

TEST REPORT

Test Report Reference: F092137E1

Equipment under Test: cB-0925-01-1-0x

Model name cB-0925-01

FCC ID: PVH0925

IC: 5325A-0925

Serial Number: None

Applicant: connectBlue AB

Manufacturer: connectBlue AB

**Test Laboratory
(CAB)
accredited by
DATech in der TGA GmbH
in compliance with DIN EN ISO/IEC 17025
under the
Reg. No. DAT-P-105/99-21,
FCC Test site registration number 90877
and
Industry Canada Test site registration IC3469A-1 and
FCC Test site registration number 90877**

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1 IDENTIFICATION

1.1 APPLICANT

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	Malmö SE-211 19
Country:	Sweden
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1.2 MANUFACTURER

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Address:	Norra Vallgatan 64 3V
	Malmö SE-211 19
Country:	Sweden
Name for contact purposes:	Mr. Martin Engdahl
Tel:	+ 46 40 63 07 100
Fax:	+ 46 40 23 71 37
e-mail address:	martin.engdahl@connectblue.se

1.3 DATES

Date of receipt of test sample:	25 August 2009
Start of test:	25 August 2009
End of test:	02 September 2009

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1.4 TEST LABORATORY

The tests were carried out at: **PHOENIX TESTLAB GmbH**
Königswinkel 10
D-32825 Blomberg Phone: **+49 (0) 52 35 / 95 00-0**
Germany Fax: **+49 (0) 52 35 / 95 00-10**

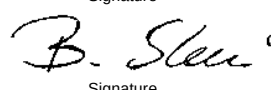
accredited by DATech in der TGA GmbH in compliance with DIN EN ISO/IEC 17025 under Reg. No. DAT-P-105/99, Industry Canada Test site registration IC3469A-1 and FCC Test site registration number 90877.

Test engineer: Thomas KÜHN
Name


Signature

08 September 2009
Date

Test report checked: Bernd STEINER
Name


Signature

08 September 2009
Date

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Tel. 0 52 35 / 95 00-0
Fax 0 52 35 / 95 00-10

Stamp

1.5 RESERVATION

This test report is only valid in its original form.

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The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT REFERENCE.

1.6 NORMATIVE REFERENCES

- [1] **ANSI C63.4-2003** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC CFR 47 Part 15 (October 2008)** Radio Frequency Devices
- [3] **FCC Public Notice DA 00-705 (March 2000)**
- [4] **RSS-210 Issue 7 (June 2007)** Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment
- [5] **RSS-Gen Issue 2 (June 2007)** General Requirements and Information for the Certification of Radiocommunication Equipment
- [6] **Publication Number 913591 (March 2007)** Measurement of radiated emissions at the edge of the band for a Part 15 RF Device

1.7 TEST RESULTS

The requirements of this test document are fulfilled by the equipment under test. The complete test results are presented in the following.

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2 TECHNICAL DATA OF EQUIPMENT

Equipment under test: *	CB-0905-01-1-0x					
Model name: *	cB-0925-01					
Type of equipment: *	Bluetooth module					
FCC ID: *	PVH0925					
IC: *	5325A-0925					
Fulfills Bluetooth specification: *	2.0 with EDR					
Antenna type: *	Integral and external (refer table below)					
Antenna gain: *	refer table below					
Rated output power: *	Max. 4 dBm					
Antenna connector: *	With internal antenna, no antenna connector is mounted. For external antennas an Hirose U.FL connector is used					
Power supply: *	U _{nom} =	5.0 V DC	U _{min} =	3.0 V DC	U _{max} =	6.0 V DC
Type of modulation: *	FHSS: GFSK (1 Mbps), $\pi/4$ -DPQSK (2 Mbps) or 8DPSK (3 Mbps)					
Operating frequency range:*	2402 MHz to 2480 MHz					
Number of channels: *	79					
Temperature range: *	-40 °C to +85 °C					

*: declared by the applicant

Bluetooth operates in the unlicensed ISM band at 2.4 GHz. In North America (USA and Canada) a band with a width of 83.5 MHz is available. In this band 79 RF channels spaced 1 MHz apart are defined. The channel is represented by a pseudo random hopping sequence through the 79 channels. The normally occupancy time of one frequency will be 625 μ s. The ordinary hopping rate will be 1600 hops/s. All frequencies will be used equally.

The following external I/O cables were used:

Identification	Connector		Lenght
	EUT	Ancillary	
Power supply	5.5 mm jack plug	-	2 m
-	-	-	-
-	-	-	-

*: Length during the test if no other specified.

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Used antennas:

Model name*	Antenna type	Cable length / connector	Rated Antenna gain*
Fractus, FR05-S1-N-0-104	Internal SMD	-	0.0
Fractus, FR05-S1-N-0-102	Internal SMD	-	+1.0
Laird Technologies, NanoBlue-IP04	Patch	10 cm / U.FL	+2.0
ProAnt, InSide-2400	Patch	10 cm / U.FL	+3.0
Laird Technologies, WCR2400-SMRP, WCR2400-IP04, WCR2400-IP10	Monopole	- / RPSMA 10 cm / U.FL 25 cm / U.FL	+2.0
Radiall, R380.500.139	Monopole	- / RPSMA	+2.0
PlanTec, m70cxr REEL	Patch	20cm / RPSMA 100 cm / RPSMA 300cm / RPSMA	+1.0
Mobile Mark, PSTG0-2400HS	Monopole	- / RPSMA	0.0
Joymax, IHF-242	Monopole	Cable to MCX and IPC (U.FL) connector	+2.0
Joymax, IW-145	Monopole	- / RPSMA	+4.0
Joymax, IH-151	Monopole	- / RPSMA	+5.0
Huber+Suhner, SPA 2400/75/8/0/V	Patch	- / TNC female reverse pigtail	+7.5
ProAnt, FlatWhip-2400	Monopole	- / RPSMA	+3.0
ProAnt, TwinGain-2400	Patch	- / RPSMA	+8.0
ProAnt, Outside-2400	Monopole	10 cm / U.FL 25 cm / U.FL	+3.0
ProAnt, Ex-IT 2400 RP-SMA 28-001	Monopole	- / RPSMA	+3.0
ProAnt, Ex-IT 2400 MHF 28	Monopole	10 cm / U.FL	+2.0
ProAnt, Ex-IT 2400 RP-SMA 70-002	Monopole	- / RPSMA	+3.0
ProAnt, Ex-IT 2400 RP-SMA 70-001	Monopole	- / RPSMA	+3.0
ProAnt, Ex-IT 2400 MHF 70-001	Monopole	10 cm / U.FL	+3.0

*: declared by the applicant

2.1 PERIPHERY DEVICES

The following equipment was used as control unit and ancillary equipment:

- A personal computer with a terminal-software was used, connected temporary to the EUT, for setting the equipment into the necessary operation mode. During the measurements the personal computer was disconnected.
- For measurements on the power supply line an AC/DC adaptor type mascot 2121 was used.

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3 OPERATIONAL STATES AND PHYSICAL BOUNDARIES

The EUT is intended to be used in several Bluetooth applications. Because the cB-0925-01-1-0x is a module, which will be implemented in a final application, it was mounted on a carrier board to change the operation modes of the EUT from a Laptop with test software. The tests were carried out with one unmodified sample with an internal antenna (cB-0925-01-1-01, sample marked with "11") and one unmodified sample with an antenna connector (cB-0925-01-1-02, sample marked with "28")

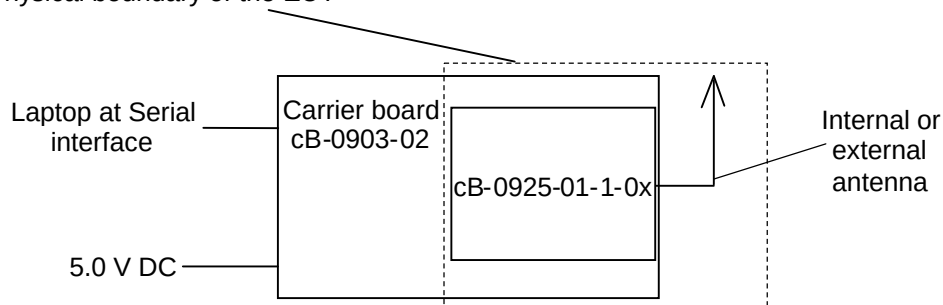
During the tests the test sample was powered by an external power supply via the carrier board with 5.0 V DC.

For selecting an operation mode, a personal computer with a software delivered by the applicant was connected to the carrier board. After adjusting the operating mode, the personal computer was removed. To do this the test-engineer was instructed by the applicant.

The following operation modes were used during the tests:

Operation mode	Description of the operation mode	Modulation	Data rate / Mbps
1	Continuous transmitting on 2402 MHz	GFSK	1
1a		$\pi/4$ -DQPSK	2
1b		8DPSK	3
2	Continuous transmitting on 2441 MHz	GFSK	1
2a		$\pi/4$ -DQPSK	2
2b		8DPSK	3
3	Continuous transmitting on 2480 MHz	GFSK	1
3a		$\pi/4$ -DQPSK	2
3b		8DPSK	3
4	Transmitter hopping on all channels	GFSK	1
4a		$\pi/4$ -DQPSK	2
4b		8DPSK	3
5	Continuous receiving on 2441 MHz		

Physical boundary of the EUT



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The following test modes were adjusted during the tests:

Preliminary tests were performed in different data rates and different orthogonal directions (if applicable), to find worst-case configuration and position. The data rate shown in the table below shows the found worst-case rate with respect to specific test item. The following table shows a list of the test modes used for the results, documented in this report. The radiated emission measurement was carried out in the orthogonal direction that emits the highest spurious emission levels.

Test items	Operation mode
20 dB bandwidth	1b, 2b, 3b (3 Mbps)
Carrier frequency separation	4b, 4b, 4b (3 Mbps)
Number of hopping channels	4 (1 Mbps)
Dwell time	2, 2a, 2b (1-, 2- and 3 Mbps)
Maximum peak output power	1, 1a, 1b, 2, 2a, 2b, 3, 3a and 3b (1-, 2- and 3 Mbps)
Conducted emissions (transmitter)	1, 2, 3 (1 Mbps)
Band edge compliance (radiated)	1, 3, 4 (1 Mbps)
Radiated emissions (transmitter)	1, 2, 3 (1 Mbps)
Conducted emissions on supply line	4b (3 Mbps)
Radiated emissions (receiver)	5

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4 LIST OF MEASUREMENTS

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS 210, Issue 7 [4] or RSS-Gen, Issue 2 [5]	Status	Refer page
20 dB bandwidth	General	15.247 (a) (1)	A8.1 (b) [4]	Passed	11 et seq.
Carrier frequency separation	General	15.247 (a) (1)	A8.1 (b) [4]	Passed	14 et seq.
Number of hopping channels	2400.0 - 2483.5	15.247 (a) (1) (iii)	A8.1 (d) [4]	Passed	17 et seq.
Dwell time	2400.0 - 2483.5	15.247 (a) (1) (iii)	A8.1 (d) [4]	Passed	19 et seq.
Maximum peak output power	2400.0 - 2483.5	15.247 (b) (1)	A8.4 (2) [4]	Passed	23 et seq.
Band edge compliance	2400.0 - 2483.5	15.247 (d)	A8.5 [4]	Passed	26 et seq.
Radiated emissions (transmitter)	0.009 - 25,000	15.205 (a) 15.209 (a)	A8.5 [4] 2.6 [4]	Passed	39 et seq.
Conducted emissions on supply line	0.15 - 30	15.207 (a)	7.2.2 [5]	Passed	79 et seq.
Radiated emissions (receiver)	0.009 - 25,000	15.109 (a)	6 [5] 2.6 [4]	Passed	Annex D

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5 TEST RESULTS

5.1 20 dB BANDWIDTH

5.1.1 METHOD OF MEASUREMENT (20 dB BANDWIDTH)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be disenabled, the transmitter shall work with its maximum data rate.

The following spectrum analyser settings shall be used:

- Span: App. 2 to 3 times the 20 dB bandwidth, centred on the actual hopping channel.
- Resolution bandwidth: $\geq 1\%$ of the 20 dB bandwidth.
- Video bandwidth: $\geq$ the resolution bandwidth.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 20 dB below the first line (or the peak marker). The frequency lines shall be set on the intersection points between the second display line and the measured curve.

The measurement will be performed at the upper, the lower end and the middle of the assigned frequency band.

Test set-up:

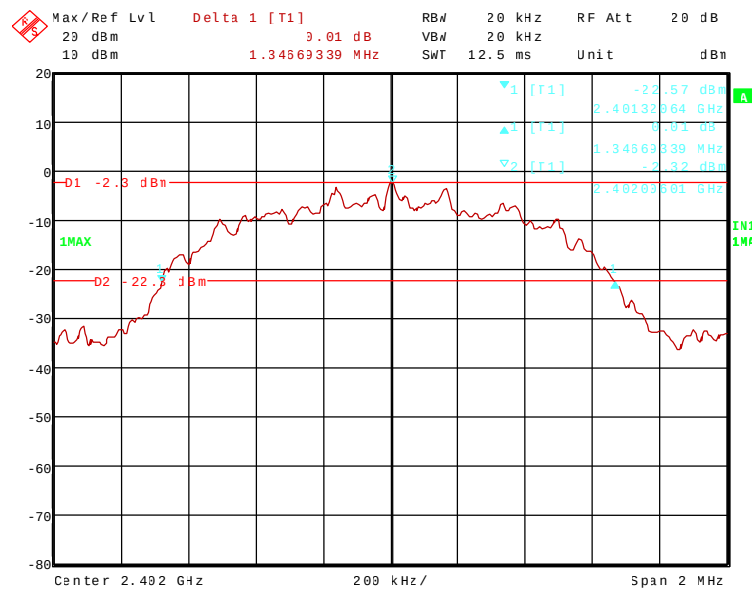


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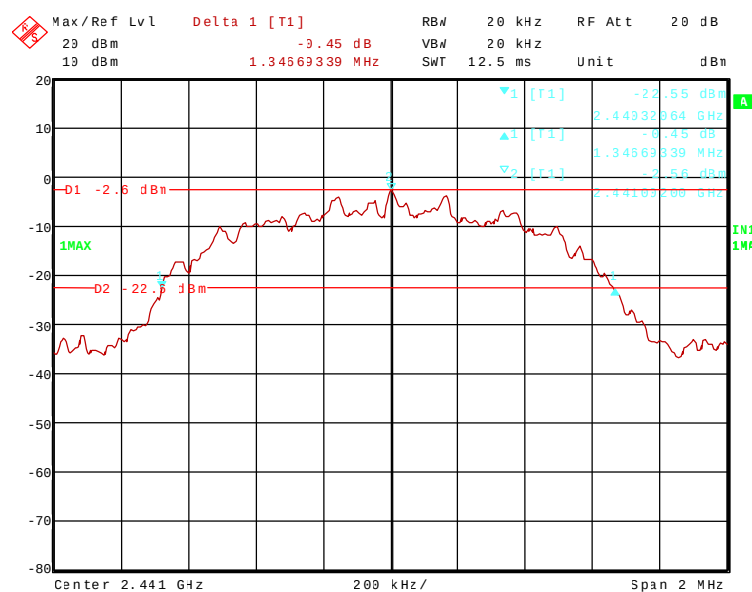
5.1.2 TEST RESULTS (20 dB BANDWIDTH)

Ambient temperature	21 °C	Relative humidity	50 %
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92137_149.wmf: 20 dB bandwidth at the lower end of the assigned frequency band (operation mode 1b):

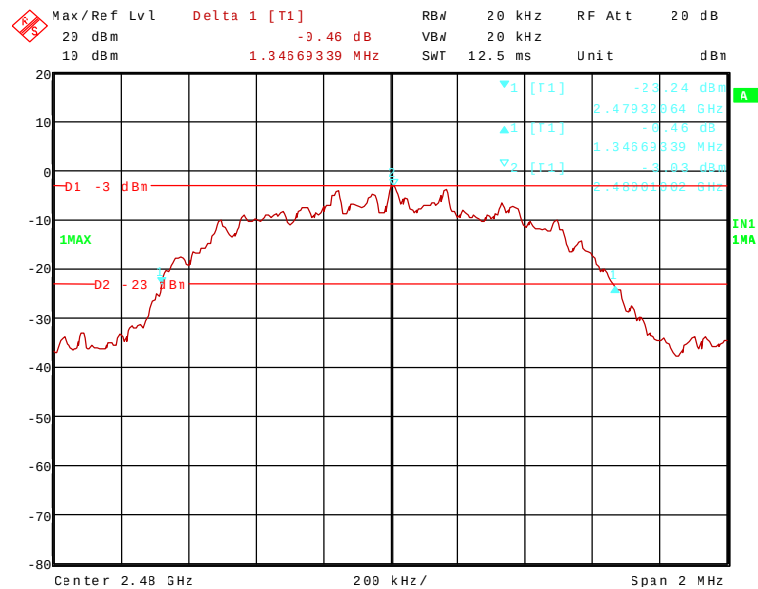


92137_152.wmf: 20 dB bandwidth at the middle of the assigned frequency band (operation mode 2b):



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92137_155.wmf: 20 dB bandwidth at the upper end of the assigned frequency band (operation mode 3b):



Channel number	Channel frequency [MHz]	20 dB bandwidth [kHz]
Operation mode 1b, 2b, 3b		
0	2402	1346.693
39	2441	1346.693
78	2480	1346.693
Measurement uncertainty		+0.66 dB / -0.72 dB

TEST EQUIPMENT USED FOR THE TEST:

31

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5.2 CARRIER FREQUENCY SEPARATION

5.2.1 METHOD OF MEASUREMENT (CARRIER FREQUENCY SEPARATION)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be enabled.

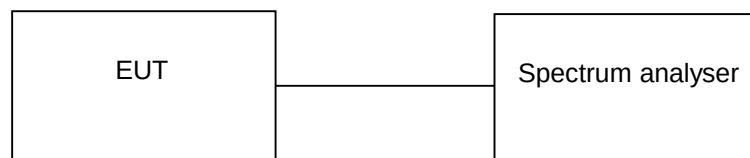
The following spectrum analyser settings shall be used:

- Span: Wide enough to capture the peaks of two adjacent channels.
- Resolution bandwidth: ≥ 1 % of the span.
- Video bandwidth: $\geq$ the resolution bandwidth.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.

After trace stabilisation the marker and the delta marker function will be used to determine the separation between the peaks of two adjacent channel signals.

The measurement will be performed at the upper, the lower end and the middle of the assigned frequency band.

Test set-up:

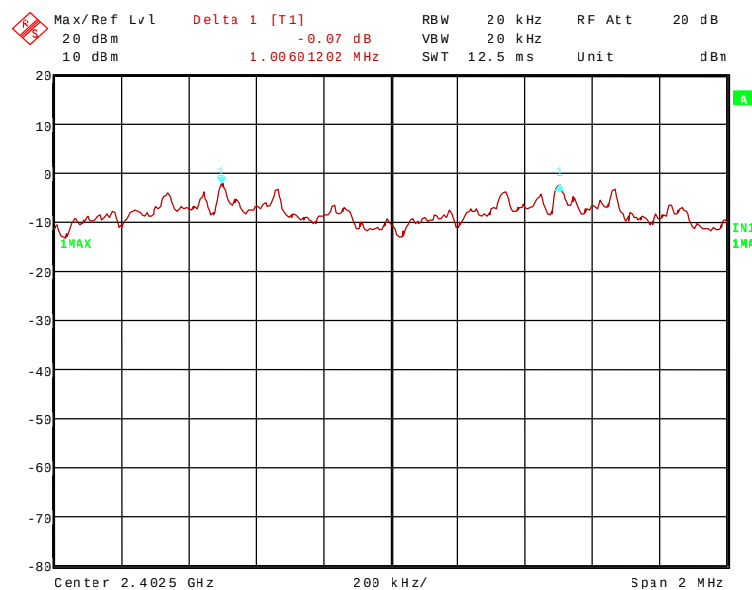


TEST REPORT REFERENCE: F092137E1

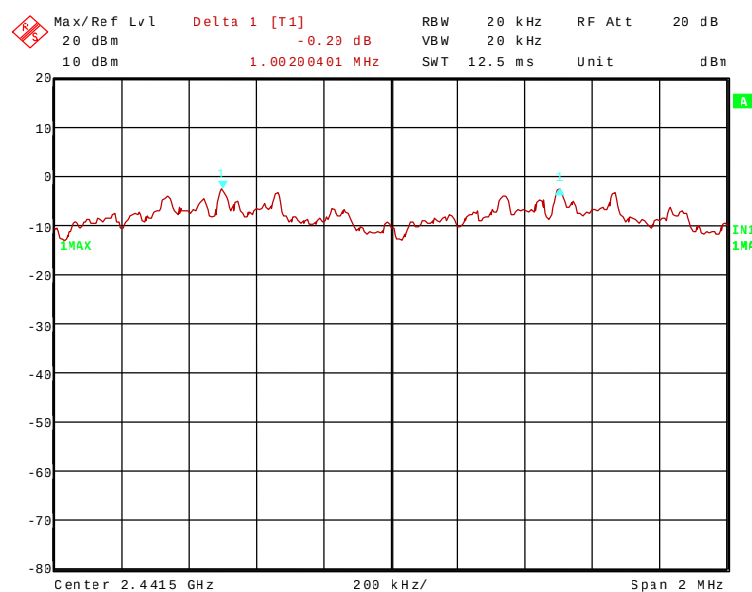
5.2.2 TEST RESULTS (CARRIER FREQUENCY SEPARATION)

Ambient temperature	21 °C	Relative humidity	50 %
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92137_162.wmf: Channel separation at the lower end of the assigned frequency band (operation mode 1b):

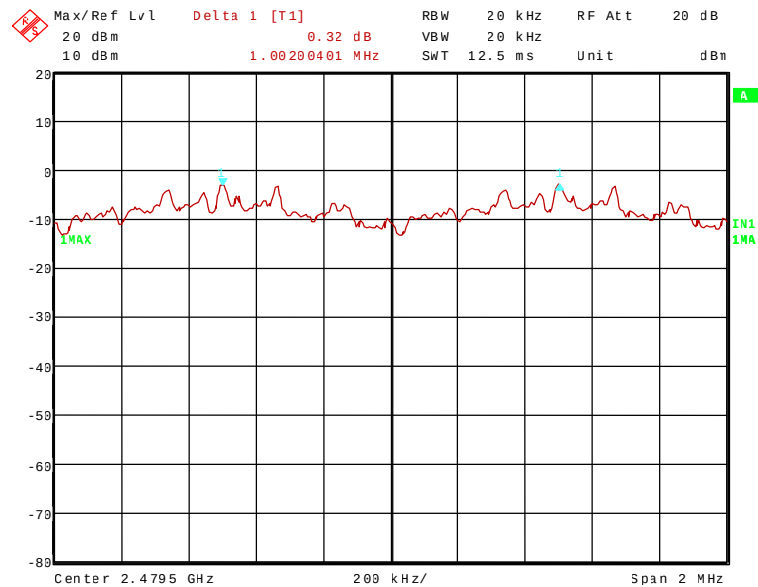


92137_163.wmf: Channel separation at the middle of the assigned frequency band (operation mode 2b):



TEST REPORT REFERENCE: F092137E1

92137_164.wmf: Channel separation at the upper end of the assigned frequency band (operation mode 3b):



Channel number	Channel frequency [MHz]	Channel separation [kHz]	Minimum limit [kHz]
Operation mode 1b, 2b, 3b			
0	2402	1006	897.795 ($\frac{2}{3}$ of the 20 dB bandwidth)
39	2441	1002	897.795 ($\frac{2}{3}$ of the 20 dB bandwidth)
78	2480	1002	897.795 ($\frac{2}{3}$ of the 20 dB bandwidth)
Measurement uncertainty			$<10^{-7}$

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

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5.3 NUMBER OF HOPPING FREQUENCIES

5.3.1 METHOD OF MEASUREMENT (NUMBER OF HOPPING FREQUENCIES)

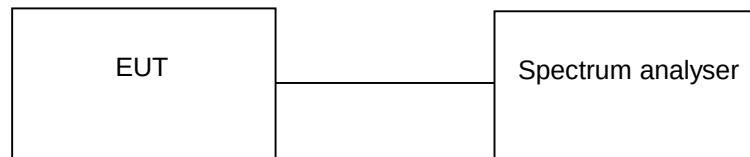
The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be enabled.

The following spectrum analyser settings shall be used:

- Span: Equal to the assigned frequency band.
- Resolution bandwidth: $\geq 1\%$ of the span.
- Video bandwidth: $\geq$ the resolution bandwidth.
- Sweep: Auto.
- Detector function: Peak.
- Trace mode: Max hold.

After trace stabilisation the number of hopping channels could be counted. It might be possible to divide the span into some sub ranges in order to clearly show all hopping frequencies.

Test set-up:

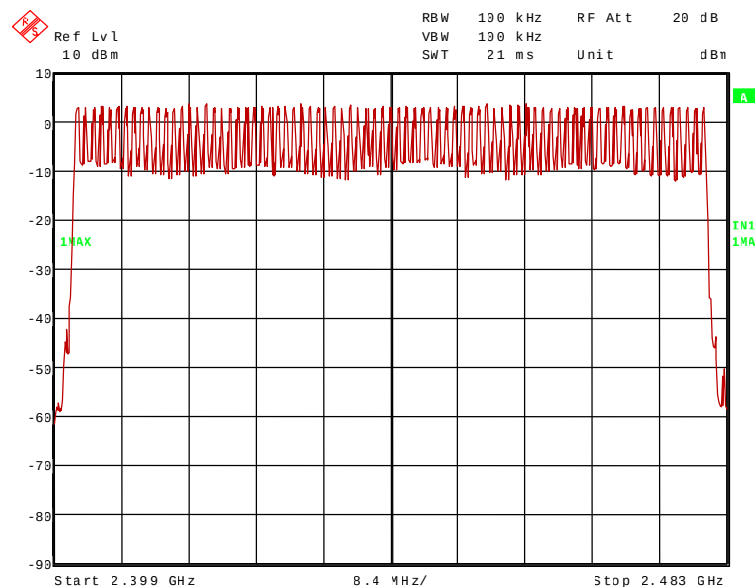


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5.3.2 TEST RESULTS (NUMBER OF HOPPING FREQUENCIES)

Ambient temperature	21 °C	Relative humidity	50 %
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92137_146.wmf: Number of hopping channels (operation mode 4):



Number of hopping channels	Limit
79	At least 15

TEST EQUIPMENT USED FOR THE TEST:

31

TEST REPORT REFERENCE: F092137E1

5.4 DWELL TIME

5.4.1 METHOD OF MEASUREMENT (DWELL TIME)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be enabled.

The following spectrum analyser settings shall be used:

- Span: Zero, centred on a hopping channel.
- Resolution bandwidth: 1 MHz.
- Video bandwidth: $\geq$ the resolution bandwidth.
- Sweep: As necessary to capture the entire dwell time per hopping channel.
- Detector function: peak.
- Trace mode: Max hold.

The marker and delta marker function of the spectrum analyser will be used to determine the dwell time.

The measurement will be performed at the upper and lower end and the middle of the assigned frequency band.

If the EUT is possible to operate with different mode of operation (data rates, modulation formats etc.) the test will be repeated with every different operation mode of the EUT.

Test set-up:

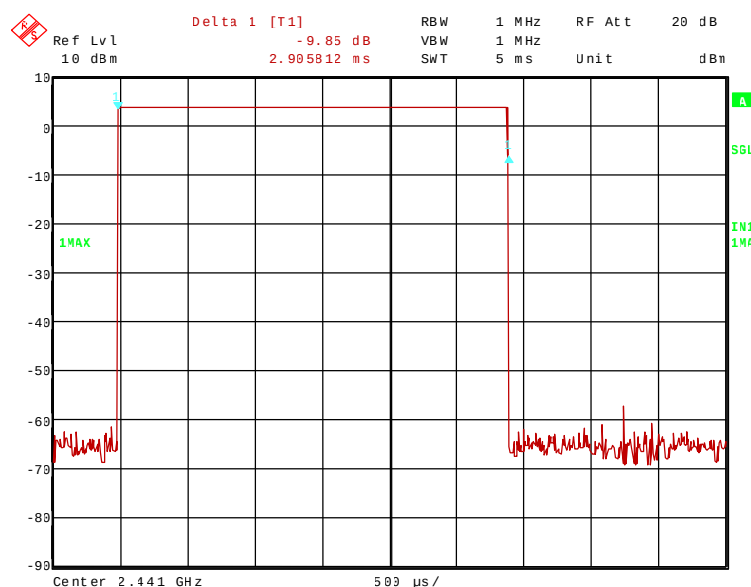


TEST REPORT REFERENCE: F092137E1

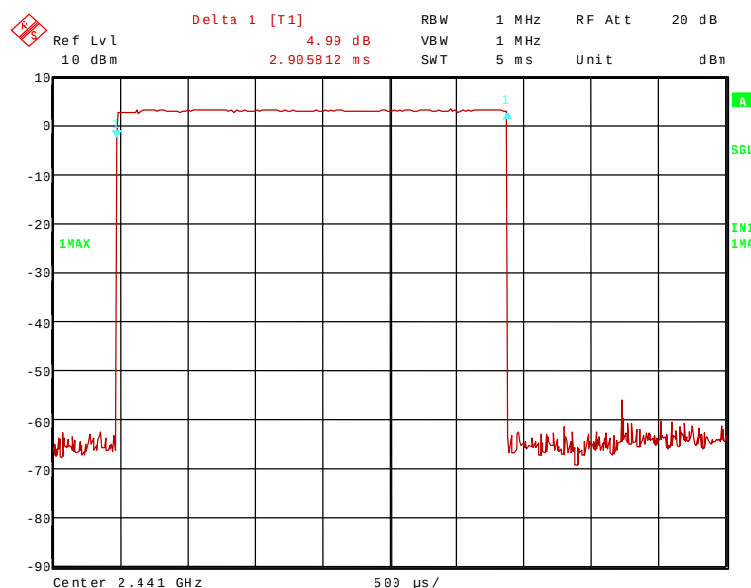
5.4.2 TEST RESULTS (DWEELL TIME)

Ambient temperature	21 °C	Relative humidity	50 %
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92137_165.wmf: Dwell time at the middle of the assigned frequency band (operation mode 2):

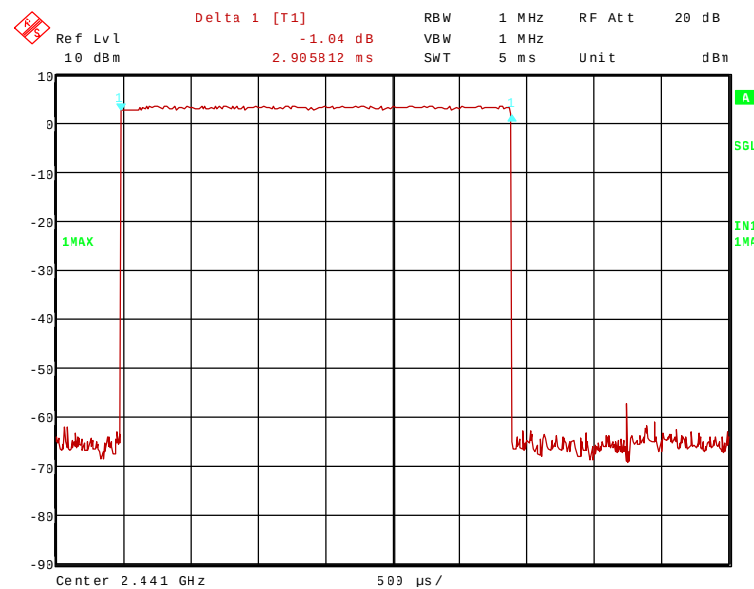


92137_166.wmf: Dwell time at the middle of the assigned frequency band (operation mode 2a):



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92137_167.wmf: Dwell time at the middle of the assigned frequency band (operation mode 2b):



The dwell time is calculated with the following formula:

Dwell time = $t_{\text{pulse}} \times n_{\text{hops}} / \text{number of hopping channels} \times 31.6$ (equal to 0.4 s x number of hopping channels)

Where:

t_{pulse} is the measured pulse time (pls. refer the plots of the spectrum analyser above) [s],
 n_{hops} is the number of hops per second in the actual operating mode of the transmitter [1/s].

The hopping rate of the system is 1600 hops per second and the system uses 79 channels. For this reason one time slot has a length of 625 μs .

With the used hopping modes DH5, 2DH5 and 3DH5 a packet need 5 timeslots for transmitting and the next timeslot for receiving. So the system makes in worst case 267 hops per second in transmit mode ($n_{\text{hops}} = 267 \text{ 1/s}$).

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Operation mode 2				
Channel number	Channel frequency [MHz]	t _{pulse} [μs]	Dwell time [ms]	Limit [ms]
39	2441	2905.812	309.953	400
Operation mode 2a				
Channel number	Channel frequency [MHz]	t _{pulse} [μs]	Dwell time [ms]	Limit [ms]
39	2441	2905.812	309.953	400
Operation mode 2b				
Channel number	Channel frequency [MHz]	t _{pulse} [μs]	Dwell time [ms]	Limit [ms]
39	2441	2905.812	309.953	400
Measurement uncertainty			<10 ⁻⁷	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

31

TEST REPORT REFERENCE: F092137E1

5.5 MAXIMUM PEAK OUTPUT POWER

5.5.1 METHOD OF MEASUREMENT (MAXIMUM PEAK OUTPUT POWER)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be disenabled.

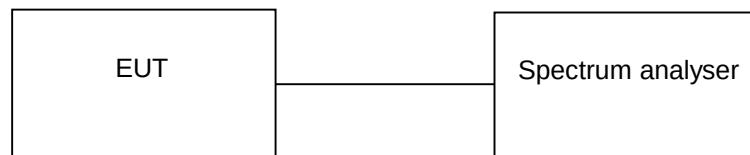
The following spectrum analyser settings shall be used:

- Span: Approx. 5 times the 20 dB bandwidth, centred on a hopping channel.
- Resolution bandwidth: > the 20 dB bandwidth of the emission being measured.
- Video bandwidth: $\geq$ the resolution bandwidth.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The indicated level is the peak output power, which has to be corrected with the value of the cable loss and an external attenuation (if necessary).

The measurement will be performed at the upper and lower end and the middle of the assigned frequency band.

Test set-up:

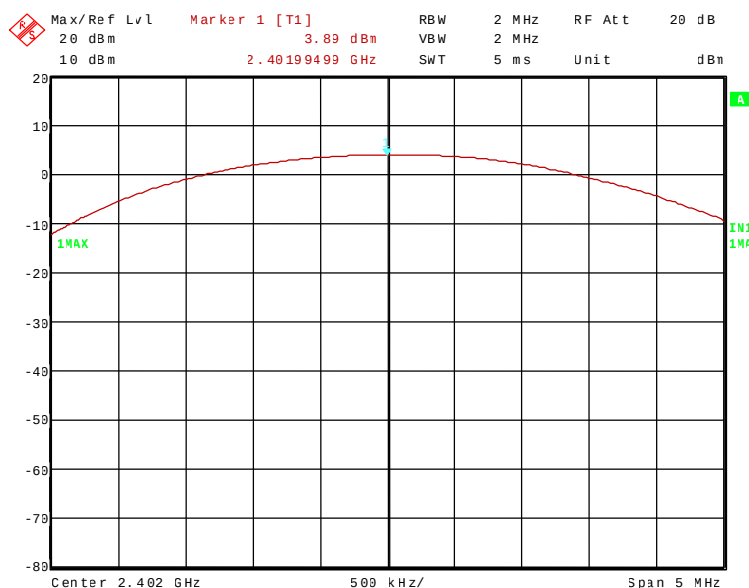


TEST REPORT REFERENCE: F092137E1

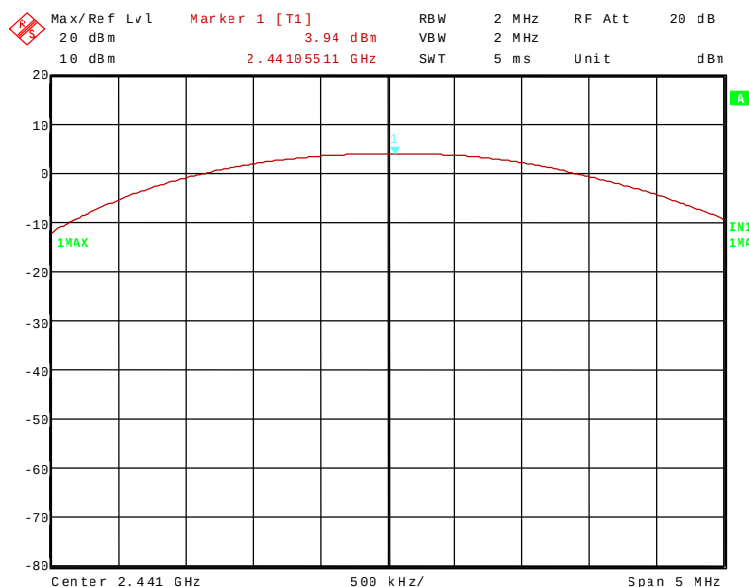
5.5.2 TEST RESULTS (MAXIMUM PEAK OUTPUT POWER)

Ambient temperature	21 °C	Relative humidity	50 %
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92137_137.wmf: Maximum peak output power at the lower end of the assigned frequency band (operation mode 1):

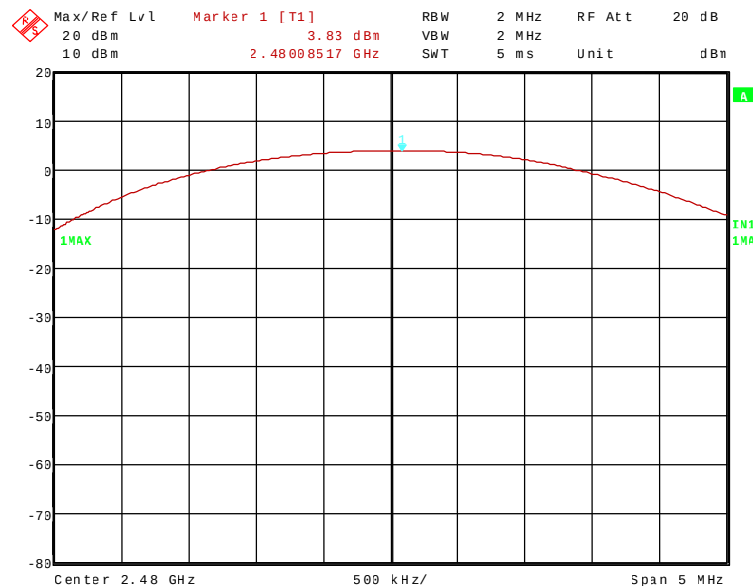


92137_138.wmf: Maximum peak output power at the middle of the assigned frequency band (operation mode 2):



TEST REPORT REFERENCE: F092137E1

92137_139.wmf: Maximum peak output power at the upper end of the assigned frequency band (operation mode 3):



Operation mode	Channel number	Channel frequency [MHz]	Maximum peak output power [dBm]	Antenna gain [dBi]	Peak power limit [dBm]
1	0	2402	3.9	8.0 *	28.0 *
1a			3.6		
1b			3.5		
2	39	2441	3.9	8.0 *	28.0 *
2a			3.6		
2b			3.6		
3	78	2480	3.8	8.0 *	28.0 *
3a			3.5		
3b			3.5		
Measurement uncertainty				+0.66 dB / -0.72 dB	

*: Because the maximum antenna gain exceeds 6 dBi, the limit of the peak power was decreased by the amount of the exceedance.

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

31

TEST REPORT REFERENCE: F092137E1

5.6 BAND-EDGE COMPLIANCE

5.6.1 METHOD OF MEASUREMENT (BAND-EDGE COMPLIANCE (RADIATED))

The same test set-up as used for the final radiated emission measurement shall be used (refer also subclause 5.8.1 of this test report). The measurements shall be carried out with using a resolution bandwidth of 100 kHz.

The following spectrum analyser settings shall be used:

- Span: Wide enough to capture the peak level of the emission on the channel closest to the band-edge, as well as any modulation products, which fall outside the assigned frequency band.
- Resolution bandwidth: 100 kHz.
- Video bandwidth: $\geq$ the resolution bandwidth.
- Sweep: Auto.
- Detector function: Peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 20 dB below the first line (or the peak marker). The frequency line shall be set on the edge of the assigned frequency band. Set the second marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is higher than that at the band-edge. This frequency shall be measured with the EMI receiver as described in subclause 5.8.1 of this test report, but 100 kHz resolution bandwidth shall be used.

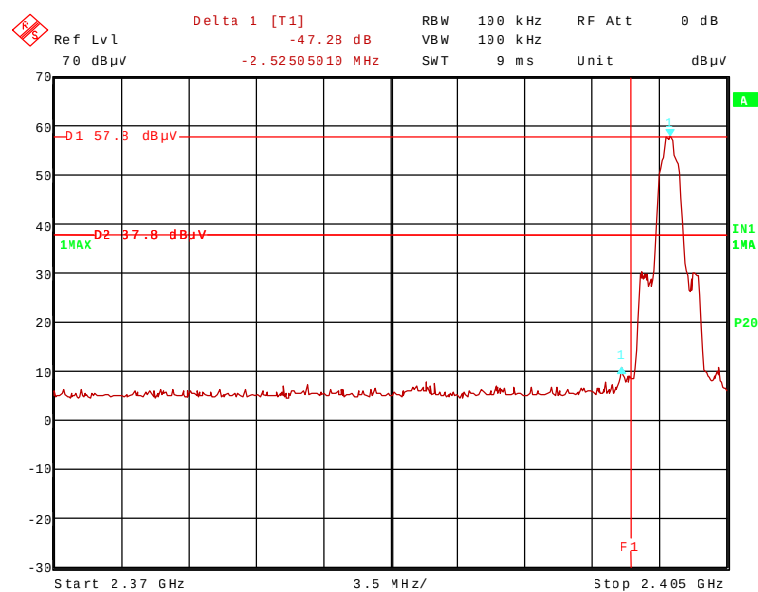
The measurement will be performed at the upper end of the assigned frequency band and with hopping on and off.

TEST REPORT REFERENCE: F092137E1

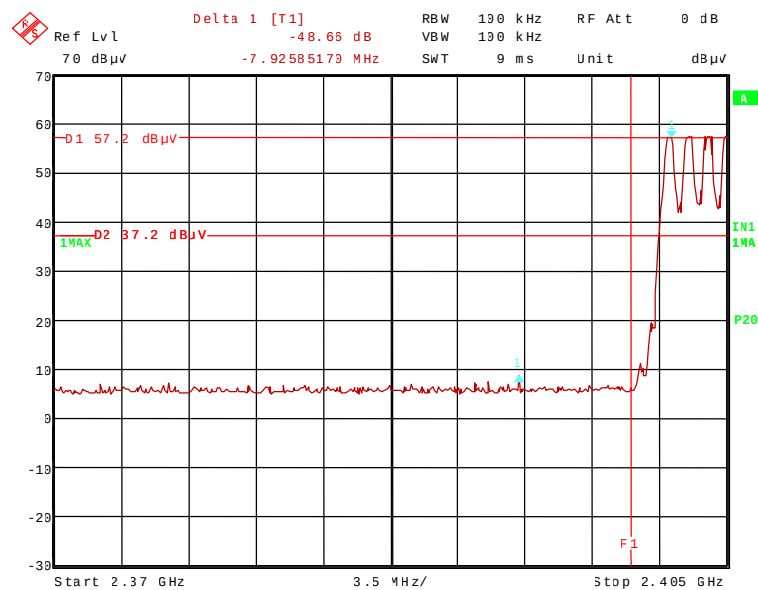
5.6.2 TEST RESULT (BAND-EDGE COMPLIANCE (RADIATED)) WITH INTERNAL ANTENNA

Ambient temperature	21 °C	Relative humidity	60 %
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92137_45.wmf: Radiated band-edge compliance, lower band edge, hopping off (operation mode 1):

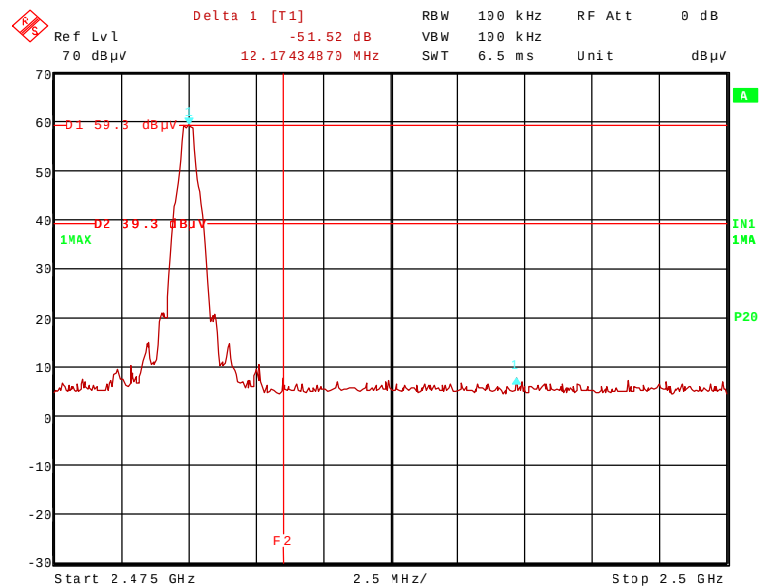


92137_48.wmf: Radiated band-edge compliance, lower band edge, hopping on (operation mode 4):

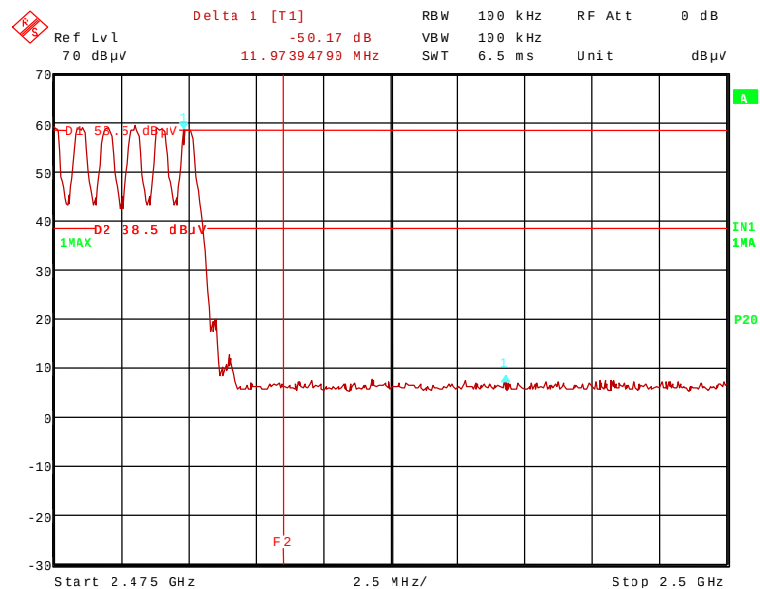


TEST REPORT REFERENCE: F092137E1

92137_46.wmf: Radiated band-edge compliance, upper band edge, hopping off (operation mode 3):



92137_47.wmf: Radiated band-edge compliance, upper band edge, hopping on (operation mode 4):



TEST REPORT REFERENCE: F092137E1

The plots on the page before are showing the radiated band-edge compliance for the upper band-edge, with and without hopping. The display line 1 (D1) in these plots represents the highest level within the assigned frequency band. The display line 2 (D2) represents the 20 dB offset to this highest level and shows the compliance with FCC 47 CFR Part 15.247 (d). The frequency line 1 (F1) shows the edge of the assigned frequency.

Band-edge compliance (lower band edge. hopping disenabled)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	91.0	-	-	58.5	28.8	0.0	3.7	150	Vert.	-
2.3996	43.7	74.0	30.3	11.2	28.8	0.0	3.7	150	Vert.	No
Result measured with the average detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	88.0	-	-	55.5	28.8	0.0	3.7	150	Vert.	-
2.3996	40.7	68.0	27.3	8.2	28.8	0.0	3.7	150	Vert.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (lower band edge. hopping enabled)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	91.0	-	-	58.5	28.8	0.0	3.7	150	Vert.	-
2.3943	42.2	74.0	31.8	9.8	28.7	0.0	3.7	150	Vert.	No
Result measured with the average detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	88.0	-	-	55.5	28.8	0.0	3.7	150	Vert.	-
2.3943	39.2	68.0	28.8	6.8	28.7	0.0	3.7	150	Vert.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

TEST REPORT REFERENCE: F092137E1

Band-edge compliance (upper band edge. hopping disenabled)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	92.6	-	-	59.8	29.0	0.0	3.8	150	Vert.	-
2.4923	41.4	74.0	32.6	8.6	29.0	0.0	3.8	150	Vert.	Yes
Result measured with the average detector:										
Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	89.7	-	-	56.9	29.0	0.0	3.8	150	Vert.	-
2.4923	38.5	54.0	15.5	5.7	29.0	0.0	3.8	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (upper band edge. hopping enabled)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	92.6	-	-	59.8	29.0	0.0	3.8	150	Vert.	-
2.4919	42.4	74.0	31.6	9.6	29.0	0.0	3.8	150	Vert.	Yes
Result measured with the average detector:										
Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	89.7	-	-	56.9	29.0	0.0	3.8	150	Vert.	-
2.4919	39.5	54.0	14.5	6.7	29.0	0.0	3.8	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

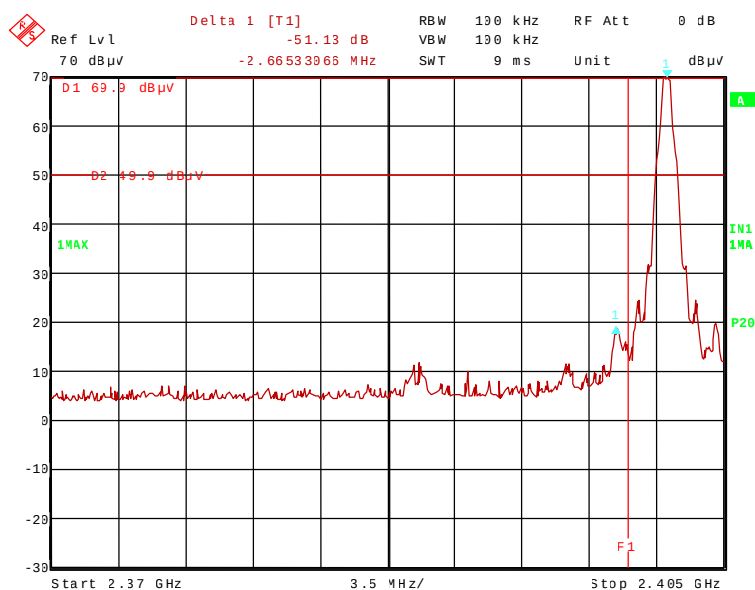
TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 34, 36, 44

TEST REPORT REFERENCE: F092137E1

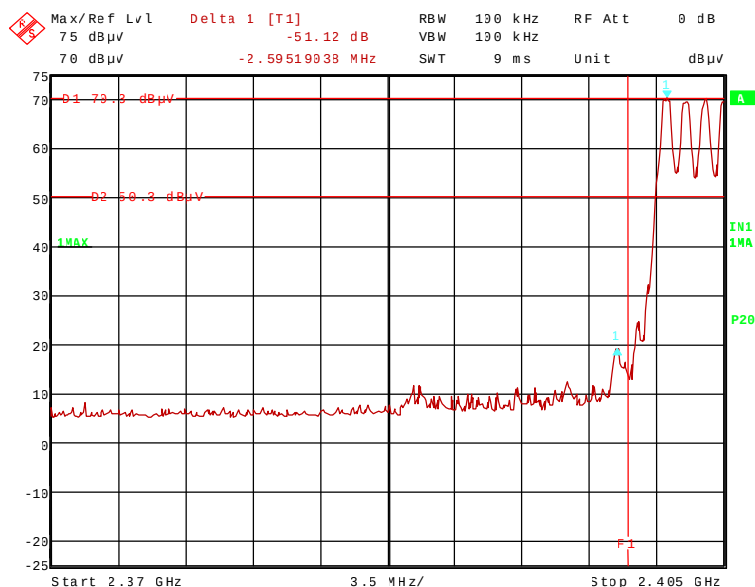
5.6.3 TEST RESULT (BAND-EDGE COMPLIANCE (RADIATED)) WITH EXTERNAL MONOPOLE ANTENNA

Ambient temperature	21 °C	Relative humidity	60 %
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92137_12.wmf: Radiated band-edge compliance, lower band edge, hopping off (operation mode 1):

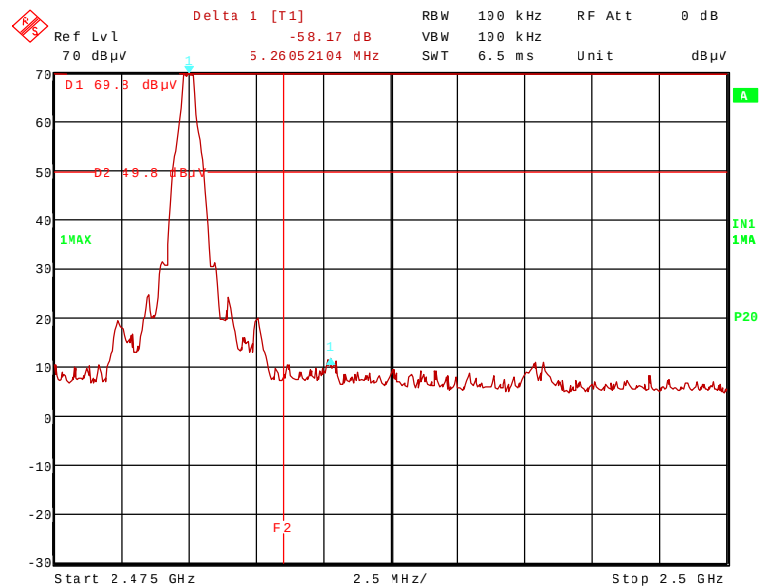


92137_13.wmf: Radiated band-edge compliance, lower band edge, hopping on (operation mode 4):

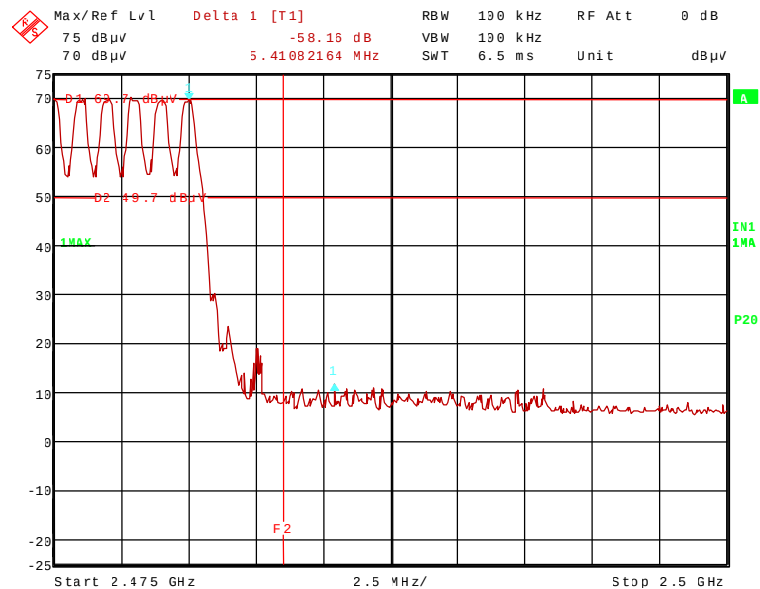


TEST REPORT REFERENCE: F092137E1

92137_11.wmf: Radiated band-edge compliance, upper band edge, hopping off (operation mode 3):



92137_14.wmf: Radiated band-edge compliance, upper band edge, hopping on (operation mode 4):



TEST REPORT REFERENCE: F092137E1

The plots on the page before are showing the radiated band-edge compliance for the upper band-edge, with and without hopping. The display line 1 (D1) in these plots represents the highest level within the assigned frequency band. The display line 2 (D2) represents the 20 dB offset to this highest level and shows the compliance with FCC 47 CFR Part 15.247 (d). The frequency line 1 (F1) shows the edge of the assigned frequency.

Band-edge compliance (lower band edge, hopping disenabled)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	103.0	-	-	70.5	28.8	0.0	3.7	150	Vert.	-
2.3996	51.9	83.0	31.1	19.4	28.8	0.0	3.7	150	Vert.	No
Result measured with the average detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	100.1	-	-	67.6	28.8	0.0	3.7	150	Vert.	-
2.3996	49.0	80.1	31.1	16.5	28.8	0.0	3.7	150	Vert.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (lower band edge, hopping enabled)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	103.0	-	-	70.5	28.8	0.0	3.7	150	Vert.	-
2.3996	51.9	83.0	31.1	19.4	28.8	0.0	3.7	150	Vert.	No
Result measured with the average detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	100.1	-	-	67.6	28.8	0.0	3.7	150	Vert.	-
2.3996	49.0	80.1	31.1	16.5	28.8	0.0	3.7	150	Vert.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

TEST REPORT REFERENCE: F092137E1

Band-edge compliance (upper band edge, hopping disenabled)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	103.3	-	-	70.5	29.0	0.0	3.8	150	Vert.	-
2.4853	45.1	74.0	28.9	12.3	29.0	0.0	3.8	150	Vert.	Yes
Result measured with the average detector:										
Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	100.5	-	-	67.7	29.0	0.0	3.8	150	Vert.	-
2.4853	42.3	54.0	11.7	9.5	29.0	0.0	3.8	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (upper band edge, hopping enabled)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	103.3	-	-	70.5	29.0	0.0	3.8	150	Vert.	-
2.4853	45.1	74.0	28.9	12.3	29.0	0.0	3.8	150	Vert.	Yes
Result measured with the average detector:										
Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	100.5	-	-	67.7	29.0	0.0	3.8	150	Vert.	-
2.4853	42.3	54.0	11.7	9.5	29.0	0.0	3.8	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

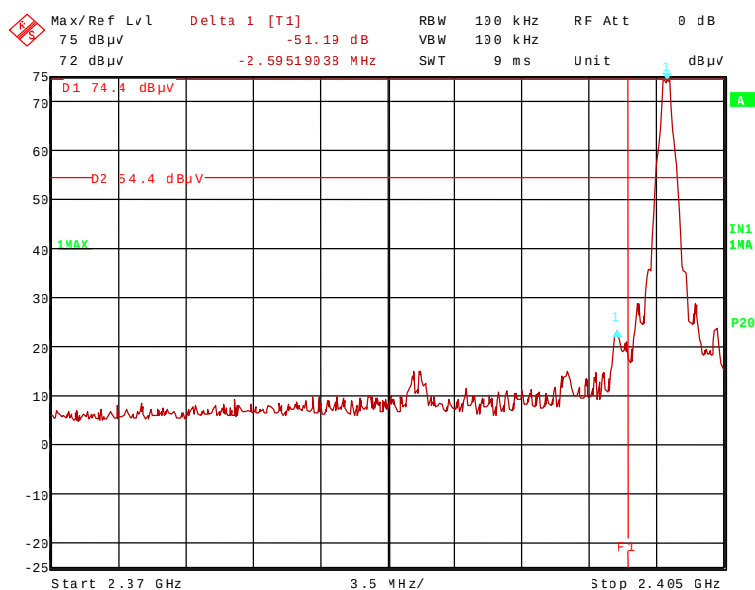
TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 34, 36, 44

TEST REPORT REFERENCE: F092137E1

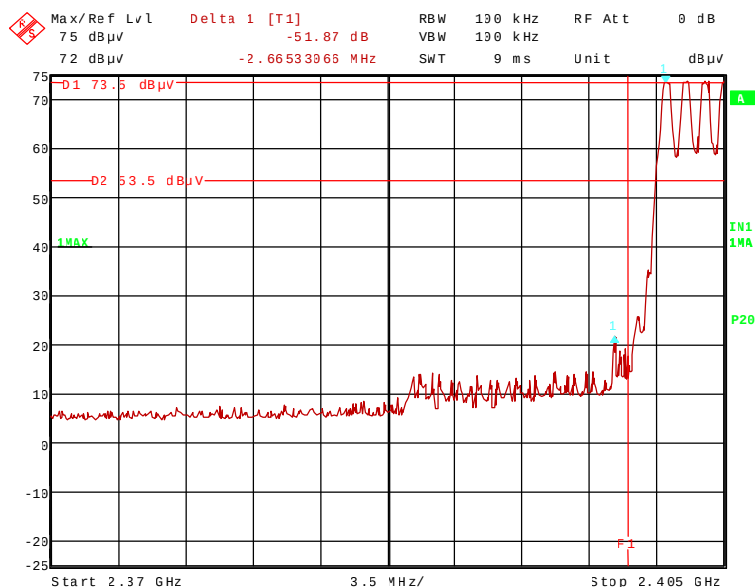
5.6.4 TEST RESULT (BAND-EDGE COMPLIANCE (RADIATED)) WITH EXTERNAL PATCH ANTENNA

Ambient temperature	21 °C	Relative humidity	60 %
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92137_30.wmf: Radiated band-edge compliance, lower band edge, hopping off (operation mode 1):

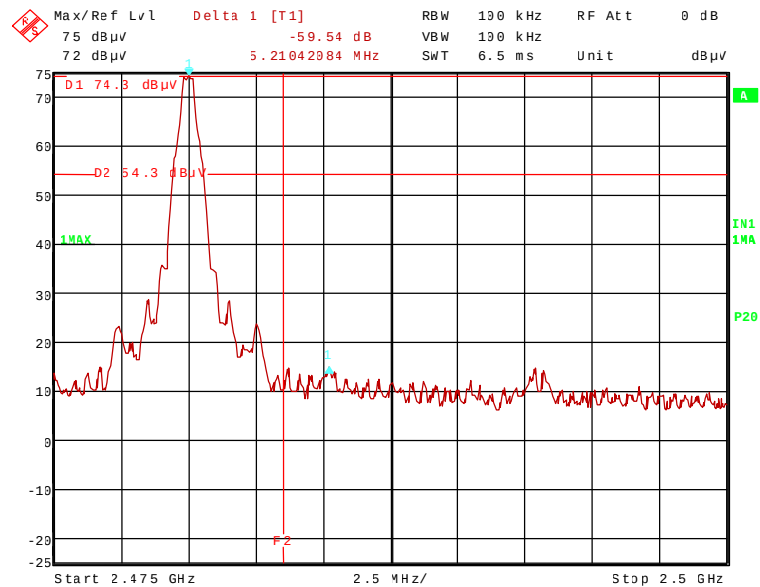


92137_29.wmf: Radiated band-edge compliance, lower band edge, hopping on (operation mode 4):

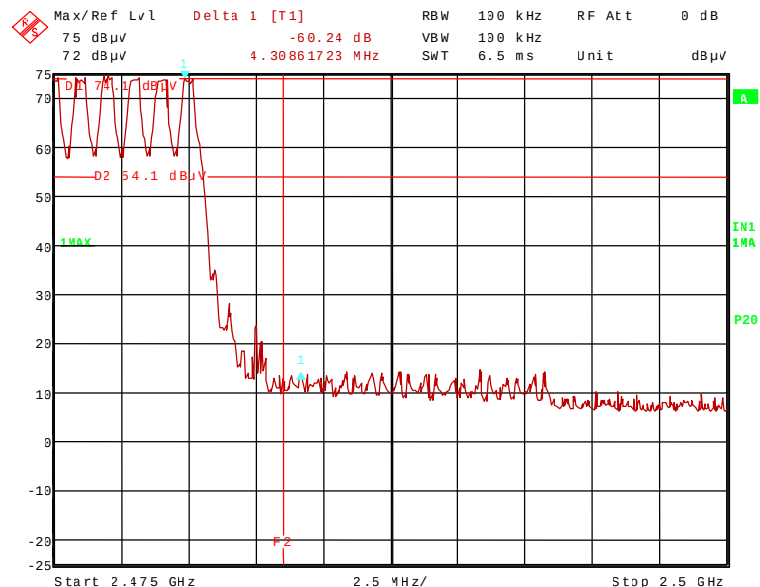


TEST REPORT REFERENCE: F092137E1

92137_27.wmf: Radiated band-edge compliance, upper band edge, hopping off (operation mode 3):



92137_28.wmf: Radiated band-edge compliance, upper band edge, hopping on (operation mode 4):



TEST REPORT REFERENCE: F092137E1

The plots on the page before are showing the radiated band-edge compliance for the upper band-edge, with and without hopping. The display line 1 (D1) in these plots represents the highest level within the assigned frequency band. The display line 2 (D2) represents the 20 dB offset to this highest level and shows the compliance with FCC 47 CFR Part 15.247 (d). The frequency line 1 (F1) shows the edge of the assigned frequency.

Band-edge compliance (lower band edge. hopping disenabled)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	106.9	-	-	74.4	28.8	0.0	3.7	150	Vert.	-
2.3994	55.7	86.9	31.2	23.2	28.8	0.0	3.7	150	Vert.	No
Result measured with the average detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	103.9	-	-	71.4	28.8	0.0	3.7	150	Vert.	-
2.3994	52.7	83.9	31.2	20.2	28.8	0.0	3.7	150	Vert.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (lower band edge. hopping enabled)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	106.9	-	-	74.4	28.8	0.0	3.7	150	Vert.	-
2.3994	55.1	86.9	31.8	22.6	28.8	0.0	3.7	150	Vert.	No
Result measured with the average detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	103.9	-	-	71.4	28.8	0.0	3.7	150	Vert.	-
2.3994	52.1	83.9	31.8	19.6	28.8	0.0	3.7	150	Vert.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

TEST REPORT REFERENCE: F092137E1

Band-edge compliance (upper band edge. hopping disenabled)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	107.0	-	-	74.2	29.0	0.0	3.8	150	Vert.	-
2.4852	47.5	74.0	26.5	14.7	29.0	0.0	3.8	150	Vert.	Yes
Result measured with the average detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	104.0	-	-	71.2	29.0	0.0	3.8	150	Vert.	-
2.4852	44.5	54.0	9.5	11.7	29.0	0.0	3.8	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (upper band edge. hopping enabled)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	107.0	-	-	74.2	29.0	0.0	3.8	150	Vert.	-
2.4842	46.8	74.0	27.2	14.0	29.0	0.0	3.8	150	Vert.	Yes
Result measured with the average detector:										
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	104.0	-	-	71.2	29.0	0.0	3.8	150	Vert.	-
2.4842	43.8	54.0	10.2	11.0	29.0	0.0	3.8	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 34, 36, 44

TEST REPORT REFERENCE: F092137E1

5.7 RADIATED EMISSIONS

5.7.1 METHOD OF MEASUREMENT (RADIATED EMISSIONS)

The radiated emission measurement is subdivided into four stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 30 MHz to 1 GHz.
- A final measurement carried out on an open area test site with reflecting ground plane and various antenna height in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a variable antenna distance and height in the frequency range 1 GHz to 110 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 110 GHz.

All measurements will be carried out with the EUT working on the middle of the assigned frequency band.

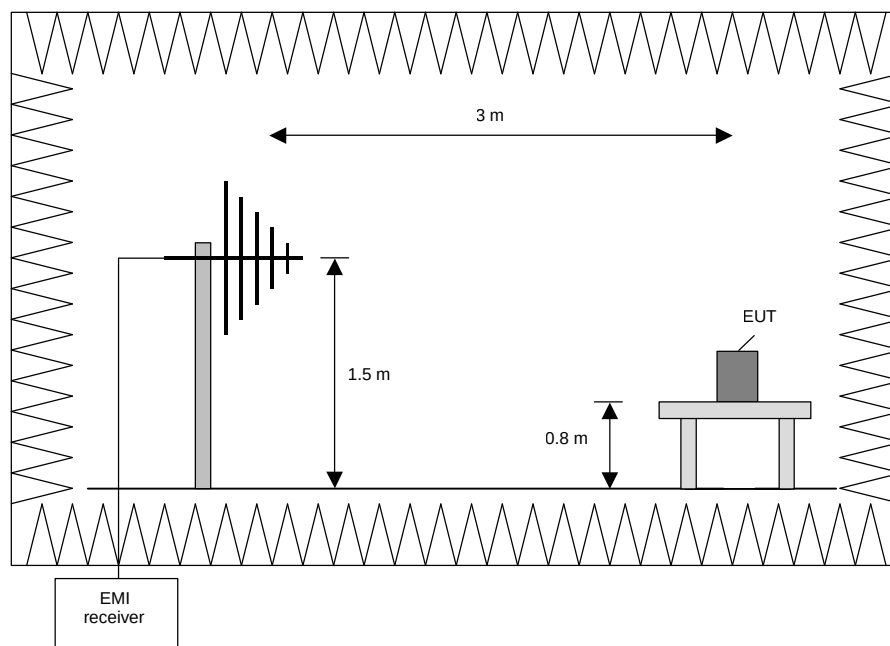
Preliminary measurement (30 MHz to 1 GHz)

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 230 MHz	100 kHz
230 MHz to 1 GHz	100 kHz



TEST REPORT REFERENCE: F092137E1

Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.

The following procedure will be used:

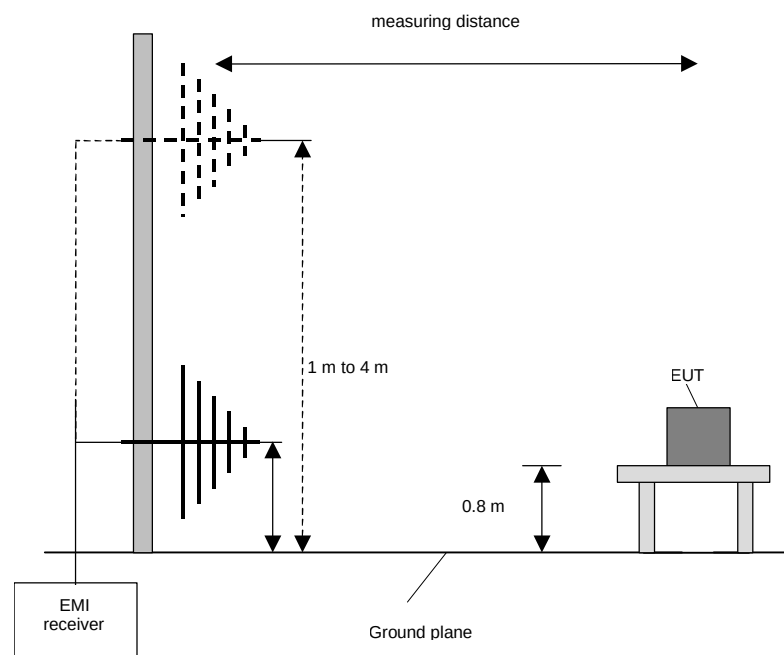
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6. Repeat 1) to 4) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).
7. Repeat 1) to 5) with the vertical polarisation of the measuring antenna.

Final measurement (30 MHz to 1 GHz)

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



TEST REPORT REFERENCE: F092137E1

Procedure final measurement:

The following procedure will be used:

- 1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.
- 2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
- 3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.
- 4) Repeat 1) to 3) for the other orthogonal antenna polarization.
- 5) Move the antenna and the turntable to the position where the maximum value is detected.
- 6) Measure while moving the antenna slowly +/- 1 m.
- 7) Set the antenna to the position where the maximum value is found.
- 8) Measure while moving the turntable +/- 45 °.
- 9) Set the turntable to the azimuth where the maximum value is found.
- 10) Measure with Final detector (QP and AV) and note the value.
- 11) Repeat 5) to 10) for each frequency.
- 12) Repeat 1) to 11) for each orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).

Preliminary and final measurement (1 GHz to 110 GHz)

This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].

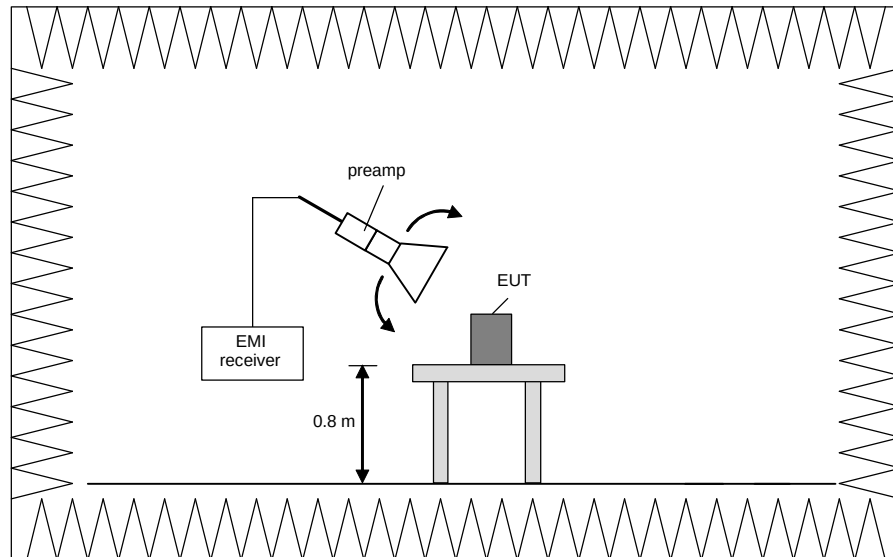
Preliminary measurement (1 GHz to 110 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyser set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna, the antenna close to the EUT and while moving the antenna over all sides of the EUT. With the spectrum analyser in CLEAR / WRITE mode the cone of the emission should be found and than the measuring distance will be set to 3 m with the receiving antenna moving in this cone of emission. At this position the final measurement will be carried out.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	100 kHz
4 GHz to 12 GHz	100 kHz
12 GHz to 18 GHz	100 kHz
18 GHz to 26.5 GHz	100 kHz
26.5 GHz to 40 GHz	100 kHz
40 GHz to 60 GHz	100 kHz
50 GHz to 75 GHz	100 kHz
75 GHz to 110 GHz	100 kHz

TEST REPORT REFERENCE: F092137E1



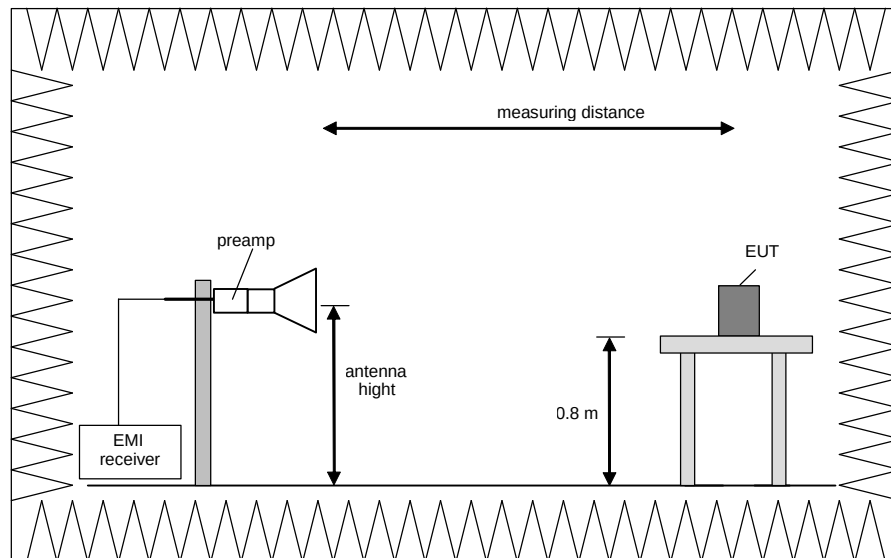
Final measurement (1 GHz to 110 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 ° in order to have the antenna inside the cone of radiation.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz
40 GHz to 60 GHz	1 MHz
50 GHz to 75 GHz	1 MHz
75 GHz to 110 GHz	1 MHz

TEST REPORT REFERENCE: F092137E1



Procedure of measurement:

The measurements were performed in the frequency range 1 GHz to 4 GHz, 4 GHz to 12 GHz, 12 GHz to 18 GHz, 18 GHz to 26.5 GHz, 26.5 GHz to 40 GHz, 40 GHz to 60 GHz, 60 GHz to 75 GHz and 75 GHz to 110 GHz.

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and move the antenna over all sides of the EUT (if necessary move the EUT to another orthogonal axis).
- 2) Change the antenna polarisation and repeat 1) with vertical polarisation.
- 3) Make a hardcopy of the spectrum.
- 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 5) Change the analyser mode to Clear / Write and found the cone of emission.
- 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3 m and the antenna will be still inside the cone of emission.
- 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarisation and azimuth and the peak and average detector, which causes the maximum emission.
- 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.

Step 1) to 6) are defined as preliminary measurement.

TEST REPORT REFERENCE: F092137E1

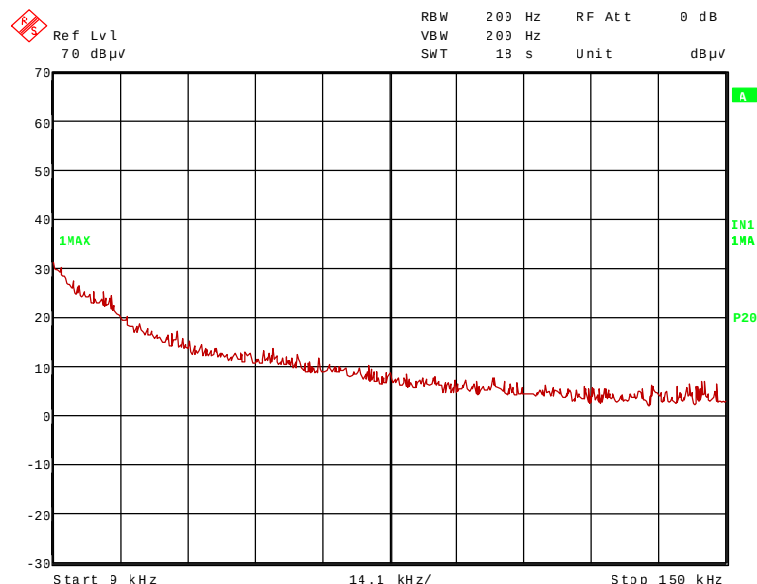
5.7.2 TEST RESULTS (RADIATED EMISSIONS)

5.7.2.1 PRELIMINARY MEASUREMENT (9 kHz to 1 GHz) WITH EXTERNAL PATCH ANTENNA

Ambient temperature	21 °C	Relative humidity	55 %
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Position of EUT:	The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
Cable guide:	The cable of the EUT is running vertically to the false floor. For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.
Test record:	All results are shown in the following.
Supply voltage:	During all measurements the EUT was supplied with 5.0 V DC via the carrier board.
Remark:	As pre-tests have shown, the emissions in the frequency range 9 kHz to 1 GHz are not depending on the transmitter operation mode. The largest emissions in this frequency range were emitted if an external antenna is used. Therefore the emissions in this frequency range were measured only with the transmitter operates in operation mode 2 and the external patch Huber+Suhner SPA 2400/75/8/0/V is used, because this antenna has the highest gain in single polarisation from the antennas in question.

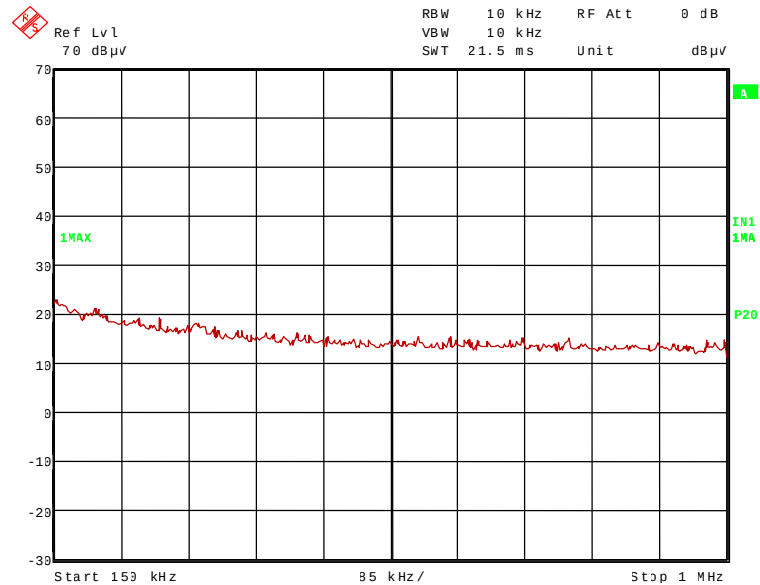
92137_59.wmf: Spurious emissions from 9 kHz to 150 kHz (operation mode 2):



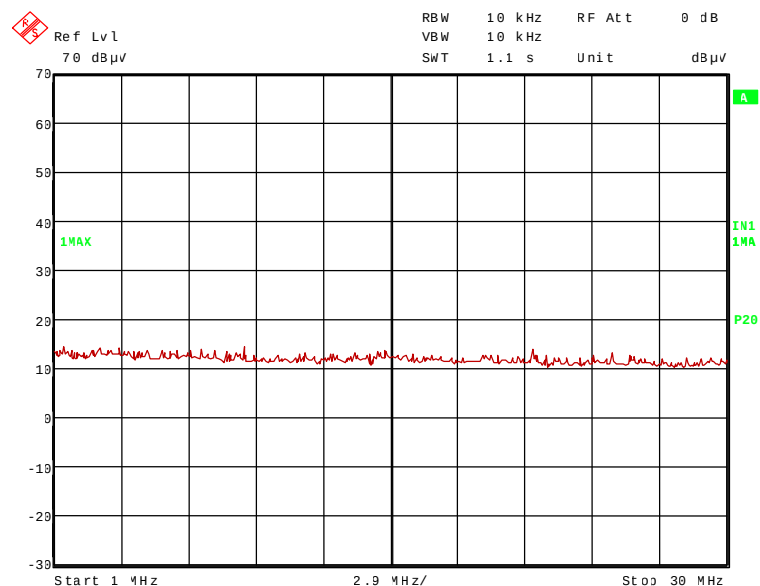
TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 35, 43, 55

TEST REPORT REFERENCE: F092137E1

92137_60.wmf: Spurious emissions from 150 kHz to 1 MHz (operation mode 2):



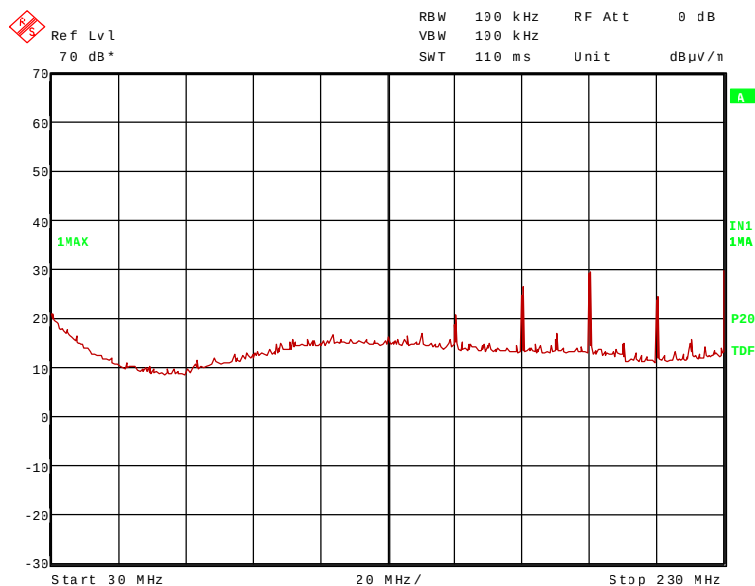
92137_61.wmf: Spurious emissions from 1 MHz to 30 MHz (operation mode 2):



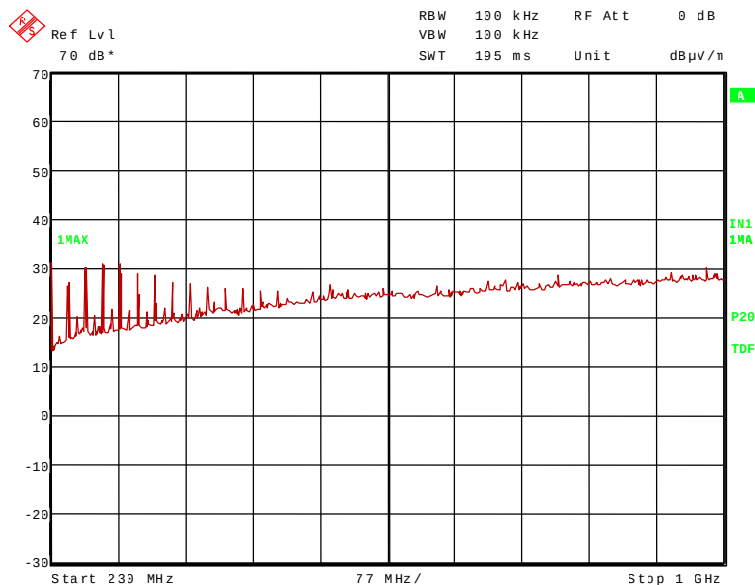
No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the outdoor test site.

TEST REPORT REFERENCE: F092137E1

92137_54.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 2):



92137_53.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 2):



The following frequencies were found during the preliminary radiated emission test:

190.000 MHz, 210.000 MHz, 230.000 MHz, 290.000 MHz, 310.000 MHz and 550.000 MHz.

The following frequencies were found inside the restricted bands during the radiated emission test:

170.000 MHz, 270.000 MHz and 410.000 MHz.

These frequencies have to be measured on the open area test site. The result is presented in the following.

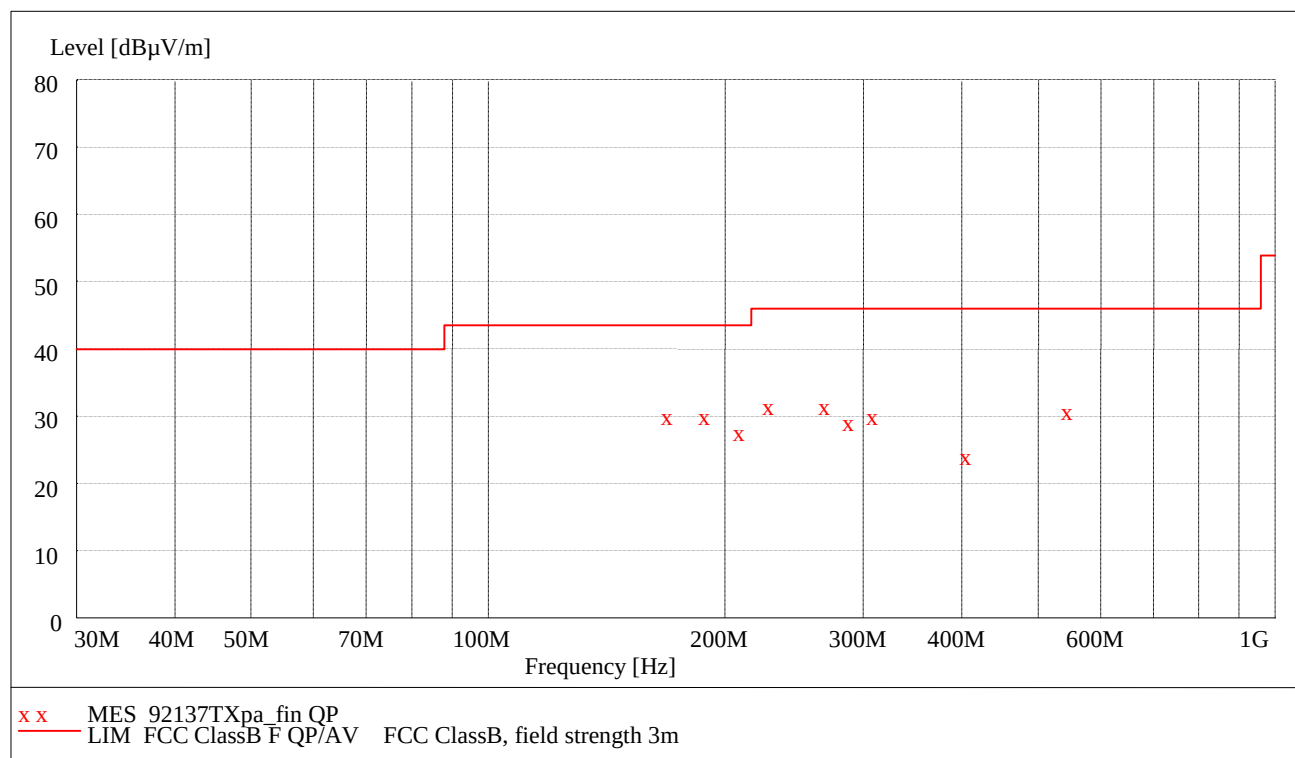
TEST REPORT REFERENCE: F092137E1

5.7.2.2 FINAL RADIATED EMISSION TEST (30 MHz to 1 GHz) WITH EXTERNAL PATCH ANTENNA

Ambient temperature	21 °C	Relative humidity	55 %
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- Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide: The cable of the EUT is running vertically to the false floor. For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.
- Test record: All results are shown in the following.
- Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.
- Test results: The test results were calculated with the following formula:
- $$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]}$$

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with an x are the measured results of the standard final measurement on the open area test site.



Data record name: 92137TXpa

TEST REPORT REFERENCE: F092137E1

The results of the standard subsequent measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

The measurement time with the quasi-peak measuring detector is 1 second.

Result measured with the quasipeak detector:

(This value is marked in the diagram by an x)

Spurious emissions outside restricted bands									
Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
190.000	30.3	43.5	13.2	19.8	9.0	1.5	100.0	7.0	Vert.
210.000	28.3	43.5	15.2	17.4	9.3	1.6	155.0	27.0	Hor.
230.000	31.9	46.0	14.1	20.0	10.3	1.6	125.0	245.0	Hor.
290.000	29.7	46.0	16.3	14.8	13.0	1.9	115.0	69.0	Hor.
310.000	30.3	46.0	15.7	15.5	12.9	1.9	103.0	225.0	Hor.
550.000	31.1	46.0	14.9	8.8	19.6	2.7	354.0	134.0	Vert.
Spurious emissions in restricted bands									
Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
170.000	30.3	43.5	13.2	18.8	10.1	1.4	100.0	299.0	Vert.
270.000	32.0	46.0	14.0	17.8	12.3	1.9	103.0	233.0	Hor.
410.000	24.6	46.0	21.4	6.5	15.9	2.2	100.0	270.0	Vert.
Measurement uncertainty				+2.2 dB / -3.6 dB					

The test results were calculated with the following formula:

Result [dBμV/m] = reading [dBμV] + cable loss [dB] + antenna factor [dB/m]

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

14 – 20

TEST REPORT REFERENCE: F092137E1

5.7.2.3 PRELIMINARY MEASUREMENT (1 GHz to 25 GHz) WITH INTERNAL ANTENNA

Ambient temperature	21 °C	Relative humidity	60 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cable of the EUT is running vertically to the false floor. For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

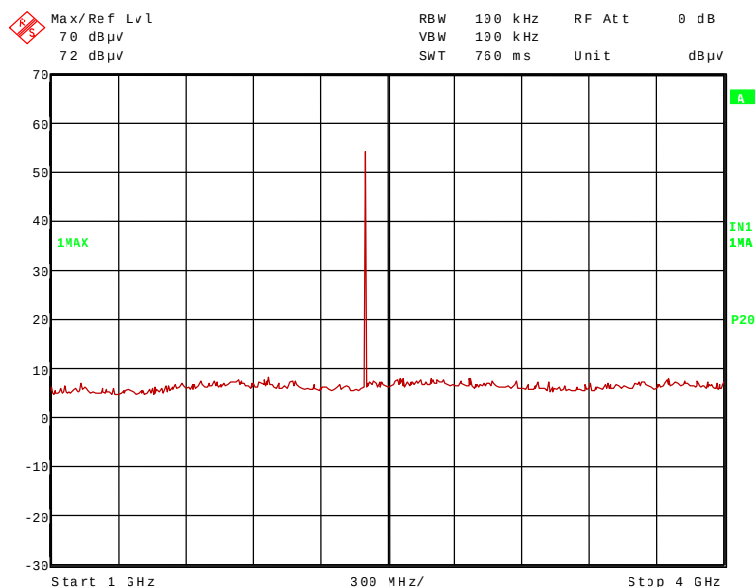
Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Remark: The emission measurement in this frequency range was carried out by using the internal antenna type Fractus FR05-S1-N-0-102, because of this antenna has the highest antenna gain of all internal antennas in question.

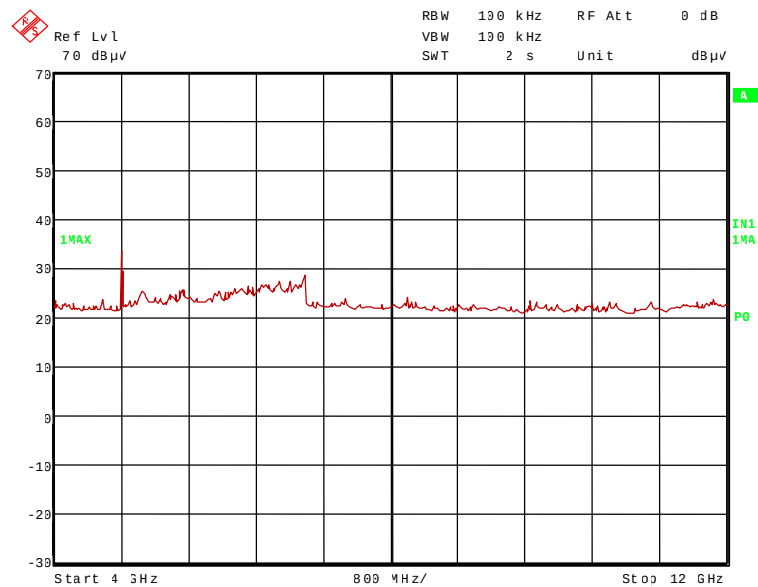
Transmitter operates at the lower end of the assigned frequency band

92137_35.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 1):

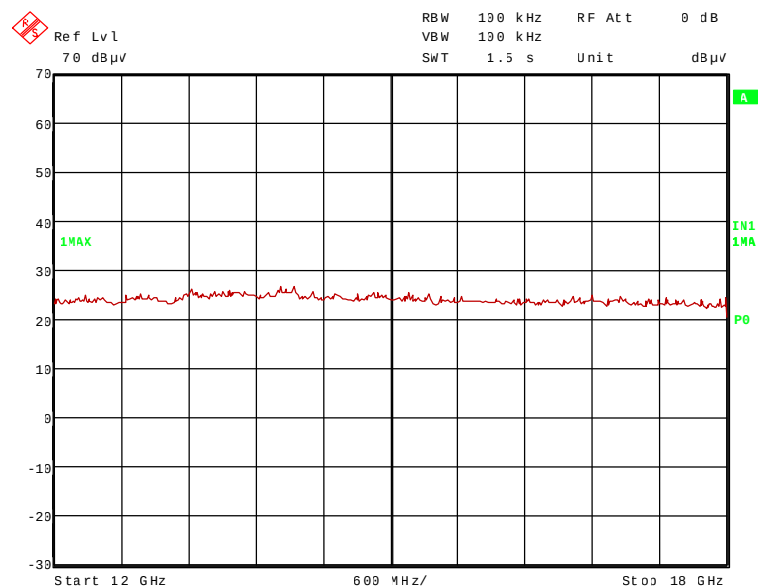


TEST REPORT REFERENCE: F092137E1

92137_40.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 1):

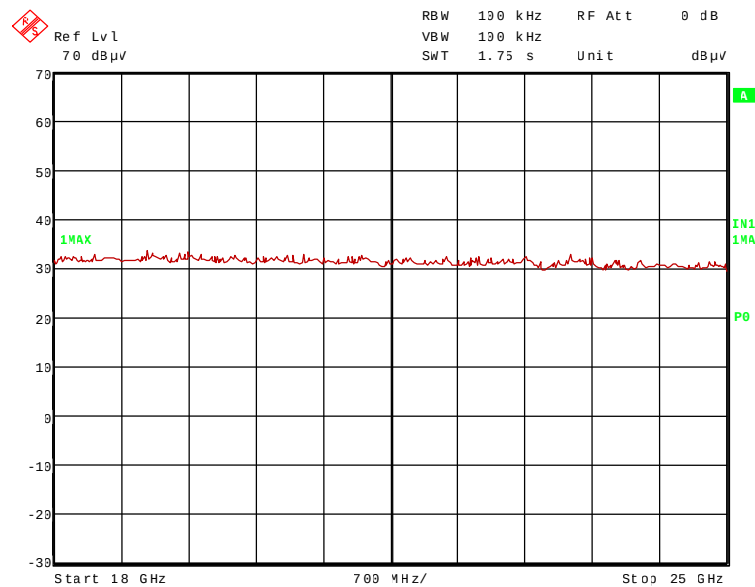


92137_104.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 1):



TEST REPORT REFERENCE: F092137E1

92137_99.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 1):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 4.804 GHz and 4.822 GHz.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.402 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

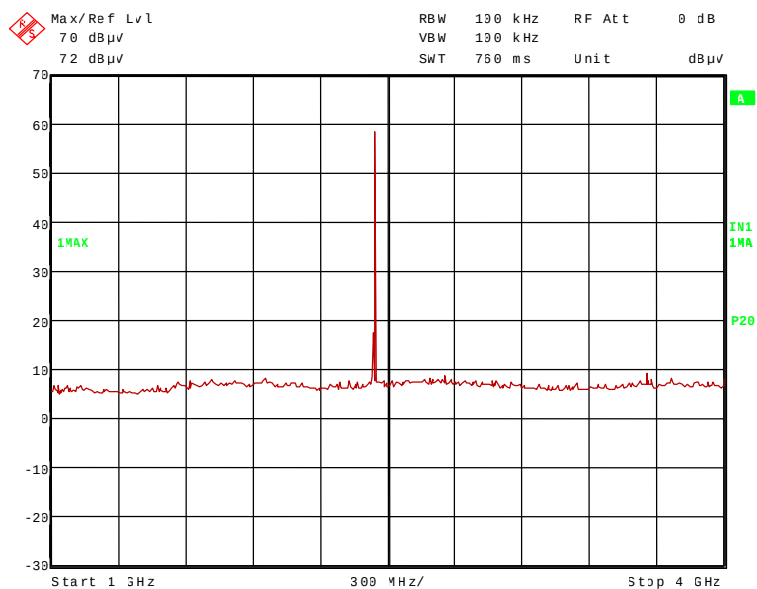
TEST EQUIPMENT USED FOR THE TEST:

29, 31 –34, 36, 37, 39, 44, 46, 49 - 51, 72

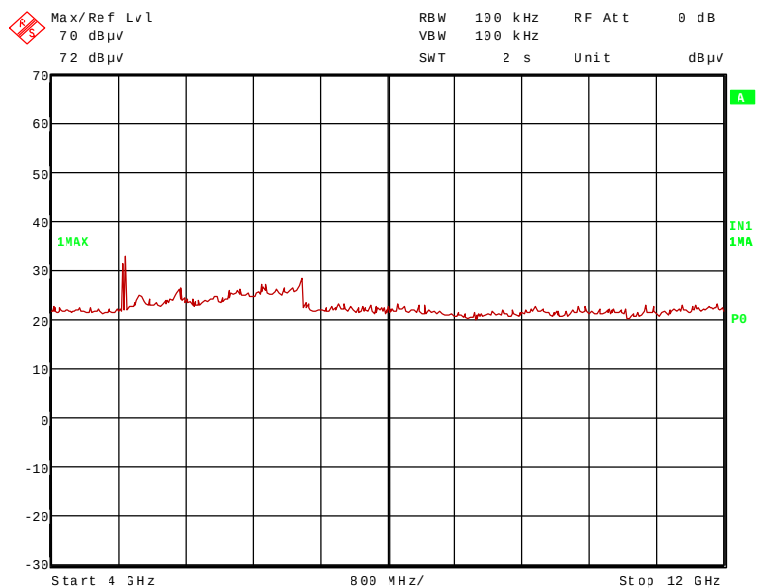
TEST REPORT REFERENCE: F092137E1

Transmitter operates on the middle of the assigned frequency band

92137_36.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 2):

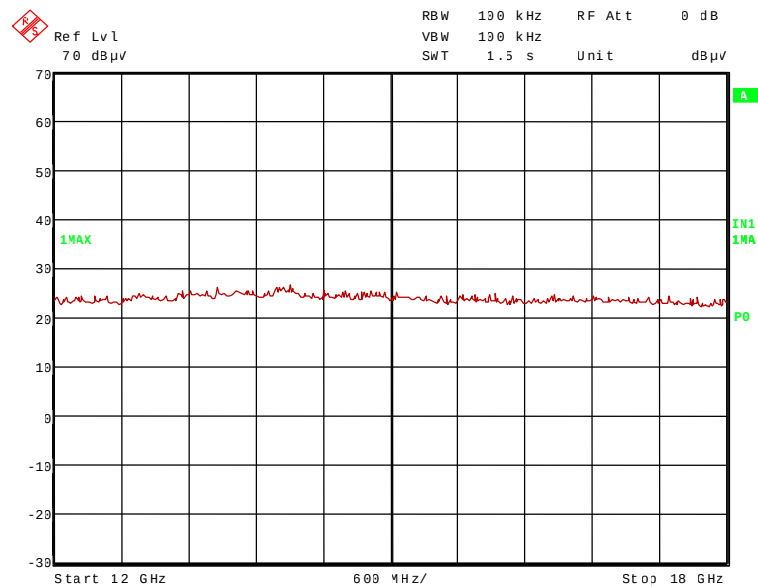


92137_39.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 2):

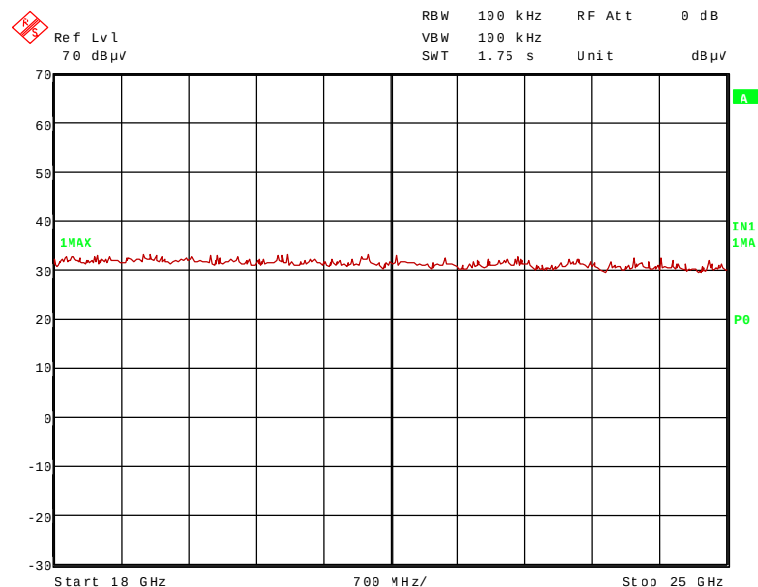


TEST REPORT REFERENCE: F092137E1

92137_103.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 2):



92137_100.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 2):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 4.860 GHz and 4.882 GHz.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

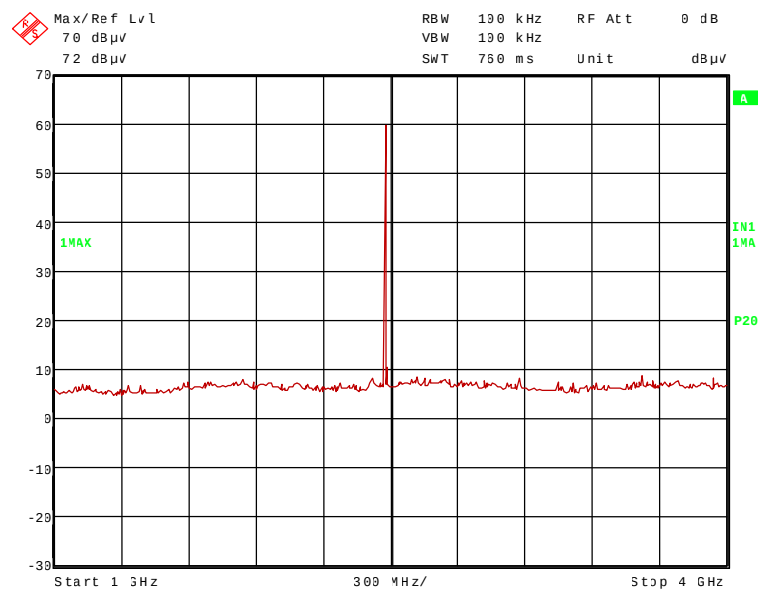
- 2.441 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

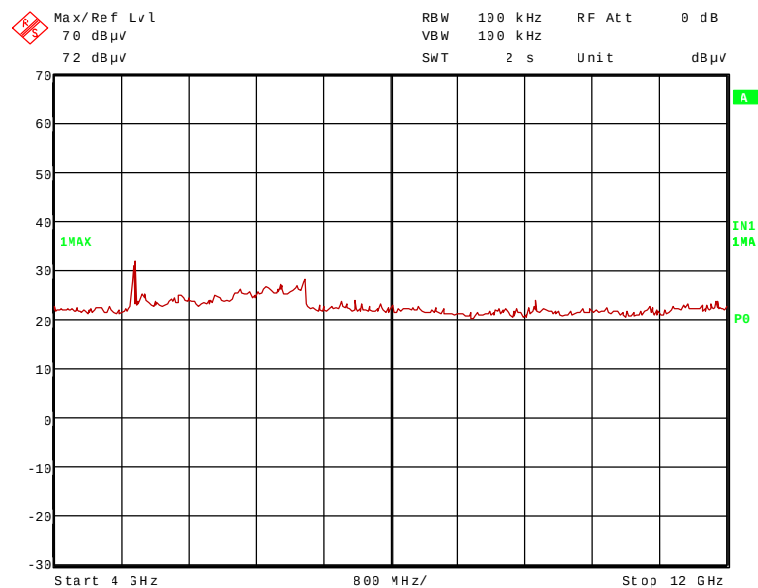
TEST REPORT REFERENCE: F092137E1

Transmitter operates on the upper end of the assigned frequency

92137_37.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 3):

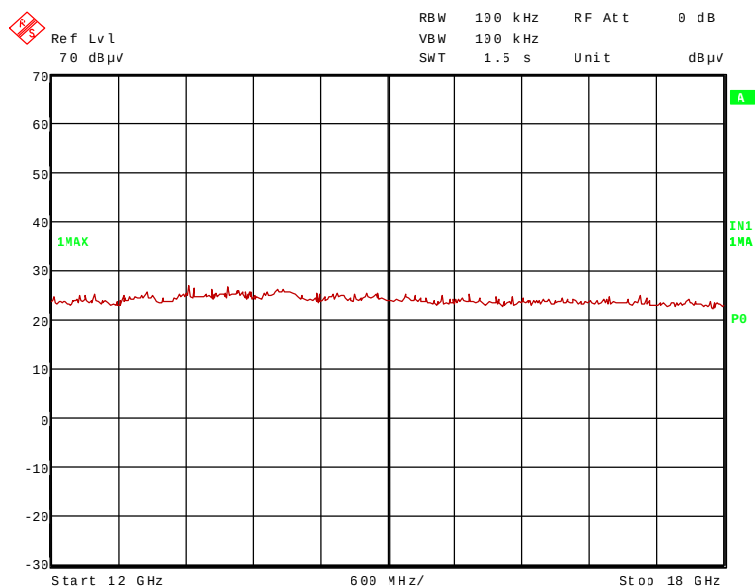


92137_38.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 3):

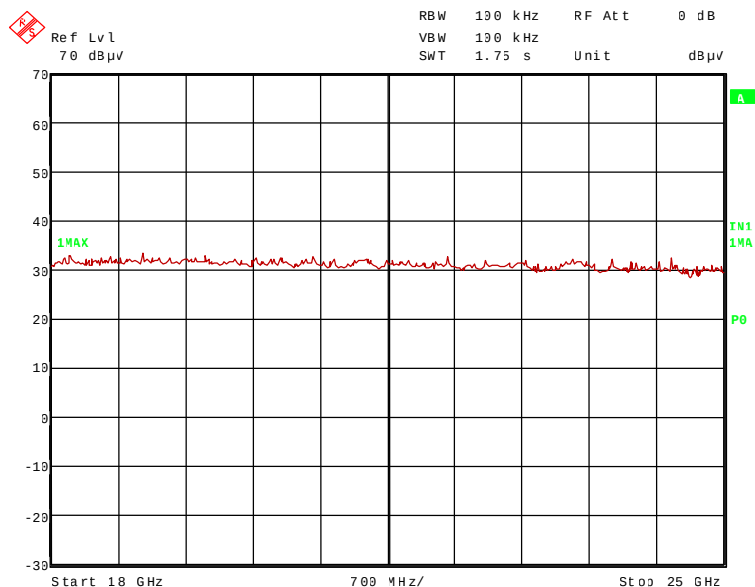


TEST REPORT REFERENCE: F092137E1

92137_102.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 3):



92137_101.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 3):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 4.938 GHz and 4.960 GHz.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.480 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

TEST REPORT REFERENCE: F092137E1

5.7.2.4 FINAL MEASUREMENT (1 GHz to 25 GHz) WITH INTERNAL ANTENNA

Ambient temperature	21 °C	Relative humidity	60 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cable of the EUT is running vertically to the false floor. For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC by the carrier board.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

Remark: The emission measurement in this frequency range was carried out by using the internal antenna type Fractus FR05-S1-N-0-102, because of this antenna has the highest antenna gain of all internal antennas in question.

Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

Result measured with the peak detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	91.0	-	-	58.5	28.8	0.0	3.7	150	Vert.	-
4.804	51.9	74.0	22.1	38.6	33.7	25.7	5.3	150	Hor.	Yes
4.822	49.5	74.0	24.5	36.2	33.7	25.7	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.402	88.0	-	-	55.5	28.8	0.0	3.7	150	Vert.	-
4.804	45.4	54.0	8.6	32.1	33.7	25.7	5.3	150	Hor.	Yes
4.822	31.3	54.0	22.7	18.0	33.7	25.7	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: F092137E1

Transmitter operates at the middle of the assigned frequency band (operation mode 2)

Result measured with the peak detector:

Frequency GHz	Corr. value dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height Cm	Pol.	Restr. Band
2.441	91.0	-	-	58.4	28.9	0.0	3.7	150	Vert.	-
4.860	50.3	74.0	23.7	37.0	33.8	25.7	5.2	150	Hor.	Yes
4.882	52.1	74.0	21.9	38.7	33.8	25.7	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	Corr. value dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.441	88.1	-	-	55.5	28.9	0.0	3.7	150	Vert.	-
4.860	31.5	54.0	22.5	18.2	33.8	25.7	5.2	150	Hor.	Yes
4.882	46.0	54.0	8.0	32.6	33.8	25.7	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: F092137E1

Transmitter operates at the upper end of the assigned frequency band (operation mode 3)

Result measured with the peak detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	92.6	-	-	59.8	29.0	0.0	3.8	150	Vert.	-
4.938	50.1	74.0	23.9	36.4	34.0	25.6	5.3	150	Hor.	Yes
4.960	50.4	74.0	23.6	36.7	34.0	25.6	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	89.7	-	-	56.9	29.0	0.0	3.8	150	Vert.	-
4.938	31.9	54.0	22.1	18.2	34.0	25.6	5.3	150	Hor.	Yes
4.960	43.9	54.0	10.1	30.2	34.0	25.6	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 –34, 36, 37, 39, 44, 46, 49 - 51, 72

TEST REPORT REFERENCE: F092137E1

5.7.2.5 PRELIMINARY MEASUREMENT (1 GHz to 25 GHz) WITH EXTERNAL MONOPOLOL ANTENNA

Ambient temperature	21 °C	Relative humidity	55 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cable of the EUT is running vertically to the false floor. For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

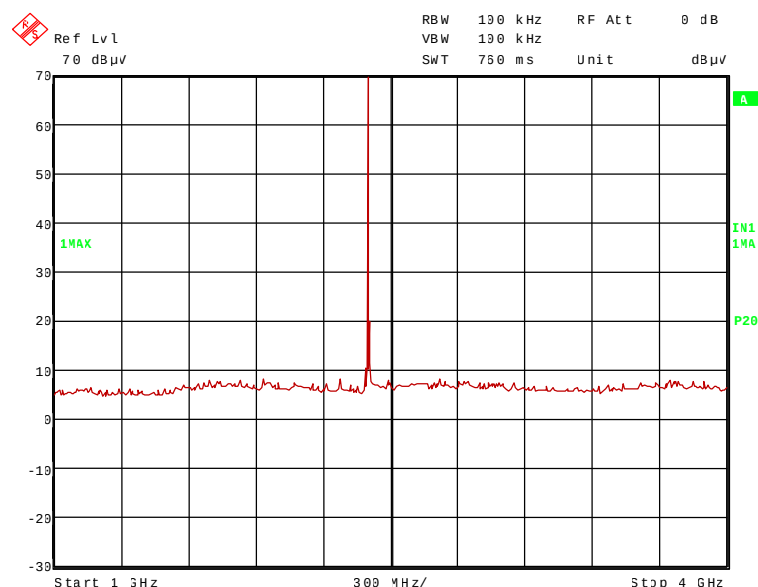
Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Remark: The emission measurement in this frequency range was carried out by using the external monopole antenna type Joymax IH-151, because of this antenna has the highest antenna gain of all external monopole antennas in question.

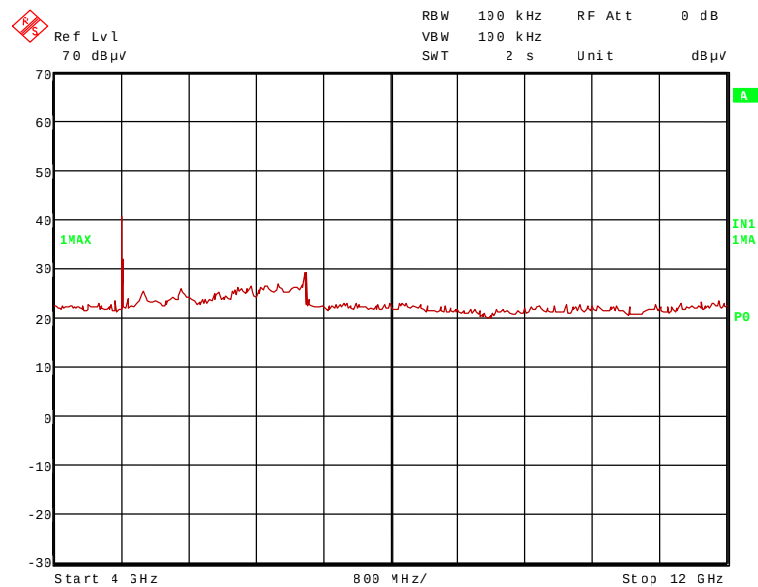
Transmitter operates at the lower end of the assigned frequency band

92137_1.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 1):

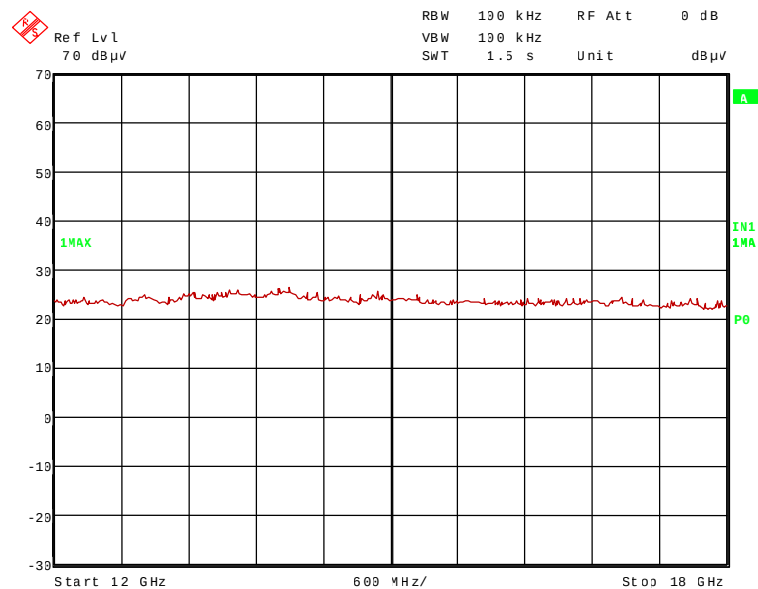


TEST REPORT REFERENCE: F092137E1

92137_4.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 1):

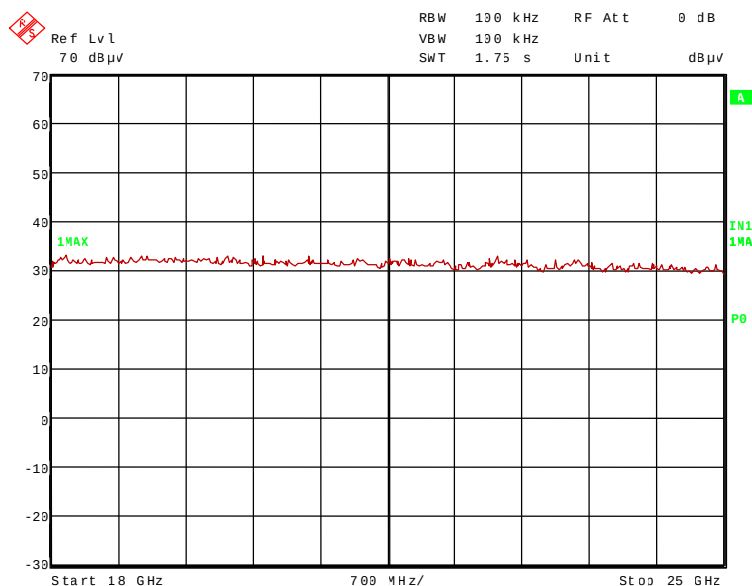


92137_105.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 1):



TEST REPORT REFERENCE: F092137E1

92137_110.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 1):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 2.389 GHz, 4.804 GHz and 4.822 GHz.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.402 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

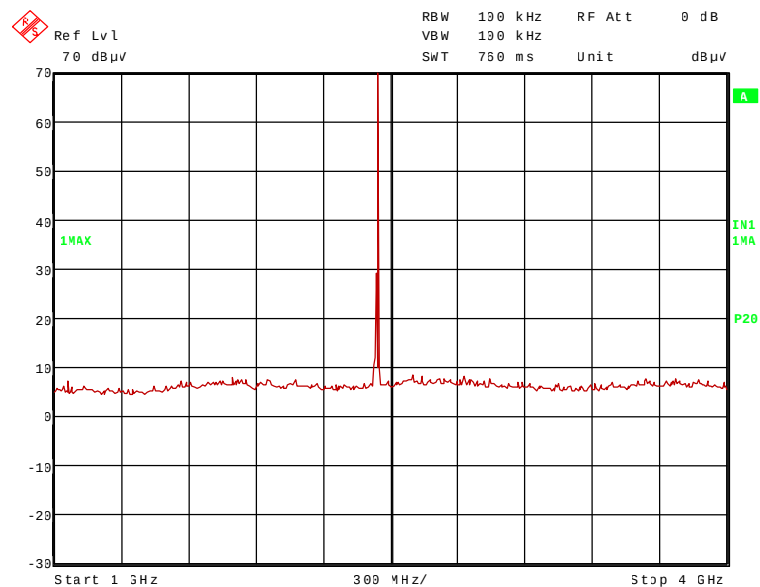
TEST EQUIPMENT USED FOR THE TEST:

29, 31 –34, 36, 37, 39, 44, 46, 49 - 51, 72

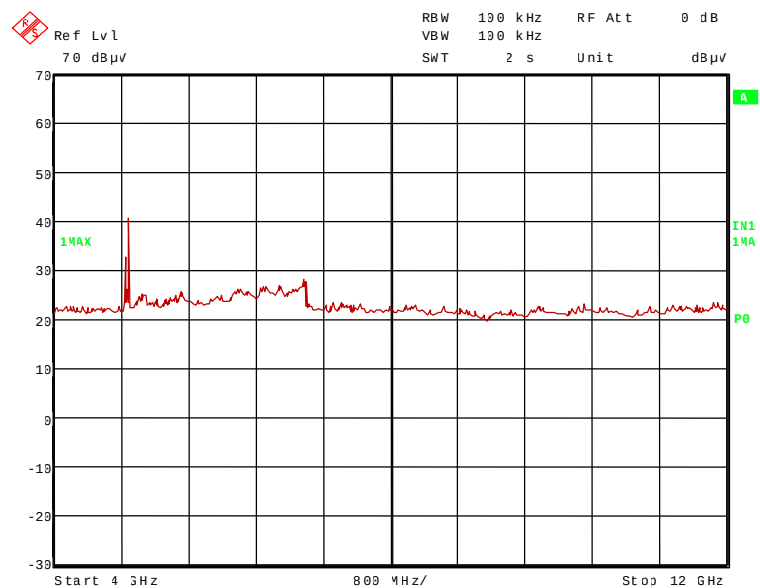
TEST REPORT REFERENCE: F092137E1

Transmitter operates on the middle of the assigned frequency band

92137_2.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 2):

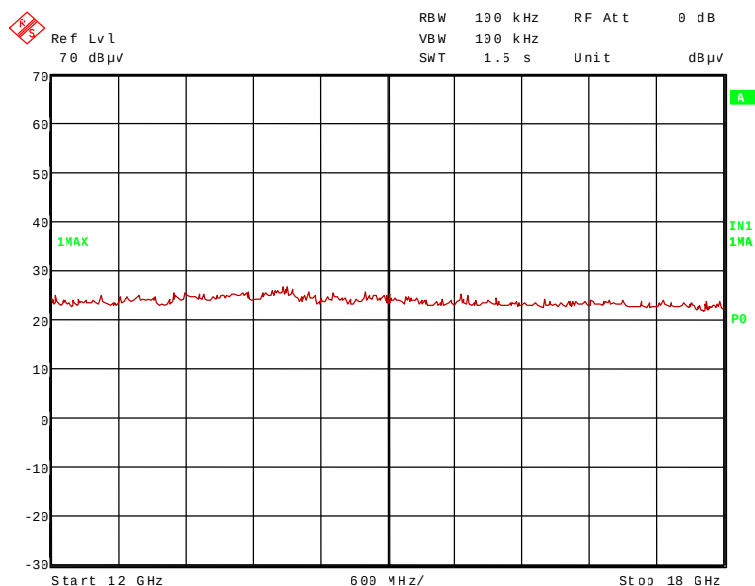


92137_5.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 2):

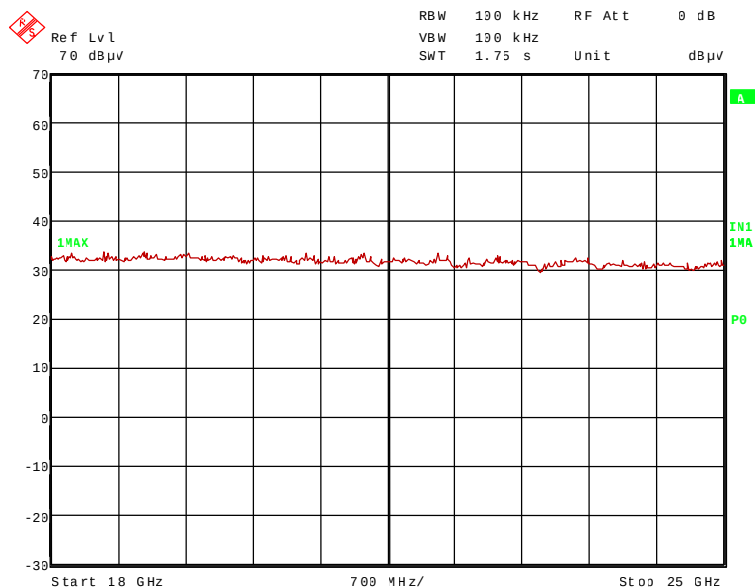


TEST REPORT REFERENCE: F092137E1

92137_106.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 2):



92137_109.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 2):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 4.860 GHz and 4.882 GHz.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

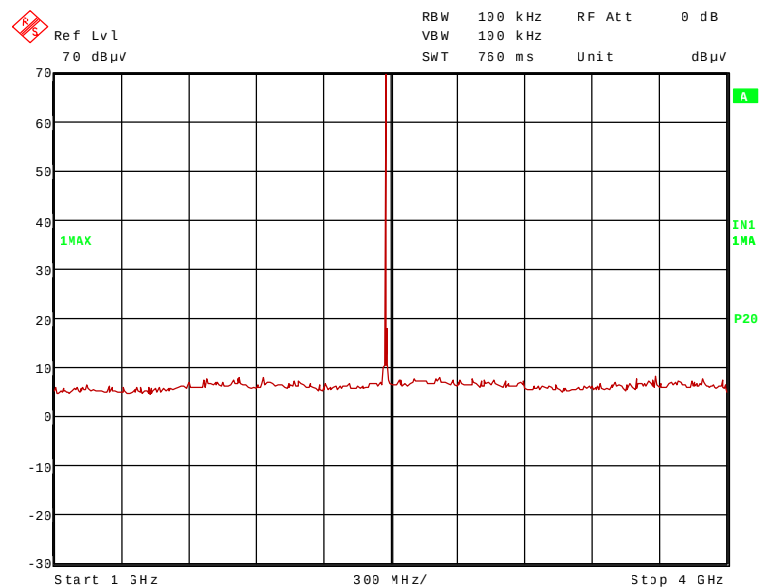
- 2.441 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

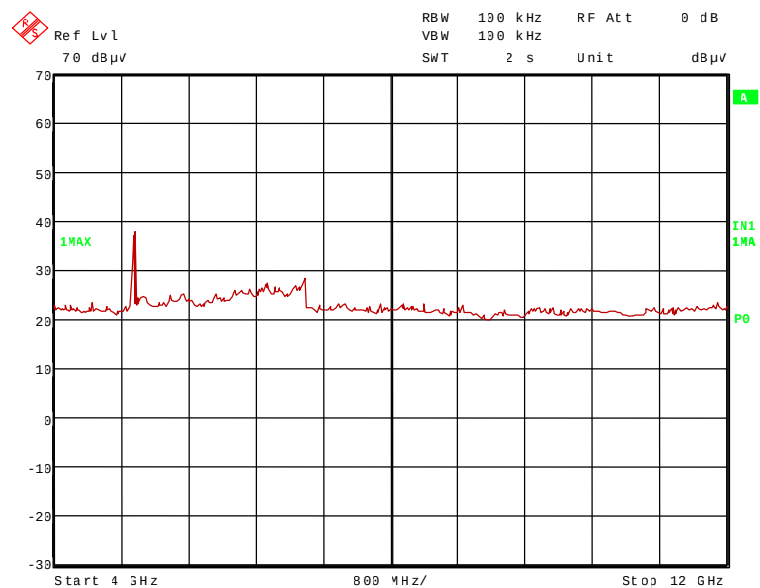
TEST REPORT REFERENCE: F092137E1

Transmitter operates on the upper end of the assigned frequency

92137_3.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 3):

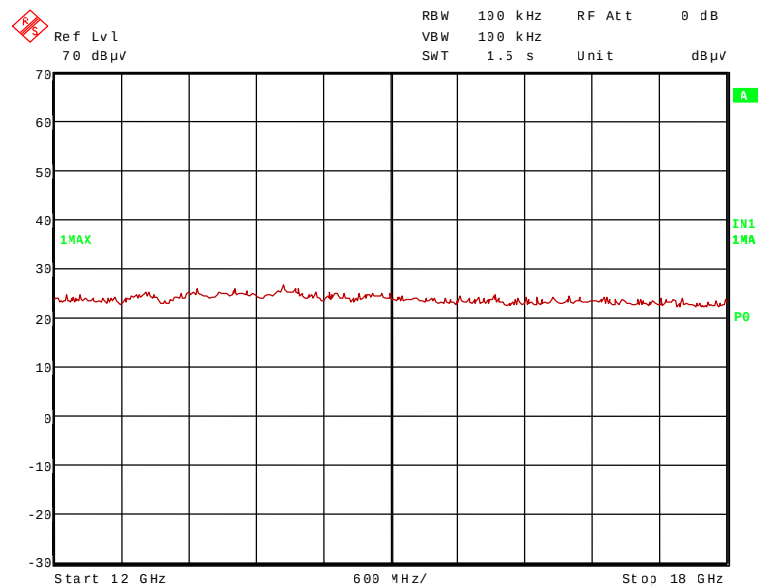


92137_6.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 3):

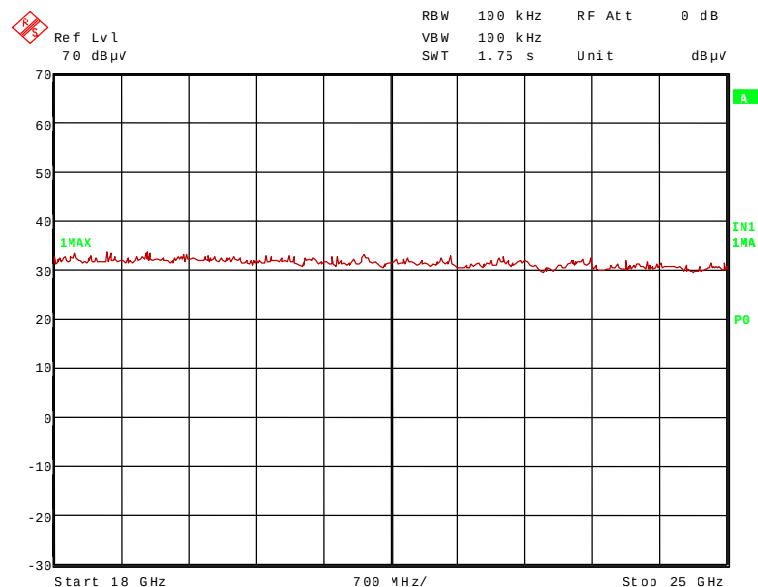


TEST REPORT REFERENCE: F092137E1

92137_107.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 3):



92137_108.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 3):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 2.493 GHz, 4.938 GHz and 4.960 GHz.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.480 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

TEST REPORT REFERENCE: F092137E1

5.7.2.6 FINAL MEASUREMENT (1 GHz to 25 GHz) WITH EXTERNAL MONOPOLE ANTENNA

Ambient temperature	21 °C	Relative humidity	55 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cable of the EUT is running vertically to the false floor. For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC by the carrier board.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

Remark: The emission measurement in this frequency range was carried out by using the external monopole antenna type Joymax IH-151, because of this antenna has the highest antenna gain of all external monopole antennas in question.

Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

Result measured with the peak detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.389	53.1	74.0	20.9	20.7	28.7	0.0	3.7	150	Vert.	Yes
2.402	103.0	-	-	70.5	28.8	0.0	3.7	150	Vert.	-
4.804	59.9	74.0	14.1	46.6	33.7	25.7	5.3	150	Vert.	Yes
4.822	50.4	74.0	23.6	37.1	33.7	25.7	5.3	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.389	38.7	54.0	15.3	6.3	28.7	0.0	3.7	150	Vert.	Yes
2.402	100.1	-	-	67.6	28.8	0.0	3.7	150	Vert.	-
4.804	51.9	54.0	2.1	38.6	33.7	25.7	5.3	150	Vert.	Yes
4.822	32.7	54.0	21.3	19.4	33.7	25.7	5.3	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: F092137E1

Transmitter operates at the middle of the assigned frequency band (operation mode 2)

Result measured with the peak detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height Cm	Pol.	Restr. Band
2.441	103.7	-	-	71.1	28.9	0.0	3.7	150	Vert.	-
4.860	51.3	74.0	22.7	38.0	33.8	25.7	5.2	150	Vert.	Yes
4.882	59.7	74.0	14.3	46.3	33.8	25.7	5.3	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.441	100.8	-	-	68.2	28.9	0.0	3.7	150	Vert.	-
4.860	33.3	54.0	20.7	20.0	33.8	25.7	5.2	150	Vert.	Yes
4.882	51.9	54.0	2.1	38.5	33.8	25.7	5.3	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: F092137E1

Transmitter operates at the upper end of the assigned frequency band (operation mode 3)

Result measured with the peak detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	103.3	-	-	70.5	29.0	0.0	3.8	150	Vert.	-
2.493	54.9	74.0	19.1	22.1	29.0	0.0	3.8	150	Vert.	Yes
4.938	51.6	74.0	22.4	37.9	34.0	25.6	5.3	150	Vert.	Yes
4.960	57.8	74.0	16.2	44.1	34.0	25.6	5.3	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	100.5	-	-	67.7	29.0	0.0	3.8	150	Vert.	-
2.493	39.5	54.0	14.5	6.7	29.0	0.0	3.8	150	Vert.	Yes
4.938	34.1	54.0	19.9	20.4	34.0	25.6	5.3	150	Vert.	Yes
4.960	49.8	54.0	4.2	36.1	34.0	25.6	5.3	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 –34, 36, 37, 39, 44, 46, 49 - 51, 72

TEST REPORT REFERENCE: F092137E1

5.7.2.7 PRELIMINARY MEASUREMENT (1 GHz to 25 GHz) WITH EXTERNAL PATCH ANTENNA

Ambient temperature	21 °C	Relative humidity	60 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cable of the EUT is running vertically to the false floor. For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

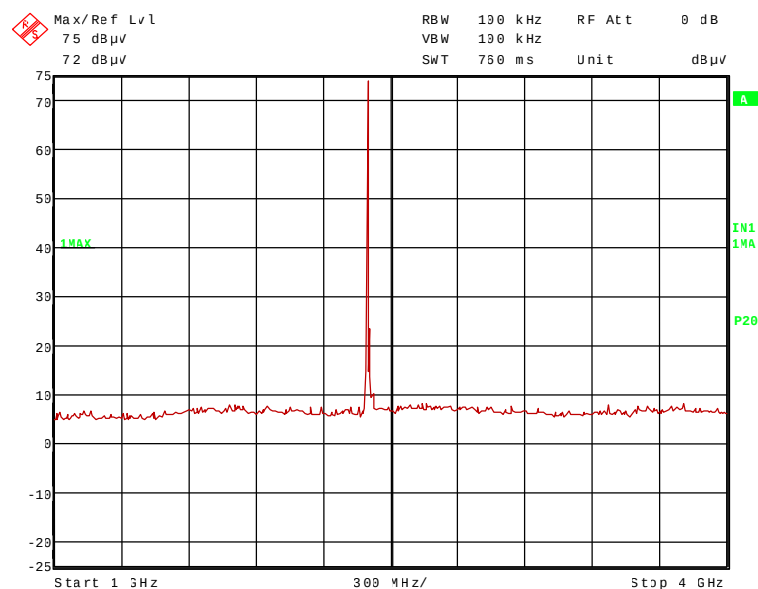
Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Remark: The emission measurement in this frequency range was carried out by using the external patch antenna type Huber+Suhner SPA 2400/75/8/0/V, because of this antenna has the highest antenna gain in single polarisation of all external patch antennas in question.

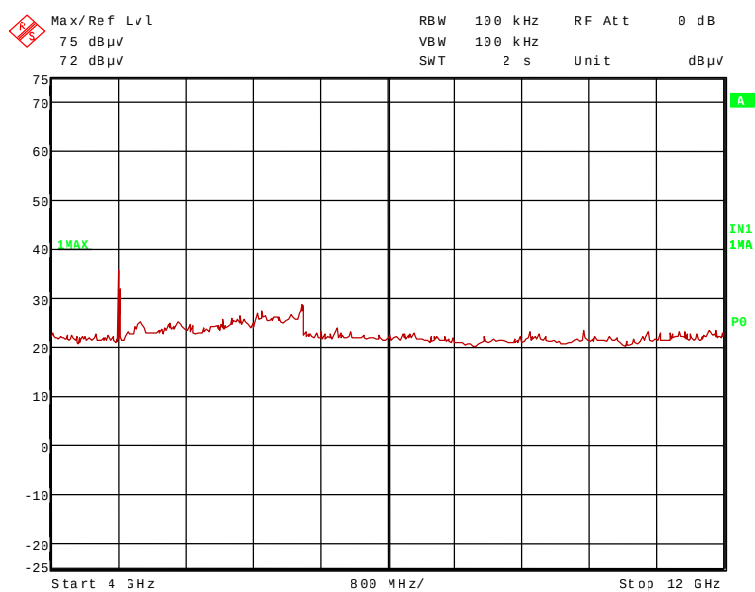
Transmitter operates at the lower end of the assigned frequency band

92137_17.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 1):

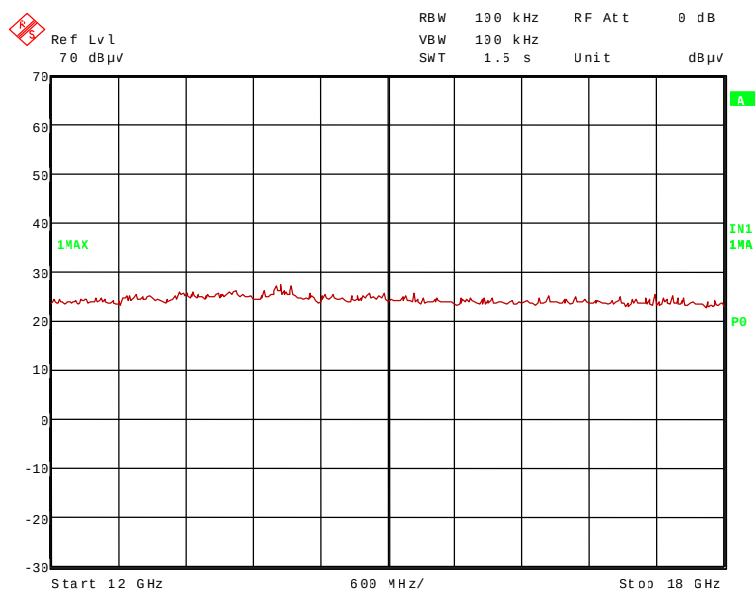


TEST REPORT REFERENCE: F092137E1

92137_22.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 1):

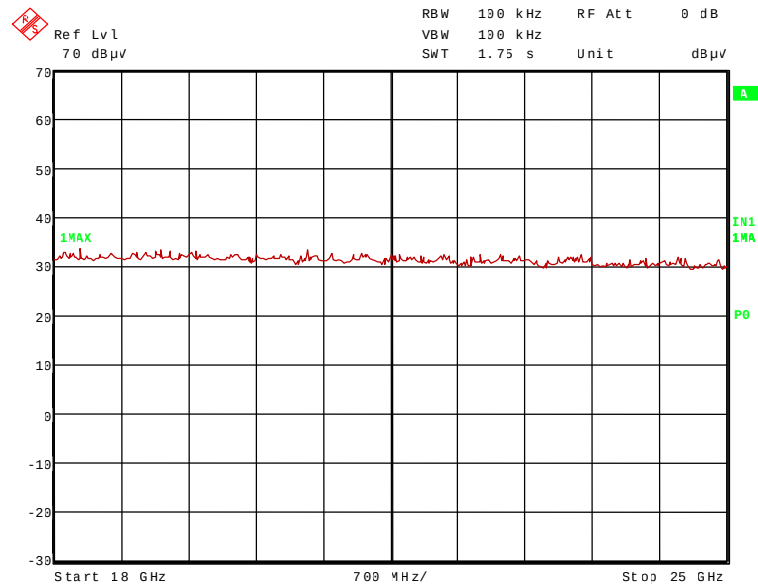


92137_116.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 1):



TEST REPORT REFERENCE: F092137E1

92137_111.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 1):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 2.389 GHz, 4.804 GHz and 4.822 GHz.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.402 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

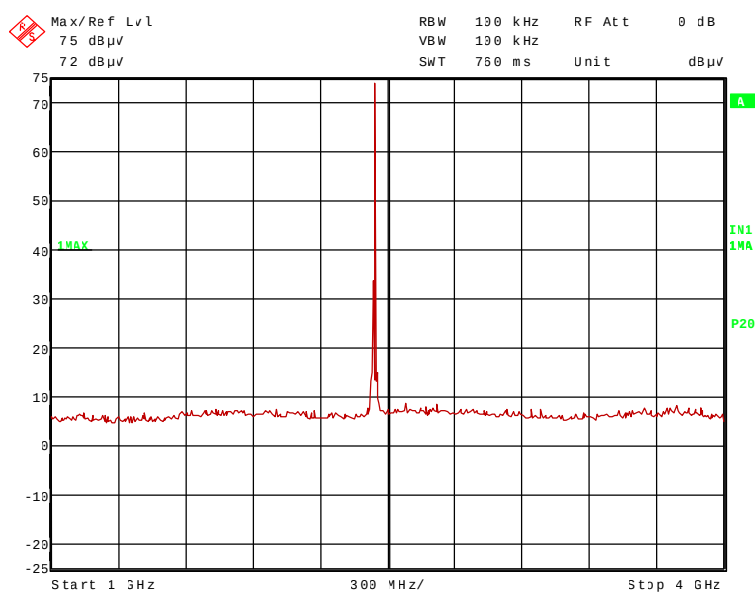
TEST EQUIPMENT USED FOR THE TEST:

29, 31 –34, 36, 37, 39, 44, 46, 49 - 51, 72

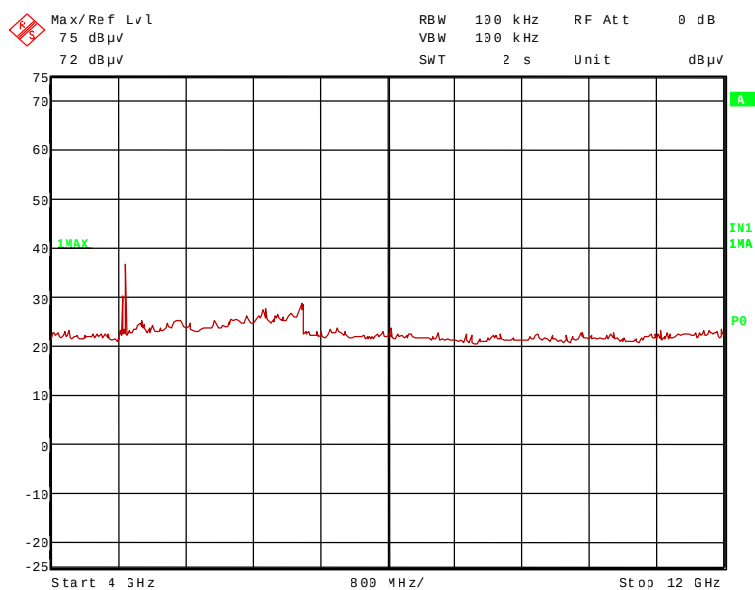
TEST REPORT REFERENCE: F092137E1

Transmitter operates on the middle of the assigned frequency band

92137_18.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 2):

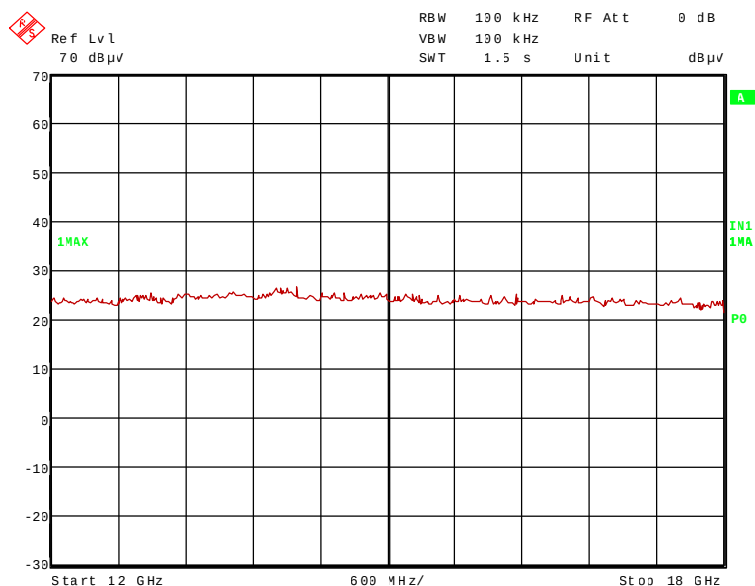


92137_21.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 2):

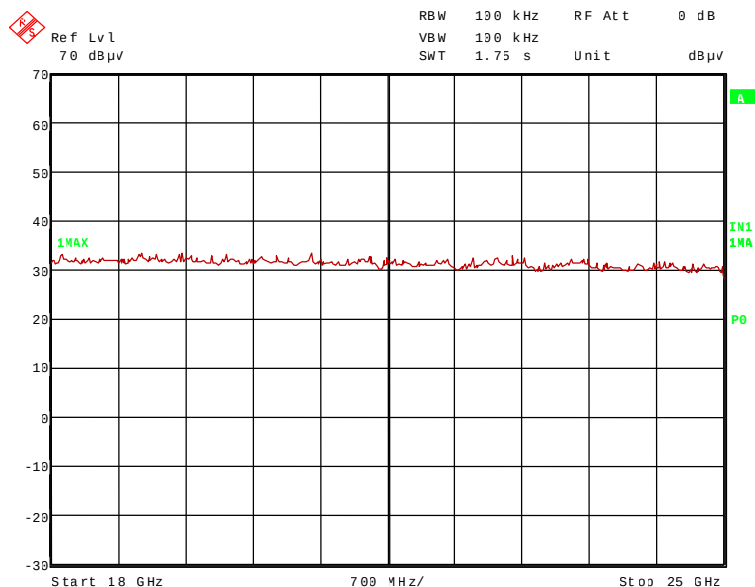


TEST REPORT REFERENCE: F092137E1

92137_115.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 2):



92137_112.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 2):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 4.860 GHz and 4.882 GHz.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

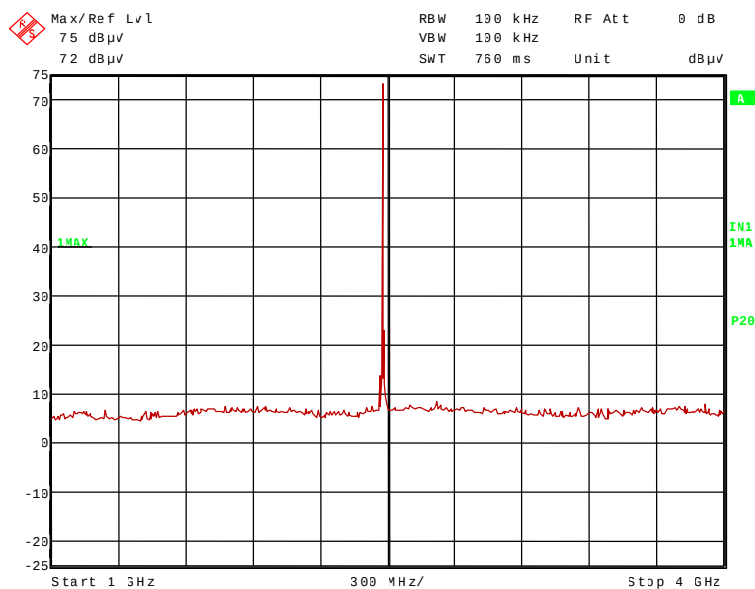
- 2.441 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

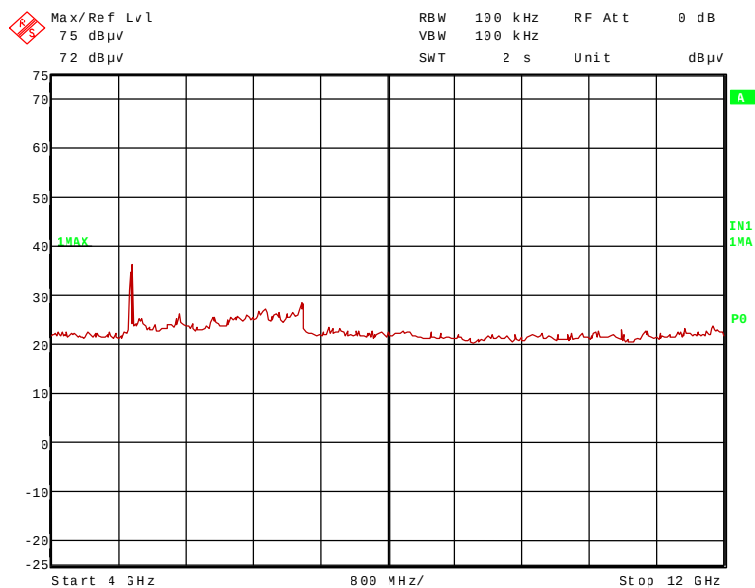
TEST REPORT REFERENCE: F092137E1

Transmitter operates on the upper end of the assigned frequency

92137_19.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 3):

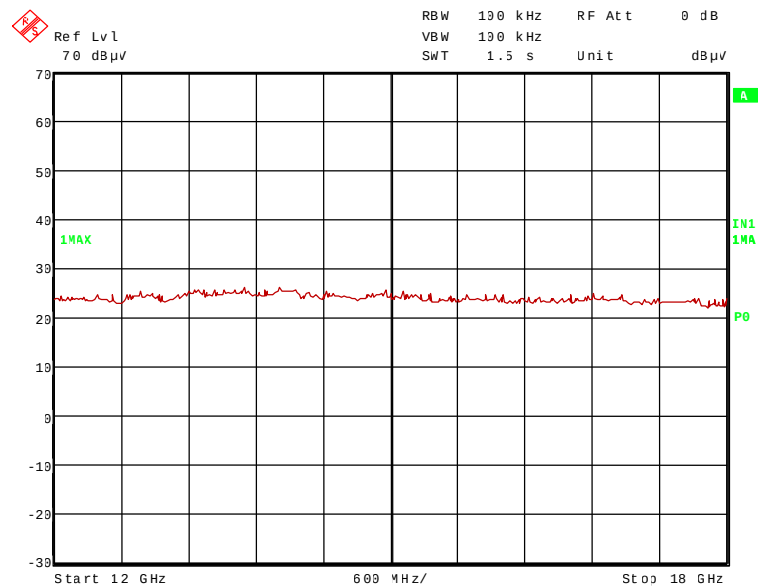


92137_20.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 3):

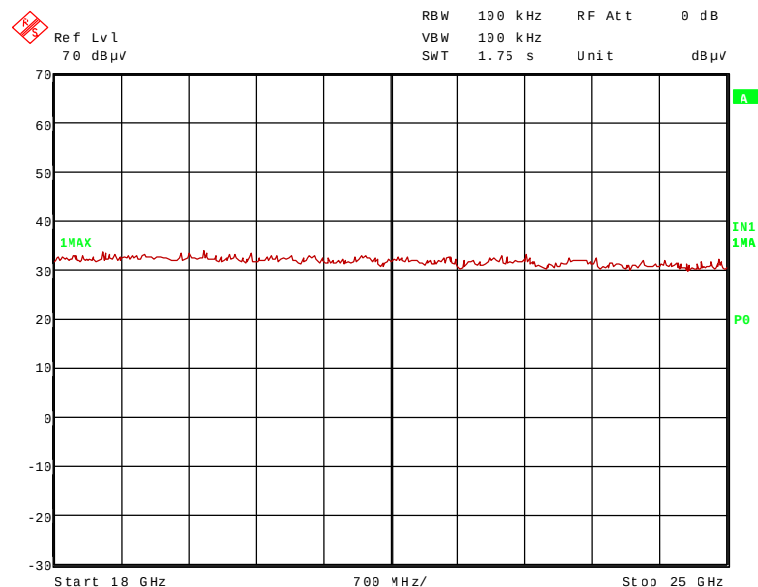


TEST REPORT REFERENCE: F092137E1

92137_114.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 3):



92137_113.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 3):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 2.493 GHz, 4.938 GHz and 4.960 GHz.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.480 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

TEST REPORT REFERENCE: F092137E1

5.7.2.8 FINAL MEASUREMENT (1 GHz to 25 GHz) WITH EXTERNAL PATCH ANTENNA

Ambient temperature	21 °C	Relative humidity	60 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cable of the EUT is running vertically to the false floor. For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC by the carrier board.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

Remark: The emission measurement in this frequency range was carried out by using the external patch antenna type Huber+Suhner SPA 2400/75/8/0/V, because of this antenna has the highest antenna gain in single polarisation of all external patch antennas in question.

Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

Result measured with the peak detector:

Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.389	55.9	74.0	18.1	23.5	28.7	0.0	3.7	150	Vert.	Yes
2.402	106.9	-	-	74.4	28.8	0.0	3.7	150	Vert.	-
4.804	56.2	74.0	17.8	42.9	33.7	25.7	5.3	150	Vert.	Yes
4.822	49.9	74.0	24.1	36.6	33.7	25.7	5.3	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.389	41.7	54.0	12.3	9.3	28.7	0.0	3.7	150	Vert.	Yes
2.402	103.9	-	-	71.4	28.8	0.0	3.7	150	Vert.	-
4.804	47.5	54.0	6.5	34.2	33.7	25.7	5.3	150	Vert.	Yes
4.822	32.5	54.0	21.5	19.2	33.7	25.7	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: F092137E1

Transmitter operates at the middle of the assigned frequency band (operation mode 2)

Result measured with the peak detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height Cm	Pol.	Restr. Band
2.441	107.0	-	-	74.4	28.9	0.0	3.7	150	Vert.	-
4.860	51.3	74.0	22.7	38.0	33.8	25.7	5.2	150	Vert.	Yes
4.882	54.1	74.0	19.9	40.7	33.8	25.7	5.3	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.441	104.1	-	-	71.5	28.9	0.0	3.7	150	Vert.	-
4.860	33.2	54.0	20.8	19.9	33.8	25.7	5.2	150	Hor.	Yes
4.882	46.6	54.0	7.4	33.2	33.8	25.7	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

TEST REPORT REFERENCE: F092137E1

Transmitter operates at the upper end of the assigned frequency band (operation mode 3)

Result measured with the peak detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	107.0	-	-	74.2	29.0	0.0	3.8	150	Vert.	-
2.493	57.9	74.0	16.1	25.1	29.0	0.0	3.8	150	Vert.	Yes
4.938	51.9	74.0	22.1	38.2	34.0	25.6	5.3	150	Hor.	Yes
4.960	54.0	74.0	20.0	40.3	34.0	25.6	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	Corr. value dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	104.0	-	-	71.2	29.0	0.0	3.8	150	Vert.	-
2.493	41.8	54.0	12.2	9.0	29.0	0.0	3.8	150	Vert.	Yes
4.938	34.2	54.0	19.8	20.5	34.0	25.6	5.3	150	Hor.	Yes
4.960	45.6	54.0	8.4	31.9	34.0	25.6	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 –34, 36, 37, 39, 44, 46, 49 - 51, 72

TEST REPORT REFERENCE: F092137E1

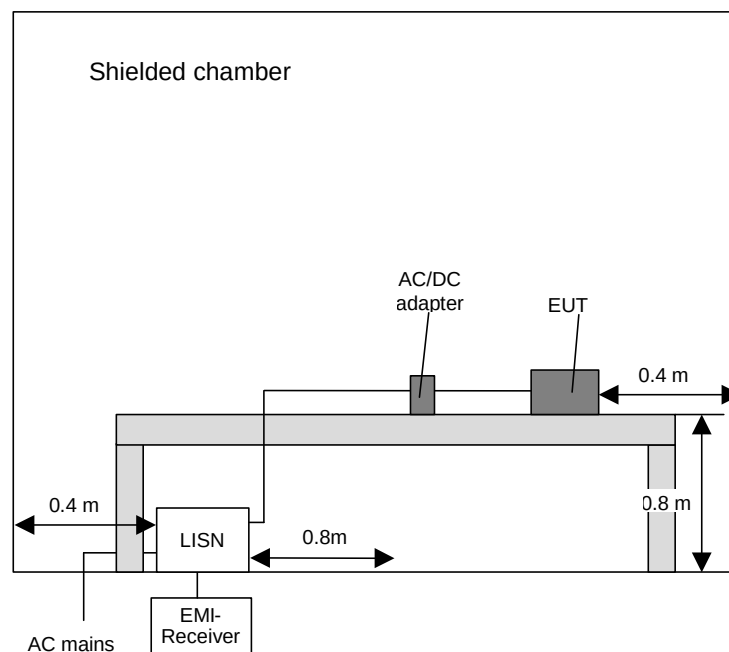
5.8 CONDUCTED EMISSIONS ON POWER SUPPLY LINES (150 kHz to 30 MHz)

5.8.1 METHOD OF MEASUREMENT

This test will be carried out in a shielded chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm above the ground plane. Floor-standing devices will be placed directly on the ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].

The frequency range 150 kHz to 30 MHz will be measured with an EMI Receiver set to MAX Hold mode with peak and average detector and a resolution bandwidth of 9 kHz. A scan will be carried out on the phase (or plus pole in case of DC powered devices) of the AC mains network. If levels detected 10 dB below the appropriate limit, this emission will be measured with the average and quasi-peak detector on all lines.

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz



TEST REPORT REFERENCE: F092137E1

5.8.2 TEST RESULTS (CONDUCTED EMISSIONS ON POWER SUPPLY LINES)

Ambient temperature	20 °C	Relative humidity	50 %
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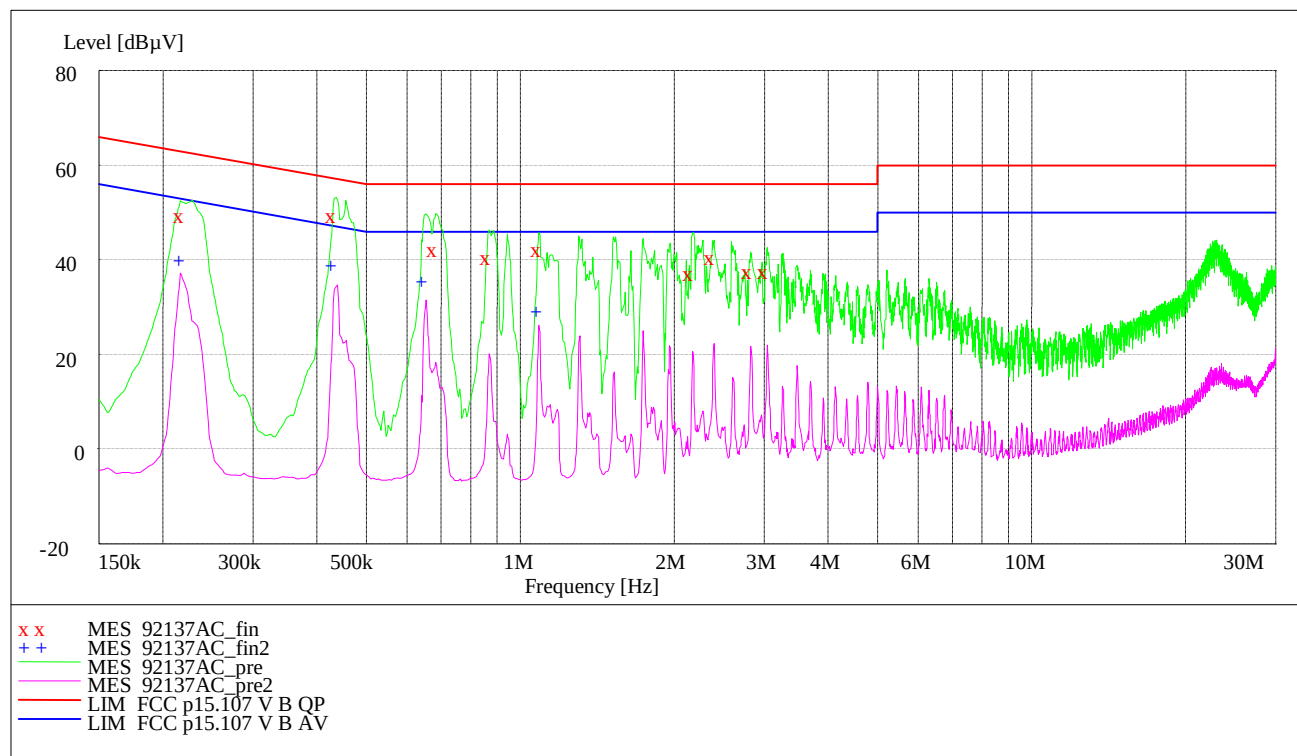
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: The EUT operates in operation mode 4. All results are shown in the following.

Supply voltage: During the measurement the EUT was supplied 5 V DC by an AC / DC adaptor type Mascot 2121, which was supplied by 120 V AC / 60 Hz.

The curves in the diagram only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by an x and the average measured points by an +.



Data record name: 92137AC

TEST REPORT REFERENCE: F092137E1

Result measured with the quasipeak detector:

(These values are marked in the diagram by an x)

Frequency MHz	Level dBμV	Transducer dB	Limit dBμV	Margin dB	Line	PE
0.219300	50.1	0.4	63	12.7	N	FLO
0.435300	50.4	0.2	57	6.8	N	FLO
0.682800	42.9	0.1	56	13.1	N	FLO
0.869100	41.4	0.1	56	14.6	N	FLO
1.087800	42.8	0.1	56	13.2	N	FLO
2.172300	38.1	0.5	56	17.9	N	FLO
2.391900	41.3	0.5	56	14.7	N	FLO
2.827500	38.6	0.6	56	17.4	N	FLO
3.042600	38.6	0.6	56	17.4	N	FLO
Measurement uncertainty				+3.6 dB / -4.5 dB		

Data record name: 92137AC_fin

Result measured with the average detector:

(These values are marked in the diagram by an +)

Frequency MHz	Level dBμV	Transducer dB	Limit dBμV	Margin dB	Line	PE
0.218400	40.8	0.4	53	12.1	N	FLO
0.435300	39.8	0.2	47	7.4	N	FLO
0.652200	36.1	0.1	46	9.9	N	FLO
1.087800	30.2	0.1	46	15.8	N	FLO
Measurement uncertainty				+3.6 dB / -4.5 dB		

Data record name: 92137AC_fin2

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

1 – 4, 20

TEST REPORT REFERENCE: F092137E1

6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

TEST REPORT REFERENCE: F092137E1

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
1	Shielded chamber M47	-	Albatross Projects	B83117-C6439-T262 -	480662	Weekly verification (system cal.)	
2	EMI Receiver	ESCS 30	Rohde & Schwarz	834489/011	580007	02/27/2008	02/2010
3	LISN	ESH2-Z5	Rohde & Schwarz	879675/037	580006	06/14/2009	06/2010
4	High pass filter	HR 0.13- 5ENN	FSY Microwave Inc.	DC 0109 SN 002	480340	Weekly verification (system cal.)	
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	Measuring receiver	ESIB7	Rohde & Schwarz	100304	480521	02/26/2008	02/2010
16	Controller	HD100	Deisel	100/670	480139	-	-
17	Turntable	DS420HE	Deisel	420/620/80	480087	-	-
18	Antenna support	AS615P	Deisel	615/310	480086	-	-
19	Antenna	CBL6111 A	Chase	1643	480147	08/01/2007	08/2012
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
30	Spectrum analyser	FSU	Rohde & Schwarz	200125	480956	02/04/2009	02/2011
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	02/25/2008	02/2010
32	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
34	Antenna support	AS615P	Deisel	615/310	480187	-	-
35	Antenna	CBL6112 B	Chase	2688	480328	10/11/2005	10/2010
36	Antenna	3115 A	EMCO	9609-4918	480183	04/11/2008	11/2013
37	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	483	480294	Six month verification (system cal.)	
39	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	411	480297	Six month verification (system cal.)	
43	RF-cable No. 30	RTK 081	Rosenberger	-	410141	Weekly verification (system cal.)	
44	RF-cable No. 31	RTK 081	Rosenberger	-	410142	Weekly verification (system cal.)	
46	RF-cable 1m	KPS-1533- 400-KPS	Insulated Wire	-	480301	Six month verification (system cal.)	
49	Preamplifier	JS3- 00101200- 23-5A	Miteq	681851	480337	Six month verification (system cal.)	
50	Preamplifier	JS3- 12001800- 16-5A	Miteq	571667	480343	Six month verification (system cal.)	
51	Preamplifier	JS3- 18002600- 20-5A	Miteq	658697	480342	Six month verification (system cal.)	
55	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	02/19/2008	02/2013
72	4 GHz High Pass Filter	WHKX4.0/18 G-8SS	Wainwright Instruments	1	480587	Weekly verification (system cal.)	

TEST REPORT REFERENCE: F092137E1

7 LIST OF ANNEXES

ANNEX A	PHOTOGRAPHS OF THE TEST SET-UPS:	8 pages
	cB-0925-01-1-01, test set-up fully anechoic chamber	92137_6.jpg
	cB-0925-01-1-02 with patch antenna, test set-up fully anechoic chamber	92137_10.jpg
	cB-0925-01-1-02, test set-up fully anechoic chamber	92137_13.jpg
	cB-0925-01-1-02, test set-up fully anechoic chamber	92137_11.jpg
	cB-0925-01-1-02, test set-up fully anechoic chamber	92137_12.jpg
	cB-0925-01-1-01, test set-up fully anechoic chamber	92137_5.jpg
	cB-0925-01-1-02, test set-up open area test site	92137_27.jpg
	cB-0925-01-1-01, test set-up shielded chamber	92137_33.jpg
ANNEX B	INTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:	7 pages
	cb-0925-01-1-02, top view	92137_d.jpg
	cB-0925-01-1-01, top view	92137_e.jpg
	cB-0925-01-1-01, shielding removed, top view	92137_g.jpg
	cB-0925-01-1-0x, bottom view	92137_g.jpg
	cB-0925-01-1-02 mounted on carrier board	92137_a.jpg
	cB-0903-02, carrier board, top view	92137_b.jpg
	cB-0903-02, carrier board, bottom view	92137_c.jpg
ANNEX C	EXTERNAL PHOTOGRAPHS OF THE TEST SAMPLE:	0 pages
	Because the EUT is a module, which is intended to be implemented inside a final application, no external photographs were available	
ANNEX D	ADDITIONAL RESULTS FOR INDUSTRY CANADA:	14 pages