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TEST REPORT

Test report no.: 1-4254/12-62-19-A

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

Testing laboratory

CETECOM ICT Services GmbH
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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
Area of Testing: Radio/Satellite Communications

Applicant

Sony Mobile Communications AB
Nya Vattentornet
22188 Lund / SWEDEN
Phone: +46 46 19 30 00
Fax: +46 46 19 32 95
Contact: Håkan Sjöberg
e-mail: hakan.sjoberg@sonymobile.com
Phone: +46 46 19 35 59

Manufacturer

Sony Mobile Communications AB
Nya Vattentornet
22188 Lund / SWEDEN

Test standard/s

47 CFR Part 24	Title 47 of the Code of Federal Regulations; Chapter I Part 24 - Personal communications services
RSS - 133 Issue 5	Spectrum Management and Telecommunications Policy - Radio Standards Specifications 2 GHz Personal Communication Services

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

Test Item

Kind of test item:	**GSM Mobile Phone GPRS/EGPRS 850/900/1800/1900; UMTS HSPA FDDI/II/IV/V/VIII; LTE FDD 1/2/4/5/17; WLAN a/b/g/n; BT 3.1; BT LE; RFID; FM Rx; A-GPS**
Model name:	**PM-0230-BV**
FCC ID:	**PY7PM-0230**
IC:	**4170B-PM0230**
Frequency:	LTE Band II: 1850 MHz to 1910 MHz
Technology tested:	LTE
Antenna:	Integrated antenna
Power Supply:	3.7 V DC by Li – polymer battery
Temperature Range:	-30°C to +60 °C

Test report authorised:

2013-02-12 Marco Bertolino
Testing Manager

Test performed:

2013-02-12 Andreas Luckenbill
Expert

1 Table of contents

2 General information

2.1 Notes and disclaimer

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2.2 Application details

Date of receipt of order:	2012-11-06
Date of receipt of test item:	2012-11-08
Start of test:	2012-12-03
End of test:	2013-02-12
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 24	2010-10	Title 47 of the Code of Federal Regulations; Chapter I Part 24 - Personal communications services
RSS - 133 Issue 5	2009-02	Spectrum Management and Telecommunications Policy - Radio Standards Specifications 2 GHz Personal Communication Services

4 Test environment

Temperature:	T_{nom}	+22 °C	during room temperature tests
	T_{max}	+60 °C	during high temperature tests
	T_{min}	-30 °C	during low temperature tests
Relative humidity content:		40 %	
Barometric pressure:		not relevant for this kind of testing	
Power supply:	V_{nom}	3.7 V	DC ba Li-polymer battery
	V_{max}	4.4 V	
	V_{min}	3.3 V	

5 Test item

Kind of test item	**:**	**GSM Mobile Phone GPRS/EGPRS 850/900/1800/1900; UMTS HSPA FDDI/II/IV/V/VIII; LTE FDD 1/2/4/5/17; WLAN a/b/g/n; BT 3.1; BT LE; RFID; FM Rx; A-GPS**
Type identification	**:**	**PM-0230-BV**
S/N serial number	**:**	**Rad. CB5121Z4G3, CB5121Z4E1** **Cond. CB5121Z4FH**
HW hardware status	**:**	**SP1.2**
SW software status	**:**	**10.1.A.0.194, and 10.1.A.1.17**
Frequency band [MHz]	**:**	**LTE Band II: 1850 MHz to 1910 MHz**
Type of modulation	**:**	**QPSK, 16-QAM**
Antenna	**:**	**Integrated antenna**
Power supply	**:**	**3.7 V DC by Li – polymer battery**
Temperature range	**:**	**-30°C to +60 °C**

5.1 Additional information

Test setup- and EUT-photos are included in test report 1-4254/12-62-03.

6 Test laboratories sub-contracted

None

7 Summary of measurement results

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained

TC identifier	Description	verdict	date	Remark
RF-Testing	CFR Part 24 RSS 133	passed	2013-02-12	-/-

7.1 LTE band II

Test Case	temperature conditions	power source voltages	Pass	Fail	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: NA = Not applicable; NP = Not performed

8 RF measurements

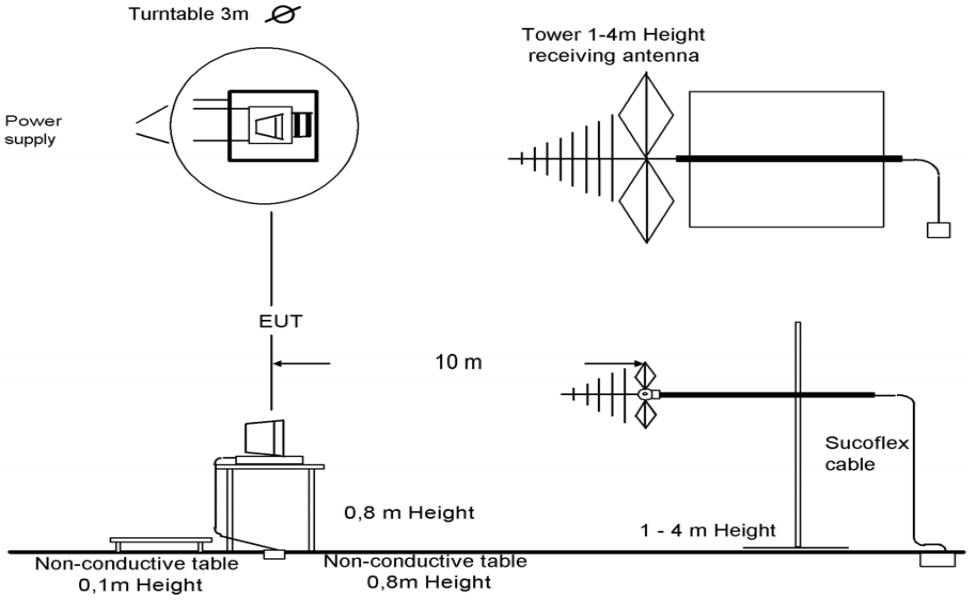
8.1 Description of test setup

For the spurious measurements we use the substitution method according TIA/EIA 603.

8.1.1 Radiated measurements

The radiated emissions from the EUT are performed in a semi anechoic chamber. The EUT is placed on a conductive turntable and powered with nominal voltage. The signalling is performed either from outside the chamber with a signalling unit (AP or other) by air link using a signalling antenna or directly by special test software from the customer.

Semi anechoic chamber

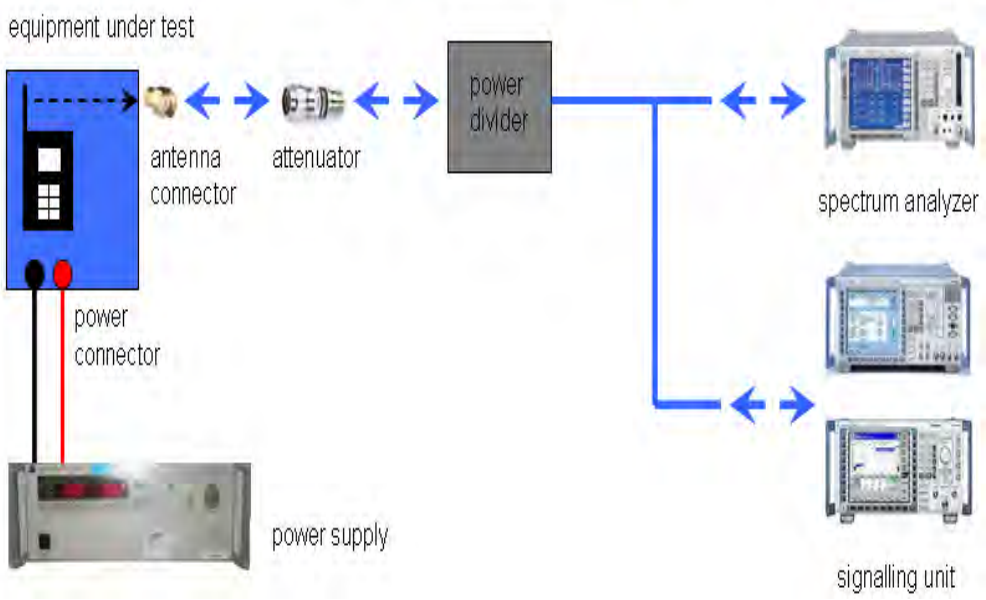


Picture 1: Diagram radiated measurements

9 kHz - 30 MHz:	active loop antenna
30 MHz – 1 GHz:	tri-log antenna
> 1 GHz:	horn antenna

8.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is first 10dB attenuated before it is power divided (~6dB loss per branch). One of the signal paths is connected to the signalling unit (AP or other), the other one is connected to the spectrum analyzer. The specific losses for both signal paths are first checked within a calibration. The measurement readings on the signalling unit/spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signalling unit and the spectrum analyzer are impedance matched on 50 Ohm. If special software is used, there is no power divider necessary.



Picture 2: Diagram conducted measurements

The term measuring receiver refers to either a selective voltmeter or a spectrum analyser.

Frequency being measured f	Measuring receiver bandwidth 6 dB	Spectrum analyser bandwidth 3dB
f < 150 kHz	200 Hz or	300 Hz
150 kHz ≤ f < 25 MHz	9 kHz or	10 kHz
25 MHz ≤ f < 1000 MHz	120 kHz or	100 kHz
1000 MHz ≤ f		1 MHz
NOTE: Specific requirements in CEPT/ERC/Recommendation 70-03 [2] shall be applied where applicable.		

8.2 RSP100 test report cover sheet / performance test data

Test Report Number	:	1-4254/12-62-19-A			
Equipment Model Number	:	PM-0230-BV			
Certification Number	:	4170B-PM0230			
Manufacturer (complete Address)	:	Sony Mobile Communications AB Nya Vattentornet 22188 Lund / SWEDEN			
Tested to radio standards specification no.	:	RSS - 133 Issue 5			
Open Area Test Site IC No.	:	IC 3462C-1			
Frequency Range	:	LTE: 1850.7 MHz to 1909.3 MHz			
GPS receiver turned	:	On			
RF-power [dBm] (max.)	:	Channel Bandwidth	Conducted	ERP / EIRP	Mode
		1.4 MHz	23.7 dBm	27.3 dBm	QPSK
			23.0 dBm	26.2 dBm	16-QAM
		3 MHz	23.8 dBm	27.2 dBm	QPSK
			22.4 dBm	26.2 dBm	16-QAM
		5 MHz	23.6 dBm	27.1 dBm	QPSK
			22.5 dBm	26.0 dBm	16-QAM
		10 MHz	23.7 dBm	27.0 dBm	QPSK
			22.3 dBm	26.0 dBm	16-QAM
		15 MHz	23.6 dBm	27.0 dBm	QPSK
			22.4 dBm	26.0 dBm	16-QAM
		20 MHz	23.6 dBm	27.1 dBm	QPSK
			22.8 dBm	26.1 dBm	16-QAM
Occupied bandwidth (99%-BW) [kHz]	:	1.4 MHz	1093		QPSK
			1099		16-QAM
		3 MHz	2733		QPSK
			2731		16-QAM
		5 MHz	4497		QPSK
			4500		16-QAM
		10 MHz	8967		QPSK
			8969		16-QAM
		15 MHz	13471		QPSK
			13450		16-QAM
		20 MHz	17986		QPSK
			17996		16-QAM
Type of modulation	:	QPSK; 16QAM			
Emission Designator (TRC-43)	:	1.4 MHz	1M09G7D		QPSK
			1M10W7D		16-QAM
		3 MHz	2M73G7D		QPSK
			2M73W7D		16-QAM
		5 MHz	4M50G7D		QPSK
			4M50W7D		16-QAM
		10 MHz	8M97G7D		QPSK
			8M97W7D		16-QAM
		15 MHz	13M5G7D		QPSK
			13M5W7D		16-QAM
		20 MHz	18M0G7D		QPSK
			18M0W7D		16-QAM
Antenna Information	:	integrated antenna			
Transmitter Spurious (worst case) [dBm]	:	-48 @ 12.5 GHz (noise floor / peak)			

ATTESTATION:
DECLARATION OF COMPLIANCE:

I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned Industry Canada standard(s); and that the equipment identified in this application has been subjected to all the applicable test conditions specified in the Industry Canada standards and all of the requirements of the standard have been met.

Laboratory Manager:

2013-02-12	Andreas Luckenbill	
Date	Name	Signature

8.3 Results LTE band II

The EUT was set to transmit the maximum power.

8.3.1 Antenna gain

Description:

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module

Results:

T_{nom}	V_{nom}	lowest channel	middle channel	highest channel
Conducted power [dBm]		22.6	22.7	22.4
Radiated power [dBm]		26.4	27.3	26.9
Gain [dBi] Calculated		3.8	4.6	4.5

8.3.2 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:	Measured with CMW500
Sweep time:	
Video bandwidth:	
Resolution bandwidth:	
Span:	
Trace-Mode:	

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)						
Bandwidth (MHz)	**Frequency (MHz)**	**Resource block allocation**	**Average Output Power (dBm) QPSK**	**Peak to Average Ratio (dB)**	**Average Output Power (dBm) 16-QAM**	**Peak to Average Ratio (dB)**
1.4	1850.7	1 RB low	23.5	4.5	22.9	5.0
		1 RB high	23.4	4.5	22.8	5.0
		50% RB mid	23.5	4.6	22.6	5.4
		100% RB	22.6	5.5	21.7	6.0
	1880.0	1 RB low	23.4	5.2	23.0	5.5
		1 RB high	23.5	5.2	23.0	5.6
		50% RB mid	23.7	5.3	22.5	6.4
		100% RB	22.7	5.9	21.6	7.2
	1909.3	1 RB low	23.4	4.5	22.7	5.0
		1 RB high	23.3	4.5	22.7	4.9
		50% RB mid	23.5	4.3	22.5	5.5
		100% RB	22.4	5.6	21.4	5.9
3	1851.5	1 RB low	23.7	4.4	22.3	5.6
		1 RB high	23.8	4.5	22.4	5.7
		50% RB mid	22.7	5.4	21.9	6.3
		100% RB	22.5	5.7	21.6	7.0
	1880.0	1 RB low	23.6	5.3	22.3	6.1
		1 RB high	23.7	5.2	22.3	6.2
		50% RB mid	22.6	5.7	21.7	7.0
		100% RB	22.6	6.0	21.6	7.1
	1908.5	1 RB low	23.6	4.6	22.3	5.7
		1 RB high	23.5	4.4	22.0	5.6
		50% RB mid	22.5	5.4	21.6	6.3
		100% RB	22.4	5.8	21.4	6.9
5	1852.5	1 RB low	23.6	4.5	22.4	5.5
		1 RB high	23.3	5.0	22.4	5.7
		50% RB mid	22.8	5.5	21.7	6.7
		100% RB	22.6	5.8	21.6	7.1
	1880.0	1 RB low	23.6	5.1	22.3	6.1
		1 RB high	23.4	5.3	22.3	6.1
		50% RB mid	22.6	6.1	21.6	7.3
		100% RB	22.5	6.0	21.4	7.6
	1907.5	1 RB low	23.6	4.8	22.5	5.7
		1 RB high	23.4	4.4	22.2	5.5
		50% RB mid	22.5	5.3	21.5	6.6
		100% RB	22.4	6.0	21.4	7.1

10	1855	1 RB low	23.7	4.5	22.3	5.6
		1 RB high	23.5	5.1	22.2	6.1
		50% RB mid	22.5	5.7	21.5	6.9
		100% RB	22.3	6.3	21.3	7.3
	1880	1 RB low	23.6	5.2	22.3	6.2
		1 RB high	23.6	6.4	22.1	6.3
		50% RB mid	22.4	5.9	21.4	6.9
		100% RB	22.4	6.6	21.4	7.3
	1905	1 RB low	23.5	5.0	22.2	6.0
		1 RB high	23.5	4.5	22.1	5.6
		50% RB mid	22.5	5.7	21.6	6.8
		100% RB	22.4	6.4	21.4	7.2
15	1857.5	1 RB low	23.6	4.4	22.3	5.6
		1 RB high	23.4	5.1	22.2	6.0
		50% RB mid	22.4	5.9	21.4	7.0
		100% RB	22.4	6.5	21.4	7.5
	1880.0	1 RB low	23.6	5.1	22.4	6.0
		1 RB high	23.4	5.4	22.2	6.2
		50% RB mid	22.5	6.2	21.4	7.2
		100% RB	22.4	6.5	21.4	7.6
	1902.5	1 RB low	23.5	5.0	22.3	5.9
		1 RB high	23.4	4.5	22.1	5.5
		50% RB mid	22.4	6.0	21.5	6.9
		100% RB	22.4	6.3	21.4	7.3
20	1860	1 RB low	23.6	4.4	22.5	6.1
		1 RB high	23.5	4.9	22.5	5.6
		50% RB mid	22.2	6.4	21.3	7.4
		100% RB	22.4	6.5	21.4	7.5
	1880	1 RB low	23.5	5.0	22.8	6.0
		1 RB high	23.4	5.1	22.7	6.3
		50% RB mid	22.4	6.5	21.4	7.5
		100% RB	22.5	6.6	21.5	7.6
	1900	1 RB low	23.5	5.1	22.8	6.2
		1 RB high	23.2	4.5	22.5	5.5
		50% RB mid	22.4	6.3	21.3	7.3
		100% RB	22.4	6.5	21.4	7.4
Measurement uncertainty			± 0.5 dB			

The output power was measured with the lowest supported channel bandwidth and with the maximum number of resource blocks.

All other bandwidths were calculated with the corresponding antenna gain (with full resource blocks).

Output Power (radiated)			
Bandwidth (MHz)	**Frequency (MHz)**	**Average Output Power (dBm) QPSK**	**Average Output Power (dBm) 16-QAM**
1.4	1850.7	26.4	25.5
	1880.0	27.3	26.2
	1909.3	26.9	25.9
3	1851.5	26.3	25.4
	1880.0	27.2	26.2
	1908.5	26.9	25.9
5	1852.5	26.4	25.4
	1880.0	27.1	26.0
	1907.5	26.9	25.9
10	1855.0	26.1	25.1
	1880.0	27.0	26.0
	1905.0	26.9	25.9
15	1857.5	26.2	25.2
	1880.0	27.0	26.0
	1902.5	26.9	25.9
20	1860.0	26.2	25.2
	1880.0	27.1	26.1
	1900.0	26.9	25.9
Measurement uncertainty		± 3.0 dB	

Result: **Passed**

8.3.3 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 CMW500 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 CMW500 and in a simulated call on channel 9400 (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:	

Limits:

FCC	IC
CFR Part 24.235 CFR Part 2.1055	RSS 133
Frequency Stability	
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.	

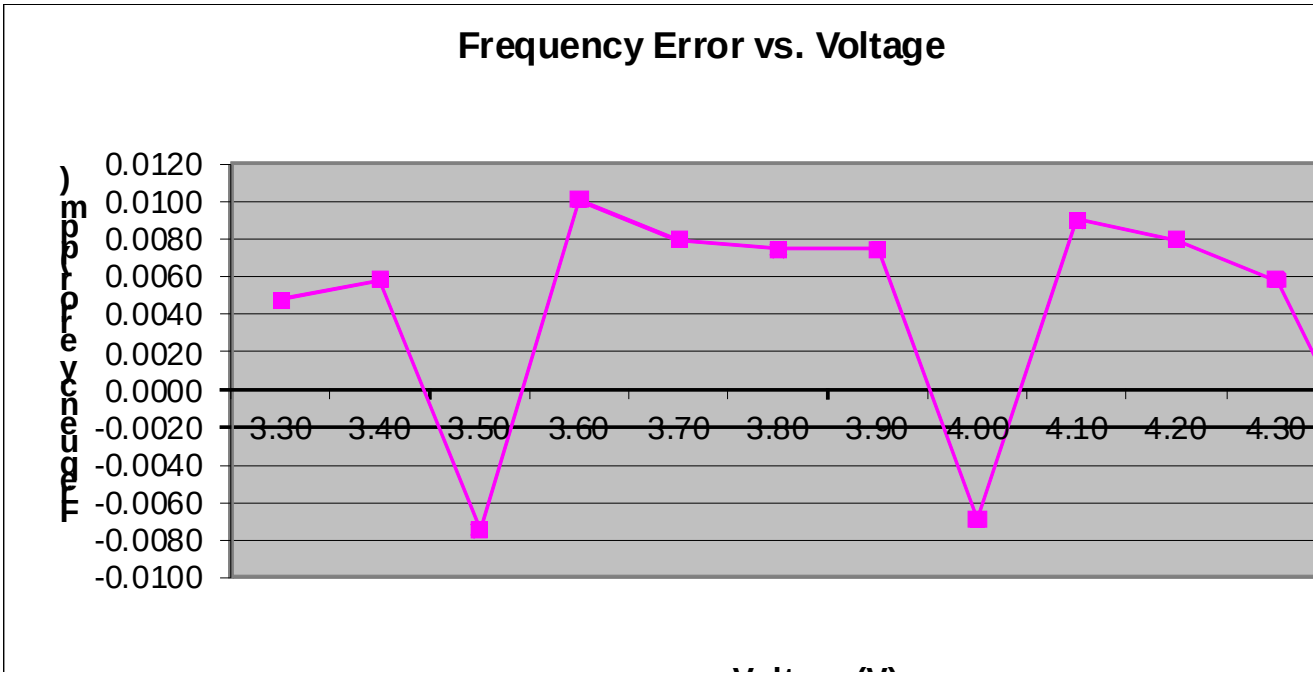
Results:

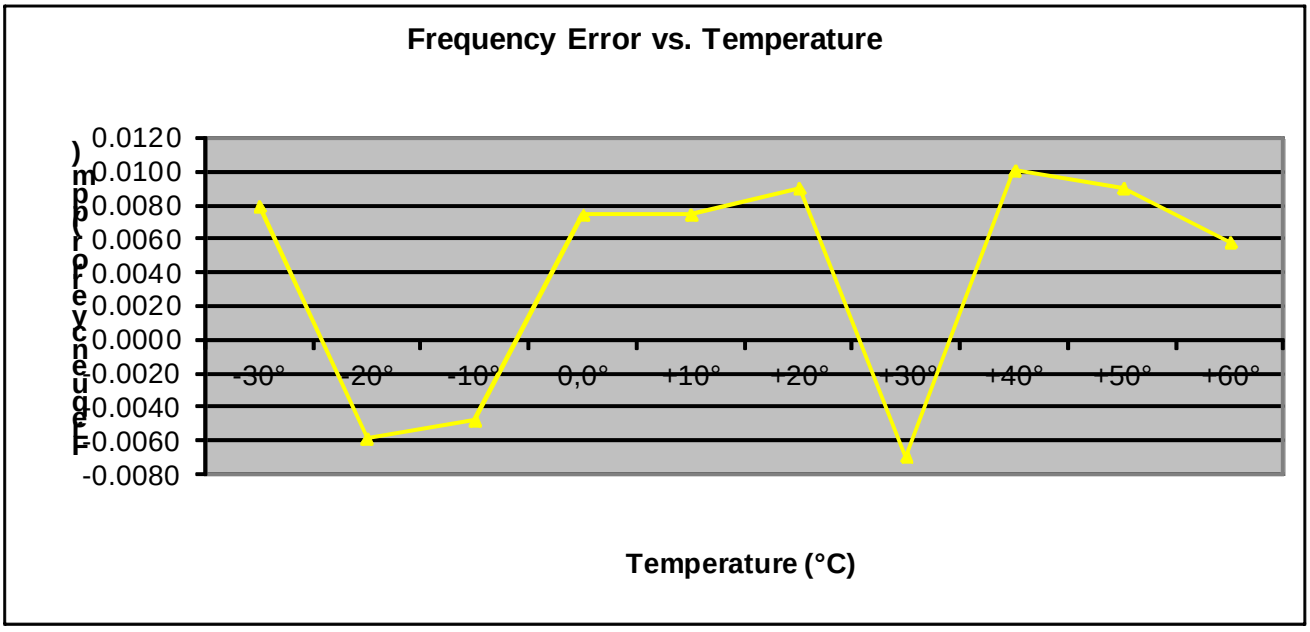
AFC FREQ ERROR versus VOLTAGE

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
3.3	9	0.00000048	0.0048
3.4	11	0.00000059	0.0059
3.5	-14	-0.00000074	-0.0074
3.6	19	0.00000101	0.0101
3.7	15	0.00000080	0.0080
3.8	14	0.00000074	0.0074
3.9	14	0.00000074	0.0074
4.0	-13	-0.00000069	-0.0069
4.1	17	0.00000090	0.0090
4.2	15	0.00000080	0.0080
4.3	11	0.00000059	0.0059
4.4	-9	-0.00000048	-0.0048

AFC FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	15	0.00000080	0.0080
-20	-11	-0.00000059	-0.0059
-10	-9	-0.00000048	-0.0048
± 0	14	0.00000074	0.0074
10	14	0.00000074	0.0074
20	17	0.00000090	0.0090
30	-13	-0.00000069	-0.0069
40	19	0.00000101	0.0101
50	17	0.00000090	0.0090
60	11	0.00000059	0.0059





Result: Passed

8.3.4 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 C63.4:2009 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. This was rounded up to 20 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 LTE band II.

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

Limits:

FCC	IC
CFR Part 24.238 CFR Part 2.1053	RSS 133
Spurious Emissions Radiated	
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results:

Radiated emissions measurements were made only at the center carrier frequency of the LTE band II (1880 MHz). It was decided that measurements at this carrier frequency 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 LTE 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.

QPSK:

SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3710.0	No emissions detected.	2	3760.0	No emissions detected.	2	3810.0	No emissions detected.
3	5565.0		3	5640.0		3	5715.0	
4	7420.0		4	7520.0		4	7620.0	
5	9275.0		5	9400.0		5	9525.0	
6	11130.0		6	11280.0		6	11430.0	
7	12985.0		7	13160.0		7	13335.0	
8	14840.0		8	15040.0		8	15240.0	
9	16695.0		9	16920.0		9	17145.0	
10	18550.0		10	18800.0		10	19050.0	
Measurement uncertainty		± 3dB						

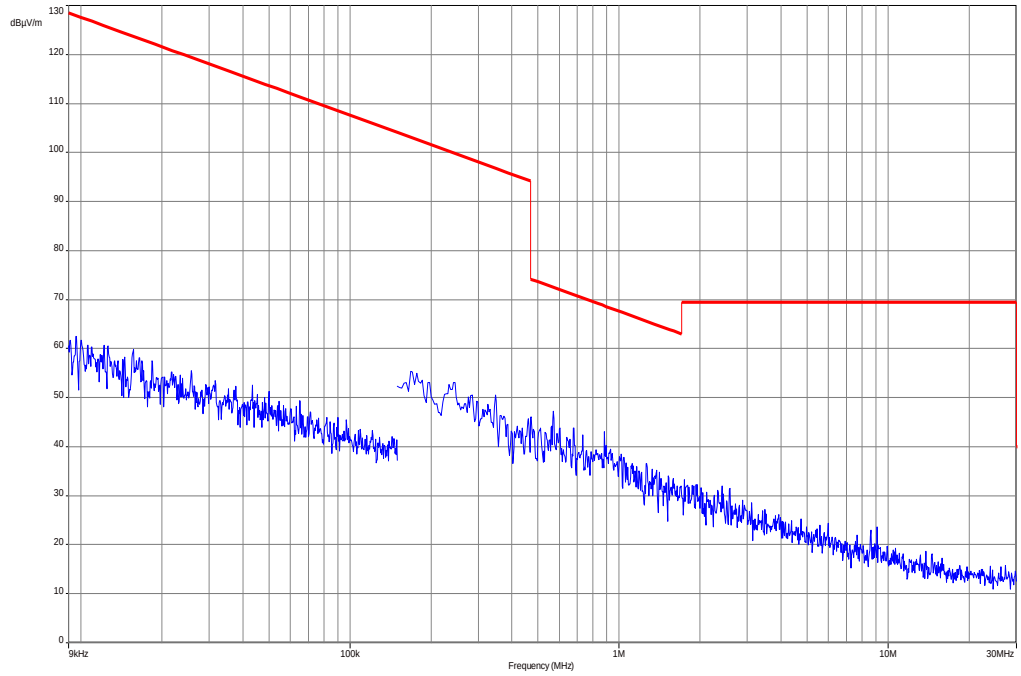
16-QAM:

SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3710.0	No emissions detected.	2	3760.0	No emissions detected.	2	3810.0	No emissions detected.
3	5565.0		3	5640.0		3	5715.0	
4	7420.0		4	7520.0		4	7620.0	
5	9275.0		5	9400.0		5	9525.0	
6	11130.0		6	11280.0		6	11430.0	
7	12985.0		7	13160.0		7	13335.0	
8	14840.0		8	15040.0		8	15240.0	
9	16695.0		9	16920.0		9	17145.0	
10	18550.0		10	18800.0		10	19050.0	
Measurement uncertainty			± 3dB					

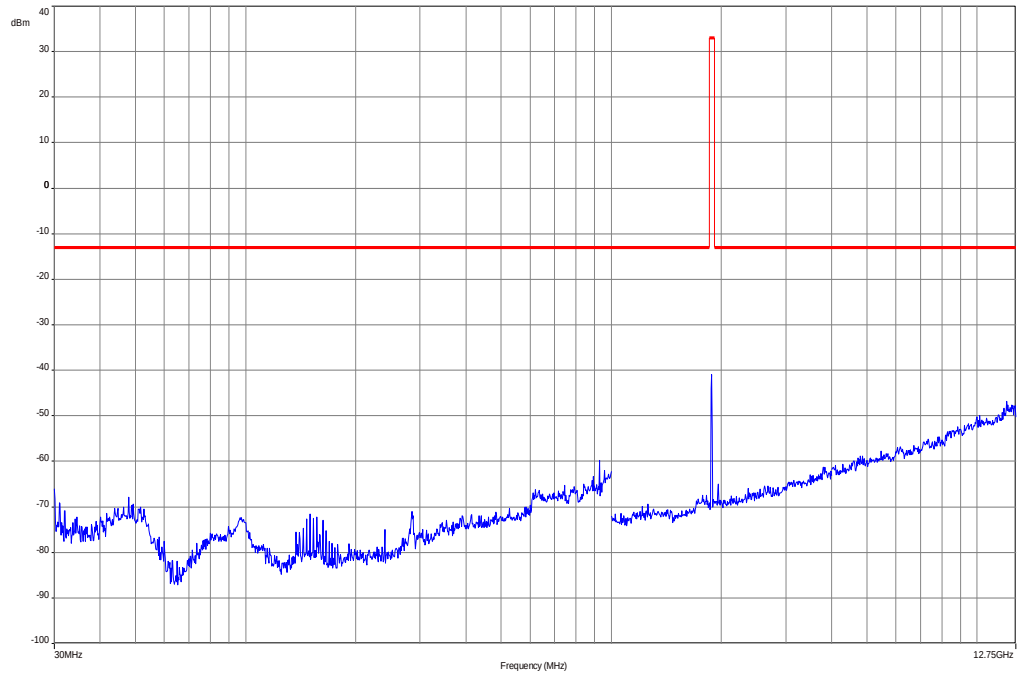
Result: **Passed**

QPSK with 10 MHz channel bandwidth

Plot 1: Channel 18900 (Traffic mode up to 30 MHz)

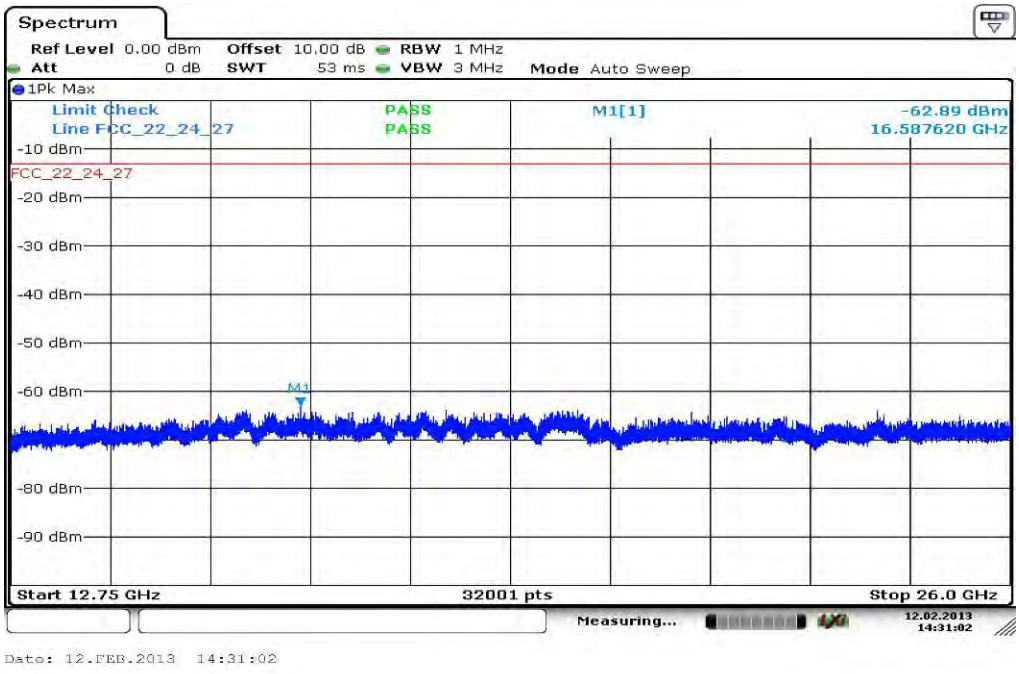


Plot 2: Channel 18900 (30 MHz – 12.75 GHz)



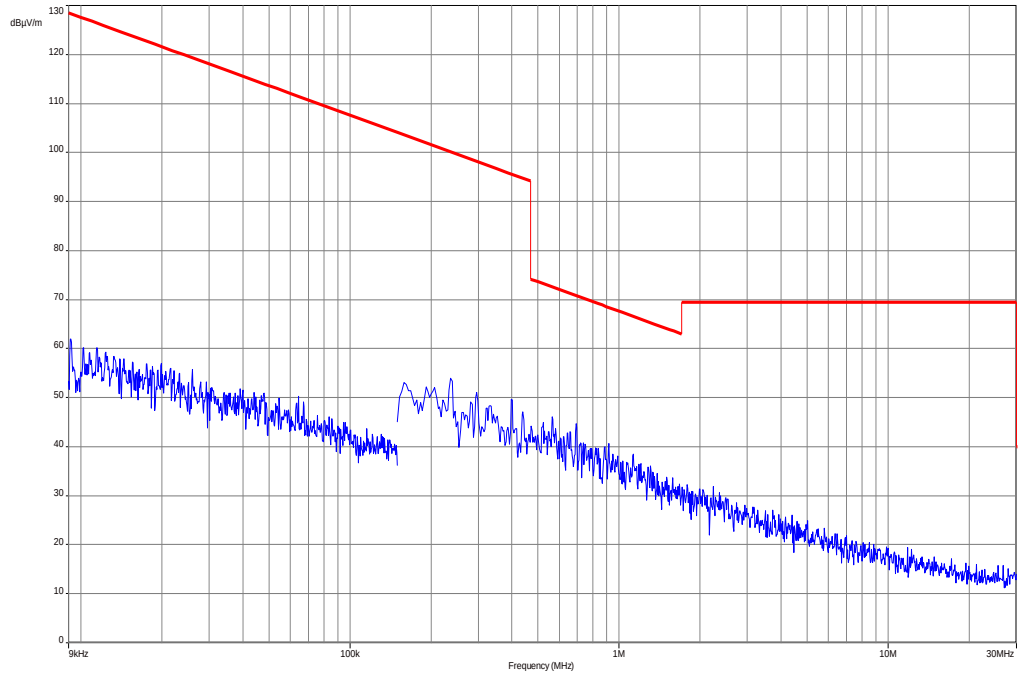
Carrier notched with 1.9 GHz rejection filter

Plot 3: Channel 18900 (12 GHz – 25 GHz)

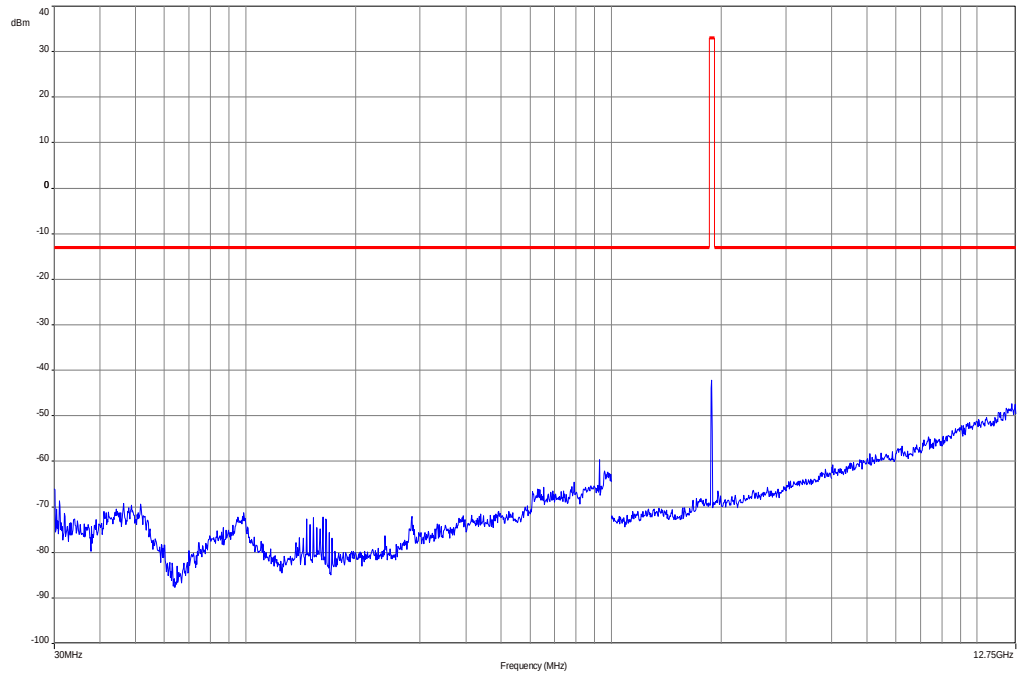


16-QAM with 10 MHz channel bandwidth

Plot 4: Channel 18900 (Traffic mode up to 30 MHz)

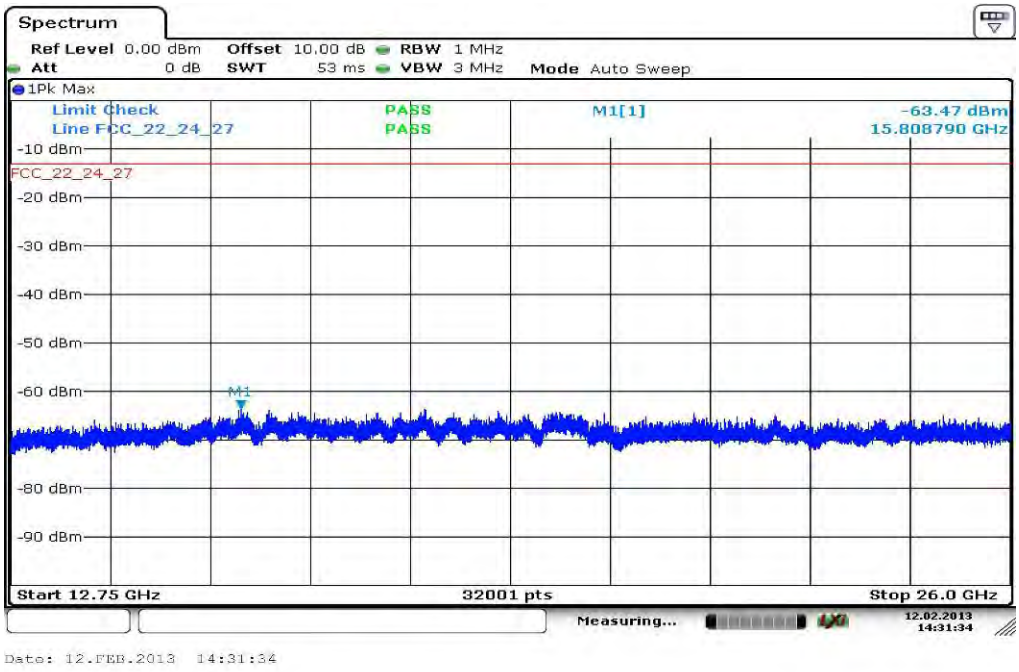


Plot 5: Channel 18900 (30 MHz – 12.75 GHz)



Carrier notched with 1.9 GHz rejection filter

Plot 6: Channel 18900 (12 GHz – 25 GHz)



8.3.5 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.

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:	30 MHz – 25 GHz
Trace-Mode:	Max Hold

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: **for 1.4 MHz channel bandwidth**

QPSK:

SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3701.4	No emissions detected.	2	3760.0	No emissions detected.	2	3818.6	No emissions detected.
3	5552.1		3	5640.0		3	5727.9	
4	7402.8		4	7520.0		4	7637.2	
5	9253.5		5	9400.0		5	9546.5	
6	11104.2		6	11280.0		6	11455.8	
7	12954.9		7	13160.0		7	13365.1	
8	14805.6		8	15040.0		8	15274.4	
9	16656.3		9	16920.0		9	17183.7	
10	18507.0		10	18800.0		10	19093.0	
Measurement uncertainty			± 0.5dB					

16-QAM:

SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3701.4	No emissions detected.	2	3760.0	No emissions detected.	2	3818.6	No emissions detected.
3	5552.1		3	5640.0		3	5727.9	
4	7402.8		4	7520.0		4	7637.2	
5	9253.5		5	9400.0		5	9546.5	
6	11104.2		6	11280.0		6	11455.8	
7	12954.9		7	13160.0		7	13365.1	
8	14805.6		8	15040.0		8	15274.4	
9	16656.3		9	16920.0		9	17183.7	
10	18507.0		10	18800.0		10	19093.0	
Measurement uncertainty			± 0.5dB					

Results: **for 5 MHz channel bandwidth**

QPSK:

SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3705	No emissions detected.	2	3760.0	No emissions detected.	2	3815	No emissions detected.
3	5557.5		3	5640.0		3	5722.5	
4	7410.0		4	7520.0		4	7630.0	
5	9262.5		5	9400.0		5	9537.5	
6	11115.0		6	11280.0		6	11445.0	
7	12967.5		7	13160.0		7	13352.5	
8	14820.0		8	15040.0		8	15260.0	
9	16672.5		9	16920.0		9	17167.5	
10	18525.0		10	18800.0		10	19075.0	
Measurement uncertainty			± 0.5dB					

16-QAM:

SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3705	No emissions detected.	2	3760.0	No emissions detected.	2	3815	No emissions detected.
3	5557.5		3	5640.0		3	5722.5	
4	7410.0		4	7520.0		4	7630.0	
5	9262.5		5	9400.0		5	9537.5	
6	11115.0		6	11280.0		6	11445.0	
7	12967.5		7	13160.0		7	13352.5	
8	14820.0		8	15040.0		8	15260.0	
9	16672.5		9	16920.0		9	17167.5	
10	18525.0		10	18800.0		10	19075.0	
Measurement uncertainty			± 0.5dB					

Results: **for 10 MHz channel bandwidth**

QPSK:

SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3710.0	No emissions detected.	2	3760.0	No emissions detected.	2	3810.0	No emissions detected.
3	5565.0		3	5640.0		3	5715.0	
4	7420.0		4	7520.0		4	7620.0	
5	9275.0		5	9400.0		5	9525.0	
6	11130.0		6	11280.0		6	11430.0	
7	12985.0		7	13160.0		7	13335.0	
8	14840.0		8	15040.0		8	15240.0	
9	16695.0		9	16920.0		9	17145.0	
10	18550.0		10	18800.0		10	19050.0	
Measurement uncertainty			± 0.5dB					

16-QAM:

SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3710.0	No emissions detected.	2	3760.0	No emissions detected.	2	3810.0	No emissions detected.
3	5565.0		3	5640.0		3	5715.0	
4	7420.0		4	7520.0		4	7620.0	
5	9275.0		5	9400.0		5	9525.0	
6	11130.0		6	11280.0		6	11430.0	
7	12985.0		7	13160.0		7	13335.0	
8	14840.0		8	15040.0		8	15240.0	
9	16695.0		9	16920.0		9	17145.0	
10	18550.0		10	18800.0		10	19050.0	
Measurement uncertainty			± 0.5dB					

Results: for 20 MHz channel bandwidth

QPSK:

SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3720	No emissions detected.	2	3760.0	No emissions detected.	2	3800	No emissions detected.
3	5580.0		3	5640.0		3	5700.0	
4	7440.0		4	7520.0		4	7600.0	
5	9300.0		5	9400.0		5	9500.0	
6	11160.0		6	11280.0		6	11400.0	
7	13020.0		7	13160.0		7	13300.0	
8	14880.0		8	15040.0		8	15200.0	
9	16740.0		9	16920.0		9	17100.0	
10	18600.0		10	18800.0		10	19000.0	
Measurement uncertainty			± 0.5dB					

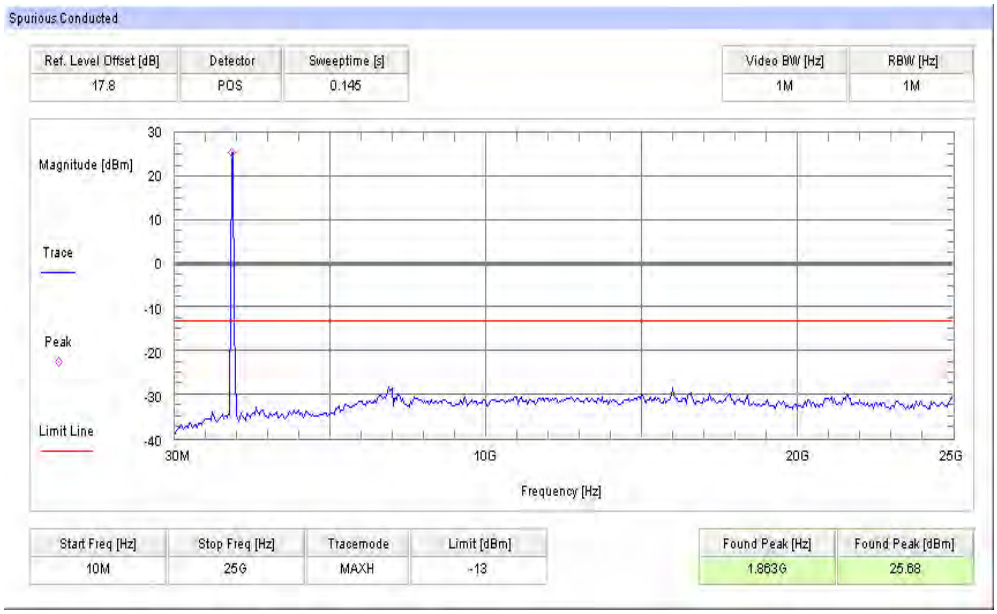
16-QAM:

SPURIOUS EMISSION LEVEL (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3720	No emissions detected.	2	3760.0	No emissions detected.	2	3800	No emissions detected.
3	5580.0		3	5640.0		3	5700.0	
4	7440.0		4	7520.0		4	7600.0	
5	9300.0		5	9400.0		5	9500.0	
6	11160.0		6	11280.0		6	11400.0	
7	13020.0		7	13160.0		7	13300.0	
8	14880.0		8	15040.0		8	15200.0	
9	16740.0		9	16920.0		9	17100.0	
10	18600.0		10	18800.0		10	19000.0	
Measurement uncertainty			± 0.5dB					

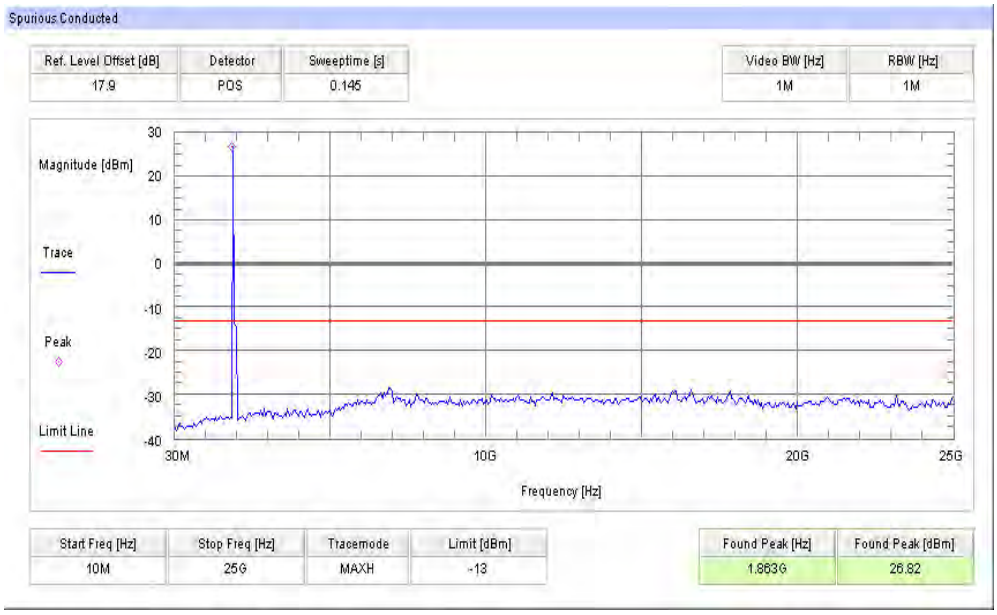
Result: **Passed**

Plots: QPSK with 1.4 MHz channel bandwidth

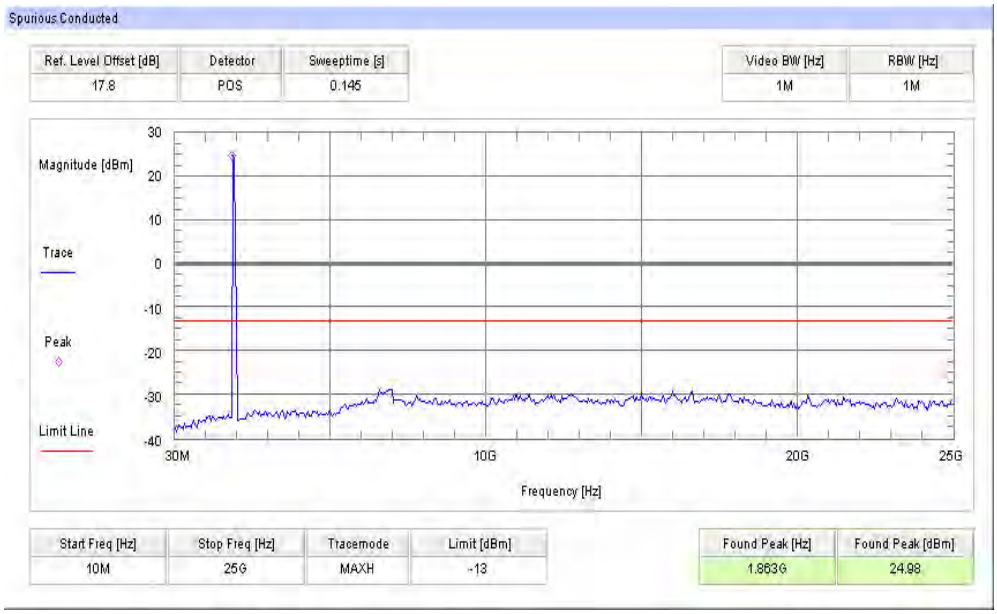
Plot 1: Lowest Channel (10 MHz - 25 GHz)



Plot 2: Middle Channel (10 MHz - 25 GHz)

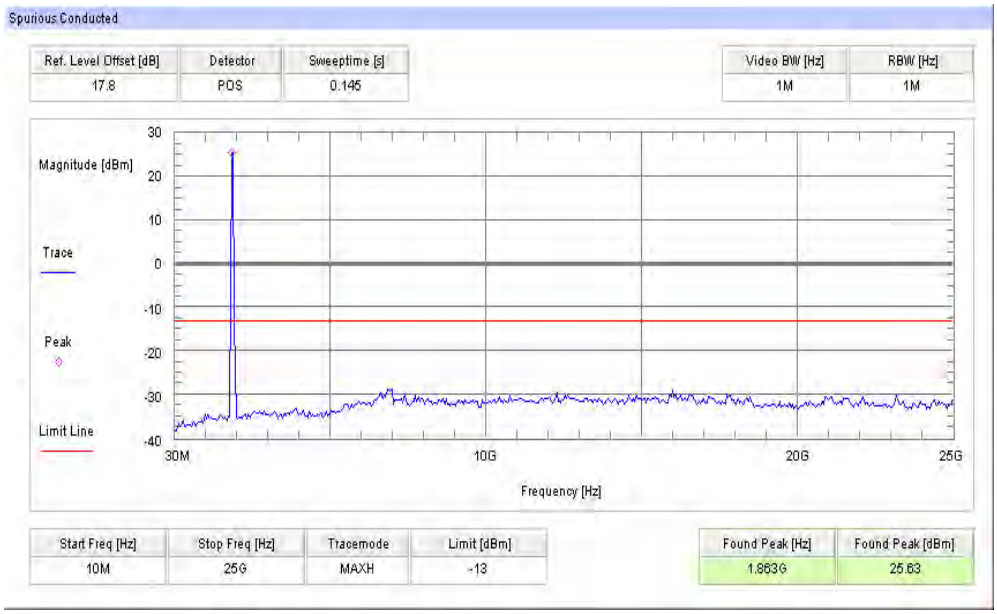


Plot 3: Highest Channel (10 MHz - 25 GHz)

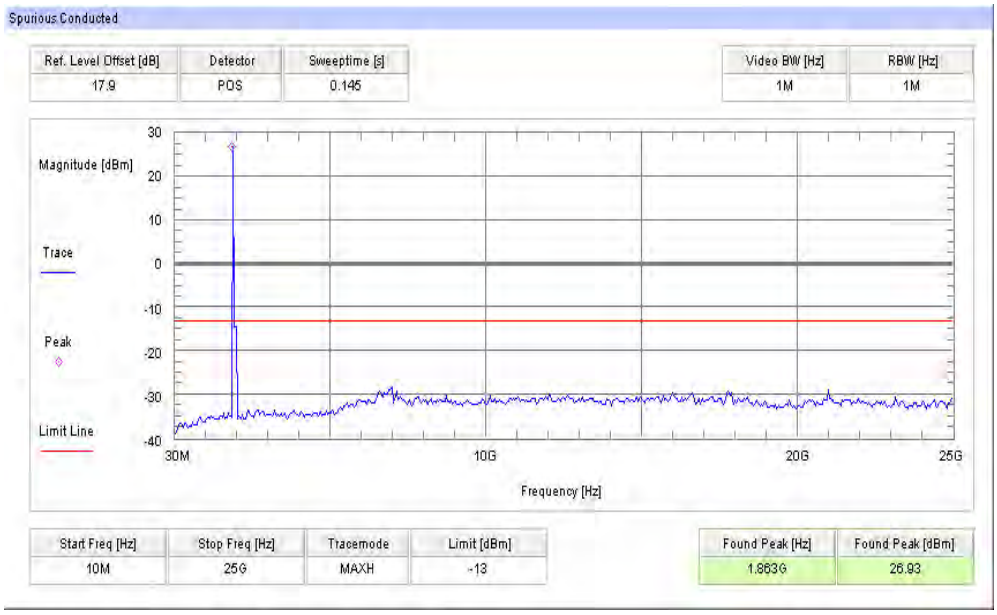


Plots: 16-QAM with 1.4 MHz channel bandwidth

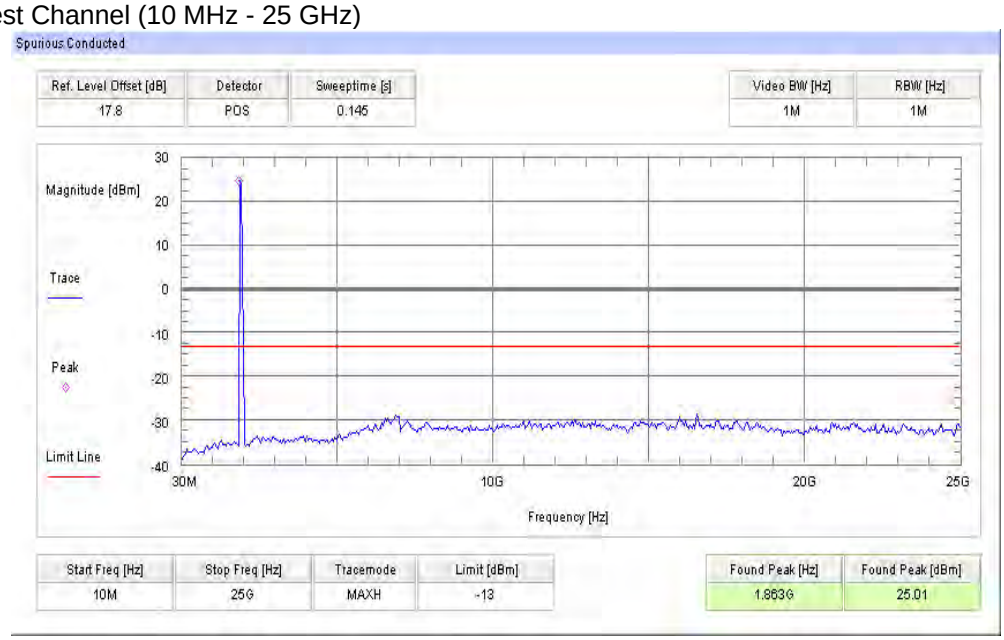
Plot 4: Lowest Channel (10 MHz - 25 GHz)



Plot 5: Middle Channel (10 MHz - 25 GHz)

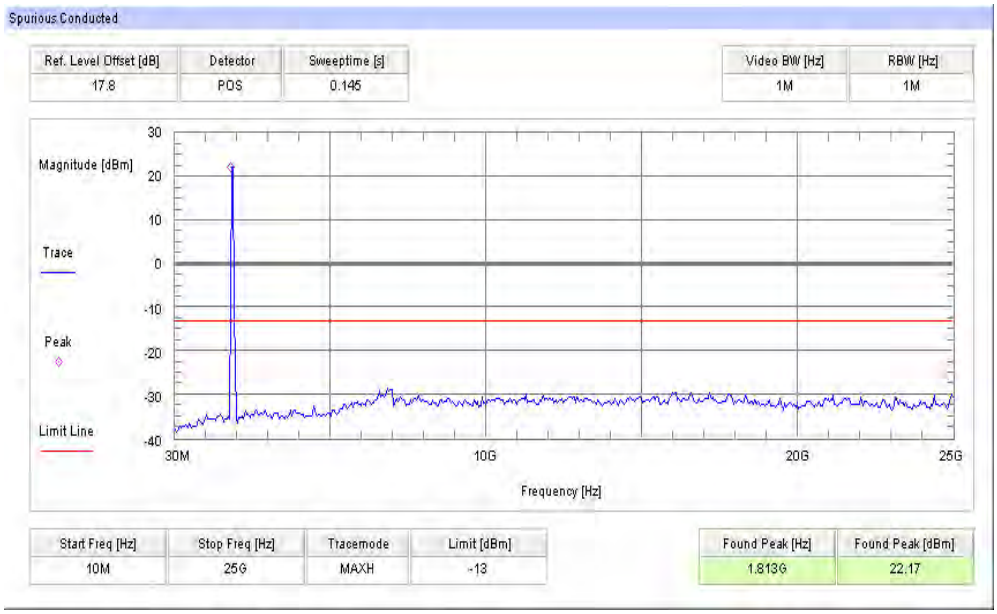


Plot 6: Highest Channel (10 MHz - 25 GHz)

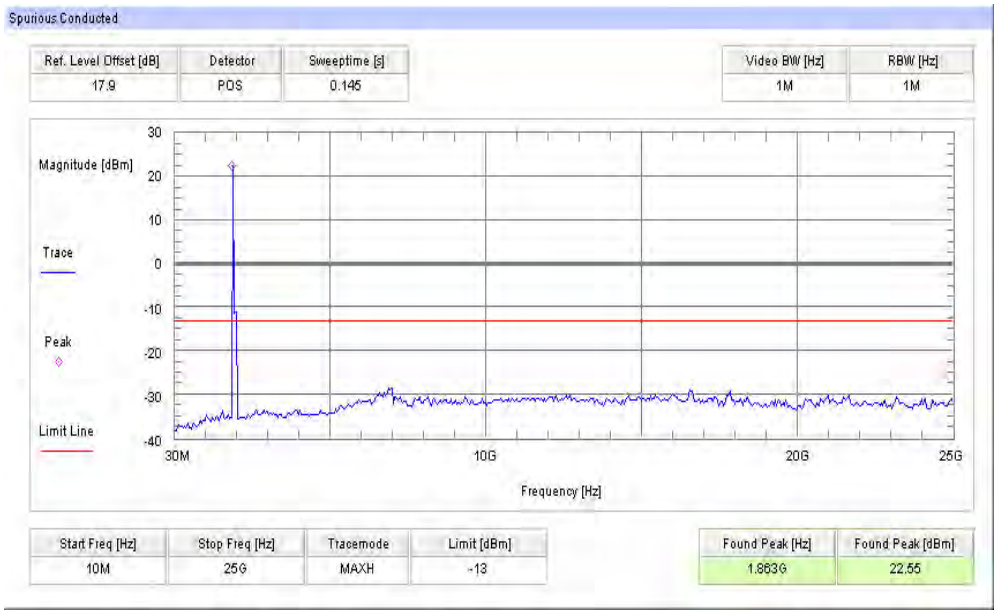


Plots: QPSK with 5 MHz channel bandwidth

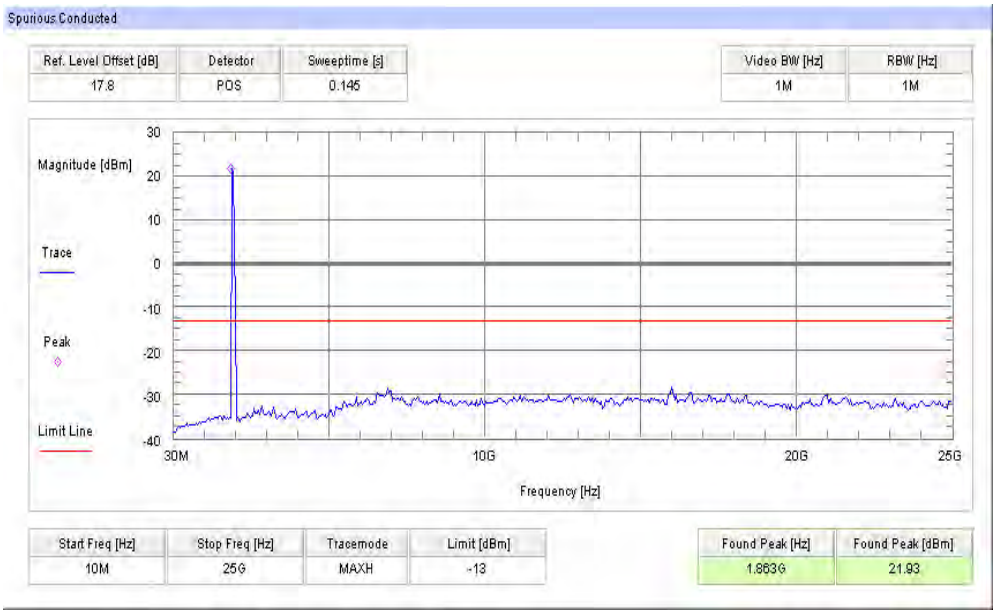
Plot 1: Lowest Channel (10 MHz - 25 GHz)



Plot 2: Middle Channel (10 MHz - 25 GHz)

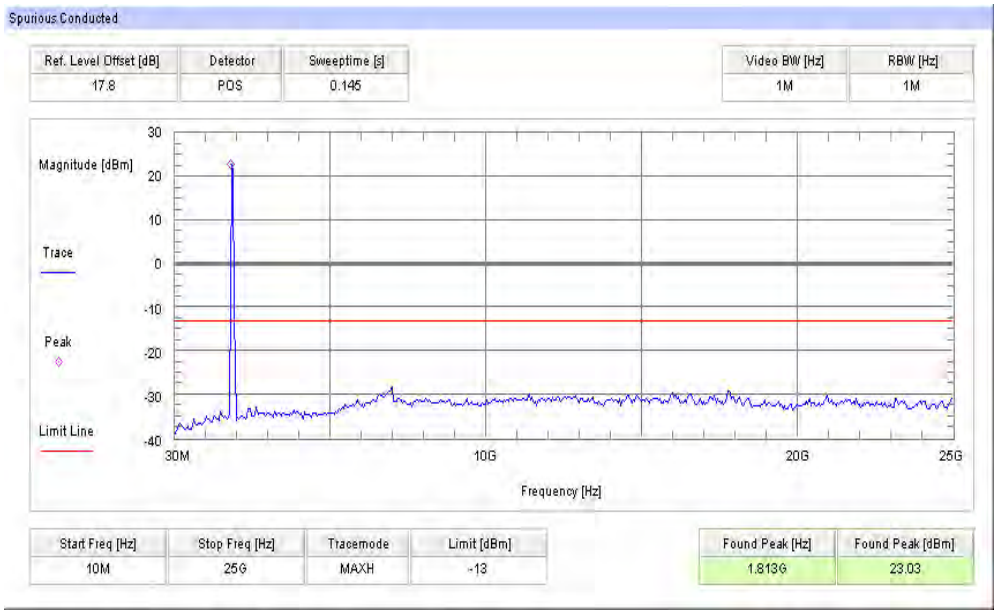


Plot 3: Highest Channel (10 MHz - 25 GHz)

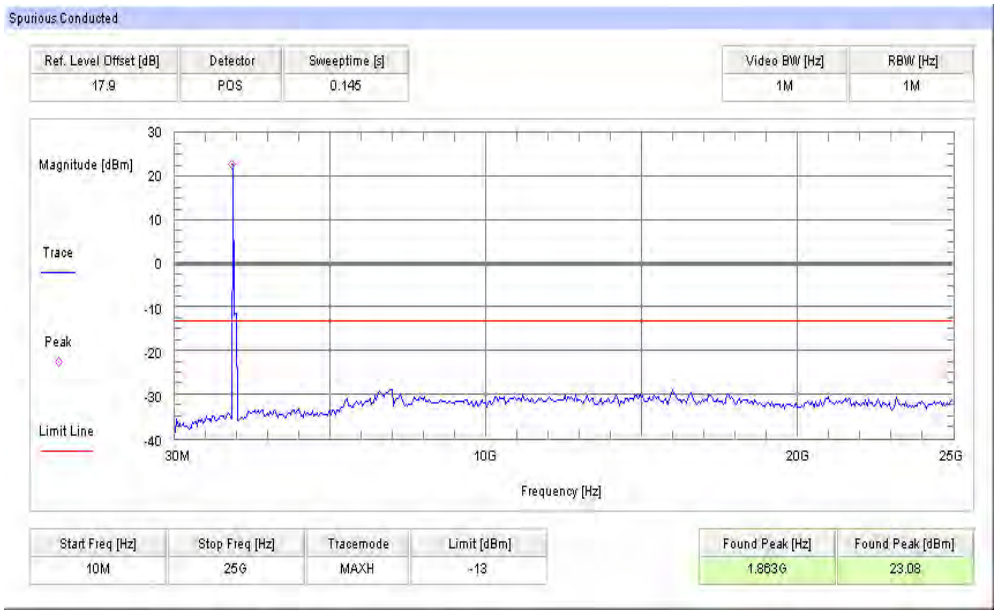


Plots: 16-QAM with 5 MHz channel bandwidth

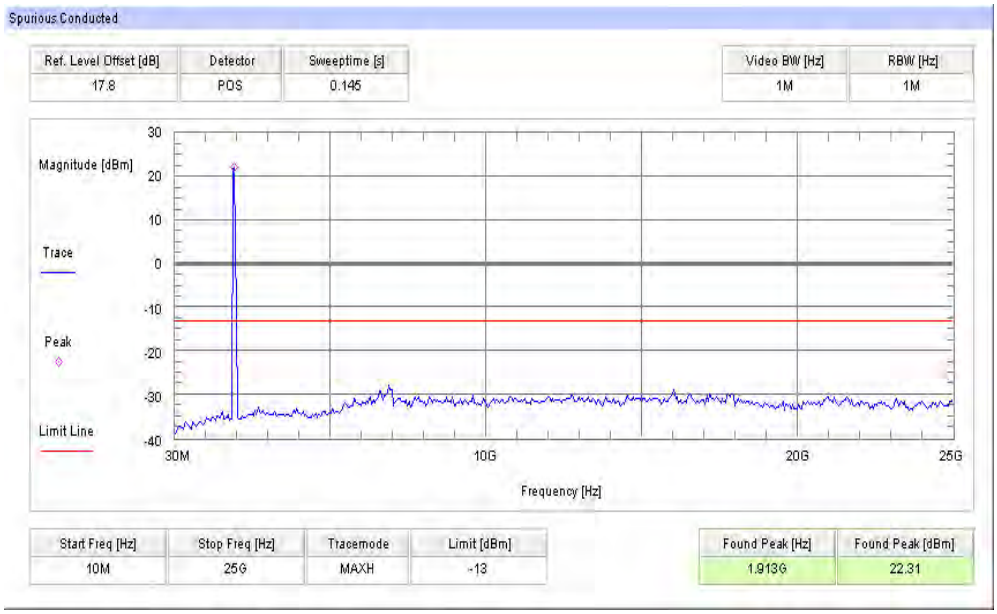
Plot 4: Lowest Channel (10 MHz - 25 GHz)



Plot 5: Middle Channel (10 MHz - 25 GHz)

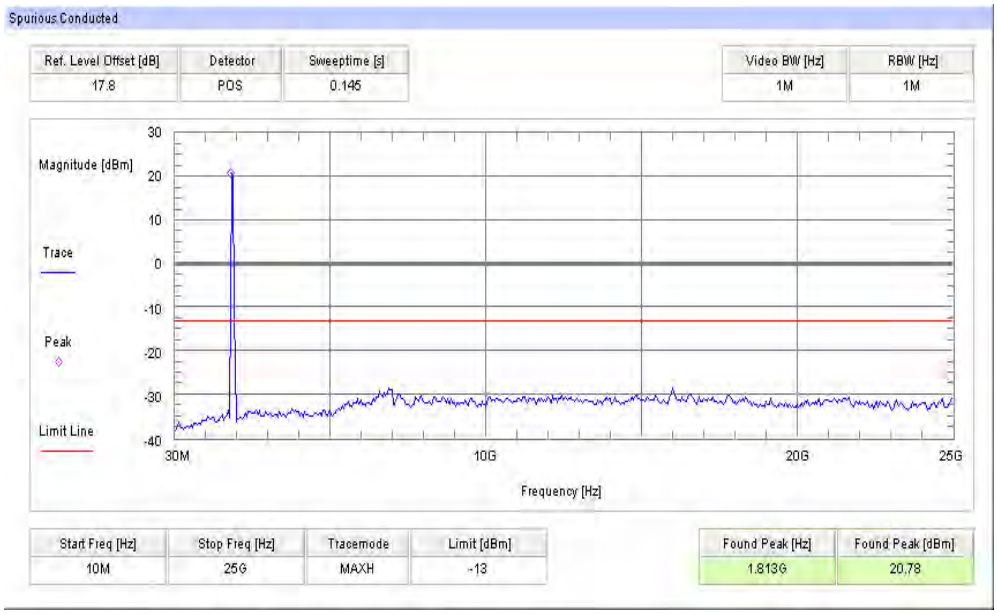


Plot 6: Highest Channel (10 MHz - 25 GHz)

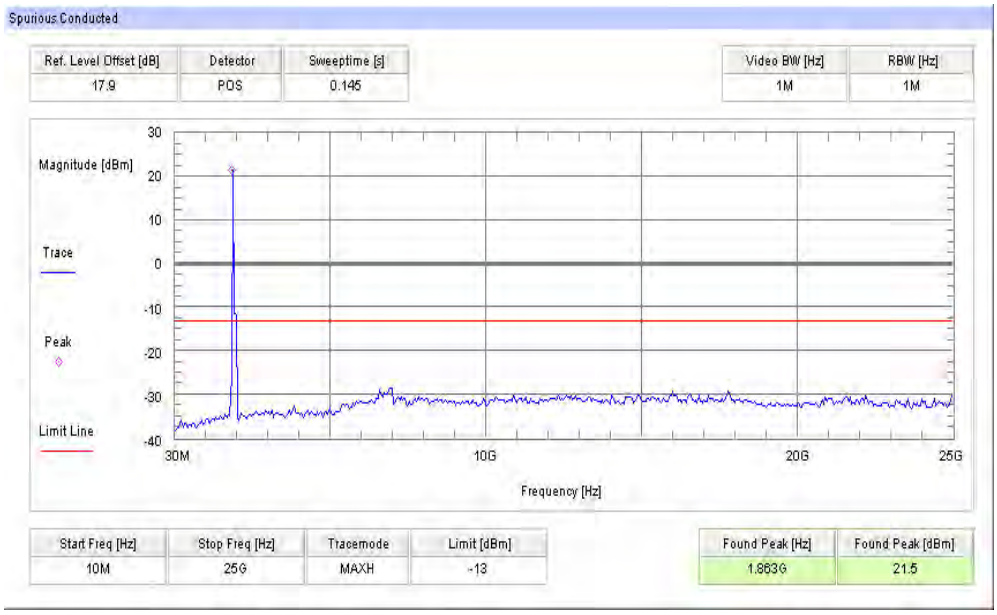


Plots: QPSK with 10 MHz channel bandwidth

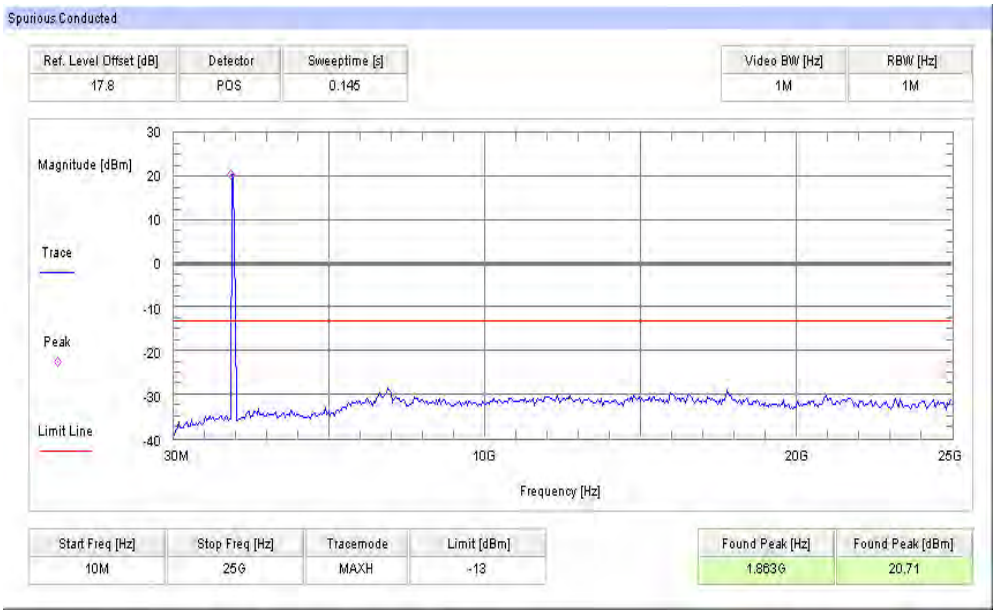
Plot 1: Lowest Channel (10 MHz - 25 GHz)



Plot 2: Middle Channel (10 MHz - 25 GHz)

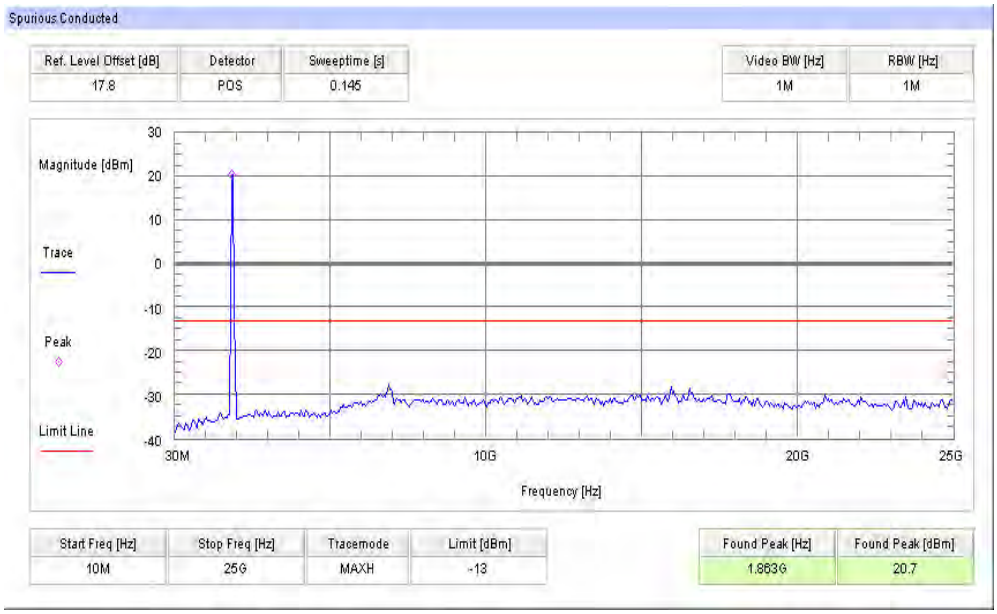


Plot 3: Highest Channel (10 MHz - 25 GHz)

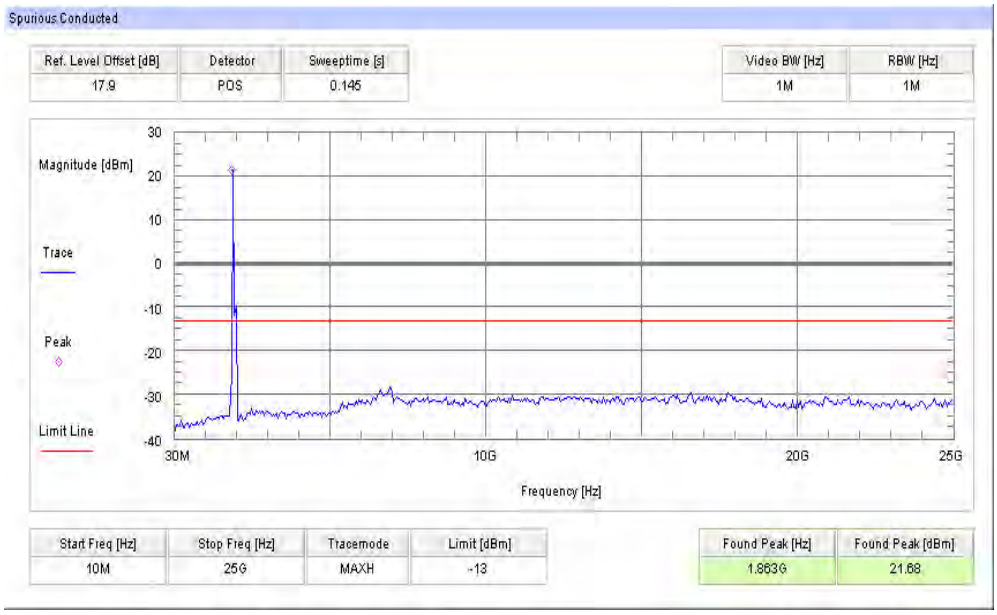


Plots: 16-QAM with 10 MHz channel bandwidth

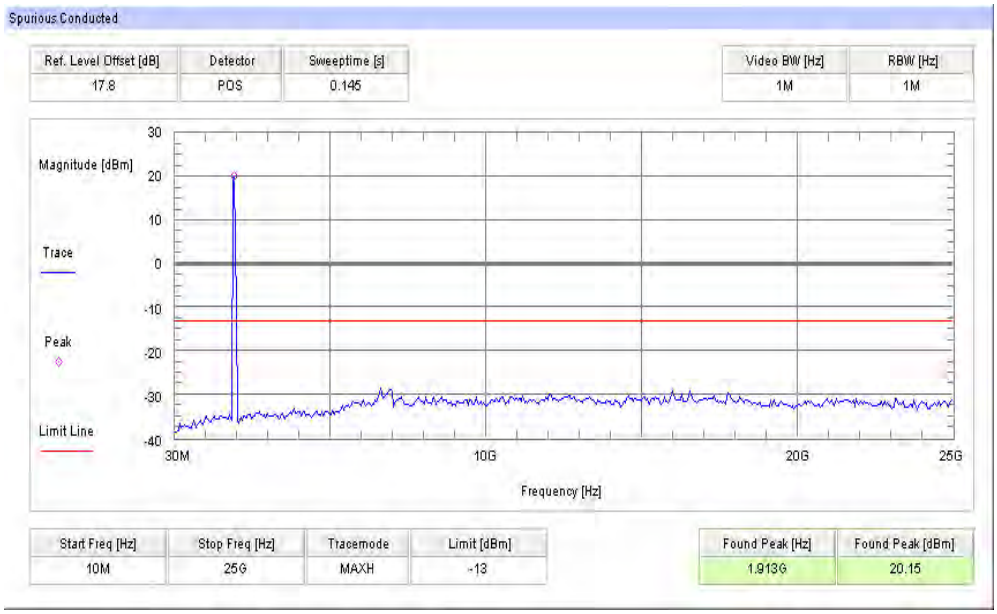
Plot 4: Lowest Channel (10 MHz - 25 GHz)



Plot 5: Middle Channel (10 MHz - 25 GHz)

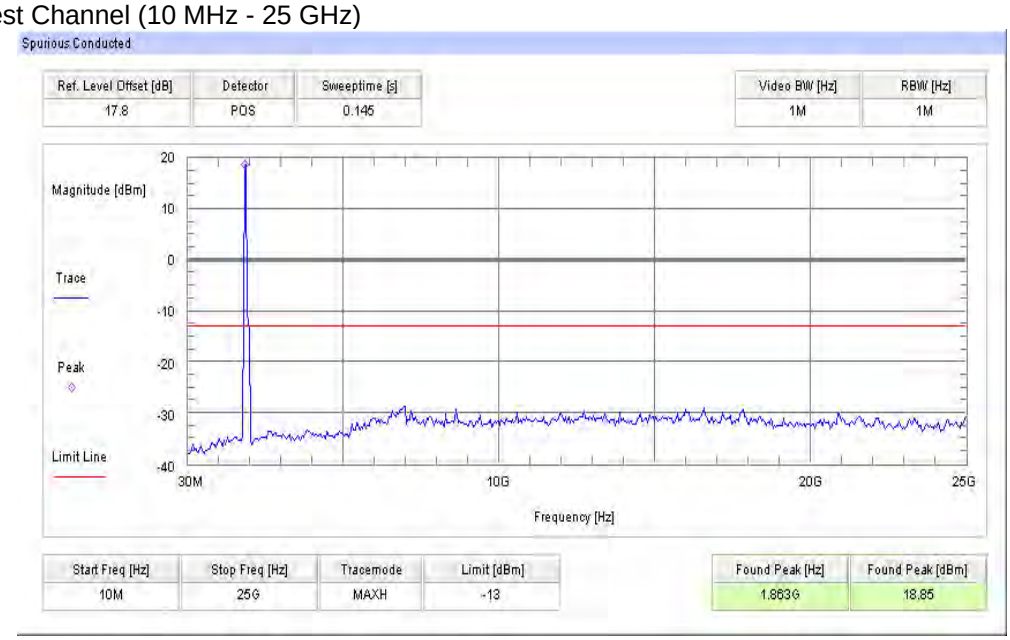


Plot 6: Highest Channel (10 MHz - 25 GHz)

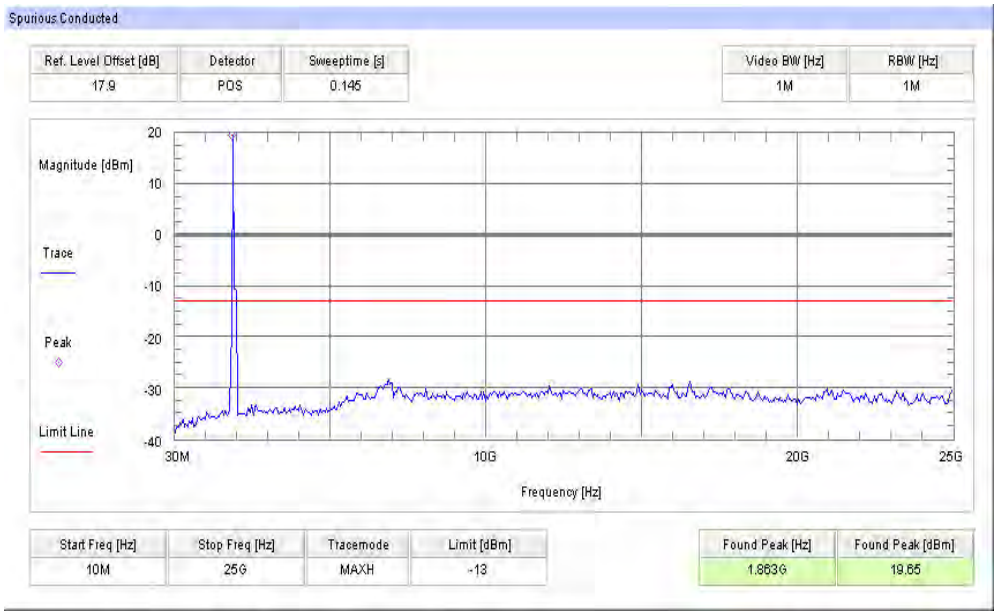


Plots: QPSK with 20 MHz channel bandwidth

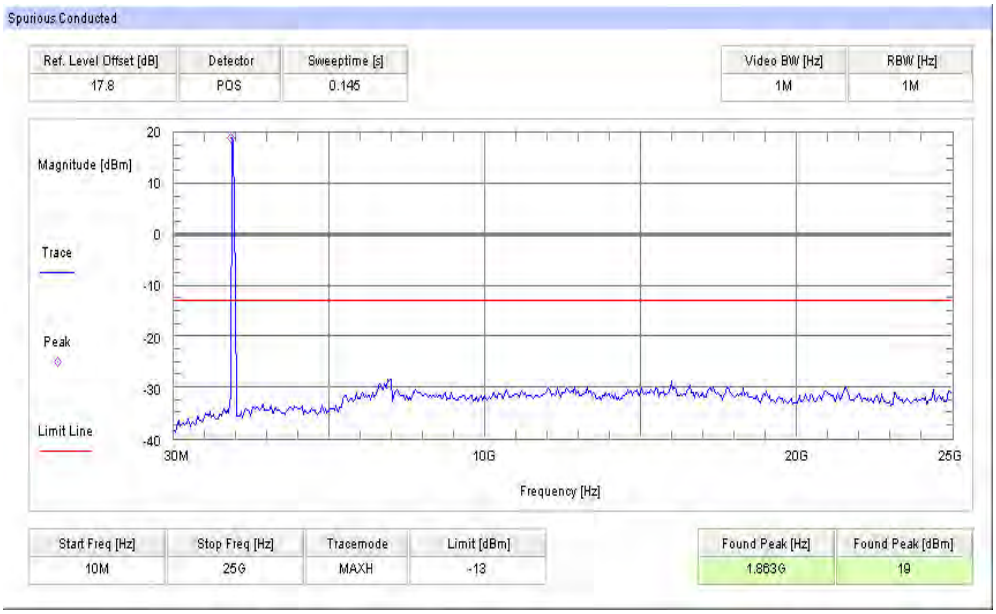
Plot 1: Lowest Channel (10 MHz - 25 GHz)



Plot 2: Middle Channel (10 MHz - 25 GHz)

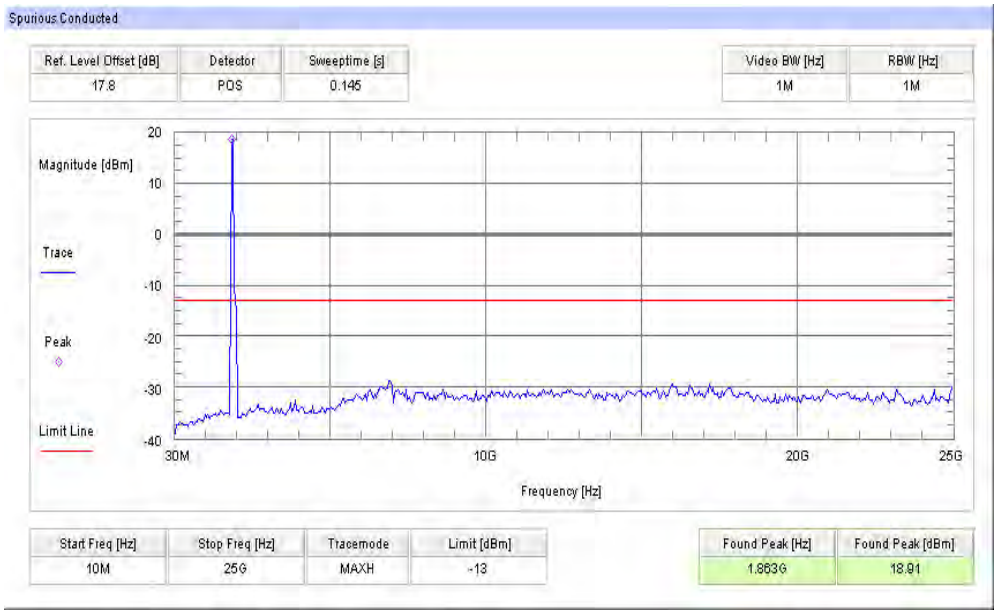


Plot 3: Highest Channel (10 MHz - 25 GHz)

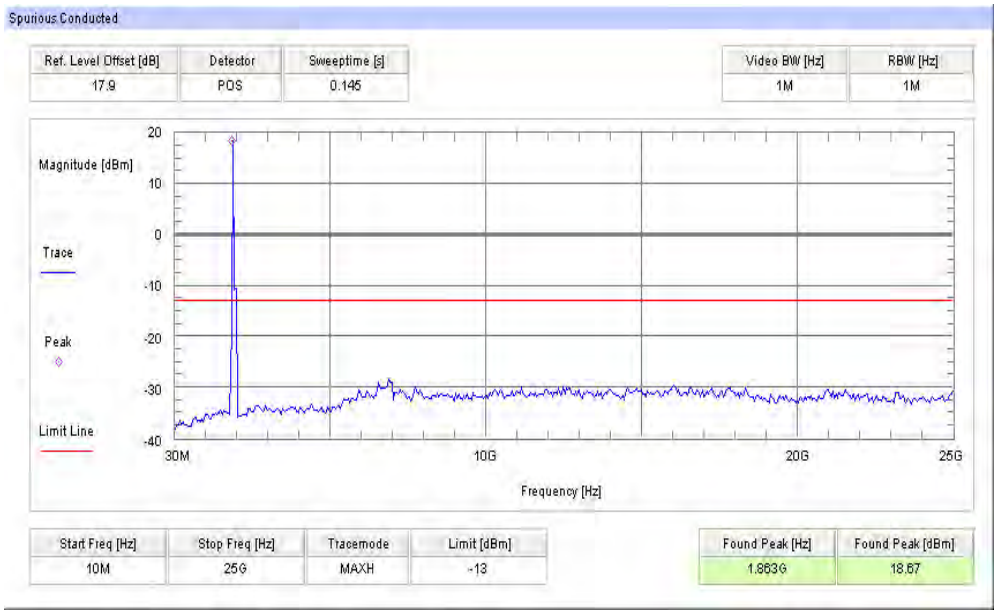


Plots: 16-QAM with 20 MHz channel bandwidth

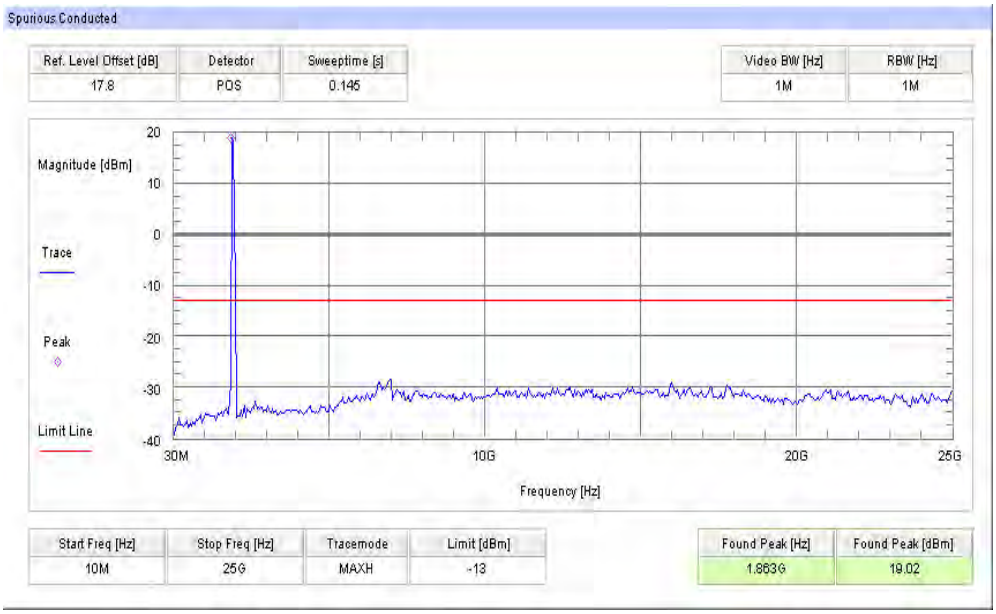
Plot 4: Lowest Channel (10 MHz - 25 GHz)



Plot 5: Middle Channel (10 MHz - 25 GHz)



Plot 6: Highest Channel (10 MHz - 25 GHz)



8.3.6 Block edge compliance

Description:

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

Measurement:

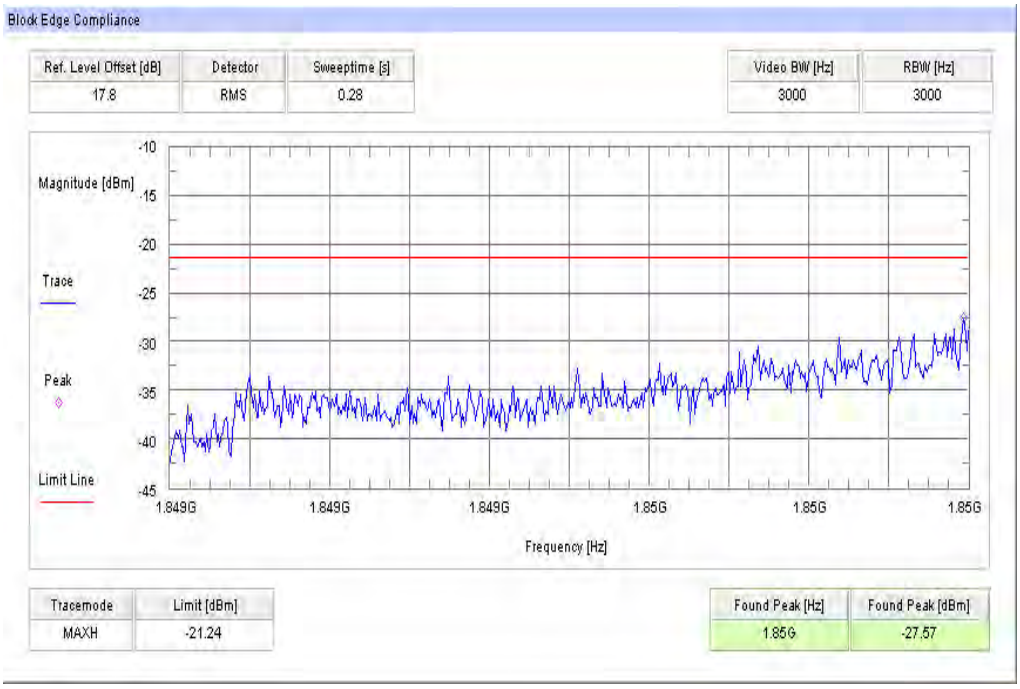
Measurement parameters	
Detector:	RMS
Sweep time:	60 sec.
Video bandwidth:	30 kHz
Resolution bandwidth:	30 kHz
Span:	1 MHz
Trace-Mode:	Max Hold

Limits:

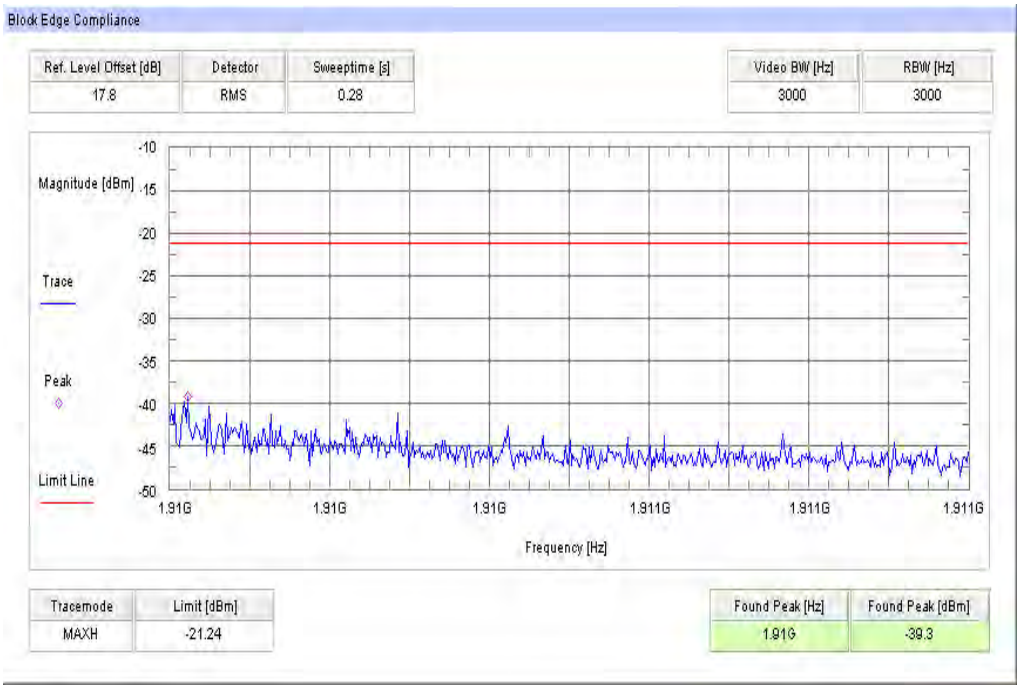
FCC	IC
CFR Part 24.238 CFR Part 2.1051	RSS 133
Block Edge Compliance	
Part 24.238 specifies that “the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.” However, in publication number 890810, The FCC Office of Engineering and Technology specified the following correction to the limits when a resolution bandwidth smaller than 1% of the emission bandwidth is used: “An alternative is to add an additional correction factor of 10 Log (RBW1/ RBW2) to the 43 +10 Log (P) limit. RBW1 is the narrower measurement resolution bandwidth and RBW2 is either the 1% emissions bandwidth or 1 MHz.” When using a 30 kHz bandwidth, this yields a -8.24 adjustment to the limit [10log(30kHz/200kHz) = -8.24]. When this adjustment is applied to the limit, the limit becomes -21.24 dBm.	
worst case: -21.24 dBm	

Results: **1.4 MHz channel bandwidth**

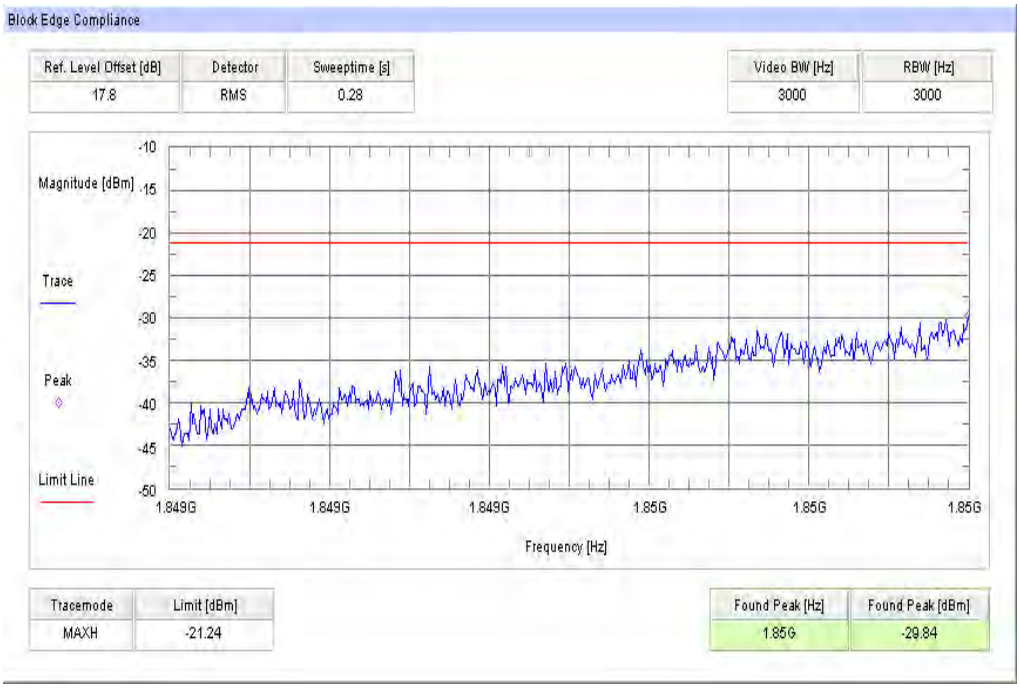
Plot 1: Lowest channel – QPSK



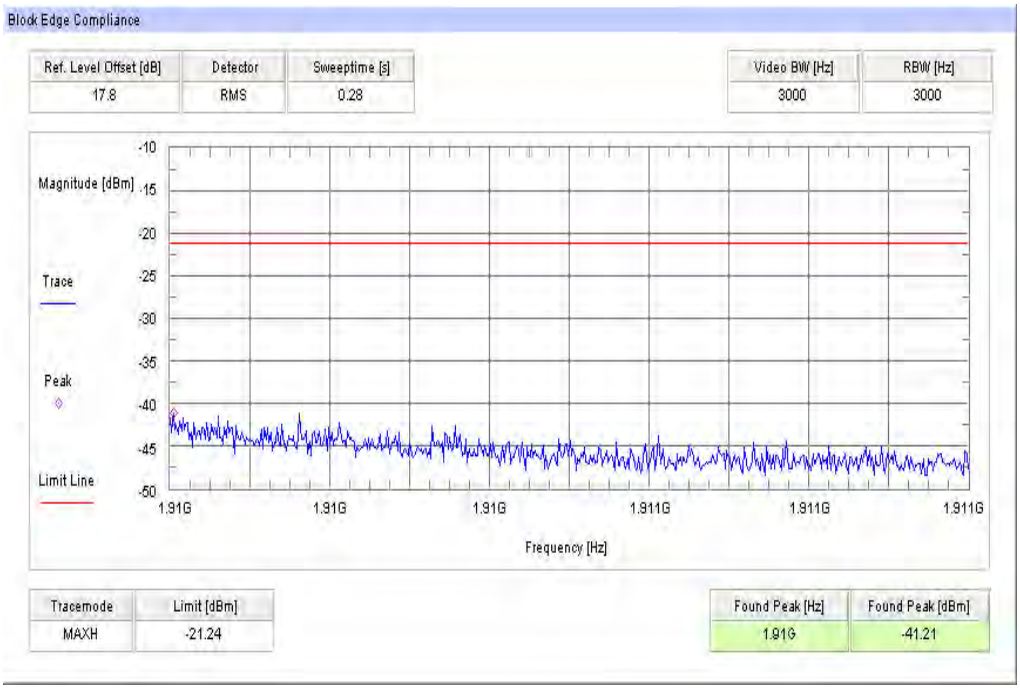
Plot 2: Highest channel – QPSK



Plot 3: Lowest channel – 16-QAM

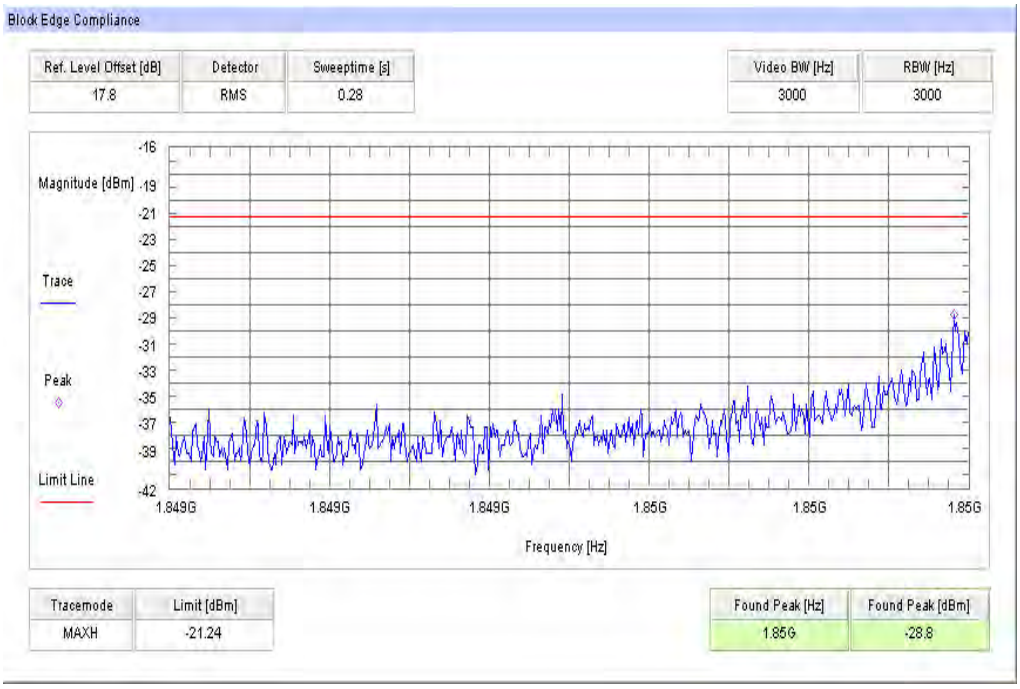


Plot 4: Highest channel – 16-QAM

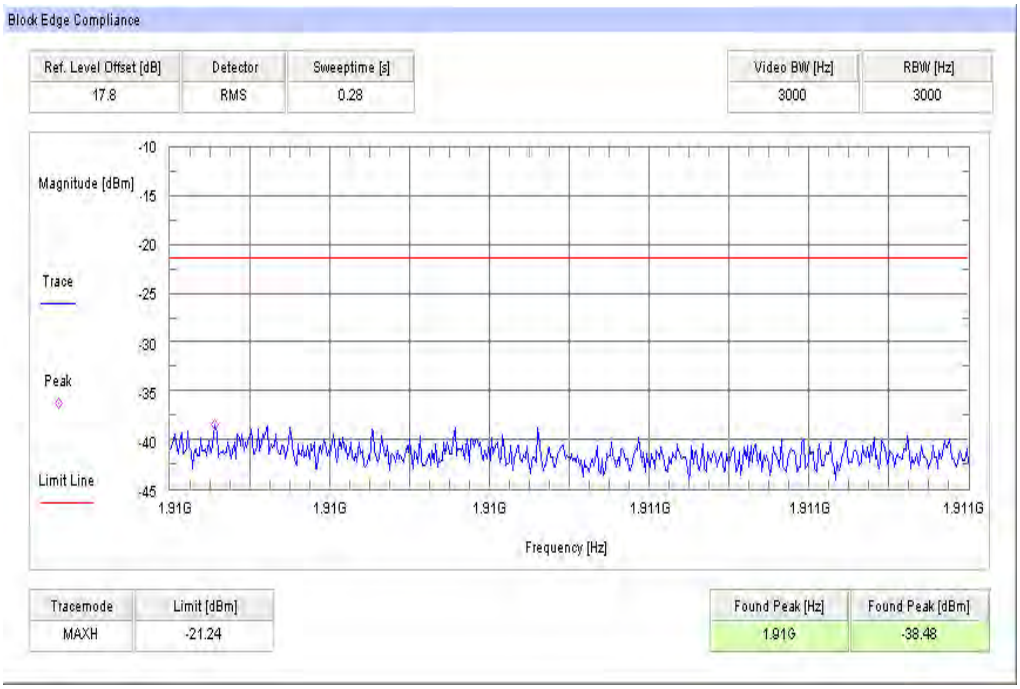


Results: **3 MHz channel bandwidth**

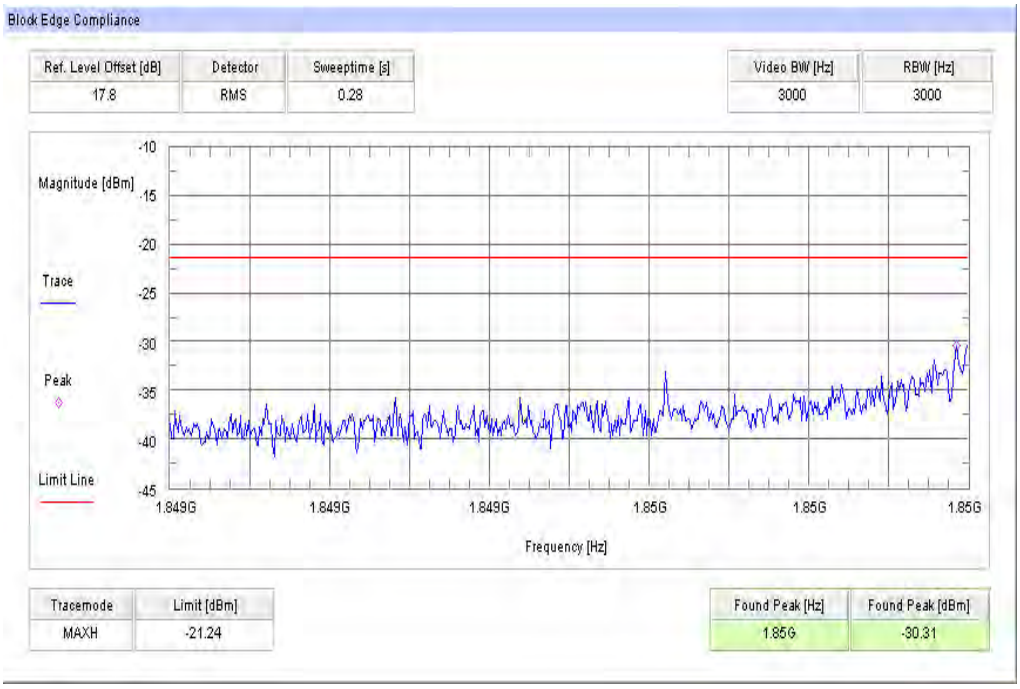
Plot 1: Lowest channel – QPSK



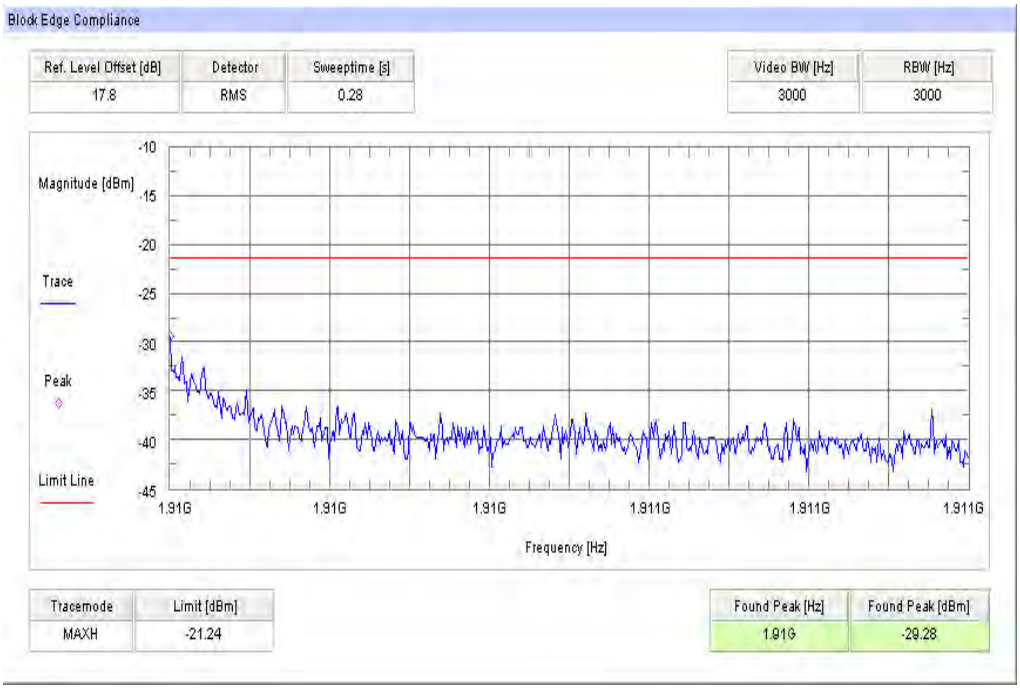
Plot 2: Highest channel – QPSK



Plot 3: Lowest channel – 16-QAM

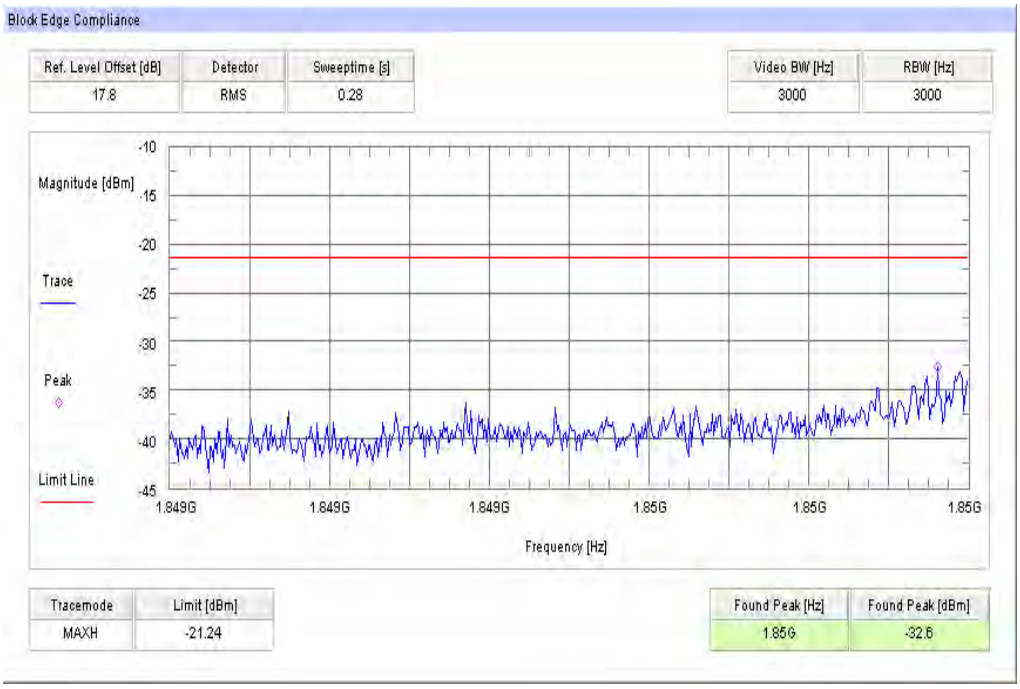


Plot 4: Highest channel – 16-QAM

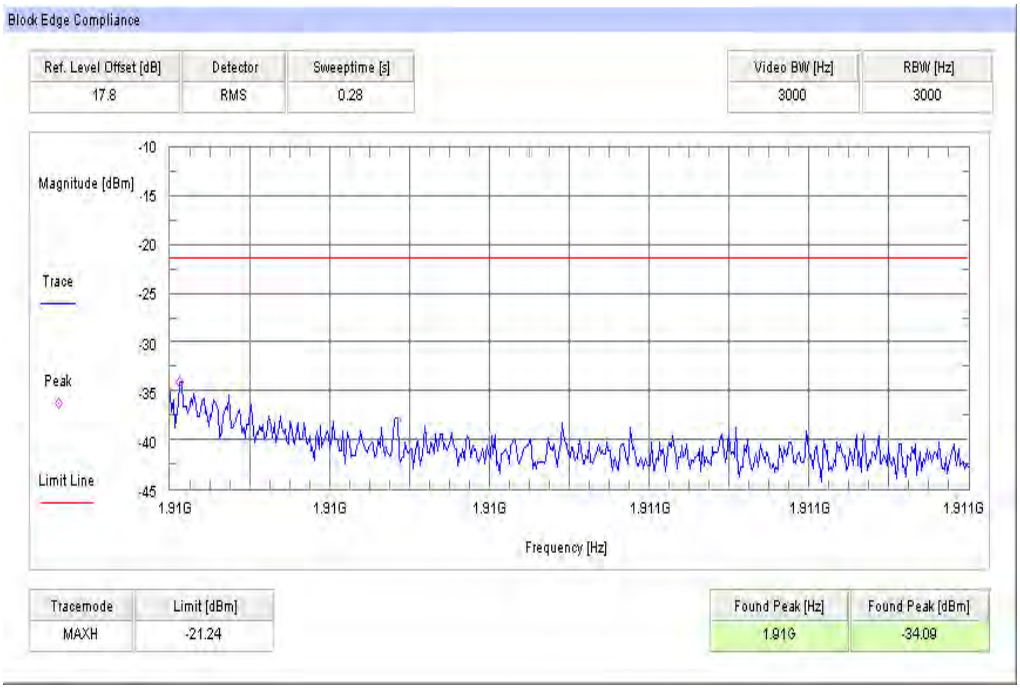


Results: **5 MHz channel bandwidth**

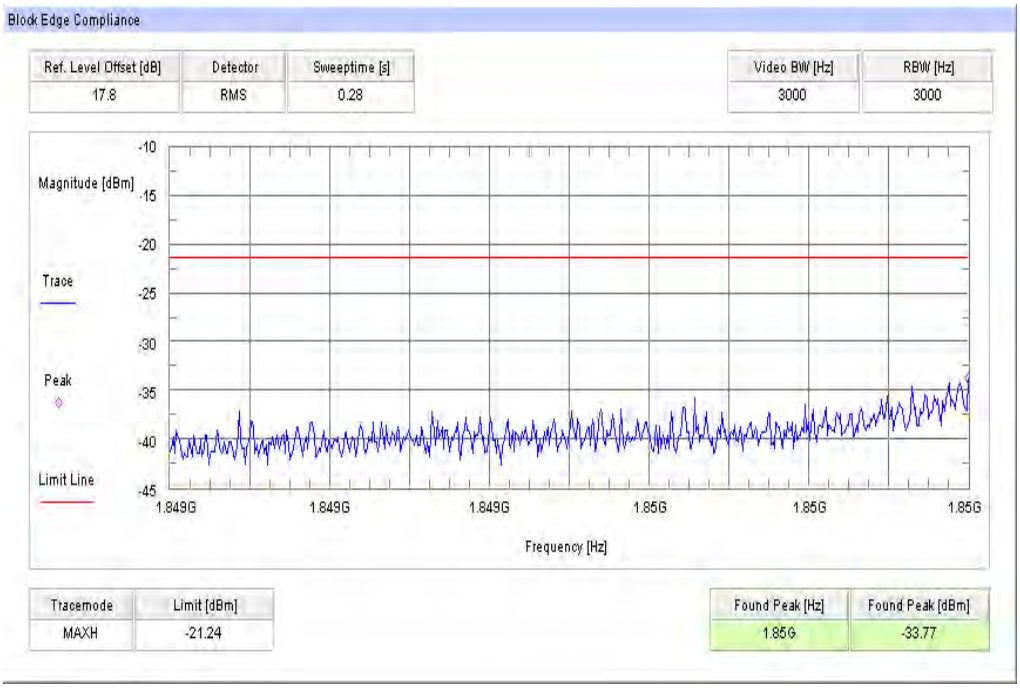
Plot 1: Lowest channel – QPSK



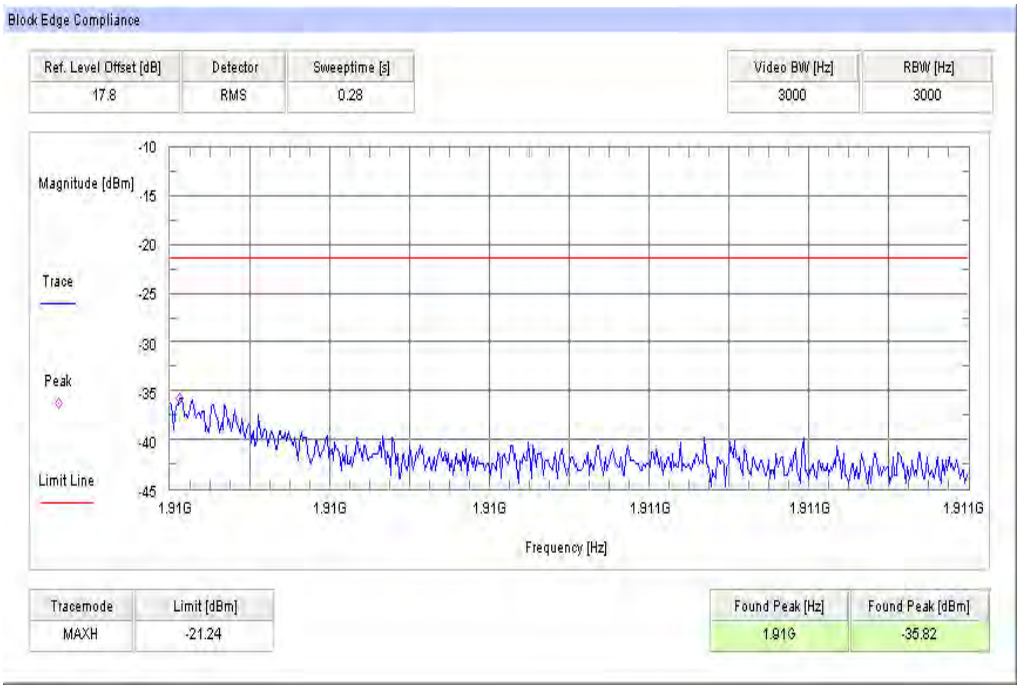
Plot 2: Highest channel – QPSK



Plot 3: Lowest channel – 16-QAM

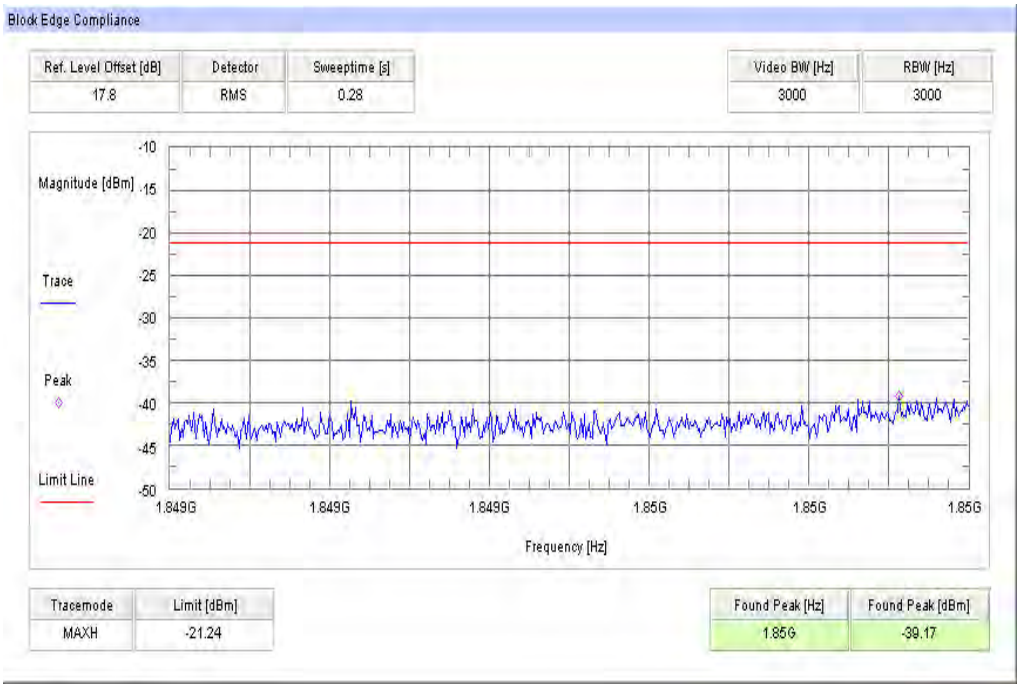


Plot 4: Highest channel – 16-QAM

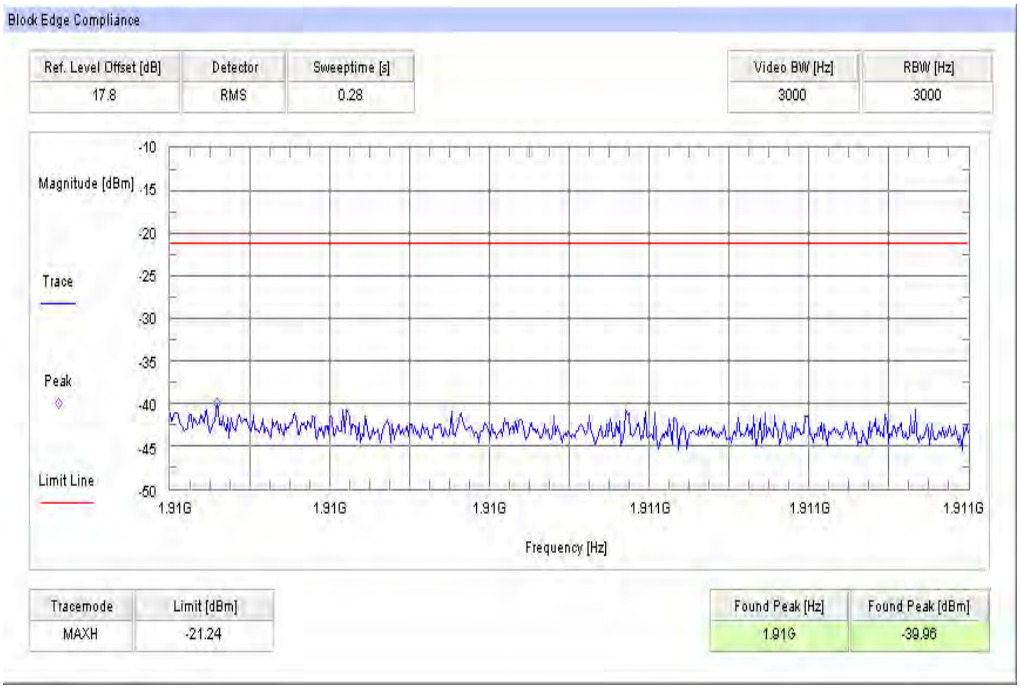


Results: **10 MHz channel bandwidth**

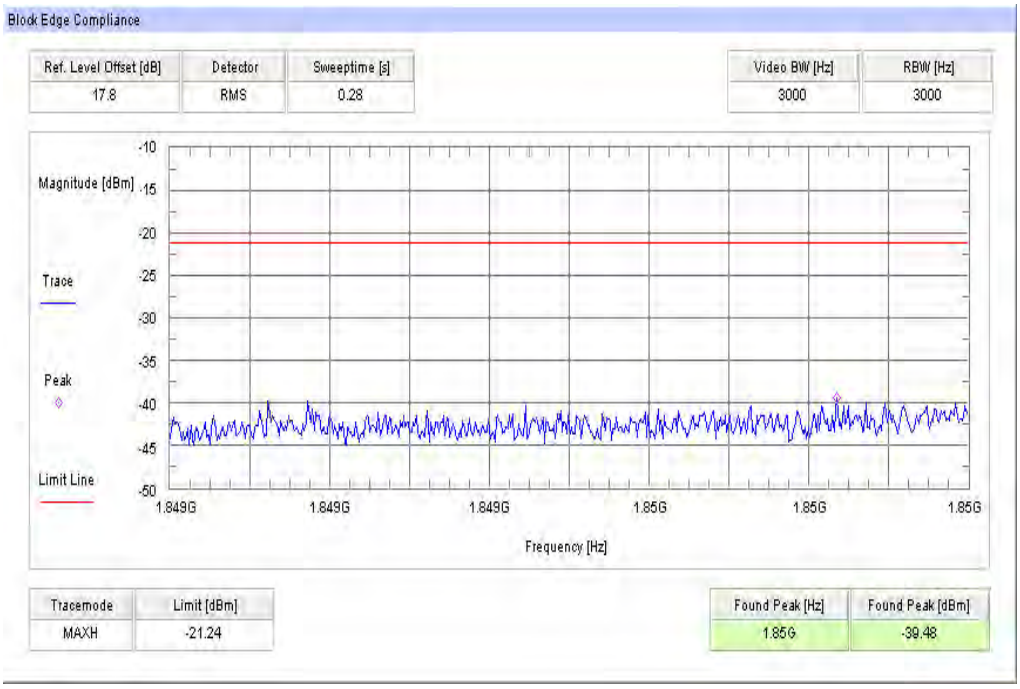
Plot 1: Lowest channel – QPSK



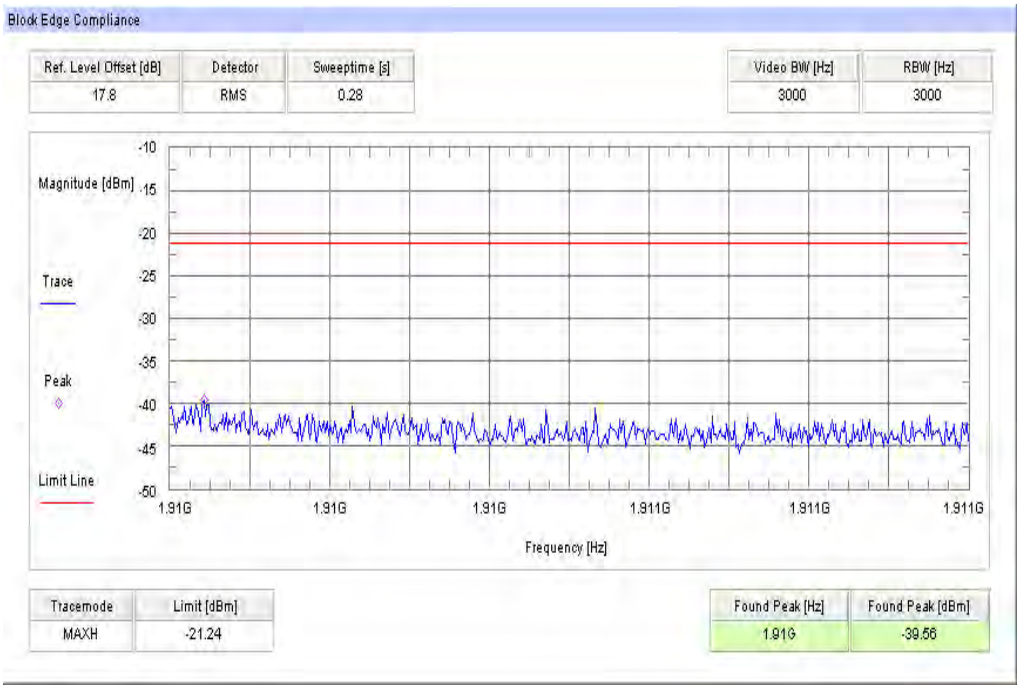
Plot 2: Highest channel – QPSK



Plot 3: Lowest channel – 16-QAM

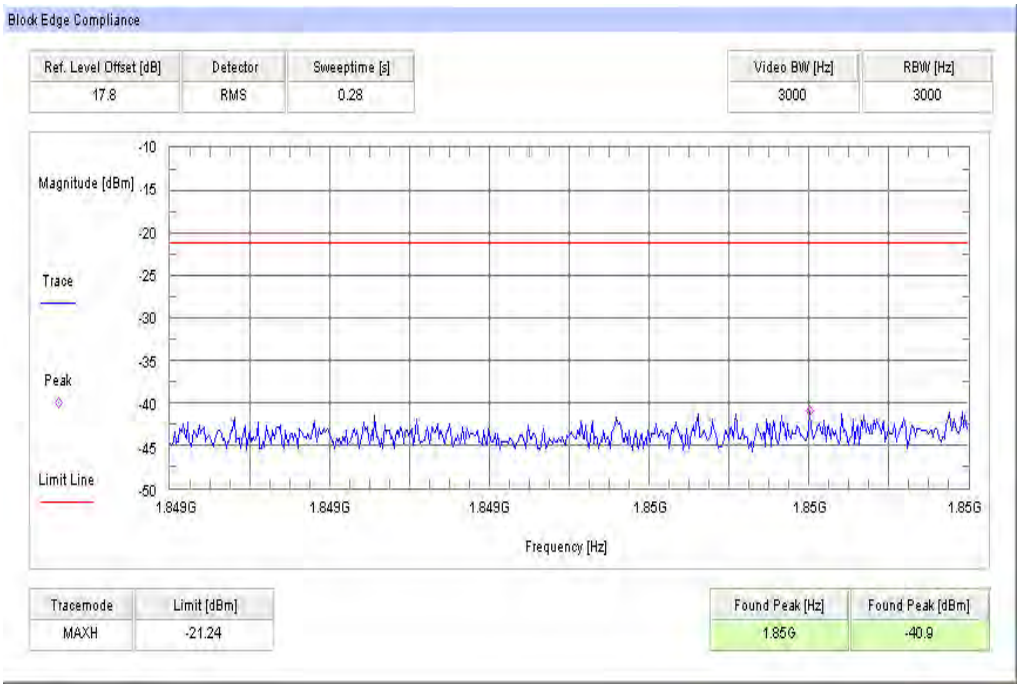


Plot 4: Highest channel – 16-QAM

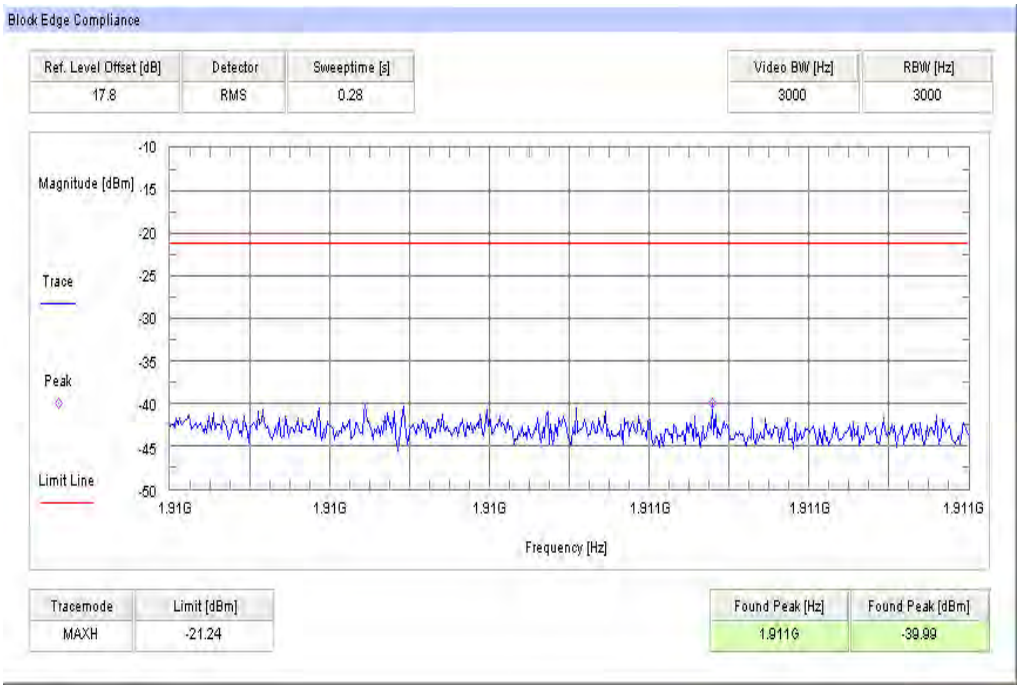


Results: **15 MHz channel bandwidth**

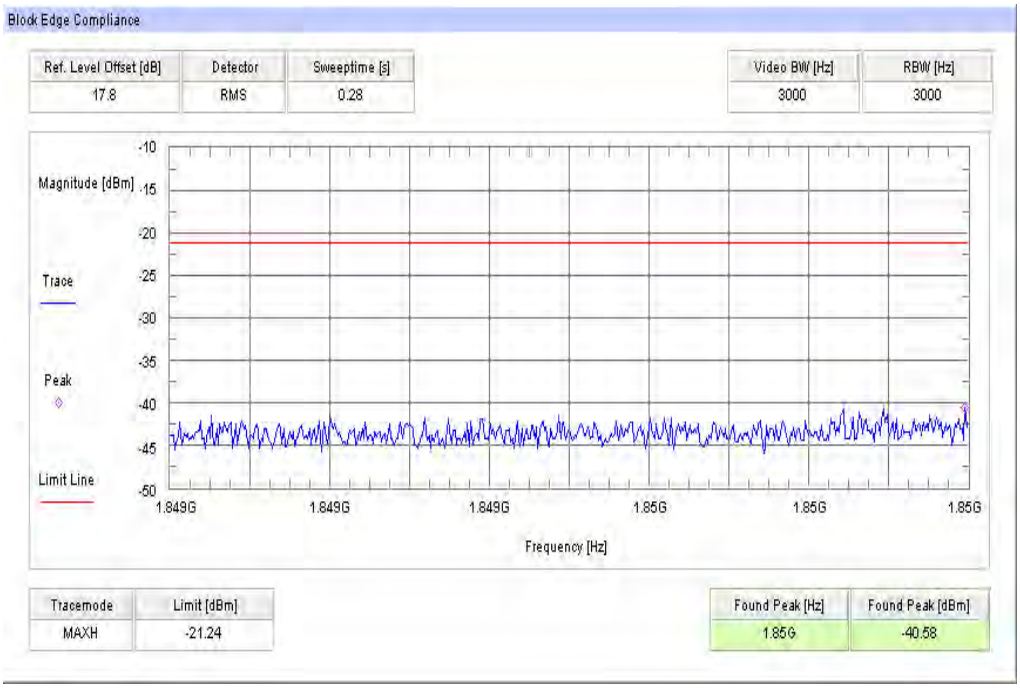
Plot 1: Lowest channel – QPSK



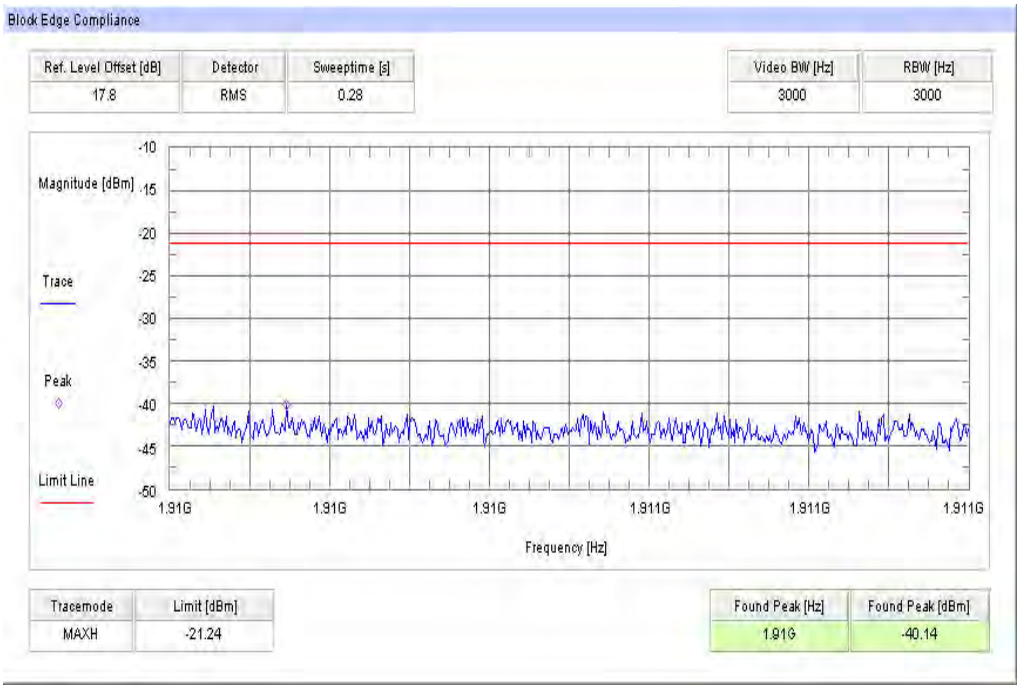
Plot 2: Highest channel – QPSK



Plot 3: Lowest channel – 16-QAM

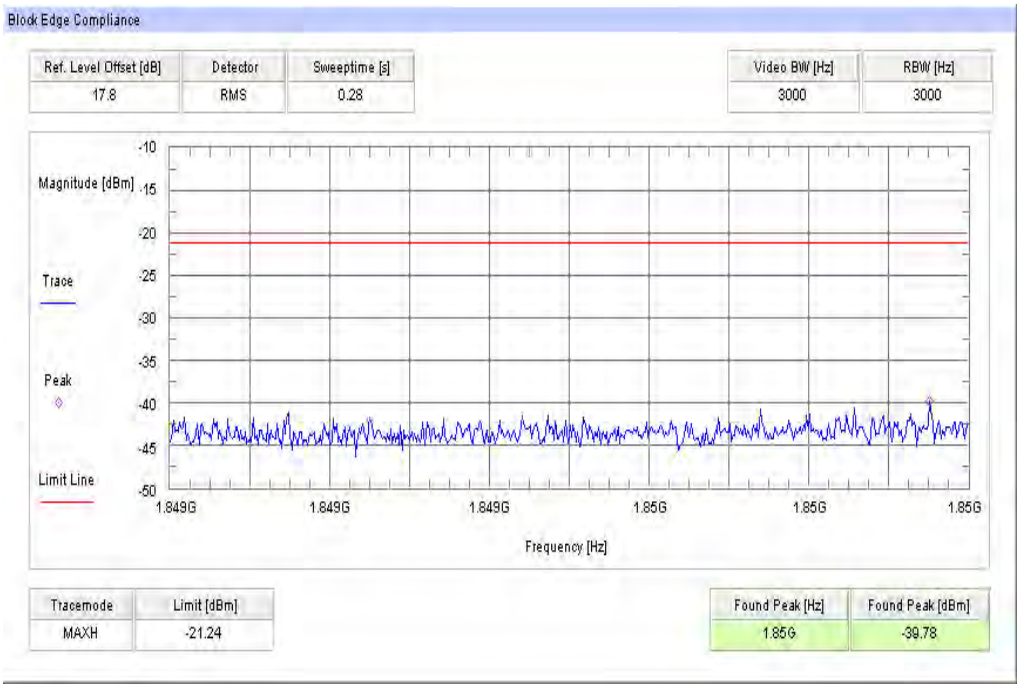


Plot 4: Highest channel – 16-QAM

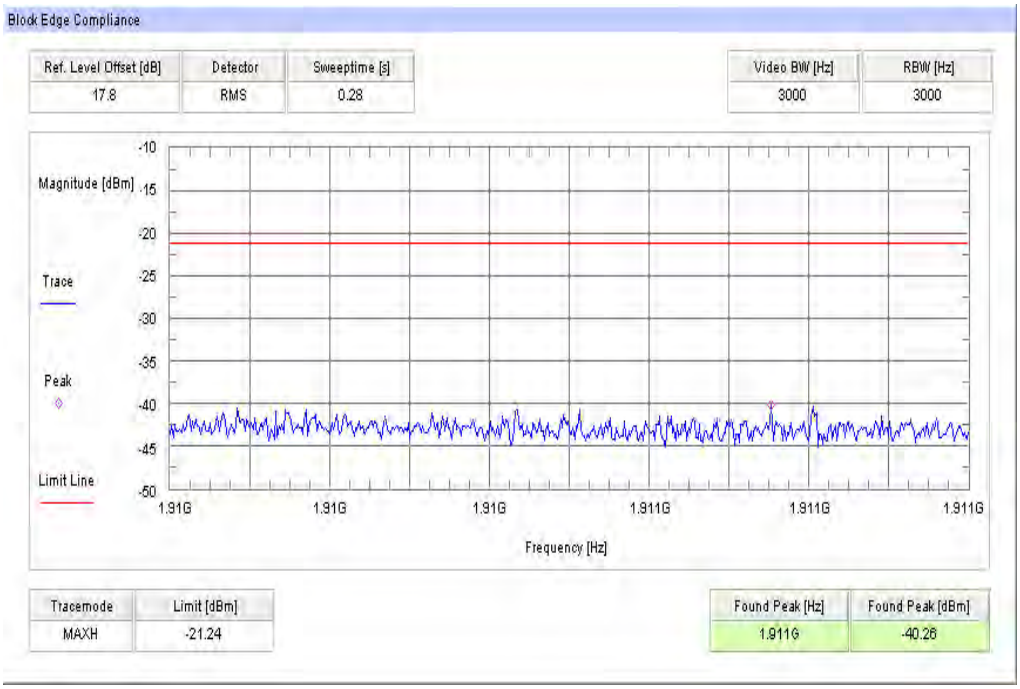


Results: **20 MHz channel bandwidth**

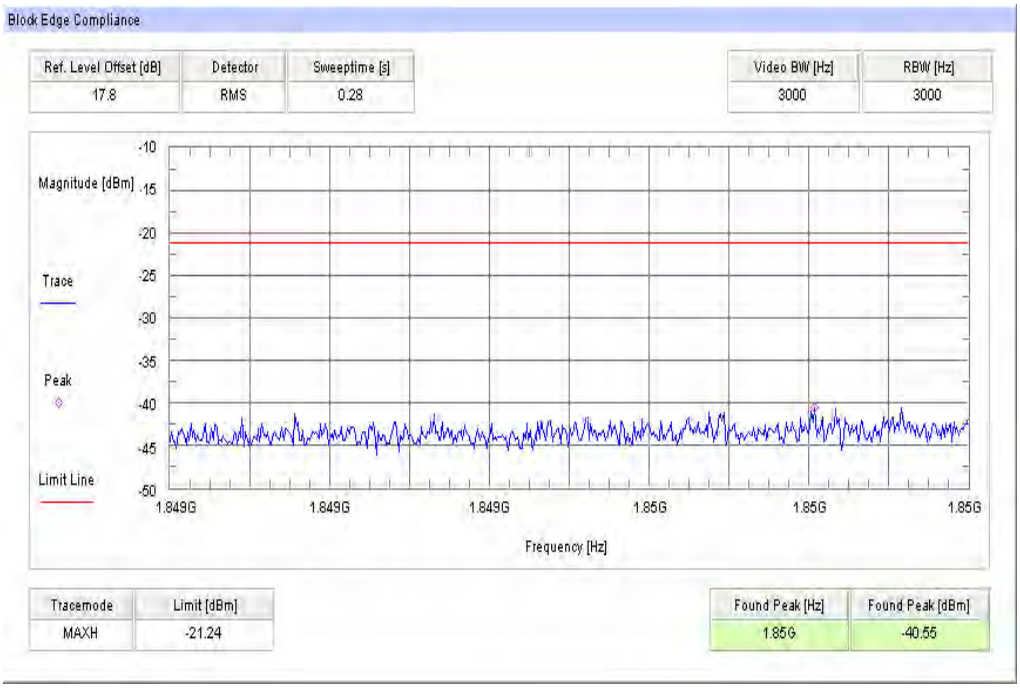
Plot 1: Lowest channel – QPSK



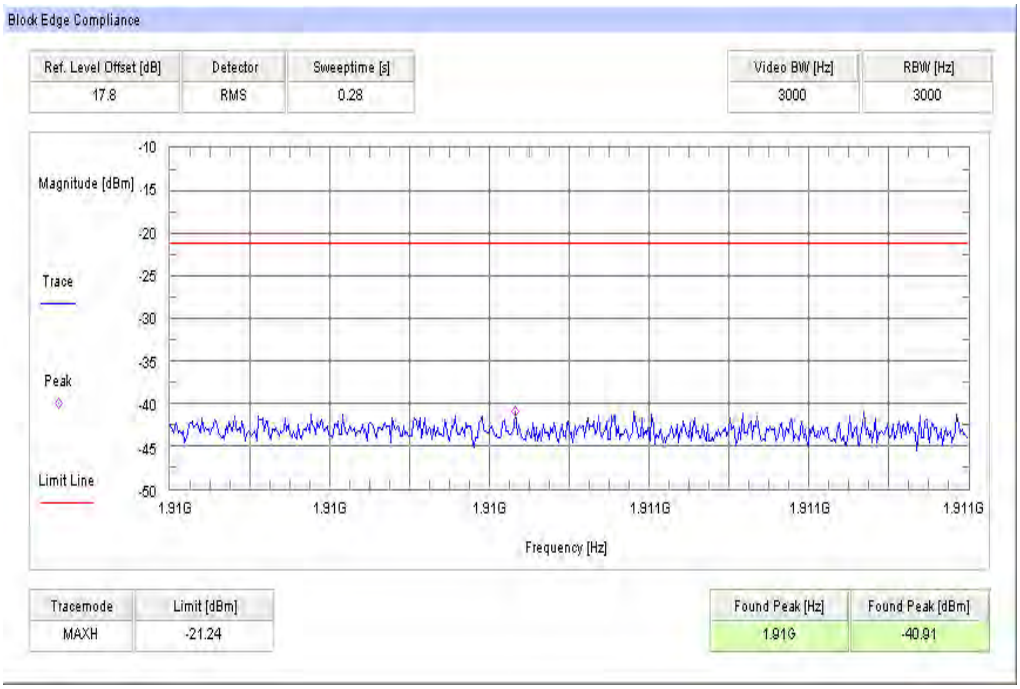
Plot 2: Highest channel – QPSK



Plot 3: Lowest channel – 16-QAM



Plot 4: Highest channel – 16-QAM



Result: **Passed**

8.3.7 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 LTE band II frequency band. The table below lists the measured 99% power occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	Depending on signal. See plots.
Resolution bandwidth:	Depending on signal. See plots.
Span:	2 x nominal bandwidth
Trace-Mode:	Max Hold

Limits:

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

Results:

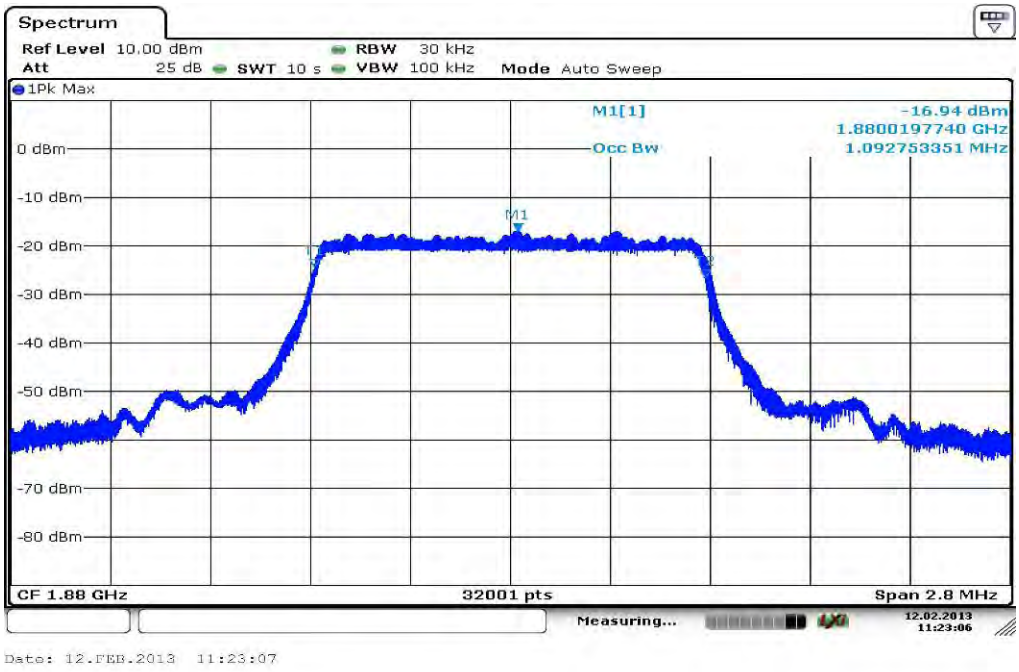
Occupied Bandwidth – QPSK	
Bandwidth (MHz)	**99% OBW (kHz)**
1.4	1093
3.0	2733
5.0	4497
10.0	8967
15.0	13471
20.0	17986
Measurement uncertainty	± 10 kHz

Occupied Bandwidth – 16-QAM	
Bandwidth (MHz)	**99% OBW (kHz)**
1.4	1099
3.0	2731
5.0	4500
10.0	8969
15.0	13450
20.0	17996
Measurement uncertainty	± 10 kHz

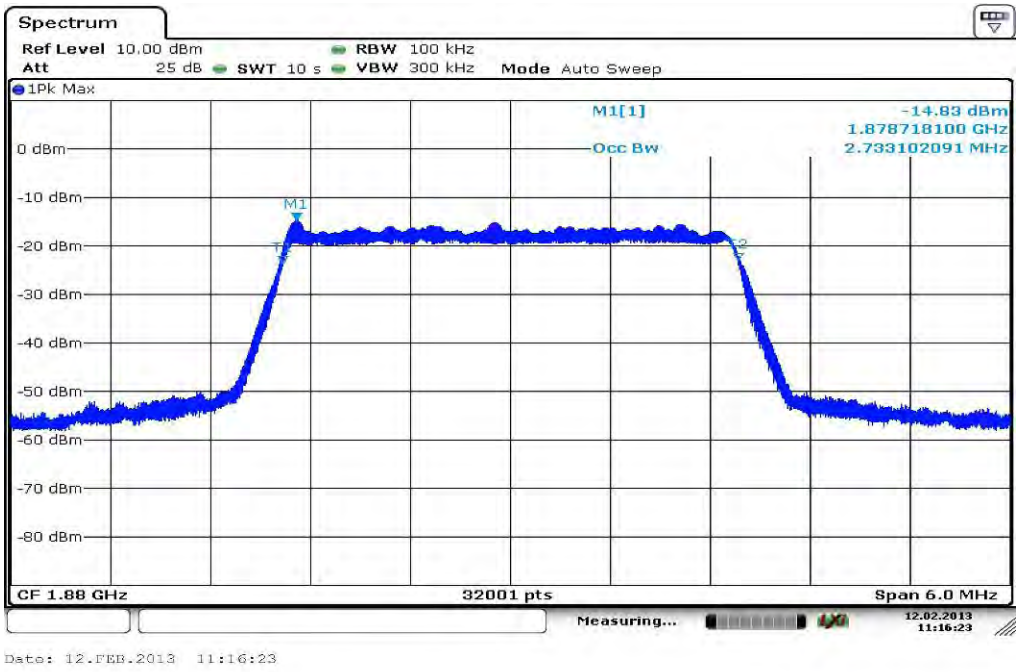
Result: **Passed**

Plots: QPSK

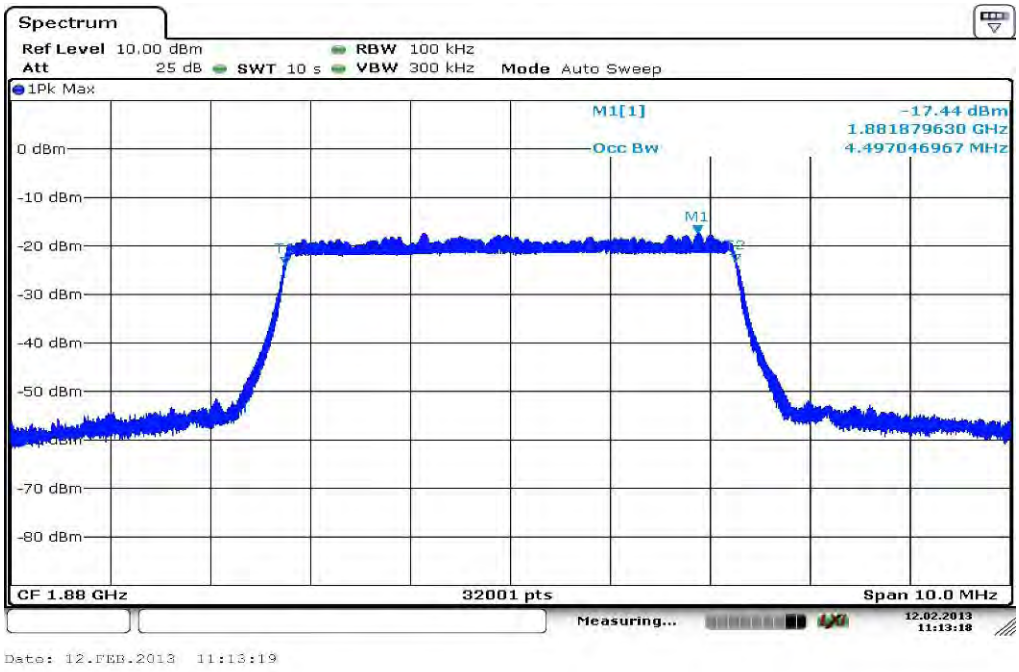
Plot 1: 1.4 MHz (99% - OBW)



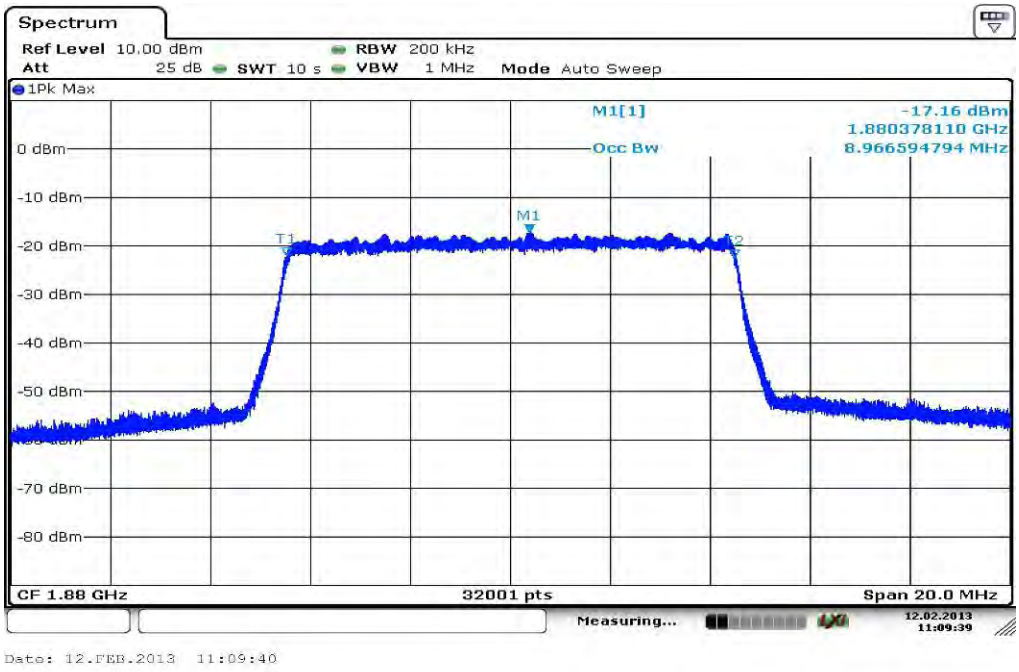
Plot 2: 3 MHz (99% - OBW)



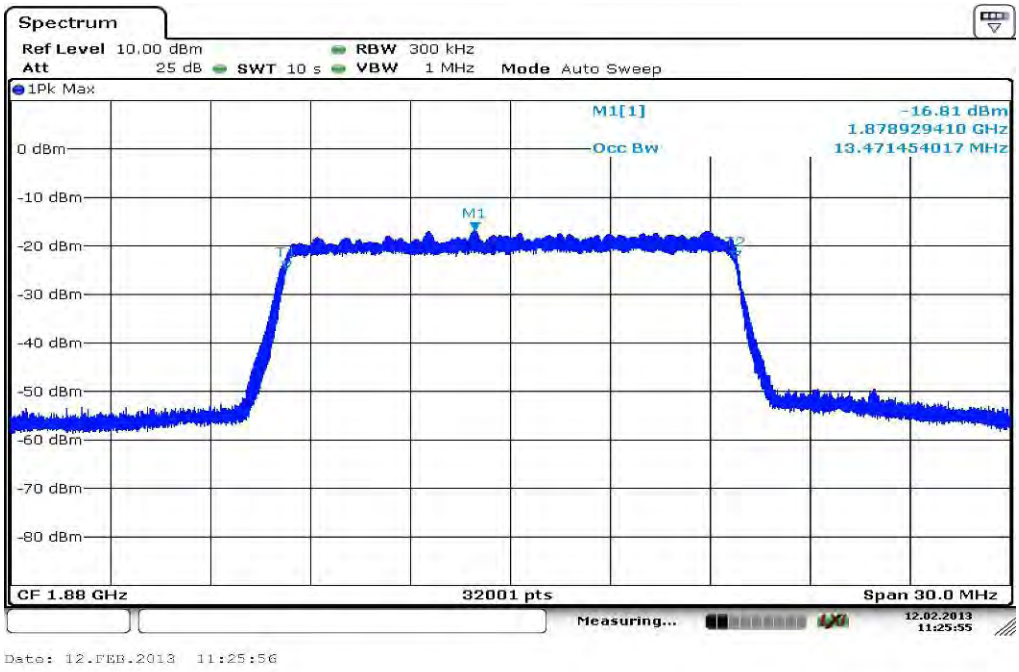
Plot 3: 5 MHz (99% - OBW)



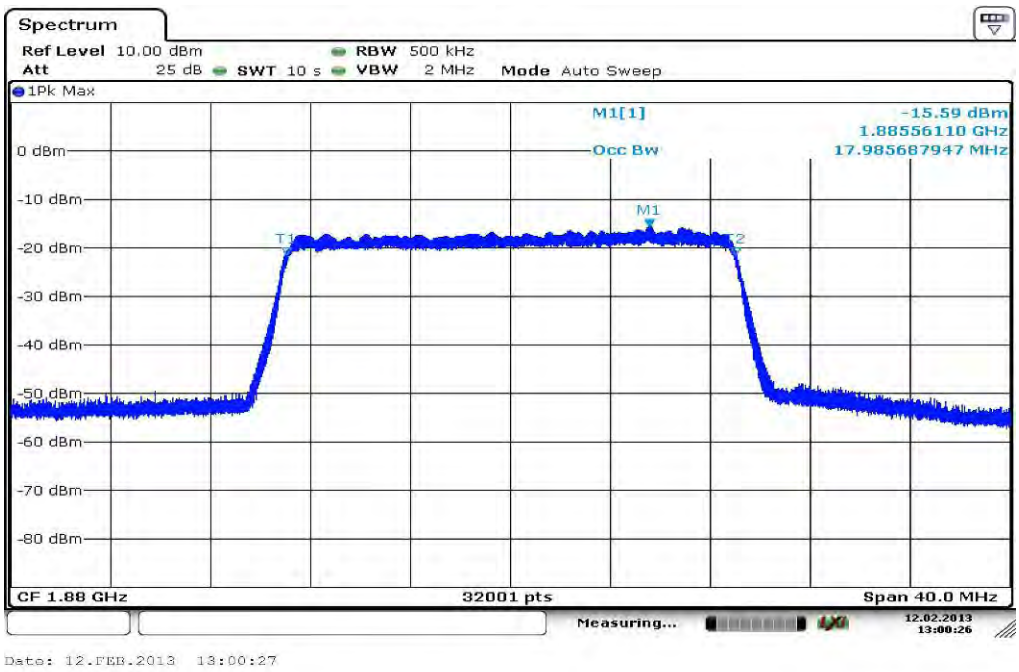
Plot 4: 10 MHz (99% - OBW)



Plot 5: 15 MHz (99% - OBW)

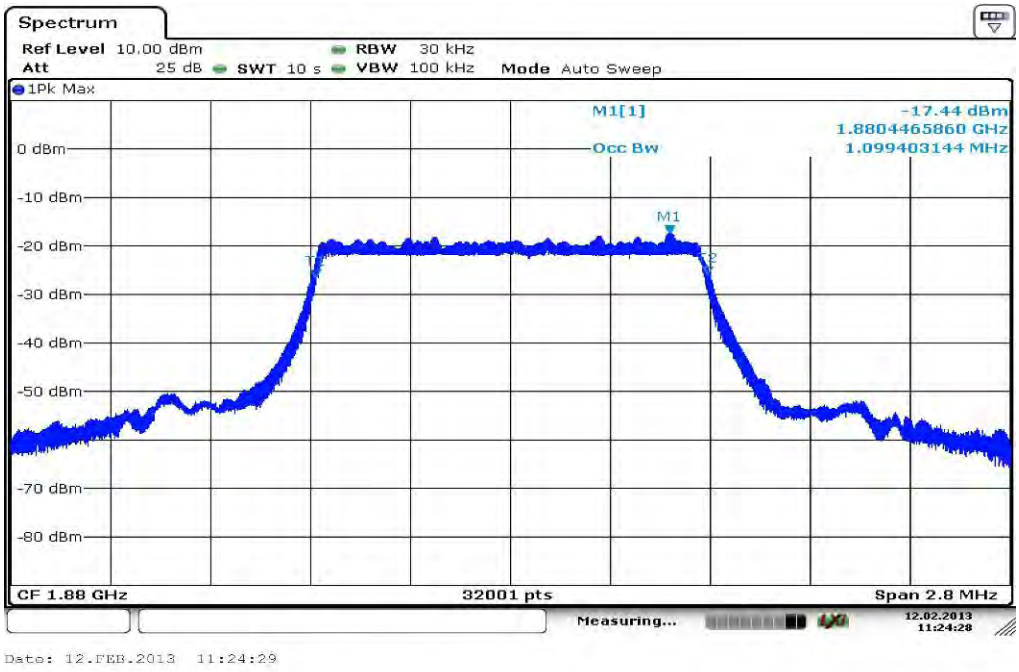


Plot 6: 20 MHz (99% - OBW)

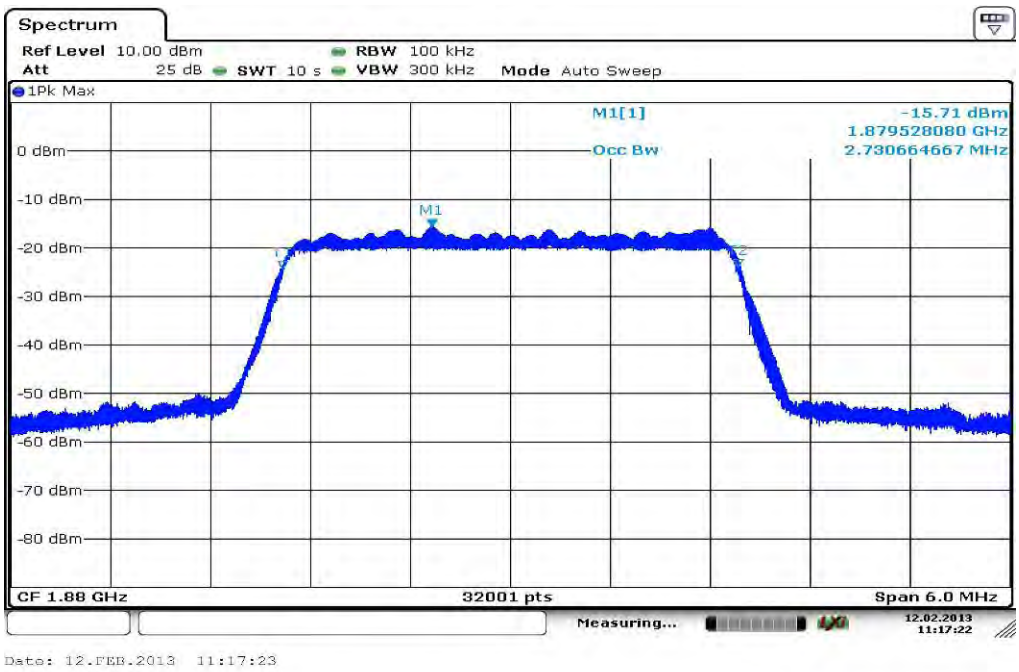


Plots: 16-QAM

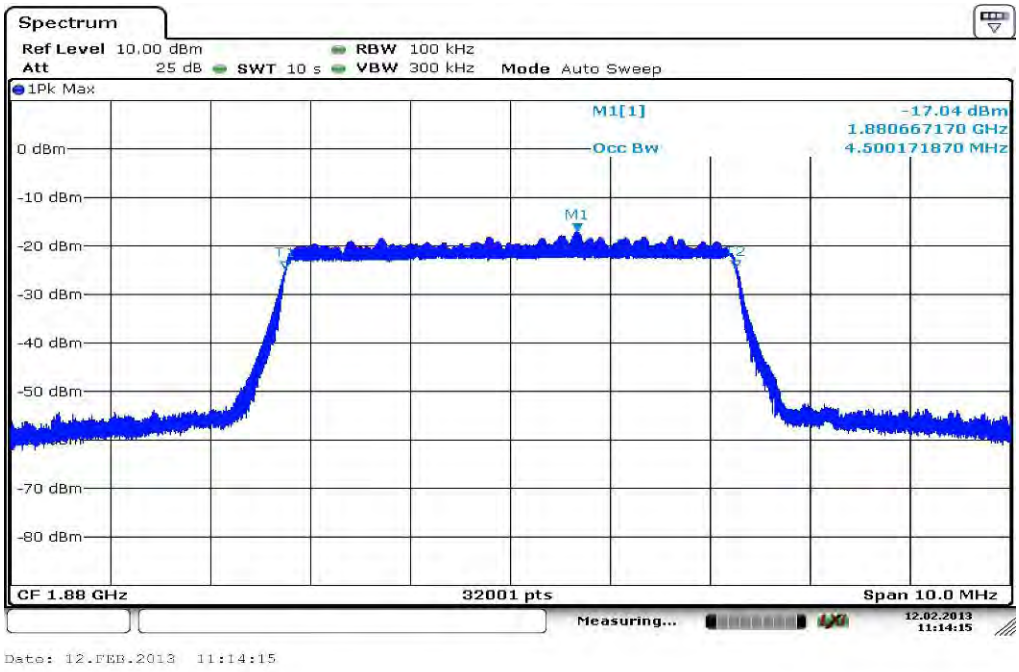
Plot 1: 1.4 MHz (99% - OBW)



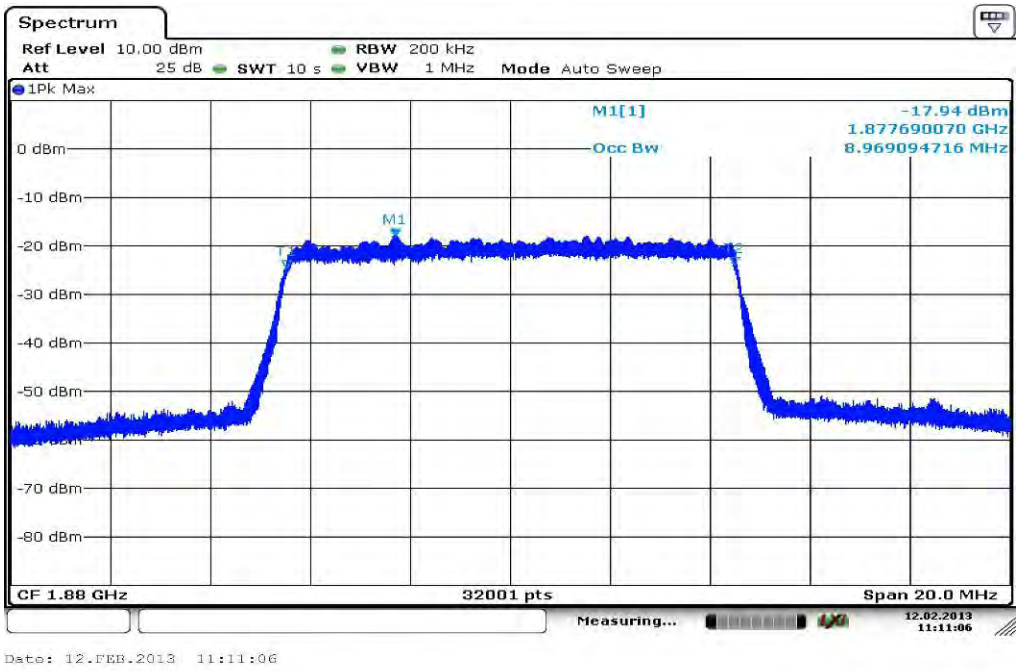
Plot 2: 3 MHz (99% - OBW)



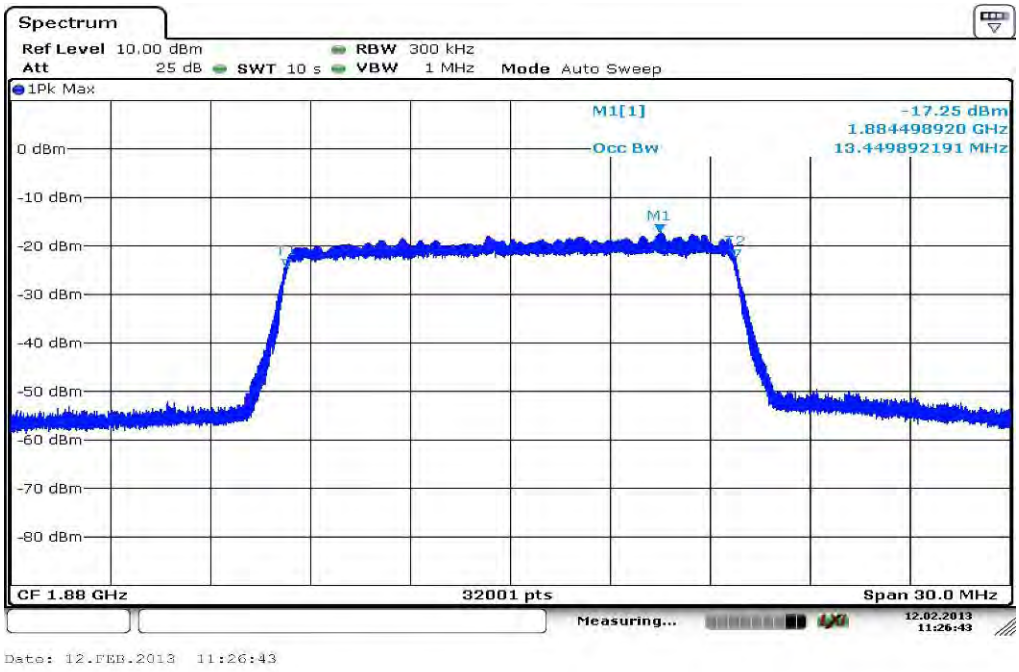
Plot 3: 5 MHz (99% - OBW)



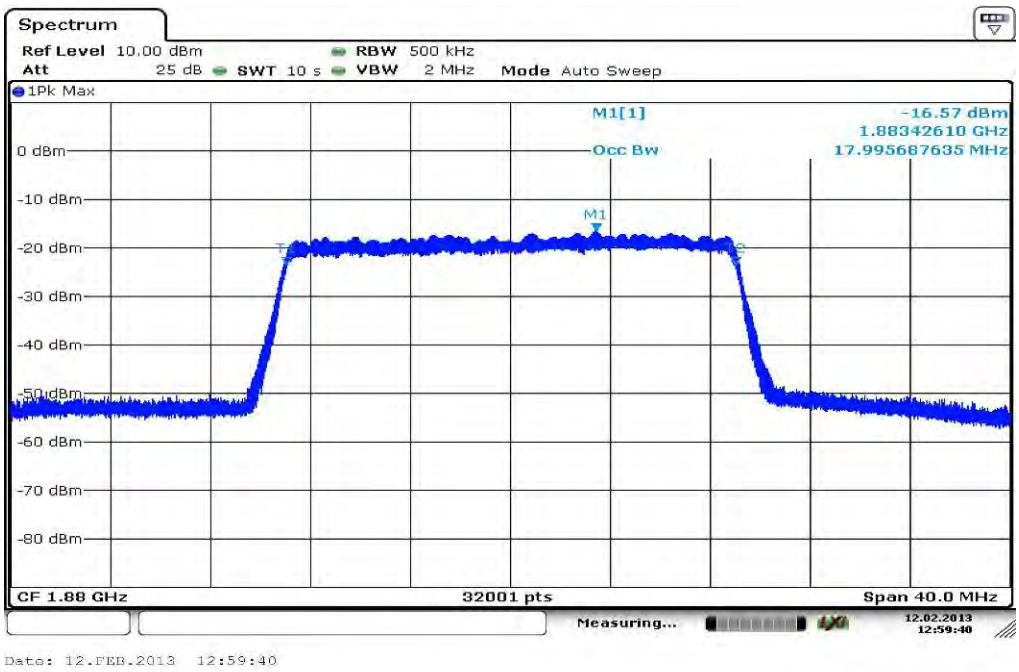
Plot 4: 10 MHz (99% - OBW)



Plot 5: 15 MHz (99% - OBW)



Plot 6: 20 MHz (99% - OBW)



9 Test equipment and ancillaries used for tests

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 signalling 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 (Labor/Item).

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2818A03450	300001040	Ve	12.01.2012	12.01.2015
2	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vlKl!	11.05.2011	11.05.2013
3	n. a.	Active Loop Antenna	6502	EMCO	2210	300001015	ne		
4	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
5	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	*	300000199	ne		
6	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	2719A15013	300001156	ne		
7	9	Isolating Transformer	MPL IEC625 Bus Regeltrennt ravo	Erfi	91350	300001155	ne		
8	n. a.	Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997	ne		
9	n. a.	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
10	n. a.	Band Reject filter	WRCG1855/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev		
11	n. a.	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
12	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
13	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vlKl!	14.10.2011	14.10.2014
14	n. a.	MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	19.12.2011	19.12.2012
15	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	2605e08770	300001443	ne		
16	n. a.	Signal Analyzer 20Hz-26,5GHz-150 to + 30 DBM	FSiQ26	R&S	835111/0004	300002678	Ve	04.11.2010	
17	n. a.	Power Supply 0-20V; 0-5A	6632B	HP	US37478366	400000117	vlKl!	20.08.2012	20.08.2014

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
vlkI!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

10 Observations

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

Annex A Document history

Version	Applied changes	Date of release
1.0	Initial release	2013-02-12

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

Annex C Accreditation Certificate

DAkkS Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH
German Accreditation Body

Entrusted according to Section 8 subsection1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV
Signatory to the Multilateral Agreements of
EA, ILAC and IAF for Mutual Recognition

Accreditation

The Deutsche Akkreditierungsstelle GmbH (German Accreditation Body) attests that the testing laboratory

CETECOM ICT Services GmbH
Untertürkheimer Straße 6-10
66117 Saarbrücken

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields:

Wired communications and DECT
Acoustic
Radio
Shirt Range Devices (SRD)
RFID
WiMax and Richtfunk
Mobile radio (GSM / DCS), Over the Air (OTA) Performance
Electromagnetic Compatibility (EMC) incl. Automotive
Product safety
SAR and Hearing Aid Compatibility (HAC)
Environmental simulation
Smart Card Terminals
Bluetooth
WI-FI-Services

The accreditation certificate shall only apply in connection with the notice of accreditation of 13.04.2011 with the accreditation number D-PL-12076-01 and is valid until 03.09.2014. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 62 pages.

Registration number of the certificate: **D-PL-12076-01-01**

Frankfurt am Main, 13.04.2011

This document is a translation. The definitive version is the original German accreditation certificate.

Front side of certificate

Deutsche Akkreditierungsstelle GmbH

Office Berlin
Spittelmarkt 10
10117 Berlin

Office Frankfurt am Main
Gartenstraße 6
60594 Frankfurt am Main

Office Braunschweig
Bundesallee 100
38116 Braunschweig

The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAkkS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf.

No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkkS.

The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAkkS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations.

The up-to-date state of membership can be retrieved from the following websites:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

Back side of certificate

Note:
The current certificate including annex is published on our website (see link below) or may be received from CETECOM ICT Services on request.

http://www.cetecom.com/fileadmin/de/CETECOM_D_Saarbruecken/accreditations_Jan_2010/DAKKS_Akkredi_Urk_EN17025-En_incl_Annex.pdf