







**TEST REPORT**  
 No.: 6-0143-12-2-3a

According to:  
**FCC Regulations**  
 Part 22, Part 24 & Part 27

**IC-Regulations**  
 RSS-132, RSS-133, RSS-139 &  
 RSS-Gen

for  
**u-blox AG**

RF-Module LISA-U230  
*FCC-ID: XPYLISAU230*  
*IC-ID: 8595A-LISAU230*

Laboratory Accreditation and Listings			
 Deutsche Akkreditierungsstelle D-PL-12047-01-01	 FEDERAL COMMUNICATIONS COMMISSION USA Reg. No.: 736496 MRA US-EU 0003	 Industry Canada Reg. No.: 3462D-1 Reg. No.: 3462D-2 Reg. No.: 3462D-3	 Voluntary Controls for Electromagnetic Emissions Reg. No.: R-2665, R-2666 C-2914, T-1967, G-301
 <b>WiFi</b> ALLIANCE <b>AUTHORIZED            RF LABORATORY</b>	 <b>CTIA Authorized Test Lab</b> <b>LAB CODE 20011130-00</b>		
accredited according to DIN EN ISO/IEC 17025			
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### 1. Summary of test results

The test results apply exclusively to the test samples as presented in this Report. The CETECOM GmbH does not assume responsibility for any conclusions and generalizations taken in conjunction with other specimens or samples of the type of the item presented to tests.

The presented RF-Module includes GSM/(E)GPRS and W-CDMA technologies. This test report shows results for GSM, (E)GPRS (Band 850/1900) and W-CDMA Band 2, 4 and 5 technologies in TX-Mode.

Following tests have been performed to show compliance with applicable FCC Part 2, Part 22, Subpart H and Part 24, Subpart E (Broadband PCS), Part 27 of the FCC CFR 47 Rules, Edition 1st October 2011 and Canada RSS-132 Issue 2, RSS-133 Issue 5, RSS-139 Issue 2 and RSS-Gen Issue 3 standards.

#### 1.1. TX Mode TESTS OVERVIEW FCC (USA) and RSS (CANADA) Standards

TEST CASES	PORT	REFERENCES & LIMITS			EUT set-up	EUT op-mode	Result
		FCC Standard	RSS Section	TEST LIMIT			
<b>Diagram section 1: EMI-AC Power lines tests</b>							
Emissions AC-Power Lines 0,15-30 MHz conducted	AC-Power lines	§15.207	RSS-Gen, Issue 3: Chapter 7.2.4	FCC §15.107 class B limits §15.207 limits IC: Table 4	1	2 + 3 + 5 + 6 + 7	Passed
<b>Diagram section 2: Electric field strength tests</b>							
SPURIOUS EMISSIONS radiated	Cabinet + Interconnecting cables	§2.1053(a) §2.1057 §22.917(a)(b) §24.238(a)(b) §27.53(h)	RSS-132: 4.5.1 & 4.5.2 RSS 133: 6.5.1(a)(b) RSS-139: 6.5	43+10log(P) dBc	1	2 + 4 + 5 + 6 + 7	Passed
RF-POWER (ERP/EIRP) radiated	Cabinet	§2.1046 §22.913(a)(2) §24.232(c) §27.50(4)	RSS-132: 4.4 SRSP-503: 5.1.3 RSS-133:4.1/6.4 SRSP-510: 5.1.2 RSS-139: 6.4	< 7 Watt (ERP) < 2 Watt (EIRP)	1	1 + 2 + 3 + 4 + 5 + 6 + 7	Passed
<b>Diagram section 3: Magnetic field strength tests</b>							
field strength <30 MHz radiated	Cabinet +Interconnecting cables	§15.209(a)	RSS-Gen: 4.11	2400/F(kHz) µV/m 24000/F(kHz) µV/m 30 µV/m	1	2 + 4 + 5 + 6 + 7	Passed
<b>Diagram section 4: Conducted tests</b>							
SPURIOUS EMISSIONS conducted	Antenna terminal	§2.1051 §2.1057 §22.917(a)(b) §24.238(a)(b) §27.53 (h)	RSS-132: 4.5.1 RSS-133: 6.5.1(a)(b) RSS-139: 6.5	43+10log(P) dBc	2	1 + 2 + 3 + 4 + 5 + 6 + 7	Passed
RF POWER conducted	Antenna terminal	§2.1046	--	N/A	2	1 + 2 + 3 + 4 + 5 + 6 + 7	Passed
26dB EMISSION BANDWIDTH + 99%OCCUPIED BANDWIDTH	Antenna terminal	§2.202 §2.1049 §22.917(a) §24.238(a) §27.53(h)	RSS Gen:4.6.1	99% Power	2	1 + 2 + 3 + 4 + 5 + 6 + 7	Passed
FREQUENCY STABILITY conducted	Antenna terminal	§2.1055(a)(2) §22.355, table C-1 §24.235, §27.54	RSS-132: 4.3 RSS 133: 6.3 RSS-139: 6.3	< ±2.5ppm <±0.1 ppm <±0.1 ppm	2	1 + 2 + 3 + 4 + 5 + 6 + 7	Passed

Remark: See separate test report TR6-0143-12-2-3b for RX mode.

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Dipl.-Ing. B. Taslica  
Responsible for test report

## 2. Administrative Data

### 2.1. Identification of the testing laboratory

Company name:	CETECOM GmbH
Address:	Im Teelbruch 116 45219 Essen - Kettwig Germany
Responsible for testing laboratory:	Dipl.-Ing. W. Richter
Deputy:	Dipl.-Ing. J. Schmitt
Laboratory accreditations/Listings:	DAkkS-Registration No. D-PL-12047-01-01 FCC-Registration No.: 736496, MRA US-EU 0003 IC-Registration No. 3462D-1, 3462D-2, 3462D-3 VCCI Reg. No. R-2665, R-2666, C-2914, T-1967, G-301

### 2.2. Test location

#### 2.2.1. Test laboratory "CTC"

Company name:	see chapter 2.1. Identification of the testing laboratory
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### 2.3. Organizational items

Order No.:	E600143002
Responsible for test report and project leader:	Dipl.-Ing. B. Taslica
Receipt of EUT:	2012-03-19
Date(s) of test:	2012-03-20- 2011-03-30
Date of report:	2012-04-10
-----	
Version of template:	11.10

### 2.4. Applicant's details

Applicant's name:	u-blox AG
Address:	Zürcherstrasse 68 8800 Thalwil  Switzerland
Contact person:	Mr. Giulio Comar

### 2.5. Manufacturer's details

Manufacturer's name:	please see Applicant's details
Address:	please see Applicant's details

### 3. Equipment under test (EUT)

#### 3.1. Technical description of main EUT

##### GSM

Main function	GSM/GPRS/WCDMA RF Module		
Type	RF module		
GSM Frequency range (US/Canada -bands)	GSM 850: 824 – 849MHz (Uplink), 869-894MHz (Downlink) GSM1900: 1850-1910MHz (Uplink), 1930-1990MHz (Downlink)		
Type of modulation	GMSK/8-PSK		
Number of channels (USA/Canada -bands)	GSM 850: 128 – 251, 125 channels GSM1900: 512 – 810, 300 channels		
EMISSION DESIGNATOR(S)	244KGXW (GPRS850) 242KGXW (EDGE850) 247KG7W (GPRS1900) 244KG7W (EDGE 1900)		
Antenna Type	<input type="checkbox"/> Integrated <input type="checkbox"/> External, no RF- connector <input checked="" type="checkbox"/> External, separate RF-connector	Frequency range of 'EUT E' antenna: 800MHz to 2200MHz	
Antenna Gain	<input checked="" type="checkbox"/> radiated:.3.0 dBi average gain		
Output Power (conducted): GSM 850 EDGE 850	32.33 dBm (PK) / 32.14 dBm (AV) 29.26 dBm (PK) / 26.48 dBm (AV)		
Output Power (radiated): GSM 850 EDGE 850	27.80 dBm (PK) 22.50 dBm (PK)		
Output Power (conducted): GSM 1900 EDGE 1900	29.24 dBm (PK) / 29.06 dBm (AV) 28.06 dBm (PK) / 25.29 dBm (AV)		
Output Power (radiated): GSM 1900 EDGE 1900	29.30 dBm (PK) 27.70 dBm (PK)		
FCC-ID	XPYLISAU230		
IC	8595-LISAU230		
Installed options	<input checked="" type="checkbox"/> GSM900 and GSM1800 Bands (not usable in USA/Canada) <input checked="" type="checkbox"/> W-CDMA Band II, IV and Band V (usable in USA/Canada) <input checked="" type="checkbox"/> W-CDMA Band I, VI and VIII (not usable in USA/Canada)		
Power supply	<input checked="" type="checkbox"/> over AC/DC adaptor: 110V/60Hz <input checked="" type="checkbox"/> DC power 3.8 Volt (nominal)		
Voltage settings	3.8 V DC (nominal), 3.4 V DC (minimum) and 4.2 V DC (maximum)		
Special EMI components	--		
Lowest radio frequency signal	Master clock 26 MHz		
Temperature range	Lowest -20 °C to highest +65°C (manufacturer declared)		
EUT sample type	<input type="checkbox"/> Production	<input checked="" type="checkbox"/> Pre-Production	<input type="checkbox"/> Engineering

**FDD**

Main function	GSM/GPRS/WCDMA RF Module		
Type	RF module		
TX-frequency range	FDD Band 2: 1852.4–1907.6 MHz (Uplink), 1930-1990MHz (Downlink) FDD Band 4: 1712.4–1752.6 MHz (Uplink), 2110-2155MHz (Downlink) FDD Band 5: 826.4-846.6 MHz (Uplink), 869-894MHz (Downlink)		
Type of modulation	FDD-Mode Release99: QPSK FDD Mode Release 5+6: DL: 16QAM, UL: BPSK		
Number of channels	FDD Band 2: UARFCN range 9262 – 9400 – 9538 FDD Band 4: UARFCN range 1312 – 1413 – 1513 FDD Band 5: UARFCN range 4132 – 4183 – 4233		
EMISSION DESIGNATOR(S)	4M06F9D (FDD 2) 4M05F9D (FDD 4) 4M08F9D (FDD 5)		
Antenna Type	<input type="checkbox"/> Integrated <input type="checkbox"/> External, no RF- connector <input checked="" type="checkbox"/> External, separate RF-connector	Frequency range of 'EUT E' antenna: 800MHz to 2200MHz	
Antenna Gain	<input checked="" type="checkbox"/> radiated:.3.0 dBi average gain    Output Power (radiated)		
Output Power (radiated)	FDD-Mode 2    24.8 dBm (PK) FDD-Mode 4    27.1 dBm (PK) FDD-Mode 5    25.7 dBm (PK)		
Output Power (conducted)	FDD-Mode 2    25.86 dBm (PK) / 22.72 dBm (AV) FDD-Mode 4    25.65 dBm (PK) / 22.45 dBm (AV) FDD-Mode 5    26.12 dBm (PK) / 22.82 dBm (AV)		
FCC-ID	XPYLISAU230		
IC	8959-LISAU230		
Installed option	<input checked="" type="checkbox"/> GSM900, G850, DCS1800 and PCS1900 Bands. <input checked="" type="checkbox"/> W-CDMA Band I, VI and VIII (not usable in USA/Canada)		
Special EMI components	--		
Lowest radio frequency signal	Master clock 26 MHz		
Power supply	<input checked="" type="checkbox"/> over AC/DC adaptor: 110V/60Hz		
Voltage settings	3.8 V DC (nominal), 3.4 V DC (minimum) and 4.2 V DC (maximum)		
Temperature range	Lowest -20 °C to highest +65°C (manufacturer declared)		
EUT sample type	<input type="checkbox"/> Production	<input checked="" type="checkbox"/> Pre-Production	<input type="checkbox"/> Engineering

### 3.2. EUT: Type, S/N etc. and short descriptions used in this test report

Short description*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	RF-Module	LISA-U230	IMEI: 35223705001 1958	146AA0	22.00
EUT B	RF-Module	LISA-U230	IMEI: 35223705001 1990	146AA0	22.00
EUT C	Adapter Board	LISA-U200 FAE	SN096	IP02_HW_CS_ 150000	--
EUT D	Adapter Board	LISA-U200 FAE	SN073	IP02_HW_CS_ 150000	--
EUT E	Magnetic Mount Antenna	Taoglas GA.107	#1	--	--

\*) EUT short description is used to simplify the identification of the EUT in this test report.

### 3.3. Auxiliary Equipment (AE): Type, S/N etc. and short descriptions

AE short description *)	Auxiliary Equipment	Type	S/N serial number	HW hardware status	SW software status
AE 1	AC/DC adaptor (AC 110V/60Hz, DC 12 V)	0055 (Power supply connected on EUT A)	# 1	--	--
AE 2	Portable earphone	V109	--	--	--

\*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.

### 3.4. EUT set-ups

EUT set-up no. *)	Combination of EUT and AE	Remarks
Set. 1	EUT A + EUT C + EUT E + AE 1 + AE 2	Used for radiated tests.
Set. 2	EUT B + EUT D + AE 2	Used for conducted tests (power supply cables at EUT B for low, high and low voltage)

\*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

Remark: Voice call with AE 2 and special AT command string send it with HyperTerminal program. After successful connection Laptop disconnected from the EUTC.

### 3.5. EUT operating modes

EUT operating mode no. *)	Description of operating modes	Additional information
op. 1	GSM 850 TCH mode TCH=128/192/251	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 33 dBm (power class 4; power control level 5). USF_Duty CYCLE set to 100%, coding scheme CS-1 for GMSK modulation, slot 3 active, uplink gamma: 3 (33dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.
op. 2	EGPRS 850 TCH mode TCH=128/192/251	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 33 dBm (power class 4; power control level 5). USF_Duty CYCLE set to 100%, coding scheme MCS-5 for 8PSK modulation, slot 3 active, uplink gamma: 6 (27dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.
op. 3	GSM 1900 TCH mode TCH=512/661/810	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 30 dBm (power class 1; power control level 0). USF_Duty CYCLE set to 100%, coding scheme CS-1 for GMSK modulation, slot 3 active, uplink gamma: 3 (30dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link
op. 4	EGPRS 1900 TCH mode PCL=0 (max. power) TCH=512/661/810	A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 30 dBm (power class 1; power control level 0). USF_Duty CYCLE set to 100%, coding scheme MCS-5 for 8-PSK modulation, slot 3 active, uplink gamma: 5 (26dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link
op. 5	FDD Mode 2 12.2 kbps RMC	A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 24dBm.
op. 6	FDD Mode 4 12.2 kbps RMC	The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link according Table E5.1/Table E5.1A as described in 3GPP TS34.121, Annex E.  Chosen settings: 12.2kbps RMC + HSPA 34.108  This setting was chosen for all Release 6 mobile equipment.
op. 7	FDD Mode 5 12.2 kbps RMC	

\*) EUT operating mode no. is used to simplify the test report.



### 3.6. Parameter Settings on mobile phone and base station CMU200

Following settings apply to the MS during the measurements in **GSM/(E)GPRS-Mode** only:

Parameter	Traffic Mode	Idle Mode
Traffic Channels mobile station (EUT)	GSM 850 TCH <sub>MS</sub> = 128/ 192 /251 GSM 1900 TCH <sub>MS</sub> = 512 / 661 / 810	--
maximum power level (PCL)	GSM 850: PCL = 5 (2 Watt) GSM 1900: PCL = 0 (1 Watt)	--
Modulation	GSM/GPRS: GMSK-Modulation Scheme EDGE: 8-PSK Modulation Scheme	--
DTX	Off	--
Bitstream	PRBS 2E9-1 (pseudo-random-sequence) – CCITT 0.153	
Timeslot	3	
Hopping	Off	
Timeslot (slot mode)	GPRS/EDGE-Mode: maximum power on one uplink slot according MS class	
MS slot class	Class 8	
Maximum data transmission rate, single time slot	GPRS: 20,0 kbit/s Slot EDGE: 59,2 kbit/s Slot	
Speech transcoding (Traffic Mode)	Full rate Version 1	
Domain	Packet Switched(PS)	
Mode	BCCH and TCH	
BCCH – base station (CMU,CMD)		GSM 850: 182 GSM 1900: 651
TCH – base station (CMD, CMU)	auto	
Power level TCH – base station (used timeslot level)	- 70 dBm	
Power level BCCH – base station (control channel level)	- 80 dBm	
External attenuation RF/AF-Input/Output	Accord. calibration prior to measurements	
Mobile Country Code	310	310
BS_AG_BLKS_RES	Not applicable	0
Paging reorganisation		Off (0)
Signalling channel		SDCCH
Location Update		Auto
Cell access		Disabled (barred)

Following settings apply to the UE (EUT) during the measurements in **FDD-Mode** only:

Parameter	Traffic Mode	Idle Mode
UARFCN UE Uplink (EUT) (according TS34.108)	FDD 2 = 9262/ 9400/ 9538 FDD 4 = 1312/1413/1513 FDD 5 = 4132/ 4182/ 4233	--
UARFCN Node B (downlink) (according TS34.108)	FDD 2 = 9663/ 9800/ 9937 FDD 4 = 1537/1675/1738 FDD 5 = 4358/ 4040/ 4457	
UE power class	Class 3 (+24dBm)	
HSDPA UE category/ HSUPA category	14/6	
Maximum power	FDD 2/5 12.2kbps RMC99 -> all TPC bits up ("1") HSDPA-mode = accord. Subtests 1,2,3,4 defined in 3GPP TS34.121 HSUPA mode = accord. Subtests 1,2,3,4,5 defined in 3GPP TS34.121	--
Modulation	12.2kbps RMC99-mode: QPSK-Modulation Scheme HSDPA/HSUPA = QPSK, BPSK and 16 QAM Modulation Scheme is applicable	--
Compression mode	Off	--
Bitstream	PRBS 2E9-1 (pseudo-random-sequence) – CCITT 0.153	
Maximum data transmission rate:	GPRS: 20.0 kbps/ Slot EDGE: 59.2 kbps/ Slot FDD: 12.2 kbps	
Node B Downlink physical channels settings	According Table E.5.1/E.5.1A in 3GPP TS34.121	
External attenuation RF/AF-Input/Output	Accord. Set-up calibration prior to measurements	

**Settings for CMU (general)**

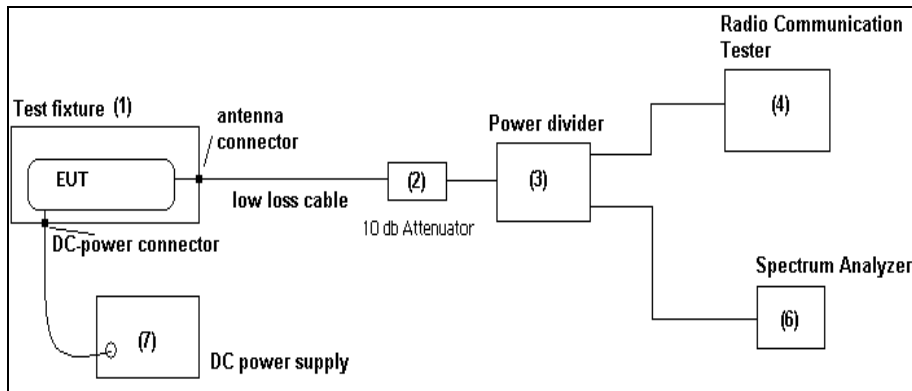
Repetition	Continuous	
Stop condition	None	
Display mode	Max./Min	
Statistic Count	1000 Bursts	
Decoder	Standard	

Additional settings on the base stations CMU200 for frequency stability measurements

## 4. DESCRIPTION OF TEST SET-UP'S

### 4.1. Test set-up for conducted measurements at antenna connector port

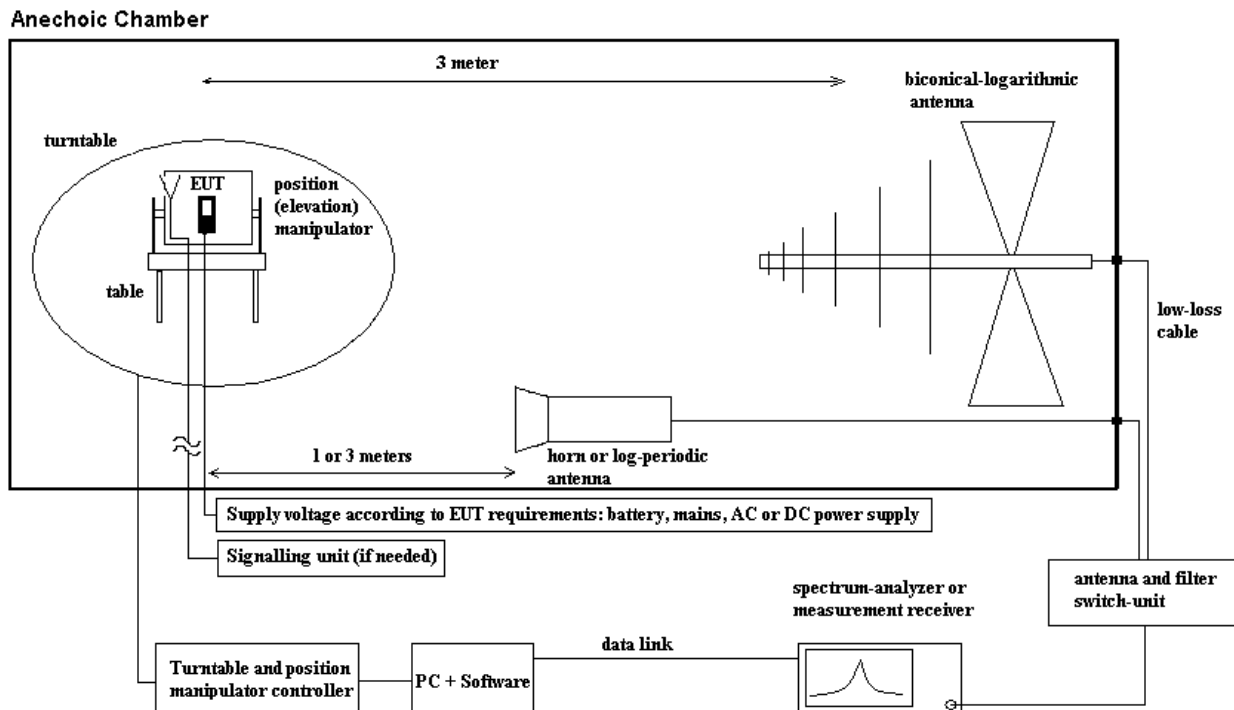
The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first 10 dB attenuated (2) before it is 0° divided by a power divider (3). One of the signal path is connected to the communication base station (4), other branch is connected to the spectrum – analyzer (6). The specific attenuation losses for both signal paths/branches are determined prior to the measurement within a set-up calibration. These are then taken into account by correcting the measurement readings on the spectrum-analyzer.



**Schematic: Test set-up conducted (also used for the climatic tests)**

The above-mentioned test set-up schematic apply also for tests performed inside the climatic chamber:  
Frequency stability

## 4.2. Test set-up for radiated measurements



**Schematic: radiated measurements test set-up**

### MEASUREMENT METHOD in the range 30 MHz to 1 GHz (Ref. no 441: EMI SAR)

An EMI receiver together with a broadband antenna was used in order to identify the emissions from the EUT by positioning the antenna close to the EUT surfaces. The interconnecting cables and equipment position were varied in order to maximize the emissions. Then most critical frequencies are recorded for further investigations. Based on the exploratory measurements, the most critical frequencies are re-measured by maintaining the EUT's operating mode, cable position, etc. The EUT was placed on a non-conductive support of 0.8 m height. By rotating the turntable angle in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position) and the measurement antenna height from 1 meter to 4 meters, the maximized emissions are recorded. The measurements are performed for both polarizations of the measuring antenna: horizontal and vertical.

### MEASUREMENT METHOD above 30 MHz (Ref. no 443: EMI FAR)

The EUT and accessories are placed on a non-conducting tipping table 1.55m height (fully-anechoic chamber) which is situated in the middle of the turntable. The turntable can rotate the device under test 360 degree, the tipping table can rotate the device from laid to standing position. This way the device under test can be rotated in all three orthogonal planes in order to maximize the detected emissions. The turn- and tipping table are controlled by a controller unit. All positions manipulations are software controlled from a operator PC. The measurements are performed for both receiving antenna polarisations: vertical and horizontal.

Up to 18 GHz a measurement distance of 3 meters is used, above 18 GHz the distance is 1 meter. A logarithmic-periodic antenna for frequencies above 1 GHz up to 26.5 GHz is used. For frequencies above 26.5 GHz a horn antenna is used, pls. compare the equipment list for more details.

The EUT is powered either by an external DC-supply with nominal voltage or an AC/DC power supply as accessory. The communication signalling (if necessary for operation) is performed from outside the chamber with a communication test simulator and a signalling antenna place near the EUT.

## 5. Measurements

### 5.1. Conducted emissions on AC-Power lines

#### 5.1.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter 2.2.1)	<input type="checkbox"/> Please see Chapter 2.2.2		<input type="checkbox"/> Please see Chapter 2.2.3	
test site	<input type="checkbox"/> 333 EMI field	<input checked="" type="checkbox"/> 348 EMI cond.			
receiver	<input type="checkbox"/> 001 ESS	<input checked="" type="checkbox"/> 377 ESCS 30			
LISN	<input checked="" type="checkbox"/> 005 ESH2-Z5	<input type="checkbox"/> 007 ESH3-Z6	<input type="checkbox"/> 300 ESH3-Z5 & 50Ω used for AE	<input type="checkbox"/> no LISN for AE	
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 436 CMU	<input checked="" type="checkbox"/> 547 CMU		
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains		<input checked="" type="checkbox"/> 060 110 V 60 Hz via PAS 5000		

#### 5.1.2 STANDARDS AND LIMITS:

##### FCC PART 15, SUBPART B, §15.207, CANADA: RSS-Gen

Frequency [MHz]	<input checked="" type="checkbox"/> Conducted limit Class B		<input type="checkbox"/> Conducted limit Class A	
	QUASI-Peak [dBμV]	AVERAGE [dBμV]	QUASI-Peak [dBμV]	AVERAGE [dBμV]
0.15 – 0.5	66 to 56*	56 to 46*	79	66
0.5 – 5	56	46	73	60
5 – 30	60	50	73	60

Remark: \* decreases with the logarithm of the frequency

#### 5.1.3 TEST CONDITION AND MEASUREMENT PROCEDURES ANSI C63.4:2009

link to test system (if used):	<input checked="" type="checkbox"/> air link	<input checked="" type="checkbox"/> cable connection	<input type="checkbox"/>
EUT-grounding	<input checked="" type="checkbox"/> none	<input type="checkbox"/> with power supply	<input type="checkbox"/> additional connection
Equipment set up	<input checked="" type="checkbox"/> table top (40 cm distance to reference ground plane (wall))		<input type="checkbox"/> floor standing EUT stands isolated on reference ground plane (floor)
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%
EMI-Receiver (Analyzer) Settings	Frequency Range: 150 kHz to 30 MHz RBW: 9 kHz		

Devices which can be connected to the public AC-power network should be tested against the radio frequency voltage conducted back into the AC-power line in the frequency range 150kHz to 30 MHz. Compliance should be tested by measuring the radio frequency voltage between each power line and ground at the power terminals in the stated frequency range.

A 50 Ohm/50 μH line impedance stabilization network (LISN) is used therefore. The EUT power input leads are connected through the LISN to the AC-power source. The LISN enclosure is electrically connected to the GND-plane. The measuring instrument is connected to the coaxial output of the LISN. Tabletop devices were set-up on a 80 cm height table over reference ground plane, floor standing equipment 10 cm raised above ground plane.

Measurements have been performed on each phase line and neutral line of the devices AC-power lines. The EUT was power supplied with 110 V/60Hz.

The EUT was tested in the defined operating mode and installed (connected) to accessory equipment according the general description of use given by the applicant.

**Preliminary testing** as a first step, determines the worst-case phase line (neutral or phase) as well as the most critical amplitude by changing the operating mode. A complete frequency-sweep is performed with PK-Detector.

**Final testing** for power phases and critical frequencies (Margin to AV- or QP limit lower than 3dB) as a second step includes measurements either on discrete frequency components with receivers detector set to Quasi-Peak and Average per frequency component or a complete frequency sweep with corresponding detector according to ANSI 63.4, CISPR 16.

**5.1.4 MEASUREMENT RESULTS**

EUT Type and S/N or EUT set-up no.		EUT set-up 1				
Diagram No.	EUT operating mode no. or comment	Used Detector	Power line	Limit Class	Additional (scan-) information	Result
1.01	EUT operating mode 2 (ARFCN 192)	<input checked="" type="checkbox"/> Peak <input type="checkbox"/> CAV <input type="checkbox"/> QP	L1/ N	<input type="checkbox"/> A <input checked="" type="checkbox"/> B	The Diagram shows PK detector at pre-measurements on L1 and N with maxhold mode.	passed
1.02	EUT operating mode 3 (ARFCN 661)	<input type="checkbox"/> Peak <input checked="" type="checkbox"/> CAV <input checked="" type="checkbox"/> QP	L1/ N	<input type="checkbox"/> A <input checked="" type="checkbox"/> B	The Diagram shows QP/CAV detector at final-measurements on L1 and N with maxhold mode.	passed
1.03	EUT operating mode 5 (U-ARFCN 9400)	<input checked="" type="checkbox"/> Peak <input type="checkbox"/> CAV <input type="checkbox"/> QP	L1/ N	<input type="checkbox"/> A <input checked="" type="checkbox"/> B	The Diagram shows PK detector at pre-measurements on L1 and N with maxhold mode.	passed
1.04	EUT operating mode 6 (U-ARFCN 1413)	<input checked="" type="checkbox"/> Peak <input type="checkbox"/> CAV <input type="checkbox"/> QP	L1/ N	<input type="checkbox"/> A <input checked="" type="checkbox"/> B	The Diagram shows PK detector at pre-measurements on L1 and N with maxhold mode.	passed
1.05	EUT operating mode 7 (U-ARFCN 4182)	<input type="checkbox"/> Peak <input checked="" type="checkbox"/> CAV <input checked="" type="checkbox"/> QP	L1/ N	<input type="checkbox"/> A <input checked="" type="checkbox"/> B	The Diagram shows QP/CAV detector at final-measurements on L1 and N with maxhold mode.	passed

Remarks: For more information please see diagrams at the next pages of this report.  
Positive margin means passed result.

Margin to Limit for verdict:  $M = L_T - R_R + C_{Loss}$

Abbreviations used:

- $R_R$  : Receiver readings in dB $\mu$ V
- $C_{Loss}$ : cable loss
- $L_T$  : Limit in dB $\mu$ V

**5.1.5 VERDICT**

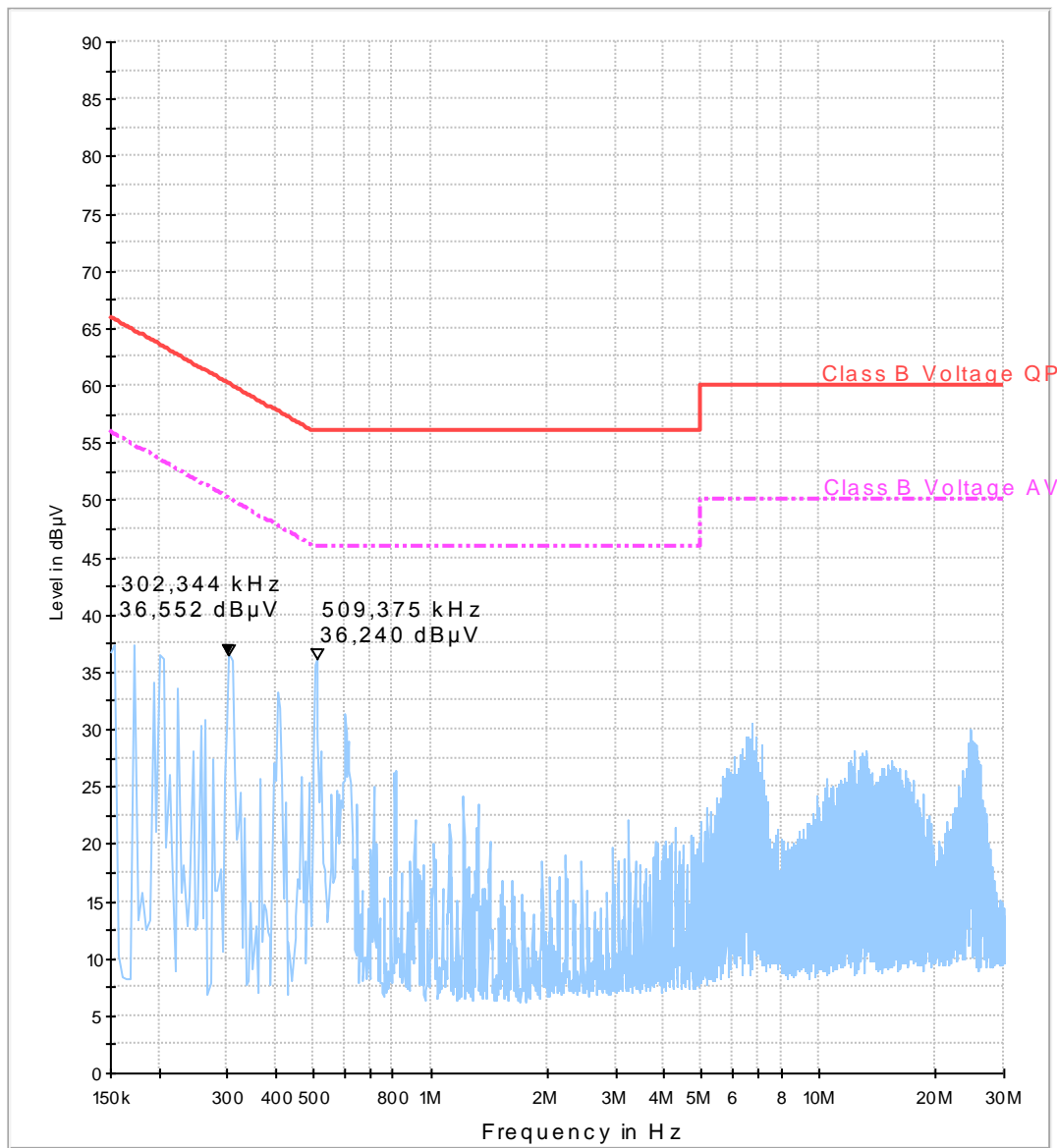
Summary of measurement results for conducted emissions on AC-Power lines: Passed

DIAGRAMS

Diagram No. 1.01

Date: 22.03.2012	Page 1 of 2
Test Description:	Conducted Voltage Measurement Class B
Testspezifikation:	FCC 15.207 Class B/ RSS-Gen Issue 3
Technical Data:	Please see next page for detailed information
Diagram:	Shows the peak values as a sum of measured ports (N+L1) in maxhold mode
Operator name:	Hla
Report.- Nr.	6-0143-12-2-3a
EUT:	LISA-U230
Manufacturer:	U-blox AG
Operating mode:	GSM 850 E-GPRS TX (channel:192)
Measured on line:	Mains AC L1 and N
Power during test:	110 V AC 60 Hz
Comment 1:	AC/DC adapter + Magn. Ant. Taoglas GA.107

01\_Class B\_Voltage\_PK\_QPAV\_N\_L1



Date: 22.03.2012 Page 2 of 2

## Technical Data of Measurements with R&S EMC32 V8.51.1

### EMI Auto Test Template: 01\_Class B\_Voltage\_PK\_QPAV\_N\_L1

Hardware Setup: ESH2-Z5  
Measurement Type: 4 Line LISN  
Frequency Range: 150 kHz - 30 MHz  
Graphics Level Range: 0 dB $\mu$ V - 90 dB $\mu$ V

Preview Measurements:  
Scan Test Template: 02\_Class B\_pre\_PK\_fast

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	61.035 Hz	PK+	200 Hz	0,00005 s	0 dB
150 kHz - 30 MHz	3.906 kHz	PK+	9 kHz	0,00005 s	0 dB

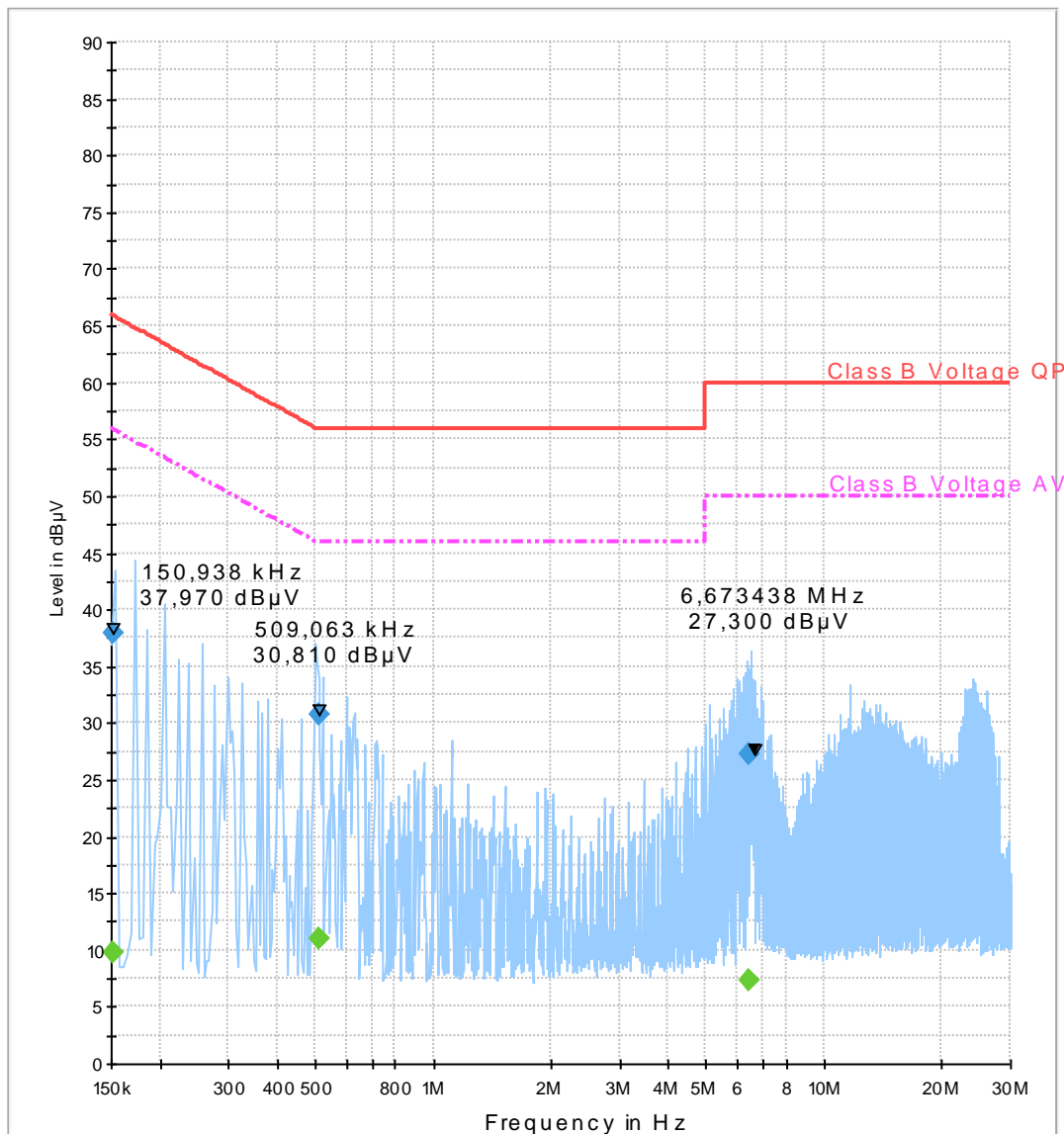
Receiver: [ESCS 30]



### Diagram No. 1.02

Test Description:	Date: 28.03.2012 Page 1 of 3
Testspezifikation:	Conducted Voltage Measurement Class B
Technical Data:	FCC 15.207, RSS-Gen. Issue 3
Diagram:	Please see next page for detailed information
Operator name:	Shows the peak values as a sum of measured ports (N+L1) in maxhold mode
Report.- Nr.	Tas 6-0143-12-2-3a
EUT:	LISA-U230
Manufacturer:	U-blox AG
Operating mode:	PCS 1900 GSM-TX (ARFCN:661)
Measured on line:	Mains AC L1 and N
Power during test:	110 V AC 60 Hz
Comment 1:	AC/DC adapter + Magn. Ant. Taoglas GA.107

01\_Class B\_Voltage\_PK\_QPAV\_N\_L1



Date: 28.03.2012 Page 2 of 2

**Final Result 1**

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150938	38.0	15000.0	9.000	GND	L1	0.0	28.0	65.9
0.509063	30.8	15000.0	9.000	GND	L1	0.0	25.2	56.0
6.430938	27.3	15000.0	9.000	GND	L1	0.1	32.7	60.0

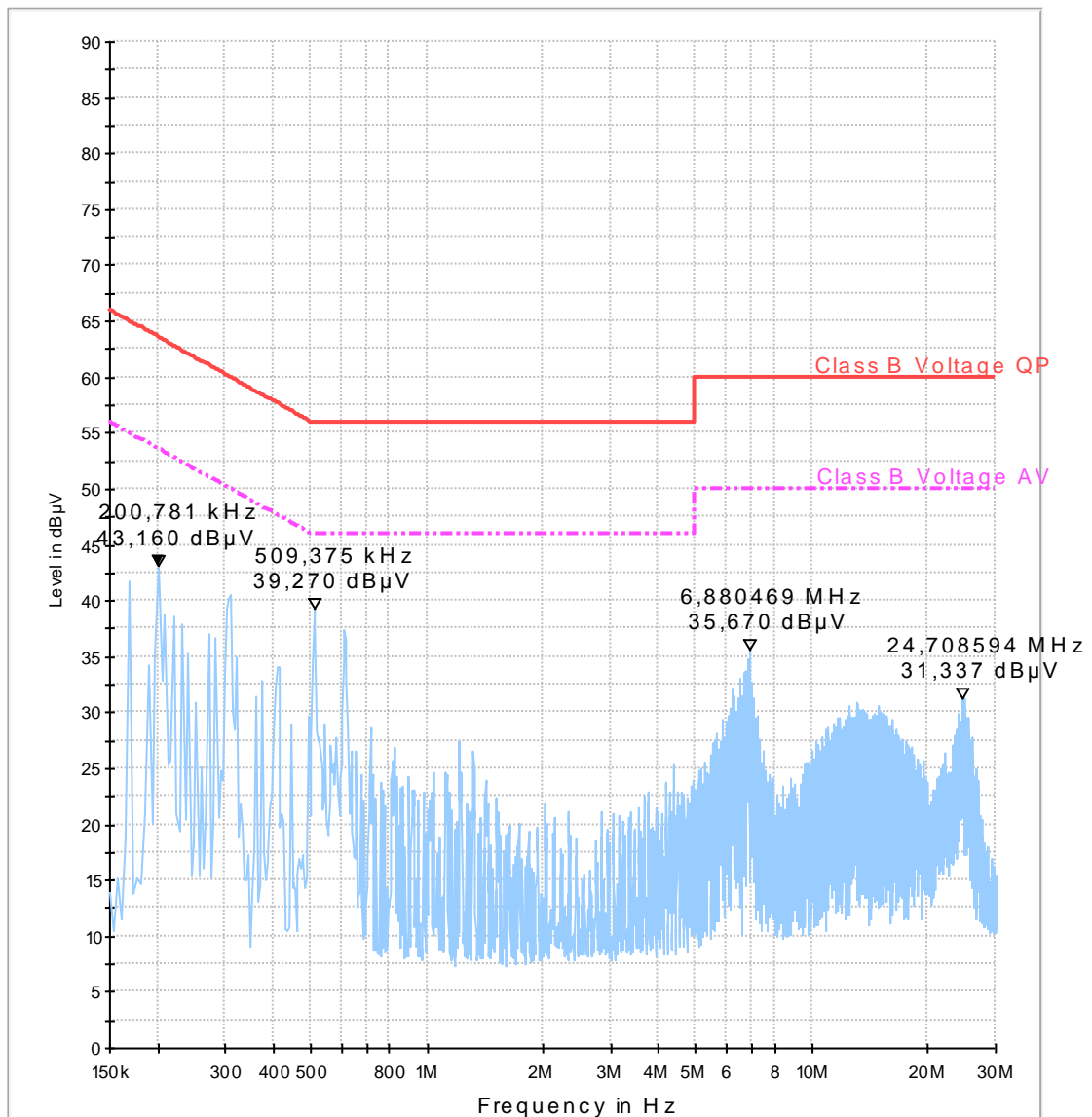
**Final Result 2**

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150938	9.9	15000.0	9.000	GND	L1	0.0	46.1	55.9
0.509063	11.0	15000.0	9.000	GND	L1	0.0	35.0	46.0
6.430938	7.3	15000.0	9.000	GND	L1	0.1	42.7	50.0

### Diagram No. 1.03

Test Description:	Date: 28.03.2012
Testspezifikation:	Conducted Voltage Measurement Class B
Technical Data:	FCC 15.207, RSS-Gen. Issue 3
Diagram:	Please see next page for detailed information
Operator name:	Shows the peak values as a sum of measured ports (N+L1) in maxhold mode
Report.- Nr.	Tas 6-0143-12-2-3a
EUT:	LISA-U230
Manufacturer:	U-blox AG
Operating mode:	FDD II - TX (channel:9400)
Measured on line:	Mains AC L1 and N
Power during test:	110 V AC 60 Hz
Comment 1:	AC/DC adapter + Magn. Ant. Taoglas GA.107

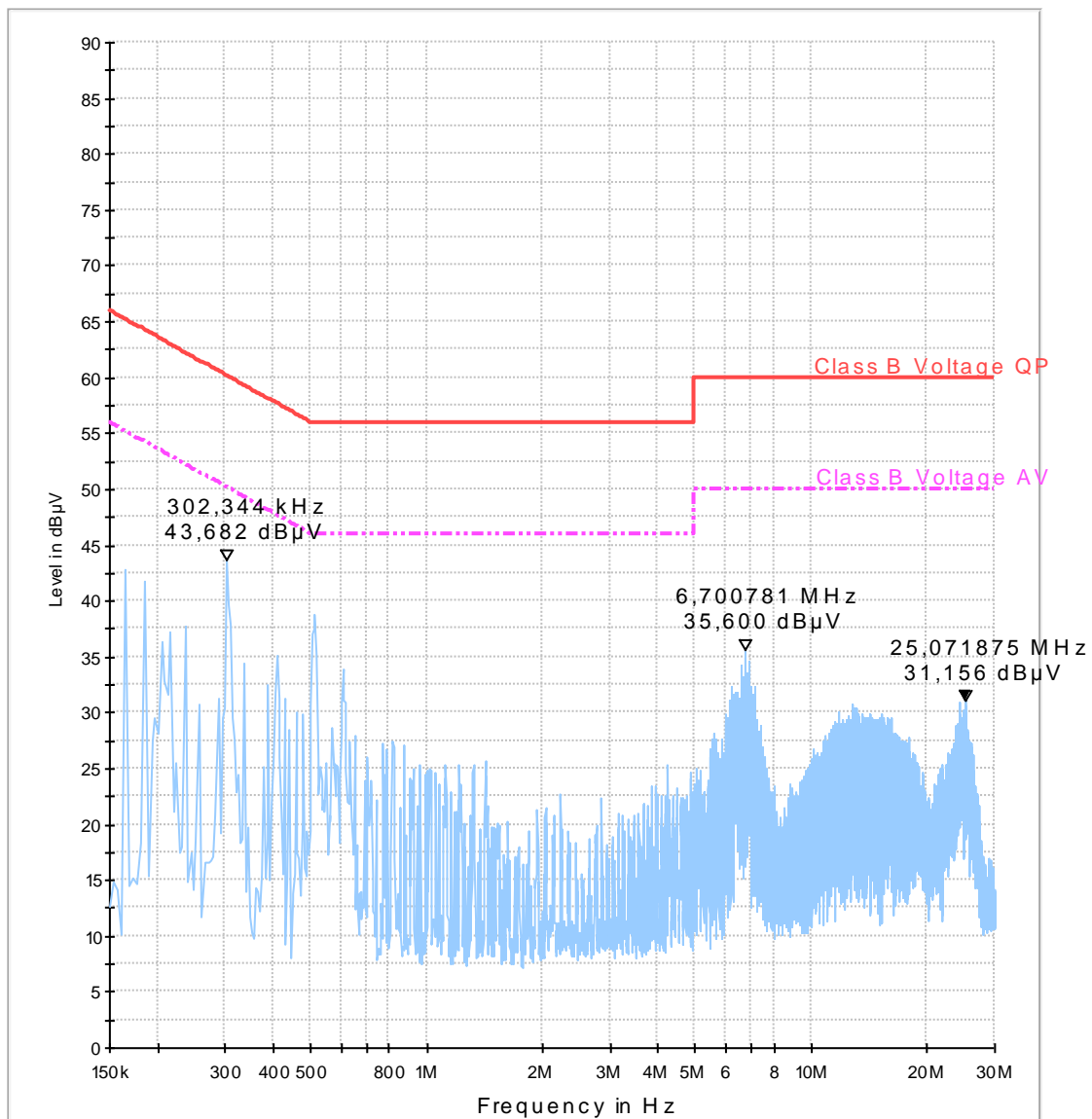
01\_Class B\_Voltage\_PK\_QPAV\_N\_L1



### Diagram No. 1.04

Test Description:	Date: 28.03.2012
Testspezifikation:	Conducted Voltage Measurement Class B
Technical Data:	FCC 15.207, RSS-Gen. Issue 3
Diagram:	Please see next page for detailed information
Operator name:	Shows the peak values as a sum of measured ports (N+L1) in maxhold mode
Report.- Nr.	Tas 6-0143-12-2-3a
EUT:	LISA-U230
Manufacturer:	U-blox AG
Operating mode:	FDD IV - TX (channel:1413)
Measured on line:	Mains AC L1 and N
Power during test:	110 V AC 60 Hz
Comment 1:	AC/DC adapter + Magn. Ant. Taoglas GA.107

01\_Class B\_Voltage\_PK\_QPAV\_N\_L1



### Diagram No. 1.05

Test Description:	Date: 28.03.2012
Testspezifikation:	Conducted Voltage Measurement Class B
Technical Data:	FCC 15.207, RSS-Gen. Issue 3
Diagram:	Please see next page for detailed information
Operator name:	Shows the peak values as a sum of measured ports (N+L1) in maxhold mode
Report.- Nr.	Tas 6-0143-12-2-3a
EUT:	LISA-U230
Manufacturer:	U-blox AG
Operating mode:	FDD V - TX (channel:4182)
Measured on line:	Mains AC L1 and N
Power during test:	110 V AC 60 Hz
Comment 1:	AC/DC adapter + Magn. Ant. Taoglas GA.107

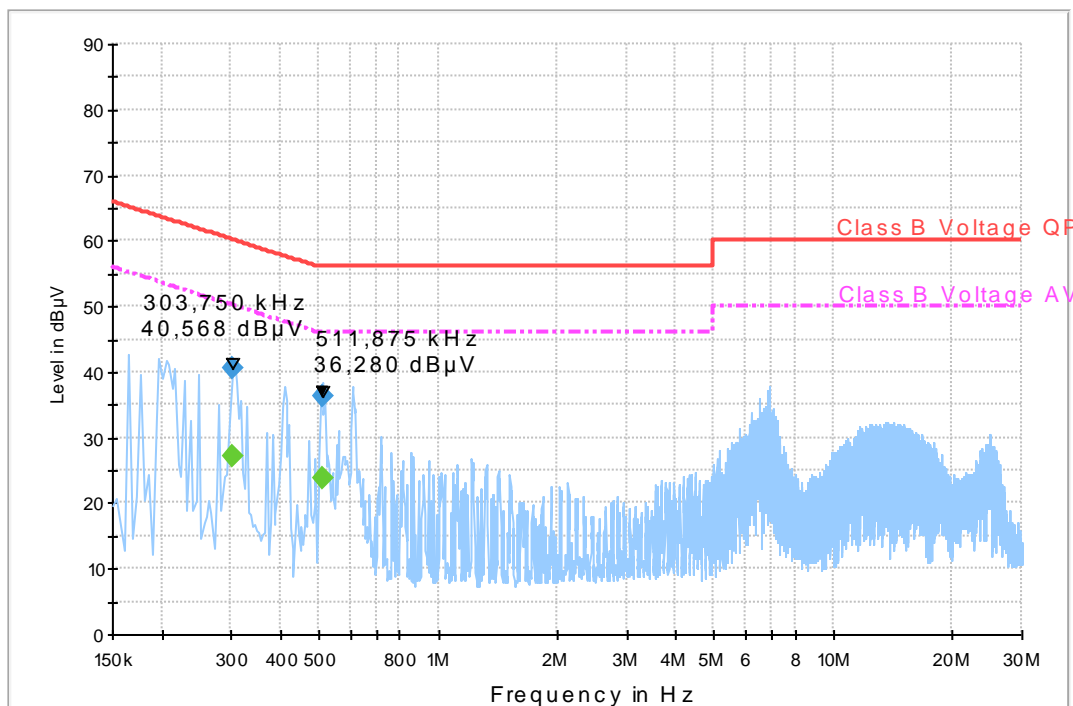
#### Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.303750	40.6	15000.0	9.000	GND	N	0.0	19.6	60.1
0.511875	36.3	15000.0	9.000	GND	N	0.0	19.7	56.0

#### Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.303750	27.2	15000.0	9.000	GND	N	0.0	22.9	50.1
0.511875	23.9	15000.0	9.000	GND	N	0.0	22.1	46.0

01\_Class B\_Voltage\_PK\_QPA V\_N\_L1



## 5.2. Radiated out of Band RF emissions and Block Edge

### 5.2.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

test site	<input type="checkbox"/> 441 EMISAR	<input type="checkbox"/> 348 EMI cond.	<input checked="" type="checkbox"/> 443 EMI FAR	<input type="checkbox"/> 347 Radio.lab.	<input type="checkbox"/> 337 OATS	<input type="checkbox"/>
equipment	<input type="checkbox"/> 331 HC 4055	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK	<input checked="" type="checkbox"/> 489 ESU	<input type="checkbox"/>	<input type="checkbox"/>
antenna meas	<input type="checkbox"/> 574 BTA-L	<input type="checkbox"/> 289 CBL 6141	<input checked="" type="checkbox"/> 608 HL 562	<input checked="" type="checkbox"/> 549 HL025	<input type="checkbox"/> 302 BBHA9170	<input type="checkbox"/> 477 GPS
antenna meas	<input type="checkbox"/> 123 HUF-Z2	<input type="checkbox"/> 132 HUF-Z3	<input type="checkbox"/> 030 HFH-Z2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
antenna subst	<input type="checkbox"/> 071 HUF-Z2	<input type="checkbox"/> 020 EMCO3115	<input type="checkbox"/> 063 LP 3146	<input type="checkbox"/> 303 BBHA9170	<input type="checkbox"/>	<input type="checkbox"/>
power meter	<input type="checkbox"/> 009 NRV	<input type="checkbox"/> 010 URV5-Z2	<input type="checkbox"/> 011 URV5-Z2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
signalgener.	<input type="checkbox"/> 008 SMG	<input type="checkbox"/> 140 SMHU	<input type="checkbox"/> 263 SMP04	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
power meter	<input type="checkbox"/> 262 NRV-S	<input type="checkbox"/> 266 NRV-Z31	<input type="checkbox"/> 265 NRV-Z33	<input type="checkbox"/> 261 NRV-Z55	<input type="checkbox"/> 356 NRV-Z1	<input type="checkbox"/>
multimeter	<input type="checkbox"/> 341 Fluke 112	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 436 CMU	<input checked="" type="checkbox"/> 546 CMU			
DCpower	<input type="checkbox"/> 086 LNG50-10	<input type="checkbox"/> 087 EA3013	<input type="checkbox"/> 354 NGPE 40	<input type="checkbox"/> 349 car battery	<input type="checkbox"/> 350 Car battery	<input type="checkbox"/>
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains		<input checked="" type="checkbox"/> 060 110 V 60 Hz via PAS 5000			

### 5.2.2. Test condition and measurement test set-up

link to test system (if used):	<input checked="" type="checkbox"/> air link	<input type="checkbox"/> cable connection	<input type="checkbox"/>
EUT-grounding	<input checked="" type="checkbox"/> none	<input type="checkbox"/> with power supply	<input type="checkbox"/> additional connection
Equipment set up	<input checked="" type="checkbox"/> table top 1.55m height		<input type="checkbox"/> floor standing
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%

### 5.2.3. Requirement

#### **Part 22.917(a) & Part 24.238(a)**

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB

#### **Part 27.53(g):**

(g) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log_{10}(P)$  dB.

### 5.2.4. Measurement conditions

- radiated set-up, see chapter 4.2
- UE is set TX mode, highest transmit power conditions
- UE set to low, middle, and high nominal operating frequency (10<sup>th</sup> harmonic) within the operating range

### 5.2.5. Measurement procedure

By rotating the EUT in three orthogonal planes, the emissions were recorded with Peak-Detector and Hold-Max function of the spectrum-analyzer. If the harmonic could not be detected above the noise floor, the ambient level was recorded. Measurement antenna was set to horizontal plane (h) and vertical plane (v) for measuring the emissions. Measurement distance is 3 m up to 18 GHz, 1 m from 18 to 25 GHz. Critical measurements near the limit are re-measured with a substitution method accord. TIA/EIA 603.

#### **Settings on spectrum analyzer outside the frequency block:**

Frequency range	RBW	VBW	Sweep Time	Sweep Mode	Detector
30 MHz. .. 20 GHz	1 MHz	3 MHz	High enough to maintain necessary accuracy	Repetitive scan, Max-Hold mode	Max-Peak

**Settings on spectrum analyzer for Band-Edge compliance GSM/FDD measurements:**

Band (GSM/FDD)	Frequency range	RBW	VBW	Sweep Time	Sweep Mode	Detector
G850 /5	823-824 MHz 849-850 MHz	30 kHz (PK) 3 kHz (AV)	300 kHz (PK) 30 kHz (AV)	High enough to maintain necessary accuracy	Repetitive scan, Max-Hold mode	Max-Peak and/or Average
-/4	1709-1710 MHz 1770-1771 MHz					
1900/ 2	1849-1850 MHz 1910-1911 MHz					

Due to not available exact 1% RBW of the measurement equipment, the lower available RBW was used for these measurements.

An additional correction factor of 10 Log (RBW1/ RBW2) to the result was added to RBW1 is the narrower measurement resolution bandwidth (used RBW) and RBW2 is either the 1% emissions bandwidth or 1 MHz.

**Formula:** Block-Edge compliance correction factor for FDD bands -> 10log(50kHz/30KHz) to be used=2.22dB

**5.2.6. Results (Radiated)**

Due to uncritical pre-measurements have been showing only noise floor in EDGE Mode. Therefore measurements mentioned-below performed only in GSM Mode.

Only worst-case level from the measurements are selected in the tables. Please refer at the next chapter 'diagrams' for more details at all diagrams.

**5.2.6.1. GSM 850 Mode: Op. Mode 1, Set-up 1**

Transmitting channels/ frequencies: TX = 128/ 824.2 MHz, 192/ 837 MHz, 251/ 848.8 MHz							
Sweep no.	Diagram number(s)	Frequency of emission [MHz]	Worst-Level Polarisation [dBm]	Frequency of worst-peak level [GHz]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1 <sup>1.)</sup>	2.01-03	30 to 9000	H	2.472	-22.8	-13	Passed
Sweep 2 <sup>2.)</sup>	2.03_BE	849.01	H/V	--	-18.6 (PK)		Passed

Remark: 1.) Carrier of wanted TX on diagram and performed as final-measurement  
2.) Block-Edge compliance

**5.2.6.2. GSM TCH 1900: Op. Mode 3, Set-up 1**

Transmitting channels/ frequency: TX = 512/ 1850.2 MHz, 661/ 1880 MHz, 810/ 1909.8 MHz							
Sweep no.	Diagram number(s)	Frequency of emission [MHz]	Worst-Level Polarisation [dBm]	Frequency of worst-peak level [GHz]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1 <sup>1.)</sup>	2.04-06	30 to 20000	H	5.551	-21.1	-13	Passed
Sweep 2 <sup>2.)</sup>	2.04_BE	1849.99	H/V	--	-16.8 (PK)		Passed

Remark: 1.) Carrier of wanted TX on diagram and performed as final-measurement  
2.) Block-Edge compliance

**5.2.6.3. FDD II TCH : Op. Mode 5, Set-up 1**

Transmitting channels/ frequencies: TX = 9262/ 1852.4 MHz, 9400/ 1880 MHz, 9538/ 1907.6 MHz							
Sweep no.	Diagram number(s)	Frequency of emission [MHz]	Worst-Level Polarisation [dBm]	Frequency of worst-peak level [GHz]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1 <sup>1.)</sup>	2.07-09	30 to 20000	V	5.643	-23.6	-13	Passed
Sweep 2 <sup>2.)</sup>	2.09_BE	1910.02	H/V	--	<-23.9+2.22=-27.08 (PK)		Passed

Remark: 1.) Carrier of wanted TX on diagram and performed as final-measurement  
 2.) Block-Edge compliance incl. formula

**5.2.6.4. FDD IV TCH : Op. Mode 6, Set-up 1**

Transmitting channels/ frequencies: TX = 1312/ 1712.4 MHz, 1413/ 1732.6 MHz, 1513/ 1752.6 MHz							
Sweep no.	Diagram number(s)	Frequency of emission [MHz]	Worst-Level Polarisation [dBm]	Frequency of worst-peak level [GHz]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1 <sup>1.)</sup>	2.10-12	30 to 18000	H/V	5.139	-36.38	-13	Passed
Sweep 2 <sup>2.)</sup>	2.10_BE	1709.9	H/V	--	<-22.1+2.22=-19.88 (PK)		Passed

Remark: 1.) Carrier of wanted TX on diagram and performed as pre-measurement  
 2.) Block-Edge compliance incl. formula

**5.2.6.5. FDD V TCH : Op. Mode 7, Set-up 1**

Transmitting channels/ frequencies: TX = 4132/ 826.4 MHz, 4182/ 836.4 MHz, 4233/ 846.6 MHz							
Sweep no.	Diagram number(s)	Frequency of emission [MHz]	Worst-Level Polarisation [dBm]	Frequency of worst-peak level [GHz]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1 <sup>1.)</sup>	2.13-15	30 to 9000	V	2.512	-21.3	-13	Passed
Sweep 2 <sup>2.)</sup>	2.15_BE	849.01	--	--	<-23.3+2.22=-21.08(PK)		Passed

Remark: 1.) Carrier of wanted TX on diagram and performed as final-measurement  
 2.) Block-Edge compliance incl. formula



**Diagrams**

**Diagram no. 2.01**

**Common Information**

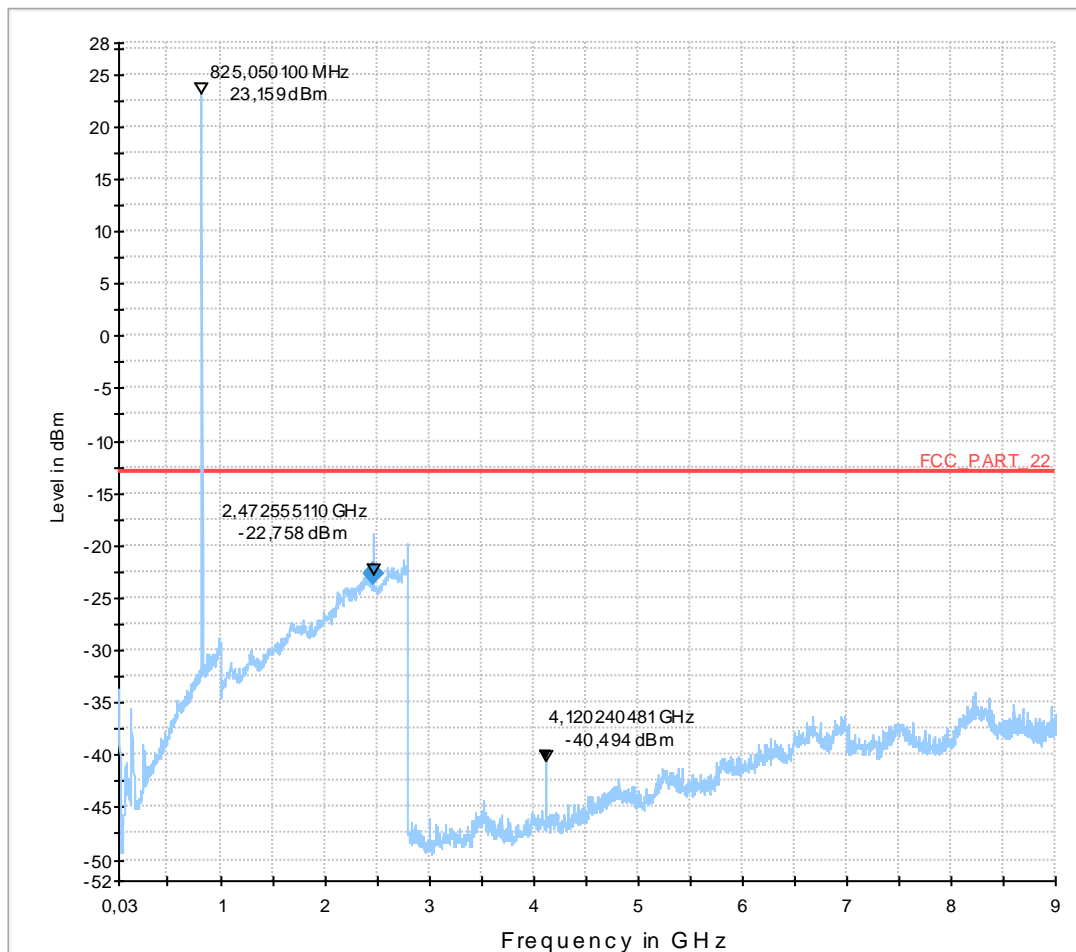
Test Description:	Radiated Spurious Emissions GSM 850
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part22,RSS-132
Operating Mode:	UE TX_mode, ARFCN 128 (low channel)
Environmental Conditions:	Humidity: 30%rH; Temperature: 19°C
Operator:	HLA 6-0143-12-2-3a

**EUT Information**

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)

**Final Measurement Result 1**

Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)
2472.555110	-22.8	5000.0	1000.000	H	312.0	90.0	-59.6



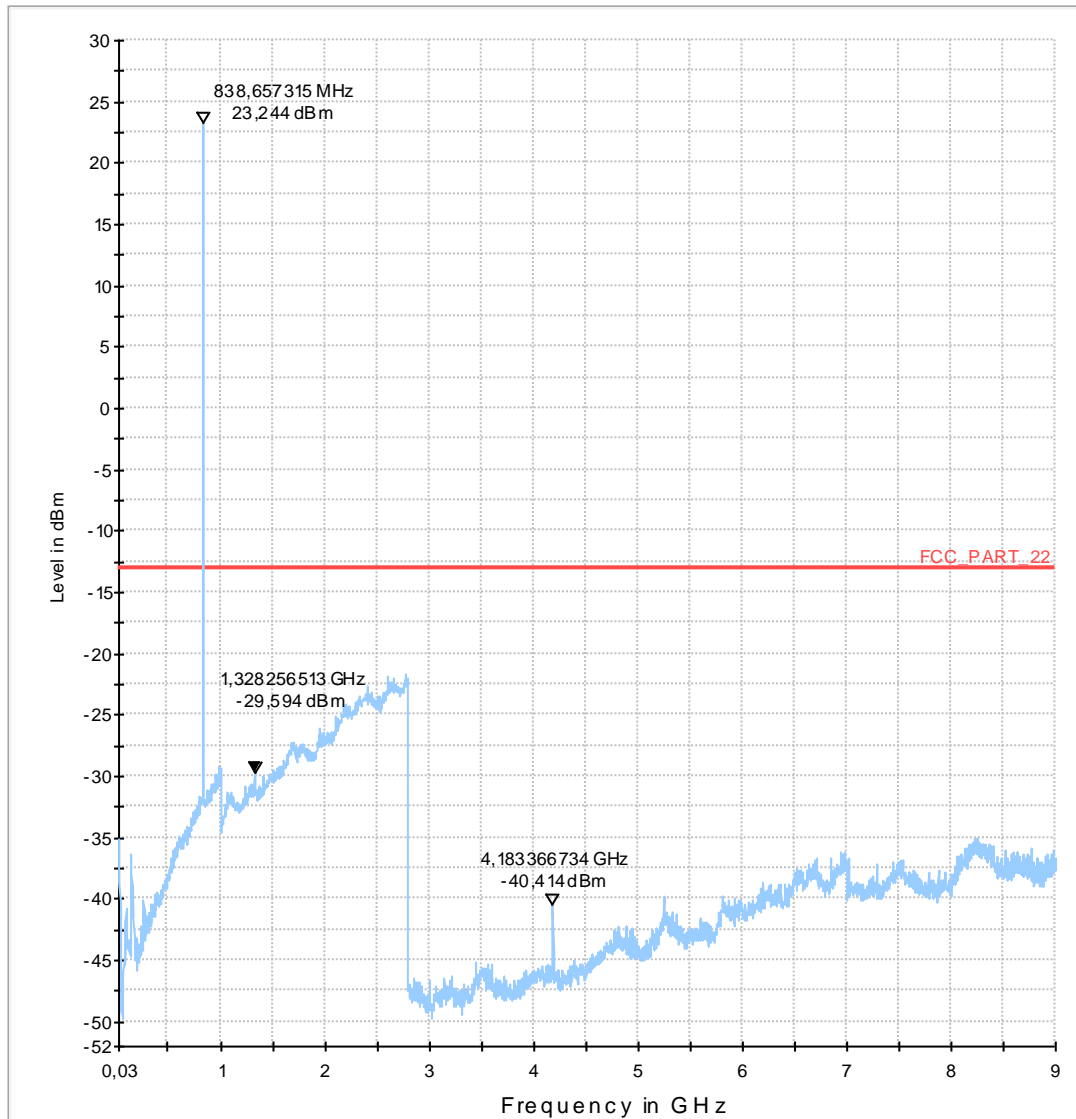
### Diagram no. 2.02

#### Common Information

Test Description:	Radiated Spurious Emissions GSM 850
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part22,RSS-132
Operating Mode:	UE TX_mode, ARFCN 192 (middle channel)
Environmental Conditions:	Humidity: 30%rH; Temperature: 19°C
Operator:	HLA 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)



### Diagram no. 2.03

#### Common Information

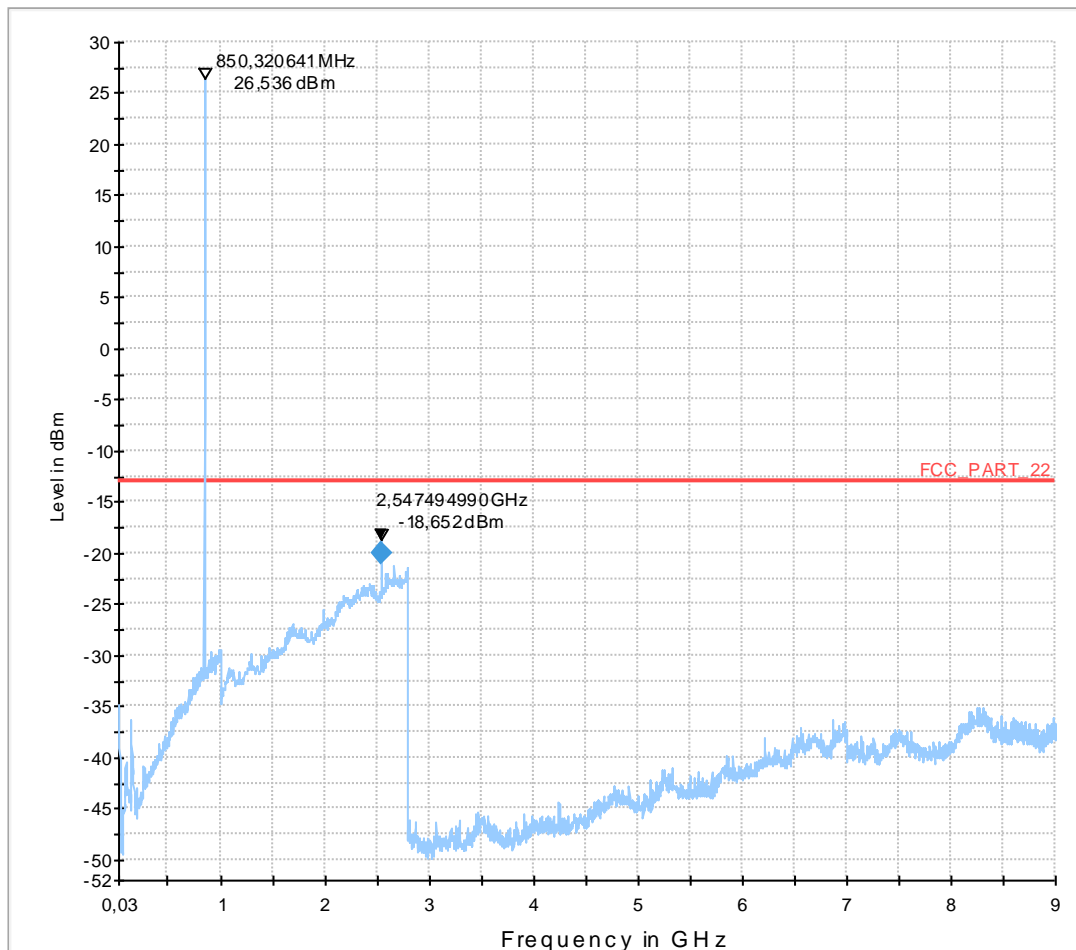
Test Description:	Radiated Spurious Emissions GSM 850
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part22,RSS-132
Operating Mode:	UE TX_mode, ARFCN 251 (high channel)
Environmental Conditions:	Humidity: 30%rH; Temperature: 19°C
Operator:	HLa 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)

#### Final Measurement Result 1

Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)
2546.122245	-20.1	5000.0	1000.000	H	268.0	0.0	-59.3



### Diagram no. 2.01\_BE

#### Common Information

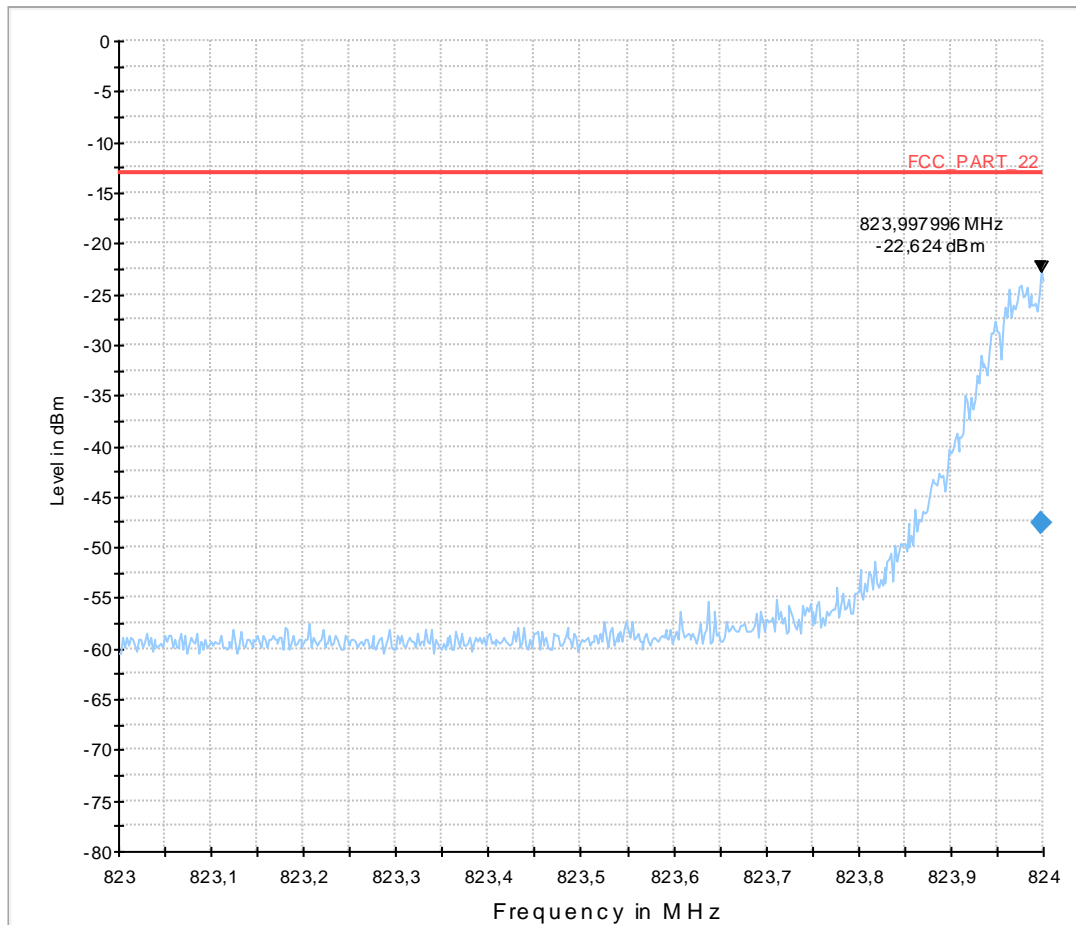
Test Description:	Radiated Band Edge Compliance GSM850
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 22.917
Operating Mode:	MS allocated channel 128 (fc = 824.2MHz), Voice, PCL5 (+33dBm)
Exclusionband:	824 - 849MHz
Environmental Conditions:	Humidity: 30%rH; Temperature: 19.2°C
Operator:	Tas 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)

#### Final Result 1

Frequency (MHz)	Average (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)	Margin (dB)	Limit (dBm)
823.997996	-47.5	10000	3.000	H	-24.0	90.0	-75.9	34.5	-13.0



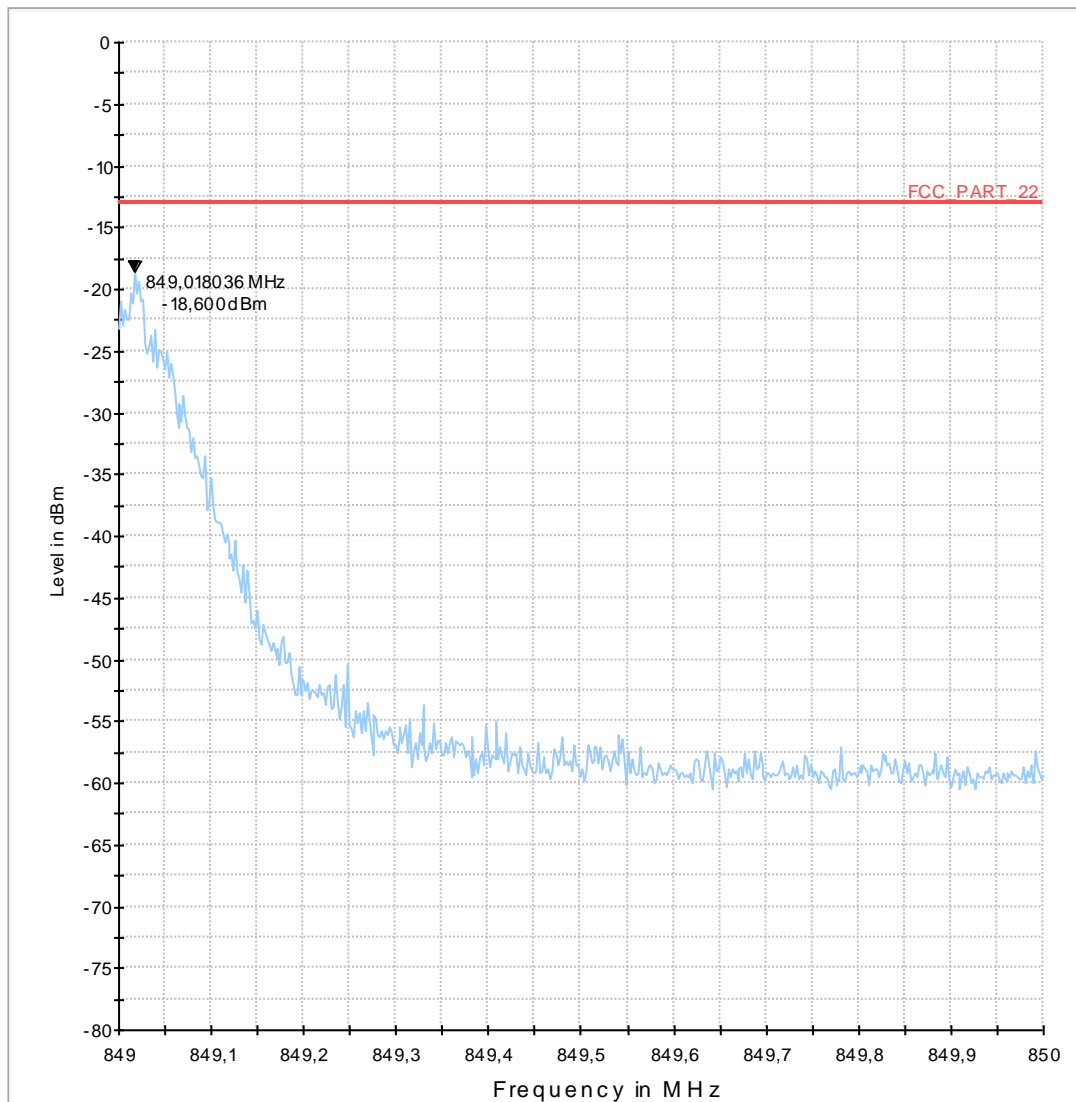
### Diagram no. 2.03\_BE

#### Common Information

Test Description:	Radiated Band Edge Compliance GSM850
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 22.917
Operating Mode:	MS allocated channel 251 (fc = 848.8MHz), Voice, PCL0 (+33dBm)
Exclusionband:	824 - 849MHz
Environmental Conditions:	Humidity: 30%rH; Temperature: 19°C
Operator:	Tas 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)



### Diagram no. 2.04

#### Common Information

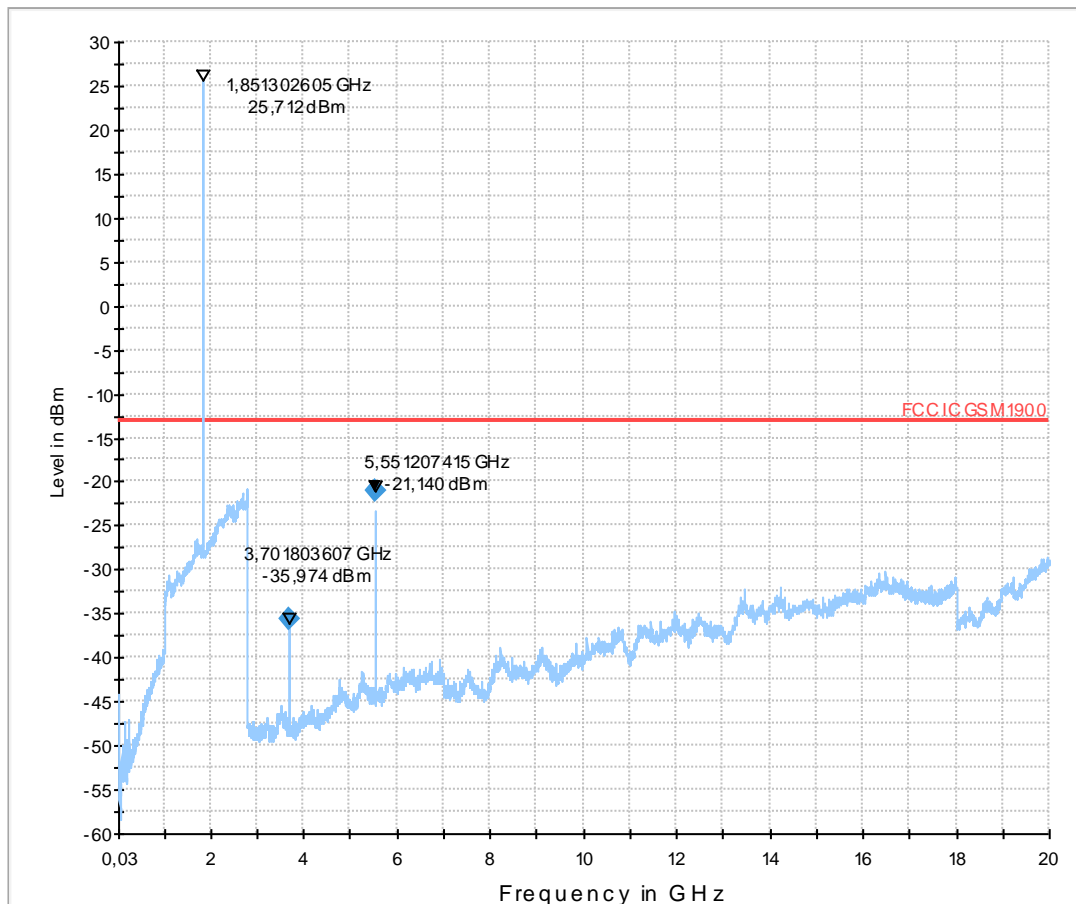
Test Description:	Radiated Spurious Emissions GSM1900
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part24,RSS-133
Comm. Link:	GSM1900, Voice
Operating Mode:	MS allocated channel 512 (UL = 1850.2MHz)
Exclusionband:	1850- 1910MHz
Environmental Conditions:	Humidity: 37%rH; Temperature: 19°C
Operator:	hla 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adpater(110 V/60 Hz)

#### Final Result 1

Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)	Margin (dB)	Limit (dBm)
3700.295591	-35.7	5000.0	3000.000	V	137.0	90.0	-94.9	22.7	-13.0
5551.207415	-21.1	5000.0	3000.000	H	310.0	0.0	-89.9	8.1	-13.0



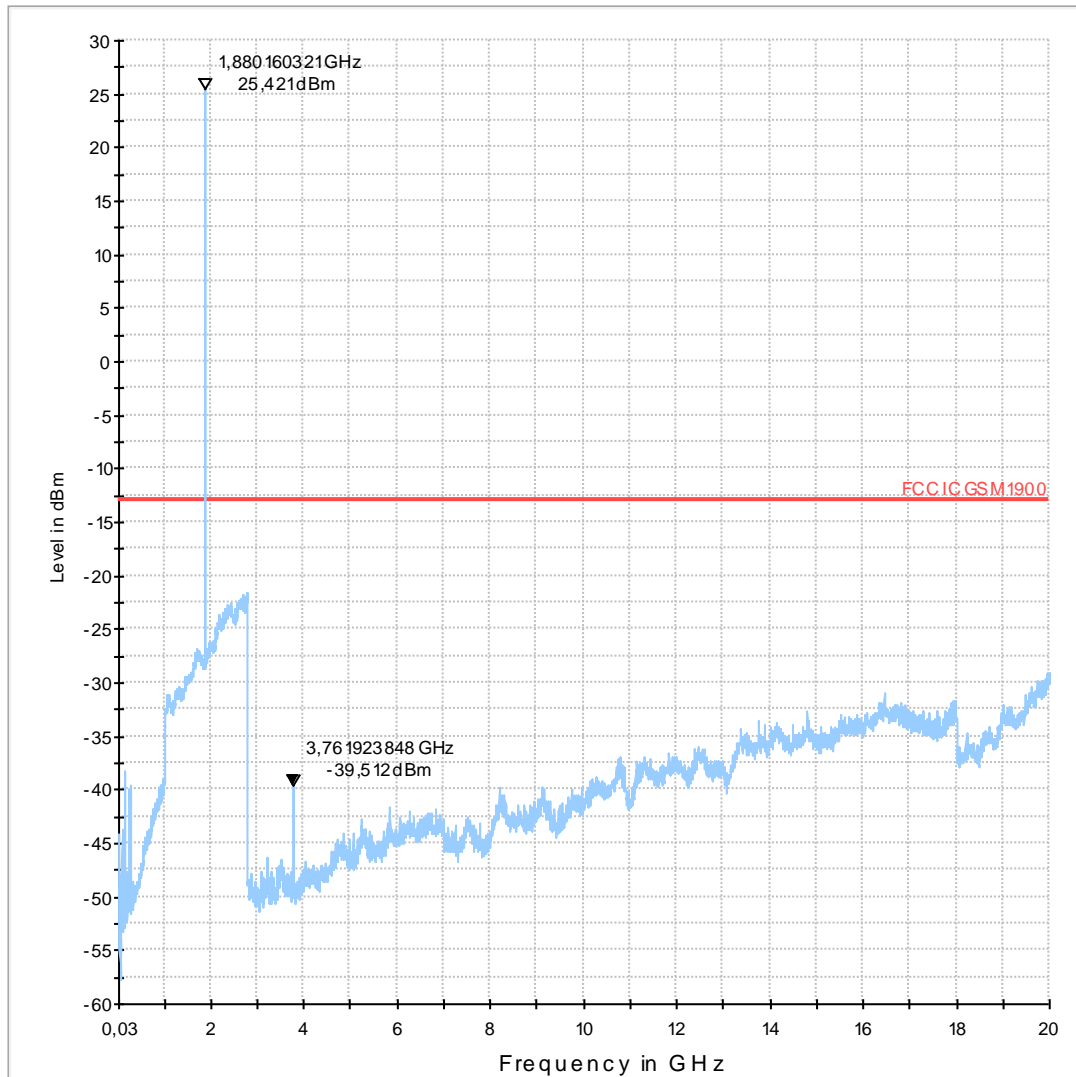
### Diagram no. 2.05

#### Common Information

Test Description:	Radiated Spurious Emissions GSM1900
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part24,RSS-133
Comm. Link:	GSM1900, Voice
Operating Mode:	MS allocated channel 661 (UL = 1880MHz)
Exclusionband:	1850- 1910MHz
Environmental Conditions:	Humidity: 37%rH; Temperature: 19°C
Operator:	hla 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)



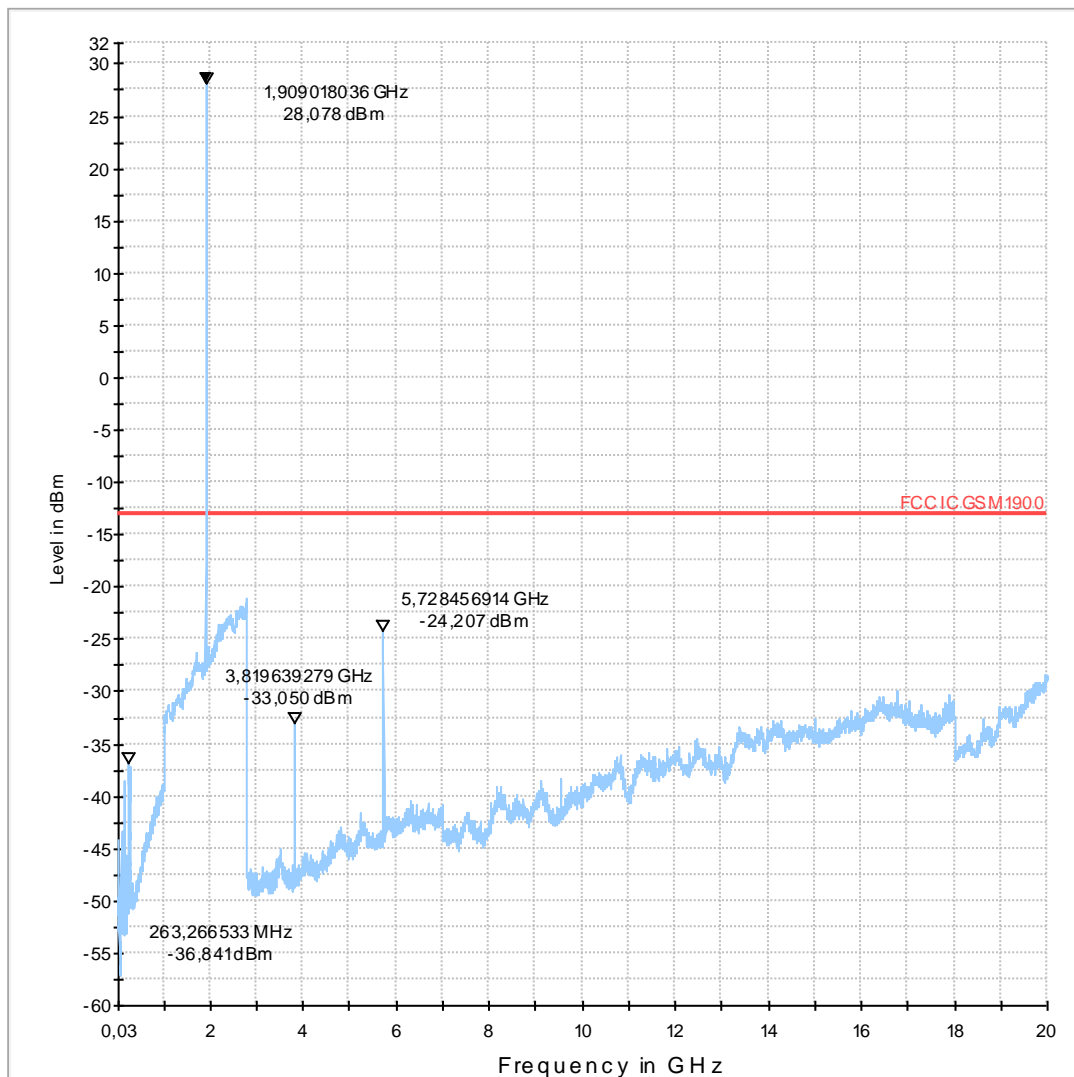
### Diagram no. 2.06

#### Common Information

Test Description:	Radiated Spurious Emissions GSM1900
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 24.238
Comm. Link:	GSM1900, Voice
Operating Mode:	UE TX_mode, ARFCN 810 (high channel)
Exclusionband:	1850- 1910MHz
Environmental Conditions:	Humidity: 37%rH; Temperature: 19°C
Operator:	Tas 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)





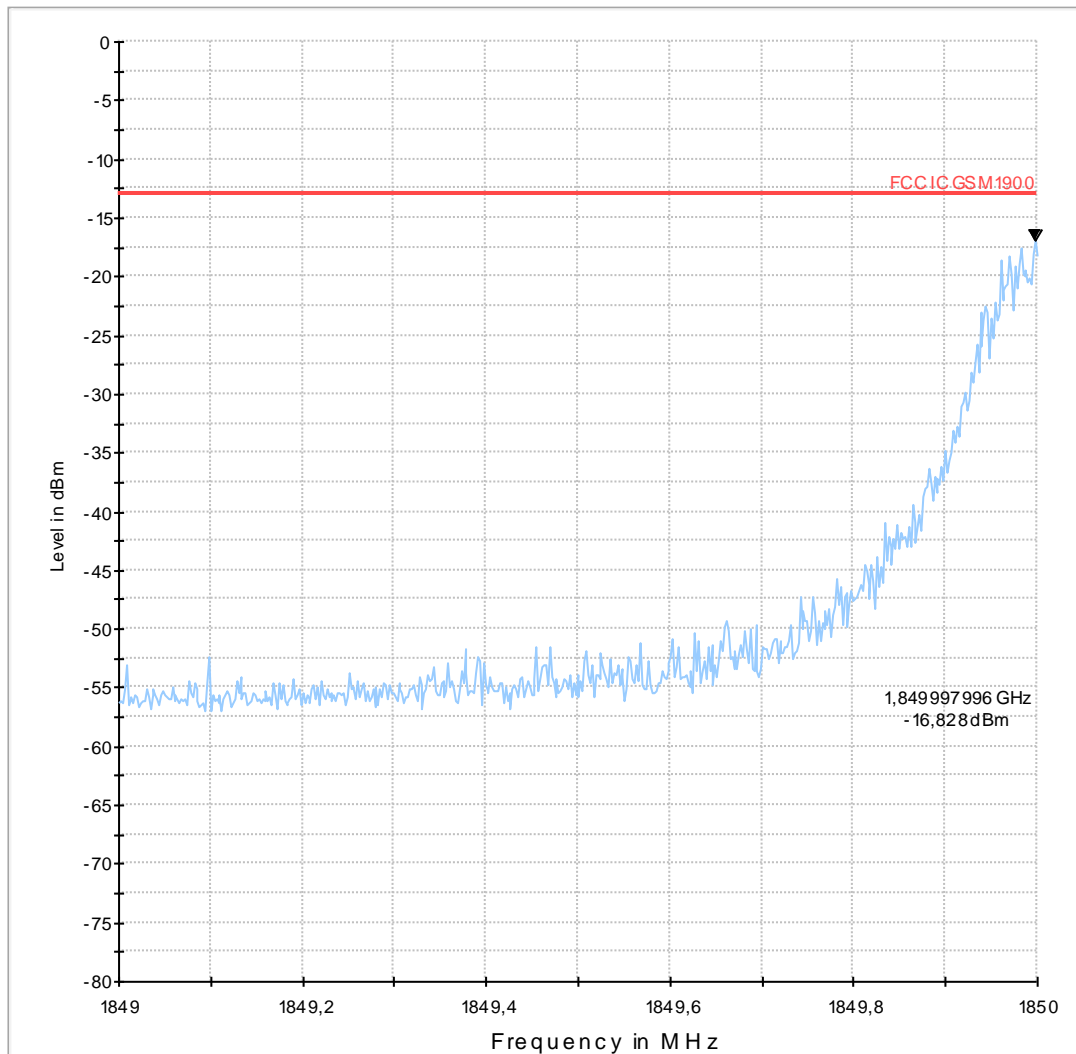
### Diagram no. 2.04\_BE

#### Common Information

Test Description:	Band-Edge Radiated GSM PCS1900
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 24.238
Comm. Link:	GSM1900, Voice
Operating Mode:	MS allocated channel 512 (UL = 1850.2MHz),661 (UL = 1880.0MHz),810 (UL = 1909.8MHz)
Exclusionband:	1850- 1910MHz
Environmental Conditions:	Humidity: 33%rH; Temperature: 21.8°C
Operator:	Tas 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adpater(110 V/60 Hz)



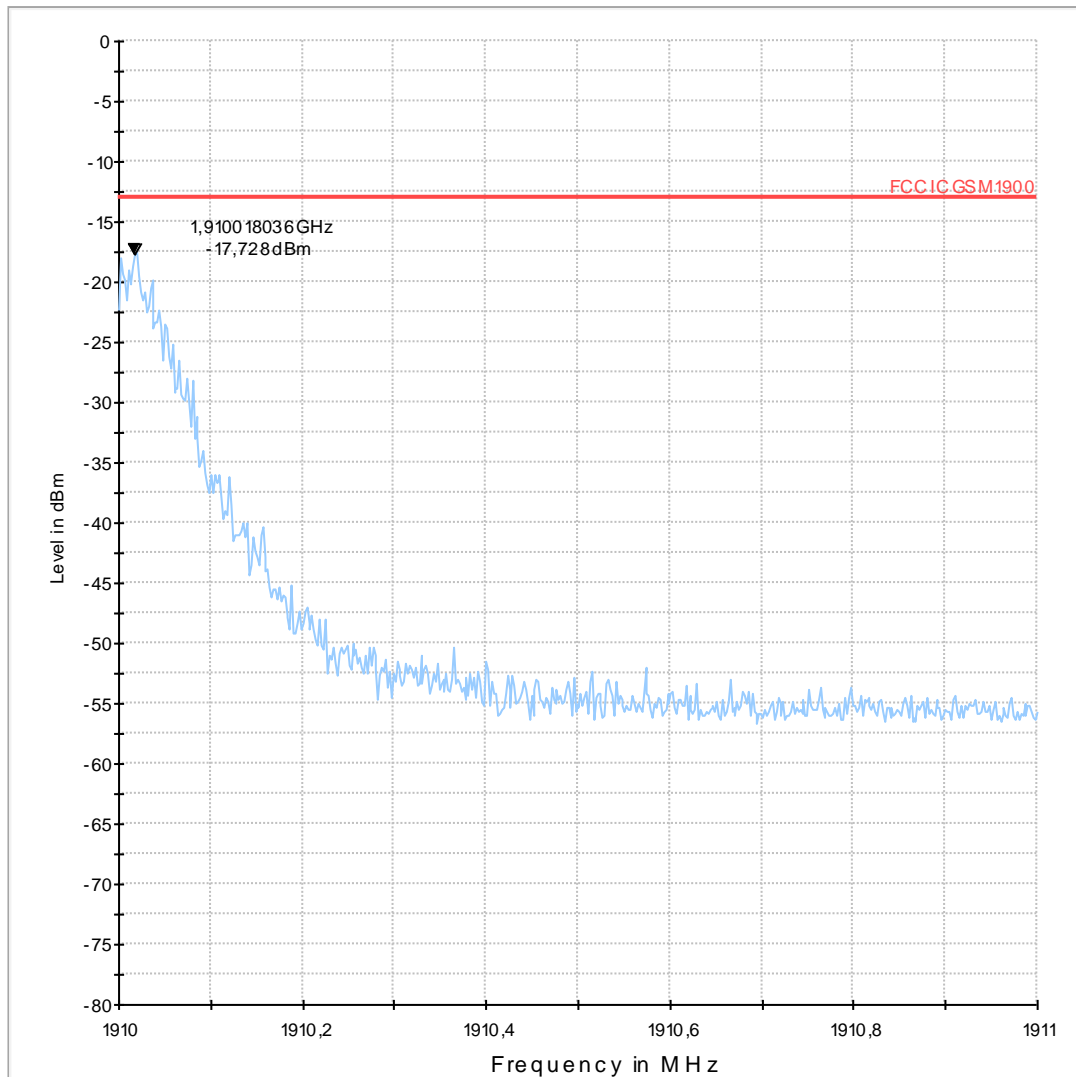
### Diagram no. 2.06\_BE

#### Common Information

Test Description:	Band-Edge Radiated GSM PCS1900
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 24.238
Comm. Link:	GSM1900, Voice
Operating Mode:	UE TX_mode, ARFCN 810 (high channel)
Exclusionband:	1850- 1910MHz
Environmental Conditions:	Humidity: 37%rH; Temperature: 19°C
Operator:	Tas 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)



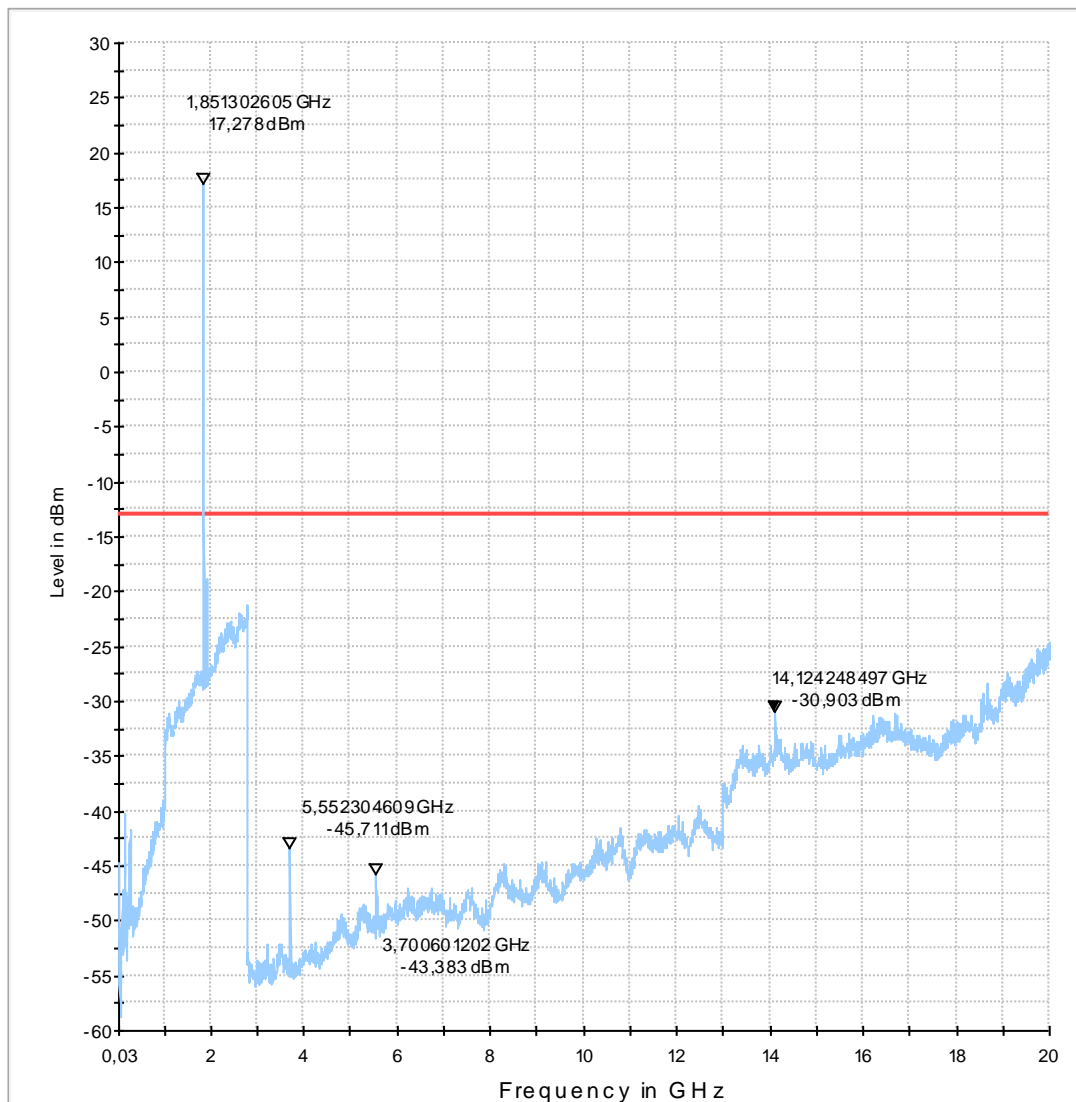
### Diagram No.: 2.07

#### Common Information

Test Description:	Radiated Spurious Emissions UMTS FDDII
Test Site:	FAR
Test Standard:	FCC Part 24, RSS-133
Antenna polarisation:	vertical / horizontal
Operation mode:	UE TX_mode, U-ARFCN 9262 (low channel)
Operator Name:	HLA
Comment:	Humidity: 30%rH; Temperature: 19.2°C 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)



### Diagram No.: 2.08

#### Common Information

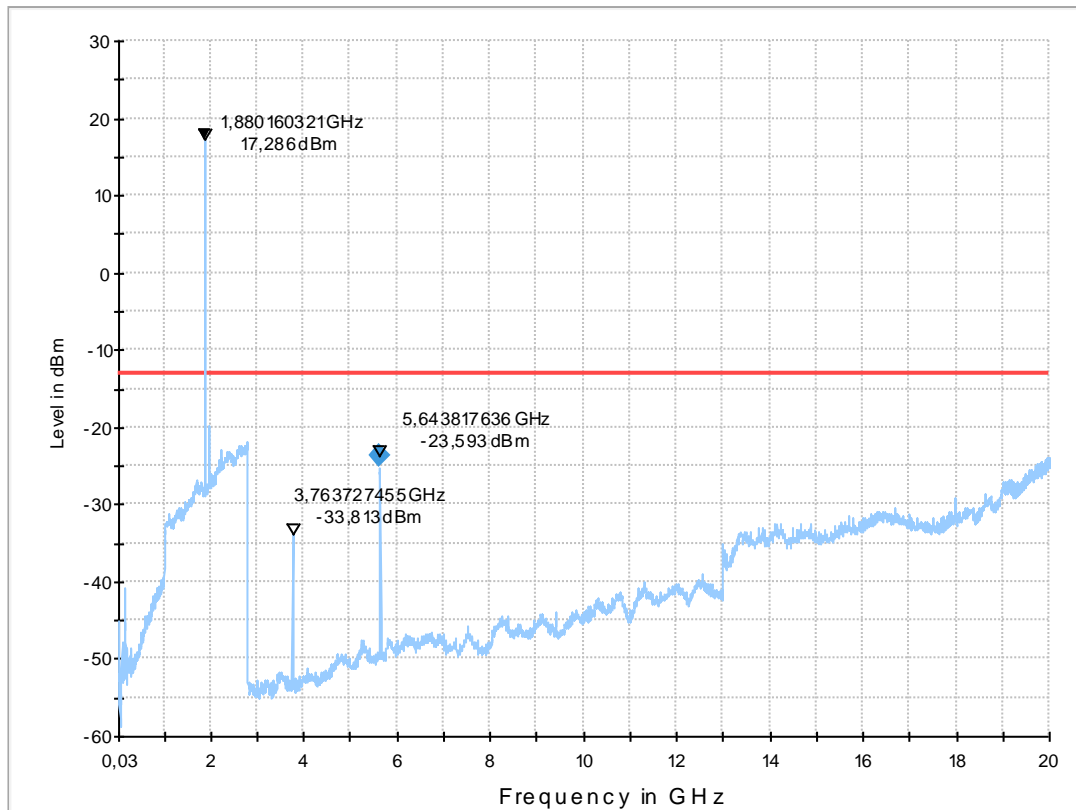
Test Description: Radiated Spurious Emissions UMTS FDDII  
 Test Site: FAR  
 Test Standard: FCC Part 24, RSS-133  
 Antenna polarisation: vertical / horizontal  
  
 Operation mode: UE TX\_mode, U-ARFCN 9400 (middle channel)  
 Operator Name: HLa  
 Comment: Humidity: 30%rH; Temperature: 19.2°C  
 6-0143-12-2-3a

#### EUT Information

Manufacturer: u-blox AG  
 EUT: LISA-U230  
 Serial Number: 352237-05-001195-8  
 Hardware Rev: 146AA0  
 SW: 22.00  
 Accessories: HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)

#### Final Result 1

Frequency (MHz)	Max Peak (dBm)	Meas. Time (ms)	Band-width (kHz)	Height (cm)	Pol.	Azi-muth (deg)	Elev. (deg)	Corr. (dB)	Mar-gin (dB)	Limit (dBm)
5643.817636	-23.6	10000.0	1000.000	155.0	V	105.0	90.0	-89.7	10.6	-13.0



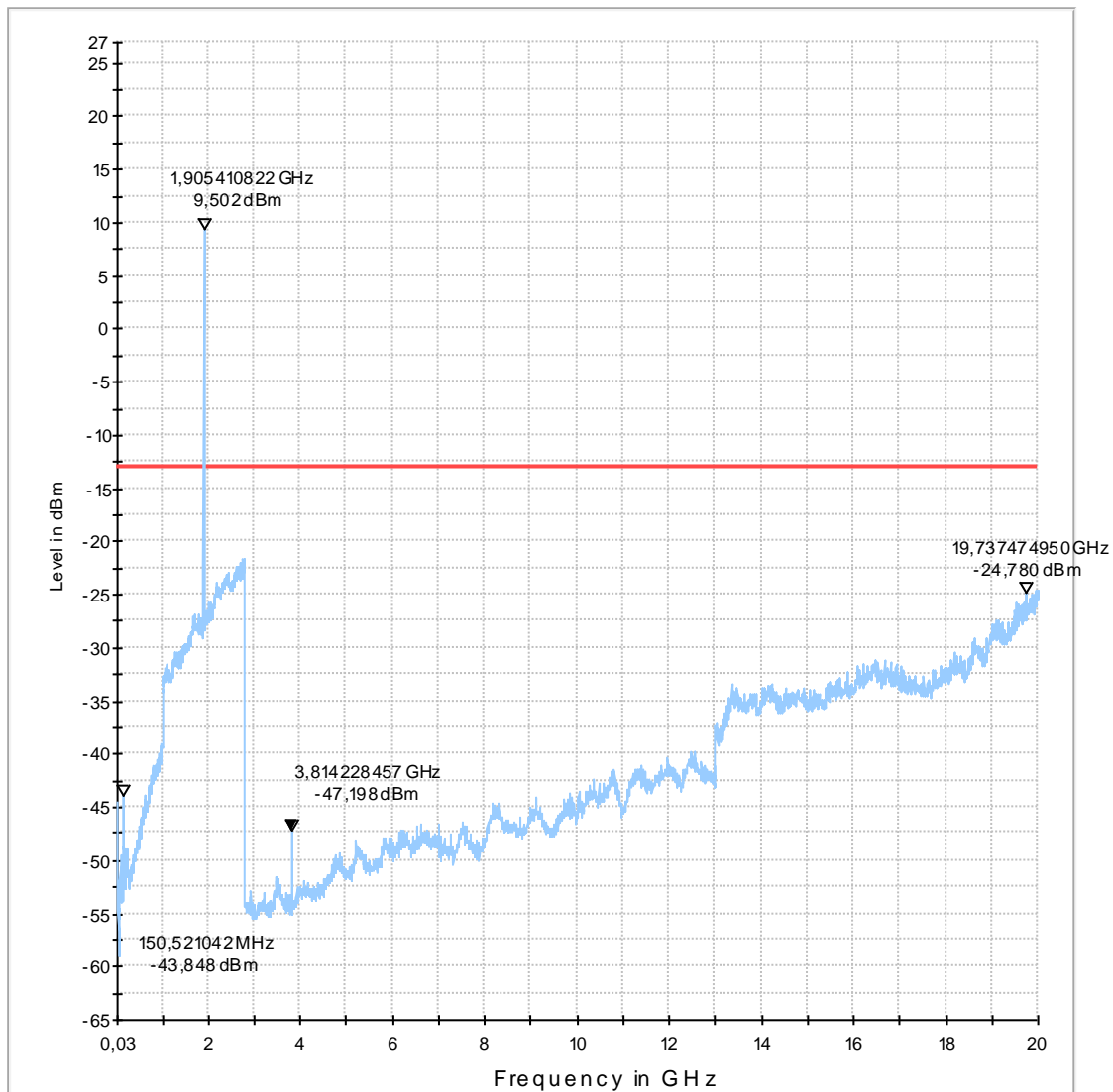
### Diagram No.: 2.09

#### Common Information

Test Description:	Radiated Spurious Emissions UMTS FDDII
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 22, RSS-133
Antenna polarisation:	vertical / horizontal
Operation mode:	UE TX_mode, U-ARFCN 9538 (high channel)
Operator Name:	Tas
Comment:	Humidity: 37%rH; Temperature: 19°C 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adpater(110 V/60 Hz)



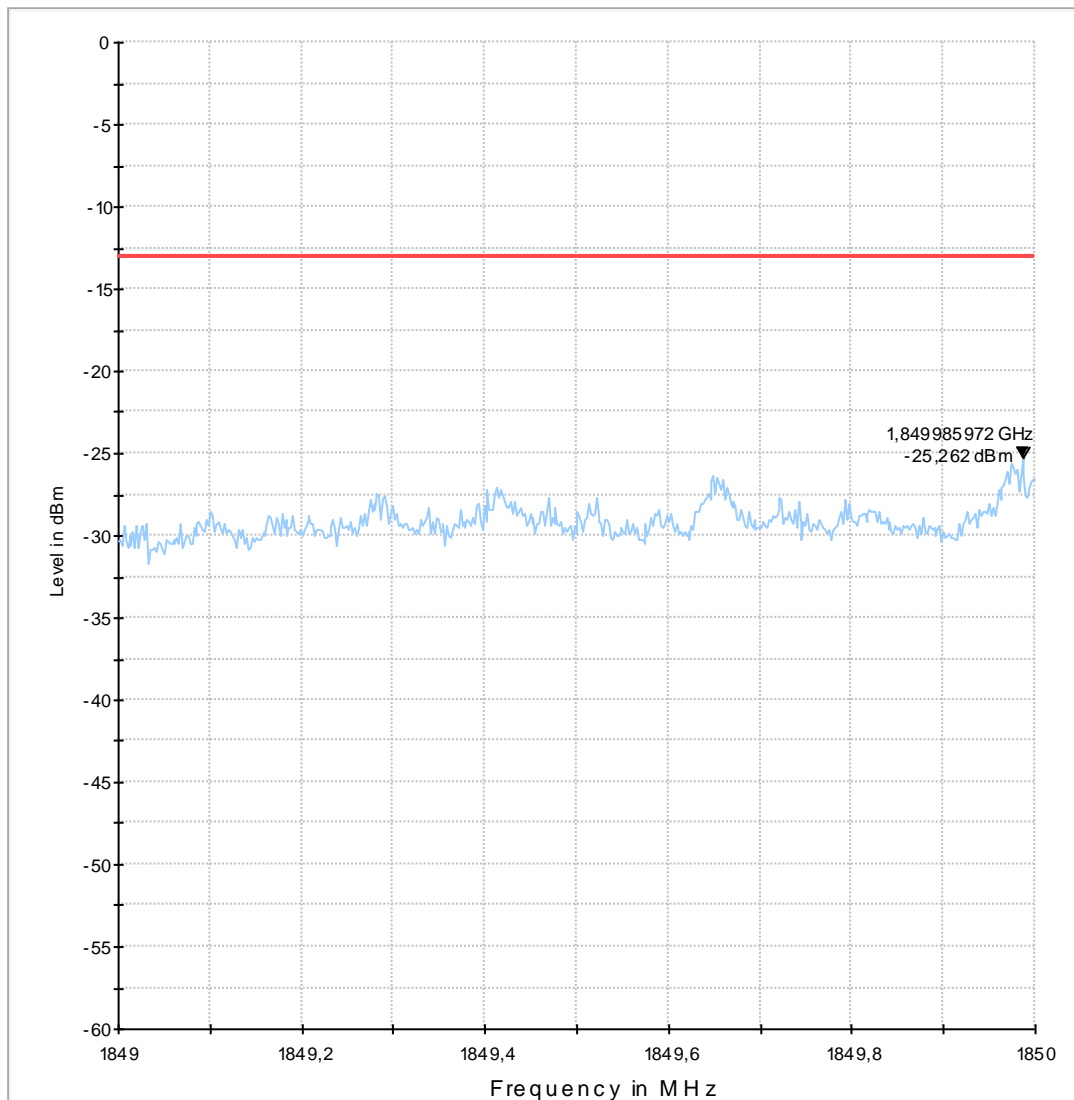
### Diagram No.: 2.07\_BE

#### Common Information

Test Description:	Band-Edge Radiated UMTS FDDII
Test Site:	FAR
Test Standard:	FCC Part 24, RSS-133
Antenna polarisation:	vertical / horizontal
Operation mode:	UE TX_mode, U-ARFCN 9262 (low channel)
Operator Name:	HLA
Comment:	Humidity: 30%rH; Temperature: 19.2°C 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)



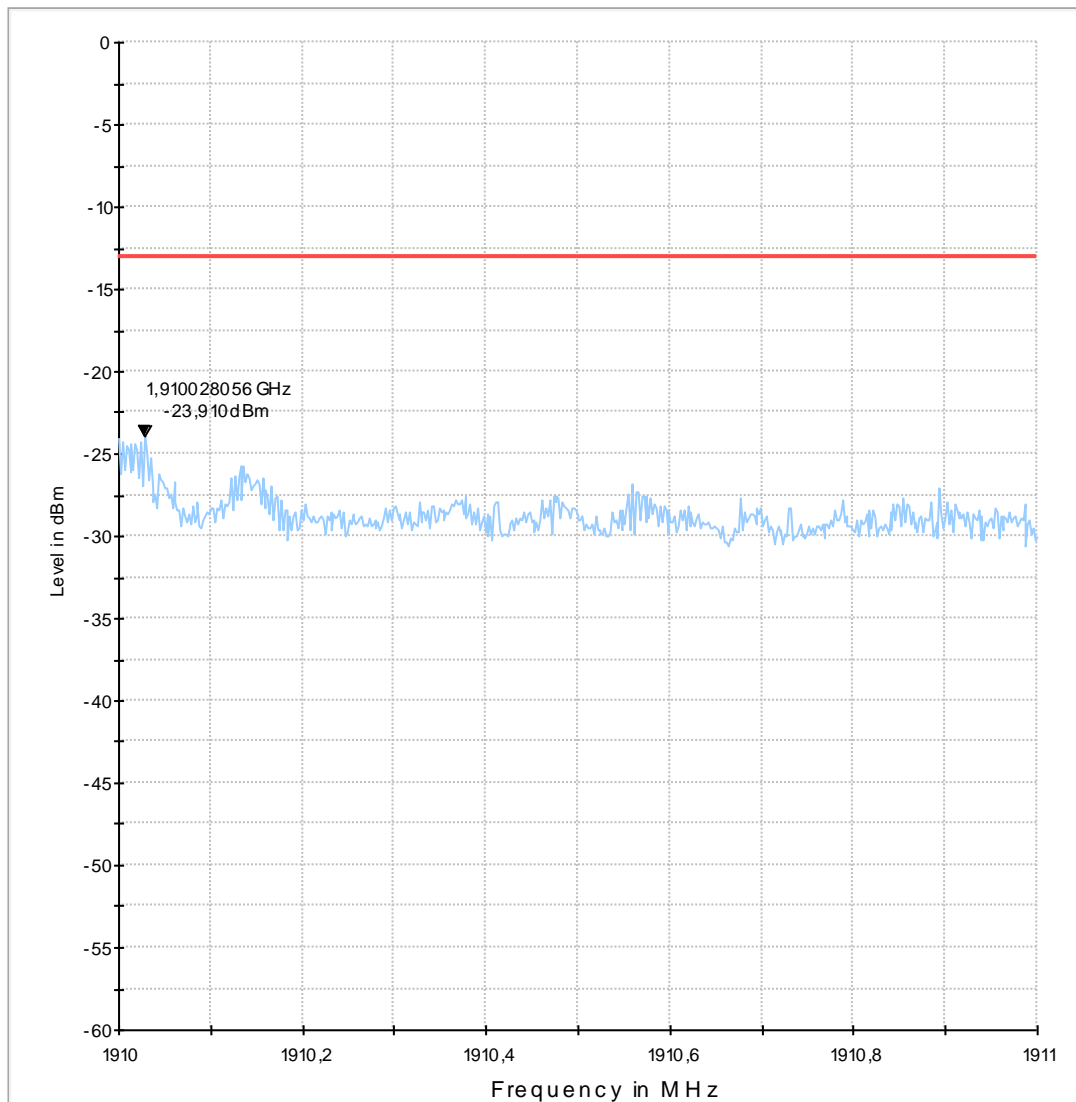
### Diagram No.: 2.09\_BE

#### Common Information

Test Description:	Band-Edge Radiated UMTS FDDII
Test Site:	FAR
Test Standard:	FCC Part 24, RSS-133
Antenna polarisation:	vertical / horizontal
Operation mode:	UE TX_mode, U-ARFCN 9538 (high channel)
Operator Name:	HLa
Comment:	Humidity: 30%rH; Temperature: 19.2°C 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)



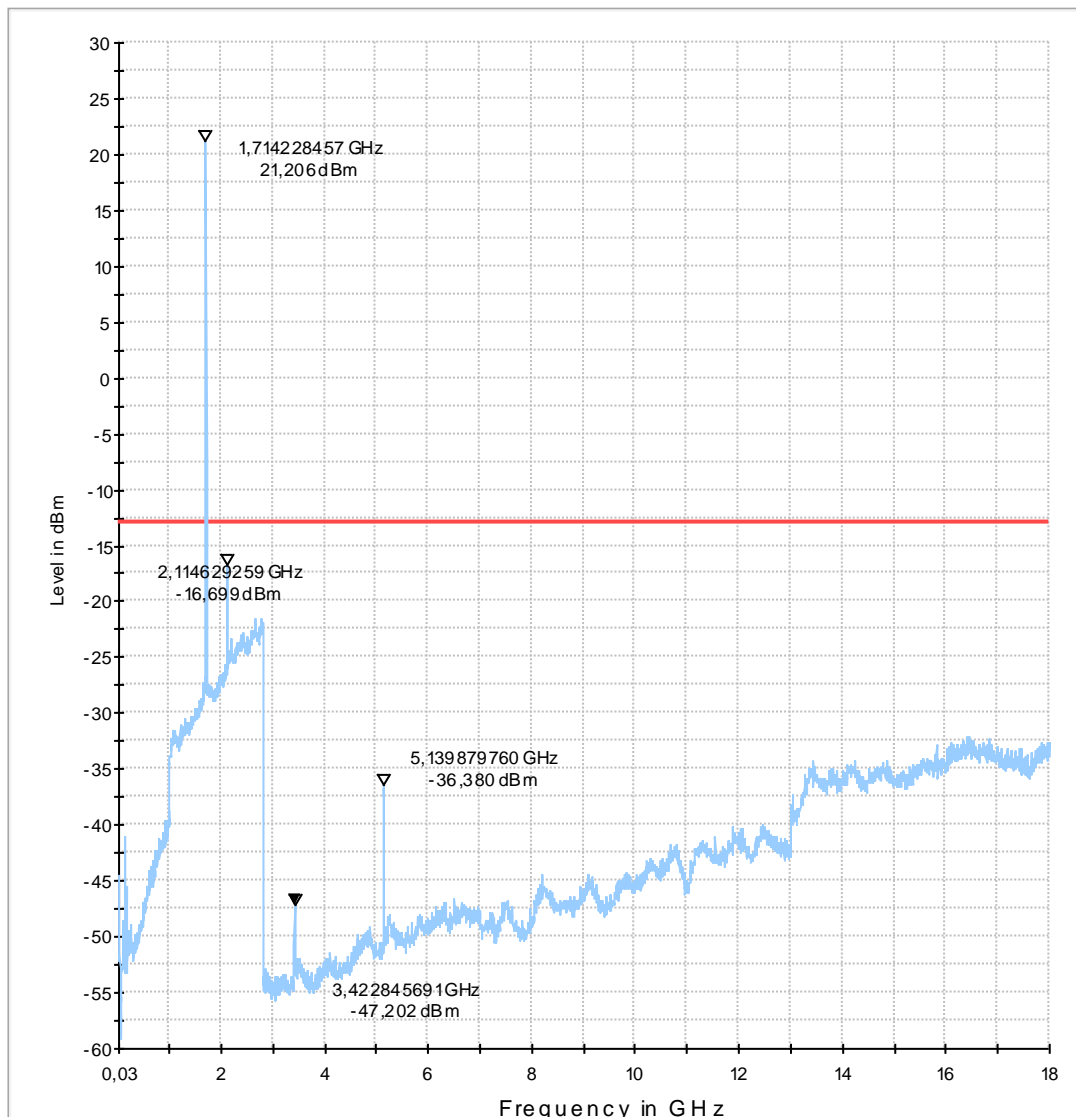
### Diagram No.: 2.10

#### Common Information

Test Description:	Radiated Spurious Emissions UMTS FDDIV
Test Site:	FAR
Test Standard:	FCC Part 27, RSS-139
Antenna polarisation:	vertical / horizontal
Operation mode:	UE TX_mode, U-ARFCN 1312 (low channel)
Operator Name:	HLA
Comment:	Humidity: 30%rH; Temperature: 19.2°C

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)





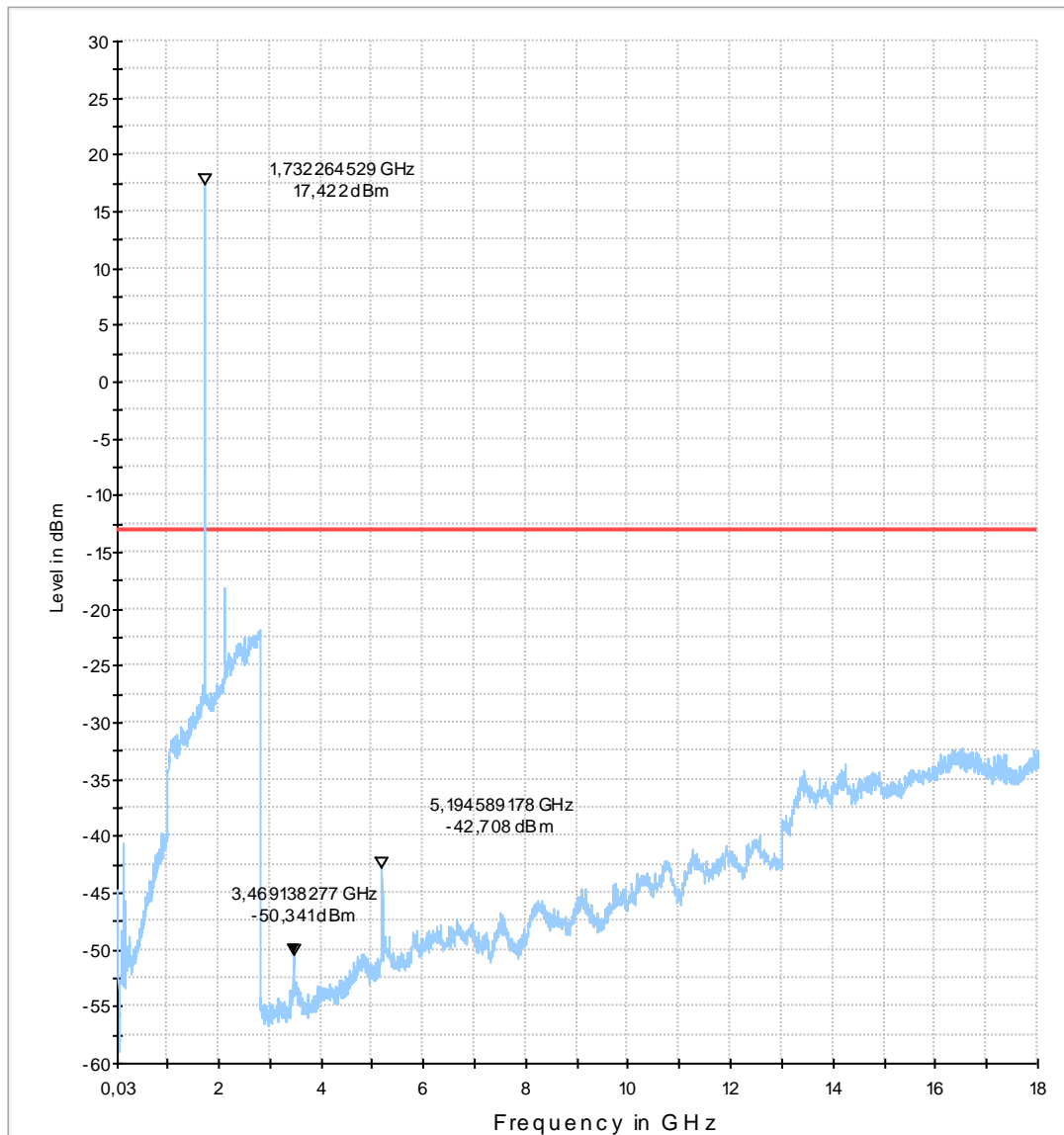
### Diagram no. 2.11

#### Common Information

Test Description:	Radiated Spurious Emissions UMTS FDDIV
Test Site:	FAR
Test Standard:	FCC Part 27, RSS-139
Antenna polarisation:	vertical / horizontal
Operating Conditions:	UE TX_mode, U-ARFCN 1413 (middle channel)
Operator Name:	HLa
Comment:	Humidity: 30%rH; Temperature: 19.2°C

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)



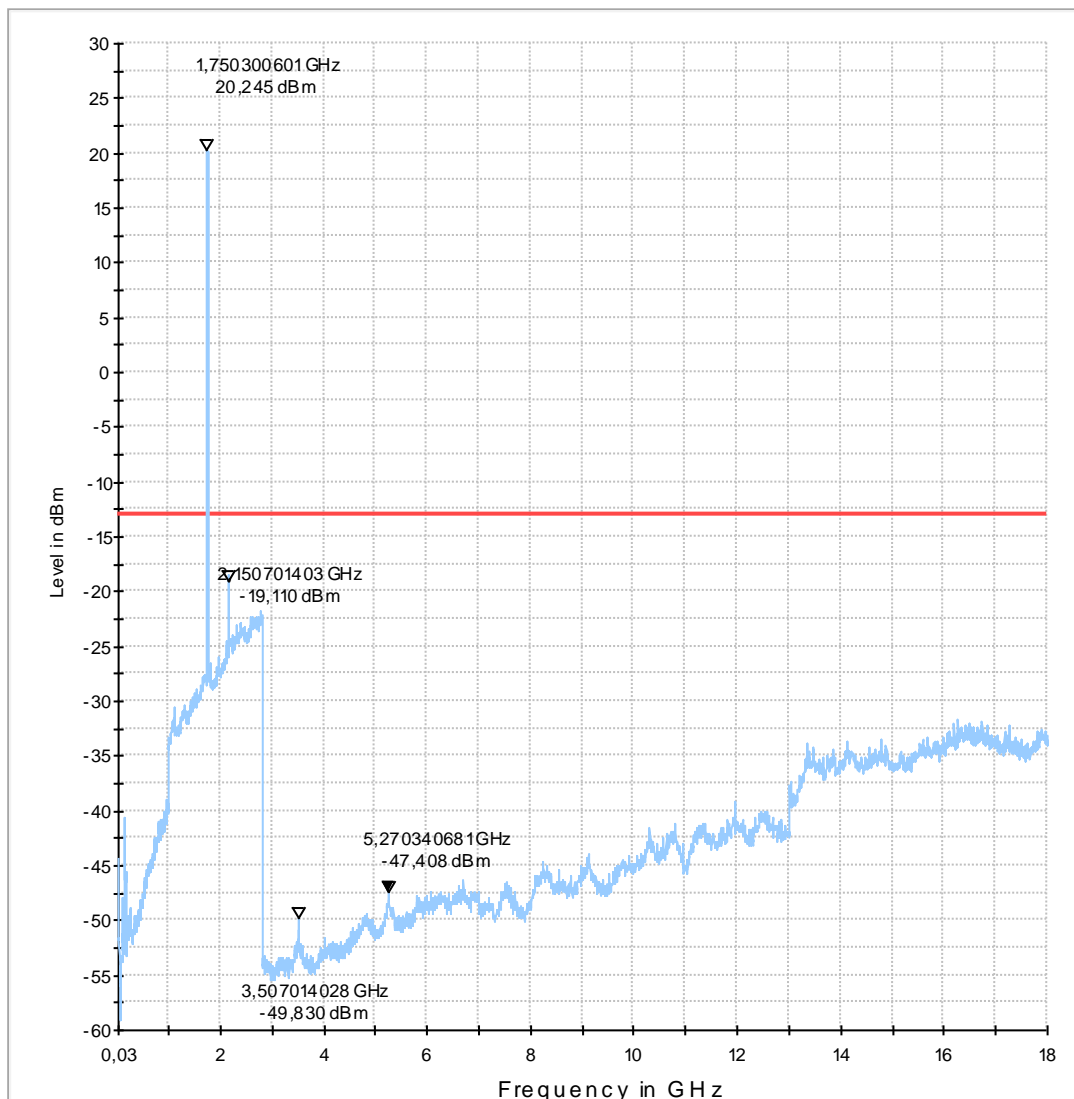
### Diagram No.: 2.12

#### Common Information

Test Description:	Radiated Spurious Emissions UMTS FDDIV
Test Site:	FAR
Test Standard:	FCC Part 27, RSS-139
Antenna polarisation:	vertical / horizontal
Operation mode:	UE TX_mode, U-ARFCN 1513 (high channel)
Operator Name:	HLa
Comment:	Humidity: 30%rH; Temperature: 19.2°C 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)



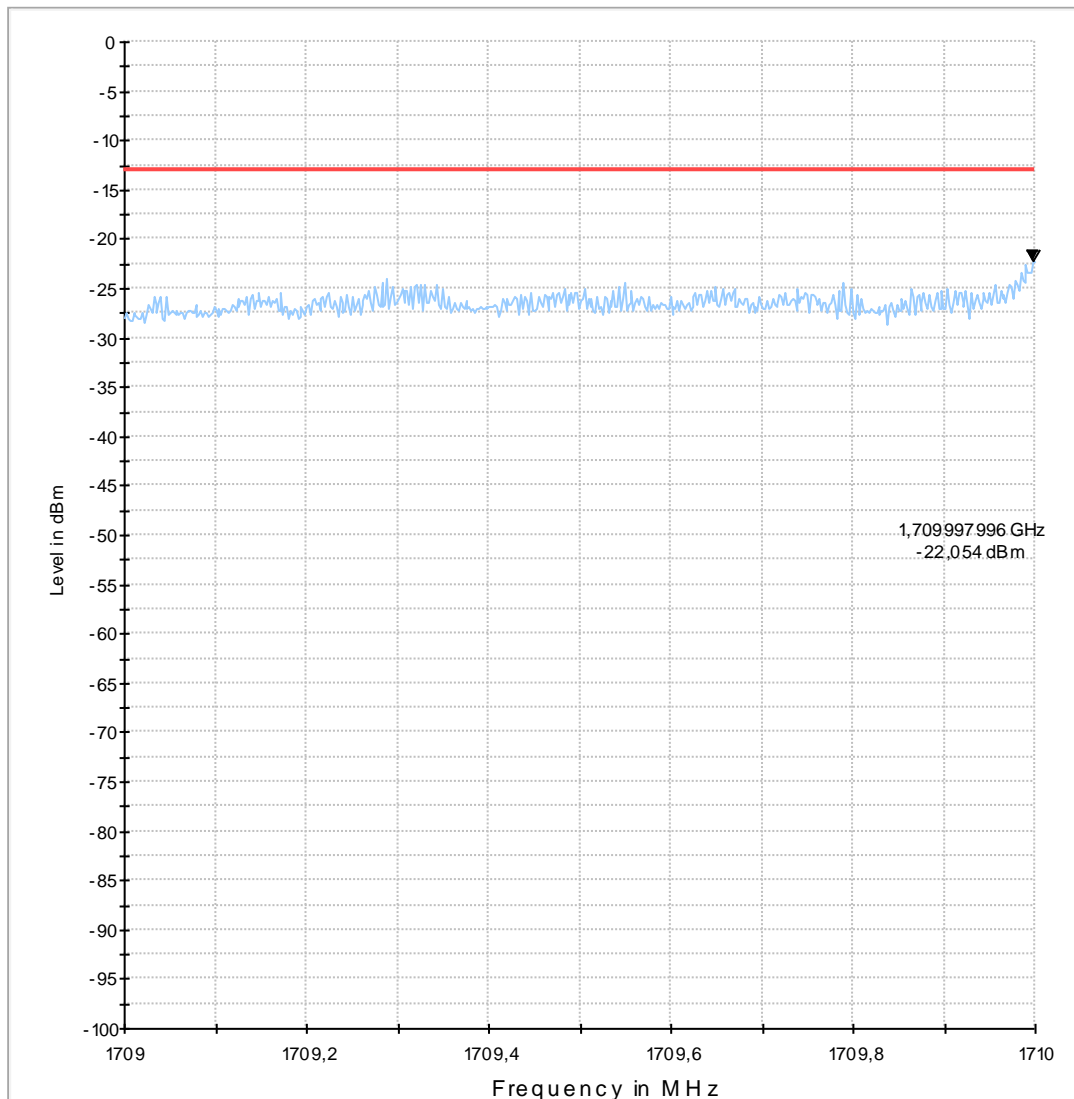
### Diagram No.: 2.10\_BE

#### Common Information

Test Description:	Band-Edge Radiated UMTS FDDIV
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 27, RSS-139
Antenna polarisation:	vertical / horizontal
Operation mode:	UE TX_mode, U-ARFCN 1312 (low channel)
Operator Name:	Tas
Comment:	Humidity: 30%rH; Temperature: 19.2°C 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)



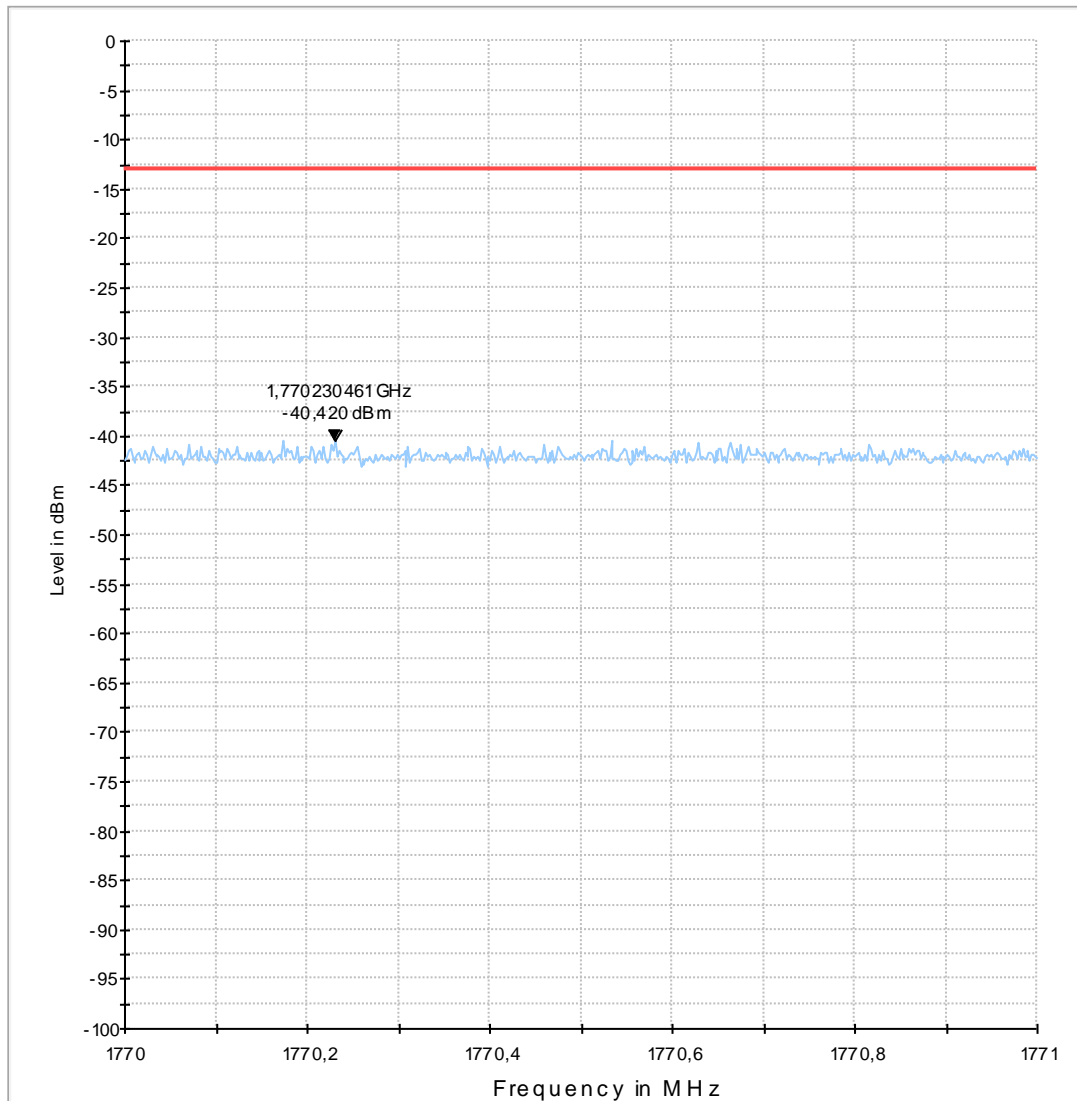
### Diagram No.: 2.12\_BE

#### Common Information

Test Description:	Band-Edge Radiated UMTS FDDIV
Test Site:	FAR
Test Standard:	FCC Part 27, RSS-139
Antenna polarisation:	vertical / horizontal
Operation mode:	UE TX_mode, U-ARFCN 1513 (high channel)
Operator Name:	HLA
Comment:	Humidity: 30%rH; Temperature: 19.2°C 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)



### Diagram No.: 2.13

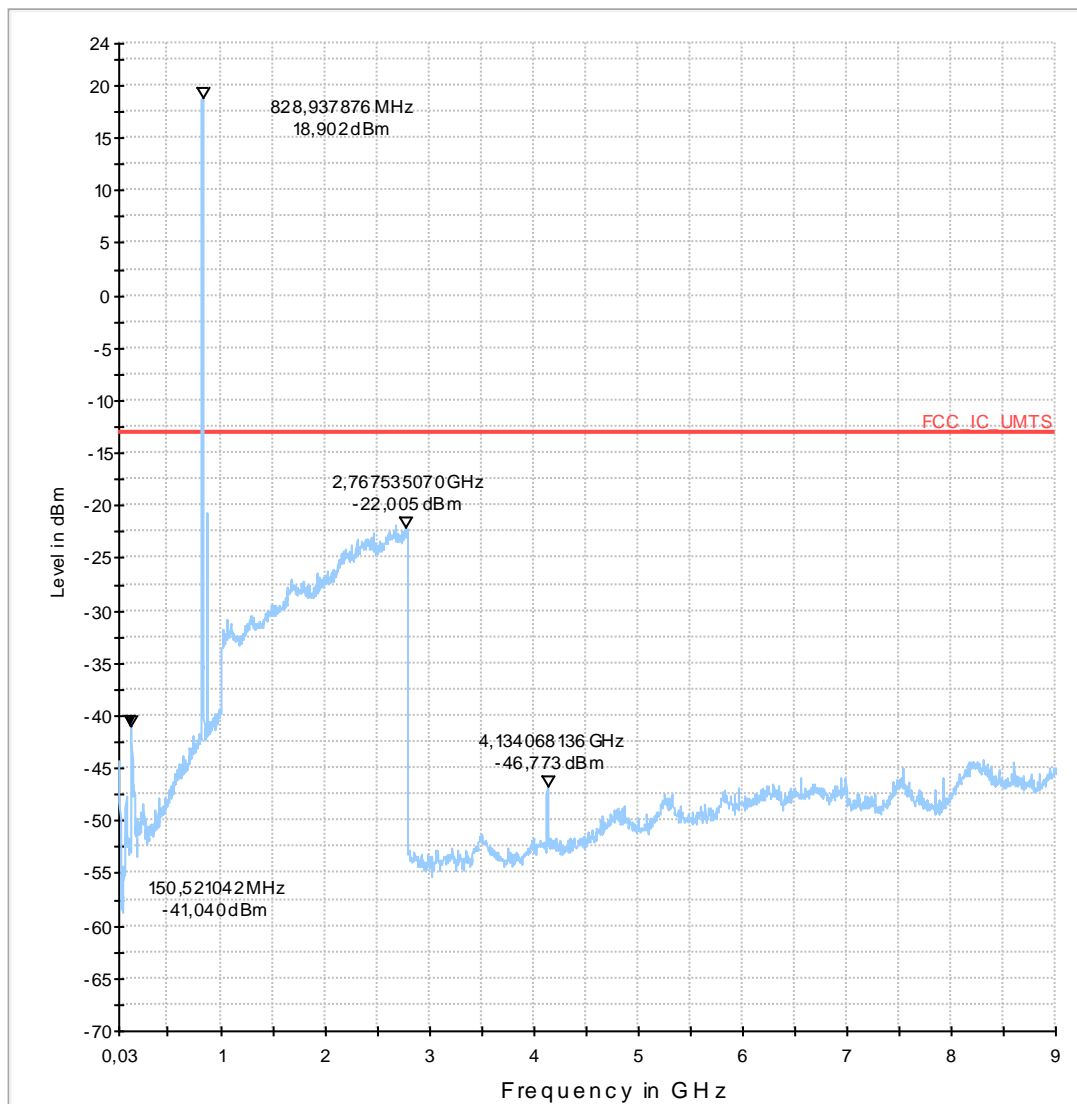
#### Common Information

Test Description: Radiated Spurious Emissions UMTS FDDV  
 Test Site: Fully Anechoic Room (FAR)  
 Test Standard: FCC Part 22, RSS-132  
 Antenna polarisation: vertical / horizontal

Operation mode: UE TX\_mode, U-ARFCN 4132 (low channel)  
 Operator Name: Tas  
 Comment: Humidity: 33%rH; Temperature: 21.8°C  
 6-0143-12-2-3a  
 At 871 MHz DL channel visible of FDD V

#### EUT Information

Manufacturer: u-blox AG  
 EUT: LISA-U230  
 Serial Number: 352237-05-001195-8  
 Hardware Rev: 146AA0  
 SW: 22.00  
 Accessories: HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)



### Diagram No.: 2.14

#### Common Information

Test Description: Radiated Spurious Emissions UMTS FDDV  
 Test Site: Fully Anechoic Room (FAR)  
 Test Standard: FCC Part 22, RSS-132  
 Antenna polarisation: vertical / horizontal

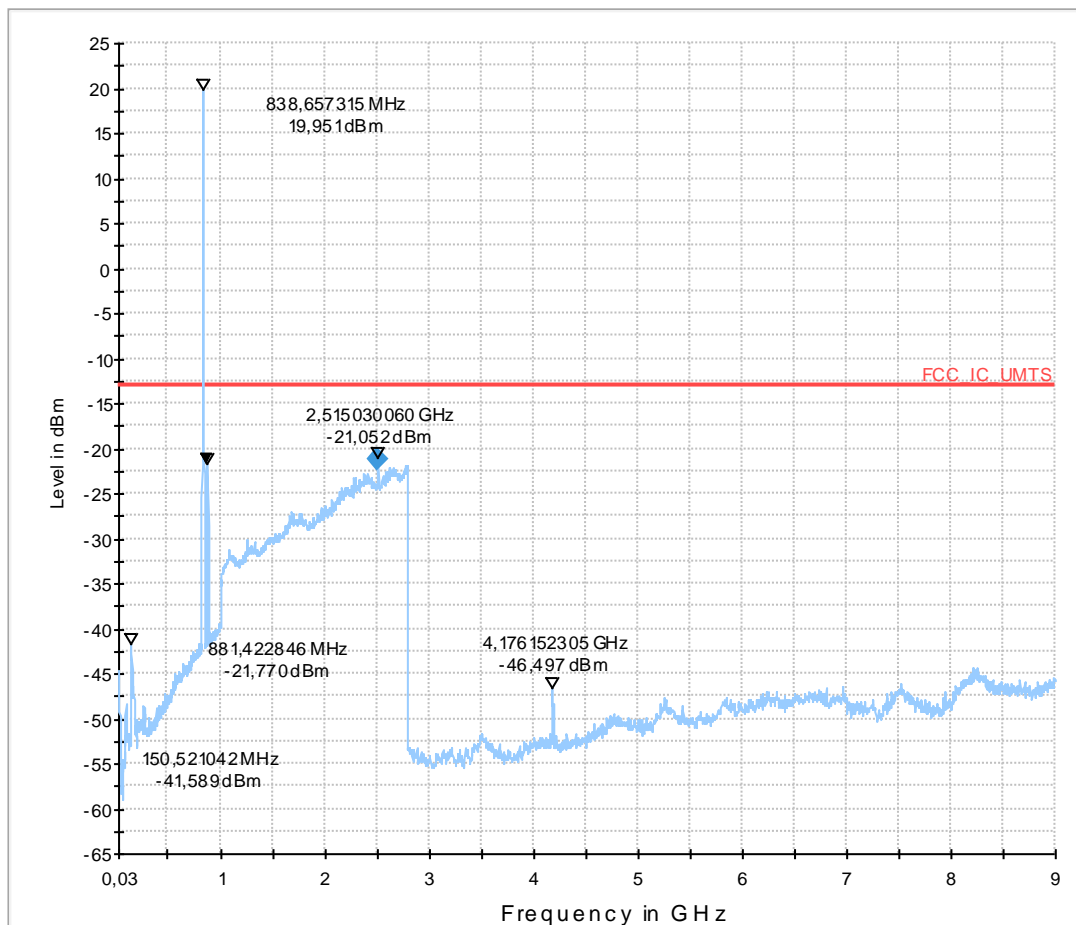
Operation mode: UE TX\_mode, U-ARFCN 4182 (middle channel)  
 Operator Name: Tas  
 Comment: Humidity: 33%rH; Temperature: 21.8°C  
 6-0143-12-2-3a  
 At 881 MHz DL channel visible of FDDV

#### EUT Information

Manufacturer: u-blox AG  
 EUT: LISA-U230  
 Serial Number: 352237-05-001195-8  
 Hardware Rev: 146AA0  
 SW: 22.00  
 Accessories: HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)

#### Final Measurement Result 1

Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Elevation (deg)	Corr. (dB)	Comment
2512.194389	-21.3	10000.0	1000.000	155.0	V	145.0	90.0	-59.6	



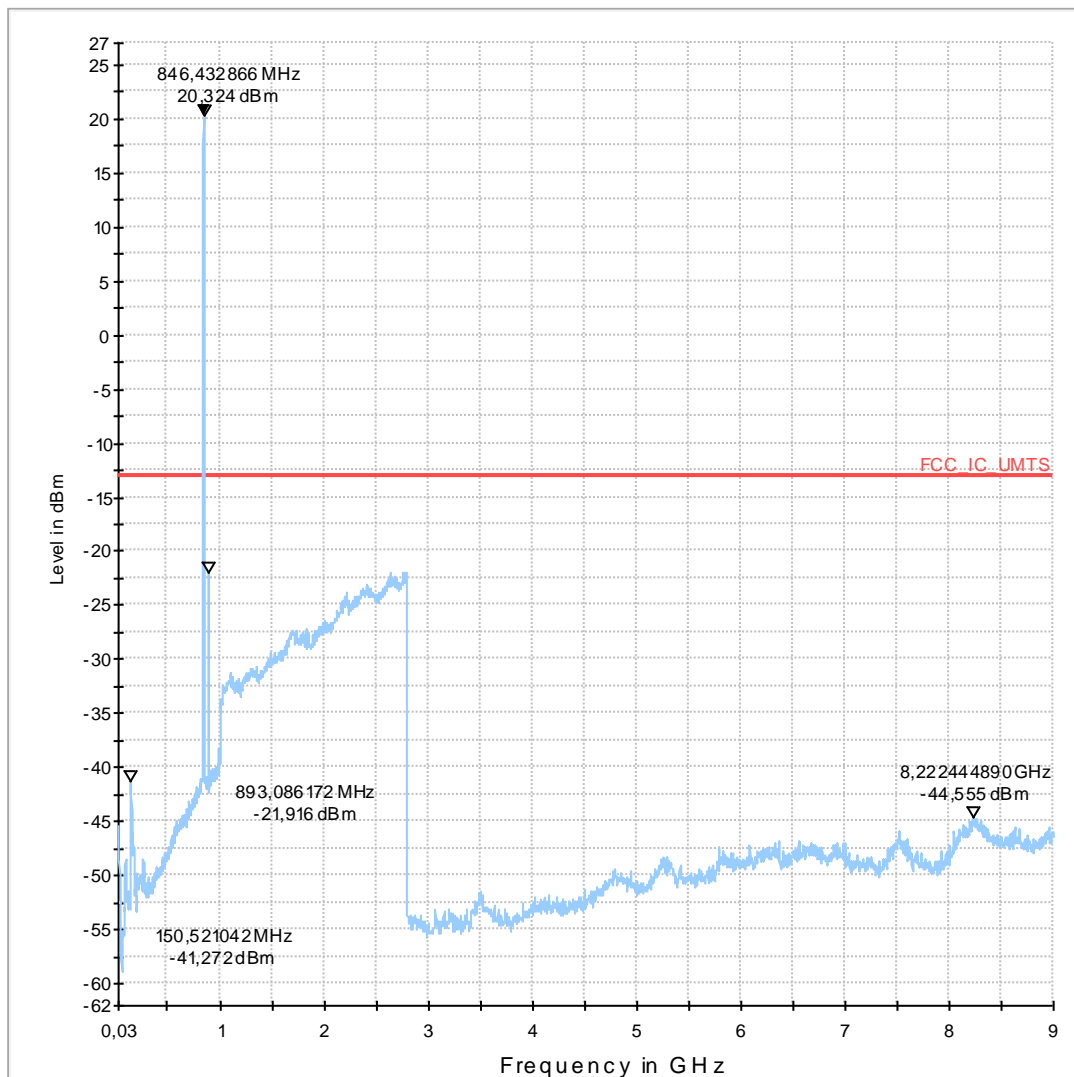
### Diagram No.: 2.15

#### Common Information

Test Description:	Radiated Spurious Emissions UMTS FDDV
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 22, RSS-132
Antenna polarisation:	vertical / horizontal
Operation mode:	UE TX_mode, U-ARFCN 4233 (high channel)
Operator Name:	Tas
Comment:	Humidity: 33%rH; Temperature: 21.8°C 6-0143-12-2-3a At 893 MHz DL channel visible of FDDV

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)



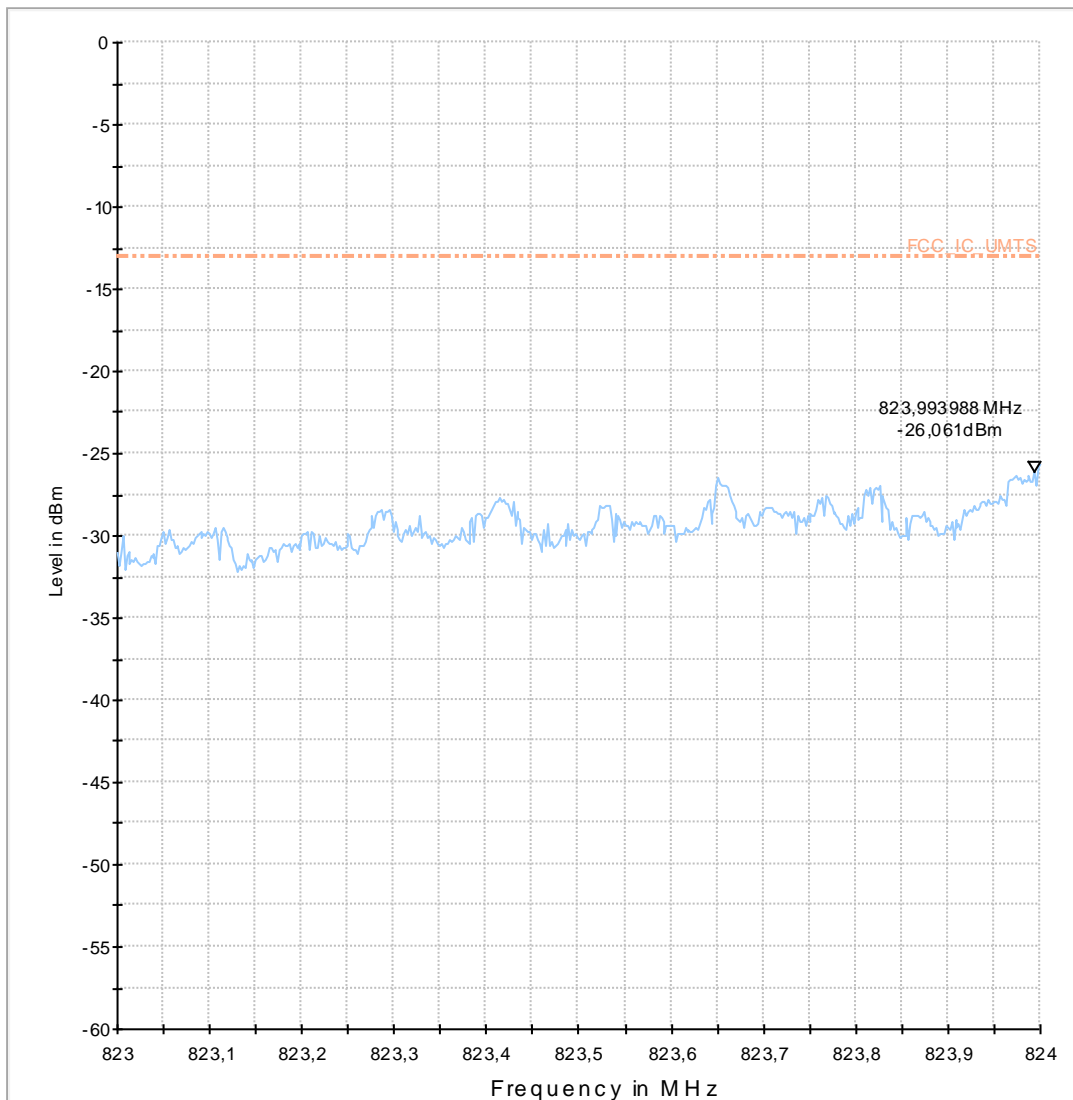
### Diagram No.: 2.13\_BE

#### Common Information

Test Description:	Band-Edge Radiated UMTS FDDV
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 22, RSS-132
Antenna polarisation:	vertical / horizontal
Operation mode:	UE TX_mode, U-ARFCN 4132 (low channel)
Operator Name:	Tas
Comment:	Humidity: 33%rH; Temperature: 21.8°C 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adapter(110 V/60 Hz)





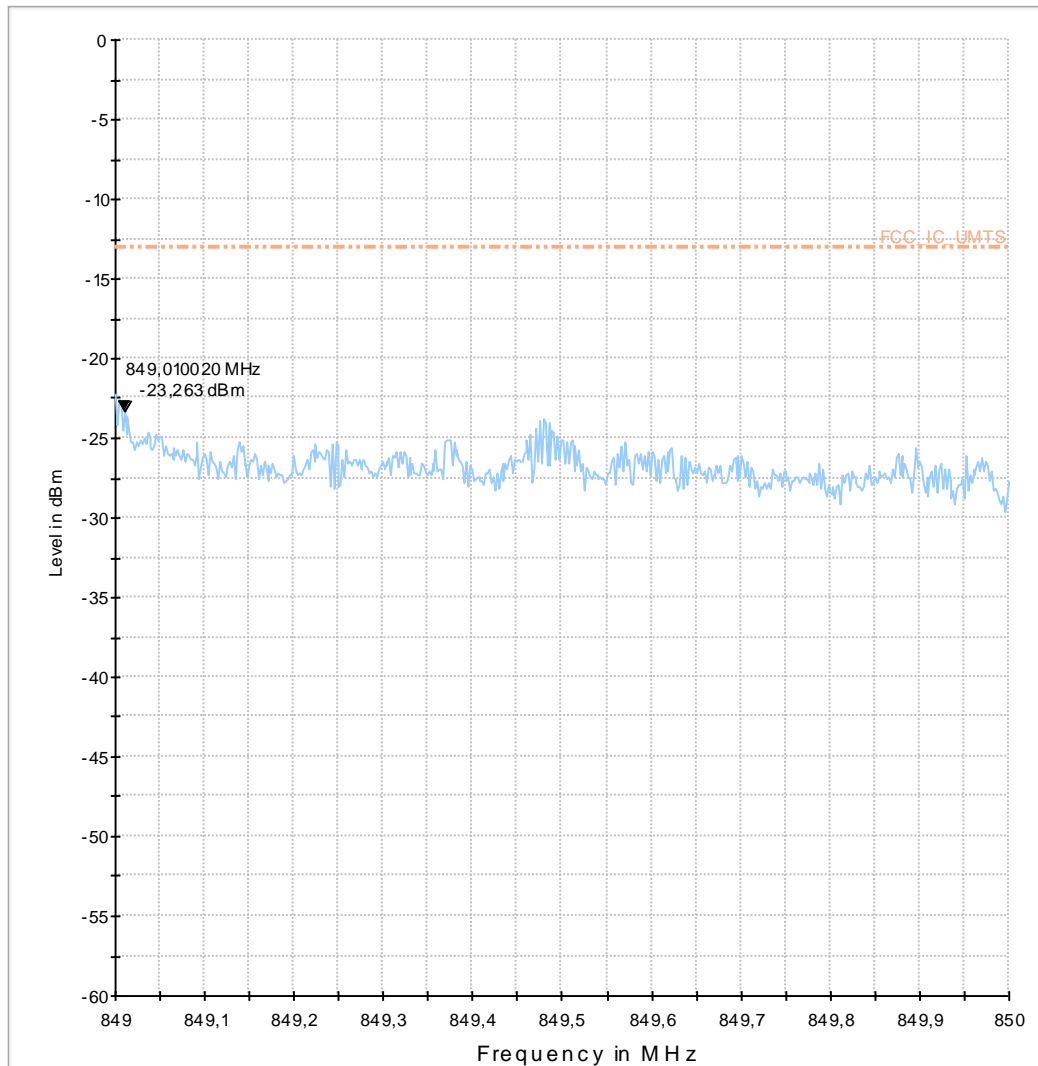
### Diagram No.: 2.15\_BE

#### Common Information

Test Description:	Band-Edge Radiated UMTS FDDV
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 22, RSS-132
Antenna polarisation:	vertical / horizontal
Operation mode:	UE TX_mode, U-ARFCN 4233 (high channel)
Operator Name:	Tas
Comment:	Humidity: 33%rH; Temperature: 21.8°C 6-0143-12-2-3a

#### EUT Information

Manufacturer:	u-blox AG
EUT:	LISA-U230
Serial Number:	352237-05-001195-8
Hardware Rev:	146AA0
SW:	22.00
Accessories:	HS portable earphone V109 + Magn. Ant. Taoglas GA.107+ USB adapter cable 1m + AC/DC adpater(110 V/60 Hz)



### 5.3. RF Peak power output radiated

#### 5.3.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input type="checkbox"/> 347 Radio.lab. <input checked="" type="checkbox"/> 443 FAR
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input checked="" type="checkbox"/> 489 ESU 40
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK
antenna	<input type="checkbox"/> 574 BTA-L	<input type="checkbox"/> 133 EMCO3115	<input type="checkbox"/> 302 BBHA9170 <input checked="" type="checkbox"/> 608 HL 562 <input checked="" type="checkbox"/> 549 HL025 <input type="checkbox"/> 477 GPS
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 436 CMU	<input checked="" type="checkbox"/> 546 CMU
otherwise	<input type="checkbox"/> 400 FTC40x15E	<input type="checkbox"/> 401 FTC40x15E	<input type="checkbox"/> 110 USB LWL <input type="checkbox"/> 482 Filter Matrix <input type="checkbox"/> 378 RadiSense
DC power	<input type="checkbox"/> 456 EA 3013A	<input checked="" type="checkbox"/> 463 HP3245A	<input type="checkbox"/> 459 EA 2032-50 <input type="checkbox"/> 268 EA- 3050 <input type="checkbox"/> 494 AG6632A <input type="checkbox"/> 498 NGPE 40
otherwise	<input type="checkbox"/> 331 HC 4055	<input type="checkbox"/> 248 6 dB Attenuator	<input type="checkbox"/> 529 Power divider <input type="checkbox"/> - cable OTA20
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains <input type="checkbox"/> 060 110 V 60 Hz via PAS 5000		

#### 5.3.2. REFERENCES

FCC: §2.1046 (radiated), §22.913(a)(2), § 24.232(c), § 27.51(d)(4)

IC: RSS-132:4.4 + SRSP 503:5.1.3 for GSM 850/FDDV; RSS-133:4.1/6.4 + SRSP-510:5.1.2 for GSM 1900/FDDII; RSS-139 for FDDIV

- Maximum Power Output of the mobile phone should be determined while measured radiated E(I)RP.
- Limit GSM850/FDDV: 7 Watt
- Limit GSM1900/FDDII: 2 Watt
- Limit FDDIV : 1 Watt

#### Test condition and measurement test set-up

link to test system (if used):	<input type="checkbox"/> air link	<input type="checkbox"/> cable connection	<input type="checkbox"/>
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%

#### 5.3.3. MOBILE PHONE SETTINGS

- according to chapter 3.6

#### 5.3.4. BASE STATION SETTING

- according to chapter 3.6

#### 5.3.5. RADIATED RF-POWER

#### TEST METHOD

- 1.) The measurements were made at the upper, middle and lower carrier traffic frequencies of the operating band. Choosing three TX-carrier frequencies of the mobile phone within each operable GSM band, should be sufficient to demonstrate compliance.
- 2.) The measurements were performed with the integrated power measurement function of the „radio communication tester CMU200 from Rohde&Schwarz company. In this way spectrum-analyzers instrument limitations can be avoided or minimized. Instead, CMU manufacturers declared measurement error can be considered for this measurement.
- 3.) The attenuation (insertion loss) at the RF Inputs/Outputs of CMU were set according to the path loss of the test set-up, determined in a step before starting the measurements.
- 4.) PK and Average Values have been recorded for each channel and band.

The measurements were made at the upper, center, and lower carrier traffic frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance.

The measurements were performed by using the **substitution method** (ANSI/TIA/EIA 603) with a spectrum-analyzer. This method can be described like follows:

1. choosing of suitable spectrum-analyzer settings for performing the measurements. This settings of the spectrum analyzer must be maintained for both stages of the measurements: EUT emission measurements and also for measurements of the substituted level.

Parameter	Setting for GSM measurements	Settings for UTRA/FDD measurements
RBW <sub>3dB</sub>	3 MHz	10 MHz
VBW	10 MHz	10 MHz
Span	20 MHz	50 MHz
Detector Mode	Positive max-hold	Positive max-hold
Average	off	off
Sweep Time	coupled	coupled

2. The maximum level of the peak power was recorded, while the emissions were maximized by rotating the EUT in three orthogonal axes, which was situated on a non-conductive turntable of 1.55 m height ( $P_{MEAS,1}$ ). This was performed for both measuring antenna polarisations (vertical/horizontal), the maximum of both values is used for further measurements and final substitution ( $P_{MEAS, 1, MAX}$ ).
3. As the maximum emission is recorded, the EUT is replaced by a frequency dependant suitable antenna, which is connected to a RF-signal generator, which is transmitting on the determined worst-case frequency as determined in step 2.
4. The RF-signal level of the signal generator is adjusted as long the same worst-case level determined first step is measured at the spectrum analyzer ( $P_{SMHU}=P_{MEAS,1, MAX}$ )
5. Than the RF-signal cable is disconnected from the antenna and connected to a power-level meter. The level is determined ( $P_{MEAS,2}$ ).
6. The final result is calculated by adding the ERP/EIRP gain of the antenna which substitutes the EUT.  
 $P_{EUT,SUBST} = P_{MEAS,2} + G_{ANTENNA}$

### 5.3.6 Results

#### G850 RESULTS (RADIATED)

Channel/ Frequency (MHz) (SET-up 1)		Peak Output Power (dBm)			Antenna Polarisation for maximum Power	Verdict
		PK	AV			
GSM 850	Channel 128/ 824.2 MHz	24.5	1.)	ERP-Value	V/H	Passed
	Channel 192/ 837.0 MHz	26.8				
	Channel 251/ 848.8 MHz	<b>27.8</b>				
E-GPRS 850	Channel 128/ 824.2 MHz	<b>22.5</b>	1.)	ERP-Value	V/H	Passed
	Channel 192/ 837.0 MHz	21.2				
	Channel 251/ 848.8 MHz	<b>22.5</b>				

Remark: 1.) see conducted measurements for PAR factor

#### PCS 1900 RESULTS (RADIATED)

Channel/ Frequency (MHz) (SET-up 1)		Peak Output Power (dBm)			Antenna Polarisation for maximum Power	Verdict
		PK	AV			
GSM 1900	Channel 512/ 1850.2 MHz	<b>29.3</b>	1.)	EIRP-Value	V/H	Passed
	Channel 661/ 1880.0 MHz	28.8				
	Channel 810/ 1909.8 MHz	27.9				
E-GPRS 1900	Channel 512/ 1850.2 MHz	<b>29.4</b>	1.)	EIRP-Value	V/H	Passed
	Channel 661/ 1880.0 MHz	27.6				
	Channel 810/ 1909.8 MHz	27.7				

Remark: 1.) see conducted measurements for PAR factor

**FDD II RESULTS (RADIATED)**

Channel/ Frequency (MHz) (SET-up 1)		Peak Output Power (dBm)		Antenna Polarisation for maximum Power	Verdict	
		PK	AV			
FDD II	Channel 9262	23.5	1.)	EIRP-Value	V/H	Passed
	Channel 9400	24.6				
	Channel 9538	<b>24.8</b>				

Remark: 1.) see conducted measurements for PAR factor

**FDD IV RESULTS (RADIATED)**

Channel/ Frequency (MHz) (SET-up 1)		Peak Output Power (dBm)		Antenna Polarisation for maximum Power	Verdict	
		PK	AV			
FDD IV	Channel 1312	<b>27.1</b>	1.)	EIRP-Value	V/H	Passed
	Channel 1412	21.7				
	Channel 1513	24.3				

Remark: 1.) see conducted measurements for PAR factor

**FDD V RESULTS (RADIATED)**

Channel/ Frequency (MHz) (SET-up 1)		Peak Output Power (dBm)		Antenna Polarisation for maximum Power	Verdict	
		PK	AV			
FDD V	Channel 4132	24.5	1.)	EIRP-Value	V/H	Passed
	Channel 4183	23.3				
	Channel 4233	<b>25.7</b>				

Remark: 1.) see conducted measurements for PAR factor

### 5.4. Radiated field strength emissions below 30 MHz

#### 5.4.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input checked="" type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input type="checkbox"/> 347 Radio.lab.
receiver	<input type="checkbox"/> 377 ESCS30	<input checked="" type="checkbox"/> 001 ESS	<input type="checkbox"/>
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK
antenna	<input type="checkbox"/> 574 BTA-L	<input type="checkbox"/> 133 EMCO3115	<input type="checkbox"/> 302 BBHA9170
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 436 CMU	<input type="checkbox"/> 547 CMU
otherwise	<input type="checkbox"/> 400 FTC40x15E	<input type="checkbox"/> 401 FTC40x15E	<input type="checkbox"/> 110 USB LWL
DC power	<input type="checkbox"/> 456 EA 3013A	<input type="checkbox"/> 457 EA 3013A	<input type="checkbox"/> 459 EA 2032-50
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains	<input checked="" type="checkbox"/> 060 110 V 60 Hz via PAS 5000	<input type="checkbox"/> 289 CBL 6141
			<input checked="" type="checkbox"/> 030 HFH-Z2
			<input type="checkbox"/> 477 GPS
			<input type="checkbox"/> 482 Filter Matrix
			<input type="checkbox"/> 378 RadiSense
			<input type="checkbox"/> 494 AG6632A
			<input type="checkbox"/> 498 NGPE 40

#### 5.4.2 STANDARDS AND LIMITS: CFR 47, §15.205, §15.209, RSS-Gen

Frequency [MHz]	Field strength		Measurement distance [meters]	Remarks
	[µV/m]	[dBuV/m]		
0.009 – 0.490	2400/f (kHz)	67.6 – 20Log(f) (kHz)	300	Correction factor used due to measurement distance of 3m
0.490 – 1.705	24000/f (kHz)	87.6 – 20 Log(f) (kHz)	30	Correction factor used due to measurement distance of 3m
1.705 – 30	30	29.54	30	Correction factor used due to measurement distance of 3m

Remark: \* decreases with the logarithm of the frequency

#### 5.4.3 TEST CONDITION AND MEASUREMENT TEST SET-UP

link to test system (if used):	<input checked="" type="checkbox"/> air link	<input type="checkbox"/> cable connection	<input type="checkbox"/>
EUT-grounding	<input checked="" type="checkbox"/> none	<input type="checkbox"/> with power supply	<input type="checkbox"/> additional connection
Equipment set up	<input checked="" type="checkbox"/> table top	<input type="checkbox"/> floor standing	
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%
EMI-Receiver (Analyzer) Settings	Span/Range: 9kHz to 150kHz; 150 kHz to 30 MHz RBW/VBW: 200Hz/auto; 10 kHz/ auto (ANSI63.10/CISPR#16) Detector/ Mode: PEAK, TRACE max-hold mode, repetitive scan for exploratory measurements Quasi-Peak, for final measurement on critical frequencies (f<1GHz)		

#### 5.4.4 GENERAL MEASUREMENT PROCEDURES:

The measurement test set-up and test procedure are in accordance with the provisions described in ANSI 63.10: 2009

The **Equipment under Test (EUT)** was set-up to defined operating mode and installed (connected) to accessory equipment according the general description of use given by the applicant.

The measurement loop antenna was situated in 3m distance to the EUT. Between EUT and measurement antenna absorbers are covering the GND-Plane. With these absorbers the chamber fulfills CIPR16-1-4 site VSWR-criteria. Radiated magnetic emission measurements were made with the antenna situated in 1 meter height. The loop antenna was moved at least to 2-perpendicular axes (antenna vector in direction of EUT and parallel to EUT) in order to maximize the emissions, the EUT itself either over 3-orthogonal axes (no defined usage position) or 2-orthogonal axis (defined usage position) by the position manipulator.

According the standard the compliance should be checked in 30m and 300m measurement distance. Therefore a additional extrapolation factor was used in order to normalize the measurement data. The frequency dependent extrapolation factor used for this reduced measurement distance, can be found on page 16.

### 5.4.5 GSM Measurement Results

Due to uncritical measurements between GSM and EDGE (only noise floor) will be showing the EDGE Mode.

#### G850

Set-up No.		1								
Operating Mode		2								
Diagram no.	Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB) (C <sub>F</sub> )	Margin (dB) (M)	Limit (dBμV/m) (L <sub>T</sub> )
3.02 (mid. ch.)	Same settings (see below)	See diagram	10	Same settings (see below)	100	--	0°..360°	Same settings (see below)	See diagram	
3.03 (high ch.)										
3.01 (low channel)	0.009 to 0.150	<-58	10	0.2	100	--	0°..360°	300 to 3m	>20	See diagram
	0.150 to 0.5	~ -15		10				300 to 3m	>20	
	0.5 to 30	~ 17		10				300 to 3m 30 to 3m	12.54	

Remark: Selected worst-case measurement to the closest limit of E-GPRS mode. Please see the other measured channels as diagrams at the next chapter.

#### PCS1900

Set-up No.		1								
Operating Mode		4								
Diagram no.	Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB) (C <sub>F</sub> )	Margin (dB) (M)	Limit (dBμV/m) (L <sub>T</sub> )
a_3.04 (low ch.)	Same settings (see below)	See diagram	10	Same settings (see below)	100	--	0°..360°	Same settings (see below)	See diagram	
a_3.05 (mid. ch.)										
a_3.06 (high channel)	0.009 to 0.150	<-58	10	0.2	100	--	0°..360°	300 to 3m	>20	See diagram
	0.150 to 0.5	~ -19.3		10				300 to 3m	>20	
	0.5 to 30	-19		10				300 to 3m 30 to 3m	>20	

Remark: Selected worst-case measurement to the closest limit of E-GPRS mode. Please see the other measured channels as diagrams at the next chapter.

### 5.4.6 VERDICT: Summary of all EDGE measurement results for radiated frequencies below 30 MHz - Passed

### 5.4.7 GSM Measurement Results

#### FDD II

Set-up No.		1								
Operating Mode		5								
Diagram no.	Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB) (C <sub>F</sub> )	Margin (dB) (M)	Limit (dB $\mu$ V/m) (L <sub>T</sub> )
3.07 (low ch.)	Same settings (see below)	See diagram	10	Same settings (see below)	100	--	0°..360°	Same settings (see below)	See diagram	
3.09 (high ch.)										
3.08 (mid. channel)	0.009 to 0.150	<-58	10	0.2	100	--	0°..360°	300 to 3m	>20	See diagram
	0.150 to 0.5	~ -65.7		10				300 to 3m	>20	
	0.5 to 30	~ -16.2		10				300 to 3m 30 to 3m	>20	34.00

Remark: Selected worst-case measurement to the closest limit of FDD II mode. Please see the other measured channels as diagrams at the next chapter.

#### FDD IV

Set-up No.		1								
Operating Mode		6								
Diagram no.	Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB) (C <sub>F</sub> )	Margin (dB) (M)	Limit (dB $\mu$ V/m) (L <sub>T</sub> )
3.11 (mid. ch.)	Same settings (see below)	See diagram	10	Same settings (see below)	100	--	0°..360°	Same settings (see below)	See diagram	
3.12 (high ch.)										
3.10 (low channel)	0.009 to 0.150	<-58	10	0.2	100	--	0°..360°	300 to 3m	>20	See diagram
	0.150 to 0.5	~ -60		10				300 to 3m	>20	
	0.5 to 30	~ 13		10				300 to 3m 30 to 3m	>20	34.00

Remark: Selected worst-case measurement to the closest limit of FDD IV mode. Please see the other measured channels as diagrams at the next chapter.

**FDD V**

Set-up No.		1								
Operating Mode		7								
Diagram no.	Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB) (C <sub>F</sub> )	Margin (dB) (M)	Limit (dBμV/m) (L <sub>T</sub> )
3.13 (low ch)	Same settings (see below)	See diagram	10	Same settings (see below)	100	--	0°..360°	Same settings (see below)	See diagram	
3.15 (high ch.)										
3.14 (mid. channel)	0.009 to 0.150	<-58	10	0.2	100	--	0°..360°	300 to 3m	>20	See diagram
	0.150 to 0.5	~ -60		10				300 to 3m	>20	
	0.5 to 30	~ 12		10				300 to 3m 30 to 3m	>20	

Remark: Selected worst-case measurement to the closest limit of FDD V mode. Please see the other measured channels as diagrams at the next chapter.

**5.4.8 VERDICT:** Summary of all FDD measurement results for radiated frequencies below 30 MHz - Passed

<p><b>Margin to Limit:</b></p> $M = L_T - R_R + C_F + D_F$ $= L_T - R_R + (AF_{ANTENNA} + Cable_{LOSS}) + D_F$	<p><b>Abbreviations used:</b></p> <ul style="list-style-type: none"> <li>• R<sub>R</sub> : Receiver readings in dBμV/m</li> <li>• C<sub>F</sub>: Transducer in dB = AF (antenna factor) + CL (cable loss)</li> <li>• D<sub>F</sub>: distance correction factor (if different measurement distance used than specified in the standard)</li> <li>• L<sub>T</sub> : Limit in dBμV/m</li> </ul>
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**Diagrams**

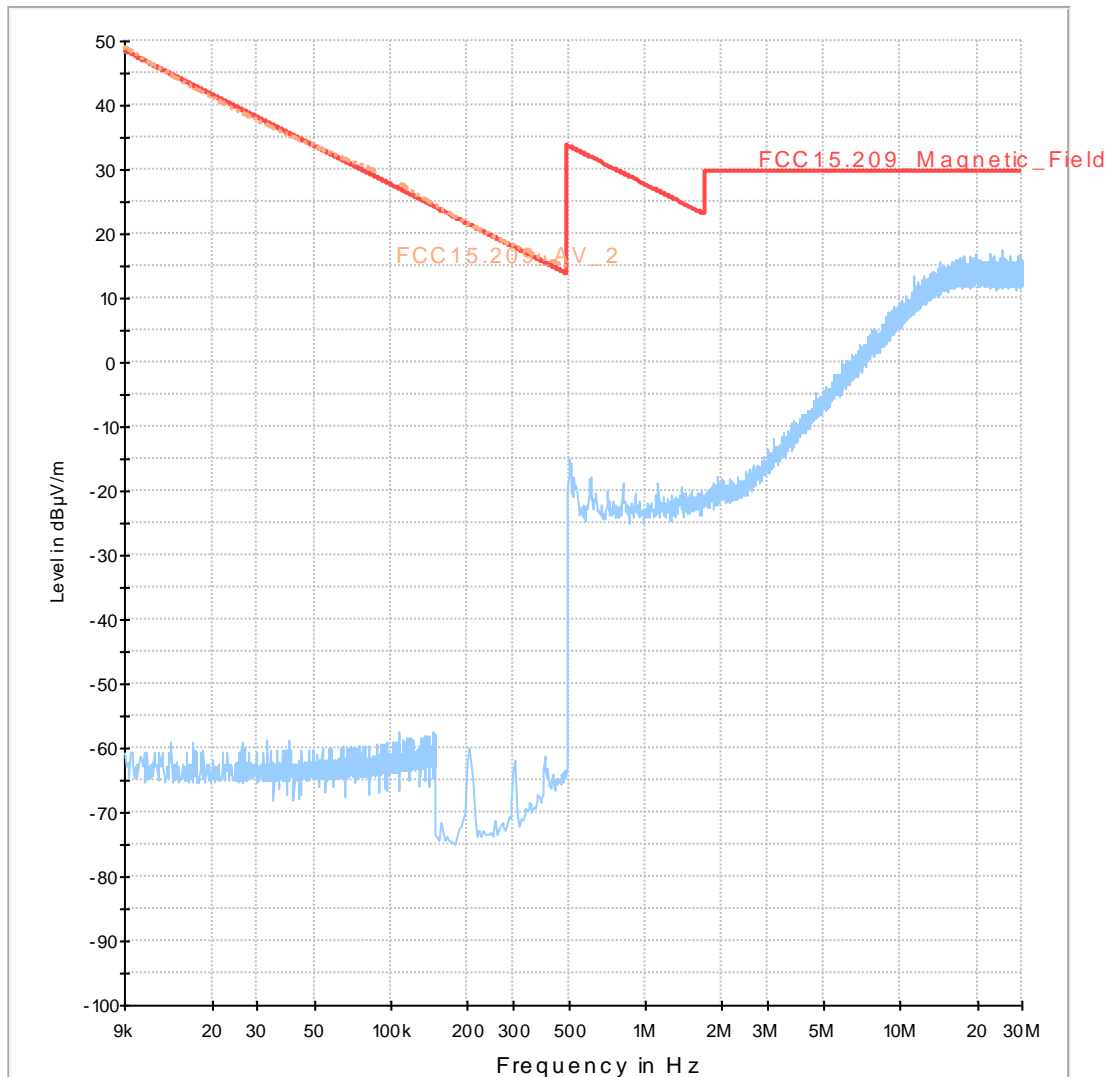
**Diagram No. 3.01**

Date:	19.03.2012
Test description:	Magnetic Fieldstrength Measurement related to 3 m distance
Test site and distance:	Semi Anechoic Room covered with absorbers (SAR) with 3 m measurement distance
Distance correction:	no used
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3
Operator:	OOu
Operating conditions:	EGPRS TX-on
Power during tests:	110V 60Hz
Operating Mode:	Channel low (128) G850

**EUT Information**

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC15.209\_magn hor+vert



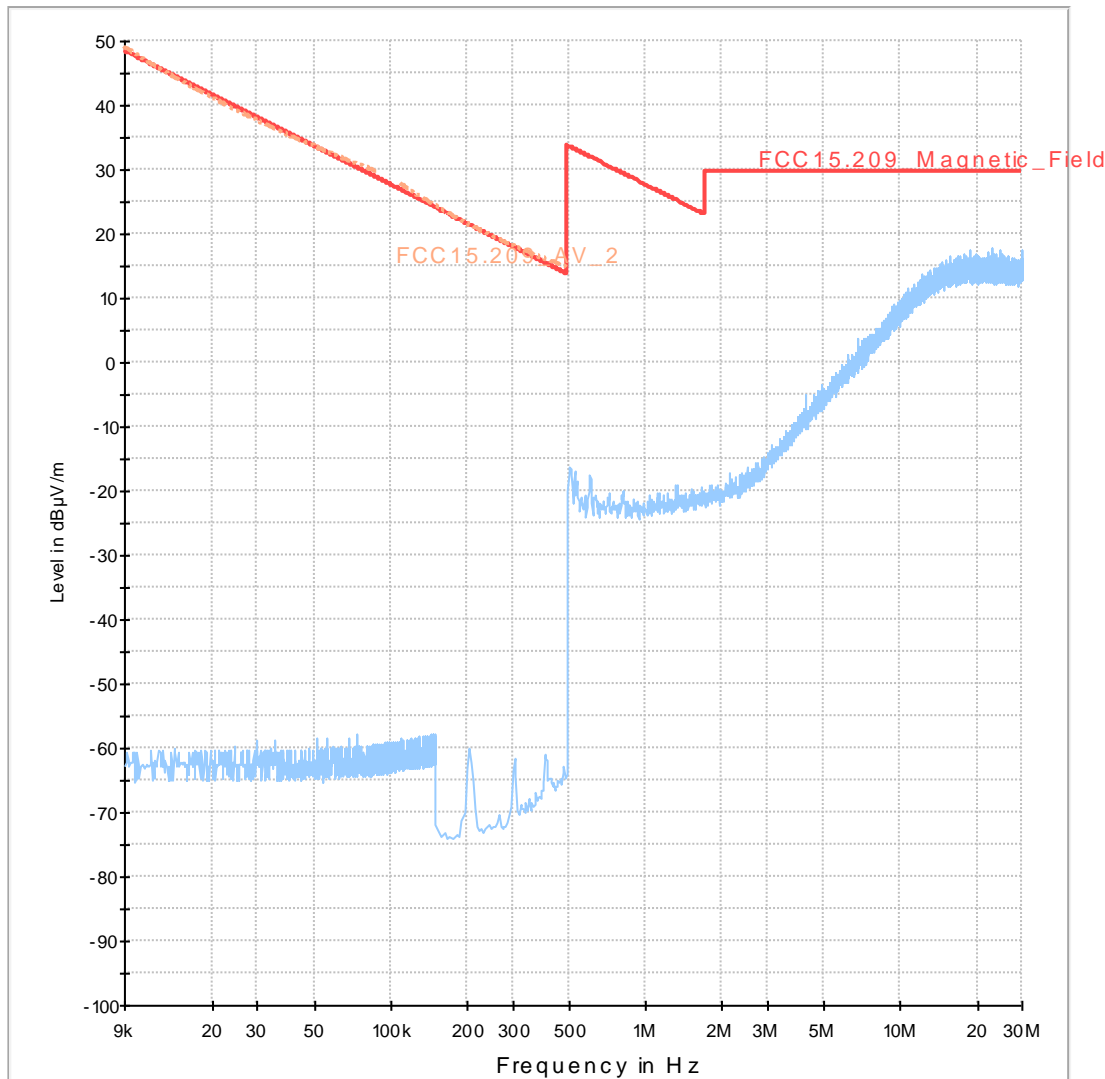
### Diagram No. 3.02

Date:	19.03.2012
Test description:	Magnetic Fieldstrength Measurement related to 3 m distance
Test site and distance:	Semi Anechoic Room covered with absorbers (SAR) with 3 m measurement distance
Distance correction:	no used
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3
Operator:	OOu
Operating conditions:	EGPRS TX-on
Power during tests:	110V 60Hz
Operating Mode:	Channel middle (192) G850

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC15.209\_magn hor+vert



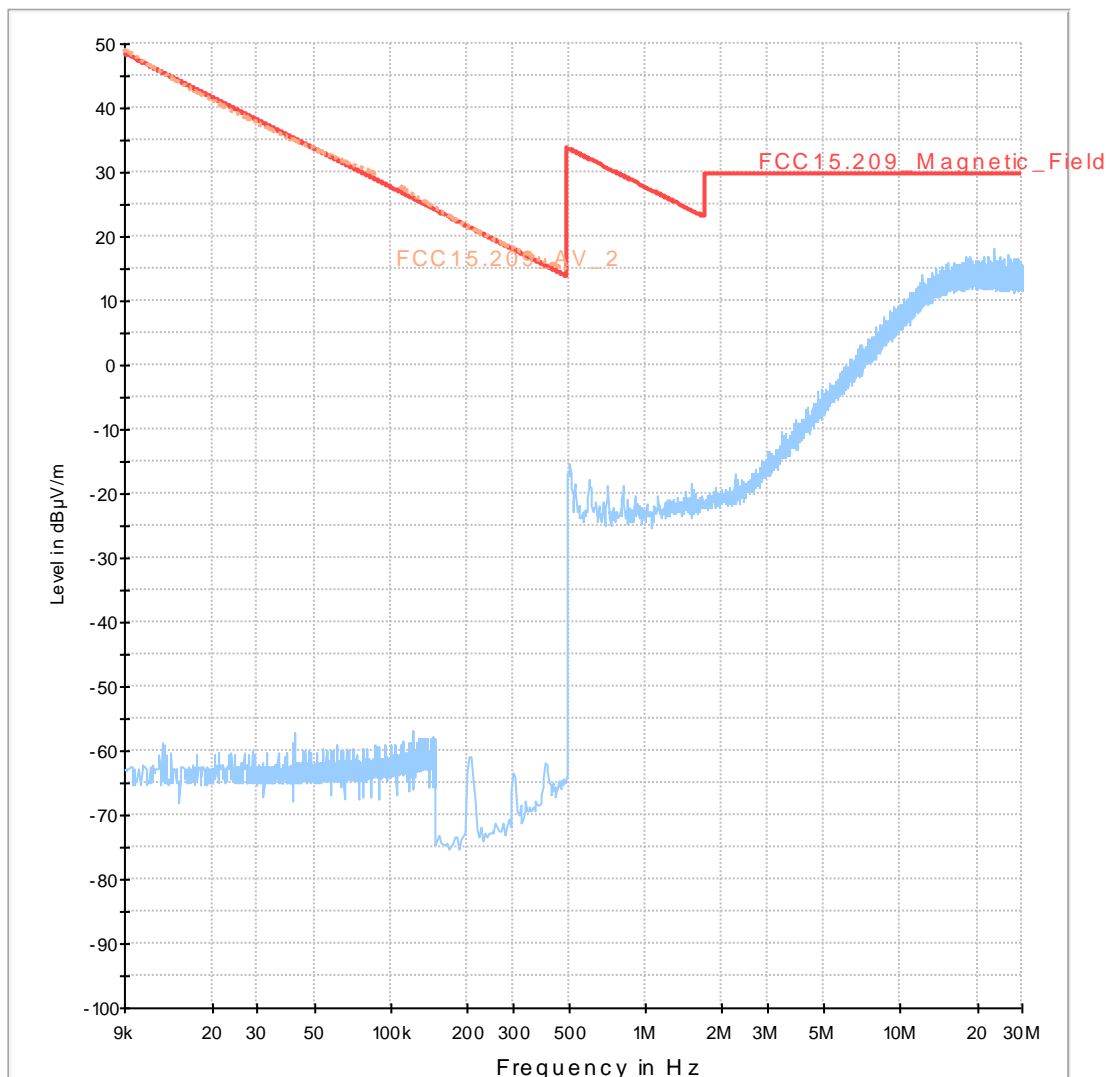
### Diagram No. 3.03

Test description:	Date: 19.03.2012 Page 1 of 2
Test site and distance:	Magnetic Fieldstrength Measurement related to 3 m distance
Distance correction:	Semi Anechoic Room covered with absorbers (SAR) with 3 m measurement distance
Technical Data:	no used
Rec. antenna (pre-scan):	Please see page 2 for detailed data of measurement setup
Used filter:	height 1.00 m, parallel and 90° to EUT polarisation
Test specification:	bypass
	FCC 15.205 § 15.209; RSS-Gen: Issue 3
Operator:	OOu
Operating conditions:	EGPRS TX-on
Power during tests:	110V 60Hz
Operating Mode:	Channel high (251) G850

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC 15.209\_magn hor+vert



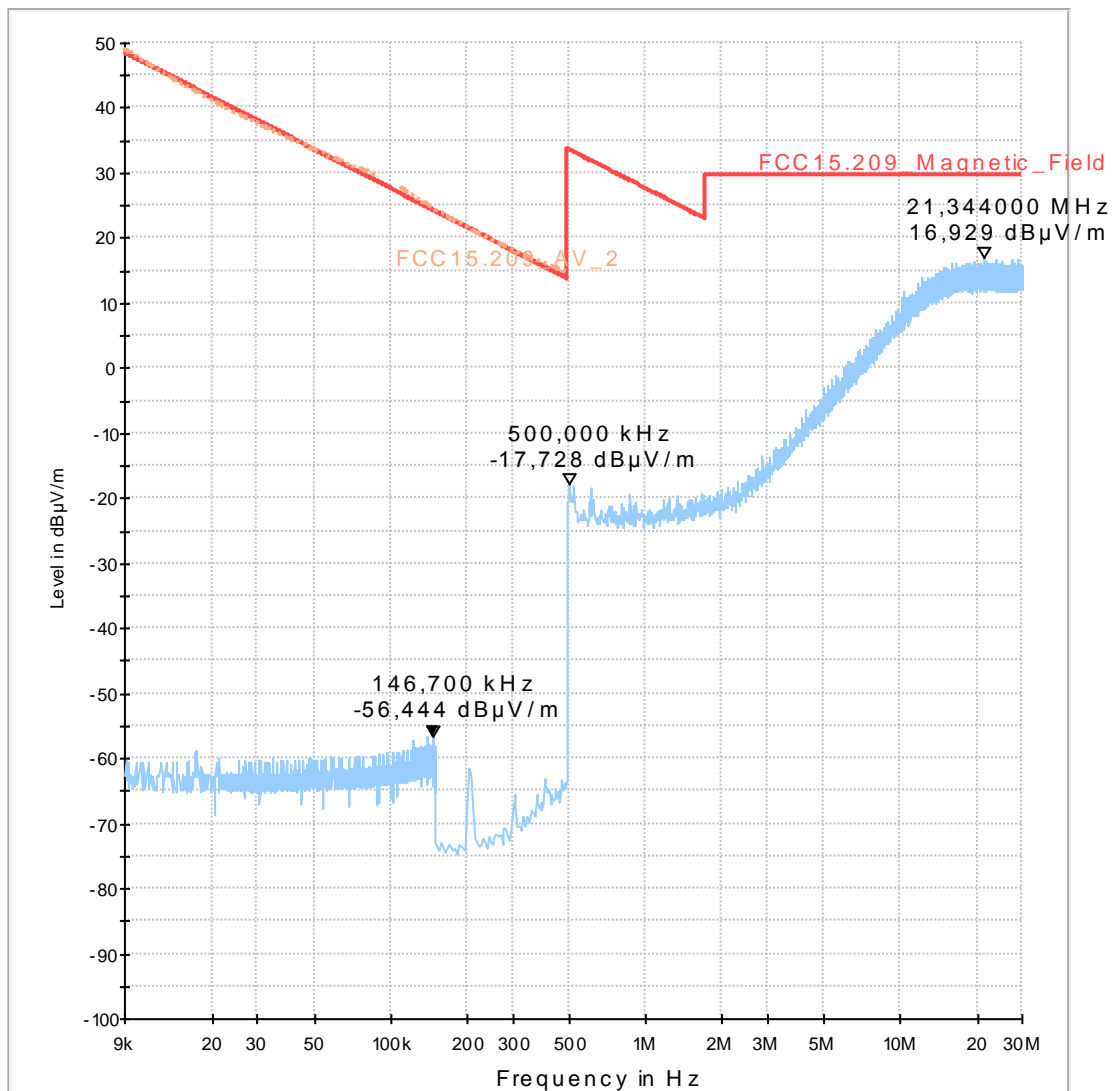
### Diagram No. 3.04

Test description:	Date: 20.03.2012 Page 1 of 2
Test site and distance:	Magnetic Fieldstrength Measurement related to 3 m distance
Distance correction:	Semi Anechoic Room with mobile absorbers on the floor (SAR) with 3 m measurement distance
Technical Data:	no used
Rec. antenna (pre-scan):	Please see page 2 for detailed data of measurement setup
Used filter:	height 1.00 m, parallel and 90° to EUT polarisation
Test specification:	bypass
	FCC 15.205 § 15.209; RSS-Gen: Issue 3
Operator:	Tas
Operating conditions:	TX-on
Power during tests:	110V 60Hz
Operating mode	Channel low (512) EGPRS-PCS1900

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC15.209\_magn hor+vert



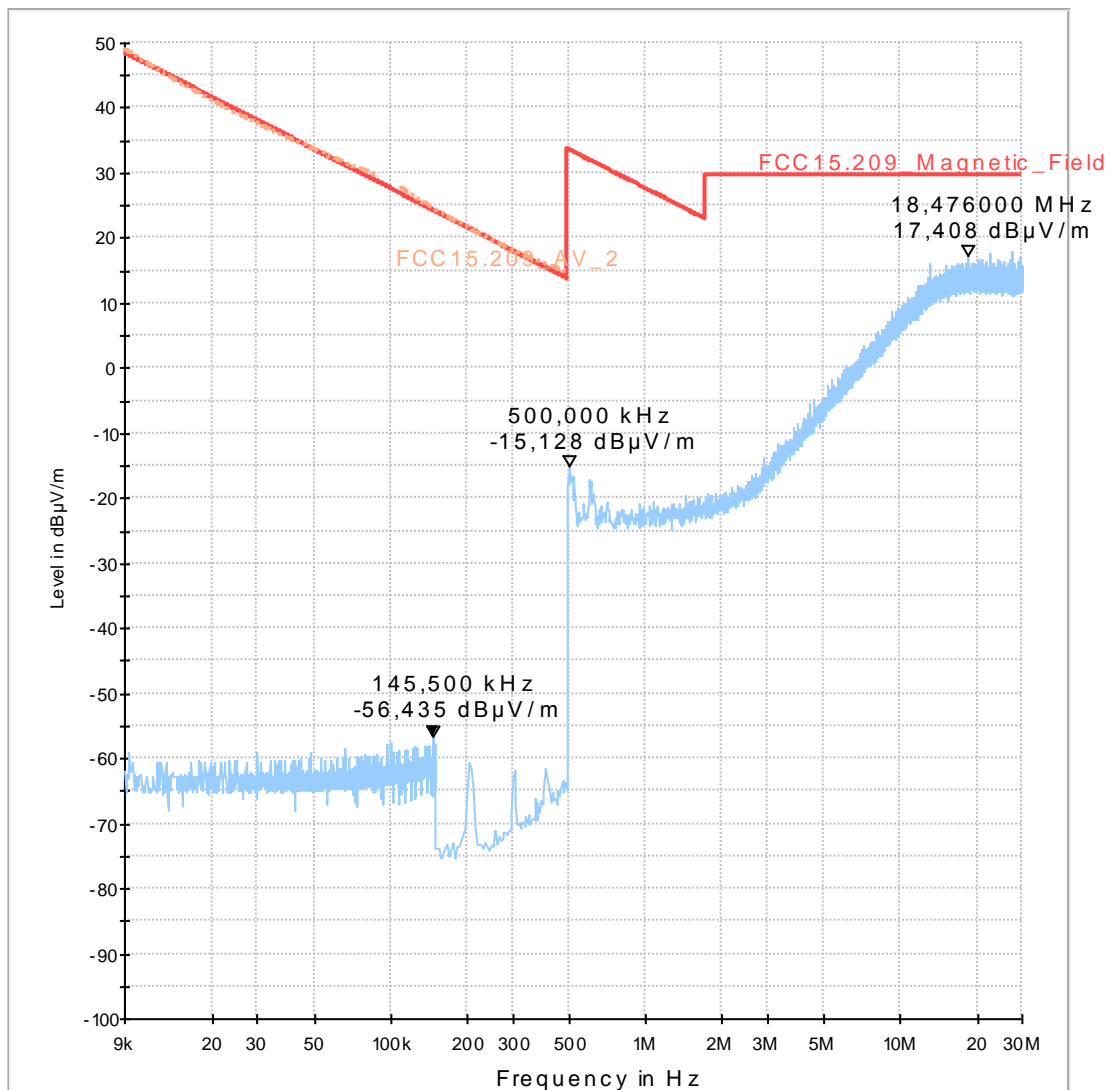
### Diagram No. 3.05

Test description:	Date: 20.03.2012 Page 1
Test site and distance:	Magnetic Fieldstrength Measurement related to 3 m distance
Distance correction:	Semi Anechoic Room with mobile absorbers on the floor (SAR) with 3 m measurement distance no used
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3
Operator:	Tas
Operating conditions:	TX-on
Power during tests:	110V 60Hz
Operating mode	Channel middle (661) EGPRS-PCS1900

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC15.209\_magn hor+vert



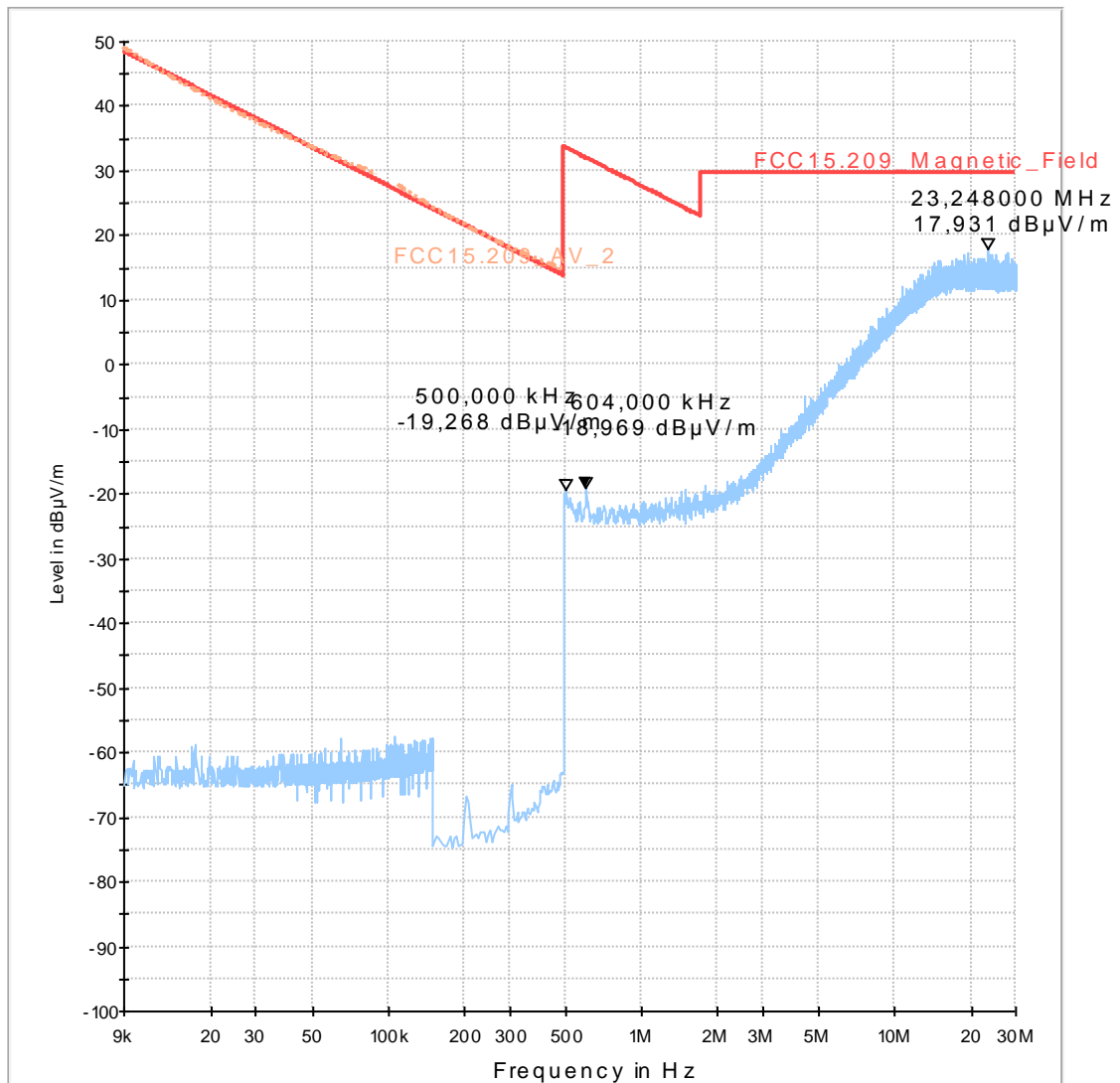
### Diagram No. 3.06

Test description:	Date: 20.03.2012 Page 1
Test site and distance:	Magnetic Fieldstrength Measurement related to 3 m distance
Distance correction:	Semi Anechoic Room with mobile absorbers on the floor (SAR) with 3 m measurement distance
Technical Data:	no used
Rec. antenna (pre-scan):	Please see page 2 for detailed data of measurement setup
Used filter:	height 1.00 m, parallel and 90° to EUT polarisation
Test specification:	bypass
	FCC 15.205 § 15.209; RSS-Gen: Issue 3
Operator:	Tas
Operating conditions:	TX-on
Power during tests:	110V 60Hz
Operating mode:	Channel high (810) EGPRS-PCS1900

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC15.209\_magn hor+vert



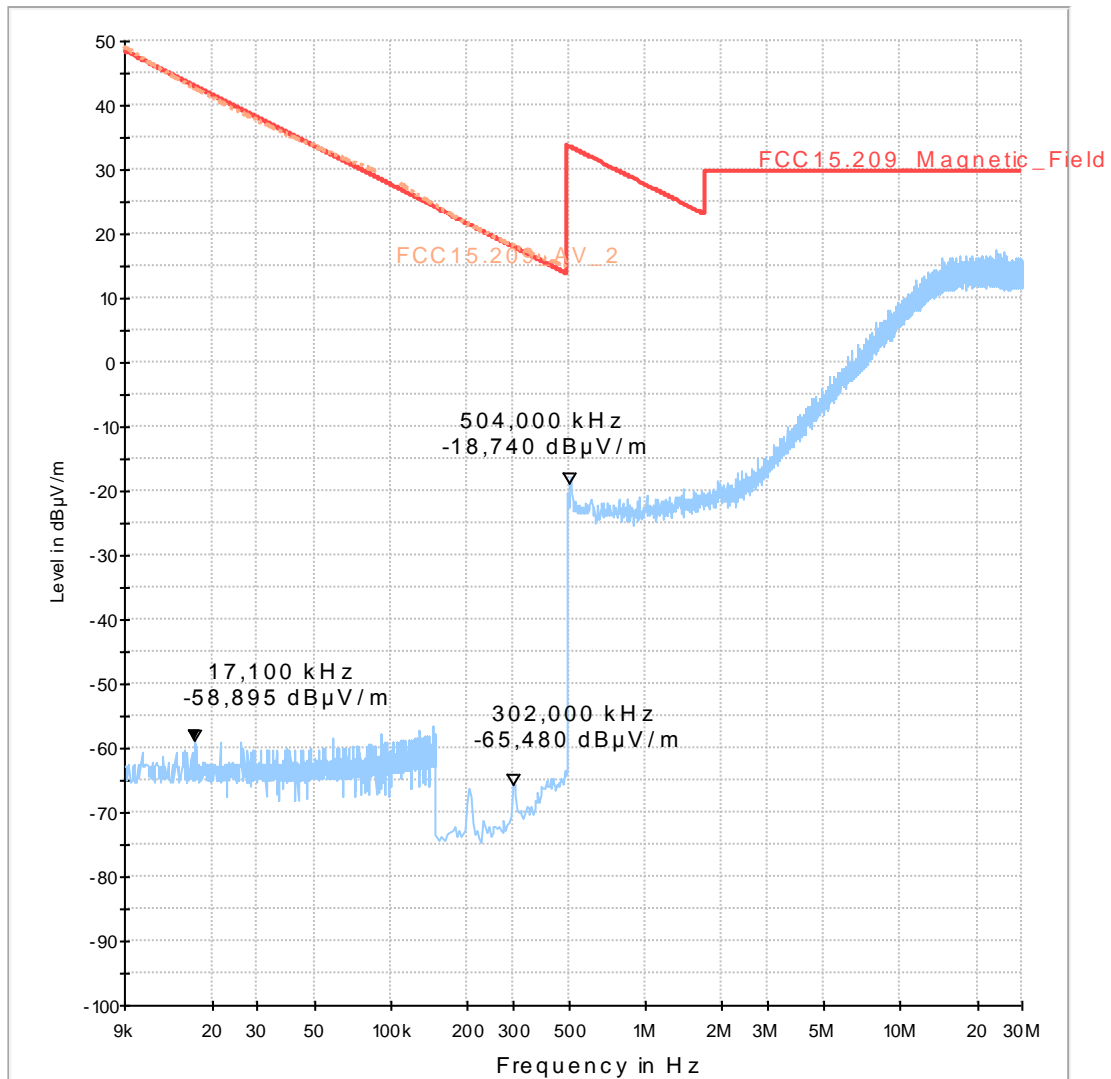
### Diagram No. 3.07

Date:	19.03.2012	Page 1
Test description:	Magnetic Fieldstrength Measurement related to 3 m distance	
Test site and distance:	Semi Anechoic Room covered with absorbers (SAR) with 3 m measurement distance	
Distance correction:	no used	
Technical Data:	Please see page 2 for detailed data of measurement setup	
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation	
Used filter:	bypass	
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3	
Operator:	Hla	
Operating conditions:	FDD II RMC99	
Power during tests:	110V 60Hz	
Operating Mode:	Channel low (9262) FDD II	

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC 15.209\_magn hor+vert



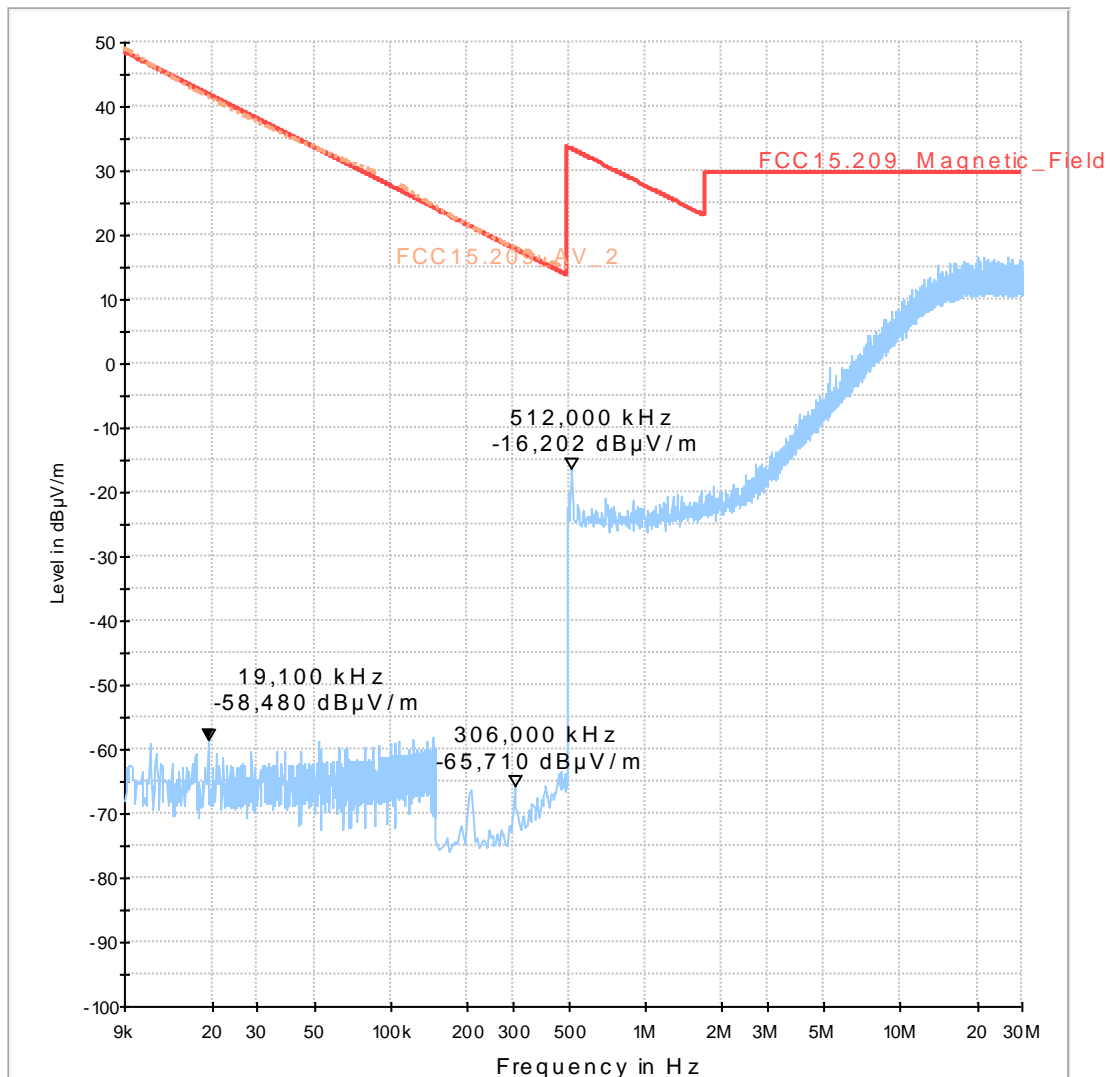
### Diagram No. 3.08

Date:	19.03.2012 Page 1
Test description:	Magnetic Fieldstrength Measurement related to 3 m distance
Test site and distance:	Semi Anechoic Room covered with absorbers (SAR) with 3 m measurement distance
Distance correction:	no used
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3
Operator:	Hla
Operating conditions:	FDD II RMC99
Power during tests:	110V 60Hz
Operating Mode:	Channel middle (9400) FDD II

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC15.209\_magn hor+vert





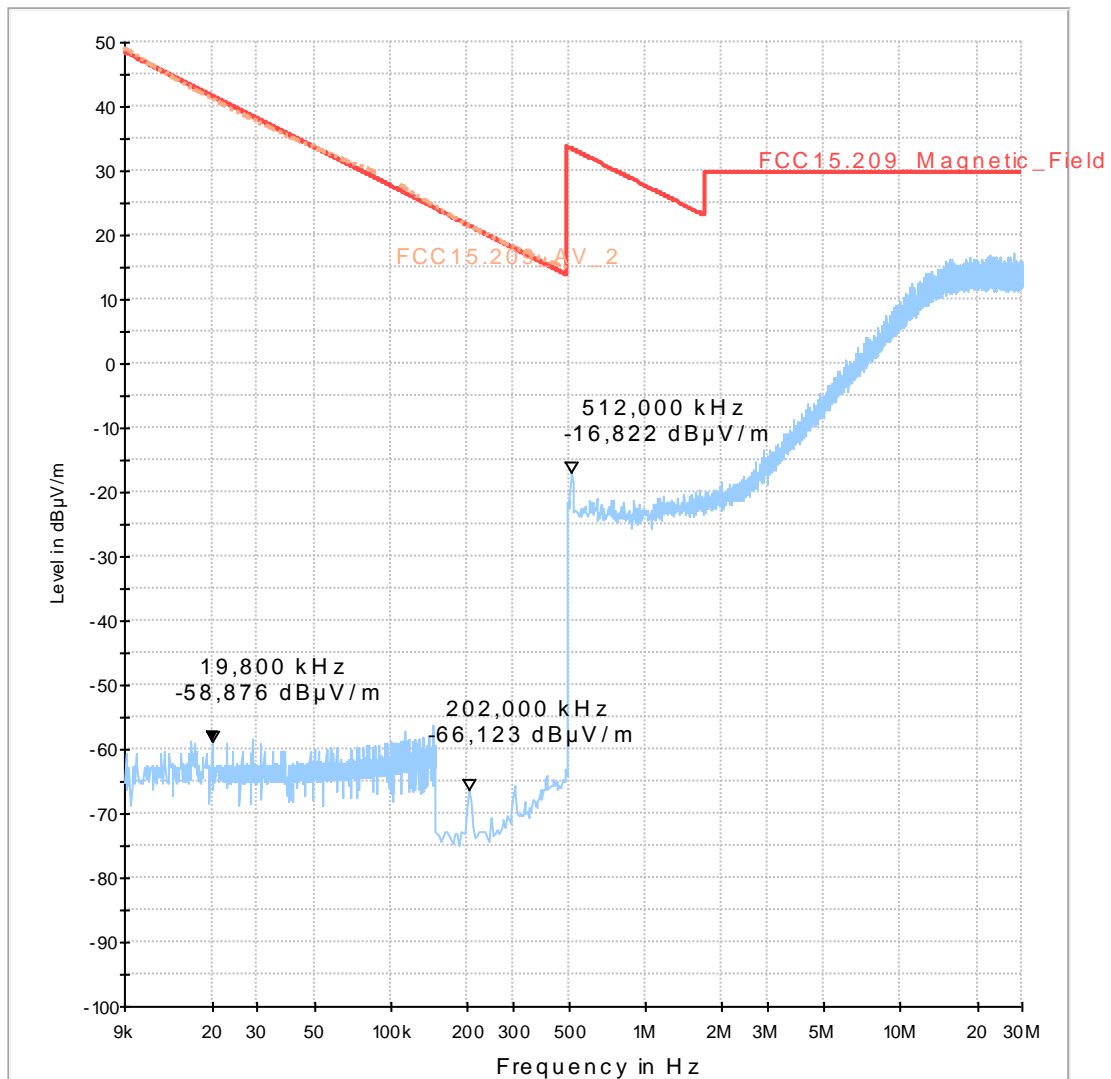
### Diagram No. 3.09

Date:	19.03.2012	Page 1
Test description:	Magnetic Fieldstrength Measurement related to 3 m distance	
Test site and distance:	Semi Anechoic Room covered with absorbers (SAR) with 3 m measurement distance	
Distance correction:	no used	
Technical Data:	Please see page 2 for detailed data of measurement setup	
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation	
Used filter:	bypass	
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3	
Operator:	Hla	
Operating conditions:	FDD II RMC99	
Power during tests:	110V 60Hz	
Operating Mode:	Channel high (9538) FDD II	

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC15.209\_magn hor+vert



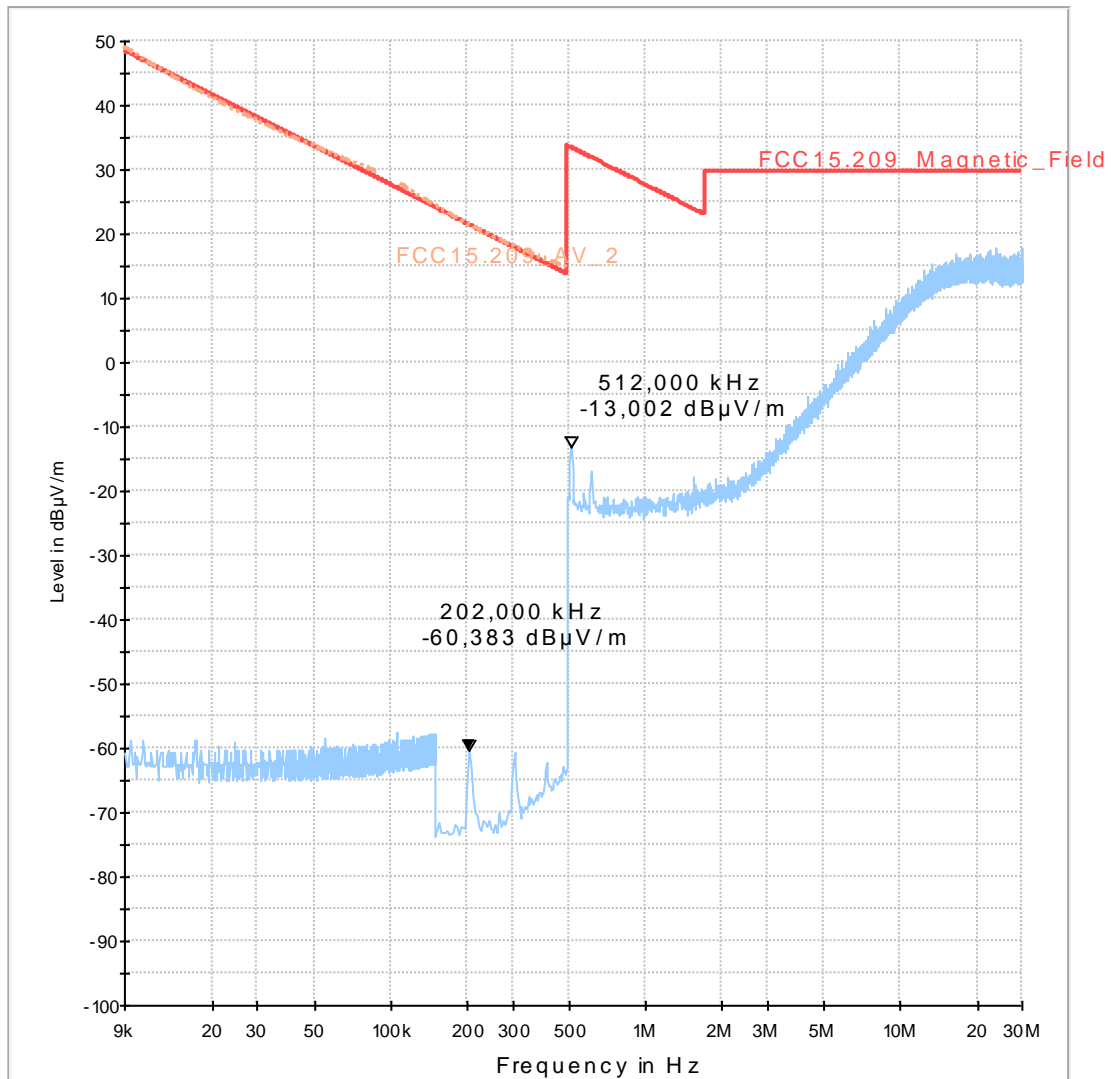
### Diagram No. 3.10

Date:	19.03.2012	Page 1
Test description:	Magnetic Fieldstrength Measurement related to 3 m distance	
Test site and distance:	Semi Anechoic Room covered with absorbers (SAR) with 3 m measurement distance	
Distance correction:	no used	
Technical Data:	Please see page 2 for detailed data of measurement setup	
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation	
Used filter:	bypass	
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3	
Operator:	Hla	
Operating conditions:	FDD IV RMC99	
Power during tests:	110V 60Hz	
Operating Mode:	Channel low (1312) FDD IV	

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC 15.209\_magn hor+vert



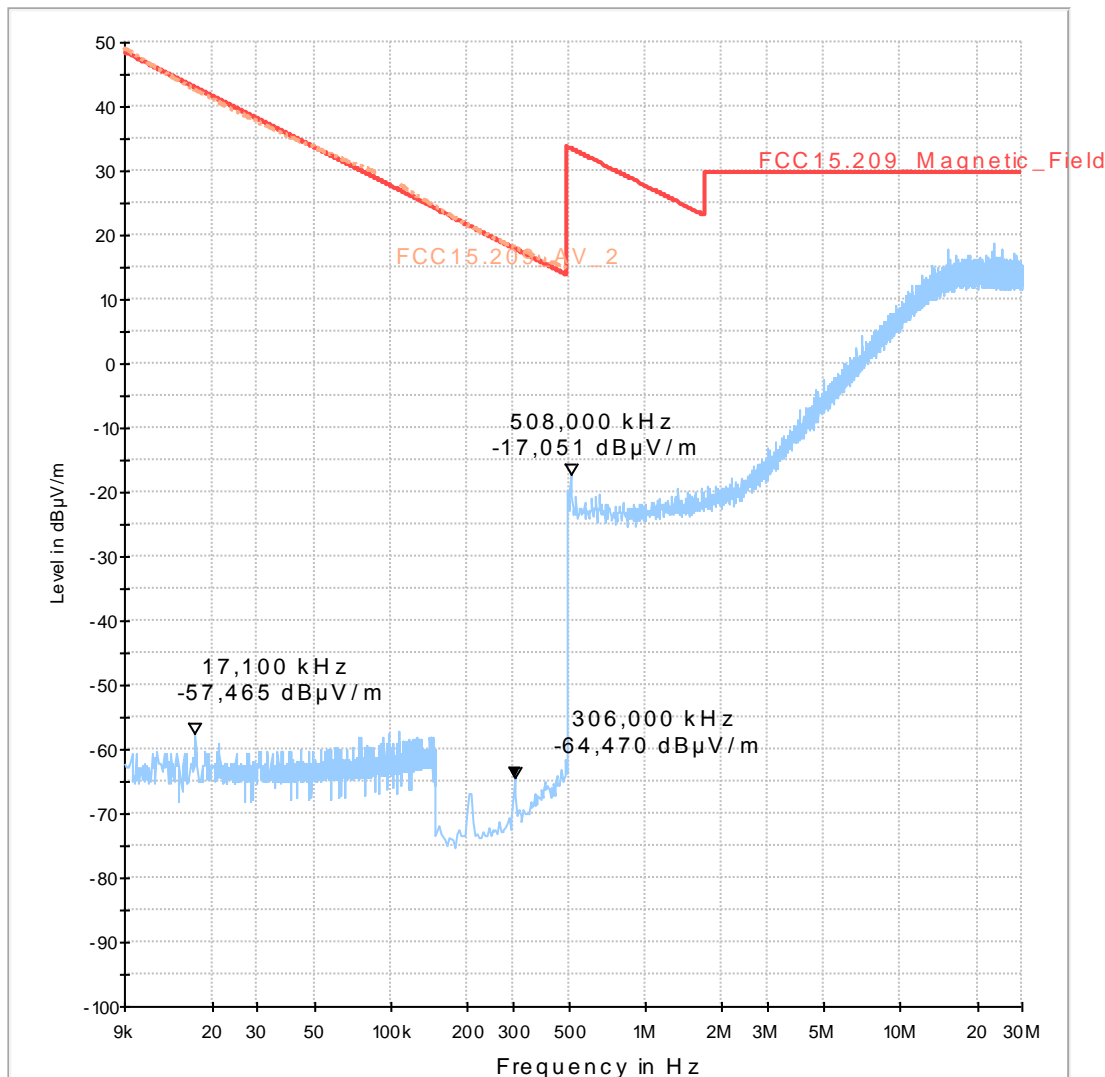
### Diagram No. 3.11

Date:	19.03.2012	Page 1
Test description:	Magnetic Fieldstrength Measurement related to 3 m distance	
Test site and distance:	Semi Anechoic Room covered with absorbers (SAR) with 3 m measurement distance	
Distance correction:	no used	
Technical Data:	Please see page 2 for detailed data of measurement setup	
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation	
Used filter:	bypass	
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3	
Operator:	Hla	
Operating conditions:	FDD IV RMC99	
Power during tests:	110V 60Hz	
Operating Mode:	Channel middle (1413) FDD IV	

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC15.209\_magn hor+vert



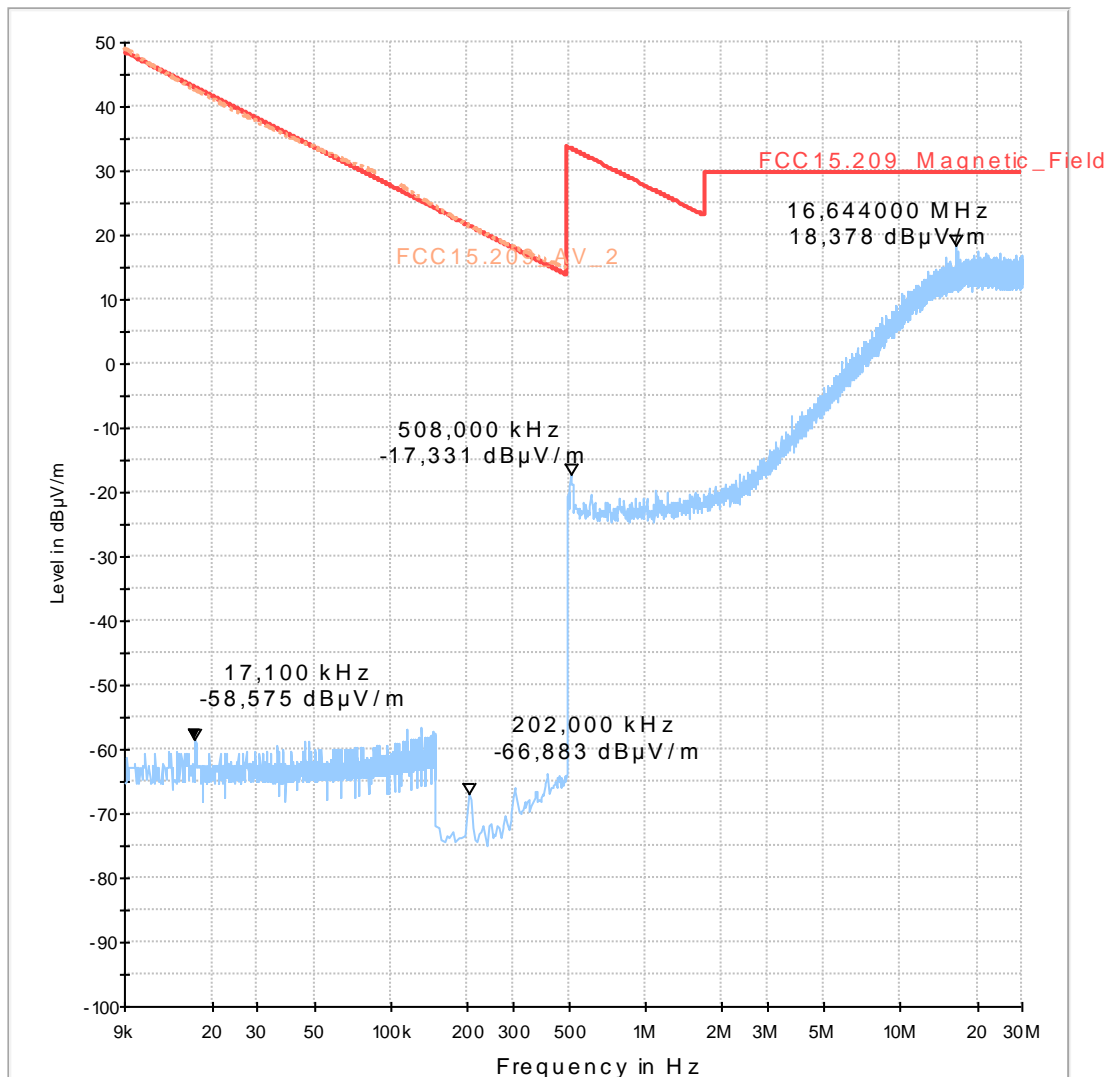
### Diagram No. 3.12

Date:	19.03.2012 Page 1
Test description:	Magnetic Fieldstrength Measurement related to 3 m distance
Test site and distance:	Semi Anechoic Room covered with absorbers (SAR) with 3 m measurement distance
Distance correction:	no used
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3
Operator:	Hla
Operating conditions:	FDD IV RMC99
Power during tests:	110V 60Hz
Operating Mode:	Channel high (1513) FDD IV

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC15.209\_magn hor+vert



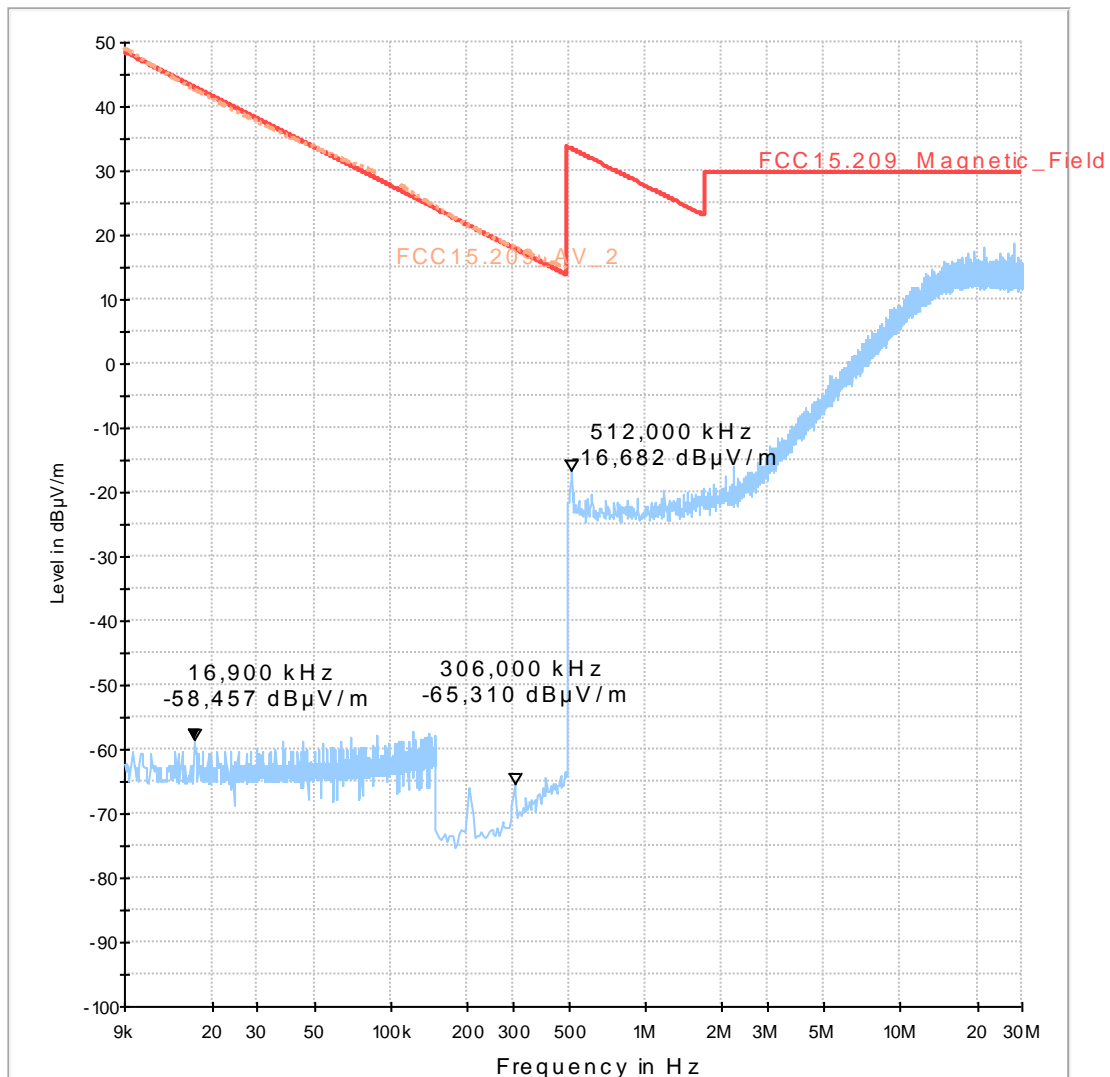
### Diagram No. 3.13

Date:	19.03.2012	Page 1
Test description:	Magnetic Fieldstrength Measurement related to 3 m distance	
Test site and distance:	Semi Anechoic Room covered with absorbers (SAR) with 3 m measurement distance	
Distance correction:	no used	
Technical Data:	Please see page 2 for detailed data of measurement setup	
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation	
Used filter:	bypass	
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3	
Operator:	Hla	
Operating conditions:	FDD V RMC99	
Power during tests:	110V 60Hz	
Operating Mode:	Channel low (4132) FDD V	

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC15.209\_magn hor+vert



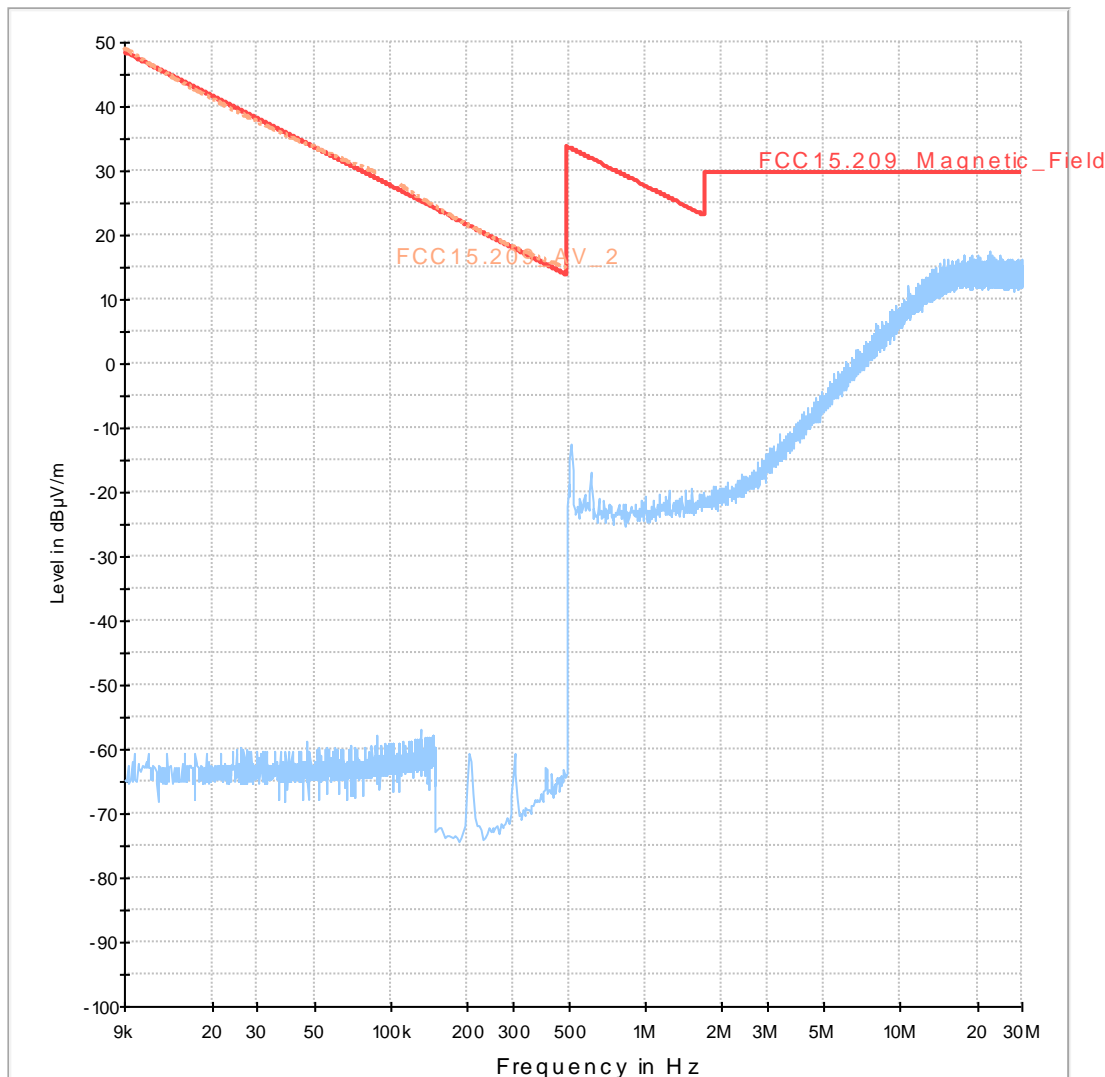
### Diagram No. 3.14

Date:	19.03.2012	Page 1
Test description:	Magnetic Fieldstrength Measurement related to 3 m distance	
Test site and distance:	Semi Anechoic Room covered with absorbers (SAR) with 3 m measurement distance	
Distance correction:	no used	
Technical Data:	Please see page 2 for detailed data of measurement setup	
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation	
Used filter:	bypass	
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3	
Operator:	Hla	
Operating conditions:	FDD V RMC99	
Power during tests:	110V 60Hz	
Operating Mode:	Channel middle (4182) FDD V	

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC15.209\_magn hor+vert



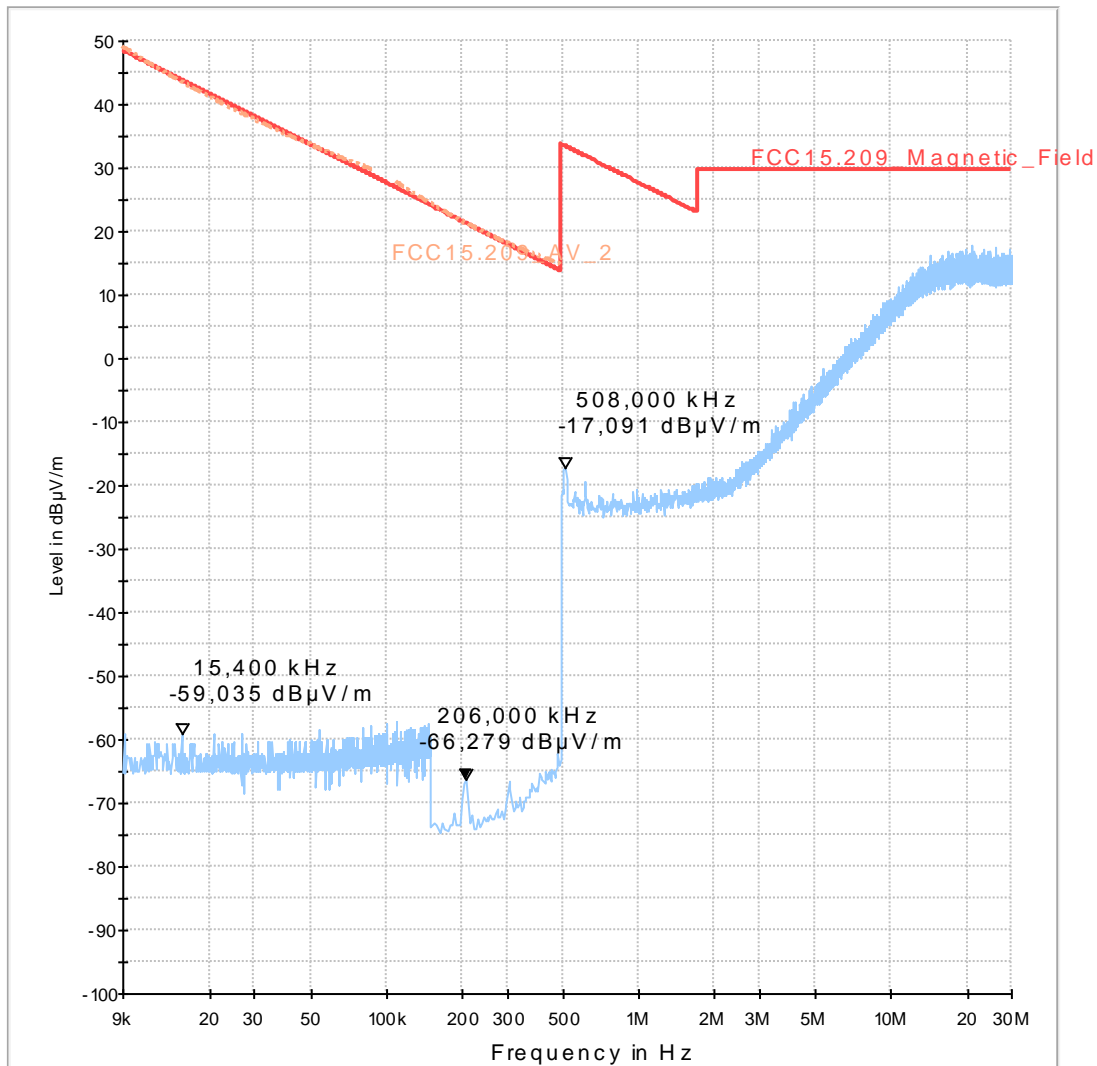
### Diagram No. 3.15

Date:	19.03.2012	Page 1
Test description:	Magnetic Fieldstrength Measurement related to 3 m distance	
Test site and distance:	Semi Anechoic Room covered with absorbers (SAR) with 3 m measurement distance	
Distance correction:	no used	
Technical Data:	Please see page 2 for detailed data of measurement setup	
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation	
Used filter:	bypass	
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 3	
Operator:	Hla	
Operating conditions:	FDD V RMC99	
Power during tests:	110V 60Hz	
Operating Mode:	Channel high (4233) FDD V	

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
IMEI:	352237-05-001195-8
FW:	22.00
Accessories:	AC/DC adapter Model 0055 + Portable earphones V109 + Magnetic Ant. GA.107 Taoglas

FCC 15.209\_magn hor+vert







## 5.5. Conducted out of Band RF emissions and Block Edge

### 5.5.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input type="checkbox"/> 337 OATS
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input checked="" type="checkbox"/> 489 ESU
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK
antenna	<input type="checkbox"/> 574 BTA-L	<input type="checkbox"/> 133 EMCO3115	<input type="checkbox"/> 302 BBHA9170
signaling	<input type="checkbox"/> 017 CMD 65	<input type="checkbox"/> 323 CMD 55	<input type="checkbox"/> 340 CMD 55
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 436 CMU	<input checked="" type="checkbox"/> 547 CMU
power supply	<input type="checkbox"/> 463 HP3245A	<input type="checkbox"/> 457 EA 3013A	<input type="checkbox"/> 459 EA 2032-50
otherwise	<input checked="" type="checkbox"/> 529 6dB divider	<input checked="" type="checkbox"/> 530 10dB Att.	<input type="checkbox"/> 110 USB LWL
line voltage	<input checked="" type="checkbox"/> 110 V 60 Hz via public mains	<input checked="" type="checkbox"/> 060 110 V 60 Hz via PAS 5000	<input type="checkbox"/> 268 EA- 3050
			<input type="checkbox"/> 494 AG6632A
			<input checked="" type="checkbox"/> 498 NGPE 40
			<input type="checkbox"/> 431 Near field

### 5.5.2 References

FCC: §2.1053(a)-conducted, §2.1057, §22.917(a)(b); §24.238(a)(b); § 27.53(g)  
 IC: RSS-132: 4.5.1&4.5.2, RSS-133: 6.5.1(a)(b), RSS-139

„the power of emissions shall be attenuated below the transmitter output power (p) by at least least 43+10Log(P) dB“

### 5.5.3 Test condition and measurement test set-up

link to test system (if used):	<input checked="" type="checkbox"/> air link (radiated)	<input checked="" type="checkbox"/> cable connection (conducted)	<input type="checkbox"/>
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%

### 5.5.4 Frequency range

The spectrum was scanned from 9 kHz to the 10th harmonic of the highest frequency generated within the equipment. A PEAK detector was used except measurements near the block-edge where a AVERAGE detector applied.

“The specification that all emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range of the mobile phone (1 to 0.001 W) to a constant limit of -13 dBm.”

“§ 2.1057 Frequency spectrum to be investigated. (a) In all of the measurements set forth in §§ 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz”

### 5.5.5 Description of Set-up

- see conducted set-up in chapter 4.1

### 5.5.6 Settings on Mobile Phone

The measurements were made at the upper, middle, and lower carrier frequencies of the operating band. Choosing three representative TX-carrier frequencies of the mobile phone within each operable GSM band, should be sufficient to demonstrate compliance with the emissions limits outside and adjacent to the frequency blocks.

A call was established with settings according chapter 3.7

**5.5.8 Settings of Spectrum-Analyser**

Frequency range	RBW (resolution bandwidth)	VBW (video bandwidth)
<b>BLOCK-EDGE compliance:</b> 1 MHz immediately adjacent to the frequency blocks	1% from applicants stated/measured emission bandwidth	3..10 times the RBW
More than 1 MHz outside and adjacent the frequency blocks	1kHz or 100kHz to measurement frequencies up to 1MHz 1 MHz for measurement frequency range 1MHz to maximum 10-times TX-frequency	3..10 times the RBW

**5.5.8.1 Settings for G850/FDDV Mode**

	Start freq. MHz	Stop freq. MHz	R-BW MHz	V-BW MHz	Sweep time sec.	Att.	Detector
Sweep 1 (subrange 1)	0.009	1	0.001	0.01	10	25	MaxH-PK
Sweep 1 (subrange 2)	1	30	0.1	1	5	25	MaxH-PK
Sweep 2 (subrange 1)	30	1000	0.1	1	10	35	MaxH-PK
Sweep 2 (subrange 2)	1000	2500	1	1	15	35	MaxH-PK
Sweep 2 (subrange 3)	2500	9000	1	1	60	35	MaxH-PK
Sweep 3a (Block-Edge)	823	824	0.003	0.01	30	35	MaxH-PK
Sweep 3b (Block-Edge)	823	824	0.003	0.01	30	35	MaxH-AV
Sweep 4a (Block-Edge)	850	851	0.003	0.01	30	35	MaxH-PK
Sweep 4b (Block-Edge)	850	851	0.003	0.01	30	35	MaxH-AV

**5.5.8.2 Settings for PCS1900/FDD II/ FDD IV Mode**

	Start freq. MHz	Stop freq. MHz	R-BW MHz	V-BW MHz	Sweep time sec.	Att.	Detector
Sweep 1 (subrange 1)	0.009	1	0.001	0.01	10	25	MaxH-PK
Sweep 1 (subrange 2)	1	30	0.1	1	5	25	MaxH-PK
Sweep 2 (subrange 1)	30	1000	0.1	1	10	35	MaxH-PK
Sweep 2 (subrange 2)	1000	2500	1	1	15	35	MaxH-PK
Sweep 2 (subrange 3)	2500	19500	1	1	160	35	MaxH-PK
Sweep 3a (Block-Edge)	1849	1850	0.003	0.01	30	35	MaxH-PK
Sweep 3b (Block-Edge)	1849	1850	0.003	0.01	30	35	MaxH-AV
Sweep 4a (Block-Edge)	1910	1911	0.003	0.01	30	35	MaxH-PK
Sweep 4b (Block-Edge)	1910	1911	0.003	0.01	30	35	MaxH-AV

**5.5.8.3 Block-Edge settings for FDD IV**

Sweep 3a (Block-Edge)	1709	1710	0.003	0.01	30	35	MaxH-PK
Sweep 3b (Block-Edge)	1755	1756	0.003	0.01	30	35	MaxH-AV
Sweep 4a (Block-Edge)	1709	1710	0.003	0.01	30	35	MaxH-PK
Sweep 4b (Block-Edge)	1755	1756	0.003	0.01	30	35	MaxH-AV

**Remarks:** Due to not available exact 1% RBW of the measurement equipment, the lower available RBW was used for the FDD measurements.

An an additional correction factor of 10 Log (RBW1/ RBW2) to the result was added.

RBW1 is the narrower measurement resolution bandwidth (used RBW) and RBW2 is either the 1% emissions bandwidth or 1 MHz (**KDB890810**).

**Formula:** Block-Edge compliance correction factor for FDD bands->  $10\log(50\text{kHz}/30\text{KHz})$  to be used=2.22dB

**5.5.2. Results (conducted)**

Only worst-case level from the measurements are selected in the tables. Please refer at the next chapter ‘diagrams’ for more details at all diagrams.

**5.5.2.1. GSM TCH 850: Op. Mode 1, Set-up 2**

Transmitting channels/ frequencies: TX = 128/ 824.2 MHz, 192/ 837 MHz, 251/ 848.8 MHz							
Sweep no.	Diagram numbers	Frequency of emission [MHz]	Worst-Peak level [dBm]	Frequency of worst-peak level [GHz]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1	4.01-03	0.009 to 30	--	--	<-51.00	-13	Passed
Sweep 2	4.05	30 to 9000	-22.53	8.09	--		Passed
Sweep 3 & 4 <sup>1.)</sup>	4.07_AV	823.99	-25.1	--	--		Passed

Remark: 1.) Block-Edge compliance

**5.5.2.2. E-GPRS TCH 850: Op. Mode 2, Set-up 2**

Transmitting channels/ frequencies: TX = 128/ 824.2 MHz, 192/ 837 MHz, 251/ 848.8 MHz							
Sweep no.	Diagram number(s)	Frequency of emission [MHz]	Worst-Peak level [dBm]	Frequency of worst-peak level [GHz]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1	--	0.009 to 30	--	--	--	-13	Passed
Sweep 2	4.09	30 to 9000	-22.4	6.92	--		Passed
Sweep 3 & 4 <sup>1.)</sup>	4.12_AV	823.98	-17.73	--	--		Passed

Remark: 1.) Block-Edge compliance

**5.5.2.3. GSM TCH 1900: Op. Mode 3, Set-up 2**

Transmitting channels/ frequency: TX = 512/ 1850.2 MHz, 661/ 1880 MHz, 810/ 1909.8 MHz							
Sweep no.	Diagram numbers	Frequency of emission [MHz]	Worst-Peak level [dBm]	Frequency of worst-peak level [GHz]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1	4.14-16	0.009 to 30	--	--	<-51.00	-13	Passed
Sweep 2	4.19	30 to 20000	-19.3	19.27	--		Passed
Sweep 3 & 4 <sup>1.)</sup>	4.20_AV	1849.99	-27.3	--	--		Passed

Remark: 1.) Block-Edge compliance

**5.5.2.4. E-GPRS TCH 1900: Op. Mode 4, Set-up 2**

Transmitting channels/ frequency: TX = 512/ 1850.2 MHz, 661/ 1880 MHz, 810/ 1909.8 MHz							
Sweep no.	Diagram number(s)	Frequency of emission [MHz]	Worst-Peak level [dBm]	Frequency of worst-peak level [GHz]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1	--	0.009 to 30	--	--	--	-13	Passed
Sweep 2	4.22	30 to 20000	-19.3	19.35	--		Passed
Sweep 3 & 4 <sup>1.)</sup>	4.26_PK	1910.02	-18.2	--	--		Passed

Remark: 1.) Block-Edge compliance

**5.5.2.5. FDD II TCH : Op. Mode 5, Set-up 2**

Transmitting channels/ frequencies: TX = 9262/ 1852.4 MHz, 9400/ 1880 MHz, 9538/ 1907.6 MHz							
Sweep no.	Diagram numbers	Frequency of emission [MHz]	Worst-Peak level [dBm]	Frequency of worst-peak level [GHz]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1	4.27-29	0.009 to 30	--	--	<-47	-13	Passed
Sweep 2	4.30-32	30 to 20000	--	--	<-27		Passed
Sweep 3 & 4 <sup>1.)</sup>	4.33_PK	1849.96	-19.7+2.22= -17.48	--	--		Passed

Remark: 1.) Block-Edge compliance incl. formula

**5.5.2.6. FDD IV TCH : Op. Mode 6, Set-up 2**

Transmitting channels/ frequencies: TX = 1312/ 1712.4 MHz, 1413/ 1732.6 MHz, 1513/ 1752.6 MHz							
Sweep no.	Diagram numbers	Frequency of emission [MHz]	Worst-Peak level [dBm]	Frequency of worst-peak level [GHz]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1	4.35-37	0.009 to 30	--	--	<-47	-13	Passed
Sweep 2	4.38-40	30 to 18000	--	--	<-25		Passed
Sweep 3 & 4 <sup>1.)</sup>	4.41-42	823-824/ 849-850	<-20+2.22= -17.78	--	--		Passed

Remark: 1.) Block-Edge compliance incl. formula

**5.5.2.7. FDD V TCH : Op. Mode 7, Set-up 2**

Transmitting channels/ frequencies: TX = 4132/ 826.4 MHz, 4182/ 836.4 MHz, 4233/ 846.6 MHz							
Sweep no.	Diagram numbers	Frequency of emission [MHz]	Worst-Peak level [dBm]	Frequency of worst-peak level [GHz]	Result [dBm]	Limit [dBm]	Verdict
Sweep 1	4.43-45	0.009 to 30	--	--	<-47	-13	Passed
Sweep 2	4.46-48	30 to 9000	--	--	<-30		Passed
Sweep 3 & 4 <sup>1.)</sup>	4.49-50	823-824/ 849-850	<-19+2.22= -16.78	--	--		Passed

Remark: 1.) Block-Edge compliance incl. formula

Diagrams

Diagram No.: 4.01

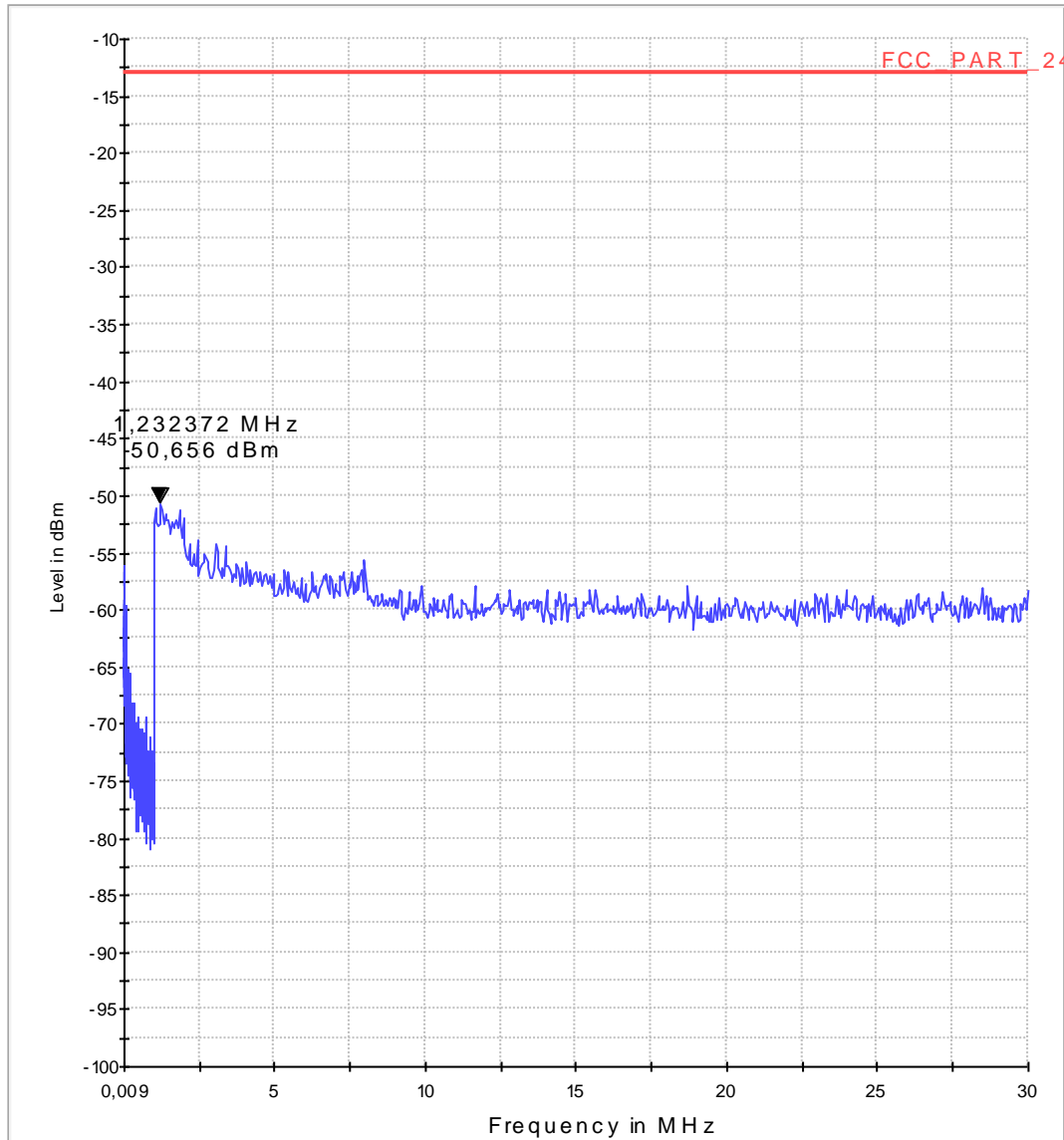
Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory
Test Standard:	FCC Part 22.917, RSS-132
Operation mode:	TCH - GSM, G850, ARFCN 128_low
Operator Name:	Tas

EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_1



### Diagram No.: 4.02

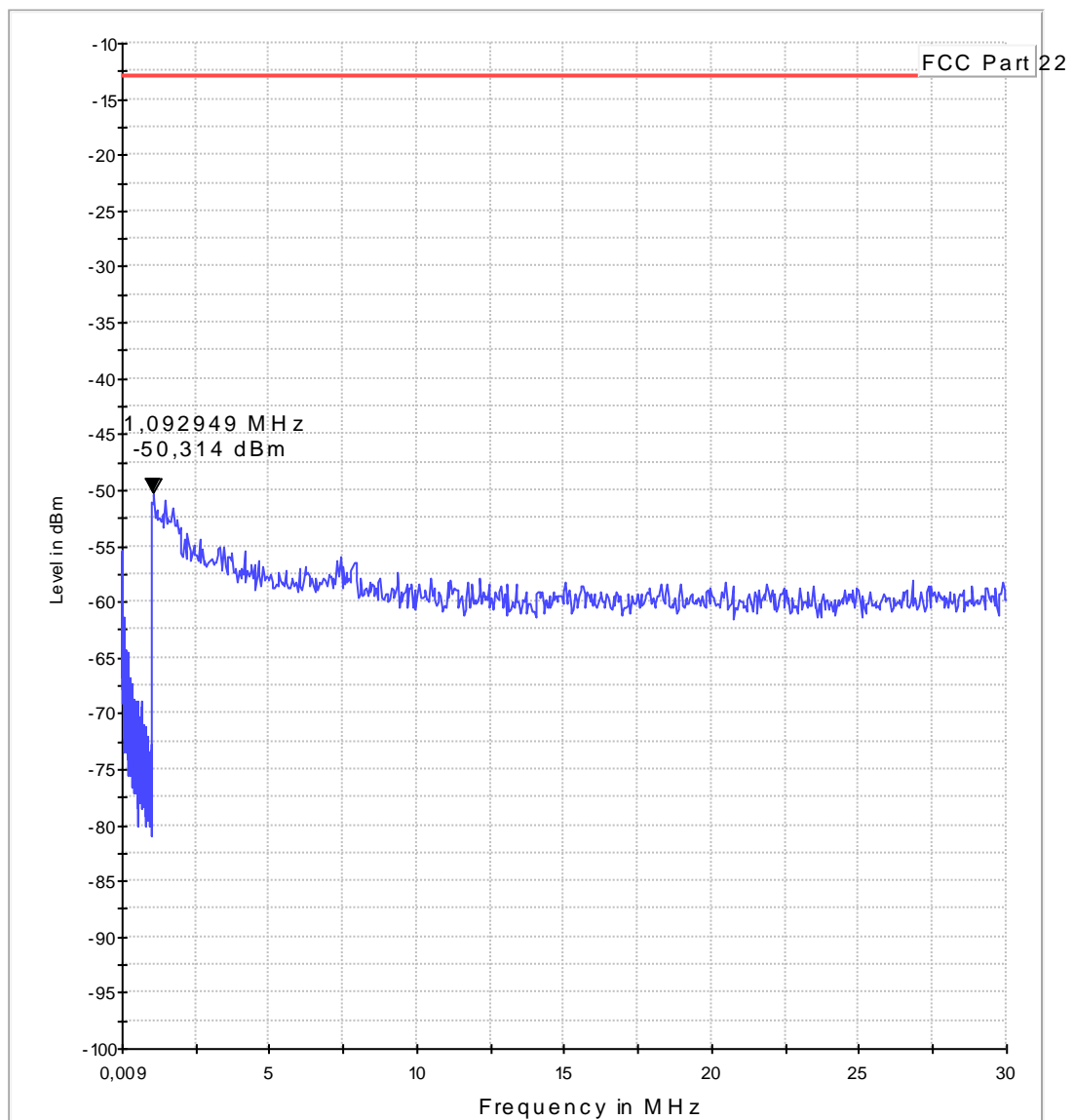
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory
Test Standard:	FCC Part 22, RSS-132
Operation mode:	TCH - GSM G850, ARFCN 192_middle
Operator Name:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_1



### Diagram No.: 4.03

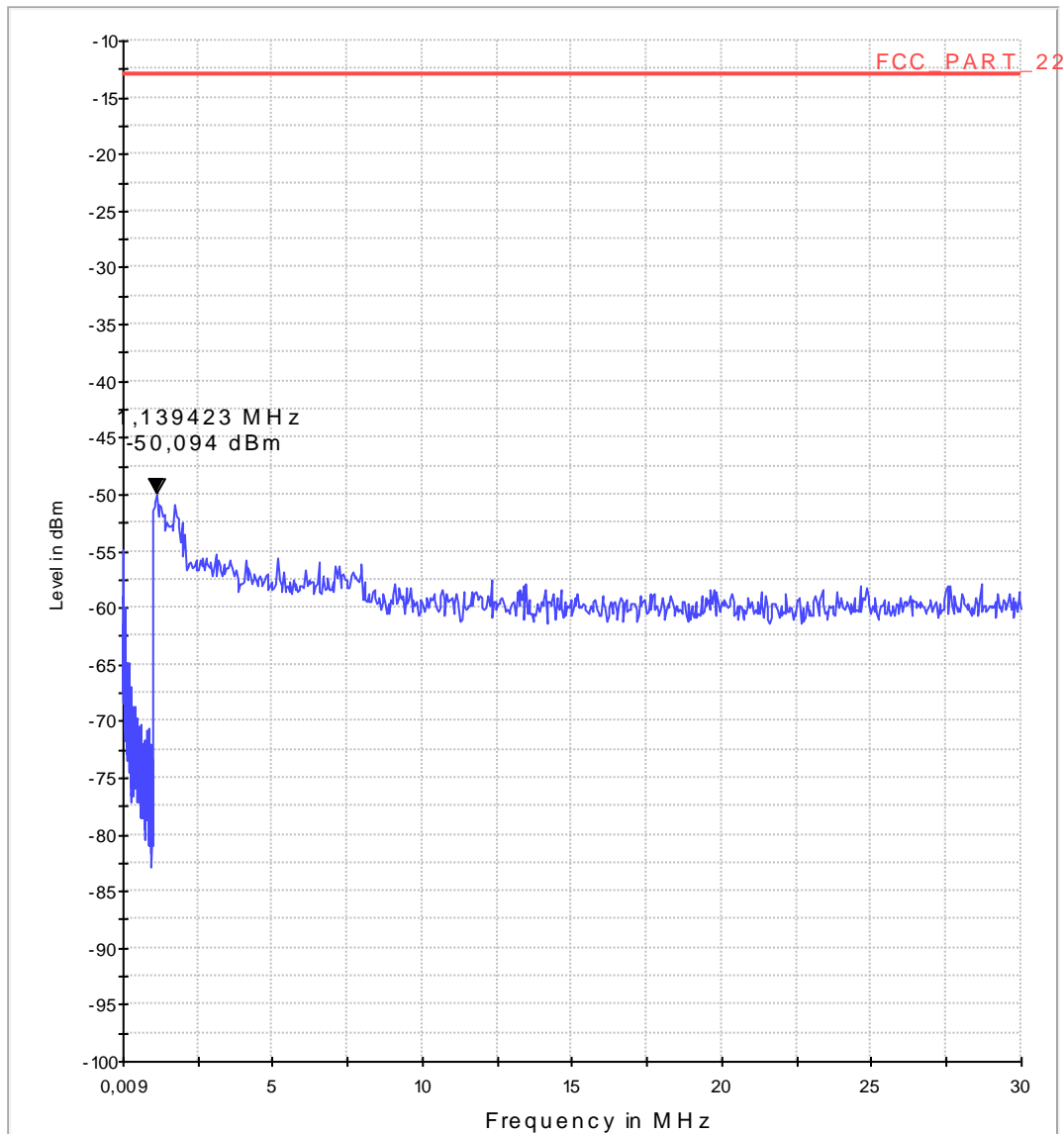
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory
Test Standard:	FCC Part 22, RSS-132
Operation mode:	TCH - GSM G850, ARFCN 251_high
Operator Name:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_1





### Diagram No.: 4.04

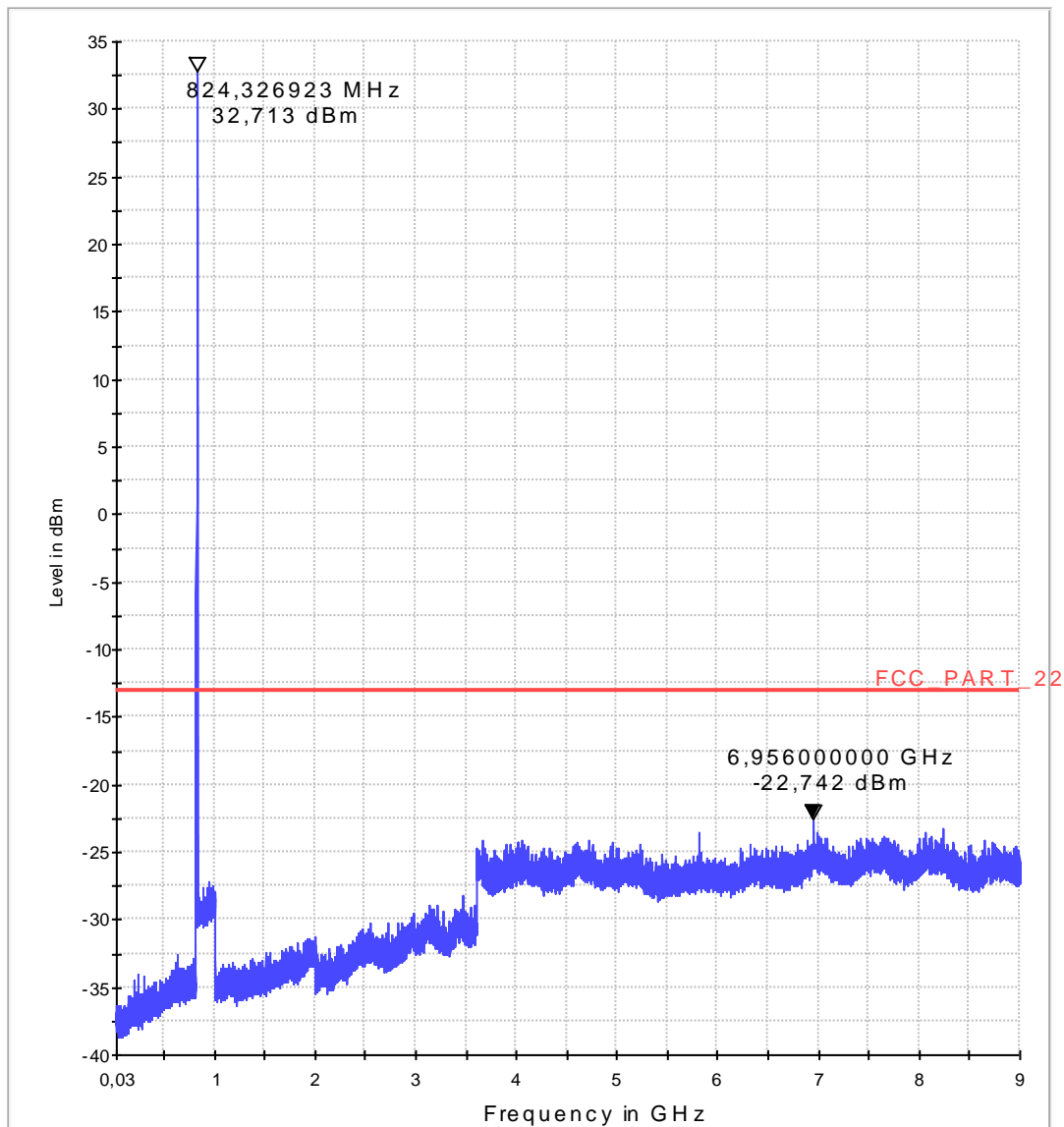
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory
Test Standard:	FCC Part 22, RSS-132
Operation mode:	TCH - GSM, G850, ARFCN 192_low
Operator Name:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram No.: 4.05

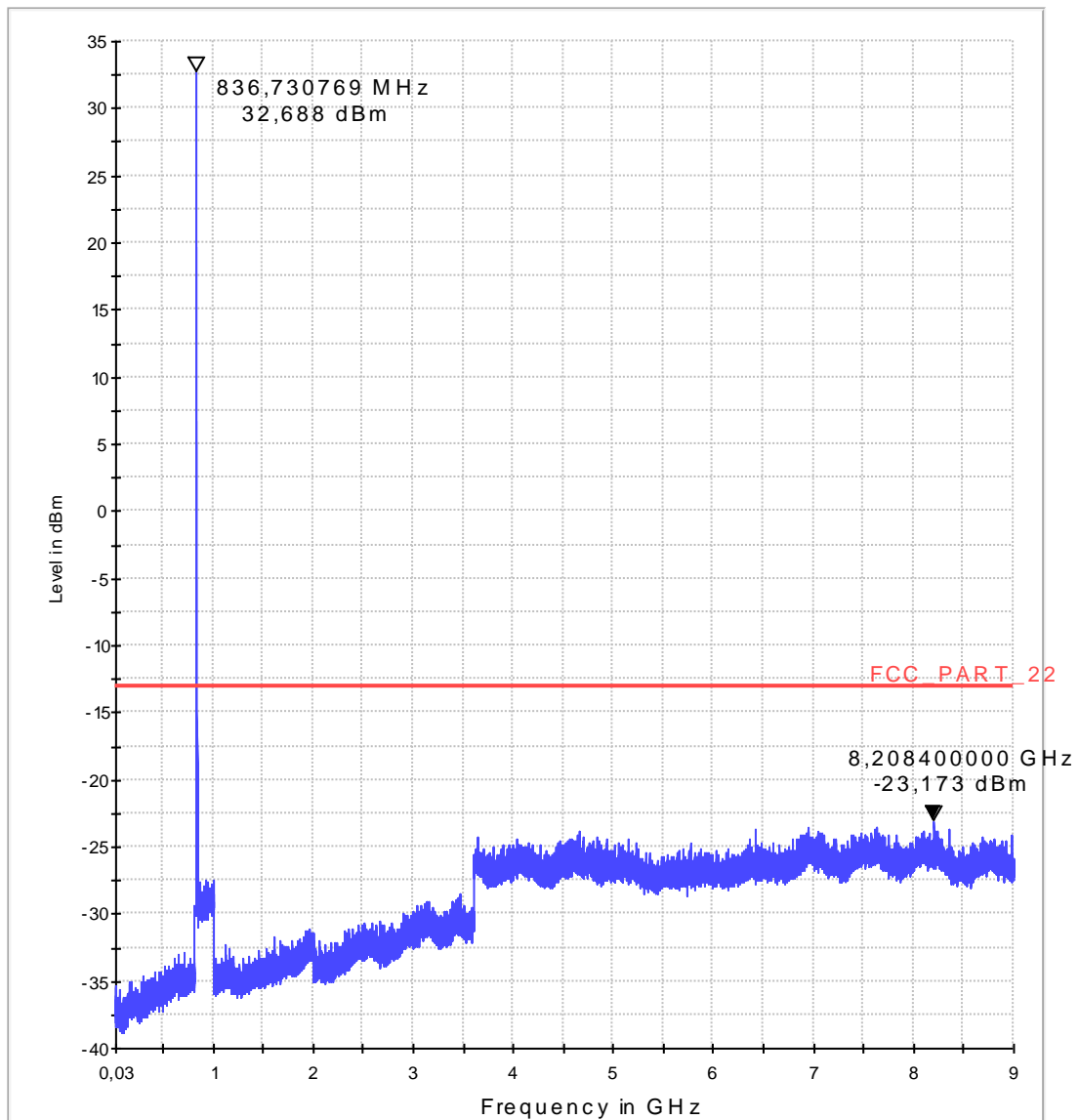
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory
Test Standard:	FCC Part 22, RSS-132
Operation mode:	TCH - GSM G850, ARFCN 192_middle
Operator Name:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram No.: 4.06

#### Common Information

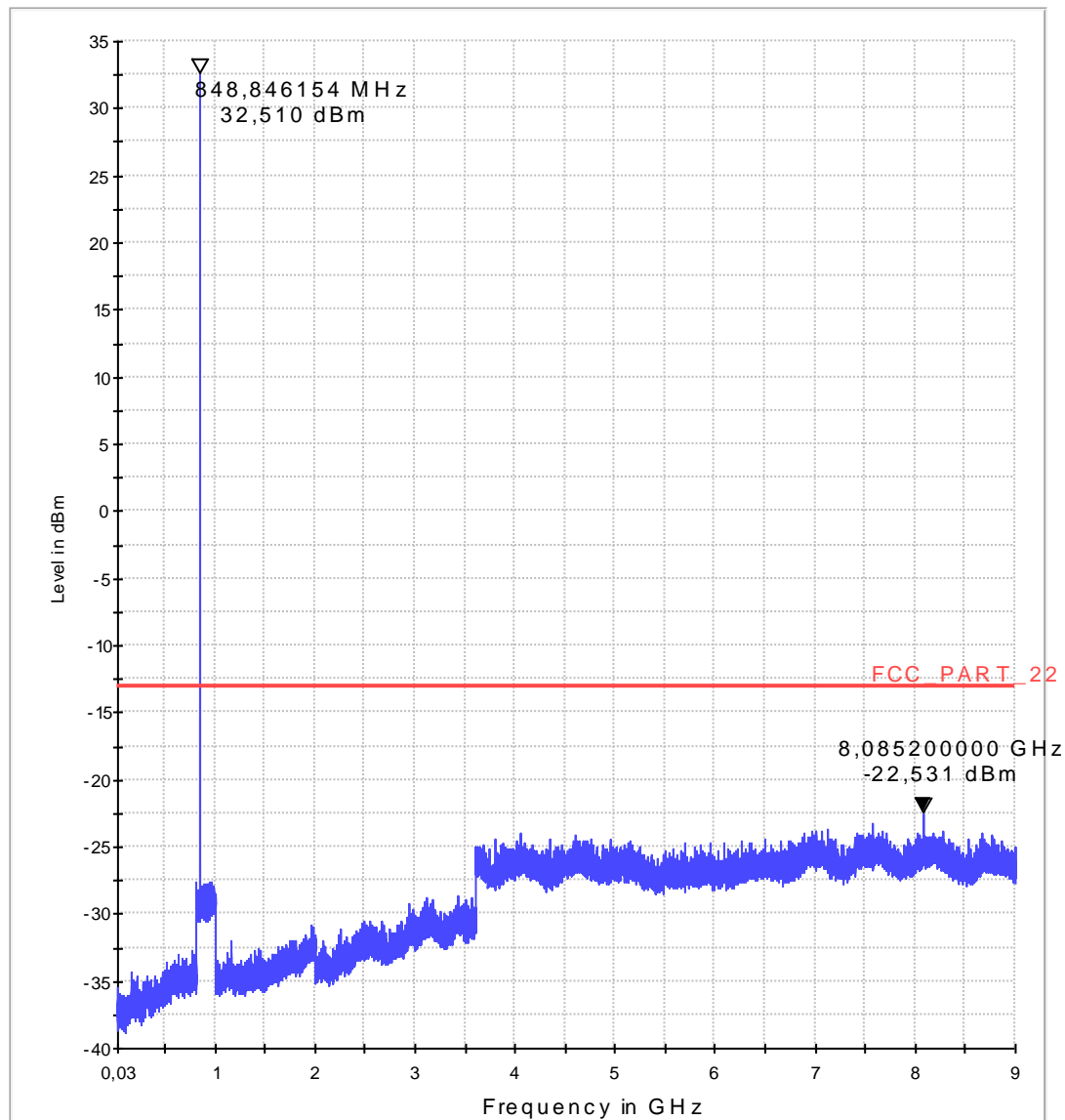
Test Description: TX Spurious Emission conducted  
Test Site: Radio laboratory  
Test Standard: FCC Part 22, RSS-132

Operation mode: TCH - GSM G850, ARFCN 251\_high  
Operator Name: Tas

#### EUT Information

EUT Name: LISA-U230  
IMEI: 352237-05-001199-0  
HW, FW: 146AA0, 22.00  
Manufacturer: u-blox AG  
Voltage: 3,8 VDC

Sweep\_2



### Diagram No. 4.07\_AV

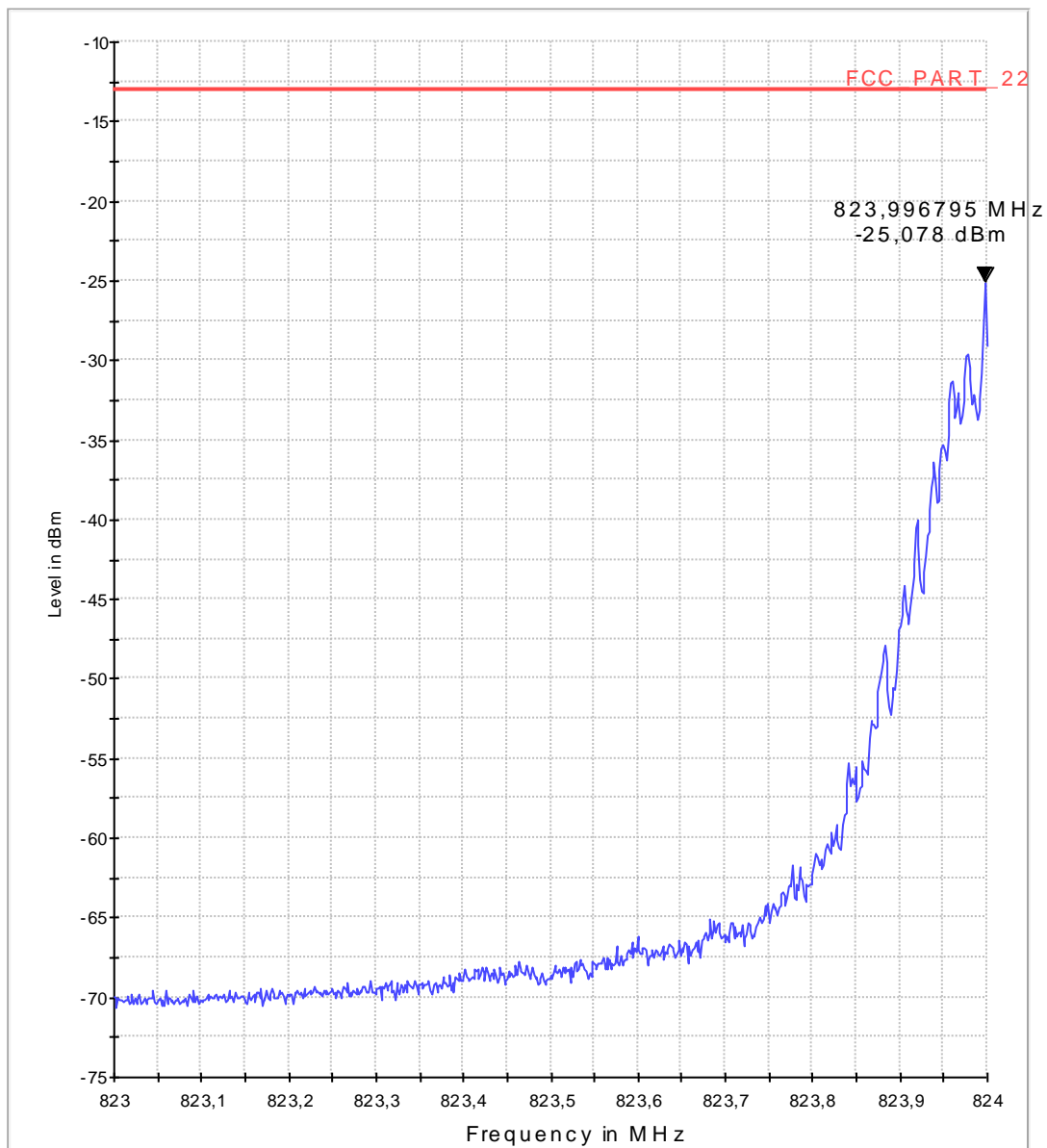
#### Common Information

Test Description:	Transmitter unwanted emissions (Band-Edge)/ FCC requirements
Test site:	Radio laboratory
Test standard:	FCC Part 22
Operating mode:	GSM - TX_low ARFCN:128

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_3b\_Band\_Edge\_Channel\_128\_AV



### Diagram No. 4.08\_AV

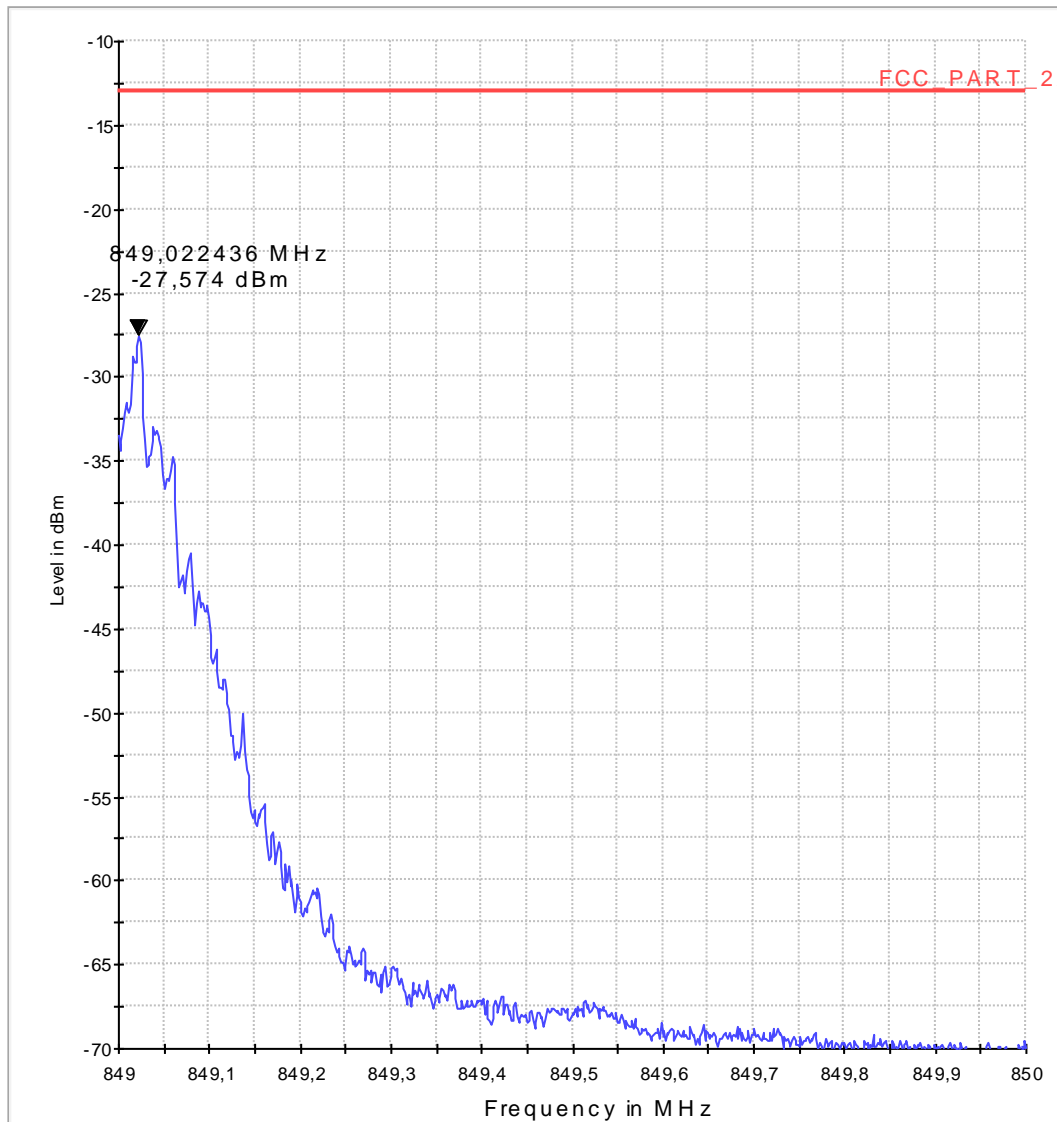
#### Common Information

Test Description:	Transmitter unwanted emissions (Band-Edge)/ FCC requirements
Test Site:	Radio laboratory 1
Test Standard:	FCC Part 22.917 (a,b)
Environment Conditions:	Normal conditions (Vnominal, Tnominal)
Operator Name:	Tas
Operating mode:	GSM-TX_high channel on ARFCN 251

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_4b\_Band\_Edge\_Channel\_251\_AV



### Diagram No.: 4.09

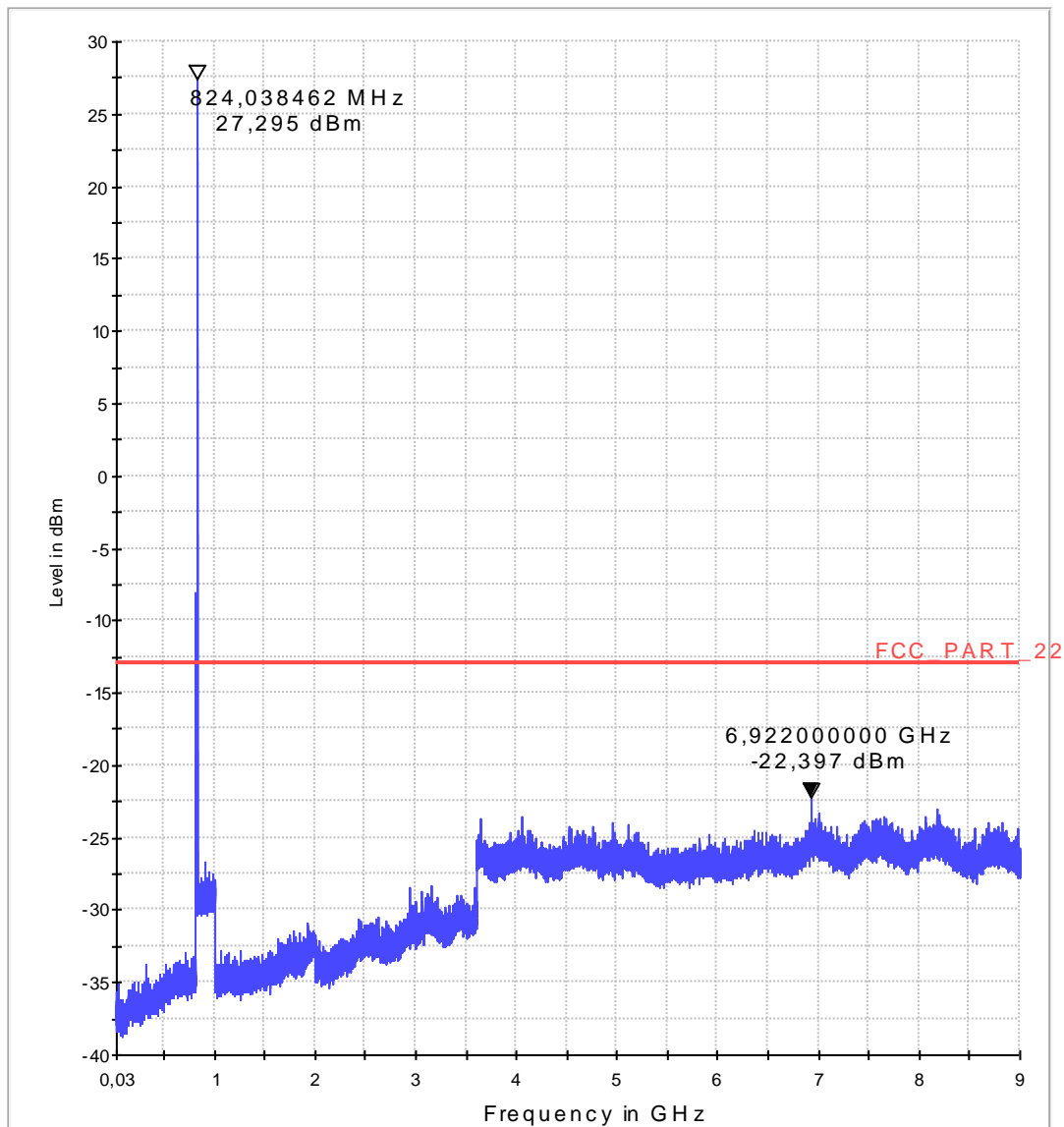
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory 1
Test Standard:	FCC Part 22.917, RSS-132
Operation mode:	TCH - E-GPRS G850, ARFCN 128_low
Operator Name:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram No.: 4.10

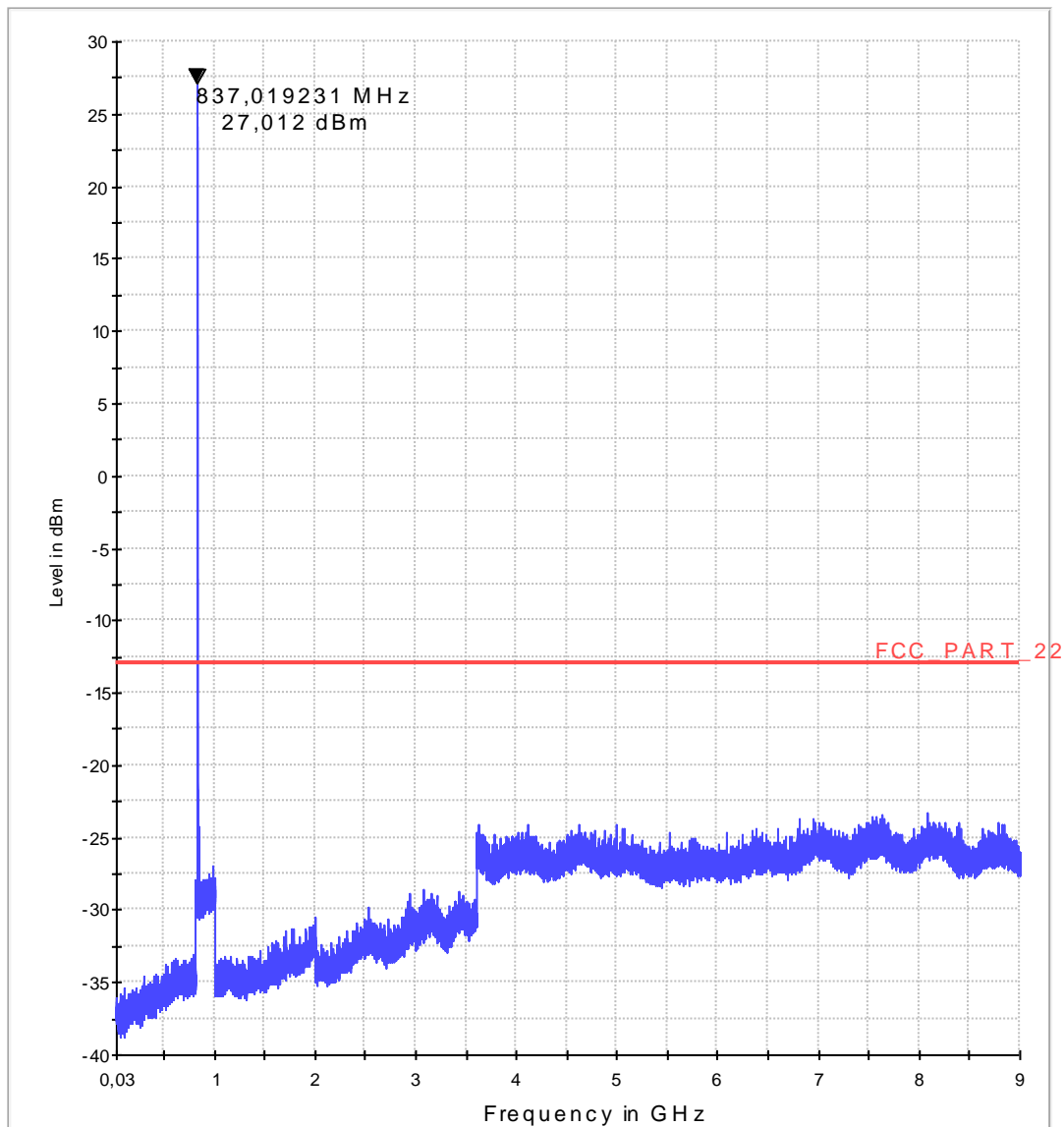
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory 1
Test Standard:	FCC Part 22, RSS-132
Operation mode:	TCH - E-GPRS G850, ARFCN 192_middle
Operator Name:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram No.: 4.11

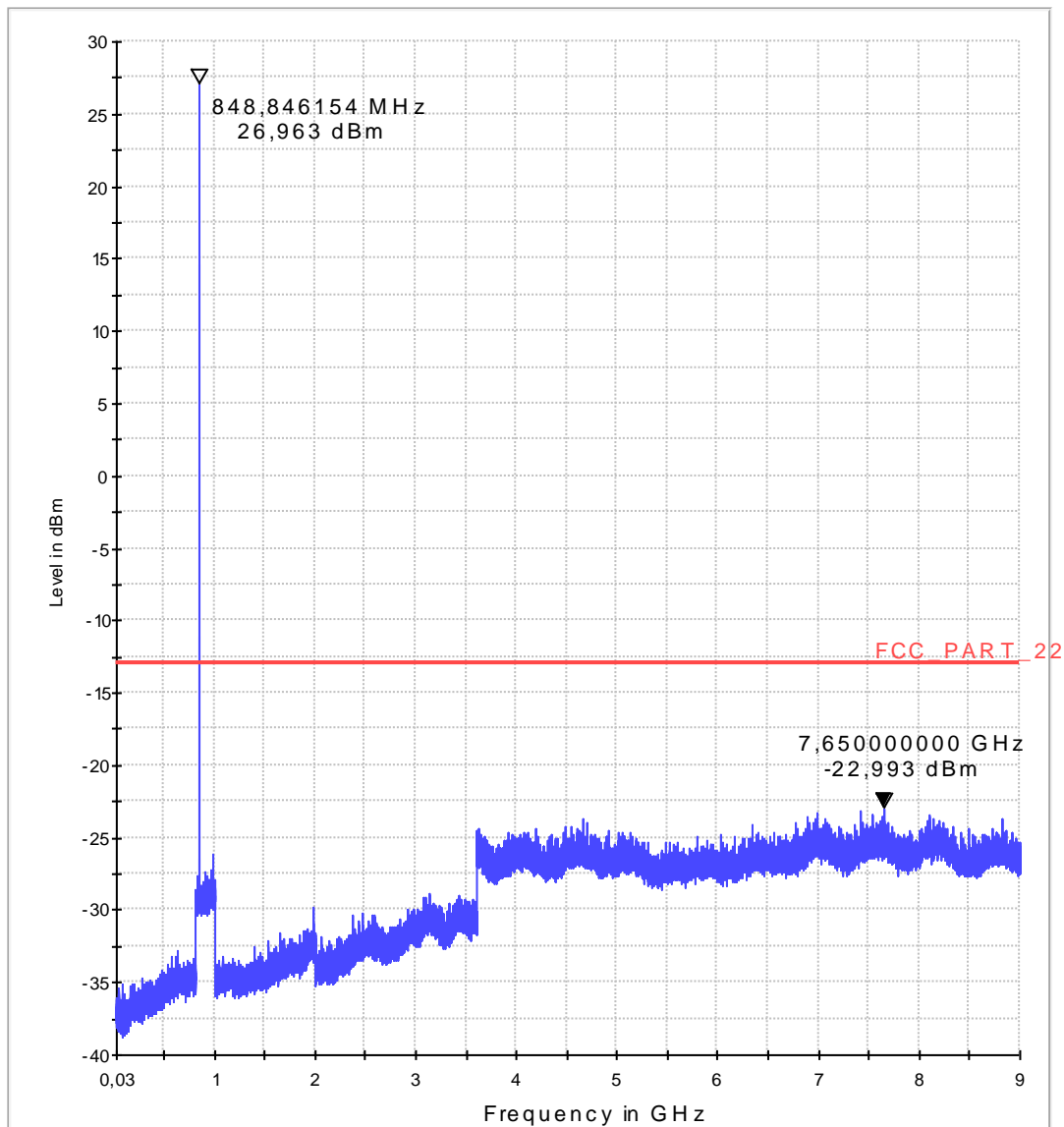
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory 1
Test Standard:	FCC Part 22, RSS-132
Operation mode:	TCH - E-GPRS G850, ARFCN 251_high
Operator Name:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2





### Diagram No. 4.12\_PK

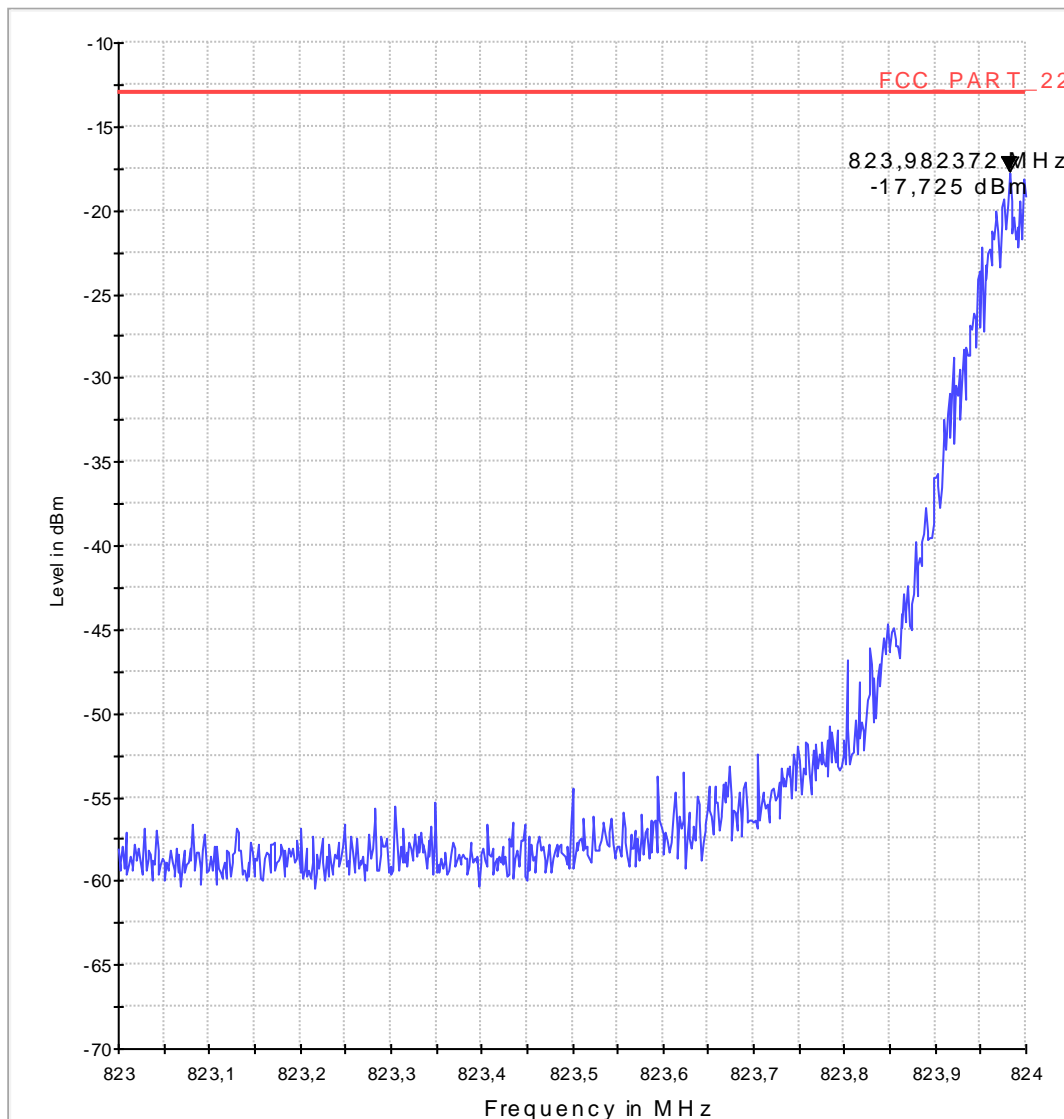
#### Common Information

Test Description:	Transmitter unwanted emissions (Band-Edge)/ FCC requirements
Test Site:	Radio laboratory 1
Test Standard:	FCC Part 22.917 (a,b)
Environment Conditions:	Normal conditions (Vnominal, Tnominal)
Operator Name:	Tas
Operating mode:	E-GPRS-TX_low channel on ARFCN 128

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_3a\_Band\_Edge\_Channel\_128\_PK



### Diagram No. 4.13\_PK

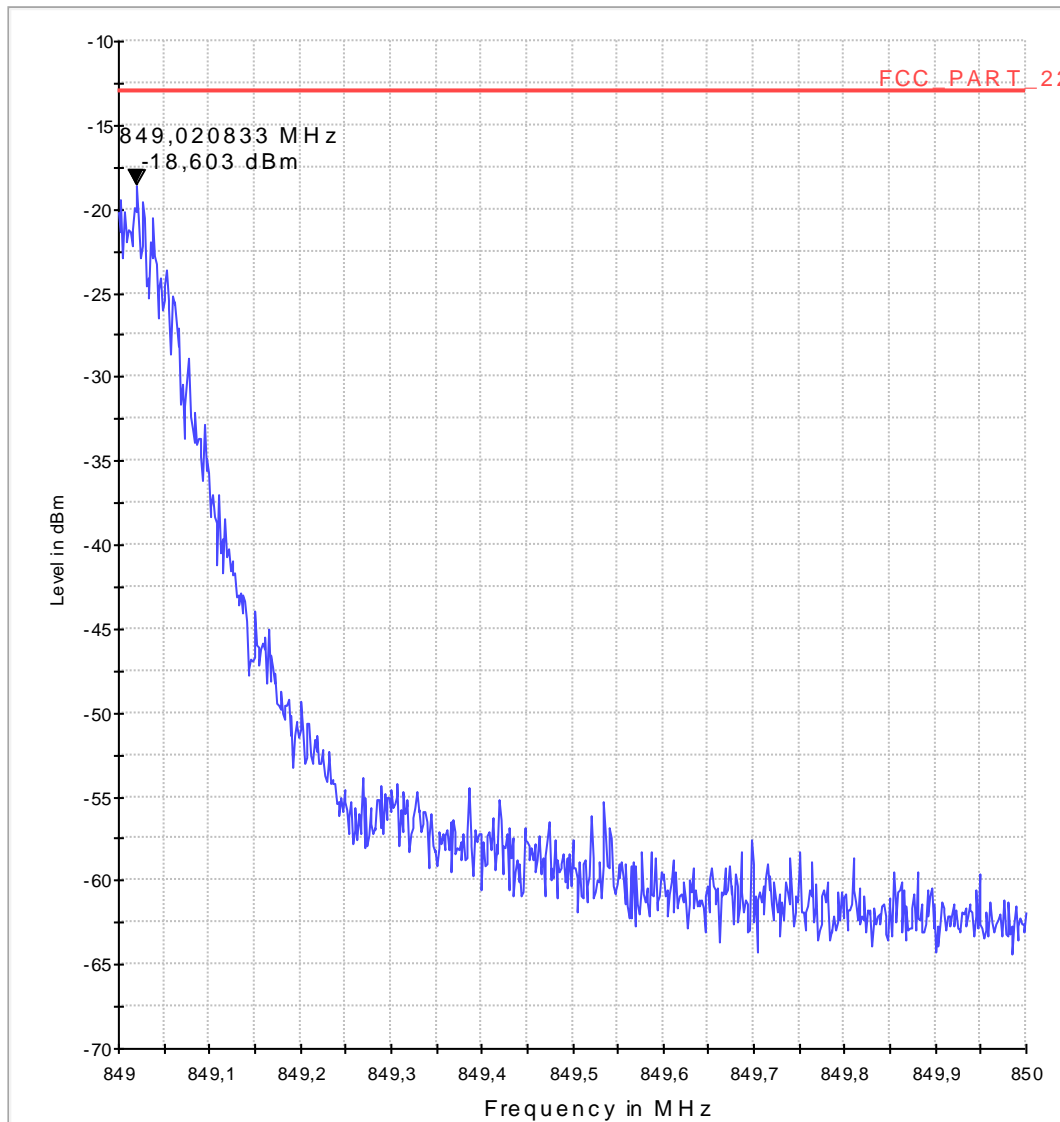
#### Common Information

Test Description:	Transmitter unwanted emissions (Band-Edge)/ FCC requirements
Test Site:	Radio laboratory 1
Test Standard:	FCC Part 22.917 (a,b)
Environment Conditions:	Normal conditions (Vnominal, Tnominal)
Operator Name:	Tas
Operating mode:	E-GPRS-TX_high channel on ARFCN 251

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_4a\_Band\_Edge\_Channel\_251\_PK



### Diagram No.: 4.14

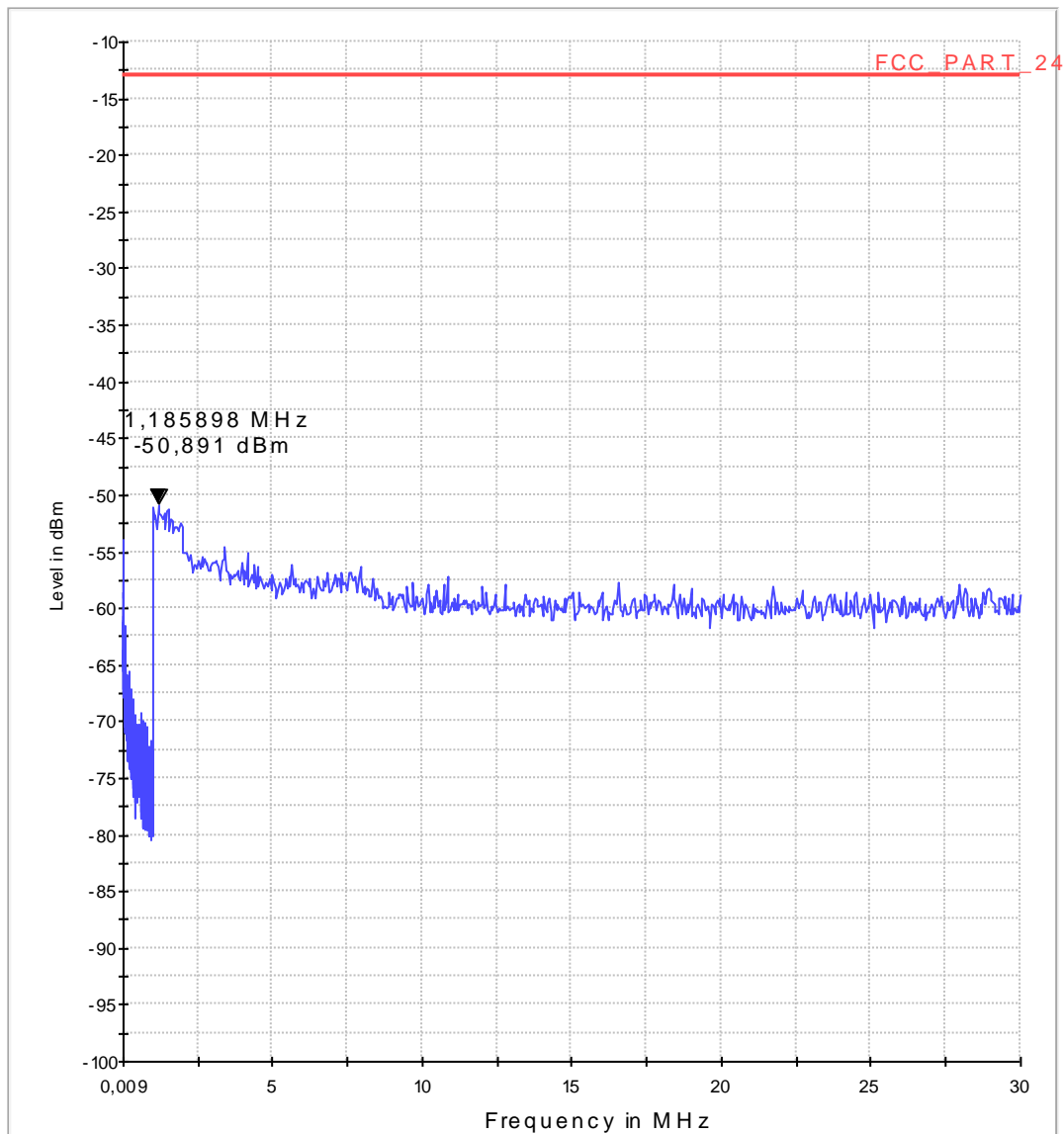
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory 1
Test Standard:	FCC Part 24.238 RSS-133
Operation mode:	TCH - GSM, PCS1900, ARFCN 512_low
Operator Name:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_1



### Diagram No.: 4.15

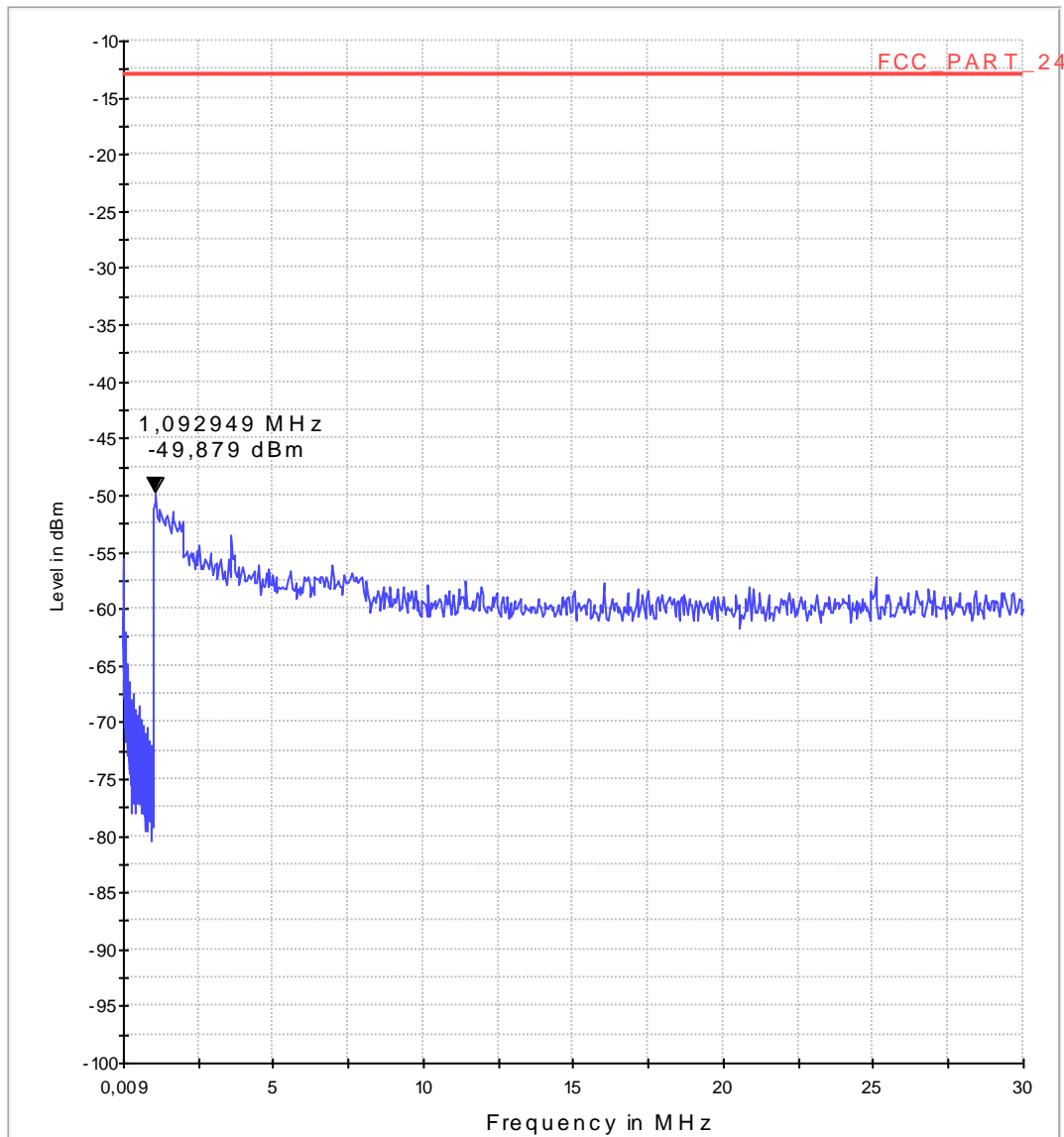
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory 1
Test Standard:	FCC FCC Part 24.238 Broadband PCS, RSS-133
Operation mode:	TCH - GSM, PCS1900, ARFCN 661_middle
Operator Name:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_1



### Diagram No.: 4.16

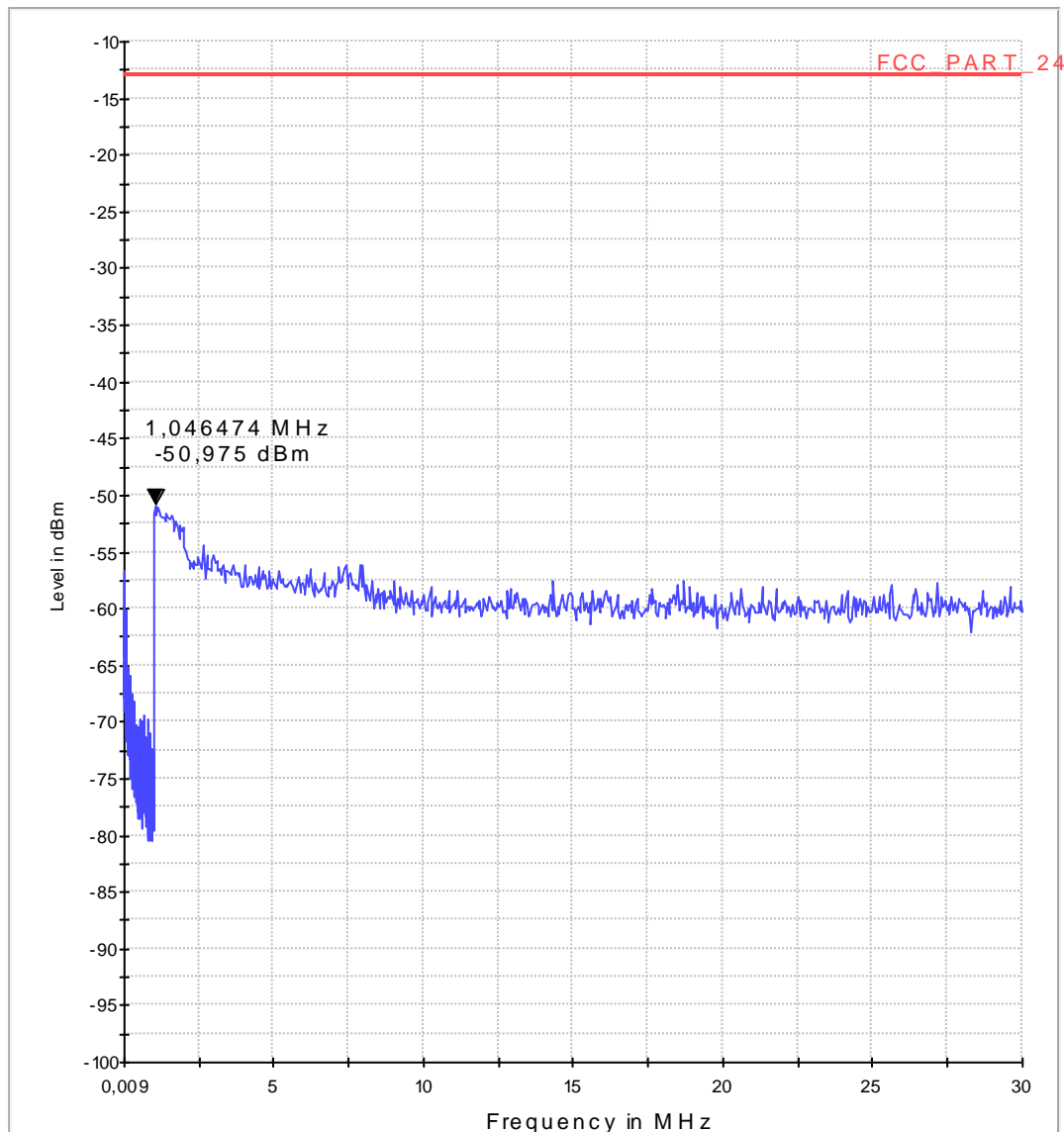
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory 1
Test Standard:	FCC FCC Part 24.238 Broadband PCS, RSS-133
Operation mode:	TCH - GSM, PCS1900, ARFCN 810_high
Operator Name:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_1



### Diagram No. 4.17

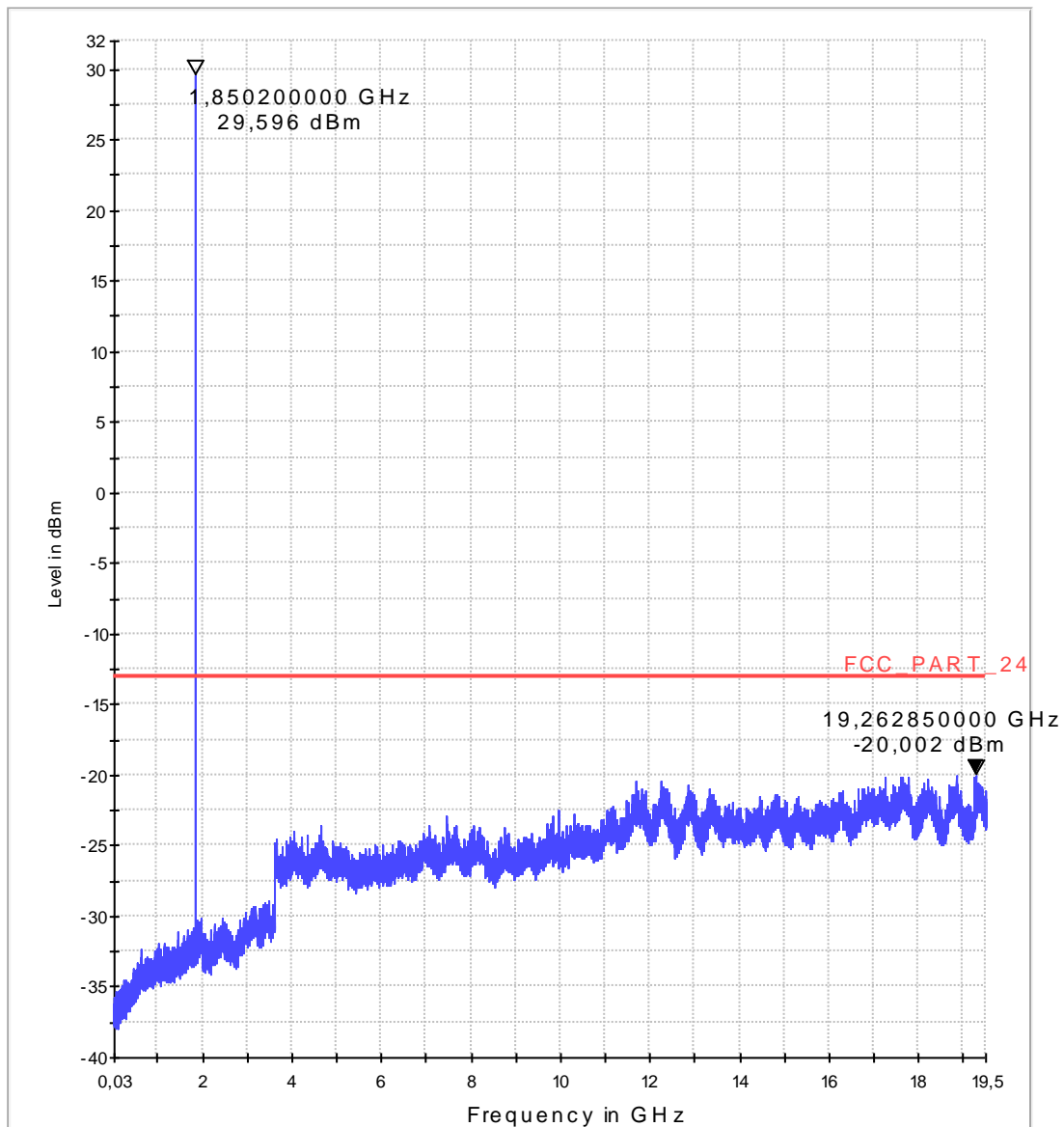
#### Common Information

Test Description:	TX Spurious Emission conducted
Operating Conditions:	Radio laboratory 1
Operator Name:	FCC Part 24.238 RSS-133
Operating mode:	TCH - GSM, PCS1900, ARFCN 512_low
Operator	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram No.: 4.18

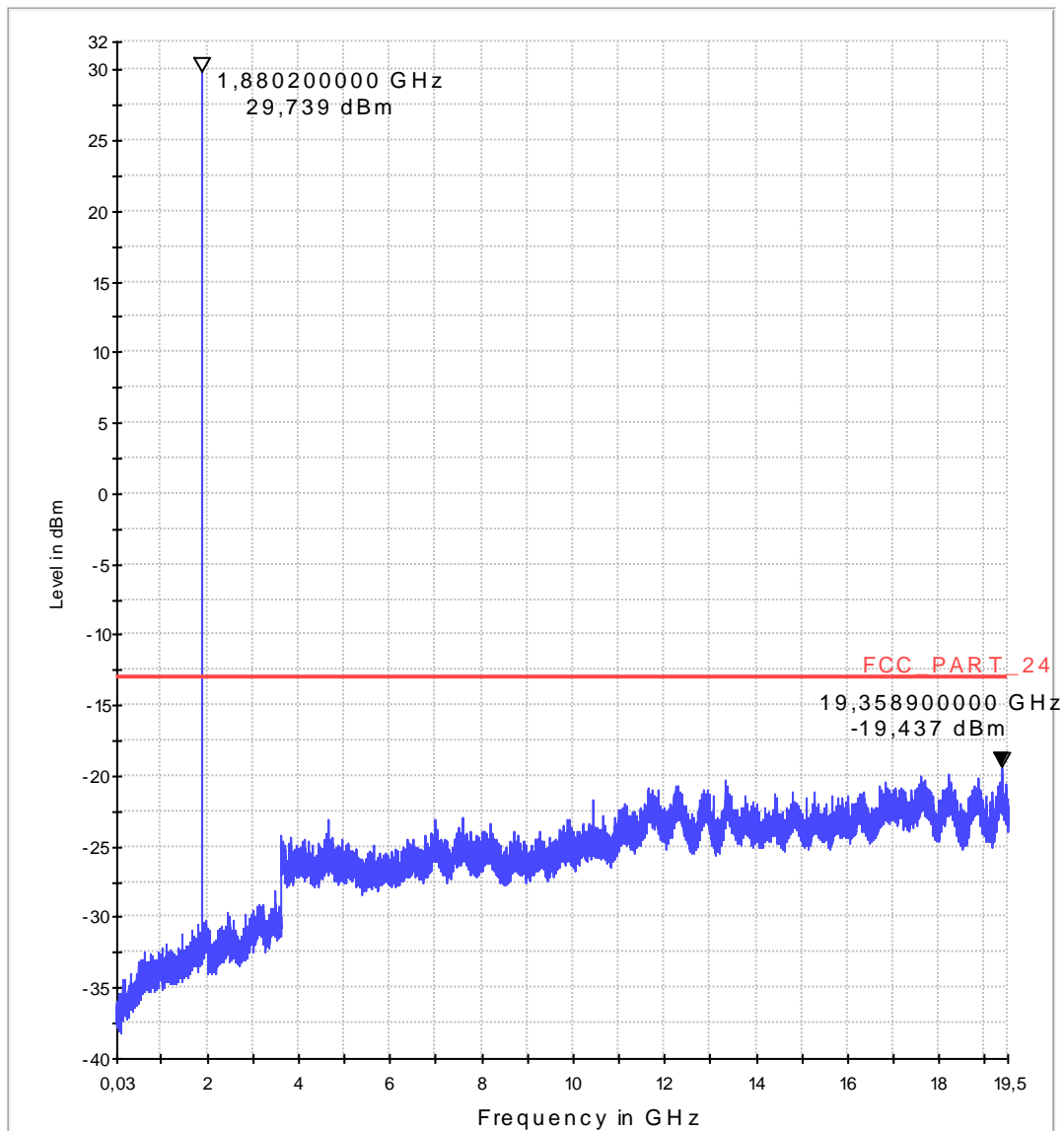
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory 1
Test Standard:	FCC Part 24.238 Broadband PCS, RSS-133
Operation mode:	TCH - GSM, PCS1900, ARFCN 661_middle
Operator Name:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram No.: 4.19

#### Common Information

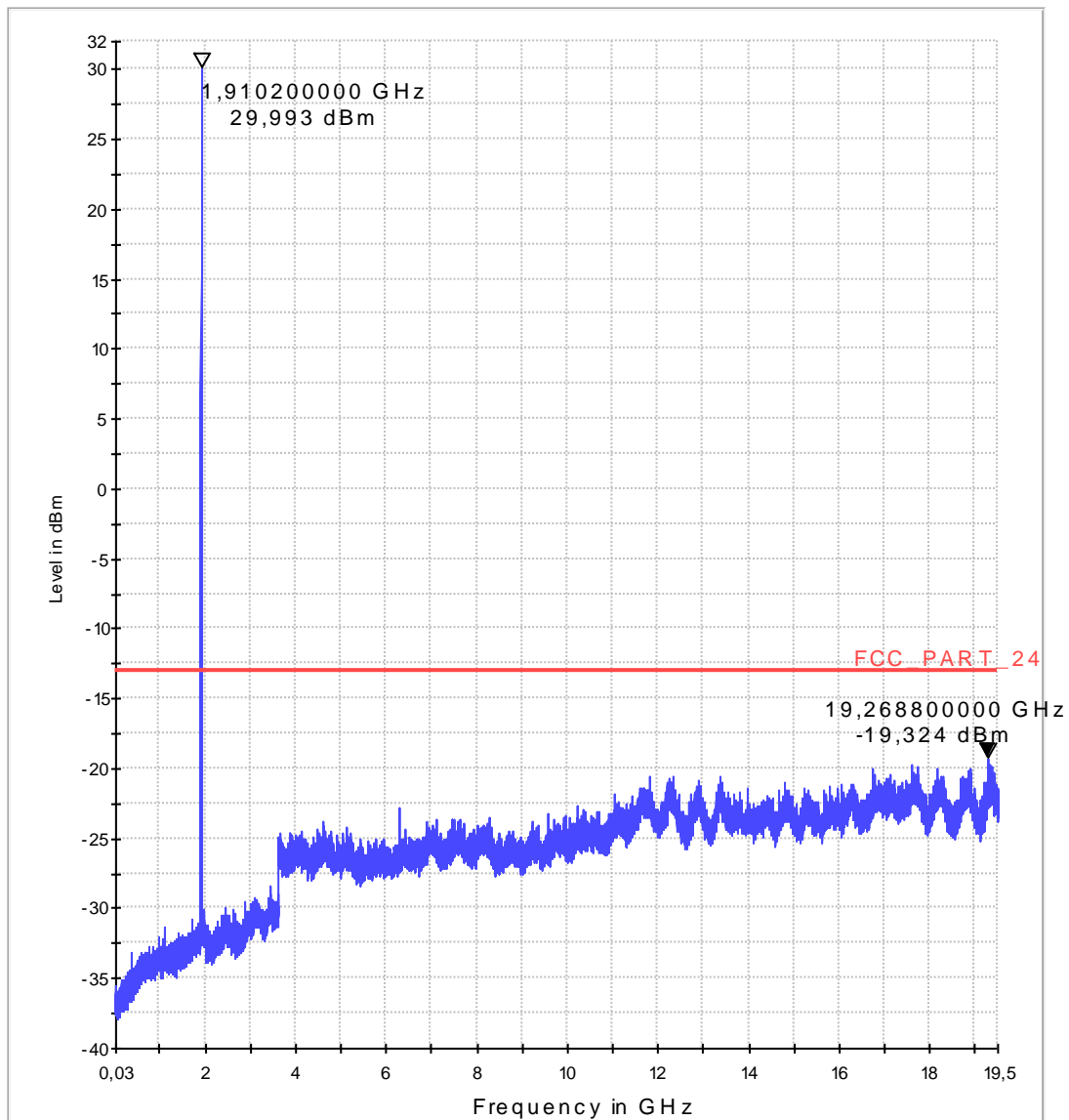
Test Description: TX Spurious Emission conducted  
Test Site: Radio laboratory 1  
Test Standard: FCC Part 24.238 Broadband PCS

Operation mode: TCH - GSM, PCS1900, ARFCN 810\_high  
Operator Name: Tas

#### EUT Information

EUT Name: LISA-U230  
IMEI: 352237-05-001199-0  
HW, FW: 146AA0, 22.00  
Manufacturer: u-blox AG  
Voltage: 3,8 VDC

Sweep\_2





### Diagram No. 4.20\_AV

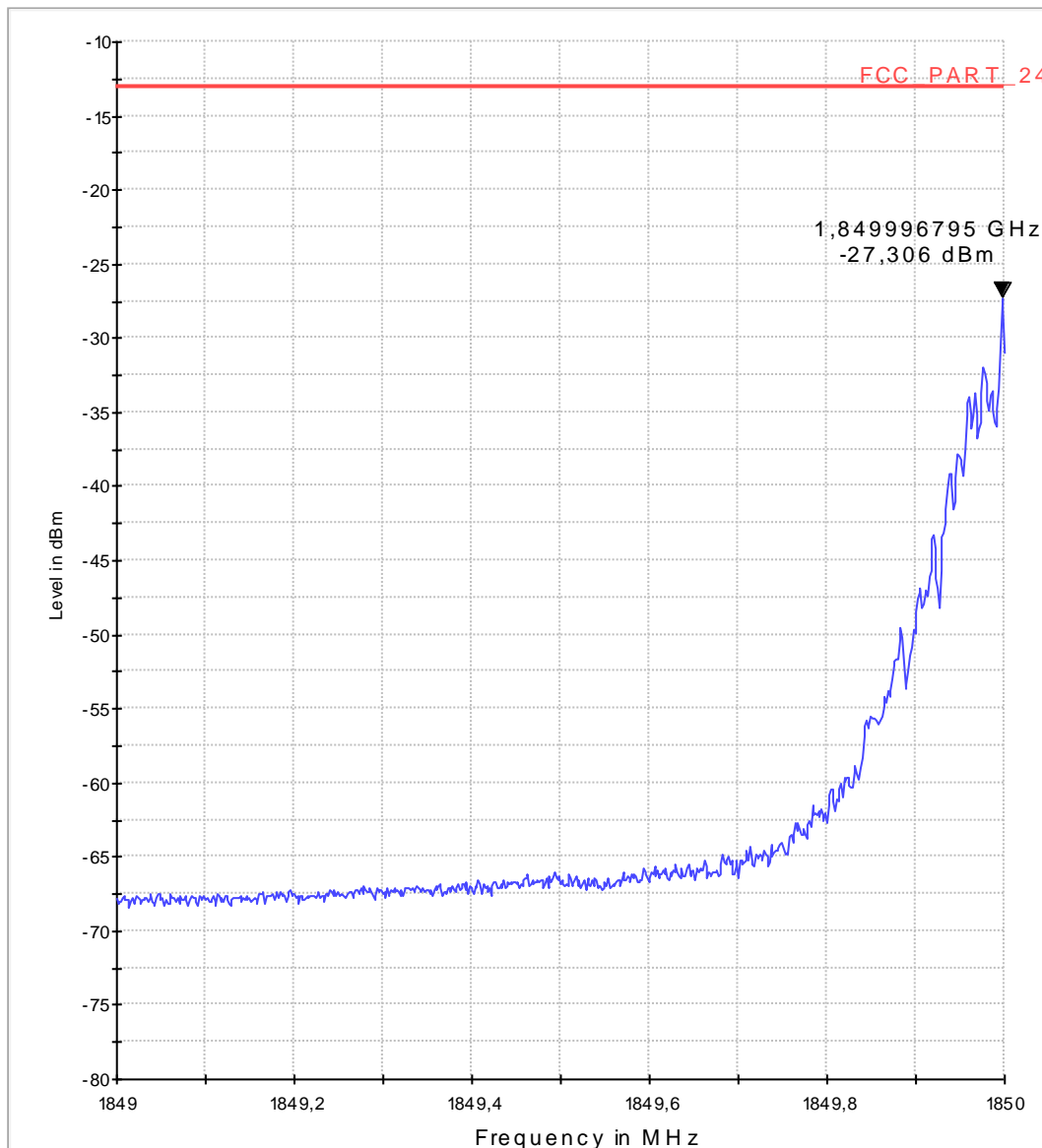
#### Common Information

Test Description:	Transmitter unwanted emissions (Band-Edge)/ FCC requirements
Operating Conditions:	Radio laboratory 1
Test Standards:	FCC Part 24.238
Operating mode:	TCH - GSM, PCS1900, ARFCN 512_low
Operator:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_3b\_Band\_Edge\_Channel\_512\_AV



### Diagram No.: 4.21\_AV

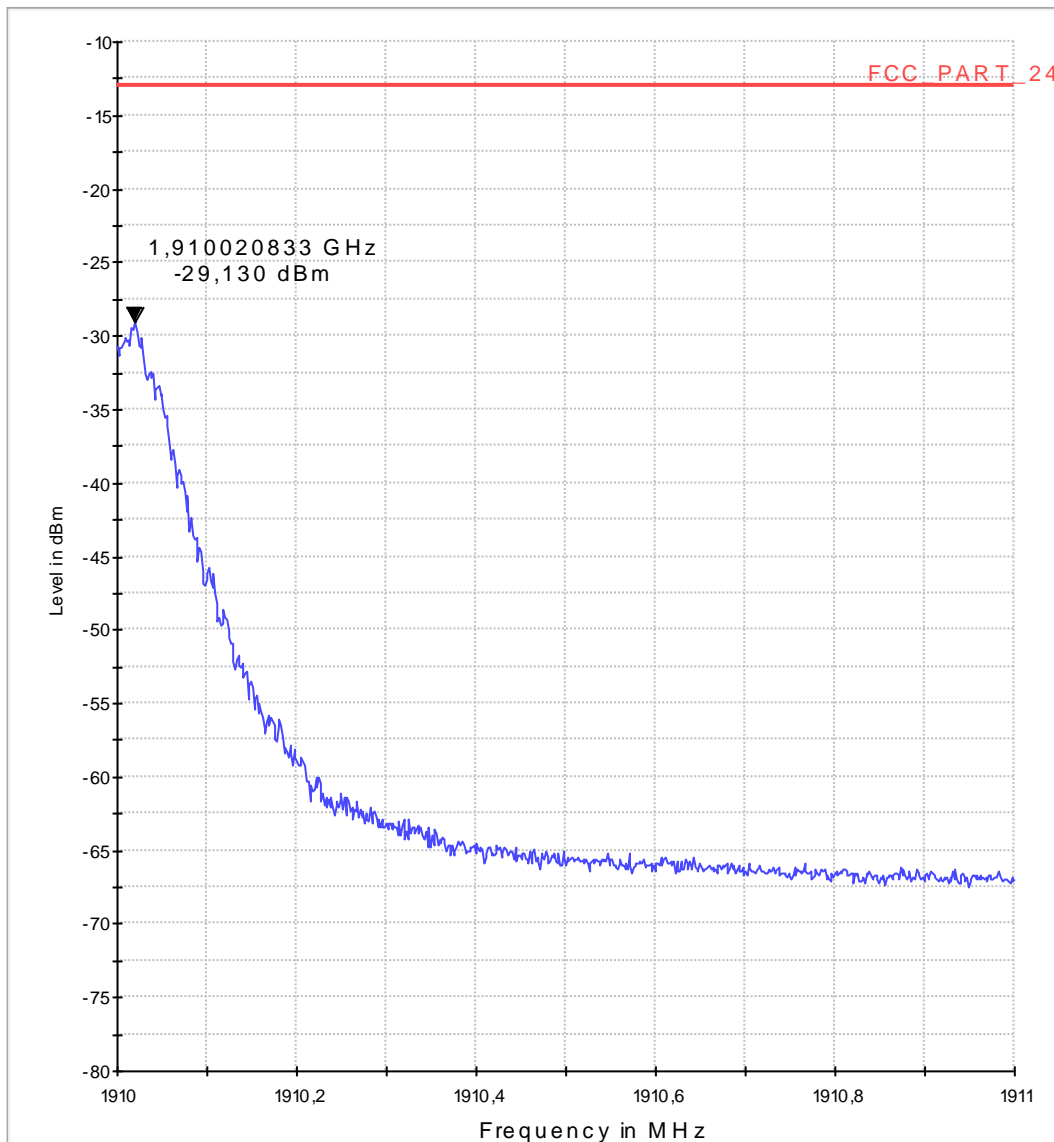
#### Common Information

Test Description:	Transmitter unwanted emissions (Band-Edge)/ FCC requirements
Operating Conditions:	Radio laboratory 1
Test Standards:	FCC Part 24.238
Operating mode:	TCH - GSM, PCS1900, ARFCN 810_high
Operator:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_4b\_Band\_Edge\_Channel\_810\_AV



### Diagram No.: 4.22

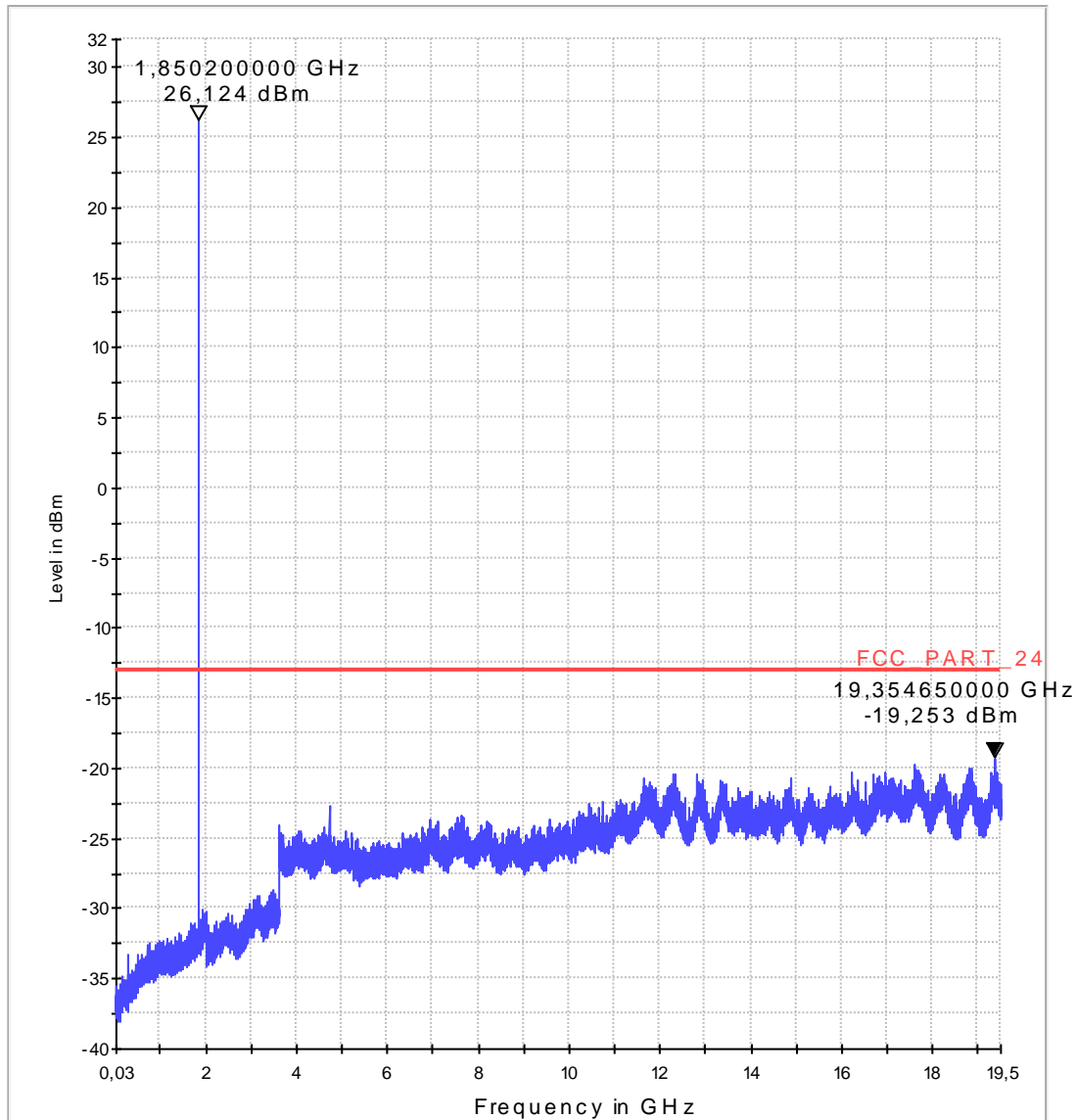
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory 1
Test Standard:	FCC FCC Part 24.238 Broadband PCS
Operation mode:	TCH - E-GPRS, PCS1900, ARFCN 512_low
Operator Name:	Tas

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram No.: 4.23

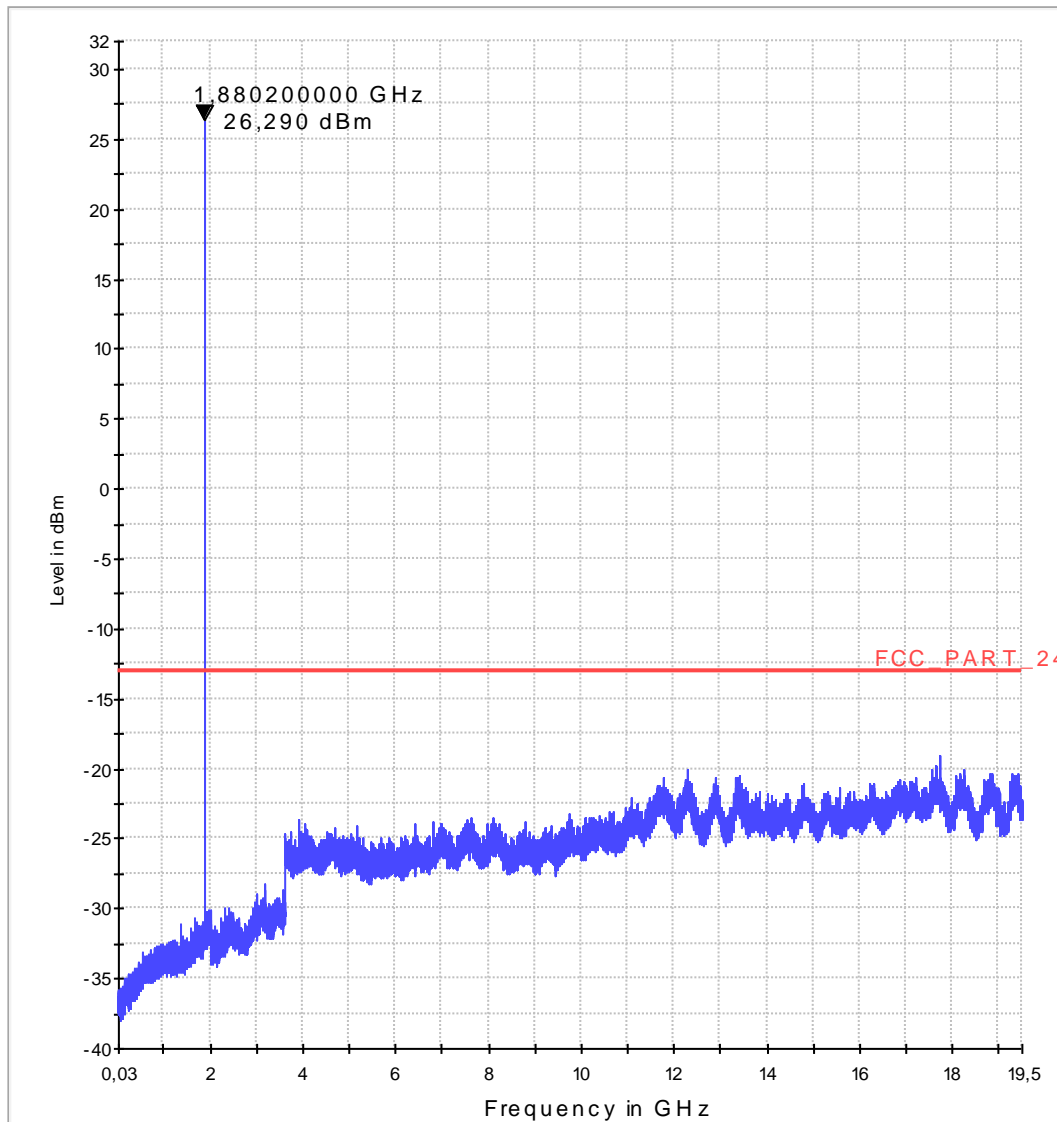
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory 1
Test Standard:	FCC FCC Part 24.238 Broadband PCS
Operation mode:	TCH - E-GPRS, PCS1900, ARFCN 661_middle
Operator Name:	Tas
SAP No.:	6-0143-12-2-3a

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram No.: 4.24

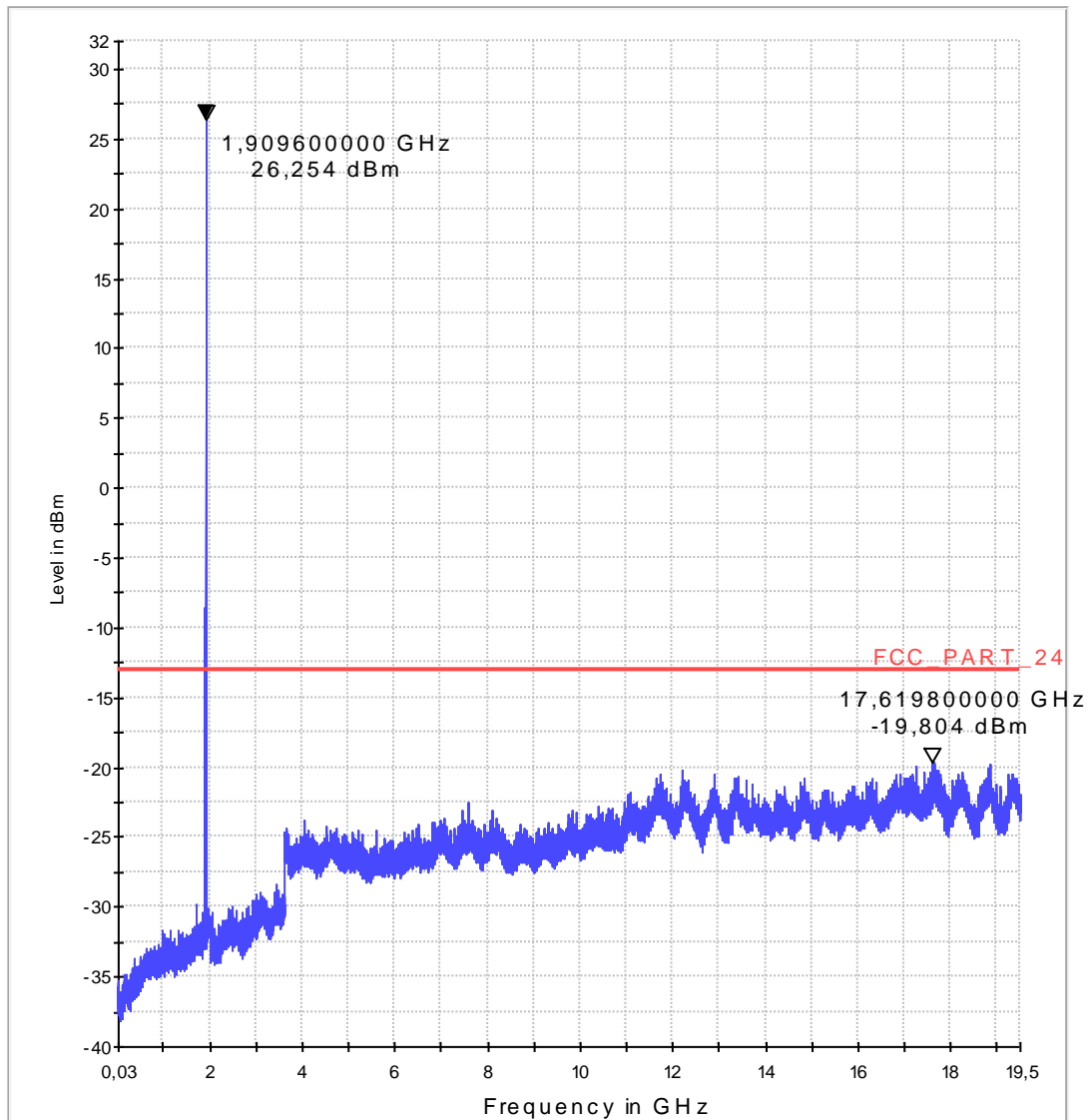
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory 1
Test Standard:	FCC FCC Part 24.238 Broadband PCS
Operation mode:	TCH - E-GPRS, PCS1900, ARFCN 810_high
Operator Name:	Tas
SAP no.	6-0143-12-2-3a

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram No. 4.25\_PK

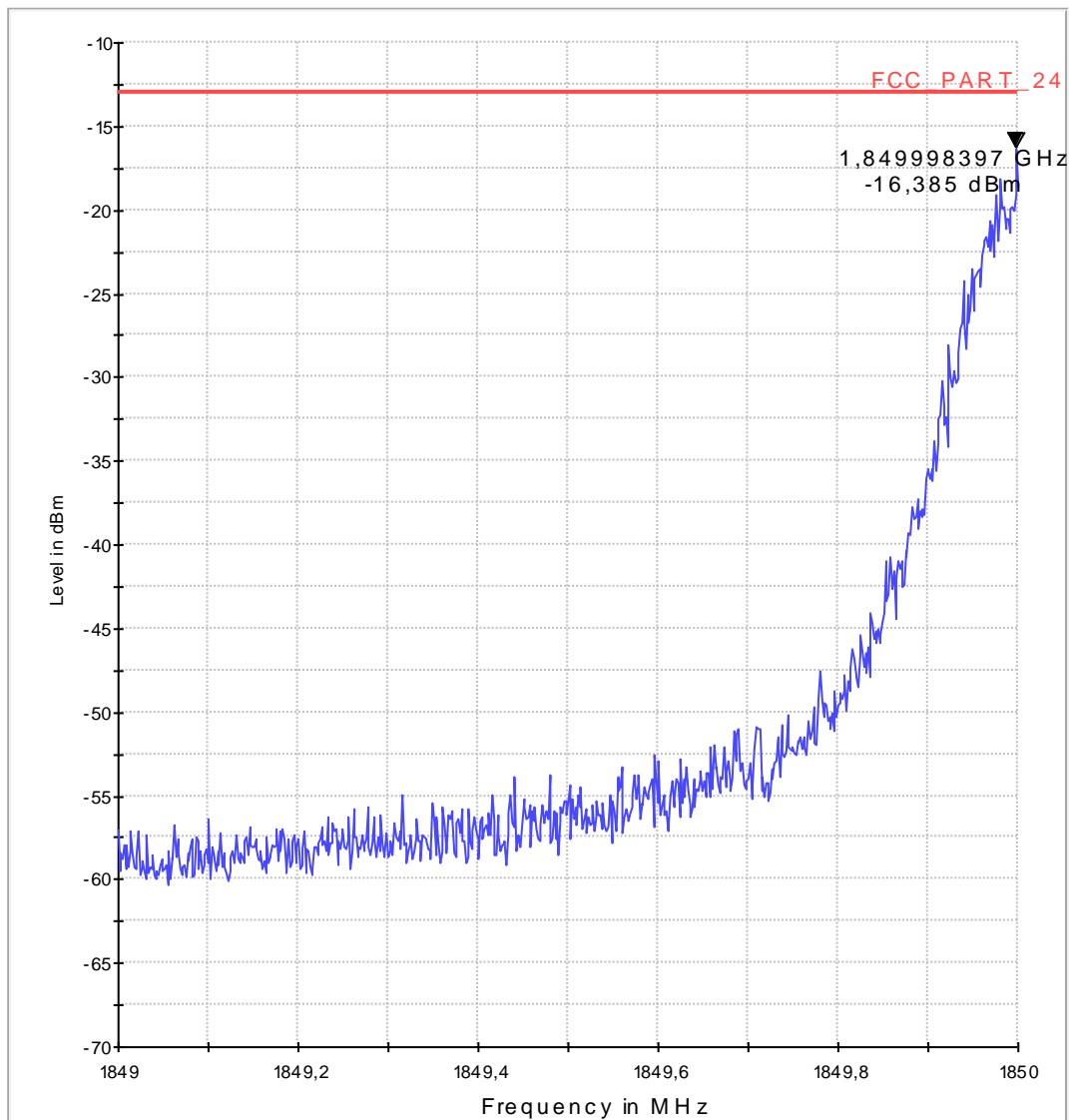
#### Common Information

Test Description:	Transmitter unwanted emissions (Band-Edge)/ FCC requirements
Test Site:	Radio laboratory 1
Test Standard:	FCC Part 24.238 (a,b)
Environment Conditions:	Normal conditions (Vnominal, Tnominal)
Operator Name:	Tas
Operating mode:	E-GPRS-TX_low channel PCS1900 on ARFCN 512
SAP no.	6-0143-12-2-3a

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_3a\_Band\_Edge\_Channel\_512\_PK



### Diagram No.: 4.26\_PK

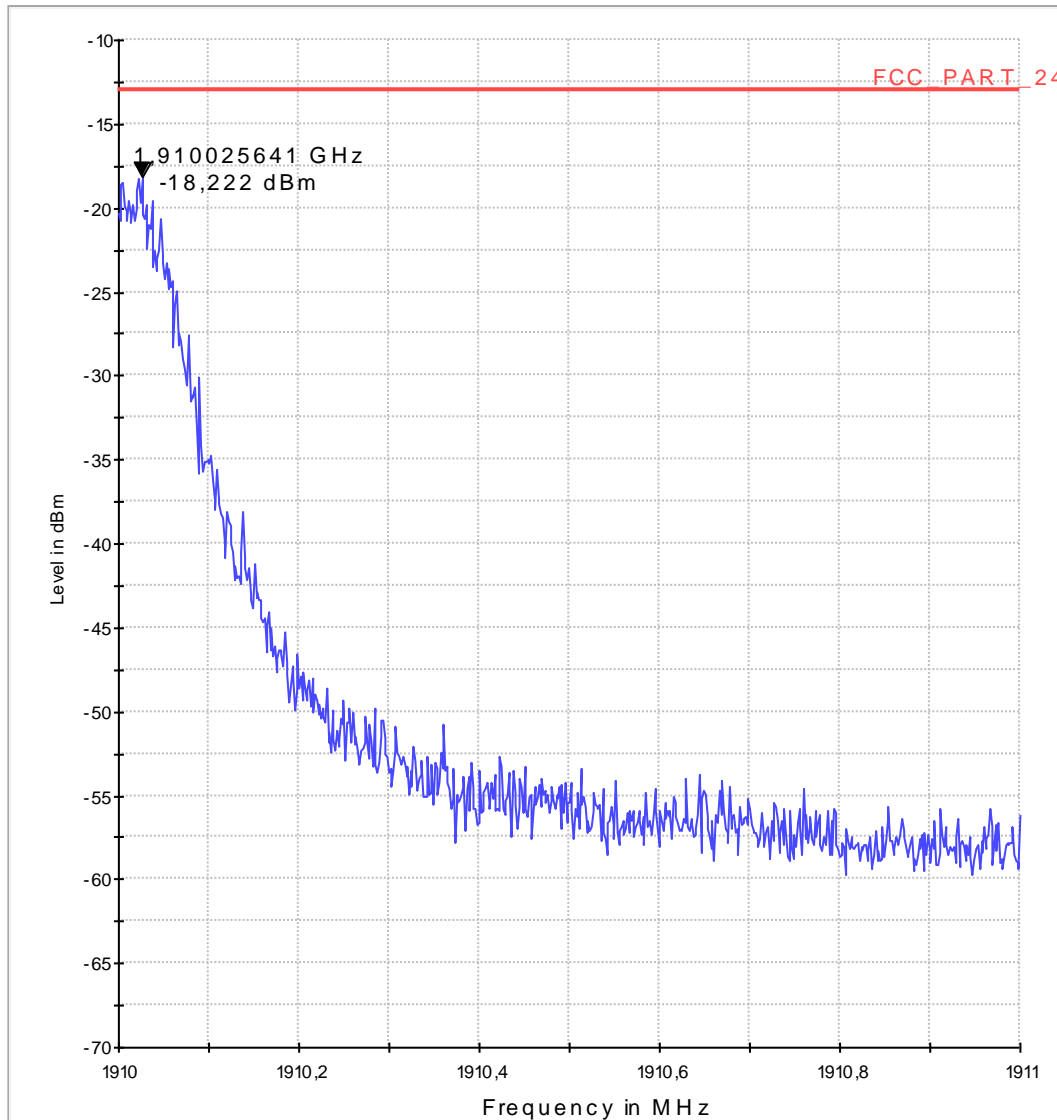
#### Common Information

Test Description:	Transmitter unwanted emissions (Band-Edge)/ FCC requirements
Test Site:	Radio laboratory 1
Test Standard:	FCC FCC Part 24.238 Broadband PCS
Operation mode:	TCH - E-GPRS, PCS1900, ARFCN 810_high
Operator Name:	Tas
SAP no.:	6-0143-12-2-3a

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_4a\_Band\_Edge\_Channel\_810\_PK



### Diagram No.: 4.27

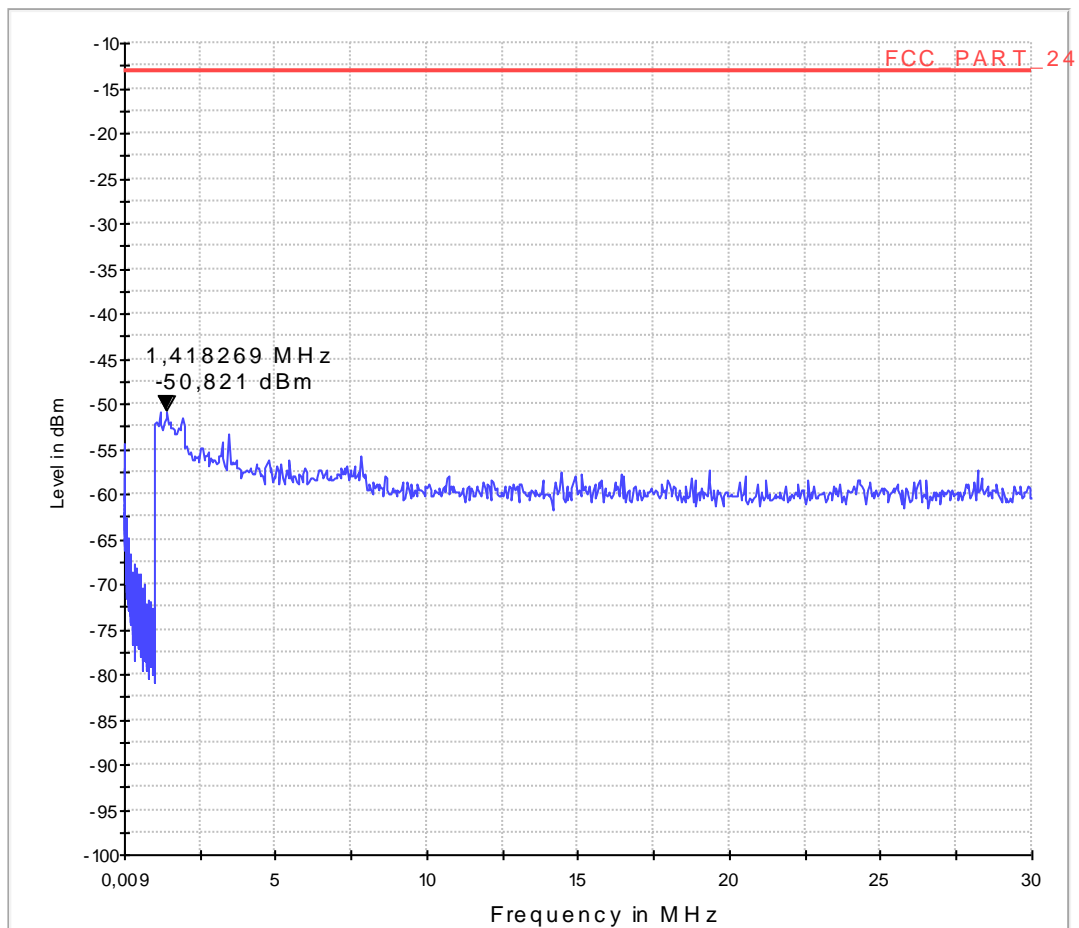
#### Common Information

Test Description:	TX Spurious Emission conducted
Antenna polarisation:	Radio laboratory
Operation mode:	FDDII voice
Operator Name:	HLa
Comment:	channel:9262

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_1





### Diagram No.: 4.28

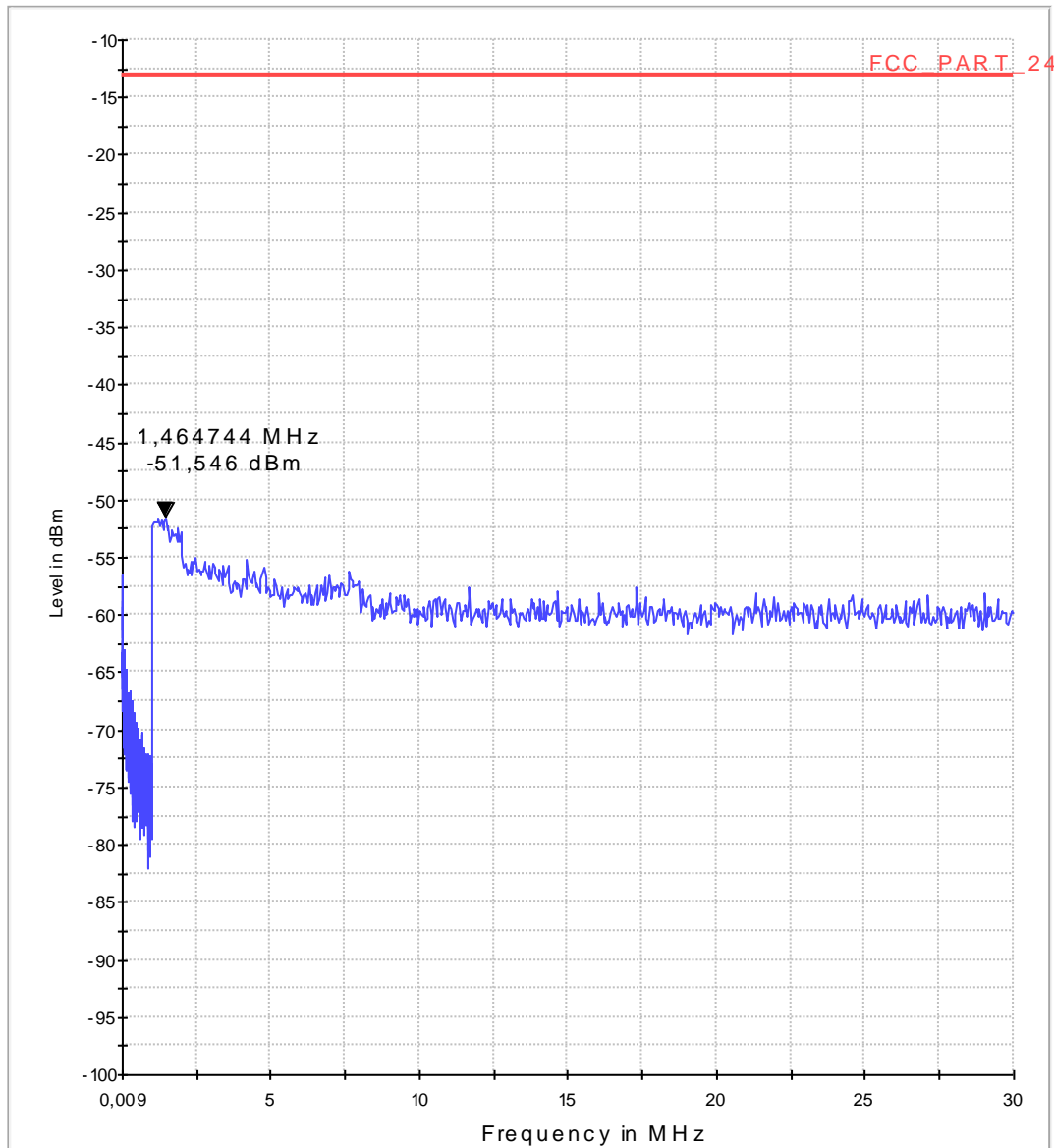
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory
Test Standard:	FCC Part 24, RSS-133
Operation mode:	FDDII voice
Operator Name:	HLa
Comment:	channel : 9400

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_1



### Diagram No.: 4.29

#### Common Information

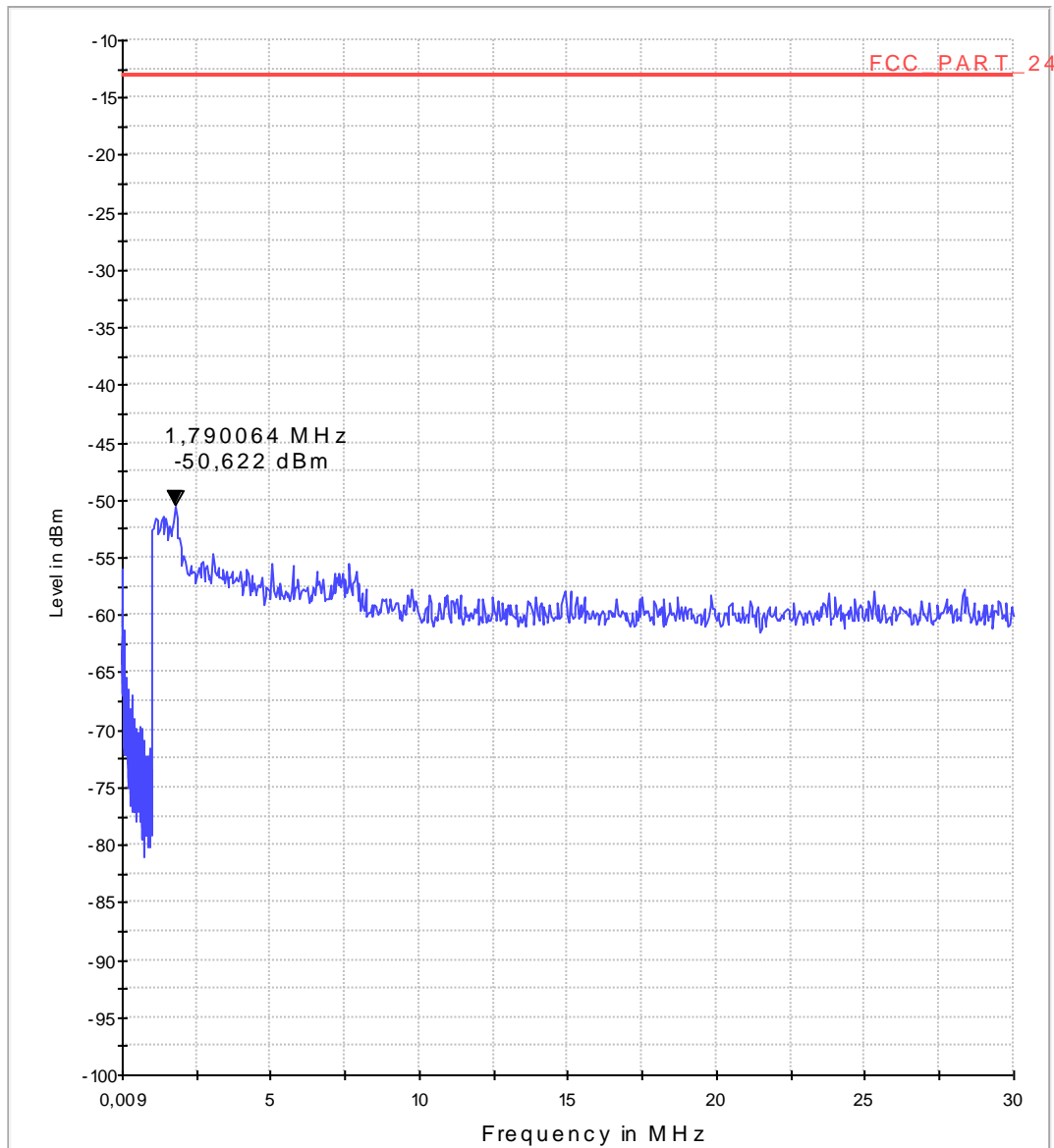
Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory
Test Standard:	FCC Part 24, RSS-133
Operation mode:	FDDII voice
Operator Name:	HLa
Comment:	channel : 9538

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

#### Sweep\_1

Sweep\_1



### Diagram no.: 4.30

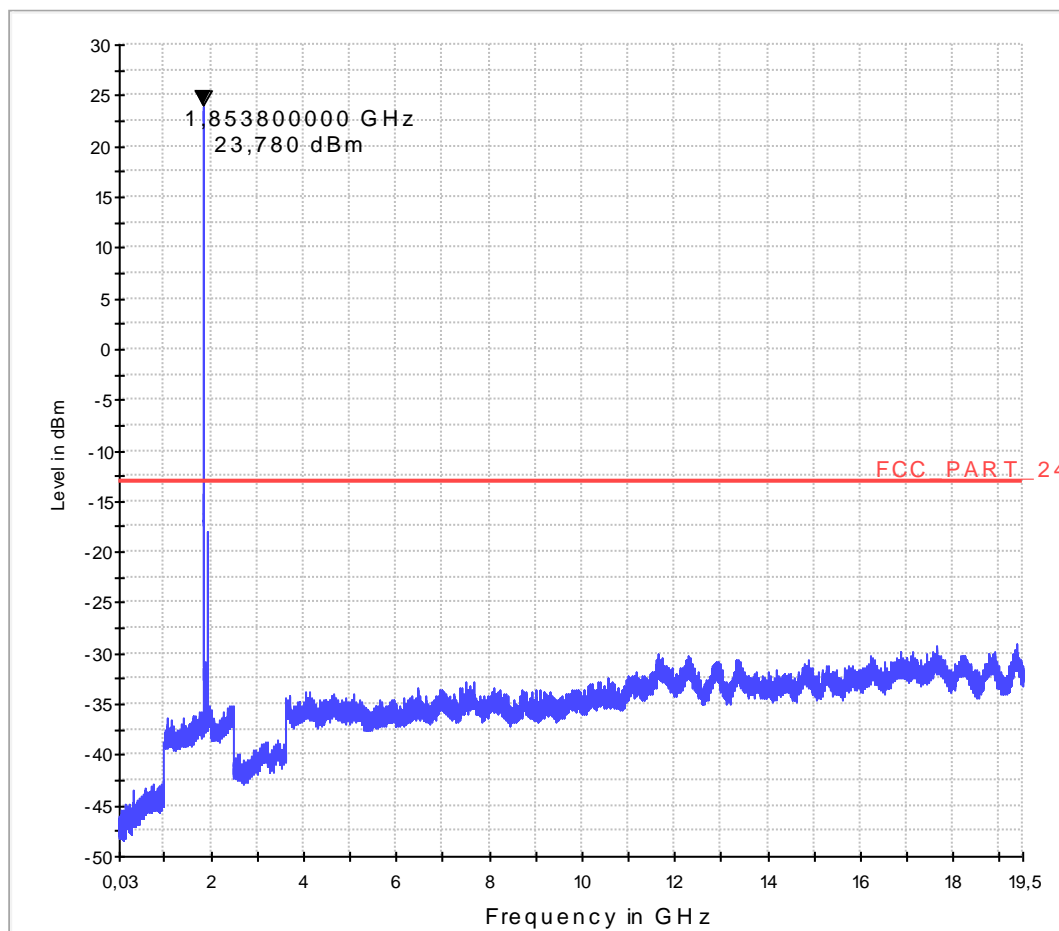
#### Common Information

Test Description:	TX Spurious Emission conducted
Test site:	Radio laboratory
Test standard:	FCC Part 24.238 RSS-133
Operation mode:	FDDII voice (channel:9262_low)
Operator Name:	HLa

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram no.: 4.31

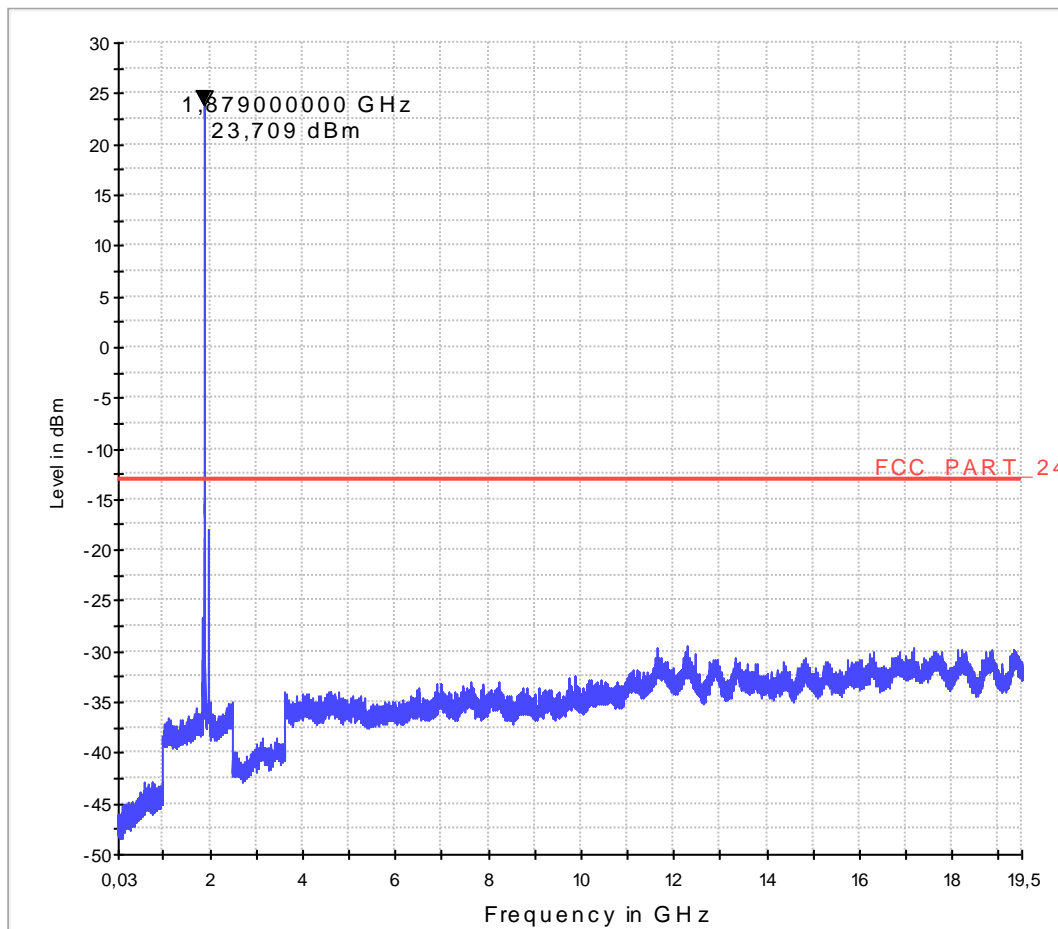
#### Common Information

Test Description:	TX Spurious Emission conducted
Test site:	Radio laboratory
Test standard:	FCC Part 24.238 RSS-133
Operation mode:	FDDII voice (channel:9400_middle)
Operator Name:	HLa

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram No.:4.32

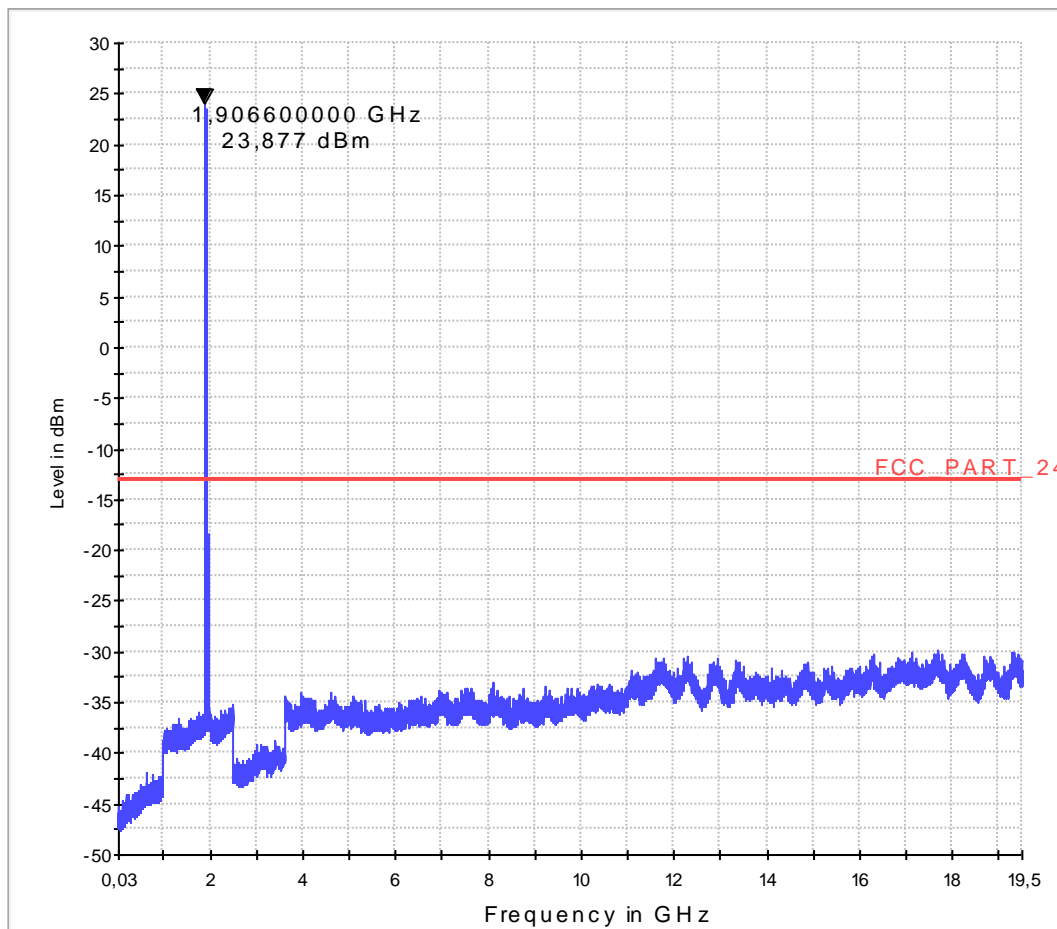
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory
Test standard:	FCC Part 24, RSS-133
Operation mode:	FDDII voice (channel:9538_high)
Operator Name:	HLa

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram no.: 4.33

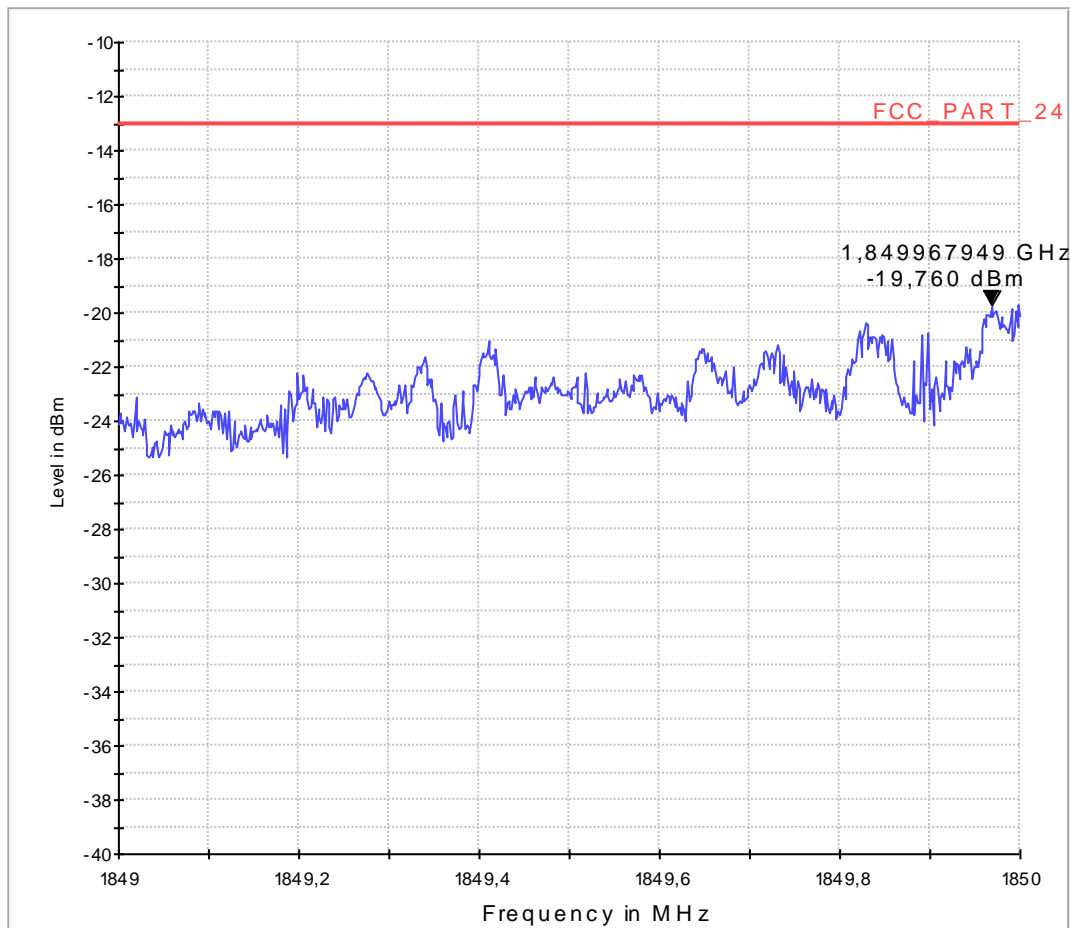
#### Common Information

Test Description:	TX Spurious Emission conducted
Test site:	Radio laboratory
Test standard:	FCC Part 24.238 RSS-133
Operation mode:	FDDII voice (channel:9262)
Operator:	HLa

#### EUT Information

EUT Name:	LISA-U230
IMEI:	352237-05-001199-0
HW, FW:	146AA0, 22.00
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_3a\_Band\_Edge\_Channel\_9262\_PK



### Diagram no. 4.34

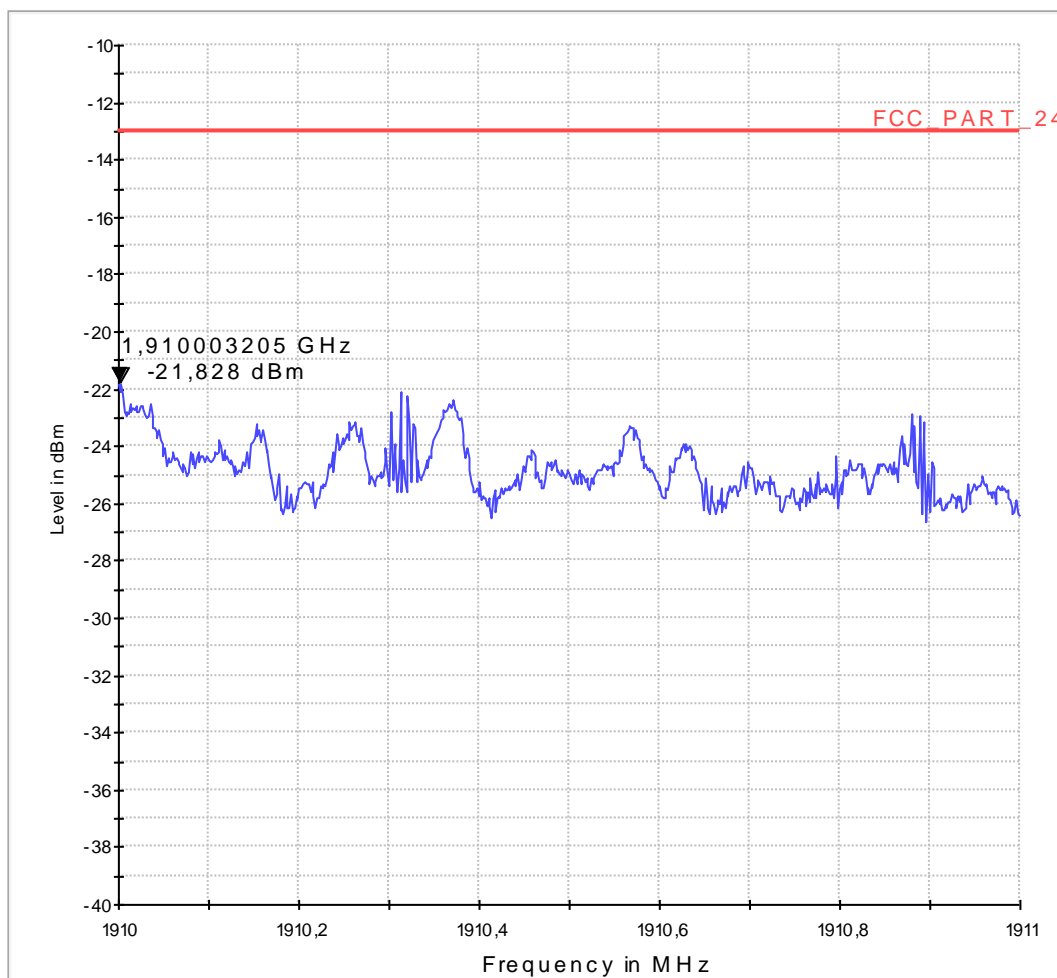
#### Common Information

Test Description:	TX Spurious Emission conducted
Test site:	Radio laboratory
Test standard:	FCC Part 24.238 RSS-133
Operation mode:	FDDII voice (channel:9538)
Operator Name:	HLa

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_3a\_Band\_Edge\_Channel\_9538\_PK



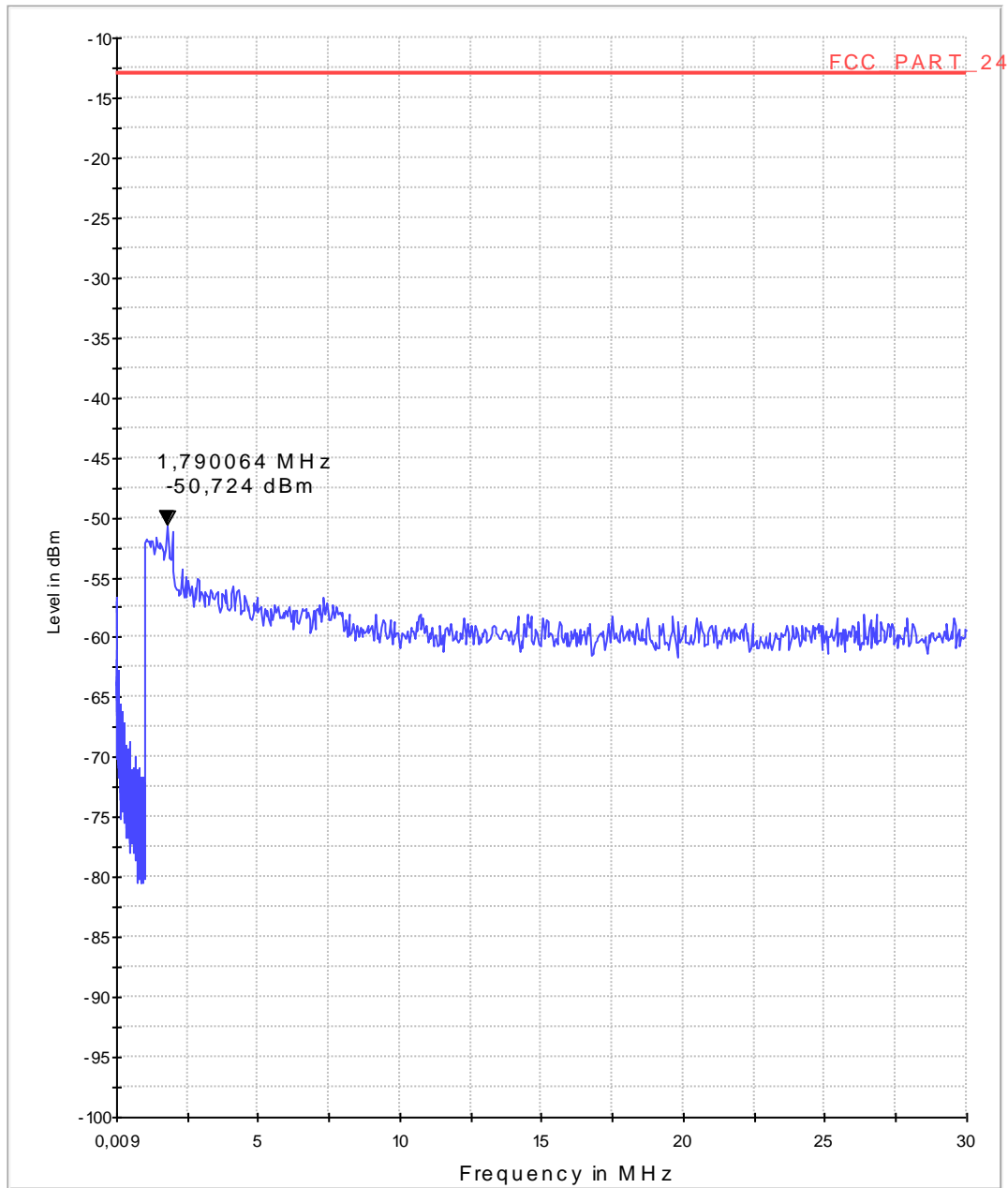
### Diagram No.:4.35

#### Common Information

Test Description: TX Spurious Emission conducted  
Test Site: Radio laboratory  
Test Standard: FCC Part 27, RSS-139

EUT: LISA-U230  
Manufacturer: u-blox AG  
Operation mode: FDD IV voice  
Operator Name: HLA  
Comment: Channel 1312\_low

Sweep\_1





### Diagram No.:4.36

#### Common Information

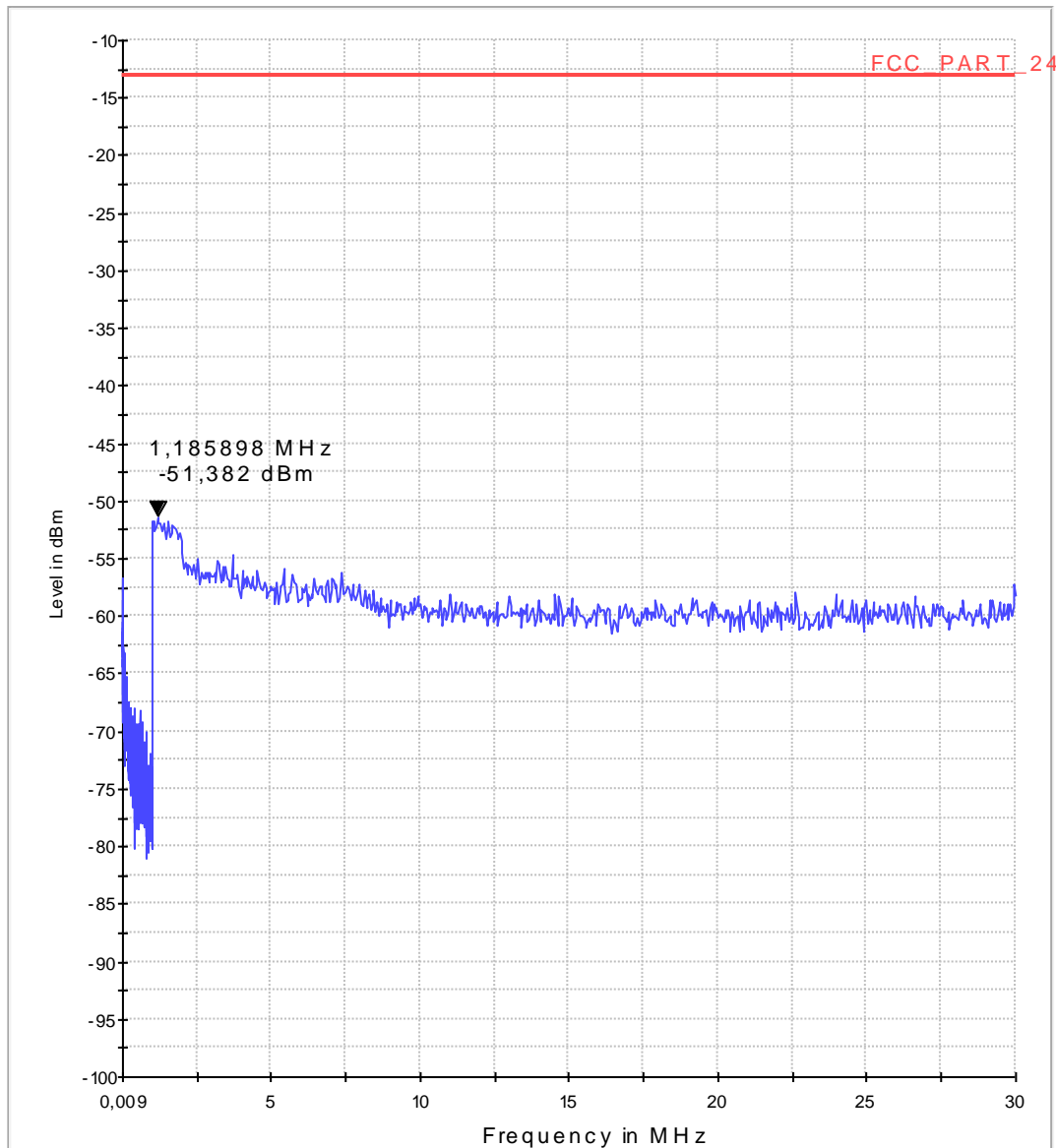
Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory
Test Standard:	FCC Part 27
Operation mode:	FDD IV voice
Operator Name:	HLa
Comment:	Channel 1413_middle

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

#### Sweep\_1

Sweep\_1



### Diagram No.:4.37

#### Common Information

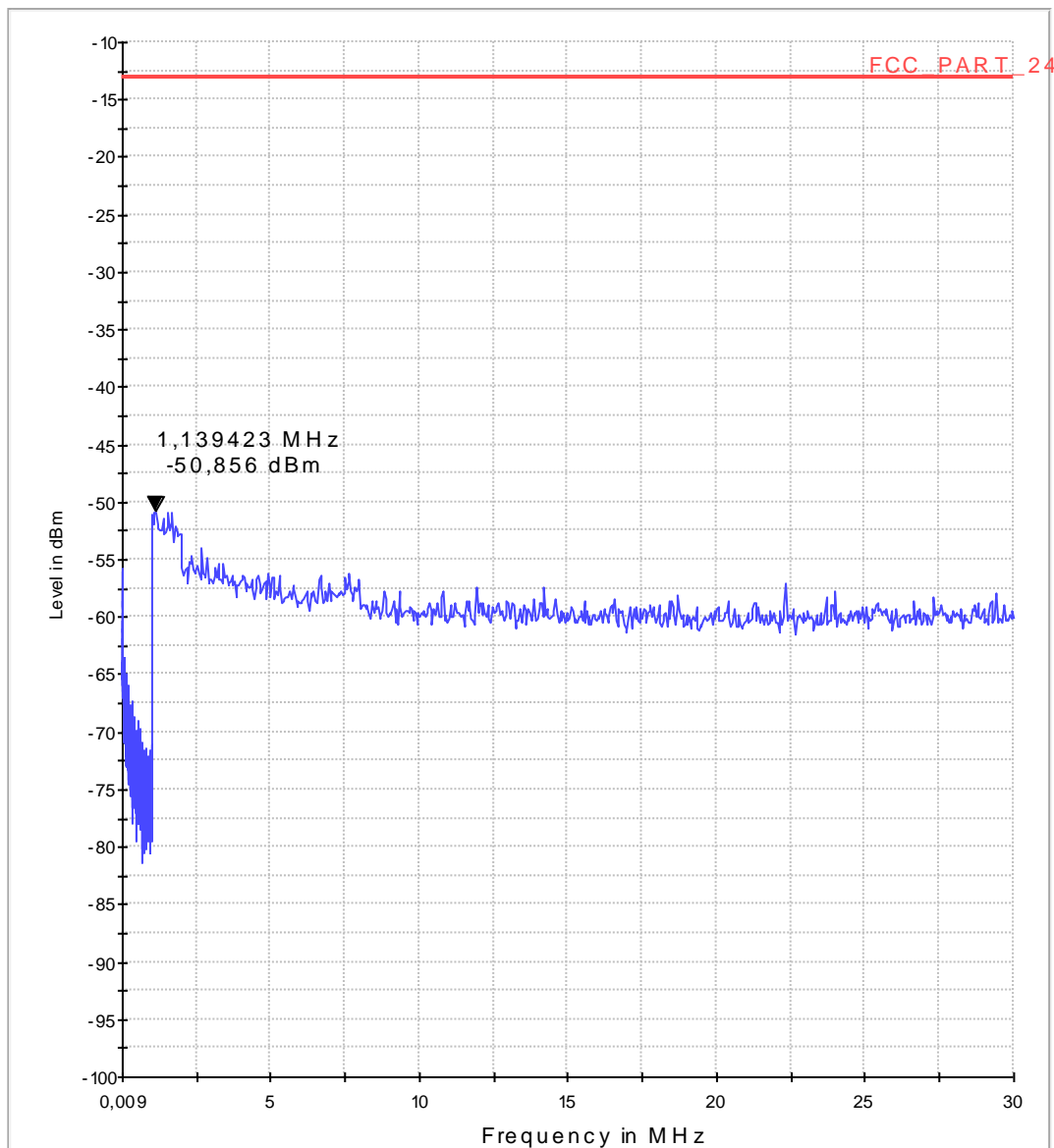
Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory
Test Standard:	FCC Part 27
Operation mode:	FDD IV voice
Operator Name:	HLa
Comment:	channel : 1513_high

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

#### Sweep\_1

Sweep\_1



### Diagram no.: 4.38

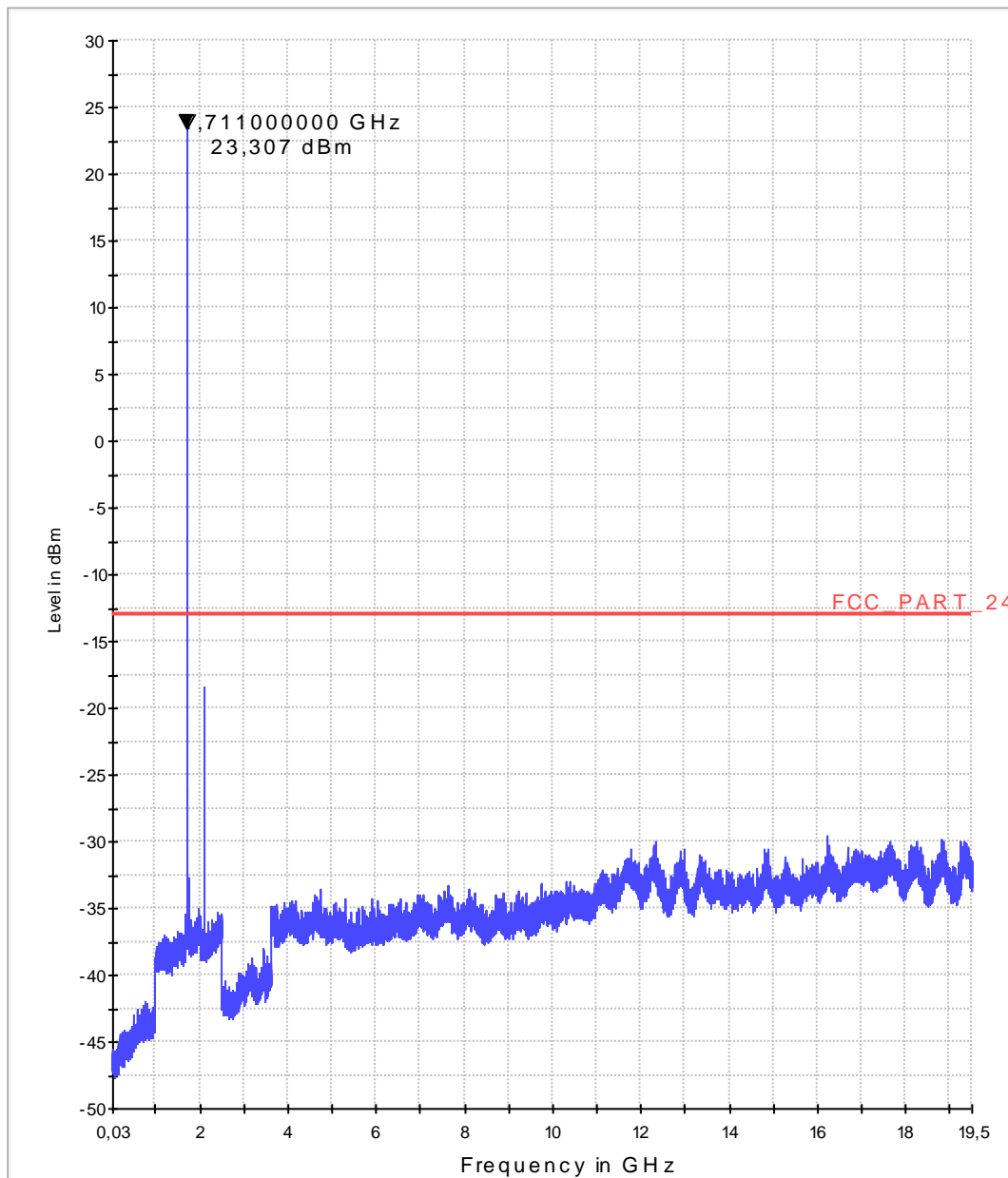
#### Common Information

Test Description:	TX Spurious Emission conducted
Test sides:	Radio laboratory
Operation mode:	FDD IV voice (1312 channel_low)
Operator Name:	HLA

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram no.: 4.39

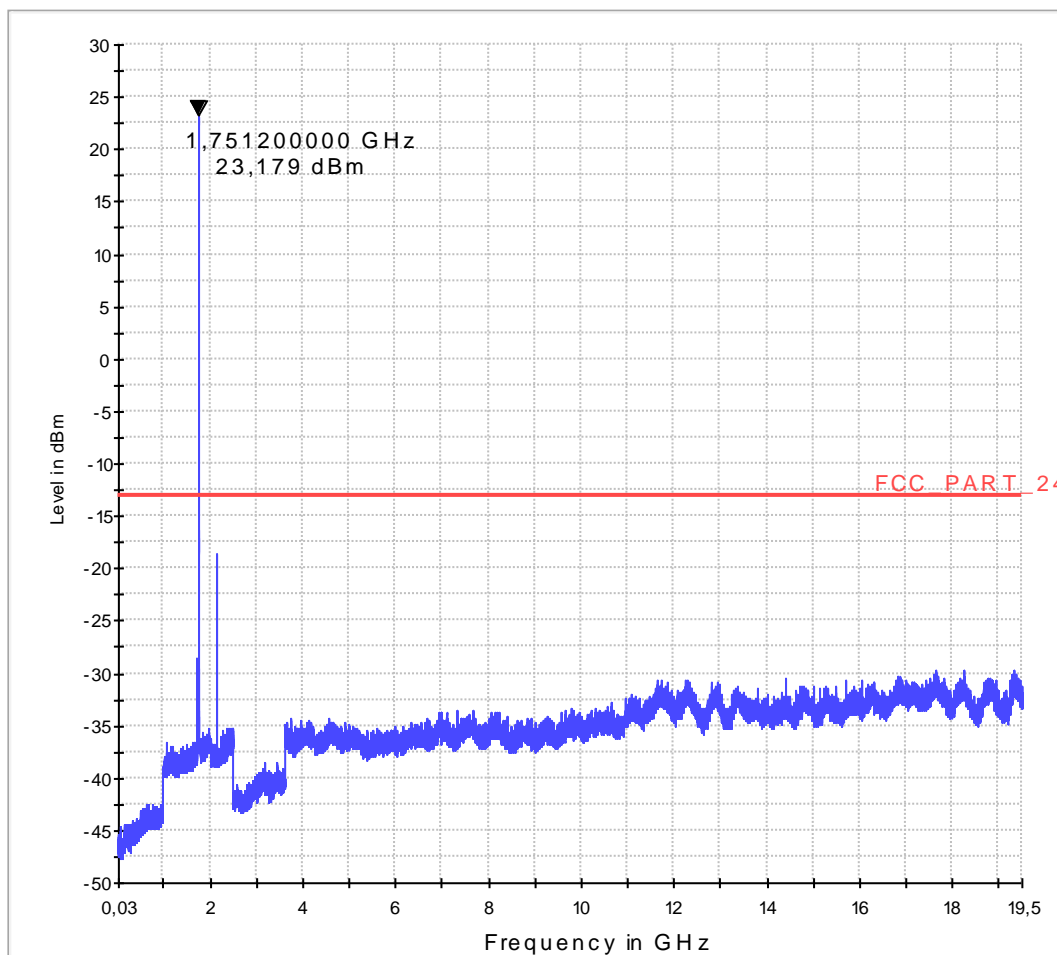
#### Common Information

Test Description:	TX Spurious Emission conducted
Test side:	Radio laboratory
Test standard:	FCC Part 27
Operation mode:	FDD IV voice (1413 channel_middle)
Operator Name:	HLa

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram no.: 4.40

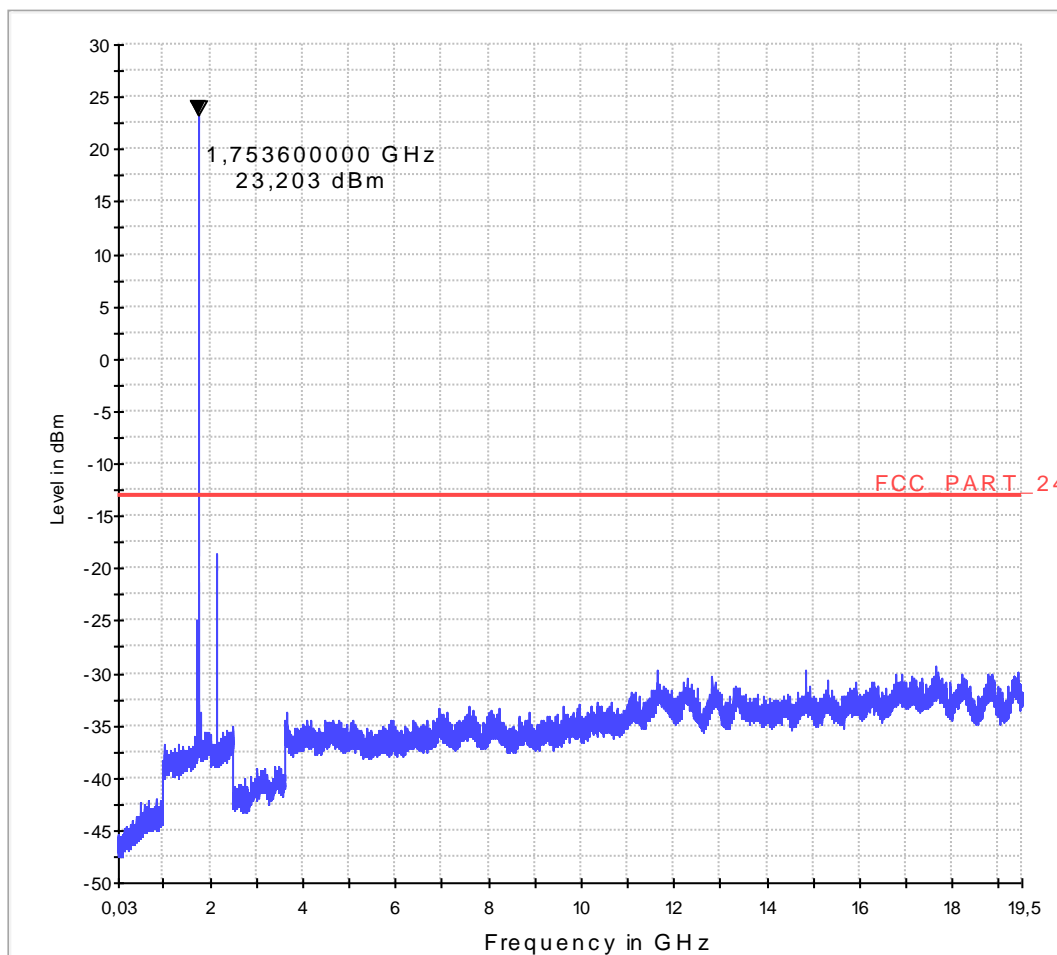
#### Common Information

Test Description:	TX Spurious Emission conducted
Test site:	Radio laboratory
Test standard:	FCC Part 27
Operation mode:	FDD IV voice (1513 channel_high)
Operator Name:	HLA

#### EUT Information

EUT Name:	LISa-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram no.: 4.41

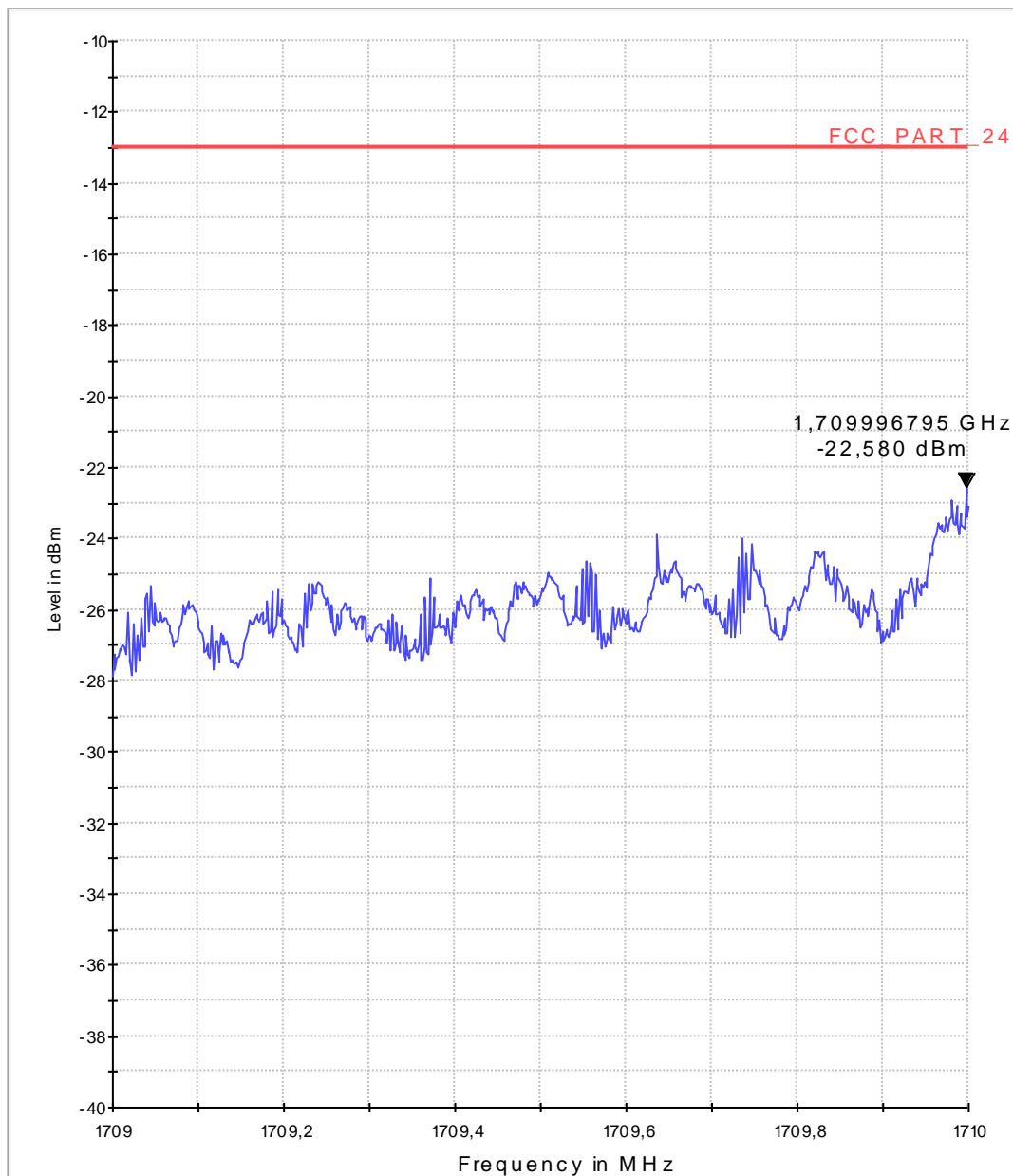
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Side:	Radio laboratory
Operating Conditions:	FDD IV voice (1312 channel_low)
Operator:	HLA

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_3a\_Band\_Edge\_Channel\_1312\_PK



### Diagram no.: 4.42

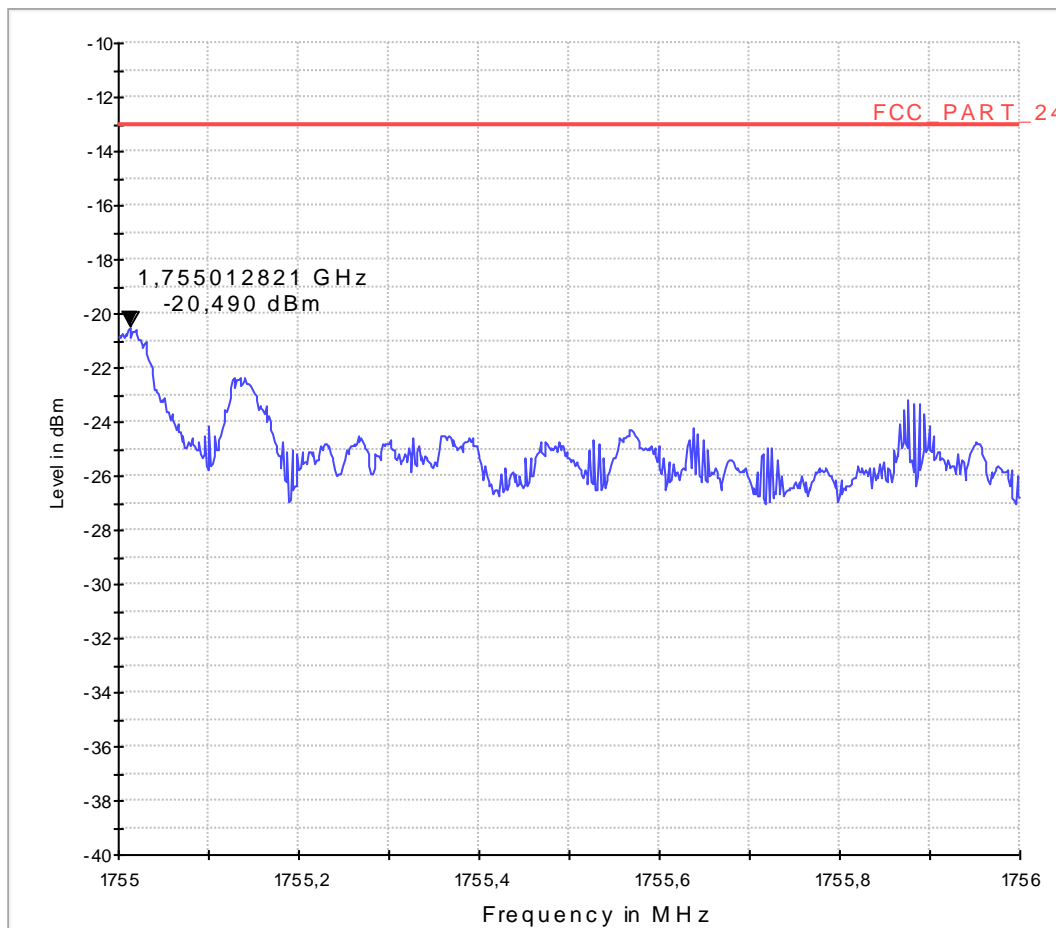
#### Common Information

Test Description:	TX Spurious Emission conducted
Test site:	Radio laboratory
Test standard:	FCC Part 27
Operating Conditions:	FDD IV voice (1513 channel_high)
Operator Name:	HLA

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_3a\_Band\_Edge\_Channel\_1513\_PK



### Diagram No.: 4.43

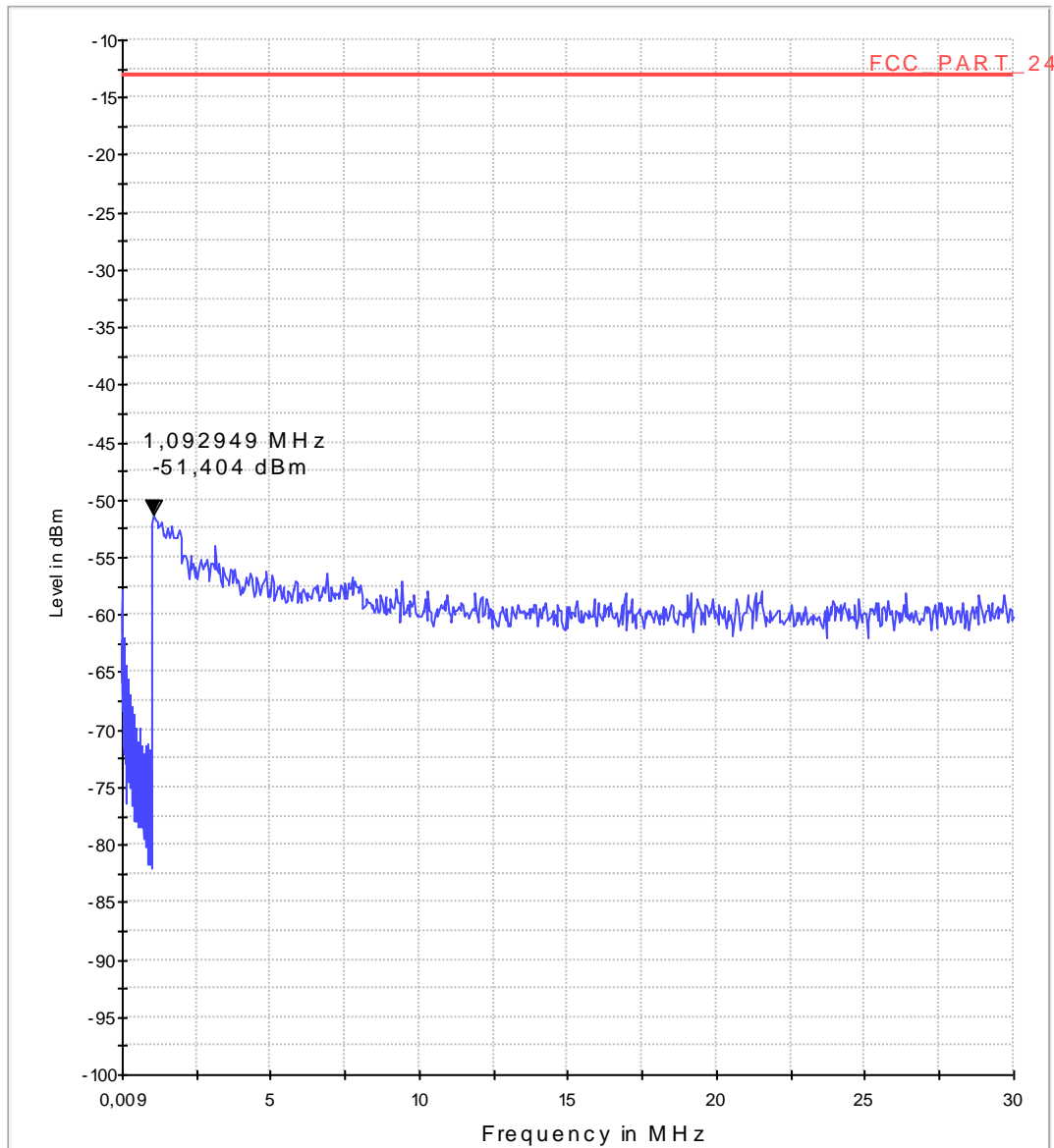
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory
Test Standard:	FCC Part 22_LowBand
Operation mode:	FDD V voice
Operator Name:	HLa
Comment:	channel : 4132

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_1





### Diagram No.: 4.44

#### Common Information

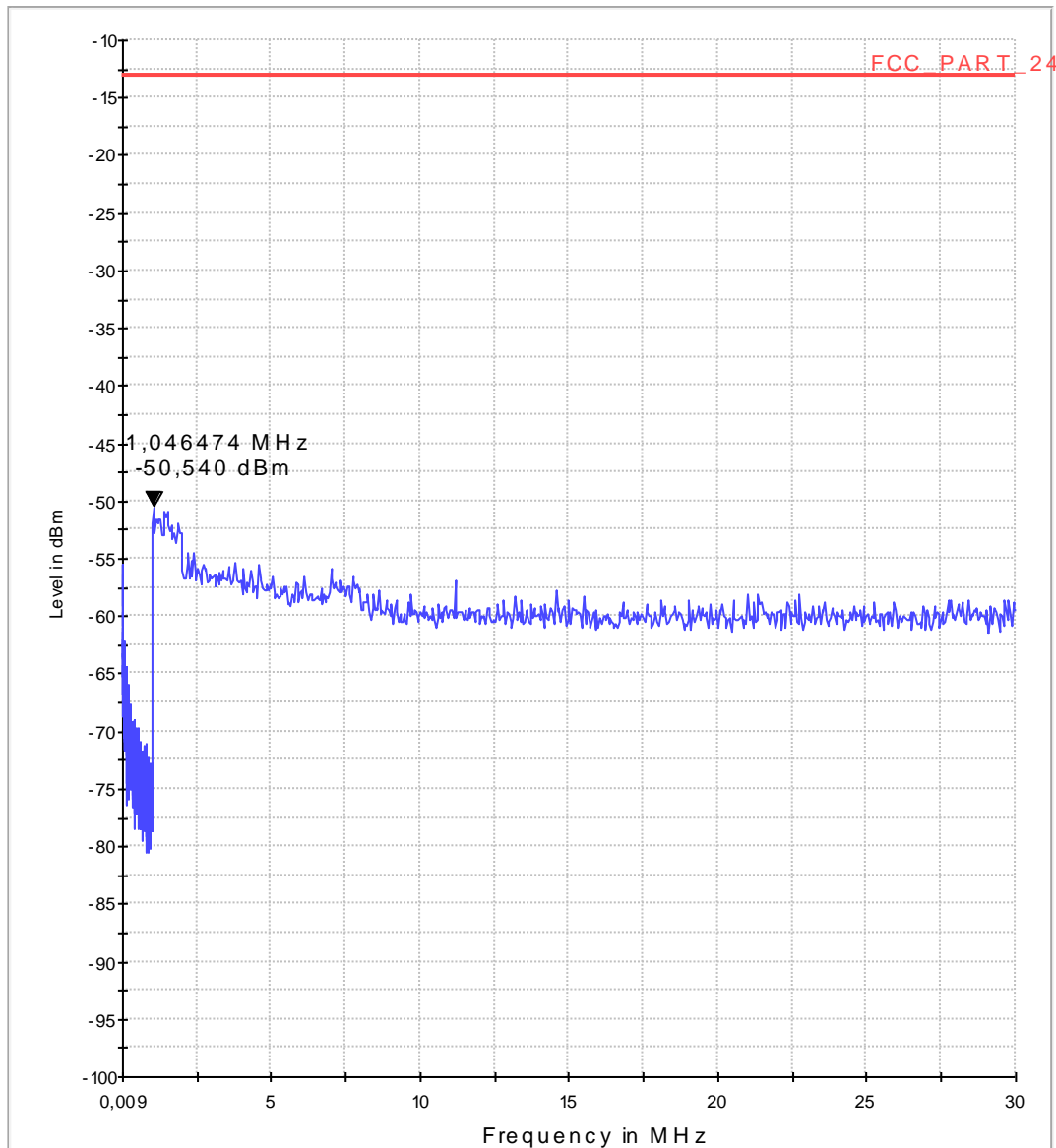
Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory
Test Standard:	FCC Part 22_LowBand
Operation mode:	FDD V voice
Operator Name:	HLa
Comment:	channel : 4183

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

#### Sweep\_1

Sweep\_1



### Diagram No.: 4.45

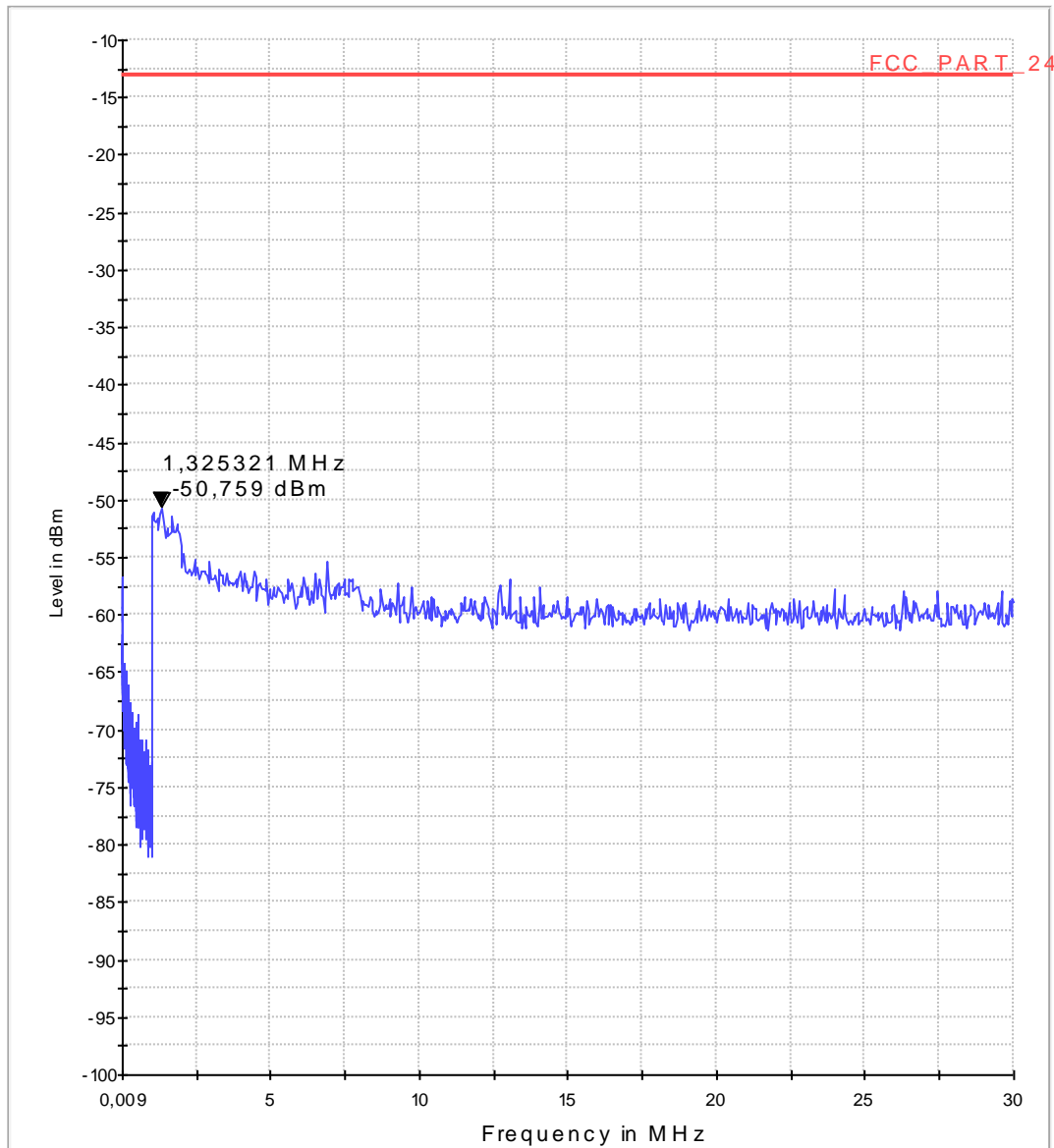
#### Common Information

Test Description:	TX Spurious Emission conducted
Test Site:	Radio laboratory
Test Standard:	FCC Part 22_LowBand
Operation mode:	FDD V voice
Operator Name:	HLa
Comment:	channel : 4233

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_1



### Diagram no.: 4.46

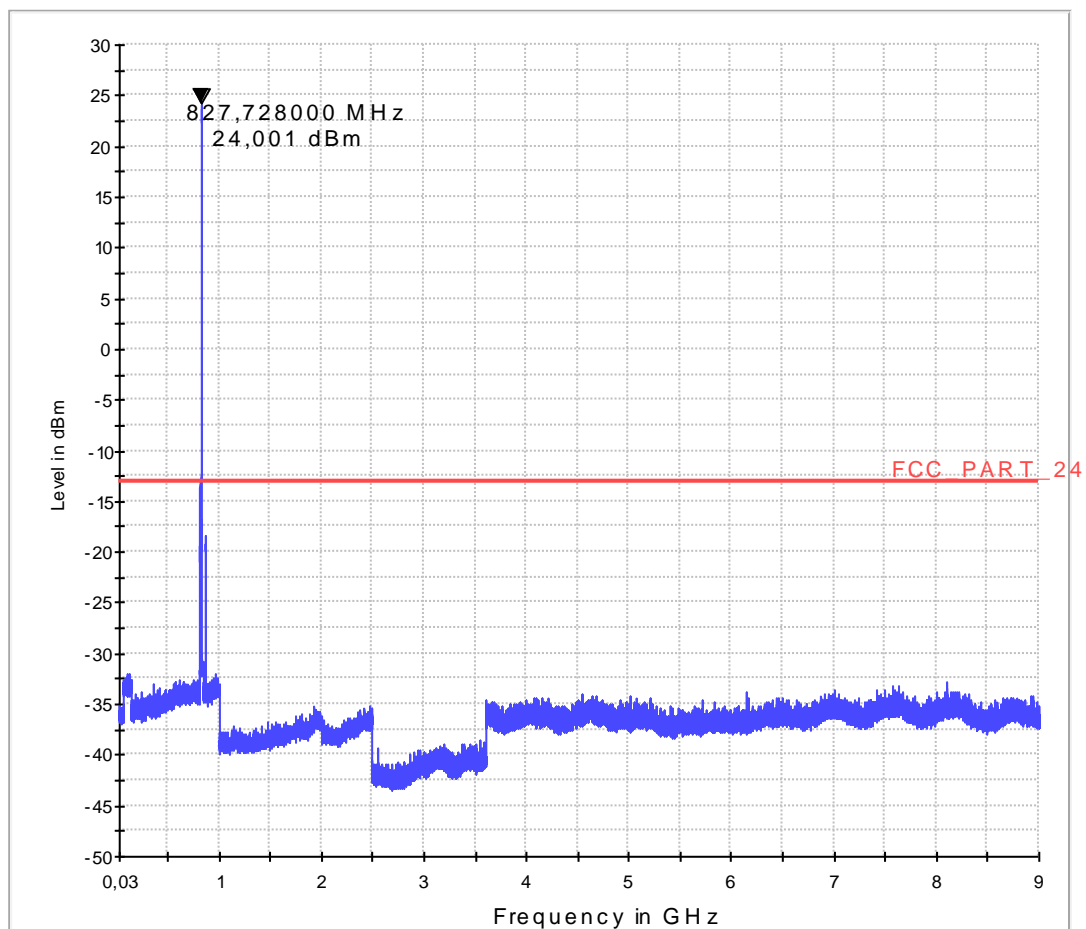
#### Common Information

Test Description:	TX Spurious Emission conducted
Test site:	Radio laboratory
Test standard:	FCC Part 22_LowBand
Operation mode:	FDDV voice (channel:4132_low)
Operator Name:	HLa

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram no.: 4.47

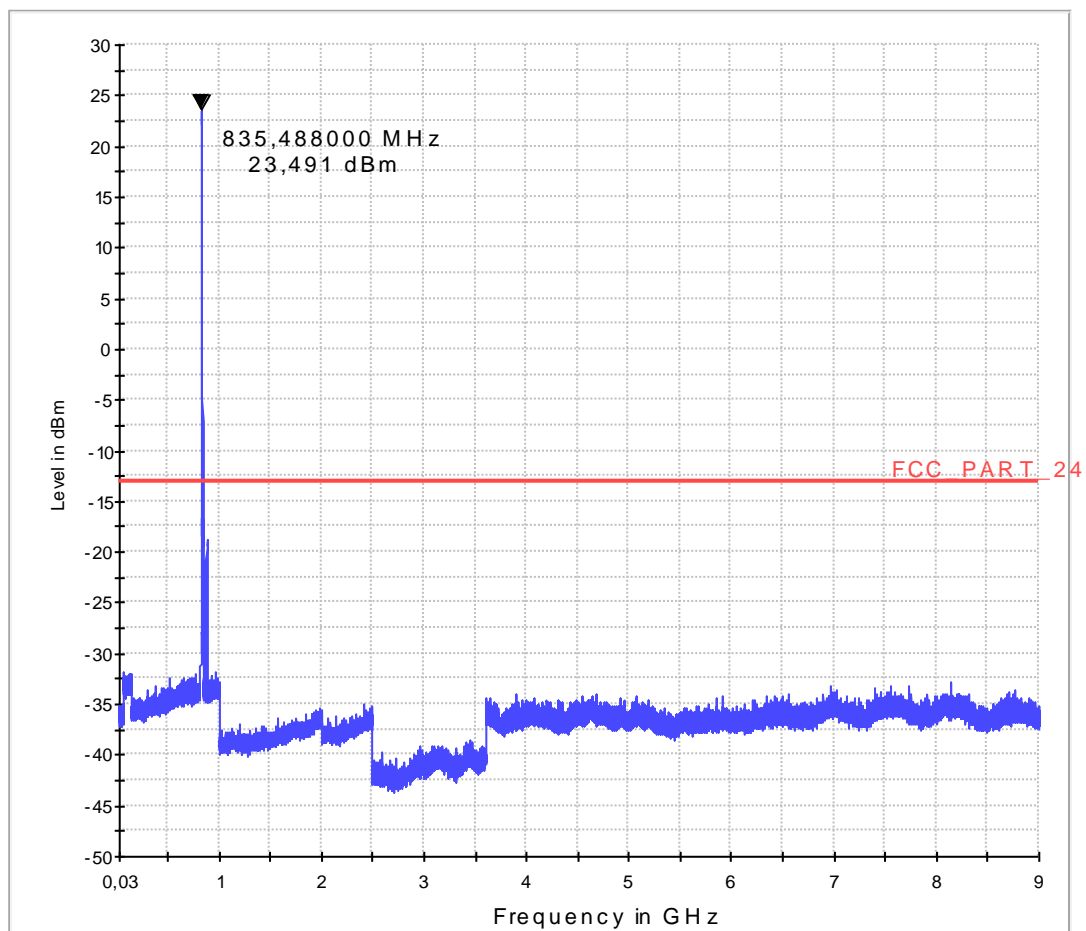
#### Common Information

Test Description:	TX Spurious Emission conducted
Test site:	Radio laboratory
Test standard:	FCC Part 22_LowBand
Operation mode:	FDDII voice (channel:4182_middle)
Operator Name:	HLa

#### EUT Information

EUT Name:	Lisa u-230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram no.: 4.48

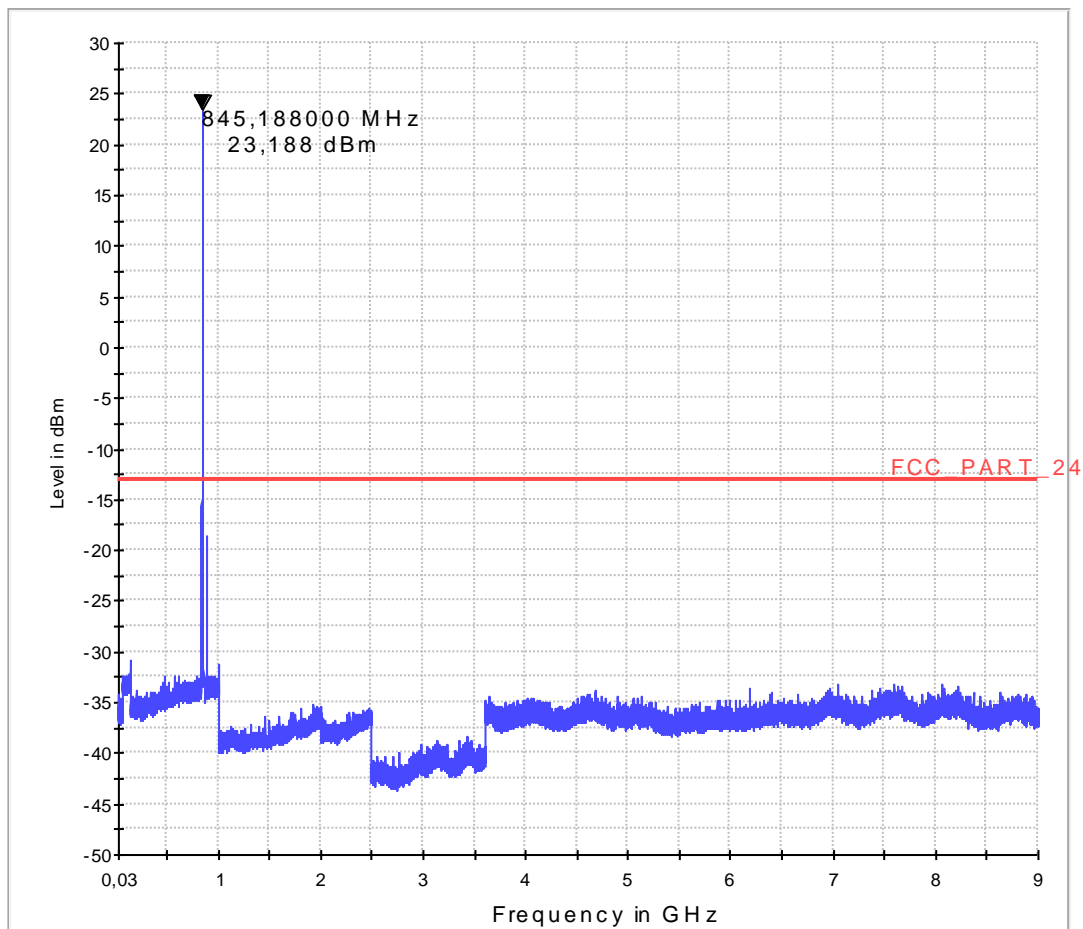
#### Common Information

Test Description:	TX Spurious Emission conducted
Test site:	Radio laboratory
Test standard:	FCC Part 22_LowBand
operation mode:	FDDII voice (channel:4233)
Operator Name:	HLa

#### EUT Information

EUT Name:	Lisa u-230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_2



### Diagram no.: 4.49

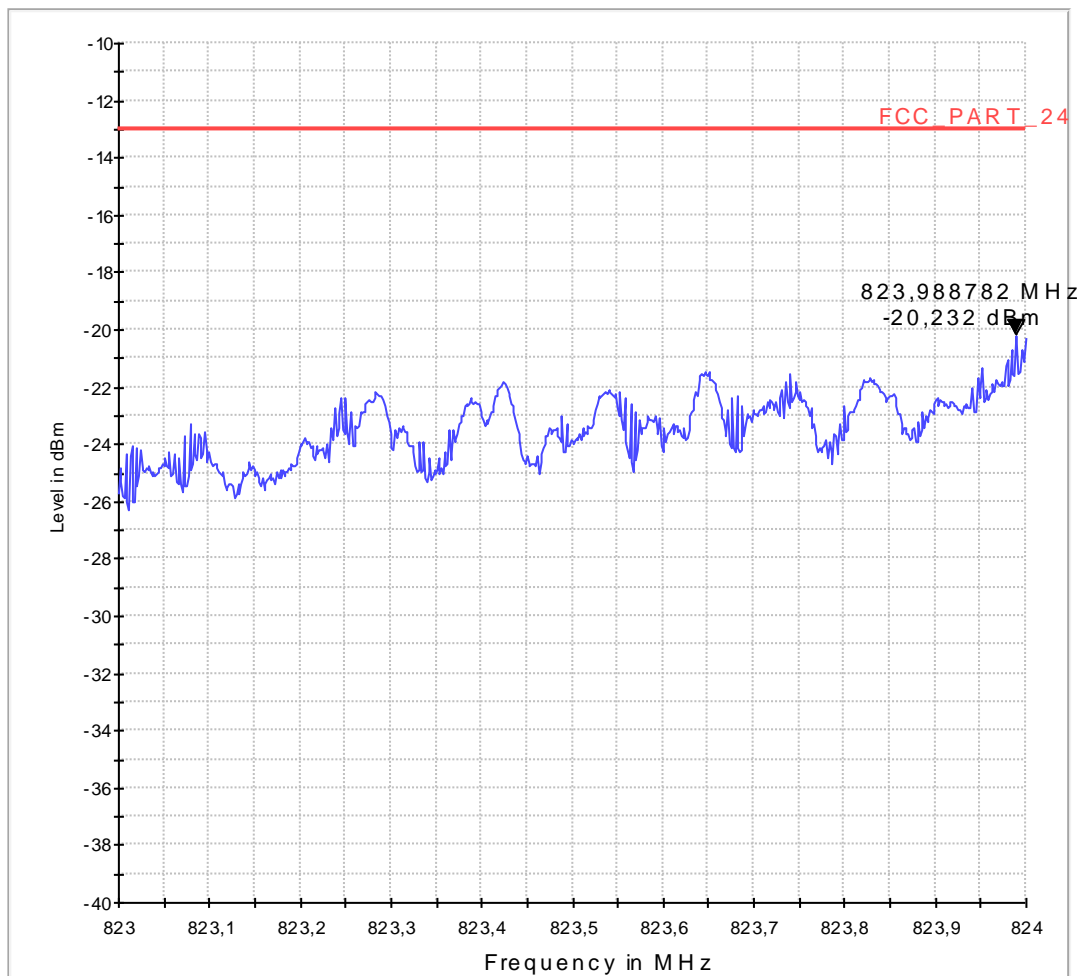
#### Common Information

Test Description:	TX Spurious Emission conducted
Test site:	Radio laboratory
Test standard:	FCC Part 22_LowBand
Operation mode:	FDDV voice (channel:4132_low)
Operator Name:	HLA

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_3a\_Band\_Edge\_Channel\_4132\_PK



### Diagram no.: 4.50

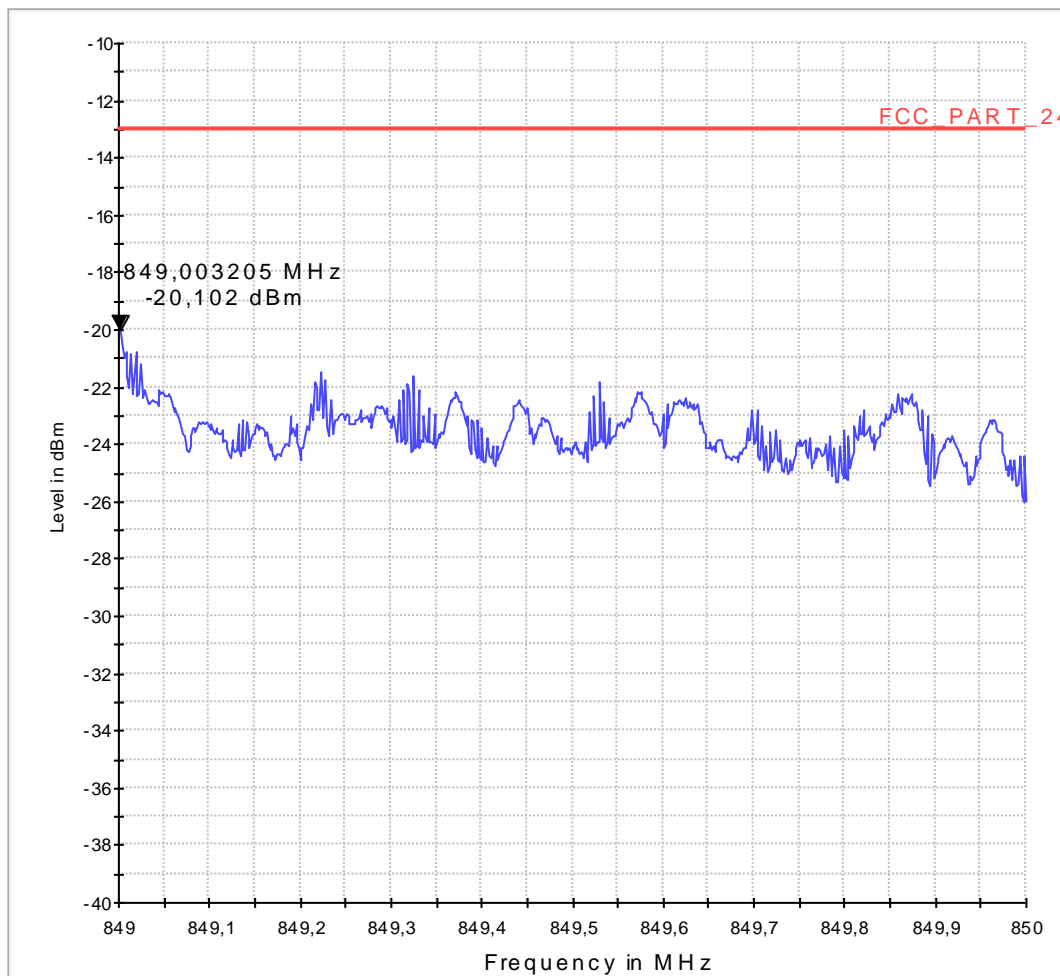
#### Common Information

Test Description:	TX Spurious Emission conducted
Test site:	Radio laboratory
Test standard:	FCC Part 22_LowBand
Operation mode:	FDDV voice (channel:4233)
Operator Name:	HLA

#### EUT Information

EUT Name:	LISA-U230
Manufacturer:	u-blox AG
Voltage:	3,8 VDC

Sweep\_3a\_Band\_Edge\_Channel\_4233\_PK



## 5.6. RF Peak power output conducted

### 5.6.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input type="checkbox"/> 347 Radio.lab.
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input type="checkbox"/> 489 ESU 40
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK
antenna	<input type="checkbox"/> 574 BTA-L	<input type="checkbox"/> 133 EMCO3115	<input type="checkbox"/> 302 BBHA9170
signaling	<input type="checkbox"/> 392 MT8820A	<input checked="" type="checkbox"/> 436 CMU	<input type="checkbox"/> 547 CMU
otherwise	<input type="checkbox"/> 400 FTC40x15E	<input type="checkbox"/> 401 FTC40x15E	<input type="checkbox"/> 110 USB LWL
DC power	<input type="checkbox"/> 456 EA 3013A	<input checked="" type="checkbox"/> 463 HP3245A	<input type="checkbox"/> 459 EA 2032-50
otherwise	<input type="checkbox"/> 331 HC 4055	<input checked="" type="checkbox"/> 248 6 dB Attenuator	<input type="checkbox"/> 529 Power divider
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains		<input type="checkbox"/> 060 110 V 60 Hz via PAS 5000

### 5.7.2 Standards and References

FCC: §2.1046 (conducted), §22.913(a)(2), § 24.232(c), § 27.51(d)(4)

IC: RSS-132:4.4 + SRSP 503:5.1.3 for GSM 850/FDDV; RSS-133:4.1/6.4 + SRSP-510:5.1.2 for GSM 1900/FDDII; RSS-139 for FDDIV

- Maximum Power Output of the mobile phone should be determined while measured conducted E(IRP).
- Limit GSM850/FDDV: 7 Watt
- Limit GSM1900/FDDII: 2 Watt
- Limit FDDIV : 1 Watt

### Test condition and measurement test set-up

link to test system (if used):	<input type="checkbox"/> air link	<input checked="" type="checkbox"/> cable connection	<input type="checkbox"/>
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%

### 5.7.3 TEST SET-UP (CONDUCTED)

- see conducted measurement set-up, description in chapter 4.1
- a suitable artificial antenna or RF-connector is provided by the applicant in order to perform the conducted measurements. Any data provided with the artificial antenna or connector, have been taken in account in order to correct the measurement data. (0.3dB for attenuation of antenna connector)

### MOBILE PHONE SETTINGS

- according chapter 3.6

### BASE STATION SETTING

- according 3.6 chapter



### 5.7.2 RESULTS (CONDUCTED)

The test results for FDD bands do not covered the HSDPA/HSUPA power values for portable application and should be reported in later certification of each product based on this RF module.

#### Op. Mode 1, Set-up 2

Channel/ Frequency (MHz)		Peak Output Power (dBm)	Average Output Power (dBm)
GSM 850	Channel 128/ 824.2 MHz	32.20	32.01
	Channel 192/ 837.0 MHz	32.24	32.08
	Channel 251/ 848.8 MHz	<b>32.33</b>	<b>32.14</b>

#### Op. Mode 2, Set-up 2

Channel/ Frequency (MHz)		Peak Output Power (dBm)	Average Output Power (dBm)
E-GPRS 850	Channel 128/ 824.2 MHz	29.22	26.32
	Channel 192/ 837.0 MHz	29.23	26.39
	Channel 251/ 848.8 MHz	<b>29.26</b>	<b>26.48</b>

#### Op. Mode 3, Set-up 2

Channel/ Frequency (MHz)		Peak Output Power (dBm)	Average Output Power (dBm)
GSM1900	Channel 512/ 1850.2 MHz	29.18	29.02
	Channel 661/ 1880.0 MHz	<b>29.24</b>	<b>29.06</b>
	Channel 810/ 1909.8 MHz	29.11	28.97

#### Op. Mode 4, Set-up 2

Channel/ Frequency (MHz)		Peak Output Power (dBm)	Average Output Power (dBm)
E-GPRS 1900	Channel 512/ 1850.2 MHz	28.04	25.24
	Channel 661/ 1880.0 MHz	<b>28.06</b>	<b>25.29</b>
	Channel 810/ 1909.8 MHz	27.93	25.19

#### Op. Mode 5, Set-up 2

Channel/ Frequency (MHz)		Peak Output Power (dBm)	Average Output Power (dBm)
FDD II	Channel 512/ 1850.2 MHz	25.74	22.69
	Channel 661/ 1880.0 MHz	<b>25.86</b>	<b>22.72</b>
	Channel 810/ 1909.8 MHz	25.41	22.51

#### Op. Mode 6, Set-up 2

Channel/ Frequency (MHz)		Peak Output Power (dBm)	Average Output Power (dBm)
FDD IV	Channel 512/ 1850.2 MHz	25.55	22.35
	Channel 661/ 1880.0 MHz	25.49	22.32
	Channel 810/ 1909.8 MHz	<b>25.65</b>	<b>22.45</b>

#### Op. Mode 7, Set-up 2

Channel/ Frequency (MHz)		Peak Output Power (dBm)	Average Output Power (dBm)
FDD V	Channel 512/ 1850.2 MHz	<b>26.12</b>	22.01
	Channel 661/ 1880.0 MHz	26.11	<b>22.82</b>
	Channel 810/ 1909.8 MHz	25.86	22.72

General remarks: PAR factor < 13dB

**5.7.3 FINAL VERDICT:** Passed

## 5.7. Occupied and emission bandwidth

### 5.7.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input type="checkbox"/> 337 OATS <input checked="" type="checkbox"/> 347 Radio.lab.
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input checked="" type="checkbox"/> 489 ESU
signaling	<input checked="" type="checkbox"/> 547 CMU		
otherwise	<input checked="" type="checkbox"/> 530 10dB Attenuator		<input checked="" type="checkbox"/> cable K15

### 5.7.2. References of occupied and emission bandwidth

FCC: §2.202, §2.1049, §22.917(a), §24.238(a), §27.53(h)

IC: RSS-Gen: 4.6.1

„the **occupied bandwidth** is the frequency bandwidth, such that, below it lower and above it upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated”

### 5.7.3. Test Set-up

- see conducted measurement set-up described in 4.1

### 5.7.4. Mobile phone settings

- Provisions with the requirements is based on the fact, that GSM modulation scheme is GMSK Modulation for GSM equipment with a maximum data transmission rate of 17,6 kBit/s per Slot.
- Provisions with the requirements is based on the fact, that EDGE modulation scheme is 8-PSK Modulation for EDGE equipment with a maximum data transmission rate of 69,2 kBit/s per Slot.
- Provisions with the requirements is based on the fact, that FDD modulation scheme is QPSK Modulation for FDD equipment with a maximum data transmission rate of 12,2 kBit/s per Slot.
- a call was established with settings according chapter 3.6

### 5.7.5. Settings of the Spectrum-Analyser

Frequency range	RBW (resolution bandwidth)	VBW (video bandwidth)
1 MHz around carrier frequency	1% from applicants stated/measured emission bandwidth	3..10 times the RBW

### 5.7.6. Test method

The measurements were made at the upper, middle and lower carrier traffic frequencies of the operating band. Choosing three TX-carrier frequencies of the mobile phone within each operable GSM band, should be sufficient to demonstrate compliance

Additionally the emission bandwidth (-26 dBc bandwidth) was recorded for all three channels. The results were taken in order to determine according the §24.238 the measurement resolution bandwidth, which should be approximately 1% of the emission bandwidth.

### 5.7.7. Results

#### Set-up 2, Op-Mode 1

Channel/ Frequency (MHz)	Occupied 99% bandwidth [kHz]	Emission bandwidth [kHz]
GSM 850	Channel 128/ 824.2 MHz	<b>243.59</b>
	Channel 192/ 837.0 MHz	241.99
	Channel 251/ 848.8 MHz	240.38

#### Set-up 2, Op-Mode 2

Channel/ Frequency (MHz)	Occupied 99% bandwidth [kHz]	Emission bandwidth [kHz]
EGPRS 850	Channel 128/ 824.2 MHz	240.38
	Channel 192/ 837.0 MHz	<b>241.99</b>
	Channel 251/ 848.8 MHz	<b>241.99</b>

Remarks: See diagrams at the next chapter

## Set-up 2, Op-Mode 3

Channel/ Frequency (MHz)		Occupied 99% bandwidth [kHz]	Emission bandwidth [kHz]
GSM 1900	Channel 512/ 1850.2 MHz	241.99	288.46
	Channel 661/ 1880.0 MHz	<b>246.79</b>	291.67
	Channel 810/ 1909.8 MHz	240.38	<b>302.88</b>

Remarks: See diagrams at the next chapter

## Set-up 2, Op-Mode 4

Channel/ Frequency (MHz)		Occupied 99% bandwidth [kHz]	Emission bandwidth [kHz]
EGPRS 1900	Channel 512/ 1850.2 MHz	240.38	274.04
	Channel 661/ 1880.0 MHz	<b>243.59</b>	<b>286.86</b>
	Channel 810/ 1909.8 MHz	241.99	275.64

Remarks: See diagrams at the next chapter

## Set-up 2, Op-Mode 5

Channel/ Frequency (MHz)		Occupied 99% bandwidth [MHz]	Emission bandwidth [MHz]
FDD II	Channel 9262	4.049	4.487
	Channel 9400	<b>4.060</b>	4.554
	Channel 9538	<b>4.060</b>	<b>4.565</b>

Remarks: See diagrams at the next chapter

## Set-up 2, Op-Mode 6

Channel/ Frequency (MHz)		Occupied 99% bandwidth [MHz]	Emission bandwidth [MHz]
FDD IV	Channel 1312	4.027	4.520
	Channel 1412	<b>4.049</b>	4.453
	Channel 1513	<b>4.049</b>	<b>4.543</b>

Remarks: See diagrams at the next chapter

## Set-up 2, Op-Mode 7

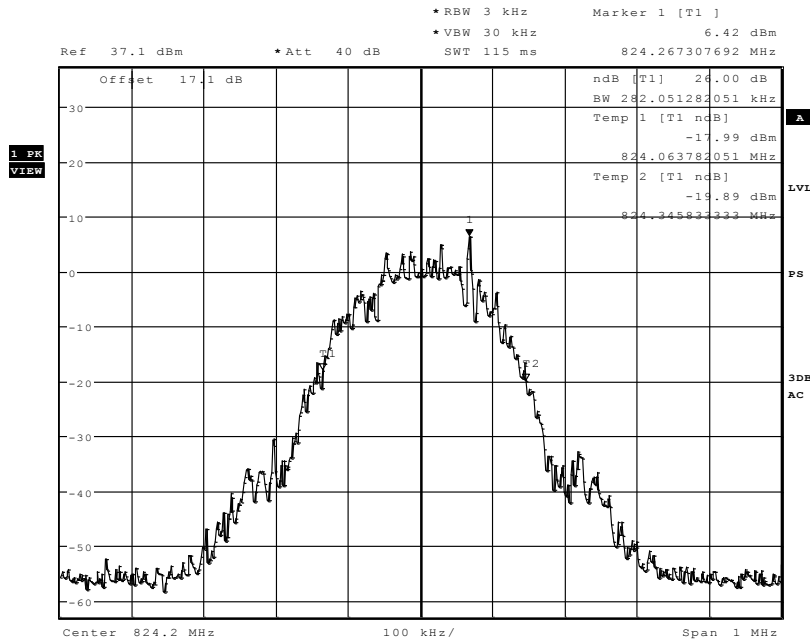
Channel/ Frequency (MHz)		Occupied 99% bandwidth [MHz]	Emission bandwidth [MHz]
FDD V	Channel 4132	4.072	<b>4.565</b>
	Channel 4183	4.072	4.554
	Channel 4233	<b>4.083</b>	4.475

Remarks: See diagrams at the next chapter

**5.7.8.VERDICT:** Passed

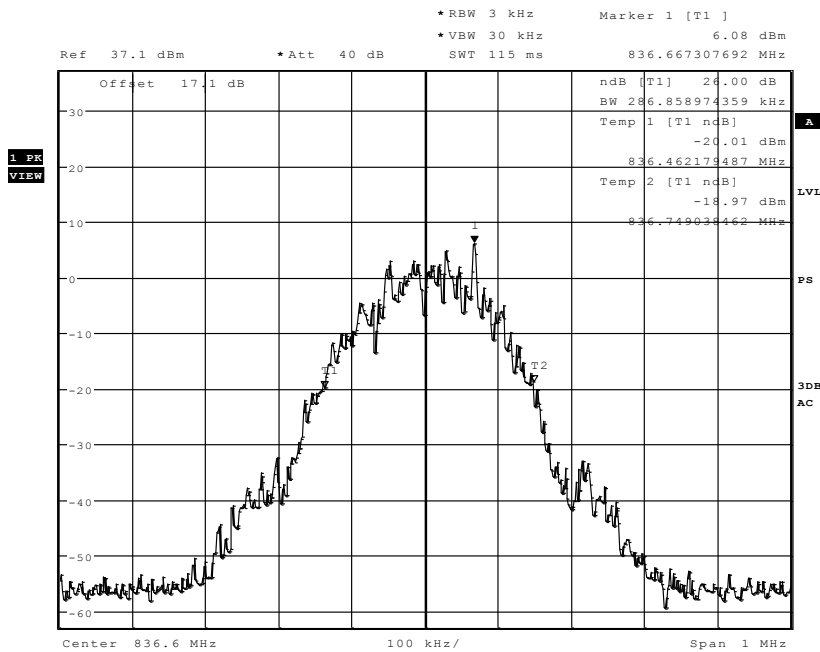
## Diagrams

### GSM850-EBW\_low



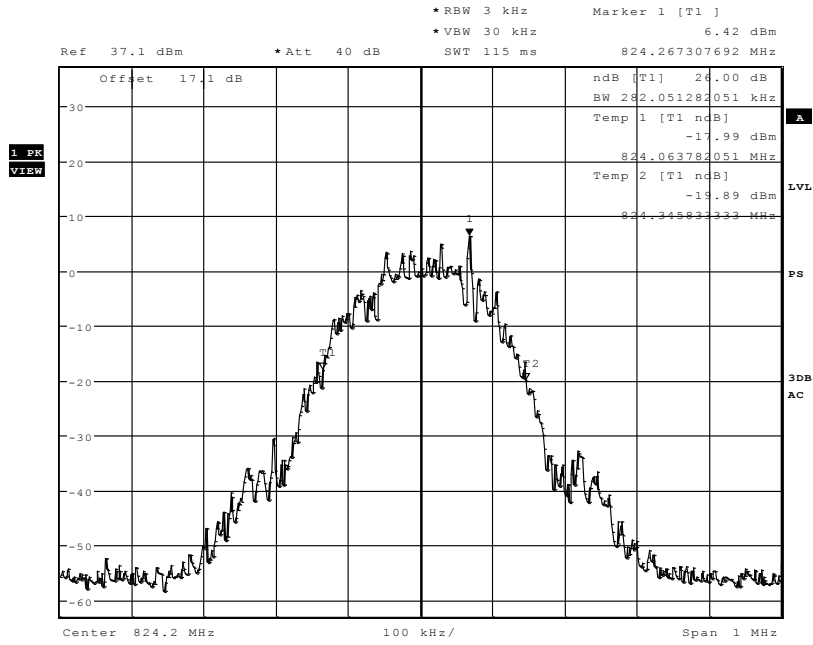
Date: 19.MAR.2012 17:13:45

### GSM850-EBW\_middle



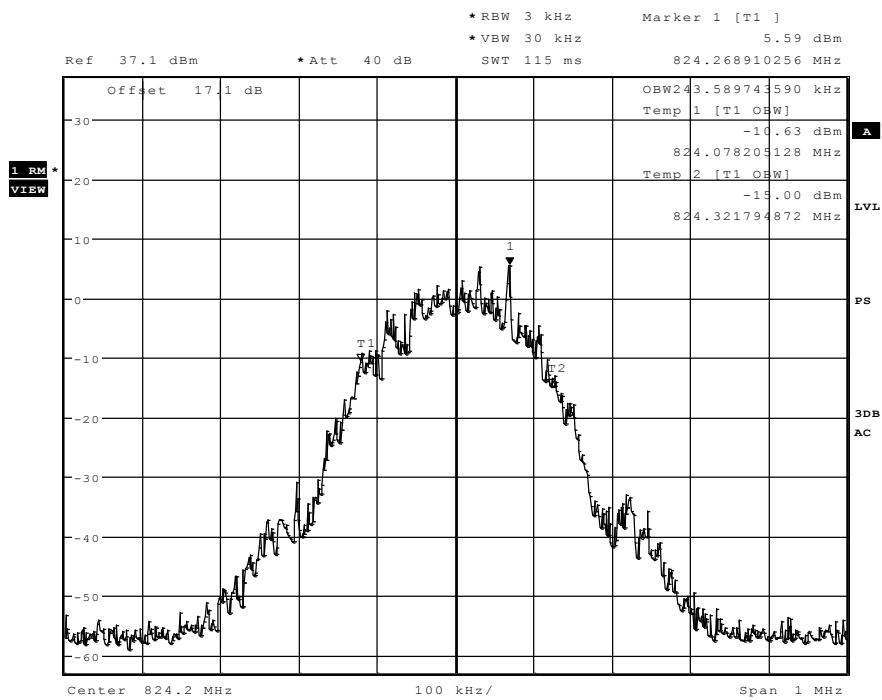
Date: 19.MAR.2012 17:21:25

### GSM850-EBW\_high



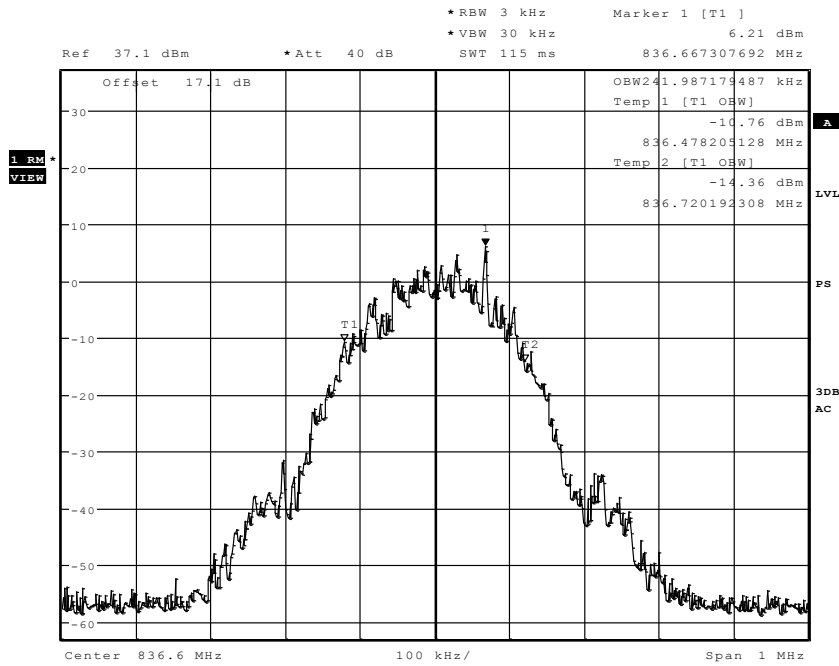
Date: 19.MAR.2012 17:13:45

### GSM850\_OBW-low



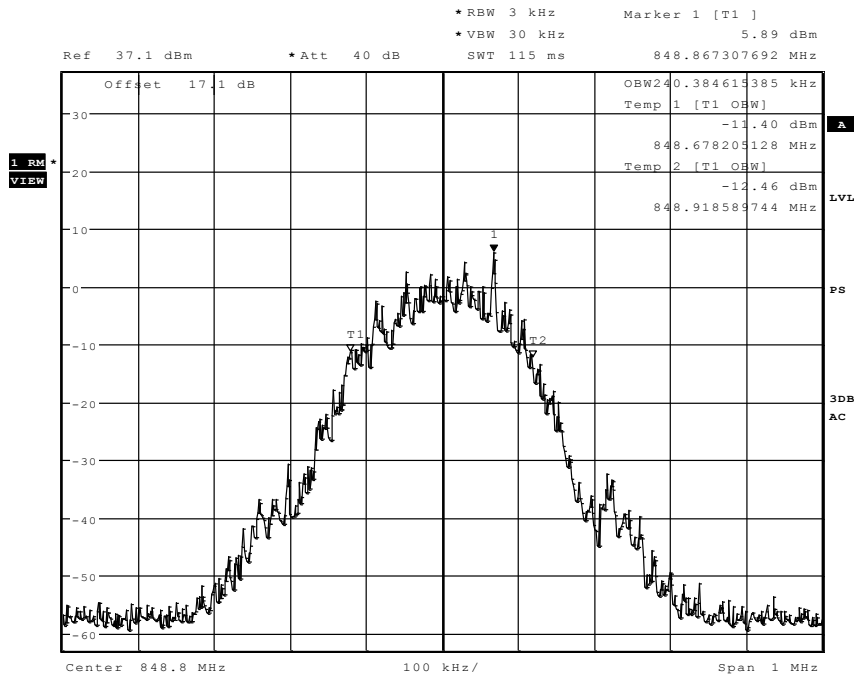
Date: 19.MAR.2012 17:10:15

**GSM850\_OBW-middle**



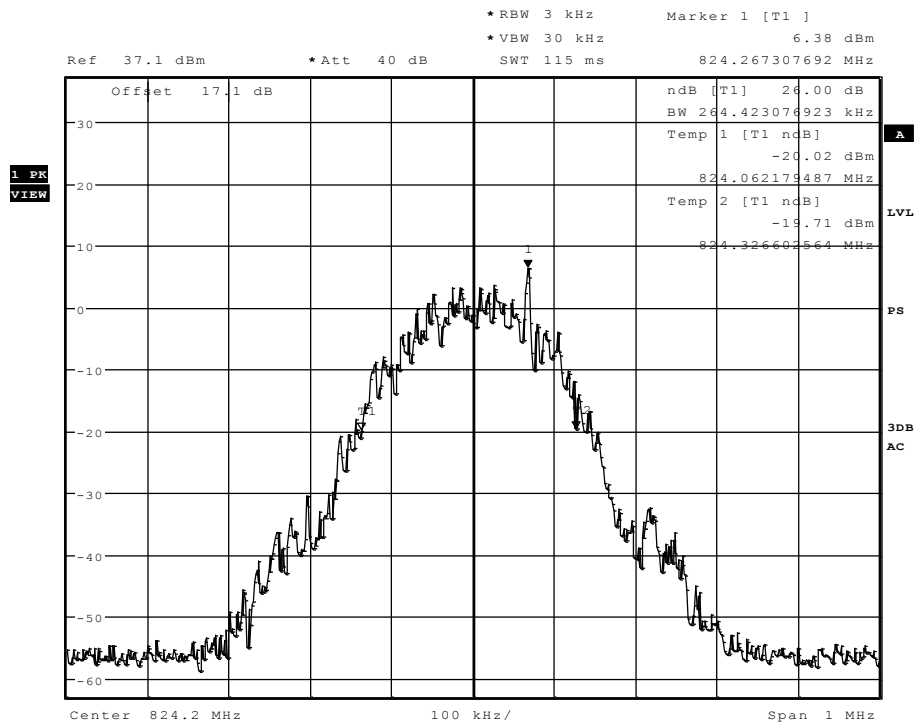
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**GSM850\_OBW-high**



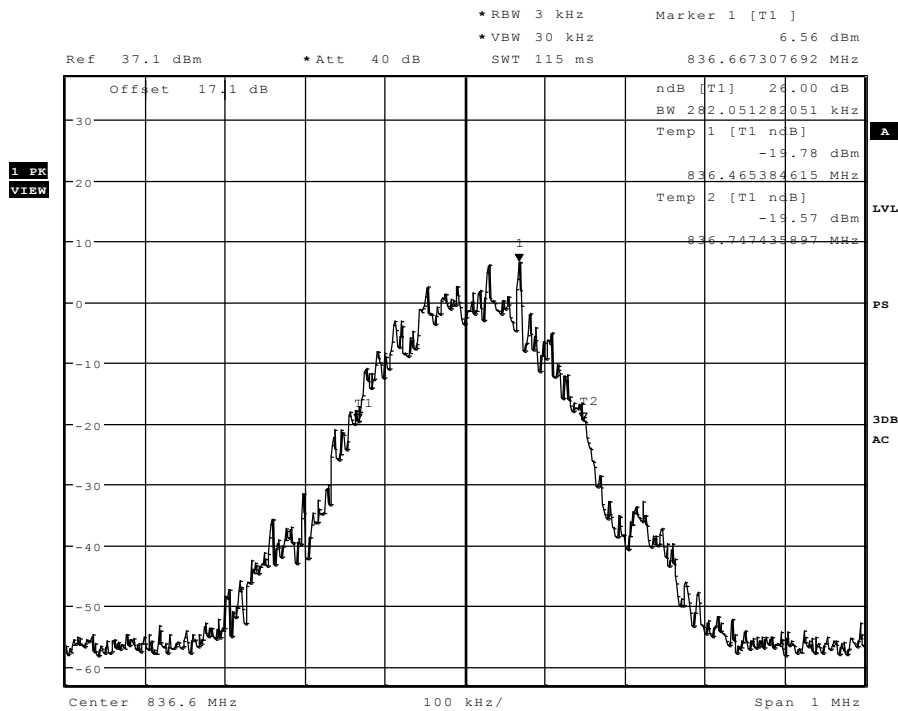
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**EGPRS850-EBW\_low**



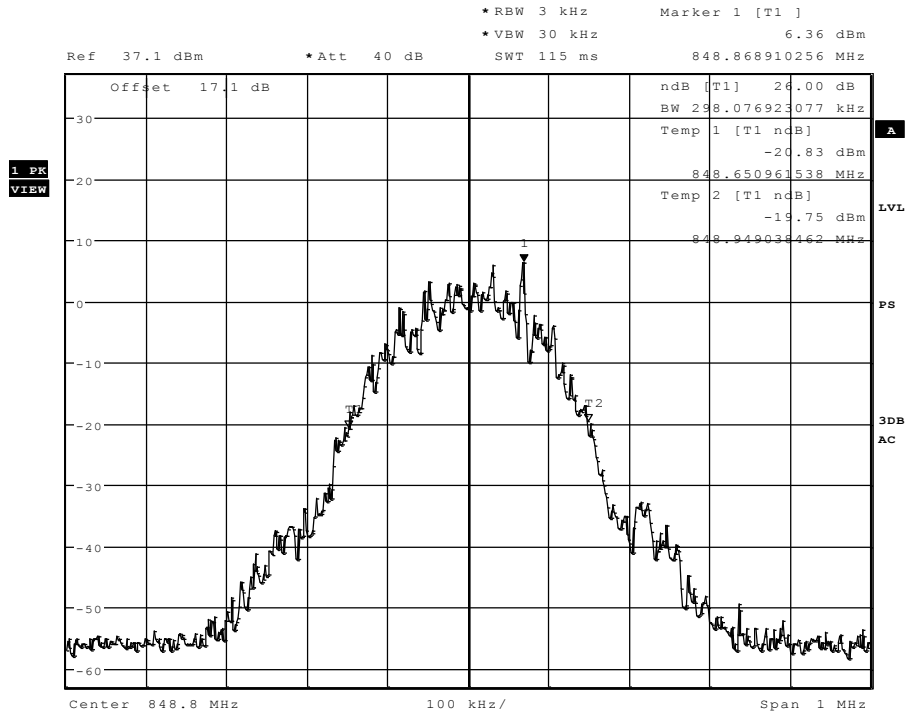
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**EGPRS850-EBW\_middle**



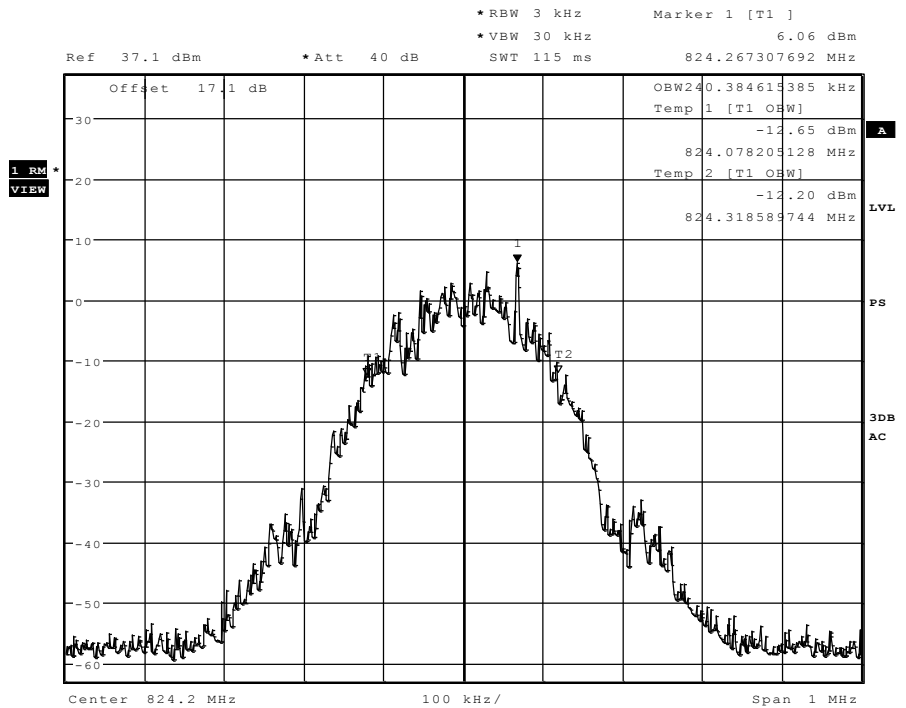
Date: 19.MAR.2012 18:26:32

### EGPRS850-EBW\_high



Date: 19.MAR.2012 18:28:28

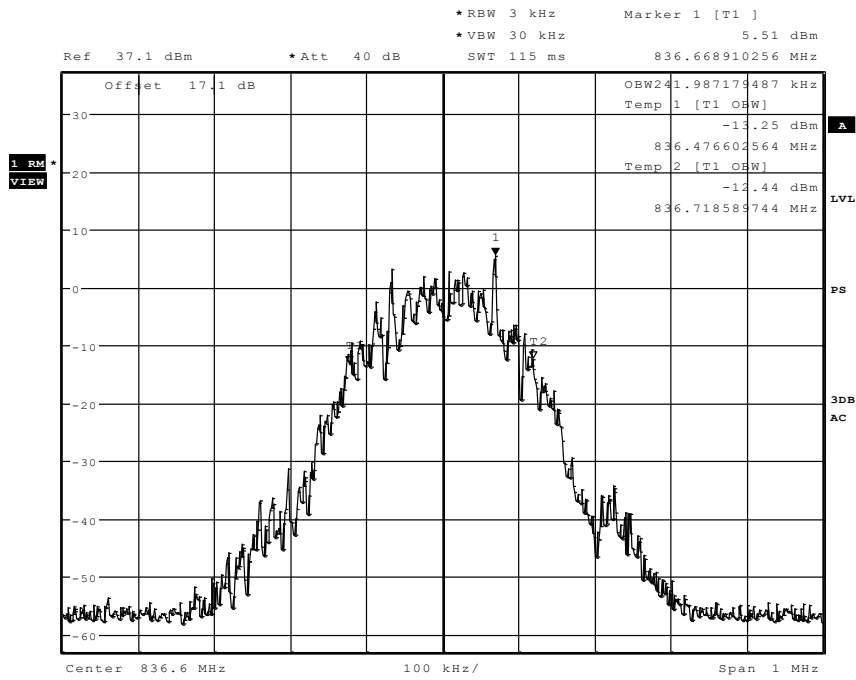
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Date: 19.MAR.2012 18:21:32

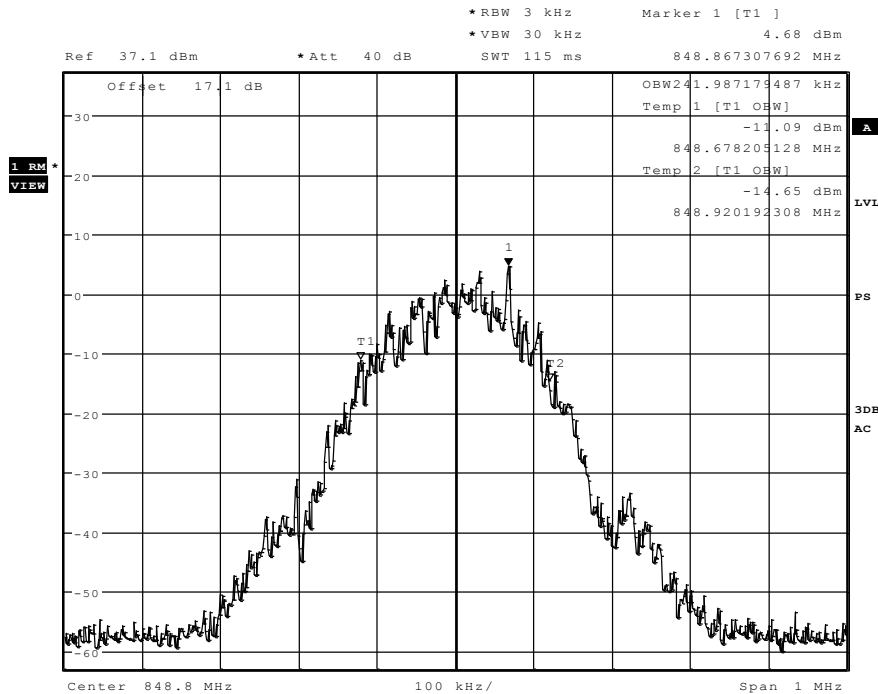


**EGPRS850-OBW\_middle**



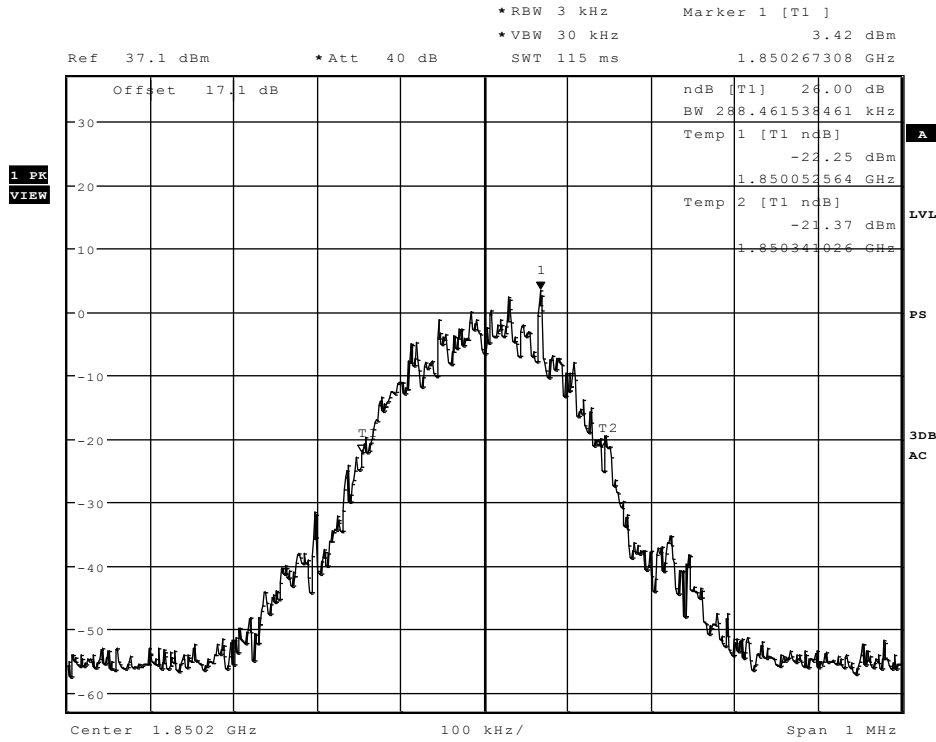
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**EGPRS850-OBW\_high**



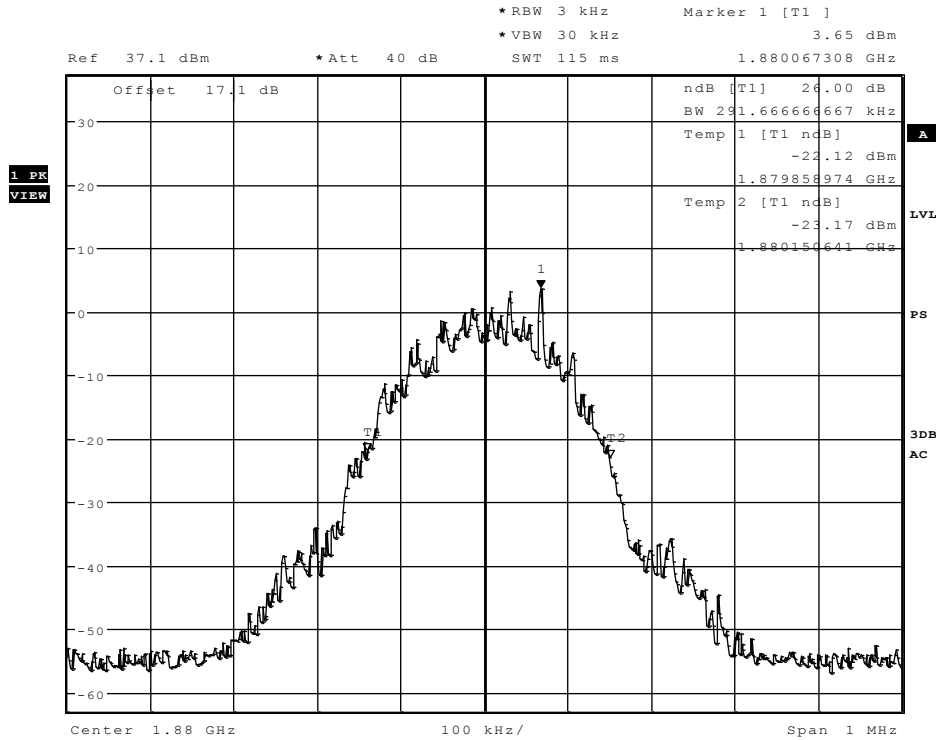
Date: 19.MAR.2012 18:30:40

**GSM1900\_EBW-low**



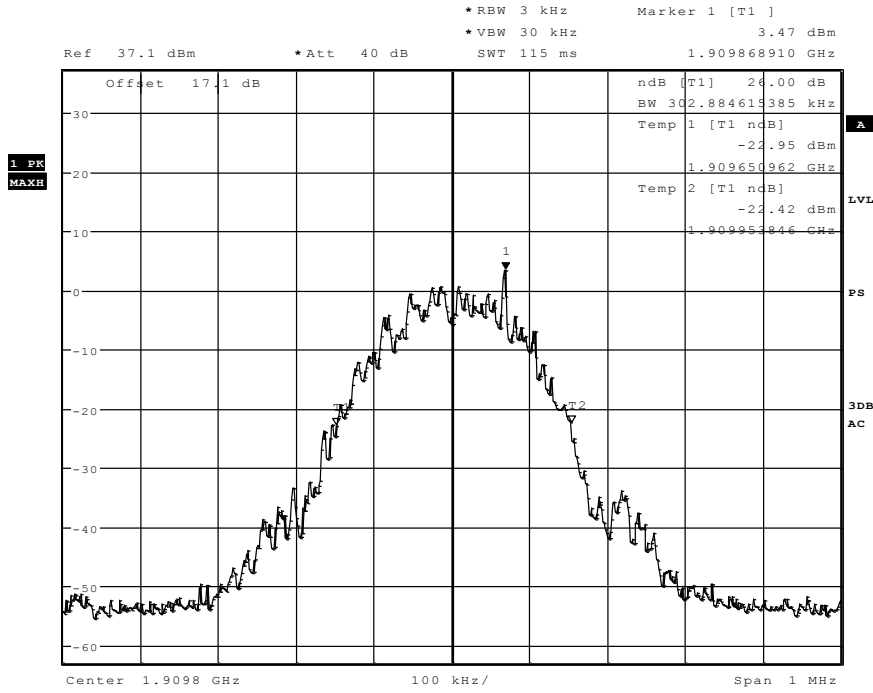
Date: 19.MAR.2012 17:33:57

**GSM1900\_EBW-middle**



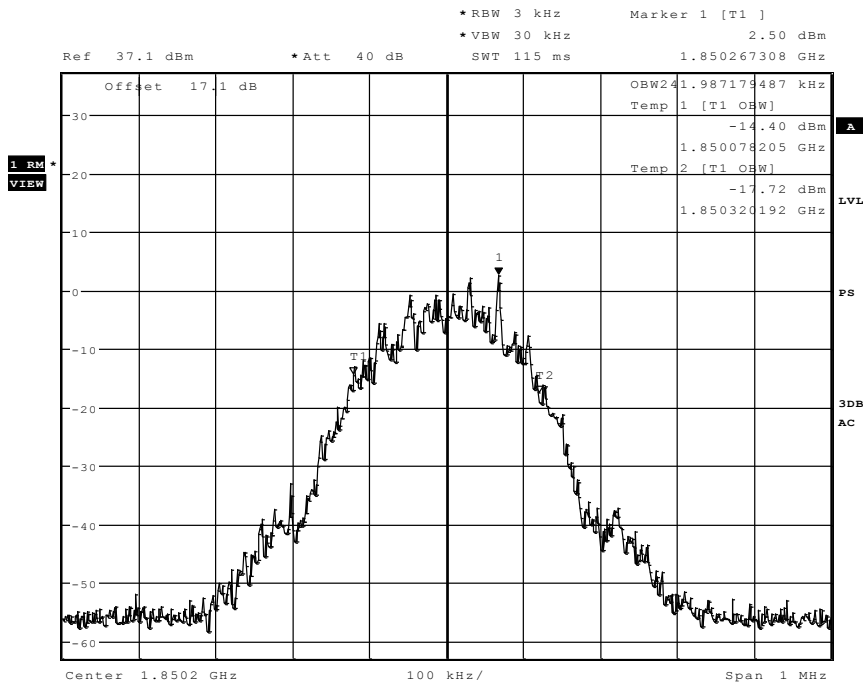
Date: 19.MAR.2012 17:51:09

### GSM1900\_EBW-high



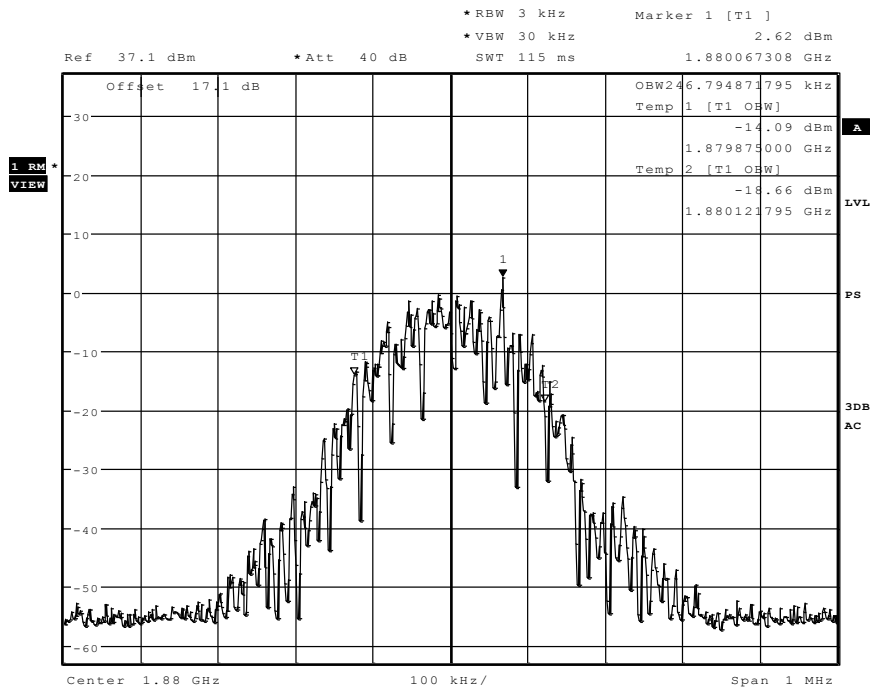
Date: 19.MAR.2012 17:47:18

### GSM1900\_OBW-low



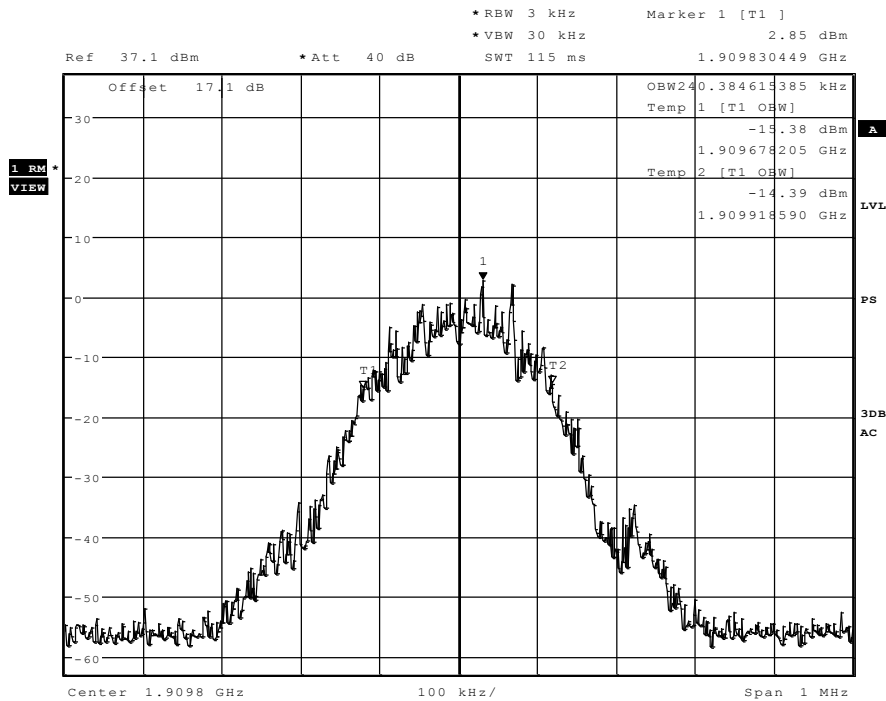
Date: 19.MAR.2012 17:36:09

**GSM1900\_OBW-middle**



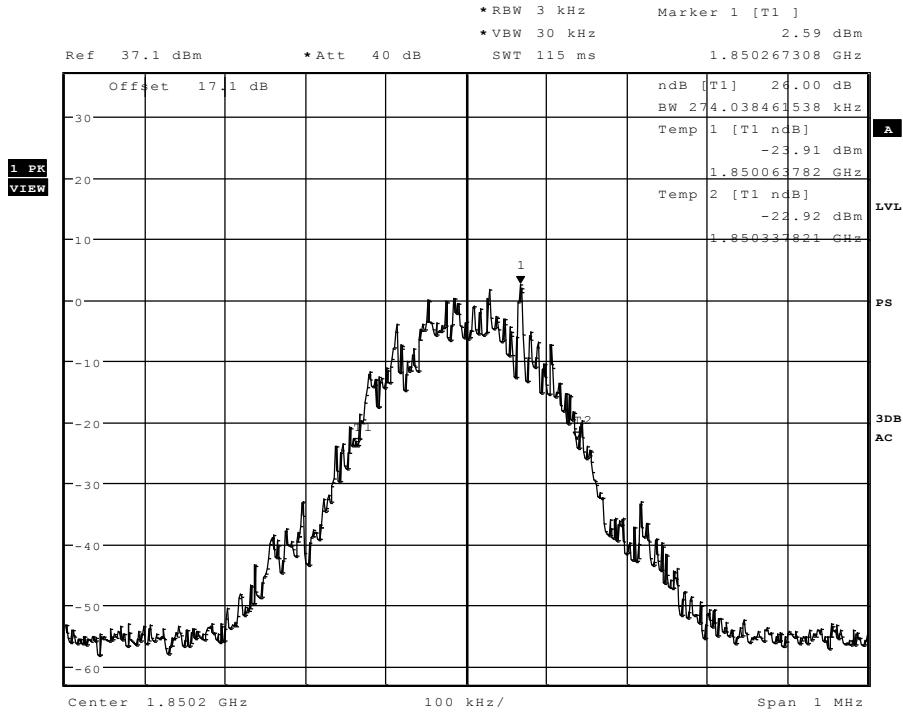
Date: 19.MAR.2012 17:52:56

**GSM1900\_OBW-high**



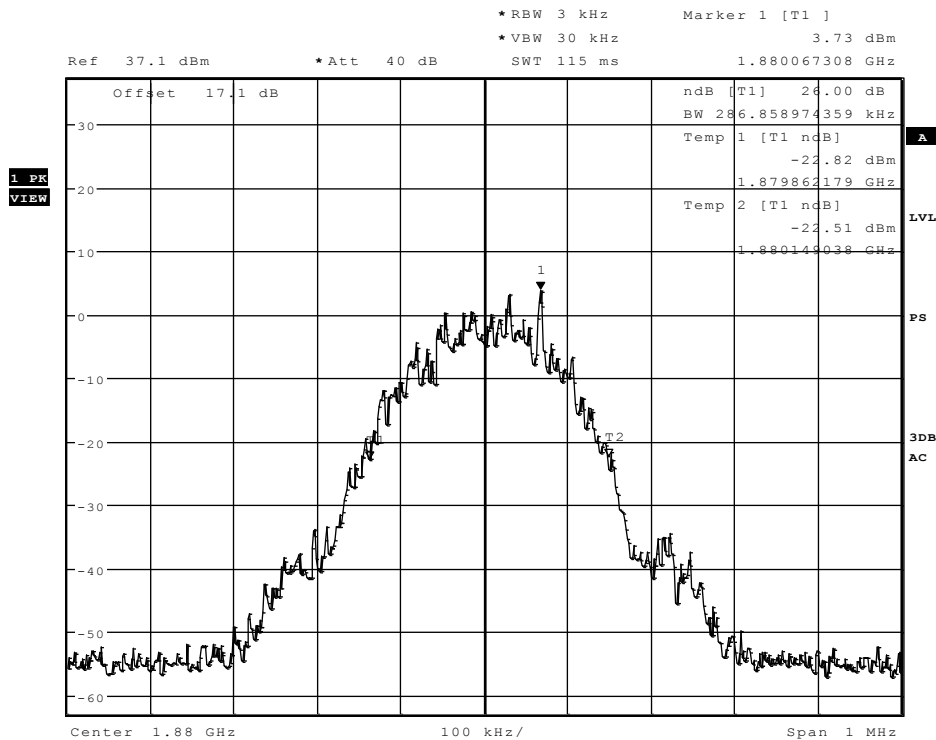
Date: 19.MAR.2012 17:48:56

**EGPRS1900\_EBW-low**



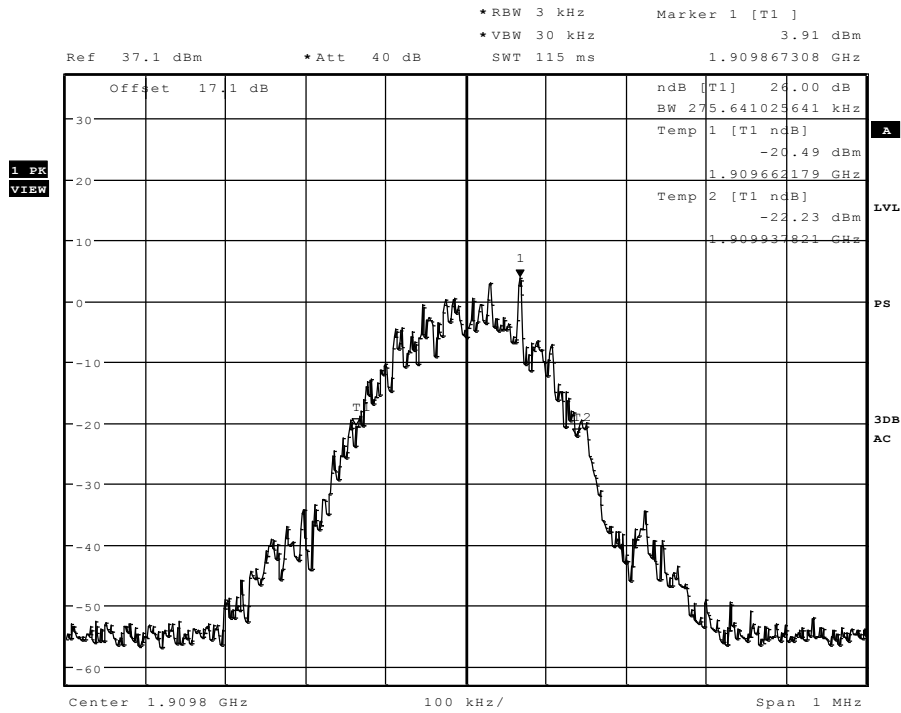
Date: 19.MAR.2012 18:10:33

**EGPRS1900\_EBW-middle**



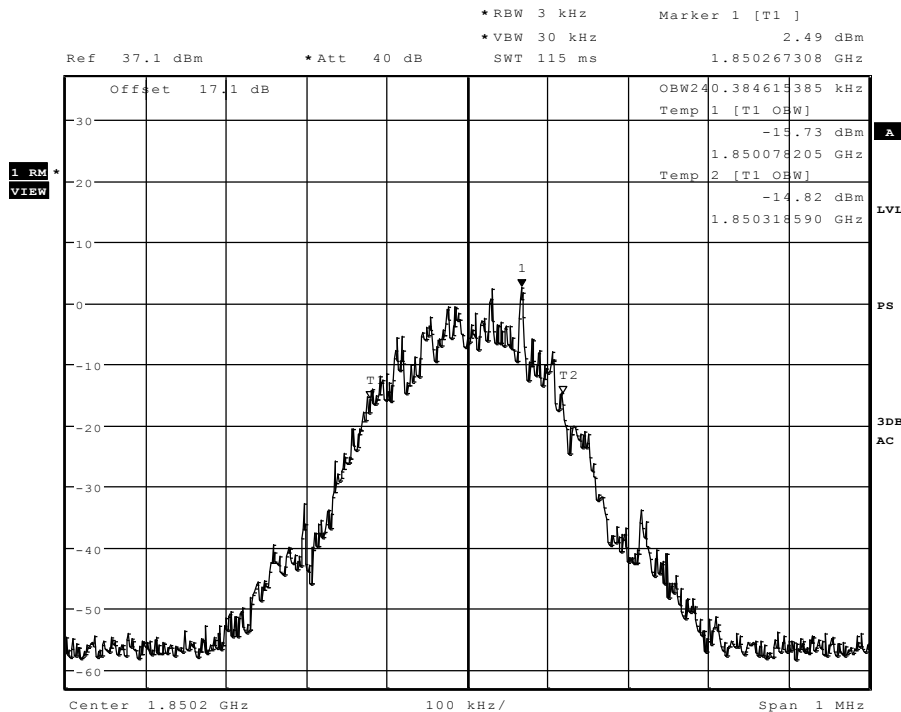
Date: 19.MAR.2012 18:11:40

### EGPRS1900\_EBW-high



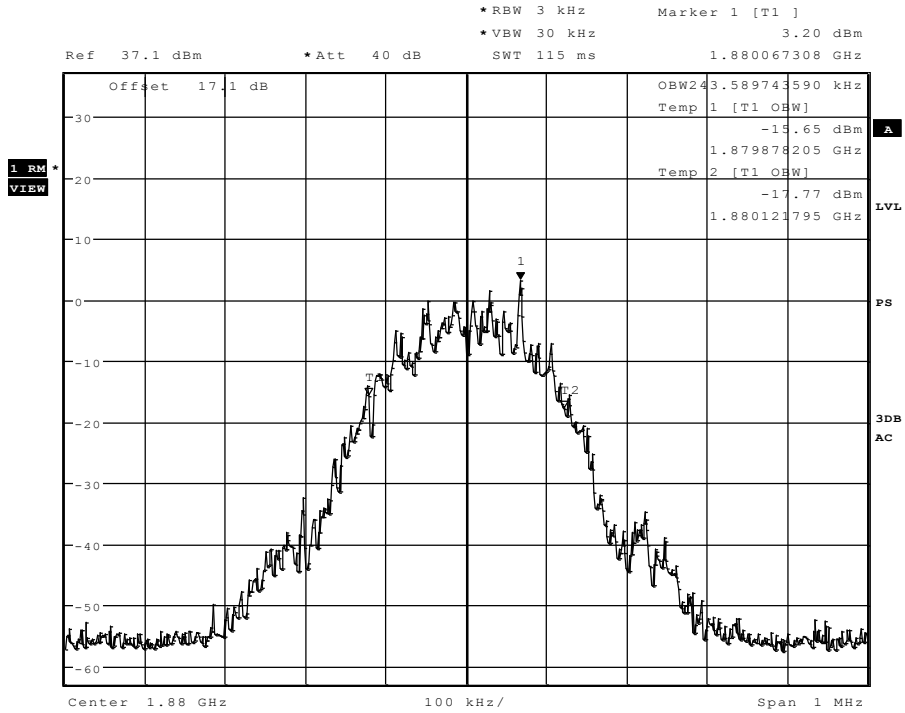
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### EGPRS1900\_OBW-low



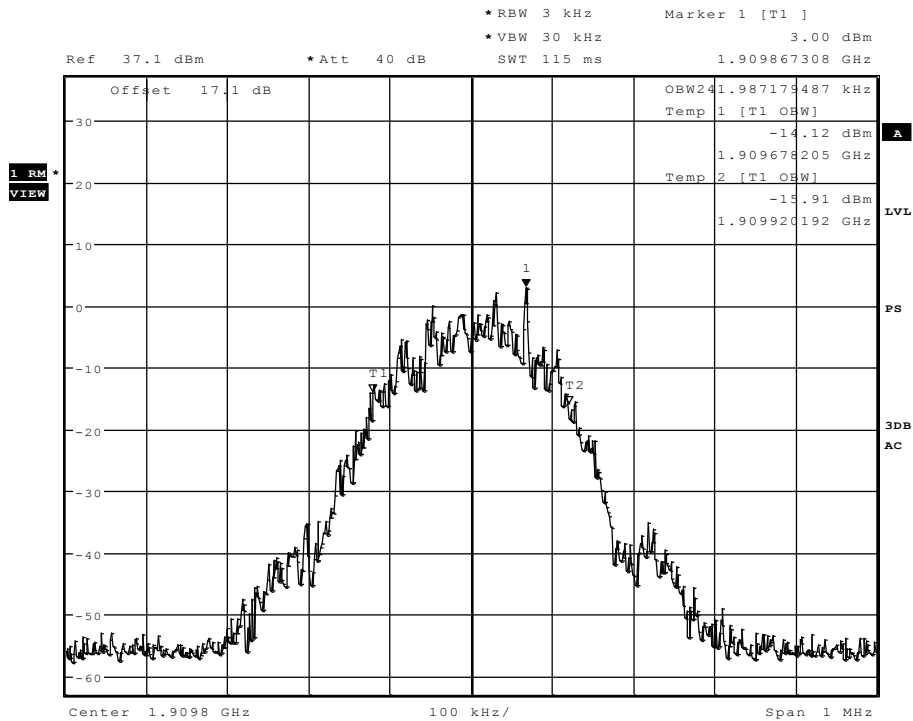
Date: 19.MAR.2012 18:08:45

**EGPRS1900\_OBW-middle**



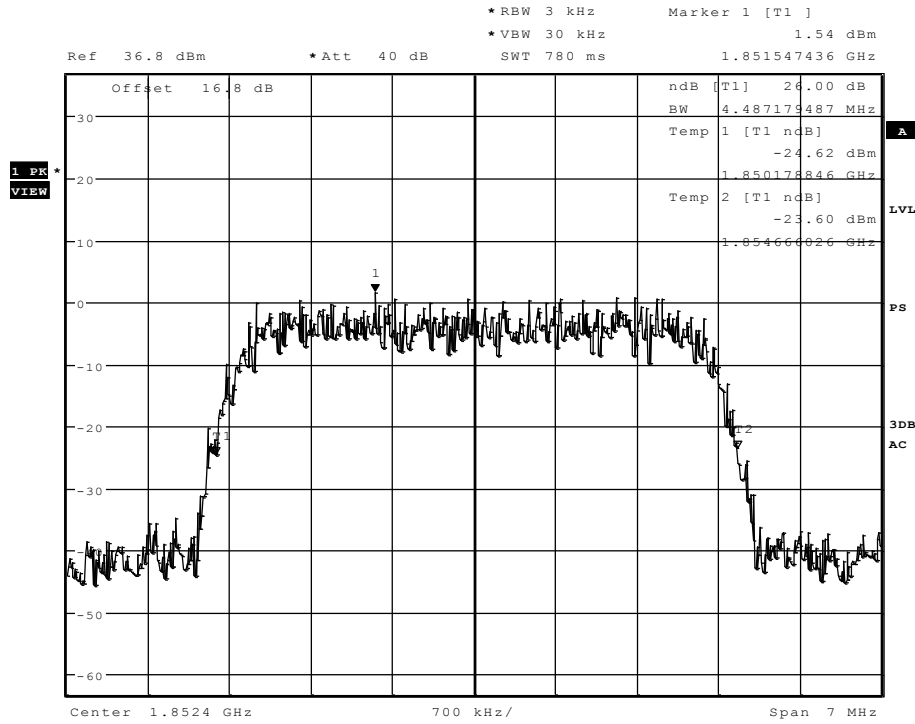
Date: 19.MAR.2012 18:13:22

**EGPRS1900\_OBW-high**



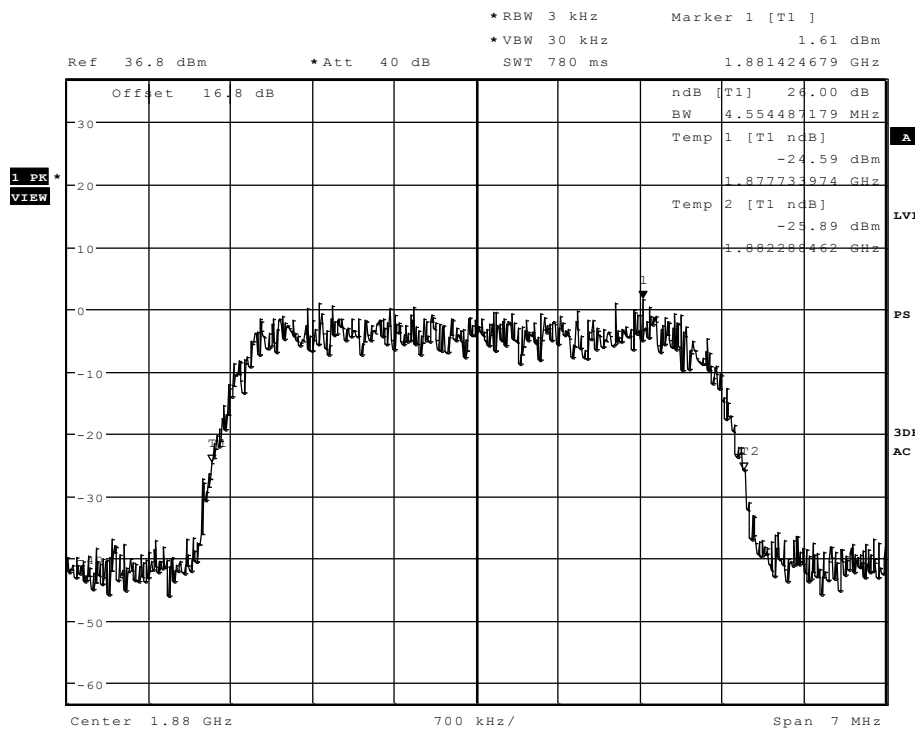
Date: 19.MAR.2012 18:14:33

FDDII-EBW\_low



Date: 19.MAR.2012 15:52:08

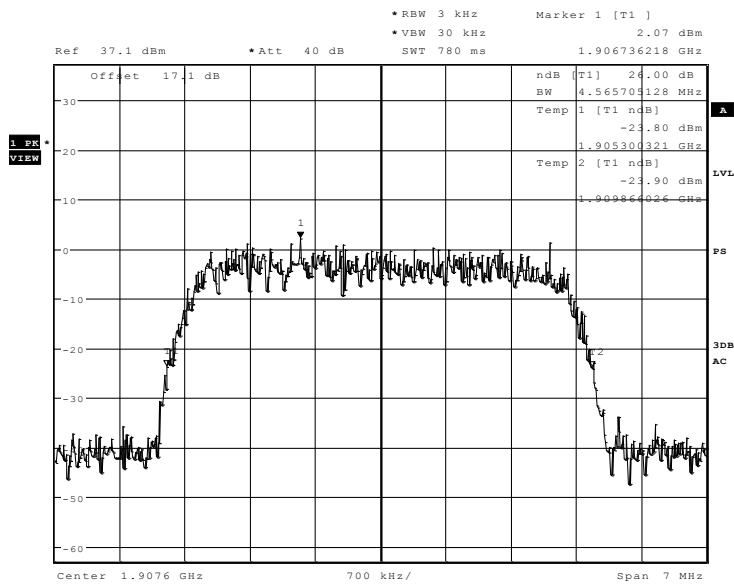
FDDII-EBW\_middle



Date: 19.MAR.2012 15:55:01

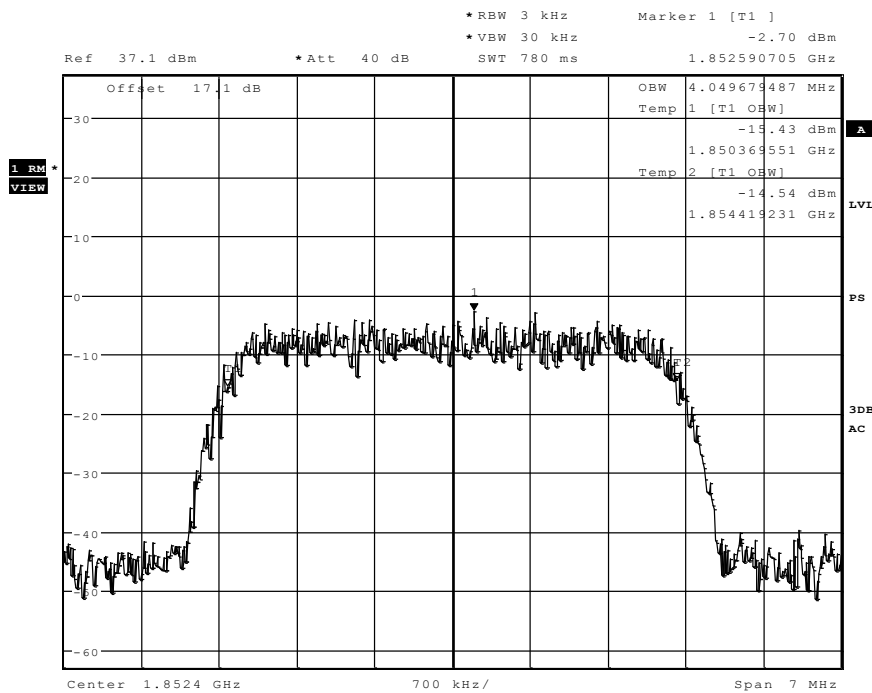


### FDDII-EBW\_high



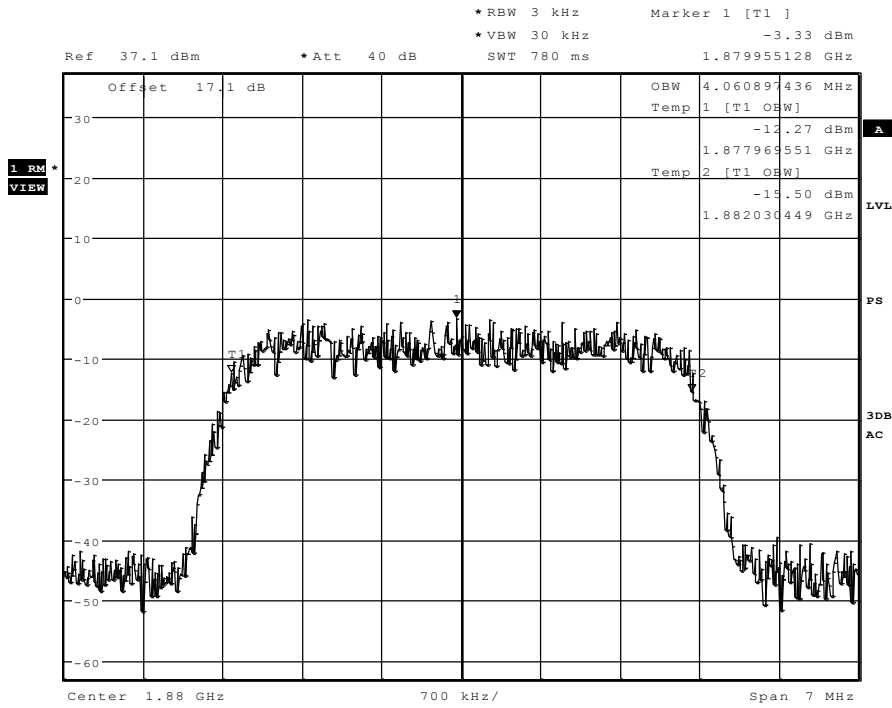
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### FDDII-OBW\_low



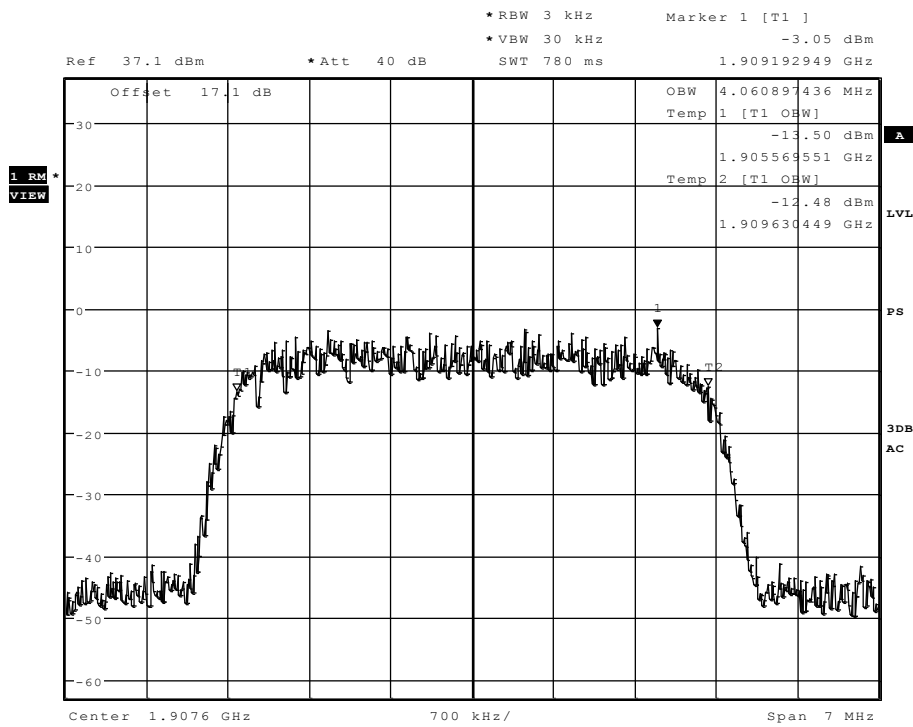
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**FDDII-OBW\_middle**



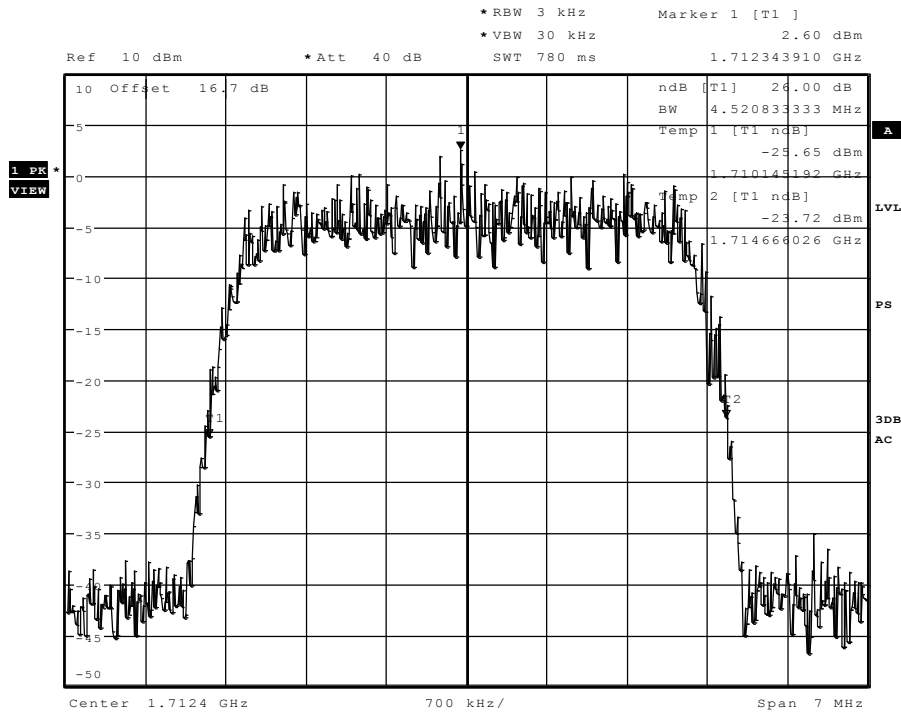
Date: 19.MAR.2012 15:57:34

**FDDII-OBW\_high**



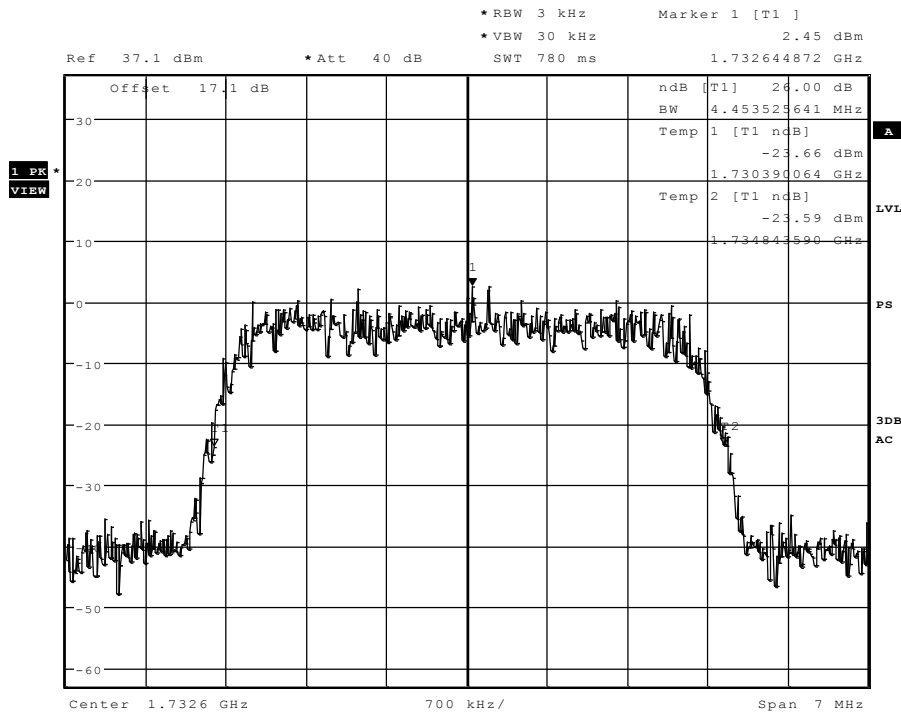
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### FDDIV-EBW\_low



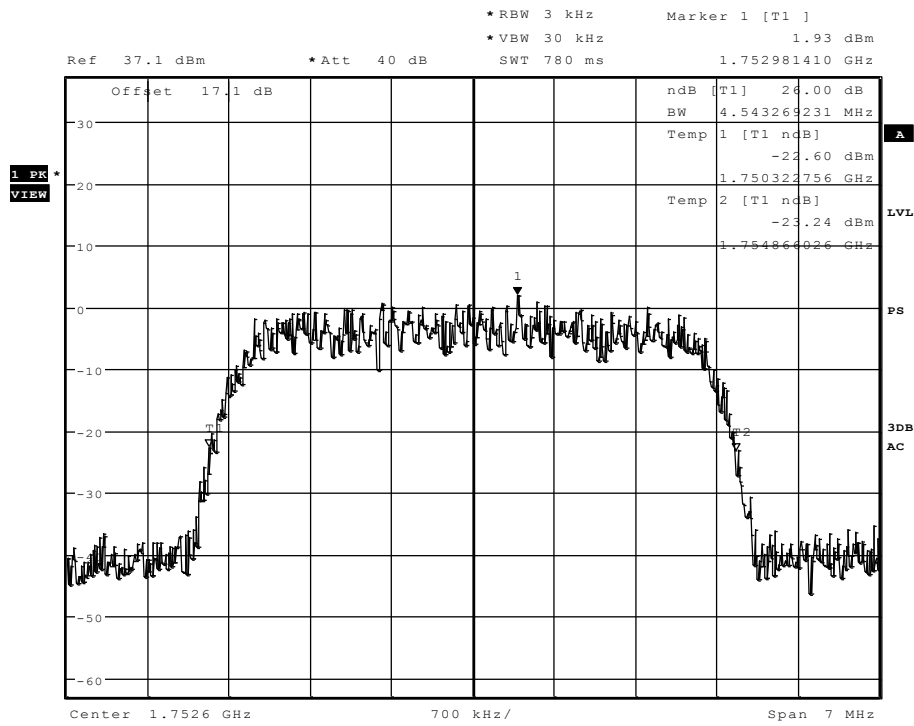
Date: 19.MAR.2012 14:30:38

### FDDIV-EBW\_middle



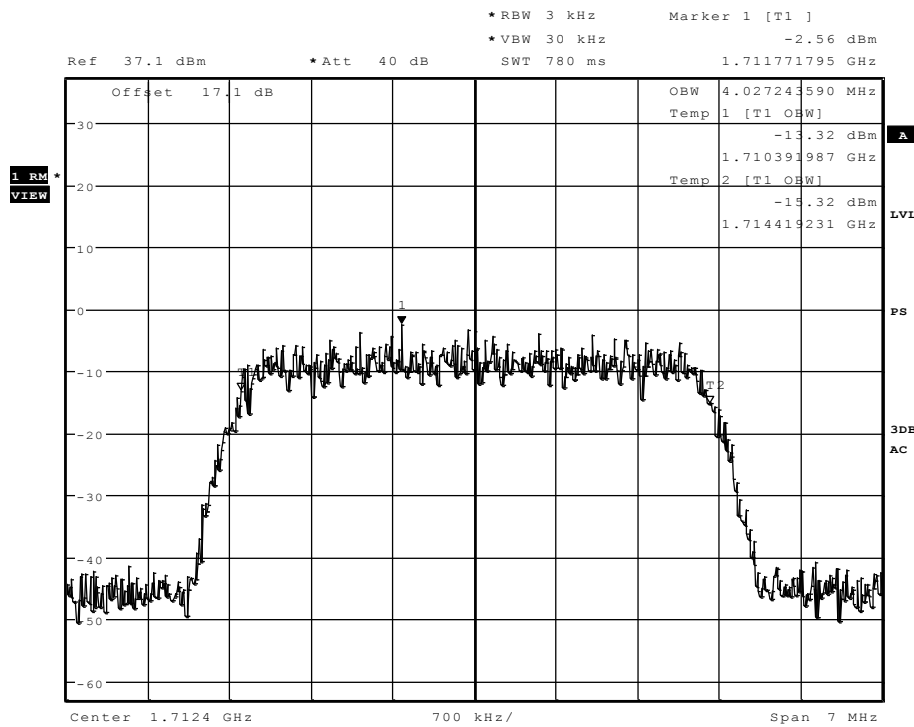
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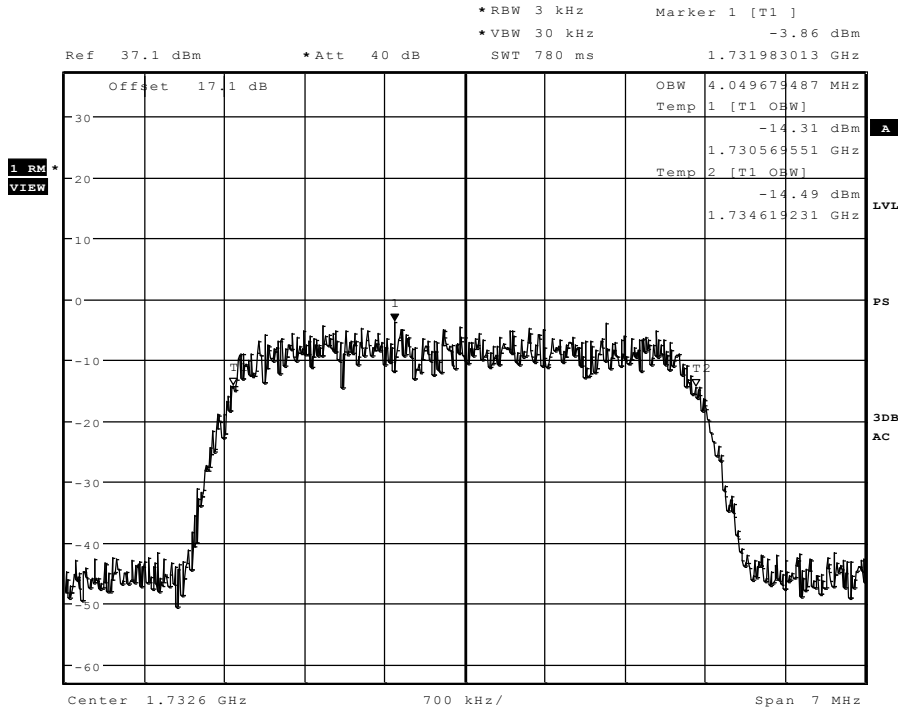
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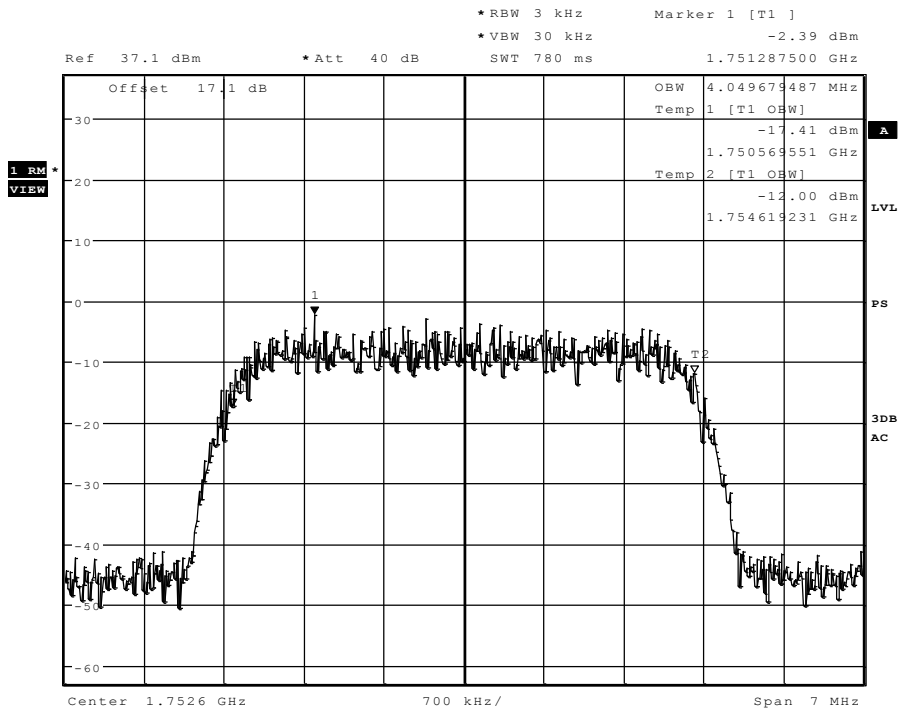
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### FDDIV-OBW\_middle



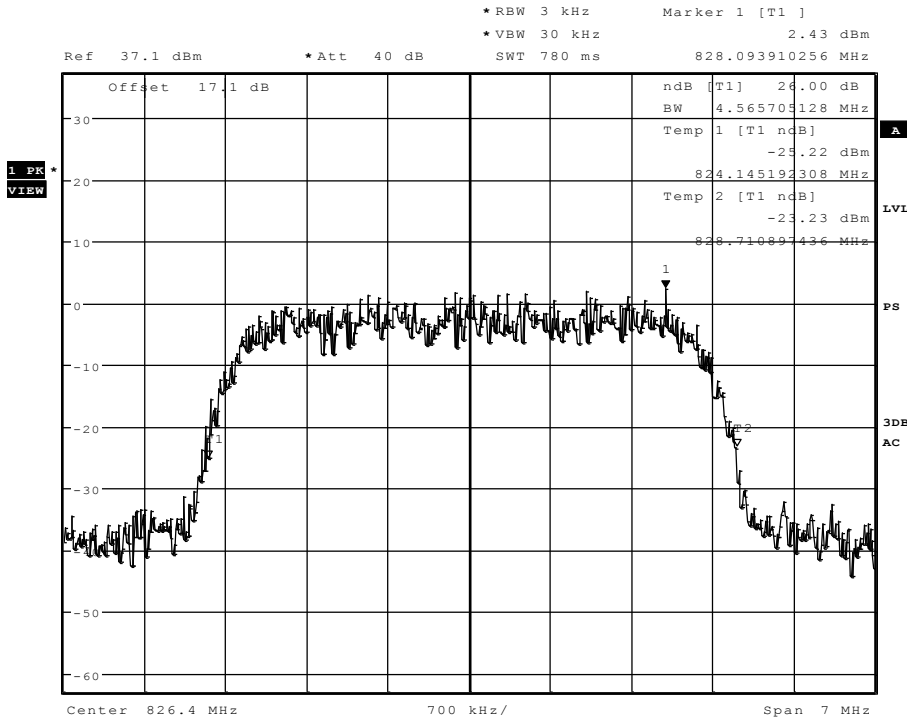
Date: 19.MAR.2012 14:34:29

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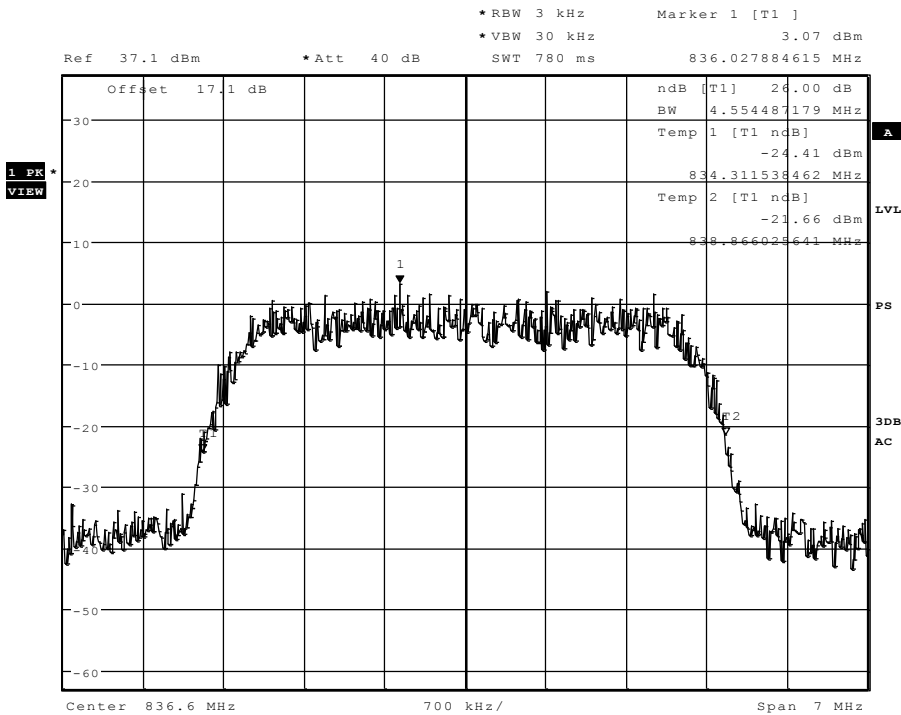
Date: 19.MAR.2012 14:37:13

### FDDV-EBW\_low



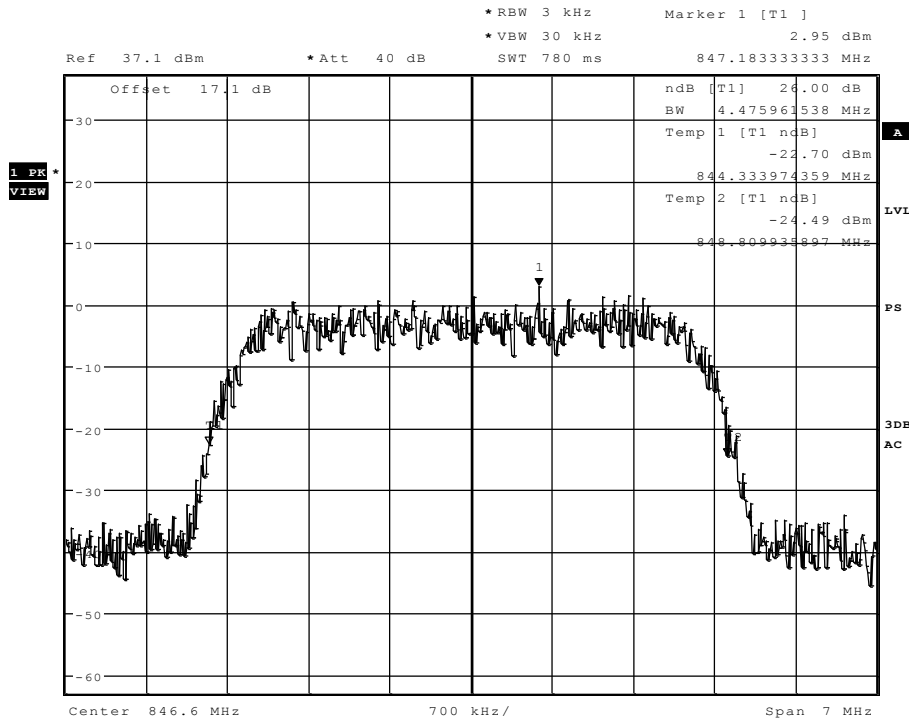
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### FDDV-EBW\_middle



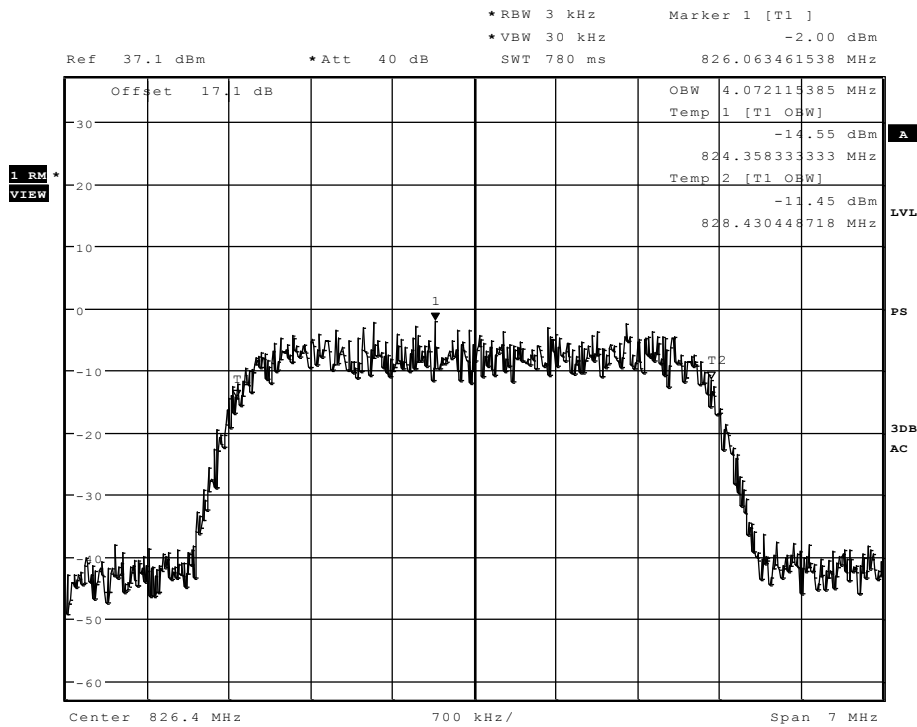
Date: 19.MAR.2012 16:28:41

**FDDV-EBW\_high**



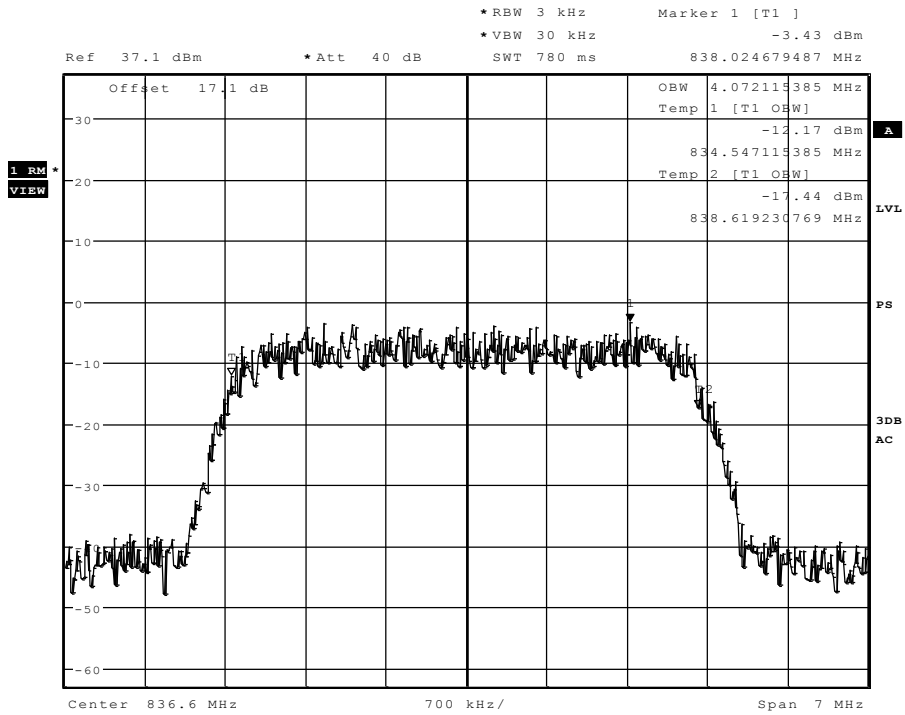
Date: 19.MAR.2012 16:30:38

**FDDV-OBW\_low**



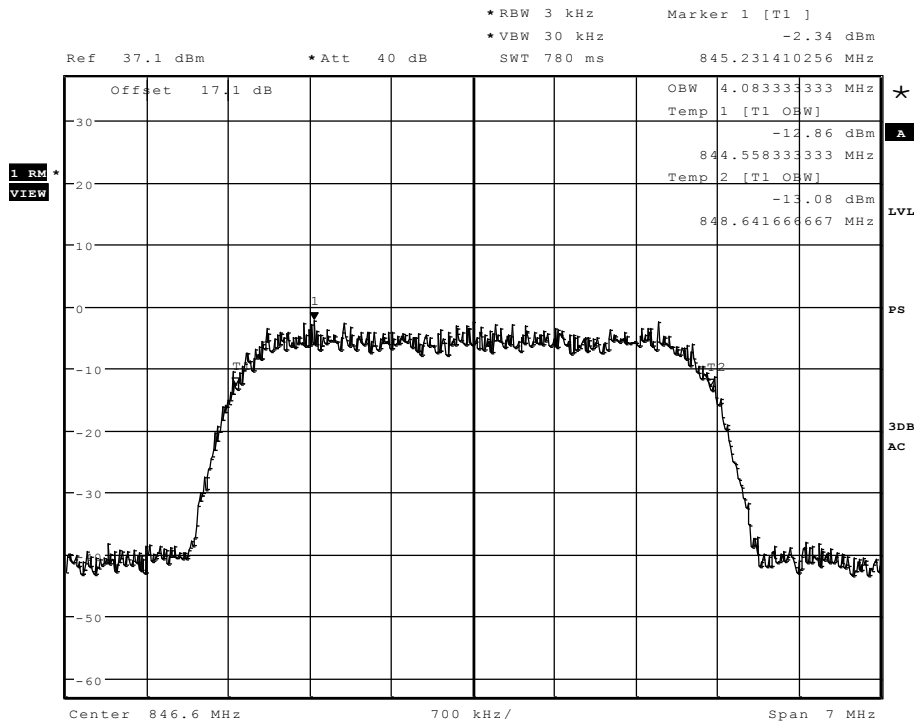
Date: 19.MAR.2012 16:24:36

FDDV-OBW\_middle



Date: 19.MAR.2012 16:26:39

FDDV-OBW\_high



Date: 19.MAR.2012 16:33:13



## 5.8. Frequency stability on temperature and voltage variations

### 5.8.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

test location	<input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)	<input type="checkbox"/> Please see Chapter. 2.2.2	<input type="checkbox"/> Please see Chapter. 2.2.3
test site	<input type="checkbox"/> 441 EMI SAR	<input type="checkbox"/> 487 SAR NSA	<input checked="" type="checkbox"/> 347 Radio.lab.
receiver	<input type="checkbox"/> 377 ESCS30	<input type="checkbox"/> 001 ESS	<input type="checkbox"/> 489 ESU 40
spectr. analys.	<input type="checkbox"/> 584 FSU	<input type="checkbox"/> 120 FSEM	<input type="checkbox"/> 264 FSEK
antenna	<input type="checkbox"/> 574 BTA-L	<input type="checkbox"/> 133 EMCO3115	<input type="checkbox"/> 302 BBHA9170
signaling	<input type="checkbox"/> 392 MT8820A	<input type="checkbox"/> 436 CMU	<input checked="" type="checkbox"/> 547 CMU
otherwise	<input type="checkbox"/> 400 FTC40x15E	<input type="checkbox"/> 401 FTC40x15E	<input type="checkbox"/> 110 USB LWL
DC power	<input type="checkbox"/> 456 EA 3013A	<input type="checkbox"/> 457 EA 3013A	<input type="checkbox"/> 459 EA 2032-50
Climatic test chamber	<input checked="" type="checkbox"/> 331 HC 4055		
line voltage	<input type="checkbox"/> 230 V 50 Hz via public mains	<input type="checkbox"/> 060 110 V 60 Hz via PAS 5000	

### 5.8.2. Standards and References:

FCC: §2.1055(a)(2), §22.355, §24.235, §27.54

IC: RSS-GEN issue 3: 7.2.6, RSS-132: 4.3, RSS-133: 6.3, RSS-139: 6.3

#### §22.355 Table C-1;

*“The frequency stability shall be sufficient to ensure that the fundamental emission stays within  $\pm 2.5$  ppm in Hz of frequency block”*

#### § 24.235, §27.54:

*The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation*

### 5.8.3. Test condition and measurement test set-up

link to test system (if used):	<input type="checkbox"/> air link	<input checked="" type="checkbox"/> cable connection	<input type="checkbox"/>
Climatic conditions	Temperature: (22±3°C)		Rel. humidity: (40±20)%

## LIMIT

As the limit is not specified in detail for FDD Band II/IV, it was fixed to an limit according 3GPP34.121 ( $0.1 \times f \times 10^{-06}$ ) Hz (0.1ppm), where f the frequency [Hz] of the transmitting equipment

## TEST SET-UP

In order to maintain the voltage constant over the time period of the tests, a dummy battery was connected to a laboratory power supply. The power supply voltage was controlled on the input of the power supply terminals of the EUT.

A conducted measurement test set-up like described in chapter 4.1 was used.

## MOBILE PHONE SETTINGS

The measurements were made at the upper, middle, and lower carrier frequencies of the operating band. Choosing three representative TX-carrier frequencies of the mobile phone within each operable GSM band, should be sufficient to demonstrate compliance.

A call was established with settings according chapter 3.7

## TEST METHOD

The RF Channel spacing is 200 kHz, with a guard band of 200 kHz of each band of the sub-bands. The aim of the EUT is to function under all extreme conditions within authorized sub-bands in regard to temperature and voltage variations. The frequency deviation was recorded with base station’s build in capability. (CMU) As the standard requires that the fundamental emissions stays within the authorized band, a limit of 2.5 for G850/FDDV and 0.1ppm for 1900/FDDII/FDDIV bands is considered low enough to ensure this.

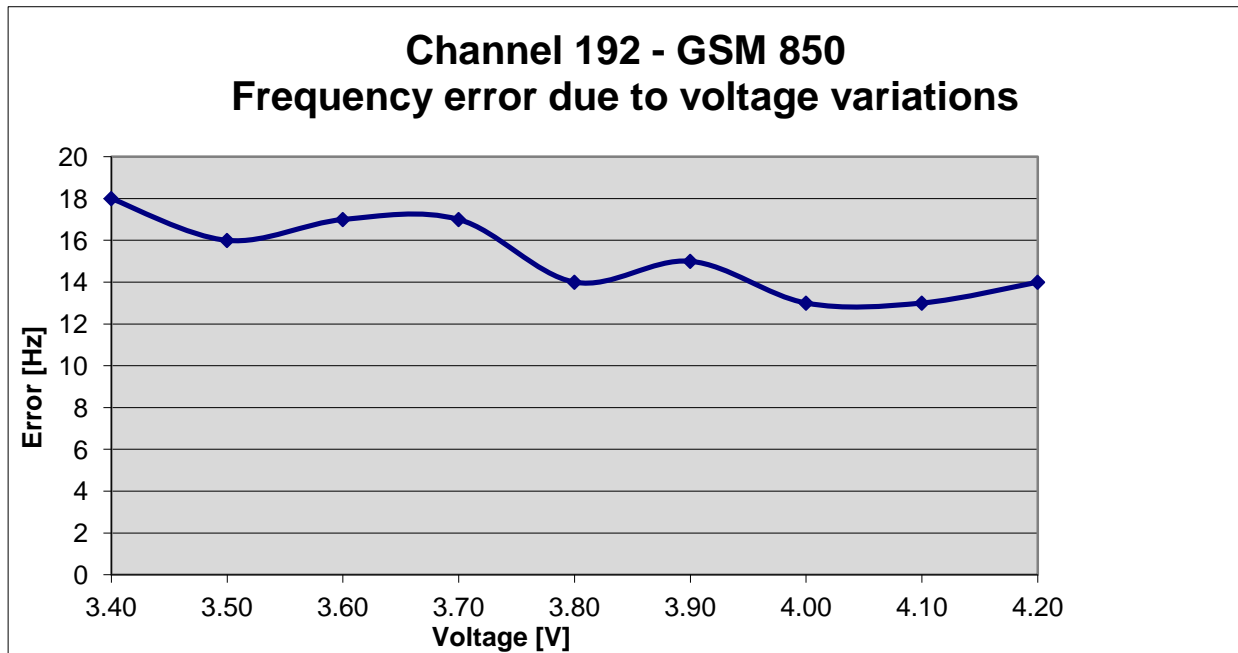
**5.8.4. Frequency shift of carrier against a voltage range at constant nominal temperature of 20° Celsius**

- 1.) determine the carrier frequency for the middle channel at room temperature and nominal voltage [20°C]
- 2.) The voltage was reduced in 0.1V steps to the lower end point, where the mobile phone stops working. (this shall be specified by the manufacturer) Record the carrier frequency shift within 2 minutes after powering on the mobile phone, to prevent for self heating effects.
- 3.) The voltage was increased in 0.1V steps to the upper declared voltage of the battery. Record the carrier frequency shift within 2 minutes after powering on the mobile phone, to prevent for self heating effects.

**5.8.4.1.RESULTS**

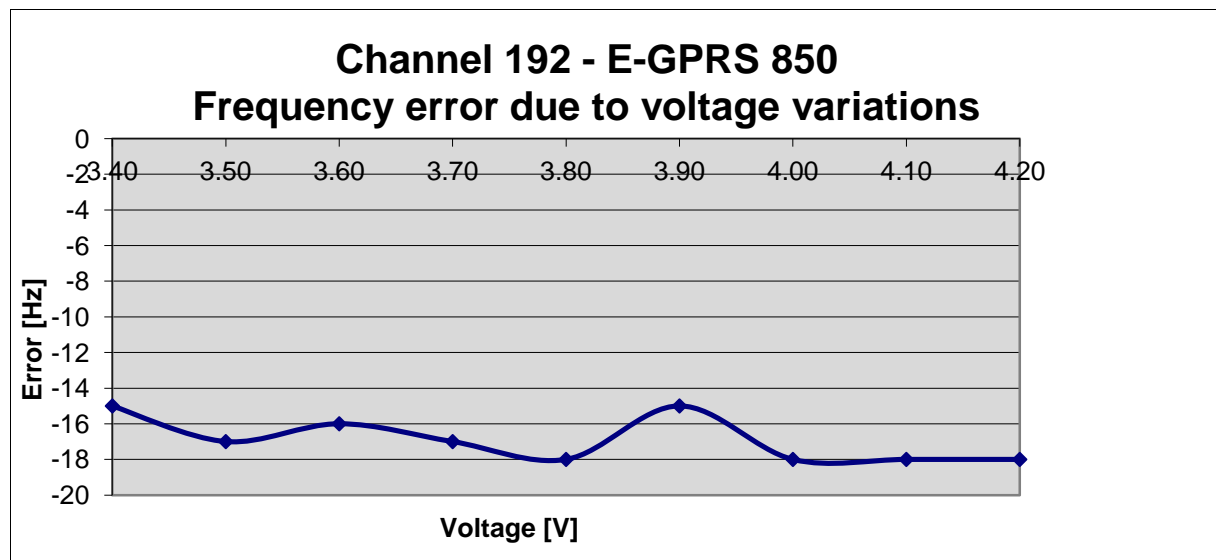
**5.8.4.2. GSM 850 Mode: Op. Mode 1, set-up 2**

Voltage [V]	Nominal Frequency [Hz]	Maximum frequency error		Verdict
		[Hz]	[ppm]	
				Limit=±2.5ppm
3.40	837000000	18	0.022	Passed
3.50		16	0.019	
3.60		17	0.020	
3.70		17	0.020	
3.80		14	0.017	
3.90		15	0.018	
4.00		13	0.016	
4.10		13	0.016	
4.20		14	0.017	



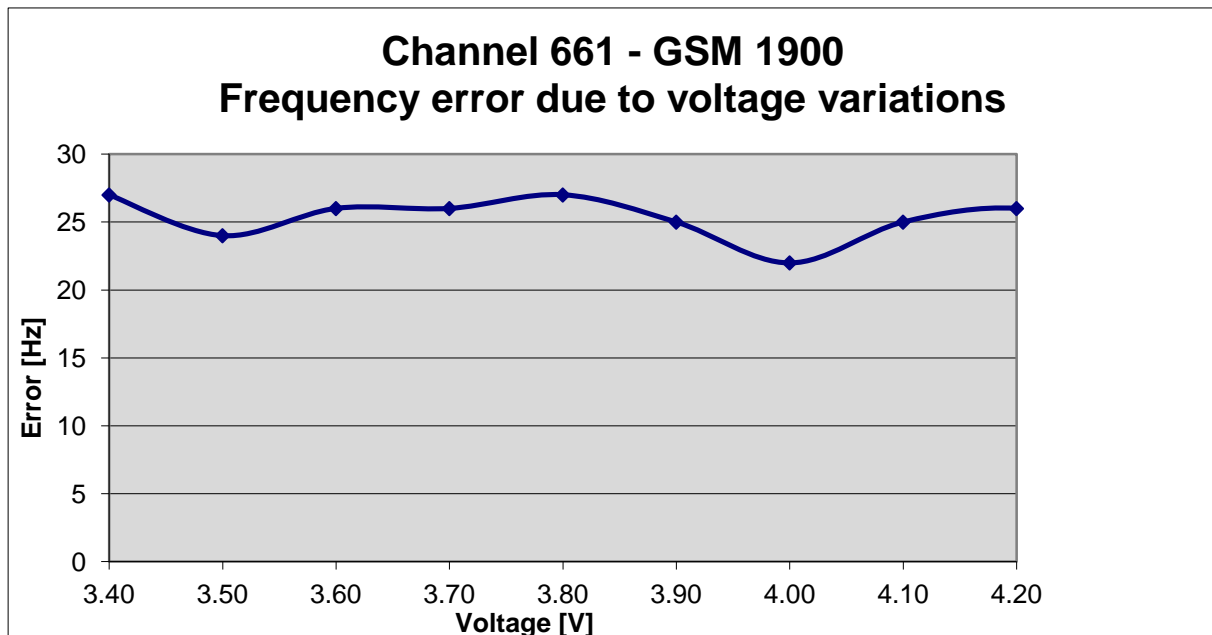
**5.8.4.3. E-GPRS G850 Mode: Op. Mode 2, set-up 1**

Voltage [V]	Nominal Frequency [Hz]	Maximum frequency error		Verdict Limit=±2.5ppm	
		[Hz]	[ppm]		
3.40	837000000	-15	-0.018	Passed	
3.50		-17	-0.020		
3.60		-16	-0.019		
3.70		-17	-0.020		
3.80		-18	-0.022		
3.90		-15	-0.018		
4.00		-18	-0.022		
4.10		-18	-0.022		
4.20		-18	-0.022		



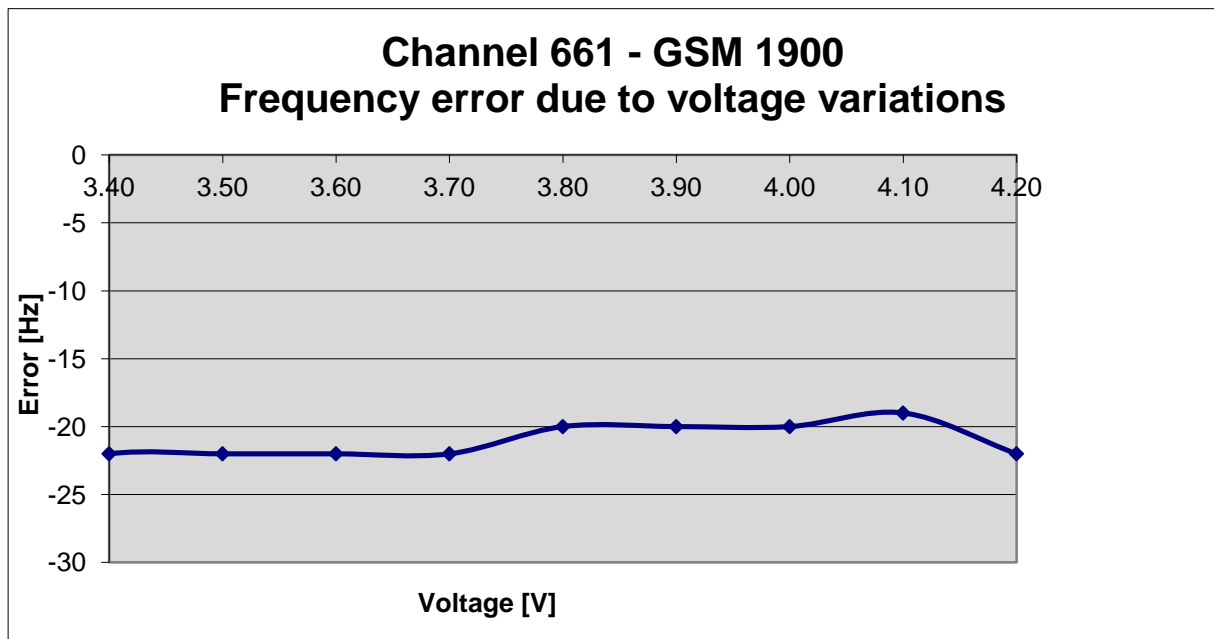
**5.8.4.4. GSM PCS 1900 Mode: Op. Mode 3, set-up 2**

Voltage [V]	Nominal Frequency [Hz]	Maximum frequency error		Verdict Limit=±0.1ppm
		[Hz]	[ppm]	
	1880000000			Passed
3.40		27	0.014	
3.50		24	0.013	
3.60		26	0.014	
3.70		26	0.014	
3.80		27	0.014	
3.90		25	0.013	
4.00		22	0.012	
4.10		25	0.013	
4.20		26	0.014	
4.30		24	0.013	



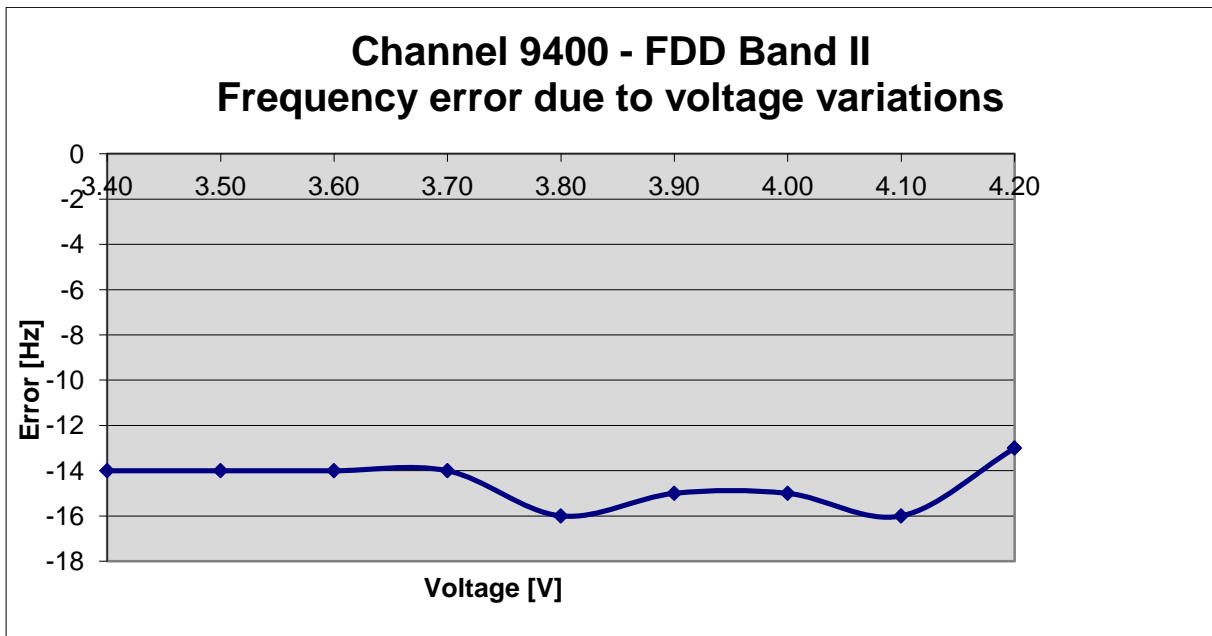
**5.8.4.5. EGPRS PCS 1900 Mode: Op. Mode 4, set-up 2**

Voltage [V]	Nominal Frequency [Hz]	Maximum frequency error		Verdict Limit=±0.1ppm
		[Hz]	[ppm]	
3.30	1880000000	-24	-0.013	Passed
3.40		-22	-0.012	
3.50		-22	-0.012	
3.60		-22	-0.012	
3.70		-22	-0.012	
3.80		-20	-0.011	
3.90		-20	-0.011	
4.00		-20	-0.011	
4.10		-19	-0.010	
4.20		-22	-0.012	



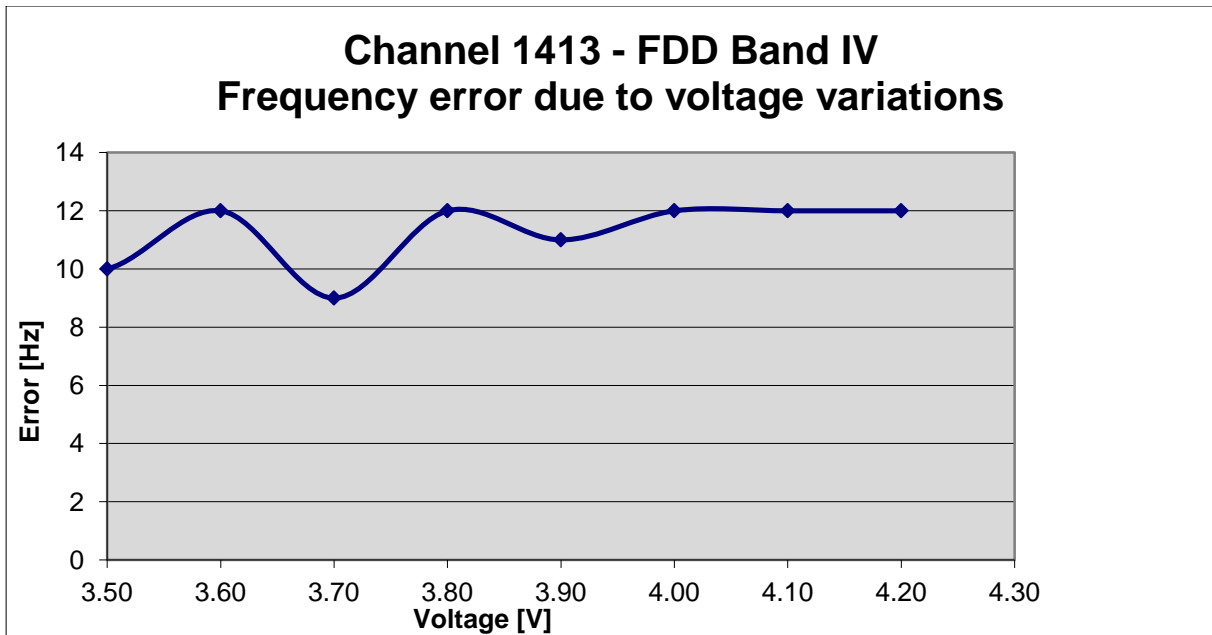
**5.8.4.6. FDD II Mode: Op. Mode 5, set-up 2**

Voltage [V]	Nominal Frequency [Hz]	Maximum frequency error		Verdict
		[Hz]	[ppm]	
				Limit=±0.1ppm
3.40	1880000000	-14	-0.007	Passed
3.50		-14	-0.007	
3.60		-14	-0.007	
3.70		-14	-0.007	
3.80		-16	-0.009	
3.90		-15	-0.008	
4.00		-15	-0.008	
4.10		-16	-0.009	
4.20		-13	-0.007	



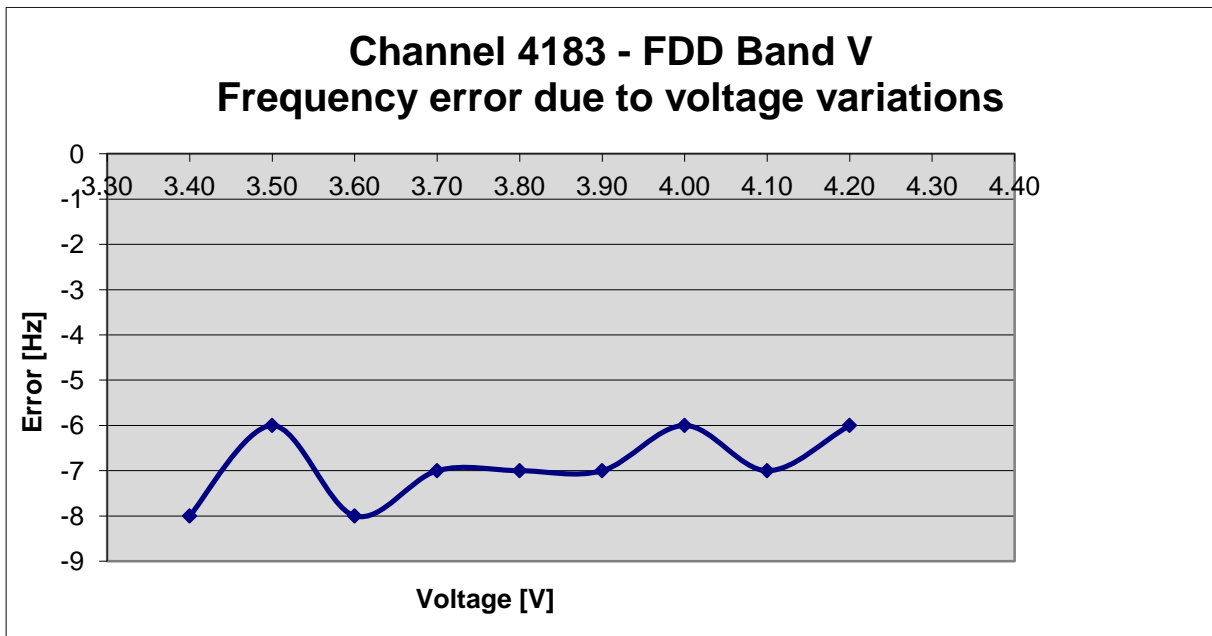
**5.8.4.7. FDD IV Mode: Op. Mode 6, set-up 2**

Voltage [V]	Nominal Frequency [Hz]	Maximum frequency error		Verdict
		[Hz]	[ppm]	
				Limit=±0.1ppm
3.40	1732600000	10	0.006	Passed
3.50		10	0.006	
3.60		12	0.007	
3.70		9	0.005	
3.80		12	0.007	
3.90		11	0.006	
4.00		12	0.007	
4.10		12	0.007	
4.20		12	0.007	



**5.8.4.8. FDD V Mode: Op. Mode 7, set-up 2**

Voltage [V]	Nominal Frequency [Hz]	Maximum frequency error		Verdict
		[Hz]	[ppm]	
				Limit=±0.1ppm
3.40	836600000	-8	-0.010	Passed
3.50		-6	-0.007	
3.60		-8	-0.010	
3.70		-7	-0.008	
3.80		-7	-0.008	
3.90		-7	-0.008	
4.00		-6	-0.007	
4.10		-7	-0.008	
4.20		-6	-0.007	



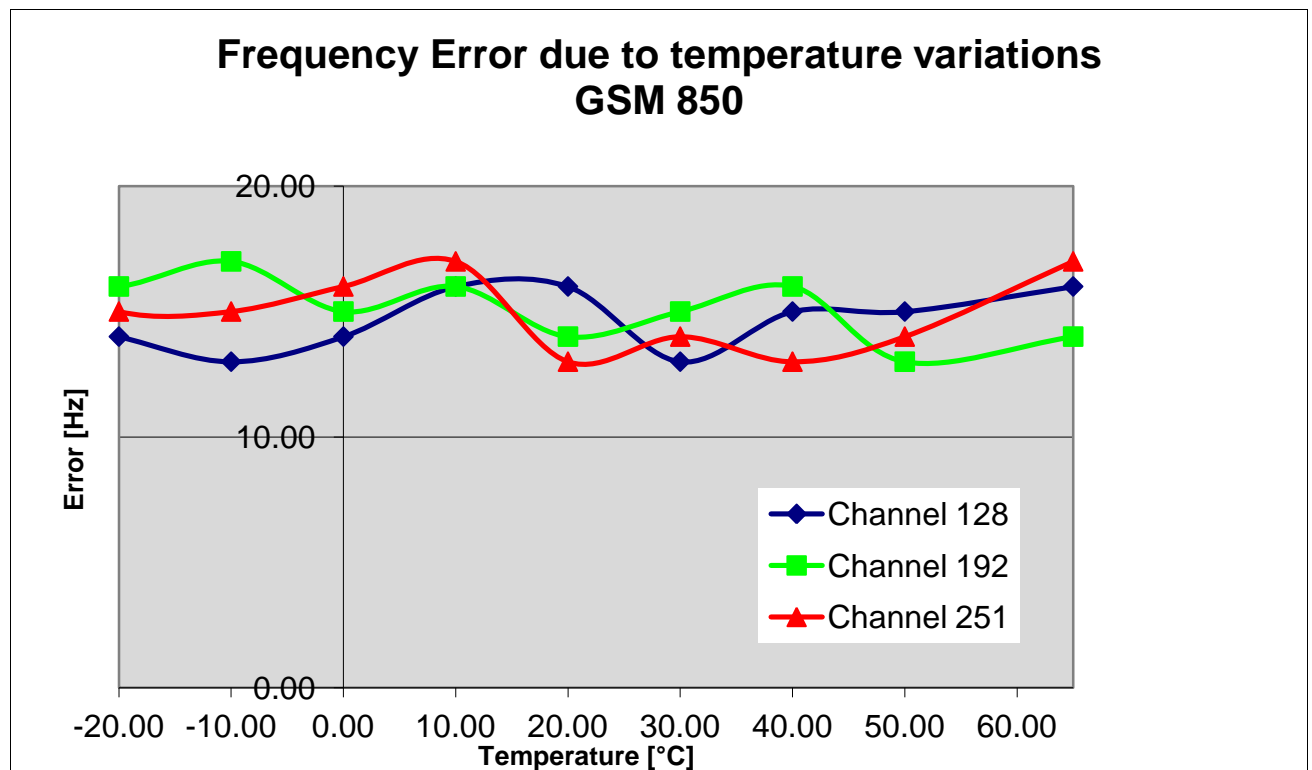


**5.8.5. Frequency shift of carrier against temperature at constant power supply voltage**

- 1.) determine the carrier frequency for the lowest, middle and highest channel at room temperature and nominal voltage [20°C]
- 2.) expose the mobile station to -30°C, wait sufficient time to have constant temperature.
- 3.) Perform the carrier frequencies measurements in 10°C increments from -30°C to +60°C. For about half hour at the specified temperature the mobile was powered-off. After powering-on, the measurements were made within 2 minute for the channel lower channel, in order to prevent self-warming of the mobile.

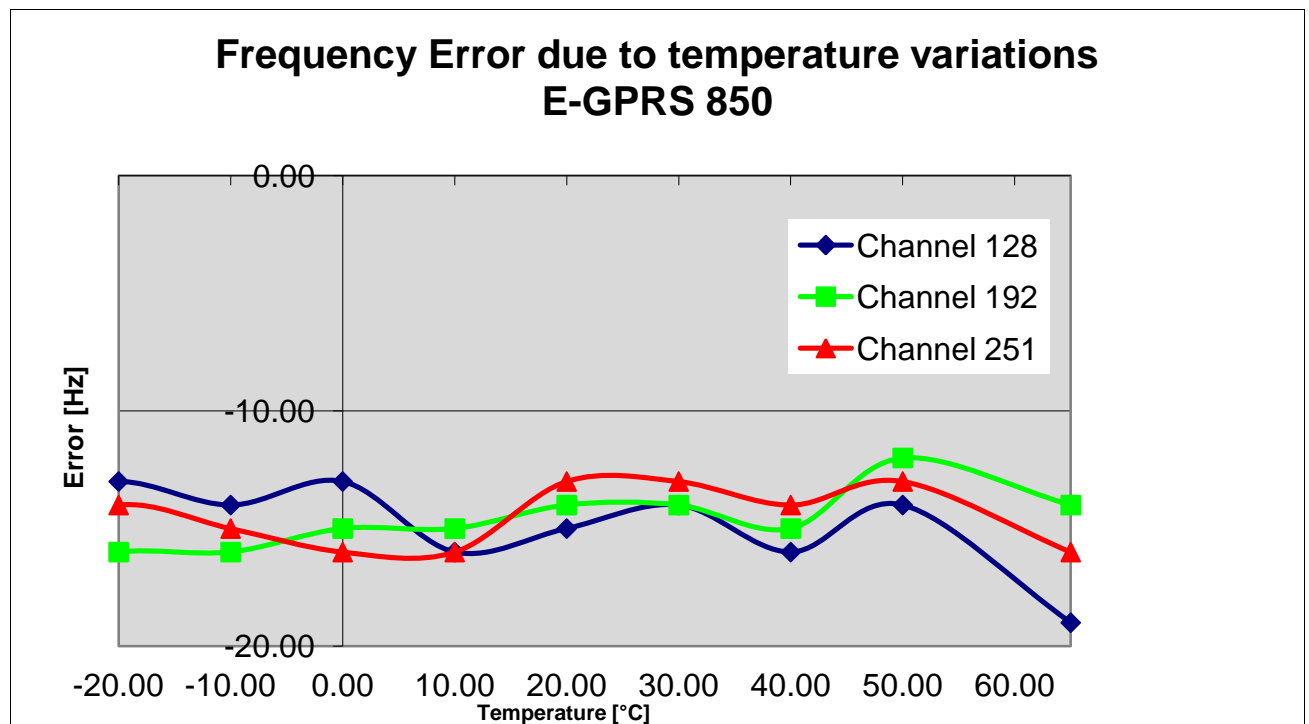
**5.8.5.1. GSM 850 Mode: Op. Mode 1, set-up 3**

Temperature	Maximum frequency error						Verdict Limit=±2.5ppm
	Channel 128	Channel 189	Channel 250	Channel 128	Channel 189	Channel 250	
	[Hz]			[ppm]			
-30	15	16	17	0.018	0.019	0.020	Passed
-20	14	16	15	0.017	0.019	0.018	
-10	13	17	15	0.016	0.020	0.018	
0	14	15	16	0.017	0.018	0.019	
10	16	16	17	0.019	0.019	0.020	
20	16	14	13	0.019	0.019	0.015	
30	13	15	14	0.016	0.018	0.016	
40	15	16	13	0.018	0.019	0.015	
50	15	13	14	0.018	0.016	0.016	
65	16	14	17	0.019	0.017	0.020	



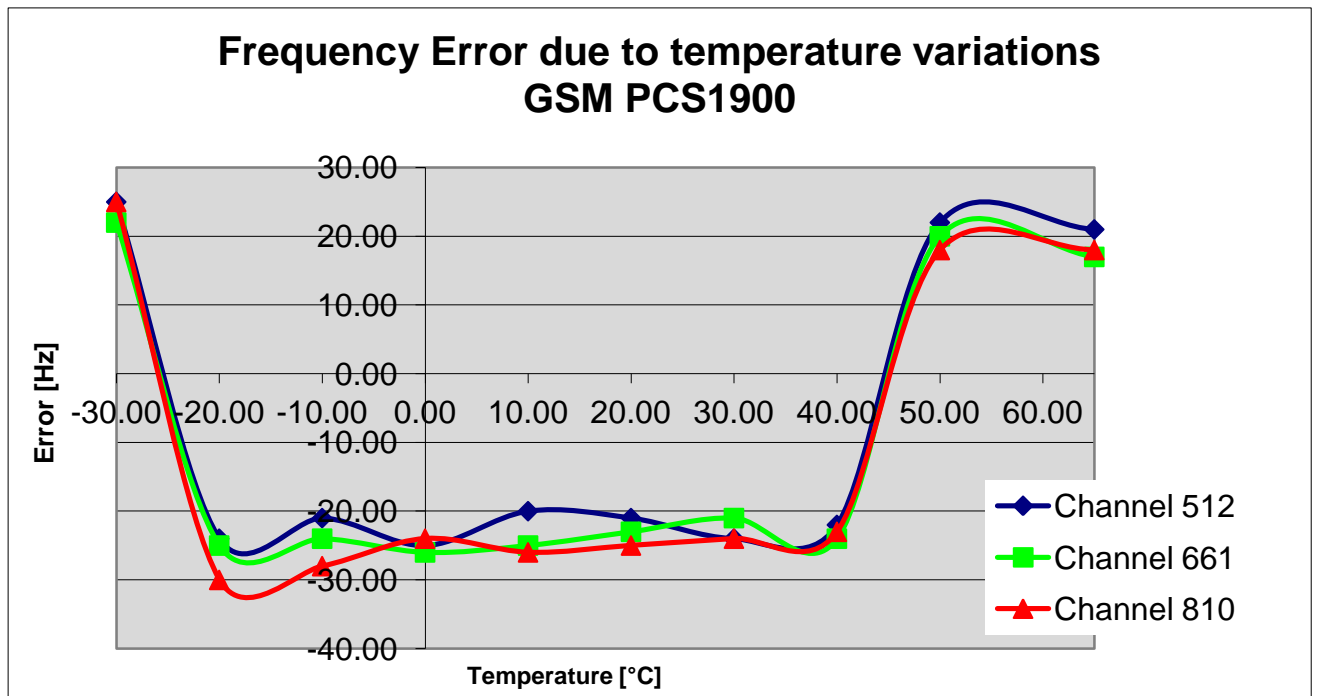
5.8.5.2. E-GPRS 850 Mode: Op. Mode 2, set-up 2

Temperature	Maximum frequency error						Verdict Limit=±2.5ppm
	Channel 128	Channel 189	Channel 250	Channel 128	Channel 189	Channel 250	
	[Hz]			[ppm]			
-30	-14	-17	-16	-0.017	-0.020	-0.019	Passed
-20	-13	-16	-14	-0.016	-0.019	-0.016	
-10	-14	-16	-15	-0.017	-0.019	-0.018	
0	-13	-15	-16	-0.016	-0.018	-0.019	
10	-16	-15	-16	-0.019	-0.018	-0.019	
20	-15	-14	-13	-0.018	-0.018	-0.015	
30	-14	-14	-13	-0.017	-0.017	-0.015	
40	-16	-15	-14	-0.019	-0.018	-0.016	
50	-14	-12	-13	-0.017	-0.014	-0.015	
65	-19	-14	-16	-0.023	-0.017	-0.019	



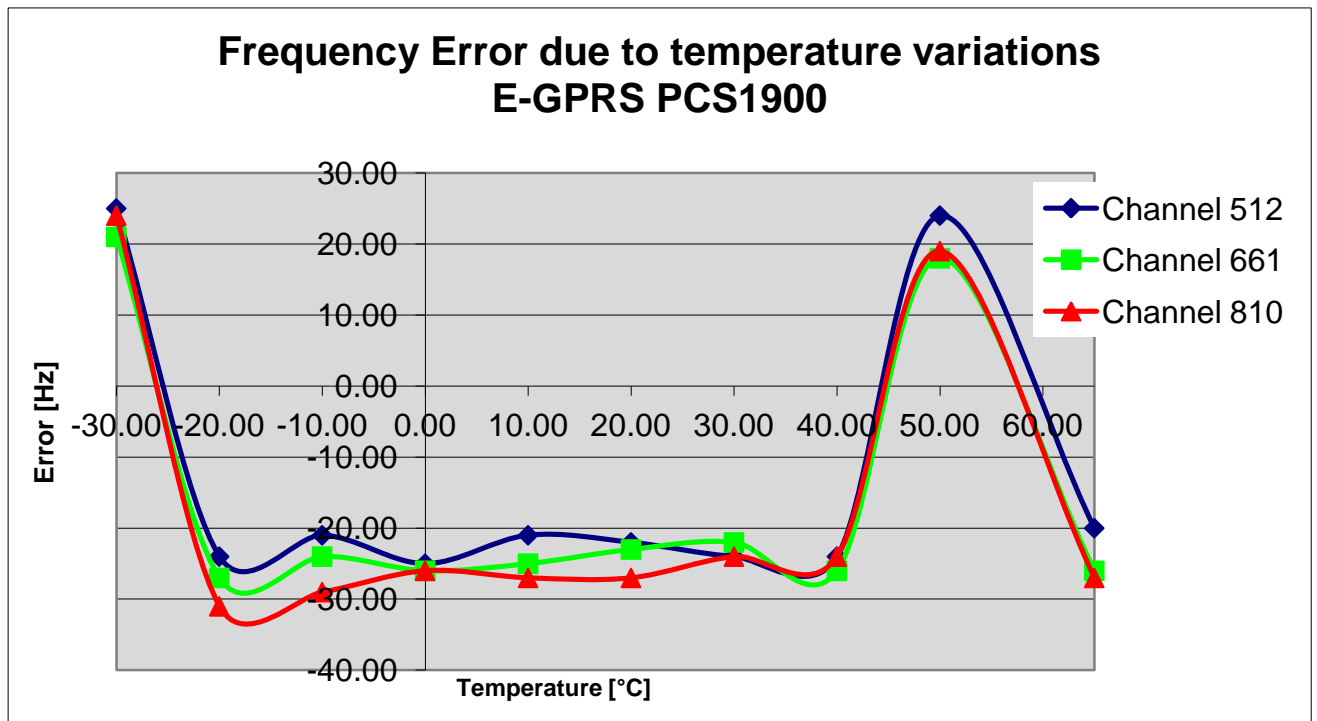
5.8.5.3. GSM PCS 1900 Mode: Op. Mode 3, set-up 2

Temperature	Maximum frequency error						Verdict Limit=±0.1ppm
	Channel 512	Channel 661	Channel 810	Channel 512	Channel 661	Channel 810	
	[Hz]			[ppm]			
-30	25	22	25	0.014	0.012	0.013	Passed
-20	-24	-25	-30	-0.013	-0.013	-0.016	
-10	-21	-24	-28	-0.011	-0.013	-0.015	
0	-25	-26	-24	-0.014	-0.014	-0.013	
10	-20	-25	-26	-0.011	-0.013	-0.014	
20	-21	-23	-25	-0.011	-0.012	-0.013	
30	-24	-21	-24	-0.013	-0.011	-0.013	
40	-22	-24	-23	-0.012	-0.013	-0.012	
50	22	20	18	0.012	0.011	0.009	
65	21	17	18	0.011	0.009	0.009	



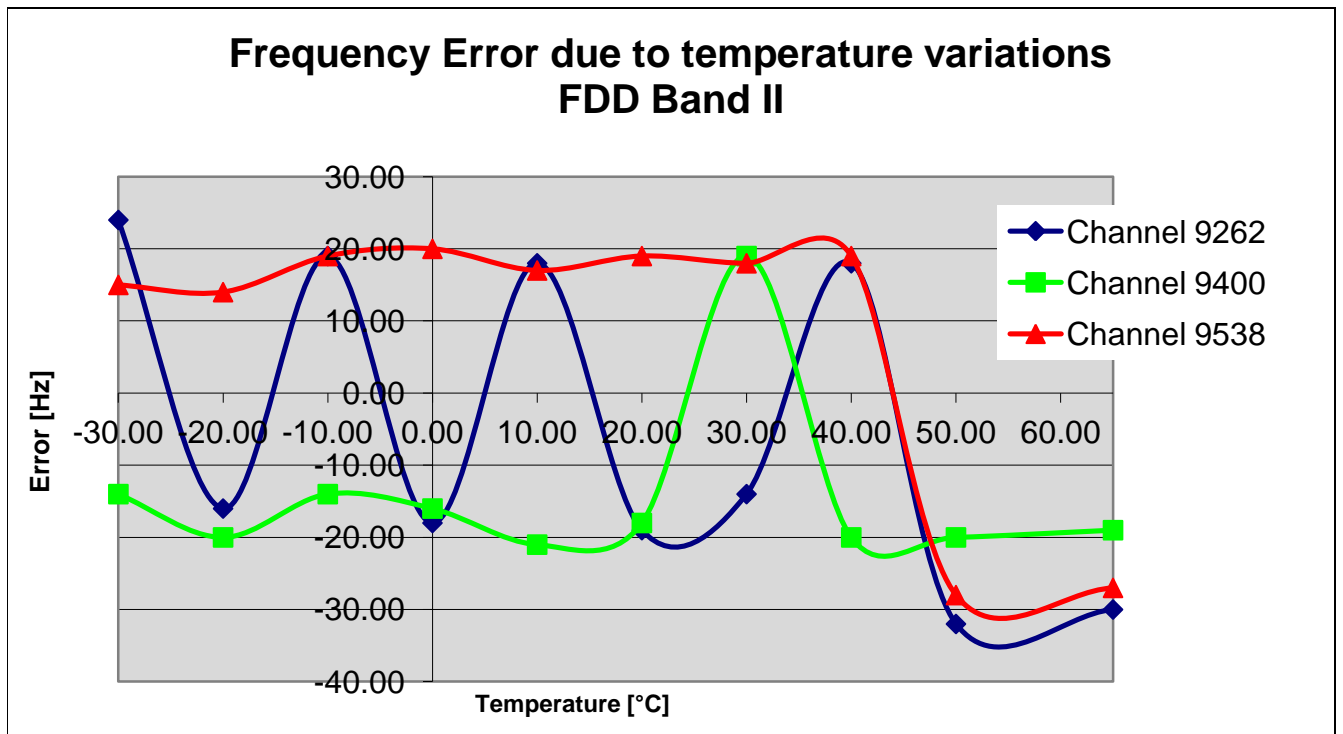
5.8.5.4. GPRS PCS 1900 Mode: Op. Mode 4, set-up 2

Temperature	Maximum frequency error						Verdict Limit=±0.1ppm
	Channel 512	Channel 661	Channel 810	Channel 512	Channel 661	Channel 810	
	[Hz]			[ppm]			
-30	25	21	24	0.014	0.011	0.013	Passed
-20	-24	-27	-31	-0.013	-0.014	-0.016	
-10	-21	-24	-29	-0.011	-0.013	-0.015	
0	-25	-26	-26	-0.014	-0.014	-0.014	
10	-21	-25	-27	-0.011	-0.013	-0.014	
20	-22	-23	-27	-0.012	-0.012	-0.014	
30	-24	-22	-24	-0.013	-0.012	-0.013	
40	-24	-26	-24	-0.013	-0.014	-0.013	
50	24	18	19	0.013	0.010	0.010	
65	-20	-26	-27	-0.011	-0.014	-0.014	



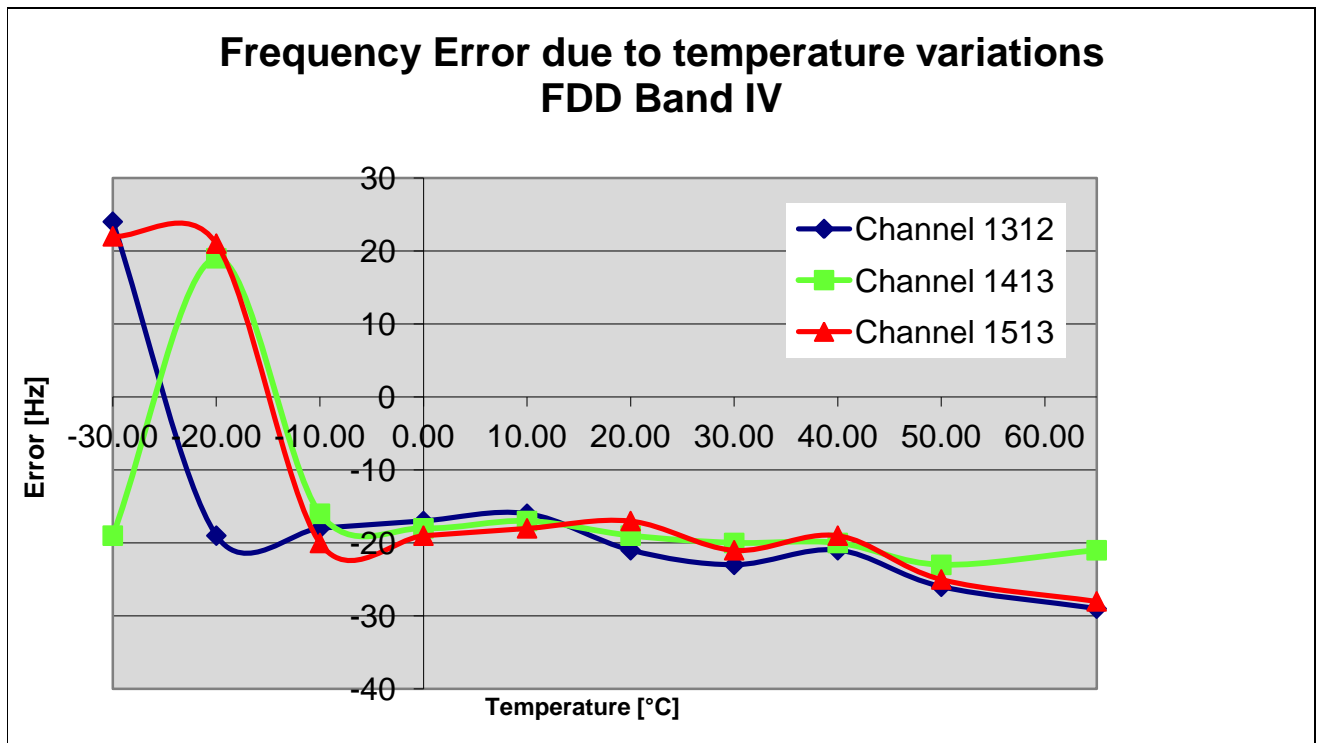
5.8.5.5. FDD II Mode: Op. Mode 5, set-up 2

Temperature	Maximum frequency error						Verdict Limit=±0.1ppm
	Channel 9262	Channel 9400	Channel 9538	Channel 9262	Channel 9400	Channel 9538	
	[Hz]			[ppm]			
-30	24	-14	15	0.013	-0.007	0.008	Passed
-20	-16	-20	14	-0.009	-0.011	0.007	
-10	19	-14	19	0.010	-0.007	0.010	
0	-18	-16	20	-0.010	-0.009	0.010	
10	18	-21	17	0.010	-0.011	0.009	
20	-19	-18	19	-0.010	-0.010	0.010	
30	-14	19	18	-0.008	0.010	0.009	
40	18	-20	19	0.010	-0.011	0.010	
50	-32	-20	-28	-0.017	-0.011	-0.015	
65	-30	-19	-27	-0.016	-0.010	-0.014	



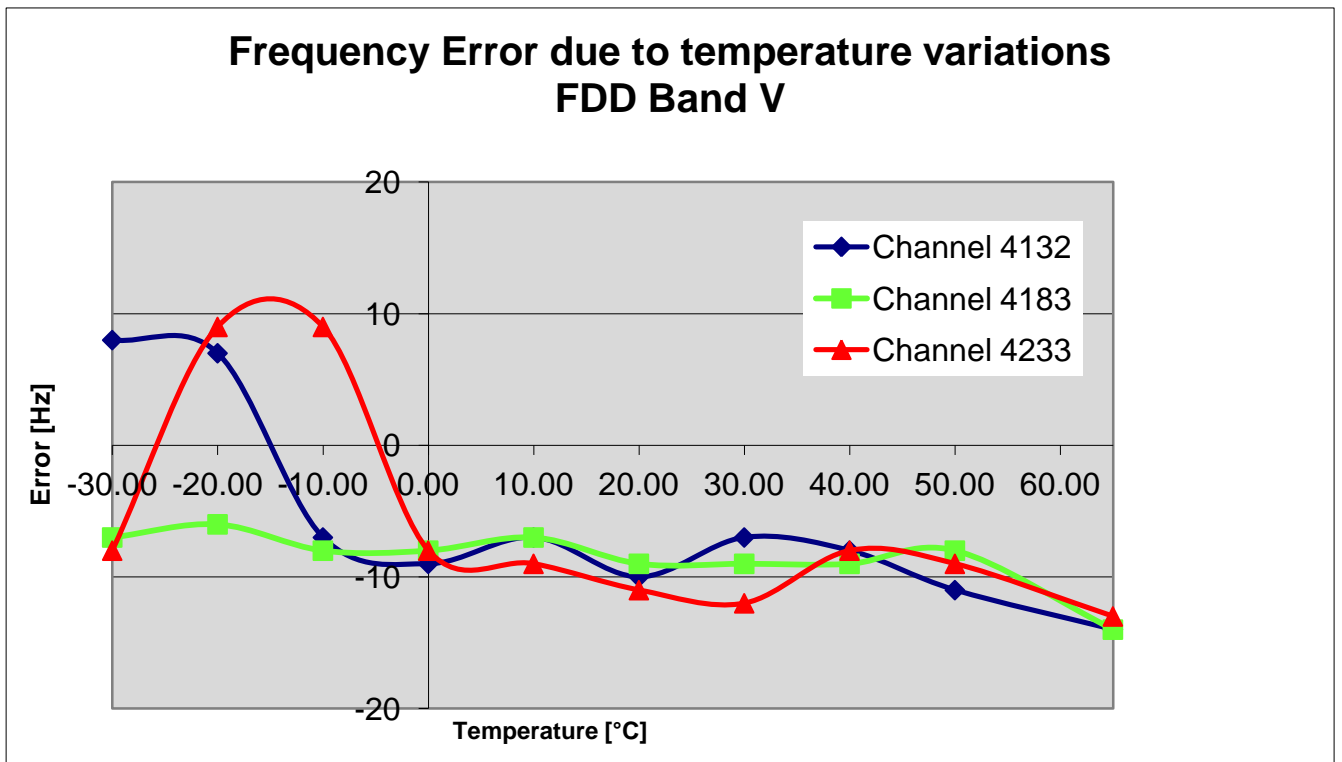
5.8.6. FDD IV Mode: Op. Mode 6, set-up 2

Temperature	Maximum frequency error						Verdict Limit=±0.1ppm
	Channel 1312	Channel 1413	Channel 1513	Channel 1312	Channel 1413	Channel 1513	
	[Hz]			[ppm]			
-30	24	-19	22	0.014	-0.110	0.126	Passed
-20	-19	19	21	-0.011	0.110	0.120	
-10	-18	-16	-20	-0.011	-0.092	-0.114	
0	-17	-18	-19	-0.010	-0.104	-0.108	
10	-16	-17	-18	-0.009	-0.098	-0.103	
20	-21	-19	-17	-0.012	-0.110	-0.097	
30	-23	-20	-21	-0.013	-0.115	-0.120	
40	-21	-20	-19	-0.012	-0.115	-0.108	
50	-26	-23	-25	-0.015	-0.133	-0.143	
65	-29	-21	-28	-0.017	-0.121	-0.160	



5.8.7. FDD V Mode: Op. Mode 7, set-up 2

Temperature	Maximum frequency error						Verdict Limit=±2.5ppm
	Channel 4132	Channel 4183	Channel 4233	Channel 4132	Channel 4183	Channel 4233	
	[Hz]			[ppm]			
-30	8	-7	-8	0.010	-0.008	-0.009	Passed
-20	7	-6	9	0.008	-0.007	0.011	
-10	-7	-8	9	-0.008	-0.010	0.011	
0	-9	-8	-8	-0.011	-0.010	-0.009	
10	-7	-7	-9	-0.008	-0.008	-0.011	
20	-10	-9	-11	-0.012	-0.011	-0.013	
30	-7	-9	-12	-0.008	-0.011	-0.014	
40	-8	-9	-8	-0.010	-0.011	-0.009	
50	-11	-8	-9	-0.013	-0.010	-0.011	
65	-14	-14	-13	-0.017	-0.017	-0.015	



### 5.9. Measurement uncertainties

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved.

For uncertainty determination, each component used in the concrete measurement set-up was taken in account and it's contribution to the overall uncertainty according it's statistical distribution calculated.

Following table shows expectable uncertainties for each measurement type performed.

RF-Measurement	Frequency range	Calculated uncertainty based on a confidence level of 95%	Remarks:
Power Output conducted	9 kHz .. 20 GHz	1 dB	--
Power Output radiated	30 MHz .. 4 GHz	3.17 dB	Substitution method
Conducted emissions on antenna ports	9 kHz .. 20 GHz	1 dB	--
Radiated emissions enclosure	150 kHz .. 30 MHz	5 dB	Magnetic field
	30 MHz .. 1 GHz	4.2 dB	E-Field
	1 GHz .. 20 GHz	3.17 dB	Substitution method
Occupied bandwidth	9 kHz .. 4 GHz	0.1272 ppm (Delta Marker )	Frequency error
		1 dB	Power
Emission bandwidth	9 kHz .. 4 GHz	0.1272 ppm (Delta Marker)	Frequency error
		1 dB	Power
Frequency stability	9 kHz .. 20 GHz	0.0636 ppm	--
Conducted emissions on AC-mains port (U <sub>CISPR</sub> )	9 kHz .. 150 kHz	4 dB	--
	150 kHz .. 30 MHz	3.6 dB	--

**Table: measurement uncertainties, valid for conducted/radiated measurements**

### 6. Accreditation details of CETECOM's laboratories and test sites

Ref.-No.	Accreditation Certificate	Valid for laboratory area or test site	Accreditation Body
-	D-PL-12047-01-01	All laboratories and test sites of CETECOM GmbH, Essen	DAkKS, Deutsche Akkreditierungsstelle GmbH
337 487 558 348 348	736496	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measur.	FCC, Federal Communications Commission Laboratory Division, USA (MRA US-EU 0003)
337 487 550 558	3462D-1 3462D-2 3462D-2 3462D-3	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR)	IC, Industry Canada Certification and Engineering Bureau
337 487 550 348 348	R-2665 R-2666 G-301 C-2914 T-1967	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measur.	VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan
OATS = Open Area Test Site, SAR = Semi Anechoic Room, FAR = Fully Anechoic Room			



## 7. Instruments and Ancillary

### 7.1. Used equipment “CTC”

The “Ref.-No” in the left column of the following tables allows the clear identification of the laboratory equipment.

#### 7.1.1. Test software and firmware of equipment

Ref.-No.	Equipment	Type	Serial-No.	Version of Firmware or Software during the test
001	Emi Test Receiver	ESS	825132/017	Firm.= 1.21 , OTP=2.0, GRA=2.0
012	Signal Generator (EMS-cond.)	SMY 01	839069/027	Firm.= V 2.02
013	Power Meter (EMS cond.)	NRVD	839111/003	Firm.= V 1.51
017	Digital Radiocommunication Tester	CMD 60 M	844365/014	Firmware = V 3.52 .22.01.99, DECT = D2.87 13.01.99
053	Audio Analyzer	UPA3	860612/022	Firm. V 4,3
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	Firm.= V 3.1DHG
140	Signal Generator	SMHU	831314/006	Firm.= 3.21
261	Thermal Power Sensor	NRV-Z55	825083/0008	EPROM-Datum 02.12.04, SE EE 1 B
262	Power Meter	NRV-S	825770/0010	Firm.= 2.6
263	Signal Generator	SMP 04	826190/0007	Firm.=3.21
264	Spectrum Analyzer	FSEK 30	826939/005	Bios=2.1, Analyzer= 3.20
295	Racal Digital Radio Test Set	6103	1572	UNIT Firmware= 4.04, SW-Main=4.04, SW-BBP=1.04, SW-DSP=1.02, Hardboot=1.02, Softboot=2.02
298	Univ. Radio Communication Tester	CMU 200	832221/091	R&S Test Firmware =3.53 /3.54 (current Testsoftw. f. all band used
323	Digital Radiocommunication Tester	CMD 55	825878/0034	Firm.= 3.52 .22.01.99
331	Climatic Test Chamber -40/+80 Grad	HC 4055	43146	TSI 1.53
335	System-CTC-EMS-Conducted	System EMS Conducted	-	EMC 32 V 8.40
340	Digital Radiocommunication Tester	CMD 55	849709/037	Firm.= 3.52 .22.01.99
355	Power Meter	URV 5	891310/027	Firm.= 1.31
365	10V Insertion Unit 50 Ohm	URV5-Z2	100880	Eprom Data = 31.03.08
366	Ultra Compact Simulator	UCS 500 M4	V0531100594	Firm. UCS 500=001925/3.06a02, rc=ISMIEC 4.10
371	Bluetooth Tester	CBT32	100153	CBT V5.30+ SW-Option K55
377	Emi Test Receiver	ESCS 30	100160	Firm.= 2.30, OTP= 02.01, GRA= 02.36
378	Broadband RF Field Monitor	RadiSense III	03D00013SNO-08	Firm.= V.03D13
383	Signal Generator	SME 03	842 828 /034	Firm.= 4.61
389	Digital Multimeter	Keithley 2000	0583926	Firm. = A13 (Mainboard) A02 (Display)
392	Radio Communication Tester	MT8820A	6K00000788	Firm.= 4.50 #005, IPL=4.01#001,OS=4.02#001, GSM=4.41#013, W-CDMA= 4.54#004, scenario= 4.52#002
436	Univ. Radio Communication Tester	CMU 200	103083	R&S Test Firmware Base=5.14, Mess-Software= GSM:5.14 WCDMA:5.14 (current Testsoftw. F. all band to be used ,
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR) Cable	-	EMC 32 Version 8.40
442	CTC-SAR-EMS	System EMS field (SAR)	-	EMC 32 Version 8.40
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	Spuri 7.2.5 or EMC 32 Ver. 8.40
444	CTC-FAR-EMS field	System-EMS-Field (FAR)	-	EMC 32 Version 8.40
460	Univ. Radio Communication Tester	CMU 200	108901	R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.,f. all band to be used,
489	Emi Test Receiver	ESU40	1000-30	Firmware=4.43 SP3, Bios=V5.1-16-3, Spec. =01.00
491	ESD Simulator dito	ESD dito	dito307022	V 2.30
524	Voltage Drop Simulator	VDS 200	0196-16	Software Nr. 000037 Version V4.20a01
526	Burst Generator	EFT 200 A	0496-06	Software Nr. 000034 Version V2.32
527	Micro Pulse Generator	MPG 200 B	0496-05	Software-Nr. 000030 Version V2.43
528	Load Dump Simulator	LD 200B	0496-06	Software-Nr. 000031 Version V2.35a01
546	Univ. Radio Communication Tester	CMU 200	106436	R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.,f. all band to be used
547	Univ. Radio Communication Tester	CMU 200	835390/014	R&S Test Firmware Base=V5.1403 (current Testsoftw., f. all band used, GSM = 5.14 WCDMA: = 5.14
584	Spectrum Analyzer	FSU 8	100248	2.82_SP3
594	Univ. Radio Communication Tester	CMW500	101757	Firmware Base=2.0.20.9, LTE=2.0.20.8. CDMA= 2.0.10
597	Univ. Radio Communication Tester	CMU 200	100347	R&S Test Firmware Base=5.01, GSM=5.02 WCDMA= not installed, Mainboard= µP1=V.850
598	Spectrum Analyzer	FSEM 30 (Reserve)	831259/013	Firmware Bios 3.40 , Analyzer 3.40 Sp 2

7.1.2. Single instruments and test systems

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
001	Emi Test Receiver	ESS	825132/017	Rohde & Schwarz	12 M	-	31.03.2013
005	AC - LISN (50 Ohm/50µH, test site 1)	ESH2-Z5	861741/005	Rohde & Schwarz	24/12 M	-	31.03.2013
007	DC - LISN (50 Ohm/5µH)	ESH3-Z6	892563/002	Rohde & Schwarz	24/12 M	-	31.03.2013
009	Power Meter (EMS-radiated)	NRV	863056/017	Rohde & Schwarz	24 M	-	31.03.2013
016	Line Impedance Simulating Network	Op. 24-D	B6366	Spitzenberger+Spies	36 M	-	31.03.2013
020	Horn Antenna 18 GHz (Subst 1)	3115	9107-3699	EMCO	36/12 M	-	31.03.2013
021	Loop Antenna (H-Field)	6502	9206-2770	EMCO	36 M	-	31.03.2013
030	Loop Antenna (H-field)	HFH-Z2	879604/026	Rohde & Schwarz	36 M	-	31.03.2013
033	RF-current probe (100kHz-30MHz)	ESH2-Z1	879581/18	Rohde & Schwarz	24 M	-	31.03.2013
057	relay-switch-unit (EMS system)	RSU	494440/002	Rohde & Schwarz	pre-m	1a	
060	power amplifier (DC-2kHz)	PAS 5000	B6363	Spitzenberger+Spies	-	3	
066	notch filter (WCDMA; FDD1)	WRCT 1900/2200-5/40-10EEK	5	Wainwright GmbH	12 M	1c	30.06.2013
086	DC - power supply, 0 -10 A	LNG 50-10	-	Heinzinger Electronic	pre-m	2	
087	DC - power supply, 0 -5 A	EA-3013 S	-	Elektro Automatik	pre-m	2	
090	Helmholtz coil: 2x10 coils in series	-	-	RWTÜV	-	4	
091	USB-LWL-Converter	OLS-1	007/2006	Ing. Büro Scheiba	-	4	
099	passive voltage probe	ESH2-Z3	299.7810.52	Rohde & Schwarz	36 M	-	31.03.2013
100	passive voltage probe	Probe TK 9416	without	Schwarzbeck	36 M	-	31.03.2013
110	USB-LWL-Converter	OLS-1	-	Ing. Büro Scheiba	-	4	
119	RT Harmonics Analyzer dig. Flickermeter	B10	G60547	BOCONSULT	36 M	-	31.03.2013
134	horn antenna 18 GHz (Subst 2)	3115	9005-3414	EMCO	12 M	-	31.03.2013
136	adjustable dipole antenna (Dipole 1)	3121C-DB4	9105-0697	EMCO	12 M	-	31.03.2013
140	Signal Generator	SMHU	831314/006	Rohde & Schwarz	24 M	-	31.03.2013
248	attenuator	SMA 6dB 2W	-	Radiall	pre-m	2	
249	attenuator	SMA 10dB 10W	-	Radiall	pre-m	2	
252	attenuator	N 6dB 12W	-	Radiall	pre-m	2	
256	attenuator	SMA 3dB 2W	-	Radiall	pre-m	2	
257	hybrid	4031C	04491	Narda	pre-m	2	
260	hybrid coupler	4032C	11342	Narda	pre-m	2	
261	Thermal Power Sensor	NRV-Z55	825083/0008	Rohde & Schwarz	24/12 M	-	31.03.2013
262	Power Meter	NRV-S	825770/0010	Rohde & Schwarz	24 M	-	31.03.2013
263	Signal Generator	SMP 04	826190/0007	Rohde & Schwarz	36 M	-	31.03.2013
264	Spectrum Analyzer	FSEK 30	826939/005	Rohde & Schwarz	12 M	-	31.03.2014
265	peak power sensor	NRV-Z33, Model 04	840414/009	Rohde & Schwarz	24 M	-	31.03.2013
266	peak power sensor	NRV-Z31, Model 04	843383/016	Rohde & Schwarz	24 M	-	31.03.2013
267	notch filter GSM 850	WRCA 800/960-6EEK	9	Wainwright GmbH	pre-m	2	
268	AC/DC power supply	EA 3050-A	9823636	Elektro Automatik	pre-m	2	
270	termination	1418 N	BB6935	Weinschel	pre-m	2	
271	termination	1418 N	BE6384	Weinschel	pre-m	2	
272	attenuator (20 dB) 50 W	Model 47	BF6239	Weinschel	pre-m	2	
273	attenuator (10 dB) 100 W	Model 48	BF9229	Weinschel	pre-m	2	
274	attenuator (10 dB) 50 W	Model 47 (10 dB) 50 W	BG0321	Weinschel	pre-m	2	
275	DC-Block	Model 7003 (N)	C5129	Weinschel	pre-m	2	
276	DC-Block	Model 7006 (SMA)	C7061	Weinschel	pre-m	2	
279	power divider	1515 (SMA)	LH855	Weinschel	pre-m	2	
287	pre-amplifier 25MHz - 4GHz	AMF-2D-100M4G-35-10P	379418	Miteq	12 M	1c	30.06.2013
291	high pass filter GSM 850/900	WHJ 2200-4EE	14	Wainwright GmbH	12 M	1c	30.06.2013
298	Univ. Radio Communication Tester	CMU 200	832221/091	Rohde & Schwarz	pre-m	3	
300	AC LISN (50 Ohm/50µH, 1-phase)	ESH3-Z5	892 239/020	Rohde & Schwarz	24/12 M	-	31.03.2013
301	attenuator (20 dB) 50W, 18GHz	47-20-33	AW0272	Lucas Weinschel	pre-m	2	
302	horn antenna 40 GHz (Meas 1)	BBHA9170	155	Schwarzbeck	36 M	-	31.03.2014
303	horn antenna 40 GHz (Subst 1)	BBHA9170	156	Schwarzbeck	36 M	-	31.03.2014
331	Climatic Test Chamber -40/+80 Grad	HC 4055	43146	Heraeus Vötsch	24 M	-	30.11.2013
341	Digital Multimeter	Fluke 112	81650455	Fluke	24 M	-	31.03.2013
342	Digital Multimeter	Voltcraft M-4660A	IB 255466	Voltcraft	24 M	-	31.03.2013
347	laboratory site	radio lab.	-	-	-	5	
348	laboratory site	EMI conducted	-	-	-	5	
354	DC - Power Supply 40A	NGPE 40/40	448	Rohde & Schwarz	pre-m	2	
355	Power Meter	URV 5	891310/027	Rohde & Schwarz	24 M	-	31.03.2013
356	power sensor	NRV-Z1	882322/014	Rohde & Schwarz	24 M	-	31.03.2013
357	power sensor	NRV-Z1	861761/002	Rohde & Schwarz	24 M	-	31.03.2013
373	V-Network 5µH/50 Ohm	ESH3-Z6	100535	Rohde & Schwarz	24/12 M	-	31.03.2013
376	Horn Antenna 6 GHz	BBHA9120 E	BBHA 9120 E.179	Schwarzbeck	12 M	-	31.03.2013
377	Emi Test Receiver	ESCS 30	100160	Rohde & Schwarz	12 M	-	31.03.2013
389	Digital Multimeter	Keithley 2000	0583926	Keithley	24 M	-	31.03.2013
392	Radio Communication Tester	MT8820A	6K00000788	Anritsu	12 M	-	31.03.2013
431	Model 7405	Near-Field Probe Set	9305-2457	EMCO	-	4	
436	Univ. Radio Communication Tester	CMU 200	103083	Rohde & Schwarz	12 M	-	31.03.2013
441	CTC-SAR-EMI Cable Loss	System EMI field (SAR) Cable	-	CETECOM	12 M	5	31.10.2013

Ref.-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
443	CTC-FAR-EMI-RSE	System CTC-FAR-EMI-RSE	-	ETS-Lindgren/CETECOM	12 M	5	30.06.2013
448	notch filter WCDMA_FDD II	WRCT 1850.0/2170.0-5/40-10SSK	5	Wainwright Instruments GmbH	12 M	1c	30.06.2013
449	notch filter WCDMA FDD V	WRCT 824.0/894.0-5/40-8SSK	1	Wainwright	12 M	1c	30.06.2013
454	Oscilloscope	HM 205-3	9210 P 29661	Hameg	-	4	
456	DC-Power supply 0-5 A	EA 3013 S	207810	Elektro Automatik	pre-m	2	
459	DC -Power supply 0-5 A , 0-32 V	EA-PS 2032-50	910722	Elektro Automatik	pre-m	2	
460	Univ. Radio Communication Tester	CMU 200	108901	Rohde & Schwarz	12 M	-	31.03.2013
463	Universal source	HP3245A	2831A03472	Agilent	-	4	
466	Digital Multimeter	Fluke 112	89210157	Fluke USA	24 M	-	31.03.2013
467	Digital Multimeter	Fluke 112	89680306	Fluke USA	24 M	-	31.03.2013
468	Digital Multimeter	Fluke 112	90090455	Fluke USA	24 M	-	31.03.2013
477	ReRadiating GPS-System	AS-47	-	Automotive Cons. Fink	-	3	
480	power meter (Fula)	NRVS	838392/031	Rohde & Schwarz	24 M	-	31.03.2013
482	filter matrix	Filter matrix SAR 1	-	CETECOM (Brl)	-	1d	
484	pre-amplifier 2,5 - 18 GHz	AMF-5D-02501800-25-10P	1244554	Miteq	12 M	-	30.07.2013
487	System CTC NSA-Verification SAR-EMI	System EMI field (SAR) NSA	-	ETS Lindgren/CETECOM	24 M	-	30.09.2013
489	Emi Test Receiver	ESU40	1000-30	Rohde & Schwarz	12 M	-	31.03.2013
502	band reject filter	WRCG 1709/1786-1699/1796-	SN 9	Wainwright	pre-m	2	
503	band reject filter	WRCG 824/849-814/859-60/10SS	SN 5	Wainwright	pre-m	2	
512	notch filter GSM 850	WRCA 800/960-02/40-6EEK	SN 24	Wainwright	12 M	1c	30.06.2012
517	relais switch matrix	HF Relais Box Keithley System	SE 04	Keithley	pre-m	2	
523	Digital Multimeter	L4411A	MY46000154	Agilent	24 M	-	31.03.2013
529	6 dB Broadband resistive power divider	Model 1515	LH 855	Weinschel	pre-m	2	
530	10 dB Broadband resistive power divider	R 416110000	LOT 9828	-	pre-m	2	
546	Univ. Radio Communication Tester	CMU 200	106436	R&S	12 M	-	31.03.2013
547	Univ. Radio Communication Tester	CMU 200	835390/014	Rohde & Schwarz	12 M	-	31.03.2013
548	Digital-Barometer	GBP 2300	without	Greisinger GmbH	36/12 M	-	31.03.2013
549	Log.Per-Antenna	HL025	1000060	Rohde & Schwarz	36/12 M	-	31.03.2013
552	high pass filter 2,8-18GHz	WHKX 2.8/18G-10SS	4	Wainwright	12 M	1c	30.07.2012
558	System CTC FAR S-VSWR	System CTC FAR S-VSWR	-	CTC	24 M	-	31.07.2013
574	Biconilog Hybrid Antenna	BTA-L	980026L	Frankonia	36/12 M	-	30.03.2013
584	Spectrum Analyzer	FSU 8	100248	Rohde & Schwarz	12 M	-	31.03.2013
594	Univ. Radio Communication Tester	CMW500	101757	Rohde & Schwarz	24 M	-	31.03.2013
597	Univ. Radio Communication Tester	CMU 200	100347	Rohde & Schwarz	12 M	-	31.03.2013
598	Spectrum Analyzer	FSEM 30 (Reserve)	831259/013	Rohde & Schwarz	24 M	-	13.01.2013
600	power meter	NRVD (Reserve)	834501/018	Rohde & Schwarz	24 M	-	31.03.2013
601	medium-sensitivity diode sensor	NRV-Z5 (Reserve)	8435323/003	Rohde & Schwarz	24 M	-	12.01.2013
602	peak power sensor	NRV-Z32 (Reserve)	835080	Rohde & Schwarz	24 M	-	12.01.2013
608	UltraLog-Antenna	HL 562	830547/009	Rohde & Schwarz	36/12 M	-	31.03.2014
611	DC power supply	E3632A	KR 75305854	Agilent	pre-m	2	
612	DC power supply	E3632A	MY 40001321	Agilent	pre-m	2	
613	Attenuator	R416120000 20dB 10W	Lot. 9828	Radiall	pre-m	2	

### 7.1.3. Legend

Note / remarks		Calibrated during system calibration:
	1a	System CTC-SAR-EMS (Ref.-No. 442)
	1b	System-CTC-EMS-Conducted (Ref.-No. 335)
	1c	System CTC-FAR-EMI-RSE (Ref.-No . 443)
	1d	System CTC-SAR-EMI (Ref.-No . 441)
	1e	System CTC-OATS (EMI radiated) (Ref.-No. 337)
	1 f	System CTC-CTIA-OTA (Ref.-No . 420)
	1 g	System CTC-FAR-EMS (Ref.-No . 444)
	2	Calibration or equipment check immediately before measurement
	3	Regulatory maintained equipment for functional check or support purpose
	4	Ancillary equipment without calibration e.g. mechanical equipment or monitoring equipment
	5	Test System

Interval of calibration		
	12 M	12 month
	24 M	24 month
	36 M	36 month
	24/12 M	Calibration every 24 months, between this every 12 months internal validation
	36/12 M	Calibration every 36 months, between this every 12 months internal validation
	Pre-m	Check before starting the measurement
	-	Without calibration