



FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Portable wireless modem

**Model / Trade Name:
GT2000 / GOLDTEK,
TDL 3G / TRIMBLE**

Issued to

**GOLDTEK TECHNOLOGY CO., LTD.
3F, No. Ln.768, Sec.4, Patch Rd. Taipei 115, Taiwan, R.O.C**

Issued by



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1. TEST RESULT CERTIFICATION

Applicant: GOLDTEK TECHNOLOGY CO., LTD.
3F, No, Ln.768, Sec.4, Patch Rd. Taipei 115, Taiwan, R.O.C

Equipment Under Test: Portable wireless modem

Model / Trade Name: GT2000 / GOLDTEK,
TDL 3G / TRIMBLE

Date of Test: November 15 ~ 21, 2009

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C	No non-compliance noted

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in **ANSI C63.4: 2003** and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Rex Lai
Section Manager
Compliance Certification Services Inc.

Reviewed by:

Gina Lo
Section Manager
Compliance Certification Services Inc.



2. EUT DESCRIPTION

Product	Portable wireless modem
Model / Trade Name	GT2000 / GOLDTEK, TDL 3G / TRIMBLE
Model Discrepancy	All the specification and layout are identical except they come with different model numbers for marketing purposes.
Power Supply	1. Power Adapter: JPC / Model: KSAS0100500200D5 I/P: 100-240V, 50-60Hz, 0.4A O/P: 5.0V, 2.0A 2. VDC from Battery Rating: DC3.7V, 3000mAh, 11.1W/hr
Frequency Range	2402 ~ 2480 MHz
Transmit Power	3.25 dBm
Modulation Technique	Bluetooth: GFSK for 1Mbps; $\pi/4$ -DQPSK for 2Mbps; 8DPSK for 3Mbps
Number of Channels	79 Channels
Antenna Specification	Gain: 0.15 dBi
Antenna Designation	PIFA Antenna

Remark:

1. The sample selected for test was production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: XTFGT2000 filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.



3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CFR 47 Part 15.207, 15.209 and 15.247.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4.



3.4FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

- (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

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

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

- (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.



3.5 DESCRIPTION OF TEST MODES

The EUT (model: GT2000) had been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting mode was programmed.

Software used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

Channel Low (2402MHz), Mid (2441MHz) and High (2480MHz) with 1Mbps data rate was chosen for full testing.

During the preliminary test, GFSK, $\pi/4$ -QPSK & 8DPSK with DH1 were pre-tested and found that 8DPSK emits the highest output power. Then the tests were carried on with DH1 compare to DH3 & DH5 and found that 8DPSK with DH5 emit the highest output power, and therefore had been tested under operating condition.

Following channels were selected for the radiated emission testing only as listed below:

Tested Channel	Modulation Type	Packet Type	Data Rate
Low, Mid, High	GFSK	DH 5	1
Low, Mid, High	8DPSK	DH 5	3



4. INSTRUMENT CALIBRATION

4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

4.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Remark: Each piece of equipment is scheduled for calibration once a year.

Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	02/23/2010
Power Meter	Agilent	E4416A	GB41291611	04/05/2010
Power Sensor	Agilent	E9327A	US40441097	06/05/2010

3M Semi Anechoic Chamber				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US42510252	10/26/2010
Test Receiver	Rohde&Schwarz	ESCI	100064	12/24/2009
Switch Controller	TRC	Switch Controller	SC94050010	05/02/2010
4 Port Switch	TRC	4 Port Switch	SC94050020	05/02/2010
Loop Antenna	EMCO	6502	8905/2356	05/28/2010
Horn-Antenna	TRC	HA-0502	06	06/03/2010
Horn-Antenna	TRC	HA-0801	04	10/19/2010
Horn-Antenna	TRC	HA-1201A	01	10/14/2010
Horn-Antenna	TRC	HA-1301A	01	10/14/2010
Bilog- Antenna	Sunol Sciences	JB3	A030205	09/11/2010
Turn Table	Max-Full	MFT-120S	T120S940302	N.C.R.
Antenna Tower	Max-Full	MFA-430	A440940302	N.C.R.
Controller	Max-Full	MF-CM886	CC-C-1F-13	N.C.R.
Site NSA	CCS	N/A	FCC MRA: TW1039 IC: IC 2324G-1/-2	10/17/2010 11/04/2010
Test S/W	LABVIEW (V 6.1)			

Powerline Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver 9kHz-30MHz	Rohde & Schwarz	ESHS30	828144/003	11/24/2010
Two-Line V-Network 9kHz-30MHz	Schaffner	NNB41	03/10013	06/10/2010
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	04/08/2010
Test S/W	LABVIEW (V 6.1)			



4.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission	+/- 2.81
3M Semi Anechoic Chamber / 30MHz ~ 1GHz	+/-3.7046
3M Semi Anechoic Chamber / Above 1GHz	+/-3.0958

Remark: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.



5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☒ No.11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☐ No.81-1, Lane 210, Bade 2nd Rd., Luchu Hsiang, Taoyuan Hsien 338, Taiwan
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT




Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

**5.3 TABLE OF ACCREDITATIONS AND LISTINGS**

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3M Semi Anechoic Chamber (FCC MRA: TW1039) to perform FCC Part 15 measurements	 FCC MRA: TW1039
Taiwan	TAF	LP0002, RTTE01, FCC Method-47 CFR Part 15 Subpart C, D, E, RSS-210, RSS-310 IDA TS SRD, AS/NZS 4268, AS/NZS 4771, TS 12.1 & 12.2, ETSI EN 300 440-1, ETSI EN 300 440-2, ETSI EN 300 328, ETSI EN 300 220-1, ETSI EN 300 220-2, ETSI EN 301 893, ETSI EN 301 489-1/3/7/17 FCC OET Bulletin 65 + Supplement C, EN 50360, EN 50361, EN 50371, RSS 102, EN 50383, EN 50385, EN 50392, IEC 62209, CNS 14958-1, CNS 14959 FCC Method -47 CFR Part 15 Subpart B IEC / EN 61000-3-2, IEC / EN 61000-3-3, IEC / EN 61000-4-2/3/4/5/6/8/11	 Testing Laboratory 1309
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	 IC 2324G-1 IC 2324G-2

** No part of this report may be used to claim or imply product endorsement by A2LA or any agency of the US Government.*



6. SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

6.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1.	Notebook PC	DELL	PP10L	50XP51J	FCC DoC	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
2.	Bluetooth Tester (Remote)	Anritsu	MT8852B	750013	N/A	N/A	Unshielded, 1.8m

Remark:

- 1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
- 2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*



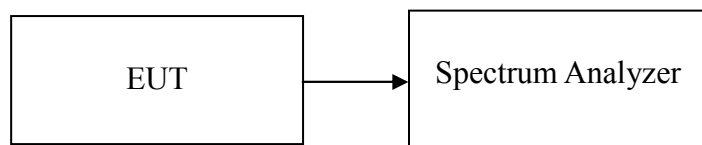
7. FCC PART 15.247 REQUIREMENTS

7.120 DB BANDWIDTH

LIMIT

None; for reporting purposes only.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=10kHz, VBW = 30kHz, Span = 1.5MHz, Sweep = auto.
4. Mark the peak frequency and 20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

TEST RESULTS

No non-compliance noted.

Test Data

For GFSK / DH5

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	0.9559
Mid	2441	0.9519
High	2480	0.9564

For 8DPSK / DH5

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.295
Mid	2441	1.290
High	2480	1.320



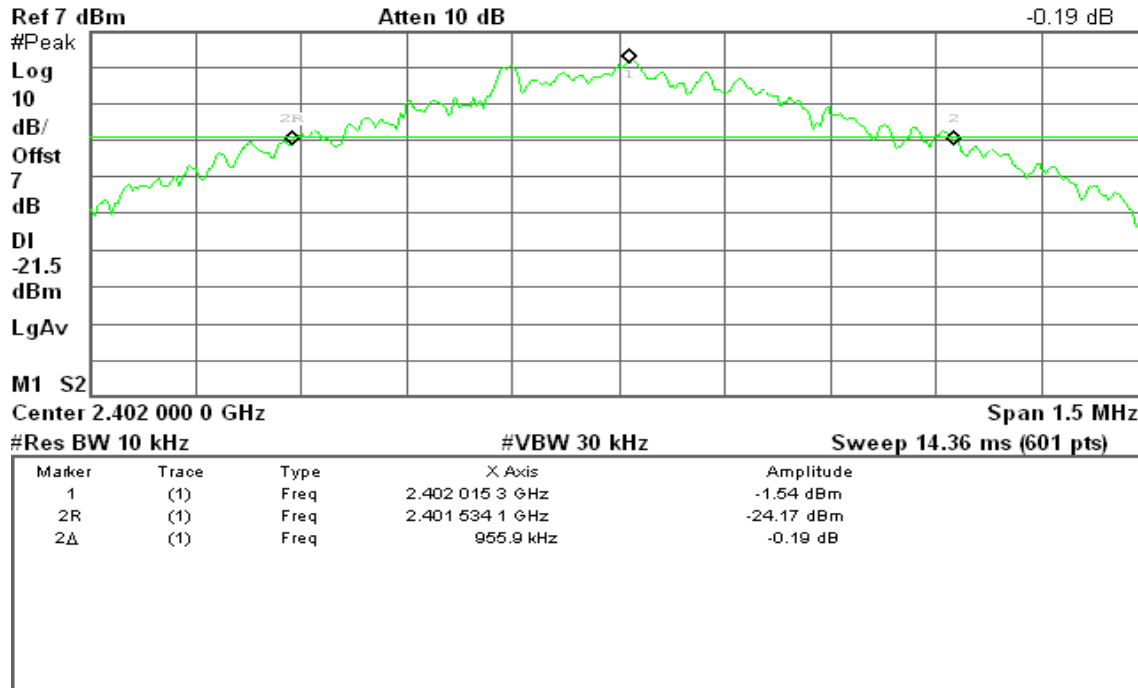
Test Plot

For GFSK / DH5

20dB Bandwidth (CH Low)

* Agilent 09:20:25 Nov 19, 2009

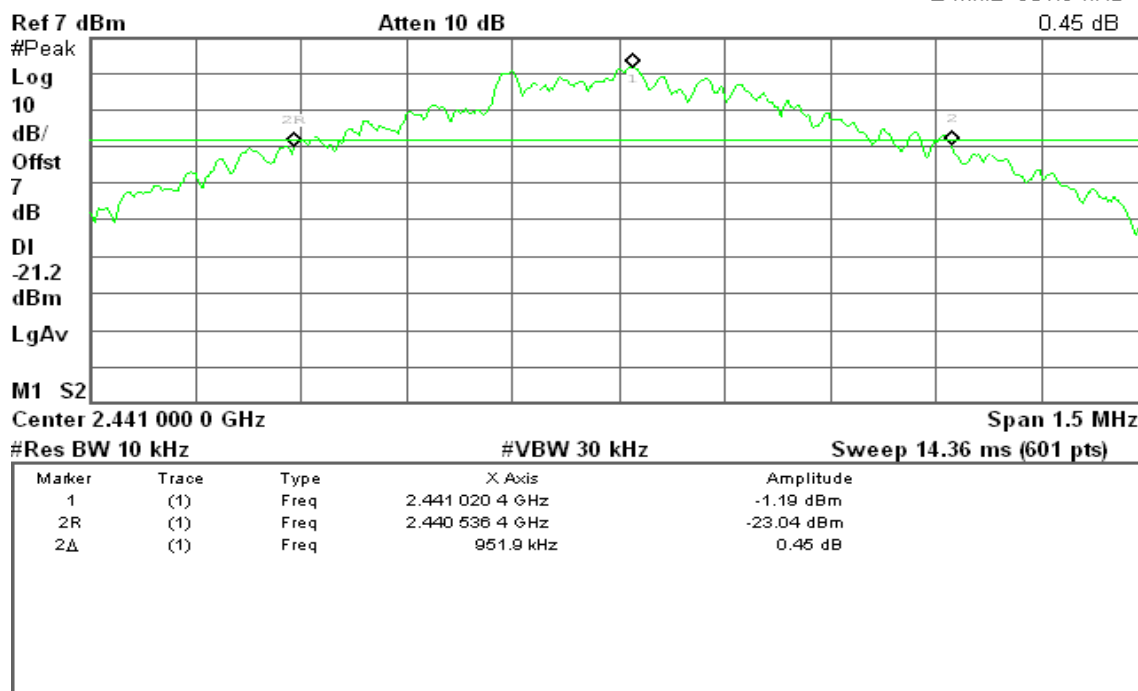
R T

 Δ Mkr2 955.9 kHz
-0.19 dB

20dB Bandwidth (CH Mid)

* Agilent 09:18:10 Nov 19, 2009

R T

 Δ Mkr2 951.9 kHz
0.45 dB

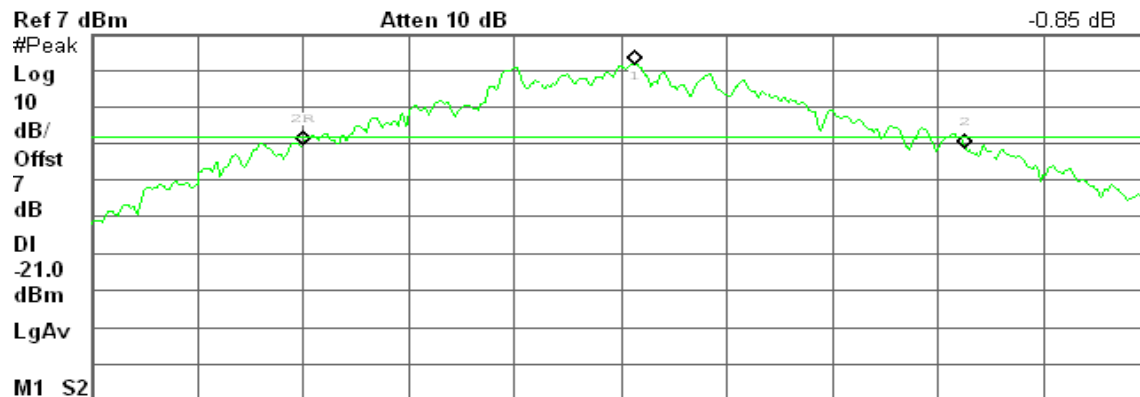


20dB Bandwidth (CH High)

Agilent 09:22:07 Nov 19, 2009

R T

Δ Mkr2 956.4 kHz
-0.85 dB



Center 2.480 000 0 GHz

Span 1.5 MHz

#Res BW 10 kHz

#VBW 30 kHz

Sweep 14.36 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.480 020 4 GHz	-1.03 dBm
2R	(1)	Freq	2.479 534 7 GHz	-23.11 dBm
2Δ	(1)	Freq	956.4 kHz	-0.85 dB



For 8DPSK / DH5

20dB Bandwidth (CH Low)

* Agilent 12:10:38 Nov 19, 2009

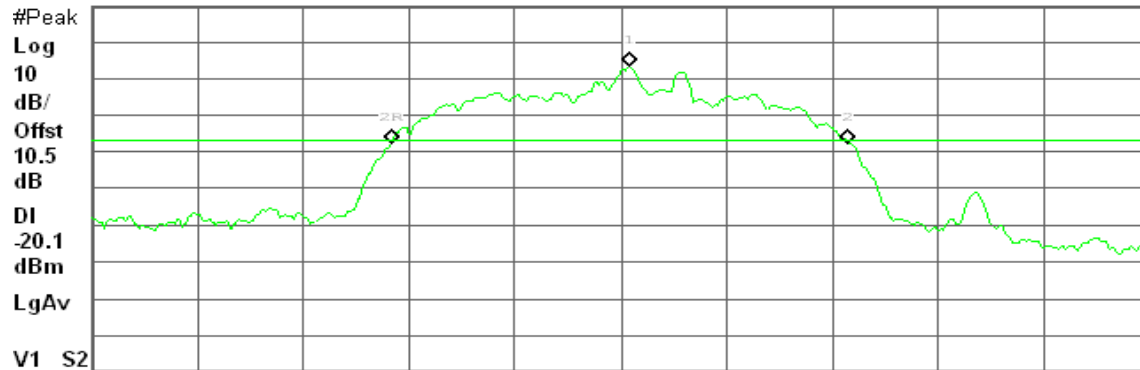
R T

 Δ Mkr2 1.295 MHz

Ref 16.5 dBm

Atten 20 dB

-0.14 dB



Center 2.402 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 100 kHz

Sweep 3.2 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.402 025 GHz	-0.14 dBm
2R	(1)	Freq	2.401 350 GHz	-21.13 dBm
2A	(1)	Freq	1.295 MHz	-0.14 dB

20dB Bandwidth (CH Mid)

* Agilent 12:19:33 Nov 19, 2009

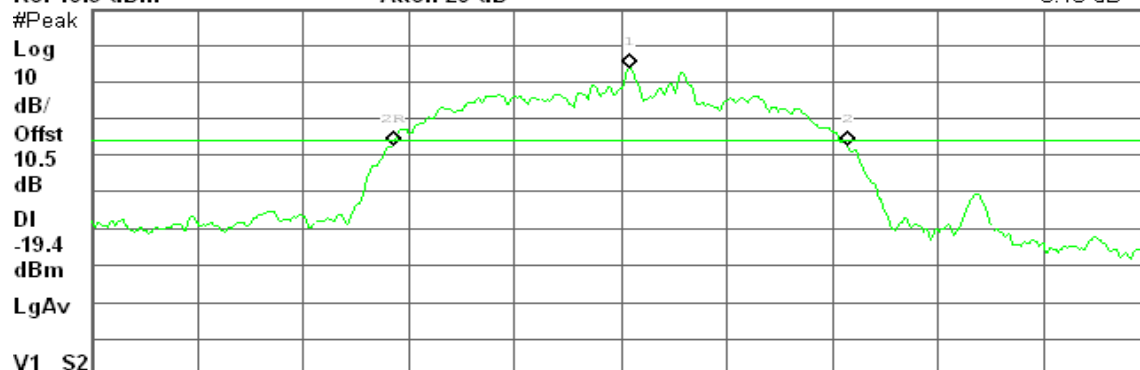
R T

 Δ Mkr2 1.290 MHz

Ref 16.5 dBm

Atten 20 dB

0.13 dB



Center 2.441 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 100 kHz

Sweep 3.2 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.441 025 GHz	0.63 dBm
2R	(1)	Freq	2.440 355 GHz	-20.78 dBm
2A	(1)	Freq	1.290 MHz	0.13 dB



20dB Bandwidth (CH High)

Agilent 12:21:55 Nov 19, 2009

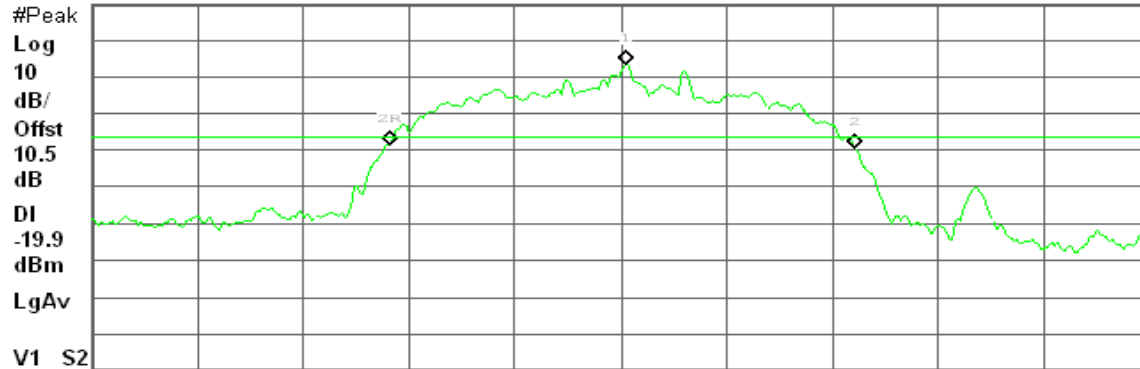
R T

Δ Mkr2 1.320 MHz

-0.92 dB

Ref 16.5 dBm

Atten 20 dB



Center 2.480 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 100 kHz

Sweep 3.2 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.480 015 GHz	0.09 dBm
2R	(1)	Freq	2.479 345 GHz	-22.00 dBm
2Δ	(1)	Freq	1.320 MHz	-0.92 dB



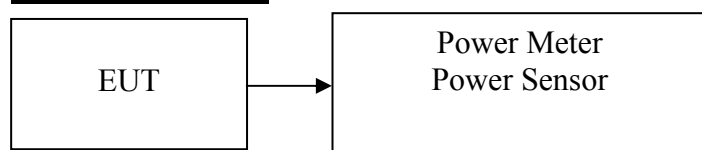
7.2 PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.
2. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
3. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Power Meter. The Power Meter is set to the peak power detection.

TEST RESULTS

No non-compliance noted.

**Test Data****For GFSK / DH5**

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	2.90	0.00195	0.125	PASS
Mid	2441	3.25	0.00211		PASS
High	2480	3.17	0.00207		PASS

For 8DPSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	0.26	0.00106	0.125	PASS
Mid	2441	0.53	0.00113		PASS
High	2480	0.41	0.00110		PASS

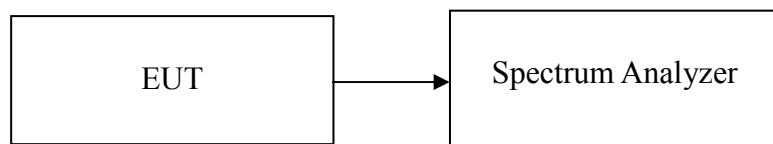


7.3 AVERAGE POWER

LIMIT

None; for reporting purposes only.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the average power detection.

TEST RESULTS

No non-compliance noted.

Test Data

For GFSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2402	2.45	0.00176
Mid	2441	2.75	0.00188
High	2480	2.68	0.00185

For 8DPSK / DH5

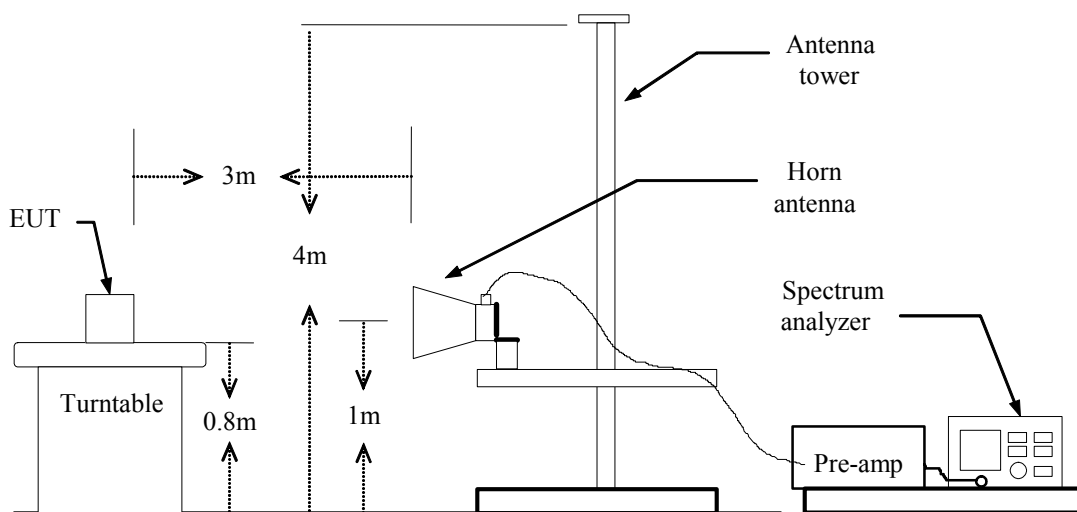
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2402	-1.42	0.00072
Mid	2441	-1.01	0.00079
High	2480	-1.38	0.00073

7.4BAND EDGES MEASUREMENT

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

Test Configuration

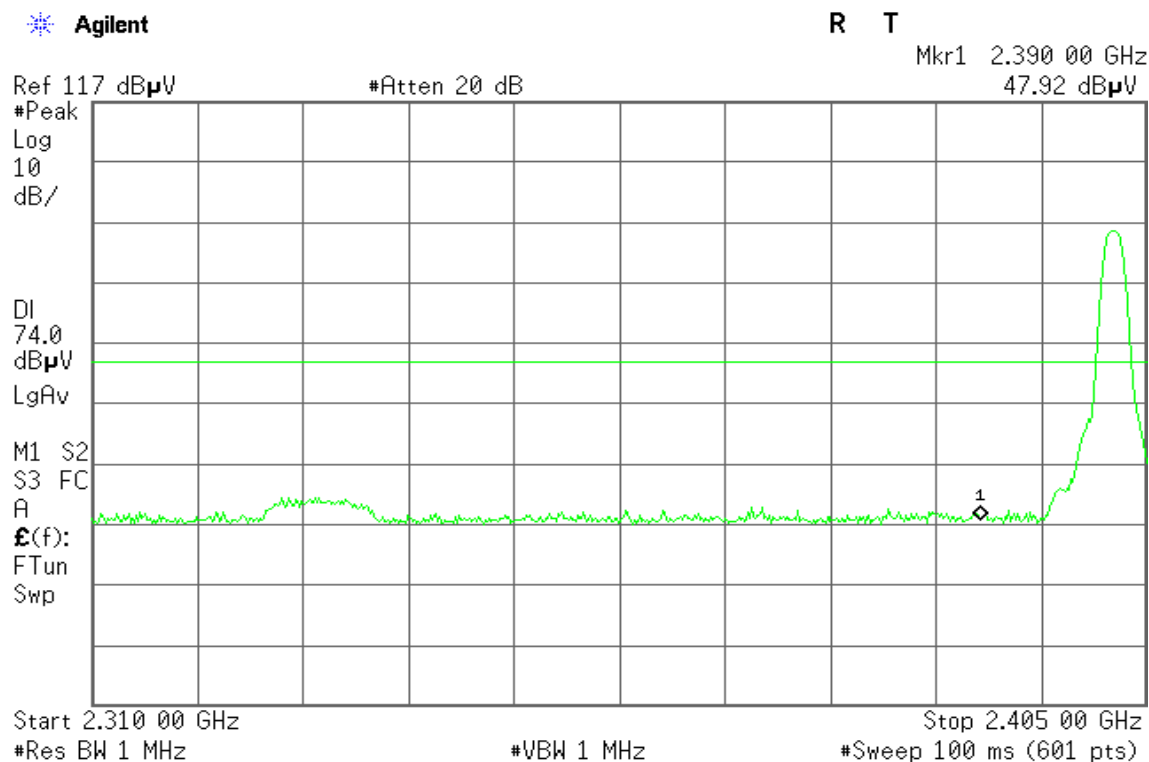
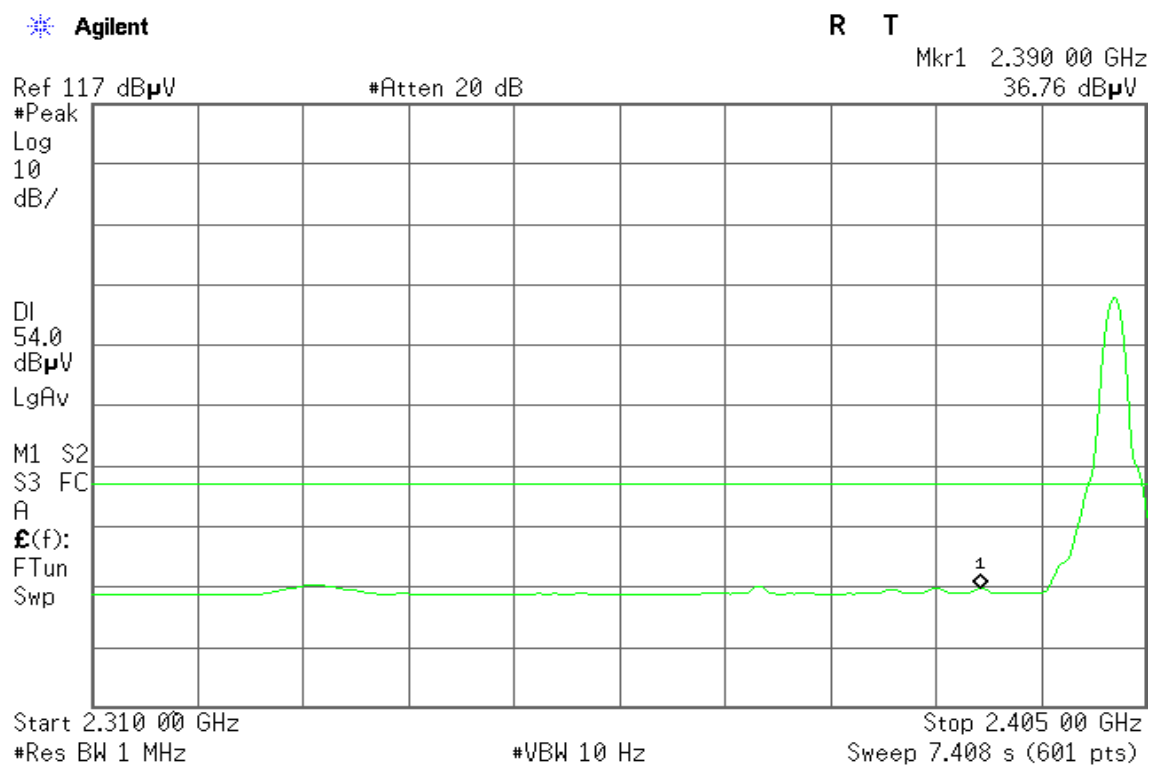


TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
 - (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

TEST RESULTS

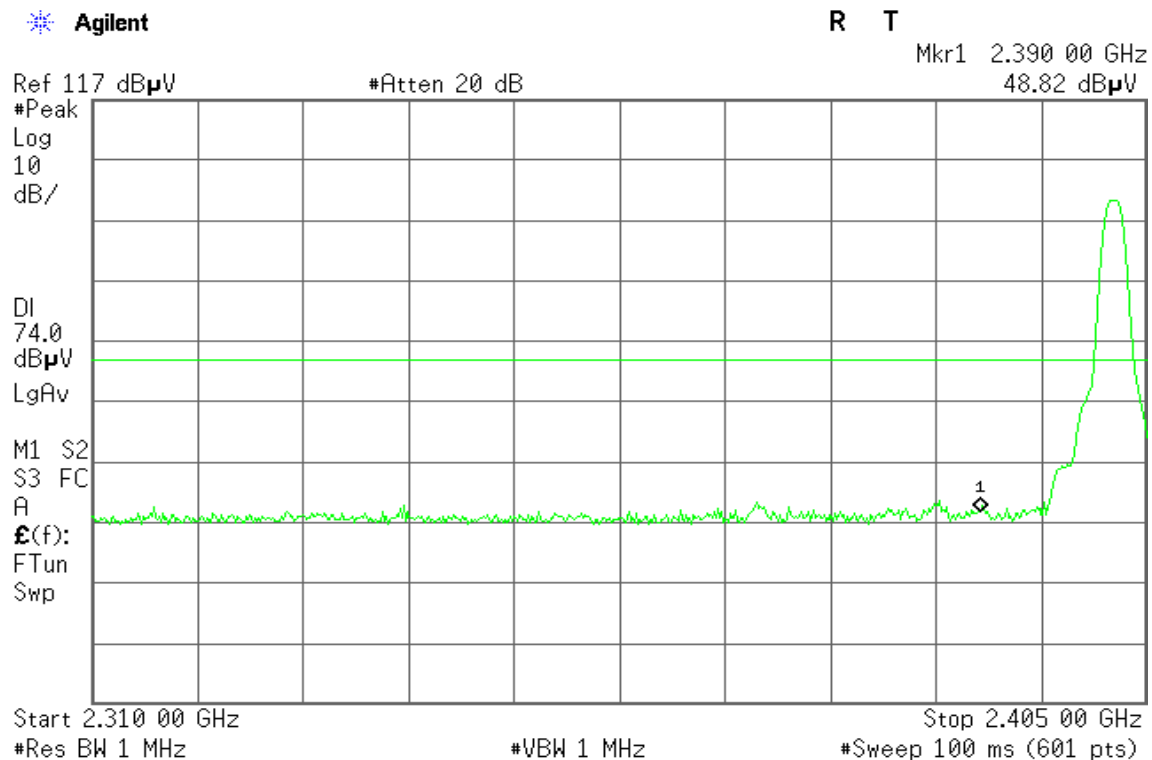
Refer to attach spectrum analyzer data chart.

**For GFSK / DH5****Band Edges (CH Low)****Detector mode: Peak****Polarity: Vertical****Detector mode: Average****Polarity: Vertical**



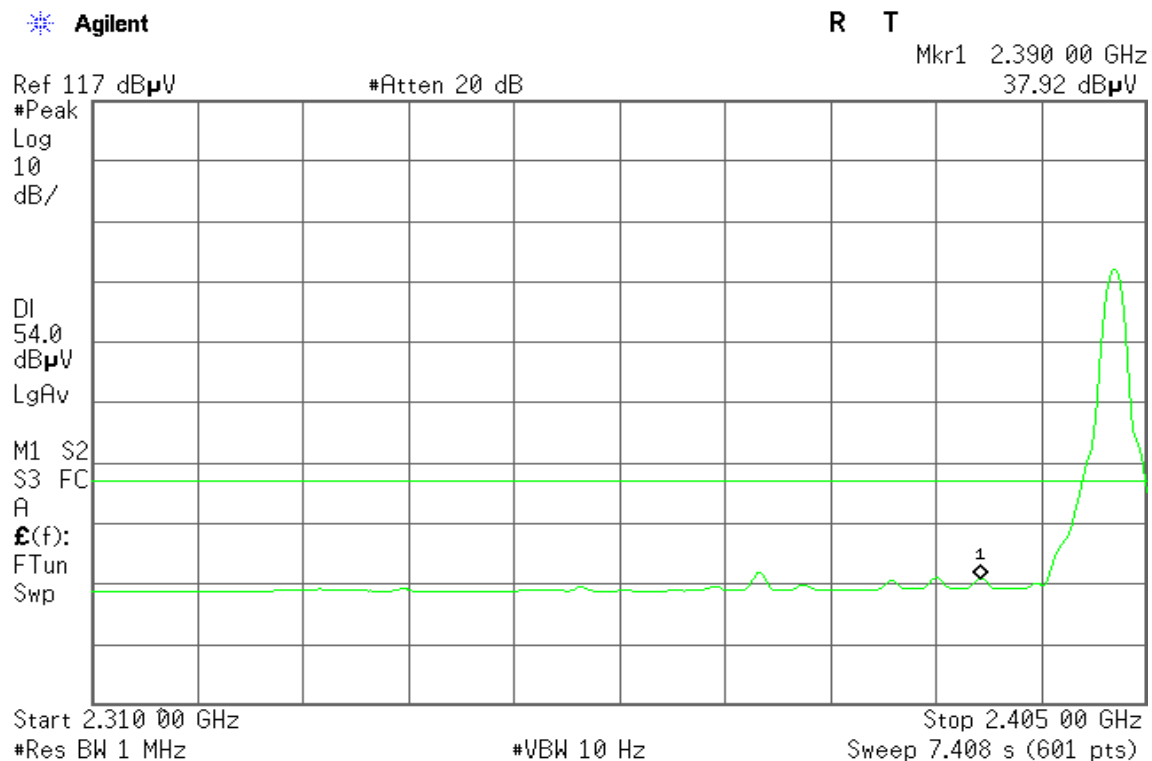
Detector mode: Peak

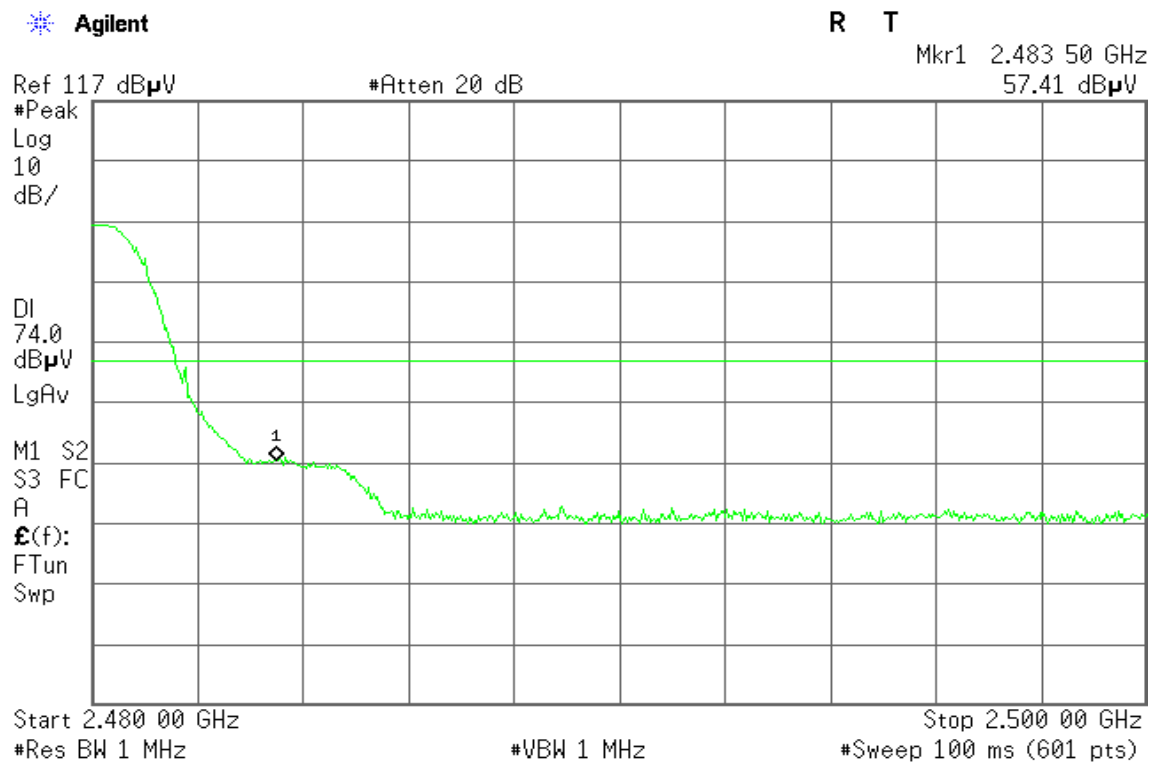
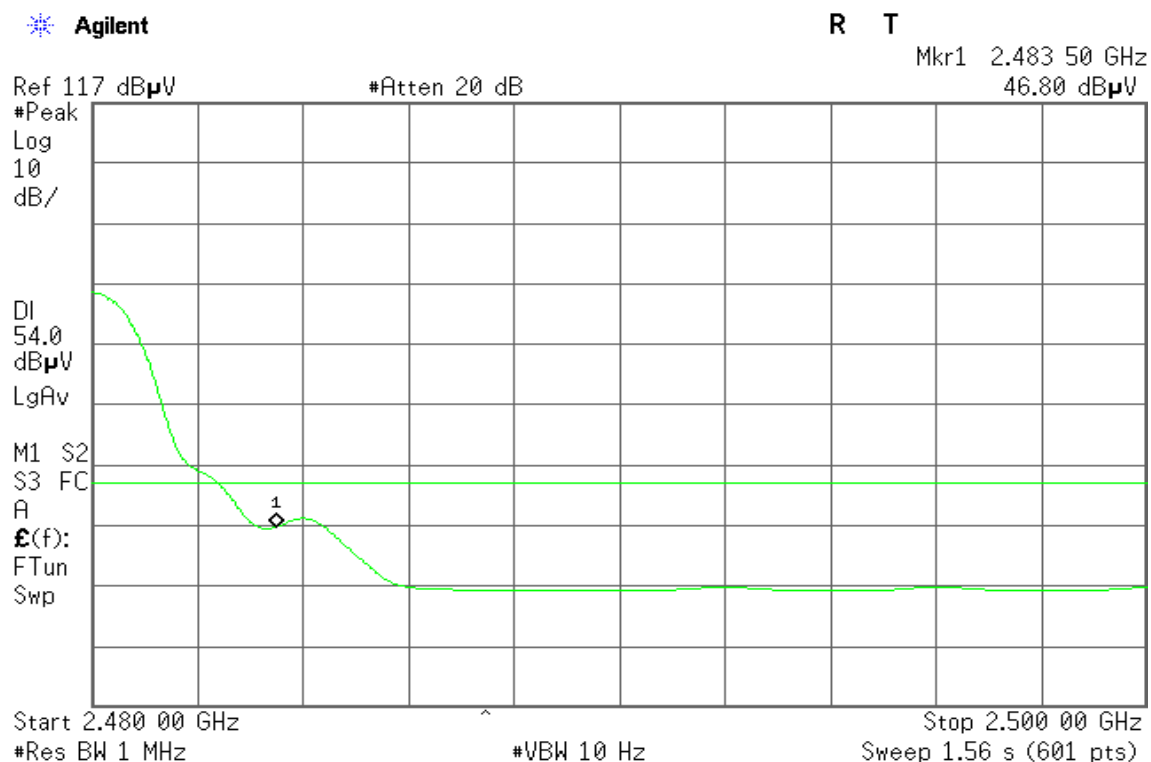
Polarity: Horizontal



Detector mode: Average

Polarity: Horizontal



**Band Edges (CH High)****Detector mode: Peak****Polarity: Vertical****Detector mode: Average****Polarity: Vertical**



Detector mode: Peak

Polarity: Horizontal

Agilent

R T

Mkr1 2.483 50 GHz
59.73 dB μ VRef 117 dB μ V

#Atten 20 dB

#Peak
Log
10
dB/DI
74.0
dB μ V
LgAvM1 S2
S3 FC
A£(f):
FTun
Swp

Start 2.480 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

Stop 2.500 00 GHz

#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Horizontal

Agilent

R T

Mkr1 2.483 50 GHz
48.74 dB μ VRef 117 dB μ V

#Atten 20 dB

#Peak
Log
10
dB/DI
54.0
dB μ V
LgAvM1 S2
S3 FC
A£(f):
FTun
Swp

Start 2.480 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

^ Stop 2.500 00 GHz

Sweep 1.56 s (601 pts)

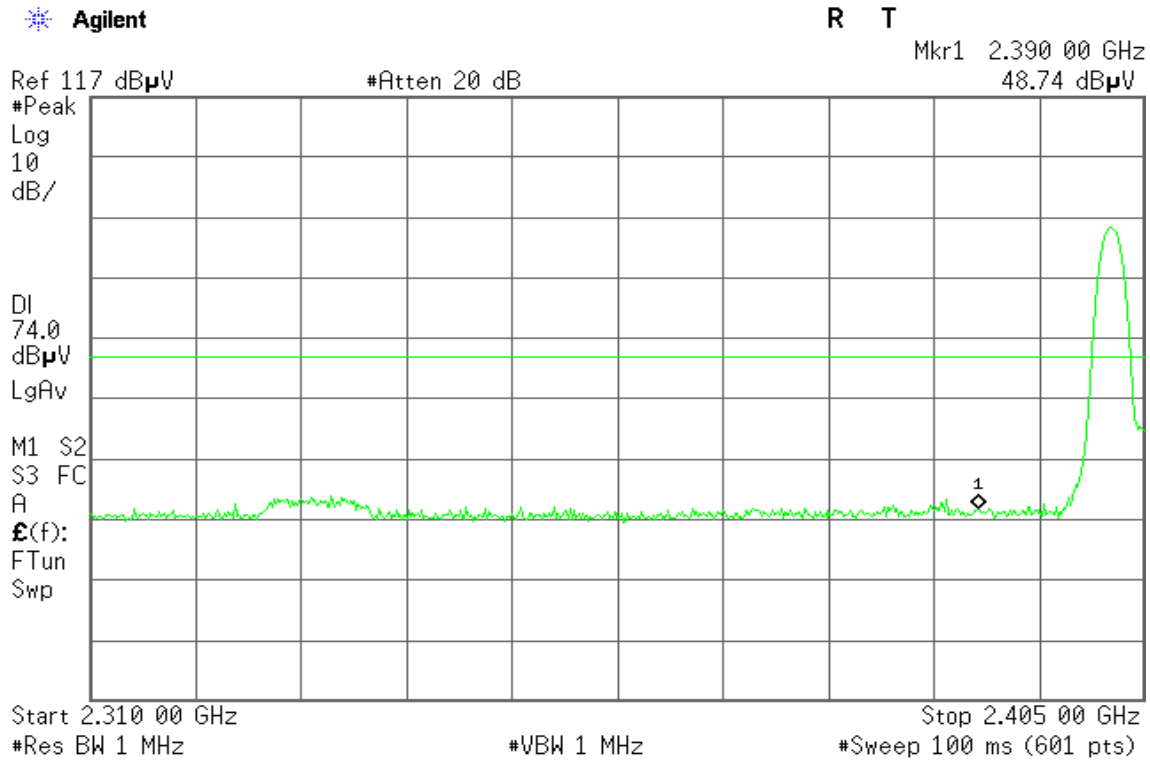


For 8DPSK / DH5

Band Edges (CH Low)

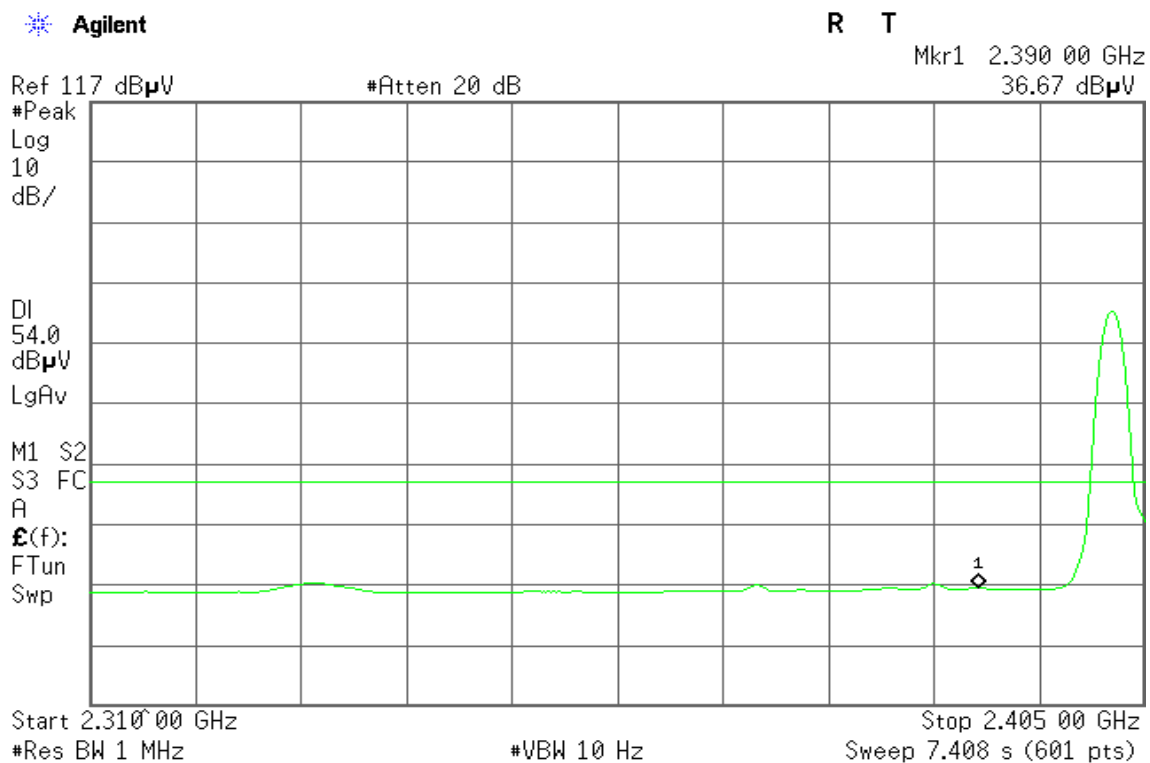
Detector mode: Peak

Polarity: Vertical



Detector mode: Average

Polarity: Vertical





Detector mode: Peak

Polarity: Horizontal

Agilent

R T

Mkr1 2.390 00 GHz
49.40 dB μ VRef 117 dB μ V

#Atten 20 dB

#Peak
Log
10
dB/DI
74.0
dB μ V
LgAvM1 S2
S3 FC
A
£(f):
FTun
SwpStart 2.310 00 GHz
#Res BW 1 MHz

#VBW 1 MHz

Stop 2.405 00 GHz
#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Horizontal

Agilent

R T

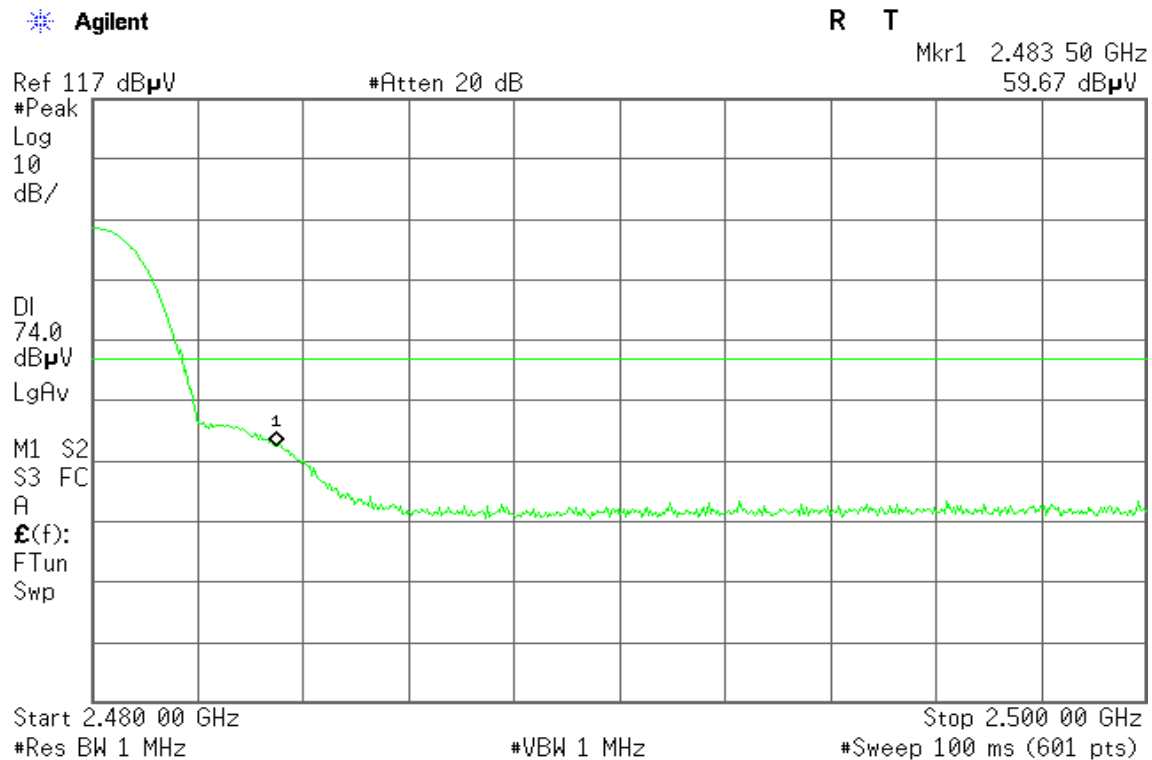
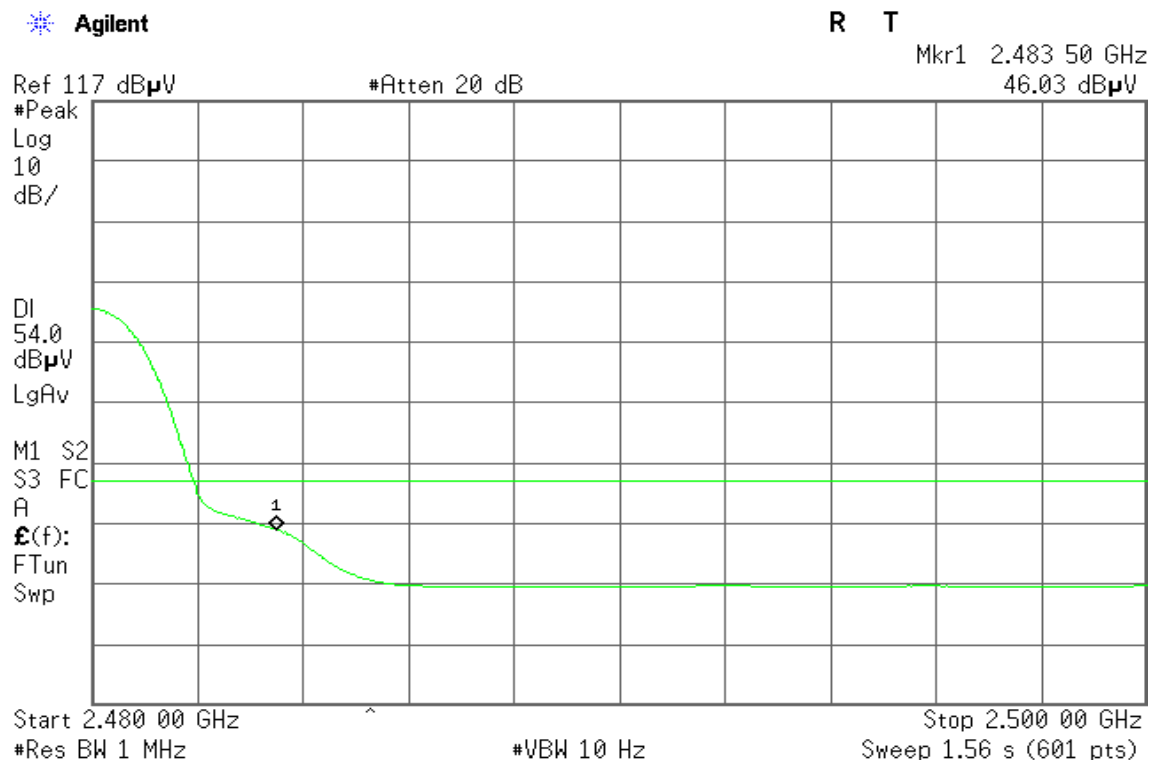
Mkr1 2.390 00 GHz
37.679 dB μ VRef 117 dB μ V

#Atten 20 dB

#Peak
Log
10
dB/DI
54.0
dB μ V
LgAvM1 S2
S3 FC
A
£(f):
FTun
SwpStart 2.310 00 GHz
#Res BW 1 MHz

#VBW 10 Hz

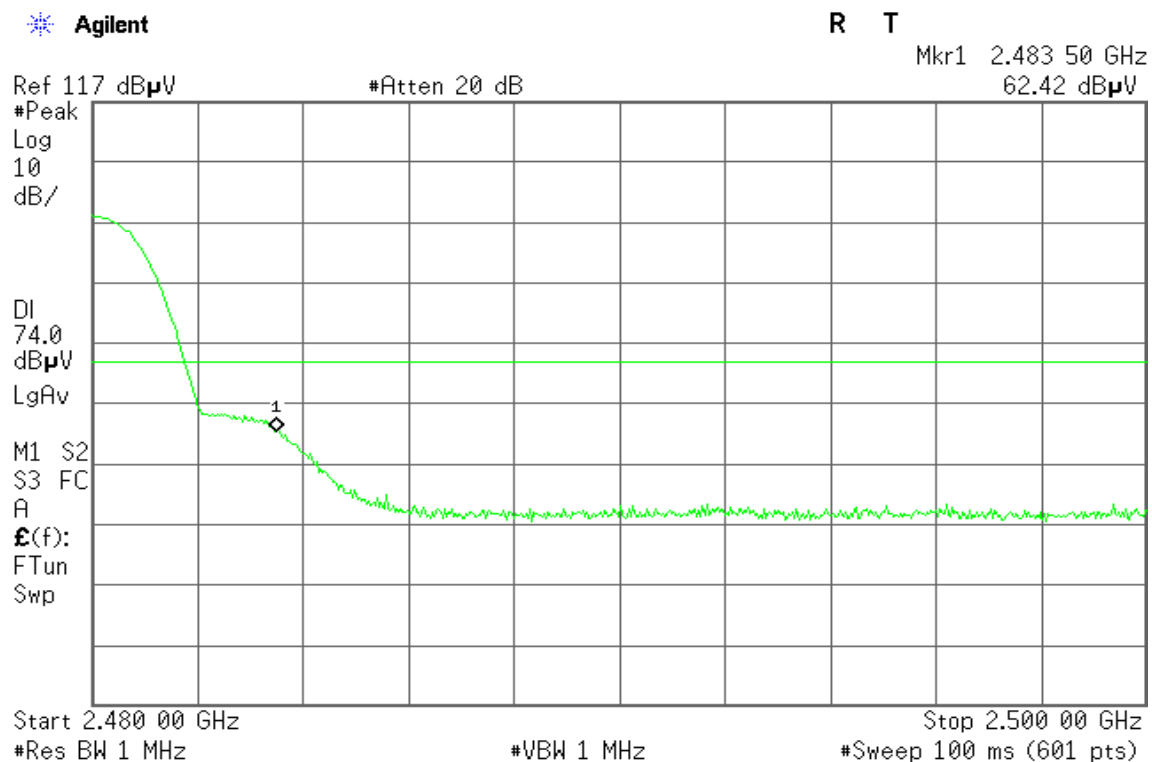
^ Stop 2.405 00 GHz
Sweep 7.408 s (601 pts)

**Band Edges (CH High)****Detector mode: Peak****Polarity: Vertical****Detector mode: Average****Polarity: Vertical**



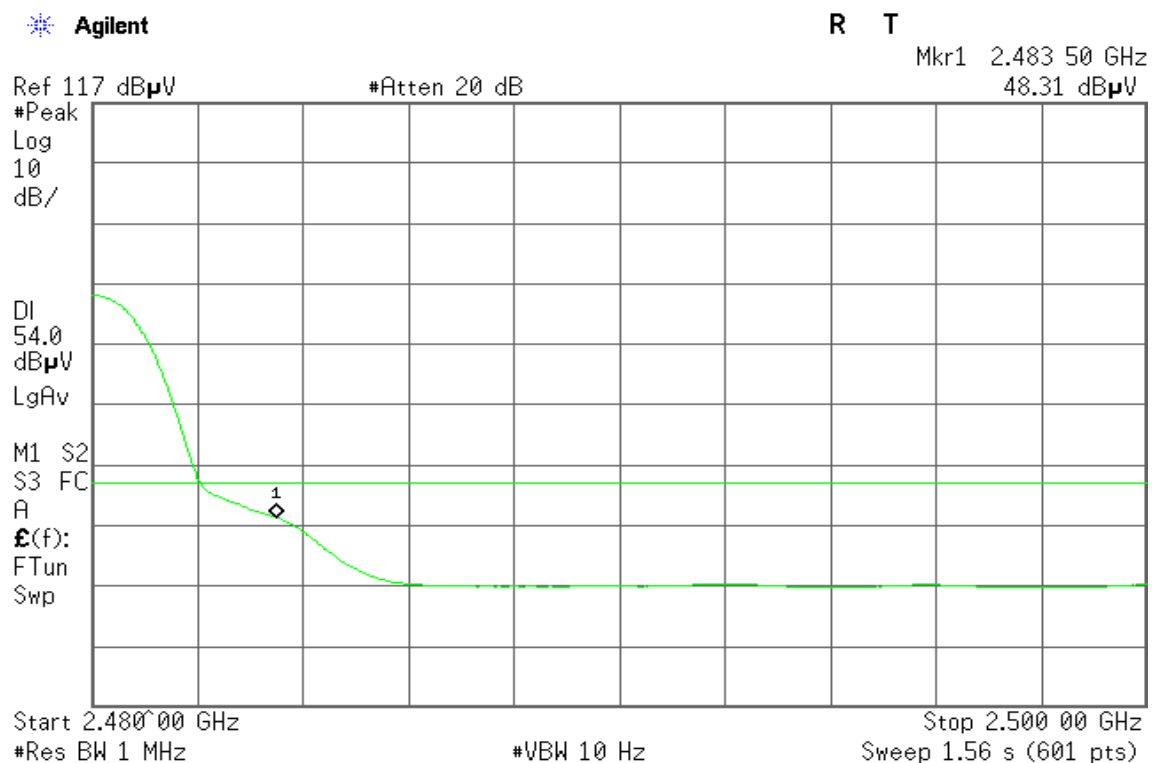
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

Polarity: Horizontal



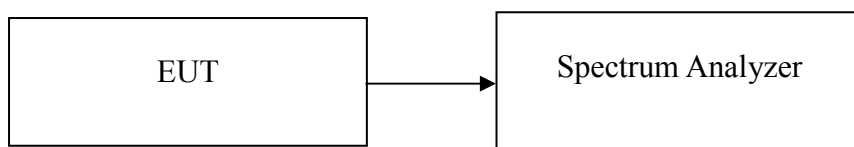


7.5 PEAK POWER SPECTRAL DENSITY

LIMIT

1. According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
2. According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 300kHz, Sweep=100s
4. Record the max. reading.
5. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

No non-compliance noted

**Test Data****For GFSK / DH5**

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2402	-6.44	8.00	PASS
Mid	2441	-6.41		PASS
High	2480	-6.38		PASS

For 8DPSK / DH5

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2402	-10.76	8.00	PASS
Mid	2441	-10.55		PASS
High	2480	-10.76		PASS



Test Plot

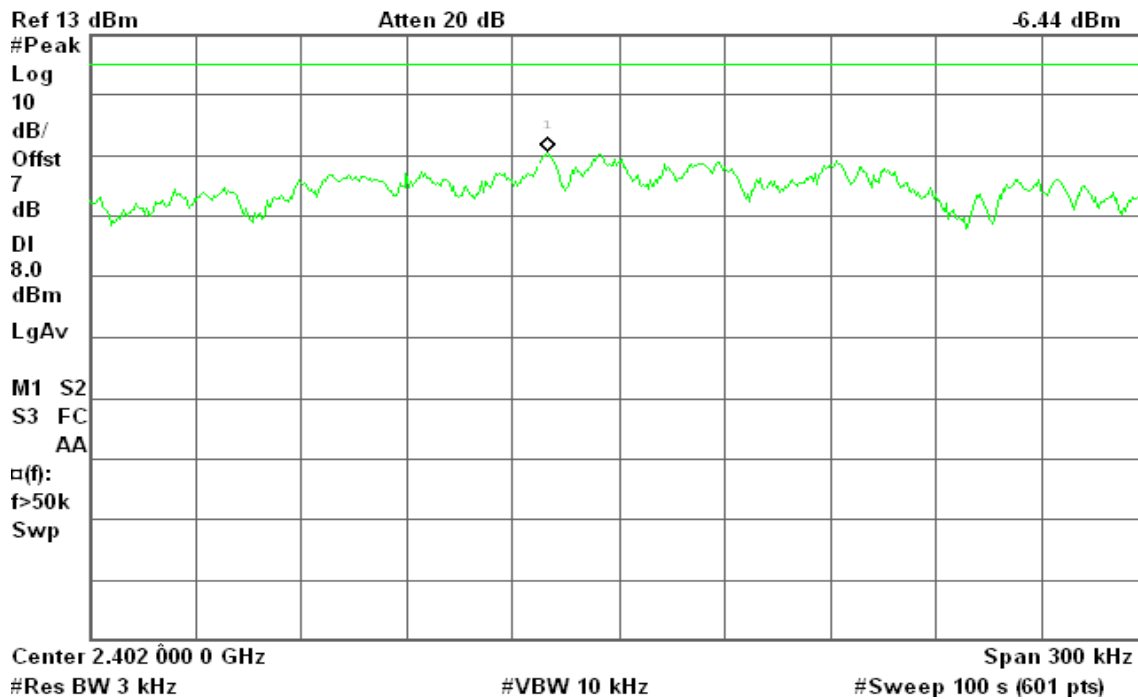
For GFSK / DH5

PPSD (CH Low)

Agilent 10:20:18 Nov 19, 2009

R T

Mkr1 2.401 979 9 GHz

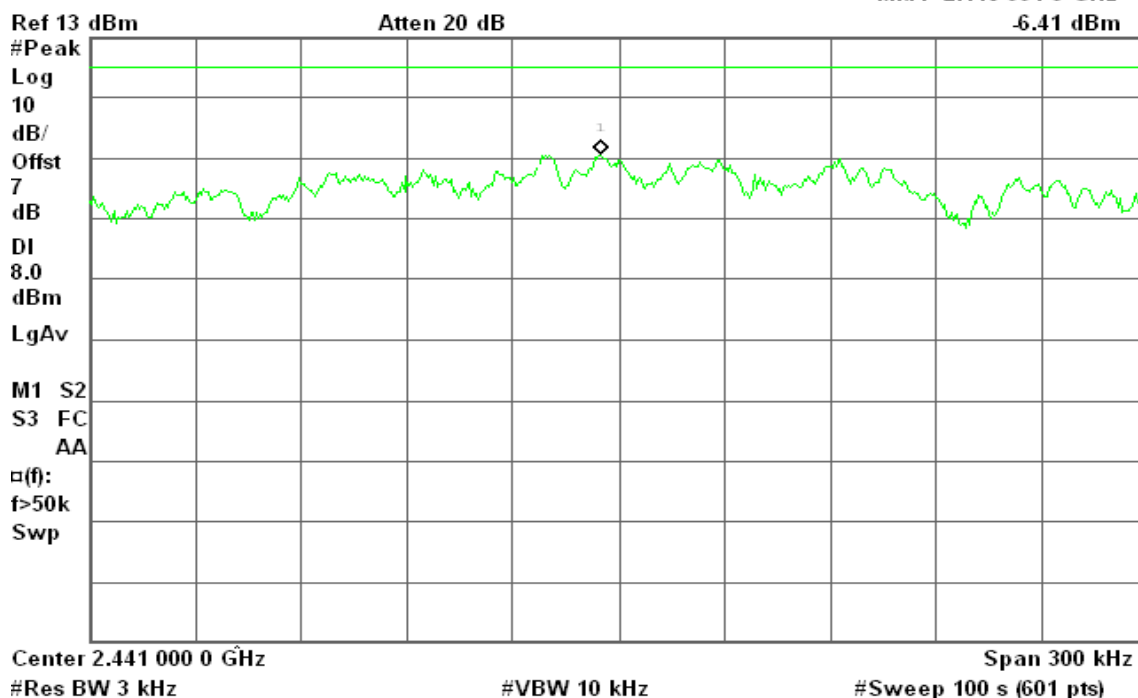


PPSD (CH Mid)

Agilent 10:15:44 Nov 19, 2009

R T

Mkr1 2.440 994 5 GHz



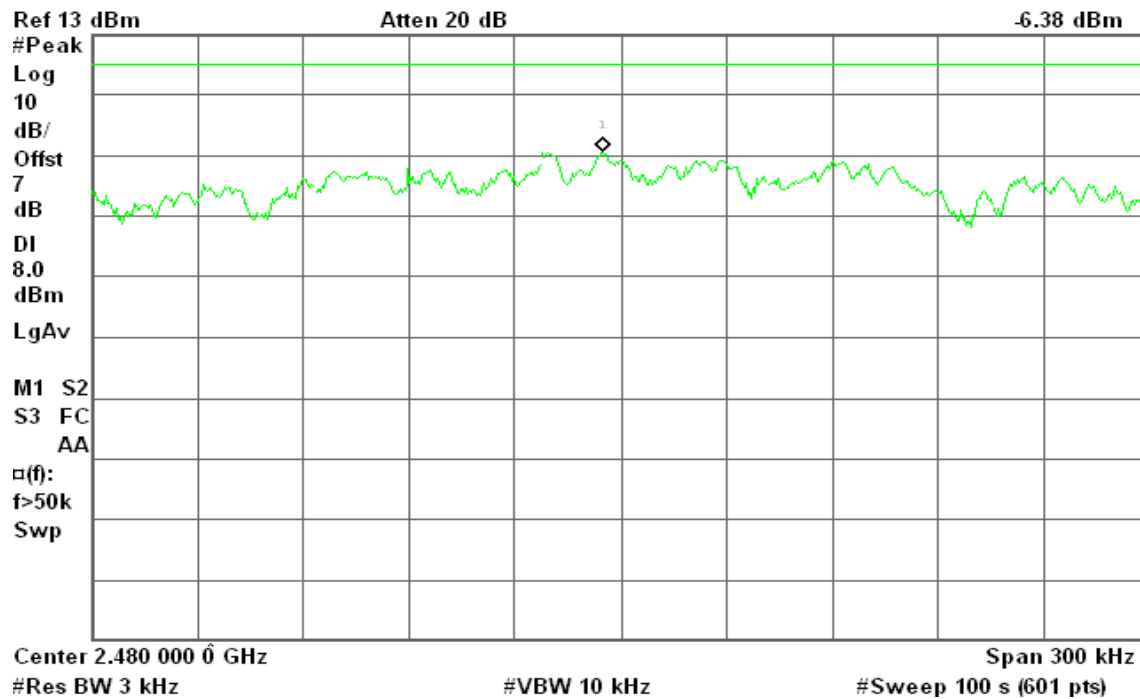


PPSD (CH High)

Agilent 10:18:09 Nov 19, 2009

R T

Mkr1 2.479 994 5 GHz





For GFSK / DH5

PPSD (CH Low)

* Agilent 13:22:38 Nov 19, 2009

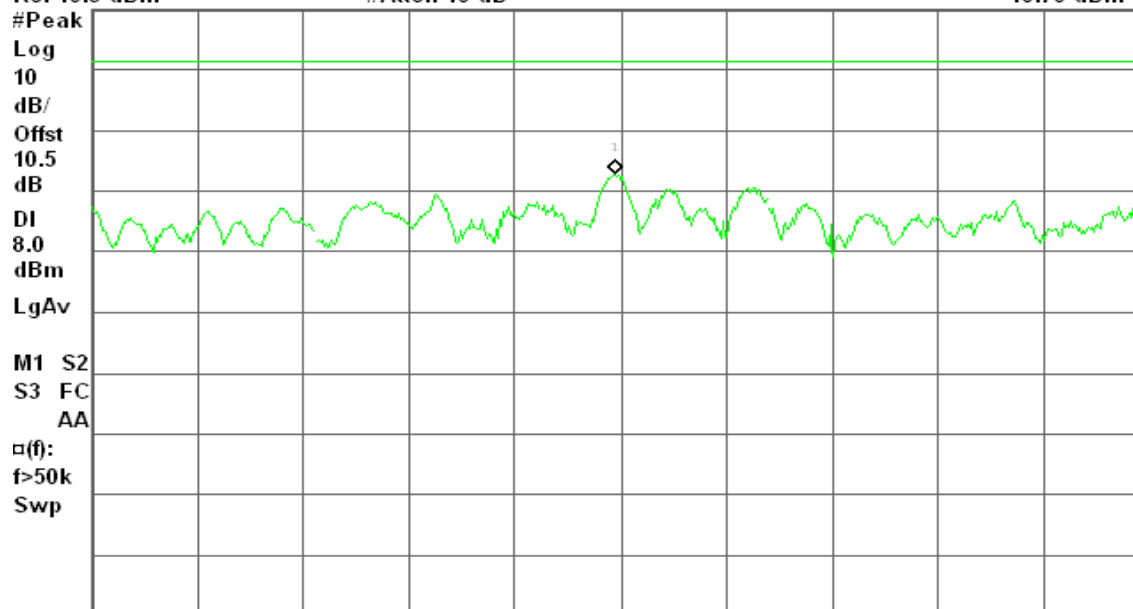
R T

Mkr1 2.401 998 0 GHz

-10.76 dBm

Ref 16.5 dBm

#Atten 16 dB



Center 2.402 000 0 GHz

Span 300 kHz

#Res BW 3 kHz

#VBW 10 kHz

#Sweep 100 s (601 pts)

PPSD (CH Mid)

* Agilent 13:17:45 Nov 19, 2009

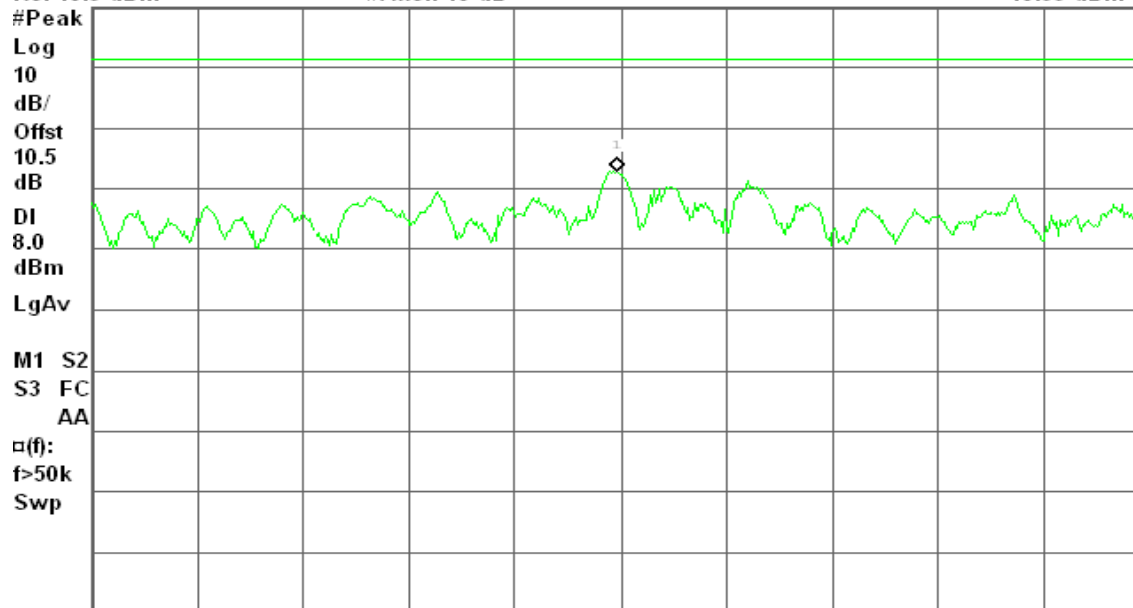
R T

Mkr1 2.440 998 5 GHz

-10.55 dBm

Ref 16.5 dBm

#Atten 16 dB



Center 2.441 000 0 GHz

Span 300 kHz

#Res BW 3 kHz

#VBW 10 kHz

#Sweep 100 s (601 pts)



PPSD (CH High)

Agilent 13:14:32 Nov 19, 2009

R T

Mkr1 2.479 998 5 GHz

-10.76 dBm

Ref 16.5 dBm

#Atten 16 dB

#Peak

Log

10

dB/

Offst

10.5

dB

DI

8.0

dBm

LgAv

M1 S2

S3 FC

AA

□(f):

f>50k

Swp

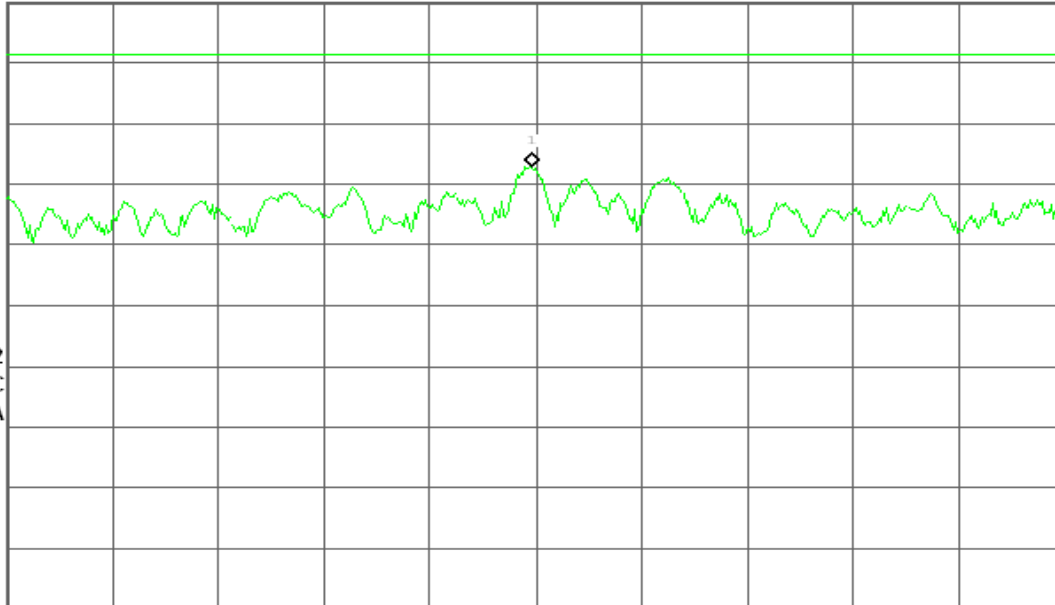
Center 2.480 000 0 GHz

#Res BW 3 kHz

#VBW 10 kHz

Span 300 kHz

#Sweep 100 s (601 pts)



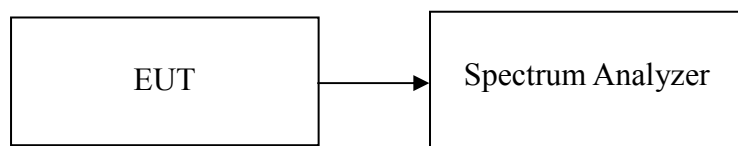


7.6 FREQUENCY SEPARATION

LIMIT

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel.
4. Set the spectrum analyzer as RBW = 30kHz, VBW = 100kHz, Span = 3MHz, Sweep = auto.
5. Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency.

TEST RESULTS

No non-compliance noted

Test Data

For GFSK / DH5

Channel Separation (MHz)	20dB Bandwidth (kHz)	Channel Separation Limit	Result
1.00	637.6	>two-thirds of the 20 dB bandwidth	Pass

For 8DPSK / DH5

Channel Separation (MHz)	20dB Bandwidth (kHz)	Channel Separation Limit	Result
1.00	880	>two-thirds of the 20 dB bandwidth	Pass

**Test Plot****For GFSK / DH5****Measurement of Channel Separation**

* Agilent 13:36:24 Nov 19, 2009

R T

Mkr3 2.442 015 GHz

0.60 dBm

Ref 16.5 dBm

#Atten 16 dB

#Peak

Log

10

dB/

Offst

10.5

dB

LgAv

V1 S2

Center 2.441 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 100 kHz

Sweep 3.2 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.440 015 GHz	0.45 dBm
2	(1)	Freq	2.441 015 GHz	0.77 dBm
3	(1)	Freq	2.442 015 GHz	0.60 dBm

Measurement of 20dB Bandwidth

* Agilent 09:22:07 Nov 19, 2009

R T

Δ Mkr2 956.4 kHz

-0.85 dB

Ref 7 dBm

Atten 10 dB

#Peak

Log

10

dB/

Offst

7

dB

DI

-21.0

dBm

LgAv

M1 S2

Center 2.480 000 0 GHz

Span 1.5 MHz

#Res BW 10 kHz

#VBW 30 kHz

Sweep 14.36 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.480 020 4 GHz	-1.03 dBm
2R	(1)	Freq	2.479 534 7 GHz	-23.11 dBm
2Δ	(1)	Freq	956.4 kHz	-0.85 dB

**For 8DPSK / DH5****Measurement of Channel Separation**

* Agilent 13:36:24 Nov 19, 2009

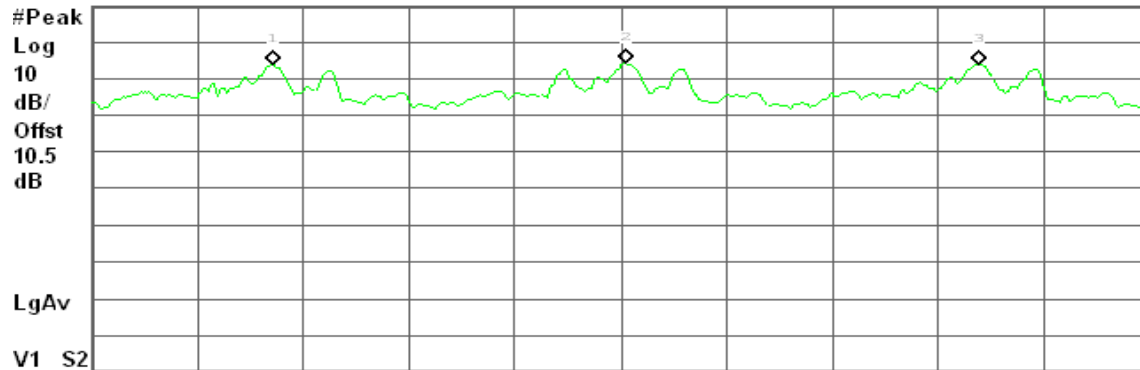
R T

Mkr3 2.442 015 GHz

Ref 16.5 dBm

#Atten 16 dB

0.60 dBm



Center 2.441 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 100 kHz

Sweep 3.2 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.440 015 GHz	0.45 dBm
2	(1)	Freq	2.441 015 GHz	0.77 dBm
3	(1)	Freq	2.442 015 GHz	0.60 dBm

Measurement of 20dB Bandwidth

* Agilent 12:21:55 Nov 19, 2009

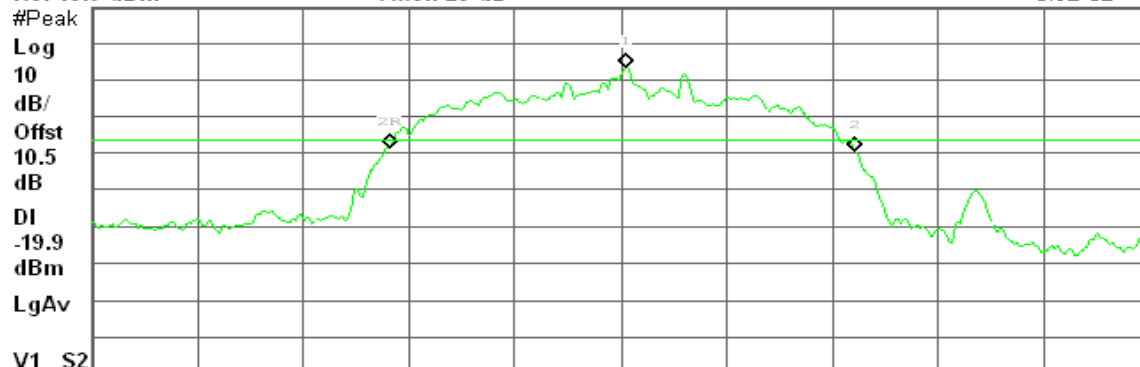
R T

Δ Mkr2 1.320 MHz

-0.92 dB

Ref 16.5 dBm

Atten 20 dB



Center 2.480 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 100 kHz

Sweep 3.2 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.480 015 GHz	0.09 dBm
2R	(1)	Freq	2.479 345 GHz	-22.00 dBm
2Δ	(1)	Freq	1.320 MHz	-0.92 dB

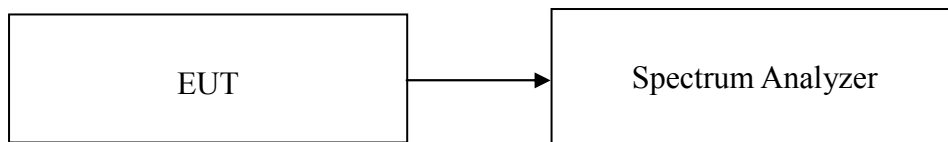


7.7 NUMBER OF HOPPING FREQUENCY

LIMIT

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2441.5MHz, Sweep = auto and Start=2441.5MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW, VBW=510kHz.
5. Max hold, view and count how many channel in the band.

TEST RESULTS

No non-compliance noted

Test Data

For GFSK / 8DPSK

Result (No. of CH)	Limit (No. of CH)	Result
79	>15	PASS



Test Plot

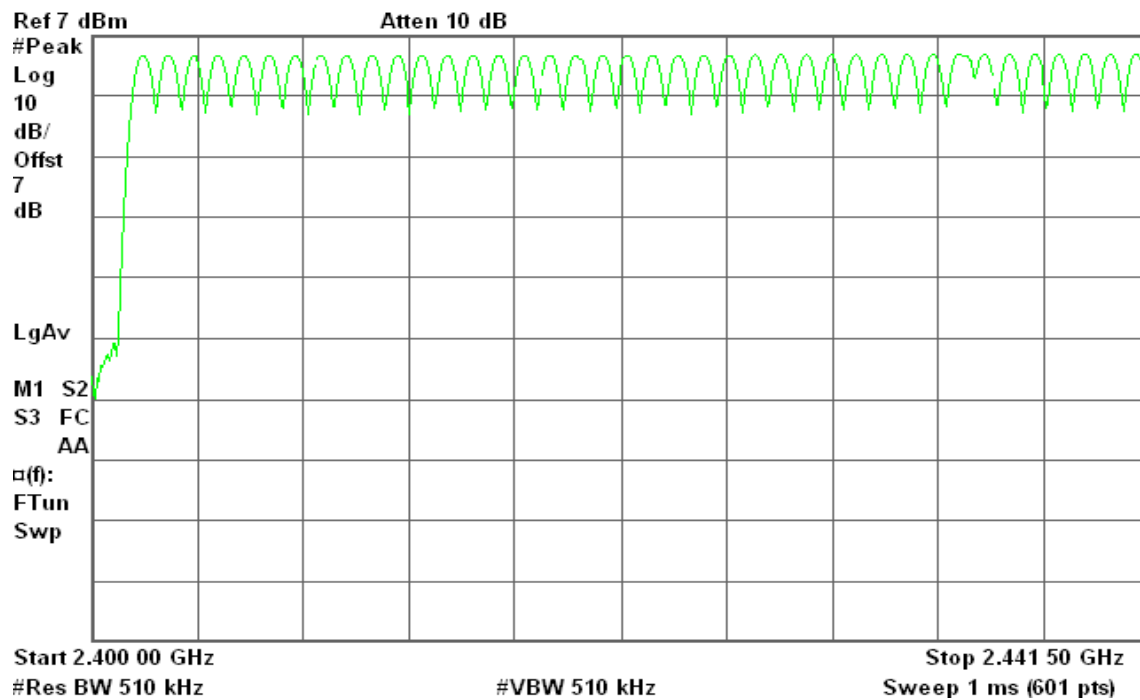
For GFSK

Channel Number

2.4 GHz – 2.4415 GHz

Agilent 10:06:00 Nov 19, 2009

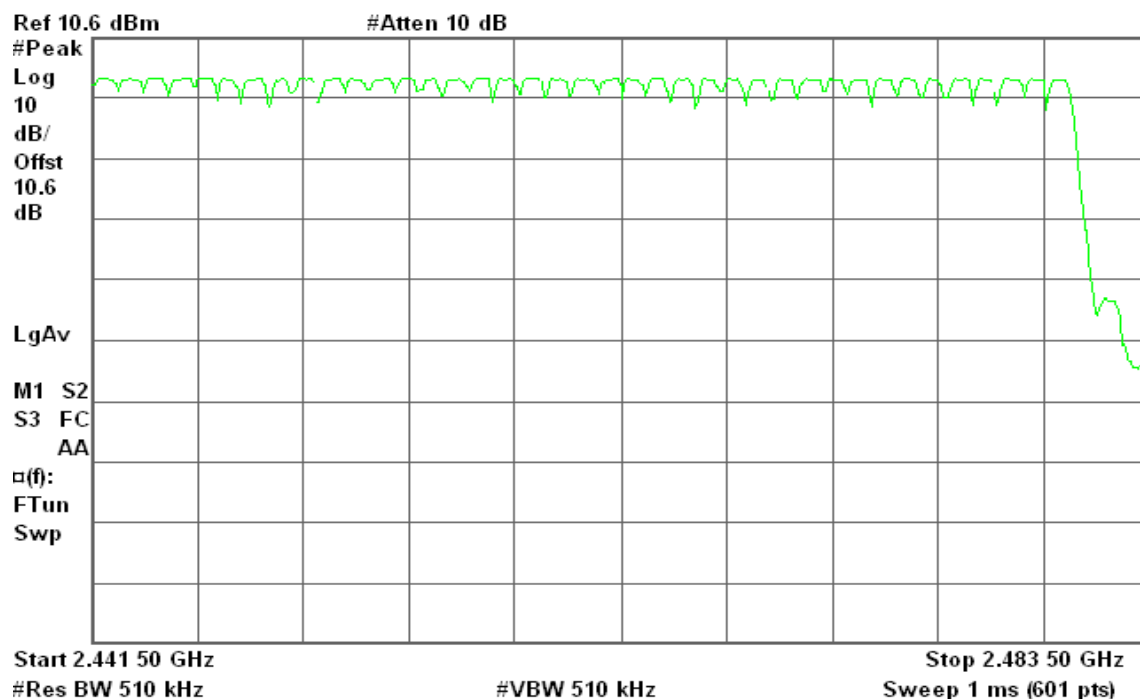
R T



2.4415 GHz – 2.4835 GHz

Agilent 01:22:28 Nov 19, 2009

R T





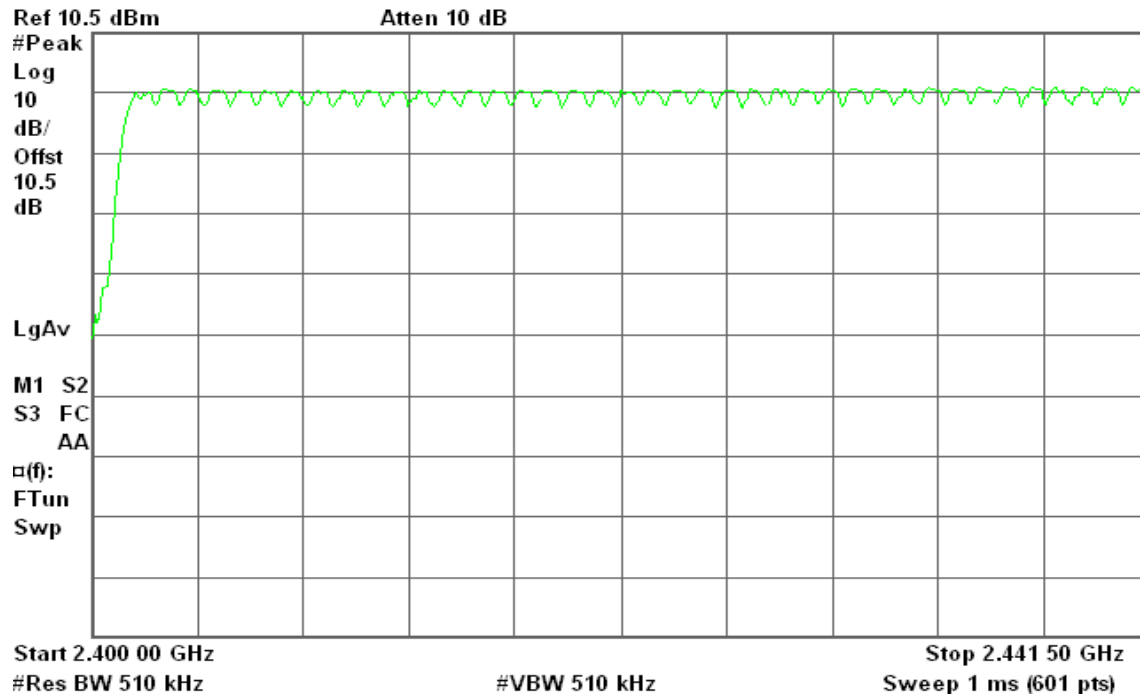
For 8DPSK

Channel Number

2.4 GHz – 2.4415 GHz

✱ Agilent 13:06:59 Nov 19, 2009

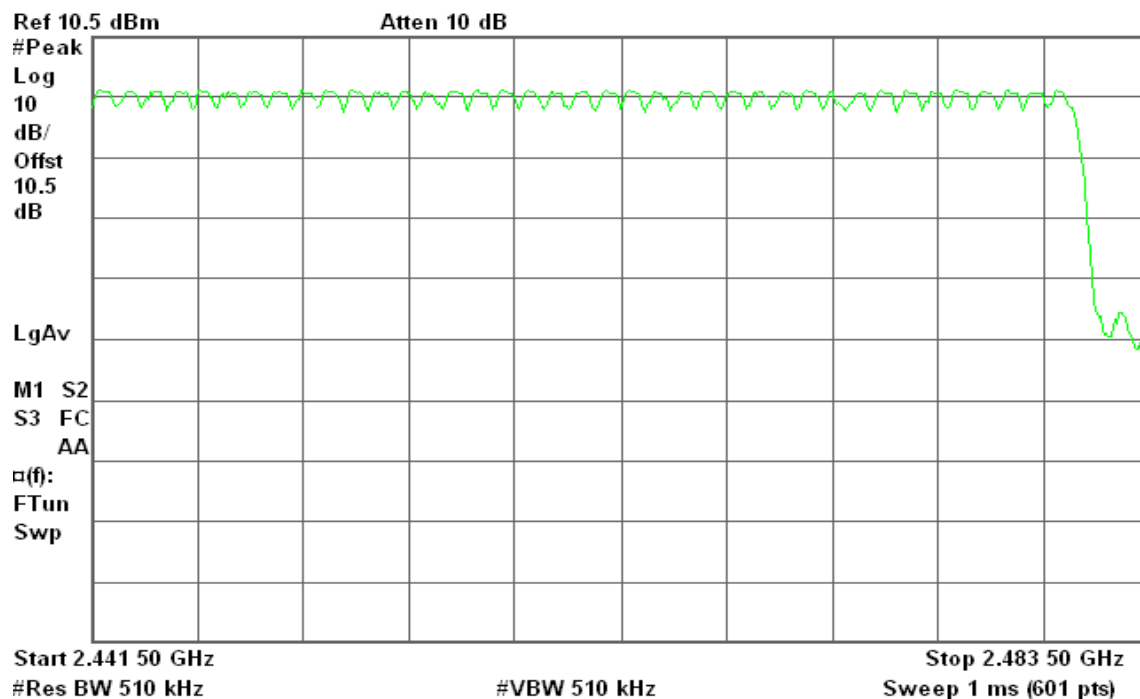
R T



2.4415 GHz – 2.4835 GHz

✱ Agilent 13:08:42 Nov 19, 2009

R T



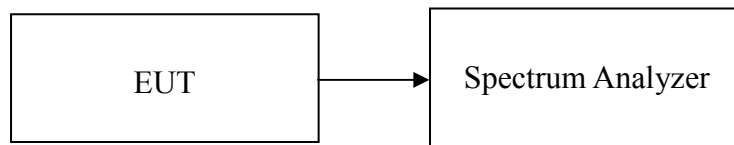


7.8 TIME OF OCCUPANCY (DWEELL TIME)

LIMIT

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.
5. Repeat above procedures until all frequency measured were complete.

**Test Data****For GFSK****DH 1**CH Low: $0.533 * (1600/2)/79 * 31.6 = 170.7$ (ms)CH Mid: $0.517 * (1600/2)/79 * 31.6 = 165.3$ (ms)CH High: $0.517 * (1600/2)/79 * 31.6 = 165.3$ (ms)

	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.533	170.7	31.60	400.00	PASS
Mid	0.517	165.3	31.60		PASS
High	0.517	165.3	31.60		PASS

DH 3CH Low: $1.783 * (1600/4)/79 * 31.6 = 285.3$ (ms)CH Mid: $1.783 * (1600/4)/79 * 31.6 = 285.3$ (ms)CH High: $1.766 * (1600/4)/79 * 31.6 = 282.6$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.783	285.3	31.60	400.00	PASS
Mid	1.783	285.3	31.60		PASS
High	1.766	282.6	31.60		PASS

DH 5CH Low: $3.0163 * (1600/6)/79 * 31.6 = 321.7$ (ms)CH Mid: $3.0163 * (1600/6)/79 * 31.6 = 321.7$ (ms)CH High: $3.0333 * (1600/6)/79 * 31.6 = 323.6$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	3.0163	321.7	31.60	400.00	PASS
Mid	3.0163	321.7	31.60		PASS
High	3.0333	323.6	31.60		PASS

**Test Plot****For GFSK****DH 1****CH Low**

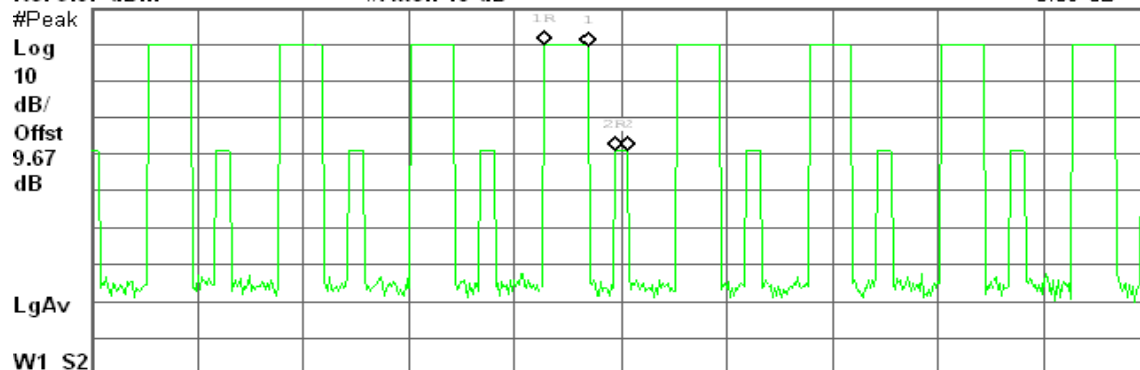
* Agilent 15:01:28 Nov 19, 2009

R T

 Δ Mkr1 400 μ s
-0.39 dB

Ref 9.67 dBm

#Atten 10 dB

**CH Mid**

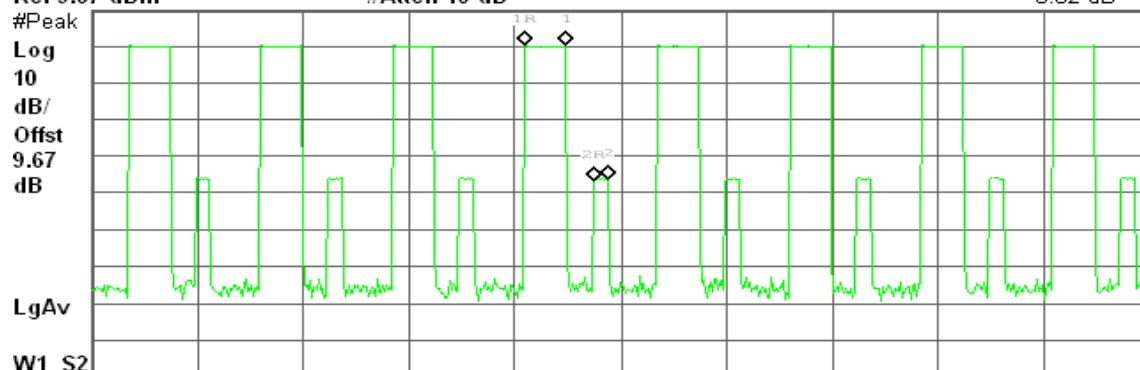
* Agilent 15:03:10 Nov 19, 2009

R T

 Δ Mkr1 383.3 μ s
-0.02 dB

Ref 9.67 dBm

#Atten 10 dB



**CH High**

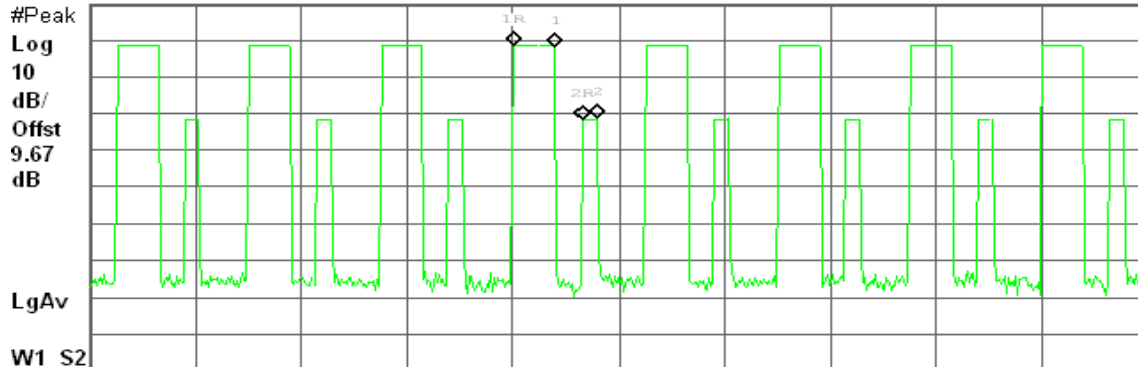
* Agilent 15:06:45 Nov 19, 2009

R T

 Δ Mkr2 133.3 μ s
0.26 dB

Ref 9.67 dBm

#Atten 10 dB



W1 S2

Center 2.480 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	4.017 ms	-1.57 dBm
1A	(1)	Time	383.3 μ s	-0.25 dB
2R	(1)	Time	4.65 ms	-21.96 dBm
2A	(1)	Time	133.3 μ s	0.26 dB

DH 3**CH Low**

* Agilent 15:02:13 Nov 19, 2009

R T

 Δ Mkr2 133.3 μ s
7.47 dB

Ref 9.67 dBm

#Atten 10 dB



W1 S2

Center 2.402 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	4.8 ms	-0.22 dBm
1A	(1)	Time	1.65 ms	-0.15 dB
2R	(1)	Time	6.683 ms	-36.89 dBm
2A	(1)	Time	133.3 μ s	7.47 dB



CH Mid

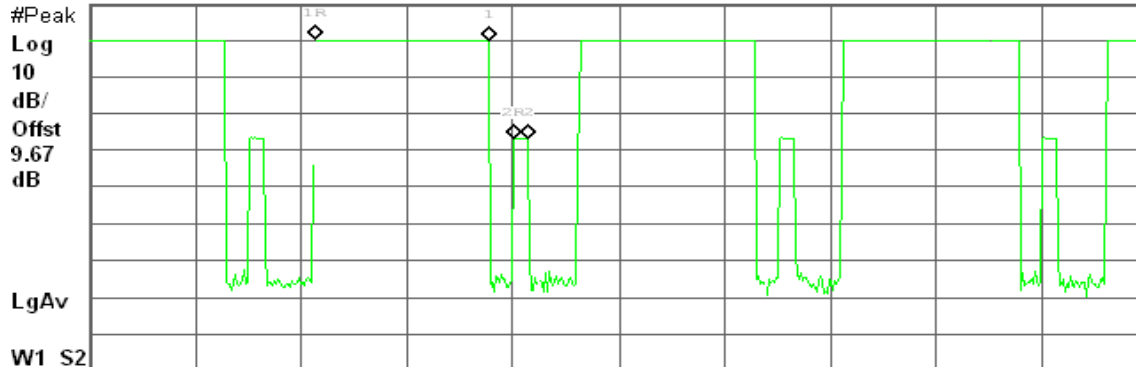
* Agilent 15:05:12 Nov 19, 2009

R T

 Δ Mkr2 133.3 μ s
0.30 dB

Ref 9.67 dBm

#Atten 10 dB



Res BW 1 MHz

#VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	2.133 ms	-0.05 dBm
1A	(1)	Time	1.65 ms	-0.12 dB
2R	(1)	Time	4.017 ms	-27.25 dBm
2A	(1)	Time	133.3 μ s	0.30 dB

CH High

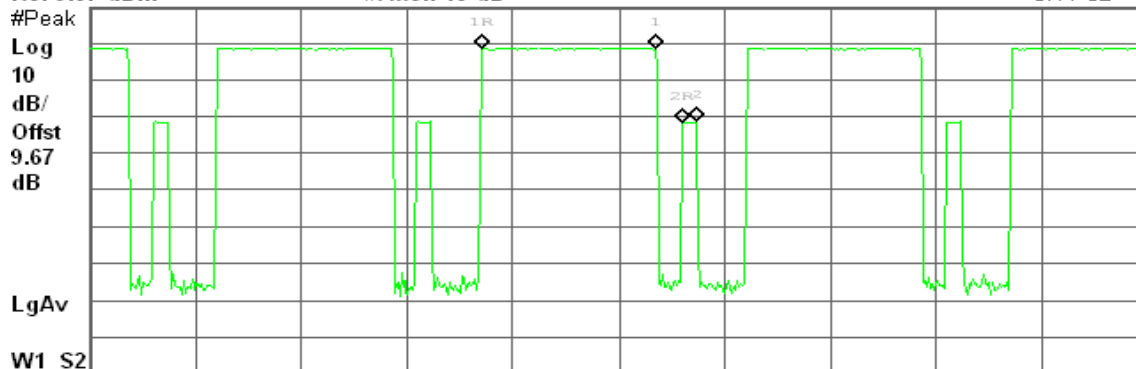
* Agilent 15:11:19 Nov 19, 2009

R T

 Δ Mkr1 1.633 ms
-0.11 dB

Ref 9.67 dBm

#Atten 10 dB



Res BW 1 MHz

#VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	3.717 ms	-1.64 dBm
1A	(1)	Time	1.633 ms	-0.11 dB
2R	(1)	Time	5.6 ms	-21.92 dBm
2A	(1)	Time	133.3 μ s	0.31 dB

**DH 5****CH Low**

* Agilent 15:00:39 Nov 19, 2009

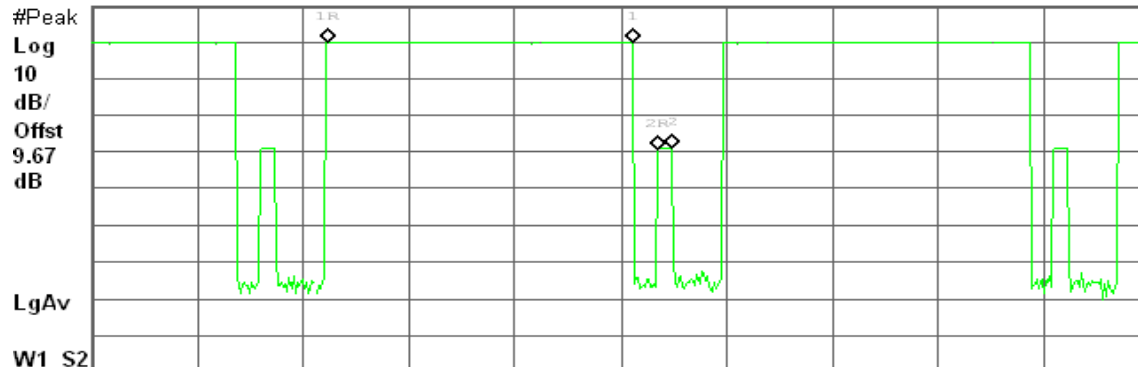
R T

 Δ Mkr2 133.3 μ s

0.38 dB

Ref 9.67 dBm

#Atten 10 dB



Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	2.233 ms	-0.22 dBm
1A	(1)	Time	2.883 ms	-0.28 dB
2R	(1)	Time	5.35 ms	-29.81 dBm
2A	(1)	Time	133.3 μ s	0.38 dB

CH Mid

* Agilent 15:05:50 Nov 19, 2009

R T

 Δ Mkr1 2.883 ms

-0.01 dB

Ref 9.67 dBm

#Atten 10 dB



Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	2.667 ms	-0.12 dBm
1A	(1)	Time	2.883 ms	-0.01 dB
2R	(1)	Time	5.8 ms	-26.80 dBm
2A	(1)	Time	133.3 μ s	-0.03 dB



CH High

* Agilent 15:12:07 Nov 19, 2009

R T

 Δ Mkr2 133.3 μ s
0.14 dB

Ref 9.67 dBm

#Atten 10 dB

#Peak

Log

10

dB/

Offst

9.67

dB

LgAv

W1 S2

Center 2.480 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	2.567 ms	-1.71 dBm
1 Δ	(1)	Time	2.9 ms	-0.06 dB
2R	(1)	Time	5.717 ms	-21.66 dBm
2 Δ	(1)	Time	133.3 μ s	0.14 dB

**Test Data****For 8DPSK****DH 1**CH Low: $0.5333 * (1600/2)/79 * 31.6 = 170.7$ (ms)CH Mid: $0.5500 * (1600/2)/79 * 31.6 = 176.0$ (ms)CH High: $0.5333 * (1600/2)/79 * 31.6 = 170.7$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.5333	170.7	31.60	400.00	PASS
Mid	0.5500	176.0	31.60		PASS
High	0.5333	170.7	31.60		PASS

DH 3CH Low: $1.8003 * (1600/4)/79 * 31.6 = 288.0$ (ms)CH Mid: $1.8003 * (1600/4)/79 * 31.6 = 288.0$ (ms)CH High: $1.8003 * (1600/4)/79 * 31.6 = 288.0$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.8003	288.0	31.60	400.00	PASS
Mid	1.8003	288.0	31.60		PASS
High	1.8003	288.0	31.60		PASS

DH 5CH Low: $3.0333 * (1600/6)/79 * 31.6 = 323.6$ (ms)CH Mid: $3.0503 * (1600/6)/79 * 31.6 = 325.4$ (ms)CH High: $3.0167 * (1600/6)/79 * 31.6 = 321.8$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	3.0333	323.6	31.60	400.00	PASS
Mid	3.0503	325.4	31.60		PASS
High	3.0167	321.8	31.60		PASS



For 8DPSK

DH 1

CH Low

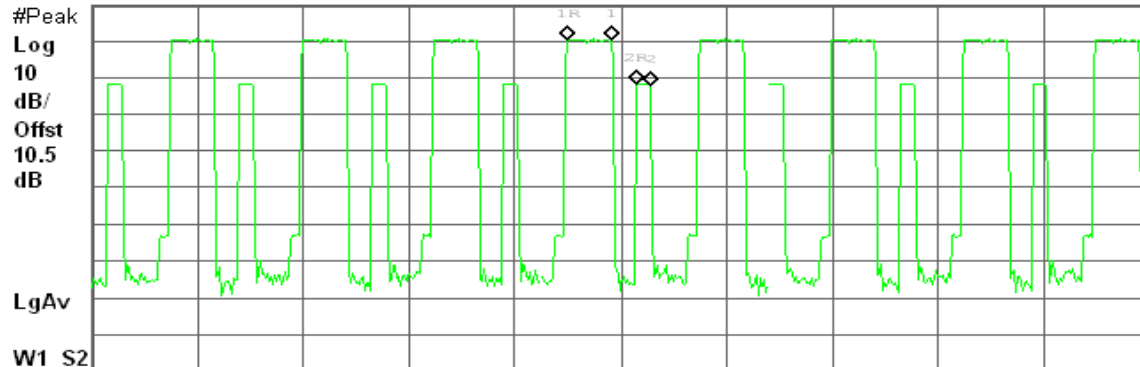
* Agilent 12:47:43 Nov 19, 2009

R T

 Δ Mkr2 133.3 μ s
-0.27 dB

Ref 10.5 dBm

Atten 10 dB



Center 2.402 000 GHz

Span 0 Hz

Res BW 1 MHz

VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	4.5 ms	1.09 dBm
1A	(1)	Time	400 μ s	-0.18 dB
2R	(1)	Time	5.15 ms	-11.10 dBm
2A	(1)	Time	133.3 μ s	-0.27 dB

CH Mid

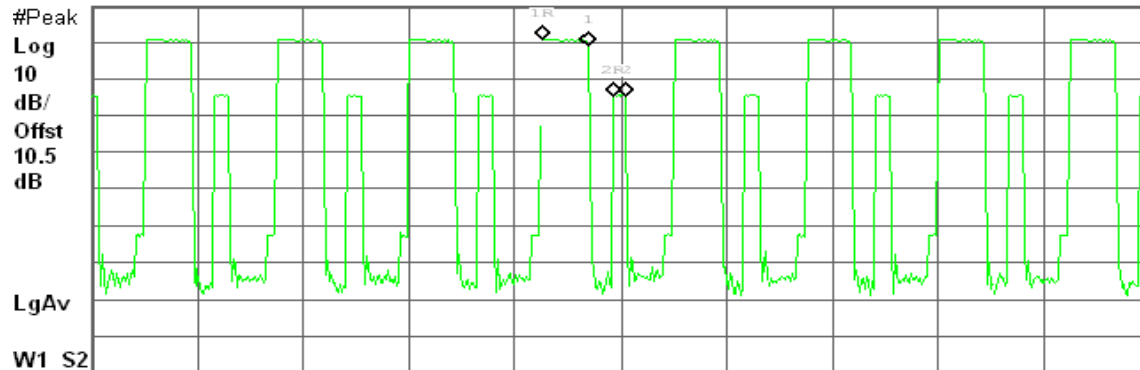
* Agilent 12:46:07 Nov 19, 2009

R T

 Δ Mkr2 133.3 μ s
0.08 dB

Ref 10.5 dBm

Atten 10 dB



Center 2.441 000 GHz

Span 0 Hz

Res BW 1 MHz

VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	4.267 ms	1.32 dBm
1A	(1)	Time	416.7 μ s	-1.55 dB
2R	(1)	Time	4.917 ms	-14.08 dBm
2A	(1)	Time	133.3 μ s	0.08 dB

**CH High**

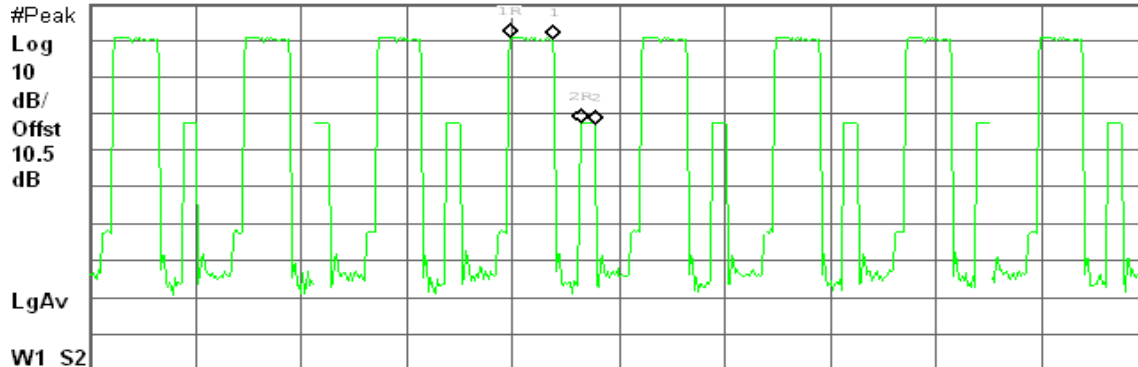
* Agilent 12:44:48 Nov 19, 2009

R T

 Δ Mkr1 400 μ s
-0.18 dB

Ref 10.5 dBm

Atten 10 dB



Center 2.480 000 GHz

Span 0 Hz

Res BW 1 MHz

VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	3.983 ms	1.20 dBm
1A	(1)	Time	400 μ s	-0.18 dB
2R	(1)	Time	4.633 ms	-21.93 dBm
2A	(1)	Time	133.3 μ s	-0.30 dB

DH 3**CH Low**

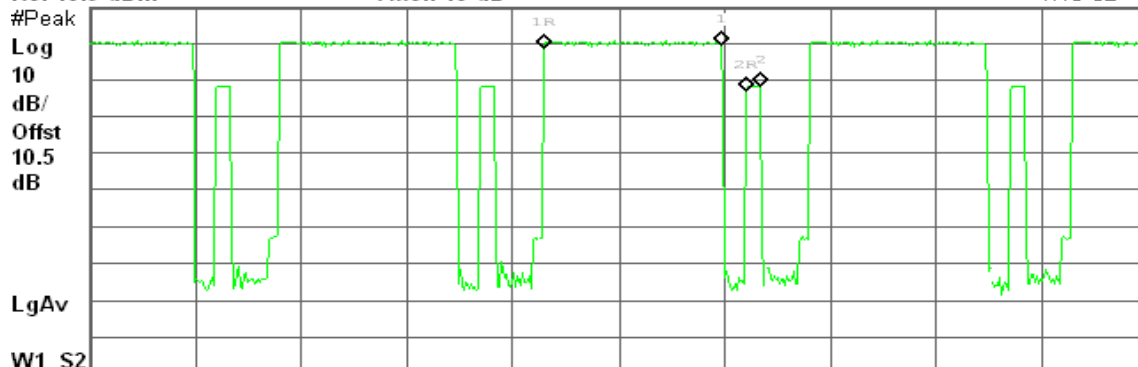
* Agilent 12:48:48 Nov 19, 2009

R T

 Δ Mkr2 133.3 μ s
1.10 dB

Ref 10.5 dBm

Atten 10 dB



Center 2.402 000 GHz

Span 0 Hz

Res BW 1 MHz

VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	4.3 ms	-0.68 dBm
1A	(1)	Time	1.667 ms	0.92 dB
2R	(1)	Time	6.2 ms	-12.27 dBm
2A	(1)	Time	133.3 μ s	1.10 dB



CH Mid

* Agilent 12:59:13 Nov 19, 2009

R T

 Δ Mkr2 133.3 μ s
0.00 dB

Ref 10.5 dBm

Atten 10 dB

#Peak

Log
10
dB/
Offst
10.5
dB

LgAv

W1 S2

Center 2.441 000 GHz

Span 0 Hz

Res BW 1 MHz

VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	3.467 ms	1.23 dBm
1 Δ	(1)	Time	1.667 ms	-2.19 dB
2R	(1)	Time	5.367 ms	-14.12 dBm
2 Δ	(1)	Time	133.3 μ s	0.00 dB

CH High

* Agilent 13:01:35 Nov 19, 2009

R T

 Δ Mkr2 133.3 μ s
0.04 dB

Ref 10.5 dBm

Atten 10 dB

#Peak

Log
10
dB/
Offst
10.5
dB

LgAv

W1 S2

Center 2.480 000 GHz

Span 0 Hz

Res BW 1 MHz

VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	3.283 ms	1.04 dBm
1 Δ	(1)	Time	1.667 ms	-1.60 dB
2R	(1)	Time	5.183 ms	-22.08 dBm
2 Δ	(1)	Time	133.3 μ s	0.04 dB

**DH 5****CH Low**

* Agilent 12:37:05 Nov 19, 2009

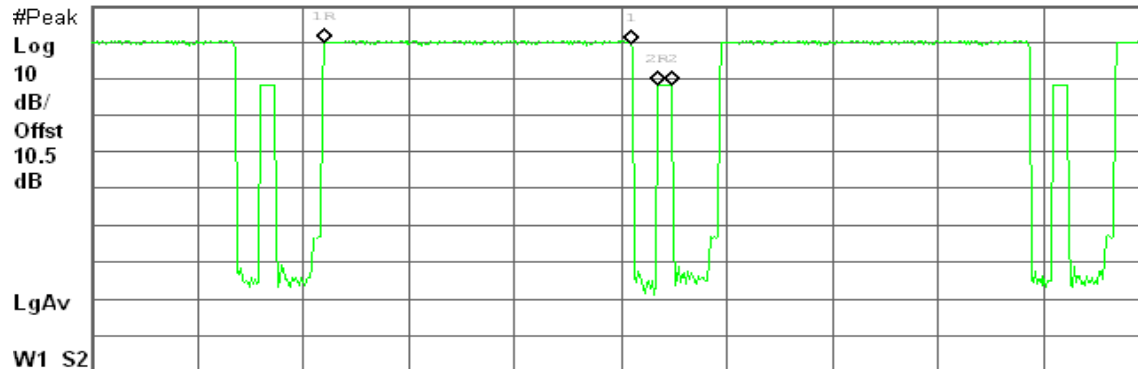
R T

 Δ Mkr2 133.3 μ s

0.01 dB

Ref 10.5 dBm

Atten 10 dB



Center 2.402 000 GHz

Span 0 Hz

Res BW 1 MHz

VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	2.2 ms	0.68 dBm
1A	(1)	Time	2.9 ms	-0.56 dB
2R	(1)	Time	5.35 ms	-11.24 dBm
2A	(1)	Time	133.3 μ s	0.01 dB

CH Mid

* Agilent 12:39:16 Nov 19, 2009

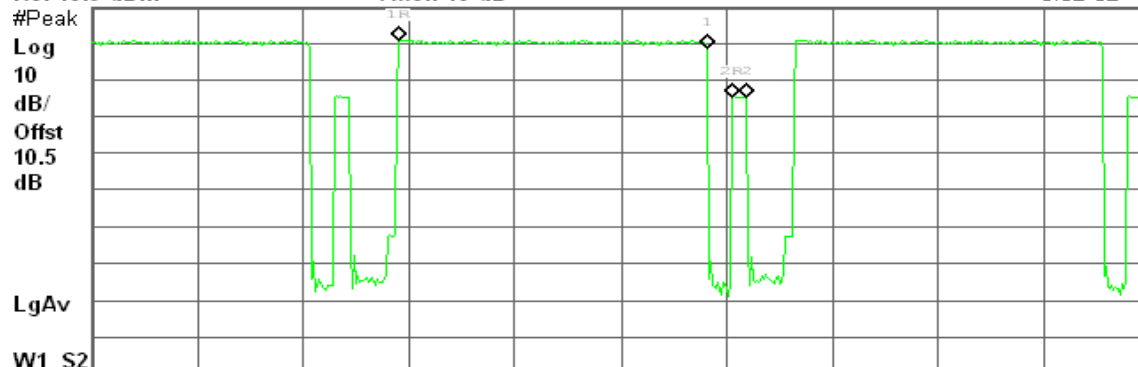
R T

 Δ Mkr2 133.3 μ s

0.02 dB

Ref 10.5 dBm

Atten 10 dB



Center 2.441 000 GHz

Span 0 Hz

Res BW 1 MHz

VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	2.9 ms	1.24 dBm
1A	(1)	Time	2.917 ms	-1.91 dB
2R	(1)	Time	6.05 ms	-14.11 dBm
2A	(1)	Time	133.3 μ s	0.02 dB



CH High

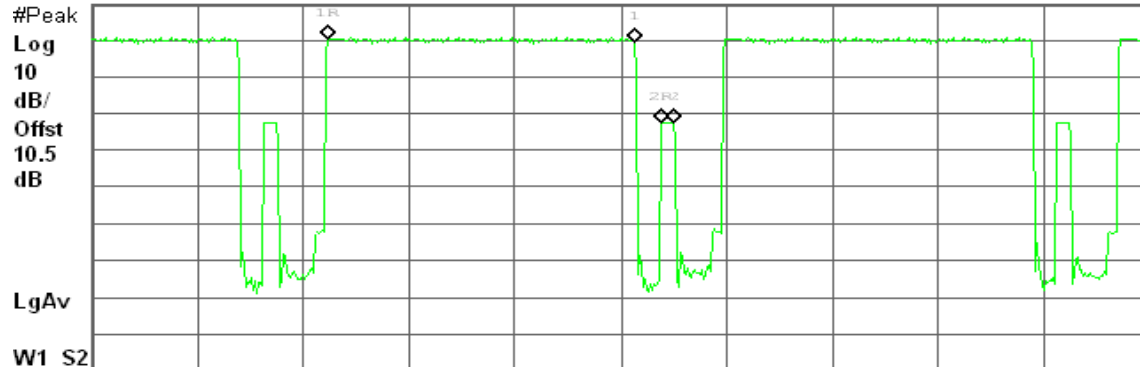
Agilent 12:42:37 Nov 19, 2009

R T

Δ Mkr2 116.7 μs
-0.14 dB

Ref 10.5 dBm

Atten 10 dB



Center 2.480 000 GHz

Span 0 Hz

Res BW 1 MHz

VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	2.233 ms	1.06 dBm
1Δ	(1)	Time	2.9 ms	-0.79 dB
2R	(1)	Time	5.383 ms	-21.94 dBm
2Δ	(1)	Time	116.7 μs	-0.14 dB



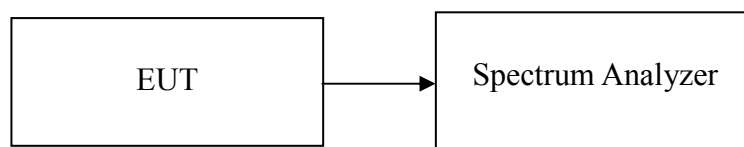
7.9 SPURIOUS EMISSIONS

7.9.1 Conducted Measurement

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

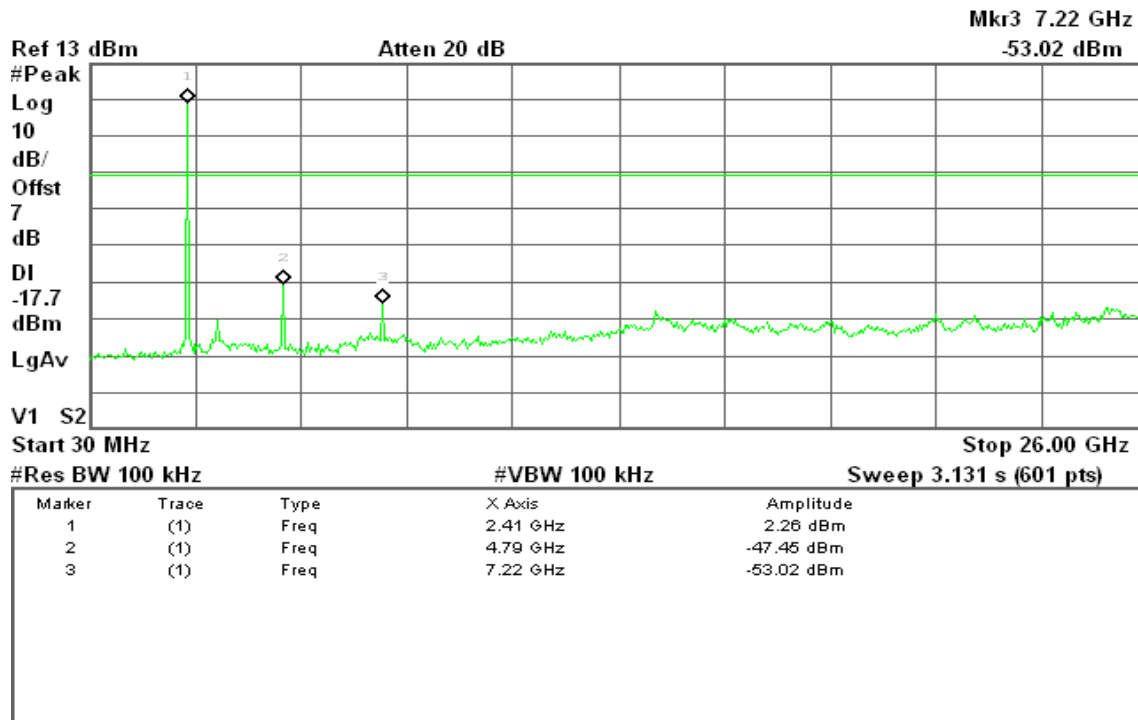
TEST RESULTS

No non-compliance noted

**Test Plot****For GFSK / DH5****CH Low**

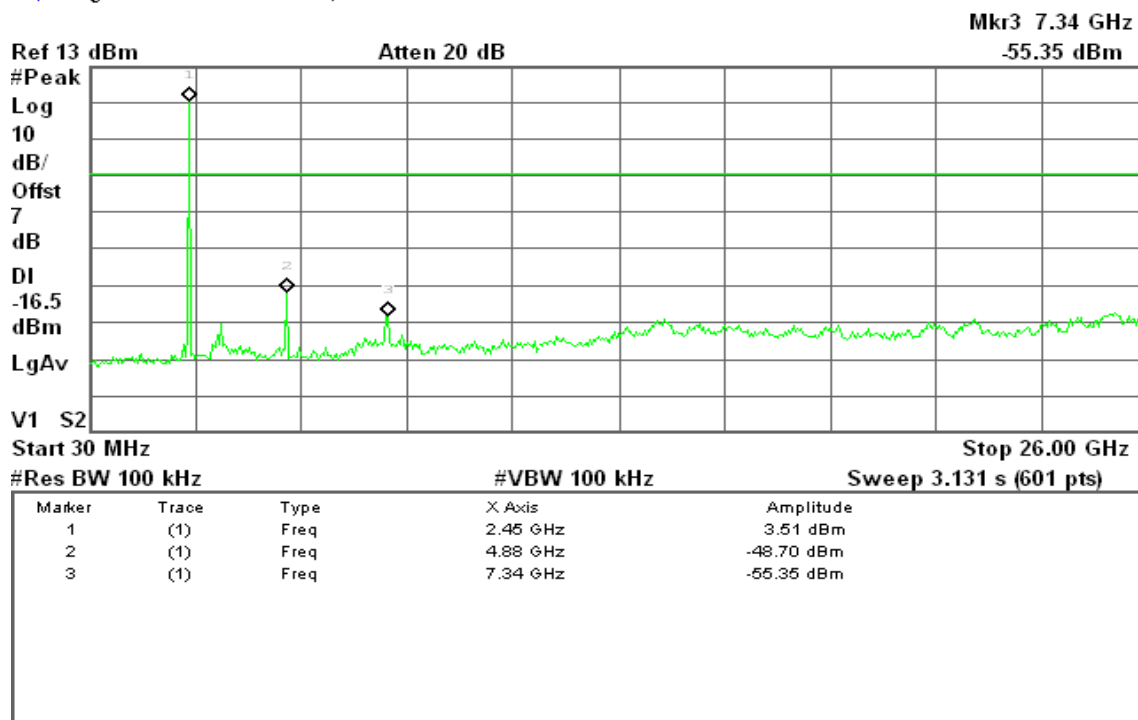
* Agilent 10:30:34 Nov 19, 2009

R T

**CH Mid**

* Agilent 10:29:11 Nov 19, 2009

R T

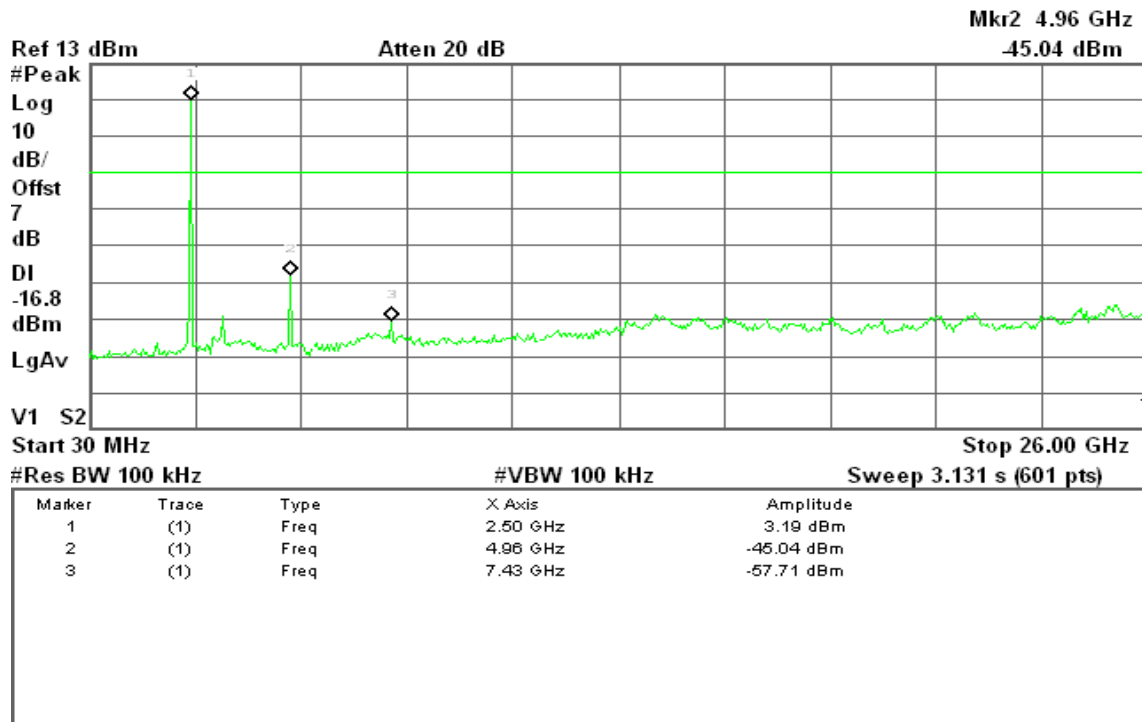




CH High

Agilent 10:27:37 Nov 19, 2009

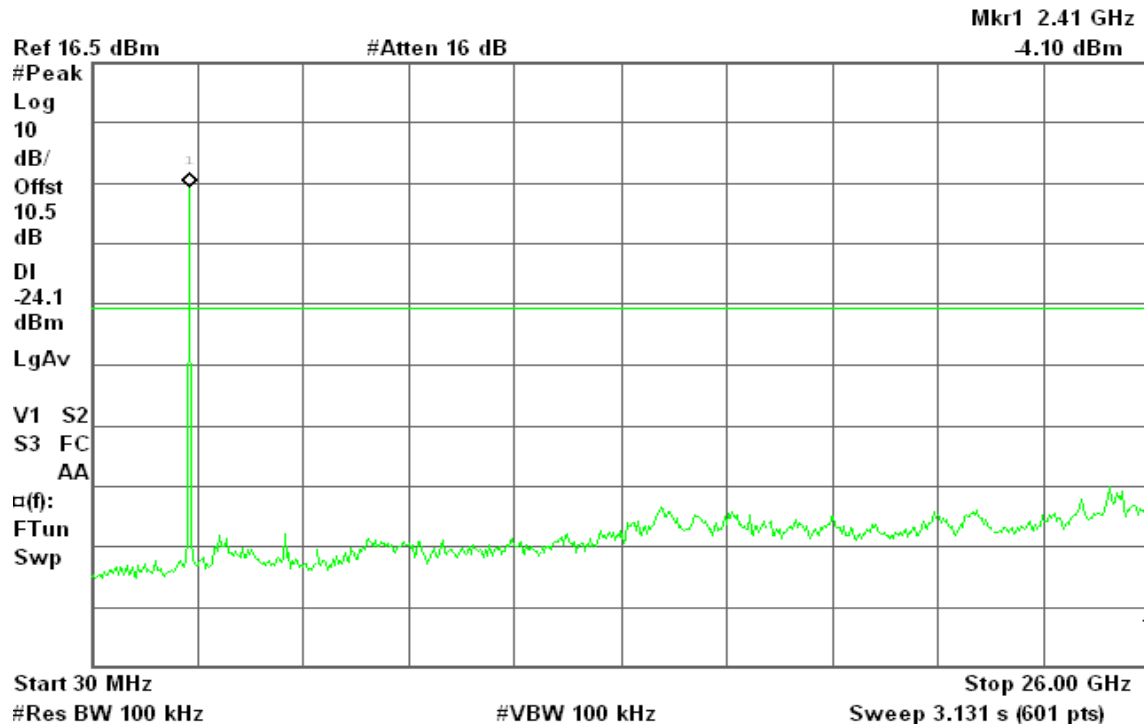
R T



**For 8DPSK / DH5****CH Low**

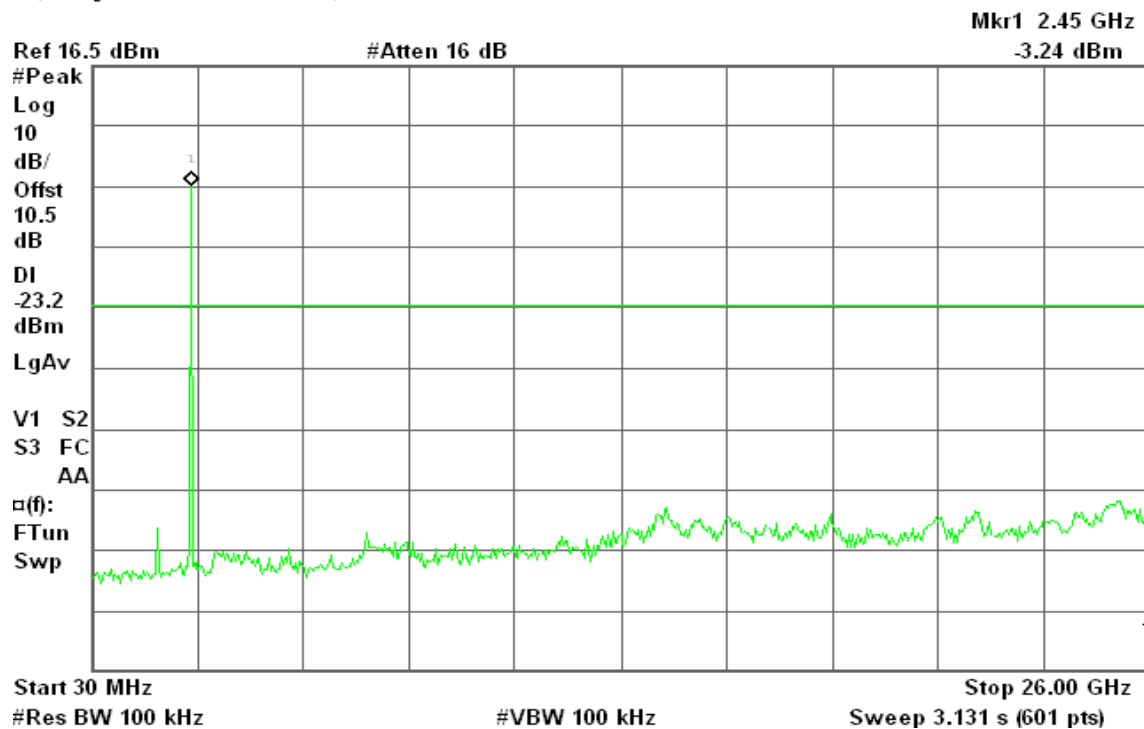
* Agilent 13:25:14 Nov 19, 2009

R T

**CH Mid**

* Agilent 13:27:44 Nov 19, 2009

R T

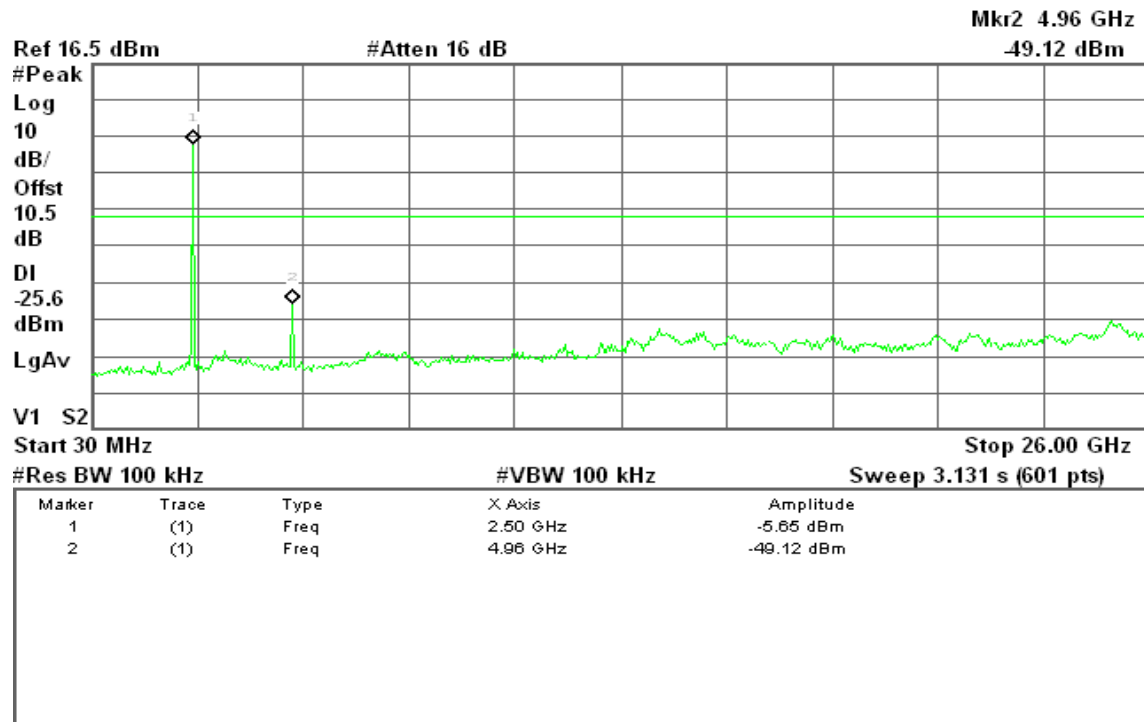




CH High

Agilent 13:30:00 Nov 19, 2009

R T





7.9.2 Radiated Emissions

LIMIT

1. According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)
(MHz)		
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

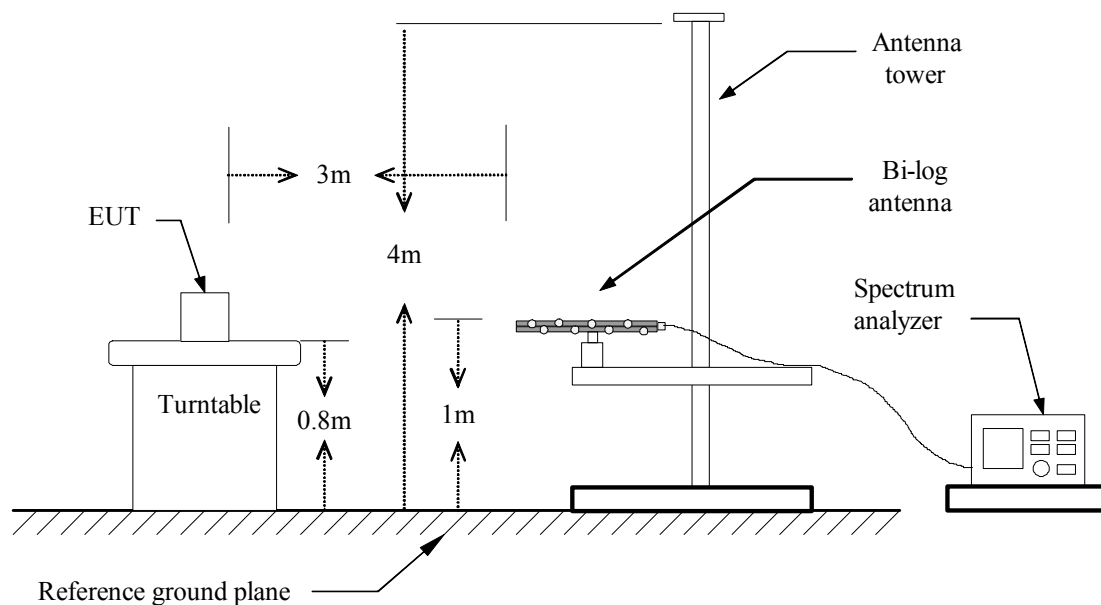
Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

2. In the emission table above, the tighter limit applies at the band edges.

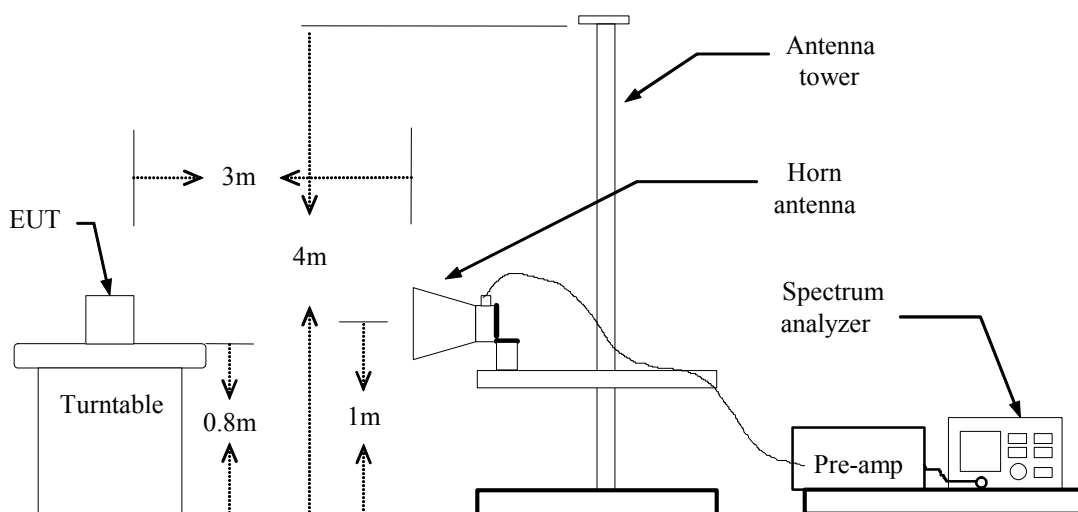
Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3-meter)	Field Strength (dB $\mu\text{V/m}$ at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

Below 1 GHz



Above 1 GHz





TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:
Below 1GHz:
RBW=100kHz / VBW=300kHz / Sweep=AUTO
Above 1GHz:
(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

**Below 1 GHz****Operation Mode:** Normal Link**Test Date:** November 21, 2009**Temperature:** 23°C**Tested by:** Mimic Yang**Humidity:** 53 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
54.25	V	41.46	-15.28	26.18	40.00	-13.82	Peak
89.82	V	47.76	-15.31	32.44	43.50	-11.06	Peak
296.75	V	35.26	-8.74	26.52	46.00	-19.48	Peak
351.72	V	33.13	-7.39	25.74	46.00	-20.26	Peak
405.07	V	32.31	-6.26	26.05	46.00	-19.95	Peak
647.57	V	31.36	-1.77	29.59	46.00	-16.41	Peak
89.82	H	34.87	-15.31	19.55	43.50	-23.95	Peak
105.98	H	29.66	-11.82	17.83	43.50	-25.67	Peak
131.85	H	26.86	-9.54	17.32	43.50	-26.18	Peak
296.75	H	29.35	-8.74	20.61	46.00	-25.39	Peak
409.92	H	25.89	-6.12	19.77	46.00	-26.23	Peak
448.72	H	25.47	-5.05	20.41	46.00	-25.59	Peak

Remark:

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
2. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

**Above 1 GHz****Operation Mode:** TX / GFSK / DH5 / CH Low**Test Date:** November 20, 2009**Temperature:** 25°C**Tested by:** Nan Tsai**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1330.00	V	54.70	---	-7.35	47.35	---	74.00	54.00	-6.65	Peak
1500.00	V	53.60	---	-7.03	46.57	---	74.00	54.00	-7.43	Peak
1663.33	V	52.56	---	-5.47	47.09	---	74.00	54.00	-6.91	Peak
1830.00	V	54.71	---	-3.88	50.83	---	74.00	54.00	-3.17	Peak
2333.33	V	53.01	---	-1.70	51.32	---	74.00	54.00	-2.68	Peak
2663.33	V	51.69	---	-1.10	50.60	---	74.00	54.00	-3.40	Peak
1496.67	H	53.39	---	-7.04	46.36	---	74.00	54.00	-7.64	Peak
1830.00	H	53.53	---	-3.88	49.65	---	74.00	54.00	-4.35	Peak
2030.00	H	51.36	---	-2.20	49.16	---	74.00	54.00	-4.84	Peak
2453.33	H	54.21	38.08	-1.50	52.71	36.58	74.00	54.00	-17.42	AVG
4808.33	H	55.22	49.83	1.04	56.26	50.87	74.00	54.00	-3.13	AVG
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Operation Mode:** TX / GFSK / DH5 / CH Mid**Test Date:** November 20, 2009**Temperature:** 25°C**Tested by:** Nan Tsai**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1333.33	V	53.49	---	-7.34	46.15	---	74.00	54.00	-7.85	Peak
1500.00	V	53.94	---	-7.03	46.91	---	74.00	54.00	-7.09	Peak
1830.00	V	53.71	---	-3.88	49.83	---	74.00	54.00	-4.17	Peak
2330.00	V	52.34	---	-1.70	50.64	---	74.00	54.00	-3.36	Peak
2663.33	V	52.34	---	-1.10	51.24	---	74.00	54.00	-2.76	Peak
4883.33	V	52.44	46.40	1.02	53.46	47.42	74.00	54.00	-6.58	AVG
1500.00	H	52.98	---	-7.03	45.95	---	74.00	54.00	-8.05	Peak
1830.00	H	53.91	---	-3.88	50.03	---	74.00	54.00	-3.97	Peak
4883.33	H	56.61	50.12	1.02	57.63	51.14	74.00	54.00	-2.86	AVG
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$.

**Operation Mode:** TX / GFSK / DH5 / CH High**Test Date:** November 20, 2009**Temperature:** 25°C**Tested by:** Nan Tsai**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1306.67	V	57.56	---	-7.39	50.17	---	74.00	54.00	-3.83	Peak
1830.00	V	53.83	---	-3.88	49.95	---	74.00	54.00	-4.05	Peak
2330.00	V	53.05	---	-1.70	51.35	---	74.00	54.00	-2.65	Peak
2460.00	V	58.78	38.92	-1.49	57.30	37.43	74.00	54.00	-16.57	AVG
4958.33	V	53.26	48.10	1.00	54.26	49.10	74.00	54.00	-4.90	AVG
N/A										
1500.00	H	52.69	---	-7.03	45.66	---	74.00	54.00	-8.34	Peak
1830.00	H	53.57	---	-3.88	49.69	---	74.00	54.00	-4.31	Peak
4958.33	H	54.78	48.86	1.00	55.78	49.86	74.00	54.00	-4.14	AVG
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$.

**Operation Mode:** TX / 8DPSK / DH5 / CH Low**Test Date:** November 20, 2009**Temperature:** 25°C**Tested by:** Nan Tsai**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1053.33	V	54.76	---	-7.86	46.90	---	74.00	54.00	-7.10	Peak
1663.33	V	52.44	---	-5.47	46.98	---	74.00	54.00	-7.02	Peak
1830.00	V	54.26	---	-3.88	50.39	---	74.00	54.00	-3.61	Peak
2273.33	V	51.86	---	-1.80	50.06	---	74.00	54.00	-3.94	Peak
2333.33	V	53.07	---	-1.70	51.37	---	74.00	54.00	-2.63	Peak
5208.33	V	49.48	---	1.23	50.71	---	74.00	54.00	-3.29	Peak
1830.00	H	53.58	---	-3.88	49.71	---	74.00	54.00	-4.29	Peak
2460.00	H	54.75	38.09	-1.49	53.27	36.60	74.00	54.00	-17.40	AVG
4833.33	H	48.68	---	1.03	49.72	---	74.00	54.00	-4.28	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$.

**Operation Mode:** TX / 8DPSK / DH5 / CH Mid**Test Date:** November 20, 2009**Temperature:** 25°C**Tested by:** Nan Tsai**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1663.33	V	54.20	---	-5.47	48.73	---	74.00	54.00	-5.27	Peak
1830.00	V	54.28	---	-3.88	50.41	---	74.00	54.00	-3.59	Peak
2333.33	V	53.01	---	-1.70	51.32	---	74.00	54.00	-2.68	Peak
2660.00	V	51.85	---	-1.10	50.75	---	74.00	54.00	-3.25	Peak
2763.33	V	51.54	---	-0.90	50.64	---	74.00	54.00	-3.36	Peak
5158.33	V	49.57	---	1.17	50.74	---	74.00	54.00	-3.26	Peak
1830.00	H	52.95	---	-3.88	49.07	---	74.00	54.00	-4.93	Peak
4883.33	H	49.05	---	1.02	50.07	---	74.00	54.00	-3.93	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$.

**Operation Mode:** TX / 8DPSK / DH5 / CH High**Test Date:** November 20, 2009**Temperature:** 25°C**Tested by:** Nan Tsai**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1330.00	V	54.04	---	-7.35	46.69	---	74.00	54.00	-7.31	Peak
1830.00	V	54.16	---	-3.88	50.28	---	74.00	54.00	-3.72	Peak
2333.33	V	52.84	---	-1.70	51.15	---	74.00	54.00	-2.85	Peak
2456.67	V	58.34	38.91	-1.49	56.85	37.42	74.00	54.00	-16.58	AVG
4950.00	V	49.17	---	1.00	50.17	---	74.00	54.00	-3.83	Peak
N/A										
1333.33	H	54.99	---	-7.34	47.65	---	74.00	54.00	-6.35	Peak
1830.00	H	53.78	---	-3.88	49.91	---	74.00	54.00	-4.09	Peak
2453.33	H	53.33	---	-1.50	51.84	---	74.00	54.00	-2.16	Peak
4741.67	H	49.95	---	1.06	51.01	---	74.00	54.00	-2.99	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$.



7.10 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

* Decreases with the logarithm of the frequency.

Test Configuration

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.



TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Test Data

Operation Mode: Normal Link

Test Date: November 15, 2009

Temperature: 22°C

Tested by: Lawrence Lee

Humidity: 45% RH

Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB)	QP Result (dBuV)	AV Result (dBuV)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.1800	32.00	21.70	0.10	32.10	21.80	64.49	54.49	-32.39	-32.69	L1
0.5400	27.94	19.94	0.06	28.00	20.00	56.00	46.00	-28.00	-26.00	L1
0.7000	17.34	7.64	0.06	17.40	7.70	56.00	46.00	-38.60	-38.30	L1
2.6350	13.04	3.34	0.06	13.10	3.40	56.00	46.00	-42.90	-42.60	L1
7.8850	15.31	6.41	0.09	15.40	6.50	60.00	50.00	-44.60	-43.50	L1
13.3800	20.24	10.74	0.26	20.50	11.00	60.00	50.00	-39.50	-39.00	L1
0.2000	52.20	39.80	0.10	52.30	39.90	63.61	53.61	-11.31	-13.71	L2
0.3000	42.11	27.71	0.09	42.20	27.80	60.24	50.24	-18.04	-22.44	L2
0.4050	34.61	22.81	0.09	34.70	22.90	57.75	47.75	-23.05	-24.85	L2
1.4950	30.12	12.42	0.08	30.20	12.50	56.00	46.00	-25.80	-33.50	L2
10.3650	27.56	17.26	0.14	27.70	17.40	60.00	50.00	-32.30	-32.60	L2
13.9500	36.70	24.80	0.20	36.90	25.00	60.00	50.00	-23.10	-25.00	L2

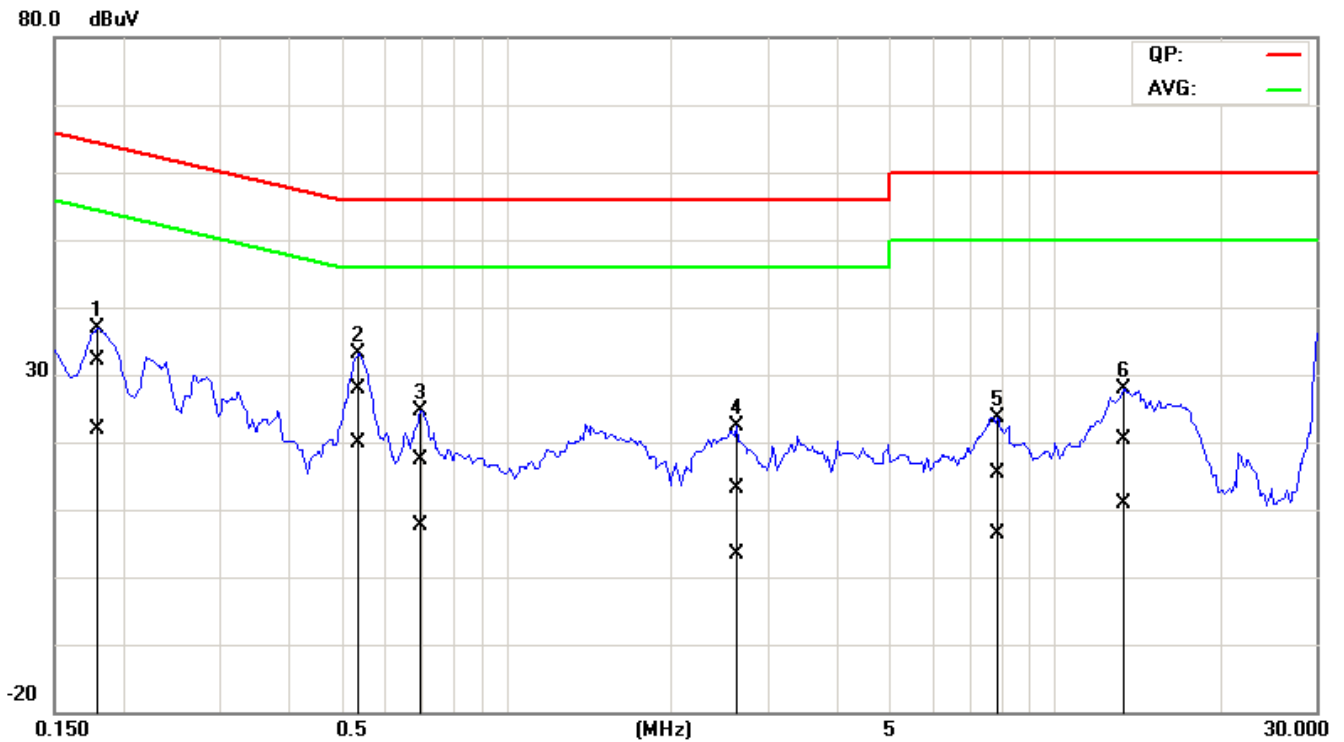
Remark:

1. Measuring frequencies from 0.15 MHz to 30MHz.
2. The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.
3. The IF bandwidth of SPA between 0.15MHz and 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz;
4. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)



Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)

