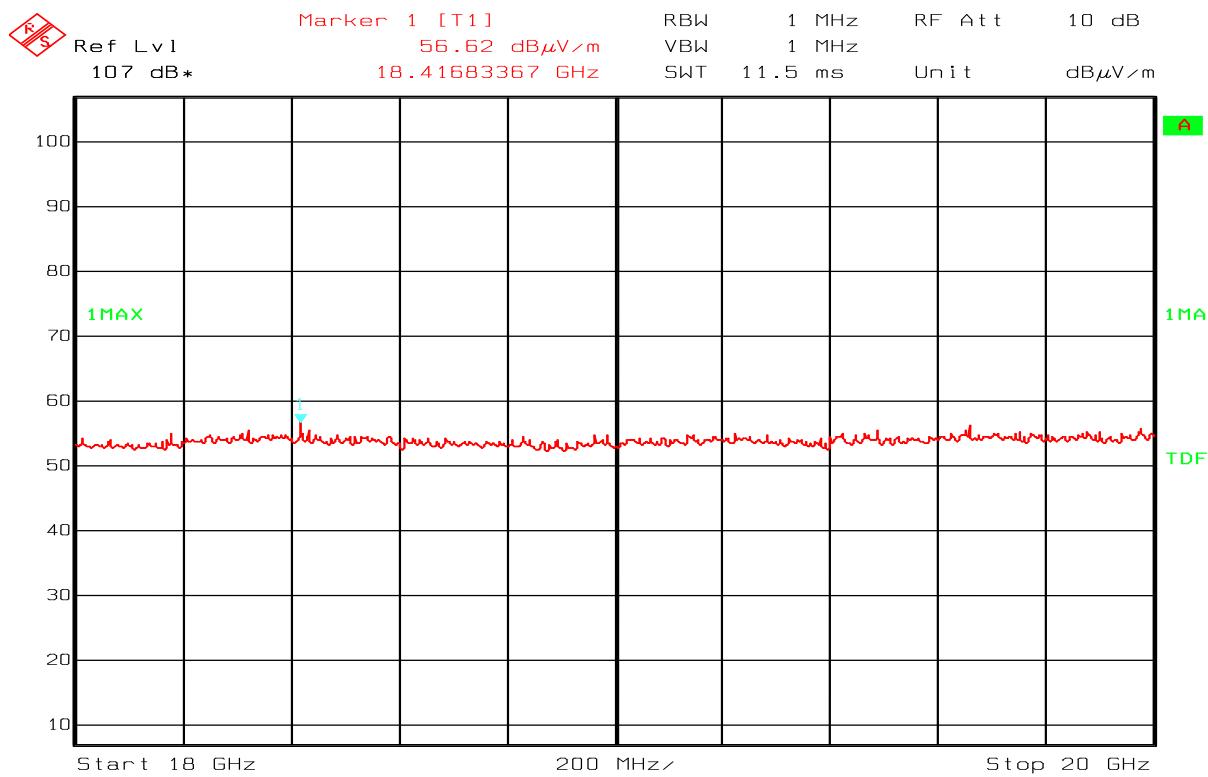
Date: 14.JUL.2006 14:12:44

### Spurious Emissions 8.5 - 12 GHz

Ref Lvl  
97 dB\*Marker 1 [T1]  
61.86 dB $\mu$ V/m  
17.86773547 GHzRBW 1 MHz  
VBW 1 MHz  
SWT 34 ms  
RF Att Unit 0 dB  
dB $\mu$ V/m

Date: 14.JUL.2006 14:42:02

### Spurious Emissions 12 - 18 GHz



## 4.25 Receiver Spurious Emissions

### Measurement Procedure:

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

### Test results:

The Receiver Spurious Emissions are covered by paragraph 4.23 Spurious Emissions Radiated. No separate Spurious Emissions which could be related to the receiver were detected during the radiated test.

## 5 Test Setups

### 5.1 Frequency Measurements

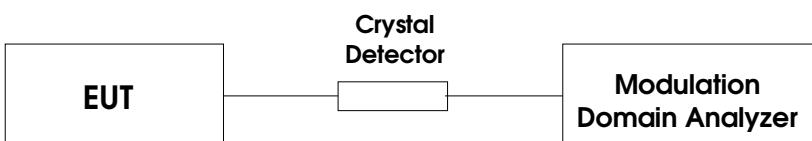


*Test equipment included: 5*

#### Test Set-up 1

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

### 5.2 Timing Measurements

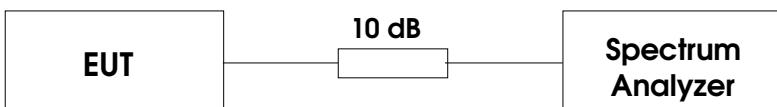


*Test equipment included: 5, 7*

#### Test Set-up 2

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

### 5.3 Conducted Emission Tests



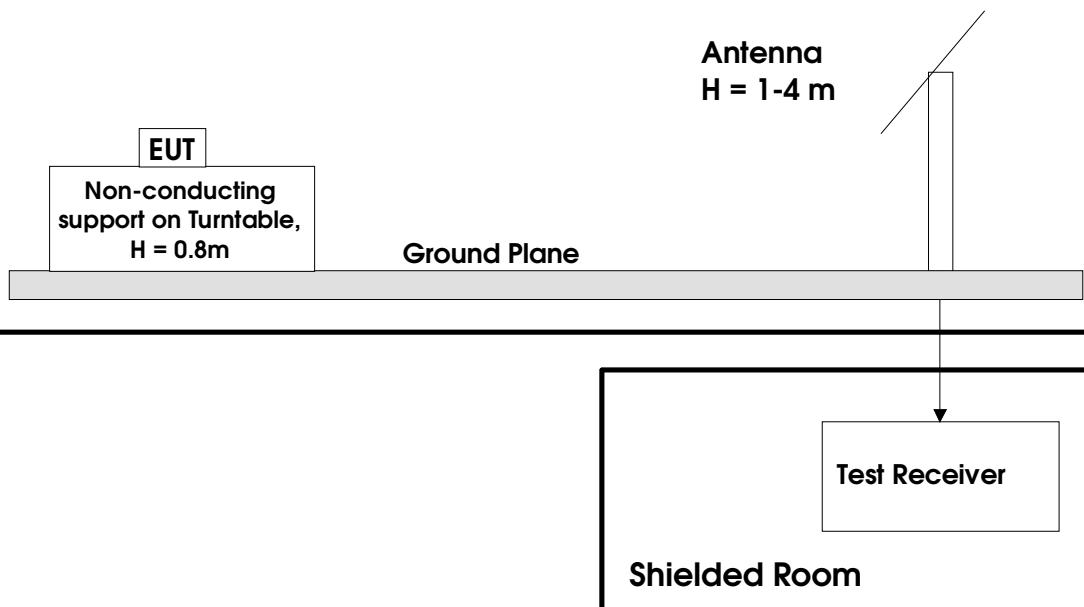
*Test equipment included: 1, 13*

#### Test Set-up 3

This setup is used for all conducted emission tests.

## 5.4 Radiated Emission Tests

### Anechoic Chamber



Test equipment: 1, 8, 9, 10, 11, 20, 21, 22, 23, 24, 25, 26

#### Test Set-Up 4

This test setup is used for all radiated emissions tests. For frequencies below 30 MHz the measuring distance is 10 m, for all other frequencies it is 3m or 1m. Emissions above 1 GHz were measured with a Spectrum Analyzer and Horn Antenna and with the preamplifier after the antenna. For measurements above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss.

## 5.5 Power Line Conducted Emissions Tests

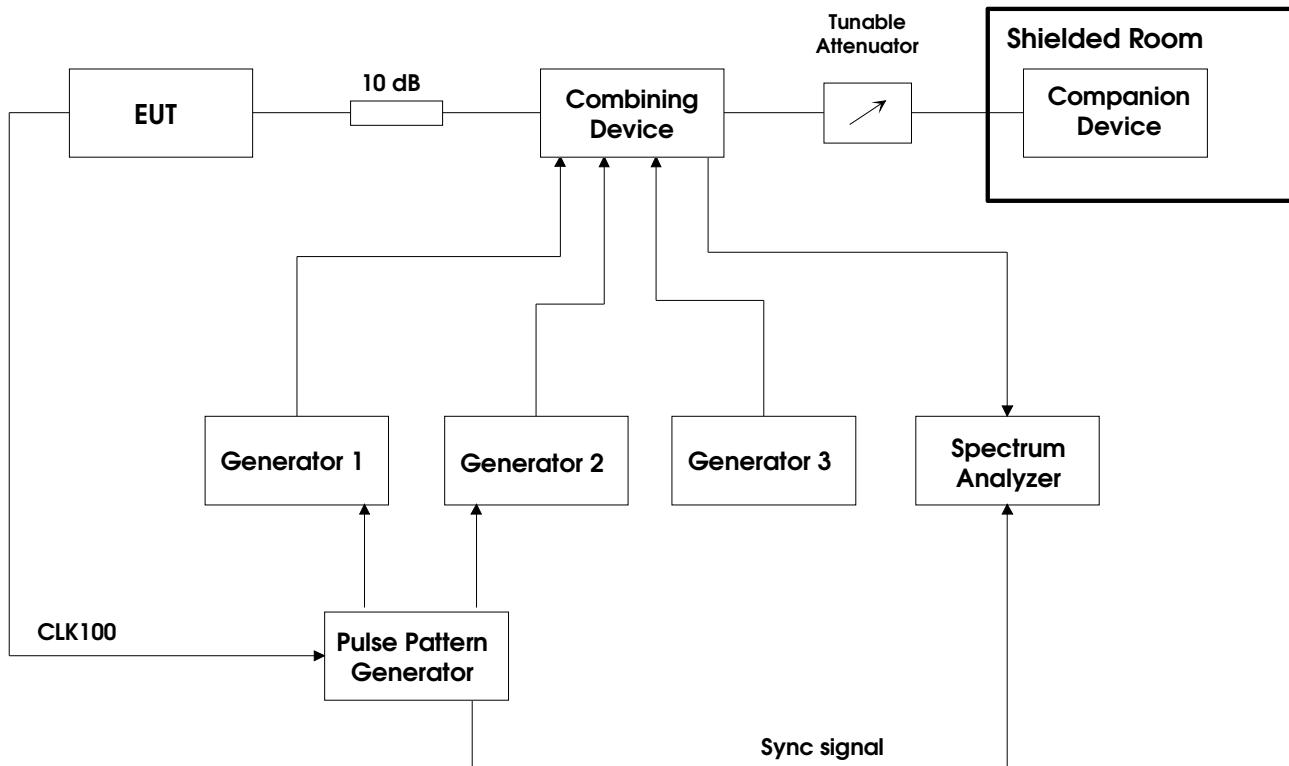
### Shielded Room



Test equipment: 12, 27, 28

#### Test Set-Up 5

## 5.6 Monitoring Tests



Test equipment: 1, 2, 3, 4, 6, 13, 14, 15, 16, 17, 18, 19

### 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 are 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 Test Laboratory.

No.	Instrument/ancillary	Type of instrument/ancillary	Manufacturer	Ref. no.
1	FSEK30	Spectrum Analyzer	Rohde & Schwarz	LR 1337
2	SME03	Signal generator	Rohde & Schwarz	LR 1238
3	SMP04	Signal generator	Rohde & Schwarz	LR 1336
4	SMHU52	Signal generator	Rohde & Schwarz	LR 1240
5	53310A	Modulation Domain Analyzer	Hewlett Packard	LR 1483
6	81104A	Pulse-/ Pattern Generator	Agilent	LR 1502
7	8470B	Crystal Detector	Hewlett Packard	LR 1207
8	8449B	Preamplifier	Hewlett Packard	LR 1322
9	4HC3000/18000	Highpass filter	Trilithic	S.No.: 9849045
10	ESVS30	Measuring Receiver	Rohde & Schwarz	LR 1101
11	ESN	Measuring Receiver	Rohde & Schwarz	LR 1237
12	ESAI	Measuring Receiver	Rohde & Schwarz	LR 1090
13	6810.17B	Attenuator	Narda	LR1212
14	745-69	Step Attenuator	Narda	LR 1442
15	WE 1506A	Power Splitter	Weinchel	LR 244
16	WE 1506A	Power Splitter	Weinchel	LR 245
17	H-9	Hybrid	Anzac	LR 86
18	H-9	Hybrid	Anzac	LR 257
19	S212DS	RF Switch	Narda	LR 1244
20	3115	Horn Antenna	EMCO	LR 1330
21	PM 7320X	Horn Antenna	Sivers Lab	LR 103
22	DBF-520-20	Horn Antenna	Systron Donner	LR 101
23	638	Horn Antenna	Narda	LR 1480
24	HL223	Biconical Antenna	Rohde & Schwarz	LR 1261
25	HK116	Logperiod Antenna	Rohde & Schwarz	LR 1260
26	HFH2-Z2	Loop Antenna	Rohde & Schwarz	LR 285
27	ESH3-Z5	Two Line V-Network	Rohde & Schwarz	LR 1076
28	80S	Signal Generator	Powertron	LT 502