

Certification Test Report

FCC ID: AZ489FT6009

IC: 109U-89FT6009

FCC Rule Part: 15.247

IC Radio Standards Specification: RSS-210

ACS Report Number: 13-2168.W06.1A

Manufacturer: Motorola Solutions SDNBHD

Model: PMMN4095A

Test Begin Date: January 10, 2014

Test End Date: February 14, 2014

Report Issue Date: March 18, 2014



FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

This report must not be used by the client to claim product certification, approval, or endorsement by ACCLASS, ANSI, or any agency of the Federal Government.

Project Manager:

A handwritten signature in blue ink, appearing to read "Thierry Jean-Charles".

Thierry Jean-Charles
EMC Engineer
Advanced Compliance Solutions, Inc.

Reviewed by:

A handwritten signature in blue ink, appearing to read "Kirby Munroe".

Kirby Munroe
Director, Wireless Certifications
Advanced Compliance Solutions, Inc.

This test report shall not be reproduced except in full. This report may be reproduced in part with prior written consent of ACS, Inc. The results contained in this report are representative of the sample(s) submitted for evaluation.

This report contains 69 pages

TABLE OF CONTENTS

1	GENERAL	3
1.1	Purpose	3
1.2	Product Description	3
1.3	Manufacturer Information	3
1.4	Test Methodology and Considerations.....	4
2	TEST FACILITIES	5
2.1	Location.....	5
2.2	Laboratory Accreditations/Recognitions/Certifications.....	5
2.3	Radiated & Conducted Emissions Test Site Description.....	6
3	APPLICABLE STANDARD REFERENCES.....	8
4	LIST OF TEST EQUIPMENT	9
5	SUPPORT EQUIPMENT	10
6	EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM	10
7	SUMMARY OF TESTS	12
7.1	Antenna Requirement – FCC: Section 15.203	12
7.2	Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.4.....	12
7.3	Peak Output Power - FCC Section 15.247(b)(1) IC: RSS-210 A8.4(2).....	15
7.4	Channel Usage Requirements	21
7.5	Band-Edge Compliance and Spurious Emissions-FCC 15.247(d) IC: RSS-210 A8.5	38
8	CONCLUSION	68

1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210.

1.2 Product Description

The Wireless Remote Speaker Microphone (WRSM), model PMMN4095A, is a Bluetooth audio device that can be paired with Bluetooth audio gateway for TX & RX audio and supports data communication. The radio also includes a 125 kHz transmitter.

Table1.3-1: Bluetooth Radio Properties

Mode of Operation	Frequency Range (MHz)	Number of Channels	Channel Separation (kHz)	Data Rates Supported (kbps)
GFSK	2402 - 2480	79	1000	1000
$\pi/4$ -DQPSK	2402 - 2480	79	1000	2000
8DPSK	2402 - 2480	79	1000	3000

1.3 Manufacturer Information

Motorola Solutions Malaysia Sdn Bhd
Plot 2, Bayan Lepas,
Technoplex Industrial Park,
Mukim 12, SWD (CSC)
11900 Bayan Lepas, Penang Malaysia

Model Number: PMMN4095A

Test Sample Serial Number(s): ACS#2 (Radiated), ACS#18 (RF Conducted)

Test Sample Condition: The samples were in good conditions with no observable physical damages.

1.4 Test Methodology and Considerations

The EUT was evaluated for RF conducted, radiated and power line conducted emissions for the 2.4 GHz Bluetooth transceiver.

The RF conducted measurements were performed with the EUT configured with a temporary SMA connector at the RF port.

The radiated emissions evaluation was performed up to the 10th harmonic, with the EUT set in 3 orthogonal orientations. The final measurements were performed using the EUT orientation leading to the highest emissions as compared to the limits. For the radiated emission results, the EUT set vertically for the emissions at the band-edges and set on the right side for the spurious emissions.

The power line measurements were performed for all available modulations and the results are provided for the worst case.

The Bluetooth radio was configured using the CSR BlueTest3 Software. The test power settings were selected as listed below.

GFSK: TX PA Atten = 0; Power (1, 26)
 $\pi/4$ DQPSK: TX PA Atten = 4; Power (1, 27)
8DPSK: TX PA Atten = 4; Power (1, 27)

The frequencies and data rates used during the evaluation are provided below.

Table 1.4-1: Bluetooth Radio Test configuration

Mode of Operations	Frequency (MHz)	Data Rate (kbps)
GFSK	2402	1000
	2441	1000
	2480	1000
$\pi/4$ DQPSK	2402	2000
	2441	2000
	2480	2000
8 DPSK	2402	3000
	2441	3000
	2480	3000

The EUT was also evaluated for unintentional emissions. The results are documented separately in a Verification test report.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

FCC Test Firm Registration #: 475089
Industry Canada Lab Code: 4175C

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ACLASS program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl floor.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flushed with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1050 Multi-device Controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

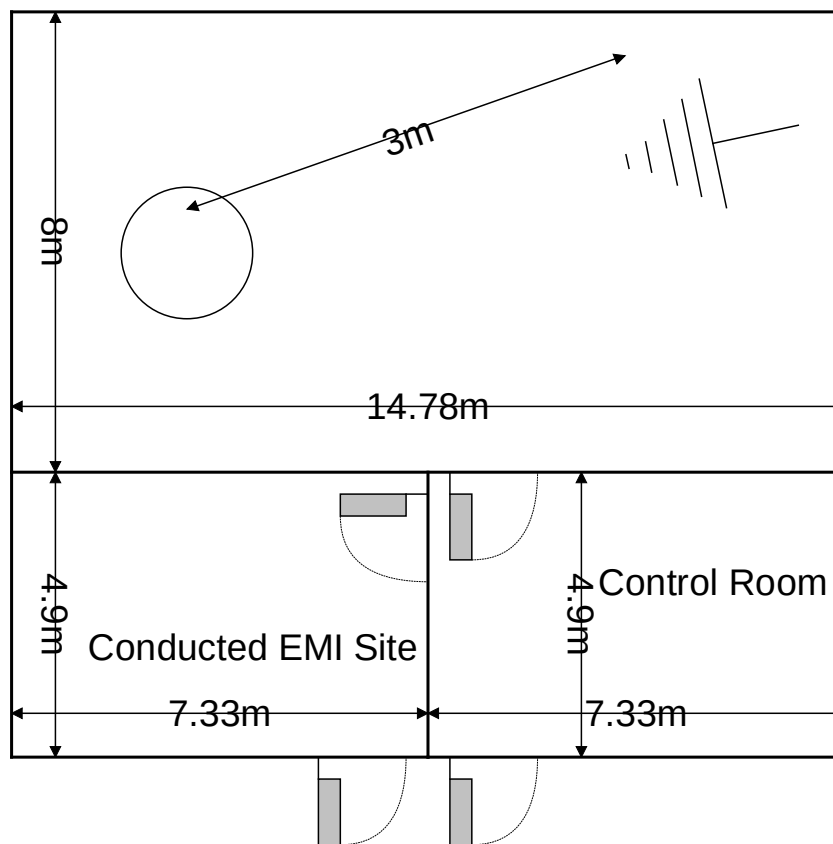


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are $7.3 \times 4.9 \times 3 \text{ m}^3$. As per ANSI C63.4 2003 requirements, the data were taken using two LISNs; a Solar Model 8028-50 $50 \Omega/50 \mu\text{H}$ and an EMCO Model 3825, which are installed as shown in Photograph 3. For 220 V, 50 Hz, a Polarad LISN (S/N 879341/048) is used in conjunction with a 1 kVA, 50 Hz/220 V EDGAR variable frequency generator, Model 1001B, to filter conducted noise from the generator.

A diagram of the room is shown below in figure 2.3.2-1:

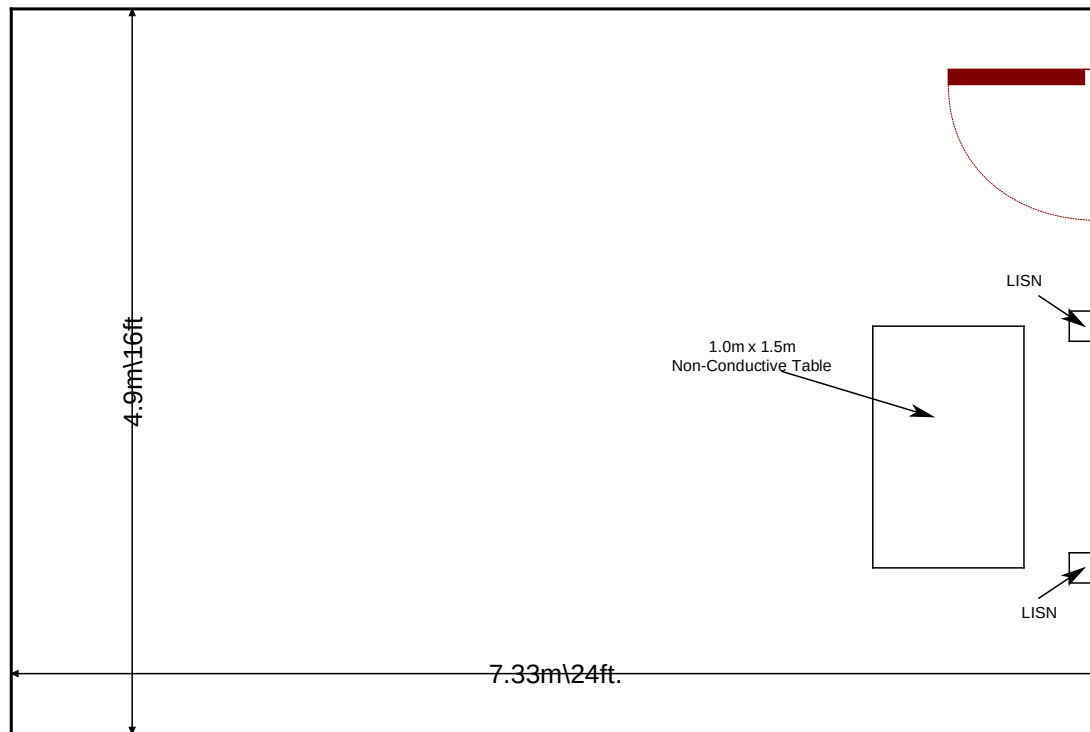


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- ❖ ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2014
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2014
- ❖ FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000
- ❖ Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8 December 2010.
- ❖ Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 3, December 2010.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment List

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/8/2013	1/8/2015
524	Chase	CBL6111	Antennas	1138	1/7/2013	1/7/2015
2006	EMCO	3115	Antennas	2573	4/24/2013	4/24/2015
2008	COM-Power	AH-826	Antennas	81009	NCR	NCR
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	12/31/2013	12/31/2014
2022	EMCO	LISN3825/2R	LISN	1095	9/9/2013	9/9/2015
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	1/1/2014	1/1/2015
2044	QMI	N/A	Cables	2044	12/31/2013	12/31/2014
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	1/1/2014	1/1/2015
2070	Mini Circuits	VHF-8400+	Filter	2070	1/1/2014	1/1/2015
2072	Mini Circuits	VHF-3100+	Filter	30737	1/1/2014	1/1/2015
2075	Hewlett Packard	8495B	Attenuators	2626A11012	1/2/2014	1/2/2015
2076	Hewlett Packard	HP5061-5458	Cables	2076	12/31/2013	12/31/2014
2082	Teledyne Storm Products	90-010-048	Cables	2082	5/31/2013	5/31/2014
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/16/2013	12/16/2014
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
3002	Rohde & Schwarz	ESU40	Receiver	100346	11/5/2013	11/5/2014
3004	Teseq	CFL 9206A	Attenuators	34720	10/21/2013	10/21/2015

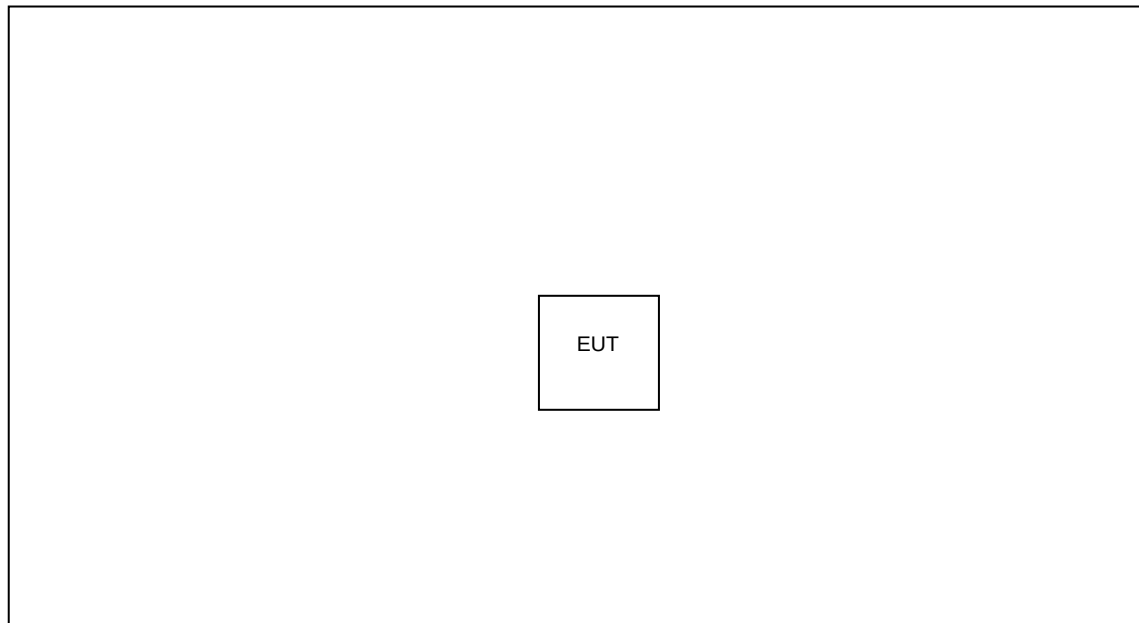
Notes: NCR=No Calibration Required

5 SUPPORT EQUIPMENT**Table 5-1: Support Equipment**

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	Charger	Motorola	PMNL6714A	N/A
2	Charger Power Supply	Motorola	MU15-M050275-A1	1100051039134010987
3	Headset	Motorola	WADN4190B	1119

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	Headset cable	0.68 m	No	EUT to headset
B	Power cable	1.5 m	No	EUT to power supply
C	Ext Power Cord	1.82 m	No	Power Supply to AC Mains

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM**Figure 6-1: Radiated Emissions Setup**

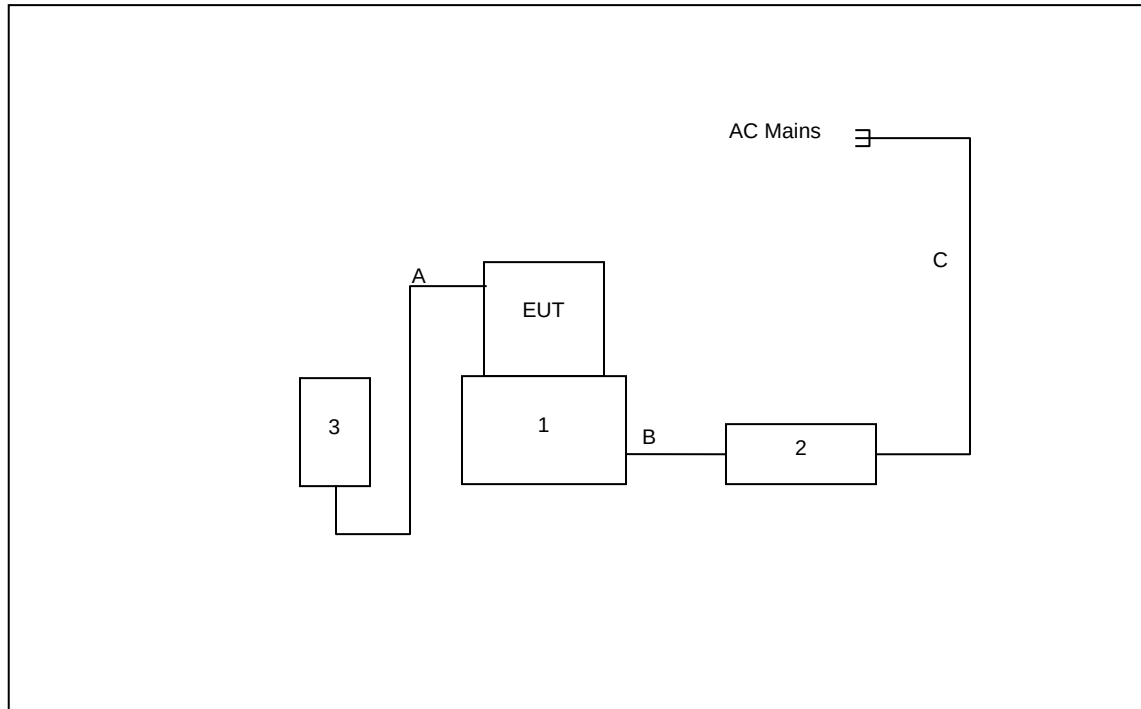


Figure 6-2: Power Line Conducted Emissions Setup

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The EUT uses an internal 2.84 dBi planar inverted-F antenna (PIFA) for the Bluetooth radio. The antenna is not detachable, thus meeting the requirements of FCC 15.203.

7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.4

7.2.1 Measurement Procedure

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

7.2.2 Measurement Results

Results of the test corresponding to the EUT configuration leading to the worse case emissions are shown below in Table 7.2.2-1 and Figure 7.2.2-1 to Figure 7.2.2-2.

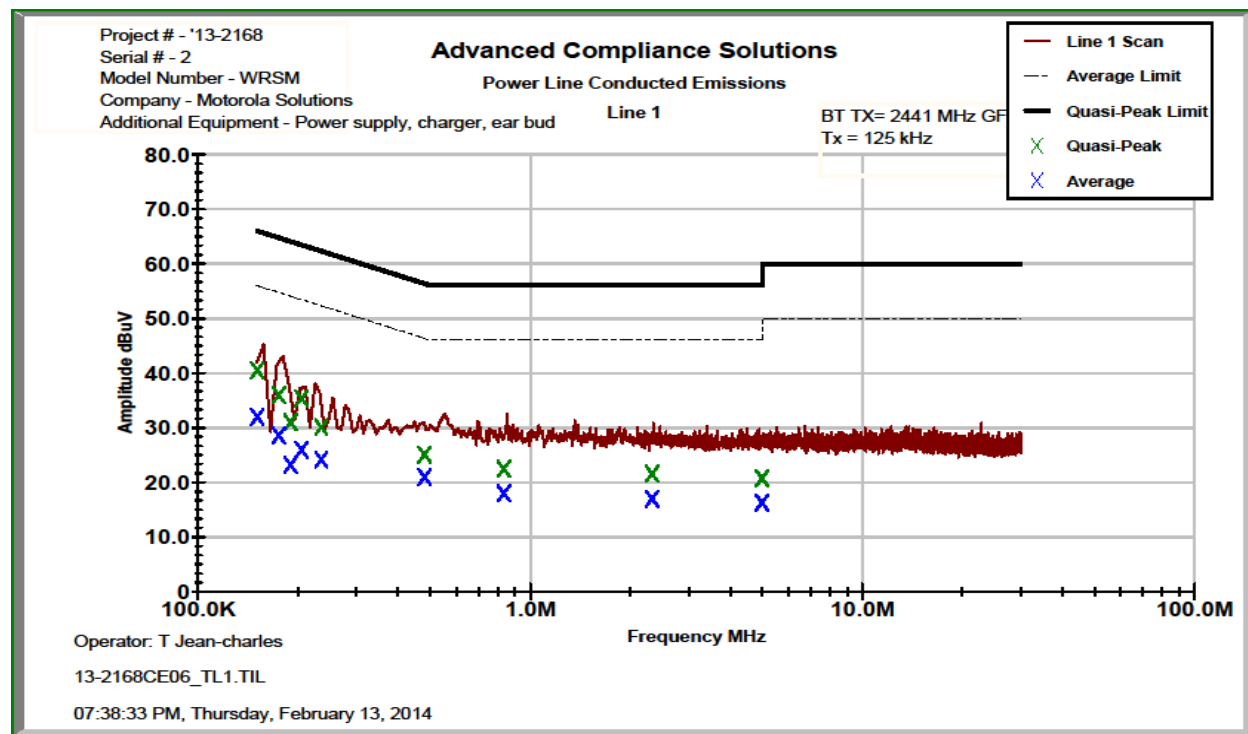


Figure 7.2.2-1: Conducted Emissions Results – Line 1

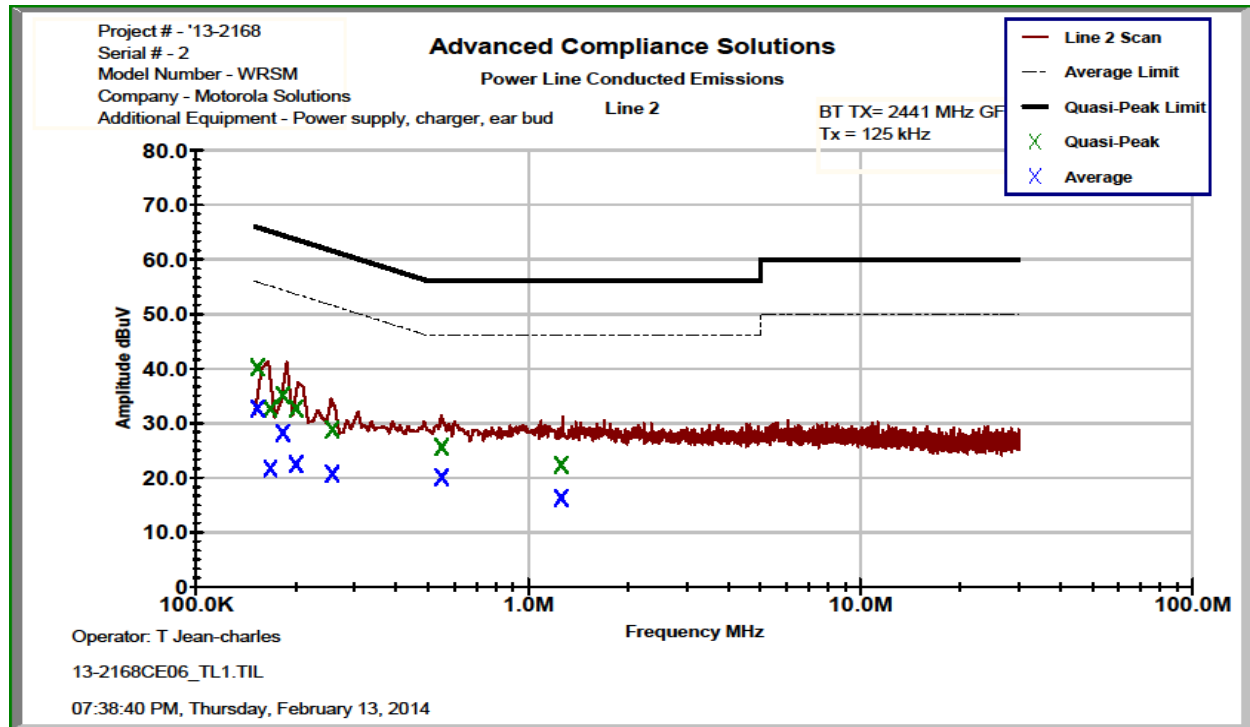


Figure 7.2.2-2: Conducted Emissions Results – Line 2

Table 7.2.2-1: Conducted EMI Results

☒ Line 1 ☒ Line 2 ☐ Line 3 ☐ Line 4 ☐ To Ground ☒ Floating ☐ Telecom Port ☐ dBµV ☐ dBµA Plot Number: <u>13-2168CE06</u> Power Supply Description: <u>5 VDC</u>									
Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
Line 1									
0.150513	30.403	21.866	10.10	40.50	31.96	65.97	55.97	25.5	24.0
0.174749	25.848	18.492	10.09	35.93	28.58	64.73	54.73	28.8	26.2
0.189699	20.854	13.067	10.09	30.94	23.15	64.05	54.05	33.1	30.9
0.204625	25.258	15.86	10.10	35.35	25.96	63.42	53.42	28.1	27.5
0.234475	19.977	14.086	10.10	30.07	24.18	62.29	52.29	32.2	28.1
0.479999	15.002	10.875	10.08	25.08	20.95	56.34	46.34	31.3	25.4
0.831475	12.317	7.872	10.09	22.41	17.97	56.00	46.00	33.6	28.0
2.32397	11.305	6.801	10.18	21.49	16.98	56.00	46.00	34.5	29.0
4.98	10.333	5.947	10.28	20.61	16.23	56.00	46.00	35.4	29.8
Line 2									
0.152825	30.082	22.577	10.08	40.16	32.65	65.85	55.85	25.7	23.2
0.167313	22.539	11.587	10.08	32.62	21.66	65.09	55.09	32.5	33.4
0.182237	25.011	18.123	10.07	35.08	28.19	64.38	54.38	29.3	26.2
0.1997	22.58	12.31	10.07	32.65	22.38	63.62	53.62	31.0	31.2
0.2571	18.75	10.63	10.07	28.82	20.70	61.52	51.52	32.7	30.8
0.5484	15.49	10.02	10.06	25.55	20.08	56.00	46.00	30.5	25.9
1.255	12.25	6.208	10.08	22.33	16.29	56.00	46.00	33.7	29.7

* Note: Results are reported for the EUT configuration leading to the worst case emissions.

7.3 Peak Output Power - FCC Section 15.247(b)(1) IC: RSS-210 A8.4(2)

7.3.1 Measurement Procedure (Conducted Method)

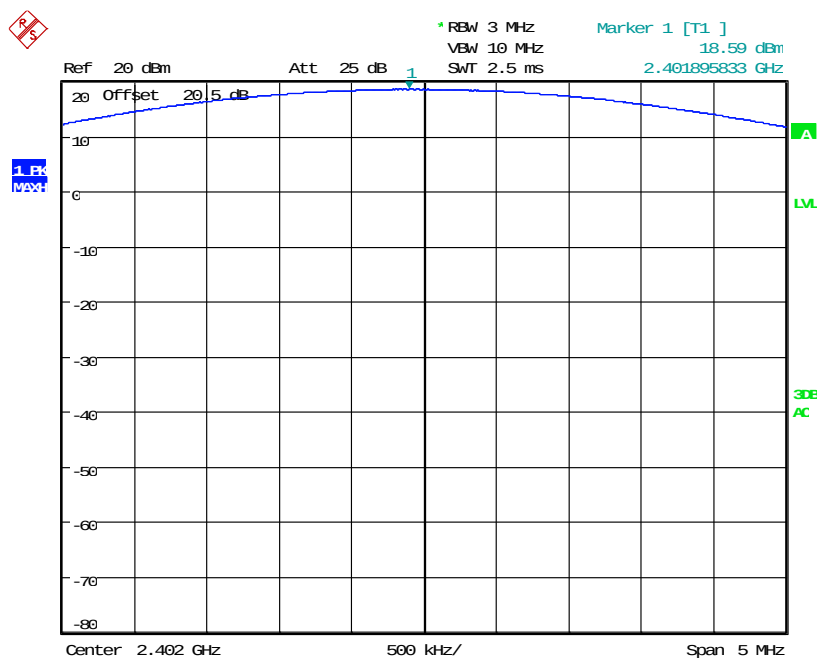
The RF output port of the EUT was directly connected to the input of the spectrum analyzer through suitable attenuation.

7.3.2 Measurement Results

Results are shown below in Table 7.3.2-1 to Table 7.3.2-3 and Figure 7.3.2-1 to Figure 7.3.2-9 below:

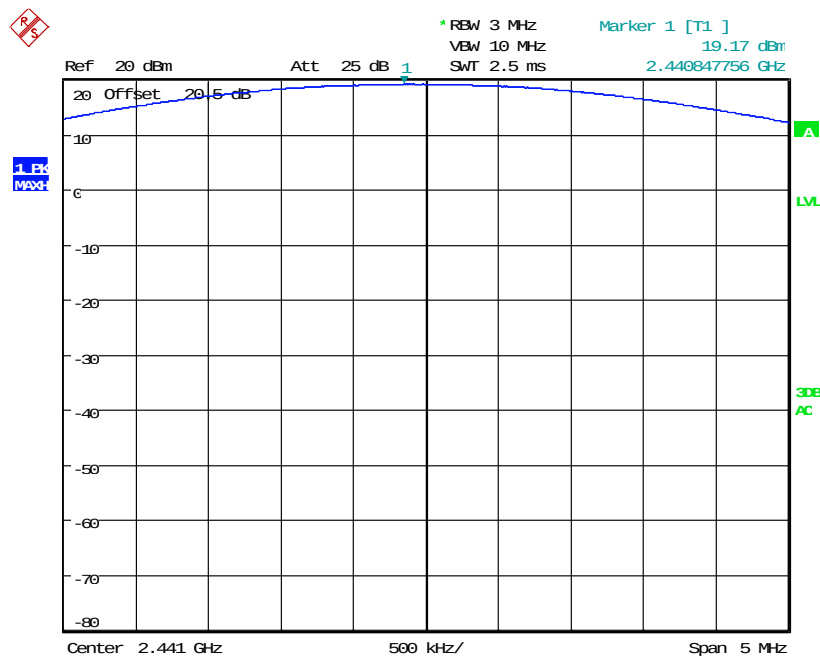
Table 7.3.2-1: RF Output Power (GFSK)

Frequency (MHz)	Power (dBm)
2402	18.59
2441	19.17
2480	18.72



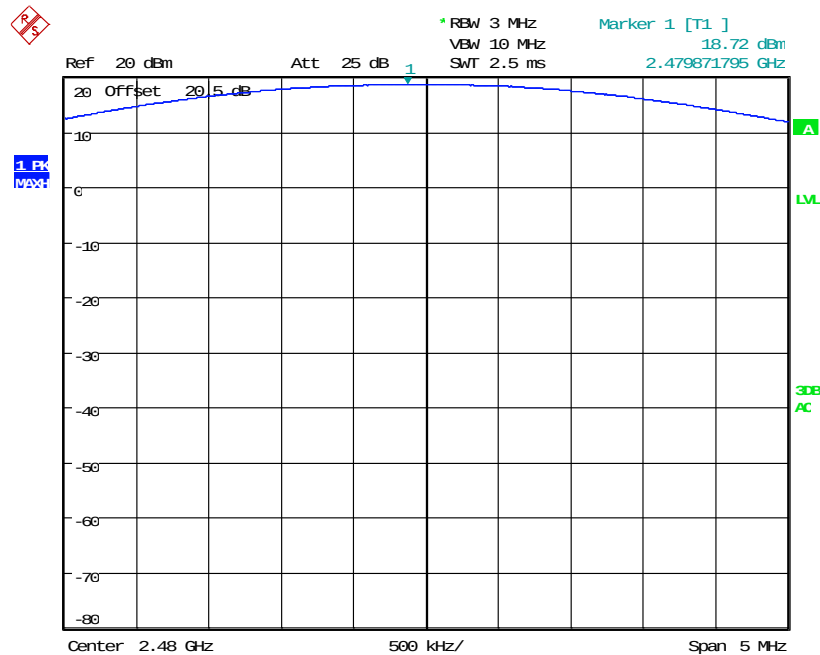
Date: 28.JAN.2014 16:22:44

Figure 7.3.2-1: RF Output Power (GFSK) - Low Channel



Date: 28.JAN.2014 16:21:46

Figure 7.3.2-2: RF Output Power (GFSK) - Middle Channel

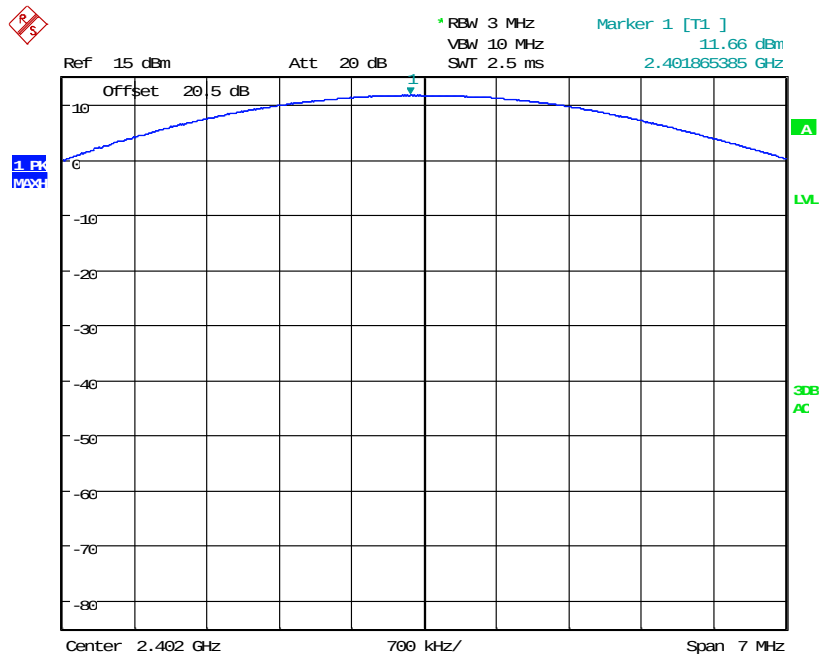


Date: 28.JAN.2014 16:20:14

Figure 7.3.2-3: RF Output Power (GFSK) - High Channel

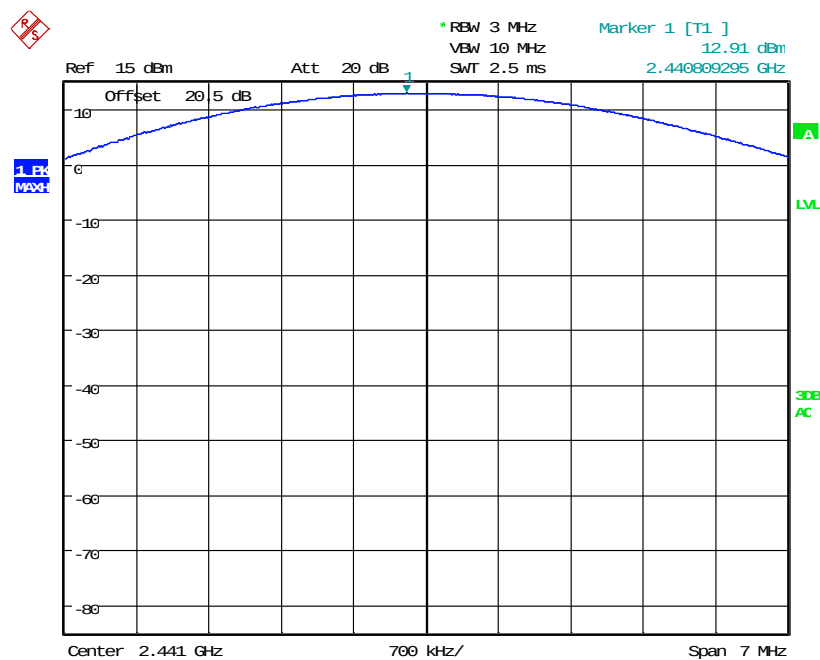
Table 7.3.2-2: RF Output Power ($\pi/4$ DQPSK)

Frequency (MHz)	Power (dBm)
2402	11.66
2441	12.91
2480	12.62

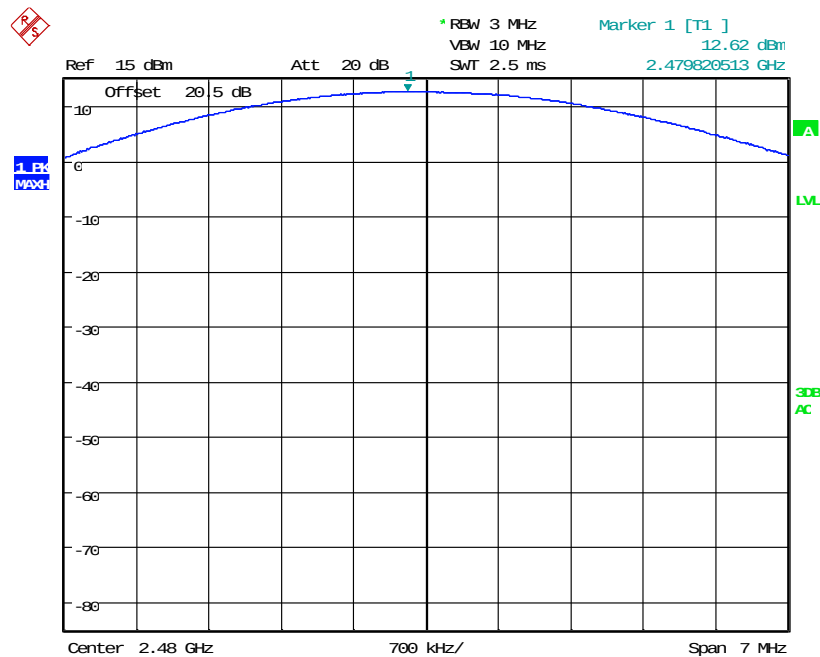


Date: 28.JAN.2014 16:59:19

Figure 7.3.2-4: RF Output Power ($\pi/4$ DQPSK) - Low Channel



Date: 28.JAN.2014 17:00:30

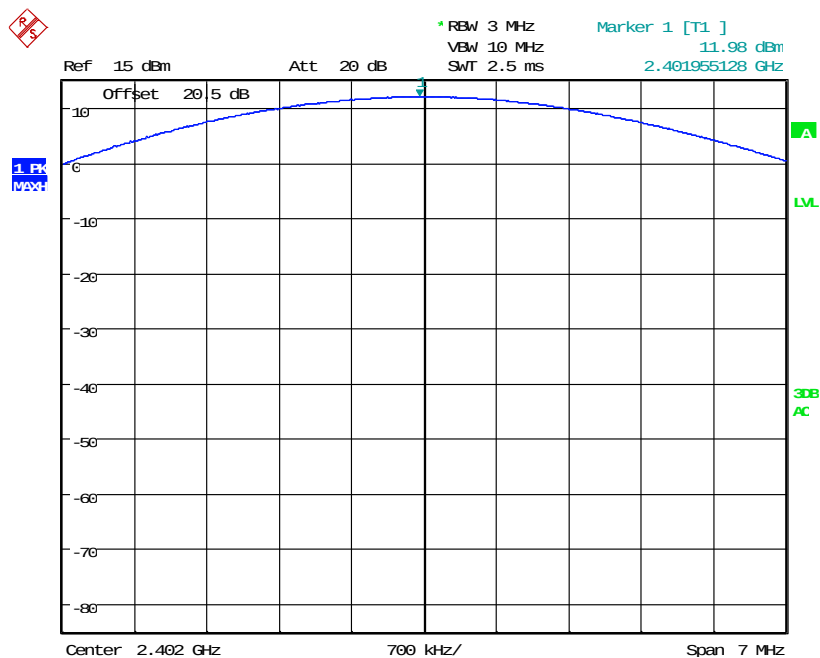
Figure 7.3.2-5: RF Output Power ($\pi/4$ DQPSK) - Middle Channel

Date: 28.JAN.2014 17:01:30

Figure 7.3.2-6: RF Output Power ($\pi/4$ DQPSK) - High Channel

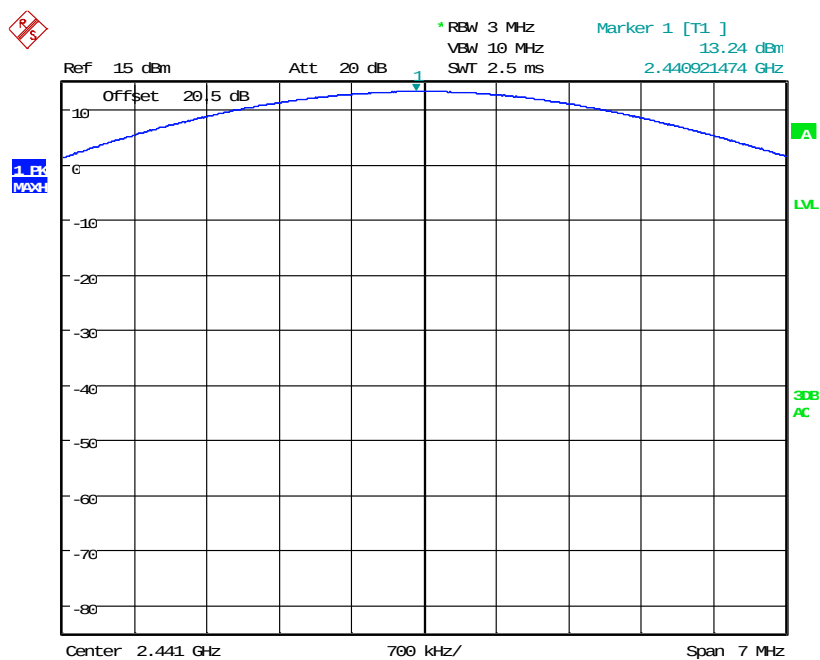
Table 7.3.2-3 RF Output Power (8DPSK)

Frequency (MHz)	Power (dBm)
2402	11.98
2441	13.24
2480	12.90



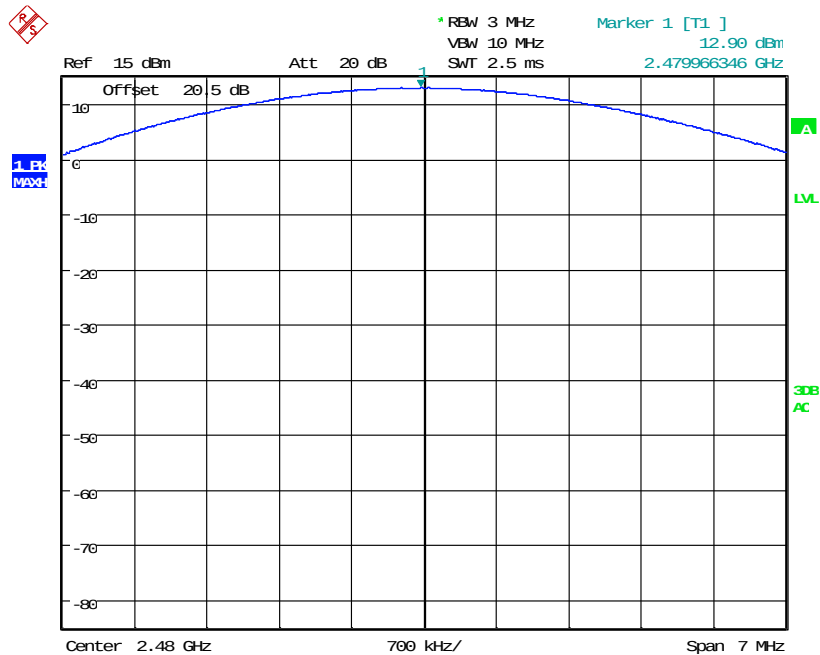
Date: 28.JAN.2014 17:51:45

Figure 7.3.2-7: RF Output Power (8DPSK) - Low Channel



Date: 28.JAN.2014 17:53:13

Figure 7.3.2-8: RF Output Power (8DPSK) - Middle Channel



Date: 28.JAN.2014 17:55:31

Figure 7.3.2-9: RF Output Power (8DPSK) - High Channel

7.4 Channel Usage Requirements

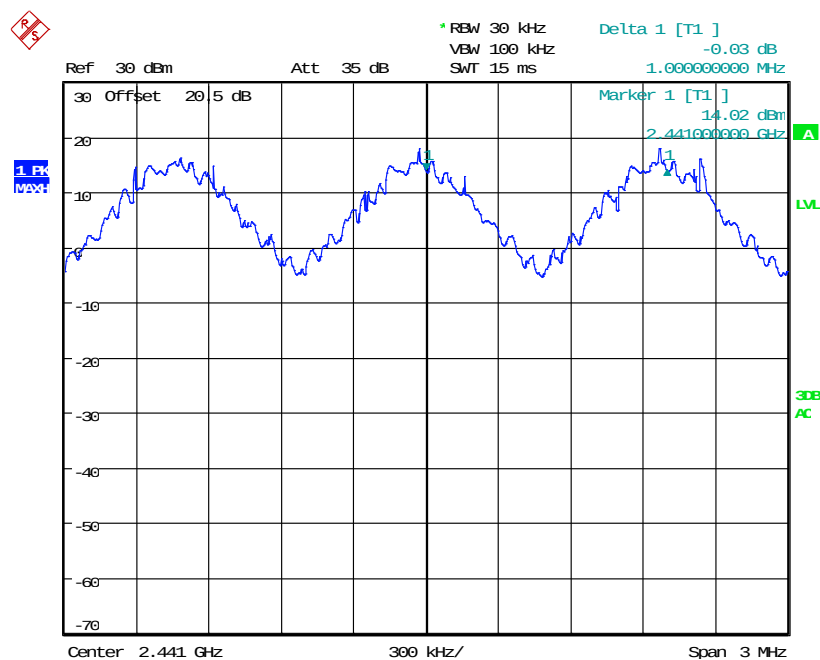
7.4.1 Carrier Frequency Separation – FCC: Section 15.247(a)(1) IC: RSS-210 A8.1(b)

7.4.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set wide enough to capture two adjacent peaks and the RBW and VBW were set to $\geq 1\%$ of the span.

7.4.1.2 Measurement Results

Results are shown below in Figure 7.4.1.2-1.



Date: 30.JAN.2014 14:49:35

Figure 7.4.1.2-1: Carrier Frequency Separation

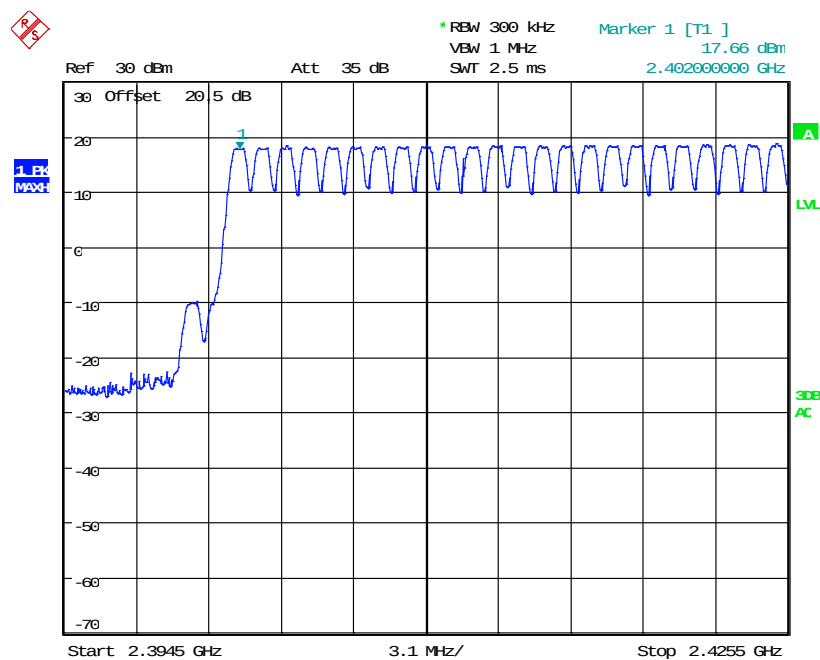
7.4.2 Number of Hopping Channels – FCC: Section 15.247(a)(1)(iii) IC: RSS-210 A8.1(d)

7.4.2.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set wide enough to capture the number of hopping channels. The peak detector max hold function was enabled for the measurements.

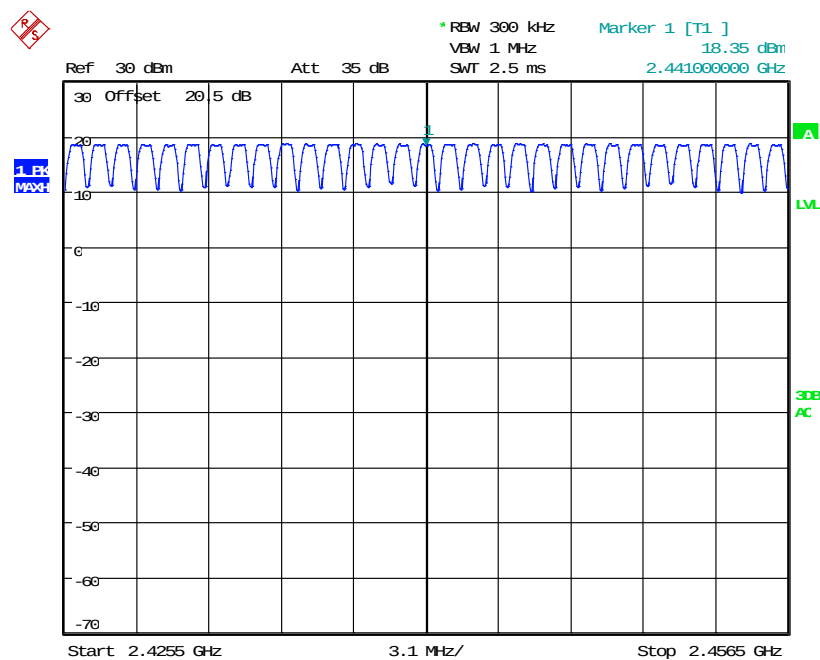
7.4.2.2 Measurement Results

Results are shown below in Figures 7.4.2.2-1 to 7.4.2.2-3.



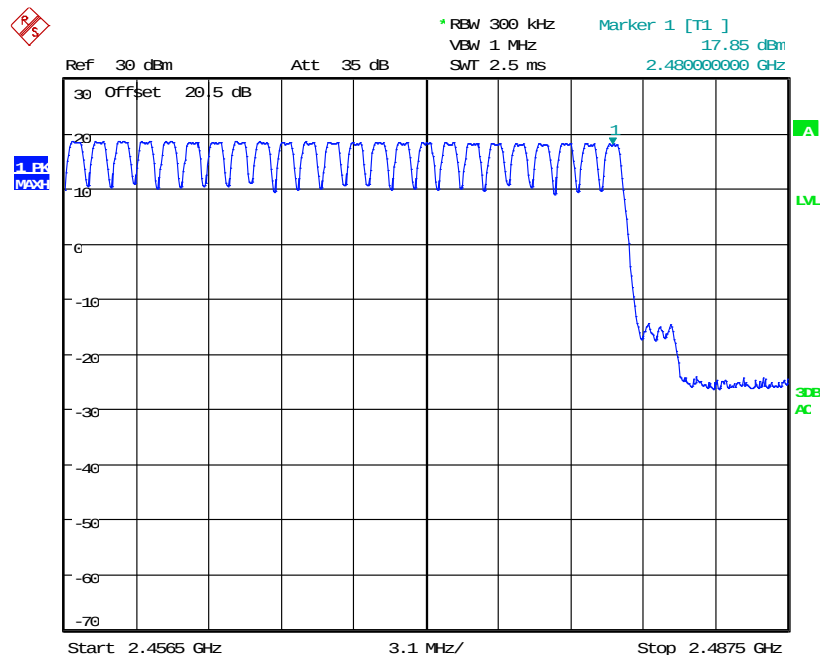
Date: 30.JAN.2014 14:55:41

Figure 7.4.2.2-1: Number of Hopping Channels (1 – 24)



Date: 30.JAN.2014 14:54:22

Figure 7.4.2.2-2: Number of Hopping Channels (25 – 55)



Date: 30.JAN.2014 14:56:43

Figure 7.4.2.2-3: Number of Hopping Channels (56 – 79)

7.4.3 Channel Dwell Time – FCC: Section 15.247(a)(1)(iii) IC: RSS-210 A8.1(d)

7.4.3.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set 0 Hz centered on a hopping channel. The RBW was set to 1 MHz and the sweep time adjusted to capture the entire dwell time per channel with peak detector max hold function.

7.4.3.2 Measurement Results

Results are shown below in Table 7.4.3.2-1 and Figure 7.4.3.2-1 to Figure 7.4.3.2-3

Table 7.4.3.2-1 Dwell Time on a 31.6 Second Cycle

Packet Format	Number of Hops Per Sec. (NHPS)	Number of Hops per Channel Per Sec. (NHPCPS)	Number of hops on a 31.6 s Cycle (NHPC)	Measured Dwell Times (ms)	Dwell Times on a 31.6 s Cycle	Limit (ms)	Status
DH1	800	10.13	320	0.524	167.68	400	PASS
DH3	400	5.06	160	1.778	284.48	400	PASS
DH5	266.67	3.38	106.67	3.028	323.00	400	PASS

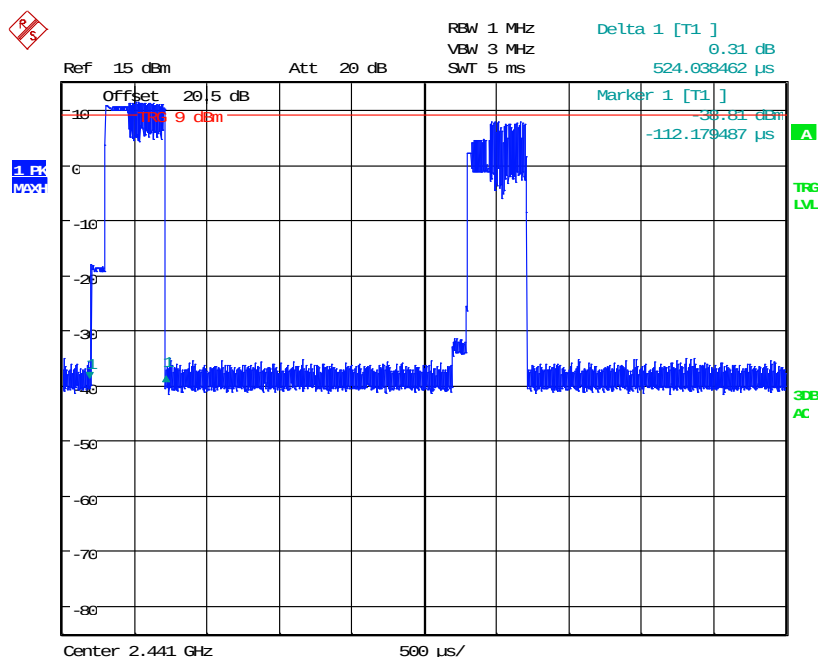
*Notes:

NHPS = (1600 /sec)/ (NT+NR) (where NT and NR are the number of transmit and receive packets, respectively)

NHPCPS = NHPS/79

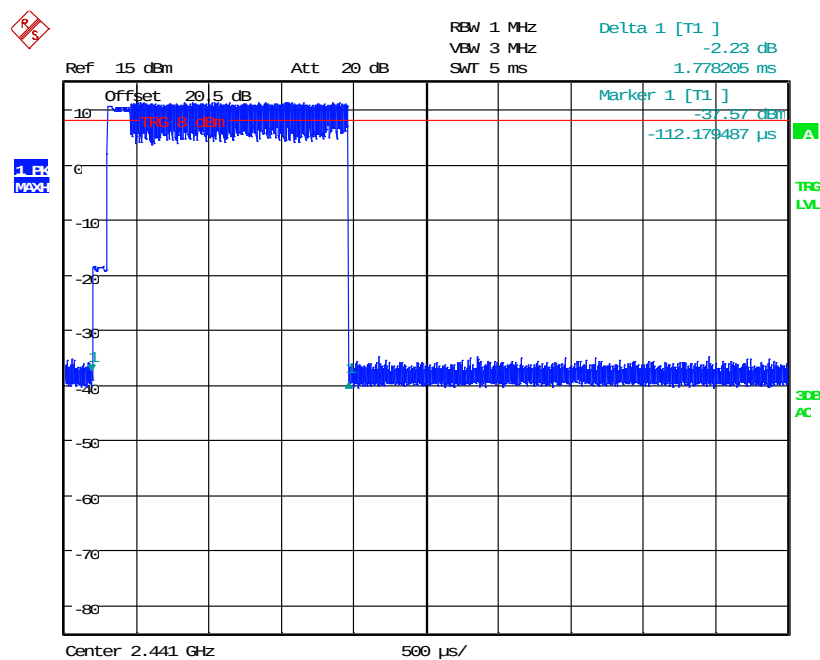
NHPC = NHPCPS * 31.6s

Dwell Time per Cycle = NHPC* Measured Dwell Time



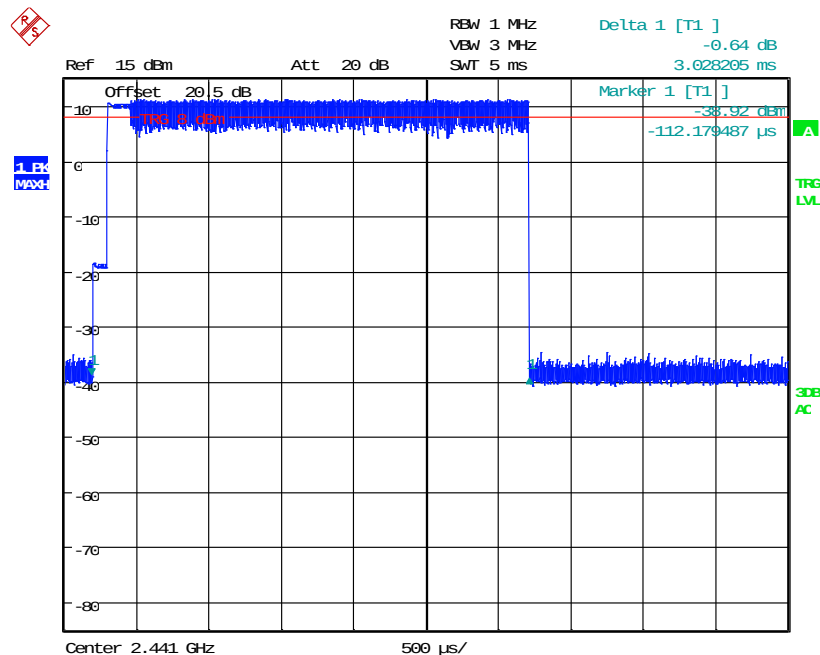
Date: 1.FEB.2014 13:14:15

Figure 7.4.3.2-1: Channel Dwell Time – DH1



Date: 1.FEB.2014 12:45:01

Figure 7.4.3.2-2: Channel Dwell Time – DH3



Date: 1.FEB.2014 12:38:57

Figure 7.4.3.2-3: Channel Dwell Time – DH5

7.4.4 20dB / 99% Bandwidth - FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(a)

7.4.4.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The spectrum analyzer span was set to 2 to 3 times the estimated bandwidth of the emission. The RBW was to $\geq 1\%$ of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

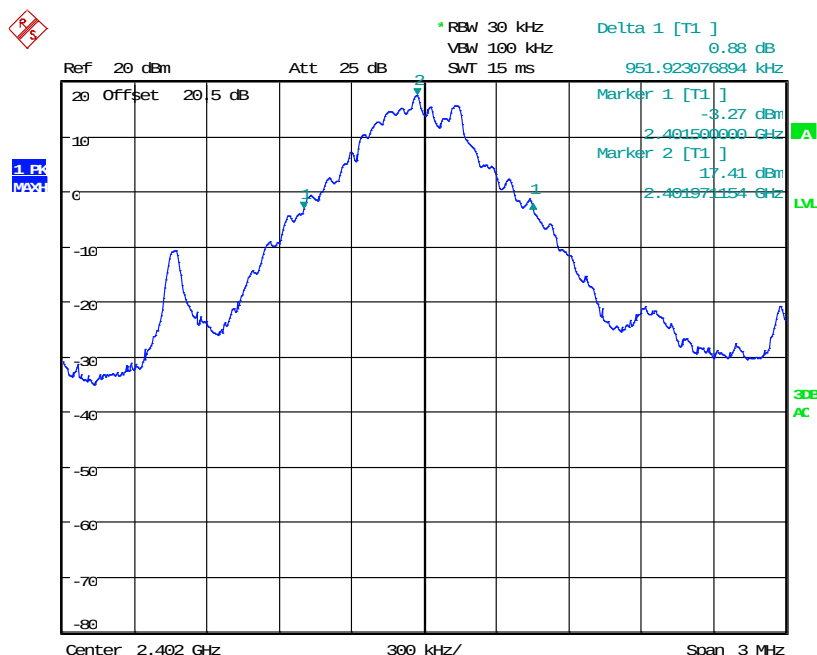
The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission, including the emissions skirts. The RBW was to 1% of the span. . The occupied 99% bandwidth was measured by using a delta marker at the lower and upper frequencies leading to 0.5% of the total power.

7.4.4.2 Measurement Results

Results are shown below:

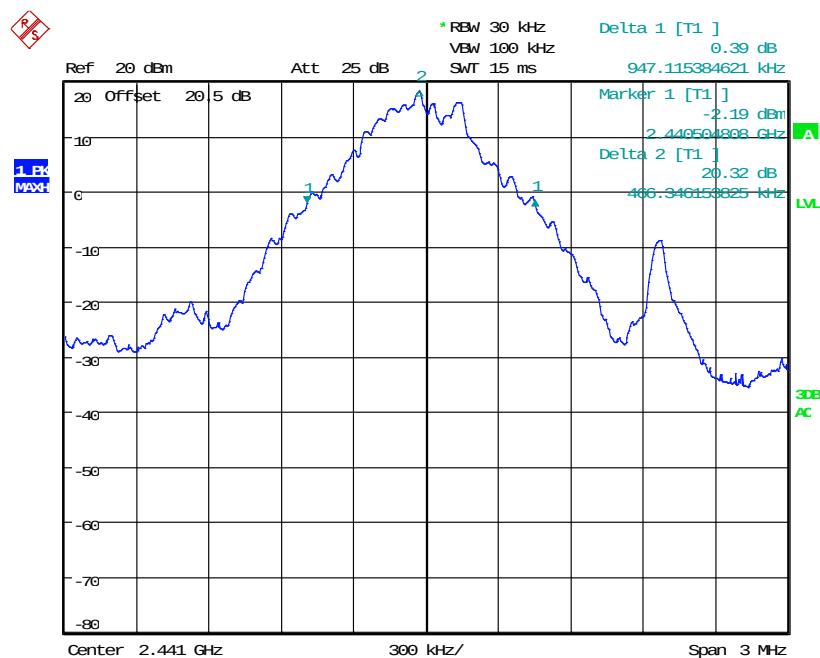
Table 7.4.4.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	951.923	1057.69
2442	947.115	993.590
2480	947.115	993.590



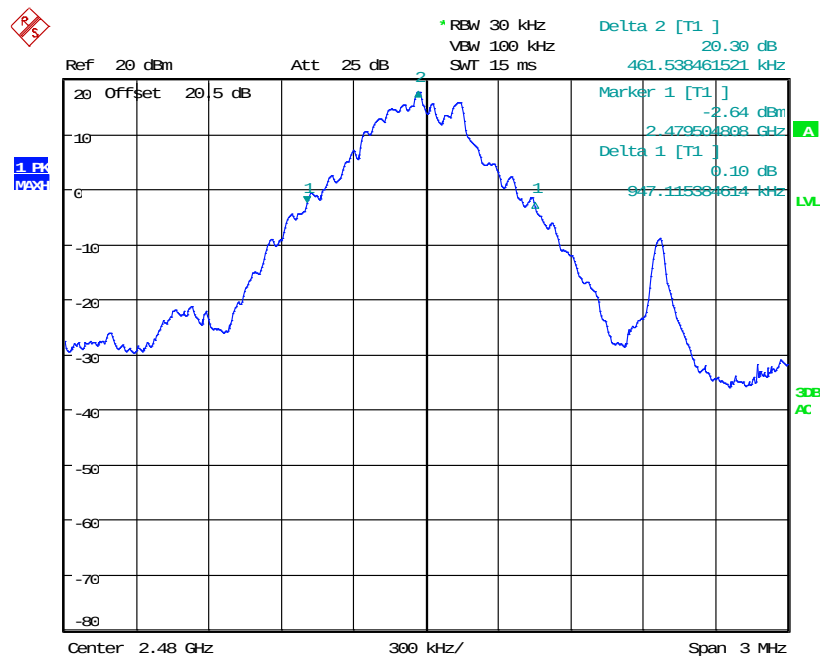
Date: 28.JAN.2014 15:07:18

Figure 7.4.4.2-1: 20dB BW Low Channel (GFSK)



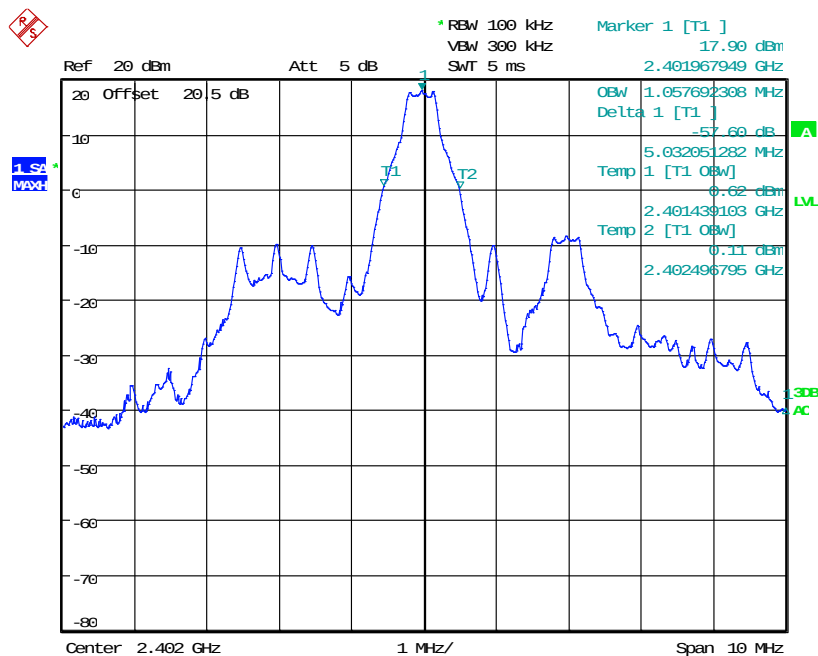
Date: 28.JAN.2014 16:08:54

Figure 7.4.4.2-2: 20dB BW Middle Channel (GFSK)



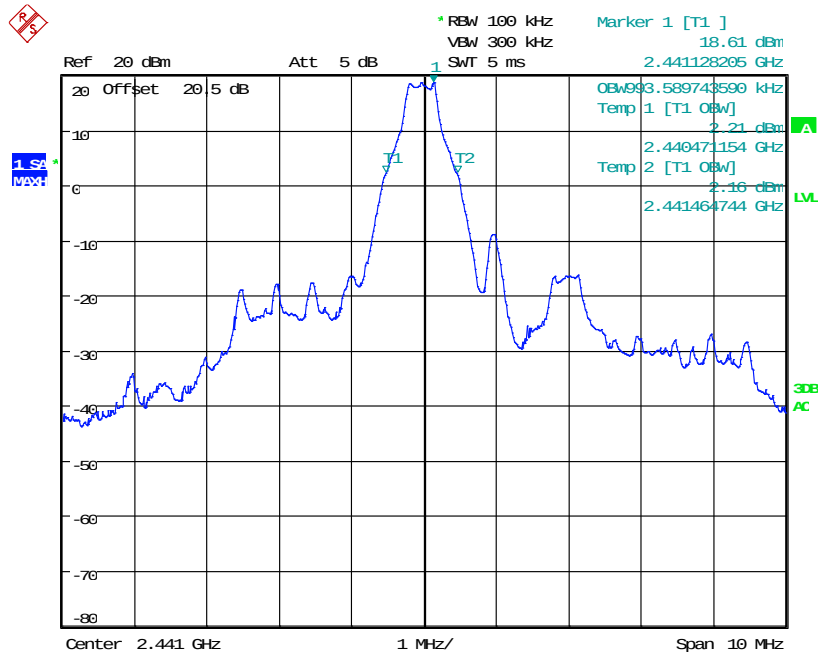
Date: 28.JAN.2014 15:59:26

Figure 7.4.4.2-3: 20dB BW High Channel (GFSK)



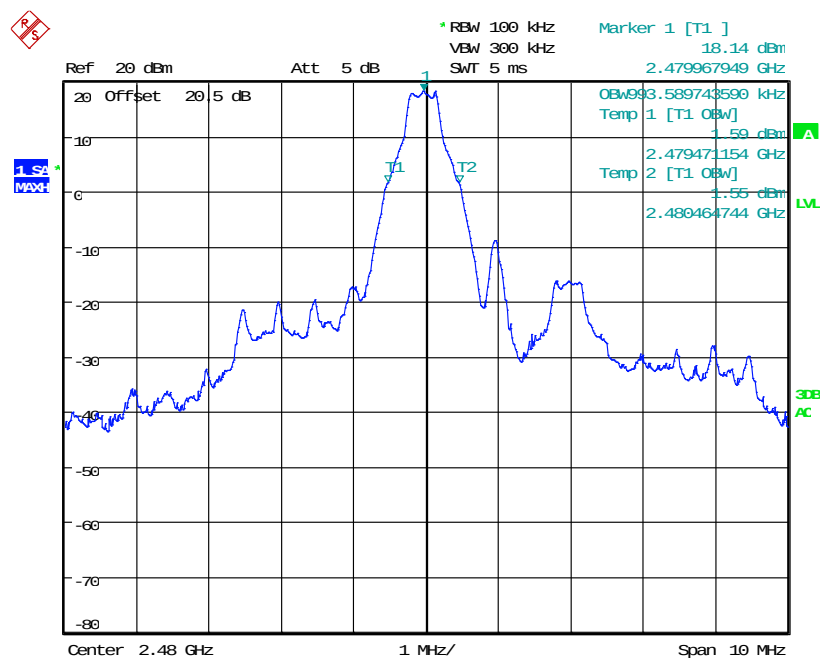
Date: 30.JAN.2014 15:20:57

Figure 7.4.4.2-4: 99% OBW Low Channel (GFSK)



Date: 28.JAN.2014 16:12:36

Figure 7.4.4.2-5: 99% OBW Middle Channel (GFSK)

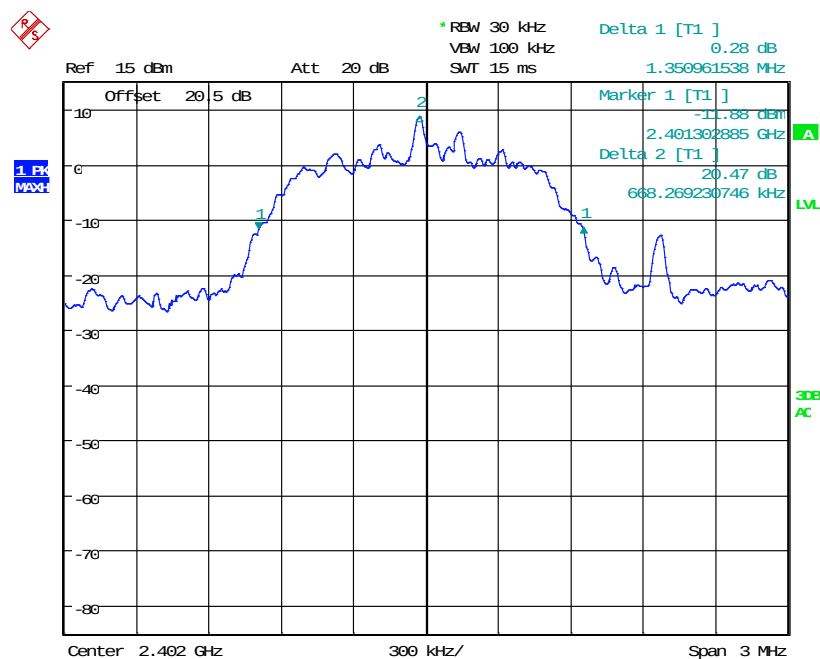


Date: 28.JAN.2014 16:18:08

Figure 7.4.4.2-6: 99% OBW High Channel (GFSK)

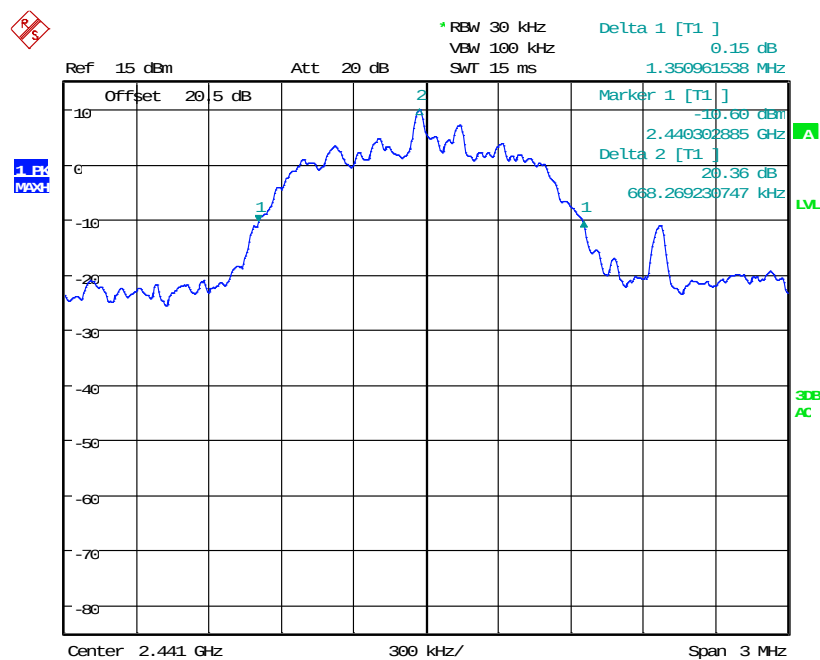
Table 7.4.4.2-2: 20dB / 99% Bandwidth ($\pi/4$ DQPSK)

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	1350.96	1426.28
2441	1350.96	1474.36
2480	1341.35	1442.31

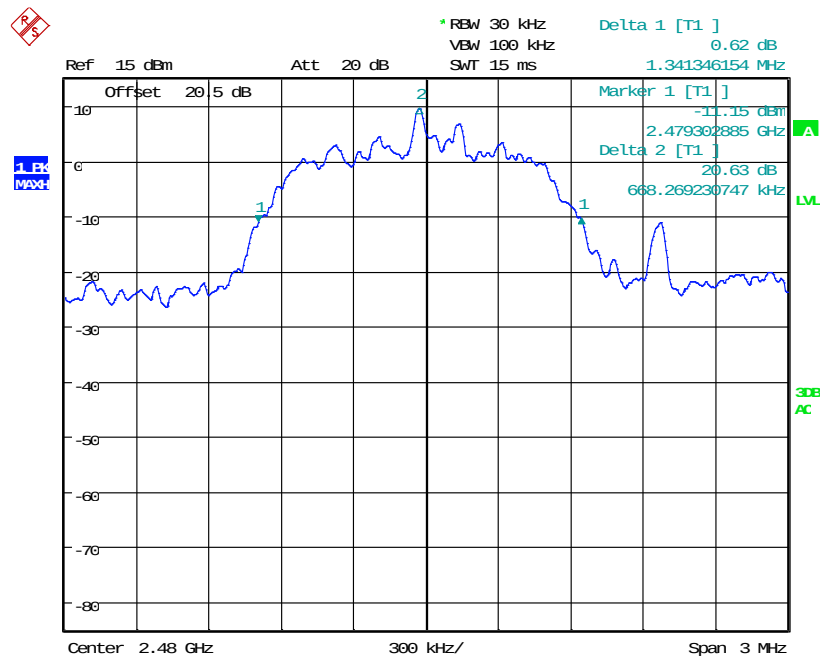


Date: 28.JAN.2014 16:56:55

Figure 7.4.4.2-7: 20dB BW Low Channel ($\pi/4$ DQPSK)

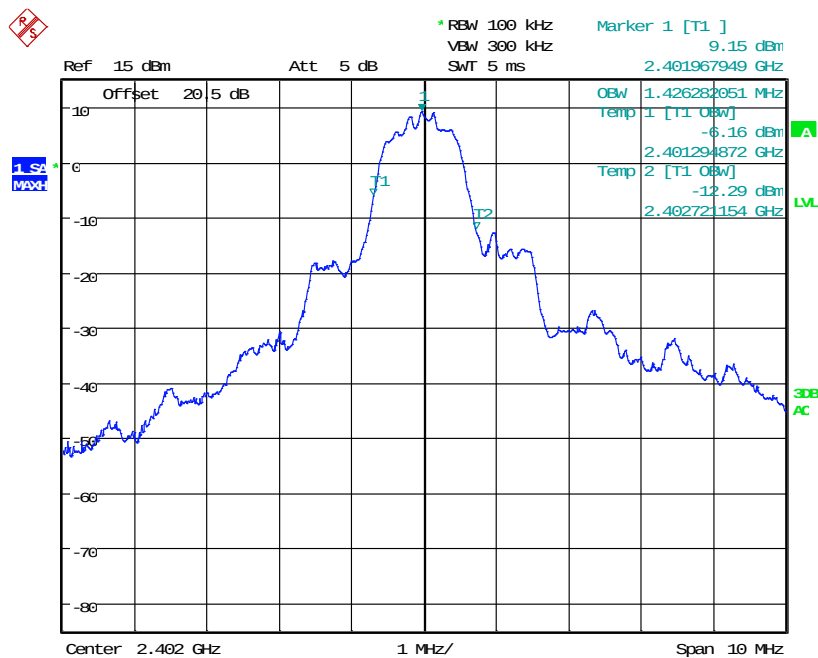


Date: 28.JAN.2014 16:54:09

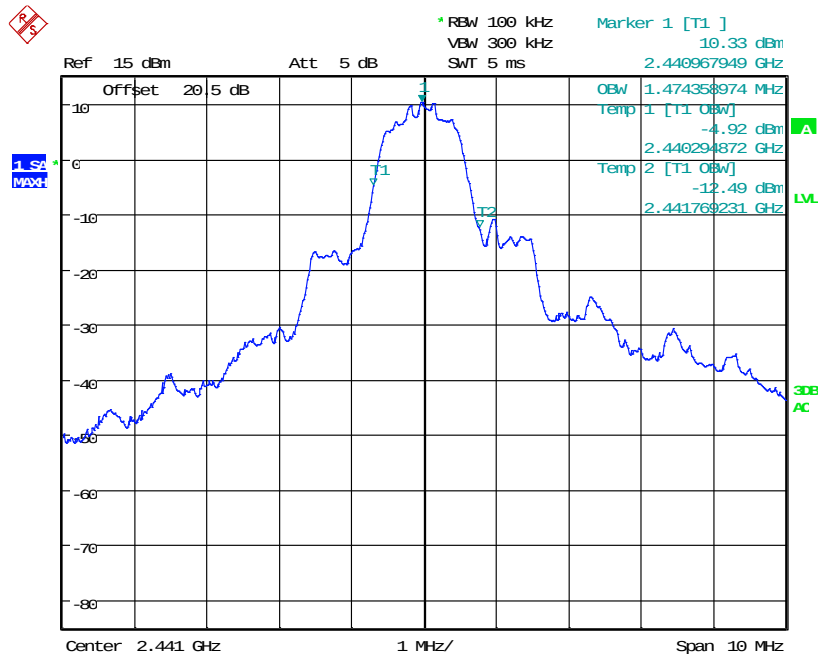
Figure 7.4.4.2-8: 20dB BW Middle Channel ($\pi/4$ DQPSK)

Date: 28.JAN.2014 16:46:22

Figure 7.4.4.2-9: 20dB BW High Channel ($\pi/4$ DQPSK)

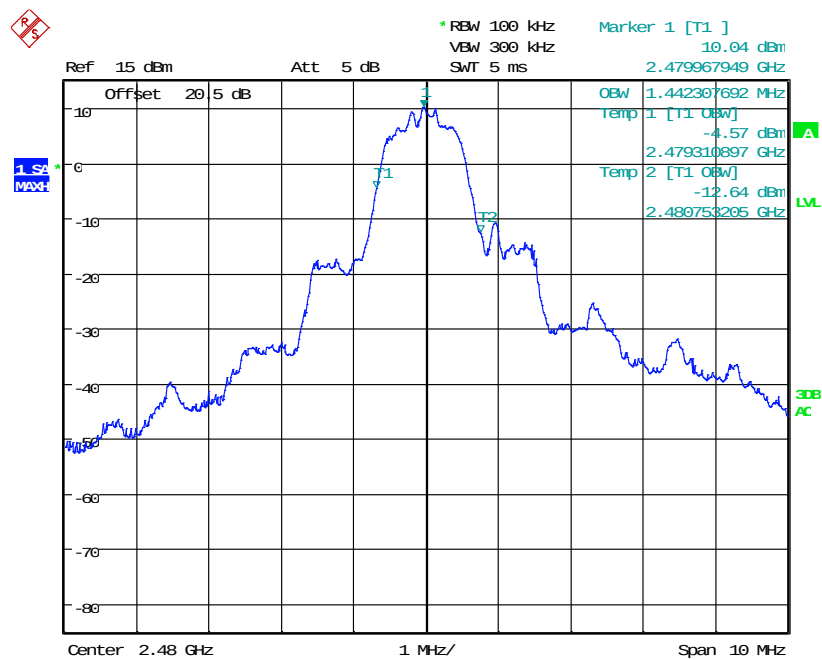


Date: 28.JAN.2014 17:08:15

Figure 7.4.4.2-10: 99% OBW Low Channel ($\pi/4$ DQPSK)

Date: 28.JAN.2014 17:13:25

Figure 7.4.4.2-11: 99% OBW Middle Channel ($\pi/4$ DQPSK)

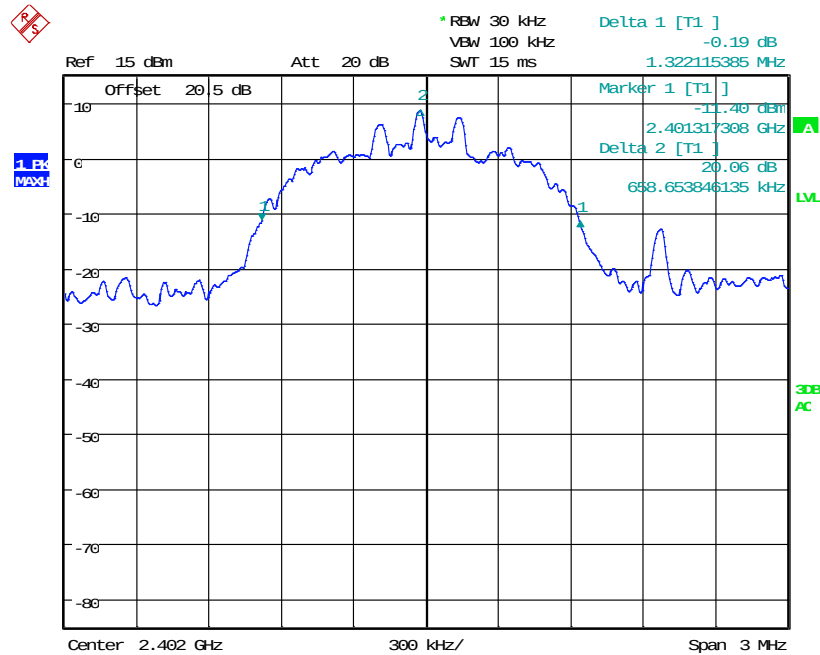


Date: 28.JAN.2014 17:15:34

Figure 7.4.4.2-12: 99% OBW High Channel ($\pi/4$ DQPSK)

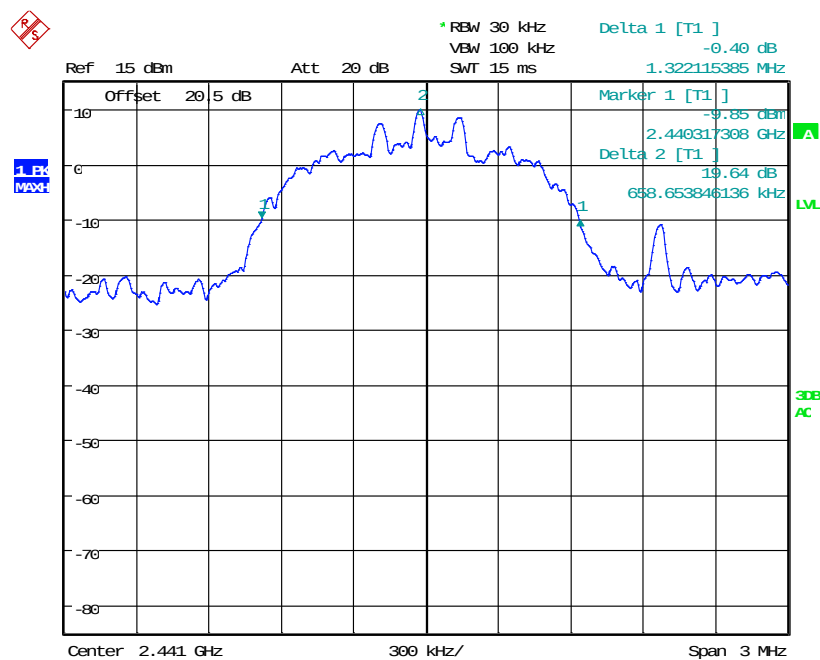
Table 7.4.4.2-3: 20dB / 99% Bandwidth (8DPSK)

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	1322.12	1458.33
2441	1322.12	1506.41
2480	1326.92	1410.26



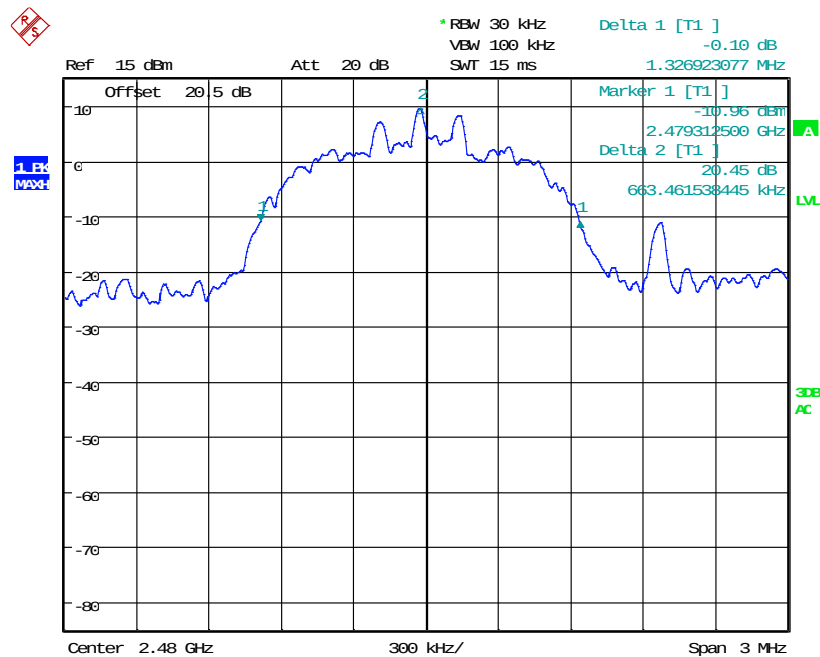
Date: 28.JAN.2014 17:40:19

Figure 7.4.4.2-13: 20dB BW Low Channel (8DPSK)



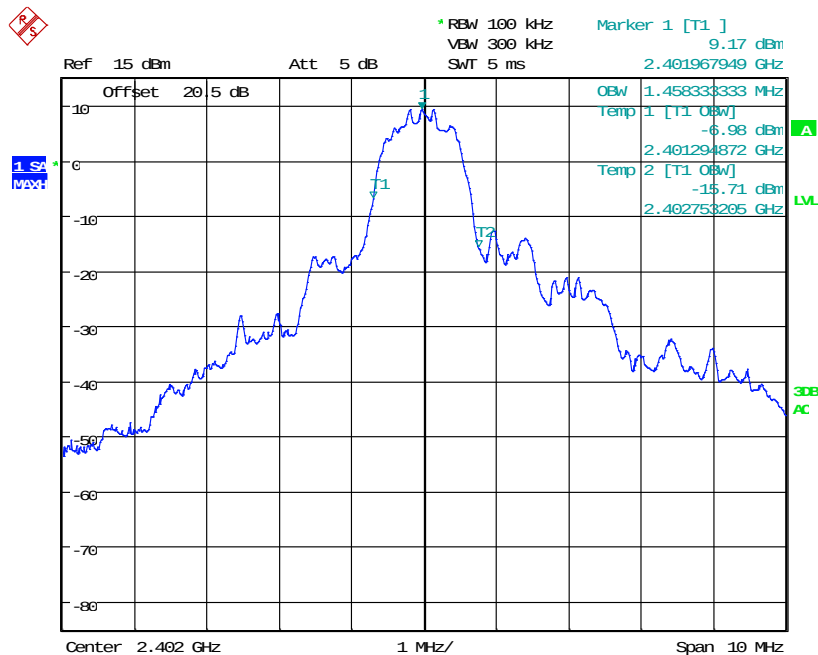
Date: 28.JAN.2014 17:43:57

Figure 7.4.4.2-14: 20dB BW Middle Channel (8DPSK)



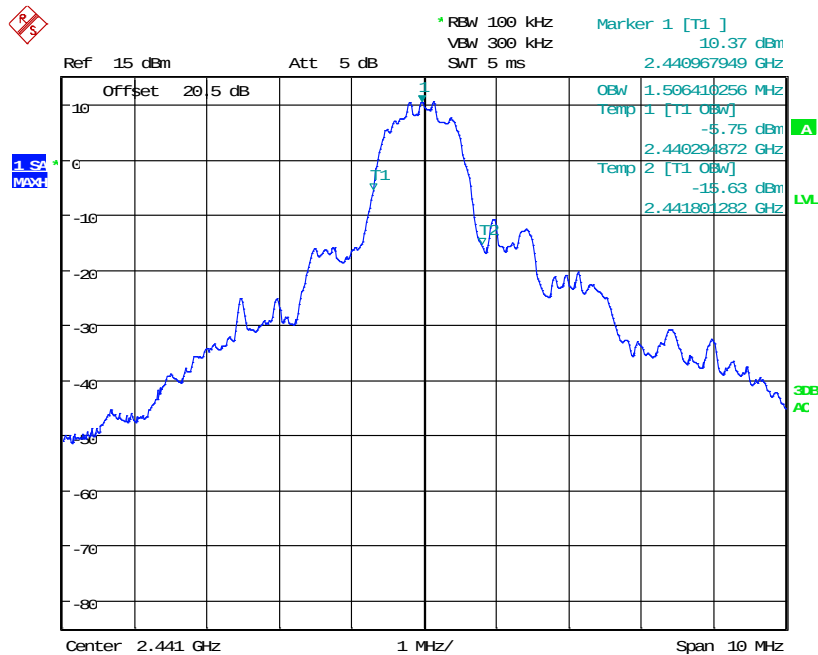
Date: 28.JAN.2014 17:48:25

Figure 7.4.4.2-15: 20dB BW High Channel (8DPSK)



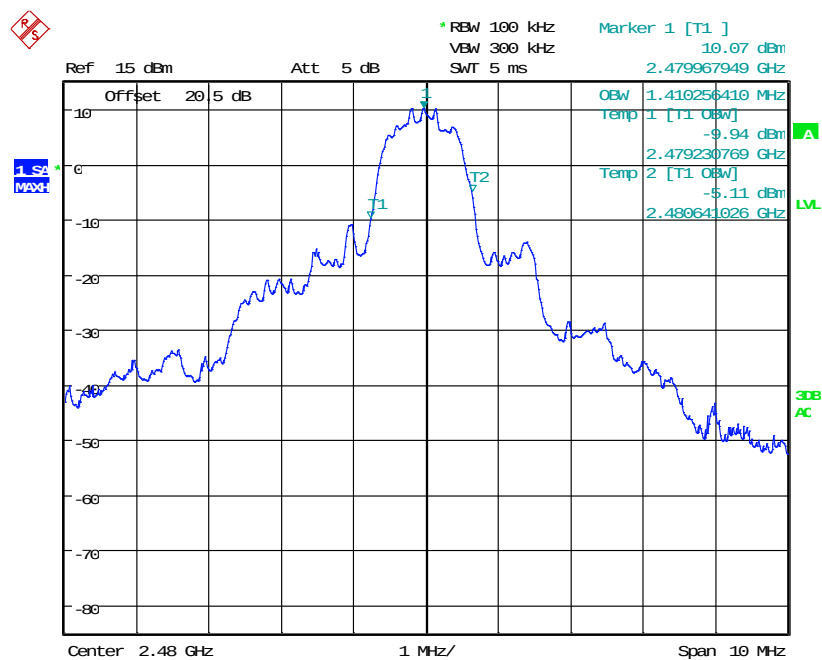
Date: 28.JAN.2014 17:36:25

Figure 7.4.4.2-16: 99% OBW Low Channel (8DPSK)



Date: 28.JAN.2014 17:33:03

Figure 7.4.4.2-17: 99% OBW Middle Channel (8DPSK)



Date: 28.JAN.2014 17:28:18

Figure 7.4.4.2-18: 99% OBW High Channel (8DPSK)

7.5 Band-Edge Compliance and Spurious Emissions-FCC 15.247(d) IC: RSS-210 A8.5

7.5.1 Band-Edge Compliance of RF Conducted Emissions

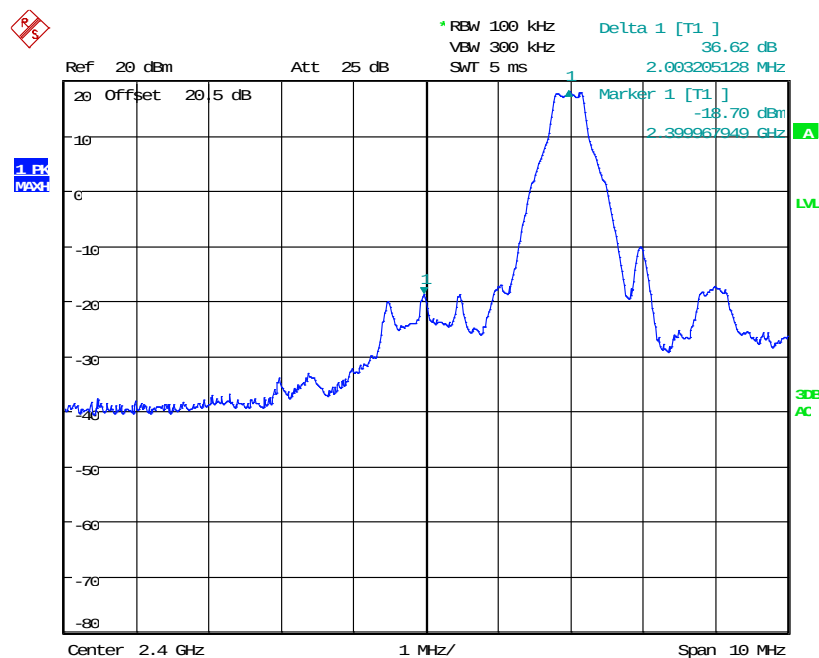
7.5.1.1 Measurement Procedure

The RF output port of the EUT was connected to the input of the spectrum analyzer through suitable attenuation. The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to 100 kHz, which is $\geq 1\%$ of the span, and the VBW was set to ≥ 300 kHz.

7.5.1.2 Measurement Results

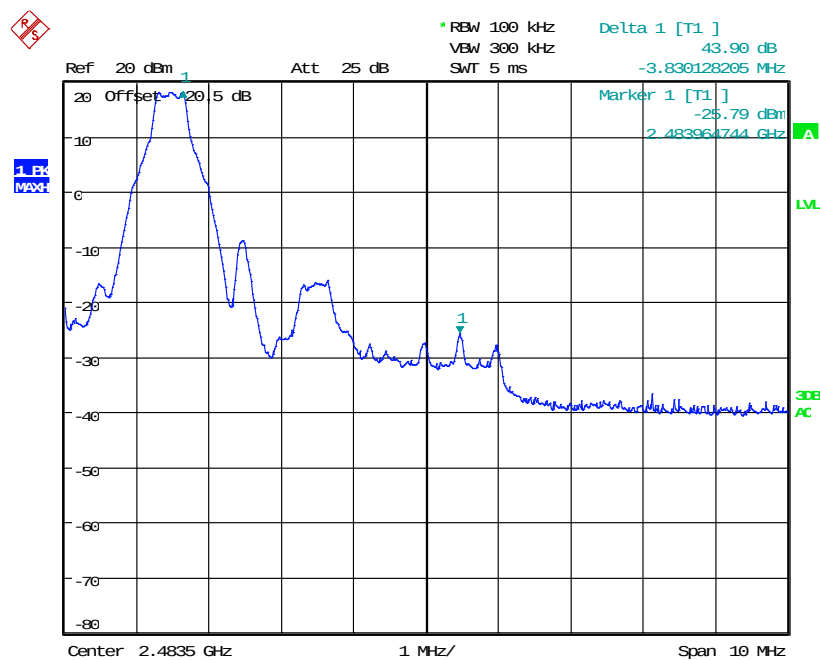
Table 7.5.1.2-1: Conducted Band Edge - GFSK

	Measured Delta (dB)		Requirements	Band Edge	
	Single TX	Hopping Mode		Single TX	Hopping Mode
Lower Band-Edge	36.62	29.47	> 20 dB	Passed	Passed
Upper Band-Edge	43.9	48.46	>20dB	Passed	Passed



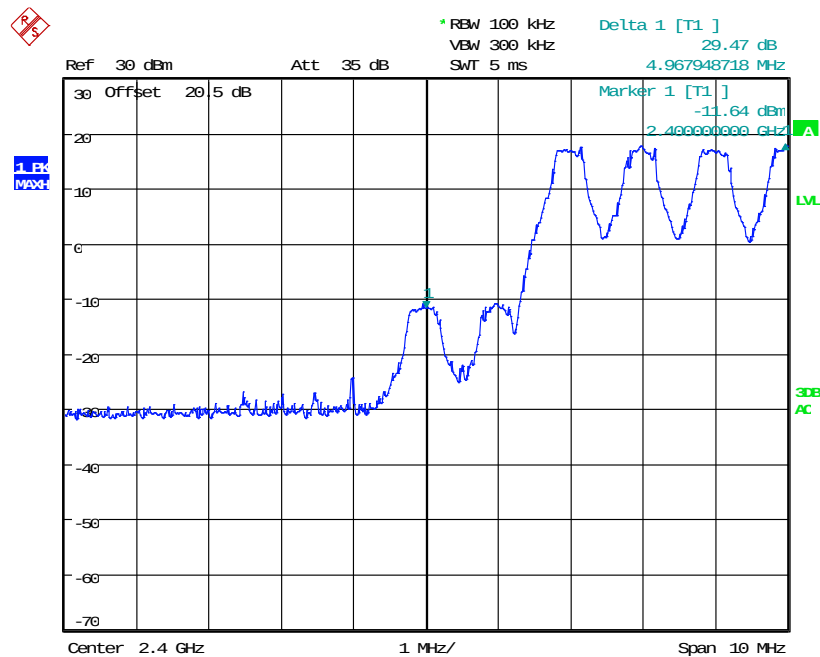
Date: 28.JAN.2014 16:25:08

Figure 7.5.1.2-1: Lower Band-edge (GFSK)



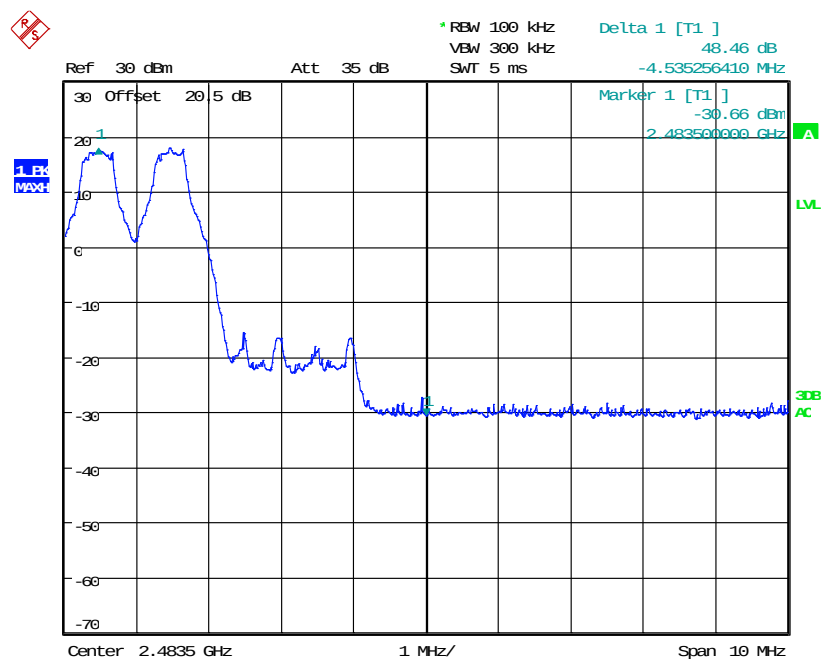
Date: 28.JAN.2014 16:27:02

Figure 7.5.1.2-2: Upper Band-edge (GFSK)



Date: 30.JAN.2014 15:11:48

Figure 7.5.1.2-3: Lower Band-edge - Hopping Mode (GFSK)

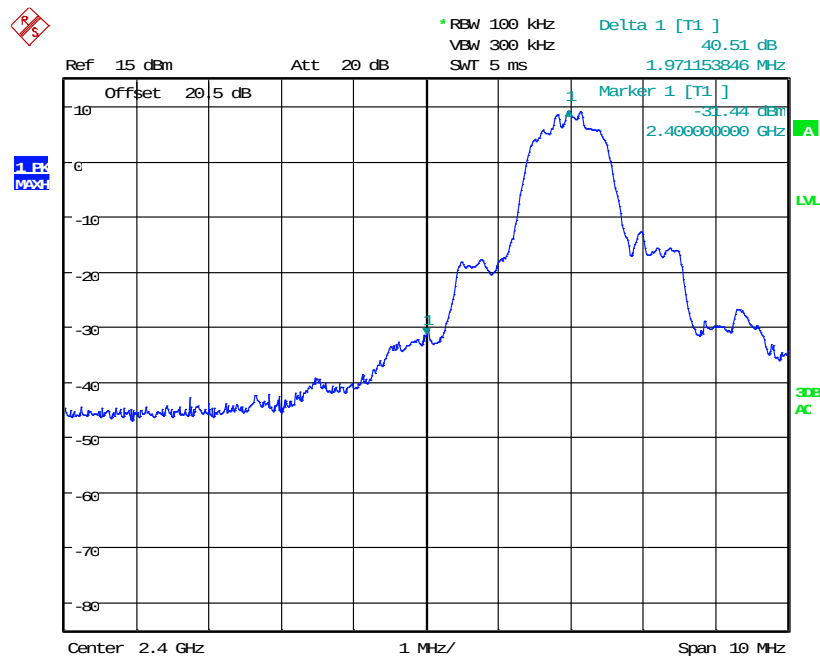


Date: 30.JAN.2014 15:13:37

Figure 7.5.1.2-4: Upper Band-edge – Hopping Mode (GFSK)

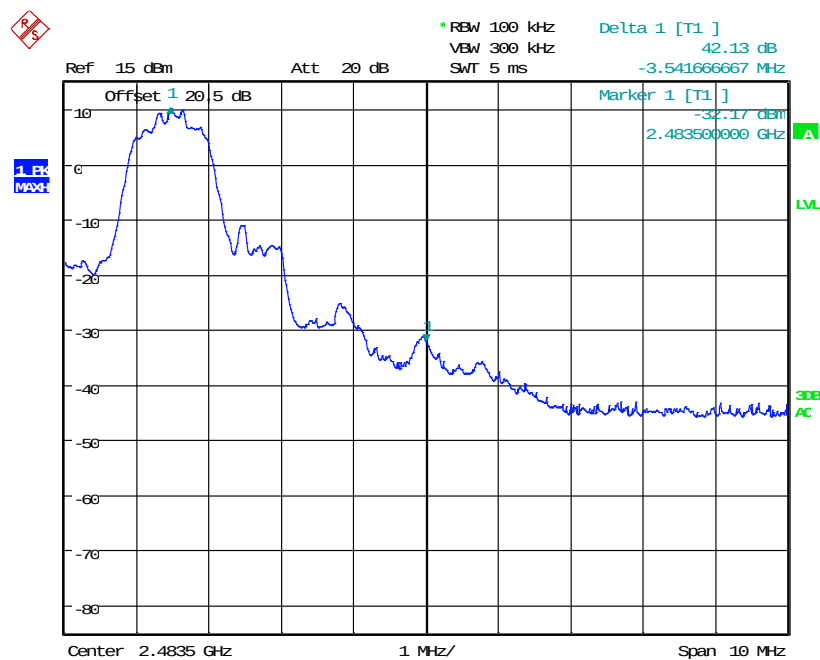
Table 7.5.1.2-2: Conducted Band Edge - $\pi/4$ DQPSK

	Measured Delta (dB)		Requirements	Band Edge	
	Single TX	Hopping Mode		Single TX	Hopping Mode
Lower Band-Edge	40.51	38.41	> 20 dB	Passed	Passed
Upper Band-Edge	42.13	41.71	> 20 dB	Passed	Passed

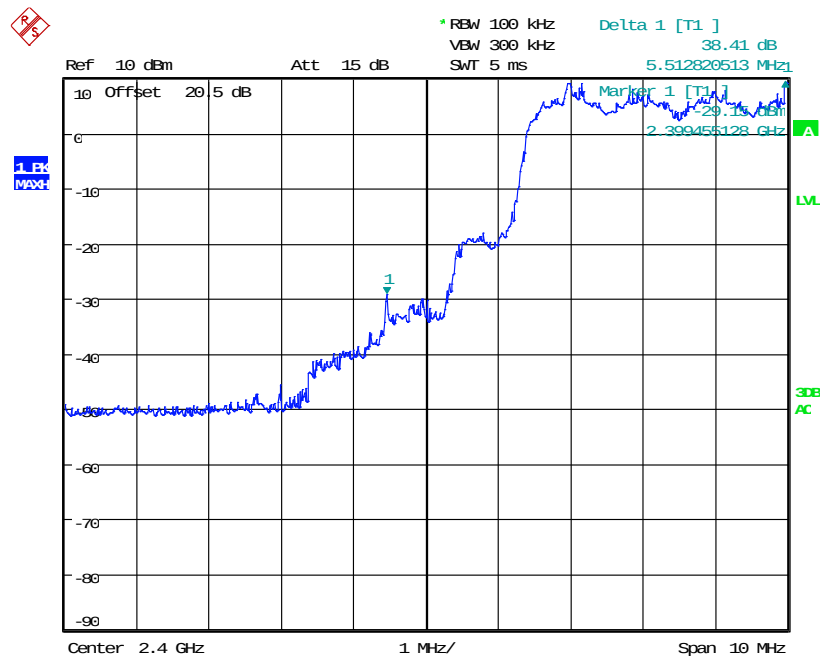


Date: 28.JAN.2014 17:04:31

Figure 7.5.1.2-5: Lower Band-edge ($\pi/4$ DQPSK)

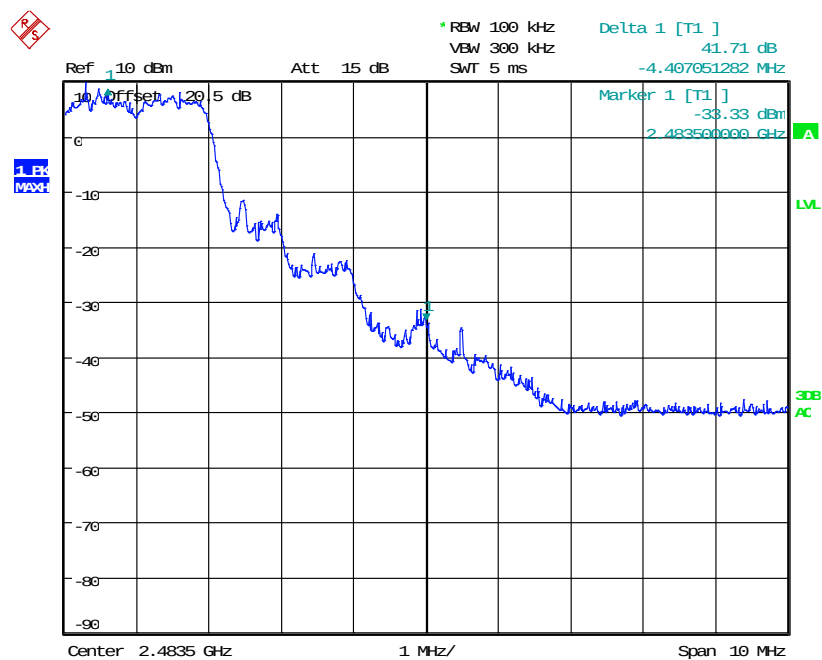


Date: 28.JAN.2014 17:03:09

Figure 7.5.1.2-6: Upper Band-edge ($\pi/4$ DQPSK)

Date: 30.JAN.2014 21:18:47

Figure 7.5.1.2-7: Lower Band-edge - Hopping Mode ($\pi/4$ DQPSK)

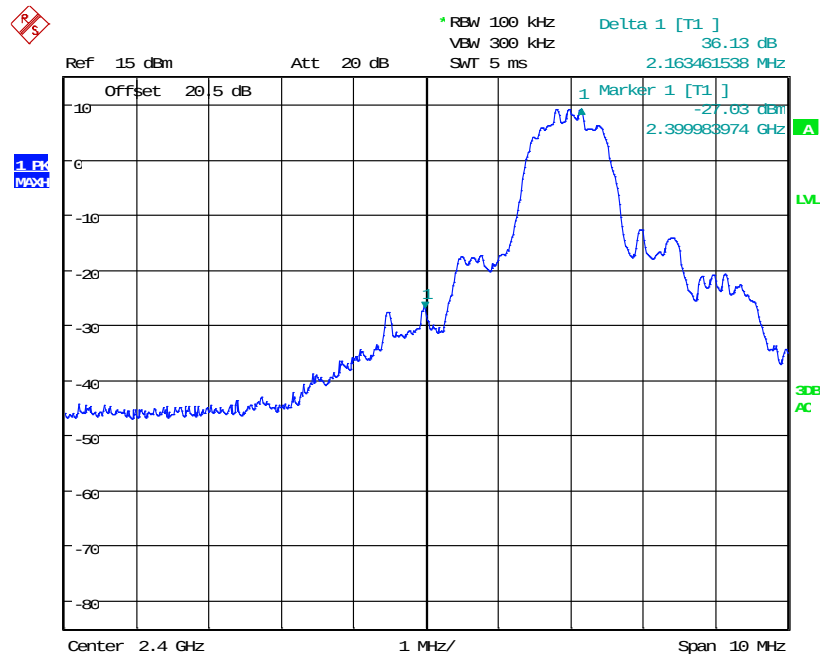


Date: 30.JAN.2014 21:20:49

Figure 7.5.1.2-8: Upper Band-edge – Hopping Mode ($\pi/4$ DQPSK)

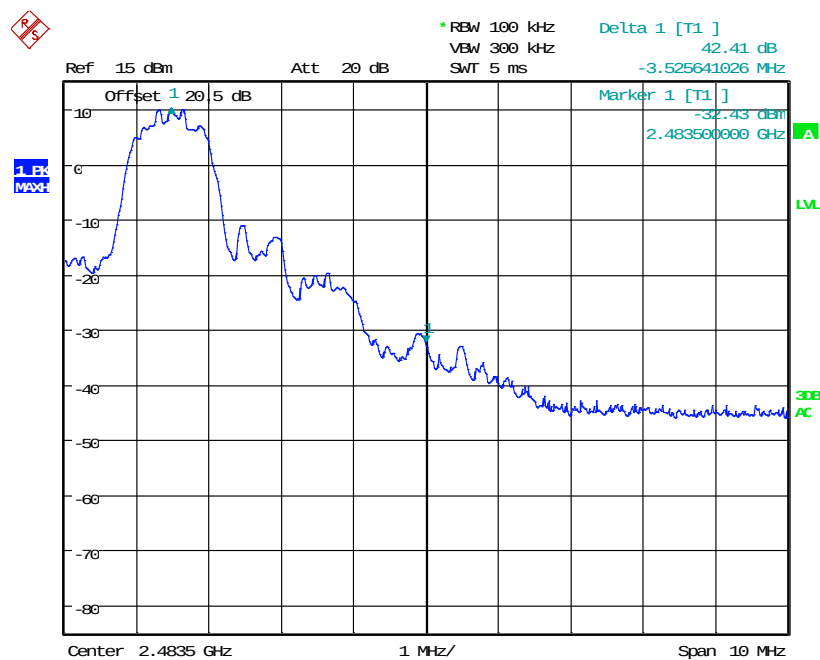
Table 7.5.1.2-3: Conducted Band Edge – 8DPSK

	Measured Delta (dB)		Requirements	Band Edge	
	Single TX	Hopping Mode		Single TX	Hopping Mode
Lower Band-Edge	36.13	37.10	> 20 dB	Passed	Passed
Upper Band-Edge	42.41	42.66	> 20 dB	Passed	Passed



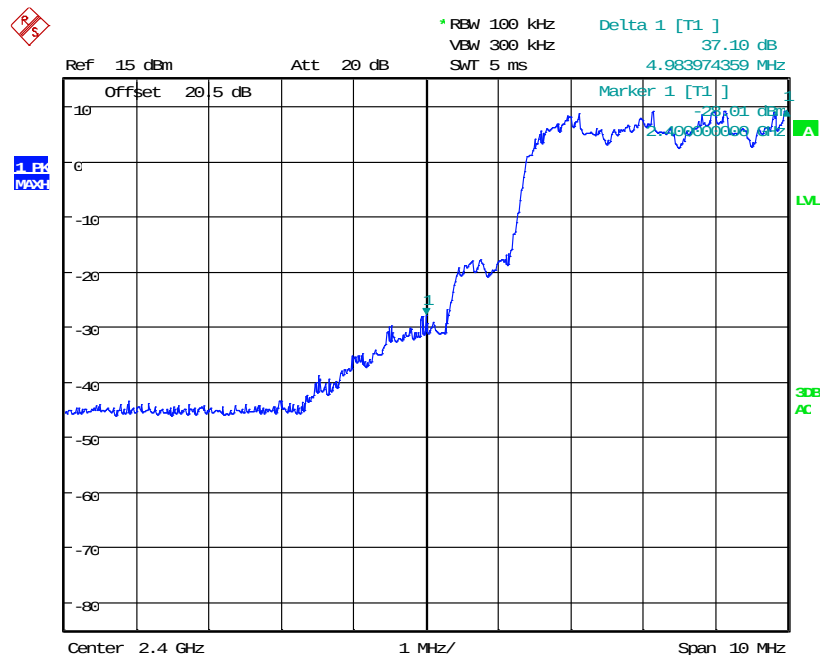
Date: 28.JAN.2014 17:50:50

Figure 7.5.1.2-9: Lower Band-edge (8DPSK)



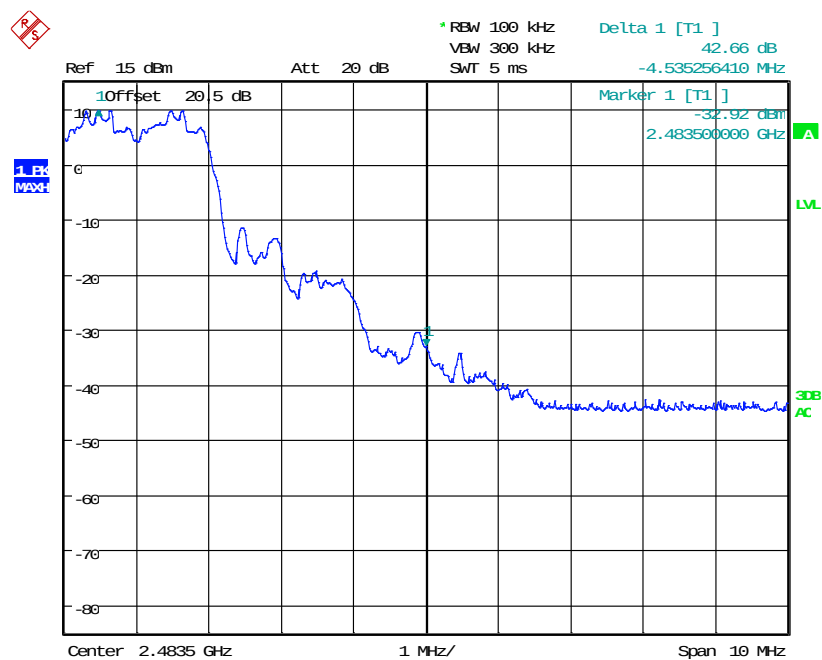
Date: 28.JAN.2014 17:49:36

Figure 7.5.1.2-10: Upper Band-edge (8DPSK)



Date: 1.FEB.2014 11:19:12

Figure 7.5.1.2-11: Lower Band-edge – Hopping Mode (8DPSK)



Date: 1.FEB.2014 11:39:37

Figure 7.5.1.2-12: Upper Band-edge – Hopping Mode (8DPSK)

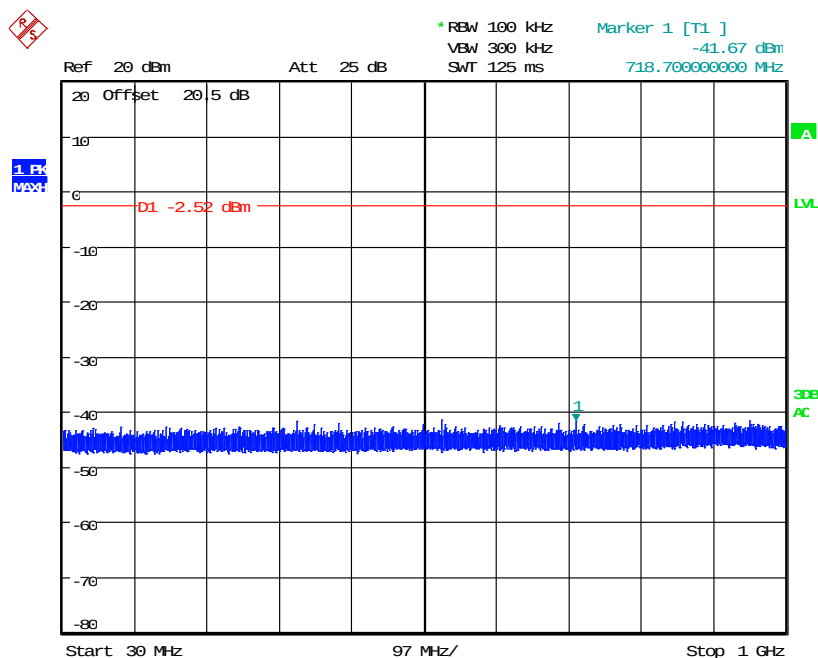
7.5.2 RF Conducted Spurious Emissions

7.5.2.1 Measurement Procedure

The RF output port of the EUT was connected to the spectrum analyzer. The EUT was investigated for conducted spurious emissions from 30MHz to 26 GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's RBW was set to 100 kHz. A peak detector function was used with the trace set to max hold. The levels were corrected for cable and attenuator losses.

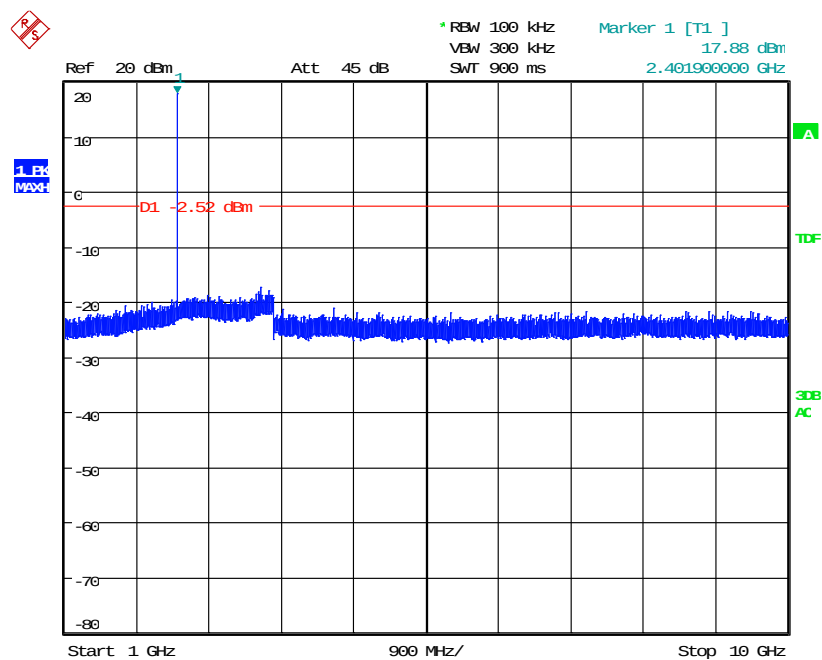
7.5.2.2 Measurement Results

Results are shown below:



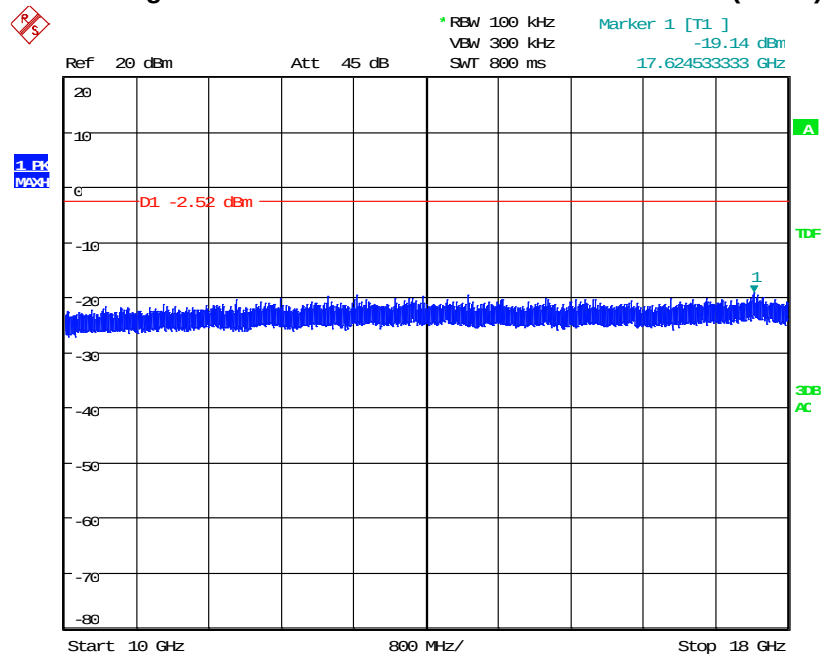
Date: 30.JAN.2014 18:14:20

Figure 7.5.2.2-1: 30 MHz – 1 GHz – Low Channel (GFSK)



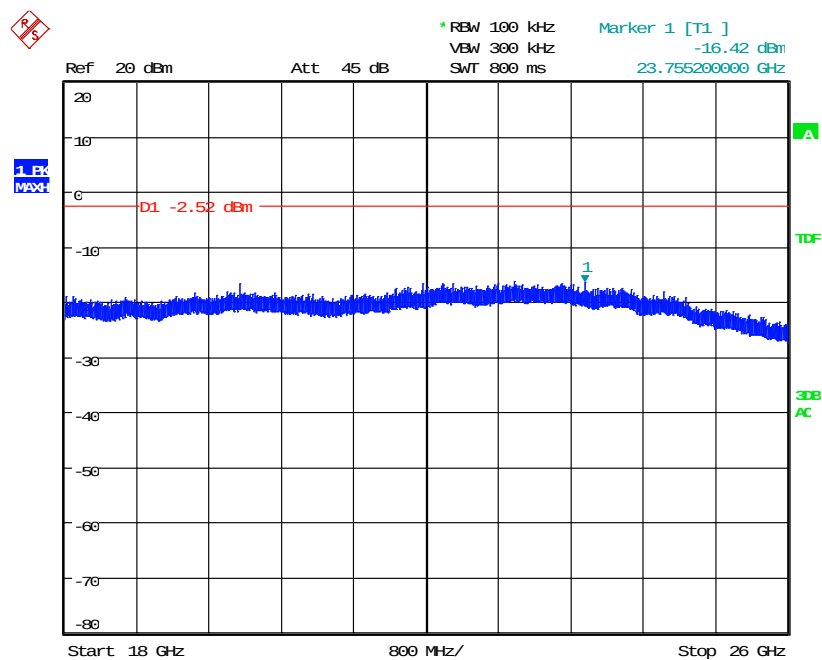
Date: 30.JAN.2014 15:52:23

Figure 7.5.2.2-2: 1 GHz –10 GHz – Low Channel (GFSK)



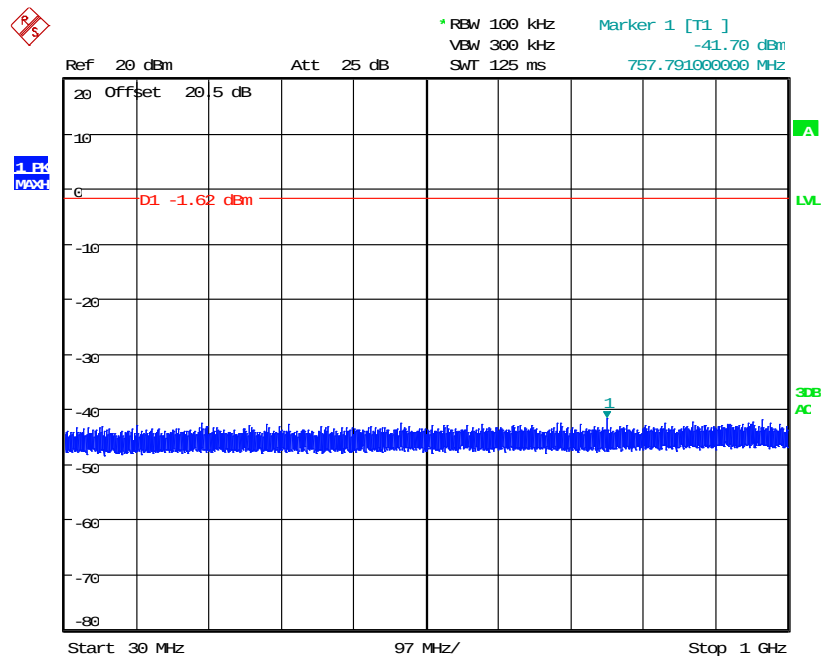
Date: 30.JAN.2014 15:54:59

Figure 7.5.2.2-3: 10 GHz –18 GHz – Low Channel (GFSK)



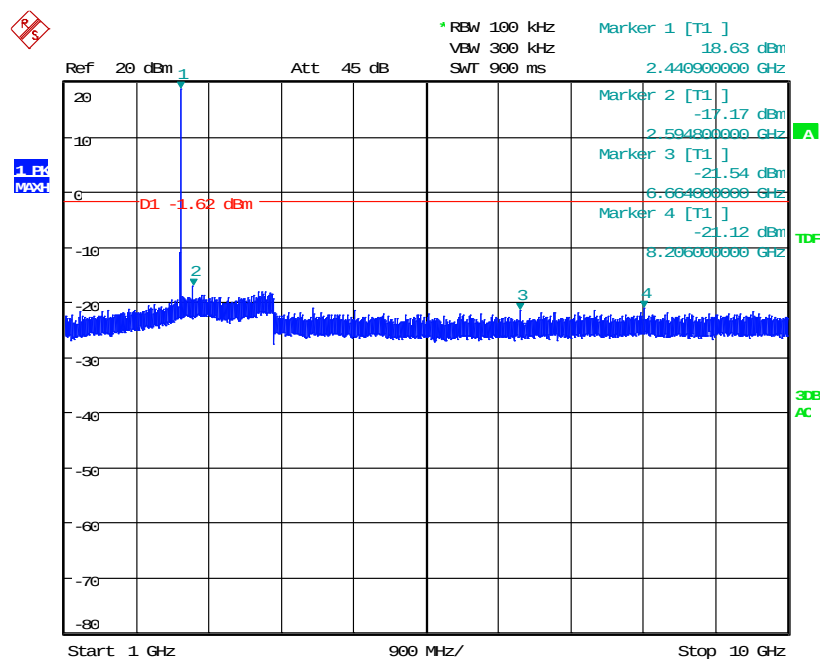
Date: 30.JAN.2014 16:13:34

Figure 7.5.2.2-4: 18 GHz –26 GHz – Low Channel (GFSK)



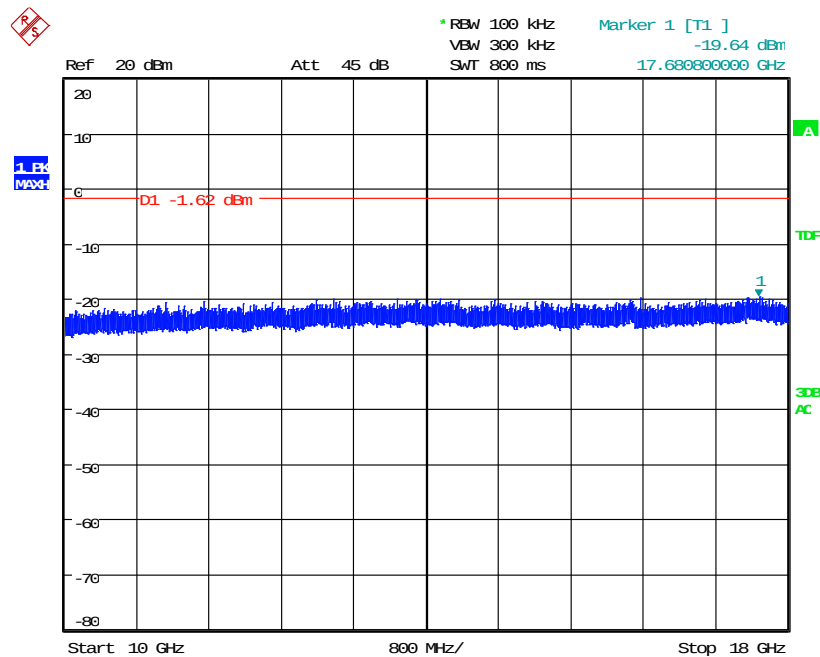
Date: 1.FEB.2014 14:02:26

Figure 7.5.2.2-5: 30 MHz – 1 GHz –Middle Channel (GFSK)



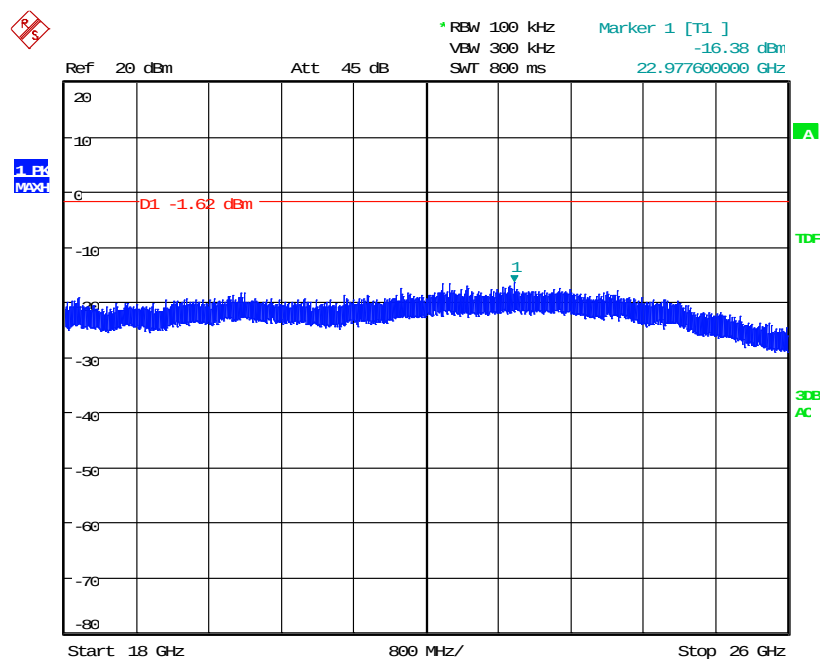
Date: 30.JAN.2014 18:24:41

Figure 7.5.2.2-6: 1 GHz –10 GHz – Middle Channel (GFSK)



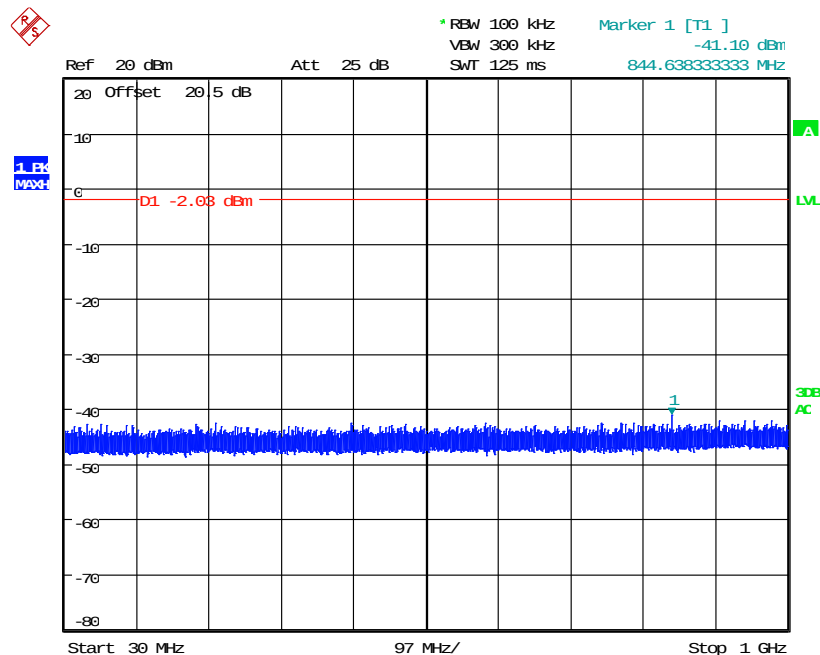
Date: 30.JAN.2014 18:28:00

Figure 7.5.2.2-7: 10 GHz –18 GHz – Middle Channel (GFSK)



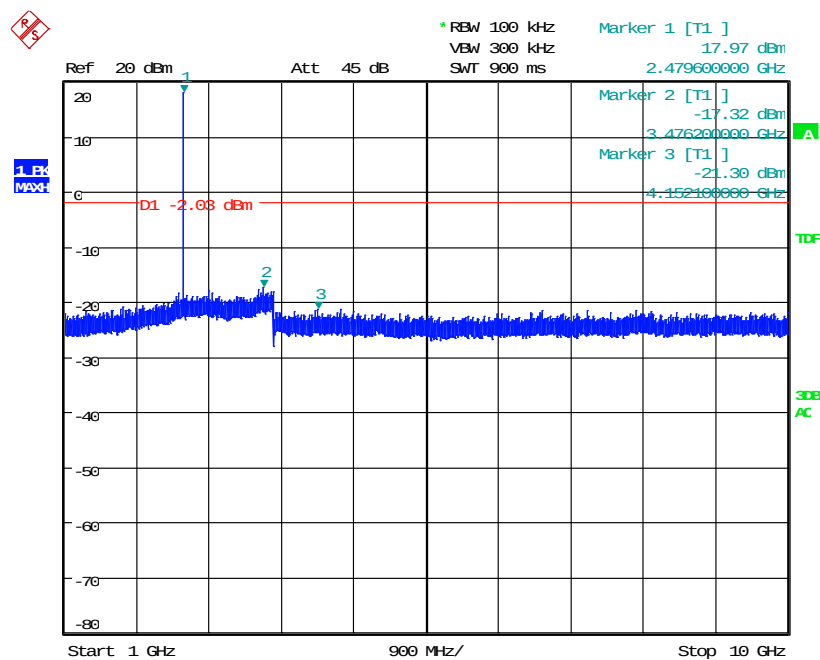
Date: 30.JAN.2014 18:29:49

Figure 7.5.2.2-8: 18 GHz –26 GHz – Middle Channel (GFSK)



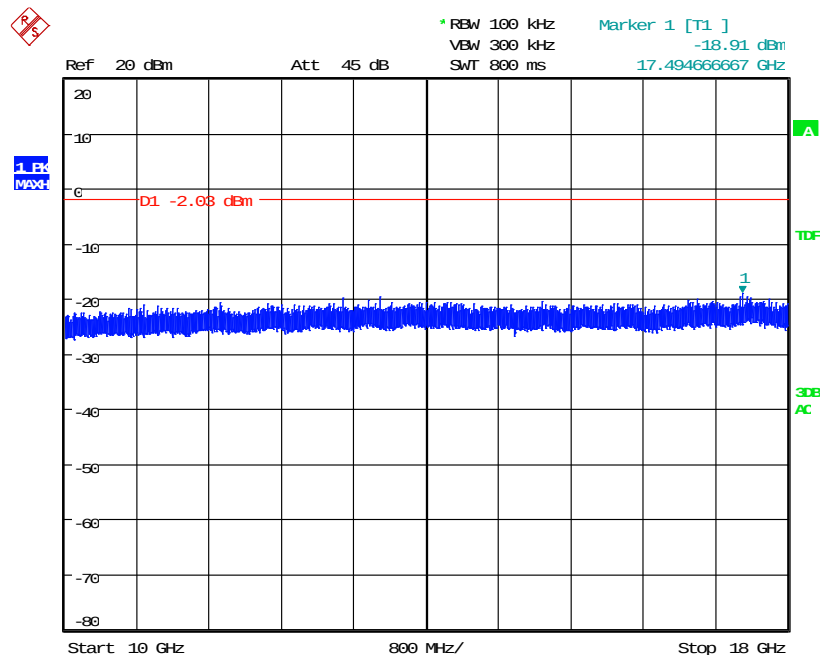
Date: 30.JAN.2014 19:11:01

Figure 7.5.2.2-9: 30 MHz – 1 GHz – High Channel (GFSK)



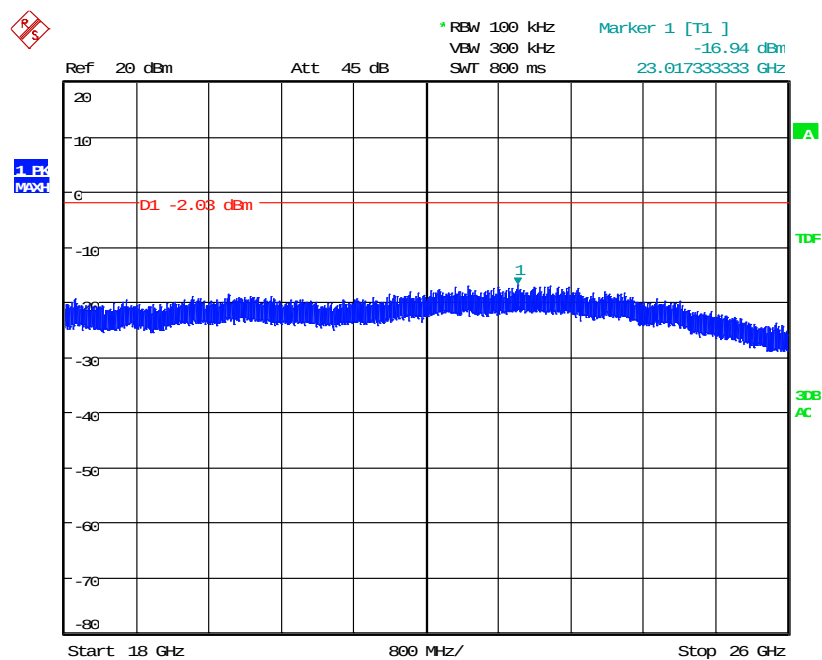
Date: 30.JAN.2014 18:38:10

Figure 7.5.2.2-10: 1 GHz –10 GHz –High Channel (GFSK)



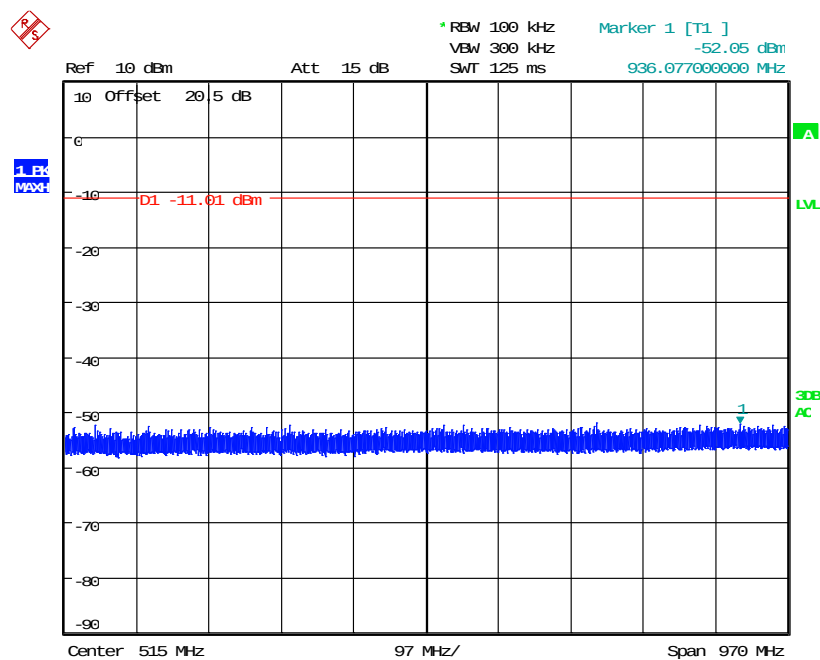
Date: 30.JAN.2014 18:40:00

Figure 7.5.2.2-11: 10 GHz –18 GHz – High Channel (GFSK)

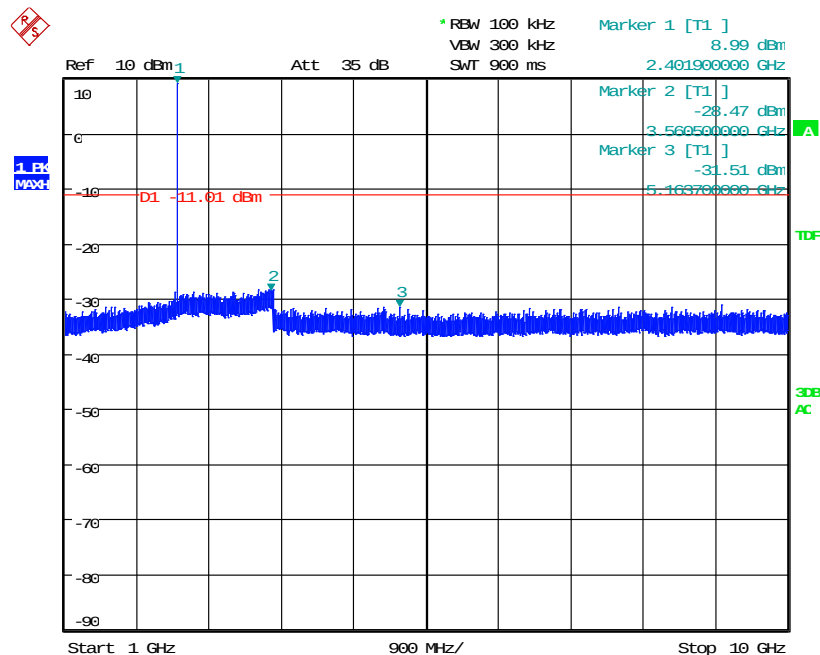


Date: 30.JAN.2014 18:41:51

Figure 7.5.2.2-12: 18 GHz –26 GHz – High Channel (GFSK)

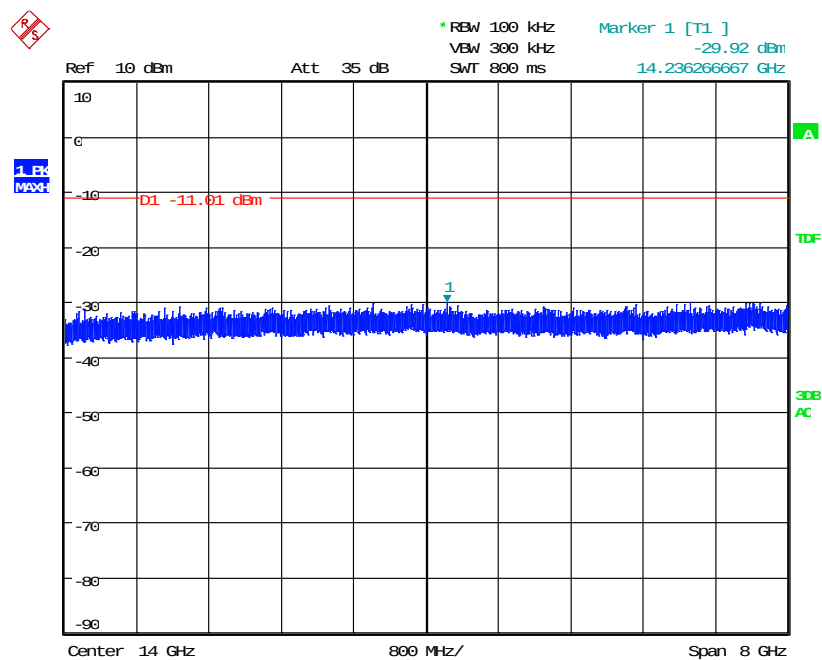


Date: 30.JAN.2014 21:15:58

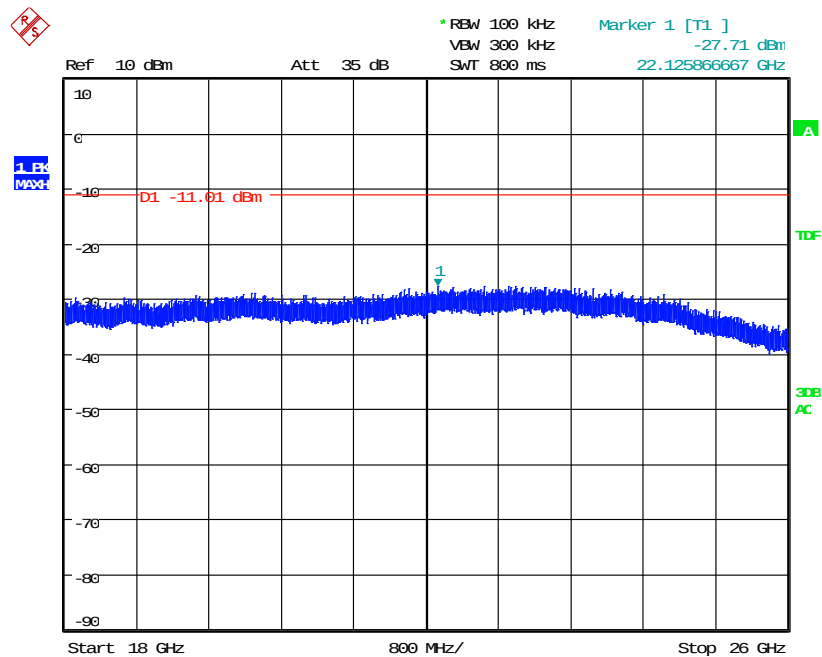
Figure 7.5.2.2-13: 30 MHz – 1 GHz – Low Channel ($\pi/4$ DQPSK)

Date: 30.JAN.2014 20:29:06

Figure 7.5.2.2-14: 1 GHz –10 GHz – Low Channel ($\pi/4$ DQPSK)

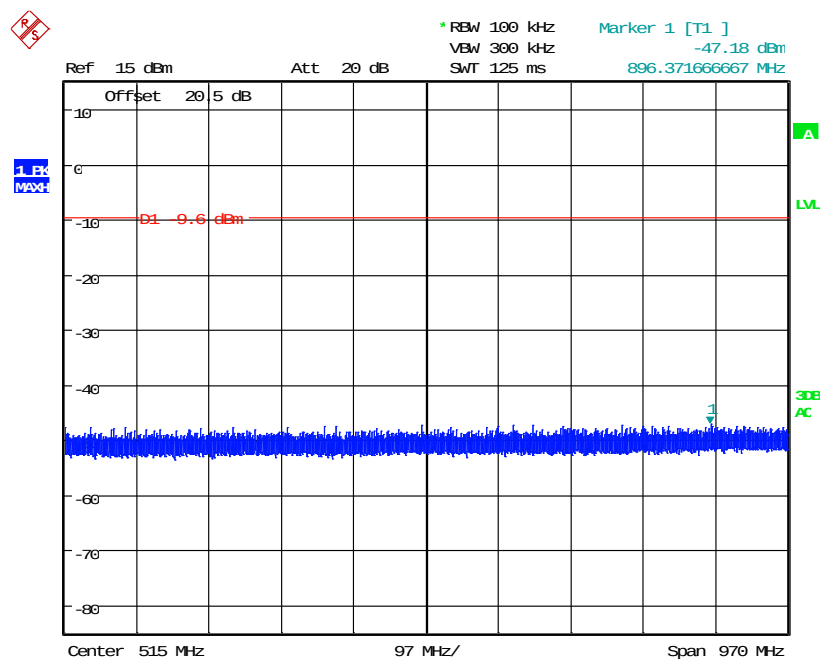


Date: 30.JAN.2014 20:30:50

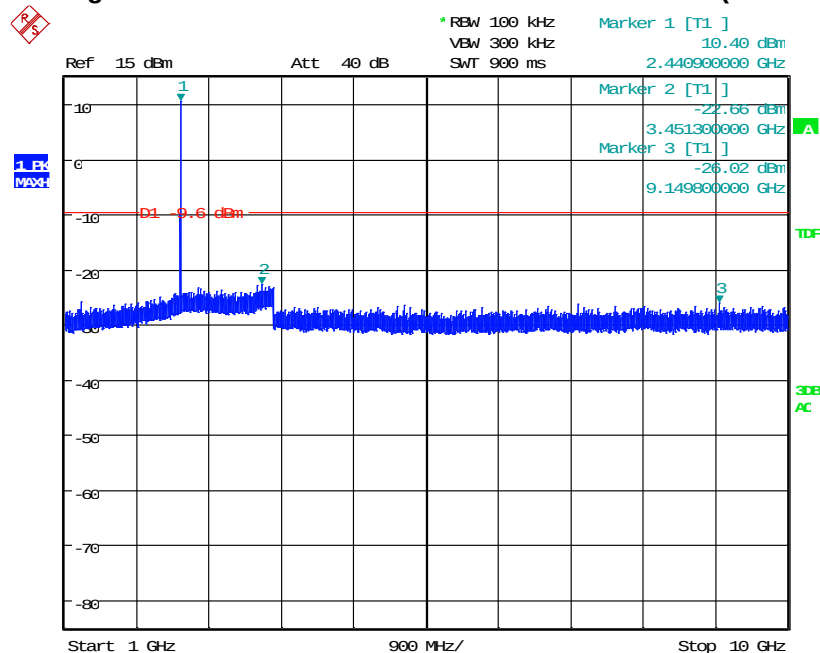
Figure 7.5.2.2-15: 10 GHz –18 GHz – Low Channel ($\pi/4$ DQPSK)

Date: 30.JAN.2014 20:34:21

Figure 7.5.2.2-16: 18 GHz –26 GHz – Low Channel ($\pi/4$ DQPSK)

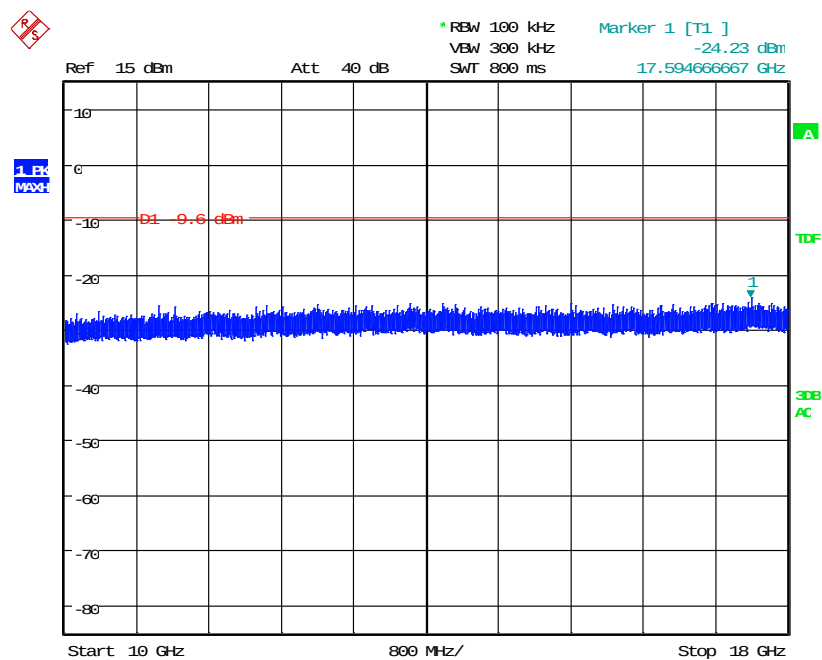


Date: 30.JAN.2014 21:10:17

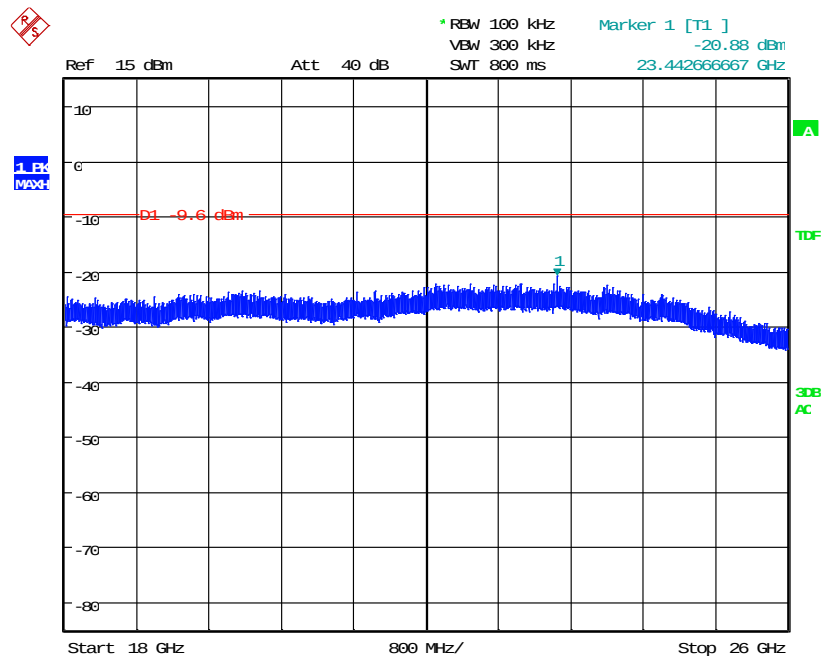
Figure 7.5.2.2-17: 30 MHz – 1 GHz –Middle Channel ($\pi/4$ DQPSK)

Date: 30.JAN.2014 20:42:08

Figure 7.5.2.2-18: 1 GHz –10 GHz – Middle Channel ($\pi/4$ DQPSK)

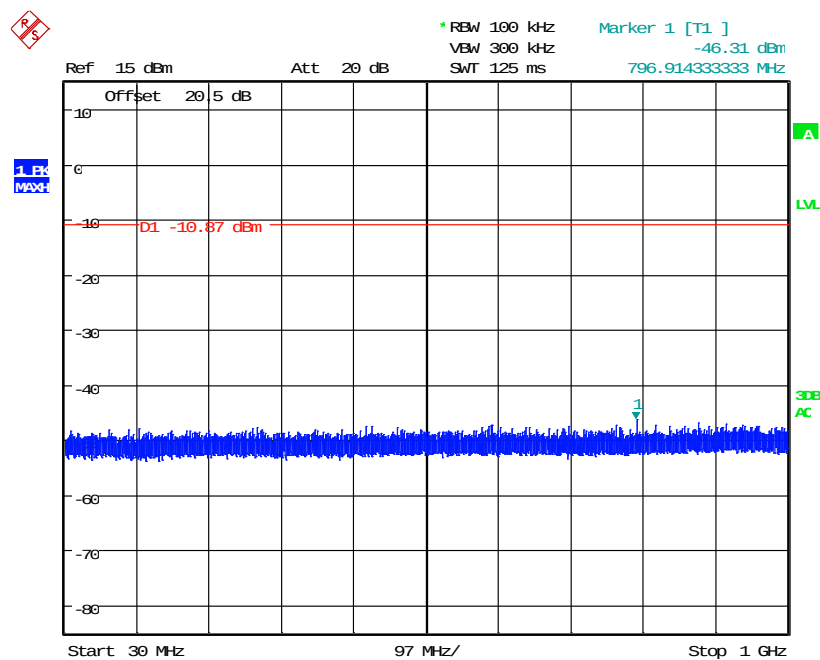


Date: 30.JAN.2014 20:43:48

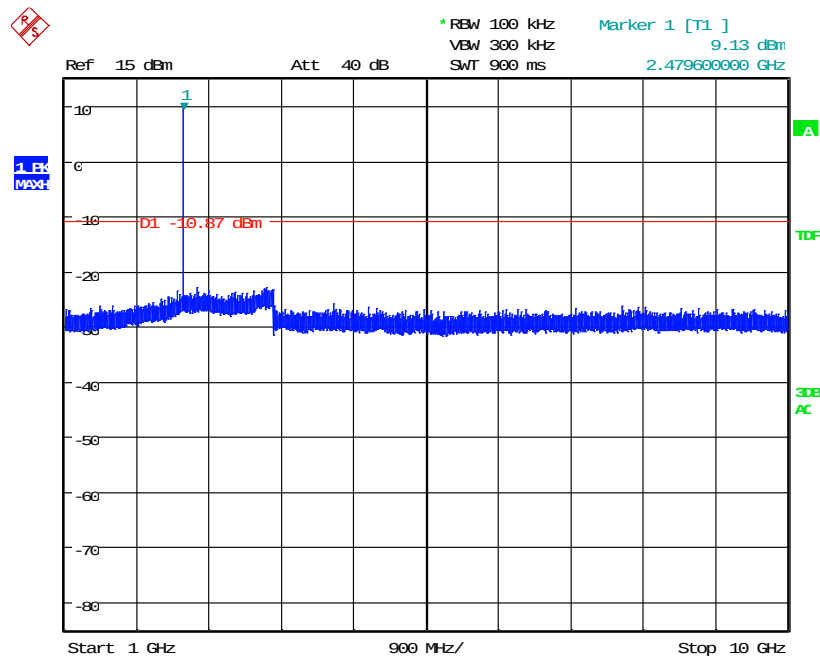
Figure 7.5.2.2-19: 10 GHz –18 GHz – Middle Channel ($\pi/4$ DQPSK)

Date: 30.JAN.2014 20:46:36

Figure 7.5.2.2-20: 18 GHz –26 GHz – Middle Channel ($\pi/4$ DQPSK)

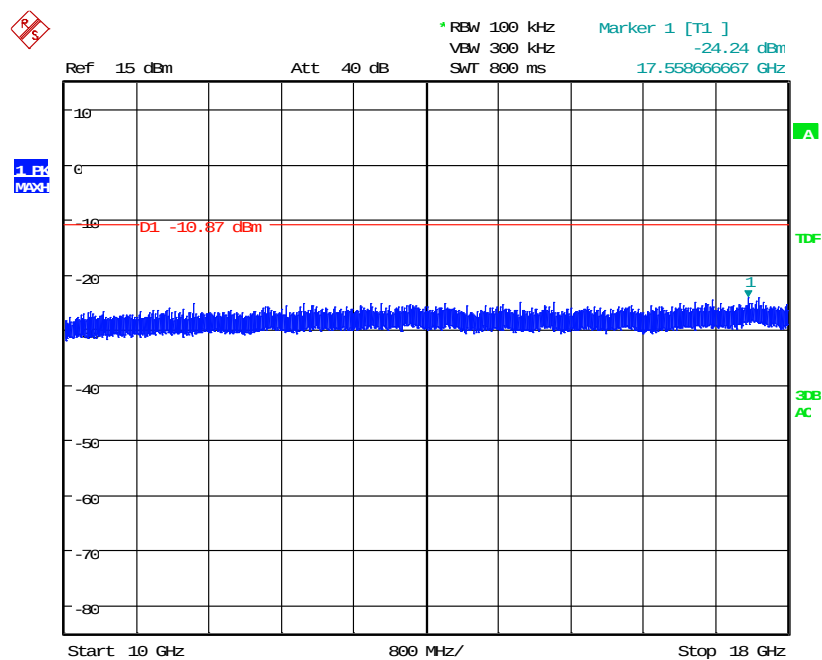


Date: 30.JAN.2014 21:07:24

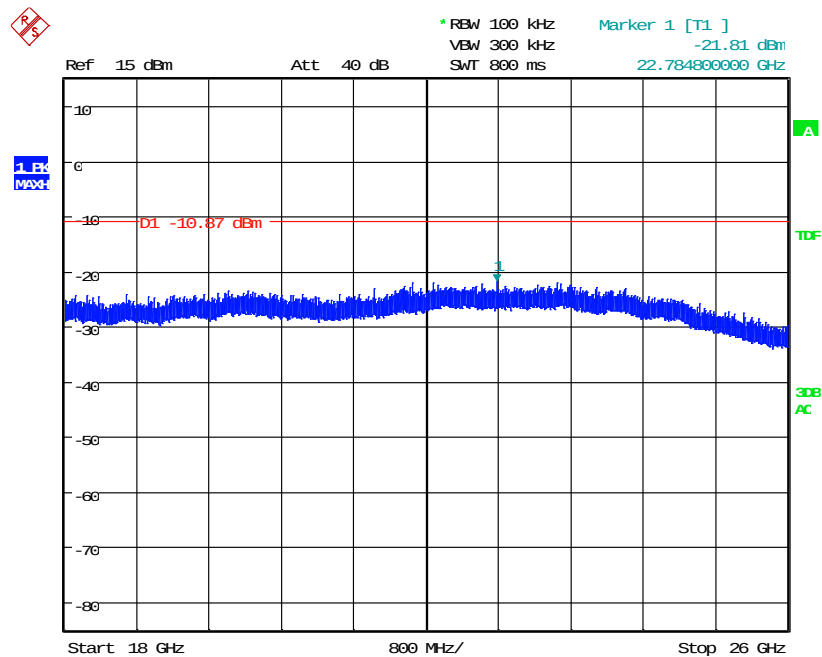
Figure 7.5.2.2-21: 30 MHz – 1 GHz – High Channel ($\pi/4$ DQPSK)

Date: 30.JAN.2014 20:54:58

Figure 7.5.2.2-22: 1 GHz –10 GHz –High Channel ($\pi/4$ DQPSK)

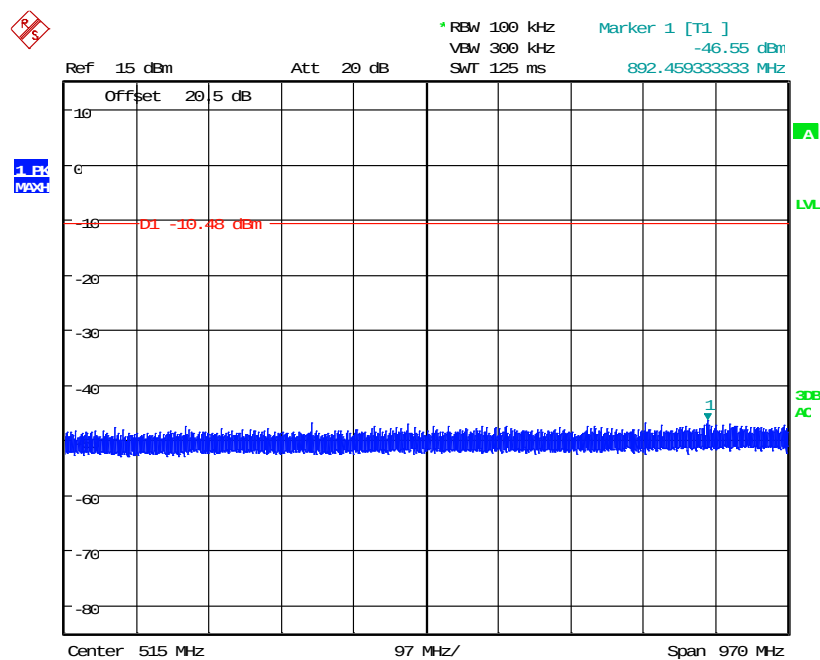


Date: 30.JAN.2014 20:58:01

Figure 7.5.2.2-23: 10 GHz –18 GHz – High Channel ($\pi/4$ DQPSK)

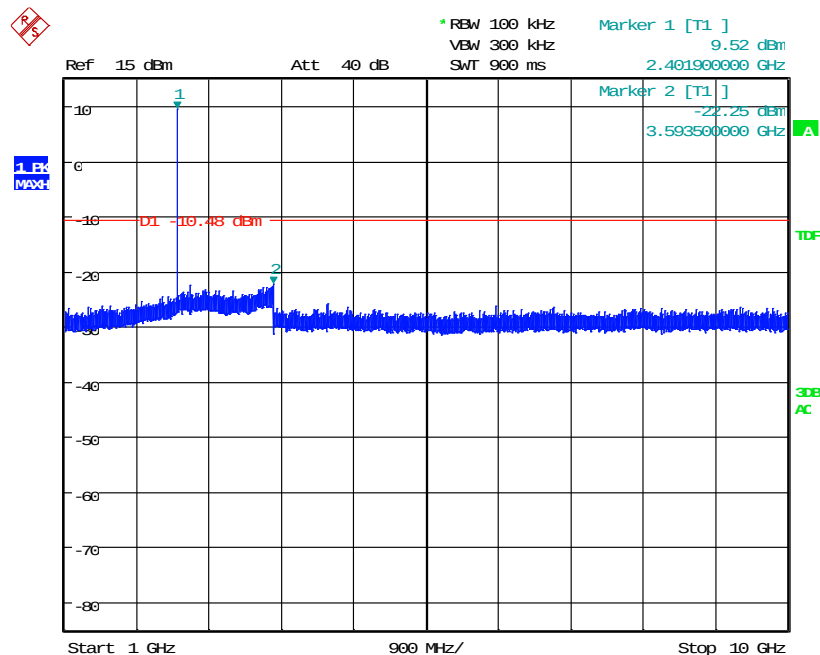
Date: 30.JAN.2014 21:01:50

Figure 7.5.2.2-24: 18 GHz –26 GHz – High Channel ($\pi/4$ DQPSK)



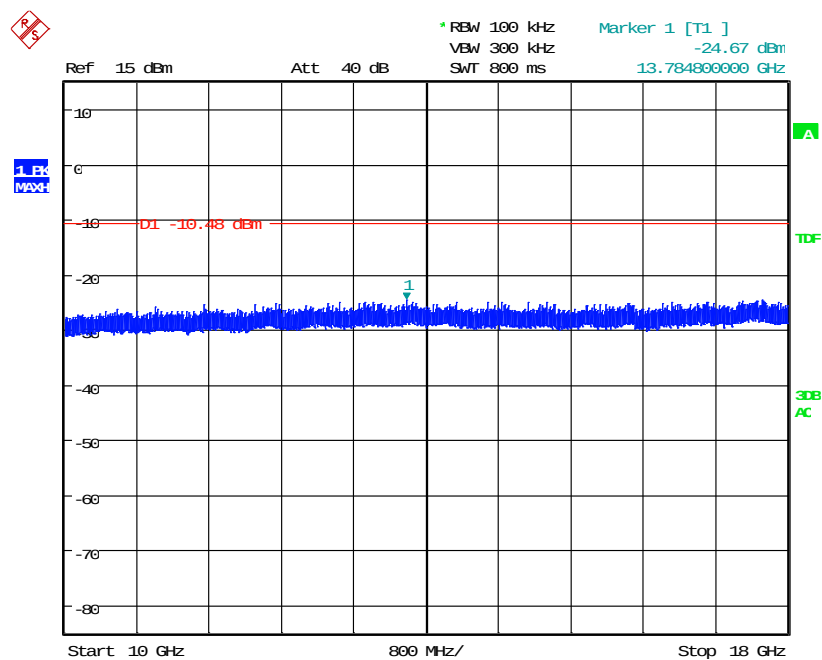
Date: 1.FEB.2014 11:11:16

Figure 7.5.2.2-25: 30 MHz – 1 GHz – Low Channel (8DPSK)



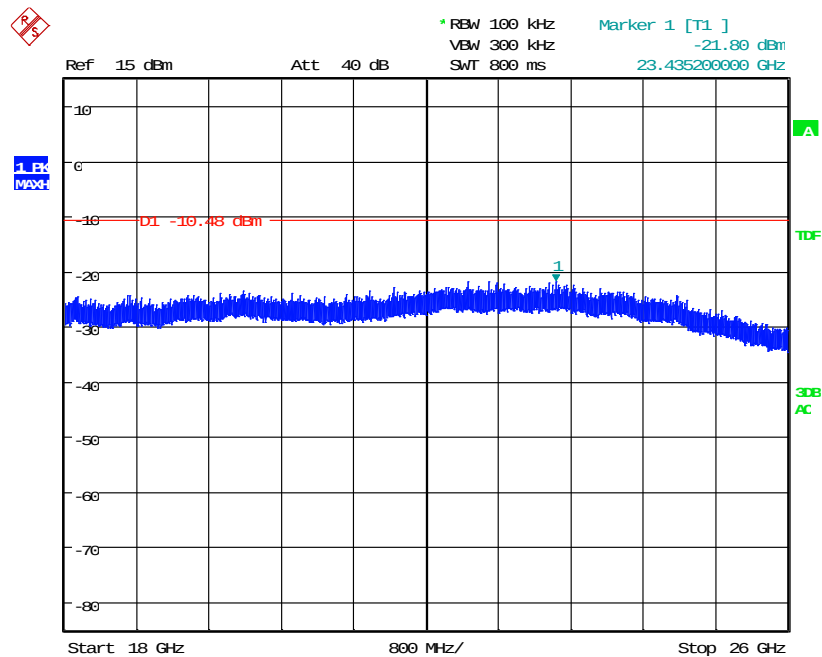
Date: 31.JAN.2014 15:32:21

Figure 7.5.2.2-26: 1 GHz –10 GHz – Low Channel (8DPSK)



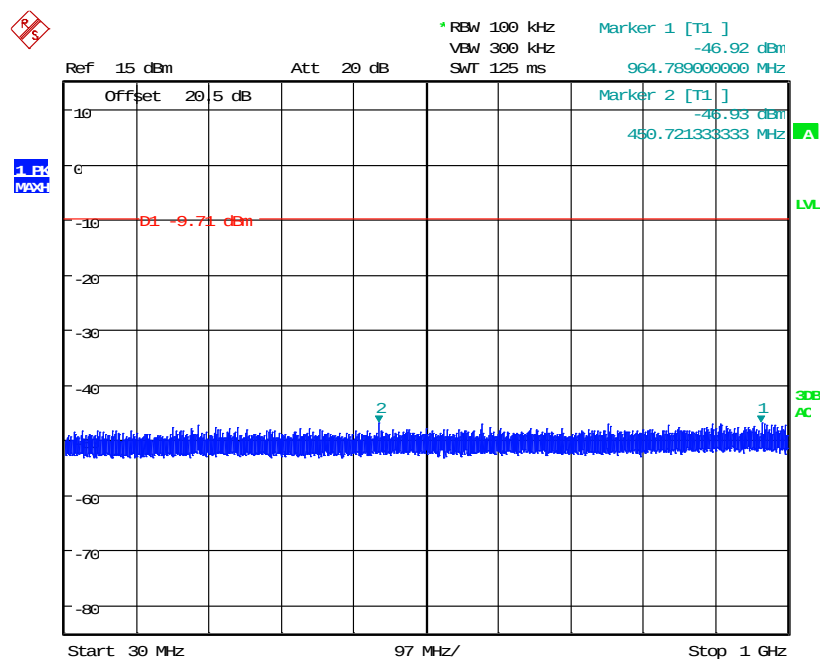
Date: 31.JAN.2014 15:38:07

Figure 7.5.2.2-27: 10 GHz –18 GHz – Low Channel (8DPSK)



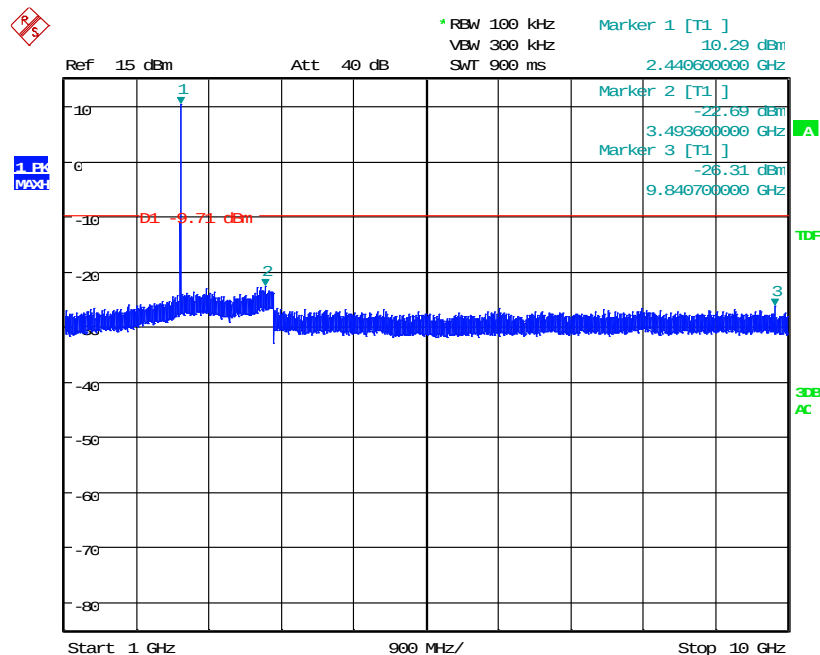
Date: 31.JAN.2014 15:40:14

Figure 7.5.2.2-28: 18 GHz –26 GHz – Low Channel (8DPSK)



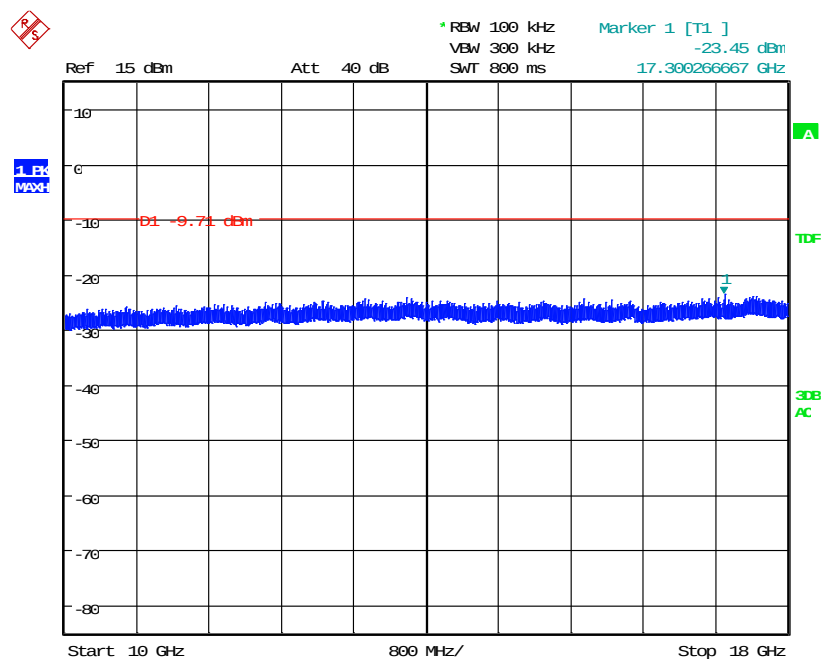
Date: 1.FEB.2014 11:06:08

Figure 7.5.2.2-29: 30 MHz – 1 GHz –Middle Channel (8DPSK)



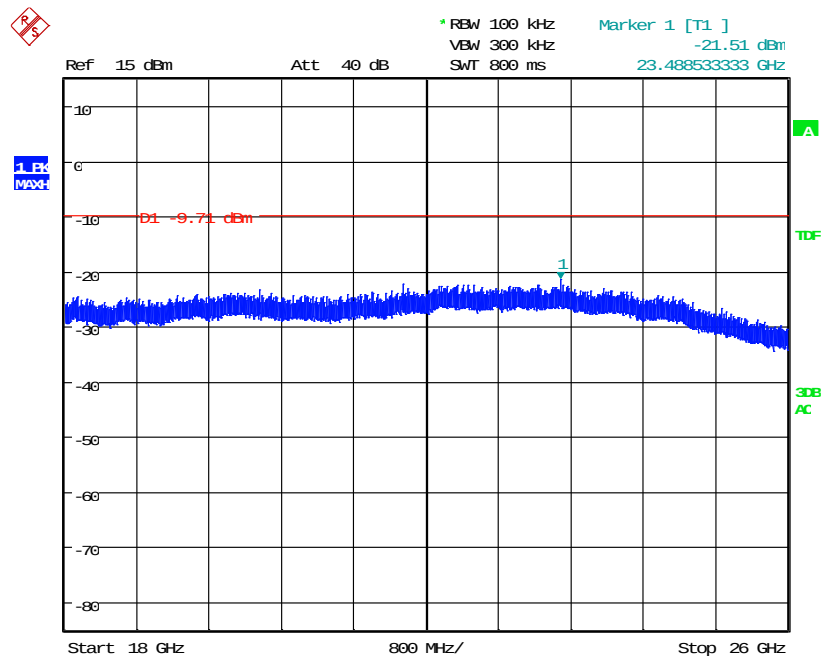
Date: 31.JAN.2014 15:45:37

Figure 7.5.2.2-30: 1 GHz –10 GHz – Middle Channel (8DPSK)



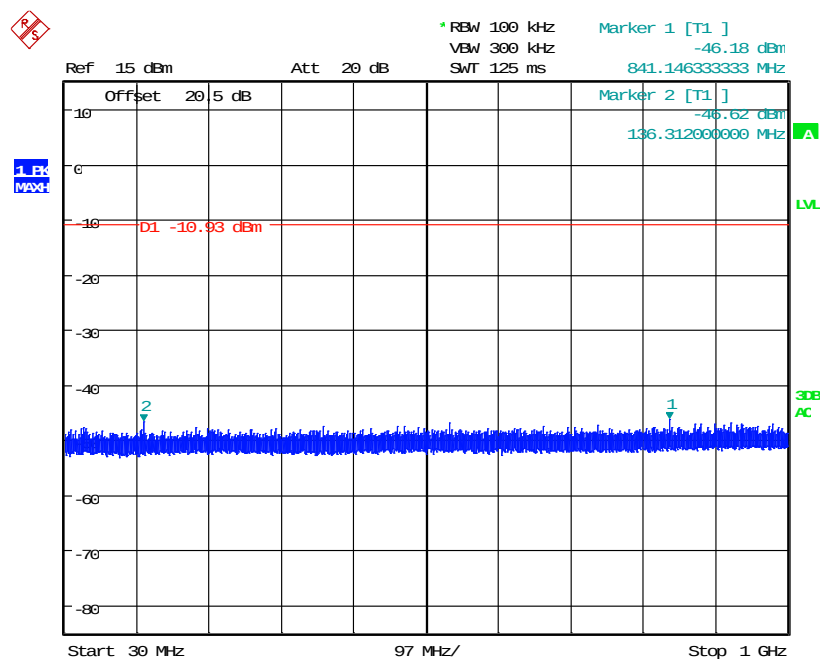
Date: 31.JAN.2014 16:15:22

Figure 7.5.2.2-31: 10 GHz –18 GHz – Middle Channel (8DPSK)



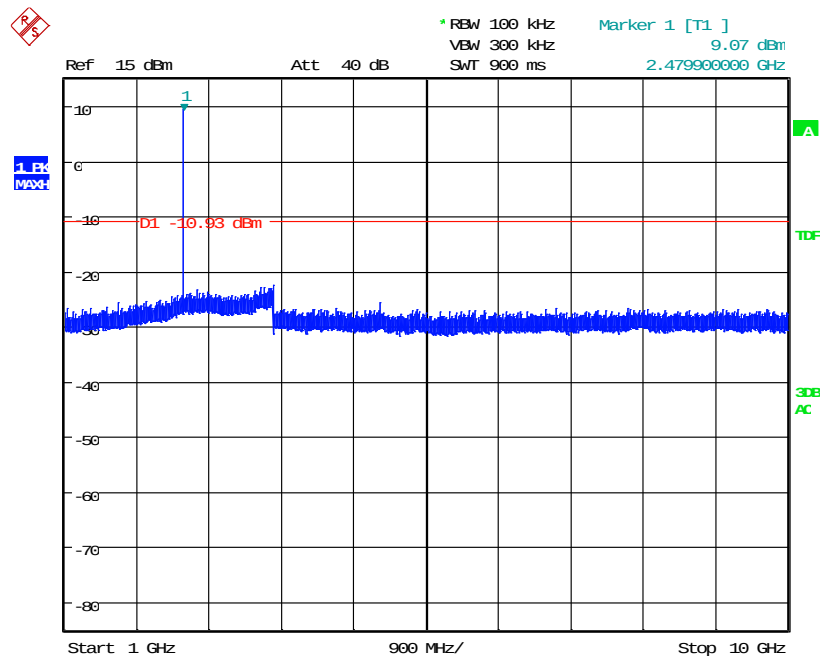
Date: 31.JAN.2014 16:18:15

Figure 7.5.2.2-32: 18 GHz –26 GHz – Middle Channel (8DPSK)



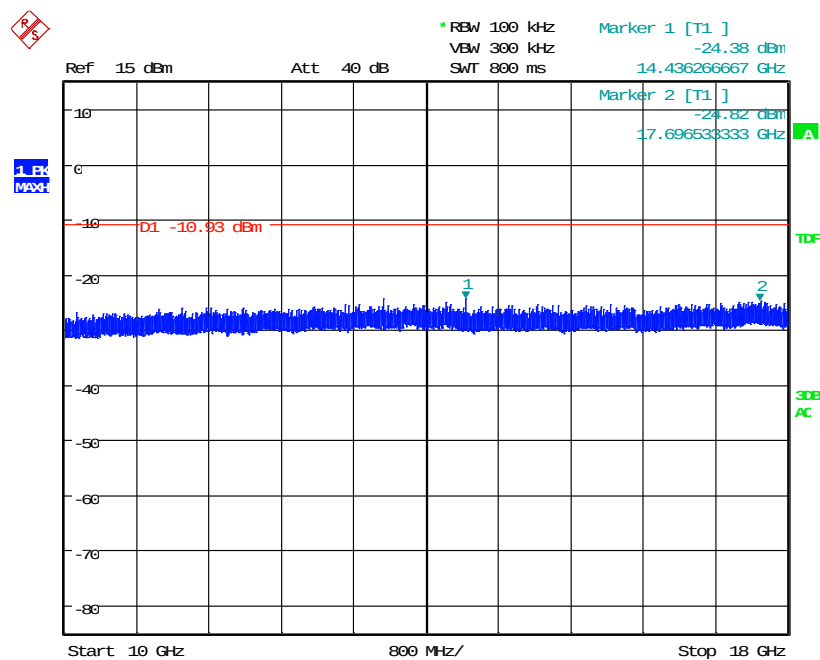
Date: 1.FEB.2014 11:02:28

Figure 7.5.2.2-33: 30 MHz – 1 GHz – High Channel (8DPSK)



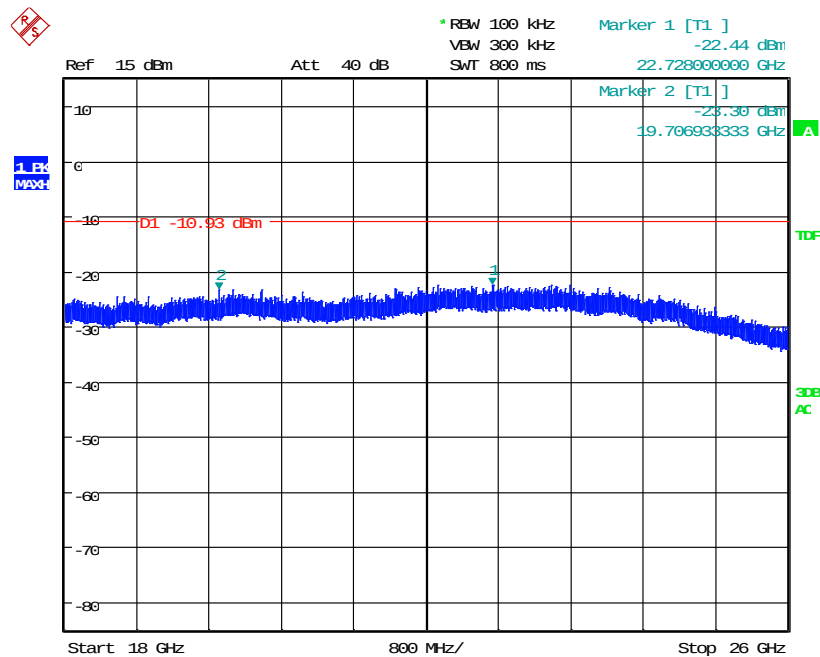
Date: 1.FEB.2014 10:48:08

Figure 7.5.2.2-34: 1 GHz –10 GHz –High Channel (8DPSK)



Date: 1.FEB.2014 10:52:12

Figure 7.5.2.2-35: 10 GHz –18 GHz – High Channel (8DPSK)



Date: 1.FEB.2014 10:55:38

Figure 7.5.2.2-36: 18 GHz –26 GHz – High Channel (8DPSK)

7.5.3 Radiated Spurious Emissions - FCC Section 15.205, 15.209; IC: RSS-Gen 7.2.2, 7.2.5

7.5.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30 MHz to 26 GHz, 10 times the highest fundamental frequency for emissions falling within the restricted bands.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak measurements made with RBW and VBW of 1 MHz and 3 MHz respectively. Average measurements were collected in the linear amplitude scale with VBW of 30 Hz.

The EUT was caused to generate a continuous carrier signal on the hopping channel.

7.5.3.2 Measurement Results

Band-edge and radiated spurious emissions found in the restricted bands of 30MHz to 26 GHz are reported in the tables below.

Table 7.5.3.2-1: Radiated Spurious Emissions Tabulated Data - GFSK

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 2402 MHz										
4804	53.08	46.31	H	-0.27	52.81	15.66	74.0	54.0	21.2	38.3
4804	50.44	42.55	V	-0.27	50.17	11.90	74.0	54.0	23.8	42.1
12010	44.85	31.52	H	12.72	57.57	13.86	83.5	63.5	25.9	49.6
12010	45.74	31.91	V	12.72	58.46	14.25	83.5	63.5	25.0	49.2
19216	42.22	28.92	V	10.94	53.16	9.48	83.5	63.5	30.3	54.0
Middle Channel = 2441 MHz										
4882	51.93	44.93	H	-0.04	51.89	14.52	74.0	54.0	22.1	39.5
4882	49.31	40.28	V	-0.04	49.27	9.87	74.0	54.0	24.7	44.1
7323	61.70	55.51	H	5.59	67.29	30.72	74.0	54.0	6.7	23.3
7323	57.19	50.17	V	5.59	62.78	25.38	74.0	54.0	11.2	28.6
12205	43.93	31.88	H	13.00	56.93	14.50	83.5	63.5	26.6	49.0
12205	44.45	31.83	V	13.00	57.45	14.45	83.5	63.5	26.1	49.0
High Channel = 2480 MHz										
2483.5	79.78	68.45	H	-7.61	72.17	30.47	74.0	54.0	1.8	23.5
2483.5	73.15	61.48	V	-7.61	65.54	23.50	74.0	54.0	8.5	30.5
4960	52.32	45.67	H	0.20	52.52	15.49	74.0	54.0	21.5	38.5
4960	51.44	44.08	V	0.20	51.64	13.90	74.0	54.0	22.4	40.1
7440	58.78	52.35	H	6.00	64.78	27.97	74.0	54.0	9.2	26.0
7440	55.36	48.00	V	6.00	61.36	23.62	74.0	54.0	12.6	30.4
12400	43.97	30.87	H	13.28	57.25	13.77	83.5	63.5	26.3	49.7
12400	44.27	30.81	V	13.28	57.55	13.71	83.5	63.5	26.0	49.8

Notes:

- A duty cycle correction factor equal to the logarithm of the dwell time over 100 ms was applied to the average measurements.
- The measurements above 10 GHz were performed at a distance of 1m.
- All the emissions above 19.21 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.5.3.2-2: Radiated Spurious Emissions Tabulated Data – ($\pi/4$) DQPSK

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 2402 MHz										
4804	47.30	34.93	H	-0.27	47.03	4.28	74.0	54.0	27.0	49.7
4804	46.62	33.63	V	-0.27	46.35	2.98	74.0	54.0	27.7	51.0
Middle Channel = 2441 MHz										
4882	47.61	36.27	H	-0.04	47.57	5.86	74.0	54.0	26.4	48.1
4882	48.02	36.23	V	-0.04	47.98	5.82	74.0	54.0	26.0	48.2
7323	49.13	38.11	H	5.59	54.72	13.32	74.0	54.0	19.3	40.7
7323	48.62	37.04	V	5.59	54.21	12.25	74.0	54.0	19.8	41.8
High Channel = 2480 MHz										
2483.5	73.81	58.79	H	-7.61	66.20	20.81	74.0	54.0	7.8	33.2
2483.5	68.93	54.47	V	-7.61	61.32	16.49	74.0	54.0	12.7	37.5
4960	46.44	34.76	H	0.20	46.64	4.58	74.0	54.0	27.4	49.4
4960	47.17	34.61	V	0.20	47.37	4.43	74.0	54.0	26.6	49.6
7440	49.32	38.66	H	6.00	55.32	14.28	74.0	54.0	18.7	39.7
7440	48.69	35.54	V	6.00	54.69	11.16	74.0	54.0	19.3	42.8

Notes:

- A duty cycle correction factor equal to the logarithm of the dwell time over 100 ms was applied to the average measurements.
- All the emissions above 7.44 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.5.3.2-3: Radiated Spurious Emissions Tabulated Data – 8DPSK

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 2402 MHz										
4804	46.67	34.77	H	-0.27	46.40	4.12	74.0	54.0	27.6	49.9
4804	46.00	33.51	V	-0.27	45.73	2.86	74.0	54.0	28.3	51.1
Middle Channel = 2441 MHz										
4882	48.39	35.99	H	-0.04	48.35	5.58	74.0	54.0	25.6	48.4
4882	47.53	36.10	V	-0.04	47.49	5.69	74.0	54.0	26.5	48.3
7323	48.96	37.71	H	5.59	54.55	12.92	74.0	54.0	19.5	41.1
7323	48.34	36.56	V	5.59	53.93	11.77	74.0	54.0	20.1	42.2
High Channel = 2480 MHz										
2483.5	73.38	59.40	H	-7.61	65.77	21.42	74.0	54.0	8.2	32.6
2483.5	69.10	54.98	V	-7.61	61.49	17.00	74.0	54.0	12.5	37.0
4960	46.41	34.42	H	0.20	46.61	4.24	74.0	54.0	27.4	49.8
4960	46.80	34.75	V	0.20	47.00	4.57	74.0	54.0	27.0	49.4
7440	49.47	38.46	H	6.00	55.47	14.08	74.0	54.0	18.5	39.9
7440	47.01	35.13	V	6.00	53.01	10.75	74.0	54.0	21.0	43.3

Notes:

- A duty cycle correction factor equal to the logarithm of the dwell time over 100 ms was applied to the average measurements.
- All the emissions above 7.44 GHz were attenuated below the limits and the noise floor of the measurement equipment.

7.5.3.3 Sample Calculation:

$$R_C = R_U + CF_T$$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Duty Cycle Correction Factor (DC): $20 \cdot \log(3.028/100) = -30.38 \text{ dB}$

Example Calculation: Peak

Corrected Level: $53.08 + (-0.27) = 52.81 \text{ dB}\mu\text{V/m}$

Margin: $74 \text{ dB}\mu\text{V/m} - 52.81 \text{ dB}\mu\text{V/m} = 21.2 \text{ dB}$

Example Calculation: Average

Corrected Level: $46.31 + (-0.27) - 30.38 = 15.66 \text{ dB}\mu\text{V/m}$

Margin: $54 \text{ dB}\mu\text{V/m} - 15.66 \text{ dB}\mu\text{V/m} = 38.3 \text{ dB}$

8 CONCLUSION

In the opinion of ACS, Inc., the PMMN4095A manufactured by Motorola Solutions SDNBHD meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT