Annex 1: Measurement diagrams
to T E S T R E P O R T
No.: 16-1-0019501T05a

According to:
FCC Regulations
Part 22, Part 24, Part 15C

IC-Regulations
RSS-132 Issue 3, RSS-133 Issue 6,
RSS-Gen Issue 4

for

u-Blox AG

GSM/W-CDMA Module SARA-U201

FCC-ID: XPY1CGM5NNN
IC: 8595A-1CGM5NNN
PMN: SARA-U201
HVIN: SARA-U201

Laboratory Accreditation and Listings			
DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-01	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-2666 C-2914, T-1967, G-301
Wi Fi ALLIANCE AUTHORIZED RF LABORATORY	ctia Authorized™ Test Lab Lab Code: 20011130-00		
accredited according to DIN EN ISO/IEC 17025			

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Table of contents

1. Measurement diagrams

1.1. Spurious emissions radiated (FDD Band II transmitting mode)

Diagram 8.20_RSE_FDD2_Ch9262_RMC

Common Information

Test Description:	Radiated Spurious Emissions UMTS FDDII
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 24
Operating Mode:	UE allocated channel 9262/9400/9538 (fc = 1852.4/1880.0/1907.6 MHz)
Environmental Conditions:	Humidity: 41%rH; Temperature: 24°C
Operator:	RIs

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
----------	----------
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-

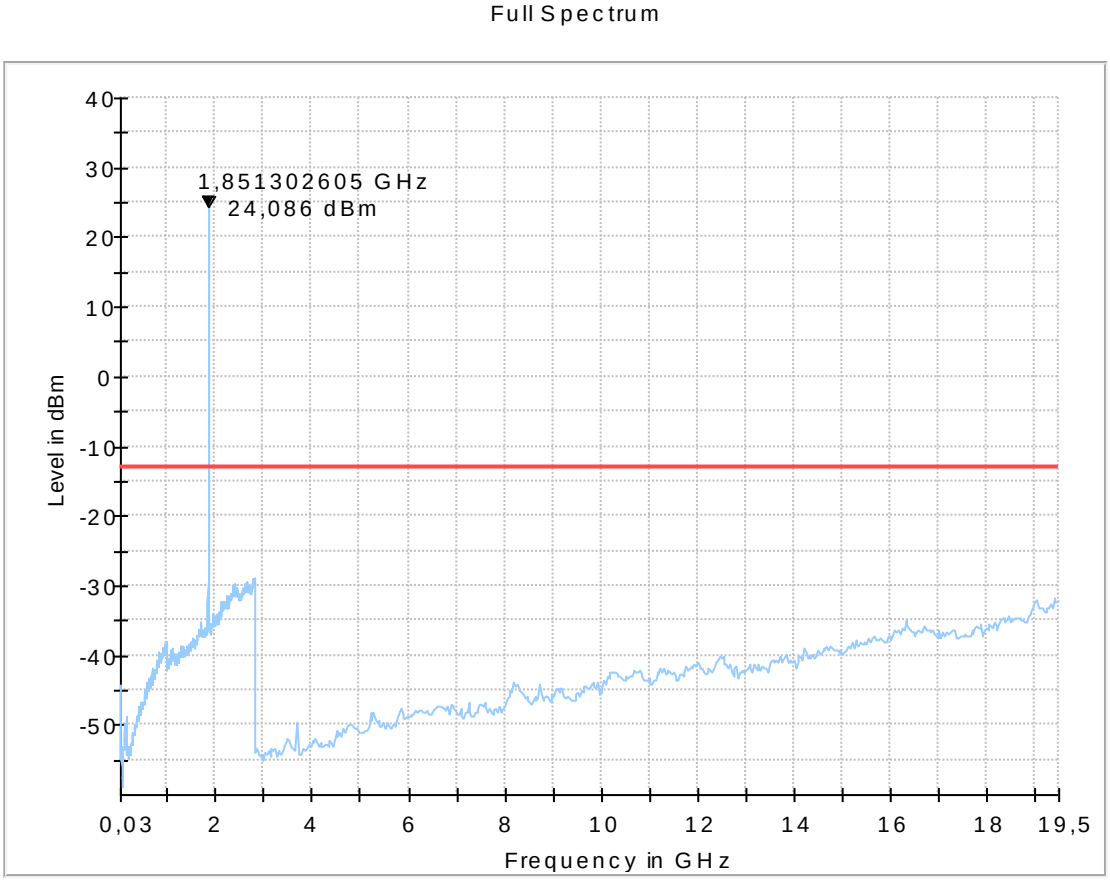


Diagram 8.21_RSE_FDD2_Ch9400_RMC

Common Information

Test Description:	Radiated Spurious Emissions UMTS FDDII
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 24
Operating Mode:	UE allocated channel 9400 (fc = 1880.0 MHz)
Environmental Conditions:	Humidity: 41%rH; Temperature: 24°C
Operator:	RIs

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-

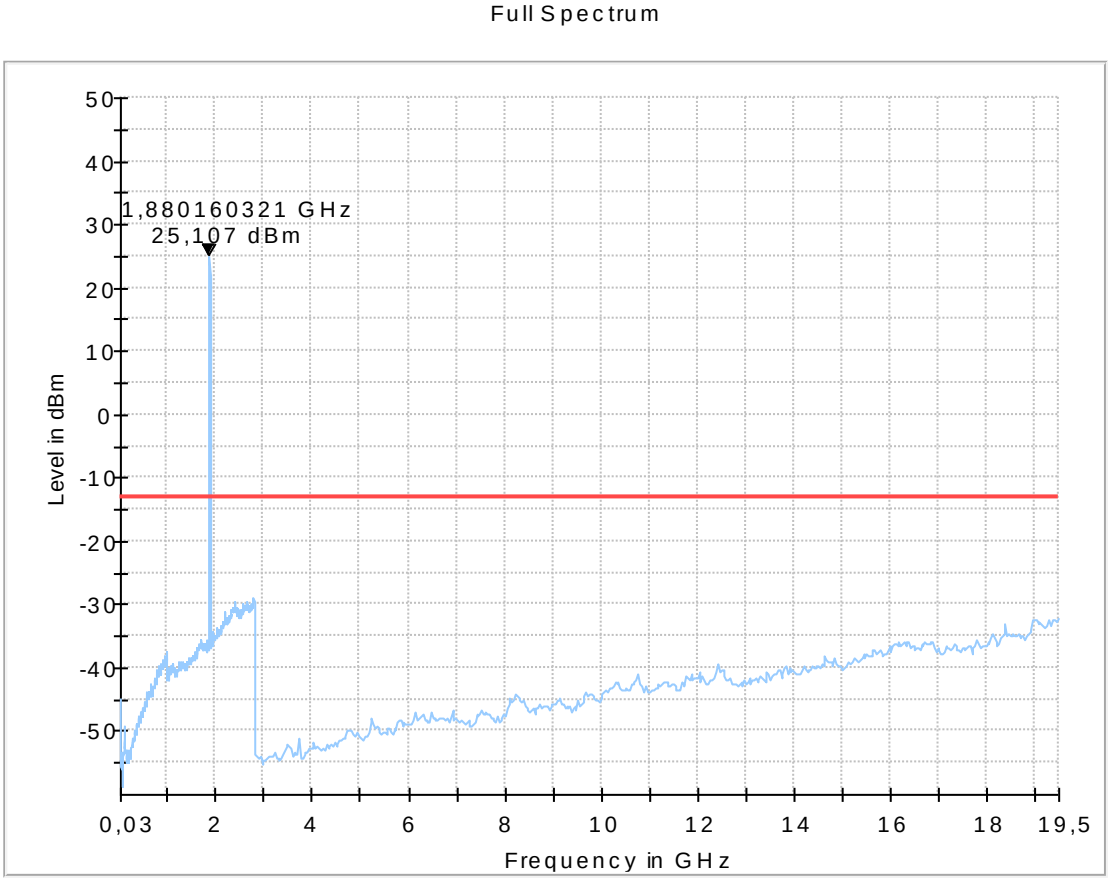


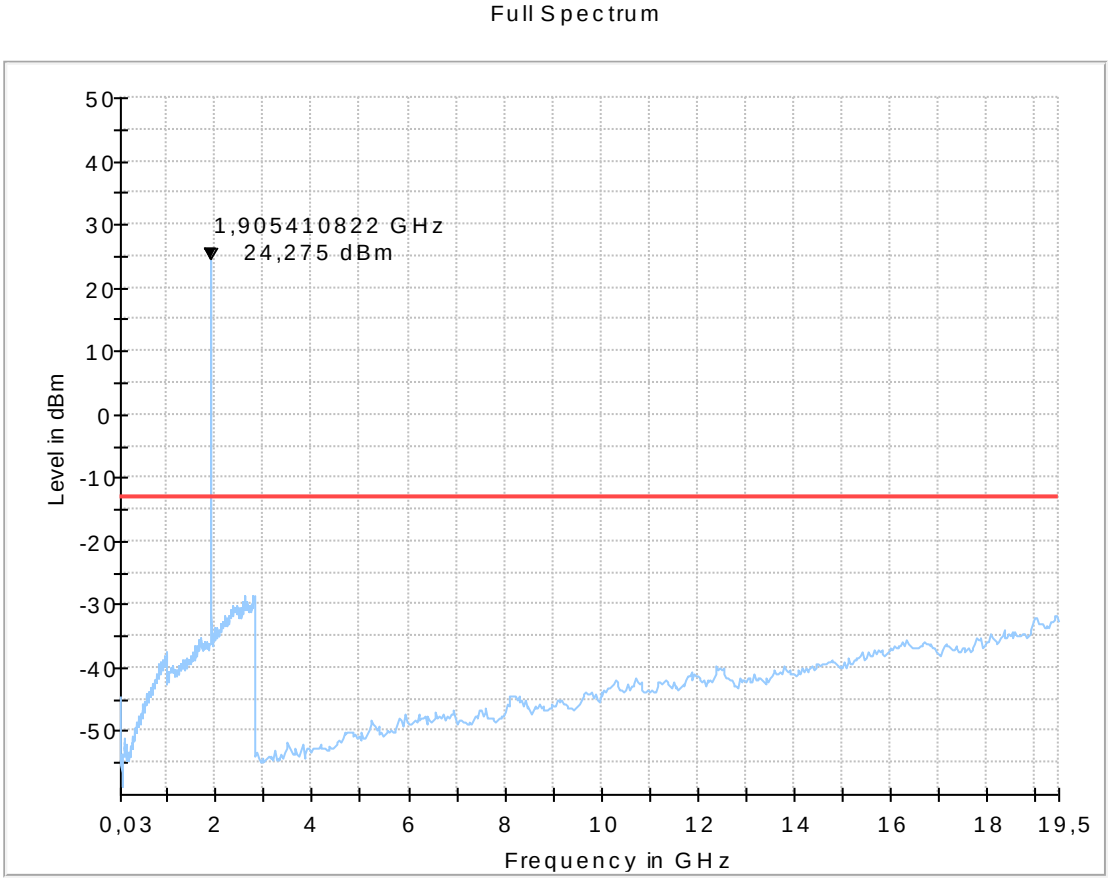
Diagram 8.22_RSE_FDD2_Ch9538_RMC

Common Information

Test Description:	Radiated Spurious Emissions UMTS FDDII
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 24
Operating Mode:	UE allocated channel 9538 (fc = 1907.6 MHz)
Environmental Conditions:	Humidity: 41%rH; Temperature: 24°C
Operator:	RIs

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-



1.2. Spurious emissions radiated (FDD Band V transmitting mode)

Diagram 8.50_RSE_Ch4132_RMC

Common Information

Test Description:	Radiated Spurious Emissions UMTS FDDV
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 22.917(a)
Operating Mode:	UE allocated channel 4132 (fc = 826.4 MHz), RMC
Environmental Conditions:	Humidity: 50%rH; Temperature: 20°C
Operator:	YZH

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-

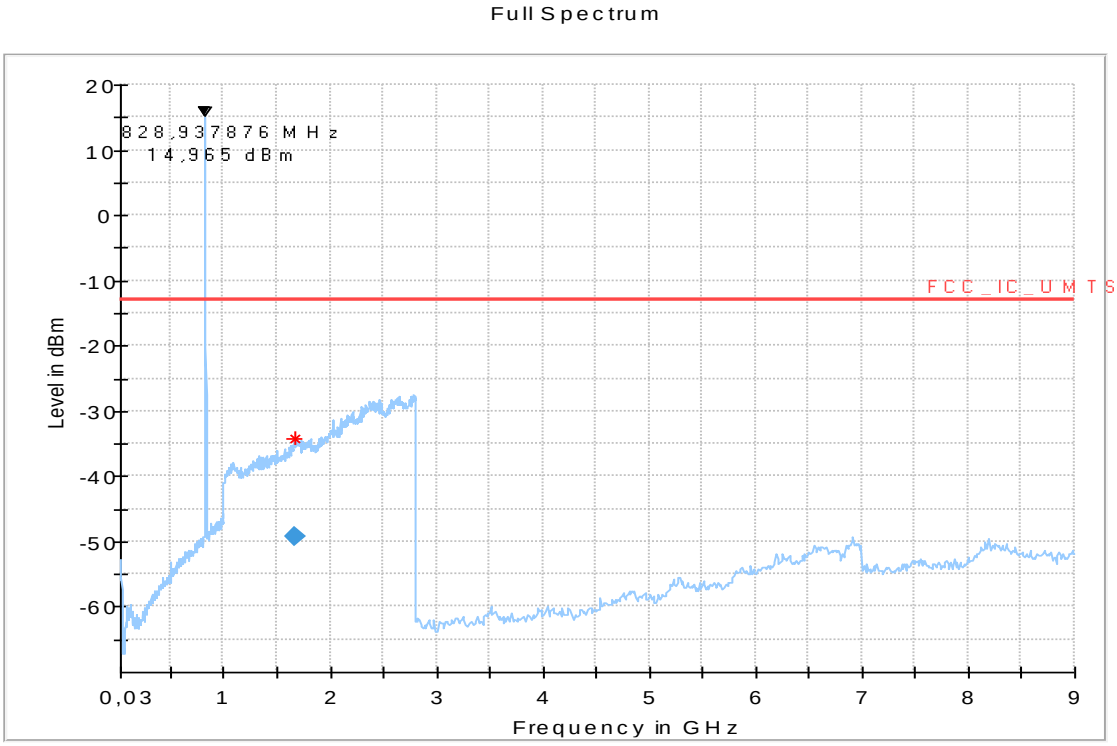


Diagram 8.51_RSE_R_Ch4183_RMC

Common Information

Test Description:	Radiated Spurious Emissions UMTS FDDV
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 22.917(a)
Operating Mode:	UE allocated channel 4183 (fc = 836,6 MHz), RMC
Environmental Conditions:	Humidity: 50%rH; Temperature: 20°C
Operator:	YZH

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-

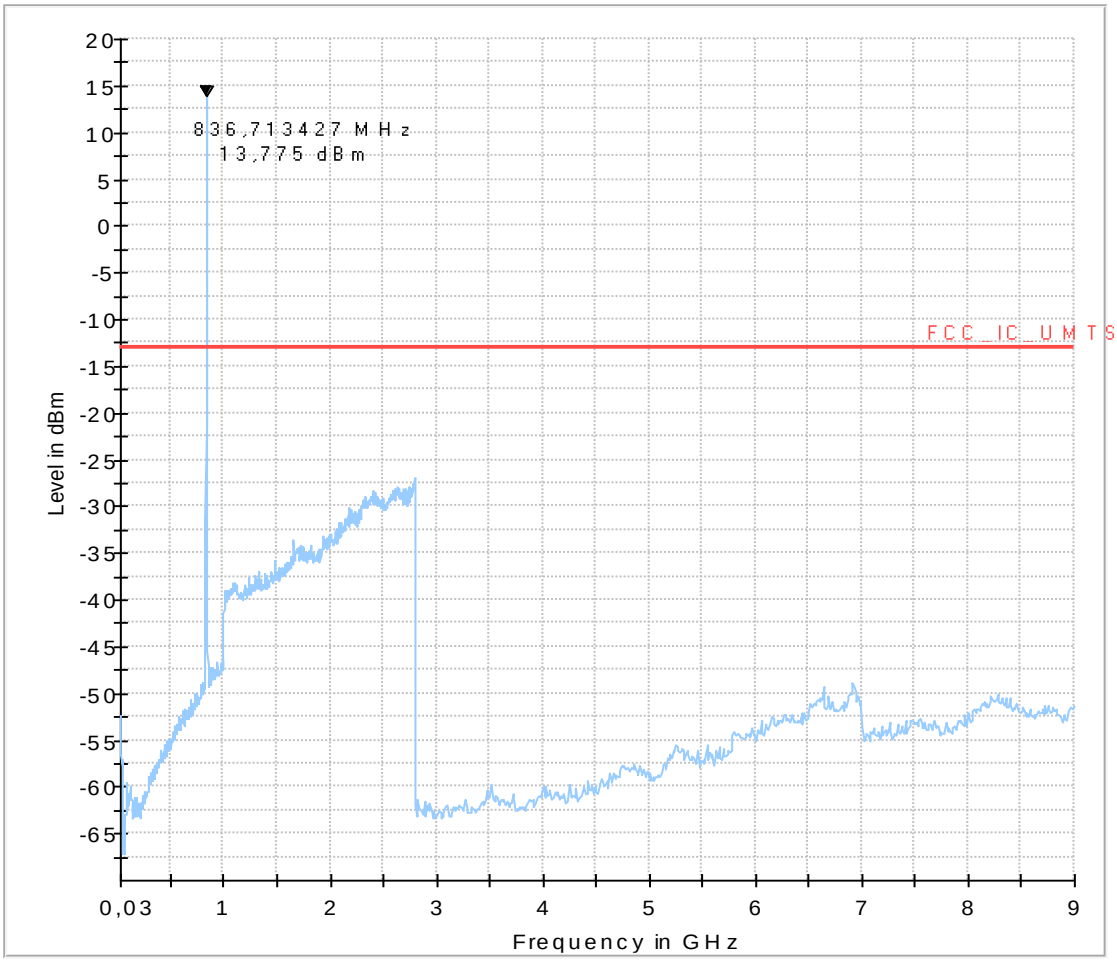


Diagram 8.52_RSE_R_Ch4233_RMC

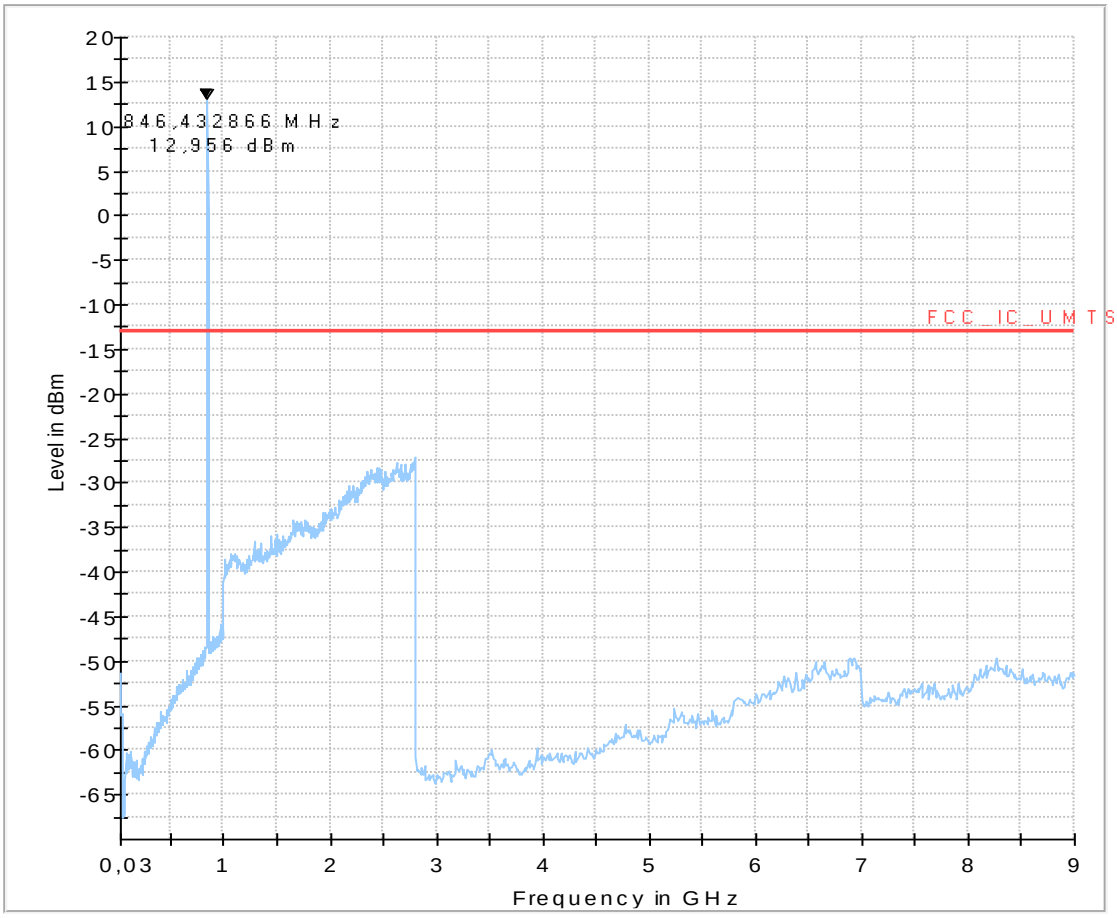
Common Information

Test Description:	Radiated Spurious Emissions UMTS FDDV
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 22.917(a)
Operating Mode:	UE allocated channel 4233 (fc = 846.6 MHz), RMC
Environmental Conditions:	Humidity: 50%rH; Temperature: 20°C
Operator:	YZH

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-

Full Spectrum



1.3. Radiated emissions on FDD Band II band-edge

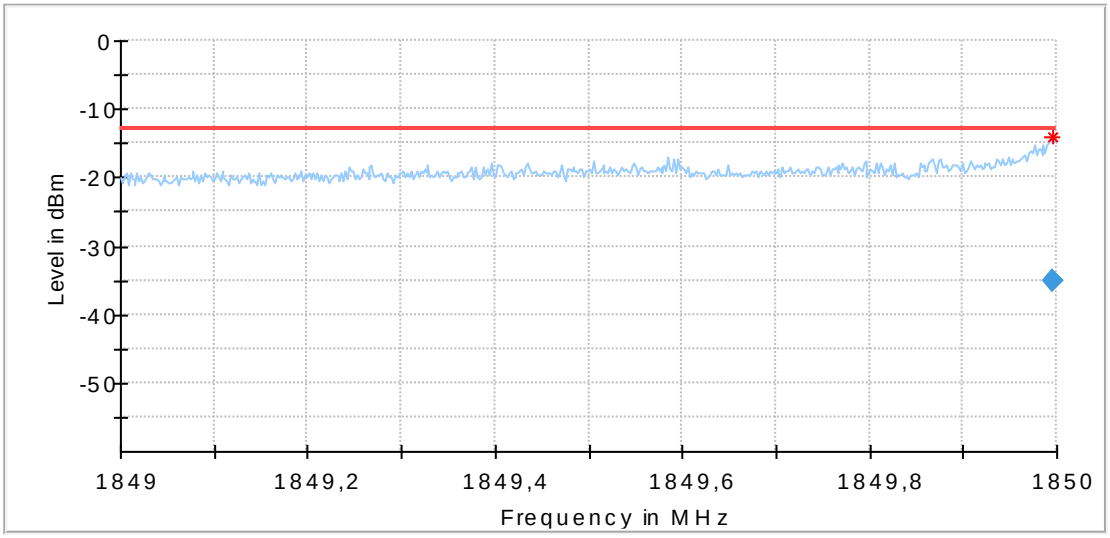
Diagram 9.20_BE_R_Ch9262_RMC

Common Information

Test Description:	Band-Edge - Radiated Spurious Emissions UMTS FDDII
Test Site:	CETECOM GmbH Essen
Test Standard:	FCC Part24.238
Antenna polarisation:	horizontal/vertical
Operation mode:	UE allocated channel 9262 (fc = 1852.4 MHz)
Environmental Condition:	Humidity: 50%rH; Temperature: 20°C
Operator Name:	YZH

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-



Final_Result

Frequency (MHz)	Average (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
1849.995992	-35.16	-13.00	22.16	10000.0	5.000	H	106.0	0.0	-63.1

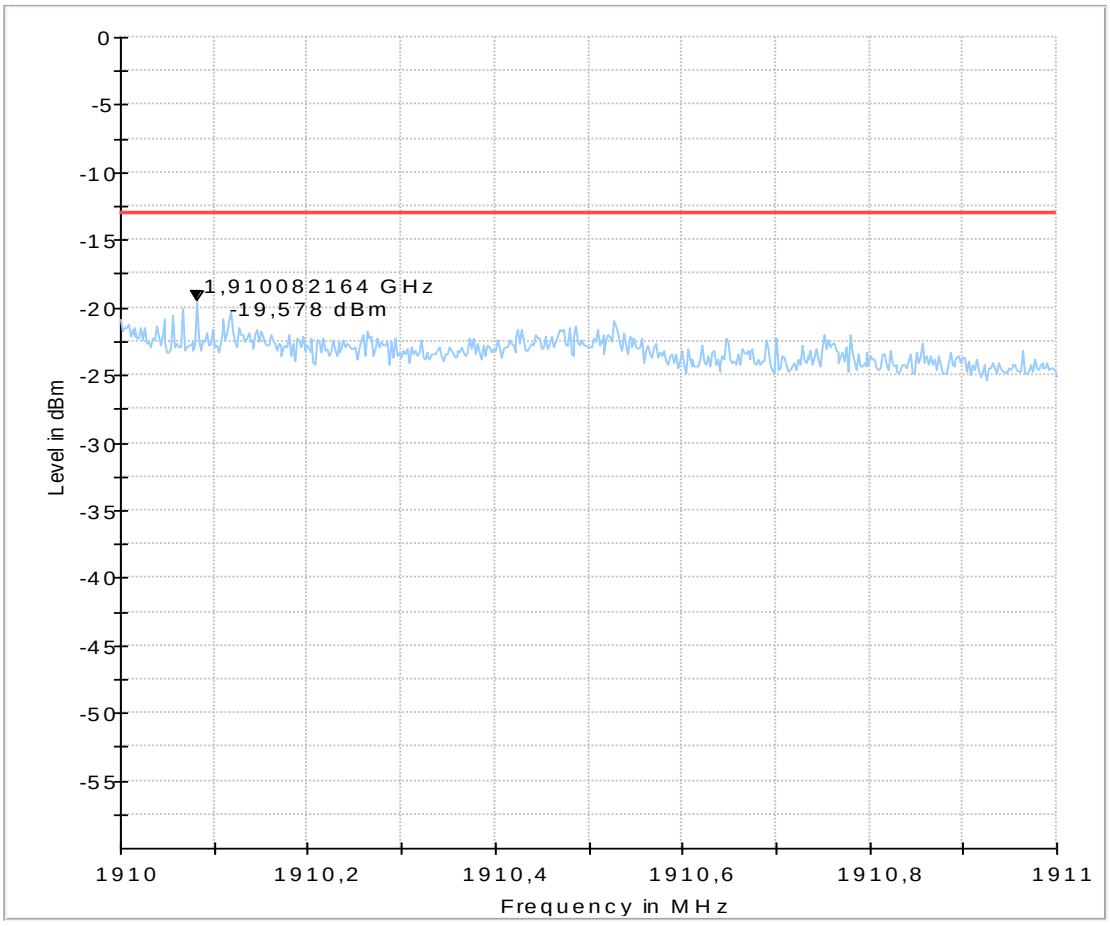
Diagram No.: 9.21_BE_R_Ch9538_RMC

Common Information

Test Description:	Band-Edge - Radiated Spurious Emissions UMTS FDDII
Test Site:	CETECOM GmbH Essen
Test Standard:	FCC Part24.238
Antenna polarisation:	horizontal/vertical
Operation mode:	UE allocated channel 9538 (fc = 1907.6 MHz)
Operator Name:	YZH
Environmental Condition:	Humidity: 49%rH; Temperature: 20°C

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-



1.4. Radiated emissions on FDD Band V band-edge

Diagram 9.50_BE_R_Ch4132_RMC

Common Information

Test Description:	Band-Edge - Radiated Spurious Emissions UMTS FDDV
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 22.917(a)
Operating Mode:	UE allocated channel 4132 (fc = 826.4 MHz), RMC
Environmental Conditions:	Humidity: 50%rH; Temperature: 20°C
Operator:	YZH

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-

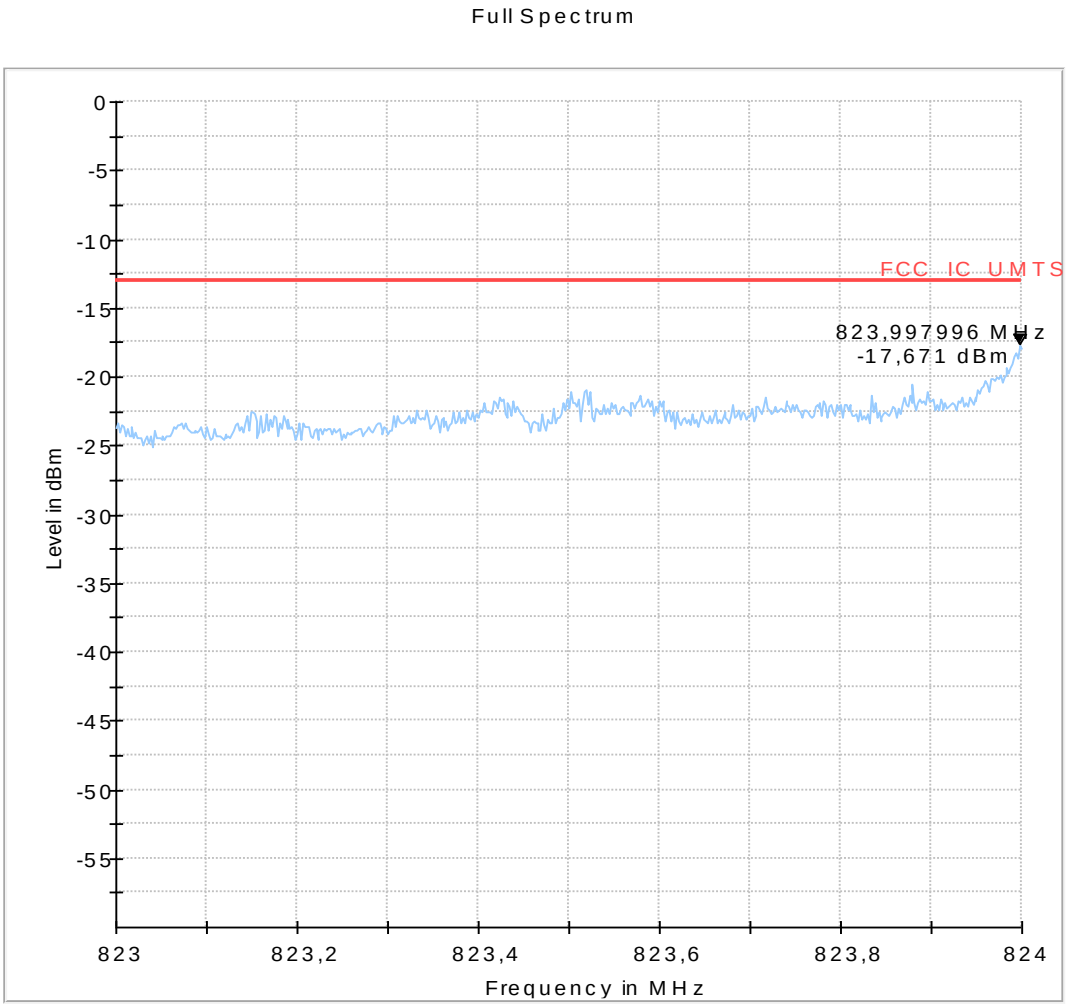


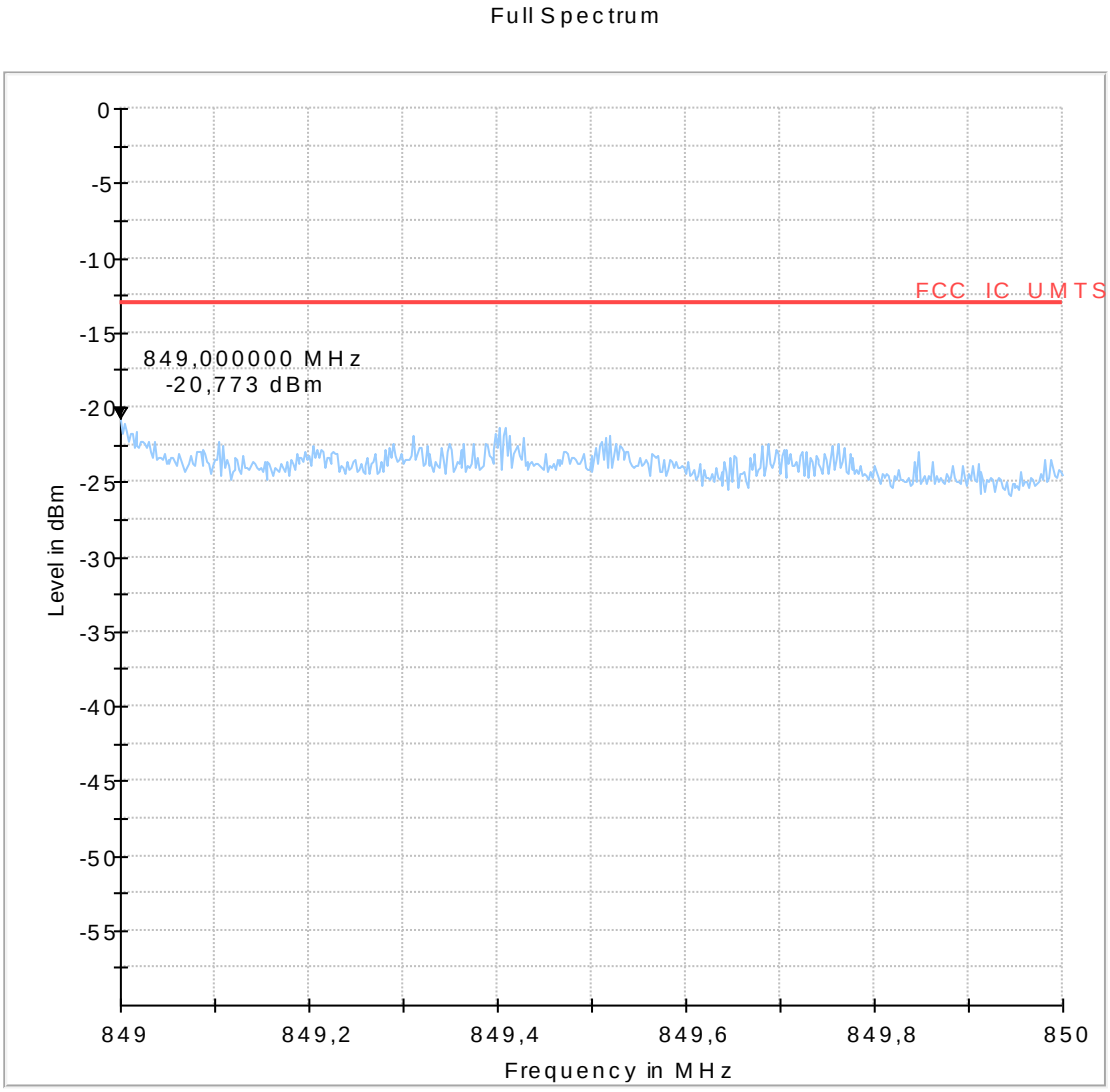
Diagram 9.51_BE_R_Ch4233_RMC

Common Information

Test Description:	Band-Edge - Radiated Spurious Emissions UMTS FDDV
Test Site Location:	CETECOM GmbH Essen
Test Site:	Fully Anechoic Room (FAR)
Test Standard:	FCC Part 22.917(a)
Operating Mode:	UE allocated channel 4233 (fc = 846.6 MHz), RMC
Environmental Conditions:	Humidity: 50%rH; Temperature: 20°C
Operator:	YZH

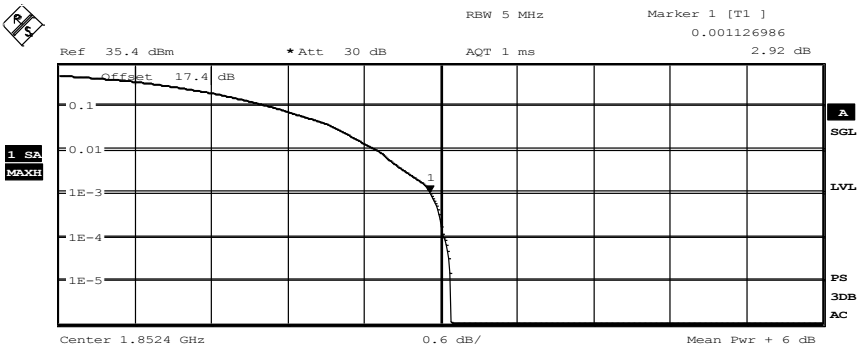
EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-



1.5. Peak power output and PAPR-Value

1.5.1. FDD Band 2



Complementary Cumulative Distribution Function
NOF samples: 8000, Usable BW: 7.1MHz

	Trace 1
Mean	23.97 dBm
Peak	27.05 dBm
Crest	3.08 dB
10 %	1.68 dB
1 %	2.50 dB
.1 %	2.92 dB
.01 %	3.03 dB

Date: 15.JUN.2016 14:39:43

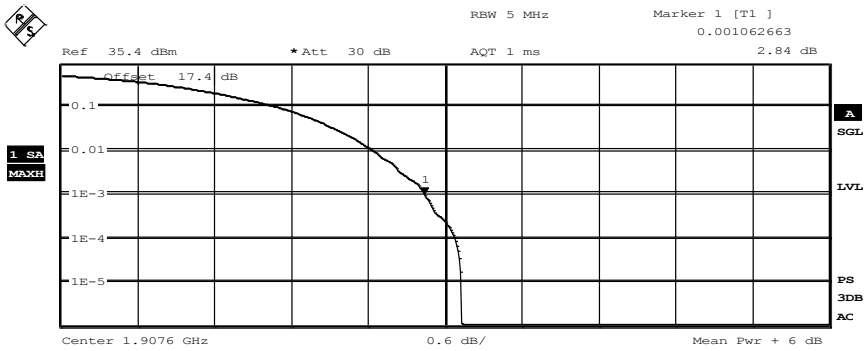
Channel 9262

Complementary Cumulative Distribution Function
NOF samples: 8000, Usable BW: 7.1MHz

	Trace 1
Mean	23.90 dBm
Peak	26.98 dBm
Crest	3.08 dB
10 %	1.73 dB
1 %	2.50 dB
.1 %	2.88 dB
.01 %	3.03 dB

Date: 15.JUN.2016 14:38:57

Channel 9400



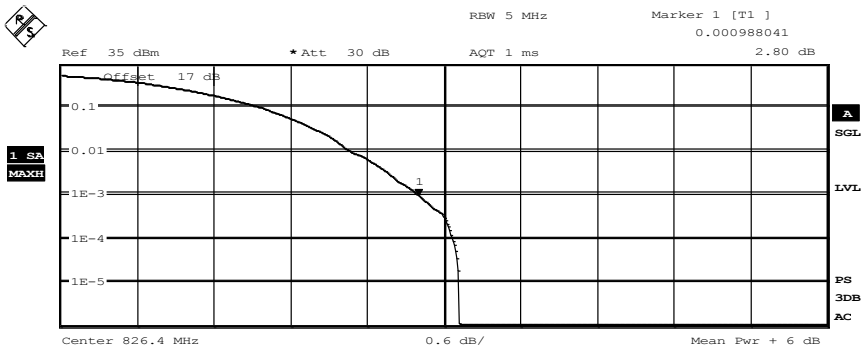
Complementary Cumulative Distribution Function
NOF samples: 8000, Usable BW: 7.1MHz

	Trace 1
Mean	24.13 dBm
Peak	27.26 dBm
Crest	3.13 dB
10 %	1.70 dB
1 %	2.44 dB
.1 %	2.85 dB
.01 %	3.08 dB

Date: 15.JUN.2016 14:38:03

Channel 9538

1.5.2. FDD Band 5

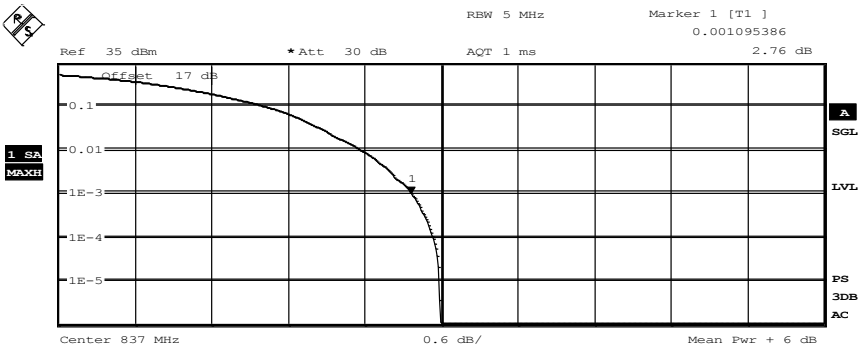


Complementary Cumulative Distribution Function
NOF samples: 8000, Usable BW: 7.1MHz

	Trace 1
Mean	23.67 dBm
Peak	26.79 dBm
Crest	3.12 dB
10 %	1.59 dB
1 %	2.27 dB
.1 %	2.80 dB
.01 %	3.07 dB

Date: 15.JUN.2016 14:42:47

Channel 4132

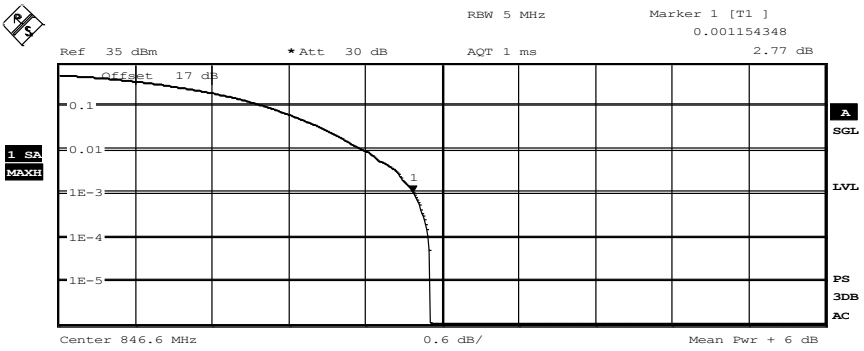


Complementary Cumulative Distribution Function
NOF samples: 8000, Usable BW: 7.1MHz

	Trace 1
Mean	23.66 dBm
Peak	26.65 dBm
Crest	2.99 dB
10 %	1.63 dB
1 %	2.38 dB
.1 %	2.77 dB
.01 %	2.93 dB

Date: 15.JUN.2016 14:43:27

Channel 4185



Complementary Cumulative Distribution Function
NOF samples: 8000, Usable BW: 7.1MHz

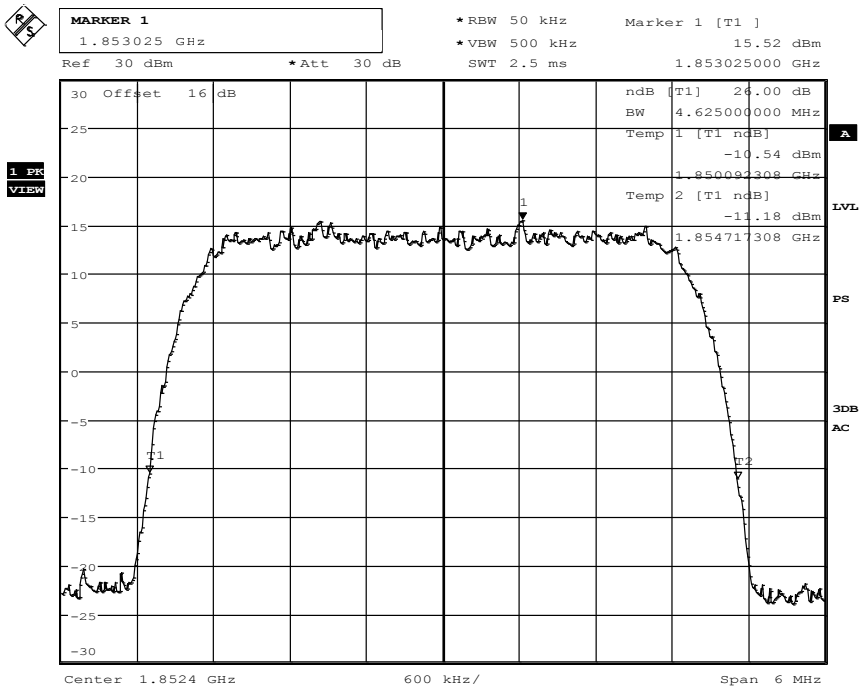
	Trace 1
Mean	23.74 dBm
Peak	26.65 dBm
Crest	2.91 dB
10 %	1.63 dB
1 %	2.39 dB
.1 %	2.79 dB
.01 %	2.89 dB

Date: 15.JUN.2016 14:44:13

Channel 4233

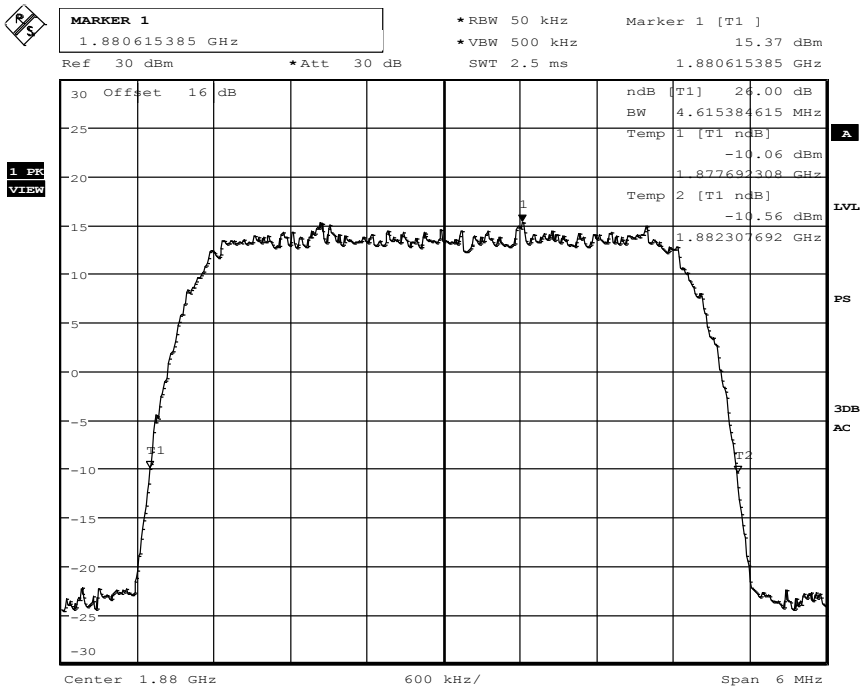
1.6. 26dBc Emission bandwidth

1.6.1. FDD II TX Mode



Date: 14.JUN.2016 11:31:19

Channel 9262



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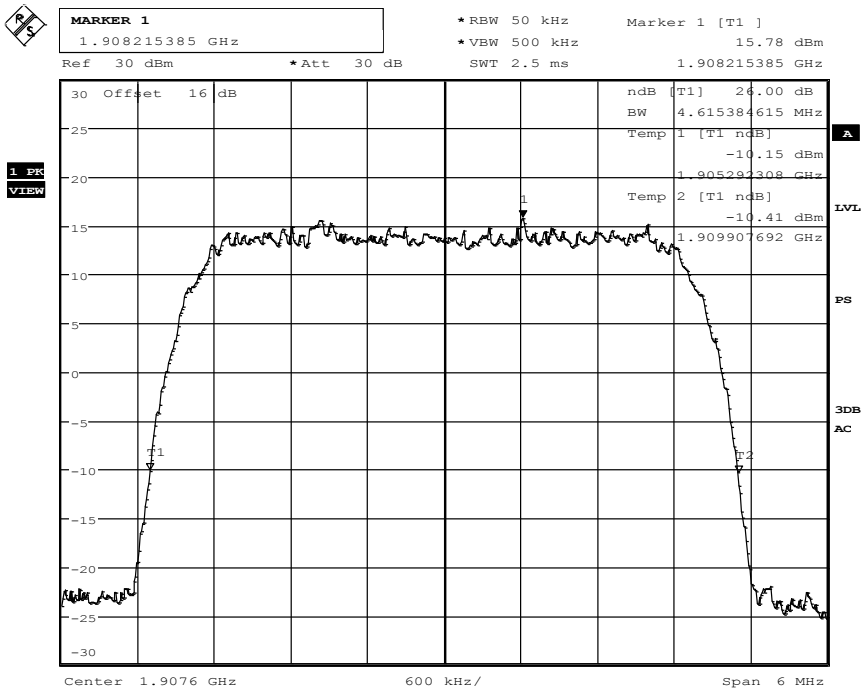
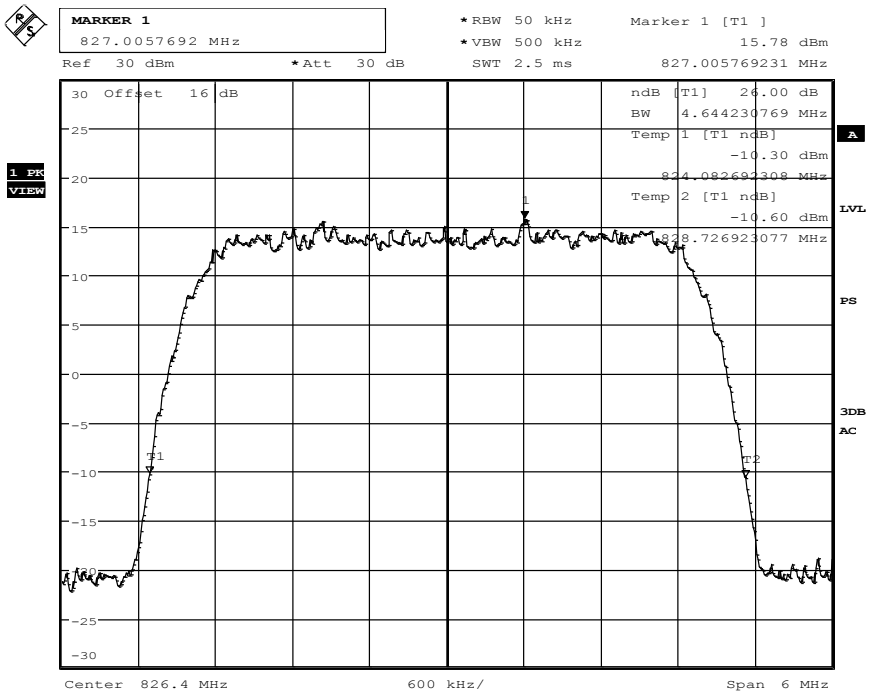
Channel 9400



Date: 14.JUN.2016 11:23:33

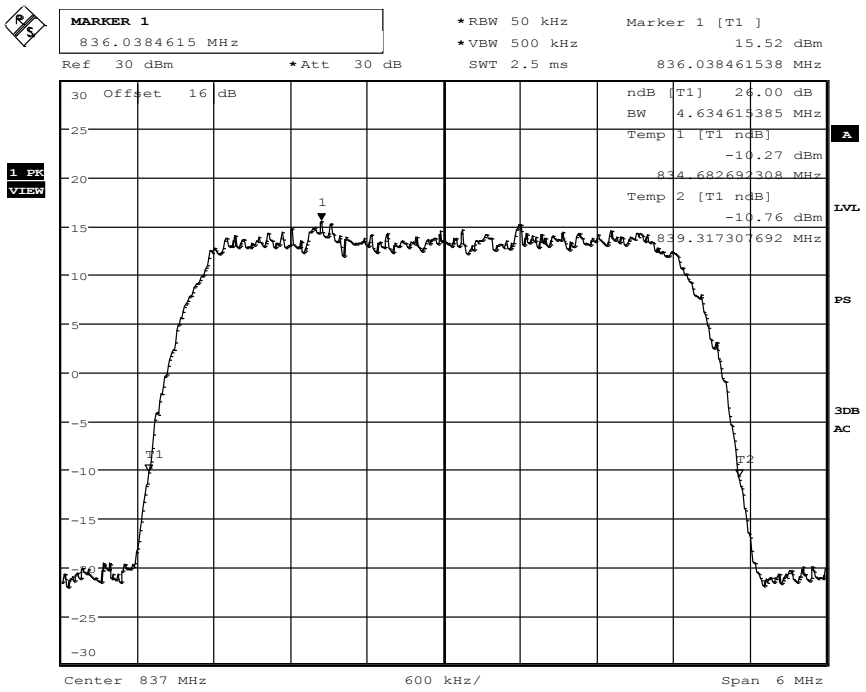
Channel 9538

1.6.2. FDD V TX Mode



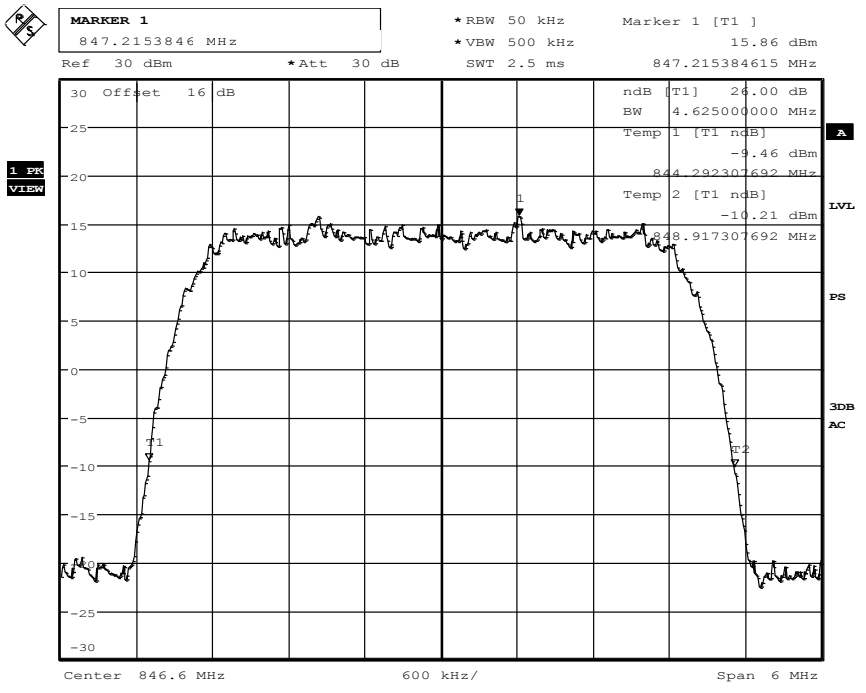
Date: 14.JUN.2016 09:56:03

Channel 4132



Date: 14.JUN.2016 10:00:29

Channel 4185



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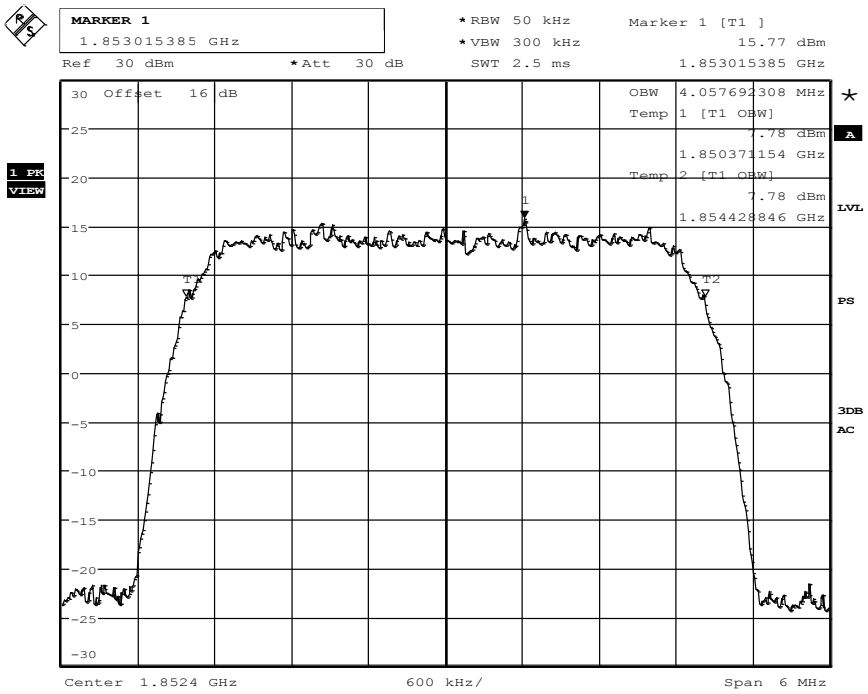
Channel 4233

1.7. 99% Occupied bandwidth

1.7.1. FDD II TX Mode



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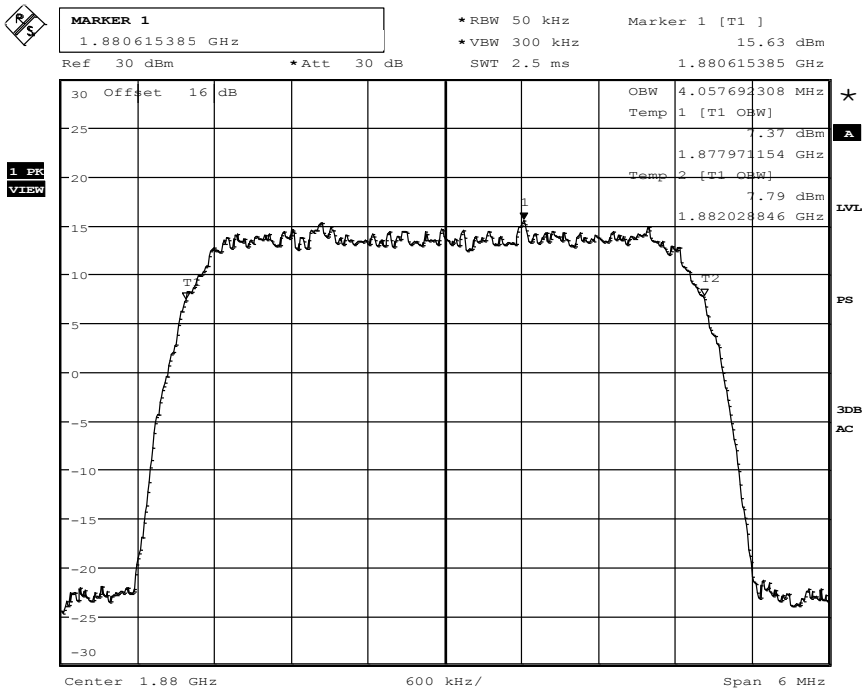
Channel 9262



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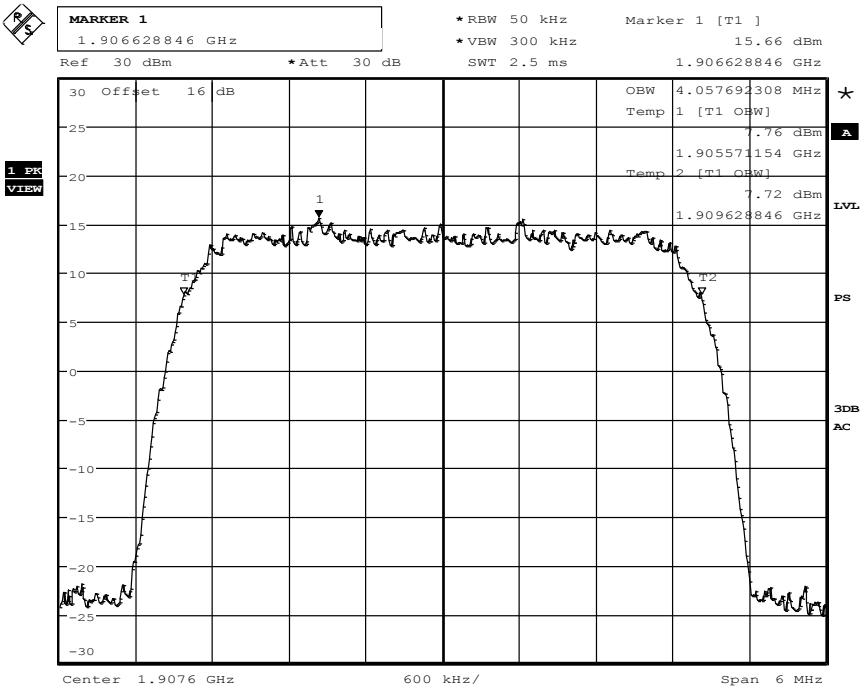
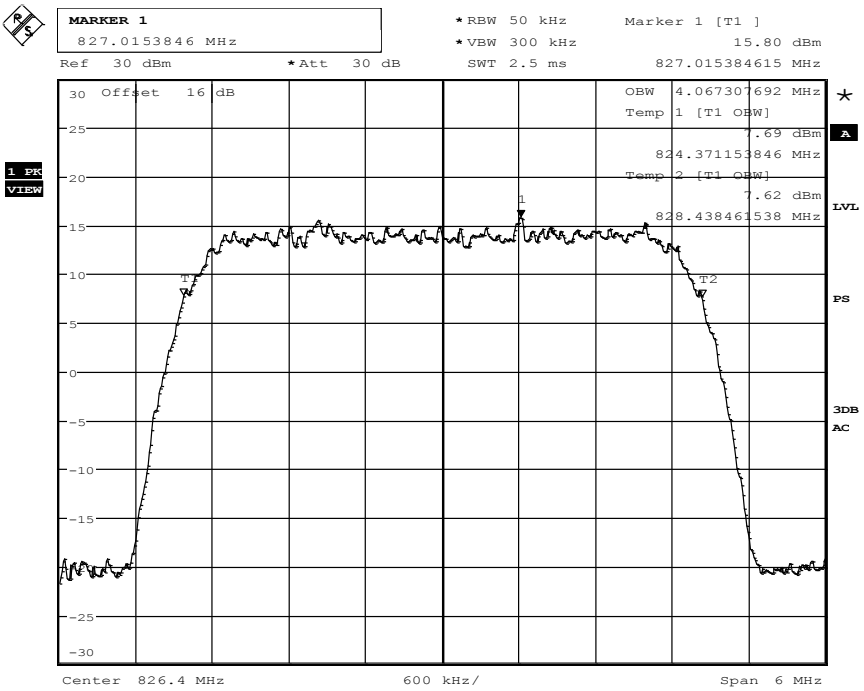
Channel 9400



Date: 14.JUN.2016 11:17:30

Channel 9538

1.7.2. FDD V TX Mode



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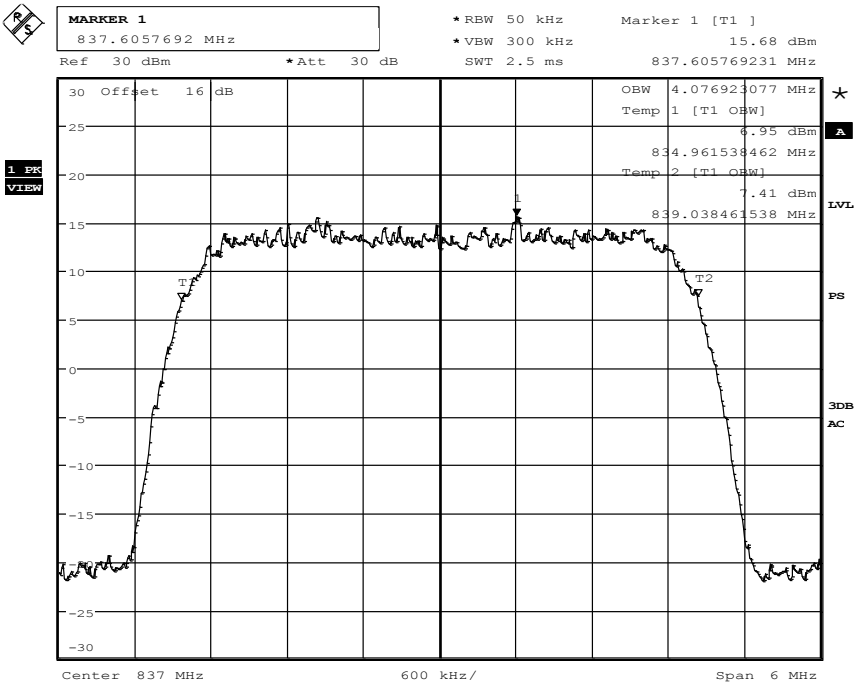
Channel 4132



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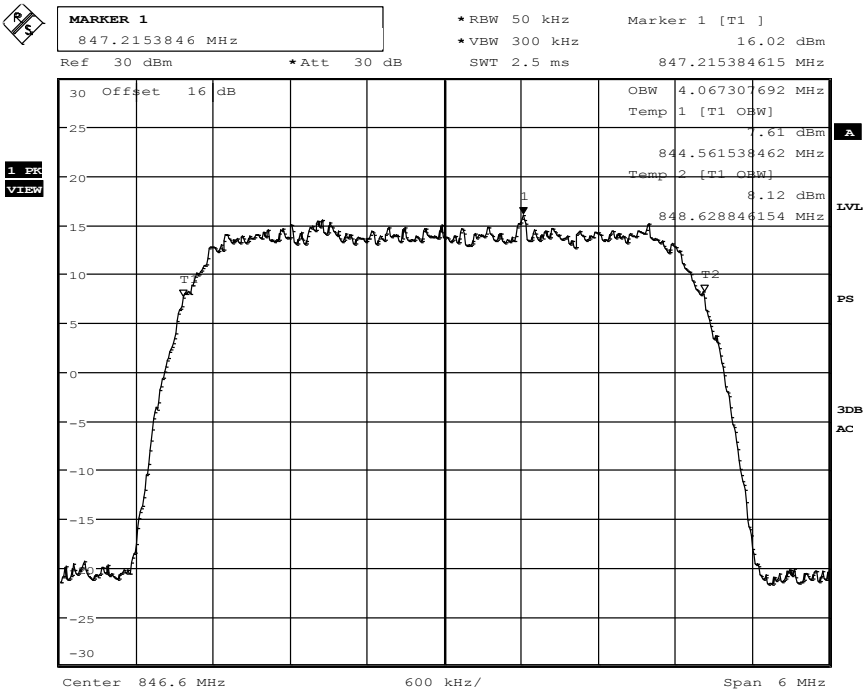
Channel 4185



Date: 14.JUN.2016 10:50:15

Channel 4233

1.8. Spurious emissions conducted on FDD Band II

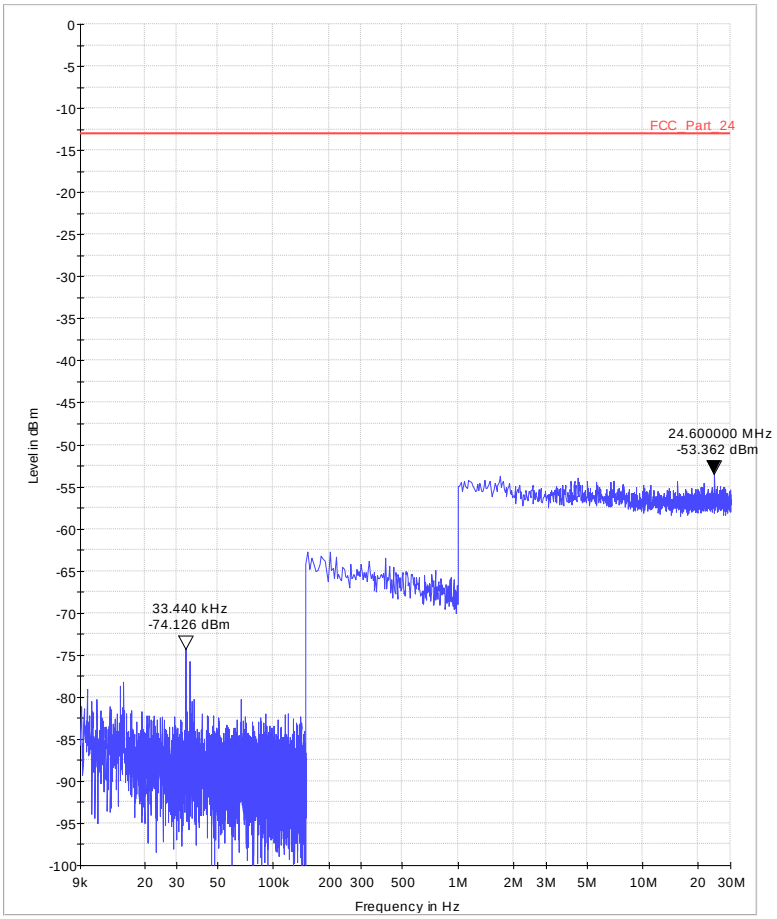


Diagram 36.01_TX_Ch9262_Sweep1

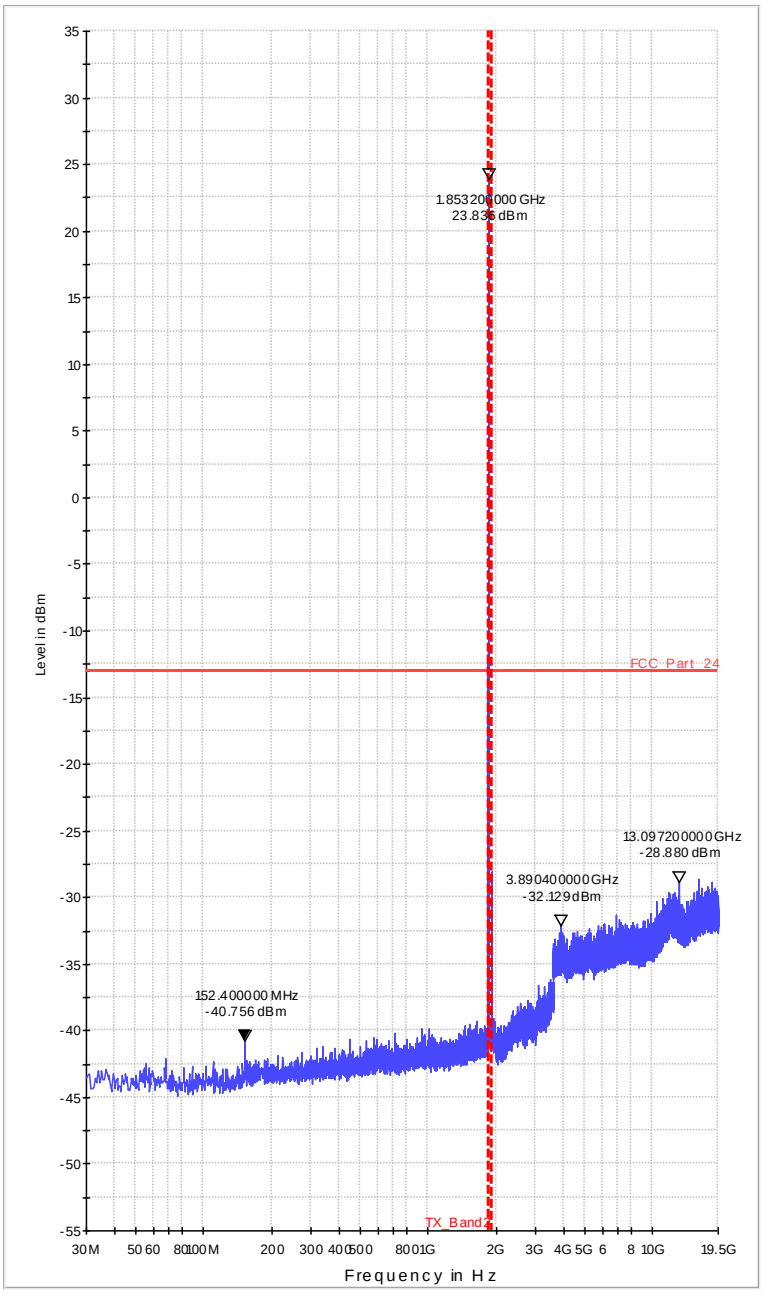


Diagram 36.02_TX_Ch9262_Sweep2

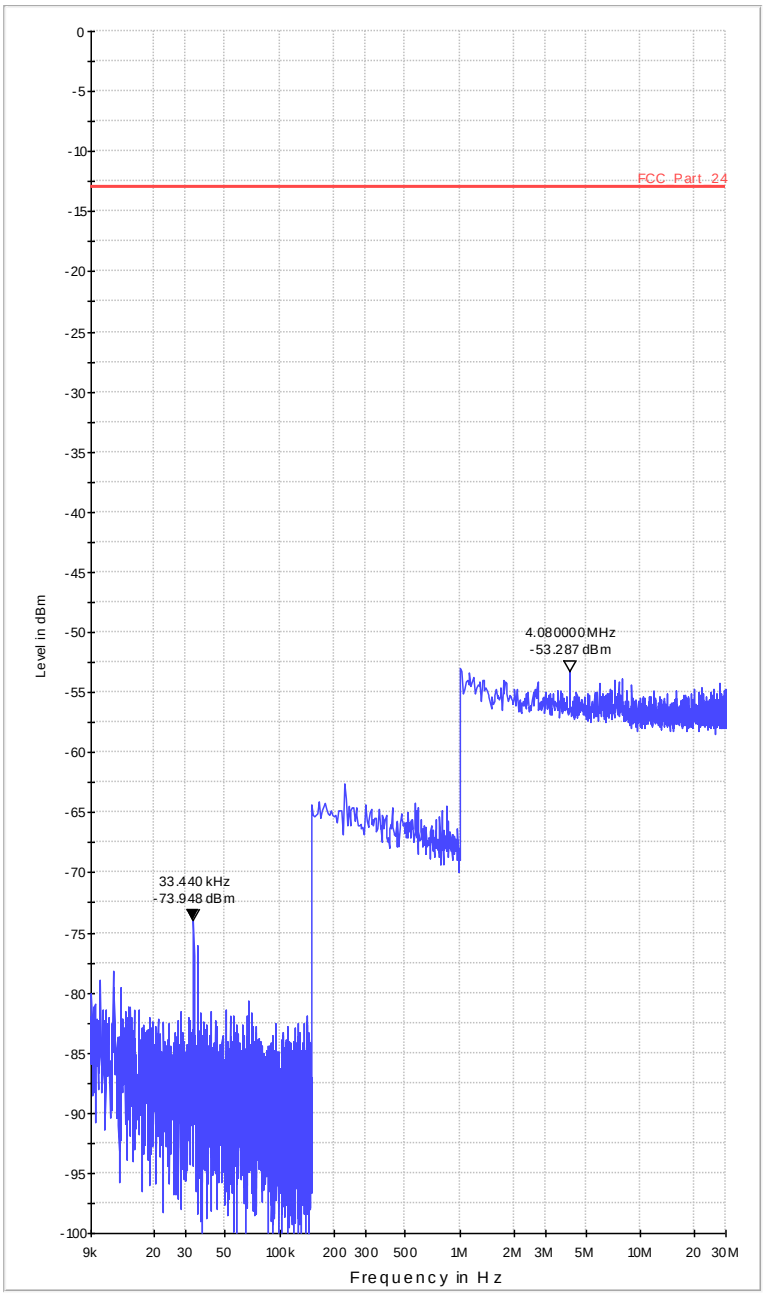


Diagram 36.03_TX_Ch9400_Sweep1

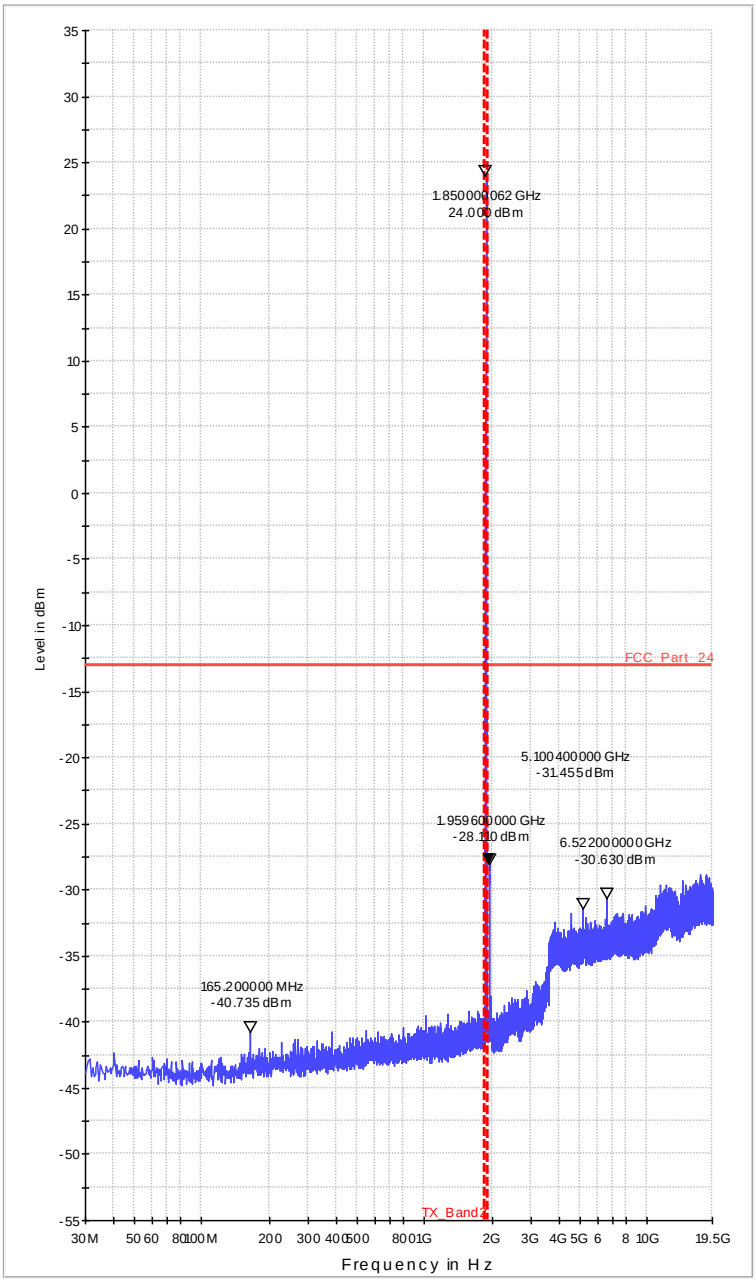


Diagram 36.04_TX_Ch9400_Sweep2

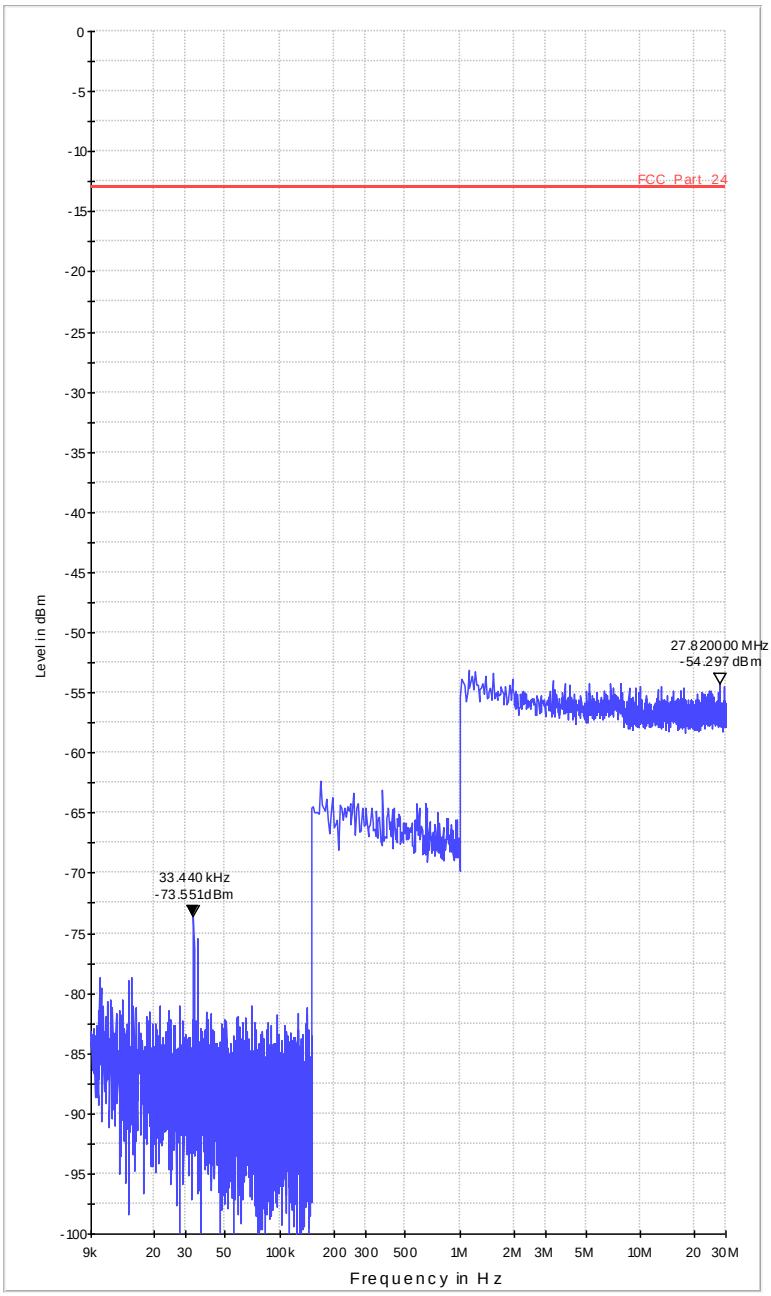


Diagram 36.05_TX_Ch9538_Sweep1

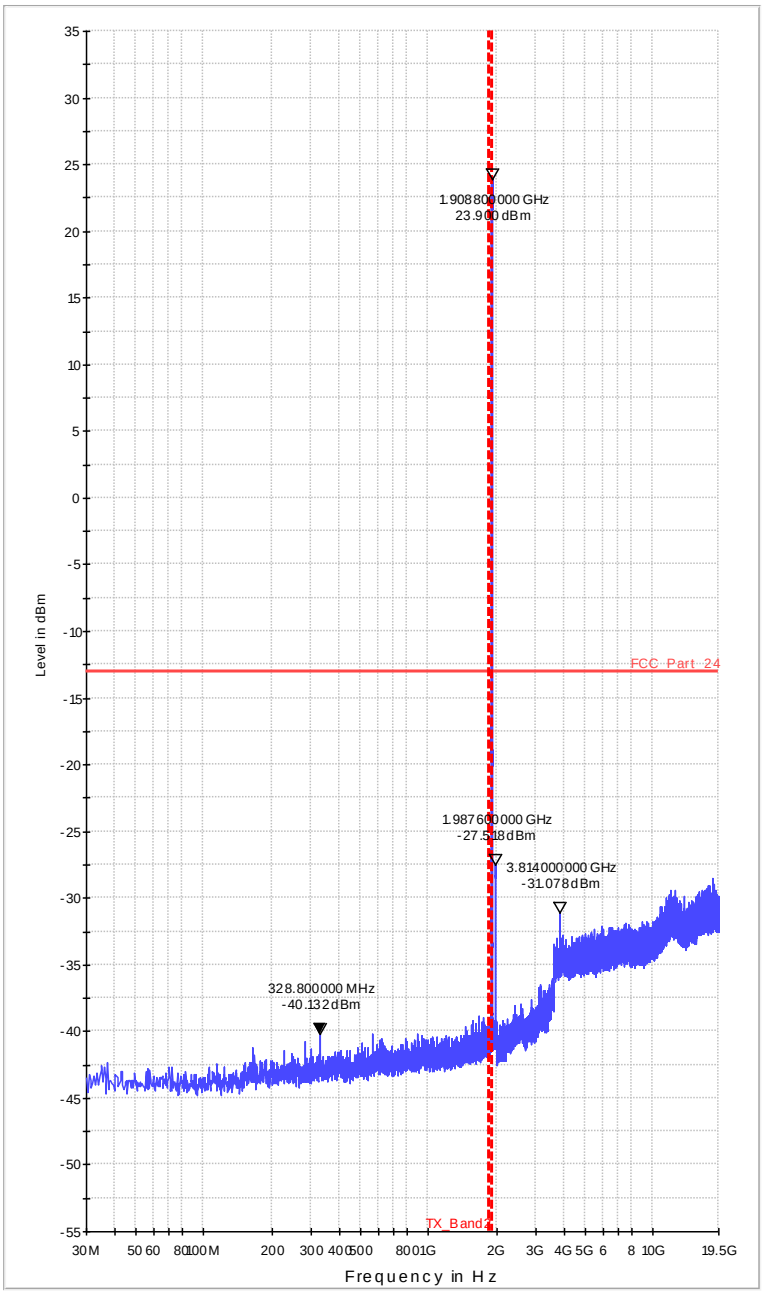


Diagram 36.06_TX_Ch9538_Sweep2

1.9. Spurious emissions conducted on FDD Band V

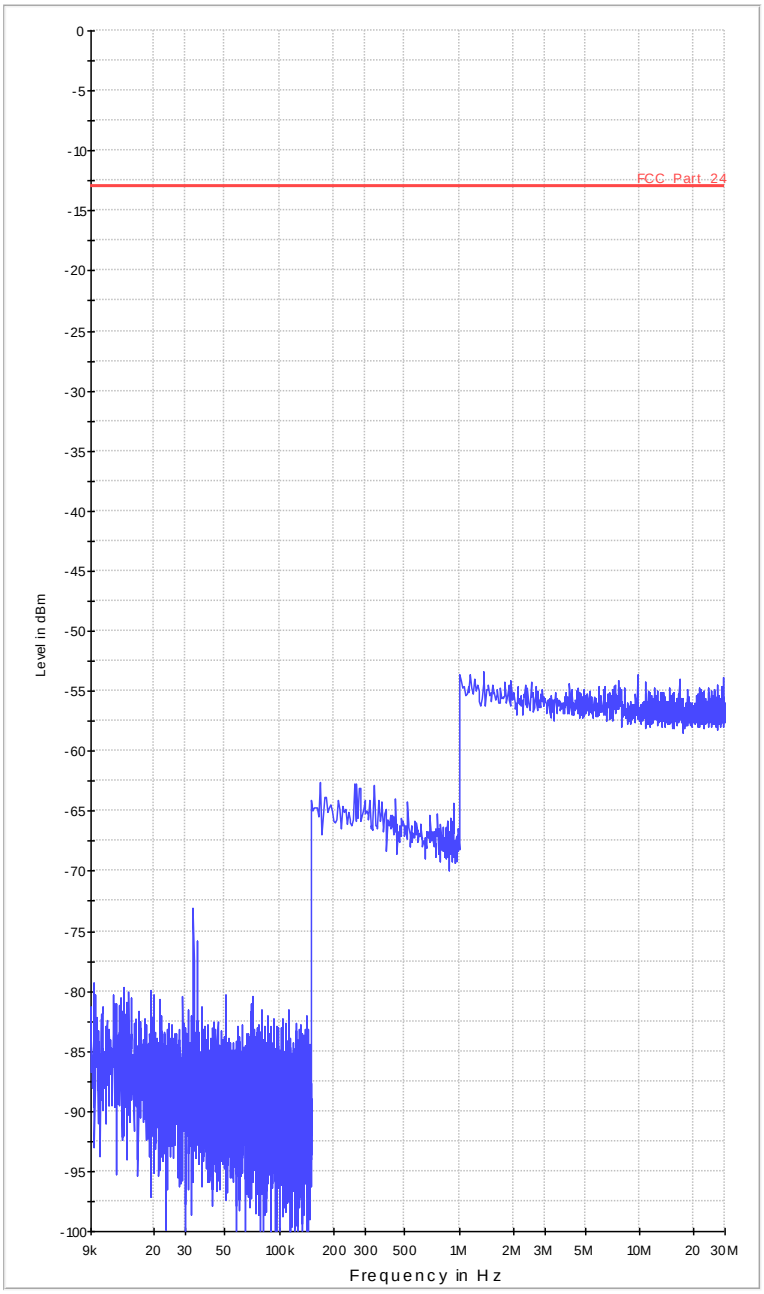


Diagram 36.07_TX_Ch4132_Sweep1

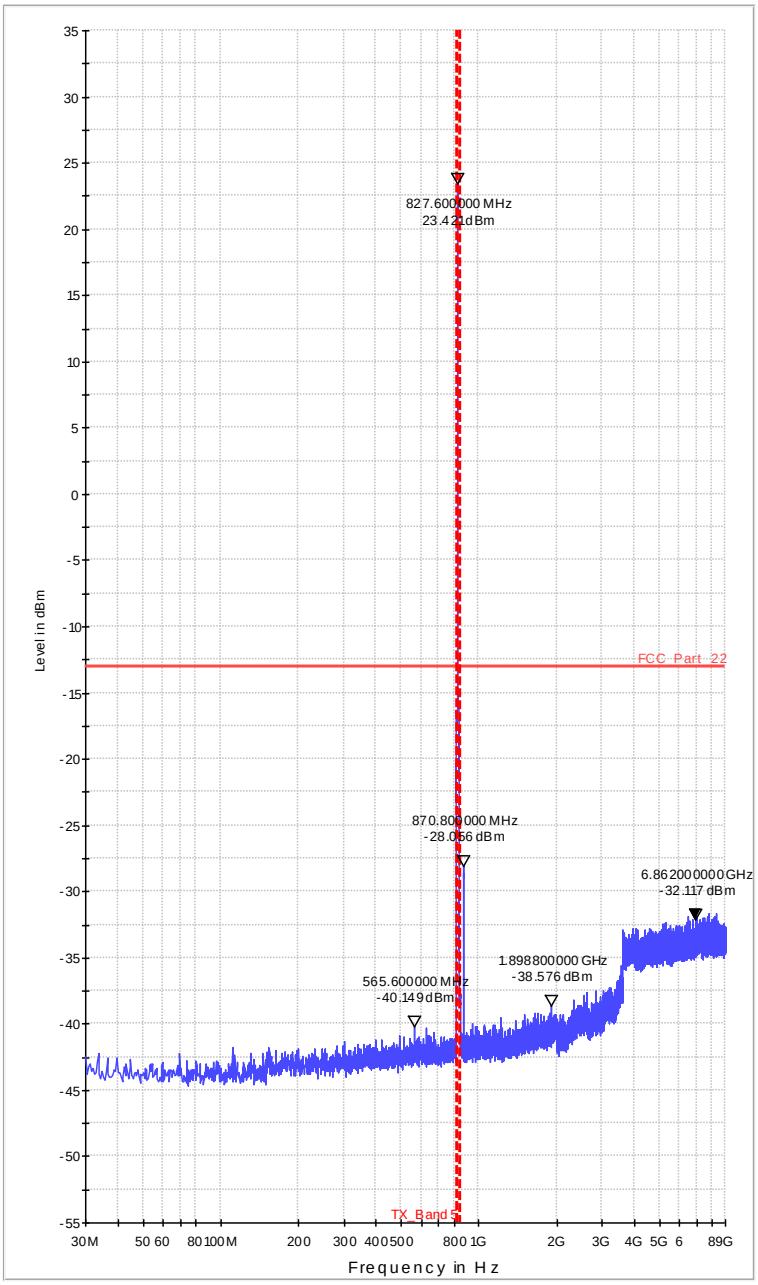


Diagram 36.08_TX_Ch4132_Sweep2

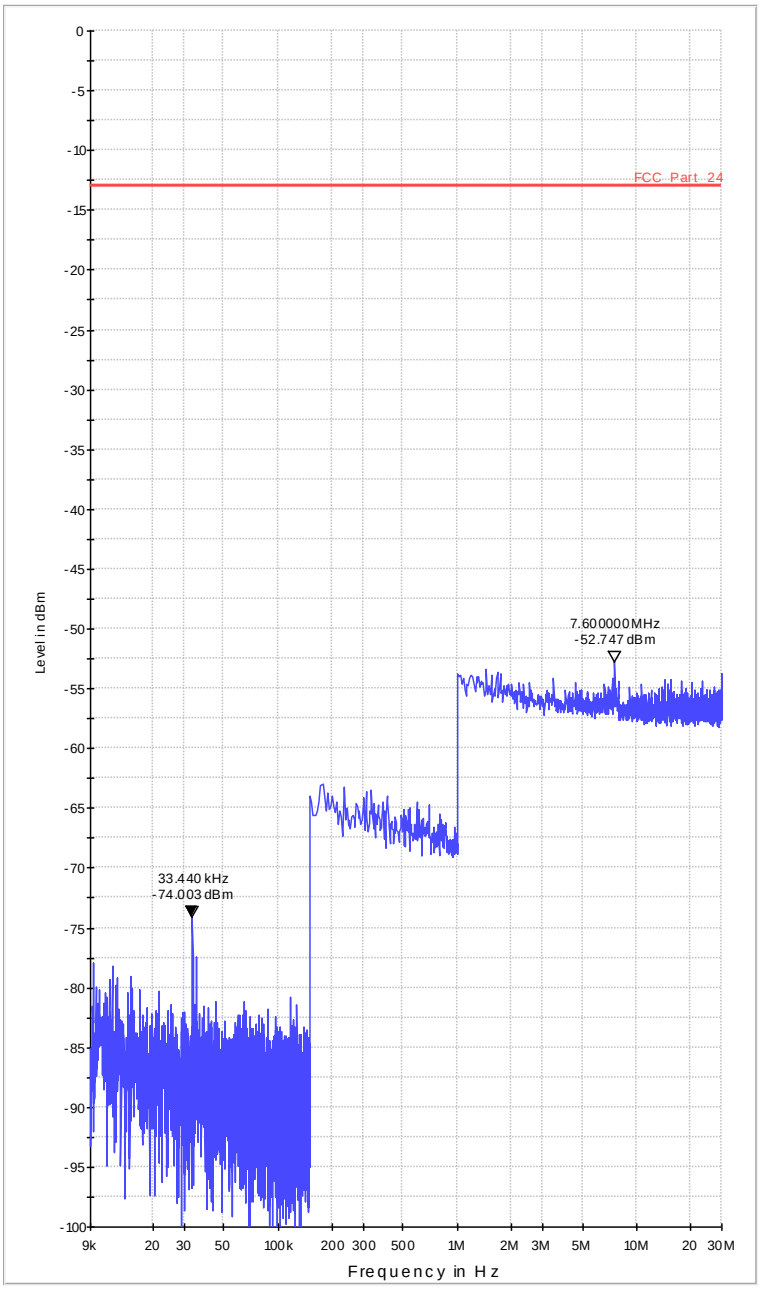


Diagram 36.09_TX_Ch4185_Sweep1

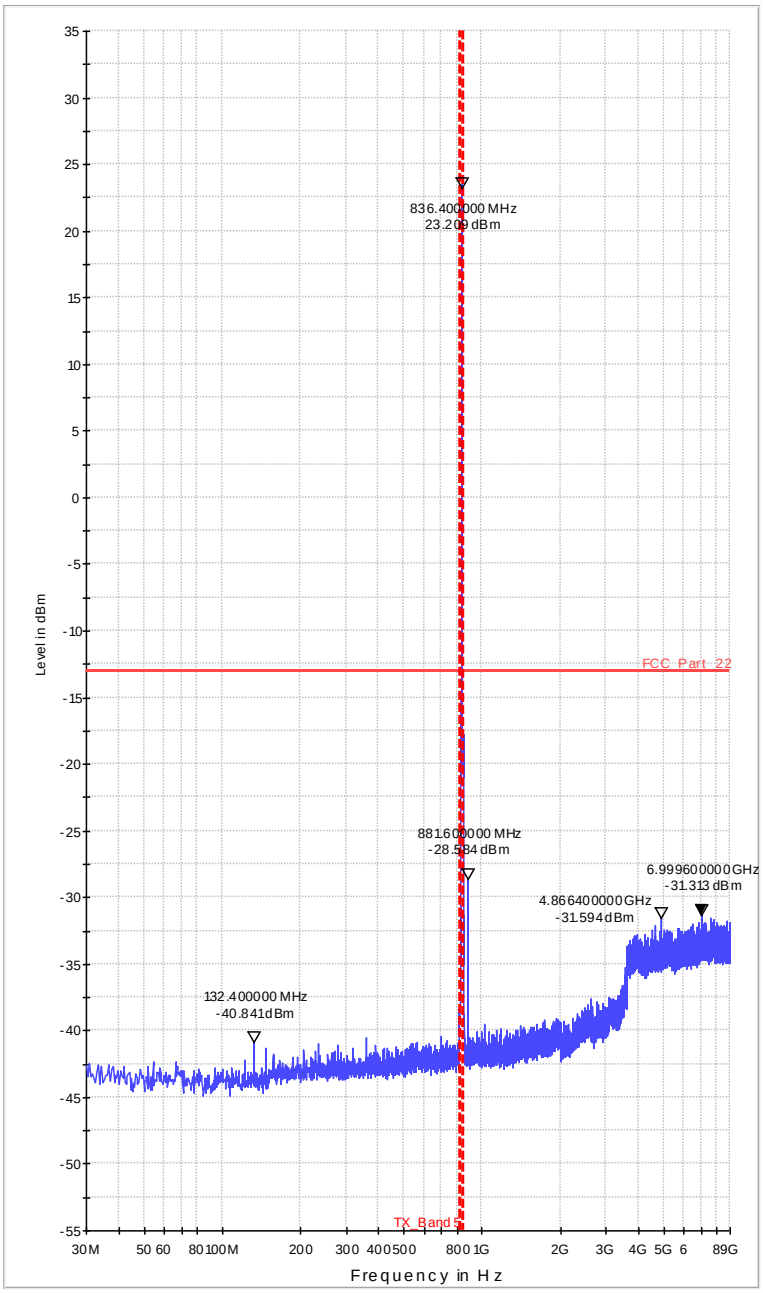


Diagram 36.10_TX_Ch4185_Sweep2

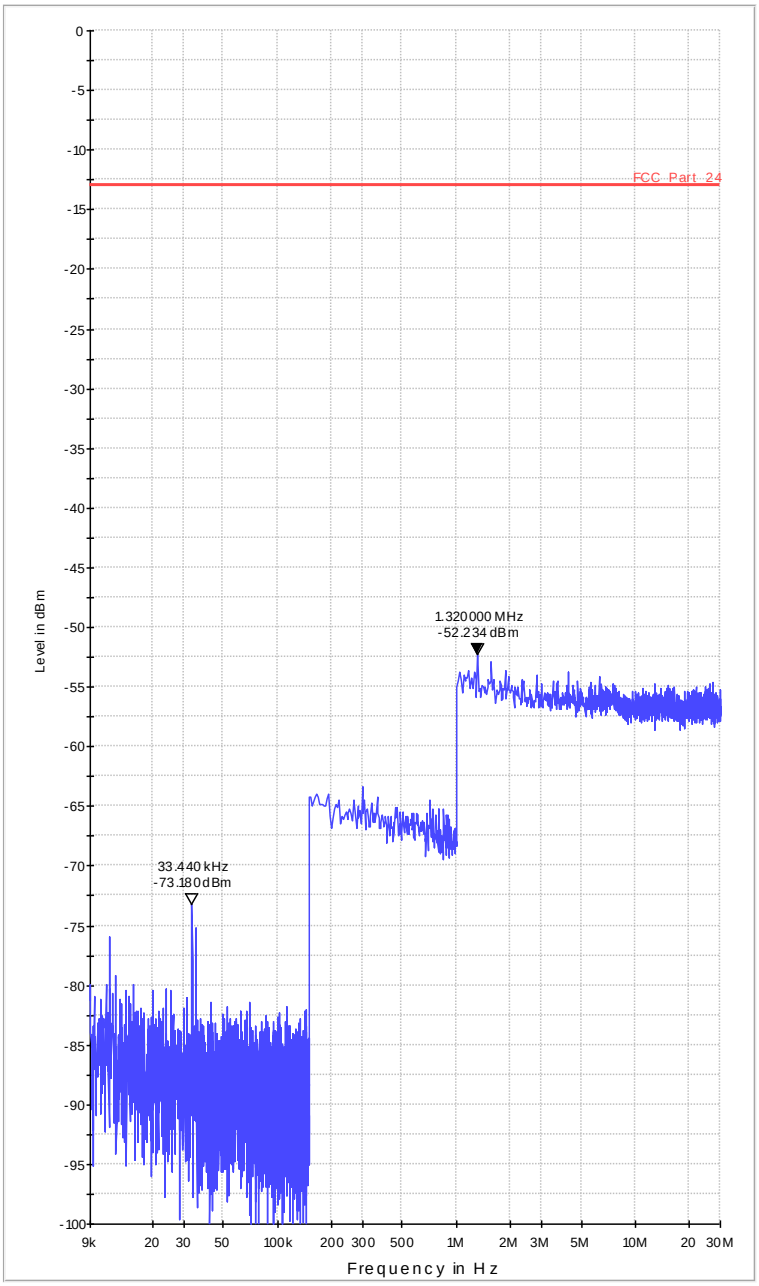


Diagram 36.11_TX_Ch4233_Sweep1

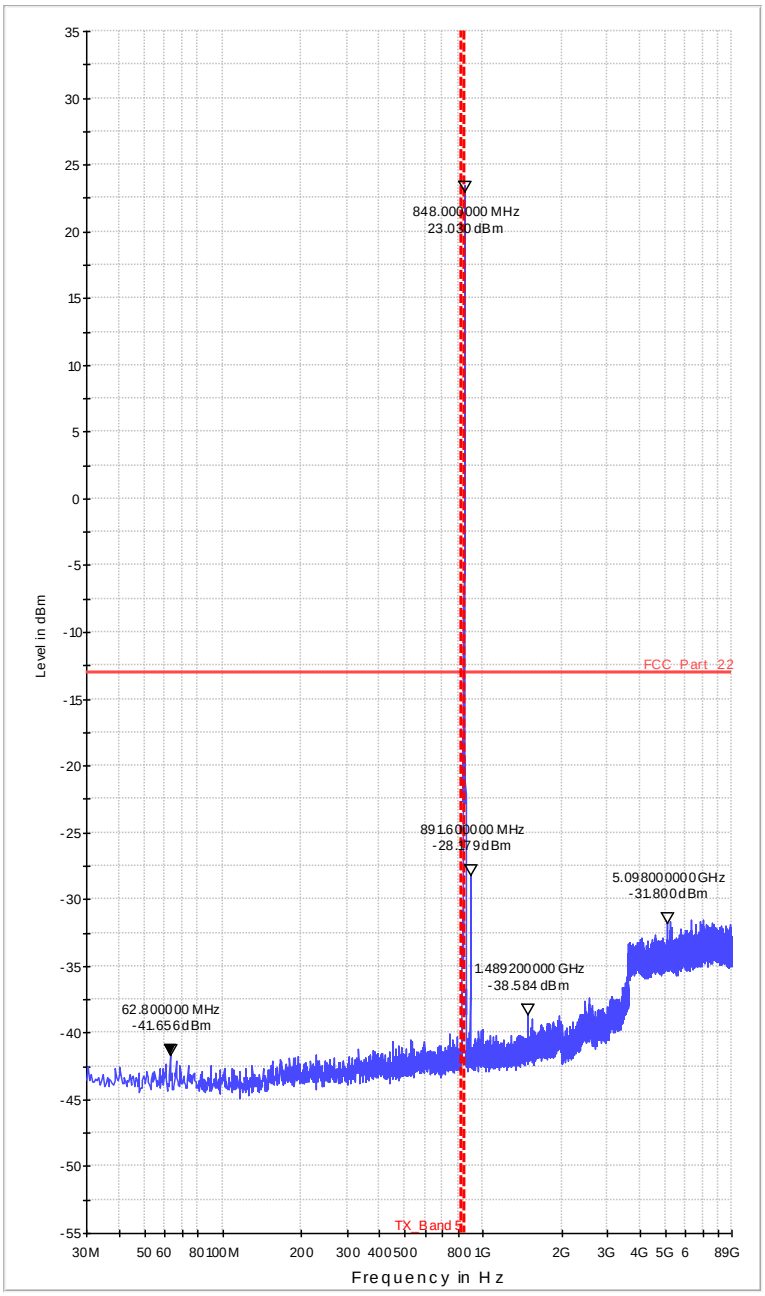


Diagram 36.12_TX_Ch4233_Sweep2

1.10. Conducted emissions on FDD Band II band-edge

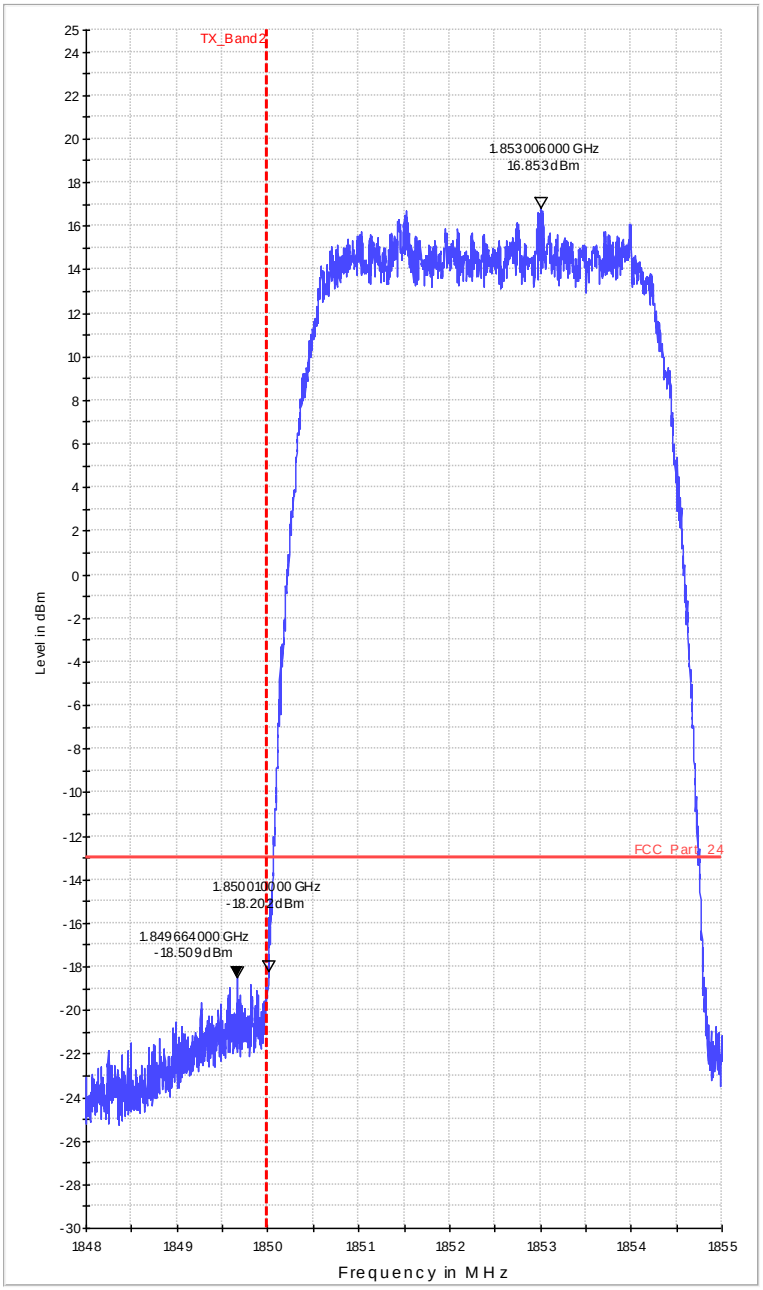


Diagram 37.01_BE_Ch9262

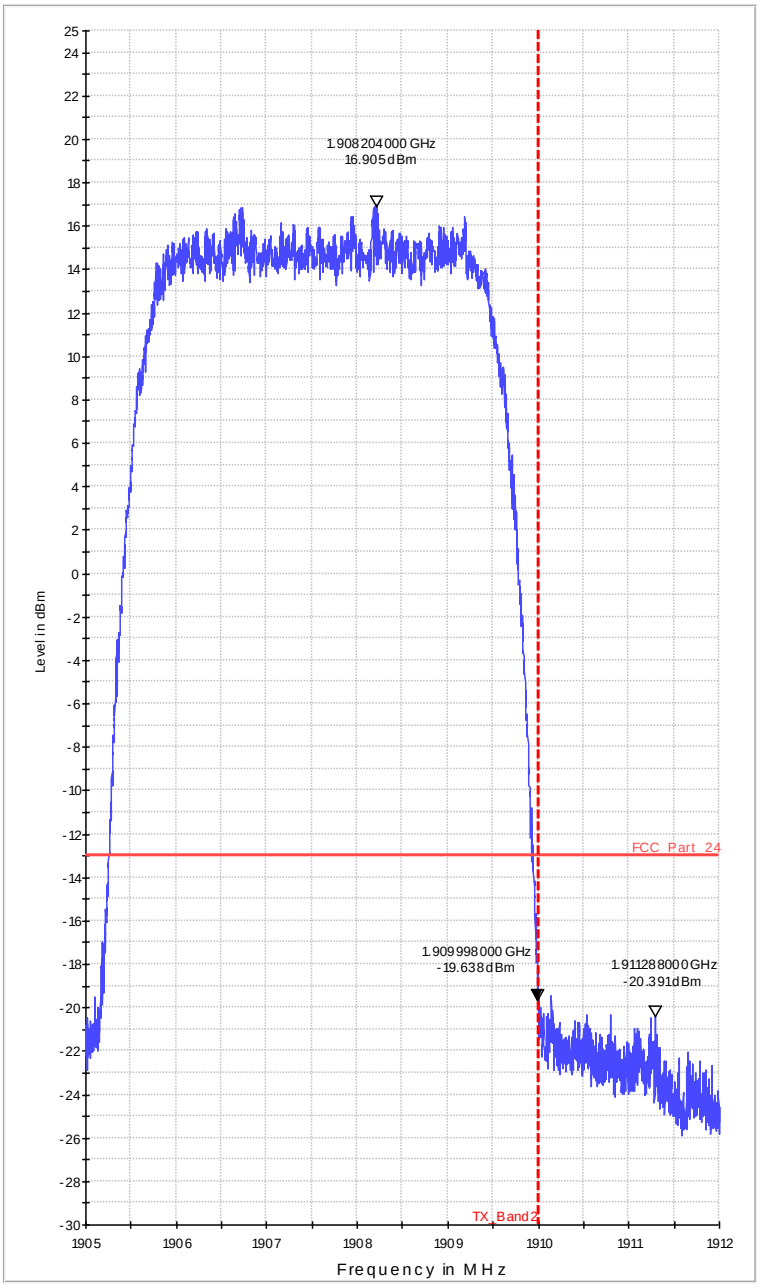


Diagram 37.02_BE_Ch9538

1.11. Conducted emissions on FDD Band V band-edge

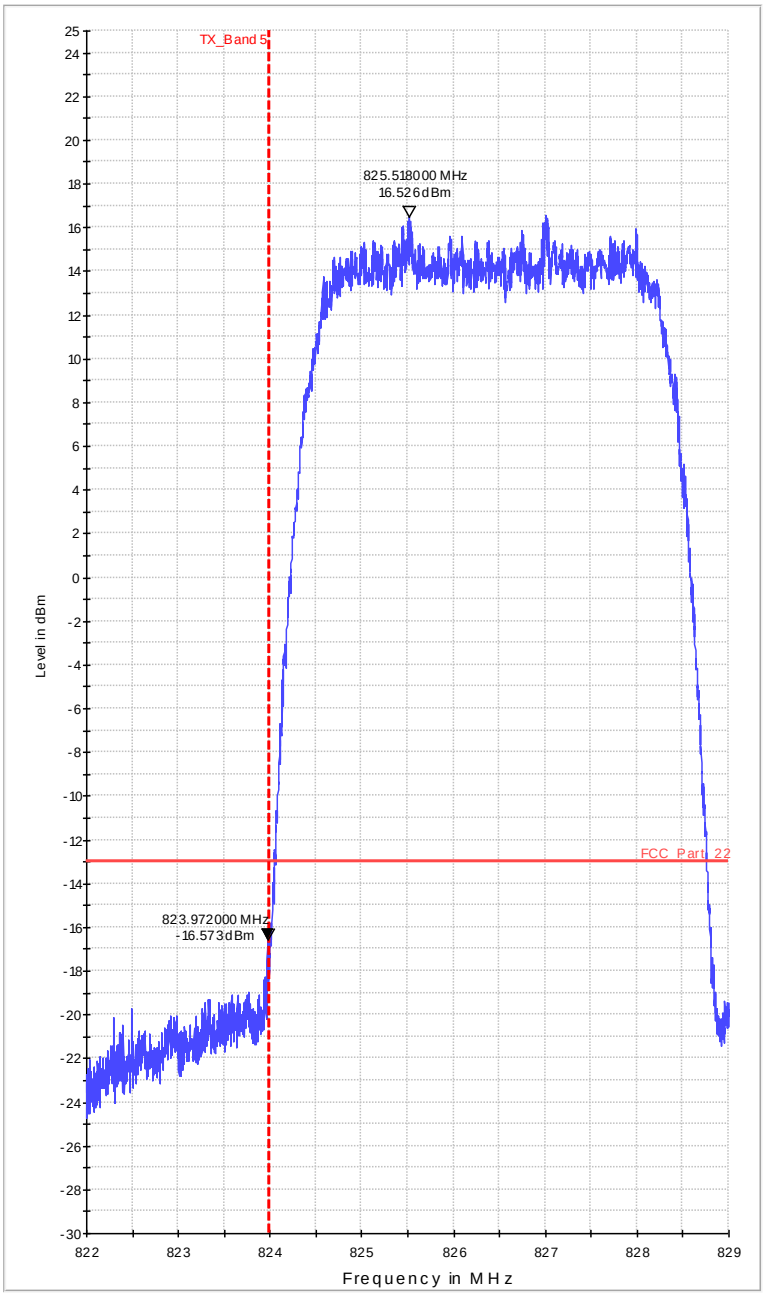


Diagram 37.03_BE_Ch4132

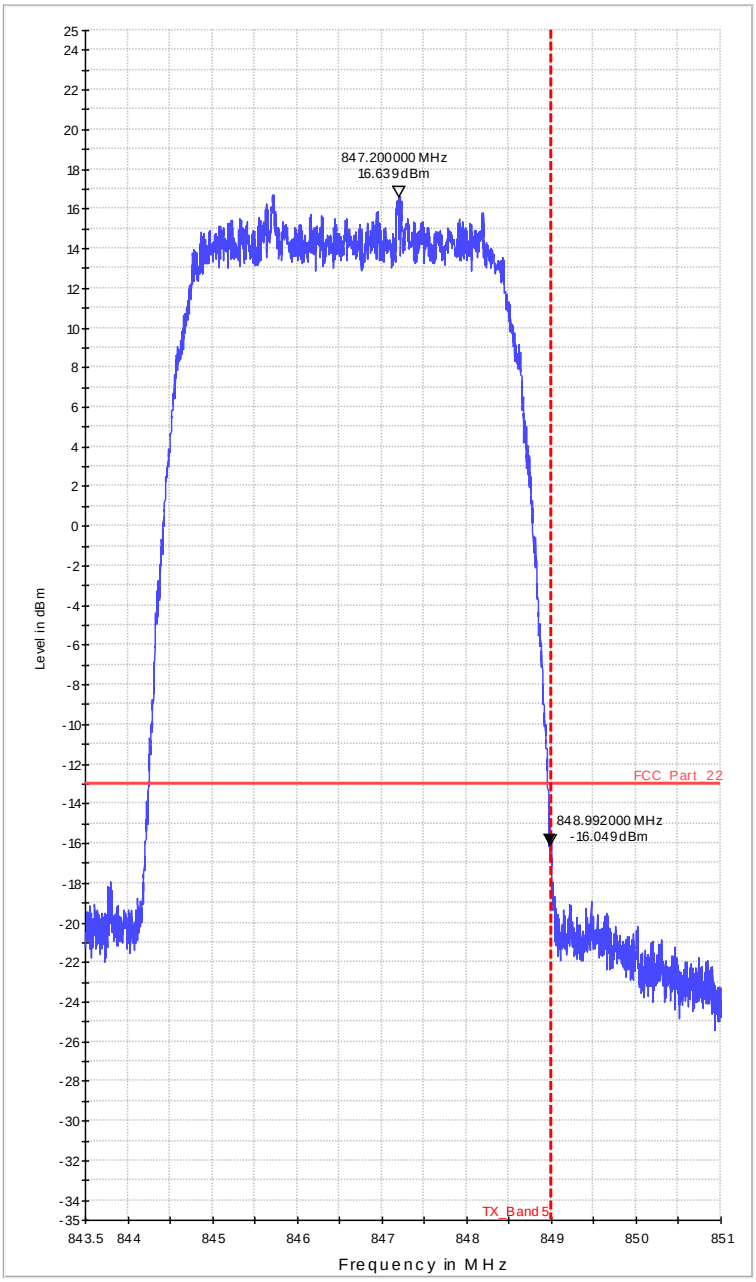


Diagram 37.04_BE_Ch4233

1.12. Magnetic field strength emissions

1.12.1. FDD 2

2.20_Low_Channel

Common Information

Test Description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Distance correction:	used accord. table, pls. see test report
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 4
Operating Conditions:	Ch9262, Voice
Power during tests:	120V AC, 3.8V DC
Operator Name:	RIs
Comment:	FDDII_L

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-

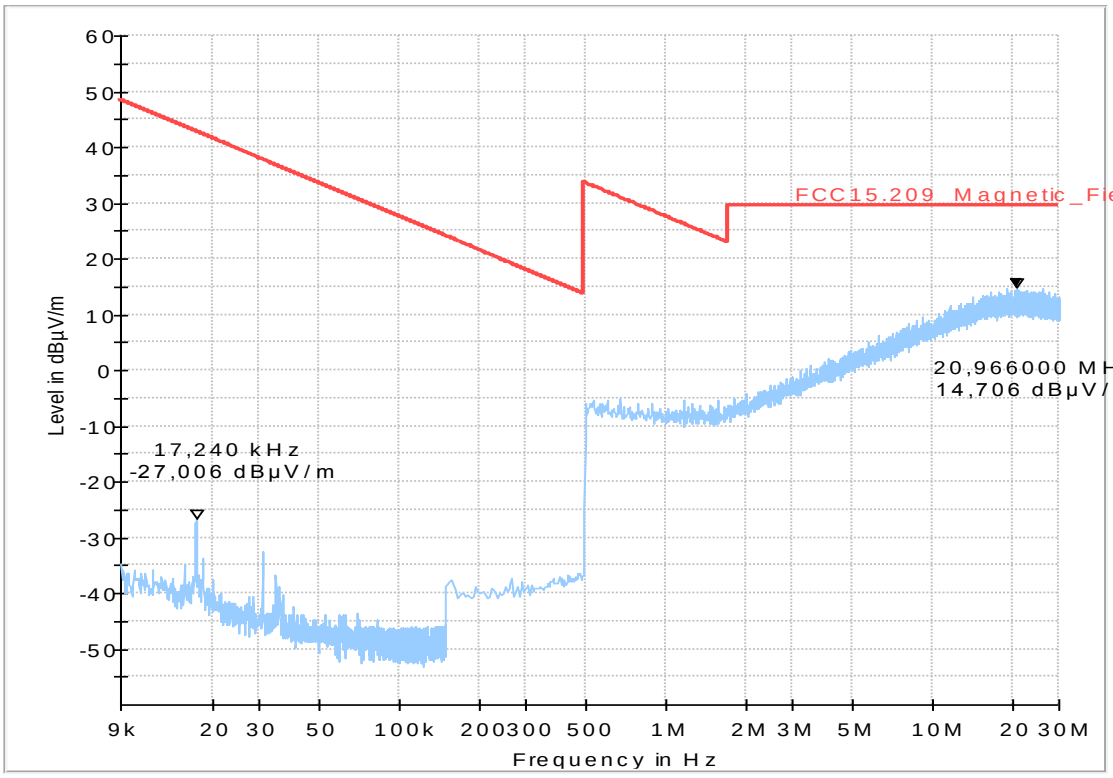


Diagram 2.21_Middle_Channel

Common Information

Test Description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Distance correction:	used accord. table, pls. see test report
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 4
Operating Conditions:	Ch9400, Voice
Power during tests:	120V AC, 3.8V DC
Operator Name:	RIs
Comment:	FDDII_M

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-

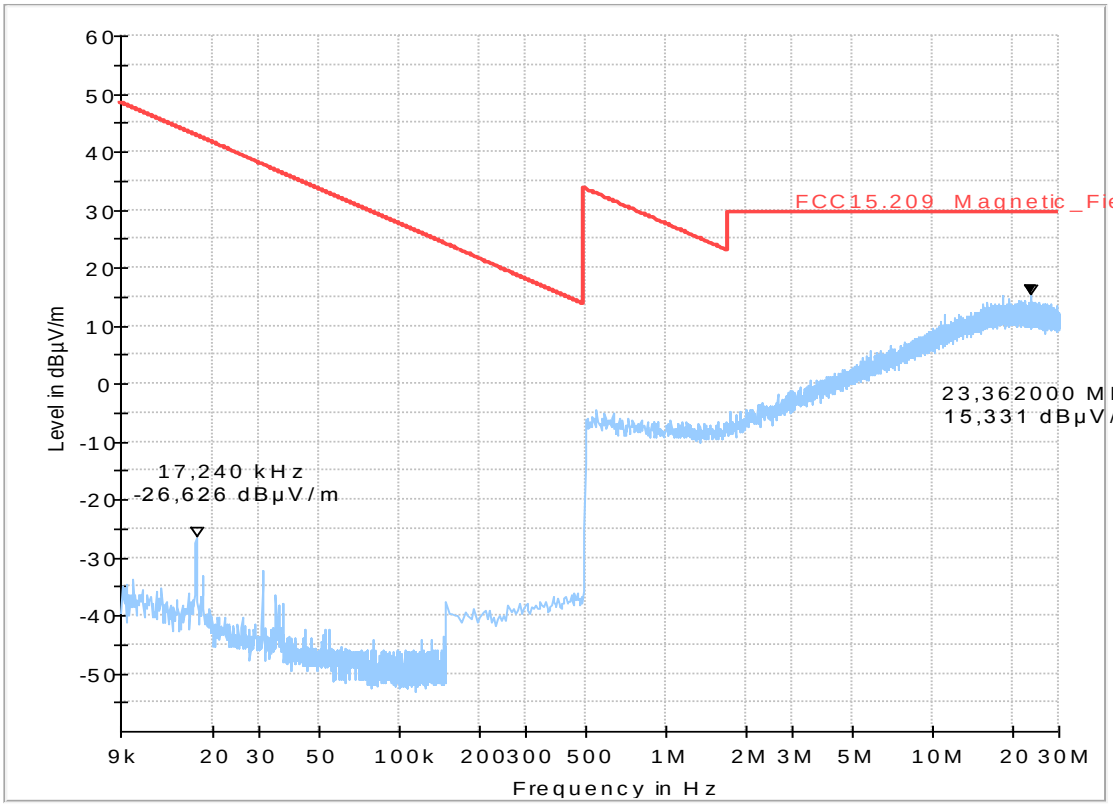


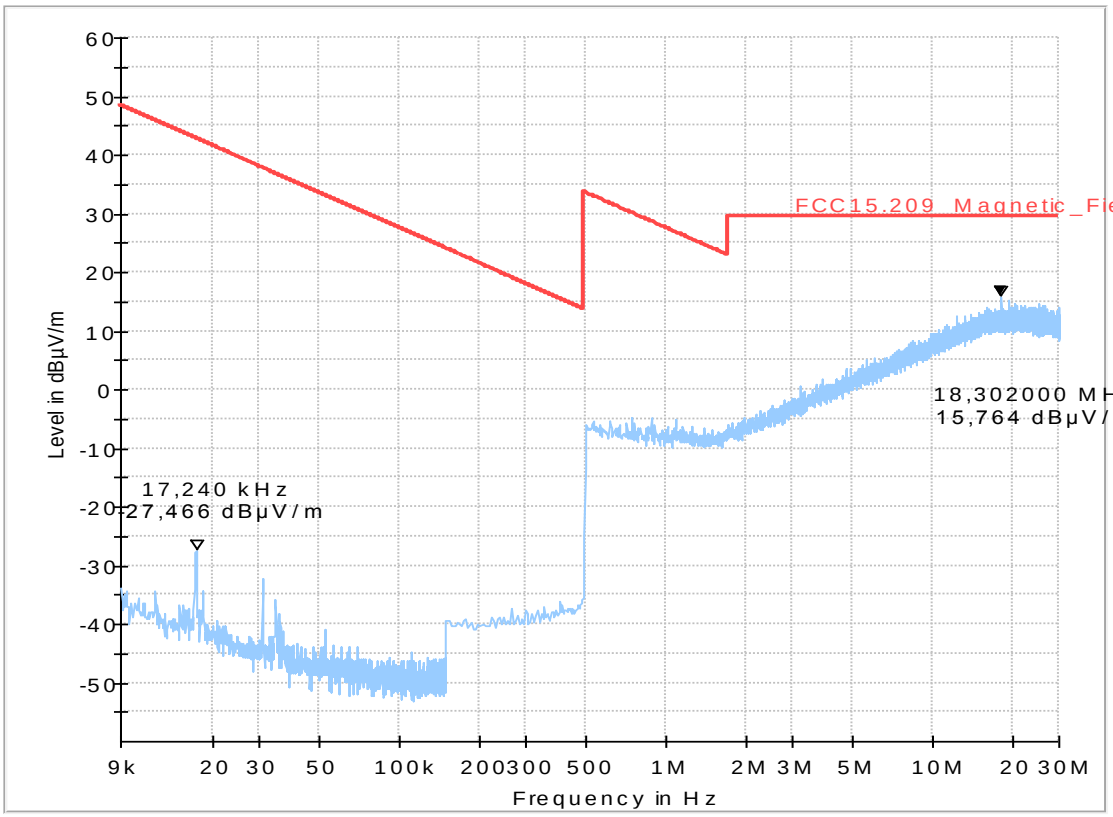
Diagram 2.22_High_Channel

Common Information

Test Description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Distance correction:	used accord. table, pls. see test report
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 4
Operating Conditions:	Ch9538, Voice
Power during tests:	120V AC, 3.8V DC
Operator Name:	RIs
Comment:	FDDII_H

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-



1.12.2. FDD 5

Diagram 2.50_Low_Channel

Common Information

Test Description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Distance correction:	used accord. table, pls. see test report
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 4
Operating Conditions:	Ch4132, Voice
Power during tests:	12V DC, 3.8V DC
Operator Name:	RIs
Comment:	

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-

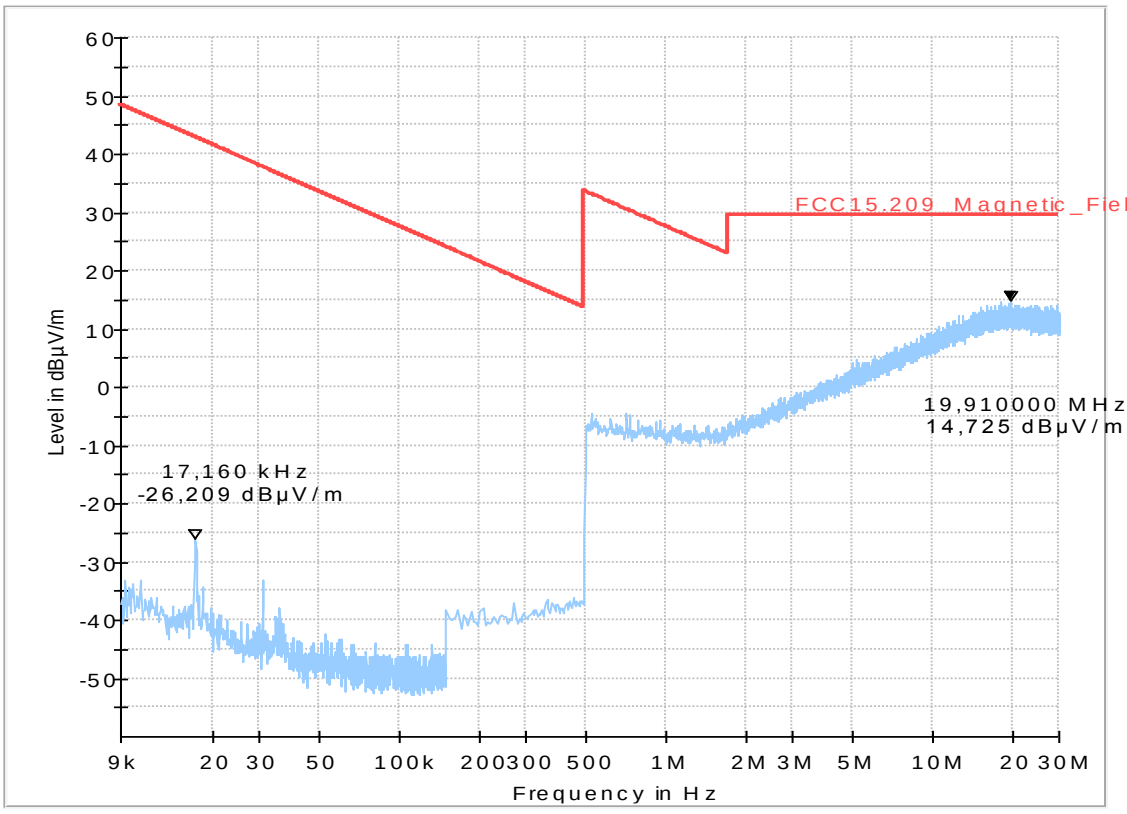


Diagram 2.51_Middle_Channel

Common Information

Test Description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Distance correction:	used accord. table, pls. see test report
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 4
Operating Conditions:	Ch4183, Voice
Power during tests:	12V DC, 3.8V DC
Operator Name:	RIs
Comment:	

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-

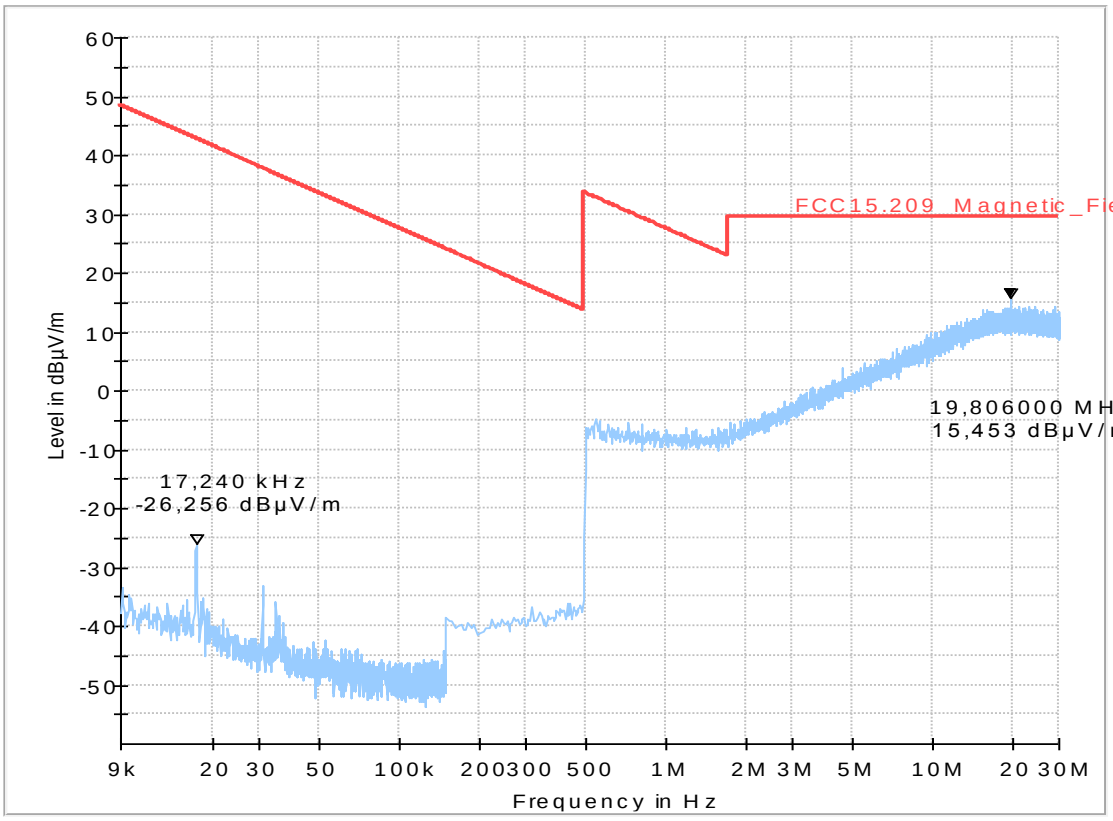


Diagram 2.52_High_Channel

Common Information

Test Description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Distance correction:	used accord. table, pls. see test report
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 4
Operating Conditions:	Ch4233, Voice
Power during tests:	12V DC, 3.8V DC
Operator Name:	RIs
Comment:	

EUT Information

Manufacturer:	u-blox AG
Model:	SARA-U201
Type:	GSM/WCDMA module
---	---
EUT:	-
HW version:	261A01
SW version:	23.56
SVN:	-
Config:	-
Serial number:	357520070020959
Connected Interfaces:	Antenna GSATT1505001611 and Headset
Power Supply:	3.8V DC
Comments:	-