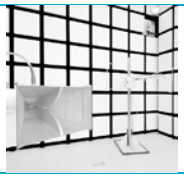
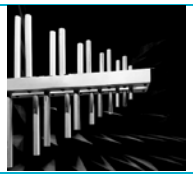
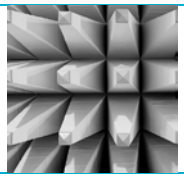

CETECOM ICT Services is now

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TEST REPORT

Test report no.: 1-1241/16-01-07-A

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-01

Testing laboratory

CTC advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: http://www.ctcadvanced.com
e-mail: mail@ctcadvanced.com

Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01

Applicant

VEGA Grieshaber KG
Am Hohenstein 113
77761 Schiltach / GERMANY
Phone: +49 783 650-0
Fax: -/-
Contact: Michael Fischer
e-mail: M.Fischer@vega.com
Phone: +49 7836 50-328

Manufacturer

VEGA Grieshaber KG
Am Hohenstein 113
77761 Schiltach / GERMANY

Test standard/s

47 CFR Part 22	Title 47 of the Code of Federal Regulations; Chapter I; Part 22 - Public mobile services
47 CFR Part 24	Title 47 of the Code of Federal Regulations; Chapter I; Part 24 - Personal communications services
47 CFR Part 27	Title 47 of the Code of Federal Regulations; Chapter I; Part 27 - Miscellaneous wireless communications services

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	**External radio communication unit for level sensors and point level detection sensors**
Model name:	**PLICSMOBILE T81**
FCC ID:	**O6QPMT8X**
IC:	**3892A-PMT8X**
Frequency:	GSM: 824.2 – 848.8 MHz, 1850.2 – 1909.8 MHz UMTS: 826.4 – 846.6 MHz, 1712.4 – 1752.6 MHz, 1852.4 – 1907.6 MHz
Technology tested:	GSM & UMTS
Antenna:	External multi band dipole antenna BMLPVDB800/1900S-NL (PCTEL)
Power supply:	24.0 V DC by external power supply
Temperature range:	-20°C to +55°C

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

p.o.

cn=Andreas Luckenbill, o=CTC advanced GmbH, ou=LUC-170203, email=Andreas.Luckenbill@ctcadvanced.com, c=DE
2017.04.27 11:26:19 +02'00'

Stefan Bös
Lab Manager
Radio Communications & EMC

Test performed:

cn=Marco Bertolino, o=CTC advanced GmbH, ou=BTL-161128, email=Marco.Bertolino@ctcadvanced.com, c=DE
2017.04.27 11:17:40 +02'00'

Marco Bertolino
Lab Manager
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

This test report replaces the test report with the number 1-1241/16-01-07 and dated 2017-02-23

2.2 Application details

Date of receipt of order:	2016-10-25
Date of receipt of test item:	2016-10-25
Start of test:	2016-10-25
End of test:	2017-02-09
Person(s) present during the test:	Mr. Tobias Müller

2.3 Test laboratories sub-contracted

None

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 22	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 22 - Public mobile services
47 CFR Part 24	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 24 - Personal communications services
47 CFR Part 27	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 27 - Miscellaneous wireless communications services
RSS - 132 Issue 3	January 2013	Spectrum Management and Telecommunications Radio Standards Specification - Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz
RSS - 133 Issue 6	January 2013	Spectrum Management and Telecommunications Policy - Radio Standards Specifications, 2 GHz Personal Communication Services
RSS - 139 Issue 3	July 2015	Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710-1780 MHz and 2110-2180 MHz

Guidance	Version	Description
ANSI C63.4-2014	-/-	American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +55°C during high temperature tests -30°C during low temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	24.0 V DC by external power supply 32.0 V 9.0 V

5 Test item

5.1 General description

Kind of test item	:	External radio communication unit for level sensors and point level detection sensors
Type identification	:	PLICSMOBILE T81
HMN	:	-/-
PMN	:	PLICSMOBILE T81
HVIN	:	PMT81R PMT81D PMT81W
FVIN	:	-/-
S/N serial number	:	No serial number!
HW hardware status	:	1-01-00
SW software status	:	0-06-12
Frequency band	:	GSM: 824.2 – 848.8 MHz, 1850.2 – 1909.8 MHz UMTS: 826.4 – 846.6 MHz, 1712.4 – 1752.6 MHz, 1852.4 – 1907.6 MHz
Type of modulation	:	GMSK; QPSK
Antenna	:	External multi band dipole antenna BMLPVDB800/1900S-NL (PCTEL)
Power supply	:	24.0 V DC by external power supply
Temperature range	:	-20°C to +55°C

5.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report: 1-1241/16-01-01_AnnexA
1-1241/16-01-01_AnnexB
1-1241/16-01-01_AnnexC

6 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

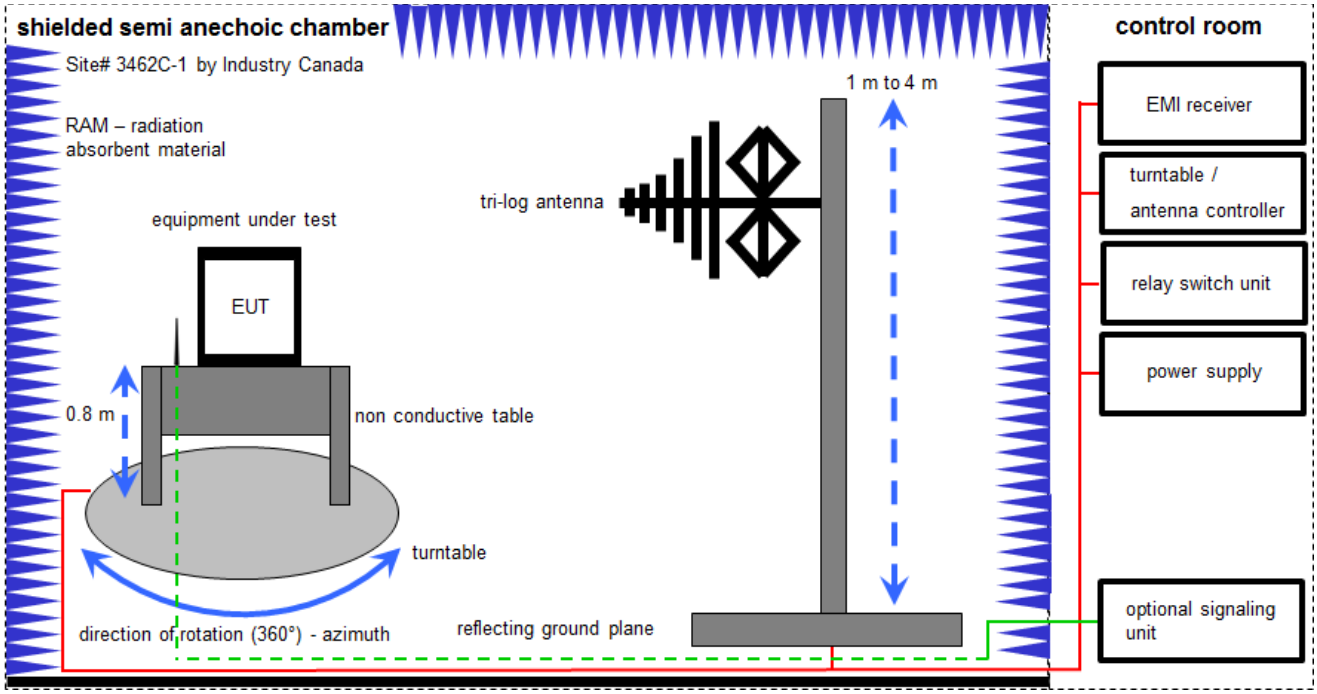
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlkl!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

6.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter

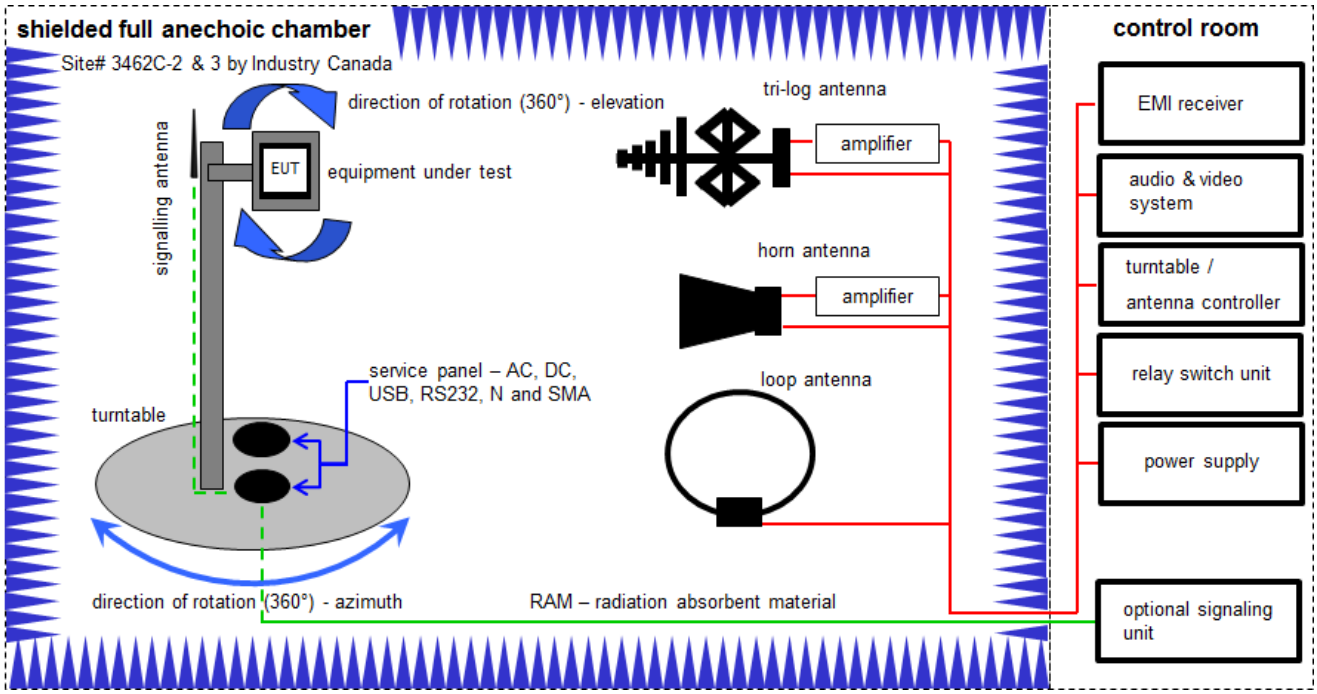
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
3	A	RF-Filter-section	85420E	HP	3427A00162	300002214	k	-/-	-/-
4	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	08.03.2016	08.03.2017
5	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
6	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
7	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
8	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	25.04.2016	25.04.2018

6.2 Shielded fully anechoic chamber



Measurement distance: tri-log antenna and horn antenna 3 meter; loop antenna 3 meter

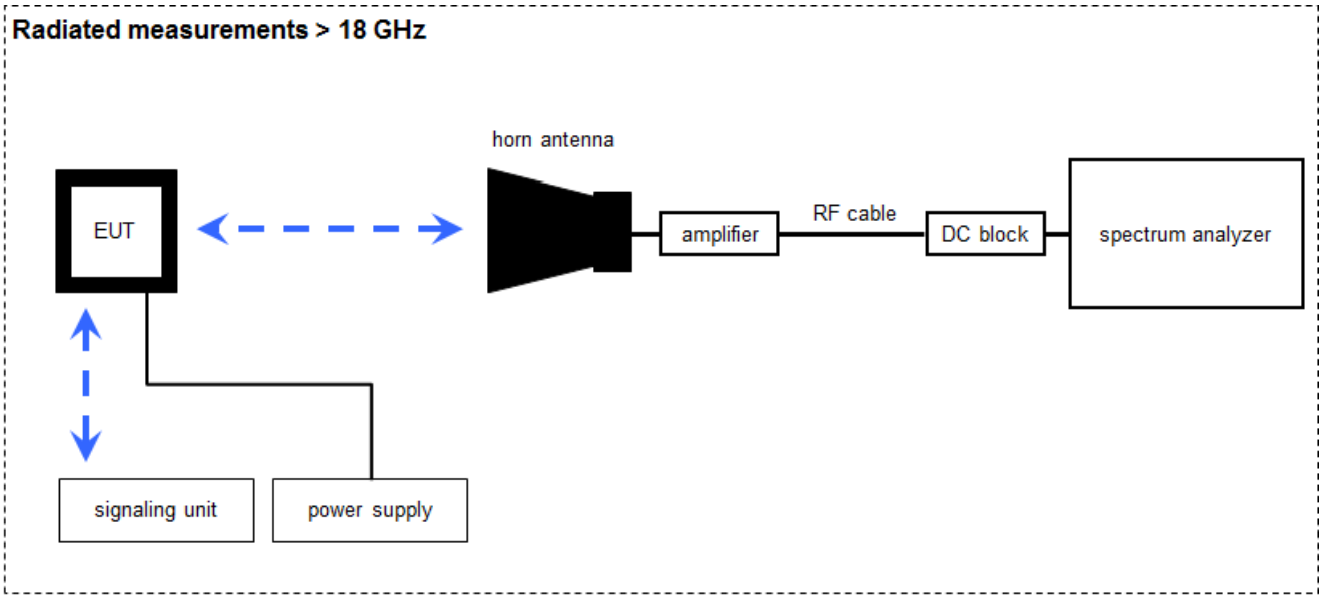
OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:
OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 µW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Horn Antenna 18,0-40,0 GHz	LHAF180	Microw.Devel	39180-103-022	300001748	k	22.05.2015	22.05.2018
2	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9709-5290	300000212	k	13.08.2015	13.08.2017
3	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	318	300003696	k	22.04.2014	22.04.2017
4	A, B	Universal Communication Tester	CMU200	R&S	106826	300003346	k	10.02.2016	10.02.2017
5	A, B	Wideband Radio Communication Tester	CMW500	R&S	102375	300004187	k	14.12.2015	14.12.2017
6	A, B	EMI Test Receiver 20Hz-26,5GHz	ESU26	R&S	100037	300003555	k	02.02.2016 13.01.2017	02.02.2017 30.01.2018
7	A	Band Reject Filter	WRCG1850/1910-1835/1925-40/8SS	Wainwright	23	400000149	ne	-/-	-/-
8	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne	-/-	-/-
9	A	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22050	300004482	ev	-/-	-/-
10	A, B	Power Supply 0-20V	6632A	HP	2851A01814	300000924	ne	-/-	-/-
11	A, B	Messrechner und Monitor	Intel Core i3 3220/3,3 GHz, Prozessor	CERNEX	2V2403033A5421	300004591	ne	-/-	-/-
12	A, B	NEXIO EMV-Software	BAT EMC	EMCO	2V2403033A5421	300004682	ne	-/-	-/-
13	B	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017

6.3 Radiated measurements > 18 GHz



Measurement distance: horn antenna 25 cm

OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

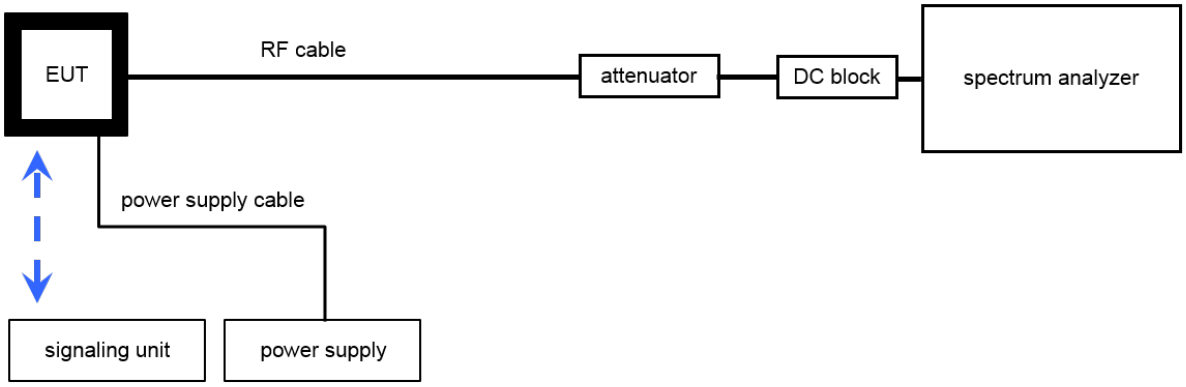
Example calculation:
OP [dBm] = -59.0 [dBm] + 44.0 [dB] - 20.0 [dBi] + 5.0 [dB] = -30 [dBm] (1 µW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A, B	RF-Cable	ST18/SMAm/SMAm/48	Huber & Suhner	Batch no. 600918	400001182	ev	-/-	-/-
2	A, B	RF-Cable	ST18/SMAm/SMm/48	Huber & Suhner	Batch no. 127377	400001183	ev	-/-	-/-
3	A, B	Horn Antenna 18,0-40,0 GHz	LHAF180	Microw.Devel	39180-103-022	300001748	k	22.05.2015	22.05.2018
4	A, B	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	14.08.2015	14.08.2017
5	A, B	Amplifier 2-40 GHz	JS32-02004000-57-5P	MITEQ	1777200	300004541	ev	-/-	-/-
6	A	Universal Communication Tester	CMU200	R&S	103992	300003231	vIKI!	29.01.2015	29.01.2017
								30.01.2017	29.01.2019
7	A, B	PC-WLAN Tester	Intel Core i3 3220/3,3 GHz, Prozessor	MITEQ	2V2403033A4523	300004589	ne	-/-	-/-
8	B	Wideband Radio Communication Tester	CMW500	R&S	102375	300004187	k	14.12.2015	14.12.2017

6.4 Conducted measurements

Conducted measurements normal conditions



OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

Example calculation:
OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A, B, C, D	Power Supply 0-20V, 0-5A	6632B	Agilent Technologies	GB42110541	400000562	vIKI!	26.01.2016	26.01.2019
2	A, C, D	PC-WLAN Tester	Intel Core i3 3220/3,3 GHz, Prozessor	MITEQ	2V2403033A4523	300004589	ne	-/-	-/-
3	A, B, C, D	RF-Cable	ST18/SMAm/SMAm/72	Huber & Suhner	Batch no. 699714	400001184	ev	-/-	-/-
4	A, B, C, D	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 699714	400001185	ev	-/-	-/-
5	A, B, C, D	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	21.01.2016 25.01.2017	21.01.2017 24.01.2018
6	A, B, C	Universal Communication Tester	CMU200	R&S	103992	300003231	vIKI!	29.01.2015 30.01.2017	29.01.2017 29.01.2019
7	C, D	Wideband Radio Communication Tester	CMW500	R&S	102375	300004187	k	14.12.2015	14.12.2017
8	B, D	Temperature Test Chamber	VT 4002	Heraeus Voetsch	521/83761	300002326	ev	03.09.2015	03.09.2017

7 Sequence of testing

7.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.5 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the premeasurement are maximized by the software by rotating the turntable from 0° to 360°. In case of the 2-axis positioner is used the elevation axis is also rotated from 0° to 360°.
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

7.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

7.3 Sequence of testing radiated spurious 1 GHz to 12 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

7.4 Sequence of testing radiated spurious above 12 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet.
- The measurement distance is as appropriate (e.g. 0.5 m).
- The EUT is set into operation.

Premeasurement

- The test antenna is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.

Final measurement

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

8 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
RF output power conducted	± 1 dB
RF output power radiated	± 3 dB
Frequency stability	± 20 Hz
Spurious emissions radiated below 30 MHz	± 3 dB
Spurious emissions radiated 30 MHz to 1 GHz	± 3 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB
Spurious emissions radiated above 12.75 GHz	± 4.5 dB
Spurious emissions conducted	± 3 dB
Block edge compliance	± 3 dB
Occupied bandwidth	± RBW

9 Summary of measurement results

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC identifier	Description	verdict	date	Remark
RF-Testing	CFR Part 22, 24, 27 RSS 132, 133, 139	See table!	2017-04-27	-/-

9.1 GSM 850

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	-/-
Frequency Stability	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☒	☐	☐	☐	-/-
Block Edge Compliance	Nominal	Nominal	☒	☐	☐	☐	-/-
Occupied Bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

9.2 PCS 1900

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	-/-
Frequency Stability	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☒	☐	☐	☐	-/-
Block Edge Compliance	Nominal	Nominal	☒	☐	☐	☐	-/-
Occupied Bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

9.3 UMTS band II

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	-/-
Frequency Stability	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☒	☐	☐	☐	-/-
Block Edge Compliance	Nominal	Nominal	☒	☐	☐	☐	-/-
Occupied Bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

9.4 UMTS band IV

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	-/-
Frequency Stability	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☒	☐	☐	☐	-/-
Block Edge Compliance	Nominal	Nominal	☒	☐	☐	☐	-/-
Occupied Bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

9.5 UMTS band V

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	-/-
Frequency Stability	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☒	☐	☐	☐	-/-
Block Edge Compliance	Nominal	Nominal	☒	☐	☐	☐	-/-
Occupied Bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

10 Results GSM 850

All GSM-band measurements are done in GSM mode only (circuit switched). All relevant tests have been repeated using 8-PSK modulation if EDGE mode is supported. All tests were performed with one timeslot in uplink activated and one timeslot in downlink activated. For each mode the highest output power was determined and used.

10.1 RF output power

Description:

This paragraph contains average power, peak output power, PAPR and ERP measurements for the mobile station.

The plots in this test report represents only an example of the measurements. All plots of this chapter are available on request.
The red line in the measurements indicates the ideal Gaussian distribution for the measured amplitude range.

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Sample
AQT:	See plot
Resolution bandwidth:	1 MHz
Used equipment:	See chapter 6.1 – A & 6.4 – A
Measurement uncertainty:	see chapter 8

Limits:

FCC	IC
+38.45 dBm In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

Results:

Output Power (conducted) GMSK mode			
Frequency (MHz)	**Peak Output Power (dBm)**	**Average Output Power (dBm)**	**Peak to Average Ratio (dB) CCDF**
824.2	27.5	27.3	0.13
836.4	27.4	26.5	0.98
848.8	27.4	27.2	0.14

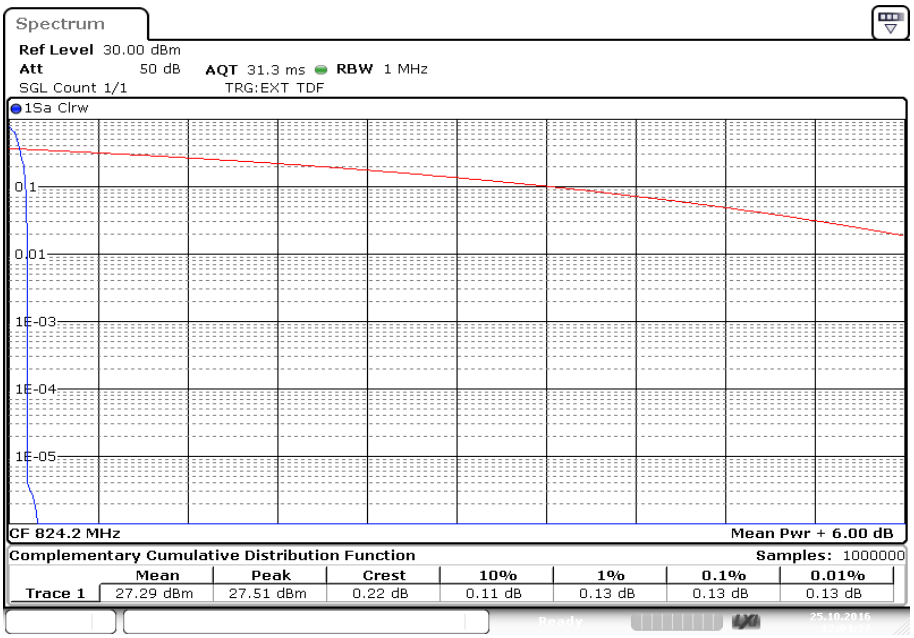
Output Power (conducted) 8-PSK mode			
Frequency (MHz)	**Peak Output Power (dBm)**	**Average Output Power (dBm)**	**Peak to Average Ratio (dB) CCDF**
824.2	24.4	21.3	3.05
836.4	27.4	21.8	5.57
848.8	27.4	21.8	5.57

Output Power (radiated) GMSK mode	
Frequency (MHz)	**Average Output Power (dBm) - ERP**
824.2	26.7
836.4	25.8
848.8	25.5

Output Power (radiated) 8-PSK mode	
Frequency (MHz)	**Average Output Power (dBm) - ERP**
824.2	20.7
836.4	21.1
848.8	20.1

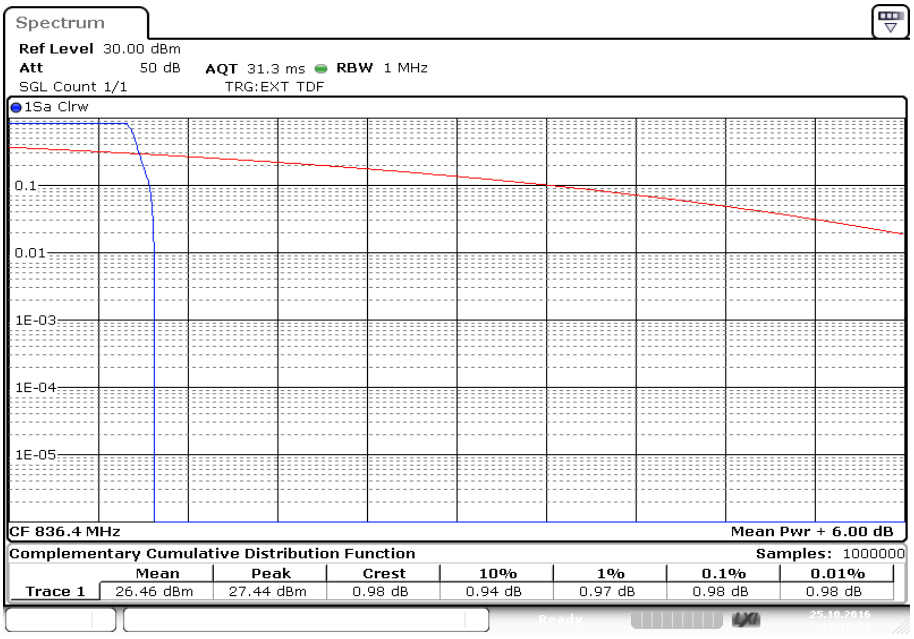
Plots: GMSK

Plot 1: CCDF, channel 128



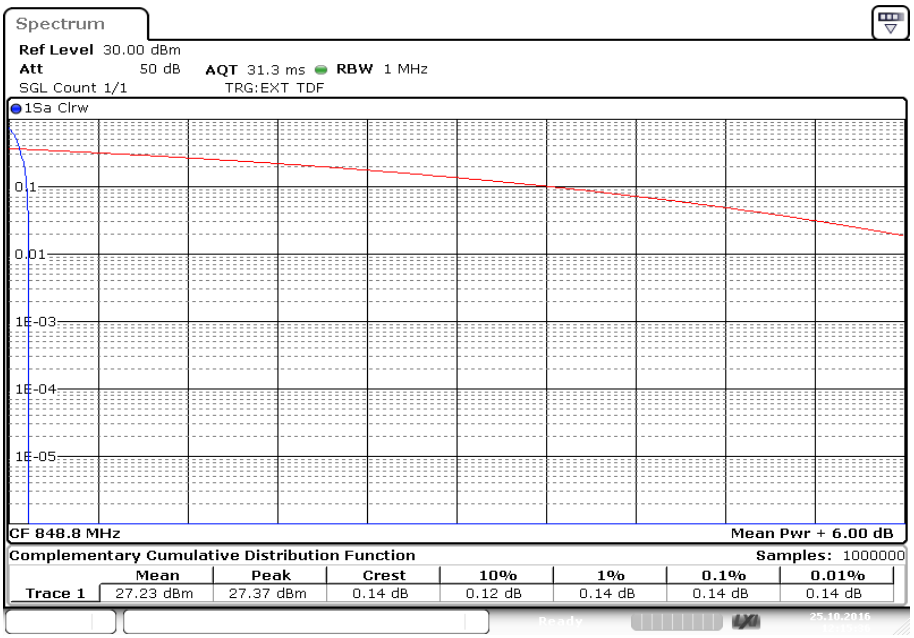
Date: 25.OCT.2016 12:04:37

Plot 2: CCDF, channel 189



Date: 25.OCT.2016 12:10:23

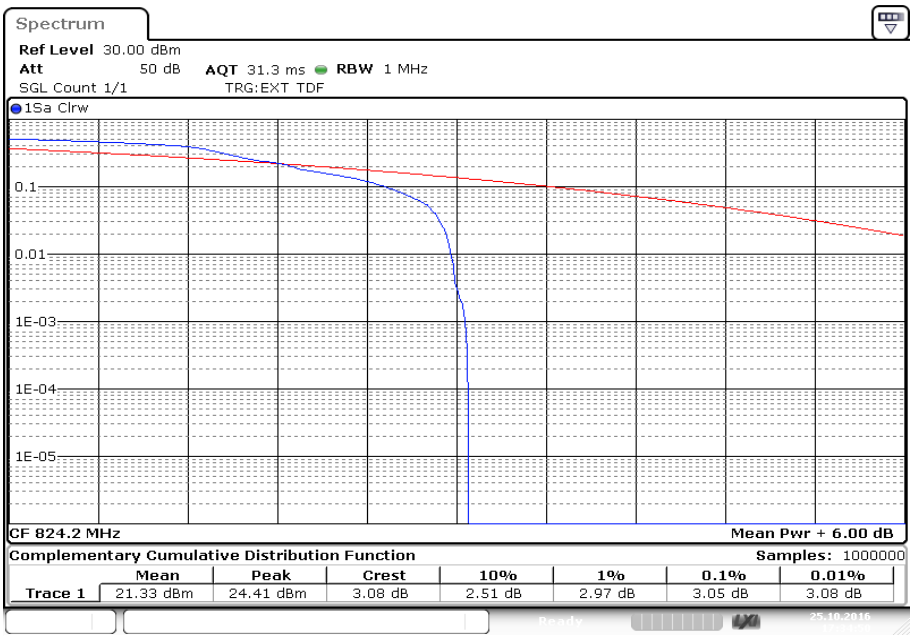
Plot 3: CCDF, channel 251



Date: 25.OCT.2016 12:15:36

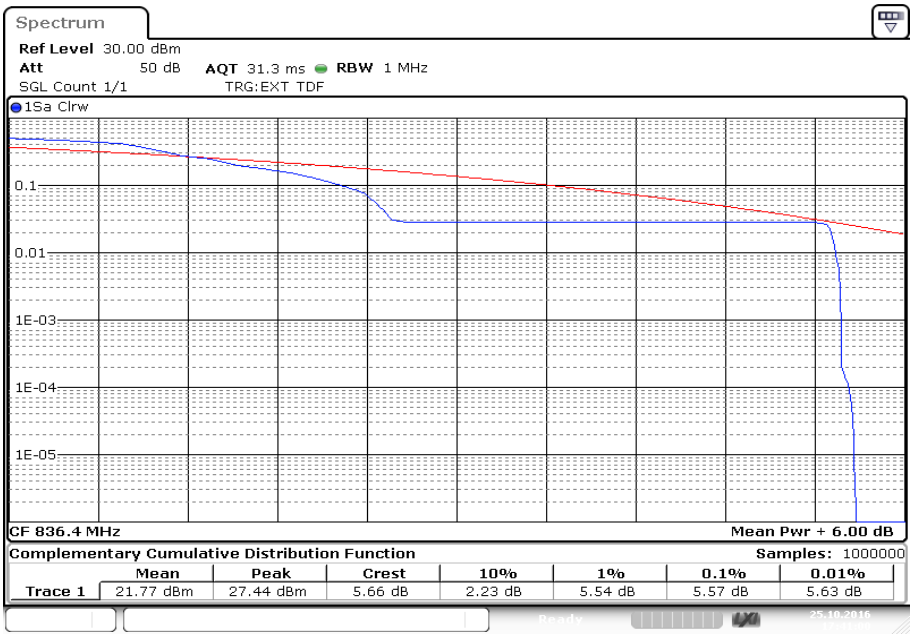
Plots: 8 PSK

Plot 1: CCDF, channel 128



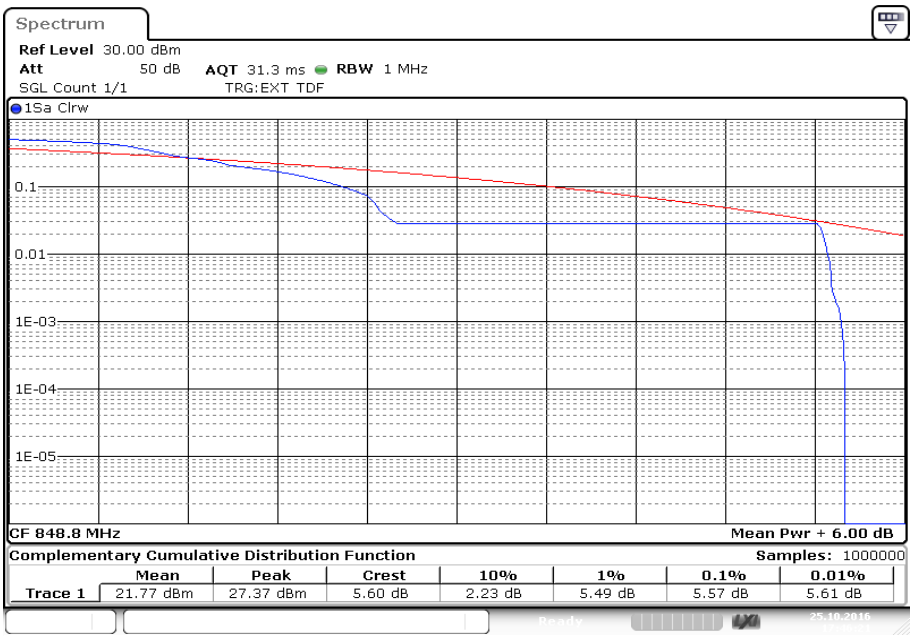
Date: 25.OCT.2016 17:34:50

Plot 2: CCDF, channel 189



Date: 25.OCT.2016 17:41:00

Plot 3: CCDF, channel 251



Date: 25.OCT.2016 17:46:21

10.2 Frequency stability

Description:

In order to measure the carrier frequency under normal conditions it is necessary to make measurements with the mobile station connected to R&S CMU200 Wideband Radio Communication Tester.

1. Measure the carrier frequency at room temperature.
2. Subject the mobile station to overnight soak at -30 C.
3. With the mobile station powered with V_{nom} connected to the CMU200 on the center channel. Measure the carrier frequency. These measurements should be made within two minutes of powering up the mobile station to prevent significant self warming.
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 15 minutes at each temperature unpowered before making measurements.
5. Remeasure carrier frequency at room temperature with V_{nom}. Vary supply voltage to V_{min} and measure the carrier frequency then setup V_{max} and repeat the measurement.
6. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

Measurement:

Measurement parameters	
Detector:	Measured with CMU200
Sweep time:	
Video bandwidth:	
Resolution bandwidth:	
Span:	
Trace mode:	
Test setup:	See chapter 6.4 – B
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
± 2.5 ppm	

Results:

AFC FREQ ERROR versus VOLTAGE

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
9	7	0.00000084	0.0084
24	-7	-0.00000084	-0.0084
32	6	0.00000072	0.0072

AFC FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	9	0.00000108	0.0108
-20	-14	-0.00000167	-0.0167
-10	9	0.00000108	0.0108
± 0	18	0.00000215	0.0215
10	-7	-0.00000084	-0.0084
20	2	0.00000024	0.0024
30	9	0.00000108	0.0108
40	-11	-0.00000132	-0.0132
50	8	0.00000096	0.0096
55	6	0.00000072	0.0072

10.3 Spurious emissions radiated

Description:

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2014 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 848.8 MHz. Measurements made up to 9 GHz. The resolution bandwidth is set as outlined in Part 22.917. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the GSM-850 band.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 s
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	100 MHz Steps
Trace mode:	Max Hold
Used equipment:	See chapter 6.1 – A & 6.2 – B
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results GPRS & EGPRS:

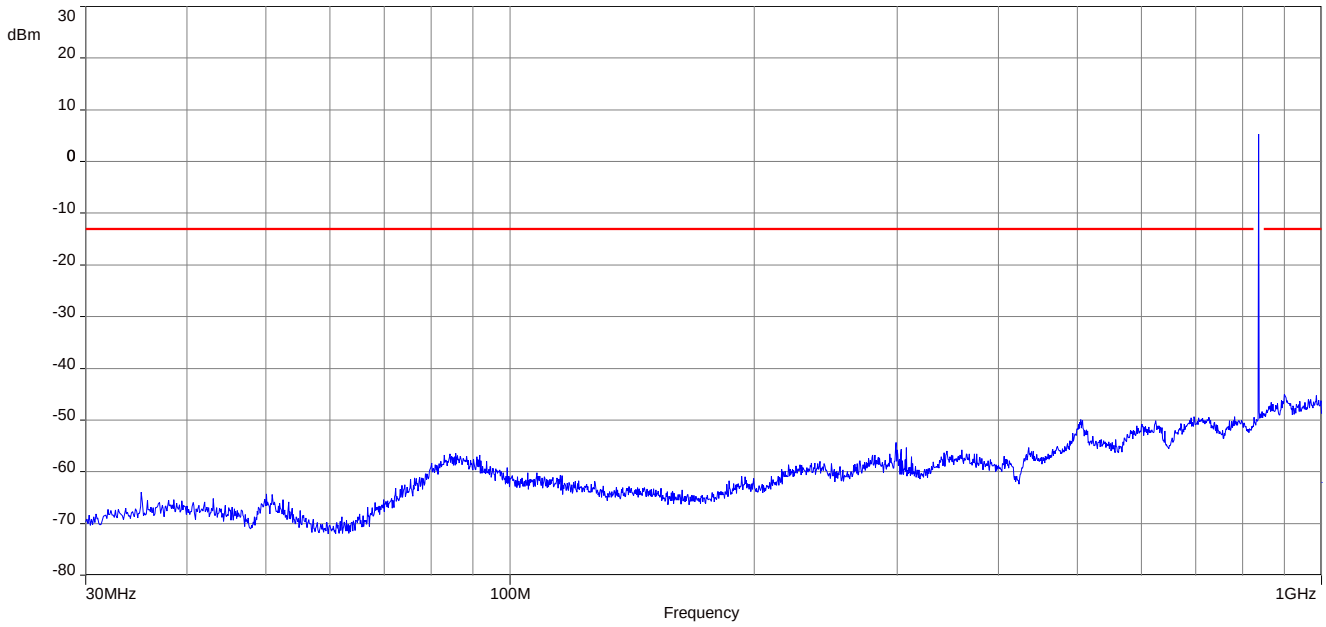
Radiated emissions measurements were made only at the center carrier frequency of the GSM-850 band (836.4 MHz). The measurements shows the cabinet radiation in transmit mode.

Results: valid for both plastic and meatal housing

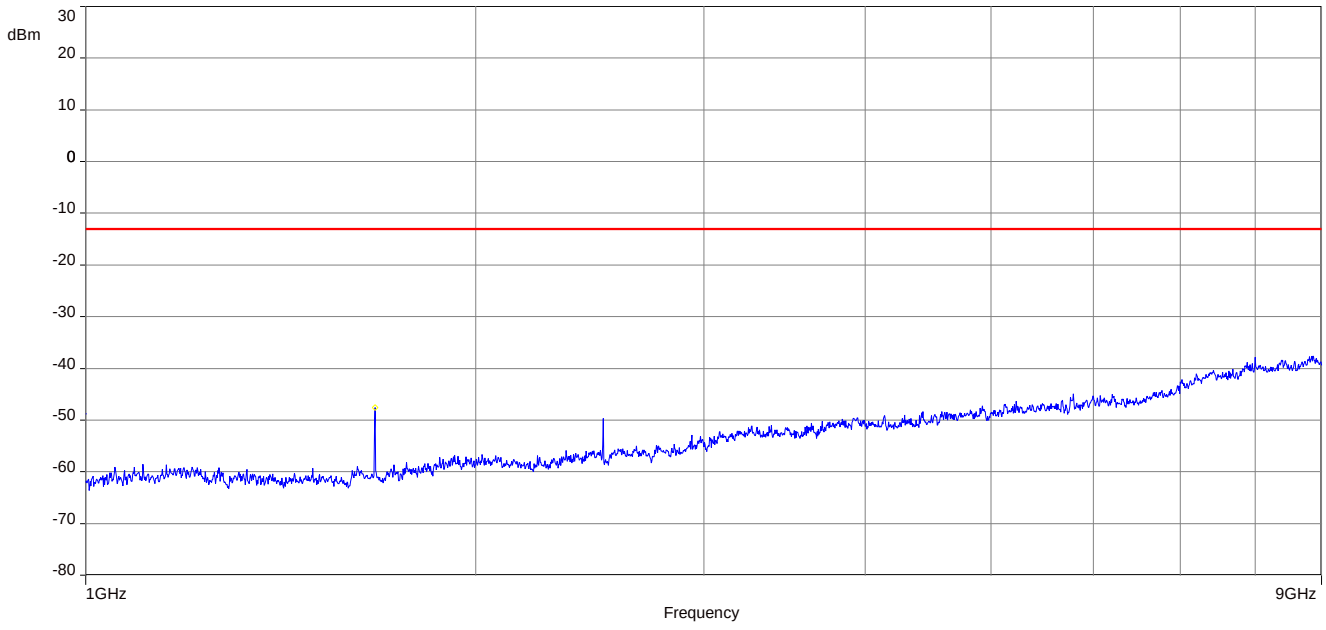
Spurious emission level (dBm)								
Harmonic	Ch. 128 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 189 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 251 Freq. (MHz)	Level [dBm]
2	1648.4	> 20 dB below limit.	2	1672.8	> 20 dB below limit.	2	1697.6	> 20 dB below limit.
3	2472.6	> 20 dB below limit.	3	2509.2	> 20 dB below limit.	3	2546.4	> 20 dB below limit.
4	3296.8	-	4	3345.6	-	4	3395.2	-
5	4121.0	-	5	4182.0	-	5	4244.0	-
6	4945.2	-	6	5018.4	-	6	5092.8	-
7	5769.4	-	7	5854.8	-	7	5941.6	-
8	6593.6	-	8	6691.2	-	8	6790.4	-
9	7417.8	-	9	7527.6	-	9	7639.2	-
10	8242.0	-	10	8364.0	-	10	8488.0	-

Plots: Plastic housing

Plot 1: Channel 189 (30 MHz – 1 GHz)

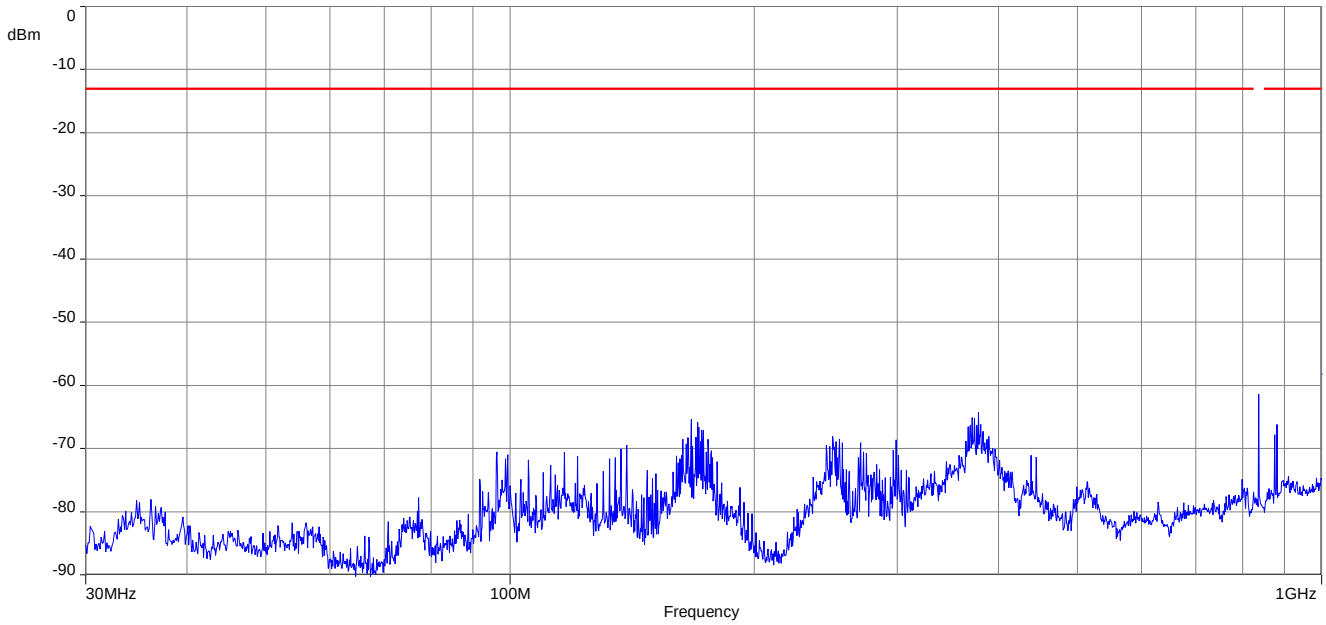


Plot 2: Channel 189 (1 GHz – 9 GHz)



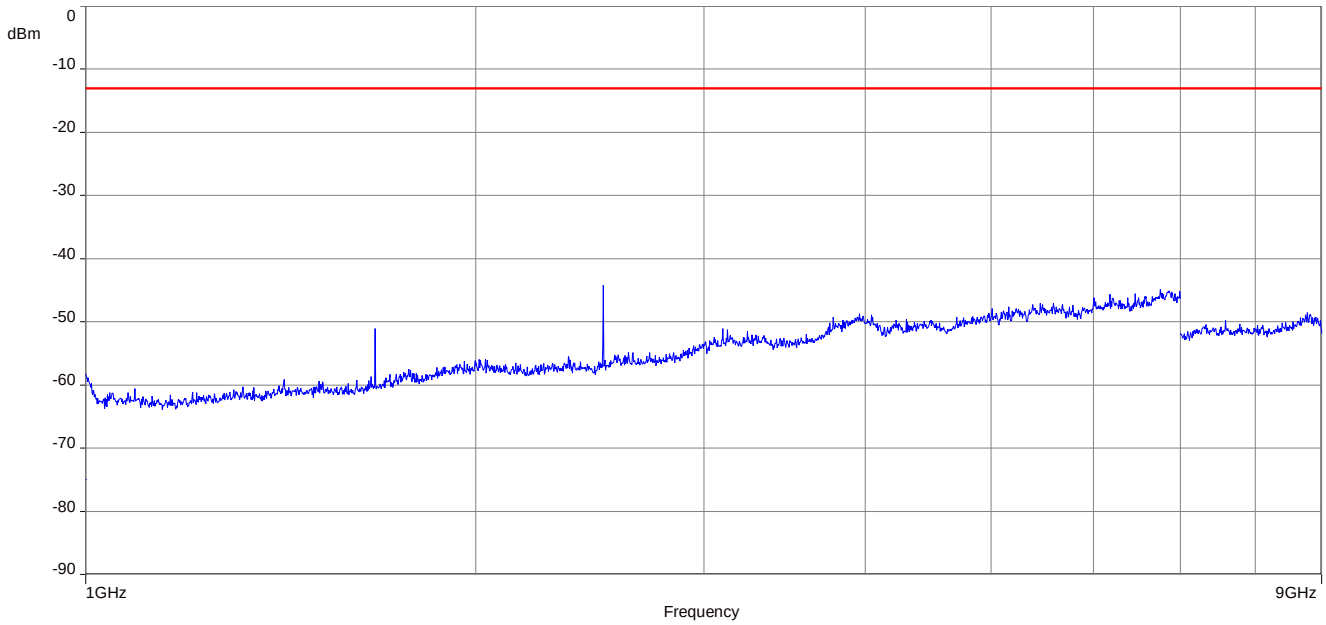
Plots: GMSK – metal housing

Plot 1: Channel 189 (30 MHz – 1 GHz)



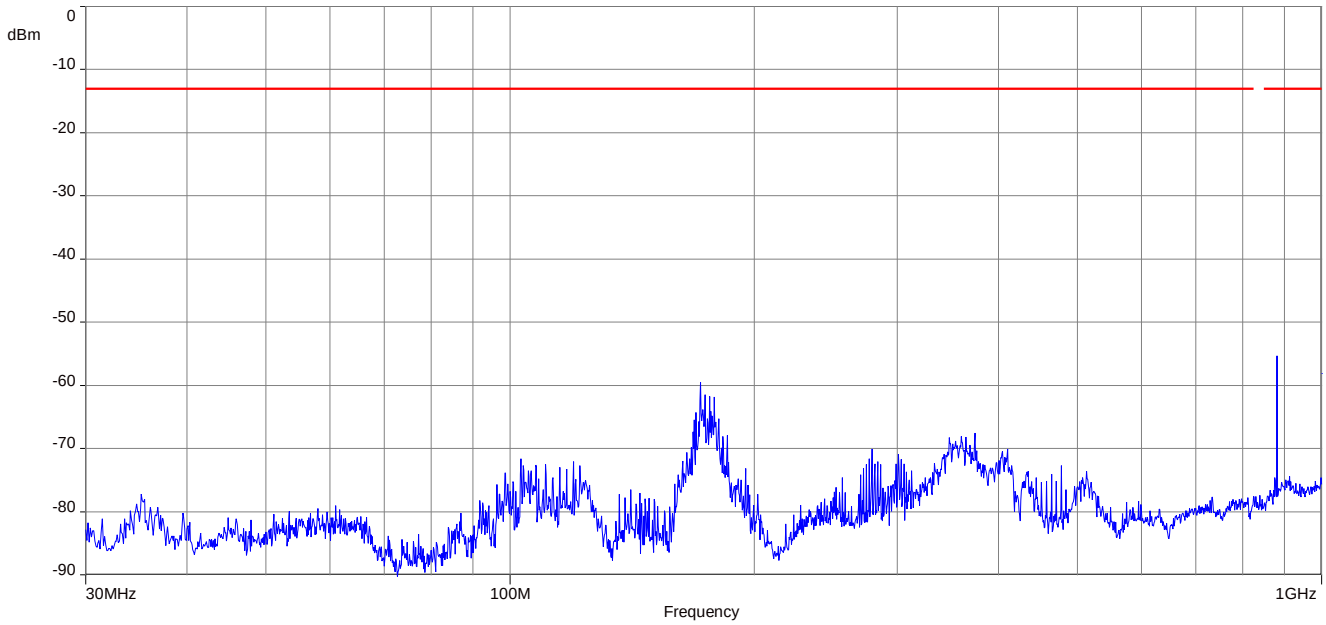
The carrier signal is notched with a band rejection filter.

Plot 2: Channel 189 (1 GHz – 9 GHz)



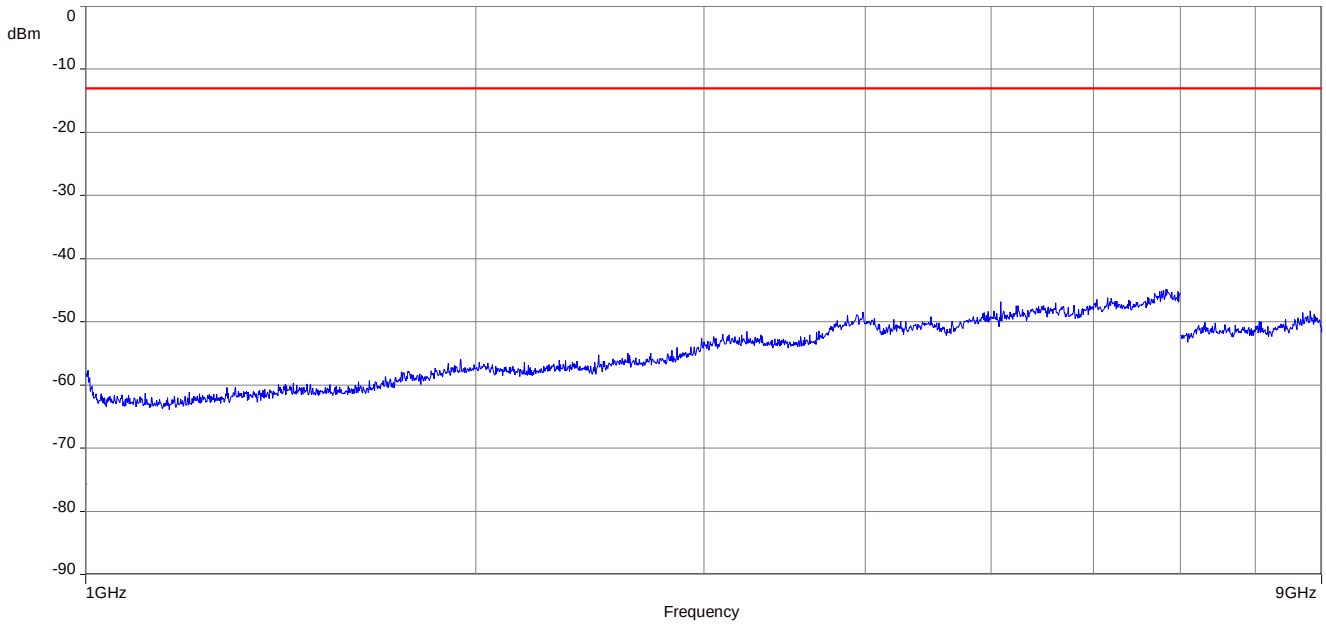
Plots: 8 PSK

Plot 1: Channel 189 (30 MHz – 1 GHz)



The carrier signal is notched with a band rejection filter.

Plot 2: Channel 189 (1 GHz – 9 GHz)



10.4 Spurious emissions conducted

Description:

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 9 GHz.
2. Determine mobile station transmits frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

GSM-850 Transmitter Channel Frequency
128 824.2 MHz
189 836.4 MHz
251 848.8 MHz

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	10 MHz – 9 GHz
Trace mode:	Max Hold
Used equipment:	See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Limits:

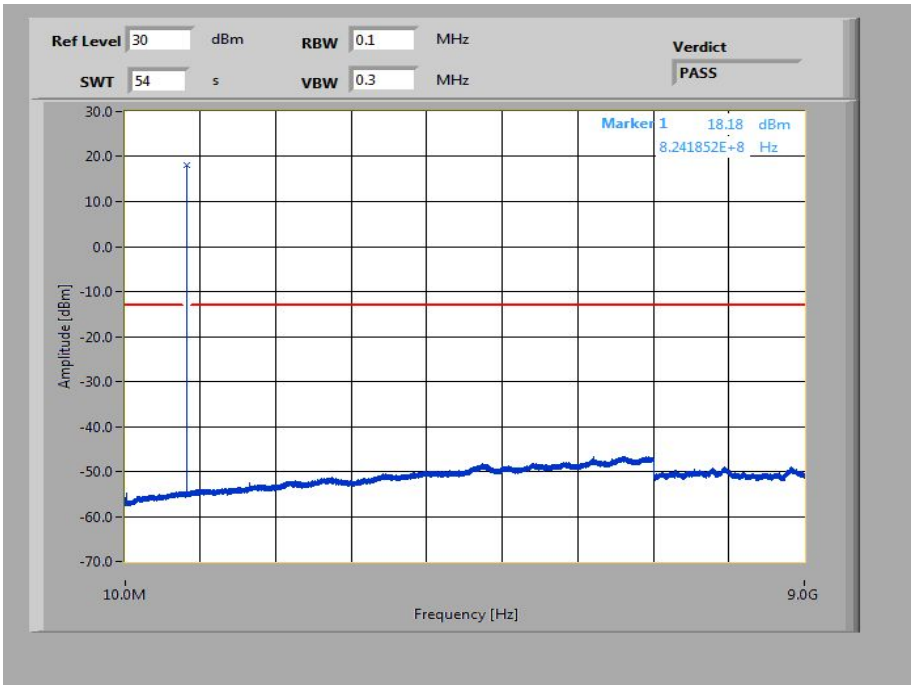
FCC	IC
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results:

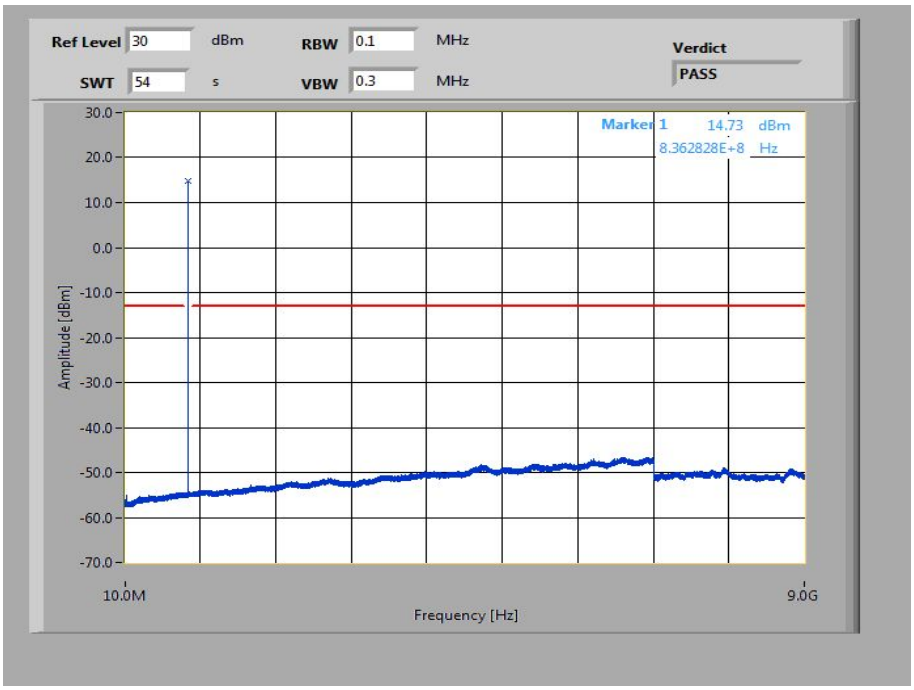
Spurious emission level (dBm)								
Harmonic	Ch. 128 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 189 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 251 Freq. (MHz)	Level [dBm]
2	1648.4	-	2	1672.8	-	2	1697.6	-
3	2472.6	-	3	2509.2	-	3	2546.4	-
4	3296.8	-	4	3345.6	-	4	3395.2	-
5	4121.0	-	5	4182.0	-	5	4244.0	-
6	4945.2	-	6	5018.4	-	6	5092.8	-
7	5769.4	-	7	5854.8	-	7	5941.6	-
8	6593.6	-	8	6691.2	-	8	6790.4	-
9	7417.8	-	9	7527.6	-	9	7639.2	-
10	8242.0	-	10	8364.0	-	10	8488.0	-

Plots: GMSK

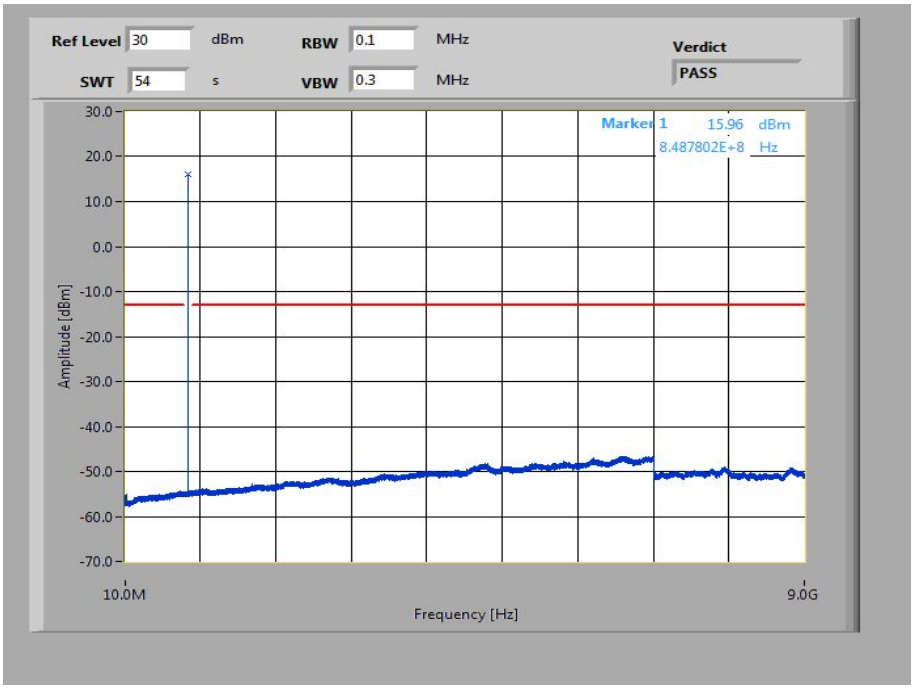
Plot 1: Channel 128 (10 MHz - 9 GHz)



Plot 2: Channel 189 (10 MHz - 9 GHz)

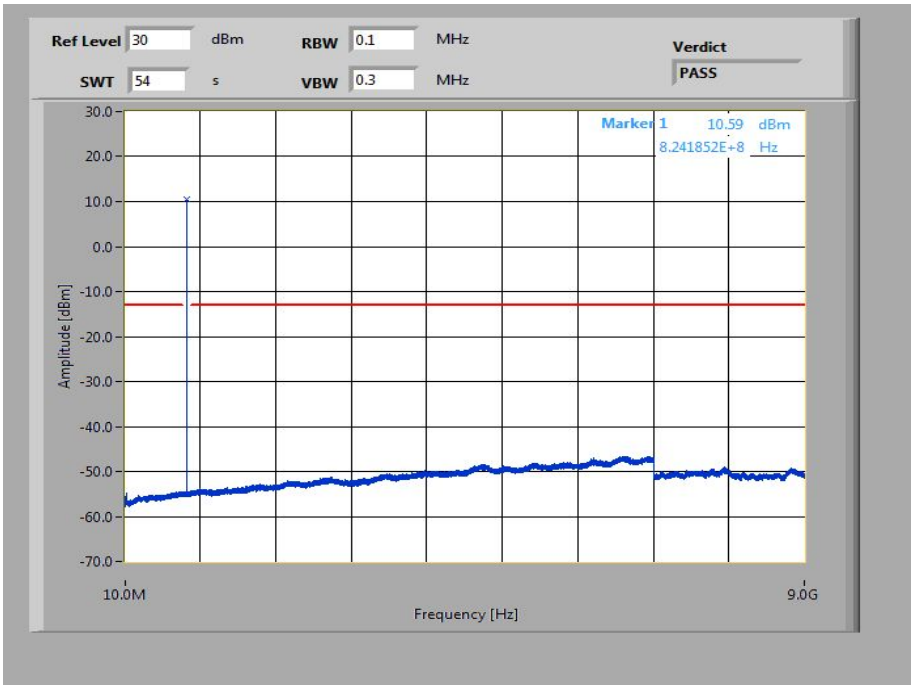


Plot 3: Channel 251 (10 MHz - 9 GHz)

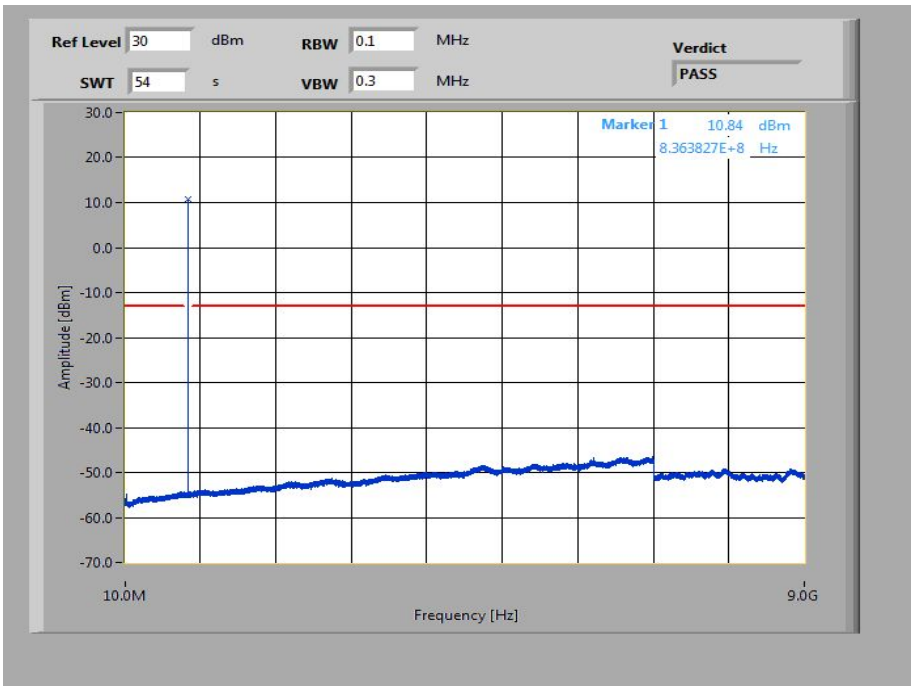


Plots: 8 PSK

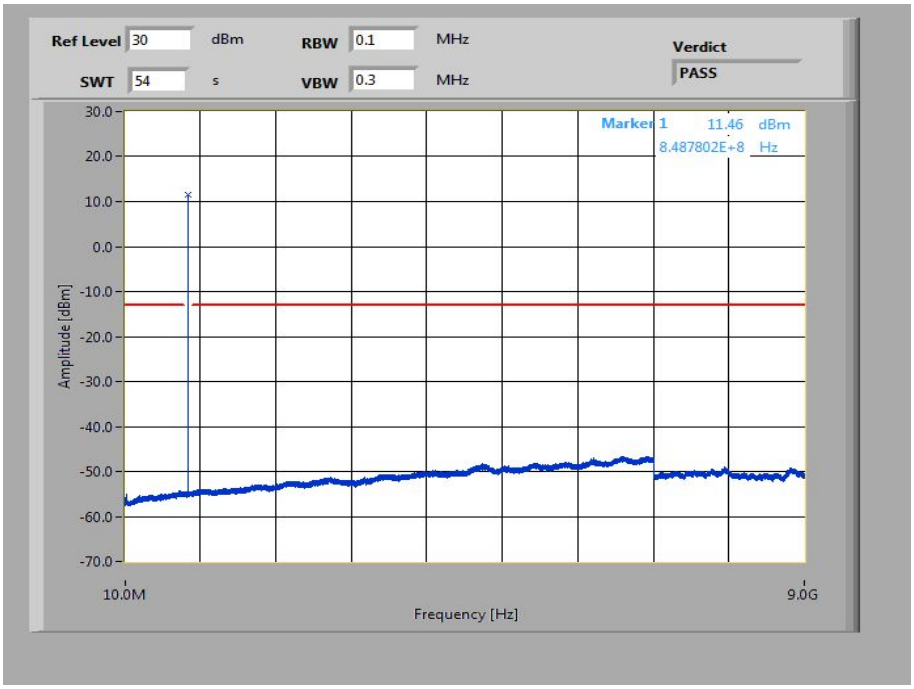
Plot 1: Channel 128 (10 MHz - 9 GHz)



Plot 2: Channel 189 (10 MHz – 9 GHz)



Plot 3: Channel 251 (10 MHz - 9 GHz)



10.5 Block edge compliance

Description:

The spectrum at the band edges must comply with the spurious emissions limits.

Measurement:

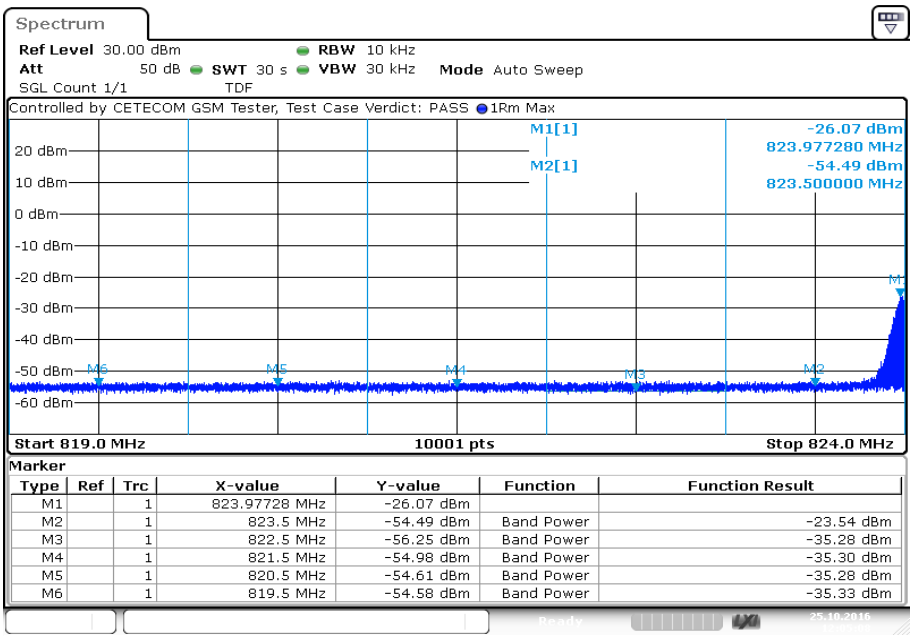
Measurement parameters	
Detector:	RMS
Sweep time:	30 sec.
Video bandwidth:	1% - 5% of the OBW
Resolution bandwidth:	≥ 3xRBW
Span:	5 MHz
Trace mode:	Max Hold
Used equipment:	See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Plots: GMSK

Plot 1: Channel 128

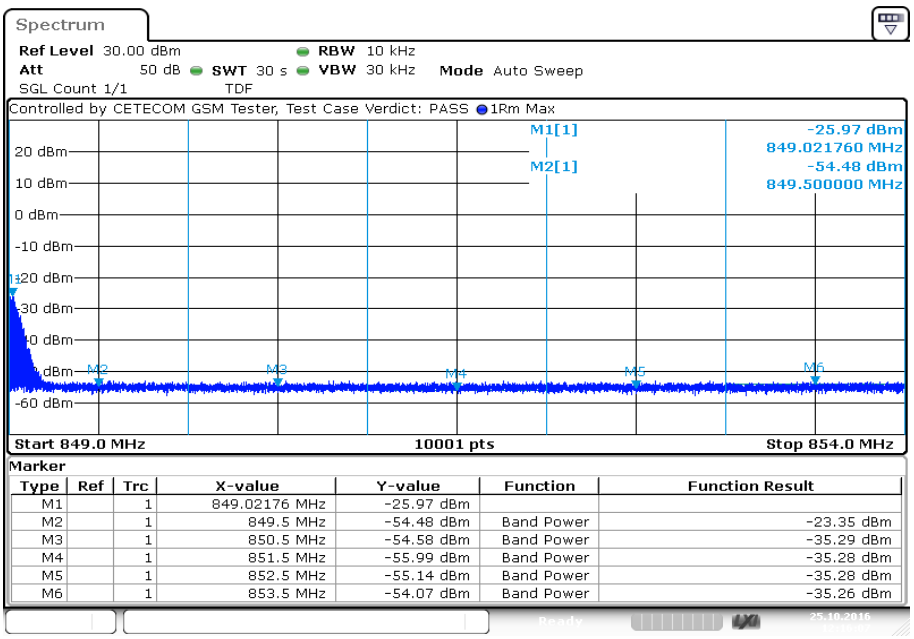


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	823.97728 MHz	-26.07 dBm		
M2		1	823.5 MHz	-54.49 dBm	Band Power	-23.54 dBm
M3		1	822.5 MHz	-56.25 dBm	Band Power	-35.28 dBm
M4		1	821.5 MHz	-54.98 dBm	Band Power	-35.30 dBm
M5		1	820.5 MHz	-54.61 dBm	Band Power	-35.28 dBm
M6		1	819.5 MHz	-54.58 dBm	Band Power	-35.33 dBm

Date: 25.OCT.2016 12:05:09

Plot 2: Channel 251



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	849.02176 MHz	-25.97 dBm		
M2		1	849.5 MHz	-54.48 dBm	Band Power	-23.35 dBm
M3		1	850.5 MHz	-54.58 dBm	Band Power	-35.29 dBm
M4		1	851.5 MHz	-55.99 dBm	Band Power	-35.28 dBm
M5		1	852.5 MHz	-55.14 dBm	Band Power	-35.28 dBm
M6		1	853.5 MHz	-54.07 dBm	Band Power	-35.26 dBm

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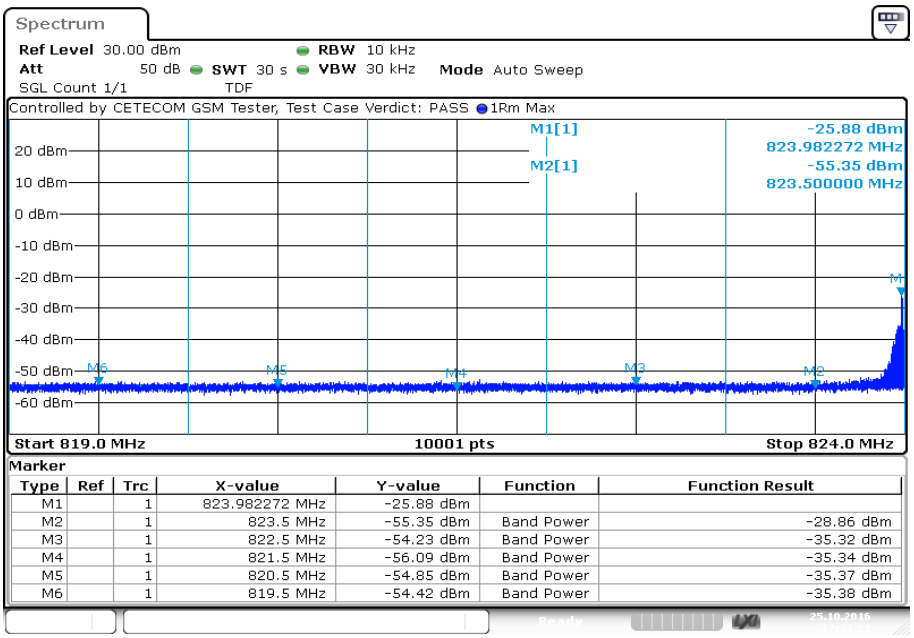
Plots: 8 PSK

Plot 1: Channel 128



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	823.982272 MHz	-25.88 dBm		
M2		1	823.5 MHz	-55.35 dBm	Band Power	-28.86 dBm
M3		1	822.5 MHz	-54.23 dBm	Band Power	-35.32 dBm
M4		1	821.5 MHz	-56.09 dBm	Band Power	-35.34 dBm
M5		1	820.5 MHz	-54.85 dBm	Band Power	-35.37 dBm
M6		1	819.5 MHz	-54.42 dBm	Band Power	-35.38 dBm

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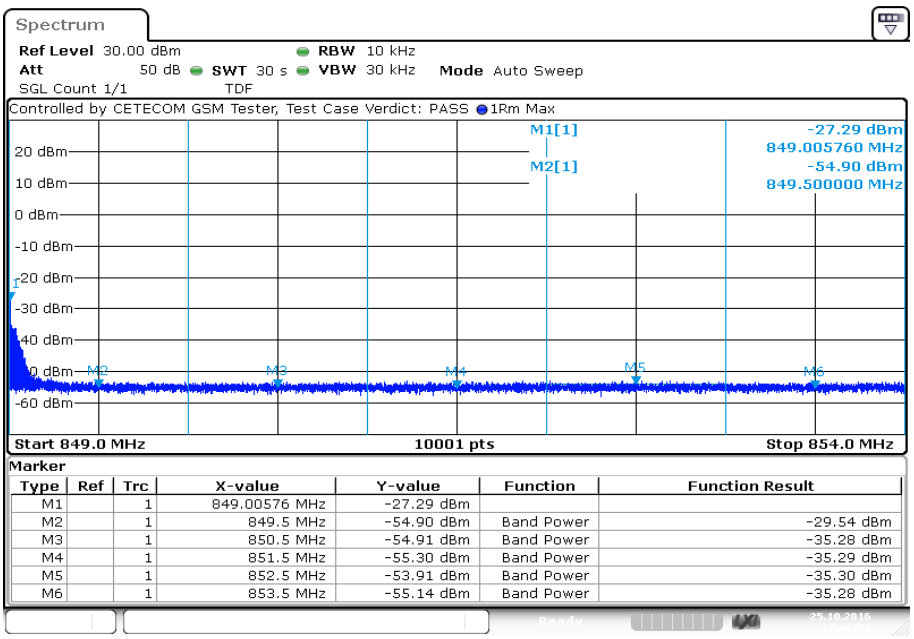
Plot 2: Channel 251



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	849.00576 MHz	-27.29 dBm		
M2		1	849.5 MHz	-54.90 dBm	Band Power	-29.54 dBm
M3		1	850.5 MHz	-54.91 dBm	Band Power	-35.28 dBm
M4		1	851.5 MHz	-55.30 dBm	Band Power	-35.29 dBm
M5		1	852.5 MHz	-53.91 dBm	Band Power	-35.30 dBm
M6		1	853.5 MHz	-55.14 dBm	Band Power	-35.28 dBm

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10.6 Occupied bandwidth

Description:

Measurement of the occupied bandwidth of the transmitted signal.

Measurement:

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the GSM-850 frequency band. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1% - 5% of the OBW
Video bandwidth:	≥ 3xRBW
Span:	2 x nominal BW
Trace mode:	Max Hold
Used equipment:	See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
Spectrum must fall completely in the specified band	

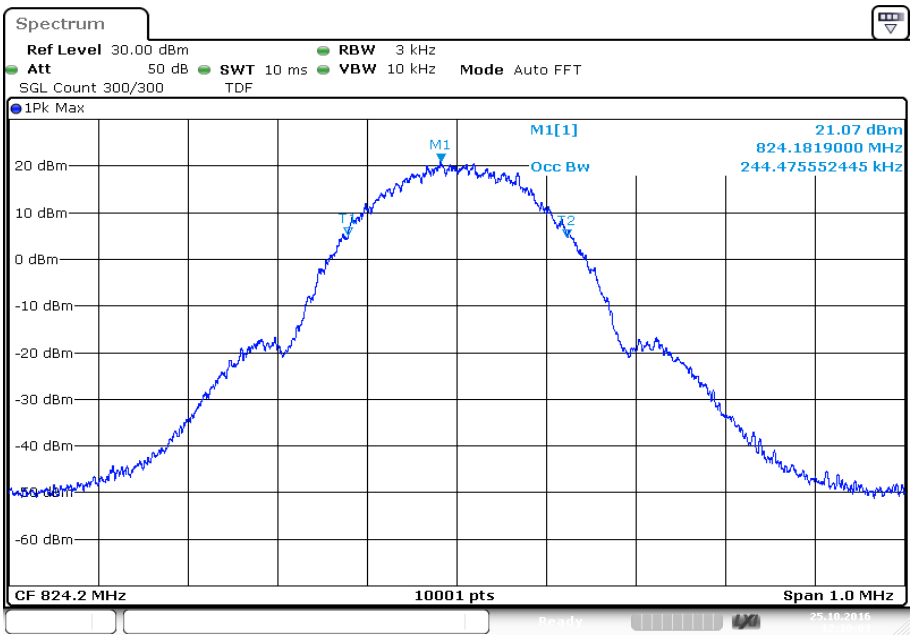
Results:

Occupied bandwidth - GMSK mode		
Frequency (MHz)	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
824.2	244	314
836.4	244	315
848.8	242	316

Occupied bandwidth – 8 PSK mode		
Frequency (MHz)	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
824.2	240	309
836.4	239	307
848.8	238	309

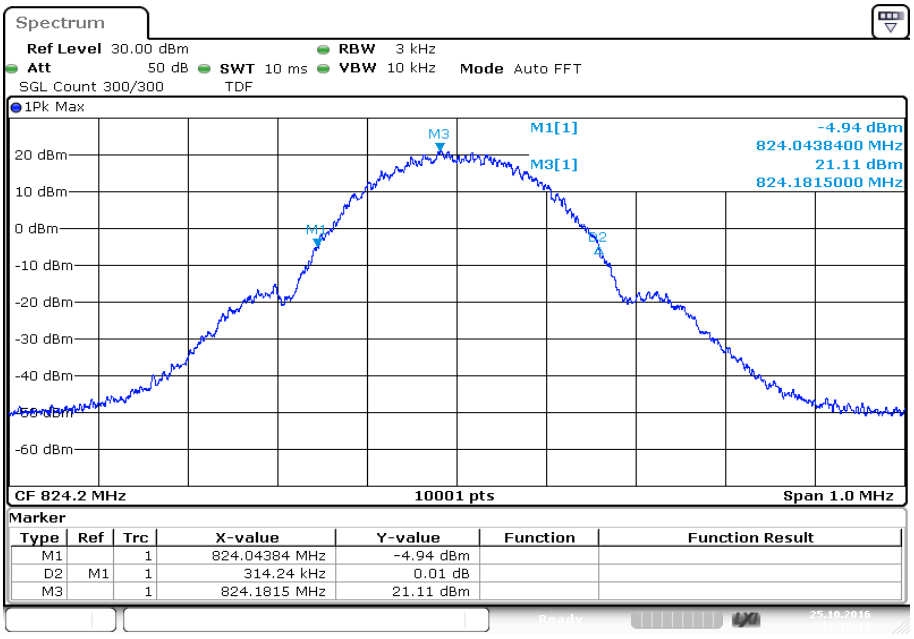
Plots: GMSK

Plot 1: Channel 128 (99% bandwidth)



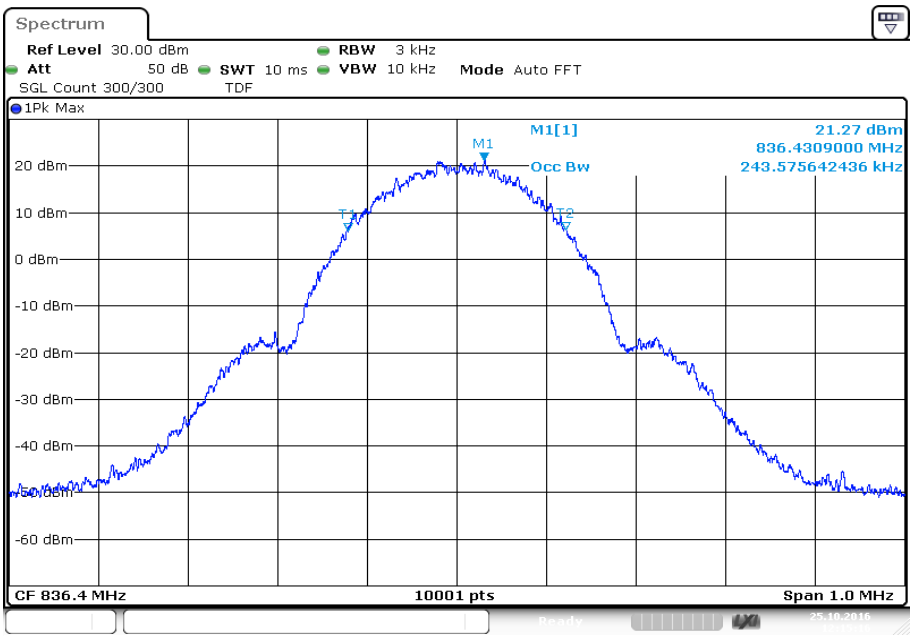
Date: 25.OCT.2016 12:10:04

Plot 2: Channel 128 (-26 dBc bandwidth)



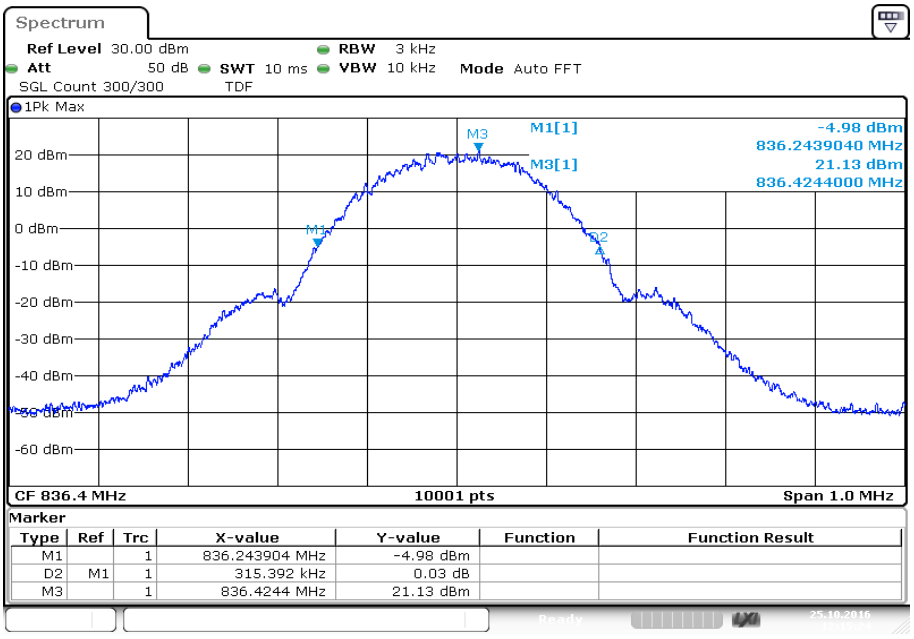
Date: 25.OCT.2016 12:10:11

Plot 3: Channel 189 (99% bandwidth)



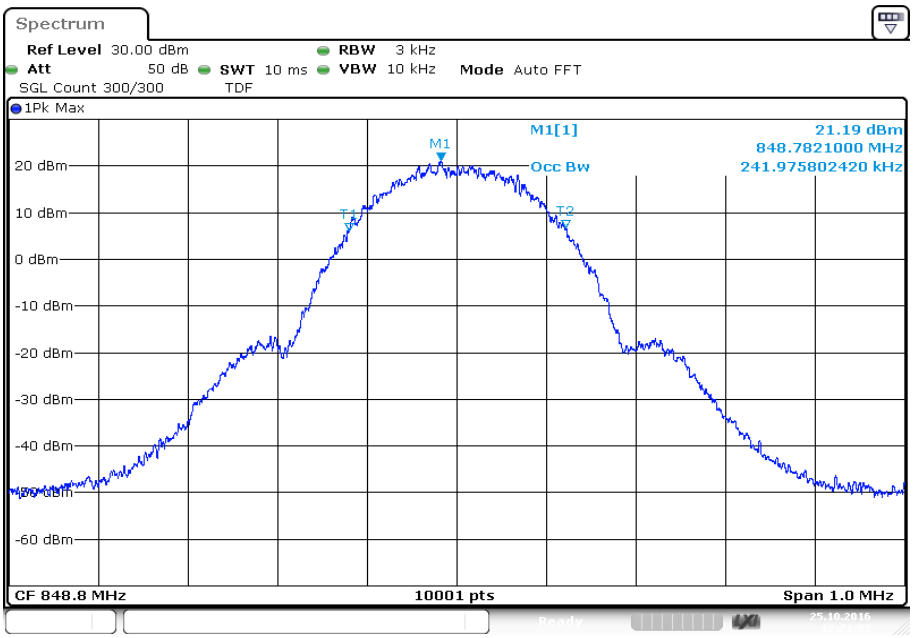
Date: 25.OCT.2016 12:15:17

Plot 4: Channel 189 (-26 dBc bandwidth)



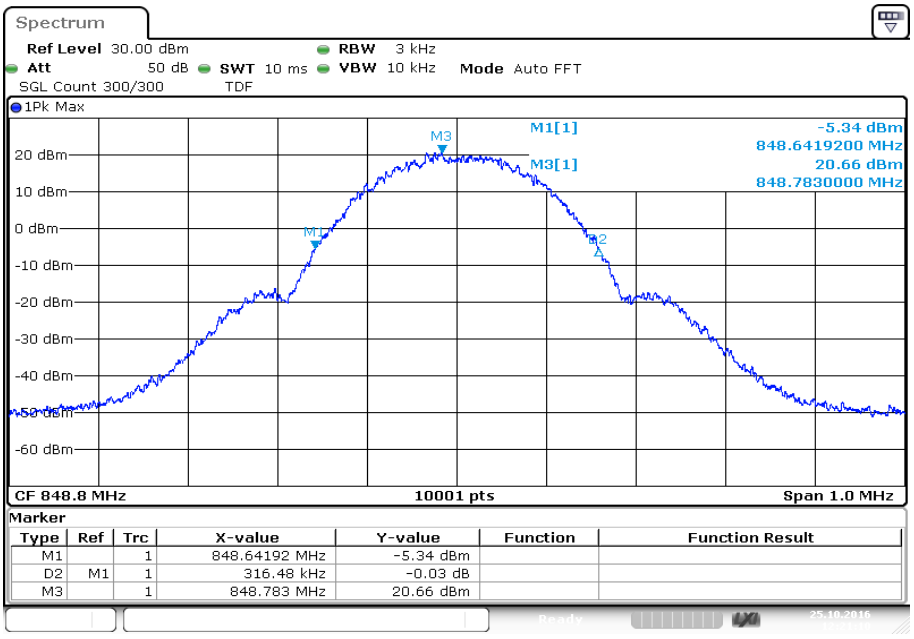
Date: 25.OCT.2016 12:15:24

Plot 5: Channel 251 (99% bandwidth)



Date: 25.OCT.2016 12:21:02

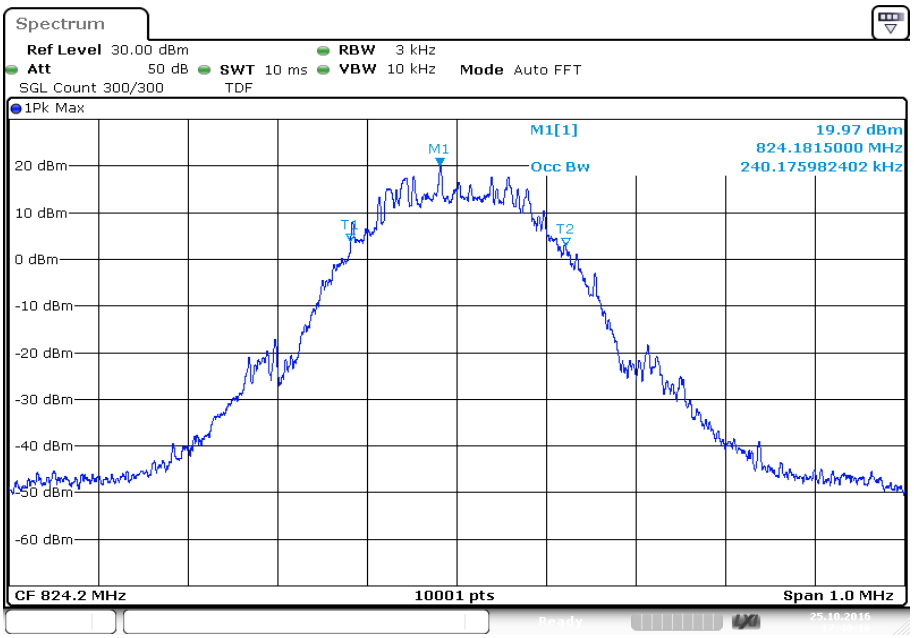
Plot 6: Channel 251 (-26 dBc bandwidth)



Date: 25.OCT.2016 12:21:10

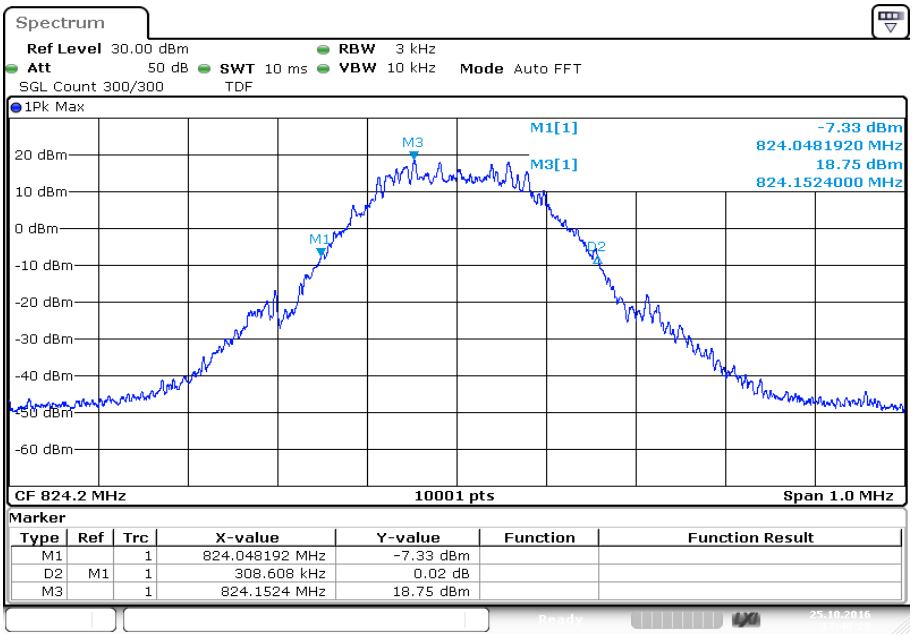
Plots: 8 PSK

Plot 1: Channel 128 (99% bandwidth)



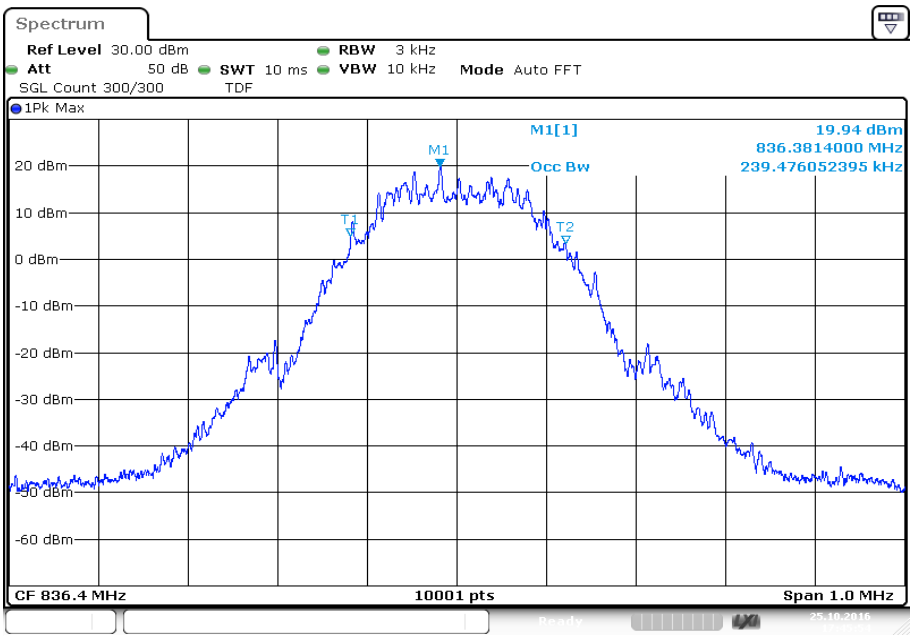
Date: 25.OCT.2016 17:40:16

Plot 2: Channel 128 (-26 dBc bandwidth)



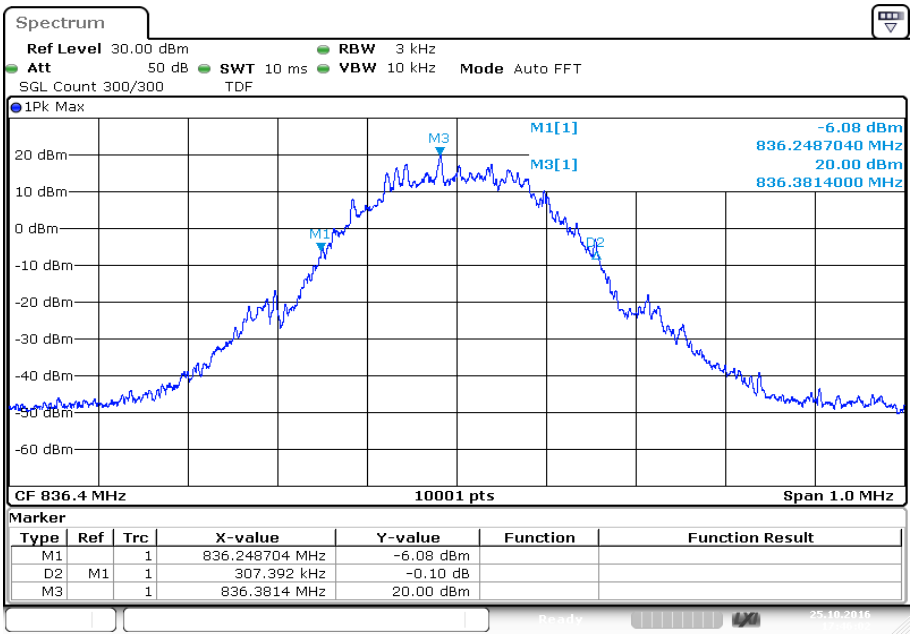
Date: 25.OCT.2016 17:40:23

Plot 3: Channel 189 (99% bandwidth)



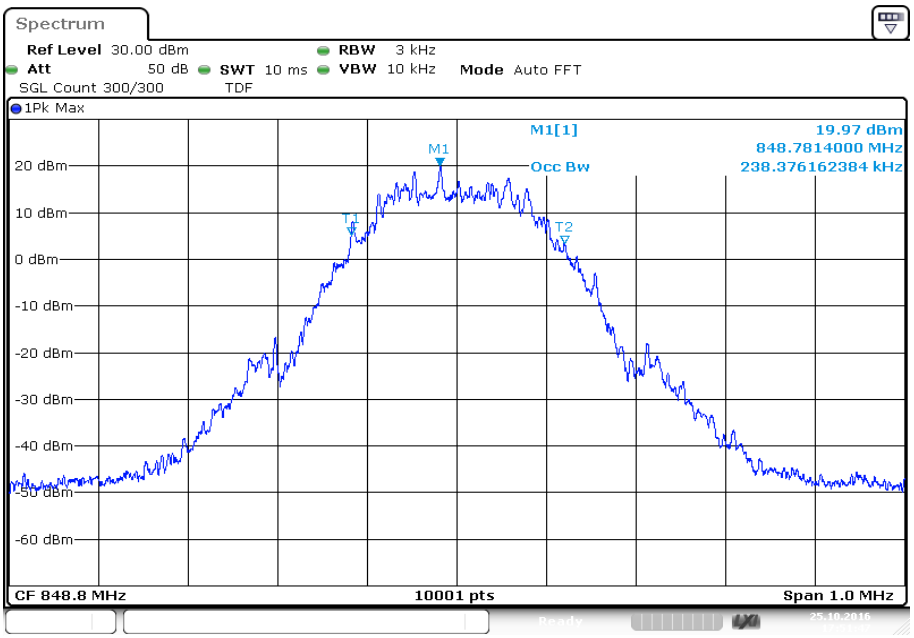
Date: 25.OCT.2016 17:45:54

Plot 4: Channel 189 (-26 dBc bandwidth)



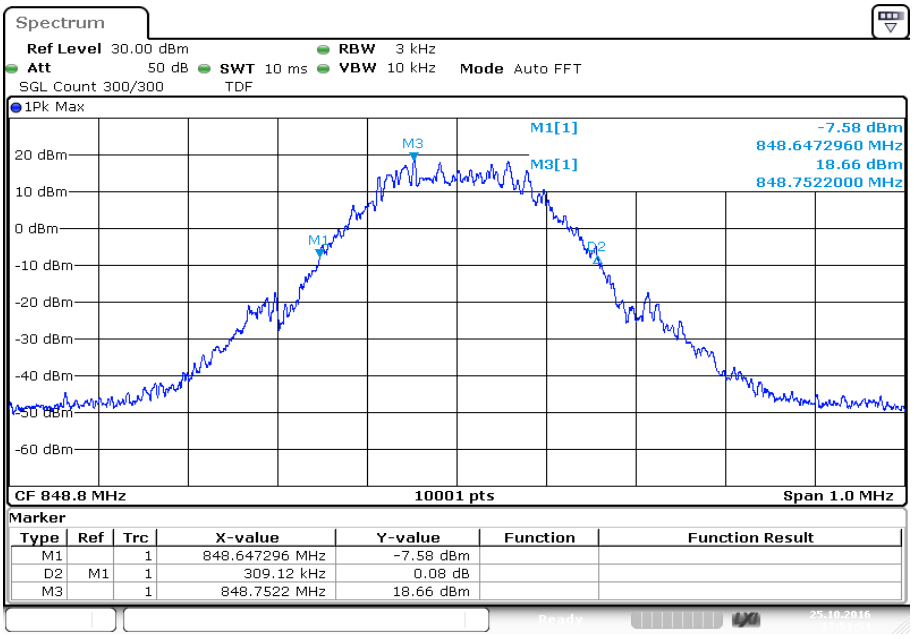
Date: 25.OCT.2016 17:46:02

Plot 5: Channel 251 (99% bandwidth)



Date: 25.OCT.2016 17:51:47

Plot 6: Channel 251 (-26 dBc bandwidth)



Date: 25.OCT.2016 17:51:54

11 Results PCS 1900

All GSM-band measurements are done in GSM mode only (circuit switched). All relevant tests have been repeated using 8-PSK modulation if EDGE mode is supported. All tests were performed with one timeslot in uplink activated and one timeslot in downlink activated. For each mode the highest output power was determined and used.

11.1 RF output power

Description:

This paragraph contains average power, peak output power, PAPR and ERP measurements for the mobile station.

The plots in this test report represents only an example of the measurements. All plots of this chapter are available on request.
The red line in the measurements indicates the ideal Gaussian distribution for the measured amplitude range.

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Sample
AQT:	See plot
Resolution bandwidth:	1 MHz
Used equipment:	See chapter 6.2 – A & 6.4 – A
Measurement uncertainty:	see chapter 8

Limits:

FCC	IC
+33.00 dBm In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

Results:

Output Power (conducted) GMSK mode			
Frequency (MHz)	**Peak Output Power (dBm)**	**Average Output Power (dBm)**	**Peak to Average Ratio (dB) CCDF**
1850.2	23.9	23.7	0.14
1880.0	23.9	23.7	0.18
1909.8	23.8	22.8	1.00

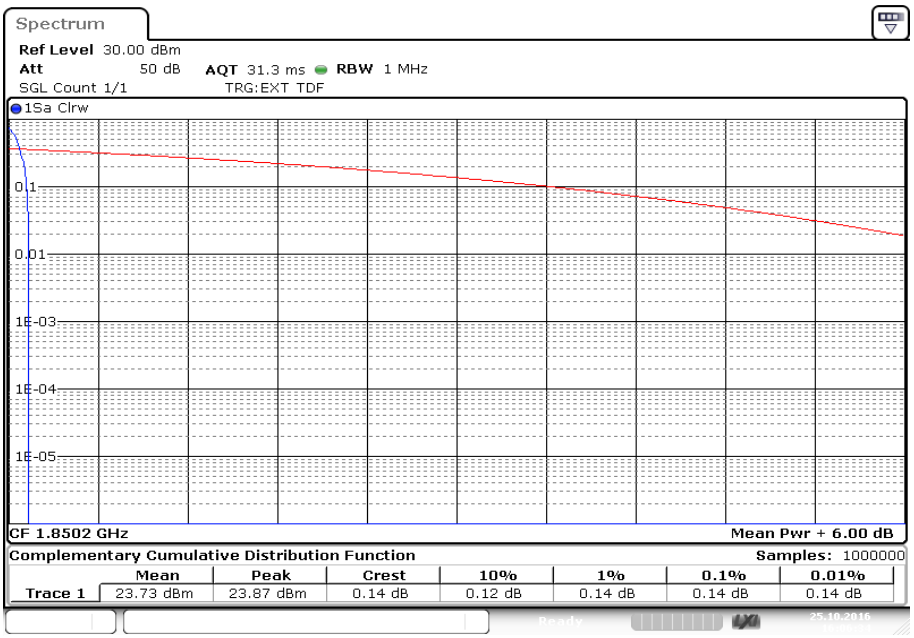
Output Power (conducted) 8-PSK mode			
Frequency (MHz)	**Peak Output Power (dBm)**	**Average Output Power (dBm)**	**Peak to Average Ratio (dB) CCDF**
1850.2	22.9	19.2	3.57
1880.0	22.8	19.0	3.70
1909.8	22.6	19.6	2.90

Output Power (radiated) GMSK mode	
Frequency (MHz)	**Average Output Power (dBm) - EIRP**
1850.2	27.5
1880.0	27.0
1909.8	25.9

Output Power (radiated) 8-PSK mode	
Frequency (MHz)	**Average Output Power (dBm) - EIRP**
1850.2	23.0
1880.0	22.3
1909.8	22.7

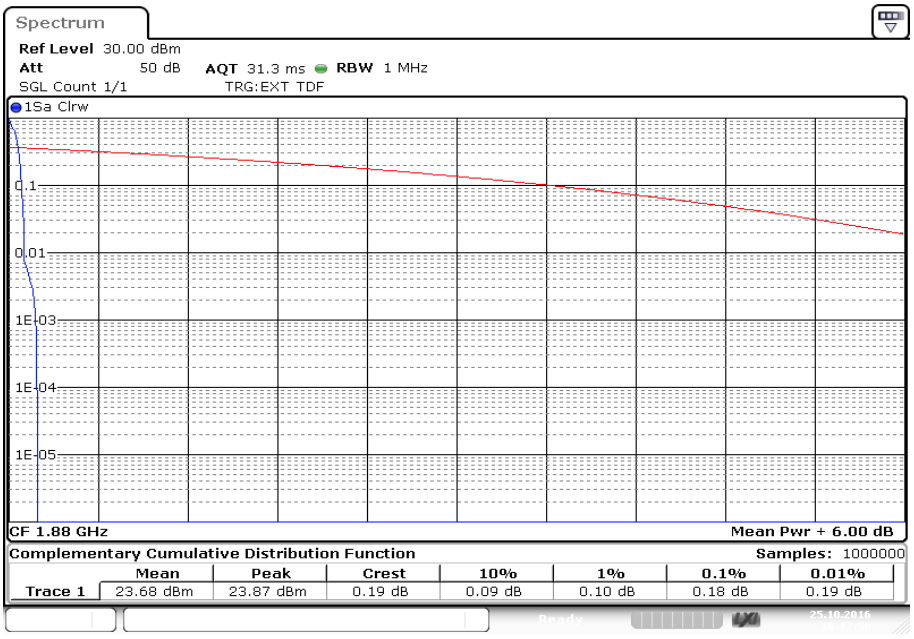
Plots: GMSK

Plot 1: CCDF, channel 512



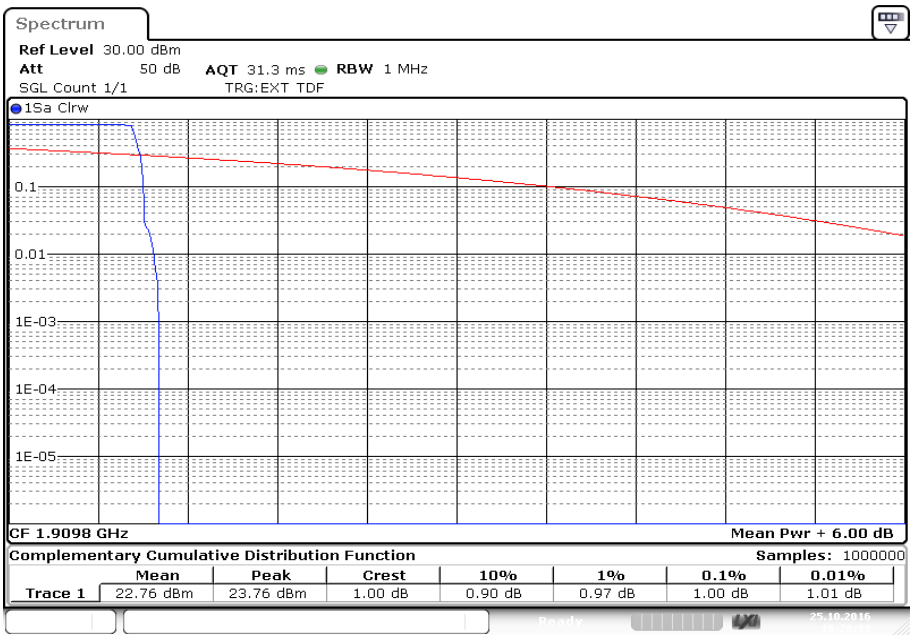
Date: 25.OCT.2016 16:06:34

Plot 2: CCDF, channel 661



Date: 25.OCT.2016 16:17:50

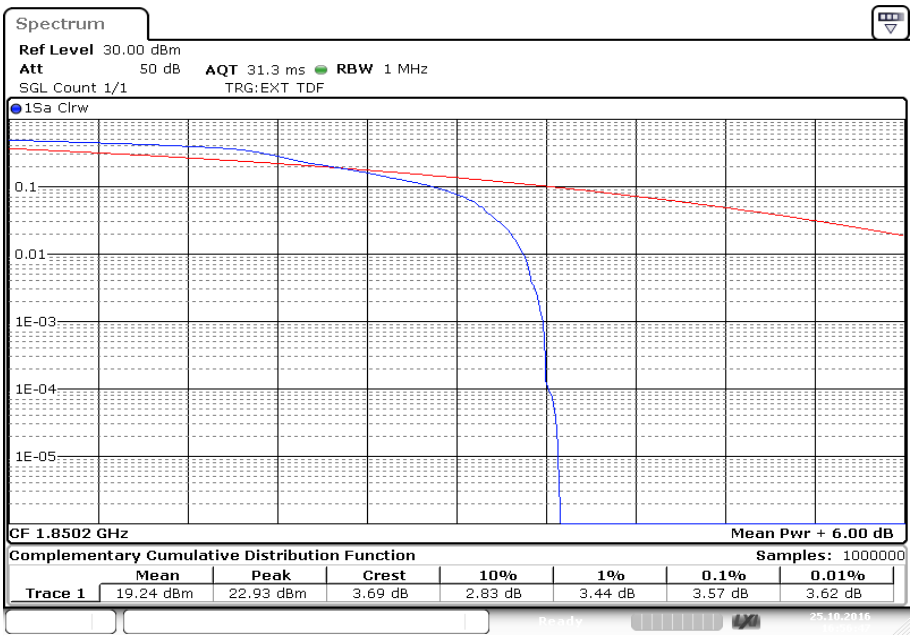
Plot 3: CCDF, channel 810



Date: 25.OCT.2016 16:28:33

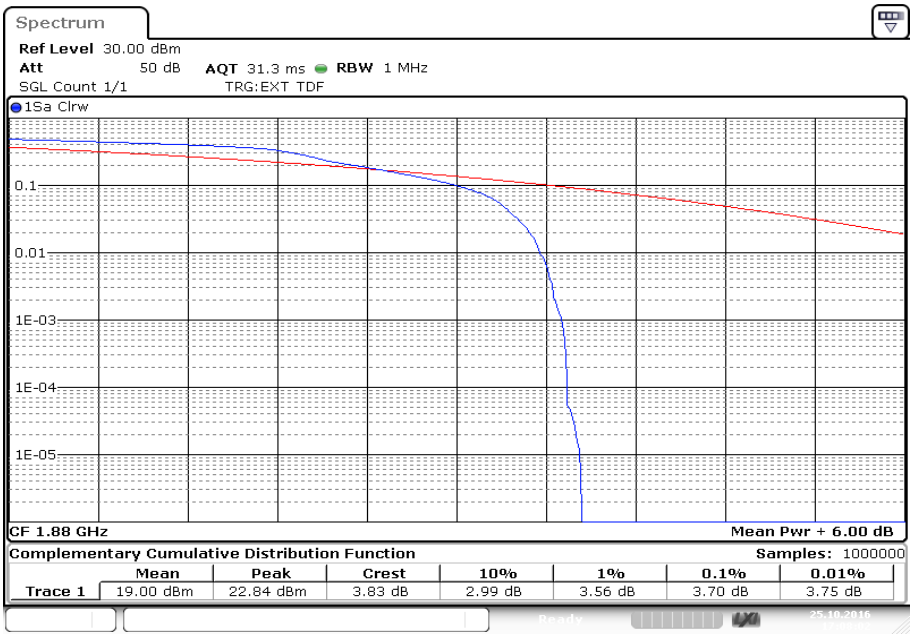
Plots: 8 PSK

Plot 1: CCDF, channel 512



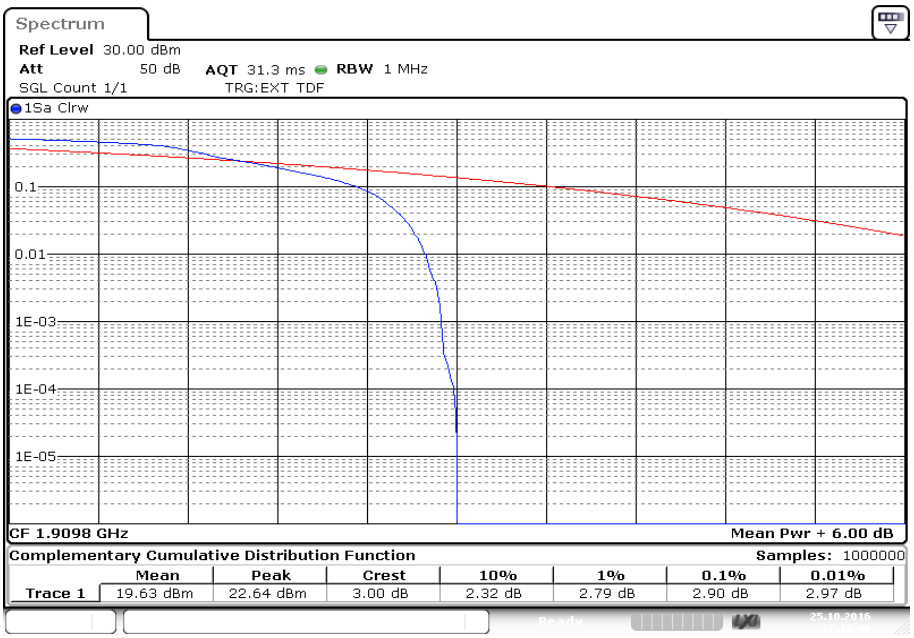
Date: 25.OCT.2016 16:56:47

Plot 2: CCDF, channel 661



Date: 25.OCT.2016 17:08:03

Plot 3: CCDF, channel 810



Date: 25.OCT.2016 17:18:46

11.2 Frequency stability

Description:

In order to measure the carrier frequency under normal conditions it is necessary to make measurements with the mobile station connected to a R&S CMU200 Wideband Radio Communication Tester.

1. Measure the carrier frequency at room temperature.
2. Subject the mobile station to overnight soak at -30 C.
3. With the mobile station powered with V_{nom} connected to the CMU200 on the center channel. Measure the carrier frequency. These measurements should be made within two minutes of powering up the mobile station to prevent significant self warming.
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 15 minutes at each temperature unpowered before making measurements.
5. Remeasure carrier frequency at room temperature with V_{nom}. Vary supply voltage to V_{min} and measure the carrier frequency then setup V_{max} and repeat the measurement.
6. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

Measurement:

Measurement parameters	
Detector:	Measured with CMU200
Sweep time:	
Video bandwidth:	
Resolution bandwidth:	
Span:	
Trace mode:	
Test setup:	See chapter 6.4 – B
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.	

Results:

AFC FREQ ERROR versus VOLTAGE

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
9	14	0.00000074	0.0074
24	16	0.00000085	0.0085
32	10	0.00000053	0.0053

AFC FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	14	0.00000074	0.0074
-20	20	0.00000106	0.0106
-10	15	0.00000080	0.0080
± 0	-11	-0.00000059	-0.0059
10	13	0.00000069	0.0069
20	11	0.00000059	0.0059
30	14	0.00000074	0.0074
40	1	0.00000005	0.0005
50	12	0.00000064	0.0064
55	14	0.00000074	0.0074

11.3 Spurious emissions radiated

Description:

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2014 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. Measurement made up to 25 GHz. The resolution bandwidth is set as outlined in Part 24.238. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the PCS1900 band.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 sec.
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	100 MHz Steps
Trace mode:	Max Hold
Used equipment:	See chapter 6.1 – A & 6.2 – B & 6.3 – A
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results GPRS & EGPRS:

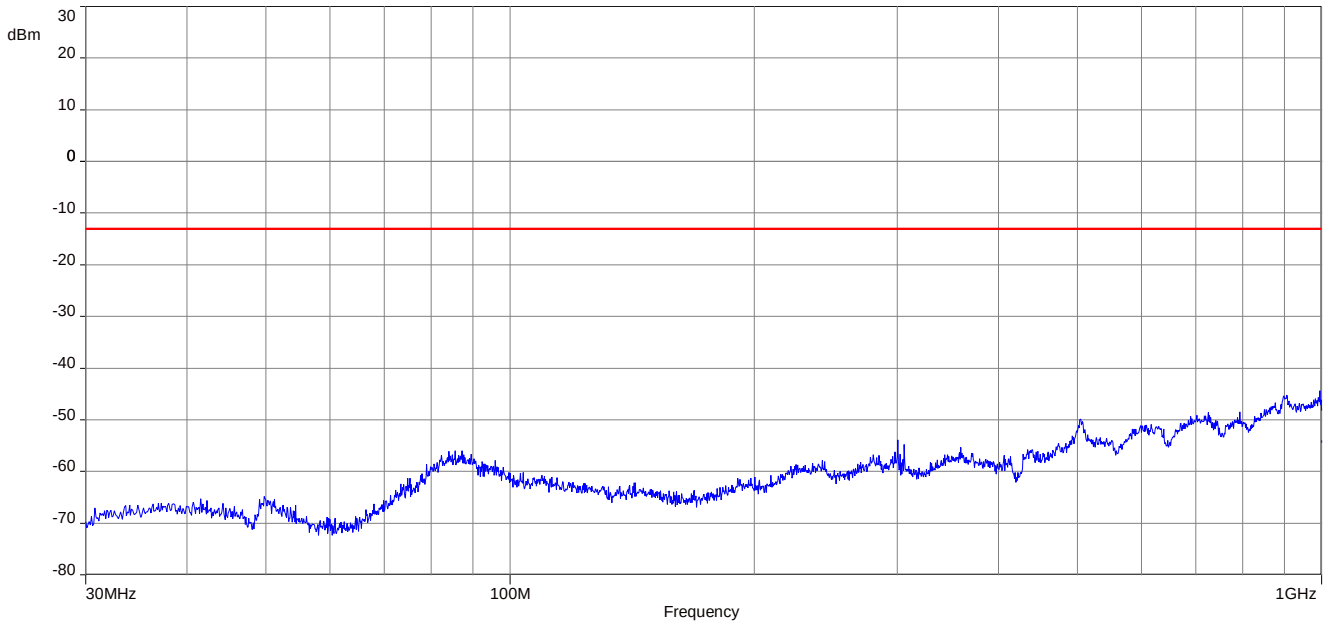
Radiated emissions measurements were made only at the center carrier frequencies of the PCS1900 band (1880.0 MHz) to show the compliance with cabinet radiation limits.

Results:

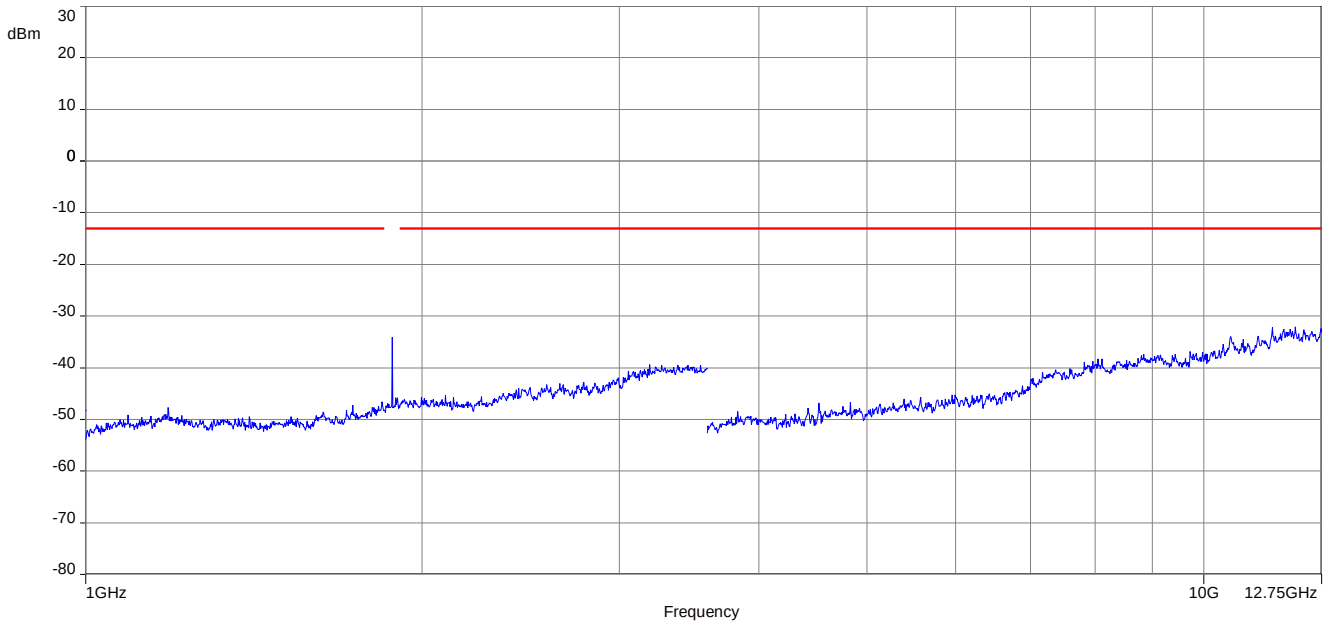
Spurious emission level (dBm)								
Harmonic	Ch. 512 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 661 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 810 Freq. (MHz)	Level [dBm]
2	3700.4	-	2	3760.0	-	2	3819.6	-
3	5550.6	-	3	5640.0	-	3	5729.4	-
4	7400.8	-	4	7520.0	-	4	7639.2	-
5	9251.0	-	5	9400.0	-	5	9549.0	-
6	11101.2	-	6	11280.0	-	6	11458.8	-
7	12951.4	-	7	13160.0	-	7	13368.6	-
8	14801.6	-	8	15040.0	-	8	15278.4	-
9	16651.8	-	9	16920.0	-	9	17188.2	-
10	18502.0	-	10	18800.0	-	10	19098.0	-

Plots: Plastic housing

Plot 1: Channel 661 (30 MHz – 1 GHz)

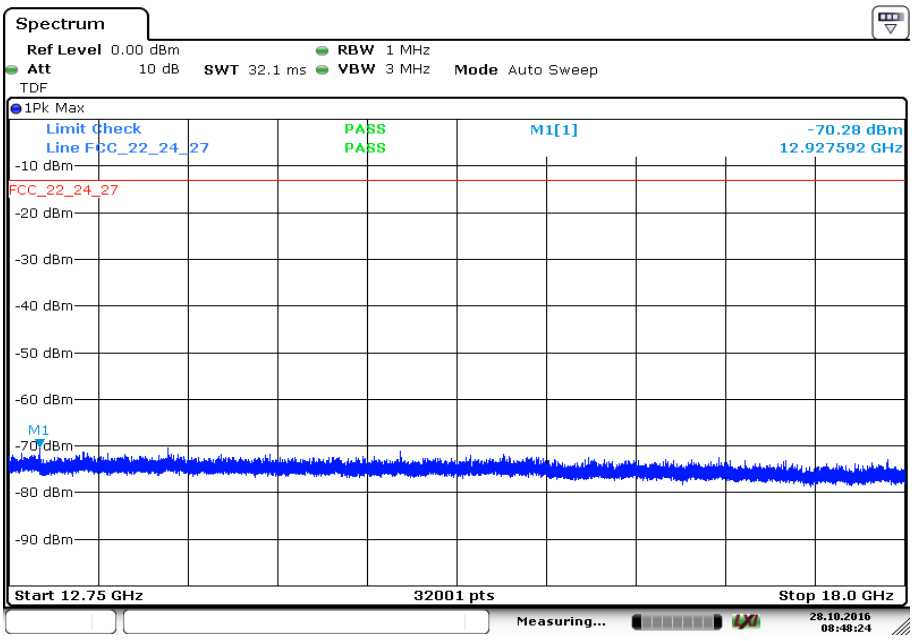


Plot 2: Channel 661 (1 GHz – 12.75 GHz)



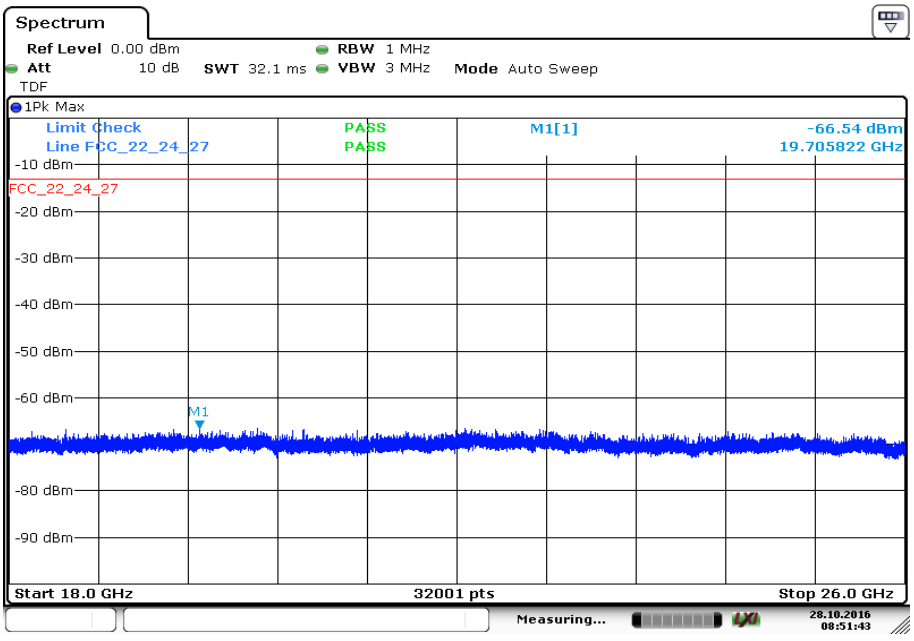
Carrier notched with 1.9 GHz rejection filter

Plot 3: Channel 661 (12.75 GHz - 18 GHz)



Date: 28.OCT.2016 08:48:23

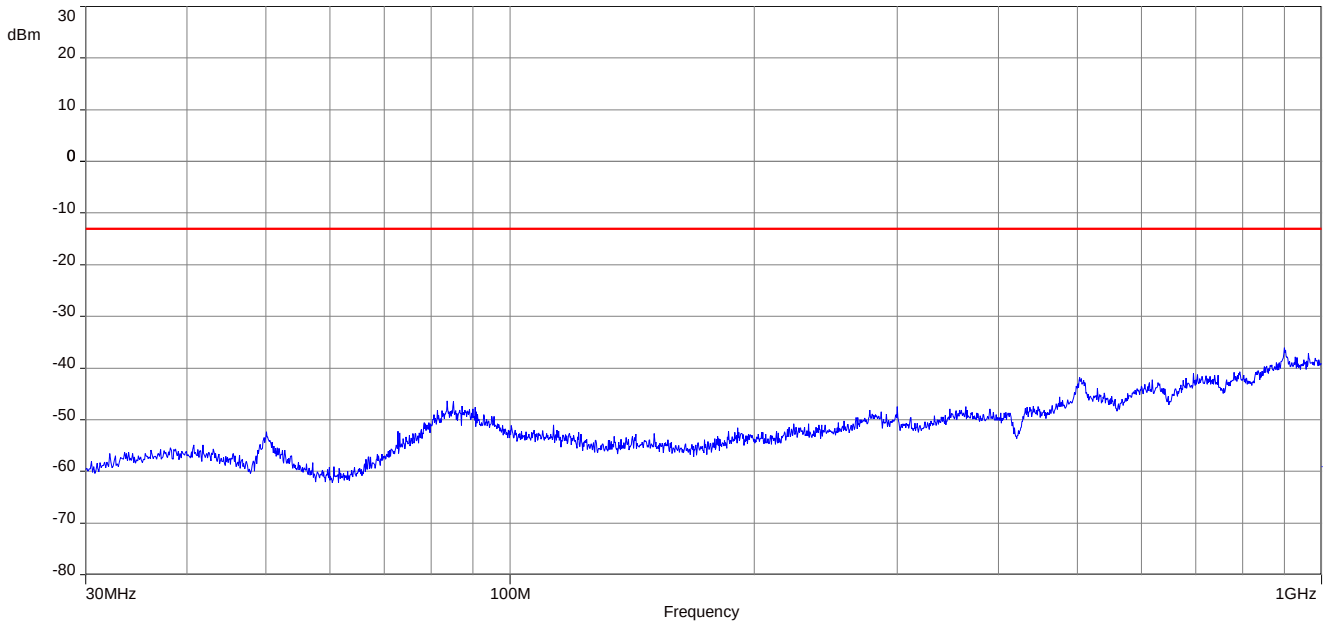
Plot 4: Channel 661 (18 GHz - 26 GHz)



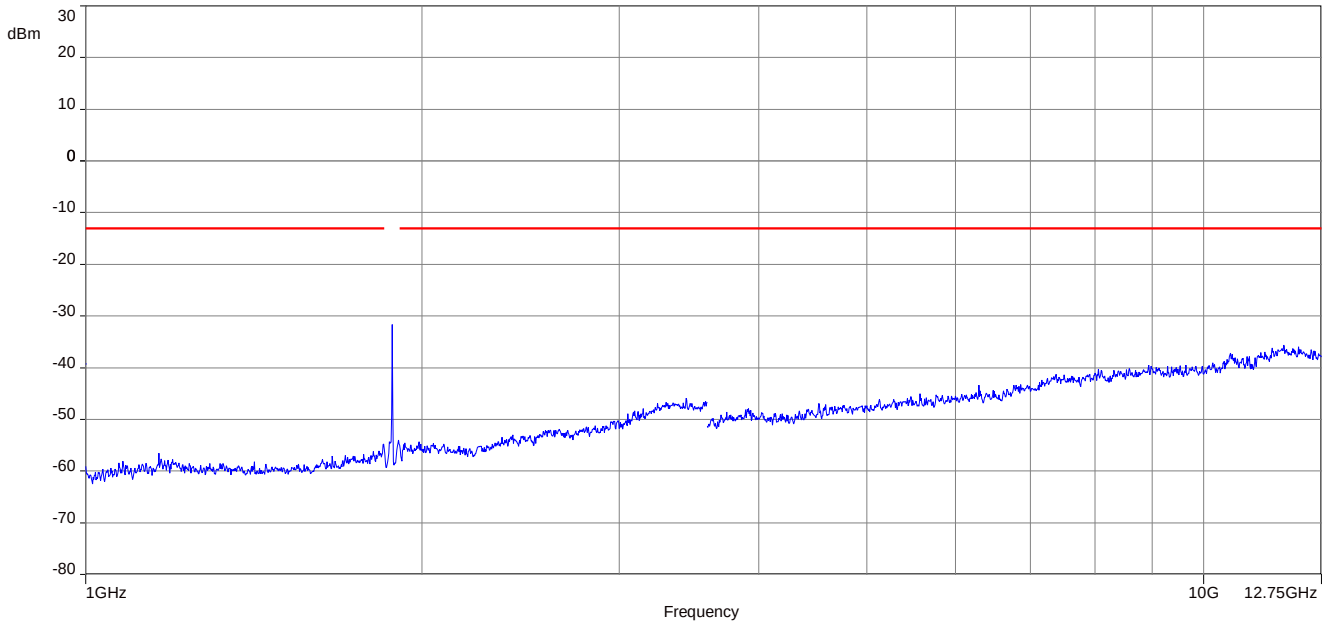
Date: 28.OCT.2016 08:51:44

Plots: GMSK, metal housing

Plot 1: Channel 661 (30 MHz – 1 GHz)

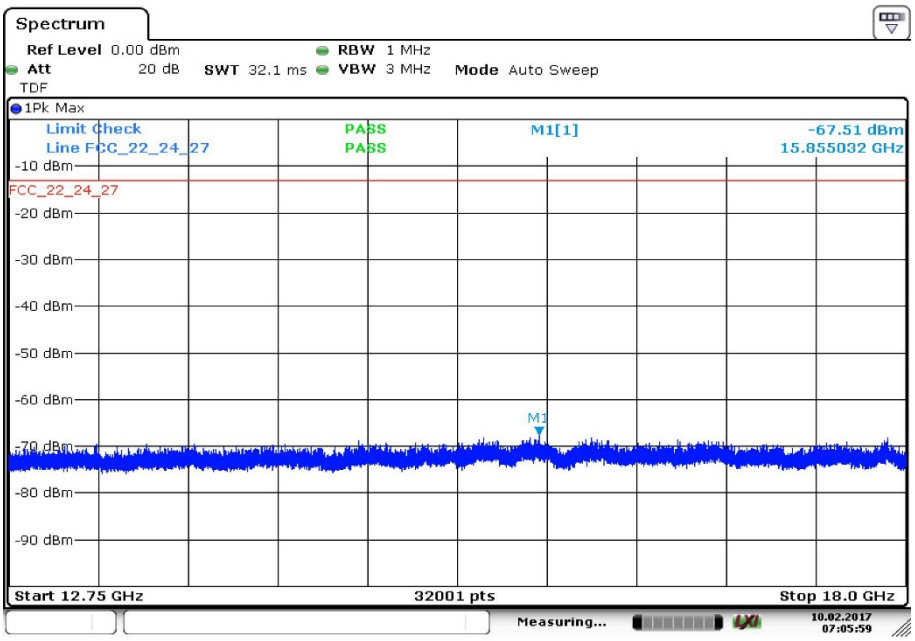


Plot 2: Channel 661 (1 GHz – 12.75 GHz)



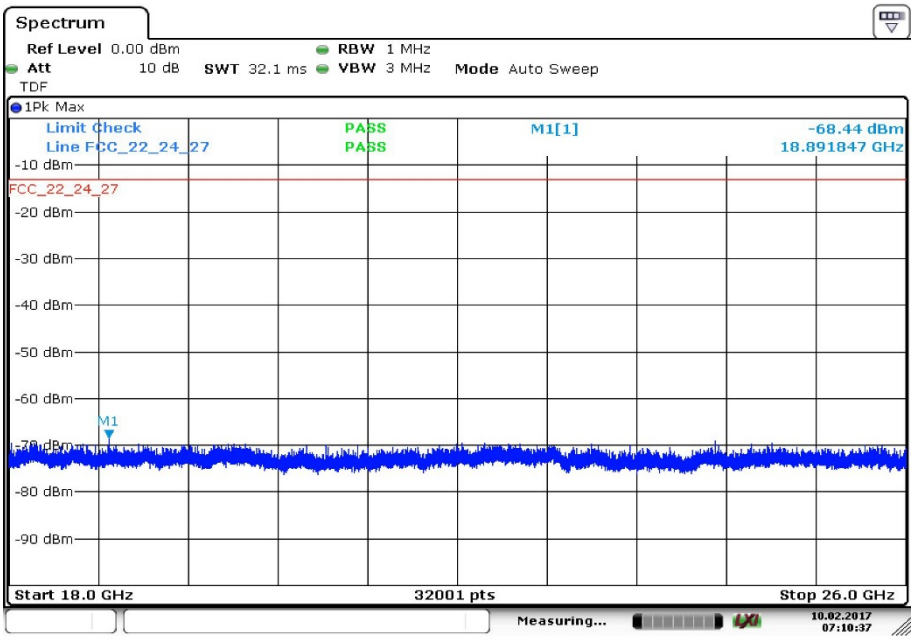
Carrier notched with 1.9 GHz rejection filter

Plot 3: Channel 661 (12.75 GHz - 18 GHz)



Date: 10.FEB.2017 07:05:59

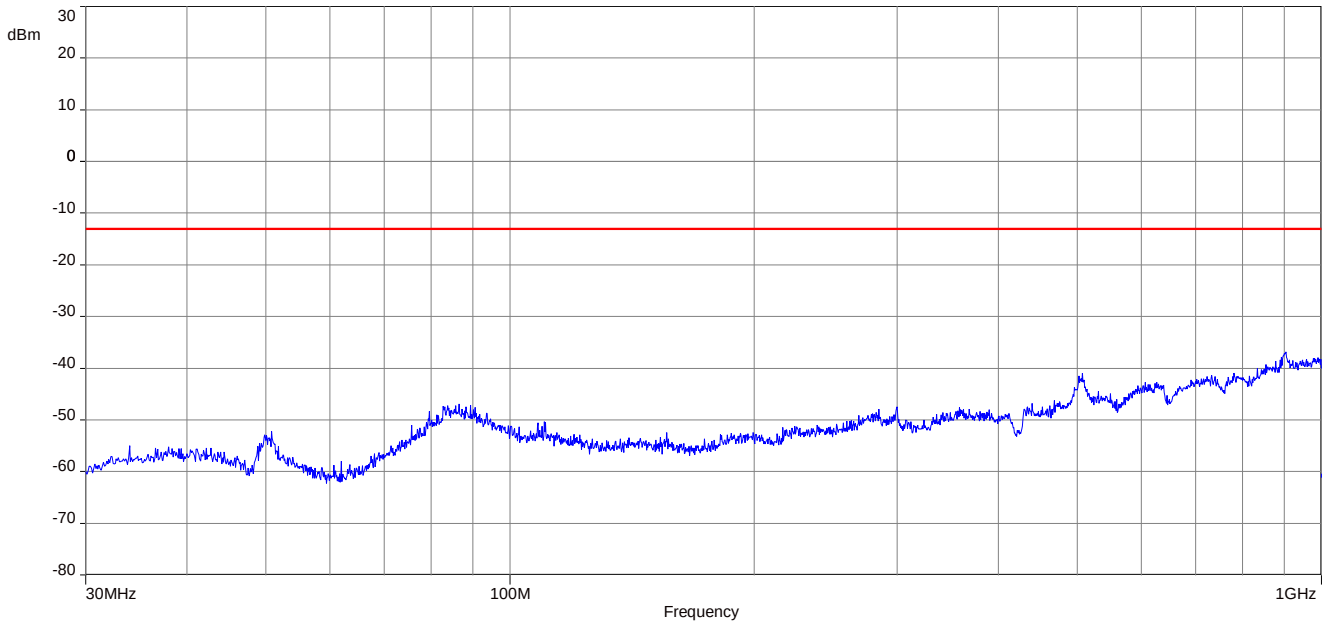
Plot 4: Channel 661 (18 GHz - 26 GHz)



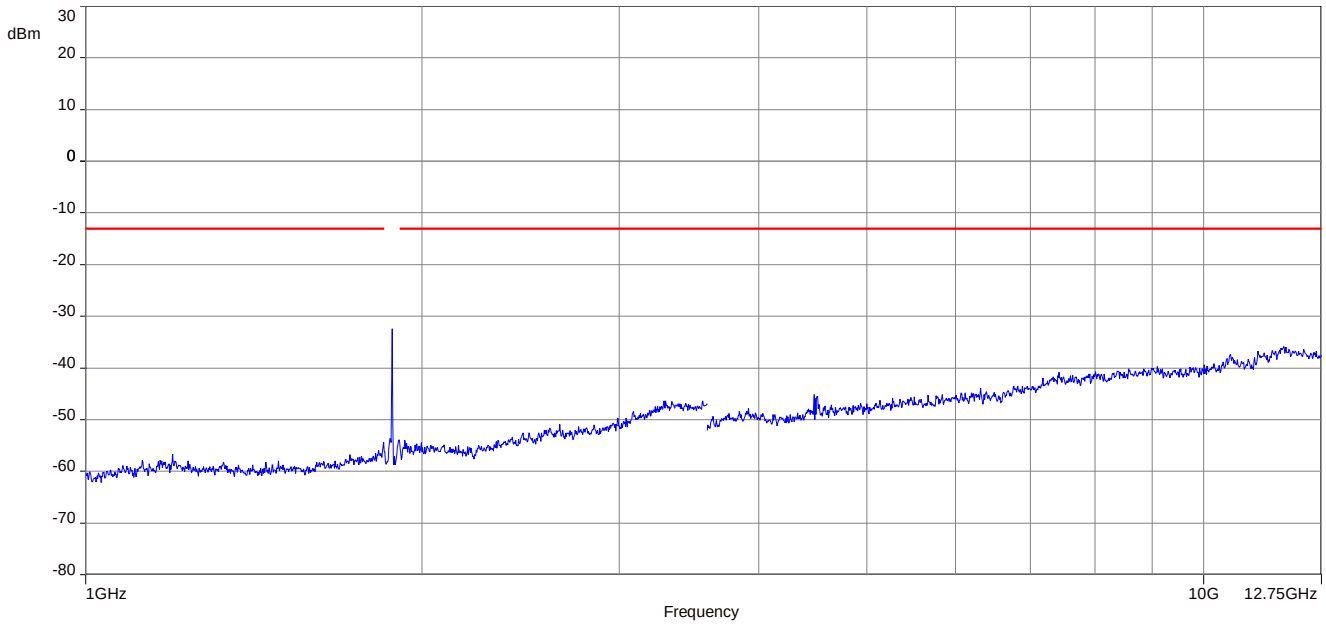
Date: 10.FEB.2017 07:10:38

Plots: 8 PSK

Plot 1: Channel 661 (30 MHz – 1 GHz)

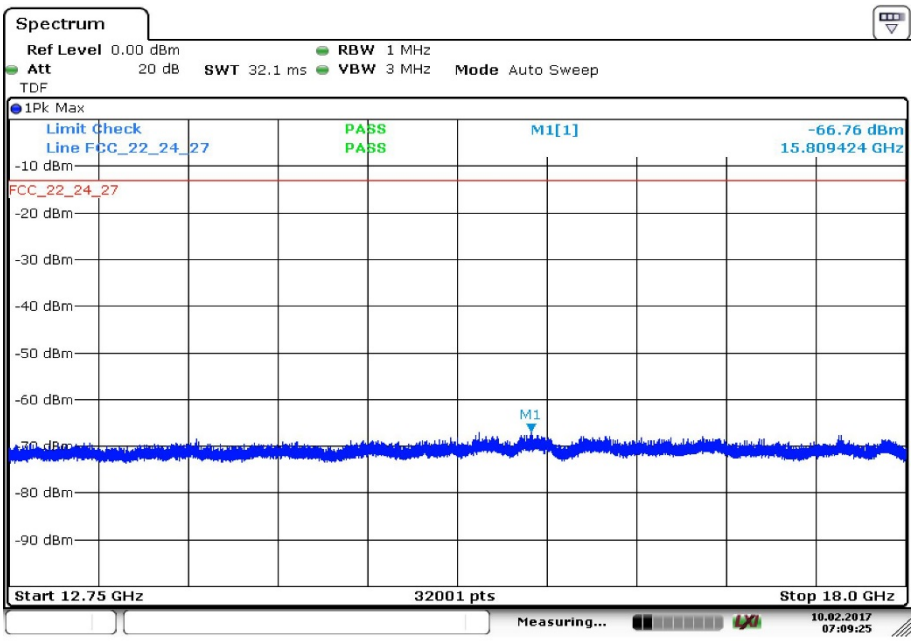


Plot 2: Channel 661 (1 GHz – 12.75 GHz)



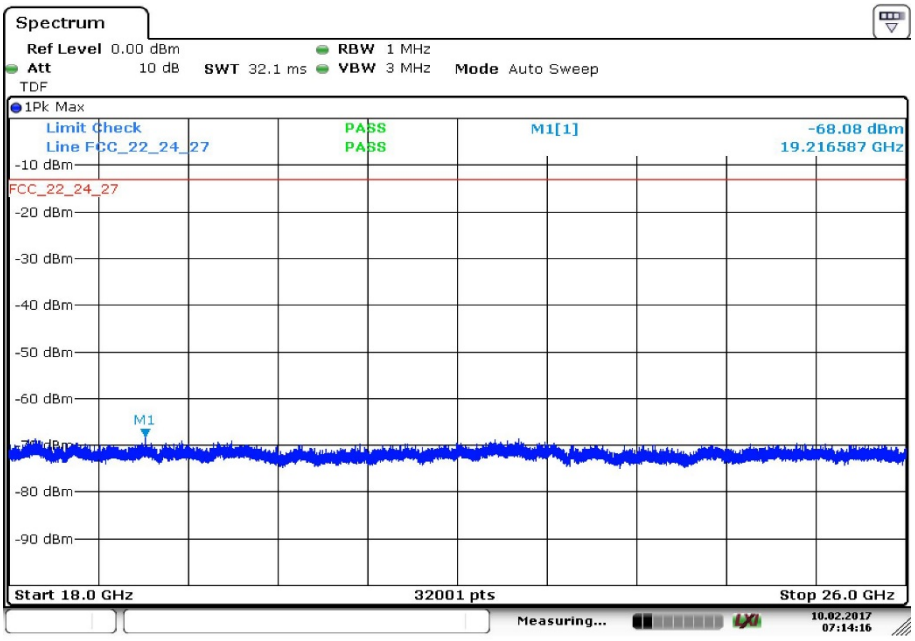
Carrier notched with 1.9 GHz rejection filter

Plot 3: Channel 661 (12.75 GHz - 18 GHz)



Date: 10.FEB.2017 07:09:25

Plot 4: Channel 661 (18 GHz - 26 GHz)



Date: 10.FEB.2017 07:14:16

11.4 Spurious emissions conducted

Description:

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 19.1 GHz, data taken from 10 MHz to 26 GHz.
2. Determine mobile station transmits frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

PCS1900 Transmitter Channel Frequency
512 1850.2 MHz
661 1880.0 MHz
810 1909.8 MHz

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	10 MHz – 26 GHz
Trace mode:	Max Hold
Used equipment:	See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Limits:

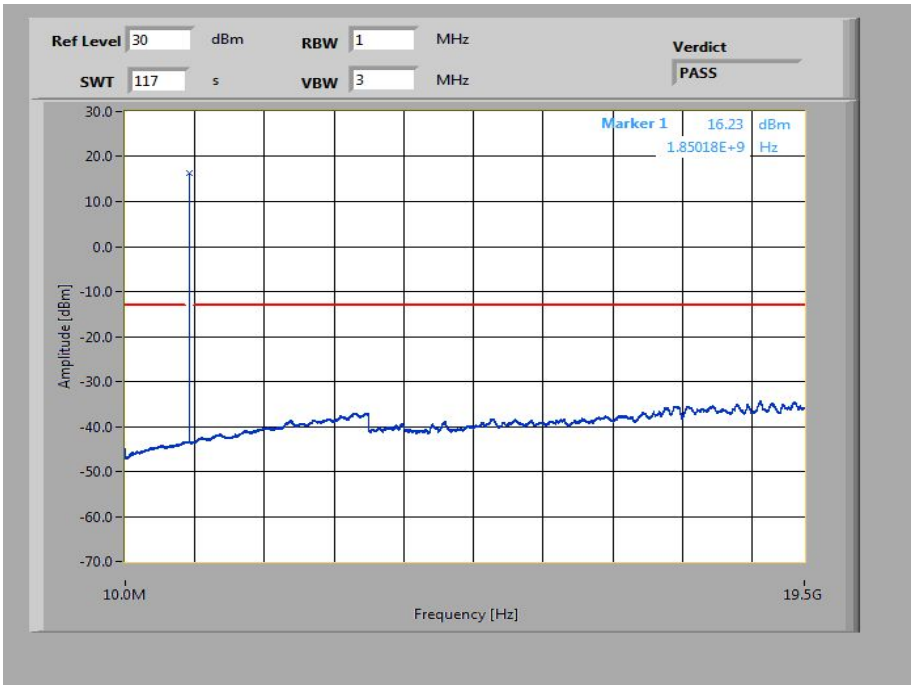
FCC	IC
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results:

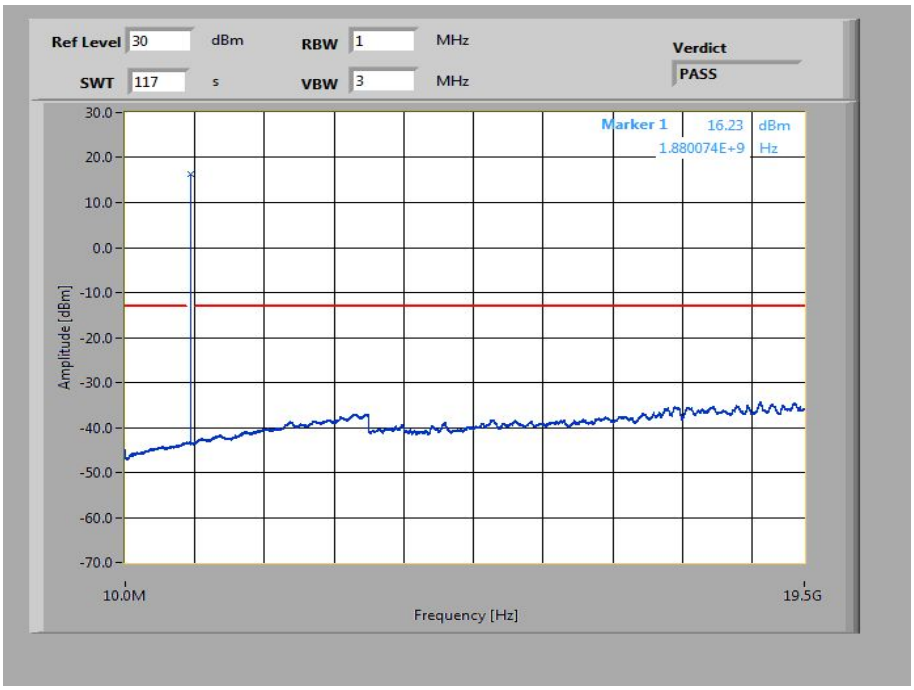
Spurious emission level (dBm)								
Harmonic	Ch. 512 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 661 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 810 Freq. (MHz)	Level [dBm]
2	3700.4	-	2	3760.0	-	2	3819.6	-
3	5550.6	-	3	5640.0	-	3	5729.4	-
4	7400.8	-	4	7520.0	-	4	7639.2	-
5	9251.0	-	5	9400.0	-	5	9549.0	-
6	11101.2	-	6	11280.0	-	6	11458.8	-
7	12951.4	-	7	13160.0	-	7	13368.6	-
8	14801.6	-	8	15040.0	-	8	15278.4	-
9	16651.8	-	9	16920.0	-	9	17188.2	-
10	18502.0	-	10	18800.0	-	10	19098.0	-

Plots: GMSK

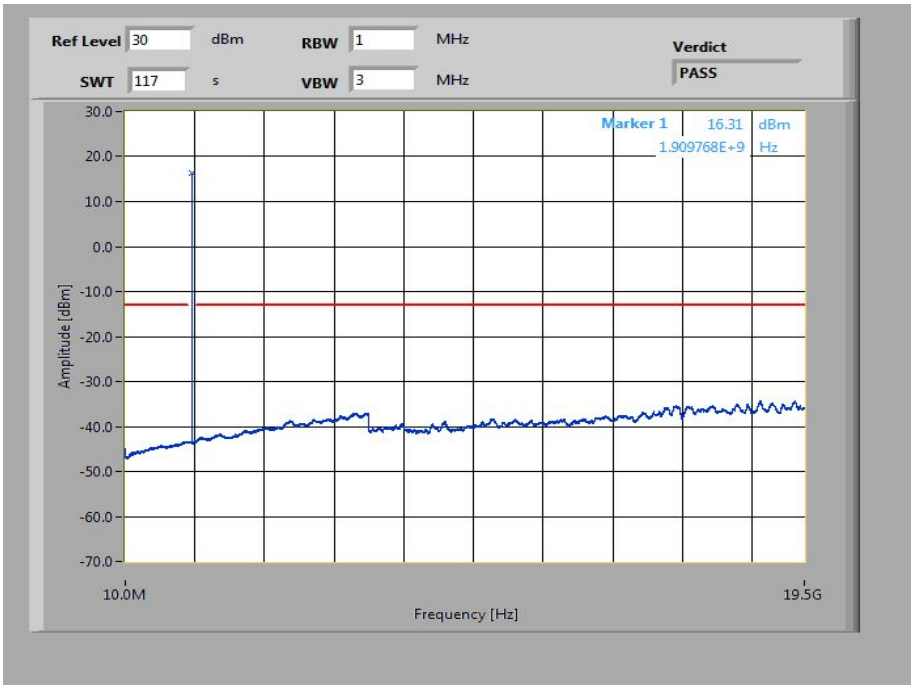
Plot 1: Channel 512 (10 MHz – 19.5 GHz)



Plot 2: Channel 661 (10 MHz – 19.5 GHz)

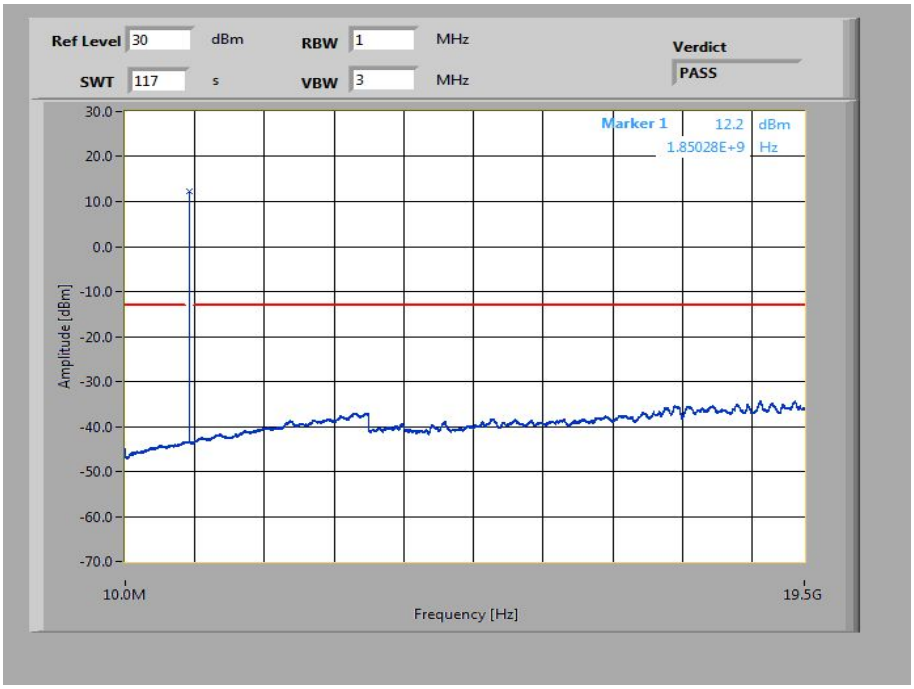


Plot 3: Channel 810 (10 MHz – 19.5 GHz)

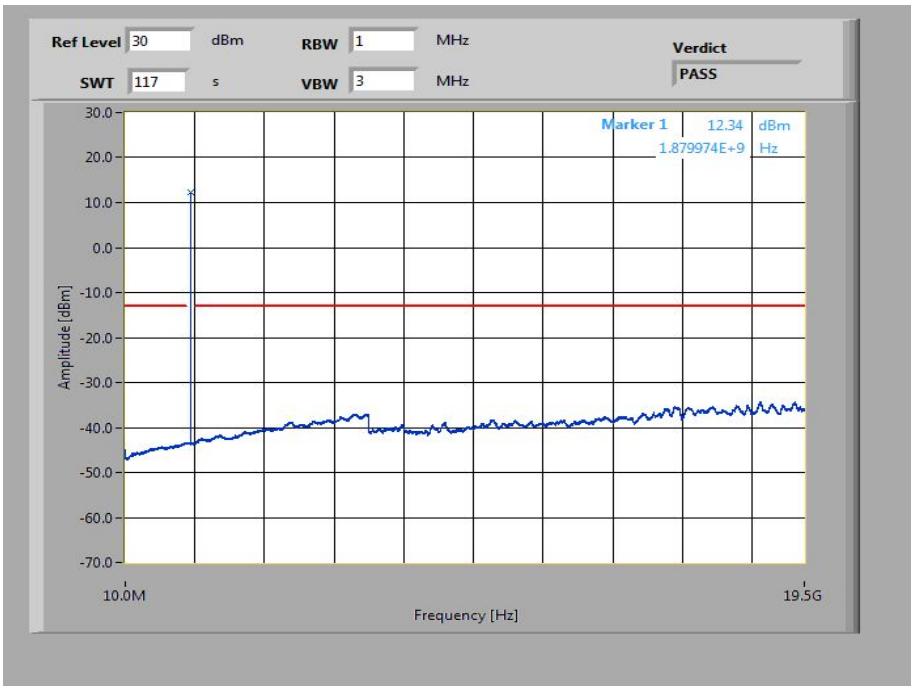


Plots: 8 PSK

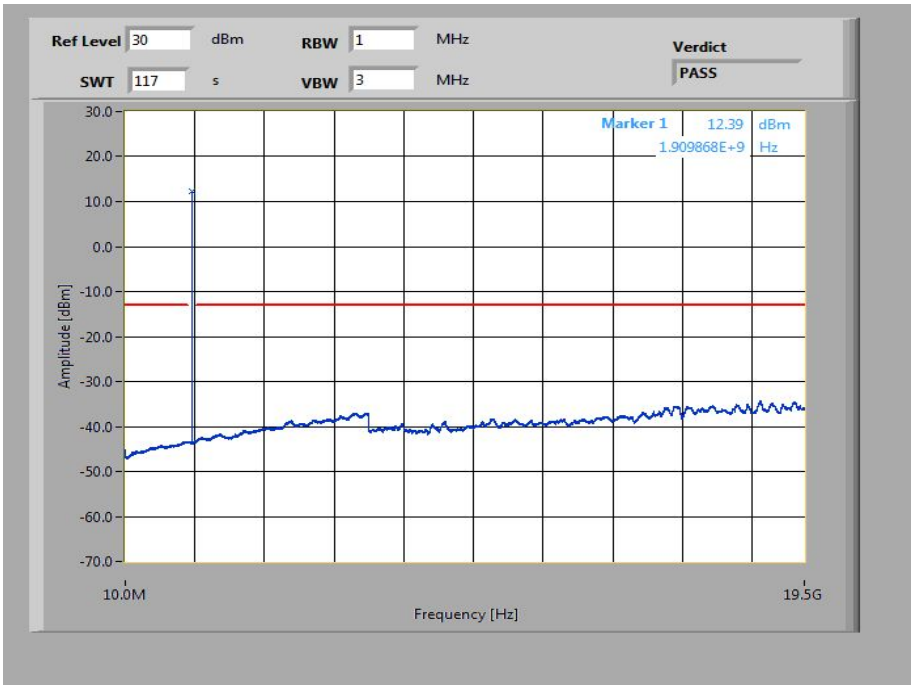
Plot 1: Channel 512 (10 MHz – 19.5 GHz)



Plot 2: Channel 661 (10 MHz – 19.5 GHz)



Plot 3: Channel 810 (10 MHz – 19.5 GHz)



11.5 Block edge compliance

Description:

The spectrum at the band edges must comply with the spurious emissions limits.

Measurement:

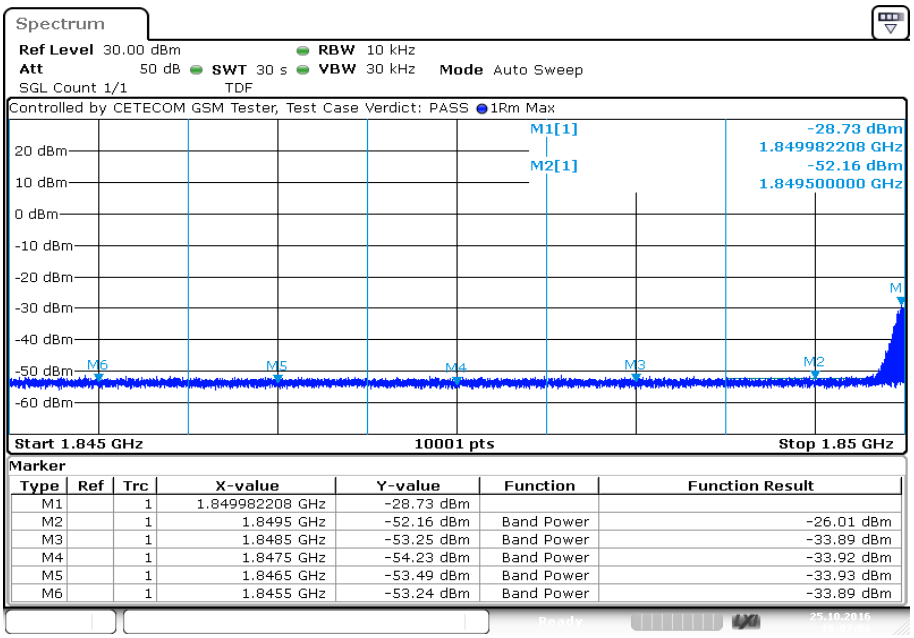
Measurement parameters	
Detector:	RMS
Sweep time:	30 sec.
Video bandwidth:	1% - 5% of the OBW
Resolution bandwidth:	≥ 3xRBW
Span:	5 MHz
Trace mode:	Max Hold
Used equipment:	See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Plots: GMSK

Plot 1: Channel 512

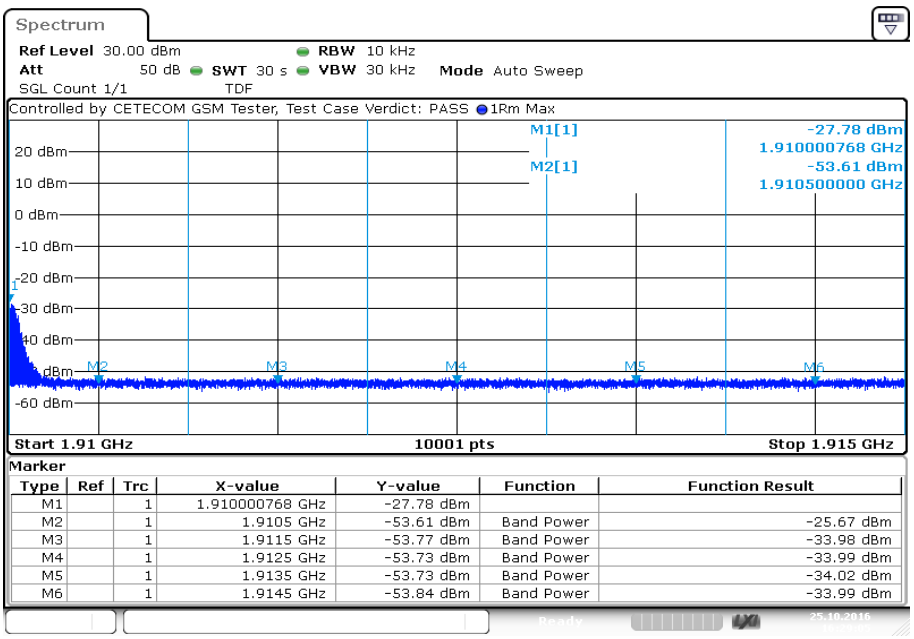


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.849982208 GHz	-28.73 dBm		
M2		1	1.8495 GHz	-52.16 dBm	Band Power	-26.01 dBm
M3		1	1.8485 GHz	-53.25 dBm	Band Power	-33.89 dBm
M4		1	1.8475 GHz	-54.23 dBm	Band Power	-33.92 dBm
M5		1	1.8465 GHz	-53.49 dBm	Band Power	-33.93 dBm
M6		1	1.8455 GHz	-53.24 dBm	Band Power	-33.89 dBm

Date: 25.OCT.2016 16:07:06

Plot 2: Channel 810



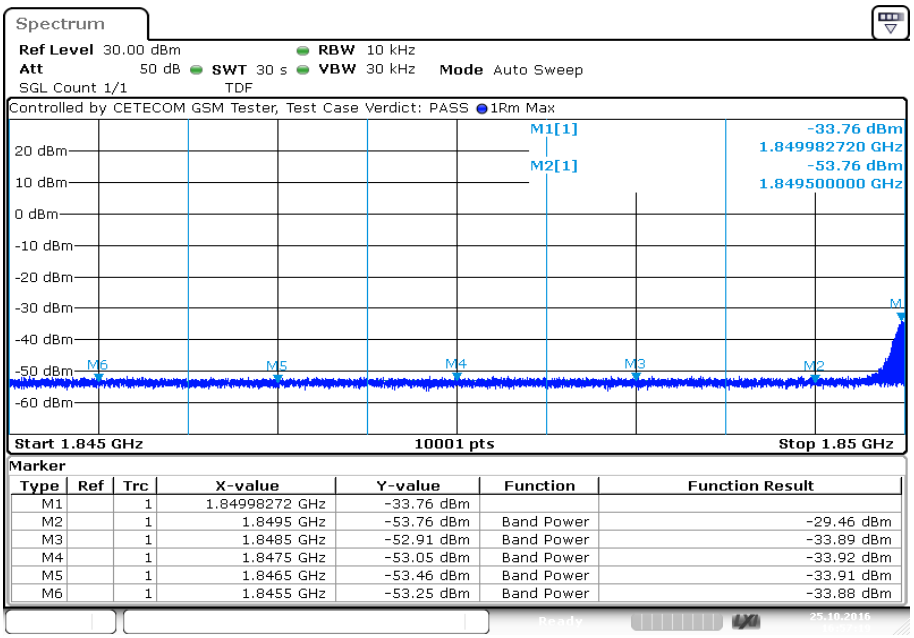
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.910000768 GHz	-27.78 dBm		
M2		1	1.9105 GHz	-53.61 dBm	Band Power	-25.67 dBm
M3		1	1.9115 GHz	-53.77 dBm	Band Power	-33.98 dBm
M4		1	1.9125 GHz	-53.73 dBm	Band Power	-33.99 dBm
M5		1	1.9135 GHz	-53.73 dBm	Band Power	-34.02 dBm
M6		1	1.9145 GHz	-53.84 dBm	Band Power	-33.99 dBm

Date: 25.OCT.2016 16:29:05

Plots: 8 PSK

Plot 1: Channel 512

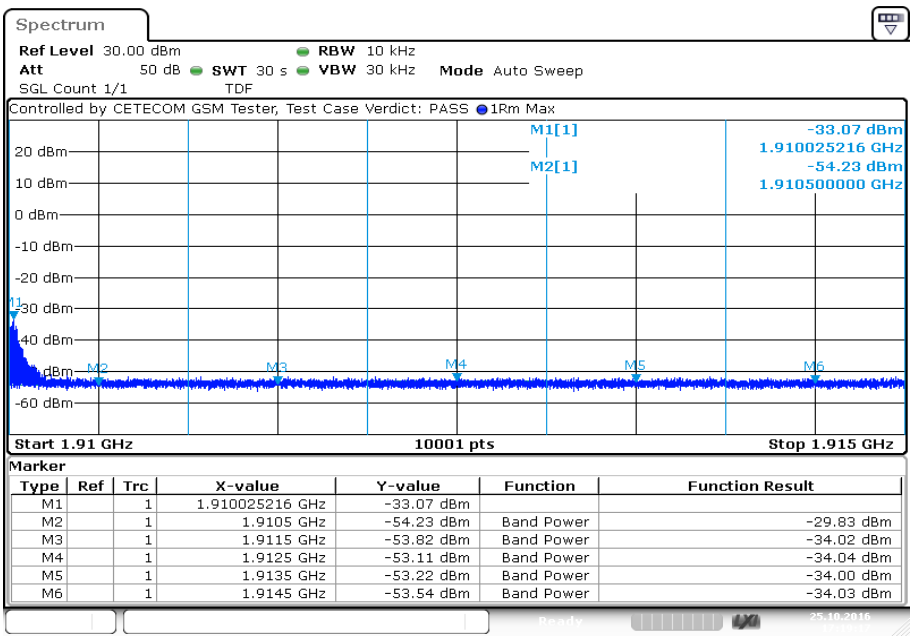


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.84998272 GHz	-33.76 dBm		
M2		1	1.8495 GHz	-53.76 dBm	Band Power	-29.46 dBm
M3		1	1.8485 GHz	-52.91 dBm	Band Power	-33.89 dBm
M4		1	1.8475 GHz	-53.05 dBm	Band Power	-33.92 dBm
M5		1	1.8465 GHz	-53.46 dBm	Band Power	-33.91 dBm
M6		1	1.8455 GHz	-53.25 dBm	Band Power	-33.88 dBm

Date: 25.OCT.2016 16:57:19

Plot 2: Channel 810



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.910025216 GHz	-33.07 dBm		
M2		1	1.9105 GHz	-54.23 dBm	Band Power	-29.83 dBm
M3		1	1.9115 GHz	-53.82 dBm	Band Power	-34.02 dBm
M4		1	1.9125 GHz	-53.11 dBm	Band Power	-34.04 dBm
M5		1	1.9135 GHz	-53.22 dBm	Band Power	-34.00 dBm
M6		1	1.9145 GHz	-53.54 dBm	Band Power	-34.03 dBm

Date: 25.OCT.2016 17:19:18

11.6 Occupied bandwidth

Description:

Measurement of the occupied bandwidth of the transmitted signal.

Measurement:

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the PCS1900 frequency band. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1% - 5% of the OBW
Video bandwidth:	≥ 3xRBW
Span:	2 x nominal BW
Trace mode:	Max Hold
Used equipment:	See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
Spectrum must fall completely in the specified band	

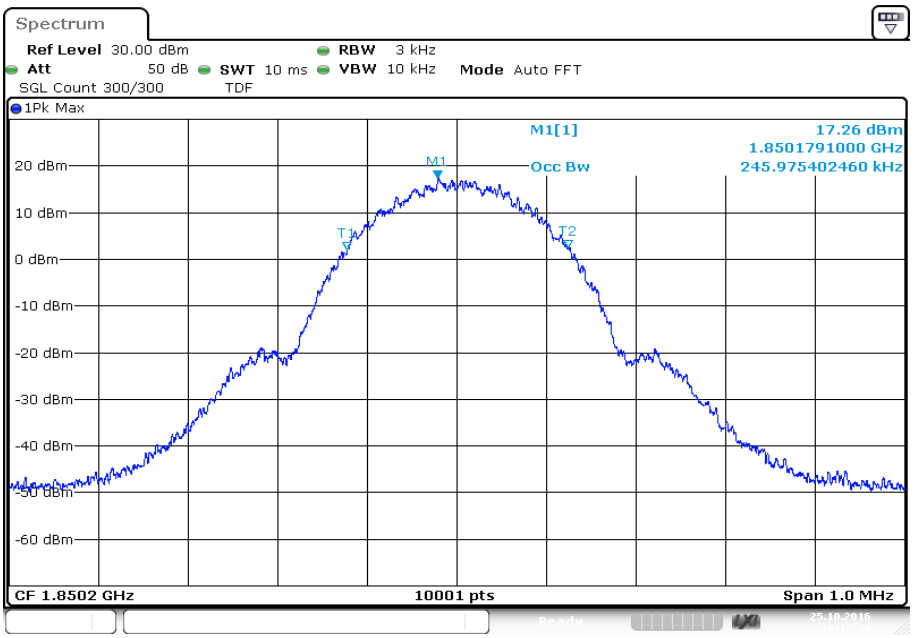
Results:

Occupied Bandwidth - GMSK mode		
Frequency (MHz)	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
1850.2	246	315
1880.0	244	317
1909.8	243	315

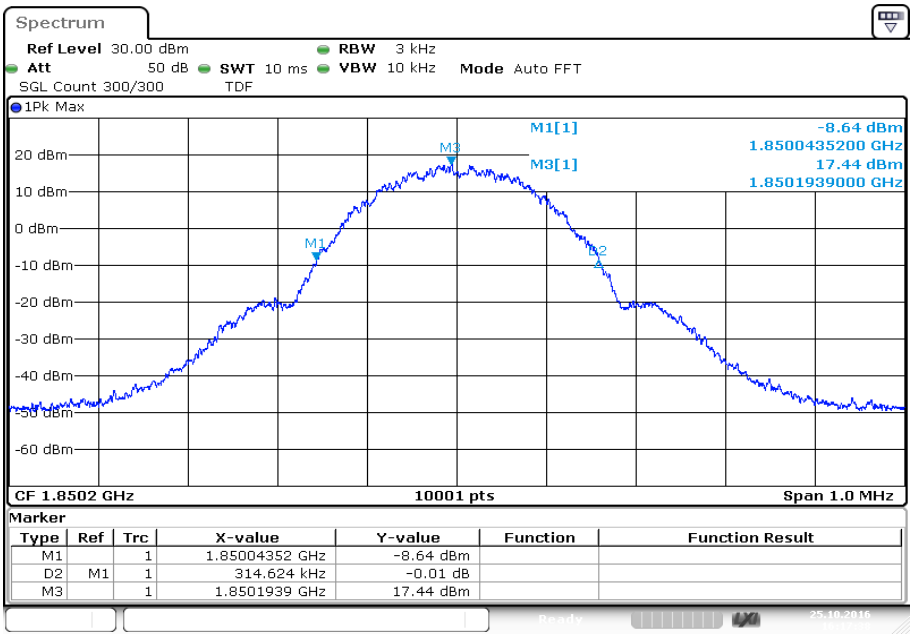
Occupied Bandwidth – 8-PSK mode		
Frequency (MHz)	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
1850.2	245	309
1880.0	245	308
1909.8	243	313

Plots: GMSK

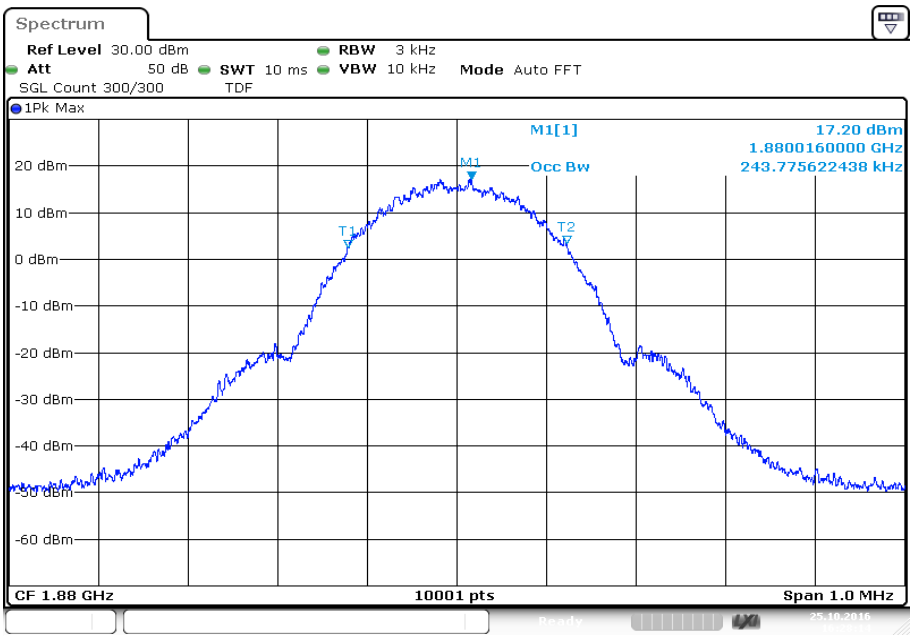
Plot 1: Channel 512 (99% bandwidth)



Plot 2: Channel 512 (-26 dBc bandwidth)

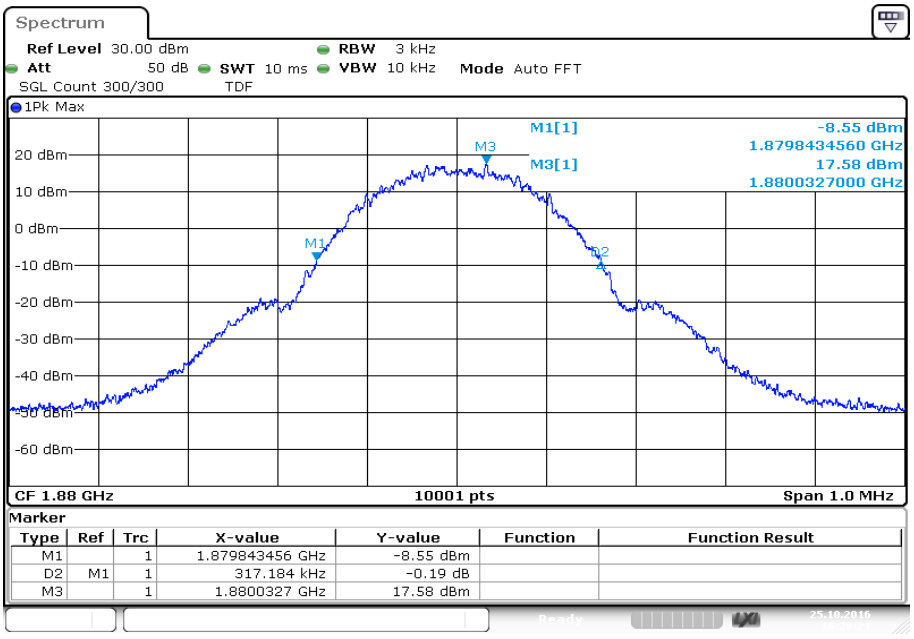


Plot 3: Channel 661 (99% bandwidth)



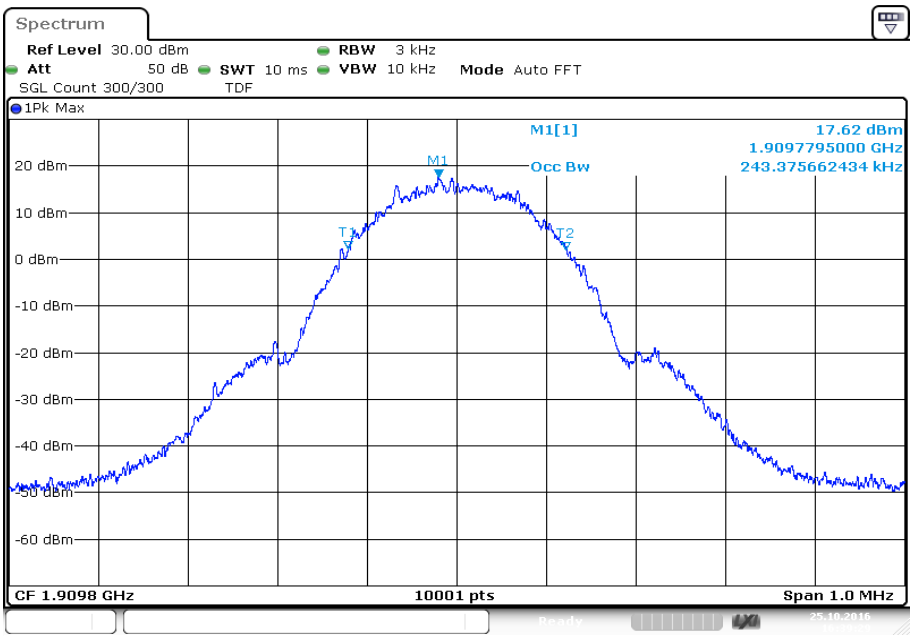
Date: 25.OCT.2016 16:28:14

Plot 4: Channel 661 (-26 dBc bandwidth)



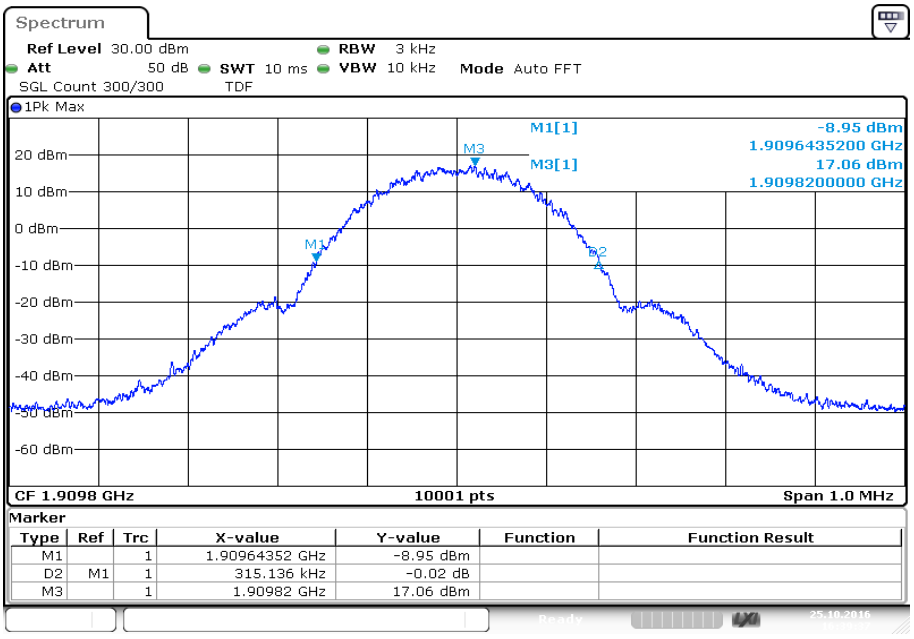
Date: 25.OCT.2016 16:28:22

Plot 5: Channel 810 (99% bandwidth)



Date: 25.OCT.2016 16:39:29

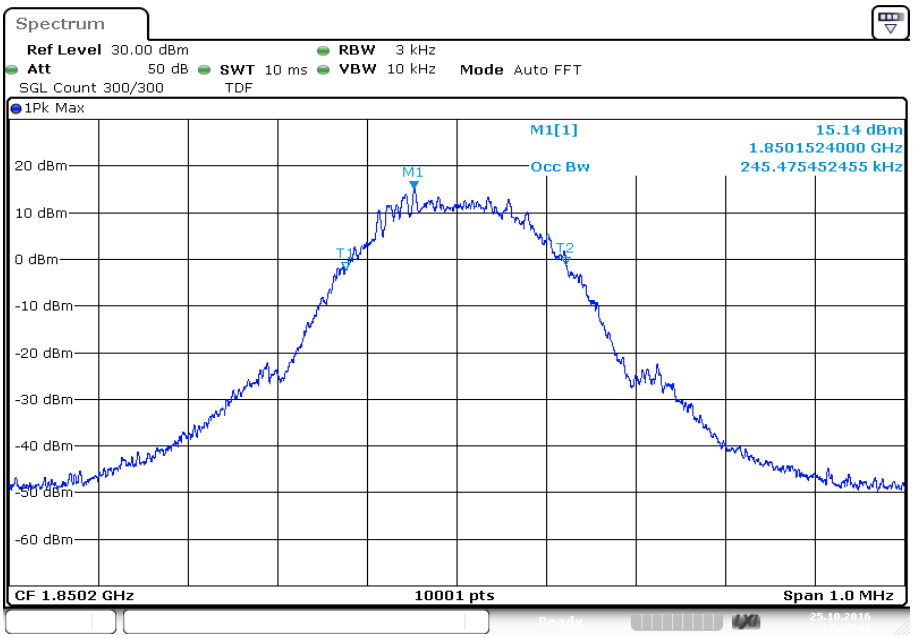
Plot 6: Channel 810 (-26 dBc bandwidth)



Date: 25.OCT.2016 16:39:37

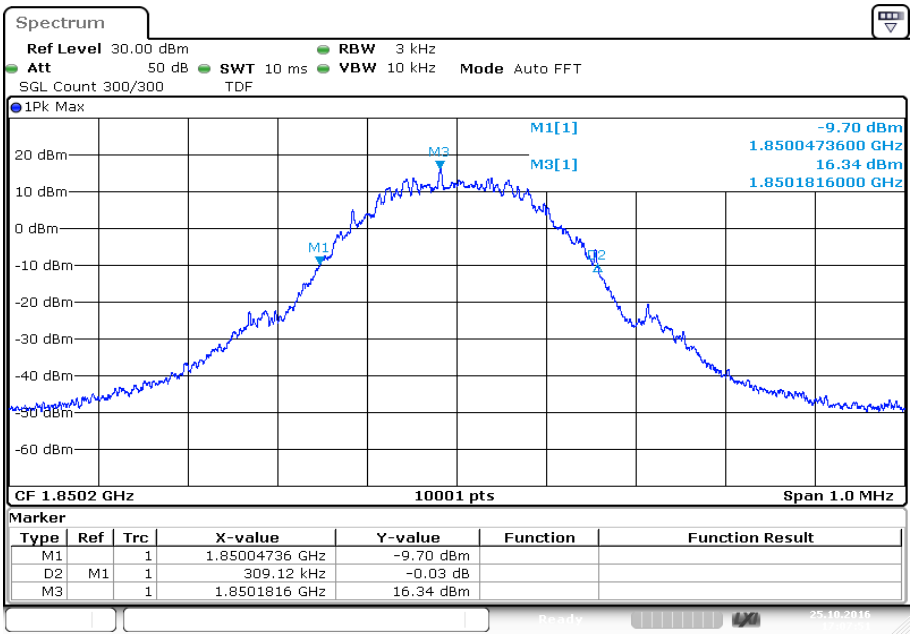
Plots: 8 PSK

Plot 1: Channel 512 (99% bandwidth)



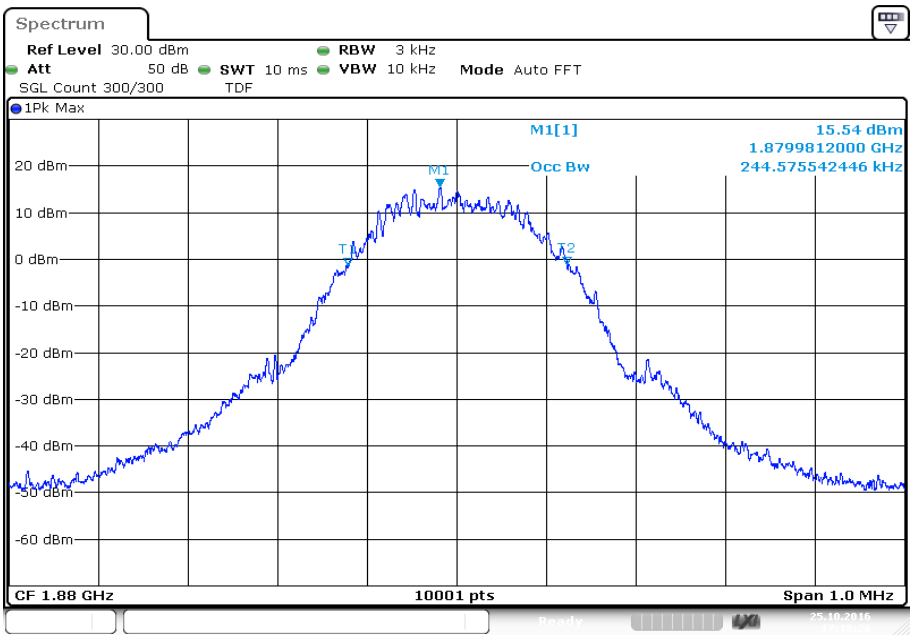
Date: 25.OCT.2016 17:07:43

Plot 2: Channel 512 (-26 dBc bandwidth)



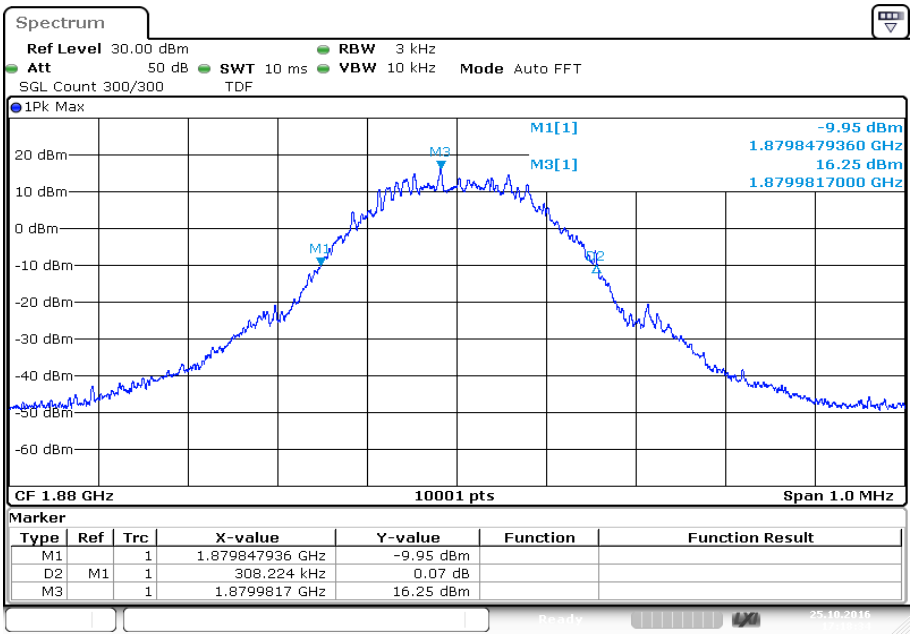
Date: 25.OCT.2016 17:07:51

Plot 3: Channel 661 (99% bandwidth)



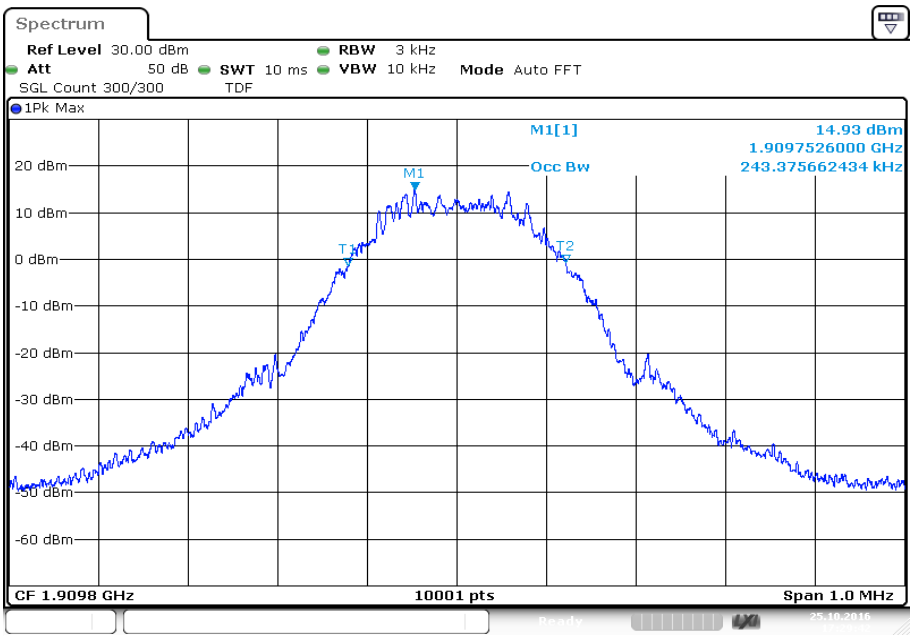
Date: 25.OCT.2016 17:18:27

Plot 4: Channel 661 (-26 dBc bandwidth)



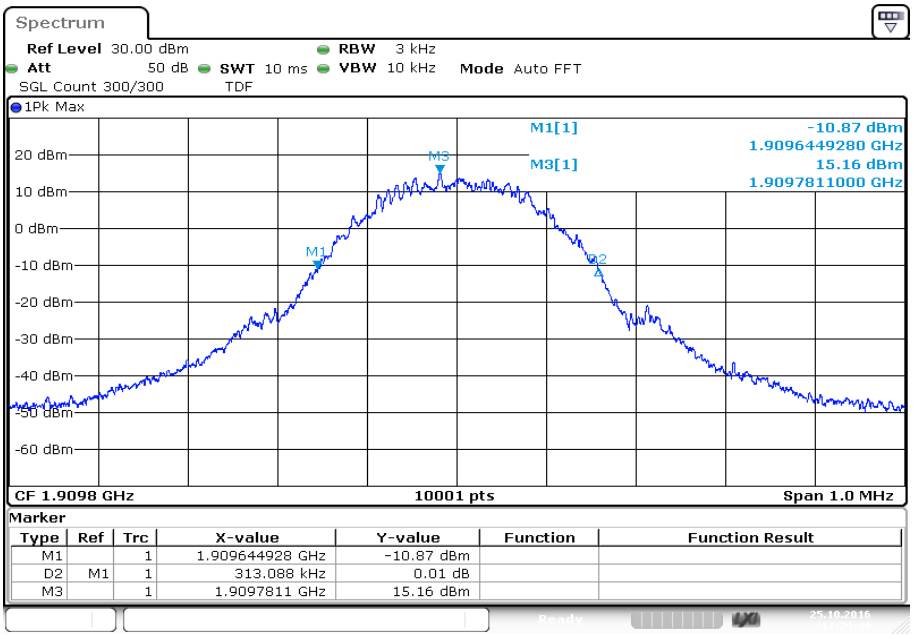
Date: 25.OCT.2016 17:18:34

Plot 5: Channel 810 (99% bandwidth)



Date: 25.OCT.2016 17:29:42

Plot 6: Channel 810 (-26 dBc bandwidth)



Date: 25.OCT.2016 17:29:50

12 Results UMTS band II

All UMTS-band measurements are done in WCDMA mode only.
The connection was established with the following setup: WCDMA CS-RMC, Max Power (All Bit up)

12.1 RF output power

Description:

This paragraph contains average power, peak output power and EIRP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Sample
Sweep time:	See plot
Video bandwidth:	1 MHz
Resolution bandwidth:	See chapter 6.2 – A & 6.4 – C
Span:	see chapter 8

Limits:

FCC	IC
CFR Part 24.232 CFR Part 2.1046	RSS 133
Nominal Peak Output Power	
+33.00 dBm In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

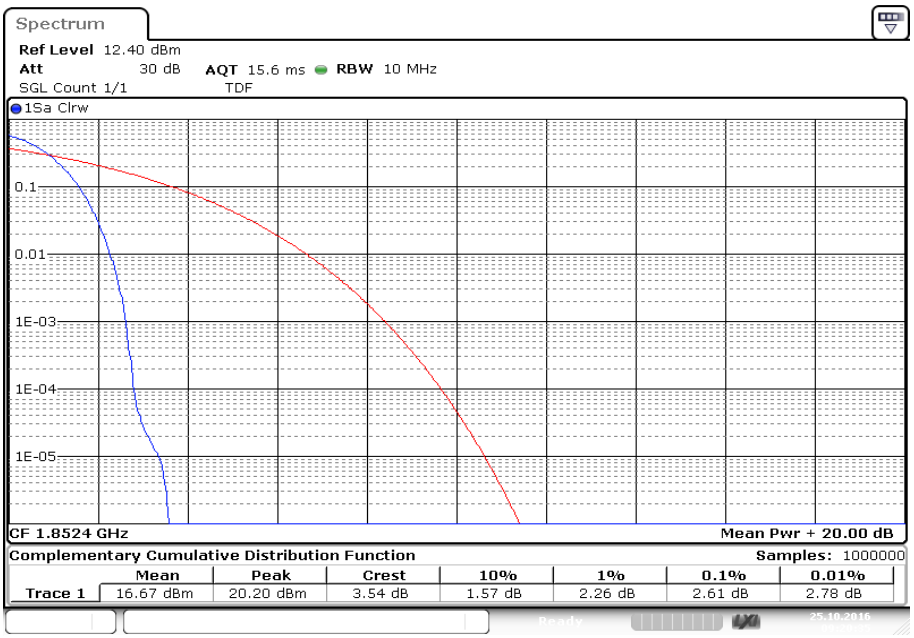
Results:

Output Power (conducted) WCDMA mode			
Frequency (MHz)	**Peak Output Power (dBm)**	**Average Output Power (dBm)**	**Peak to Average Ratio (dB) CCDF**
1852.4	20.2	16.7	2.61
1880.0	19.8	16.8	2.58
1907.6	19.6	16.8	2.52

Output Power (radiated) WCDMA mode	
Frequency (MHz)	**Average Output Power (dBm) - EIRP**
1852.4	20.5
1880.0	20.1
1907.6	19.9

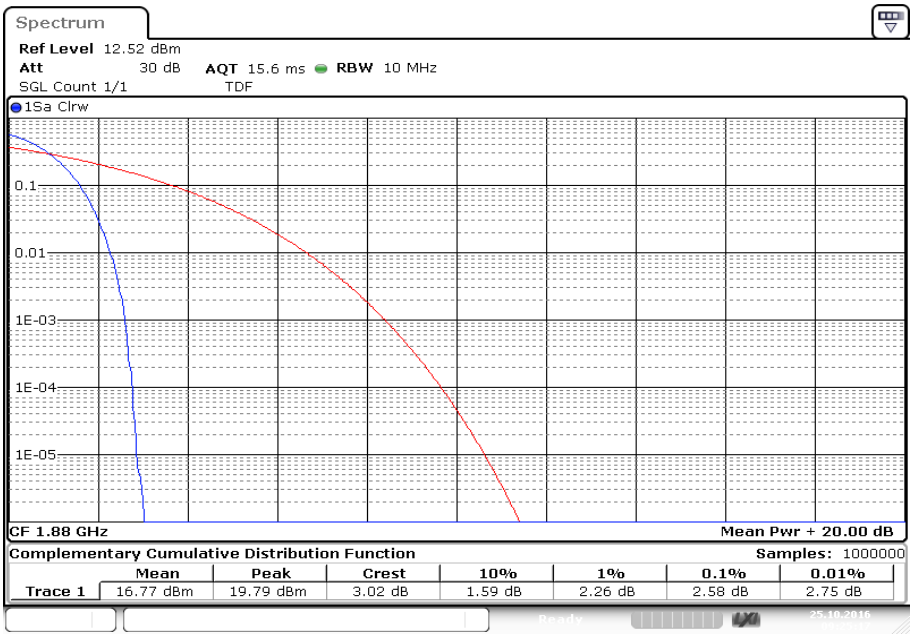
Plots:

Plot 1: CCDF, channel 9262



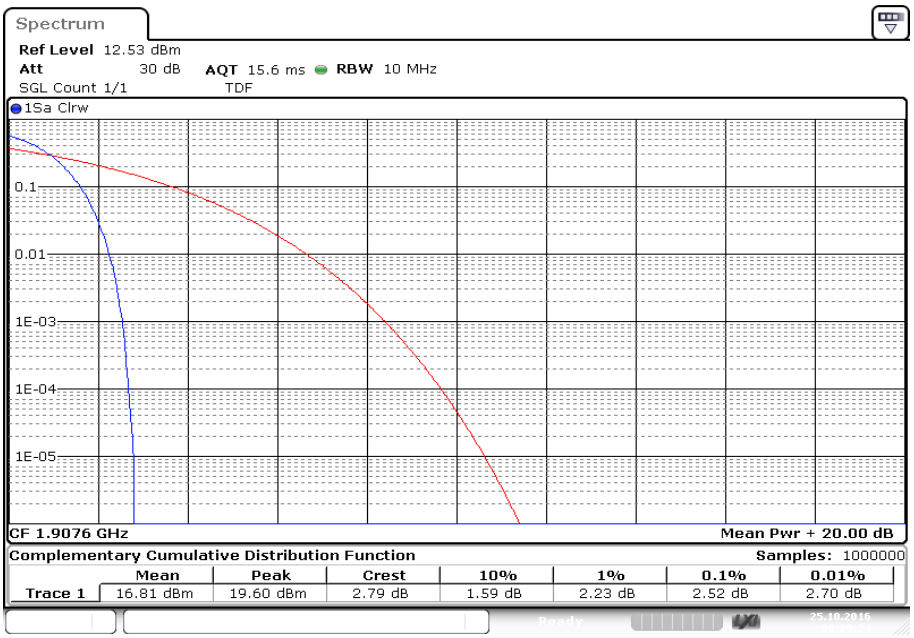
Date: 25.OCT.2016 09:20:36

Plot 2: CCDF, channel 9400



Date: 25.OCT.2016 09:25:17

Plot 3: CCDF, channel 9538



Date: 25.OCT.2016 09:29:24

12.2 Frequency stability

Description:

In order to measure the carrier frequency under normal conditions it is necessary to make measurements with the mobile station connected to a R&S CMU200 Wideband Radio Communication Tester.

1. Measure the carrier frequency at room temperature.
2. Subject the mobile station to overnight soak at -30 C.
3. With the mobile station powered with V_{nom} connected to the CMU200 on the center channel. Measure the carrier frequency. These measurements should be made within two minutes of powering up the mobile station to prevent significant self warming.
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 15 minutes at each temperature unpowered before making measurements.
5. Remeasure carrier frequency at room temperature with V_{nom}. Vary supply voltage to V_{min} and measure the carrier frequency then setup V_{max} and repeat the measurement.
6. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

Measurement:

Measurement parameters	
Detector:	Measured with CMW500
Sweep time:	
Video bandwidth:	
Resolution bandwidth:	
Span:	
Trace mode:	
Test setup:	See chapter 6.4 – D
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.	

Results:

AFC FREQ ERROR versus VOLTAGE

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
9	-12	-0.00000064	-0.0064
24	7	0.00000037	0.0037
32	-7	-0.00000037	-0.0037

AFC FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	-10	-0.00000053	-0.0053
-20	-9	-0.00000048	-0.0048
-10	-16	-0.00000085	-0.0085
± 0	-10	-0.00000053	-0.0053
10	-12	-0.00000064	-0.0064
20	4	0.00000021	0.0021
30	-6	-0.00000032	-0.0032
40	12	0.00000064	0.0064
50	17	0.00000090	0.0090
55	-10	-0.00000053	-0.0053

12.3 Spurious emissions radiated

Description:

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2014 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. Measurement made up to 25 GHz. The resolution bandwidth is set as outlined in Part 24.238. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the UMTS band II.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 sec.
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	100 MHz Steps
Trace mode:	Max Hold
Used equipment:	See chapter 6.1 – A & 6.2 – B & 6.3 – B
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results UMTS band II:

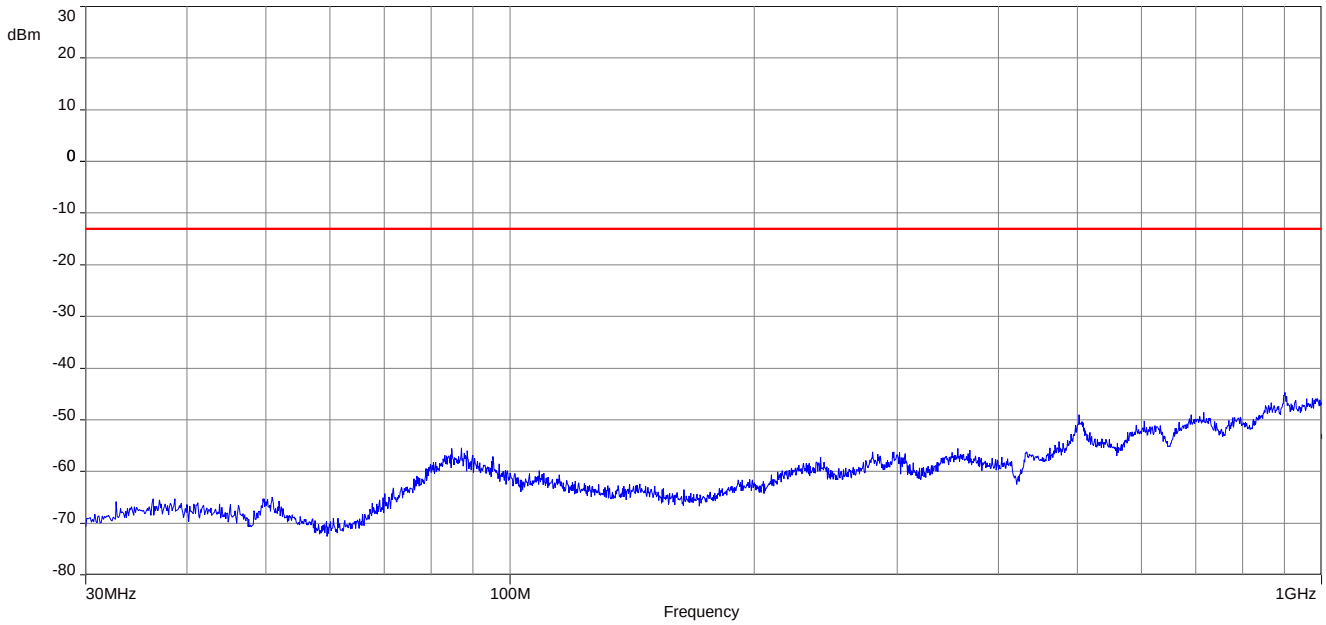
Radiated emissions measurements were made only at the center carrier frequencies of the band II (1880.0 MHz) to show the compliance with cabinet radiation limits.

Results:

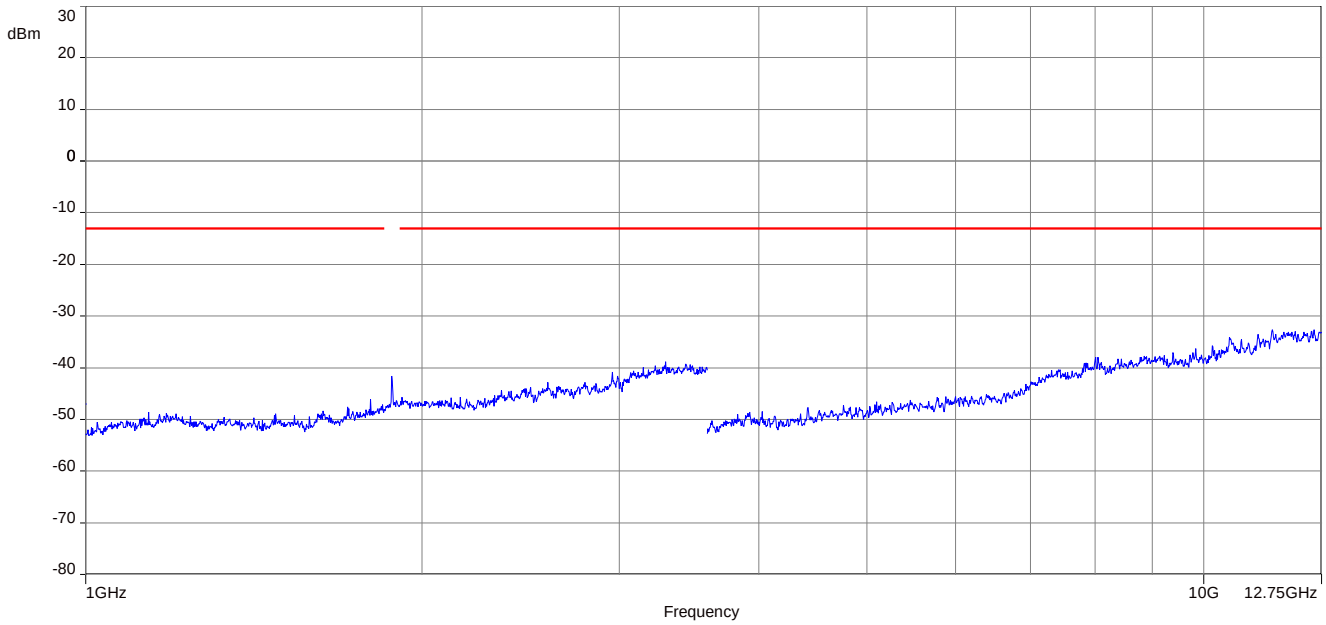
SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Ch. 9262 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 9400 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 9538 Freq. (MHz)	Level [dBm]
2	3704.8	-	2	3760.0	-	2	3815.2	-
3	5557.2	-	3	5640.0	-	3	5722.8	-
4	7409.6	-	4	7520.0	-	4	7630.4	-
5	9262.0	-	5	9400.0	-	5	9538.0	-
6	11114.4	-	6	11280.0	-	6	11445.6	-
7	12966.8	-	7	13160.0	-	7	13353.2	-
8	14819.2	-	8	15040.0	-	8	15260.8	-
9	16671.6	-	9	16920.0	-	9	17168.4	-
10	18524.0	-	10	18800.0	-	10	19076.0	-

Plots: plastic housing

Plot 1: Channel 9400 (30 MHz – 1 GHz)

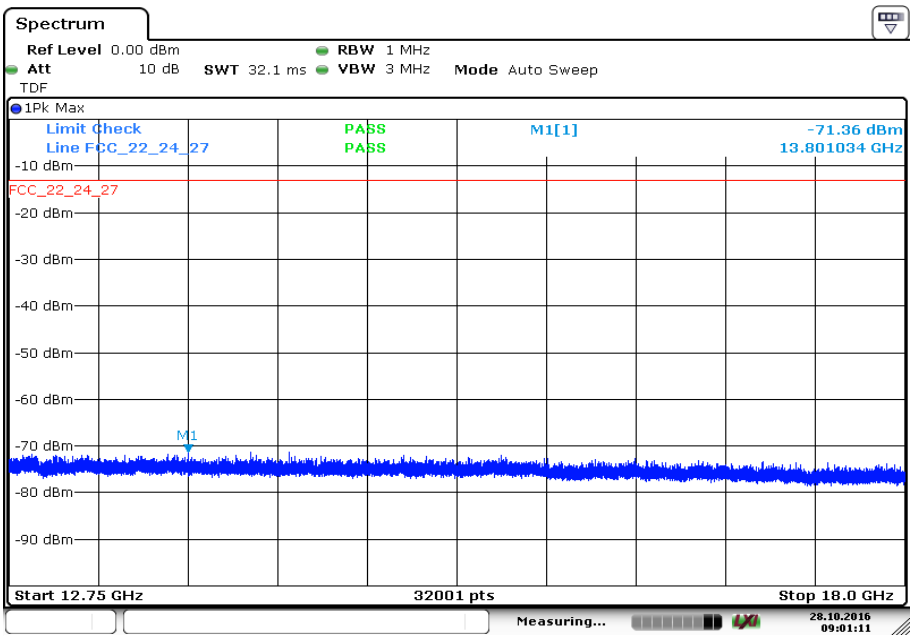


Plot 2: Channel 9400 (1 GHz – 12.75 GHz)



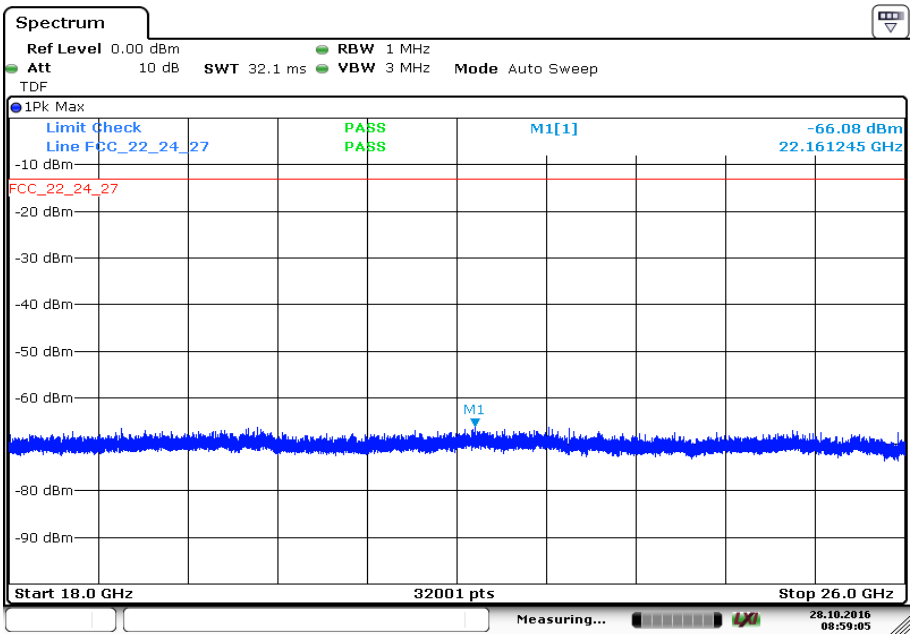
Carrier notched with 1.9 GHz rejection filter

Plot 3: Channel 9400 (12.75 GHz - 18 GHz)



Date: 28.OCT.2016 09:01:11

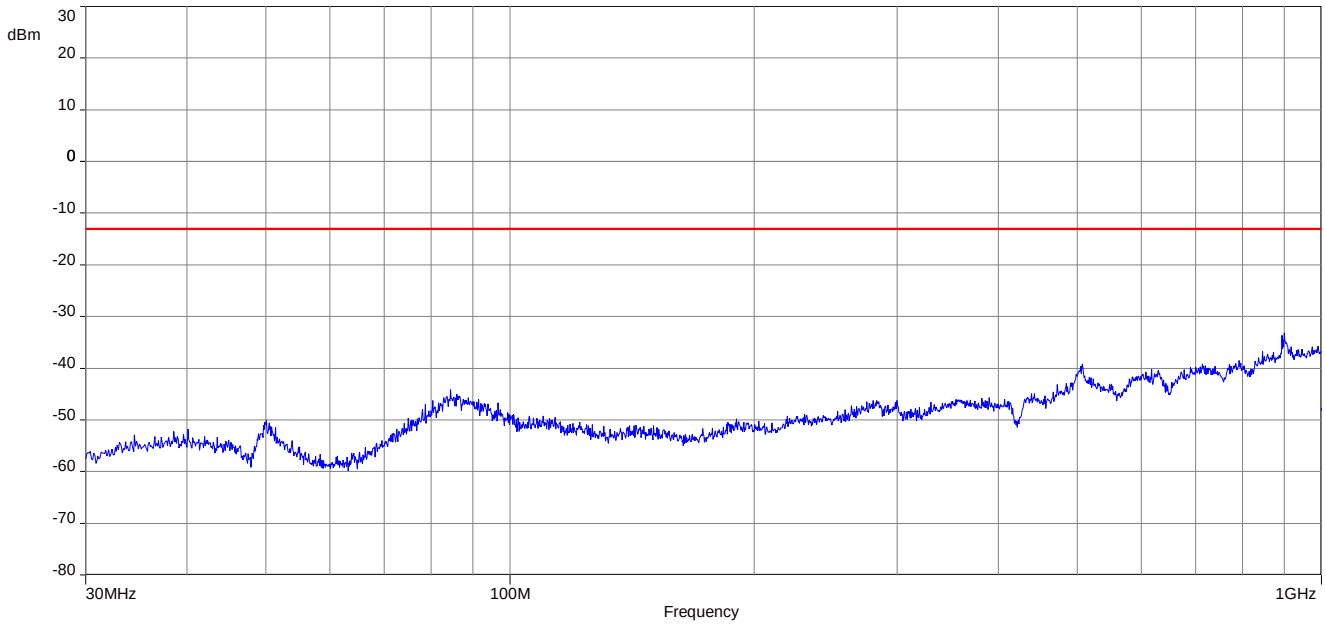
Plot 4: Channel 9400 (18 GHz - 26 GHz)



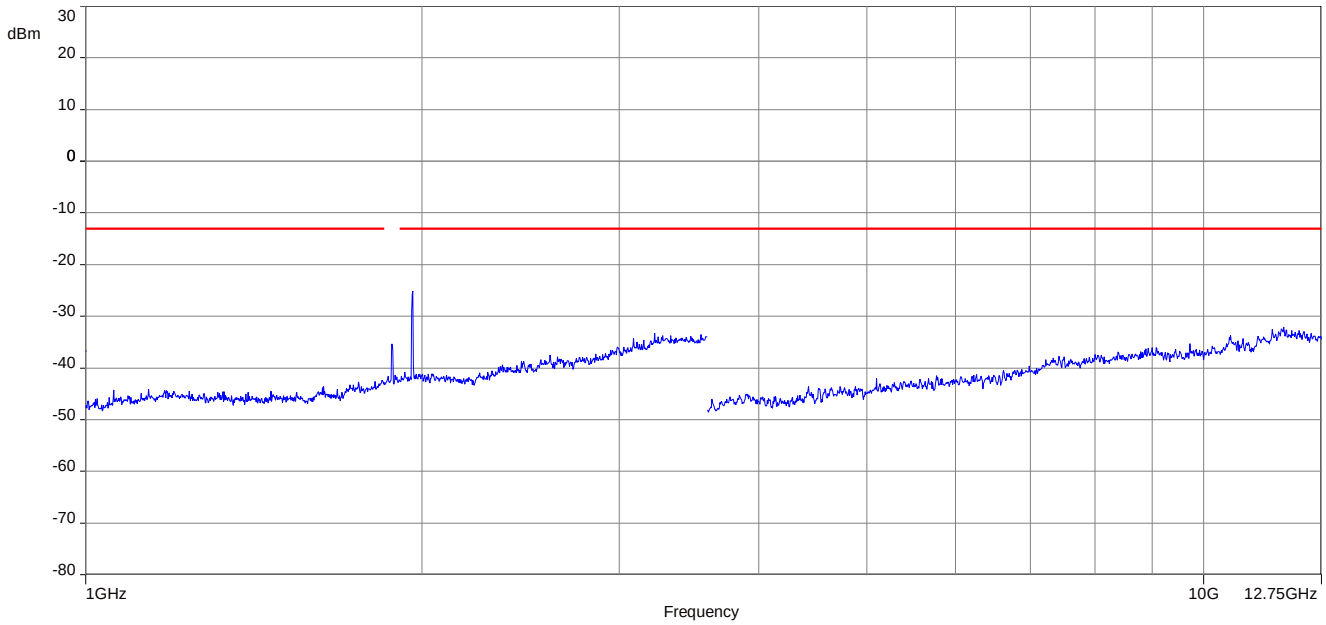
Date: 28.OCT.2016 08:59:05

Plots: metal housing

Plot 1: Channel 9400 (30 MHz – 1 GHz)

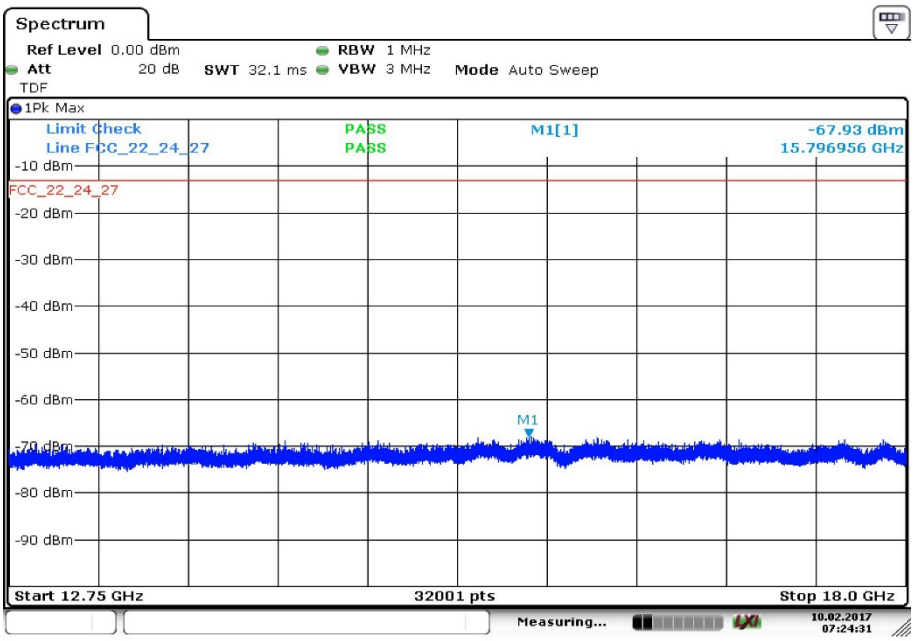


Plot 2: Channel 9400 (1 GHz – 12.75 GHz)



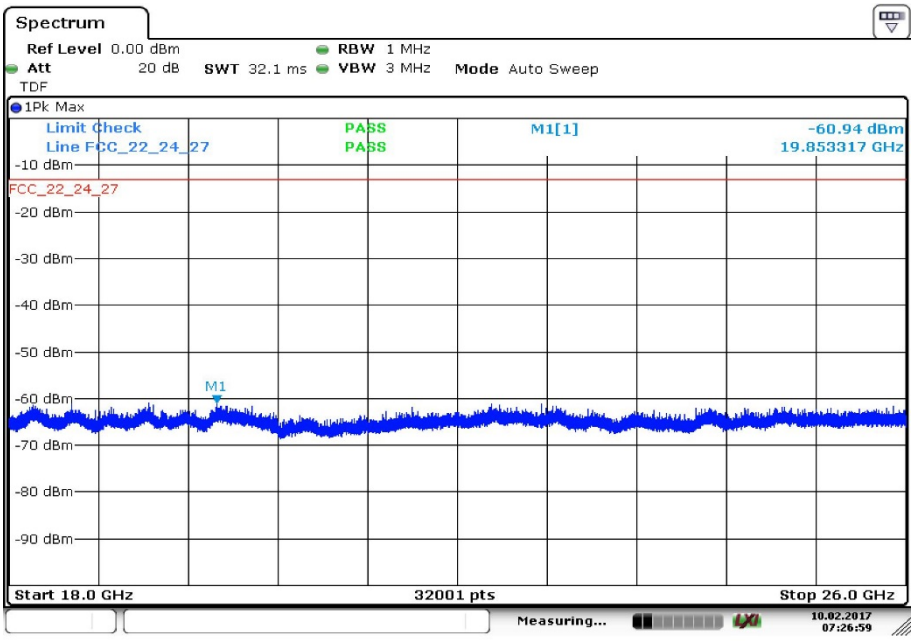
Carrier notched with 1.9 GHz rejection filter. Highest emission is the BS downlink signal.

Plot 3: Channel 9400 (12.75 GHz - 18 GHz)



Date: 10.FEB.2017 07:24:31

Plot 4: Channel 9400 (18 GHz - 26 GHz)



Date: 10.FEB.2017 07:26:59

12.4 Spurious emissions conducted

Description:

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 19.1 GHz, data taken from 10 MHz to 20 GHz.
2. Determine mobile station transmits frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

UMTS band II Transmitter Channel Frequency
9262 1852.4 MHz
9400 1880.0 MHz
9538 1907.6 MHz

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	10 MHz – 26 GHz
Trace mode:	Max Hold
Used equipment:	See chapter 6.4 – C
Measurement uncertainty:	See chapter 8

Limits:

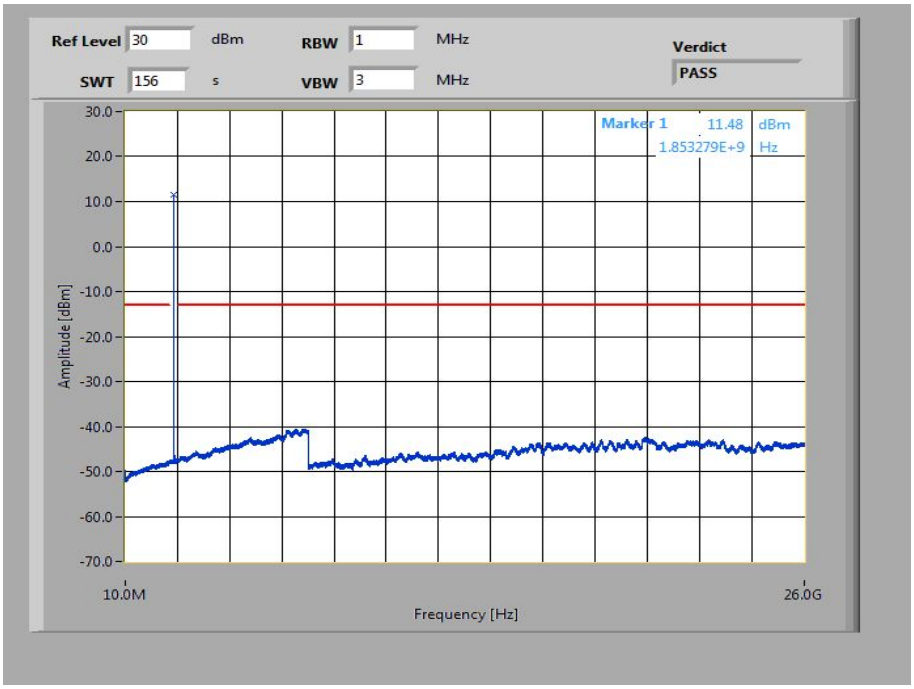
FCC	IC
CFR Part 24.238 CFR Part 2.1051	RSS 133
Spurious Emissions Conducted	
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results:

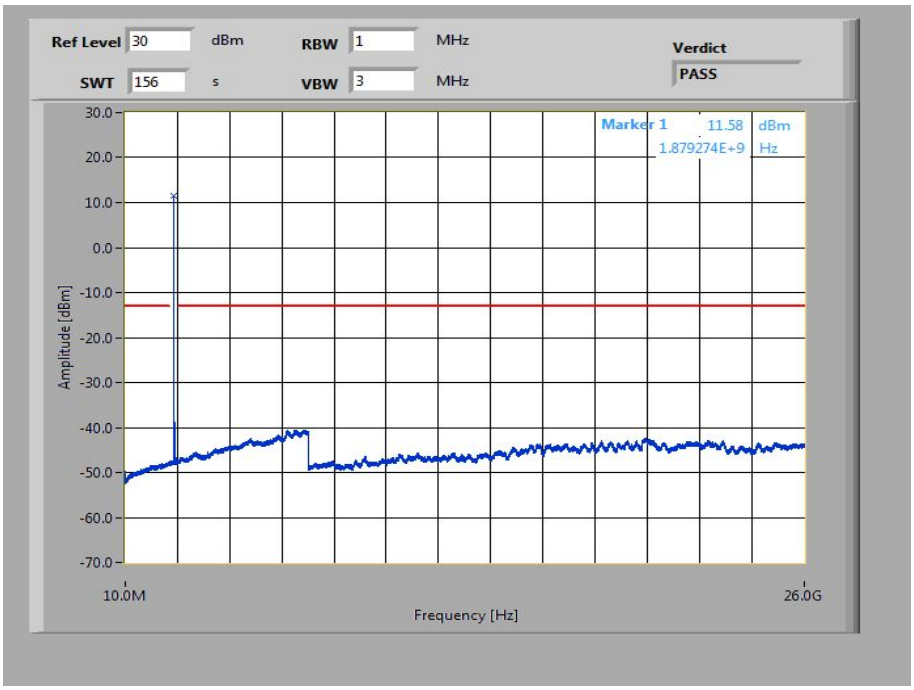
Spurious Emission Level (dBm)								
Harmonic	Ch. 9262 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 9400 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 9538 Freq. (MHz)	Level [dBm]
2	3704.8	-	2	3760.0	-	2	3815.2	-
3	5557.2	-	3	5640.0	-	3	5722.8	-
4	7409.6	-	4	7520.0	-	4	7630.4	-
5	9262.0	-	5	9400.0	-	5	9538.0	-
6	11114.4	-	6	11280.0	-	6	11445.6	-
7	12966.8	-	7	13160.0	-	7	13353.2	-
8	14819.2	-	8	15040.0	-	8	15260.8	-
9	16671.6	-	9	16920.0	-	9	17168.4	-
10	18524.0	-	10	18800.0	-	10	19076.0	-

Plots:

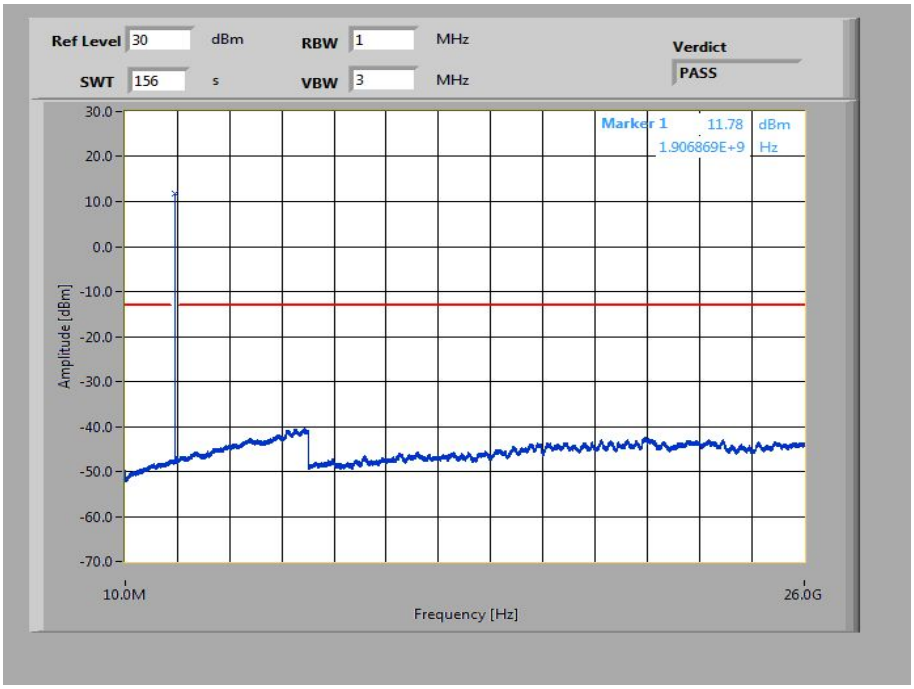
Plot 1: Channel 9262 (10 MHz - 26 GHz)



Plot 2: Channel 9400 (10 MHz - 26 GHz)



Plot 3: Channel 9538 (10 MHz - 26 GHz)



12.5 Block edge compliance

Description:

The spectrum at the band edges must comply with the spurious emissions limits.

Measurement:

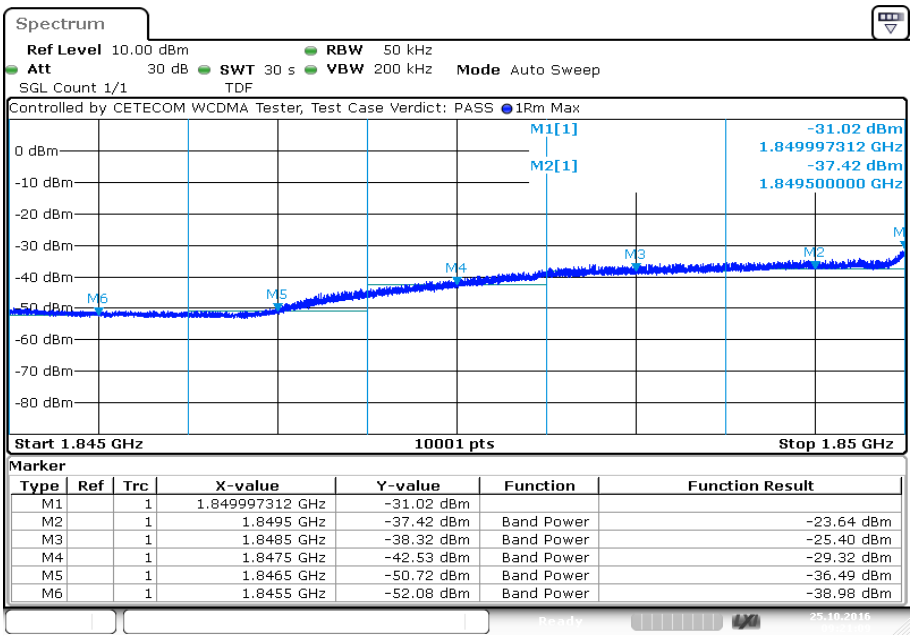
Measurement parameters	
Detector:	RMS
Sweep time:	30 sec.
Video bandwidth:	1% - 5% of the OBW
Resolution bandwidth:	≥ 3xRBW
Span:	5 MHz
Trace mode:	Max Hold
Used equipment:	See chapter 6.4 – C
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Plots:

Plot 1: Channel 9262



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.849997312 GHz	-31.02 dBm		
M2		1	1.8495 GHz	-37.42 dBm	Band Power	-23.64 dBm
M3		1	1.8485 GHz	-38.32 dBm	Band Power	-25.40 dBm
M4		1	1.8475 GHz	-42.53 dBm	Band Power	-29.32 dBm
M5		1	1.8465 GHz	-50.72 dBm	Band Power	-36.49 dBm
M6		1	1.8455 GHz	-52.08 dBm	Band Power	-38.98 dBm

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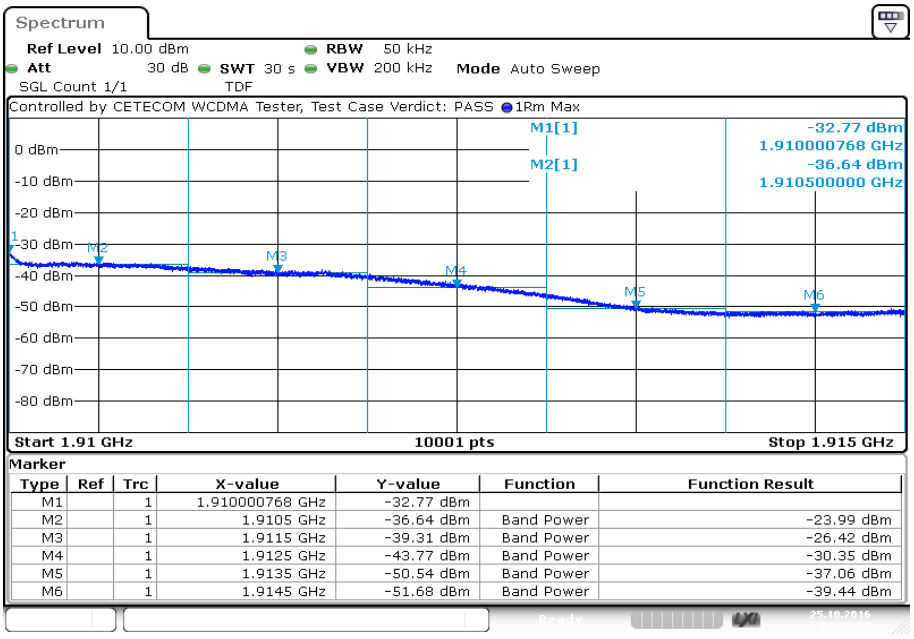
Plot 2: Channel 9538



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.910000768 GHz	-32.77 dBm		
M2		1	1.9105 GHz	-36.64 dBm	Band Power	-23.99 dBm
M3		1	1.9115 GHz	-39.31 dBm	Band Power	-26.42 dBm
M4		1	1.9125 GHz	-43.77 dBm	Band Power	-30.35 dBm
M5		1	1.9135 GHz	-50.54 dBm	Band Power	-37.06 dBm
M6		1	1.9145 GHz	-51.68 dBm	Band Power	-39.44 dBm

Date: 25.OCT.2016 09:29:57

12.6 Occupied bandwidth

Description:

Measurement of the occupied bandwidth of the transmitted signal.

Measurement:

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the UMTS band II frequency band. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Part 24.238 requires a measurement bandwidth of at least 1% of the occupied bandwidth. For ca. 4700 kHz, this equates to a resolution bandwidth of at least 50 kHz.

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	50 kHz
Video bandwidth:	≥ 3xRBW
Span:	2 x nominal BW
Trace mode:	Max Hold
Used equipment:	See chapter 6.4 – C
Measurement uncertainty:	See chapter 8

Limits:

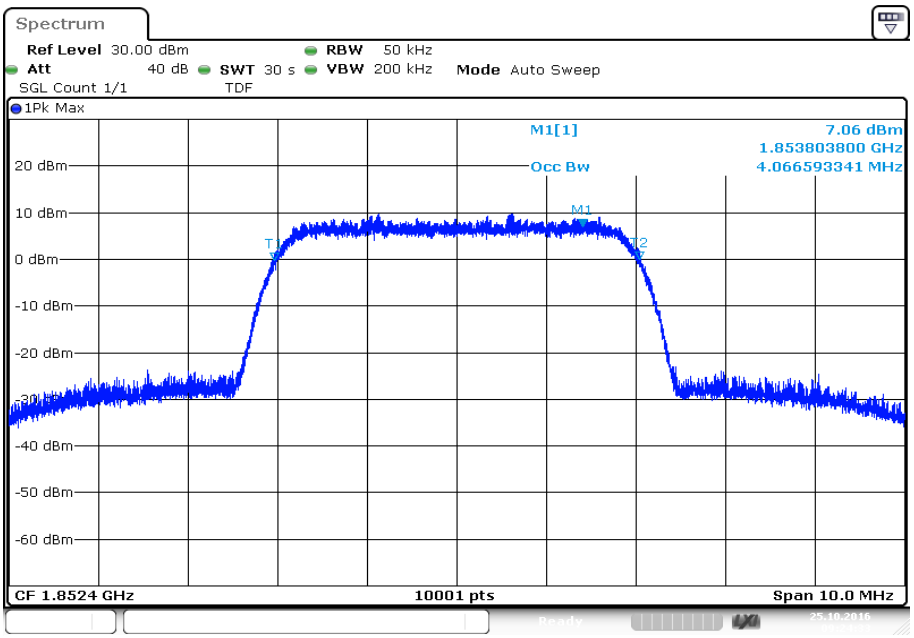
FCC	IC
CFR Part 24.238 CFR Part 2.1049	RSS 133
Occupied Bandwidth	
Spectrum must fall completely in the specified band	

Results:

Occupied Bandwidth		
Frequency (MHz)	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
1852.4	4067	4622
1880.0	4067	4617
1907.6	4063	4616

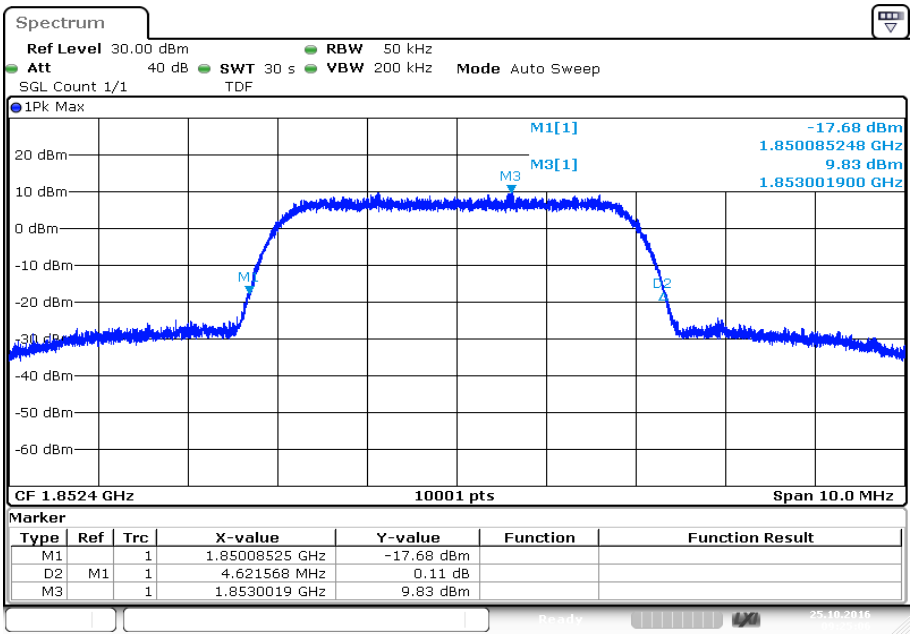
Plots:

Plot 1: Channel 9262 (99% - OBW)



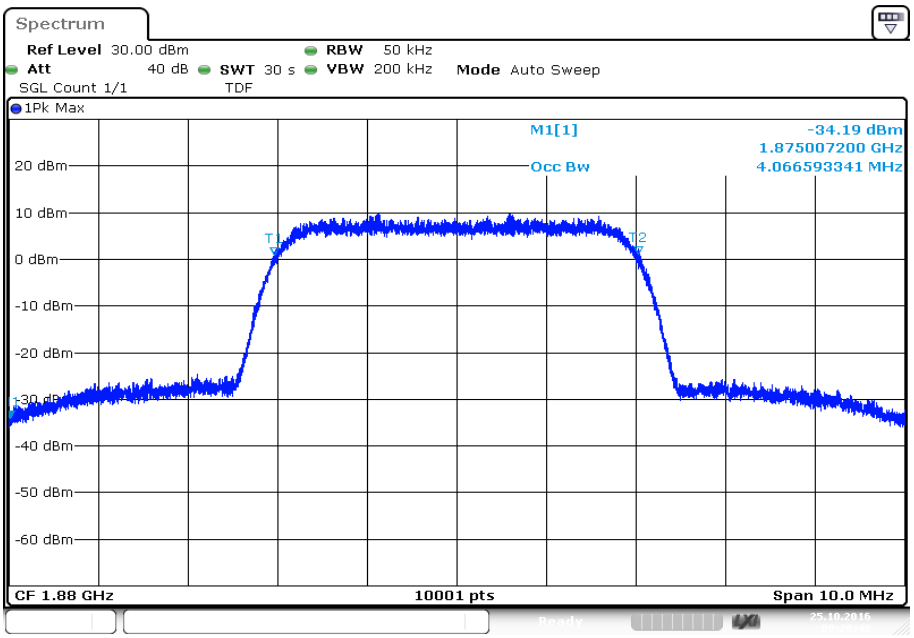
Date: 25.OCT.2016 09:24:33

Plot 2: Channel 9262 (-26 dBc BW)



Date: 25.OCT.2016 09:25:06

Plot 3: Channel 9400 (99% - OBW)



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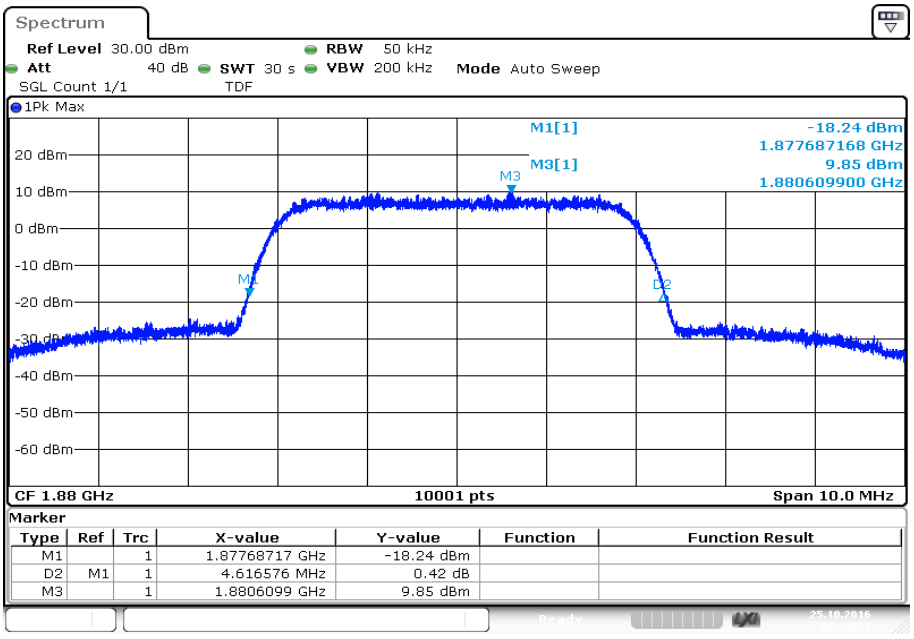
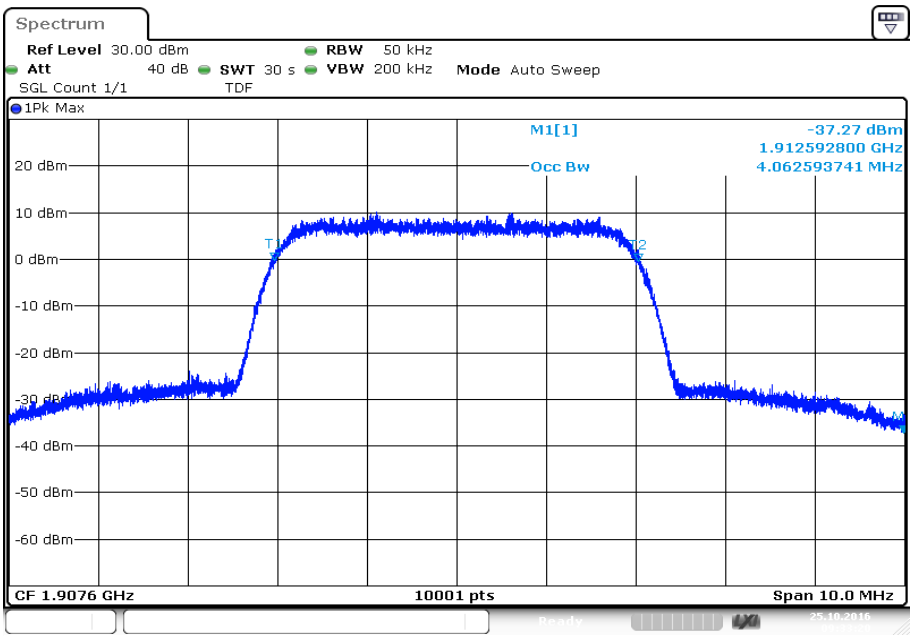
Plot 4: Channel 9400 (-26 dBc BW)



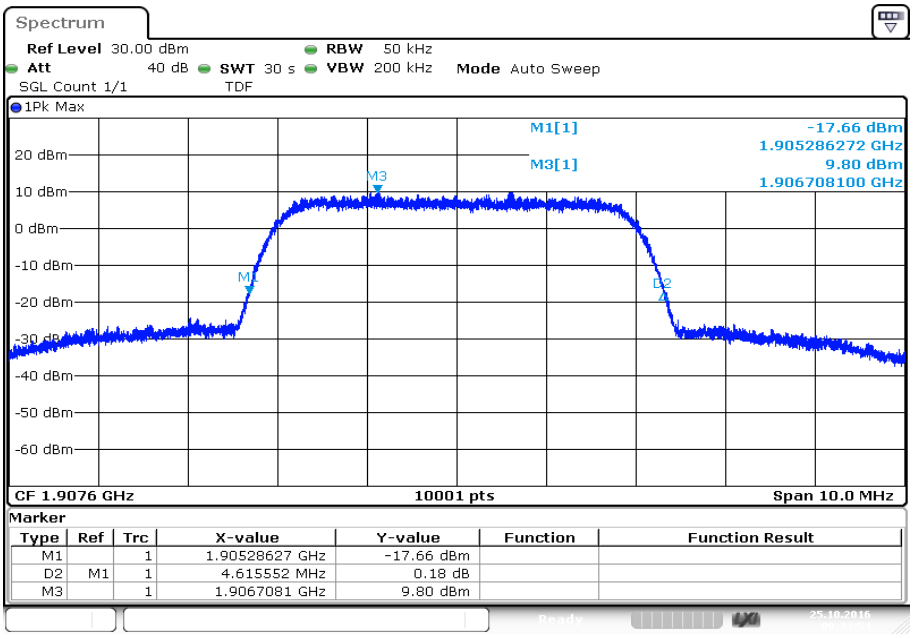
Date: 25.OCT.2016 09:29:13

Plot 5: Channel 9538 (99% - OBW)



Date: 25.OCT.2016 09:33:21

Plot 6: Channel 9538 (-26 dBc BW)



Date: 25.OCT.2016 09:33:54

13 Results UMTS band IV

All UMTS-band measurements are done in WCDMA mode only.
The connection was established with the following setup: WCDMA CS-RMC, Max Power (All Bit up)

13.1 RF output power

Description:

This paragraph contains average power, peak output power and EIRP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Sample
AQT:	See plot
Resolution bandwidth:	1 MHz
Used equipment:	See chapter 6.1 – A & 6.4 – A & 6.3 – B
Measurement uncertainty:	see chapter 8

Limits:

FCC	IC
CFR Part 27.50 CFR Part 2.1046	RSS 139
Nominal Peak Output Power	
+30.00 dBm In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

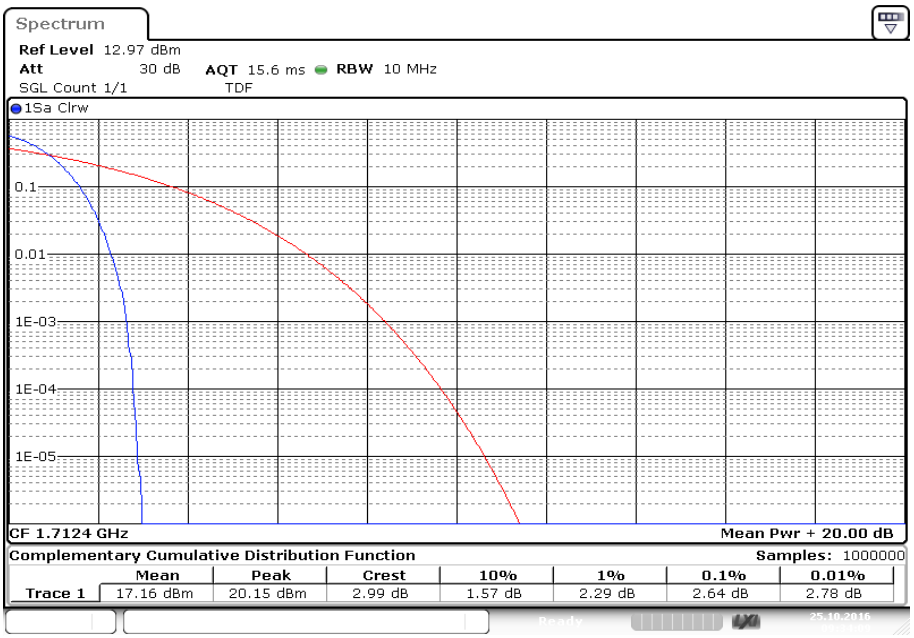
Results:

Output Power (conducted) WCDMA mode			
Frequency (MHz)	**Peak Output Power (dBm)**	**Average Output Power (dBm)**	**Peak to Average Ratio (dB) CCDF**
1712.4	20.2	17.2	2.64
1732.4	19.7	16.8	2:64
1752.6	19.6	16.6	2.64

Output Power (radiated) WCDMA mode	
Frequency (MHz)	**Average Output Power (dBm) - EIRP**
1712.4	21.5
1732.4	22.2
1752.6	22.1

Plots:

Plot 1: CCDF, channel 1312



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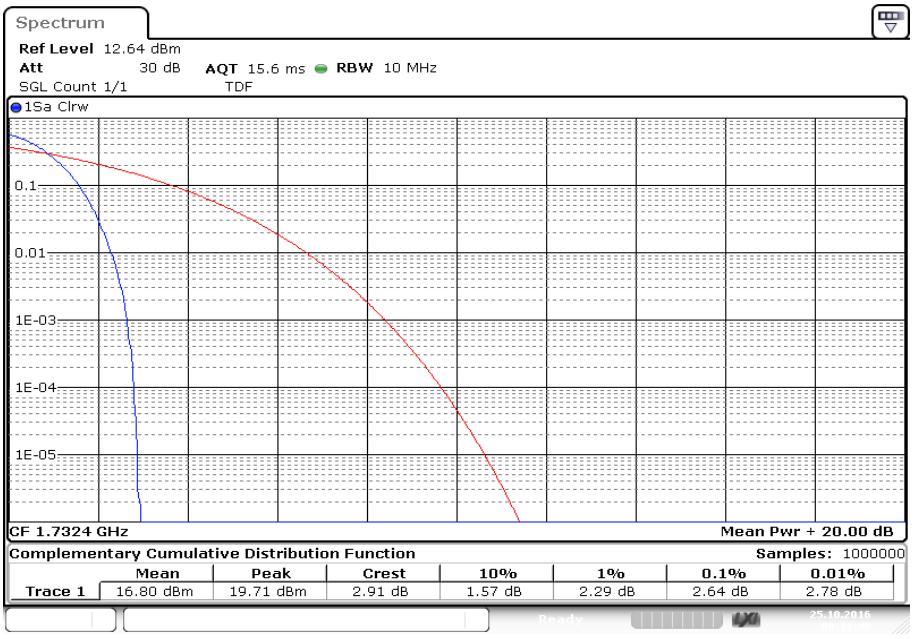
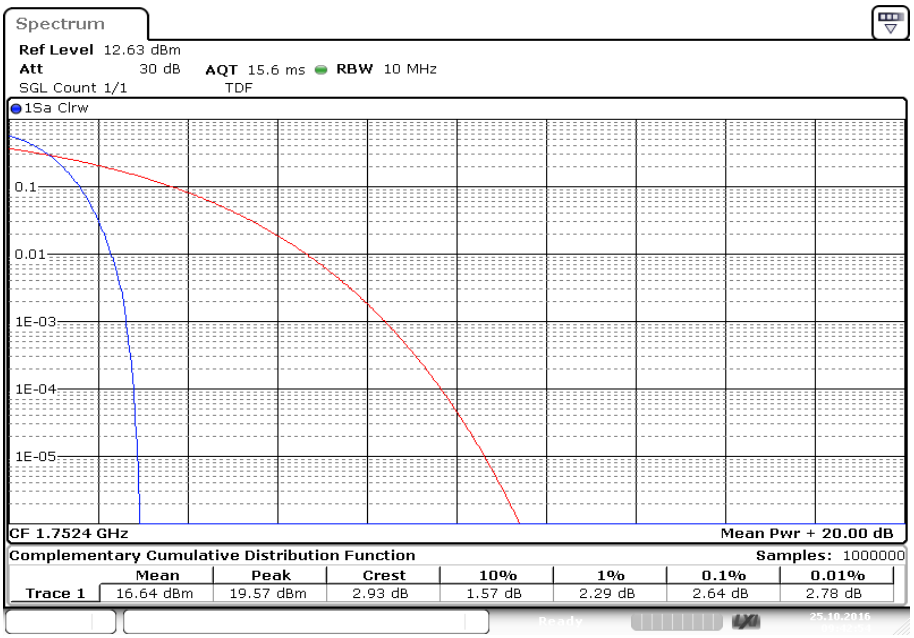
Plot 2: CCDF, channel 1412



Date: 25.OCT.2016 09:38:48

Plot 3: CCDF, channel 1513



Date: 25.OCT.2016 09:42:54

13.2 Frequency stability

Description:

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the mobile station in a “call mode”. This is accomplished with the use of a R&S CMU200 DIGITAL RADIOCOMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the mobile station to overnight soak at -30 C.
3. With the mobile station, powered with V_{nom}, connected to the CMU200 and in a simulated call on channel 1412 (centre channel), measure the carrier frequency. These measurements should be made within two minutes of powering up the mobile station, to prevent significant self warming.
4. Repeat the above measurements at 10°C increments from -30°C to +60°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with V_{nom}. Vary supply voltage from V_{min} to V_{max}, in 0.1 Volt steps remeasuring carrier frequency at each voltage. Pause at V_{nom} for 1.5 hours unpowered, to allow any self heating to stabilize, before continuing.
6. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

Measurement:

Measurement parameters	
Detector:	Measured with CMW500
Sweep time:	
Video bandwidth:	
Resolution bandwidth:	
Span:	
Trace mode:	
Test setup:	See chapter 6.4 – D
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
CFR Part 27.54 CFR Part 2.1055	RSS 139
Frequency Stability	
± 2.5 ppm	

Results:

AFC FREQ ERROR versus VOLTAGE

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
9	4	0.00000023	0.0023
24	-1	-0.00000006	-0.0006
32	-7	-0.00000040	-0.0040

AFC FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	7	0.00000040	0.0040
-20	-10	-0.00000058	-0.0058
-10	-28	-0.00000162	-0.0162
± 0	8	0.00000046	0.0046
10	-6	-0.00000035	-0.0035
20	-4	-0.00000023	-0.0023
30	-9	-0.00000052	-0.0052
40	18	0.00000104	0.0104
50	7	0.00000040	0.0040
55	-23	-0.00000133	-0.0133

13.3 Spurious emissions radiated

Description:

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2014 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1755 MHz. Measurement made up to 25 GHz. The resolution bandwidth is set as outlined in Part 27.53. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the UMTS band IV.

The final open field emission (here 10m semi-anechoic chamber listed by FCC) test procedure is as follows:

a) The test item was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna.
b) The antenna output was terminated in a 50 ohm load (if possible).
c) A double ridged wave guide antenna was placed on an adjustable height antenna mast 3 meters from the test item for emission measurements.
d) Detected emissions were maximized at each frequency by rotating the test item and adjusting the receive antenna height and polarization. The maximum meter reading was recorded. The radiated emission measurements of the harmonics of the transmit frequency through the 10th harmonic were measured with peak detector and 1 MHz bandwidth. If the harmonic could not be detected above the noise floor, the ambient level was recorded. The equivalent power into a dipole antenna was calculated from the field intensity levels measured at 3 meters.
e) Now each detected emissions were substituted by the substitution method, in accordance with the TIA/EIA 603.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 sec.
Video bandwidth:	Below 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Resolution bandwidth:	Below 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Span:	100 MHz Steps
Trace mode:	Max Hold
Used equipment:	See chapter 6.1 – A & 6.2 – A / B & 6.3 – B
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
CFR Part 27.53(g) CFR Part 2.1053	RSS 139
Spurious Emissions Radiated	
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results:

Radiated emissions measurements were made only at the upper, center, and lower carrier frequencies of the UMTS band IV (1712.4 MHz, 1732.4 MHz and 1752.6 MHz). It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the UMTS band IV into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

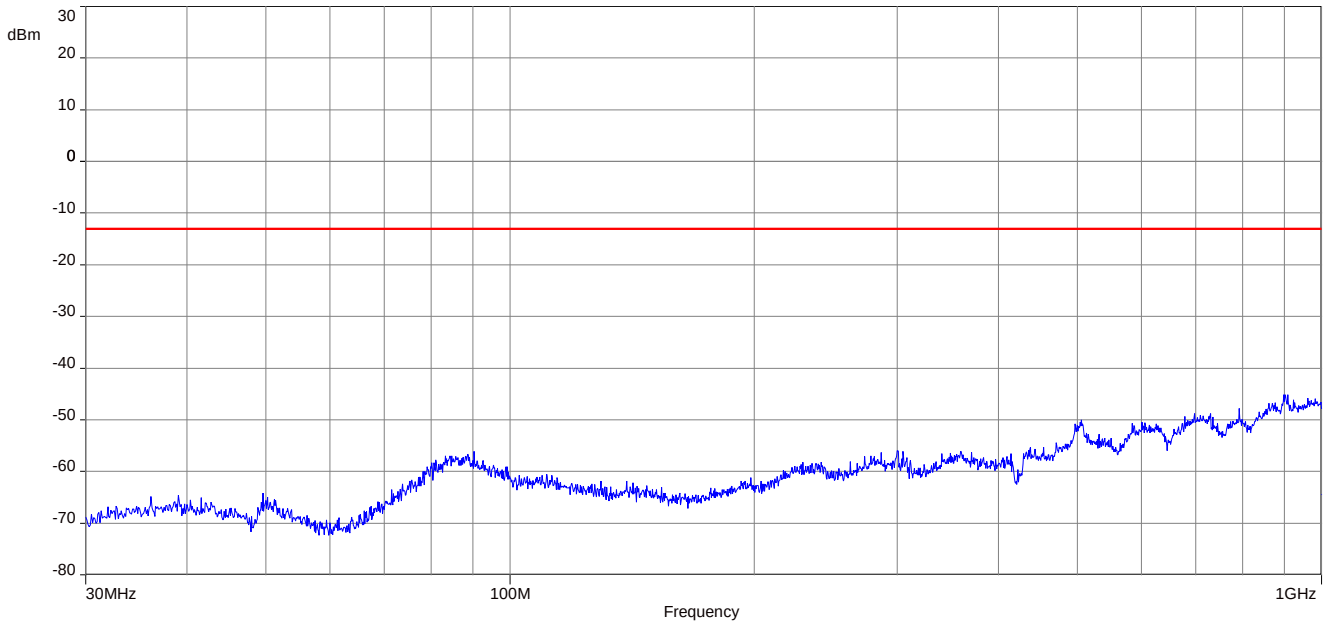
The final open field radiated levels are presented on the next pages.
All measurements were done in horizontal and vertical polarization; the plots show the worst case.
The plots show only the middle channel. If spurious were detected, the lowest and highest channel were checked too. The found values are stated in the table below.

As can be seen from this data, the emissions from the test item were within the specification limit.

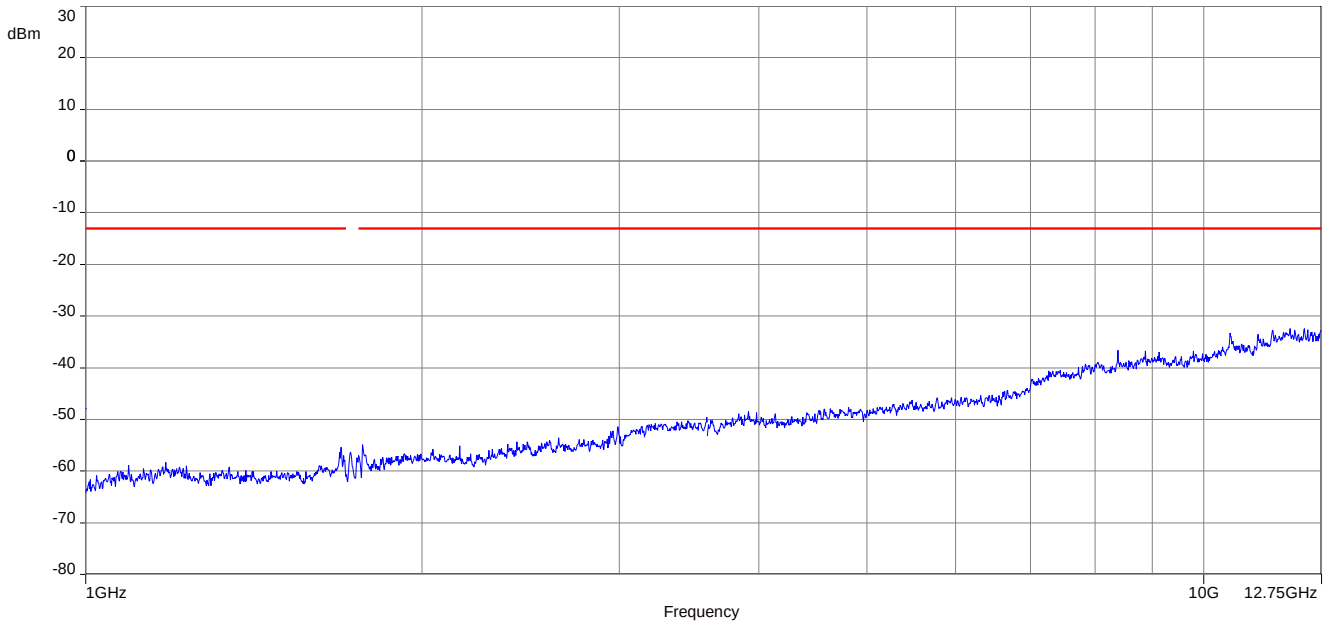
Spurious Emission Level (dBm)								
Harmonic	Ch. 1312 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 1412 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 1513 Freq. (MHz)	Level [dBm]
2	3424.8	-	2	3464.8	-	2	3505.2	-
3	5137.2	-	3	5197.2	-	3	5257.8	-
4	6849.6	-	4	6929.6	-	4	7010.4	-
5	8562.0	-	5	8662.0	-	5	8763.0	-
6	10274.4	-	6	10394.4	-	6	10515.6	-
7	11986.8	-	7	12126.8	-	7	12268.2	-
8	13699.2	-	8	13859.2	-	8	14020.8	-
9	15411.6	-	9	15591.6	-	9	15773.4	-
10	17124.0	-	10	17324.0	-	10	17526.0	-

Plots: plastic housing

Plot 1: Channel 1412 (30 MHz – 1 GHz)

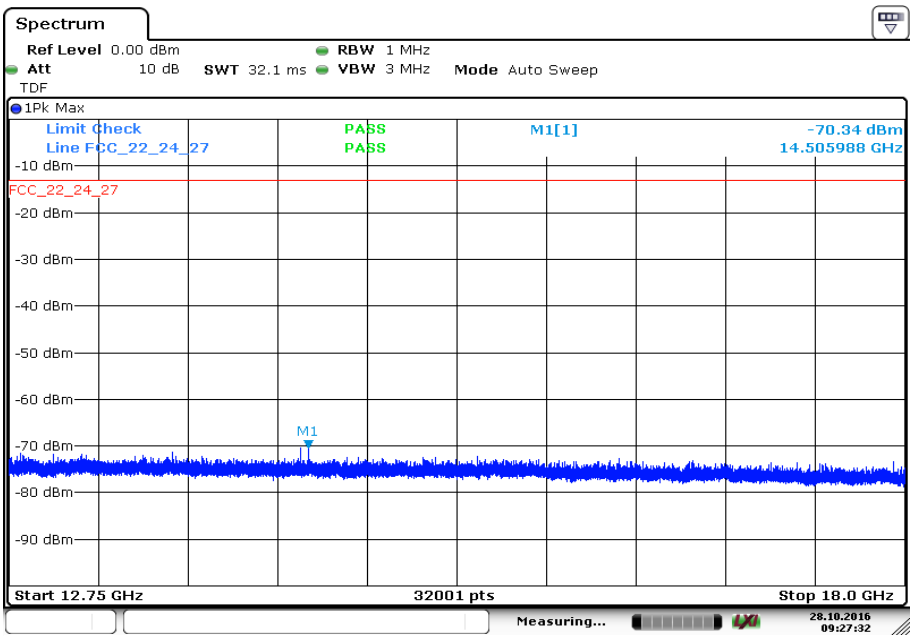


Plot 2: Channel 1412 (1 GHz – 12.75 GHz)



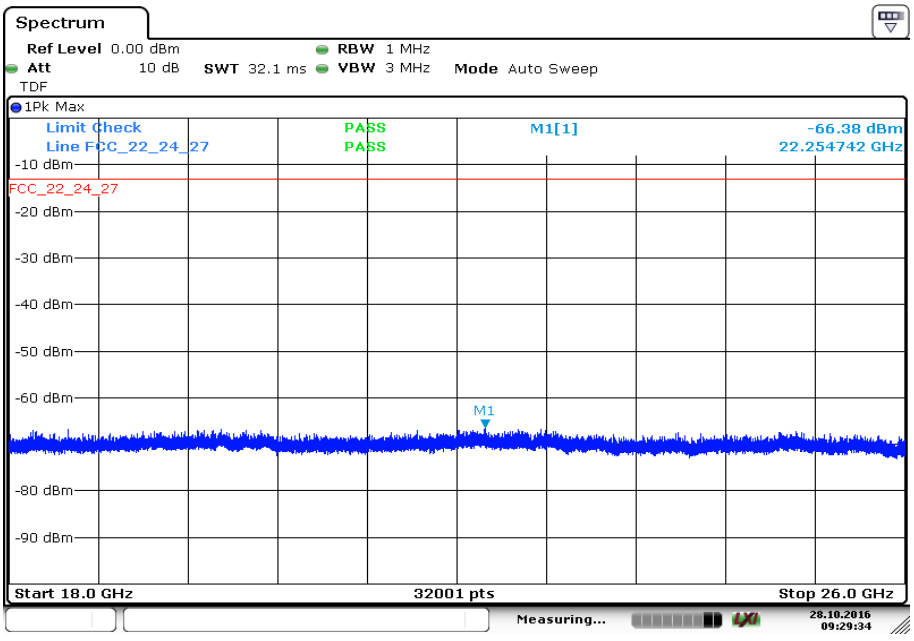
The carrier signal is notched with a band notch filter.

Plot 3: Channel 1412 (12.75 GHz – 18 GHz)



Date: 28.OCT.2016 09:27:32

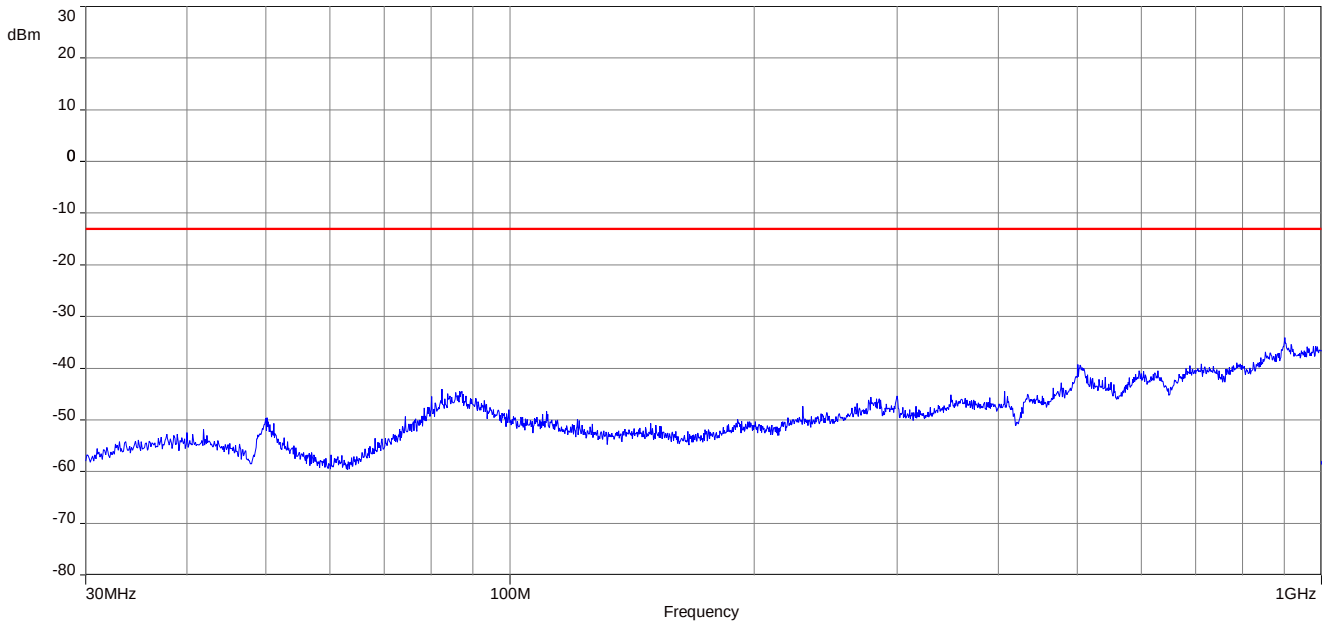
Plot 4: Channel 1412 (18 GHz – 26 GHz)



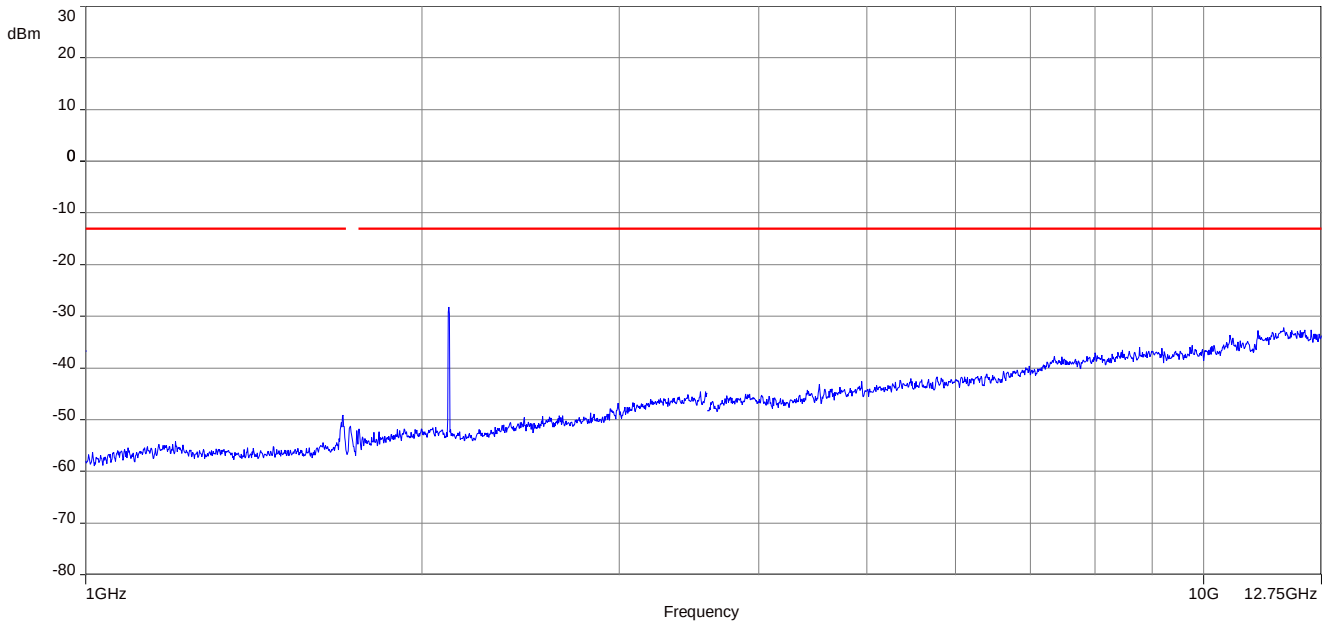
Date: 28.OCT.2016 09:29:34

Plots: metal housing

Plot 1 Channel 1412 (30 MHz – 1 GHz)

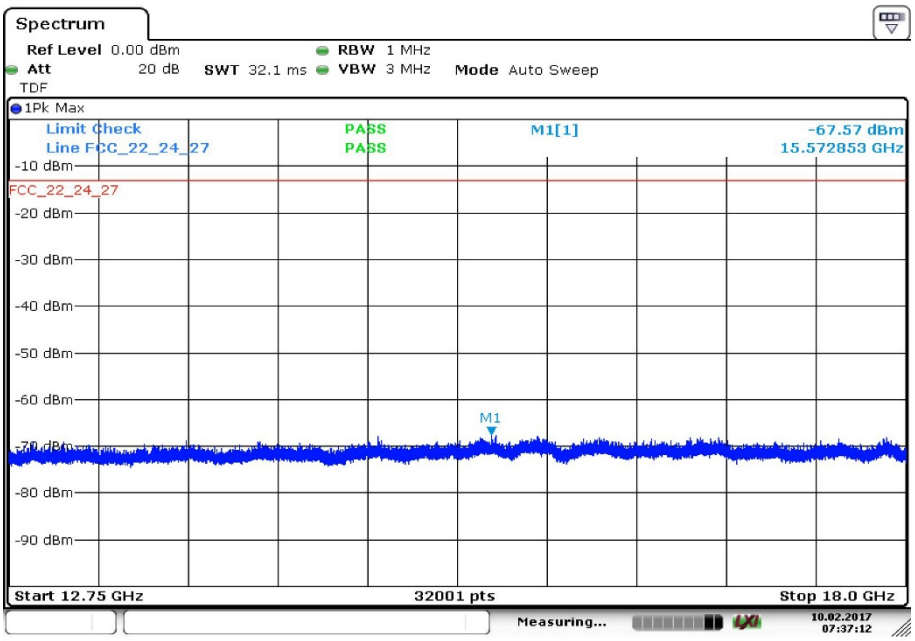


Plot 2: Channel 1412 (1 GHz – 12.75 GHz)



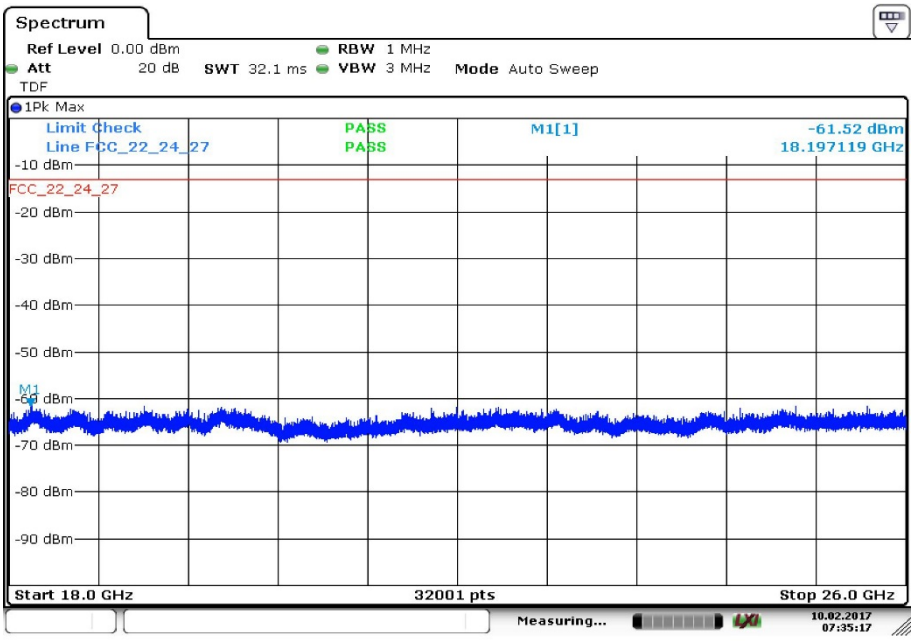
The carrier signal is notched with a band notch filter. Highest emission is the BS downlink signal.

Plot 3: Channel 1412 (12.75 GHz – 18 GHz)



Date: 10.FEB.2017 07:37:11

Plot 4: Channel 1412 (18 GHz – 26 GHz)



Date: 10.FEB.2017 07:35:17

13.4 Spurious emissions conducted

Description:

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 17.6 GHz, data taken from 10 MHz to 25 GHz.
2. Determine mobile station transmits frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

UMTS band IV Transmitter Channel Frequency
1312 1712.4 MHz
1412 1732.4 MHz
1513 1752.6 MHz

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	Pre-measurement with 1 MHz On spurious detection re-measurement below 1 GHz with 100 kHz Above 1 GHz with 1 MHz
Resolution bandwidth:	Pre-measurement with 1 MHz On spurious detection re-measurement below 1 GHz with 100 kHz Above 1 GHz with 1 MHz
Span:	10 MHz – 26 GHz
Trace mode:	Max Hold
Used equipment:	See chapter 6.4 – C
Measurement uncertainty:	See chapter 8

Limits:

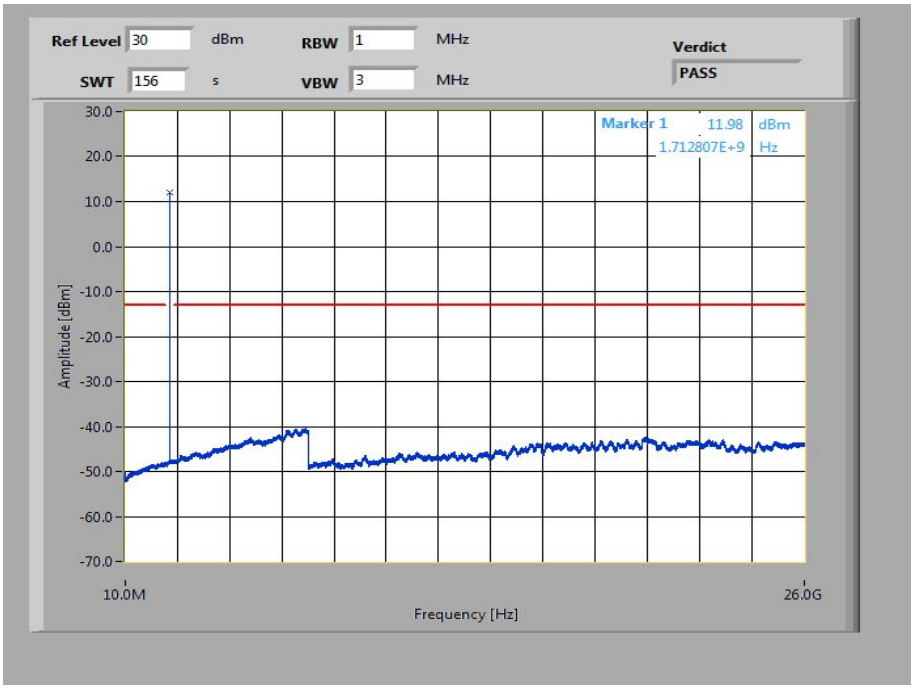
FCC	IC
CFR Part 27.53(g) CFR Part 2.1053	RSS 139
Spurious Emissions Conducted	
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results:

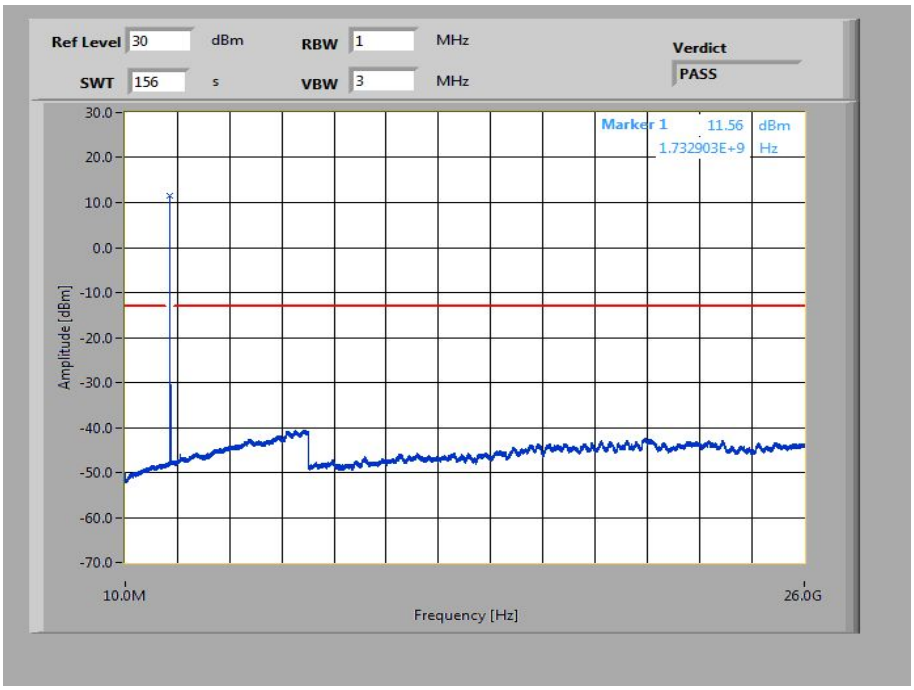
SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Ch. 1312 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 1412 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 1513 Freq. (MHz)	Level [dBm]
2	3424.8	-	2	3464.8	-	2	3505.2	-
3	5137.2	-	3	5197.2	-	3	5257.8	-
4	6849.6	-	4	6929.6	-	4	7010.4	-
5	8562.0	-	5	8662.0	-	5	8763.0	-
6	10274.4	-	6	10394.4	-	6	10515.6	-
7	11986.8	-	7	12126.8	-	7	12268.2	-
8	13699.2	-	8	13859.2	-	8	14020.8	-
9	15411.6	-	9	15591.6	-	9	15773.4	-
10	17124.0	-	10	17324.0	-	10	17526.0	-

Plots:

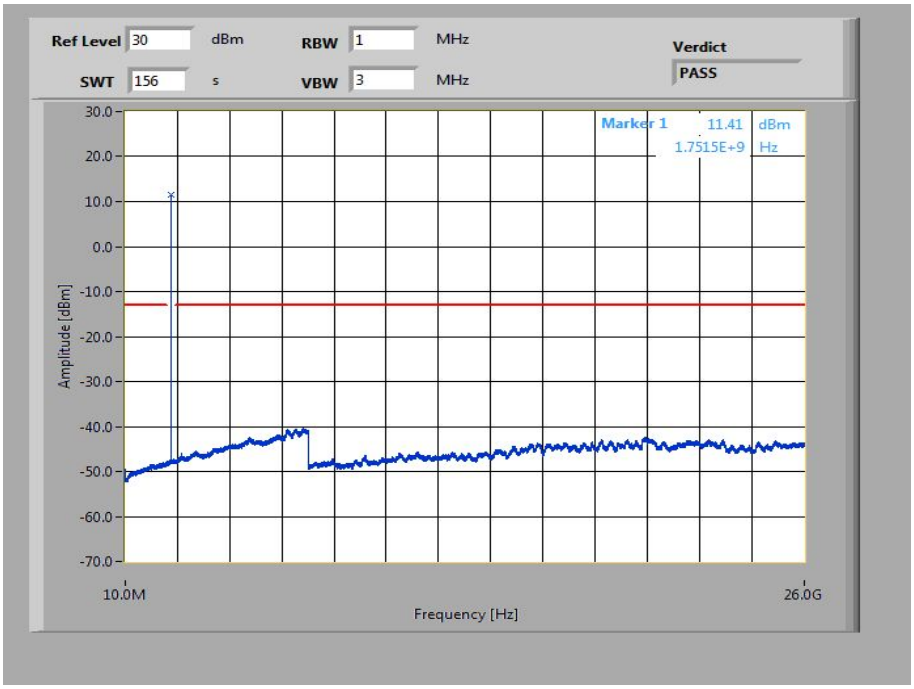
Plot 1: Channel 1312 (10 MHz - 26 GHz)



Plot 2: Channel 1412 (10 MHz - 26 GHz)



Plot 3: Channel 1513 (10 MHz - 26 GHz)



13.5 Block edge compliance

Description:

The spectrum at the band edges must comply with the spurious emissions limits.

Measurement:

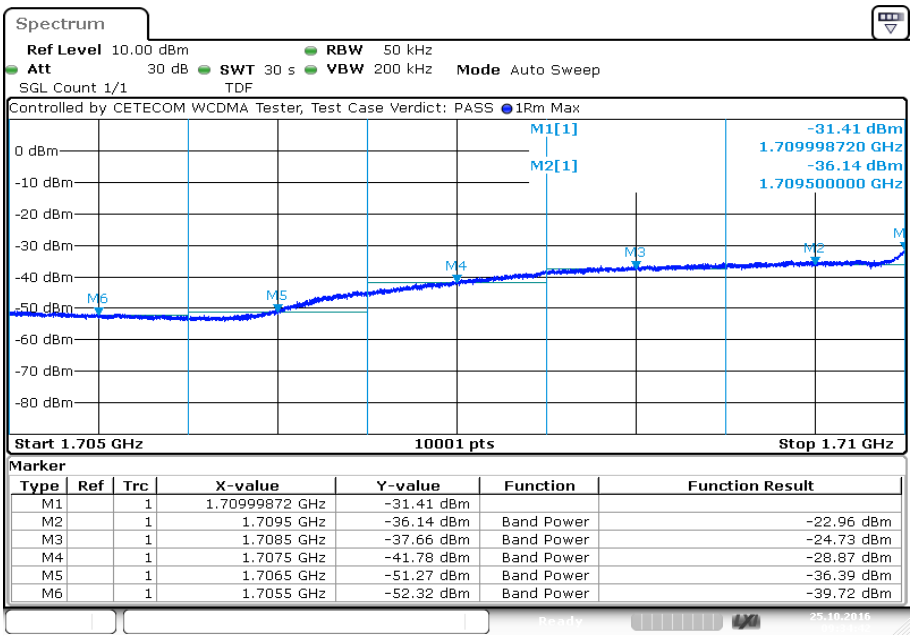
Measurement parameters	
Detector:	RMS
Sweep time:	30 sec.
Video bandwidth:	200 kHz
Resolution bandwidth:	50 kHz
Span:	5 MHz
Trace mode:	Max Hold
Used equipment:	See chapter 6.4 – C
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
CFR Part 27.53(g) CFR Part 2.1053	RSS 139
Block Edge Compliance	
-13 dBm	

Plots:

Plot 1: Channel 1312

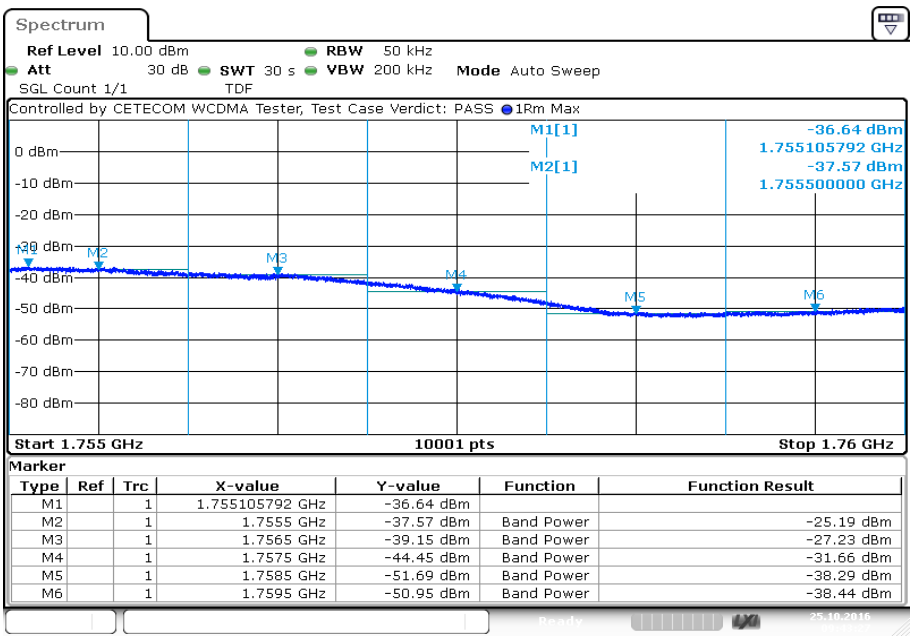


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.70999872 GHz	-31.41 dBm		
M2		1	1.7095 GHz	-36.14 dBm	Band Power	-22.96 dBm
M3		1	1.7085 GHz	-37.66 dBm	Band Power	-24.73 dBm
M4		1	1.7075 GHz	-41.78 dBm	Band Power	-28.87 dBm
M5		1	1.7065 GHz	-51.27 dBm	Band Power	-36.39 dBm
M6		1	1.7055 GHz	-52.32 dBm	Band Power	-39.72 dBm

Date: 25.OCT.2016 09:34:42

Plot 2: Channel 1513



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.755105792 GHz	-36.64 dBm		
M2		1	1.7555 GHz	-37.57 dBm	Band Power	-25.19 dBm
M3		1	1.7565 GHz	-39.15 dBm	Band Power	-27.23 dBm
M4		1	1.7575 GHz	-44.45 dBm	Band Power	-31.66 dBm
M5		1	1.7585 GHz	-51.69 dBm	Band Power	-38.29 dBm
M6		1	1.7595 GHz	-50.95 dBm	Band Power	-38.44 dBm

Date: 25.OCT.2016 09:43:27

13.6 Occupied bandwidth

Description:

Measurement of the occupied bandwidth of the transmitted signal.

Measurement:

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the UMTS band IV frequency band. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Part 27.53 requires a measurement bandwidth of at least 1% of the occupied bandwidth. For ca. 4700 kHz, this equates to a resolution bandwidth of at least 50 kHz. For this testing, a resolution bandwidth 100 kHz was used.

Measurement parameters	
Detector:	Peak
Sweep time:	30s
Video bandwidth:	200 kHz
Resolution bandwidth:	50 kHz
Span:	10 MHz
Trace-Mode:	Max Hold
Used equipment:	See chapter 6.4 – C
Measurement uncertainty:	See chapter 8

Limits:

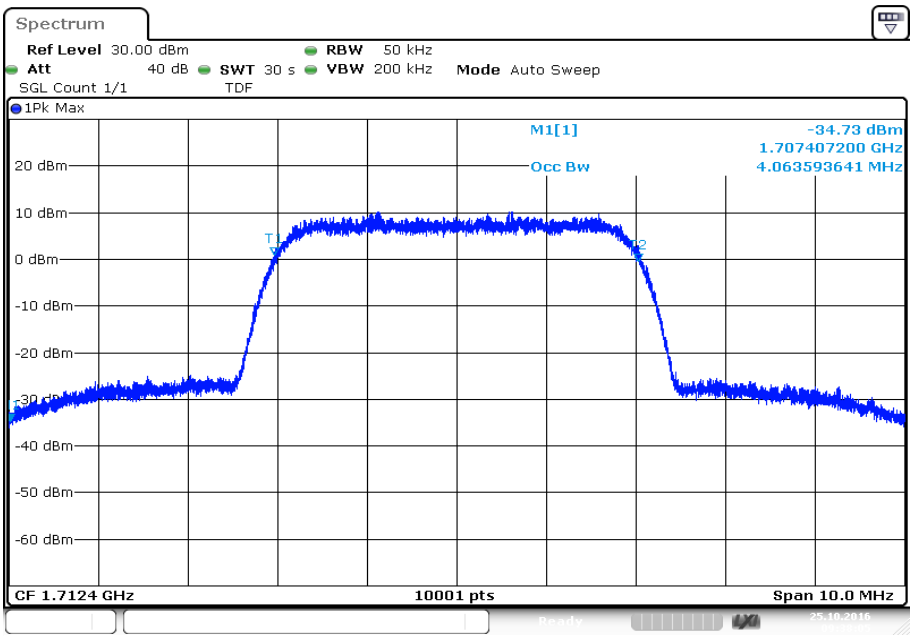
FCC	IC
CFR Part 27.53(g) CFR Part 2.1049	RSS 139
Occupied Bandwidth	
Spectrum must fall completely in the specified band	

Results:

Occupied Bandwidth		
Frequency (MHz)	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
1712.4	4064	4616
1732.4	4065	4618
1752.6	4064	4609

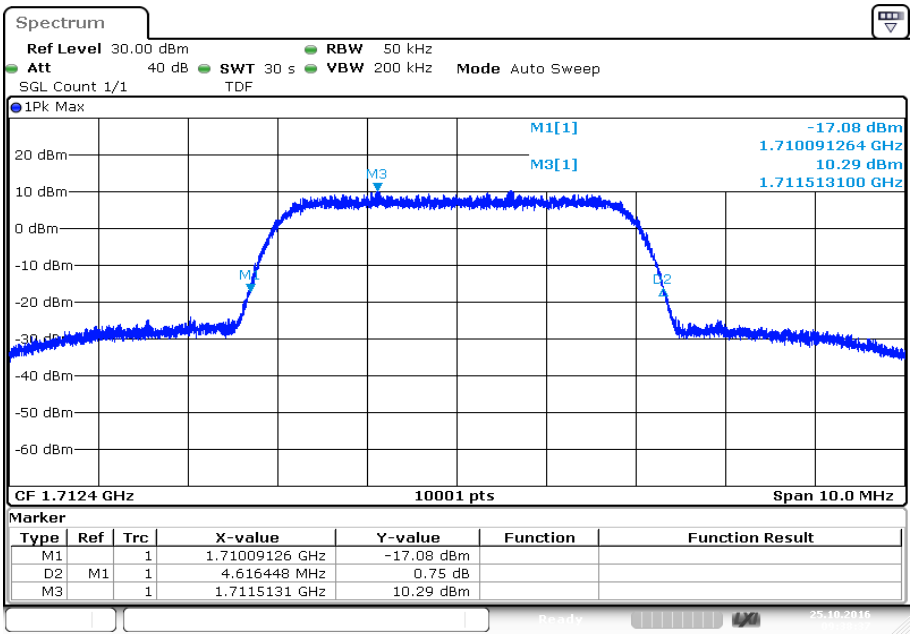
Plots:

Plot 1: Channel 1312 (99% - OBW)



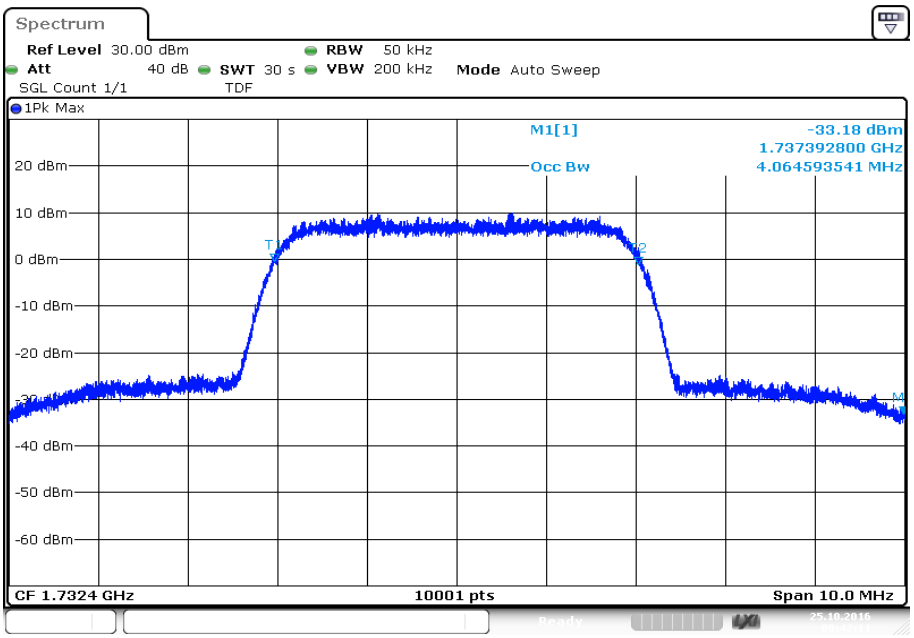
Date: 25.OCT.2016 09:38:05

Plot 2: Channel 1312 (-26 dBc BW)



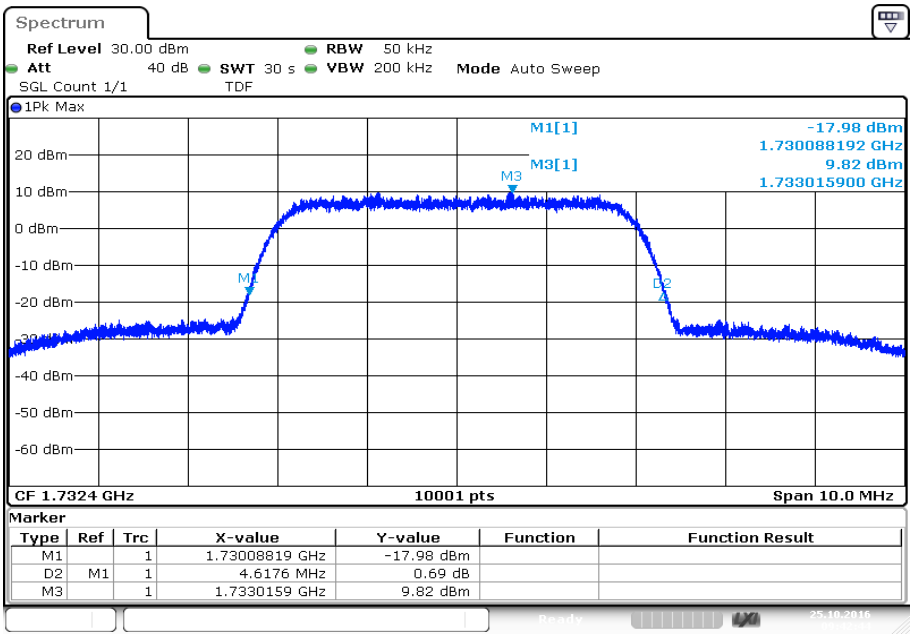
Date: 25.OCT.2016 09:38:38

Plot 3: Channel 1412 (99% - OBW)



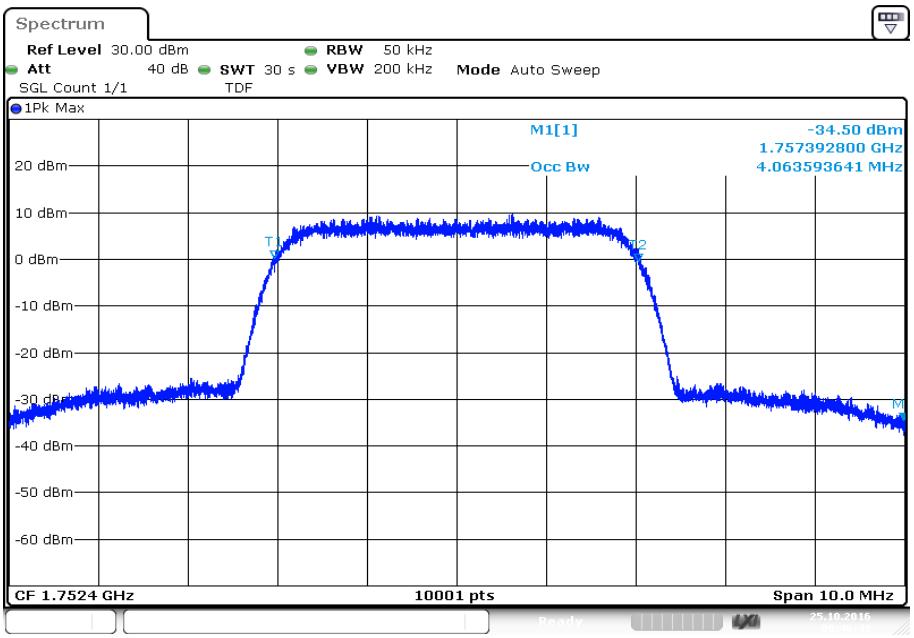
Date: 25.OCT.2016 09:42:11

Plot 4: Channel 1412 (-26 dBc BW)



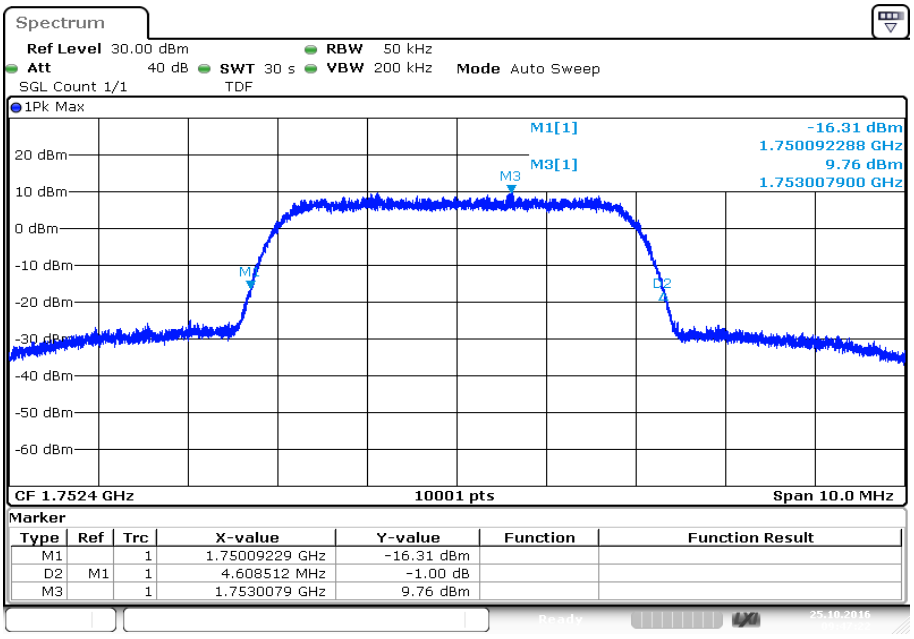
Date: 25.OCT.2016 09:42:44

Plot 5: Channel 1513 (99% - OBW)



Date: 25.OCT.2016 09:46:50

Plot 6: Channel 1513 (-26 dBc BW)



Date: 25.OCT.2016 09:47:22

14 Results UMTS band V

All UMTS-band measurements are done in WCDMA mode only.
The connection was established with the following setup: WCDMA CS-RMC, Max Power (All Bit up)

14.1 RF output power

Description:

This paragraph contains average power, peak output power and ERP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Sample
AQT:	See plot
Resolution bandwidth:	1 MHz
Used equipment:	See chapter 6.1 – A & 6.4 – C
Measurement uncertainty:	see chapter 8

Limits:

FCC	IC
CFR Part 22.913 CFR Part 2.1046	RSS 132
Nominal Peak Output Power	
+38.45 dBm In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

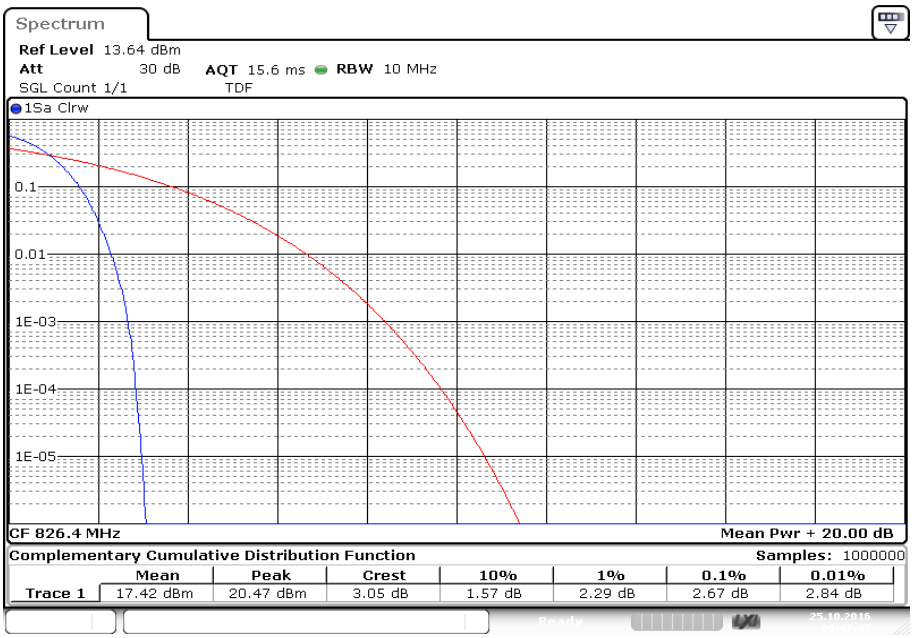
Results:

Output Power (conducted) WCDMA mode			
Frequency (MHz)	**Peak Output Power (dBm)**	**Average Output Power (dBm)**	**Peak to Average Ratio (dB) CCDF**
826.4	20.5	17.4	2.67
836.0	20.1	17.2	2.61
846.6	20.5	17.3	2.64

Output Power (radiated) WCDMA mode	
Frequency (MHz)	**Average Output Power (dBm) - ERP**
826.4	16.8
836.0	16.5
846.6	15.6

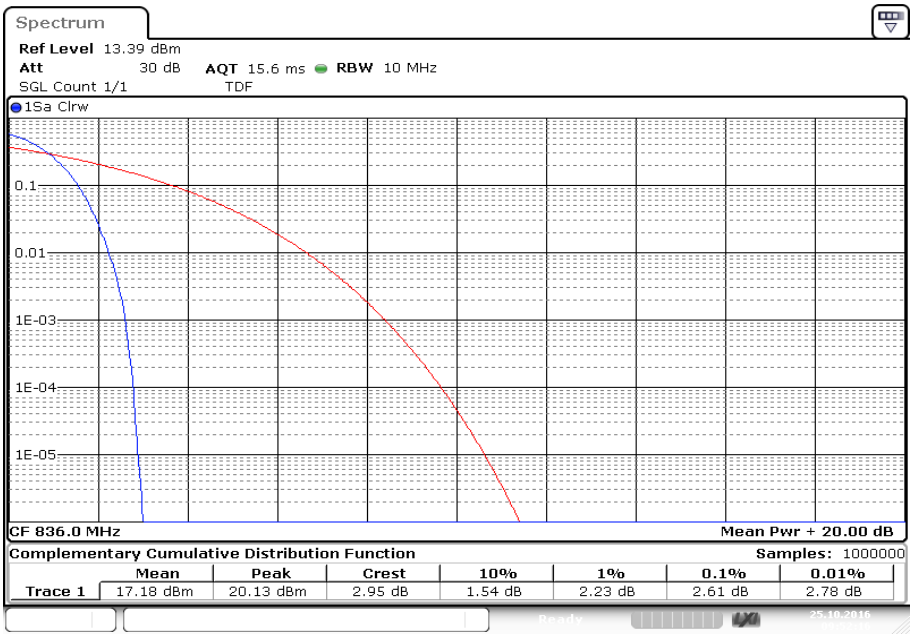
Plots:

Plot 1: CCDF, channel 4132



Date: 25.OCT.2016 09:47:38

Plot 2: CCDF, channel 4180



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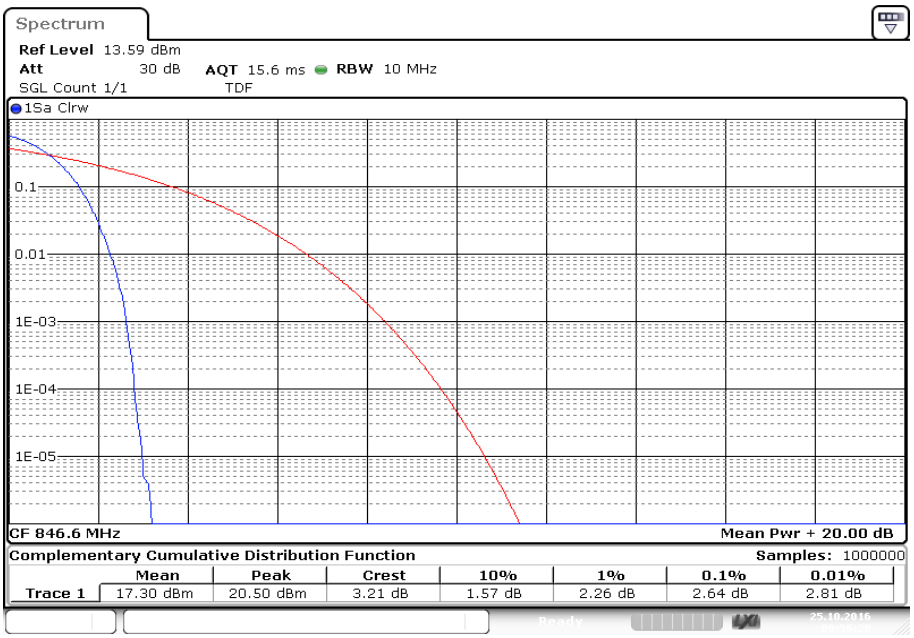
Plot 3: CCDF, channel 4233



Date: 25.OCT.2016 09:56:21

14.2 Frequency stability

Description:

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the mobile station in a “call mode”. This is accomplished with the use of a R&S CMU200 DIGITAL RADIOCOMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the mobile station to overnight soak at -30 C.
3. With the mobile station, powered with V_{nom}, connected to the CMU200 and in a simulated call on channel 4180 (centre channel), measure the carrier frequency. These measurements should be made within two minutes of powering up the mobile station, to prevent significant self warming.
4. Repeat the above measurements at 10°C increments from -30°C to +60°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with V_{nom}. Vary supply voltage from V_{min} to V_{max}, in 0.1 Volt steps remeasuring carrier frequency at each voltage. Pause at V_{nom} for 1.5 hours unpowered, to allow any self heating to stabilize, before continuing.
6. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

Measurement:

Measurement parameters	
Detector:	Measured with CMW500
Sweep time:	
Video bandwidth:	
Resolution bandwidth:	
Span:	
Trace mode:	
Test setup:	See chapter 6.4 – D
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
CFR Part 22.355 CFR Part 2.1055	RSS 132
Frequency Stability	
± 0.1 ppm	

Results:

AFC FREQ ERROR versus VOLTAGE

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
9	3	0.00000036	0.0036
24	-5	-0.00000060	-0.0060
32	-5	-0.00000060	-0.0060

AFC FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	-7	-0.00000084	-0.0084
-20	-6	-0.00000072	-0.0072
-10	-8	-0.00000096	-0.0096
± 0	-7	-0.00000084	-0.0084
10	-14	-0.00000167	-0.0167
20	6	0.00000072	0.0072
30	-2	-0.00000024	-0.0024
40	7	0.00000084	0.0084
50	11	0.00000132	0.0132
55	-13	-0.00000156	-0.0156

14.3 Spurious emissions radiated

Description:

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2014 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 846.6 MHz. This was rounded up to 12 GHz. The resolution bandwidth is set as outlined in Part 22.917. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the UMTS band V.

The final open field emission (here 10m semi-anechoic chamber listed by FCC) test procedure is as follows:

a) The test item was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna.
b) The antenna output was terminated in a 50 ohm load (if possible).
c) A double ridged wave guide antenna was placed on an adjustable height antenna mast 3 meters from the test item for emission measurements.
d) Detected emissions were maximized at each frequency by rotating the test item and adjusting the receive antenna height and polarization. The maximum meter reading was recorded. The radiated emission measurements of the harmonics of the transmit frequency through the 10th harmonic were measured with peak detector and 1 MHz bandwidth. If the harmonic could not be detected above the noise floor, the ambient level was recorded. The equivalent power into a dipole antenna was calculated from the field intensity levels measured at 3 meters.
e) Now each detected emissions were substituted by the substitution method, in accordance with the TIA/EIA 603.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 sec.
Video bandwidth:	Below 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Resolution bandwidth:	Below 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Span:	100 MHz Steps
Trace mode:	Max Hold
Test setup:	See chapter 6.1 & 6.2 – A / B
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
CFR Part 22.917 CFR Part 2.1053	RSS 132
Spurious Emissions Radiated	
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results:

Radiated emissions measurements were made only at the upper, center, and lower carrier frequencies of the UMTS band V (826.4 MHz, 836.0 MHz and 846.6 MHz). It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the UMTS band V into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

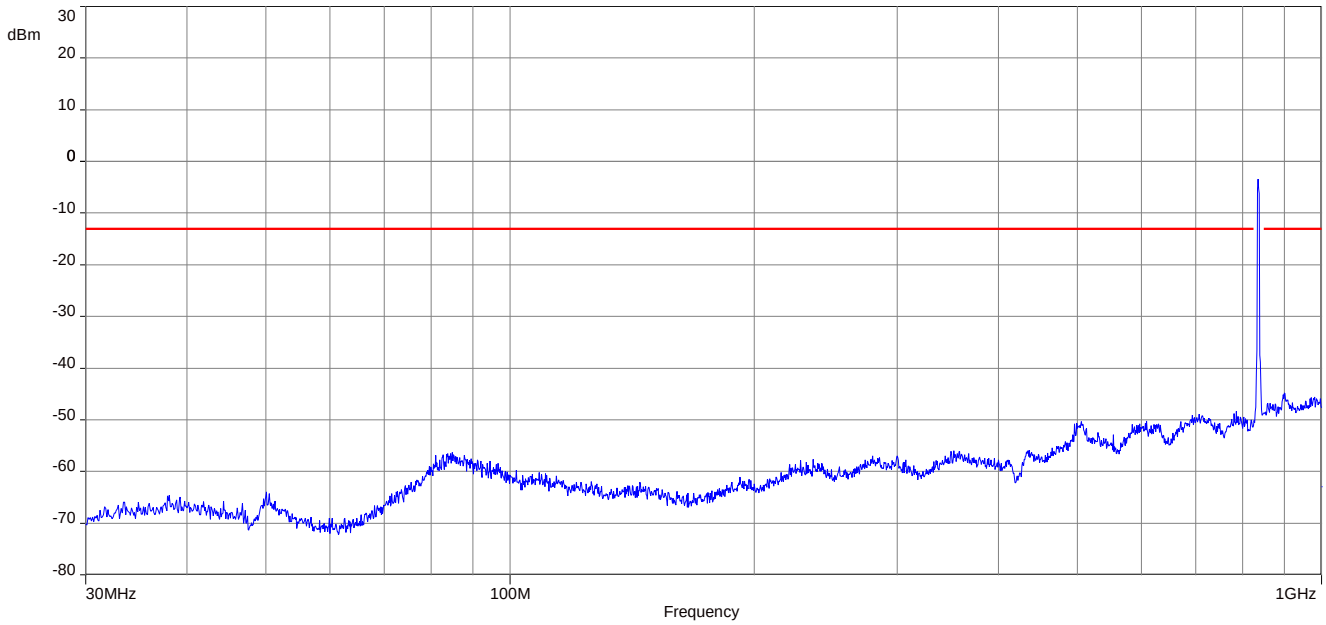
The final open field radiated levels are presented on the next pages.
All measurements were done in horizontal and vertical polarization; the plots show the worst case.
The plots show only the middle channel. If spurious were detected, the lowest and highest channel were checked too. The found values are stated in the table below.

As can be seen from this data, the emissions from the test item were within the specification limit.

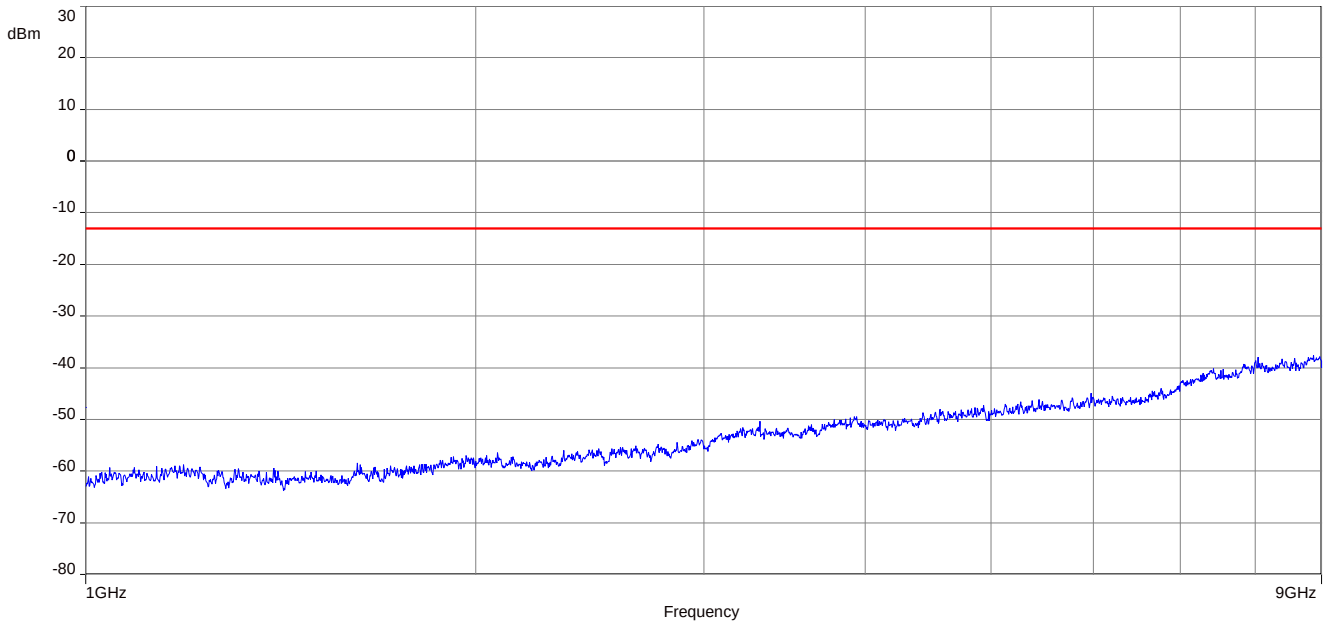
SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Ch. 4132 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 4180 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 4233 Freq. (MHz)	Level [dBm]
2	1652.8	-	2	1672.0	-	2	1693.2	-
3	2479.2	-	3	2508.0	-	3	2539.8	-
4	3305.6	-	4	3344.0	-	4	3386.4	-
5	4132.0	-	5	4180.0	-	5	4233.0	-
6	4958.4	-	6	5016.0	-	6	5079.6	-
7	5784.8	-	7	5852.0	-	7	5926.2	-
8	6611.2	-	8	6688.0	-	8	6772.8	-
9	7437.6	-	9	7524.0	-	9	7619.4	-
10	8264.0	-	10	8360.0	-	10	8466.0	-

Plots: plastic housing

Plot 1: Channel 4180 (30 MHz – 1 GHz)

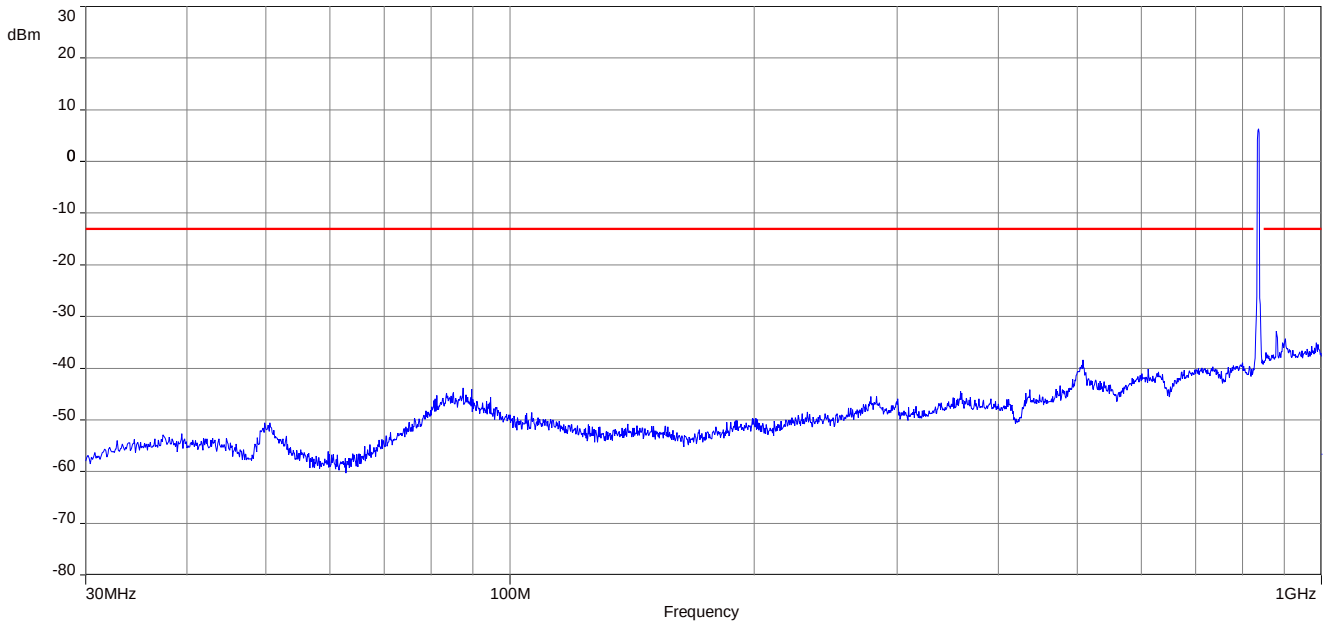


Plot 2: Channel 4180 (1 GHz – 9 GHz)

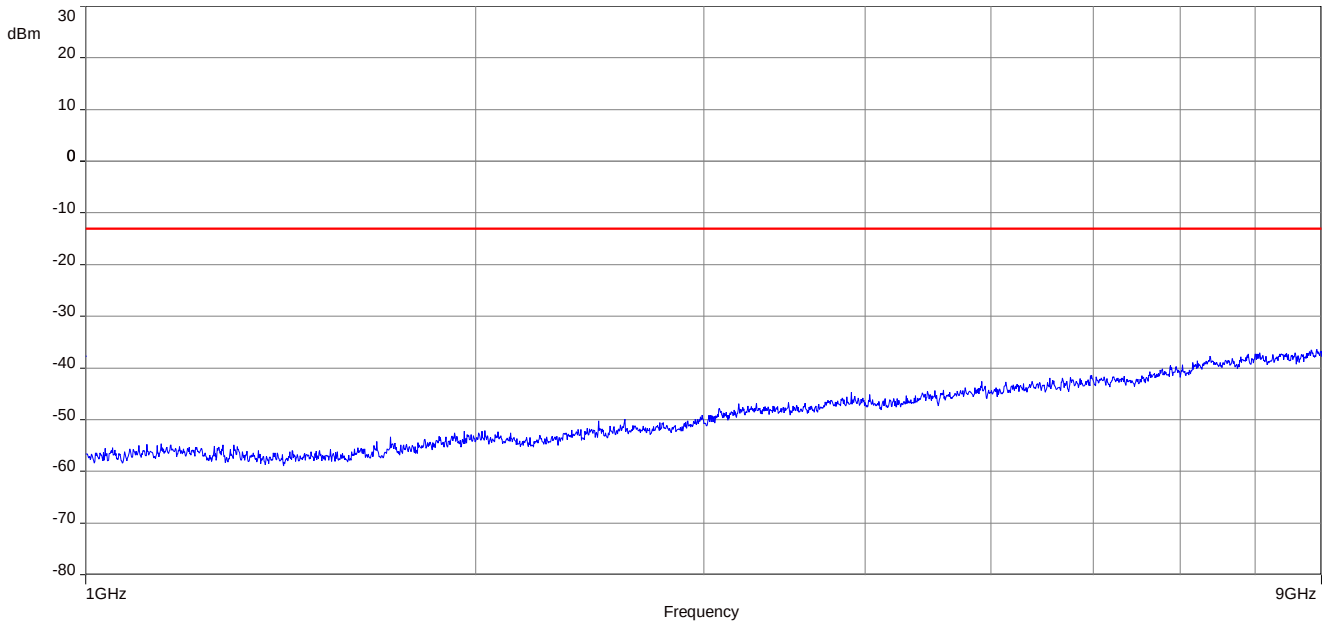


Plots: metal housing

Plot 1: Channel 4180 (30 MHz – 1 GHz)



Plot 2: Channel 4180 (1 GHz – 9 GHz)



14.4 Spurious emissions conducted

Description:

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 12 GHz.
2. Determine mobile station transmits frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

UMTS band V Transmitter Channel Frequency
4132 826.4 MHz
4180 836.0 MHz
4233 846.6 MHz

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	10 MHz – 26 GHz
Trace mode:	Max Hold
Test setup:	See chapter 6.4 – C
Measurement uncertainty:	See chapter 8

Limits:

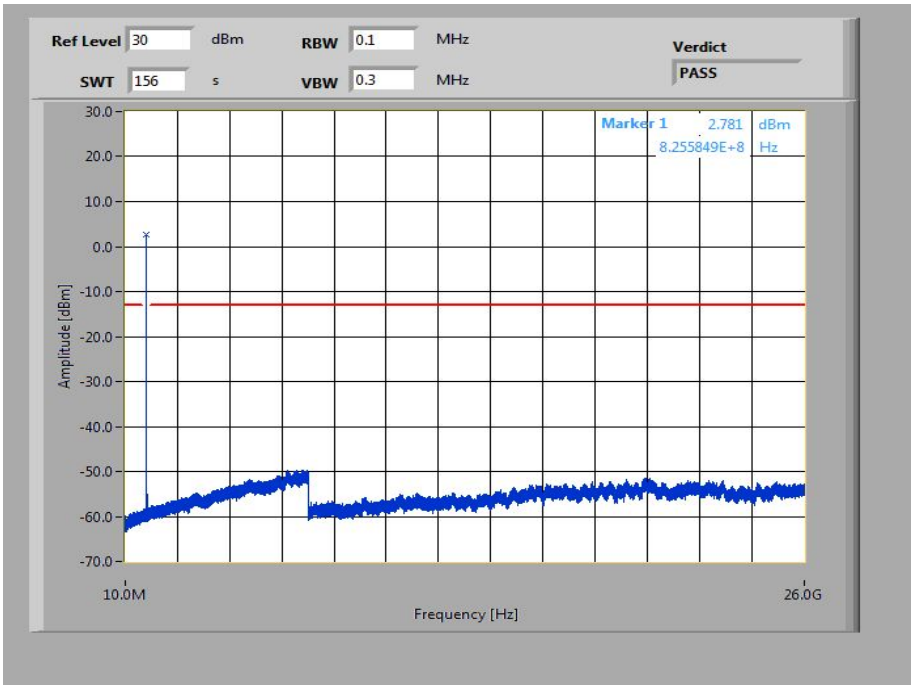
FCC	IC
CFR Part 22.917 CFR Part 2.1051	RSS 132
Spurious Emissions Conducted	
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results:

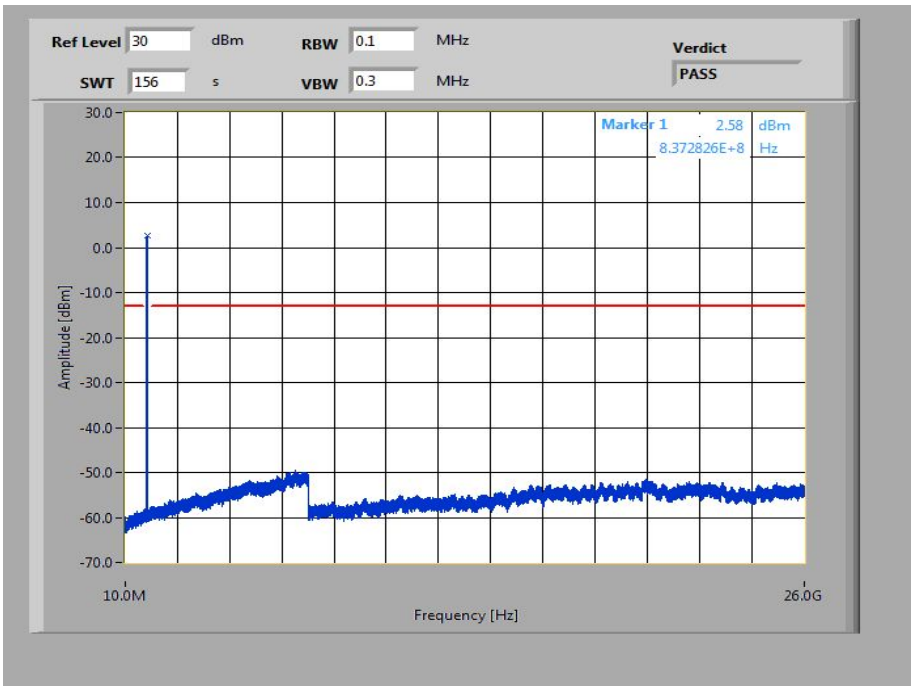
SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Ch. 4132 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 4180 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 4233 Freq. (MHz)	Level [dBm]
2	1652.8	-	2	1672.0	-	2	1693.2	-
3	2479.2	-	3	2508.0	-	3	2539.8	-
4	3305.6	-	4	3344.0	-	4	3386.4	-
5	4132.0	-	5	4180.0	-	5	4233.0	-
6	4958.4	-	6	5016.0	-	6	5079.6	-
7	5784.8	-	7	5852.0	-	7	5926.2	-
8	6611.2	-	8	6688.0	-	8	6772.8	-
9	7437.6	-	9	7524.0	-	9	7619.4	-
10	8264.0	-	10	8360.0	-	10	8466.0	-

Plots:

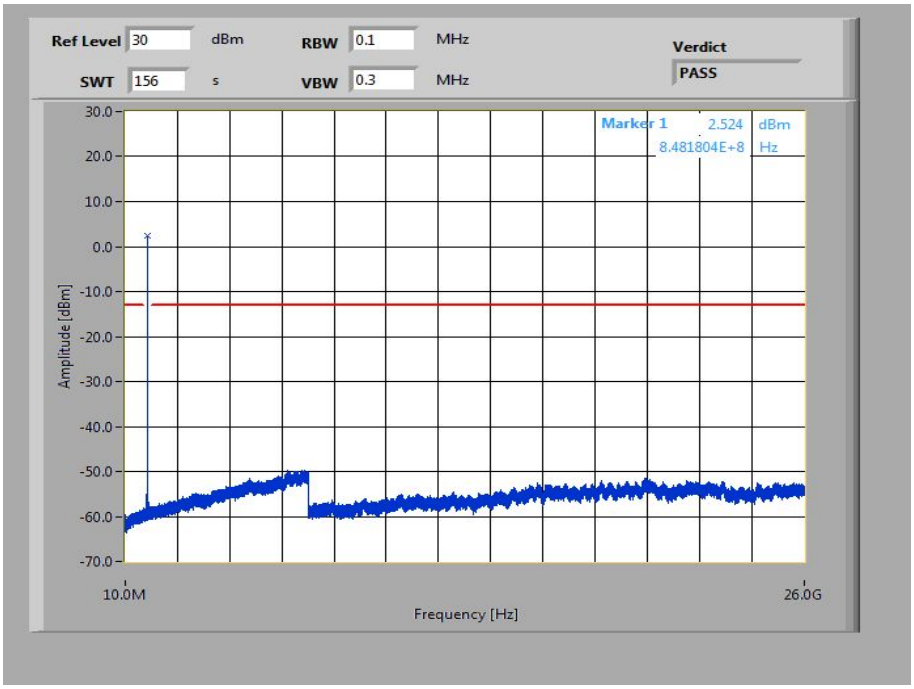
Plot 1: Channel 4132 (10 MHz - 26 GHz)



Plot 2: Channel 4180 (10 MHz - 26 GHz)



Plot 3: Channel 4233 (10 MHz - 26 GHz)



14.5 Block edge compliance

Description:

The spectrum at the band edges must comply with the spurious emissions limits.

Measurement:

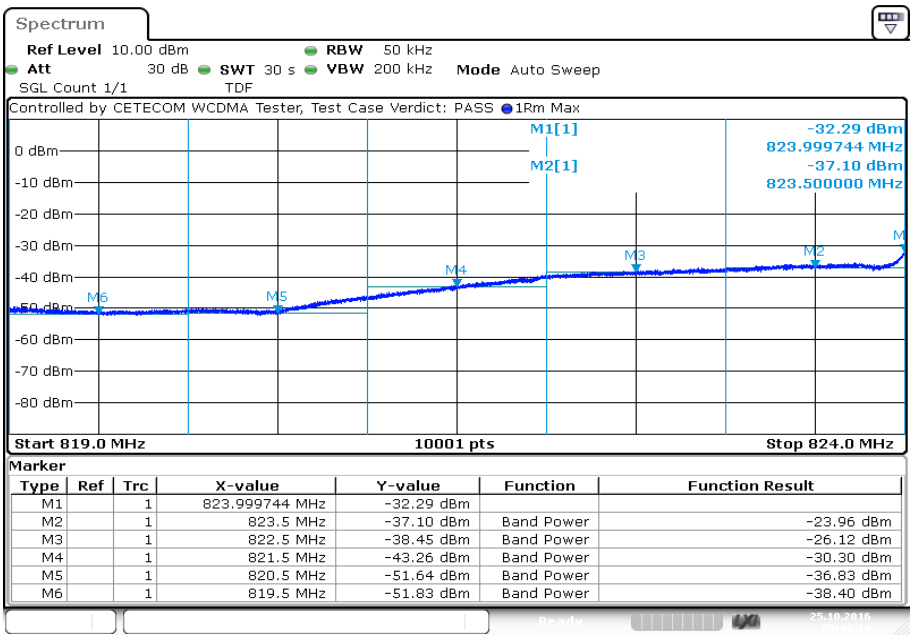
Measurement parameters	
Detector:	RMS
Sweep time:	30 sec.
Video bandwidth:	200 kHz
Resolution bandwidth:	50 kHz
Span:	5 MHz
Trace mode:	Max Hold
Used equipment:	See chapter 6.4 – C
Measurement uncertainty:	See chapter 8

Limits:

FCC	IC
CFR Part 22.917 CFR Part 2.1051	RSS 132
Block Edge Compliance	
-13 dBm	

Plots:

Plot 1: Channel 4132

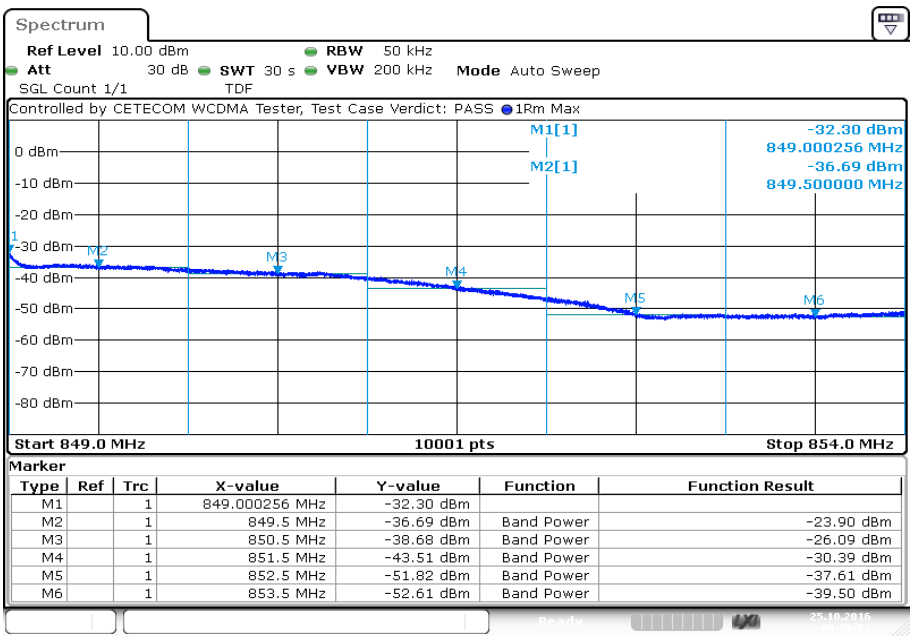


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	823.999744 MHz	-32.29 dBm		
M2		1	823.5 MHz	-37.10 dBm	Band Power	-23.96 dBm
M3		1	822.5 MHz	-38.45 dBm	Band Power	-26.12 dBm
M4		1	821.5 MHz	-43.26 dBm	Band Power	-30.30 dBm
M5		1	820.5 MHz	-51.64 dBm	Band Power	-36.83 dBm
M6		1	819.5 MHz	-51.83 dBm	Band Power	-38.40 dBm

Date: 25.OCT.2016 09:48:11

Plot 2: Channel 4233



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	849.000256 MHz	-32.30 dBm		
M2		1	849.5 MHz	-36.69 dBm	Band Power	-23.90 dBm
M3		1	850.5 MHz	-38.68 dBm	Band Power	-26.09 dBm
M4		1	851.5 MHz	-43.51 dBm	Band Power	-30.39 dBm
M5		1	852.5 MHz	-51.82 dBm	Band Power	-37.61 dBm
M6		1	853.5 MHz	-52.61 dBm	Band Power	-39.50 dBm

Date: 25.OCT.2016 09:56:53

14.6 Occupied bandwidth

Description:

Measurement of the occupied bandwidth of the transmitted signal.

Measurement:

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the UMTS band V. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Part 22.917 requires a measurement bandwidth of at least 1% of the occupied bandwidth. For ca. 4700 kHz, this equates to a resolution bandwidth of at least 50 kHz. For this testing, a resolution bandwidth 100 kHz was used.

Measurement parameters	
Detector:	Peak
Sweep time:	30s
Video bandwidth:	200 kHz
Resolution bandwidth:	50 kHz
Span:	10 MHz
Trace mode:	Max Hold
Used equipment:	See chapter 6.4 – C
Measurement uncertainty:	See chapter 8

Limits:

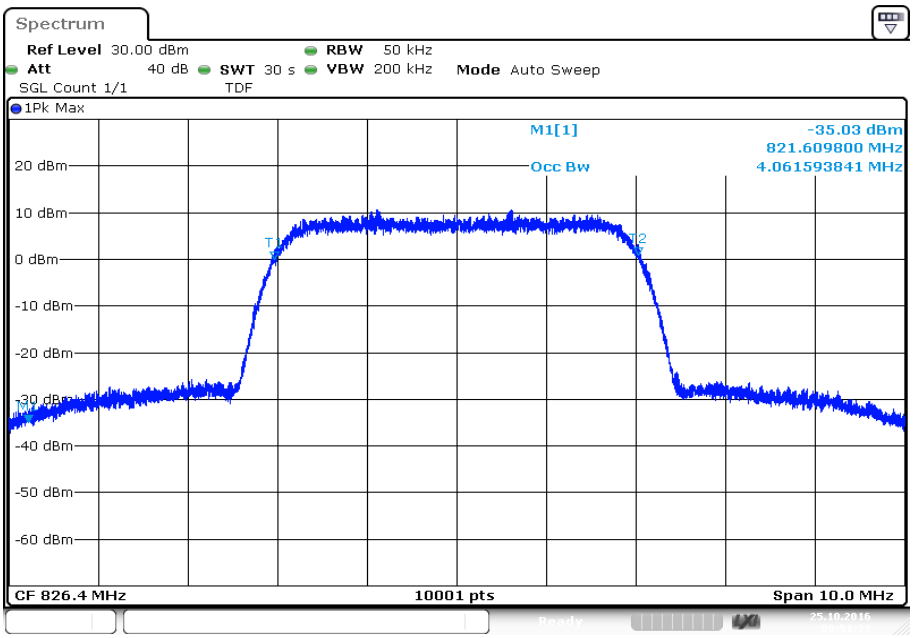
FCC	IC
CFR Part 22.917 CFR Part 2.1049	RSS 132
Occupied Bandwidth	
Spectrum must fall completely in the specified band	

Results:

Occupied Bandwidth		
Frequency (MHz)	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
826.4	4062	4607
836.0	4069	4633
846.6	4067	4613

Plots:

Plot 1: Channel 4132 (99% - OBW)



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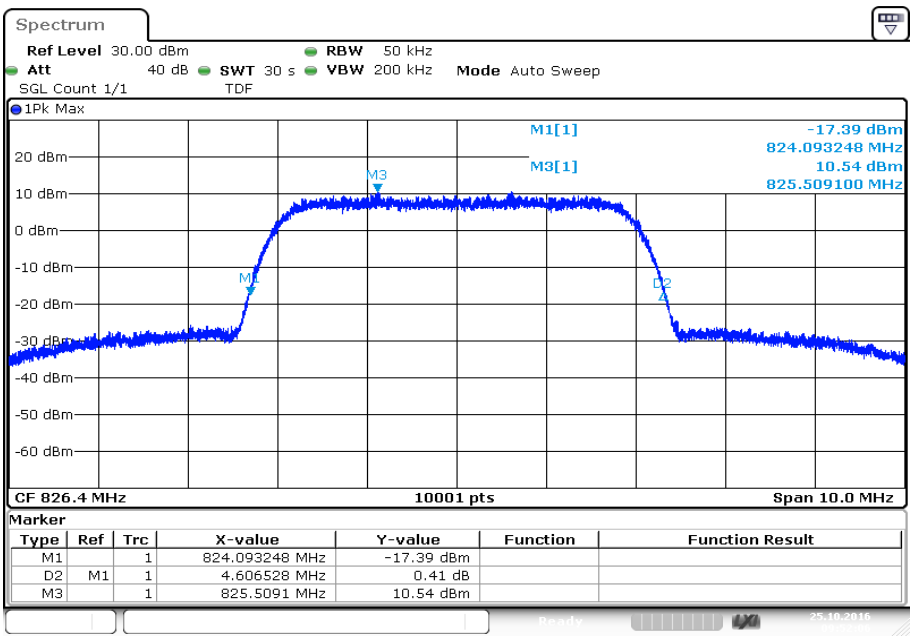
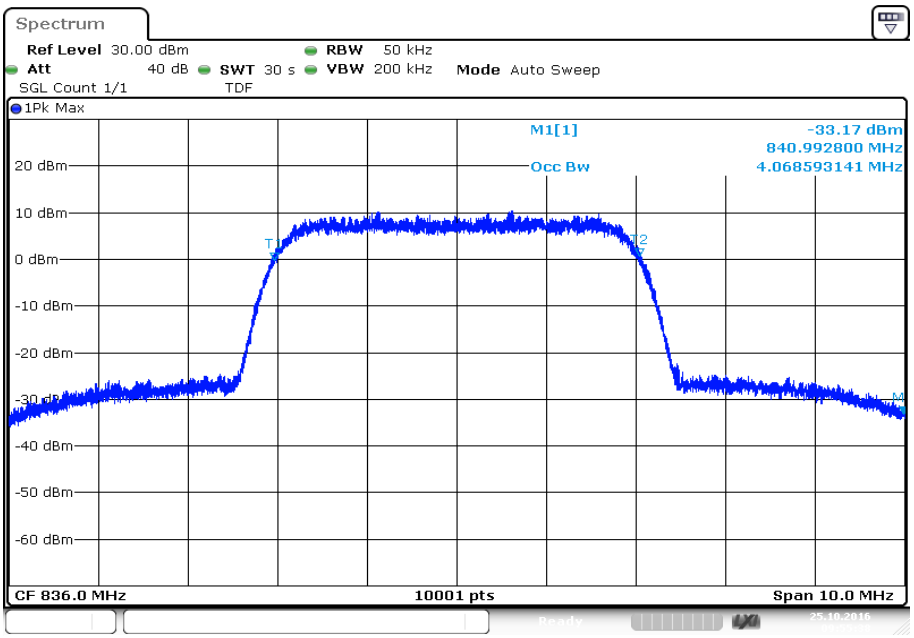
Plot 2: Channel 4132 (-26 dBc BW)



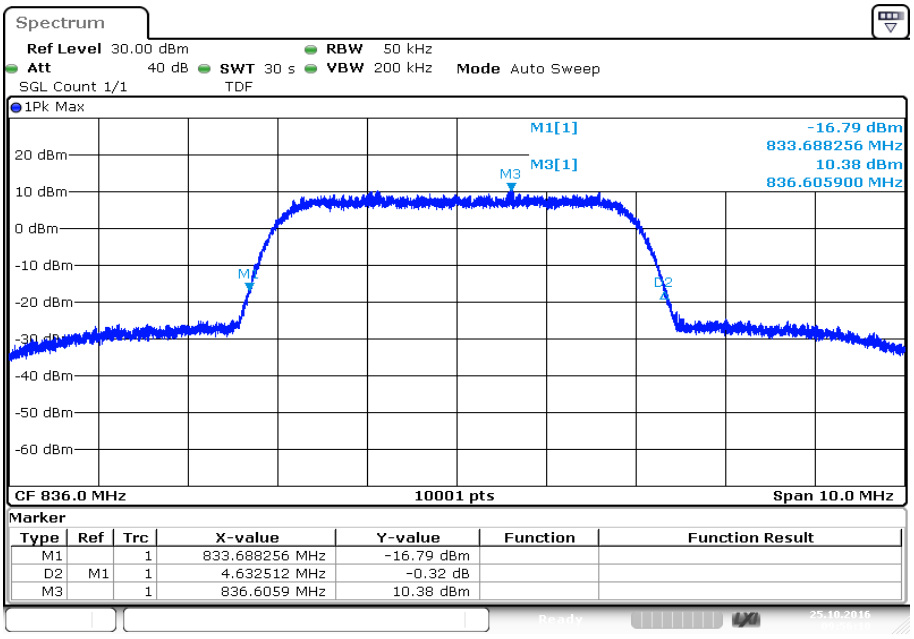
Date: 25.OCT.2016 09:52:06

Plot 3: Channel 4180 (99% - OBW)



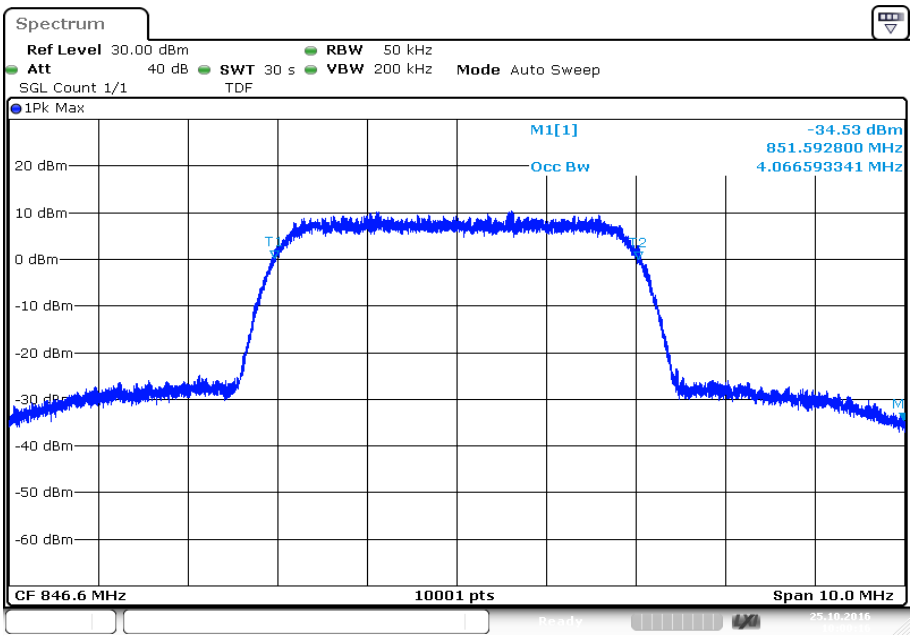
Date: 25.OCT.2016 09:55:38

Plot 4: Channel 4180 (-26 dBc BW)



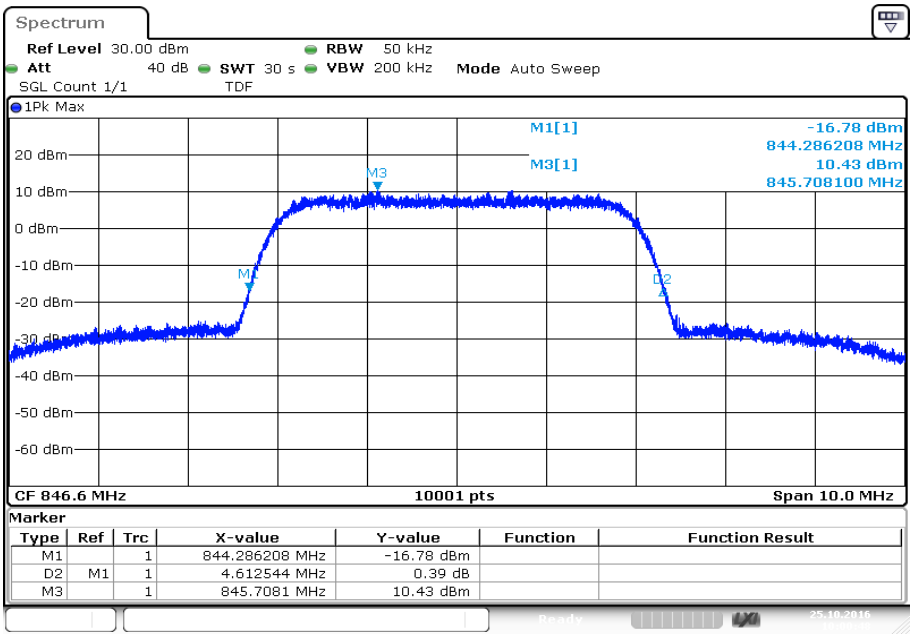
Date: 25.OCT.2016 09:56:11

Plot 5: Channel 4233 (99% - OBW)



Date: 25.OCT.2016 10:00:16

Plot 6: Channel 4233 (-26 dBc BW)



Date: 25.OCT.2016 10:00:49

15 Observations

No observations except those reported with the single test cases have been made.

Annex A Document history

Version	Applied changes	Date of release
	Initial release	2017-02-23
A	Update cabinet radiation plots + description of the base station emission in some plots	2017-04-27

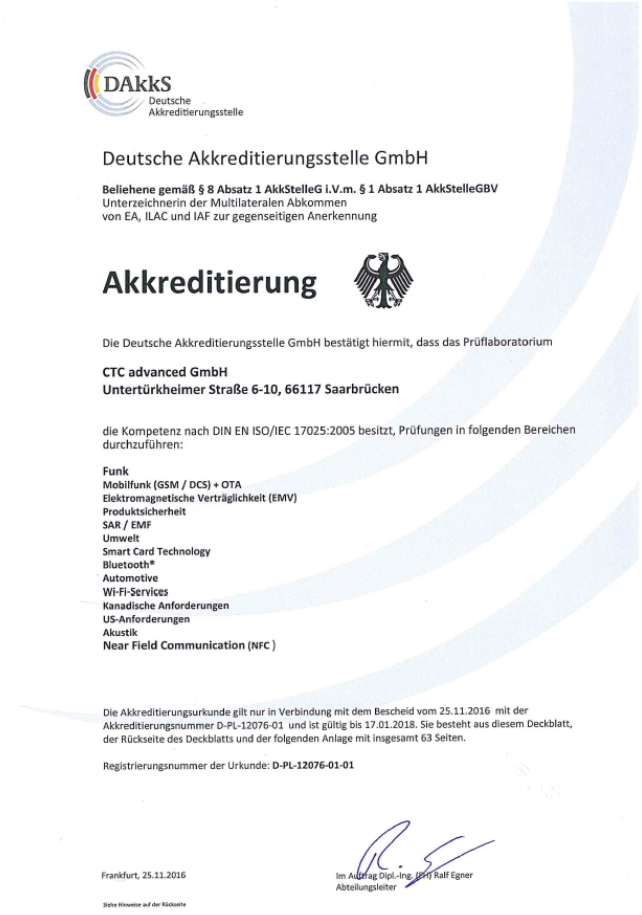
Annex B Further information

Glossary

AVG	-	Average
DUT	-	Device under test
EMC	-	Electromagnetic Compatibility
EN	-	European Standard
EUT	-	Equipment under test
ETSI	-	European Telecommunications Standard Institute
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	Not applicable
PP	-	Positive peak
QP	-	Quasi peak
S/N	-	Serial number
SW	-	Software
PMN	-	Product marketing name
HMN	-	Host marketing name
HVIN	-	Hardware version identification number
FVIN	-	Firmware version identification number
OBW		Occupied Bandwidth
OC		Operating Channel
OCW		Operating Channel Bandwidth
OOB		Out Of Band

Annex C Accreditation Certificate

first page



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Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

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Automotive
Wi-Fi-Services
Kanadische Anforderungen
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Akustik
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Frankfurt, 25.11.2016

Im Auftrag Dipl.-Ing. (FH) Ralf Egner
Abteilungsleiter

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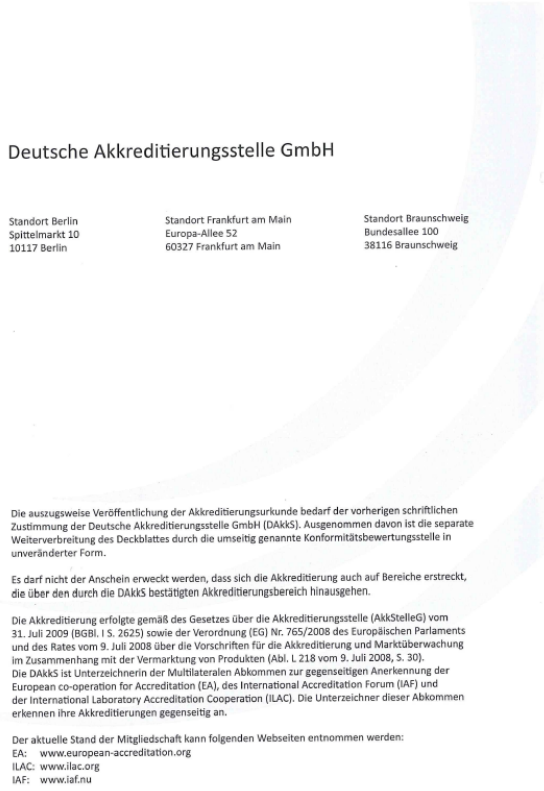
last page



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