Annex 1: Measurement diagrams 24-1-0047701T001-TR1-A201-R02

Number of pages:	22	**Date of Report:**	2024-Aug-26
Testing company:	cetecom advanced GmbH Untertuerkheimer Str. 6-10 66117 Saarbruecken GERMANY	**Applicant:**	RAFI GmbH & Co. KG
Product: **Model:**	**BLE low energy MCU** **Assembly Bluetooth Modul**		
FCC ID:	2BESPSCU101916	**IC:**	32248-101916SCUNA
Testing has been carried out in accordance with:	FCC Regulations Title 47 CFR, Chapter I Subpart C Intentional Radiators § 15.247 Operation within the bands 2400-2483.5 MHz ISED-Regulations Radio Standards Specification RSS-Gen, Issue 5 General Requirements for Compliance of Radio Apparatus RSS-247, Issue 3 Digital Transmission Systems (DTSs)		

The test results relate only to the individual items which have been tested. This report shall not be reproduced in parts without the written approval of the testing laboratory © Copyright: All rights reserved by cetecom advanced GmbH

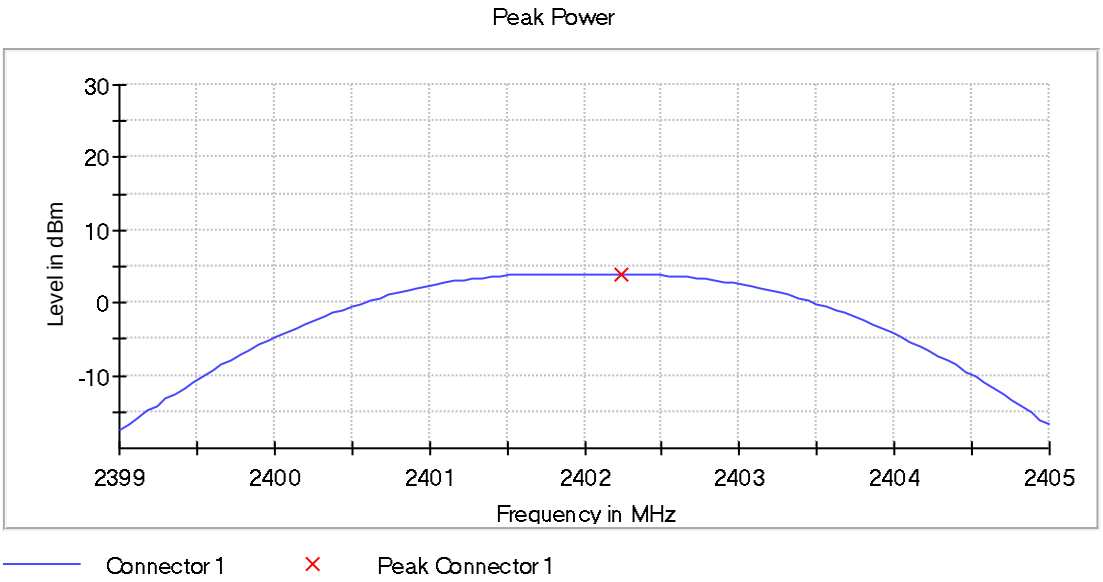
Measurement diagrams

Peak output power (Sweep) (2402 MHz; BT-LE [GFSK] (10 dBm); 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2402.000000	3.9	30.0	PASS

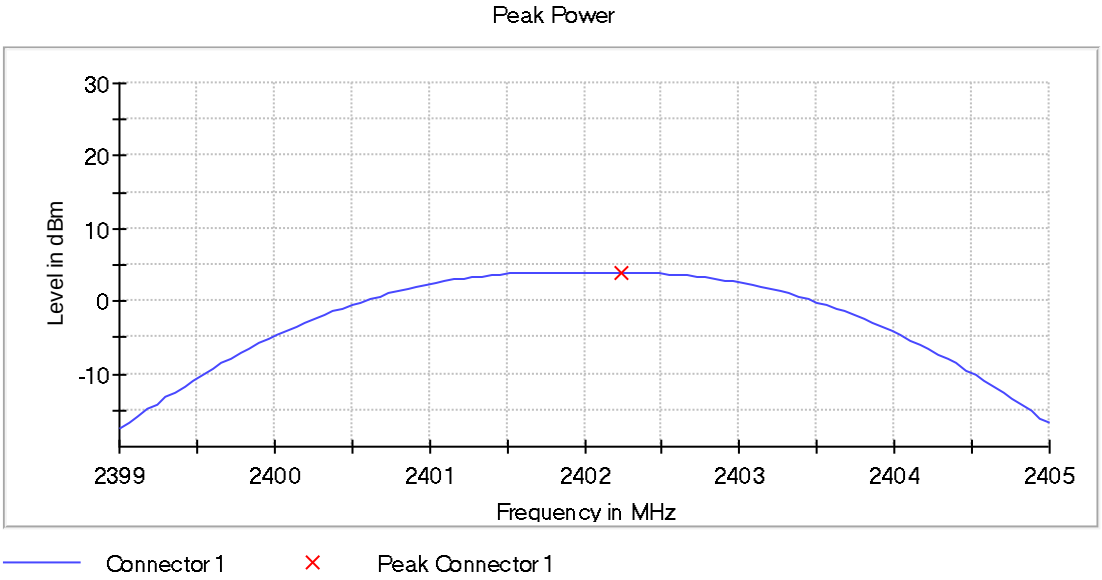


Peak output power (Sweep) (2440 MHz; BT-LE [GFSK] (10 dBm); 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2440.000000	3.9	30.0	PASS

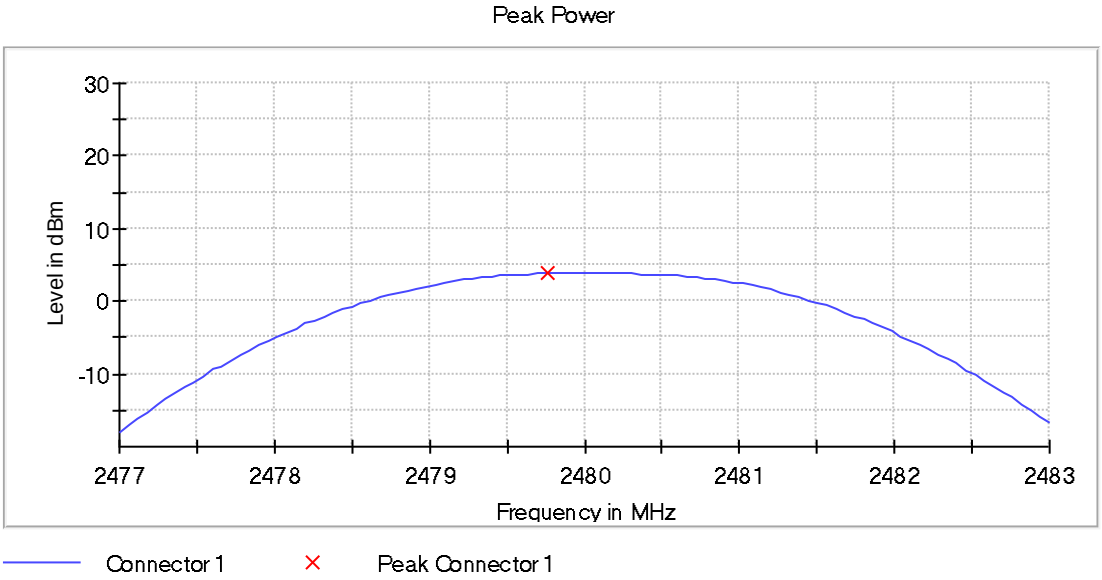


Peak output power (Sweep) (2480 MHz; BT-LE [GFSK] (10 dBm); 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10-2013

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2480.000000	3.8	30.0	PASS



2.01_BLE_ch0_laying

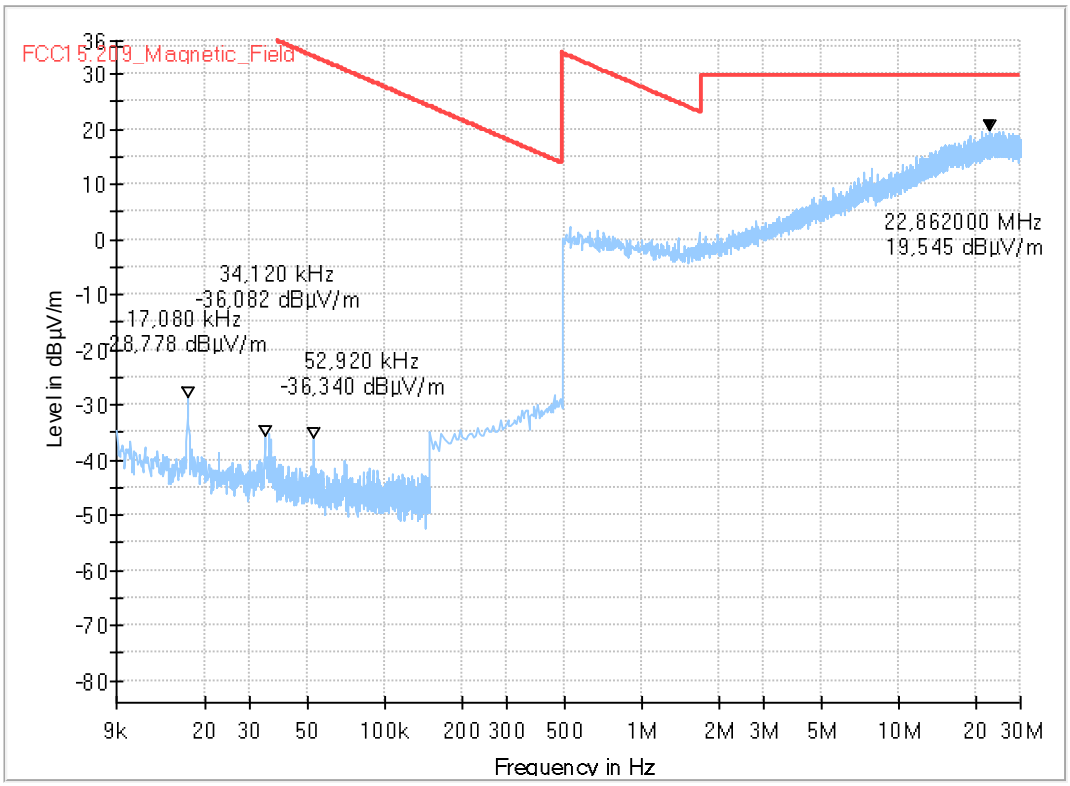
Common Information

Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test Site Location:	Ref.-Nr. 441 Semi Anechoic Chamber (SAC1) with 3 m measurement distance
Version of Testsoftware:	EMC32 V10.60.20
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 Standard:	FCC 15.205 § 15.209; RSS-Gen: Issue 5
Operator:	ASa
Operating Mode:	GFSK | 1Mbit | ch0
Power during tests:	12V DC
Comment 1:	Channel low
Environmental Conditions:	Humidity: 44 % rH; Temperature: 20.2 °C
EUT Setup:	1
Verdict:	Passed

EUT Information

PMT number:	24-1-00477S02_C01
Power:	12 V DC

Full Spectrum



2.02_BLE_ch0_standing

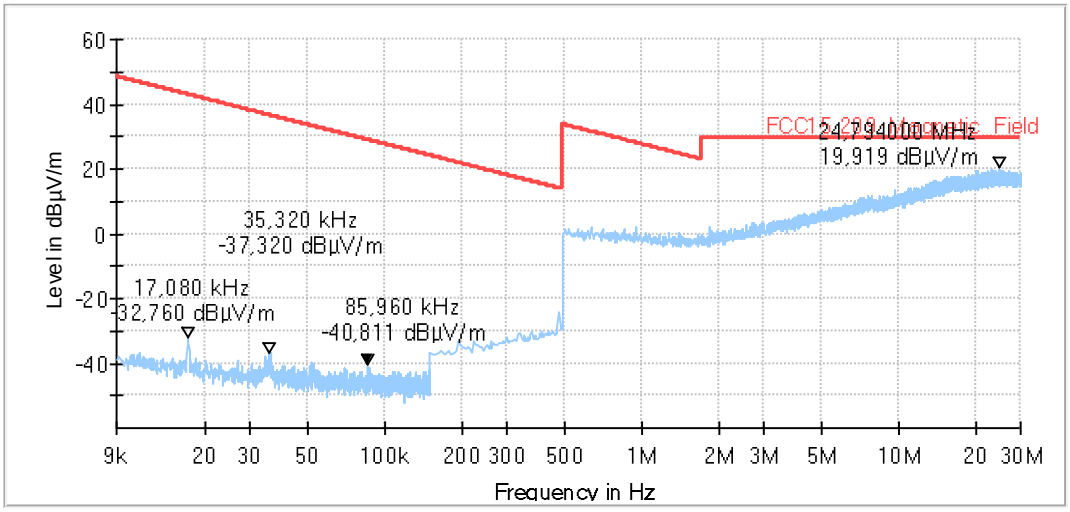
Common Information

Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test Site Location:	Ref.-Nr. 441 Semi Anechoic Chamber (SAC1) with 3 m measurement distance
Version of Testsoftware:	EMC32 V10.60.20
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 Standard:	FCC 15.205 § 15.209; RSS-Gen: Issue 5
Operator:	ASa
Operating Mode:	GFSK | 1Mbit | ch0
Power during tests:	12V DC
Comment 1:	Channel low
Environmental Conditions:	Humidity: 44 % rH; Temperature: 20.2 °C
EUT Setup:	1
Verdict:	Passed

EUT Information

PMT number:	24-1-00477S02_C01
Power:	12 V DC

Full Spectrum



2.03_BLE_ch17

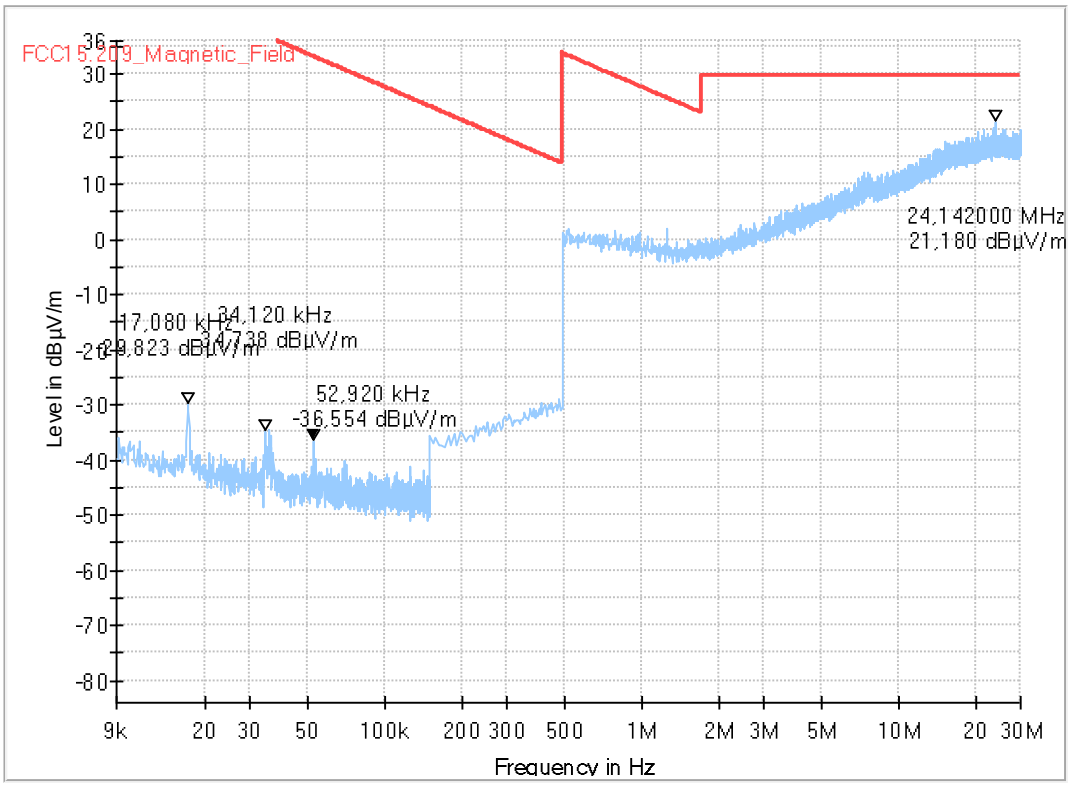
Common Information

Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test Site Location:	Ref.-Nr. 441 Semi Anechoic Chamber (SAC1) with 3 m measurement distance
Version of Testsoftware:	EMC32 V10.60.20
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 Standard:	FCC 15.205 § 15.209; RSS-Gen: Issue 5
Operator:	ASa
Operating Mode:	GFSK | 1Mbit| ch17
Power during tests:	12 V DC
Comment 1:	Channel mid
Environmental Conditions:	Humidity: 44 % rH; Temperature: 20.2 °C
EUT Setup:	2
Verdict:	Passed

EUT Information

PMT number:	24-1-00477S06_C01
Power:	12 V DC

Full Spectrum



2.04_BLE_ch39

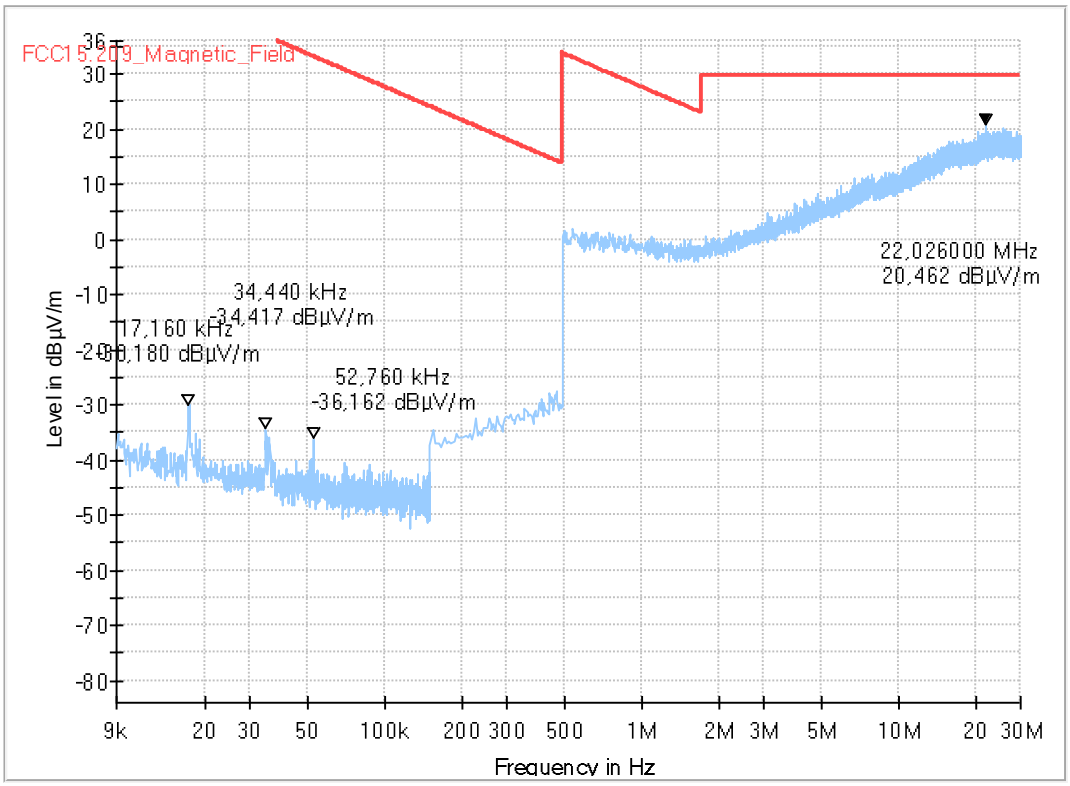
Common Information

Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test Site Location:	Ref.-Nr. 441 Semi Anechoic Chamber (SAC1) with 3 m measurement distance
Version of Testsoftware:	EMC32 V10.60.20
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 Standard:	FCC 15.205 § 15.209; RSS-Gen: Issue 5
Operator:	ASa
Operating Mode:	GFSK | 1Mbit| ch39
Power during tests:	12 V DC
Comment 1:	Channel high
Environmental Conditions:	Humidity: 44 % rH; Temperature: 20.2 °C
EUT Setup:	3
Verdict:	Passed

EUT Information

PMT number:	24-1-00477S01_C01
Power:	12 V DC

Full Spectrum



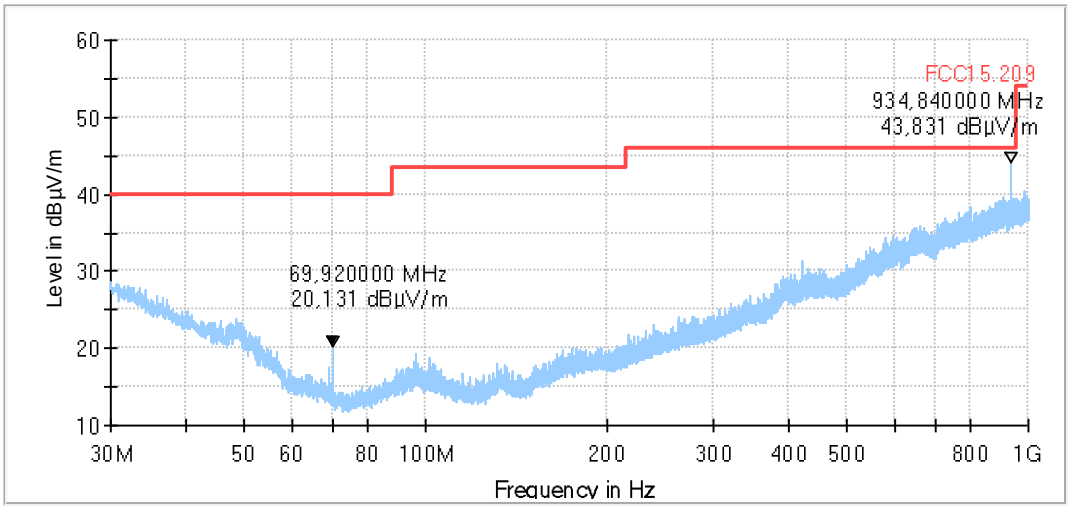
3.01_BLE_ch0

Common Information

Test Description:	Radiated field strength emission in 3m distance
Test Site:	cetecom advanced GmbH
Test Standard:	FCC 15.205&15.209 & RSS Gen. Issue 5
Antenna polarisation:	horizontal/vertical
Environmental Conditions:	Humidity: 41 %rH; Temperature: 21 °C
Operator Name:	SOz
EUT:	1
Operating Mode:	GFSK | 1Mbit | ch0
Power supply:	12 V DC
Comment:	Channel no. low
Verdict:	Passed

EUT Information

PMT number:	24-1-00477S02_C01
Power:	12 V DC



Remark: Emission at 934.84 MHz is outsite from chamber and not related to results.

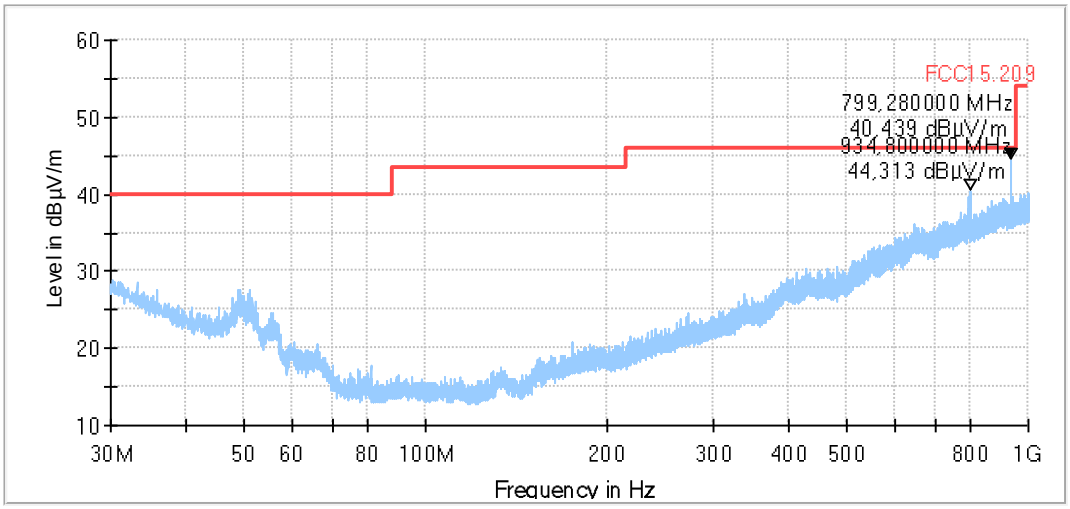
3.02_BLE_ch17

Common Information

Test Description:	Radiated field strength emission in 3m distance
Test Site:	cetecom advanced GmbH
Test Standard:	FCC 15.205&15.209 & RSS Gen. Issue 5
Antenna polarisation:	horizontal/vertical
Environmental Conditions:	Humidity: 41 % rH; Temperature: 21 °C
Operator Name:	SOz
EUT:	2
Operating Mode:	GFSK | 1Mbit | ch17
Power supply:	12 V DC
Comment:	Channel no. middle
Verdict:	Passed

EUT Information

PMT number:	24-1-00477S06_C01
Power:	12 V DC



Remark: Emission at 799.28 MHz and 934.8 MHz are outsite from chamber and not related to results.

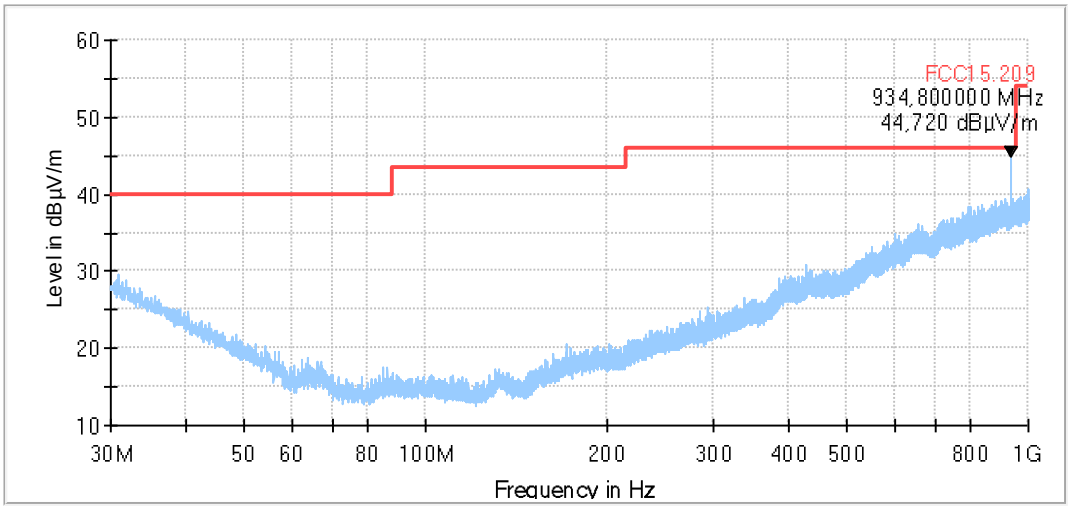
3.03_BLE_ch39

Common Information

Test Description:	Radiated field strength emission in 3m distance
Test Site:	cetecom advanced GmbH
Test Standard:	FCC 15.205&15.209 & RSS Gen. Issue 5
Antenna polarisation:	horizontal/vertical
Environmental Conditions:	Humidity: 41 % rH; Temperature: 21 °C
Operator Name:	SOz
EUT:	3
Operating Mode:	GFSK | 1Mbit | ch39
Power supply:	12 V DC
Comment:	Channel no. high
Verdict:	Passed

EUT Information

PMT number:	24-1-00477S01_C01
Power:	12 V DC



Remark: Emission at 934.8 MHz is outsite from chamber and not related to results.

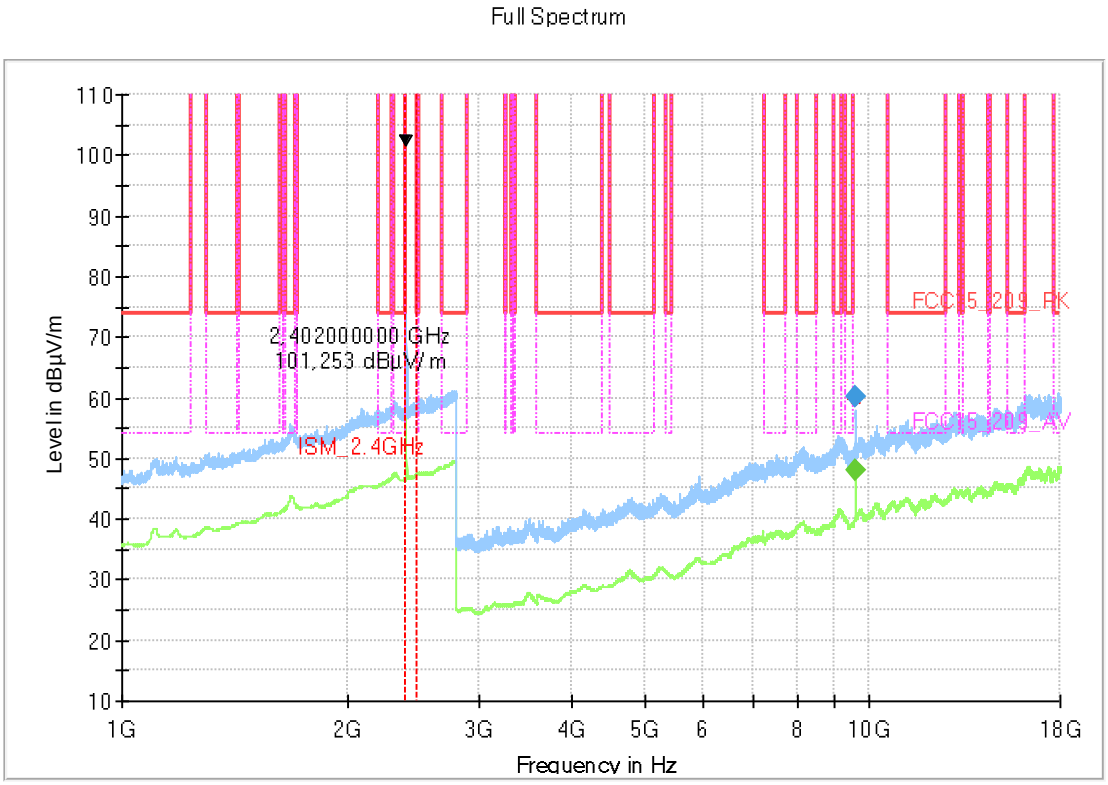
4.01_BLE_ch0

Common Information

Test Description:	Radiated field strength emission
Test Site:	Fully Anechoic Chamber (FAC1) - EMC32 V10.60.20
Test Standard:	FCC 15.247&15.209 Intentional Radiator / RSS-Gen, Issue 5
Antenna polarisation:	horizontal/vertical
Operating Mode:	GFSK | 1Mbit| ch0
Operator:	KTe
Environmental Conditions:	Humidity: 50 % rH; Temperature: 20 °C
Verdict:	Passed

EUT Information

Sample:	24-1-00477S02_C01
Power Supply :	12 V DC



Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Elevation
9607.200000	---	48.09	150.00	101.91	100.0	1000.000	155.0	H	48.0	90.0
9607.200000	60.28	---	150.00	89.72	100.0	1000.000	155.0	H	45.0	90.0

4.02_BLE_ch0_AntH

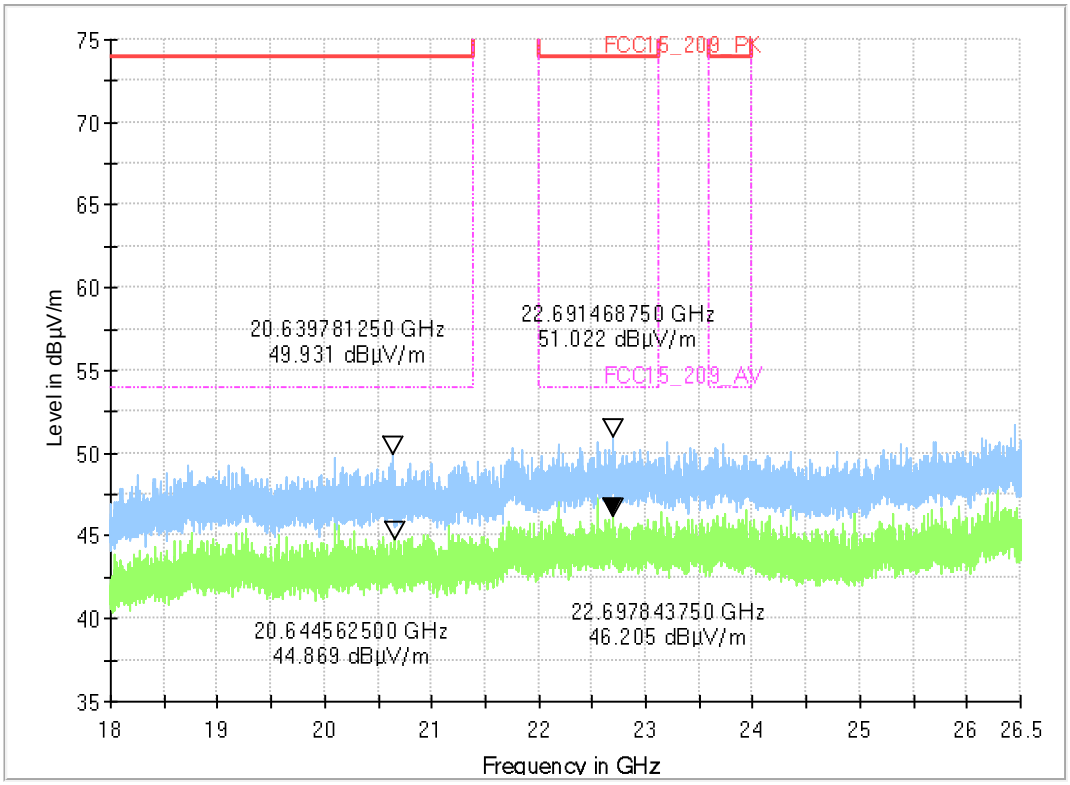
Common Information

Test Description:	Radiated Field Strength Emission
Test Site Location:	cetecom advanced Essen
Test Site:	Fully Anechoic Room (FAR2)
Test Standard:	FCC - Testing Part 15.247 & RSS-247, Issue 5
Operating Mode:	GFSK | 1Mbit| ch0
Environmental Conditions:	Humidity: 51 % rH; Temperature: 19 °C
SW-Version:	EMC32 V10.60.20
Operator:	KTe
Set-up:	1
Verdict:	Passed
Comment:	Antenna horizontal

EUT Information

PMT Sample Nr.	24-1-00477S02_C01
power:	12 V DC

Full Spectrum



4.03_BLE_ch0_AntV

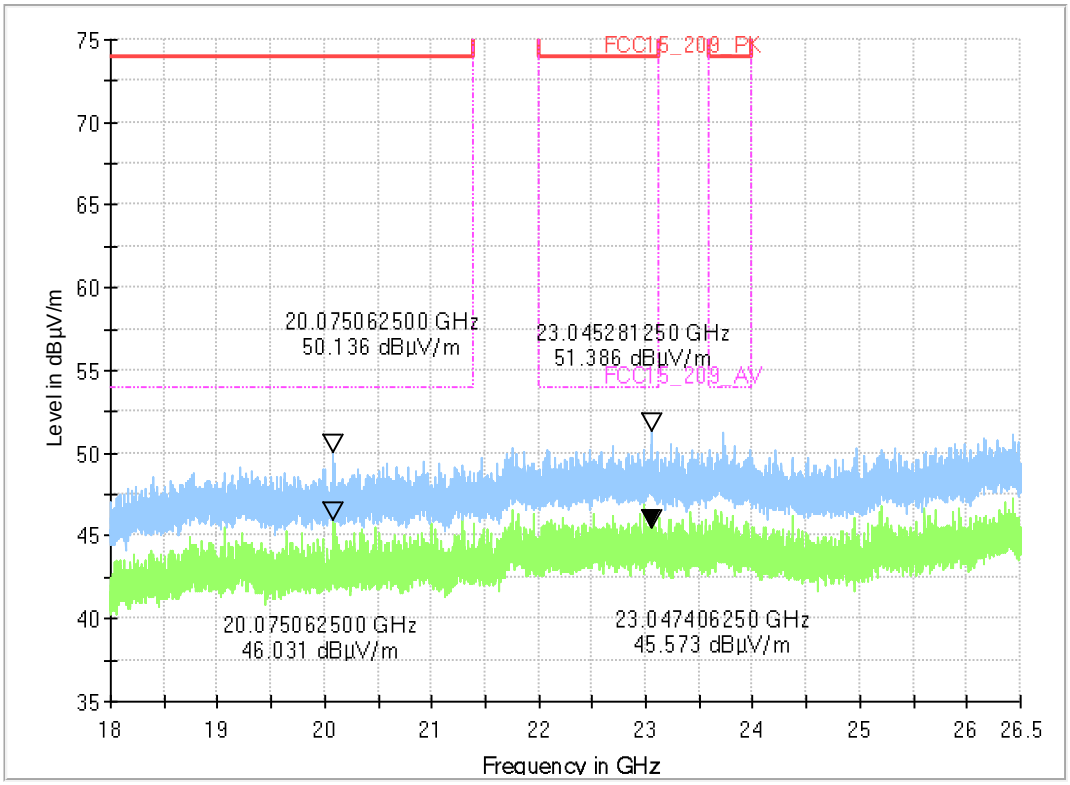
Common Information

Test Description:	Radiated Field Strength Emission
Test Site Location:	cetecom advanced Essen
Test Site:	Fully Anechoic Room (FAR2)
Test Standard:	FCC - Testing Part 15.247 & RSS-247, Issue 5
Operating Mode:	GFSK | 1Mbit| ch0
Environmental Conditions:	Humidity: 51 % rH; Temperature: 19°C
SW-Version:	EMC32 V10.60.20
Operator:	KTe
Set-up:	2
Verdict:	Passed
Comment:	Antenna vertical

EUT Information

PMT Sample Nr.	24-1-00477S02_C01
power:	12 V DC

Full Spectrum



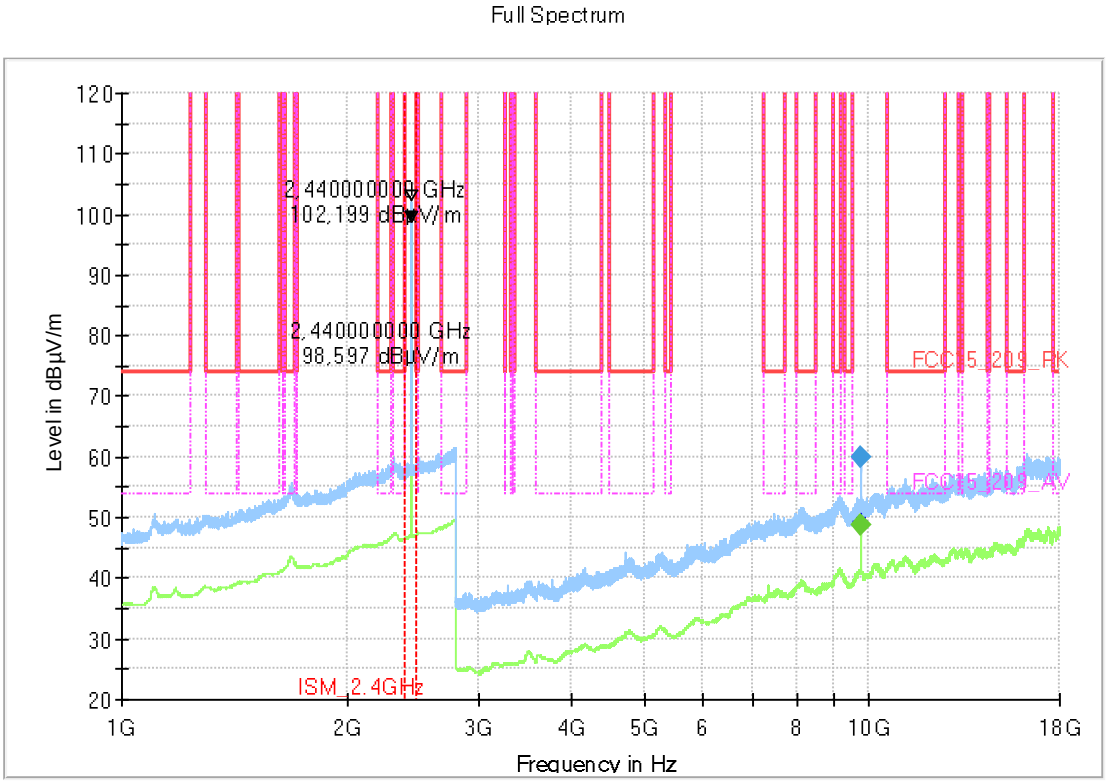
4.04_BLE_ch17

Common Information

Test Description:	Radiated field strength emission
Test Site:	Fully Anechoic Chamber (FAC1) - EMC32 V10.60.20
Test Standard:	FCC 15.247&15.209 Intentional Radiator / RSS-Gen, Issue 5
Antenna polarisation:	horizontal/vertical
Operating Mode:	GFSK | 1Mbit | ch17
Operator:	ASa / KTe
Environmental Conditions:	Humidity: 50 % rH; Temperature: 20 °C
Set-up:	2
Verdict:	Passed

EUT Information

Sample:	24-1-00477S06_C01
Power Supply :	12 V DC



Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Elevation
9759.200000	---	48.67	150.00	101.33	100.0	1000.000	155.0	H	57.0	90.0
9761.200000	59.88	---	150.00	90.12	100.0	1000.000	155.0	H	57.0	90.0

4.05_BLE_ch17_AntH

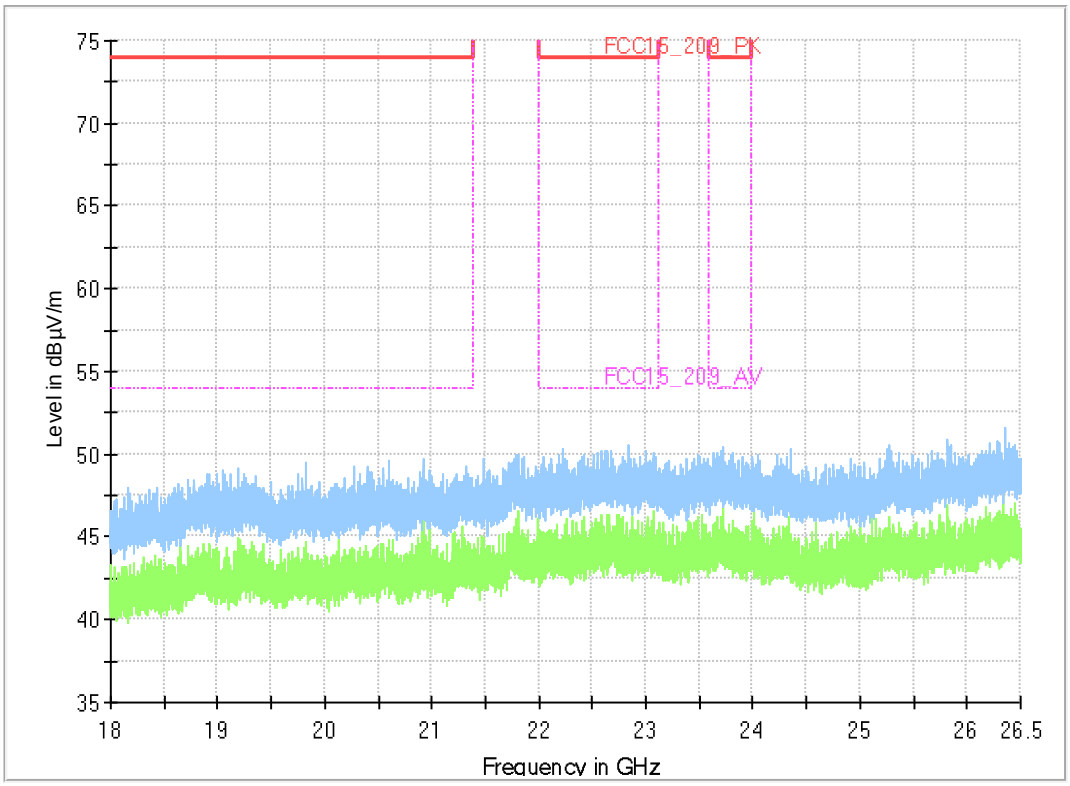
Common Information

Test Description:	Radiated Field Strength Emission@3m distance
Test Site Location:	cetecom advanced GmbH Essen
Test Site:	Fully Anechoic Room (FAR2)
Test Standard:	FCC 15.209 & RSS-Gen, Issue 5
Operating Mode:	GFSK | 1Mbit | ch17
Environmental Conditions:	Humidity: 51 % rH; Temperature: 19 °C
SW-Version:	EMC32 V10.60.20
Operator:	ASa
Set-up:	2
Verdict:	Passed

EUT Information

PMT Sample Nr.	24-1-00477S06_C01
power:	12 V DC

Full Spectrum



4.06_BLE_ch17_AntV

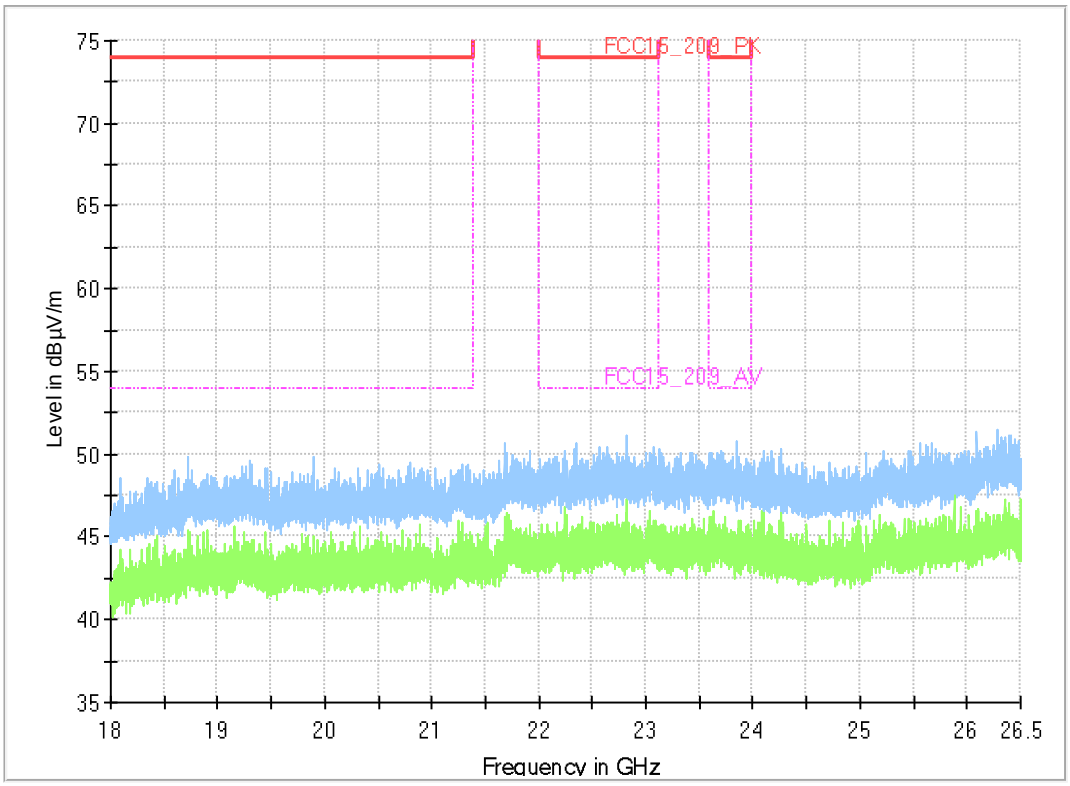
Common Information

Test Description:	Radiated Field Strength Emission@3m distance
Test Site Location:	cetecom advanced GmbH Essen
Test Site:	Fully Anechoic Room (FAR2)
Test Standard:	FCC 15.209 & RSS-Gen, Issue 5
Operating Mode:	GFSK | 1Mbit | ch17
Environmental Conditions:	Humidity: 45 % rH; Temperature: 21 °C
SW-Version:	EMC32 V10.60.20
Operator:	ASa
Set-up:	2
Verdict:	Passed

EUT Information

PMT Sample Nr.	24-1-00477S06_C01
power:	12 V DC

Full Spectrum



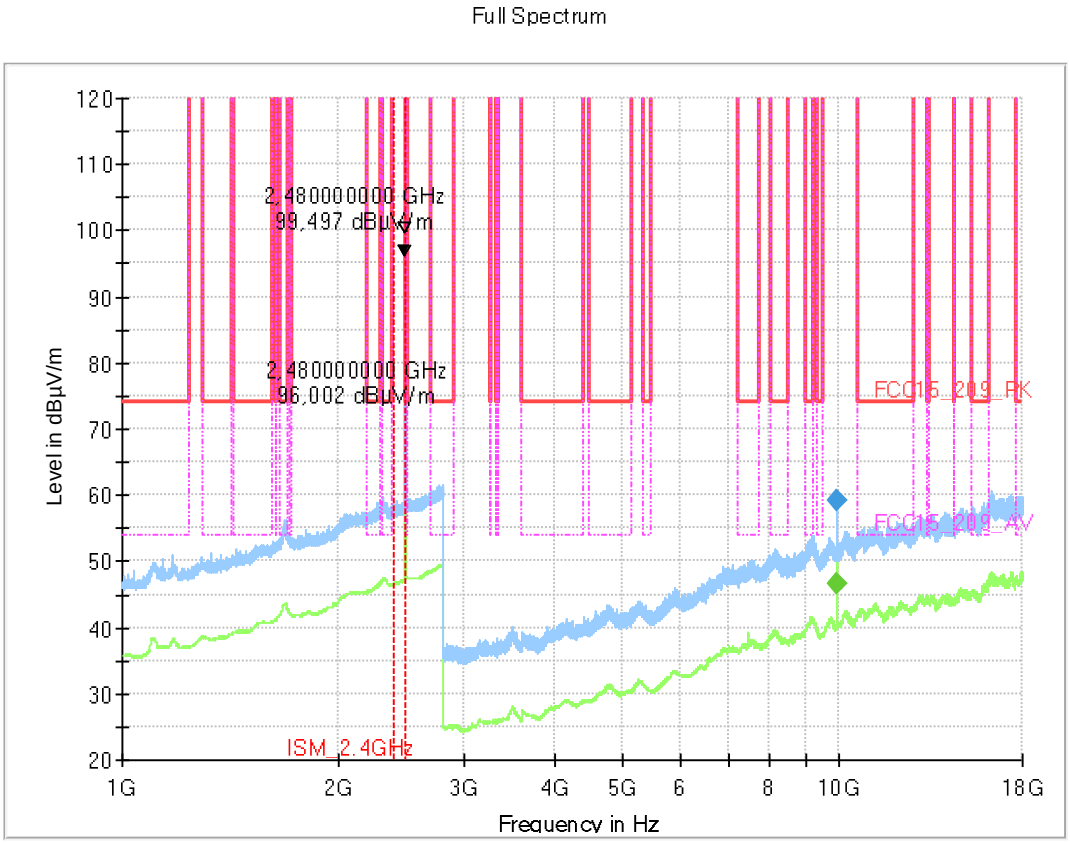
4.07_BLE_ch39

Common Information

Test Description:	Radiated field strength emission
Test Site:	Fully Anechoic Chamber (FAC1) - EMC32 V10.60.20
Test Standard:	FCC 15.247&15.209 Intentional Radiator / RSS-Gen, Issue 5
Antenna polarisation:	horizontal/vertical
Operating Mode:	GFSK | 1Mbit | ch39
Operator:	ASa
Environmental Conditions:	Humidity: 50 % rH; Temperature: 20 °C
Verdict:	Passed

EUT Information

Sample:	24-1-00477S01_C01
Power Supply :	12 V DC



Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Elevation
9919.200000	59.25	---	150.00	90.75	100.0	1000.000	155.0	H	50.0	90.0
9921.200000	---	46.66	150.00	103.34	100.0	1000.000	155.0	H	52.0	90.0

4.08_BLE_ch39_AntH

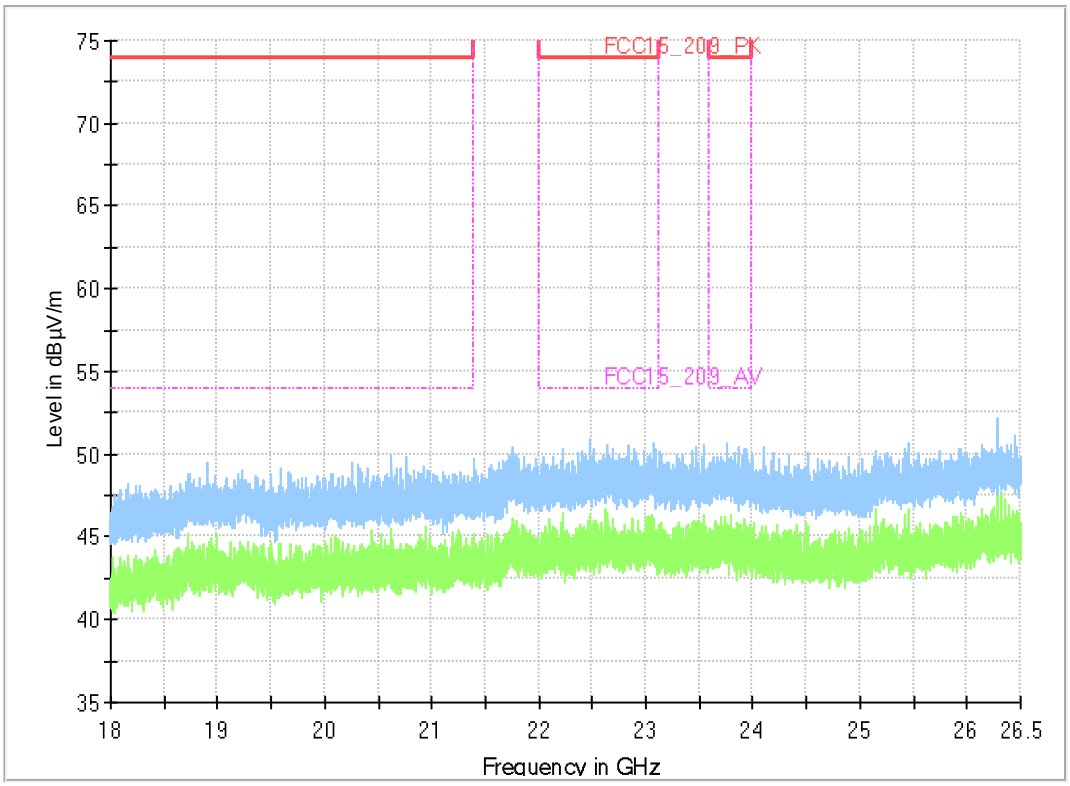
Common Information

Test Description:	Radiated Field Strength Emission@3m distance
Test Site Location:	cetecom advanced GmbH Essen
Test Site:	Fully Anechoic Room (FAR2)
Test Standard:	FCC 15.209 & RSS-Gen, Issue 5
Operating Mode:	GFSK | 1Mbit | ch39
Environmental Conditions:	Humidity: 37 % rH; Temperature: 22.6 °C
SW-Version:	EMC32 V10.60.20
Operator:	SOz
Set-up:	3
Verdict:	Passed

EUT Information

PMT Sample Nr.	24-1-00477S01_C01
power:	12 V DC

Full Spectrum



4.09_BLE_ch39_AntV

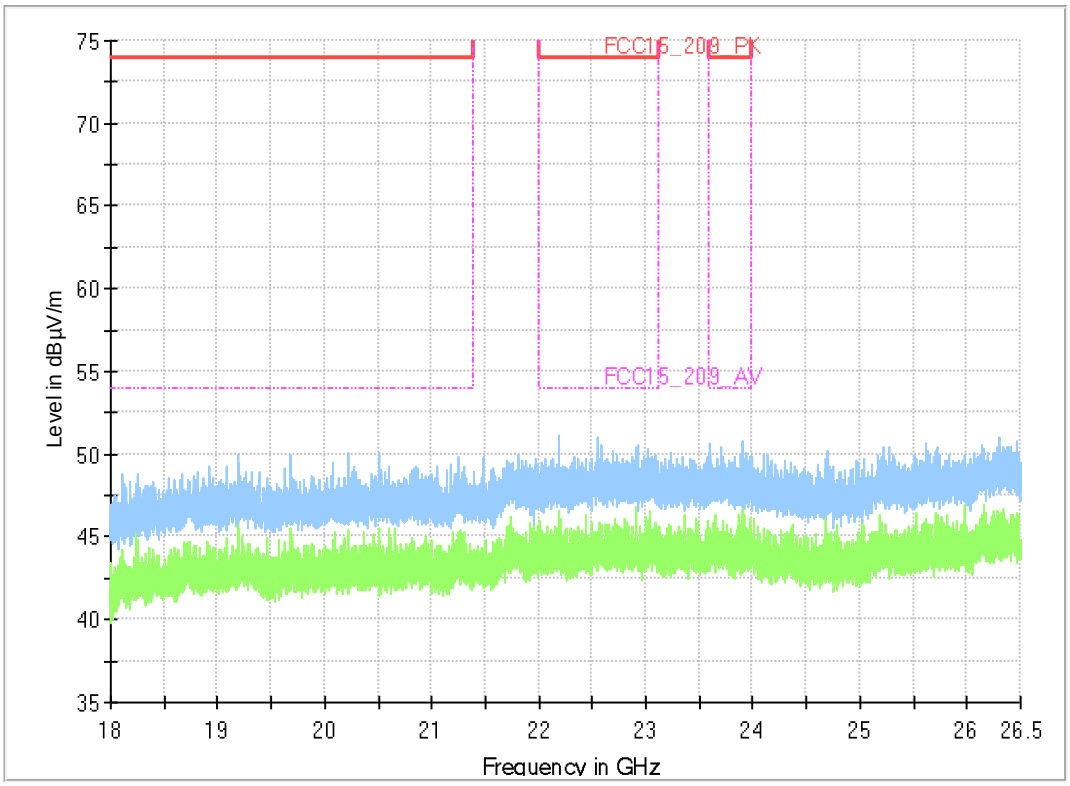
Common Information

Test Description:	Radiated Field Strength Emission@3m distance
Test Site Location:	cetecom advanced GmbH Essen
Test Site:	Fully Anechoic Room (FAR2)
Test Standard:	FCC 15.209 & RSS-Gen, Issue 5
Operating Mode:	GFSK | 1Mbit| ch39
Environmental Conditions:	Humidity: 37 % rH; Temperature: 22.6 °C
SW-Version:	EMC32 V10.60.20
Operator:	ASa
Set-up:	3
Verdict:	Passed

EUT Information

PMT Sample Nr.	24-1-00477S01_C01
power:	12 V DC

Full Spectrum



9.01_BLE_ch0

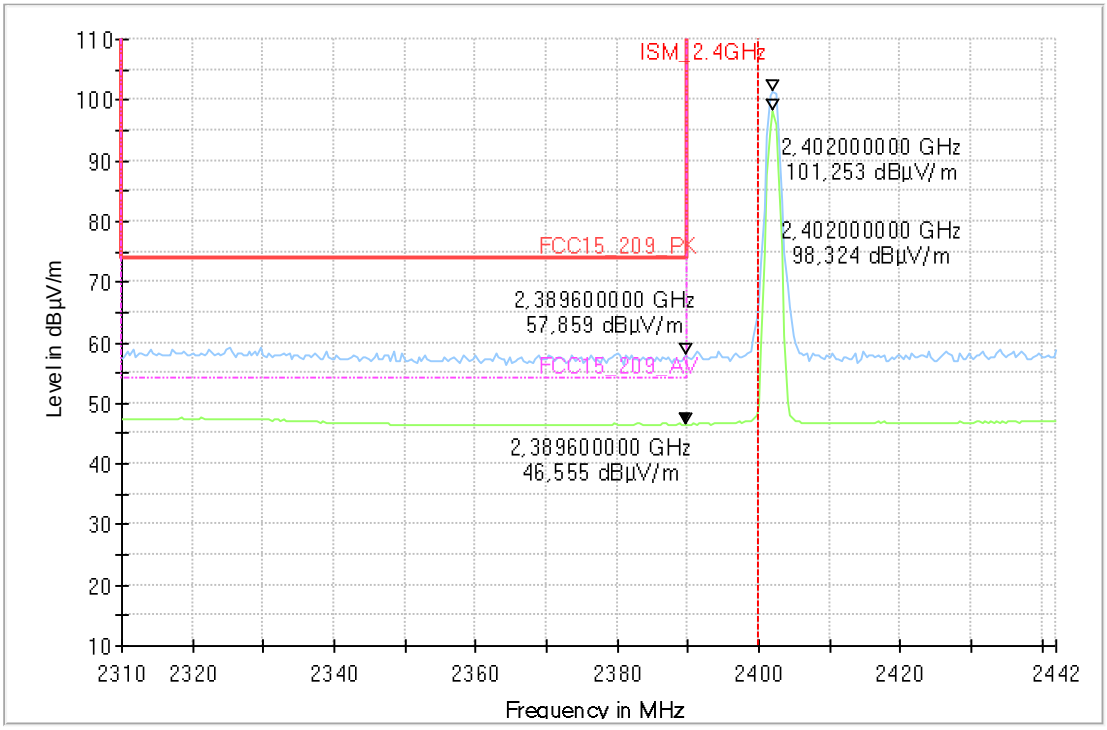
Common Information

Test Description:	Band-Edge: Radiated Field Strength Emissions Emissions
Test Site:	Fully Anechoic Chamber (FAC1) - EMC32 V10.60.20
Test Standard:	FCC 15.247&15.209 Intentional Radiator / RSS-Gen, Issue 5
Antenna polarisation:	horizontal/vertical
Operating Mode:	GFSK | 1Mbit | ch0
Operator:	KTe
Environmental Conditions:	Humidity: 50 % rH; Temperature: 20 °C
EUT Setup:	1
Verdict:	Passed

EUT Information

Sample:	24-1-00477S02_C01
Power Supply :	12 V DC

Full Spectrum



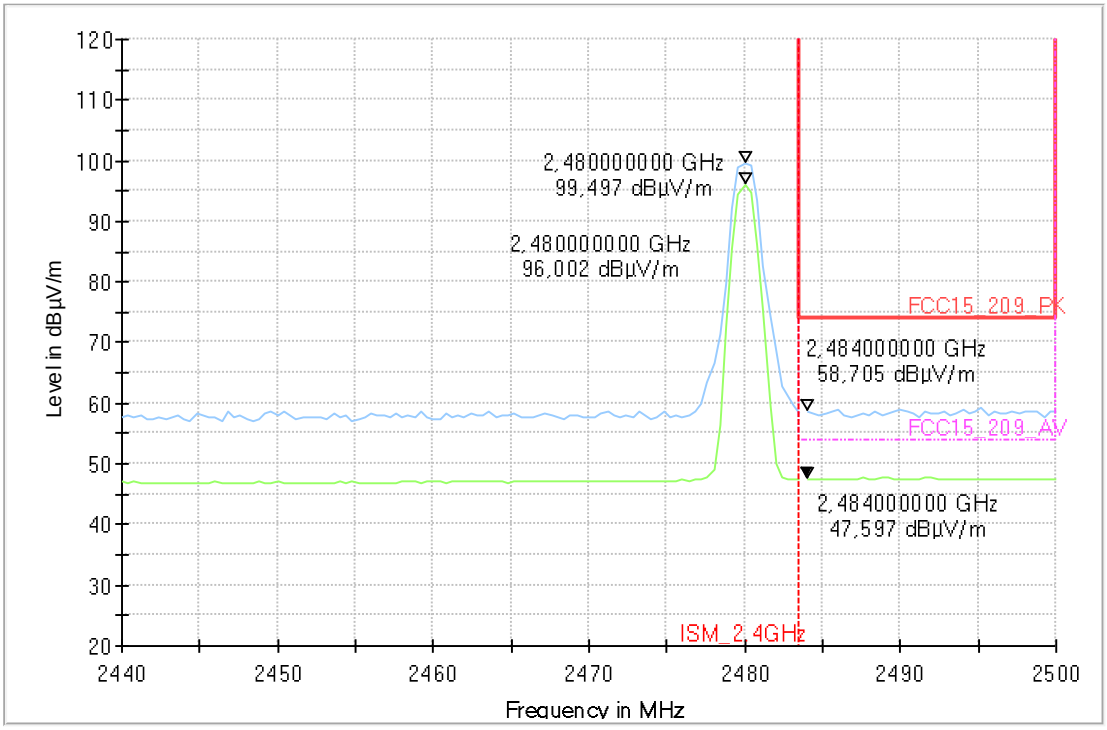
9.02_BLE_ch39

Common Information

Test Description:	Band-Edge: Radiated Field Strength Emissions Emissions
Test Site:	Fully Anechoic Chamber (FAC1) - EMC32 V10.60.20
Test Standard:	FCC 15.247&15.209 Intentional Radiator / RSS-Gen, Issue 5
Antenna polarisation:	horizontal/vertical
Operating Mode:	GFSK | 1Mbit | ch39
Operator:	KTe
Environmental Conditions:	Humidity: 50 % rH; Temperature: 20 °C
EUT Setup:	3
Verdict:	Passed

EUT Information

Sample:	24-1-00477S01_C01
Power Supply :	12 V DC



End Of Annex 1