Excellence in Compliance Testing

Certification Test Report

FCC ID: AZ489FT7088
IC: 109U-89FT7088

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-247

ACS Report Number: 15-2124.W06.1A

Manufacturer: Motorola Solutions, Inc.
Model: HK2062A

Test Begin Date: **December 2, 2015**
Test End Date: **February 15, 2016**

Report Issue Date: February 17, 2016

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

Project Manager:

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This report contains 67 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-247.

1.2 Product Description

The Motorola Solutions, Inc. Si500 model HK2062A is a video speaker microphone. The unit includes a dual band WLAN transceiver as well as a Bluetooth radio supporting both Bluetooth Classic (2.1+EDR) and Bluetooth Low Energy (BLE). The test report covers the Bluetooth 2.1+EDR modes of operation only.

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, π/4-DQPSK, 8DPSK
TX Data Rates:	GFSK: 1Mbps π/4-DQPSK: 2Mbps 8DPSK: 3Mbps
Antenna Type/Gain:	Ceramic Chip Antenna, 3.2 dBi

1.3 Manufacturer Information

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

Model Number: HK2062A

Test Sample Serial Number(s): ATP1B104 (Radiated & Power Line Conducted Emissions), ATP1B083 (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, RF conducted and Power line conducted emissions for the Classic Bluetooth mode of operation. The EUT was evaluated using the QUALCOMM Remote Evaluation Tool (QRCT) which was set to a power setting of 9. The configurations for the evaluation of the radio are provided below.

For the radiated emission investigation, preliminary evaluation was performed for the EUT standalone, set in three orthogonal orientations. Additional measurements were performed for the EUT powered via a wall adapter, for the EUT powered using a car battery and a vehicle power adapter (VPA), for the EUT connected to a computer and a multi-charger and for the EUT connected with a computer and an APX8000 radio. The EUT standalone, flat on the table top, was determined to be the configuration leading to the highest emissions as compared to the limits. That configuration was used for all the radiated emissions reported in this document.

The RF conducted emissions were investigated with the EUT configured with a temporary SMA connector at the antenna port.

The power line conducted emission test was performed for the EUT constantly transmitting while powered via a 5VDC AC power adapter. Preliminary measurements were performed for all the available modulations. The worst case was obtained for the unit operating at the middle channel using GFSK modulation and is reported in this document.

Table 1.4-1: Bluetooth Radio Test configuration

Mode of Operations	Frequency (MHz)	Data Rate (kbps)
GFSK	2402	1000
	2441	1000
	2480	1000
π/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 ANAB 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 flooring.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flush 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:

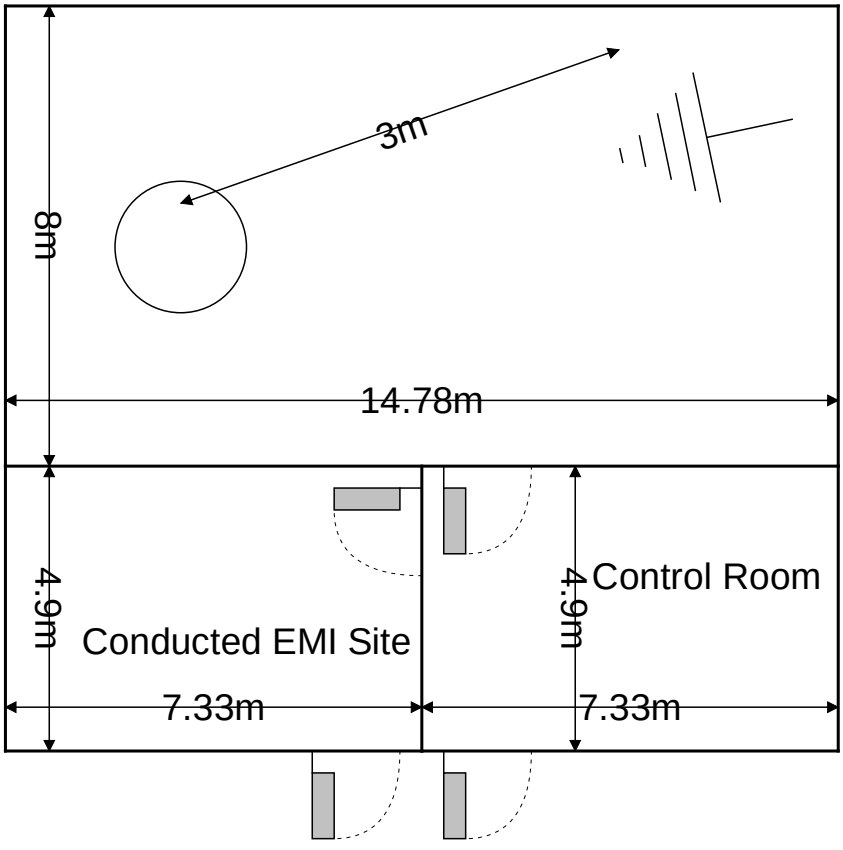


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m^3. The power line conducted emission site includes two LISNs: a Solar Model 8028-50 50 Ω/50 µH and an EMCO Model 3825/2R, which are installed as shown in the figure below. For evaluations requiring 230 V, 50 Hz AC input, a Polarad LISN (S/N 879341/048) is used in conjunction with a California Instruments signal generator Model 2001RP-OP1.

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

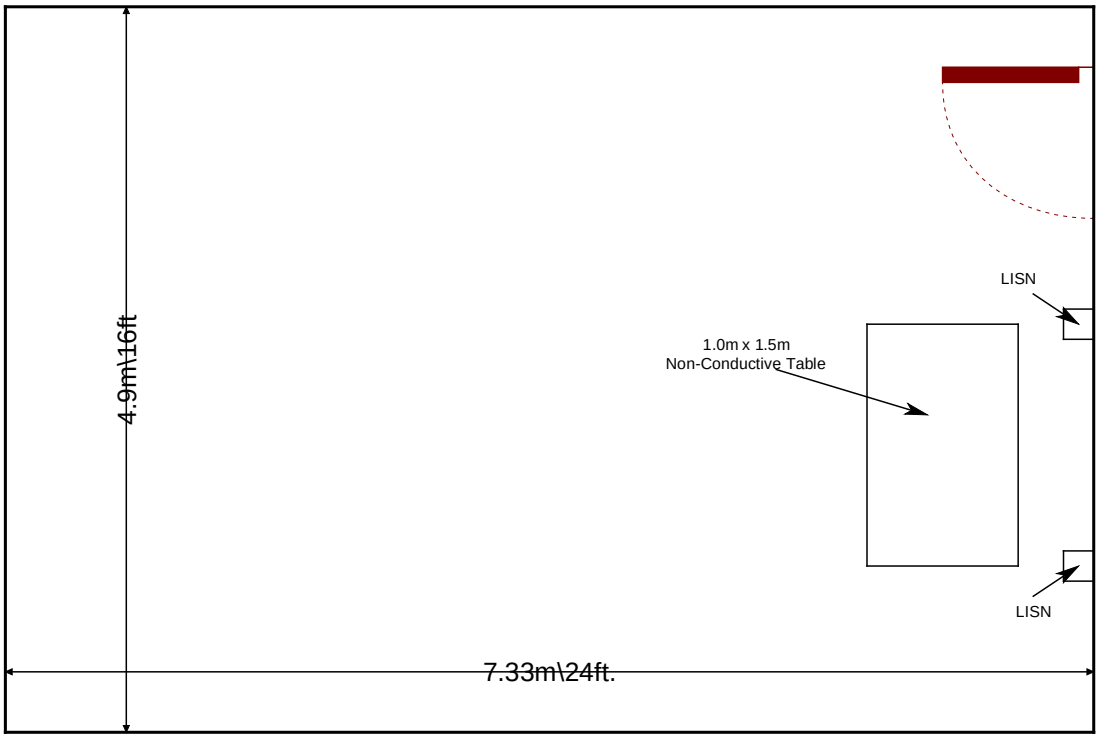


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2014: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9 kHz to 40 GHz.
- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2016.
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2016
- Industry Canada Radio Standards Specification: RSS-247 — Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 1, May 2015.
- 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
22	Agilent	8449B	Amplifiers	3008A00526	5/18/2015	5/18/2016
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	7/1/2015	7/1/2016
479	Electro-Metrics	ALP-70	Antennas	158	12/2/2013	12/2/2015
479	Electro-Metrics	ALP-70	Antennas	158	12/3/2015	12/3/2017
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/26/2014	12/26/2016
653	Suhner	SF-102A	Cables	0944/2A	4/13/2015	4/13/2016
2003	EMCO	3108	Antennas	2148	2/18/2014	2/18/2016
2004	EMCO	3146	Antennas	1385	11/19/2015	11/19/2017
2006	EMCO	3115	Antennas	2573	4/14/2015	4/14/2017
2008	COM-Power	AH-826	Antennas	81009	NCR	NCR
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	11/18/2015	11/18/2016
2022	EMCO	LISN3825/2R	LISN	1095	9/14/2015	9/14/2017
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	11/11/2015	11/11/2016
2070	Mini Circuits	VHF-8400+	Filter	2070	11/17/2015	11/17/2016
2072	Mini Circuits	VHF-3100+	Filter	30737	11/17/2015	11/17/2016
2082	Teledyne Storm Products	90-010-048	Cables	2082	4/22/2015	4/22/2016
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	11/16/2015	11/16/2016
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
2111	Aeroflex Inmet	40AH2W-20	Attenuator	2111	7/22/2015	7/22/2016
2121	ACS Boca	Radiated Cable Set	Cable Set	2121	8/22/2015	8/22/2016
3004	Teseq	CFL 9206A	Attenuators	34720	10/7/2015	10/7/2016

Notes:
NCR=No Calibration Required
The calibration information cycle for asset 479 is provided to cover the entire test period. The asset was only used during the active period of the calibration cycle.

5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment (Radiated Emissions)

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Motorola Solutions, Inc.	HK2062A	ATP1B104
2	Earpiece	Motorola Solutions, Inc.	RLN4941A	N/A

Table 5-2: Cable Description (Radiated Emissions)

Cable #	Cable Type	Length	Shield	Termination
A	Audio	0.55 m	No	Earpiece to EUT

Table 5-3: EUT and Support Equipment (Power Line Conducted Emissions)

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Motorola Solutions, Inc.	HK2062A	ATP1B104
2	Earpiece	Motorola Solutions, Inc.	RLN4941A	N/A
3	I.T.E Power Supply	Motorola Solutions, Inc.	MU08-L050150-A1	1538000119

Table 5-4: Cable Description (Power Line Conducted Emissions)

Cable #	Cable Type	Length	Shield	Termination
A	Audio	0.55 m	No	Earpiece to EUT
B	USB	1 m	No	Power Supply to EUT
C	Extension Cord	1.82 m	No	Power Supply to AC Mains

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

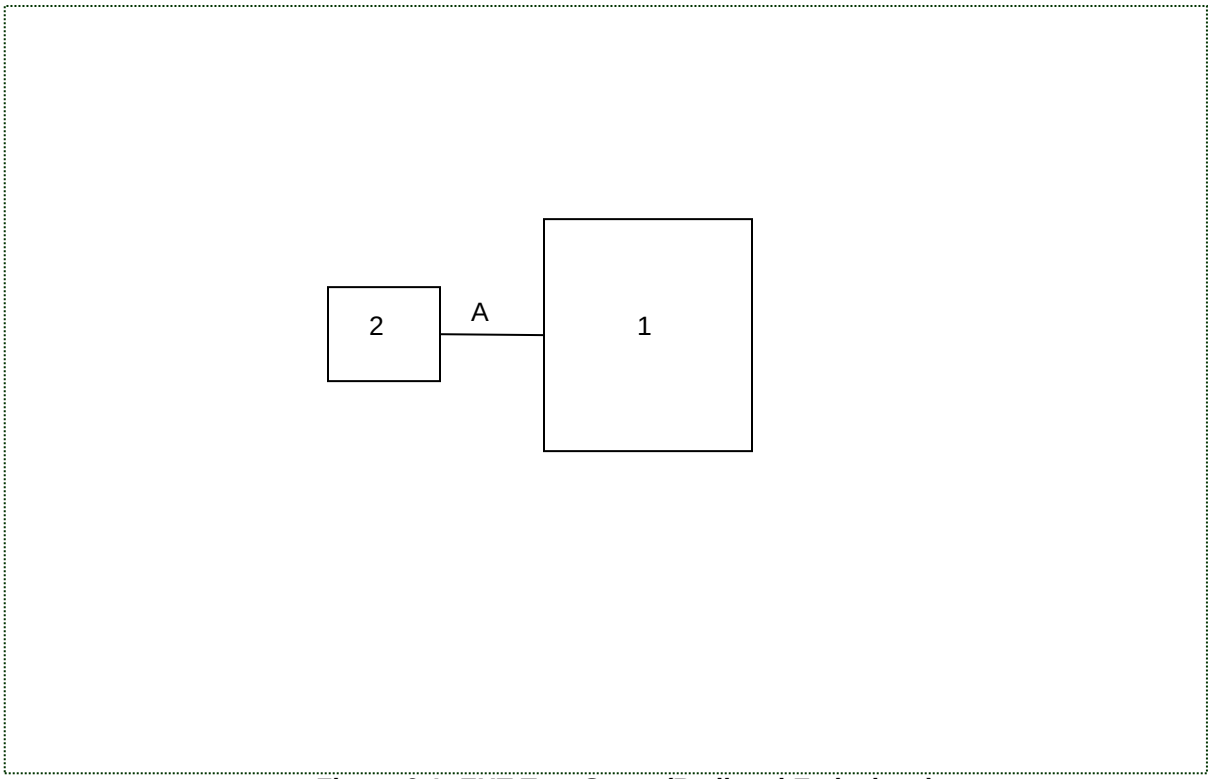


Figure 6-1: EUT Test Setup (Radiated Emissions)

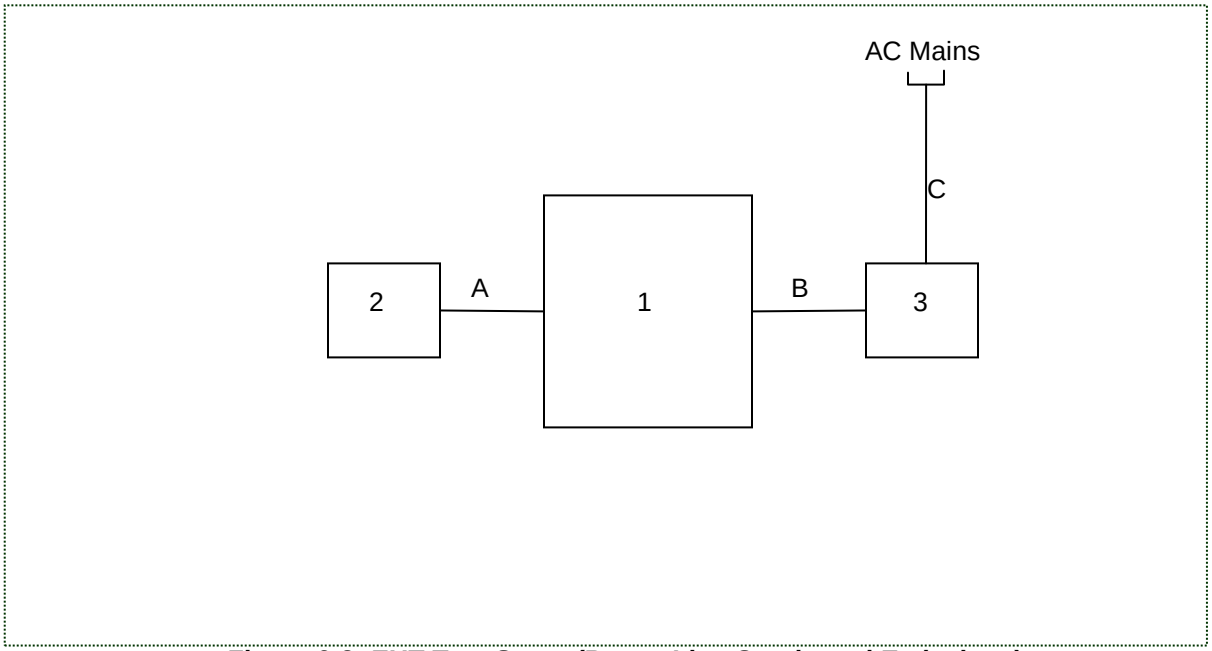


Figure 6-2: EUT Test Setup (Power Line Conducted Emissions)

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 Si500 model HK2062A uses an internal surface mount BT/WLAN antenna which is soldered directly to the PCB. The antenna is not removable and the port is not accessible externally. The EUT meets the requirements of FCC Section 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:

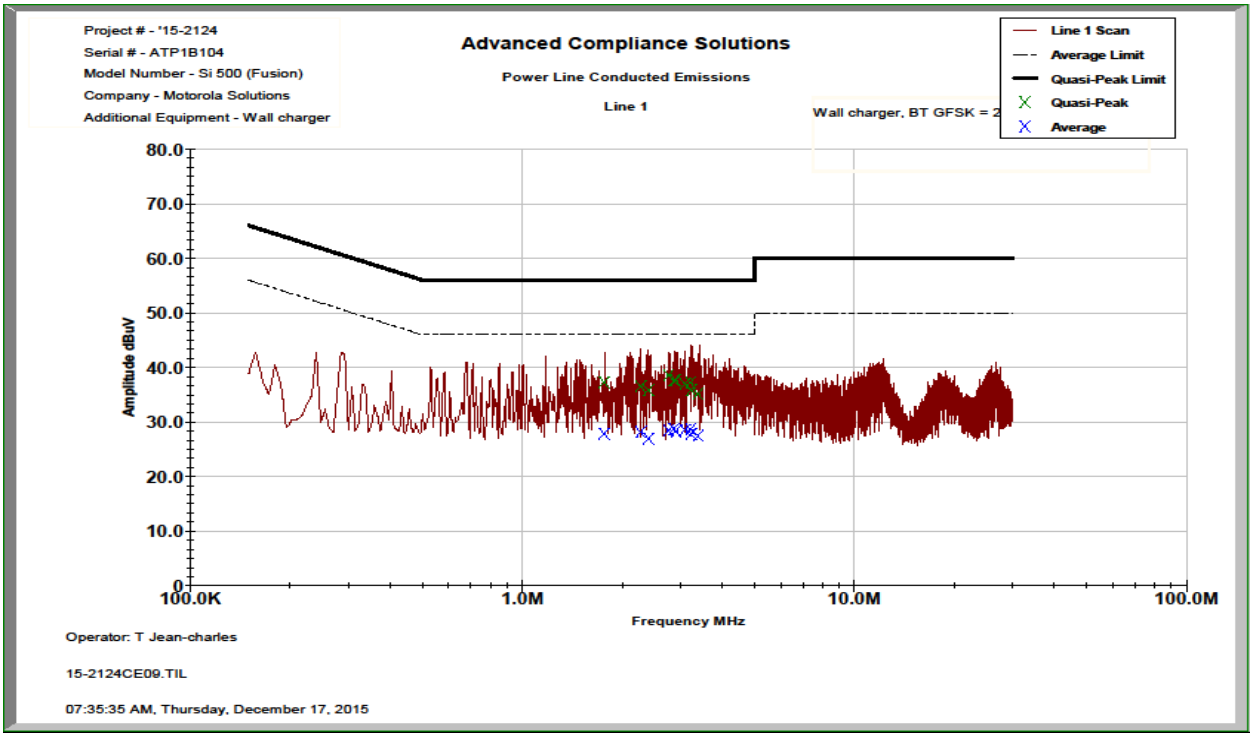


Figure 7.2.2-1: Conducted Emissions Results – Line 1

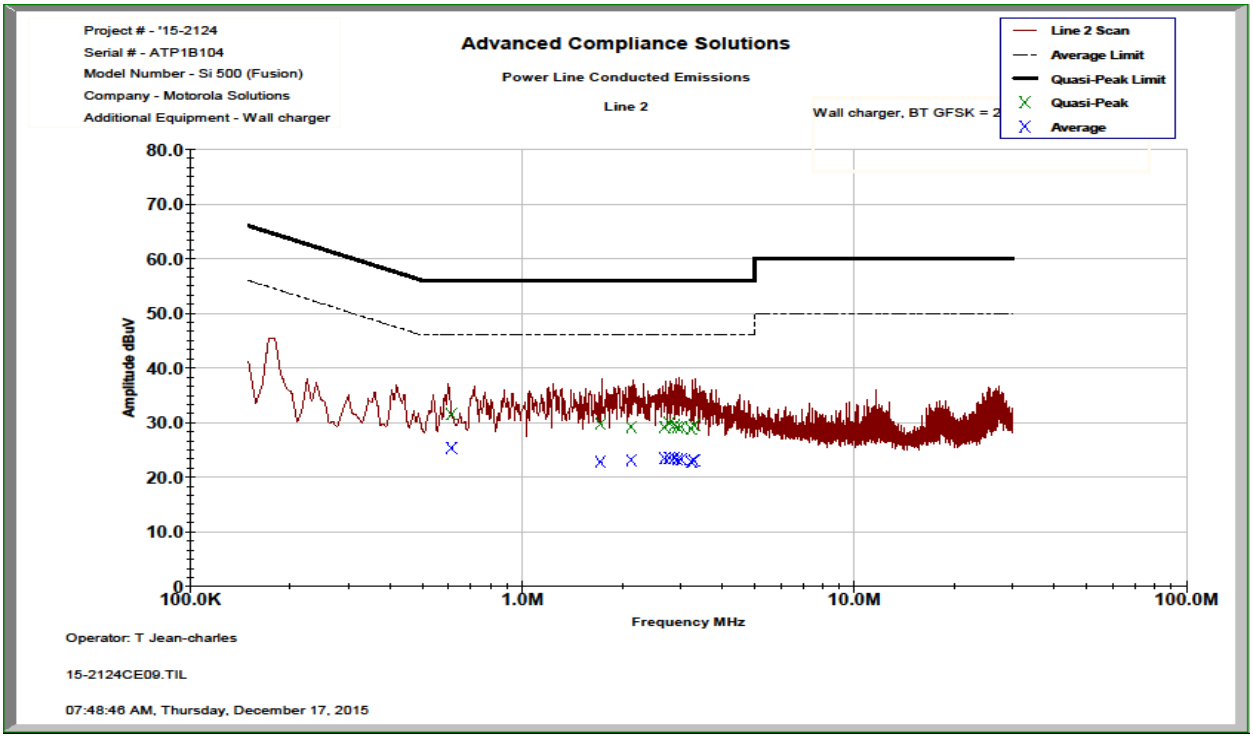


Figure 7.2.2-2: Conducted Emissions Results – Line 2

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: 15-2124CE09
Power Supply Description: 5 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									
1.76658	27.062	17.595	10.20	37.27	27.80	56.00	46.00	18.7	18.2
2.27461	26.232	17.825	10.28	36.51	28.10	56.00	46.00	19.5	17.9
2.4029	25.522	16.646	10.28	35.80	26.92	56.00	46.00	20.2	19.1
2.75979	28.204	18.158	10.28	38.48	28.43	56.00	46.00	17.5	17.6
2.86646	27.265	18.42	10.28	37.54	28.70	56.00	46.00	18.5	17.3
2.9042	27.326	17.927	10.28	37.60	28.20	56.00	46.00	18.4	17.8
3.09147	26.643	18.229	10.35	37.00	28.58	56.00	46.00	19.0	17.4
3.21206	26.84	18.291	10.35	37.19	28.64	56.00	46.00	18.8	17.4
3.22926	25.511	17.466	10.35	35.86	27.82	56.00	46.00	20.1	18.2
3.3895	24.828	17.127	10.35	35.18	27.48	56.00	46.00	20.8	18.5
Line 2									
0.6129	21.306	15.171	10.21	31.51	25.38	56.00	46.00	24.5	20.6
1.71951	19.442	12.532	10.25	29.69	22.78	56.00	46.00	26.3	23.2
2.12995	18.876	12.843	10.32	29.19	23.16	56.00	46.00	26.8	22.8
2.68217	18.832	13.079	10.32	29.15	23.40	56.00	46.00	26.9	22.6
2.77919	19.564	13.195	10.32	29.88	23.51	56.00	46.00	26.1	22.5
2.8762	19.145	13.153	10.32	29.46	23.47	56.00	46.00	26.5	22.5
2.9359	18.86	12.826	10.32	29.18	23.14	56.00	46.00	26.8	22.9
3.01052	18.857	12.875	10.39	29.25	23.27	56.00	46.00	26.8	22.7
3.2344	18.44	12.407	10.39	28.83	22.80	56.00	46.00	27.2	23.2
3.2941	19.132	12.636	10.39	29.52	23.03	56.00	46.00	26.5	23.0

7.3 Peak Output Power - FCC Section 15.247(b)(1) IC: RSS-247 5.4(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	8.98
2441	9.56
2480	9.78

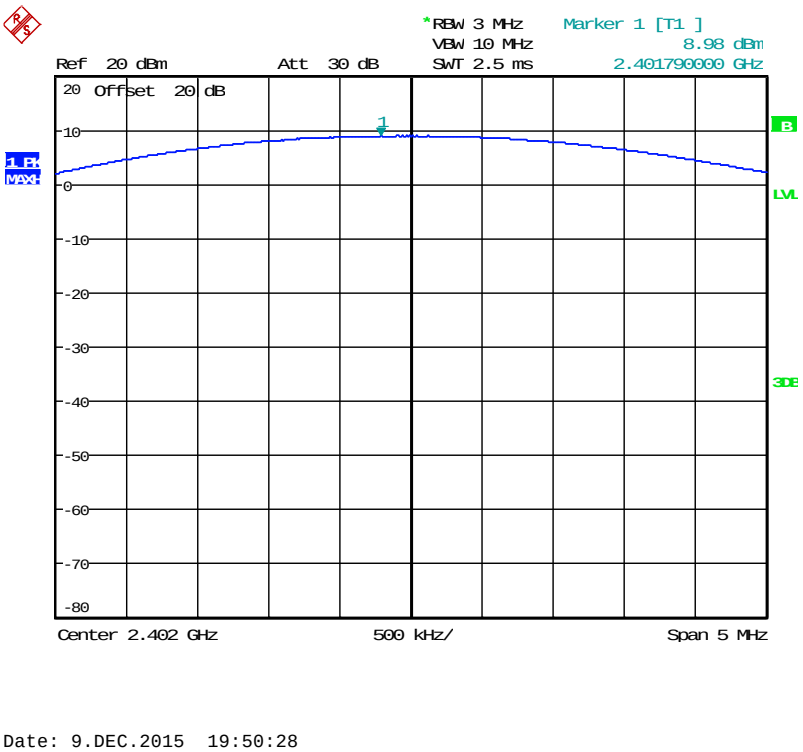
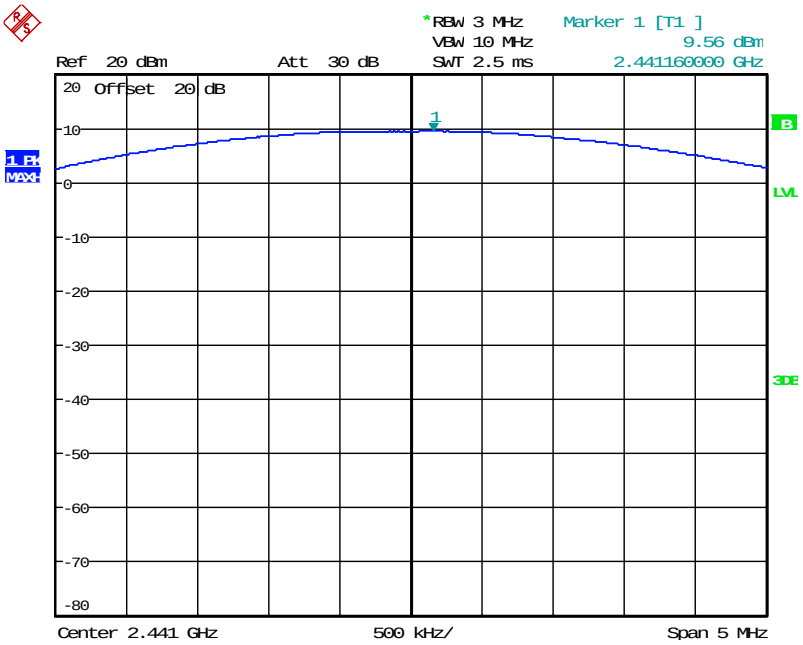
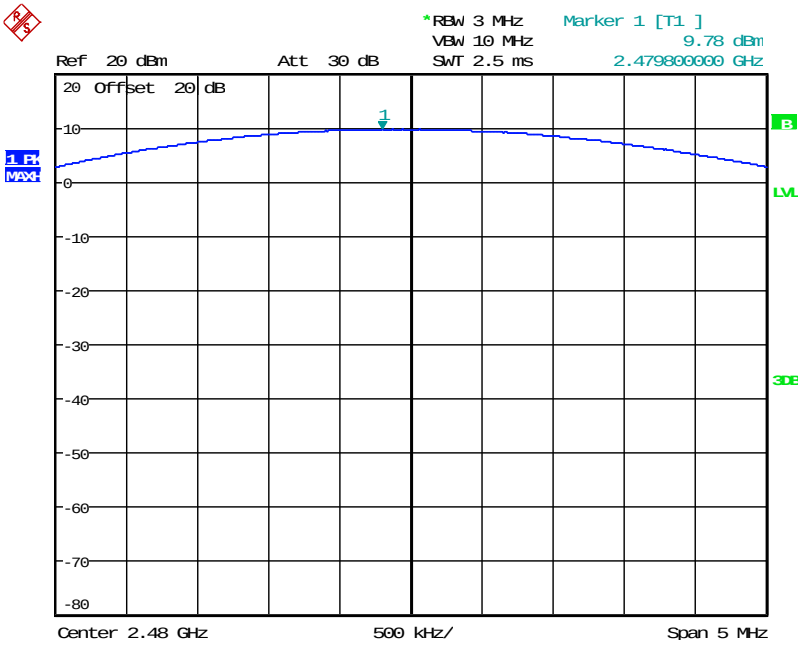


Figure 7.3.2-1: RF Output Power (GFSK) - Low Channel



Date: 9.DEC.2015 19:48:18

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



Date: 9.DEC.2015 19:44:09

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

Table 7.3.2-2: RF Output Power (π/4 DQPSK)

Frequency (MHz)	Power (dBm)
2402	9.87
2441	10.51
2480	10.66

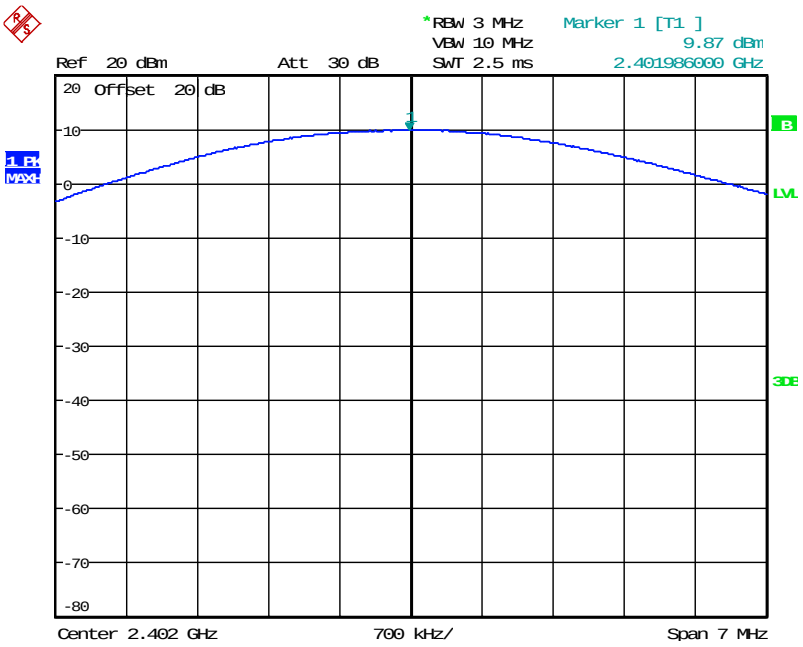


Figure 7.3.2-4: RF Output Power (π/4 DQPSK) - Low Channel

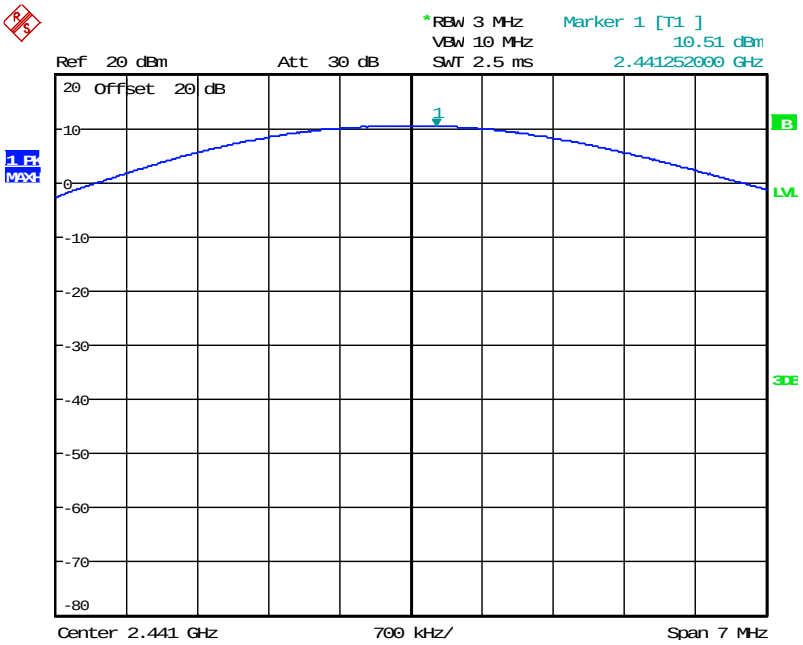


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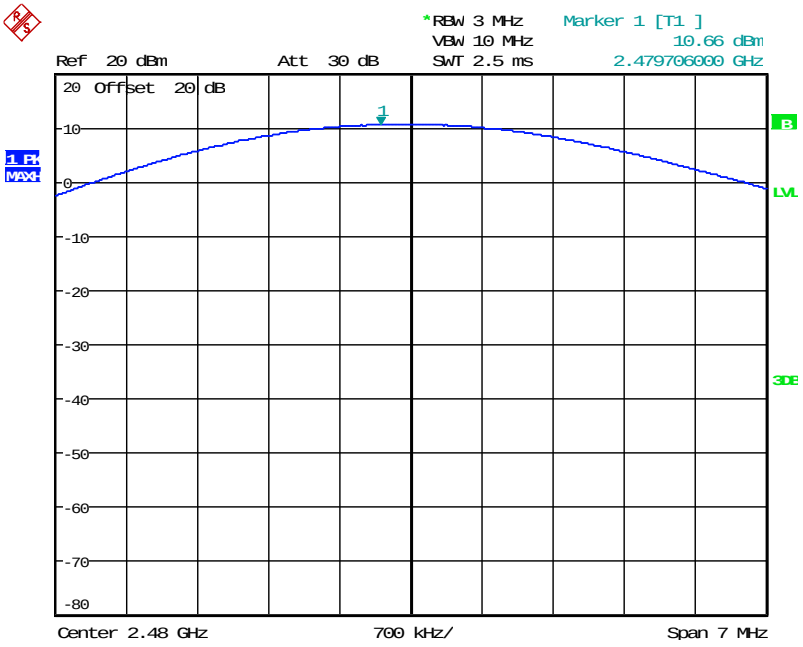
Figure 7.3.2-5: RF Output Power (π/4 DQPSK) - Middle Channel



Date: 9.DEC.2015 20:35:33

Figure 7.3.2-6: RF Output Power (π/4 DQPSK) - High Channel

Table 7.3.2-3 RF Output Power (8DPSK)

Frequency (MHz)	Power (dBm)
2402	10.23
2441	10.69
2480	11.03

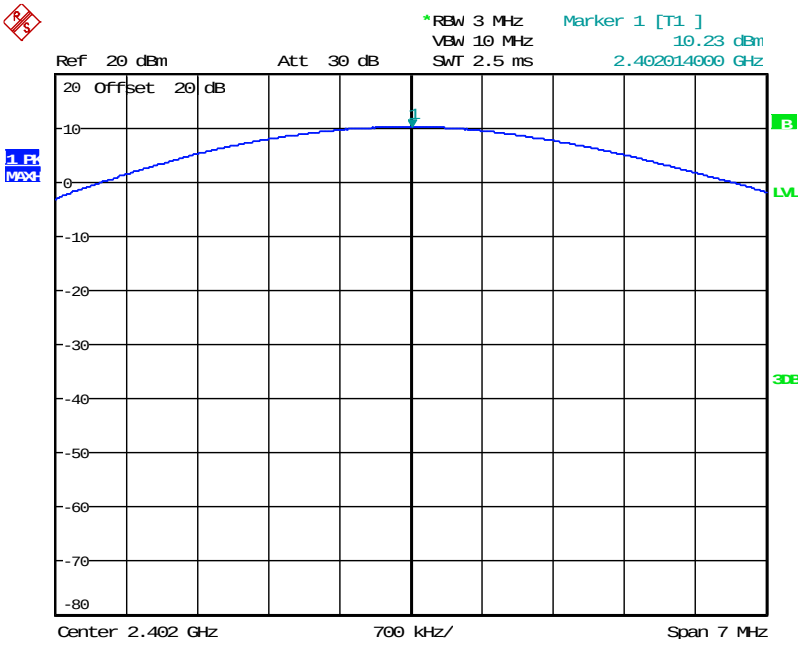
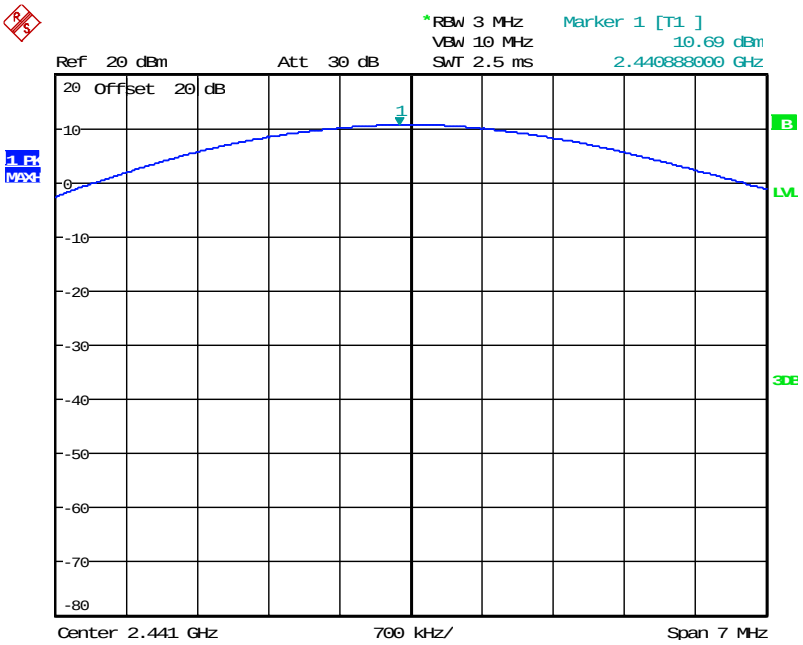
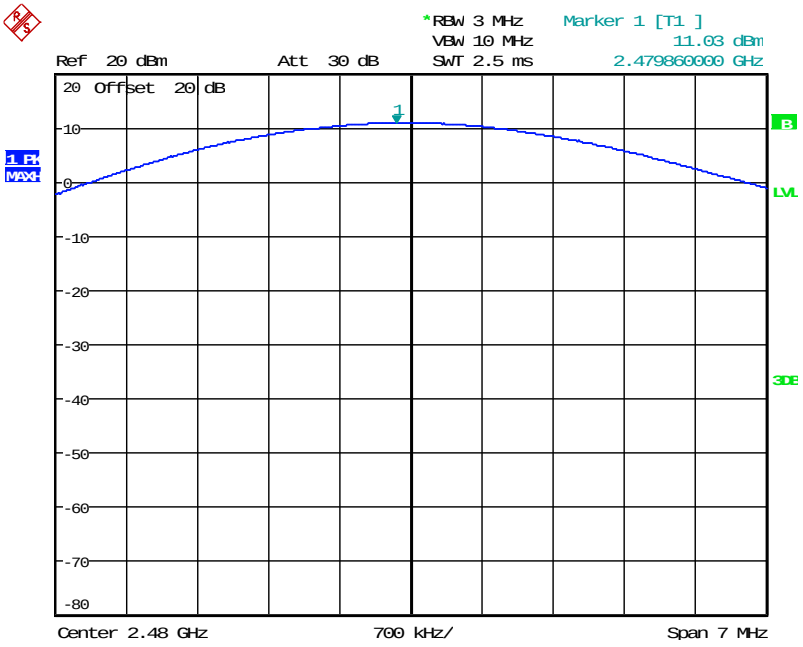


Figure 7.3.2-7: RF Output Power (8DPSK) - Low Channel



Date: 9.DEC.2015 20:28:30

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



Date: 9.DEC.2015 20:37:29

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-247 5.1(2)

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 approximately 30% of the channel spacing.

7.4.1.2 Measurement Results

Results are shown below:

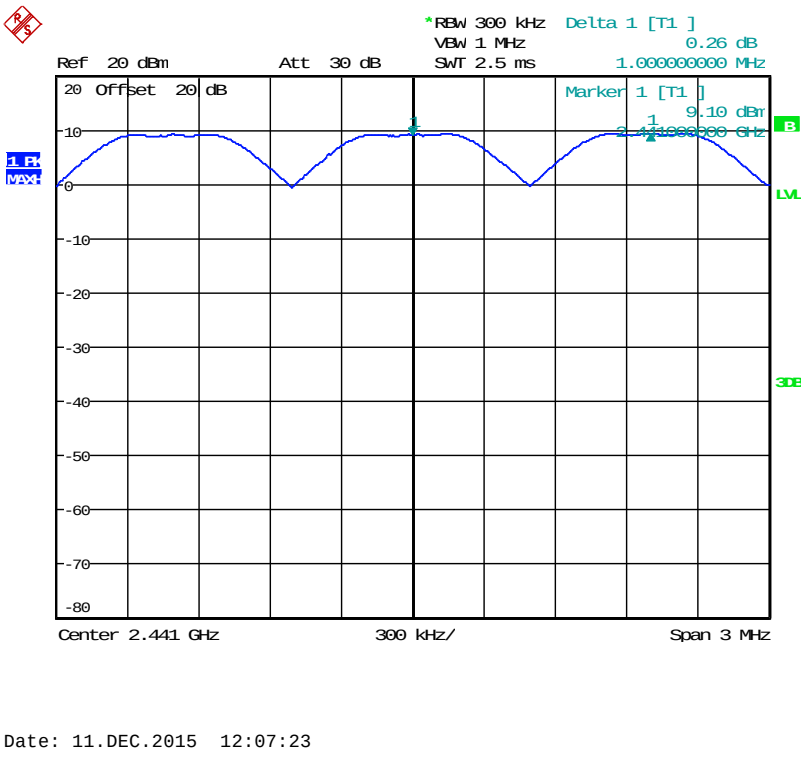


Figure 7.4.1.2-1: Carrier Frequency Separation

7.4.2 Number of Hopping Channels – FCC: Section 15.247(a)(1)(iii) IC: RSS-247 5.1(4)

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:

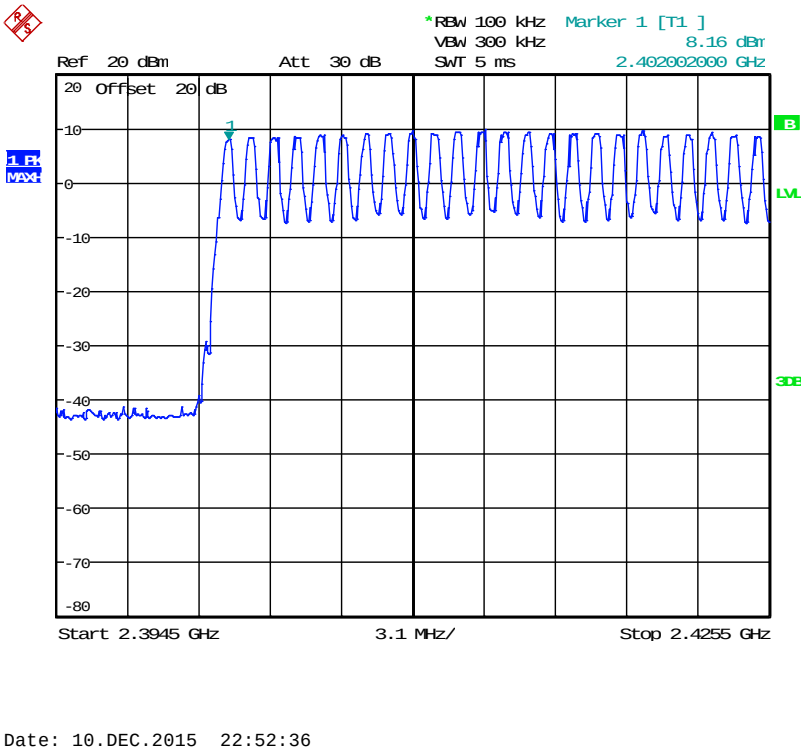
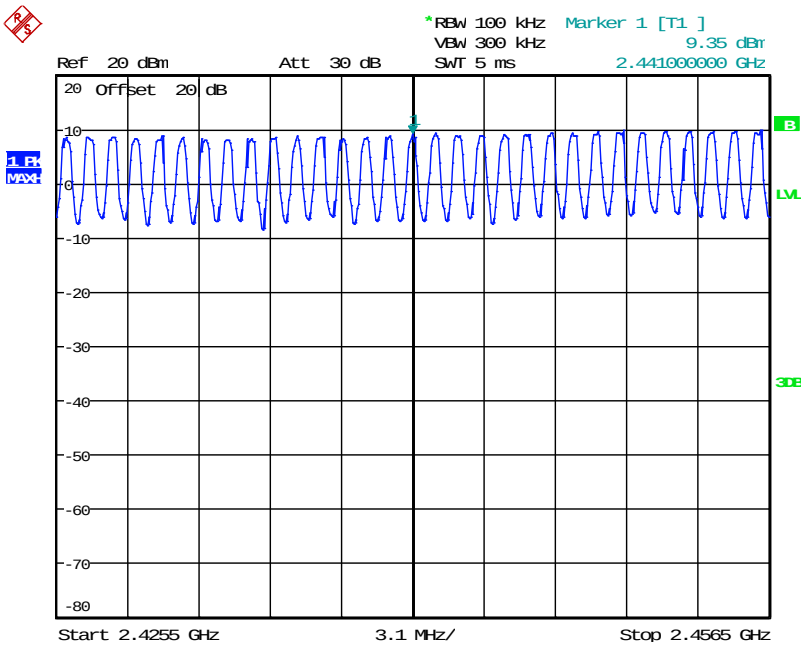
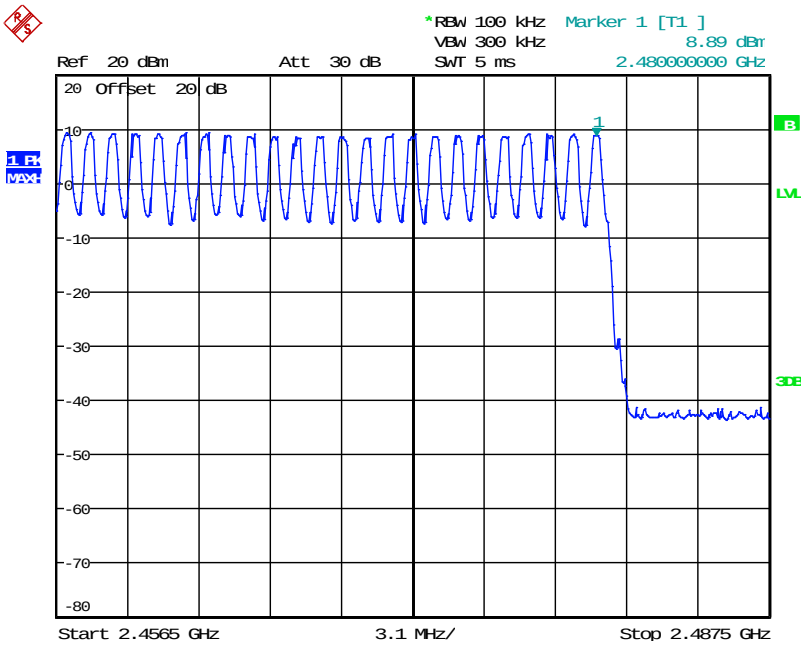


Figure 7.4.2.2-1: Number of Hopping Channels (1 – 24)



Date: 10.DEC.2015 22:50:07

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



Date: 10.DEC.2015 22:55:02

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-247 5.1(4)

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 less than 30% of the channel spacing 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	0.388	124.16	400	PASS
DH3	400	5.06	160	1.658	265.28	400	PASS
DH5	266.67	3.38	106.67	2.92	311.48	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

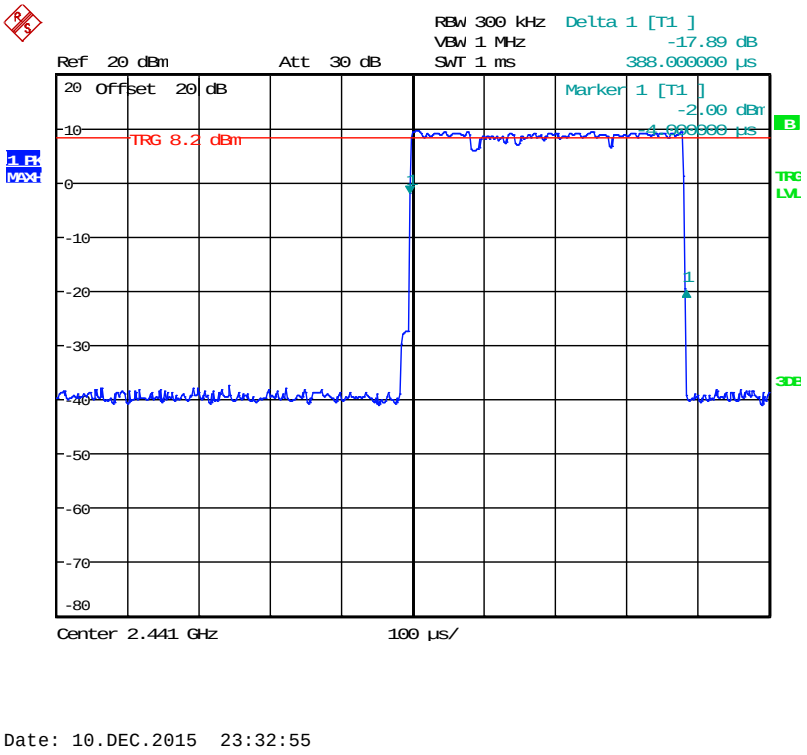


Figure 7.4.3.2-1: Channel Dwell Time – DH1

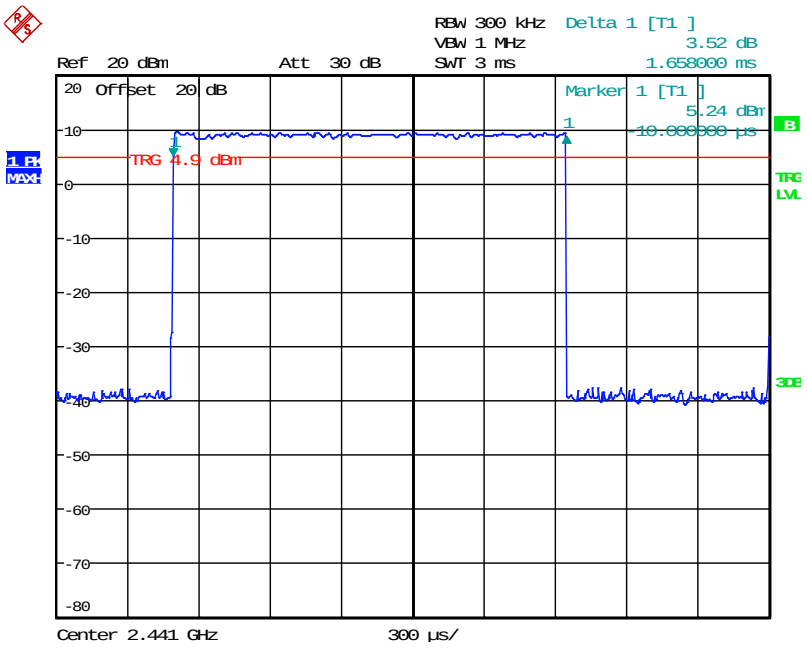


Figure 7.4.3.2-2: Channel Dwell Time – DH3

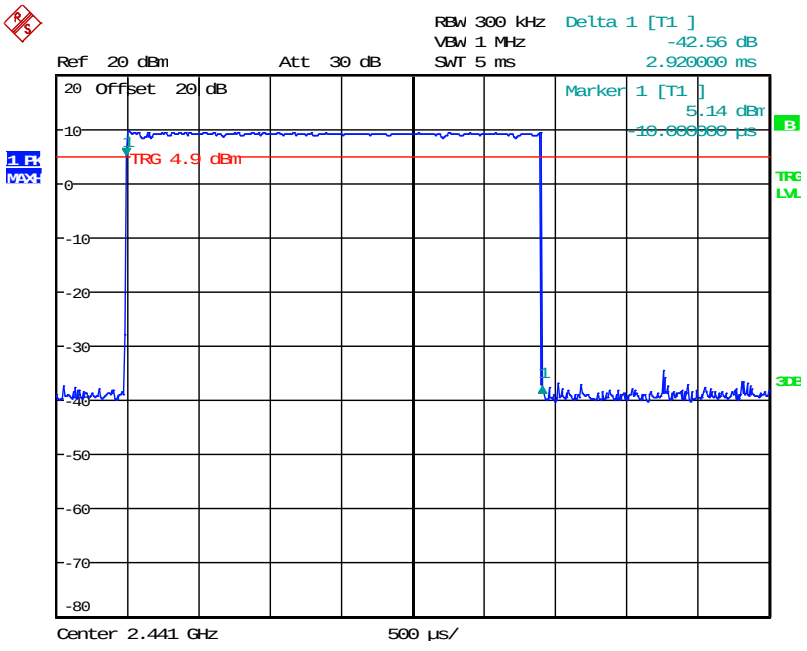


Figure 7.4.3.2-3: Channel Dwell Time – DH5

7.4.4 20dB / 99% Bandwidth - FCC: Section 15.247(a)(1)(i) IC: RSS-247 5.1(1)

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 5 times the estimated bandwidth of the emission. The RBW was set to 1% to 5% of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. The N dB function of the spectrum analyzer was used to measure the 20 dB bandwidth.

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 the 99% bandwidth equipment function of the spectrum analyzer.

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	960.00	906.00
2441	960.00	900.00
2480	966.00	900.00

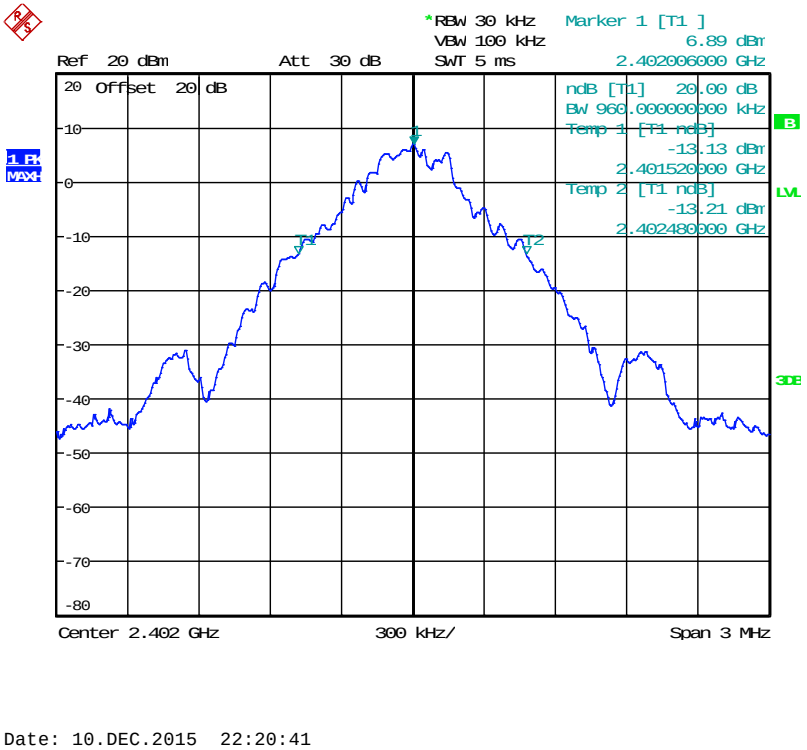
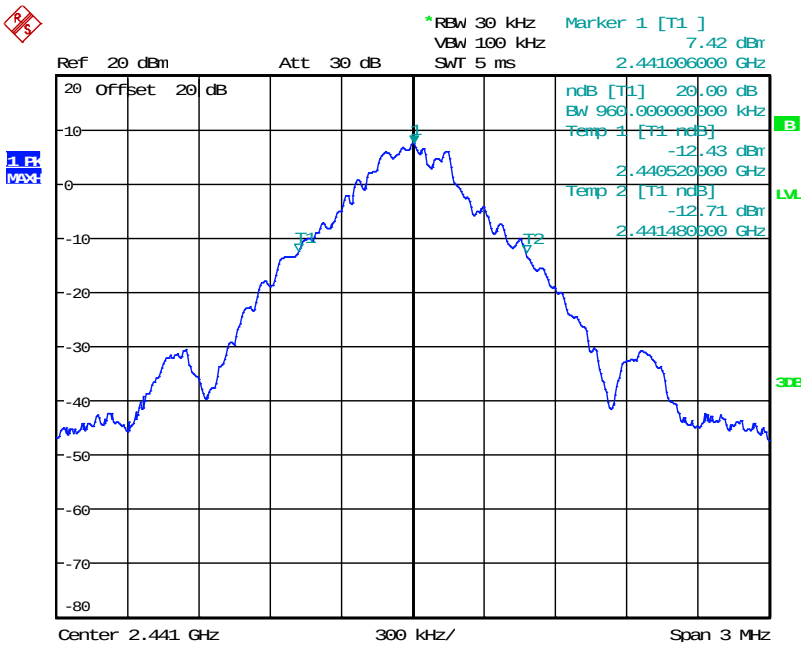
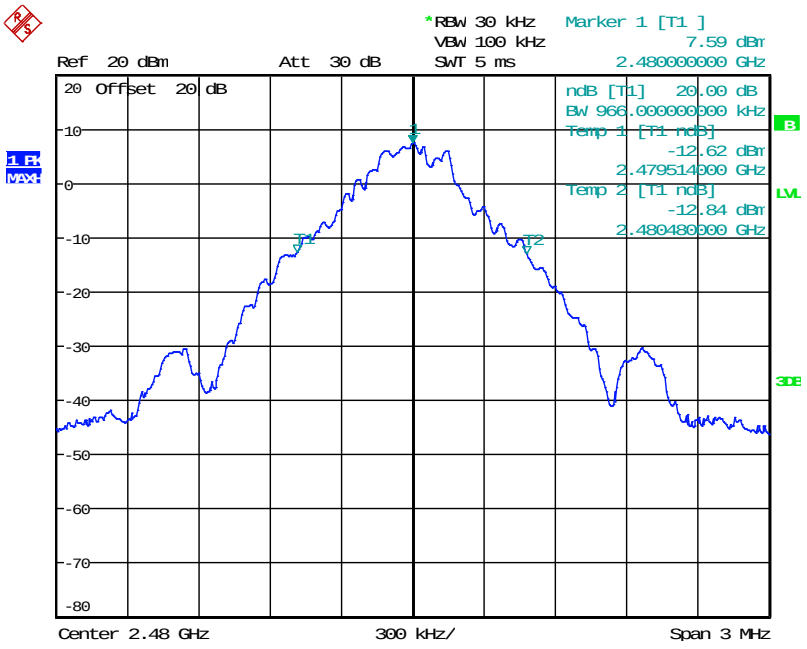


Figure 7.4.4.2-1: 20dB BW Low Channel (GFSK)



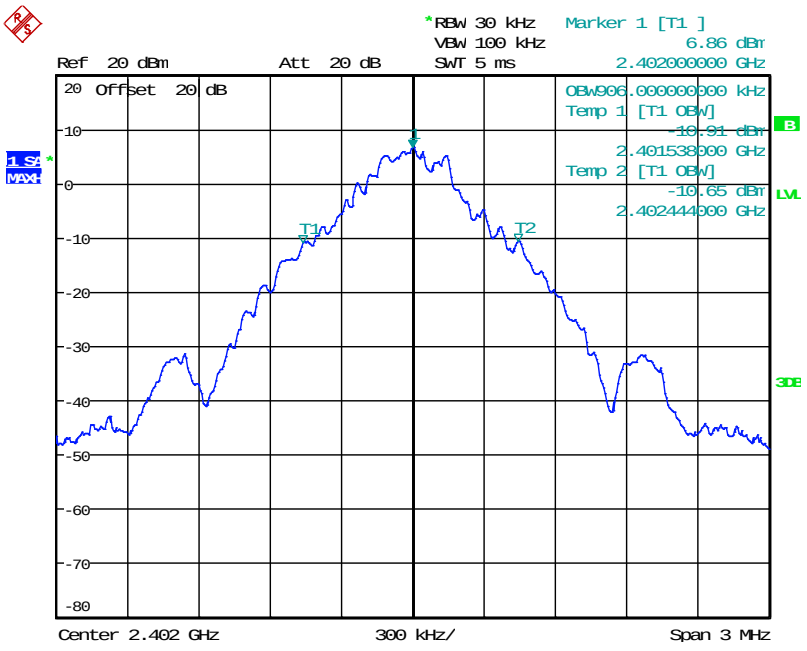
Date: 10.DEC.2015 22:21:55

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



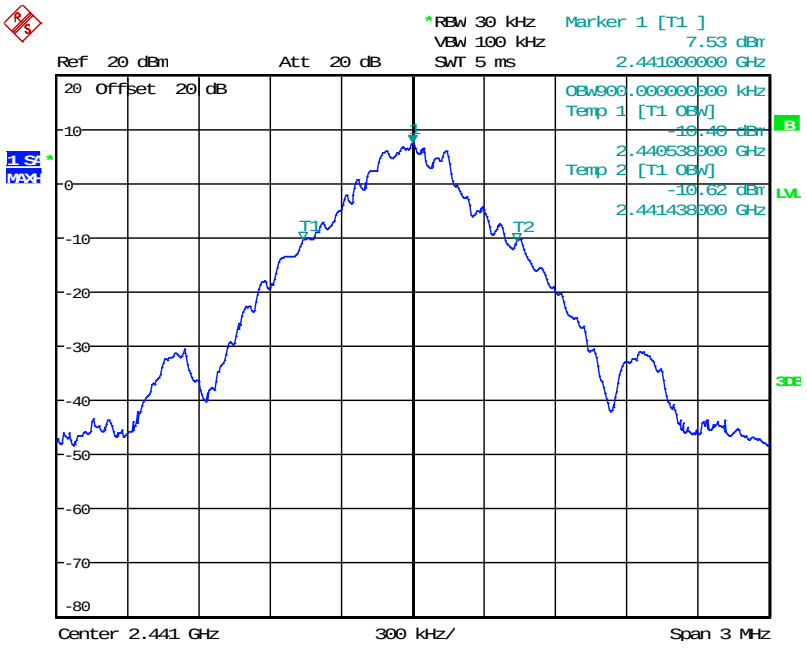
Date: 10.DEC.2015 22:23:59

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



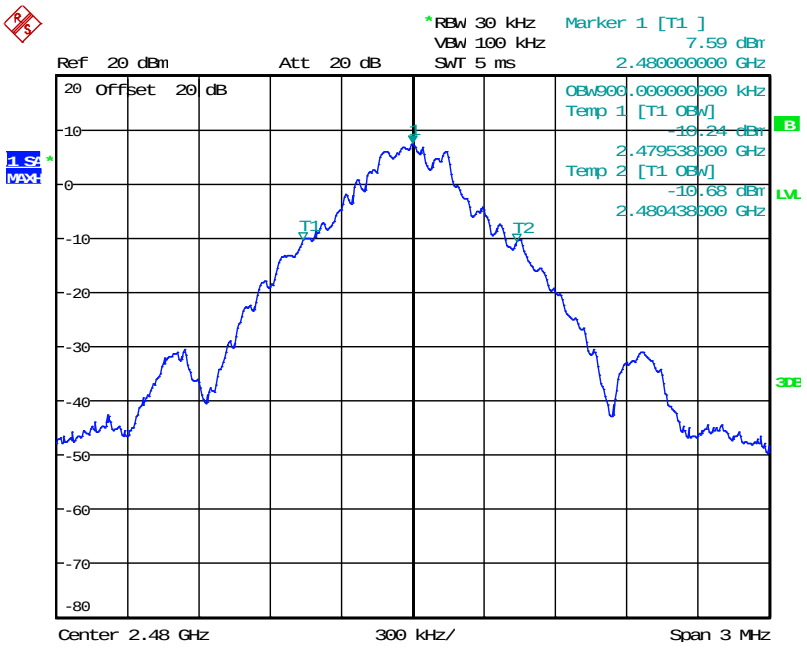
Date: 9.DEC.2015 19:37:16

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



Date: 9.DEC.2015 19:40:16

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



Date: 9.DEC.2015 19:41:55

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

Table: 7.4.4.2-2: 20dB / 99% Bandwidth (π/4 DQPSK)

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	1288.00	1170.00
2441	1296.00	1180.00
2480	1288.00	1180.00

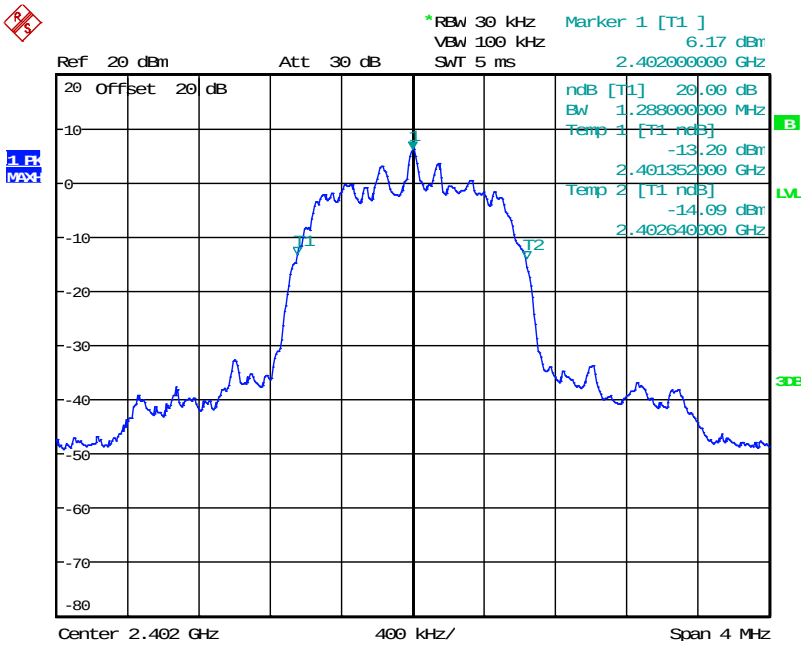


Figure 7.4.4.2-7: 20dB BW Low Channel (π/4 DQPSK)

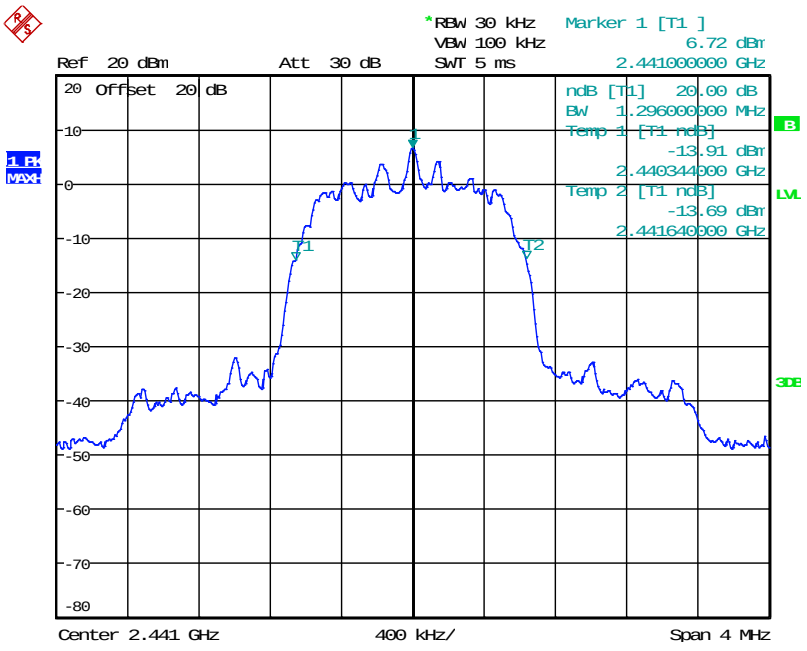


Figure 7.4.4.2-8: 20dB BW Middle Channel (π/4 DQPSK)

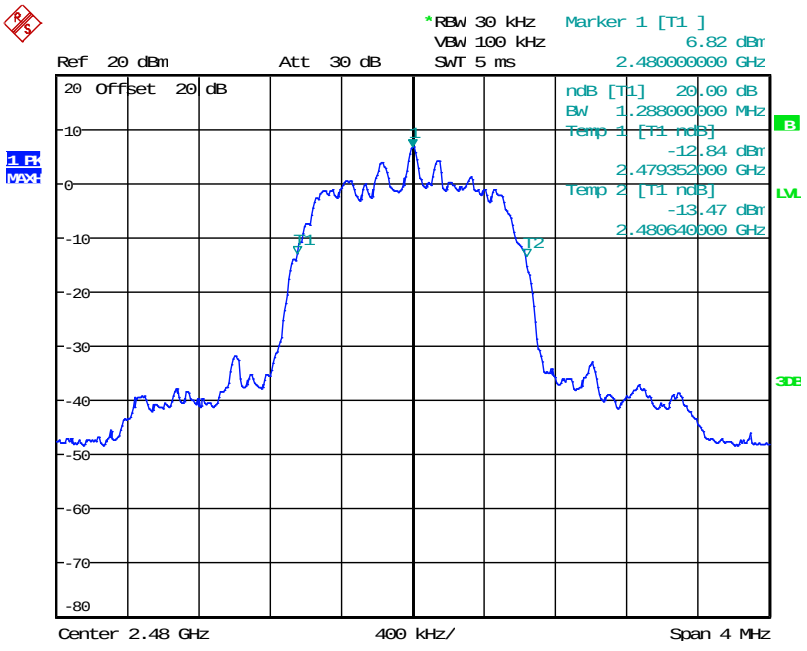
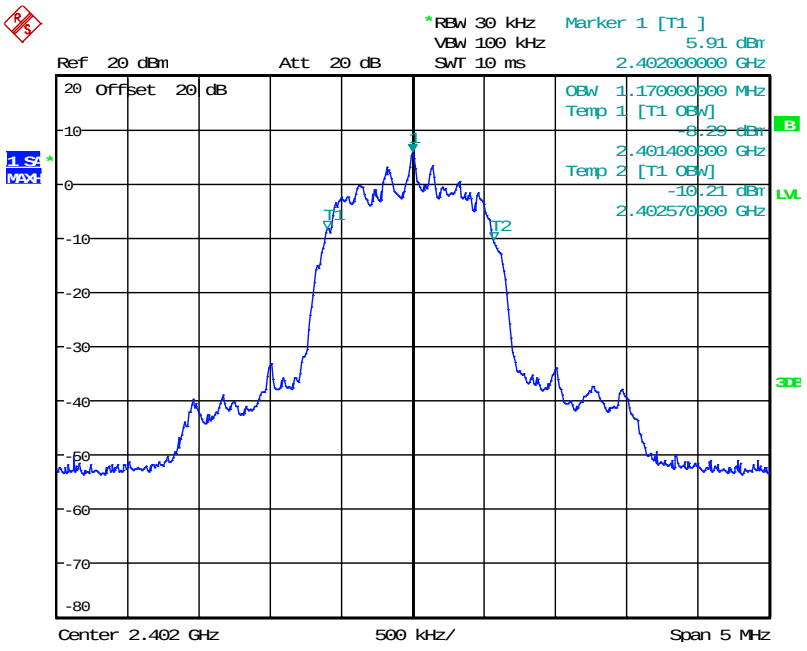
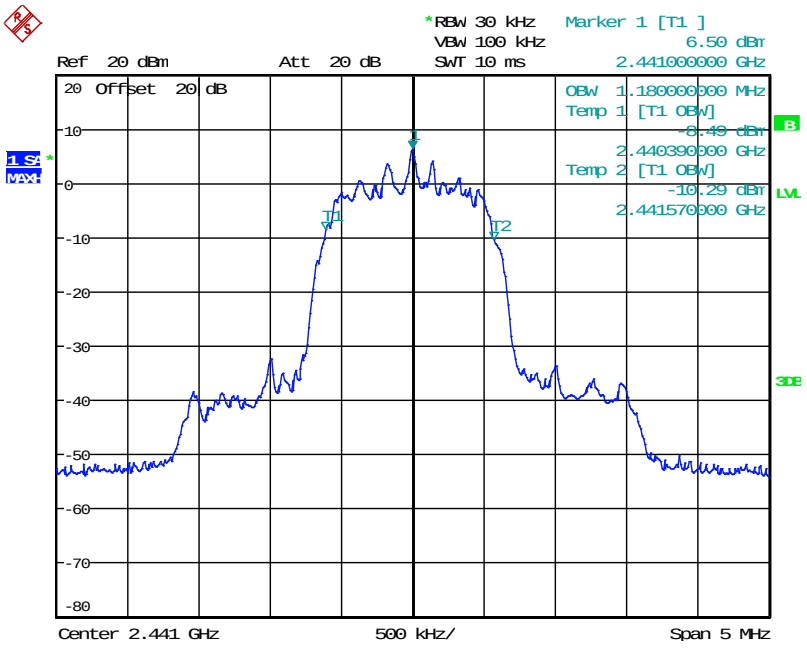


Figure 7.4.4.2-9: 20dB BW High Channel (π/4 DQPSK)



Date: 9.DEC.2015 19:22:56

Figure 7.4.4.2-10: 99% OBW Low Channel (π/4 DQPSK)



Date: 9.DEC.2015 19:01:57

Figure 7.4.4.2-11: 99% OBW Middle Channel (π/4 DQPSK)

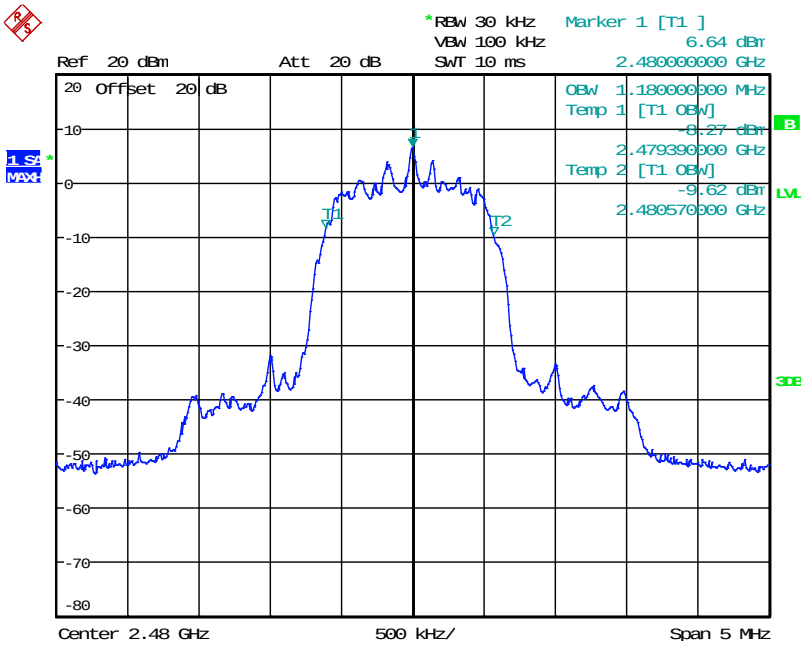


Figure 7.4.4.2-12: 99% OBW High Channel (π/4 DQPSK)

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

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	1296.00	1180.00
2441	1288.00	1170.00
2480	1288.00	1170.00

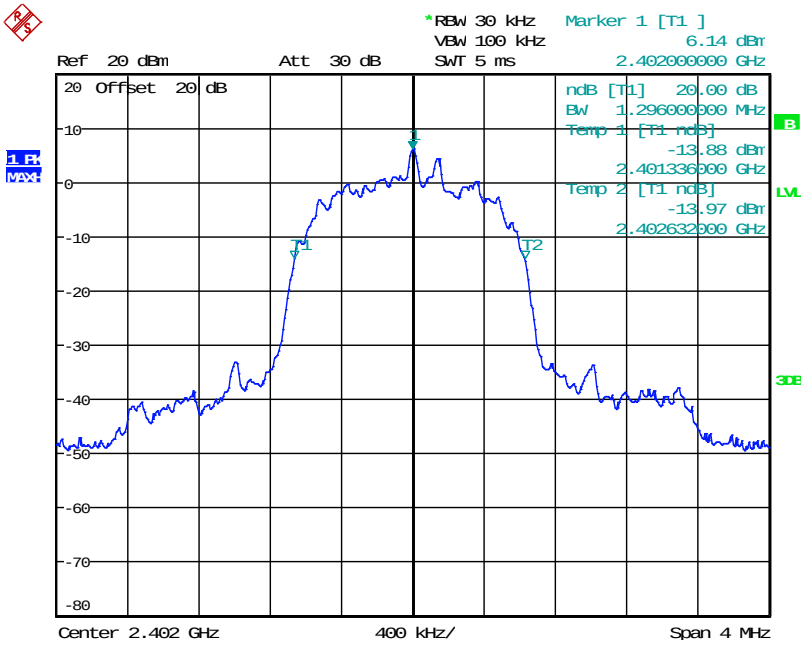
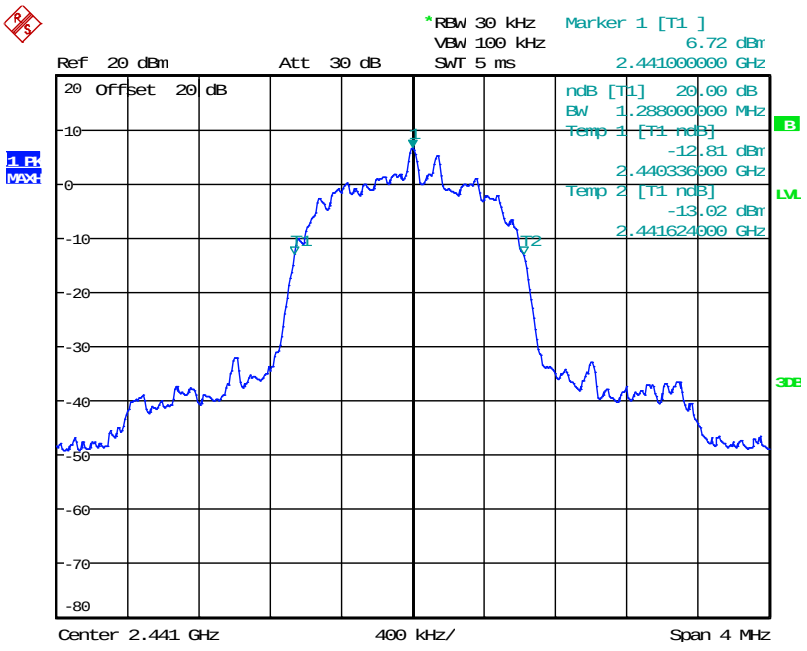
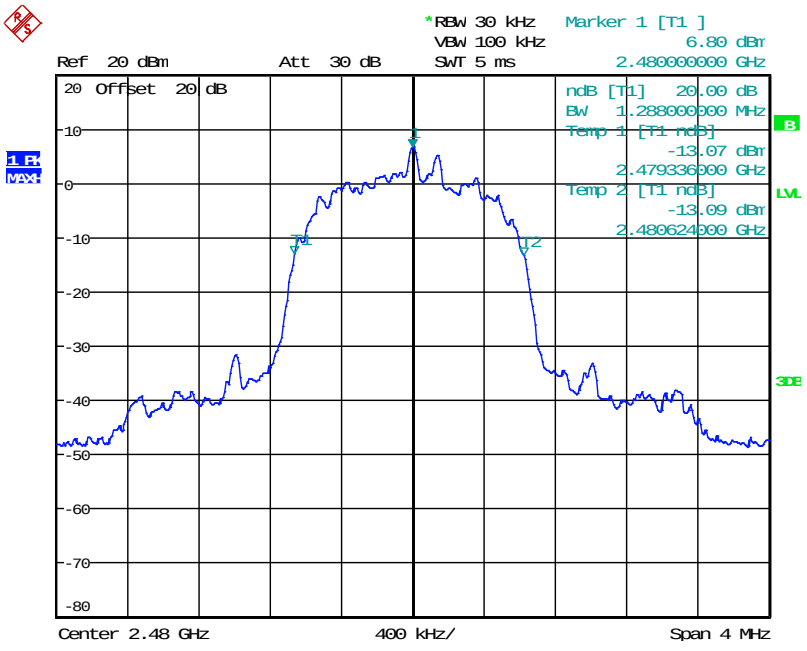


Figure 7.4.4.2-13: 20dB BW Low Channel (8DPSK)



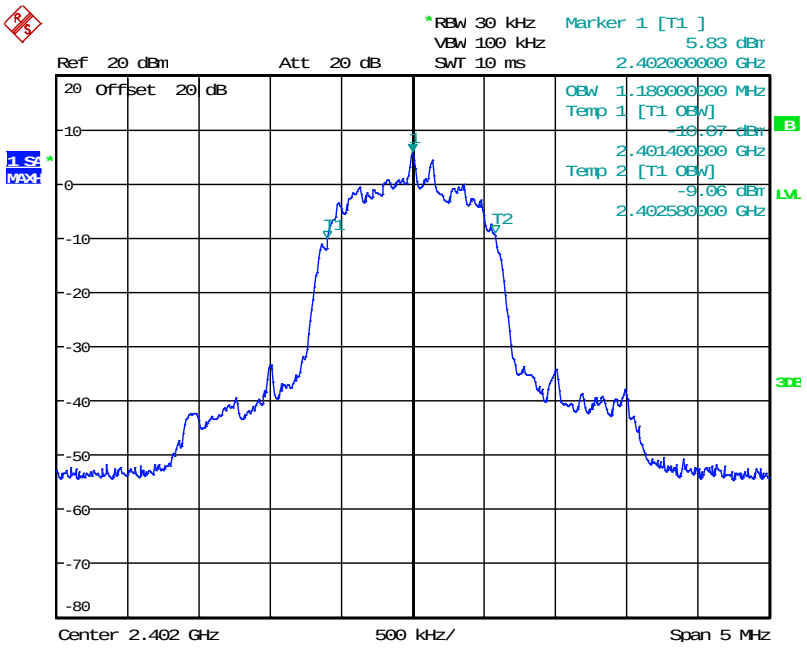
Date: 10.DEC.2015 22:38:32

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



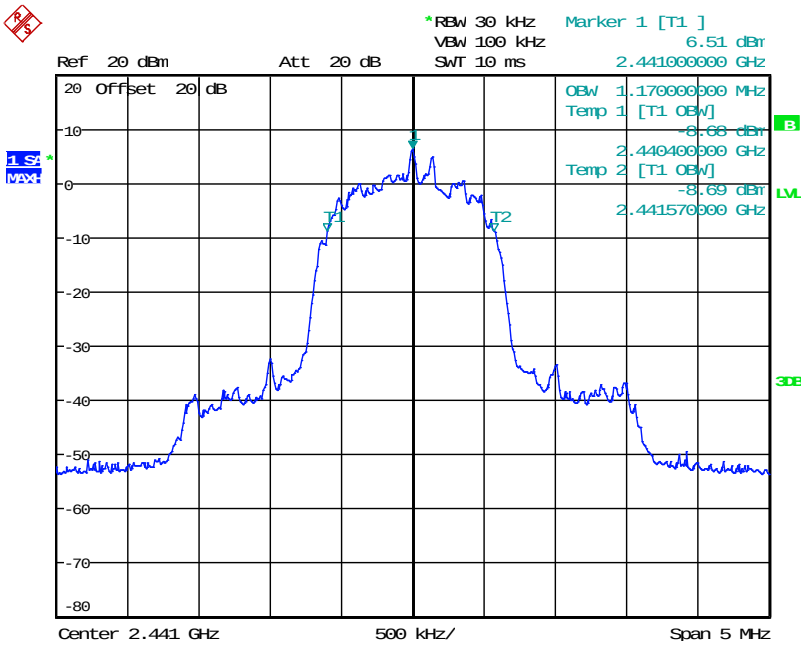
Date: 10.DEC.2015 22:36:30

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



Date: 9.DEC.2015 19:12:23

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



Date: 9.DEC.2015 19:07:22

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

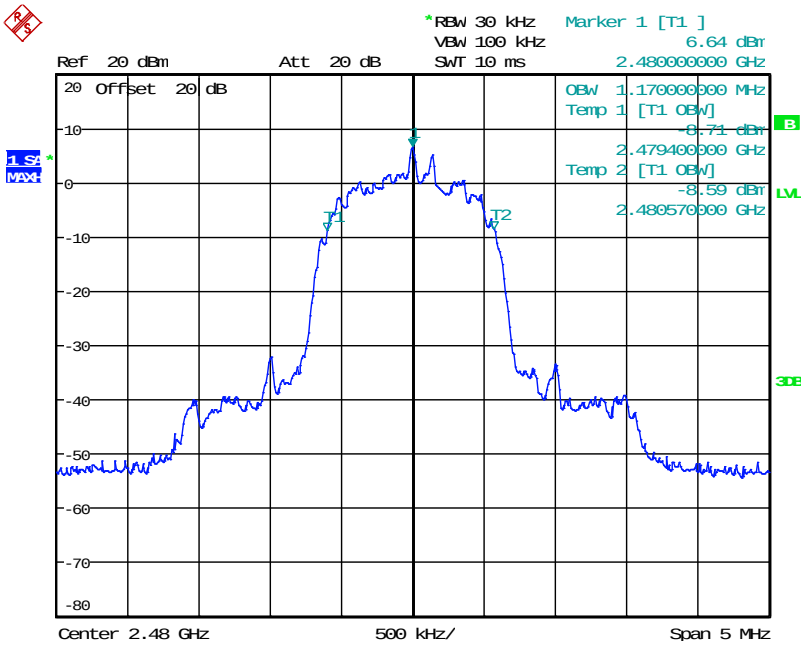


Figure 7.4.4.2-18: 99% OBW High Channel (8DPSK)

7.5 Band-Edge Compliance and Spurious Emissions-FCC 15.247(d) IC: RSS-247 5.5

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 ≥ 1% of the span, and the VBW was set to >= 300 kHz.

7.5.1.2 Measurement Results

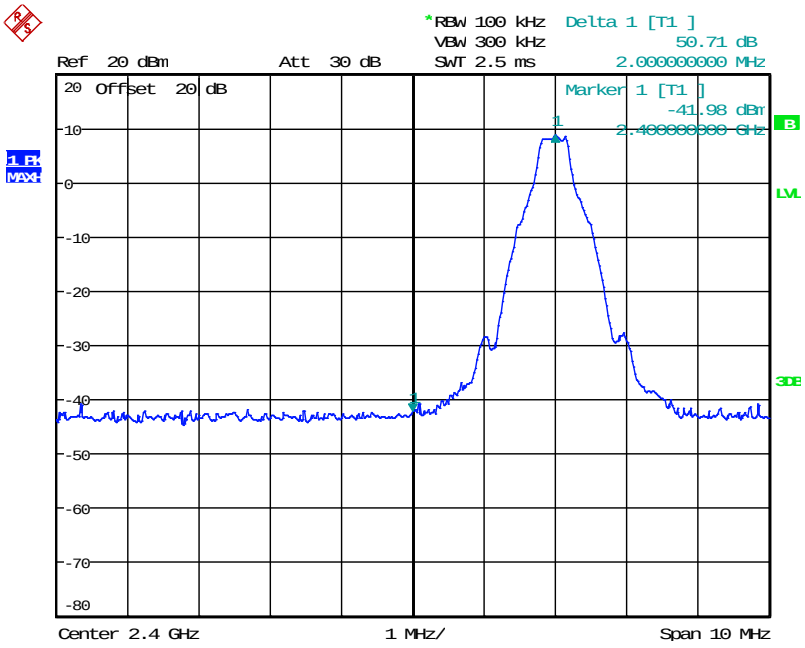


Figure 7.5.1.2-1: Lower Band-edge (GFSK)

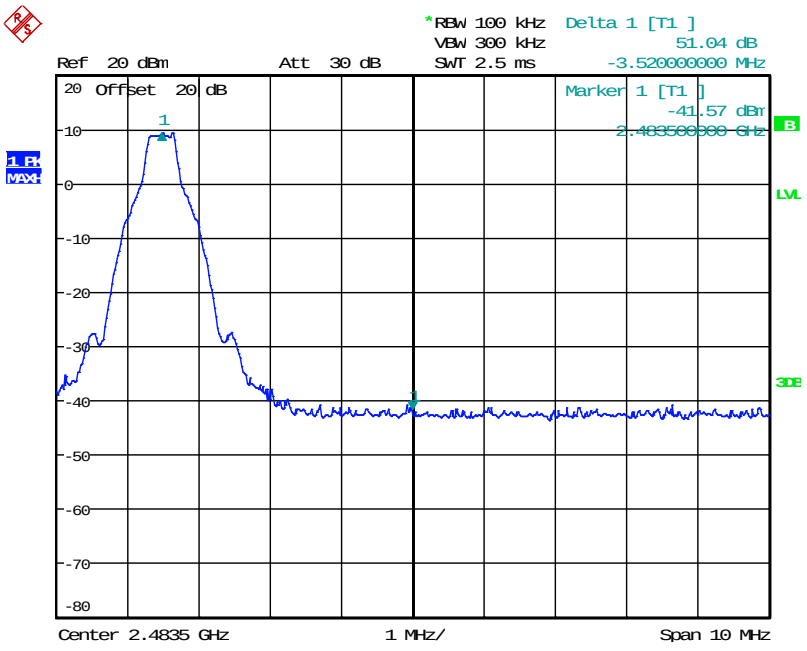


Figure 7.5.1.2-2: Upper Band-edge (GFSK)

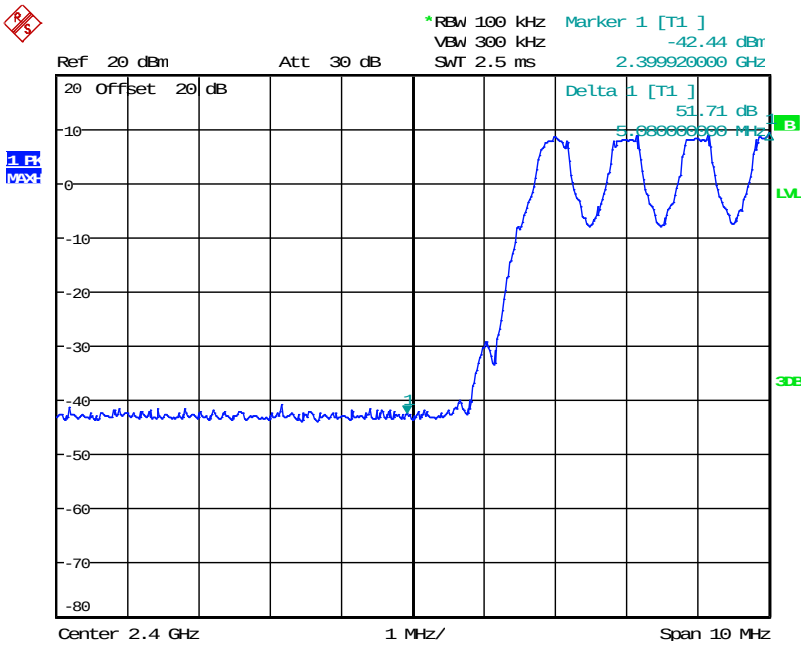


Figure 7.5.1.2-3: Lower Band-edge – Hopping Mode (GFSK)

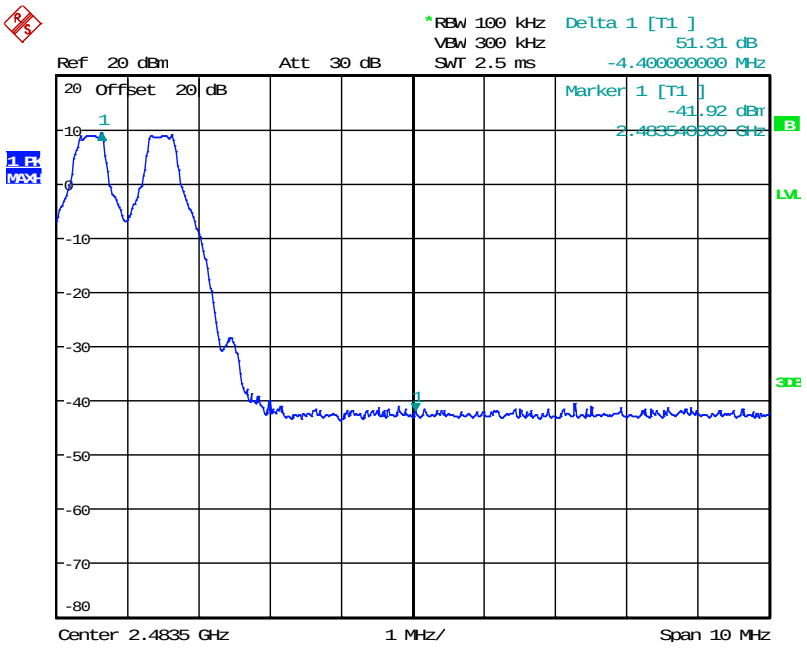


Figure 7.5.1.2-4: Upper Band-edge – Hopping Mode (GFSK)

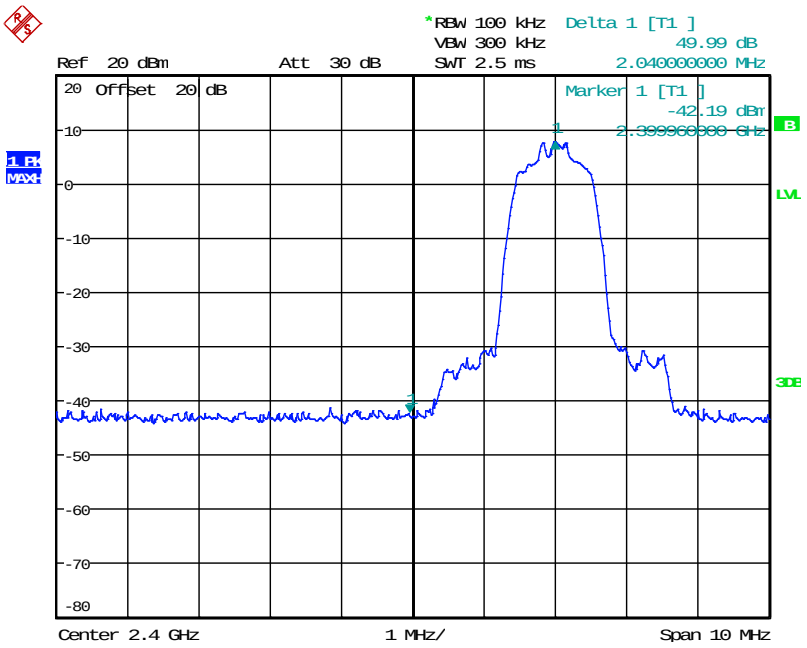


Figure 7.5.1.2-5: Lower Band-edge (π/4 DQPSK)

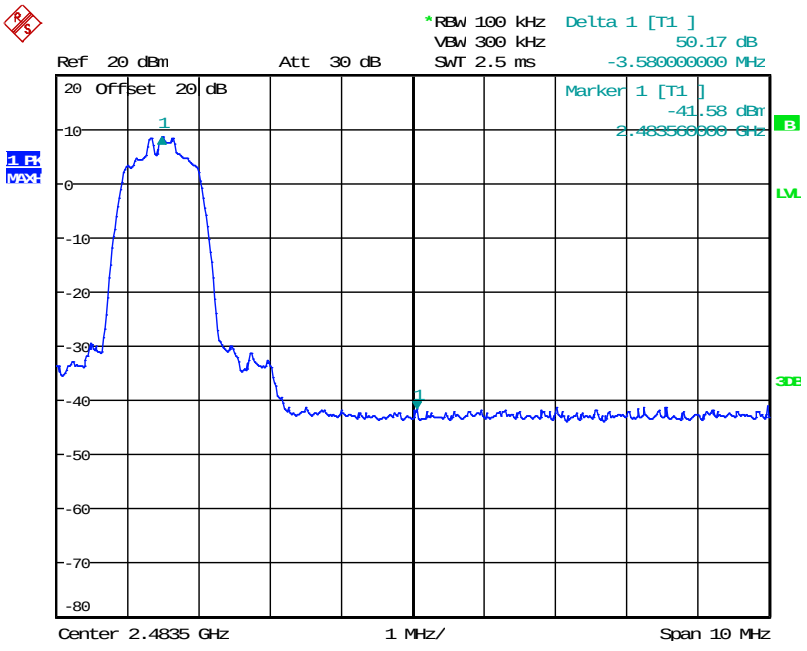


Figure 7.5.1.2-6: Upper Band-edge (π/4 DQPSK)

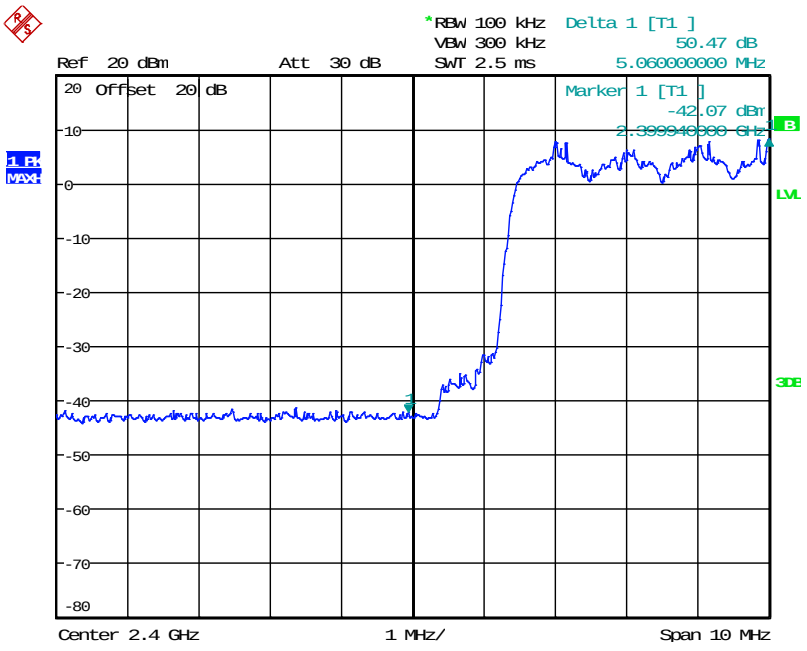


Figure 7.5.1.2-7: Lower Band-edge – Hopping Mode (π/4 DQPSK)

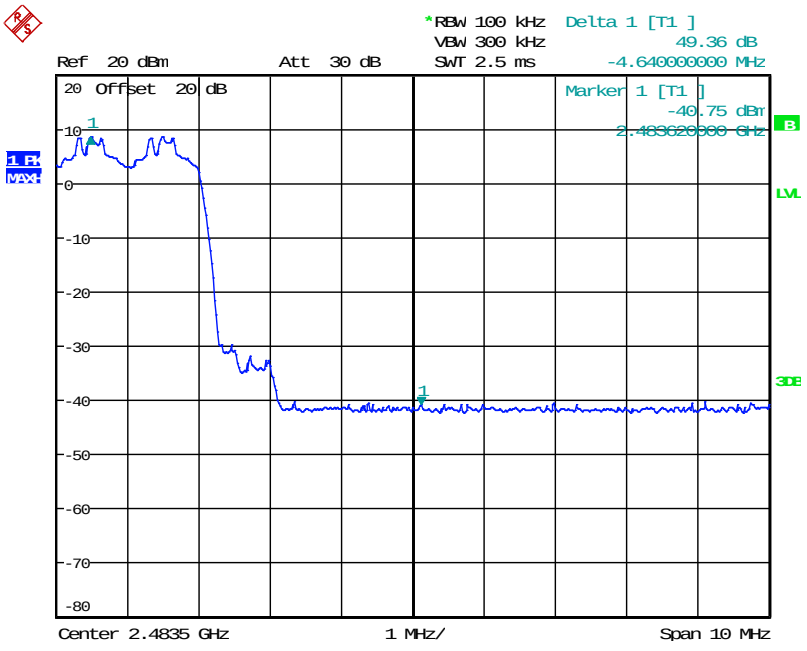
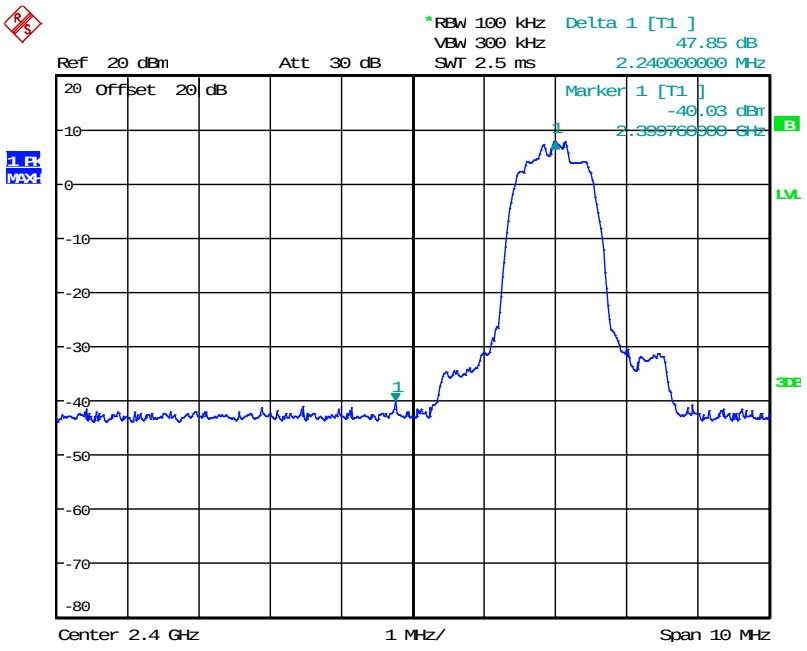
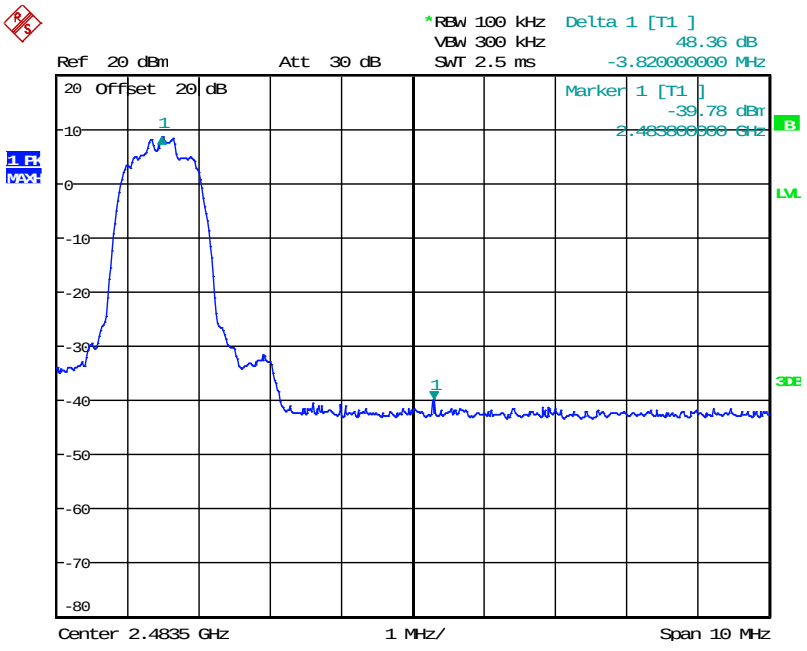


Figure 7.5.1.2-8: Upper Band-edge – Hopping Mode (π/4 DQPSK)



Date: 9.DEC.2015 16:21:43

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



Date: 9.DEC.2015 17:54:55

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

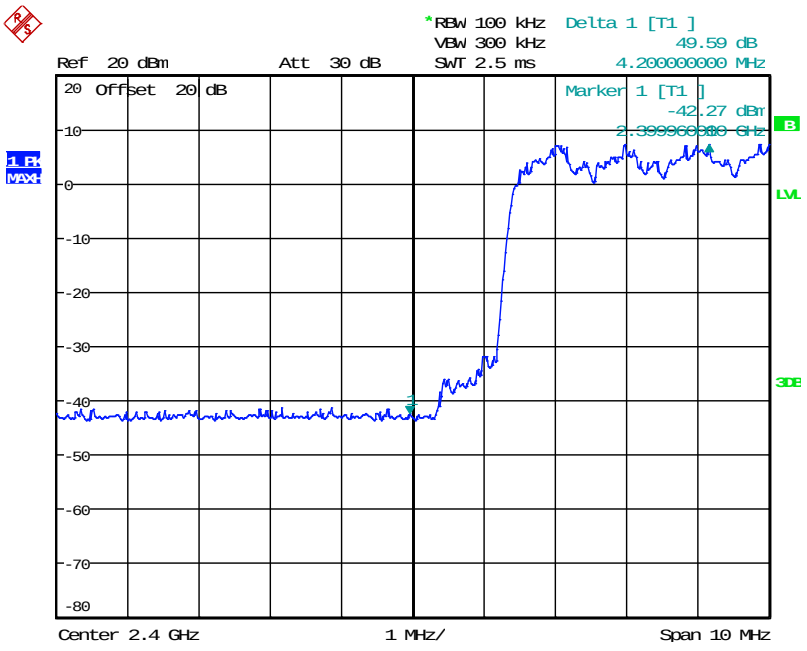


Figure 7.5.1.2-11: Lower Band-edge – Hopping Mode (8DPSK)

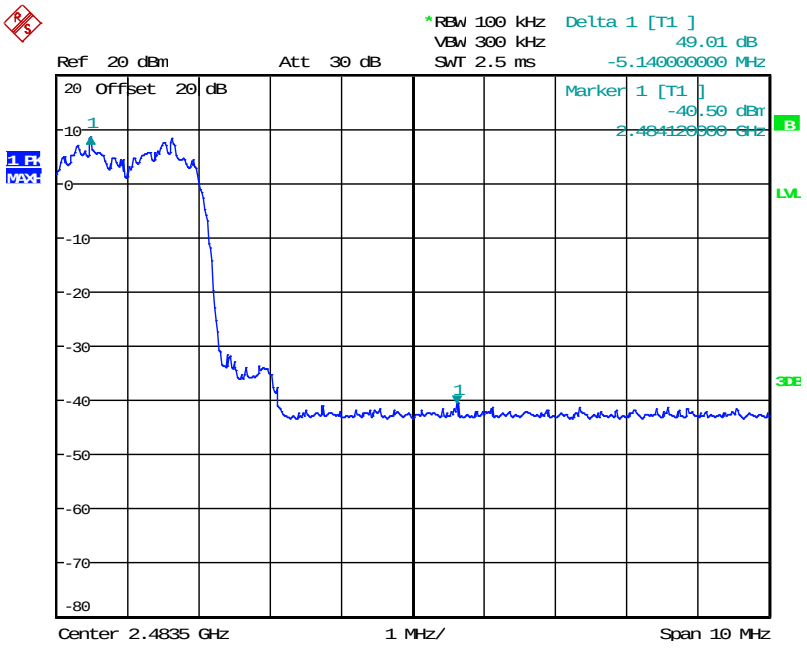


Figure 7.5.1.2-12: Upper Band-edge – Hopping Mode (8DPSK)

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 30 MHz 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:

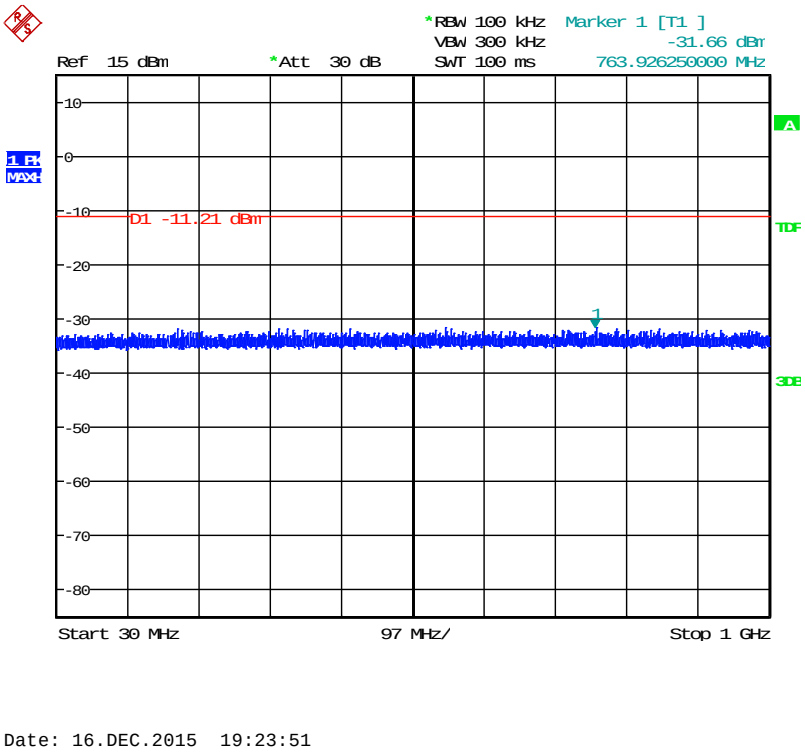
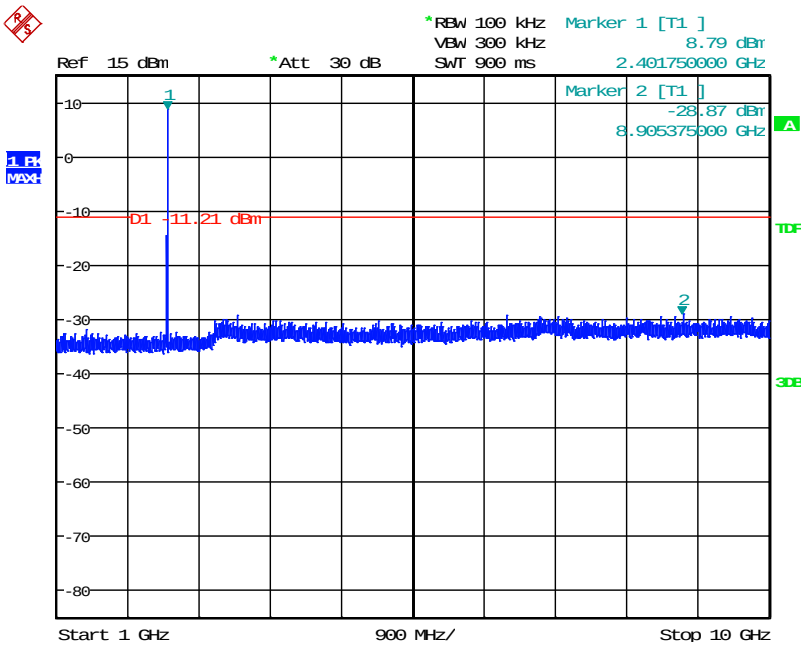
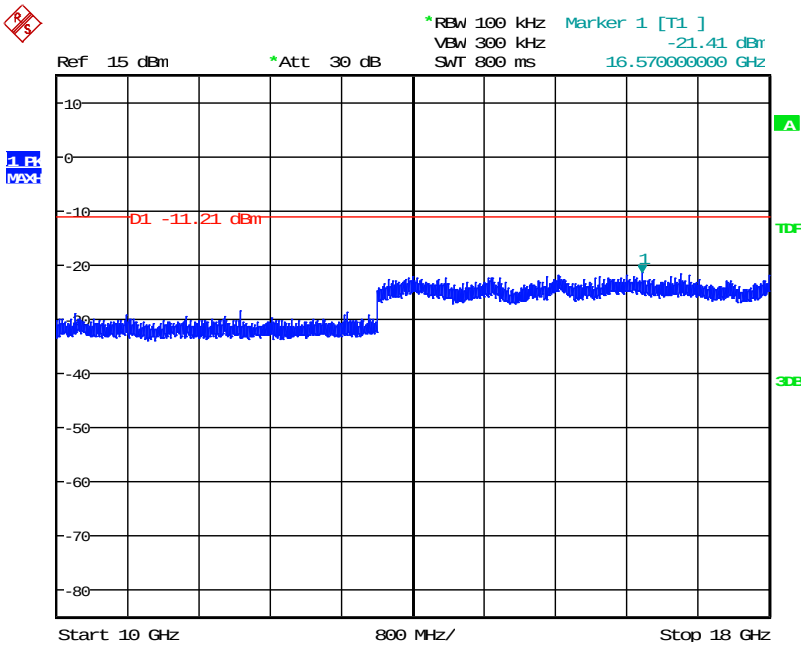


Figure 7.5.2.2-1: 30 MHz – 1 GHz – Low Channel (GFSK)



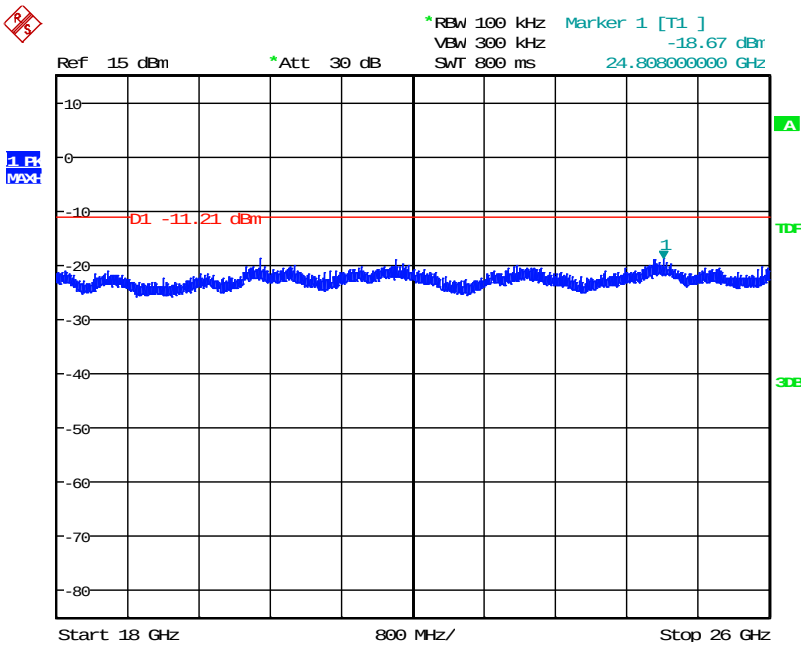
Date: 16.DEC.2015 18:45:51

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



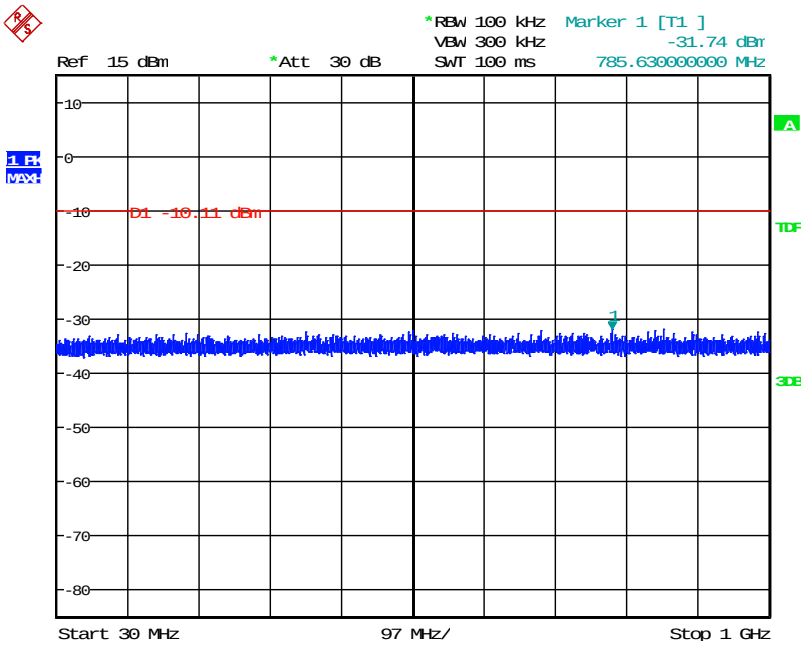
Date: 16.DEC.2015 18:48:39

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



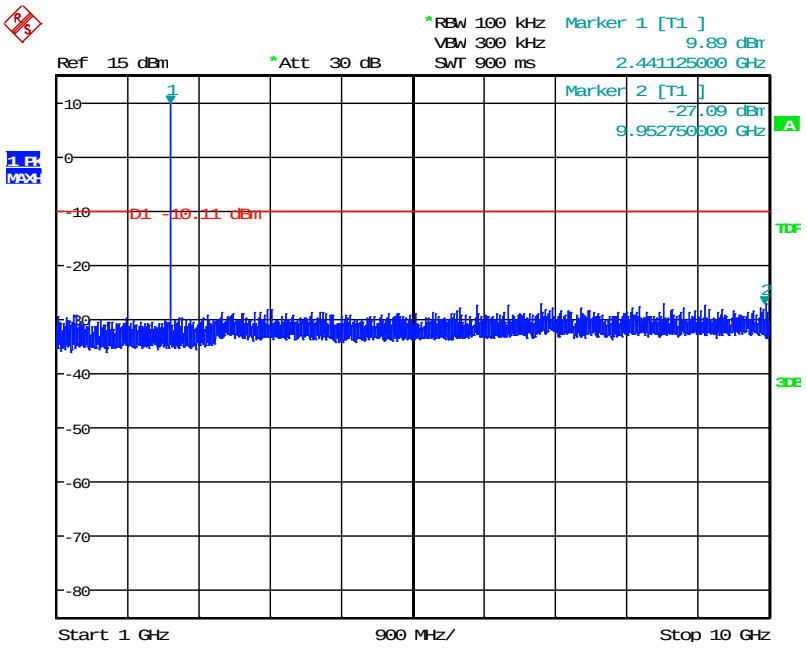
Date: 16.DEC.2015 19:10:10

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



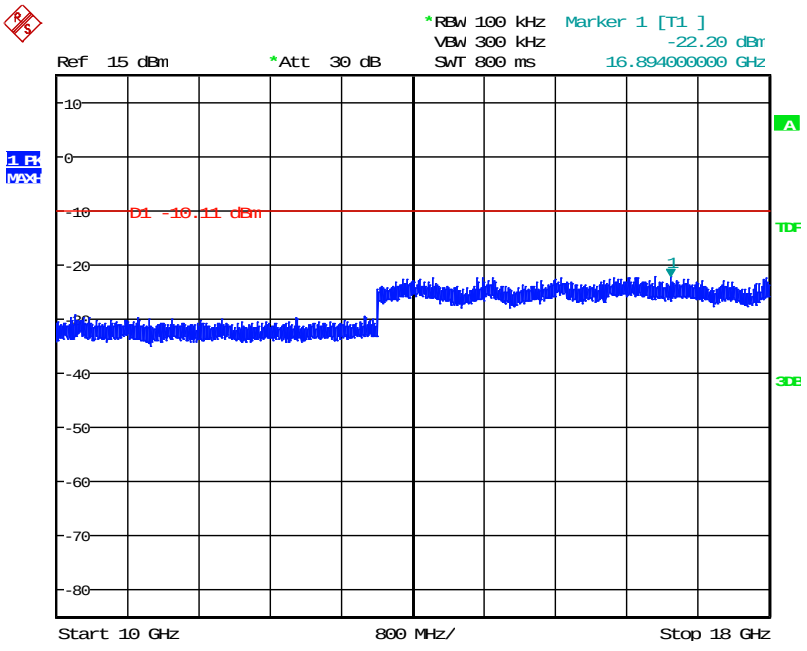
Date: 16.DEC.2015 18:42:08

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



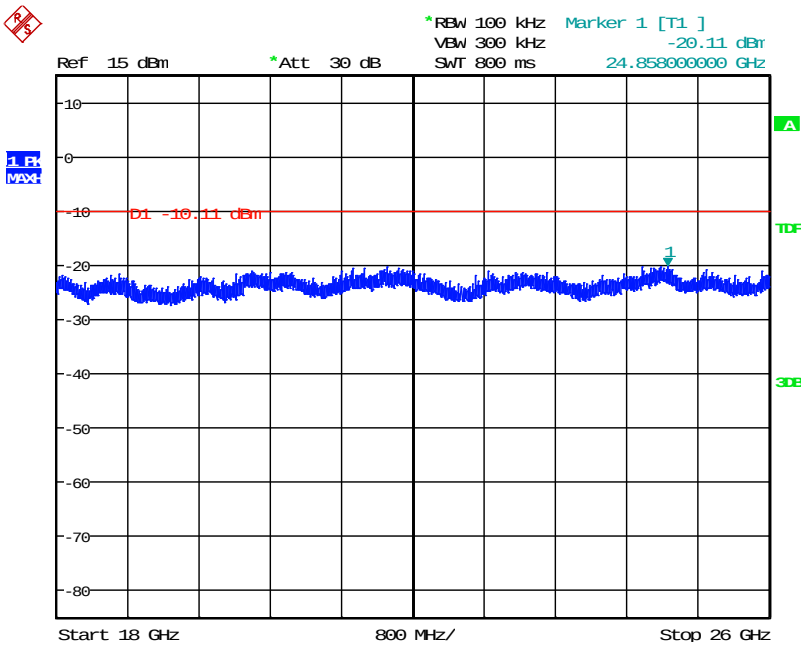
Date: 16.DEC.2015 18:36:17

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



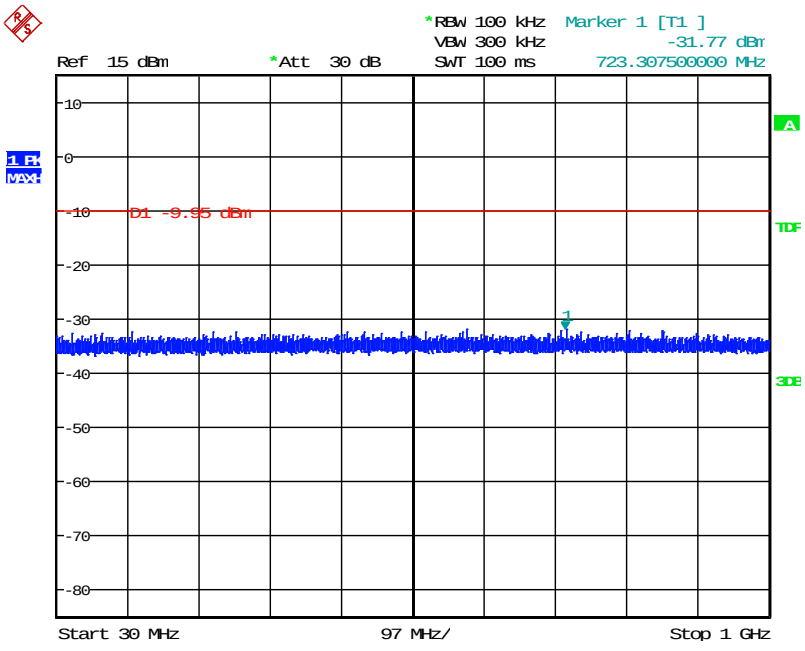
Date: 16.DEC.2015 18:37:39

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



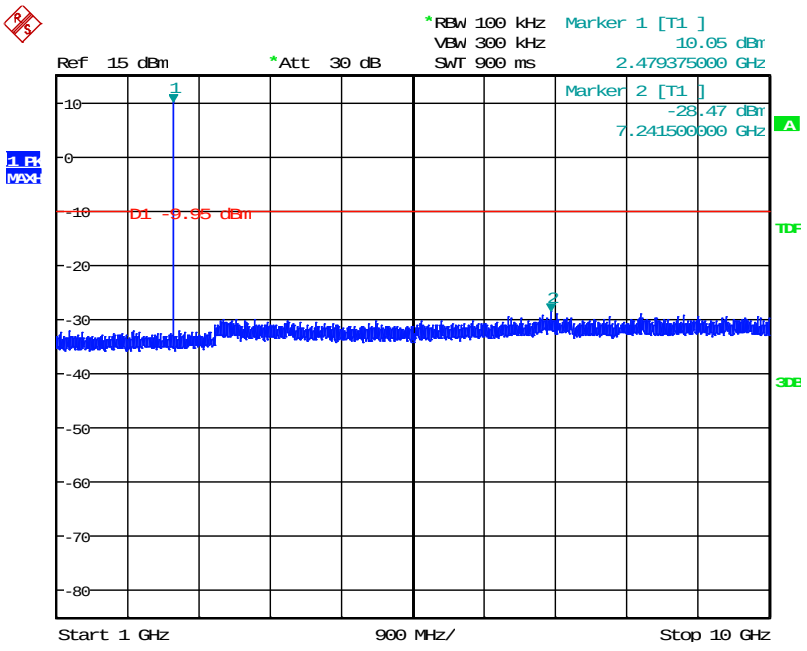
Date: 16.DEC.2015 18:39:45

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



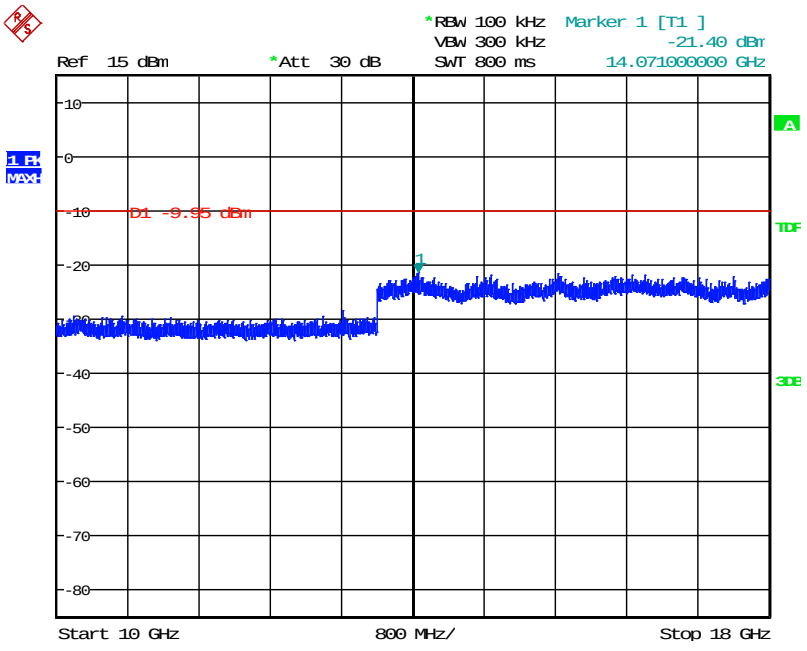
Date: 17.DEC.2015 16:11:17

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



Date: 17.DEC.2015 16:01:38

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



Date: 17.DEC.2015 16:04:12

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

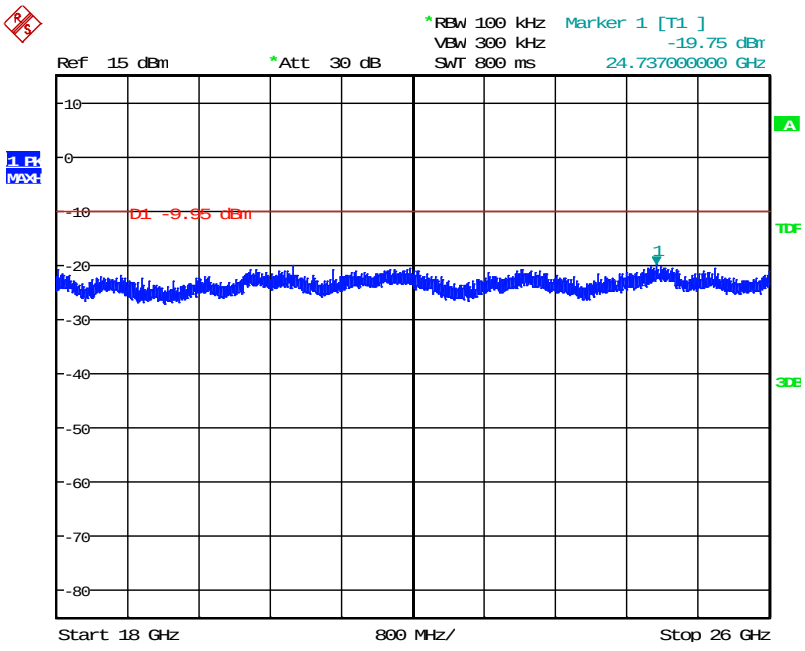
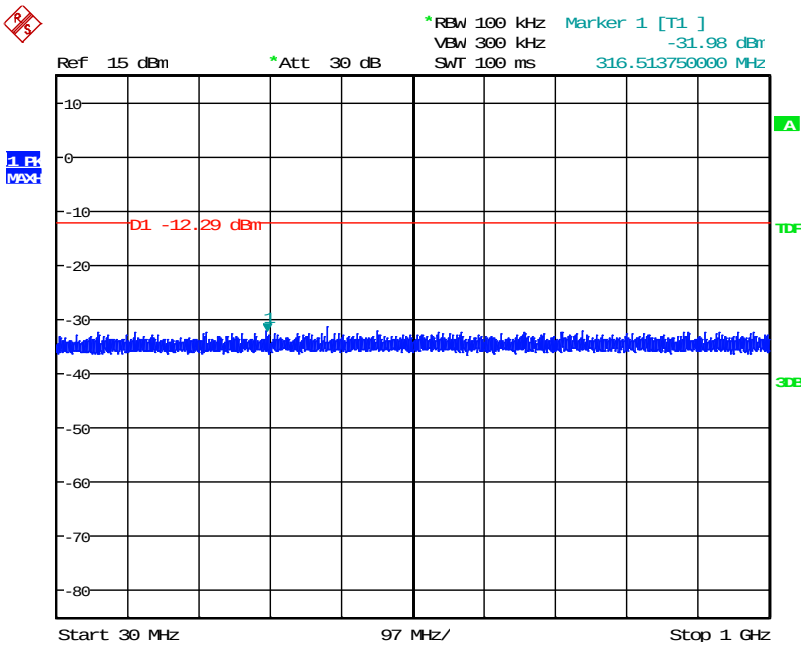
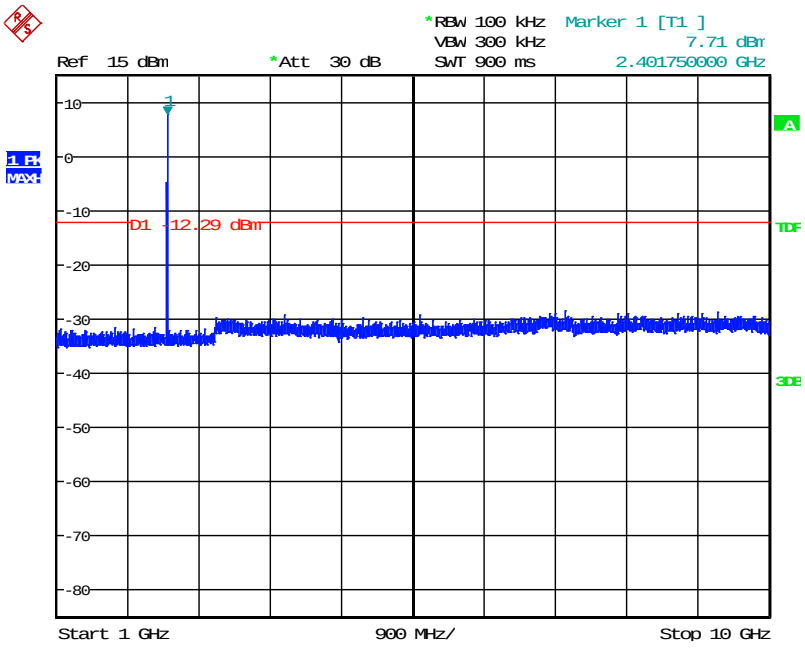


Figure 7.5.2.2-12: 18 GHz –26 GHz – High Channel (GFSK)



Date: 17.DEC.2015 17:14:20

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



Date: 17.DEC.2015 17:06:54

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

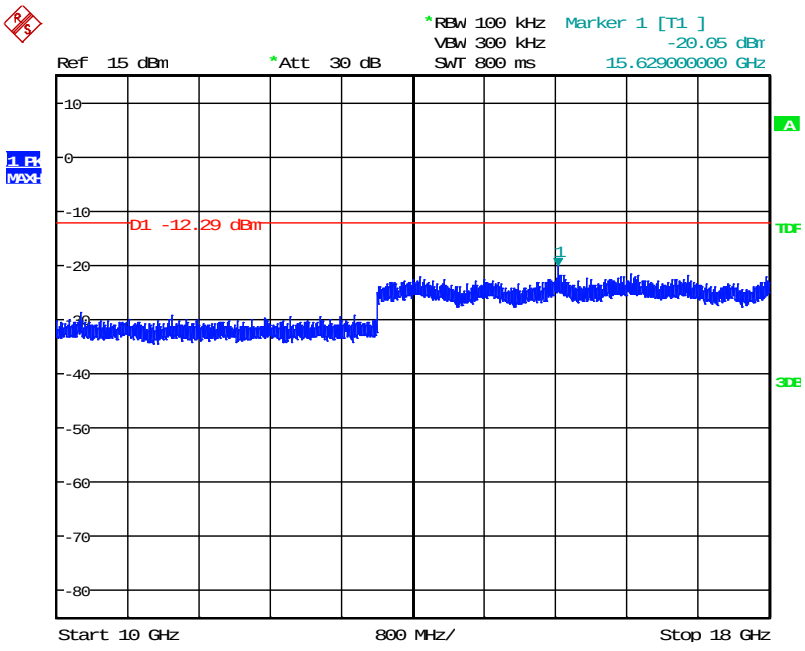


Figure 7.5.2.2-15: 103 GHz –18 GHz – Low Channel (π/4 DQPSK)

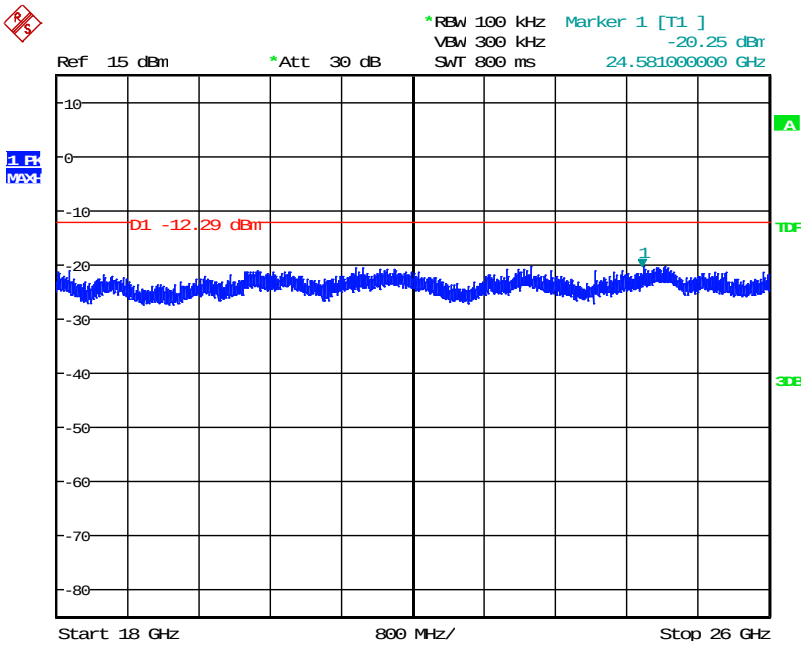
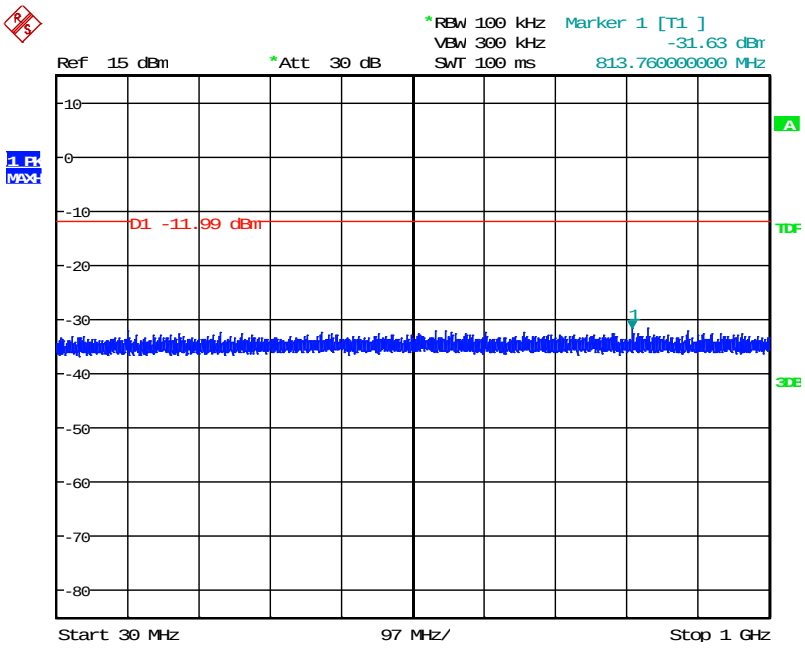
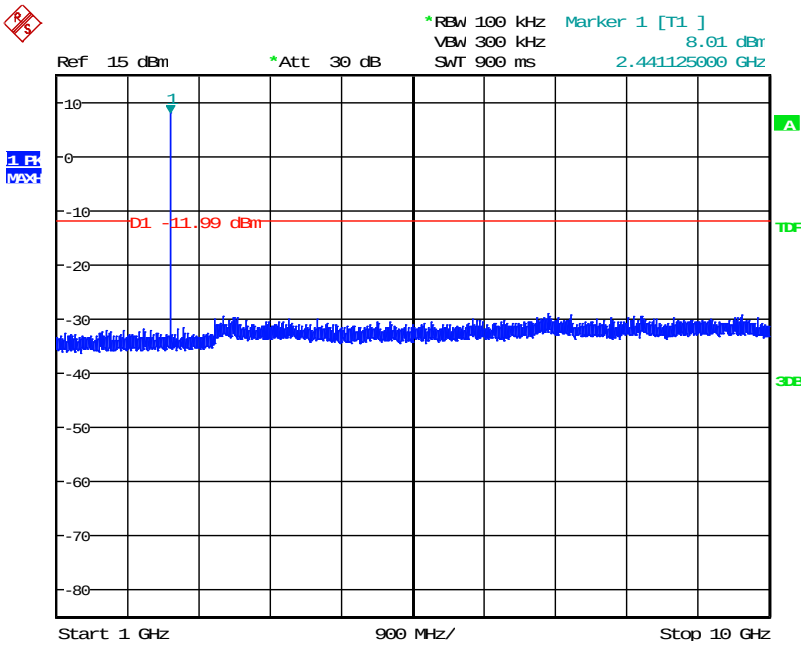


Figure 7.5.2.2-16: 18 GHz –26 GHz – Low Channel (π/4 DQPSK)



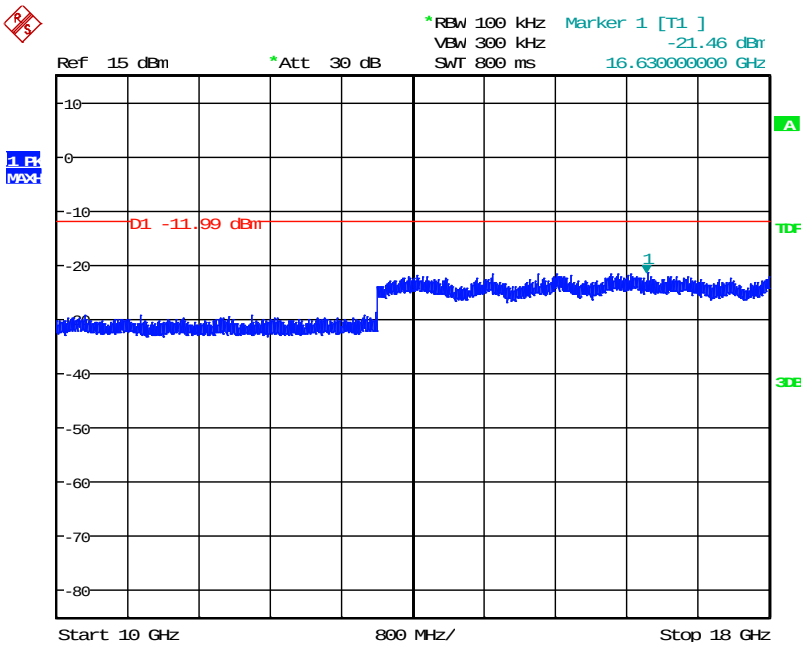
Date: 17.DEC.2015 16:47:31

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



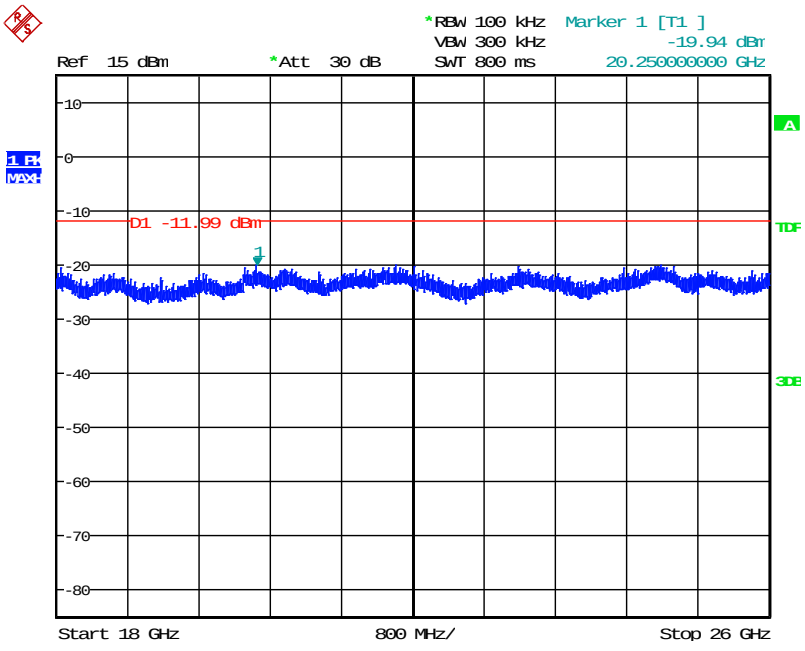
Date: 17.DEC.2015 16:35:37

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



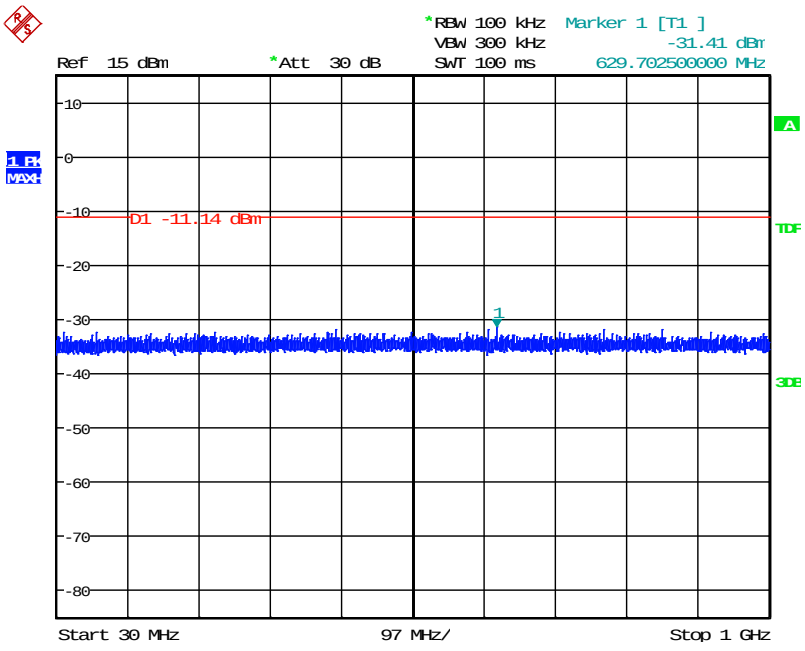
Date: 17.DEC.2015 16:41:07

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



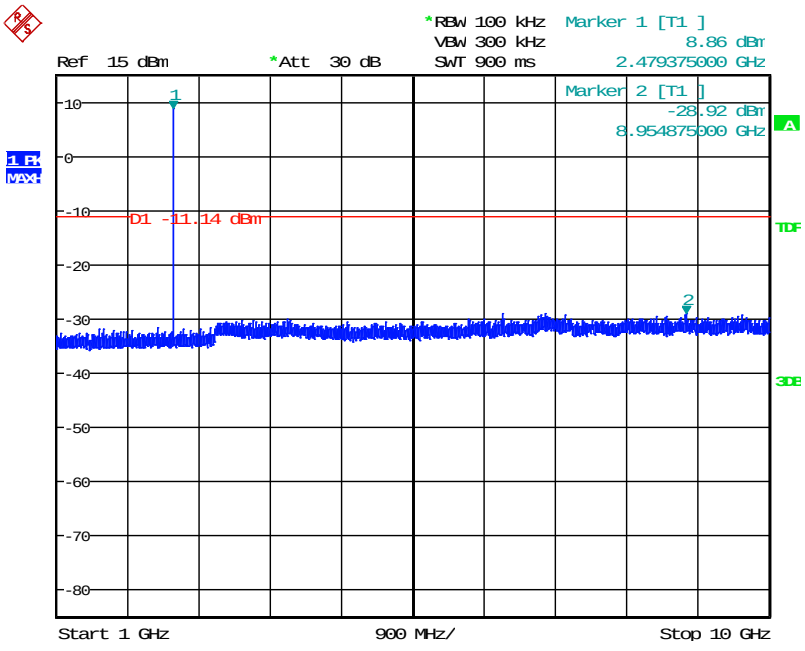
Date: 17.DEC.2015 16:44:12

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



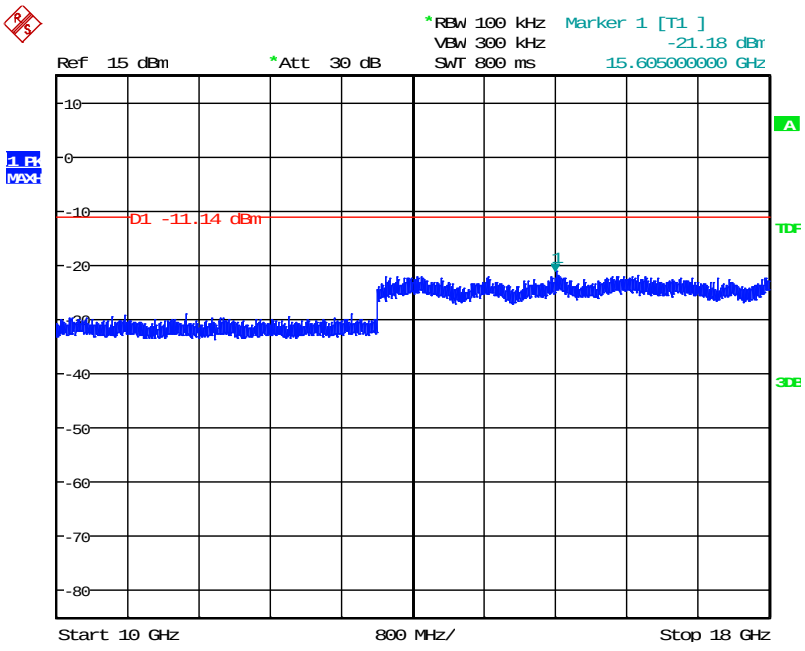
Date: 17.DEC.2015 16:31:07

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



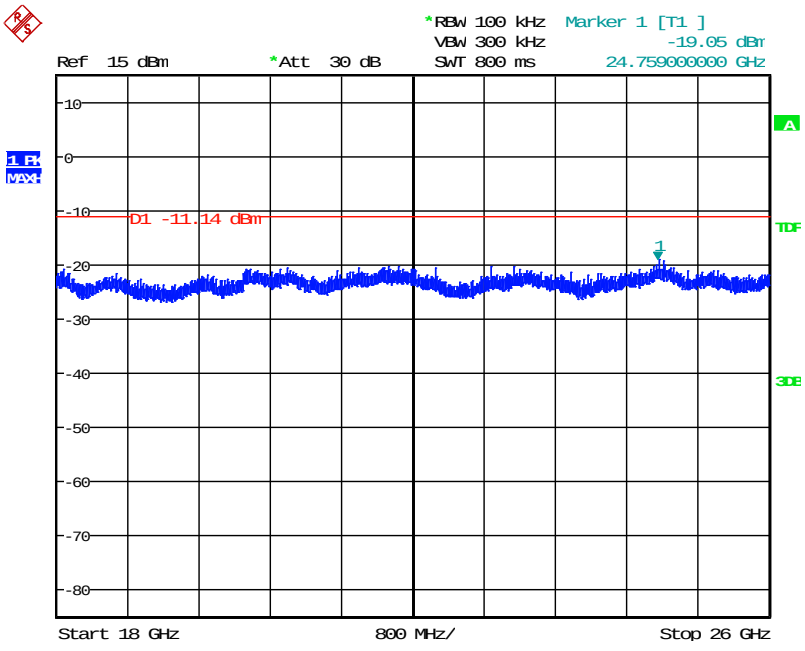
Date: 17.DEC.2015 16:19:01

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



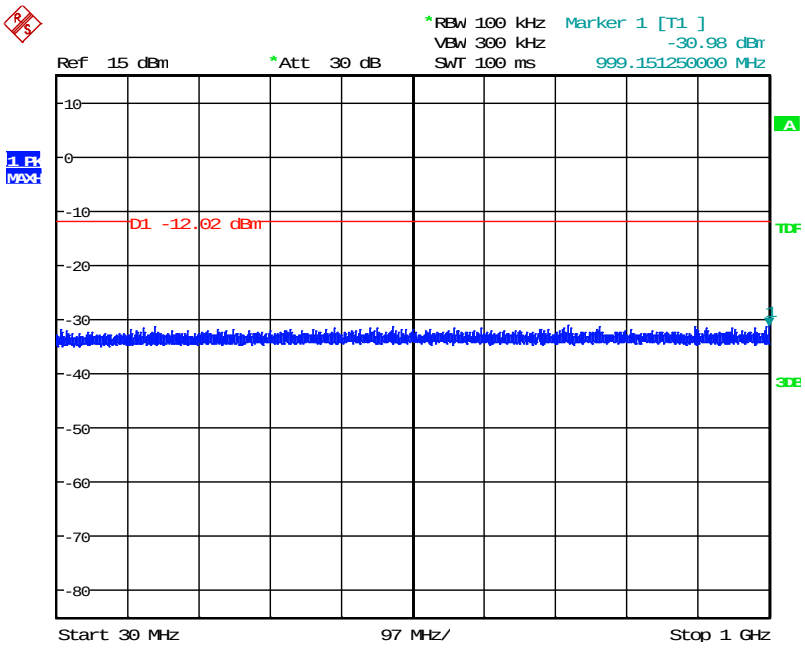
Date: 17.DEC.2015 16:22:32

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



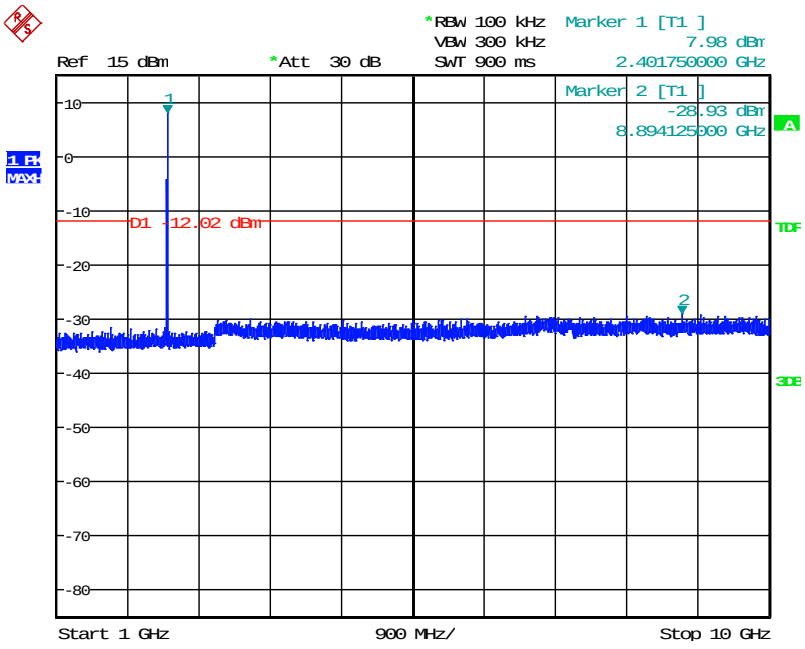
Date: 17.DEC.2015 16:26:37

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



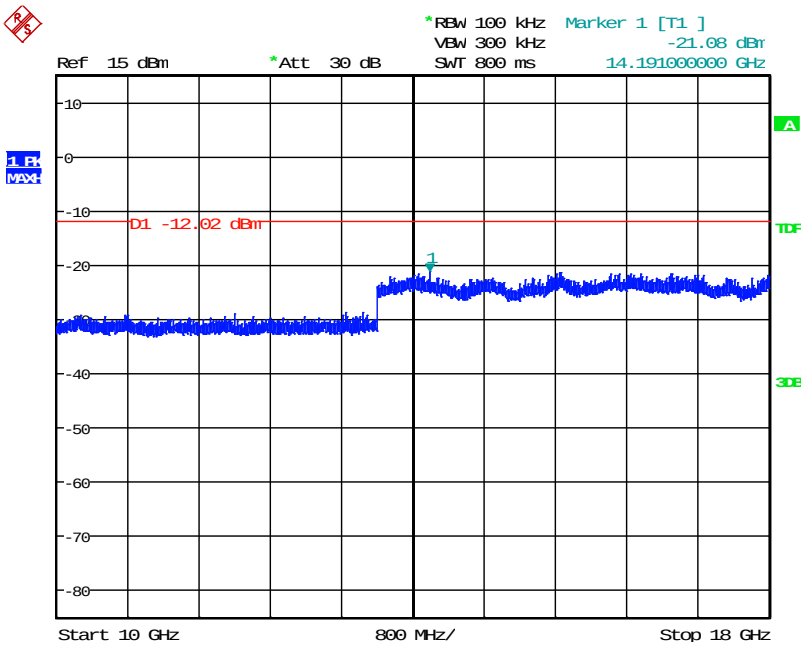
Date: 17.DEC.2015 18:23:46

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



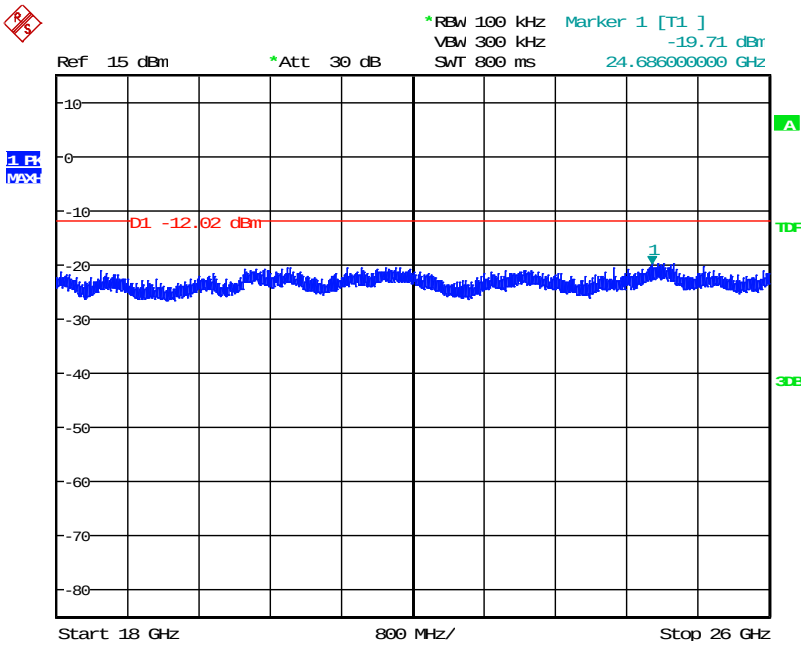
Date: 17.DEC.2015 17:21:34

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



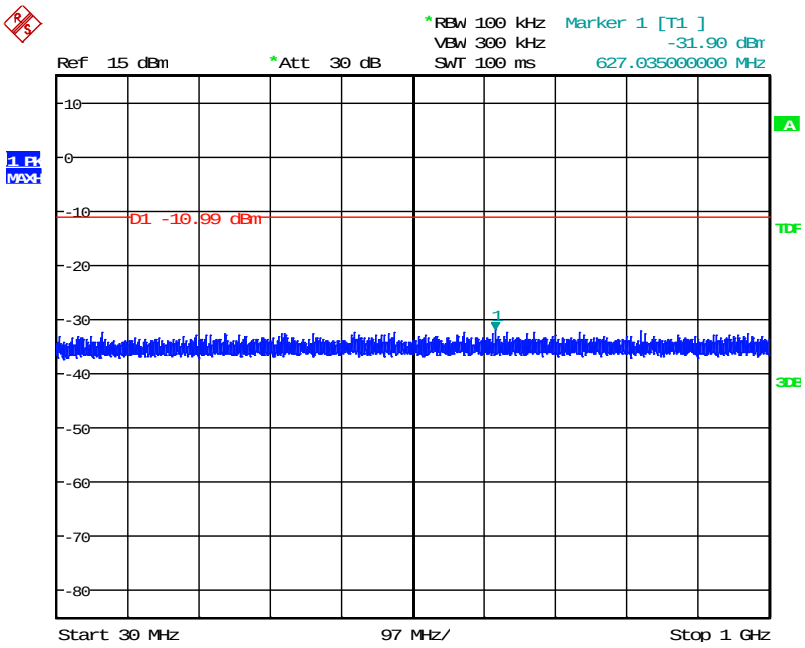
Date: 17.DEC.2015 17:27:57

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



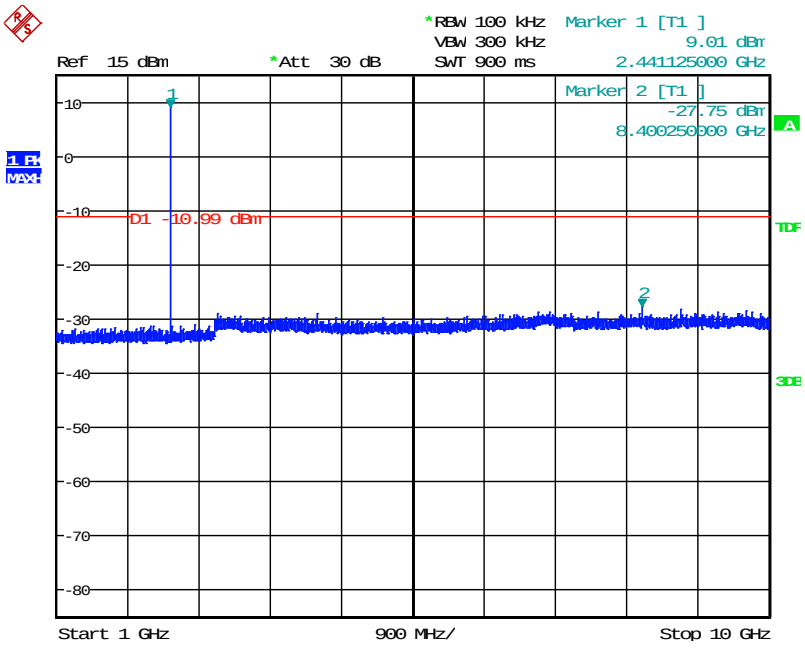
Date: 17.DEC.2015 17:32:35

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



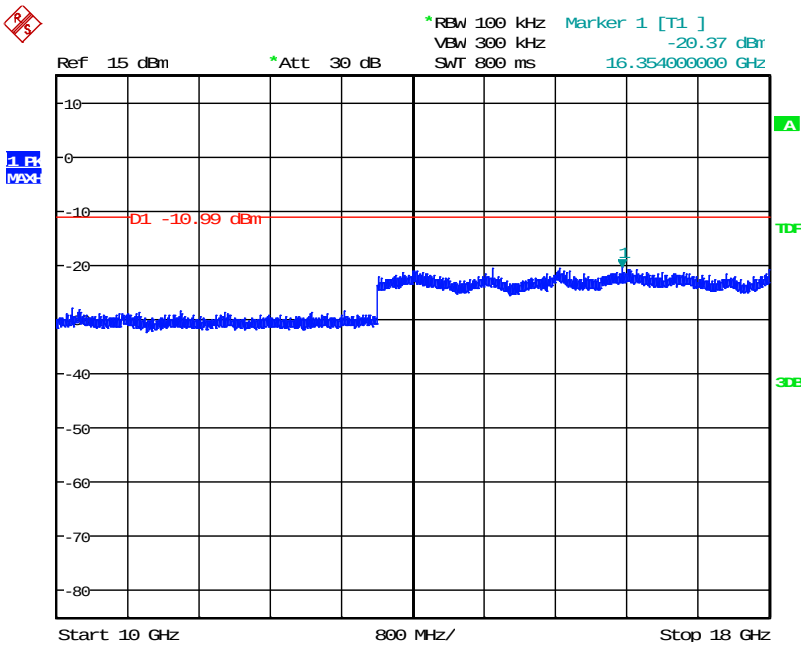
Date: 17.DEC.2015 21:58:01

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



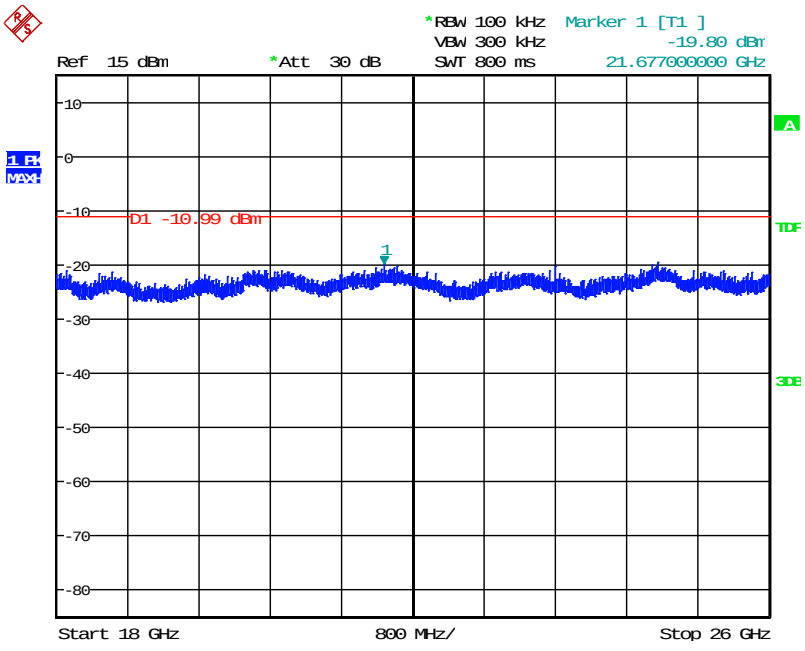
Date: 17.DEC.2015 20:58:25

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



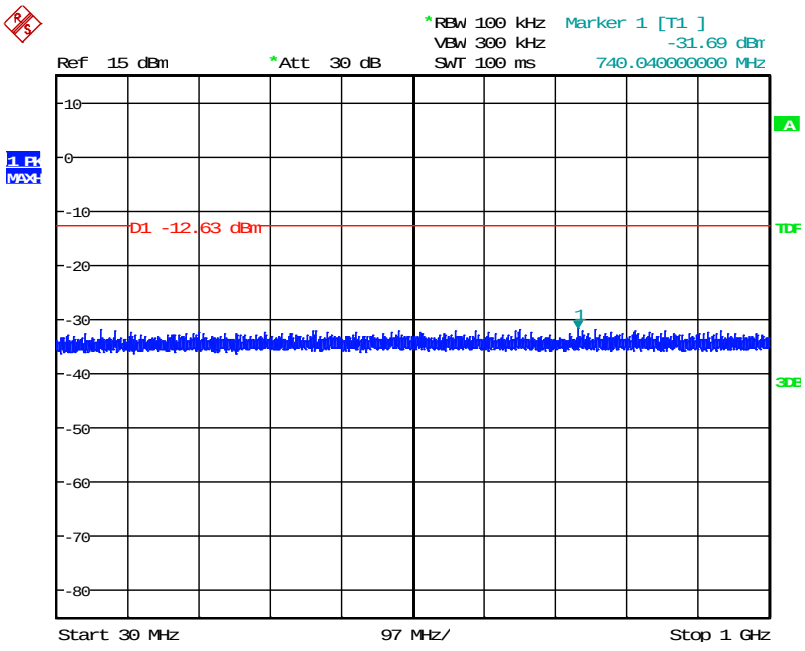
Date: 17.DEC.2015 21:53:16

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



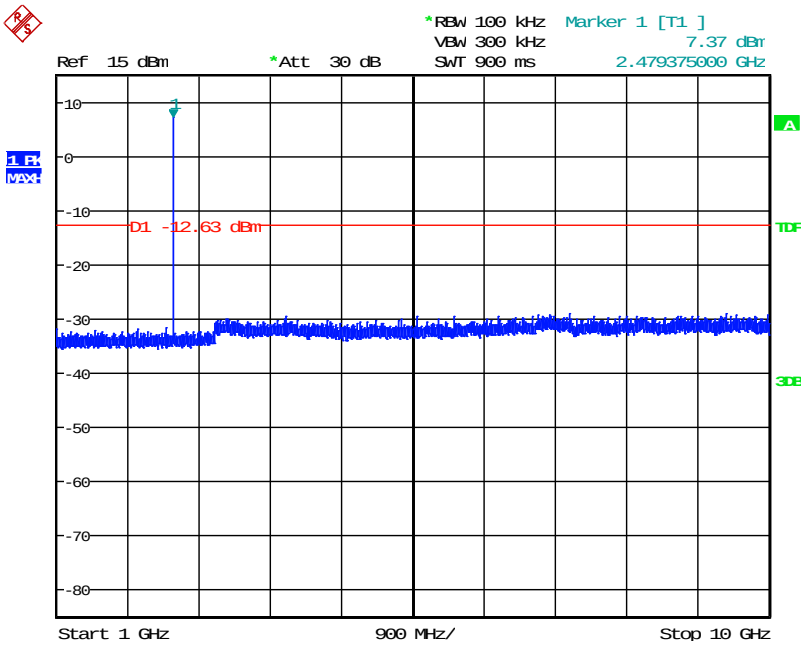
Date: 17.DEC.2015 21:56:06

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



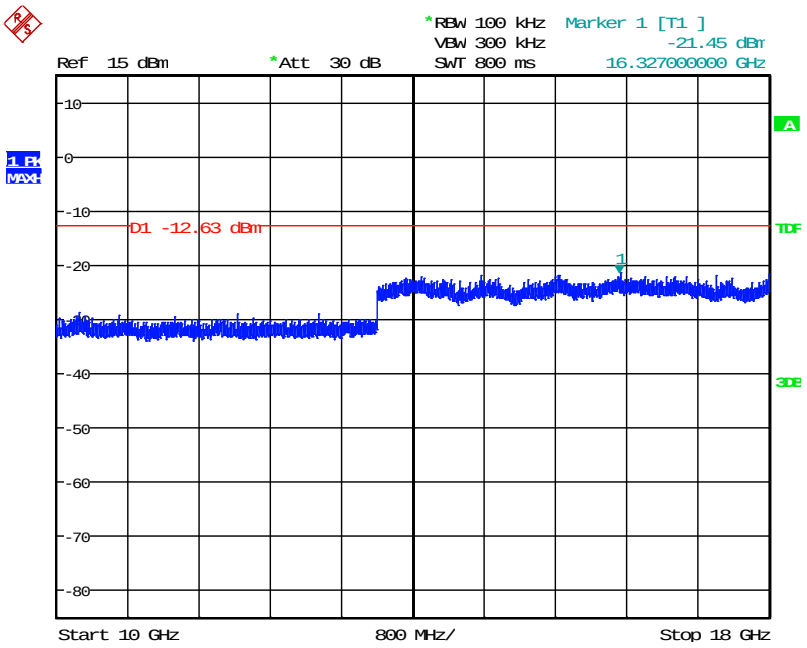
Date: 17.DEC.2015 22:23:56

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



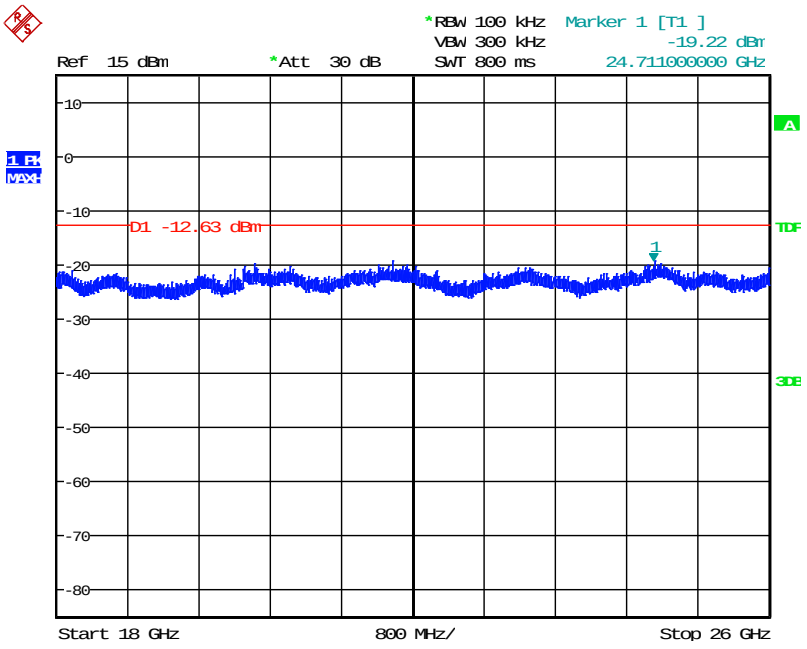
Date: 17.DEC.2015 22:08:09

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



Date: 17.DEC.2015 22:10:41

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



Date: 17.DEC.2015 22:17:30

Figure 7.5.2.2-36: 18 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 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	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 2402 MHz										
4804	39.98	28.42	H	8.53	48.51	36.95	74.0	54.0	25.5	17.0
4804	39.05	25.97	V	8.53	47.58	34.50	74.0	54.0	26.4	19.5
Middle Channel = 2441 MHz										
4882	38.88	26.51	H	8.81	47.69	35.32	74.0	54.0	26.3	18.7
4882	38.95	26.90	V	8.81	47.76	35.71	74.0	54.0	26.2	18.3
High Channel = 2480 MHz										
2483.5	53.71	47.49	H	0.79	54.50	48.28	74.0	54.0	19.5	5.7
2483.5	52.25	42.95	V	0.79	53.04	43.74	74.0	54.0	21.0	10.3
4960	40.38	28.97	H	9.09	49.47	38.06	74.0	54.0	24.5	15.9
4960	38.90	26.61	V	9.09	47.99	35.70	74.0	54.0	26.0	18.3

Note: All emissions above 4.96 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 – (π/4) DQPSK

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 2402 MHz										
4804	39.10	26.75	H	8.53	47.63	35.28	74.0	54.0	26.4	18.7
4804	38.27	26.06	V	8.53	46.80	34.59	74.0	54.0	27.2	19.4
Middle Channel = 2441 MHz										
4882	38.54	26.31	H	8.81	47.35	35.12	74.0	54.0	26.6	18.9
4882	38.10	25.34	V	8.81	46.91	34.15	74.0	54.0	27.1	19.8
High Channel = 2480 MHz										
2483.5	56.58	47.29	H	0.79	57.37	48.08	74.0	54.0	16.6	5.9
2483.5	52.05	41.98	V	0.79	52.84	42.77	74.0	54.0	21.2	11.2
4960	38.70	26.84	H	9.09	47.79	35.93	74.0	54.0	26.2	18.1
4960	38.27	25.50	V	9.09	47.36	34.59	74.0	54.0	26.6	19.4

Note: All emissions above 4.96 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	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 2402 MHz										
4804	39.50	27.36	H	8.53	48.03	35.89	74.0	54.0	26.0	18.1
4804	38.35	25.71	V	8.53	46.88	34.24	74.0	54.0	27.1	19.8
Middle Channel = 2441 MHz										
4882	38.95	26.27	H	8.81	47.76	35.08	74.0	54.0	26.2	18.9
4882	38.84	25.37	V	8.81	47.65	34.18	74.0	54.0	26.3	19.8
High Channel = 2480 MHz										
2483.5	53.58	46.97	H	0.79	54.37	47.76	74.0	54.0	19.6	6.2
2483.5	51.77	41.02	V	0.79	52.56	41.81	74.0	54.0	21.4	12.2
4960	39.65	27.31	H	9.09	48.74	36.40	74.0	54.0	25.3	17.6
4960	37.95	25.77	V	9.09	47.04	34.86	74.0	54.0	27.0	19.1

Note: All emissions above 4.96 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

Example Calculation: Peak
Corrected Level: 39.1+ 8.53 = 47.63 dBµV/m
Margin: 74 dBµV/m – 47.63 dBµV/m = 26.4dB

Example Calculation: Average
Corrected Level: 26.75 + 8.53 = 35.28 dBµV/m
Margin: 54 dBµV/m – 35.28 dBµV/m = 18.7 dB

8 CONCLUSION

In the opinion of ACS, Inc., the model HK2062A manufactured by Motorola Solutions, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-247 for the test procedures documented in the test report.

END REPORT