REPORT ON THE CERTIFICATION TESTING OF AN SENNHEISER COMMUNICATIONS A/S DW BS - US WITH RESPECT TO FCC RULES CFR 47, PART 15D July 2008 INTENTIONAL RADIATOR SPECIFICATION

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REPORT ON THE CERTIFICATION TESTING OF AN SENNHEISER COMMUNICATIONS A/S DW BS - US WITH RESPECT TO FCC RULES CFR 47, PART 15D July 2008 INTENTIONAL RADIATOR SPECIFICATION

TEST DATE: 1st – 15th September 2009

TESTED BY: Daniel Winstanley Digitally signed by Daniel Winstanley DN: CN = Daniel Winstanley, C = <n Reason: I am the author of this document Date: 2010.02.10 12:00:56 Z D WINSTANLEY

APPROVED BY: John Charters Digitally signed by John Charters DN: CN = John Charters, C = GB Reason: I am approving this document Date: 2010.02.10 12:01:04 Z J CHARTERS RADIO PRODUCT MANAGER

DATE: 10th February 2010

Distribution:

Sennheiser Communications A/S

TRaC Telecoms & Radio

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The results herein relate only to the sample tested. Full results are contained in the relevant works order file.

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Notes:

1. Component failure during test YES [ ] NO [X]
2. If Yes, details of failure:
3. The facilities used for the testing of the product contain in this report are FCC Listed.
4. The contents of the attached applicants declarations and other supplied information are not covered by the scope of this laboratory's UKAS or FCC accreditations' and is provided in good faith.

CERTIFICATE OF CONFORMITY & COMPLIANCE

FCC IDENTITY:	DMOCDBDIB
IC NUMBER:	2099D –TDB1
PURPOSE OF TEST:	Certification
TEST SPECIFICATION(s):	FCC RULES CFR 47, Part 15D July 2008 RSS-213
TEST RESULT:	Compliant to Specification
EQUIPMENT UNDER TEST:	DW BS - US
EQUIPMENT TYPE:	UPCS Transceiver
PRODUCT USE:	Personal communications
CARRIER POWER:	20.27 dBm (Conducted)
ANTENNA TYPE:	Integral
BAND OF OPERATION:	1920 MHz – 1930 MHz
CHANNEL SPACING:	1.728 MHz
NUMBER OF CHANNELS:	5 frequencies, 12 single time slots per frequency giving 60 channels
FREQUENCY GENERATION:	SAW Resonator [ ] Crystal [ ] Synthesiser [X]
MODULATION METHOD:	Amplitude [ ] Digital [X] Angle [ ]
POWER SOURCE(s):	+110 Vac or Via USB
TEST DATE(s):	1st – 15th September 2009
APPLICANT:	Sennheiser Communications A/S
ADDRESS:	Langager 6 DK-2680 Solrød Stand Denmark

TESTED BY: Daniel Winstanley

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J CHARTERS
RADIO PRODUCT MANAGER

APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT):	DW BS - US		
EQUIPMENT TYPE:	UPCS Transceiver		
PURPOSE OF TEST:	Certification		
TEST SPECIFICATION(s):	FCC RULES CFR 47, Part 15D July 2008 RSS-213		
TEST RESULT:	COMPLIANT	Yes No	[X] [ ]
APPLICANT'S CATEGORY:	MANUFACTURER IMPORTER DISTRIBUTOR TEST HOUSE AGENT		[X] [ ] [ ] [ ] [ ]
APPLICANT'S CONTACT PERSON(s):	Ms E Mujan		
E-mail address:	emujan@sennheisercommunications.com		
APPLICANT:	Sennheiser Communications A/S		
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TEL:	+45 5618 0000		
FAX:	+45 5618 0099		
TEST LABORATORY:	TRaC Telecoms & Radio, Up Holland		
TEST DATE(s):	1st – 15th September 2009		
TEST REPORT No:	8F1839WUS2		

EQUIPMENT TEST / EXAMINATIONS REQUIRED

1.

TEST/EXAMINATION	Part 15	RSS-213	Applicable
Coordination with Fixed Microwave Service	15.307 (b)	2.1	No note 1
Cross reference to Subpart B	15.309 (b)	N/A	Yes
Labelling Requirements	15.311 15.19 (a)(3)	RSS-GEN 5.2	Yes
Measurement Procedures	15.313	4.1	Yes
Antenna Requirement	15.317 15.203	4.1(e)	Yes
Modulation Techniques	15.319 (b)	4.3.1	Yes
Conducted AC Powerline	15.315 15.207	4.2	Yes
Emission Bandwidth	15.323 (a)	4.3.2.1	Yes
Peak Transmit Power	15.319 (c)	4.3.1	Yes
Power Spectral Density	15.319 (d)	4.3.2.1	Yes
Antenna Gain	15.319 (e)	4.1 (e)	Yes
Automatic Discontinuation of Transmission	15.319 (f)	4.3.4(a)	Yes
Radio Frequency Radiation Exposure	15.319 (i)	RSS-102	Yes
Monitoring Thresholds	15.323 (c)(2) 15.323 (c)(9)	4.3.4(b)(2)	Yes
Monitoring of Intended Transmit Window and Maximum Reaction Time	15.323 (c)(1)	4.3.4(b)(1)	Yes
Monitoring Bandwidth	15.323 (c)(7)	4.3.4(b)(7)	Yes
Access Criteria Functional Test	15.323 (c)(6)	4.3.4(b)(6)	Yes
Duration of Transmission	15.323 (c)(3)	4.3.4(b)(3)	Yes
Connection Acknowledgement	15.323 (c)(4)	4.3.4(b)(4)	Yes
Lower threshold Selected Channel, Power Accuracy, Segment Occupancy	15.323 (c)(5)	4.3.4(b)(5)	Yes
Monitoring Antenna	15.323 (c)(8)	4.3.4(b)(8)	Yes
Duplex Connections	15.323 (c)(10)	4.3.4(b)(10)	Yes
Alternative Monitoring Interval for Co-located Devices	15.323 (c)(11)	4.3.4(b)(11)	No Note 3
Fair Access to Spectrum Related to (c)(10) & (c)(11)	15.323 (c)(12)	4.3.4(b)(12)	Yes
Emission Inside and Outside the Sub-band	15.323 (d)	4.3.3	Yes
Frame Period	15.323 (e)	4.3.4(c)	Yes
Frequency Stability	15.323 (f)	6.2	Yes

Note:
1. Requirement removed April 4th 2005 see public notice DX 05-1005.
2. Not utilized by this EUT as devices will not be co-located within 1m of each other.

2.	Product Use:	Personal Communications	
3.	Duty Cycle:		8.33%
4.	Transmitter bit or pulse rate and level:		2Mbps
5.	Temperatures:	Ambient (Tnom)	22°C
6.	Supply Voltages:	Vnom	+110 Vac

Note: Vnom voltages are as stated above unless otherwise shown on the test report page

7.	Equipment Category:	Single channel	[ ]
		Two channel	[ ]
		Multi-channel	[X]
8.	Channel spacing:	Narrowband	[ ]
		Wideband	[X]

9. System Description:

The system is made up of two parts, a fixed part and a portable part. The portable part is a cordless headset device. The portable part is capable of operating on a maximum of 60 channels (time spectrum windows). The fixed part is a desktop transmitters connected to an exchange/personal computer.

The system operates in the 1920MHz -1930MHz band. The system use 5 different frequency channels 1.728MHz apart using MC/TDMA/TDD (Multi Carrier / Time Division Multiple Access / Time Division Duplex) using QPSK modulation.

The system employs a 10ms frame, divided into 24 equal timeslots, numbered 0-23. The Base station always transmits in the first half of the frame, and the Portable always transmits on the duplex mate in the second half of the frame.

The Portable is the initiating device. A physical bearer is composed of a transmit single-slot and a receive single-slot for narrowband communications or a transmit long-slot and a receive long-slot for wideband communications. The two halves of a given bearer are always exactly half a frame (5ms, 12 single slots) apart. When configured to operate using long slots the transmission extends in the next consecutive transmit/receive time slot.

The Fixed part is always capable of realising >40 channels when transmitting control and signalling information. The portable part is capable of realising >40 Channels in single-slot configuration and <40channels in long-slot configuration.

During the testing frequency administration was utilised to allow operation on only certain channels during the tests. The frequency administration was performed using a software interface. A portable part was supplied with a temporary antenna connector to allow conducted measurements where applicable.

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CROSS REFERENCE TO SUBPART B

The unit contains digital circuitry, which is not directly related to the radio transmitter. See emissions outside the sub-band for results.

LABELLING INFORMATION

This information is contained in a separate document. See attached exhibit(s).

ANTENNA REQUIREMENTS

The units employ an integral antenna arrangement.

MODULATION TECHNIQUES

The SENNHEISER COMMUNICATIONS A/S DW BS - US is an isochronous device operating in the 1920 MHz – 1930 MHz frequency band.

The SENNHEISER COMMUNICATIONS A/S DW BS - USs modulation technique is based on DECT technology as described in European standards EN 300 175-2 and EN 300 175-3.

The SENNHEISER COMMUNICATIONS A/S DW BS - USs modulation techniques are MC/TDMA/TDD (Multi Carrier / Time Division Multiple Access / Time Division Duplex) using QPSK modulation.

TRANSMITTER CONDUCTED EMISSIONS – AC POWER LINE

SIGNIFICANT EMISSIONS – DUMMY BEARER HEADSET CHARGING

FREQUENCY (MHz)	MEASUREMENT RECEIVER READING (dBµV)	DETECTOR	CONDUCTOR (L or N)	Limit (dBµV)
0.400	41.93	Average	47.85	Live
0.435	49.88	Quasi Peak	57.16	Live

SIGNIFICANT EMISSIONS– SINGLE SLOT CONFIGURATION

FREQUENCY (MHz)	MEASUREMENT RECEIVER READING (dBµV)	DETECTOR	CONDUCTOR (L or N)	Limit (dBµV)
0.400	42.99	Average	47.85	Live
0.535	47.62	Quasi Peak	56.00	Live

SIGNIFICANT EMISSIONS – LONG SLOT CONFIGURATION

FREQUENCY (MHz)	MEASUREMENT RECEIVER READING (dBµV)	DETECTOR	CONDUCTOR (L or N)	Limit (dBµV)
0.405	54.72	Quasi Peak	57.75	Live
0.530	49.02	Quasi Peak	56.00	Live
0.540	48.56	Quasi Peak	56.00	Live
0.680	47.32	Quasi Peak	56.00	Live

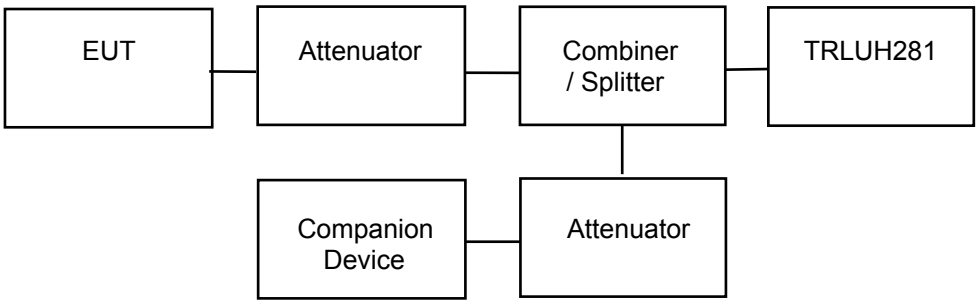
Notes:
1 See Annex C for worst case powerline plot.
2 Emissions that are 10 dB's or more below the limit are not necessarily recorded.
3 The EUT was tested transmitting a single slot traffic bearer.
4 The EUT was tested transmitting a long slot traffic bearer.
5 The EUT was tested transmitting a dummy bearer with a headset seated & charging.
6 Closest emissions to the applicable limit are recorded.

Test Method: 1 As per Radio – Noise Emissions, ANSI C63.4: 2003.

TRANSMITTER EMISSION BANDWIDTH – PART 15.323 (a)

The emission bandwidth is measured in accordance with ANSI C63.17 sub-clause 6.1.3 using the setup below

Test Setup 1:



Single Slot Configuration

f_x = 1921.536 MHz				
Δ P (dBc)	fl (MHz)	fh (MHz)	Δf (MHz)	Limit
-26	1920.813885	1922.237923	1.424	50kHz> Δf > 2.5MHz
-12	1920.924462	1922.116769	1.192	N/A
-6	1921.087923	1922.006192	0.918	N/A

f_x = 1924.992 MHz				
Δ P (dBc)	fl (MHz)	fh (MHz)	Δf (MHz)	Limit
-26	1924.258346	1925.698731	1.440	50kHz> Δf > 2.5MHz
-12	1924.373731	1925.578538	1.204	N/A
-6	1924.532385	1925.448731	0.916	N/A

f_x = 1928.448 MHz				
Δ P (dBc)	fl (MHz)	fh (MHz)	Δf (MHz)	Limit
-26	1927.732615	1929.145115	1.412	50kHz> Δf > 2.5MHz
-12	1927.833577	1929.034538	1.200	N/A
-6	1927.982615	1928.890308	0.907	N/A

Long Slot Configuration

f_x = 1921.536 MHz				
Δ P (dBc)	fl (MHz)	fh (MHz)	Δf (MHz)	Limit
-26	1920.805231	1922.233115	1.427	50kHz> Δf > 2.5MHz
-12	1920.925423	1922.117731	1.192	N/A
-6	1921.031192	1921.978308	0.947	N/A

f_x = 1924.992 MHz				
Δ P (dBc)	fl (MHz)	fh (MHz)	Δf (MHz)	Limit
-26	1924.250654	1925.696808	1.446	50kHz> Δf > 2.5MHz
-12	1924.366938	1925.571808	1.205	N/A
-6	1924.500654	1925.475654	0.975	N/A

f_x = 1928.448 MHz				
Δ P (dBc)	fl (MHz)	fh (MHz)	Δf (MHz)	Limit
-26	1927.721077	1929.138385	1.417	50kHz> Δf > 2.5MHz
-12	1927.831654	1929.023000	1.191	N/A
-6	1927.932615	1928.888385	0.955	N/A

Notes: 1. See emission bandwidth plots in Annex D.
2. Emission bandwidth Δf rounded up.
3. Emission bandwidth measured with an active communications channel.

PEAK TRANSMIT POWER – PART 15.319 (c)

The peak transmit power is measured in accordance with ANSI C63.17 sub-clause 6.1.2 using test setup 1(page 10).

The limit for Peak Transmit Power (PTP) is calculated using the following formula:

$$PTP = 5 \text{ Log}_{10} \text{ EBW} - 10 \text{ dBm}$$

This limit must be corrected to take into account any gain of the antenna greater than 3dBi.
Where: EBW is the transmitter emission bandwidth in Hz as determined in the previous test.

Limit

EBW = 1.446MHz

$PTP = 5 \text{ Log}_{10}$ 1.446MHz – 10 dBm

PTP = 20.80 dBm

Single Slot Results

Frequency (MHz)	Peak Transmit Power (dBm)	Limit (dBm)
1921.536	20.27	20.80
1924.992	20.26	20.80
1928.448	19.95	20.80

Note:
1. Permanent antenna was replaced with temporary antenna connector to enable conducted measurement.
2. Antenna gain < 3dBi and so correction of the limit is not required.
3. See Annex E for Peak Transmit Power Plots.

Long Slot Results

Frequency (MHz)	Peak Transmit Power (dBm)	Limit (dBm)
1921.536	20.27	20.80
1924.992	20.25	20.80
1928.448	19.92	20.80

Note:
1. Permanent antenna was replaced with temporary antenna connector to enable conducted measurement.
2. Antenna gain < 3dBi and so correction of the limit is not required.
3. See Annex E for Peak Transmit Power Plots.

POWER SPECTRAL DENSITY – PART 15.319 (d)

The power spectral density is measured using test setup 1, (page 10).

Limit

The power spectral density shall not exceed 3mW in any 3 kHz bandwidth as measured with a spectrum analyser having a resolution bandwidth of 3 kHz.

Single Slot Results

Frequency (MHz)	Power Spectral Density (mW/3kHz)	Limit (mW/3kHz)
1921.536	0.61	3
1924.992	0.41	3
1928.448	0.56	3

Note: 1. See Annex F for Power Spectral Density Plots.

Long Slot Results

Frequency (MHz)	Power Spectral Density (mW/3kHz)	Limit (mW/3kHz)
1921.536	0.35	3
1924.992	0.43	3
1928.448	0.47	3

Note: 1. See Annex F for Power Spectral Density Plots.

ANTENNA GAIN – PART 15.319 (e)

Any directional gain of the antenna exceeding 3dBi has an effect on the limit applied to the measurements taken for the peak transmit power test. If the directional gain of the antenna is less than 3dBi it is not required to be taken into account.

Maximum Antenna Gain	Exceeds 3dBi by
+2dBi	N/A

Note: Statement by manufacturer declaring maximum antenna gain. See attached exhibit.

AUTOMATIC DISCONTINUATION OF TRANSMISSION – PART 15.319 (f)

Automatic discontinuation of transmission means break off of transmissions that are not control and signalling information.

This test is monitored using the test setup 1(page 10) as per transmitter emission bandwidth and an active channel.

The TEOS BS 880 is a fixed part and as such transmits control and signalling information the counter part device is a portable part device and so does not transmit control and signalling information.

Part	Transmits Control and Signaling Information	Equipment Under Test
Fixed Part	X	X
Portable Part		

Results

The following tests were performed after a connection had been established with the counter part device

Number	Test	Reaction of EUT	Pass / Fail
1	Power removed from EUT	A	Pass
2	Power Removed From Companion Device	B	Pass
3	Companion Device powered down	B	Pass
4	EUT Mounted on Companion device	B	Pass

A – Connection breakdown, Cease of all transmissions.
B – Connection breakdown, EUT transmits control and signalling information.
C – Connection breakdown, Counterpart transmits control and signalling information.

RADIO FREQUENCY RADIATION EXPOSURE – PART 15.319 (i)

This information is contained is a separate document

MONITORING THRESHOLDS – PART 15.323 (c)(2); (c)(9)

The monitoring threshold calculations are carried out in accordance with ANSI C63.17 sub-clause 7.2.1 using the calculations laid out in ANSI C63.17 sub-clauses 4.3.3 and 4.3.4

Calculation of monitoring threshold limits for isochronous devices:

Lower threshold: $T_L = -174 + 10Log_{10}B + M_U + P_{MAX} - P_{EUT}$ (dBm)

Upper threshold: $T_U = -174 + 10Log_{10}B + M_U + P_{MAX} - P_{EUT}$ (dBm)

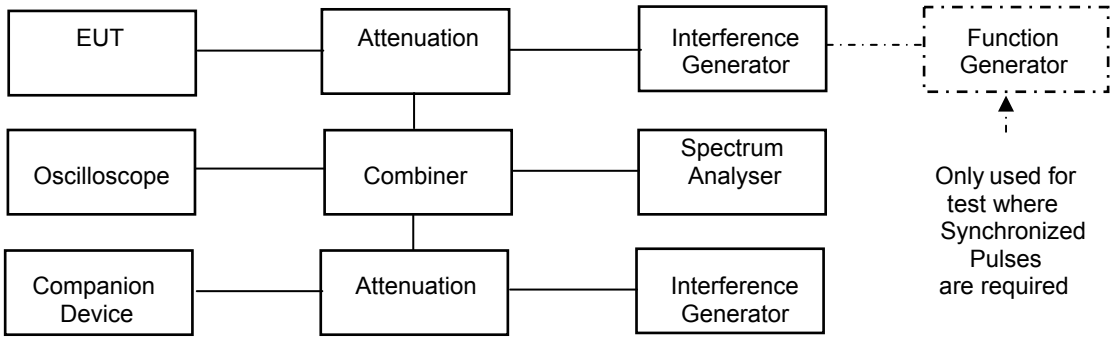
Where: B = Emission bandwidth (Hz)
M_U = dBs the threshold may exceed thermal noise (30 for T_L & 50 for T_U)
P_{MAX} = Output Power Limit (dBm)
P_{EUT} = Transmitted power (dBm)

Monitor Threshold	B (MHz)	M_U (dB)	P_{MAX} (dBm)	P_{EUT} (dBm)	Threshold (dBm)
T_L	1.446	30	20.80	20.27	-61.8
T_U	1.446	50	20.80	20.27	-81.8

Note: 1. Threshold levels rounded up/down to nearest whole number

The monitoring threshold tests are carried out in accordance with ANSI C63.17 sub-clause 7.3 using the test setup 2. The upper threshold level was determined following the procedure as laid out in ANSI C63.17 sub-clause 7.3.2 (a) Frequency administration was used to allow operation on the carrier closest to the centre of the band.

Test Setup 2:



Limits

The EUT must not transmit until the interference level is less than or equal to:

Measured Threshold Level ≤ $T_U + U_M$

Where: T_U = Calculated Upper threshold level
U_M = Margin of uncertainty in threshold measurements (6dB)

Results

Monitor threshold	Measured Threshold Level	Limit	Pass/Fail
Lower Threshold (dBm)	N/A	N/A	Pass
Upper threshold (dBm)	-62.9	-55.9	Pass

Notes: 1. The upper threshold is applicable as the EUT utilizes more than 40 system channels.

MONITORING OF INTENDED TRANSMIT WINDOW AND MAXIMUM REACTION TIME – PART 15.323 (c)(1)

The monitoring of intended transmit window was carried out in accordance with ANSI C63.17 sub-clause 7.5 using test setup 2 (page 15).

The EUT was frequency administered to only one operating frequency channel and only one of the interference generators in the test setup was utilized. The interference generator was fed pulses from the function generator to produce a pulsed carrier of the specified time length and the output of the interference generator was set to the required level. The pulse generator and EUT were synchronized so the position of the pulses corresponded to the time-slot pattern in the frame of the EUT. The test is performed with the unit frequency administered to operate only on bottom, middle or top frequency.

For each of the required tests the pulse width and interference level are as below:

Test c)

With the interference generator output set at the calculated threshold level (upper) plus measurement uncertainty (U_M) and the width of the pulse interference exceeds the largest of 50μs and $50\sqrt{1.25/B}$ μs verify that the EUT does not establish a connection.

Test d)

With the interference generator output set at 6dB above the calculated threshold level (upper) plus measurement uncertainty (U_M) and the width of the pulse interference exceeds the largest of 35μs and $35\sqrt{1.25/B}$ μs verify that the EUT does not establish a connection.

Where B = Emission bandwidth of the EUT in MHz

Results

Test Equation (μs)	Pulse Width (μs)	Interferer Level (dBm)	Connection Made	Pass/Fail
$50\sqrt{1.25/B}$	50	$T_U + U_m$	No	Pass
$35\sqrt{1.25/B}$	35	$T_U + U_m + 6$	No	Pass

Notes:
1. T_U is the calculated upper threshold.
2. U_M is Margin of uncertainty in threshold measurements (6dB).

ACCESS CRITERIA FUNCTIONAL TEST

The access criteria test interval tests were carried out in accordance with ANSI C63.17 sub-clause 8.1.1 and 8.1.2 using test setup 2 (page 15). These tests are only applied to a EUT capable of transmitting control and signaling information. ANSI C63.17 sub-clause 8.1.3 is not applicable the random waiting interval option is not implemented.

The EUT was frequency administered to only one operating frequency. The interference generator was fed pulses from the function generator to produce a pulsed carrier of the specified time length and the output of the interference generator was set to the required level. The pulse generator and EUT were synchronized so the position of the pulses corresponded to the time-slot pattern in the frame of the EUT. The tests were performed to find the following:

ANSI C63.17 sub-clause 8.1.1

Test b)
The interference generator was setup to introduce interference on all but one time slot (single slot). The free slot was set to coincide with slot 4. The transmissions if any should occur on the free time slot. Verify that the access criteria are checked not less frequently than every 30 seconds

Results

Test	Test Data Required	Test Result	Limit	Pass/Fail
Access Criteria Selection of Channel,	Any transmissions and on which time slot	Transmissions occurred on time slot 4	Transmit on time slot 4	Pass
Repetition of Access Criteria (note 1)	Interval Between Access Criteria	1.282 seconds	<30 Seconds	Pass

Note: 1. The interval between access criteria test is checked 5 times.
2. See Annex G for plots of the access criteria test interval.

ANSI C63.17 sub-clause 8.1.2

f1 = 1924.992 MHz
f2 = 1926.720 MHz

Test b)
With no interference on, the EUT must transmit on f1 or f2. The interference is then applied to the channel used by the EUT at the appropriate level. Verify that after the application of interference the EUT transmits on the open channel after the next pause.

Results

Test	Before interference applied EUT transmits on	After interference applied on f1 EUT transmits on	Limit	Pass/Fail
8.1.2 Test b	f1	f2	Change channel after application of interference	Pass

Notes: 1. See Annex H for timing plots of access criteria functional test.
2. Random Waiting Interval option not implemented.

MONITORING BANDWIDTH

The monitoring bandwidth test was carried out in accordance with ANSI C63.17 sub-clause 7.4.

ANSI C63.17 sub-clause 7.4 states that if the monitoring is made through the radio receiver used by the EUT for communication the intended bandwidth requirements for the monitoring system are met.

As declared by the manufacturer, the EUT uses the radio receiver used for communication for monitoring therefore the intended bandwidth requirements of ANSI C63.17 sub-clause 7.4 for the monitoring system are met.

DURATION OF TRANSMISSION

The duration of transmission test was carried out in accordance with ANSI C63.17 sub-clause 8.2.2 using test setup 2.(page 15) (No interference generators were active during this test).

The time/spectrum window occupied by the connection was monitored using a spectrum analyzer for the spectrum window and an oscilloscope for the time slot. The connection was watched over a period of over 3 hours during this time the access criteria was repeated several times.

Result

Repetition of Access Criteria	Maximum Transmission Time	Maximum Transmission Time Limit	Pass/Fail
Period	<3.25 Hours	<8 Hours	Pass

Notes: 1. The portable part is the initiating device that repeats the access criteria.

CONNECTION ACKNOWLEDGEMENT

The connection acknowledgement test was carried out in accordance with ANSI C63.17 sub-clause 8.2.1 using test setup 2. (Page 15)(No interference generators were active during this test).

The test was carried out in two parts. The first was to verify that with the companion device off the EUT does not transmit on the same time/spectrum window for more than the limit. The second was to verify that after a connection is broken the EUT terminates its transmission on the current communication channel within 30 seconds or less.

Result

Test	Time Taken (seconds)		Limit (seconds)	Pass/Fail
	Single Slot	Long Slot		
Transmission on communications channel no acknowledgement received (note 1)	Not Applicable (note 2)	Not Applicable (note 2)	1	Pass
Established communication channel termination, acknowledgements blocked during communication (note 1)	5.207	5.174	30	Pass

Note: 1. The companion device transmits a beacon signal when acknowledgements are blocked.
2. Test is only applicable to a EUT capable of establishing a communications channel.
3. See Annex G for Acknowledgement plots.

UPPER THRESHOLD SELECTED CHANNEL, POWER ACCURACY, SEGMENT OCCUPANCY

Least interfered Channel

The EUT utilizes more than 40 channels the least interfered channel testing is applicable. This test was carried out in accordance with ANSI C63.17 sub-clause 7.3.3 using test setup 2 (page 15).

The EUT was frequency administered to operating on two frequencies only, f1 and f2.

f1 = 1924.992 MHz
f2 = 1926.720 MHz

Test b)
Interference on f1 was set at $T_L + U_M$ + 7dB and at $T_L + U_M$ on f2. Initiate communication. The EUT should transmit on f2. Repeat 5 times. If the EUT transmits on f1 the test is failed.

Test c)
Interference on f1 was set at $T_L + U_M$ and at $T_L + U_M$ + 7dB on f2. Initiate communication. The EUT should transmit on f1. Repeat 5 times. If the EUT transmits on f2 the test is failed.

Test d)
Interference on f1 was set at $T_L + U_M$ + 1dB and at $T_L + U_M$ - 6dB on f2. Initiate communication. The EUT should transmit on f2. Repeat 5 times. If the EUT transmits on f1 the test is failed.

Test e)
Interference on f1 was set at $T_L + U_M$ - 6dB and at $T_L + U_M$ + 7dB on f2. Initiate communication. The EUT should transmit on f1. Repeat 5 times. If the EUT transmits on f2 the test is failed.

Result

Test	Transmit on f1	Transmit on f2	Wanted Transmit Channel	Pass/Fail
b	No	Yes	f2	Pass
c	Yes	No	f1	Pass
d	No	Yes	f2	Pass
e	Yes	No	f1	Pass

Note: 1. All tests were repeated 5 times.

Selected Channel Confirmation

This test was carried out in accordance with ANSI C63.17 sub-clause 7.3.4 using test setup 2 (page 15).
The test is to ensure the EUT monitors the time/spectrum window immediately prior to transmission.

The EUT was frequency administered to operating on two frequencies only, f1 and f2.

f1 = 1924.992 MHz
f2 = 1926.720 MHz

Test a)
Interference is applied on f1 at a level of $T_U + U_M$. Verify a connection is established on f2.

Any connection is terminated.

Test b)
Interference is applied on f2 at a level of $T_U + U_M$ and immediately removed from f1 and the EUT is immediately caused to attempt transmission. In this case the EUT should transmit on f1

Result

Test	Transmit on f1	Transmit on f2	Wanted Transmit Channel	Pass/Fail
a	No	Yes	f2	Pass
b	Yes	No	f1	Pass

Power Accuracy

The power measurement resolution for the previous comparison must be accurate to within 6dB. The monitoring threshold test covered in Part 15.323 (c)(2) automatically proves that this requirement is met.

Segment Occupancy

This section is not applicable as no units will be located within 1 metre of each other.

MONITORING ANTENNA – PART 15.323 (c)(8)

The antenna of the EUT used for transmitting is the same antenna that is used for monitoring.

DUPLEX CONNECTIONS – PART 15.323 (c)(10)

The tests laid out in this section verify that two devices communicating over a duplex connection meet the access criteria. For the purpose of this testing the initiating device is under test and the companion is the responding device used in conjunction with the Initiating device. These tests are carried out in accordance with ANSI C63.17 sub-clause 8.3.2 using test setup 2 (page 15). The TEOS BS 880 is the responding device; results for the TEOS HS 20 are recorded for information only. Before all tests are carried out any connection is terminated.

Test carried out in accordance with ANSI C63.17 sub-clause 8.3.1 for long slot configuration.

Test b)
The system is restricted to operation on one frequency (1924.992 MHz) using administration. Verify that a connection between the EUT and its companion device can be made.

Test c) & d)
Apply interference at a level $T_L + U_M$ to all receive time slots except one which has interference at least 10dB below T_L. Apply interference at a level $T_L + U_M$ to all transmit time slots except one which has interference at least 10dB below T_L. The interference free receive timeslot should not be the duplex mate of the interference free transmit timeslot. The EUT should not establish a connection.

Test e) & f)
Apply interference at a level $T_L + U_M$ to all transmit time slots except one which has interference at least 10dB below T_L. Apply interference at a level $T_L + U_M$ to all receive time slots except one which has interference at least 10dB below T_L. The interference free receive timeslot should not be the duplex mate of the interference free transmit timeslot. The EUT should not establish a connection.

Result

Test	Connection Made	Time Slot Selected	Required Time Slot	Pass/Fail
b	Yes	N/A	Any	Pass
c & d	Yes	No Connection Established	No Connection to be established	Pass
e & f	Yes	No Connection Established	No Connection to be established	Pass

Test carried out in accordance with ANSI C63.17 sub-clause 8.3.2 for single slot configuration.

Test b)
The system is restricted to operation on one frequency (1924.992 MHz) using administration. Verify that a connection between the EUT and its companion device can be made.

Test c) & d)
Apply interference at a level $T_L + U_M$ to all transmit time slots except one which has interference at least 10dB below T_L. Apply interference at a level $T_L + U_M + 10dB$ to all receive time slots except one which has interference at least 10dB below T_L. The interference free receive timeslot should not be the duplex mate of the interference free transmit timeslot. The EUT should establish a connection on the interference free receive slot and its duplex mate.

Test e) & f)
Apply interference at a level $T_L + U_M$ to all receive time slots except one which has interference at least 10dB below T_L. Apply interference at a level $T_L + U_M + 10dB$ to all transmit time slots except one which has interference at least 10dB below T_L. The interference free transmit timeslot should not be the duplex mate of the interference free receive timeslot. The EUT should establish a connection on the interference free transmit slot and its duplex mate.

Test g)
Apply interference at a level $T_U + U_M$ to all receive and transmit time slots except one which has interference at least 10dB below T_L. The interference free transmit and receive time slots shall not constitute a duplex pair. The EUT should not transmit or establish a connection.

Result

Test	Connection Made	Time Slot Selected	Required Time Slot	Pass/Fail
b	Yes	N/A	Any	Pass
c & d	Yes	Interference Free Receive Slot and Duplex Mate	Interference Free Receive Slot and Duplex Mate	Pass
e & f	Yes	Interference Free Transmit Slot and Duplex Mate	Interference Free Transmit Slot and Duplex Mate	Pass
g	No	None	None	Pass

ALTERNATIVE MONITORING INTERVAL FOR CO-LOCATED DEVICES – PART 15.323 (c)(11)

This test is carried out in accordance with ANSI C63.17 sub-clause 8.4.

The manufacturer declares that this provision is not utilized by the EUT.

FAIR ACCESS TO SPECTRUM RELATED TO (c)(10) & (c)(11) – PART 15.323 (c)(12)

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

The manufacturer declares that this device does not work in a mode which denies fair access to the spectrum to others.

(10) Relates to part 15.323(c)(10) and 4.3.4(b)(10)
(11) Relates to part 15.323(c)(11) and 4.3.4(b)(11)

EMISSIONS INSIDE AND OUTSIDE THE SUB-BAND – CONDUCTED

RF carrier set to the lowest carrier defined by the EUT – Single Slot Configuration

These measurements are carried out in accordance with ANSI C63.17 sub-clause 6.1.6.

Out-of-Band Emissions from UPCS bandedge	FREQ. (MHz)	MEAS. Rx. (dBm)	CABLE & ATTEN. LOSS (dB)	EMISSION LEVEL (dBm)	LIMIT (dBm)
> - 2.5MHz	Not Applicable, note 9				
- 1.25 MHz – 2.5 MHz	1918.782	-72.37	21.0	-51.37	-29.5
- 1.25 MHz				Note 8	-9.5
+ 1.25 MHz				Note 8	-9.5
+ 1.25 MHz – 2.5 MHz				Note 8	-29.5
> + 2.5MHz	Not Applicable, note 9				

Limits	**Out-of-Band Emissions From UPCS bandedge**	**Attenuation (dB) required below Reference power of 112mW**
	± 1.25MHz	30
	±1.25 MHz – 2.5 MHz	50
	> ±2.5MHz	60
	In band Emissions from centre of emission bandwidth	**Attenuation (dB) required below permitted peak power for the EUT**
	1B – 2B	30
	2B – 3B	50
	3B – UPCS band edge	60

Notes:
1 The EUT was connected via a cable and attenuator.
2 New / Fully Charged batteries used for battery powered products.
3 See Annex J for out of band emissions compliance plots.
4 See Annex K for in band emissions compliance plots.
5 Resolution bandwidth approximately 1% of emissions bandwidth.
6 Video bandwidth 3 x Resolution bandwidth.
7 Receiver detector = Peak detector, Max Hold Enabled.
8 Only emissions within 20 dB of the limit are recorded.
9 EUT utilises integral antenna, manufacturer declares radiated emission at offset >2.5MHz

Test Method:
1 The EUT was connected to a spectrum analyser via suitable attenuation or filter.
2 The Spectrum analyser was tuned across the required frequency range in steps.
3 Any emissions found were measured with the required analyser settings.

EMISSIONS INSIDE AND OUTSIDE THE SUB-BAND – CONDUCTED

RF carrier set to the lowest carrier defined by the EUT – Long Slot Configuration

These measurements are carried out in accordance with ANSI C63.17 sub-clause 6.1.6.

Out-of-Band Emissions from UPCS bandedge	**FREQ. (MHz)**	**MEAS. Rx. (dBm)**	**CABLE & ATTEN. LOSS (dB)**	**EMISSION LEVEL (dBm)**	**LIMIT (dBm)**
> - 2.5MHz	Not Applicable, note 9				
- 1.25 MHz – 2.5 MHz	1918.730	-73.17	21.0	-52.17	-29.5
- 1.25 MHz				Note 8	-9.5
+ 1.25 MHz				Note 8	-9.5
+ 1.25 MHz – 2.5 MHz				Note 8	-29.5
> + 2.5MHz	Not Applicable, note 9				

	Out-of-Band Emissions From UPCS bandedge	**Attenuation (dB) required below Reference power of 112mW**
Limits	± 1.25MHz	30
	±1.25 MHz – 2.5 MHz	50
	> ±2.5MHz	60
	In band Emissions from centre of emission bandwidth	**Attenuation (dB) required below permitted peak power for the EUT**
	1B – 2B	30
	2B – 3B	50
	3B – UPCS band edge	60

Notes:
1 The EUT was connected via a cable and attenuator.
2 New / Fully Charged batteries used for battery powered products.
3 See Annex J for out of band emissions compliance plots.
4 See Annex K for in band emissions compliance plots.
5 Resolution bandwidth approximately 1% of emissions bandwidth.
6 Video bandwidth 3 x Resolution bandwidth.
7 Receiver detector = Peak detector, Max Hold Enabled.
8 Only emissions within 20 dB of the limit are recorded.
9 EUT utilises integral antenna, manufacturer declares radiated emission at offset >2.5MHz

Test Method:
1 The EUT was connected to a spectrum analyser via suitable attenuation or filter.
2 The Spectrum analyser was tuned across the required frequency range in steps.
3 Any emissions found were measured with the required analyser settings.

EMISSIONS INSIDE AND OUTSIDE THE SUB-BAND – CONDUCTED – PART 15.323 (d)

RF carrier set to the highest carrier defined by the EUT – Single Slot Configuration

These measurements are carried out in accordance with ANSI C63.17 sub-clause 6.1.6.

Out-of-Band Emissions from UPCS bandedge	FREQ. (MHz)	MEAS. Rx. (dBm)	CABLE & ATTEN. LOSS (dB)	EMISSION LEVEL (dBm)	LIMIT (dBm)
> - 2.5MHz	Not Applicable, note 9				
- 1.25 MHz – 2.5 MHz				Note 8	-29.5
- 1.25 MHz				Note 8	-9.5
+ 1.25 MHz				Note 8	-9.5
+ 1.25 MHz – 2.5 MHz	1931.839	-71.95	21.0	-50.95	-29.5
> + 2.5MHz	Not Applicable, note 9				

Limits		
	Out-of-Band Emissions from UPCS bandedge	**Attenuation (dB) required below reference power of 112mW**
	± 1.25MHz	30
	±1.25 MHz – 2.5 MHz	50
	> ±2.5MHz	60
	In band Emissions from centre of emission bandwidth	**Attenuation (dB) required below permitted peak power for the EUT**
	1B – 2B	30
	2B – 3B	50
	3B – UPCS band edge	60

Notes:
1 The EUT was connected via a cable and attenuator.
2 New / Fully Charged batteries used for battery powered products.
3 See Annex J for out of band emissions compliance plots.
4 See Annex K for in band emissions compliance plots.
5 Resolution bandwidth approximately 1% of emissions bandwidth.
6 Video bandwidth 3 x Resolution bandwidth.
7 Receiver detector = Peak detector, Max Hold Enabled.
8 Only emissions within 20 dB of the limit are recorded.
9 EUT utilises integral antenna, manufacturer declares radiated emission at offset >2.5MHz

Test Method:
1 The EUT was connected to a spectrum analyser via suitable attenuation or filter.
2 The Spectrum analyser was tuned across the required frequency range in steps.
3 Any emissions found were measured with the required analyser settings.

EMISSIONS INSIDE AND OUTSIDE THE SUB-BAND – CONDUCTED – PART 15.323 (d)

RF carrier set to the highest carrier defined by the EUT – Long Slot Configuration

These measurements are carried out in accordance with ANSI C63.17 sub-clause 6.1.6.

Out-of-Band Emissions from UPCS bandedge	FREQ. (MHz)	MEAS. Rx. (dBm)	CABLE & ATTEN. LOSS (dB)	EMISSION LEVEL (dBm)	LIMIT (dBm)
> - 2.5MHz	Not Applicable, note 9				
- 1.25 MHz – 2.5 MHz				Note 8	-29.5
- 1.25 MHz				Note 8	-9.5
+ 1.25 MHz				Note 8	-9.5
+ 1.25 MHz – 2.5 MHz	1931.237	-70.08	21.0	-49.08	-29.5
> + 2.5MHz	Not Applicable, note 9				

Limits		
	Out-of-Band Emissions from UPCS bandedge	**Attenuation (dB) required below reference power of 112mW**
	± 1.25MHz	30
	±1.25 MHz – 2.5 MHz	50
	> ±2.5MHz	60
	In band Emissions from centre of emission bandwidth	**Attenuation (dB) required below permitted peak power for the EUT**
	1B – 2B	30
	2B – 3B	50
	3B – UPCS band edge	60

Notes:
1 The EUT was connected via a cable and attenuator.
2 New / Fully Charged batteries used for battery powered products.
3 See Annex J for out of band emissions compliance plots.
4 See Annex K for in band emissions compliance plots.
5 Resolution bandwidth approximately 1% of emissions bandwidth.
6 Video bandwidth 3 x Resolution bandwidth.
7 Receiver detector = Peak detector, Max Hold Enabled.
8 Only emissions within 20 dB of the limit are recorded.
9 EUT utilises integral antenna, manufacturer declares radiated emission at offset >2.5MHz

Test Method:
1 The EUT was connected to a spectrum analyser via suitable attenuation or filter.
2 The Spectrum analyser was tuned across the required frequency range in steps.
3 Any emissions found were measured with the required analyser settings.

EMISSIONS OUTSIDE THE SUB-BAND – RADIATED

RF carrier set to the lowest carrier defined by the EUT – Single Slot Configuration

These measurements are carried out in accordance with ANSI C63.17 sub-clause 6.1.6

	FREQ. (MHz)	MEAS. Rx. (dBµV)	CABLE LOSS (dB)	ANT FACTOR	PRE AMP (dB)	EXTRAP FACTOR	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (µV/m)	LIMIT (µV/m)
1.705MHz - 30MHz								Note 9	30
30MHz - 88MHz								Note 9	100
88MHz - 216MHz								Note 9	150
216MHz - 960MHz								Note 9	200
960MHz - 1GHz								Note 9	500
1GHz - 25GHz	3483.751	46.39	2.3	31.0	36.1	9.54	34.05	50.40	500
	11530.953	36.11	4.7	39.7	35.3	9.54	35.67	60.74	500
	13448.258	38.64	4.1	40.7	35.5	9.54	38.40	83.17	500
	15369.249	34.64	7.4	38.8	36.7	9.54	34.60	53.70	500
	17290.273	33.63	5.8	42.1	35.5	9.54	36.49	66.75	500

Limits	1.705MHz to 30MHz	30µV/m @ 30m
	30MHz to 88MHz	100µV/m @ 3m
	88MHz to 216MHz	150µV/m @ 3m
	216MHz to 960MHz	200µV/m @ 3m
	960MHz to 1GHz	500µV/m @ 3m
	1GHz to 25GHz	500µV/m @ 3m

Notes:
1 Emissions were searched to: 20,000MHz inclusive, as per Part 15.33a.
2 Emission due to digital circuitry not directly associated with the radio transmitter, see page 31.
3 Measurements >1GHz @ 3m as per Part 15.31f(1).
4 Measurements >3GHz @ 1m as per Part 15.31f(1).
5 1m to 3m extrapolation 9.5 dB as per Part 15.31f
6 Receiver detector <1GHz = CISPR, Quasi-Peak, 120kHz bandwidth.
7 Receiver detector >1GHz = Average & Peak Detector, 1MHz RBW, 10MHz VBW.
8 New / Fully Charged batteries used for battery powered products.
9 Only Average emissions within 20 dB of the limit are recorded.
10 See Annex J for scan plots
11 Peak emissions are within 20 dB of the average limit.

Test Method:
1 As per Radio – Noise Emissions, ANSI C63.4: 2003.
2 Measuring distances as Notes 1 to 4 above.
3 EUT 0.8 metre above ground plane.
4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthagonal planes.
Maximum results recorded.

EMISSIONS OUTSIDE THE SUB-BAND – RADIATED

RF carrier set to the lowest carrier defined by the EUT – Long Slot Configuration

These measurements are carried out in accordance with ANSI C63.17 sub-clause 6.1.6

	FREQ. (MHz)	MEAS. Rx. (dBµV)	CABLE LOSS (dB)	ANT FACTOR	PRE AMP (dB)	EXTRAP FACTOR	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (µV/m)	LIMIT (µV/m)
1.705MHz - 30MHz								Note 9	30
30MHz - 88MHz								Note 9	100
88MHz - 216MHz								Note 9	150
216MHz - 960MHz								Note 9	200
960MHz - 1GHz								Note 9	500
1GHz - 25GHz	3843.054	50.34	2.3	31.0	36.1	9.54	38.00	79.43	500
	11527.115	37.10	4.7	39.7	35.3	9.54	36.66	68.07	500
	13448.330	41.72	4.1	40.7	35.5	9.54	41.48	118.57	500
	15369.368	34.77	7.4	38.8	36.7	9.54	34.73	54.51	500
	17290.345	33.60	5.8	42.1	35.5	9.54	36.46	66.52	500

Limits	1.705MHz to 30MHz	30µV/m @ 30m
	30MHz to 88MHz	100µV/m @ 3m
	88MHz to 216MHz	150µV/m @ 3m
	216MHz to 960MHz	200µV/m @ 3m
	960MHz to 1GHz	500µV/m @ 3m
	1GHz to 25GHz	500µV/m @ 3m

Notes:
1 Emissions were searched to: 20,000MHz inclusive, as per Part 15.33a.
2 Emission due to digital circuitry not directly associated with the radio transmitter, see page 31.
3 Measurements >1GHz @ 3m as per Part 15.31f(1).
4 Measurements >3GHz @ 1m as per Part 15.31f(1).
5 1m to 3m extrapolation 9.5 dB as per Part 15.31f
6 Receiver detector <1GHz = CISPR, Quasi-Peak, 120kHz bandwidth.
7 Receiver detector >1GHz = Average & Peak Detector, 1MHz RBW, 10MHz VBW.
8 New / Fully Charged batteries used for battery powered products.
9 Only Average emissions within 20 dB of the limit are recorded.
10 See Annex J for scan plots
11 Peak emissions are within 20 dB of the average limit.

Test Method:
1 As per Radio – Noise Emissions, ANSI C63.4: 2003.
2 Measuring distances as Notes 1 to 4 above.
3 EUT 0.8 metre above ground plane.
4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthagonal planes.
Maximum results recorded.

EMISSIONS OUTSIDE THE SUB-BAND – RADIATED

RF carrier set to the highest carrier defined by the EUT – Single Slot Configuration

These measurements are carried out in accordance with ANSI C63.17 sub-clause 6.1.6

	FREQ. (MHz)	MEAS. Rx. (dBµV)	CABLE LOSS (dB)	ANT FACTOR	PRE AMP (dB)	EXTRAP FACTOR	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (µV/m)	LIMIT (µV/m)
1.705MHz - 30MHz								Note 9	30
30MHz - 88MHz								Note 9	100
88MHz - 216MHz								Note 9	150
216MHz - 960MHz								Note 9	200
960MHz - 1GHz								Note 9	500
1GHz - 25GHz	3856.860	45.95	2.8	32.2	36.0	9.54	35.41	58.95	500
	11568.549	34.96	4.7	39.7	35.3	9.54	34.52	53.21	500
	13501.392	37.33	4.1	40.7	35.5	9.54	37.09	71.53	500
	17359.214	33.86	5.8	44.8	35.9	9.54	39.02	89.33	500

Limits	1.705MHz to 30MHz	30µV/m @ 30m
	30MHz to 88MHz	100µV/m @ 3m
	88MHz to 216MHz	150µV/m @ 3m
	216MHz to 960MHz	200µV/m @ 3m
	960MHz to 1GHz	500µV/m @ 3m
	1GHz to 25GHz	500µV/m @ 3m

Notes:
1 Emissions were searched to: 20,000MHz inclusive, as per Part 15.33a.
2 Emission due to digital circuitry not directly associated with the radio transmitter, see page 31.
3 Measurements >1GHz @ 3m as per Part 15.31f(1).
4 Measurements >3GHz @ 1m as per Part 15.31f(1).
5 1m to 3m extrapolation 9.5 dB as per Part 15.31f
6 Receiver detector <1GHz = CISPR, Quasi-Peak, 120kHz bandwidth.
7 Receiver detector >1GHz = Average & Peak Detector, 1MHz RBW, 10MHz VBW.
8 New / Fully Charged batteries used for battery powered products.
9 Only Average emissions within 20 dB of the limit are recorded.
10 See Annex J for scan plots
11 Peak emissions are within 20 dB of the average limit.

Test Method:
1 As per Radio – Noise Emissions, ANSI C63.4: 2003.
2 Measuring distances as Notes 1 to 4 above.
3 EUT 0.8 metre above ground plane.
4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthagonal planes.
Maximum results recorded.

EMISSIONS OUTSIDE THE SUB-BAND – RADIATED

RF carrier set to the highest carrier defined by the EUT – Long Slot Configuration

These measurements are carried out in accordance with ANSI C63.17 sub-clause 6.1.6

	FREQ. (MHz)	MEAS. Rx. (dBµV)	CABLE LOSS (dB)	ANT FACTOR	PRE AMP (dB)	EXTRAP FACTOR	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (µV/m)	LIMIT (µV/m)
1.705MHz - 30MHz								Note 9	30
30MHz - 88MHz								Note 9	100
88MHz - 216MHz								Note 9	150
216MHz - 960MHz								Note 9	200
960MHz - 1GHz								Note 9	500
1GHz - 25GHz	3856.939	49.75	2.8	32.2	36.0	9.54	39.21	91.30	500
	11570.387	35.86	4.7	39.7	35.3	9.54	35.42	59.02	500
	13501.759	39.85	4.1	40.7	35.5	9.54	39.61	95.61	500
	17353.238	35.69	5.8	42.1	35.5	9.54	38.55	84.62	500

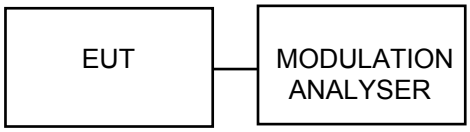
Limits	1.705MHz to 30MHz	30µV/m @ 30m
	30MHz to 88MHz	100µV/m @ 3m
	88MHz to 216MHz	150µV/m @ 3m
	216MHz to 960MHz	200µV/m @ 3m
	960MHz to 1GHz	500µV/m @ 3m
	1GHz to 25GHz	500µV/m @ 3m

Notes:
1 Emissions were searched to: 20,000MHz inclusive, as per Part 15.33a.
2 Emission due to digital circuitry not directly associated with the radio transmitter, see page 31.
3 Measurements >1GHz @ 3m as per Part 15.31f(1).
4 Measurements >3GHz @ 1m as per Part 15.31f(1).
5 1m to 3m extrapolation 9.5 dB as per Part 15.31f
6 Receiver detector <1GHz = CISPR, Quasi-Peak, 120kHz bandwidth.
7 Receiver detector >1GHz = Average & Peak Detector, 1MHz RBW, 10MHz VBW.
8 New / Fully Charged batteries used for battery powered products.
9 Only Average emissions within 20 dB of the limit are recorded.
10 See Annex J for scan plots
11 Peak emissions are within 20 dB of the average limit.

Test Method:
1 As per Radio – Noise Emissions, ANSI C63.4: 2003.
2 Measuring distances as Notes 1 to 4 above.
3 EUT 0.8 metre above ground plane.
4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthagonal planes.
Maximum results recorded.

FRAME PERIOD 15.323 (e)

Frame repetition stability is tested according with ANSI C63.17 sub-clause 6.2.2. Frame period and jitter are tested in accordance with ANSI C63.17 sub-clause 6.2.3. The test setup below is used for the above measurements.



Test Setup 3:

Frame Repetition Stability

This is the mean value of the frame repetition rate recorded over 1000 samples. For devices that divide access in time the repetition rate shall not exceed 10ppm.

Result

Operating Voltage	Frame Repetition Stability (ppm)	Limit (ppm)	Pass/Fail
+110 Vac	-0.77 ppm	10ppm	Pass
USB	-0.58 ppm	10ppm	Pass

Frame Period and Jitter

Jitter is the difference in time between the rising edges of consecutive pulses.

Result

Maximum Jitter (µs)	3xSD Jitter (µs)	Frame period (ms)	Limit (µs)		Pass/Fail
			Frame Period (ms)	Jitter (µs)	
-0.01	0.03	10.00003	2 or 10/X	25	Pass

Notes: 1. See Annex N for frame period plot.

FREQUENCY STABILITY – PART 15.323 (e)

The frequency stability is tests are carried out according with ANSI C63.17 sub-clause 6.2.1 using test setup number 3 (page 29). This testing is carried out with the following conditions over 5000 samples.

Results

Powered By 110 Vac

Temperature (°C)	Voltage (V)	Fc (MHz)	offset (kHz)	offset (ppm)	Limit (ppm)
+20	110 Vac	1924.992	-13 kHz	-6.75 ppm	±10
+20	85% Vnom	1924.992	0 kHz	0.00 ppm	±10
+20	115% Vnom	1924.992	0 kHz	0.00 ppm	±10
-20	Vnom	1924.992	+2 kHz	+1.04 ppm	±10
+55	Vnom	1924.992	-11 kHz	-5.71 kHz	±10

Note: 1. Frequency variation at Tnom relative to EUT operating Frequency.
2. Frequency variation at Temperature extremes relative to frequency at Tnom.

Powered By USB

Temperature (°C)	Voltage (V)	Fc (MHz)	offset (kHz)	offset (ppm)	Limit (ppm)
+20	USB	1924.992	-9 kHz	-4.67 ppm	±10
-20	USB	1924.992	0 kHz	0.00 ppm	±10
+55	USB	1924.992	-10 kHz	-1.04 ppm	±10

Note: 1. The EUT is powered By regulated USB therefore voltage variations are not perfomed.
2. Frequency variation at Tnom relative to EUT operating Frequency.
3. Frequency variation at Temperature extremes relative to frequency at Tnom.

UNINTENTIONAL RADIATED EMISSIONS

These measurements are carried out in accordance with ANSI C63.17 sub-clause 6.1.6

	FREQ. (MHz)	MEAS. Rx. (dBµV)	CABLE LOSS (dB)	PRE AMP (dB)	ANT FACTOR	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (µV/m)	LIMIT (µV/m)
1.705MHz - 30MHz							Note 8	30
30MHz - 88MHz	39.75	12.5	0.6	-	12.9	26.0	19.95	100
	45.60	10.5	0.7	-	9.8	21.0	21.00	100
	48.00	12.7	0.7	-	8.6	22.0	12.60	100
	60.00	16.0	0.8	-	5.1	21.9	12.44	100
88MHz - 216MHz	144.0	15.0	1.3	-	11.0	27.3	23.17	150
	168.0	15.2	1.4	-	9.3	25.9	19.72	150
216MHz - 960MHz	240.00	25.0	1.6	-	10.3	36.9	69.98	200
	250.00	23.0	1.8	-	12.1	36.9	69.98	200
	318.75	10.5	2.0	-	13.5	26.0	19.95	200
	332.20	14.6	2.0	-	14.0	30.6	33.88	200
	356.80	19.4	2.2	-	14.4	36.0	63.09	200
	386.85	10.4	2.2	-	15.4	28.0	25.12	200
	399.50	11.5	2.2	-	16.3	30.0	31.62	200
	432.00	15.9	2.4	-	16.6	34.9	55.59	200
	500.40	9.3	2.7	-	18.0	30.0	31.62	200
	959.95	9.6	3.9	-	24.9	38.4	83.17	200
960MHz - 1GHz							Note 8	500
1GHz - 20GHz							Note 8	500

Limits		
	1.705MHz to 30MHz	30µV/m @ 30m
	30MHz to 88MHz	100µV/m @ 3m
	88MHz to 216MHz	150µV/m @ 3m
	216MHz to 960MHz	200µV/m @ 3m
	960MHz to 1GHz	500µV/m @ 3m
	1GHz to 20GHz	500µV/m @ 3m

Notes:

1 Emissions were searched to: 20000MHz inclusive, as per Part 15.33a.
2 Measurements <3GHz @ 3m as per Part 15.31f(1).
3 Measurements >1GHz @ 1m as per Part 15.31f(1).
4 Receiver detector <1GHz = CISPR, Quasi-Peak, 120kHz bandwidth.
5 Receiver detector >1GHz = Average & Peak Detector, 1MHz RBW, 10MHz VBW.
6 New / Fully Charged batteries used for battery powered products.
7 Peak emissions are within 20 dB of the average limit.
8 Only average emissions within 20 dB of the limit are recorded.

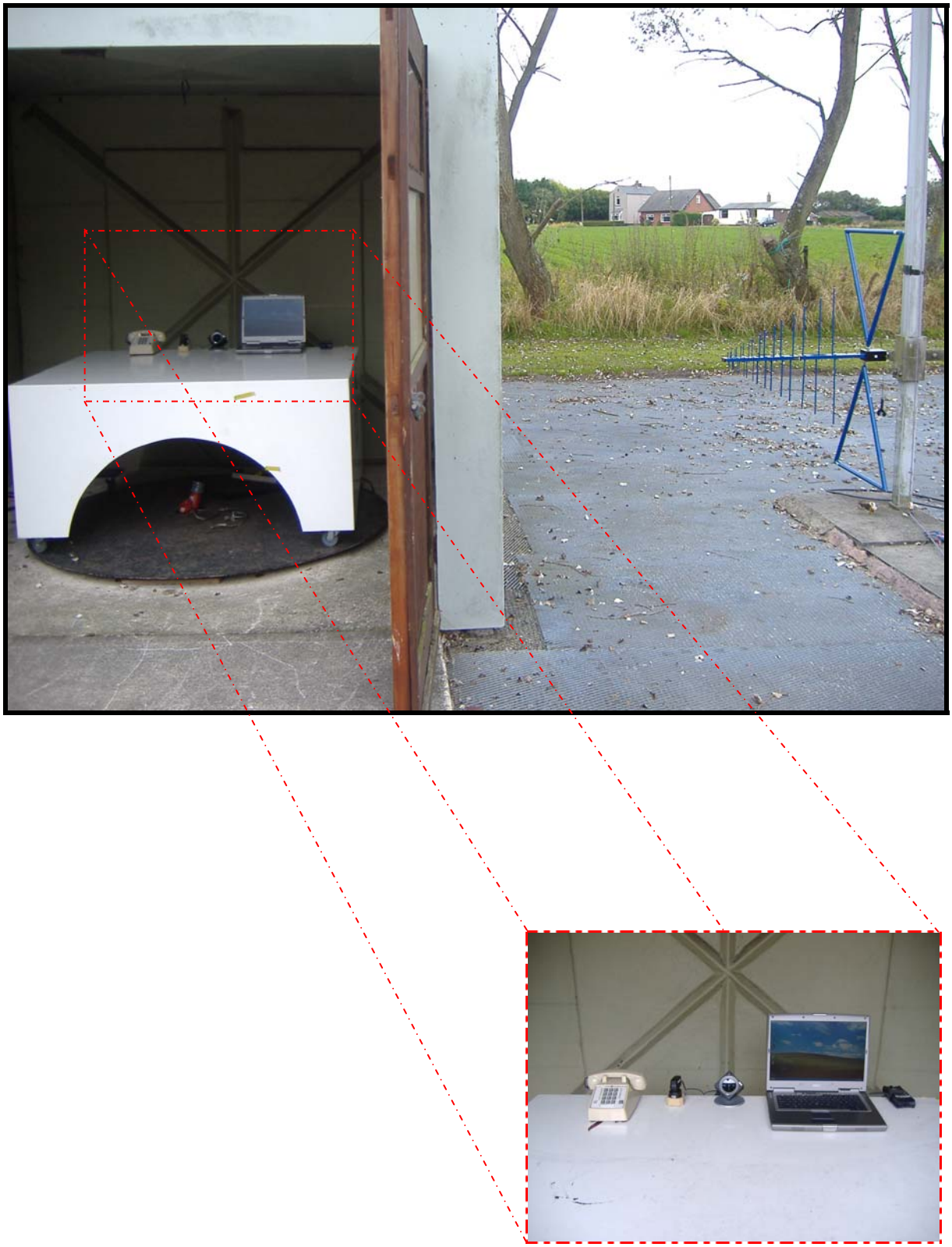
Test Method:

1 As per Radio – Noise Emissions, ANSI C63.4: 2003.
2 Measuring distances as Notes 1 to 4 above.
3 EUT 0.8 metre above ground plane.
4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthagonal planes.
Maximum results recorded.

ANNEX A

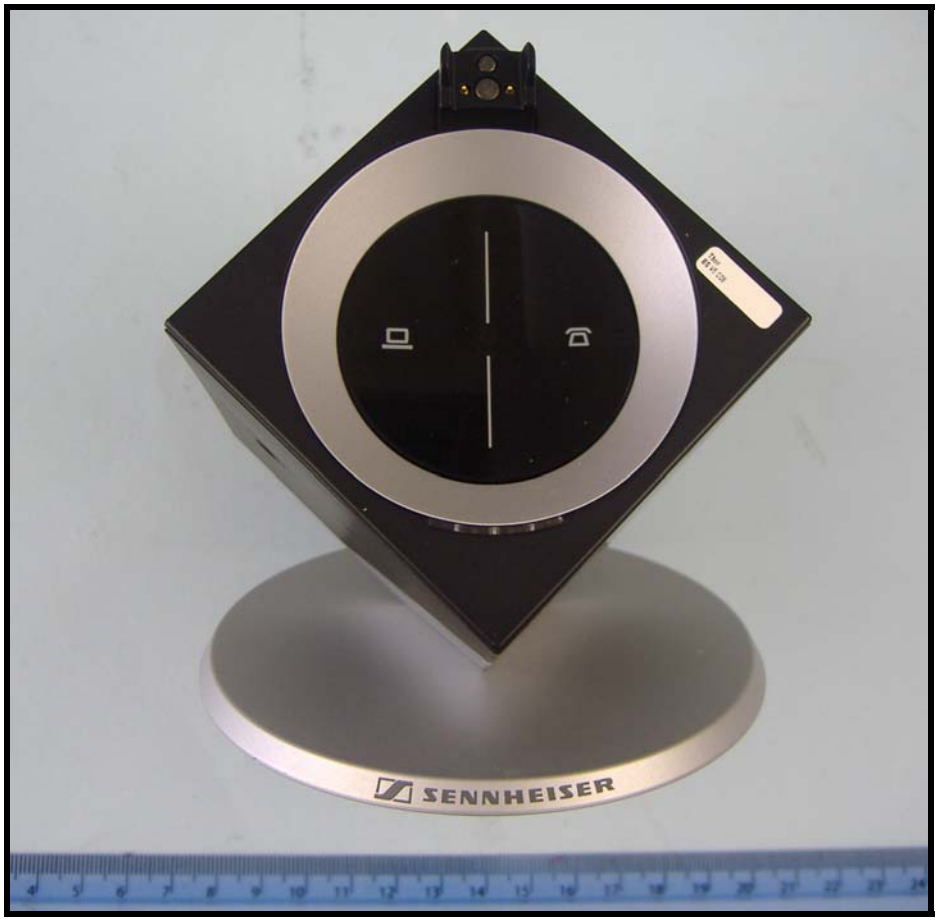
PHOTOGRAPHS

PHOTOGRAPH No. 1 **RADIATED TEST SETUP**



PHOTOGRAPH No. 2 **POWERLINE CONDUCTION TEST SETUP**

PHOTOGRAPH No. 3 **TOP OVERVIEW**



PHOTOGRAPH No. 4 **REAR OVERVIEW - CONNECTORS**

ANNEX B

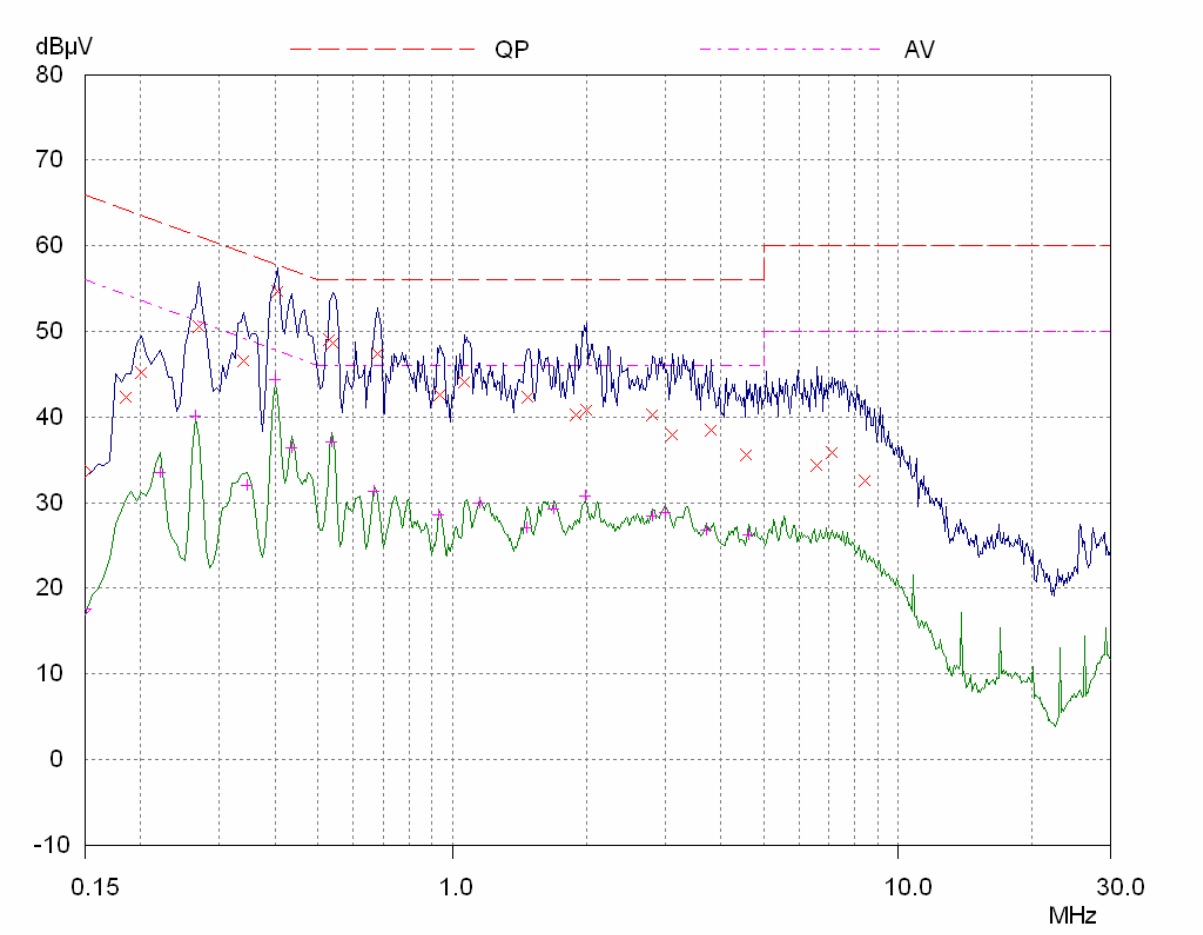
APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

a.	TCB	-	APPLICATION	[X]
		-	FEE	[X]
b.	AGENT'S LETTER OF AUTHORISATION	-		[X]
c.	MODEL(s) vs IDENTITY	-		[ ]
d.	ALTERNATIVE TRADE NAME DECLARATION(s)	-		[ ]
e.	LABELLING	-	PHOTOGRAPHS	[ ]
		-	DECLARATION	[ ]
		-	DRAWINGS	[X]
f.	TECHNICAL DESCRIPTION	-		[X]
g.	BLOCK DIAGRAMS	-	Tx	[X]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
h.	CIRCUIT DIAGRAMS	-	Tx	[X]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
i.	COMPONENT LOCATION	-	Tx	[X]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
j.	PCB TRACK LAYOUT	-	Tx	[X]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
k.	BILL OF MATERIALS	-	Tx	[X]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
l.	USER INSTALLATION / OPERATING INSTRUCTIONS	-		[X]

ANNEX C

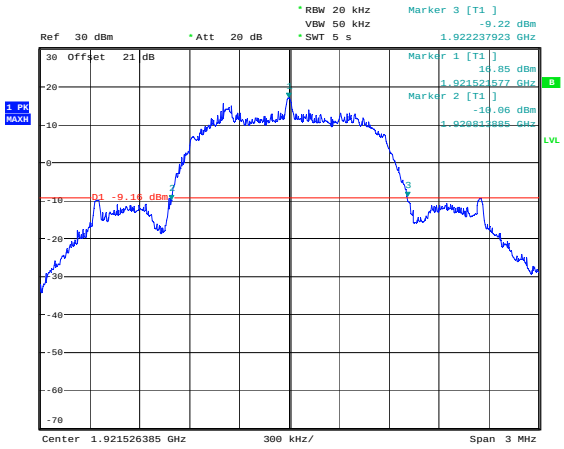
AC POWERLINE CONDUCTION


dBµV
QP
AV
80
70
60
50
40
30
20
10
0
-10
0.15
1.0
10.0
30.0
MHz

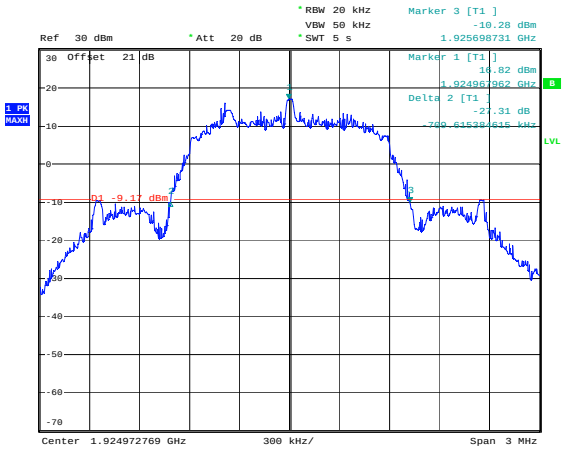
ANNEX D

EMISSION BANDWIDTH

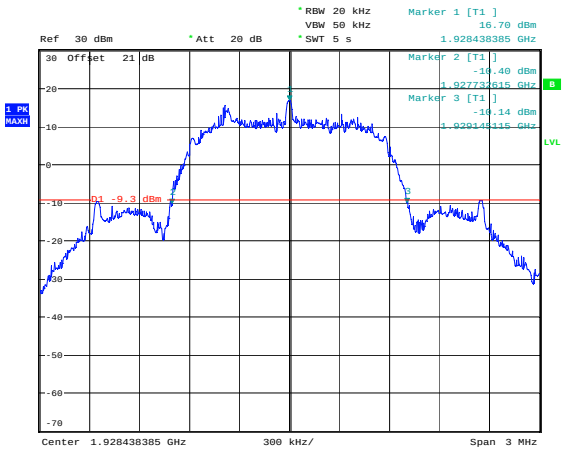
Single Slot Operation



Date: 1.SEP.2009 14:05:31

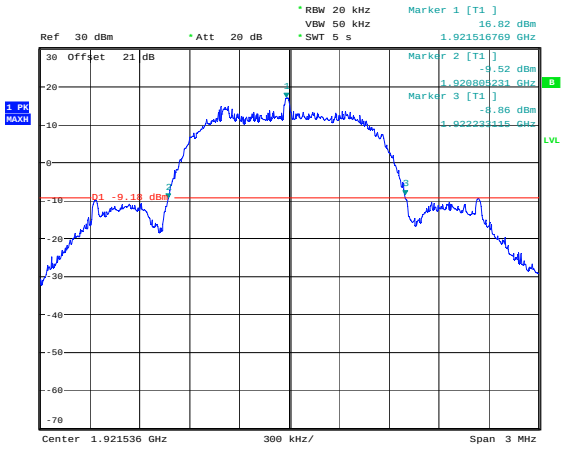


Date: 1.SEP.2009 13:28:12

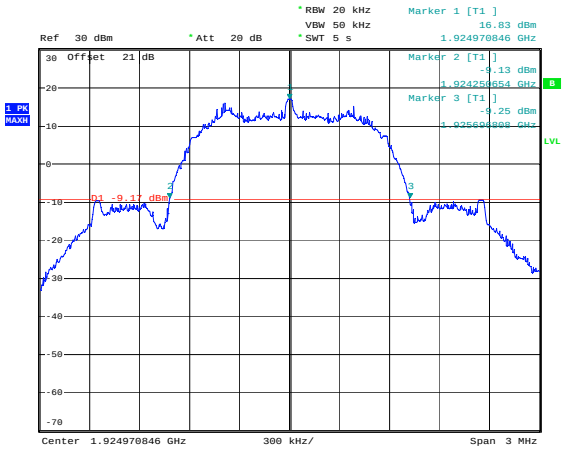


Date: 1.SEP.2009 14:13:39

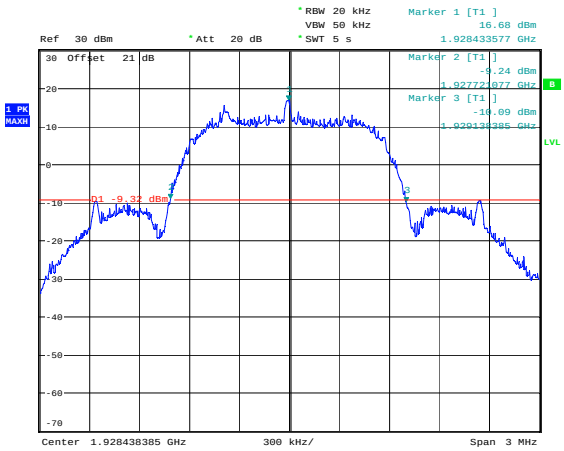
Long Slot Operation



Date: 1.SEP.2009 11:31:57



Date: 1.SEP.2009 13:47:13

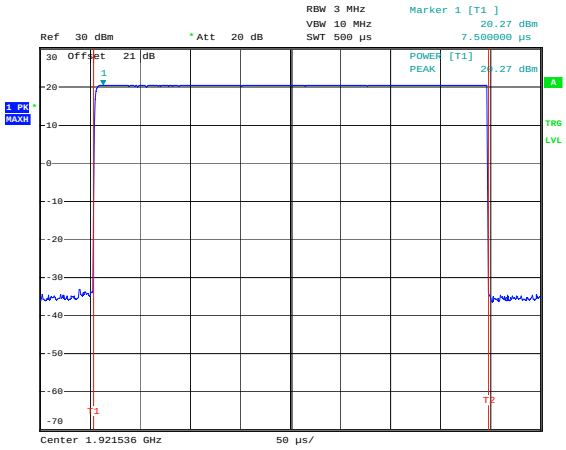


Date: 1.SEP.2009 14:24:47

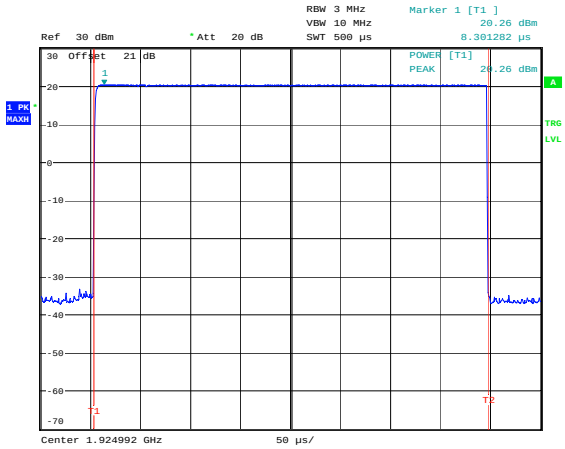
ANNEX E

PEAK TRANSMIT POWER

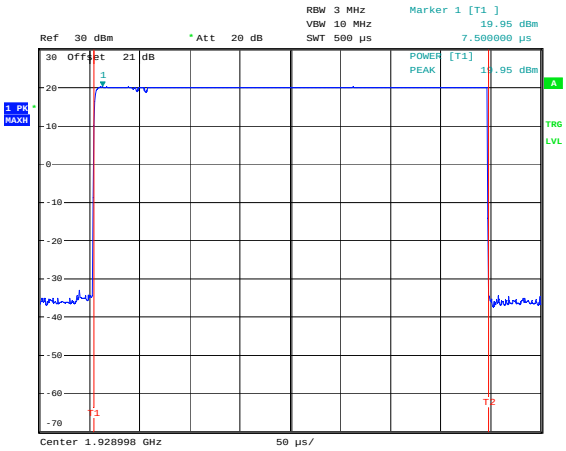
Single Slot Operation



Date: 1.SEP.2009 13:05:57

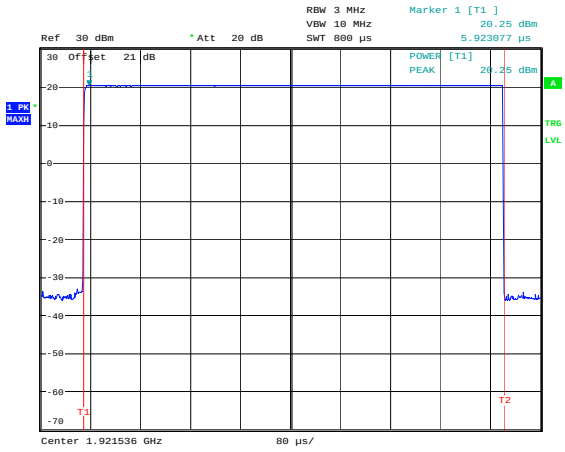


Date: 1.SEP.2009 13:24:59

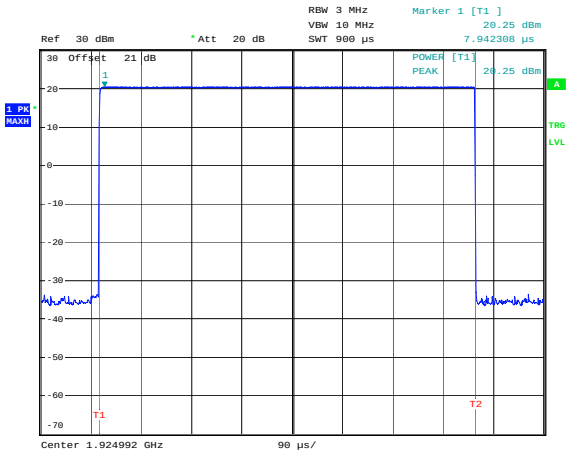


Date: 1.SEP.2009 14:11:31

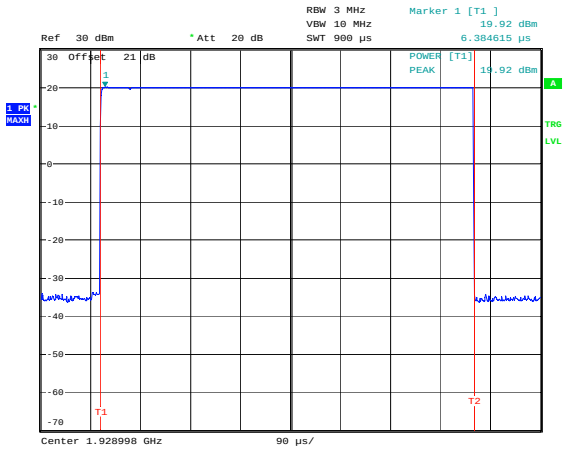
Long Slot Operation



Date: 1.SEP.2009 11:09:39



Date: 1.SEP.2009 13:37:46

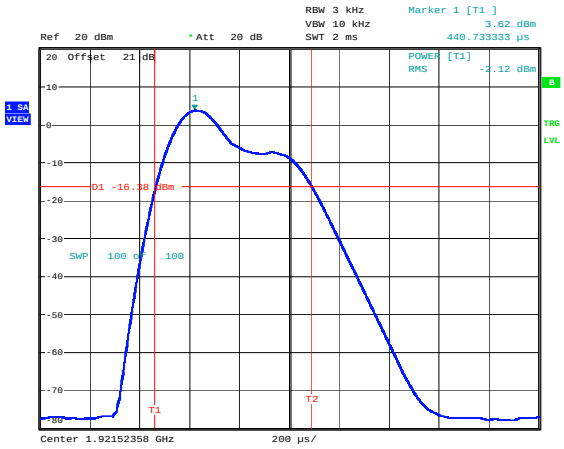


Date: 1.SEP.2009 14:22:23

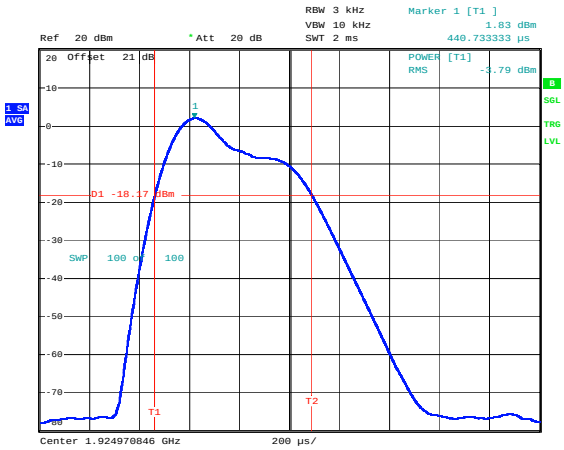
ANNEX F

POWER SPECTRAL DENSITY

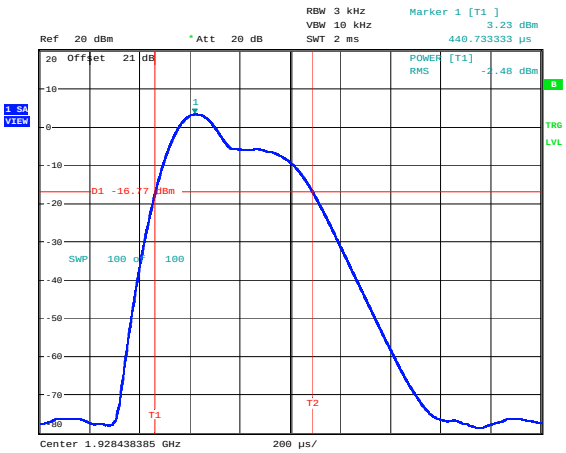
Single Slot Operation



Date: 1.SEP.2009 14:07:58

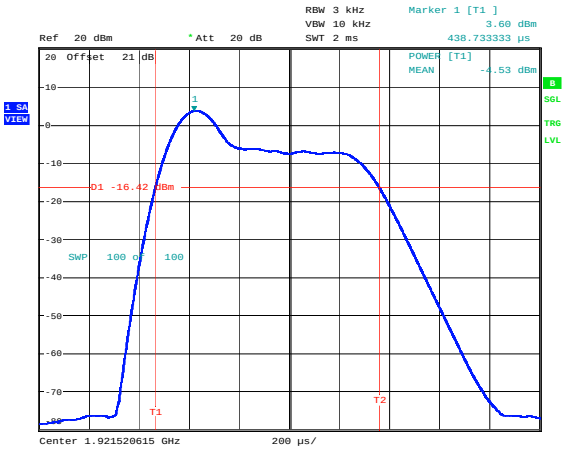


Date: 1.SEP.2009 13:36:14

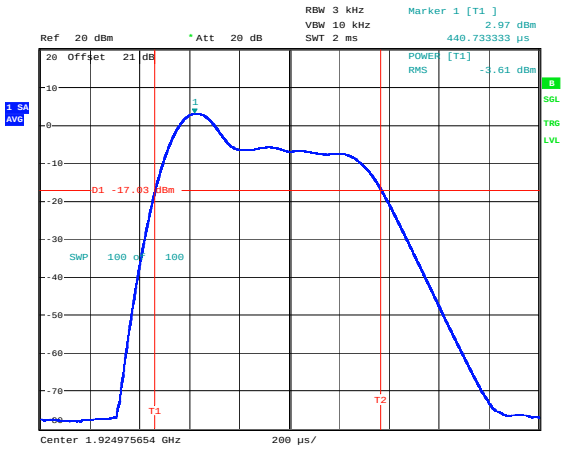


Date: 1.SEP.2009 14:20:36

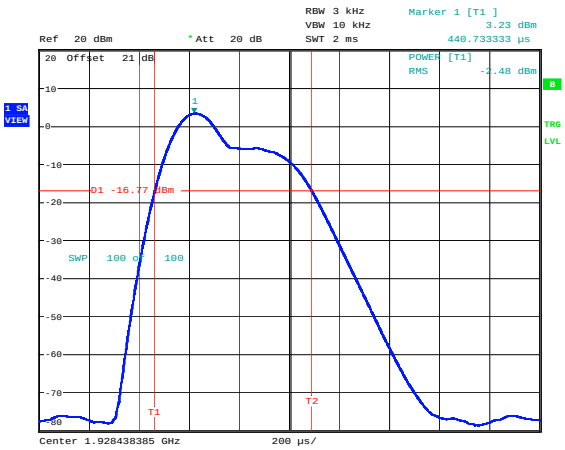
Long Slot Operation



Date: 1.SEP.2009 13:03:36



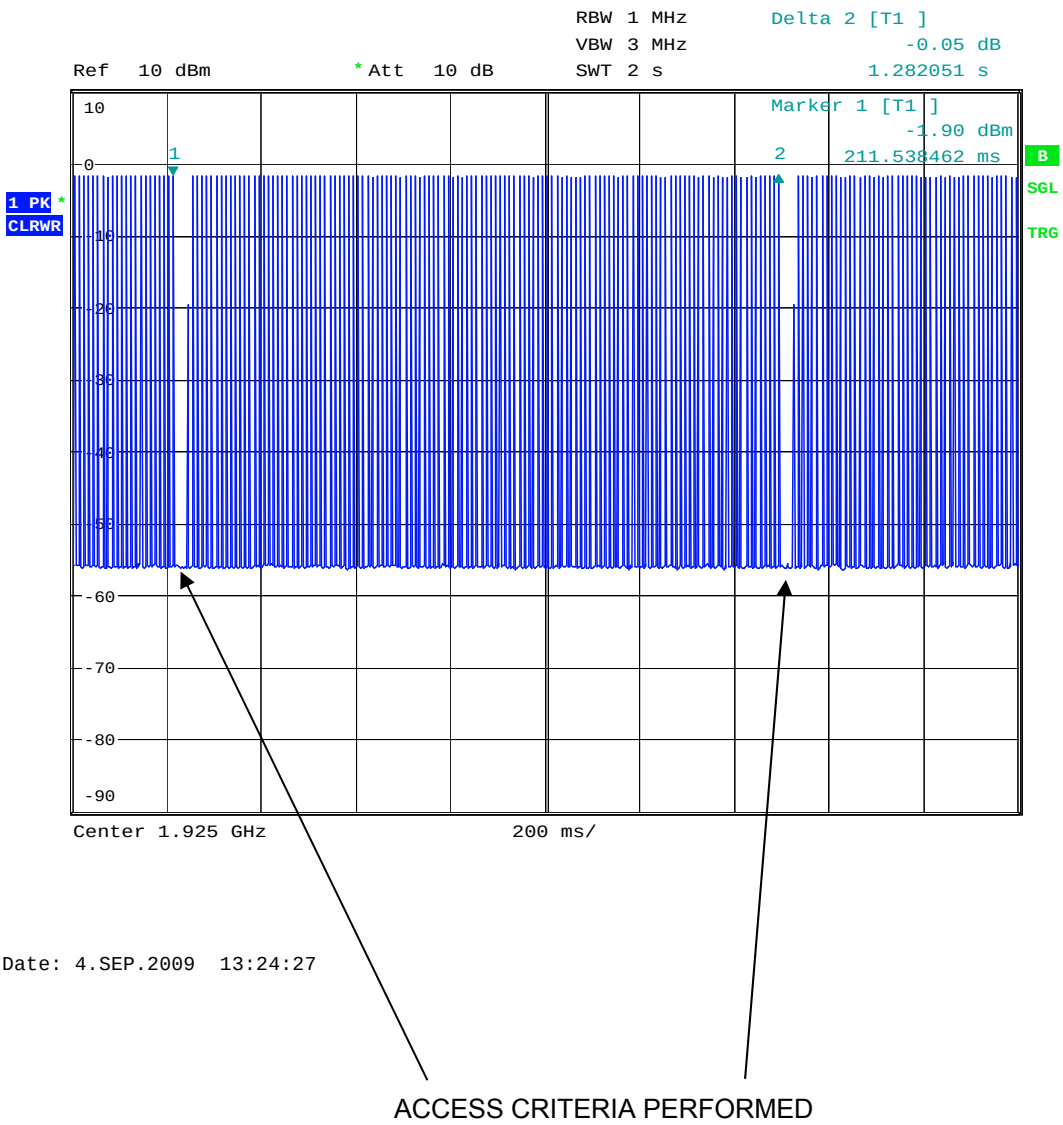
Date: 1.SEP.2009 13:53:00



Date: 1.SEP.2009 14:20:36

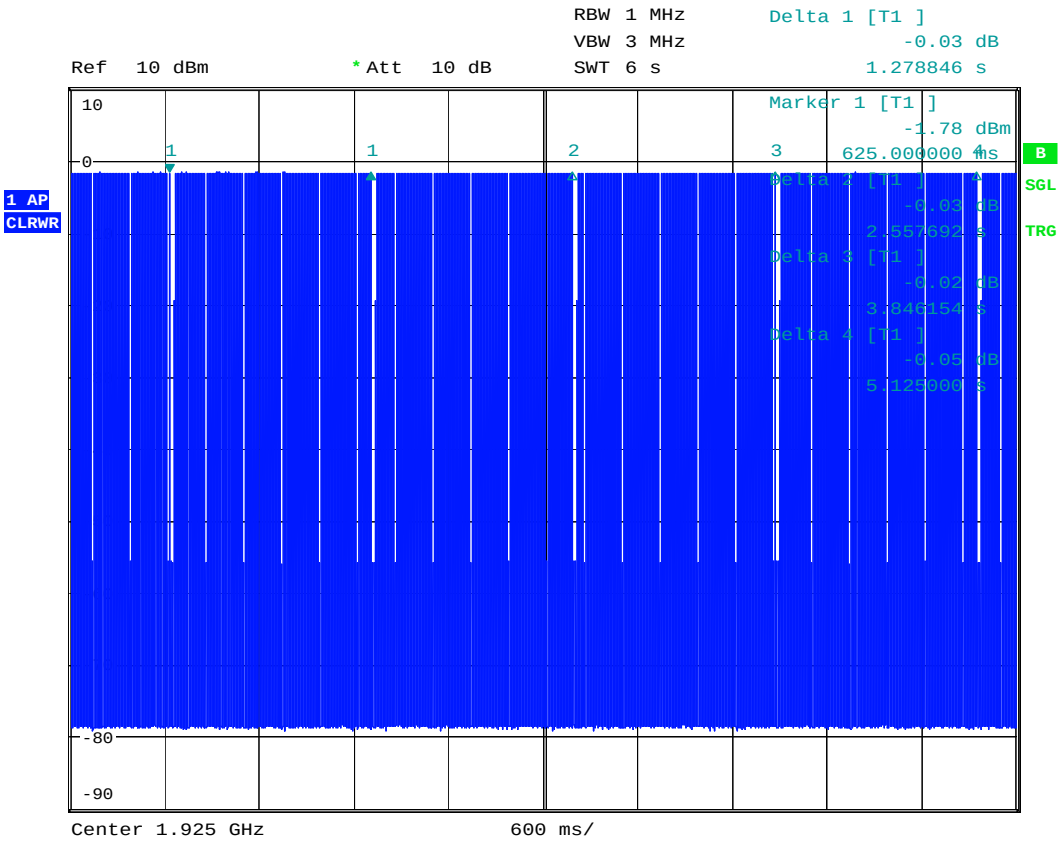
ANNEX G

ACCESS CRITERIA TEST INTERVAL



ACCESS CRITERIA PERFORMED

5 REPETITIONS OF ACCESS CRITERIA

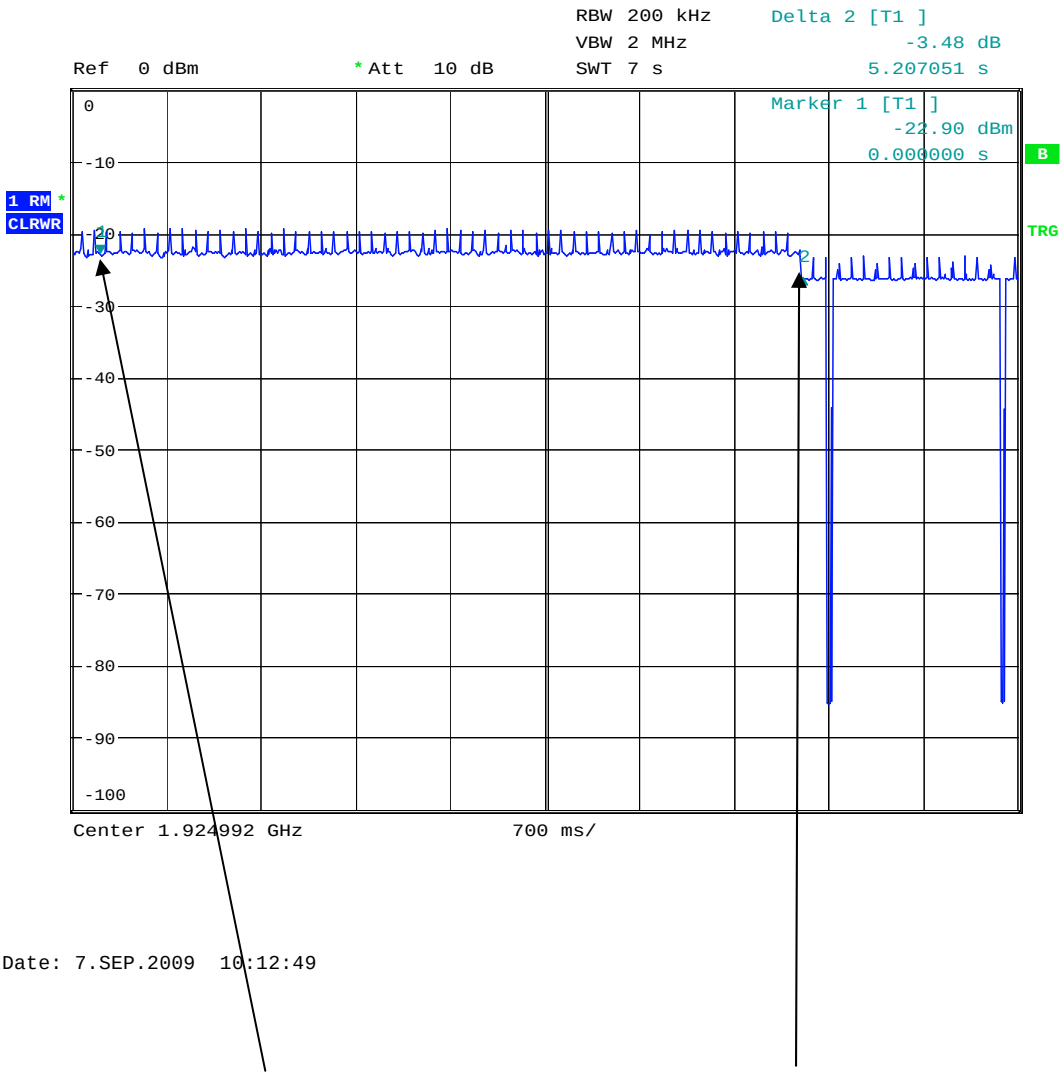


Date: 4.SEP.2009 13:25:47

ANNEX H

ACKNOWLEDGEMENTS

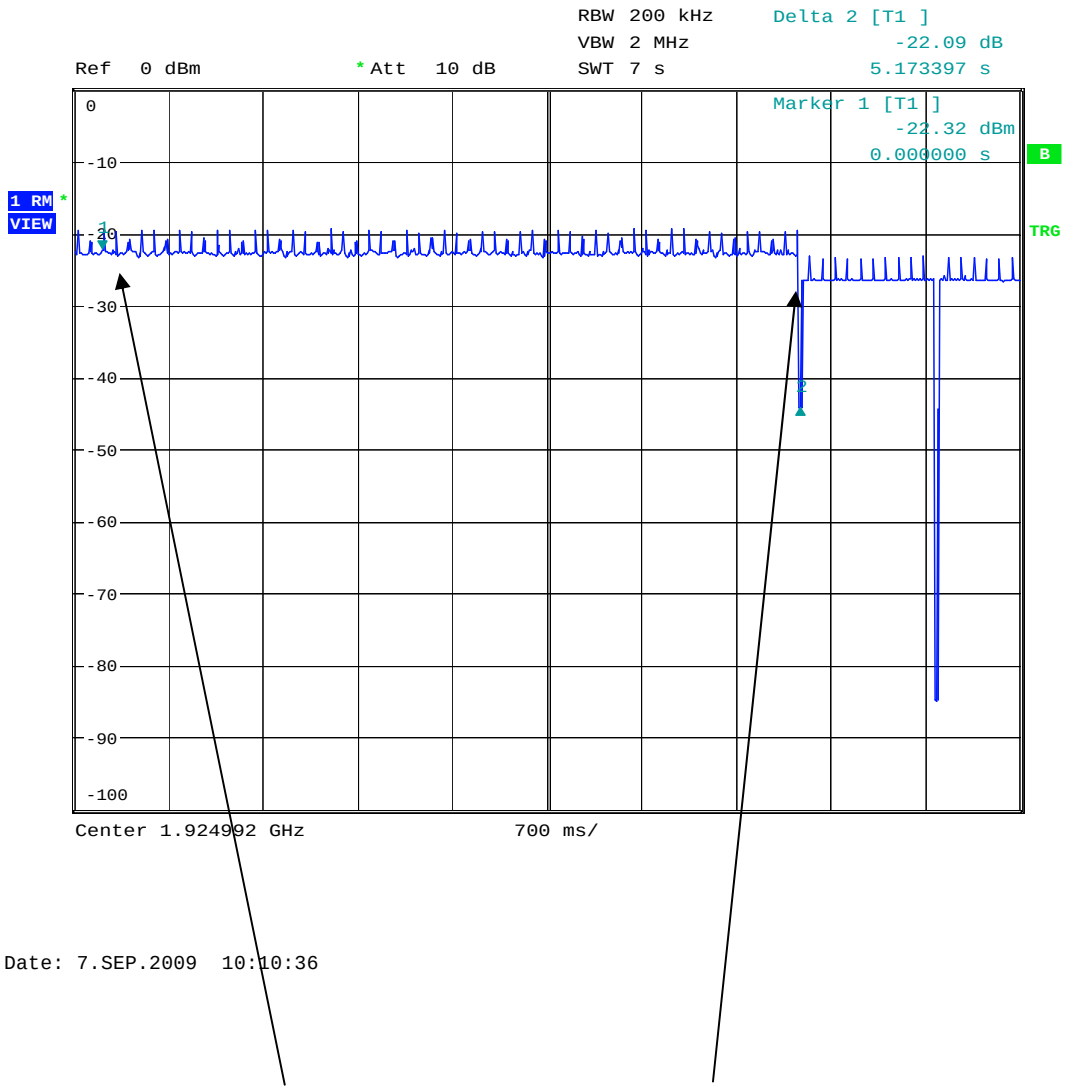
Cease of Transmissions on Single Slot Communications Channel
Acknowledgements Blocked



Acknowledgements Blocked

Cease of transmissions on a Single Slot Communications Channel

Cease of Transmissions on a Long Slot Communications Channel
Acknowledgements Blocked



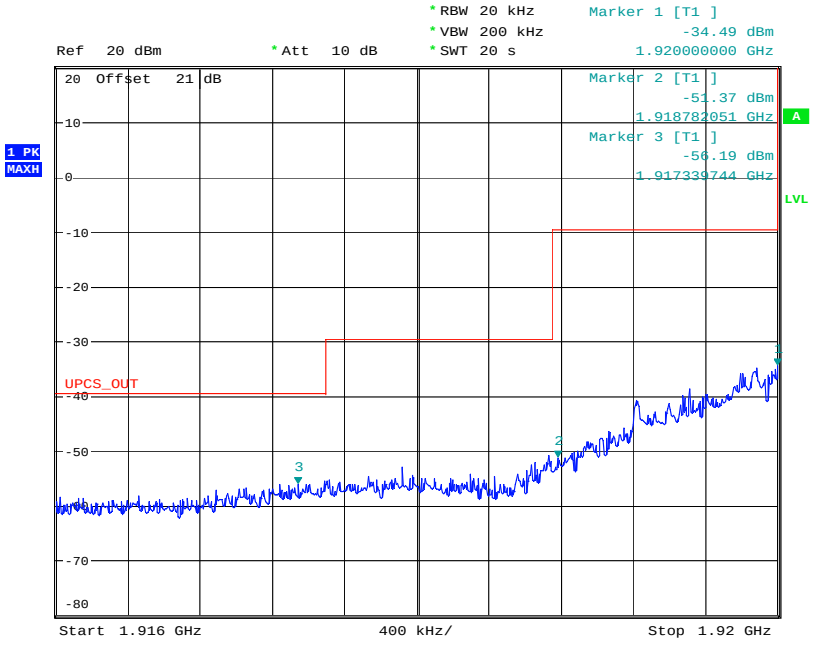
Acknowledgements Blocked

Cease of transmissions on a Long Slot Communications Channel

ANNEX I

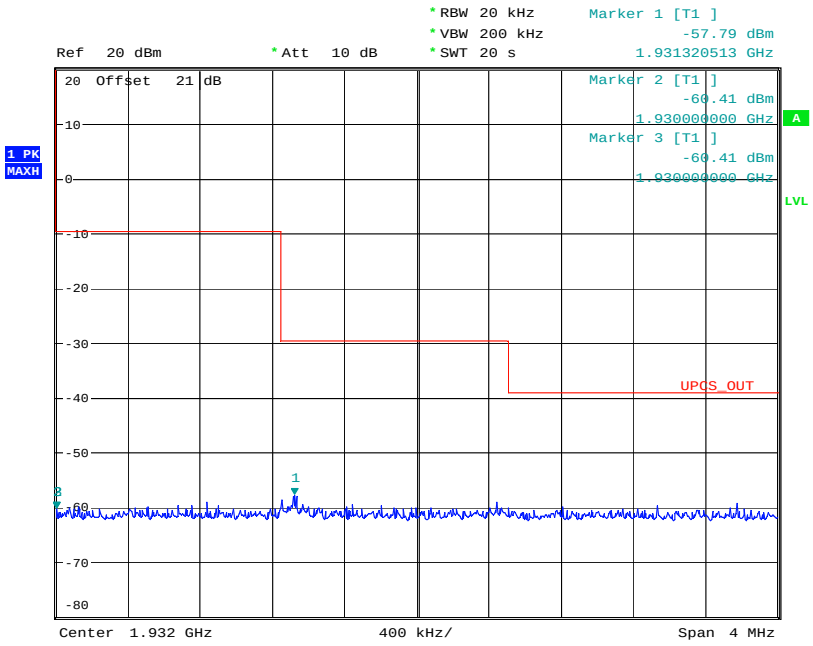
EMISSIONS OUTSIDE THE SUB-BAND

RF carrier set to the lowest carrier defined by the EUT– Single Slot Operation



Date: 2.SEP.2009 11:36:29

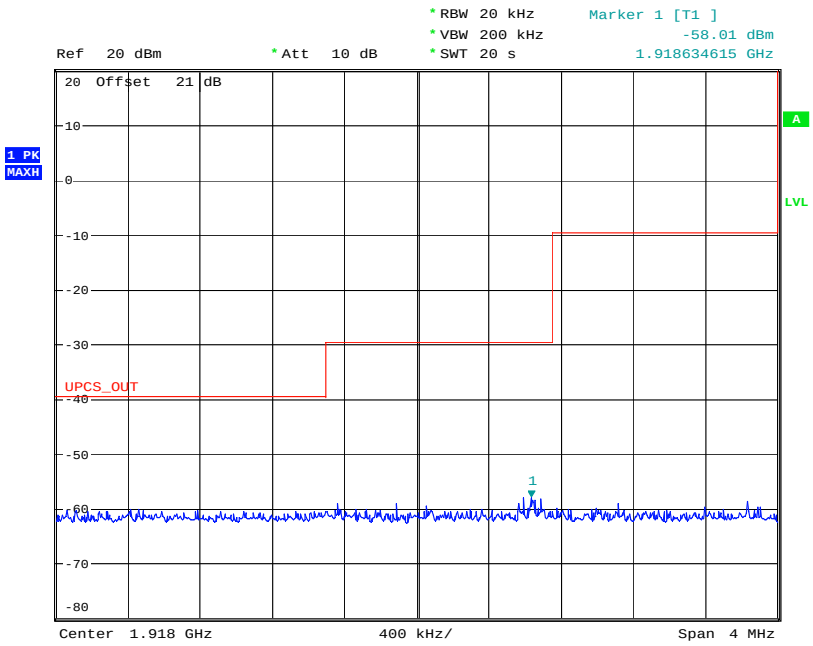
Lower bandedge - > 2.5MHz



Date: 2.SEP.2009 11:40:32

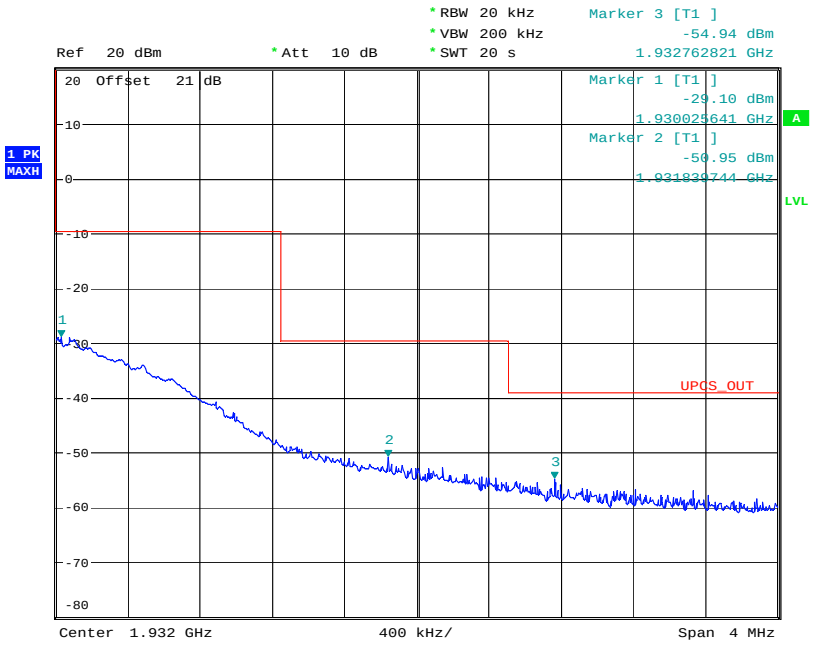
Upper bandedge - > 2.5MHz

RF carrier set to the highest carrier defined by the EUT– Single Slot Operation



Date: 2.SEP.2009 11:25:20

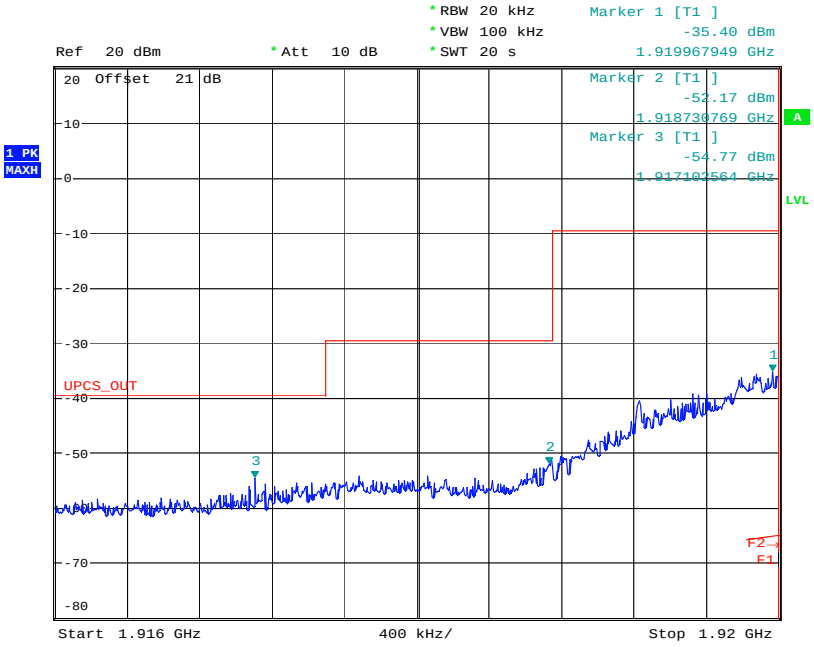
Lower bandedge - > 2.5MHz



Date: 2.SEP.2009 11:22:27

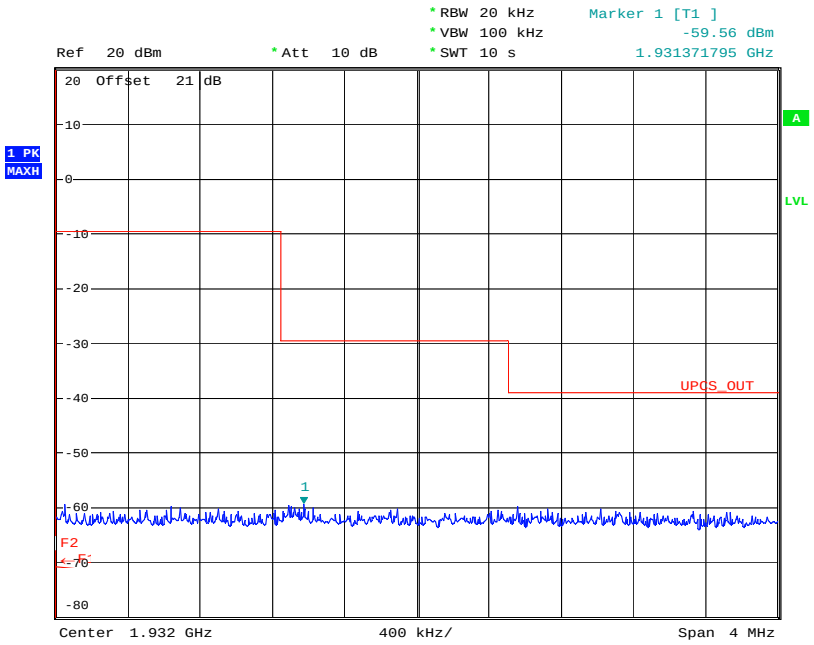
Upper bandedge - > 2.5MHz

RF carrier set to the lowest carrier defined by the EUT– Long Slot Operation



Date: 1.SEP.2009 15:51:41

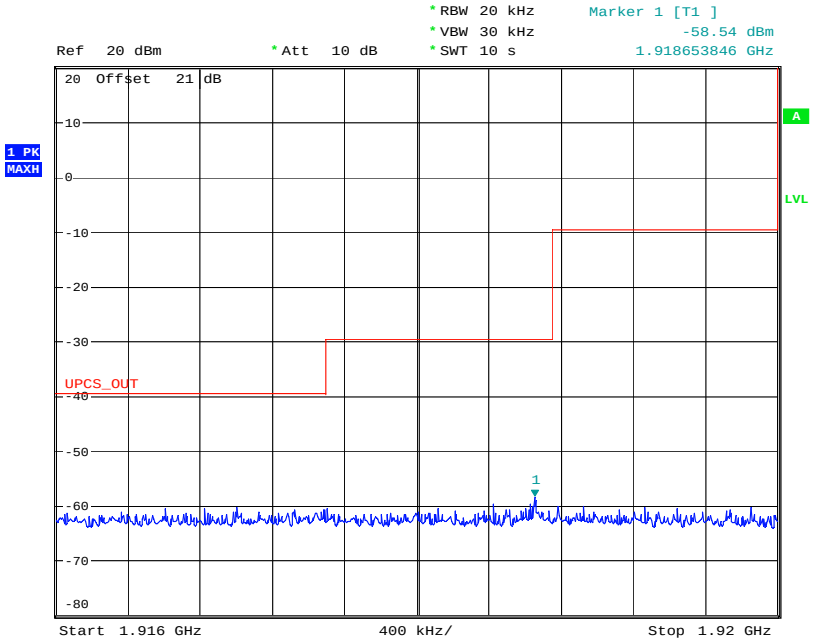
Lower bandedge - > 2.5MHz



Date: 1.SEP.2009 15:52:56

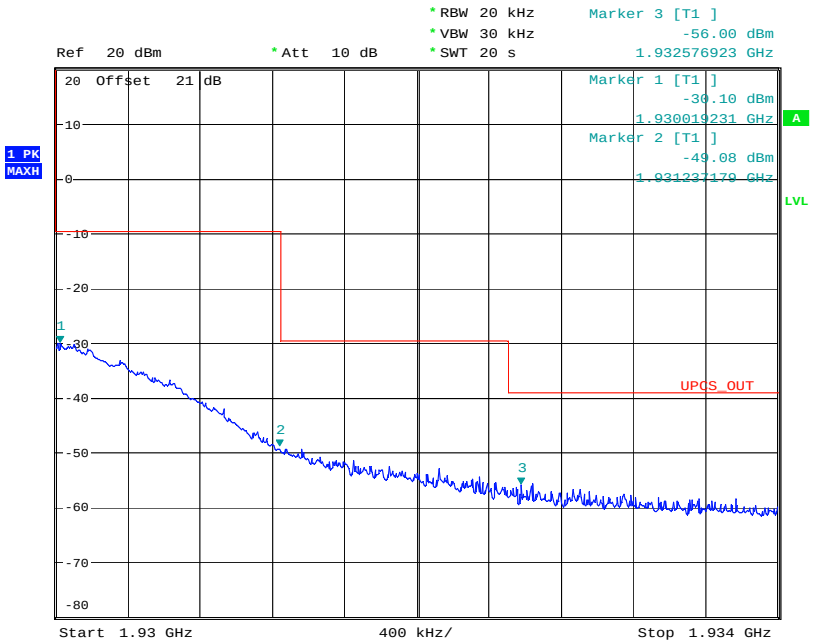
Upper bandedge - > 2.5MHz

RF carrier set to the highest carrier defined by the EUT– Long Slot Operation



Date: 2.SEP.2009 10:45:32

Lower bandedge - > 2.5MHz



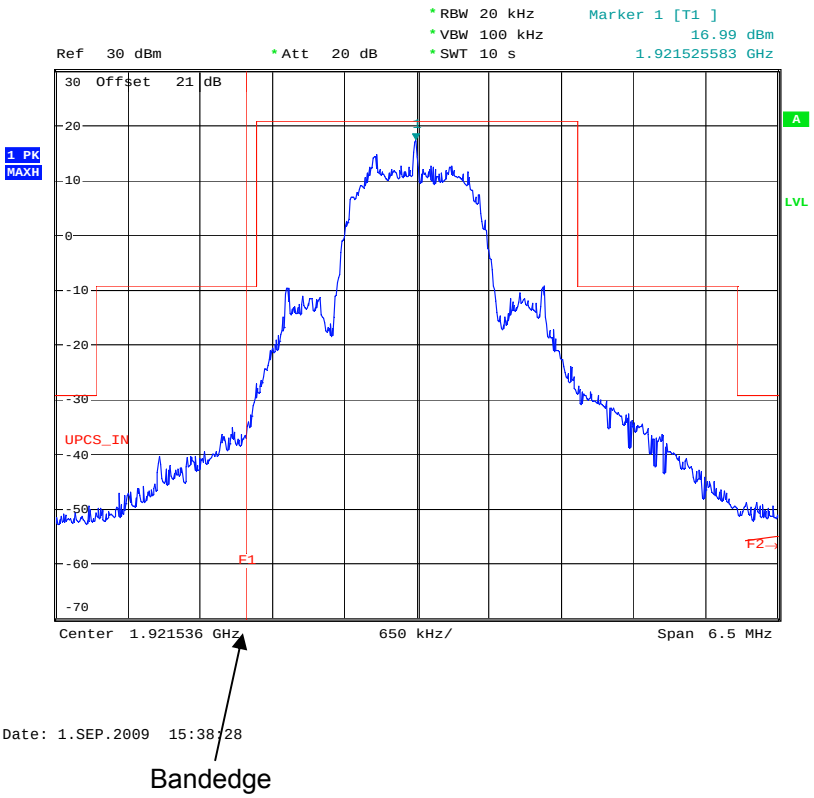
Date: 2.SEP.2009 10:48:51

Upper bandedge - > 2.5MHz

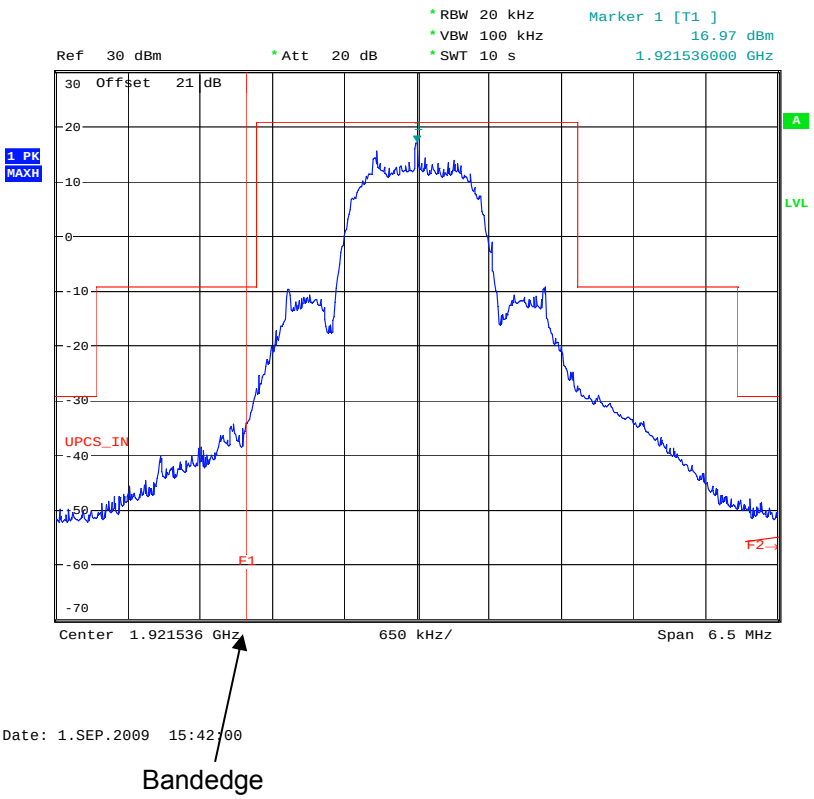
ANNEX J

EMISSIONS INSIDE THE SUB-BAND – CONDUCTED

RF carrier set to the lowest carrier defined by the EUT

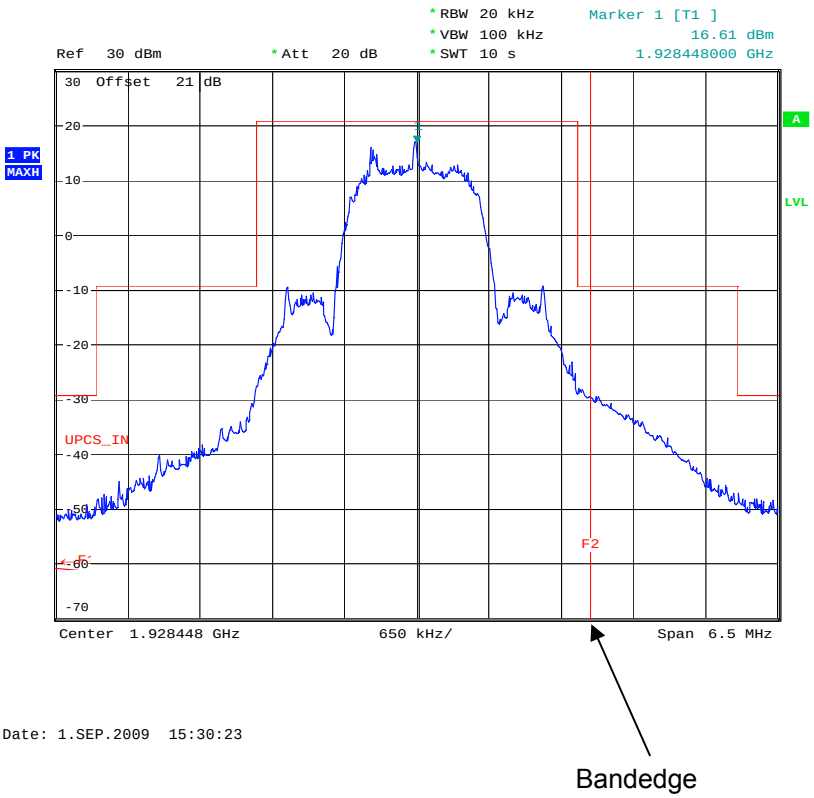


Single Slot Operation

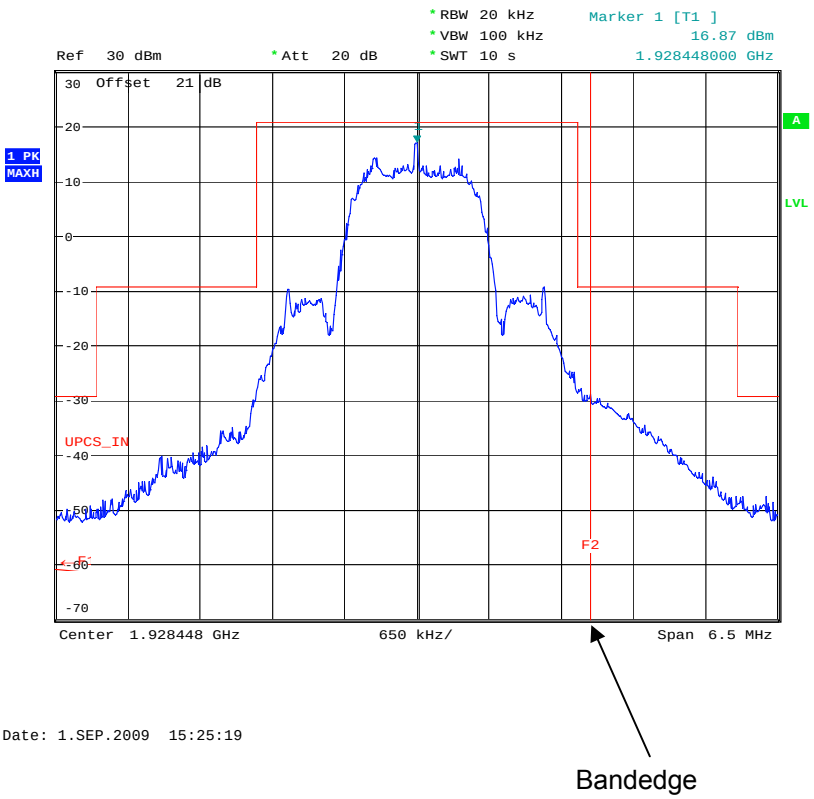


Long Slot operation

RF carrier set to the highest carrier defined by the EUT



Single Slot Operation

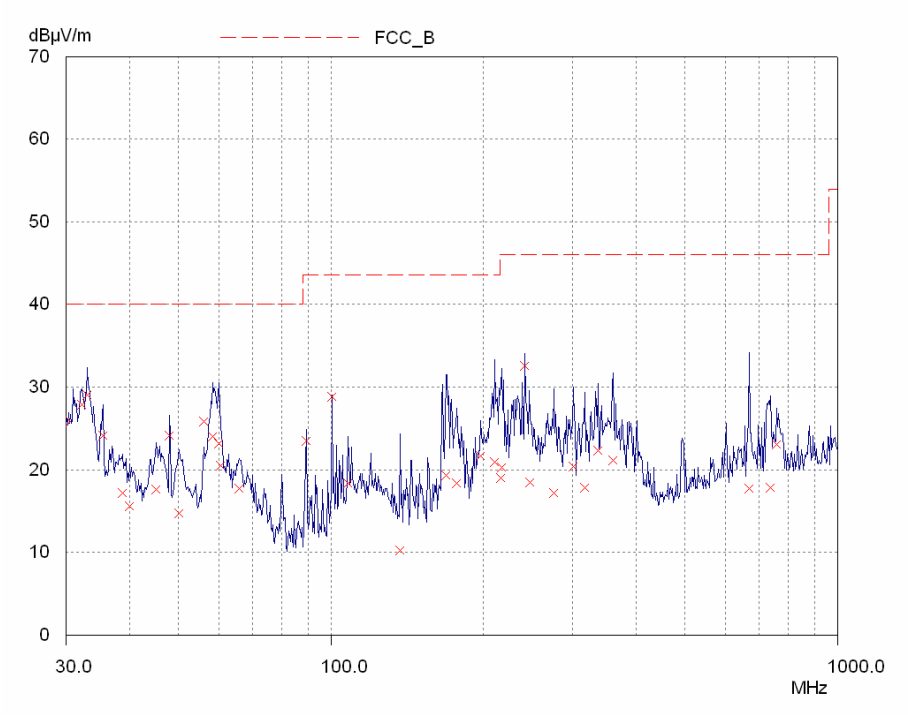


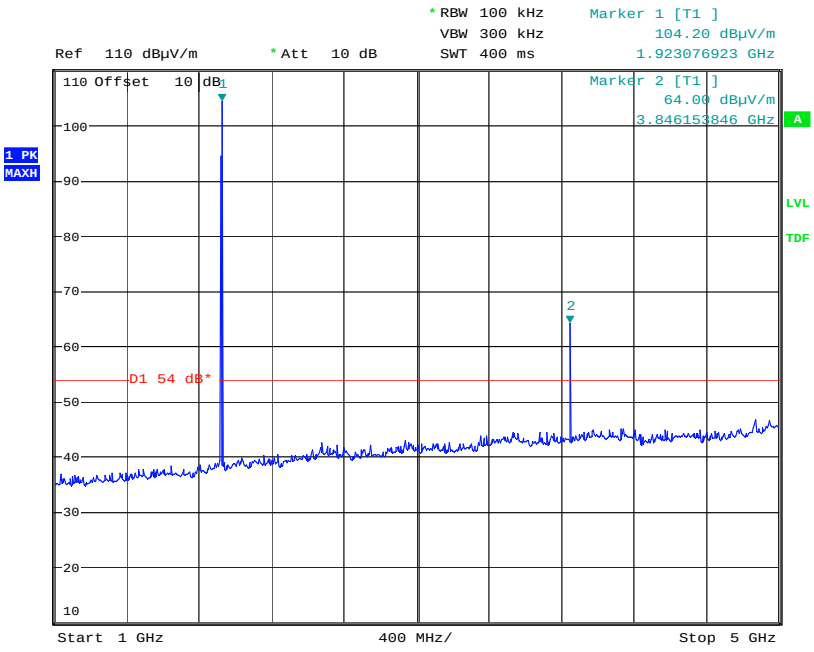
Long Slot Operation

ANNEX K

SPURIOUS EMISSIONS – RADIATED

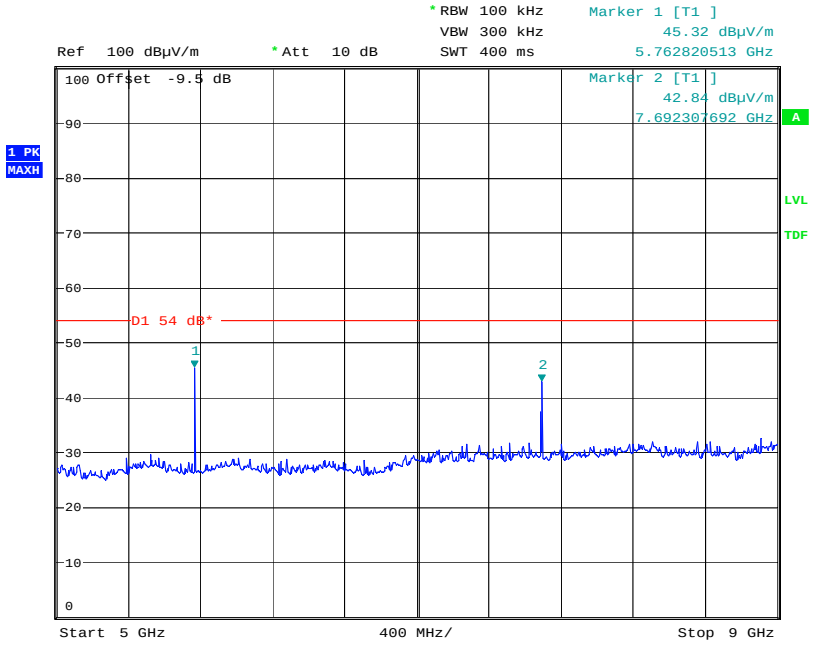
RF carrier set to the lowest carrier defined by the EUT – Single Slot Operation



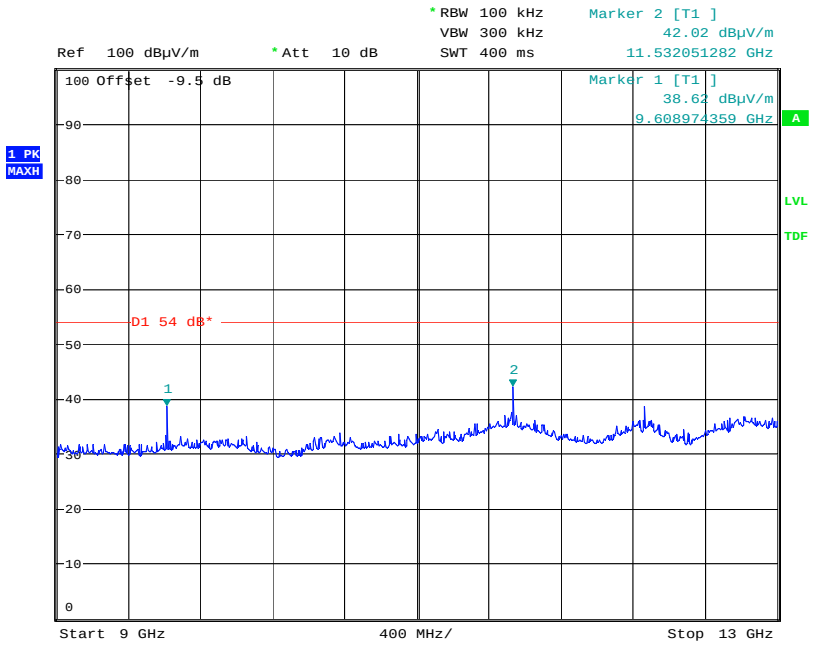


Date: 12.AUG.2009 15:43:58

RF carrier set to the lowest carrier defined by the EUT – Single Slot Operation

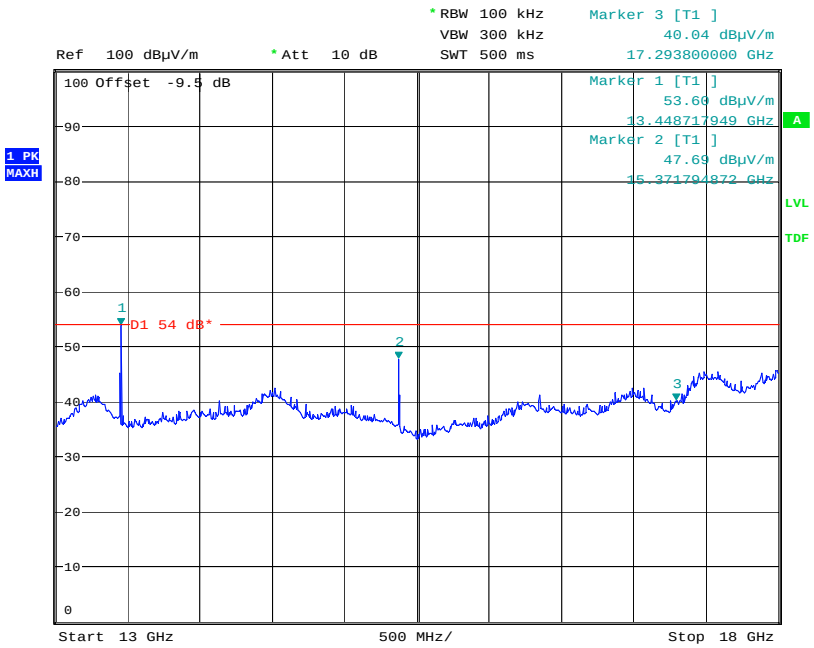


Date: 13.AUG.2009 12:39:08

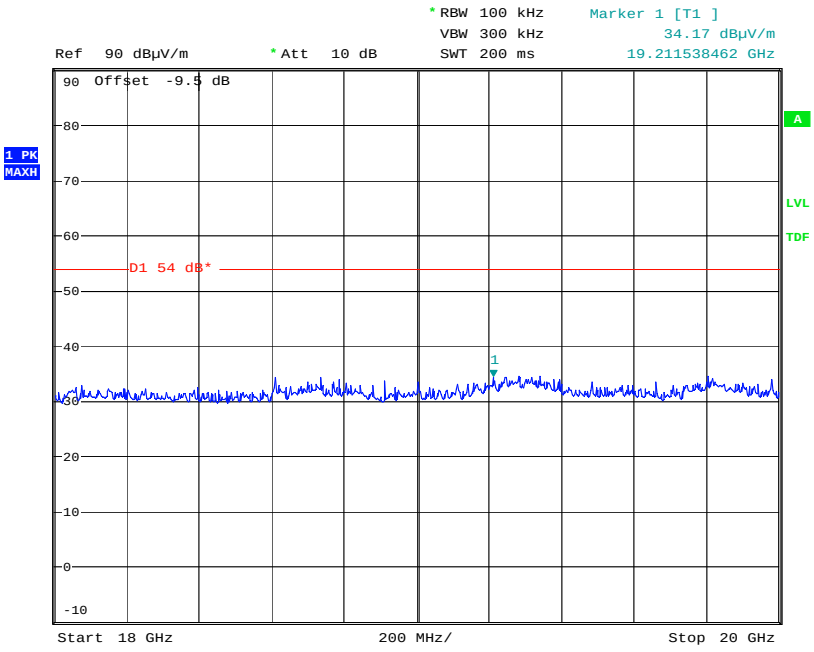


Date: 13.AUG.2009 12:39:27

RF carrier set to the lowest carrier defined by the EUT – Single Slot Operation

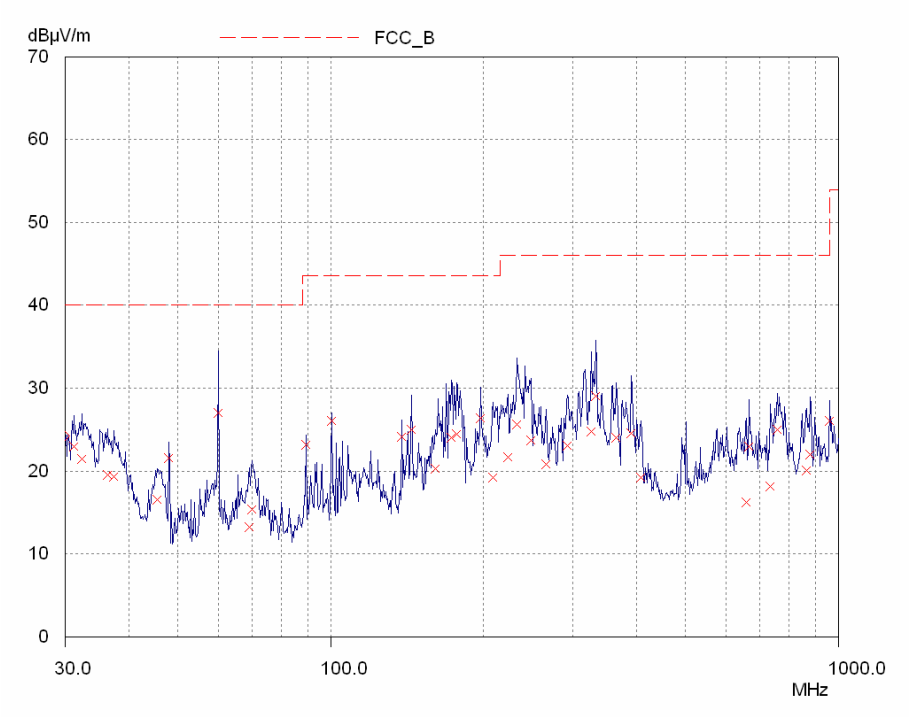


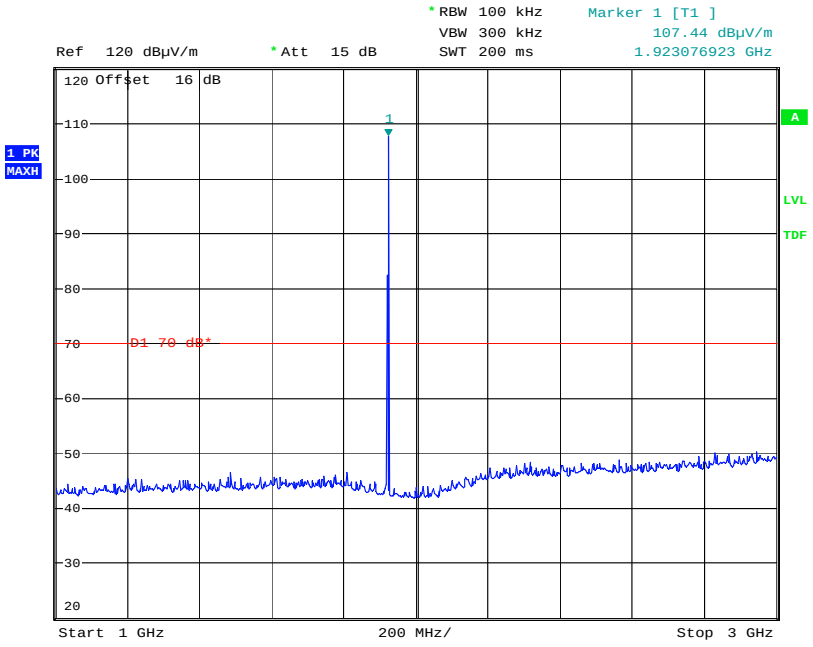
Date: 13.AUG.2009 12:40:27



Date: 13.AUG.2009 11:27:02

RF carrier set to the lowest carrier defined by the EUT – Long Slot Operation





Date: 10.SEP.2009 16:37:10

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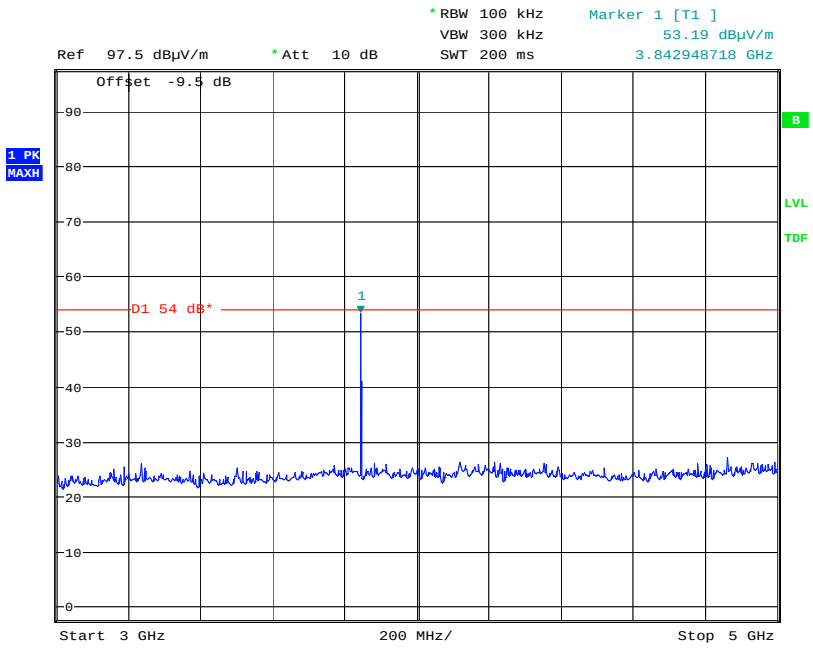
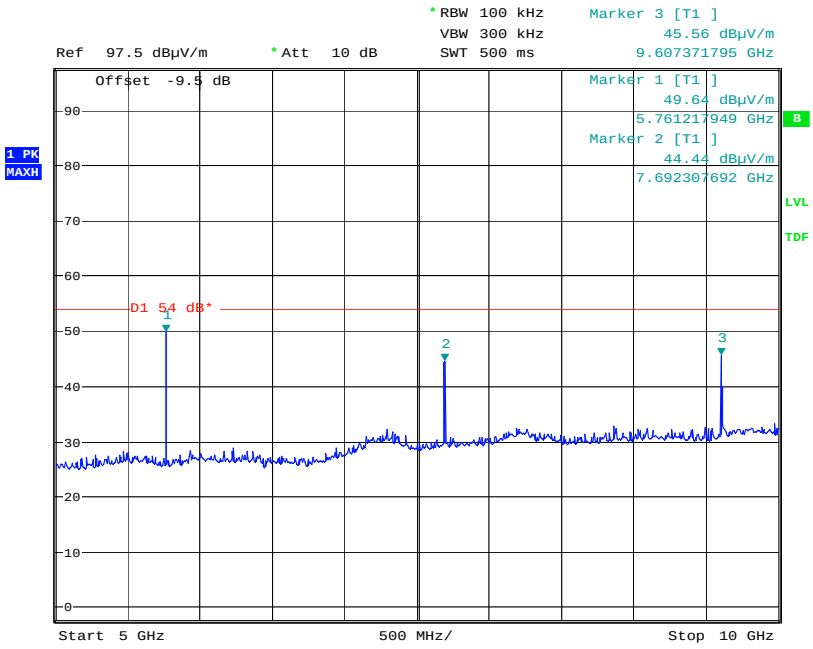
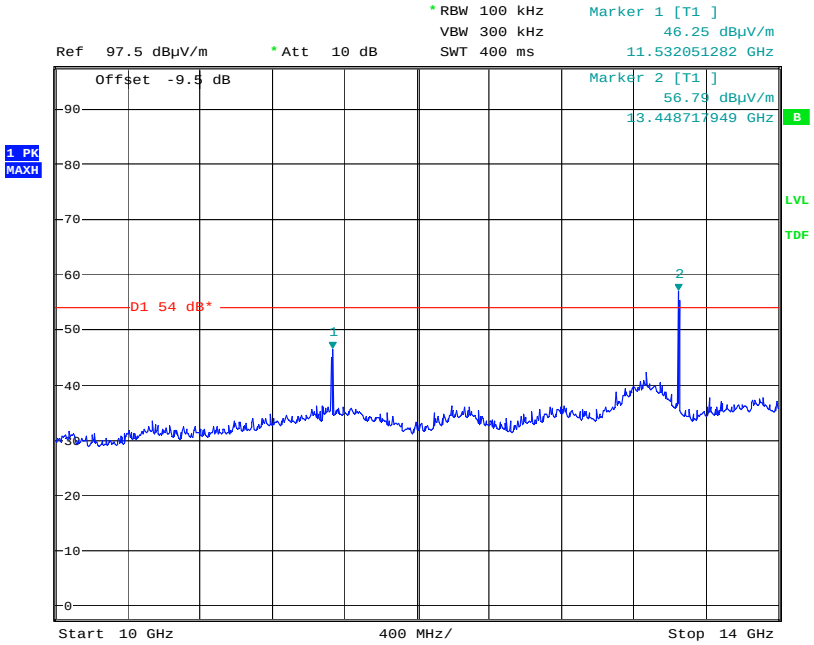


Date: 10.SEP.2009 13:34:08

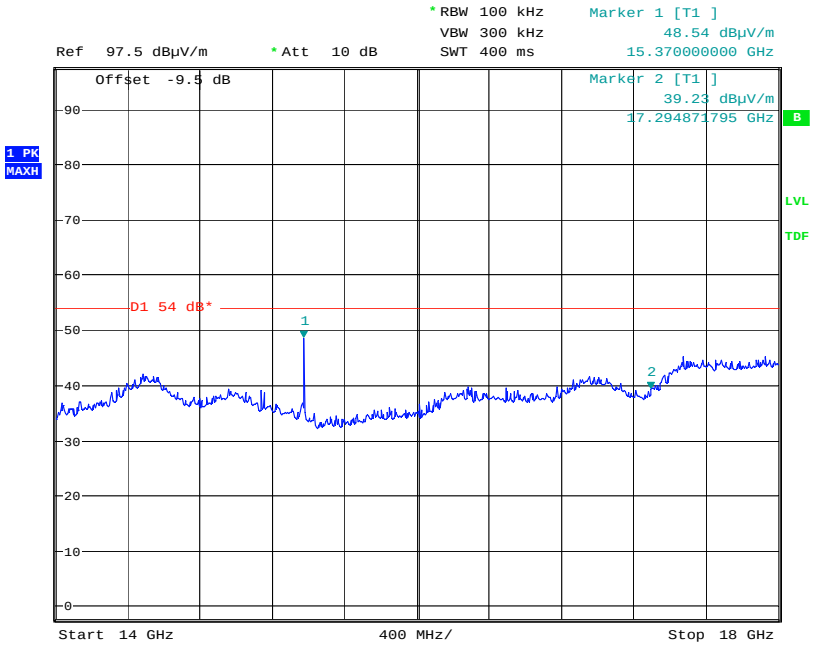


Date: 10.SEP.2009 13:33:53

RF carrier set to the lowest carrier defined by the EUT – Long Slot Operation

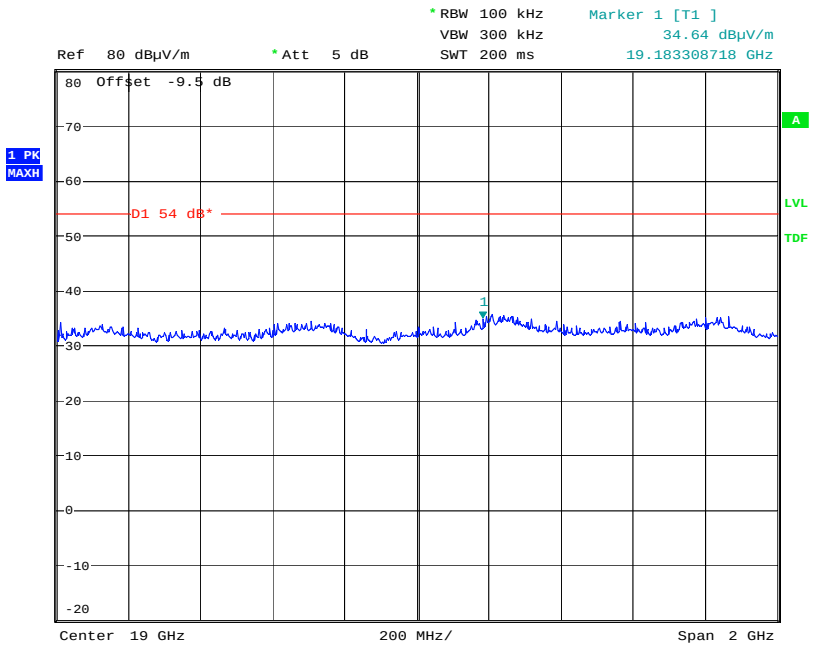


Date: 10.SEP.2009 13:33:01



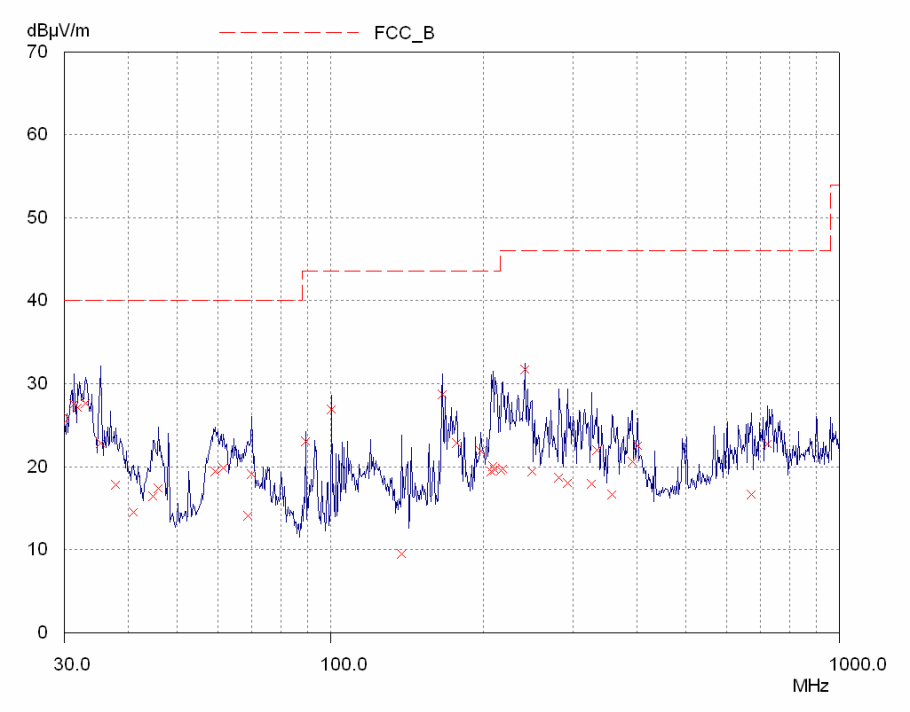
Date: 10.SEP.2009 13:32:39

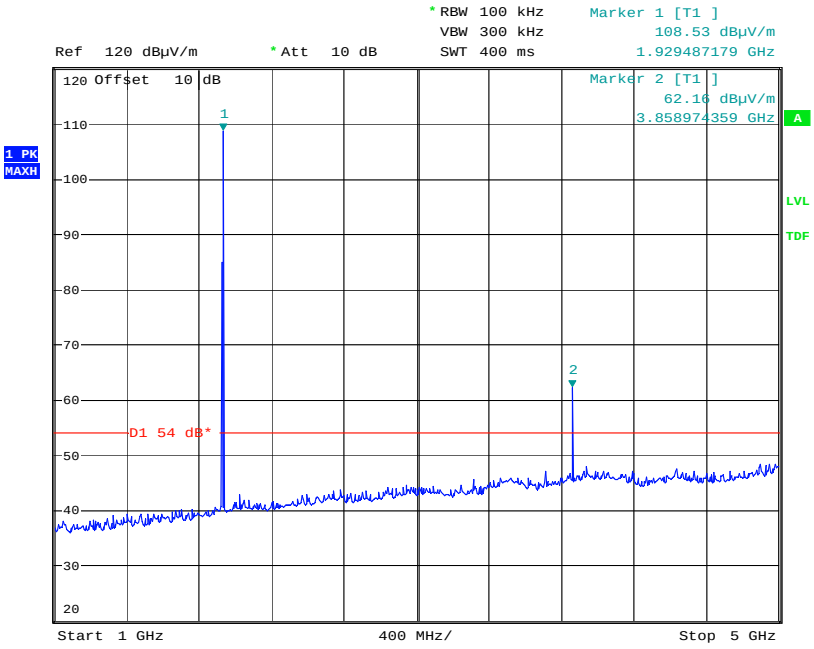
RF carrier set to the lowest carrier defined by the EUT – Long Slot Operation



Date: 10.SEP.2009 15:37:19

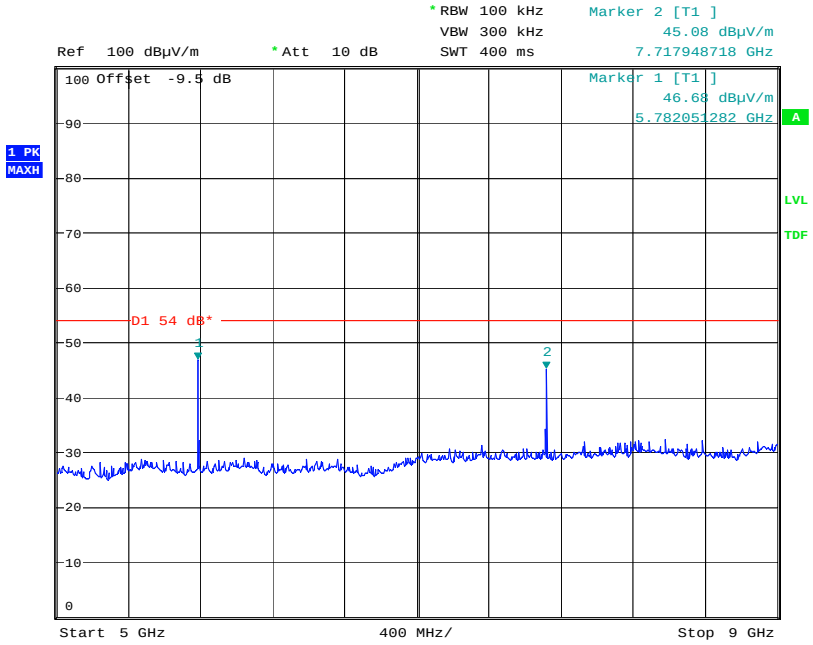
RF carrier set to the highest carrier defined by the EUT – Single Slot Operation



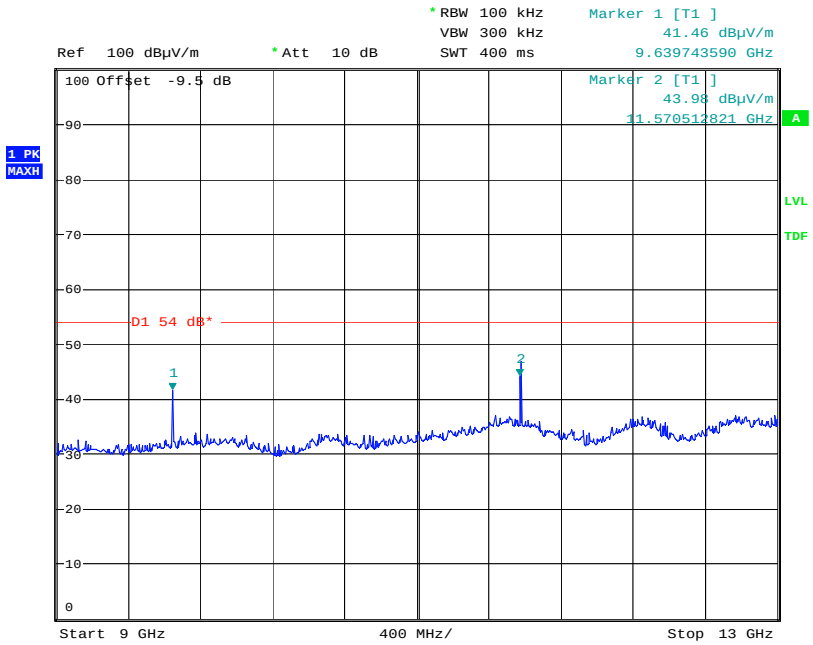


Date: 12.AUG.2009 15:40:04

RF carrier set to the highest carrier defined by the EUT – Single Slot Operation

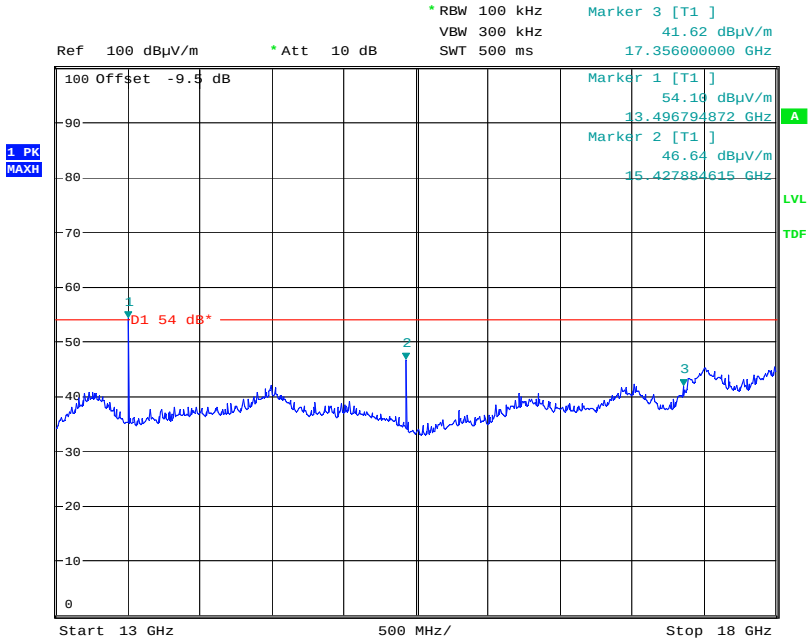


Date: 13.AUG.2009 12:38:42

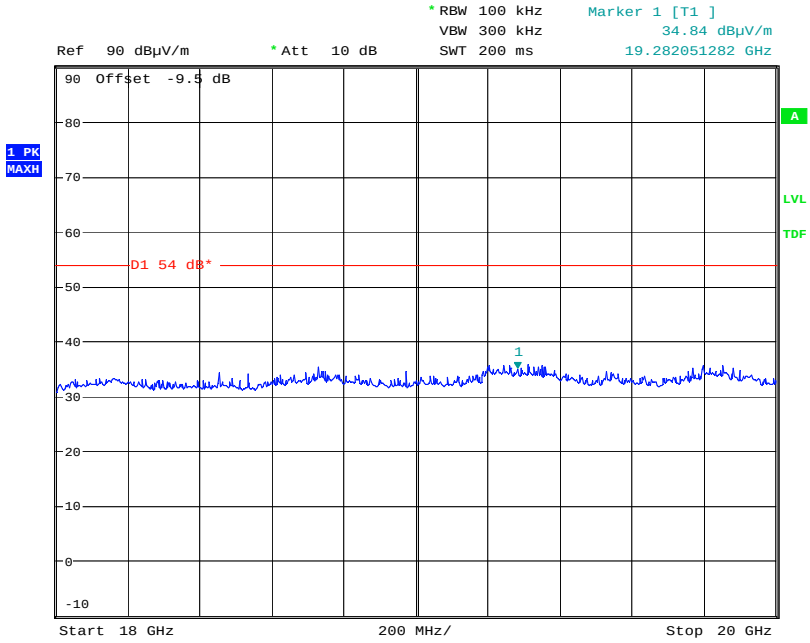


Date: 13.AUG.2009 12:38:23

RF carrier set to the highest carrier defined by the EUT – Single Slot Operation

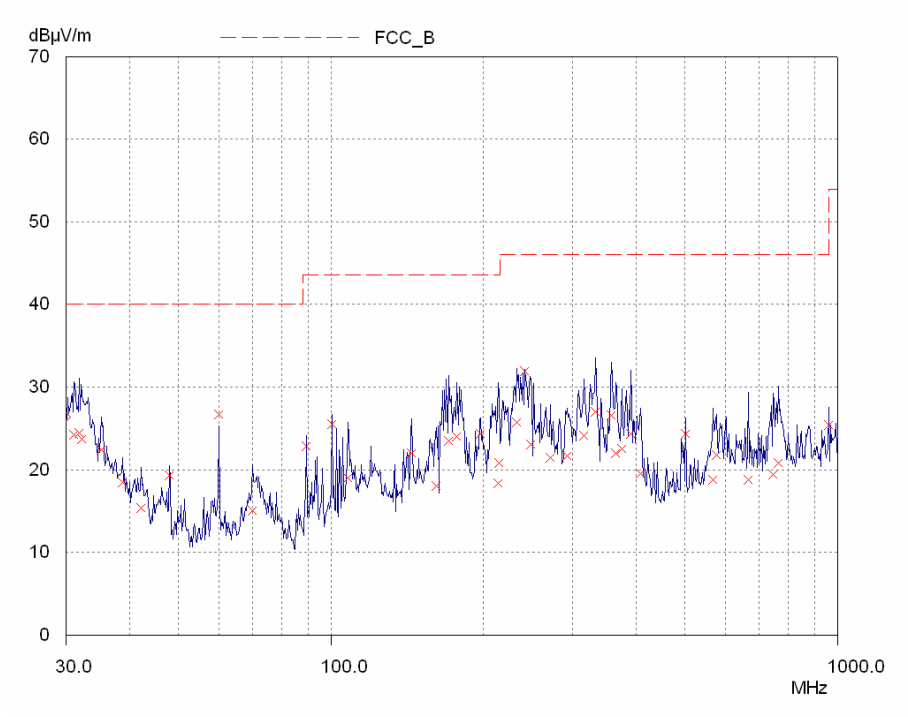


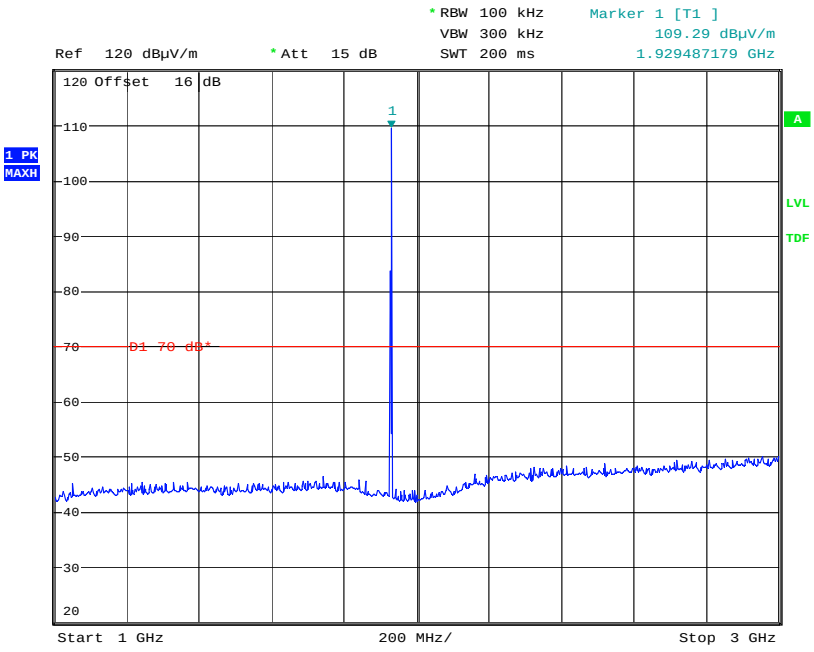
Date: 13.AUG.2009 12:37:52



Date: 13.AUG.2009 11:25:01

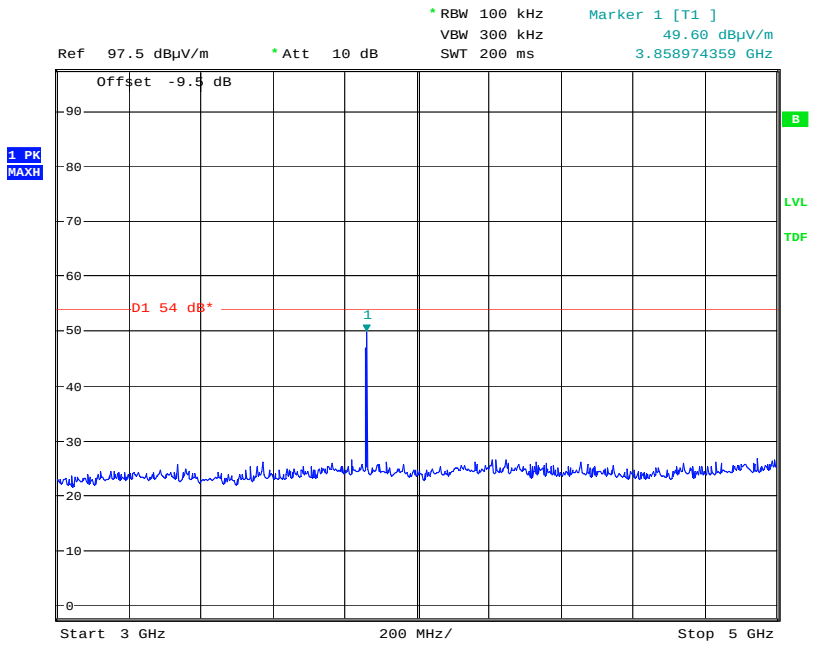
RF carrier set to the highest carrier defined by the EUT – Long Slot Operation



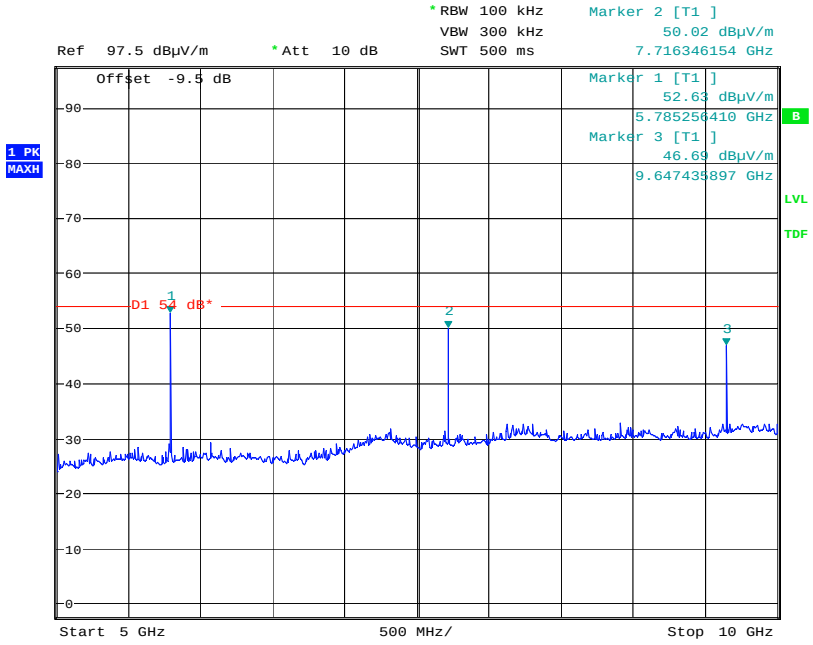


Date: 10.SEP.2009 16:24:46

RF carrier set to the highest carrier defined by the EUT – Long Slot Operation

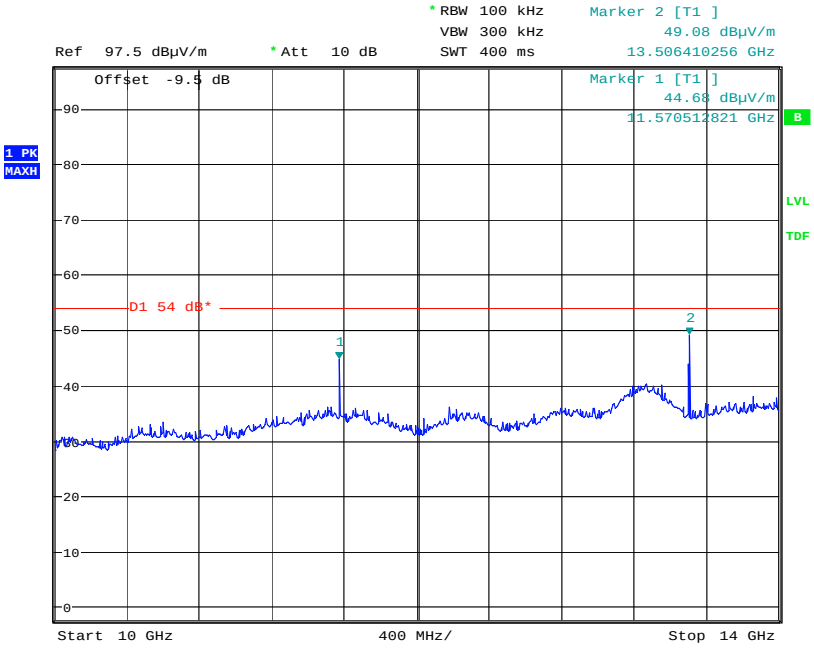


Date: 10.SEP.2009 10:34:04

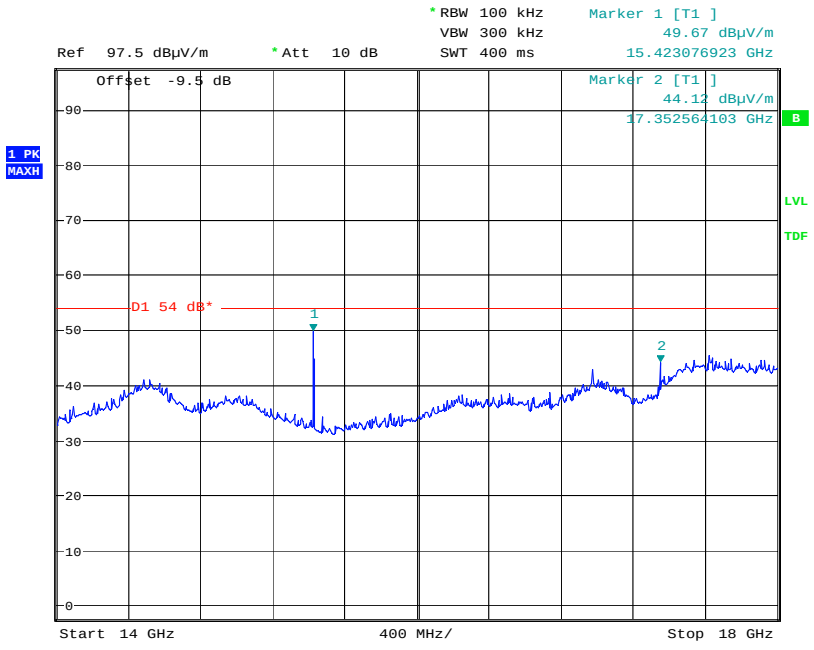


Date: 10.SEP.2009 10:29:23

RF carrier set to the highest carrier defined by the EUT – Long Slot Operation

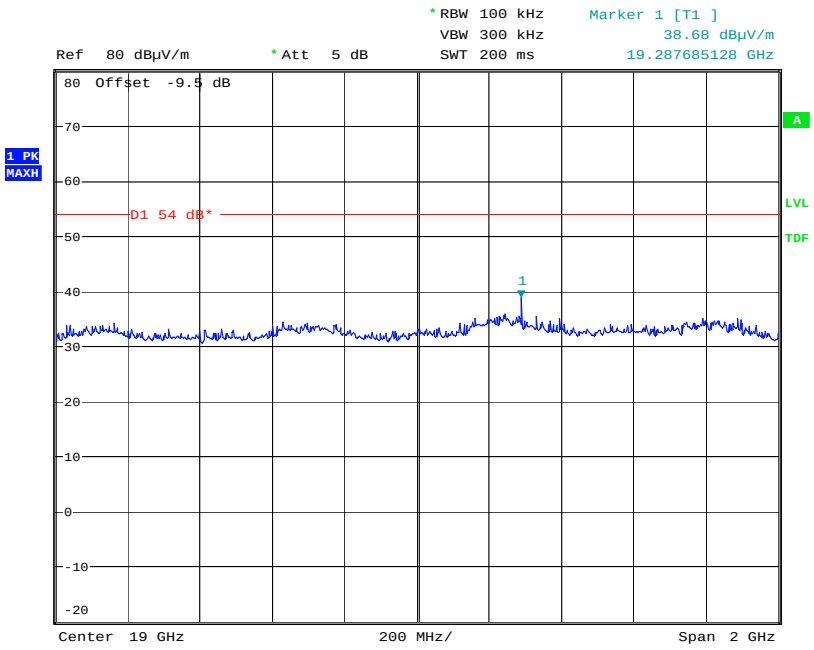


Date: 10.SEP.2009 10:30:20



Date: 10.SEP.2009 10:32:13

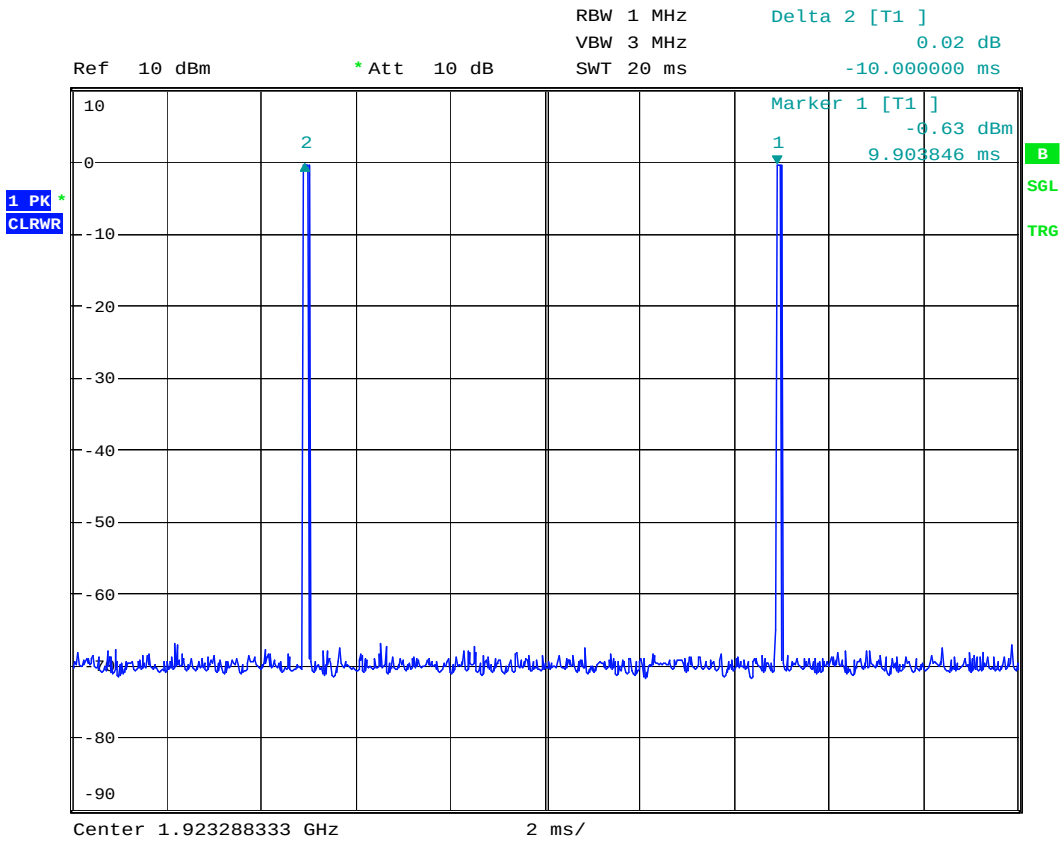
RF carrier set to the highest carrier defined by the EUT – Long Slot Operation



Date: 10.SEP.2009 15:40:43

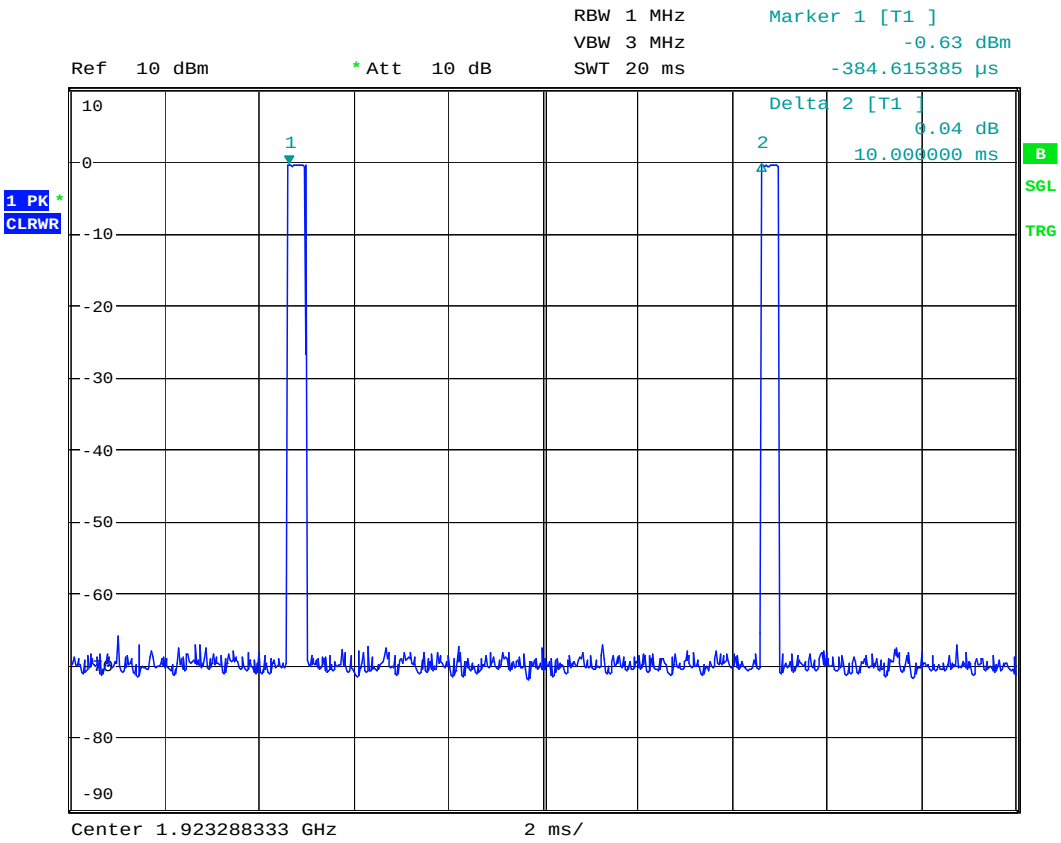
ANNEX L

FRAME PERIOD



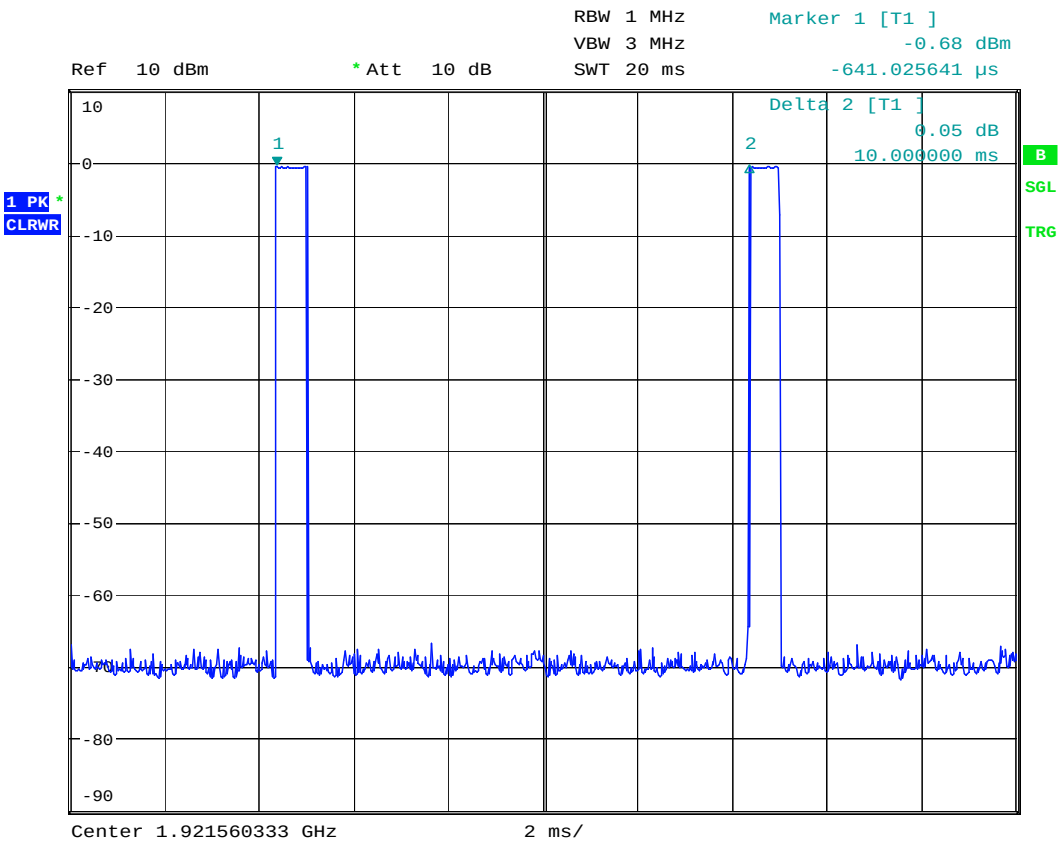
Date: 28.SEP.2009 14:37:54

Single Slot Communications Channel Active



Date: 28.SEP.2009 14:39:49

Long Slot Communications Channel Active



Date: 28.SEP.2009 14:41:21

ANNEX M

EQUIPMENT DETAILS & CALIBRATION

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
TEMPERATURE CHAMBER	SHARTREE	TCC 125-815P	CS 203	11	X
ATTENUATOR	BIRD	8302-060	N/A	106	X
ATTENUATOR	BIRD	8302-100	N/A	173	X
SIGNAL GENERATOR	MARCONI	2042	119388/080	176	X
ATTENUATOR	BIRD	8304-100-N	N/A	222	X
ATTENUATOR	BIRD	8304-0600-N	N/A	246	X
SIGNAL GENERATOR	MARCONI	2042	119562/021	254	X
TEMPERATURE INDICATOR	FLUKE	52 Series II	74700044	426	X
FUNCTION GENERATOR	WAVETEK	178	V644080	638	X
OSCILLOSCOPE	TEKTRONIX	TDS520B	B020491	UH122	X
FUNCTION GENERATOR	WAVETEK	271	C6841078	UH221	X
SPECTRUM ANALYSER	ROHDE & SCHWARZ	FSU 46	200034	UH281	X
POWER SPLITTER/COMBINER	HP	11667A	13723	UH303	X
POWER SPLITTER/COMBINER	HP	11667A	06690	UH305	X
POWER SPLITTER/COMBINER	HP	11667A	332	UH306	X
CRYSTAL DETECTOR	HP	8472A	1822A00897	UH307	X
ATTENUATOR	MIDWEST MICROWAVE	290-3dB	N/A	UH331	X
ATTENUATOR	RADIALL	R414706000	N/A	UH332	X
ATTENUATOR	NARDA	771-6	28	UH335	X
MODULATION ANALYSER	ROHDE & SCHWARZ	CMD 60	84934410002	RFG433	X
SIGNAL GENERATOR	AGILENT	E4438C	MY4509185000 5403406506	REF844	X
HIGH PASS FILTER	BCS FILTERS	SH4141	973501	RFG445	X

TRL Number	Equipment Type	Manufacturer	Last Cal Calibration	Calibration Period	Due For Calibration
L011	Temperature chamber	Shartree	Use Calibrated Temperature Indicator		
L106	Attenuator	Bird	Calibrate in use		
L173	Attenuator	Bird	Calibrate in use		
L176	Signal Generator	Marconi	23/06/2009	12	23/06/2010
L222	Attenuator	Bird	Calibrate in use		
L246	Attenuator	Bird	Calibrate in use		
L254	Signal Generator	Marconi	25/02/09	12	25/02/10
L426	Temperature Indicator	Fluke	21/01/2009	12	21/01/2010
L638	Function Generator	Wavetek	Use Calibrated oscilloscope		
UH122	Oscilloscope	Tektronix	10/12/2007	24	10/12/2009
UH221	Function Generator	Wavetek	Use Calibrated oscilloscope		
UH281	Spectrum Analyser	R&S	24/07/2006	12	24/07/2007
UH303	Power Splitter/Combiner	HP	Calibrate in use		
UH305	Power Splitter/Combiner	HP	Calibrate in use		
UH306	Power Splitter/Combiner	HP	Calibrate in use		
UH307	Crystal Detector	HP	For information only		
UH331	Attenuator	Midwest Microwave	Calibrate in use		
UH332	Attenuator	Radiall	Calibrate in use		
UH335	Attenuator	Narda	Calibrate in use		
RFG443	CMD 60	R&S	12/12/08	12	12/12/09
REF844	Signal Generator	Agilent	05/03/08	24	05/03/10
RFG445	High Pass Filter	BSC Filters	15/07/09	12	15/07/09

ANNEX N

MEASUREMENT UNCERTAINTY

Radio Testing – General Uncertainty Schedule

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence where no required test level exists.

[1] Adjacent Channel Power

Uncertainty in test result = **1.86dB**

[2] Carrier Power

Uncertainty in test result (Equipment - TRLUH120) = **2.18dB**
Uncertainty in test result (Equipment – TRL05) = **1.08dB**
Uncertainty in test result (Equipment – TRL479) = **2.48dB**

[3] Effective Radiated Power

Uncertainty in test result = **4.71dB**

[4] Spurious Emissions

Uncertainty in test result = **4.75dB**

[5] Maximum frequency error

Uncertainty in test result (Equipment - TRLUH120) = **119ppm**
Uncertainty in test result (Equipment – TRL05) = **0.113ppm**
Uncertainty in test result (Equipment – TRL479) = **0.265ppm**

[6] Radiated Emissions, field strength OATS 14kHz-18GHz Electric Field

Uncertainty in test result (14kHz – 30MHz) = **4.8dB**, Uncertainty in test result (30MHz – 1GHz) = **4.6dB**, Uncertainty in test result (1GHz-18GHz) = **4.7dB**

[7] Frequency deviation

Uncertainty in test result = **3.2%**

[8] Magnetic Field Emissions

Uncertainty in test result = **2.3dB**

[9] Conducted Spurious

Uncertainty in test result (Equipment TRL479) Up to 8.1GHz = **3.31dB**
Uncertainty in test result (Equipment TRL479) 8.1GHz – 15.3GHz = **4.43dB**
Uncertainty in test result (Equipment TRL479) 15.3GHz – 21GHz = **5.34dB**
Uncertainty in test result (Equipment TRLUH120) Up to 26GHz = **3.14dB**

[10] Channel Bandwidth

Uncertainty in test result = **15.5%**

[11] Amplitude and Time Measurement – Oscilloscope

Uncertainty in overall test level = **2.1dB**, Uncertainty in time measurement = **0.59%,** Uncertainty in Amplitude measurement = **0.82%**

[11] Power Line Conduction

Uncertainty in test result = **3.4dB**

[12] Spectrum Mask Measurements

Uncertainty in test result = **2.59% (frequency)**
Uncertainty in test result = **1.32dB (amplitude)**

[13] Adjacent Sub Band Selectivity

Uncertainty in test result = **1.24dB**

[14] Receiver Blocking – Listen Mode, Radiated

Uncertainty in test result = **3.42dB**

[15] Receiver Blocking – Talk Mode, Radiated

Uncertainty in test result = **3.36dB**

[16] Receiver Blocking – Talk Mode, Conducted

Uncertainty in test result = **1.24dB**

[17] Receiver Threshold

Uncertainty in test result = **3.23dB**

[18] Transmission Time Measurement

Uncertainty in test result = **7.98%**