

TRaC Wireless Test Report : TTR-002403WUS2

Applicant : Quail Ltd

Apparatus : Q-DTB (QD Drive Thru Base)

Specification(s) : CFR47 Part 15D

Purpose of Test : **Certification**

FCCID : UDDQDTB

Authorised by :



: Radio Product Manager

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Contents

Section 1:	Introduction	3
1.1	General	3
1.2	Tests Requested By	4
1.3	Manufacturer	4
1.4	Apparatus Assessed	4
1.5	System Description	5
1.6	Test Result Summary	6
1.7	Notes Relating To The Assessment	8
1.7	Deviations from Test Standards	8
Section 2:	Measurement Uncertainty	9
2.1	Measurement Uncertainty Values	9
Section 3:	Modifications	10
3.1	Modifications Performed During Assessment	10
Appendix A:	Formal Emission Test Results	11
A1	Cross Reference To Subpart B	12
A2	Labelling Information	12
A3	Antenna Requirements	12
A4	Modulation Techniques	12
A5	Radio Frequency Radiation Exposure	12
A6	Transmitter Emission Bandwidth	13
A7	Peak Transmit Power	14
A8	Power Spectral Density	15
A9	Antenna Gain	16
A10	Automatic Discontinuation of Transmissions	17
A11	Monitoring Thresholds	18
A12	Monitoring of Intended Transmit Window & Maximum Reaction Time	19
A13	Monitoring Bandwidth & Antenna	20
A14	Power Accuracy	21
A15	Segment Occupancy	22
A16	Access Criteria Test Interval	23
A17	Access Criteria Functional Test	24
A18	Duration Of Transmission	25
A19	Connection Acknowledgement	26
A20	Least Interfered Channel (LIC) Procedure	27
A21	Selected Channel Confirmation	28
A22	Duplex Connections	29
A23	Alternative Monitoring Interval for Co-Located Devices	30
A24	Fair Access To Spectrum	31
A25	Emissions Inside and Outside the Sub-Band - Conducted	32
A27	Frame Repetition Stability	34
A28	Frequency Stability	35
A29	Power Line Conducted Emissions – Drive Thru Base	36
A30	Power Line Conducted Emissions – Retail Base	38
A31	Unintentional Radiated Emissions - Drive Thru Base	40
A32	Unintentional Radiated Emissions - Retail Base	43
Appendix B:	Supporting Graphical Data	45
Appendix D:	Additional Information	75
Appendix E:	Photographs and Figures	76

Section 1:**Introduction****1.1 General**

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on samples submitted to the Laboratory.

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1.2 Tests Requested By

This testing in this report was requested by :

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1.3 Manufacturer

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1.4 Apparatus Assessed

The following apparatus was assessed between 21 December 2010 – 31 March 2011:

Q-DTB (QD Drive Thru Base) – Full Testing

QD Retail Base – Radiated emission & Powerline conducted emissions

This report covers 2 fixed part variants. The Drive Thru Base and Retail Base. Both base stations utilise the same RF module. The RF and Etiquette parameters results contained in this report were taken as conducted measurements from an RF module with a temporary antenna connector. This module may be utilised in either base station these results relate to both devices. The unintentional radiated emissions and AC Powerline conducted emissions for each device are also covered in this report.

1.5 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 wall mounted base station transmitter.

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 GFSK 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. The two halves of a given bearer are always exactly half a frame (5ms, 12 single slots) apart.

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 and a fixed part with a temporary antenna connector were supplied to allow conducted measurements where applicable.

1.6 Test Result Summary

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

The statements relating to compliance with the standards below apply ONLY as qualified in the notes and deviations stated in sections 1.6 to 1.7 of this test report.

Full details of test results are contained within Appendix A. The table overleaf summarises the results of the assessment.

Abbreviations used in the overleaf table:

CFR : Code of Federal Regulations
RSS : Radio Standards Specification

ANSI : American National Standards Institution
PLCE : Power Line Conducted Emissions

TEST/EXAMINATION	Part 15	Result
Coordination with Fixed Microwave Service	15.307 (b)	N/A note 1
Cross reference to Subpart B	15.309 (b)	Pass
Labelling Requirements	15.311 15.19 (a)(3)	Pass
Measurement Procedures	15.313	Pass
Antenna Requirement	15.317 15.203	Pass
Modulation Techniques	15.319 (b)	Pass
Conducted AC Powerline	15.315 15.207	Pass
Emission Bandwidth	15.323 (a)	Pass
Peak Transmit Power	15.319 (c)	Pass
Power Spectral Density	15.319 (d)	Pass
Antenna Gain	15.319 (e)	Pass
Automatic Discontinuation of Transmission	15.319 (f)	Pass
Radio Frequency Radiation Exposure	15.319 (i)	Pass
Monitoring Thresholds	15.323 (c)(2) 15.323 (c)(9)	Pass
Monitoring of Intended Transmit Window and Maximum Reaction Time	15.323 (c)(1)	Pass
Monitoring Bandwidth	15.323 (c)(7)	Pass
Access Criteria Functional Test	15.323 (c)(6)	Pass
Duration of Transmission	15.323 (c)(3)	Pass
Connection Acknowledgement	15.323 (c)(4)	Pass
Lower threshold Selected Channel, Power Accuracy, Segment Occupancy	15.323 (c)(5)	Pass
Monitoring Antenna	15.323 (c)(8)	Pass
Duplex Connections	15.323 (c)(10)	Pass
Alternative Monitoring Interval for Co-located Devices	15.323 (c)(11)	Pass
Fair Access to Spectrum Related to (c)(10) & (c)(11)	15.323 (c)(12)	Pass
Emission Inside and Outside the Sub-band	15.323 (d)	Pass
Frame Period	15.323 (e)	Pass
Frequency Stability	15.323 (f)	Pass

- 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.

1.7 Notes Relating To The Assessment

With regard to this assessment, the following points should be noted:

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

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 1.7 of this test report (Deviations from Test Standards).

For emissions testing, throughout this test report, "Pass" indicates that the results for the sample as tested were below the specified limit (refer also to Section 2, Measurement Uncertainty).

Where relevant, the apparatus was only assessed using the monitoring methods and susceptibility criteria defined in this report.

All testing with the exception of testing at the Open Area Test Site was performed under the following environmental conditions:

Temperature	: 17 to 23 °C
Humidity	: 45 to 75 %
Barometric Pressure	: 86 to 106 kPa

All dates used in this report are in the format dd/mm/yy.

This assessment has been performed in accordance with the requirements of ISO/IEC 17025.

1.7 Deviations from Test Standards

There were no deviations from the standards tested to.

Section 2:

Measurement Uncertainty

2.1 Measurement Uncertainty Values

For the test data recorded in accordance with note (iii) of Section 2.1 the following measurement uncertainty was calculated:

Section 3:**Modifications****3.1 Modifications Performed During Assessment****Drive Thru Base**

Mod State	Date	Eng	Details	Samples Modified	Judged to affect other tests
0	21/12/2010	DW	Initial sample	S21	NO
1	31/03/2011	DW	<p>Customer Modifications to address for Unintentional Radiated emissions & Powerline Conduction.</p> <ul style="list-style-type: none">• Ribbon cable between Main PCB & DTM PCB had filters fitted at either end.• Farnell 33RH26X28.5X13 Ferrite Core 13mm ID – 1 Turn @ EUT end• VDB PCB removed from Housing	S22	<p>NO</p> <p>All other tests Performed are related to the radio module PCB and performed Conducted</p>

Retail Base

No modifications performed.

Appendix A:**Formal Emission Test Results**

Abbreviations used in the tables in this appendix:

Spec	: Specification	ALSR	: Absorber Lined Screened Room
Mod	: Modification	OATS	: Open Area Test Site
		ATS	: Alternative Test Site
EUT	: Equipment Under Test		
SE	: Support Equipment	Ref	: Reference
		Freq	: Frequency
L	: Live Power Line		
N	: Neutral Power Line	MD	: Measurement Distance
E	: Earth Power Line	SD	: Spec Distance
Pk	: Peak Detector	Pol	: Polarisation
QP	: Quasi-Peak Detector	H	: Horizontal Polarisation
Av	: Average Detector	V	: Vertical Polarisation
CDN	: Coupling & decoupling network		

A1 Cross Reference To Subpart B

CFR 47 Part 15.309(b)

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

A2 Labelling Information

CFR 47 Part 15.311 & 15.19(a)(3)

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

A3 Antenna Requirements

CFR 47 Part 15.317 & 15.203

The unit employs an integral antenna arrangement.

A4 Modulation Techniques

CFR 47 Part 15.139(b)

The Quail Ltd Q-DTB (QD Drive Thru Base) is an isochronous device operating in the 1920 MHz – 1930 MHz frequency band.

The Quail Ltd Q-DTB (QD Drive Thru Base) modulation technique is based on DECT technology as described in European standards EN 300 175-2 and EN 300 175-3.

The Quail Ltd Q-DTB (QD Drive Thru Base) modulation techniques are MC/TDMA/TDD (Multi Carrier / Time Division Multiple Access / Time Division Duplex) using QPSK modulation.

The above statements also relate to the retail base as the same RF module is used in both devices.

A5 Radio Frequency Radiation Exposure

CFR 47 Part 15.319(i)

This information is contained in a separate document

A6 Transmitter Emission Bandwidth

Test Details:	
Regulation	CFR 47 Part 15.323(a)
Measurement standard	ANSI C63.17 sub-clause 6.1.3
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

Test Details: $f_i = 1921.536$ MHz				
ΔP (dBc)	f_l (MHz)	f_h (MHz)	Δf (MHz)	Limit
-26	1920.834077	1922.252346	1.418	50kHz > Δf > 2.5MHz
-12	1920.949462	1922.122538	1.173	N/A
-6	1921.136962	1921.689846	0.553	N/A

Test Details: $f_c = 1924.992$ MHz				
ΔP (dBc)	f_l (MHz)	f_h (MHz)	Δf (MHz)	Limit
-26	1924.290077	1925.708346	1.418	50kHz > Δf > 2.5MHz
-12	1924.410269	1925.578538	1.168	N/A
-6	1924.612192	1925.155462	0.543	N/A

Test Details: $f_h = 1928.448$ MHz				
ΔP (dBc)	f_l (MHz)	f_h (MHz)	Δf (MHz)	Limit
-26	1927.750885	1929.164346	1.413	50kHz > Δf > 2.5MHz
-12	1927.861462	1929.034538	1.173	N/A
-6	1928.077808	1928.606654	0.529	N/A

A7 Peak Transmit Power

Test Details:	
Regulation	CFR 47 Part 15.319(c)
Measurement standard	ANSI C63.17 sub-clause 6.1.2
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

Frequency (MHz)	Peak Transmit Power (dBm)	Limit (dBm)
1921.536	11.32	20.76
1924.992	11.31	20.76
1928.448	11.31	20.76

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 Appendix B for Peak Transmit Power Plots.

Limit

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

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

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.

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

$$EBW = 1.418269 \text{ MHz}$$

$$PTP = 20.76 \text{ dBm}$$

A8 Power Spectral Density

Test Details:	
Regulation	CFR 47 Part 15.319(d)
Measurement standard	ANSI C63.17 sub-clause 6.1.2
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

Frequency (MHz)	Power Spectral Density (mW/3kHz)	Limit (mW/3kHz)
1921.536	0.05	3
1924.992	0.03	3
1928.448	0.03	3

- 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 Appendix B for power Spectral Density Plots.

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.

A9 Antenna Gain**CFR 47 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
Monopole, 2dBi	N/A

Note: Antenna Gain Declared by Manufacturer

A10 Automatic Discontinuation of Transmissions

Test Details:	
Regulation	CFR 47 Part 15.319(f)
Measurement standard	ANSI C63.17 sub-clause 6.1.2
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

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

The Q-DTB (QD Drive Thru Base) is a fixed part and as such transmits control and signalling information the counter part device is a portable part device and does not transmit control and signalling information.

Part	Transmits Control and Signalling 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	Remove Power From Base Station	A	Pass
2	Remove Battery From 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.

A11 Monitoring Thresholds

Test Details:	
Regulation	CFR 47 Part 15.323(c)(2)
Measurement standard - Calculation	ANSI C63.17 sub-clause 7.2.1
Calculations	As laid out in ANSI C63.17 sub-clauses 4.3.3 and 4.3.4
Measurement standard	ANSI C63.17 sub-clause 7.3
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

Calculation of monitoring threshold limits for isochronous devices:

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

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

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	1.418269	30.00	20.76	11.32	-73.04
T_U	1.418269	50.00	20.76	11.32	-53.04

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

The 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.

Limits

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

$$\text{Measured Threshold Level} \leq T_U + U_M$$

Where:

- T_U = Calculated Upper threshold level
- T_L = Calculated Lower 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)	-65.04	-47.04	Pass

A12 Monitoring of Intended Transmit Window & Maximum Reaction Time

Test Details:	
Regulation	CFR 47 Part 15.323(c)(1)
Measurement standard	ANSI C63.17 sub-clause 7.5
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

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 companion device 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 middle 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 relevant calculated threshold level plus measurement uncertainty (U_M) and the width of the pulse interference exceeds the largest of $50\mu s$ 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 relevant calculated threshold level plus measurement uncertainty (U_M) and the width of the pulse interference exceeds the largest of $35\mu s$ 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**Single Slot Configuration**

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).

A13 Monitoring Bandwidth & Antenna

Monitoring Bandwidth – CFR 47 Part 15.323(c)(7)

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 for the monitoring system are met of ANSI C63.17 sub-clause 7.4 are met.

Monitoring Antenna – CFR 47 Part 15.323(c)(8)

As declared by the manufacturer the antenna of the EUT used for transmitting is the same antenna that is used for monitoring.

A14 Power Accuracy

CFR 47 Part 15.323(c)(5)

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.

A15 Segment Occupancy

CFR 47 Part 15.323(c)(5)

The manufacturer declares that no device or group of co-operating devices located within 1 meter of each other shall, during any frame period, occupy more than 6 MHz of aggregate bandwidth, or alternatively, more than one third of the time and spectrum windows defined by the system.

A16 Access Criteria Test Interval

Test Details:	
Regulation	CFR 47 Part 15.323(c)(1)
Measurement standard	ANSI C63.17 sub-clause 8.1.1
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

These tests are only applied to a EUT capable of transmitting control and signalling information.

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:

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 2. 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	TX Slot 2	TX Slot 2	Pass
Repetition of Access Criteria (note 1)	Interval Between Access Criteria	28	<30 Seconds	Pass
		28		Pass
		28		Pass
		28		Pass
		27.87		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.

A17 Access Criteria Functional Test

Test Details:	
Regulation	CFR 47 Part 15.323(c)(6)
Measurement standard	ANSI C63.17 sub-clause 8.1.2 / 8.1.3
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

ANSI C63.17 sub-clause 8.1.2

ANSI C63.17 sub-clause 8.1.2 is not applicable as the random waiting interval option is implemented.

ANSI C63.17 sub-clause 8.1.3

These tests are only applied to a EUT capable of transmitting control and signalling information. ANSI C63.17 sub-clause 8.1.2 is not applicable as the random waiting interval option is implemented.

The EUT was frequency administered to one operating frequency. The interference generator was set to the required level. The tests were performed to find the following:

f1 = 1924.992 MHz

Test b)

With no interference on, the EUT must transmit on f1. The interference is then applied to f1. The EUT must stop transmitting within 30 Seconds.

Test c)

Cancel the interference. Measure the time interval between the end of the interference transmission and the beginning of transmission by the EUT.

Test d)

Repeat the test steps b) and c) 100 times. If each of the time intervals measured is equal to or greater than 10 ms and less than or equal to 150 ms and the measured time intervals vary uniformly between 10 ms and 150 ms, the EUT passes the test.

Test	Measured Minimum Interval (ms)	Measured Maximum Interval (ms)	Limit		Pass/Fail
			Min	Max	
8.1.2 Test b	11.5	34.0	10ms	150ms	Pass

Notes: 1. Random Waiting Interval option implemented.
2. Interval measured 100 times.

A18 Duration Of Transmission

Test Details:	
Regulation	CFR 47 Part 15.323(c)(3)
Measurement standard	ANSI C63.17 sub-clause 8.2.2
EUT sample number	NA
Modification state	NA
SE in test environment	NA
SE isolated from EUT	NA
EUT set up	NA

The test 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.

Result

Repetition of Access Criteria	Maximum Transmission Time	Maximum Transmission Time Limit	Pass/Fail
Period	7.55 Hours	<8 Hours	Pass

- Note: 1. The portable part is the initiating device that repeats the access criteria
2. Maximum transmission time is a declaration (see section 1.7)

A19 Connection Acknowledgement

Test Details:	
Regulation	CFR 47 Part 15.323(c)(4)
Measurement standard	ANSI C63.17 sub-clause 8.2.1
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

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
Transmission on communications channel no acknowledgement received (note 1)	N/A (Note 2)	N/A (Note 2)	Pass
Established communication channel termination, acknowledgements to EUT blocked during communication (note 1)	5.016	30	Pass
Established communication channel termination, acknowledgements to Companion device blocked during communication (note 2)	4.917	30	Pass

- Note:
1. The EUT transmits a beacon signal when acknowledgements are blocked.
 2. The companion device activates the communications channel.
 3. See Appendix B for Acknowledgement plots.

A20 Least Interfered Channel (LIC) Procedure

Test Details:	
Regulation	CFR 47 Part 15.323(c)(5)
Measurement standard	ANSI C63.17 sub-clause 7.3.3
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

The EUT utilizes more than 40 channels; therefore the least interfered channel testing is applicable.

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

$$f1 = 1923.246 \text{ MHz}$$

$$f2 = 1924.992 \text{ MHz}$$

Test b)

Interference on f1 was set at $T_L + U_M + 7\text{dB}$ 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 $T_L + U_M + 7\text{dB}$ 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 $T_L + U_M + 1\text{dB}$ and at $T_L + U_M - 6\text{dB}$ 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 $T_L + U_M - 6\text{dB}$ and at $T_L + U_M + 7\text{dB}$ 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.

A21 Selected Channel Confirmation

Test Details:	
Regulation	CFR 47 Part 15.323(c)(1) & (c)(5)
Measurement standard	ANSI C63.17 sub-clause 7.3.4
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

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.

$$f1 = 1923.246 \text{ MHz}$$

$$f2 = 1924.992 \text{ MHz}$$

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

The test is applied in both single and long slot configurations.

Result

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

Note:

A22 Duplex Connections

Test Details:	
Regulation	CFR 47 Part 15.323(c)(10)
Measurement standard	ANSI C63.17 sub-clause 8.3.2
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

Before all tests are carried out any connection is terminated.

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 $T_L + U_M + 10\text{dB}$ 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 $T_L + U_M + 10\text{dB}$ 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

Note:

1. The Q-DT8 is the initiating device,
2. The Q-DTB is the responding device

A23 Alternative Monitoring Interval for Co-Located Devices

Test Details:	
Regulation	CFR 47 Part 15.323(c)(11)
Measurement standard	ANSI C63.17 sub-clause 8.4.
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

For the purposes of this testing the EUT is the initiating device and the companion is the responding device

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)

Apply interference at a level $T_L + U_M$ to all transmit time/spectrum windows on the enabled carrier. The interferer must use the same physical layer as the EUT transmissions, but with a system identifier different from that used by the EUT and companion device. Apply no interference to the receive time/spectrum windows on the enabled carriers.

Test d)

Cause the EUT to attempt to establish a connection. If a connection is established, the test is failed.

Result

Test	Connection Made	Pass/Fail
b	Yes	Pass
d	No	Pass

Note:

1. The Q-DT8 is the initiating device,
2. The Q-DTB is the responding device

A24 Fair Access To Spectrum

CFR 47 Part 15.323(c)(12)

The provisions of (10) & (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)

A25 Emissions Inside and Outside the Sub-Band - Conducted

Test Details: Lowest Operating Frequency	
Regulation	CFR 47 Part 15.323(d)
Measurement standard	ANSI C63.17 sub-clause 6.1.6.
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

Out-of-Band Emissions from UPCS bandedge	FREQ. (MHz)	MEAS. Rx. (dBm)	CABLE & ATTEN. LOSS (dB)	EMISSION LEVEL (dBm)	LIMIT (dBm)
> - 2.5MHz	No Significant Emissions Within 20 dB of Limit				
- 1.25 MHz – 2.5 MHz					
- 1.25 MHz					
+ 1.25 MHz					
+ 1.25 MHz – 2.5 MHz					
> + 2.5MHz					
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 EUT fitted with temporary antenna connector.
- 2 New / Fully Charged batteries used for battery powered products.
- 3 See Appendix B for out of band emissions compliance plots, offsets <2.5 MHz
- 4 See Appendix B 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.

Test Method:

- 1 The EUT was connected to a spectrum analyser via suitable attenuation or filter.
- 2 The Spectrum analyser was tuned to upper and lower offsets in turn.
- 3 Any emissions found were measured with the required analyser settings.

Test Details: Highest Operating Frequency	
Regulation	CFR 47 Part 15.323(d)
Measurement standard	ANSI C63.17 sub-clause 6.1.6.
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	S14
EUT set up	Refer to Appendix C

Out-of-Band Emissions from UPCS bandedge	FREQ. (MHz)	MEAS. Rx. (dBm)	CABLE & ATTEN. LOSS (dB)	EMISSION LEVEL (dBm)	LIMIT (dBm)
> - 2.5MHz	No Significant Emissions Within 20 dB of Limit				
- 1.25 MHz – 2.5 MHz					
- 1.25 MHz					
+ 1.25 MHz					
+ 1.25 MHz – 2.5 MHz					
> + 2.5MHz					
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		

A27 Frame Repetition Stability

Test Details:	
Regulation	CFR 47 Part 15.323(e)
Measurement standard	ANSI C63.17 sub-clause 6.2.2 & 6.2.3
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C

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

Frame Repetition Stability (ppm)	Limit (ppm)	Pass/Fail
0.26	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	0	0	2 or 10/X	12.5	Pass

A28 Frequency Stability

Test Details:	
Regulation	CFR 47 Part 15.323(f)
Measurement standard	ANSI C63.17 sub-clause 6.2.1
EUT sample number	S21
Modification state	0
SE in test environment	None
SE isolated from EUT	RFG433
EUT set up	Refer to Appendix C

This testing is carried out with the following conditions over 5000 samples.

Results

Temperature (°C)	Voltage (Vdc)	Fc (MHz)	offset (kHz)	offset (ppm)	Limit (ppm)
+20	110 Vac	1924.992	1	0.52	±10
+20	85% Vnom	1924.992	-2	-1.04	±10
+20	115% Vnom	1924.992	-4	-2.08	±10
-20	Vnom	1924.992	-8	-4.16	±10
+55	Vnom	1924.992	3	1.56	±10

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

A29 Power Line Conducted Emissions – Drive Thru Base

Preview power line conducted emission measurements were performed with a peak and average detector in a screened room. The effect of the EUT set-up on the measurements is summarised in note (b). Where applicable formal measurements of the emissions were performed with a quasi peak and/or average detector.

Test Details:	
Regulation	CFR 47 Part 15.315 & 15.207
Measurement standard	ANSI C63.10:2003
Frequency range	150kHz to 30MHz
EUT sample number	S21
Modification state	0
SE in test environment	S05
SE isolated from EUT	RFG433
EUT set up	Refer to Appendix C
Photographs (Appendix F)	

The worst-case power line conducted emission measurements are listed below:

Results measured using the average detector compared to the average limit

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
No significant Emissions Within 20 dB of the limit						

Results measured using the quasi-peak detector compared to the quasi-peak limit

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
1	0.18	Live	45.15	64.49	-19.34	Pass

Specification limits :

Conducted emission limits (47 CFR Part 15: Clause 15.207):

Conducted disturbance at the mains ports.

Frequency range MHz	Limits dB μ V	
	Quasi-peak	Average
0.15 to 0.5	66 to 56 ²	56 to 46 ²
0.5 to 5	56	46
5 to 30	60	50
Notes:		
1. The lower limit shall apply at the transition frequency.		
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.		

Notes:

- (a) The levels may have been rounded for display purposes.
- (b) The following table summarises the effect of the EUT operating mode and internal configuration on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels		✓		
Effect of EUT internal configuration on emission levels		✓		
(i) Parameter defined by standard and / or single possible, refer to Appendix C (ii) Parameter defined by client and / or single possible, refer to Appendix C (iii) Parameter had a negligible effect on emission levels, refer to Appendix C (iv) Worst case determined by initial measurement, refer to Appendix C				

A30 Power Line Conducted Emissions – Retail Base

Preview power line conducted emission measurements were performed with a peak and average detector in a screened room. The effect of the EUT set-up on the measurements is summarised in note (b). Where applicable formal measurements of the emissions were performed with a quasi peak and/or average detector.

Test Details:	
Regulation	CFR 47 Part 15.315 & 15.207
Measurement standard	ANSI C63.10:2003
Frequency range	150kHz to 30MHz
EUT sample number	S14
Modification state	0
SE in test environment	S05
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	

The worst-case power line conducted emission measurements are listed below:

Results measured using the average detector compared to the average limit

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
1	0.17	Neutral	40.78	55.21	14.43	Pass
2	0.20	Neutral	38.56	53.61	15.05	Pass
3	0.26	Live	41.53	51.43	9.90	Pass
4	0.34	Neutral	34.06	49.33	15.27	Pass
5	0.43	Neutral	42.39	47.25	4.86	Pass
6	0.44	Neutral	41.69	47.16	5.47	Pass
7	0.54	Neutral	28.88	46.00	17.12	Pass
8	0.66	Live	29.42	46.00	16.58	Pass
9	0.79	Live	34.31	46.00	11.69	Pass
10	1.04	Live	34.06	46.00	11.94	Pass
11	1.44	Live	28.84	46.00	17.16	Pass
12	1.83	Live	31.94	46.00	14.06	Pass
13	2.35	Live	28.33	46.00	17.67	Pass
14	2.88	Live	28.67	46.00	17.33	Pass
15	3.14	Live	27.72	46.00	18.28	Pass
16	3.59	Live	26.98	46.00	19.02	Pass
17	4.18	Live	28.08	46.00	17.92	Pass
18	4.18	Live	30.85	46.00	15.15	Pass
19	4.97	Live	30.81	46.00	15.19	Pass

Results measured using the quasi-peak detector compared to the quasi-peak limit

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
1	0.17	Live	55.10	65.21	10.11	0.17
2	0.18	Live	53.10	64.49	11.39	0.18
3	0.20	Live	49.65	63.82	14.17	0.20
4	0.21	Live	48.33	63.41	15.08	0.21
5	0.26	Live	45.00	61.43	16.43	0.26
6	0.33	Neutral	42.91	59.58	16.67	0.33
7	0.35	Neutral	40.56	58.96	18.40	0.35
8	0.43	Neutral	49.99	57.25	7.26	0.43
9	0.44	Live	49.43	57.16	7.73	0.44
10	0.54	Neutral	37.64	56.00	18.36	0.54
11	0.79	Live	36.80	56.00	19.20	0.79
12	1.04	Live	36.10	56.00	19.90	1.04
13	1.83	Live	36.10	56.00	19.90	1.83
14	4.18	Live	36.12	56.00	19.88	4.18
15	4.31	Live	36.30	56.00	19.70	4.31

Specification limits :

Conducted emission limits (47 CFR Part 15: Clause 15.207):

Conducted disturbance at the mains ports.

Frequency range MHz	Limits dB μ V	
	Quasi-peak	Average
0.15 to 0.5	66 to 56 ²	56 to 46 ²
0.5 to 5	56	46
5 to 30	60	50

Notes:

3. The lower limit shall apply at the transition frequency.

4. The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

Notes:

- (a) The levels may have been rounded for display purposes.
- (b) The following table summarises the effect of the EUT operating mode and internal configuration on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels		✓		
Effect of EUT internal configuration on emission levels		✓		
(v) Parameter defined by standard and / or single possible, refer to Appendix C (vi) Parameter defined by client and / or single possible, refer to Appendix C (vii) Parameter had a negligible effect on emission levels, refer to Appendix C (viii) Worst case determined by initial measurement, refer to Appendix C				

A31 Unintentional Radiated Emissions - Drive Thru Base

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to all spurious emissions not directly related to the transmitter. The maximum permitted field strength is listed in Section 15.109. The EUT was set to operate in a transmit standby / receive mode.

The following test site was used for final measurements as specified by the standard tested to:

3m open area test site :

☐

3m alternative test site :

☒

The effect of the EUT set-up on the measurements is summarised in note (c) below.

Test Details:	
Regulation	CFR 47 Part 15.323(d)
Measurement standard	ANSI C63.17 sub-clause 6.1.6.
Frequency range	30MHz – 20 GHz
EUT sample number	S21
Modification state	01
SE in test environment	S05
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	

The worst case radiated emission measurements for spurious emissions are listed Overleaf:

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1	55.45	15.90	1.10	6.10	-	23.10	-	14.29	100
2	58.40	21.20	1.10	5.50	-	27.80	-	24.55	100
3	58.90	22.00	1.10	5.40	-	28.50	-	26.61	100
4	59.05	21.60	1.10	5.40	-	28.10	-	25.41	100
5	59.60	20.20	1.10	5.30	-	26.60	-	21.38	100
6	59.80	20.80	1.10	5.20	-	27.10	-	22.65	100
7	60.30	20.60	1.10	5.20	-	26.90	-	22.13	100
8	61.35	17.70	1.10	5.30	-	24.10	-	16.03	100
9	132.85	14.20	1.30	11.10	-	26.60	-	21.38	150
10	133.95	14.50	1.30	11.10	-	26.90	-	22.13	150
11	135.05	14.20	1.30	11.00	-	26.50	-	21.13	150
12	140.65	15.20	1.30	10.70	-	27.20	-	22.91	150
13	144.00	15.40	1.30	10.40	-	27.10	-	22.65	150
14	150.70	16.00	1.40	9.80	-	27.20	-	22.91	150
15	204.80	20.00	1.60	8.80	-	30.40	-	33.11	150
16	221.25	24.00	1.70	8.60	-	34.30	-	51.88	200
17	237.05	22.10	1.80	10.60	-	34.50	-	53.09	200
18	239.75	17.60	1.80	10.90	-	30.30	-	32.73	200
19	250.00	21.80	1.80	12.10	-	35.70	-	60.95	200
20	256.00	19.60	1.80	12.60	-	34.00	-	50.12	200
21	258.10	21.50	1.80	12.80	-	36.10	-	63.83	200
22	260.10	19.80	1.80	13.00	-	34.60	-	53.70	200
23	264.15	19.40	1.90	13.20	-	34.50	-	53.09	200
24	270.30	21.20	1.90	12.50	-	35.60	-	60.26	200
25	274.45	18.00	1.90	12.50	-	32.40	-	41.69	200
26	276.60	17.60	1.90	12.40	-	31.90	-	39.36	200
27	294.85	13.60	2.00	12.90	-	28.50	-	26.61	200
28	313.35	11.90	2.00	13.50	-	27.40	-	23.44	200
29	331.85	20.00	2.10	13.80	-	35.90	-	62.37	200
30	333.80	11.90	2.10	13.80	-	27.80	-	24.55	200
31	350.00	19.50	2.20	14.30	-	36.00	-	63.10	200
32	400.00	17.20	2.30	15.80	-	35.30	-	58.21	200
33	562.60	13.30	2.70	18.50	-	34.50	-	53.09	200
34	582.70	14.10	2.80	18.50	-	35.40	-	58.88	200
35	602.80	12.40	2.80	18.60	-	33.80	-	48.98	200
36	622.90	14.00	2.90	19.10	-	36.00	-	63.10	200
37	642.95	13.10	2.90	18.90	-	34.90	-	55.59	200
38	663.05	10.00	2.90	18.90	-	31.80	-	38.90	200
39	683.15	9.30	3.00	18.90	-	31.20	-	36.31	200
40	750.00	11.80	3.10	19.90	-	34.80	-	54.95	200
41	850.00	16.10	3.30	20.30	-	39.70	-	96.61	200
42	900.00	9.80	3.40	20.70	-	33.90	-	49.55	200
43	950.00	16.70	3.50	20.90	-	41.10	-	113.50	200
44	1055.00	57.56	0.60	24.80	32.30	50.66	-9.54	41.12	500
45	1137.34	57.85	0.60	25.10	32.30	51.25	-9.54	41.71	500
46	3858.63	47.74	1.30	32.60	32.50	49.14	-9.54	39.60	500
47	7703.45	42.81	1.70	36.40	31.80	49.11	-9.54	39.57	500

Notes:

- 1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 1 For emissions below 30MHz the cable losses are assumed to be negligible.
- 2 In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
- 3 Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.
- 4 For Frequencies below 1 GHz, RBW = 120 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

Peak RBW=VBW= 1MHz
Average RBW=VBW= 1MHz

The upper and lower frequency of the measurement range was decided according to 47 CFR Part 15:2008 Clause 15.33(a) and 15.33(a)(1).

Radiated emission limits 47 CFR Part 15: Clause 15.209 for all emissions:

Frequency of emission (MHz)	Field strength $\mu\text{V/m}$	Measurement Distance m	Field strength $\text{dB}\mu\text{V/m}$
0.009-0.490	2400/F(kHz)	300	67.6/F (kHz)
0.490-1.705	24000/F(kHz)	30	87.6/F (kHz)
1.705-30	30	30	29.5
30-88	100	3	40.0
88-216	150	3	43.5
216-960	200	3	46.0
Above 960	500	3	54.0

- (a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

$$\text{Extrapolation (dB)} = 20 \log_{10} \left(\frac{\text{measurement distance}}{\text{specification distance}} \right)$$

- (b) The levels may have been rounded for display purposes.
- (c) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels	✓			
Effect of EUT internal configuration on emission levels		✓		
Effect of Position of EUT cables & samples on emission levels		✓		
(i) Parameter defined by standard and / or single possible, refer to Appendix D (ii) Parameter defined by client and / or single possible, refer to Appendix D (iii) Parameter had a negligible effect on emission levels, refer to Appendix D (iv) Worst case determined by initial measurement, refer to Appendix D				

A32 Unintentional Radiated Emissions - Retail Base

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to all spurious emissions not directly related to the transmitter. The maximum permitted field strength is listed in Section 15.109. The EUT was set to operate in a transmit standby / receive mode.

The following test site was used for final measurements as specified by the standard tested to:

3m open area test site : ☐

3m alternative test site : ☒

The effect of the EUT set-up on the measurements is summarised in note (c) below.

Test Details:	
Regulation	CFR 47 Part 15.323(d)
Measurement standard	ANSI C63.17 sub-clause 6.1.6.
Frequency range	30 MHz – 20 GHz
EUT sample number	S14
Modification state	0
SE in test environment	S05
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	

The worst case radiated emission measurements for spurious emissions are listed below:

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBµV/m)	EXTRAP FACT (dB)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1	40.00	43.10	1.1	12.5	27.5	29.20	-	28.84	100
2	43.77	43.80	1.1	10.6	27.5	28.00	-	25.12	100
3	400.00	48.50	2.3	15.8	27.5	39.10	-	90.16	200
4	500.00	29.20	2.60	17.20	27.40	21.60	-	12.02	200
5	550.00	29.90	2.70	18.50	27.60	23.50	-	14.96	200
6	650.00	26.40	2.90	19.10	27.70	20.70	-	10.84	200
7	750.00	31.60	3.10	19.90	28.00	26.60	-	21.38	200
8	850.00	25.50	3.30	20.30	28.20	20.90	-	11.09	200
9	900.00	27.60	3.40	20.70	28.10	23.60	-	15.14	200
10	950.00	30.00	3.50	20.90	27.90	26.50	-	21.13	200
11	1001.00	54.90	0.60	24.40	32.20	47.70	-9.54	38.16	500
12	1050.00	57.11	0.60	24.70	32.30	50.11	-9.54	40.57	500
13	1150.00	53.87	0.60	25.10	32.30	47.27	-9.54	37.73	500
14	1250.00	56.37	0.70	25.20	32.30	49.97	-9.54	40.43	500
15	1699.63	52.55	0.80	26.50	32.40	47.45	-9.54	37.91	500
16	3855.35	47.62	1.30	32.60	32.50	49.02	-9.54	39.48	500
17	7703.46	45.70	1.70	36.40	31.80	52.00	-9.54	42.46	500

Notes:

- 1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 1 For emissions below 30MHz the cable losses are assumed to be negligible.
- 2 In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
- 3 Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.
- 4 For Frequencies below 1 GHz, RBW = 120 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

Peak RBW=VBW= 1MHz
Average RBW=VBW= 1MHz

The upper and lower frequency of the measurement range was decided according to 47 CFR Part 15:2008 Clause 15.33(a) and 15.33(a)(1).

Radiated emission limits 47 CFR Part 15: Clause 15.209 for all emissions:

Frequency of emission (MHz)	Field strength $\mu\text{V/m}$	Measurement Distance m	Field strength $\text{dB}\mu\text{V/m}$
0.009-0.490	2400/F(kHz)	300	67.6/F (kHz)
0.490-1.705	24000/F(kHz)	30	87.6/F (kHz)
1.705-30	30	30	29.5
30-88	100	3	40.0
88-216	150	3	43.5
216-960	200	3	46.0
Above 960	500	3	54.0

- (a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

$$\text{Extrapolation (dB)} = 20 \log_{10} \left(\frac{\text{measurement distance}}{\text{specification distance}} \right)$$

- (b) The levels may have been rounded for display purposes.
- (c) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels	✓			
Effect of EUT internal configuration on emission levels		✓		
Effect of Position of EUT cables & samples on emission levels		✓		
(i) Parameter defined by standard and / or single possible, refer to Appendix D (ii) Parameter defined by client and / or single possible, refer to Appendix D (iii) Parameter had a negligible effect on emission levels, refer to Appendix D (iv) Worst case determined by initial measurement, refer to Appendix D				

Appendix B:

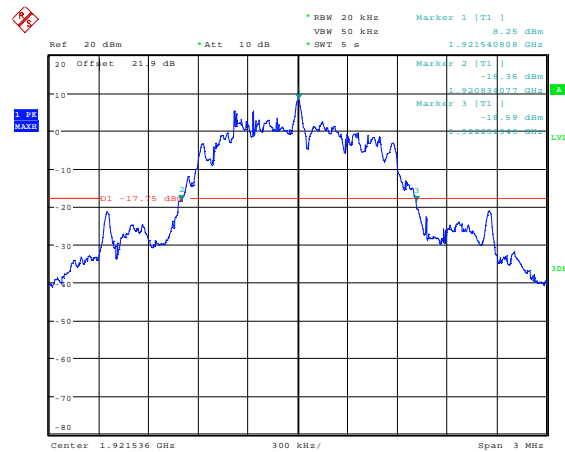
Supporting Graphical Data

This appendix contains graphical data obtained during testing.

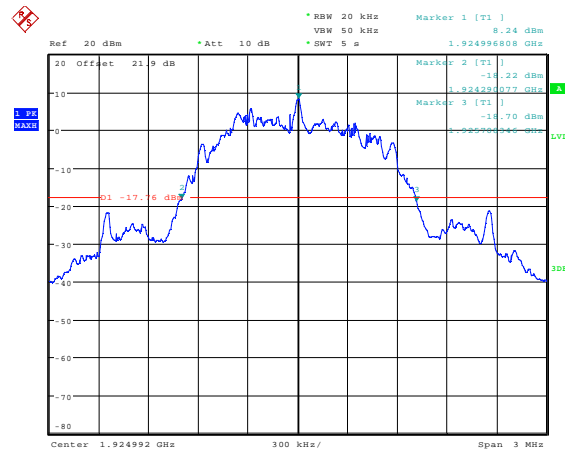
Notes:

- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.
- (b) The time and date on the plots do not necessarily equate to the time of the test.
- (c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.
- (d) Appendix C details the numbering system used to identify the sample and its modification state.
- (e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.

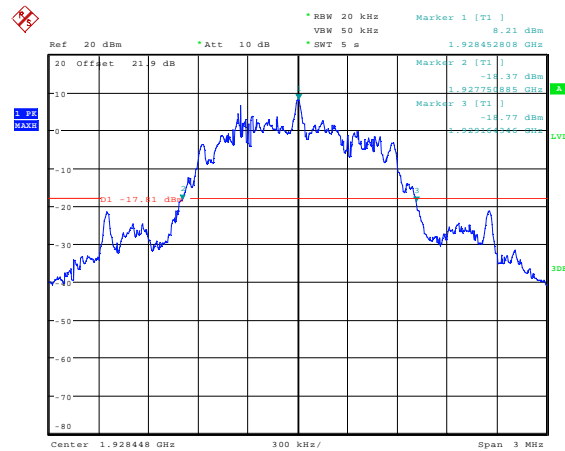
Emission Bandwidth



Date: 5.JAN.2011 14:18:33

 f_1 

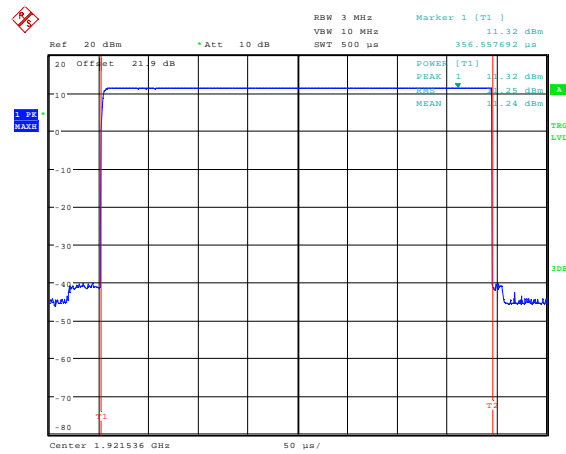
Date: 5.JAN.2011 16:08:29

 f_c 

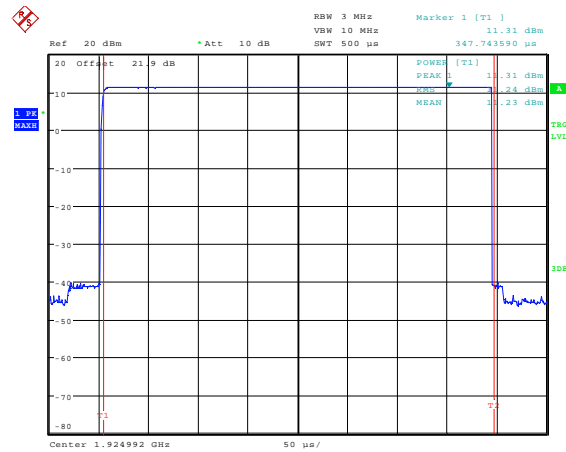
Date: 5.JAN.2011 13:35:14

 f_h

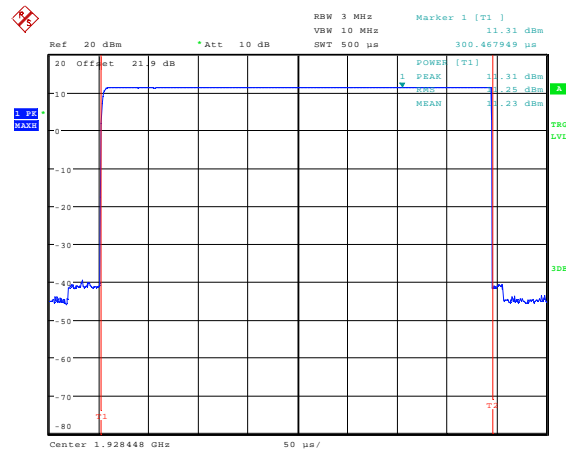
Peak Transmit Power



Date: 5.JAN.2011 14:08:56

 f_l 

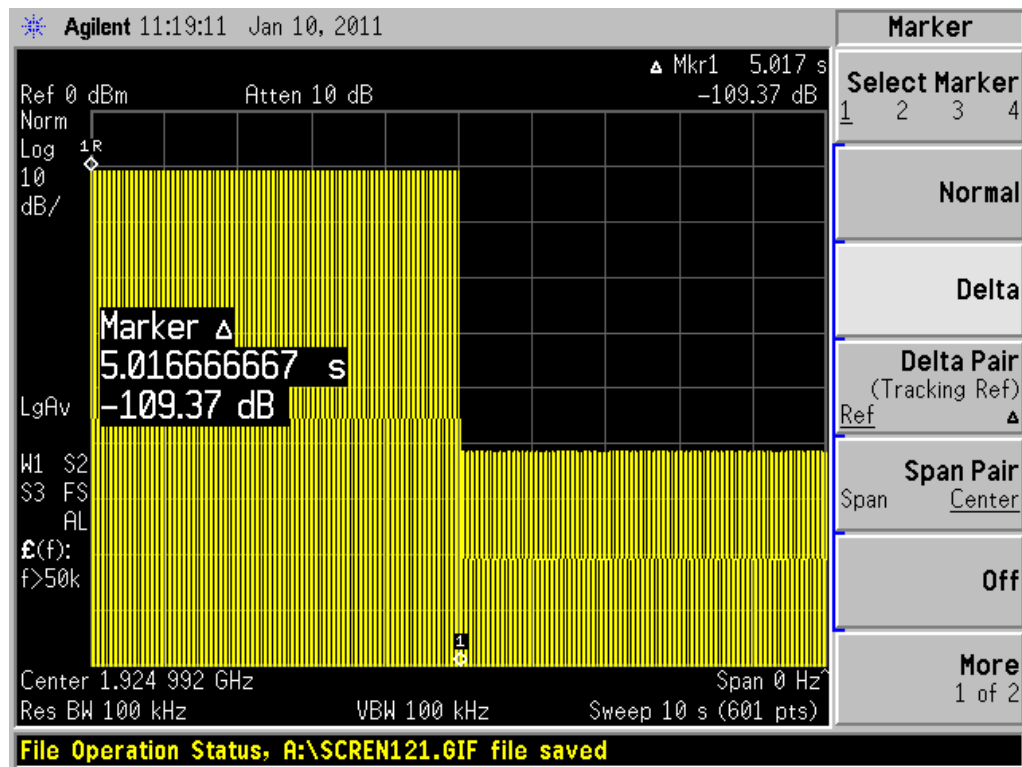
Date: 5.JAN.2011 15:32:05

 f_c 

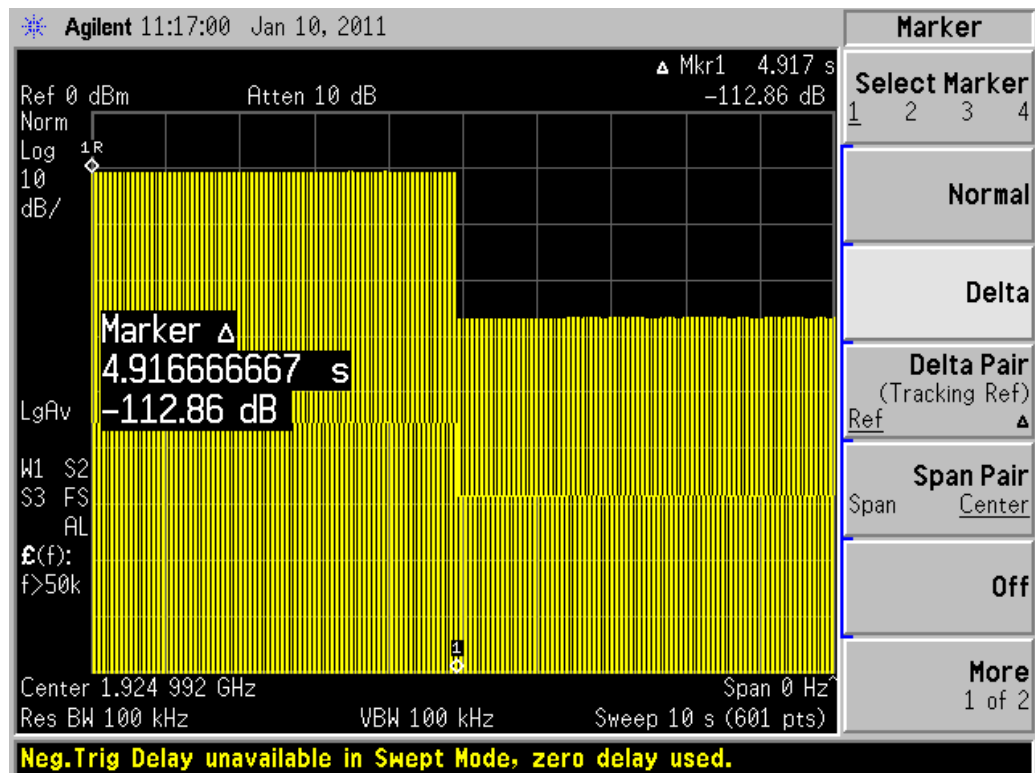
Date: 5.JAN.2011 13:32:48

 f_h

Acknowledgements

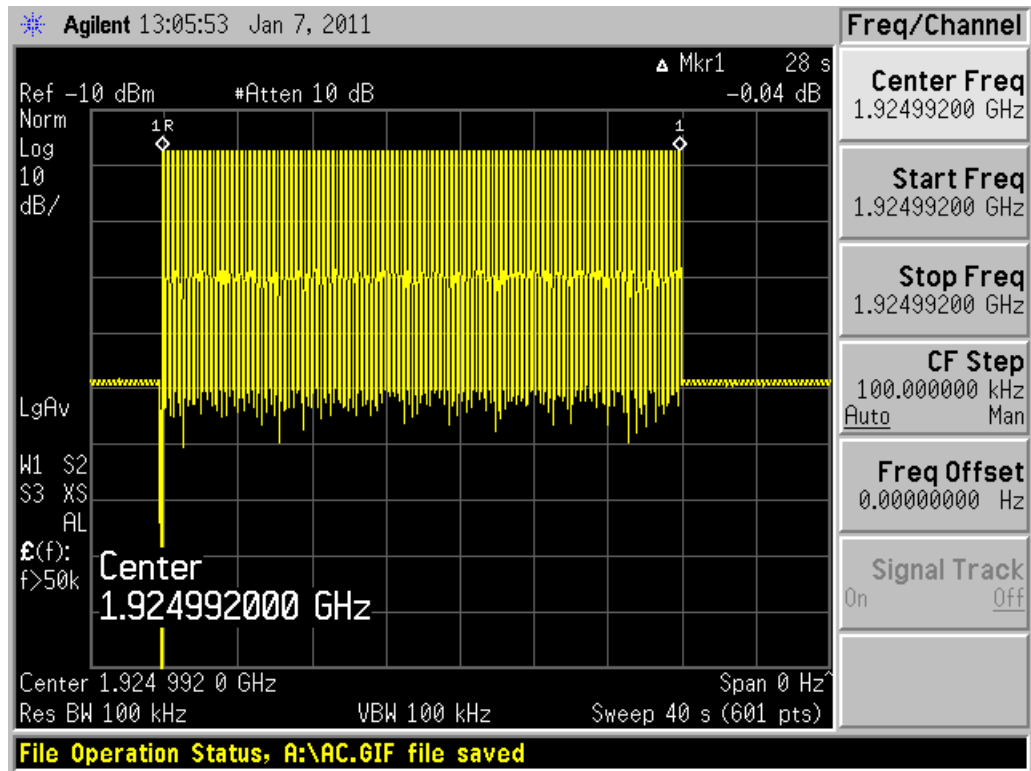


Cease Of Transmissions on Communications Channel – Acknowledgement To EUT Blocked

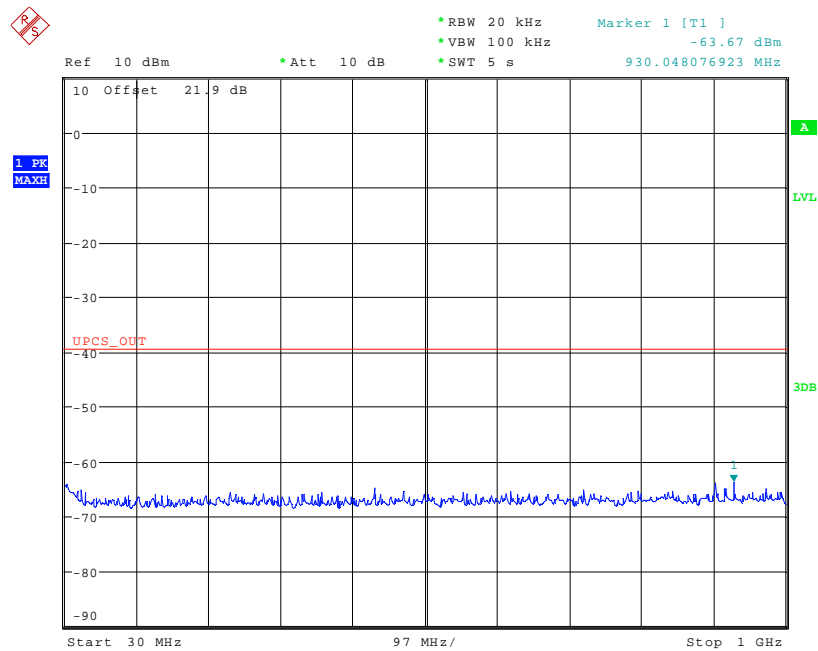


Cease Of Transmissions on Communications Channel – Acknowledgement To Companion Blocked

Access Criteria Repetition

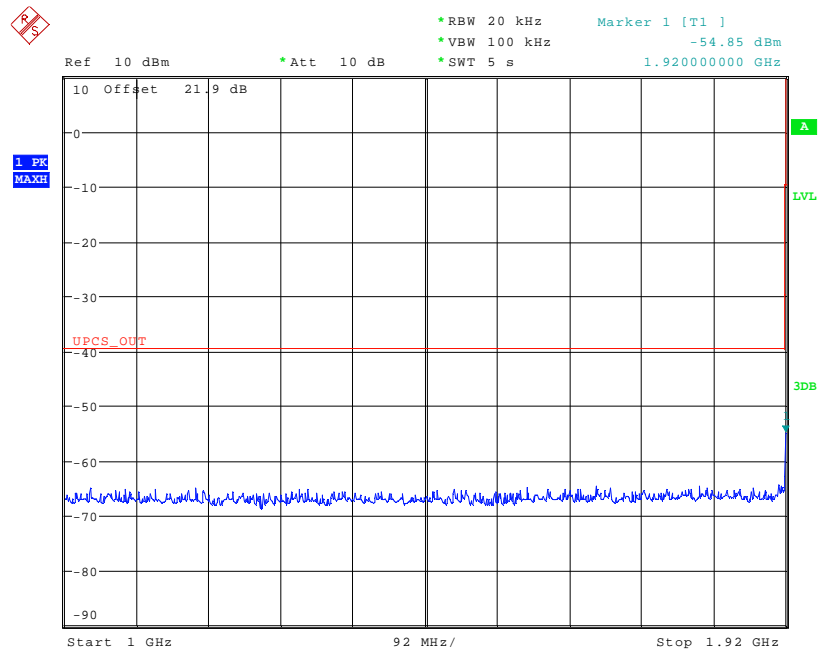


Conducted Emissions outside the Sub-Band RF carrier set to the lowest carrier defined by the EUT



Date: 5.JAN.2011 14:31:13

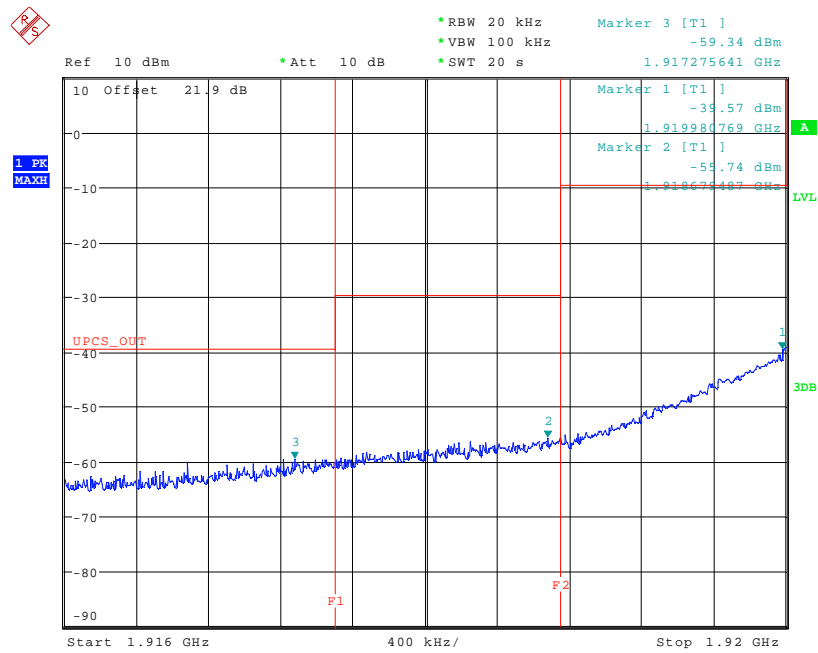
30MHz – 1GHz



Date: 5.JAN.2011 14:31:51

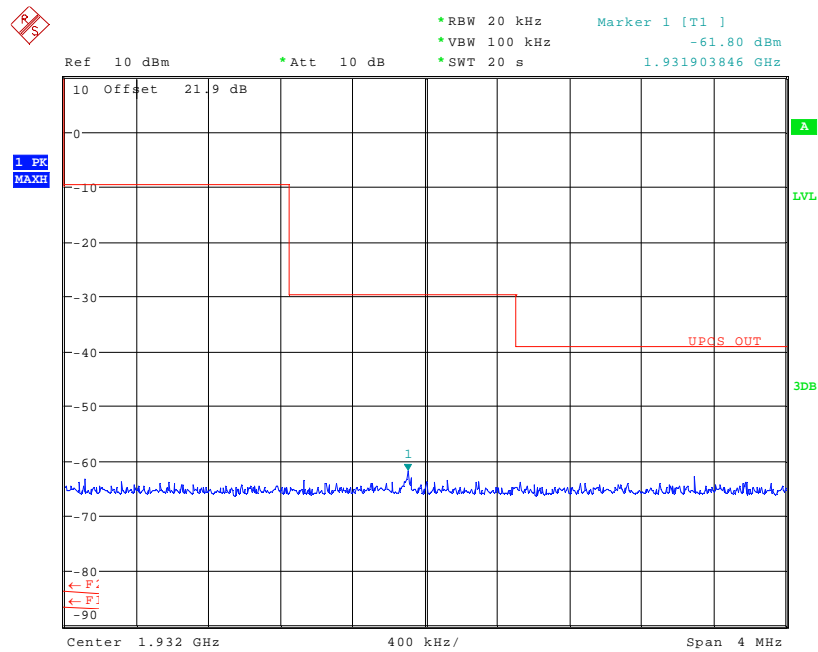
1GHz – Lower Bandedge

Conducted Emissions outside the Sub-Band RF carrier set to the lowest carrier defined by the EUT



Date: 5.JAN.2011 14:35:49

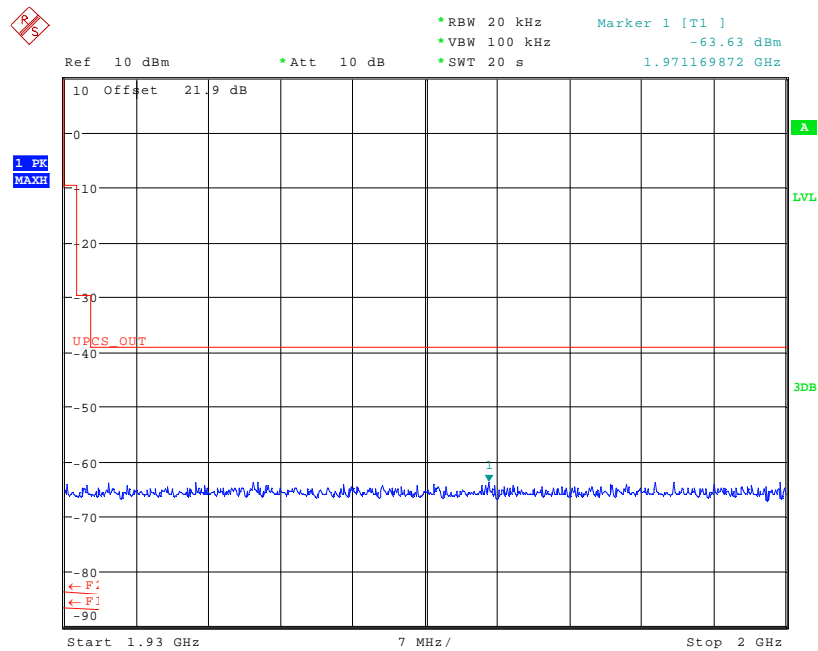
Lower Bandedge - > 2.5MHz



Date: 5.JAN.2011 14:37:49

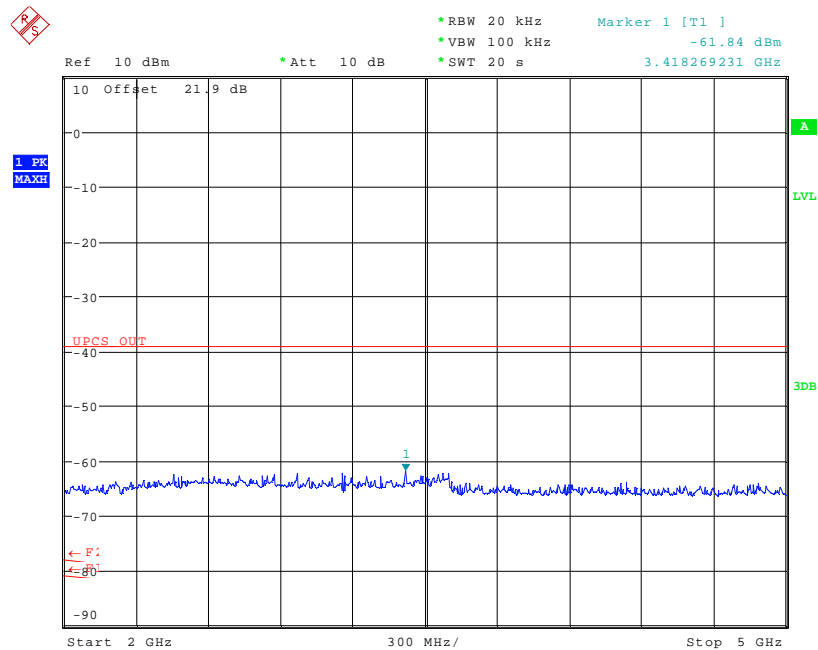
Upper Bandedge - > 2.5MHz

Conducted Emissions outside the Sub-Band RF carrier set to the lowest carrier defined by the EUT



Date: 5.JAN.2011 14:38:54

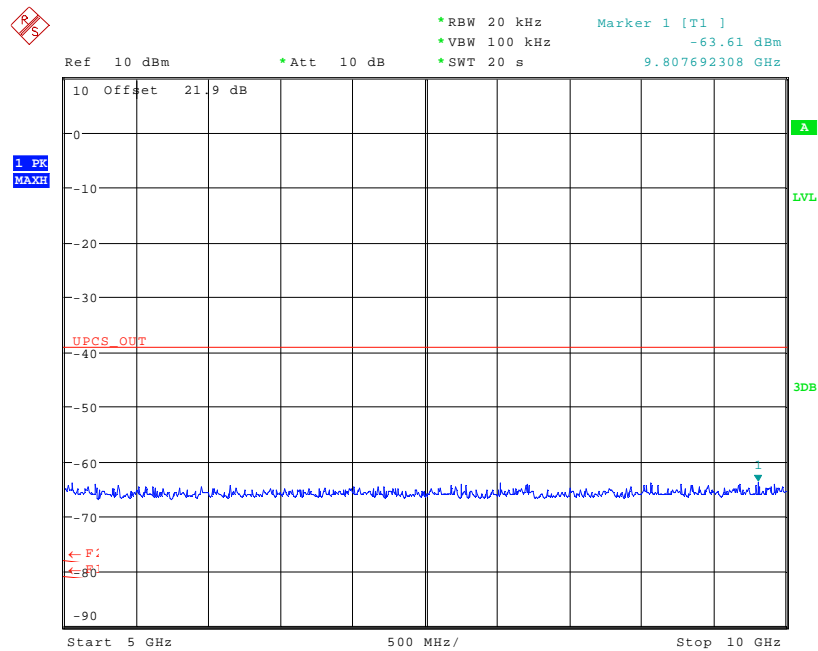
Upper Bandedge – 2GHz



Date: 5.JAN.2011 14:41:06

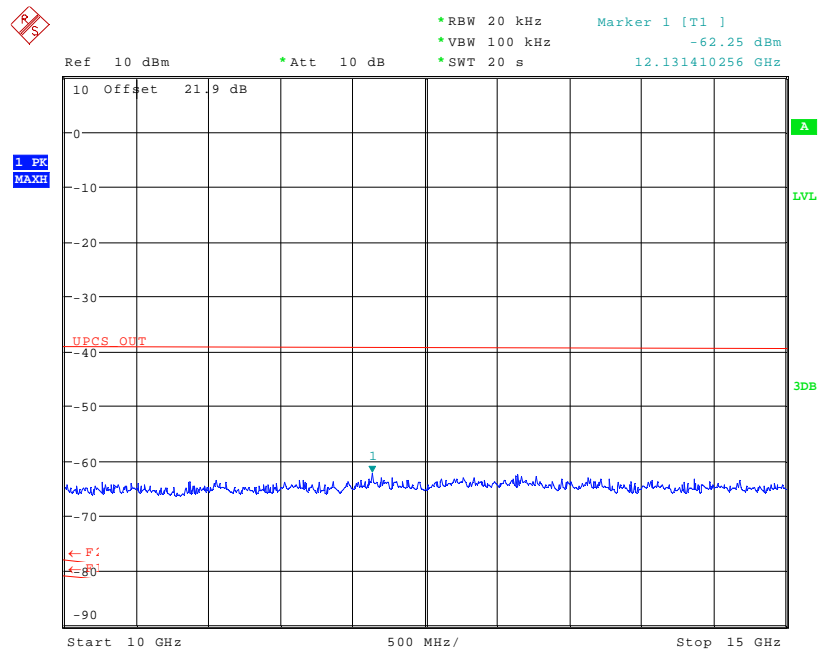
2 GHz – 5 GHz

Conducted Emissions outside the Sub-Band RF carrier set to the lowest carrier defined by the EUT



Date: 5.JAN.2011 14:44:04

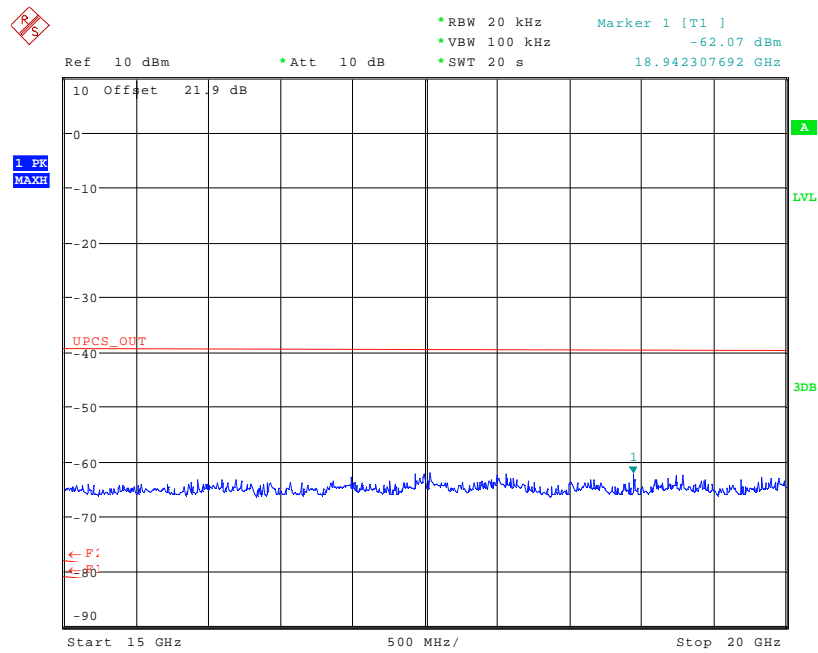
5 GHz – 10 GHz



Date: 5.JAN.2011 14:52:02

10 GHz – 15 GHz

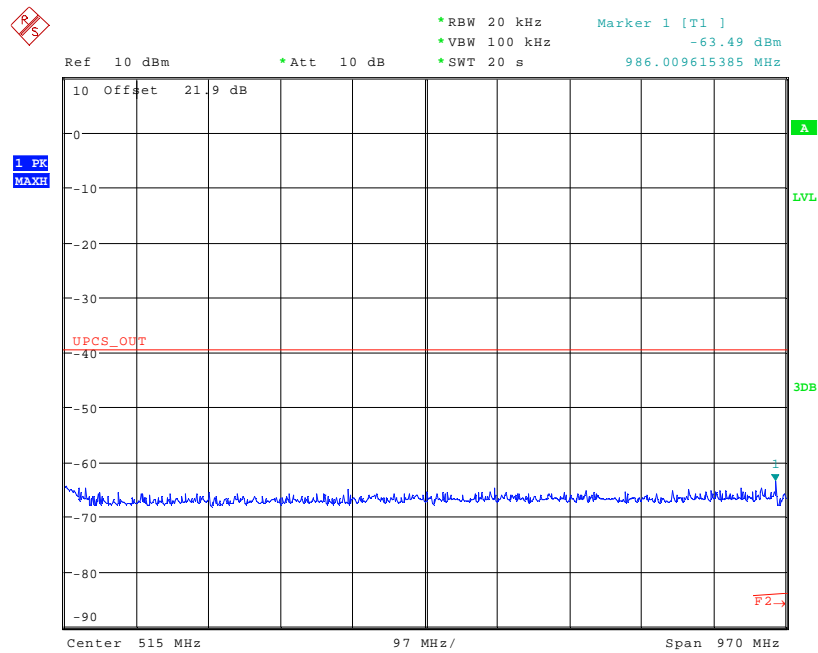
Conducted Emissions outside the Sub-Band RF carrier set to the lowest carrier defined by the EUT



Date: 5.JAN.2011 14:49:26

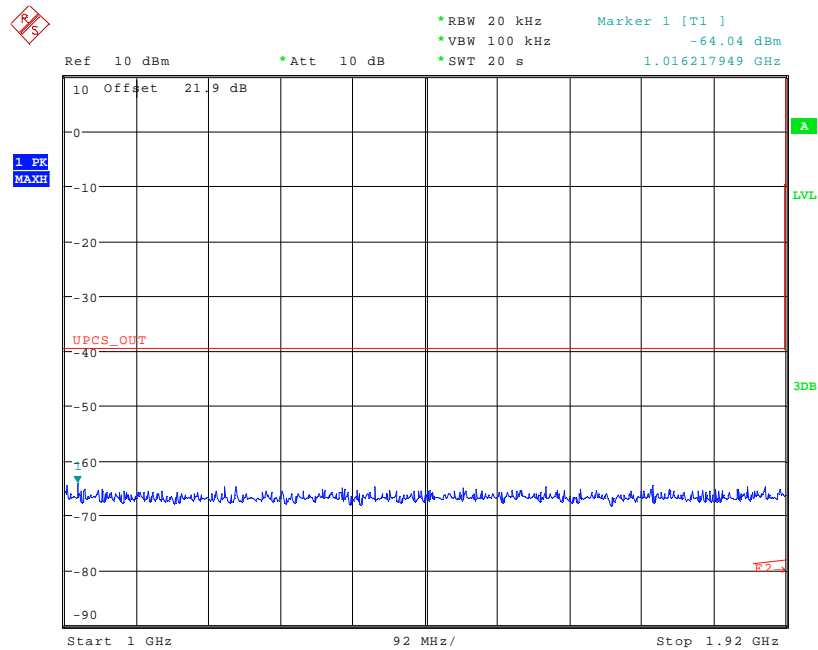
15 GHz – 20 GHz

Conducted Emissions outside the Sub-Band RF carrier set to the highest carrier defined by the EUT



Date: 5.JAN.2011 13:52:42

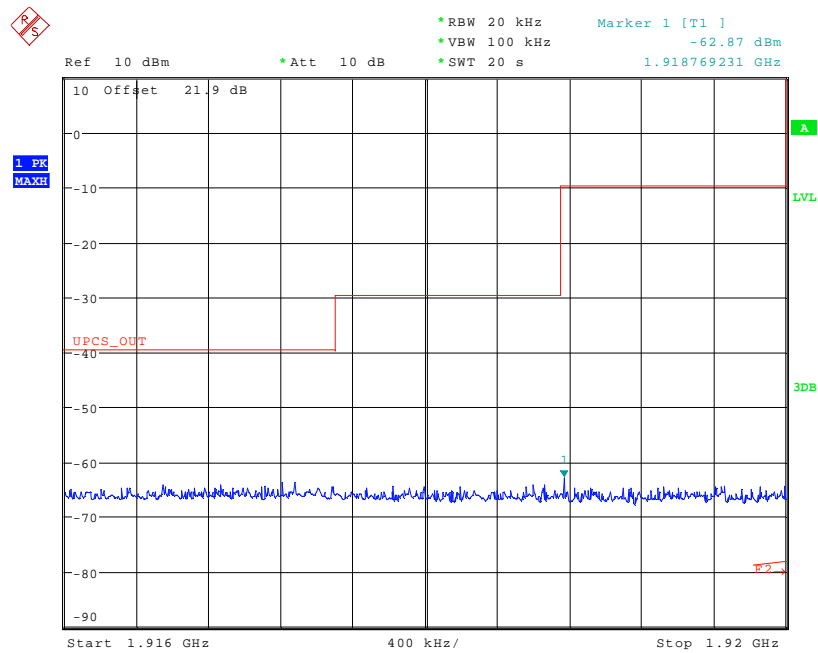
30MHz – 1GHz



Date: 5.JAN.2011 13:53:31

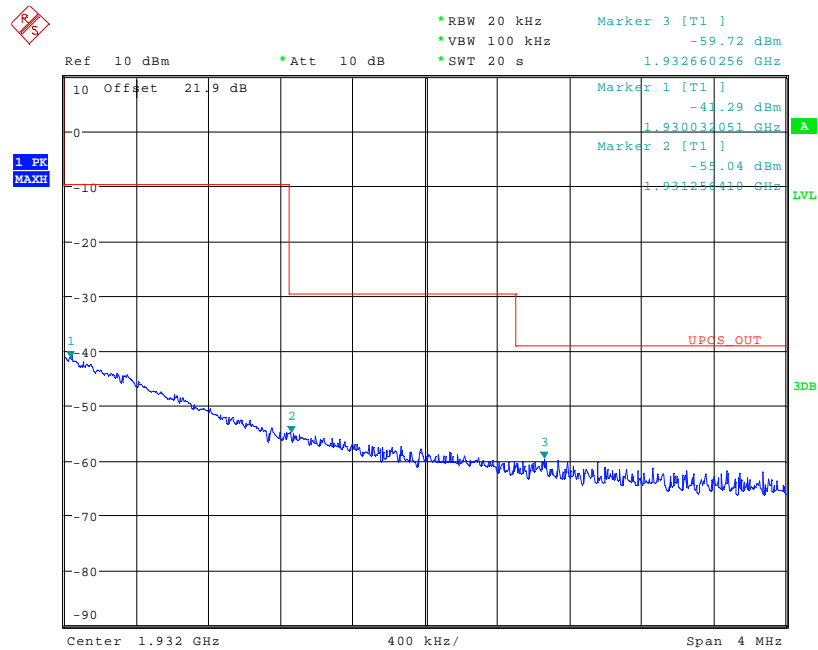
1GHz – Lower Bandedge

Conducted Emissions outside the Sub-Band RF carrier set to the highest carrier defined by the EUT



Date: 5.JAN.2011 13:54:15

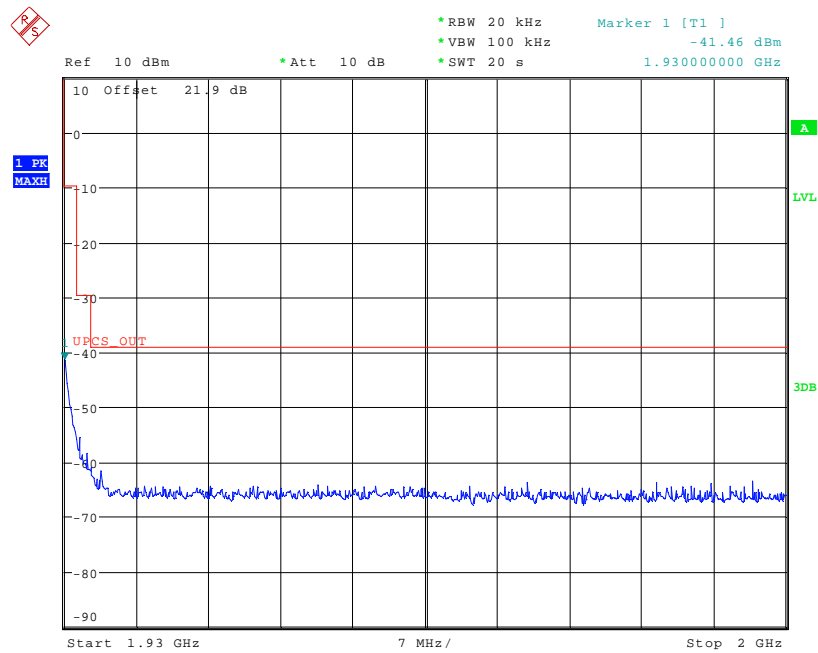
Lower Bandedge - > 2.5MHz



Date: 5.JAN.2011 13:55:22

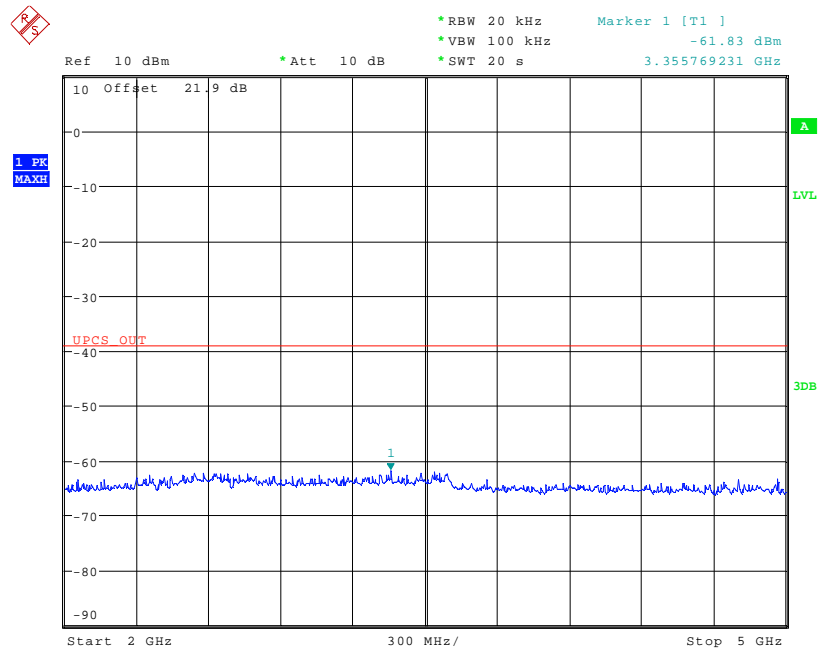
Upper Bandedge - > 2.5MHz

Conducted Emissions outside the Sub-Band RF carrier set to the highest carrier defined by the EUT



Date: 5.JAN.2011 13:55:59

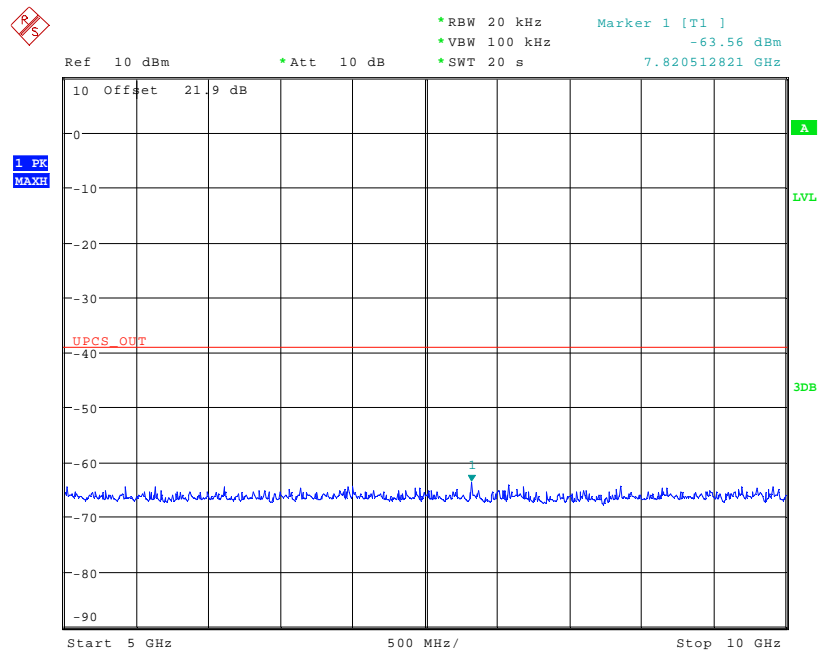
Upper Bandedge – 2GHz



Date: 5.JAN.2011 13:59:04

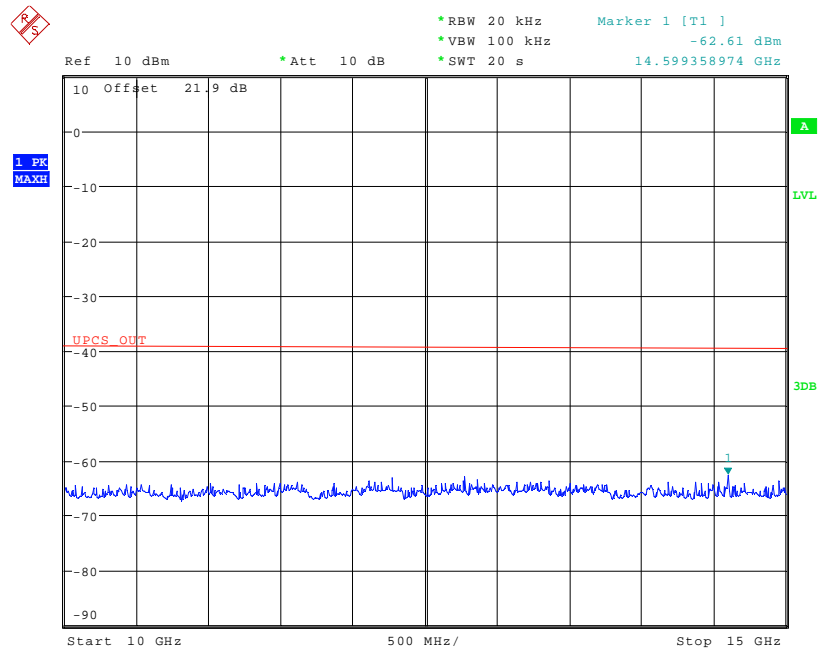
2 GHz – 5GHz

Conducted Emissions outside the Sub-Band RF carrier set to the highest carrier defined by the EUT



Date: 5.JAN.2011 14:00:12

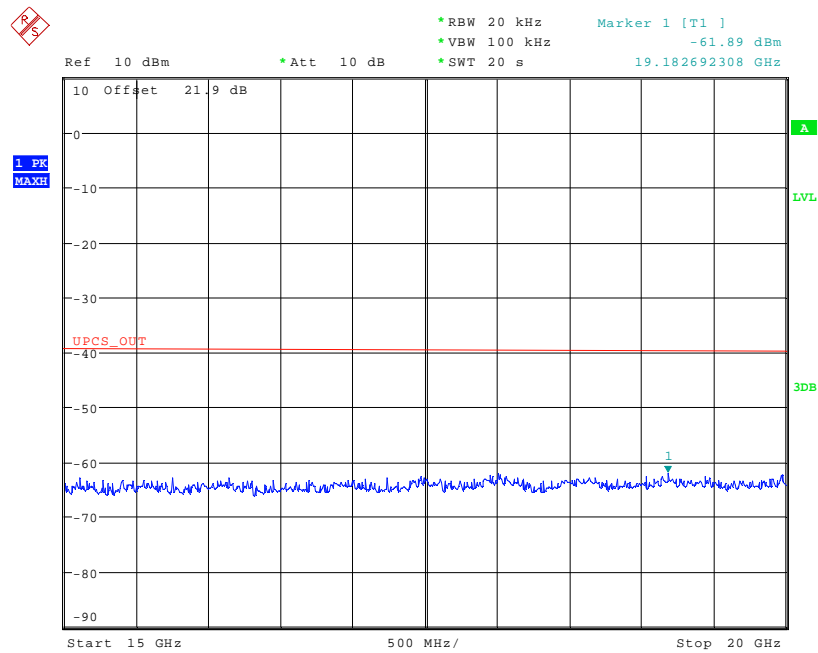
5 GHz – 10 GHz



Date: 5.JAN.2011 14:00:48

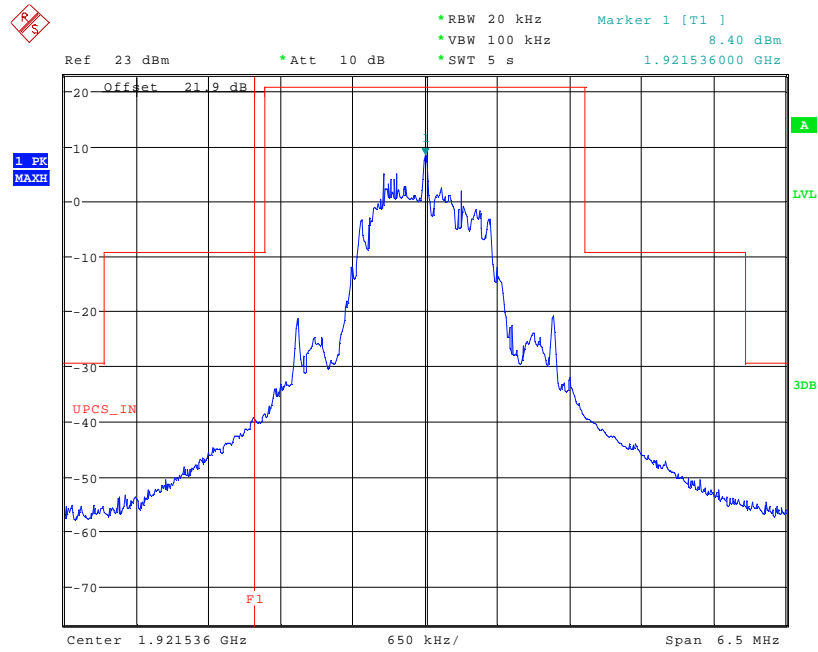
10 GHz – 15 GHz

Conducted Emissions outside the Sub-Band RF carrier set to the highest carrier defined by the EUT



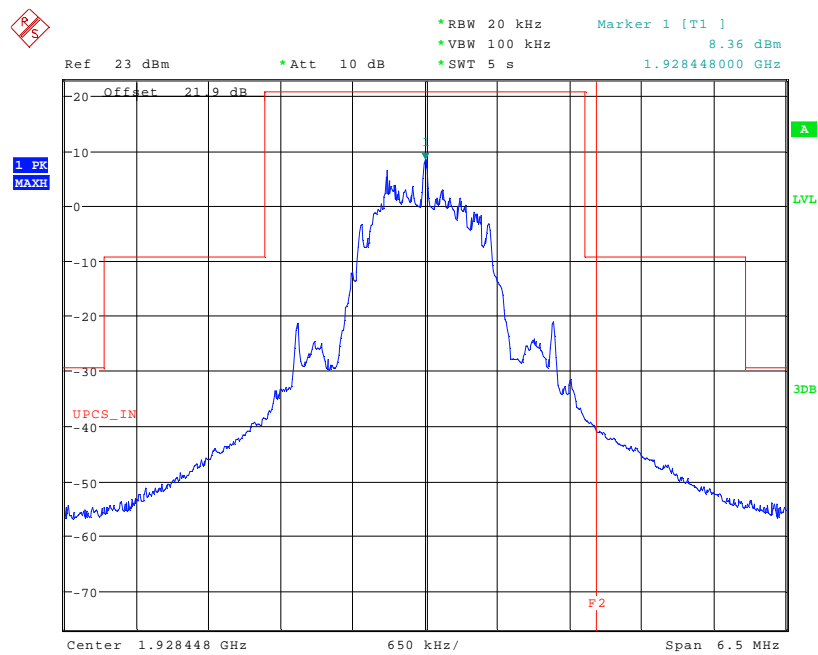
Date: 5.JAN.2011 14:02:41

15 GHz – 20 GHz



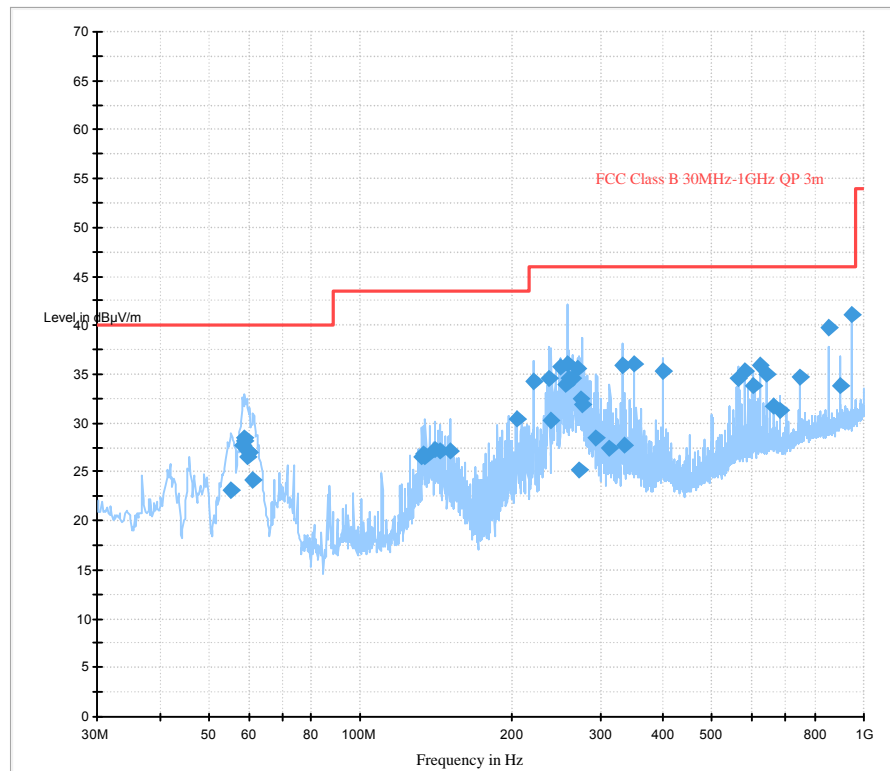
Date: 5.JAN.2011 14:26:21

Emissions inside the Sub-Band RF carrier set to the highest carrier defined by the EUT

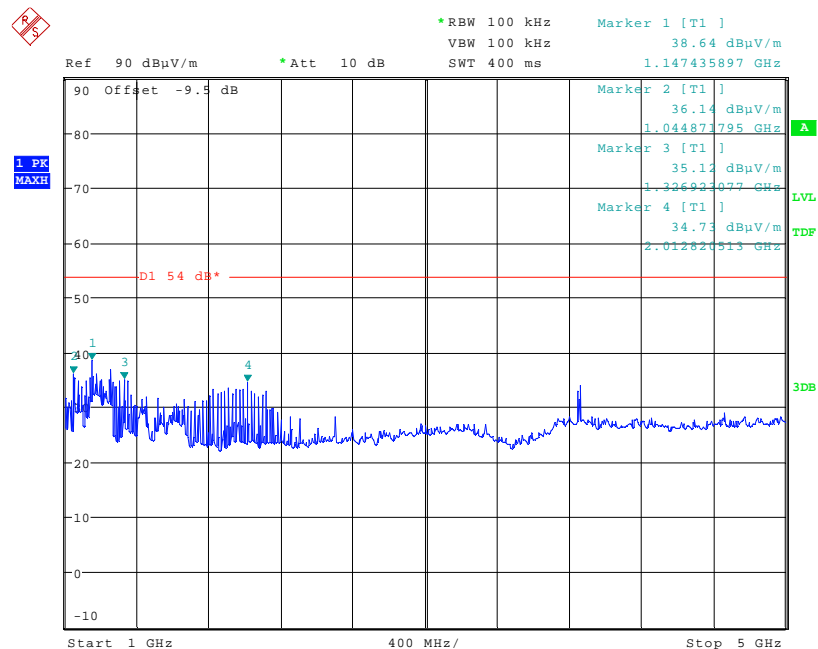


Date: 5.JAN.2011 13:49:05

Emissions inside the Sub-Band RF carrier set to the highest carrier defined by the EUT

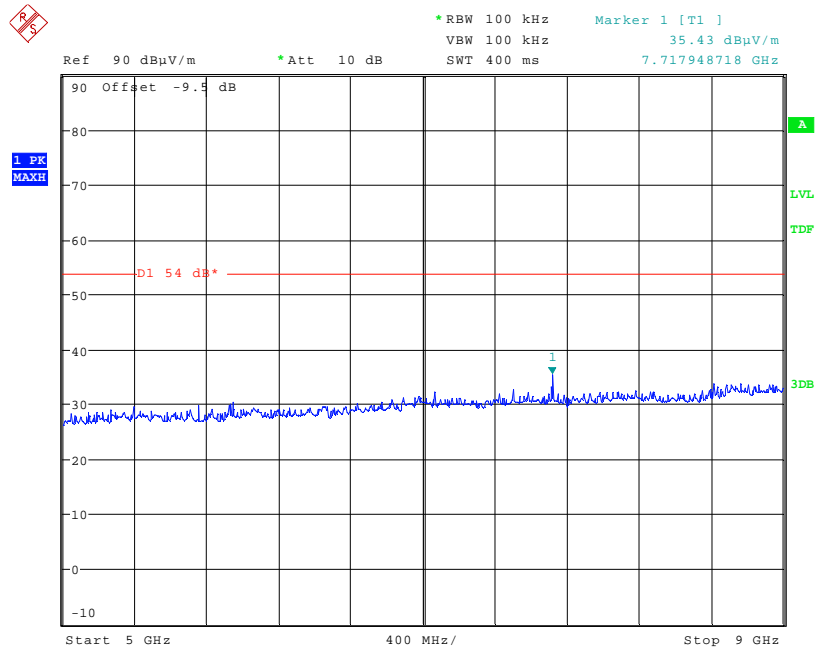


Drive Thru Base – Unintentional Radiated spurious emissions 30 MHz to 1 GHz



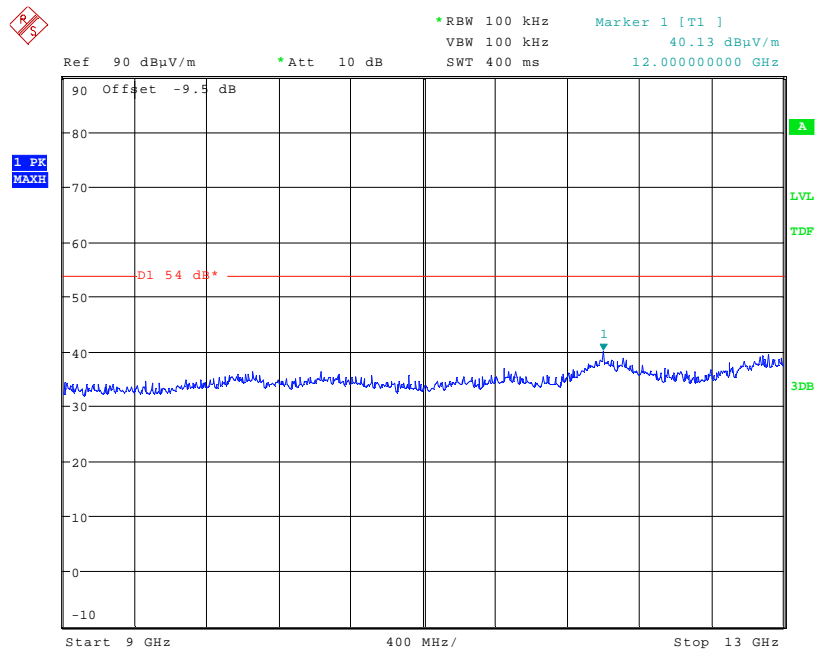
Date: 18.JAN.2011 11:54:59

Drive Thru Base – Unintentional Radiated spurious emissions 1 GHz to 5 GHz



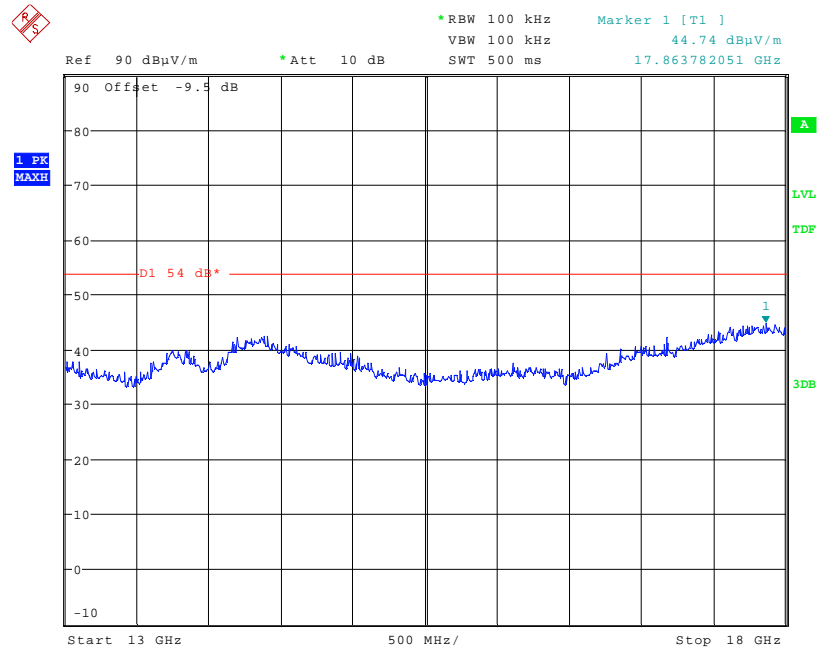
Date: 18.JAN.2011 11:59:38

Drive Thru Base – Unintentional Radiated spurious emissions 5 GHz to 9 GHz



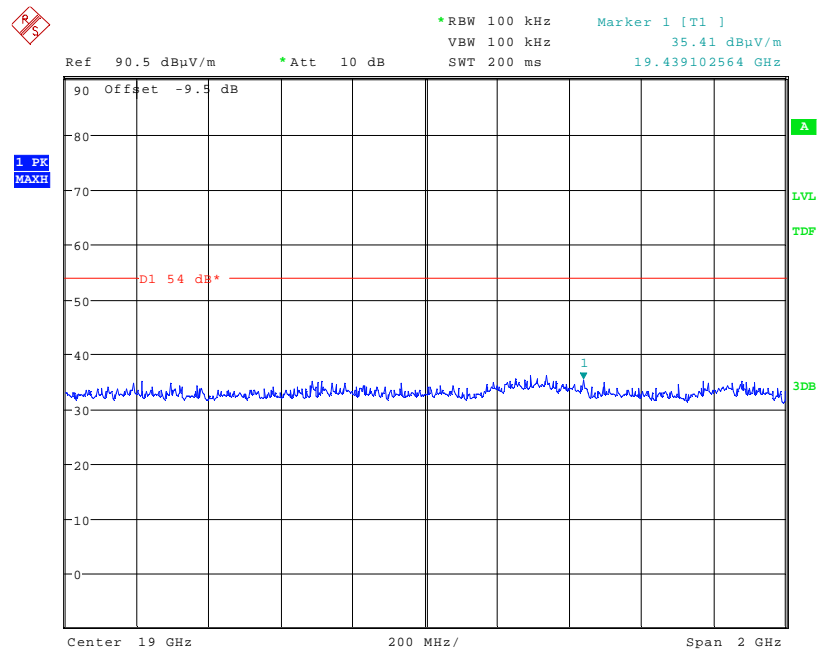
Date: 18.JAN.2011 11:57:31

Drive Thru Base – Unintentional Radiated spurious emissions 9 GHz to 13 GHz



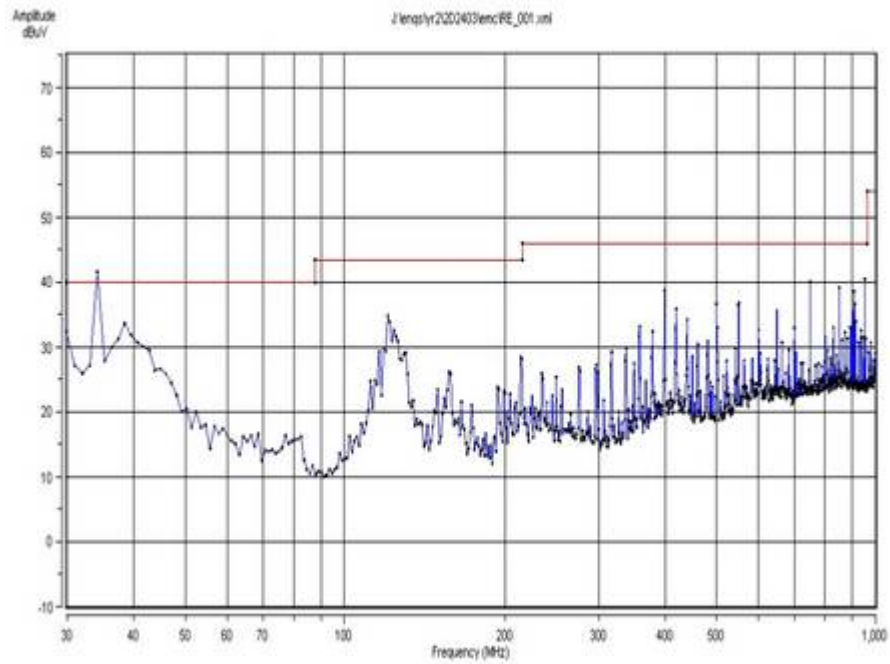
Date: 18.JAN.2011 11:57:49

Drive Thru Base – Unintentional Radiated spurious emissions 13 GHz to 18GHz

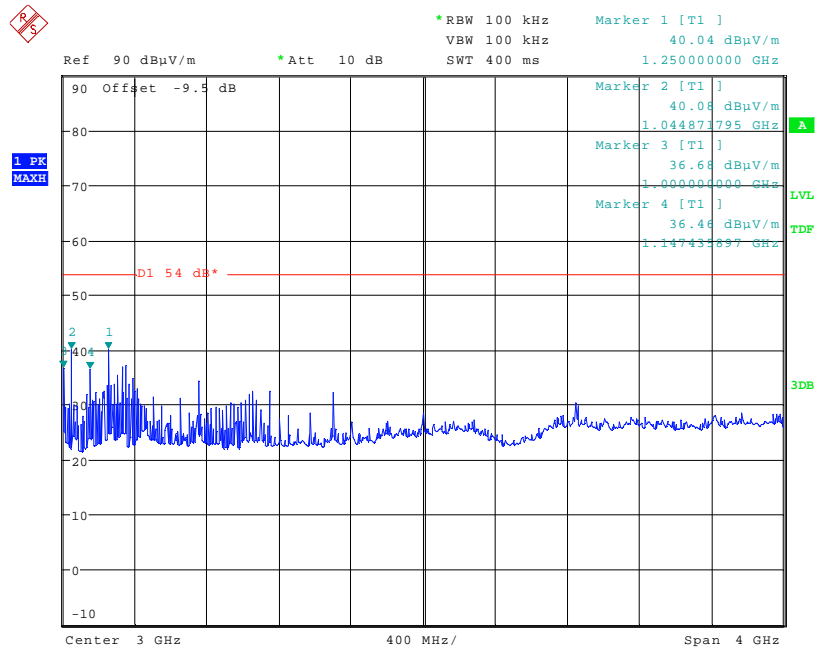


Date: 18.JAN.2011 11:29:45

Drive Thru Base – Unintentional Radiated spurious emissions 18 GHz to 20 GHz

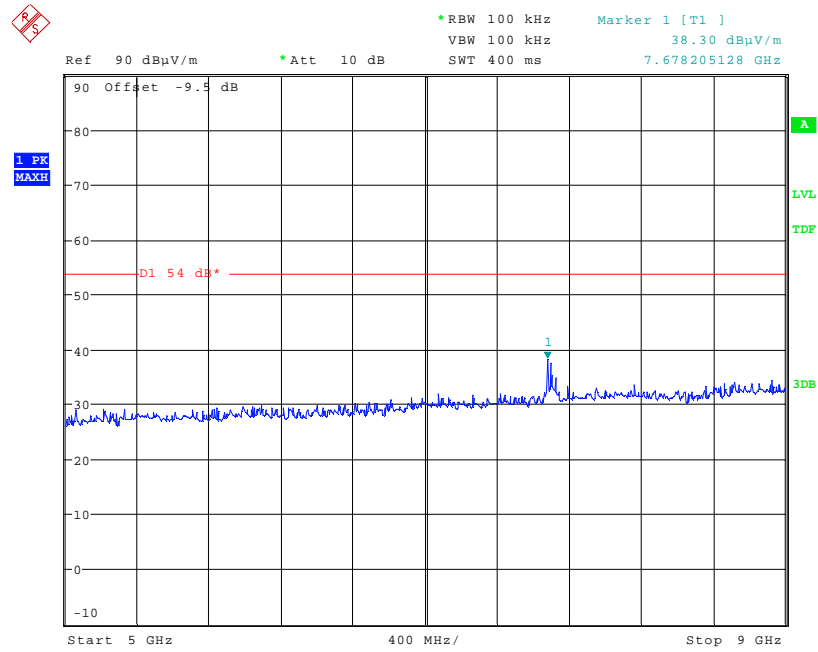


Retail Base – Unintentional Radiated spurious emissions 30 MHz to 1 GHz



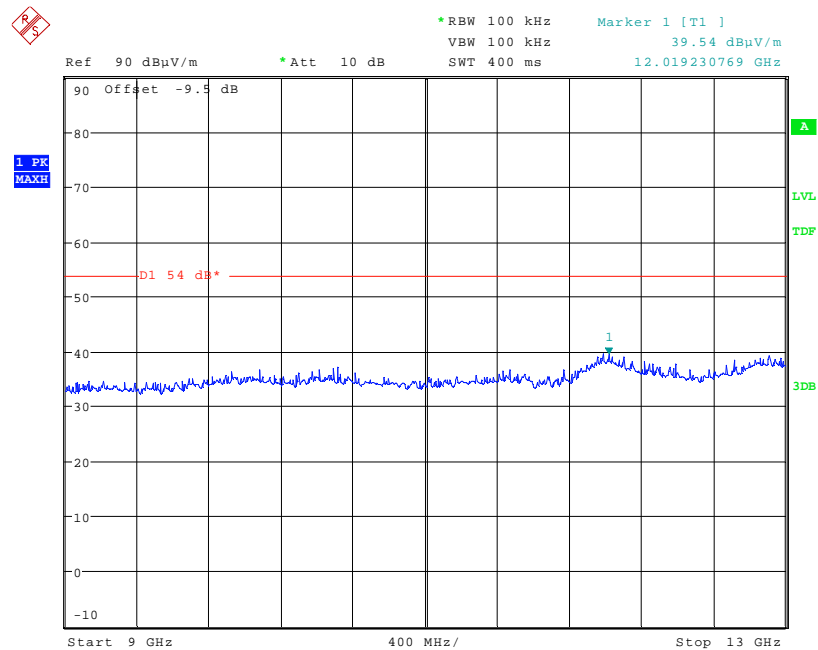
Date: 18.JAN.2011 15:20:50

Retail Base – Unintentional Radiated spurious emissions 1 GHz to 5 GHz



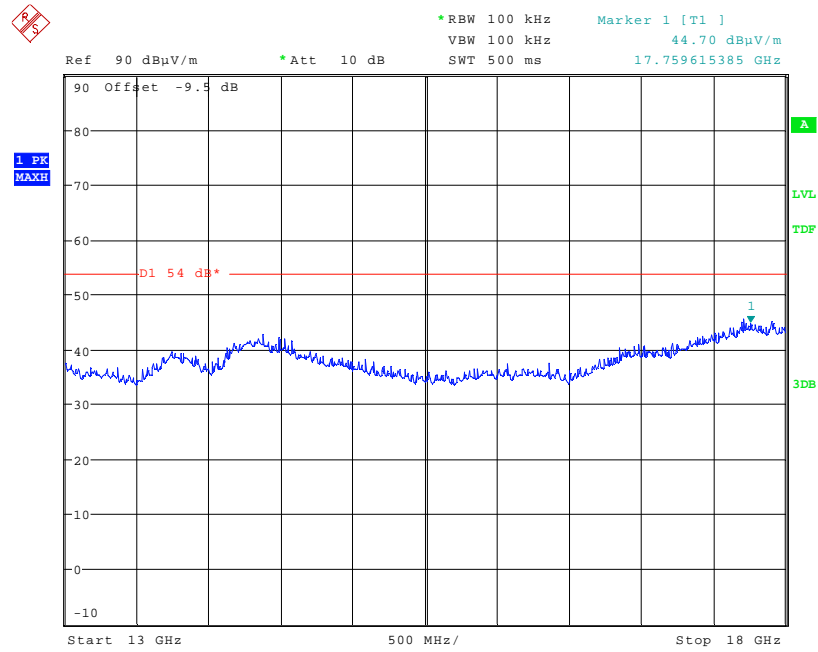
Date: 18.JAN.2011 15:21:25

Retail Base – Unintentional Radiated spurious emissions 5 GHz to 9 GHz



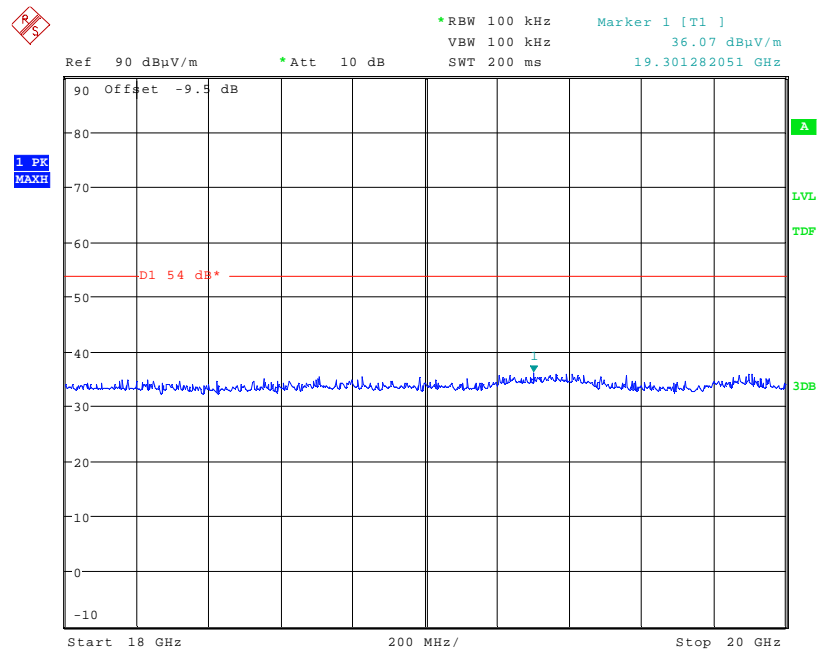
Date: 18.JAN.2011 15:24:11

Retail Base – Unintentional Radiated spurious emissions 9 GHz to 13 GHz



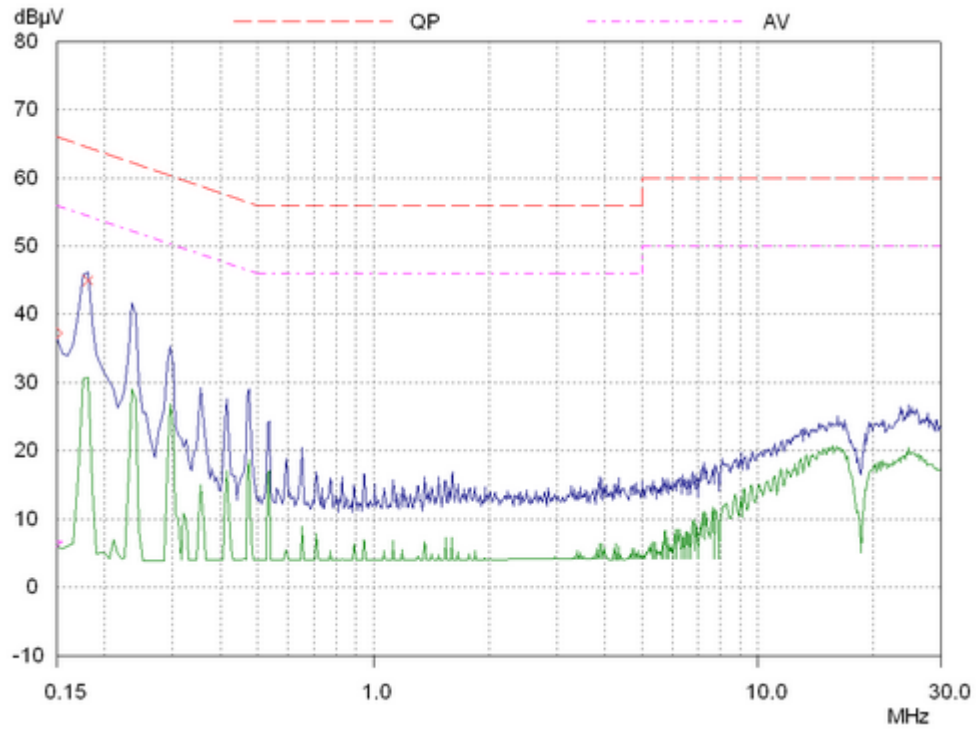
Date: 18.JAN.2011 15:23:02

Retail Base – Unintentional Radiated spurious emissions 13 GHz to 18GHz

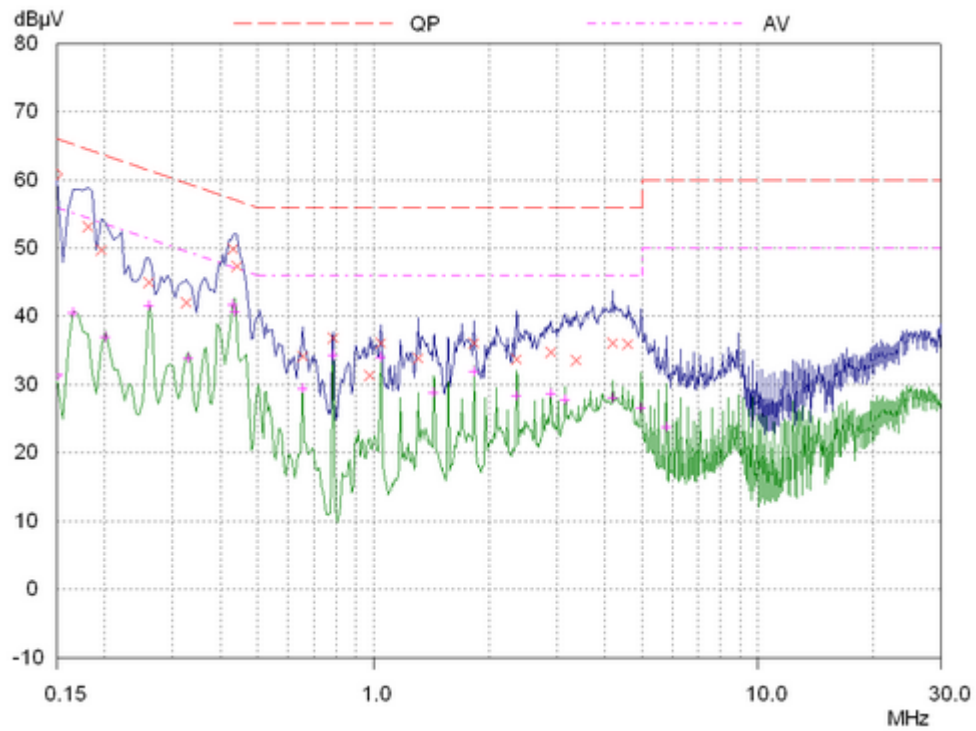


Date: 18.JAN.2011 16:10:28

Retail Base – Unintentional Radiated spurious emissions 18 GHz to 20 GHz



Drive Thru Base – AC Powerline Conducted Emissions



Retail Base – AC Powerline Conducted Emissions

Appendix C: Additional Test and Sample Details

This appendix contains details of:

1. The samples submitted for testing.
2. Details of EUT operating mode(s)
3. Details of EUT configuration(s) (see below).
4. EUT arrangement (see below).

Throughout testing, the following numbering system is used to identify the sample and its modification state:

Sample No: Sxx Mod w

where:

xx	= sample number	eg. S01
w	= modification number	eg. Mod 2

The following terminology is used throughout the test report:

Support Equipment (SE) is any additional equipment required to exercise the EUT in the applicable operating mode. Where relevant SE is divided into two categories:

SE in test environment: The SE is positioned in the test environment and is not isolated from the EUT (e.g. on the table top during REFE testing).

SE isolated from the EUT: The SE is isolated via filtering from the EUT. (e.g. equipment placed externally to the ALSR during REFE testing).

EUT configuration refers to the internal set-up of the EUT. It may include for example:

- Positioning of cards in a chassis.
- Setting of any internal switches.
- Circuit board jumper settings.
- Alternative internal power supplies.

Where no change in EUT configuration is **possible**, the configuration is described as “single possible configuration”.

EUT arrangement refers to the termination of EUT ports / connection of support equipment, and where relevant, the relative positioning of samples (EUT and SE) in the test environment.

For further details of the test procedures and general test set ups used during testing please refer to the related document "EMC Test Methods - An Overview", which can be supplied by TRaC Telecoms & Radio upon request.

C1) Test samples

The following samples of the apparatus were submitted by the client for testing :

Sample No.	Description	Identification
S21	Drive Thru Base	None
S14	Retail Base	None
S05	Stontronics Ltd Switching Adaptor	none

The following samples of apparatus were submitted by the client as host, support or drive equipment (auxiliary equipment):

Sample No.	Description	Identification
S14	Headset – Temporary Antenna Connector	None
S16	Headset – Radiated Sample	None

The following samples of apparatus were supplied by TRaC Telecoms & Radio as support or drive equipment (auxiliary equipment):

Identification	Description
	None

C2) EUT Operating Mode During Testing.

During testing, the EUT was exercised as described in the following tables :

Test	Description of Operating Mode
RF Parameter Testing	EUT transmitting in normal communications with companion device or a controlling and signalling transmission. Frequency administered to operate on a single frequency as required

Test	Description of Operating Mode
RF Etiquette Testing	EUT normal communications with companion device. Frequency administered to operate single/multiple frequencies and selected time slots as required.

Test	Description of Operating Mode:
Receiver (ERP) spurious emissions	EUT active but non-transmitting.

Test	Description of Operating Mode:
Ac Powerline Conducted Emission	EUT transmitting in normal communications with companion device or a controlling and signalling transmission.

C3) EUT Configuration Information.

The EUT was submitted for testing in one single possible configuration.

C4) List of EUT Ports

The tables below describe the termination of EUT ports:

Sample : S21
Tests : Conducted

Port	Description of Cable Attached	Cable length	Equipment Connected
Temporary Antenna	Coaxial Cable	10cm	Measurement System

Sample : S21
Tests : Radiated Emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
Spk +	4 core 3x2x22AWG Individually Screened LSF RoHS x1183C	25m	12 Ω Load between Spk+ & Spk -
Spk -			
Mic +			6 Ω Load between Mic+ & Mic -
Mic -			Open
Mic Scr			
+12Vdc	2 core unscreened	1m	S05

Sample : S17
Tests : Radiated Emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
AC Power	3 core unscreened	1.5m	Mains supply

C5 Details of Equipment Used

TRAC Ref	Type	Description	Manufacturer	Date Calibrated.
TRLUH281	FSU46	Spectrum Analyser	Rhode & Schwarz	10/02/2011
TRL138	3115	1-18GHz Horn Antenna	EMCO	10/09/2009
TRL139	3115	1-18GHz Horn Antenna	EMCO	17/08/2009
TRL572	8499B	1 – 26.5 GHz Pre Amplifier	Agilent	24/11/2010
UH004	ESHS10	Receiver	Rhode & Schwarz	14/12/2010
TRLUH191	CBL611/A	BiLog Periodic Antenna	York	08/11/2010
TRLUH93		BiLog Periodic Antenna	Chase	03/06/2009
TRLUH377	ESU26	EMI Receiver	Rhode & Schwarz	11/06/2010
TRL11	TCC 125-815P	Temperature Chamber	Shartree	Use TRL426
TRL426	52 Series II	Temperature indicator	Fluke	04/03/2011
TRL176	2042	Signal Generator	Marconi	08/07/2010
TRLUH221	271	Function Generator	Wavetek	Use UH122
TRLUH122	TDS520B	Oscilloscope	Tektronix	Info Only
TRLUH303	11667A	Splitter/Combiner	HP	Cal in use
TRLUH305	11667A	Splitter/Combiner	HP	Cal in use
TRLUH307	8472A	Crystal Detector	HP	Info only
RFG433	CMD60	Modulation Analyser	Rhode & Schwarz	11/12/2008
REF844	E4438C	Signal Generator	Agilent	19/02/2010
N/A	SH4141	High Pass Filter	BCS Filters	04/12/2009

Appendix D:

Additional Information

No additional information is included within this test report.

Appendix E:

Photographs and Figures

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement: Drive Thru Base Overview.
2. Radiated electric field emissions arrangement: Drive Thru Base close up.
3. AC Powerline Conduction: Drive Thru Base Overview
4. Radiated electric field emissions arrangement: Retail Base Overview.
5. Radiated electric field emissions arrangement: Retail Base close up.
6. AC Powerline Conduction: Retail Base Overview



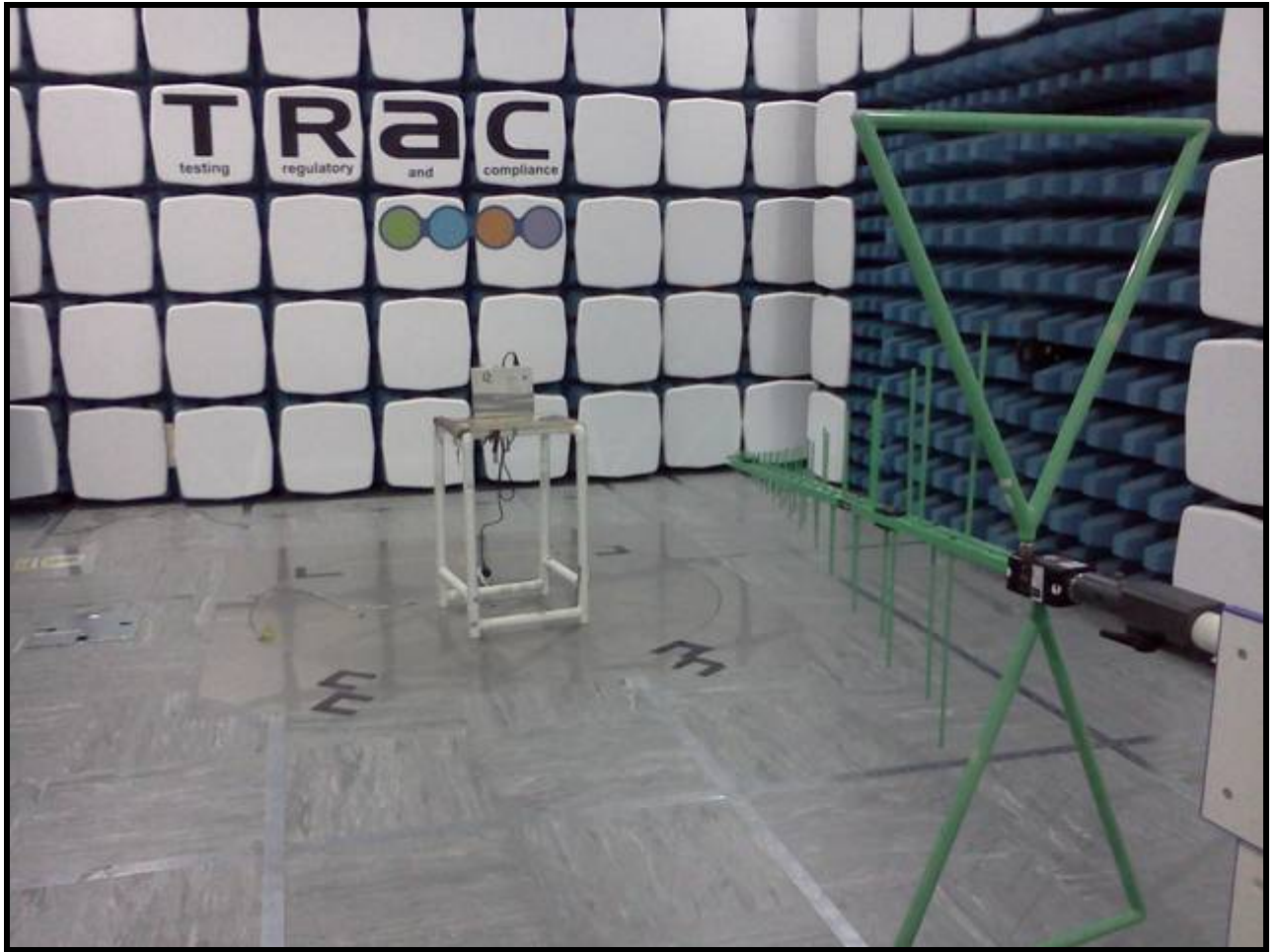
Photograph 1



Photograph 2



Photograph 3



Photograph 4



Photograph 5



Photograph 6

