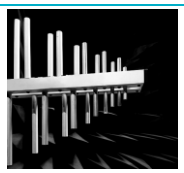
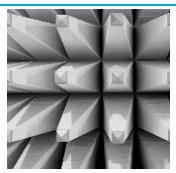




CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test report no.: 1-5326/17-01-02-C

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-03

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-12076-01-03

Applicant

Phoenix Contact GmbH & Co.KG
Flachsmarktstraße 8
32825 Blomberg / GERMANY
Phone: +49 (0) 52 35 3-00
Fax: +49 (0) 52 35 3-30 99 9
Contact: Andreas Pape
e-mail: apape@phoenixcontact.com
Phone: +49 (0) 5281 9 46-1545

Manufacturer

Silex Technology, Inc.
2-3-1 Hikaridai, Seika-cho Sourakugun
619-0237 Kyoto / JAPAN

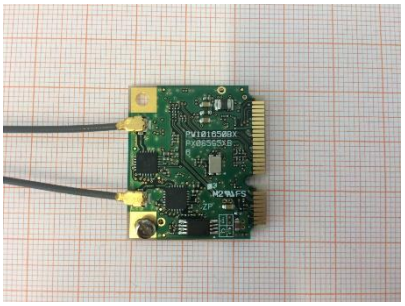
Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices

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

Test Item

Kind of test item:	**WLAN module**
Model name:	**SX-PCEAN2**
FCC ID:	**YG3-SXPCEAN2**
IC:	**4720B-SXPCEAN2**
Frequency:	DTS band 2400 MHz to 2483.5 MHz
Technology tested:	WLAN
Antenna:	2 External antennas
Power supply:	2.805 V to 3.795 V DC, by Evaluation Board
Temperature range:	0°C to +60°C



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.

Test report authorized:

cn=Marco Bertolino, o=CTC advanced GmbH, ou=BTL-161128, email=Marco.Bertolino@ctcadvanced.com, c=DE
2018.08.27 06:20:19 +02'00'

Marco Bertolino
Lab Manager
Radio Communications & EMC

Test performed:

Digital unterschrieben von David Lang
DN: cn=David Lang, o=CTC advanced GmbH, ou=LNG-161129, email=david.lang@ctcadvanced.com, c=DE
Datum: 2018.08.24 13:27:11 +02'00'

David Lang
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 1-5326/17-01-02-B and dated 2018-07-06.

2.2 Application details

Date of receipt of order:	2017-11-21
Date of receipt of test item:	2017-11-21
Start of test:	2017-12-14
End of test:	2018-05-16
Person(s) present during the test:	-/-

2.3 Test laboratories sub-contracted

None

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 15	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 2	February 2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices
RSS - Gen Issue 4	November 2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

Guidance	Version	Description
DTS: KDB 558074 D01	V04	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
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
ANSI C63.10-2013	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices
KDB 662911 D01	V02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests No testing under extreme conditions required! No testing under extreme conditions required!
Relative humidity content	:		42 %
Barometric pressure	:		Not relevant for testing
Power supply	:	V_{nom} V_{max} V_{min}	24.0 V DC by external power supply No testing under extreme conditions required! No testing under extreme conditions required!

5 Test item

5.1 General description

<table>
<tr><td>Kind of test item :</td><td>WLAN module</td></tr>
<tr><td>Type identification :</td><td>SX-PCEAN2</td></tr>
<tr><td>HMN :</td><td>-/-</td></tr>
<tr><td>PMN :</td><td>SX-PCEAN2</td></tr>
<tr><td>HVIN :</td><td>SX-PCEAN2</td></tr>
<tr><td>FVIN :</td><td>1.0.3.0.2</td></tr>
<tr><td>S/N serial number :</td><td>Rad. M7086839;
Cond. M7086839</td></tr>
<tr><td>HW hardware status :</td><td>ZXE03263 (separation of hw by changing of order code)</td></tr>
<tr><td>SW software status :</td><td>RF test software</td></tr>
<tr><td>Frequency band :</td><td>DTS band 2400 MHz to 2483.5 MHz</td></tr>
<tr><td>Type of radio transmission :
Use of frequency spectrum :</td><td>DSSS, OFDM</td></tr>
<tr><td>Type of modulation :</td><td>BPSK, QPSK, 16 – QAM, 64 – QAM</td></tr>
<tr><td>Number of channels :</td><td>11</td></tr>
<tr><td>Antenna :</td><td>2 External antennas;
The device is equipped with two external antenna ports and will be sold with a variant of Omni-directional and Directional Antennas:

<table>
<tr><th>Antenna name</th><th>Type</th><th>Gain [dBi]</th></tr>
<tr><td>ANT-OMNI-2459-02</td><td>Rod Antenna</td><td>2.5 @ 2.4 GHz
5 @ 5 GHz</td></tr>
<tr><td>ANT-OMNI-5900-01</td><td>Rod Antenna</td><td>5 @ 5 GHz</td></tr>
<tr><td>RAD-ISM-2400-ANT-OMNI-2-1-RSMA</td><td>Rod Antenna</td><td>2 @ 2.4 GHz</td></tr>
<tr><td>RAD-ISM-2400-ANT-VAN-3-0-RSMA</td><td>Omni Ceiling Antenna</td><td>3 @ 2.4 GHz</td></tr>
<tr><td>RAD-ISM-2400-ANT-OMNI-6-0</td><td>Rod Antenna</td><td>6 @ 2.4 GHz</td></tr>
<tr><td>ANT-DIR-2459-01</td><td>Directional</td><td>9 @ 2.4 GHz
9 @ 5 GHz</td></tr>
</table>

For the purpose of testing the antenna with the highest gain for any type of antenna is considered:
- Omni Ceiling Antenna (3 dBi)
- Rod Antenna (6 dBi)
- Directional Antenna (9 dBi)</td></tr>
<tr><td>Power supply :</td><td>2.805 V to 3.795 V DC, by Evaluation Board</td></tr>
<tr><td>Temperature range :</td><td>0°C to +60°C</td></tr>
</table>

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: 1-5326/17-01-01_AnnexA
1-5326/17-01-01_AnnexB
1-5326/17-01-01_AnnexD

6 Description of the test setup

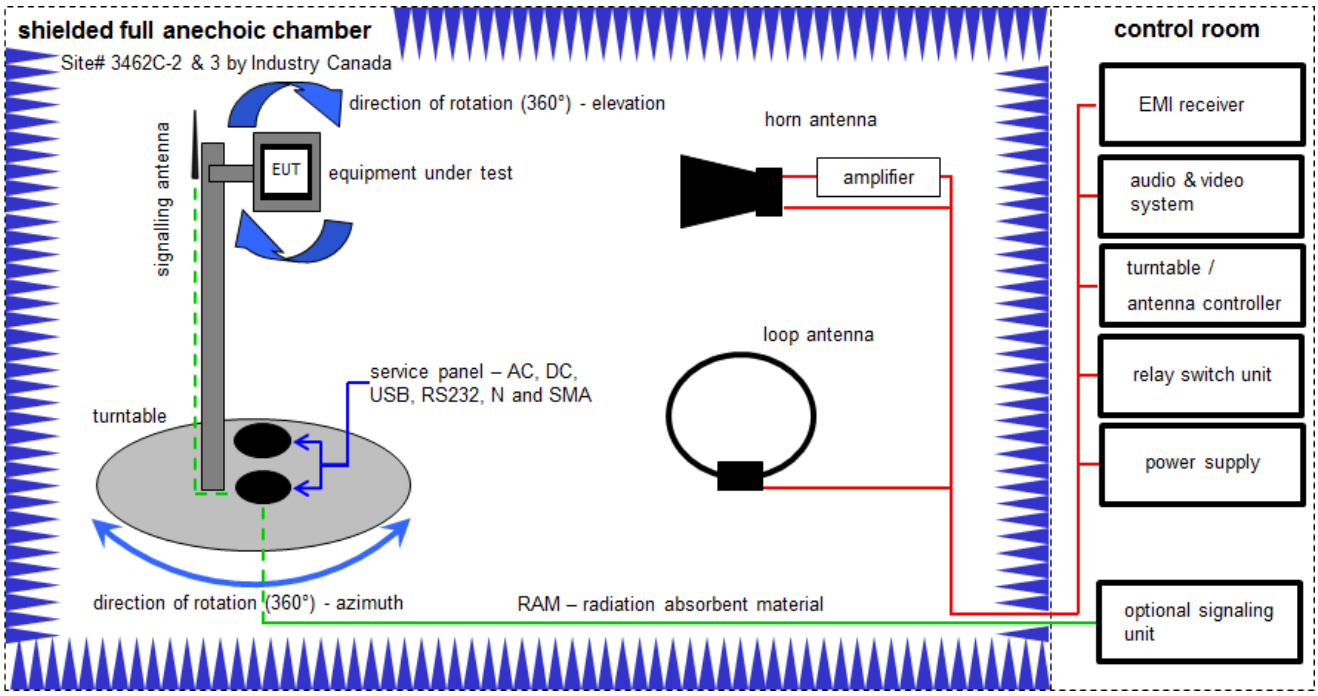
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements 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 fully anechoic chamber



Measurement distance: horn antenna 3 meter; loop antenna 3 meter

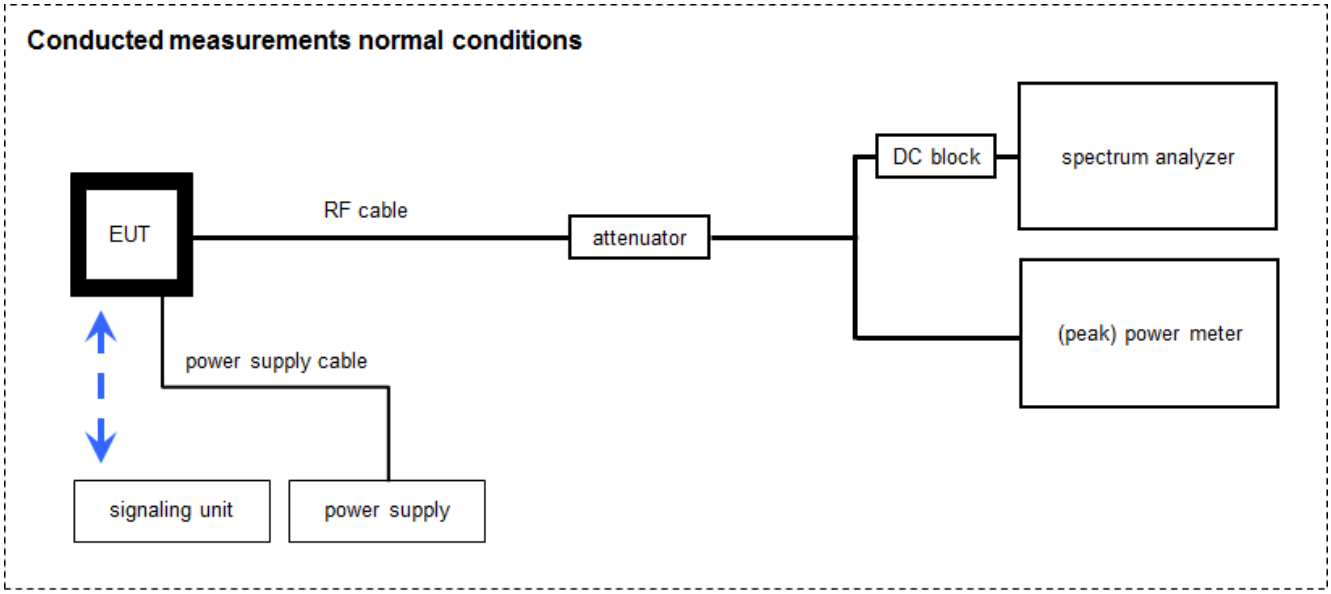
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	07.07.2017	06.07.2019
2	A+B	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04590	300001041	vIKI!	14.12.2017	13.12.2020
3	A	Band Reject Filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	26	300003792	ne	-/-	-/-
4	A+B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne	-/-	-/-
5	A+B	Computer	Intel Core i3 3220/3,3 GHz, Prozessor		2V2403033A5421	300004591	ne	-/-	-/-
6	A+B	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO		300004682	ne	-/-	-/-
7	A+B	Anechoic chamber		TDK		300003726	ne	-/-	-/-
8	A+B	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	k	14.12.2017	13.12.2018
9	A	RF Amplifier	AFS4-00100800-28-20P-4-R	MITEQ	2008992	300005204	ne	-/-	-/-
10	B	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	k	07.07.2017	06.07.2019

6.2 Conducted measurements with peak power meter & spectrum analyzer



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	PTL	Power Meter	NRV-Z32	Rohde & Schwarz	849745/016	-/-	k	2017-02-24	2018-02-23
2	A	DC Power Supply 0 – 32V	1108-32	Heiden Elektronik	001702	300001392	vIKI!	26.01.2017	25.01.2020
3	A	PC-WLAN Tester	Intel Core i3 3220/3,3 GHz, Prozessor		2V2403033A4523	300004589	ne	-/-	-/-
4	A	Teststand	Teststand Custom Sequence Editor	National Instruments GmbH		300004590	ne	-/-	-/-
5	A	Power Sensor	NRP-Z81	R&S	100010	300003780	k	26.01.2017	25.01.2019
6	A	RF-Cable	ST18/SMAm/SMAm/60	Huber & Suhner	Batch no. 606844	400001181	ev	-/-	-/-
7	A	DC-Blocker 0.1-40 GHz	8141A	Inmet		400001185	ev	-/-	-/-
8	A	Coax Attenuator 10 dB 2W 0-40 GHz	MCL BW-K10-2W44+	Mini Circuits		400001186	ev	-/-	-/-
9	B	Signal Analyzer 40 GHz	FSV40	R&S	101353	300004819	k	12.12.2017	11.12.2019
10	B	RF-Cable WLAN-Tester Port 0	ST18/SMAm/SMAm/48	Huber & Suhner	Batch no. 1273777	400001249	ev	-/-	-/-
11	C	PXA Spectrum Analyzer 3Hz to 50GHz	N9030A PXA Signal Analyzer	Agilent Technologies	US51350267	300004338	k	05.03.2018	04.03.2019

*PTL = Phoenix Test Lab

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, it is placed on a table with 0.8 m height.
- 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 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 pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- 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.

*)Note: The sequence will be repeated three times with different EUT orientations.

7.2 Sequence of testing radiated spurious 1 GHz to 18 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.

8 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
Antenna gain	± 3 dB
Power spectral density	± 1.5 dB
DTS bandwidth	± 100 kHz (depends on the used RBW)
Occupied bandwidth	± 100 kHz (depends on the used RBW)
Maximum output power	± 1.5 dB
Detailed spurious emissions @ the band edge - conducted	± 1.5 dB
Band edge compliance radiated	± 3 dB
Spurious emissions conducted	± 3 dB
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 below 30 MHz (AC conducted)	± 2.6 dB

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 15 RSS - 247, Issue 2	See table!	2018-08-24	Reduced test plan according customer specifications. Module integration!

Test specification clause	Test case	Guideline	Temperature conditions	Power source voltages	Mode	C	NC	NA	NP	Remark
§15.247(b)(4) RSS - 247 / 5.4 (f)(ii)	Antenna gain	-/-	Nominal	Nominal	DSSS	As per data sheet!				-/-
§15.35	Duty cycle	-/-	Nominal	Nominal	DSSS OFDM	-/-				-/-
§15.247(e) RSS - 247 / 5.2 (b)	Power spectral density	KDB 558074 DTS clause: 10.2	Nominal	Nominal	DSSS OFDM	☐	☐	☐	☒	-/-
§15.247(a)(2) RSS - 247 / 5.2 (a)	DTS bandwidth	KDB 558074 DTS clause: 8.1	Nominal	Nominal	DSSS OFDM	☐	☐	☐	☒	-/-
RSS Gen clause 4.6.1	Occupied bandwidth	-/-	Nominal	Nominal	DSSS OFDM	☐	☐	☐	☒	-/-
§15.247(b)(3) RSS - 247 / 5.4 (d)	Maximum output power	KDB 558074 DTS clause: 9.1.2	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5	Detailed spurious emissions @ the band edge – cond.	-/-	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.205 RSS - 247 / 5.5 RSS - Gen	Band edge compliance cond.	KDB 558074 DTS clause: 13.3.2 and clause 12.2.2	Nominal	Nominal	DSSS OFDM	☐	☐	☐	☒	-/-
§15.247(d) RSS - 247 / 5.5	TX spurious emissions cond. (Non-restricted bands)	KDB 558074 DTS clause: 11.1 & 11.2 11.3	Nominal	Nominal	DSSS OFDM	☐	☐	☐	☒	*1
§15.209(a) RSS-Gen	TX spurious emissions. below 30 MHz	-/-	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5 RSS-Gen	TX spurious emissions 30 MHz to 1 GHz	-/-	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5 RSS-Gen	TX spurious emissions above 1 GHz	-/-	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	*2
§15.109 RSS-Gen	RX spurious emissions rad. 30 MHz to 1 GHz	-/-	Nominal	Nominal	RX / idle	☐	☐	☐	☒	*1
§15.109 RSS-Gen	RX spurious emissions above 1 GHz	-/-	Nominal	Nominal	RX / idle	☐	☐	☐	☒	*1
§15.107(a) §15.207	Conducted emissions < 30 MHz	-/-	Nominal	Nominal	DSSS OFDM	☐	☐	☐	☒	*1

Notes:

C	Compliant	**NC**	Not compliant	**NA**	Not applicable	**NP**	Not performed

*1 As per module report
*2 Restricted band measurements are performed in a conducted way. Emissions exceeding the applicable limit were verified by repeating a single frequency measurement in a radiated measurement, considering the representative set of antennas (see section 10 – special test descriptions).
The radiated measurement was chosen to show compliance since the applicable correction factor accounting for the antenna gain is not known for frequencies that are outside the useful band.

10 Additional comments

Reference documents: Module Report: F161629E1_2ndVersion.pdf issued by Phoenix TESTLAB, 2017-04-18.

Antenna specification:
- ANT-DIR-2459-01-2701186_expanded
- ANT-OMNI-2459-02–2701408_Datasheet Radiation Pattern – Preliminary
- ANT-OMNI-5900-01-2701347_expanded
- RAD-ISM-2400-ANT-OMNI-2-1-RSMA-2701362
- RAD-ISM-2400-ANT-OMNI-6-0-2885919
- RAD-ISM-2400-ANT-VAN-3-0-RSMA – 2701358

Special test descriptions: For any declared antenna type respectively structure the antenna with the highest gain was chosen to represent the worst case scenario for radiated emission measurements.

For conducted measurements two operating modes are considered:
- OP1: Single antenna operation (for 9dBi Directional-Antenna)
- OP2: Dual antenna operation (for 6dBi Omni-Antennas)

Hence, a 9dB correction factor was used to account for antenna gain (see 12.6).

Configuration descriptions: As provided by manufacturer:

Modulation	Data rate / Modulation scheme	Target Power per Chain (dBm)		
		2412 MHz	2437 MHz	2462 MHz
DSSS	1 Mbit/s	12.5	14.5	11.0
OFDM (20 MHz)	9 Mbit/s	11.5	13.0	11.5
		2422 MHz	2437 MHz	2452 MHz
OFDM (40 MHz)	MCS0	5.0	11.0	3.5

Note: Settings applicable for dual and single-chain operation.

11 Additional EUT parameter

Test mode:

☐ No test mode available
Iperf was used to ping another device with the largest support packet size

☒ Test mode available
Special software is used.
EUT is transmitting pseudo random data by itself

Modulation types:

☒ Wide Band Modulation (None Hopping – e.g. DSSS, OFDM)

☐ Frequency Hopping Spread Spectrum (FHSS)

Antennas and transmit operating modes:

☒ Operating mode 1 (single antenna)

- *Equipment with 1 antenna,*
- *Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used,*
- *Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)*

☒ Operating mode 2 (multiple antennas, no beamforming)

- *Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.*

☐ Operating mode 3 (multiple antennas, with beamforming)

- *Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming.*
  In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.

12 Measurement results

12.1 Testability check

Description:

Comparison of the first assessment with the current product based on the performance and decision of the test ability.

Measurement:

Measurement parameters	
Peak Power Meter	
Test setup	See chapter 6.2 - PTL
Measurement uncertainty	See chapter 8

Limits:

Main report value -2 dB / +1 dB

Results:

T_{nom}	V_{nom}	lowest channel	middle channel	highest channel
DSSS mode (Antenna 0)				
Conducted power / dBm Main report F161629E1_2ndVersion		12.7	14.8	10.4
Conducted power / dBm Test ability check – delta sample		12.5	14.5	10.7
OFDM (20 MHz mode (Antenna 1)				
Conducted power / dBm Main report F161629E1_2ndVersion		20.5	22.4	18.8
Conducted power / dBm Test ability check – delta sample		20.6	22.7	18.4

12.2 Antenna gain

As declared by manufacturer (see section 5.1).

The gain of two different antenna configurations is considered in this test report:

The directional 9dBi antenna is considered for single-chain operation only.

The omni-directional 6dBi antenna is considered for dual-chain operation to represent all stated omni antennas with less than 6dBi.

12.3 Identify worst case data rate

Description:

All modes of the module will be measured with an average power meter or spectrum analyzer to identify the maximum transmission power.

In further tests only the identified worst case modulation scheme or bandwidth will be measured and this mode is used as representative mode for all other modulation schemes.

Results:

Modulation scheme / bandwidth	
DSSS / b – mode	1 Mbit/s
OFDM / g – mode	9 Mbit/s
OFDM / n HT20 – mode	MCS0
OFDM / n HT40 – mode	MCS0

Note: Worst case data rate or modulation scheme according Module Report F161629E1_2ndVersion

12.4 Duty cycle

Description:

Measurement of the timing behavior.

Measurement:

Measurement parameter	
Detector	Peak
Sweep time	Depends on the signal see plot
Resolution bandwidth	10 MHz
Video bandwidth	10 MHz
Trace mode	Max hold
Test setup	See chapter 6.2 - B
Measurement uncertainty	See chapter 8

Limits:

FCC	IC
No limitation!	

Results:

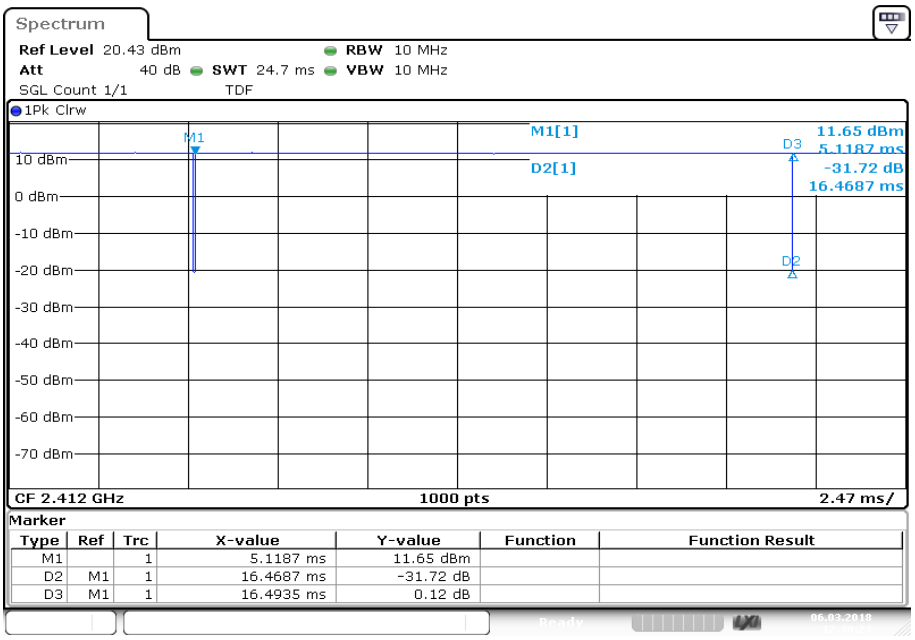
T_{nom}	V_{nom}	lowest channel	middle channel	highest channel
DSSS / b – mode		99.7 % / 0.0 dB	99.7 % / 0.0 dB	99.7 % / 0.0 dB
OFDM / g – mode		96.8 % / 0.1 dB	96.8 % / 0.1 dB	96.8 % / 0.1 dB
OFDM / n HT20 – mode		94.4 % / 0.2 dB	94.4 % / 0.2 dB	94.4 % / 0.2 dB
OFDM / n HT40 – mode		94.8 % / 0.2 dB	94.8 % / 0.2 dB	94.8 % / 0.2 dB

Note: The highest correction factor of 0.23dB is applied to the Reference Level Offset during the conducted measurements if AVG is used.

Plots:

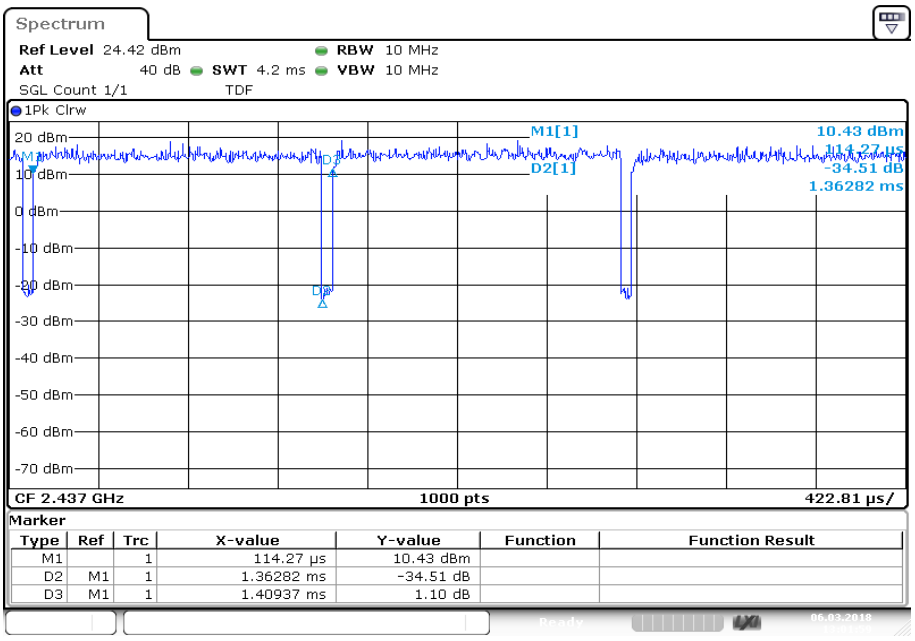
Duty cycle and correction factor (example for one channel & one antenna port):

Plot 1: duty cycle of the transmitter; b – mode



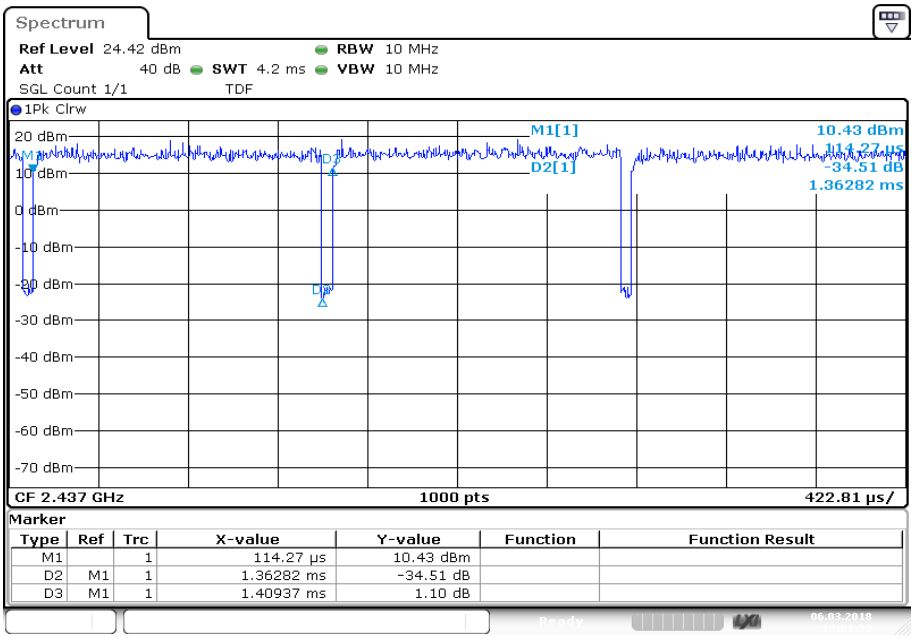
Date: 6.MAR.2018 12:30:24

Plot 2: duty cycle of the transmitter; g – mode



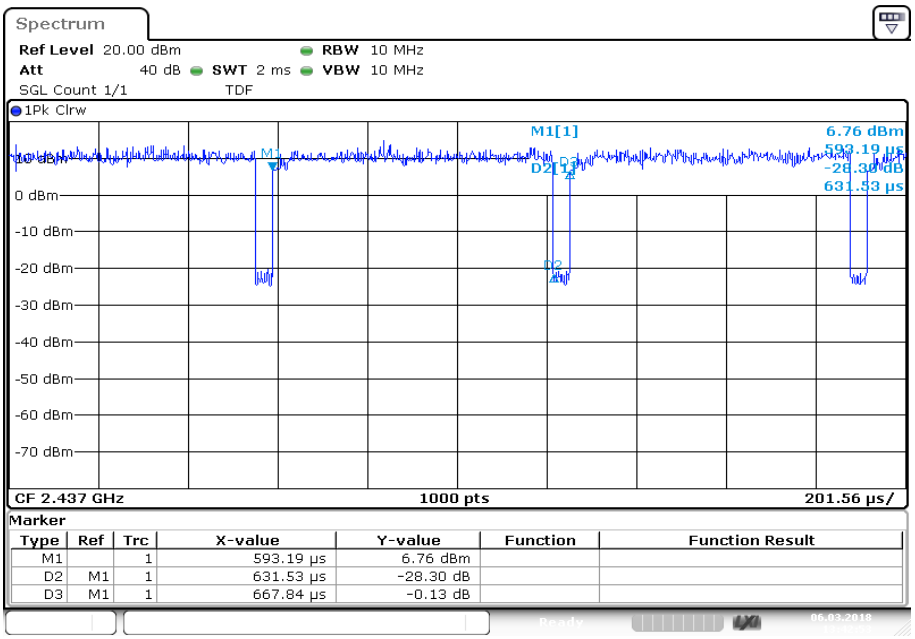
Date: 6.MAR.2018 13:02:00

Plot 3: duty cycle of the transmitter; n – mode



Date: 6.MAR.2018 13:02:00

Plot 4: duty cycle of the transmitter; n40 – mode



Date: 6.MAR.2018 13:42:53

12.5 Maximum output power

Description:

Measurement of the maximum conducted peak output power. The measurements are performed using the data rate identified in the previous chapter.

Measurement:

Measurement parameter	
According to DTS clause: 9.1.2	
Peak power meter	
Test setup	See chapter 6.2 - A
Measurement uncertainty	See chapter 8

Limits:

FCC	IC
Conducted 1.0 W / 30 dBm with an antenna gain of max. 6 dBi	
Conducted limit with a gain of 9 dBi = 27 dBm	

Results:

Single-chain operation (max. 9dBi; Limit 27dBm)

antenna port 0	maximum output power / dBm		
	lowest channel	middle channel	highest channel
Output power conducted DSSS / b – mode	15.1	16.7	12.9
Output power conducted OFDM / g – mode	22.1	22.7	21.8
Output power conducted OFDM / n HT20 – mode	22.3	23.0	22.6
Output power conducted OFDM / n HT40 – mode	18.4	23.1	15.9

antenna port 1	maximum output power / dBm		
	lowest channel	middle channel	highest channel
Output power conducted DSSS / b – mode	14.7	16.7	12.6
Output power conducted OFDM / g – mode	22.3	23.0	21.8
Output power conducted OFDM / n HT20 – mode	22.3	23.4	22.7
Output power conducted OFDM / n HT40 – mode	17.6	23.0	16.2

Dual-chain operation (max. 6dBi; Limit 30dBm)

antenna port 0 + 1 calculated	maximum output power / dBm		
	lowest channel	middle channel	highest channel
Output power conducted DSSS / b – mode	17.9	19.7	15.8
Output power conducted OFDM / g – mode	25.2	25.9	24.8
Output power conducted OFDM / n HT20 – mode	25.3	26.2	25.7
Output power conducted OFDM / n HT40 – mode	21.0	26.1	19.1

12.6 Emissions in restricted frequency bands < 30MHz (radiated)

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The limits are recalculated to a measurement distance of 3 m with 40 dB/decade according CFR Part 2.

Measurement:

Measurement parameter	
Detector	Peak / Quasi Peak
Sweep time	Auto
Resolution bandwidth	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span	9 kHz to 30 MHz
Trace mode	Max Hold
Measured modulation	☒ DSSS b – mode ☐ OFDM g – mode ☒ OFDM n HT20 – mode ☒ OFDM n HT40 – mode
Test setup	See chapter 6.1 B
Measurement uncertainty	See chapter 8

Limits:

FCC		IC
Frequency / MHz	Field Strength / (dBµV / m)	Measurement distance / m
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

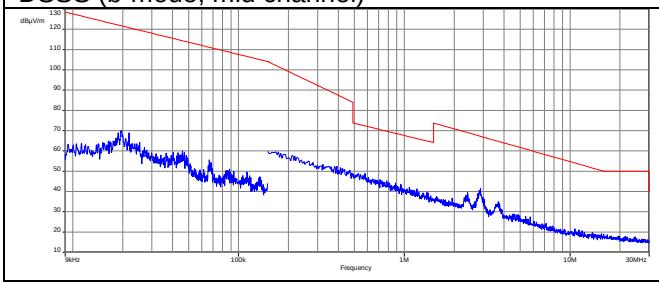
Results:

TX spurious emissions radiated < 30 MHz / (dBµV / m) @ 3 m		
Frequency / MHz	Detector	Level / (dBµV / m)
All detected peaks are more than 20 dB below the limit.		

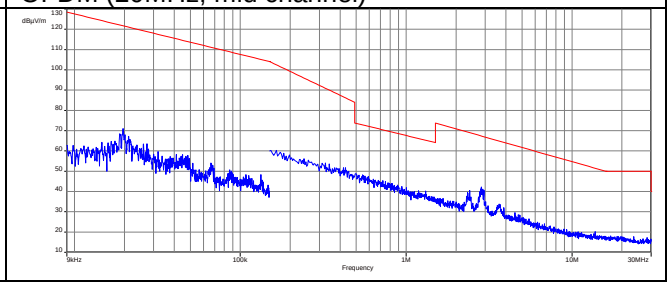
Note: Peak Emissions detected are more than 20dB below the limit on all tested channels, data rates and antenna configurations. Therefore, only one plot per modulation and antenna configuration is reported.

Plots: ANT-DIR-2459-01, single-chain, antenna 0

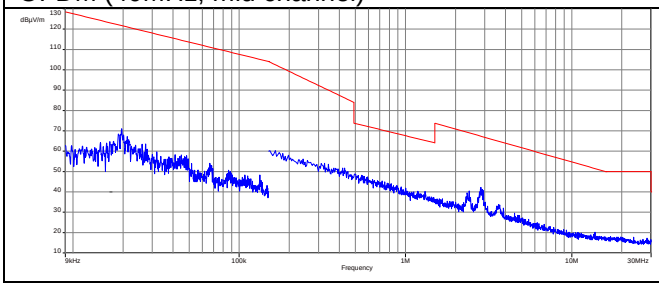
DSSS (b-mode, mid channel)



OFDM (20MHz, mid channel)

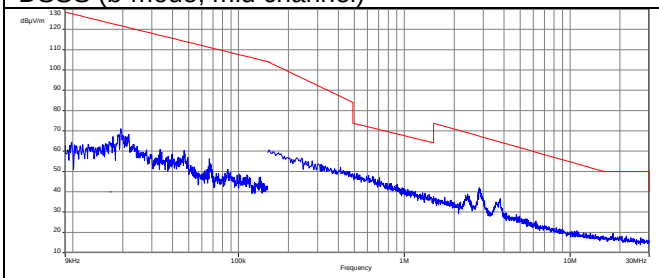


OFDM (40MHz, mid channel)

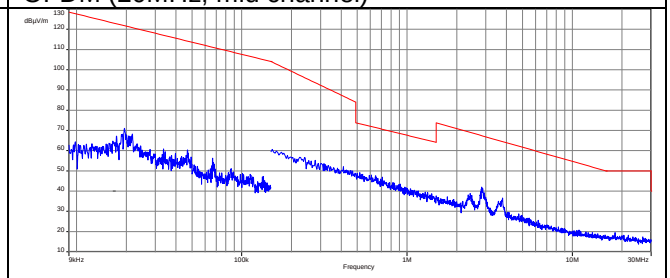


Plots: ANT-DIR-2459-01, single-chain, antenna 1

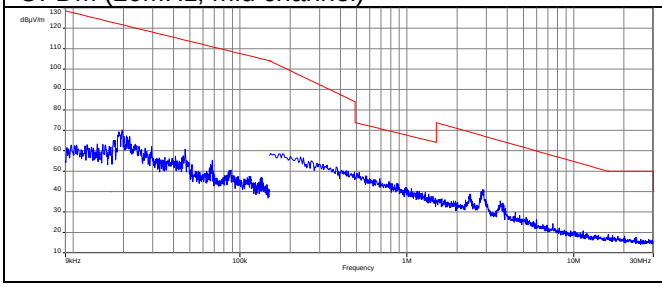
DSSS (b-mode, mid channel)



OFDM (20MHz, mid channel)

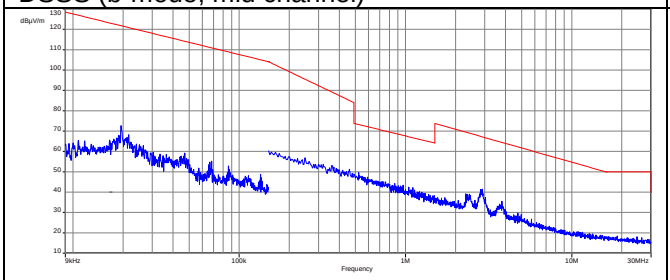


OFDM (20MHz, mid channel)

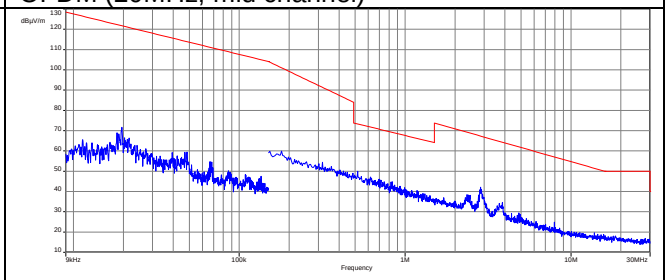


Plots: RAD-ISM-2400-ANT-OMNI-6-0, dual-chain, antenna 0&1

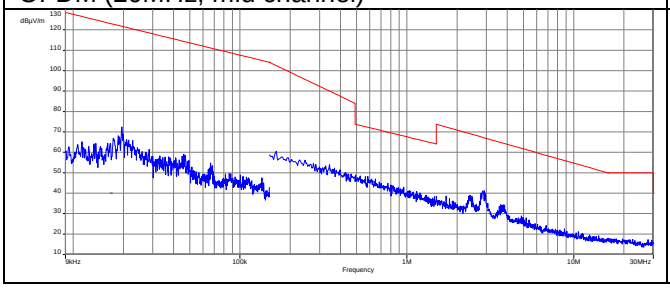
DSSS (b-mode, mid channel)



OFDM (20MHz, mid channel)

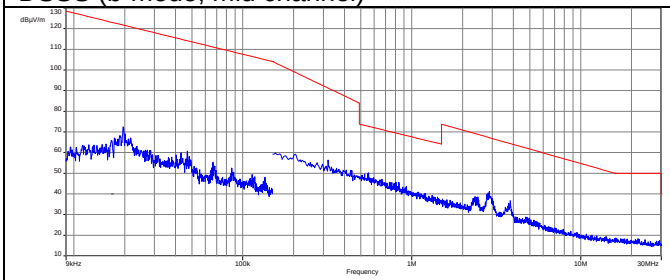


OFDM (20MHz, mid channel)

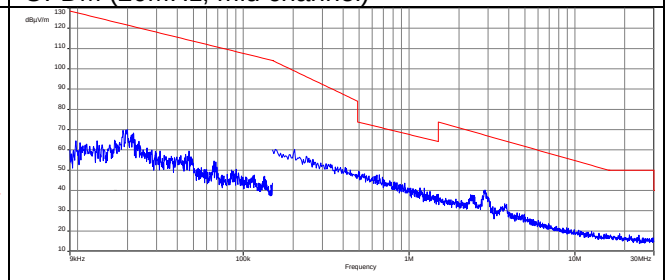


Plots: RAD-ISM-2400-ANT-VAN-3-0-RSMA, dual-chain, antenna 0&1

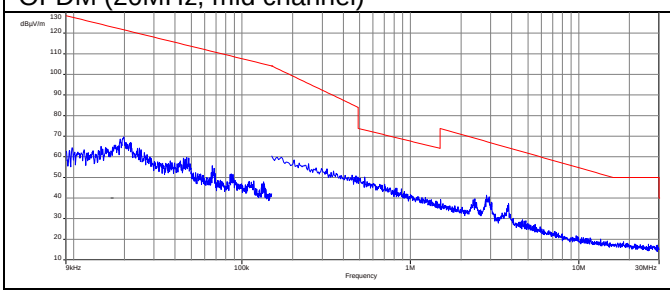
DSSS (b-mode, mid channel)



OFDM (20MHz, mid channel)



OFDM (20MHz, mid channel)



12.7 Emissions in restricted frequency bands > 30 MHz (conducted)

Description:

The DTS rules specify that emissions which fall into restricted frequency bands shall comply with the general radiated emission limits.

Measurement:

Measurement parameter	
According to DTS clause 12.2.2	
Detector	Peak / RMS
Sweep time	Auto
Resolution bandwidth	30 MHz > F > 1 GHz: 100 kHz 1 GHz > F > 26 GHz: 1 MHz
Video bandwidth	3x RBW
Span	30 MHz to 26 GHz
Trace mode	Max Hold / Trace Average
Measured modulation	☒ DSSS b – mode ☐ OFDM g – mode ☒ OFDM n HT20 – mode ☒ OFDM n HT40 – mode ☐ RX / Idle – mode
Test setup	See chapter 6.2 – B (f < 1 GHz) See chapter 6.2 – B (f > 1 GHz)
Measurement uncertainty	See chapter 8

Limits:

FCC	IC

Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

As per DTS KDB clause 12.2.2 (e) the field strength limit as specified in §15.209(a) is converted to an EIRP limit by the formula

EIRP = E + 20log D - 104.8

where:
E = electric field strength in dBµV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.

Frequency / MHz	Field Strength Limit / (dBµV / m)	Distance / m	Ground Reflection Factor / dB	EIRP Limit / dBm
30 - 88	40.0	3	4.7	-60.0
88 - 216	43.5	3	4.7	-56.4
216 - 960	46.0	3	4.7	-53.9
960 - 1000	53.9	3	4.7	-46.0
Above 1000	53.9	3	0	-41.3

Note: The EIRP Limit is further reduced to account for the Ground Reflection Factor.
Antenna gain as well as antenna multiplication factor* (if applicable) is considered in the Ref.Level Offset.

***Antenna multiplication factor = 10 log (n)**

where:
n = number of antenna chains

The EIRP Limit is reduced further to account for the Ground Reflection Factor.

A **9dB** Offset is used to account for the maximum gain of the directional antenna (ANT-DIR-2459-01) in single-chain mode.

The **9dB** Offset is also used to account for the 6dBi antenna (RAD-ISM-2400-ANT-OMNI-6-0) in dual-chain mode (6dBi + 10 log (2) = 9dB).

For measurements performed with an Average Detector (>1GHz) an additional Offset of 0.23 dB is used to account for the Duty Cycle correction. A factor of 0.23 was used to represent the worst case or lowest duty cycle respectively.

Note:

The result tables below contain the worst case emissions per sub-range or frequencies exceeding the applicable limit. Additional frequencies can be found in the result tables below the plots.
With regards to the emission at **2288 MHz** which is exceeding the applicable limit, the restricted band measurement was repeated on this frequency in a radiated way using a representative set of antennas as declared in section 10. The results of these measurements can be found in section 12.8.

Results: DSSS (single-chain, antenna 1)

TX spurious emissions radiated / dBm								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm
4824.0	AVG	-43.0	4874.0	AVG	-45.3	4924.0	AVG	-49.6
7234.8	AVG	-53.9	7311.8	AVG	-51.5	-/-	-/-	-/-

Results: OFDM – 20 MHz (single-chain, antenna 1)

TX spurious emissions radiated / dBm								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm
2390.0	AVG	-45.4	2483.5	AVG	-43.8	2115.0	AVG	-50.7
2483.5	AVG	-45.4	7312.8	AVG	-55.6	2483.5	AVG	-43.7
4825.8	AVG	-53.7	-/-	-/-	-/-	-/-	-/-	-/-

Results: OFDM – 40 MHz (single-chain, antenna 1)

TX spurious emissions radiated / dBm								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm
2288.0	AVG	-46.8	2288.0	AVG	-47.0	2288.0	AVG	-47.4
2390.0	AVG	-41.6	2390.0	AVG	-43.1	2483.5	AVG	-45.0
2483.5	AVG	-45.2	2483.5	AVG	-42.4	-/-	-/-	-/-

Results: DSSS (single-chain, antenna port 1)

TX spurious emissions radiated / dBm								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm
172.6	Peak	-69.3	2288.0	AVG	-42.1	2288.0	AVG	-41.3
2288.0	AVG	-42.3	2319.9	AVG	-43.7	2319.9	AVG	-43.9
2319.9	AVG	-43.3	2390.0	AVG	-44.7	2390.0	AVG	-46.3
2390.0	AVG	-45.9	2483.5	AVG	-45.5	2483.5	AVG	-45.8
2483.5	AVG	-46.2	4874.5	AVG	-46.6	4924.5	AVG	-50.1
4824.8	AVG	-44.2	-/-	-/-	-/-	-/-	-/-	-/-

Results: OFDM – 20 MHz (single-chain, antenna port 1)

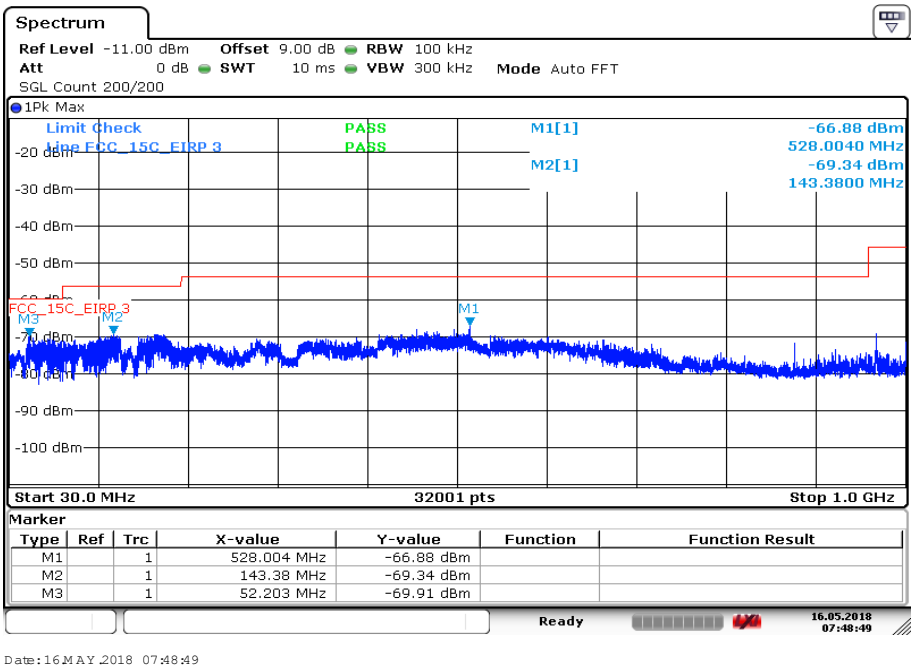
TX spurious emissions radiated / dBm								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm
170.2	Peak	-69.5	170.2	Peak	-71.3	2288.0	AVG	-46.4
2288.0	AVG	-46.6	2319.9	AVG	-43.3	2319.9	AVG	-43.6
2319.9	AVG	-43.8	2390.0	AVG	-44.7	2390.0	AVG	-45.8
2390.0	AVG	-45.6	2483.5	AVG	-44.3	2483.5	AVG	-45.2
2483.5	AVG	-45.9	-/-	-/-	-/-	-/-	-/-	-/-

Results: OFDM – 40 MHz (single-chain, antenna port 1)

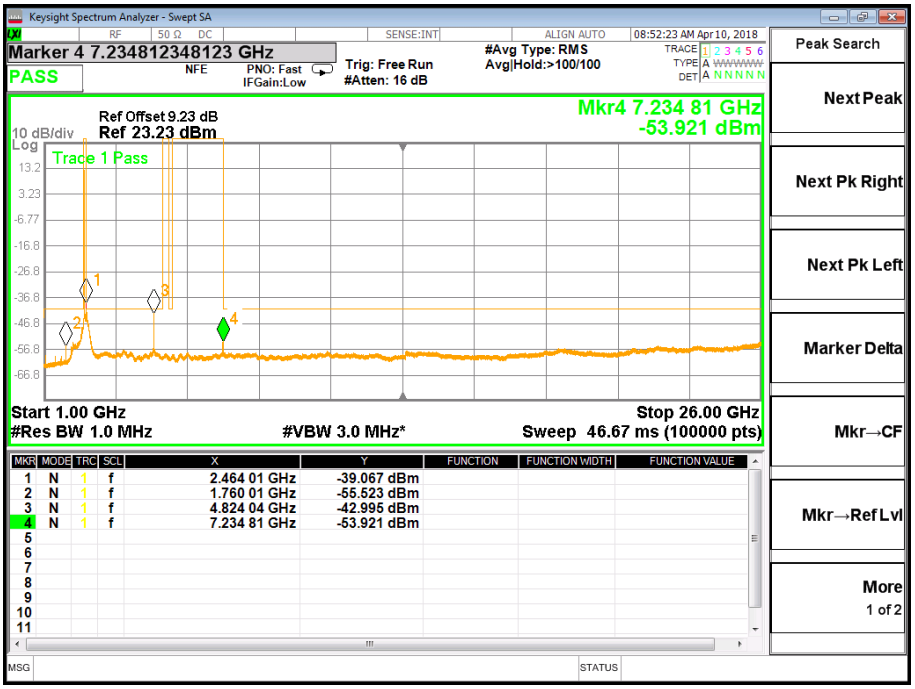
TX spurious emissions radiated / dBm								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm
2288.0	AVG	-44.7	2288.3	AVG	-45.7	170.2	Peak	-69.2
2319.9	AVG	-44.1	2320.1	AVG	-43.5	2288.0	AVG	-44.5
2390.0	AVG	-43.3	2390.0	AVG	-43.7	2319.9	AVG	-44.2
2483.5	AVG	-47.9	2483.5	AVG	-44.2	2390.0	AVG	-49.7
-/-	-/-	-/-	-/-	-/-	-/-	2483.5	AVG	-44.9

Plots: DSSS / b – mode

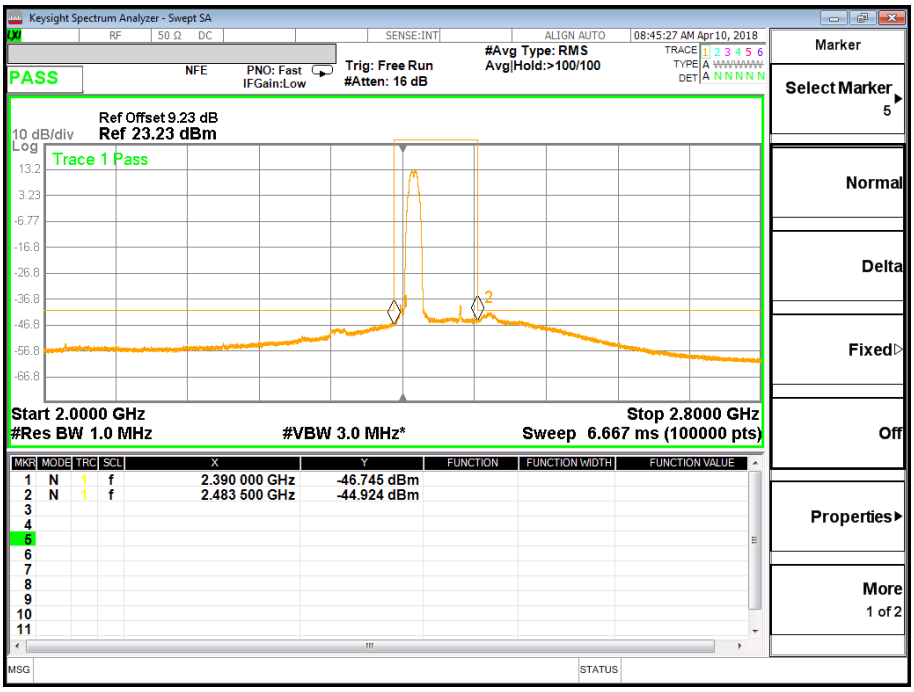
Plot 1: Lowest channel / 30MHz to 1GHz / Antenna port 0



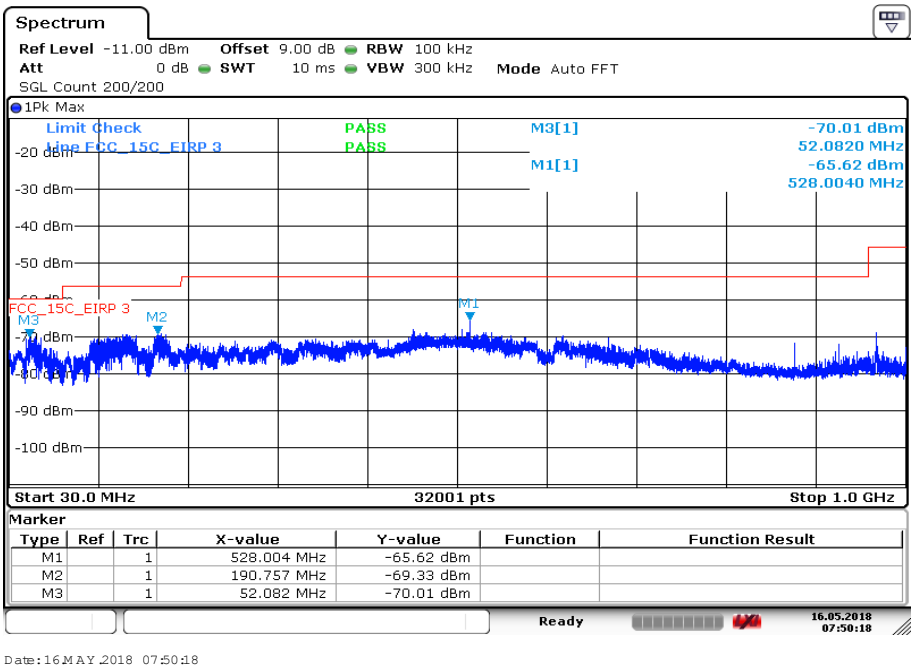
Plot 2: Lowest channel / 1GHz to 26GHz / Antenna port 0



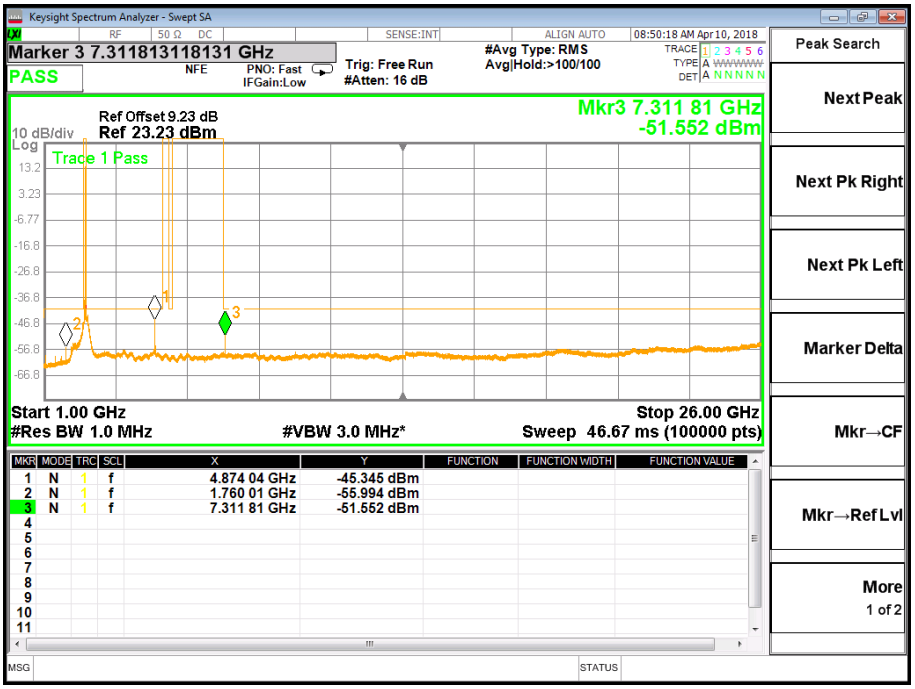
Plot 3: Lowest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)



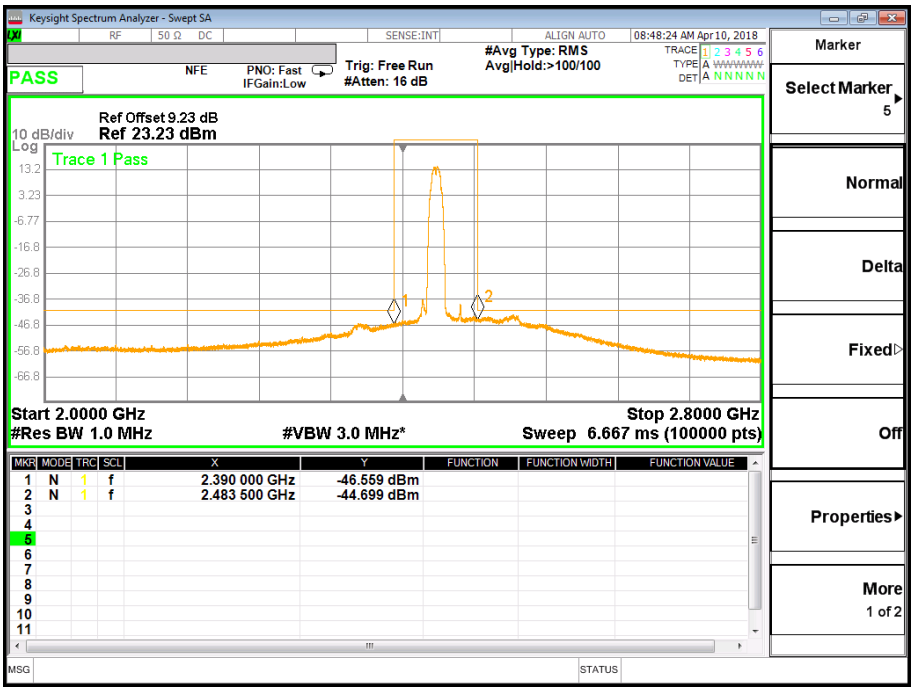
Plot 4: Middle channel / 30MHz to 1GHz / Antenna port 0



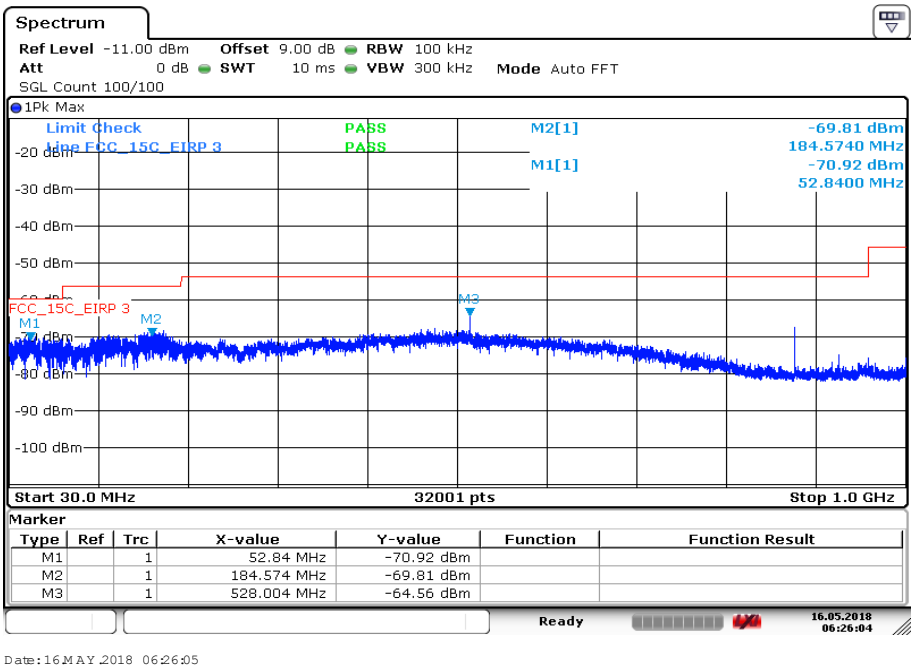
Plot 5: Middle channel / 1GHz to 26GHz / Antenna port 0



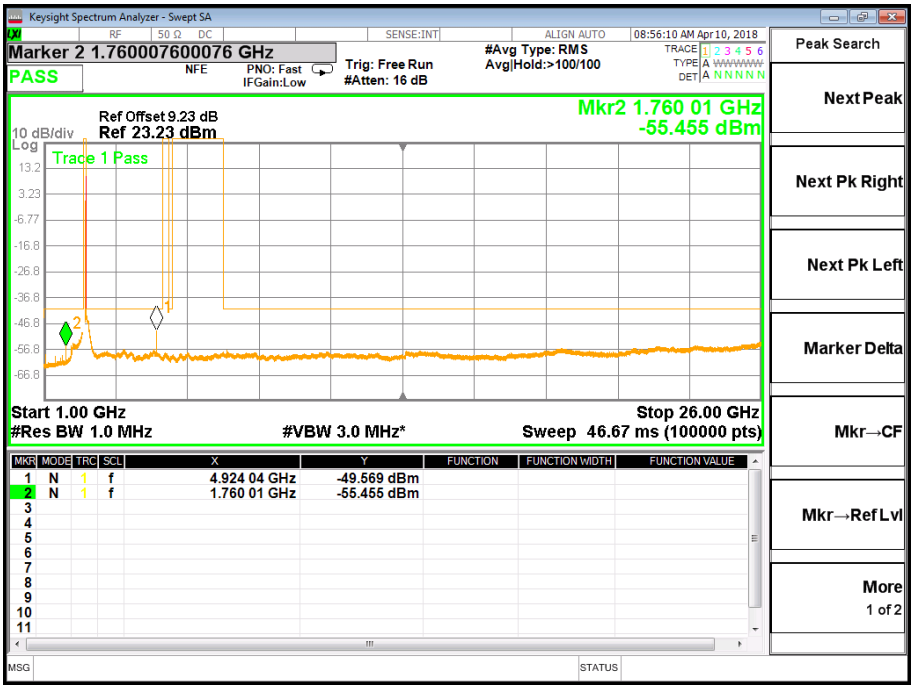
Plot 6: Middle channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)



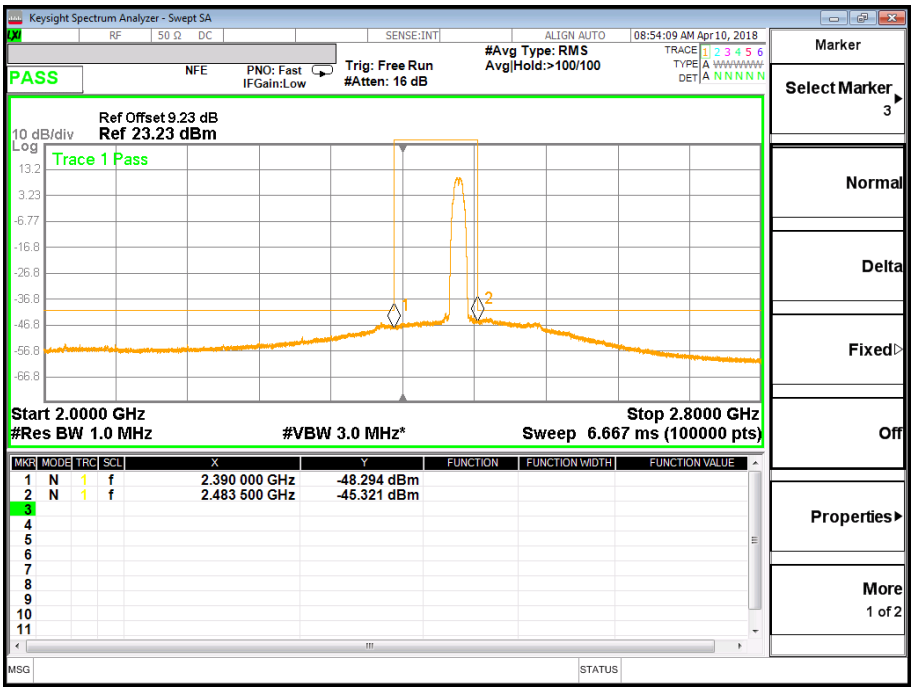
Plot 7: Highest channel / 30MHz to 1GHz / Antenna port 0



Plot 8: Highest channel / 1GHz to 26GHz / Antenna port

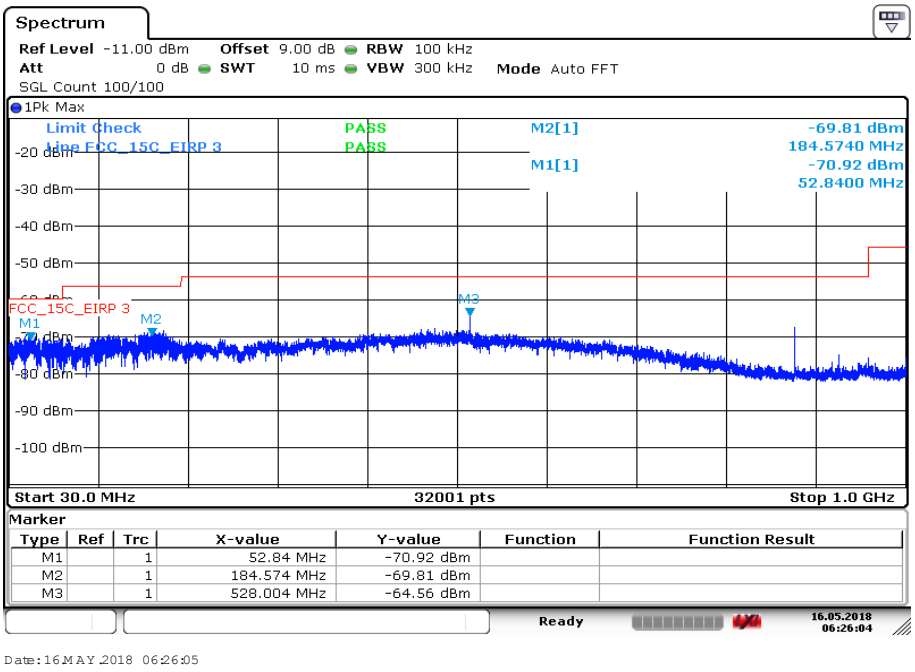


Plot 9: Highest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)

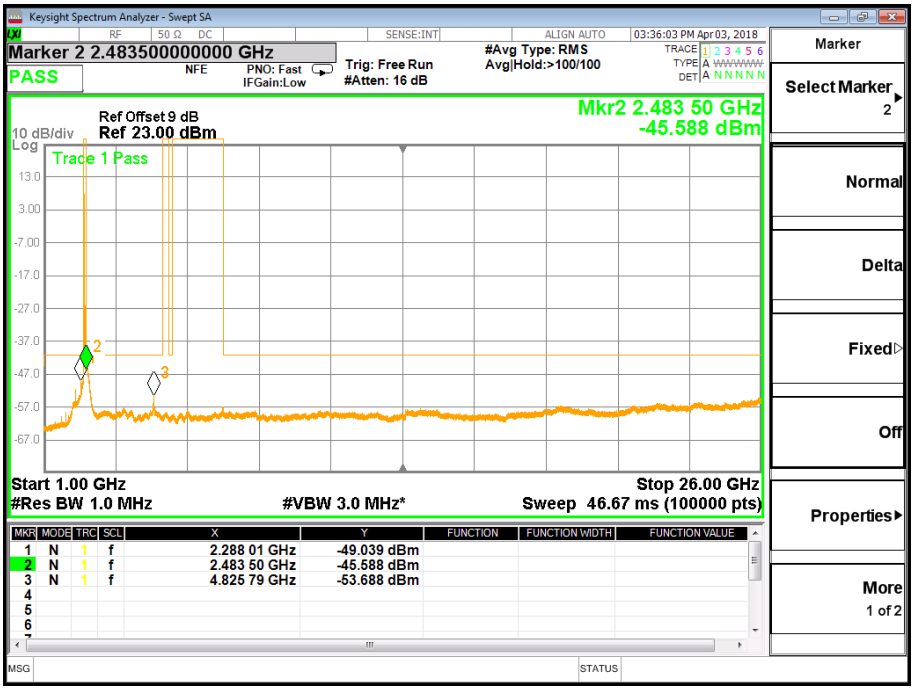


Plots: OFDM – 20 MHz

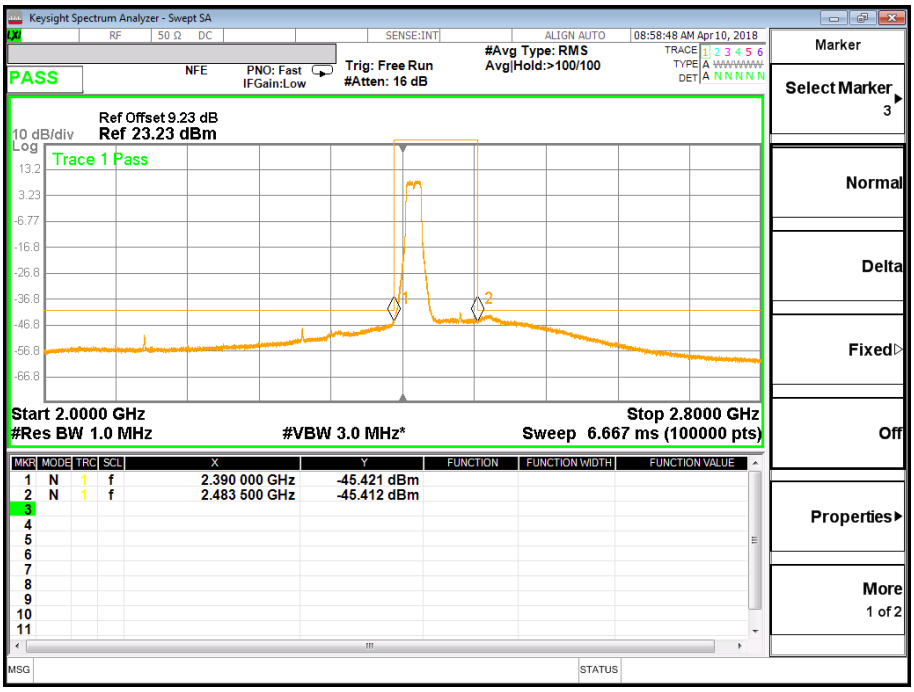
Plot 1: Lowest channel / 30MHz to 1GHz / Antenna port 0



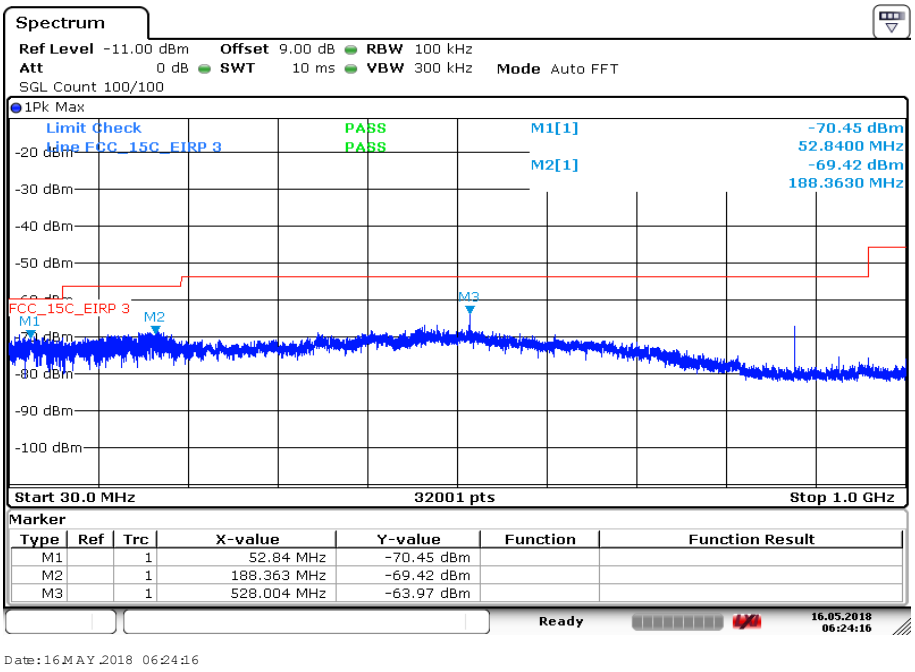
Plot 2: Lowest channel / 1GHz to 26GHz / Antenna port 0



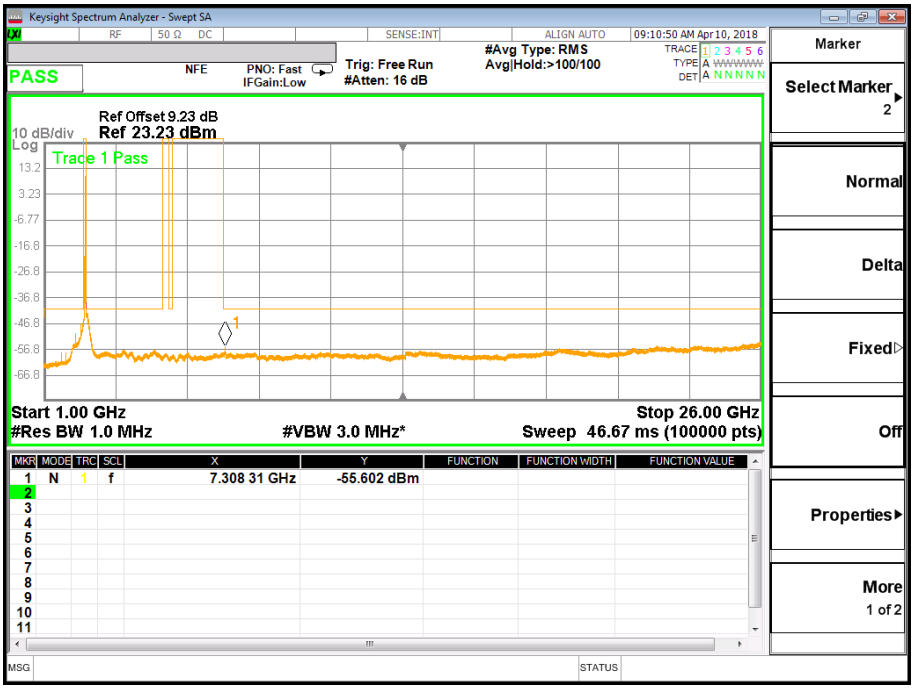
Plot 3: Lowest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)



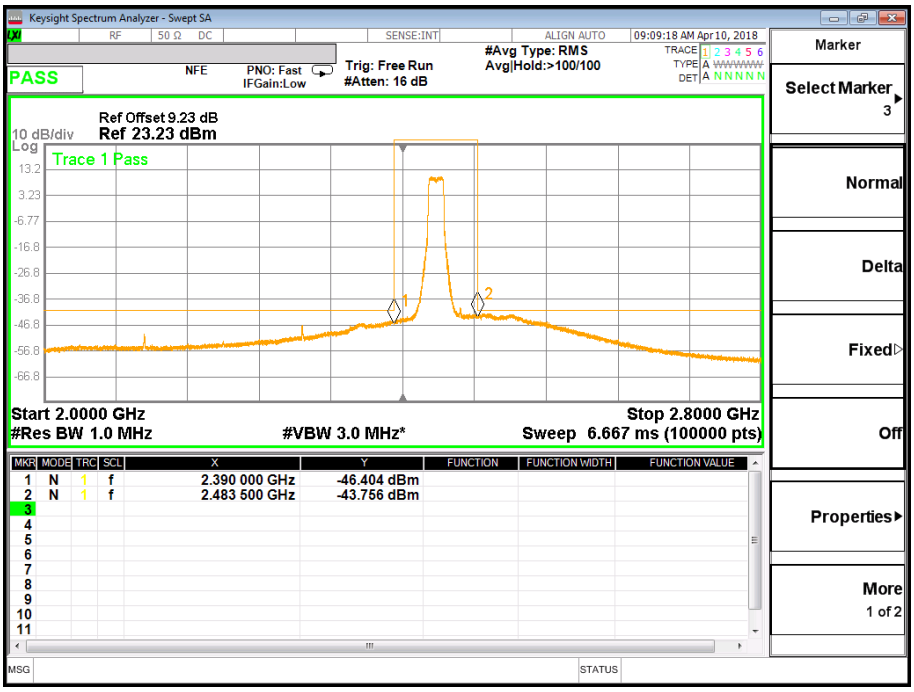
Plot 4: Middle channel / 30MHz to 1GHz / Antenna port 0



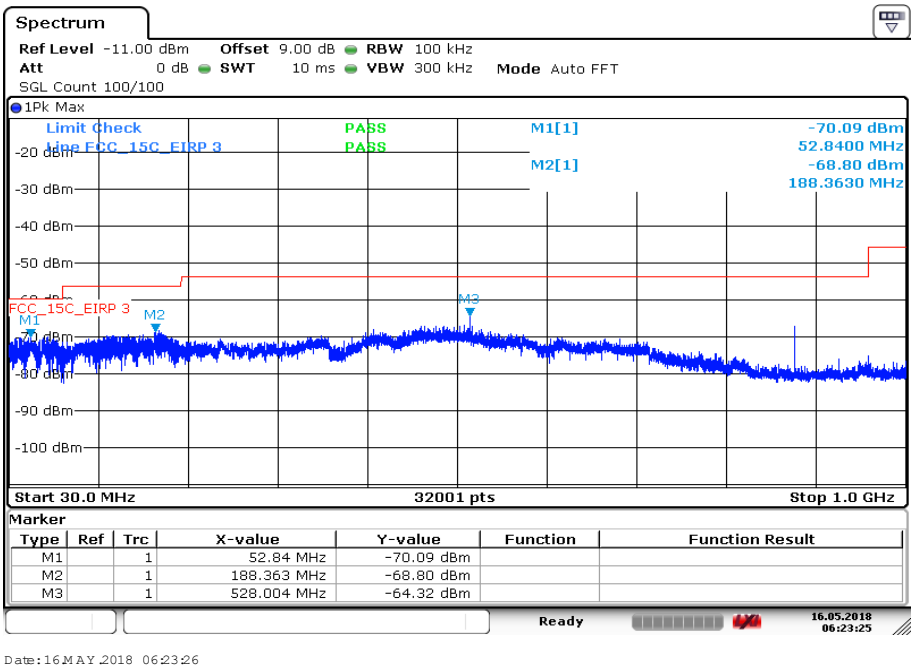
Plot 5: Middle channel / 1GHz to 26GHz / Antenna port 0



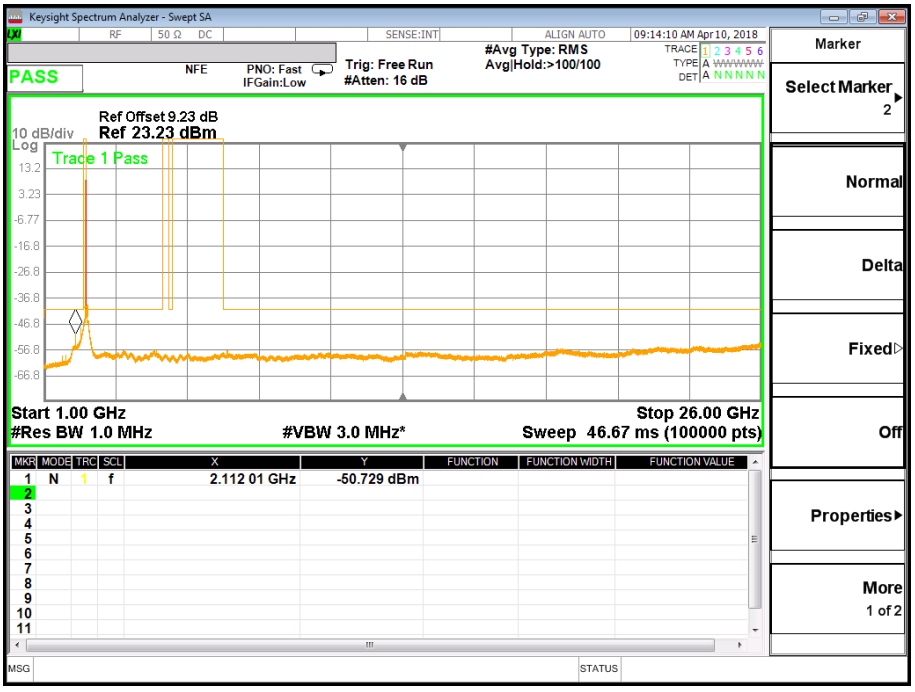
Plot 6: Middle channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)



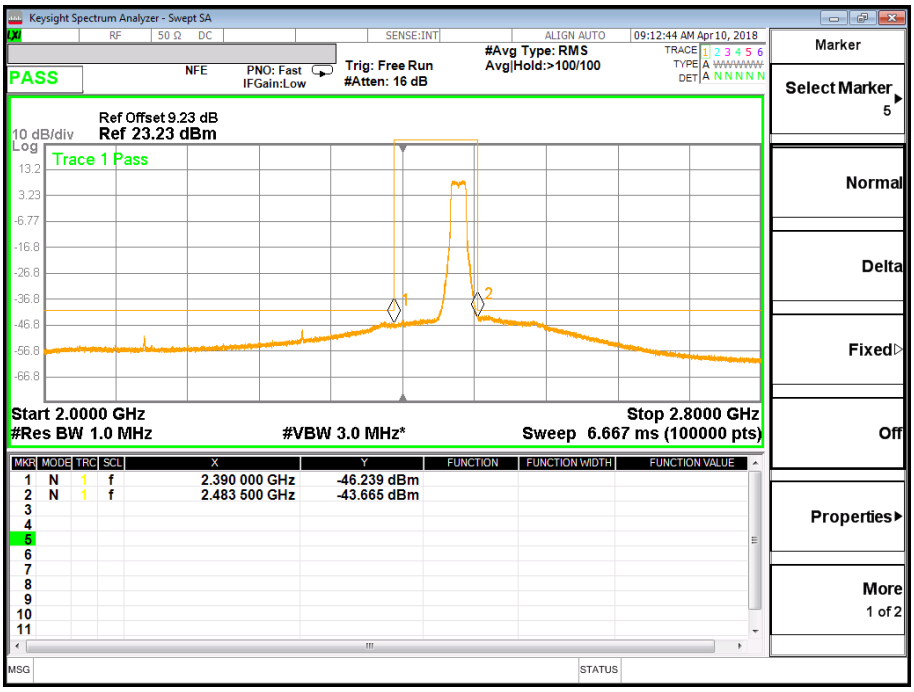
Plot 7: Highest channel / 30MHz to 1GHz / Antenna port 0



Plot 8: Highest channel / 1GHz to 26GHz / Antenna port 0

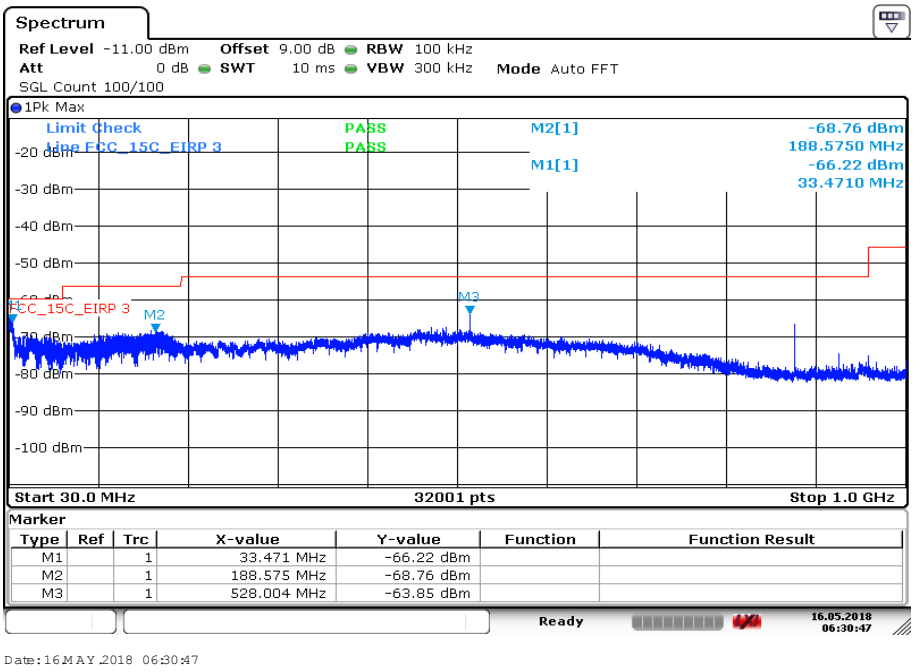


Plot 9: Highest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)

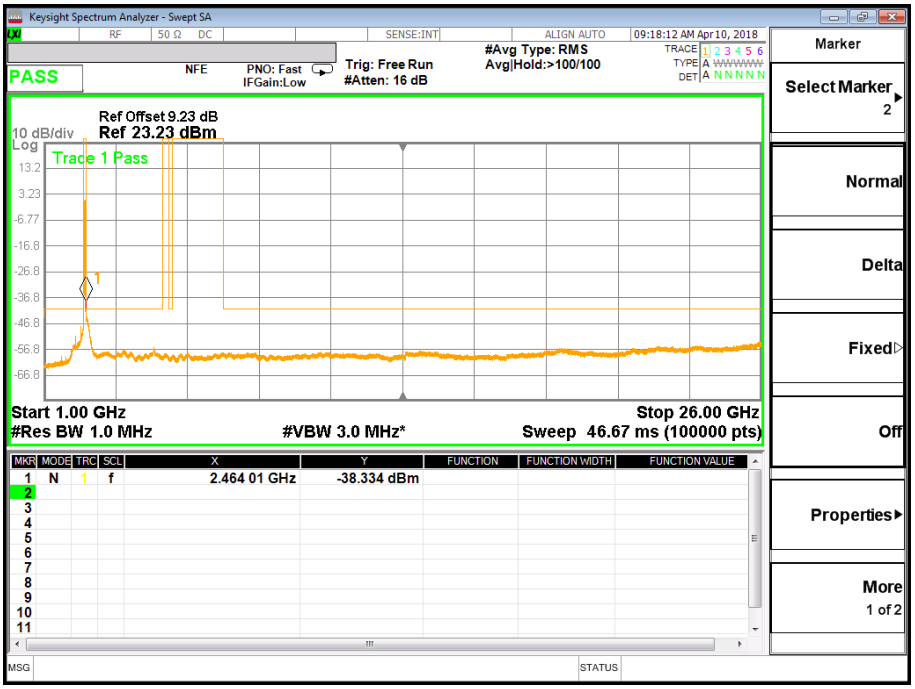


Plots: OFDM / n40 – mode

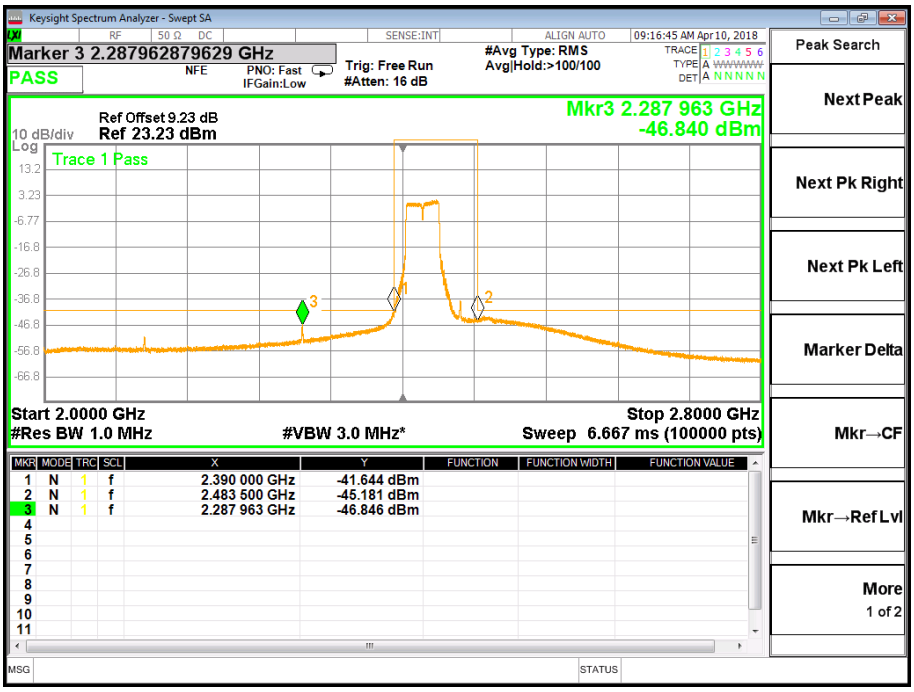
Plot 1: Lowest channel / 30MHz to 1GHz / Antenna port 0



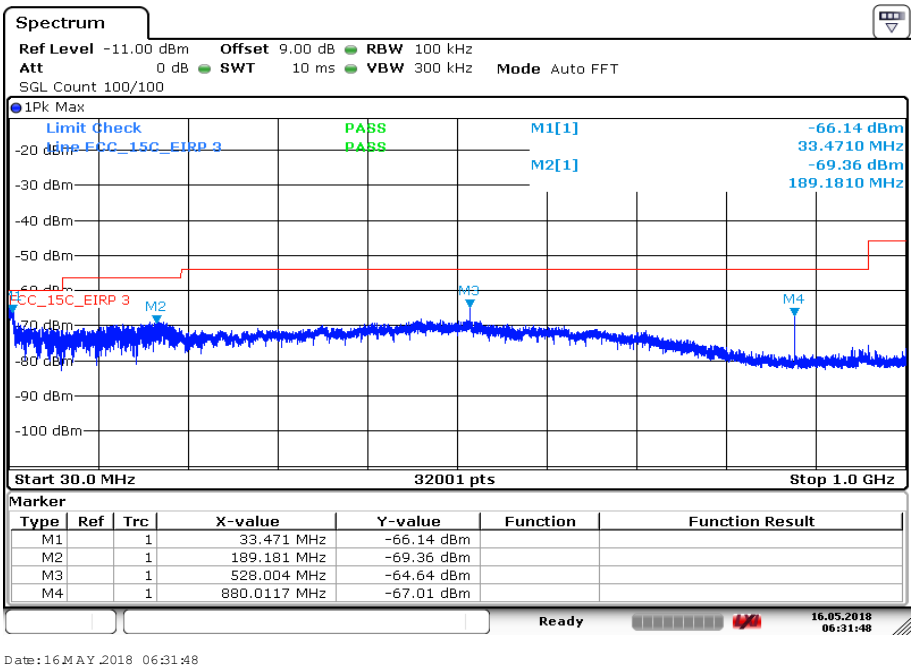
Plot 2: Lowest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)



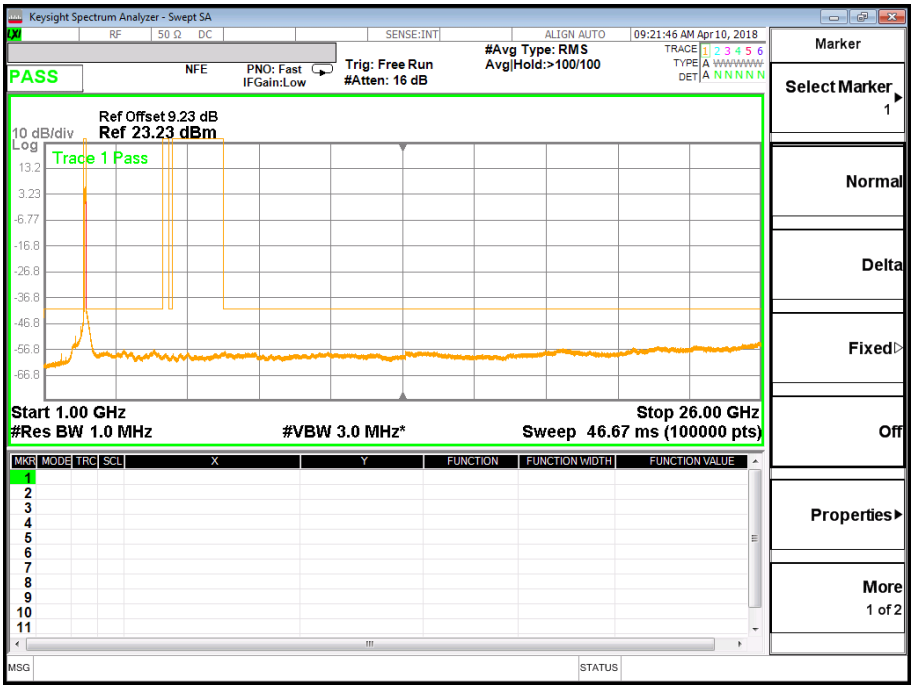
Plot 3: Lowest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)



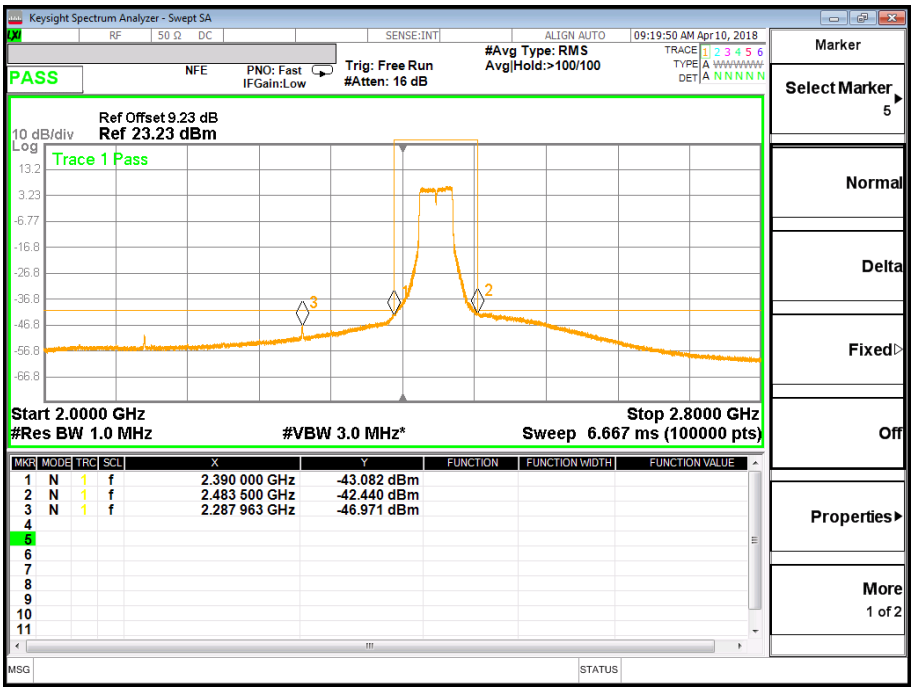
Plot 4: Middle channel / 30MHz to 1GHz / Antenna port 0



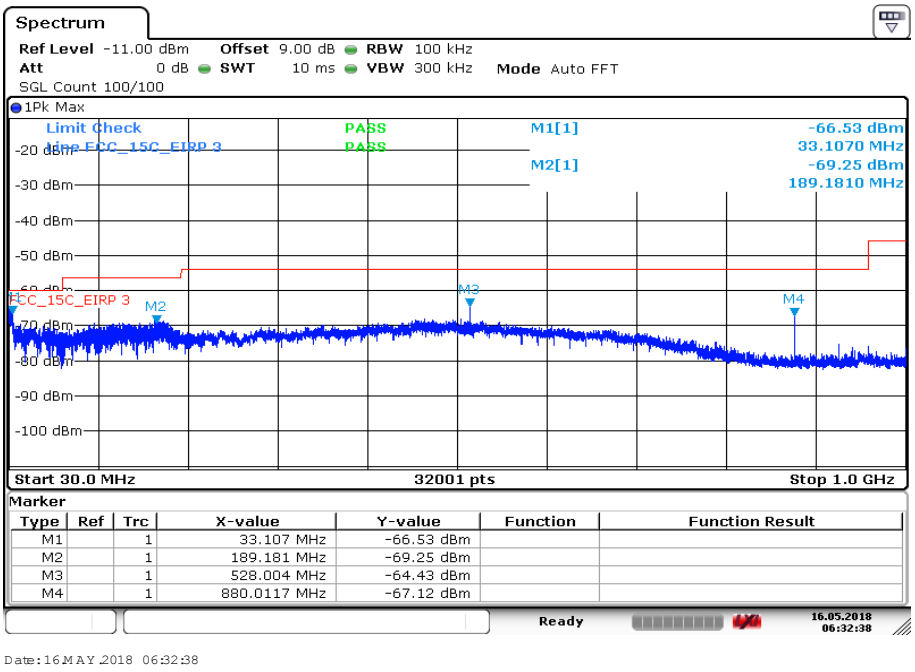
Plot 5: Middle channel / 1GHz to 26GHz / Antenna port 0



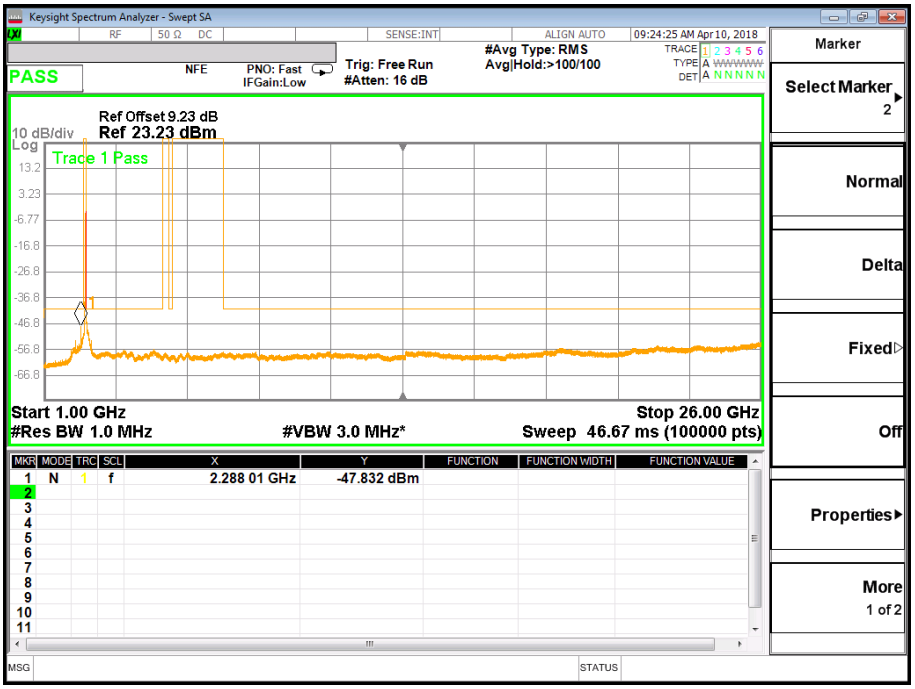
Plot 6: Middle channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)



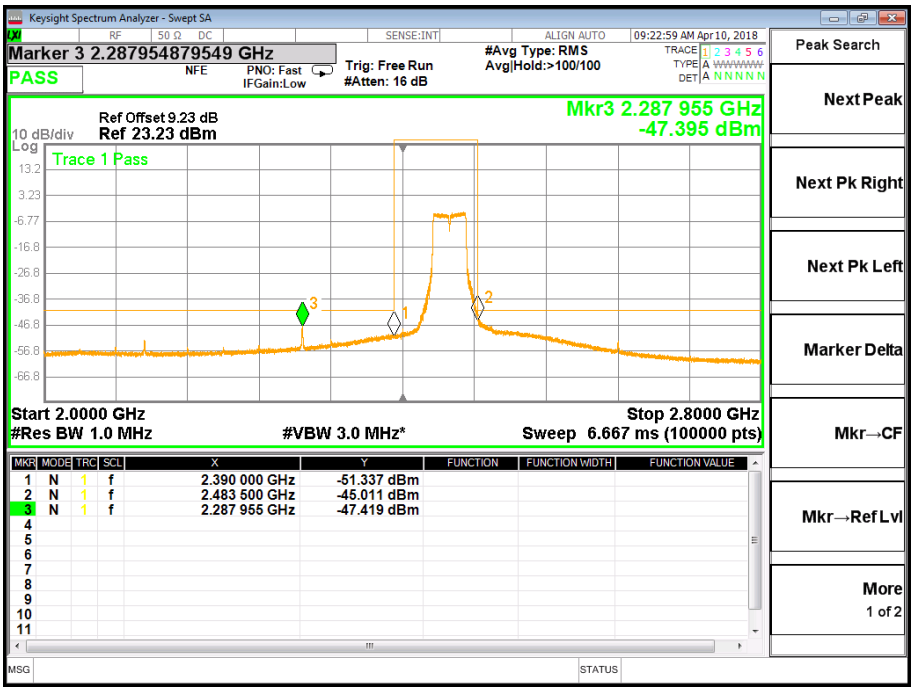
Plot 7: Highest channel / 30MHz to 1GHz / Antenna port 0



Plot 8: Highest channel / 1GHz to 26GHz / Antenna port

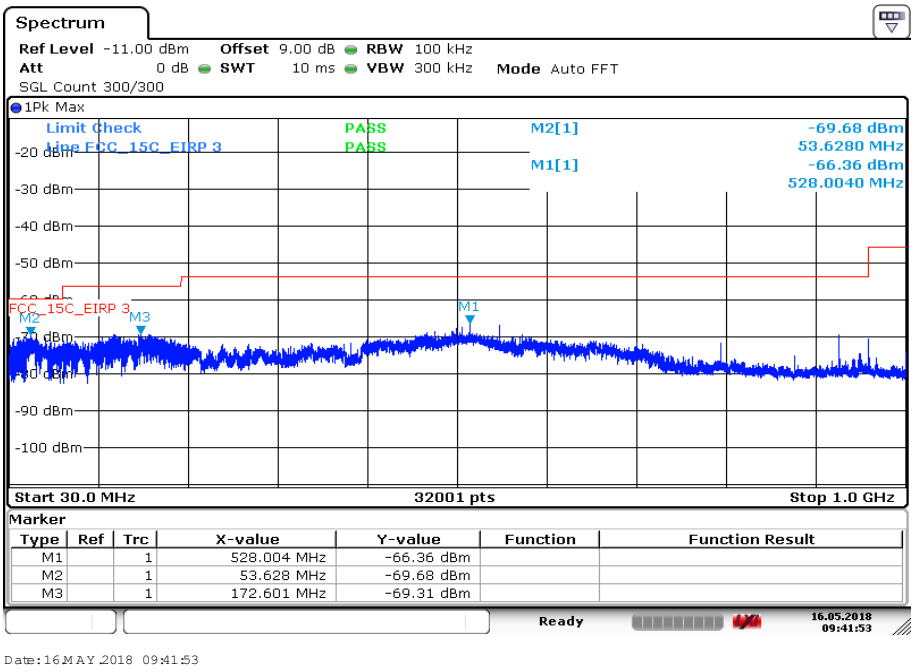


Plot 9: Highest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)

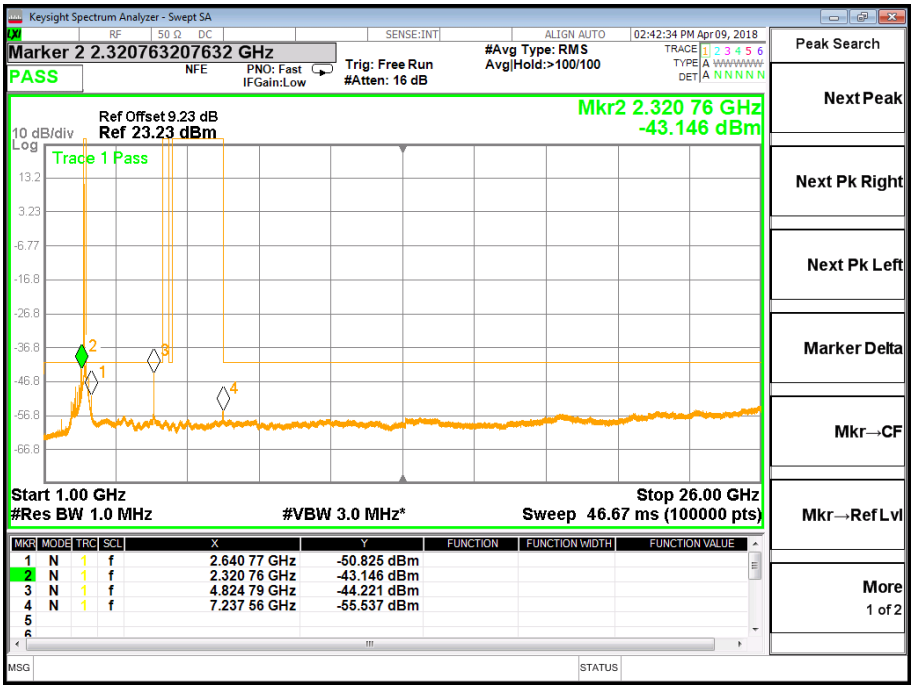


Plots: DSSS / b – mode

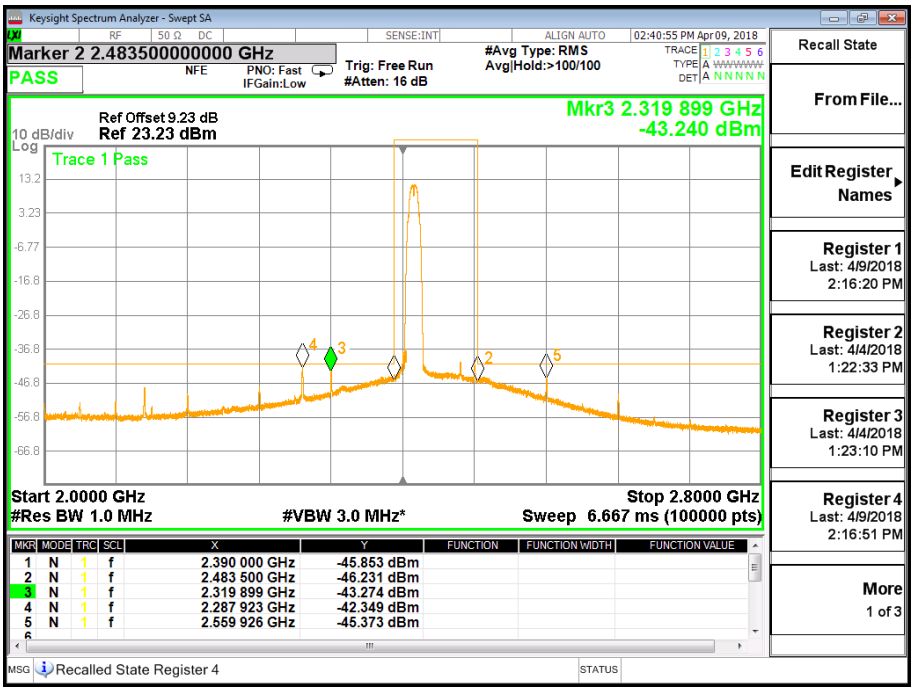
Plot 1: Lowest channel / 30MHz to 1GHz / Antenna port 1



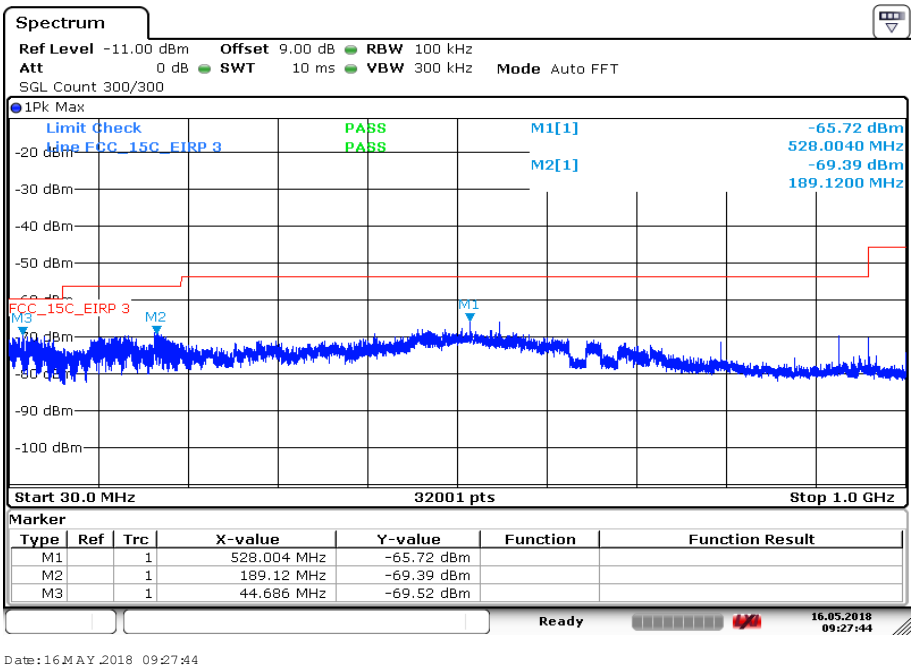
Plot 2: Lowest channel / 1GHz to 26GHz / Antenna port 1



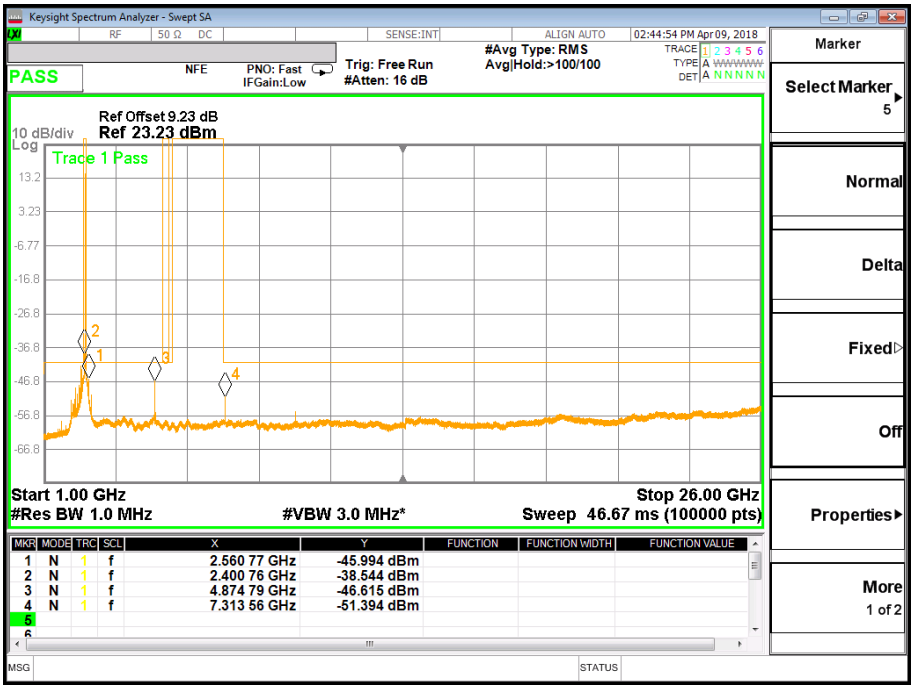
Plot 3: Lowest channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)



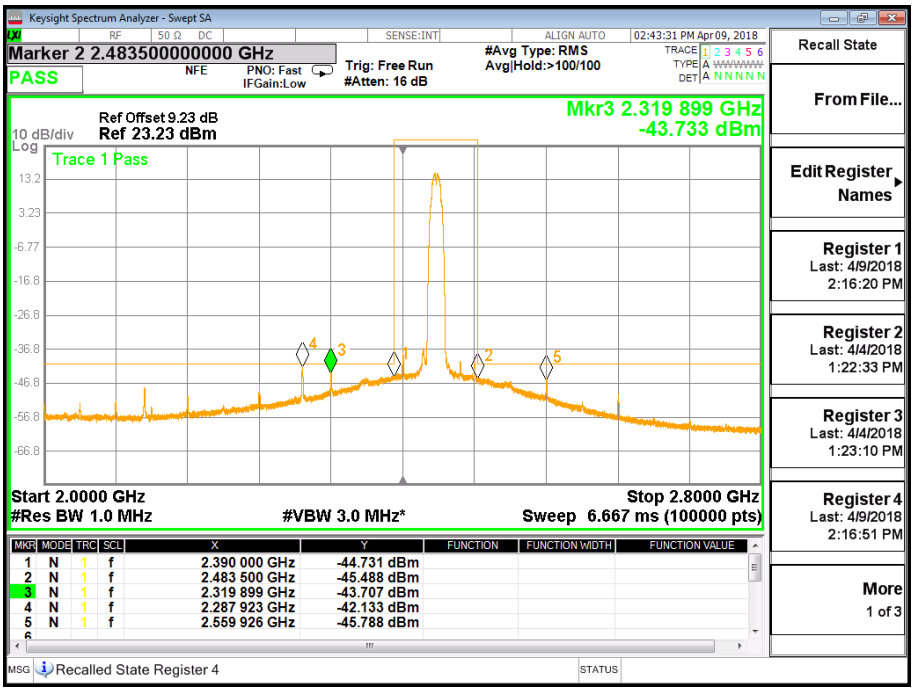
Plot 4: Middle channel / 30MHz to 1GHz / Antenna port 1



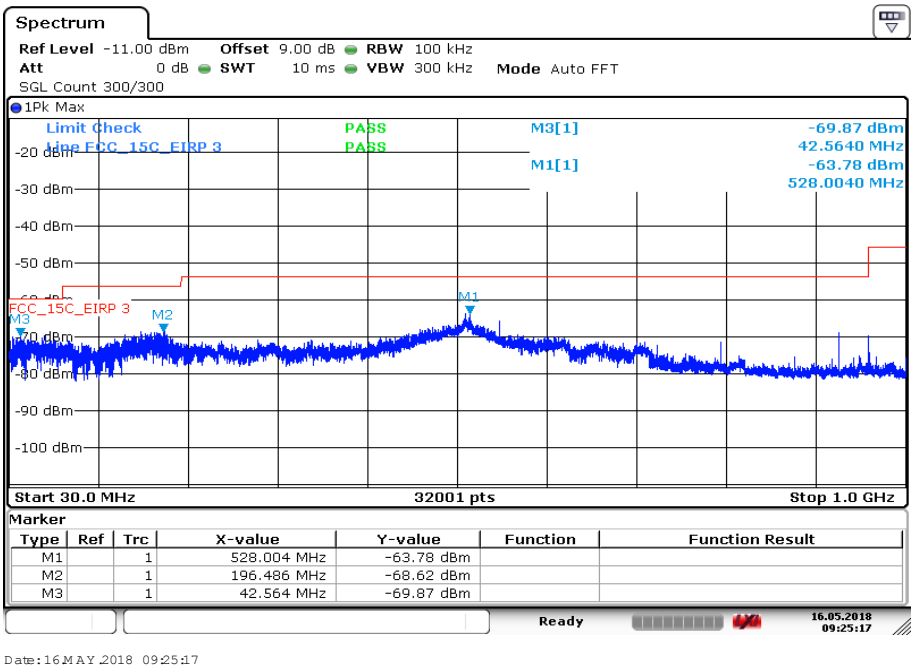
Plot 5: Middle channel / 1GHz to 26GHz / Antenna port 1



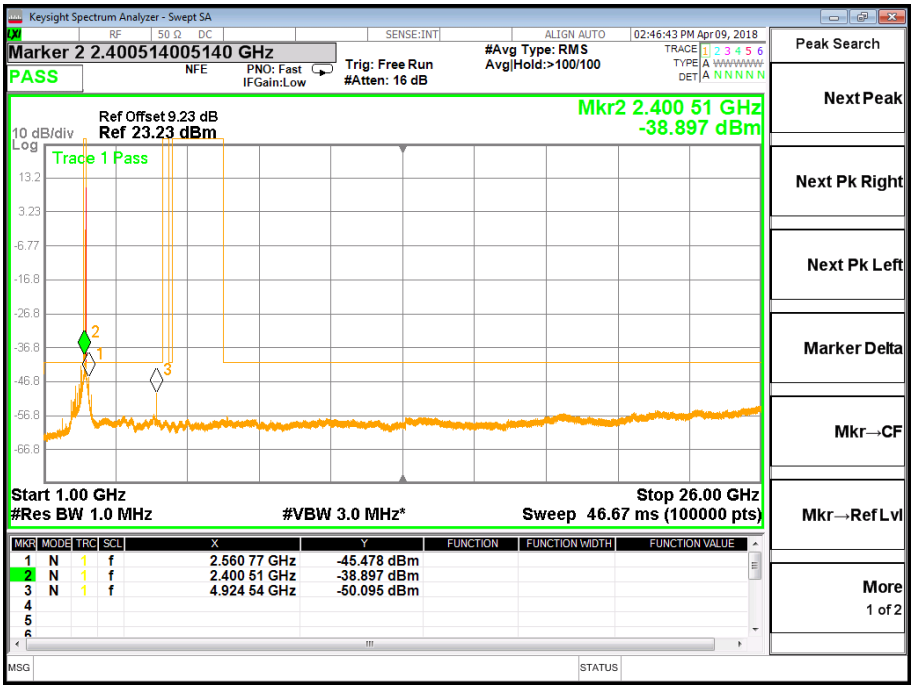
Plot 6: Middle channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)



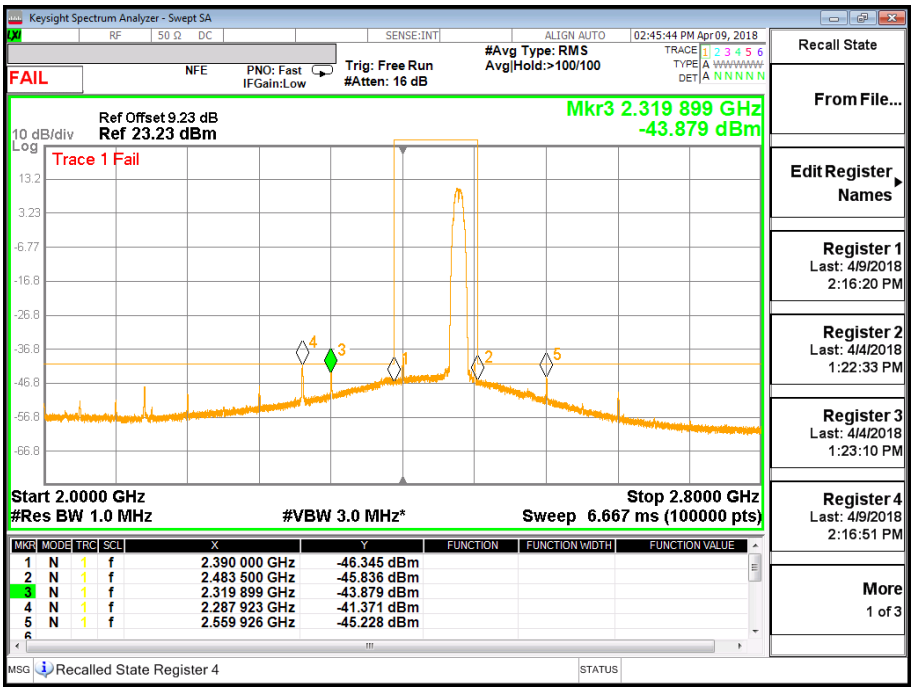
Plot 7: Highest channel / 30MHz to 1GHz / Antenna port 1



Plot 8: Highest channel / 1GHz to 26GHz / Antenna port

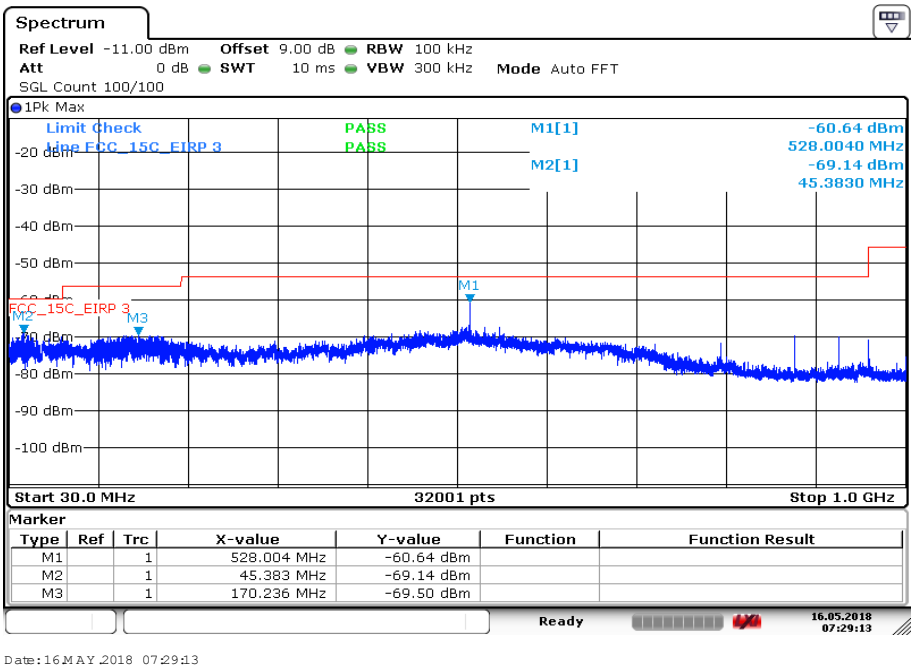


Plot 9: Highest channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)



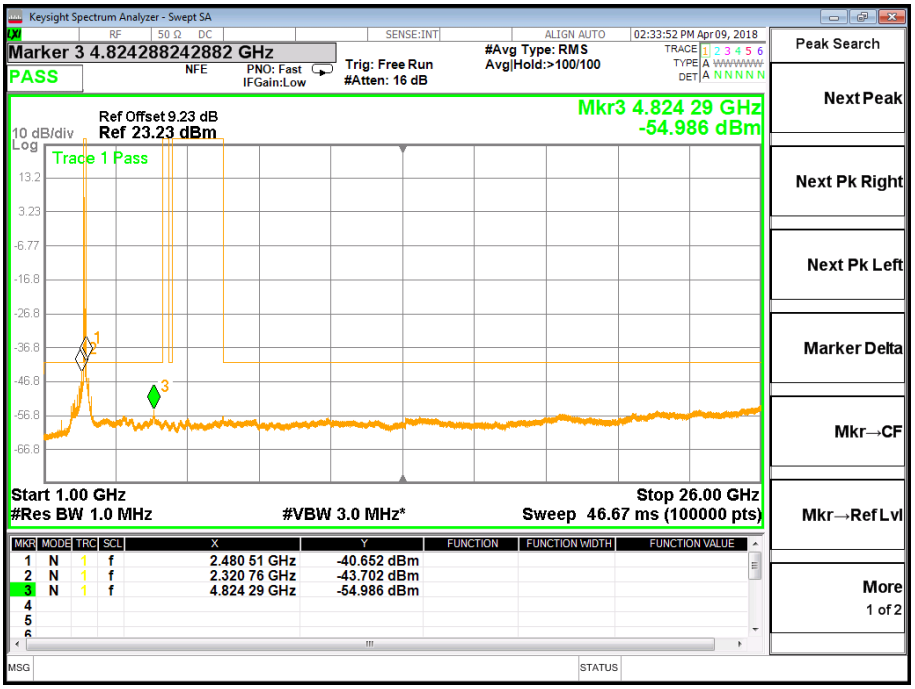
Plots: OFDM – 20 MHz

Plot 1: Lowest channel / 30MHz to 1GHz / Antenna port 1

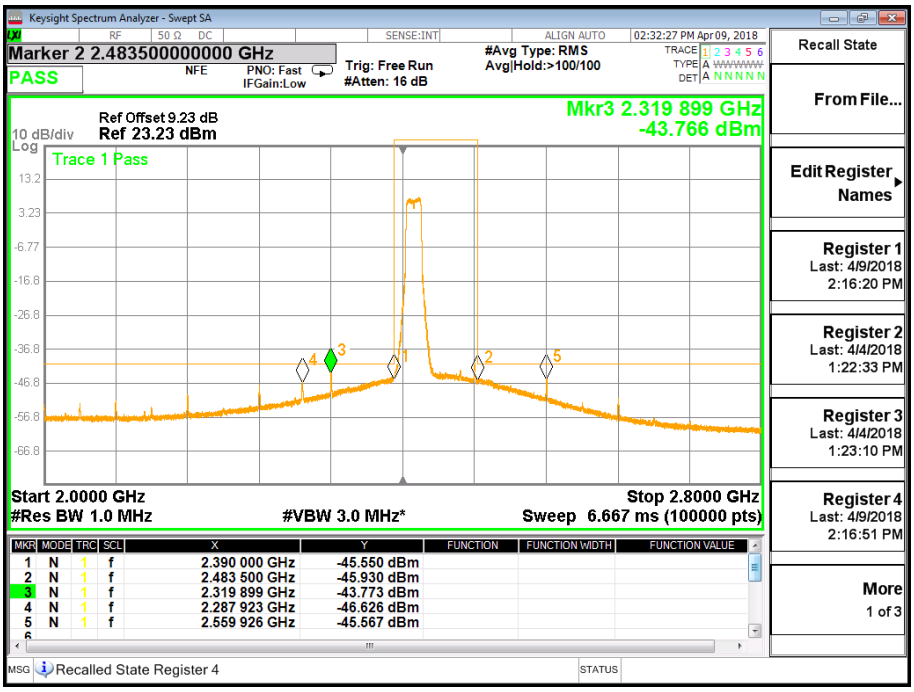


Date:16.MAY.2018 07:29:13

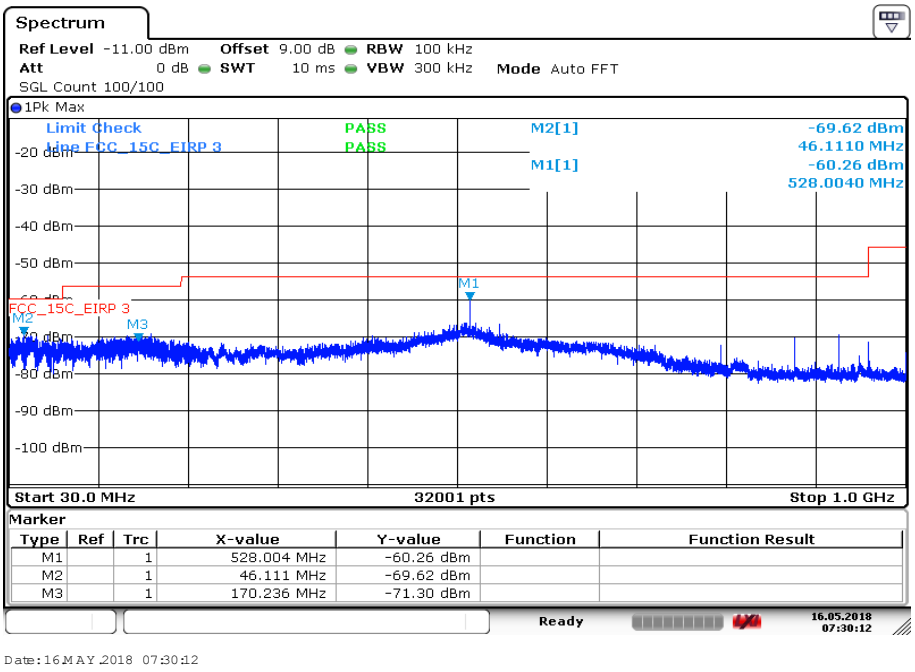
Plot 2: Lowest channel / 1GHz to 26GHz / Antenna port 1



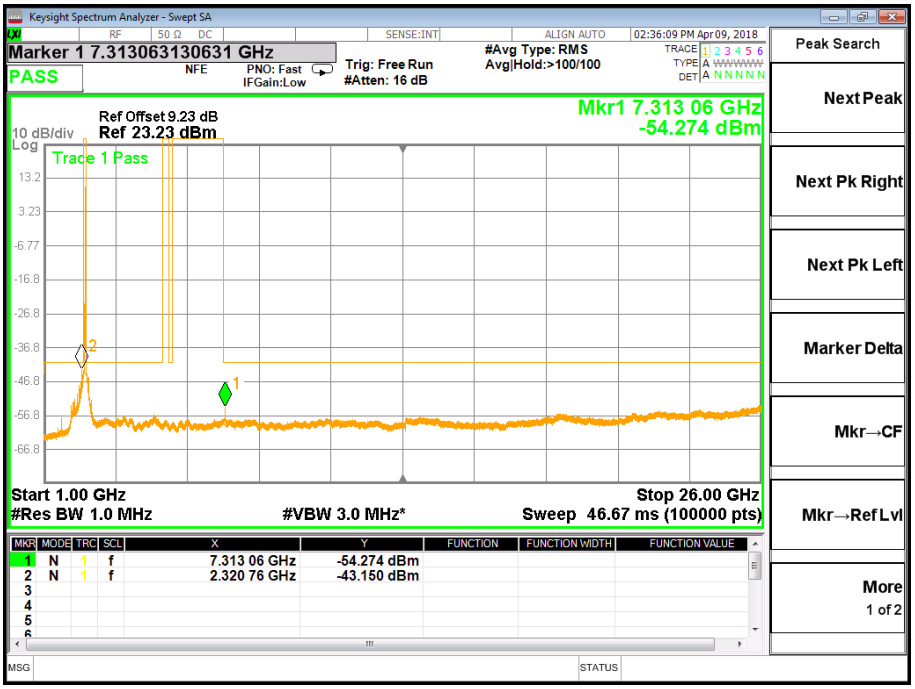
Plot 3: Lowest channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)



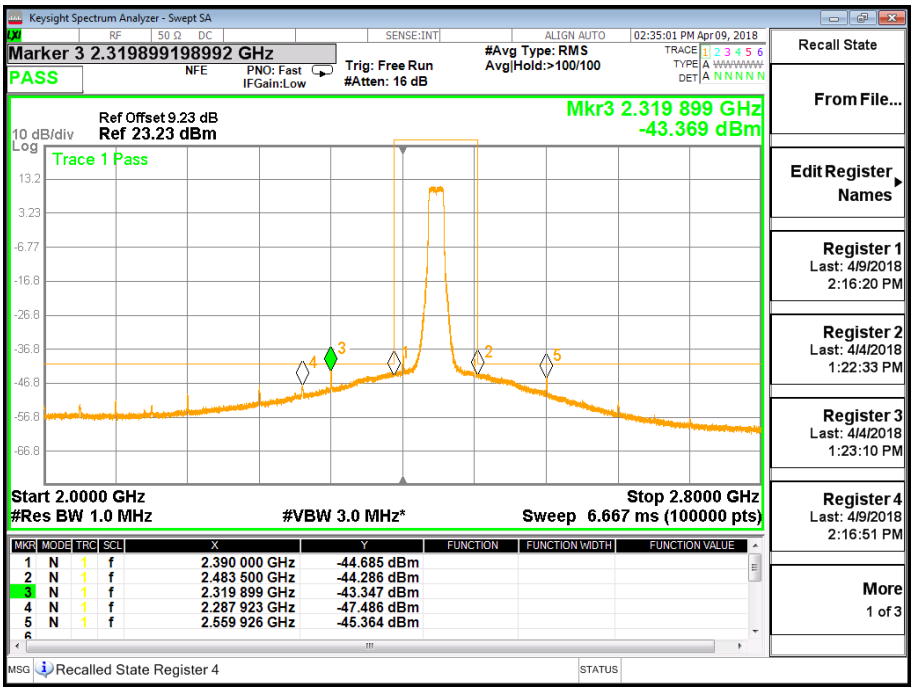
Plot 4: Middle channel / 30MHz to 1GHz / Antenna port 1



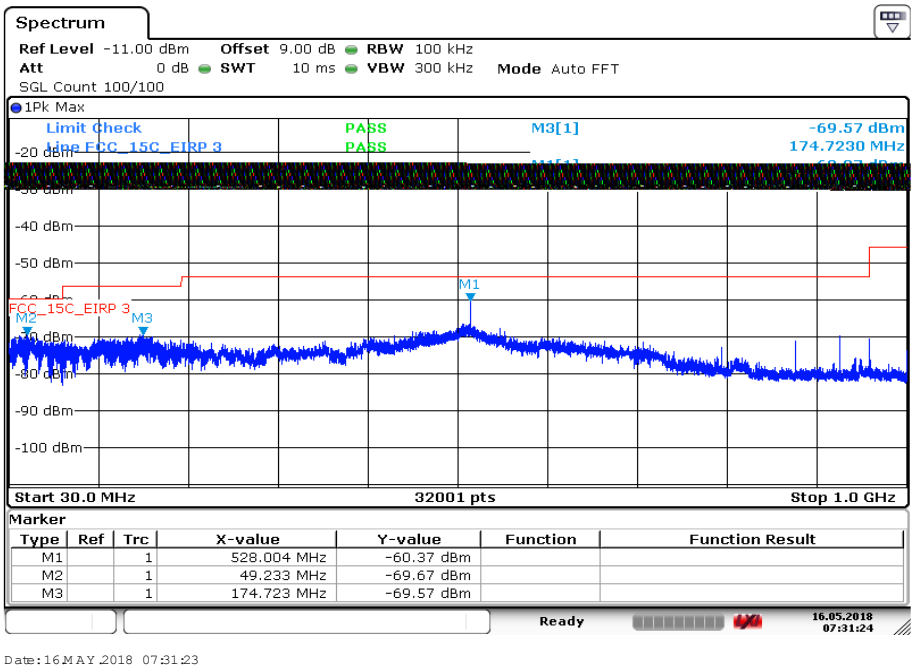
Plot 5: Middle channel / 1GHz to 26GHz / Antenna port 1



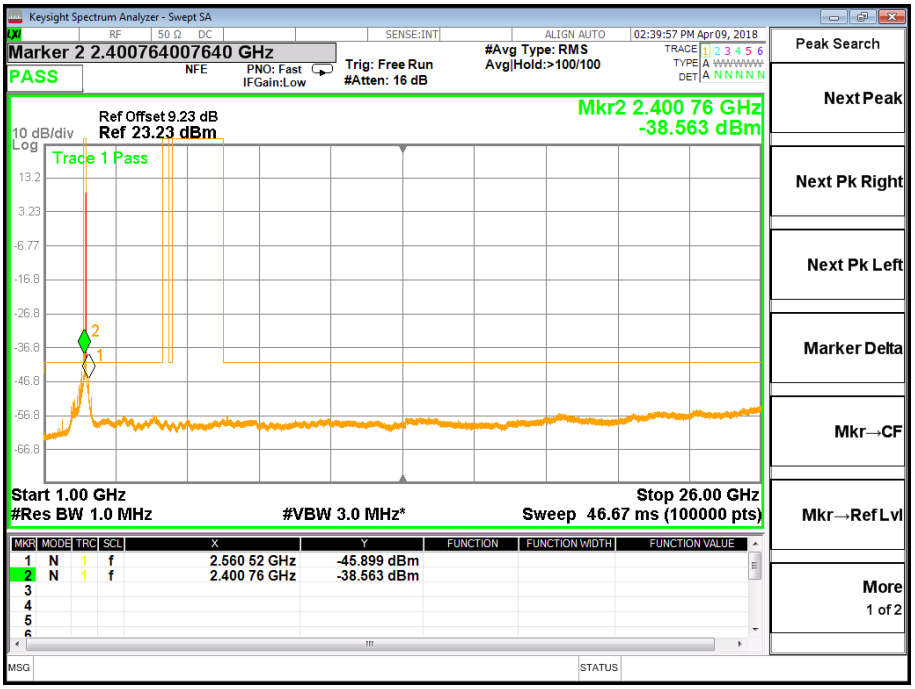
Plot 6: Middle channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)



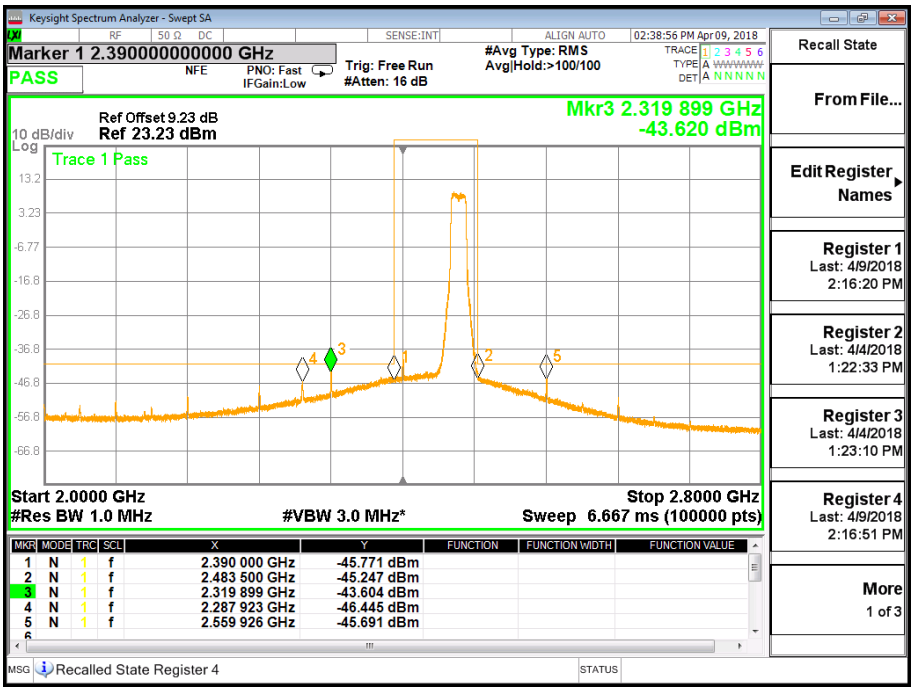
Plot 7: Highest channel / 30MHz to 1GHz / Antenna port 1



Plot 8: Highest channel / 1GHz to 26GHz / Antenna port

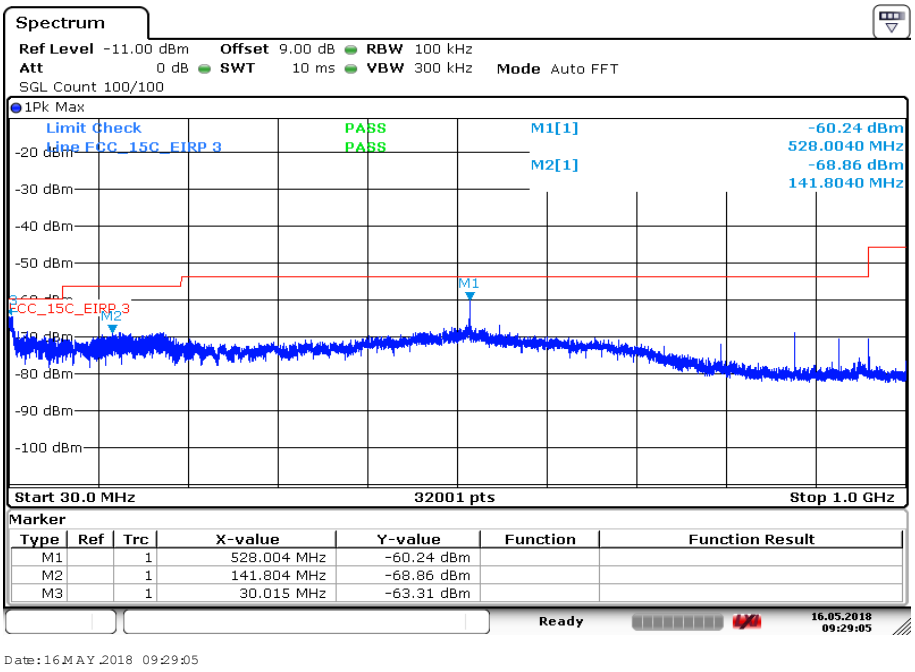


Plot 9: Highest channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)

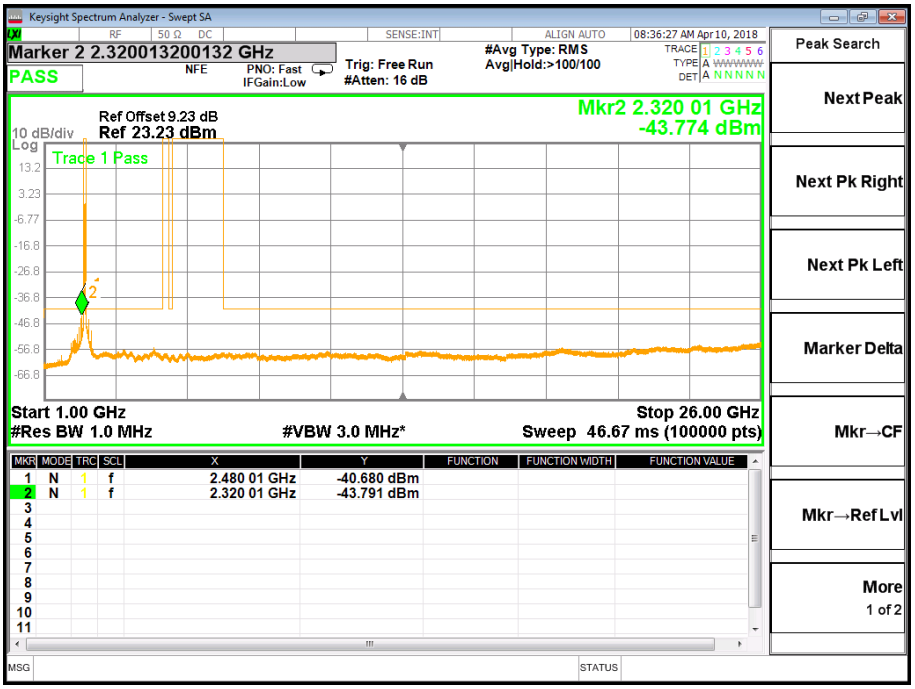


Plots: OFDM / n40 – mode

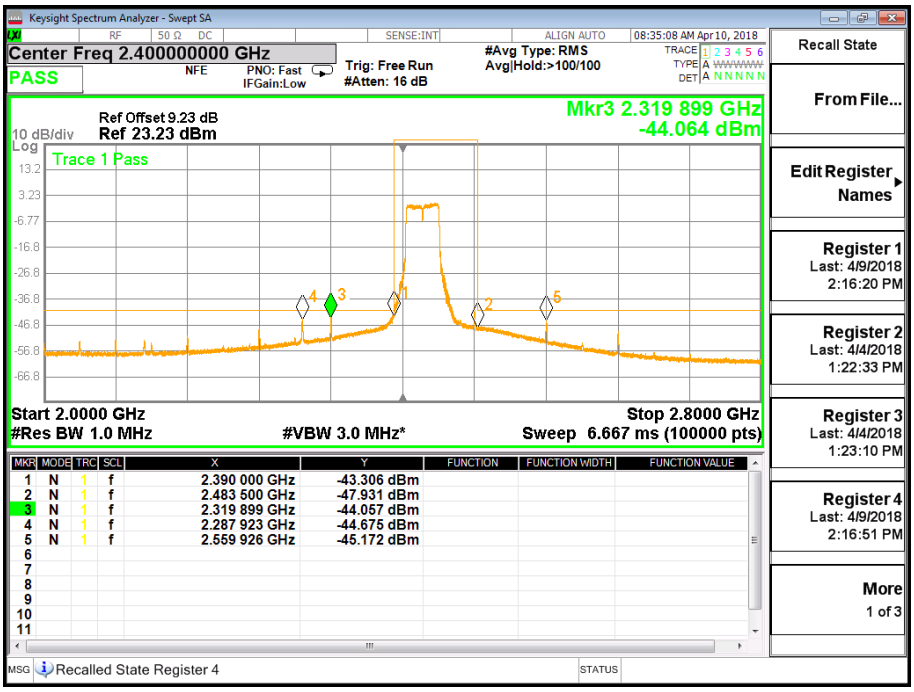
Plot 1: Lowest channel / 30MHz to 1GHz / Antenna port 1



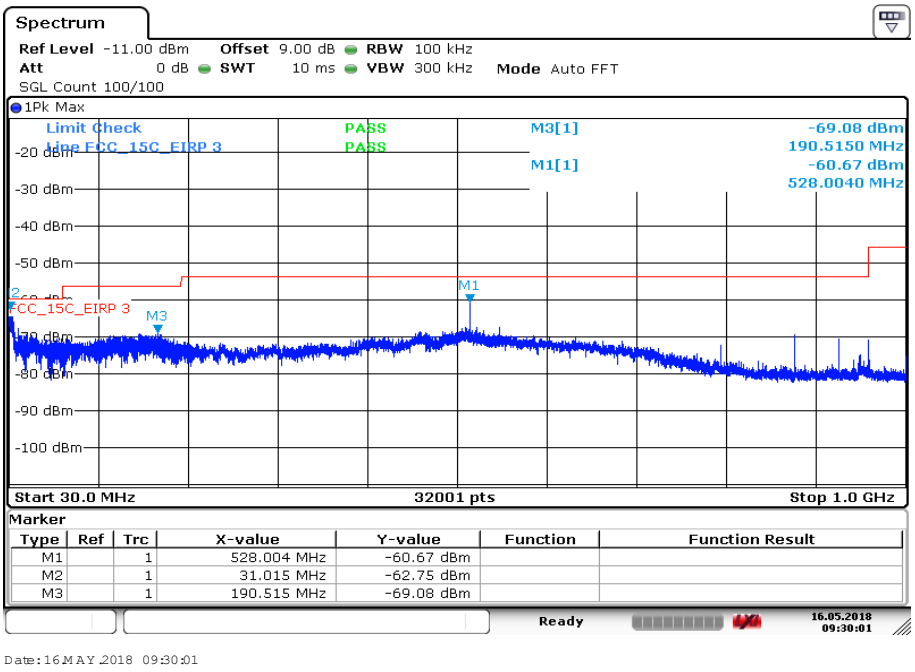
Plot 2: Lowest channel / 1GHz to 26GHz / Antenna port 1



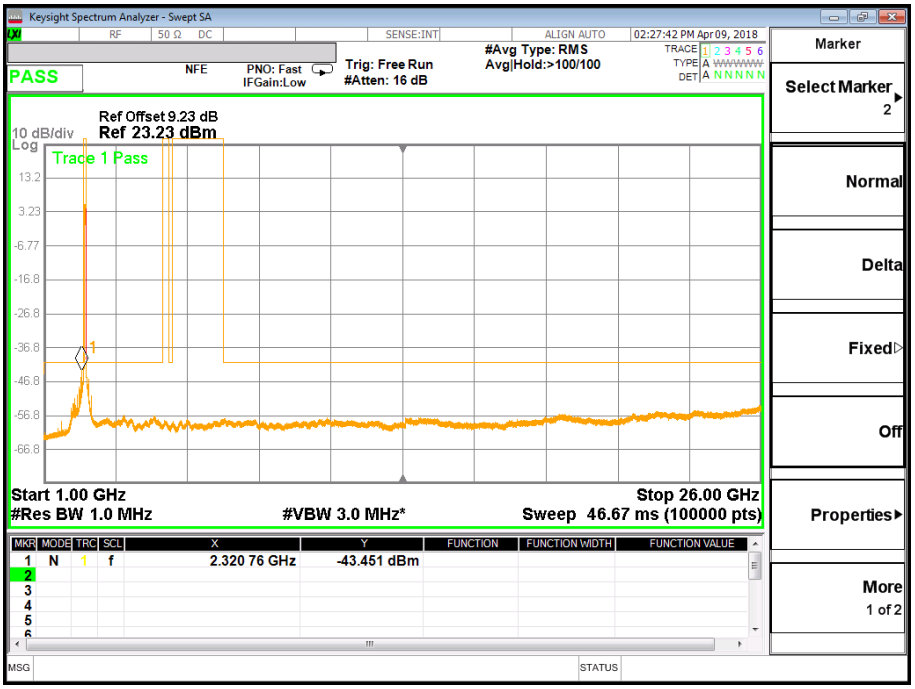
Plot 3: Lowest channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)



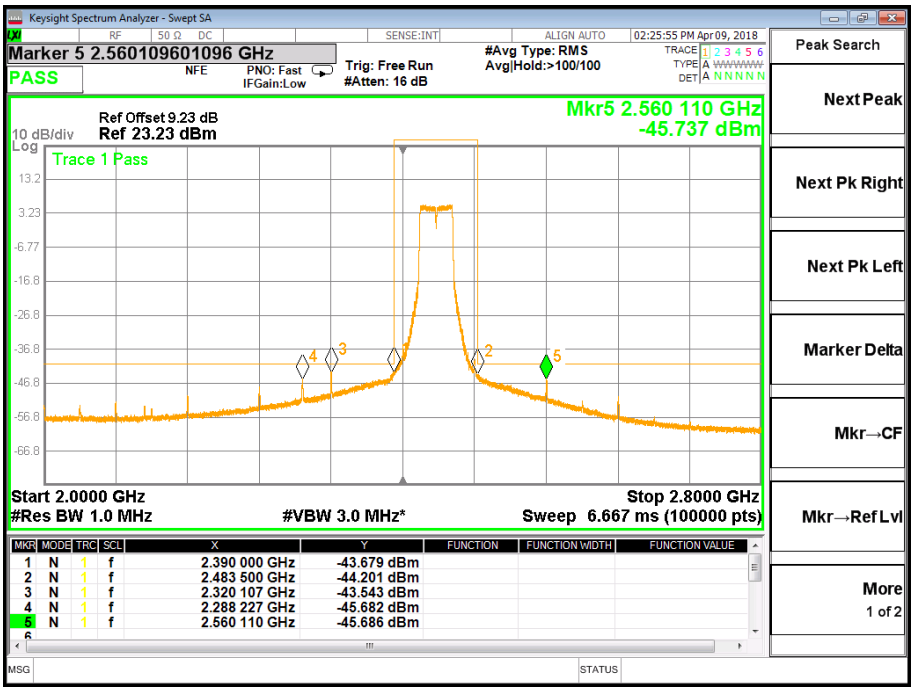
Plot 4: Middle channel / 30MHz to 1GHz / Antenna port 1



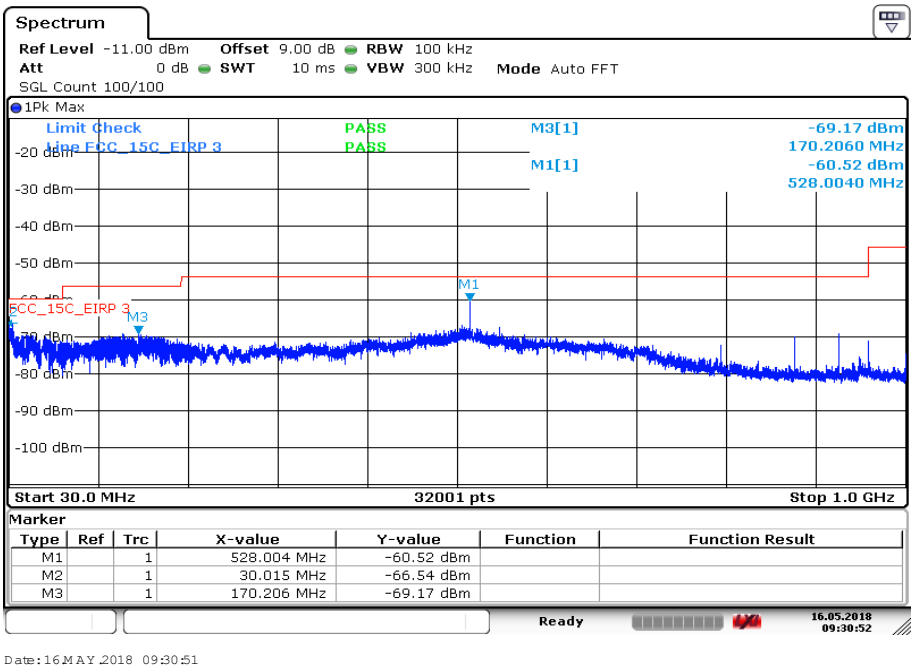
Plot 5: Middle channel / 1GHz to 26GHz / Antenna port 1



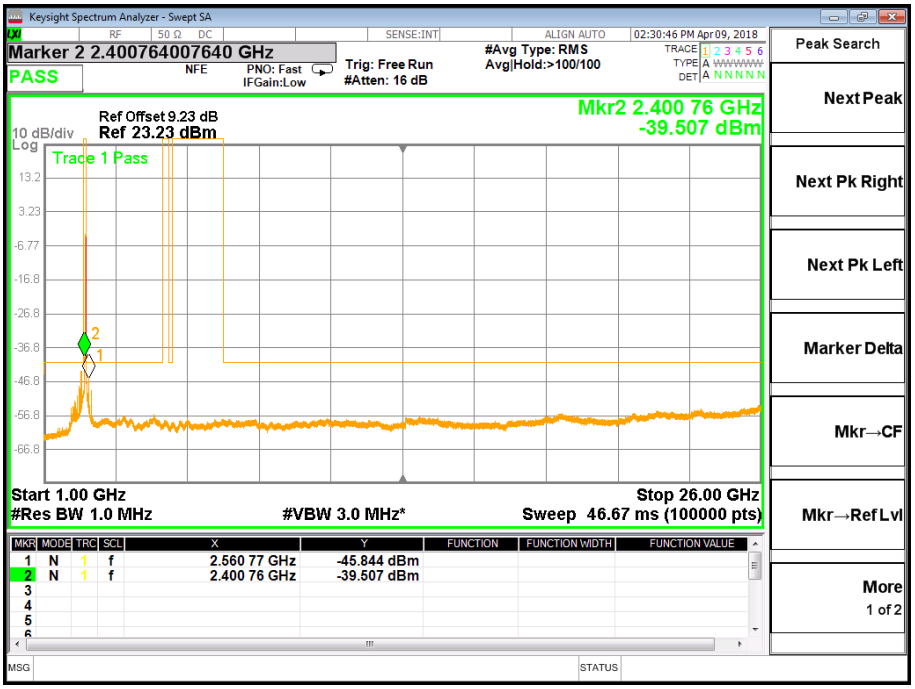
Plot 6: Middle channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)



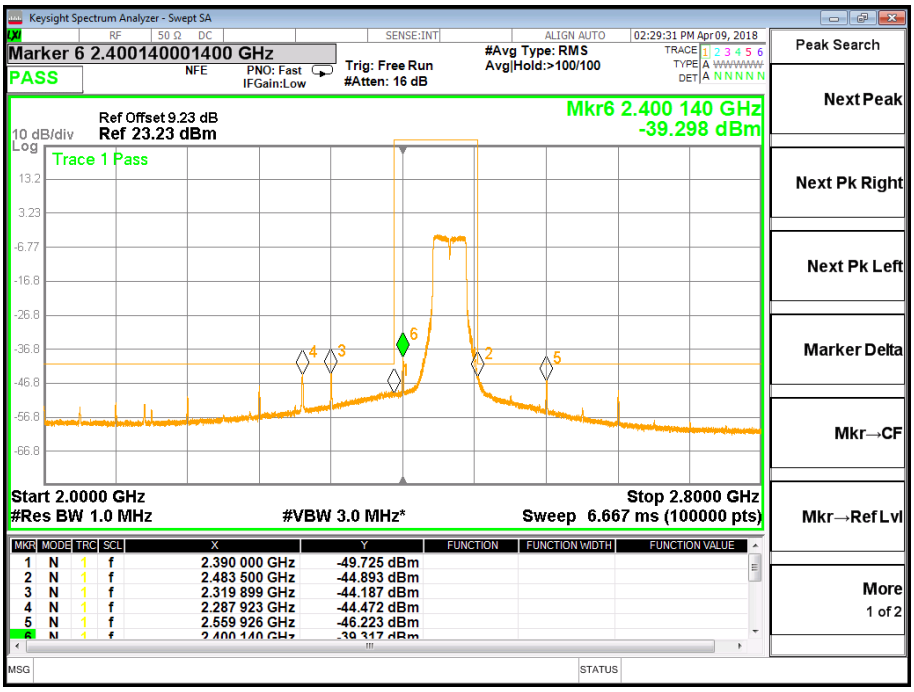
Plot 7: Highest channel / 30MHz to 1GHz / Antenna port 1



Plot 8: Highest channel / 1GHz to 26GHz / Antenna port



Plot 9: Highest channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)



12.8 Emissions in restricted frequency bands above 1 GHz (radiated)

Note:

This section of the report only contains results as part of a single frequency verification in addition to the results stated in 12.7.
Neither power setting, data rate, or channel have a significant impact to the measurement results at 2288 MHz and 2320 MHz, hence there is only one plot reported per antenna setup.

Description:

The DTS rules specify that emissions which fall into restricted frequency bands shall comply with the general radiated emission limits.

Measurement:

Measurement parameter	
Detector	Peak / RMS
Sweep time	Auto
Resolution bandwidth	1 MHz
Video bandwidth	3x RBW
Span	9 kHz to 26 GHz
Trace mode	Max Hold / Trace Average
Measured modulation	☒ DSSS b – mode ☐ OFDM g – mode ☒ OFDM n HT20 – mode ☒ OFDM n HT40 – mode
Test setup	See chapter 6.1 - A
Measurement uncertainty	See chapter 8

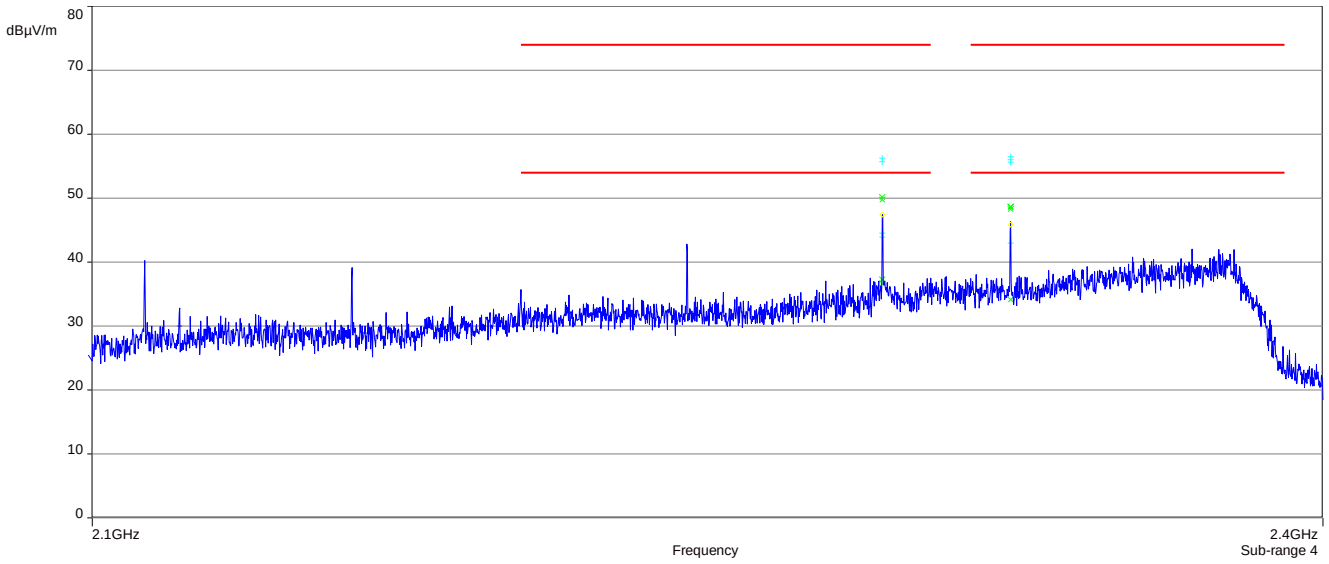
Limits:

FCC	IC	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).		
Frequency / MHz	Field Strength / (dBµV / m)	Measurement distance / m
Above 960	54.0 (AVG)	3
	74.0 (Peak)	

Results: ANT-DIR-2459-01, single-chain, antenna 2

TX spurious emissions radiated / dBµV/m @ 3 m		
f / MHz	Detector	Level / dBµV/m
2288	Peak	56.2
	AVG	50.1
2320	Peak	56.5
	AVG	48.7

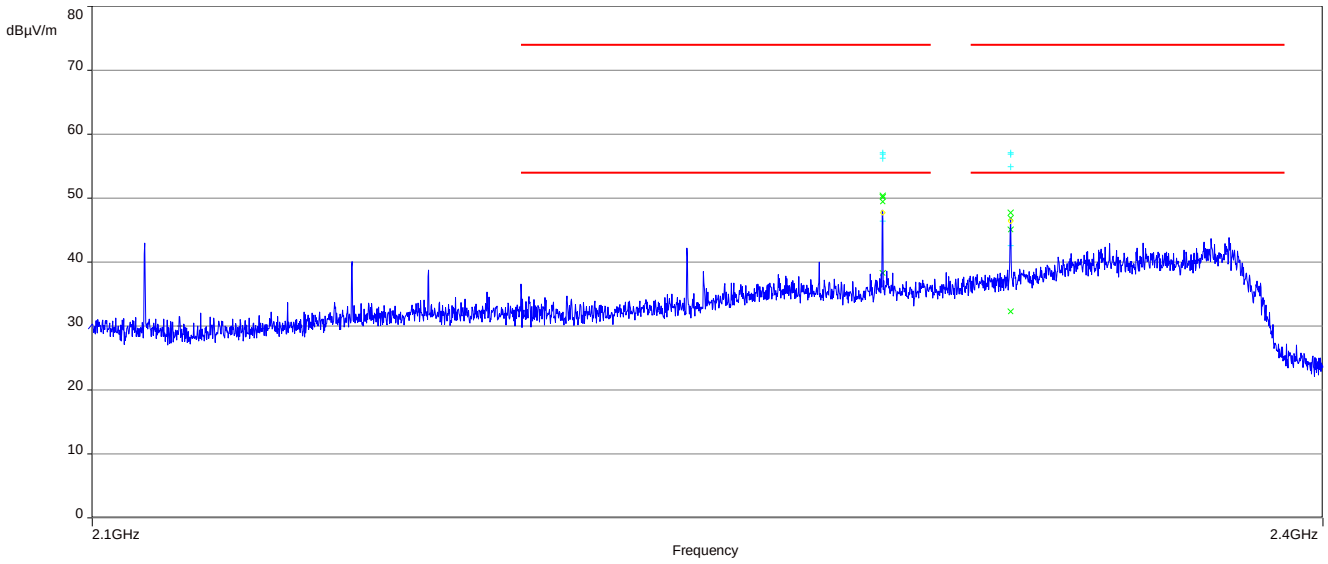
Plot:



Results: RAD-ISM-2400-ANT-OMNI-6-0, dual-chain, antenna 0&1

TX spurious emissions radiated / dBµV/m @ 3 m		
f / MHz	Detector	Level / dBµV/m
2288	Peak	57.1
	AVG	50.4
2320	Peak	57.1
	AVG	47.7

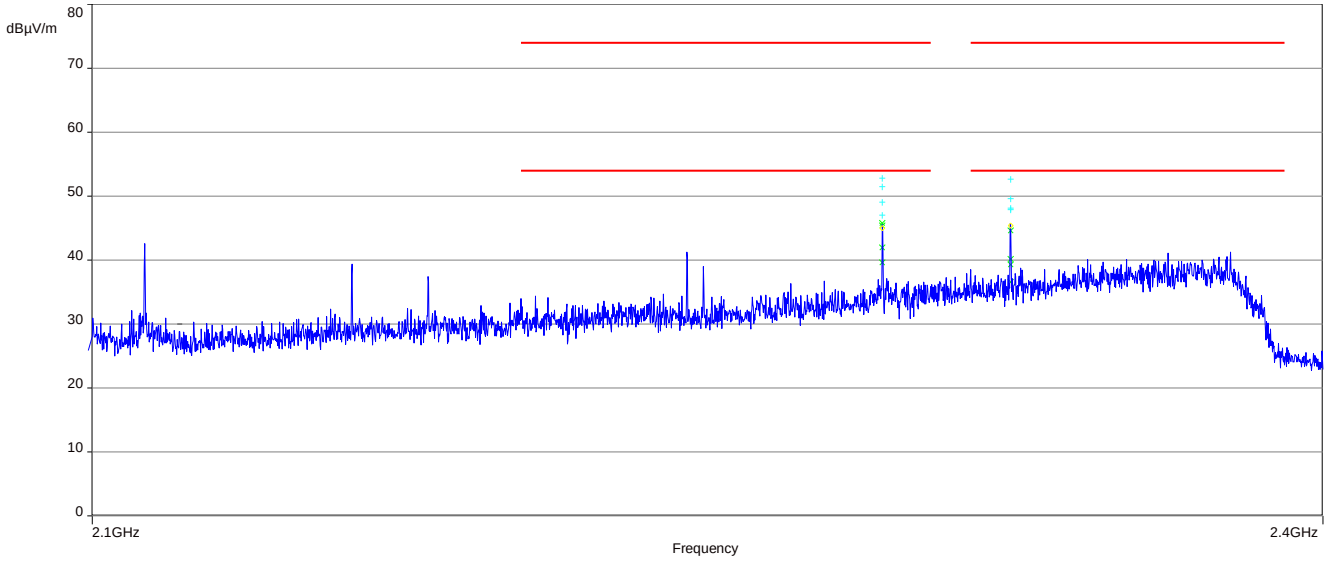
Plot:



Results: RAD-ISM-2400-ANT-VAN-3-0-RSMA, dual-chain, antenna 0&1

TX spurious emissions radiated / dBµV/m @ 3 m		
f / MHz	Detector	Level / dBµV/m
2288	Peak	52.9
	AVG	45.4
2320	Peak	52.6
	AVG	44.6

Plot:



12.9 Emissions in restricted bands / Cabinet radiation

Compliant as per Module Report F161629E1_2ndVersion.

12.10 Emissions in non-restricted frequency bands

Compliant as per Module Report F161629E1_2ndVersion.

13 Observations

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

Annex A Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit under test
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
IC	Industry Canada
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number
EMC	Electromagnetic Compatibility
HW	Hardware
SW	Software
Inv. No.	Inventory number
S/N or SN	Serial number
C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed
PP	Positive peak
QP	Quasi peak
AVG	Average
OC	Operating channel
OCW	Operating channel bandwidth
OBW	Occupied bandwidth
OOB	Out of band
DC	Duty cycle
PER	Packet error rate
CW	Clean wave
MC	Modulated carrier
WLAN	Wireless local area network
RLAN	Radio local area network
DSSS	Dynamic sequence spread spectrum
OFDM	Orthogonal frequency division multiplexing

Annex B Document history

Version	Applied changes	Date of release
-/-	Initial release	2018-05-18
A	Applicant, Manufacturer, FVIN, HVIN, HMN and type identification changed	2018-05-24
B	FVIN, HVIN, HMN changed	2018-07-06
C	HVIN revised	2018-08-24

Annex C Accreditation Certificate

first page	last page
	

Note: The current certificate annex is published on the website (link see below) of the Accreditation Body DAkkS or may be received by CTC advanced GmbH on request

http://www.dakks.de/as/ast/d/D-PL-12076-01-03.pdf