FCC Part 15C
Measurement and Test Report

For

IAG Group Ltd.

Sanecore Science & Technology Industry Park, Jiuwei Village, Xixiang Town,

Shenzhen, China

FCC ID: 2AO5F-M-ONE

FCC Rule(s):	FCC Part 15.247
Product Description:	Power Amplifier
Tested Model:	M-ONE
Report No.:	HCT17LR371E
Sample Receipt Date:	2017-12-13
Tested Date:	2018-01-03 to 2018-03-02
Issued Date:	2018-03-05
Tested By:	Jason Su/ Engineer
Reviewed By:	Silin Chen / EMC Manager
Approved & Authorized By:	Jandy So / PSQ Manager
Prepared By:	

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	IAG Group Ltd.
Address of applicant:	Sanecore Science & Technology Industry Park, Jiuwei Village, Xixiang Town, Shenzhen, China
Manufacturer:	IAG Group Ltd.
Address of manufacturer:	Sanecore Science & Technology Industry Park, Jiuwei Village, Xixiang Town, Shenzhen, China

General Description of EUT	
Product Name:	Power Amplifier
Brand Name:	audiolab
Model No.:	M-ONE
Adding Model(s):	/
Rated Voltage:	Input:AC100-120V 50/60Hz 150W
Software Version:	V4.2
Hardware Version:	JS1T__V01B
Note: The test data is gathered from a production sample, provided by the manufacturer.	

Technical Characteristics of EUT	
Bluetooth Version:	V4.0 (Single mode)
Frequency Range:	2402-2480MHz
RF Output Power:	3.790dBm (Conducted)
Modulation:	GFSK, π/4 DQPSK, 8DPSK
Quantity of Channels:	79
Channel Separation:	1MHz
Type of Antenna:	Cylindrical Antenna
Antenna Gain:	2.90dBi
Lowest Internal Frequency of EUT:	26MHz

1.2 Test Standards

The following report is prepared on behalf of the IAG Group Ltd. in accordance with FCC Part15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices.

1.4 Test Facility

FCC – Registration No.: 125990

Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipment subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM. Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Low Channel	2402MHz
TM2	Middle Channel	2441MHz
TM3	High Channel	2480MHz
TM4	Hopping	2402-2480MHz

Modulation Configure			
Modulation	Packet	Packet Type	Packet Size
GFSK	DH1	4	27
	DH3	11	183
	DH5	15	339
π/4 DQPSK	2DH1	20	54
	2DH3	26	367
	2DH5	30	679
8DPSK	3DH1	24	83
	3DH3	27	552
	3DH5	31	1021
Normal mode: the Bluetooth has been tested on the modulation of GFSK, (Pi/4)DQPSK and 8DPSK, compliance test and record the worst case.			

Accessories Equipment List and Details			
Description	**Manufacturer**	**Model No.**	**Serial Number**
/	/	/	/
Accessories Cable List and Details			
Cable Description	**Length (m)**	**Shielded/Unshielded**	**With Core/Without Core**
/	/	/	/
EUT Cable List and Details			
Cable Description	**Length (m)**	**Shielded/Unshielded**	**With Core/Without Core**
USB Cable	0.95	Shielded	Without Core
Earphone	1.2	Unshielded	Without Core

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	±0.42dB
Occupied Bandwidth	Conducted	±1.5%
Conducted Spurious Emission	Conducted	±2.17dB
Conducted Emissions	Conducted	9-150kHz ±3.74dB
		0.15-30MHz ±3.34dB
Transmitter Spurious Emissions	Radiated	30-200MHz ±4.52dB
		0.2-1GHz ±5.56dB
		1-6GHz ±3.84dB
		6-18GHz ±3.92dB

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2017-06-12	2018-06-11
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2017-06-12	2018-06-11
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2017-06-12	2018-06-11
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2017-06-12	2018-06-11
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2017-06-12	2018-06-11
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-08	2018-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2018-06-07
SEMT-1121	Horn Antenna	Schwarz beck	BBHA 9170	BBHA9170582	2017-06-08	2018-06-07
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2018-06-07
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2017-06-12	2018-06-11
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2017-06-12	2018-06-11
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2017-06-12	2018-06-11
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2017-08-15	2018-08-14
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2017-08-15	2018-08-14
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2017-06-12	2018-06-11
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2017-03-09	2018-03-08

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 2.1093	RF Exposure	Compliant
§15.203;§15.247(b)(4)(i)	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§15.207(a)	Conducted Emission	Compliant
§15.209(a)	Radiated Spurious Emissions	Compliant
§15.247(a)(1)(iii)	Quantity of Hopping Channel	Compliant
§15.247(a)(1)	Channel Separation	Compliant
§15.247(a)(1)(iii)	Time of Occupancy (Dwell time)	Compliant
§15.247(a)	20dB Bandwidth	Compliant
§15.247(b)(1)	RF Power Output	Compliant
§15.247(d)	Band Edge (Out of Band Emissions)	Compliant
§15.247(a)(1)	Frequency Hopping Sequence	Compliant
§15.247(g), (h)	Frequency Hopping System	Compliant

N/A: not applicable

3. RF Exposure

3.1 Standard Applicable

According to§1.1307 and §2.1093, the portable transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.

4. Antenna Requirement

4.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

4.2 Evaluation Information

This product has an integral antenna, fulfill the requirement of this section.

5. Frequency Hopping System Requirements

5.1 Standard Applicable

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

5.2 Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

This device was tested with an bluetooth system receiver to check that the device maintained hopping synchronization, and the device complied with these requirements for DA 00-705 and FCC Part 15.247 rule.

5.3 EUT Pseudorandom Frequency Hopping Sequence

Pseudorandom Frequency Hopping Sequence Table as below:
Channel: 08, 24, 40, 56, 40, 56, 72, 09, 01, 09, 33, 41, 33, 41, 65, 73, 53, 69, 06, 22, 04, 20, 36, 52, 38, 46, 70, 78, 68, 76, 21, 29, 10, 26, 42, 58, 44, 60, 76, 13, 03, 11, 35, 43, 37, 45, 69, 77, 55, 71, 08, 24, 08, 24, 40, 56, 40, 48, 72, 01, 72, 01, 25, 33, 12, 28, 44, 60, 42, 58, 74, 11, 05, 13, 37, 45 etc.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

6. Quantity of Hopping Channels and Channel Separation

6.1 Standard Applicable

According to FCC 15.247(a)(1), 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,and frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

6.2 Test Procedure

According to ANSI C63.10-2013 section 7.8.3, the number of hopping frequencies test method as follows.

a) Span: The frequency band of operation. Depending on the number of channels the devicesupports, it may be necessary to divide the frequency range of operation across multiple spans,to allow the individual channels to be clearly seen.
b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channelspacing or the 20 dB bandwidth, whichever is smaller.
c) VBW ≥ RBW.
d) Sweep: Auto.
e) Detector function: Peak.
f) Trace: Max hold.
g) Allow the trace to stabilize.

According to ANSI C63.10-2013 section 7.8.2, the EUT shall have its hopping function enabled, the Carrier frequency separation test method as follows:

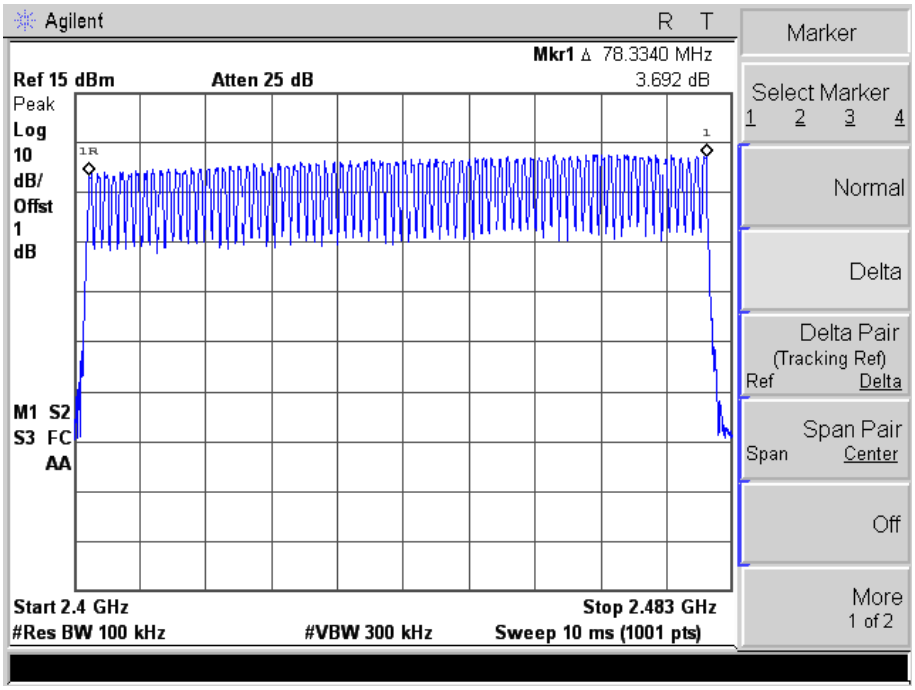
a) Span: Wide enough to capture the peaks of two adjacent channels.
b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessaryto best identify the center of each individual channel.
c) Video (or average) bandwidth (VBW) ≥ RBW.
d) Sweep: Auto.
e) Detector function: Peak.
f) Trace: Max hold.
g) Allow the trace to stabilize.
Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

6.3 Environmental Conditions

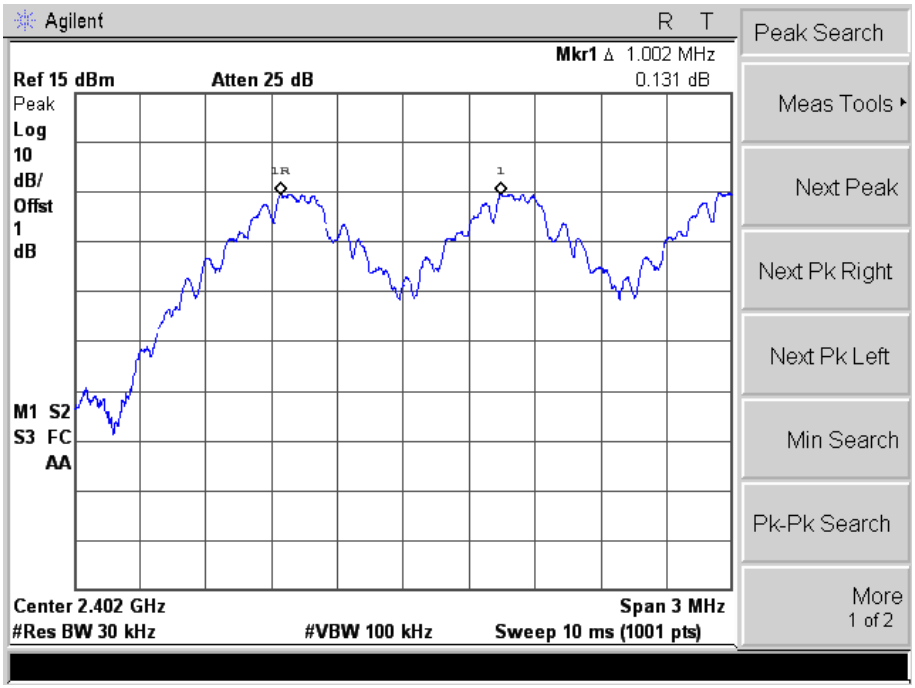
Temperature:	24 °C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

6.4 Summary of Test Results/Plots

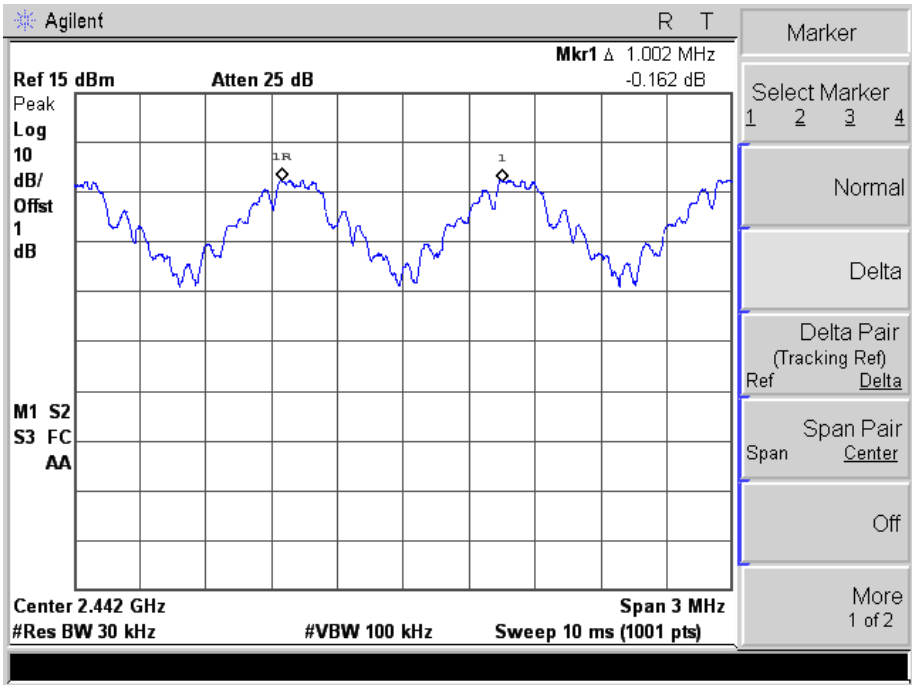
No. of Channel = 79



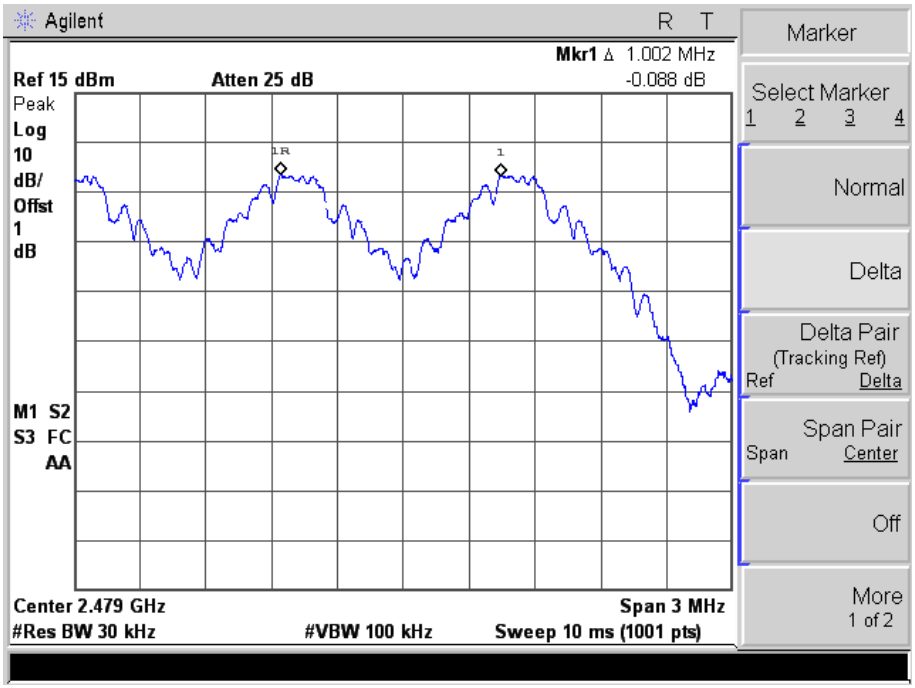
For GFSK mode
Channel Spacing (Low CH=1MHz)



Channel Spacing (Middle CH=1MHz)

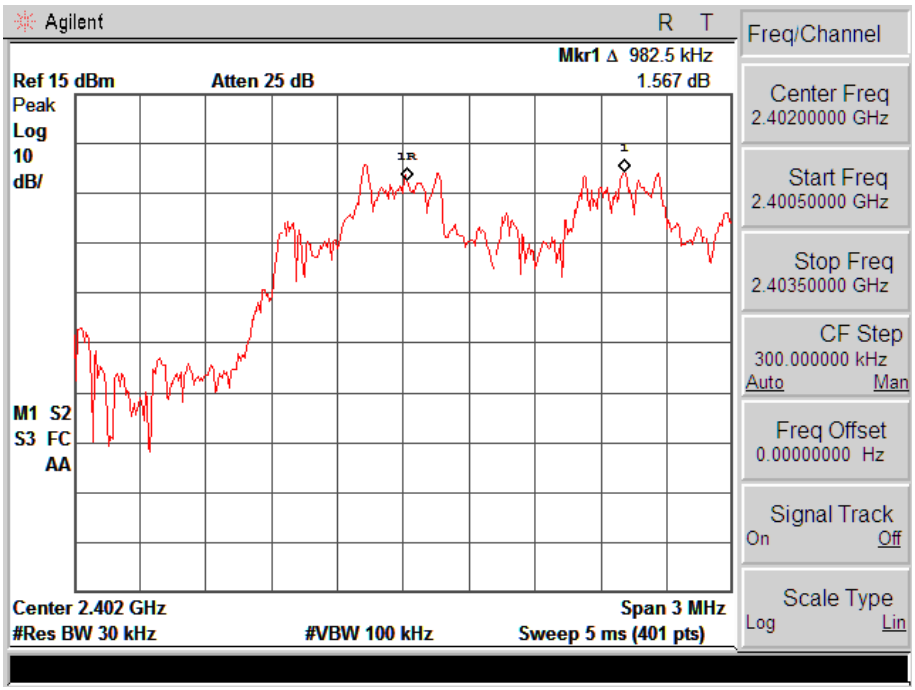


Channel Spacing (High CH=1MHz)

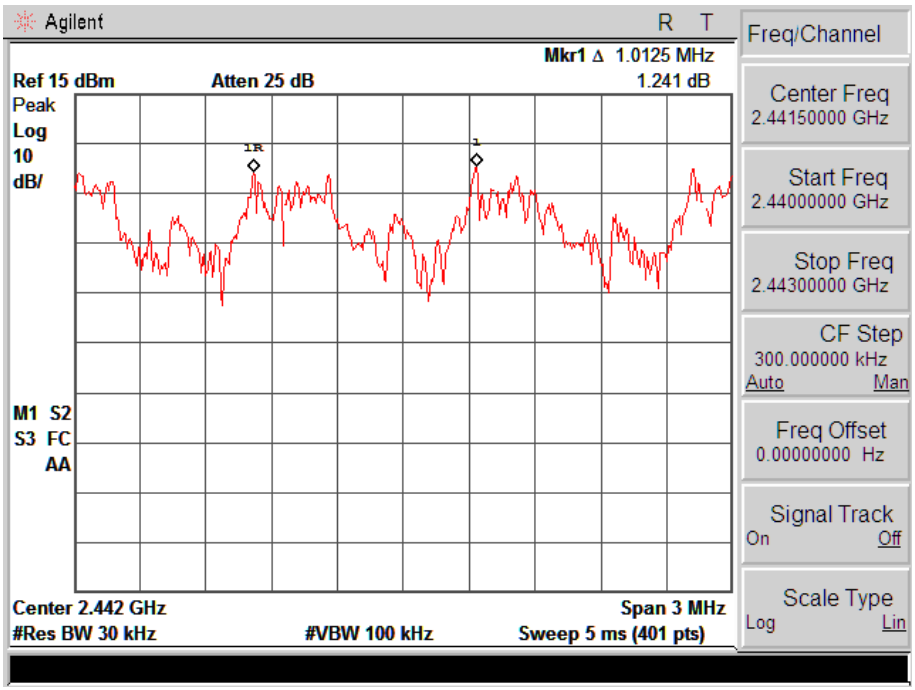


For Pi/4QDPSK mode

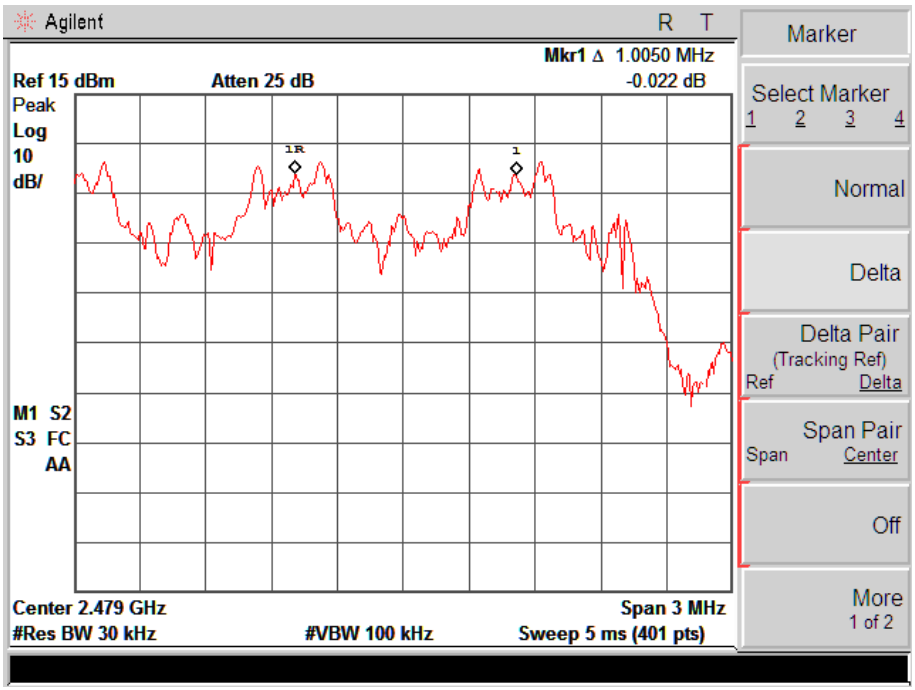
Channel Spacing (Low CH=1MHz)



Channel Spacing (Middle CH=1MHz)

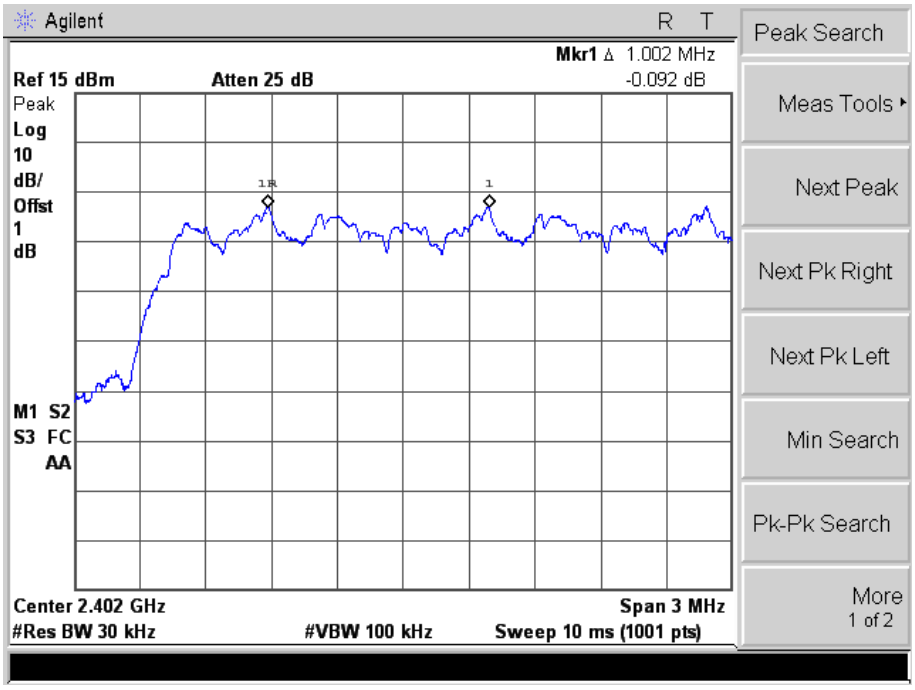


Channel Spacing (High CH=1MHz)

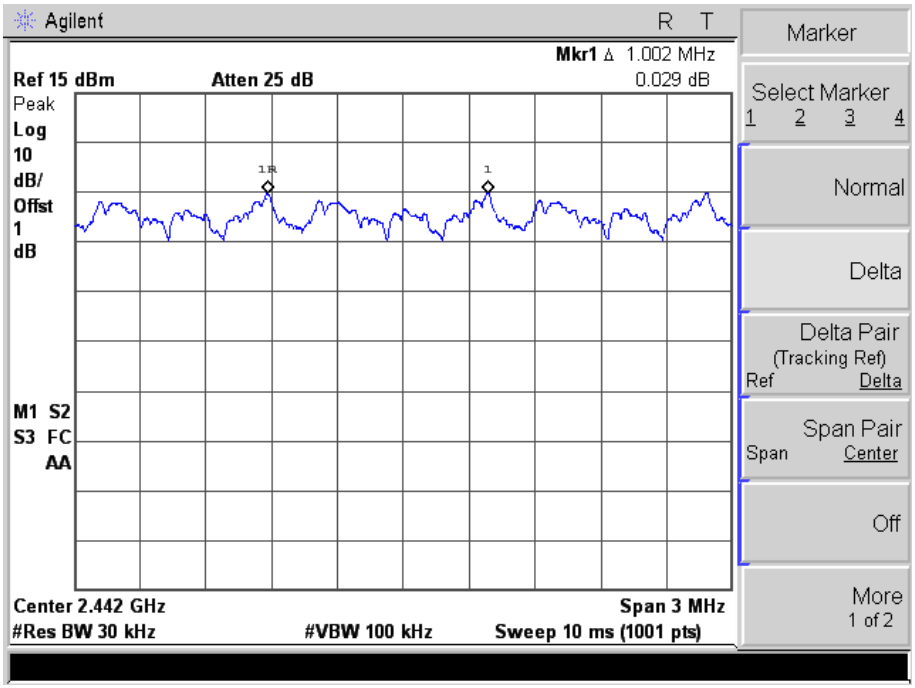


For 8DPSK mode

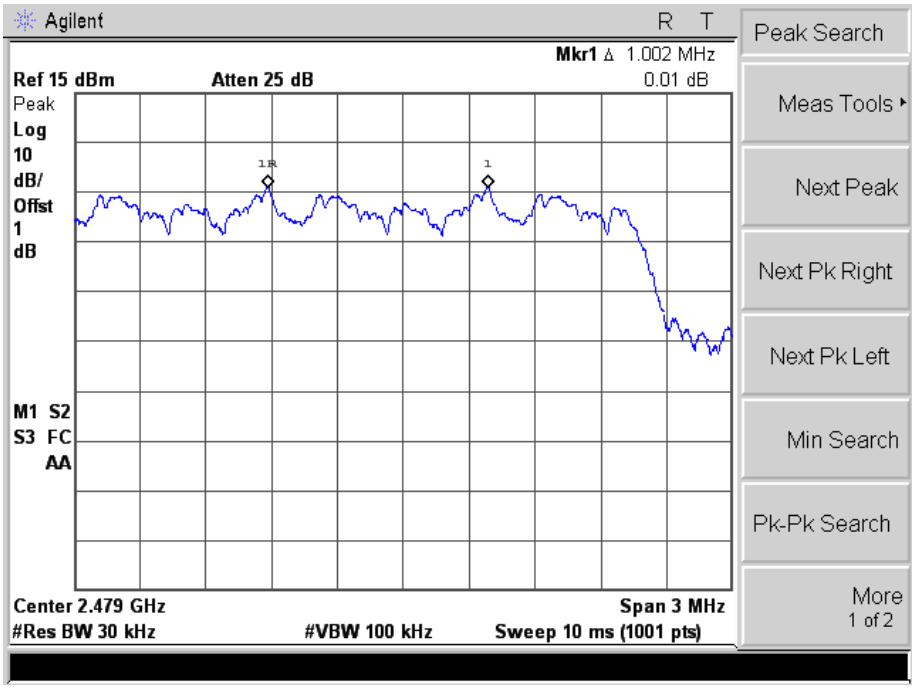
Channel Spacing (Low CH=1MHz)



Channel Spacing (Middle CH=1MHz)



Channel Spacing (High CH=1MHz)



7. Dwell Time of Hopping Channel

7.1 Standard Applicable

According to 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. 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.

7.2 Test Procedure

According to ANSI C63.10-2013 section 7.8.4, the dwell time of a hopping channel test method as follows.

a) Span: Zero span, centered on a hopping channel.
b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use avideo trigger and trigger delay so that the transmitted signal starts a little to the right of the start
of the plot. The trigger level might need slight adjustment to prevent triggering when the systemhops on an adjacent channel; a second plot might be needed with a longer sweep time to showtwo successive hops on a channel.
d) Detector function: Peak.
e) Trace: Max hold.

Use the marker-delta function to determine the transmit time per hop. If this value varies with differentmodes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this testfor each variation in transmit time.
Repeat the measurement using a longer sweep time to determine the number of hops over the periodspecified in the requirements. The sweep time shall be equal to, or less than, the period specified in therequirements. Determine the number of hops over the sweep time and calculate the total number of hops inthe period specified in the requirements, using the following equation:
(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)
The average time of occupancy is calculated from the transmit time per hop multiplied by the number ofhops in the period specified in the requirements. If the number of hops in a specific time varies withdifferent modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeatthis test for each variation.
The measured transmit time and time between hops shall be consistent with the values described in theoperational description for the EUT.

7.3 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

7.4 Summary of Test Results/Plots

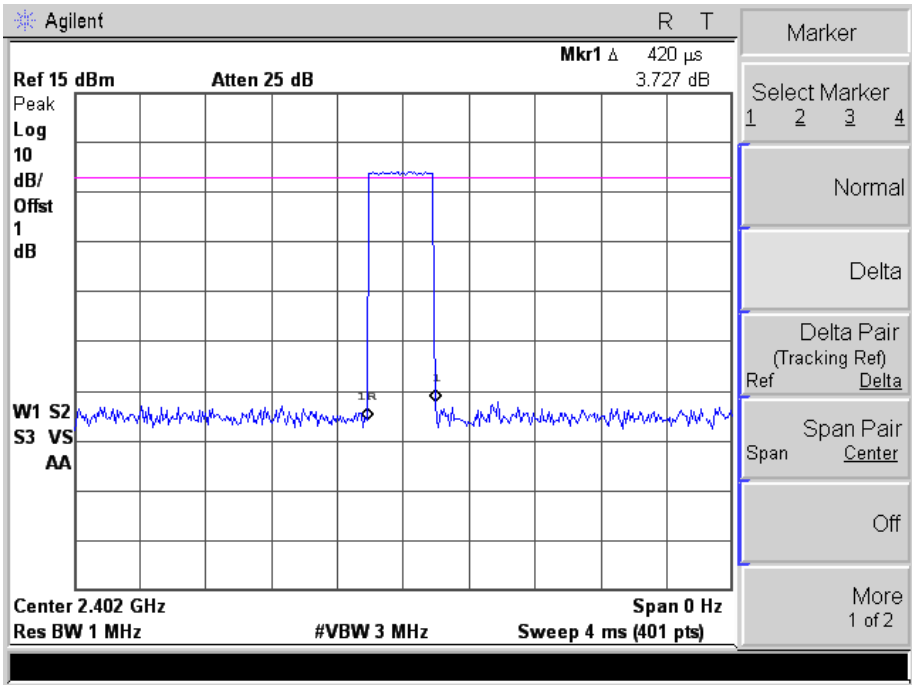
The dwell time within a period in data mode is independent from the packet type (packet length).

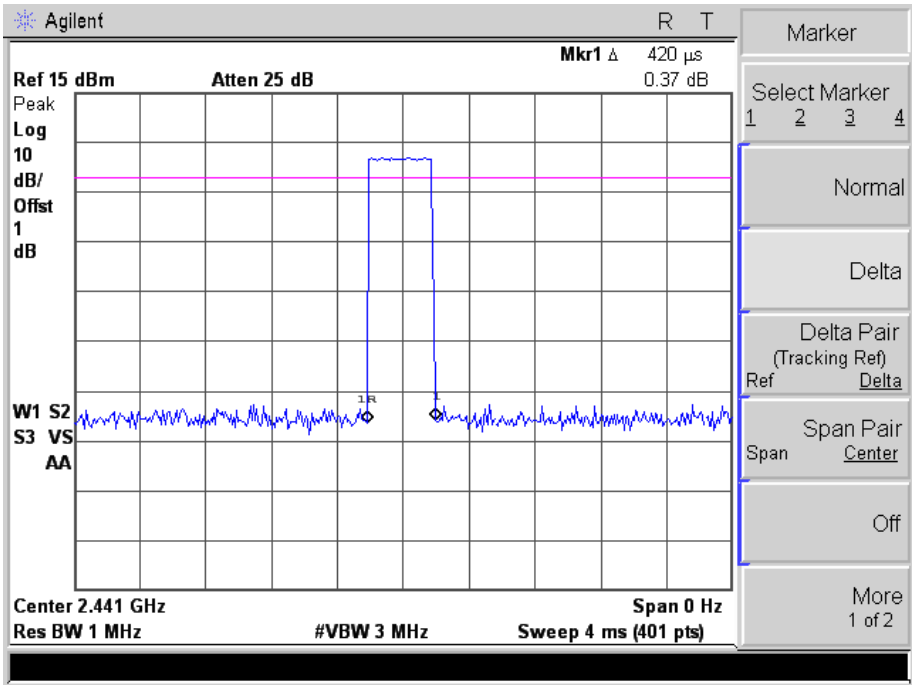
The test period: T = 0.4 Second * 79 Channel = 31.6 s
Dwell time (DH1) = time slot length * (1600 / 2 / 79) * 31.6
Dwell time (DH3) = time slot length * (1600 / 4 / 79) * 31.6
Dwell time (DH5) = time slot length * (1600 / 6 / 79) * 31.6

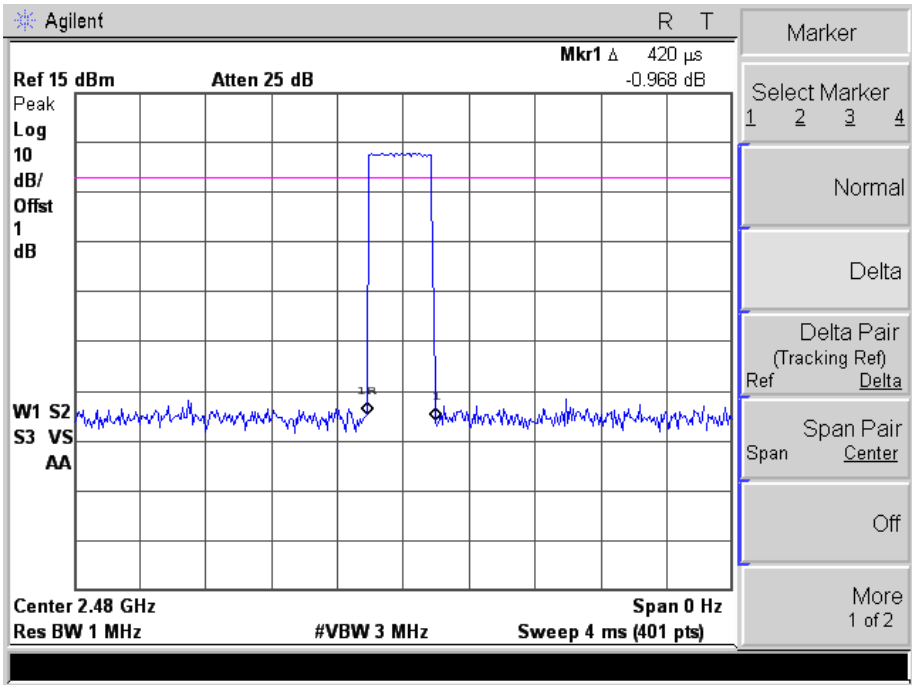
Modulation	Test Channel	Packet	Time Slot Length	Dwell Time	Limit
			ms	ms	ms
GFSK	2402MHz	DH1	0.420	134.400	400
		DH3	1.680	268.800	400
		DH5	2.930	312.533	400
	2441MHz	DH1	0.420	134.400	400
		DH3	1.680	268.800	400
		DH5	2.920	311.467	400
	2480MHz	DH1	0.420	134.400	400
		DH3	1.680	268.800	400
		DH5	2.920	311.467	400
Pi/4 QDPSK	2402MHz	2DH1	0.380	121.600	400
		2DH3	1.640	262.400	400
		2DH5	2.880	307.200	400
	2441MHz	2DH1	0.380	121.600	400
		2DH3	1.640	262.400	400
		2DH5	2.880	307.200	400
	2480MHz	2DH1	0.370	118.400	400
		2DH3	1.640	262.400	400
		2DH5	2.880	307.200	400
8DPSK	2402MHz	3DH1	0.430	137.600	400
		3DH3	1.680	268.800	400
		3DH5	2.930	312.533	400
	2441MHz	3DH1	0.440	140.800	400
		3DH3	1.680	268.800	400
		3DH5	2.940	313.600	400
	2480MHz	3DH1	0.440	140.800	400
		3DH3	1.680	268.800	400
		3DH5	2.940	313.600	400

Please refer to the test plots as below:

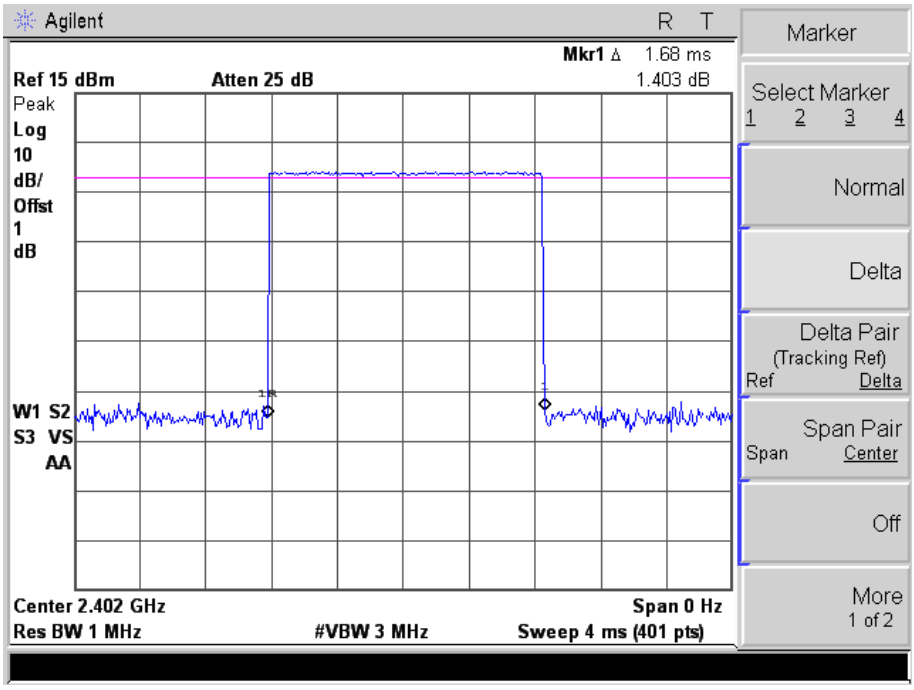
DH1 time slot (Low, Middle, High Channels)

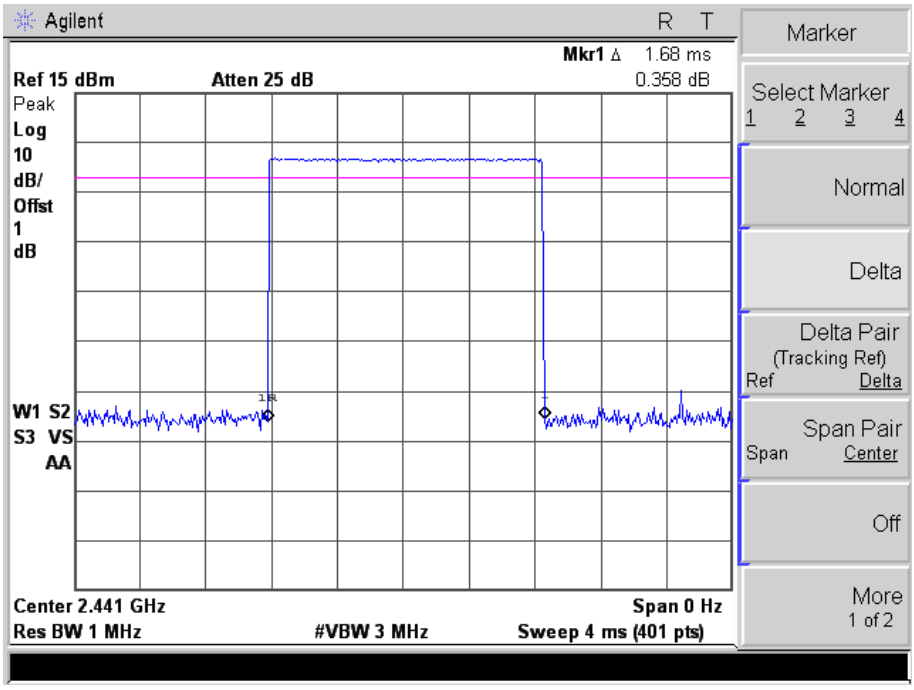






DH3 time slot (Low, Middle, High Channels)




Agilent
R T
Mkr1 Δ 1.68 ms
0.358 dB
Ref 15 dBm
Atten 25 dB
Peak
Log
10
dB/
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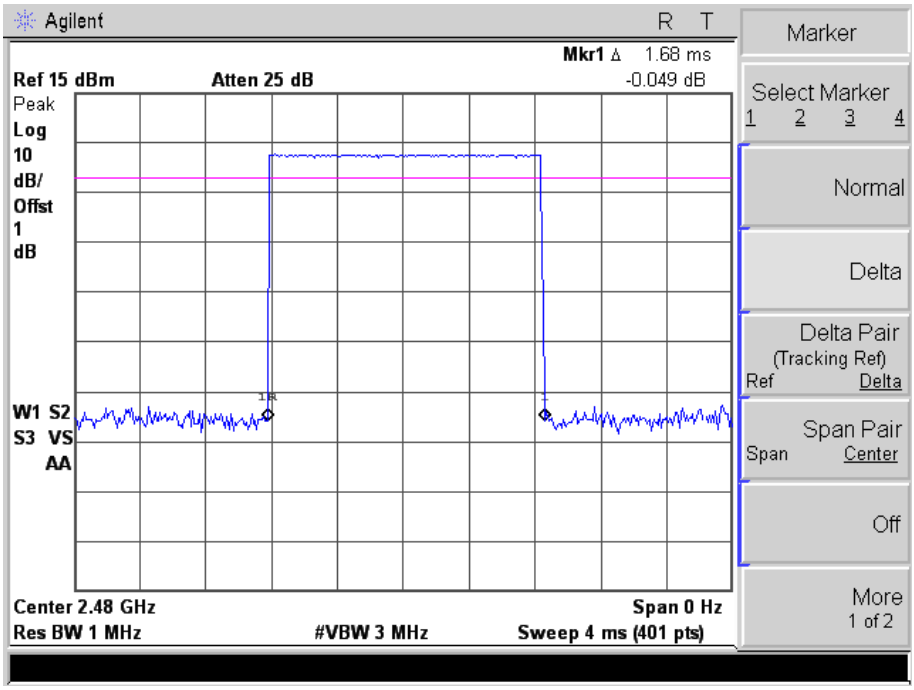
1
dB
W1 S2
S3 VS
AA
Center 2.441 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 4 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent
R T
Mkr1 Δ 1.68 ms
-0.049 dB
Ref 15 dBm
Atten 25 dB
Peak
Log
10
dB/
Offst
1
dB
W1 S2
S3 VS
AA
Center 2.48 GHz
Res BW 1 MHz
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Span 0 Hz
Sweep 4 ms (401 pts)
Marker
Select Marker
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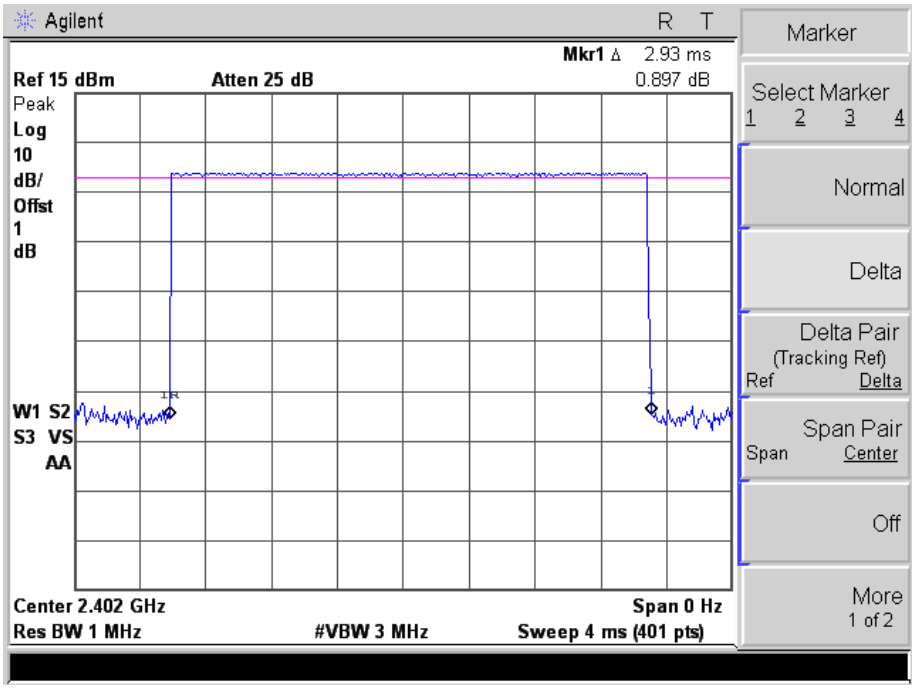
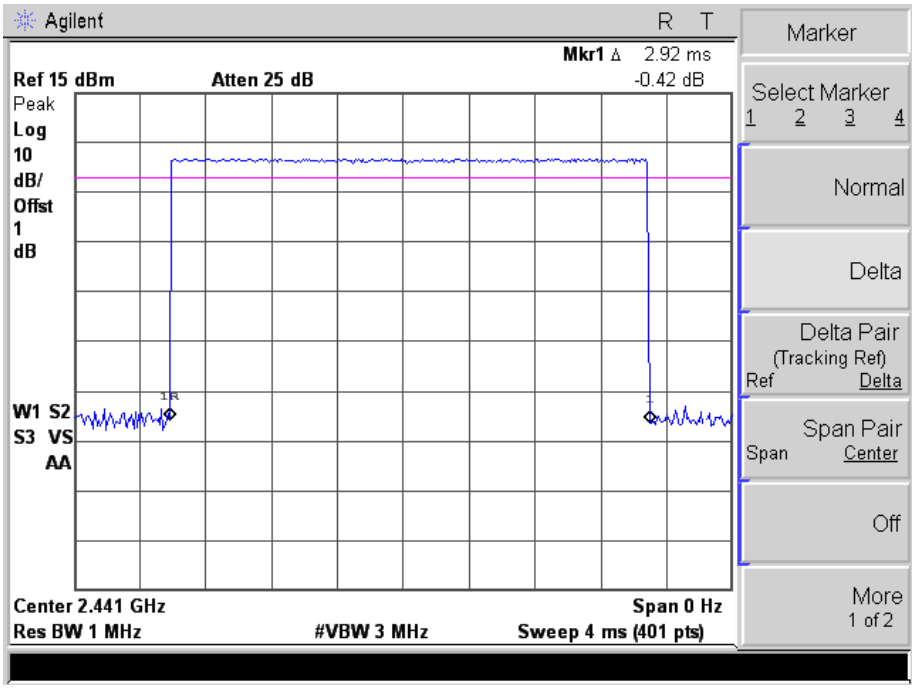
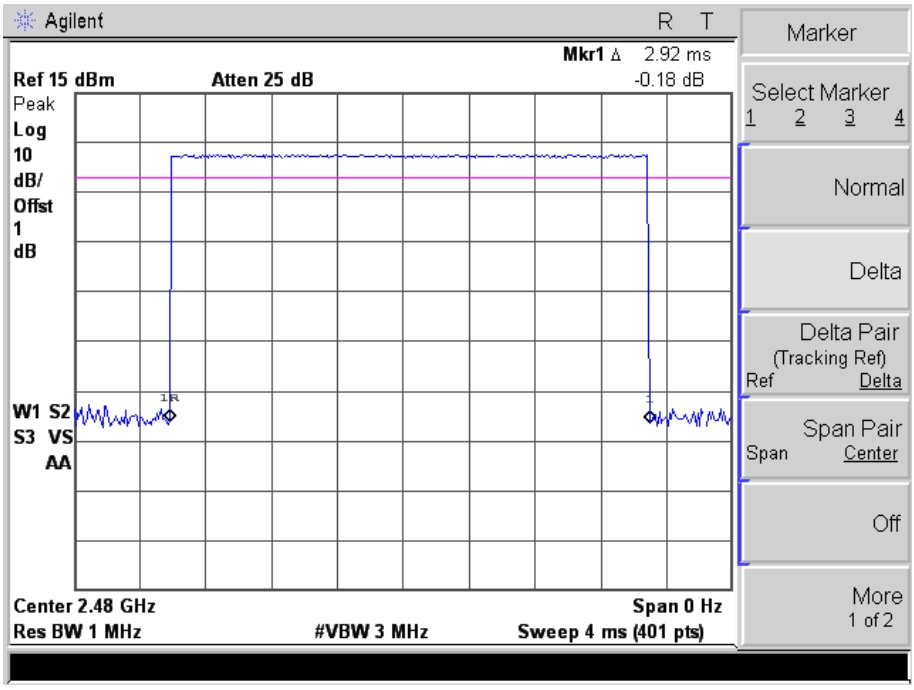
Off
More
1 of 2

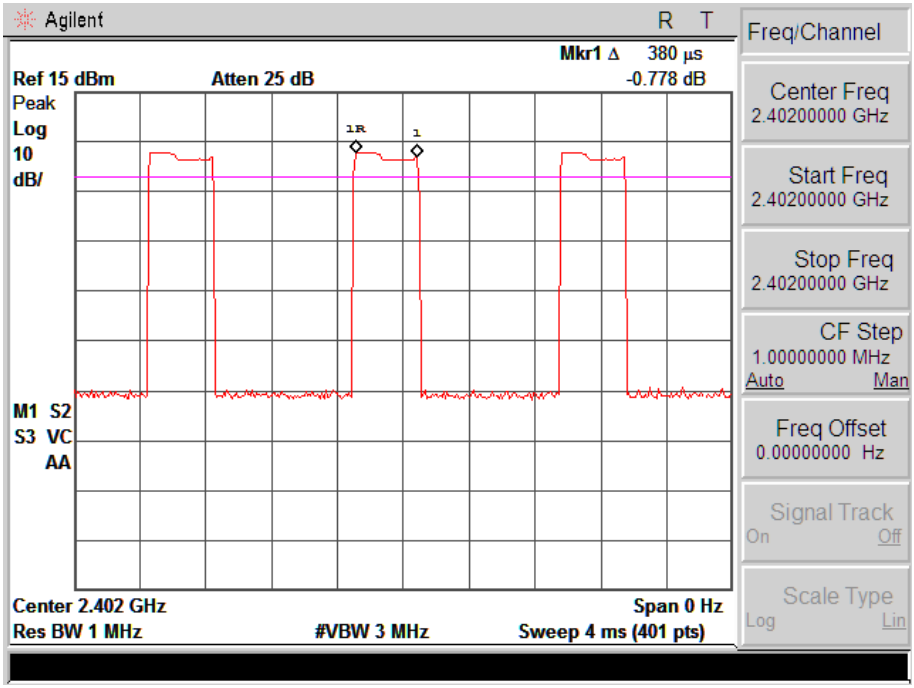
DH5 time slot (Low, Middle, High Channels)

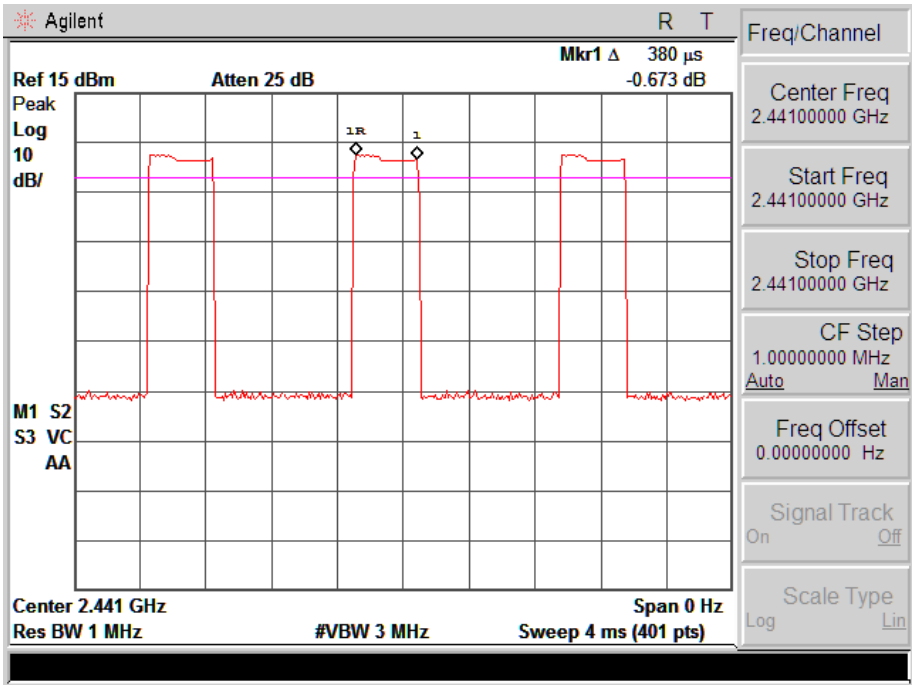


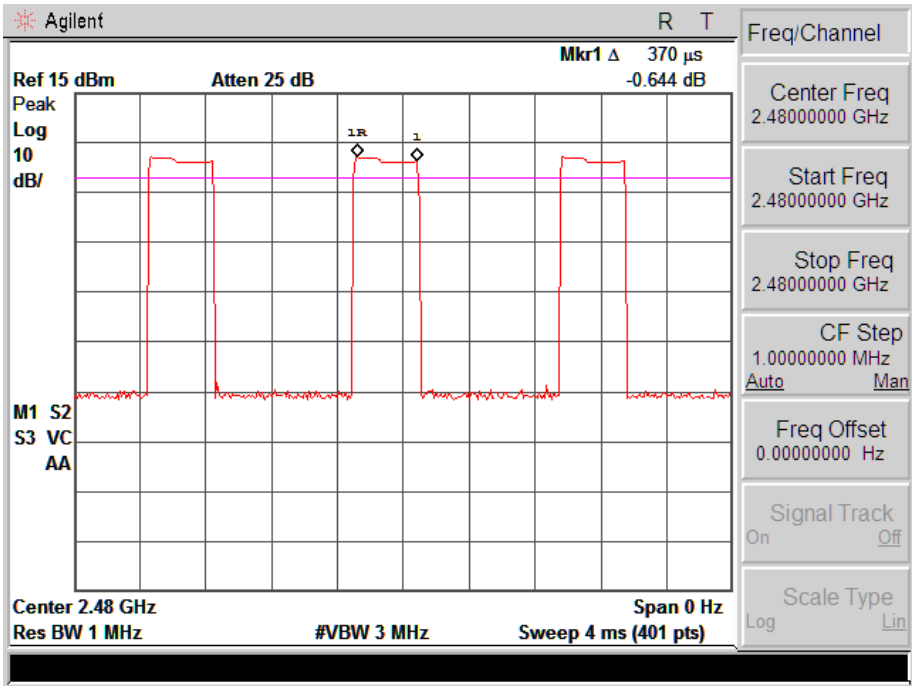




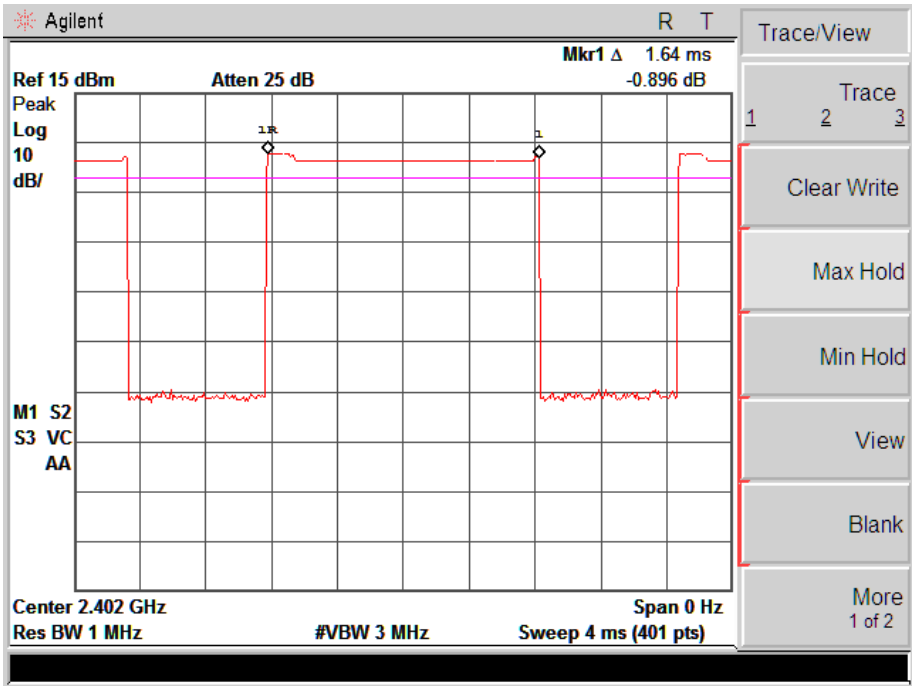
2DH1 time slot (Low, Middle, High Channels)

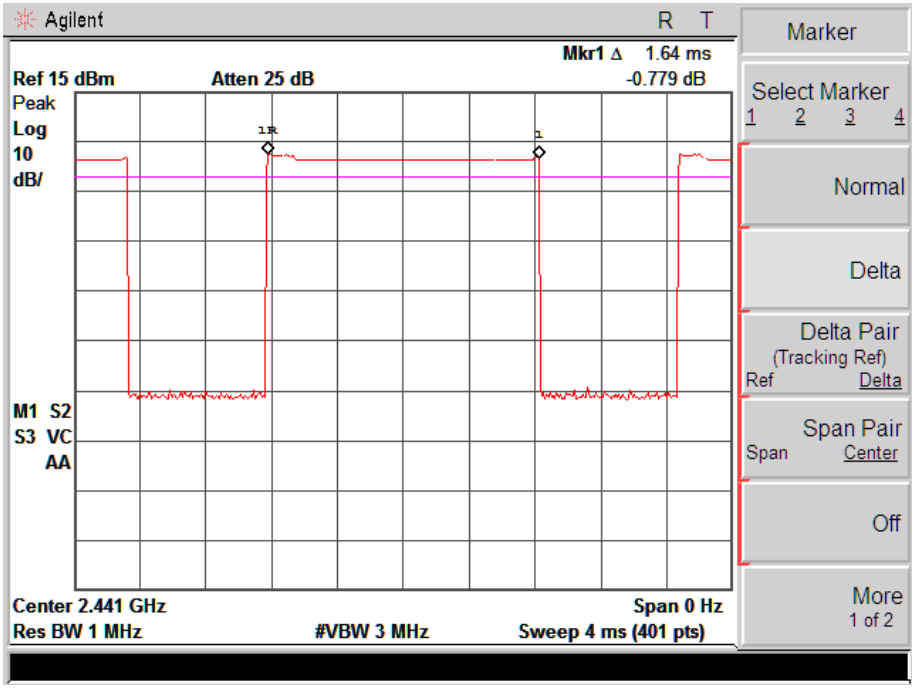


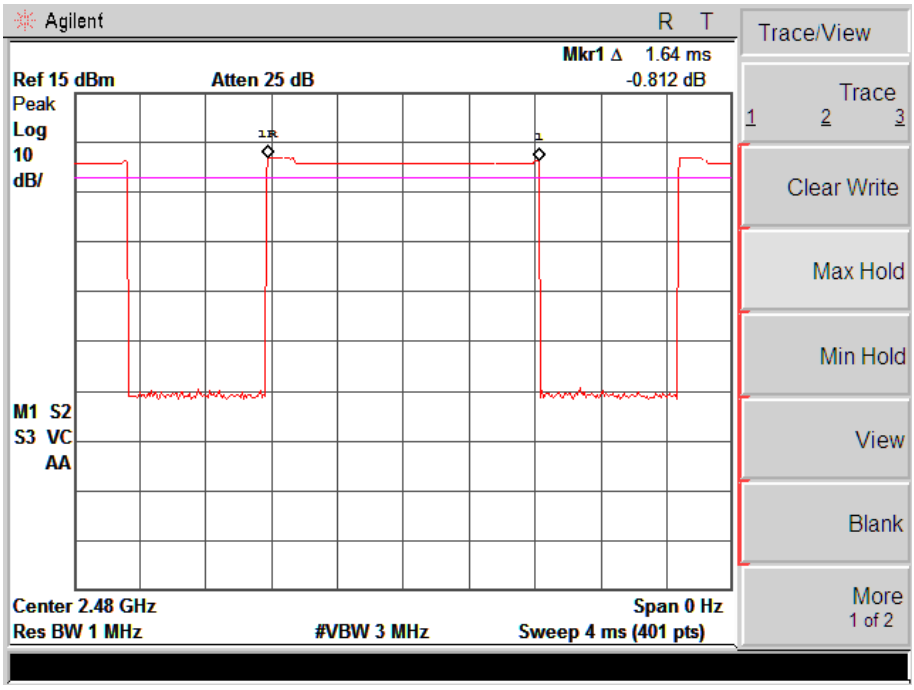

Agilent
R T
Mkr1 Δ 380 µs
-0.673 dB
Ref 15 dBm
Atten 25 dB
Peak
Log
10
dB/
1R
1
M1 S2
S3 VC
AA
Center 2.441 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 4 ms (401 pts)
Freq/Channel
Center Freq
2.44100000 GHz
Start Freq
2.44100000 GHz
Stop Freq
2.44100000 GHz
CF Step
1.00000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin


Agilent
R T
Mkr1 Δ 370 µs
-0.644 dB
Ref 15 dBm
Atten 25 dB
Peak
Log
10
dB/
1R
1
M1 S2
S3 VC
AA
Center 2.48 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 4 ms (401 pts)
Freq/Channel
Center Freq
2.48000000 GHz
Start Freq
2.48000000 GHz
Stop Freq
2.48000000 GHz
CF Step
1.00000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

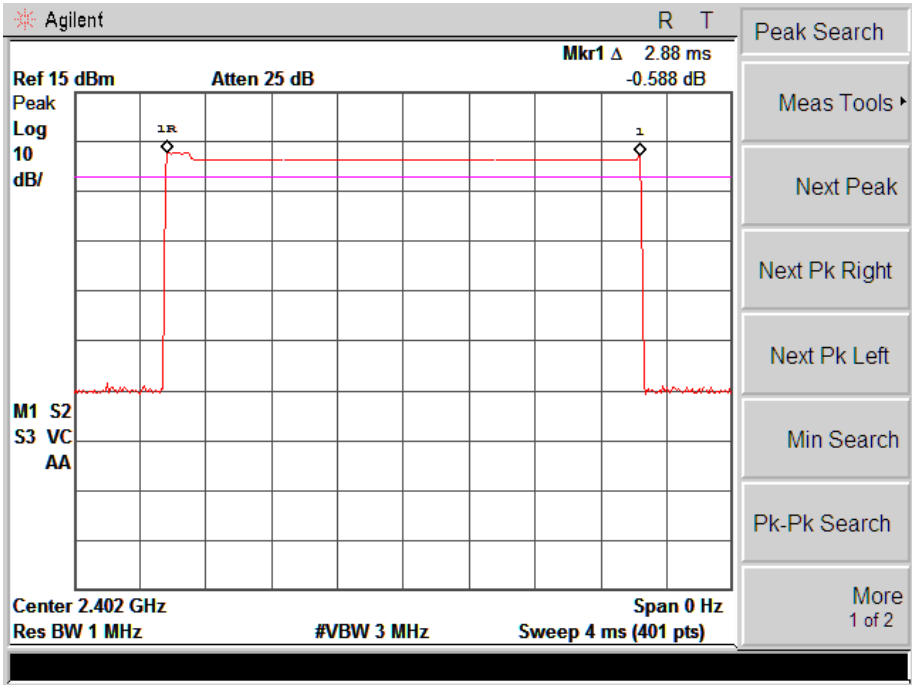
2DH3 time slot (Low, Middle, High Channels)

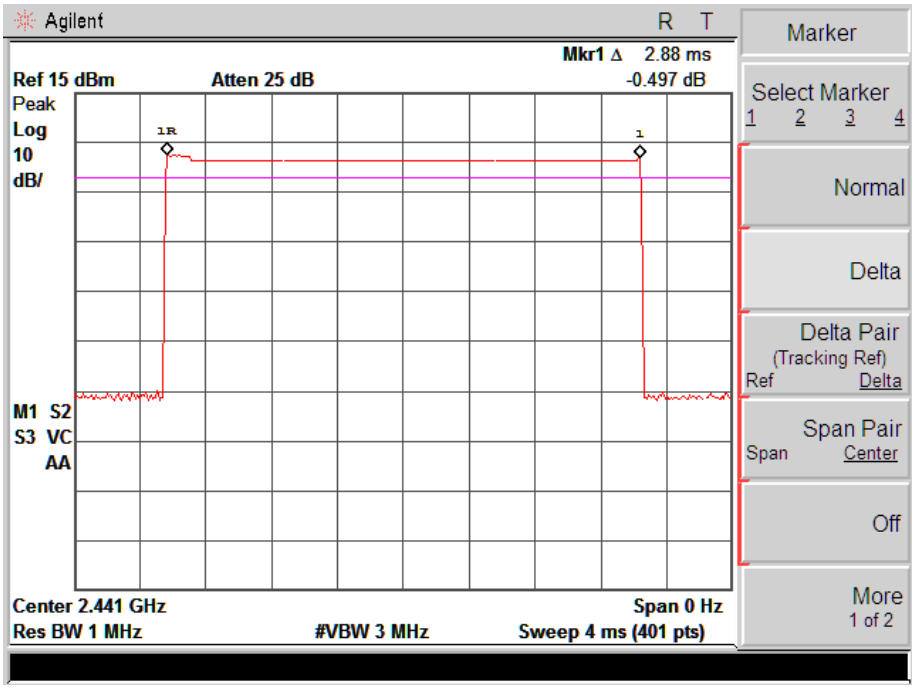


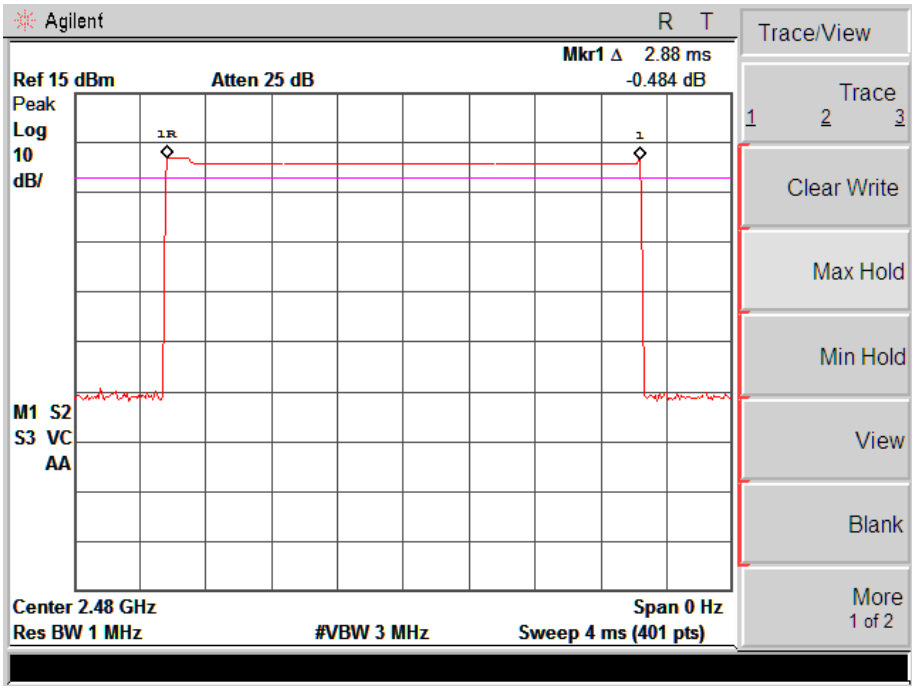




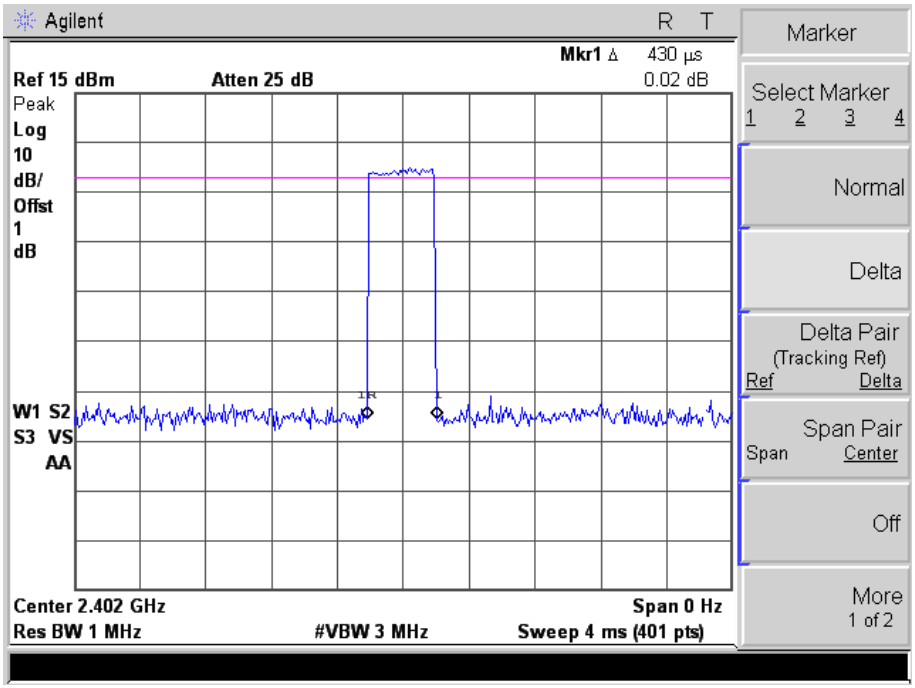
2DH5 time slot (Low, Middle, High Channels)

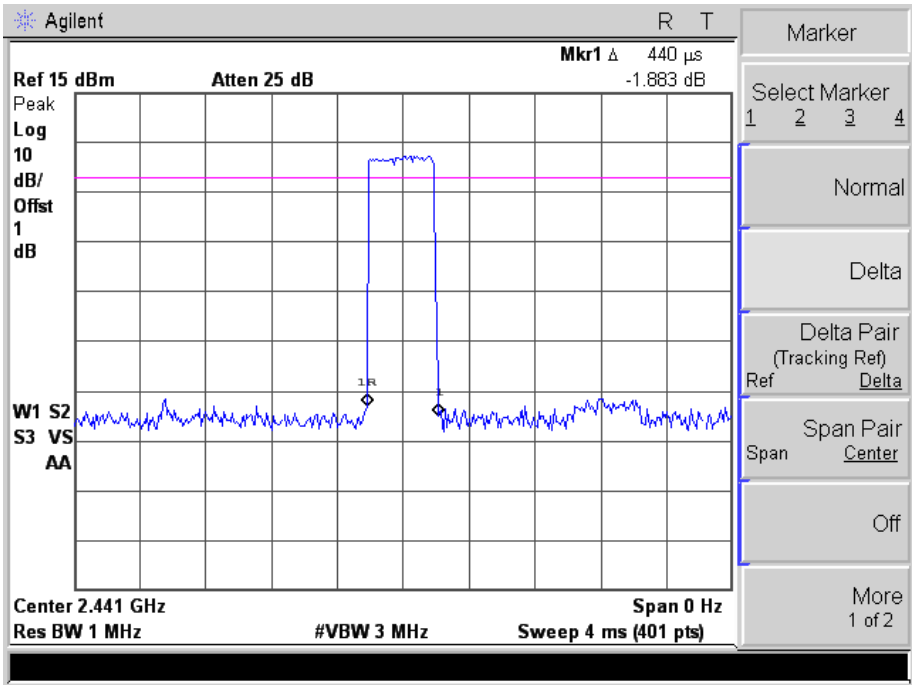


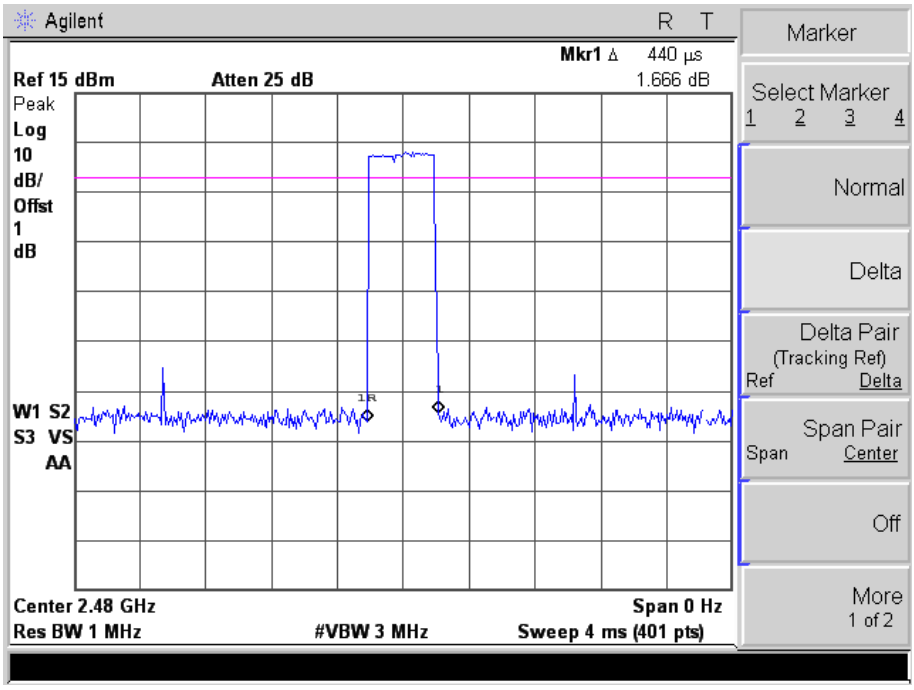

Agilent
R T
Mkr1 Δ 2.88 ms
-0.497 dB
Ref 15 dBm
Atten 25 dB
Peak
Log
10
dB/
1R
1
M1 S2
S3 VC
AA
Center 2.441 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 4 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent
R T
Mkr1 Δ 2.88 ms
-0.484 dB
Ref 15 dBm
Atten 25 dB
Peak
Log
10
dB/
1R
1
M1 S2
S3 VC
AA
Center 2.48 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 4 ms (401 pts)
Trace/View
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

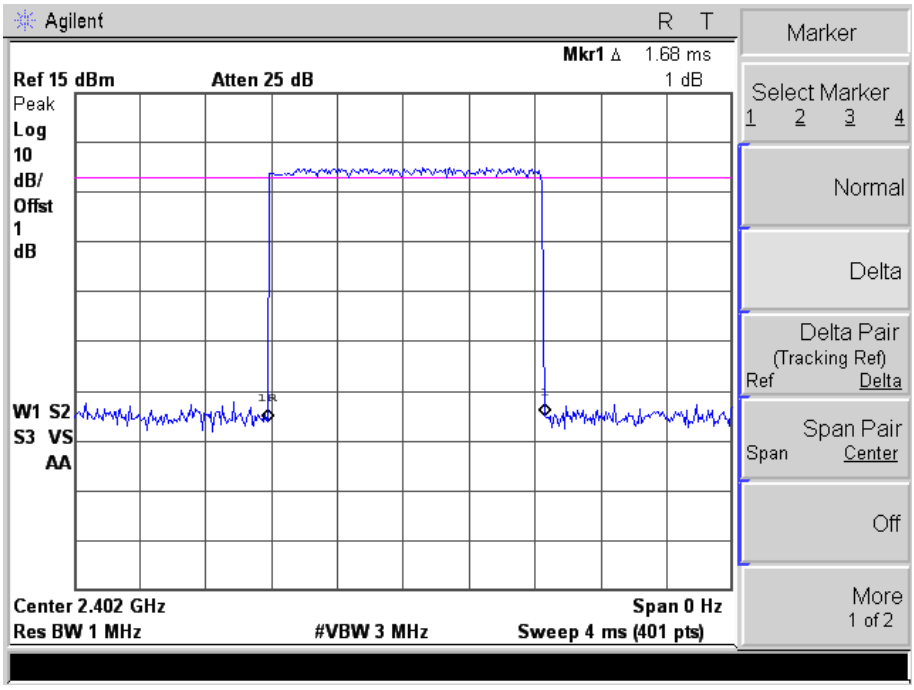
3DH1 time slot (Low, Middle, High Channels)

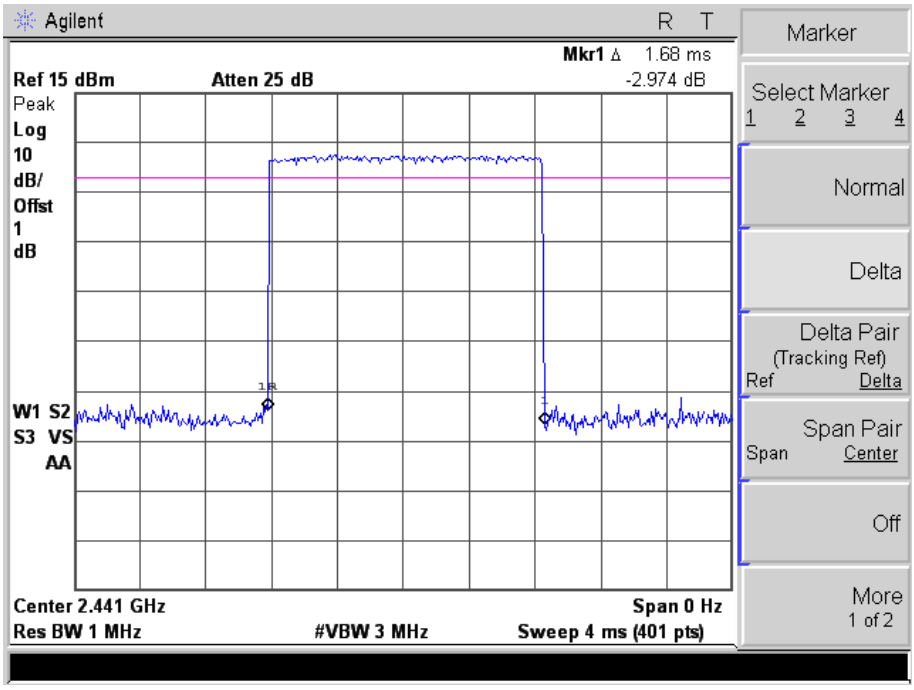


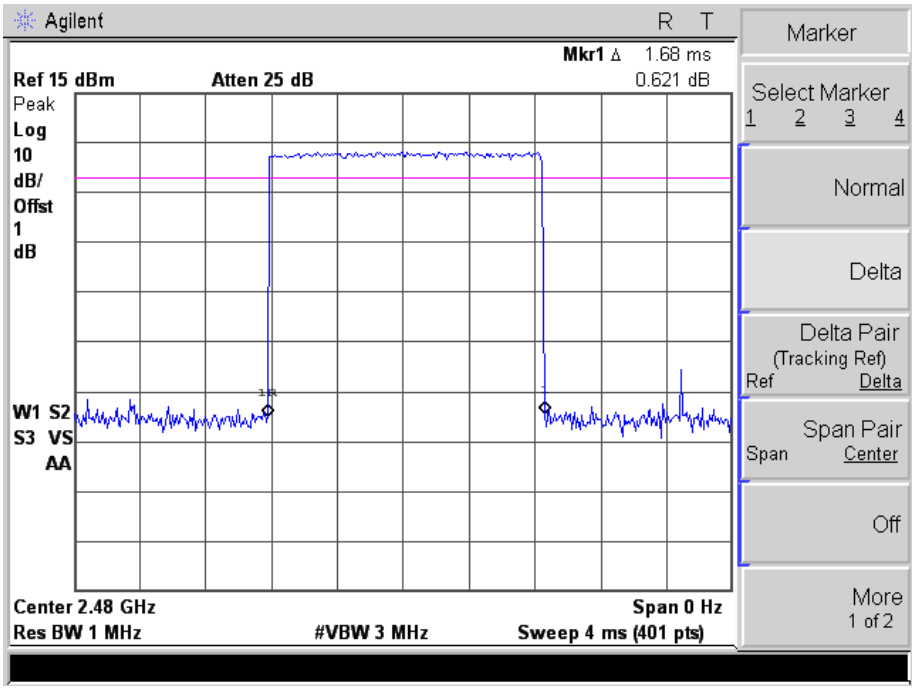




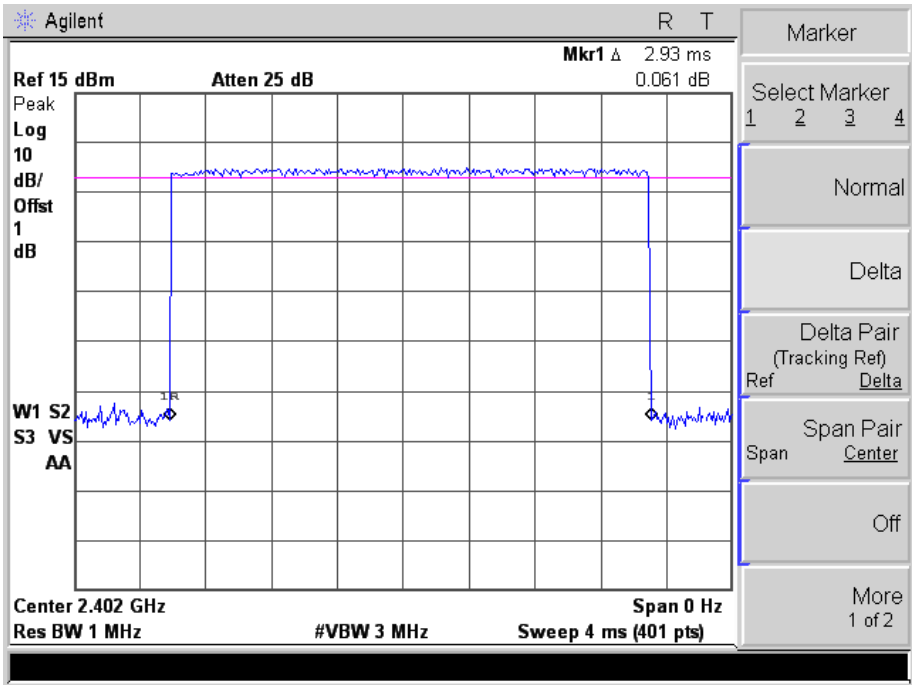
3DH3 time slot (Low, Middle, High Channels)

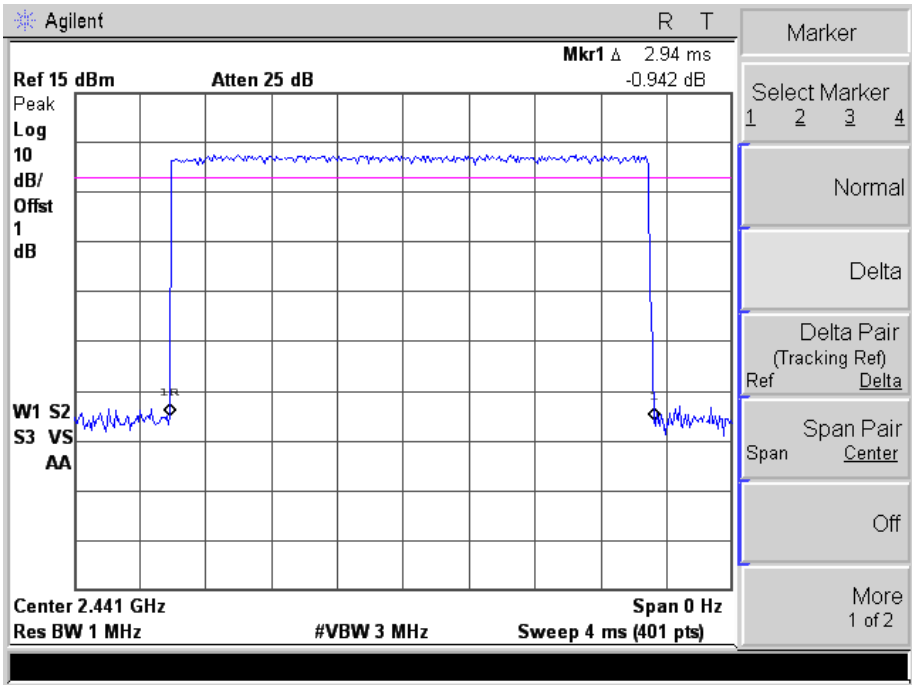


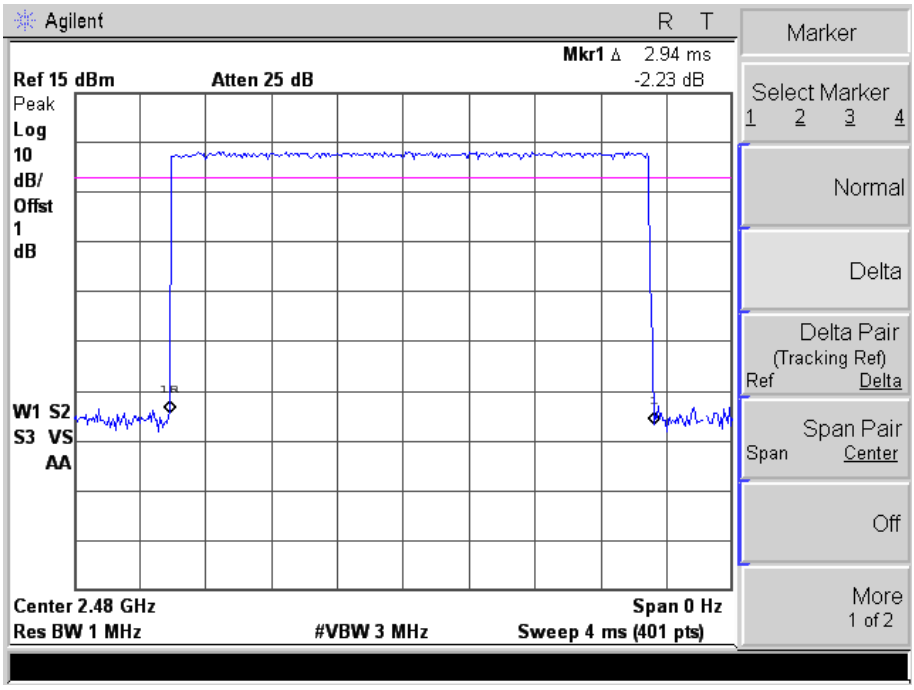

Agilent
R T
Mkr1 Δ 1.68 ms
-2.974 dB
Ref 15 dBm
Atten 25 dB
Peak
Log
10
dB/
Offst
1
dB
W1 S2
S3 VS
AA
Center 2.441 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 4 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent
R T
Mkr1 Δ 1.68 ms
0.621 dB
Ref 15 dBm
Atten 25 dB
Peak
Log
10
dB/
Offst
1
dB
W1 S2
S3 VS
AA
Center 2.48 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 4 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

3DH5 time slot (Low, Middle, High Channels)






Agilent
R T
Mkr1 Δ 2.94 ms
-2.23 dB
Ref 15 dBm
Atten 25 dB
Peak
Log
10
dB/
Offst
1
dB
W1 S2
S3 VS
AA
Center 2.48 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 4 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

8. 20dB Bandwidth

8.1 Standard Applicable

According to 15.247(a) and 15.215(c). 20dB bandwidth is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

8.2 Test Procedure

According to ANSI C63.10-2013 section 6.9.2, the 20dB bandwidth test method as follows.

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency.The span range for the EMI receiver or spectrum analyzer shall be between two times and fivetimes the OBW.
b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW andvideo bandwidth (VBW) shall be approximately three times RBW, unless otherwise specifiedby the applicable requirement.
c) Set the reference level of the instrument as required, keeping the signal from exceeding themaximum input mixer level for linear operation. In general, the peak of the spectral envelopeshall be more than [10 log (OBW/RBW)] below the reference level.
d) Steps a) through c) might require iteration to adjust within the specified tolerances.
e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below thetarget "−xx dB down" requirement; that is, if the requirement calls for measuring the −20 dBOBW, the instrument noise floor at the selected RBW shall be at least 30 dB below thereference value.
f) Set detection mode to peak and trace mode to max hold.
g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulatedsignal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to thehighest level of the displayed trace (this is the reference value).
h) Determine the "−xx dB down amplitude" using [(reference value) − xx]. Alternatively, thiscalculation may be made by using the marker-delta function of the instrument.
i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulationON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow thenew trace to stabilize. Otherwise, the trace from step g) shall be used for step j).
j) Place two markers, one at the lowest frequency and the other at the highest frequency of theenvelope of the spectral display, such that each marker is at or slightly below the "−xx dB downamplitude" determined in step h). If a marker is below this "−xx dB down amplitude" value,then it shall be as close as possible to this value. The occupied bandwidth is the frequencydifference between the two markers. Alternatively, set a marker at the lowest frequency of theenvelope of the spectral display, such that the marker is at or slightly below the "−xx dB down amplitude" determined in step h). Reset the marker-delta function and move the marker to theother side of the emission until the delta marker amplitude is at the same level as the referencemarker amplitude. The marker-delta frequency reading at this point is the specified emissionbandwidth.
k) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrumentdisplay; the plot axes and the scale units per division shall be clearly labeled. Tabular data maybe reported in addition to the plot(s).

8.3 Environmental Conditions

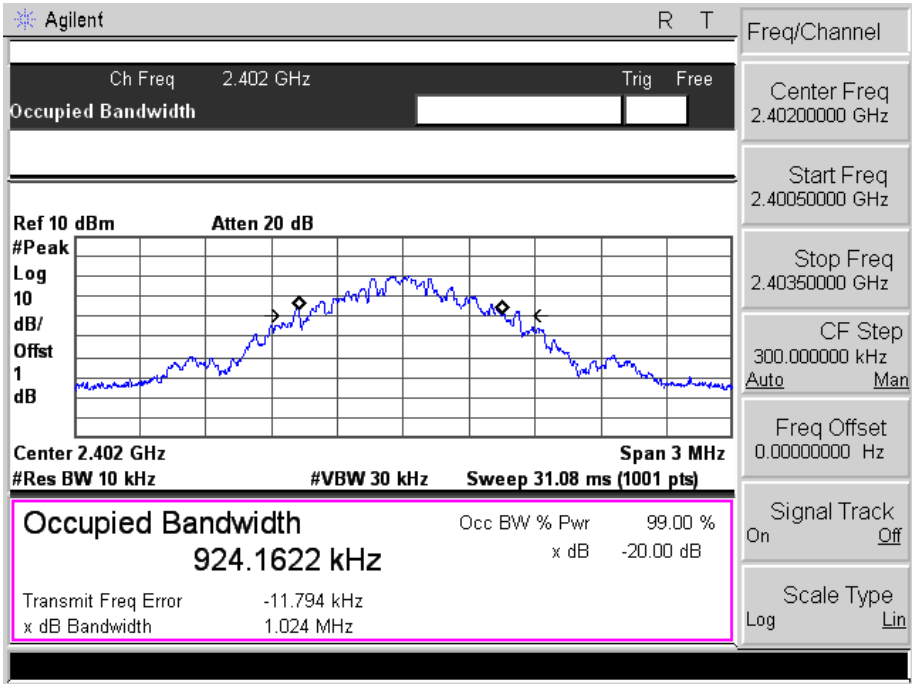
Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

8.4 Summary of Test Results/Plots

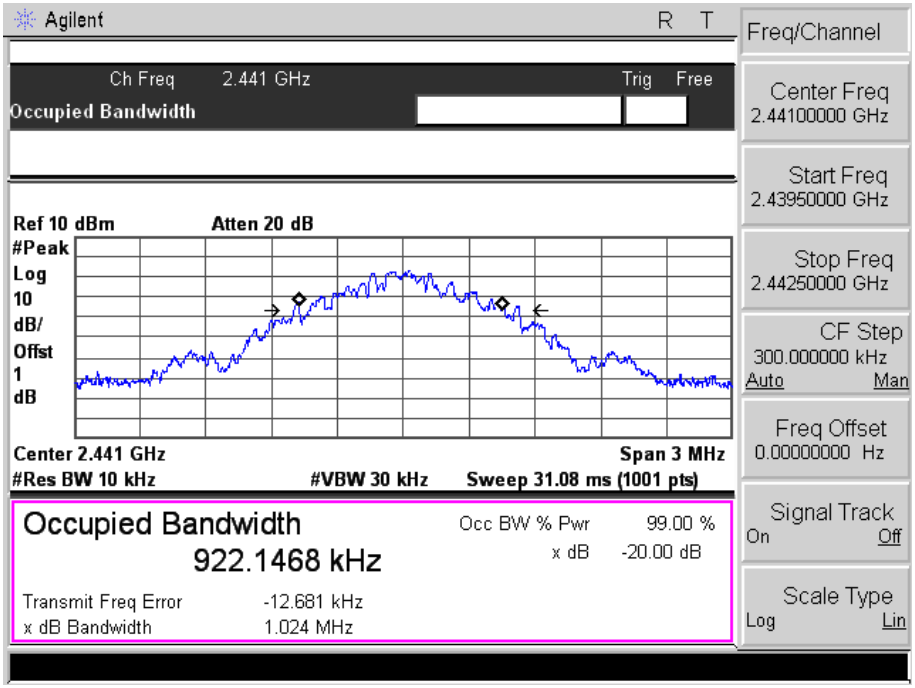
Test Mode	Test Channel MHz	20 dB Bandwidth MHz	99% Bandwidth KHz	Result
GFSK	2402	1.024	924.1622	Pass
	2441	1.024	922.1468	Pass
	2480	1.024	925.4027	Pass
Pi/4 QDPSK	2402	1.029	1019.2000	Pass
	2441	1.025	1018.3000	Pass
	2480	1.026	1018.5000	Pass
8DPSK	2402	1.360	1201.1000	Pass
	2441	1.365	1210.4000	Pass
	2480	1.369	1224.5000	Pass

For GFSK

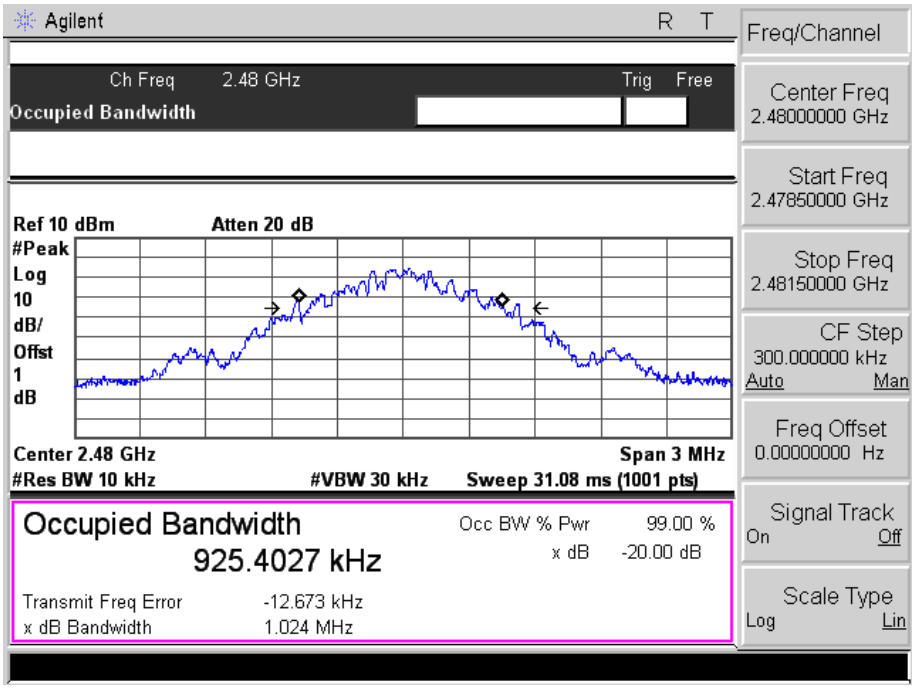
Low Channel:



Middle Channel:

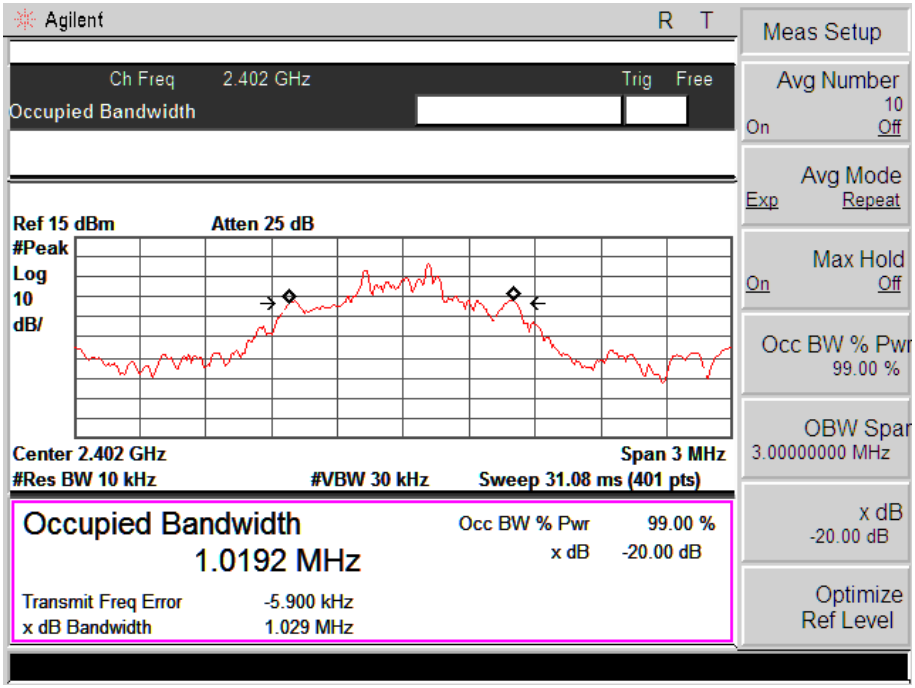


High Channel:

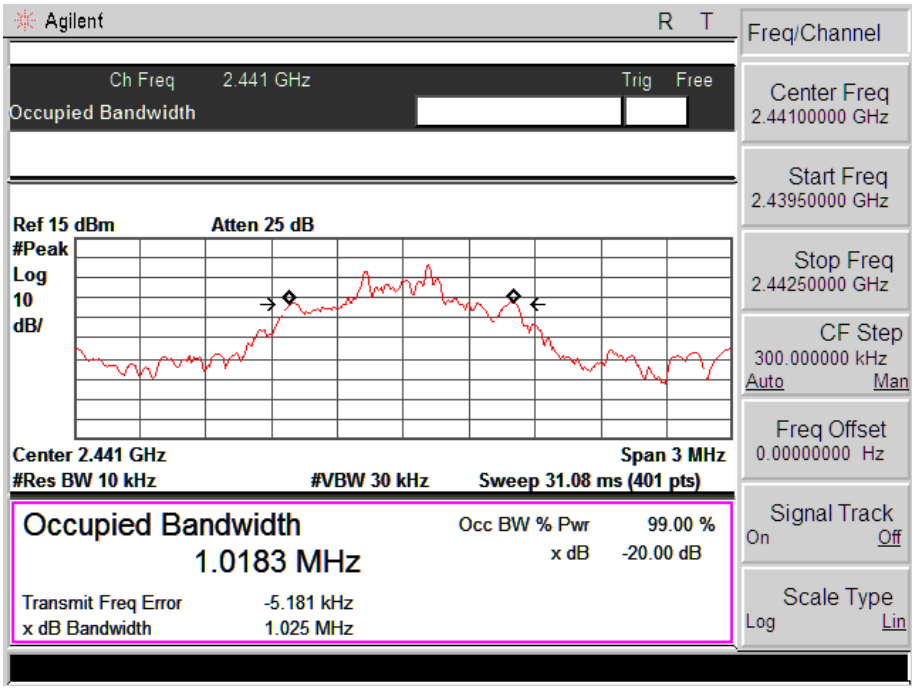


For Pi/4 QDPSK

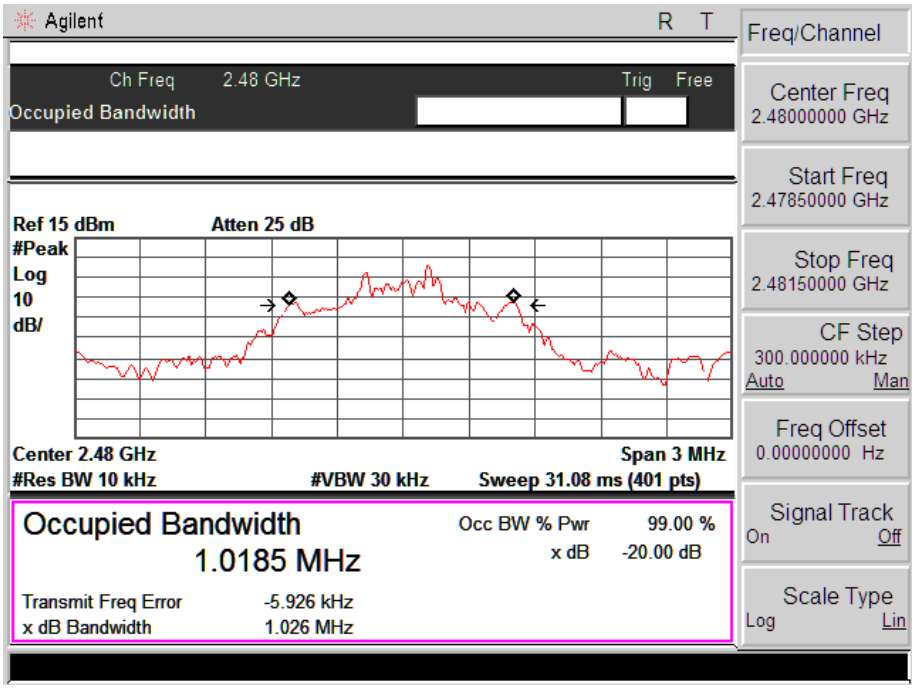
Low Channel:



Middle Channel:

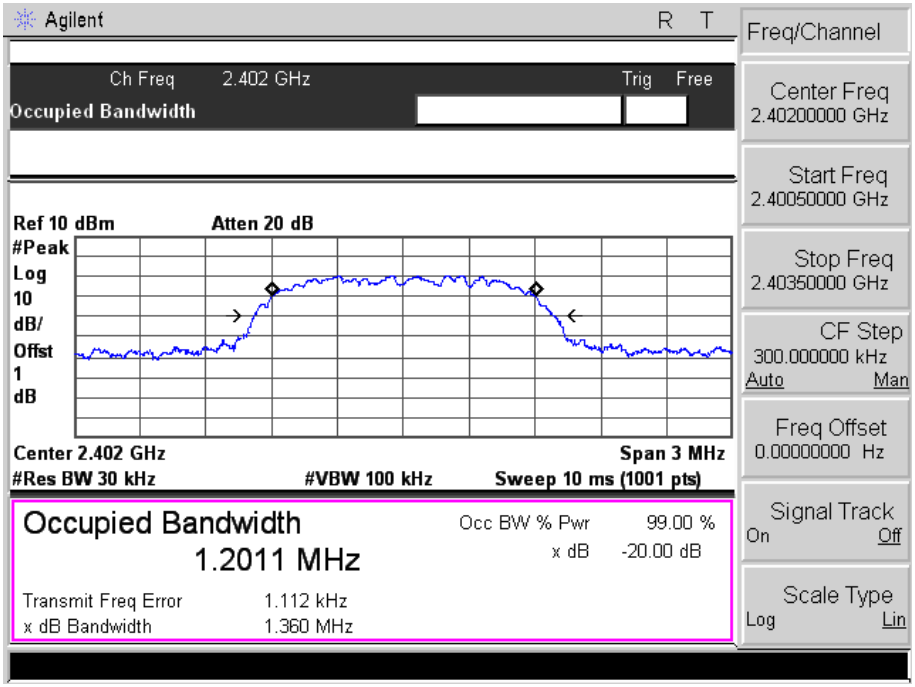


High Channel:

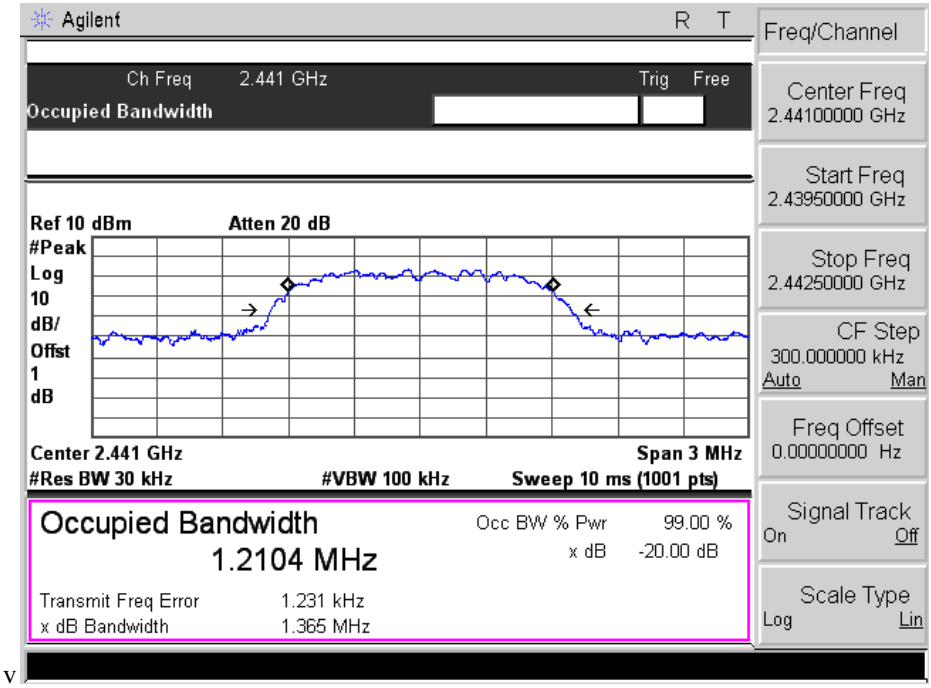


For 8DPSK

Low Channel:

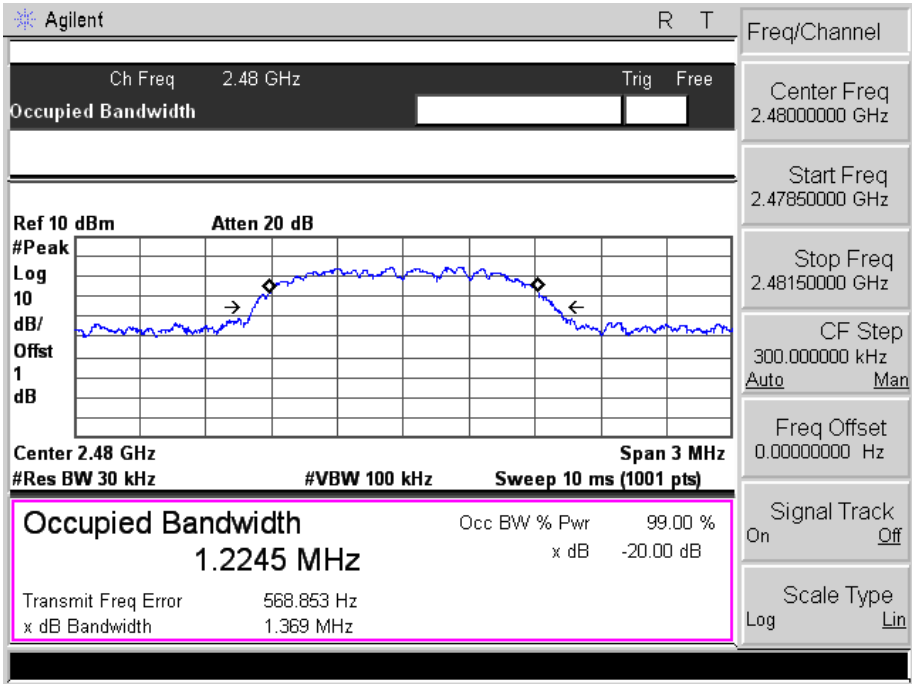


Middle Channel:



v

High Channel:



9. RF Output Power

9.1 Standard Applicable

According to 15.247(b)(1). For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

9.2 Test Procedure

According to ANSI C63.10-2013 section 7.8.5, the output power test method as follows.
Remove the antenna from the EUT and then connect a low loss RF cable from the antennaport to the spectrum analyzer.
This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between theantenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation.
Thehopping shall be disabled for this test:
a) Use the following spectrum analyzer settings:
   1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
   2) RBW > 20 dB bandwidth of the emission being measured.
   3) VBW ≥ RBW.
   4) Sweep: Auto.
   5) Detector function: Peak.
   6) Trace: Max hold.
b) Allow trace to stabilize.
c) Use the marker-to-peak function to set the marker to the peak of the emission.
d) The indicated level is the peak output power, after any corrections for external attenuators andcables.
e) A plot of the test results and setup description shall be included in the test report.

9.3 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	55%
ATM Pressure:	1011 mbar

9.4 Summary of Test Results/Plots

For GFSK

Channel	Frequency MHz	Measured Value dBm	Output Power mW	Limit mW
Low Channel	2402	-0.851	0.822	1000
Middle Channel	2442	1.802	1.514	1000
High Channel	2480	2.855	1.930	1000

For Pi/4 QDPSK

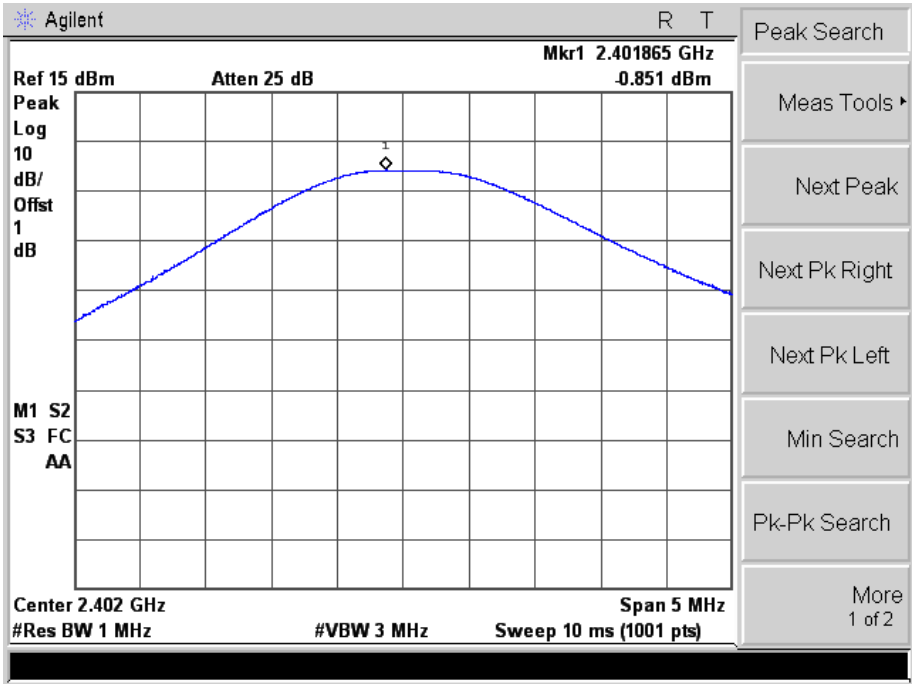
Channel	Frequency MHz	Measured Value dBm	Output Power mW	Limit mW
Low Channel	2402	0.322	1.077	1000
Middle Channel	2442	2.863	1.933	1000
High Channel	2480	3.708	2.349	1000

For 8DPSK

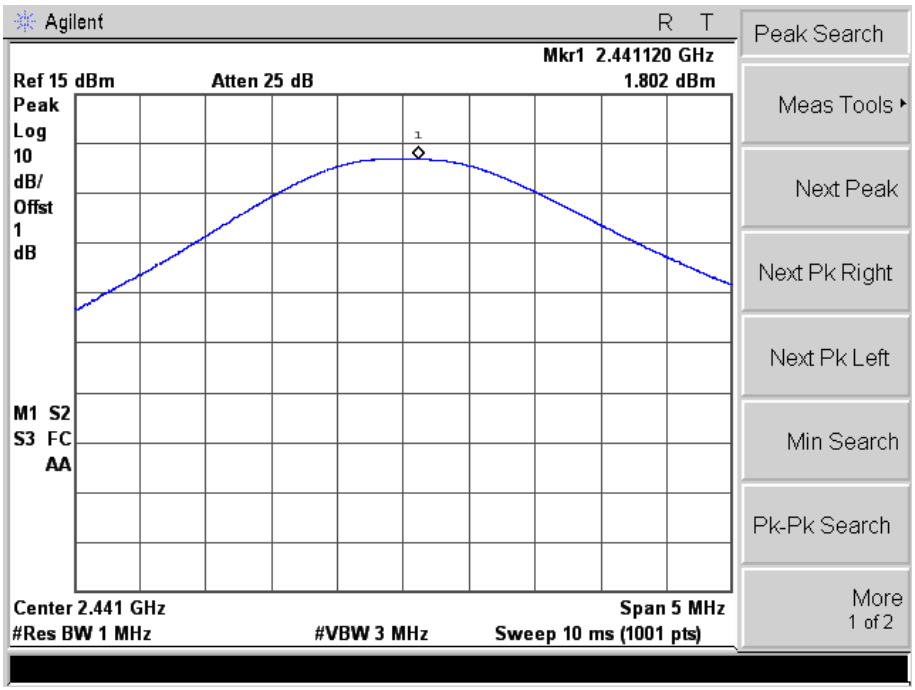
Channel	Frequency MHz	Measured Value dBm	Output Power mW	Limit mW
Low Channel	2402	0.504	1.123	1000
Middle Channel	2442	3.079	2.032	1000
High Channel	2480	3.790	2.393	1000

Note: the antenna gain of 0.23dBi less than 6dBi maximum permission antenna gain value based on 1 watt peak output power limit.

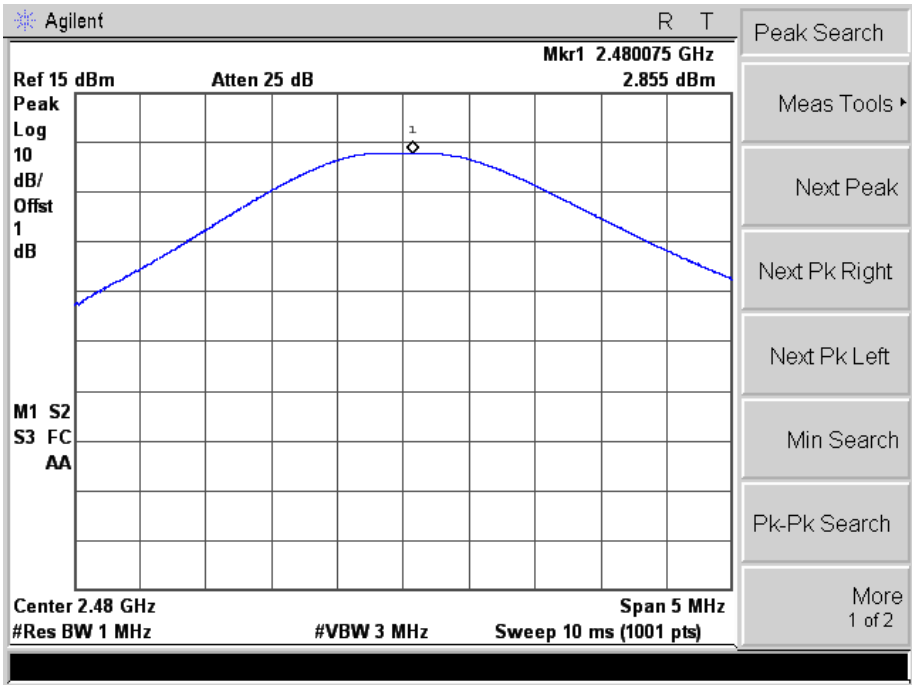
For GFSK
Low Channel



Middle Channel

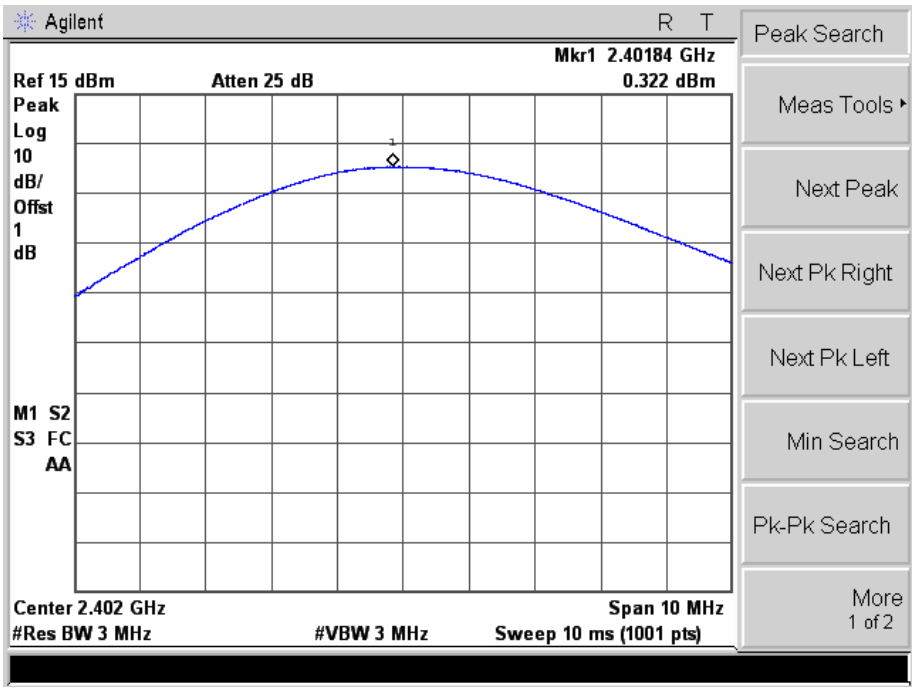


High Channel

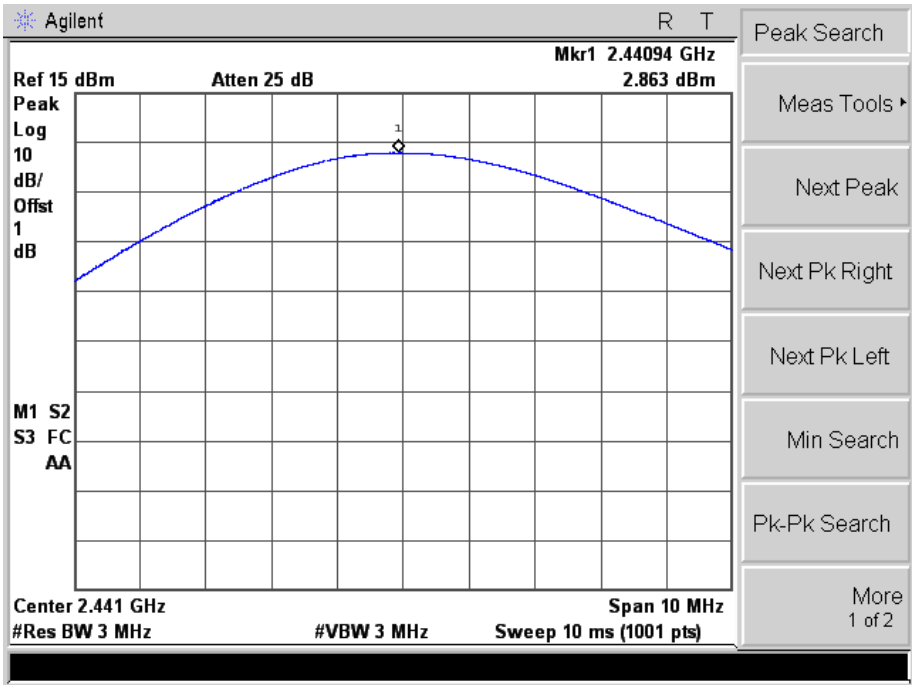


For Pi/4 QDPSK

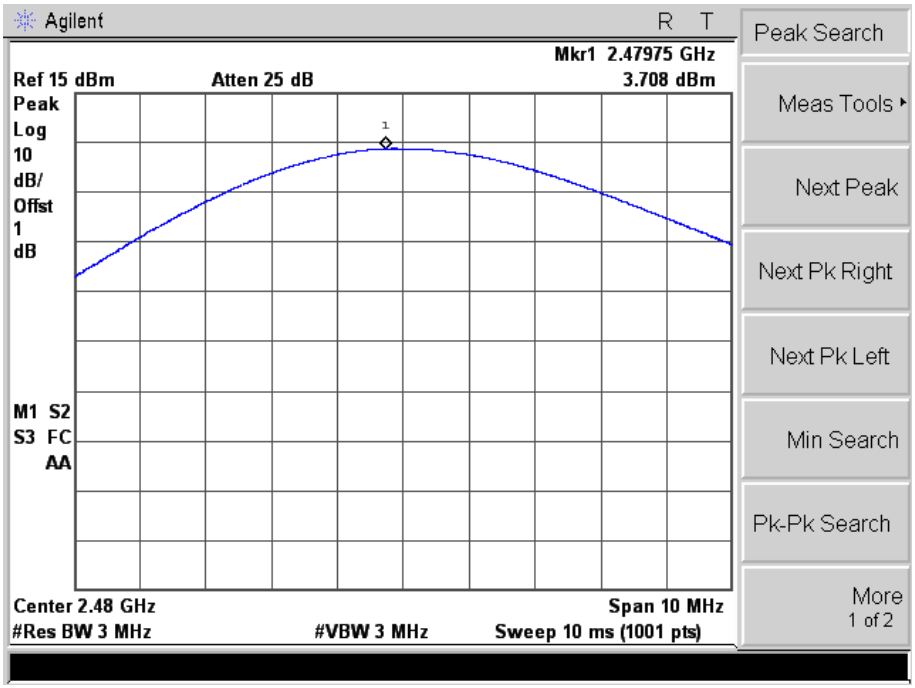
Low Channel



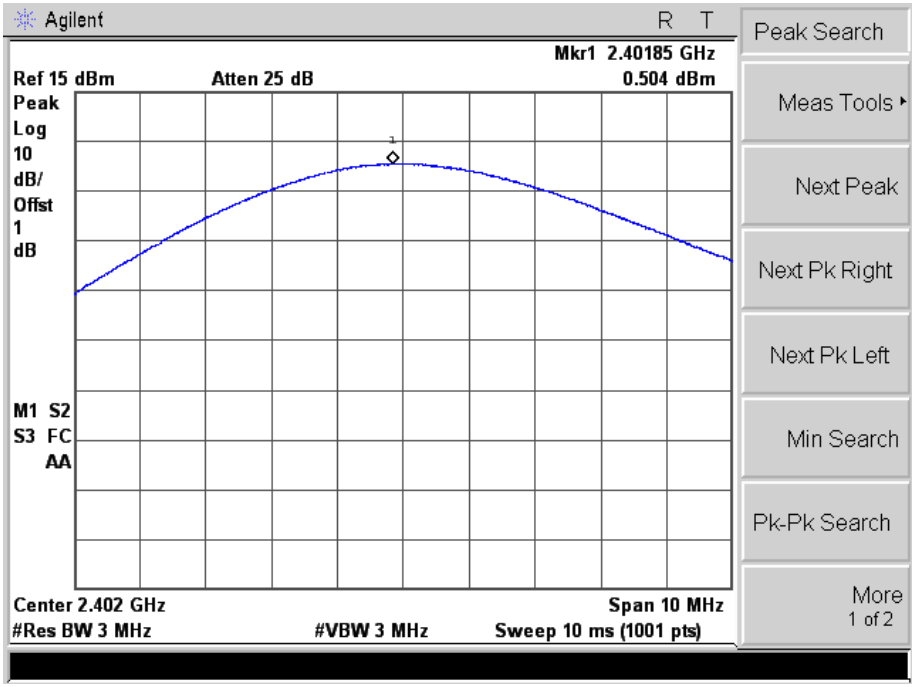
Middle Channel



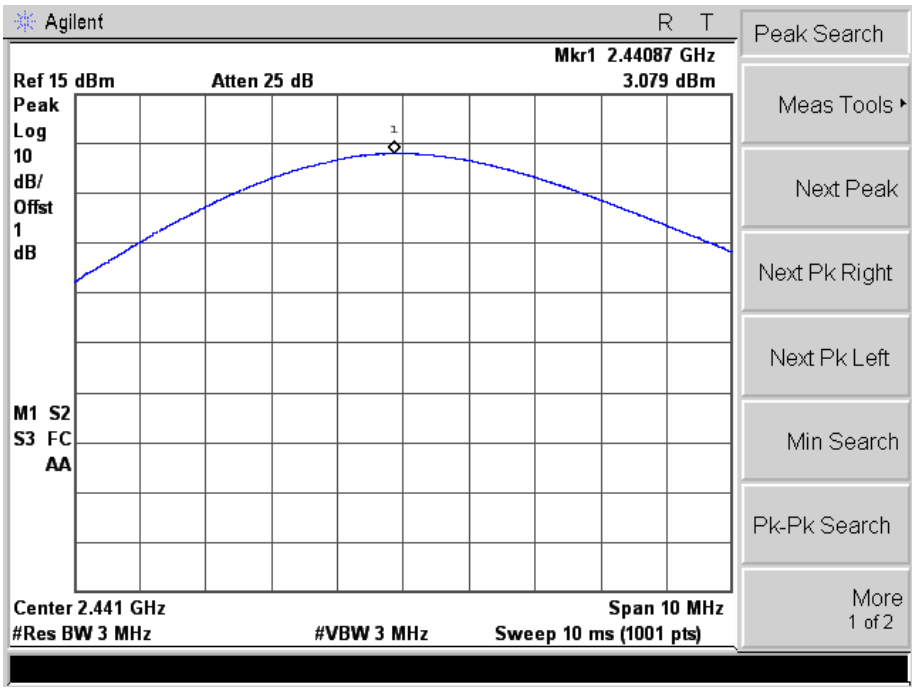
High Channel



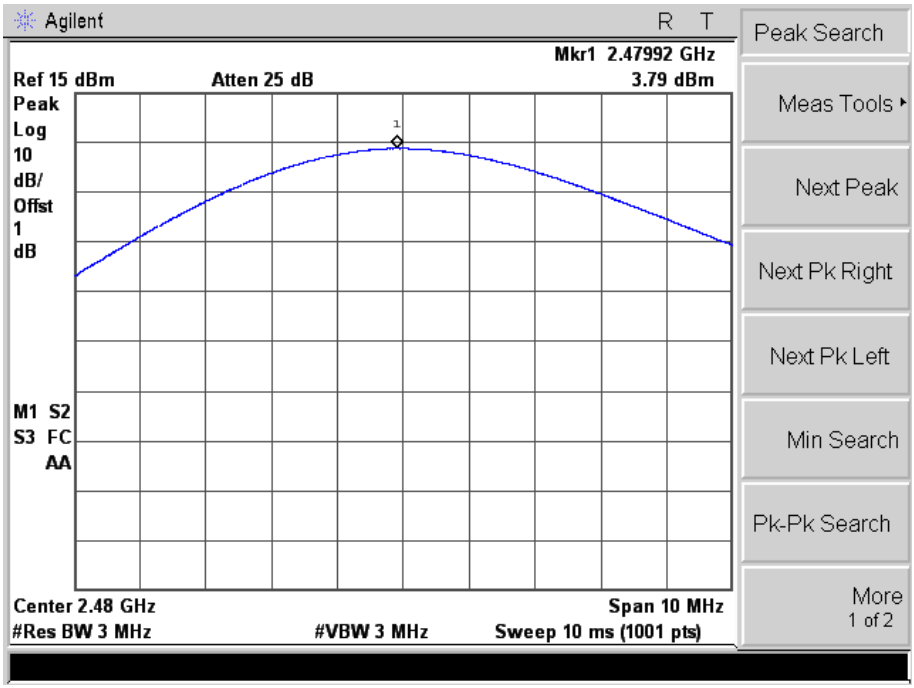
For 8DPSK
Low Channel



Middle Channel



High Channel



10. Field Strength of Spurious Emissions

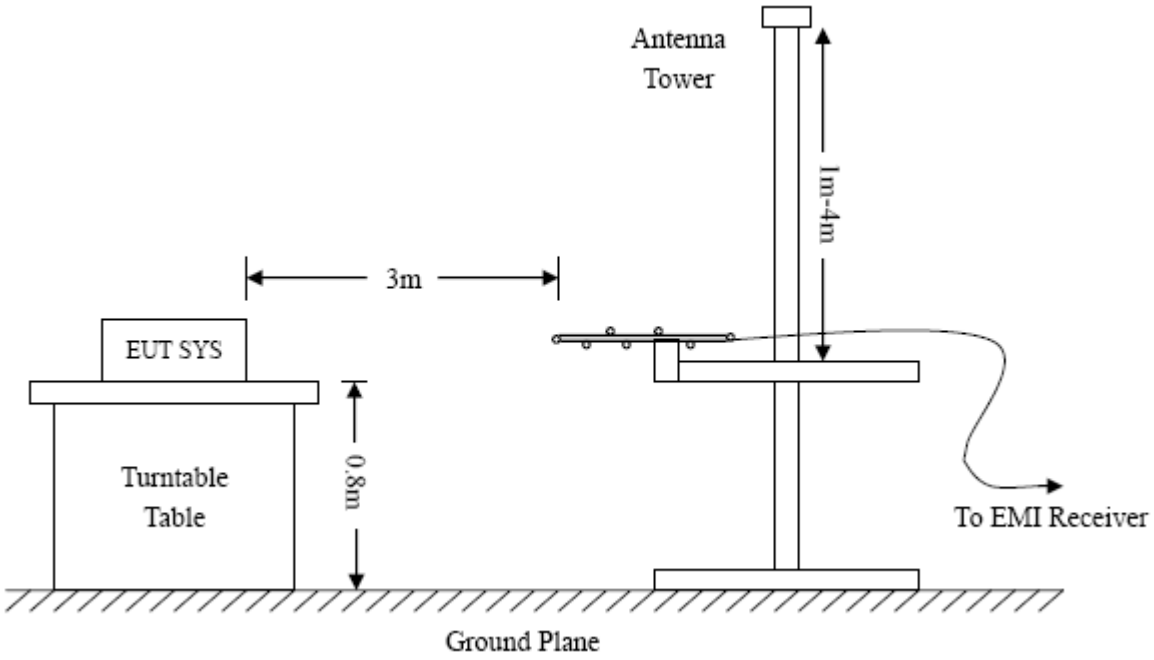
10.1 Standard Applicable

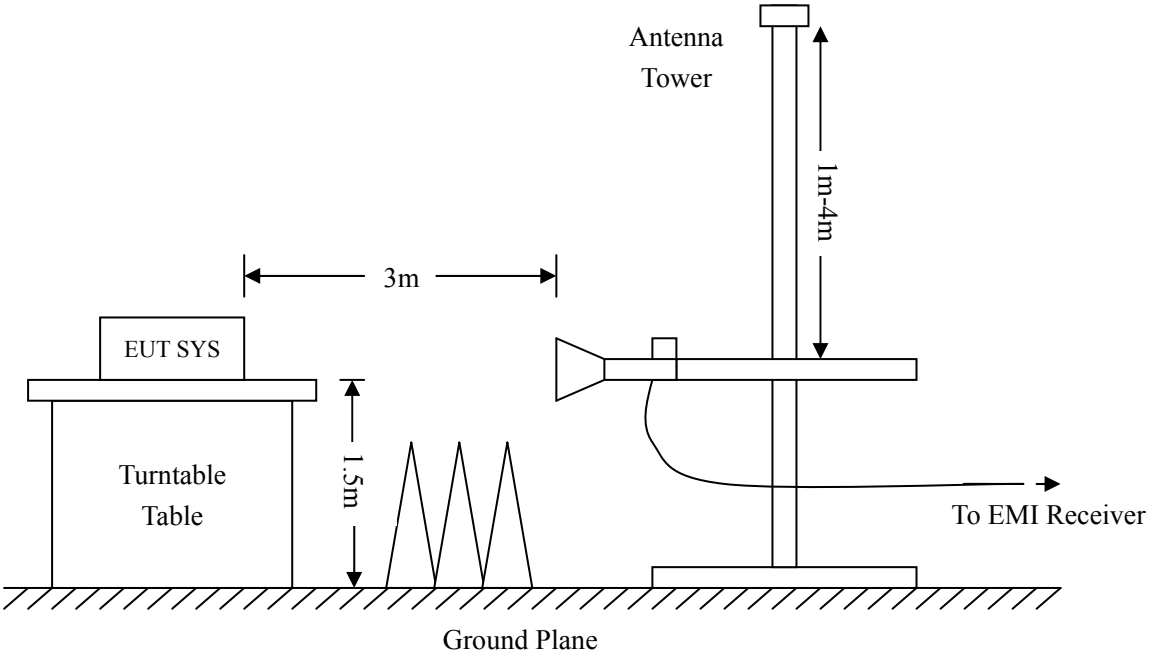
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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).

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

10.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.





Frequency :9kHz-30MHz	Frequency :30MHz-1GHz	Frequency :Above 1GHz
RBW=10KHz,	RBW=120KHz,	RBW=1MHz,
VBW =30KHz	VBW=300KHz	VBW=3MHz(Peak), 10Hz(AV)
Sweep time= Auto	Sweep time= Auto	Sweep time= Auto
Trace = max hold	Trace = max hold	Trace = max hold
Detector function = peak	Detector function = peak, QP	Detector function = peak, AV

10.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – Ampl. Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – FCCPart15 Limit

10.4 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

10.5 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst cases:

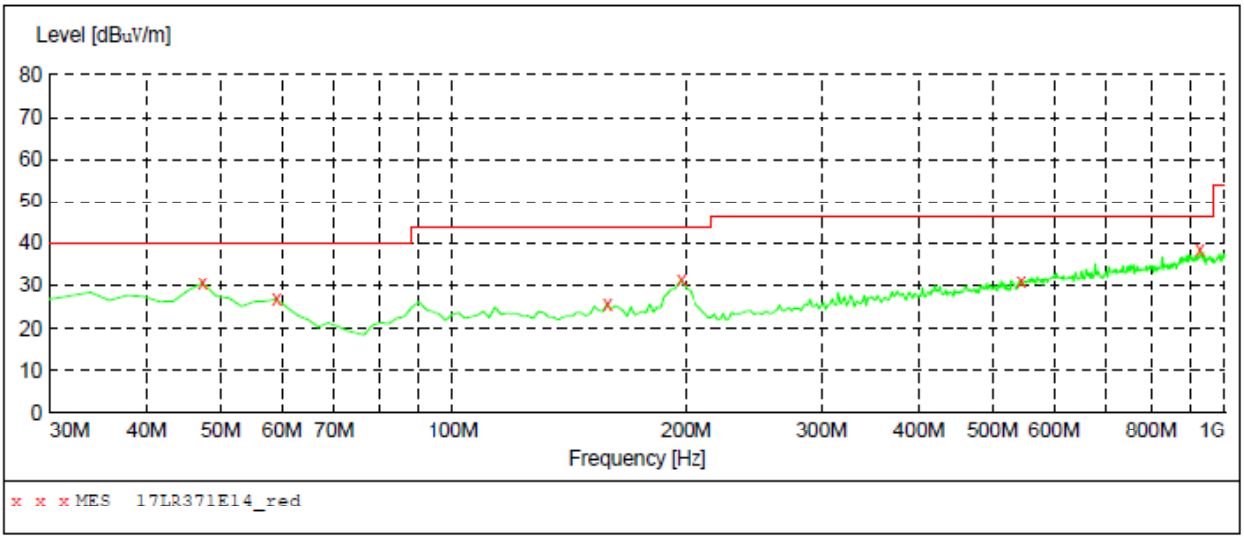
Plot of Radiated Emissions Test Data (30MHz to 1GHz)

EUT: *Power Amplifier*
Tested Model: *M-ONE*
Operating Condition: *GFSK Transmitting Low Channel (2402MHz)*
Comment: *AC 120V/60Hz*

Test Specification: *Horizontal*

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "17LR371E14_red"

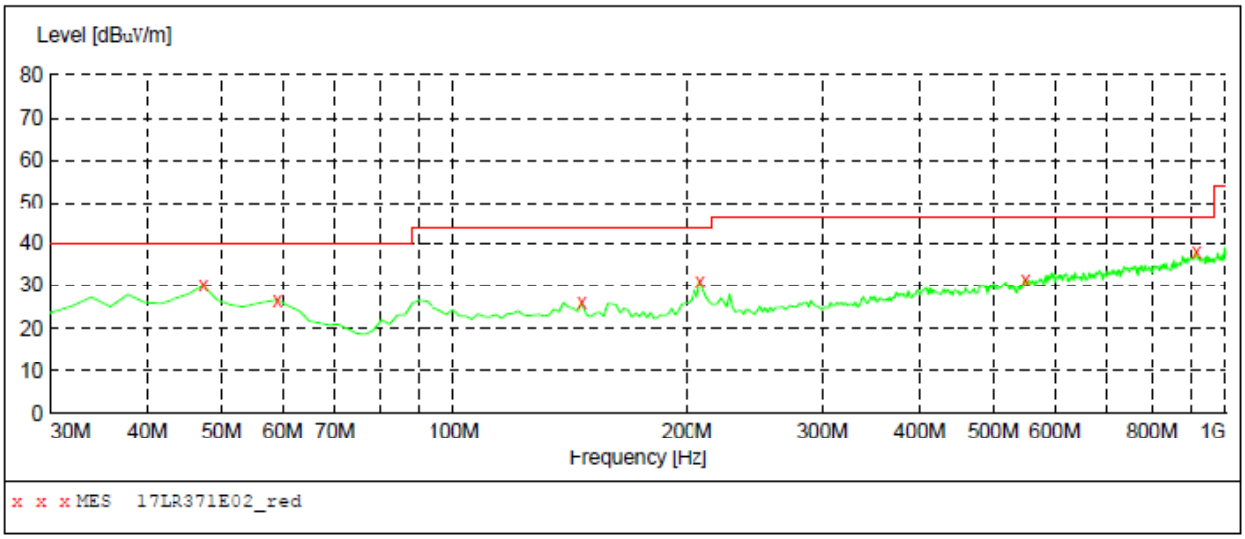
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	30.50	16.7	40.0	9.5	---	100.0	0.00	HORIZONTAL
59.100000	26.80	15.7	40.0	13.2	---	100.0	0.00	HORIZONTAL
158.040000	25.70	12.3	43.5	17.8	---	100.0	0.00	HORIZONTAL
196.840000	31.30	13.8	43.5	12.2	---	100.0	0.00	HORIZONTAL
544.100000	31.20	19.9	46.0	14.8	---	100.0	0.00	HORIZONTAL
924.340000	38.30	25.8	46.0	7.7	---	100.0	0.00	HORIZONTAL

Test Specification: *Vertical*

SWEEP TABLE: "test (30M-1G)"

Short Description: Field Strength

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "17LR371E02_red"

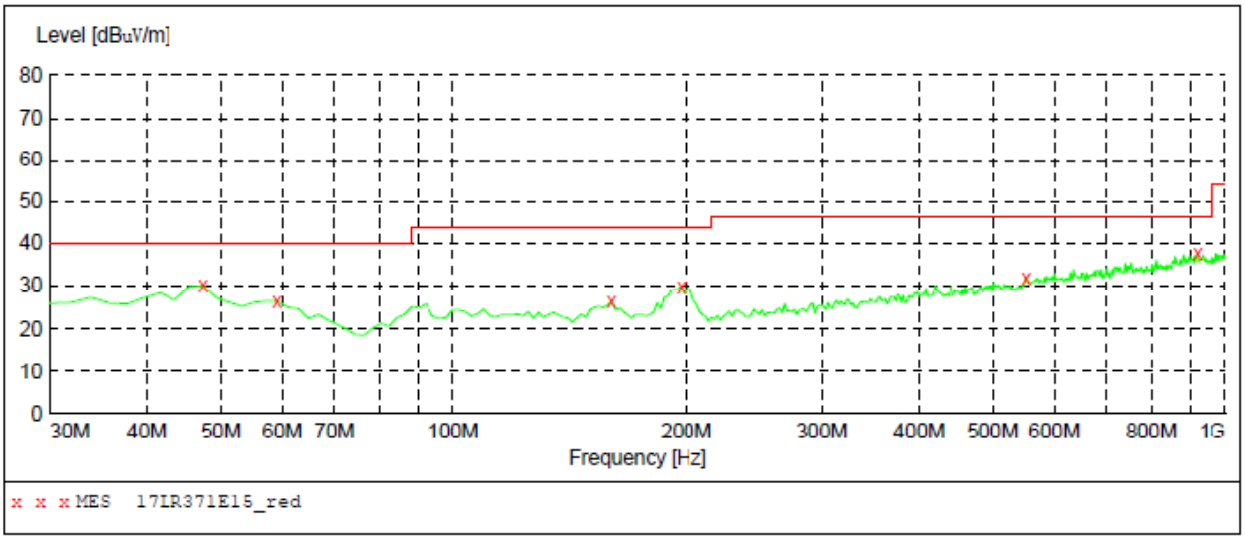
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	30.00	16.7	40.0	10.0	---	100.0	0.00	VERTICAL
59.100000	26.60	15.7	40.0	13.4	---	100.0	0.00	VERTICAL
146.400000	25.90	12.0	43.5	17.6	---	100.0	0.00	VERTICAL
208.480000	31.20	14.1	43.5	12.3	---	100.0	0.00	VERTICAL
549.920000	31.60	20.5	46.0	14.4	---	100.0	0.00	VERTICAL
912.700000	37.90	25.8	46.0	8.1	---	100.0	0.00	VERTICAL

Operating Condition: *GFSK Transmitting Middle Channel (2441MHz)*
Comment: *AC 120V/60Hz*

Test Specification: *Horizontal*

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



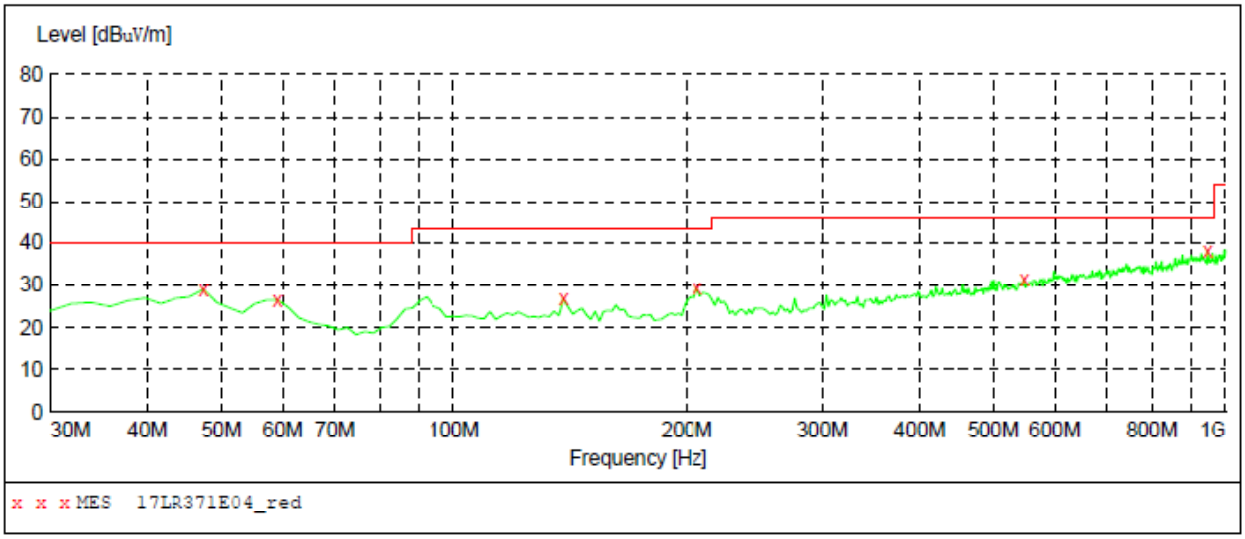
MEASUREMENT RESULT: "17LR371E15_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	30.10	16.7	40.0	9.9	---	100.0	0.00	HORIZONTAL
59.100000	26.60	15.7	40.0	13.4	---	100.0	0.00	HORIZONTAL
159.980000	26.30	12.9	43.5	17.2	---	100.0	0.00	HORIZONTAL
196.840000	29.90	13.8	43.5	13.6	---	100.0	0.00	HORIZONTAL
551.860000	32.00	20.5	46.0	14.0	---	100.0	0.00	HORIZONTAL
916.580000	37.50	25.8	46.0	8.5	---	100.0	0.00	HORIZONTAL

Test Specification: *Vertical*

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "17LR371E04_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	29.10	16.7	40.0	10.9	---	100.0	0.00	VERTICAL
59.100000	26.60	15.7	40.0	13.4	---	100.0	0.00	VERTICAL
138.640000	26.80	12.6	43.5	16.7	---	100.0	0.00	VERTICAL
206.540000	29.40	14.1	43.5	14.1	---	100.0	0.00	VERTICAL
547.980000	31.30	20.3	46.0	14.7	---	100.0	0.00	VERTICAL
943.740000	38.00	25.3	46.0	8.0	---	100.0	0.00	VERTICAL

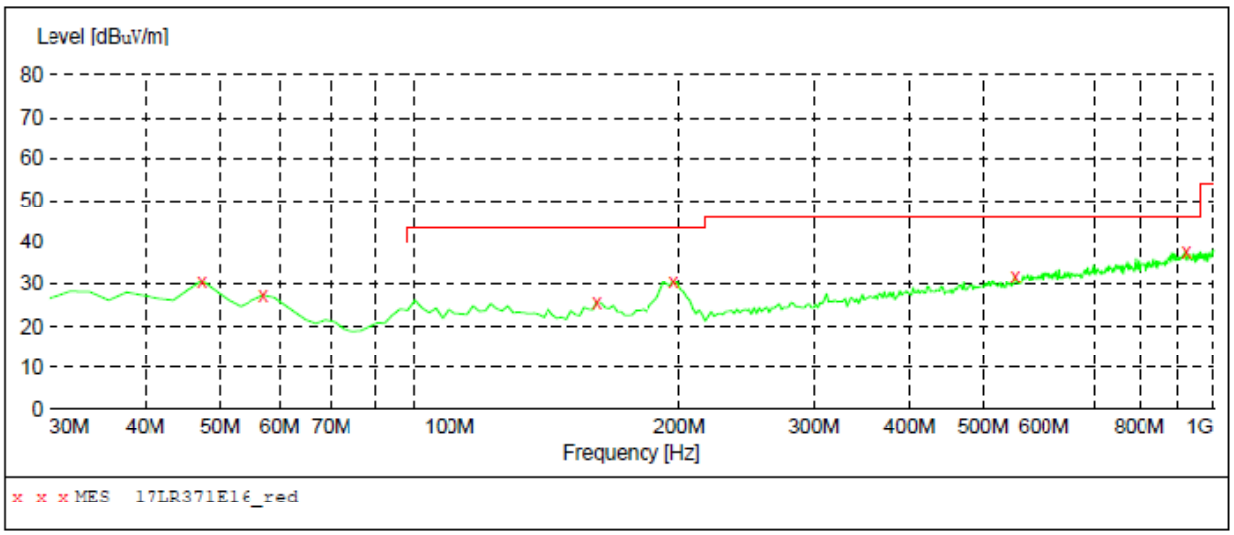
Operating Condition: *GFSK Transmitting High Channel (2480MHz)*
Comment: *AC 120V/60Hz*

Test Specification: *Horizontal*

SWEEP TABLE: "test (30M-1G)"

Short Description: Field Strength

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "17LR371E16_red"

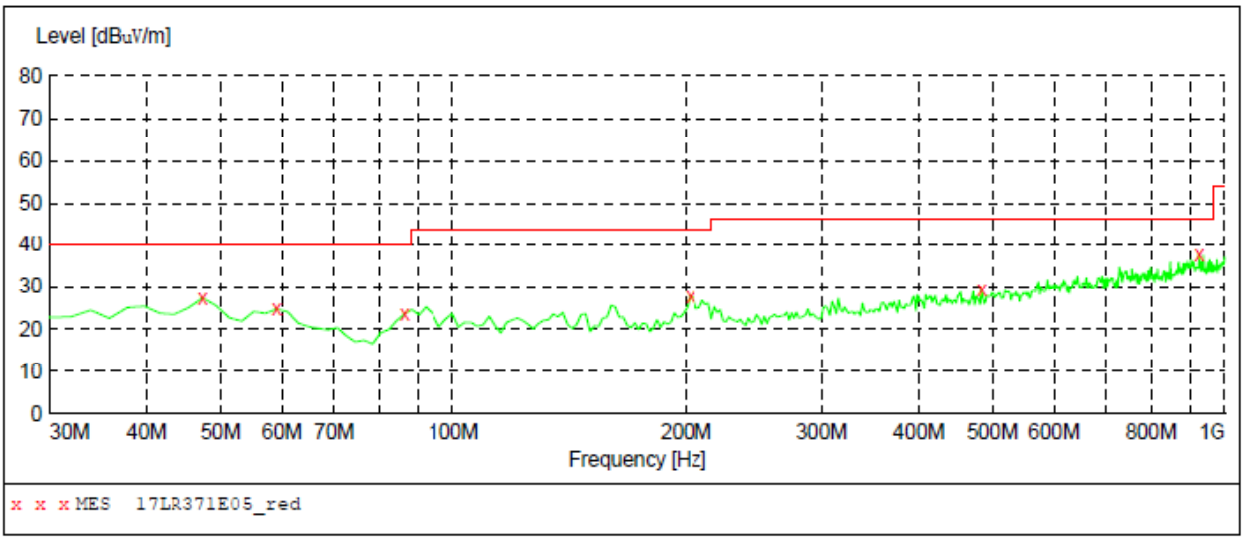
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	30.80	16.7	40.0	9.2	---	100.0	0.00	HORIZONTAL
57.160000	27.40	15.7	40.0	12.6	---	100.0	0.00	HORIZONTAL
156.100000	25.70	11.6	43.5	17.8	---	100.0	0.00	HORIZONTAL
196.840000	30.70	13.8	43.5	12.8	---	100.0	0.00	HORIZONTAL
549.920000	31.80	20.5	46.0	14.2	---	100.0	0.00	HORIZONTAL
922.400000	37.80	25.8	46.0	8.2	---	100.0	0.00	HORIZONTAL

Test Specification: *Vertical*

SWEEP TABLE: "test (30M-1G)"

Short Description: Field Strength

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "17LR371E05_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	27.30	16.7	40.0	12.7		100.0	0.00	VERTICAL
59.100000	24.70	15.7	40.0	15.3	---	100.0	0.00	VERTICAL
86.260000	23.50	12.9	40.0	16.5	---	100.0	0.00	VERTICAL
202.660000	27.90	14.0	43.5	15.6	---	100.0	0.00	VERTICAL
483.960000	29.20	19.1	46.0	16.8	---	100.0	0.00	VERTICAL
922.400000	37.50	25.8	46.0	8.5	---	100.0	0.00	VERTICAL

Plot of Radiated Emissions Test Data (30MHz to 1GHz)

EUT: *Power Amplifier*

Tested Model: *M-ONE*

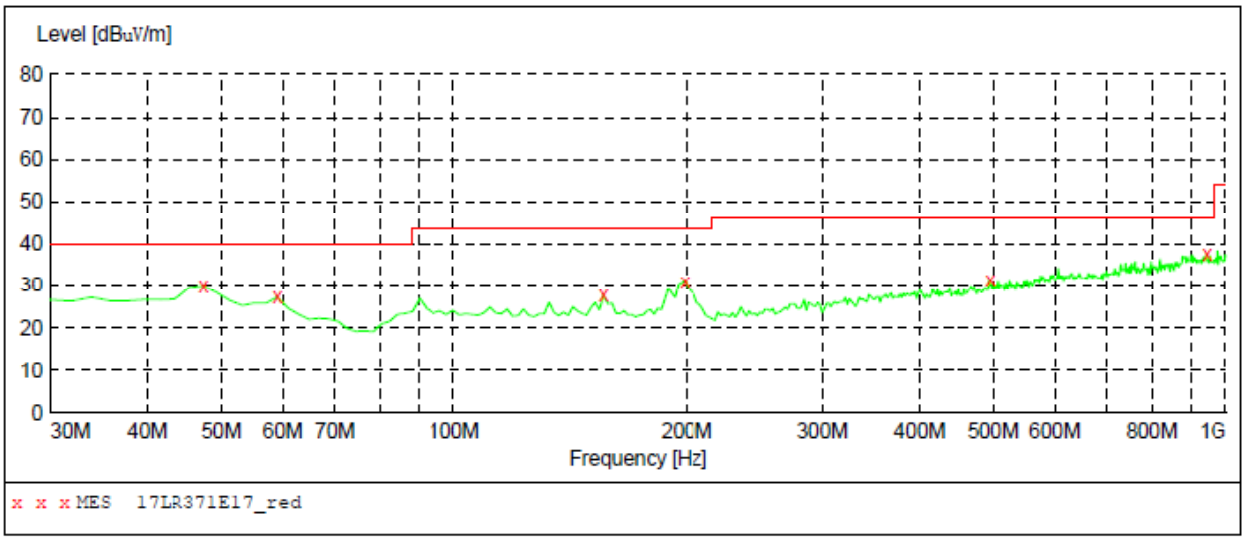
Operating Condition: *Pi/4 DQPSK Transmitting Low Channel (2402MHz)*

Comment: *AC 120V/60Hz*

Test Specification: *Horizontal*

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



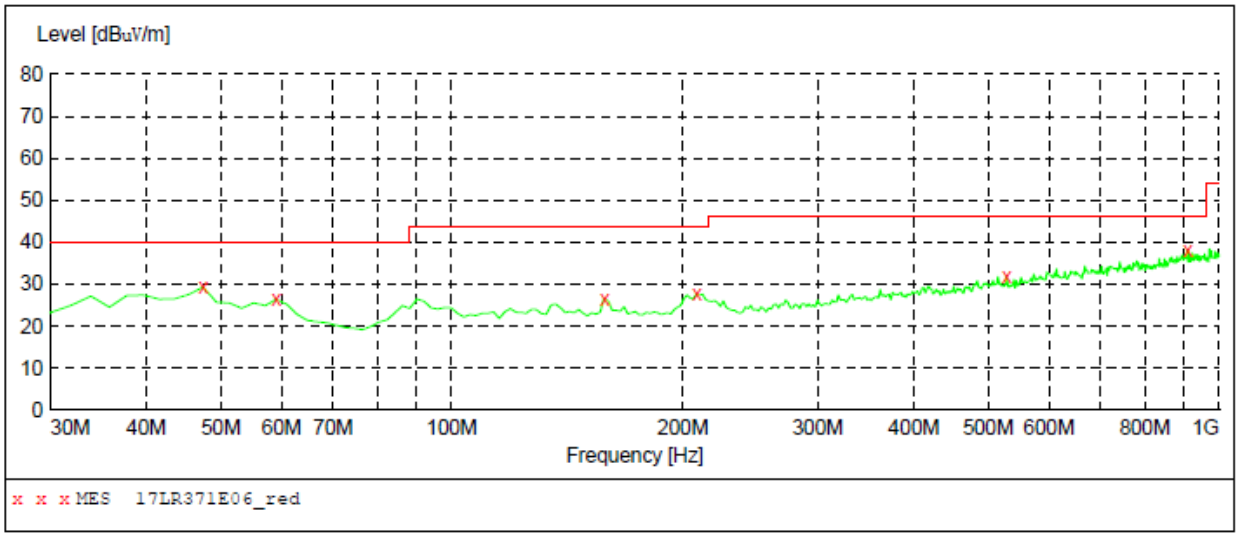
MEASUREMENT RESULT: "17LR371E17_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	29.00	16.7	40.0	10.2		100.0	0.00	HORIZONTAL
59.100000	27.20	15.7	40.0	12.8	---	100.0	0.00	HORIZONTAL
156.100000	27.60	11.6	43.5	15.9	---	100.0	0.00	HORIZONTAL
198.780000	31.20	13.9	43.5	12.3	---	100.0	0.00	HORIZONTAL
495.600000	31.50	19.5	46.0	14.5	---	100.0	0.00	HORIZONTAL
941.800000	37.70	25.3	46.0	8.3	---	100.0	0.00	HORIZONTAL

Test Specification: *Vertical*

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "17LR371E06_red"

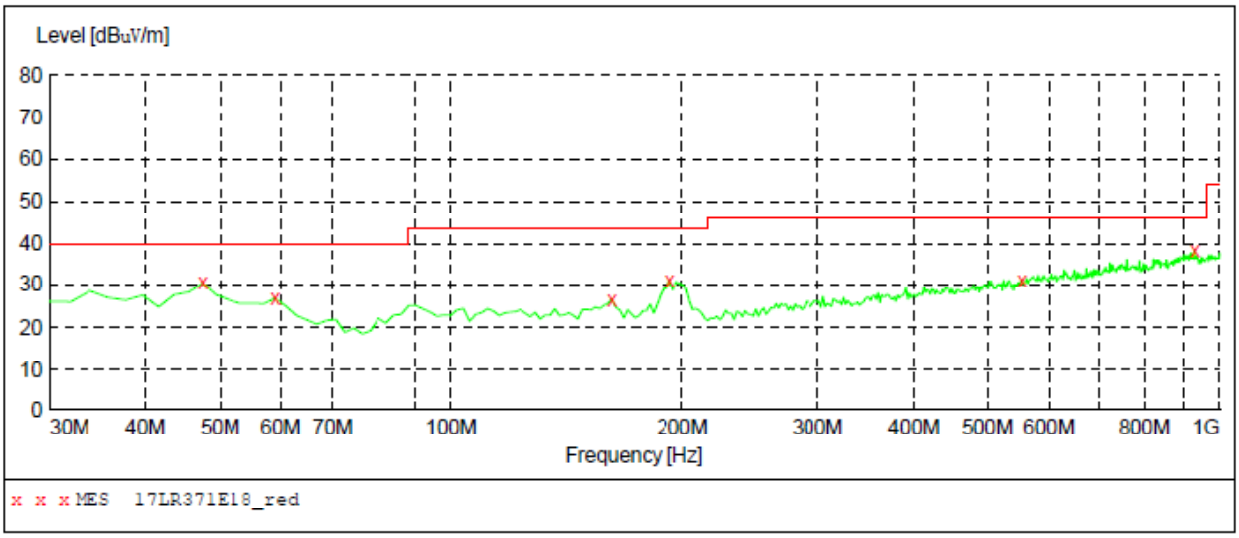
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	29.40	16.7	40.0	10.6	---	100.0	0.00	VERTICAL
59.100000	26.40	15.7	40.0	13.6	---	100.0	0.00	VERTICAL
158.040000	26.60	12.3	43.5	16.9	---	100.0	0.00	VERTICAL
208.480000	27.70	14.1	43.5	15.8	---	100.0	0.00	VERTICAL
528.580000	31.90	19.7	46.0	14.1	---	100.0	0.00	VERTICAL
908.820000	38.20	25.8	46.0	7.8	---	100.0	0.00	VERTICAL

Operating Condition: *Pi/4 DQPSK Transmitting Middle Channel (2441MHz)*
Comment: *AC 120V/60Hz*

Test Specification: *Horizontal*

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



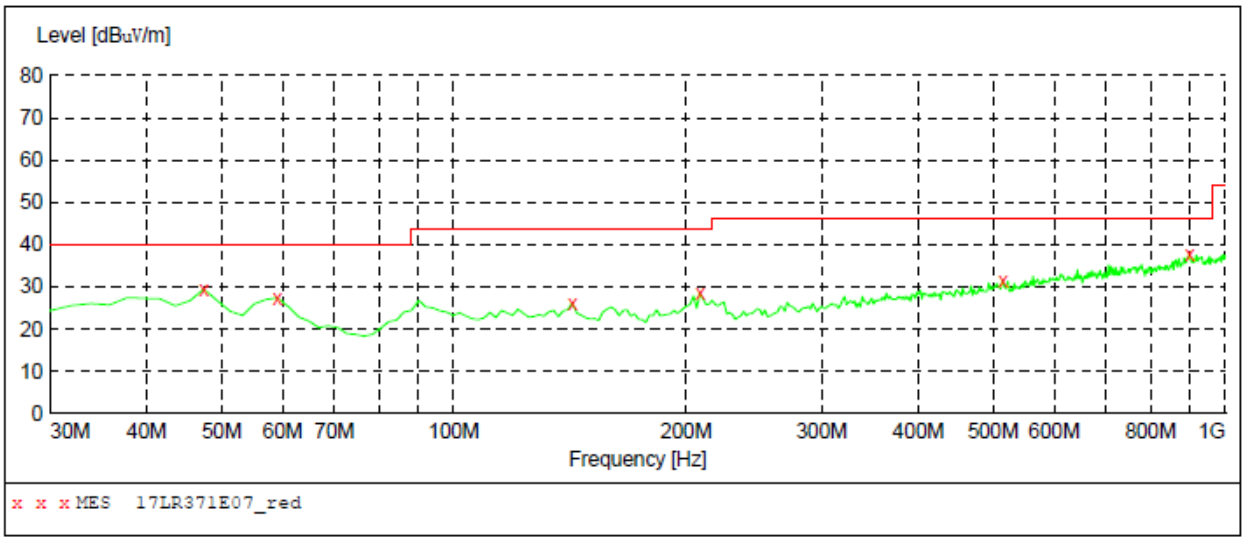
MEASUREMENT RESULT: "17LR371E18_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	30.40	16.7	40.0	9.6	---	100.0	0.00	HORIZONTAL
59.100000	26.90	15.7	40.0	13.1		100.0	0.00	HORIZONTAL
161.920000	26.60	12.9	43.5	16.9	---	100.0	0.00	HORIZONTAL
192.960000	31.10	13.7	43.5	12.4	---	100.0	0.00	HORIZONTAL
553.800000	31.10	20.4	46.0	14.9	---	100.0	0.00	HORIZONTAL
928.220000	38.60	25.9	46.0	7.4	---	100.0	0.00	HORIZONTAL

Test Specification: *Vertical*

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "17LR371E07_red"

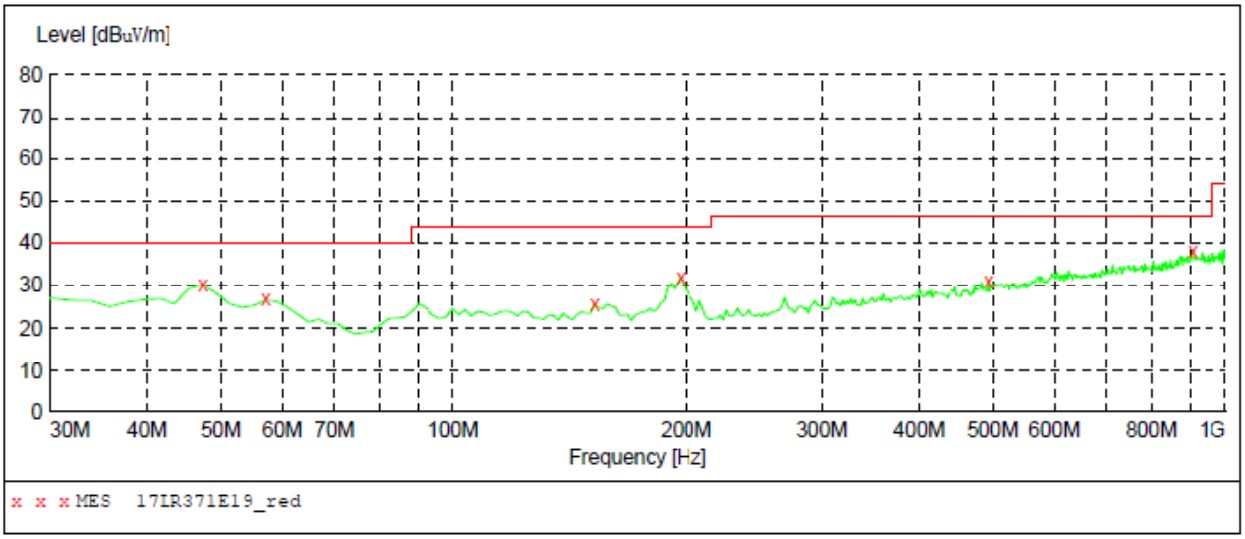
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	29.50	16.7	40.0	10.5	---	100.0	0.00	VERTICAL
59.100000	27.40	15.7	40.0	12.6	---	100.0	0.00	VERTICAL
142.520000	26.20	12.3	43.5	17.3	---	100.0	0.00	VERTICAL
208.480000	28.50	14.1	43.5	15.0	---	100.0	0.00	VERTICAL
515.000000	31.50	19.6	46.0	14.5	---	100.0	0.00	VERTICAL
899.120000	37.60	25.8	46.0	8.4	---	100.0	0.00	VERTICAL

Operating Condition: *Pi/4 DQPSK Transmitting High Channel (2480MHz)*
Comment: *AC 120V/60Hz*

Test Specification: *Horizontal*

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



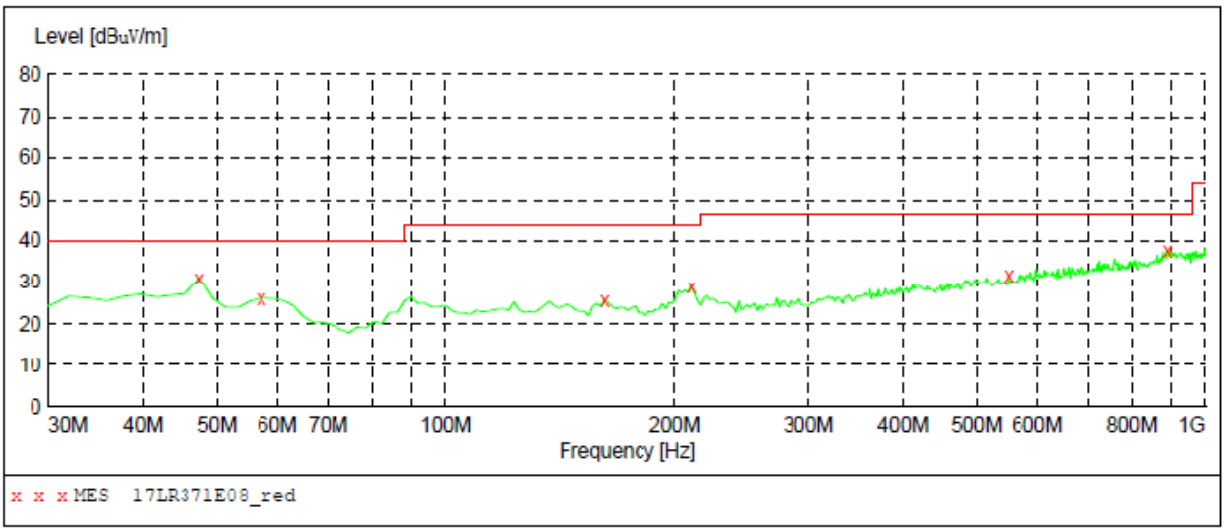
MEASUREMENT RESULT: "17LR371E19_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	30.10	16.7	40.0	9.9	---	100.0	0.00	HORIZONTAL
57.160000	26.70	15.7	40.0	13.3	---	100.0	0.00	HORIZONTAL
152.220000	25.80	11.4	43.5	17.7	---	100.0	0.00	HORIZONTAL
196.840000	32.00	13.8	43.5	11.5	---	100.0	0.00	HORIZONTAL
493.660000	31.10	19.5	46.0	14.9	---	100.0	0.00	HORIZONTAL
904.940000	37.90	25.8	46.0	8.1	---	100.0	0.00	HORIZONTAL

Test Specification: *Vertical*

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "17LR371E08_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	31.20	16.7	40.0	8.8	---	100.0	0.00	VERTICAL
57.160000	26.20	15.7	40.0	13.8	---	100.0	0.00	VERTICAL
161.920000	25.70	12.9	43.5	17.8	---	100.0	0.00	VERTICAL
210.420000	29.00	14.0	43.5	14.5	---	100.0	0.00	VERTICAL
549.920000	31.70	20.5	46.0	14.3	---	100.0	0.00	VERTICAL
889.420000	37.70	25.5	46.0	8.3	---	100.0	0.00	VERTICAL

Plot of Radiated Emissions Test Data (30MHz to 1GHz)

EUT: *Power Amplifier*

Tested Model: *M-ONE*

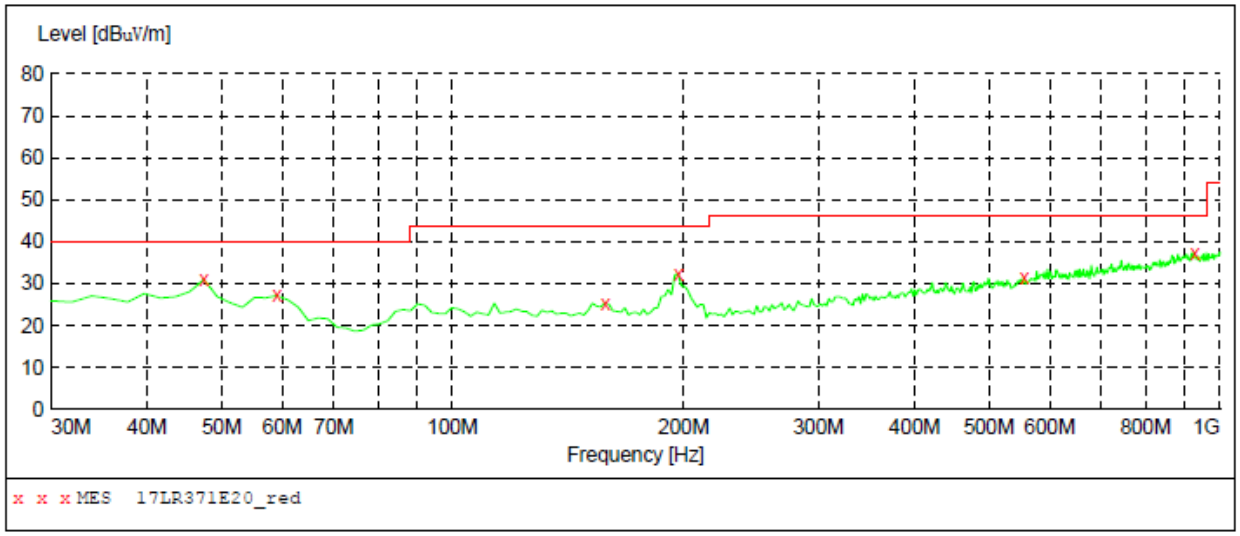
Operating Condition: *8DPSK Transmitting Low Channel (2402MHz)*

Comment: *AC 120V/60Hz*

Test Specification: *Horizontal*

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



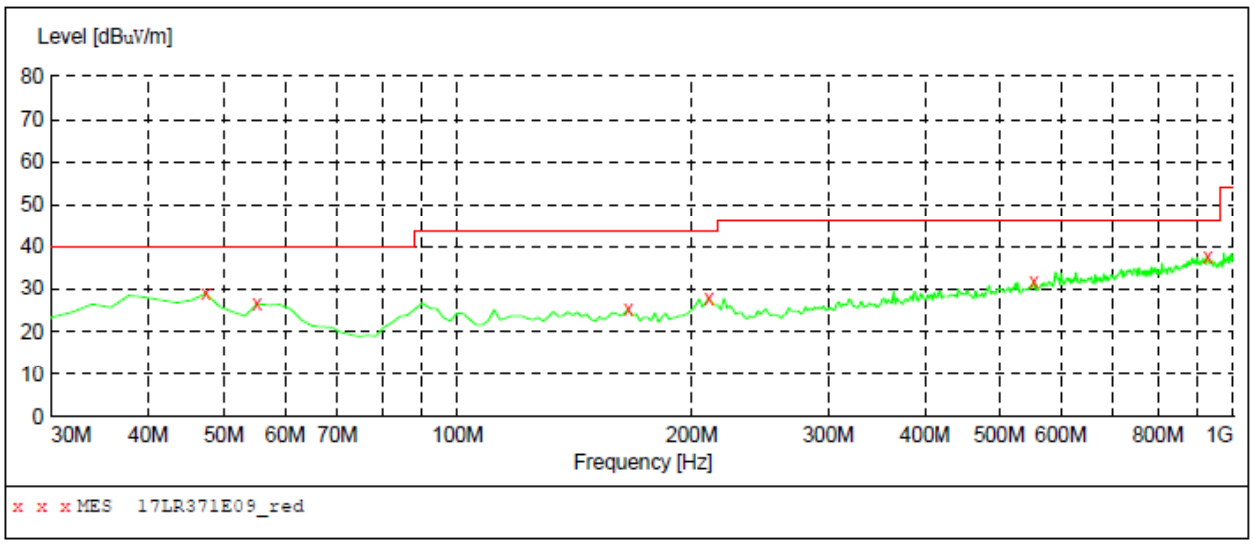
MEASUREMENT RESULT: "17LR371E20_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	31.00	16.7	40.0	9.0	---	100.0	0.00	HORIZONTAL
59.100000	27.20	15.7	40.0	12.8	---	100.0	0.00	HORIZONTAL
158.040000	25.40	12.3	43.5	18.1	---	100.0	0.00	HORIZONTAL
196.840000	32.40	13.8	43.5	11.1	---	100.0	0.00	HORIZONTAL
555.740000	31.40	20.4	46.0	14.6	---	100.0	0.00	HORIZONTAL
926.280000	37.40	25.9	46.0	8.6	---	100.0	0.00	HORIZONTAL

Test Specification: *Vertical*

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "17LR371E09_red"

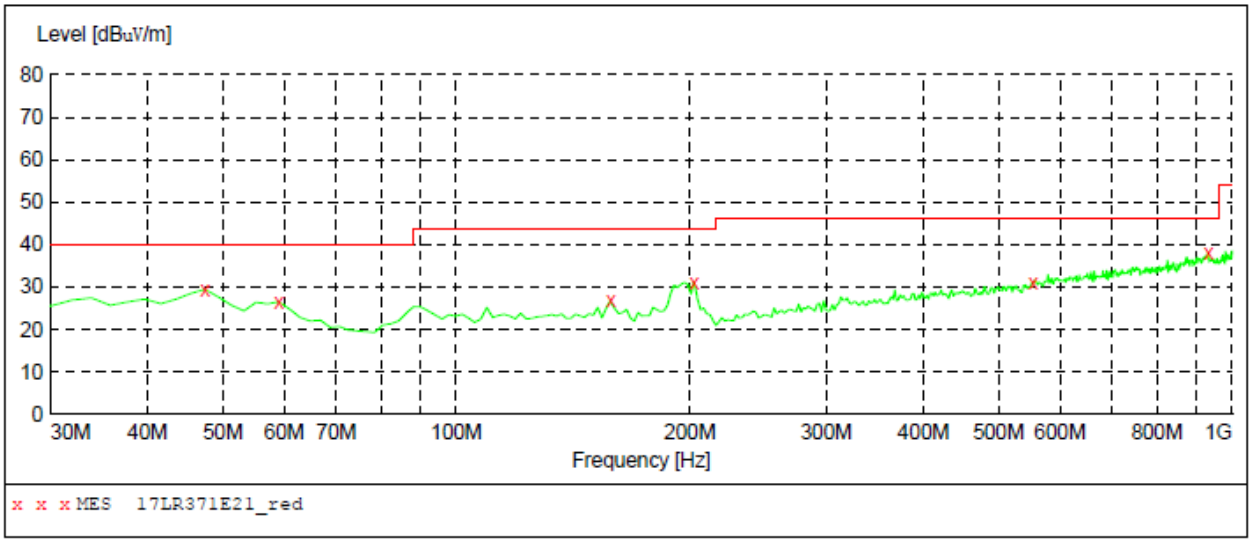
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	28.80	16.7	40.0	11.2	---	100.0	0.00	VERTICAL
55.220000	26.40	15.1	40.0	13.6	---	100.0	0.00	VERTICAL
165.800000	25.20	12.9	43.5	18.3	---	100.0	0.00	VERTICAL
210.420000	27.70	14.0	43.5	15.8	---	100.0	0.00	VERTICAL
553.800000	31.90	20.4	46.0	14.1	---	100.0	0.00	VERTICAL
926.280000	37.60	25.9	46.0	8.4	---	100.0	0.00	VERTICAL

Operating Condition: *8DPSK Transmitting Middle Channel (2441MHz)*
Comment: *AC 120V/60Hz*

Test Specification: *Horizontal*

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "17LR371E21_red"

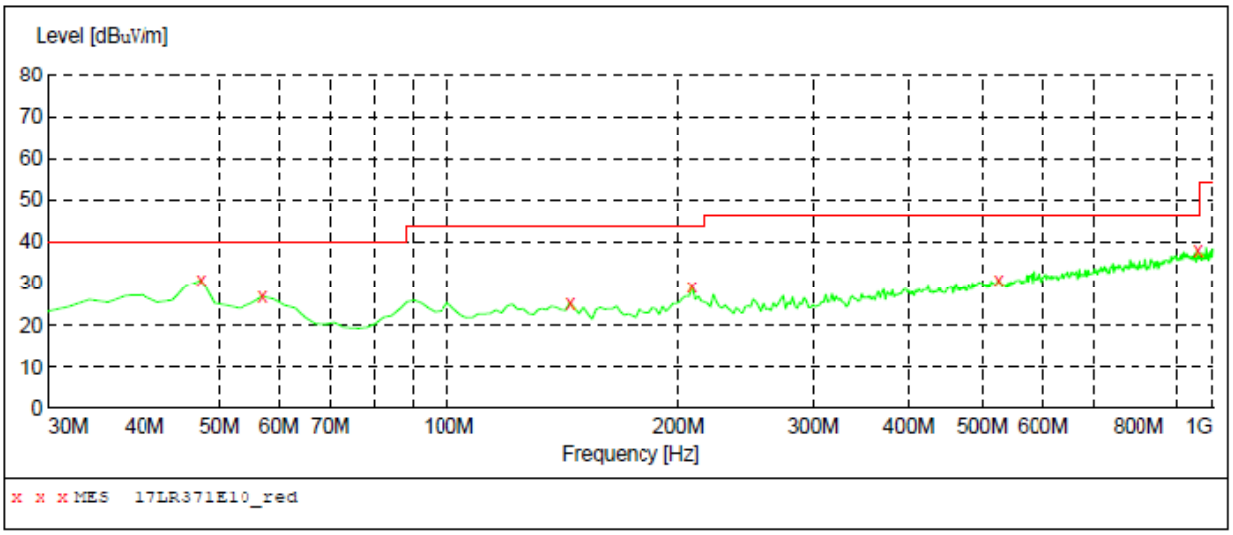
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	29.50	16.7	40.0	10.5	---	100.0	0.00	HORIZONTAL
59.100000	26.60	15.7	40.0	13.4	---	100.0	0.00	HORIZONTAL
158.040000	26.70	12.3	43.5	16.8	---	100.0	0.00	HORIZONTAL
202.660000	31.20	14.0	43.5	12.3	---	100.0	0.00	HORIZONTAL
553.800000	31.20	20.4	46.0	14.8	---	100.0	0.00	HORIZONTAL
932.100000	38.00	25.8	46.0	8.0	---	100.0	0.00	HORIZONTAL

Test Specification: *Vertical*

SWEEP TABLE: "test (30M-1G)"

Short Description: Field Strength

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "17LR371E10_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	31.00	16.7	40.0	9.0	---	100.0	0.00	VERTICAL
57.160000	26.80	15.7	40.0	13.2	---	100.0	0.00	VERTICAL
144.460000	25.40	12.2	43.5	18.1	---	100.0	0.00	VERTICAL
208.480000	29.30	14.1	43.5	14.2	---	100.0	0.00	VERTICAL
524.700000	31.10	19.7	46.0	14.9	---	100.0	0.00	VERTICAL
955.380000	37.90	25.3	46.0	8.1	---	100.0	0.00	VERTICAL

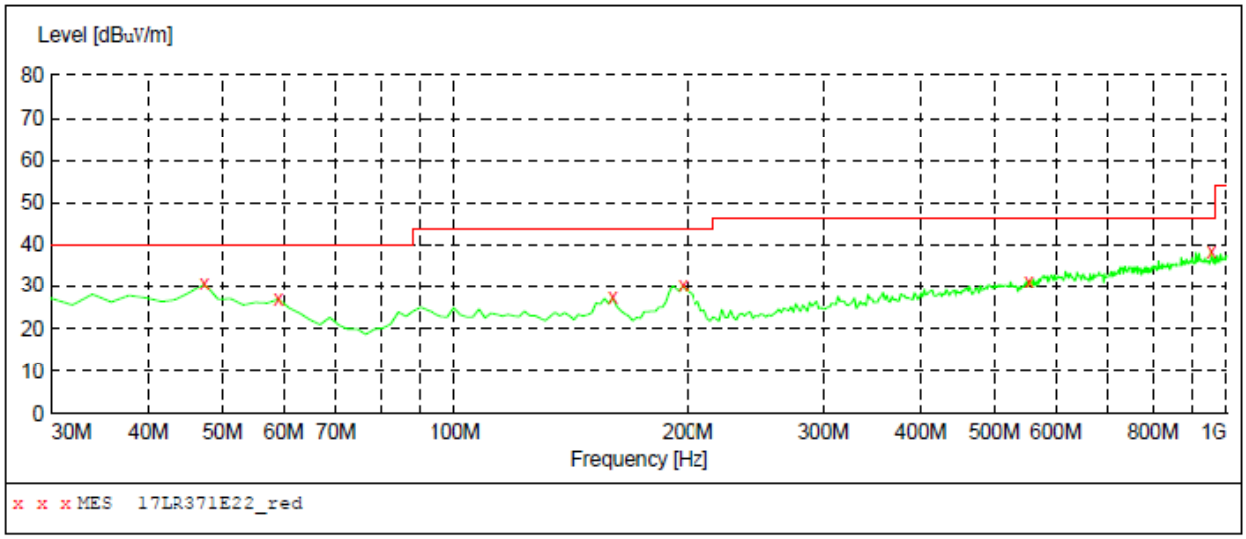
Operating Condition: *8DPSK Transmitting High Channel (2480MHz)*
Comment: *AC 120V/60Hz*

Test Specification: *Horizontal*

SWEEP TABLE: "test (30M-1G)"

Short Description: Field Strength

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



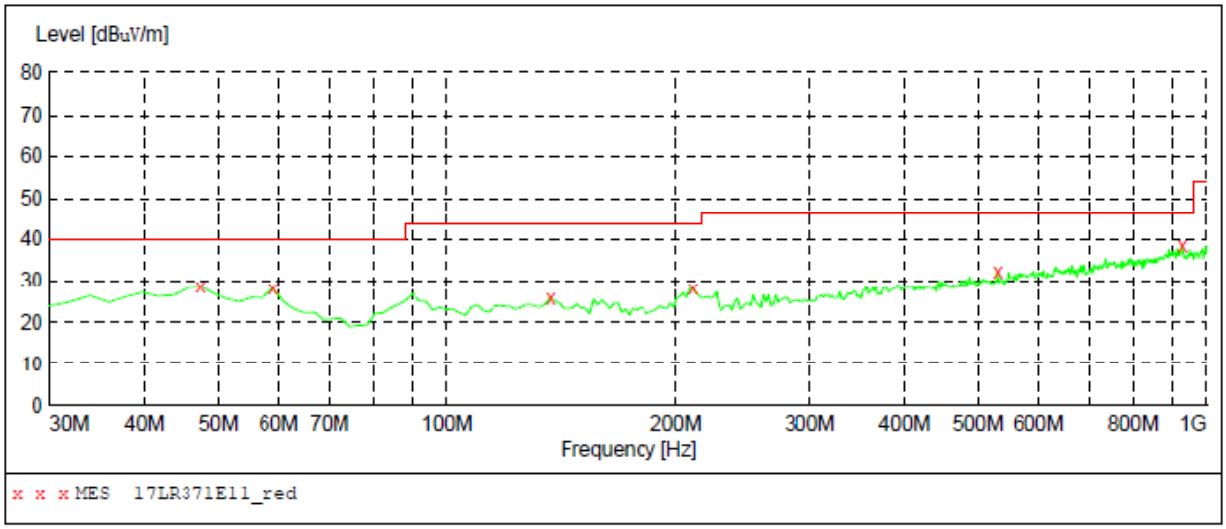
MEASUREMENT RESULT: "17LR371E22_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	30.40	16.7	40.0	9.6	---	100.0	0.00	HORIZONTAL
59.100000	26.80	15.7	40.0	13.2	---	100.0	0.00	HORIZONTAL
159.980000	27.10	12.9	43.5	16.4	---	100.0	0.00	HORIZONTAL
196.840000	30.00	13.8	43.5	13.5	---	100.0	0.00	HORIZONTAL
553.800000	31.20	20.4	46.0	14.8	---	100.0	0.00	HORIZONTAL
951.500000	38.70	25.3	46.0	7.3	---	100.0	0.00	HORIZONTAL

Test Specification: *Vertical*

SWEEP TABLE: "test (30M-1G)"

Short Description:		Field Strength			
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "17LR371E11_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	28.60	16.7	40.0	11.4	---	100.0	0.00	VERTICAL
59.100000	28.00	15.7	40.0	12.0	---	100.0	0.00	VERTICAL
136.700000	25.70	12.6	43.5	17.8	---	100.0	0.00	VERTICAL
210.420000	28.20	14.0	43.5	15.3	---	100.0	0.00	VERTICAL
530.520000	32.20	19.6	46.0	13.8	---	100.0	0.00	VERTICAL
930.160000	38.40	25.9	46.0	7.6	---	100.0	0.00	VERTICAL

Spurious Emissions Above 1GHz(GFSK)

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2402MHz							
4804	60.75	-3.59	57.16	74	-16.84	H	PK
4804	40.87	-3.59	37.28	54	-16.72	H	AV
7206	62.04	-0.52	61.52	74	-12.48	H	PK
7206	41.33	-0.52	40.81	54	-13.19	H	AV
4804	62.15	-3.59	58.56	74	-15.44	V	PK
4804	41.25	-3.59	37.66	54	-16.34	V	AV
7206	61.86	-0.52	61.34	74	-12.66	V	PK
7206	38.25	-0.52	37.73	54	-16.27	V	AV
Middle Channel-2441MHz							
4884	62.07	-3.49	58.58	74	-15.42	H	PK
4884	39.68	-3.49	36.19	54	-17.81	H	AV
7326	61.39	-0.47	60.92	74	-13.08	H	PK
7326	41.64	-0.47	41.17	54	-12.83	H	AV
4884	61.56	-3.49	58.07	74	-15.93	V	PK
4884	41.68	-3.49	38.19	54	-15.81	V	AV
7326	62.22	-0.47	61.75	74	-12.25	V	PK
7326	39.18	-0.47	38.71	54	-15.29	V	AV
High Channel-2480MHz							
4960	60.92	-3.41	57.51	74	-16.49	H	PK
4960	39.7	-3.41	36.29	54	-17.71	H	AV
7440	60.47	-0.42	60.05	74	-13.95	H	PK
7440	41.32	-0.42	40.9	54	-13.1	H	AV
4960	61.66	-3.41	58.25	74	-15.75	V	PK
4960	41.65	-3.41	38.24	54	-15.76	V	AV
7440	60.68	-0.42	60.26	74	-13.74	V	PK
7440	38.71	-0.42	38.29	54	-15.71	V	AV

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Spurious Emissions Above 1GHz(Pi/4 DQPSK)

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2402MHz							
4804	61.55	-2.79	58.76	74	-15.24	H	PK
4804	41.47	-2.99	38.48	54	-15.52	H	AV
7206	62.74	0.18	62.92	74	-11.08	H	PK
7206	41.53	-0.32	41.21	54	-12.79	H	AV
4804	62.45	-3.29	59.16	74	-14.84	V	PK
4804	41.75	-3.09	38.66	54	-15.34	V	AV
7206	62.76	0.38	63.14	74	-10.86	V	PK
7206	38.35	-0.42	37.93	54	-16.07	V	AV
Middle Channel-2441MHz							
4884	62.87	-2.69	60.18	74	-13.82	H	PK
4884	40.28	-2.89	37.39	54	-16.61	H	AV
7326	62.09	0.23	62.32	74	-11.68	H	PK
7326	41.84	-0.27	41.57	54	-12.43	H	AV
4884	61.86	-3.19	58.67	74	-15.33	V	PK
4884	42.18	-2.99	39.19	54	-14.81	V	AV
7326	63.12	0.43	63.55	74	-10.45	V	PK
7326	39.28	-0.37	38.91	54	-15.09	V	AV
High Channel-2480MHz							
4960	61.72	-2.61	59.11	74	-14.89	H	PK
4960	40.30	-2.81	37.49	54	-16.51	H	AV
7440	61.17	0.28	61.45	74	-12.55	H	PK
7440	41.52	-0.22	41.30	54	-12.70	H	AV
4960	61.96	-3.11	58.85	74	-15.15	V	PK
4960	42.15	-2.91	39.24	54	-14.76	V	AV
7440	61.58	0.48	62.06	74	-11.94	V	PK
7440	38.81	-0.32	38.49	54	-15.51	V	AV

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Spurious Emissions Above 1GHz(8DPSK)

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2402MHz							
4804	60.25	-4.09	56.16	74	-17.84	H	PK
4804	40.27	-4.19	36.08	54	-17.92	H	AV
7206	61.64	-0.92	60.72	74	-13.28	H	PK
7206	40.53	-1.32	39.21	54	-14.79	H	AV
4804	61.85	-3.89	57.96	74	-16.04	V	PK
4804	40.55	-4.29	36.26	54	-17.74	V	AV
7206	61.66	-0.72	60.94	74	-13.06	V	PK
7206	37.75	-1.02	36.73	54	-17.27	V	AV
Middle Channel-2441MHz							
4884	61.57	-3.99	57.58	74	-16.42	H	PK
4884	39.08	-4.09	34.99	54	-19.01	H	AV
7326	60.99	-0.87	60.12	74	-13.88	H	PK
7326	40.84	-1.27	39.57	54	-14.43	H	AV
4884	61.26	-3.79	57.47	74	-16.53	V	PK
4884	40.98	-4.19	36.79	54	-17.21	V	AV
7326	62.02	-0.67	61.35	74	-12.65	V	PK
7326	38.68	-0.97	37.71	54	-16.29	V	AV
High Channel-2480MHz							
4960	60.42	-3.91	56.51	74	-17.49	H	PK
4960	39.10	-4.01	35.09	54	-18.91	H	AV
7440	60.07	-0.82	59.25	74	-14.75	H	PK
7440	40.52	-1.22	39.30	54	-14.70	H	AV
4960	61.36	-3.71	57.65	74	-16.35	V	PK
4960	40.95	-4.11	36.84	54	-17.16	V	AV
7440	60.48	-0.62	59.86	74	-14.14	V	PK
7440	38.21	-0.92	37.29	54	-16.71	V	AV

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

11. Out of Band Emissions

11.1 Standard Applicable

According to §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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).

11.2 Test Procedure

According to ANSI C63.10-2013 section 7.8.6, the Band-edge measurements for RF conducted emissions test method as follows.

a) Connect the EMI receiver or spectrum analyzer to the EUT using an appropriate RF cableconnected to the EUT output. Configure the spectrum analyzer settings as described in step e)(be sure to enter all losses between the unlicensed wireless device output and the spectrumanalyzer).
b) Set the EUT to the lowest frequency channel (for the hopping on test, the hopping sequenceshall include the lowest frequency channel).
c) Set the EUT to operate at maximum output power and 100% duty cycle, or equivalent “normalmode of operation” as specified in 6.10.3.
d) If using the radiated method, then use the applicable procedure(s) of 6.4, 6.5, or 6.6, and orientthe EUT and measurement antenna positions to produce the highest emission level.
e) Perform the test as follows:

1) Span: Wide enough to capture the peak level of the emission operating on the channelclosest to the band edge, as well as any modulation products that fall outside of theauthorized band of operation.
2) Reference level: As required to keep the signal from exceeding the maximuminstrument input mixer level for linear operation. In general, the peak of the spectralenvelope shall be more than [10 log (OBW/RBW)] below the reference level. Specificguidance is given in 4.1.5.2.
3) Attenuation: Auto (at least 10 dB preferred).
4) Sweep time: Coupled.
5) Resolution bandwidth: 100 kHz.
6) Video bandwidth: 300 kHz.
7) Detector: Peak.
8) Trace: Max hold.

f) Allow the trace to stabilize. For the test with the hopping function turned ON, this can takeseveral minutes to achieve a reasonable probability of intercepting any emissions due tooscillator overshoot.
g) Set the marker on the emission at the band edge, or on the highest modulation product outside ofthe band, if this level is greater than that at the band edge. Enable the marker-delta function, andthen use the marker-to-peak

function to move the marker to the peak of the in-band emission.
h) Repeat step c) through step e) for every applicable modulation.
i) Set the EUT to the highest frequency channel (for the hopping on test, the hopping sequenceshall include the highest frequency channel) and repeat step c) through step d).
j) The band-edge measurement shall be reported by providing plot(s) of the measuring instrumentdisplay; the plot axes and the scale units per division shall be clearly labeled. Tabular data maybe reported in addition to the plot(s).

Restricted-band band-edge test method please refers to ANSI C63.10-2013 section 6.10.5. The emission must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205. Note that the method of measurement KDB publication number: 913591 may be used for the radiated band-edge measurements.

According to ANSI C63.10-2013 section 7.8.8, Conducted spurious emissions shall be measured for the transmit frequency, per 5.5 and 5.6, and at themaximum transmit powers.
Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results,account for all losses between the unlicensed wireless device output and the spectrum analyzer. Theinstrument shall span 30 MHz to 10 times the operating frequency in GHz, with a resolution bandwidth of100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector. The band 30 MHzto the highest frequency may be split into smaller spans, as long as the entire spectrum is covered.

11.3 Environmental Conditions

Temperature:	23°C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

11.4 Summary of Test Results/Plots

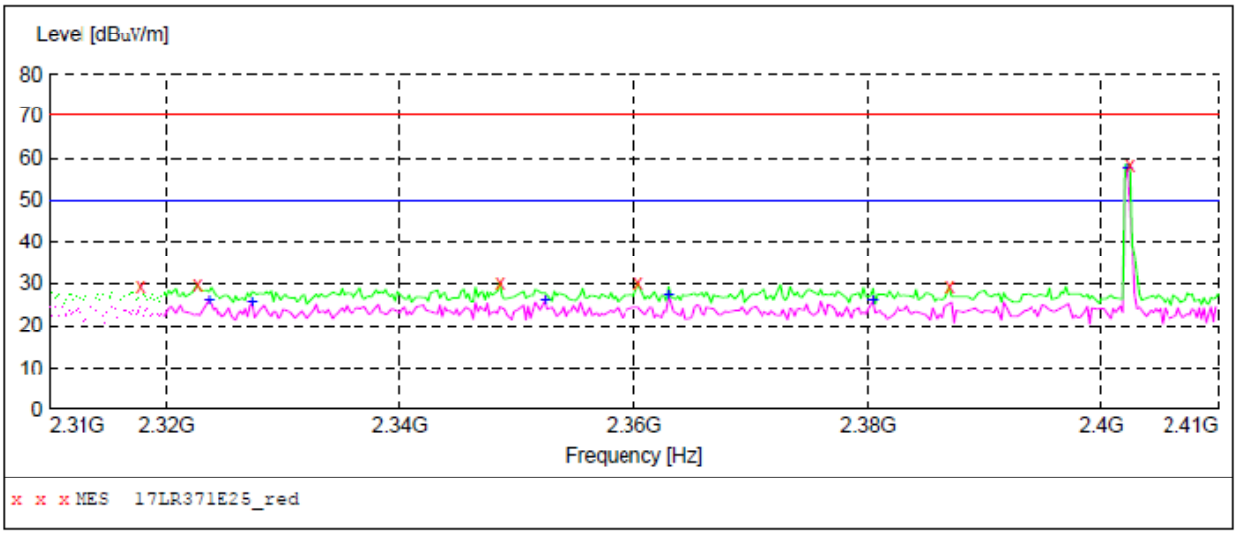
Bandedge (Radiated)

Lowest Bandedge

Vertical (GFSK)

SWEEP TABLE: "test (1M-7G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	7.0 GHz	MaxPeak Average	Coupled	100 kHz	BBHA 9120A NEW



MEASUREMENT RESULT: "17LR371E25_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
2317.800000	29.10	-4.1	70.0	40.9	---	100.0	0.00	VERTICAL
2322.600000	29.70	-4.1	70.0	40.3	---	100.0	0.00	VERTICAL
2348.600000	30.00	-4.1	70.0	40.0	---	100.0	0.00	VERTICAL
2360.400000	29.90	-4.1	70.0	40.1	---	100.0	0.00	VERTICAL
2387.000000	29.10	-4.1	70.0	40.9	---	100.0	0.00	VERTICAL
2402.400000	58.50	-4.0	70.0	11.5	---	100.0	0.00	VERTICAL

MEASUREMENT RESULT: "17LR371E25_red2"

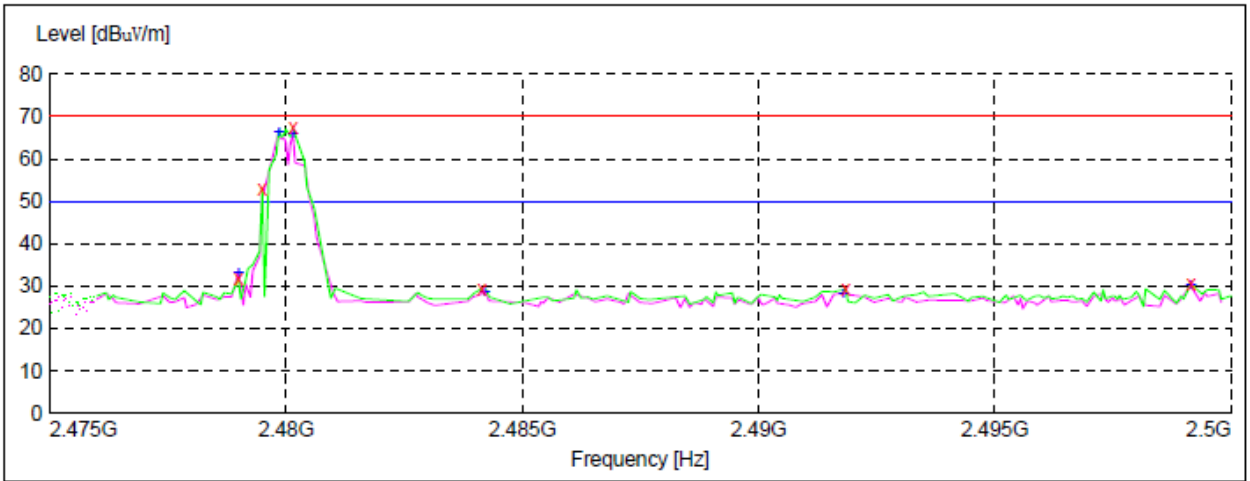
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
2323.600000	26.00	-4.1	50.0	24.0	---	100.0	0.00	VERTICAL
2327.400000	25.40	-4.1	50.0	24.6	---	100.0	0.00	VERTICAL
2352.400000	25.90	-4.1	50.0	24.1	---	100.0	0.00	VERTICAL
2363.000000	27.20	-4.1	50.0	22.8	---	100.0	0.00	VERTICAL
2380.400000	25.80	-4.1	50.0	24.2	---	100.0	0.00	VERTICAL
2402.200000	57.50	-4.0	50.0	-7.5	---	100.0	0.00	VERTICAL

Highest Bandedge

Vertical (GFSK)

SWEEP TABLE: "test (1M-7G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	7.0 GHz	MaxPeak Average	Coupled	100 kHz	BBHA 9120A NEW



MEASUREMENT RESULT: "17LR371E29_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
2479.000000	31.60	-3.4	70.0	38.4	---	100.0	0.00	VERTICAL
2479.500000	53.00	-3.4	70.0	17.0	---	100.0	0.00	VERTICAL
2480.150000	67.20	-3.4	70.0	2.8	---	100.0	0.00	VERTICAL
2484.150000	29.40	-3.3	70.0	40.6	---	100.0	0.00	VERTICAL
2491.850000	29.20	-3.3	70.0	40.8	---	100.0	0.00	VERTICAL
2499.150000	30.40	-3.2	70.0	39.6	---	100.0	0.00	VERTICAL

MEASUREMENT RESULT: "17LR371E29_red2"

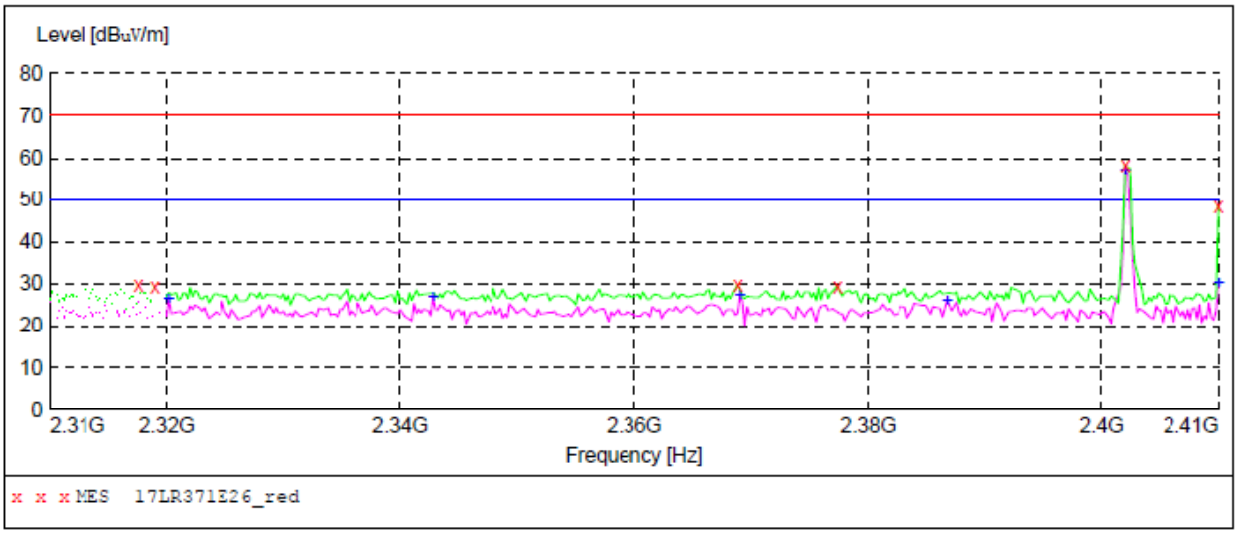
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
2479.000000	33.10	-3.4	50.0	16.9	---	100.0	0.00	VERTICAL
2479.850000	66.20	-3.4	50.0	-16.2	---	100.0	0.00	VERTICAL
2480.150000	65.80	-3.4	50.0	-15.8	---	100.0	0.00	VERTICAL
2484.200000	28.40	-3.3	50.0	21.6	---	100.0	0.00	VERTICAL
2491.800000	28.20	-3.3	50.0	21.8	---	100.0	0.00	VERTICAL
2499.150000	30.10	-3.2	50.0	19.9	---	100.0	0.00	VERTICAL

Lowest Bandedge

Vertical (Pi/4 DQPSK)

SWEEP TABLE: "test (1M-7G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	7.0 GHz	MaxPeak Average	Coupled	100 kHz	BBHA 9120A NEW



MEASUREMENT RESULT: "17LR371E26_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
2317.600000	29.70	-4.1	70.0	40.3	---	100.0	0.00	VERTICAL
2319.000000	29.30	-4.1	70.0	40.7	---	100.0	0.00	VERTICAL
2368.800000	29.60	-4.1	70.0	40.4	---	100.0	0.00	VERTICAL
2377.400000	29.40	-4.1	70.0	40.6	---	100.0	0.00	VERTICAL
2402.000000	58.20	-4.0	70.0	11.8	---	100.0	0.00	VERTICAL
2410.000000	48.20	-4.0	70.0	21.8	---	100.0	0.00	VERTICAL

MEASUREMENT RESULT: "17LR371E26_red2"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
2320.200000	26.30	-4.1	50.0	23.7	---	100.0	0.00	VERTICAL
2342.800000	26.80	-4.1	50.0	23.2	---	100.0	0.00	VERTICAL
2369.000000	27.10	-4.1	50.0	22.9	---	100.0	0.00	VERTICAL
2386.800000	26.10	-4.1	50.0	23.9	---	100.0	0.00	VERTICAL
2402.000000	57.10	-4.0	50.0	-7.1	---	100.0	0.00	VERTICAL
2410.000000	30.00	-4.0	50.0	20.0	---	100.0	0.00	VERTICAL

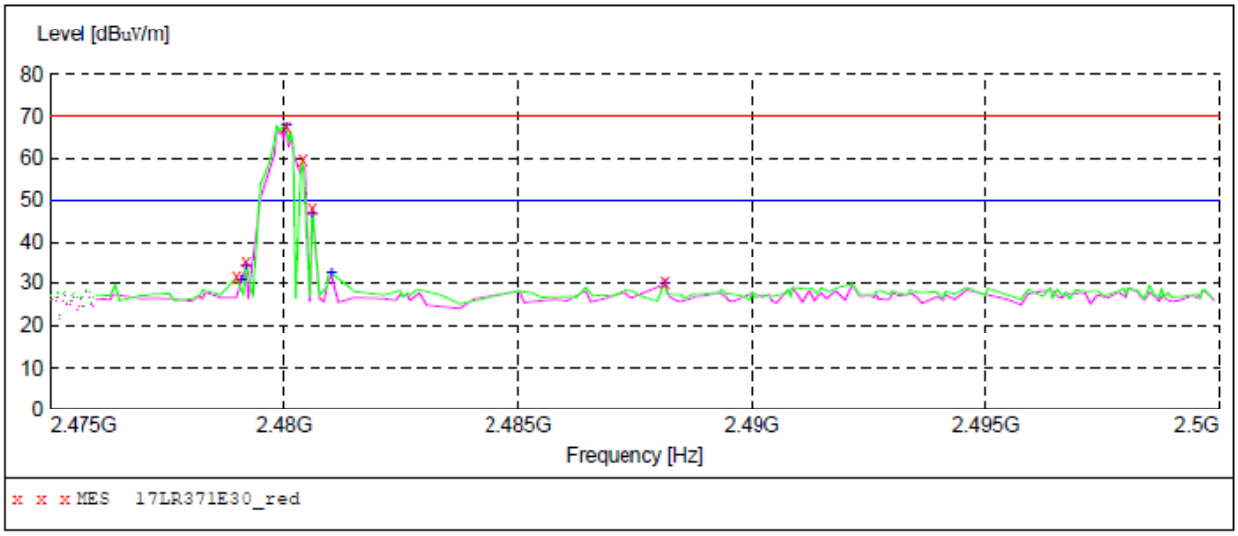
Highest Bandedge

Vertical (Pi/4 DQPSK)

SWEEP TABLE: "test (1M-7G)"

Short Description: Field Strength

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	7.0 GHz	MaxPeak Average	Coupled	100 kHz	BBHA 9120A NEW



MEASUREMENT RESULT: "17LR371E30_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
2479.000000	31.20	-3.4	70.0	38.8	---	100.0	0.00	VERTICAL
2479.200000	35.00	-3.4	70.0	35.0	---	100.0	0.00	VERTICAL
2480.050000	67.60	-3.4	70.0	2.4	---	100.0	0.00	VERTICAL
2480.400000	59.40	-3.4	70.0	10.6	---	100.0	0.00	VERTICAL
2480.600000	47.80	-3.4	70.0	22.2	---	100.0	0.00	VERTICAL
2488.150000	30.30	-3.3	70.0	39.7	---	100.0	0.00	VERTICAL

MEASUREMENT RESULT: "17LR371E30_red2"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
2479.100000	30.40	-3.4	50.0	19.6	---	100.0	0.00	VERTICAL
2479.200000	33.80	-3.4	50.0	16.2	---	100.0	0.00	VERTICAL
2480.050000	67.50	-3.4	50.0	-17.5	---	100.0	0.00	VERTICAL
2480.600000	46.70	-3.4	50.0	3.3	---	100.0	0.00	VERTICAL
2481.000000	32.00	-3.4	50.0	18.0	---	100.0	0.00	VERTICAL
2488.150000	29.70	-3.3	50.0	20.3	---	100.0	0.00	VERTICAL

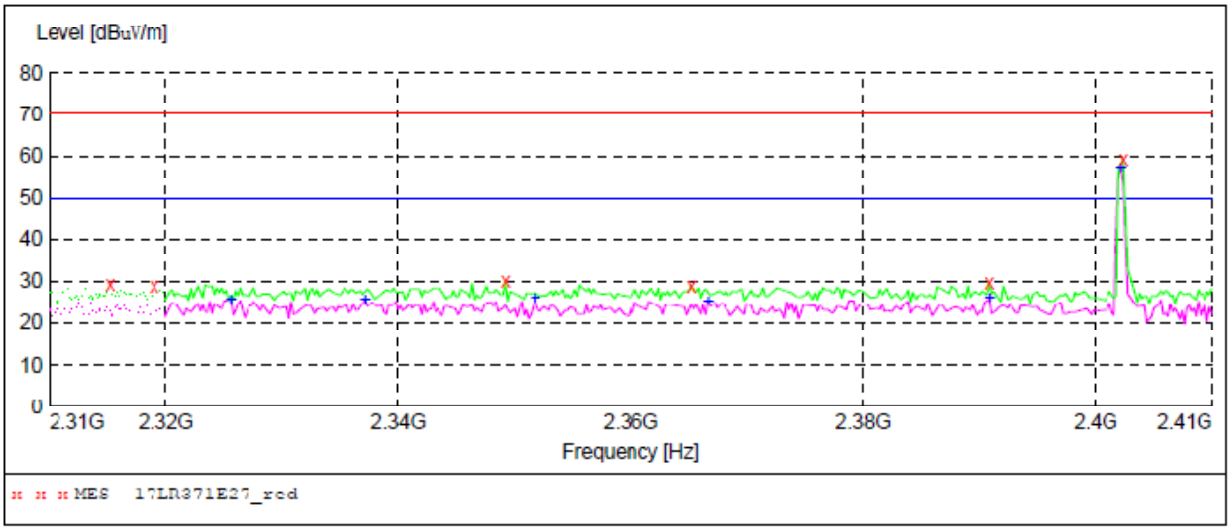
Lowest Bandedge

Vertical (8DPSK)

SWEEP TABLE: "test (1M-7G)"

Short Description: Field Strength

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	7.0 GHz	MaxPeak Average	Coupled	100 kHz	BBHA 9120A NEW



MEASUREMENT RESULT: "17LR371E27_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
2315.200000	29.30	-4.1	70.0	40.7	---	100.0	0.00	VERTICAL
2319.000000	28.80	-4.1	70.0	41.2	---	100.0	0.00	VERTICAL
2349.200000	29.90	-4.1	70.0	40.1	---	100.0	0.00	VERTICAL
2365.200000	28.70	-4.1	70.0	41.3	---	100.0	0.00	VERTICAL
2390.800000	29.60	-4.1	70.0	40.4	---	100.0	0.00	VERTICAL
2402.400000	59.00	-4.0	70.0	11.0	---	100.0	0.00	VERTICAL

MEASUREMENT RESULT: "17LR371E27_red2"

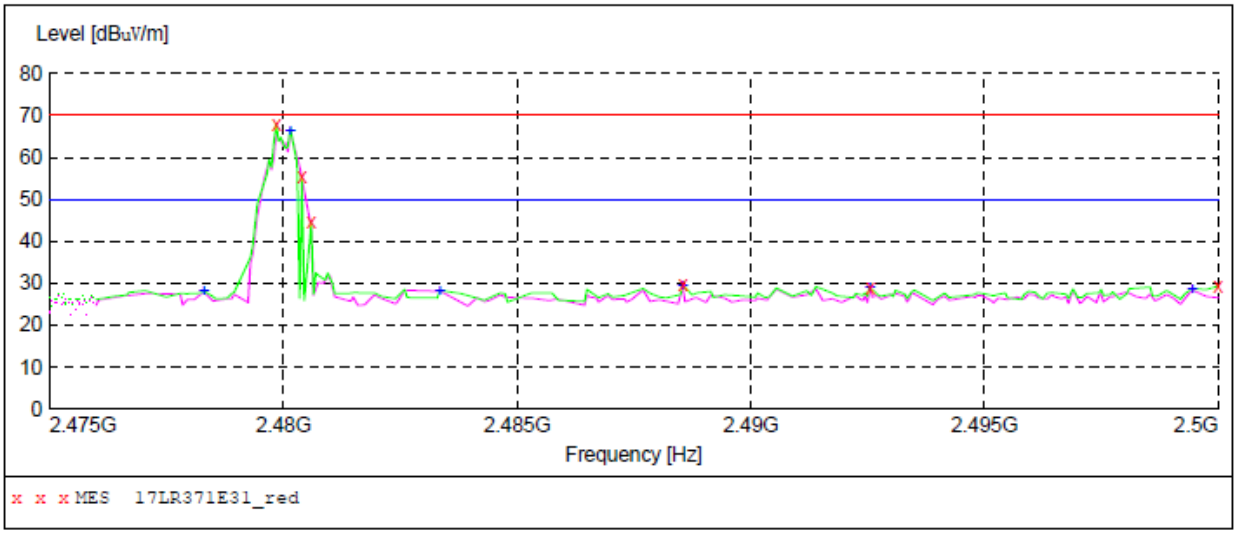
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
2325.600000	25.60	-4.1	50.0	24.4	---	100.0	0.00	VERTICAL
2337.200000	25.60	-4.1	50.0	24.4	---	100.0	0.00	VERTICAL
2351.800000	25.90	-4.1	50.0	24.1	---	100.0	0.00	VERTICAL
2366.600000	25.30	-4.1	50.0	24.7	---	100.0	0.00	VERTICAL
2390.800000	25.80	-4.1	50.0	24.2	---	100.0	0.00	VERTICAL
2402.200000	57.10	-4.0	50.0	-7.1	---	100.0	0.00	VERTICAL

Highest Bandedge

Vertical (8DPSK)

SWEEP TABLE: "test (1M-7G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	7.0 GHz	MaxPeak Average	Coupled	100 kHz	BBHA 9120A NEW



MEASUREMENT RESULT: "17LR371E31_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
2479.850000	67.90	-3.4	70.0	2.1	---	100.0	0.00	VERTICAL
2480.400000	55.20	-3.4	70.0	14.8	---	100.0	0.00	VERTICAL
2480.600000	44.40	-3.4	70.0	25.6	---	100.0	0.00	VERTICAL
2488.550000	29.70	-3.3	70.0	40.3	---	100.0	0.00	VERTICAL
2492.550000	29.00	-3.3	70.0	41.0	---	100.0	0.00	VERTICAL
2500.000000	29.30	-3.2	70.0	40.7	---	100.0	0.00	VERTICAL

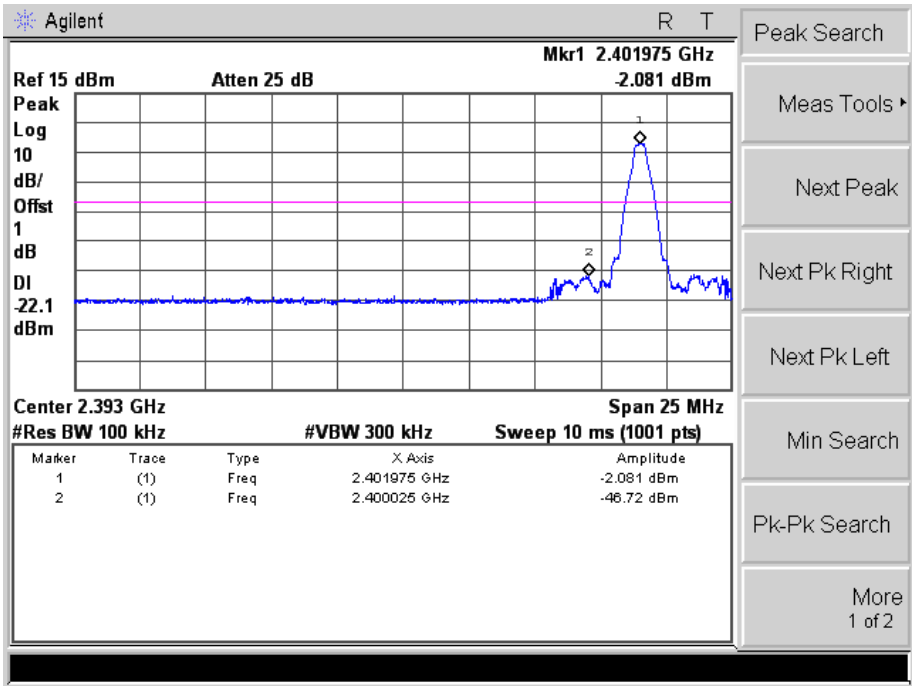
MEASUREMENT RESULT: "17LR371E31_red2"

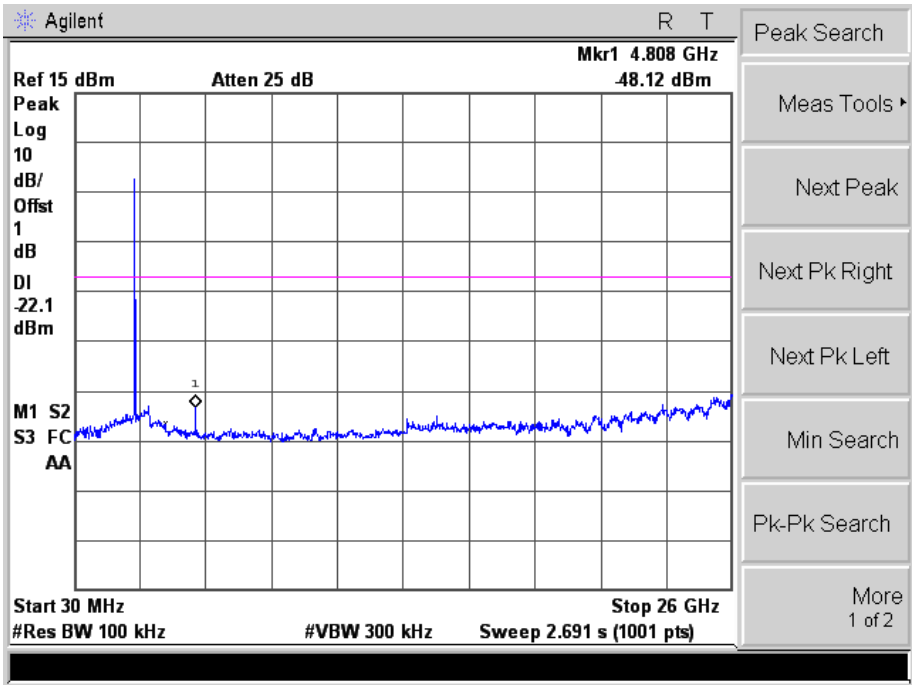
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
2478.300000	28.00	-3.4	50.0	22.0	---	100.0	0.00	VERTICAL
2480.150000	66.10	-3.4	50.0	-16.1	---	100.0	0.00	VERTICAL
2483.350000	28.10	-3.3	50.0	21.9	---	100.0	0.00	VERTICAL
2488.550000	29.10	-3.3	50.0	20.9	---	100.0	0.00	VERTICAL
2492.550000	28.70	-3.3	50.0	21.3	---	100.0	0.00	VERTICAL
2499.450000	28.40	-3.2	50.0	21.6	---	100.0	0.00	VERTICAL

GFSK

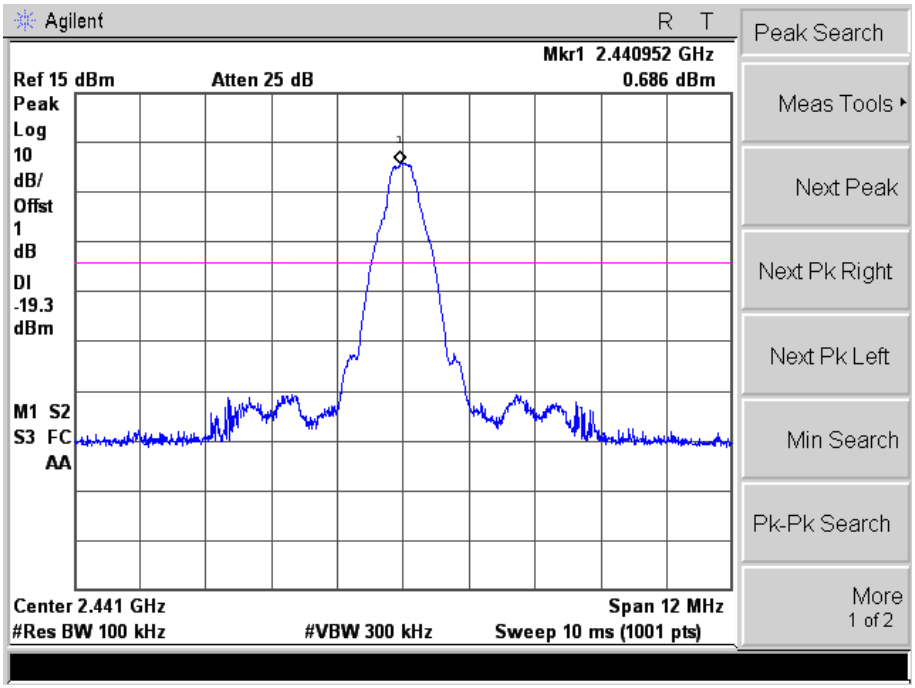
Bandedge (Conducted)

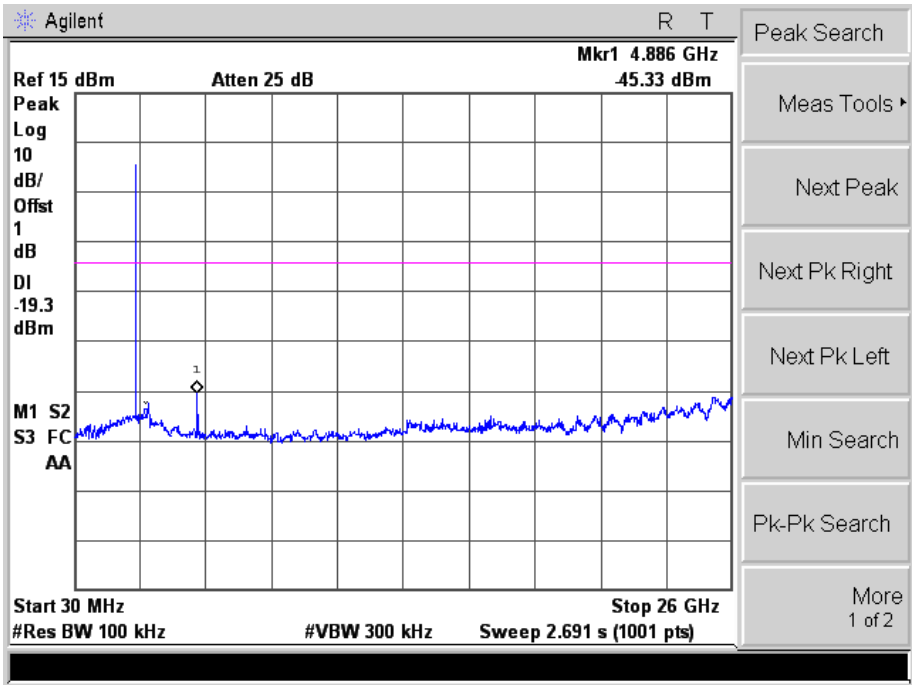
Lowest



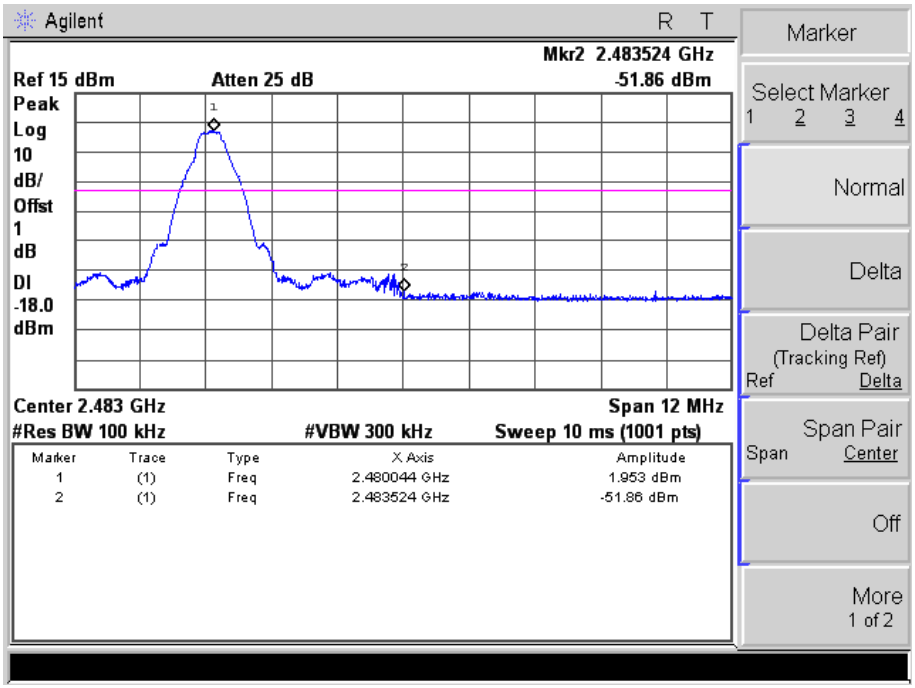


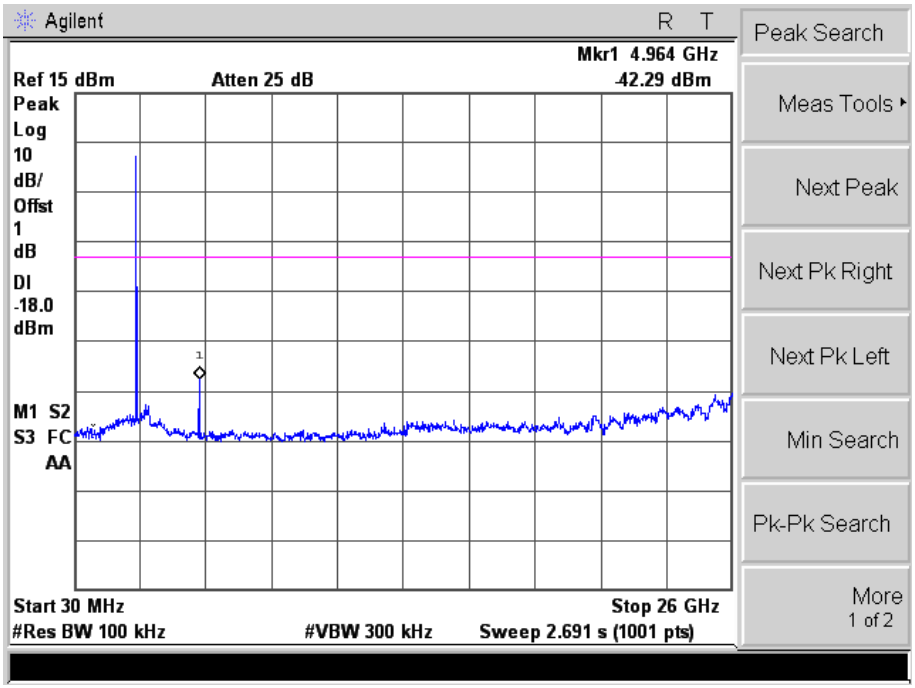
Middle Channel



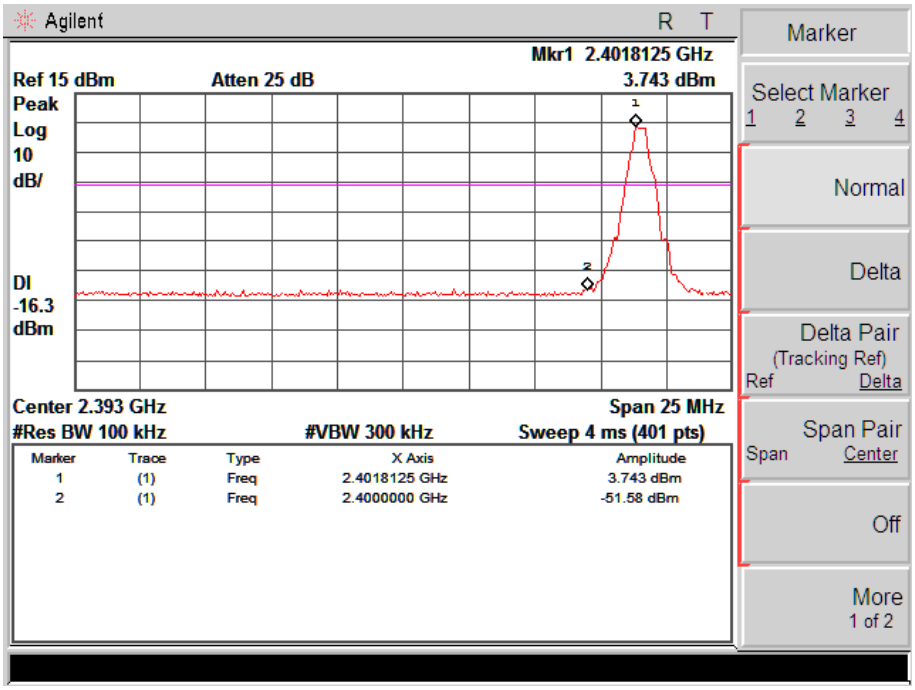


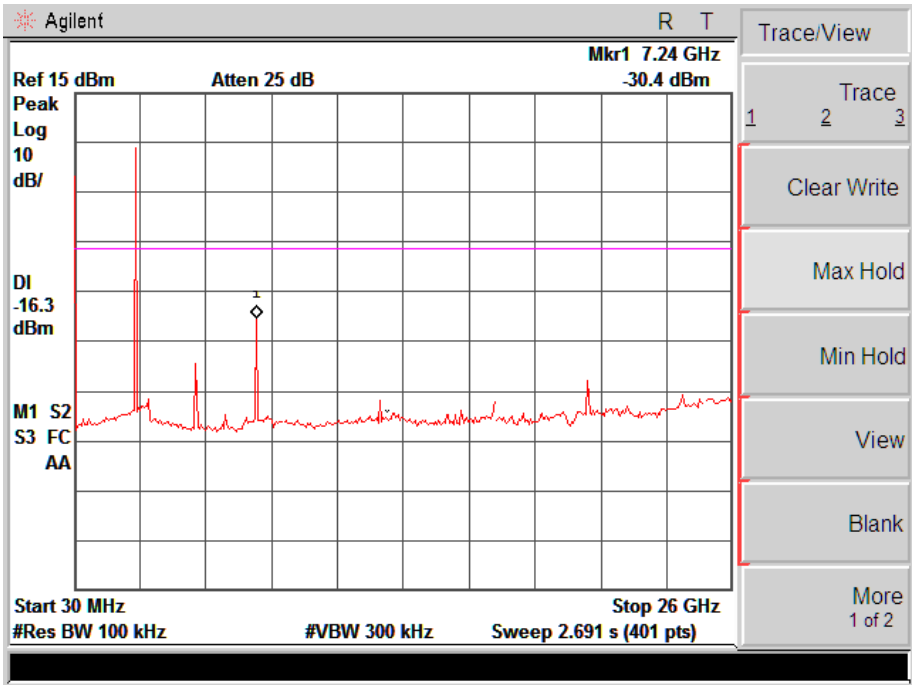
Highest


Agilent
R T
Mkr2 2.483524 GHz
Ref 15 dBm
Atten 25 dB
-51.86 dBm
Peak
Log
10
dB/
Offst
1
dB
Dl
-18.0
dBm
Center 2.483 GHz
Span 12 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.480044 GHz 1.953 dBm
2 (1) Freq 2.483524 GHz -51.86 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

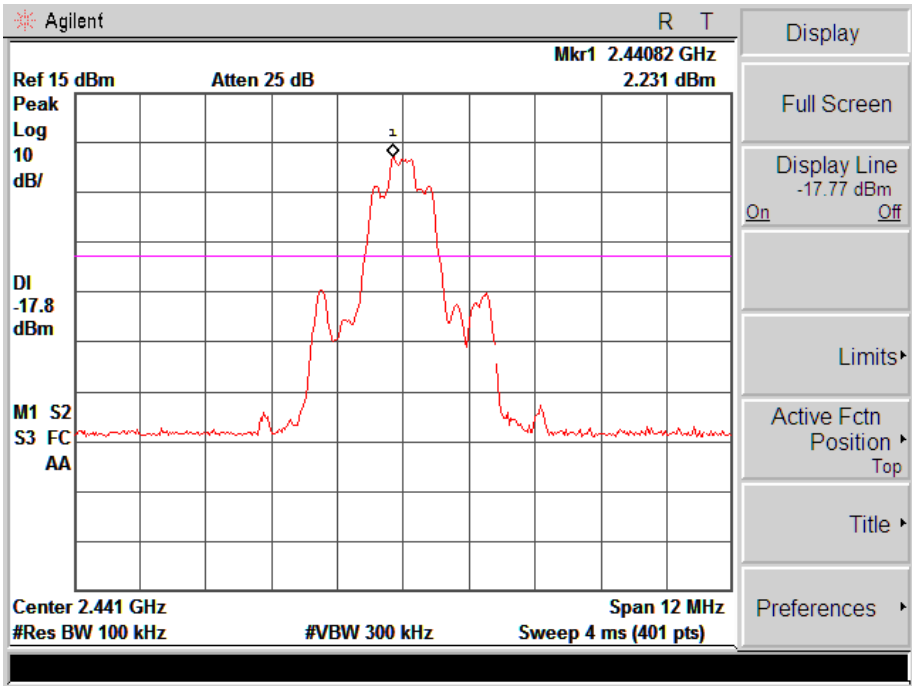

Agilent
R T
Mkr1 4.964 GHz
Ref 15 dBm
Atten 25 dB
-42.29 dBm
Peak
Log
10
dB/
Offst
1
dB
Dl
-18.0
dBm
M1 S2
S3 FC
AA
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (1001 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

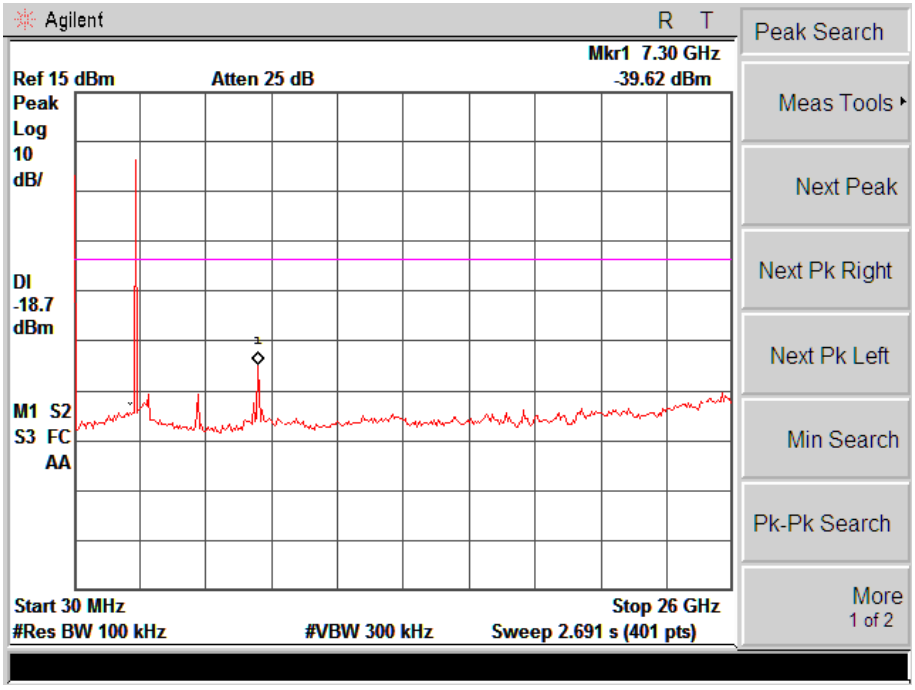
Pi/4 DQPSK
Bandedge (Conducted)
Lowest



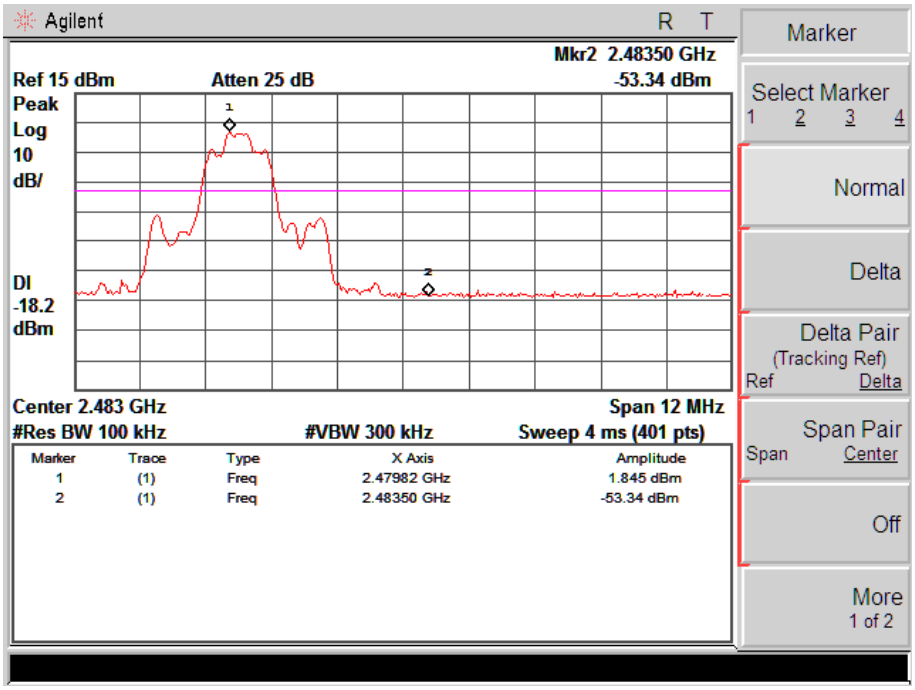


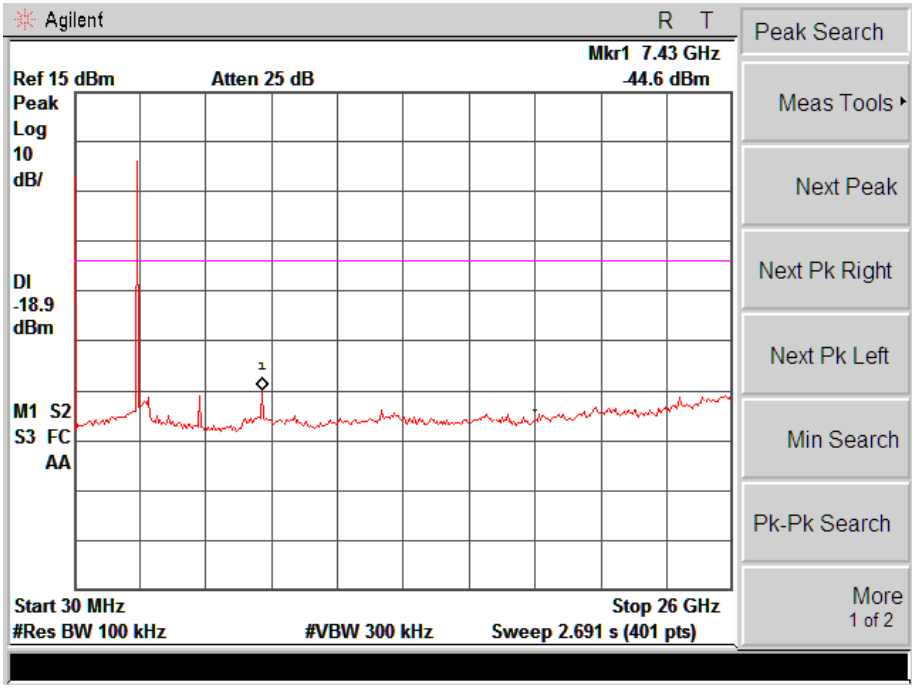
Middle Channel



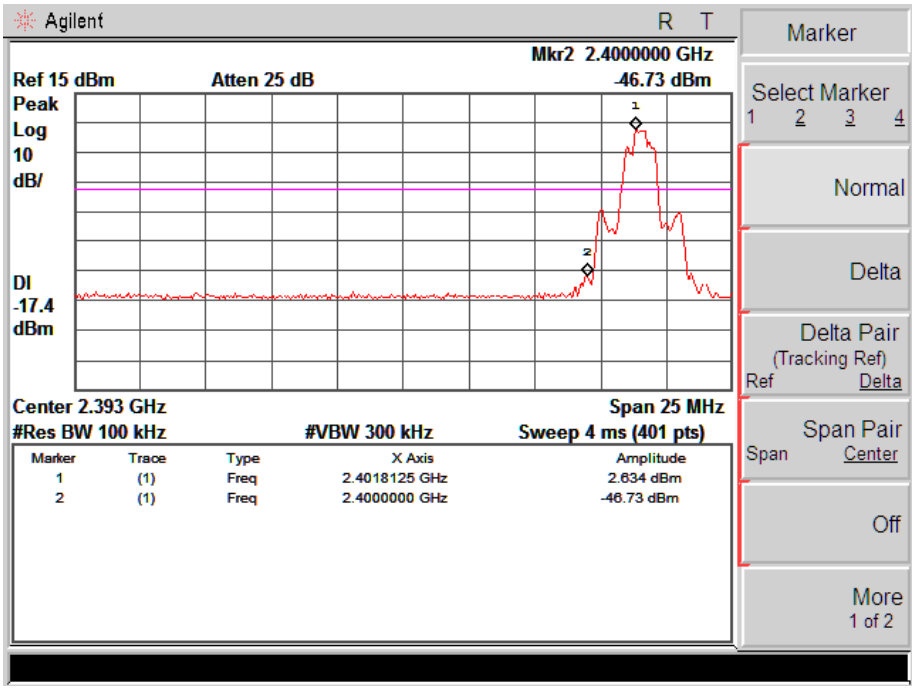


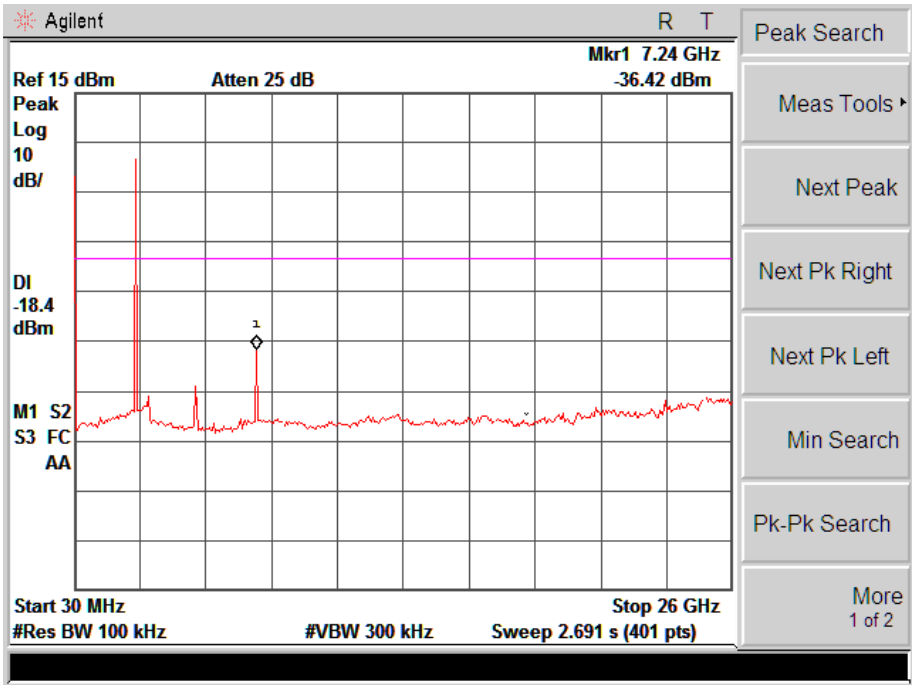
Highest


Agilent
R T
Mkr2 2.48350 GHz
Ref 15 dBm
Atten 25 dB
-53.34 dBm
Peak
Log
10
dB/
DI
-18.2
dBm
Center 2.483 GHz
Span 12 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.47982 GHz 1.845 dBm
2 (1) Freq 2.48350 GHz -53.34 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

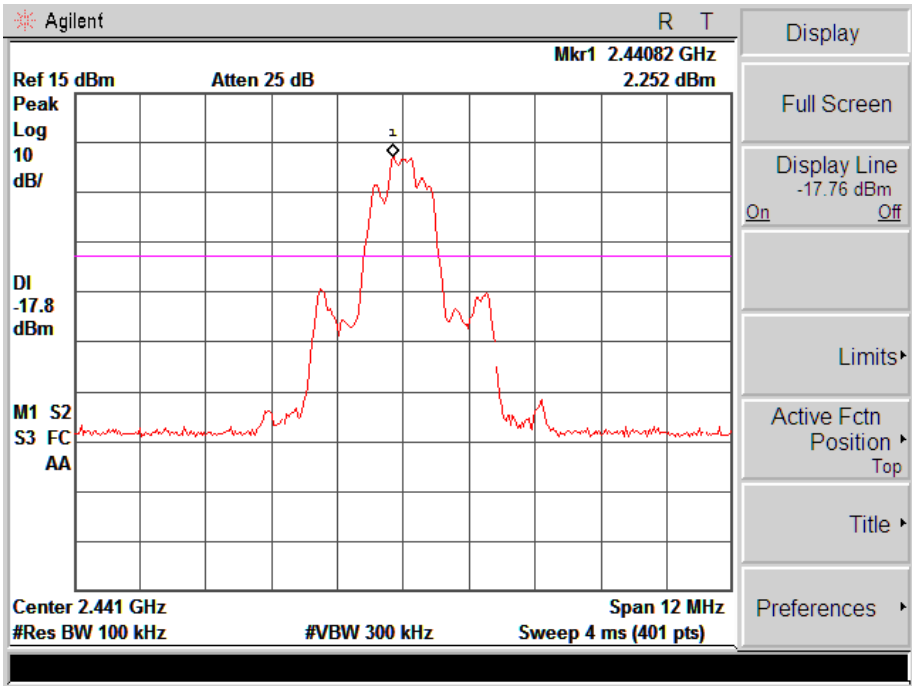

Agilent
R T
Mkr1 7.43 GHz
Ref 15 dBm
Atten 25 dB
-44.6 dBm
Peak
Log
10
dB/
DI
-18.9
dBm
M1 S2
S3 FC
AA
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

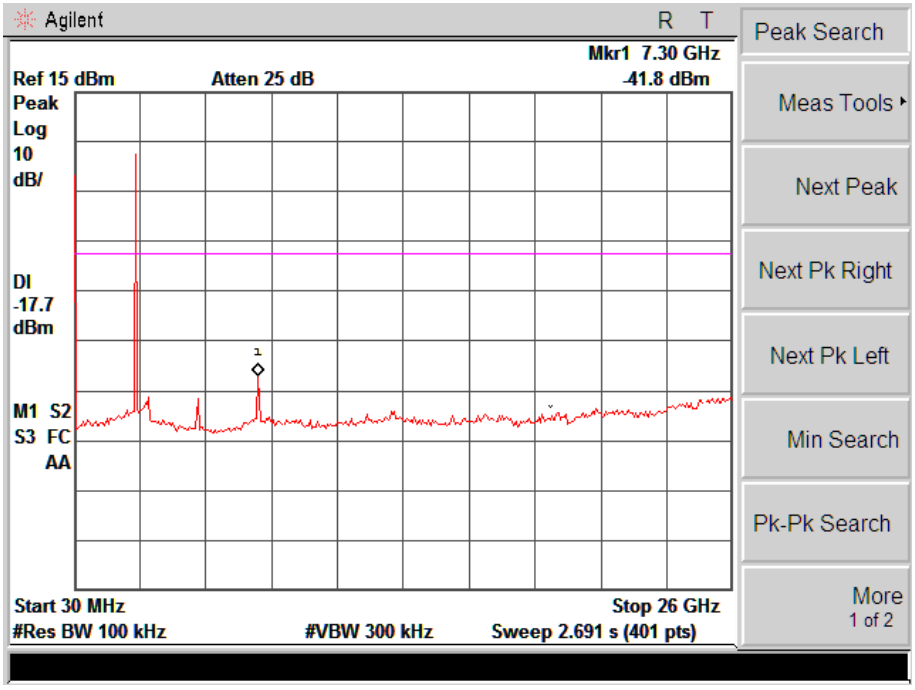
8DPSK
Bandedge (Conducted)
Lowest



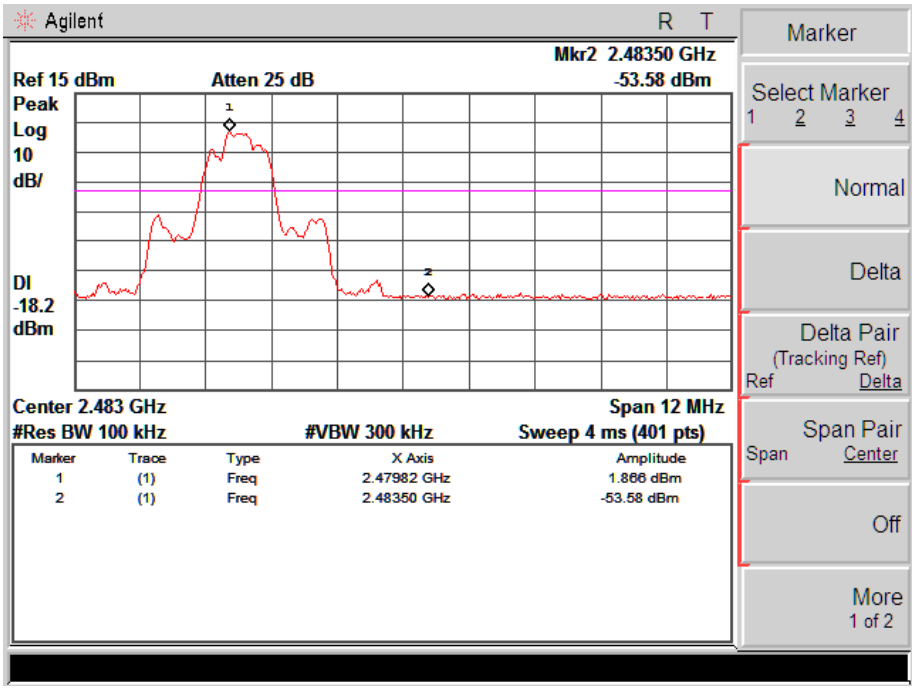


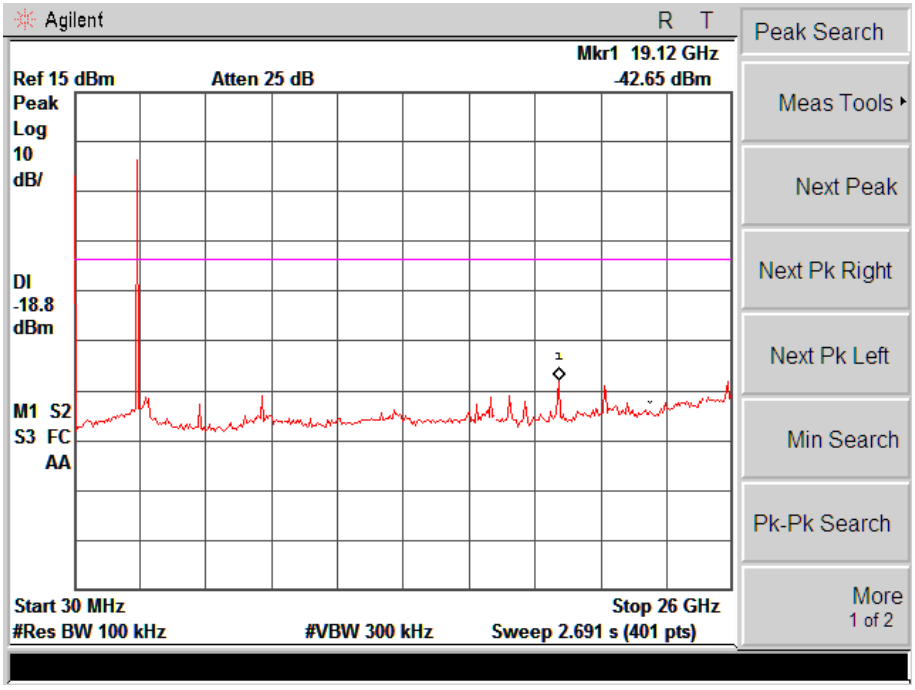
Middle Channel





Highest

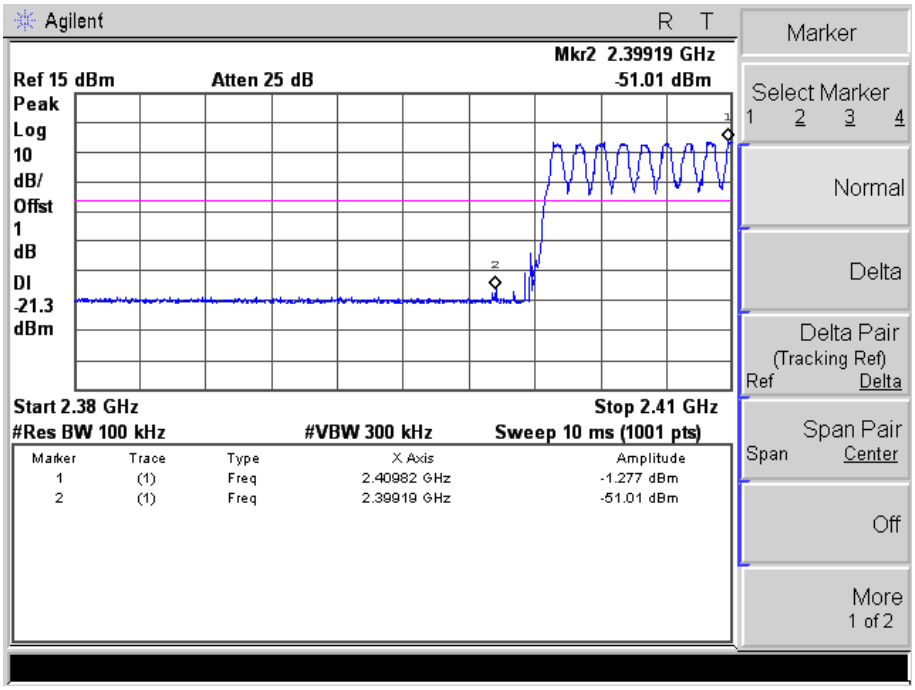

Agilent
R T
Mkr2 2.48350 GHz
Ref 15 dBm
Atten 25 dB
-53.58 dBm
Peak
Log
10
dB/
DI
-18.2
dBm
Center 2.483 GHz
Span 12 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.47982 GHz 1.866 dBm
2 (1) Freq 2.48350 GHz -53.58 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2


Agilent
R T
Mkr1 19.12 GHz
Ref 15 dBm
Atten 25 dB
-42.65 dBm
Peak
Log
10
dB/
DI
-18.8
dBm
M1 S2
S3 FC
AA
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

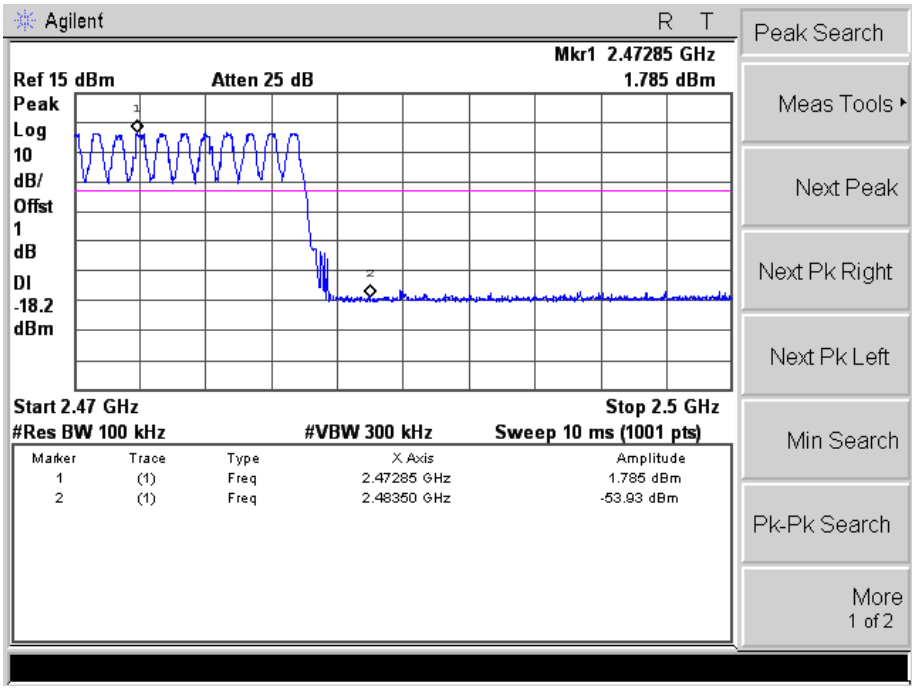
Bandedge with Hopping on:

Worst mode(GFSK):

Lowest Bandedge



Highest Bandedge

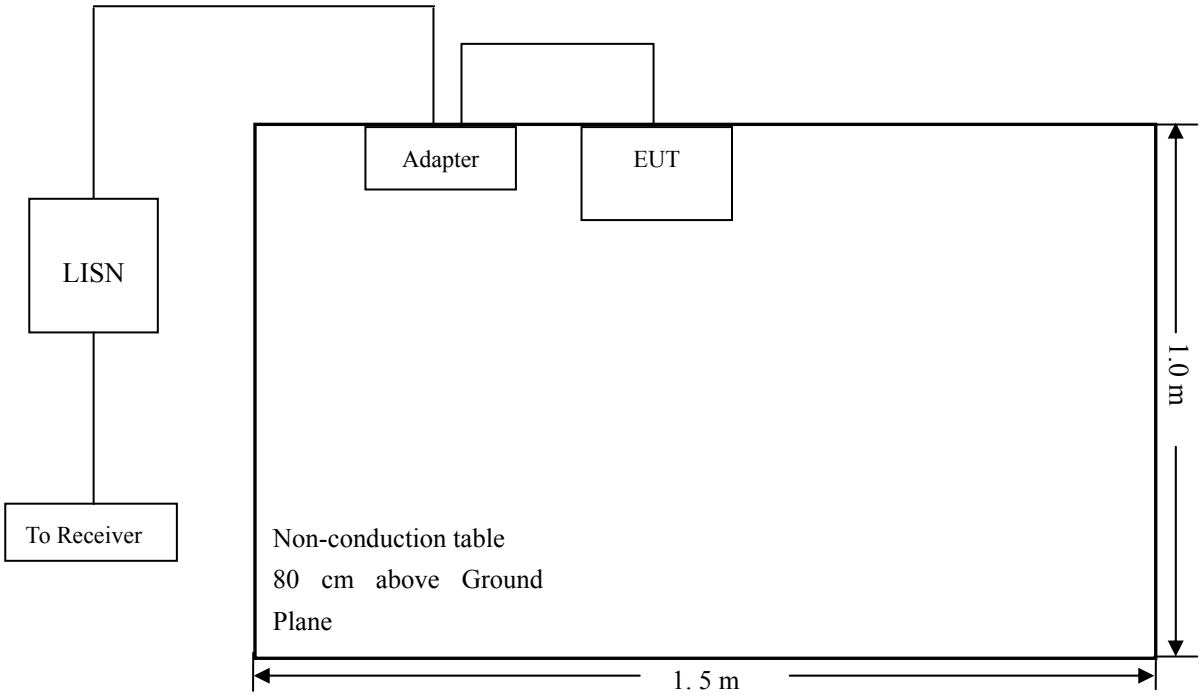


12. Conducted Emissions

12.1 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.

12.2Basic Test Setup Block Diagram



12.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

12.4 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency ..... 150 kHz
Stop Frequency ..... 30 MHz
Sweep Speed ..... Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth ..... 9 kHz
Quasi-Peak Adapter Mode ..... Normal

12.5 Summary of Test Results/Plots

We test all the modes, and the mode of charging & BT Transmitting has the worst margin.

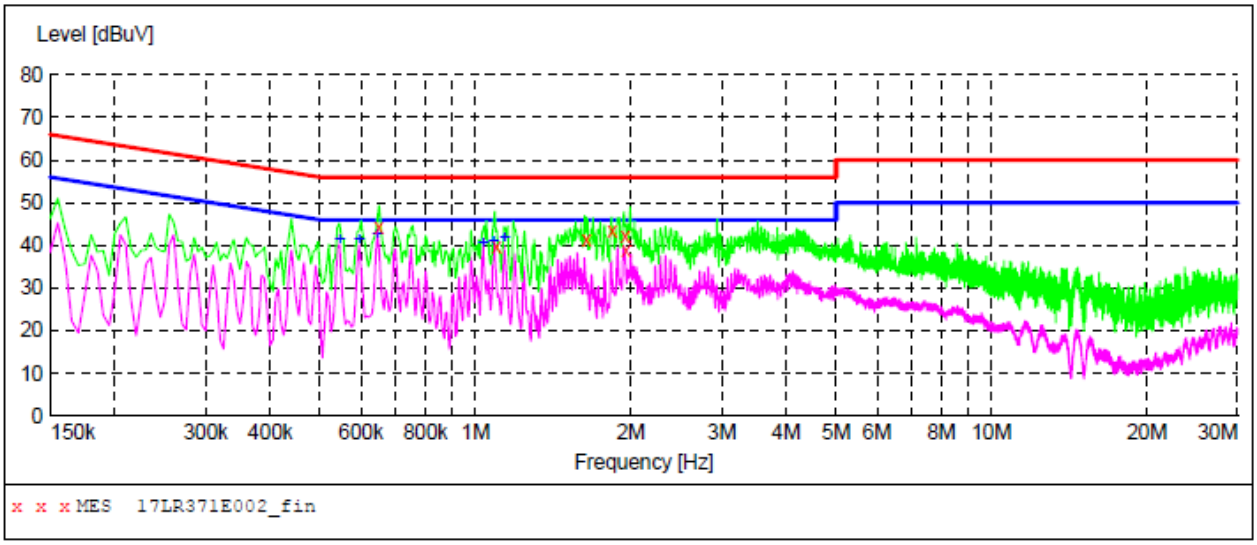
12.6 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

EUT: *Power Amplifier*
Tested Model: *M-ONE*
Operating Condition: *Charging & BT Transmitting GFSK*
Comment: AC 120V/60Hz

Test Specification: *Neutral*

SCAN TABLE: "Voltage(150K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "17LR371E002_fin"

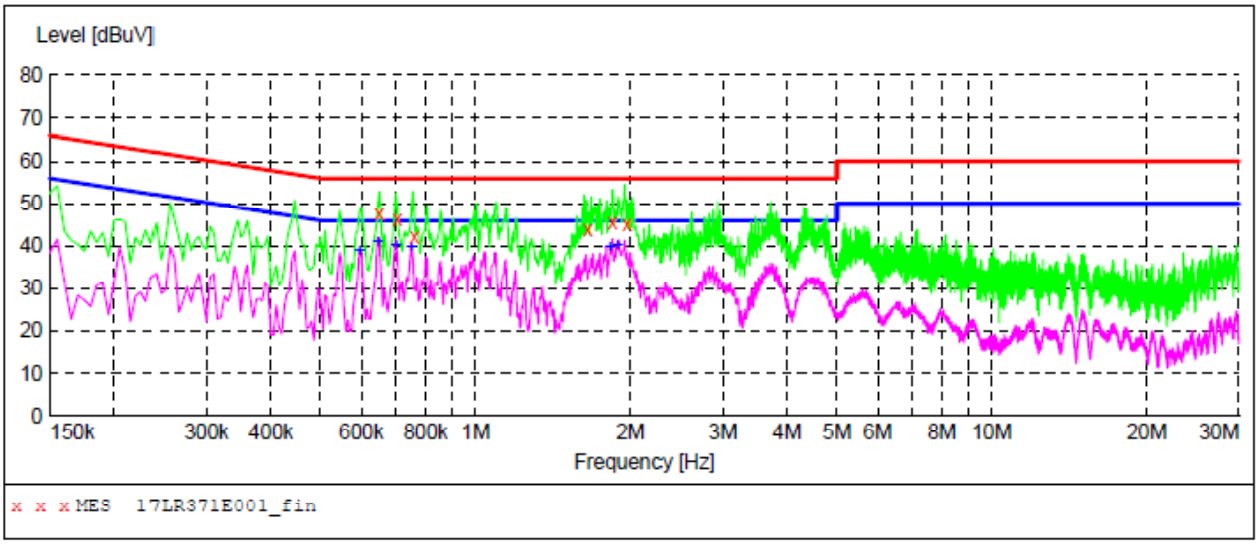
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.650000	44.20	10.4	56	11.8	QP	N	GND
1.100000	39.60	10.5	56	16.4	QP	N	GND
1.640000	41.50	11.0	56	14.5	QP	N	GND
1.840000	43.60	11.2	56	12.4	QP	N	GND
1.950000	42.10	11.2	56	13.9	QP	N	GND
1.960000	38.70	11.2	56	17.3	QP	N	GND

MEASUREMENT RESULT: "17LR371E002_fin2"

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.545000	41.20	10.4	46	4.8	AV	N	GND
0.595000	41.20	10.4	46	4.8	AV	N	GND
0.645000	42.40	10.4	46	3.6	AV	N	GND
1.035000	40.70	10.5	46	5.3	AV	N	GND
1.085000	40.90	10.5	46	5.1	AV	N	GND
1.140000	41.60	10.6	46	4.4	AV	N	GND

Test Specification: *Line*

SCAN TABLE: "Voltage(150K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "17LR371E001_fin"

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.650000	47.60	10.4	56	8.4	QP	L1	GND
0.705000	46.20	10.3	56	9.8	QP	L1	GND
0.760000	42.00	10.3	56	14.0	QP	L1	GND
1.650000	44.00	11.0	56	12.0	QP	L1	GND
1.845000	45.60	11.2	56	10.4	QP	L1	GND
1.970000	45.00	11.3	56	11.0	QP	L1	GND

MEASUREMENT RESULT: "17LR371E001_fin2"

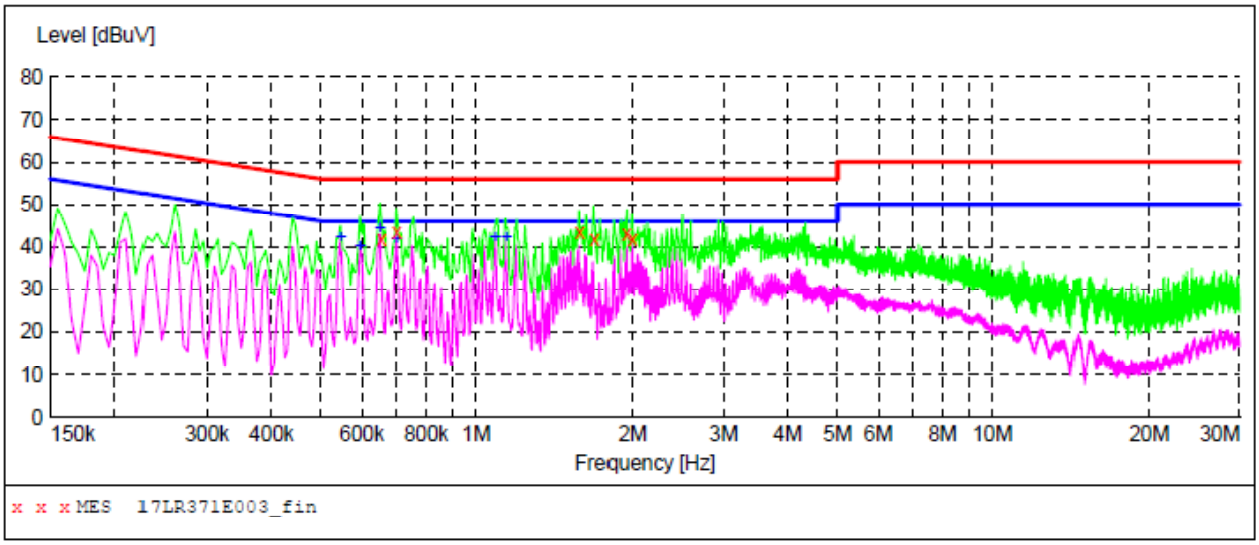
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.595000	38.90	10.4	46	7.1	AV	L1	GND
0.645000	41.10	10.4	46	4.9	AV	L1	GND
0.700000	40.00	10.3	46	6.0	AV	L1	GND
0.750000	39.70	10.3	46	6.3	AV	L1	GND
1.825000	39.80	11.2	46	6.2	AV	L1	GND
1.885000	39.90	11.2	46	6.1	AV	L1	GND

Plot of Conducted Emissions Test Data

EUT: *Power Amplifier*
Tested Model: *M-ONE*
Operating Condition: *Charging & BT Transmitting Pi/4 DQPSK*
Comment: AC 120V/60Hz

Test Specification: *Neutral*

SCAN TABLE: "Voltage(150K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "17LR371E003_fin"

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.655000	41.60	10.4	56	14.4	QP	N	GND
0.700000	43.40	10.3	56	12.6	QP	N	GND
1.585000	43.60	11.0	56	12.4	QP	N	GND
1.695000	41.70	11.1	56	14.3	QP	N	GND
1.945000	43.00	11.2	56	13.0	QP	N	GND
1.995000	41.90	11.3	56	14.1	QP	N	GND

MEASUREMENT RESULT: "17LR371E003_fin2"

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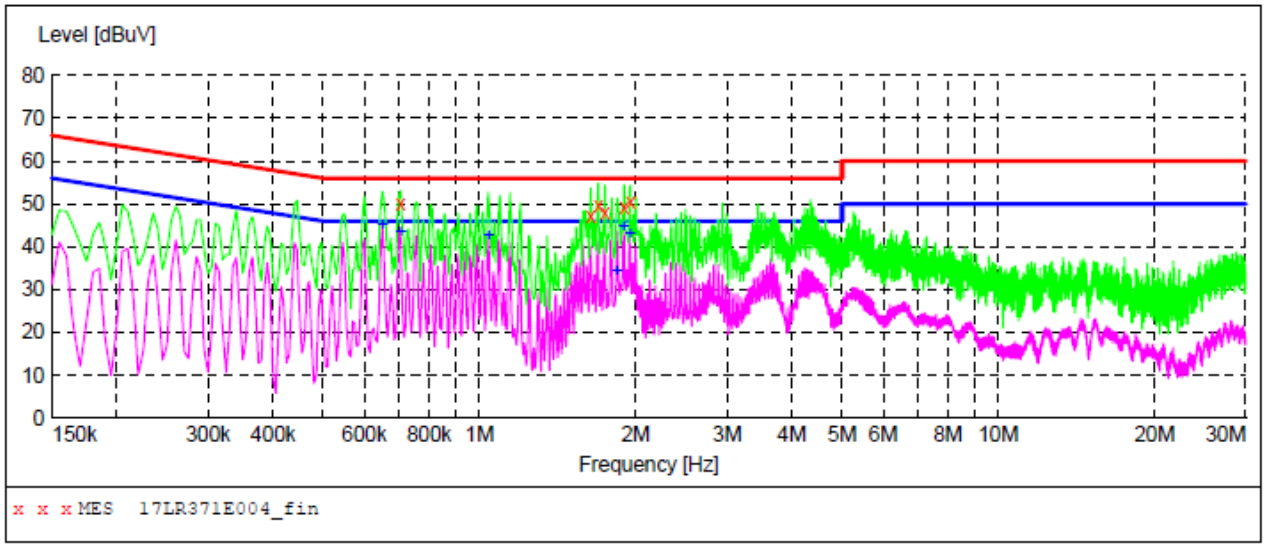
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.545000	42.10	10.4	46	3.9	AV	N	GND
0.595000	39.90	10.4	46	6.1	AV	N	GND
0.650000	44.10	10.4	46	1.9	AV	N	GND
0.700000	41.60	10.3	46	4.4	AV	N	GND
1.090000	42.30	10.5	46	3.7	AV	N	GND
1.145000	42.20	10.6	46	3.8	AV	N	GND

Test Specification: *Line*

SCAN TABLE: "Voltage(150K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "17LR371E004_fin"

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.705000	50.10	10.3	56	5.9	QP	L1	GND
1.640000	47.20	11.0	56	8.8	QP	L1	GND
1.695000	49.60	11.1	56	6.4	QP	L1	GND
1.745000	48.00	11.1	56	8.0	QP	L1	GND
1.900000	49.30	11.2	56	6.7	QP	L1	GND
1.955000	50.30	11.2	56	5.7	QP	L1	GND

MEASUREMENT RESULT: "17LR371E004_fin2"

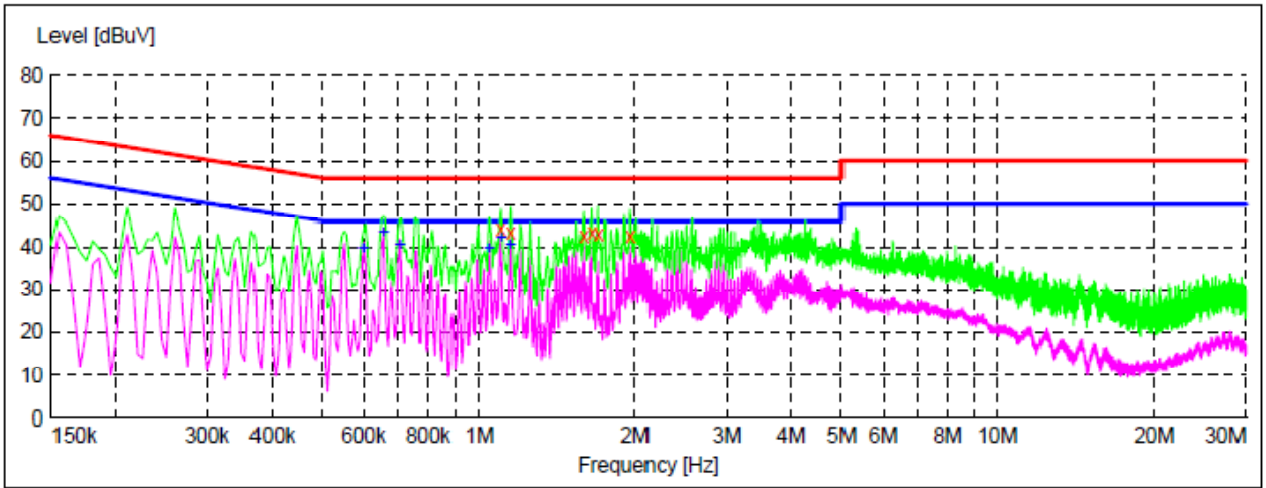
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.650000	45.00	10.4	46	1.0	AV	L1	GND
0.705000	43.40	10.3	46	2.6	AV	L1	GND
1.040000	42.50	10.5	46	3.5	AV	L1	GND
1.840000	34.30	11.2	46	11.7	AV	L1	GND
1.900000	44.60	11.2	46	1.4	AV	L1	GND
1.955000	42.90	11.2	46	3.1	AV	L1	GND

Plot of Conducted Emissions Test Data

EUT: *Power Amplifier*
Tested Model: *M-ONE*
Operating Condition: *Charging & BT Transmitting 8DPSK*
Comment: AC 120V/60Hz

Test Specification: *Neutral*

SCAN TABLE: "Voltage(150K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "17LR371E006_fin"

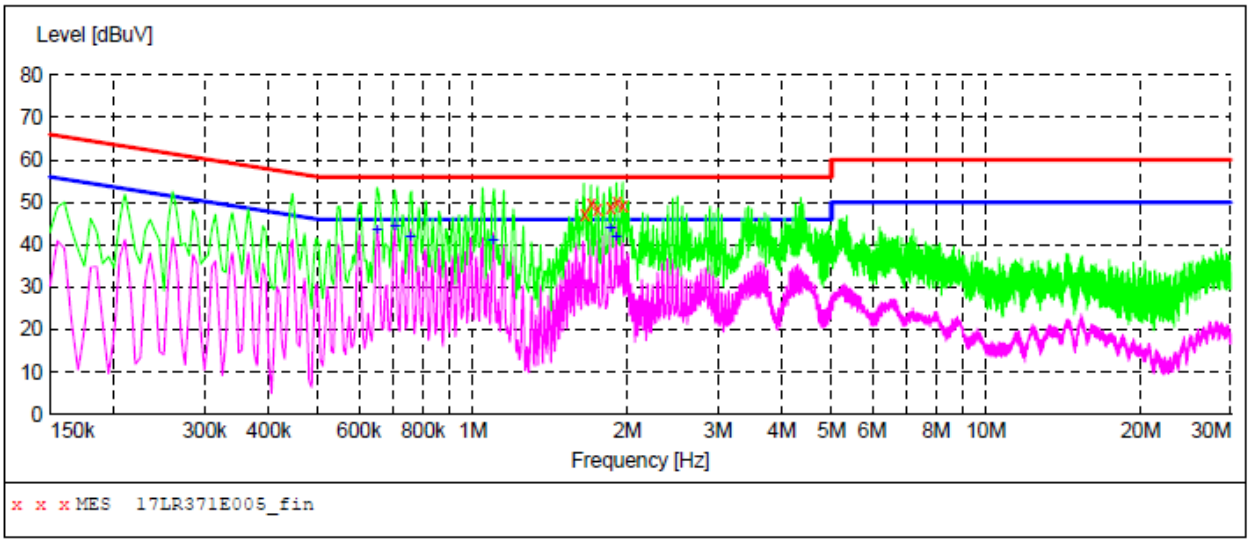
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
1.100000	44.20	10.5	56	11.8	QP	N	GND
1.150000	43.50	10.6	56	12.5	QP	N	GND
1.595000	42.70	11.0	56	13.3	QP	N	GND
1.655000	43.30	11.0	56	12.7	QP	N	GND
1.705000	43.00	11.1	56	13.0	QP	N	GND
1.960000	42.50	11.2	56	13.5	QP	N	GND

MEASUREMENT RESULT: "17LR371E006_fin2"

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.600000	39.80	10.4	46	6.2	AV	N	GND
0.655000	43.50	10.4	46	2.5	AV	N	GND
0.705000	40.70	10.3	46	5.3	AV	N	GND
1.045000	39.50	10.5	46	6.5	AV	N	GND
1.100000	42.30	10.5	46	3.7	AV	N	GND
1.150000	40.70	10.6	46	5.3	AV	N	GND

Test Specification: *Line*

SCAN TABLE: "Voltage(150K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "17LR371E005_fin"

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
1.650000	47.30	11.0	56	8.7	QP	L1	GND
1.700000	49.60	11.1	56	6.4	QP	L1	GND
1.750000	48.40	11.1	56	7.6	QP	L1	GND
1.855000	48.90	11.2	56	7.1	QP	L1	GND
1.910000	50.20	11.2	56	5.8	QP	L1	GND
1.960000	49.30	11.2	56	6.7	QP	L1	GND

MEASUREMENT RESULT: "17LR371E005_fin2"

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.650000	43.40	10.4	46	2.6	AV	L1	GND
0.705000	44.40	10.3	46	1.6	AV	L1	GND
0.755000	41.70	10.3	46	4.3	AV	L1	GND
1.095000	41.10	10.5	46	4.9	AV	L1	GND
1.855000	43.90	11.2	46	2.1	AV	L1	GND
1.905000	41.60	11.2	46	4.4	AV	L1	GND

******* END OF REPORT *******