Annex 1: Measurement diagrams to
T E S T R E P O R T
No.: 17-1-0172601T21a-C3

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

ISED-Regulations
RSS-132 Issue 3, RSS-133 Issue 6,
RSS-139 Issue 2, RSS-Gen Issue 4
RSS-130 Issue 1

for

Robert Bosch Tool Corporation
GPS 25-4

With integrated SARA-R410M LTE Cat-M1 Module

FCC ID: TXTGPS25-4
ISED: 909H-GPS254

Laboratory Accreditation
ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-01 D-PL-12047-01-03 D-PL-12047-01-04
accredited according to DIN EN ISO/IEC 17025

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Table of contents

1. Measurement diagrams LTE-mode

1.1. Power conducted

1.1.1. Power conducted LTE-Band 2

LTE-Band 2				QPSK-Modulation			16-QAM-Modulation						
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency [MHz]	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	max- modulation	max. modulation	max. bandwidth	absolute max. value channels/band widths
1.4 MHz	18900	1880	1 RB low	27,53	22,71	4,82	27,52	22,81	4,71	22,79	22,82	22,82	22,82
			1 RB high	27,48	22,71	4,77	27,48	22,82	4,66				
			100% RB	26,6	22,79	3,81	27,08	22,72	4,36				

1.1.2. Power conducted LTE-Band 4

LTE-Band 4				QPSK-Modulation			16-QAM-Modulation						
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	max- modulat	max. modualti	max. channel	absolute max. value
1.4 MHz	19957	1711	1 RB low	28,05	23,41	4,64	27,97	23,29	4,68	23,41	23,29	23,41	23,410
			1 RB high	28,24	23,37	4,87	28,08	23,29	4,79				
			100% RB	27,06	23,26	3,8	27,73	23,21	4,52				

1.1.3. Power conducted LTE-Band 5

LTE-Band 5				QPSK-Modulation			16-QAM-Modulation						
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	max- modulati	max. modulati	max. channel	absolute max. value
1.4 MHz	20407	824.7	1 RB low	28,35	23,55	4,8	28,2	23,54	4,66	23,60	23,55	23,60	23,60
			1 RB high	28,38	23,6	4,78	28,25	23,55	4,7				
			100% RB	27,33	23,58	3,75	27,8	23,54	4,26				

1.1.4. Power conducted LTE-Band 12

LTE-Band 12				QPSK-Modulation			16-QAM-Modulation						
channel bandwidth	ARFCN ch. no.	ARFCN-Frequency	Resource block allocation	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	Peak detektor [dBm]	RMS detektor [dBm]	PAR Faktor [dB]	max- modulat	max. modulat	max. channel	absolute max. value
1.4 MHz	23173	715.3	1 RB low	28,51	23,69	4,82	28,47	23,70	4,77	23,69	23,70	23,70	23,70
			1 RB high	28,50	23,69	4,81	28,43	23,66	4,77				
			100% RB	27,32	23,59	3,73	28,21	23,70	4,51				

1.2. PAPR-Value (CCDF plots)

1.2.1. LTE Band 2

Worst-Case of each maximum Peak power value was tested with the CCDF method

1.2.1.1. 1.4MHz signal bandwidth

Diagram: Channel_18900_100%RB_Modulation_QPSK

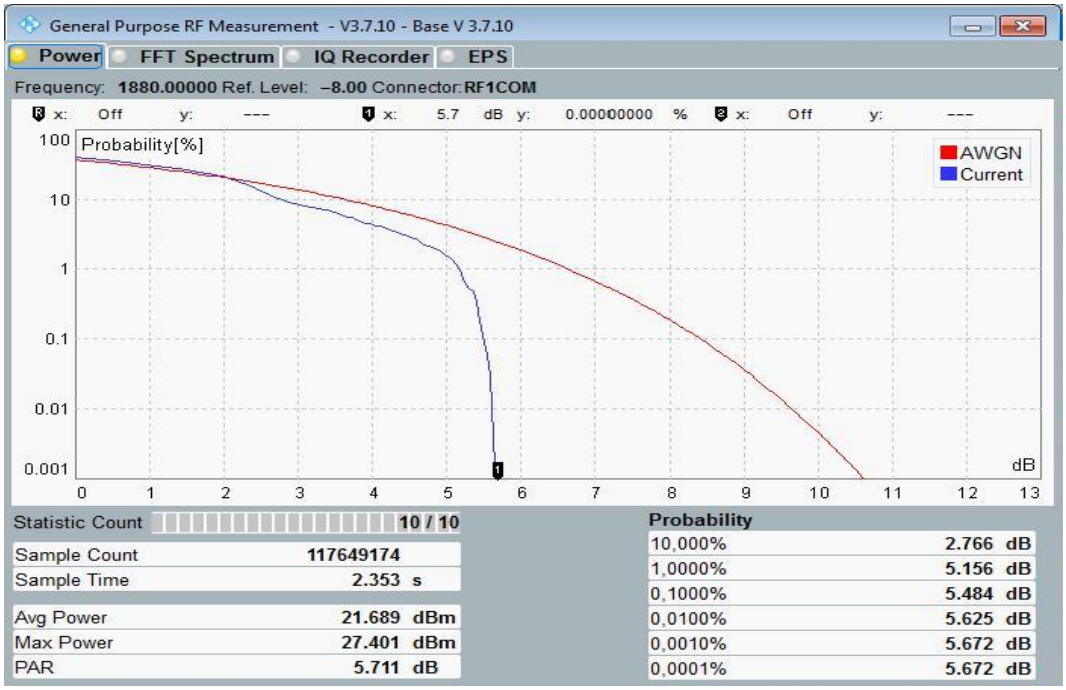


Diagram: Channel_18900_1RB_high_Modulation_16QAM

1.2.2. LTE Band 4

Worst-Case of each maximum Peak power value was tested with the CCDF method

1.2.2.1. 1.4MHz signal bandwidth

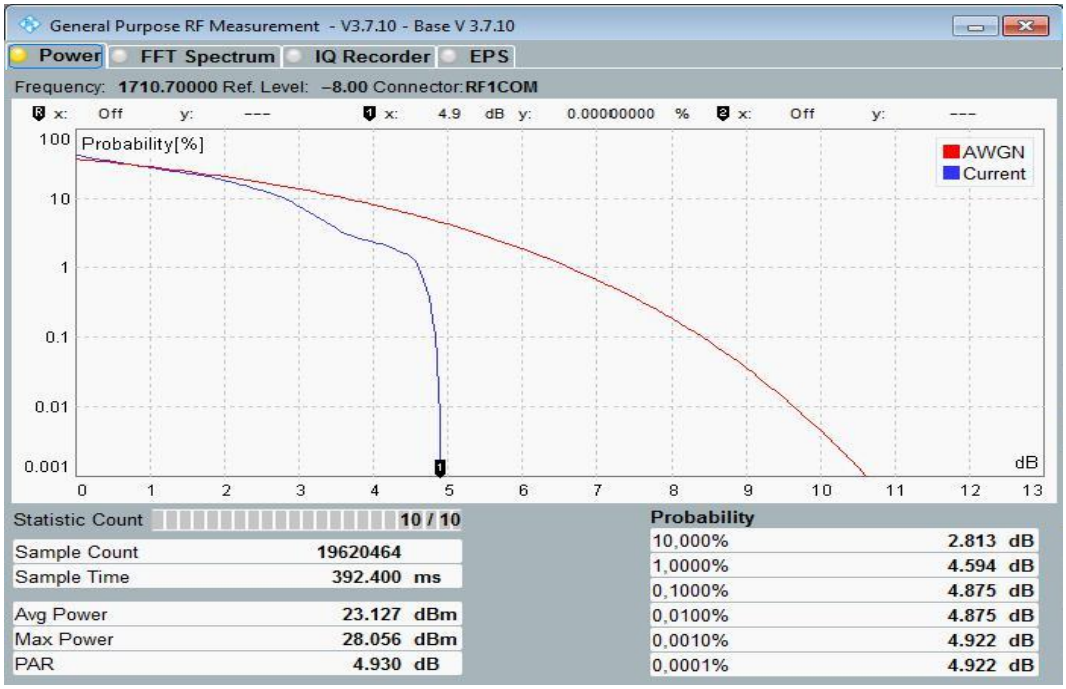


Diagram: Channel_19957_1RB_low_Modulation_QPSK

Diagram: Channel_19957_1RB_high_Modulation_16QAM

1.2.3. LTE Band 5

Worst-Case of each maximum Peak power value was tested with the CCDF method

1.2.3.1. 1.4MHz signal bandwidth

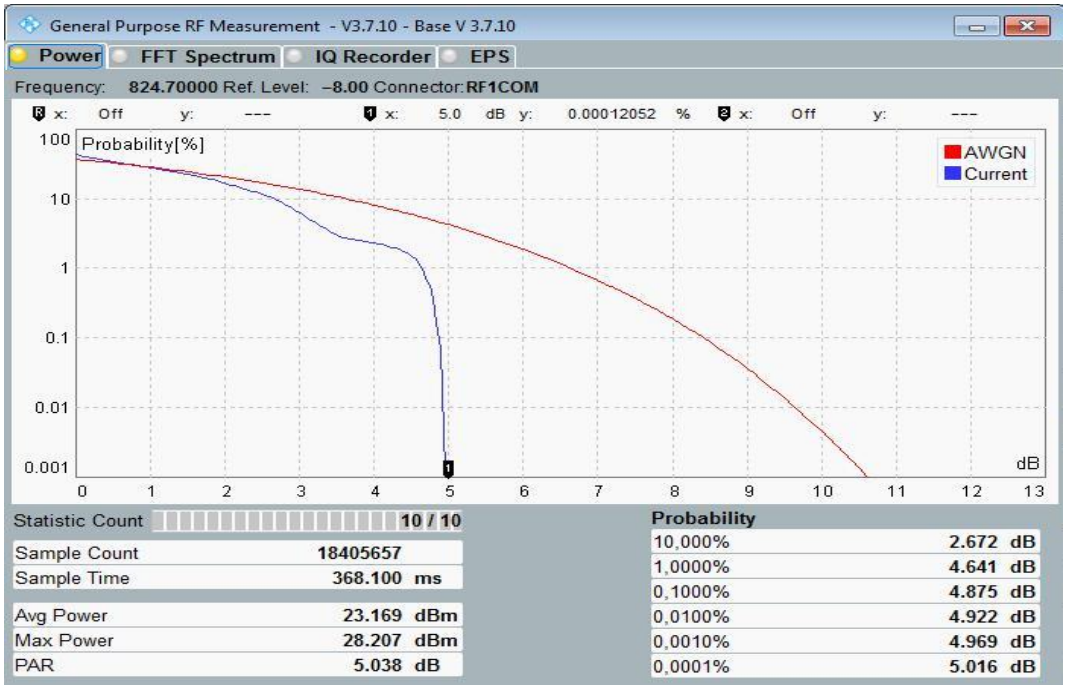


Diagram: Channel_20407_1RB_high_Modulation_QPSK

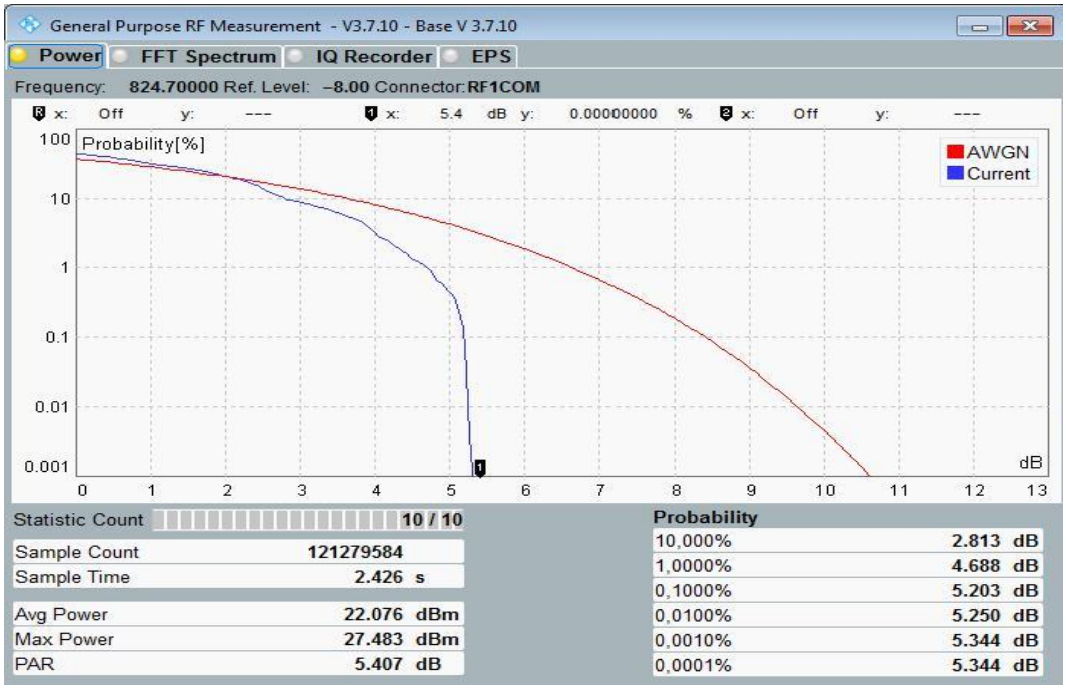


Diagram: Channel_20407_1RB_high_Modulation_16QAM

1.2.4. LTE Band 12

Worst-Case of each maximum Peak power value was tested with the CCDF method

1.2.4.1. 1.4MHz signal bandwidth

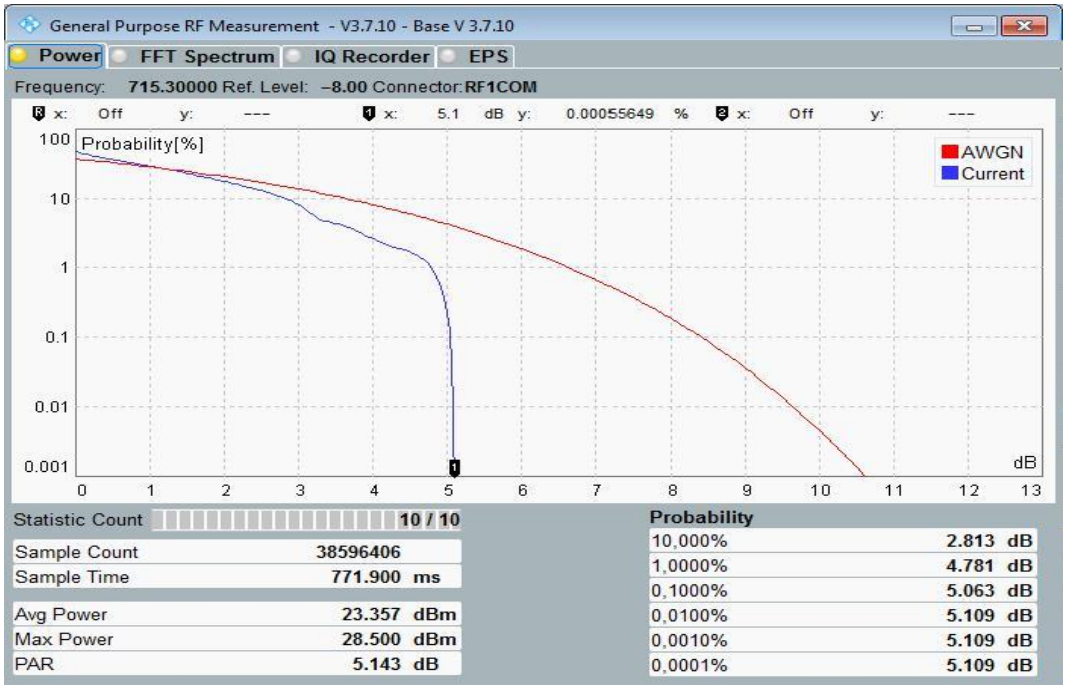


Diagram: Channel_23173_1RB_low_Modulation_QPSK

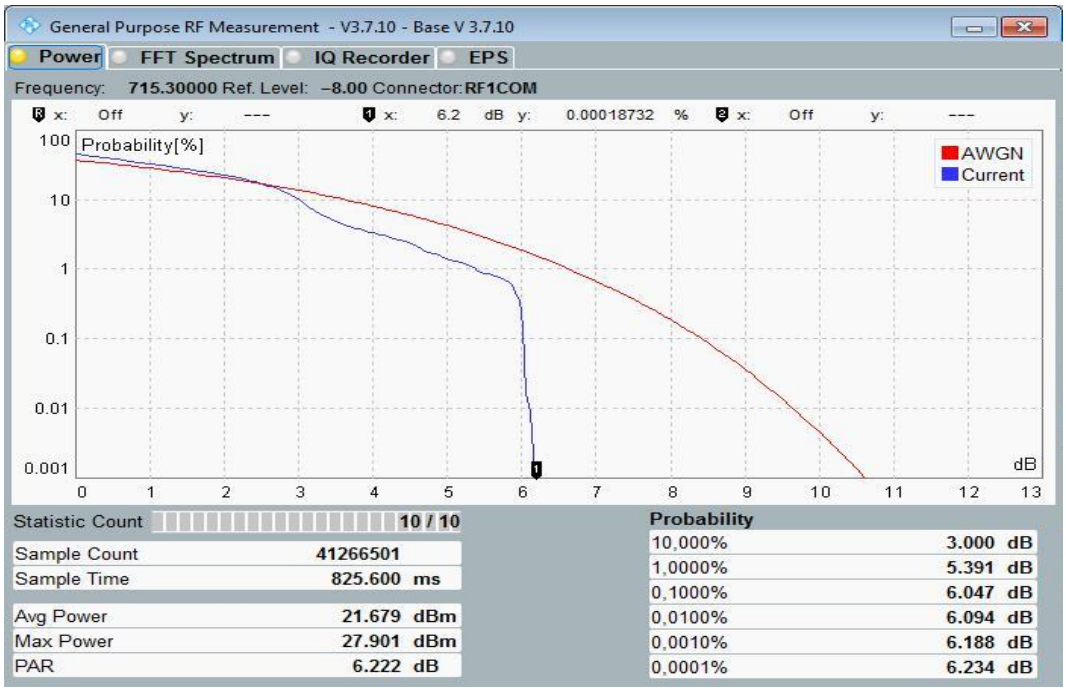


Diagram: Channel_23173_1RB_low_Modulation_16QAM

1.3. AC-Power Lines_Emissions Conducted(0,15 - 30 MHz)

1.01

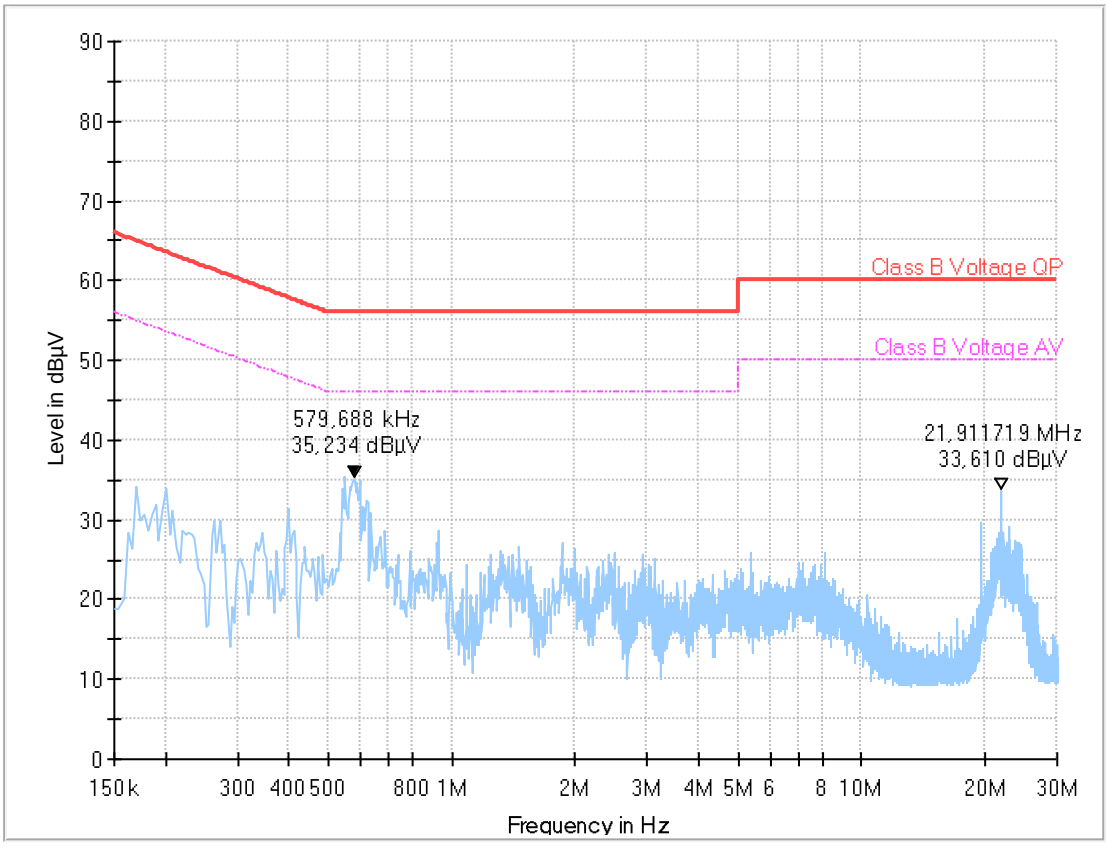
Common Information

Test Description:	Conducted Voltage Measurement Class B
Test Site & Location:	Conducted Emission, CETECOM GmbH Essen
Test Software:	R&S EMC32 v9.15
Test Specification:	FCC 15.107, FCC 15.207
Operating Mode:	Ch18900_BW_1,4MHz_1RB_high_16QAM
Measured on line:	N/L1
Diagram details:	Shows the peak values as a sum of measured ports in maxhold mode
Environmental Conditions:	Humidity: 38%rH; Temperature: 22°C
Operator:	Aho

EUT Information

Manufacturer:	Robert Bosch Power Tools GmbH
Model:	GPS25-4
Type:	Retrofit Tracker US
HW version: tbd	PCB-R2802 #200
SW version:	Doberman-Retrofit-US-1.0.0
Serial number:	IMEI-No: 352753090098185
Power Supply:	120V-

Full Spectrum

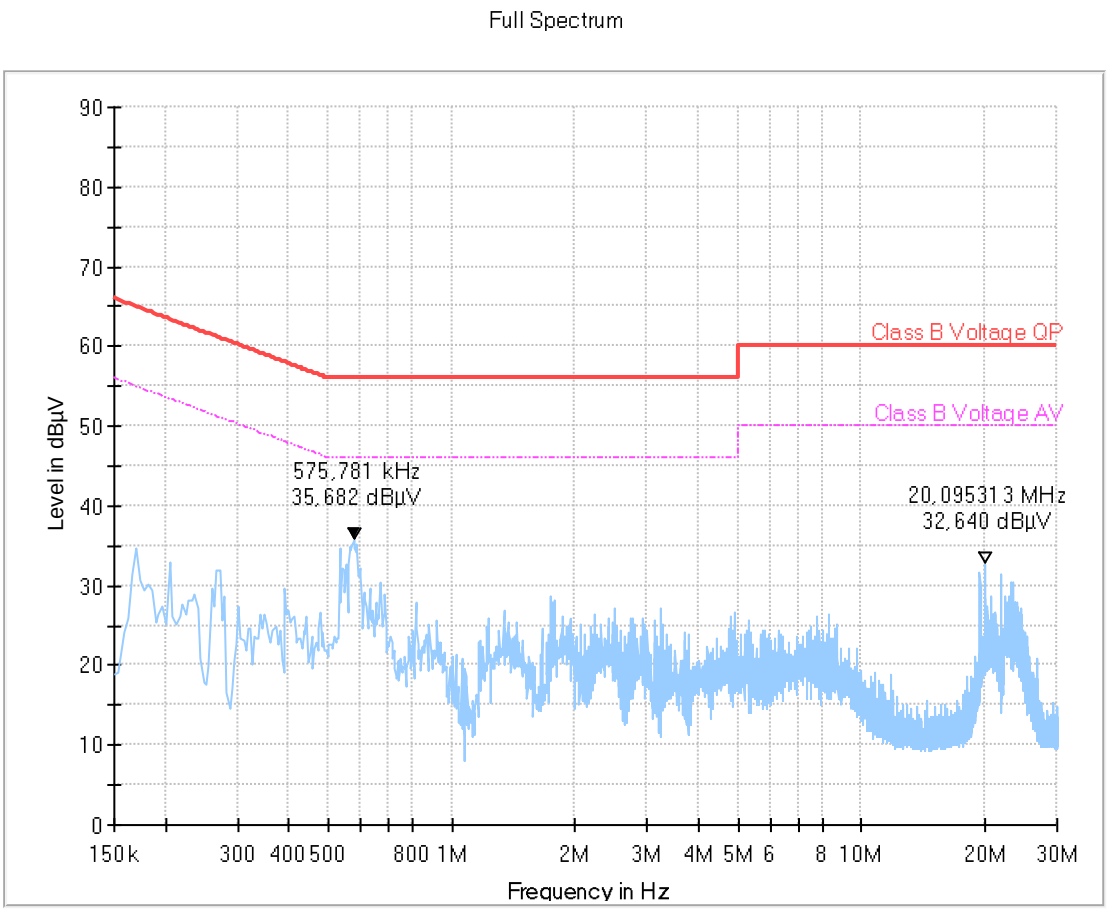


1.02

Common Information

Test Description:	Conducted Voltage Measurement Class B
Test Site & Location:	Conducted Emission, CETECOM GmbH Essen
Test Software:	R&S EMC32 v9.15
Test Specification:	FCC 15.107, FCC 15.207
Operating Mode:	Ch19957_BW_1,4MHz_1RB_low_QPSK_LTE_band_4
Measured on line:	N/L1
Diagram details:	Shows the peak values as a sum of measured ports in maxhold mode
Environmental Conditions:	Humidity: 38%rH; Temperature: 22°C
Operator:	Aho

EUT Information **Please see under Diagram Number:1.01**



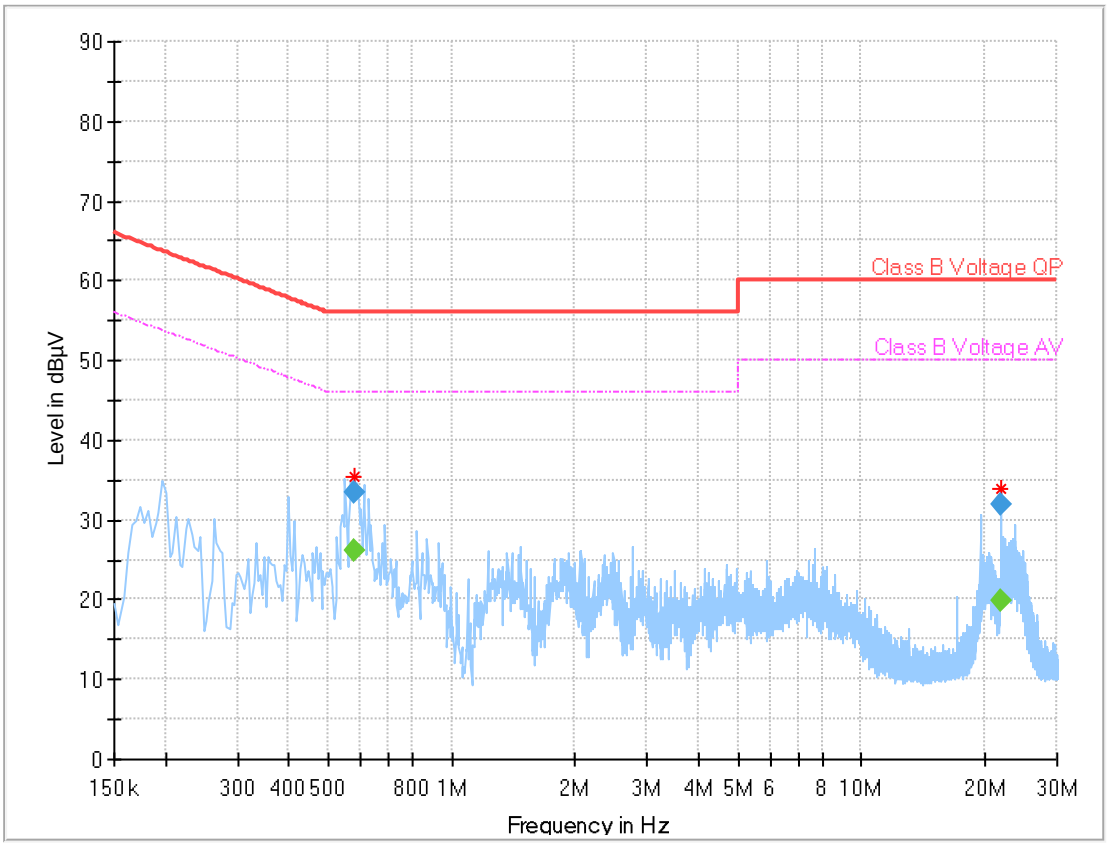
1.03

Common Information

Test Description:	Conducted Voltage Measurement Class B
Test Site & Location:	Conducted Emission, CETECOM GmbH Essen
Test Software:	R&S EMC32 v9.15
Test Specification:	FCC 15.107, FCC 15.207
Operating Mode:	Ch20407_BW_1,4MHz_1RB_high_QPSK_LTE_band_5
Measured on line:	N/L1
Diagram details:	Shows the peak values as a sum of measured ports in maxhold mode
Environmental Conditions:	Humidity: 38%rH; Temperature: 22°C
Operator:	Aho

EUT Information **Please see under Diagram Number:1.01**

Full Spectrum



Final_Result

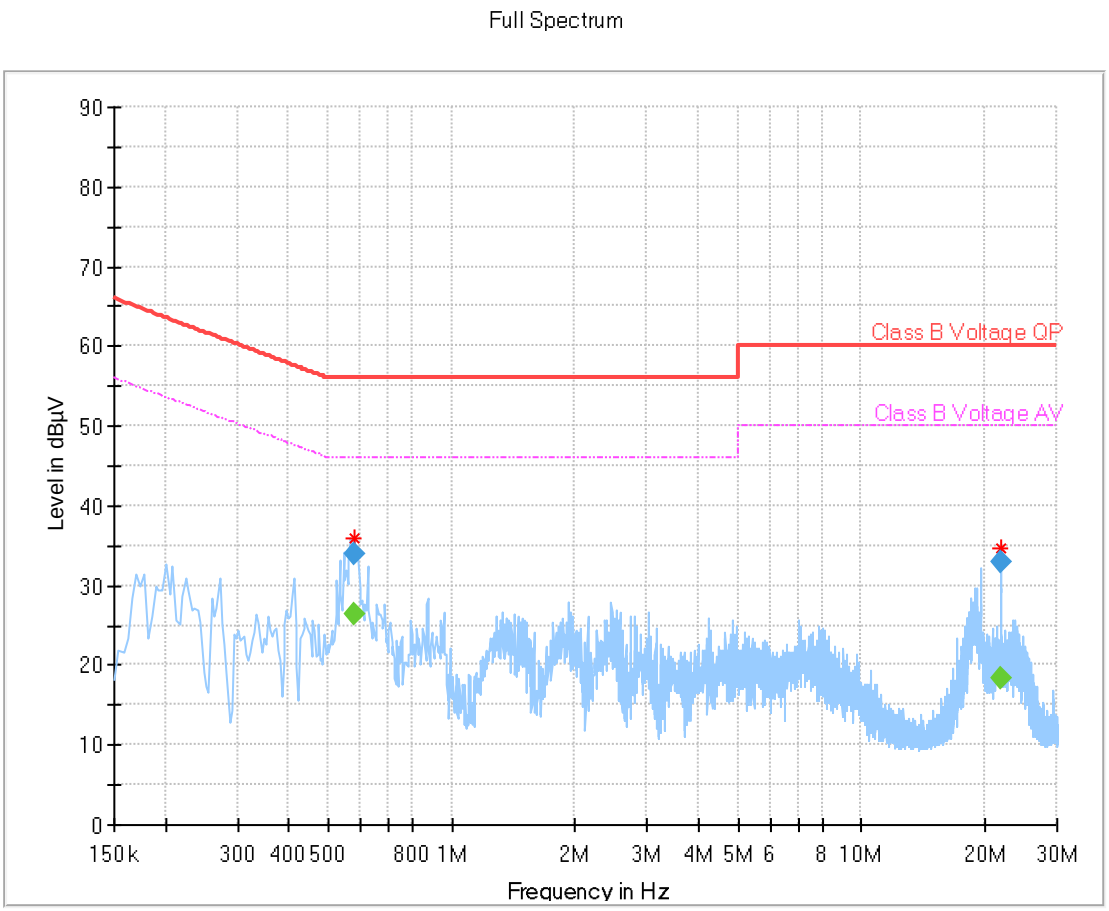
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)
0.577188	---	26.13	46.00
0.577188	33.48	---	56.00
21.890781	---	19.81	50.00
21.890781	31.94	---	60.00

1.04

Common Information

Test Description:	Conducted Voltage Measurement Class B
Test Site & Location:	Conducted Emission, CETECOM GmbH Essen
Test Software:	R&S EMC32 v9.15
Test Specification:	FCC 15.107, FCC 15.207
Operating Mode:	Ch23173_BW_1,4MHz_1RB_low_16QAM_LTE_band_12
Measured on line:	N/L1
Diagram details:	Shows the peak values as a sum of measured ports in maxhold mode
Environmental Conditions:	Humidity: 38%rH; Temperature: 22°C
Operator:	Aho

EUT Information **Please see under Diagram Number:1.01**



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)
0.575469	---	26.43	46.00
0.575469	33.95	---	56.00
21.893594	---	18.41	50.00
21.893594	32.93	---	60.00

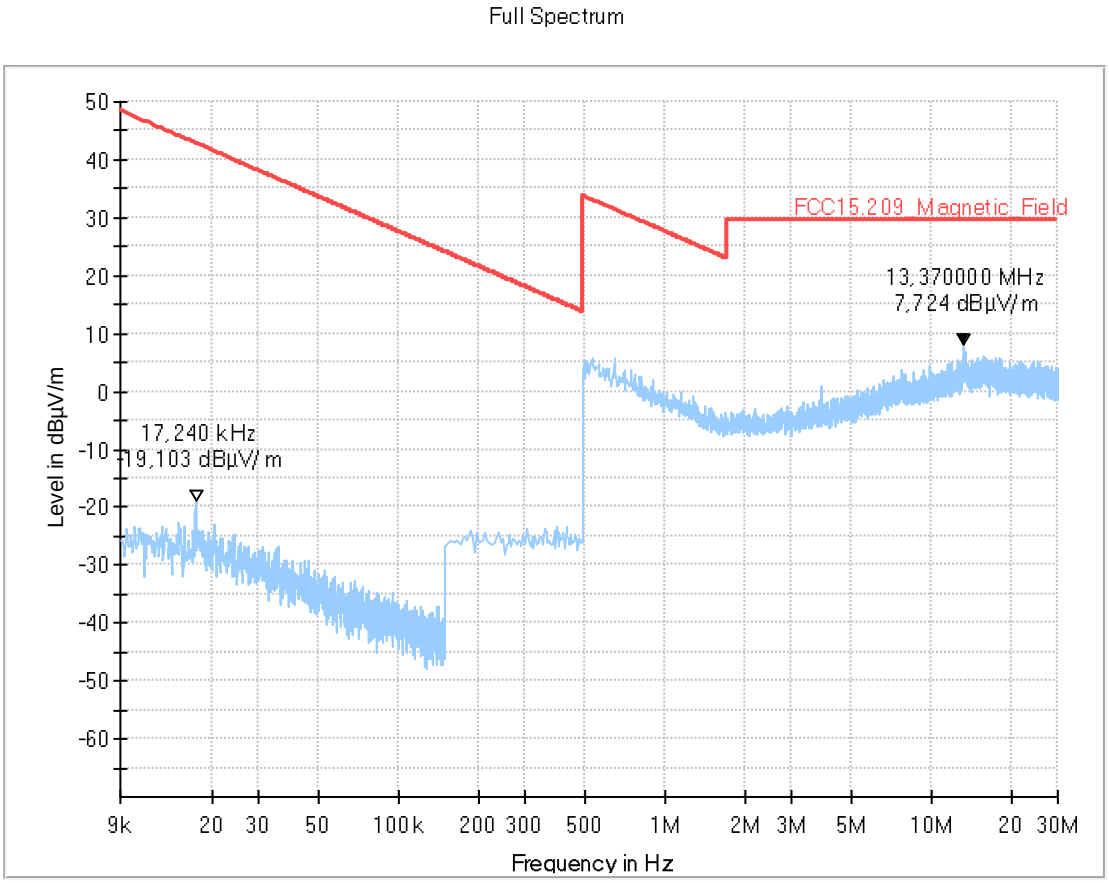
1.4. Spurious emissions radiated (LTE Band 2)

1.4.1. Magnetic field strength radiated (LTE Band 2)

2.01

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
Operator:	TFra
Operating Mode:	Band_2_Channel_18900_BW_1M4_1RB_high_16QAM
Power during tests:	120V AC

EUT Information **Please see under Diagram Number:1.01**



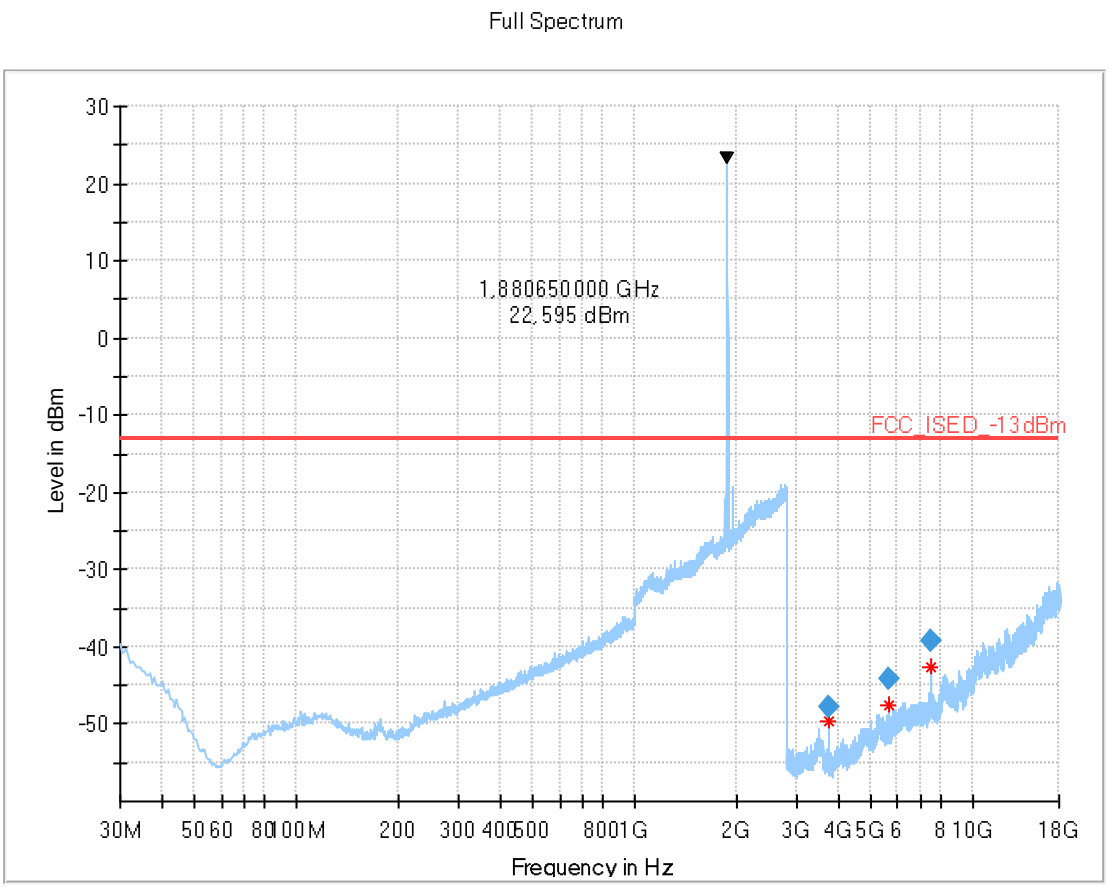
1.4.2. Emissions above 30MHz (LTE Band 2)

8.01

Common Information

Test Description:	Radiated emission
Test Site:	Fully-Anechoic Room
Test Standard:	FCC FCC Part 27.53(h) AWS emission limits / RSS-139, Issue 3
Antenna polarisation:	vertical / horizontal
Measurement software version	EMC32 V9.26.0
Operation mode:	LTE Band 2_channel_19957_BW_1,4_1RB_high_QPSK
Operator Name:	TFr

EUT Information **Please see the Diagram number:1.01**



Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
3760.798334	-47.92	-13.00	34.92	100.0	1000.000	154.0	H	200.0	90.0	-95.1
5641.420000	-44.23	-13.00	31.23	100.0	1000.000	154.0	H	116.0	90.0	-89.7
7521.893334	-39.15	-13.00	26.15	100.0	1000.000	154.0	H	229.0	90.0	-83.4

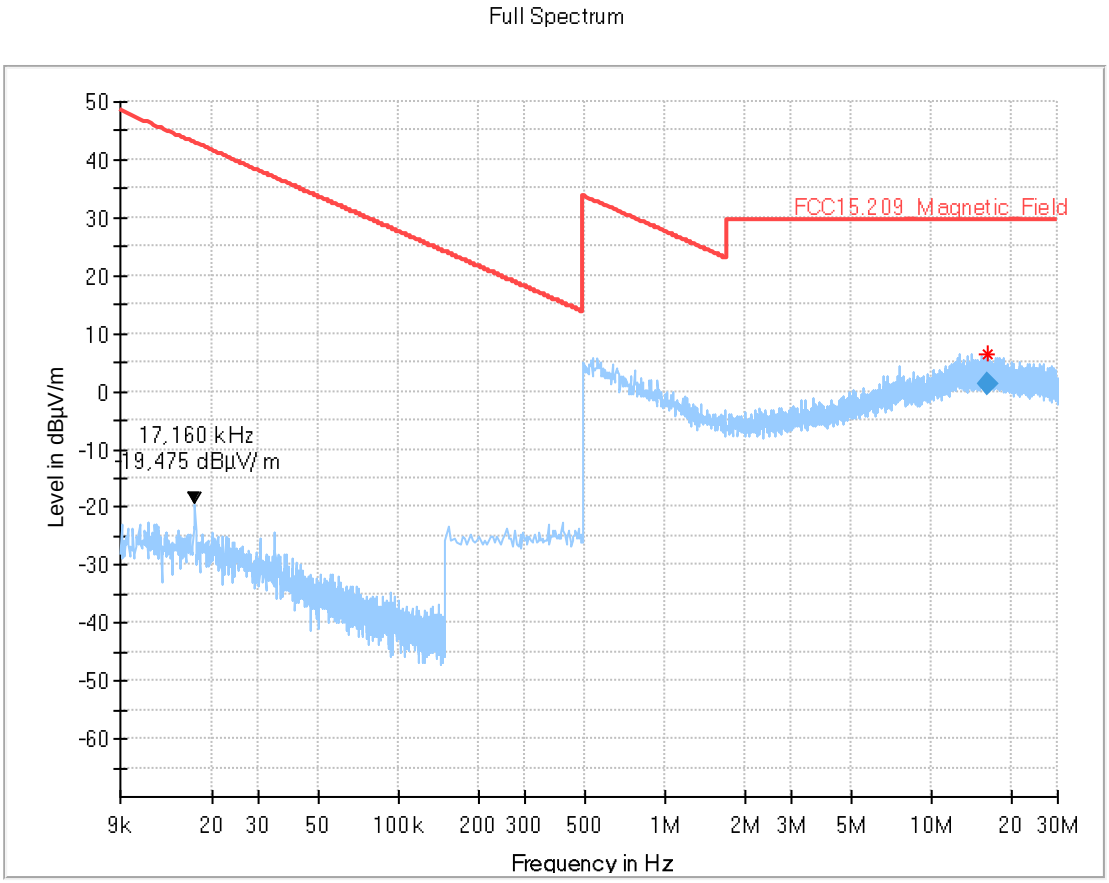
1.5. Spurious emissions radiated (LTE Band 4)

1.5.1. Magnetic field strength radiated (LTE Band 4)

2.02

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
Operator:	TFra
Operating Mode:	Band_4_Channel_19957_BW_1M4_1RB_low_QPSK
Power during tests:	120V AC

EUT Information **Please see the Diagram number:1.01**



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
16.392600	1.33	29.54	28.21	1000.0	9.000	100.0	V	81.0	-11.1

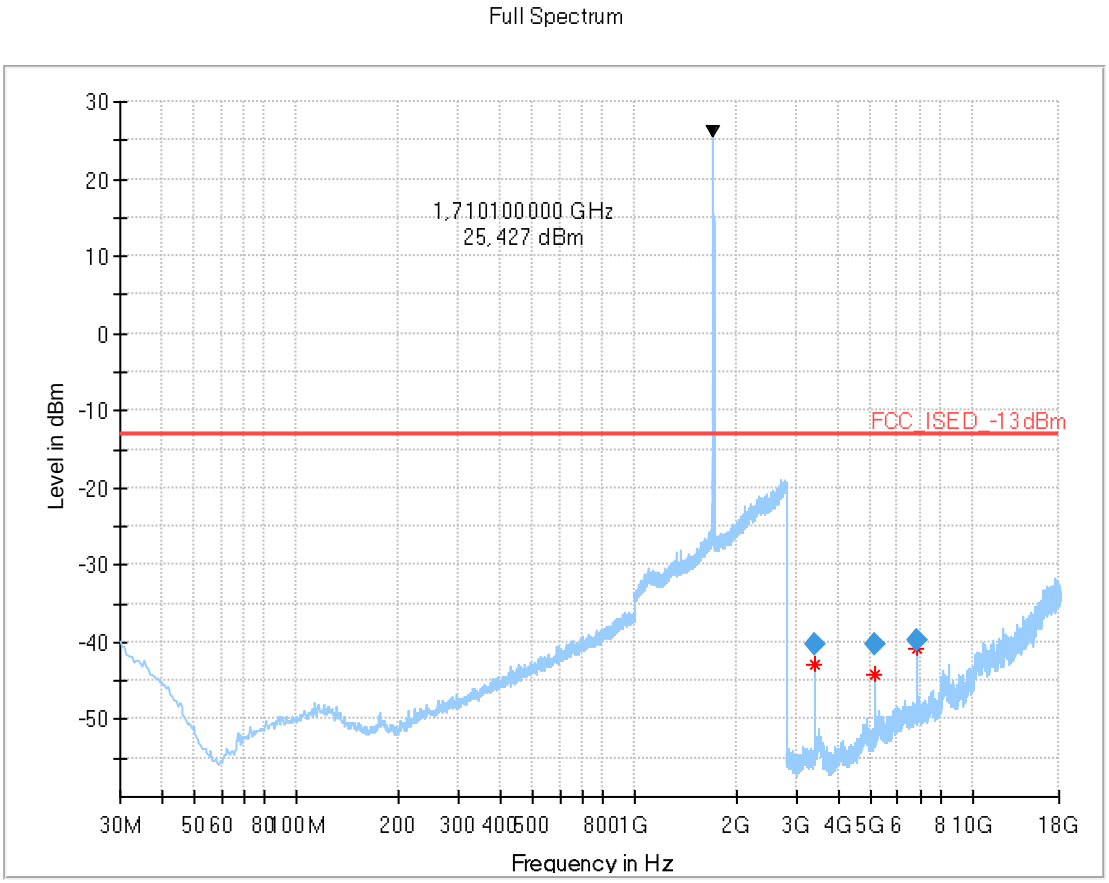
1.5.2. Emissions above 30MHz (LTE Band 4)

8.02

Common Information

Test Description:	Radiated emission
Test Site:	Fully-Anechoic Room
Test Standard:	FCC FCC Part 27.53(h) AWS emission limits / RSS-139, Issue 3
Antenna polarisation:	vertical / horizontal
Measurement software version	EMC32 V9.26.0
Operation mode:	LTE Band 4, channel no=19957 BW=1,4 RB=1 Modulation=QPSK
Operator Name:	TFr

EUT Information **Please see the Diagram number:1.01**



Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
3422.223333	-40.40	-13.00	27.41	100.0	1000.000	154.0	V	239.0	0.0	-95.0
5130.740000	-40.26	-13.00	27.26	100.0	1000.000	154.0	V	349.0	90.0	-90.6
6840.970000	-39.71	-13.00	26.71	100.0	1000.000	154.0	H	64.0	90.0	-85.6

1.6. Spurious emissions radiated (LTE Band 5)

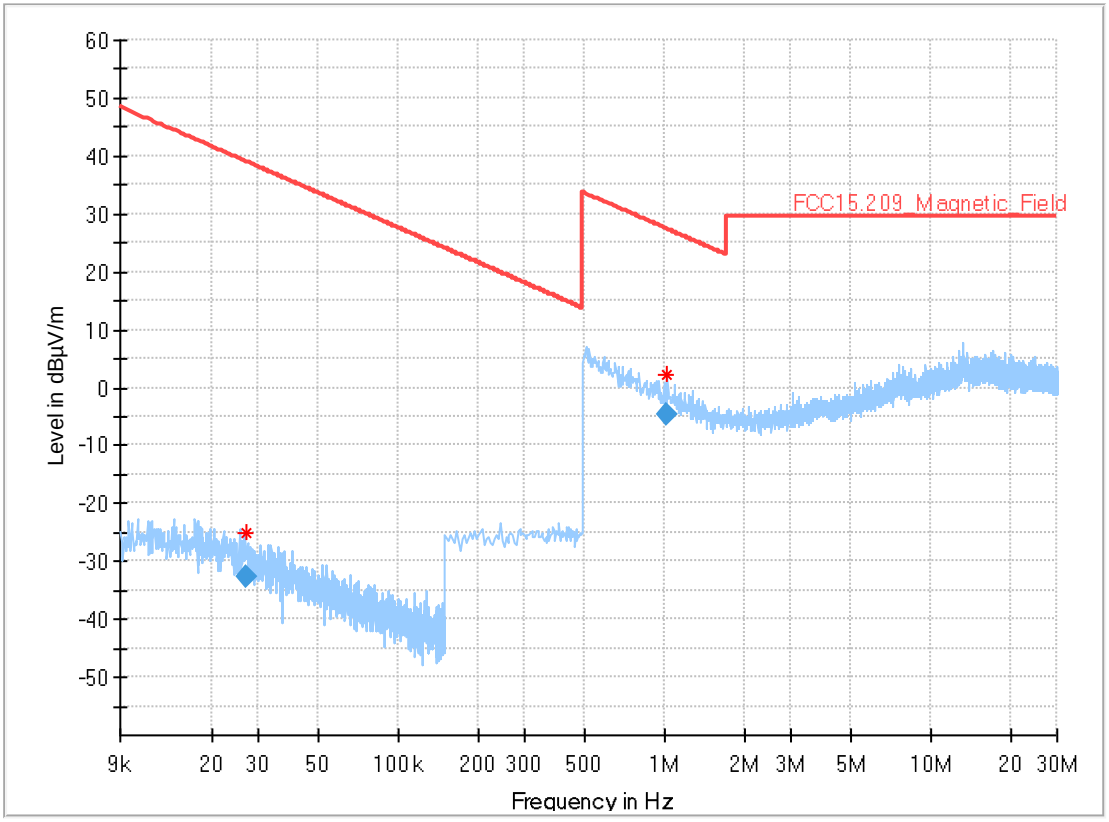
1.6.1. Magnetic field strength radiated (LTE Band 5)

2.03

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
Operator:	TFra
Operating Mode:	Band_5_Channel_20407_BW_1M4_1RB_high_QPSK
Power during tests:	120V AC

EUT Information **Please see under Diagram Number:1.01**

Full Spectrum



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.026780	-32.51	39.04	71.55	1000.0	0.200	100.0	V	31.0	-65.7
1.027800	-4.56	27.38	31.94	1000.0	9.000	100.0	V	158.0	-28.9

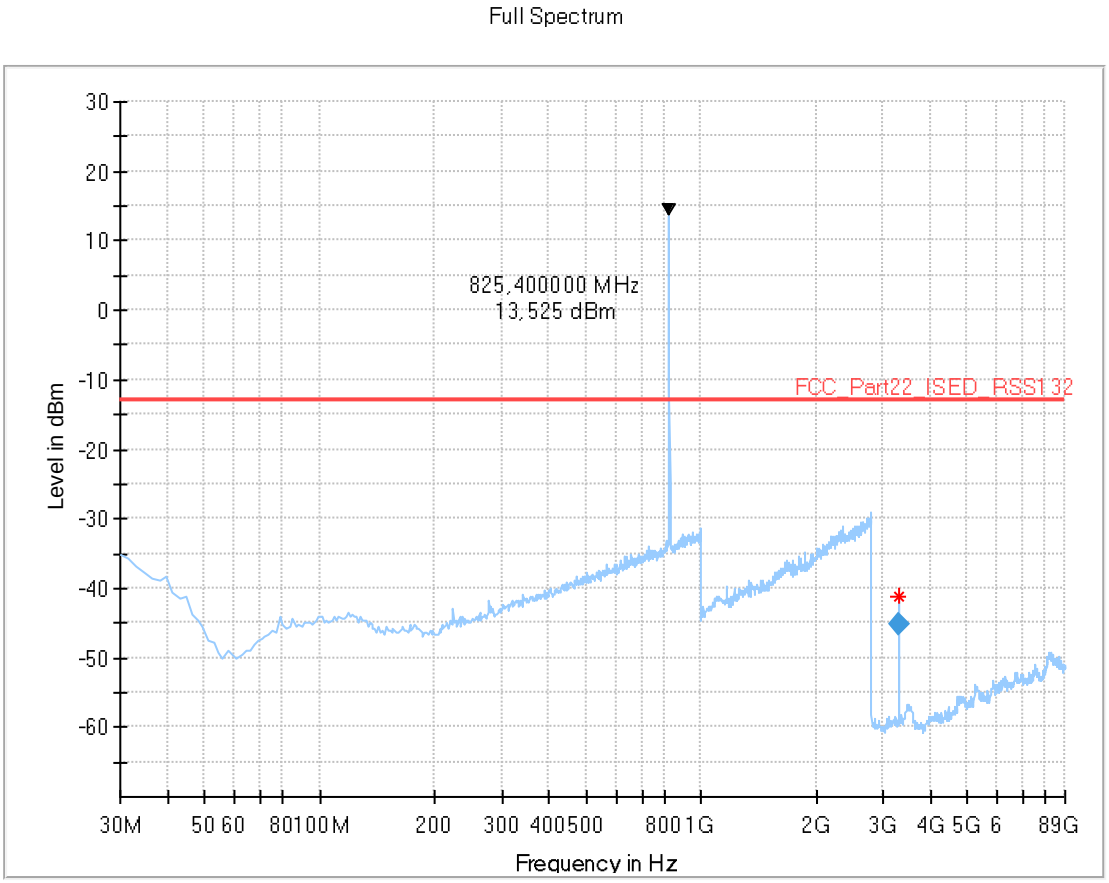
1.6.2. Emissions above 30MHz (LTE Band 5)

8.03

Common Information

Test Description:	Radiated emission
Test Site:	Fully-Anechoic Room
Test Standard:	FCC FCC Part 27.53(h) AWS emission limits / RSS-139, Issue 3
Antenna polarisation:	vertical / horizontal
Measurement software version	EMC32 V9.26.0
Operation mode:	LTE Band 5_channel_20407_BW_1M4_1RB_high_QPSK
Operator Name:	TFr

EUT Information **Please see the Diagram number:1.01**



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
3300.575000	-45.33	-13.00	32.33	100.0	100.000	154.0	V	269.0	90.0	-95.8

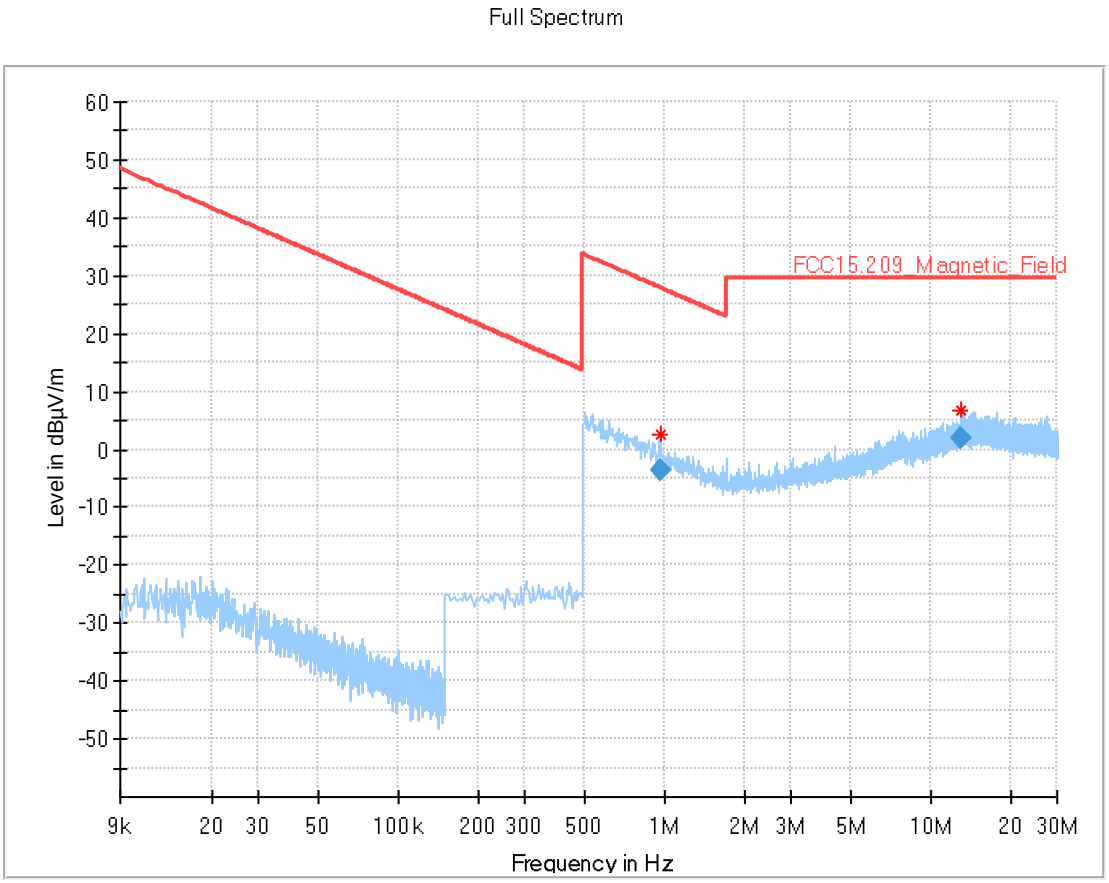
1.7. Spurious emissions radiated (LTE Band 12)

1.7.1. Magnetic field strength radiated (LTE Band 12)

2.04

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
Operator:	TFra
Operating conditions:	Band_12_Channel_23173_BW_1M4_1RB_low_16QAM
Power during tests:	120V AC

EUT Information **Please see the Diagram number:1.01**



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.963400	-3.79	27.94	31.73	1000.0	9.000	100.0	V	246.0	-28.9
13.169000	2.06	29.54	27.48	1000.0	9.000	100.0	V	175.0	-12.0

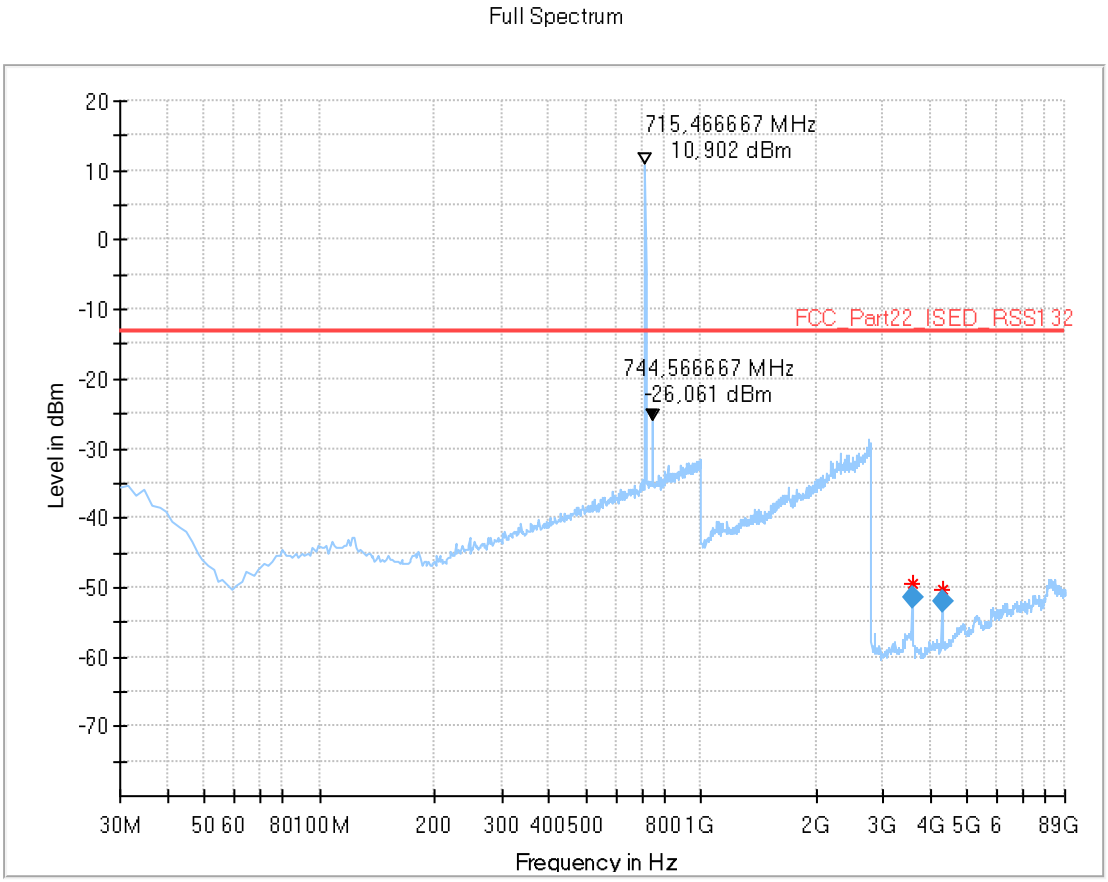
1.7.2. Emissions above 30MHz (LTE Band 12)

8.04

Common Information

Test Description:	Radiated emission related to 1m
Test Site:	FAR
Test Standard:	FCC FCC Part 24.238 Broadband PCS
Antenna polarisation:	vertical / horizontal
Manufacturer:	Rosenberger Hochfrequenz Technik
Operation mode:	LTE_band_12_Ch23173_BW_1M4_1RB_low_16QAM
Operator Name:	FKa

EUT Information **Please see the Diagram number:1.01**



Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
3574.250000	-51.47	-13.00	38.47	100.0	100.000	154.0	V	274.0	0.0	-94.3
4289.050000	-52.03	-13.00	39.03	100.0	100.000	154.0	H	172.0	90.0	-93.6

1.8. Radiated emissions – band-edge (LTE Band 2)

1.8.1. Low band-edge

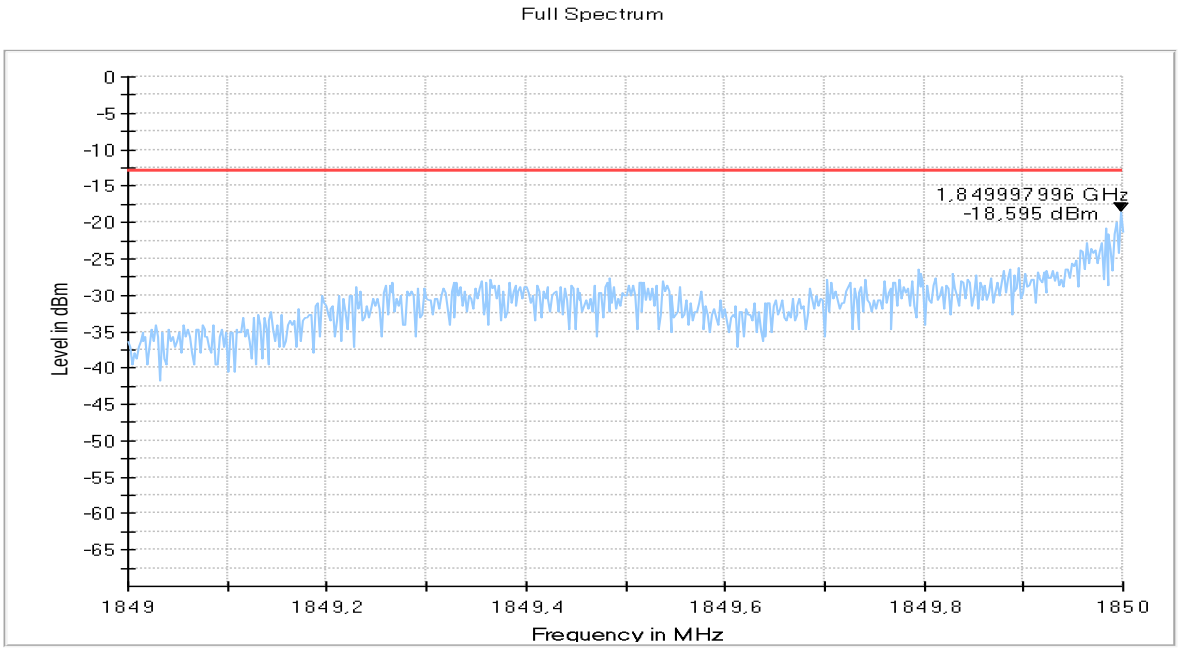


Diagram: 9.01_Ch18607_BW1.4_1RB_Low_QPSK

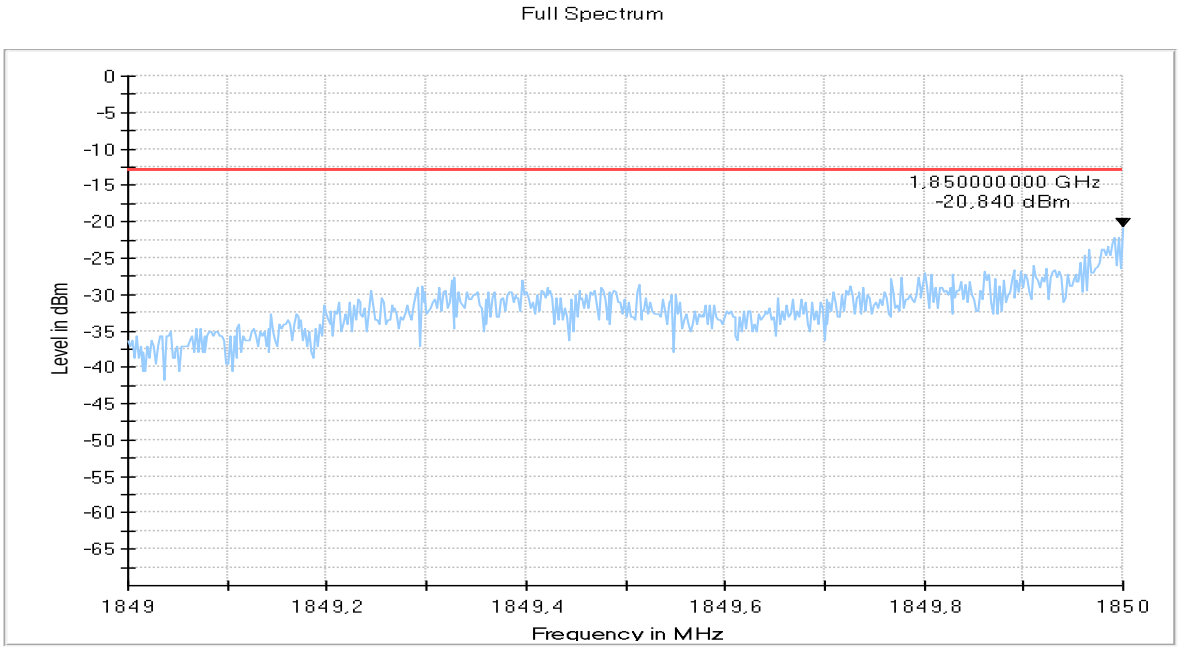


Diagram: 9.02_Ch18607_BW1.4_1RB_Low_16QAM

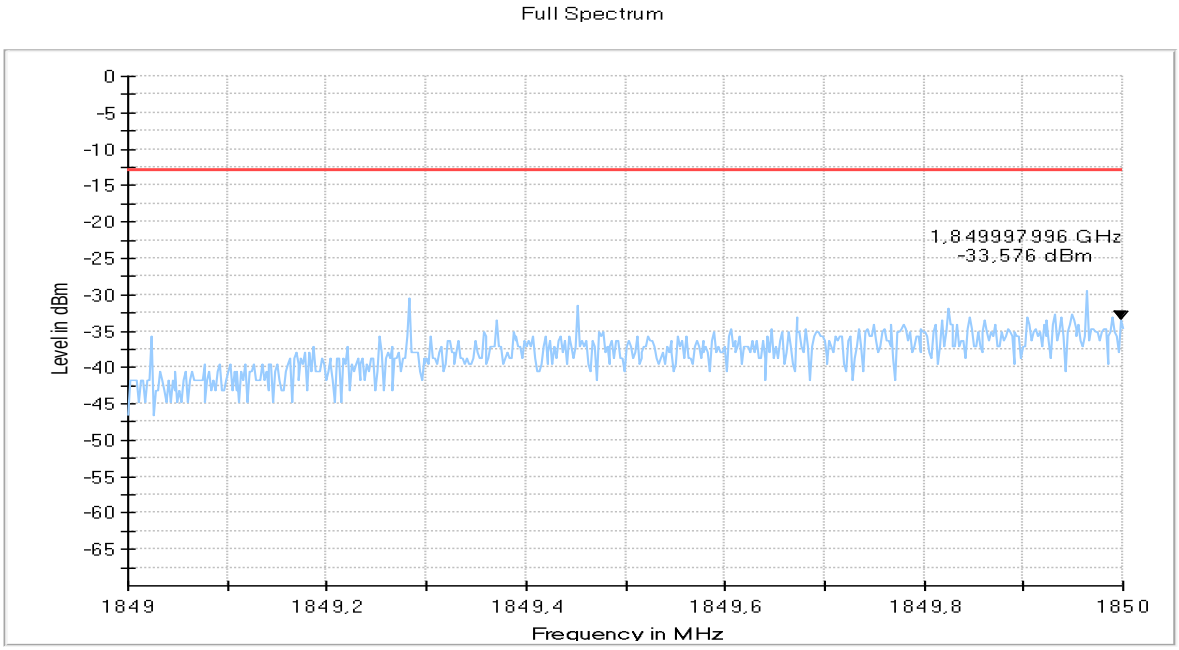


Diagram: 9.03_Ch18607_BW1.4_1RB_High_16QAM

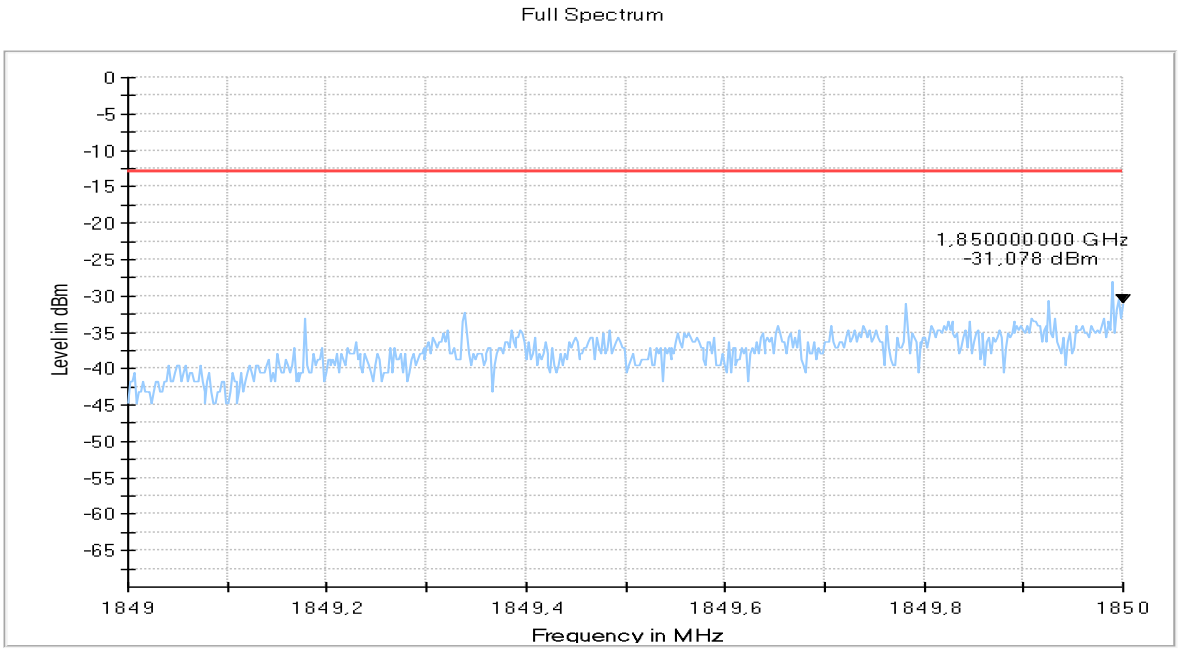


Diagram: 9.04_Ch18607_BW1.4_1RB_High_QPSK

1.8.2. High band-edge

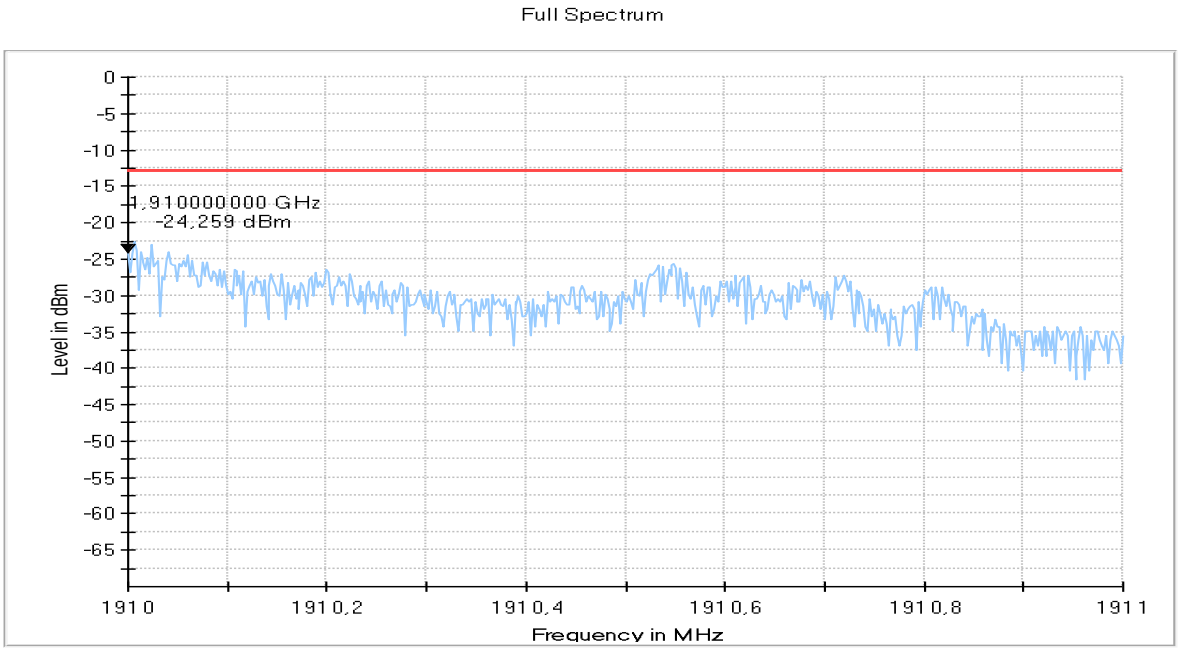


Diagram: 9.05_Ch19193_BW1.4_1RB_Low_QPSK

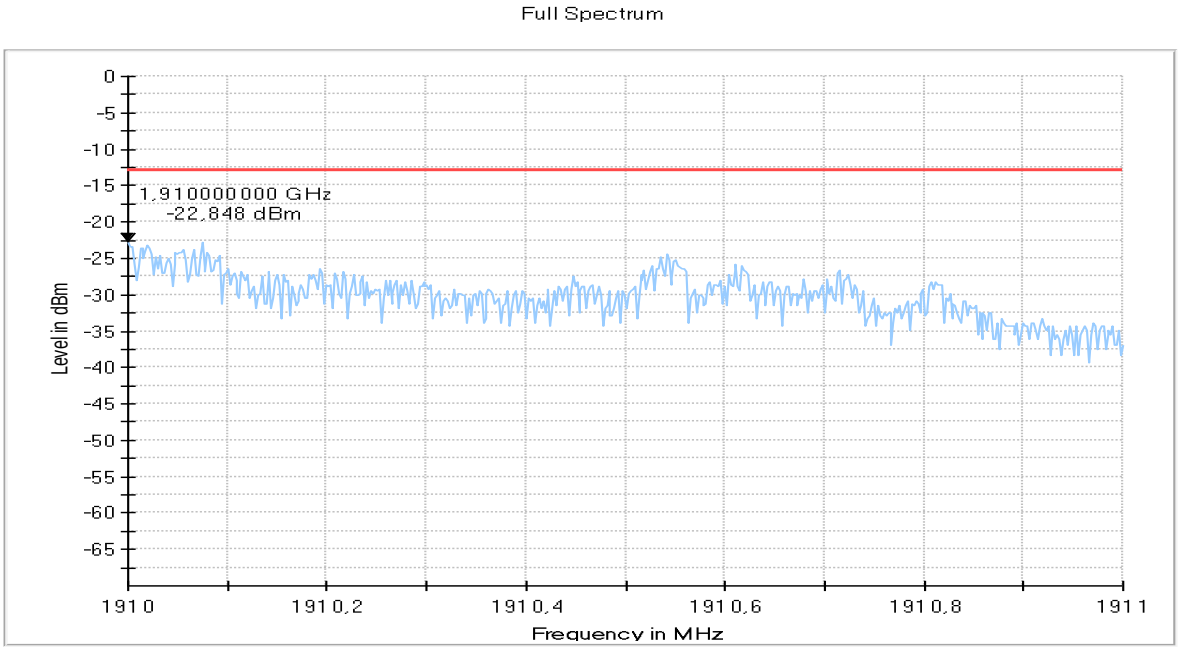


Diagram: 9.06_Ch19193_BW1.4_1RB_Low_16QAM

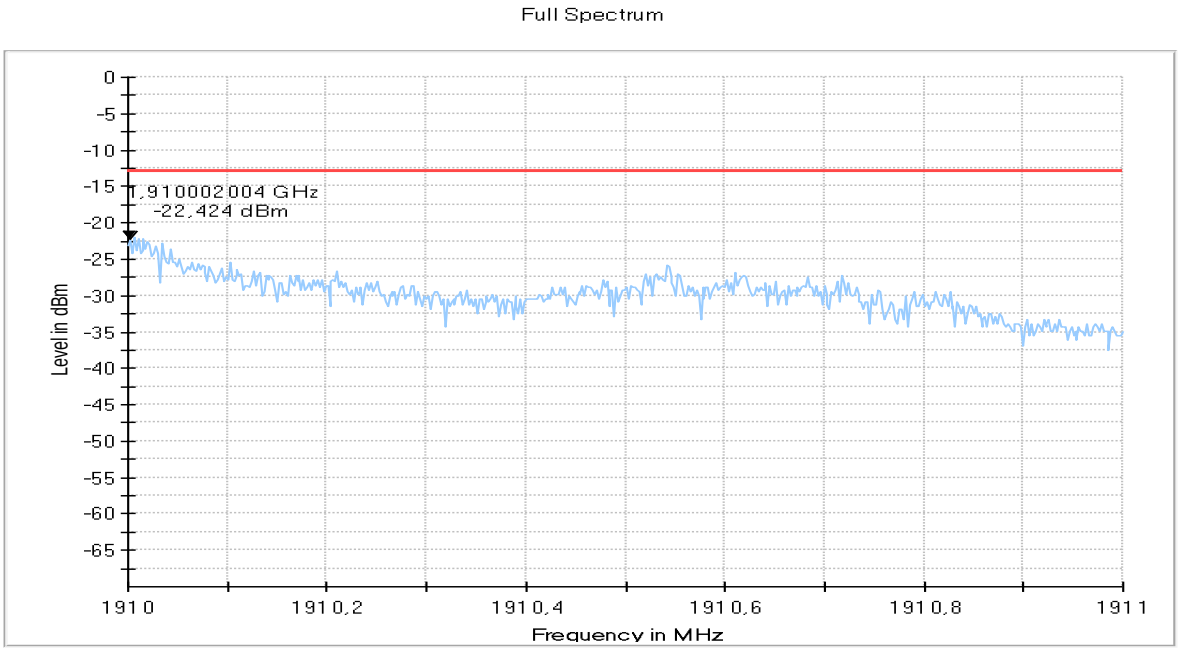


Diagram: 9.07_Ch19193_BW1.4_1RB_High_QPSK

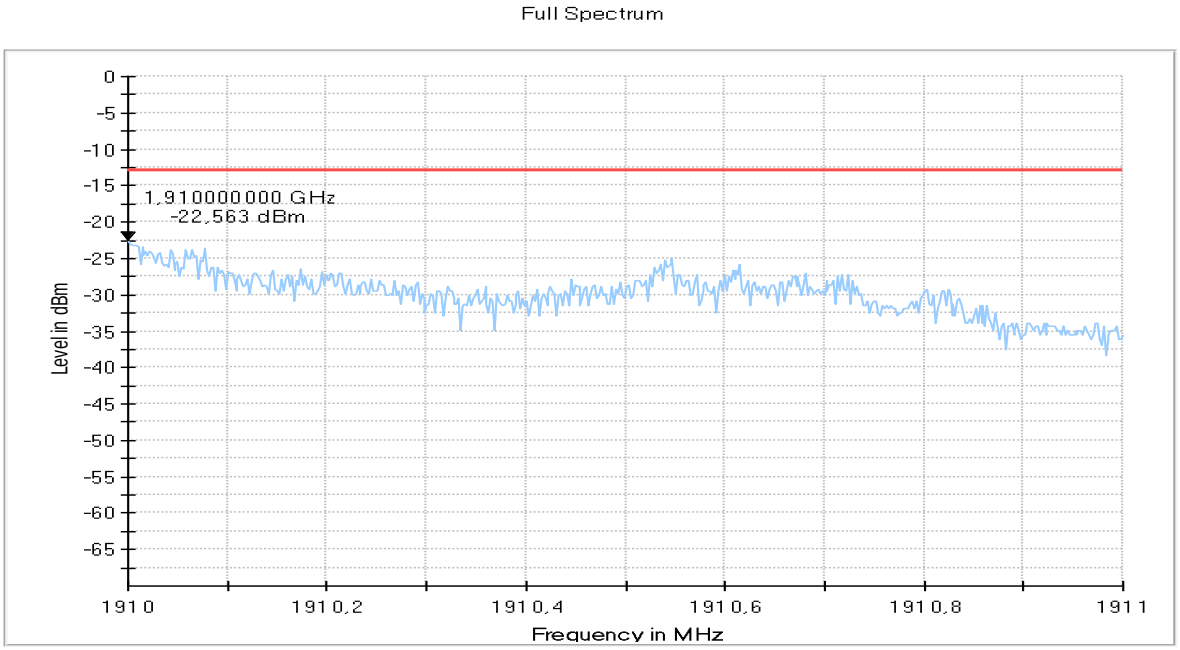


Diagram: 9.08_Ch19193_BW1.4_1RB_High_16QAM

1.9. Radiated emissions – band-edge (LTE Band 4)

1.9.1. Low Band-Edge

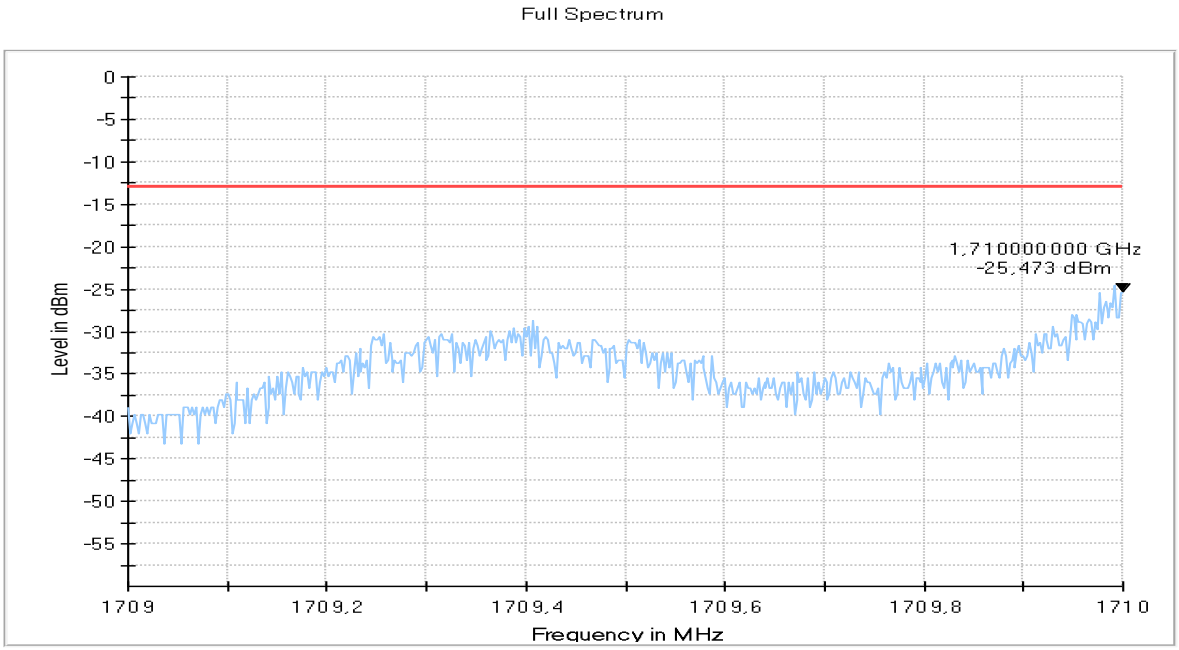


Diagram: 9.09_Ch19957_BW1.4_1RB_Low_QPSK

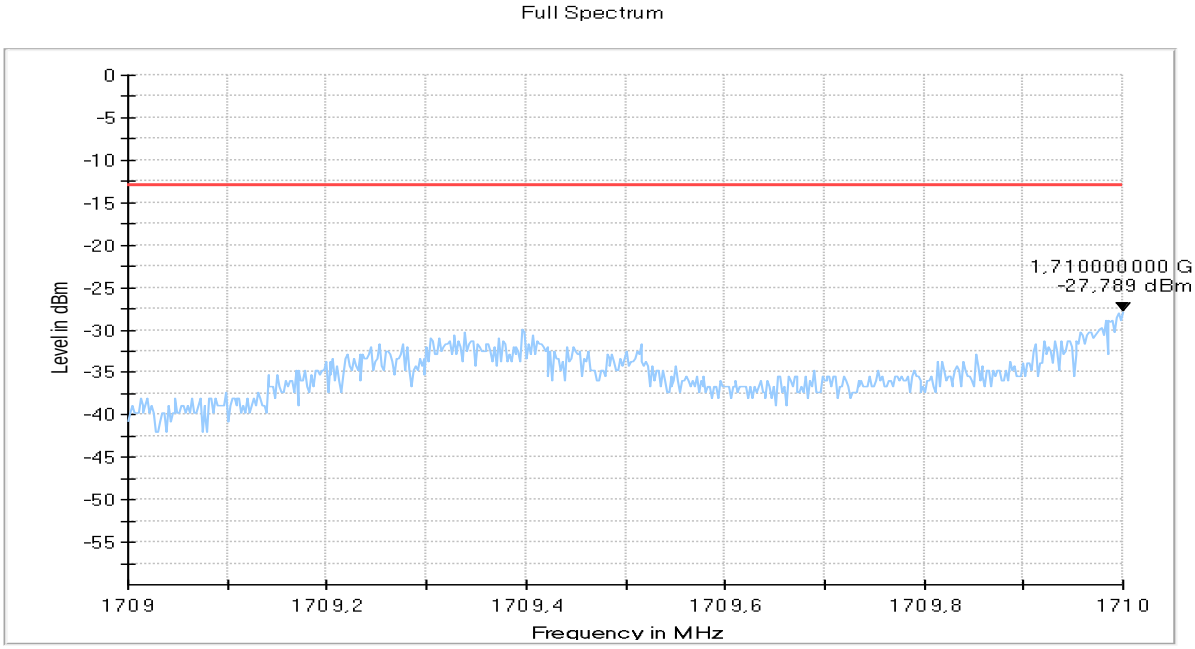


Diagram: 9.10_Ch19957_BW1.4_1RB_Low_16QAM

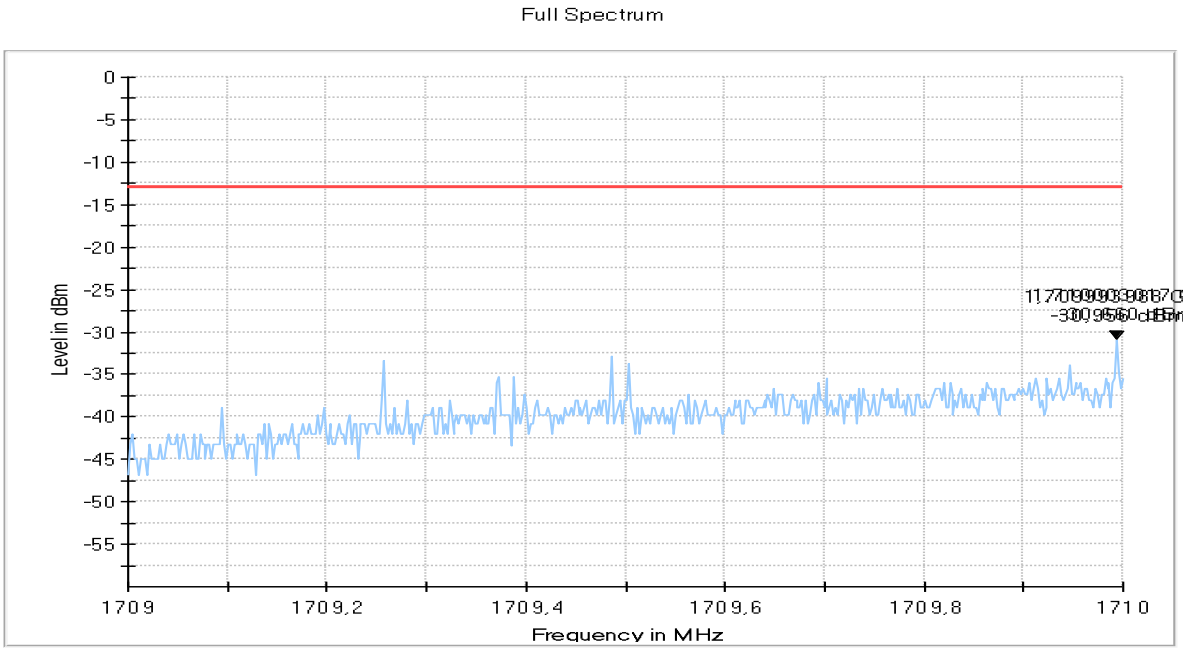


Diagram: 9.11_Ch19957_BW1.4_1RB_High_QPSK

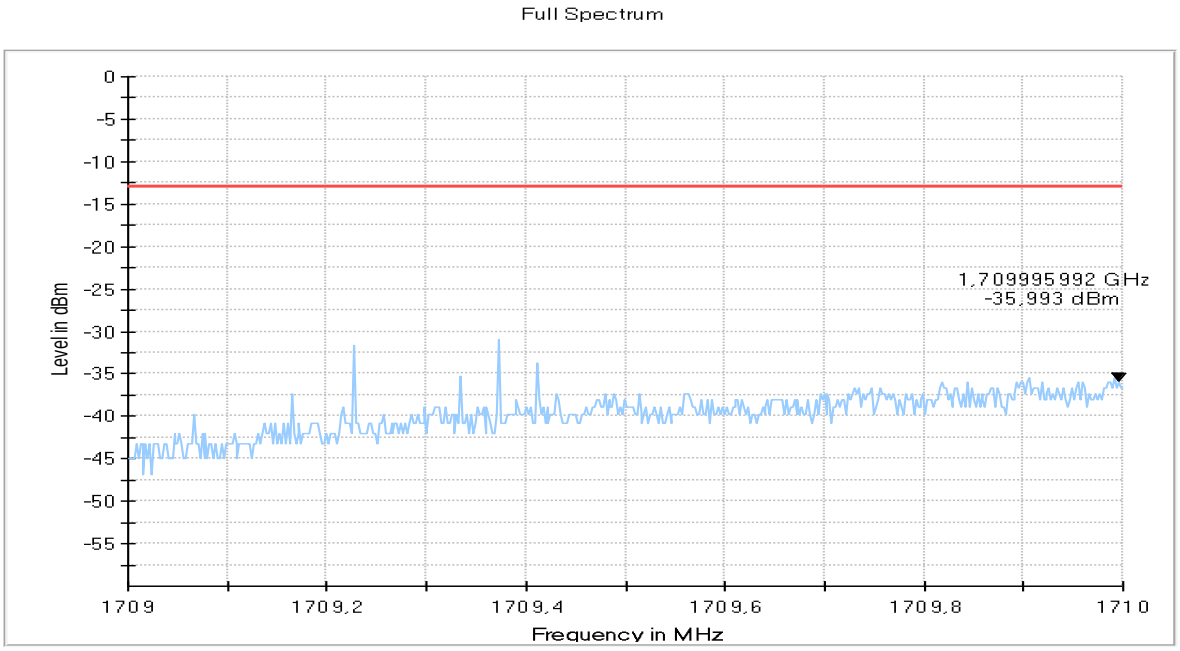


Diagram: 9.12_Ch19957_BW1.4_1RB_High_16QAM

1.9.2. High Band-Edge

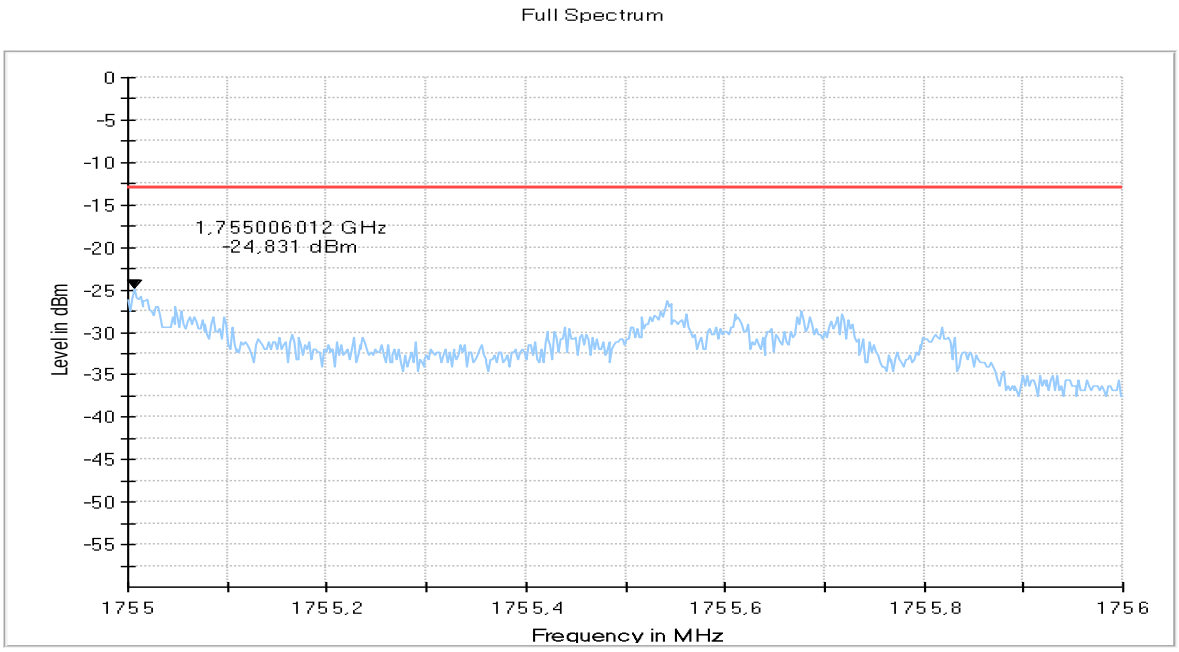


Diagram: 9.13_Ch20393_BW1.4_1RB_Low_QPSK

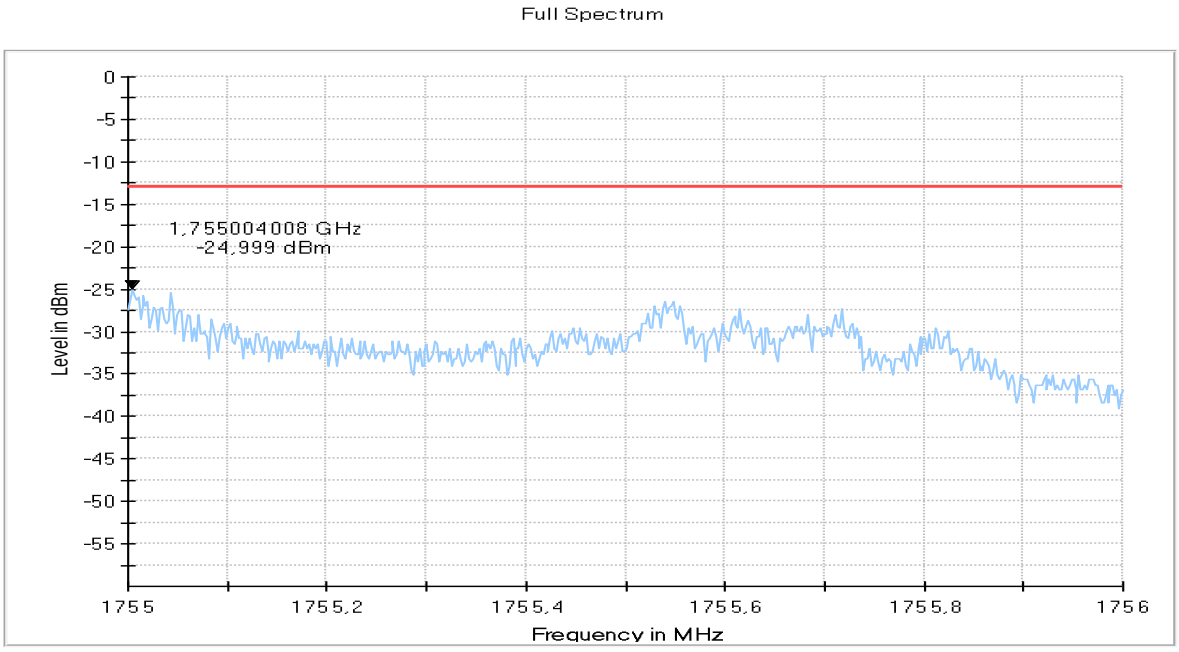


Diagram: 9.14_Ch20393_BW1.4_1RB_Low_16QAM

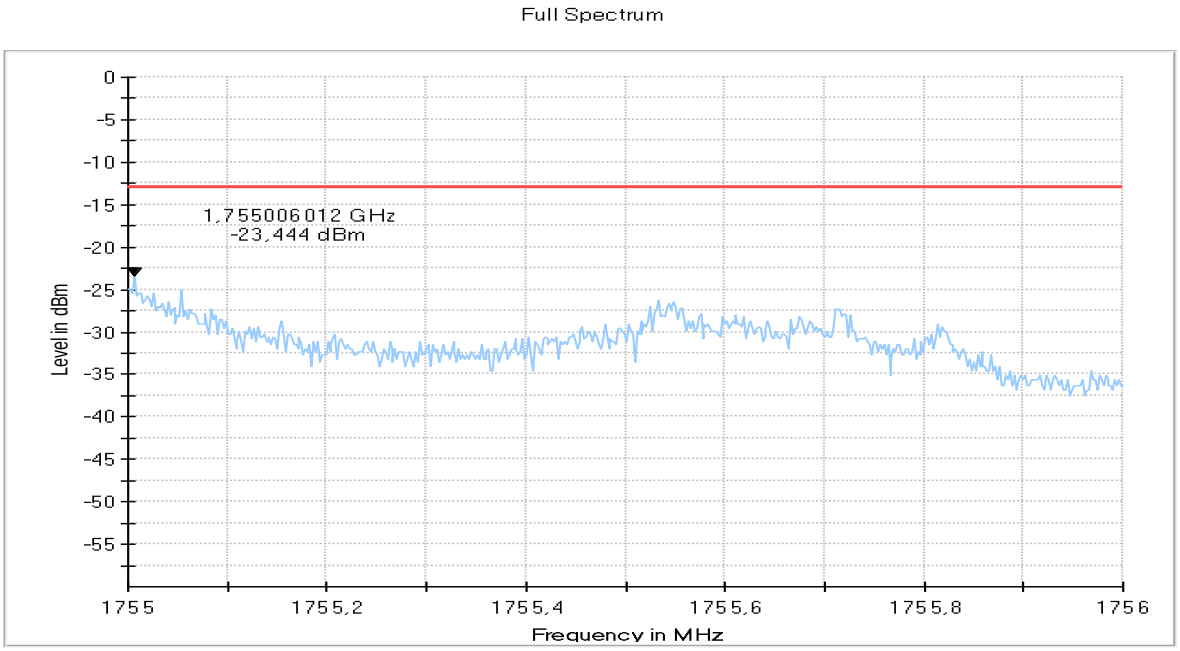


Diagram: 9.15_Ch20393_BW1.4_1RB_High_QPSK

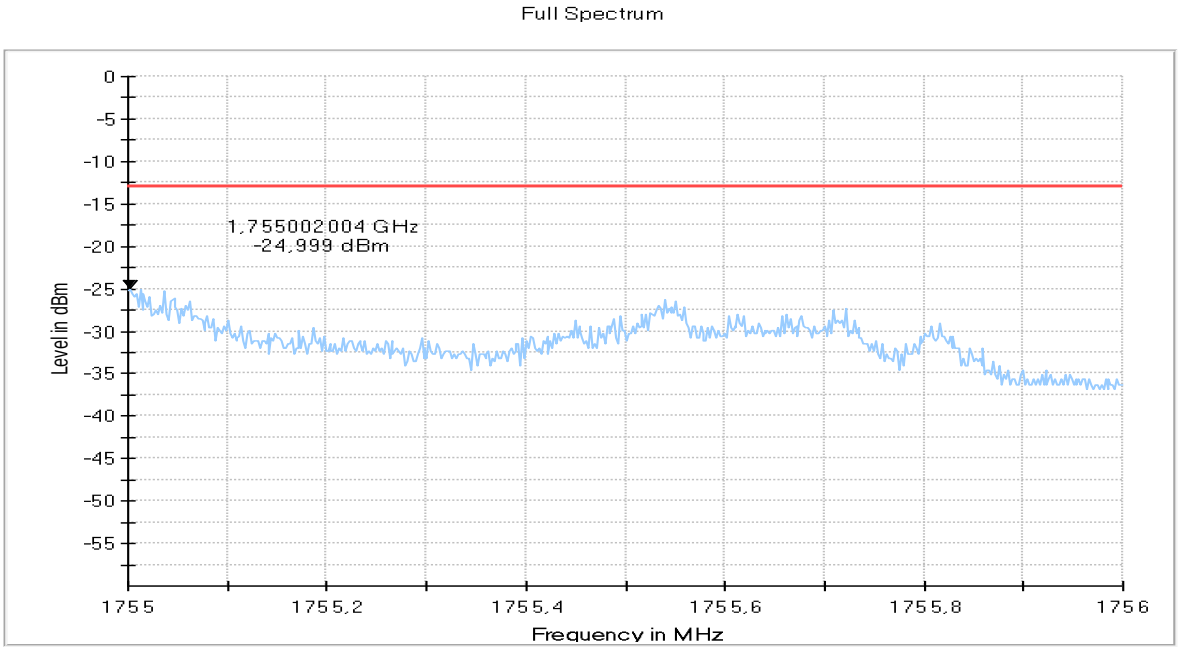


Diagram: 9.16_Ch20393_BW1.4_1RB_High_16QAM

1.10. Radiated emissions – band-edge (LTE Band 5)

1.10.1. Low Band-Edge

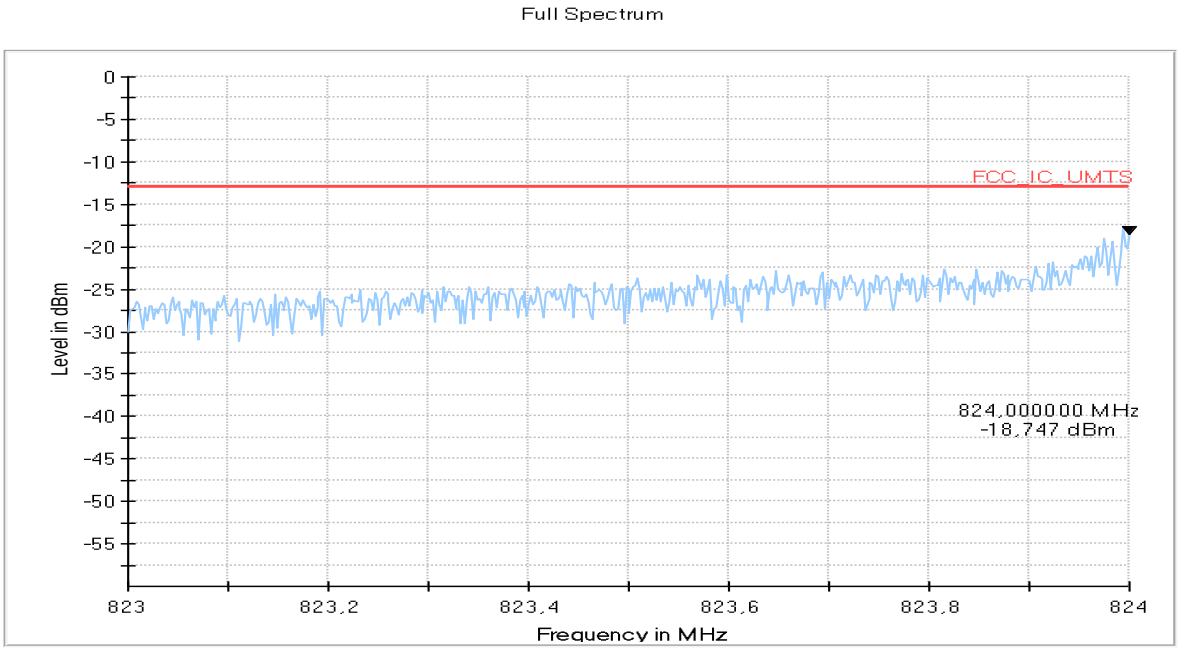


Diagram: 9.17_Ch20407_BW1.4_1RB_Low_QPSK

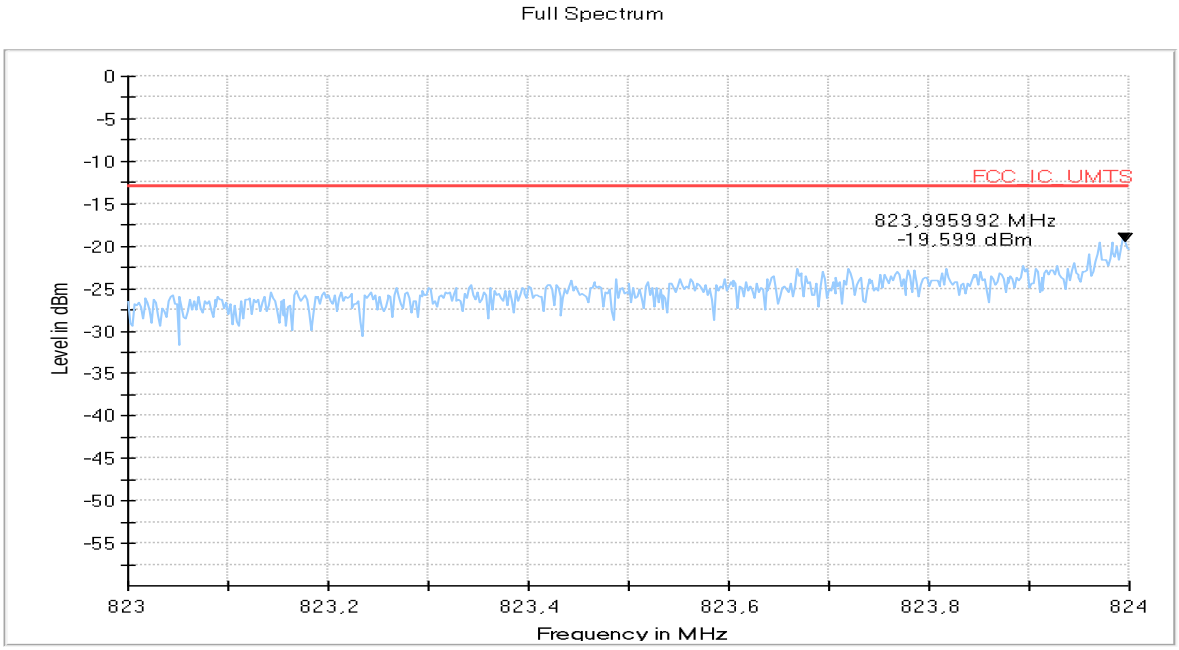


Diagram: 9.18_Ch20407_BW1.4_1RB_Low_16QAM

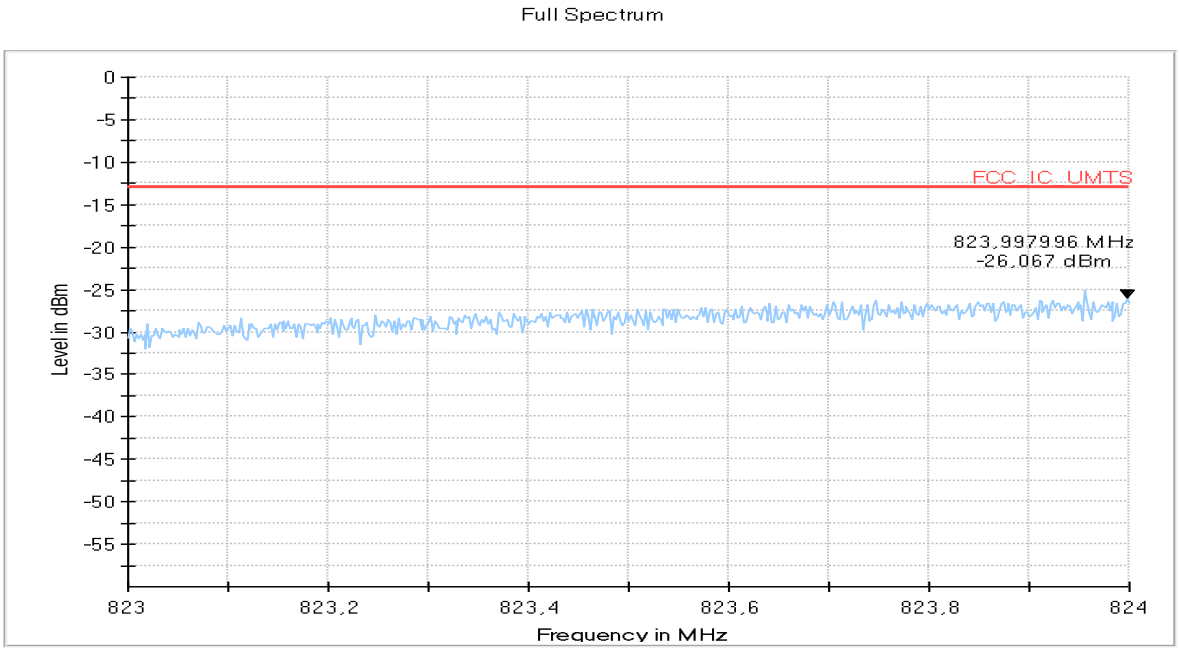


Diagram: 9.19_Ch20407_BW1.4_1RB_High_QPSK

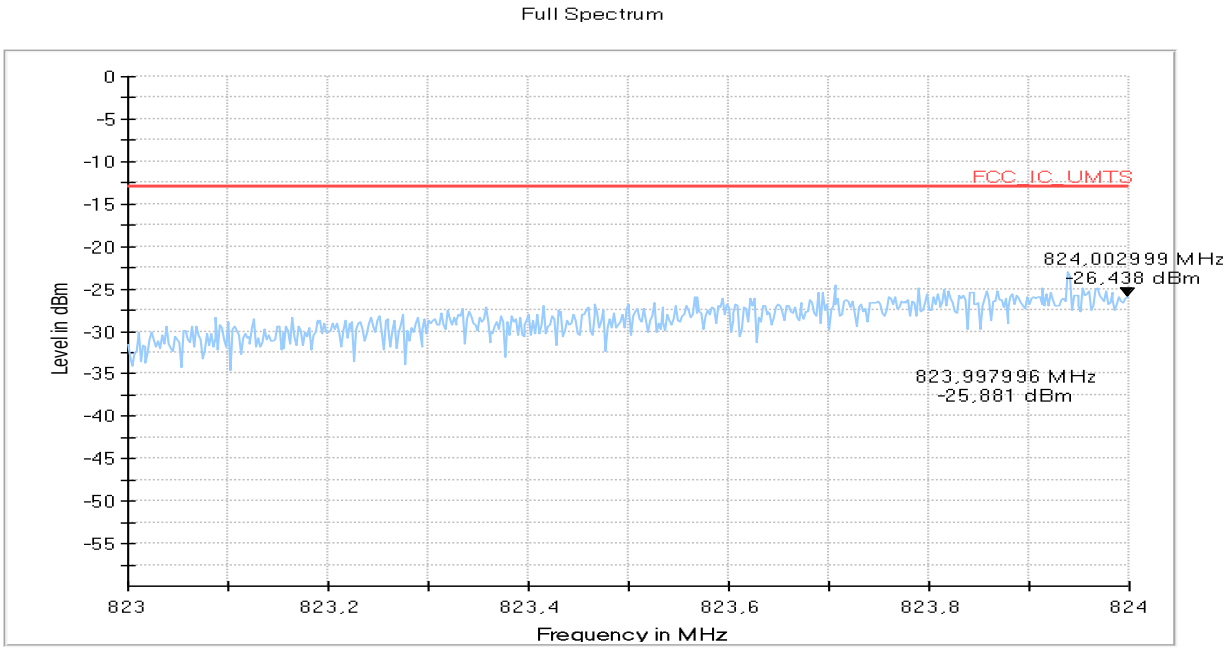


Diagram: 9.20_Ch20407_BW1.4_1RB_High_16QAM

1.10.2. High Band-Edge

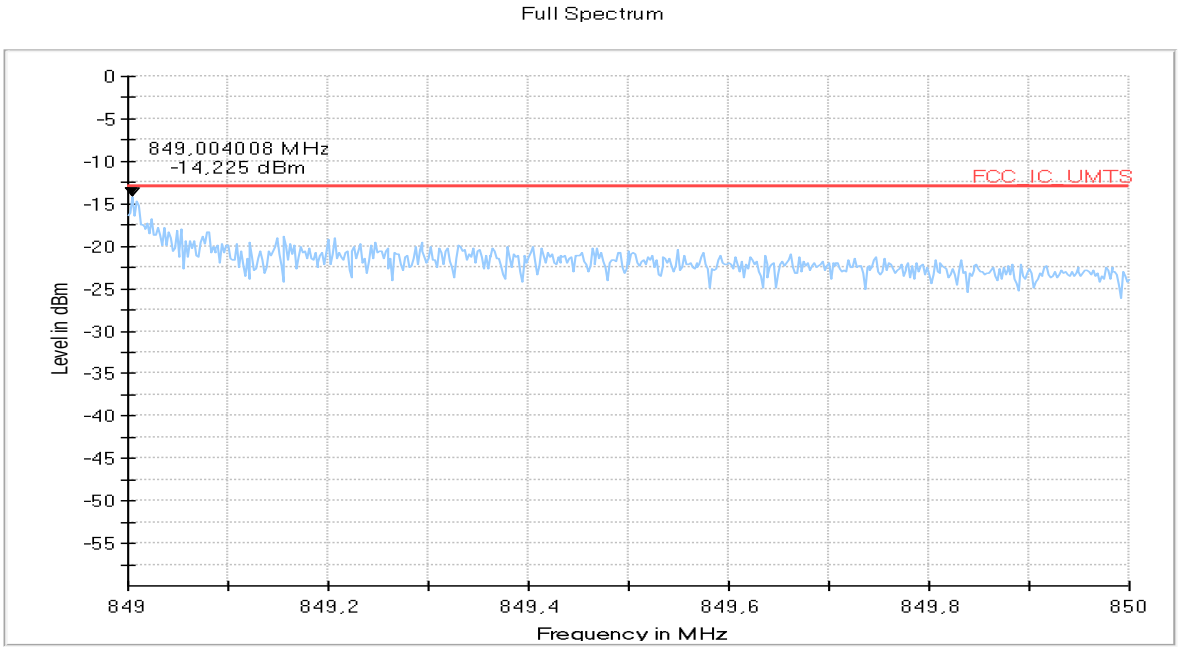


Diagram: 9.21_Ch20643_BW1.4_1RB_Low_QPSK

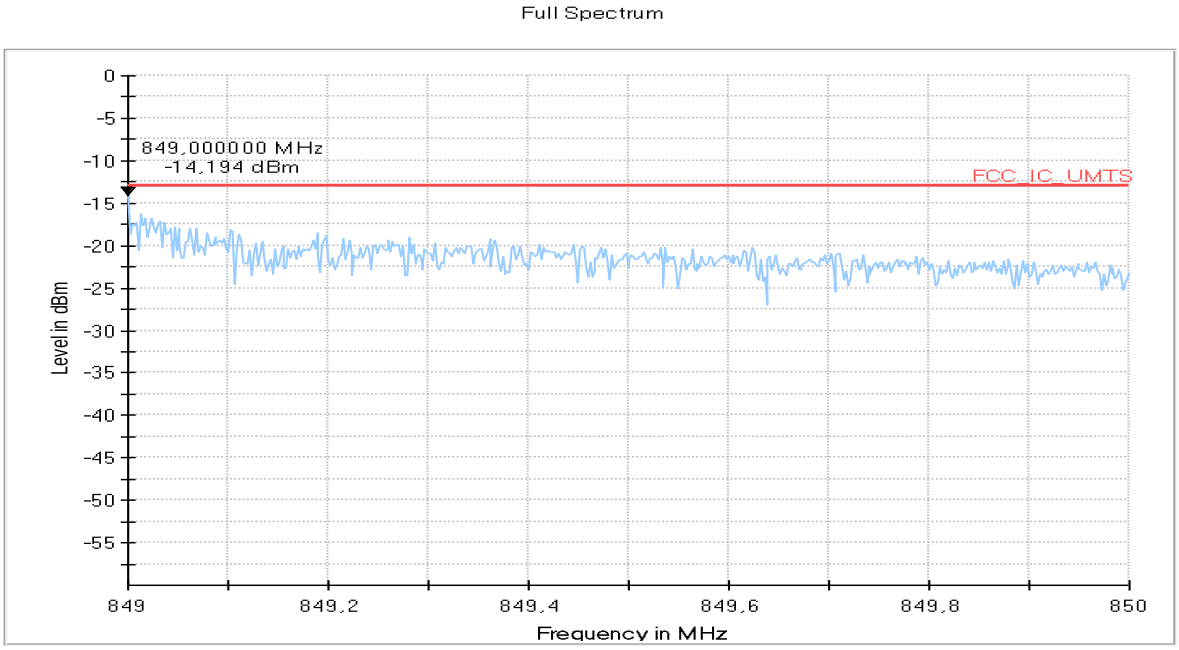


Diagram: 9.22_Ch20643_BW1.4_1RB_Low_16QAM

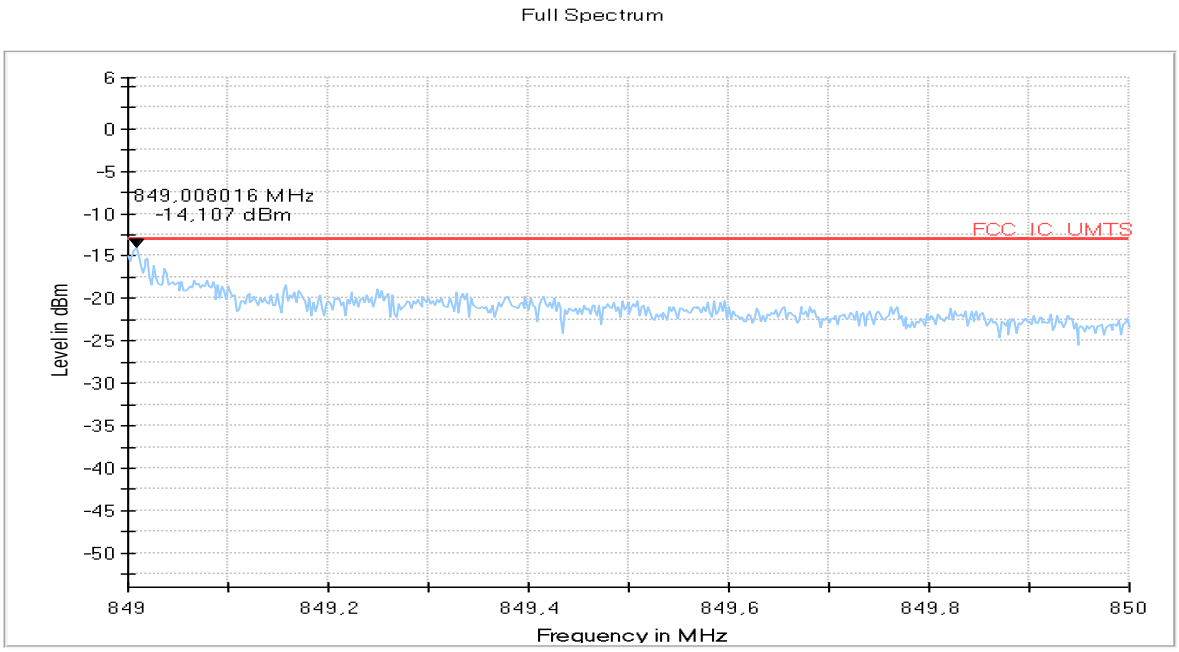


Diagram: 9.23_Ch20643_BW1.4_1RB_High_QPSK

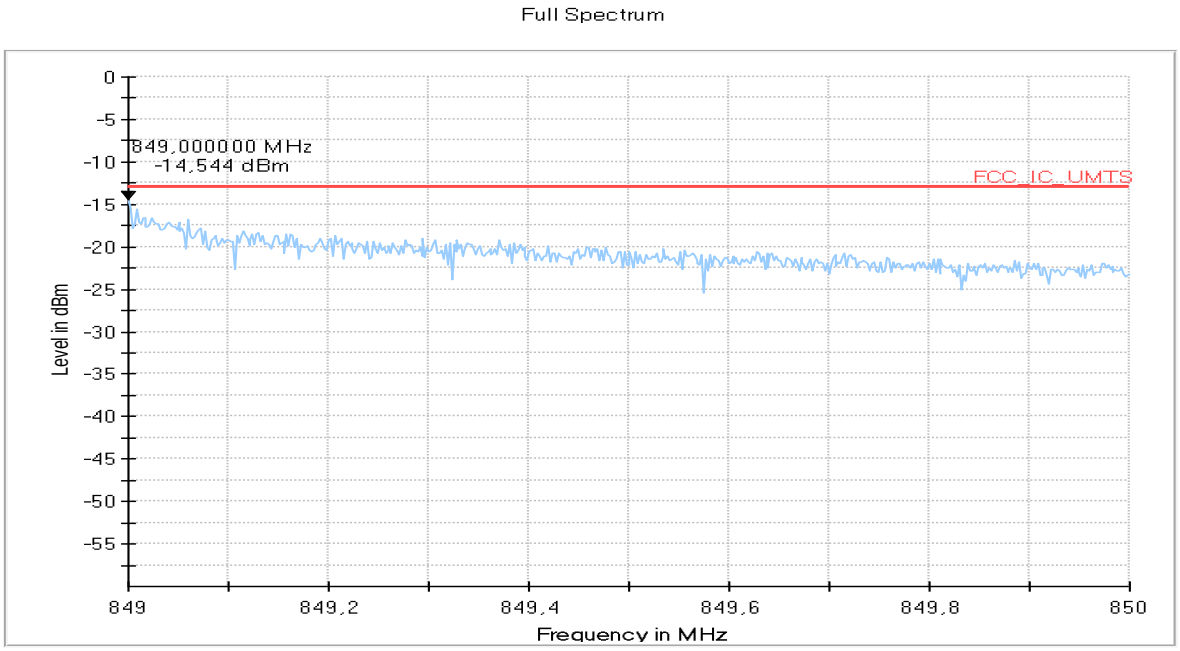


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Diagram: 9.24_Ch20643_BW1.4_1RB_High_16QAM

1.11. Radiated emissions – band-edge (LTE Band 12)

1.11.1. Low Band-Edge

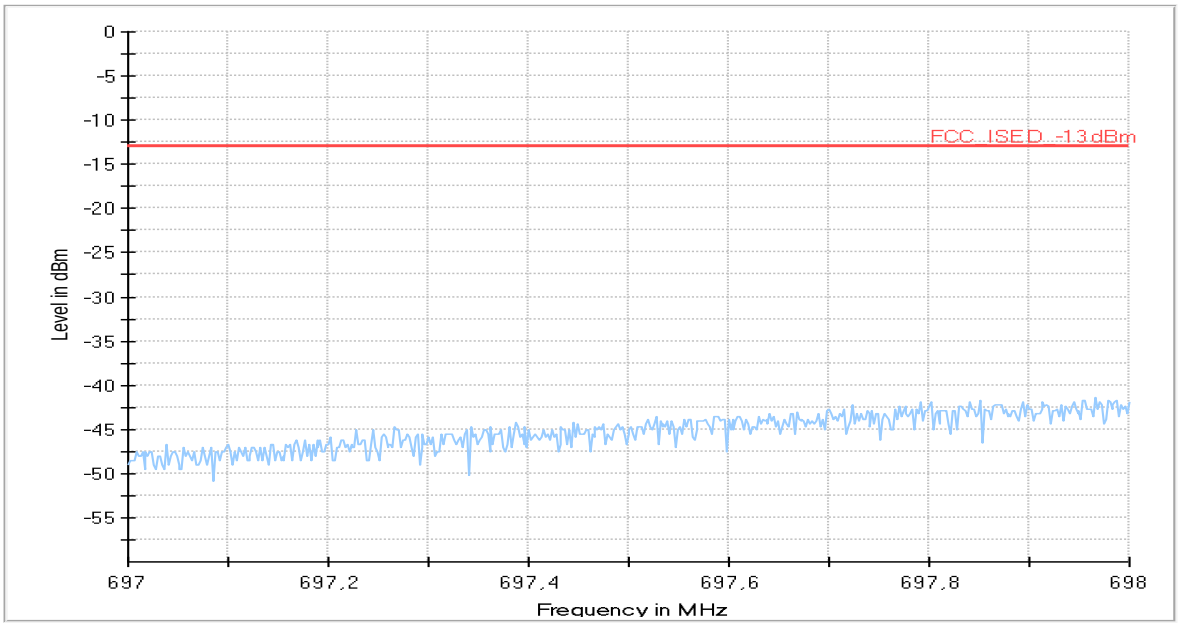

Diagram: 9.25_Ch-23017_BW1,4_1RB_Low_QPSK

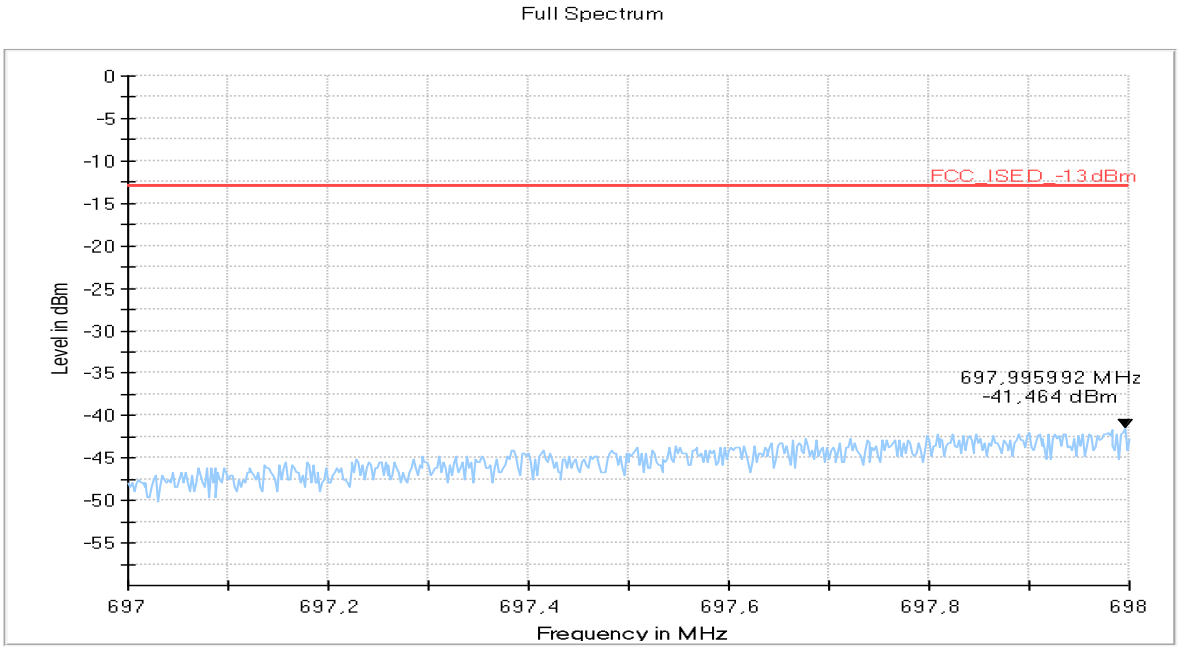

Diagram: 9.26_Ch-23017_BW1,4_1RB_Low_16QAM

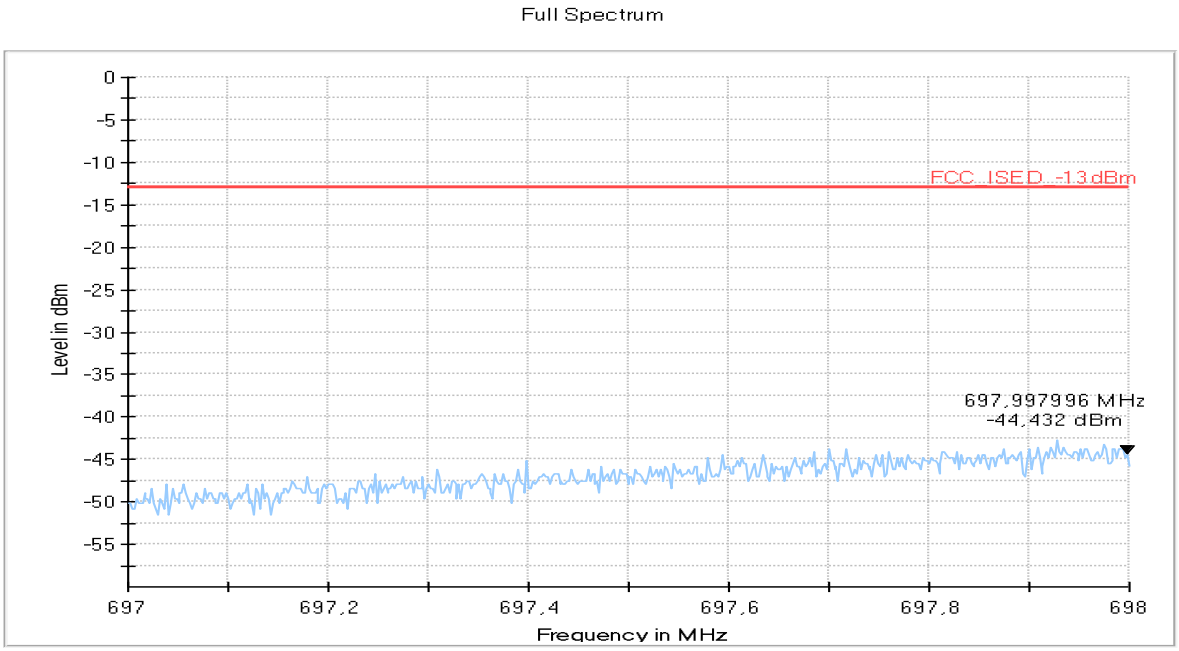

Diagram: 9.27_Ch-23017_BW1,4_1RB_High_QPSK

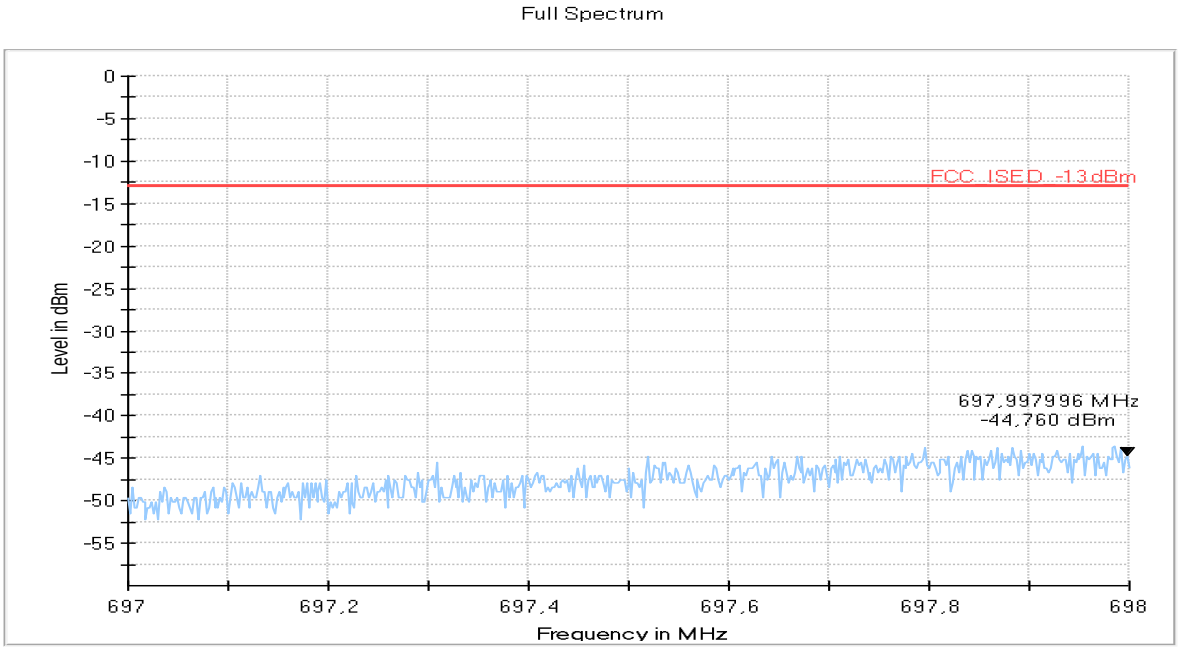

Diagram: 9.28_Ch-23017_BW1,4_1RB_High_16QAM

1.11.2. High Band-Edge

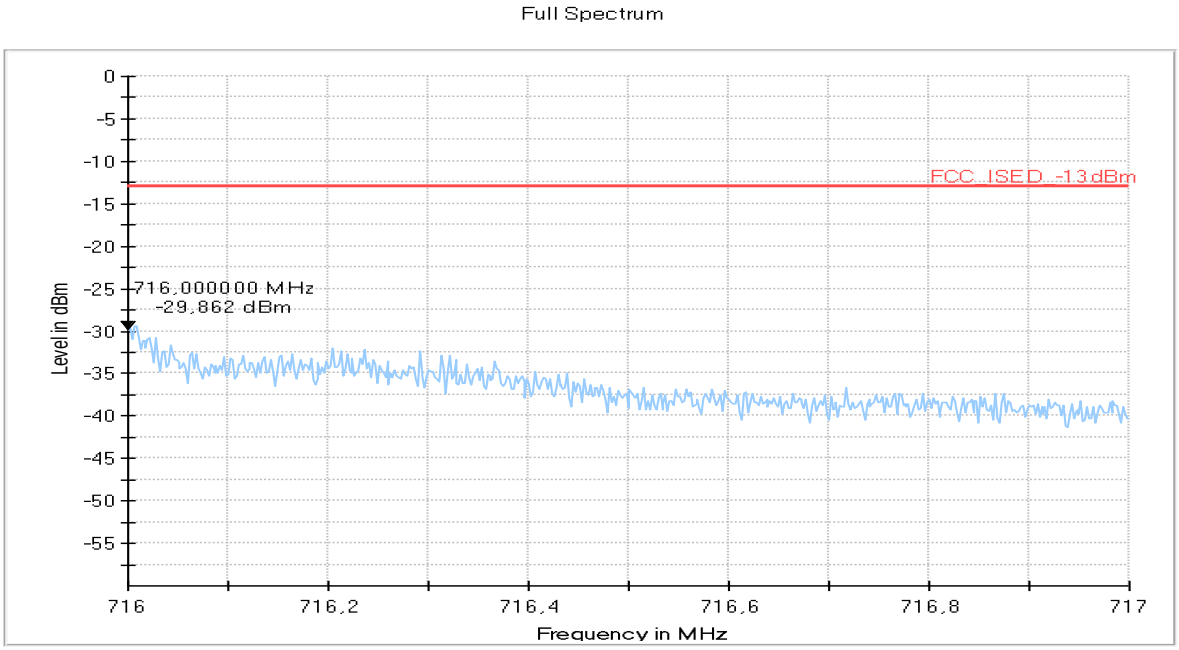

Diagram: 9.29_Ch-23173_BW1,4_1RB_Low_QPSK

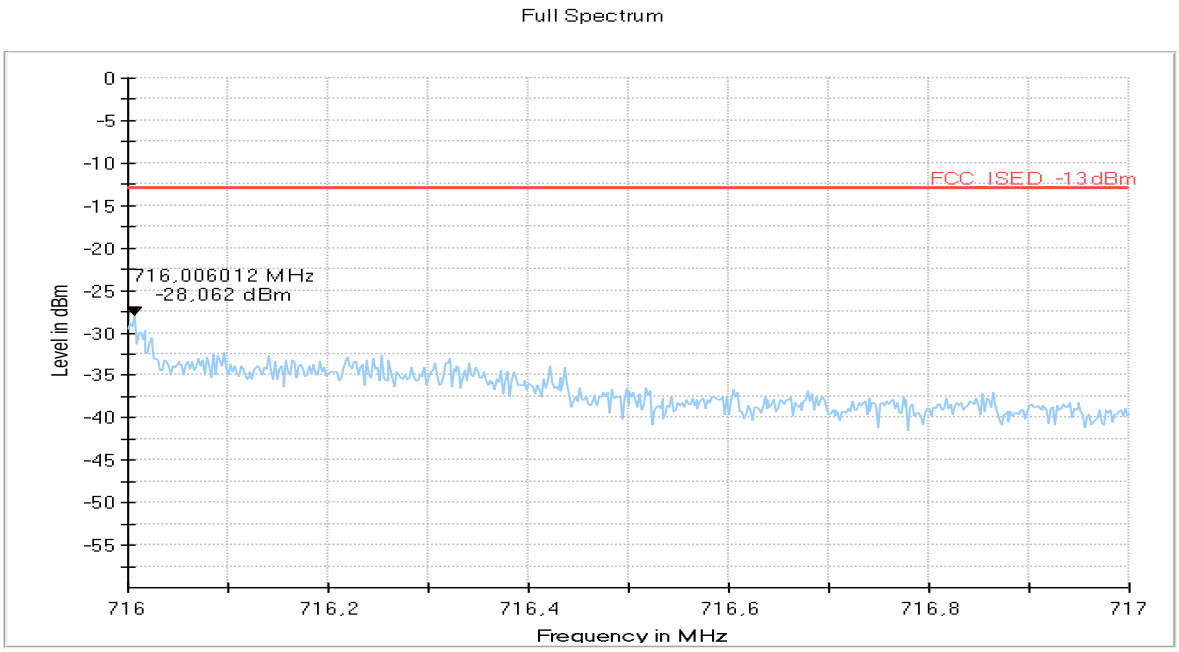

Diagram: 9.30_Ch-23173_BW1,4_1RB_Low_16QAM

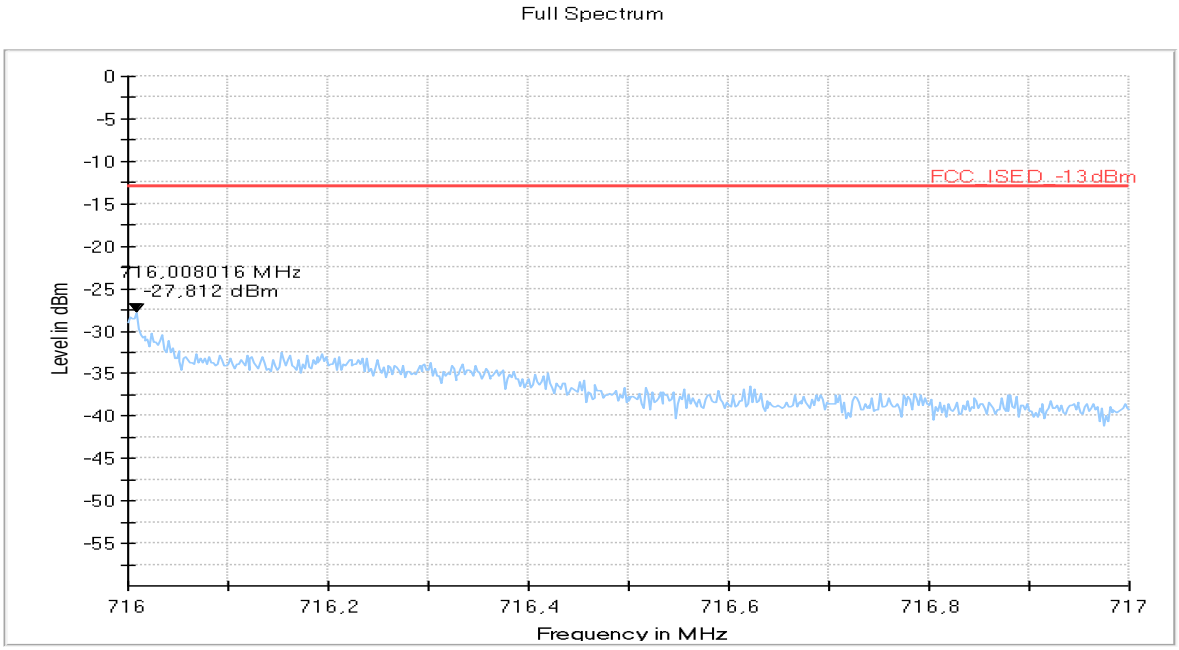

Diagram: 9.31_Ch-23173_BW1,4_1RB_High_QPSK

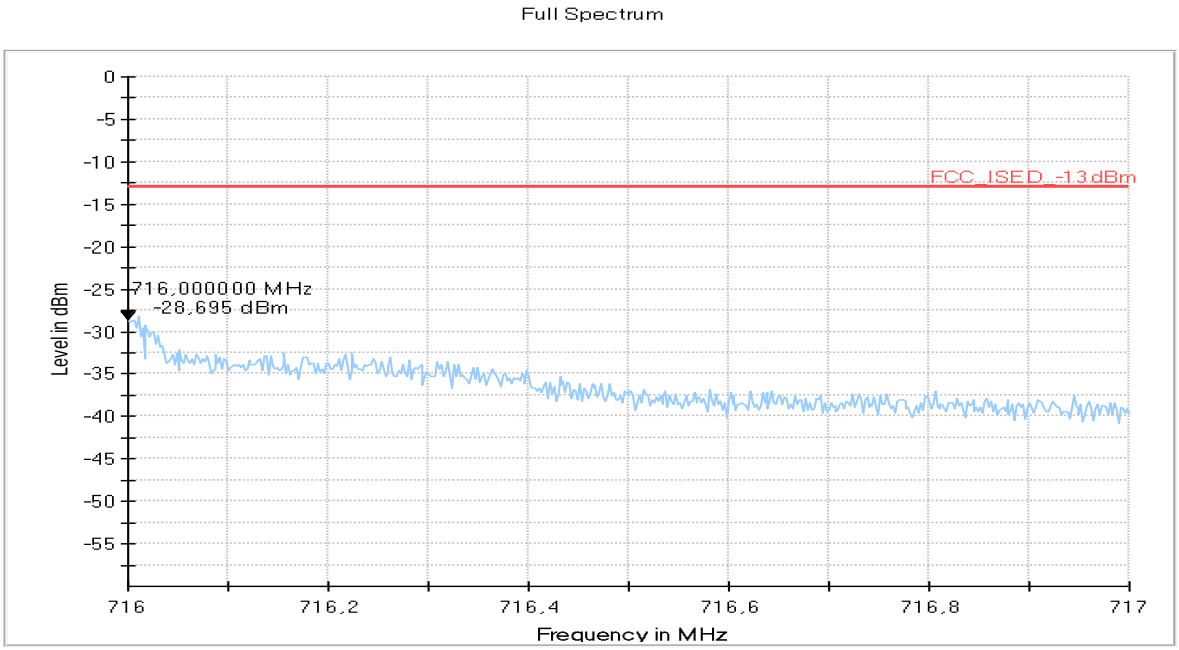

Diagram: 9.32_Ch-23173_BW1,4_1RB_High_16QAM

End of Report