



FCC CFR47 PART 15 SUBPART C

Bluetooth

CERTIFICATION TEST REPORT

FOR

AIRWAY CLEARANCE SYSTEM

PRODUCT NAME: PMACS1NA

FCC ID: 2AJKO-PMACS1NA

REPORT NUMBER: 4787592605-E6V3

ISSUE DATE: JAN 06, 2017

Prepared for

**Hill-Rom Services Private Limited
1 Yishun Avenue 7, 768923, Singapore**

Prepared by

**UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16675, Korea
TEL: (031) 337-9902
FAX: (031) 213-5433**



Revision History

Rev.	Issue Date	Revisions	Revised By
V1	12/26/16	Initial issue	SungGil Park
V2	01/05/17	Addressed TCB's questions	SungGil Park
V3	01/06/17	Addressed TCB's questions	SungGil Park

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	5
1.1. INTRODUCTION OF TEST DATA REUSE	6
1.2. TEST DATA REUSE	6
1.3. TESTING PERFORMED	6
1.4. REFERENCE DETAIL	6
2. TEST METHODOLOGY	7
3. FACILITIES AND ACCREDITATION	7
4. CALIBRATION AND UNCERTAINTY	7
4.1. MEASURING INSTRUMENT CALIBRATION	7
4.2. SAMPLE CALCULATION	7
4.3. MEASUREMENT UNCERTAINTY	7
5. EQUIPMENT UNDER TEST	8
5.1. DESCRIPTION OF EUT	8
5.2. MAXIMUM OUTPUT POWER	8
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	8
5.4. WORST-CASE CONFIGURATION AND MODE	8
5.5. DESCRIPTION OF TEST SETUP	9
6. TEST AND MEASUREMENT EQUIPMENT	11
7. SUMMARY TABLE	12
8. ANTENNA PORT TEST RESULTS	13
8.1. 20 dB AND 99% BANDWIDTH	13
8.1.1. BASIC DATA RATE GFSK MODULATION	13
8.1.2. ENHANCED DATA RATE Pi/4-DQPSK MODULATION	13
8.1.3. ENHANCED DATA RATE 8PSK MODULATION	13
8.1.4. 20 dB AND 99% BANDWIDTH PLOTS	14
8.2. HOPPING FREQUENCY SEPARATION	17
8.3. NUMBER OF HOPPING CHANNELS	18
8.4. AVERAGE TIME OF OCCUPANCY	20
8.5. OUTPUT POWER	31
8.5.1. BASIC DATA RATE GFSK MODULATION	31
8.5.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION	31
8.5.3. ENHANCED DATA RATE 8PSK MODULATION	31
8.5.4. OUTPUT POWER PLOTS	32
8.6. AVERAGE POWER	35

8.6.1.	BASIC DATA RATE GFSK MODULATION.....	35
8.6.2.	DATA RATE PI/4-DQPSK MODULATION	35
8.6.3.	ENHANCED DATA RATE 8PSK MODULATION	35
8.7.	CONDUCTED SPURIOUS EMISSIONS.....	36
8.7.1.	BASIC DATA RATE GFSK MODULATION.....	37
9.	RADIATED TEST RESULTS	49
9.1.	LIMITS AND PROCEDURE	49
9.2.	TRANSMITTER ABOVE 1 GHz	51
9.2.1.	BASIC DATA RATE GFSK MODULATION.....	51
9.2.2.	ENHANCED DATA RATE 8PSK MODULATION	61
9.3.	WORST-CASE BELOW 1 GHz	71
10.	AC POWER LINE CONDUCTED EMISSIONS	73
11.	SETUP PHOTOS	78

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Hill-Rom Services Private Limited
EUT DESCRIPTION: Airway Clearance System
PRODUCT NAME: PMACS1NA
SERIAL NUMBER: PREDVM0036 (RADIATED & CONDUCTED)
DATE TESTED: OCT 07, 2016 - JAN 04, 2017

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:



CY Choi
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:



SungGil Park
Suwon Lab Engineer
UL Korea, Ltd.

1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: 2AJKO-PMACS1WI, BT(CFR 47 Part 15 Subpart C). And the applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID.

1.2. TEST DATA REUSE

The FCC ID: 2AJKO-PMACS1NA shares the same enclosure and circuit board as FCC ID: 2AJKO-PMACS1WI. The re-used circuitry and layout are identical between these two units. (BT/BLE module is the same between 2AJKO-PMACS1NA and 2AJKO-PMACS1WI) The only difference between the 2AJKO-PMACS1WI and the 2AJKO-PMACS1NA is that WiFi module is removed.

1.3. TESTING PERFORMED

Testing performed under this test report (4787592605-E6) are AC power line conducted emissions and radiated emissions. All other data is referenced to 4787592605-E3. (FCC ID : 2AJKO-PMACS1WI)

1.4. REFERENCE DETAIL

Reference application that contains the reused reference data.

Equipment Class	Reference FCC ID	Type Grant/Permissive Change	Reference Application	Folder Test/RF Exposure	Report Title / Section
DSS(BT)	2AJKO-PMACS1WI	Grant(New)	AN16T0686	Test	4787592605-E3, Section 8 (Antenna Port results)

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro	
☒	Chamber 1
☐	Chamber 2

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <http://www.iasonline.org/PDF/TL/TL-637.pdf>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.32 dB
Radiated Disturbance, Below 1GHz	4.14 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Airway Clearance System with BT/BLE features.
This test report addresses the DSS (BT) operational mode.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range [MHz]	Mode	Power Mode	Output Power [dBm]	Output Power [mW]
2402 - 2480	Basic GFSK	Average	7.998	6.307
		Peak	8.255	6.691
	Enhanced Pi/4-DPSK	Average	5.155	3.277
		Peak	7.093	5.120
	Enhanced 8PSK	Average	5.176	3.293
		Peak	7.464	5.577

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an Chip antenna, with a maximum gain of 0.5 dBi.

5.4. WORST-CASE CONFIGURATION AND MODE

Radiated emission below 1GHz and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Radiated emission above 1GHz was performed with the EUT set to transmit low/mid/high channels.

The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

Note: GFSK, Pi/4-DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on this mode to showing compliance. For average power data please refer to section 8.6.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Adapter	SHENZHEN MEGMEET ELECTRICAL CO., LTD	MANGO120-24CK	8801631000045	N/A

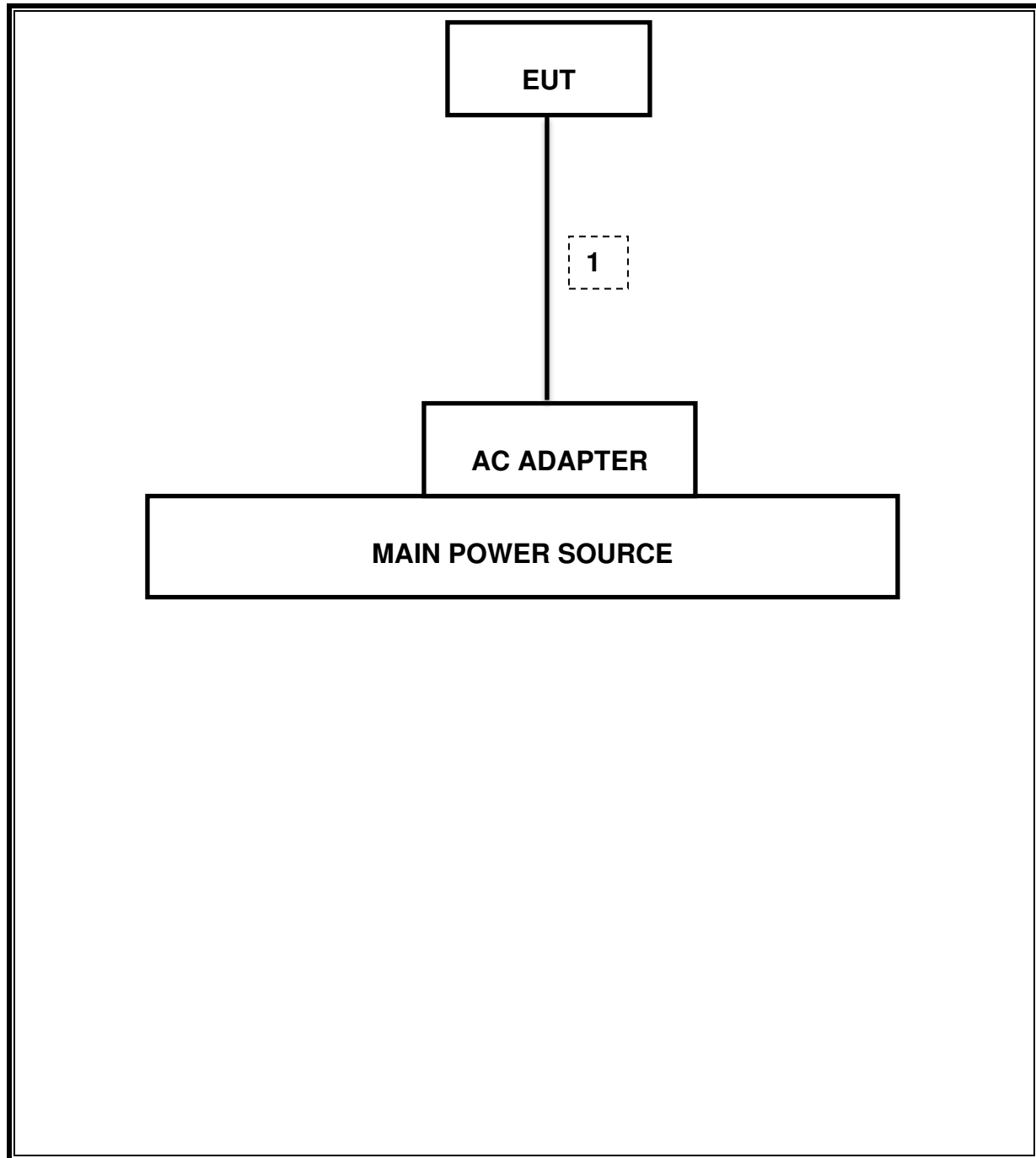
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	Mini-DIN	Shielded	1.2m	N/A

TEST SETUP

The EUT is a stand-alone unit during the tests.
Test software exercised the EUT to enable BT mode.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	Manufacturer	Model	S/N	Cal Due
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	04-25-17
Antenna, Horn, 18 GHz	ETS	3115	00161451	05-17-17
Antenna, Horn, 18 GHz	ETS	3117	00168724	06-17-17
Antenna, Horn, 18 GHz	ETS	3117	00168717	06-17-17
Antenna, Horn, 40 GHz	ETS	3116C	00166155	11-30-17
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	12-15-17
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-17-17
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-16-17
Preamplifier	ETS	3115-PA	00167475	08-17-17
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-16-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-17-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-16-17
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	08-18-17
Average Power Sensor	R&S	NRZ-Z91	102681	08-16-17
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-17-17
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-17-17
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-16-17
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-16-17
Attenuator / Switch driver	HP	11713A	3748A04272	N/A
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-17-17
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-16-17
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-17-17
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-16-17
High Pass Filter 6GHz	Micro-Tronics	HPM17542	009	08-17-17
High Pass Filter 6GHz	Micro-Tronics	HPM17542	016	08-16-17
LISN	R&S	ENV-216	101836	08-16-17
LISN	R&S	ENV-216	101837	08-16-17
Attenuator	PASTERNAK	PE7087-10	A009	08-16-17
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	11-25-17

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result	Worst Case
2.1049	Occupied Band width (99%)	N/A	Conducted	Pass	1.163 MHz
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-38.41 dBm
15.247 (b)(1)	TX conducted output power	<21dBm		Pass	8.255 dBm (Peak)
15.247 (a)(1)	Hopping frequency separation	> 25KHz		Pass	1 MHz
15.247 (a)(1)(iii)	Number of Hopping channels	More than 15 non-overlapping channels		Pass	79
15.247 (a)(1)(iii)	Avg Time of Occupancy	< 0.4sec		Pass	0.31823 sec
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	48.48 dBuV (Qp)
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass	45.2 dBuV/m (Av)

8. ANTENNA PORT TEST RESULTS

8.1. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

DA 00-705: The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to $\geq$ RBW. The sweep time is coupled.

RESULTS

8.1.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [kHz]	99% Bandwidth [KHz]
Low	2402	905.900	860.200
Mid	2441	885.900	862.600
High	2480	888.200	861.130
Worst		905.900	862.600

8.1.2. ENHANCED DATA RATE Pi/4-DQPSK MODULATION

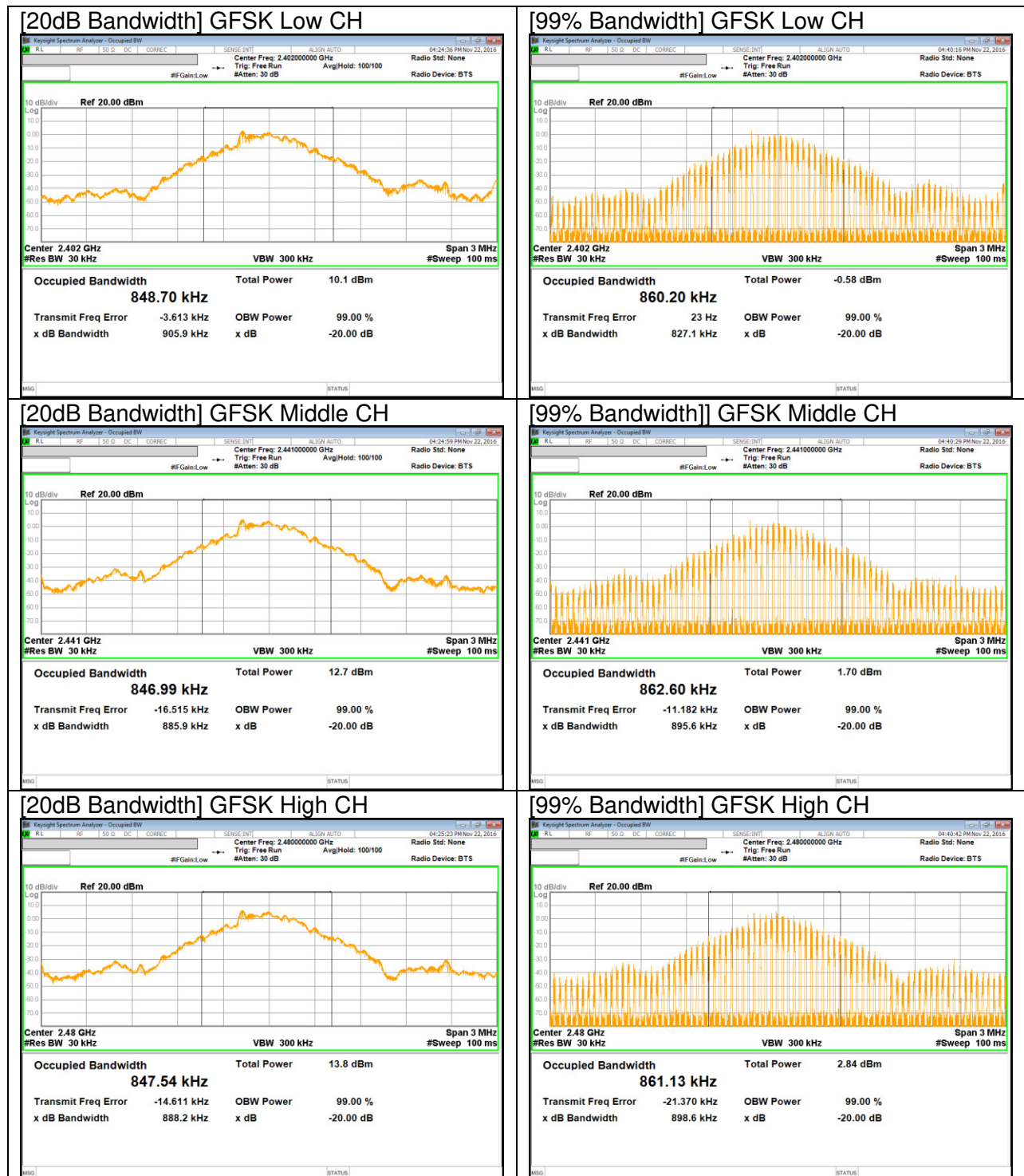
Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.256	1.161
Mid	2441	1.228	1.161
High	2480	1.230	1.162
Worst		1.256	1.162

8.1.3. ENHANCED DATA RATE 8PSK MODULATION

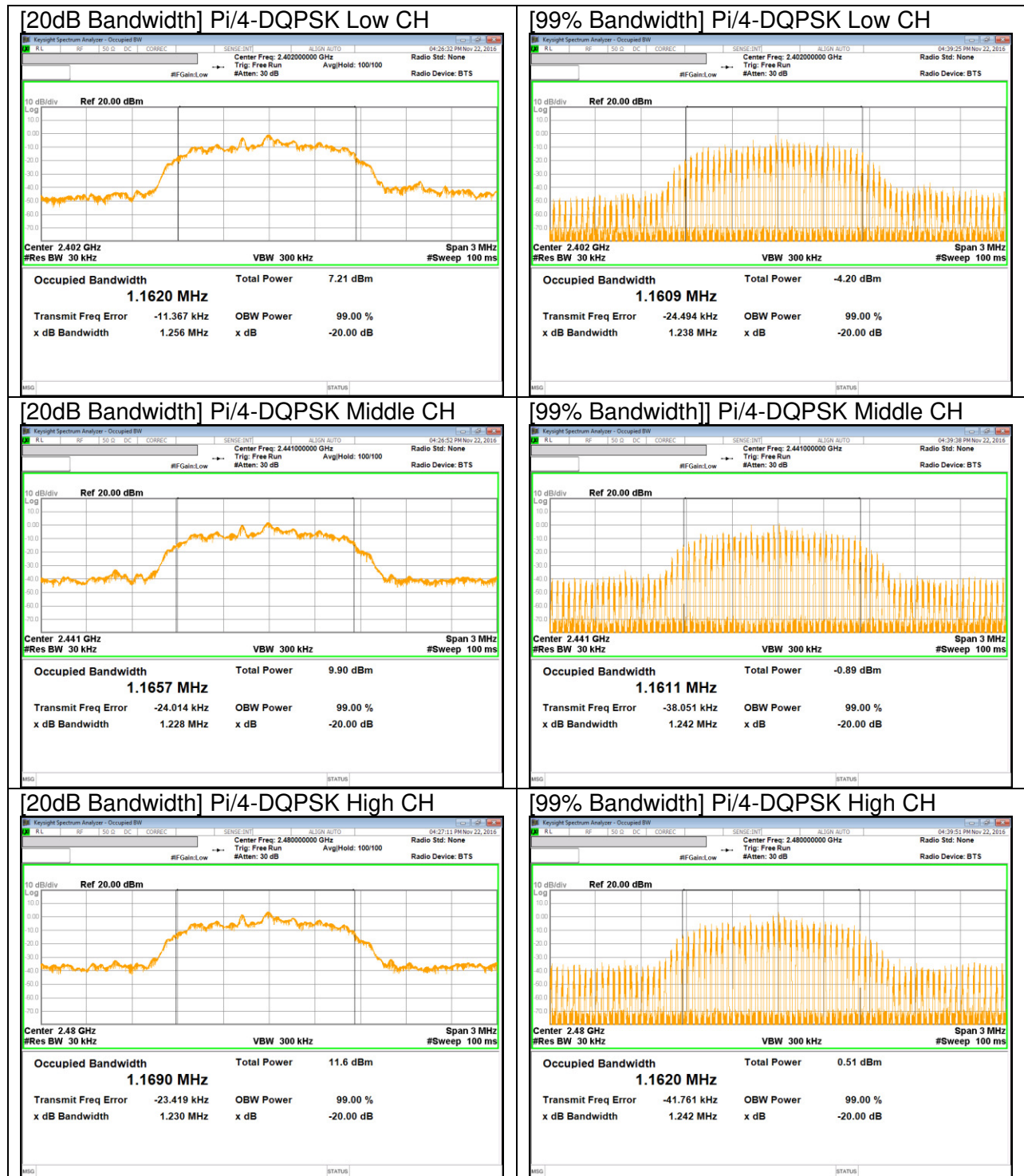
Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.218	1.163
Mid	2441	1.236	1.160
High	2480	1.236	1.161
Worst		1.236	1.163

8.1.4. 20 dB AND 99% BANDWIDTH PLOTS

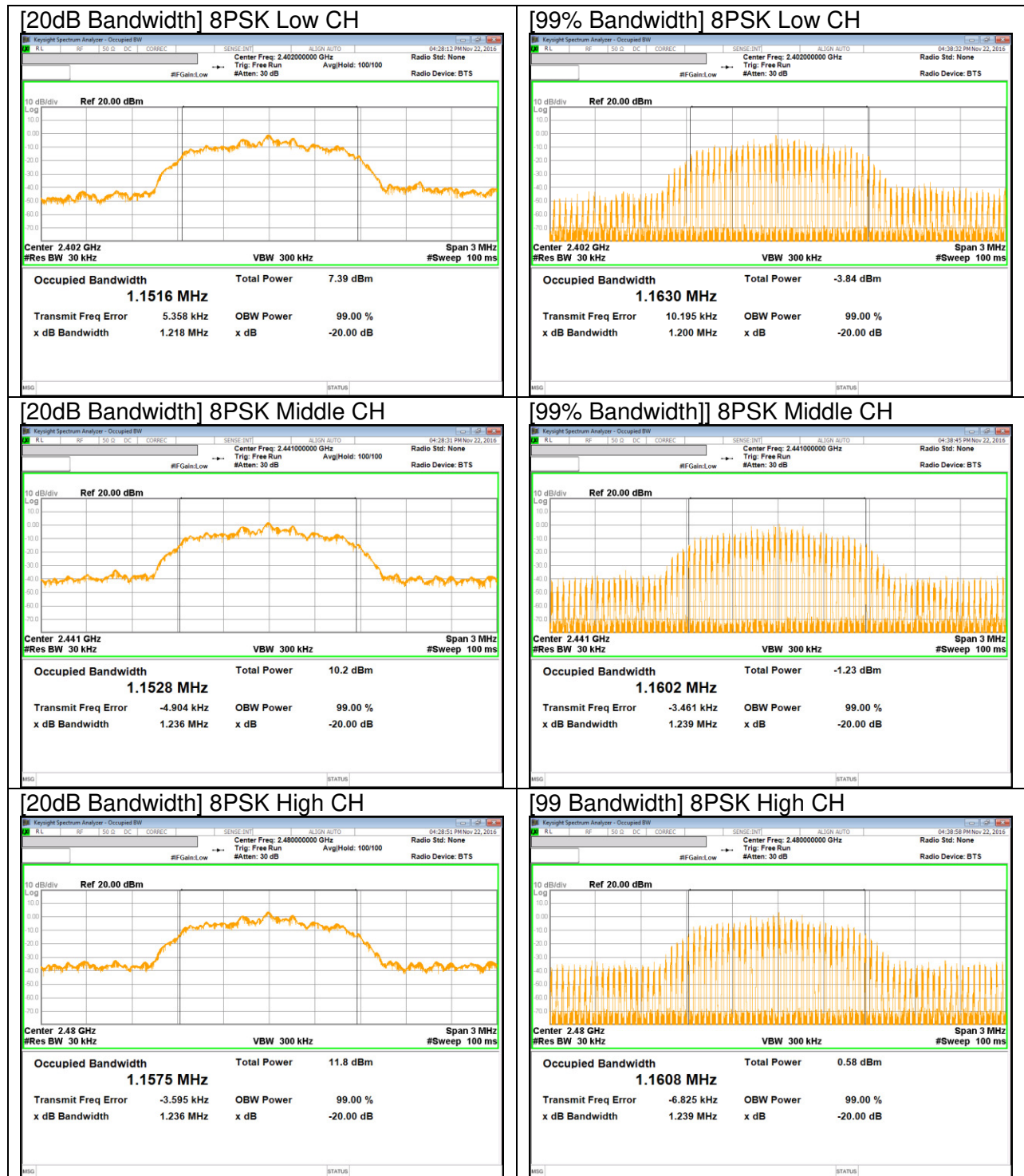
GFSK BANDWIDTH



Pi/4-DQPSK BANDWIDTH



8PSK BANDWIDTH



8.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §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.

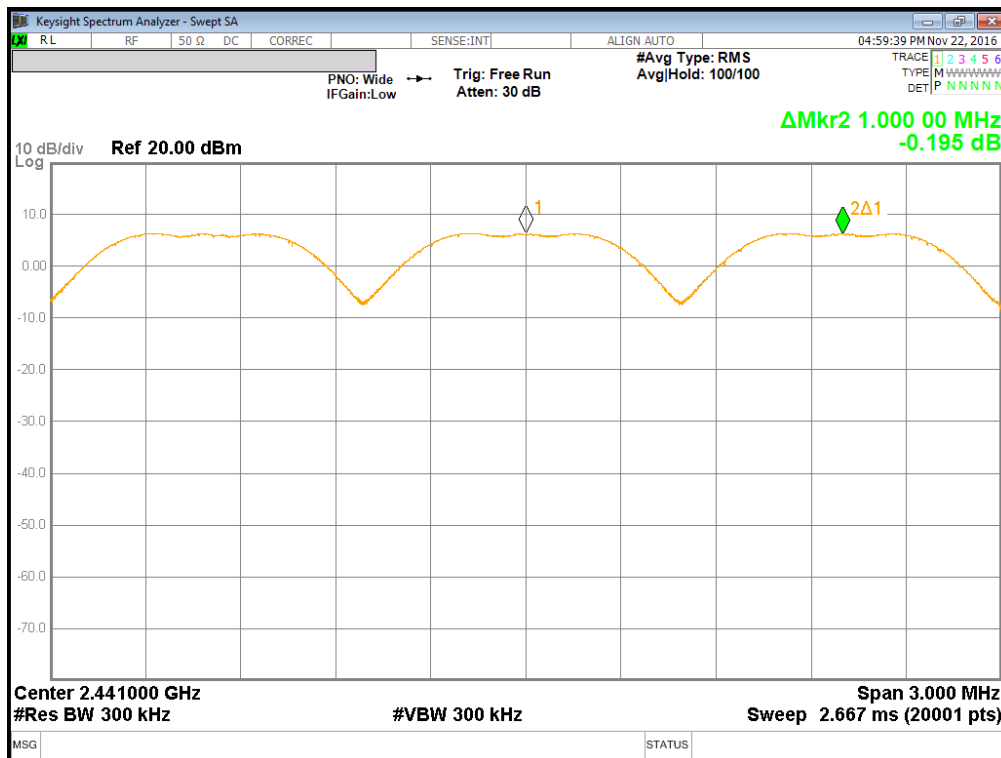
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

DA 00-705: The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION PLOT





8.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to $10 * (\# \text{ of pulses in } 0.8 \text{ s}) * \text{pulse width}$.

RESULTS

- GFSK

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK Normal					
DH1	0.377	32	0.120480	0.4	-0.2795
DH3	1.632	16	0.261120	0.4	-0.1389
DH5	2.879	11	0.316690	0.4	-0.0833
GFSK AFH					
DH Packet	Pulse Width [msec]	Number of Pulses in 0.8 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK AFH					
DH1	0.377	8	0.030120	0.4	-0.36988
DH3	1.632	4	0.065280	0.4	-0.33472
DH5	2.879	2.75	0.079173	0.4	-0.32083

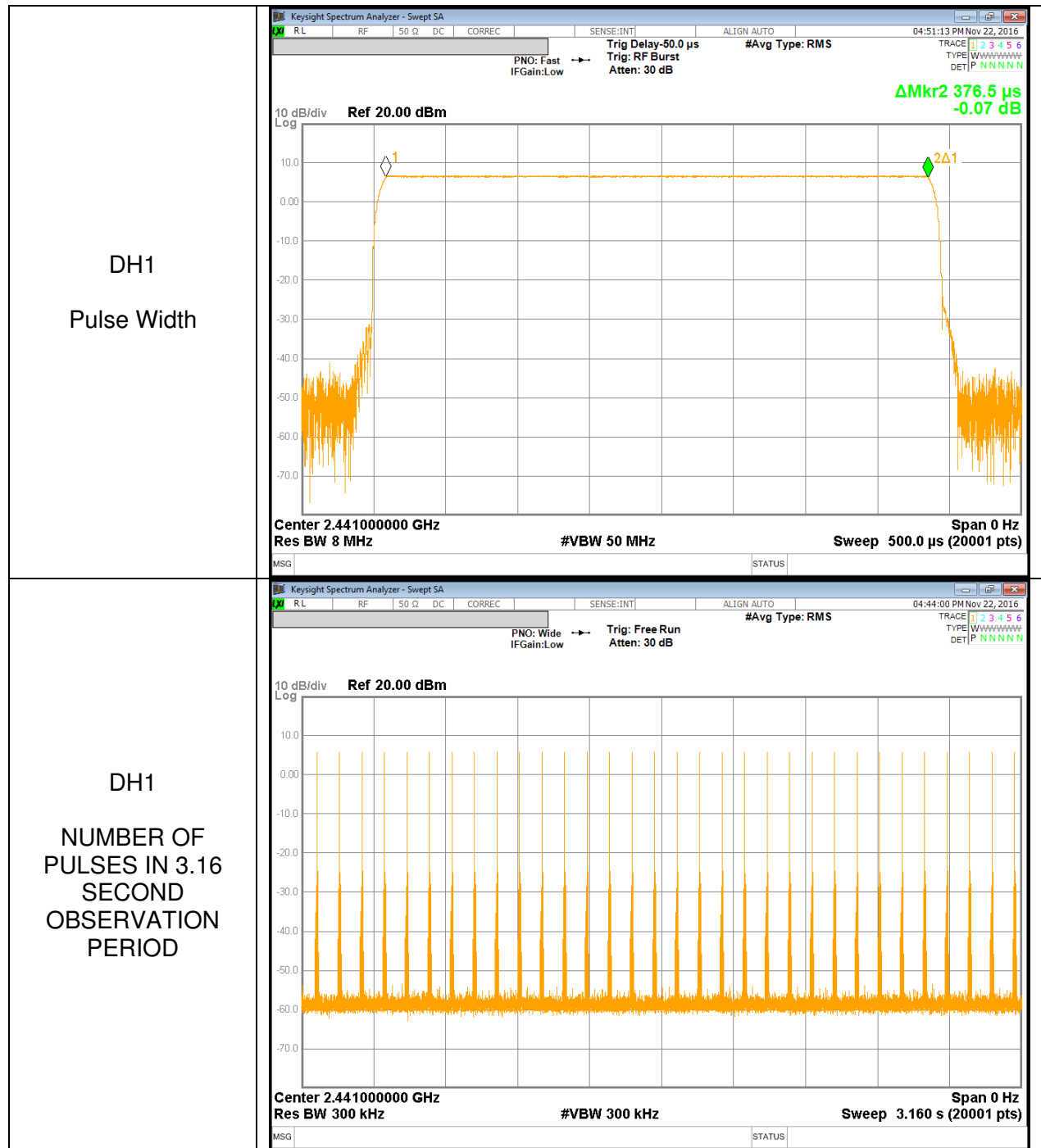
- Pi/4-DQPSK

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
Pi/4-DPSK Normal					
DH1	0.392	32	0.125440	0.4	-0.2746
DH3	1.644	16	0.263040	0.4	-0.1370
DH5	2.886	11	0.317460	0.4	-0.0825
DH Packet	Pulse Width [msec]	Number of Pulses in 0.8 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
Pi/4-DPSK AFH					
DH1	0.392	8	0.031360	0.4	-0.36864
DH3	1.644	4	0.065760	0.4	-0.33424
DH5	2.886	2.75	0.079365	0.4	-0.32064

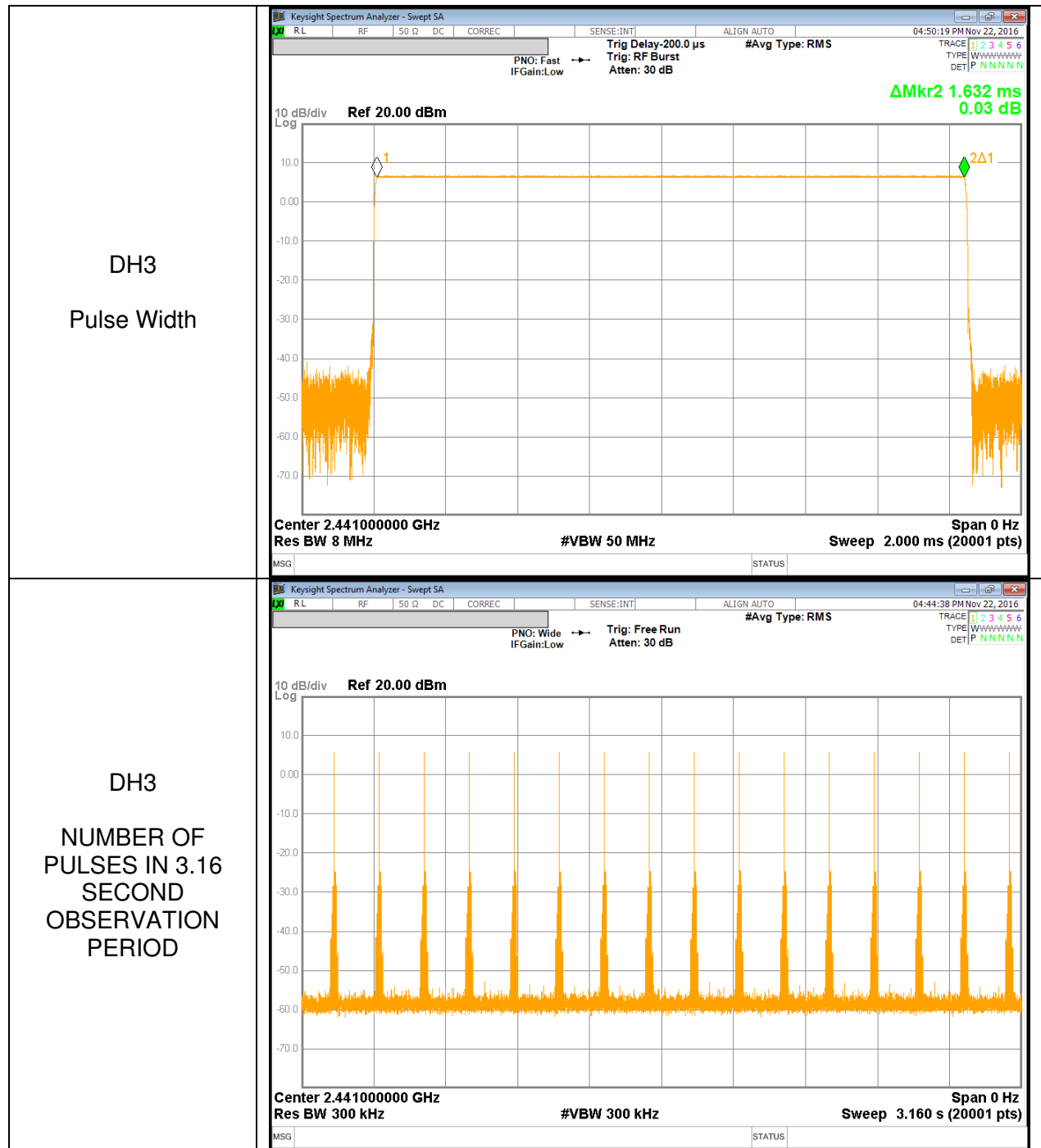
- 8PSK

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
8PSK Normal					
DH1	0.392	32	0.125440	0.4	-0.2746
DH3	1.642	16	0.262720	0.4	-0.1373
DH5	2.893	11	0.318230	0.4	-0.0818
DH Packet	Pulse Width [msec]	Number of Pulses in 0.8 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
8PSK AFH					
DH1	0.392	8	0.031360	0.4	-0.36864
DH3	1.642	4	0.065680	0.4	-0.33432
DH5	2.893	2.75	0.079558	0.4	-0.32044

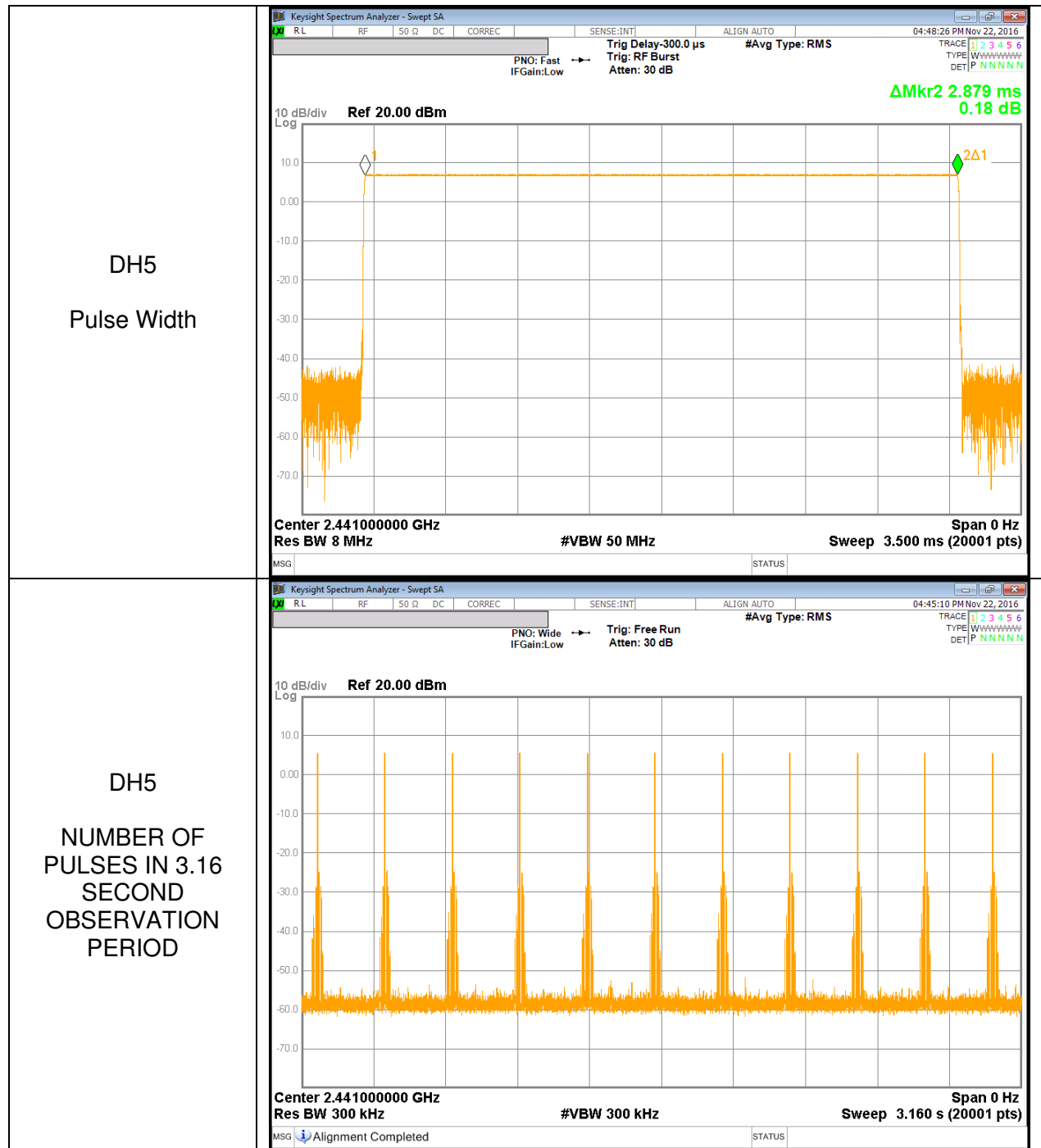
GFSK DH1



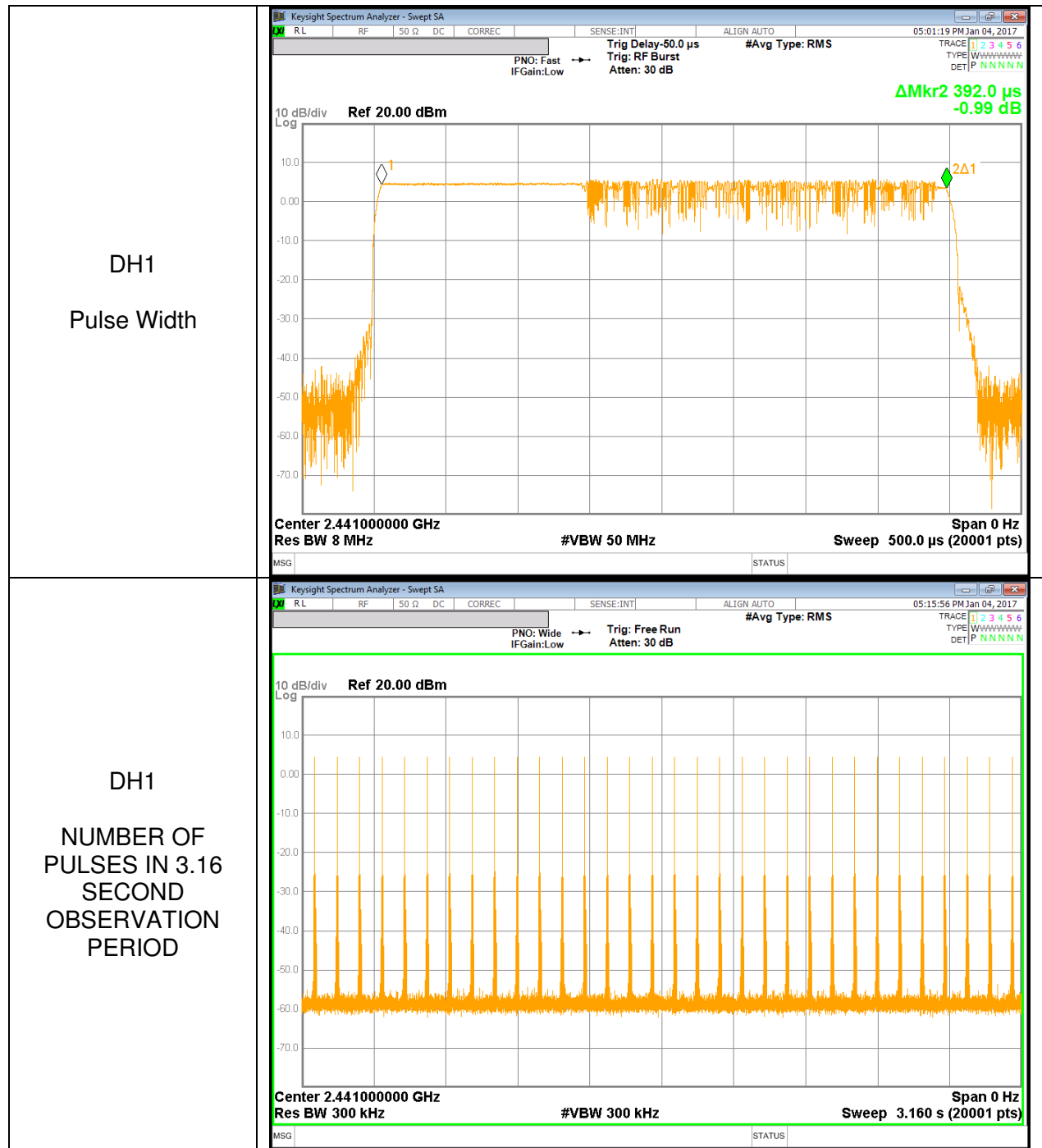
GFSK DH3



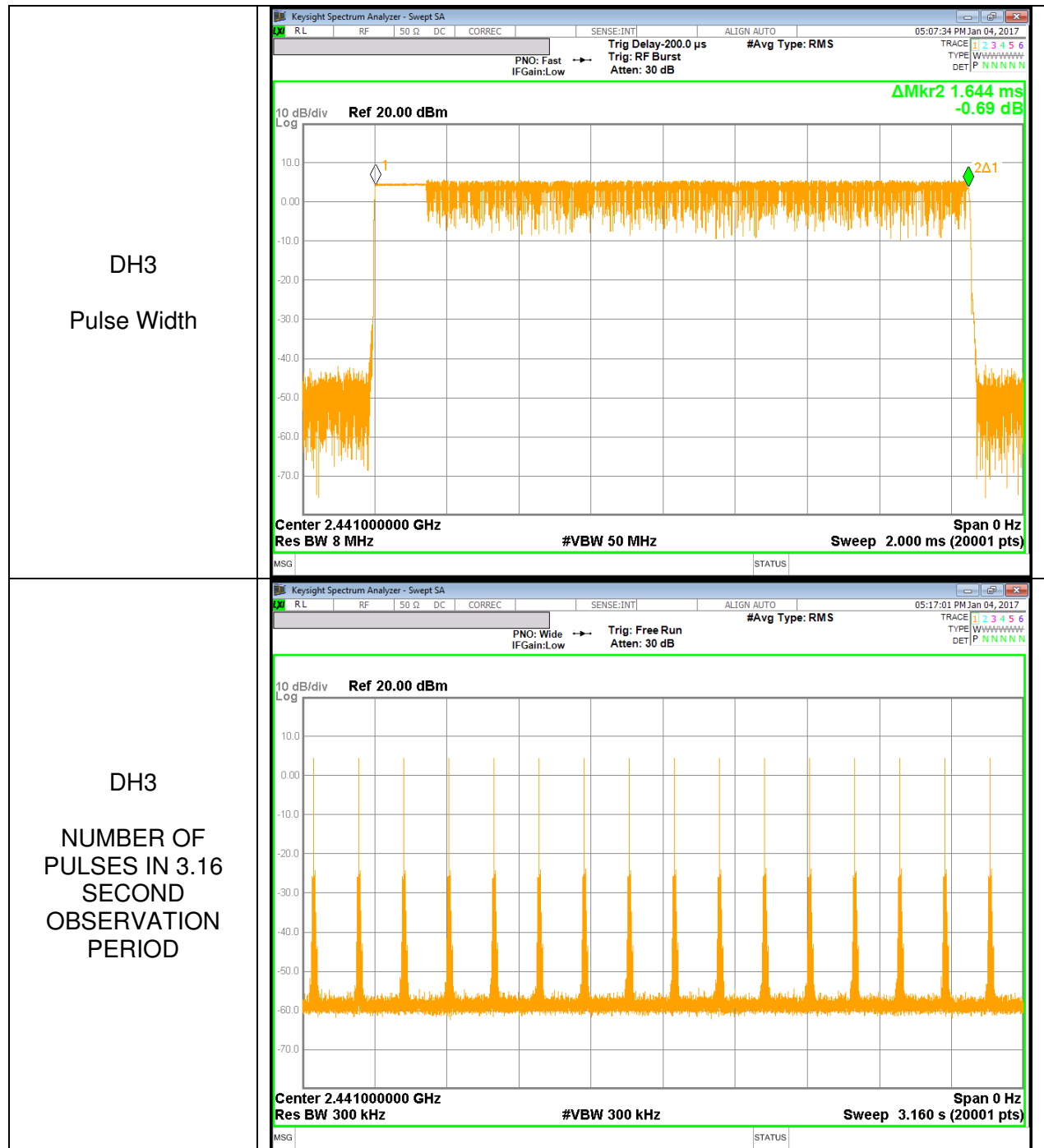
GFSK DH5



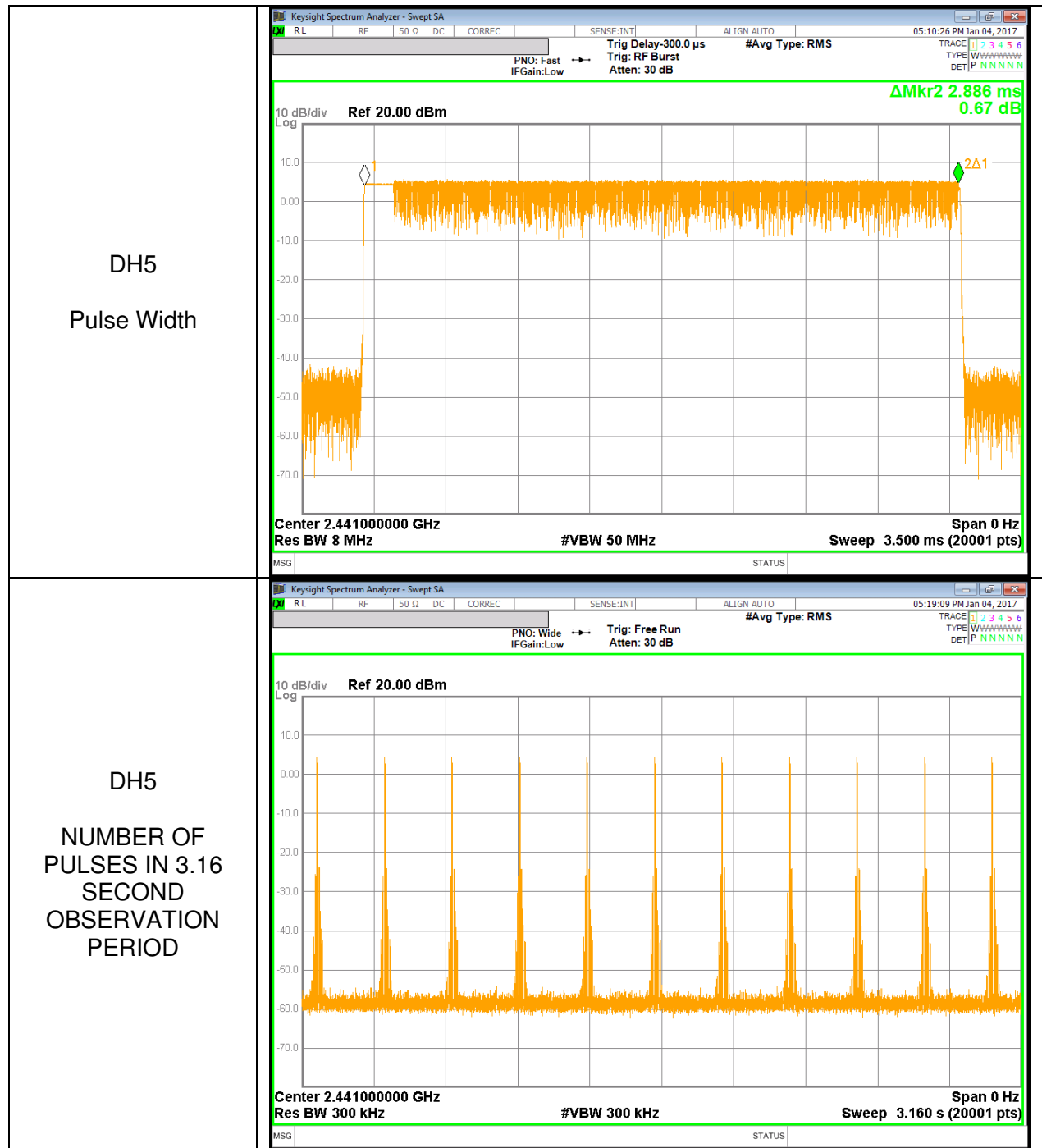
Pi/4-DPSK DH1



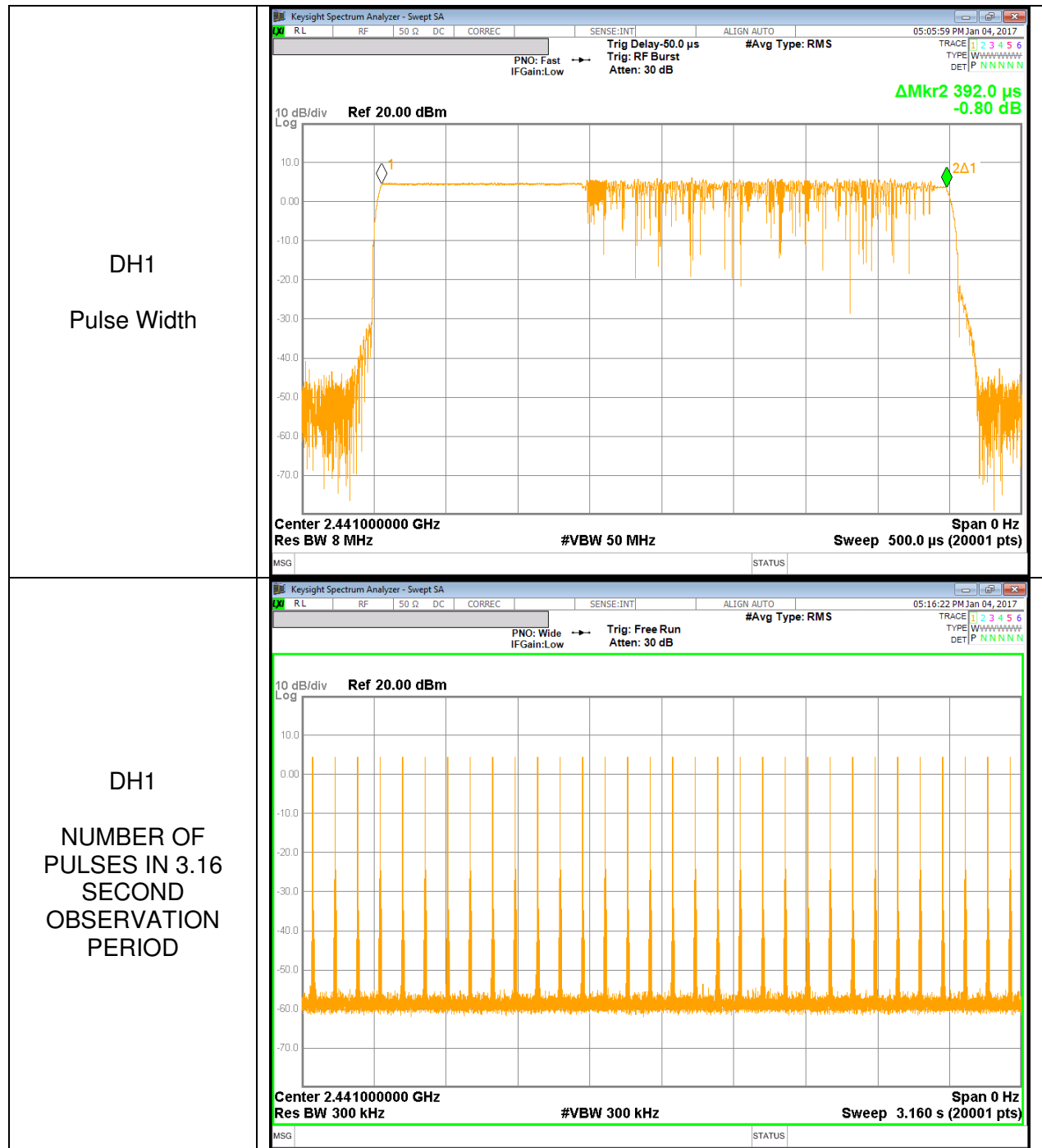
Pi/4-DPSK DH3



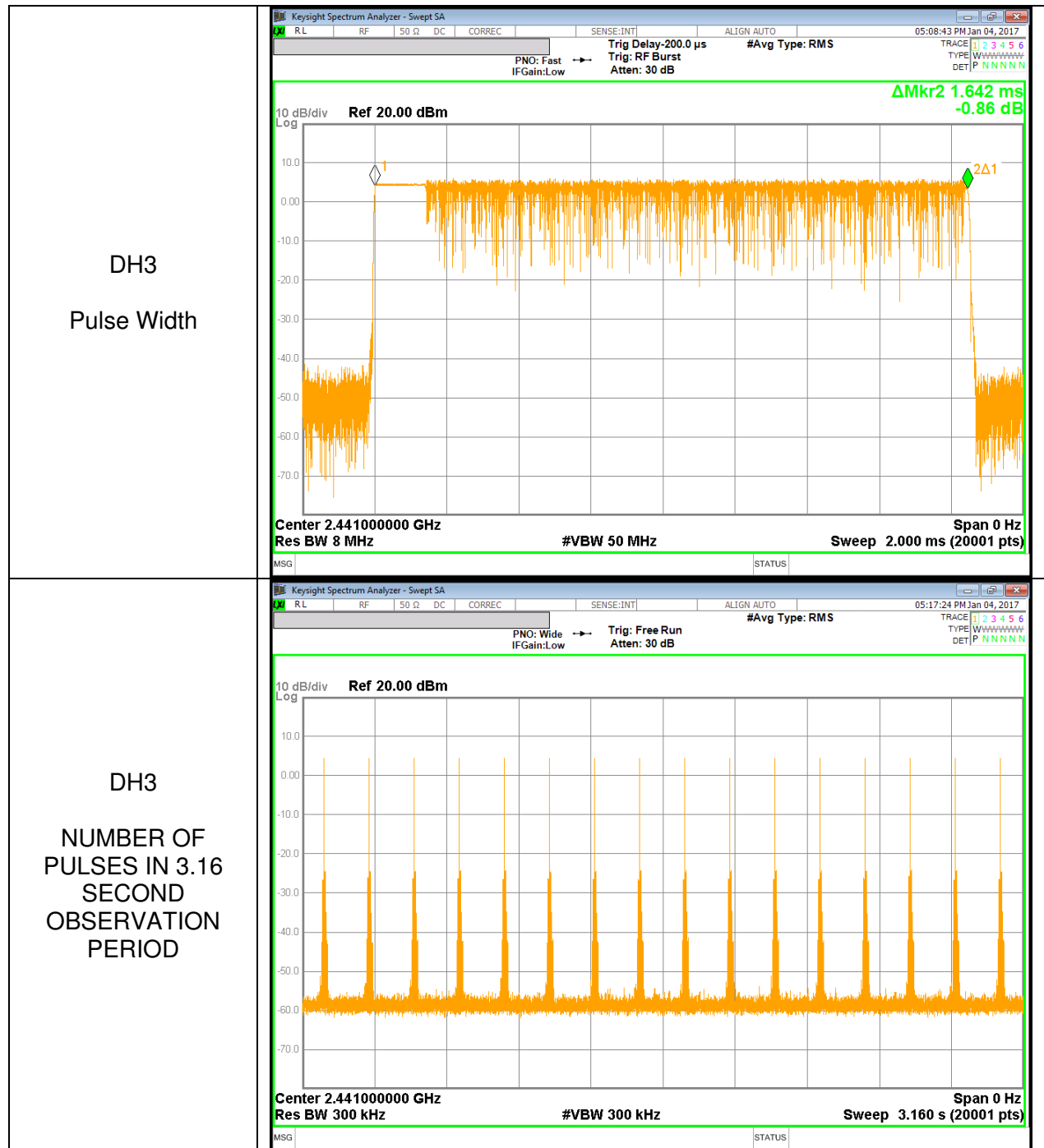
Pi/4-DPSK DH5



8PSK DH1



8PSK DH3



8.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

The maximum antenna gain is less than 6 dBi, therefore the limit is 21 dBm.

TEST PROCEDURE

DA 00-705: The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

8.5.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	5.083	21	-15.917
Middle	2441	7.343	21	-13.657
High	2480	8.255	21	-12.745
Worst		8.255	21	-12.745

8.5.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

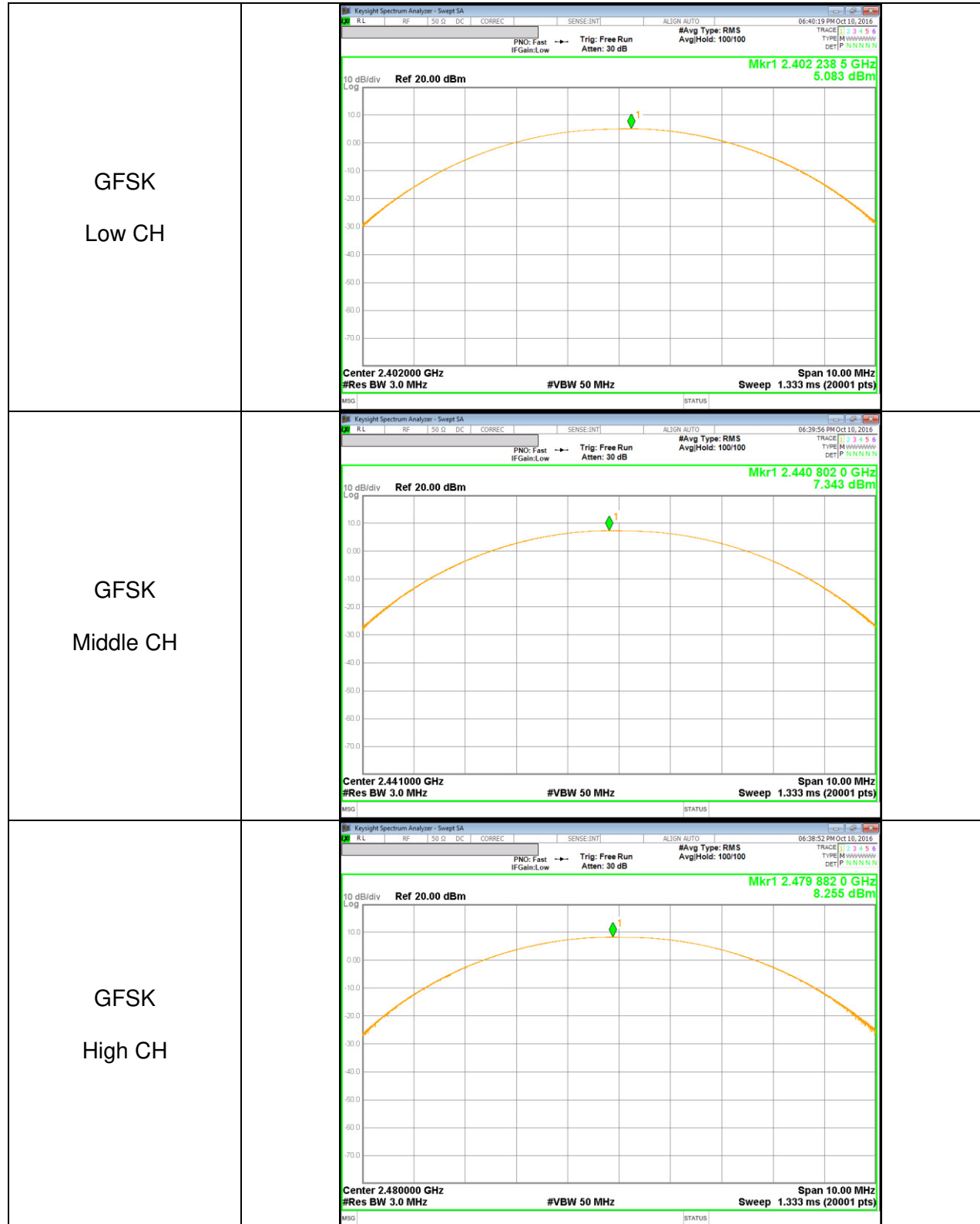
Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	3.202	21	-17.798
Middle	2441	5.911	21	-15.089
High	2480	7.093	21	-13.907
Worst		7.093	21	-13.907

8.5.3. ENHANCED DATA RATE 8PSK MODULATION

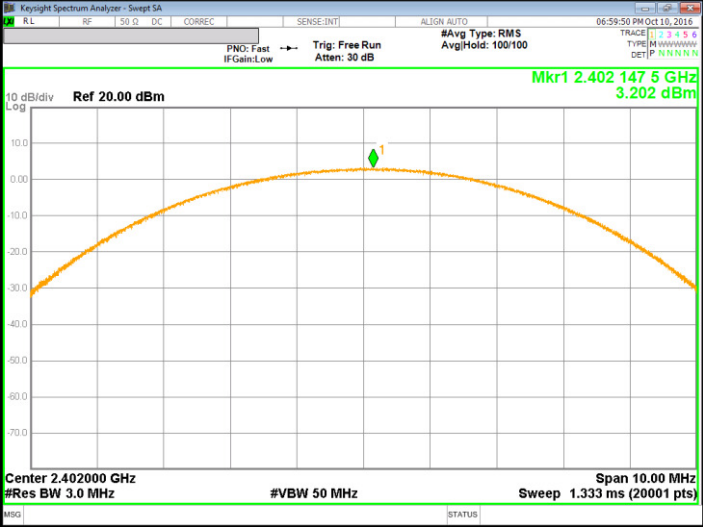
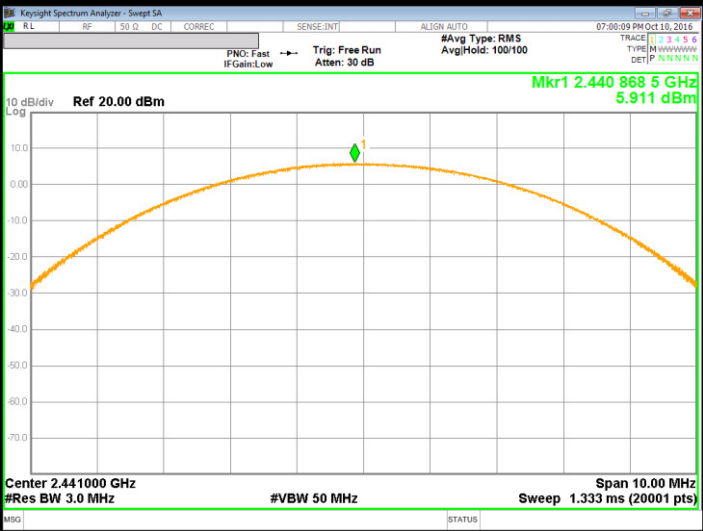
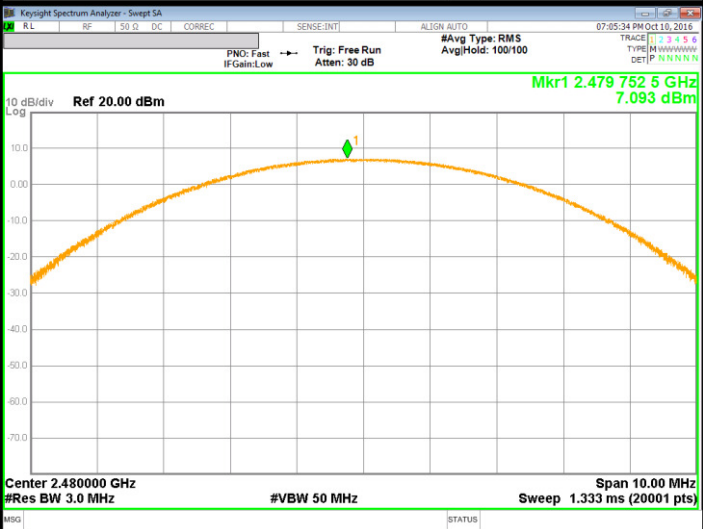
Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	3.613	21	-17.387
Middle	2441	6.177	21	-14.823
High	2480	7.464	21	-13.536
Worst		7.464	21	-13.536

8.5.4. OUTPUT POWER PLOTS

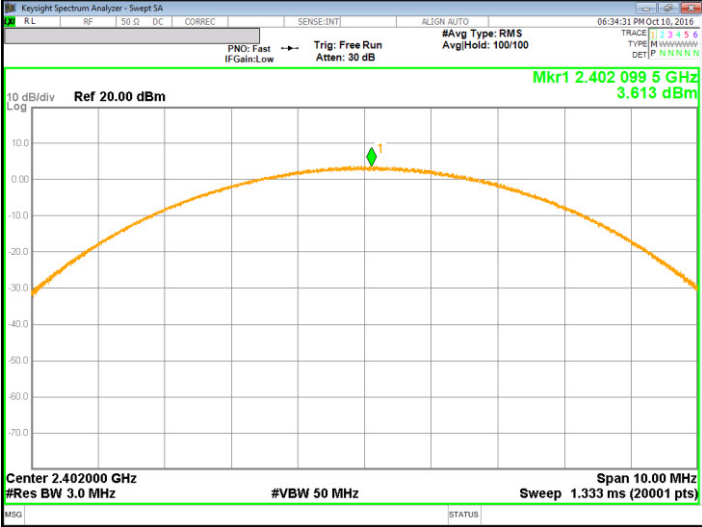
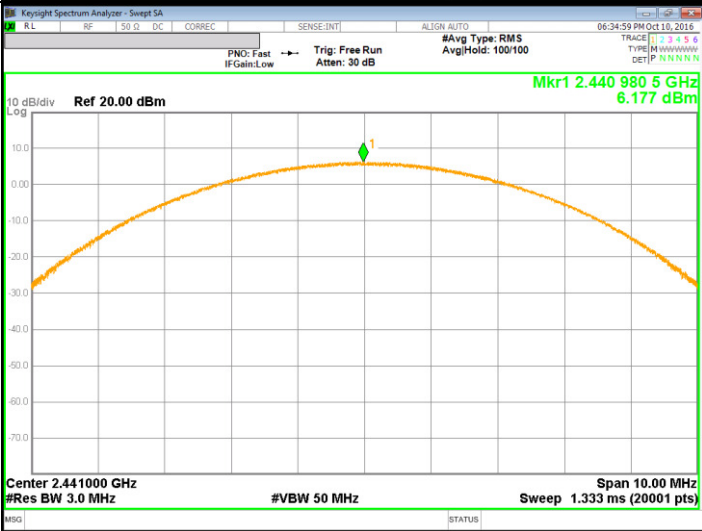
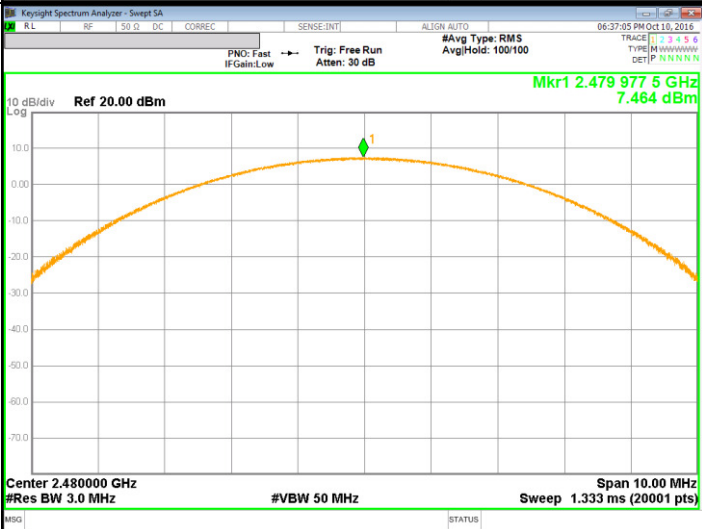
GFSK OUTPUT POWER



Pi/4-DPSK OUTPUT POWER

Pi/4-DPSK Low CH	 KeySight Spectrum Analyzer - Swept SA #Avg Type: RMS AvgHold: 100/100 Trig: Free Run Atten: 30 dB PNO: Fast IF Gain: Low Mkr1 2.402 147 5 GHz 3.202 dBm Ref 20.00 dBm Center 2.402000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 10.00 MHz Sweep 1.333 ms (20001 pts)
Pi/4-DPSK Middle CH	 KeySight Spectrum Analyzer - Swept SA #Avg Type: RMS AvgHold: 100/100 Trig: Free Run Atten: 30 dB PNO: Fast IF Gain: Low Mkr1 2.440 868 5 GHz 5.911 dBm Ref 20.00 dBm Center 2.441000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 10.00 MHz Sweep 1.333 ms (20001 pts)
Pi/4-DPSK High CH	 KeySight Spectrum Analyzer - Swept SA #Avg Type: RMS AvgHold: 100/100 Trig: Free Run Atten: 30 dB PNO: Fast IF Gain: Low Mkr1 2.479 752 5 GHz 7.093 dBm Ref 20.00 dBm Center 2.480000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 10.00 MHz Sweep 1.333 ms (20001 pts)

8PSK OUTPUT POWER

8PSK Low CH	 KeySight Spectrum Analyzer - Swept SA RL RF 50 Ω DC CORREC SENSE:INT ALIGN: AUTO 06:34:31 PM Oct 10, 2016 PNO: Fast Trig: Free Run #Avg Type: RMS AvgHold: 100/100 IF Gain: Low Atten: 30 dB Mkr1 2.402 099 5 GHz 3.613 dBm 10 dB/div Log Ref 20.00 dBm Center 2.402000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 10.00 MHz Sweep 1.333 ms (20001 pts) MSG STATUS
8PSK Middle CH	 KeySight Spectrum Analyzer - Swept SA RL RF 50 Ω DC CORREC SENSE:INT ALIGN: AUTO 06:34:59 PM Oct 10, 2016 PNO: Fast Trig: Free Run #Avg Type: RMS AvgHold: 100/100 IF Gain: Low Atten: 30 dB Mkr1 2.440 980 5 GHz 6.177 dBm 10 dB/div Log Ref 20.00 dBm Center 2.441000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 10.00 MHz Sweep 1.333 ms (20001 pts) MSG STATUS
8PSK High CH	 KeySight Spectrum Analyzer - Swept SA RL RF 50 Ω DC CORREC SENSE:INT ALIGN: AUTO 06:37:05 PM Oct 10, 2016 PNO: Fast Trig: Free Run #Avg Type: RMS AvgHold: 100/100 IF Gain: Low Atten: 30 dB Mkr1 2.479 977 5 GHz 7.464 dBm 10 dB/div Log Ref 20.00 dBm Center 2.480000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 10.00 MHz Sweep 1.333 ms (20001 pts) MSG STATUS

8.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

DA 00-705: The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.1 dB (including 10 dB pad and 0.1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

8.6.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	4.652	2.92
Middle	2441	7.003	5.01
High	2480	7.998	6.31

8.6.2. DATA RATE PI/4-DQPSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	0.910	1.23
Middle	2441	3.789	2.39
High	2480	5.155	3.28

8.6.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	0.920	1.24
Middle	2441	3.823	2.41
High	2480	5.176	3.29

8.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

Limit = -20 dBc

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

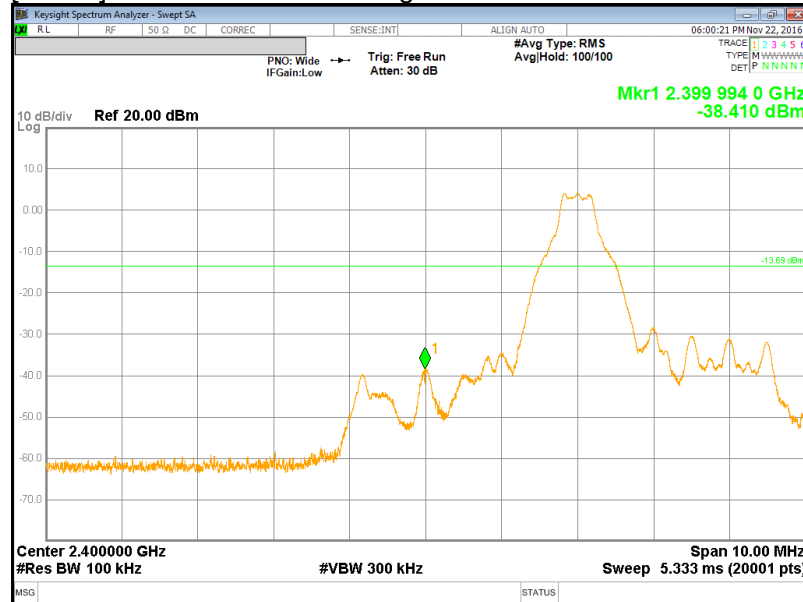
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

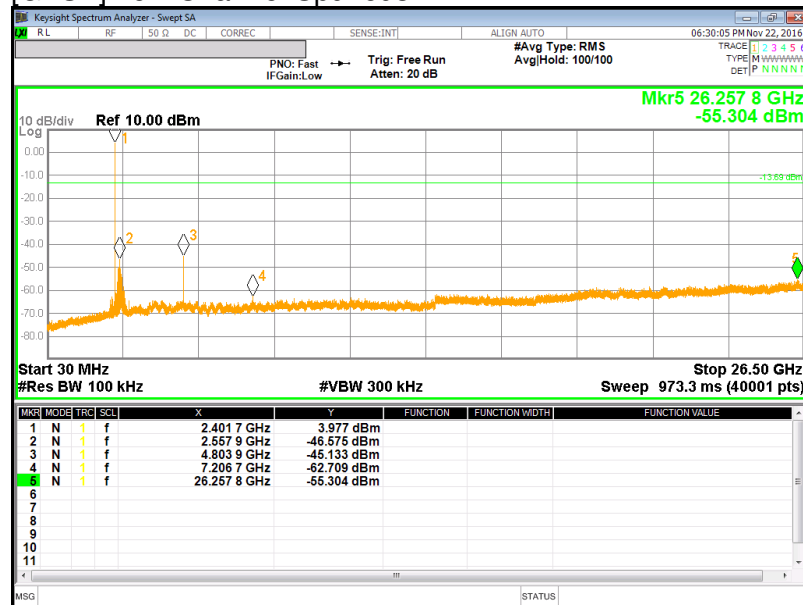
8.7.1. BASIC DATA RATE GFSK MODULATION

GFSK Mode

[GFSK] Low Channel BandEdge



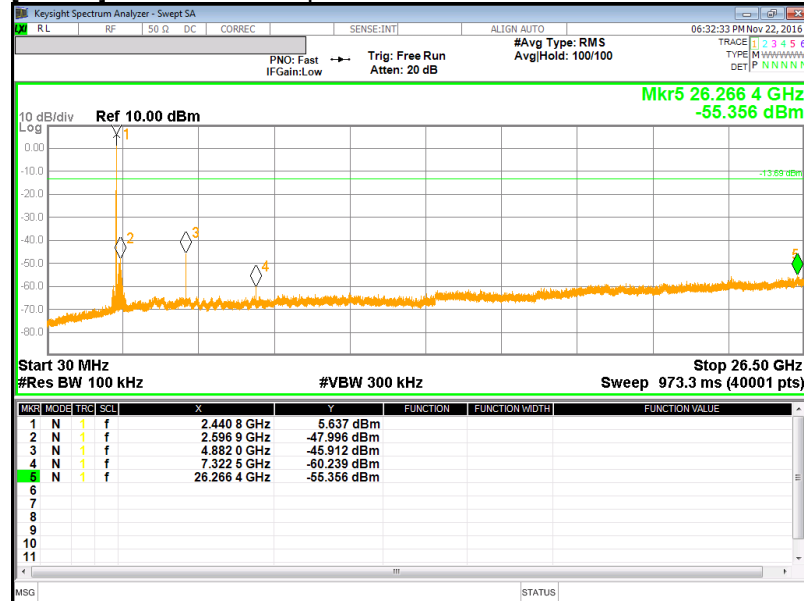
[GFSK] Low Channel Spurious



[GFSK] Mid Channel BandEdge



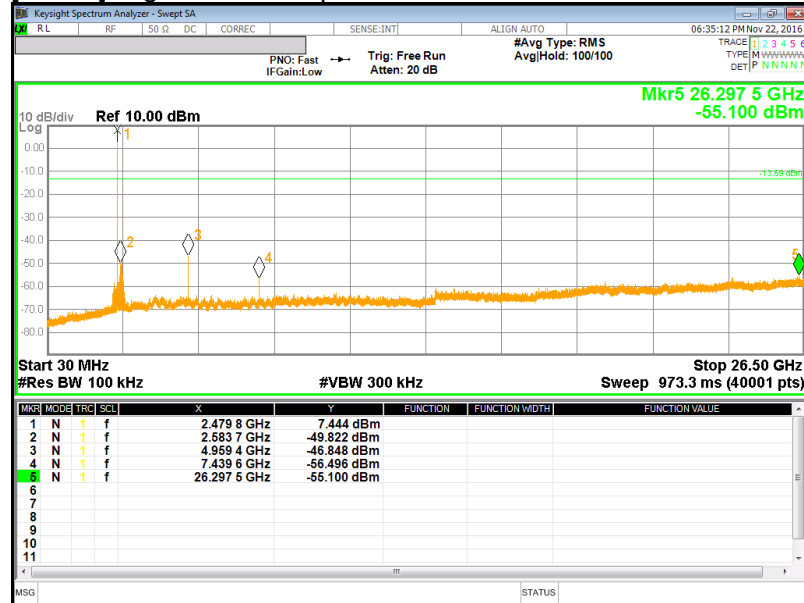
[GFSK] Mid Channel Spurious



[GFSK] High Channel BandEdge



[GFSK] High Channel Spurious



BandEdge Emission at GFSK Hopping Mode

[GFSK Hopping Mode] Low Channel BandEdge



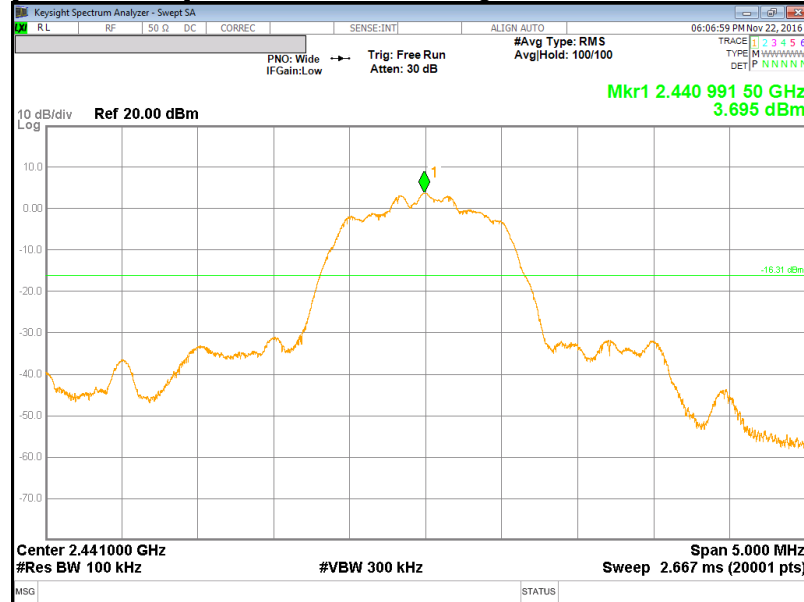
[GFSK Hopping Mode] High Channel BandEdge



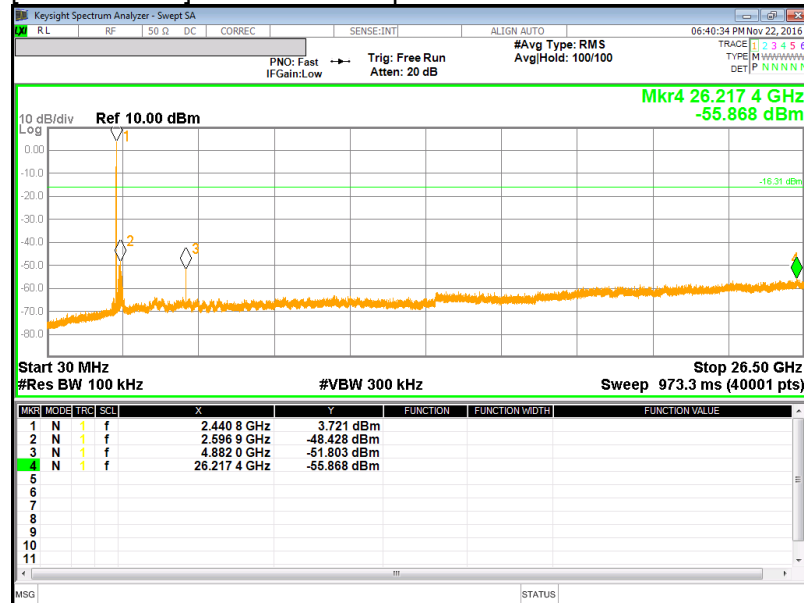
PI/4-DQPSK Mode



[PI/4-DQPSK] Mid Channel BandEdge



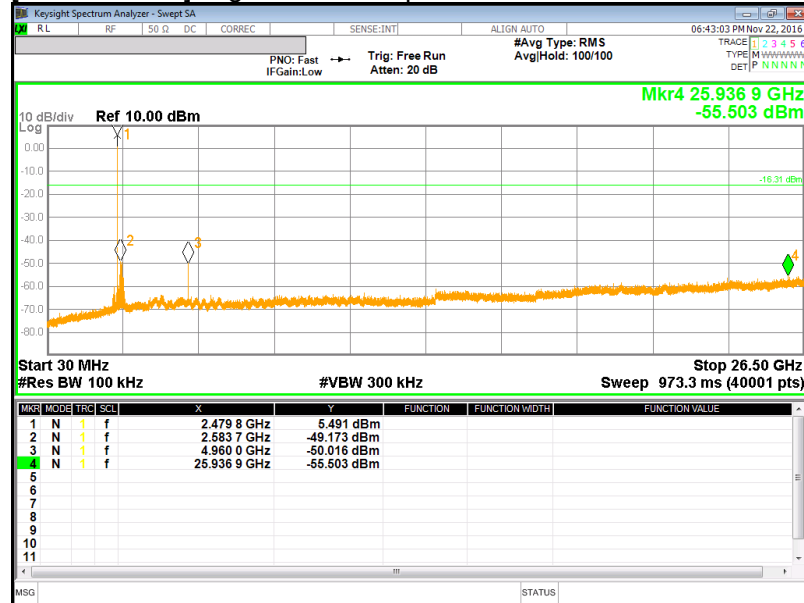
[PI/4-DQPSK] Mid Channel Spurious



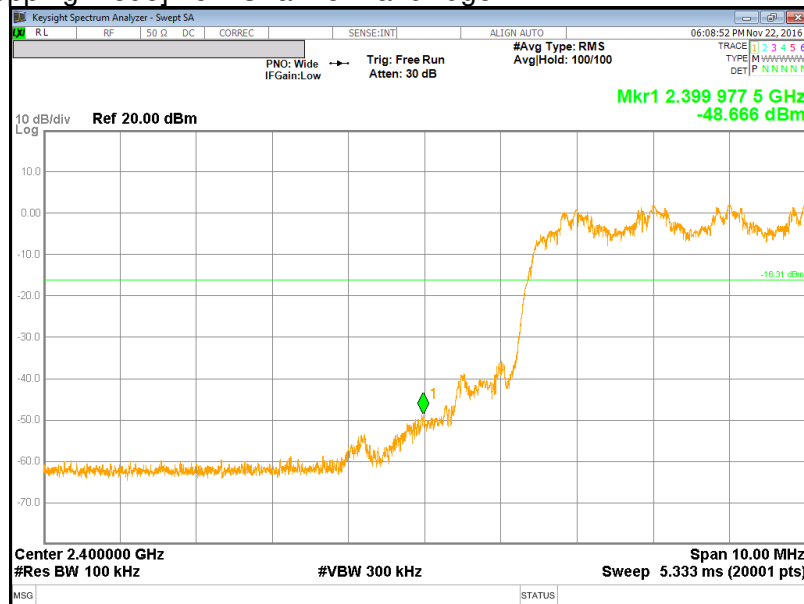
[PI/4-DQPSK] High Channel BandEdge



[PI/4-DQPSK] High Channel Spurious



[PI/4-DQPSK Hopping Mode] Low Channel BandEdge



Keysight Spectrum Analyzer - Swept SA

RL RF 50 Ω DC CORREC SENSE:INT ALIGN AUTO 06:11:05 PM Nov 22, 2016

PNO: Wide Trg: Free Run #Avg Type: RMS
IFGain: Low Atten: 30 dB AvgHld: 100/100

TRACE 1 2 3 4 5
TYPE M W W W W W W W
DET P N N N N N N

Mkr1 2.483 515 0 GHz
-57.652 dBm

10 dB/div Ref 20.00 dBm

Log

-16.31 dBm

Center 2.483500 GHz
#Res BW 100 kHz

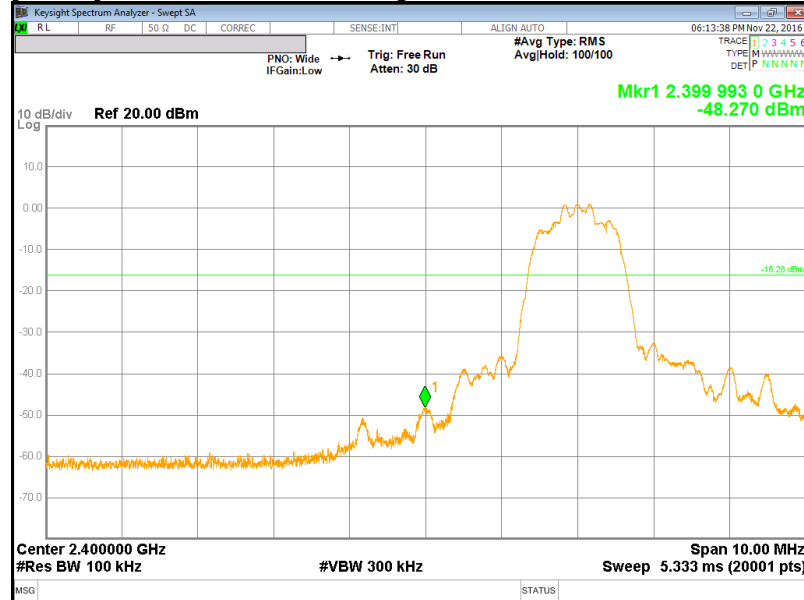
#VBW 300 kHz

Span 10.00 MHz
Sweep 5.333 ms (20001 pts)

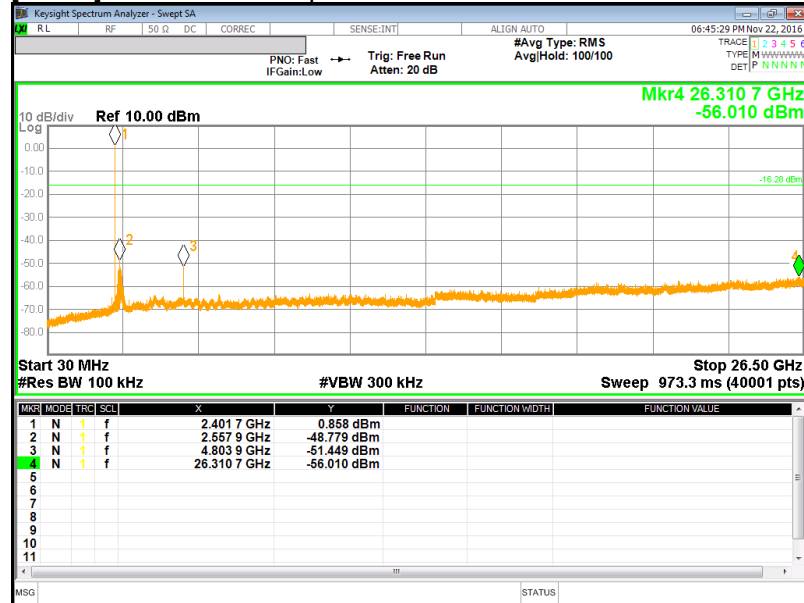
MSG STATUS

8PSK Mode

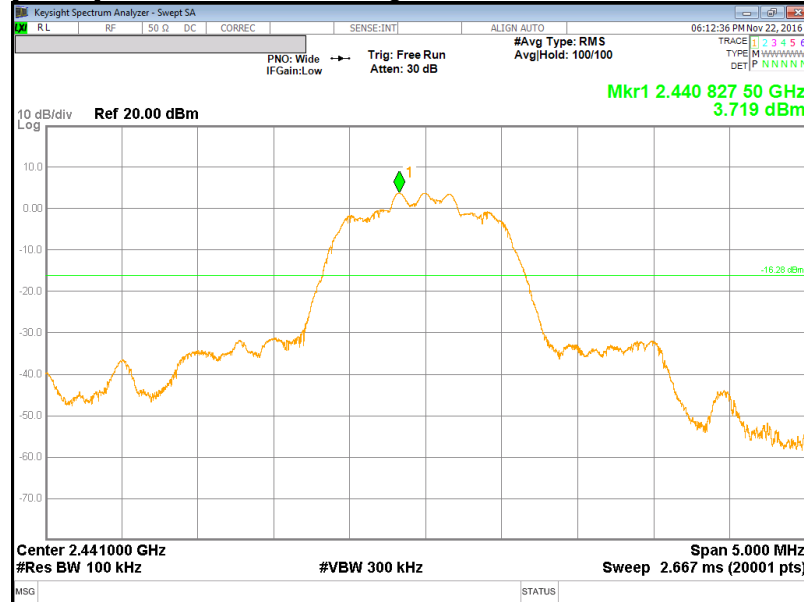
[8PSK] Low Channel BandEdge



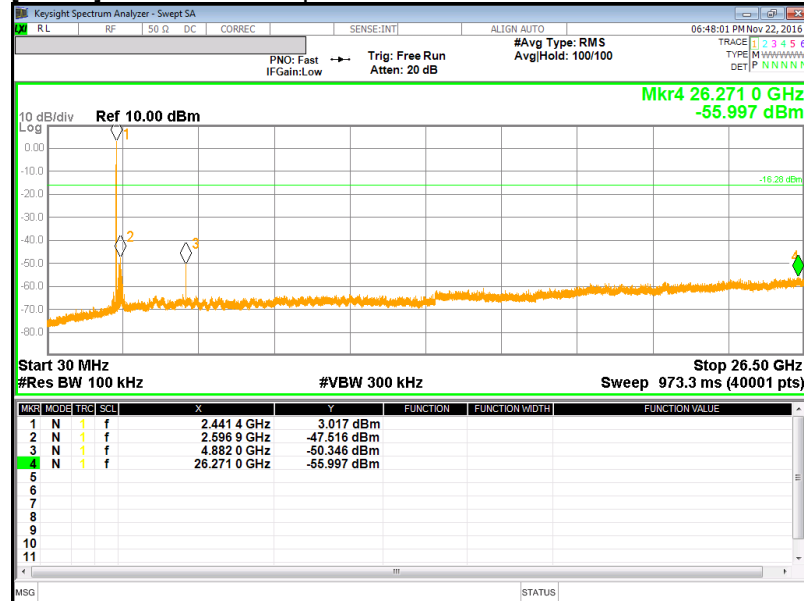
[8PSK] Low Channel Spurious



[8PSK] Mid Channel BandEdge



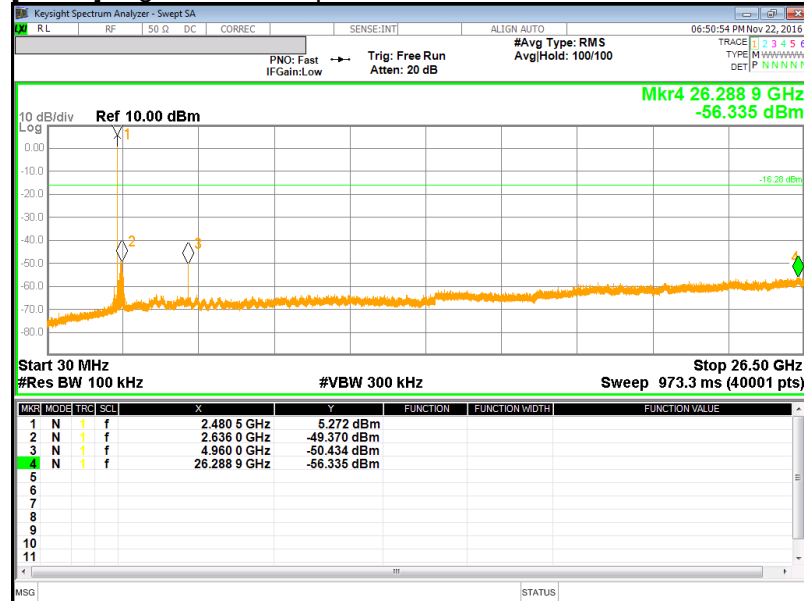
[8PSK] Mid Channel Spurious



[8PSK] High Channel BandEdge



[8PSK] High Channel Spurious



BandEdge Emission at 8PSK Hopping Mode

[8PSK Hopping Mode] Low Channel BandEdge



[8PSK Hopping Mode] High Channel BandEdge



9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (µV/m)	Measurement Distance (m)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100**	3
88 - 216	150**	3
216 – 960	200**	3
Above 960	500	3

** 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. §§ 15.231 and 15.241.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz and 150 cm for above 1GHz. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements.(Pre-scans to detect harmonic and spurious emissions, the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.)

For band edge measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1/T (on time) for average measurement.

$$\text{GFSK} = 1/T = 1 / 0.0029\text{S} = 350\text{Hz}.$$

The minimum VBW was 350Hz, but test receiver(ESU40) couldn't set value 350Hz. Due to this reason, testing VBW was set to 500Hz(Worst cases).

The spectrum from 1GHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.
(From 30MHz to 1GHz, test was performed with the EUT set to transmit at the channel with highest output power)

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

Note : Emission was pre-scanned from 9KHz to 30MHz; No emissions were detected which was at least 20dB below the specification limit (consider distance correction factor).
Per FCC part 15.31(o), test results were not reported.

Formula for converting the filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/m)

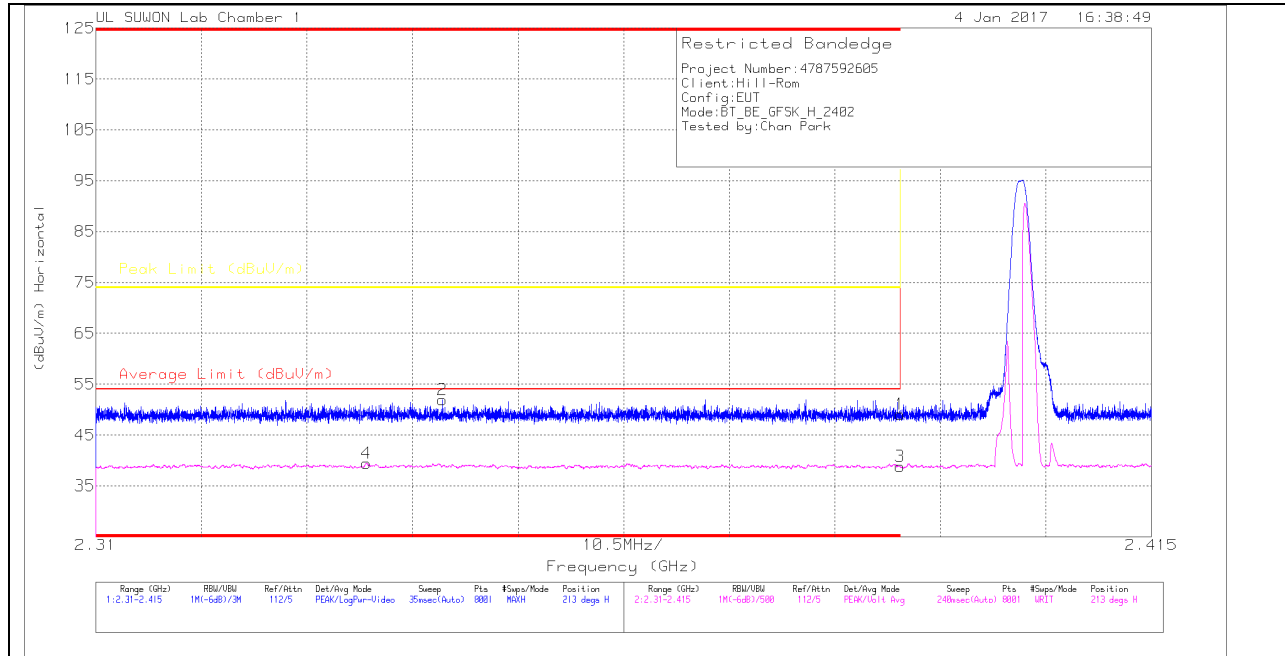
Radiated test of below 30MHz was performed inside anechoic chamber.
For check the correlation with open air site, comparison test was conducted between chamber and open site. The test results indicated that there is a close correlation.

9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

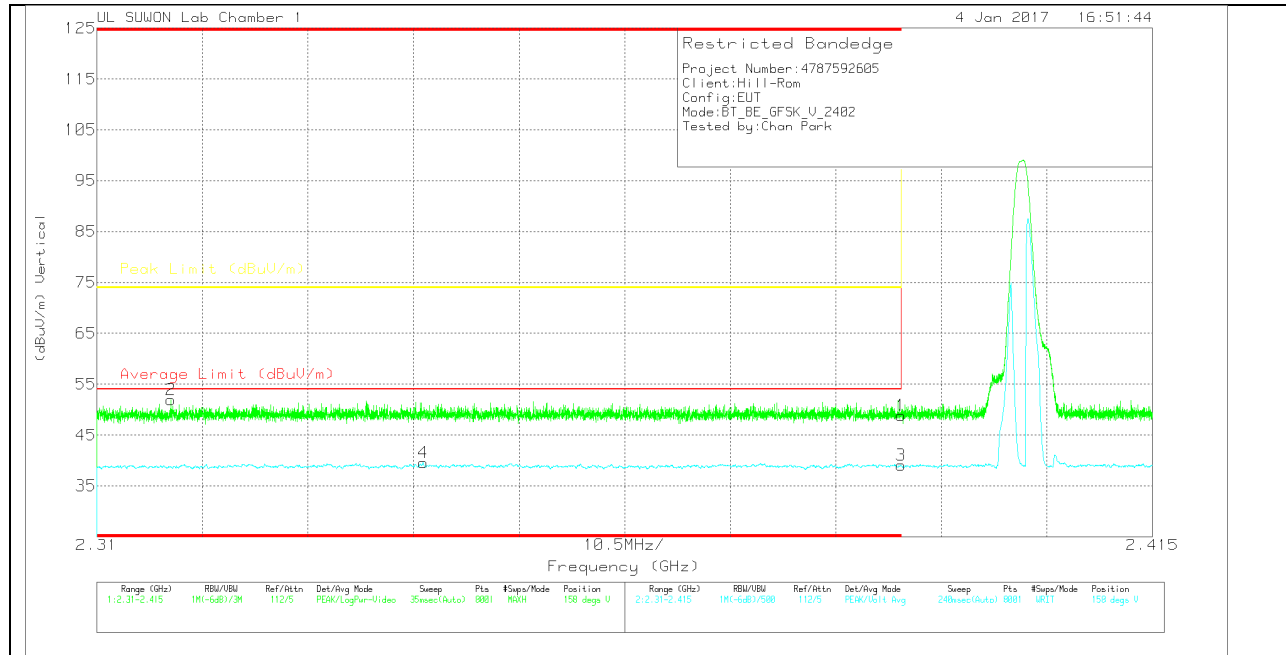
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	46.24	Pk	31.8	-29	49.04	-	-	74	-24.96	213	109	H
2	* 2.344	49.25	Pk	31.7	-29	51.95	-	-	74	-22.05	213	109	H
3	* 2.39	36	VA1T	31.8	-29	38.8	54	-15.2	-	-	213	109	H
4	* 2.337	36.73	VA1T	31.7	-29	39.43	54	-14.57	-	-	213	109	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	46.06	Pk		-29	48.86	-	-	74	-25.14	158	150	V
2	* 2.317	49.29	Pk		-29.1	51.89	-	-	74	-22.11	158	150	V
3	* 2.39	36.29	VA1T		-29	39.09	54	-14.91	-	-	158	150	V
4	* 2.342	36.85	VA1T		-29	39.55	54	-14.45	-	-	158	150	V

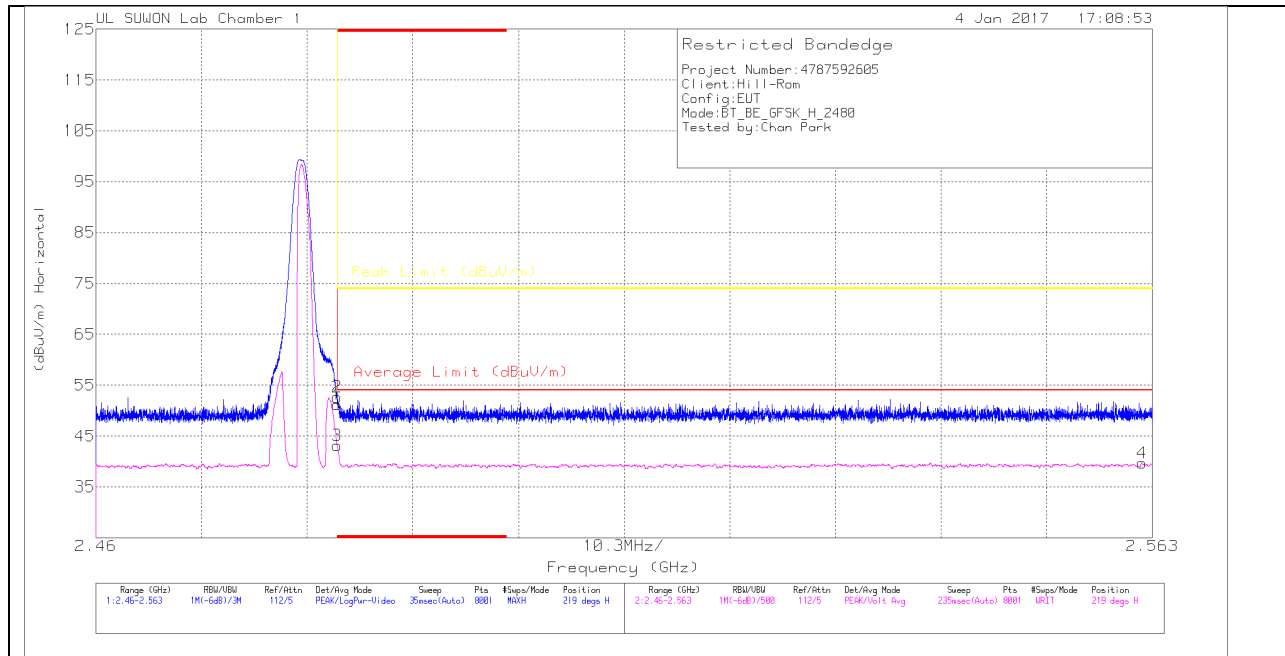
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average $VB=1/Ton$ where: Ton is transmit duration

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

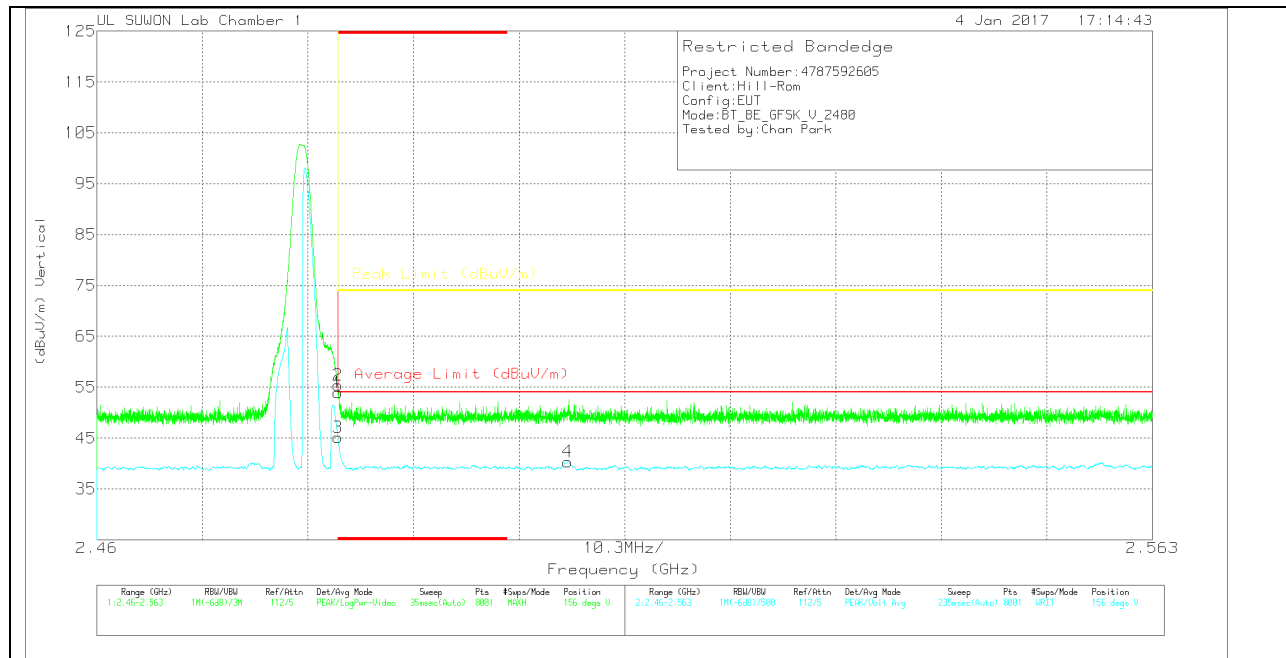
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	48.11	Pk	32	-28.9	51.21	-	-	74	-22.79	219	161	H
2	* 2.484	49.52	Pk	32	-28.9	52.62	-	-	74	-21.38	219	161	H
3	* 2.484	40.06	VA1T	32	-28.9	43.16	54	-10.84	-	-	219	161	H
4	2.562	36.5	VA1T	32	-28.8	39.7	54	-14.3	-	-	219	161	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average $V_B=1/T_{on}$ where: T_{on} is transmit duration

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	50.83	Pk	32	-28.9	53.93	-	-	74	-20.07	156	144	V
2	* 2.484	52.34	Pk	32	-28.9	55.44	-	-	74	-18.56	156	144	V
3	* 2.484	42.01	VA1T	32	-28.9	45.11	54	-8.89	-	-	156	144	V
4	2.506	37.27	VA1T	32	-28.9	40.37	54	-13.63	-	-	156	144	V

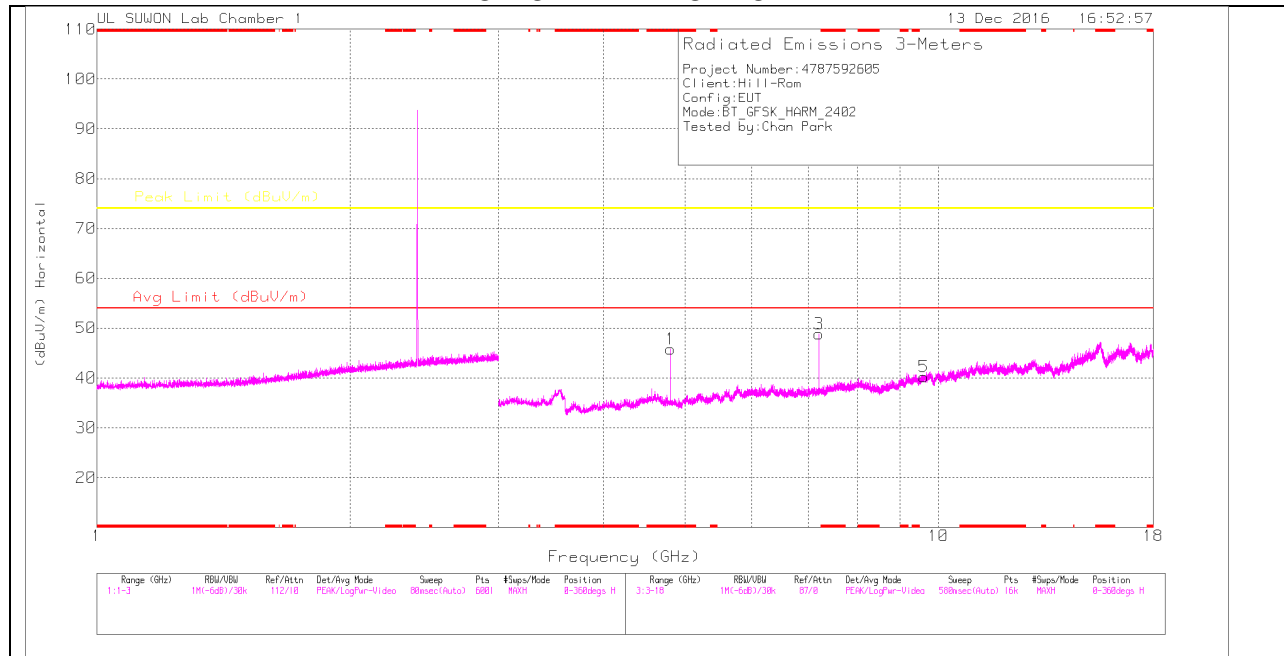
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

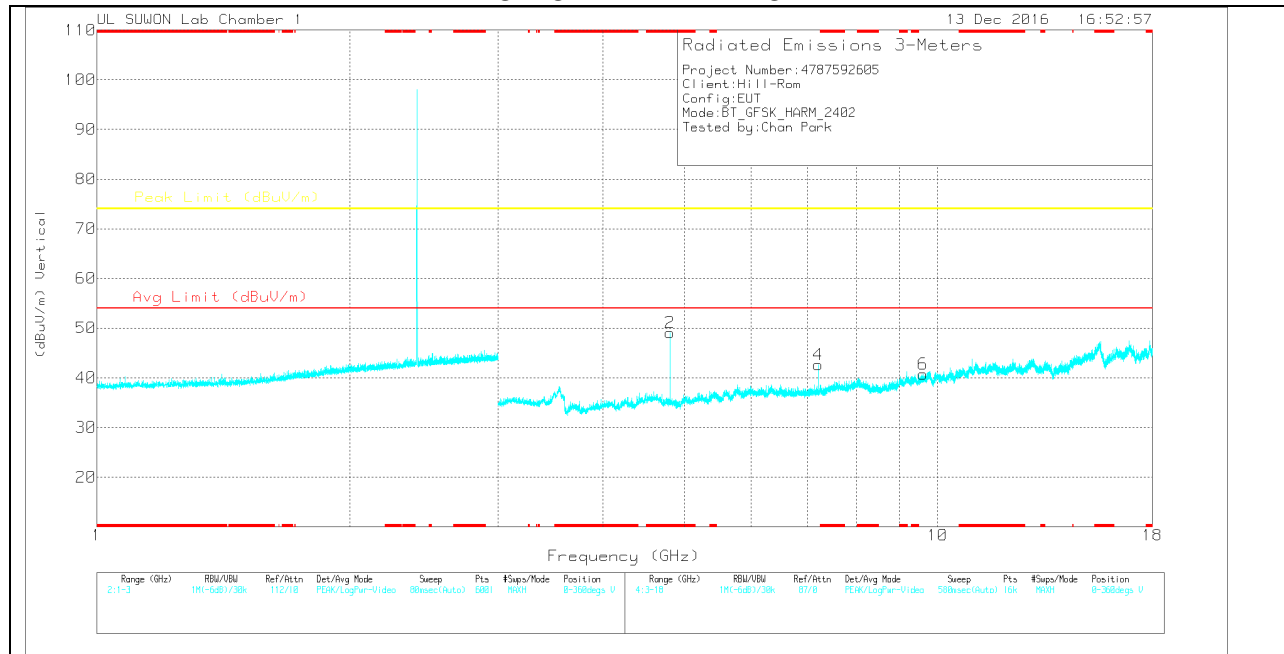
VA1T - FHSS: Linear Voltage Average $VB=1/T_{on}$ where: T_{on} is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.804	45.61	PK	34	-33.8	45.81	-	-	74	-28.19	0-360	250	H
3	7.205	43.9	PK	35.7	-30.8	48.8	-	-	74	-25.2	0-360	150	H
5	9.612	30.49	PK	37	-27.3	40.19	-	-	74	-33.81	0-360	150	H
2	* 4.804	48.87	PK	34	-33.8	49.07	-	-	74	-24.93	0-360	150	V
4	7.206	37.74	PK	35.7	-30.8	42.64	-	-	74	-31.36	0-360	250	V
6	9.606	31.04	PK	37	-27.3	40.74	-	-	74	-33.26	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak detector

Radiated Emissions

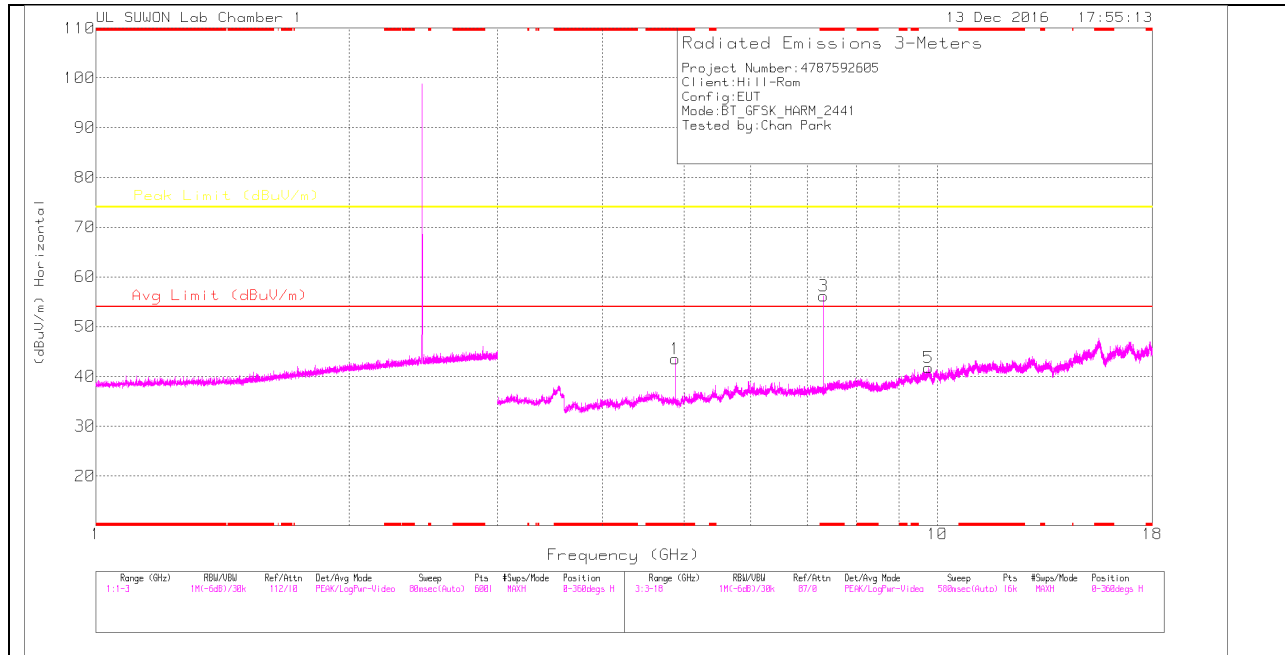
Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.804	52.77	PK2	34	-33.8	52.97	-	-	74	-21.03	94	199	H
* 4.804	39	VA1T	34	-33.8	39.2	54	-14.8	-	-	94	199	H
7.207	49.49	PK2	35.7	-30.8	54.39	-	-	74	-19.61	129	136	H
* 4.804	50.56	PK2	34	-33.8	50.76	-	-	74	-23.24	194	310	V
* 4.804	36.69	VA1T	34	-33.8	36.89	54	-17.11	-	-	194	310	V
7.206	48.07	PK2	35.7	-30.8	52.97	-	-	74	-21.03	107	170	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

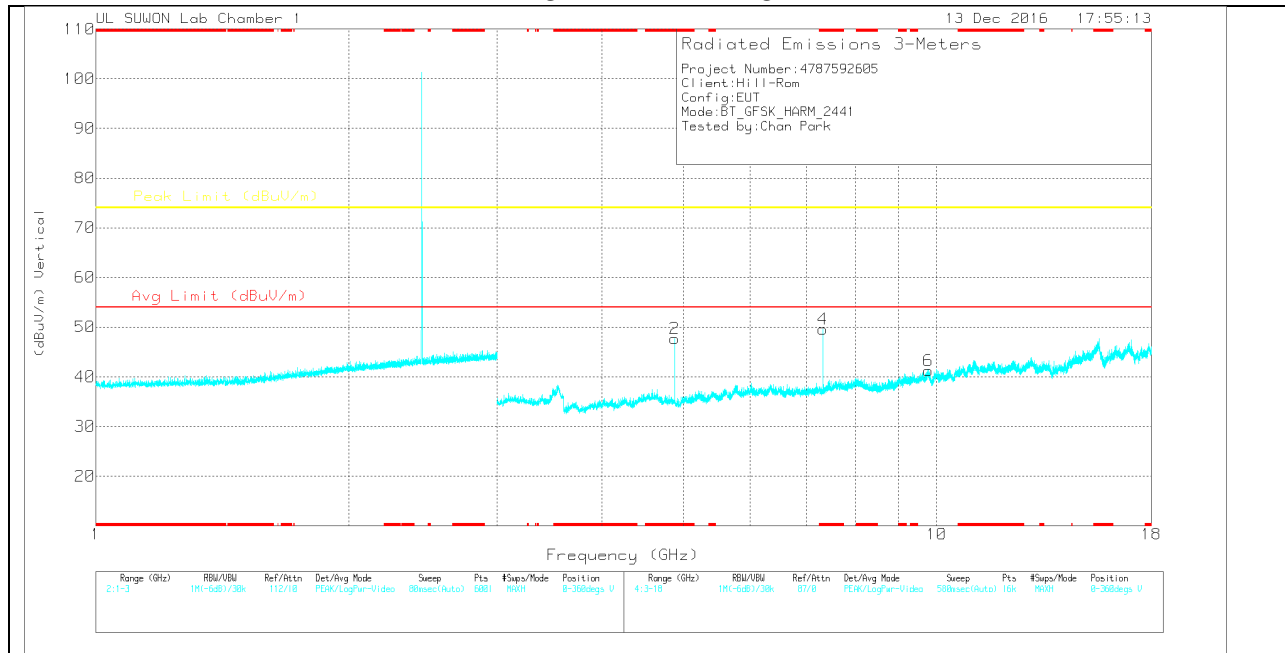
PK2 - KDB558074 Method: Maximum Peak

VA1T - FHSS: Linear Voltage Average $V_B = 1/T_{on}$ where: T_{on} is transmit duration

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.881	43.57	PK	34	-34	43.57	-	-	74	-30.43	0-360	150	H
3	* 7.323	51.3	PK	35.8	-30.9	56.2	-	-	74	-17.8	0-360	250	H
5	9.764	31.11	PK	37.2	-26.6	41.71	-	-	74	-32.29	0-360	150	H
2	* 4.881	47.73	PK	34	-34	47.73	-	-	74	-26.27	0-360	250	V
4	* 7.323	44.73	PK	35.8	-30.9	49.63	-	-	74	-24.37	0-360	150	V
6	9.767	30.58	PK	37.2	-26.5	41.28	-	-	74	-32.72	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak detector

Radiated Emissions

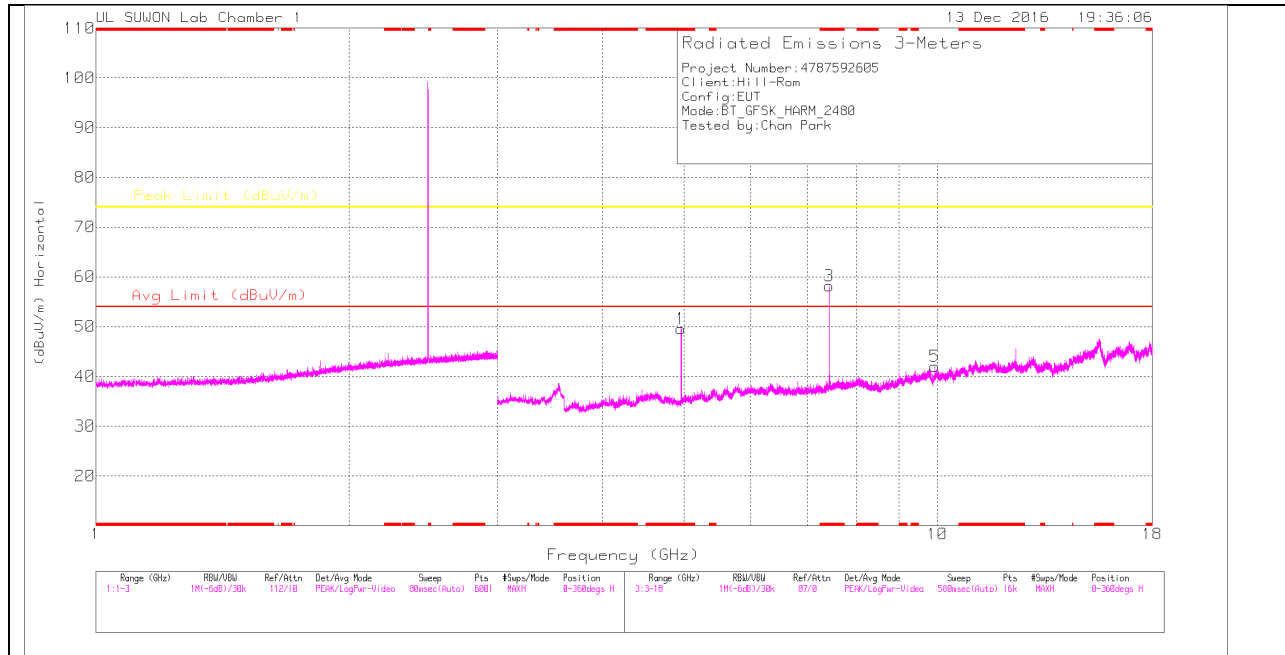
Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.882	54.26	PK2	34	-34	54.26	-	-	74	-19.74	91	153	H
* 4.882	39.95	VA1T	34	-34	39.95	54	-14.05	-	-	91	153	H
* 7.322	56	PK2	35.8	-30.9	60.9	-	-	74	-13.1	132	145	H
* 7.323	39.62	VA1T	35.8	-30.9	44.52	54	-9.48	-	-	132	145	H
* 4.882	54.29	PK2	34	-34	54.29	-	-	74	-19.71	197	121	V
* 4.882	40	VA1T	34	-34	40	54	-14	-	-	197	121	V
* 7.323	53.33	PK2	35.8	-30.9	58.23	-	-	74	-15.77	199	132	V
* 7.323	37.86	VA1T	35.8	-30.9	42.76	54	-11.24	-	-	199	132	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

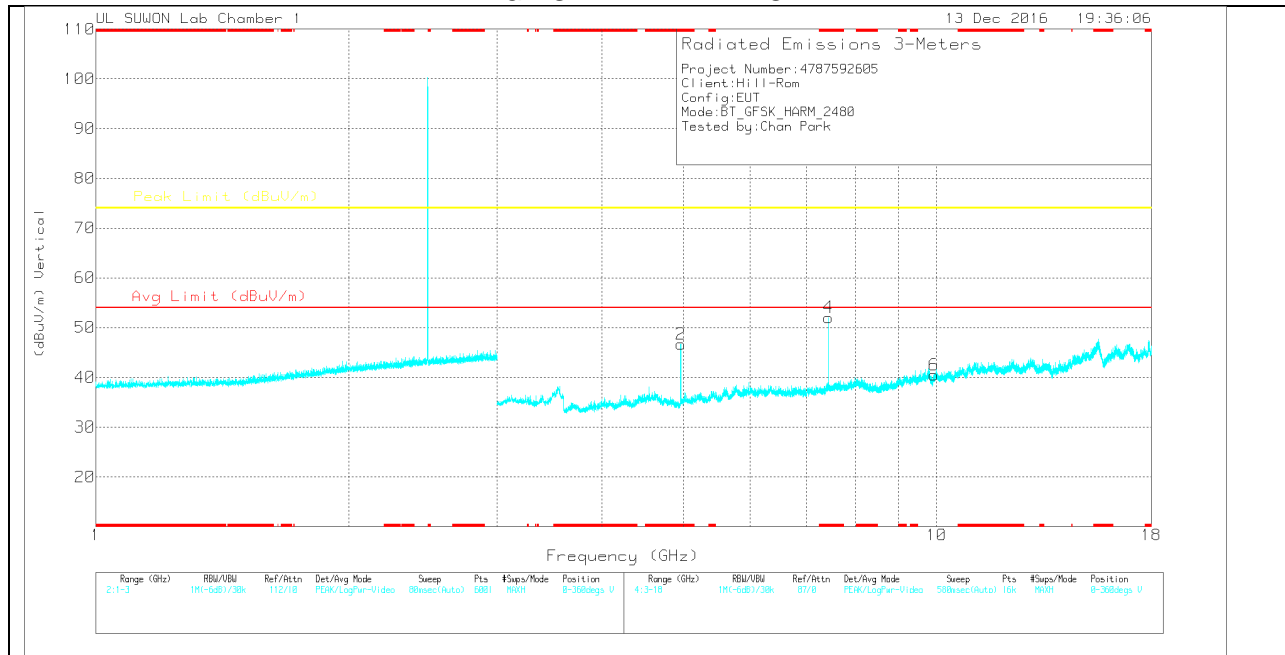
PK2 - KDB558074 Method: Maximum Peak

VA1T - FHSS: Linear Voltage Average $V_B = 1/T_{on}$ where: T_{on} is transmit duration

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.959	49.61	PK	34	-34	49.61	-	-	74	-24.39	0-360	150	H
3	* 7.44	53.04	PK	35.8	-30.7	58.14	-	-	74	-15.86	0-360	250	H
5	9.92	31.81	PK	37.4	-27.2	42.01	-	-	74	-31.99	0-360	250	H
2	* 4.96	46.72	PK	34	-34	46.72	-	-	74	-27.28	0-360	150	V
4	* 7.44	46.96	PK	35.8	-30.7	52.06	-	-	74	-21.94	0-360	150	V
6	9.924	30.17	PK	37.4	-27.1	40.47	-	-	74	-33.53	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.96	55.24	PK2	34	-34	55.24	-	-	74	-18.76	88	177	H
* 4.96	40.85	VA1T	34	-34	40.85	54	-13.15	-	-	88	177	H
* 7.439	56.05	PK2	35.8	-30.7	61.15	-	-	74	-12.85	134	151	H
* 7.44	40.1	VA1T	35.8	-30.7	45.2	54	-8.8	-	-	134	151	H
* 4.96	53.75	PK2	34	-34	53.75	-	-	74	-20.25	83	205	V
* 4.96	39.75	VA1T	34	-34	39.75	54	-14.25	-	-	83	205	V
* 7.44	53.07	PK2	35.8	-30.7	58.17	-	-	74	-15.83	59	156	V
* 7.44	37.75	VA1T	35.8	-30.7	42.85	54	-11.15	-	-	59	156	V

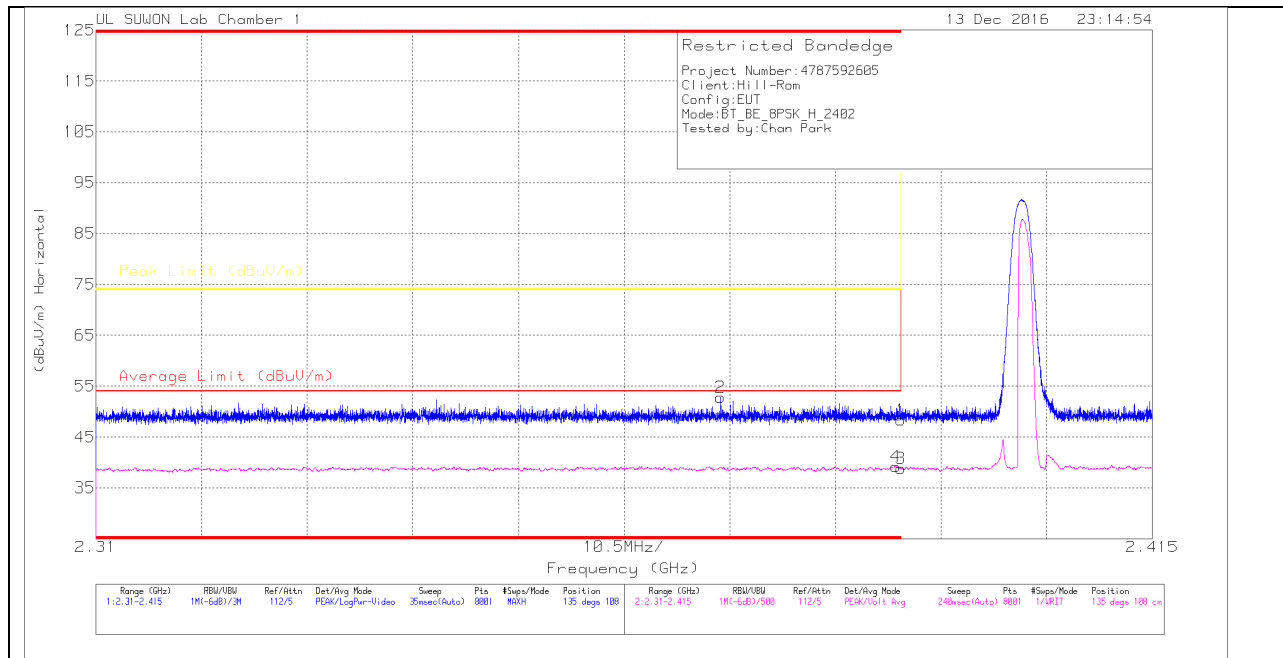
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

VA1T - FHSS: Linear Voltage Average $V_B=1/T_{on}$ where: T_{on} is transmit duration

9.2.2. ENHANCED DATA RATE 8PSK MODULATION RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

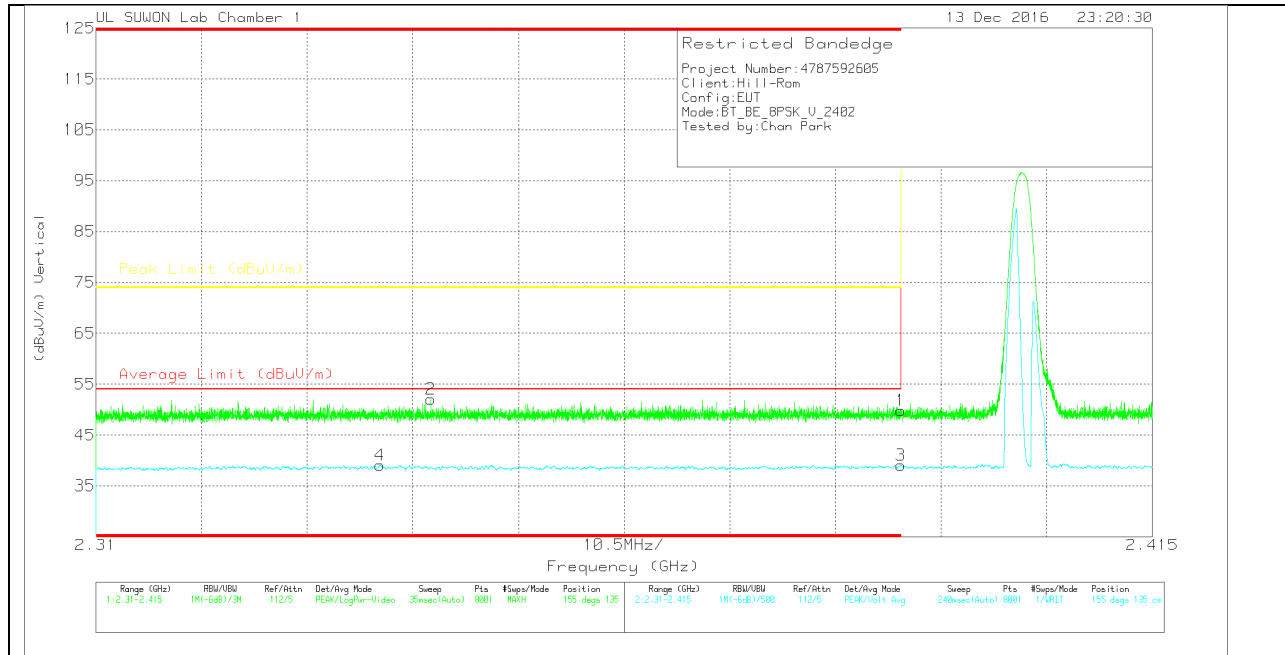
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	45.56	Pk	31.8	-29	48.36	-	-	74	-25.64	135	108	H
2	* 2.372	49.97	Pk	31.8	-29	52.77	-	-	74	-21.23	135	108	H
3	* 2.39	36.03	VA1T	31.8	-29	38.83	54	-15.17	-	-	135	108	H
4	* 2.39	36.4	VA1T	31.8	-29	39.2	54	-14.8	-	-	135	108	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average $VB=1/Ton$ where: Ton is transmit duration

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	47.04	Pk	31.8	-29	49.84	-	-	74	-24.16	155	135	V
2	* 2.343	49.34	Pk	31.7	-29	52.04	-	-	74	-21.96	155	135	V
3	* 2.39	36.28	VA1T	31.8	-29	39.08	54	-14.92	-	-	155	135	V
4	* 2.338	36.4	VA1T	31.7	-29	39.1	54	-14.9	-	-	155	135	V

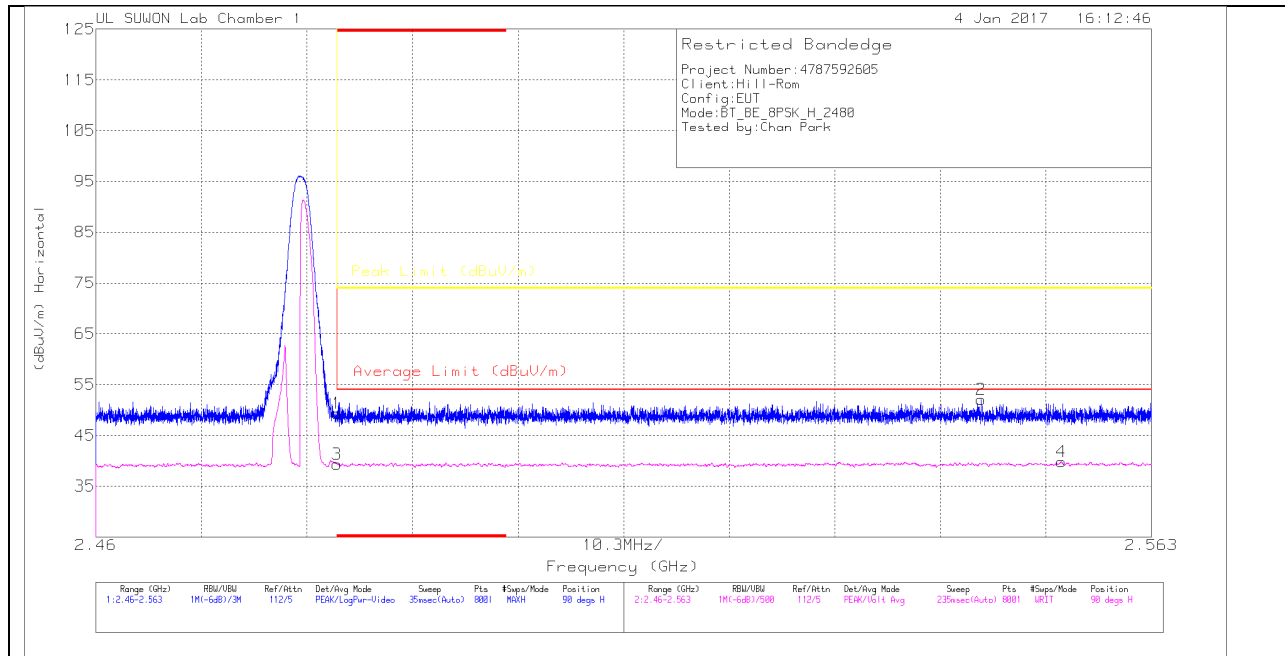
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average $V_B = 1/T_{on}$ where: T_{on} is transmit duration

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

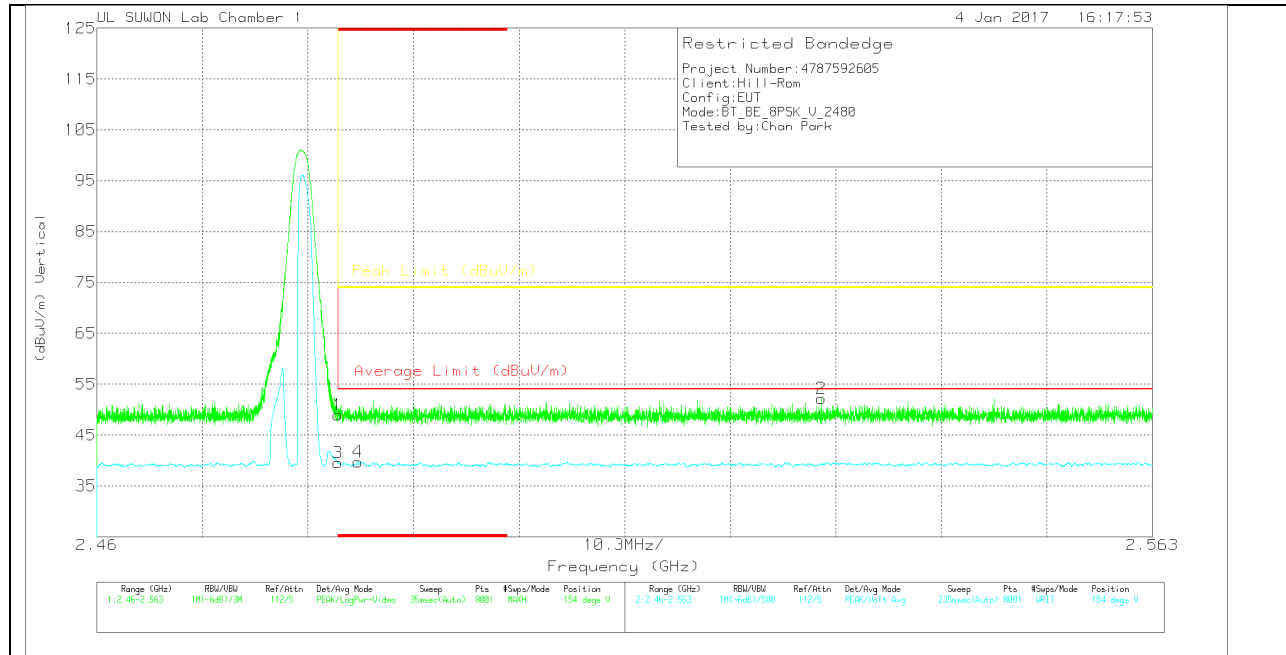
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	46.2	Pk	32	-28.9	49.3	-	-	74	-24.7	90	148	H
2	2.546	48.87	Pk	32	-28.8	52.07	-	-	74	-21.93	90	148	H
3	* 2.484	36.27	VA1T	32	-28.9	39.37	54	-14.63	-	-	90	148	H
4	2.554	36.58	VA1T	32	-28.8	39.78	54	-14.22	-	-	90	148	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	45.9	Pk	32	-28.9	49	-	-	74	-25	154	144	V
2	2.531	48.95	Pk	32	-28.8	52.15	-	-	74	-21.85	154	144	V
3	* 2.484	36.43	VA1T	32	-28.9	39.53	54	-14.47	-	-	154	144	V
4	* 2.485	36.65	VA1T	32	-28.9	39.75	54	-14.25	-	-	154	144	V

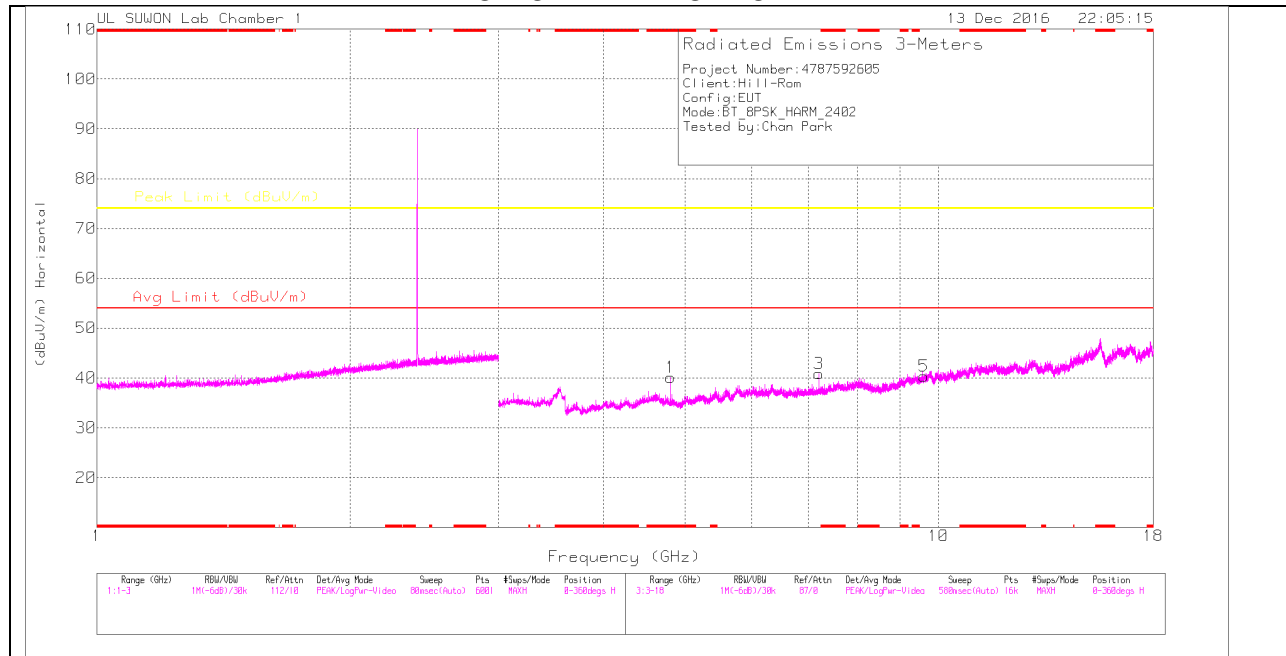
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

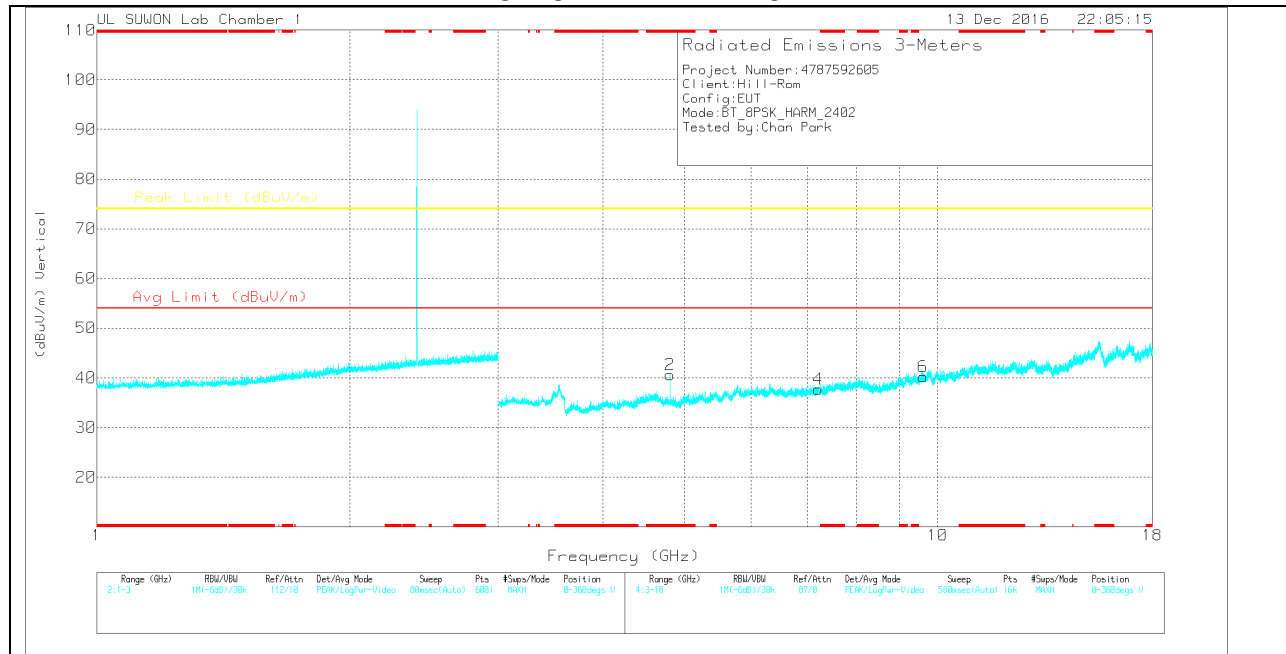
VA1T - FHSS: Linear Voltage Average $V_B = 1/T_{on}$ where: T_{on} is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.804	39.88	PK	34	-33.8	40.08	-	-	74	-33.92	0-360	150	H
3	7.205	35.98	PK	35.7	-30.8	40.88	-	-	74	-33.12	0-360	250	H
5	9.607	30.62	PK	37	-27.3	40.32	-	-	74	-33.68	0-360	150	H
2	* 4.804	40.41	PK	34	-33.8	40.61	-	-	74	-33.39	0-360	150	V
4	7.207	32.84	PK	35.7	-30.8	37.74	-	-	74	-36.26	0-360	250	V
6	9.61	30.59	PK	37	-27.3	40.29	-	-	74	-33.71	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk – Peak detector

Radiated Emissions

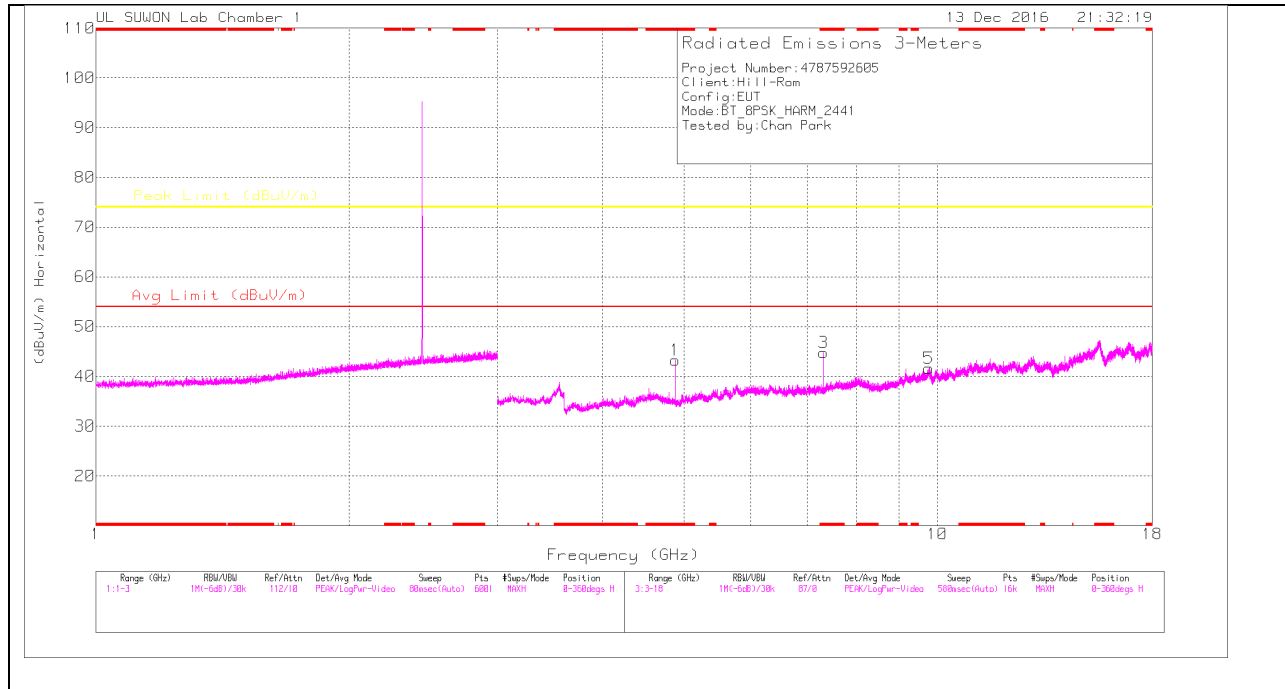
Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.804	50.82	PK2	34	-33.8	51.02	-	-	74	-22.98	214	109	H
* 4.804	35.42	VA1T	34	-33.8	35.62	54	-18.38	-	-	214	109	H
7.205	44.25	PK2	35.7	-30.8	49.15	-	-	74	-24.85	136	148	H
7.206	30.92	VA1T	35.7	-30.8	35.82	-	-	-	-	136	148	H
* 4.804	52.56	PK2	34	-33.8	52.76	-	-	74	-21.24	98	141	V
* 4.804	36.8	VA1T	34	-33.8	37	54	-17	-	-	98	141	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

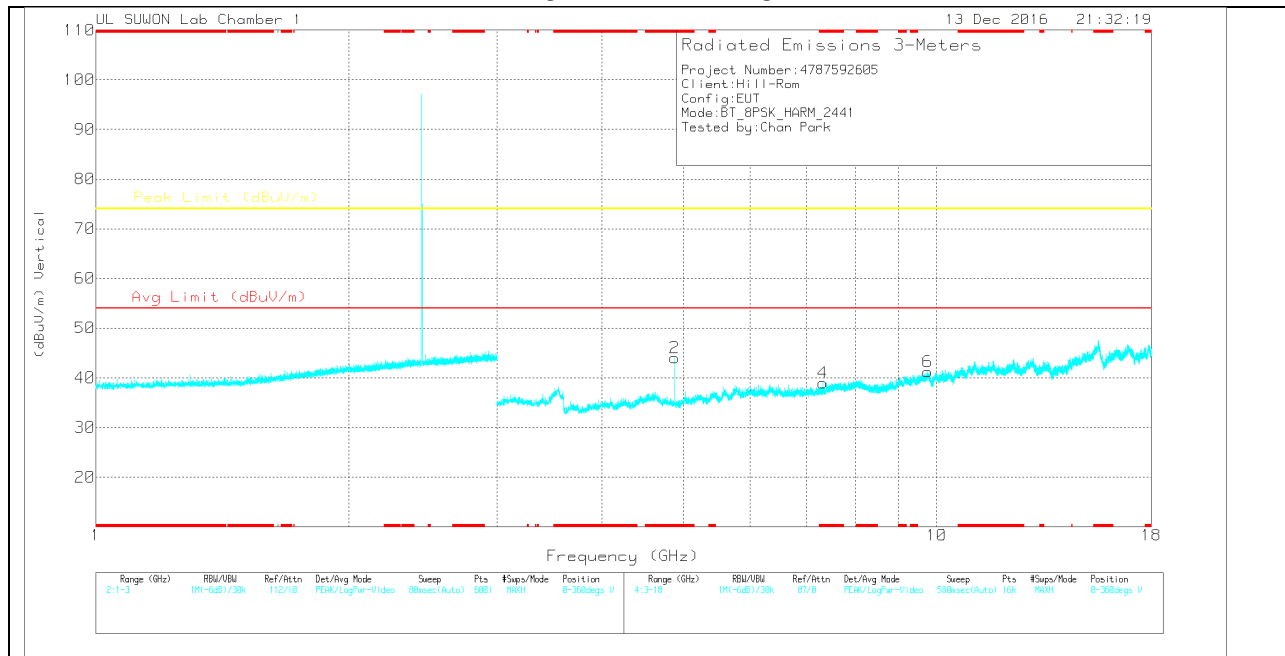
PK2 - KDB558074 Method: Maximum Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.881	43.3	PK	34	-34	43.3	-	-	74	-30.7	0-360	150	H
3	* 7.323	39.94	PK	35.8	-30.9	44.84	-	-	74	-29.16	0-360	150	H
5	9.766	31.07	PK	37.2	-26.6	41.67	-	-	74	-32.33	0-360	150	H
2	* 4.881	44	PK	34	-34	44	-	-	74	-30	0-360	250	V
4	* 7.323	34.06	PK	35.8	-30.9	38.96	-	-	74	-35.04	0-360	250	V
6	9.758	30.72	PK	37.2	-26.7	41.22	-	-	74	-32.78	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk – Peak detector

Radiated Emissions

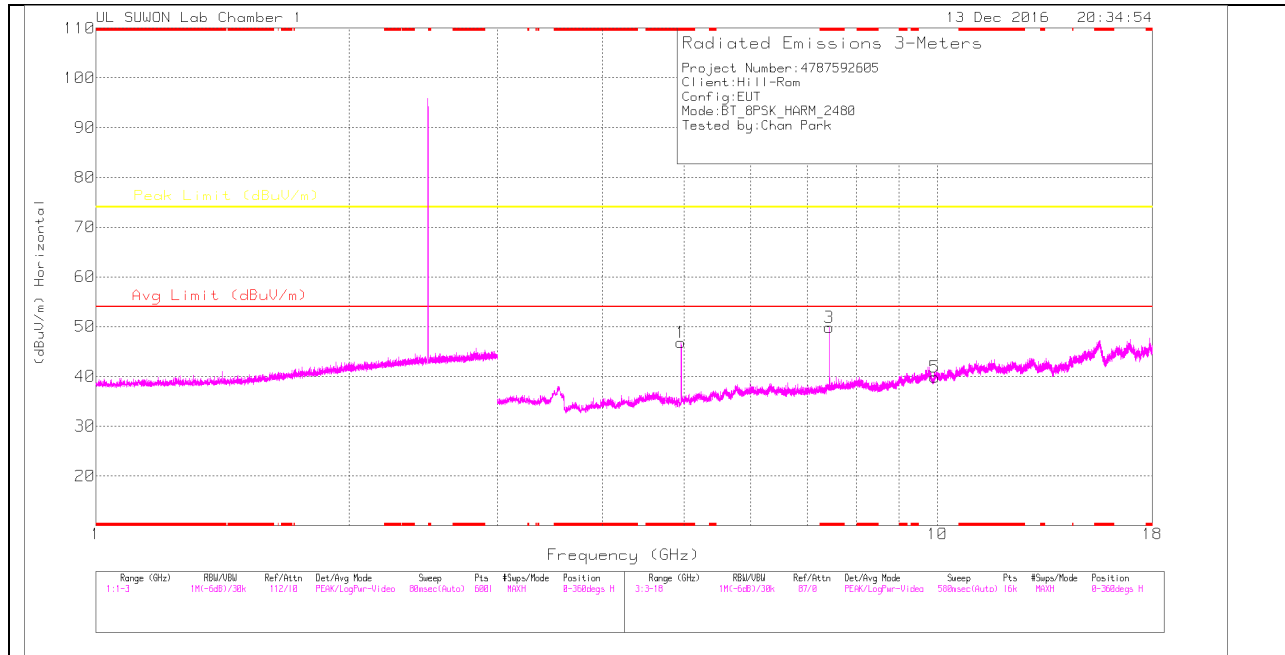
Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.882	51.22	PK2	34	-34	51.22	-	-	74	-22.78	92	151	H
* 4.882	36.28	VA1T	34	-34	36.28	54	-17.72	-	-	92	151	H
* 7.323	51.36	PK2	35.8	-30.9	56.26	-	-	74	-17.74	134	144	H
* 7.323	33.6	VA1T	35.8	-30.9	38.5	54	-15.5	-	-	134	144	H
* 4.882	51.41	PK2	34	-34	51.41	-	-	74	-22.59	85	146	V
* 4.882	37.18	VA1T	34	-34	37.18	54	-16.82	-	-	85	146	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

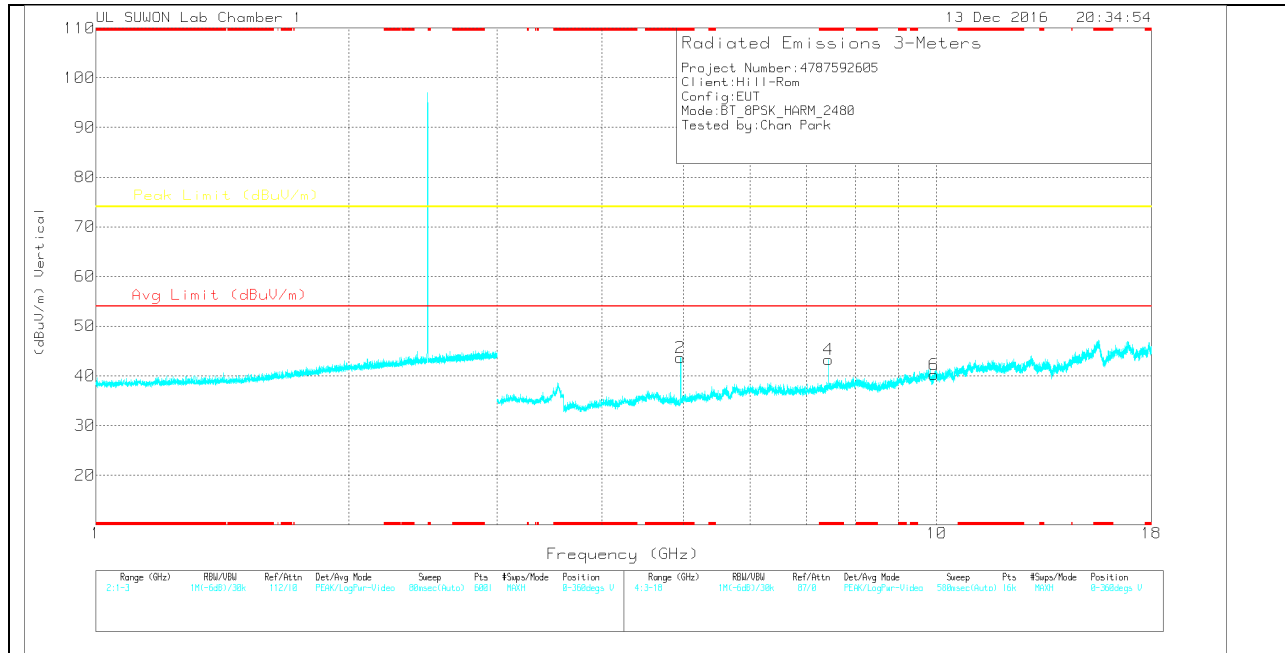
PK2 - KDB558074 Method: Maximum Peak

VA1T - FHSS: Linear Voltage Average $V_B = 1/T_{on}$ where: T_{on} is transmit duration

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.959	46.83	PK	34	-34	46.83	-	-	74	-27.17	0-360	150	H
3	* 7.44	44.73	PK	35.8	-30.7	49.83	-	-	74	-24.17	0-360	250	H
5	9.918	29.77	PK	37.4	-27.3	39.87	-	-	74	-34.13	0-360	250	H
2	* 4.959	43.7	PK	34	-34	43.7	-	-	74	-30.3	0-360	250	V
4	* 7.441	38.13	PK	35.8	-30.7	43.23	-	-	74	-30.77	0-360	150	V
6	9.919	29.98	PK	37.4	-27.2	40.18	-	-	74	-33.82	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.96	54.37	PK2	34	-34	54.37	-	-	74	-19.63	90	173	H
* 4.96	38.59	VA1T	34	-34	38.59	54	-15.41	-	-	90	173	H
* 7.44	52.44	PK2	35.8	-30.7	57.54	-	-	74	-16.46	130	171	H
* 7.44	35.02	VA1T	35.8	-30.7	40.12	54	-13.88	-	-	130	171	H
* 4.96	52.5	PK2	34	-34	52.5	-	-	74	-21.5	83	180	V
* 4.96	37.22	VA1T	34	-34	37.22	54	-16.78	-	-	83	180	V
* 7.44	49.65	PK2	35.8	-30.7	54.75	-	-	74	-19.25	60	156	V
* 7.44	33.37	VA1T	35.8	-30.7	38.47	54	-15.53	-	-	60	156	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

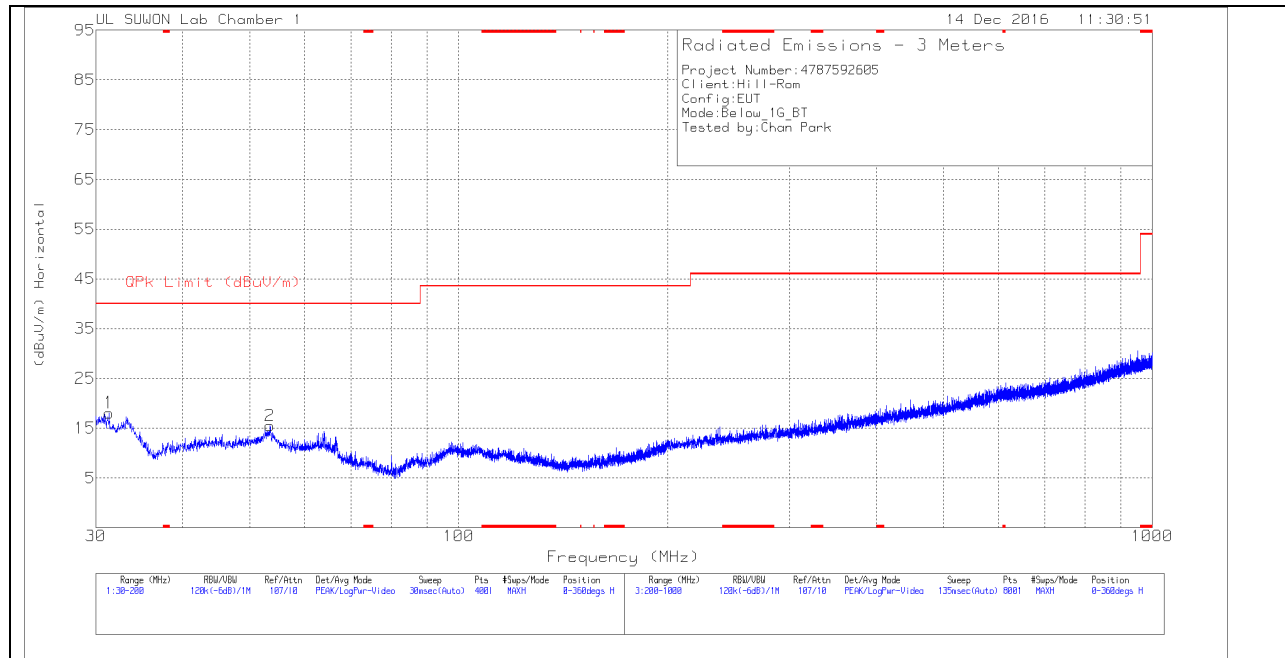
PK2 - KDB558074 Method: Maximum Peak

VA1T - FHSS: Linear Voltage Average $V_B = 1/T_{on}$ where: T_{on} is transmit duration

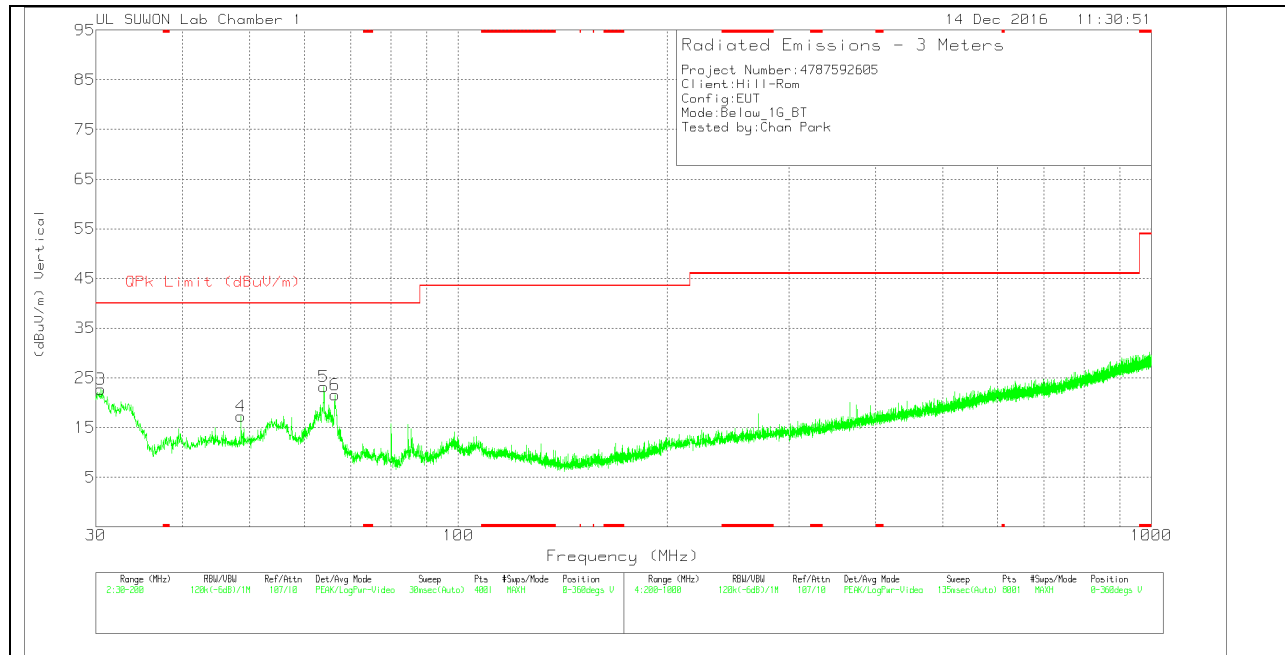
9.3. WORST-CASE BELOW 1 GHz

GFSK SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



VERTICAL PLOT



BELOW 1 GHz TABLE

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-750	Bi-Log	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	31.36	38.29	Pk	10.3	-30.5	18.09	40	-21.91	0-360	300	H
2	53.5025	32.11	Pk	13.4	-30	15.51	40	-24.49	0-360	400	H
3	30.51	42.89	Pk	10.3	-30.5	22.69	40	-17.31	0-360	100	V
4	48.5725	33.67	Pk	13.8	-30.2	17.27	40	-22.73	0-360	100	V
5	63.9575	41.56	Pk	11.5	-29.9	23.16	40	-16.84	0-360	100	V
6	66.38	40.64	Pk	10.7	-29.8	21.54	40	-18.46	0-360	100	V

Pk - Peak detector

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

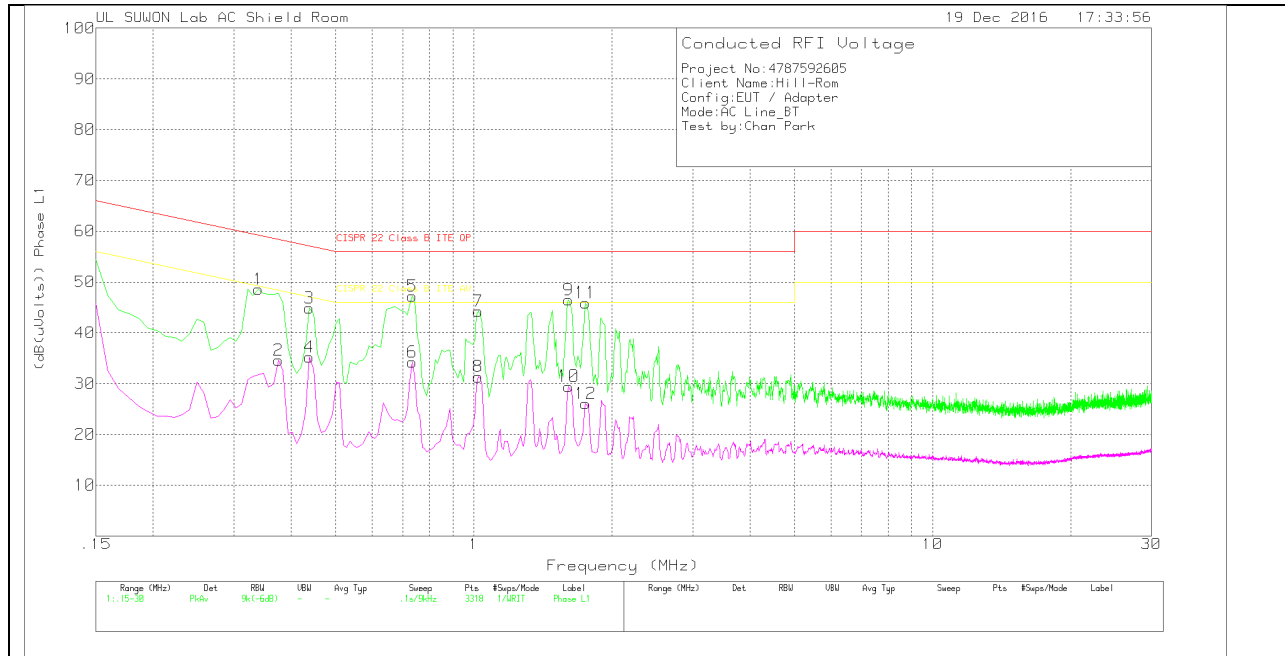
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

6 WORST EMISSIONS

LINE 1 PLOT



LINE 1 RESULTS

Trace Markers

Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_w ith ex- cord_L1	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
1	.339	38.81	Pk	9.8	0	48.61	59.23	-10.62	-	-
2	.375	24.66	Av	9.9	0	34.56	-	-	48.39	-13.83
3	.438	34.97	Pk	9.9	0	44.87	57.1	-12.23	-	-
4	.438	25.29	Av	9.9	0	35.19	-	-	47.1	-11.91
5	.735	37.32	Pk	9.9	0	47.22	56	-8.78	-	-
6	.735	24.3	Av	9.9	0	34.2	-	-	46	-11.8
7	1.023	34.45	Pk	9.8	0	44.25	56	-11.75	-	-
8	1.023	21.53	Av	9.8	0	31.33	-	-	46	-14.67
9	1.608	36.66	Pk	9.7	.1	46.46	56	-9.54	-	-
10	1.608	19.67	Av	9.7	.1	29.47	-	-	46	-16.53
11	1.752	36.12	Pk	9.7	.1	45.92	56	-10.08	-	-
12	1.752	16.29	Av	9.7	.1	26.09	-	-	46	-19.91

Pk - Peak detector

Av - Average detection

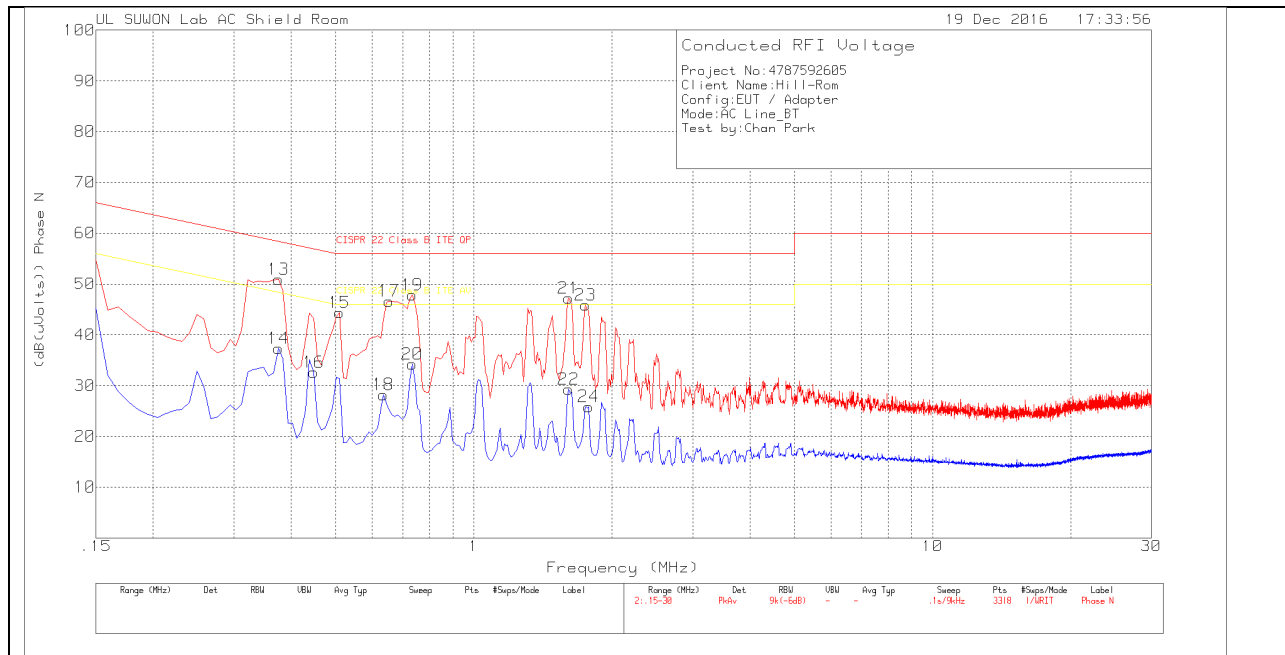
Quasi-Peak Emissions

Phase L1 .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101837_wit h ex-cord_L1	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
.3417	34.27	Qp	9.8	0	44.07	59.16	-15.09	-	-
.4425	33.32	Qp	9.9	0	43.22	57.01	-13.79	-	-
.7395	32.32	Qp	9.9	0	42.22	56	-13.78	-	-
1.0221	30.36	Qp	9.8	0	40.16	56	-15.84	-	-
1.6044	31.18	Qp	9.7	.1	40.98	56	-15.02	-	-
1.752	30.07	Qp	9.7	.1	39.87	56	-16.13	-	-

Qp – Quasi-Peak detector

LINE 2 PLOT



LINE 2 RESULTS

Trace Markers

Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_w ith ex- cord_N	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
13	.375	40.99	Pk	9.9	0	50.89	58.39	-7.5	-	-
14	.375	27.39	Av	9.9	0	37.29	-	-	48.39	-11.1
15	.51	34.49	Pk	9.9	0	44.39	56	-11.61	-	-
16	.447	22.69	Av	9.9	0	32.59	-	-	46.93	-14.34
17	.654	36.76	Pk	9.9	0	46.66	56	-9.34	-	-
18	.636	18.33	Av	9.9	0	28.23	-	-	46	-17.77
19	.735	37.98	Pk	9.9	0	47.88	56	-8.12	-	-
20	.735	24.37	Av	9.9	0	34.27	-	-	46	-11.73
21	1.608	37.46	Pk	9.7	.1	47.26	56	-8.74	-	-
22	1.608	19.46	Av	9.7	.1	29.26	-	-	46	-16.74
23	1.752	36.07	Pk	9.7	.1	45.87	56	-10.13	-	-
24	1.779	16.08	Av	9.7	.1	25.88	-	-	46	-20.12

Pk - Peak detector

Av - Average detection

Quasi-Peak Emissions

Phase N .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101837_wit h ex-cord_N	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
.3777	38.58	Qp	9.9	0	48.48	58.33	-9.85	-	-
.4425	33.04	Qp	9.9	0	42.94	57.01	-14.07	-	-
.6495	33.06	Qp	9.9	0	42.96	56	-13.04	-	-
.7305	32.57	Qp	9.9	0	42.47	56	-13.53	-	-
1.6035	32.28	Qp	9.7	.1	42.08	56	-13.92	-	-
1.7511	30.69	Qp	9.7	.1	40.49	56	-15.51	-	-

Qp – Quasi-Peak detector