

Certification Test Report

FCC ID: AZ489FT7061
IC: 109U-89FT7061

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210

ACS Report Number: 14-2134.W06.2C

Manufacturer: Motorola Solutions
Model: H91TGD9PW7AN

Test Begin Date: December 17, 2014
Test End Date: February 13, 2015

Report Issue Date: May 28, 2015



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 ACLASS, ANSI, or any agency of the Federal Government.

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

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Advanced Compliance Solutions, Inc.

Reviewed by:

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Kirby Munroe
Director, Wireless Certifications
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This report contains 66 pages

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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 EUT is a P25 Portable Public Safety Radio

Technical Details

Mode of Operation: Bluetooth 2.1 + Enhanced Data Rate (EDR)
Frequency Range: 2402 MHz - 2480 MHz
Number of Channels: 79
Channel Separation: 1 MHz
Modulations: GFSK, $\pi/4$ -DQPSK, 8DPSK
TX Data Rates: GFSK: 1Mbps
 $\pi/4$ -DQPSK: 2Mbps
8DPSK: 3Mbps
Antenna Type/Gain: PIFA, 2.58 dBi

1.3 Manufacturer Information

Motorola Solutions
8000 West Sunrise Blvd.
Fort Lauderdale, FL 33322

Model Number: H91TGD9PW7AN

Test Sample Serial Number(s): KT000006A01MK4KA127X (Radiated & Power Line Conducted Emissions), KT000006A01MK4KA12N2 (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 radiated, power line and RF conducted emissions for the Bluetooth radio.

The RF conducted measurements were performed on a sample with the back cover removed for access to the RF port.

The radiated emission evaluation was performed for the EUT set in multiple configurations. The unit was investigated stand-alone in three orthogonal orientations, when installed in a charger and when communicating with a remote computer. The final measurements were executed using the worst case configuration which consists of the EUT with the charger.

The unit was also investigated for inter-modulation products between the co-located Bluetooth and the land mobile radios. The measurements were performed for two antenna configurations of the land mobile radio. The first antenna covers the VHF, UHF, 7/800 MHz and GPS bands while the second antenna covers the 7/800 MHz and GPS band. All inter-modulation products between the co-located radios were found to be compliant to the FCC limits of 15.209 and Industry Canada RSS-GEN.

The EUT was evaluated for power line conducted emissions when installed in the charger for the radio mode of operation leading to the worst case emissions.

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 Declaration of Conformity/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:

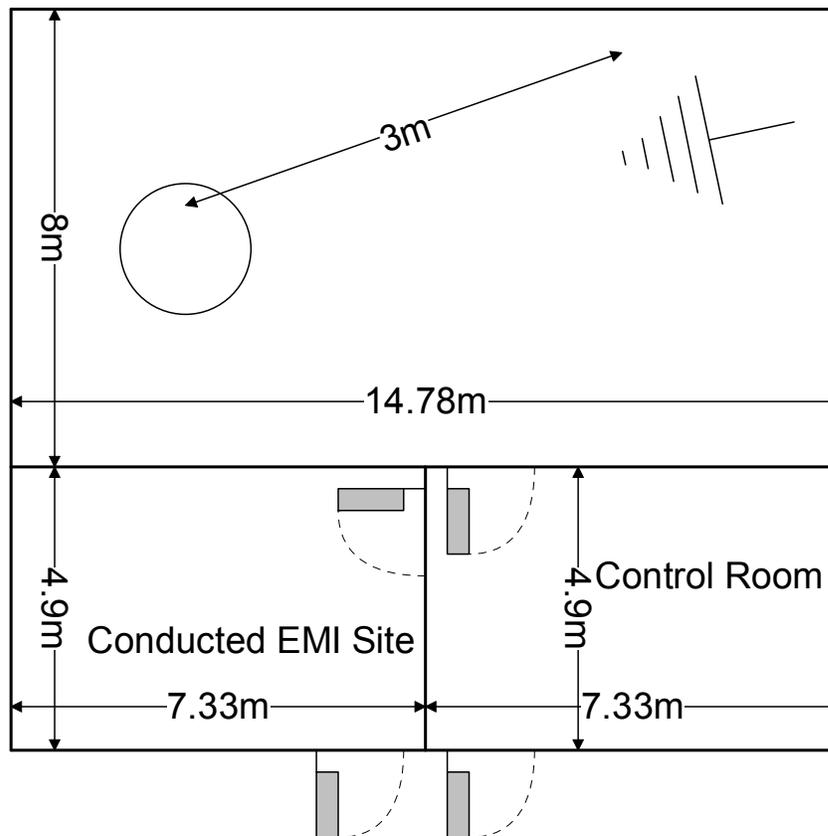


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m³. As per ANSI C63.4 2009 requirements, the data were taken using two LISNs; a Solar Model 8028-50 50 Ω/50 μH and an EMCO Model 3825, which are installed as shown in Photograph 3. For evaluations requiring 220 V, 50 Hz AC input, 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:

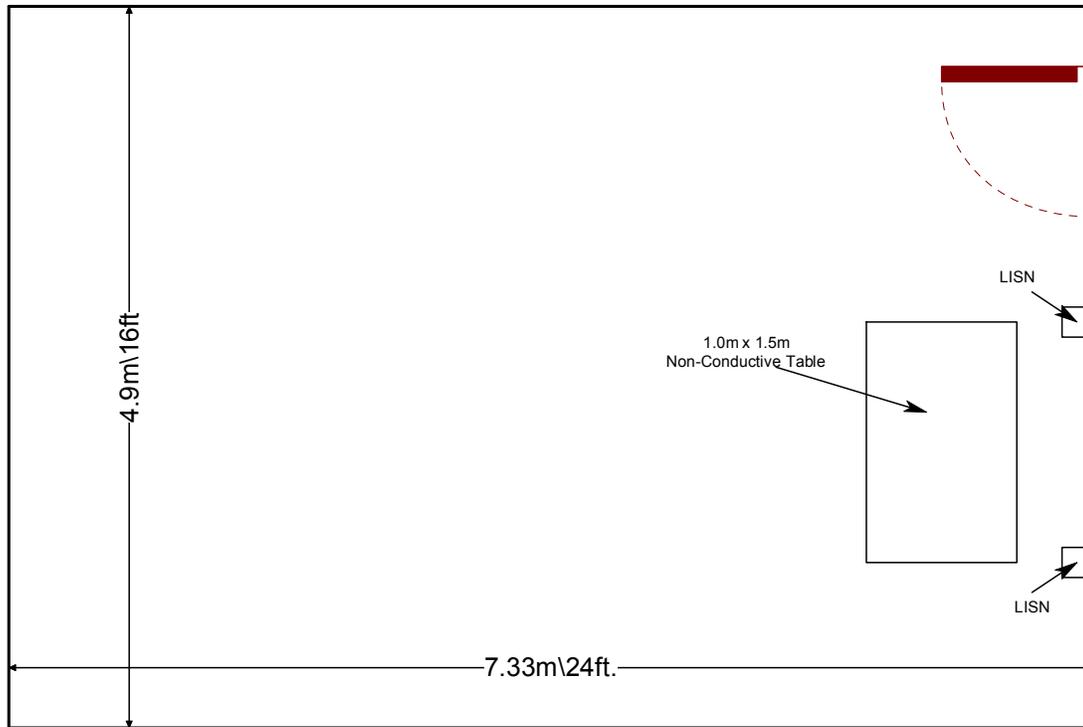


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.4-2009: 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, 2015
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2015
- ❖ 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 for Compliance of Radio Apparatus, Issue 4, November 2014.

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
2111	Aeroflex Inmet	40AH2W-20	Attenuator	2111	7/25/2014	7/25/2015
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	9/18/2013	9/18/2015
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/8/2013	1/8/2015
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/26/2014	12/26/2016
2002	EMCO	3108	Antennas	2147	11/22/2013	11/22/2015
2004	EMCO	3146	Antennas	1385	11/22/2013	11/22/2015
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
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	12/31/2014	12/31/2015
2022	EMCO	LISN3825/2R	LISN	1095	9/9/2013	9/9/2015
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	2/27/2014	2/27/2015
2044	QMI	N/A	Cables	2044	12/31/2013	12/31/2014
2044	QMI	N/A	Cables	2044	12/31/2014	12/31/2015
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	1/1/2014	1/1/2015
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	1/1/2015	1/1/2016
2070	Mini Circuits	VHF-8400+	Filter	2070	12/31/2014	12/31/2015
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
2072	Mini Circuits	VHF-3100+	Filter	30737	12/31/2014	12/31/2015
2082	Teledyne Storm Products	90-010-048	Cables	2082	5/8/2014	5/8/2015
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	12/21/2013	12/31/2014
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	12/31/2014	12/31/2015
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/12/2014	12/12/2015
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
3004	Teseq	CFL 9206A	Attenuators	34720	10/21/2013	10/21/2015

Notes:

- **NCR=No Calibration Required**
- **The asset calibration information is provided to cover the entire test period.**

5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Motorola Solutions	H91TGD9PW7AN	KT00006A01MK4KA127X
2	Dock Charger	Motorola Solutions	NNTN7079A (V3.90)	N/A
3	Power Supply	Motorola Solutions	NU20-C140150-I3	1209

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	Power	1.90 m	No	Charger to power Supply
B	Power	1.23 m	No	Power Supply to Extension Cord
C	Extension Cord	1.82 m	No	Power Cord to AC Mains

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

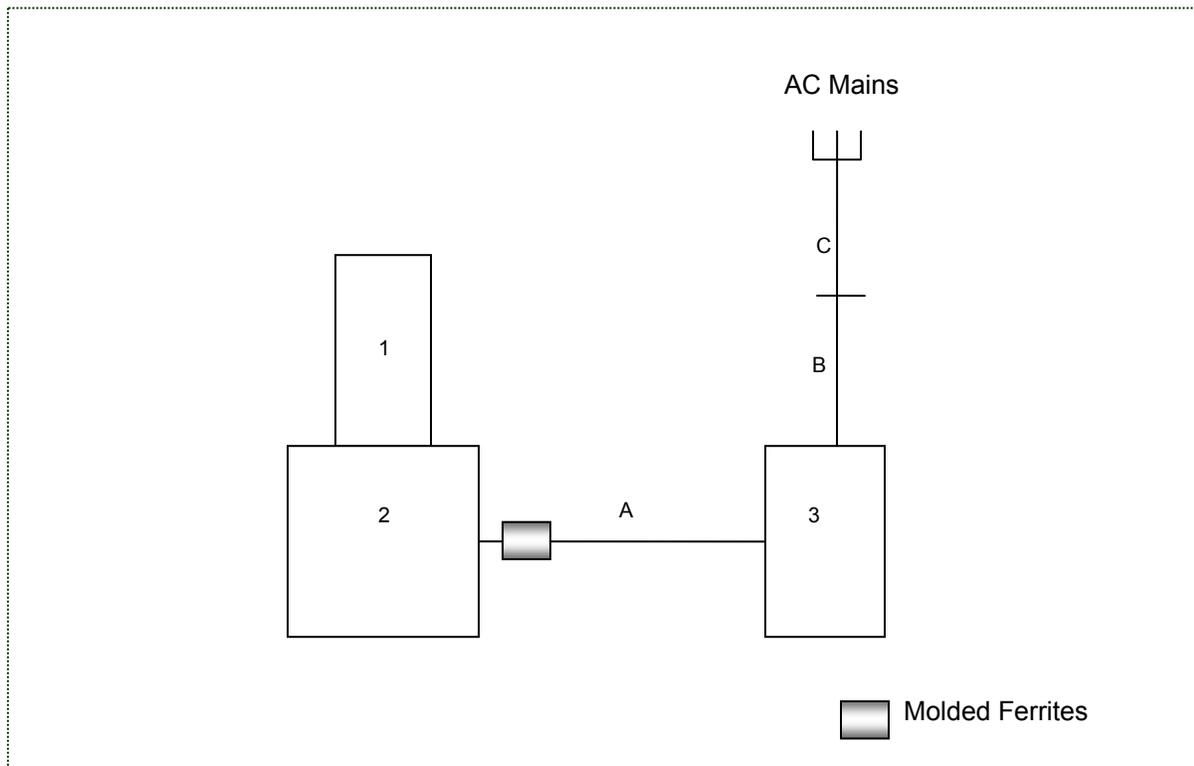


Figure 6-1: EUT Test Setup

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 a 2.58 dBi internal PIFA which connects to the RF port via a spring contact. The EUT meets the requirements of FCC 15.203.

7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 8.8

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:

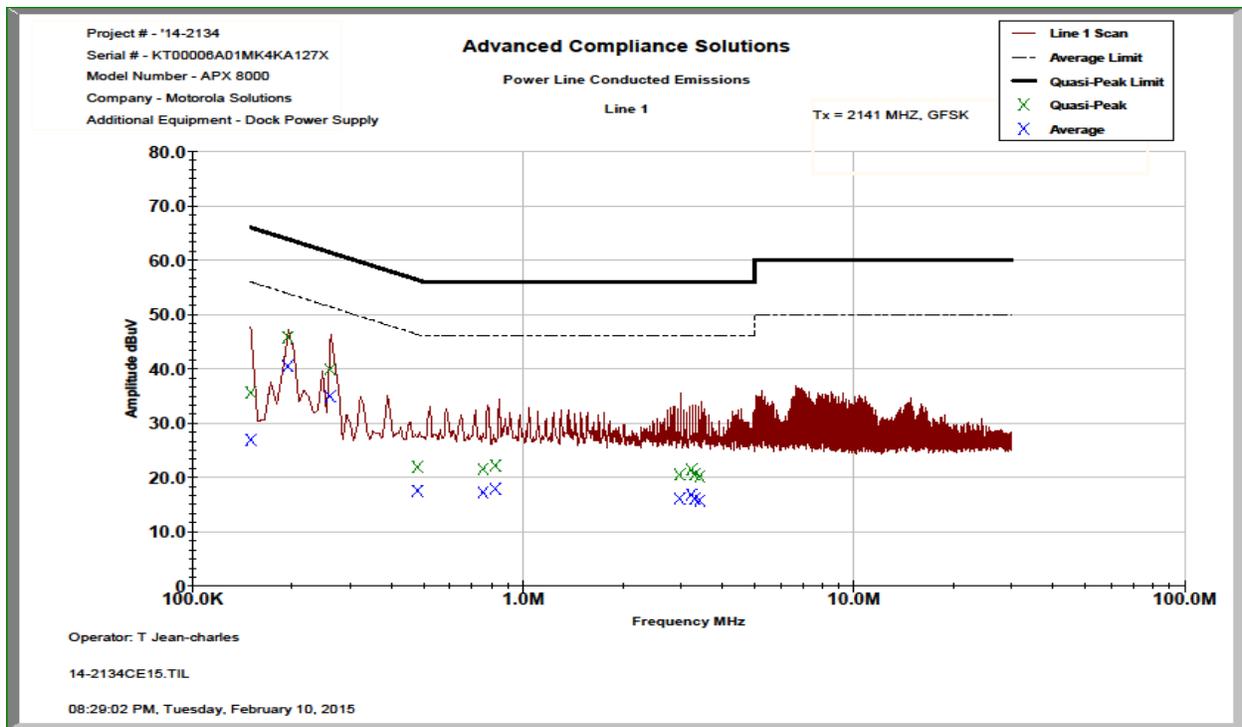


Figure 7.2.2-1: Conducted Emissions Results – Line 1

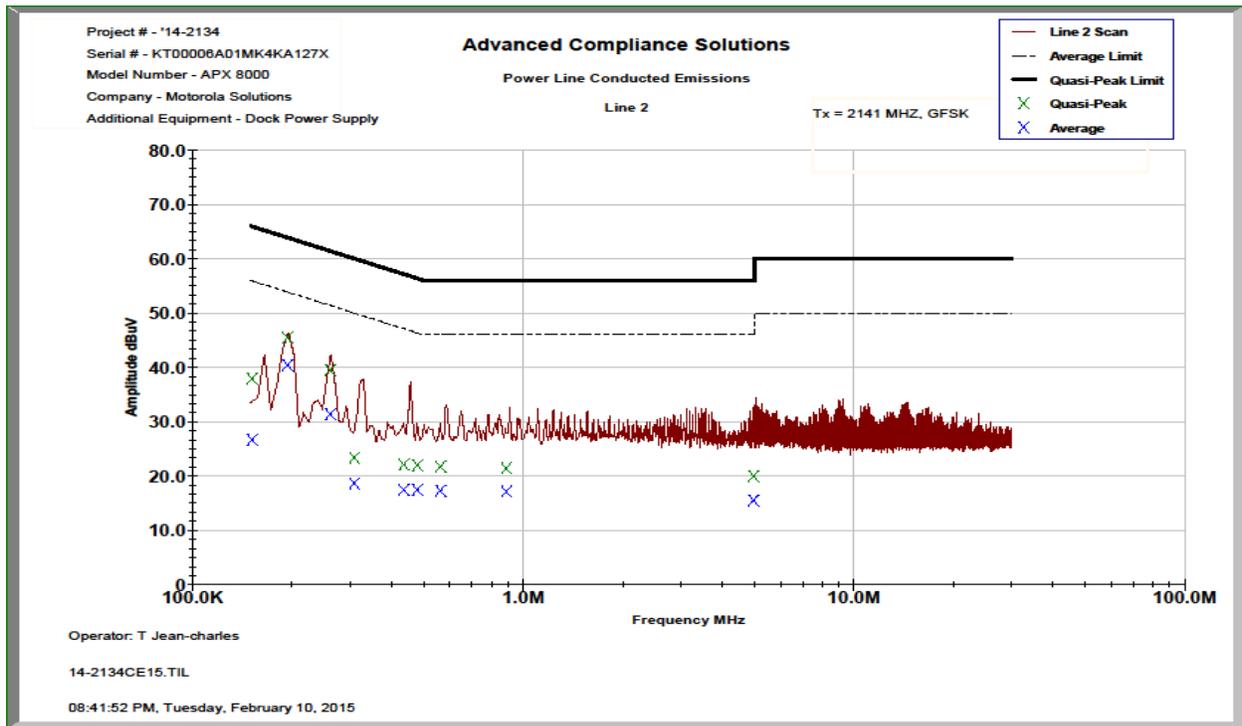


Figure 7.2.2-2: Conducted Emissions Results – Line 2

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: 14-2135CE15
 Power Supply Description: 14 VDC

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									
0.150522	25.579	16.889	10.05	35.63	26.94	65.97	55.97	30.3	29.0
0.194674	35.791	30.467	10.04	45.83	40.50	63.83	53.83	18.0	13.3
0.260938	29.936	24.897	10.03	39.96	34.92	61.40	51.40	21.4	16.5
0.48	11.886	7.528	10.03	21.91	17.56	56.34	46.34	34.4	28.8
0.75685	11.519	7.204	10.04	21.56	17.24	56.00	46.00	34.4	28.8
0.824012	12.185	7.859	10.04	22.22	17.90	56.00	46.00	33.8	28.1
2.97321	10.277	5.896	10.14	20.42	16.04	56.00	46.00	35.6	30.0
3.22694	11.195	6.616	10.20	21.40	16.82	56.00	46.00	34.6	29.2
3.30156	10.258	5.79	10.20	20.46	15.99	56.00	46.00	35.5	30.0
3.42096	9.963	5.549	10.20	20.17	15.75	56.00	46.00	35.8	30.2
Line 2									
0.151701	27.859	16.604	10.06	37.92	26.67	65.91	55.91	28.0	29.2
0.194175	35.399	30.378	10.05	45.45	40.43	63.86	53.86	18.4	13.4
0.261437	29.461	21.345	10.05	39.51	31.39	61.39	51.39	21.9	20.0
0.309099	13.336	8.6	10.04	23.37	18.64	59.99	49.99	36.6	31.4
0.435963	12.071	7.422	10.03	22.11	17.46	57.14	47.14	35.0	29.7
0.479999	11.948	7.43	10.04	21.98	17.47	56.34	46.34	34.4	28.9
0.562825	11.756	7.265	10.04	21.80	17.31	56.00	46.00	34.2	28.7
0.891175	11.378	7.068	10.06	21.44	17.13	56.00	46.00	34.6	28.9
4.98	9.699	5.202	10.26	19.96	15.46	56.00	46.00	36.0	30.5
4.9801	9.695	5.223	10.26	19.96	15.49	56.00	46.00	36.0	30.5

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

7.3.1 Measurement Procedure (Conducted Method)

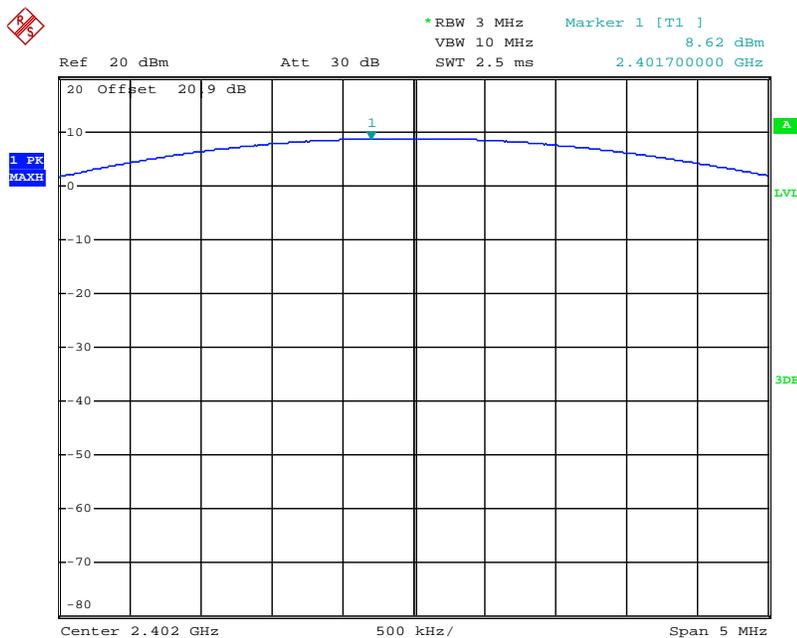
The RF output port of the EUT was directly connected to the input of the spectrum analyzer through suitable attenuation.

7.3.2 Measurement Results

Results are shown below:

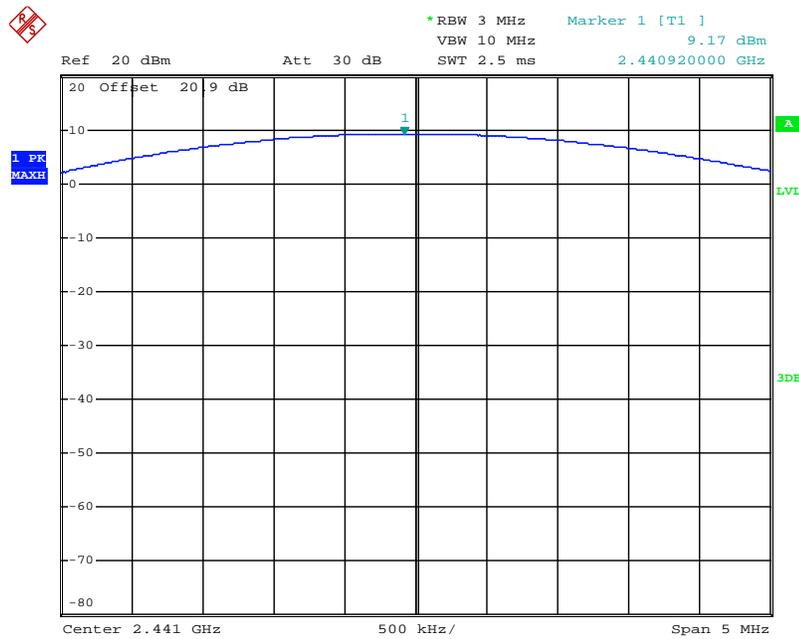
Table 7.3.2-1: RF Output Power (GFSK)

Frequency (MHz)	Power (dBm)
2402	8.62
2441	9.17
2480	9.20



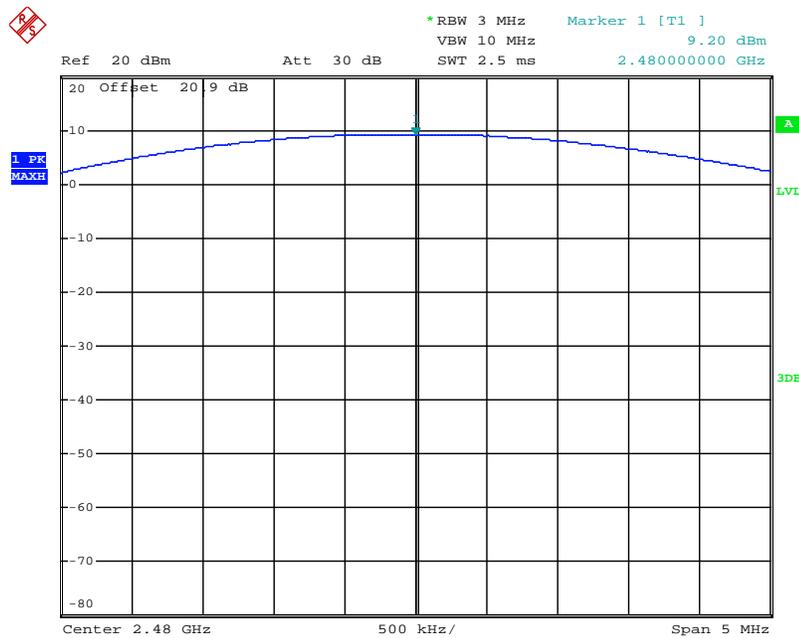
Date: 19.JAN.2015 22:07:24

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



Date: 19.JAN.2015 22:10:01

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

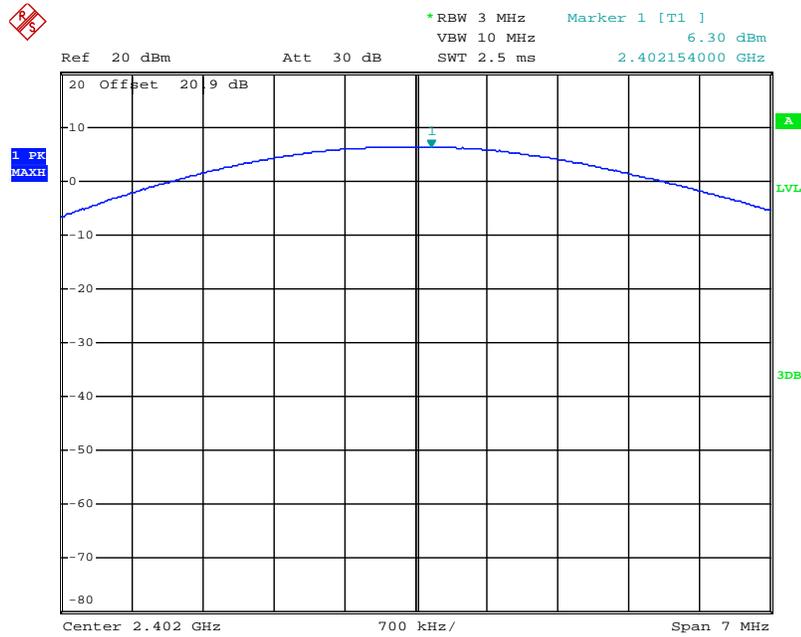


Date: 19.JAN.2015 22:14:31

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

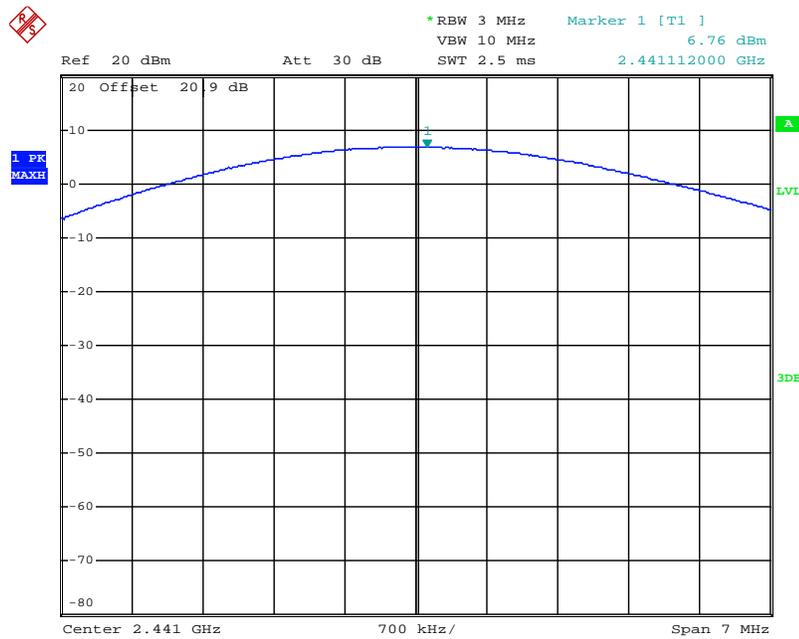
Table 7.3.2-2: RF Output Power ($\pi/4$ DQPSK)

Frequency (MHz)	Power (dBm)
2402	6.30
2441	6.76
2480	6.82



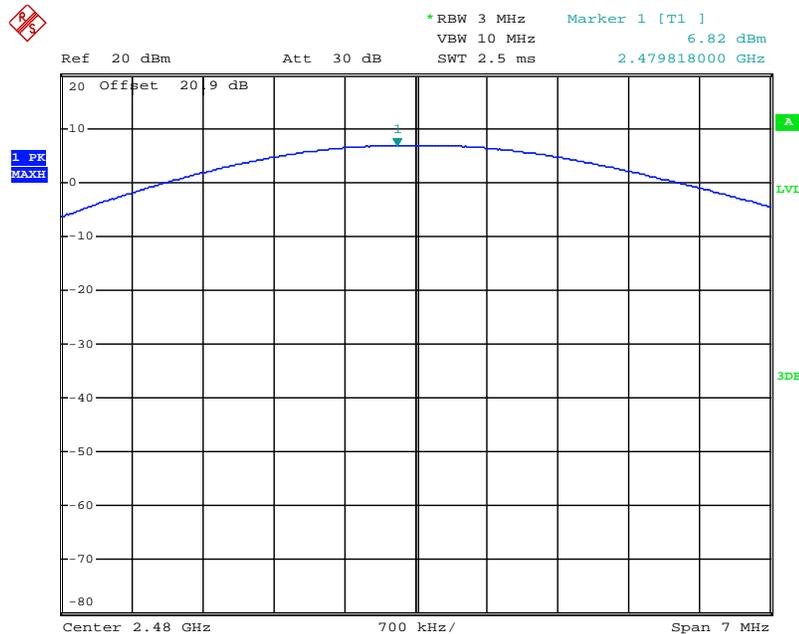
Date: 19.JAN.2015 22:20:22

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



Date: 19.JAN.2015 22:18:26

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

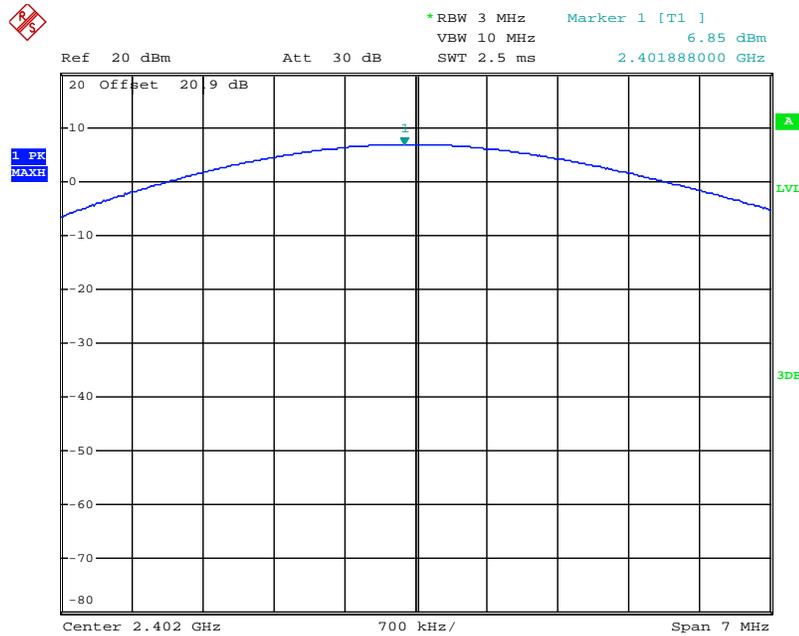


Date: 19.JAN.2015 22:16:34

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

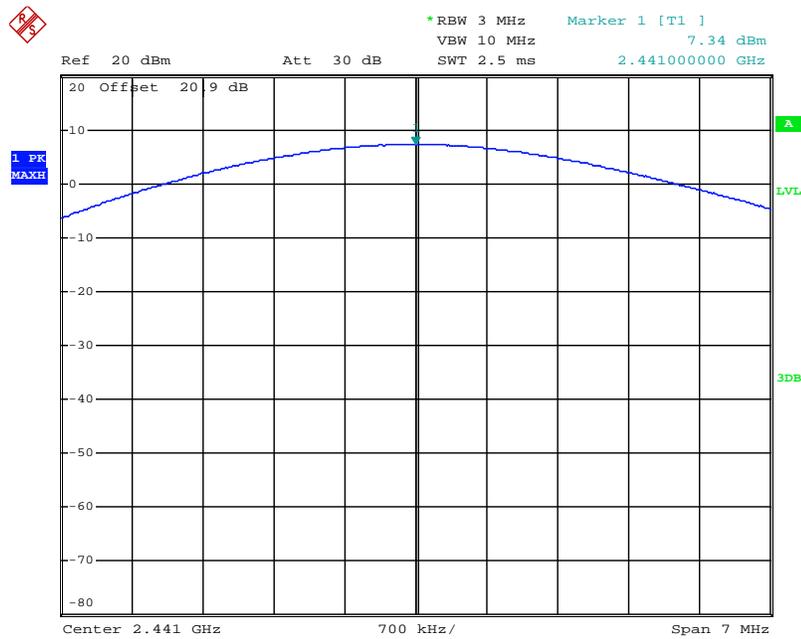
Table 7.3.2-3 RF Output Power (8DPSK)

Frequency (MHz)	Power (dBm)
2402	6.85
2441	7.34
2480	7.40



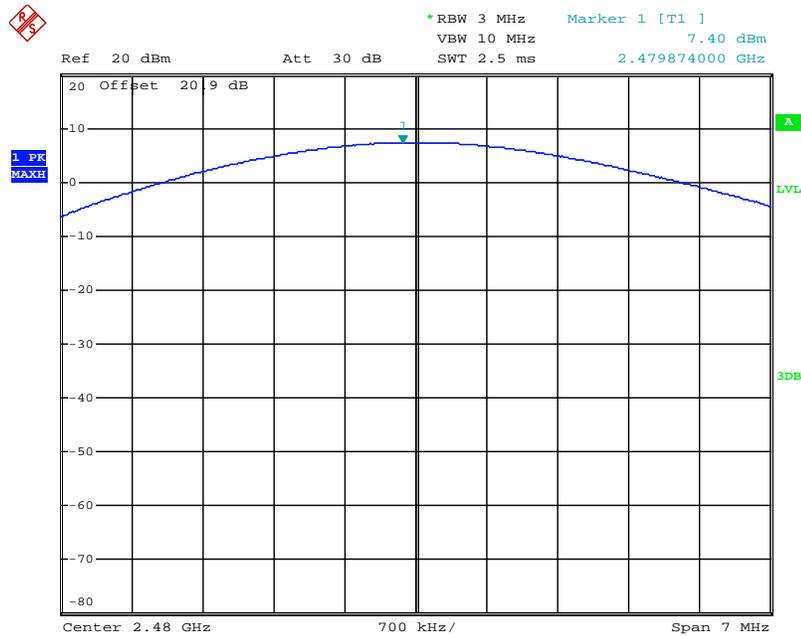
Date: 19.JAN.2015 22:24:01

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



Date: 19.JAN.2015 22:25:47

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



Date: 19.JAN.2015 22:29:03

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

7.4 Channel Usage Requirements

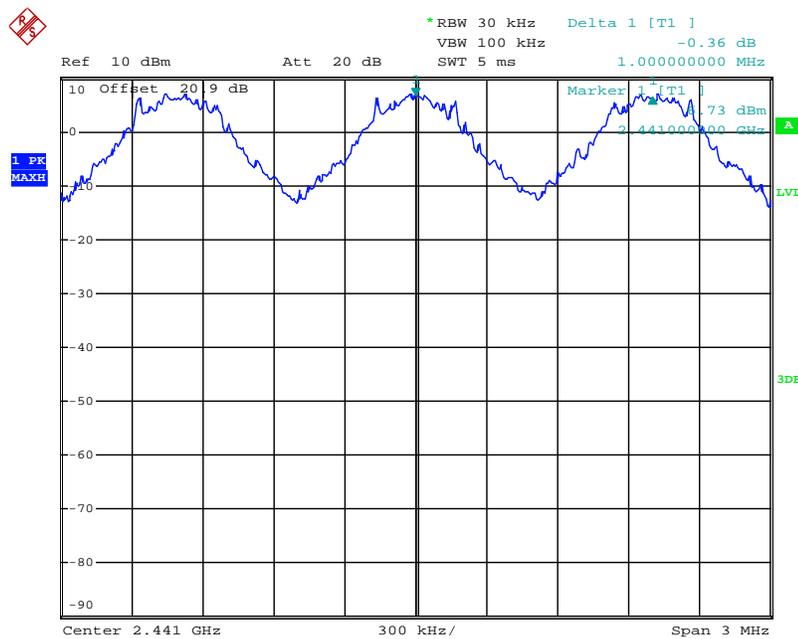
7.4.1 Carrier Frequency Separation – FCC: Section 15.247(a)(1) IC: RSS-210 A8.1(b)

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:



Date: 12.JAN.2015 15:17:11

Figure 7.4.1.2-1: Carrier Frequency Separation

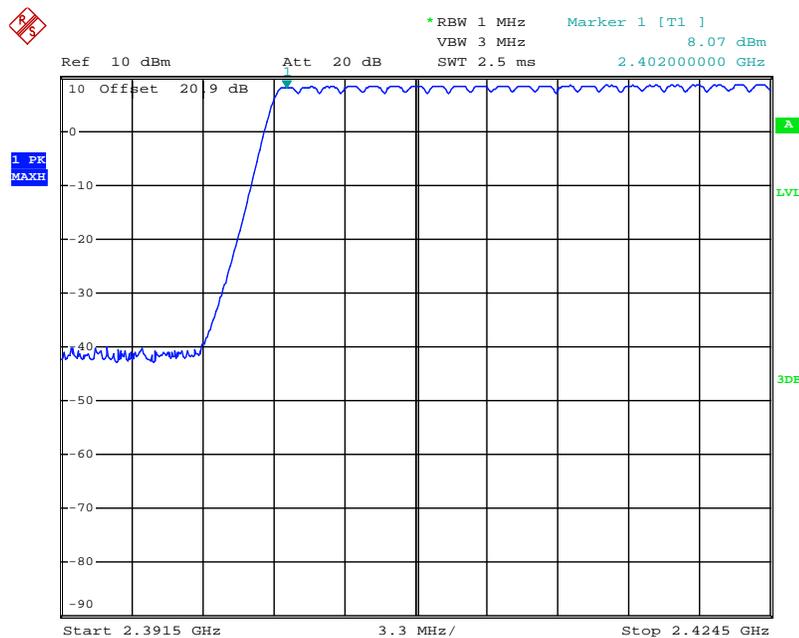
7.4.2 Number of Hopping Channels – FCC: Section 15.247(a)(1)(iii) IC: RSS-210 A8.1(d)

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.

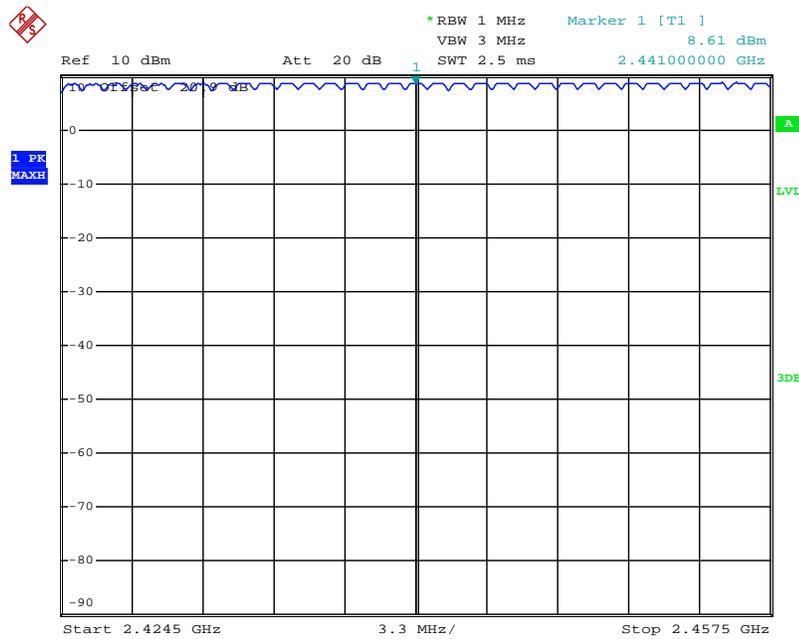
7.4.2.2 Measurement Results

Results are shown below:



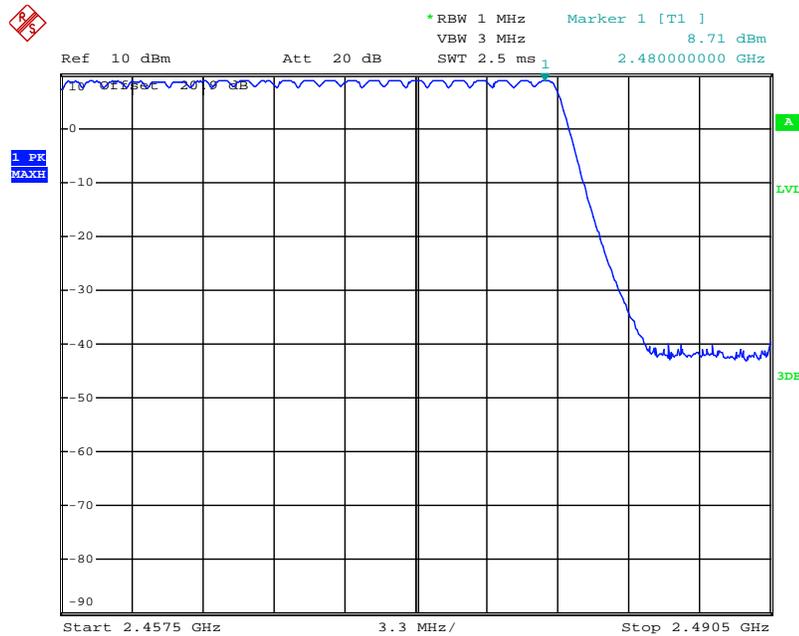
Date: 12.JAN.2015 15:23:18

Figure 7.4.2.2-1: Number of Hopping Channels (1 – 23)



Date: 12.JAN.2015 15:21:21

Figure 7.4.2.2-2: Number of Hopping Channels (24 – 56)



Date: 12.JAN.2015 15:24:17

Figure 7.4.2.2-3: Number of Hopping Channels (57 – 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.

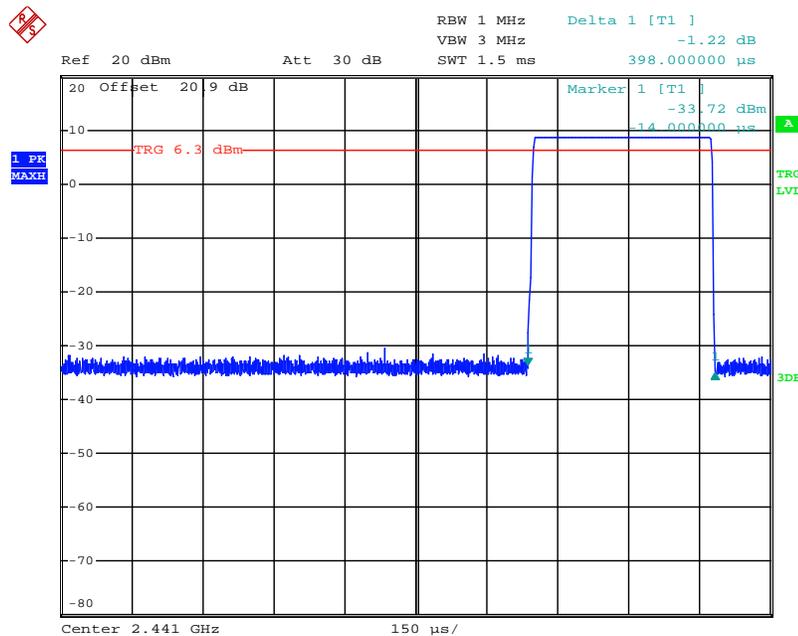
7.4.3.2 Measurement Results

Results are shown below:

Table 7.4.3.2-1 Dwell Time on a 31.6 Second Cycle

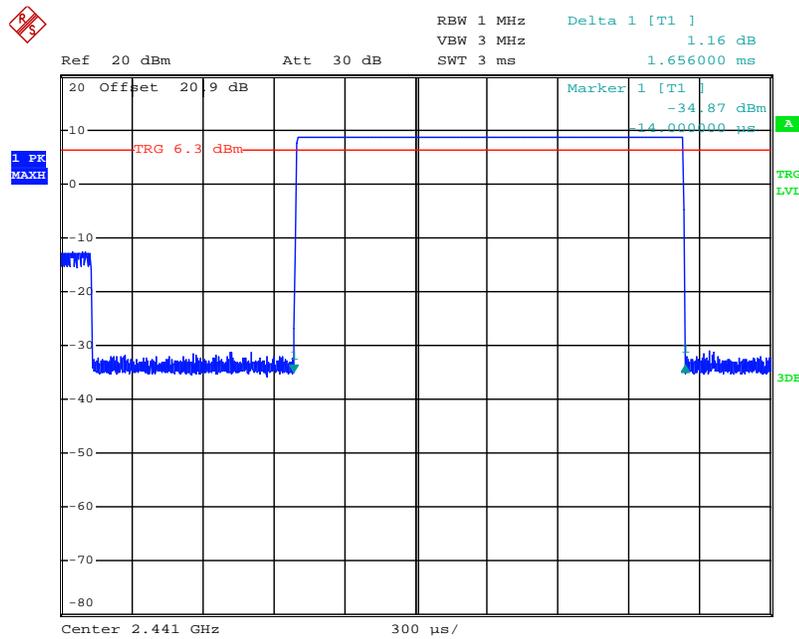
Packet Format	Number of Hops Per Sec. (NHPS)	Number of Hops per Channel Per Sec. (NHPCPS)	Number of hops on a 31.6 s Cycle (NHPC)	Measured Dwell Times (ms)	Dwell Times on a 31.6 s Cycle	Limit (ms)	Status
DH1	800	10.13	320	0.398	127.36	400	PASS
DH3	400	5.06	160	1.656	264.96	400	PASS
DH5	266.67	3.38	106.67	2.910625	310.48	400	PASS

*



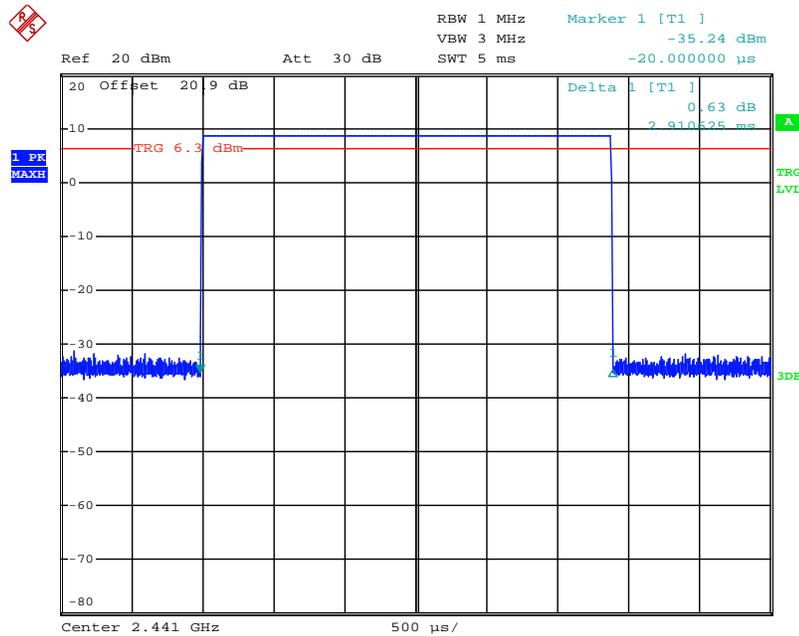
Date: 12.JAN.2015 17:32:35

Figure 7.4.3.2-1: Channel Dwell Time – DH1



Date: 12.JAN.2015 17:22:34

Figure 7.4.3.2-2: Channel Dwell Time – DH3



Date: 12.JAN.2015 17:11:45

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.

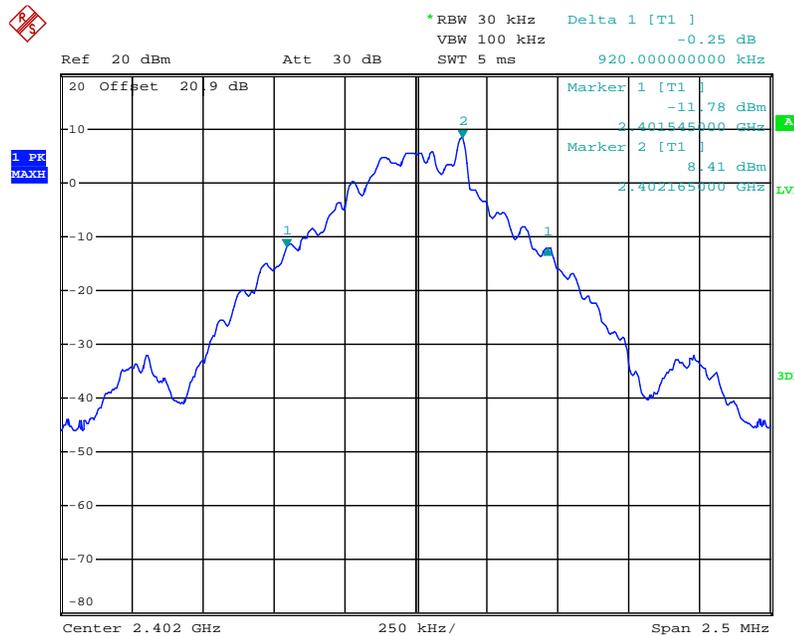
The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission. The RBW was set to 1% to 5% of the approximated bandwidth. The occupied 99% bandwidth was measured by using a delta marker at the lower and upper frequencies leading to 0.5% of the total power.

7.4.4.2 Measurement Results

Results are shown below:

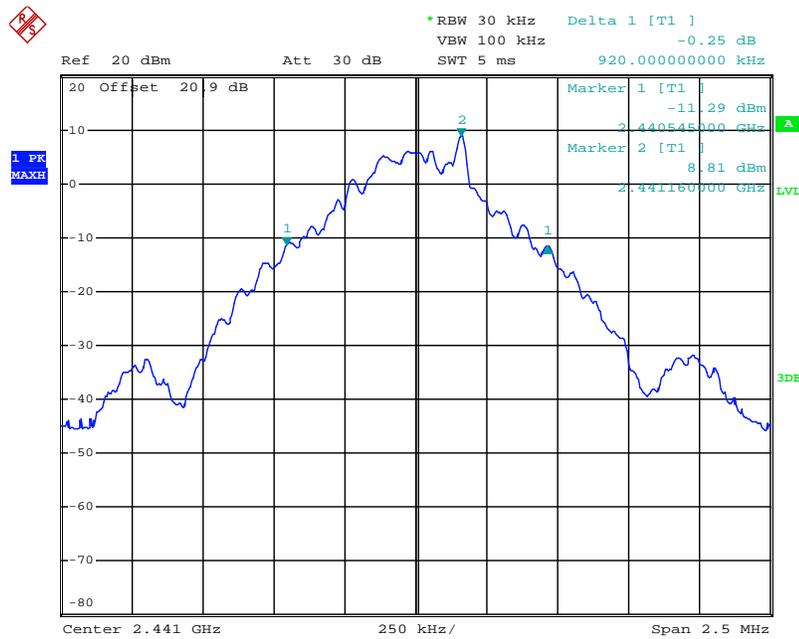
Table 7.4.4.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	920.0	852.0
2441	920.0	852.0
2480	918.0	850.0



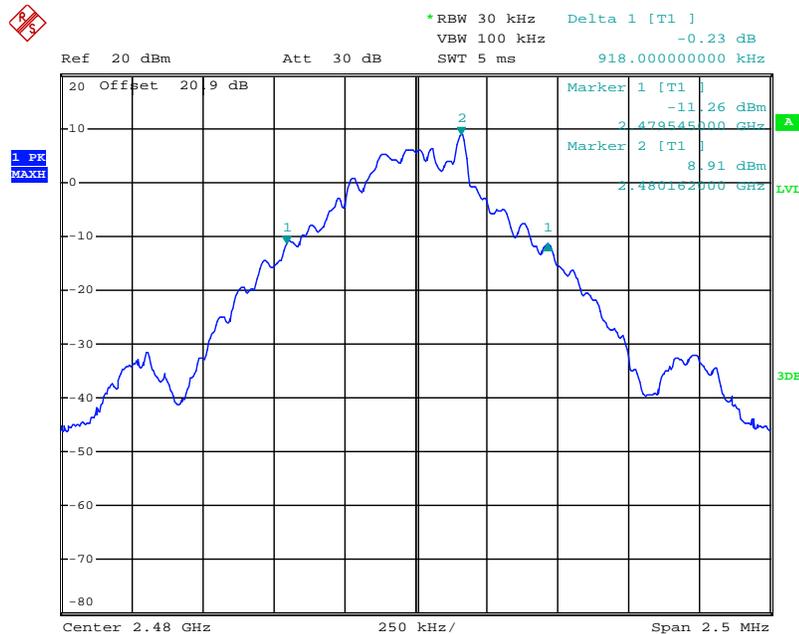
Date: 19.JAN.2015 22:05:44

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



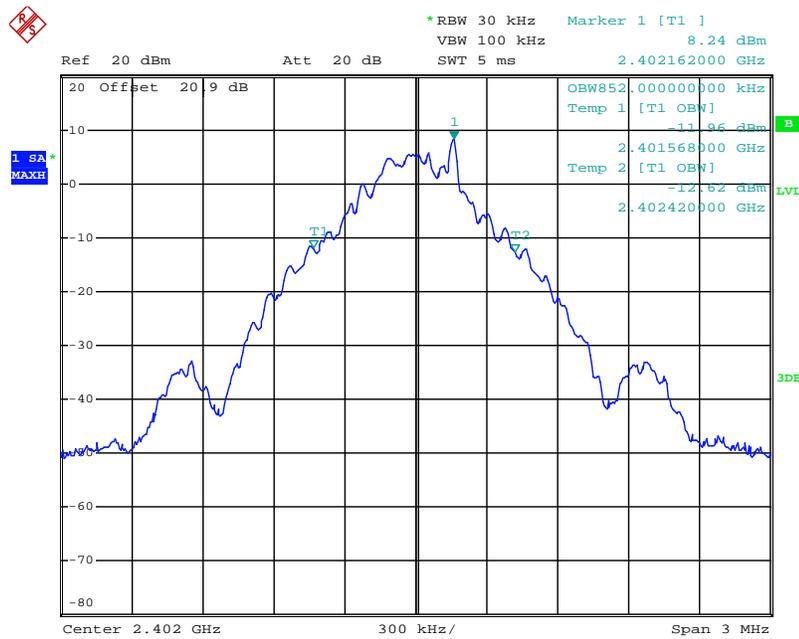
Date: 13.JAN.2015 15:21:37

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



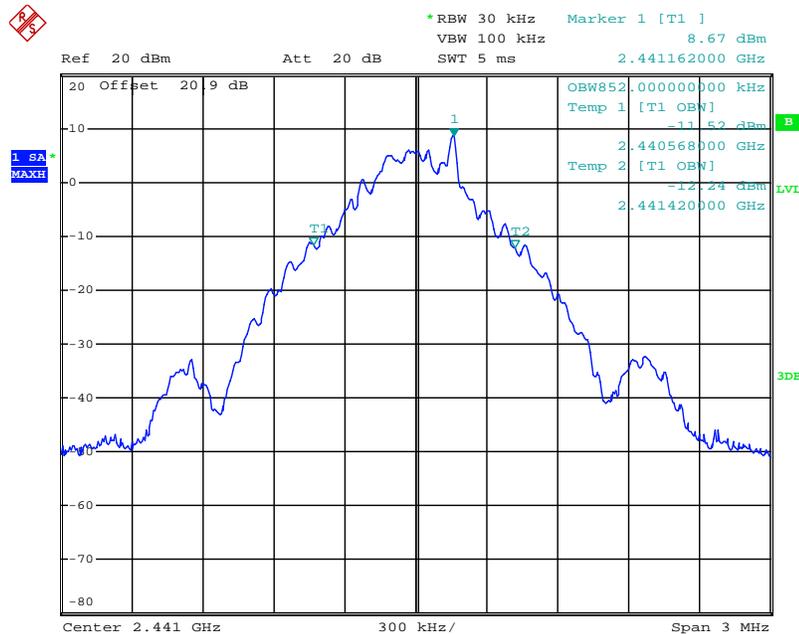
Date: 13.JAN.2015 15:16:39

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



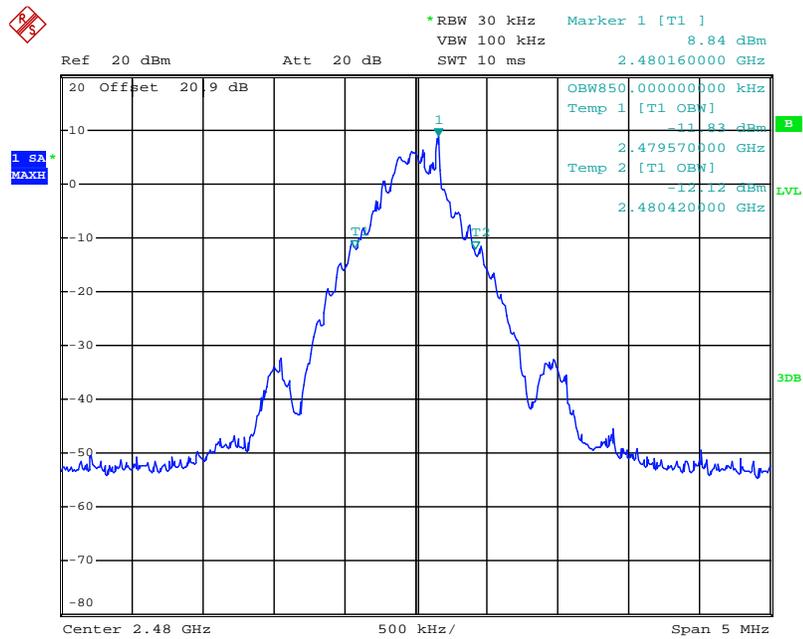
Date: 13.JAN.2015 15:31:35

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



Date: 13.JAN.2015 15:25:12

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

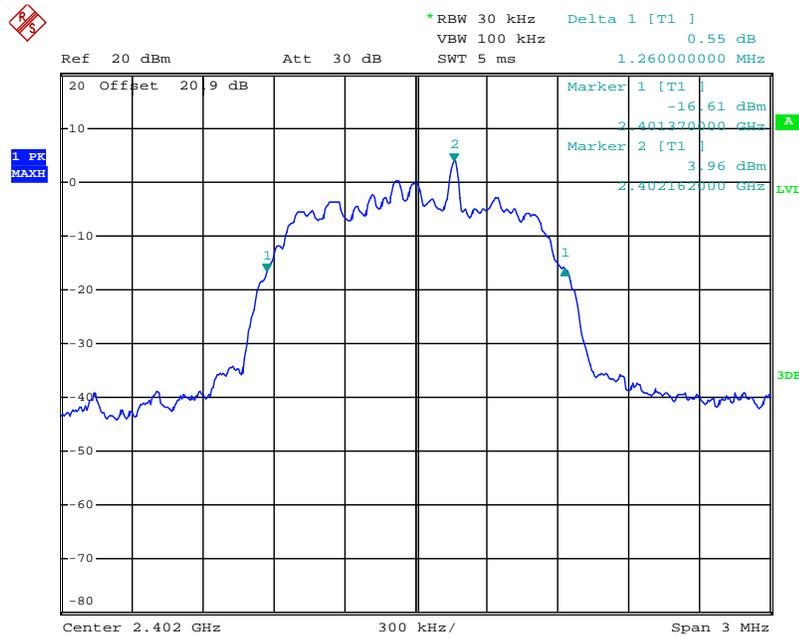


Date: 13.JAN.2015 15:11:13

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

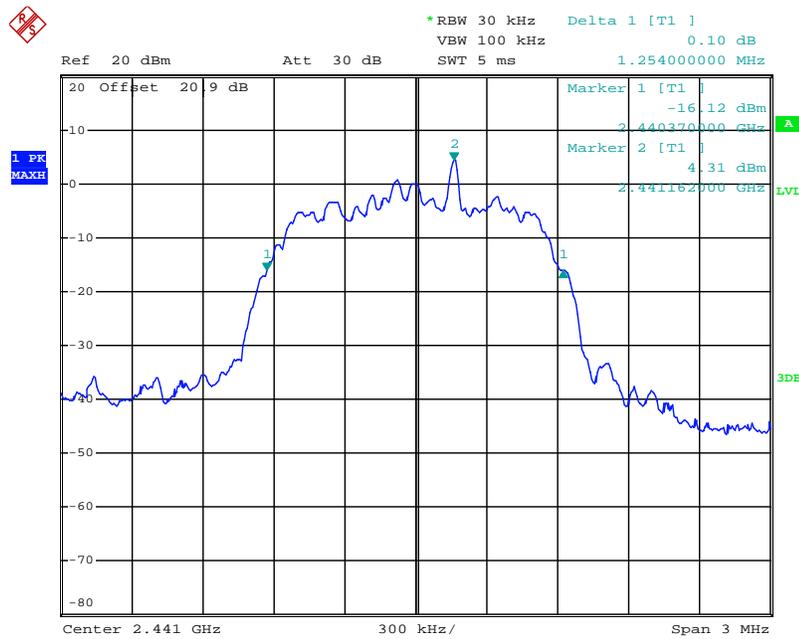
Table: 7.4.4.2-2: 20dB / 99% Bandwidth ($\pi/4$ DQPSK)

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	1260.0	1170.0
2441	1254.0	1170.0
2480	1260.0	1170.0



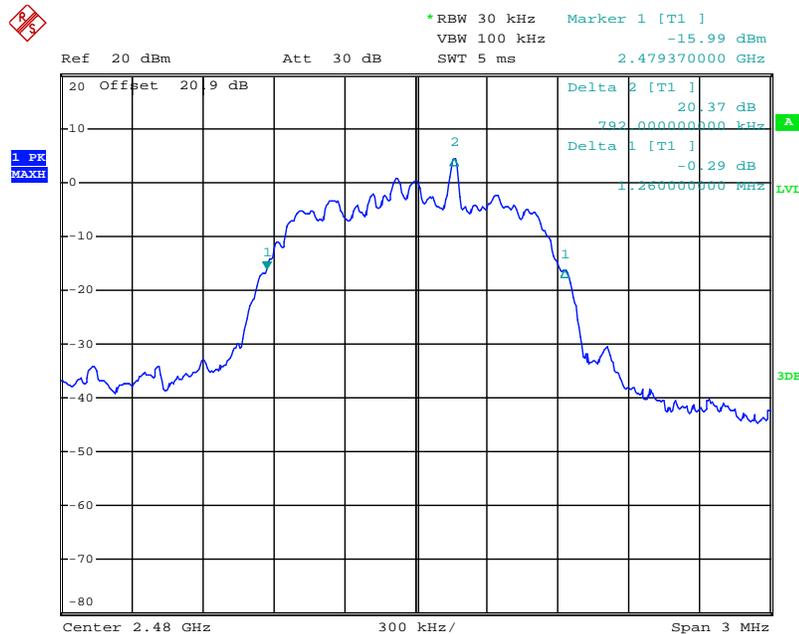
Date: 13.JAN.2015 15:04:26

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



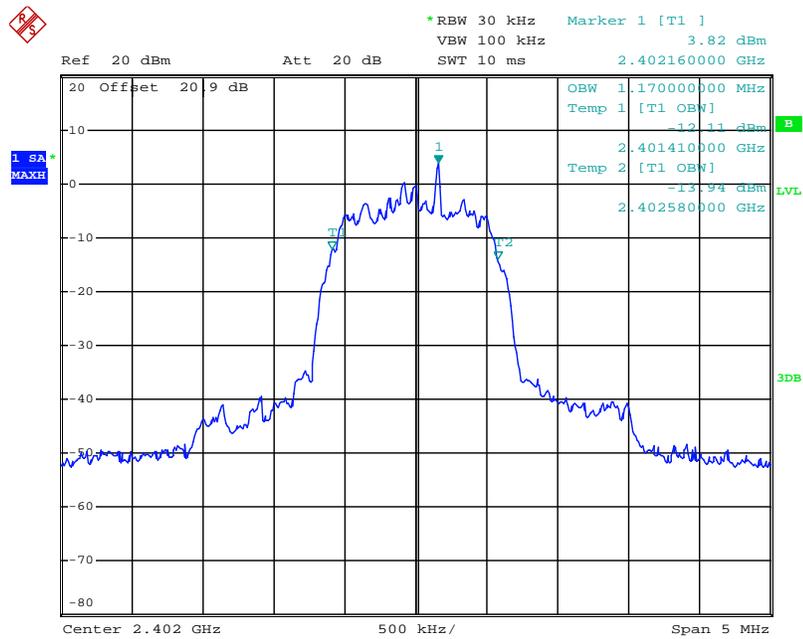
Date: 13.JAN.2015 15:01:52

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



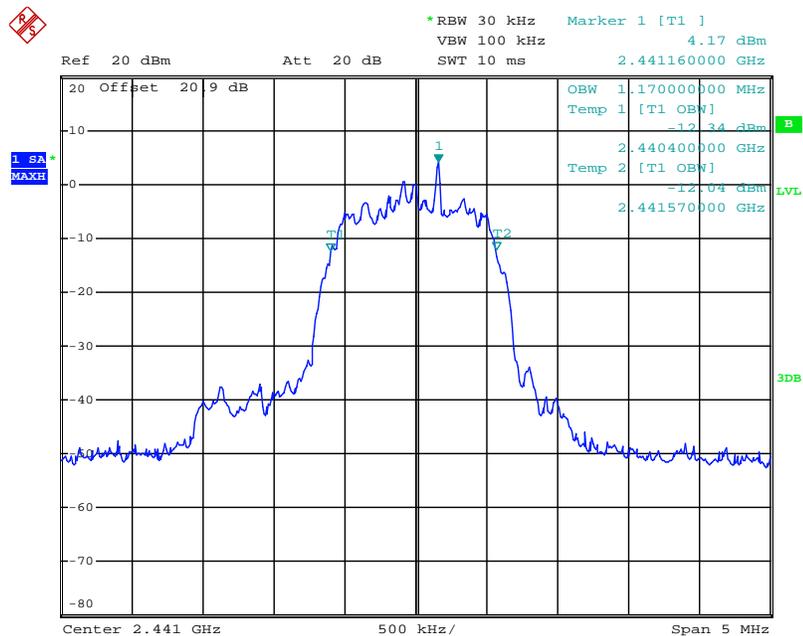
Date: 13.JAN.2015 14:55:05

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



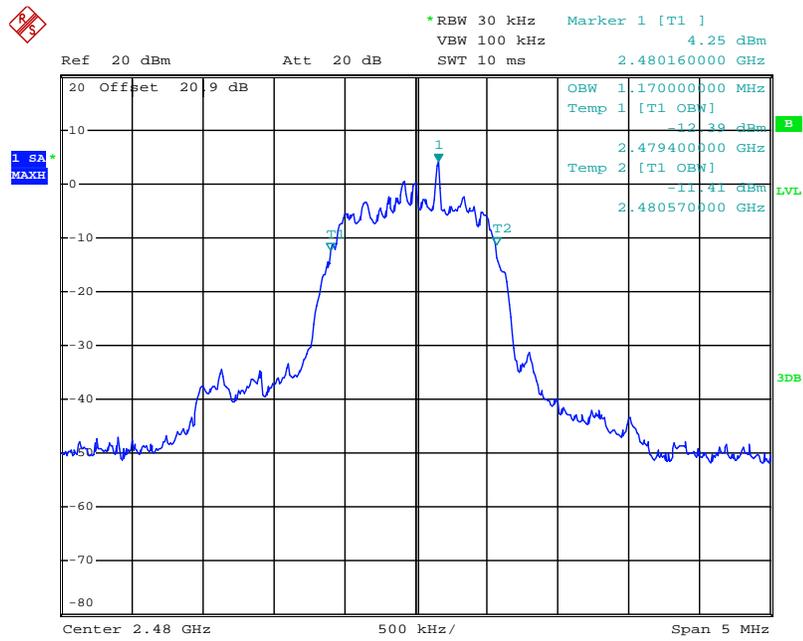
Date: 13.JAN.2015 15:08:14

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



Date: 13.JAN.2015 14:59:08

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

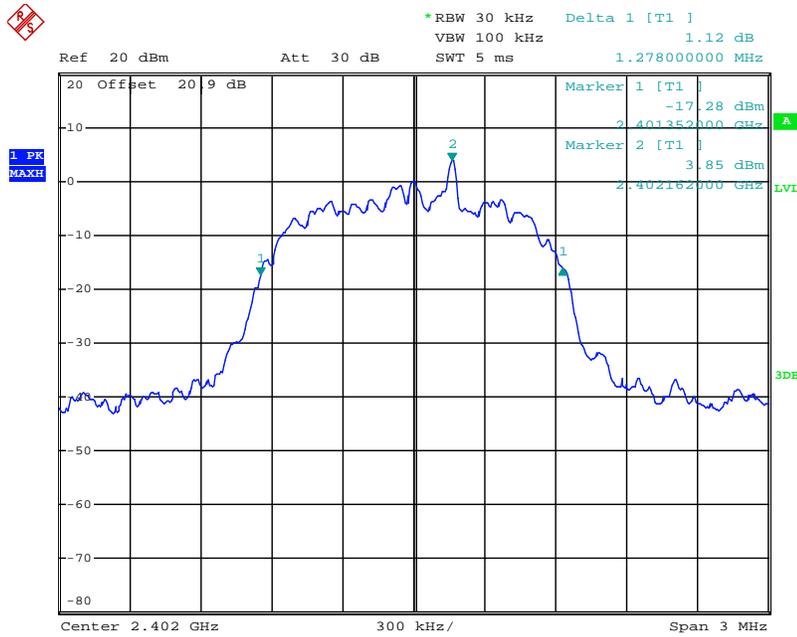


Date: 13.JAN.2015 14:56:42

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

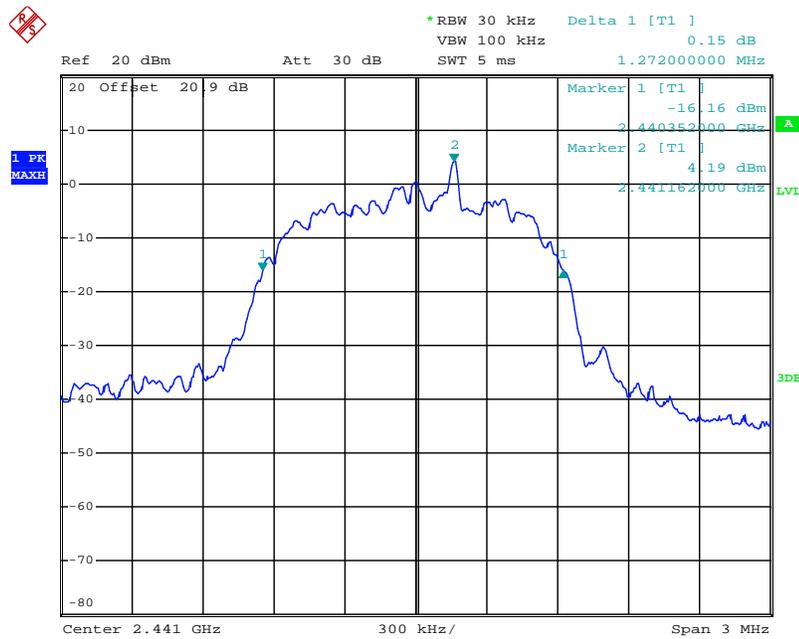
Table 7.4.4.2-3: 20dB / 99% Bandwidth (8DPSK)

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	1278.0	1180.0
2441	1272.0	1190.0
2480	1272.0	1190.0



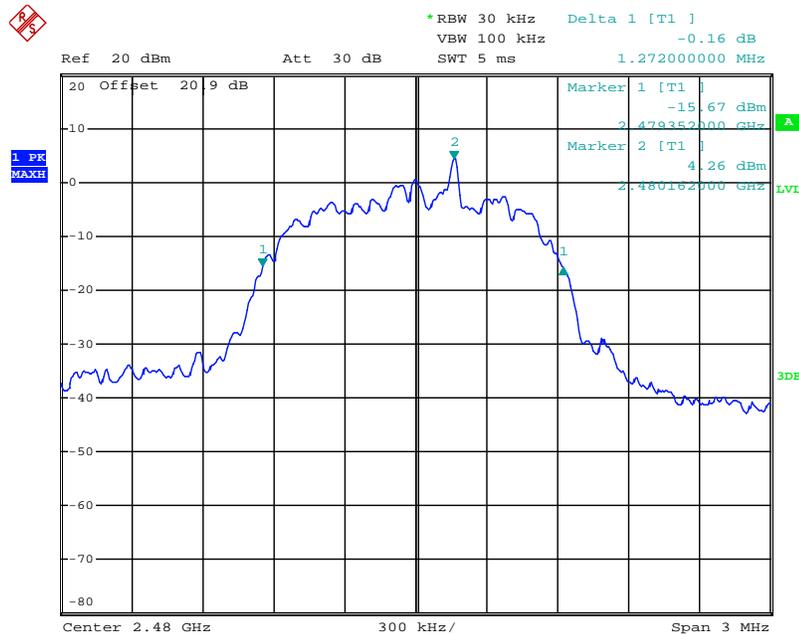
Date: 13.JAN.2015 12:35:30

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



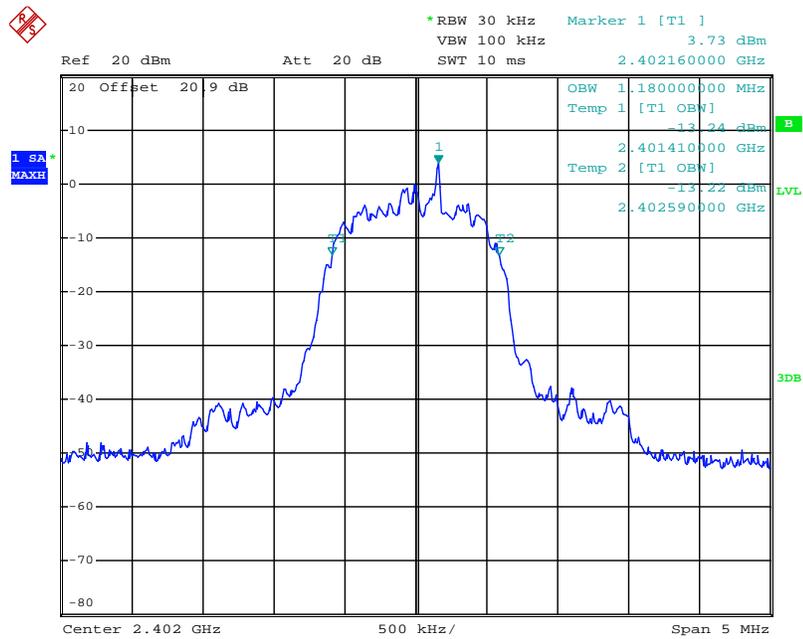
Date: 13.JAN.2015 12:23:31

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



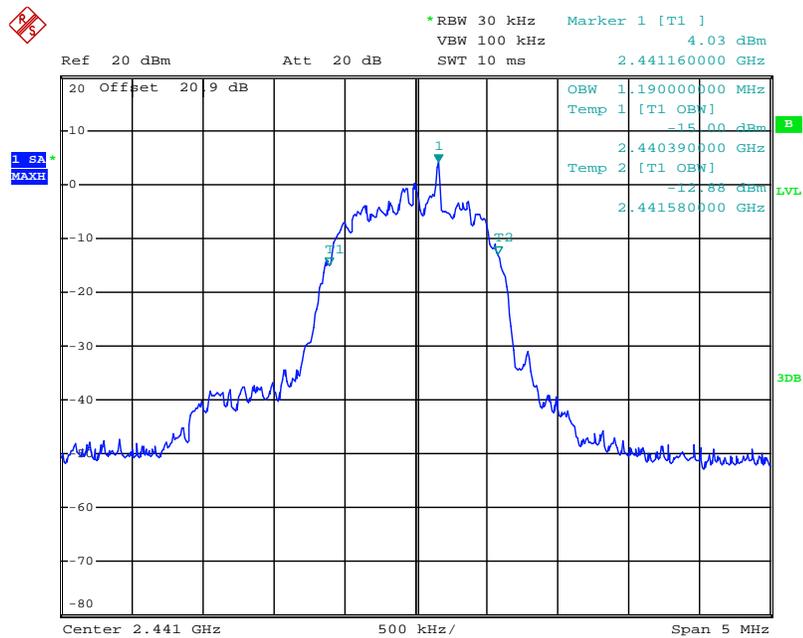
Date: 13.JAN.2015 11:56:33

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



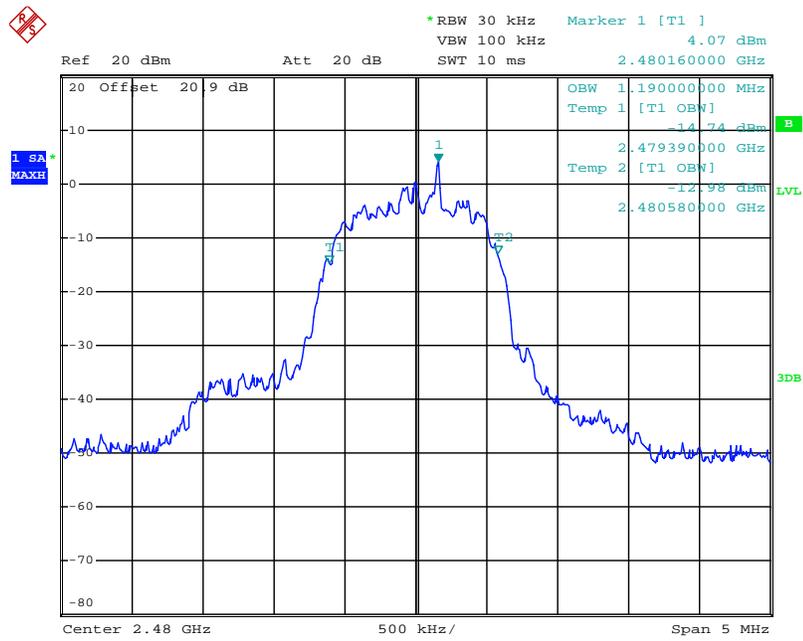
Date: 13.JAN.2015 12:38:27

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



Date: 13.JAN.2015 12:16:47

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



Date: 13.JAN.2015 12:41:03

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

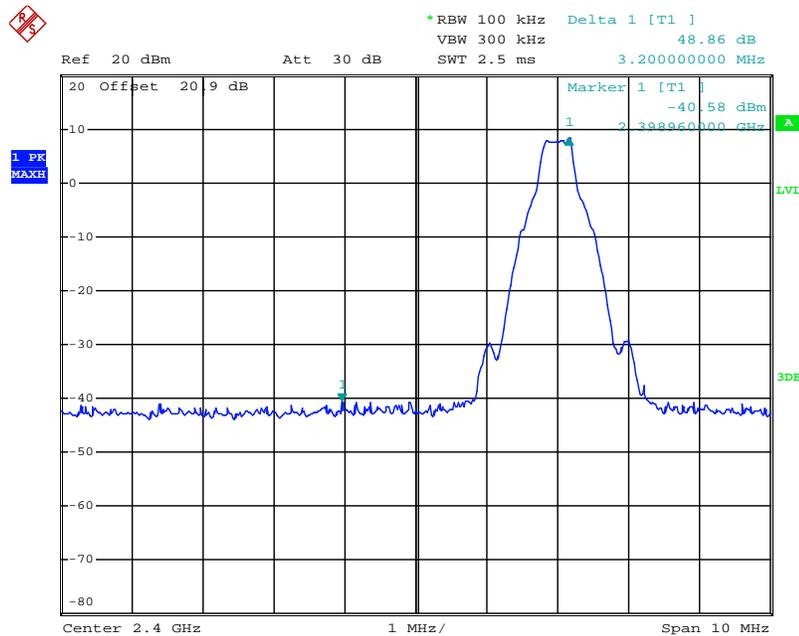
7.5 Band-Edge Compliance and Spurious Emissions-FCC 15.247(d) IC: RSS-210 A8.5

7.5.1 Band-Edge Compliance of RF Conducted Emissions

7.5.1.1 Measurement Procedure

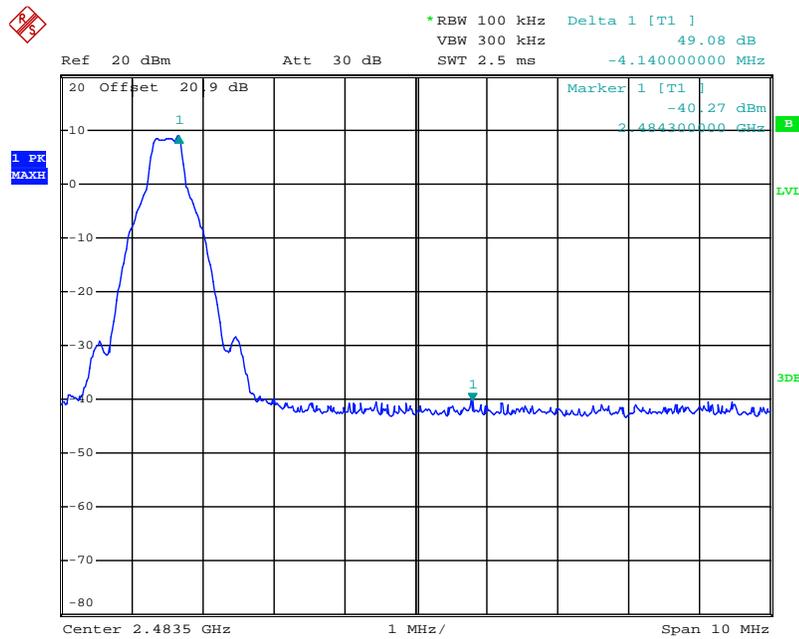
The RF output port of the EUT was connected to the input of the spectrum analyzer through suitable attenuation. The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to 100 kHz, which is \geq 1%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

7.5.1.2 Measurement Results



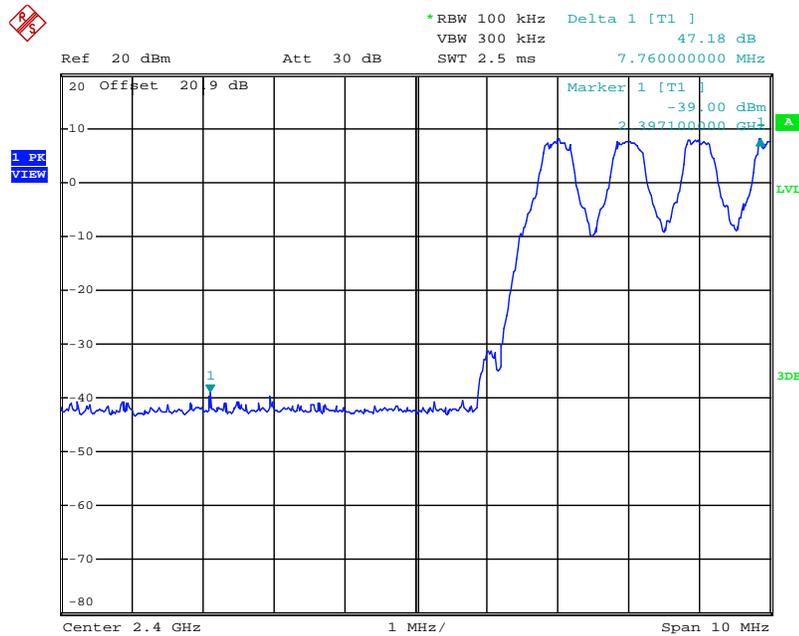
Date: 12.JAN.2015 19:45:03

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



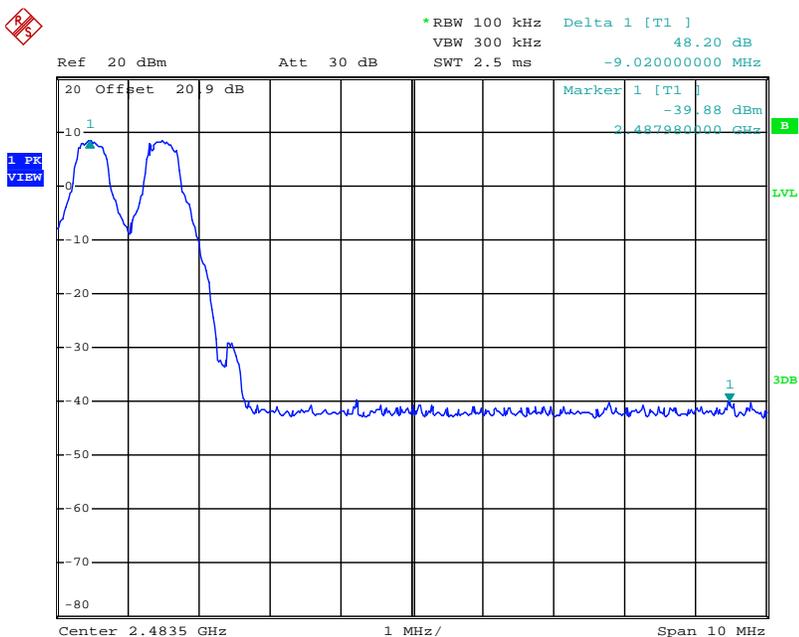
Date: 12.JAN.2015 19:47:15

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



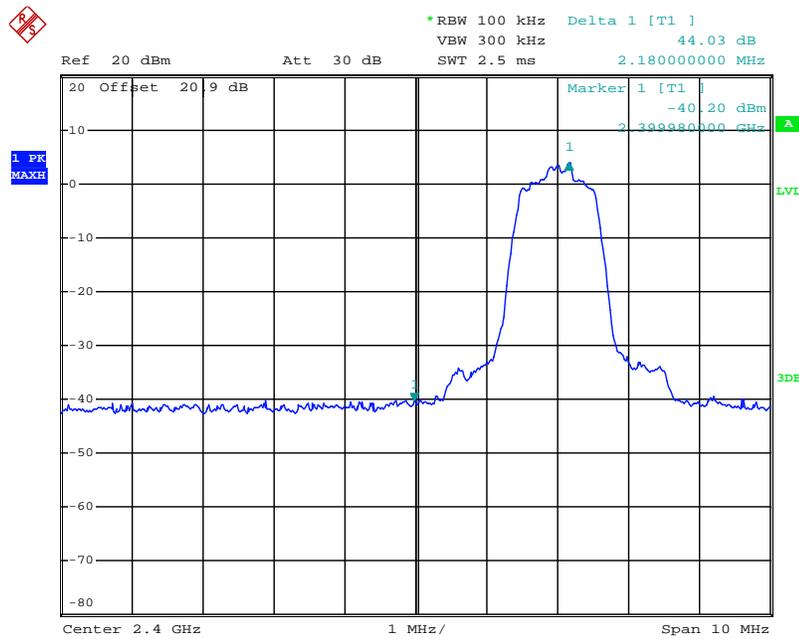
Date: 12.JAN.2015 19:40:17

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



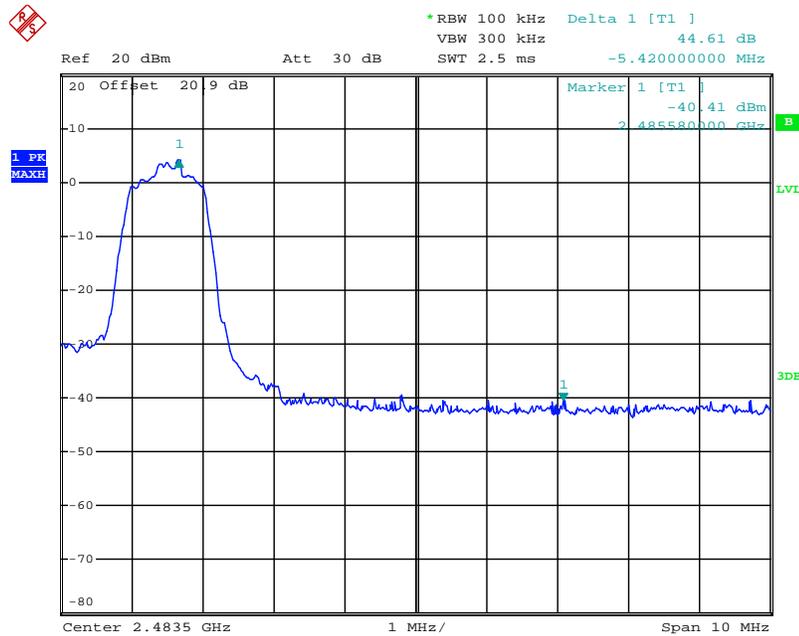
Date: 12.JAN.2015 19:39:37

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



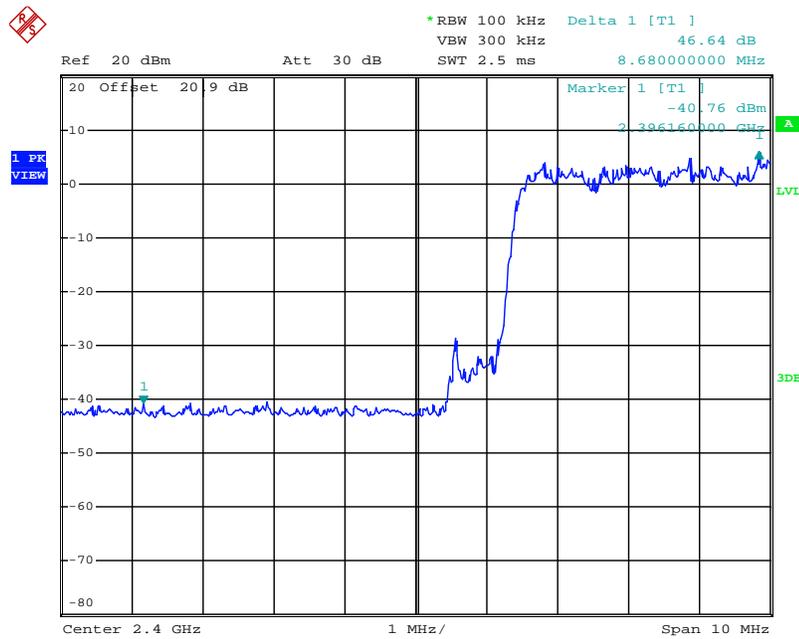
Date: 12.JAN.2015 20:01:29

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



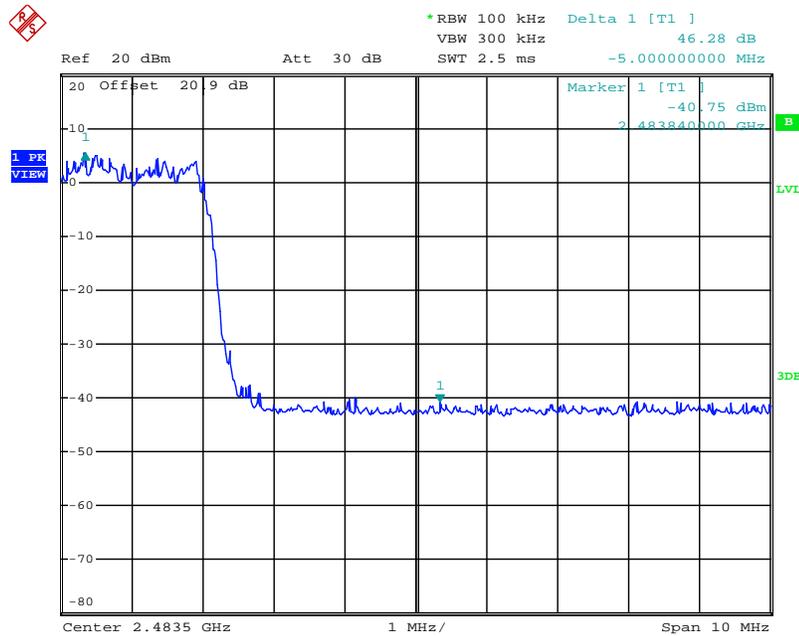
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Figure 7.5.1.2-6: Upper Band-edge ($\pi/4$ DQPSK)



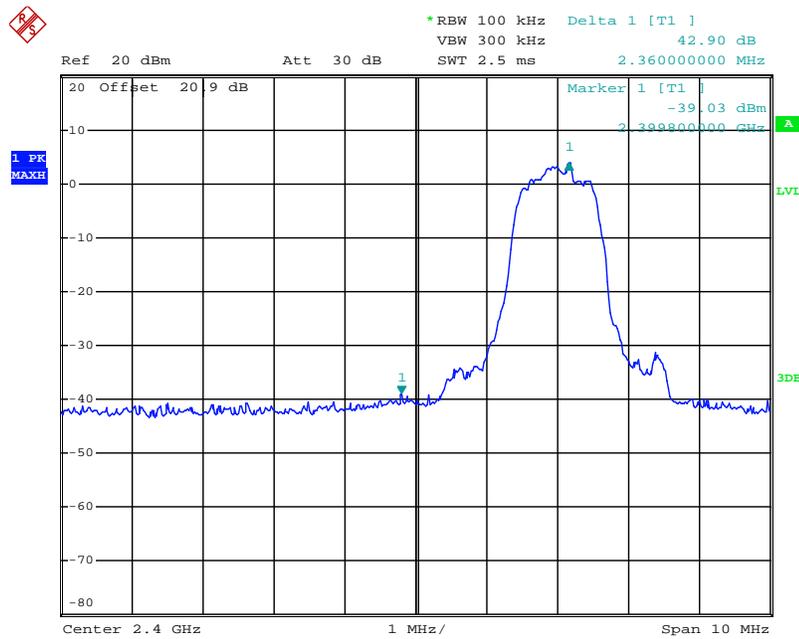
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Figure 7.5.1.2-7: Lower Band-edge – Hopping Mode ($\pi/4$ DQPSK)



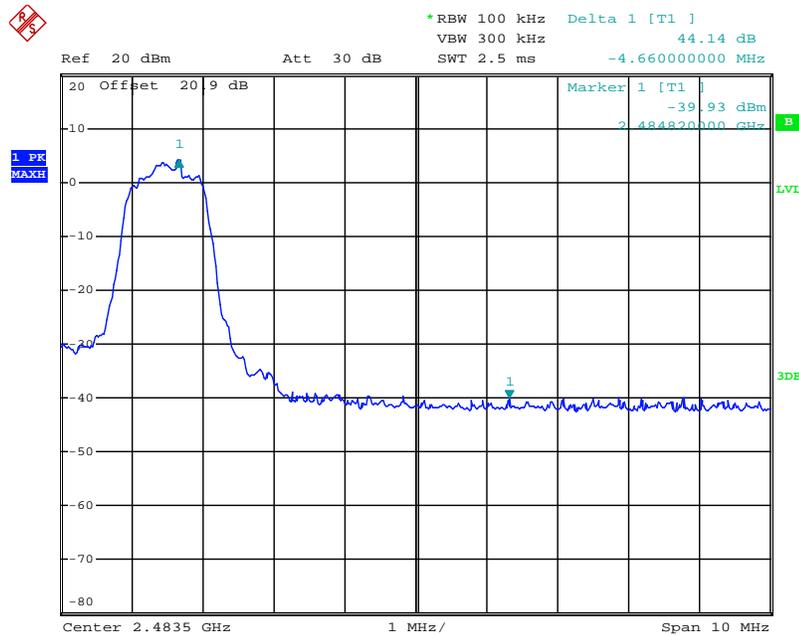
Date: 12.JAN.2015 19:29:52

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



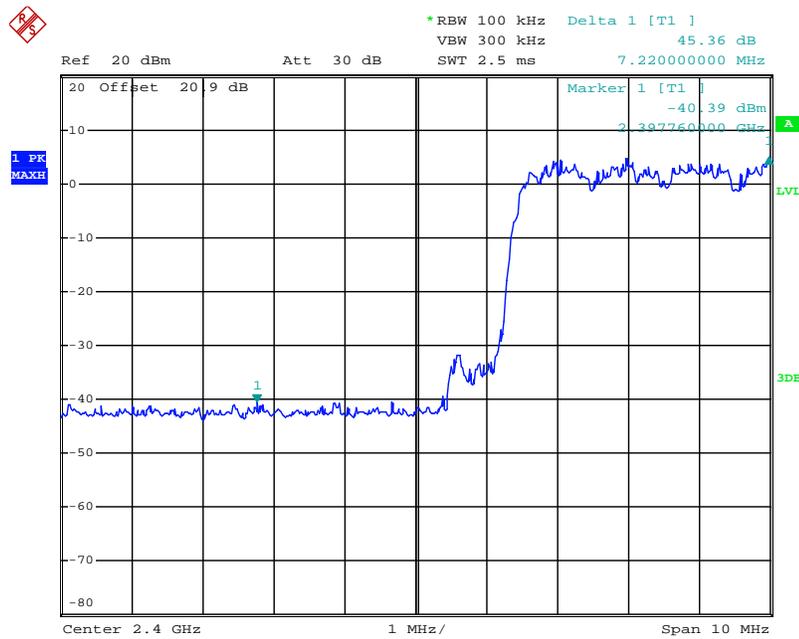
Date: 13.JAN.2015 10:51:03

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



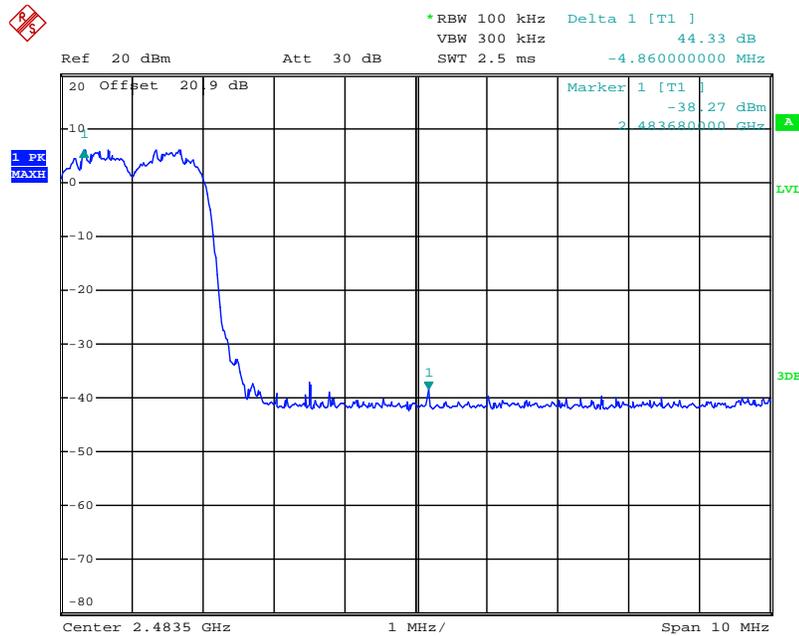
Date: 13.JAN.2015 10:59:02

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



Date: 12.JAN.2015 19:23:18

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



Date: 12.JAN.2015 19:20:39

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

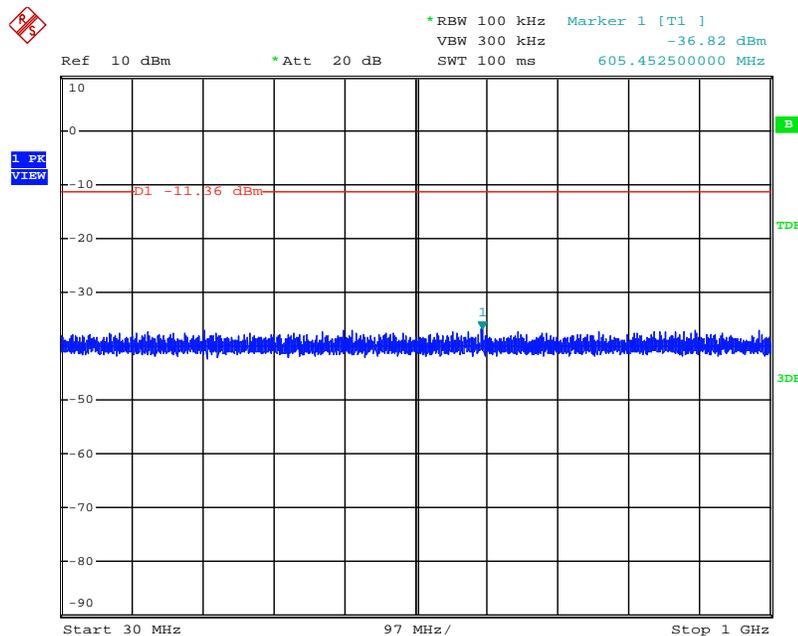
7.5.2 RF Conducted Spurious Emissions

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.

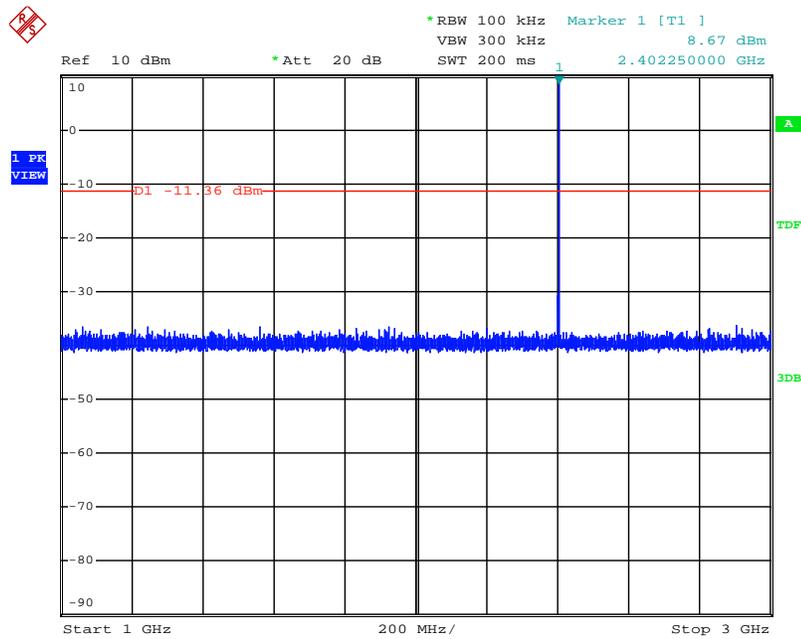
7.5.2.2 Measurement Results

Results are shown below:



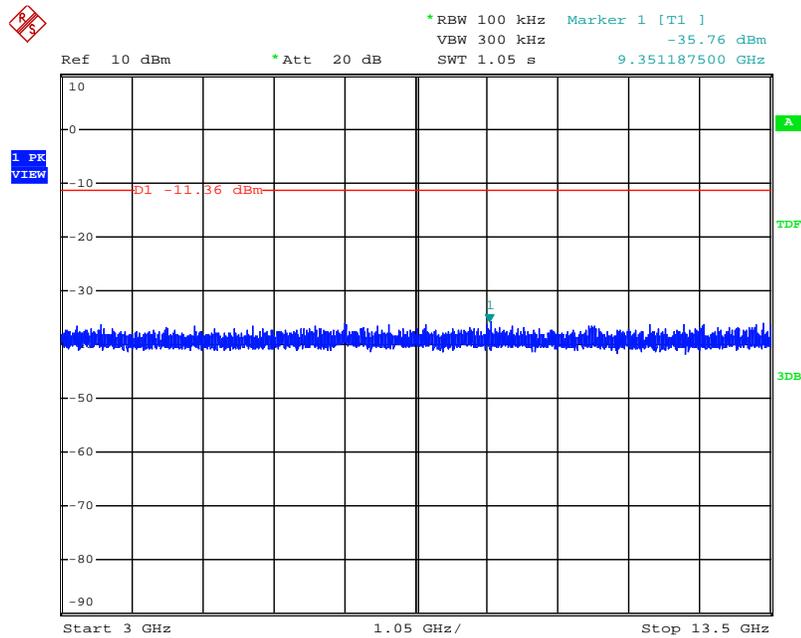
Date: 6.FEB.2015 14:41:59

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



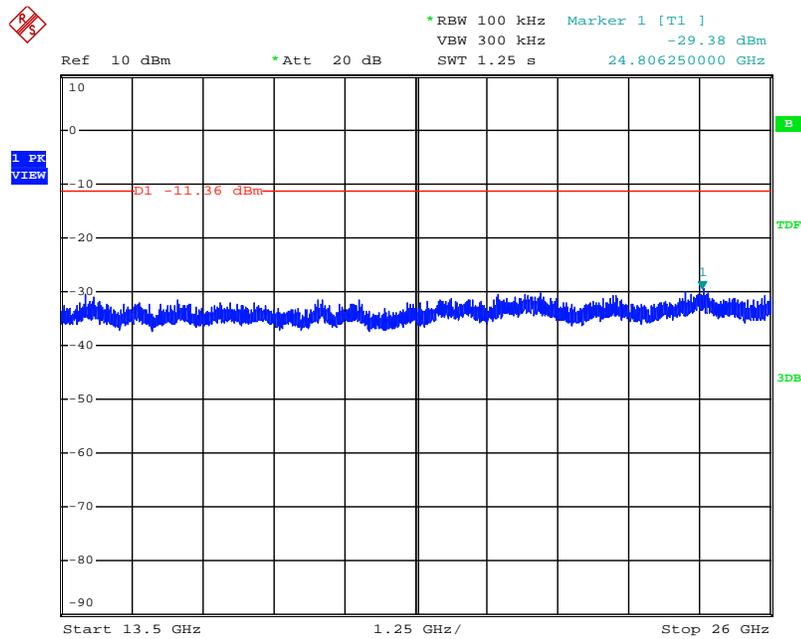
Date: 6.FEB.2015 14:42:26

Figure 7.5.2.2-2: 1 GHz -3 GHz - Low Channel (GFSK)



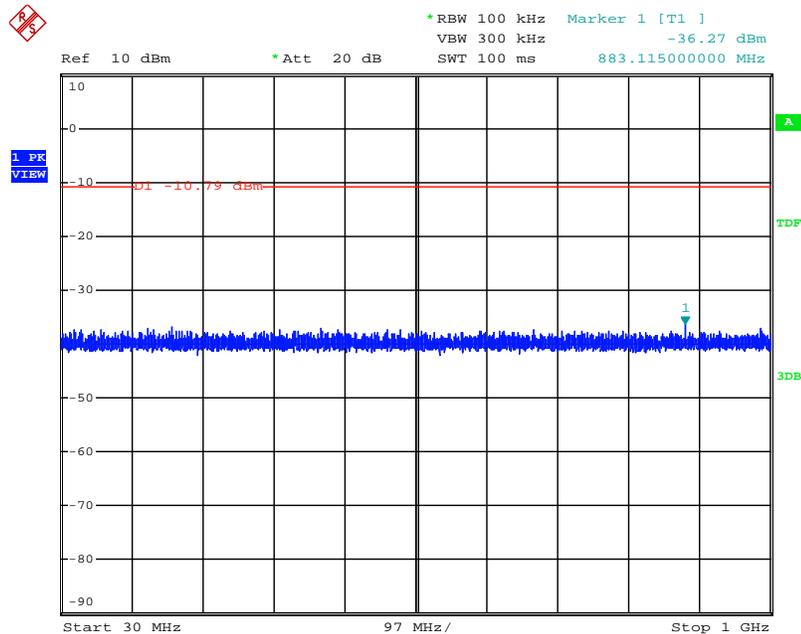
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Figure 7.5.2.2-3: 3 GHz -13.5 GHz - Low Channel (GFSK)



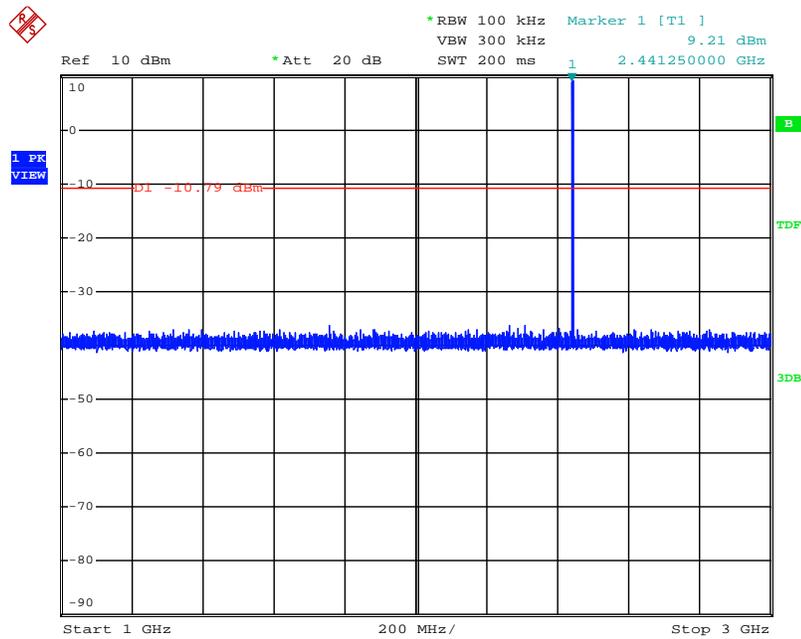
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Figure 7.5.2.2-4: 13.5 GHz –26 GHz – Low Channel (GFSK)



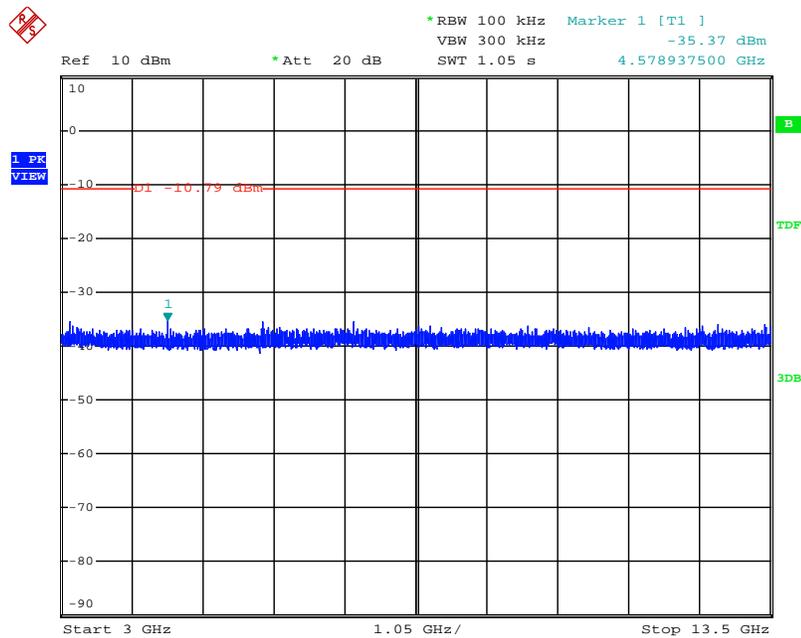
Date: 6.FEB.2015 14:56:20

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



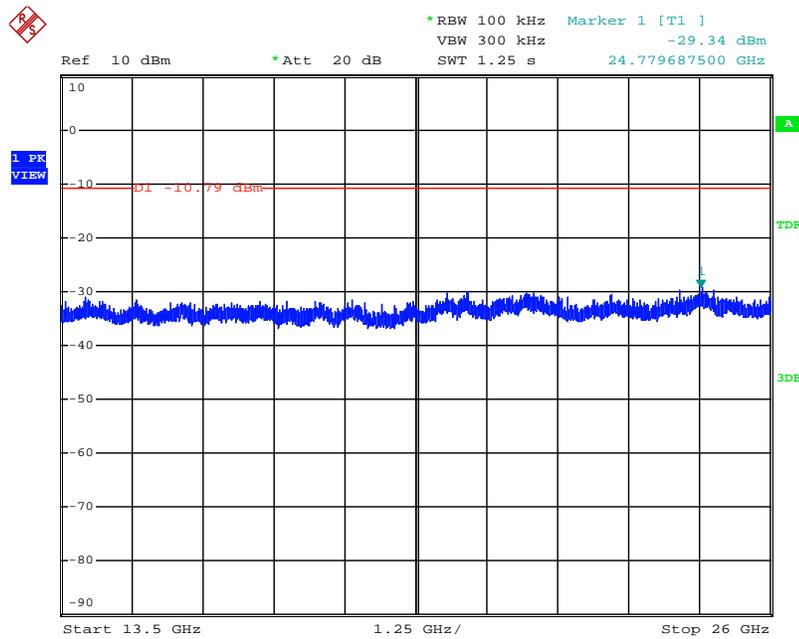
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Figure 7.5.2.2-6: 1 GHz –3 GHz – Middle Channel (GFSK)



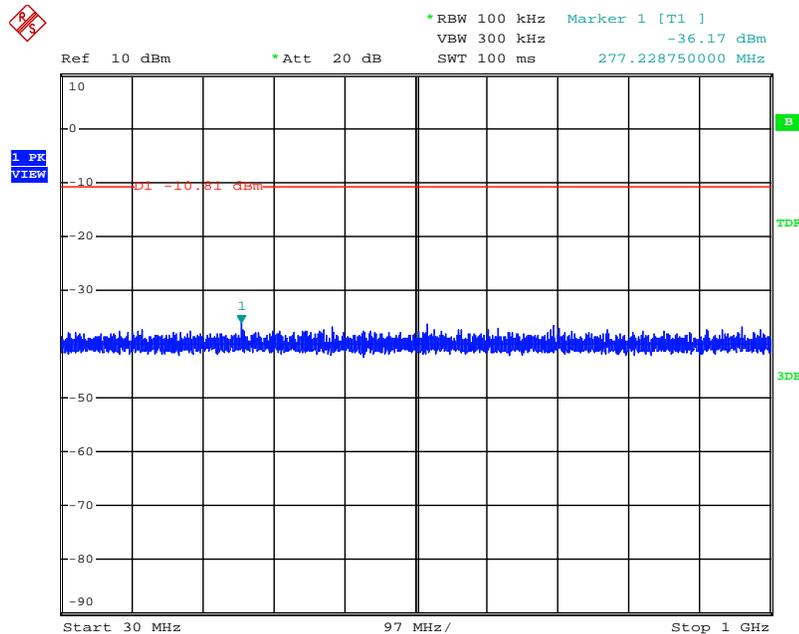
Date: 6.FEB.2015 15:01:33

Figure 7.5.2.2-7: 3 GHz –13.5 GHz – Middle Channel (GFSK)



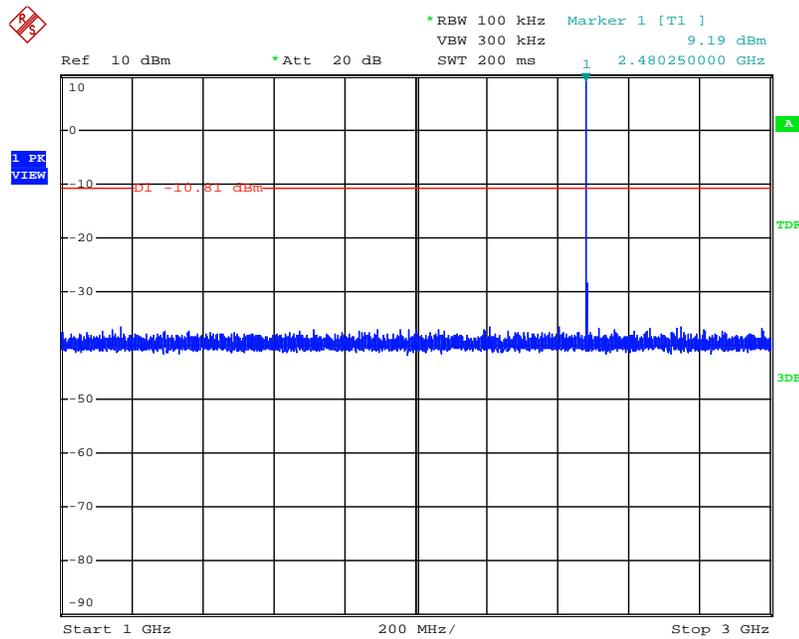
Date: 6.FEB.2015 15:00:34

Figure 7.5.2.2-8: 13.5 GHz –26 GHz – Middle Channel (GFSK)



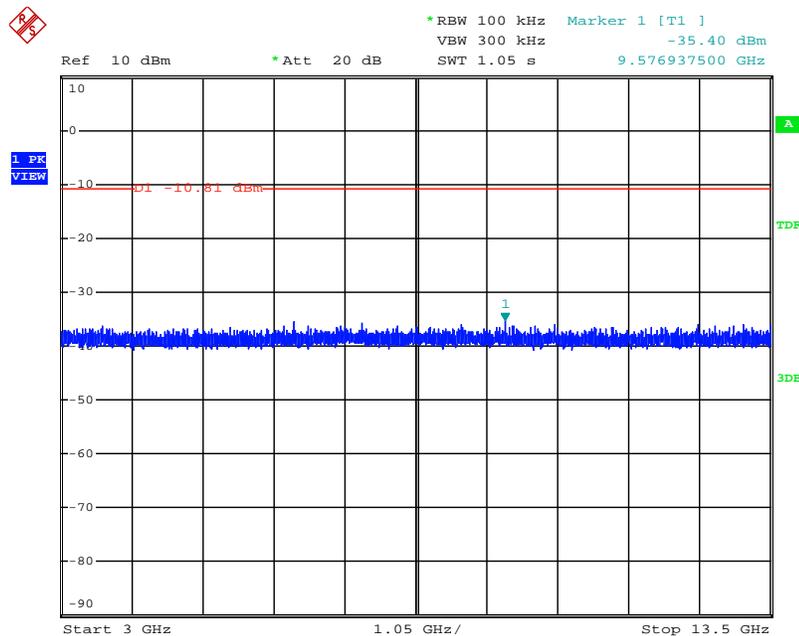
Date: 6.FEB.2015 15:10:00

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



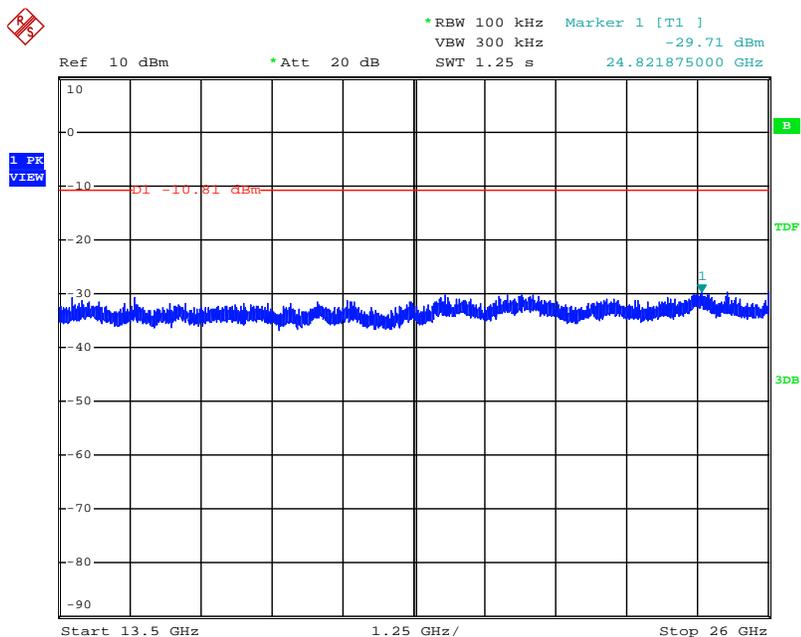
Date: 6.FEB.2015 15:10:16

Figure 7.5.2.2-10: 1 GHz –3 GHz –High Channel (GFSK)



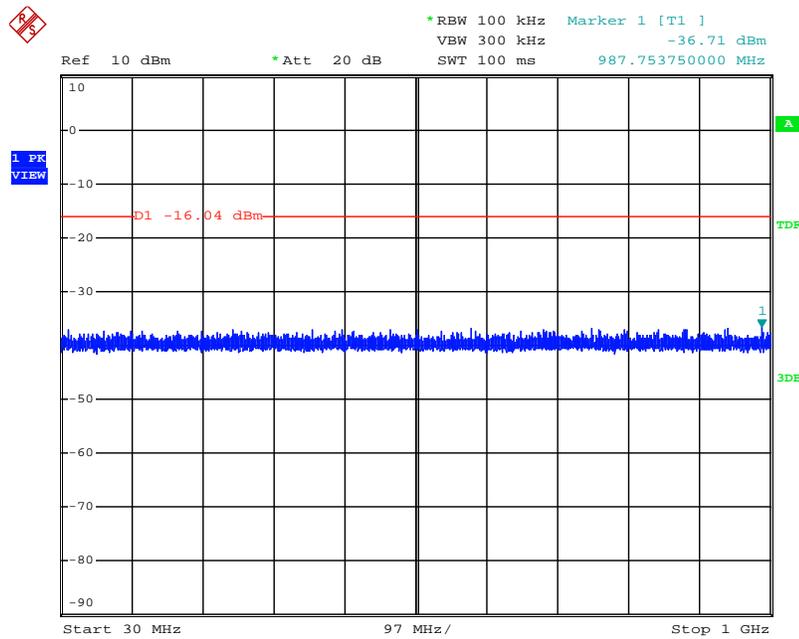
Date: 6.FEB.2015 15:16:03

Figure 7.5.2.2-11: 3 GHz –13.5 GHz – High Channel (GFSK)



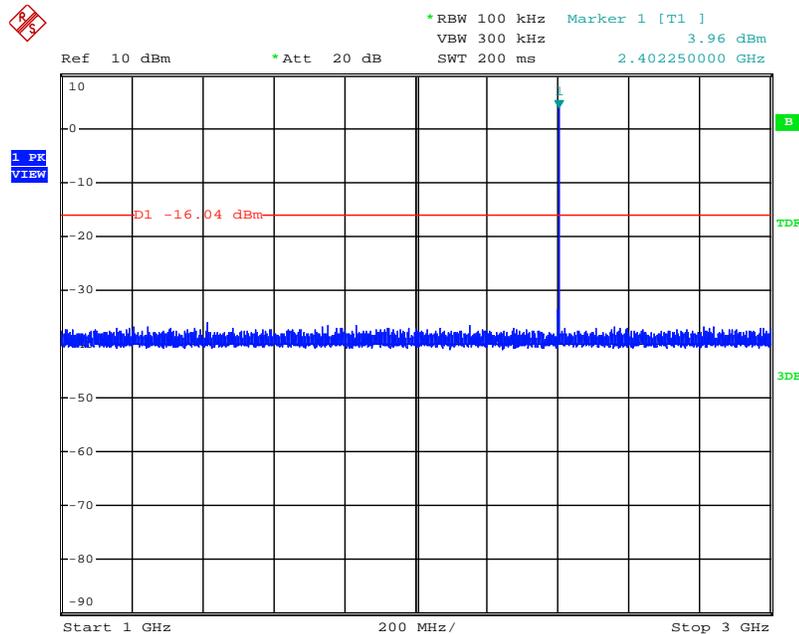
Date: 6.FEB.2015 15:15:43

Figure 7.5.2.2-12: 13.5 GHz –26 GHz – High Channel (GFSK)



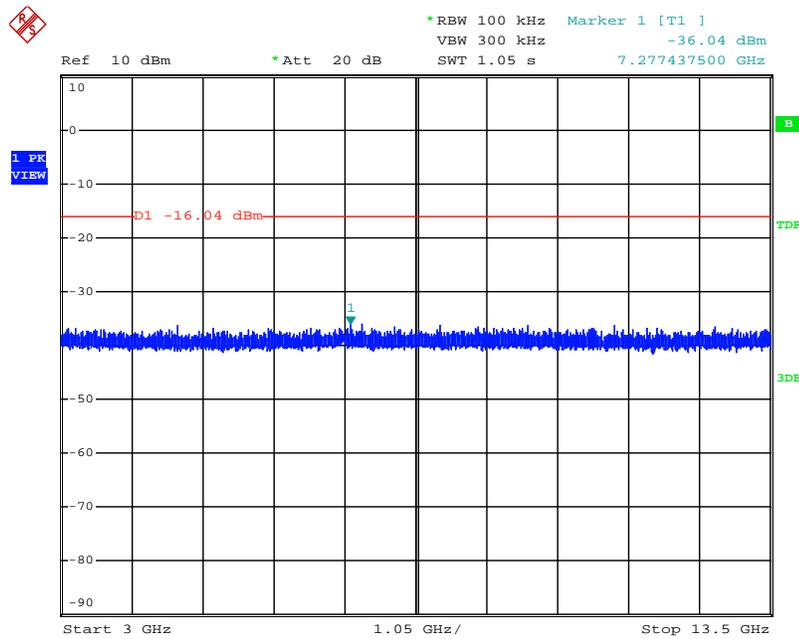
Date: 19.JAN.2015 23:16:48

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



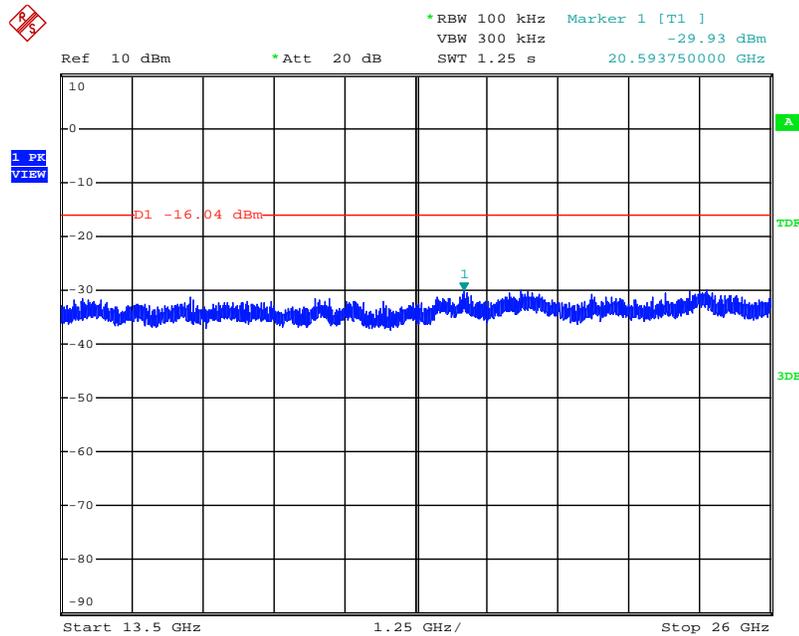
Date: 19.JAN.2015 23:17:23

Figure 7.5.2.2-14: 1 GHz –3 GHz – Low Channel ($\pi/4$ DQPSK)



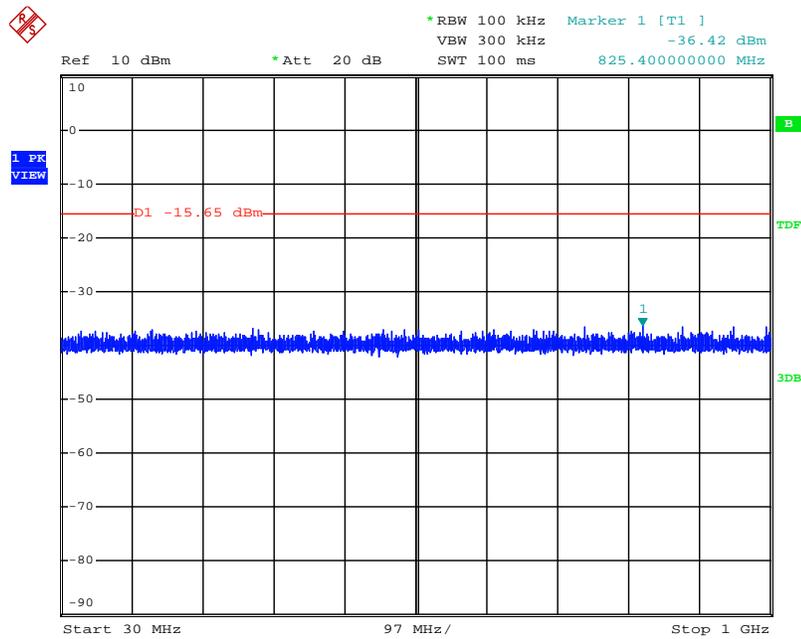
Date: 19.JAN.2015 23:21:42

Figure 7.5.2.2-15: 3 GHz –13.5 GHz – Low Channel ($\pi/4$ DQPSK)



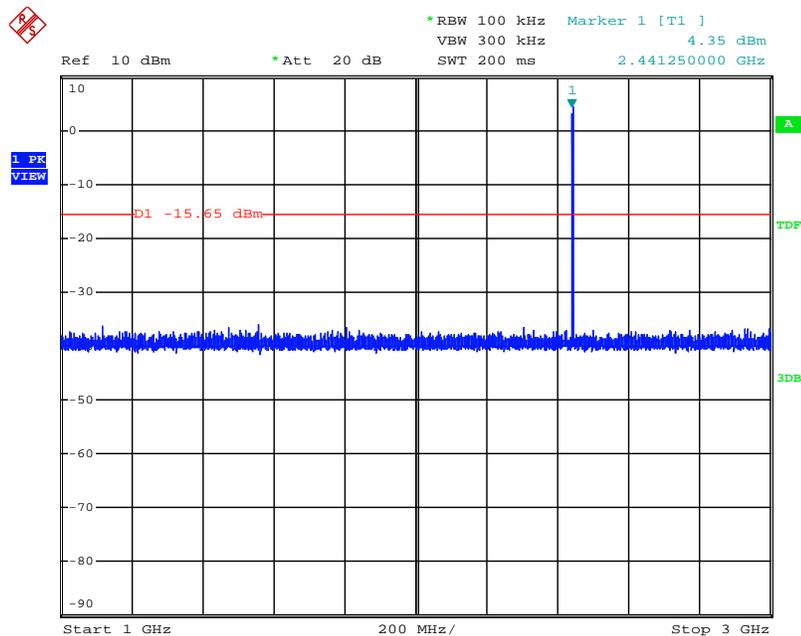
Date: 19.JAN.2015 23:21:24

Figure 7.5.2.2-16: 13.5 GHz –26 GHz – Low Channel ($\pi/4$ DQPSK)



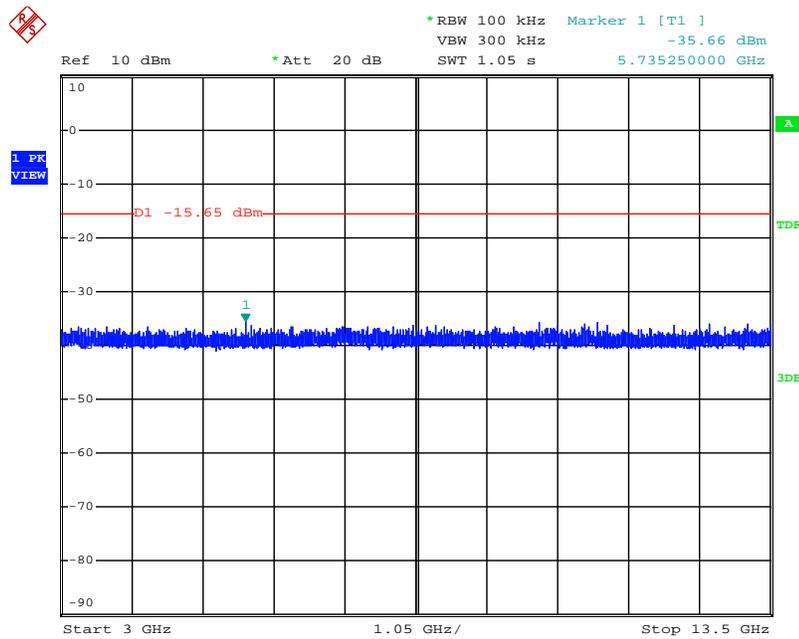
Date: 19.JAN.2015 23:27:21

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



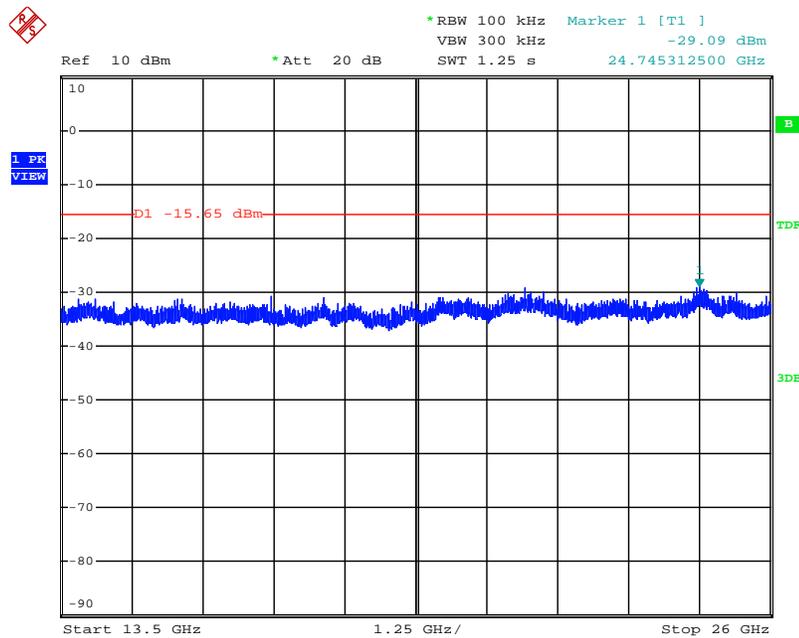
Date: 19.JAN.2015 23:27:43

Figure 7.5.2.2-18: 1 GHz –3 GHz – Middle Channel ($\pi/4$ DQPSK)



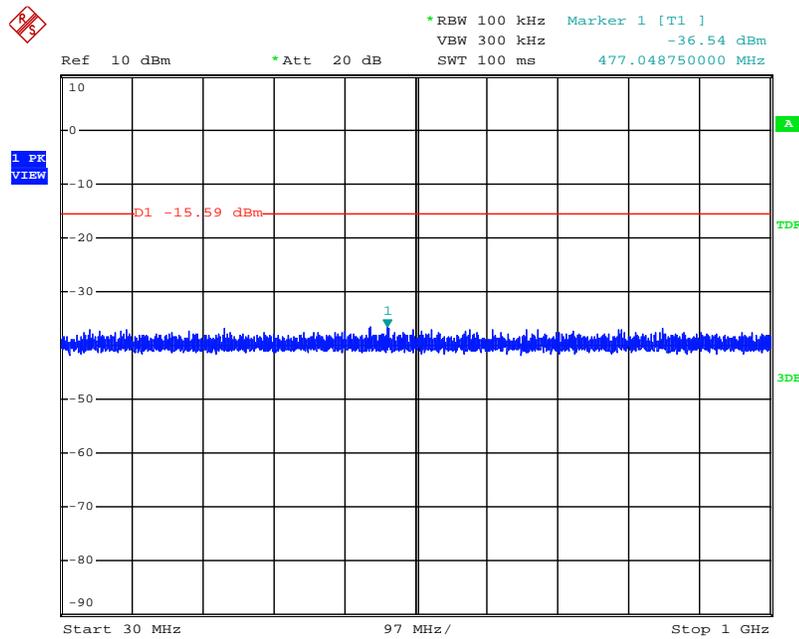
Date: 19.JAN.2015 23:31:59

Figure 7.5.2.2-19: 3 GHz –13.5 GHz – Middle Channel ($\pi/4$ DQPSK)



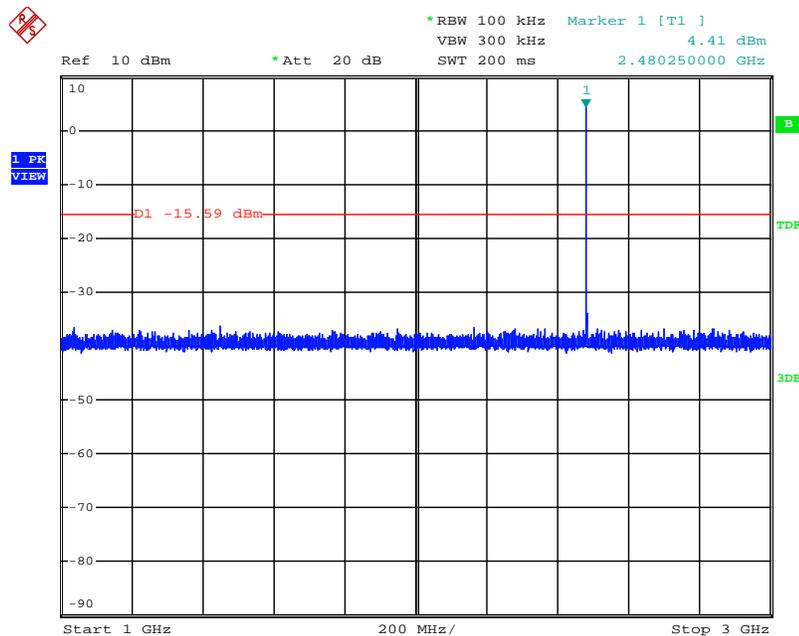
Date: 19.JAN.2015 23:31:33

Figure 7.5.2.2-20: 13.5 GHz –26 GHz – Middle Channel ($\pi/4$ DQPSK)



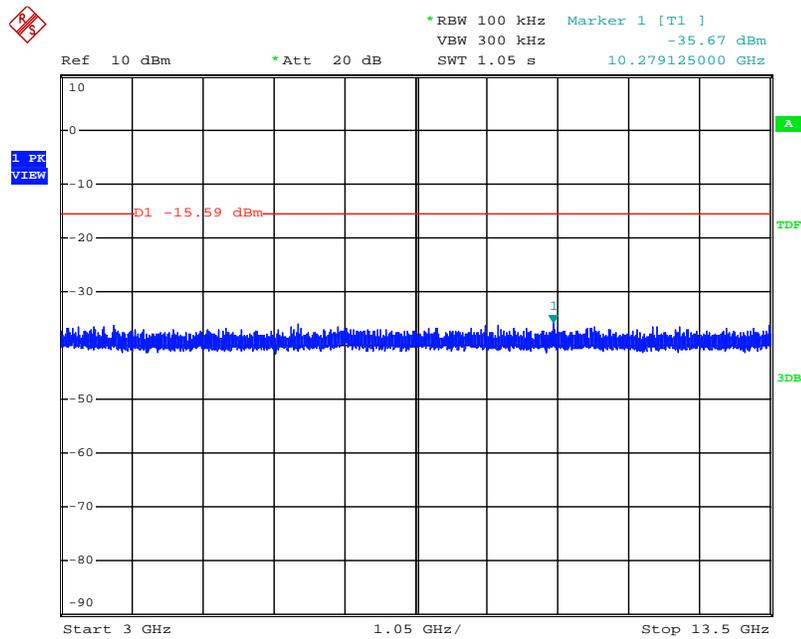
Date: 19.JAN.2015 23:48:23

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



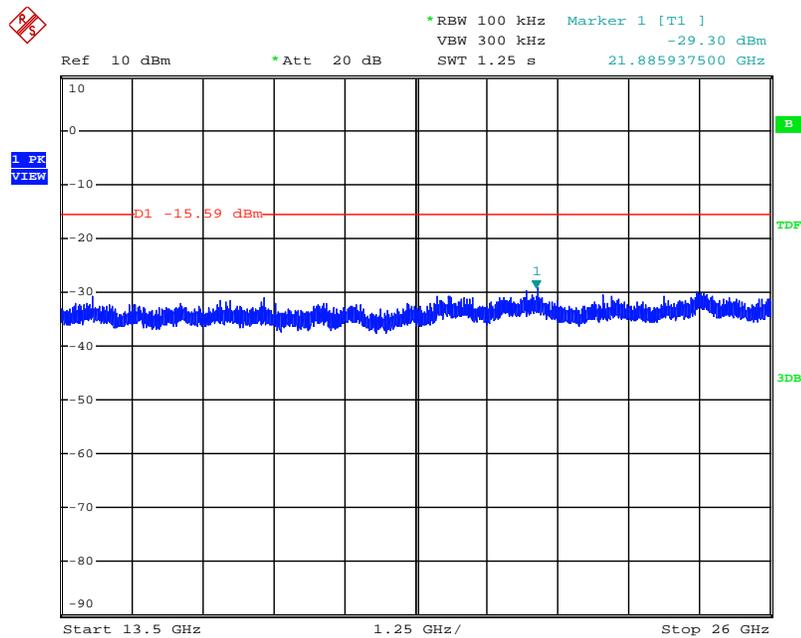
Date: 19.JAN.2015 23:47:35

Figure 7.5.2.2-22: 1 GHz –3 GHz –High Channel ($\pi/4$ DQPSK)



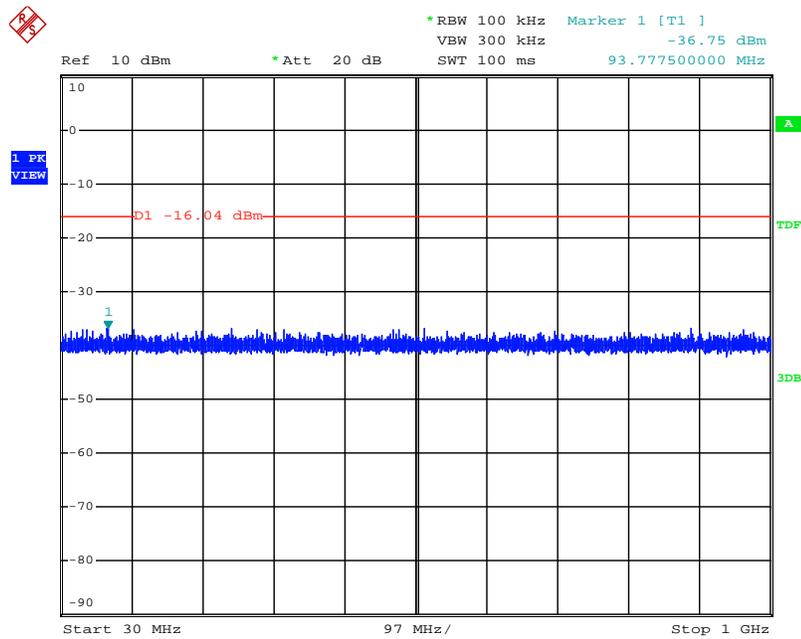
Date: 19.JAN.2015 23:51:03

Figure 7.5.2.2-23: 3 GHz –13.5 GHz – High Channel ($\pi/4$ DQPSK)



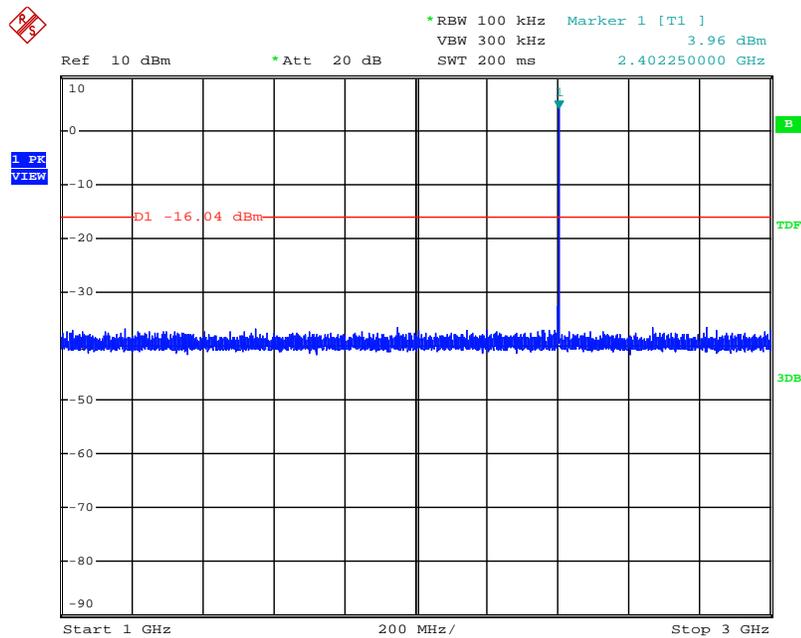
Date: 19.JAN.2015 23:50:43

Figure 7.5.2.2-24: 13.5 GHz –26 GHz – High Channel ($\pi/4$ DQPSK)



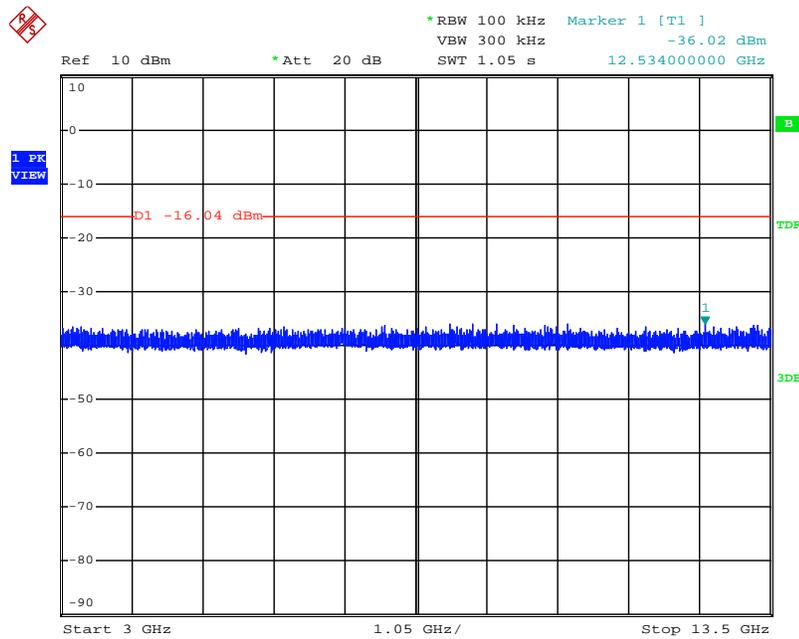
Date: 19.JAN.2015 23:05:16

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



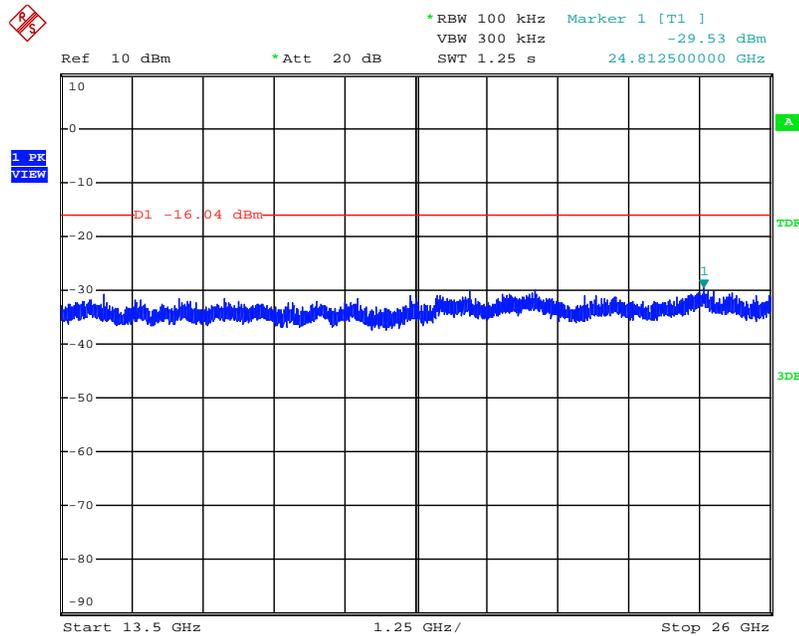
Date: 19.JAN.2015 23:05:49

Figure 7.5.2.2-26: 1 GHz –3 GHz – Low Channel (8DPSK)



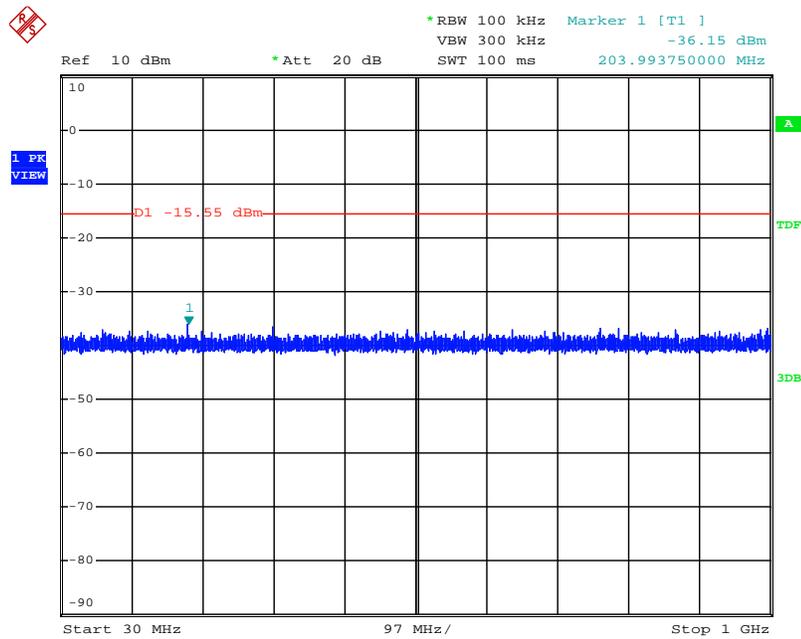
Date: 19.JAN.2015 23:09:09

Figure 7.5.2.2-27: 3 GHz –13.5 GHz – Low Channel (8DPSK)



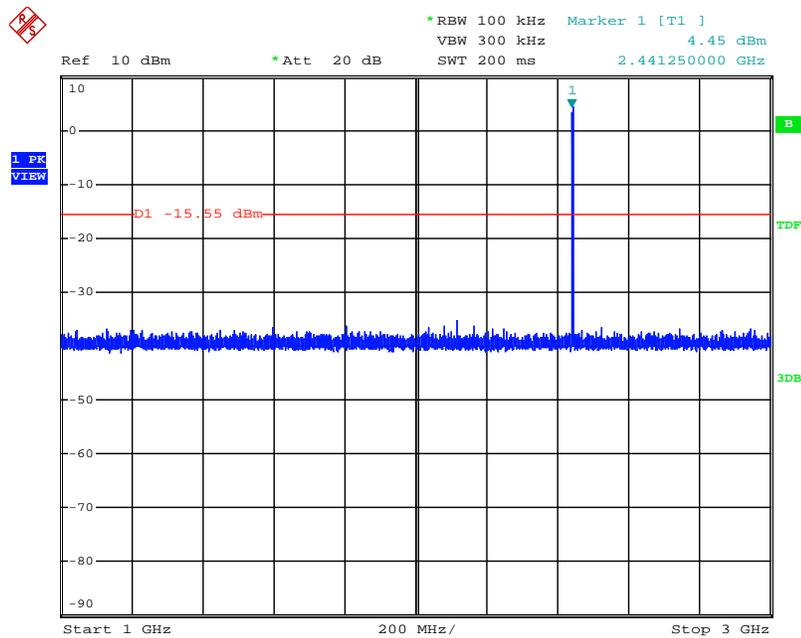
Date: 19.JAN.2015 23:09:35

Figure 7.5.2.2-28: 13.5 GHz –26 GHz – Low Channel (8DPSK)



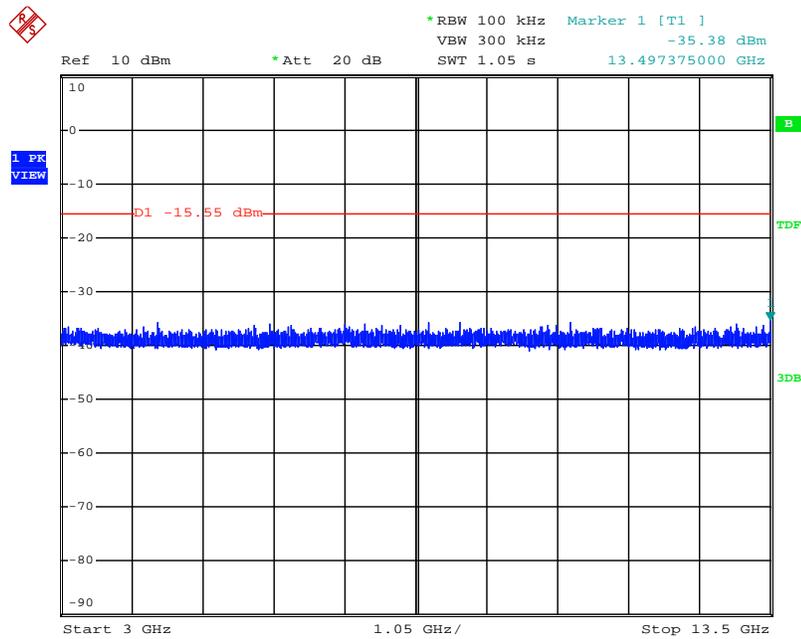
Date: 19.JAN.2015 22:56:15

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



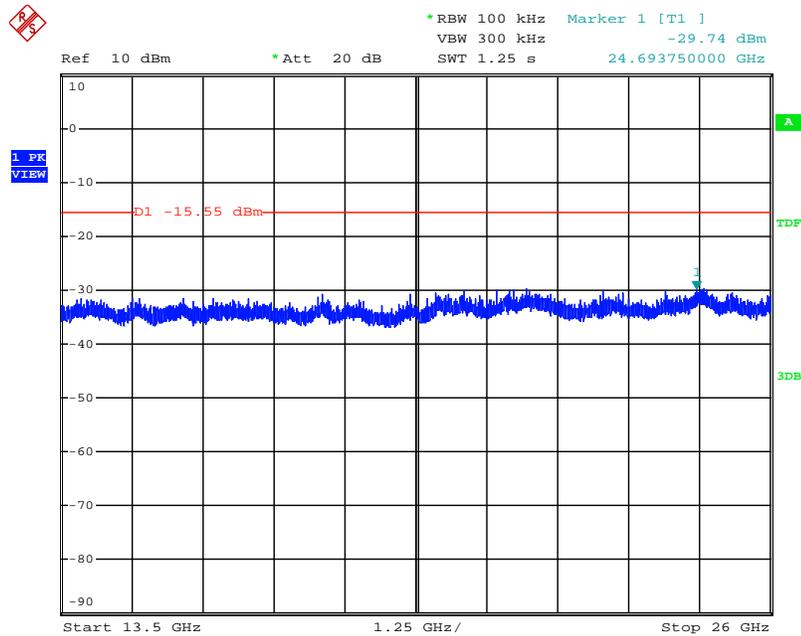
Date: 19.JAN.2015 22:56:40

Figure 7.5.2.2-30: 1 GHz –3 GHz – Middle Channel (8DPSK)



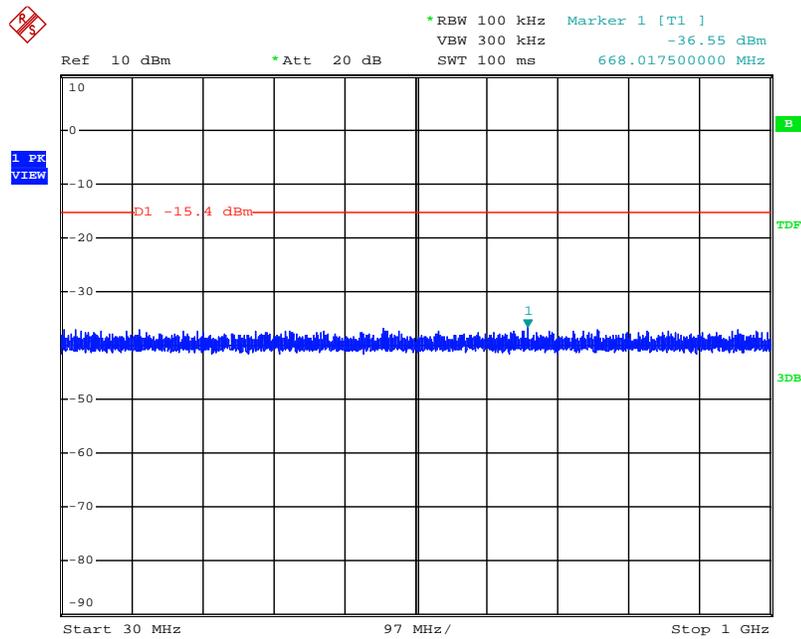
Date: 19.JAN.2015 23:00:30

Figure 7.5.2.2-31: 3 GHz –13.5 GHz – Middle Channel (8DPSK)



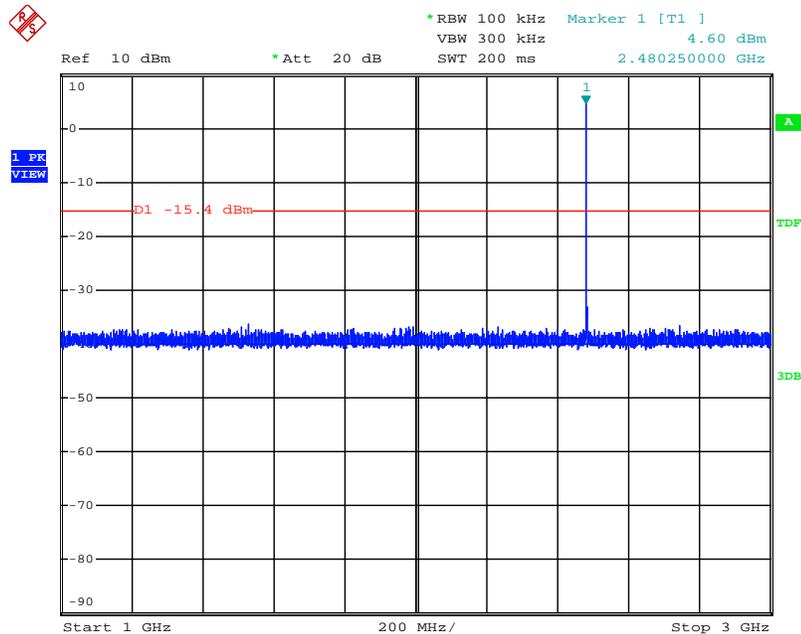
Date: 19.JAN.2015 23:00:59

Figure 7.5.2.2-32: 13.5 GHz –26 GHz – Middle Channel (8DPSK)



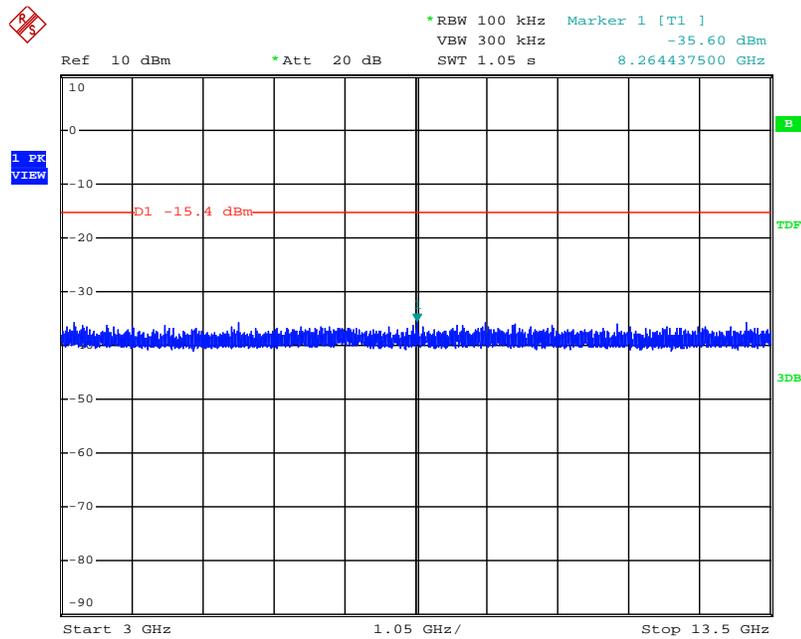
Date: 19.JAN.2015 22:46:41

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



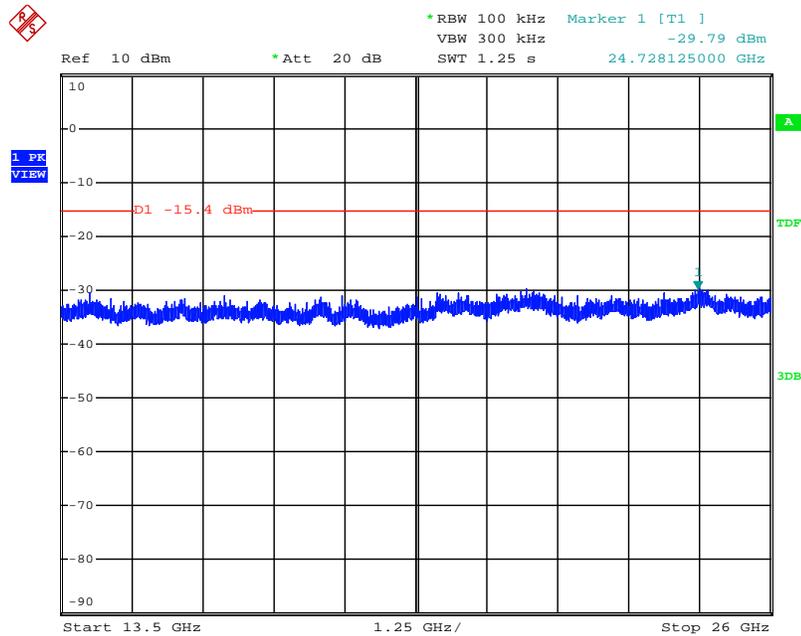
Date: 19.JAN.2015 22:46:08

Figure 7.5.2.2-34: 1 GHz –3 GHz –High Channel (8DPSK)



Date: 19.JAN.2015 22:50:46

Figure 7.5.2.2-35: 3 GHz –13.5 GHz – High Channel (8DPSK)



Date: 19.JAN.2015 22:51:09

Figure 7.5.2.2-36: 13.5 GHz –26 GHz – High Channel (8DPSK)

7.5.3 Radiated Spurious Emissions within the Restricted Bands - FCC Sections 15.205, 15.209; IC: RSS-Gen 8.9, 8.10

7.5.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 9 kHz to 26 GHz, 10 times the highest fundamental frequency. Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209.

For measurements below 30 MHz, the receive antenna height was set to 1m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

For measurements above 30 MHz, 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 were 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 9 kHz 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										
2390	60.98	46.51	V	-7.86	53.12	7.93	74.0	54.0	20.9	46.1
12010	44.98	32.54	H	13.31	58.29	15.13	83.5	63.5	25.2	48.4
12010	44.45	32.10	V	13.31	57.76	14.69	83.5	63.5	25.7	48.8
Middle Channel = 2441 MHz										
7323	52.75	45.31	H	5.32	58.07	19.91	74.0	54.0	15.9	34.1
7323	52.09	44.16	V	5.32	57.41	18.76	74.0	54.0	16.6	35.2
12205	44.81	31.49	H	13.15	57.96	13.92	83.5	63.5	25.5	49.6
High Channel = 2480 MHz										
2483.5	62.51	56.81	H	-7.47	55.04	18.62	74.0	54.0	19.0	35.4
2483.5	67.38	63.74	V	-7.47	59.91	25.55	74.0	54.0	14.1	28.4
7440	51.29	42.57	H	5.66	56.95	17.51	74.0	54.0	17.0	36.5
7440	50.34	40.26	V	5.66	56.00	15.20	74.0	54.0	18.0	38.8
12400	42.81	30.82	H	12.98	55.79	13.08	83.5	63.5	27.7	50.4

Notes:

- The average measurements were further corrected using a duty cycle correction factor corresponding to the logarithm of the dwell time over 100 ms = $20 \cdot \log(2.910625/100)$.
- All the emissions above 12.4 GHz were attenuated below the limits and the noise floor of the measurement equipment
- The emissions above 10 GHz were evaluated at a measurement distance of 1m. The limits are corrected accordingly using a distance correction factor of $20 \cdot \log(3/1) = 9.5$ dB.

Table 7.5.3.2-2: Radiated Spurious Emissions Tabulated Data – (π/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										
2390	59.80	46.68	V	-7.86	51.94	8.10	74.0	54.0	22.1	45.9
12010	45.00	32.59	H	13.31	58.31	15.18	83.5	63.5	25.2	48.3
12010	44.30	31.97	V	13.31	57.61	14.56	83.5	63.5	25.9	48.9
Middle Channel = 2441 MHz										
7323	51.70	41.56	H	5.32	57.02	16.16	74.0	54.0	17.0	37.8
7323	50.02	40.27	V	5.32	55.34	14.87	74.0	54.0	18.7	39.1
12205	44.50	31.81	H	13.15	57.65	14.24	83.5	63.5	25.9	49.3
High Channel = 2480 MHz										
2483.5	61.58	52.80	H	-7.47	54.11	14.61	74.0	54.0	19.9	39.4
2483.5	67.05	59.84	V	-7.47	59.58	21.65	74.0	54.0	14.4	32.3
7440	50.56	40.09	H	5.66	56.22	15.03	74.0	54.0	17.8	39.0
7440	50.18	38.65	V	5.66	55.84	13.59	74.0	54.0	18.2	40.4
12400	43.01	31.03	H	12.98	55.99	13.29	83.5	63.5	27.5	50.2

Notes:

- The average measurements were further corrected using a duty cycle correction factor corresponding to the logarithm of the dwell time over 100 ms = $20 \cdot \log(2.910625/100)$.
- All the emissions above 12.4 GHz were attenuated below the limits and the noise floor of the measurement equipment
- The emissions above 10 GHz were evaluated at a measurement distance of 1m. The limits are corrected accordingly using a distance correction factor of $20 \cdot \log(3/1) = 9.5$ dB.

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										
2390	61.08	46.90	V	-7.86	53.22	8.32	74.0	54.0	20.8	45.7
12010	44.43	32.06	H	13.31	57.74	14.65	83.5	63.5	25.8	48.8
12010	43.96	31.90	V	13.31	57.27	14.49	83.5	63.5	26.2	49.0
Middle Channel = 2441 MHz										
7323	51.16	41.02	H	5.32	56.48	15.62	74.0	54.0	17.5	38.4
7323	51.10	39.85	V	5.32	56.42	14.45	74.0	54.0	17.6	39.6
12205	44.34	31.29	H	13.15	57.49	13.72	83.5	63.5	26.0	49.8
12205	43.90	31.27	V	13.15	57.05	13.70	83.5	63.5	26.5	49.8
High Channel = 2480 MHz										
2483.5	63.71	53.18	H	-7.47	56.24	14.99	74.0	54.0	17.8	39.0
2483.5	70.24	60.16	V	-7.47	62.77	21.97	74.0	54.0	11.2	32.0
7440	50.73	39.69	H	5.66	56.39	14.63	74.0	54.0	17.6	39.4
7440	49.12	38.27	V	5.66	54.78	13.21	74.0	54.0	19.2	40.8
12400	44.08	30.91	H	12.98	57.06	13.17	83.5	63.5	26.4	50.3

Notes:

- The average measurements were further corrected using a duty cycle correction factor corresponding to the logarithm of the dwell time over 100 ms = $20 \cdot \log(2.910625/100)$.
- All the emissions above 12.4 GHz were attenuated below the limits and the noise floor of the measurement equipment
- The emissions above 10 GHz were evaluated at a measurement distance of 1m. The limits are corrected accordingly using a distance correction factor of $20 \cdot \log(3/1) = 9.5$ dB.

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): $20 \cdot \log(2.910625/100) = -30.72$ dB

Example Calculation: Peak

Corrected Level: $60.98 + (-7.86) = 53.12$ dB μ V/m

Margin: 74 dB μ V/m – 53.12 dB μ V/m = 20.9 dB

Example Calculation: Average

Corrected Level: $46.51 + (-7.86) - 30.72 = 7.93$ dB μ V/m

Margin: 54 dB μ V/m – 7.93 dB μ V/m = 46.1 dB

8 CONCLUSION

In the opinion of ACS, Inc., the model H91TGD9PW7AN manufactured by Motorola Solutions meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210 for the test procedures documented in the test report.

END REPORT