TEST REPORT



CTK Co., Ltd. (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel: +82-31-339-9970 Fax: +82-31-624-9501

Report No.: CTK-2020-04544 Page (1) / (89) Pages

1. Client

- Name : Samsung Electronics Co Ltd
- Address : 19 Chapin Rd, Building D. Pine Brook, New Jersey, United States
- Date of Receipt : 2020-10-26

2. Manufacturer

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
- 3. Use of Report : For FCC Conformance / ISED Conformance
- 4. Test Sample / Model: Wi-Fi/BT Transceiver / WCA942M
- 5. Date of Test : 2020-11-05 to 2020-11-20
- 6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.247
 - RSS-247 & RSS-Gen
- **7. Testing Environment:** Temp.: (23 ± 1) °C, Humidity: (49 ± 3) % R.H.
- 8. Test Results : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by Ji-Hye, Kim: (Signature)	Technical Manager Won-Jae, Hwang: (Signature)
		2020-11-20
Republic of KOREA CTK Co., Ltd.		



Report No.: CTK-2020-04544 Page (2) / (89) Pages

REPORT REVISION HISTORY

Date	Revision	Page No
2020-11-20	Issued (CTK-2020-04544)	all

This report shall not be reproduced except in full, without the written approval of CTK Co., Ltd. This document may be altered or revised by CTK Co., Ltd. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by CTK Co., Ltd. will constitute fraud and shall nullify the document.



Report No.: CTK-2020-04544 Page (3) / (89) Pages

CONTENTS

1. General Product Description 4
1.1 Client Information 4
1.2 Product Information 4
1.3 Peripheral Devices 4
1.4 Model Differences 4
2. Facility and Accreditations5
2.1 Test Facility5
2.2 Laboratory Accreditations and Listings
2.3 Calibration Details of Equipment Used for Measurement
3. Test Specifications
3.1 Standards
3.2 Mode of operation during the test \ldots 6
3.3 Maximum Measurement Uncertainty7
or maximum measurement encontainty
3.4 Test Software 7
-
3.4 Test Software
3.4 Test Software 7 4. Technical Characteristic Test 8
3.4 Test Software 7 4. Technical Characteristic Test 8 4.1 Carrier Frequency Separation 8
3.4 Test Software 7 4. Technical Characteristic Test 8 4.1 Carrier Frequency Separation 8 4.2 Number of Hopping Frequencies 11
3.4 Test Software 7 4. Technical Characteristic Test 8 4.1 Carrier Frequency Separation 8 4.2 Number of Hopping Frequencies 11 4.3 20 dB bandwidth & 99% Bandwidth 16
3.4 Test Software 7 4. Technical Characteristic Test 8 4.1 Carrier Frequency Separation 8 4.2 Number of Hopping Frequencies 11 4.3 20 dB bandwidth & 99% Bandwidth 16 4.4 Time of Occupancy 22
3.4 Test Software. 7 4. Technical Characteristic Test. 8 4.1 Carrier Frequency Separation. 8 4.2 Number of Hopping Frequencies 11 4.3 20 dB bandwidth & 99% Bandwidth 16 4.4 Time of Occupancy 22 4.5 Maximum peak Conducted Output Power. 32
3.4 Test Software. 7 4. Technical Characteristic Test. 8 4.1 Carrier Frequency Separation. 8 4.2 Number of Hopping Frequencies. 11 4.3 20 dB bandwidth & 99% Bandwidth 16 4.4 Time of Occupancy 22 4.5 Maximum peak Conducted Output Power. 32 4.6 Unwanted Emissions (Conducted). 42
3.4 Test Software. 7 4. Technical Characteristic Test. 8 4.1 Carrier Frequency Separation. 8 4.2 Number of Hopping Frequencies. 11 4.3 20 dB bandwidth & 99% Bandwidth. 16 4.4 Time of Occupancy 22 4.5 Maximum peak Conducted Output Power. 32 4.6 Unwanted Emissions (Conducted). 42 4.7 Radiated Emission 63



1. General Product Description

1.1 Client Information

Company	Samsung Electronics Co., Ltd.
Contact Point	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Contact Person	Name : Youngjoong Noh E-mail : monk.noh@samsung.com Tel : +82-277-0598 Fax : -

1.2 Product Information

FCC ID	A3LWCA942M
ISED	649E-WCA942M
Product Description	Wi-Fi/BT Transceiver
Model name	WCA942M
Variant Model name	-
Operating Frequency	2 402 MHz - 2 480 MHz
RF Output Power	GFSK : 12.886 dBm (19.436 mW) 8-DPSK : 12.907 dBm (19.530 mW)
Antenna Specification	Antenna type : Chip Antenna Peak Gain : -1.04 dBi (BT0), -5.11 dBi (BT1)
Number of channels	79
Channel Spacing	1 MHz
Type of Modulation	GFSK(1Mbps), π/4 DQPSK(2Mbps), 8DPSK(3Mbps)
Power Source	DC 5 V
Hardware Rev	V2.0
Software Rev	FC2

1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253QPR
AC/DC Adapter	HP	HSTNN-LA40	-

1.4 Model Differences

Not applicable



2. Facility and Accreditations

2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea.

2.2 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	8737A-2
KOREA	NRRA	KR0025

2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.



3. Test Specifications

3.1 Standards

Section in FCC	Section in RSS	Requirement(s)	Status (Note 1)	Test Condition
15.247(a)	RSS-247 5.1(b)	Carrier Frequency Separation	С	
15.247(a)	RSS-247 5.1(d)	Number of Hopping Frequencies	С	
15.247(a)	RSS-247 5.1(a)	20 dB Bandwidth	С	O an durate d
15.247(a)	RSS-247 5.1(d)	Time of occupancy (Dwell Time)	С	Conducted
15.247(b)	RSS-247 5.4(b)	Maximum peak conducted output power	С	
15.247(d)	RSS-247 5.5	Unwanted emission	С	
15.209	RSS-Gen 6.13	Transmitter emission	С	Radiated
15.207(a)	RSS-Gen 8.8	AC Conducted Emission C Line Conducted		
Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable				
Note 2: The data in this test report are traceable to the national or international standards.				
Note 3: The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013, RSS-247 Issue 2, RSS-GEN Issue 5				

3.2 Mode of operation during the test

The EUT is operated in a manner representative of the typical of the equipments. During at testing, system components were manipulated within the confines of typical usage to maximize each emission. All modulation modes were tests. The results are only attached worst cases.

Test Frequency

Lowest channel	Middle channel	Highest channel
2 402 MHz	2 441 MHz	2 480 MHz

Test mode

Medulation Desket type		Dete vete	Duty Cycle	
Modulation	Packet type	Data rate	BTO	BT1
GFSK	DH5	1 Mbps	77.1 %	77.2 %
8-DPSK	3-DH5	3 Mbps	77.2 %	77.3 %



Report No.: CTK-2020-04544 Page (7) / (89) Pages

3.3 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter. Coverage factor k = 2, Confidence levels of 95 %

Description	Uncertainty
Conducted RF Output Power	± 1.5 dB
Occupied Bandwidth	± 0.1 MHz
Unwanted Emission(conducted)	± 3.0 dB
Radiated Emissions (f \leq 1 GHz)	± 4.0 dB
Radiated Emissions (f > 1 GHz)	± 5.0 dB

3.4 Test Software

Conducted Test	Ics Pro Ver. 6.0.3
Radiated Test	TOYO EMI software EP5RE Ver. 6.0.1.0
Line Conducted Test	ESCI7, ESCI3 : EMC32 Ver. 8.50.0
	ESR7 : EMC32 Ver. 8.53.0



4. Technical Characteristic Test

4.1 Carrier Frequency Separation

Test Procedures

ANSI C63.10-2013 - Section 7.8.2

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled. After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to:

- a) Span = 5 MHz (wide enough to capture the peaks of two adjacent channels)
- b) RBW = 30 kHz (Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel)
- c) VBW = 30 kHz (\geq RBW) d) Sweep = auto
- e) Detector function = peak
- f) Trace = max hold

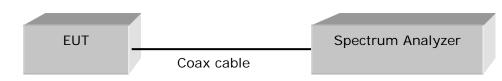


Figure 1 : Measurement setup for the carrier frequency separation

Limit

FHSS operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the -20 dB bandwidth of the hopping channel, whichever is greater.

Test Results

Test mode : GFSK

Antenna	Channel	Adjacent Hopping Channel Separation [kHz]	Two-third of 20dB bandwidth [kHz]	Minimum Bandwidth [kHz]	Result
BTO	Middle	1 000	564.7	25	Complies
BT1	widdie	1 000	564.7	25	Complies

Test mode : 8-DPSK

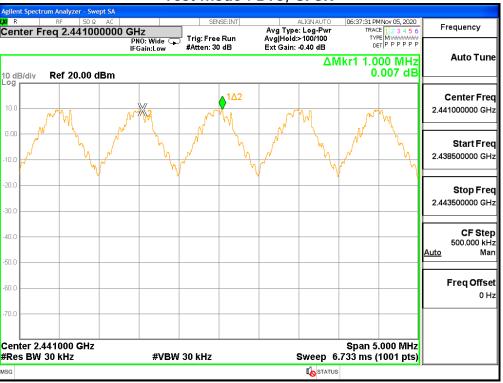
Antenna	Channel	Adjacent Hopping Channel Separation [kHz]	Two-third of 20dB bandwidth [kHz]	Minimum Bandwidth [kHz]	Result
BTO	Middle	1 010	843.3	25	Complies
BT1	Middle	0.995	842.7	25	Complies

See next pages for actual measured spectrum plots.



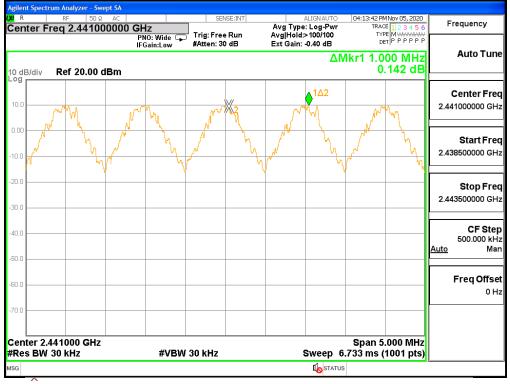
CTK Co., Ltd. (Ho-dong), 113, Yejik-ro, C

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel: +82-31-339-9970 Fax: +82-31-624-9501



Test mode : BTO, GFSK

Test mode : BT1, GFSK





				100	
				nalyzer - Swept SA	gilent Spectrum An
Frequency	06:53:17 PM Nov 05, 2020	ALIGNAUTO	SENSE:INT		C R RF
Frequency	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P P P P P P	Avg Type: Log-Pwr wg Hold:>100/100 xt Gain: -0.40 dB	Trig: Free Run #Atten: 30 dB	2.441000000 GHz PNO: Wide IFGain:Low	Center Freq 2
Auto Tune	/kr1 1.010 MHz -0.667 dB	ΔN		f 20.00 dBm	
Center Freq 2.441000000 GHz	a ma h	a10 c1	1∆2 ∧∫w	2	10.0
Start Freq 2.438500000 GHz	Mahular M.	wanter a part of the	Andrew Alt Anthra	-Proportion policy and the second	0.00 ^{Altra} Altra 10.0
Stop Freq 2.443500000 GHz					30.0
CF Step 500.000 kHz <u>Auto</u> Man					40.0
Freq Offset 0 Hz					60.0
	Onen 5 000 Mila				70.0
	Span 5.000 MHz 733 ms (1001 pts).		30 kHz		Center 2.4410 Res BW 30 k
	5	I STATUS			ISG

Test mode : BT0, 8-DPSK

Test mode : BT1, 8-DPSK

Agilent Spectrum Analyzer - Swept					
🗙 R RF 50 Ω 4 Center Freq 2.4410000	DOO GHz	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr Avg Hold:>100/100	05:31:19 PM Nov 05, 2020 TRACE 1 2 3 4 5 6 TYPE M WWWWW	Frequency
10 dB/div Ref 20.00 dB/	PNO: Wide 🖵 IFGain:Low	#Atten: 30 dB	Ext Gain: -0.40 dB	ΔMkr1 995 kHz 0.031 dB	Auto Tune
10.0	1.1 MAR	1.1.4.8	1∆2 m.dr.m.	1.ml .	Center Freq 2.441000000 GHz
0.00 mm h h h h h h h h h h h h h h h h h	Are the here	ponopillan - forthe	Manual and a contraction	M. John M. A. R. Marson for	Start Freq 2.438500000 GHz
-20.0					Stop Freq 2.443500000 GHz
-40.0					CF Step 500.000 kHz <u>Auto</u> Man
-60.0					Freq Offset 0 Hz
-70.0 Center 2.441000 GHz #Res BW 30 kHz	#VBW	30 kHz	Sweep	Span 5.000 MHz 5.733 ms (1001 pts)	
MSG			STATU		



Report No.: CTK-2020-04544 Page (11) / (89) Pages

4.2 Number of Hopping Frequencies

Test Procedures

ANSI C63.10-2013 - Section 7.8.3

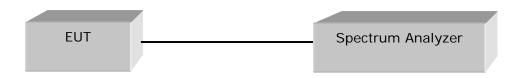
The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

a) Frequency range	1: Start = 2389.5 MHz, Stop = 2439.5 MHz
	2: Start = 2439.5 MHz, Stop = 2489.5 MHz

b) RBW = 300 kHz (To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller)

c) VBW = 300 kHz (≥ RBW)	d) Sweep = auto
e) Detector function = peak	f) Trace = max hold



Limit

FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

Test Results

Test mode : GFSK

Antenna	Total number of Hopping Channels	Result
BTO	79	Complies
BT1	79	Complies

Test mode : 8-DPSK

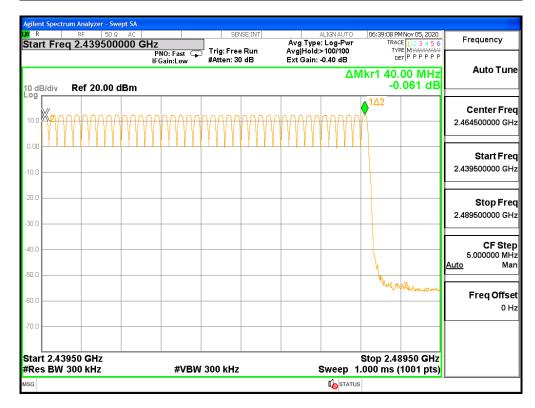
Antenna	Total number of Hopping Channels	Result
BTO	79	Complies
BT1	79	Complies

See next pages for actual measured spectrum plots.



	um Analyzer - Swe							
X/R	RF 50 Ω		SE	NSE:INT	Avg Type:	IGNAUTO	06:37:49 PM Nov 05, 2020 TRACE 1 2 3 4 5 6	Frequency
	q 2.390000	PNO: Fas IFGain:Lo	t 🎧 Trig: Fre w #Atten: 3		Avg Hold:>^ Ext Gain: -0	100/100 .40 dB	TYPE M WWWW DET P P P P P P	Auto Tune
10 dB/div	Ref 20.00 d	Bm					0.136 dB	
		w/					142	Center Freq
10.0								2.414750000 GHz
0.00								Start Fred
10.0								2.390000000 GHz
20.0								Stop Fred
30.0								2.439500000 GH
40.0								CF Step 4.950000 MH: <u>Auto</u> Mar
0.0	remandered	}						Freq Offse
70.0								
Start 2.39 #Res BW		#\	/BW 300 kHz	 	S	weep 1.	Stop 2.43950 GHz 000 ms (1001 pts)	
ISG						I STATUS		

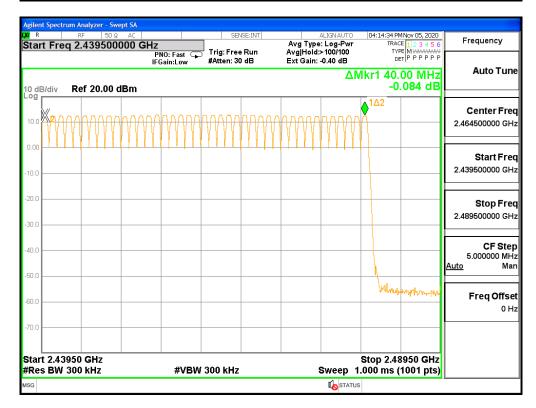
Test Mode : BTO, GFSK





	rum Analyzer - Swep					
₩ R Start Fre	RF 50 Ω q 2.39000000	AC 00 GHz	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	04:14:24 PMNov 05, 2020 TRACE 1 2 3 4 5 6	Frequency
10 dB/div	Ref 20.00 dE	PNO: Fast 🕞 IFGain:Low	┘ Trig: Free Run #Atten: 30 dB	Avg Hold>100/100 Ext Gain: -0.40 dB AMkr'	1 37.000 0 MHz -0.162 dB	Auto Tune
10.0		Manana				Center Freq 2.414750000 GHz
-10.00						Start Freq 2.390000000 GHz
-20.0						Stop Freq 2.439500000 GHz
-40.0						CF Step 4.950000 MHz <u>Auto</u> Man
-60.0	mon work who who					Freq Offset 0 Hz
-70.0 Start 2.39					Stop 2.43950 GHz	
#Res BW	300 KHZ	#VBN	/ 300 kHz	Sweep 1.	.000 ms (1001 pts)	

Test Mode : BT1, GFSK





								Analyzer - Swe	
Frequency	06:54:39 PMNov 05, 2020 TRACE 1 2 3 4 5 6	ALIGNAUTO		ISE:INT	1		00 GHz	RF 50Ω 2.3900000	N R Start Freq
Auto Tune	37.000 0 MHz -0.079 dB		Avg Hol Ext Gain		Trig: Free #Atten: 30	NO: Fast 😱 Gain:Low	IFO	Ref 20.00 d	10 dB/div
Center Freq 2.414750000 GHz	142	www	www	vvvv	$\forall \forall \forall \forall \forall t$	VVVV			10.0
Start Freq 2.390000000 GHz									-10.0
Stop Fred 2.439500000 GHz									30.0
CF Step 4.950000 MHz <u>Auto</u> Mar									40.0
Freq Offsel 0 Hz								Markell Marked	-60.0
	Stop 2.43950 GHz 000 ms (1001 pts)				300 kHz	#\/B\W			-70.0 Start 2.390 #Res BW 3
	000 ms (1001 pts)	Sweep 1.			300 KHZ	#VDVV			MSG

Test Mode : BTO, 8-DPSK

ø _R Star	t Freq	RF 50 2.43950	Ω AC 0000 GH	PNO: Fast C	Trig: Free		Avg Type Avg Hold:		TRA	MNov 05, 2020 CE 1 2 3 4 5 6 PE M WWWWW ET P P P P P P	Frequency
ΔMkr1 40.00 MHz 10 dB/div Ref 20.00 dBm 0.417 dB											
- og 10.0	Xarra	mm	mm	mm	ww	www.	www	ww	1Δ2		Center Fre 2.464500000 GH
0.00 10.0											Start Fr 2.439500000 G
20.0											Stop Fr 2.489500000 G
10.0											CF St 5.000000 M <u>Auto</u> M
0.0 0.0									- ⁴ / _w	lo la far far an	Freq Offs 0
70.0											
	t 2.439 s BW 3	50 GHz 00 kHz		#VBI	N 300 kHz	1		Sweep 1		8950 GHz (1001 pts)	



Agilent Spectrum Analyzer - Swep					0
X R RF 50 Ω Start Freq 2.3900000	PNO: Fast 😱	SENSE:INT Trig: Free Run	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	05:32:03 PMNov 05, 2020 TRACE 1 2 3 4 5 6 TYPE M	Frequency
10 dB/div Ref 20.00 dB	IFGain:Low	#Atten: 30 dB	Ext Gain: -0.40 dB AMkr'	I 37.000 0 MHz -1.873 dB	Auto Tune
10.0	Xannow	MANANAN	wwwwww	ANAAA WYAAA	Center Freq 2.414750000 GHz
10.00					Start Freq 2.390000000 GHz
30.0					Stop Freq 2.439500000 GHz
50.0					CF Step 4.950000 MHz <u>Auto</u> Mar
50.0					Freq Offse 0 Hz
70.0 Start 2.39000 GHz				Stop 2.43950 GHz	
#Res BW 300 kHz	#VBW	300 kHz	Sweep 1.	.000 ms (1001 pts)	

Test Mode : BT1, 8-DPSK

R		RF 50			SE	VSE:INT		ALIGN AUTO		MNov 05, 2020	Frequency		
tar	t Freq	2.43950		Z PNO: Fast 🕞 FGain:Low	Trig: Fre #Atten: 3		Avg Type Avg Hold: Ext Gain:		TY	CE 1 2 3 4 5 6 PE M WWWWW ET P P P P P P	Auto Tun		
	ΔMkr1 40.00 MHz 0 dB/div Ref 20.00 dBm 0.199 dB												
og 10.0	Xev v	www	www	ww	ww	www	ww	ww	1Δ2		Center Fr 2.464500000 G		
0.00											Start Fr 2.439500000 G		
0.0 0.0											Stop Fr 2.489500000 G		
0.0											CF St 5.000000 M Auto M		
0.0										annannan	Freq Offs		
0.0													
		50 GHz 00 kHz		#VBW	/ 300 kHz	<u> </u>		Sweep	Stop 2.4 1.000 ms (8950 GHz (1001 pts)			
SG								I statu	JS		L		



4.3 20 dB bandwidth & 99% Bandwidth

Test Procedures

ANSI C63.10-2013 - Section 6.9.2 RSS-GEN Issue 5 - Section 6.7

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

Test Procedures

ANSI C63.10-2013 - Section 6.9.3 RSS-GEN Issue 5 - Section 6.7

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

The spectrum analyzer is set to:

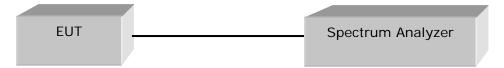
Center frequency = the highest, middle and the lowest channels

a) Span = 3 MHz (between 2 times and 5 times the OBW)

- b) RBW = 30 kHz (1% to 5% of the OBW)
- c) VBW = 100 kHz (approximately 3 times RBW)
- d) Sweep = auto

e) Detector function = peak

f) Trace = max hold



Limit

Limit : N/A



Report No.: CTK-2020-04544 Page (17) / (89) Pages

Test Results

Test mode : GFSK

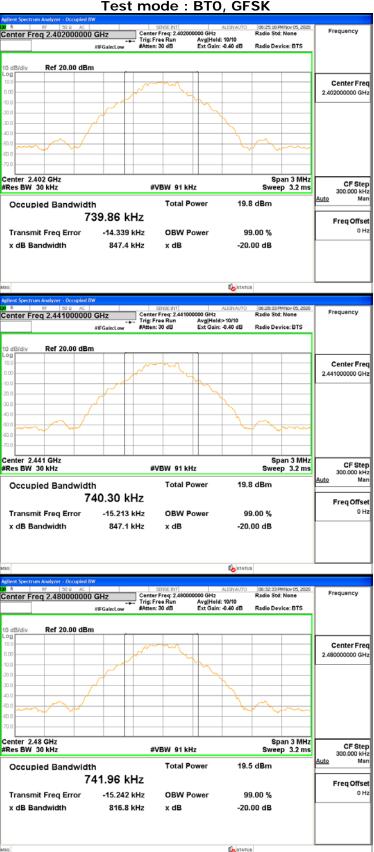
Antenna	Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]	Result
	Low	2 402	0.847	0.740	Complies
BTO	Middle	2 441	0.847	0.740	Complies
	High	2 480	0.817	0.742	Complies
	Low	2 402	0.847	0.740	Complies
BT1	Middle	2 441	0.847	0.739	Complies
	High	2 480	0.848	0.740	Complies

Test mode : 8-DPSK

Antenna	Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]	Result
	Low	2 402	1.261	1.144	Complies
BTO	Middle	2 441	1.265	1.145	Complies
	High	2 480	1.262	1.146	Complies
	Low	2 402	1.264	1.146	Complies
BT1	BT1 Middle		1.264	1.144	Complies
	High	2 480	1.26	1.146	Complies

See next pages for actual measured spectrum plots.





Test mode : BTO, GFSK





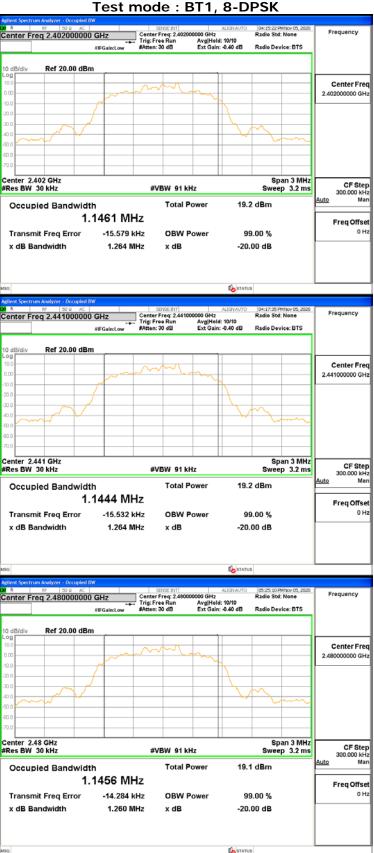
Test mode : BT1, GFSK





Test mode : BTO, 8-DPSK





Test mode : BT1, 8-DPSK



Report No.: CTK-2020-04544 Page (22) / (89) Pages

4.4 Time of Occupancy

Test Procedures

ANSI C63.10-2013 - Section 7.8.4

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled.

a) Span: Zero span, centered on a hopping channel.

b) RBW shall be \leq channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.

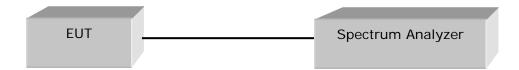
c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two 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 different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the 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)



Limit

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.



Report No.: CTK-2020-04544 Page (23) / (89) Pages

Test Results

Test mode : GFSK

Antenna	Mode	Number of hops Channels	Transmit time per hop(msec)	Result (msec)	Limit (msec)
	DH1	79	0.386	123.52	400
BTO	DH3	79	1.640	262.40	400
	DH5	79	2.889	308.16	400
	DH1	79	0.386	123.52	400
BT1	DH3	79	1.643	262.88	400
	DH5	79	2.893	308.59	400

Test mode : 8-DPSK

Antenna	Mode	Number of hops Channels	Transmit time per hop(msec)	Result (msec)	Limit (msec)
	3DH1	79	0.394	126.08	400
BTO	3DH3	79	1.645	263.20	400
	3DH5	79	2.895	308.80	400
	3DH1	79	0.391	125.12	400
BT1	3DH3	79	1.642	262.72	400
	3DH5	79	2.897	309.01	400

※ Remark:

Average time of occupancy = Transmit time per hop * Number of hopping channels in 31.6s

According the BLUETOOTH STANDARD SPECIFICATION, the nominal hop rate is 1600 hop/s. All bluetooth units participating in the piconet are time and hop synchronized to the channel. - The maximum number of hopping channels in 31.6s for DH1 = 1600 / 2 / 79 * 31.6 = 320- The maximum number of hopping channels in 31.6s for DH3 = 1600 / 4 / 79 * 31.6 = 160

- The maximum number of hopping channels in 31.6s for DH5 = 1600 / 6 / 79 * 31.6 = 107

See next pages for actual measured spectrum plots.



06:29:26 PMNov 05, 2020 TRACE 1 2 3 4 5 6 TYPE WWWWW DET P N N N N N SENSE:INT Frequency Avg Type: Log-Pwr Center Freq 2.441000000 GHz Trig: Free Run PNO: Fast ++-IFGain:Low Ext Gain: -0.40 dB #Atten: 30 dB Auto Tune ∆Mkr3 1.248 ms -17.59 dB Ref 20.00 dBm 10 dB/div **Center Freq** 0.00 2.441000000 GHz 10.0 20.C Start Freq <mark>∲2∆1</mark> \$1 30.0 2.441000000 GHz 40.0 -50.0 Stop Freq a allow a product of the state Warman -60.0 2.441000000 GHz Center 2.441000000 GHz Res BW 1.0 MHz Span 0 Hz Sweep 1.533 ms (1001 pts) CF Step #VBW 1.0 MHz 1.000000 MHz Auto Man R MODE TRC SCL FUNCTION FUNCTION WIDTH FUNCTION VALUE 243.8 μs 386.4 μs (Δ) 1.248 ms (Δ) -39.15 dBm Ν Δ1 Δ1 t t (Δ) t (Δ) 0.92 dB -17.59 dB Freq Offset 0 Hz **I**STATUS

Transmit time for PACKET Type DH1(BT0, GFSK)

Transmit time for PACKET Type DH3(BT0, GFSK)

	50 Ω AC		SENSE: If	NT	ALIGN /	AUTO 06:29:58 F	MNov 05, 2020	_
enter Freq 2.	44100000) GHz PN0: Fast ↔	Trig: Free Ru	n	Avg Type: Log	-Pwr TRA	CE 1 2 3 4 5 6 PE Winning	Frequency
		IFGain:Low	#Atten: 30 dB		Ext Gain: -0.40			Auto Tur
	20.00 dBm						63.80 μs 57 dBm	
og 10.0								Center Fre
).00								2.441000000 G
0.0								
				241				Start Fr
0.0								2.441000000 G
D.O					ير ارقو بنيار	3Δ	1	ot
D.0 M					Apple Market Market Market	and Montal And And		Stop Fr 2.441000000 G
D.O								
	~~~~						·····	
		#VBV	1.0 MHz		Swee	ep 3.000 ms	Span 0 Hz (1001 pts)	
es BW 1.0 MH Mode tre scl	z ×		Y	FUNCTION	Swee	ep 3.000 ms	(1001 pts)	1.000000 N
es BW 1.0 MH Mode TRC SCL Ν 1 t Δ1 1 t (Δ)	z ×	63.80 µs 1.640 ms (∆)	-38.57 dBm 0.03 dB	FUNCTION		ep 3.000 ms	(1001 pts)	1.000000 M <u>Auto</u> M
es BW 1.0 MH Mode TRC SCL Ν 1 t Δ1 1 t (Δ)	z ×	63.80 µs	⊻ -38.57 dBm	FUNCTION		ep 3.000 ms	(1001 pts)	1.000000 M <u>Auto</u> M Freq Offs
es BW 1.0 MH Mode TRC SCL Ν 1 t Δ1 1 t (Δ)	z ×	63.80 µs 1.640 ms (∆)	-38.57 dBm 0.03 dB	FUNCTION		ep 3.000 ms	(1001 pts)	1.000000 M <u>Auto</u> M Freq Offs
es BW 1.0 MH Mode TRC SCL Ν 1 t Δ1 1 t (Δ)	z ×	63.80 µs 1.640 ms (∆)	-38.57 dBm 0.03 dB	FUNCTION		ep 3.000 ms	(1001 pts)	1.000000 M <u>Auto</u> M Freq Offs
Δ1 1 t (Δ)	z ×	63.80 µs 1.640 ms (∆)	-38.57 dBm 0.03 dB	FUNCTION		ep 3.000 ms	(1001 pts)	CF Ste 1.000000 M <u>Auto</u> M Freq Offs 0



### Transmit time for PACKET Type DH5(BT0, GFSK)

Agilen	t Spe	ctrun	n Analy	zer - Sw	ept SA										
LXI R			RF	50 Ω	AC			SEN	SE:INT		ALIGN AUT	0 06:30	):23 PM Nov 05, 20	20	_
Cen	ter	Fre	a 2.4	44100	00000	) GHz		]		Avg	Type: Log-P\	vr	TRACE 1 2 3 4 5		Frequency
						PNO: F	ast ↔	Trig: Free					TYPE WWWW		
						IFGain:	Low	#Atten: 30	dB	Ext G	Gain: -0.40 dB		DET P N N N	N N	
10 di	3/div		Ref 2	20.00	dBm							ΔMkr	3 3.745 m -18.02 d		Auto Tune
Log														٦ŀ	
10.0				· · · ·							<u> </u>				Center Freq
0.00															2.441000000 GHz
0.00															2.441000000 0112
-10.0	<u> </u>		_											- E	
-20.0	<u> </u>		_							_				-16	Otort From
-30.0											201				Start Freq
-30.0				$^{\circ}$											2.441000000 GHz
-40.0	⊢		_	Y							- Y			┛	
-50.0													3Δ1		
	-hun		manna								Manufa	mplyping			Stop Freq
-60.0	L M. AU		the statutes of	•	_					-	. abda	. DAMAA	2017	-	2.441000000 GHz
-70.0															2.441000000 GHZ
1010															
Cen Res				0000 <b>(</b>	GHz		#VBW	1.0 MHz			Sween	5 000 1	Span 0 H ns (1001 pt		CF Step 1.000000 MHz
				<b>_</b>				1.0 10112			· · ·		· ·	· ·	Auto Man
R MOD		_			Х			Y	FUNC	TION F	UNCTION WIDTH	FUI	ICTION VALUE	<u>^</u>	
1 Ν 2 Δ1		t	(			675.0 µs		39.34 dBm 1.50 dB							
2 Δ1 3 Δ1		t	(Δ) (Δ)			2.889 ms 3.745 ms		1.50 dB -18.02 dB							Freq Offset
		Ľ	ζΔJ		•	5.740 ms	(Δ)	-10.02 UB							
5														=	0 Hz
5														-	
7															
B															
2															
í														~	
<													>		
MSG											🛵 st.	ATUS			
											-0				



<b>F</b>	04:01:35 PM Nov 05, 2020	GNAUTO		INSE:INT	SEI		DΩ AC	- 5	RF	
Frequency	TRACE 1 2 3 4 5 6 TYPE WWWWWWW DET P N N N N N	-	Avg Type:		Trig: Free	<b>−1z</b> NO: Fast ↔	000000	2.441	req	er F
Auto Tu			Ext Gain: -0	10 dB	#Atten: 30	Gain:Low				
	Vkr3 1.250 ms -7.85 dB	Δ					0 dBm	f 20.0	Re	/div
Center Fr						<b></b>				
2.441000000 G										
Start Fr										
2.441000000 G						_2∆1		1		
		3∆1				Y		Υ		
<b>Stop Fr</b> 2.441000000 G	hlywhung	μ <b>í</b>	manan	h yan <mark>bali</mark> rfan	handhar	hyperty		N	ilipp	h fan tu
CF Sto 1.000000 M	Span 0 Hz 000 ms (1001 pts)	eep 2.	Si	<u>,</u>	1.0 MHz	#VBW	) GHz	)00000 1Hz	4410 1.0 №	
<u>Auto</u> M	FUNCTION VALUE	ON WIDTH	ION FUNC		Y		Х		RC SCI	IODE T
					-45.56 di 1.16	30.0 μs 36.0 μs (Δ)		(Δ)	t	N ∆1
Freq Offs				dB	-7.85	250 ms (Δ)		(Δ)	t	Δ1
0										
	>									

### Transmit time for PACKET Type DH1(BT1, GFSK)

### Transmit time for PACKET Type DH3(BT1, GFSK)

gilent Spectrum Analyzer - Swept SA					
R   RF   50 Ω AC Center Freq 2.44100000		SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	04:02:04 PMNov 05, 2020 TRACE 1 2 3 4 5 6 TYPE WWWWWWW	Frequency
		en: 30 dB	Ext Gain: -0.40 dB	DET PNNNN	Auto Tun
IO dB/div Ref 20.00 dBm				Mkr1 263.0 µs -47.74 dBm	
- <b>og</b> 10.0			+		Center Fre
0.00					2.441000000 GH
20.0					04
30.0			Δ2Δ1		Start Fre 2.441000000 GF
				3∆1	
60.0 MARAY			hayonyon hitelanda	and the second	<b>Stop Fre</b> 2.441000000 GH
Center 2.441000000 GHz				Span 0 Hz	05.04
tes BW 1.0 MHz	#VBW 1.0 N	/IHz	Sweep 3	.000 ms (1001 pts)	CF Ste 1.000000 Mi Auto Mi
KR MODE TRC SCL X	263.0 µs -47.7	′4 dBm	ICTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> M
2 Δ1 1 t (Δ) 3 Δ1 1 t (Δ) 4		2.30 dB 9.55 dB			Freq Offs
5					01
7 8 9					
10  1				 	
SG					

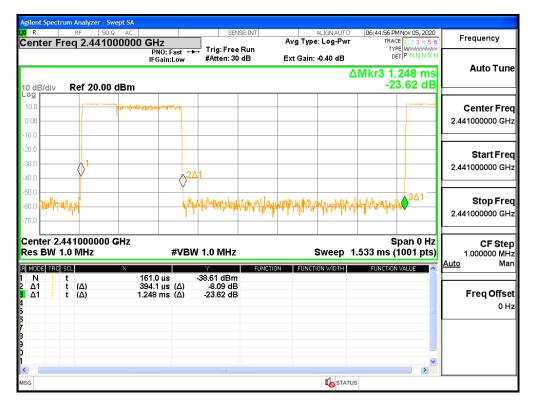


### Transmit time for PACKET Type DH5(BT1, GFSK)





### Transmit time for PACKET Type 3-DH1(BT0, 8-DPSK)



### Transmit time for PACKET Type 3-DH3(BT0, 8-DPSK)

Agilent Sp																
R Cente							1		A۱		ALIGNAUT <b>: Log-P</b> w		TRAC	MNov 05, 2021 2E 1 2 3 4 5 PE WAAAAAA	6	Frequency
					PNO: Fa FGain:L	nst ⊶⊷ ow	#Atten: 30		Ex	t Gain:	-0.40 dB		D	et   P N N N N	N	Auto Tun
10 dB/d	iv R	ef 20.	00 dB	m								N	1kr1 2 -38.1	:69.0 με 13 dBr		Auto Tun
10.0			-	the the second		*******		and the second second	- <b>1</b> 2-2-2-2					b++		Center Fre
0.00					_											2.441000000 GH
20.0															F	
30.0		1			_					<mark>∠2∆1</mark>						Start Fre 2.441000000 GH
-40.0	· · · ·									/				A 3A1	┢	
60.0	Mpddyrad									y hylla	alquiantal	11mgraf	philipperi	<b>₩</b>		Stop Fre
-70.0					-					-		_				2.441000000 GH
	r 2.441 N 1.0		00 GH	z	#	WBW	1.0 MHz				Sween	3.00		pan 0 Hz 1001 pts		CF Ste 1.000000 MH
R MODE			×				Y	FUNCT	ION		ION WIDTH		FUNCTION	· ·	·	uto Ma
Ν Δ1 Δ1		(Δ)		1.64	.0 µs 5 ms (	(Δ)	38.13 dBm -1.06 dB									Freq Offs
Δ1	1 t	(Δ)		2.49	3 ms (	Δ)	-18.73 dB									0H
<														>		
ISG											<b>I</b> osta	TUS				



### Transmit time for PACKET Type 3-DH5(BT0, 8-DPSK)

Agilent Spe	ctrum A	Analyzer	- Swept S	SA										
XI R			50Ω A			SEN	SE:INT			ALIGN AUTO		51 PM Nov 05, 2		Frequency
Center	Freq	2.44	10000	000 GH		Trig: Free	Dun	Avg	Туре	: Log-Pwr		TYPE WAAAA		Trequency
					0:Fast ↔ ain:Low	#Atten: 30		Ext	Gain:	-0.40 dB		DET P N N N		
												3.748 n		Auto Tune
10 dB/div Log	/ <b>R</b>	ef 20.	.00 dB	m								-14.90 d	в	
10.0		-		والمصاد بيحجرمون				A-Anno -					·	Center Free
0.00												•		2.441000000 GH:
														2.44 1000000 GH
10.0														
-20.0									Δ1					Start Free
-30.0	1								<u>Δ</u> ι					2.441000000 GH
-40.0	¥										3∆1			
-50.0									امام	In the second	<u> </u>		—I I	
-60.0	γų							why.	unywu	hand	M		_	Stop Free
70.0											_		_	2.441000000 GH
Center Res BW			00 GH2	Z	#VB\	V 1.0 MHz			ş	Sweep :	5.000 m	Span 0   s (1001 p	ts)	CF Stej 1.000000 MH
MODE TP	IC SCL		X			Y	FUNC	TION	UNCTI	ON WIDTH	FUNC	TION VALUE	^	<u>Auto</u> Mai
Ν 1 Δ1 1	t	(Δ)		249.0 2.895 i		-39.58 dBm 1.58 dB							-	
	ť			3.748 1		-14.90 dB								Freq Offse
													-	0 H
													_	
													~	
(												>		
SG										🚺 STATI	JS			



### Transmit time for PACKET Type 3-DH1(BT1, 8-DPSK)



### Transmit time for PACKET Type 3-DH3(BT1, 8-DPSK)

Agilent	Spec			lyze																					
X R Cent	er F		RF	.44	50 Ω			GH	z		1		NSE:IN		Avg		ALIGN AUT : Log-Pv		т	RACE	Vov 05, 2	56		Frequen	су
			1 ~					PN		st ↔ bw		ig: Fre Atten: 3		ו	Ext G	Fain:	-0.40 dB			DET	P N N N	INN		Auto	<b>T</b>
10 dB	/div	R	lef	20	.00 (	dBm	ı												Mkr1 -41	45 8.2	54.5 5 dB	us m		Auto	Tun
10.0						<b>~~~</b> ~			-Papara	<b>dir-</b> daya	-	- - - - - - - - - - - - - - - - - - -		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	ندومه _{وا} همودند							ſ		Center	Fre
0.00			+										-							_		+	2	44100000	0 Gł
10.0 - 20.0 -																								04	
30.0			_										-				\2∆1			_		+	2	Star1 44100000	
40.0 50.0 -				(	) ¹ -																				
50.0	rtyr	MA	r del	M									-				h <mark>allingli</mark> kan	m _h	NAMA PA	shir	Million	Ŵ	2	Stop	
70.0																							2.	.44 100000	
	er 2 BW				00 <b>(</b>	GHz			#	VBW	1.0	MHz	:			\$	Sweep	3.0	000 m:		an 0 001 p			CF 1.00000	St 0 M
	iode N	_	icu   t				×	45.4	l.5 µs		4	Y 8.25 d	Rm	FUNC	TION	FUN	ICTION WID	отн	FUN	CTION	VALUE	^	Aut	<u>o</u>	М
2 /	Δ1 Δ1			(Δ) (Δ)				1.64	2 ms 8 ms	s (Δ)		3.03 -11.77	dB											Freq	Offs
4 5 6																								-	0
7 8																									
9																									
11																						>			
G																	I <mark>ю</mark> sт/	ATUS							



### Transmit time for PACKET Type 3-DH5(BT1, 8-DPSK)





### 4.5 Maximum peak Conducted Output Power

### **Test Procedures**

ANSI C63.10-2013 - Section 7.8.5

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

- a) Span = 5 MHz (approximately 5 times of the 20 dB bandwidth)
- b) RBW = 3 MHz (greater than the 20 dB bandwidth of the emission being measured)
- c) VBW = 3 MHz ( $\geq$  RBW)
- e) Trace = max hold

d) Detector = peakf) Sweep = auto

EUT _____ Spectrum Analyzer

### Limit

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels.



Report No.: CTK-2020-04544 Page (33) / (89) Pages

### **Test Results**

Test mode : GFSK

Antenna	Frequency [MHz]	Channel No.	Output Power [dBm]	Output power [mW]	Result
	2 402	0	12.564	18.047	Complies
BTO	2 441	39	12.550	17.989	Complies
	2 480	78	12.458	17.612	Complies
	2 402	0	12.886	19.436	Complies
BT1	2 441	39	12.750	18.836	Complies
	2 480	78	12.574	18.088	Complies

#### Test mode : 8-DPSK

Antenna	Frequency [MHz]	Channel No.	Output Power [dBm]	Output power [mW]	Result
	2 402	0	12.673	18.505	Complies
вто	2 441	39	12.535	17.927	Complies
	2 480	78	12.449	17.575	Complies
	2 402	0	12.907	19.530	Complies
BT1	2 441	39	12.668	18.484	Complies
	2 480	78	12.726	18.733	Complies

See next pages for actual measured spectrum plots.



### Test Mode : BTO, GFSK

		-	-		um Analyzer - Swept SA	gilent Spect
_	06:25:06 PM Nov 05, 2020	ALIGN AUTO	SENSE:INT		RF 50 Ω AC	R
Frequency	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P P P P P P	vg Type: Log-Pwr /g Hold:>30/30 kt Gain: -0.40 dB	Trig: Free Run #Atten: 30 dB	D GHz PNO: Fast 😱 IFGain:Low	req 2.402000000	enter F
Auto Tun	2.401 930 GHz 12.564 dBm	Mkr1			Ref 20.00 dBm	0 dB/div
Center Fre			<b>↓</b> ¹			
2.402000000 GH						10.0
Start Fre						.00
2.399500000 GH						0.0
Stop Fre						0.0
2.404500000 GH						0.0
CF Ste 500.000 kł <u>Auto</u> Ma						0.0
						0.0
Freq Offs 0 H						0.0
						0.0
	Span 5.000 MHz .000 ms (1001 pts)	Sweep 1	3.0 MHz	#VBW	402000 GHz 3.0 MHz	
L	• • •					G

### [Lowest channel]

#### [Middle channel]

							n Analyzer - Swept SA	
Frequency	4Nov 05, 2020 E 1 2 3 4 5 6	TRAC	ALIGNAUTO	Avg Typ Avg Hold	SENSE:INT	GHz	RF 50 Ω AC eq 2.441000000	Center F
Auto Tune	75 GHz 50 dBm	2.440 9	-0.40 dB	Ext Gain	#Atten: 30 dB	PNO: Fast 😱 IFGain:Low	Ref 20.00 dBm	10 dB/div
Center Freq 2.441000000 GHz					1			10.0
<b>Start Freq</b> 2.438500000 GHz								-10.0
<b>Stop Freq</b> 2.443500000 GHz								-20.0
CF Step 500.000 kHz <u>Auto</u> Man								-40.0
Freq Offsel 0 Hz								-60.0
	.000 MHz 1001 pts)	Span 5	Sweep 1		3.0 MHz	#VBW	1000 GHz	-70.0 Center 2. #Res BW
								MSG



Report No.: CTK-2020-04544 Page (35) / (89) Pages

[Highest channel]

gilent Spectrum Analyzer - Swept SA					
<b>4</b> RF 50Ω AC		SENSE:INT	ALIGNAUTO	06:32:21 PM Nov 05, 2020 TRACE 1 2 3 4 5 6	Frequency
Center Freq 2.48000000	) GHZ PNO: Fast 😱 IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr Avg Hold⊳30/30 Ext Gain: -0.40 dB	TYPE M WWWWWW DET P P P P P P	Auto Tune
O dB/div Ref 20.00 dBm			Mkr1	2.479 915 GHz 12.458 dBm	Auto Tune
10.0					Center Freq 2.48000000 GHz
0.00					Start Freq 2.477500000 GHz
20.0					Stop Freq
30.0					2.482500000 GH;
40.0					CF Step 500.000 kH Auto Mar
60.0					Freq Offse
70.0					
Center 2.480000 GHz #Res BW 3.0 MHz	#VBW	3.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	
ISG				3	



### Test Mode : BT1, GFSK

ISG				STATUS		
Center 2. #Res BW	402000 GHz 3.0 MHz	#VBW	3.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	
-70.0						
-70.0						0 H:
-60.0						Freq Offse
.50.0						<u>Auto</u> Mai
40.0						CF Ster 500.000 kH
30.0						2.404500000 GH
20.0						Stop Fre
10.0						2.399500000 GH
0.00						Start Fre
10.0						2.402000000 GH
og						Center Fre
10 dB/div	Ref 20.00 dBm			Mkr1	2.401 970 GHz 12.886 dBm	Auto Tun
Senter 1	100 2.40200000	PNO: Fast IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Hold:>30/30 Ext Gain: -0.40 dB	DET PPPPP	A
X/R Center F	RF 50 Ω AC	CH7	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	03:57:12 PM Nov 05, 2020 TRACE 1 2 3 4 5 6	Frequency
- ·	rum Analyzer - Swept SA RF 50 Ω AC					[

#### [Lowest channel]

#### [Middle channel]

Agilent Spectrum Analyzer - Swept SA				
α RF 50 Ω AC Center Freq 2.44100000	0 GHz PN0: Fast Trig: Free Ru	Avg Type: Log-Pwr	TYPE MIAAAAAAAA	Frequency
10 dB/div Ref 20.00 dBm	IFGain:Low #Atten: 30 dE	B Ext Gain: -0.40 dB	_{Det} рррррр 1 2.441 000 GHz 12.750 dBm	Auto Tune
10.0	1			Center Freq 2.441000000 GHz
-10.0				Start Freq 2.438500000 GHz
-20.0				Stop Frec 2.443500000 GHz
-40.0				CF Step 500.000 kH: <u>Auto</u> Mar
-60.0				Freq Offse 0 H:
-70.0				
Center 2.441000 GHz #Res BW 3.0 MHz	#VBW 3.0 MHz	Sweep	Span 5.000 MHz 1.000 ms (1001 pts)	
MSG			JS	



Report No.: CTK-2020-04544 Page (37) / (89) Pages

[Highest channel]

Agilent Spectrum Analyzer - Swept SA					
<b>R</b> RF 50Ω AC		SENSE:INT	ALIGNAUTO	04:04:25 PM Nov 05, 2020	Frequency
Center Freq 2.48000000	PNO: Fast 😱 IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr Avg Hold≫30/30 Ext Gain: -0.40 dB	TRACE 1 2 3 4 5 6 TYPE M	
10 dB/div Ref 20.00 dBm			Mkr1	2.479 960 GHz 12.574 dBm	Auto Tune
10.0		¹	· · · · · · · · · · · · · · · · · · ·		Center Freq 2.48000000 GHz
0.00					2.48000000 GHz
-10.0					<b>Start Freq</b> 2.477500000 GHz
-20.0					<b>Stop Freq</b> 2.482500000 GHz
-40.0					CF Step 500.000 kHz
-50.0					<u>Auto</u> Man
-60.0					Freq Offset 0 Hz
-70.0					
Center 2.480000 GHz #Res BW 3.0 MHz	#VBW	3.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	
//SG				3	<u>[</u>



#### Test Mode : BTO, 8-DPSK

F	06:41:20 PM Nov 05, 2020	ALIGN AUTO	SENSE:INT		RF 50 Ω AC	R
Frequency	TRACE 1 2 3 4 5 6 TYPE M	g Type: Log-Pwr  Hold:>30/30 Gain: -0.40 dB	Trig: Free Run #Atten: 30 dB	GHz PNO: Fast IFGain:Low	req 2.402000000	enter F
Auto Tun	2.401 970 GHz 12.673 dBm	Mkr1			Ref 20.00 dBm	0 dB/div
Center Fre						
2.402000000 GH						10.0
Start Fre						.00
2.399500000 GH						0.0
Stop Fre						0.0
2.404500000 GH						0.0
CF Ste 500.000 kH Auto Ma						0.0
						0.0
Freq Offs 0 H						0.0
						0.0
	Span 5.000 MHz .000 ms (1001 pts)	Sween 1	3.0 MHz	#\/P\//	402000 GHz 3.0 MHz	
<u> </u>	· · · ·	Sweep 1	0.7 191112	77 LIVV -	0.0 11112	

#### [Lowest channel]

#### [Middle channel]

							um Analyzer - Swept SA	
Frequency	MNov 05, 2020 CE 1 2 3 4 5 6 PE M WWWWW ET P P P P P P	TRA	ALIGNAUTO e: Log-Pwr I>30/30	Avg Ty Avg Ho	SENSE:INT	) GHz PNO: Fast 🕞	RF 50 Ω AC req 2.441000000	Center F
Auto Tune	trip P P P P P 80 GHz 35 dBm	2.440 9	:-0.40 dB		#Atten: 30 dB	IFGain:Low	Ref 20.00 dBm	10 dB/div
Center Freq 2.441000000 GHz					1			10.0
Start Freq 2.438500000 GHz								-10.0
<b>Stop Freq</b> 2.443500000 GHz								-20.0
CF Step 500.000 kHz <u>Auto</u> Man								-40.0
Freq Offset 0 Hz								-60.0
	.000 MHz 1001 pts)	Span 5 .000 ms (	Sweep 1		3.0 MHz	#VBW	141000 GHz 3.0 MHz	Center 2. #Res BW
[[]								MSG



Report No.: CTK-2020-04544 Page (39) / (89) Pages

[Highest channel]

Agilent Spectrum Analyzer - Swept SA					
X R RF 50Ω AC		SENSE:INT	ALIGNAUTO	06:47:43 PM Nov 05, 2020	Frequency
Center Freq 2.48000000	D GHZ PNO: Fast 😱 IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr Avg Hold≫30/30 Ext Gain: -0.40 dB	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P P P P P P	
10 dB/div Ref 20.00 dBm			Mkr1	2.480 025 GHz 12.449 dBm	Auto Tune
Log		<b>↓</b> ¹			Center Fred
10.0				The Address of the Ad	2.480000000 GHz
0.00					Start Free
10.0					2.477500000 GH
20.0					Stop Fre
30.0					2.482500000 GH
40.0					CF Ste 500.000 kH Auto Ma
50.0					Auto Ma
60.0					Freq Offse 0 H
70.0					
Center 2.480000 GHz #Res BW 3.0 MHz	#VBW	3.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	
MSG				3	



#### Test Mode : BT1, 8-DPSK

_	04:15:10 PM Nov 05, 2020	ALIGN AUTO	SENSE:INT		RF 50 Ω AC	R
Frequency	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P P	Avg Type: Log-Pwr Avg Hold:>30/30 Ext Gain: -0.40 dB	Trig: Free Run #Atten: 30 dB	PNO: Fast IFGain:Low	req 2.402000000	enter F
Auto Tur	2.401 995 GHz 12.907 dBm	Mkr1			Ref 20.00 dBm	) dB/div
Center Fre			<b>1</b>			^{Jg}
2.402000000 GH						10.0
Start Fre	·					.00
2.399500000 GH						0.0
Stop Fre						0.0
2.404500000 GH						0.0
CF Ste 500.000 kH <u>Auto</u> Ma						0.0
Erog Offo						0.0
Freq Offs 0 H						0.0
						0.0
	Span 5.000 MHz .000 ms (1001 pts)	Sween 1	3.0 MHz	#\/B\/(	402000 GHz 3.0 MHz	
	· · · ·		0.0 11112	#*D14	0.0 11112	G

#### [Lowest channel]

#### [Middle channel]

							rum Analyzer - Swept SA	
Frequency	MNov 05, 2020 CE 1 2 3 4 5 6 PE M WWWWW ET P P P P P P	TRA	ALIGNAUTO e: Log-Pwr i>30/30	Avg Ty Avg Hol	SENSE:INT	OGHZ	RF 50 Ω AC req 2.441000000	Center F
Auto Tune	^{∎ PPPPPP} 90 GHz 68 dBm	2.440 8	-0.40 dB		#Atten: 30 dB	IFGain:Low	Ref 20.00 dBm	10 dB/div
Center Freq 2.441000000 GHz					¹	[_]		10.0
<b>Start Freq</b> 2.438500000 GHz								-10.0
<b>Stop Freq</b> 2.443500000 GHz								-20.0
CF Step 500.000 kHz <u>Auto</u> Man								-40.0
Freq Offset 0 Hz								-60.0
	.000 MHz 1001 pts)	Span 5 .000 ms (	Sweep 1		3.0 MHz	#VBW	441000 GHz 3.0 MHz	Center 2.
II	,							MSG



Report No.: CTK-2020-04544 Page (41) / (89) Pages

[Highest channel]

Agilent Spectrum Analyzer - Swept SA					
<b>R</b> RF 50Ω AC		SENSE:INT	ALIGNAUTO	05:24:58 PM Nov 05, 2020	Frequency
Center Freq 2.48000000	GHZ PNO: Fast 😱 IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr Avg Hold:>30/30 Ext Gain: -0.40 dB	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P P P P P P	
10 dB/div Ref 20.00 dBm			Mkr1	2.479 945 GHz 12.726 dBm	Auto Tune
10.0		¹			Center Freq 2.48000000 GHz
0.00					Start Freq 2.477500000 GHz
-20.0					Stop Fred 2.482500000 GHz
-40.0					CF Step 500.000 kH Auto Mar
60.0					Freq Offse 0 H:
70.0					
Center 2.480000 GHz #Res BW 3.0 MHz	#VBW	3.0 MHz		Span 5.000 MHz .000 ms (1001 pts)	
ASG				3	



Report No.: CTK-2020-04544 Page (42) / (89) Pages

# 4.6 Unwanted Emissions (Conducted)

#### **Test Procedures**

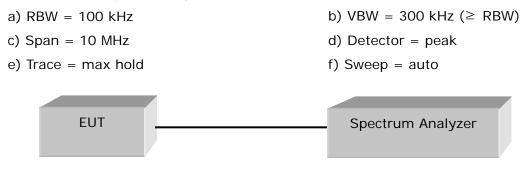
ANSI C63.10-2013 - Section 7.8.6, 7.8.8

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB.

The bandwidth at 20 dB down from the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function disabled at the highest, middle and the lowest available channels.

#### The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels



# Limit

> 20 dBc

#### **Test Results**

All conducted emission in any 100 kHz bandwidth outside of the spectrum band was at least 20 dB lower than the highest level of the in-band spectral density. Therefore the applying equipment meets the requirement.

See next pages for actual measured spectrum plots.



Report No.: CTK-2020-04544 Page (43) / (89) Pages

# Band Edge

Test Mode : Hopping mode, BTO, GFSK



r.					Analyzer - Swept SA	
Frequency	06:35:56 PM Nov 05, 2020 TRACE 1 2 3 4 5 6 TYPE M WWWWW	ALIGNAUTO Avg Type: Log-Pwr Avg Hold>30/30	SENSE:INT	GHz PNO: Wide	RF 50 Ω AC <b>q 2.483500000 (</b>	R Center Fre
Auto Tur	^{рет РРРРРР} 1 2.479 96 GHz 11.927 dBm	Ext Gain: -0.40 dB	#Atten: 30 dB	IFGain:Low	ef 20.00 dBm	
Center Fre 2.483500000 GH						- <b>og</b> 10.0
<b>Start Fre</b> 2.478500000 GF	-8.07 dBm					10.0
<b>Stop Fr</b> e 2.488500000 Gi						30.0
<b>CF Ste</b> 1.000000 Mi <u>Auto</u> M						40.0
Freq Offs 0	yyer Amon and a grant	on and the many	ampanana	har when when the	4	60.0
						70.0
	Span 10.00 MHz .000 ms (1001 pts)	Sweep 1	300 kHz	#VBW		Center 2.48 Res BW 10
L	· · · ·					ISG



Agilent Spectrum Analyzer - Swept SA					
<b>X</b> R RF 50Ω AC	~	SENSE:INT	ALIGNAUT Avg Type: Log-Pw		Frequency
Center Freq 2.40000000 (	PNO: Wide	Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pu Avg Hold:>30/30 Ext Gain: -0.40 dB	TRACE         1         2         3         4         5         6           TYPE         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M         M<	
10 dB/div Ref 20.00 dBm			М	kr1 2.404 00 GHz 12.621 dBm	Auto Tune
			<b>~</b> ~~		Center Free
10.0					2.400000000 GH
0.00			/ /	V [38 dBm	Start Free
10.0					2.395000000 GH;
20.0					Stop Free
30.0					2.405000000 GH
40.0					CF Ste 1.000000 MH
50.0	_	- M	U		<u>Auto</u> Ma
50.0 warrand all parmine hall	hannara	when the			Freq Offse 0 H
70.0					
Center 2.400000 GHz Res BW 100 kHz	#VBW 3	00 kHz	Sweep	Span 10.00 MHz 1.000 ms (1001 pts)	
SG			I STA	· · ·	

# Test Mode : Hopping mode, BT1, GFSK

								gilent Spectrum
Frequency	04:08:08 PM Nov 05, 2020 TRACE 1 2 3 4 5 6 TYPE M	ALIGNAUTO pe: Log-Pwr ld:>30/30	A	SEN	<b>1</b> Z 10: Wide 😱	0000 GH	rf 50 Ω <b>q 2.48350</b> (	enter Fre
Auto Tun	DET P P P P P P 1 2.480 00 GHz 12.120 dBm	n: -0.40 dB Mkr	B E:	#Atten: 30	Gain:Low	IF	tef 20.00 di	0 dB/div
Center Fre 2.483500000 G⊦								10.0
Start Fre 2.478500000 G⊦	-7.88 dBm						$\checkmark$	10.0
<b>Stop Fre</b> 2.488500000 GH								30.0
CF Ste 1.000000 Mi <u>Auto</u> Ma								40.0
Freq Offs	Alannon	مهمهمم	~~~~~~h~	ᡃᢑᡊᡅᡘᢦᡳᠺ	Low way	QrnA		50.0
								70.0
	Span 10.00 MHz .000 ms (1001 pts)	Sweep 1	I	300 kHz	#VBW			Center 2.48 Res BW 10
l	· · · ·							SG



gilent Spectrum Analyzer - Swept SA R RF 50 Ω AC		SENSE:INT		.IGN AUTO	06:51:45 PM	Joy 05, 2020	
enter Freq 2.40000000	) GH ₇	ee Run	Avg Type: Avg Hold> Ext Gain: -0	Log-Pwr 30/30	TRACE	123456 M	Frequency
dB/div Ref 20.00 dBm				Mkr1	2.404 1 12.30	4 GHz 6 dBm	Auto Tun
0.0			m	h gara	Luman	1 Word	<b>Center Fre</b> 2.400000000 GH
0.0						-7.69 dBm	<b>Start Fre</b> 2.395000000 GH
0.0							<b>Stop Fre</b> 2.405000000 GH
0.0		prod	, 				CF Ste 1.000000 M⊦ <u>Auto</u> Ma
0.0 phalitenaperation	mmmmm	r and					Freq Offs 0 H
enter 2.400000 GHz					Span 10	00 MH-	
Res BW 100 kHz	#VBW 300 kH	Iz	s	weep 1.	000 ms (1		
G				<b>STATUS</b>			

# Test Mode : Hopping mode, BTO, 8-DPSK

gilent Spectrum Analyz	50 Ω AC		SENSE:INT	ALIGNAUTO	06:52:40 PM Nov 05, 2020	_
enter Freq 2.4		PNO: Wide C	Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr Avg Hold:>30/30 Ext Gain: -0.40 dB	TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P	Frequency
dB/div Ref 2	0.00 dBm			Mk	r1 2.478 96 GHz 10.440 dBm	Auto Tun
0.0 1 mm May m	M					Center Fre 2.483500000 GH
0.0					-9.56 dBm	<b>Start Fre</b> 2.478500000 GH
0.0						<b>Stop Fr</b> 2.488500000 Gi
D.0	\/	w\				<b>CF St</b> e 1.000000 M <u>Auto</u> M
0.0		huhan	Mandanmaran	And the second second	mant and the second	Freq Offs
D.O						
enter 2.483500 Res BW 100 kH		#VBW	300 kHz	Sweep	Span 10.00 MHz 1.000 ms (1001 pts)	
G				<b>K</b> STATU	S	с



Agilent Spectrum Analyzer - Swept S XI R RF 50 Ω AG		SENSE:INT		ALIGNAUTO	05:27:51 PM Nov 05, 2020	
Center Freq 2.4000000	00 GHz			e: Log-Pwr	TRACE 1 2 3 4 5 (	Frequency
	PNO: Wide 🖵 IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Hold Ext Gain	: -0.40 dB	DET PPPP	A
10 dB/div Ref 20.00 dBn	ı			Mkr	1 2.403 00 GHz 12.243 dBm	Auto Tune
10.0				Mun	1 Month Mark	Center Fred 2.400000000 GH;
10.0					-7.76 dBr	Start Free 2.395000000 GH
20.0						<b>Stop Fre</b> 2.405000000 GH
40.0			ma / ma			CF Ste 1.000000 MH <u>Auto</u> Ma
50.0 60.0 Auronaurona	Way Mary manual	Manna				Freq Offse
70.0						
Center 2.400000 GHz Res BW 100 kHz	#VBW :	300 kHz		Sweep 1	Span 10.00 MHz .000 ms (1001 pts	
SG				<b>I</b> STATUS		

#### Test Mode : Hopping mode, BT1, 8-DPSK





	06:26:29 PM Nov 05, 2020	ALIGN AUTO		SENSE:INT		m Analyzer - Swept SA RF 50 Ω AC	<b>X/</b> R
Frequency	TRACE 1 2 3 4 5 6 TYPE M	:Log-Pwr >30/30	Avg Type Avg Hold Ext Gain:	Trig: Free Run #Atten: 30 dB	GHz PNO: Wide 🖵 IFGain:Low	eq 2.400000000	
Auto Tune	1 2.402 00 GHz 12.496 dBm	Mkr				Ref 20.00 dBm	I0 dB/div
Center Fred 2.400000000 GH:							10.0
Start Free 2.395000000 GH	-7.50 dBm						10.00
<b>Stop Fre</b> 2.405000000 GH							30.0
<b>CF Ste</b> 1.000000 MH <u>Auto</u> Ma	bon						10.0
<b>Freq Offse</b> 0 H	Manna			warna a	n Manna M	Mon March	50.0 60.0
	Span 10.00 MHz 000 ms (1001 pts)	Swoop 1		00 641-2	#VBW :	000000 GHz	70.0 Center 2 Res BM
	ooo nis (roor pts)	Sweep 1		VV K112	#VOVV	IVV NH2	SG SG

# Test Mode : Non-Hopping mode, BTO, GFSK

	RF 50	Ω AC		SENSE:IN	Т	ALIGN AUTO	06:32:45 PM Nov 05, 2020	-
er Fre	eq 2.4835	00000	GHz PNO: Wide G IFGain:Low		Avg Tyj Avg Hol	be:Log-Pwr d:>30/30 h:-0.40 dB	TRACE 1 2 3 4 5 6 TYPE M WWWW DET P P P P P P	Frequency
div	Ref 20.00	dBm				Mkr	1 2.479 98 GHz 12.021 dBm	Auto Tu
								Center F 2.483500000 (
							-7.98 dBm	Start F 2.478500000
								<b>Stop F</b> 2.488500000
$\sim$		h	lun					CF S 1.000000 I <u>Auto</u>
			Maria	man	M. MARIAN	hymany	Landelange and	Freq Off
ter 2.48	33500 GH	2					Span 10.00 MHz	
s BW 1	00 kHz		#VBW	300 kHz		Sweep 1	.000 ms (1001 pts)	



	57:37 PM Nov 05, 2020	03:57:37	ALIGN AUTO		VSE:INT	SEN		AC	I <mark>m Analyzer - Swe</mark> RF 50 Ω	X/ R
Frequency	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P P	TF	:Log-Pwr >30/30	Avg Typ Avg Hold Ext Gain	e Run	Trig: Free #Atten: 30	GHz PNO: Wide 😱 IFGain:Low	00000	eq 2.40000	Center I
Auto Tun	401 99 GHz I2.587 dBm					FALCEN. O	IFGain:Luw		Ref 20.00 c	10 dB/div
Center Fre 2.400000000 GH				(						10.0
Start Fre 2.39500000 GH	-7.41 dBm									10.00
<b>Stop Fre</b> 2.405000000 GH										30.0
<b>CF Ste</b> 1.000000 MH <u>Auto</u> Ma		Ann			and					40.0
Freq Offse 0 H	man	- My			a rower	www	mun Con Com Con	www.	mmmmm	50.0 <u>~~~</u> ^
		0.000							00000 01/-	70.0
	an 10.00 MHz ms (1001 pts)		Sweep 1			300 kHz	#VBW		00000 GHz 100 kHz	Res BW
										SG

# Test Mode : Non-Hopping mode, BT1, GFSK

_	:04:50 PM Nov 05, 2020	AUTO	AL	NSE:INT	SEI			n <mark>alyzer - Swe</mark> F 50 Ω	F
Frequency	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P P P P P P	0	Avg Type:   Avg Hold:>: Ext Gain: -0		Trig: Free #Atten: 30	<b>lz</b> IO: Wide 😱 Gain:Low	PN	2.48350	ter Freq
Auto Tu	479 98 GHz 12.433 dBm		Ext out.		#ritterin o	Jain.Low		ef 20.00 d	l/div Re
<b>Center Fr</b> 2.483500000 G									
<b>Start Fr</b> 2.478500000 G	-7.57 dBm								
<b>Stop Fr</b> 2.488500000 G									
CF St 1.000000 M <u>Auto</u> M						<u></u>	h		N
Freq Offs 0	man	$\Lambda_{hmv}$	www.www.	᠈᠕ᡁᡣᠬ᠈ᢔᡟᠥᡢᠬ	Whowwo	man			
	pan 10.00 MHz				300 kHz	#\/D\W			er 2.483
	) ms (1001 pts)	ep 1.u status	5		300 KHZ	#VDVV		κΠ2	



							um Analyzer - Swe	XI R
Frequency	06:41:44 PMNov 05, 2020 TRACE 1 2 3 4 5 6	ALIGNAUTO :: Log-Pwr		SENS	CH2	AC AC	RF 50Ω req 2.40000	
	DET P P P P P		Run Avg Hol	Trig: Free I #Atten: 30	PNO: Wide IFGain:Low	0000	req 2.40000	Seriler
Auto Tune	2.401 83 GHz 12.157 dBm	Mkr1				dBm	Ref 20.00 c	10 dB/div
Center Fred 2.400000000 GHz		1						10.0
Start Free			/ ~					0.00
2.395000000 GH	-7.84 dBm							10.0
<b>Stop Free</b> 2.405000000 GH:								30.0
CF Step 1.000000 MH: Auto Mar			m					40.0
Freq Offse 0 H	Some Marshan		N	www.ww	Munna		www.	60.0 <b>///~~//</b>
								70.0
	Span 10.00 MHz 000 ms (1001 pts)	Sweep 1.		300 kHz	#VBW	1	400000 GHz 100 kHz	
		<b>STATUS</b>						ISG

# Test Mode : Non-Hopping mode, BTO, 8-DPSK

					bectrum Analyzer - Swept SA
Frequency	06:48:07 PM Nov 05, 2020 TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P P P P P P	ALIGNAUTO Avg Type: Log-Pwr Avg Hold:>30/30	SENSE:INT	000 GHz PNO: Wide 🖵	RF 50 Ω AC r Freq 2.483500000
Auto Tur	1 2.480 14 GHz 11.942 dBm	Ext Gain: -0.40 dB Mkr	#Atten: 30 dB	IFGain:Low	iv Ref 20.00 dBm
Center Fre 2.483500000 GH					
<b>Start Fre</b> 2.478500000 GH	-8.06 dBm				
<b>Stop Fr</b> 2.488500000 G				M	$\mathcal{A}$
CF St 1.000000 M <u>Auto</u> N				M	
Freq Offs 0	alanna mahanal	amar and a start and a start and a start	hanna	when	
	Span 10.00 MHz .000 ms (1001 pts)	Sween 4	300 kHz	#\/D\M	- 2.483500 GHz 3W 100 kHz
		Sweep I	JVV KHZ	#4844	



R RF 50Ω AC		SENSE:INT	ALIGN AUTO	04:15:34 PMN	ny 05, 2020 🛛	
enter Freq 2.40000000		ee Run Avg	Type: Log-Pwr Hold:>30/30 Gain: -0.40 dB	TRACE TYPE	123456 MWWWWW PPPPPP	Frequency
D dB/div Ref 20.00 dBm			Mkr	1 2.401 8 12.61	3 GHz 2 dBm	Auto Tun
10.0			And the			Center Fre 2.400000000 GH
0.0					-7.39 dBm	<b>Start Fre</b> 2.395000000 GH
0.0						<b>Stop Fre</b> 2.405000000 GH
0.0		m		h		<b>CF Ste</b> 1.000000 MH <u>Auto</u> Ma
0.0 and man the Marine	man man man					Freq Offso 0 ⊦
enter 2.400000 GHz Res BW 100 kHz	#VBW 300 kH		Sween 1	Span 10. .000 ms (1		
IG IG IG IG IG	#*BW 300 K	12	Sweep 1	· ·	oo i pisj	

# Test Mode : Non-Hopping mode, BT1, 8-DPSK

R RF 50 Ω AC		SENSE:INT	ALIGNAUTO	05:25:23 PM Nov 05, 2020	
enter Freq 2.483500000 (	GHz PNO: Wide 🖵 IEGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr Avg Hold>30/30 Ext Gain: -0.40 dB	TRACE 1 2 3 4 5 6 TYPE M	Frequency
dB/div Ref 20.00 dBm			Mkr	1 2.480 00 GHz 12.483 dBm	Auto Tur
					Center Fre 2.483500000 GH
00				-7.52 dBm	<b>Start Fr</b> 2.478500000 G
.0					<b>Stop Fr</b> 2.488500000 G
					CF St 1.000000 M <u>Auto</u> M
.0	h	montenant	Marther Whyt you arrived	~~Ma_rayhowbarwan	Freq Offs 0
enter 2.483500 GHz				Span 10.00 MHz	
Res BW 100 kHz	#VBW 3	300 kHz	Sweep 1	.000 ms (1001 pts)	



# **Spurious Emission**

#### Test Mode : BTO, GFSK

[Lowest channel]

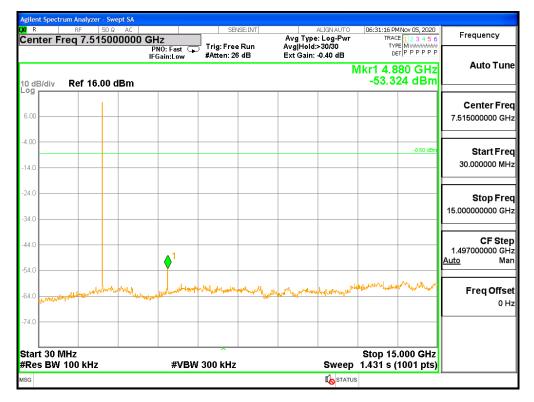
-	06:27:23 PM Nov 05, 2020	ALIGN AUTO		INSE:INT	SEM		AC	F 50 Ω	F	R
	TRACE 1 2 3 4 5 6 TYPE M		Avg Typ Avg Hold Ext Gain:		Trig: Free #Atten: 26	Hz PNO: Fast 😱 IFGain:Low		7.51500	ter Freq	ent
Auto Tu	lkr1 4.805 GHz -53.729 dBm	N					lBm	f 16.00 c	i/div Re	0 dB og r
Center Fr										5.00
7.515000000 G										
Start Fr	-8.60 dBm									.00
30.000000 N										4.0
Stop Fr										4.0
15.00000000 G										4.0
CF St										4.0
1.497000000 G <u>Auto</u> N						<b>∮</b> ¹				4.0
Freq Offs 0	have have a start and	Marterry	whywhy	where where the second	ly the property of the second second	and the state of the	Wayle warde	an Muellinite	Level more the	
										4.0
	Stop 15.000 GHz 1.431 s (1001 pts)	Sween			300 kHz	#\/B\M		kU7	: 30 MHz 8 W 100	
	1.451 5 (1001 pts)	SWEEP		-	500 KHZ	#VDVV		RATZ		G

r.				051			trum Analyzer RF	gilent Spec // R
Frequency	06:27:58 PMNov 05, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P P	ALIGNAUTO Fype: Log-Pwr Iold:>30/30		] Trig: Free	GHz PNO: Fast	50 Ω AC 000000000		
Auto Tur	/kr1 24.90 GHz -50.364 dBm	ain: -0.40 dB	3 dB	#Atten: 26	IFGain:Low	00 dBm	Ref 16.0	0 dB/div
Center Fre 20.000000000 GH								6.00
Start Fro 15.00000000 G	-8.60 dBm							4.0
<b>Stop Fr</b> 25.00000000 G								34.0
CF St 1.000000000 G <u>Auto</u> N	min Briter op Million							4.0
Freq Offs 0	and such the stand of the second such	The last and the state of the s	and a start of the	priling and the	Abdragety and adverse	hand many the stand of the	went the work	4.0 <b></b>
	Stop 25.000 GHz 55.7 ms (1001 pts)	Sween		300 kHz	#\/B\M		000 GHz / 100 kHz	
	/	зжеер з		JVV KHZ	#1000			SG SG



Report No.: CTK-2020-04544 Page (52) / (89) Pages

[Middle Channel]

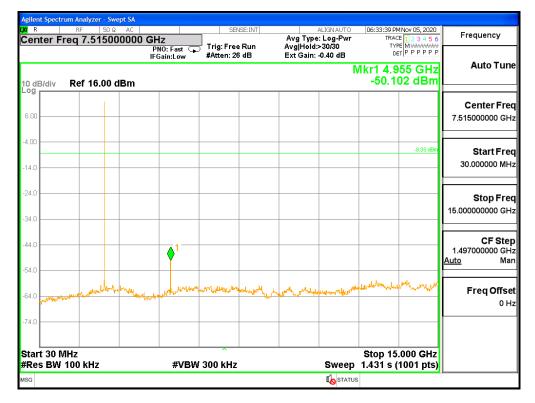






Report No.: CTK-2020-04544 Page (53) / (89) Pages

[Highest Channel]



MSG				<b>Ko</b> statu	s	
	5.000 GHz W 100 kHz	#VBW :	300 kHz	Sweep	Stop 25.000 GHz 955.7 ms (1001 pts)	
-74.0						
-64.0	Lipelinentfick." "TTVIII-sekulius	Anna Angelana an anna	· · · · · · · · · · · · · · · · · · ·			Freq Offse 0 H
-54.0	Ward Mary Mar Marine		Wylastel Malater Walk	May water	or have a server and a server and the	Auto Mar
-44.0						CF Ste 1.00000000 GH
-34.0						25.000000000 GH
-24.0						Stop Fre
-14.0						Start Free 15.000000000 GH
-4.00					-8.35 dBm	Start Era
6.00						Center Free 20.000000000 GH
10 dB/div	Ref 16.00 dBm				-50.687 dBm	
		PNO: Fast 😱 IFGain:Low	#Atten: 26 dB	Ext Gain: -0.40 dB	DET PPPPPP	Auto Tun
	Freq 20.0000000		Trig: Free Run	Avg Type: Log-Pwr Avg Hold:>30/30	TRACE 1 2 3 4 5 6	Frequency
Agilent Spe	ectrum Analyzer - Swept SA RF 50 Ω AC		SENSE:INT	ALIGNAUTO	06:34:13 PM Nov 05, 2020	0



Report No.: CTK-2020-04544 Page (54) / (89) Pages

#### Test Mode : BT1, GFSK

							um Analyzer -	
Amplitude	03:58:52 PM Nov 05, 2020 TRACE 1 2 3 4 5 6	ALIGN AUTO	0 T	SENSE:INT		Ω AC		R
<b>Ref Lev</b> 16.40 dB	TYPE MUNICIPAL PPPP DET PPPPPP	pe: Log-Pwr ld:>30/30 n: -0.40 dB №	Avg Ho	Trig: Free Run #Atten: 26 dB	PNO: Fast 😱 IFGain:Low		l 16.40 d	tet Leve
	11.850 dBm					0 dBm	Ref 16.4	0 dB/div
Attenuatior [26 dB						1		5.40
Scale/D 10 c	-8.15 dBm							3.6
Scale Tyr Log L								3.6
Presel Cent								3.6
Presel Adju 0 I	nonormheideligtherighten or	hangeleyesticheletete	with and when	Must have by	with a by with my	hurling and	and the second second	3.6 3.6
Мо								3.6
1 o	Stop 15.000 GHz 1.431 s (1001 pts)	Sweep		300 kHz	#VBW			tart 30 N Res BW
	· · ,						eak Found	sg 🔀 No P

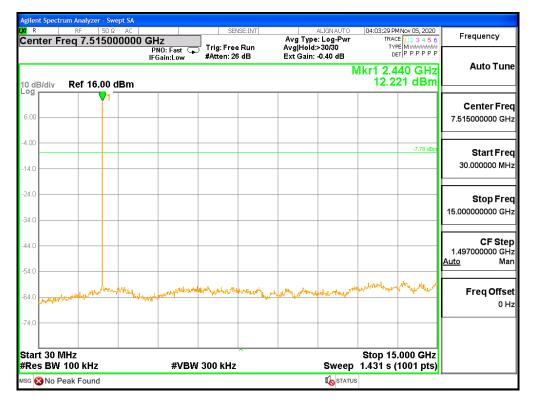
# [Lowest channel]

Amplitude	03:59:27 PMNov 05, 2020	ALIGN AUTO		SEN		zer - Swept SA 50 Ω AC	RF	<b>K</b> R
Amplitude	TRACE 1 2 3 4 5 6 TYPE M MMMMMM DET P P P P P P	ype:Log-Pwr old:>30/30		Trig: Free	PNO: Fast	0 dBm	evel 16.4	Ref I
<b>Ref Le</b> 16.40 di	^{DET PPPPPP} /kr1 24.98 GHz -51.811 dBm	iin: -0.40 dB		#Atten: 26	IFGain:Low	6.40 dBm	div <b>Ref</b>	10 dB
Attenuatio [26 dE								6.40 -
Scale/I 10	-8.15 dBm							3.60 13.6
Scale Ty								23.6 -
Log								i3.6 - i3.6 -
Presel Cer	1.	Junio Marchana Marca	M	or at the paper of the		w44,		3.6 -
Presel Adj 0					And all and a second second	an der Briden ander Berger	www.	3.6 -
<b>M</b> (								3.6
	Stop 25.000 GHz 55.7 ms (1001 pts)	Sweep 9		/ 300 kHz	#VBW		15.000 GI BW 100 I	
		STATUS						SG



Report No.: CTK-2020-04544 Page (55) / (89) Pages

[Middle Channel]

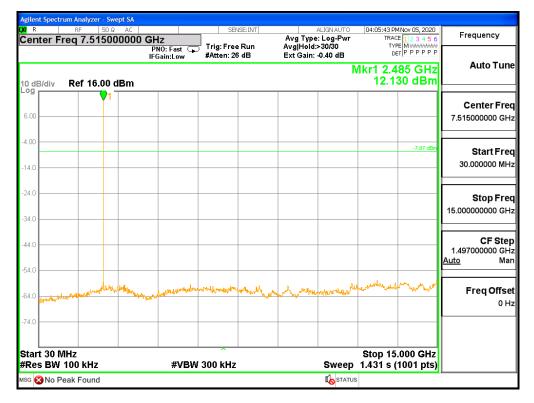


								lent Spectrum
Frequency	04:04:04 PM Nov 05, 2020 TRACE 1 2 3 4 5 6 TYPE M	ALIGNAUTO pe: Log-Pwr ld:>30/30	Run Av	Trig: Free	GHz PNO: Fast	000000	RF 50 Ω <b>q 20.000</b>	Renter Free
Auto Tun	/kr1 24.44 GHz -49.993 dBm	n: -0.40 dB	dB Ex	#Atten: 26	IFGain:Low	1	Ref 16.00 (	
Center Fre 20.000000000 GH								00
<b>Start Fre</b> 15.000000000 GH	-7.78 dBm							
Stop Fre 25.000000000 G⊦								I.O
CF Ste 1.00000000 GH <u>Auto</u> Ma	1-		the second second second	M.M. Maderia				I.O
Freq Offs 0 H	(hvapad)	velocello escentere	. Alan and	Lough Angle Alger	and the second	rbhaildagaradh	energine and a state of the sta	1.0
	Stop 25.000 GHz 55.7 ms (1001 pts)	Sweep 9		300 kHz	#VBW			art 15.000 es BW 10
						ED	NTERRUPT	🛙 🔀 Query II



Report No.: CTK-2020-04544 Page (56) / (89) Pages

[Highest Channel]



					n Analyzer - Swept SA	
Frequency	04:06:18 PMNov 05, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P P	ALIGN AUTO Type: Log-Pwr Iold:>30/30 Gain: -0.40 dB	g: Free Run ten: 26 dB	PNO: Fast 😱	RF 50Ω AC C 20.00000000000000000000000000000000000	x R Center Fre
Auto Tun	/kr1 24.29 GHz -51.022 dBm		ten: 20 db	IFGain:Low	Ref 16.00 dBm	
Center Fre 20.000000000 GH						6.00
<b>Start Fre</b> 15.000000000 GH	-7.87 dBm					-4.00
Stop Fre 25.000000000 GH						-24.0
CF Ste 1.00000000 GH <u>Auto</u> Ma	1 The land of the second					54.0
Freq Offs 0 F	and a second and a second s	and have a server of the serve	noomidelator hadden de	- Anter Janlin Magana Ma	panalan and a start and a start of the start	64.0
	[^] Stop 25.000 GHz 55.7 ms (1001 pts)	Sweep 9	ı kHz	#VBW 3		-74.0 Start 15.000 #Res BW 10
						MSG



# Test Mode : BT0, 8-DPSK

R RF 50 9		SENSE:INT	ALIGNAUTO	06:42:38 PM Nov 05, 2020	Frequency
enter Freq 7.5150	00000 GHz PNO: Fast IFGain:Low	Trig: Free Run #Atten: 26 dB	Avg Type: Log-Pwr Avg Hold:>30/30 Ext Gain: -0.40 dB	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P P	
dB/div Ref 16.00	dBm		Ν	/kr1 6.362 GHz -58.413 dBm	Auto Tun
.00					Center Fre
					7.515000000 GH
					Start Fre
4.0				-12.82 dBm	30.000000 MH
.0					Stop Fre
1.0					15.00000000 GI
.0					CF Ste 1.497000000 G
1.0		1			<u>Auto</u> M
a holy and a start	and the set of the second	How When my Mary May 11	للمستعمل والمعالية والمستعلم والمستعلم والمستعمل والمستعمل والمستعمل والمستعمل والمستعمل والمستعمل والمستعم والمست	and when a share the and the second second	Freq Offs
1.0 weekwater	- Brechtyberger				. 01
4.0					
art 30 MHz		<b>^</b>		Stop 15.000 GHz	
Res BW 100 kHz	#VE	W 300 kHz	Sweep	1.431 s (1001 pts)	

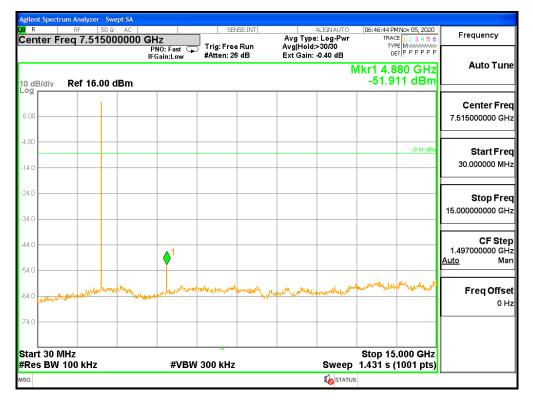
[Lowest channel]

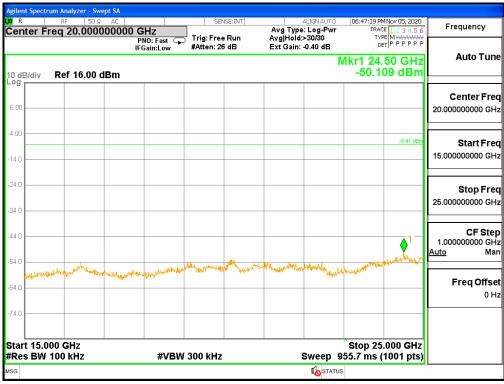
Frequency	06:43:12 PM Nov 05, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWWW	ALIGN AUTO Type: Log-Pwr Hold:>20/20		GHz	50Ω AC 0000000000000000000000000000000000	 Freq 20.0	R enter
Auto Tu	IFGain:Low #Atten: 26 dB Ext Gain: -0.40 dB DET PPPPF						
Autore	/kr1 24.99 GHz -51.354 dBm	N			.00 dBm	Ref 16	) dB/div
Center F							
20.00000000 0							.00
Start F							
15.000000000	-12.82 dBm						1.0
							1.0
Stop Fi 25.00000000 0							
							4.0
CF S 1.000000000	1						4.0
<u>Auto</u> N	. Works I of	orth Village Hall and March and Marc	u de anthe damagne	a state of the second second	N. I. I.		4.0
Freq Off			Agente -	man all all man all and the second and a second	- where and the second	for the second	4.0
C							
							4.0
	Stop 25.000 GHz 55.7 ms (1001 pts)	Sween 0		#VBW 300 kHz		.000 GHz V 100 kHz	
		Sweep 9	12	#VDVV JUU KHZ	<u> </u>	V 100 KH2	G G



Report No.: CTK-2020-04544 Page (58) / (89) Pages

[Middle Channel]

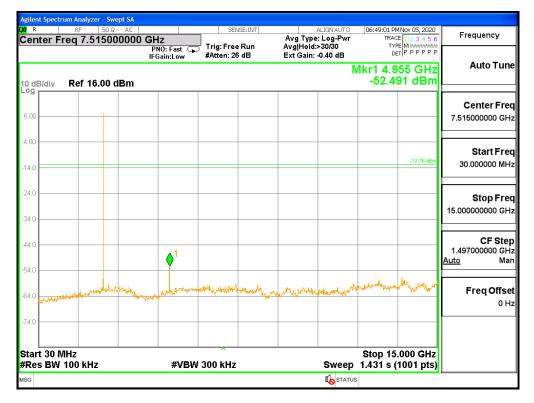






Report No.: CTK-2020-04544 Page (59) / (89) Pages

[Highest Channel]



MSG						<b>I</b> STATUS	5		
	t 15.000 GHz s BW 100 kH		#VBW	300 kHz	ę	Sweep 9	Stop 25.0 55.7 ms (10		
-74.0									
-64.0	hand and a second and a second	The Marcon particular	and and a start of the second second		and the second	ar	and the second sec		Freq Offse 0 H
-54.0		<i>(</i> <b>)</b>		adala	white a star	and at .	Maynet	1 particular and a second	1.000000000 GH <u>Auto</u> Ma
-44.0									CF Ste
-34.0									25.000000000 GH
-24.0									Stop Fre
-14.0								-12.78 dBm	Start Fre 15.000000000 GH
-4.00									
6.00									Center Fre 20.000000000 GH
10 dE Log	3/div Ref 1	6.00 dBm					-51.262		
			IFGain:Low	#Atten: 26 dB	Ext Gain: -	0.40 dB	DET F	5 GHZ	Auto Tun
		.000000000	GHz PNO: Fast	Trig: Free Run	Avg Type: Avg Hold>	: Log-Pwr	TRACE	1 2 3 4 5 6	Frequency
Agilent	t Spectrum Analy: RF	ter - Swept SA 50 Ω AC		SENSE:INT		LIGNAUTO	06:49:36 PM N		ſ



# Test Mode : BT1, 8-DPSK

R	RF	50 Ω AC		SEN	SE:INT		ALIGN AUTO		1Nov 05, 2020	Frequency
enter F	req 7.	51500000	IO GHz PNO: Fast G IFGain:Low	Trig: Free #Atten: 26		Avg Type Avg Hold Ext Gain:		TYF	E 1 2 3 4 5 6 E M WWWWWW T P P P P P P	Frequency
dB/div	Ref 1	6.00 dBm					N		95 GHz 25 dBm	Auto Tui
9		<b>▼</b> 1								Center Fre
										7.515000000 G
									-7.58 dBm	Start Fr
.0										30.000000 M
.0										Stop Fr
.0										15.000000000 G
.0										<b>CF St</b> 1.497000000 G
.0										<u>Auto</u> M
.0	-	manymen	ماسير المحر المحالية المحالية	and the star said	Mr. M. A	White whe	mulan	ralistications	1 March Land	Freq Offs
			TI NOVITIN							0
.0										
art 30 I									.000 GHz	
es BM	100 kH	Z	#VBW	/ 300 kHz			Sweep	1.431 S (	1001 pts)	

[Lowest channel]

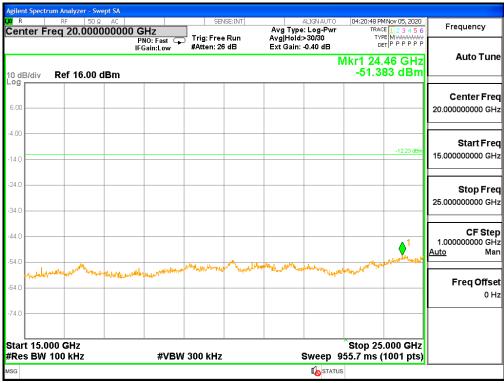
R			SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	04:17:02 PM Nov 05, 2020 TRACE 1 2 3 4 5 6	Frequency
ente	er Freq 20.00000	DUUU GHZ PNO: Fast IFGain:Low	Trig: Free Run #Atten: 26 dB	Avg Hold:>30/30 Ext Gain: -0.40 dB	TYPE MWWWWW DET P P P P P P	,
0 dB/c	div Ref 16.00 dB	m			/lkr1 24.63 GHz -51.028 dBm	Auto Tu
						Center Fr 20.000000000 G
4.0					-7.58 dBm	Start Fi 15.000000000 0
4.0 —						Stop F 25.000000000
4.0 -			he lu		1	CF Si 1.000000000 ( <u>Auto</u>
<mark>мц</mark> 4.0 —	wellererethydertraaktionedd	M United and the second s	and a second and a second second	he allow and a cardin	in the second	Freq Off C
	15.000 GHz				Stop 25.000 GHz	
tes l	BW 100 kHz	#VBW	300 kHz	Sweep 9	55.7 ms (1001 pts)	



Report No.: CTK-2020-04544 Page (61) / (89) Pages

[Middle Channel]







Report No.: CTK-2020-04544 Page (62) / (89) Pages

[Highest Channel]



	05:26:51 PMNov 05, 2020	ALIGNAUTO	1	SENSE:INT		AC	Analyzer - Sw RF 50 Ω	
Frequency	US:26:51 PMINOV US, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P	d:>30/30 a: -0.40 dB	Avgit	rig: Free Run Atten: 26 dB	GHz PNO: Fast 😱	00000	<u>א 20.000 ב</u> 20.000	
Auto Tu	/lkr1 24.55 GHz -51.527 dBm				Guilleow		ef 16.00 (	IB/div R
Center Fr 20.000000000 G								)
Start Fi 15.000000000 0	-9.06 dBm							)
<b>Stop F</b> 25.000000000								)
CF S 1.000000000 Auto	1		N					)
Freq Off ر	Andrew Anno and a	get and all the service of a service of the service	- and the second se	m path and a second again	t-alphanter and	Morth and the	ner Marken	)
	Stop 25.000 GHz 55.7 ms (1001 pts)	Sweep 9		00 kHz	#VBW :			rt 15.000 es BW 10
L	5	<b>I</b> STATUS						



Report No.: CTK-2020-04544 Page (63) / (89) Pages

# 4.7 Radiated Emission

#### Test Location

 $\boxtimes$  10 m SAC (test distance :  $\square$  10 m,  $\boxtimes$  3 m)  $\boxtimes$  3 m SAC (test distance : 3 m)

# **Test Procedures**

ANSI C63.10-2013 - Section 6.5, 6.6

- 1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency rage above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

# Instrument Settings

Frequency Range =  $9 \text{ kHz} \sim 25 \text{ GHz} (2.4 \text{ GHz} 10^{\text{th}} \text{ harmonic})$ 

- a) RBW = 1 MHz for f  $\geq$  1 GHz, 100 kHz for f < 1 GHz, 9 kHz for f < 30 MHz
- b) VBW  $\geq$  RBW
- c) Sweep time = auto couple



# Limit :

Unwanted emissions that do not fall within the restricted frequency bands of Table 1 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

FCC Part 15 § 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	MHz	GHz
0.09-0.11	8.37626-8.38675	73-74.6	399.9-410	2690-2900	10.6-12.7
¹ 0.495-0.505	8.41425-8.41475	74.8-75.2	608-614	3260-3267	13.25-13.4
2.1735-2.1905	12.29-12.293	108-121.94	960-1240	3332-3339	14.47-14.5
4.125-4.128	12.51975-12.52025	123-138	1300-1427	3345.8-3358	15.35-16.2
4.17725-4.17775	12.57675-12.57725	149.9-150.05	1435-1626.5	3600-4400	17.7-21.4
4.20725-4.20775	13.36-13.41	156.52475- 156.52525	1645.5-1646.5	4500-5150	22.01-23.12
6.215-6.218	16.42-16.423	156.7-156.9	1660-1710	5350-5460	23.6-24
6.26775-6.26825	16.69475-16.69525	162.0125-167.17	1718.8-1722.2	7250-7750	31.2-31.8
6.31175-6.31225	16.80425-16.80475	167.72-173.2	2200-2300	8025-8500	36.43-36.5
8.291-8.294	25.5-25.67	240-285	2310-2390	9000-9200	² Above 38.6
8.362-8.366	37.5-38.25	322-335.4	2483.5-2500	9300-9500	

Table 1. Restricted Frequency Bands

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

#### ² Above 38.6

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



FCC Part 15 § 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 2 Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705-30	30	-	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46	3
Above 960	500	54	3

# Table 2. General Field Strength Limits for Licence-Exempt Transmitters

** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

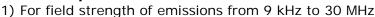
Note :

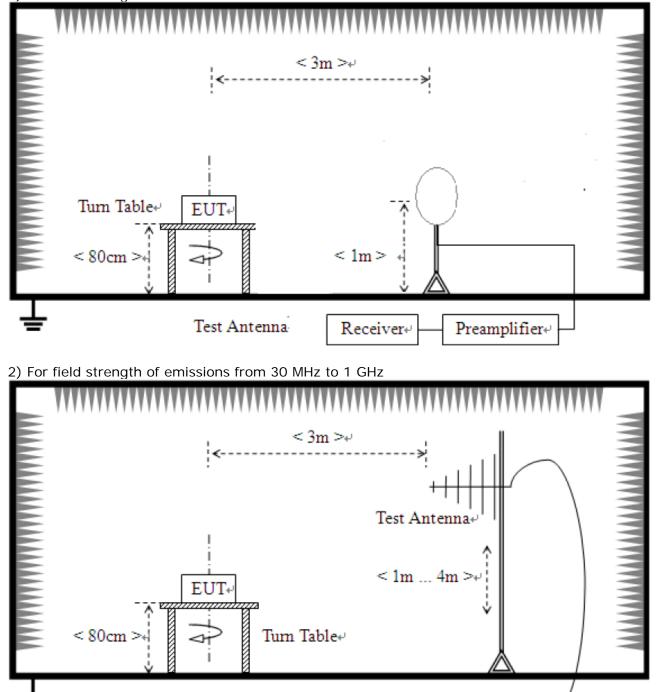
- For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)
- For measurement above 1GHz, the resolution bandwidth is set to 1 MHz and video bandwidth is set to 1 MHz for peak measurement and 10 Hz for average measurement. (Duty Cycle is > 98%,)
- 4) Duty Cycle is < 98%, VBW setting will need to > 1/T.



Report No.: CTK-2020-04544 Page (66) / (89) Pages

# Test Setup:





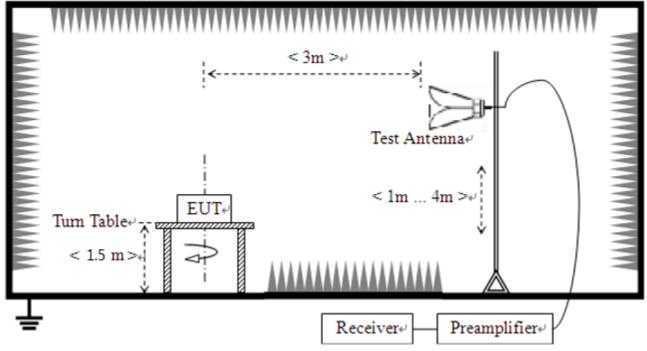
Receiver⊬

Preamplifier₽



Report No.: CTK-2020-04544 Page (67) / (89) Pages

# 3) For field strength of emissions above 1 GHz





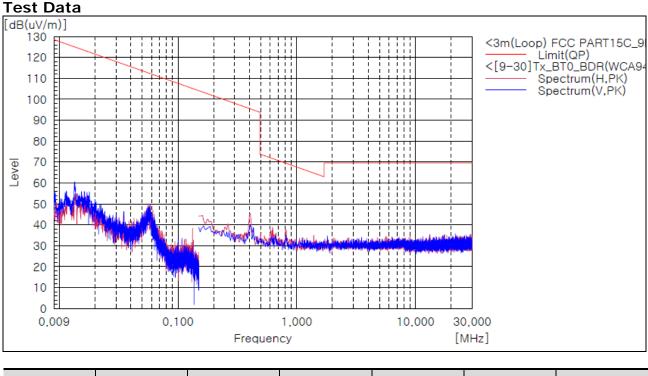
Report No.: CTK-2020-04544 Page (68) / (89) Pages

# Test results

# 1) 9 kHz to 30 MHz

Test mode : BT0_Transmitter (Worst Case)

The requirements are:  $\square$  Complies



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Level [dB(uV/m)]	Limit [dB(uV/m)]	Margin [dB]		
The emissions 9 kHz to 30 MHz were 20 dB lower than the limit.								

#### Remark :

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

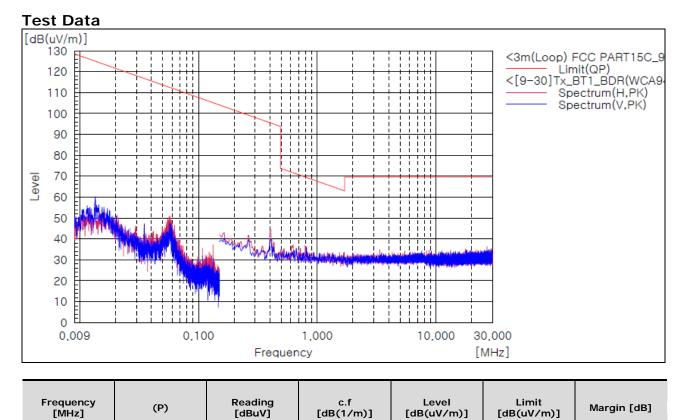
- 2. Result = Reading + c.f(Correction factor)
- 3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator Amp Gain
- 4. This data is the Peak(PK) value.



Report No.: CTK-2020-04544 Page (69) / (89) Pages



The requirements are: Complies



The emissions 9 kHz to 30 MHz were 20 dB lower than the limit.
----------------------------------------------------------------

#### Remark :

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

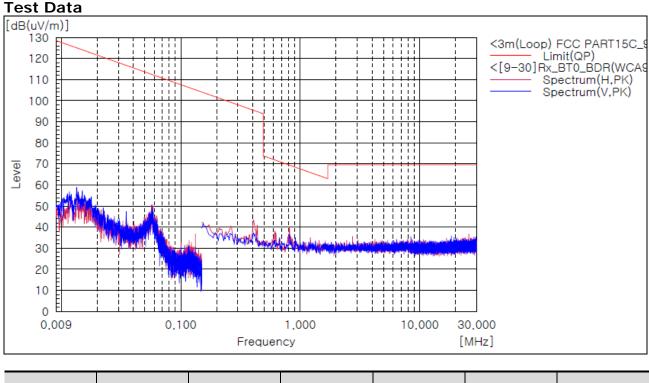
- 2. Result = Reading + c.f(Correction factor)
- 3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator Amp Gain
- 4. This data is the Peak(PK) value.



Report No.: CTK-2020-04544 Page (70) / (89) Pages

#### Test mode : BT0_Receiver (Worst Case)

The requirements are:  $\boxtimes$  Complies



The emissions	9 kHz to	30 MHz were	e 20 dB lowe	er than the limit.

c.f

[dB(1/m)]

Level

[dB(uV/m)]

#### Remark :

Frequency

[MHz]

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

2. Result = Reading + c.f(Correction factor)

(P)

3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain

Reading

[dBuV]

4. This data is the Peak(PK) value.

Margin [dB]

Limit

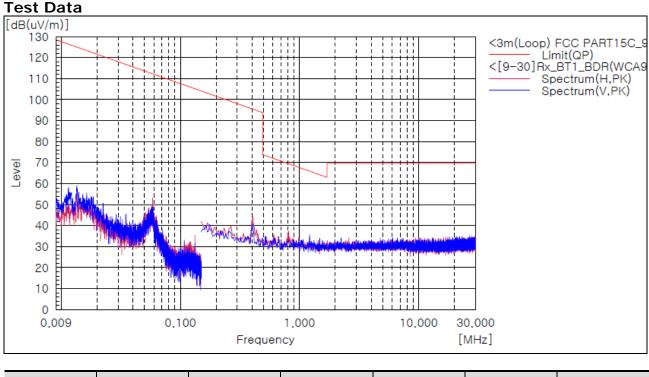
[dB(uV/m)]



Report No.: CTK-2020-04544 Page (71) / (89) Pages

#### Test mode : BT1_Receiver (Worst Case)

The requirements are: Complies



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Level [dB(uV/m)]	Limit [dB(uV/m)]	Margin [dB]	
The emissions 9 kHz to 30 MHz were 20 dB lower than the limit.							

#### Remark :

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

- 2. Result = Reading + c.f(Correction factor)
- 3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator Amp Gain
- 4. This data is the Peak(PK) value.



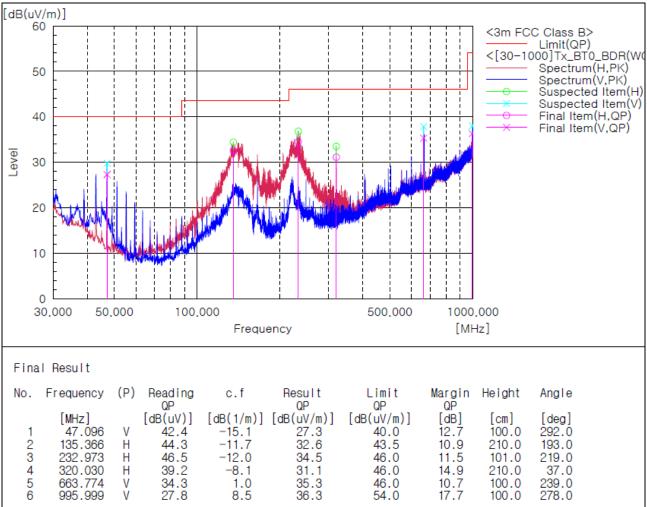
Report No.: CTK-2020-04544 Page (72) / (89) Pages

# 2) 30 MHz to 1 GHz

Test mode : BT0_Transmitter (Worst Case)

The requirements are: Complies

# Test Data



#### Remark :

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

2. Result = Reading + c.f(Correction factor)

3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain

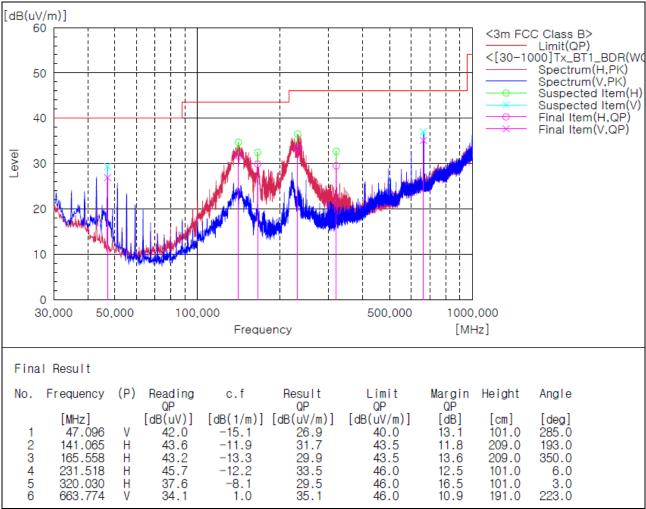


Report No.: CTK-2020-04544 Page (73) / (89) Pages



The requirements are:





## Remark :

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

2. Result = Reading + c.f(Correction factor)

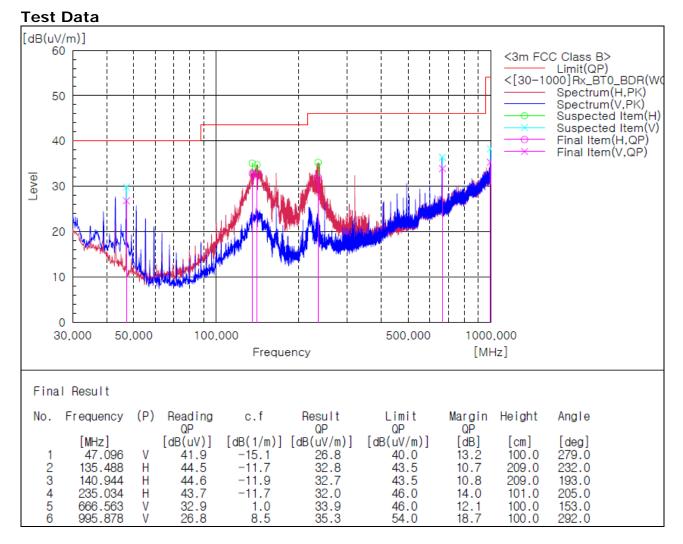
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain



Report No.: CTK-2020-04544 Page (74) / (89) Pages

## Test mode : BT0_Receiver (Worst Case)

The requirements are: Complies



#### Remark :

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

2. Result = Reading + c.f(Correction factor)

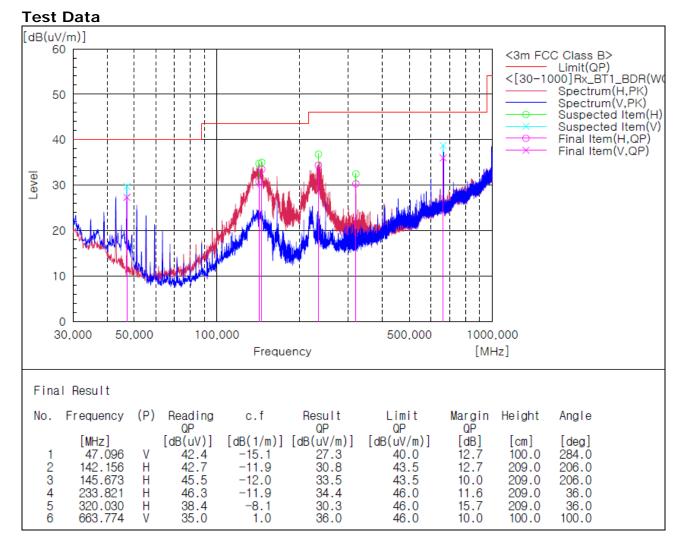
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain



Report No.: CTK-2020-04544 Page (75) / (89) Pages

## Test mode : BT1_Receiver (Worst Case)

The requirements are: Complies



#### Remark :

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

2. Result = Reading + c.f(Correction factor)

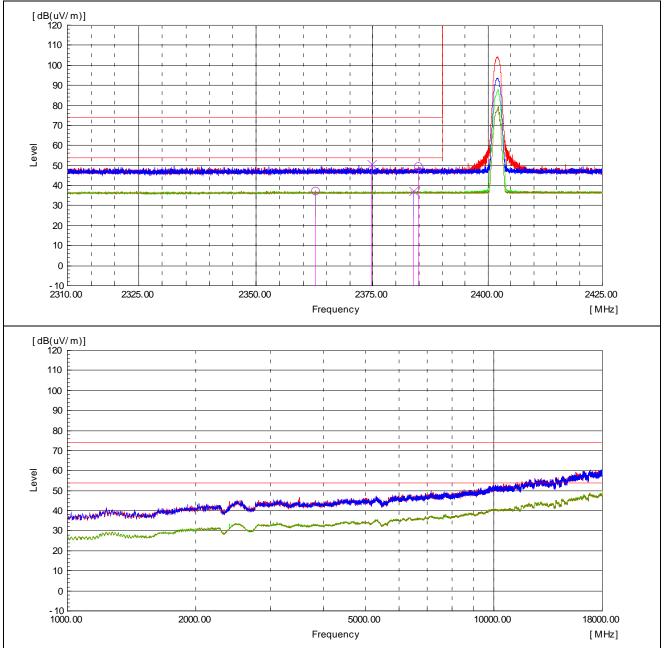
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain



## 3) above 1 GHz

The requirements are:  $\square$  Complies

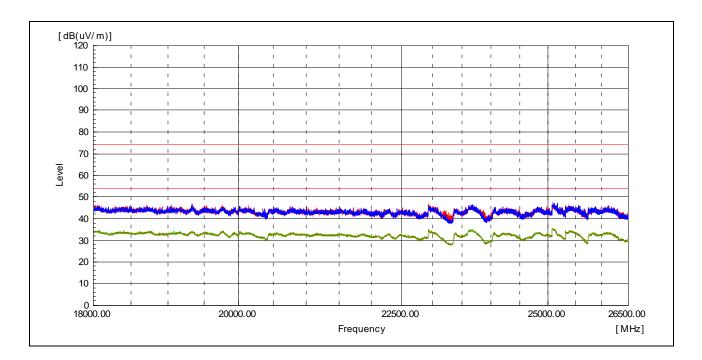




## Test Data



Report No.: CTK-2020-04544 Page (77) / (89) Pages





Report No.: CTK-2020-04544 Page (78) / (89) Pages

## Test mode : Transmitter (BTO, GFSK)

Frequen [MHz]		(P)	Reading PK [dBuV]	Reading AV [dBuV]	c.f [dB(1/m)]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]
2 384.8	39	Н	52.7		-3.1	49.6		74.0		24.4	
2 362.7	74	Н		40.4	-3.1		37.3		54.0		16.7
2 374.7	79	V	53.7		-3.1	50.6		74.0		23.4	
2 383.8	30	V		40.5	-3.1		37.4		54.0		16.6

### Lowest frequency(2 402 MHz)

#### Middle frequency(2 441 MHz)

Frequency [MHz]	(P)	Reading PK [dBuV]	Reading AV [dBuV]	C.T	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	
			The e	emissions ab	ove 1 GHz wer	e 20 dB lower	than the limit			

#### Highest frequency(2 480 MHz)

Frequency [MHz]	(P)	Reading PK [dBuV]	Reading AV [dBuV]	c.f [dB(1/m)]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	
2 483.72	Н	55.2		-2.5	52.7		74.0		21.3	
2 483.98	Н		41.3	-2.5		38.8		54.0		15.2
2 489.94	V	53.9		-2.5	51.4		74.0		22.6	
2 496.40	V		41.2	-2.4		38.8		54.0		15.2

#### Remarks

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.



Report No.: CTK-2020-04544 Page (79) / (89) Pages

## Test mode : Transmitter (BT0, 8-DPSK)

Frequ [MH		(P)	Reading PK [dBuV]	Reading AV [dBuV]	c.f [dB(1/m)]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]
2 384	4.81	Н	52.7		-3.1	49.6		74.0		24.4	
2 36	6.05	Н		40.4	-3.1		37.3		54.0		16.7
2 32	6.17	V	53.2		-3.2	50.0		74.0		24.0	
2 38	6.29	V		40.4	-3.1		37.3		54.0		16.7

## Lowest frequency(2 402 MHz)

#### Middle frequency(2 441 MHz)

Frequency [MHz]	(P)	Reading PK [dBuV]	Reading AV [dBuV]	C.T	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	
			The e	emissions ab	ove 1 GHz wer	e 20 dB lower	than the limit			

#### Highest frequency(2 480 MHz)

Frequency [MHz]	(P)		Reading AV [dBuV]	c.f [dB(1/m)]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	
2 484.10	Н	53.8		-2.5	51.3		74.0		22.7	
2 498.20	Н		41.3	-2.4		38.9		54.0		15.1
2 483.80	V	54.4		-2.5	51.9		74.0		22.1	
2 495.65	V		41.2	-2.4		38.8		54.0		15.2

#### Remarks

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.



Report No.: CTK-2020-04544 Page (80) / (89) Pages

## Test mode : Transmitter (BT1, GFSK)

Frequency [MHz]	(P)		Reading AV [dBuV]	c.f [dB(1/m)]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]
2 310.89	Н	52.6		-3.1	49.5		74.0		24.5	
2 388.73	Н		40.1	-3.1		37.0		54.0		17.0
2 374.98	V	52.6		-3.1	49.5		74.0		24.5	
2 379.56	V		40.2	-3.1		37.1		54.0		16.9

### Lowest frequency(2 402 MHz)

#### Middle frequency(2 441 MHz)

Frequency [MHz]	(P)	Reading PK [dBuV]	Reading AV [dBuV]	C.T	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	
			The e	emissions ab	ove 1 GHz wer	e 20 dB lower	than the limit			

#### Highest frequency(2 480 MHz)

Frequency [MHz]	(P)		Reading AV [dBuV]	c.f [dB(1/m)]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]
2 486.38	Н	52.5		-2.5	50.0		74.0		24.0	
2 495.90	Н		40.2	-2.4		37.8		54.0		16.2
2 497.76	V	52.4		-2.4	50.0		74.0		24.0	
2 497.20	V		40.3	-2.4		37.9		54.0		16.1

#### Remarks

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.



Report No.: CTK-2020-04544 Page (81) / (89) Pages

## Test mode : Transmitter (BT1, 8-DPSK)

F	requency [MHz]	(P)	Reading PK [dBuV]	Reading AV [dBuV]	c.f [dB(1/m)]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]
2	2 363.81	Н	52.3		-3.1	49.2		74.0		24.8	
2	2 355.01	Η		40.2	-3.1		37.1		54.0		16.9
2	2 318.45	٧	52.6		-3.2	49.4		74.0		24.6	
2	2 385.01	V		40.1	-3.1		37.0		54.0		17.0

## Lowest frequency(2 402 MHz)

#### Middle frequency(2 441 MHz)

Frequency [MHz]	(P)	Reading PK [dBuV]	Reading AV [dBuV]	C.T	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	
			The e	emissions ab	ove 1 GHz wer	e 20 dB lower	than the limit			

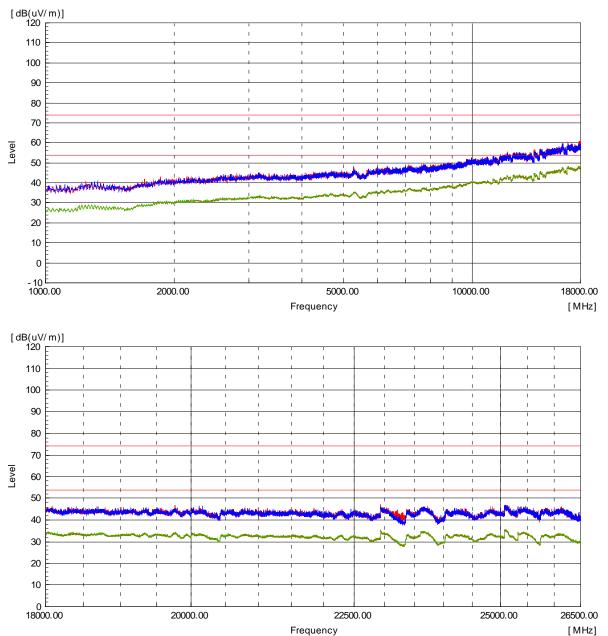
#### Highest frequency(2 480 MHz)

Frequency [MHz]	(P)		Reading AV [dBuV]	c.f [dB(1/m)]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	
2 496.04	Н	52.4		-2.4	50.0		74.0		24.0	
2 498.48	Н		40.1	-2.4		37.7		54.0		16.3
2 490.58	V	52.9		-2.5	50.4		74.0		23.6	
2 494.55	V		40.2	-2.4		37.8		54.0		16.2

#### Remarks

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.





## Test mode : Receiver (Worst Case)



## Test mode : Receiver (Worst Case)

Frequency [MHz]	(P)	Reading PK [dBuV]	Reading AV [dBuV]	c.f [dB(1/m)]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	margin	
The emissions above 1 GHz were 20 dB lower than the limit.										

#### Remarks

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.



Report No.: CTK-2020-04544 Page (84) / (89) Pages

## 4.8 AC Power Line Conducted Emissions

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits.

## Instrument Settings

IF Band Width: 9 kHz

## **Test Procedures**

RSS-Gen - Section 8.8

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.

Amplitude measurements were performed with a quasi-peak detector and an average detector.

#### Limit

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

* The level decreases linearly with the logarithm of the frequency.

** A linear average detector is required.

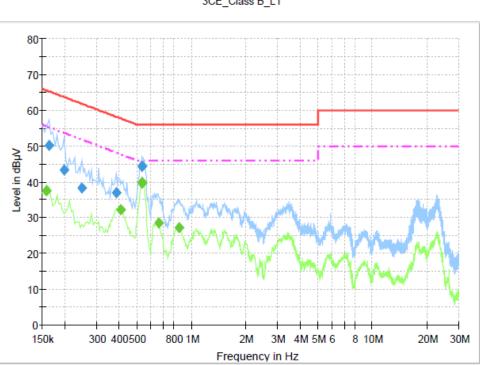
## **Test Results**

The requirements are:  $\Box$  Complies



Report No.: CTK-2020-04544 Page (85) / (89) Pages

## Test Data



## [LINE] 3CE_Class B_L1

# Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.163500	50.2	1000.0	9.000	On	L1	9.8	15.1	65.3
0.199500	43.3	1000.0	9.000	On	L1	9.8	20.3	63.6
0.249000	38.3	1000.0	9.000	On	L1	9.7	23.5	61.8
0.384000	37.1	1000.0	9.000	On	L1	10.0	21.1	58.2
0.532500	44.3	1000.0	9.000	On	L1	10.0	11.7	56.0
0.537000	44.4	1000.0	9.000	On	L1	10.0	11.6	56.0

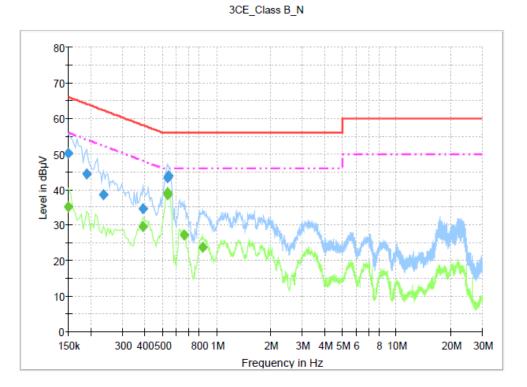
# **Final Result 2**

Frequency (MHz)	CAverage (dBµV)	Meas.	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
	(ασμν)	Time (ms)	(KHZ)			(ub)	(UD)	(ubµv)
0.159000	37.5	1000.0	9.000	On	L1	9.8	18.0	55.5
0.406500	32.2	1000.0	9.000	On	L1	10.0	15.5	47.7
0.532500	39.6	1000.0	9.000	On	L1	10.0	6.4	46.0
0.537000	39.9	1000.0	9.000	On	L1	10.0	6.1	46.0
0.663000	28.4	1000.0	9.000	On	L1	9.9	17.6	46.0
0.861000	27.1	1000.0	9.000	On	L1	9.8	18.9	46.0



Report No.: CTK-2020-04544 Page (86) / (89) Pages

[NEUTRAL]



# Final Result 1

Frequency	QuasiPeak	Meas.	Bandwidth	Filter	Line	Corr.	Margin	Limit
(MHz)	(dBµV)	Time	(kHz)			(dB)	(dB)	(dBµV)
		(ms)						
0.150000	50.2	1000.0	9.000	On	N	9.8	15.8	66.0
0.190500	44.3	1000.0	9.000	On	N	9.8	19.7	64.0
0.235500	38.6	1000.0	9.000	On	N	9.8	23.6	62.3
0.388500	34.7	1000.0	9.000	On	Ν	9.9	23.4	58.1
0.532500	43.2	1000.0	9.000	On	Ν	10.0	12.8	56.0
0.541500	43.7	1000.0	9.000	On	N	10.0	12.3	56.0

# Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
		(ms)						
0.150000	35.0	1000.0	9.000	On	N	9.8	21.0	56.0
0.388500	29.5	1000.0	9.000	On	N	9.9	18.6	48.1
0.532500	38.6	1000.0	9.000	On	N	10.0	7.4	46.0
0.537000	39.2	1000.0	9.000	On	Ν	10.0	6.8	46.0
0.663000	27.1	1000.0	9.000	On	N	9.9	18.9	46.0
0.834000	23.7	1000.0	9.000	On	N	9.8	22.3	46.0



Report No.: CTK-2020-04544 Page (87) / (89) Pages

# 4.9 Frequency Hopping System Requirements

## Standard Applicable

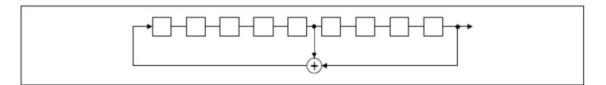
According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths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

## EUT Pseudorandom Frequency Hopping Sequence

The pseudo random sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage, and the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones. Number of shift register stages: 9 Length of pseudo-random sequence:  $2^9-1 = 511$  bits Longest sequence of zeros: 8 (non-inverted signal)



## Linear Feedback Shift Register for Generation of the PRBS sequence

0246	62 64	78 1	73 75 77
		<u> </u>	<u>i</u>

Each frequency used equally on the average by each transmitter. 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.



Report No.: CTK-2020-04544 Page (88) / (89) Pages

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.

*Example for a Bluetooth device using channel numbers would be : Ch 44, 35, 78, 03, 15, 21, 76, 40, 56, 13, 02, 19, 67, 39, 78, 20, 21, 64, 75 etc.



Report No.: CTK-2020-04544 Page (89) / (89) Pages

# **APPENDIX A – Test Equipment Used For Tests**

	Name of Equipment	Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date
1	Signal Analyzer	Agilent	N9020A	MY50200512	2020-05-25	2021-05-25
2	Signal Generator	Rohde & Schwarz	SMB100A	175528	2020-04-28	2021-04-28
3	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2020-10-20	2021-10-20
4	Bilog Antenna	Schaffner	CBL6111C	2551	2020-05-26	2022-05-26
5	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-126	2020-05-20	2022-05-20
6	6dB Attenuator	R&S	DNF	272.4110.50-2	2020-10-23	2021-10-23
7	6dB Attenuator	BIRD	5W 6dB	1744	2020-01-13	2021-01-03
8	AMPLIFIER	SONOMA	310	291721	2020-01-22	2021-01-22
9	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2020-01-17	2021-01-17
10	Preamplifier	Agilent	8449B	3008A01504	2019-12-17	2020-12-17
11	Horn Antenna	ETS-Lindgren	3117	00154525	2020-10-14	2021-10-14
12	Horn Antenna	SCHWARZBECK	BBHA9170	00967	2020-06-02	2021-06-02
13	Band Reject Filter	Micro Tronics	BRM50702	G233	2020-01-21	2021-01-21
14	Low Noise Amplifier	TESTEK	TK-PA1840H	200115-L	2020-05-29	2021-05-29
15	LISN	Rohde & Schwarz	ENV216	101235	2020-01-17	2021-01-17

	Cable	Manufacturer	Model No.	Serial No.	Check Date
1	RF Cable	Canare Corporation	L-5D2W	N/A	2020-01-19
2	RF Cable	Junkosha Inc.	MWX221	1512S127	2020-11-05
3	RF Cable	HUBER+SUHNER	SUCOFLEX 102	MY073/2	2020-05-19
4	RF Cable	HUBER+SUHNER	SUCOFLEX 104	MY27558/4	2020-05-29
5	RF Cable	HUBER+SUHNER	SUCOFLEX 104	N/A	2020-05-29
6	RF Cable	HUBER+SUHNER	SUCOFLEX 104	MY27573/4	2020-05-29
7	RF Cable	HUBER+SUHNER	SUCOFLEX 106	N/A	2020-05-29
8	RF Cable	HUBER+SUHNER	SUCOFLEX 102	803010/2	2020-10-27
9	RF Cable	HUBER+SUHNER	SUCOFLEX 102	803742/2	2020-10-27
10	RF Cable	HUBER+SUHNER	SUCOFLEX 102	MY2374/2	2020-05-07
11	RF Cable	HUBER+SUHNER	SUCOFLEX 102	MY4728/2	2020-05-07