ENGINEERING TEST REPORT

5.8GHz 802.11a 1W OEM Module
Model: n802.11a-30
FCC ID: NS9NA30

Applicant:

Microhard Systems Inc.
150 Country Hills Landing NW
Calgary, Alberta
Canada T3K 5P3

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247 Digital Modulation Systems (DTS)

UltraTech's File No.: MCRS-060F15C247

This Test report is Issued under the Authority of Tri M. Luu Vice President of Engineering UltraTech Group of Labs Date: May 29, 2013	
Report Prepared by: Dan Huynh Issued Date: May 29, 2013	Tested by: Mr. Hung Trinh Test Dates: April 21 - May 28, 2013

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

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FCC	VCCI	Industry Canada / Industrie Canada Approved Test Facility	NVLAP	BSMI	Korea KCC-RRL
91038	1309	46390-2049	NVLAP LAB CODE 200093-0	SL2-IN-E-1119R	CA2049

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.247
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15 – Radio Frequency Devices
Purpose of Test:	Equipment Certification for Digital Modulation Systems (DTS) Transmitter.
Test Procedures:	▪ ANSI C63.4 ▪ ANSI C63.10
Environmental Classification:	[x] Commercial, industrial or business environment [x] Residential environment

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19	2012	Code of Federal Regulations (CFR), Title 47 – Telecommunication
ANSI C63.4	2009	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	2009	American National Standard for Testing Unlicensed Wireless Devices
CISPR 22 & EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances
FCC, KDB Publication No. 558074 D01 DTS Meas Guidance v02	2012	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	Microhard Systems Inc.
Address:	150 Country Hills Landing NW Calgary, Alberta Canada T3K 5P3
Contact Person:	Mr. Hany Shenouda Phone #: 403 248-0028 Fax #: 403 248 2762 Email Address: shenouda@microhardcorp.com

MANUFACTURER	
Name:	Microhard Systems Inc.
Address:	150 Country Hills Landing NW Calgary, Alberta Canada T3K 5P3
Contact Person:	Mr. Hany Shenouda Phone #: 403 248-0028 Fax #: 403 248-2762 Email Address: shenouda@microhardcorp.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Microhard Systems Inc.
Product Name:	5.8GHz 802.11a 1W OEM Module
Model Name or Number:	n802.11a-30
Serial Number:	Test Sample
Type of Equipment:	Digital Transmission System (DTS)
Input Power Supply Type:	External Regulated DC Sources
Primary User Functions of EUT:	802.11a module

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	▪ Mobile ▪ Base Station (fixed use)
Intended Operating Environment:	▪ Commercial, industrial or business environment ▪ Residential environment
Power Supply Requirement:	3.3VDC
RF Output Power Rating:	0 dBm to 30 dBm
Operating Frequency Range:	5745 to 5825 MHz
RF Output Impedance:	50 Ohm
Duty Cycle:	100%
Modulation Type:	802.11a
Antenna Connector Type:	MMCX

2.4. ASSOCIATED ANTENNA DESCRIPTIONS

Antenna Type	Maximum Gain (dBi)
Rubber Ducky	4
Patch Antennas	23
The highest gain antenna from each of the above antenna types were selected for testing to represents the worst-case. Refer to user manual for antennas list information.	

2.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	RF IN/OUT Port	1	MMCX	Shielded coaxial cable with unique coupling connectors
2	DC Supply & I/O Port	1	Pin Header	No cable, direct connection

2.6. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	Test Jig
Brand name:	Microhard Systems Inc.
Model Name or Number:	N/A
Connected to EUT's Port:	I/O Port

Ancillary Equipment # 2	
Description:	Switching AC/DC Power Adaptor
Brand name:	BL
Model Name or Number:	Bl30-120200-AdU
Connected to EUT's Port:	Test Jig of the EUT

Ancillary Equipment # 3	
Description:	Laptop
Brand name:	Dell
Model Name or Number:	PPL
Connected to EUT's Port:	Test Jig of the EUT

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21 to 23 ^{o}C
Humidity:	45 to 58%
Pressure:	102 kPa
Power Input Source:	3.3VDC

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements.
Special Test Software:	Special software and hardware provided by the Applicant to operate the EUT at each channel frequency continuously. For example, the transmitter will be operated at each of the lowest, middle and highest frequencies individually continuously during testing.
Special Hardware Used:	Test Jig
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as non-integral antenna equipment as described with the test results.

Transmitter Test Signals	
Frequency Band(s):	5745 - 5825 MHz
Frequency(ies) Tested:	5745 MHz, 5785 MHz and 5825 MHz
RF Power Output: (measured maximum output power at antenna terminals)	29.93 dBm, 0.984 W (conducted)
Normal Test Modulation:	802.11a
Modulating Signal Source:	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2014-04-04.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna requirements	Yes*
15.207(a)	AC Power Line Conducted Emissions	Yes
15.247(a)(2)	6 dB Bandwidth	Yes
15.247(b)(3)	Peak Conducted Output Power - DTS	Yes
15.247(d)	Band-Edge and RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
15.247(d), 15.209 & 15.205	Transmitter Spurious Radiated Emissions	Yes
15.247(e)	Power Spectral Density	Yes
15.247(i), 1.1307, 1.1310, 2.1091	RF Exposure	Yes

* The EUT complies with the requirement; it employs a unique (non-standard) antenna.

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. TEST DATA

5.1. POWER LINE CONDUCTED EMISSIONS [§15.207(a)]

5.1.1. Limit(s)

The equipment shall meet the limits of the following table:

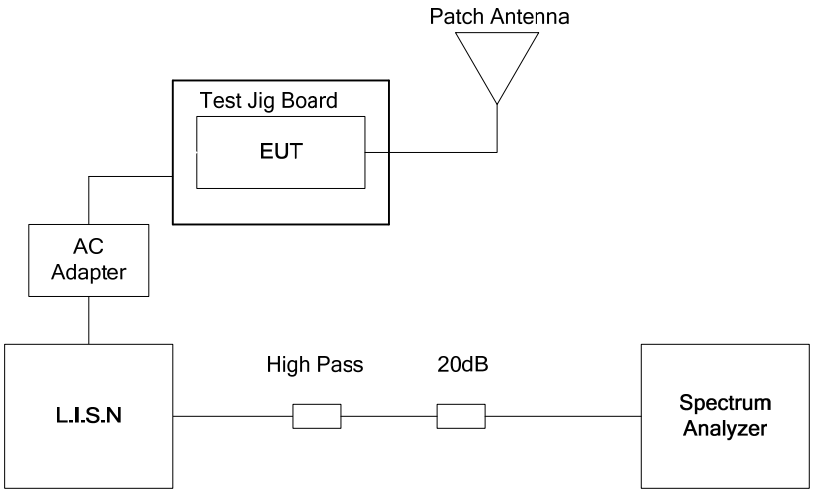
Frequency of emission (MHz)	Conducted Limits (dBμV)	
	Quasi-peak	Average
0.15–0.5 .....……..	66 to 56*	56 to 46*
0.5–5 .....……..	56	46
5-30 ……..	60 ..……..	50

*Decreases linearly with the logarithm of the frequency

5.1.2. Method of Measurements

ANSI C63.4-2009

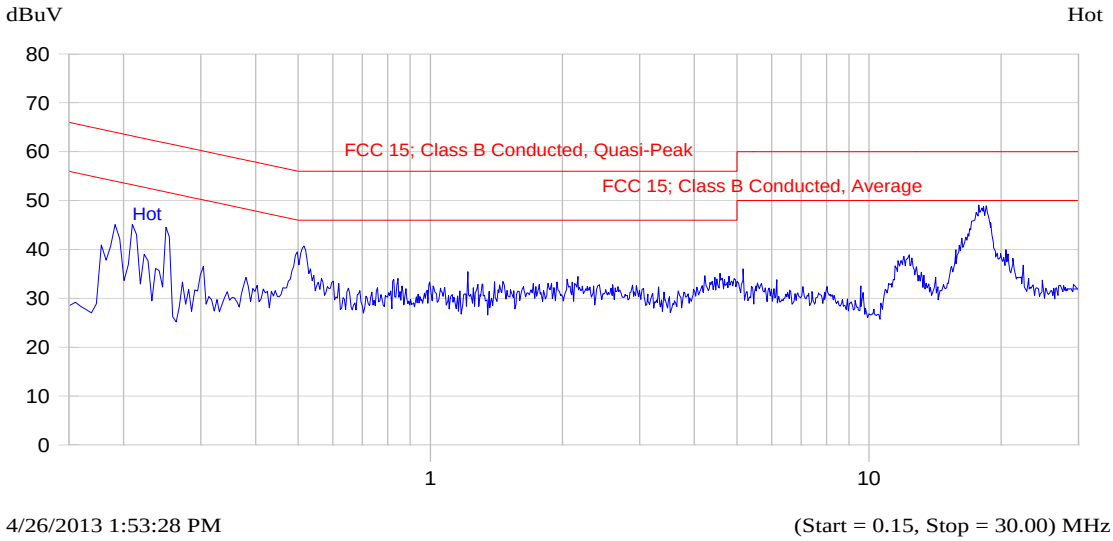
5.1.3. Test Arrangement



5.1.4. Test Data

Plot 5.1.4.1. Power Line Conducted Emissions; Line Voltage: 120 VAC; Line Tested: Hot: Tx Mode

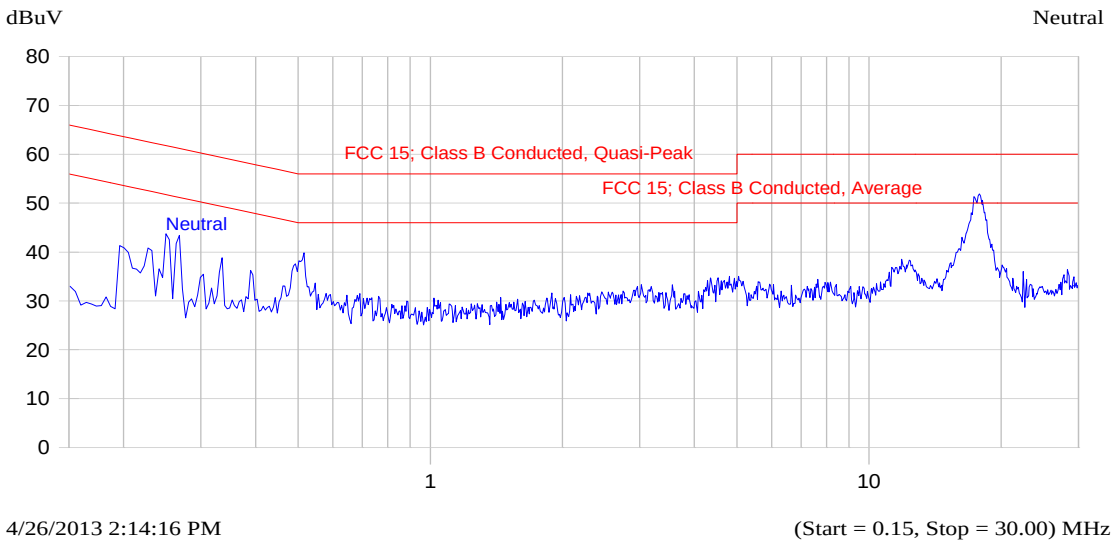
Current Graph



Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.193	49.8	42.0	-22.7	24.9	-29.8	Hot
0.197	49.0	41.7	-22.9	24.2	-30.4	Hot
0.513	42.3	39.4	-16.6	34.8	-11.2	Hot
18.491	47.9	43.7	-16.3	37.0	-13.0	Hot

Plot 5.1.4.2. Power Line Conducted Emissions; Line Voltage: 120 VAC; Line Tested: Neutral

Current Graph



Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.241	46.5	38.3	-25.1	21.0	-32.4	Neutral
0.512	41.5	38.0	-18.0	33.1	-12.9	Neutral
17.706	51.7	47.9	-12.1	41.3	-8.7	Neutral

5.2. OCCUPIED BANDWIDTH [§ 15.247(a)(2)]

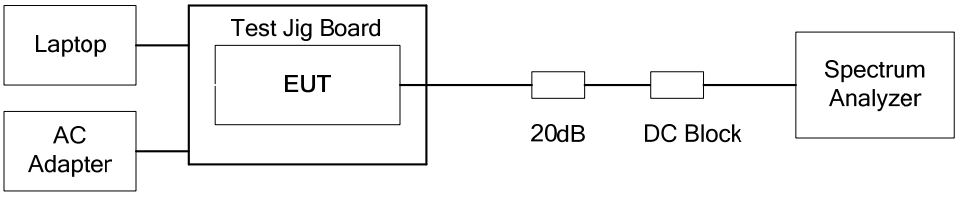
5.2.1. Limit(s)

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.2.2. Method of Measurements

KDB Publication No. 558074 D01 DTS Meas Guidance v02, Section 7.1 Option 1 DTS (6dB) Channel Bandwidth.

5.2.3. Test Arrangement

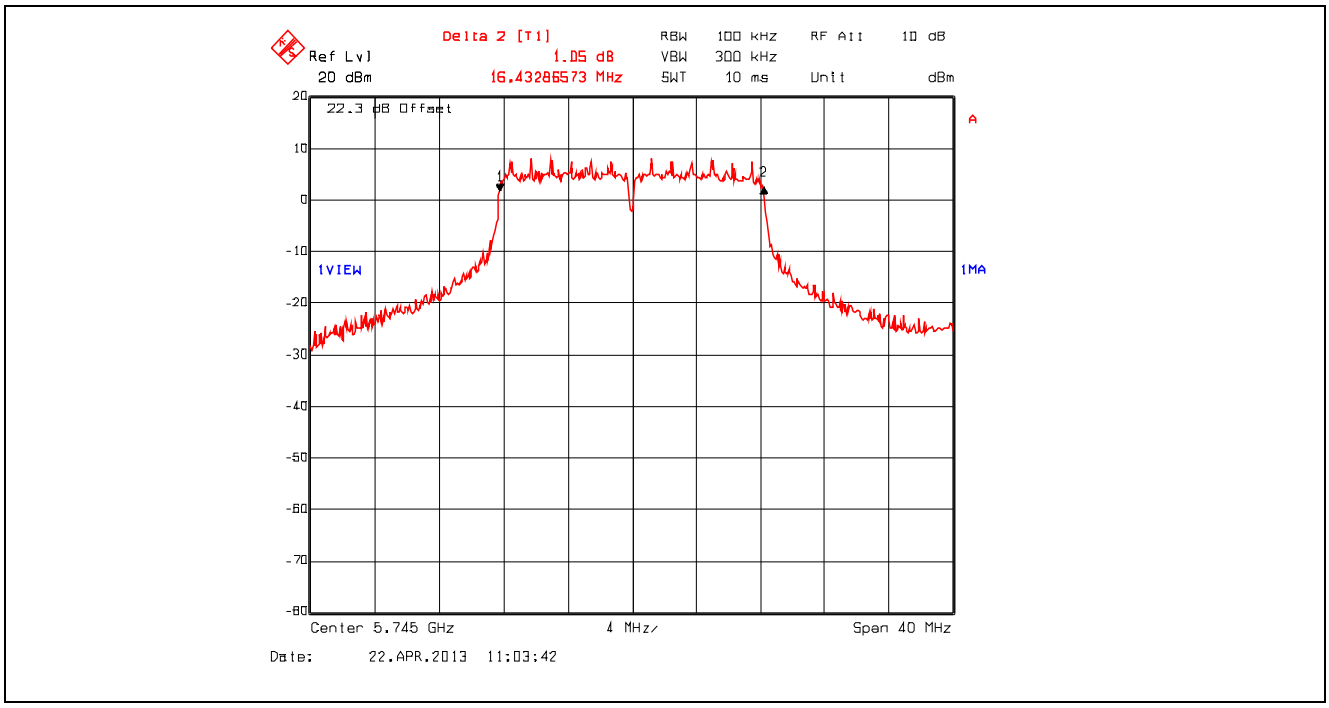


5.2.4. Test Data

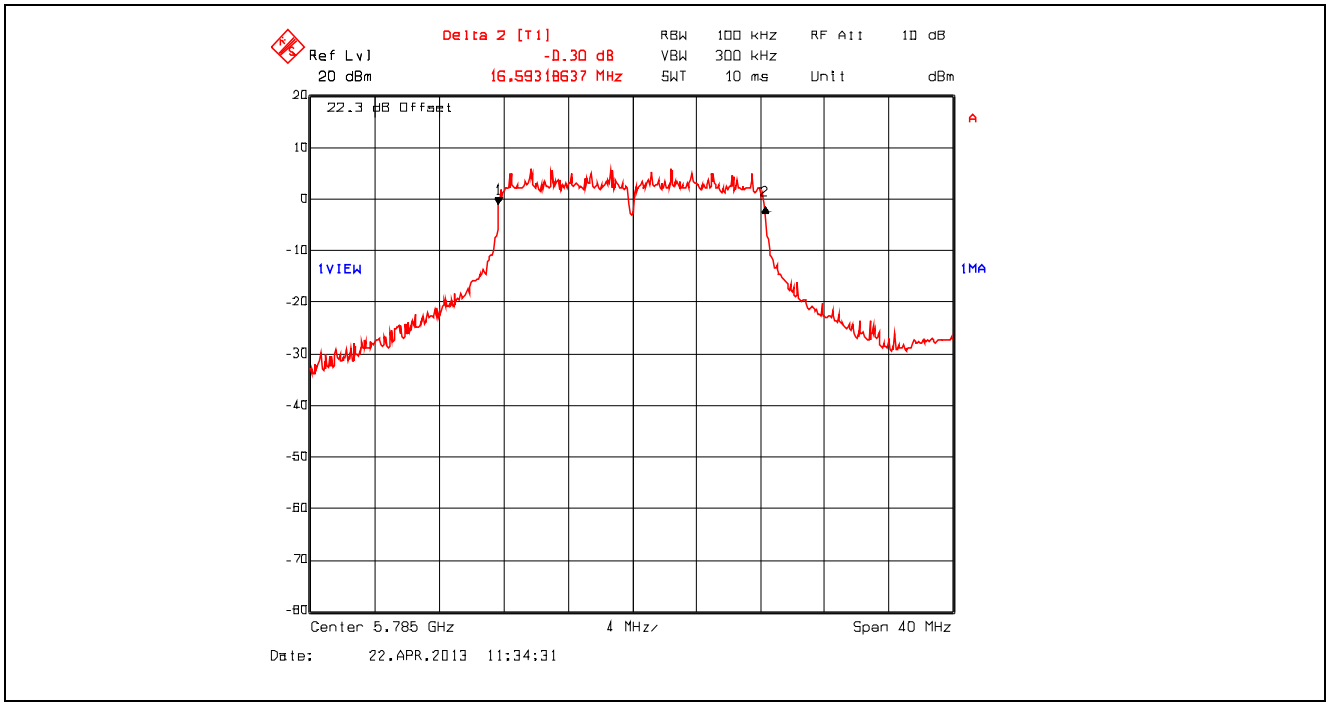
Operating Mode	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
9 Mbps BPSK	5745	16.43	17.88
	5785	16.59	17.64
	5825	16.43	17.56
18 Mbps QPSK	5745	16.59	17.31
	5785	16.59	17.39
	5825	16.59	17.31
36 Mbps 16-QAM	5745	16.59	17.23
	5785	16.59	17.15
	5825	16.59	17.15
54 Mbps 64-QAM	5745	16.59	18.12
	5785	16.59	18.04
	5825	16.59	17.64

See the following plots for detailed measurements.

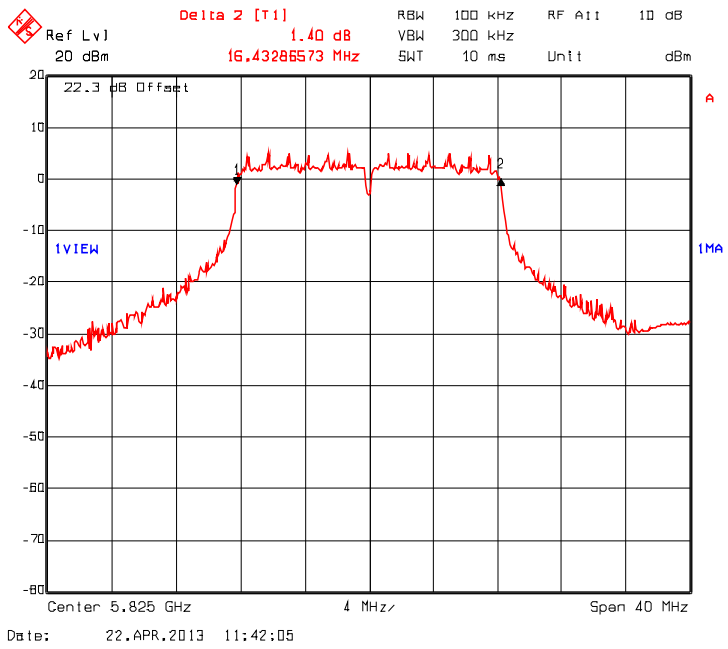
Plot 5.2.4.1. 6 dB Bandwidth, 9 Mbps BPSK, 5745 MHz, PCDAC Setting 57



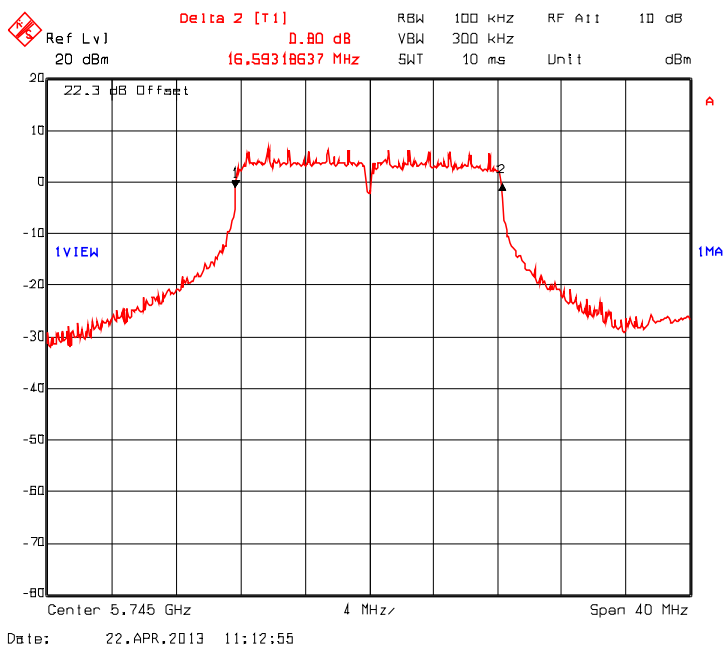
Plot 5.2.4.2. 6 dB Bandwidth, 9 Mbps BPSK, 5785 MHz, PCDAC Setting 57



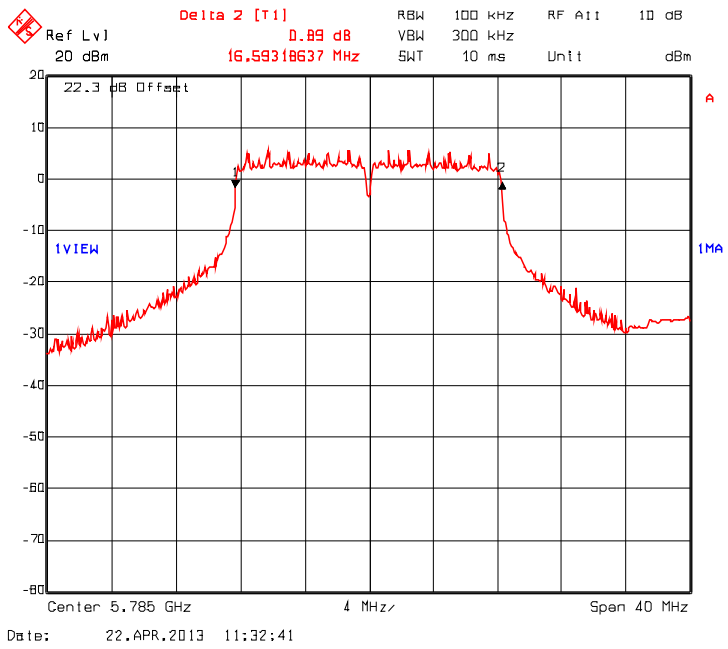
Plot 5.2.4.3. 6 dB Bandwidth, 9 Mbps BPSK, 5825 MHz, PCDAC Setting 57



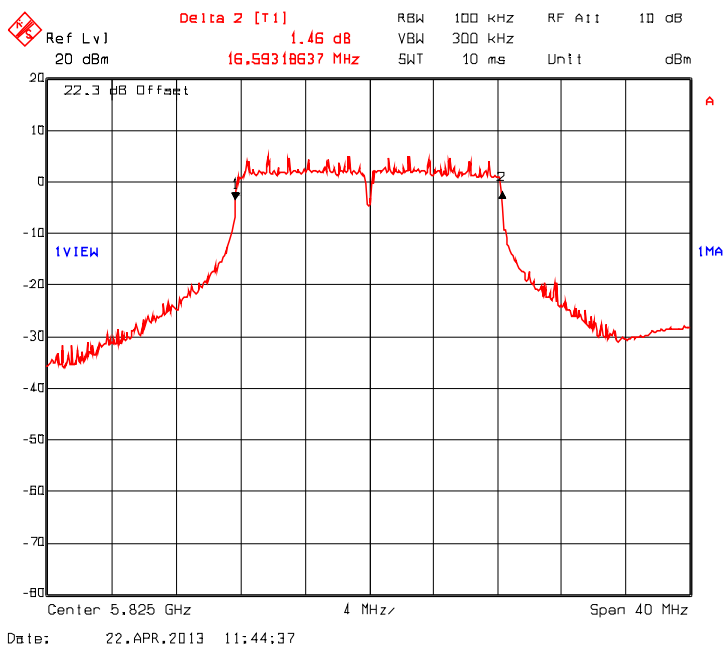
Plot 5.2.4.4. 6 dB Bandwidth, 18 Mbps QPSK, 5745 MHz, PCDAC Setting 57



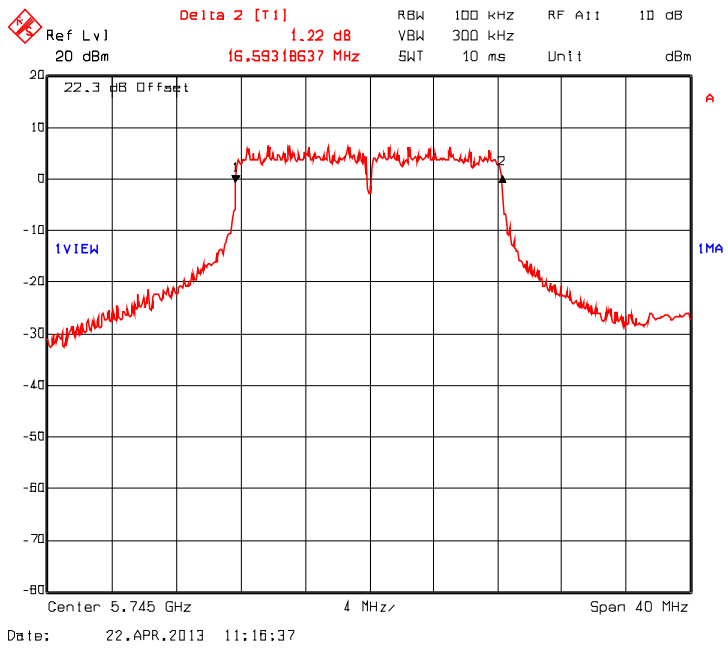
Plot 5.2.4.5. 6 dB Bandwidth, 18 Mbps QPSK, 5785 MHz, PCDAC Setting 57



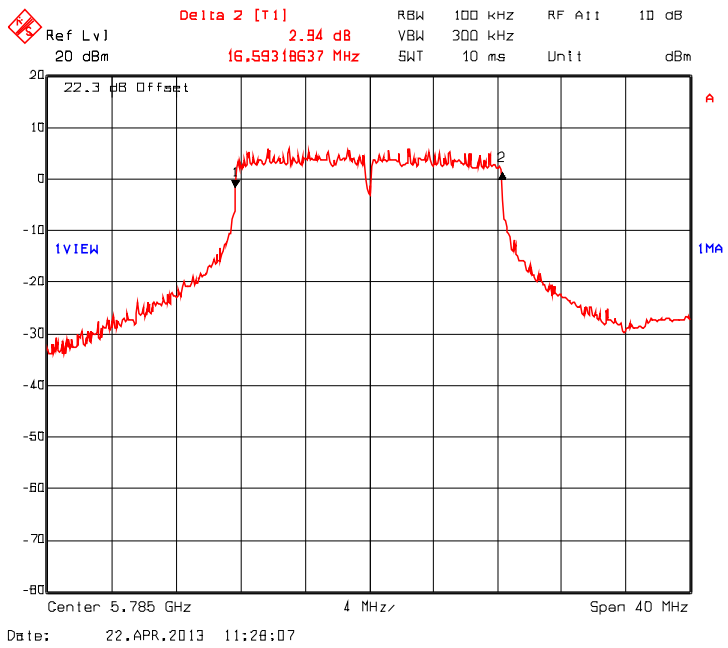
Plot 5.2.4.6. 6 dB Bandwidth, 18 Mbps QPSK, 5825 MHz, PCDAC Setting 57



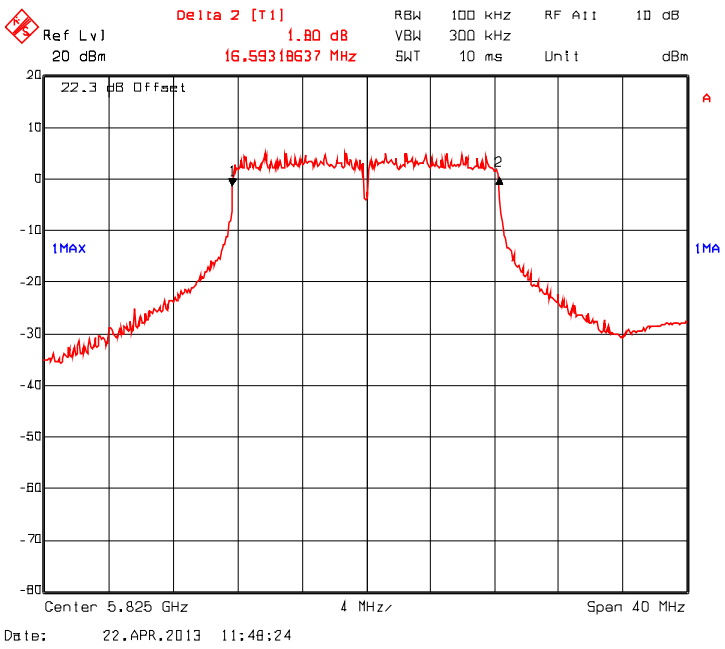
Plot 5.2.4.7. 6 dB Bandwidth, 36 Mbps 16-QAM, 5745 MHz, PCDAC Setting 57



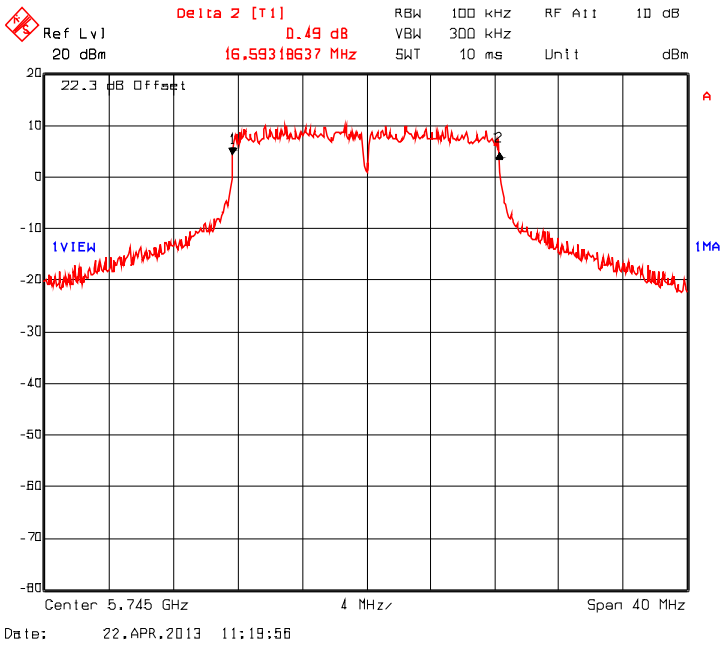
Plot 5.2.4.8. 6 dB Bandwidth, 36 Mbps 16-QAM, 5785 MHz, PCDAC Setting 57



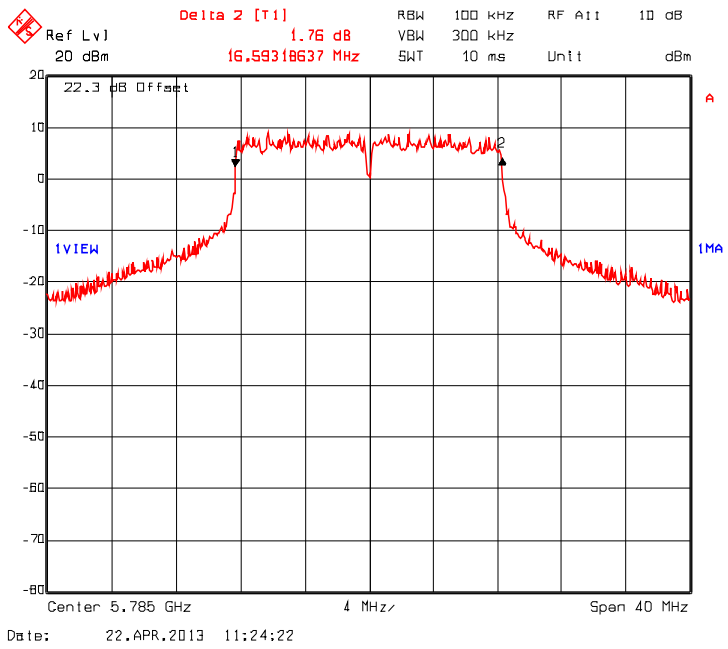
Plot 5.2.4.9. 6 dB Bandwidth, 36 Mbps 16-QAM, 5825 MHz, PCDAC Setting 57



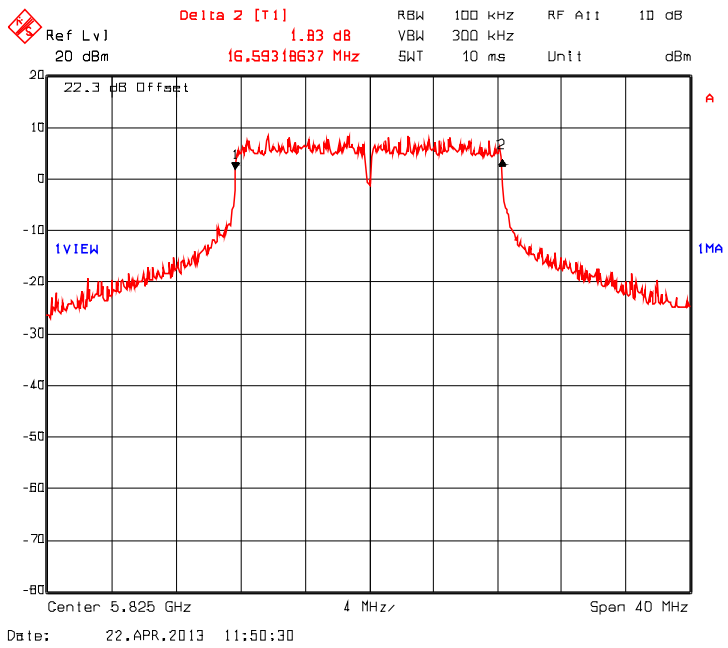
Plot 5.2.4.10. 6 dB Bandwidth, 54 Mbps 64-QAM, 5745 MHz, PCDAC Setting 57



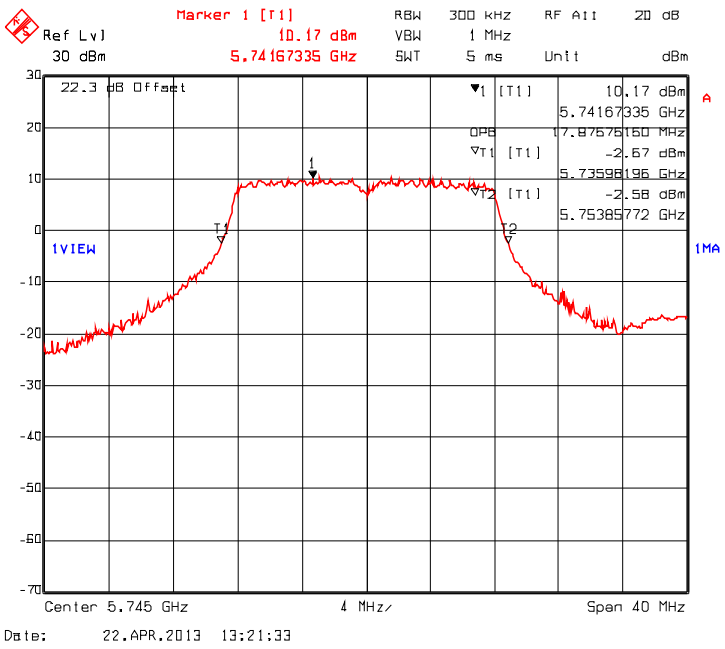
Plot 5.2.4.11. 6 dB Bandwidth, 54 Mbps 64-QAM, 5785 MHz, PCDAC Setting 57



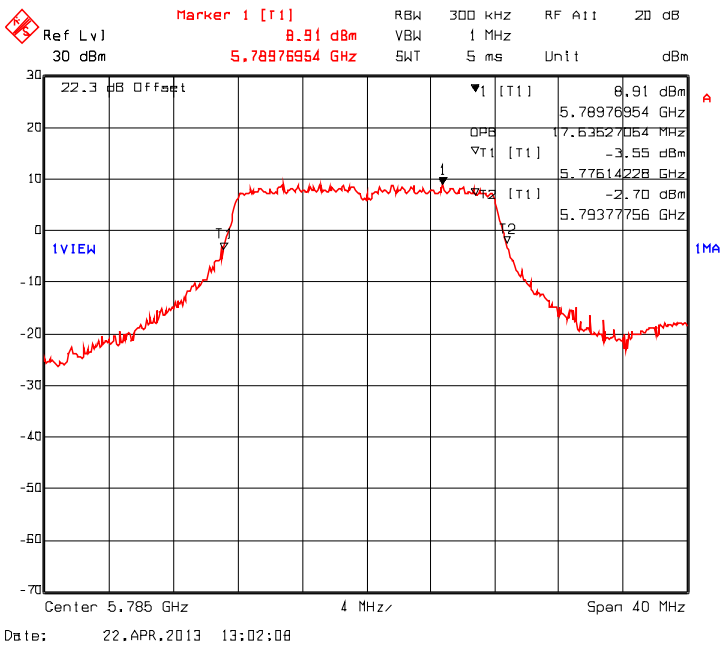
Plot 5.2.4.12. 6 dB Bandwidth, 54 Mbps 64-QAM, 5825 MHz, PCDAC Setting 57



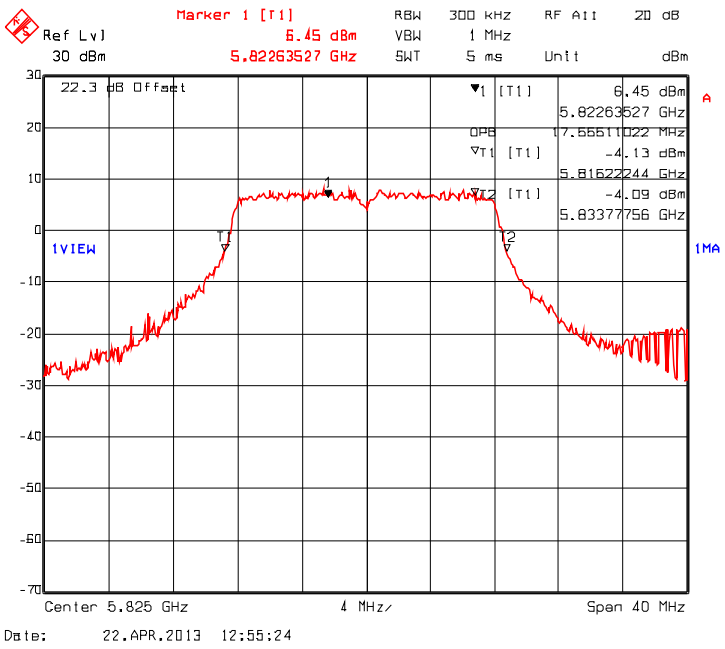
Plot 5.2.4.13. 99% Occupied Bandwidth, 9 Mbps BPSK, 5745 MHz, PCDAC Setting 57



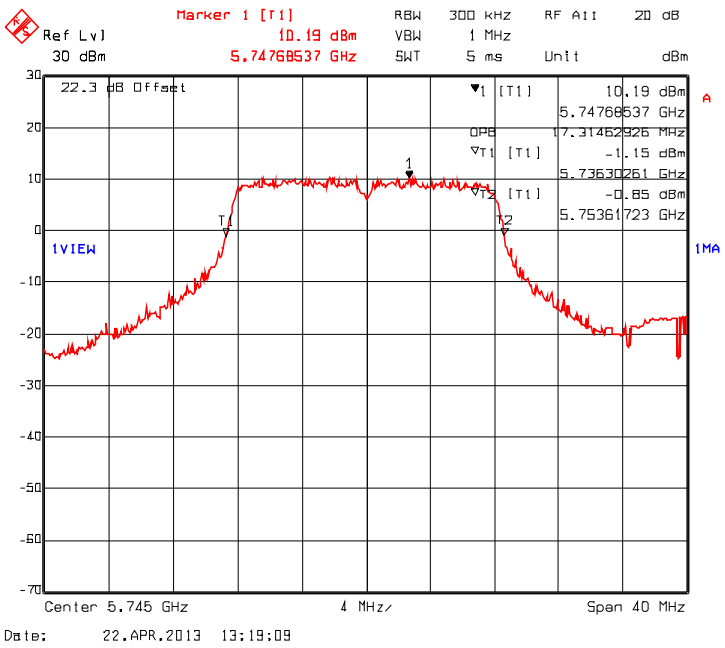
Plot 5.2.4.14. 99% Occupied Bandwidth, 9 Mbps BPSK, 5785 MHz, PCDAC Setting 57



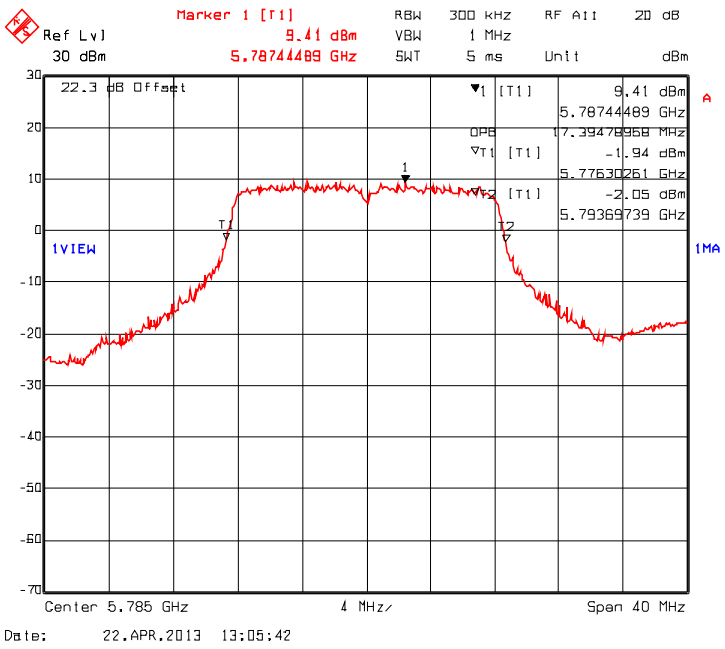
Plot 5.2.4.15. 99% Occupied Bandwidth, 9 Mbps BPSK, 5825 MHz, PCDAC Setting 57



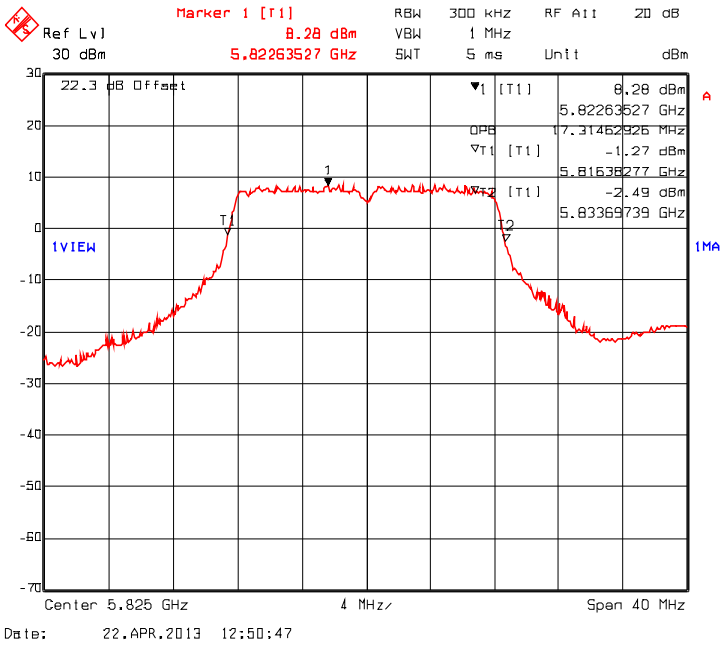
Plot 5.2.4.16. 99% Occupied Bandwidth, 18 Mbps QPSK, 5745 MHz, PCDAC Setting 57



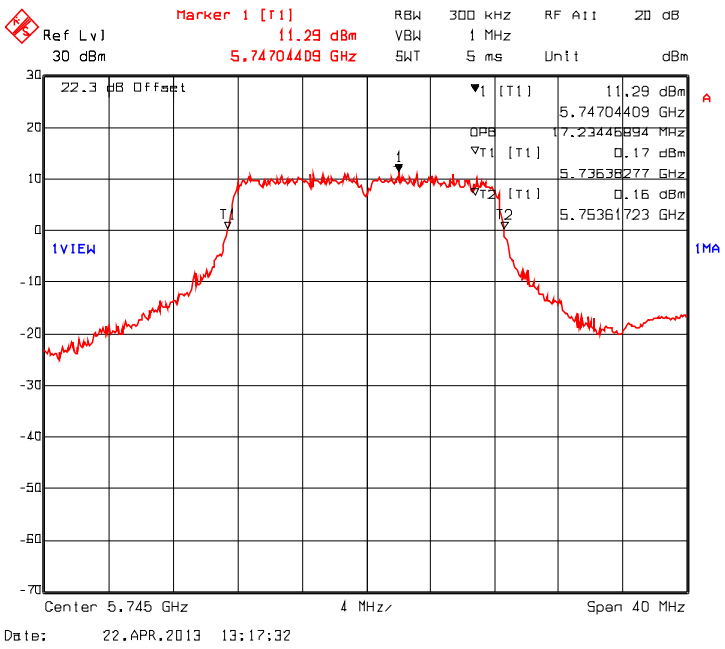
Plot 5.2.4.17. 99% Occupied Bandwidth, 18 Mbps QPSK, 5785 MHz, PCDAC Setting 57



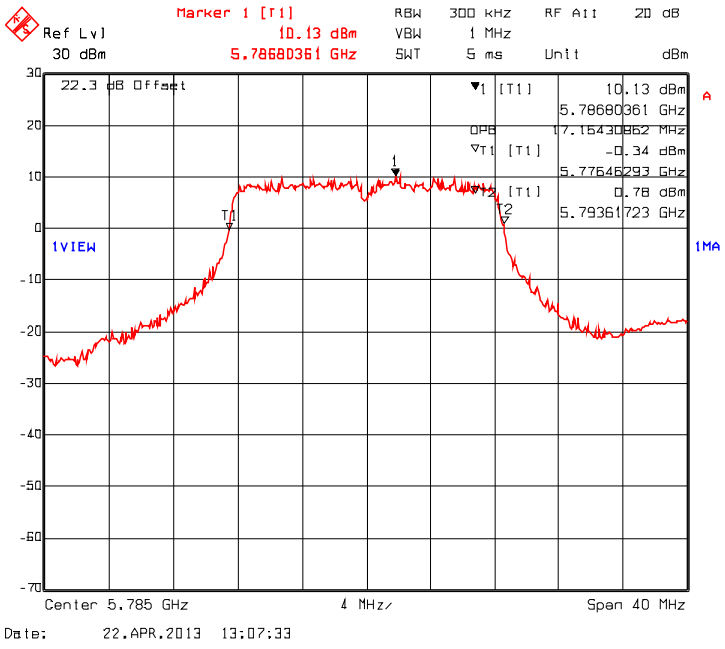
Plot 5.2.4.18. 99% Occupied Bandwidth, 18 Mbps QPSK, 5825 MHz, PCDAC Setting 57



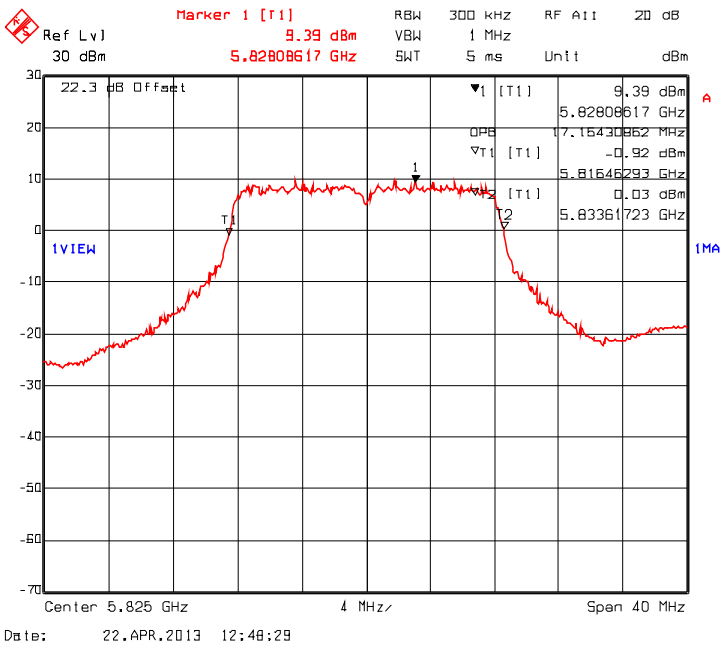
Plot 5.2.4.19. 99% Occupied Bandwidth, 36 Mbps 16-QAM, 5745 MHz, PCDAC Setting 57



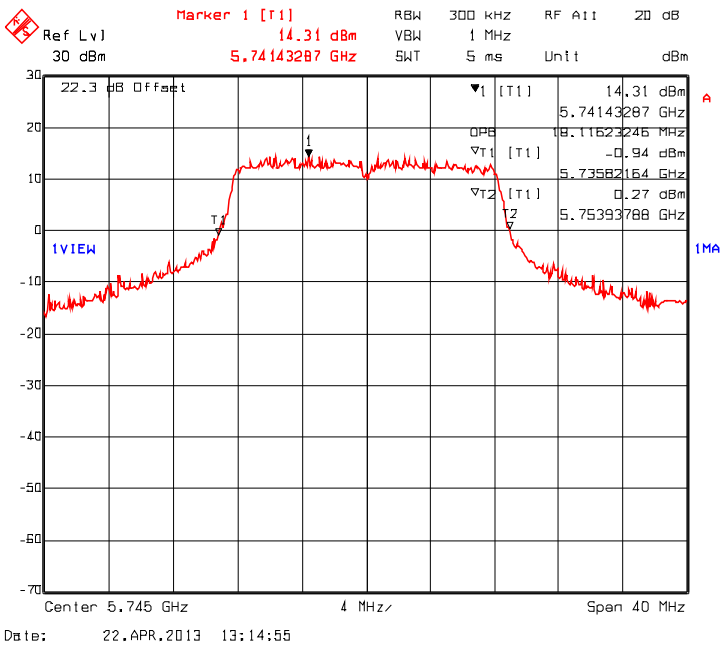
Plot 5.2.4.20. 99% Occupied Bandwidth, 36 Mbps 16-QAM, 5785 MHz, PCDAC Setting 57



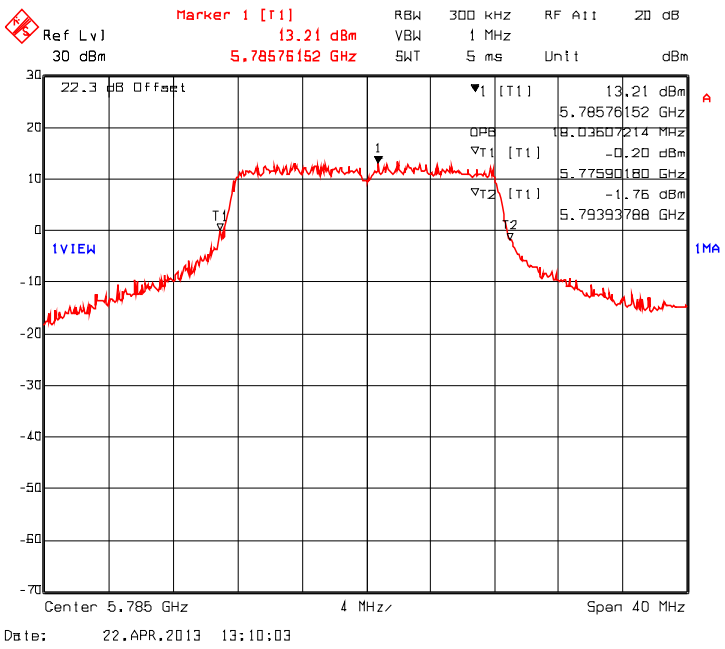
Plot 5.2.4.21. 99% Occupied Bandwidth, 36 Mbps 16-QAM, 5825 MHz, PCDAC Setting 57



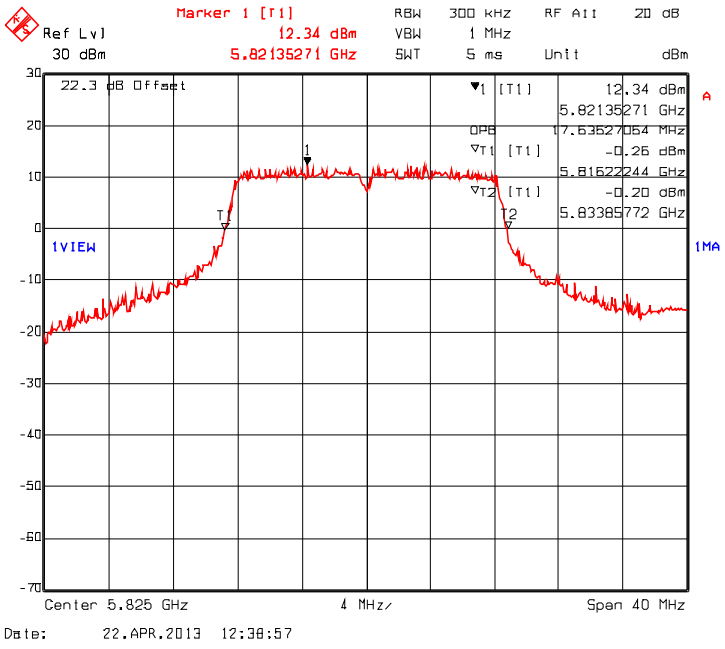
Plot 5.2.4.22. 99% Occupied Bandwidth, 54 Mbps 64-QAM, 5745 MHz, PCDAC Setting 57



Plot 5.2.4.23. 99% Occupied Bandwidth, 54 Mbps 64-QAM, 5785 MHz, PCDAC Setting 57



Plot 5.2.4.24. 99% Occupied Bandwidth, 54 Mbps 64-QAM, 5825 MHz, PCDAC Setting 57



5.3. PEAK CONDUCTED OUTPUT POWER - DTS [§ 15.247(b)(3)]

5.3.1. Limit(s)

§ 15.247(b)(3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

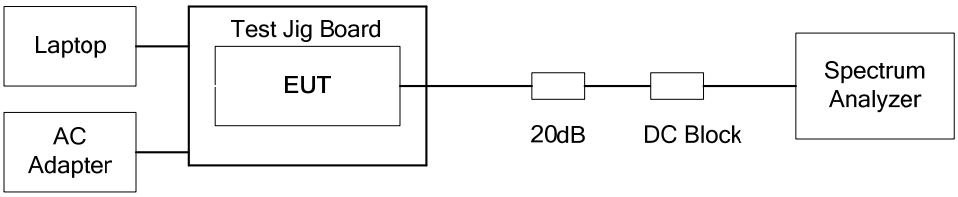
§15.247(b)(4): The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§15.247(b)(4)(ii):Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

5.3.2. Method of Measurements & Test Arrangement

KDB Publication No. 558074 D01 DTS Meas Guidance v02, Section 8.1.1 Option 1.

5.3.3. Test Arrangement



5.3.4. Test Data

5.3.4.1. Peak Power Output for Rubber Ducky Antenna with Antenna Assembly Gain of 2.88 dBi

Operation Mode	Frequency (MHz)	Modulation / Data Rate (Mbps)	Software/ PCDAC Power Setting	Peak Conducted Power (dBm)	Peak EIRP (dBm)	Peak Conducted Power Limit (dBm)	EIRP Limit (dBm)
802.11a High Power	5745	BPSK / 9	57	27.92	See Notes 1 & 2	30	36
		QPSK / 18	57	28.07	See Notes 1 & 2	30	36
		16-QAM / 36	57	28.15	See Notes 1 & 2	30	36
		64-QAM / 54	64	29.93	See Notes 1 & 2	30	36
	5785	BPSK / 9	57	26.60	See Notes 1 & 2	30	36
		QPSK / 18	57	27.05	See Notes 1 & 2	30	36
		16-QAM / 36	57	27.04	See Notes 1 & 2	30	36
		64-QAM / 54	64	29.92	See Notes 1 & 2	30	36
	5825	BPSK / 9	57	25.85	See Notes 1 & 2	30	36
		QPSK / 18	57	26.37	See Notes 1 & 2	30	36
		16-QAM / 36	57	26.55	See Notes 1 & 2	30	36
		64-QAM / 54	64	29.53	See Notes 1 & 2	30	36
802.11a Low Power	5745	BPSK / 9	12	0.02	See Notes 1 & 2	30	36
		QPSK / 18	12	0.03	See Notes 1 & 2	30	36
		16-QAM / 36	12	0.01	See Notes 1 & 2	30	36
		64-QAM / 54	12	0.01	See Notes 1 & 2	30	36
	5785	BPSK / 9	12	-0.04	See Notes 1 & 2	30	36
		QPSK / 18	12	-0.55	See Notes 1 & 2	30	36
		16-QAM / 36	12	-0.48	See Notes 1 & 2	30	36
		64-QAM / 54	12	-0.57	See Notes 1 & 2	30	36
	5825	BPSK / 9	12	0.00	See Notes 1 & 2	30	36
		QPSK / 18	12	-1.65	See Notes 1 & 2	30	36
		16-QAM / 36	12	-1.66	See Notes 1 & 2	30	36
		64-QAM / 54	12	-0.60	See Notes 1 & 2	30	36

Notes:
1. The EIRP shall be calculated based on the transmitter antenna gain (G_{dBi}), cable loss (CL_{dB}) and peak output power at antenna terminal (P_{dBm}). Calculated EIRP = $P_{dBm} + G_{dBi} - CL_{dB}$

2. EIRP shall not exceed 36 dBm limit (Power Setting = 36 dBm - $G_{dBi} + CL_{dB}$). See Operating Manual for instruction of power setting.

5.3.4.2. Peak Power Output for Patch Antenna with Antenna Assembly Gain of 19.94 dBi for Fixed, Point to Point Operations

Operation Mode	Frequency (MHz)	Modulation / Data Rate (Mbps)	Software/ PCDAC Power Setting	Peak Conducted Power (dBm)	Peak EIRP (dBm)	Peak Conducted Power Limit (dBm)	EIRP Limit (dBm)
802.11a	5745	BPSK / 9	51	23.11	43.05	30	n/a
		QPSK / 18	51	23.58	43.52	30	n/a
		16-QAM / 36	51	23.87	43.81	30	n/a
		64-QAM / 54	64	29.93	49.87	30	n/a
	5785	BPSK / 9	51	22.23	42.17	30	n/a
		QPSK / 18	51	22.93	42.87	30	n/a
		16-QAM / 36	51	23.06	43.00	30	n/a
		64-QAM / 54	64	29.92	49.86	30	n/a
	5825	BPSK / 9	51	21.88	41.82	30	n/a
		QPSK / 18	51	21.99	41.93	30	n/a
		16-QAM / 36	51	22.14	42.08	30	n/a
		64-QAM / 54	64	29.53	49.47	30	n/a

5.4. TRANSMITTER BAND-EDGE & SPURIOUS CONDUCTED EMISSIONS [§ 15.247(d)]

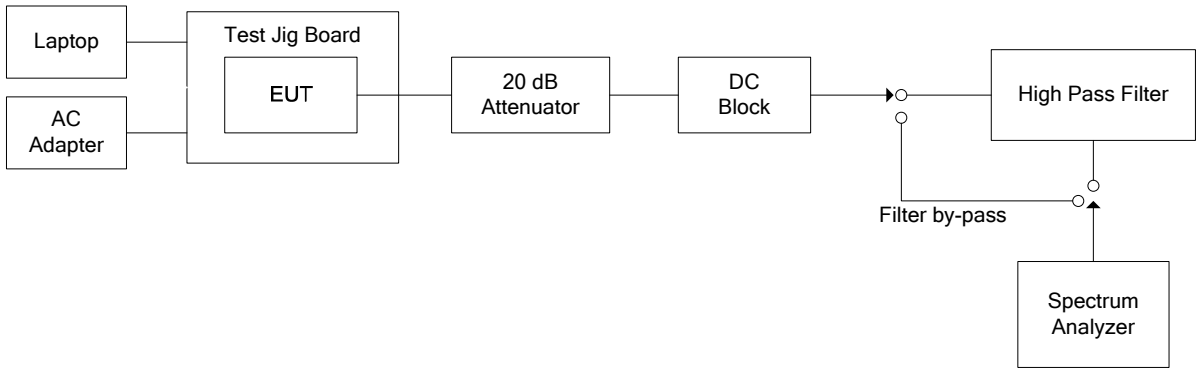
5.4.1. Limit(s)

§ 15.247 (d): 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 20 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

5.4.2. Method of Measurements

KDB Publication No. 558074 D01 DTS Meas Guidance v02, Section 10.2.5 Band-Edge Measurements and ANSI C63.10

5.4.3. Test Arrangement

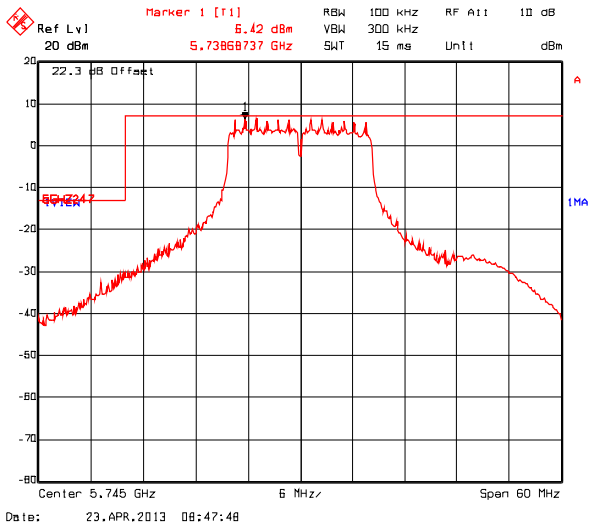


5.4.4. Test Data

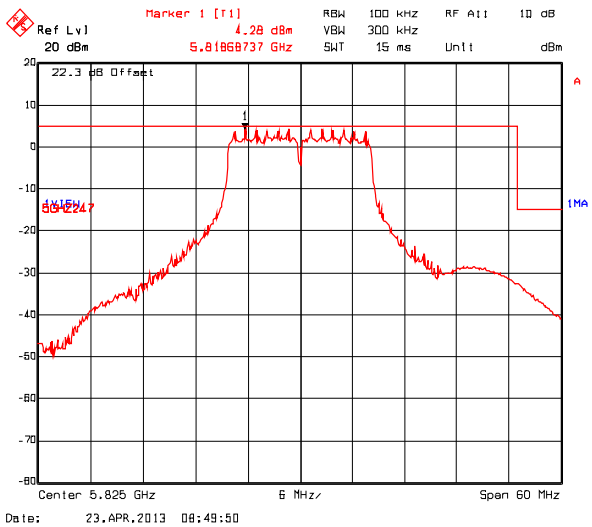
5.4.4.1. Band-Edge RF Conducted Emissions

Remark(s): Exploratory tests performed to determined worst-case test configurations, the following test results represent the worst-case.

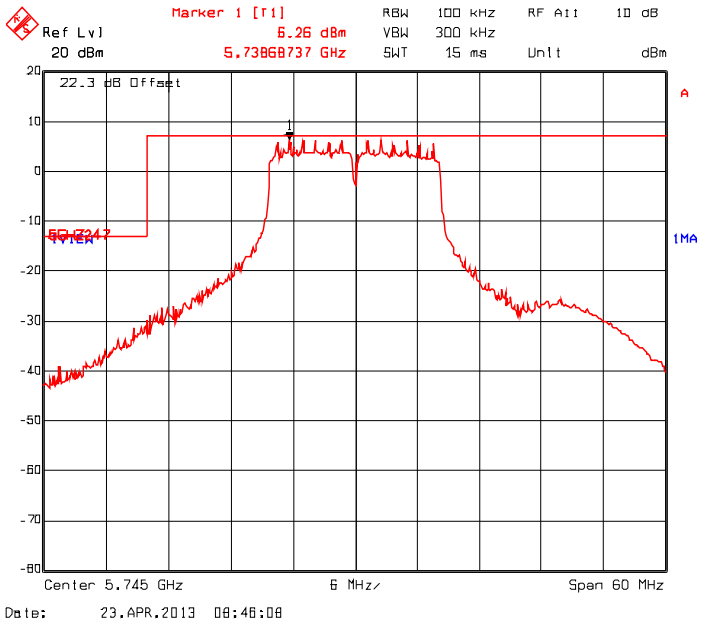
Plot 5.4.4.1.1. Band-Edge RF Conducted Emissions
Low End of Frequency Band, 9 Mbps BPSK, PCDAC Setting 57



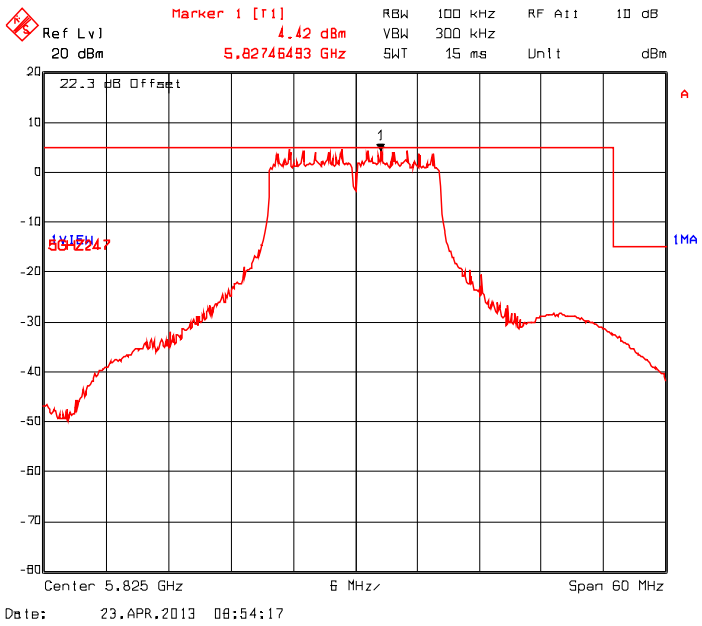
Plot 5.4.4.1.2. Band-Edge RF Conducted Emissions
High End of Frequency Band, 9 Mbps BPSK, PCDAC Setting 57



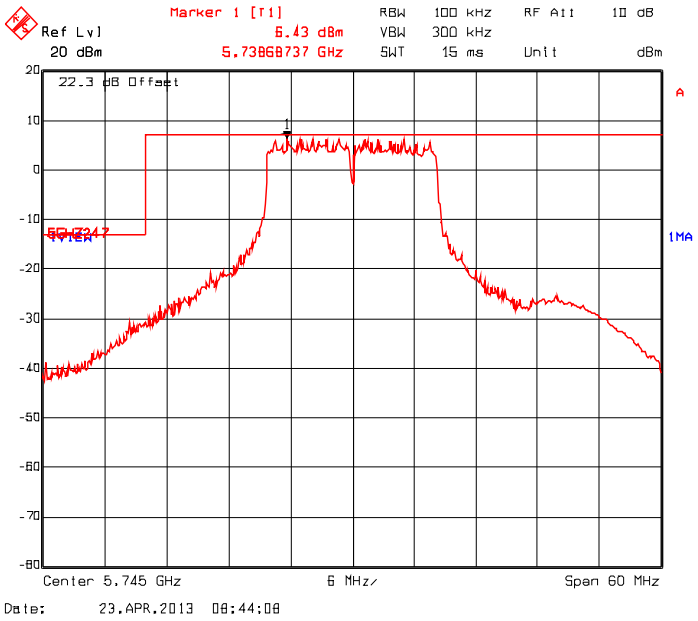
Plot 5.4.4.1.3. Band-Edge RF Conducted Emissions
Low End of Frequency Band, 18 Mbps QPSK, PCDAC Setting 57



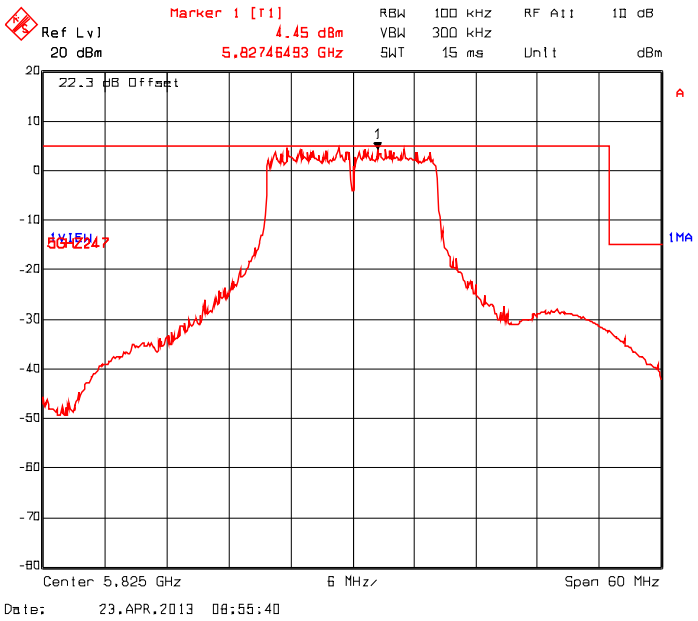
Plot 5.4.4.1.4. Band-Edge RF Conducted Emissions
High End of Frequency Band, 18 Mbps QPSK, PCDAC Setting 57



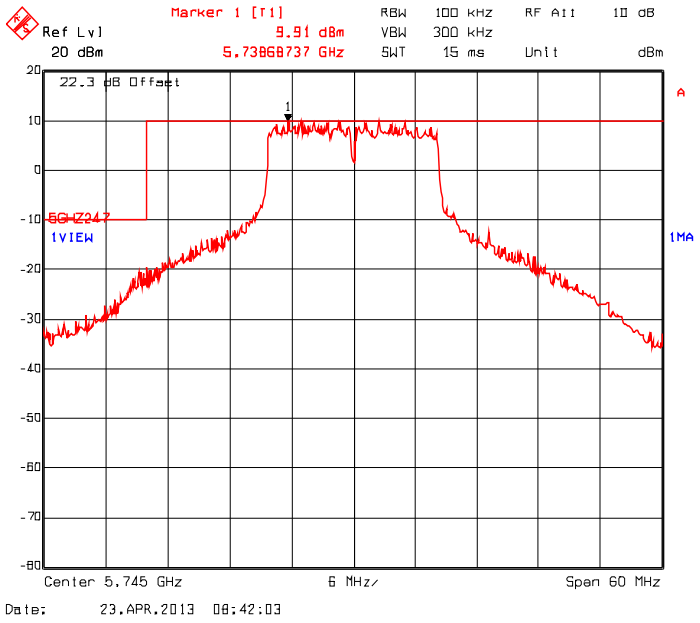
Plot 5.4.4.1.5. Band-Edge RF Conducted Emissions
Low End of Frequency Band, 36 Mbps 16-QAM, PCDAC Setting 57



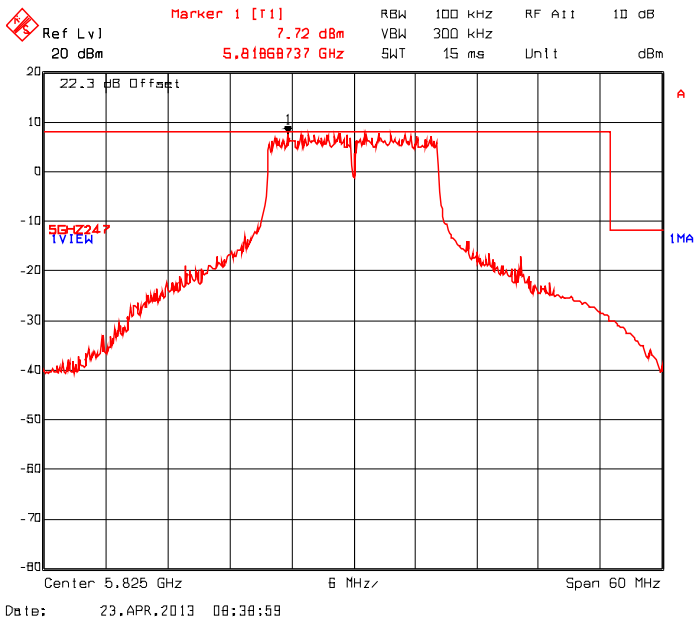
Plot 5.4.4.1.6. Band-Edge RF Conducted Emissions
High End of Frequency Band, 36 Mbps 16-QAM, PCDAC Setting 57



Plot 5.4.4.1.7. Band-Edge RF Conducted Emissions
Low End of Frequency Band, 54 Mbps 64-QAM, PCDAC Setting 64



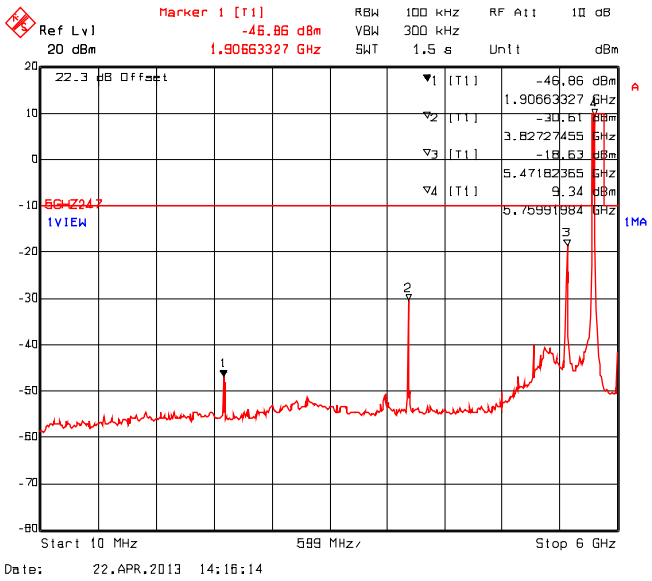
Plot 5.4.4.1.8. Band-Edge RF Conducted Emissions
High End of Frequency Band, 54 Mbps 64-QAM, PCDAC Setting 64



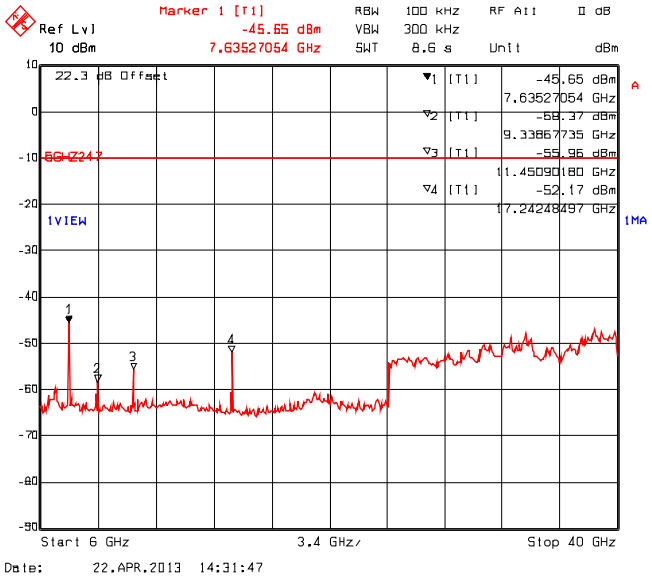
5.4.4.2. Conducted Spurious Emissions

Remark: The following test results are the worst-case measurements.

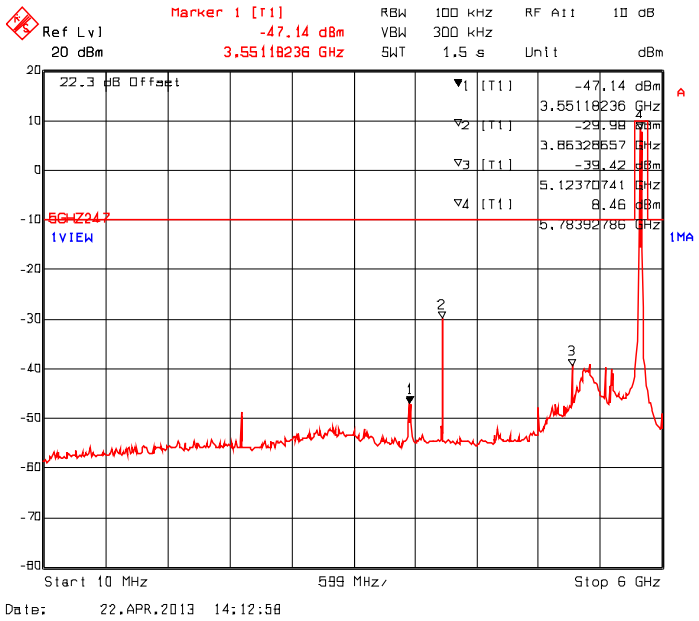
Plot 5.4.4.2.1. Conducted Spurious Emissions - High Power
5745 MHz, 54 Mbps 64-QAM, PCDAC Setting 64, 10 MHz – 6 GHz



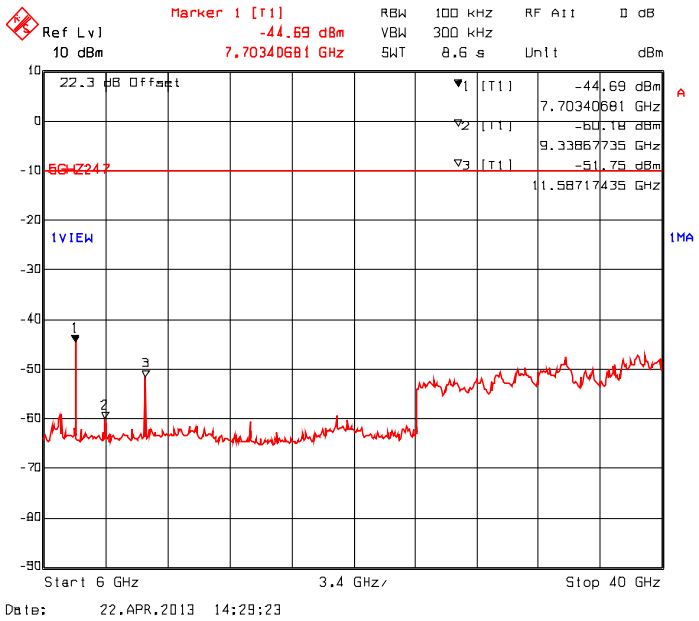
Plot 5.4.4.2.2. Conducted Spurious Emissions - High Power
5745 MHz, 54 Mbps 64-QAM, PCDAC Setting 64, 6 GHz – 40 GHz



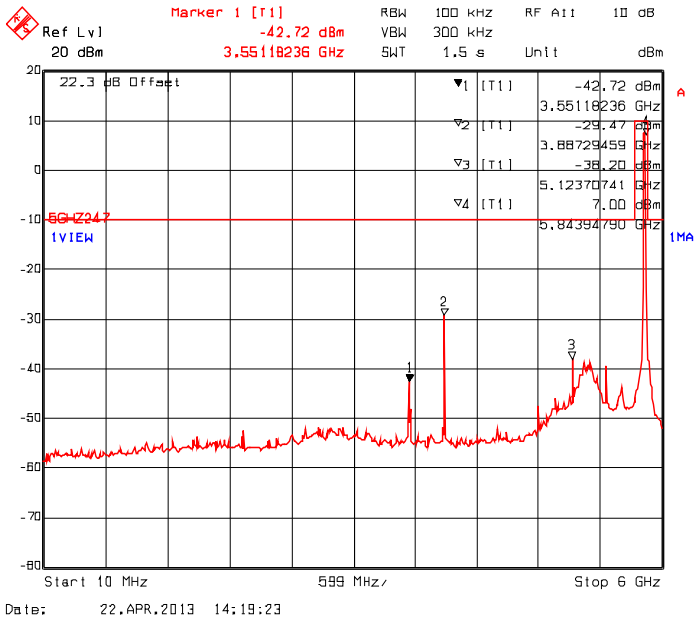
Plot 5.4.4.2.3. Conducted Spurious Emissions - High Power
5785 MHz, 54 Mbps 64-QAM, PCDAC Setting 64, 10 MHz – 6 GHz



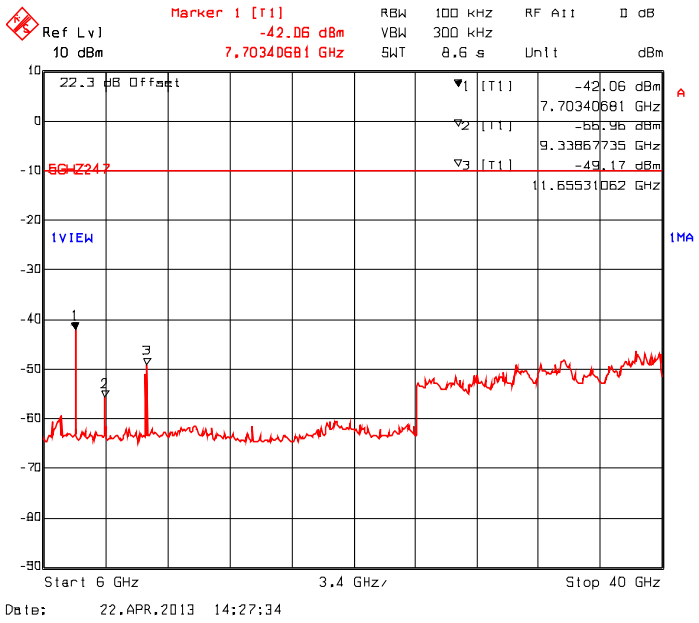
Plot 5.4.4.2.4. Conducted Spurious Emissions - High Power
5785 MHz, 54 Mbps 64-QAM, PCDAC Setting 64, 6 GHz – 40 GHz



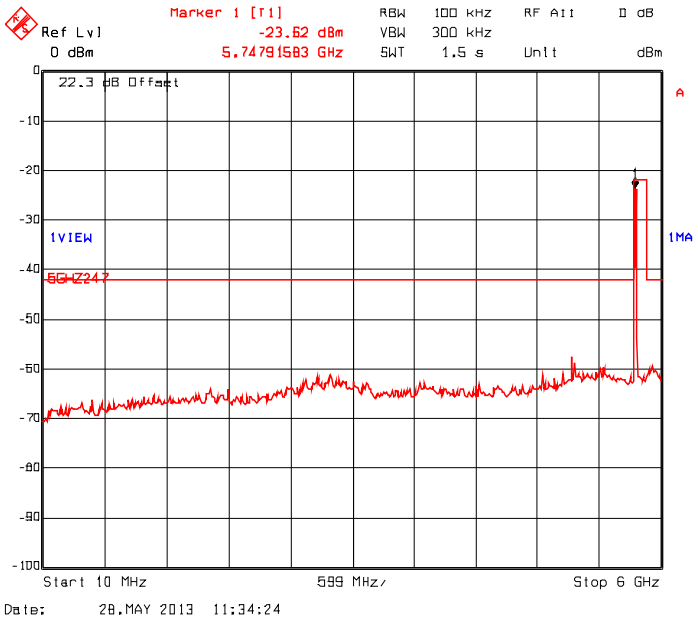
Plot 5.4.4.2.5. Conducted Spurious Emissions - High Power
5825 MHz, 54 Mbps 64-QAM, PCDAC Setting 64, 10 MHz – 6 GHz



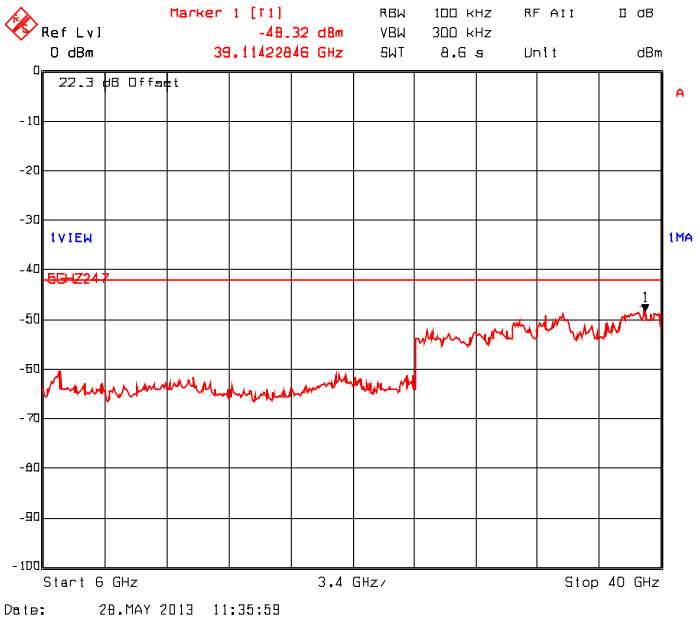
Plot 5.4.4.2.6. Conducted Spurious Emissions - High Power
5825 MHz, 54 Mbps 64-QAM, PCDAC Setting 64, 6 GHz – 40 GHz



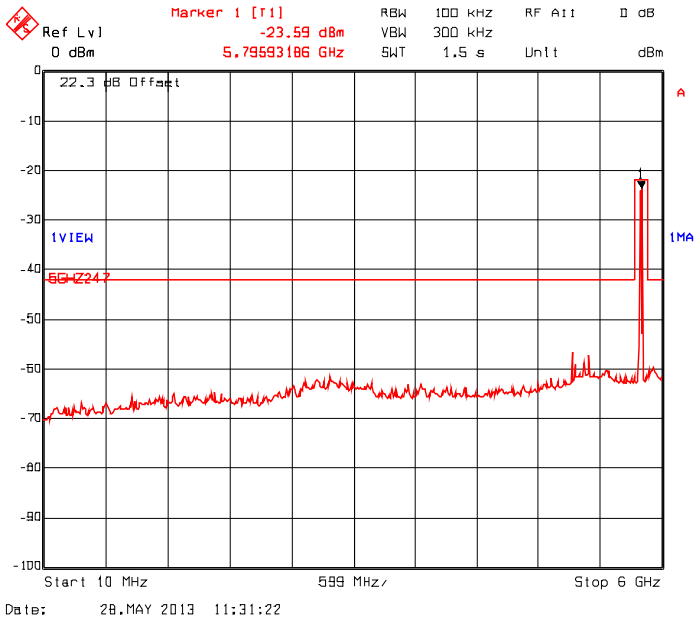
Plot 5.4.4.2.7. Conducted Spurious Emissions - Low Power
5745 MHz, 9 Mbps BPSK, PCDAC Setting 12, 10 MHz – 6 GHz



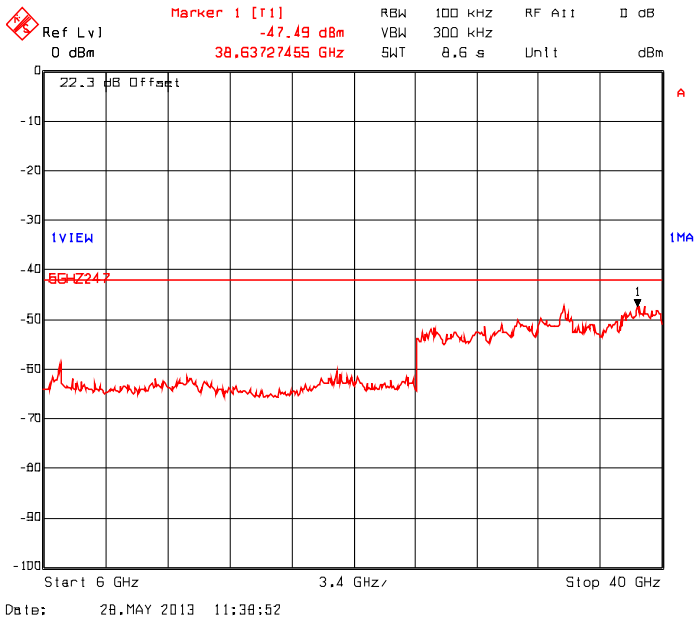
Plot 5.4.4.2.8. Conducted Spurious Emissions - Low Power
5745 MHz, 9 Mbps BPSK, PCDAC Setting 12, 6 GHz – 40 GHz



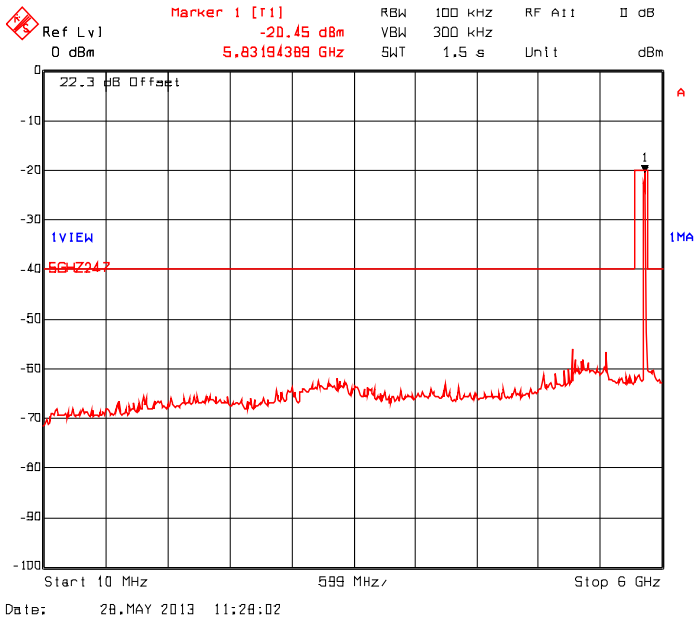
Plot 5.4.4.2.9. Conducted Spurious Emissions - Low Power
5785 MHz, 9 Mbps BPSK, PCDAC Setting 12, 10 MHz – 6 GHz



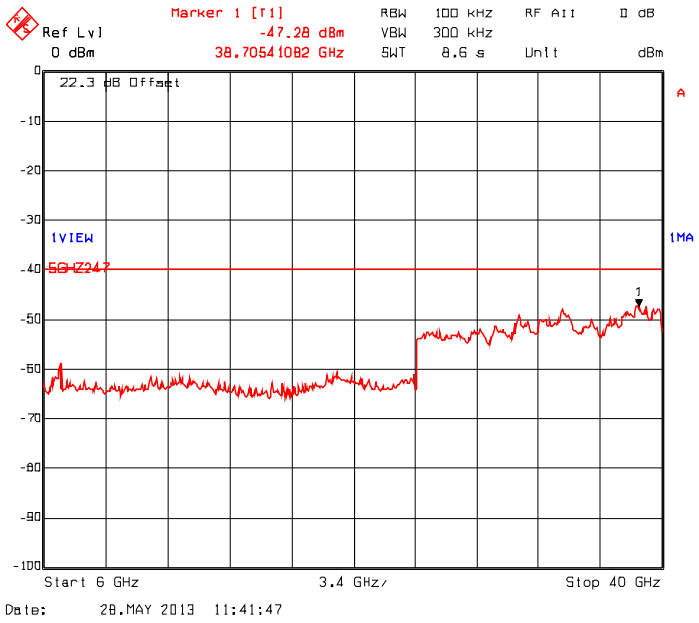
Plot 5.4.4.2.10. Conducted Spurious Emissions - Low Power
5785 MHz, 9 Mbps BPSK, PCDAC Setting 12, 6 GHz – 40 GHz



Plot 5.4.4.2.11. Conducted Spurious Emissions - Low Power
5825 MHz, 9 Mbps BPSK, PCDAC Setting 12, 10 MHz – 6 GHz



Plot 5.4.4.2.12. Conducted Spurious Emissions - Low Power
5825 MHz, 9 Mbps BPSK, PCDAC Setting 12, 6 GHz – 40 GHz



5.5. TRANSMITTER SPURIOUS RADIATED EMISSIONS AT 3 METERS [§§ 15.247(d), 15.209 & 15.205]

5.5.1. Limit

§ 15.247 (d): 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 20 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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 Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Section 15.205(a) - Restricted Bands of Operation

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	([2])
13.36–13.41.			

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
[2] Above 38.6

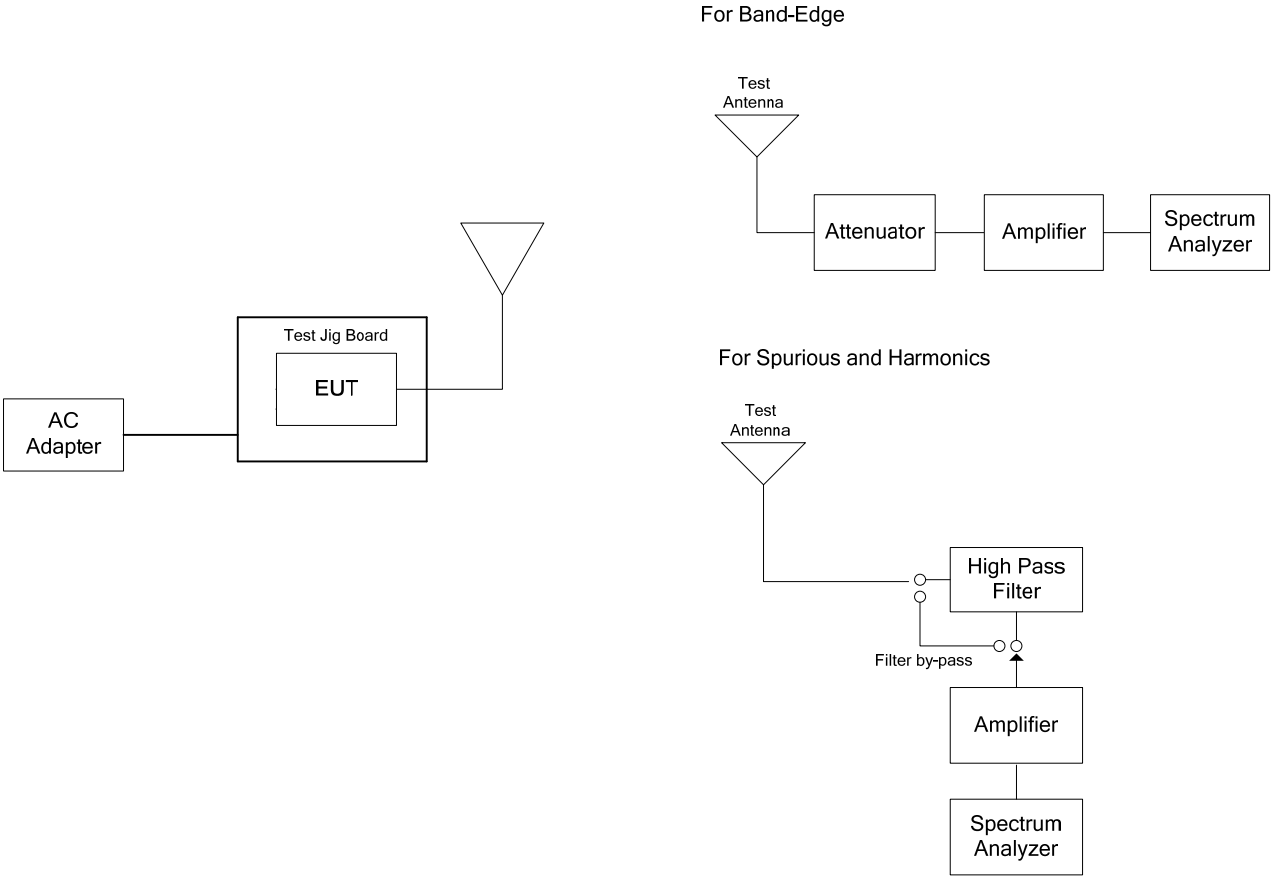
Section 15.209(a) - Field Strength Limits within Restricted Frequency Bands

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2,400 / F (kHz)	300
0.490 - 1.705	24,000 / F (kHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

5.5.2. Method of Measurements

ANSI C63.10 and ANSI 63.4 procedures.

5.5.3. Test Arrangement



5.5.4. Test Data

Remark(s):

- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT shall be tested in three orthogonal positions.
- The following test results are the worst-case measurements, derived from exploratory tests.

5.5.4.1. EUT with 4 dBi Rubber Ducky Antenna and 1.12 dB Assembly Cable Loss

5.5.4.1.1. Spurious Radiated Emissions

Fundamental Frequency:	5745 MHz
Power Setting and Operating Mode:	29.93 dBm, 54 Mbps 64-QAM, PCDAC Setting 64
Frequency Test Range:	30 MHz – 40 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
5745	120.23	--	V	--	--	--	--
5745	120.75	--	H	--	--	--	--
11490	70.52	53.69	V	54.0	100.8	-0.3	Pass*
11490	69.41	52.61	H	54.0	100.8	-1.4	Pass*

All other spurious emissions and harmonics are more than 20 dB below the applicable limit.

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:	5785 MHz
Power Setting and Operating Mode:	29.92 dBm, 54 Mbps 64-QAM, PCDAC Setting 64
Frequency Test Range:	30 MHz – 40 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
5785	119.38	--	V	--	--	--	--
5785	121.68	--	H	--	--	--	--
11570	70.39	53.03	V	54.0	101.7	-1.0	Pass*
11570	69.46	52.63	H	54.0	101.7	-1.4	Pass*

All other spurious emissions and harmonics are more than 20 dB below the applicable limit.

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:	5825 MHz
Power Setting and Operating Mode:	29.53 dBm, 54 Mbps 64-QAM, PCDAC Setting 64
Frequency Test Range:	30 MHz – 40 GHz

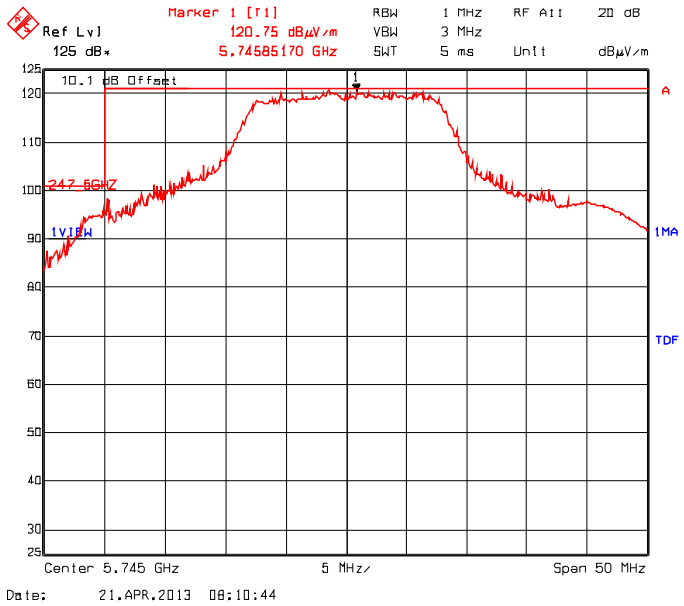
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
5825	121.25	--	V	--	--	--	--
5825	122.02	--	H	--	--	--	--
11650	69.52	51.22	V	54.0	102.0	-2.8	Pass*
11650	67.55	50.94	H	54.0	102.0	-3.1	Pass*

All other spurious emissions and harmonics are more than 20 dB below the applicable limit.

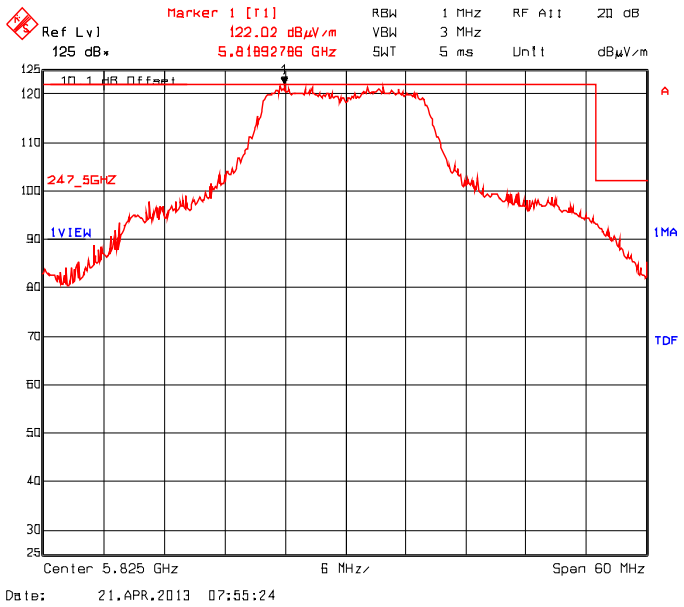
*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

5.5.4.1.2. Band-Edge RF Radiated Emissions

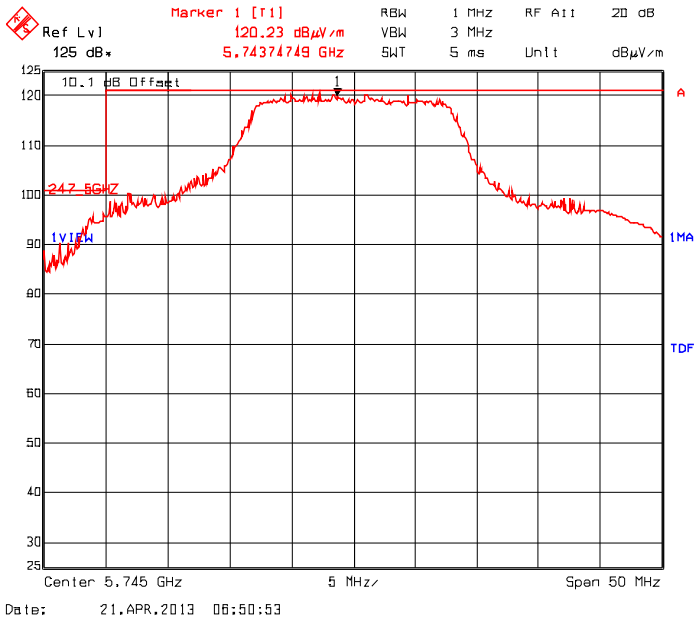
Plot 5.5.4.1.2.1. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 54 Mbps 64-QAM, PCDAC Setting 64



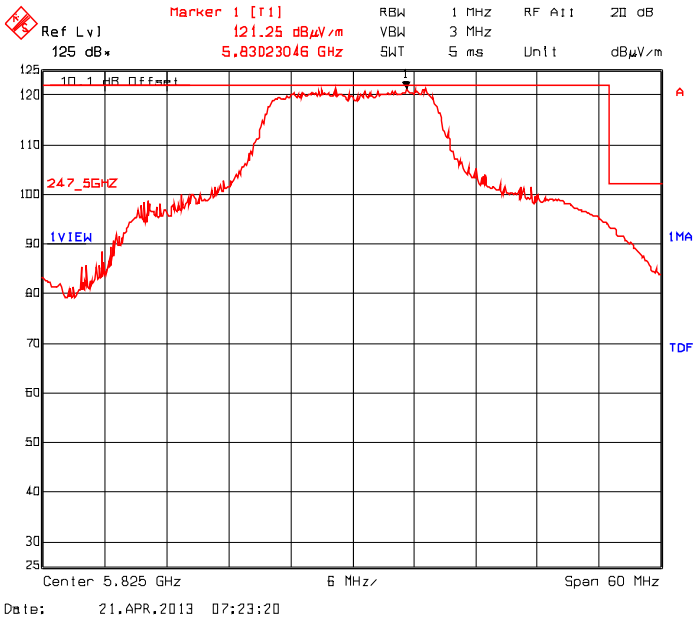
Plot 5.5.4.1.2.2. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
High End of Frequency Band, 54 Mbps 64-QAM, PCDAC Setting 64



Plot 5.5.4.1.2.3. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 54 Mbps 64-QAM, PCDAC Setting 64



Plot 5.5.4.1.2.4. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
High End of Frequency Band, 54 Mbps 64-QAM, PCDAC Setting 64



5.5.4.2. EUT with 23 dBi Patch Antenna and 3.06 dB Assembly Cable Loss

5.5.4.2.1. Spurious Radiated Emissions

Fundamental Frequency:	5745 MHz
Power Setting and Operating Mode:	29.93 dBm, 54 Mbps 64-QAM, PCDAC Setting 64
Frequency Test Range:	30 MHz – 40 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
5745	139.14	--	V	--	--	--	--
5745	139.21	--	H	--	--	--	--
11490	69.14	51.96	V	54.0	119.2	-2.0	Pass*
11490	69.56	53.63	H	54.0	119.2	-0.4	Pass*

All other spurious emissions and harmonics are more than 20 dB below the applicable limit.

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:	5785 MHz
Power Setting and Operating Mode:	29.92 dBm, 54 Mbps 64-QAM, PCDAC Setting 64
Frequency Test Range:	30 MHz – 40 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
5785	137.79	--	V	--	--	--	--
5785	138.01	--	H	--	--	--	--
11570	67.97	51.70	V	54.0	118.0	-2.3	Pass*
11570	69.96	53.76	H	54.0	118.0	-0.2	Pass*

All other spurious emissions and harmonics are more than 20 dB below the applicable limit.

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:	5825 MHz
Power Setting and Operating Mode:	29.53 dBm, 54 Mbps 64-QAM, PCDAC Setting 64
Frequency Test Range:	30 MHz – 40 GHz

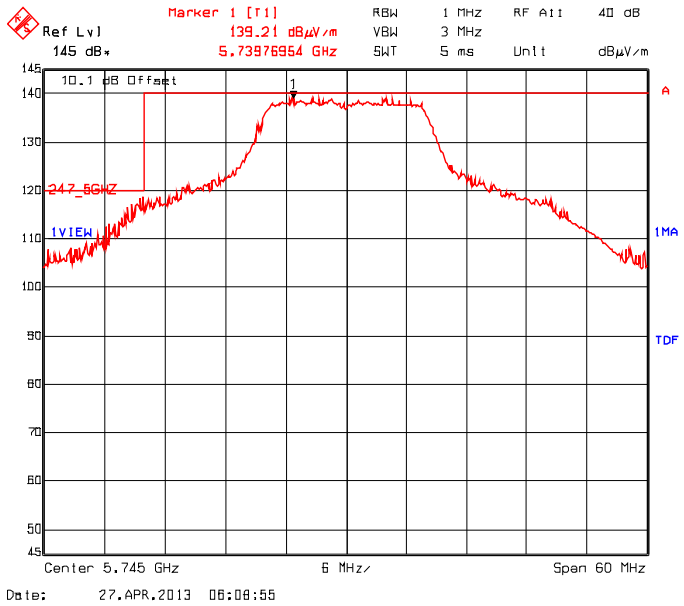
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
5825	137.17	--	V	--	--	--	--
5825	137.82	--	H	--	--	--	--
11650	66.21	49.95	V	54.0	117.8	-4.1	Pass*
11650	69.36	52.80	H	54.0	117.8	-1.2	Pass*

All other spurious emissions and harmonics are more than 20 dB below the applicable limit.

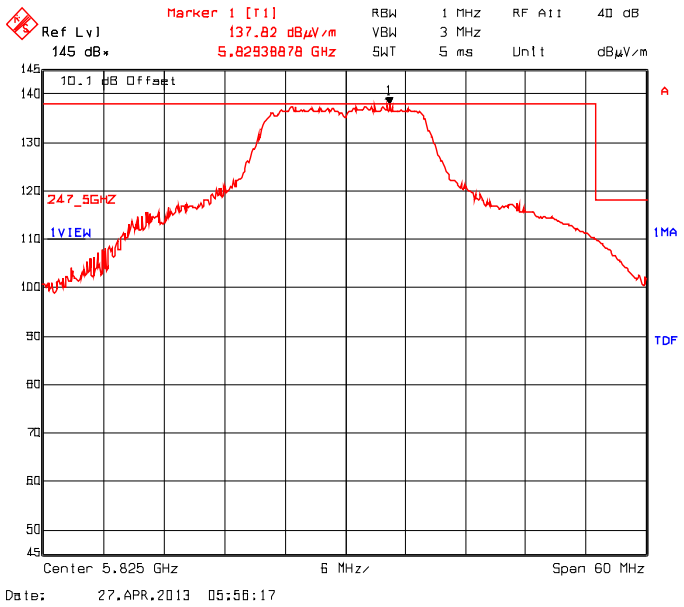
*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

5.5.4.2.2. Band-Edge RF Radiated Emissions

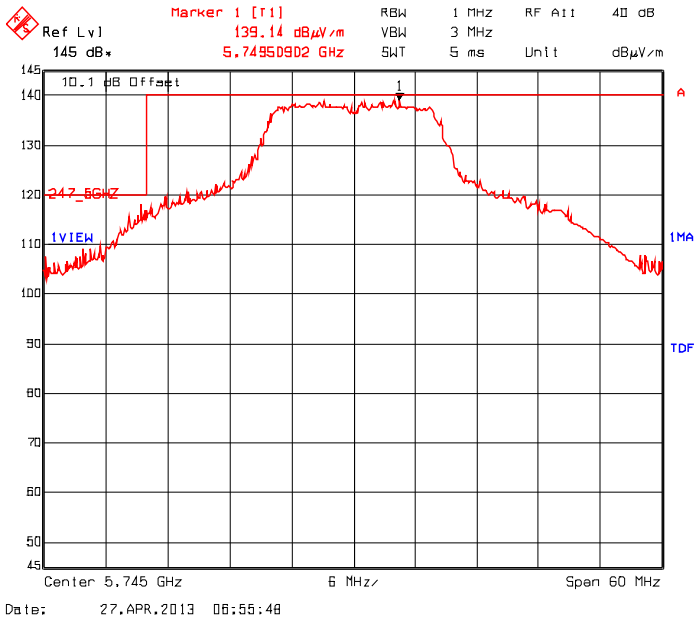
Plot 5.5.4.2.2.1. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 54 Mbps 64-QAM, PCDAC Setting 64



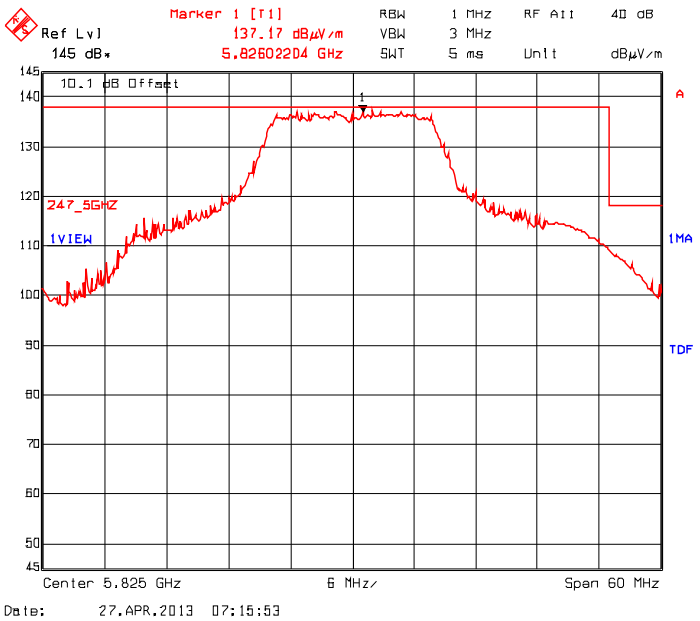
Plot 5.5.4.2.2.2. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
High End of Frequency Band, 54 Mbps 64-QAM, PCDAC Setting 64



Plot 5.5.4.2.2.3. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 54 Mbps 64-QAM, PCDAC Setting 64



Plot 5.5.4.2.2.4. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
High End of Frequency Band, 54 Mbps 64-QAM, PCDAC Setting 64



5.6. POWER SPECTRAL DENSITY [§ 15.247(e)]

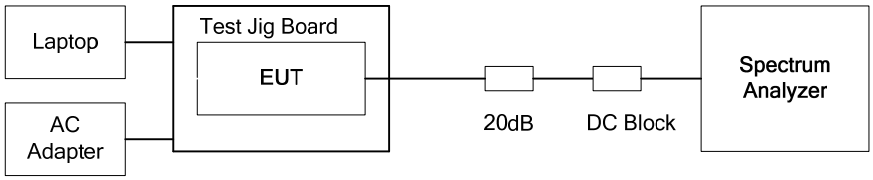
5.6.1. Limit(s)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.6.2. Method of Measurements

KDB Publication No. 558074 D01 DTS Meas Guidance v02, Section 9.1 Option 1.

5.6.3. Test Arrangement



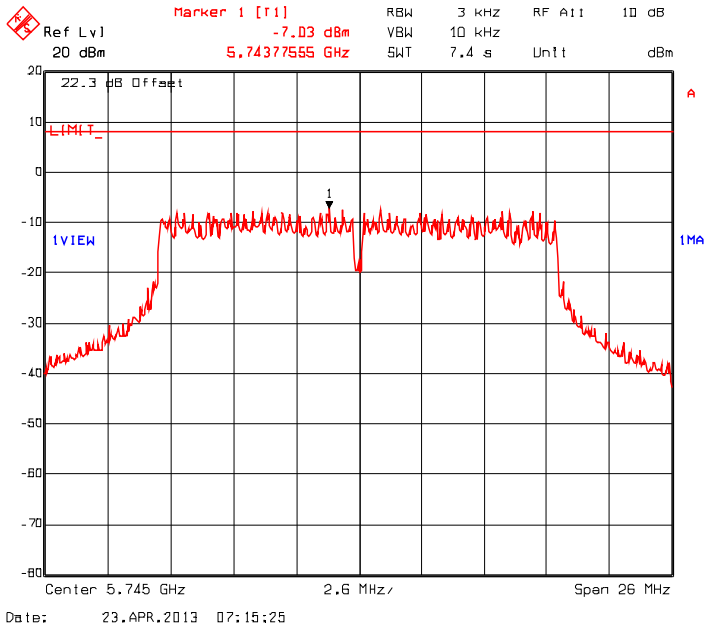
5.6.4. Test Data

Remark: Measurement method: Section 9.1 Option 1 Peak Power Spectral Density

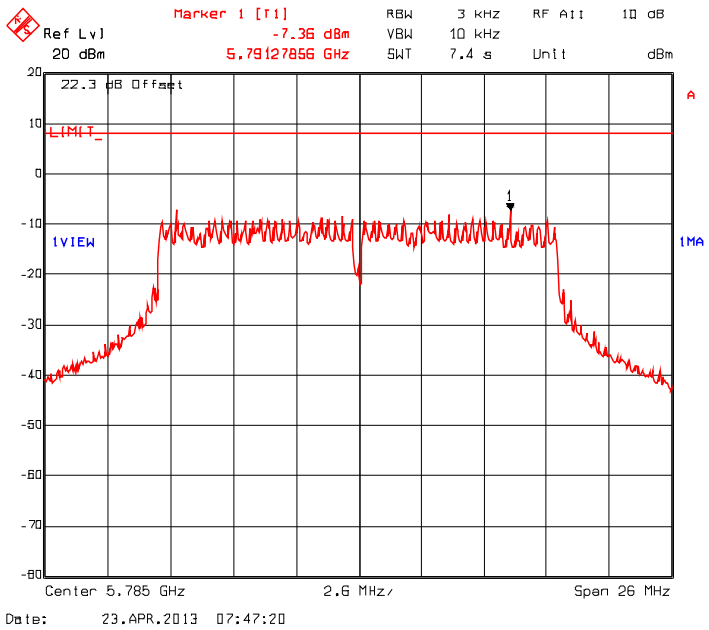
Operating Mode	Frequency (MHz)	*PSD in 3 kHz BW (dBm)	Limit (dBm)	Margin (dB)
9 Mbps BPSK	5745	-7.03	8	-15.03
	5785	-7.36	8	-15.36
	5825	-7.88	8	-15.88
18 Mbps QPSK	5745	-6.56	8	-14.56
	5785	-7.48	8	-15.48
	5825	-9.00	8	-17.00
36 Mbps 16-QAM	5745	-6.33	8	-14.33
	5785	-9.00	8	-17.00
	5825	-8.47	8	-16.47
54 Mbps 64-QAM	5745	-4.24	8	-12.24
	5785	-5.77	8	-13.77
	5825	-5.98	8	-13.98

See the following plots for measurement details.

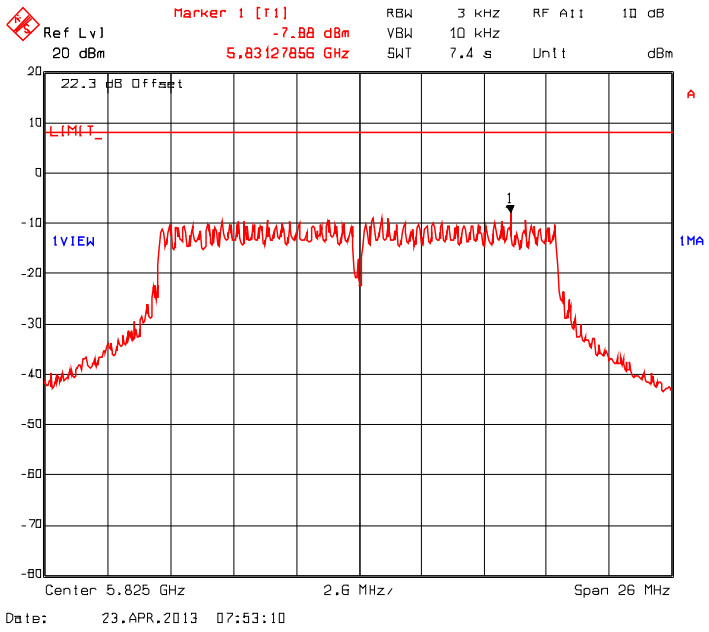
Plot 5.6.4.1. Power Spectral Density, 9 Mbps BPSK, 5745 MHz, PCDAC Setting 57



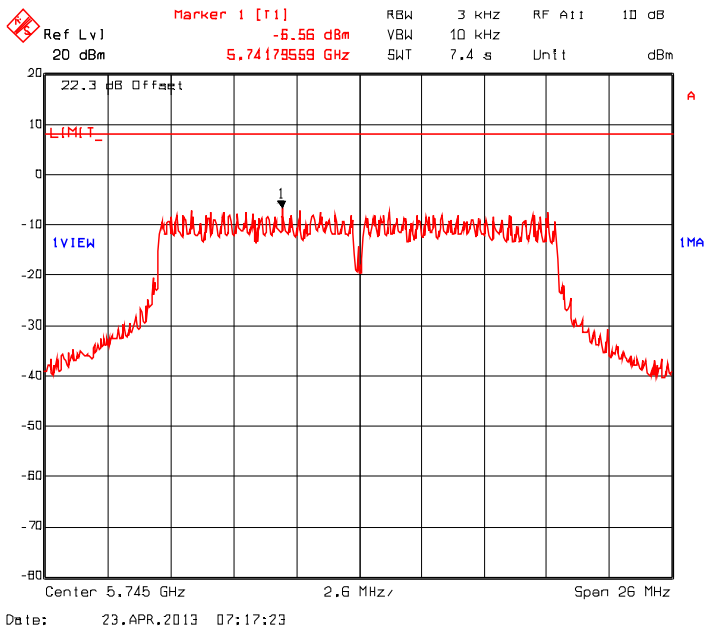
Plot 5.6.4.2. Power Spectral Density, 9 Mbps BPSK, 5785 MHz, PCDAC Setting 57



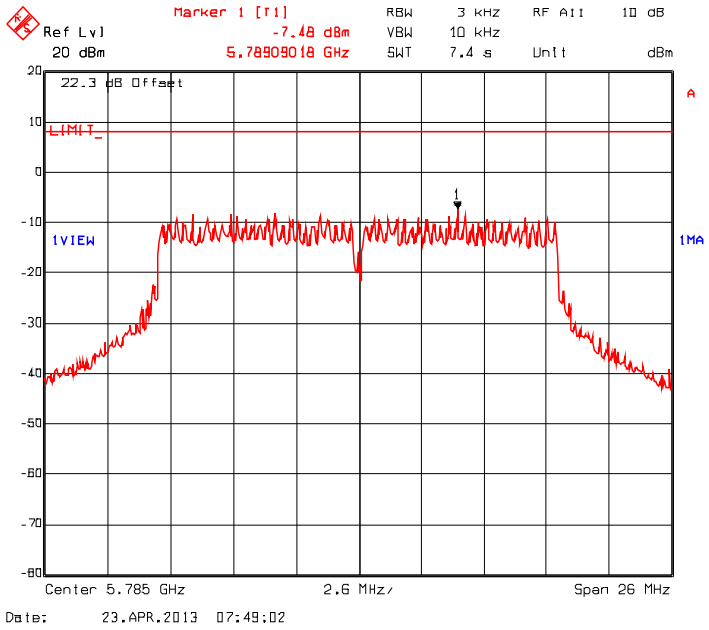
Plot 5.6.4.3. Power Spectral Density, 9 Mbps BPSK, 5825 MHz, PCDAC Setting 57



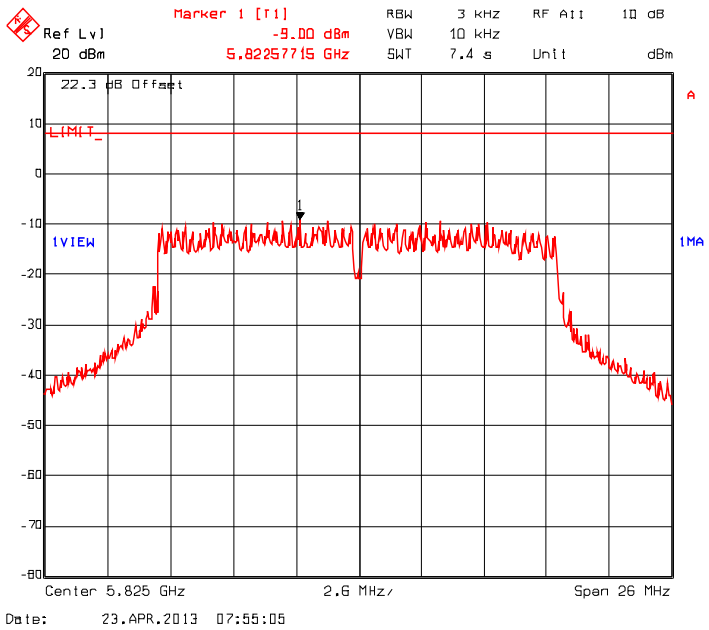
Plot 5.6.4.4. Power Spectral Density, 18 Mbps QPSK, 5745 MHz, PCDAC Setting 57



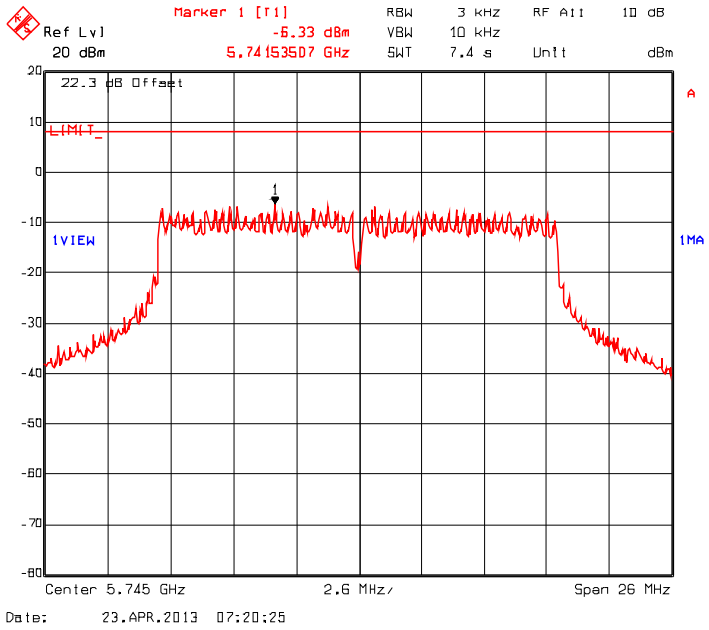
Plot 5.6.4.5. Power Spectral Density, 18 Mbps QPSK, 5785 MHz, PCDAC Setting 57



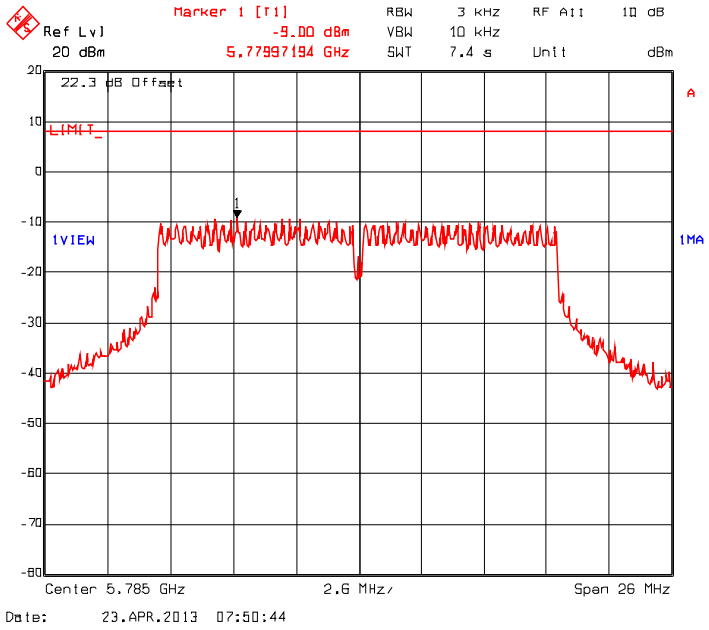
Plot 5.6.4.6. Power Spectral Density, 18 Mbps QPSK, 5825 MHz, PCDAC Setting 57



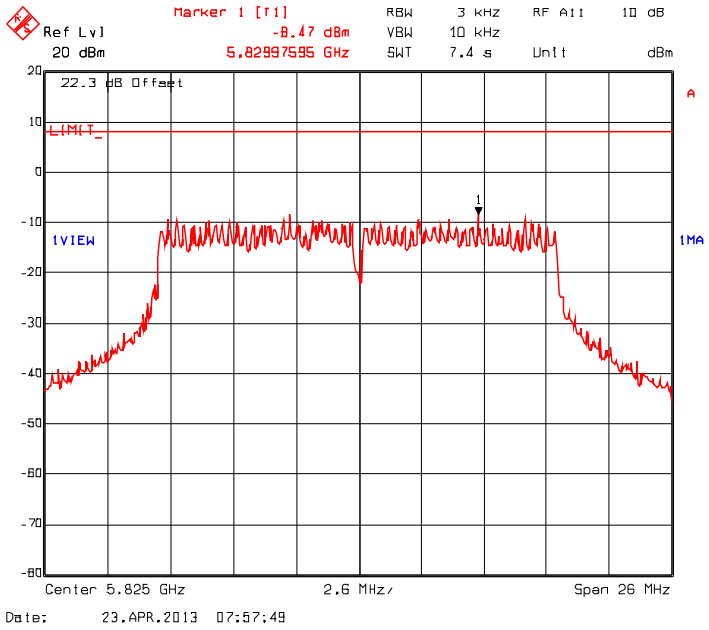
Plot 5.6.4.7. Power Spectral Density, 36 Mbps 16-QAM, 5745 MHz, PCDAC Setting 57



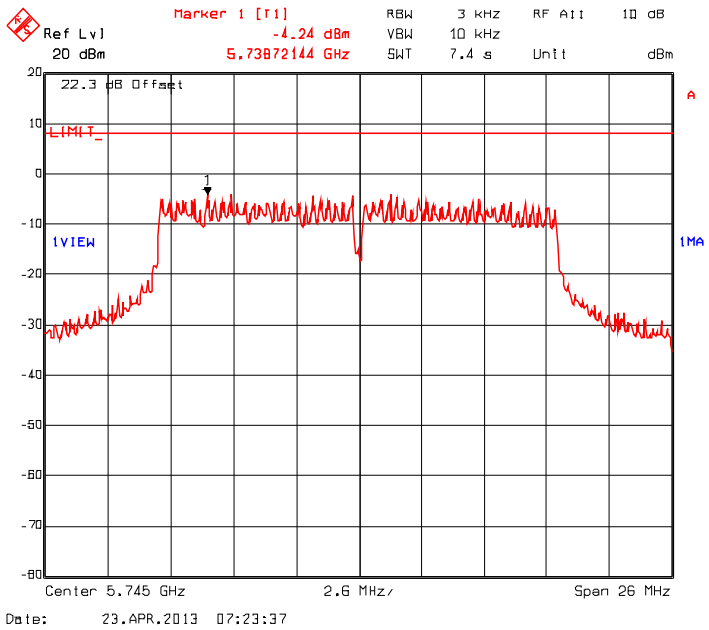
Plot 5.6.4.8. Power Spectral Density, 36 Mbps 16-QAM, 5785 MHz, PCDAC Setting 57



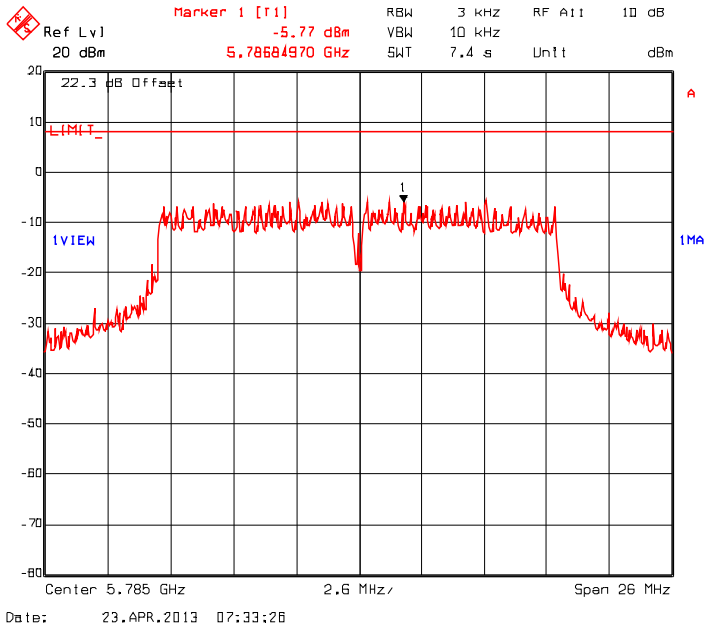
Plot 5.6.4.9. Power Spectral Density, 36 Mbps 16-QAM, 5825 MHz, PCDAC Setting 57



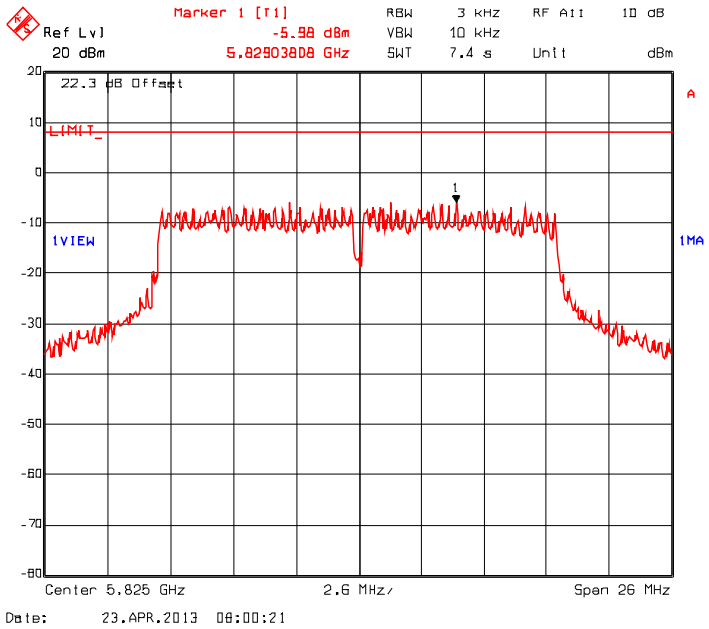
Plot 5.6.4.10. Power Spectral Density, 54 Mbps 64-QAM, 5745 MHz, PCDAC Setting 64



Plot 5.6.4.11. Power Spectral Density, 54 Mbps 64-QAM, 5785 MHz, PCDAC Setting 64



Plot 5.6.4.12. Power Spectral Density, 54 Mbps 64-QAM, 5825 MHz, PCDAC Setting 64



5.7. RF EXPOSURE REQUIRMENTS [§§ 15.247(i), 1.1310 & 2.1091]

The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation.

FCC 47 CFR § 1.1310:

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

5.7.1. Method of Measurements

Refer to Sections 1.1310, 2.1091

In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:

(1) Calculation that estimates the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits defined for free space.
(2) Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement
(3) Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits
(4) Any other RF exposure related issues that may affect MPE compliance

Calculation Method of RF Safety Distance:

$$S = \frac{P \cdot G}{4 \cdot \pi \cdot r^2} = \frac{EIRP}{4 \cdot \pi \cdot r^2}$$

Where: P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

5.7.2. RF Evaluation

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	**Compliance with FCC Rules**
Minimum calculated separation distance between antenna and persons required: ***18 cm** (For EIRP ≤ 36 dBm) and **88 cm** (for fixed, point to point operations)	Manufacturer' instruction for separation distance between antenna and persons required: **23 cm** (For EIRP ≤ 36 dBm) and **88 cm** (for fixed, point to point operations)
Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement	Antenna installation and device operating instructions shall be provided to installers to maintain and ensure compliance with RF exposure requirements.
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	Refer to User's Manual for RF Exposure Information.
Any other RF exposure related issues that may affect MPE compliance	None.

*The minimum separation distance between the antenna and bodies of users are calculated using the following formula:

RF EXPOSURE DISTANCE LIMITS

$$r = \sqrt{\frac{P \cdot G}{4 \cdot \pi \cdot S}} = \sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}}$$

For EIRP ≤ 36 dBm

S = 1.0 mW/cm^2
EIRP = 36 dBm = $10^{36/10}$ mW = 3981 mW (Worst Case)

(Minimum Safe Distance, r) = $\sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}} = \sqrt{\frac{3981}{4 \cdot \pi \cdot (1.0)}} \approx 18cm$

For fixed, point to point operations

S = 1.0 mW/cm^2
EIRP = 49.87 dBm = $10^{49.87/10}$ mW = 97051 mW (Worst Case)

(Minimum Safe Distance, r) = $\sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}} = \sqrt{\frac{97051}{4 \cdot \pi \cdot (1.0)}} \approx 88cm$

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20Hz–40 GHz	02 Nov 2013
Attenuator	Narda	4768-20	6	DC–40 GHz	Cal on use
DC Block	Hewlett Packard	11742A	12460	0.045–26.5 GHz	Cal on use
Spectrum Analyzer	Agilent	E7401A	US40240432	9 kHz–1.5 GHz	01 May 2013*
Attenuator	Pasternack	PE7010-20	-	DC–2 GHz	11 Jan 2014
L.I.S.N	EMCO	3810/2	2209	9 kHz -30 MHz	28 Aug 2013
High Pass Filter	K & L	11SH10-8000/T18000	3	Cut off 5 GHz	Cal on use
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	06 Aug 2013
Attenuator	Pasternack	PE7024-10	4	DC–26.5 GHz	Cal on use
Horn Antenna	EMCO	3155	5955	1 – 18 GHz	07 Mar 2014
Spectrum Analyzer	Rohde & Schwarz	ESU40	100033	20 Hz – 40 GHz	07 Mar 2014
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	25 Mar 2014
Biconi-Log Antenna	ETS Lindgren	3142B	1575	26 – 3000 MHz	04 May 2013*
Horn Antenna	EMCO	3160-09	118385	18 – 26.5 GHz	30 July 2014
Horn Antenna	EMCO	3160-10	102686	26– 40 GHz	30 July 2014

* Equipment was used in the period of April 21- 27, 2013.

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

	Line Conducted Emission Measurement Uncertainty (9 kHz – 30 MHz):	Measured	Limit
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	± 1.44	± 1.8
U	Expanded uncertainty U: $U = 2u_c(y)$	± 2.89	± 3.6

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	Measured (dB)	Limit (dB)
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	± 2.39	± 2.6
U	Expanded uncertainty U: $U = 2u_c(y)$	± 4.79	± 5.2

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	Measured (dB)	Limit (dB)
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	± 2.39	± 2.6
U	Expanded uncertainty U: $U = 2u_c(y)$	± 4.78	± 5.2

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	Measured (dB)	Limit (dB)
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	± 1.87	Under consideration
U	Expanded uncertainty U: $U = 2u_c(y)$	± 3.75	Under consideration