



FCC BT REPORT

Class II Permissive Change

Applicant Name:	Date of Issue:
Socket Mobile, Inc.	December 26, 2018
	Test Site/Location:
Address:	EMCE Engineering
39700 Eureka Drive	1726 Ringwood Avenue San Jose, California USA
Newark, CA, USA 94560	Report No.: EMCE-R-1812-F001

FCC ID:	LUBMA41
APPLICANT:	Socket Mobile, Inc.
Model:	S800, S840, S860
EUT Type:	Barcode Scanner
Max. RF Output Power:	3.303 dBm (2.139 mW)

Frequency Range:	2402 MHz - 2480 MHz (Bluetooth)
Modulation type	GFSK(Normal), π /4DQPSK and 8DPSK(EDR)
FCC Classification:	FCC Part 15 Spread Spectrum Transmitter
FCC Rule Part(s):	Part 15 subpart C 15.247

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

Steve.In Test Engineer Certification Division

m

Billy Kim Technical Manager Certification Division

This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the EMCE Engineering, Inc..





<u>Version</u>

TEST REPORT NO.	DATE	DESCRIPTION
EMCE-RF-1812-F001	December 26, 2018	- First Approval Report





Table of Contents

1.	GENER	AL INFORMATION
2.	EUT DE	SCRIPTION4
3.	TEST M	ETHODOLOGY
	3.1	EUT CONFIGURATION
	3.2	EUT EXERCISE
	3.3	GENERAL TEST PROCEDURES
	3.4	DESCRIPTION OF TEST MODES
4.	INSTRU	MENT CALIBRATION
5.	FACILIT	IES AND ACCREDITATIONS
	5.1	FACILITIES6
	5.2	EQUIPMENT
6.	ANTEN	IA REQUIREMENTS
7.	MEASU	REMENT UNCERTAINTY
8.	SUMMA	RY OF TEST RESULTS
9.	TEST RI	ESULT9
	9.1	PEAK POWER9
	9.2	BAND EDGES16
	9.3	FREQUENCY SEPARATION / OCCUPIED BANDWIDTH (99% BW)24
	9.4	NUMBER OF HOPPING FREQUENCY
	9.5	TIME OF OCCUPANCY (DWELL TIME)
	9.6	SPURIOUS EMISSIONS44
	9.6. 1	CONDUCTED SPURIOUS EMISSIONS44
	9.6.2	2 RADIATED SPURIOUS EMISSIONS
	9.6.3	8 RADIATED RESTRICTED BAND EDGES
	9.7	POWERLINE CONDUCTED EMISSIONS
10.		LIST OF TEST EQUIPMENT84
11.	ANNEX A	





1. GENERAL INFORMATION

Applicant:	Socket Mobile, Inc.
Address:	39700 Eureka Drive Newark, CA, USA 94560
FCC ID:	LUBMA41
EUT Type:	Barcode Scanner
Model:	S800, S840, S860
Date(s) of Tests:	November 01, 2018 ~ November 26, 2018
Place of Tests:	EMCE Engineering 1726 Ringwood Avenue San Jose, California USA

Model	S800, S840, S860	
EUT Type	Barcode Scanner	
Power Supply	Adapter DC 5.0 V / Battery 3.7 V	
Frequency Range	2402 MHz - 2480 MHz (Bluetooth)	
Max. RF Output Power:	3.303 dBm (2.139 mW)	
BT Operating Mode	Normal, EDR	
Modulation Type	GFSK(Normal), π/4DQPSK and 8DPSK(EDR)	
Modulation Technique	FHSS	
Number of Channels	79Channels	
Antenna Specification	Antenna type: PCB trace Antenna	
	Peak Gain : 0.36 dBi	

2. EUT DESCRIPTION

*** 15.247 Requirements for Bluetooth transmitter**

• This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following:

- 1) This system is hopping pseudo-randomly.
- 2) Each frequency is used equally on the average by each transmitter.
- 3) The receiver input bandwidths that match the hopping channel bandwidths of their corresponding transmitters
- 4) The receiver shifts frequencies in synchronization with the transmitted signals.

• 15.247(g): The system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this Section 15.247 should the transmitter be presented with a continuous data (or information) stream.

• 15.247(h): 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.





3. TEST METHODOLOGY

The measurement procedure described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) is used in the measurement of the test device.

3.1 EUT CONFIGURATION

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

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3.75 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 8 of ANSI C63.10. (Version: 2013). To record the final measurements, the analyzer detector function was set to CISPR quasi-peak mode and the bandwidth of the spectrum analyzer was set to 120 kHz for frequencies below 1 GHz or 1 MHz for frequencies above 1 GHz. For average measurements above 1 GHz, the analyzer was set to peak detector with a reduced VBW setting(RBW = 1 MHz, VBW = 1/T Hz, where T = Pulse width).

Conducted Antenna Terminal

See Section from 7.8.2 to 7.8.8.(ANSI 63.10-2013)





3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low, mid and high with highest data rate (worst case) is chosen for full testing.

CSR BT Power setting is bleow.

CSR Power setting GFSK		8DPSK	π/4DQPSK	
Ext 255		255	255	
Int 32		104	104	

Note. There is no design change that increases or decreases the output power. A decrease in the power setting configuration.

4. INSTRUMENT CALIBRATION

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

Espectially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2006).

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 1726 Ringwood Avenue, San Jose, CA 95131, USA The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

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





6. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203:

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

* The antennas of this E.U.T are permanently attached.

*The E.U.T Complies with the requirement of §15.203

7. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014.

All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.68
Radiated Disturbance (9 kHz ~ 30 MHz)	3.20
Radiated Disturbance (30 MHz ~ 1 GHz)	4.73
Radiated Disturbance (1 GHz ~ 18 GHz)	5.21
Radiated Disturbance (18 GHz ~ 40 GHz)	5.71





8. SUMMARY OF TEST RESULTS

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
20 dB Bandwidth	§15.247(a)(1)(ii) or (iii)	N/A		PASS
Occupied Bandwidth	N/A	N/A		N/A
Conducted Maximum Peak Output Power	§15.247(b)(1)	< 1 W if ≥ 75 non- overlapping hopping channels used < 0.125 W if < 75 non- overlapping hopping channels used		PASS
Carrier Frequency Separation	§15.247(a)(1)	>25 kHz or >2/3 of the 20dB BW	CONDUCTED	PASS
Number of Hopping Frequencies	§15.247(a)(1)(iii)	≥ 15		PASS
Time of Occupancy	§15.247(a)(1)(iii)	<400 ms		PASS
Conducted Spurious Emissions	§15.247(d)	> 20 dB for all out-of band emissions		PASS
Band Edge(Out of Band Emissions)	§15.247(d)	> 20 dB for all out-of band emissions		PASS
AC Power line Conducted Emissions	§15.207(a)	cf. Section 9.7		PASS
Radiated Spurious Emissions	§15.247(d), 15.205, 15.209	cf. Section 9.6.2		PASS
Radiated Restricted Band Edge	§15.247(d), 15.205, 15.209	cf. Section 9.6.3	KAUIATEU	PASS

NOTE

- 1. Host device use the Approval Single Modular / FCC ID : LUBMA41
- 2. There is no design change that increases or decreases the output power.

A decrease in the power setting configuration.





9. TEST RESULT

9.1 PEAK POWER

LIMIT

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

- For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 W. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 W.
- 2. The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. The Spectrum Analyzer is set to the peak detector mode. This test is performed with hopping off.

The Spectrum Analyzer is set to (7.8.5 in ANSI 63.10-2013)

- 1) Span: approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- 2) RBW > the 20 dB bandwidth of the emission being measured
- 3) VBW ≥ RBW
- 4) Sweep = Auto
- 5) Detector = Peak
- 6) Trace = Max hold

SAMPLE CALCULATION

Output Power = Spectrum Reading Power + Cable loss

= 10 dBm + 0.6 dB = 10.6 dBm

Note :

- 1. Spectrum reading values are not plot data. The power results in plot is already including the actual values of loss for the splitter and cable combination.
- 2. Spectrum offset = Cable loss





TEST RESULTS

No non-compliance noted

Test Data

Channel	Frequency	Output (GF	t Power SK)	Limit	Result	
	(MHZ)	(dBm)	(mW)	(mvv)		
Low	2402	-7.133	0.194		PASS	
Mid	2441	-7.787	0.166	125	PASS	
High	2480	-8.473	0.142		PASS	

Channel	Frequency	Output (8DF	Power PSK)	Output (π/4D0	Power QPSK)	Limit	Result
	(WHZ)	(dBm)	(mW)	(dBm)	(mW)	(mvv)	
Low	2402	3.303	2.139	3.101	2.042		PASS
Mid	2441	2.576	1.810	2.332	1.711	125	PASS
High	2480	1.758	1.499	1.561	1.433		PASS





Test Plots (GFSK) Peak Power (CH.0)

🎉 Keysight Spectrum Analyzer - Swept SA					
K RL RF 50 Ω AC Center Freq 2.402000000	CORREC SEN	NSE:INT SOURCE OFF #Avg Typ	ALIGN AUTO 01:21:0 pe: RMS TI - 1/1	PM Dec 23, 2018 RACE 1 2 3 4 5 6	Frequency
10 dB/div Ref 20.00 dBm	IFGain:Low Atten: 30) dB	Mkr1 2.401 -7.	925 GHz 133 dBm	Auto Tune
10.0					Center Freq 2.402000000 GHz
-10.0				terr and the second states of	Start Freq 2.399653688 GHz
-20.0					Stop Freq 2.404346312 GHz
-40.0					CF Step 469.262 kHz <u>Auto</u> Man
-60.0					Freq Offset 0 Hz
Center 2.402000 GHz #Res BW 3.0 MHz	#VBW 50 MHz		Span	4.693 MHz	
MSG			STATUS	And prov	

Test Plots (GFSK)









Test Plots (GFSK) Peak Power (CH.78)

🎉 Keysight Sp	ectrum Analyzer - Swept SA						
Center F	RF 50 Ω AC req 2.480000000	CORREC GHZ	SENSE:INT SO	URCE OFF AL #Avg Type: Avg Hold: 1	IGN AUTO 0 RMS	1:22:10 PM Dec 23, 2018 TRACE 1 2 3 4 5 6 TYPE M	Frequency
		PNO: Fast +++ IFGain:Low	Atten: 30 dB	Avgirioid. 1	Mkr1 2	AT9 841 GHZ	Auto Tune
10 dB/div Log	Ref 20.00 dBm					-8.473 dBm	
10.0							Center Freq
			♦ ¹				Start Freq 2.477667094 GHz
-10.0	(mandal and a second						
-20.0							Stop Freq 2.482332906 GHz
-30.0							
-40.0							CF Step 466.581 kHz Auto Man
-50.0							
-60.0							Freq Offset 0 Hz
-70.0							
Center 2	480000 GHz					Spap 4 666 MHz	
#Res BW	3.0 MHz	#VBW :	50 MHz	Si	weep 1.00	0 ms (1001 pts)	
MSG					STATUS		

Test Plots (8DPSK)









Test Plots (8DPSK)

Peak Power (CH.39)



Test Plots (8DPSK) Peak Power (CH.78)







Test Plots (π/4DQPSK)

Peak Power (CH.0)



Test Plots (π/4DQPSK) Peak Power (CH.39)







Test Plots (π/4DQPSK)



Report No.: EMCE-R-1812-F001

🎉 Keysight Sp	ectrum Analyzer - Swept SA					
Center F	RF 50 Ω AC req 2.480000000	CORREC GHZ	SENSE:INT SOU	RCE OFF ALIGN AUTO #Avg Type: RMS	01:26:58 PM Dec 23, 2018 TRACE 1 2 3 4 5 6	Frequency
10 dB/div	Ref 20.00 dBm	PNO: Fast ↔→ IFGain:Low	Atten: 30 dB	Mkr1 2.	480 124 26 GHz 1.758 dBm	Auto Tune
10.0			∮ ¹			Center Freq 2.48000000 GHz
-10.0					and a second	Start Freq 2.476730000 GHz
-20.0						Stop Freq 2.483270000 GHz
-40.0						CF Step 654.000 kHz <u>Auto</u> Man
-60.0						Freq Offset 0 Hz
-70.0 Center <u>2.</u>	480000 GHz				Span 6.540 <u>MHz</u>	
#Res BW	3.0 MHz	#VBW 5	50 MHz	Sweep 7	1.000 ms (1001 pts)	
MSG				STATU	s	





9.2 BAND EDGES

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test Configuration



TEST PROCEDURE

This test is performed with hopping off and hopping on.

The Spectrum Analyzer is set to (6.10.4 in ANSI 63.10-2013)

- Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation
- Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level.
- 3) Attenuation: Auto (at least 10 dB preferred).
- 4) Sweep time: Coupled.
- 5) RBW: 100 kHz
- 6) VBW: 300 kHz
- 7) Detector: Peak
- 8) Trace: Max hold





TEST RESULTS

See attached.

Note :

- 1. The results in plot is already including the actual values of loss for the splitter and cable combination.
- 2. Spectrum offset = Power Splitter loss + Cable loss
- 3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. Actual value of loss for the splitter and cable combination is 7.36 dB at 2402 MHz and is 7.44 dB at 2480 MHz. So, 7.4 dB is offset. And the offset gap in the 2.4 GHz range do not affect the band edge measurement final result.
- 4. And the loss of the added RF cable is 0.6dB. So, We applied 8 dB offset.

Test Data

- Without hopping

Outside	CESK			Margin				
Frequency	(dB)			(dBc)	GFSK	8DPSK	π/4DQPSK	Result
Band	(ub)	(ub)	(ub)	(UDC)	(dBc)	(dBc)	(dBc)	
Lower	37.760	47.372	46.631	20	17.76	27.37	26.63	PASS
Upper	38.200	43.125	42.897	20	18.20	23.13	22.90	PASS

- With hopping

Outside	OFOK	NDEK		Limit		Margin		
Frequency	(dD)				GFSK	8DPSK	π/4DQPSK	Result
Band	(UD)	(UD)	(UD)	(авс)	(dBc)	(dBc)	(dBc)	
Lower	37.795	48.851	47.138	20	17.80	28.85	27.14	PASS
Upper	37.152	44.254	43.387	20	17.15	24.25	23.39	PASS

Note :

- 1. The results in plot is already including the actual values of loss for cable
- 2. Spectrum offset = Cable loss





Test Plots without hopping (GFSK)



Test Plots without hopping (GFSK)







Test Plots without hopping (8DPSK)



Test Plots without hopping (8DPSK) Band Edges (CH.78)







Test Plots without hopping (π /4DQPSK)

Band Edges (CH.0)



Test Plots without hopping (π /4DQPSK) Band Edges (CH.78)







Test Plots with hopping (GFSK)



Test Plots with hopping (GFSK)







Test Plots with hopping (8DPSK)

Band Edges (CH.0)



Test Plots with hopping (8DPSK) Band Edges (CH.78)







Test Plots with hopping (π /4DQPSK)

Band Edges (CH.0)



Test Plots with hopping (π /4DQPSK) Band Edges (CH.78)







9.3 FREQUENCY SEPARATION / OCCUPIED BANDWIDTH (99% BW)

LIMIT

According to §15.247(a)(1), Frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

Test Configuration



TEST PROCEDURE

The Channel Separation test is performed with hopping on. And the 20 dB Bandwidth test is performed with hopping off.

The Spectrum Analyzer is set to (7.8.2 in ANSI 63.10-2013)

- 1) Span: Wide enough to capture the peaks of two adjacent channels
- 2) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- 3) VBW ≥ RBW
- 4) Sweep: Auto
- 5) Detector: Peak
- 6) Trace: Max hold
- 7) All the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A plot of the data shall be included in the test report.

TEST RESULTS

No non-compliance noted





Test Data

Cha	annel Separation 20dB Bandwidth (kHz) (kHz)					Limit	Result	
GFSK	8DPSK	π/4DQPSK	Channel	GFSK	8DPSK	π/4DQPSK	(KПZ)	
			Low CH	938.52	1271.20	1264.35	687.68	
1001	996	996	Middle CH	1031.52	1264.92	1275.02	872.00	Pass
		High CH	933.16	1308.00	1234.09	850.02		

Occupied Bandwidth (99% BW)

99% BW (kHz)						
Channel	GFSK	8DPSK	π/4DQPSK			
CH.0	927.89	1184.96	1185.45			
CH.39	950.89	1197.17	1182.58			
CH.78	946.74	1200.75	1182.36			

Note : The device Doesn't support AFH Mode. Device Internal system prevents to AFH Mode.





Test Plots (GFSK)

Channel Separation



Test Plots (8DPSK) Channel Separation







Test Plots (π/4DQPSK)

Channel Separation







Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (CH.0)



Test Plots (GFSK) 20 dB Bandwidth & Occupied Bandwidth (CH.39)







Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (CH.78)



Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.0)







Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.39)



Test Plots (8DPSK) 20 dB Bandwidth & Occupied Bandwidth (CH.78)







Test Plots (π/4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.0)



Test Plots (π/4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.39)







Test Plots (π/4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (CH.78)







9.4 NUMBER OF HOPPING FREQUENCY

LIMIT

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

Test Configuration



TEST PROCEDURE

The Bluetooth frequency hopping function of the EUT was enabled.

The Spectrum Analyzer is set to (7.8.3 in ANSI 63.10-2013)

- 1) Span: the frequency band of operation
- 2) RBW: 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.
- 3) VBW ≥ RBW
- 4) Sweep: Auto
- 5) Detector: Peak
- 6) Trace: Max hold
- 7) Allow the trace to stabilize.

TEST RESULTS

No non-compliance noted

Test Data

	Result (No. of CH)	1	Descrit		
GFSK	8DPSK	π/4DQPSK	Limit	Result	
79	79	79	>15	Pass	

Note : In case of AFH mode, Doesn't support.





Test Plots (GFSK)



Test Plots (GFSK)







Test Plots (8DPSK)



Test Plots (8DPSK)







Test Plots (π/4DQPSK)



Test Plots (π/4DQPSK)






9.5 TIME OF OCCUPANCY (DWELL TIME)

LIMIT

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

Test Configuration



TEST PROCEDURE

This test is performed with hopping off.

EUT was set to transmit the longest packet type (DH5)

The Spectrum Analyzer is set to (7.8.4 in ANSI 63.10-2013)

- 1) Span: Zero span, centered on a hopping channel
- 2) RBW shall be \leq channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
- 3) Sweep = as necessary to capture the entire dwell time per hopping channel
- 4) Detector: Peak
- 5) Trace: Max hold

The marker-delta function was used to determine the dwell time.

Sample Caculation

Normal Mode / EDR Mode

DH 5(The longest packet type for GFSK) CH Mid : 2.900 * (1600/6)/79 * 31.6 = 309.33 (ms) **2-DH 5**(The longest packet type for π/4DQPSK) CH Low :2.920 * (1600/6)/79 * 31.6 = 311.47 (ms) **3-DH 5**(The longest packet type for 8DPSK) CH Mid : 2.910 * (1600/6)/79 * 31.6 = 310.4 (ms)





Note :

A DH5 Packet need 5 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/6 hops per second with 79 channels. So the system have each channel 3.3755 times per second and so for 31.6 seconds the system have 106.667 times of appearance. Each tx-time per appearance of DH5 is 2.900 ms.

Dwell time = Tx-time * 106.667 = 309.33 (ms)

TEST RESULTS

See the table.

	Channel	GFSK	8DPSK	π/4DQPSK
Pulse	Low	2.900	2.920	2.900
Time	Mid	2.900	2.900	2.910
(ms)	High	2.900	2.910	2.910

Normal Mode / EDR Mode

	Channel	GFSK	8DPSK	π/4DQPSK	Period Time (s)	Limit (ms)	Result
Total of Dwell (ms)	Low	309.33	311.47	309.33	31.60		PASS
	Mid	309.33 309.33		310.40	31.60	400	PASS
	High	309.33	310.40	310.40	31.60		PASS





Test Plots (GFSK)



Marker ALIGN AUTO 0.22234 PMDec 23, 2018 Marker Marker 1 & 2.90000 ms PNO: Fast +	鱦 Keysight Sj	pectrum Analyzer - Swept SA						- F ×
Marker 1 Δ 2.90000 ms Trig: Free Run Trig: Free Run Trig: Free Run Trig: Free Run State State <td>IXI T</td> <td>RF 50 Ω AC</td> <td>CORREC</td> <td>SENS</td> <td>INT SOURCE OFF</td> <td>ALIGN AUTO</td> <td>02:22:34 PM Dec 23, 2018</td> <td>Marker</td>	IXI T	RF 50 Ω AC	CORREC	SENS	INT SOURCE OFF	ALIGN AUTO	02:22:34 PM Dec 23, 2018	Marker
Pho: Fast Img. The Kull Det Kull Select Marker Select Marker Select Marker Select Marker Morrial 10 dB/dliv Ref 10.00 dBm 2.83 dB Normal Normal Normal Delta Delt	Marker '	1 Δ 2.90000 ms		Tria: Erec F	#Av	g Type: RMS	TRACE 1 2 3 4 5 6	marker
Line Billion AMikr1 2.900 ms 2.83 dB Select Marker 1 10 gB/div Ref 10.00 dBm 2.83 dB Normal 10 gB/div Ref 10.00 dBm 1Δ2 Delta 10 gB/div X2 Delta Delta 10 gB/div Home Span 0 Hz Span 0 Hz 10 dB/div Home Sweep 10.00 ms (1001 pts)			PNO: Fast +++	#Atten: 20 d	in i		DET P NNNN	
10 dB/div Ref 10.00 dBm 2.83 dB 1 000 100 100 100 100 100 100 100 100 100 100 100 100 100 1		_	IFGall.LOW					Select Marker
10 dE/div Ref 10.00 dBm 2.83 dE 000 10 d 10 d 10 d 100 10 d 10 d 10 d 100 10 d 10 d 10 d 10 d 100 10 d 10 d 10 d 10 d 10 d 100 10 d 10 d 10 d 10 d 10 d 10 d 100 10 d						4	AMKI1 2.900 ms	1
Log 1Δ2 Normal 100 X2 Delta 200 X2 Delta 200 Delta Delta 200 De	10 dB/div	Ref 10.00 dBm					2.83 dB	
000 100								
000 102 102 102 100 1								
100 X2 1Δ2 Delta 200 X2 Delta Delta 300 X2 Delta Delta 400 X4 X4 X4 X4 400 X4 X4 X4 <td< td=""><td>0.00</td><td></td><td></td><td></td><td></td><td></td><td></td><td>Norma</td></td<>	0.00							Norma
100 2				<u></u> Δ2				
100 2 1	40.0	107		<u> </u>				
200 Delta 200	-10.0	X2						
200 0 300 0 400 0 4								Delta
300 300 300 300 300 300 300 300 300 300	-20.0							
300 Image: Sector S								
400 Image: Constraint of the second of t	.30.0							
40.0 40.0	0.0.0							Fixed
4400 4404								TIACUP
-50.0 -60.0 -70.0 -80.0 -	-40.0	a dan bank		ا بيوال بر ا	يد الليا ال	المحمد الملط ألما الم	الأوريا ليوارف سالم	
-60.0 -60.0 -60.0 -60.0 -60.0 -60.0 -60.0 -70.0 <t< td=""><td>φris, γe</td><td>l Martin Mart</td><td></td><td>¥ ተሰጓሞበት የ</td><td>an an a</td><td>ulada Alifford Alifebratic</td><td>a wa Mahari wa Kata Wali Mali</td><td></td></t<>	φ ris , γ e	l Martin Mart		¥ ተሰጓሞበት የ	an a	ulada Alifford Alifebratic	a wa Mahari wa Kata Wali Mali	
-e0 0 -e0 0 -	-50.0	·						
-000 -000								ОП
-2000 -								
-700 Image: Conter 2.402000000 GHz #VBW 3.0 MHz Sweep 10.00 ms (1001 pts)	-60.0							
200 Properties▶ 400 Properties▶								
Center 2.402000000 GHz #VBW 3.0 MHz Sweep 10.00 ms (1001 pts)	-70.0							Properties►
-80.0 Center 2.402000000 GHz Span 0 Hz Sweep 10.00 ms (1001 pts)								
Center 2.402000000 GHz Res BW 1.0 MHz #VBW 3.0 MHz Sweep 10.00 ms (1001 pts)	90.0							
Center 2.402000000 GHz Res BW 1.0 MHz #VBW 3.0 MHz Sweep 10.00 ms (1001 pts)	-00.0							
Center 2.402000000 GHz Span 0 Hz 1 of 2 Res BW 1.0 MHz #VBW 3.0 MHz Sweep 10.00 ms (1001 pts) 1								More
Res BW 1.0 MHz #VBW 3.0 MHz Sweep 10.00 ms (1001 pts)	Contor 2	40200000 CHz					Span 0 Hz	1 of 2
MSG SWEEP TOOTHIS (TOOT DIS)	Dec BW	1 0 MHz	#VBW			Swoop	Spair 0 HZ	
MSG STATUS	Kes DW	INVINITI2	#4044	WINZ		oweep	10.00 ms (100 r pts)	
	MSG					STATL	IS	

Test Plots (GFSK)

Dwell Time (CH.39)







Test Plots (GFSK) Dwell Time (CH.78)

🎉 Keysight Spectrum Analyzer - Swept SA					- F ×
X T RF 50 Ω AC CORR Marker 1 Δ 2.90000 ms	EC SEN	SE:INT SOURCE OFF #Avg Typ	ALIGN AUTO 02:23:57 I e: RMS TRA	PM Dec 23, 2018 CE 1 2 3 4 5 6	Marker
PN0 IFG8	D: Fast ↔ Trig: Free ain:Low #Atten: 20	Run dB	۳ ۱	PE WWWWWW DET PNNNNN	Select Marker
10 dB/div Ref 10.00 dBm			ΔMkr1 2	2.900 ms 1.68 dB	1
					Normal
.10.0		1∆2			
-20.0	2				Delta
-30.0					
-40.0					Fixed⊳
an and the first of the state o		Warthality	nyalasi dadarah pelahatan dal	Alen Housen and Alen	
-50.0					Off
-80.0					_
-70.0					Properties►
-80.0					More
Center 2.480000000 GHz	#VBM 3.0 MHz		Sween 10.00 mc	Span 0 Hz (1001 pts)	1 of 2
MSG	##B##"3.0 MH2		STATUS	(Toor pis)	

Test Plots (8DPSK)

Dwell Time (CH.0)







Test Plots (8DPSK)

Dwell Time (CH.39)



Test Plots (8DPSK) Dwell Time (CH.78)







Test Plots (π/4DQPSK)



Test Plots (π/4DQPSK)

Dwell Time (CH.39)







Test Plots (π/4DQPSK)







9.6 SPURIOUS EMISSIONS

9.6.1 CONDUCTED SPURIOUS EMISSIONS

Test Requirements and limit, §15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.205(c)).

Limit : 20 dBc

Test Configuration



TEST PROCEDURE

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

The transmitter output is connected to the spectrum analyzer.

The Spectrum Analyzer is set to (7.8.8 in ANSI 63.10-2013)

- 1) Span: 30 MHz to 10 times the operating frequency in GHz.
- 2) RBW: 100 kHz
- 3) VBW: 300 kHz
- 4) Sweep: Coupled
- 5) Detector: Peak

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

This test is performed with hopping off.





TEST RESULTS

No non-compliance noted.

Note : In order to simplify the report, attached plots were only the worst case channel and data rate.

Freq(MHz)	Factor(dB)	Freq(MHz)	Factor(dB)	
30	20.53	11000	21.59	
100	20.71	12000	21.72	
200	20.61	13000	21.84	
300	20.56	14000	21.79	
400	20.62	15000	21.91	
500	20.55	16000	22.06	
600	20.66	17000	22.12	
700	20.57	18000	22.28	
800	20.63	19000	22.32	
900	20.61	20000	22.44	
1000	20.59	21000	22.57	
2000	20.78	22000	22.71	
2400*	20.82	23000	22.97	
2500*	20.91	24000	22.81	
3000	20.93	25000	22.93	
4000	21.01			
5000	21.37			
6000	21.13			
7000	21.41			
8000	21.28			
9000	21.51			
10000	21.61			

Note : 1. '*' is fundamental frequency range.

2. Factor = Cable loss + Attenuator loss + Spectrum loss + EUT Cable loss





Test Plots (GFSK)- 30 MHz - 1 GHz Spurious Emission (CH.0)



Test Plots (GFSK)- 1 GHz – 3 GHz Spurious Emission (CH.0)







Test Plots(GFSK)- 3 GHz - 5 GHz

Spurious En	niss	ion	(C	<u>Ж.</u>	0)	
	and an	1.1.0			0	

🊺 Ke	ysight Spe	ctrum A	nalyzer - Sv	vept SA									
LXI R	L	RF	50 \$	2 AC	CORREC		SEN	SE:INT SOUR	CE OFF	ALIGN AUT	0 01:54:34	PM Dec 23, 2018	Frequency
Cen	iter Fr	eq 4	.0000	00000	GHZ PNO: Fai		Trig: Free	Run	#Avg Typ Avg Hold:	e: RM 5 : 1/1			
					IFGain:Lo	w	Atten: 20	dB				DET PPPPP	
										М	kr1 4.80	4 25 GHz	Auto Tune
10 di	B/div	Ref	10.00	dBm							-39.	553 dBm	
Log													
													Center Freq
0.00	<u> </u>												4.000000000 GHz
-10.0	——												
													Start Freq
-20.0													3.000000000 GHz
-30.0												-29.66 dBm	Oton From
												1	StopFreq
-40 O												•	5.000000000 GHz
40.0													
50.0	ور و باللولو و	Lutterar		n altula		il a chui				I	والقريق فالديمين اربار	Luis antibulant trans	CF Step
-30.0		maths	an a	10.15 \$1.1.980	in aller il tellar i	and the first state of the second	i <mark>alamin'ny</mark> a	a na a si na s	1967 1969 1979 1979	illial, its of , is,	lan staten in service	Lobel Mitcheller Mersen fre	200.000000 MHz
	1997 B.	Sec. 1	a di Katalaya	u ddablar pu	on soldblir (diddynau	Kanadina Maa	<mark>alite pice a</mark> ter	dentication frateday	nooplaticated of	en de la competencia de la c	o justice and international distance	fal desse som fels of	<u>Auto</u> Man
-60.0													
													Freq Offset
-70.0													0 Hz
-80.0													
	2												
Ctar	+ 3 000		7							<u> </u>	Ston	5 000 CHz	
#Re	s BW_	100 k	Hz		#	VBW 3	00 kHz		S	weep	192.0 ms	(40001 pts)	
MSG	Deint	s cho:	and: all	traces	aloarod					CT4	2117		
widd (Point	s criar	iged, all	uaces	lieared					514	103		

Test Plots (GFSK)- 5 GHz - 7 GHz







Test Plots(GFSK)- 7 GHz - 9 GHz

Spurious	Emission	(CH.0)

鱦 Ke	ysight Spec	trum Anal	yzer - Swe	pt SA								- # ×
l <mark>XI</mark> R	L	RF	50 Ω	AC	CORREC	SEN	SE:INT SOUR	CE OFF	ALIGN AUT	0 01:54:55 PI	1 Dec 23, 2018	Frequency
Cen	ter Fr	eq 8.(00000	0000	GHz	Teles Free		#Avg Typ	e: RMS	TRAC		Frequency
					PNO: Fast	Atten: 20	dB	Avginoia	: 1/1	DE	T P P P P P P	
_					IFGain:Low	Atten. 20	uD					
									M	kr1 8.202	05 GHz	Autorune
10 di	3/div	Ref 1	0.00 d	Bm						-46.9	45 dBm	
Log												
												Center Freg
n nn												8 00000000 CH7
												8.00000000 8112
-10.0												
												Start Freq
-20.0												7.00000000 GHz
											-29.66 dBm	
-30.0												Stop Freq
												9 00000000 GHz
-40.0								÷.——				
								<u>1</u>				
	it administra	and a starter of			na makia si kilis 👝 i		. n na kandi	han and a s				CF Step
-50.0	and the second			agen de		a service of the second se	Manager and a second		all and the second second		and presenting	200.000000 MHz
	fill the hole	t hilping to	and dia th	inid reliant	The state of the s	Mahani (ang disala	and the state of the	Carles States	in the state of the	رار <mark>از رساندا بار کار استان از رسا</mark> ن از ا	iliti ilitati interista dati per	<u>Auto</u> Man
-60.0												
70.0												Freq Offset
-70.0												0 Hz
-80.0												
	2											
Star	t 7.000	GHz								Stop 9	.000 GHz	
#Re	s BW 1	00 kH	z		#VBW	300 kHz		s	weep	192.0 ms (4	0001 pts)	
			101									
MSG	File	AAA.PN	iG> sav	/ed					STA	IUS		

Test Plots(GFSK)- 9 GHz - 11 GHz Spurious Emission (CH.0)







Test Plots(GFSK) 11 GHz - 13 GHz



Test Plots (GFSK)- 13 GHz – 15 GHz Spurious Emission (CH.0)







Test Plots(GFSK)– 15 GHz - 17 GHz

Spurious Emission (CH.0)



Test Plots(GFSK)- 17 GHz - 19 GHz







Test Plots (GFSK)- 19 GHz - 21 GHz

Spurious	Emission	(CH.0)

📁 Keysight Spectrum Analyzer - Swept SA					- # X
IX RL RF 50 Ω AC Cepter Freq 20 000000 Cepter Freq 20 00000 Cepter Freq 20 0000 Cep		SENSE:INT SOURCE OFF	ALIGN AUTO	01:55:57 PM Dec 23, 2018 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast ↔ Trig: F IFGain:Low Atten:	ree Run Avg 20 dB	j Hold: 1/1		Auto Tune
10 dB/div Ref 10.00 dBm			MKr1	-39.937 dBm	
0.00					Center Freq 20.000000000 GHz
-10.0					Start Freq 19.000000000 GHz
-40.0				-29.66 dBm	Stop Freq 21.00000000 GHz
-50.0	i teknisteri kire er er den bis er het sin for het sin bis er het sin bis er het sin bis er het sin bis er het Het den sin bis er er sin sin bis er het sin bis er Het den sin bis er er sin bis er het	n and and de line in an	nen aller i dellan et forsken et f In statistisken et forsken et forsk	n per per anna ann an anna an anna an anna an anna	CF Step 200.000000 MHz <u>Auto</u> Man
-70.0					Freq Offset 0 Hz
2 Start 19.000 GHz	#VDW 200 H		0	Stop 21.000 GHz	
MSG File <aaa.png> saved</aaa.png>	#VBW 300 KF	12	Sweep 19. STATUS	2.0 ms (4000 mpts)	

Test Plots (GFSK)- 21 GHz - 23 GHz







Test Plots (GFSK)- 23 GHz - 25 GHz Spurious Emission (CH.0)

🊺 Ke	ysight Spe	ectrum Analyzer -	Swept SA								
(X) R Cen	⊾ ter Fi	RF 50	Ω AC C 0000000	GHZ	SEI	NSE:INT SOUR	CE OFF	ALIGN AUTO	0 01:56:18 P TRAC	M Dec 23, 2018 DE 1 2 3 4 5 6	Frequency
10 dl	B/div	Ref 10.00) dBm	PNO: Fast ↔ IFGain:Low	Atten: 20) dB	Avg Hold:	Mkı	r1 24.470 -36.8	75 GHz 58 dBm	Auto Tune
Log 0.00											Center Freq 24.00000000 GHz
-10.0 -20.0											Start Freq 23.000000000 GHz
-30.0 -40.0		ktorik attoditis.da	. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	anı. İstinin attıkla addı at	a a ang ang ang ang ang ang ang ang ang	and a state of the second s			an a	-29.66 dBm	Stop Freq 25.000000000 GHz
-50.0	t in own this price of	<mark>na 'an talag sina ang /mark>	<mark>, gi aya ji ayaa ku ahaa /mark>	<mark>an an an Afrikan (kan kan baran an a</mark>	al <mark>hina na kata na m</mark>	nikanija urbijeka kata	llen andere for the state of the		indiana ny kampina amin'ny kaodiminin'ny fanisara dia mandra dia mandra dia mandra dia mandra dia mandra dia ma Ny INSEE dia mampina dia mandra dia	al aig stail is he wanted	CF Step 200.000000 MHz <u>Auto</u> Man
-70.0											Freq Offset 0 Hz
-80.0 Star	2 t 23.0	00 GHz		<i>4</i>) (5) (4)					Stop 25	.000 GHz	
#Re	SBW	TUU KHZ	an word	#VBW	7 300 KHZ		S	weep	192.0 MS (4	ooor pts)	
MSG	File	<aaa.png></aaa.png>	saved					STA	105		





9.6.2 RADIATED SPURIOUS EMISSIONS

LIMIT : §15.247(d), §15.205, §15.209

20dBc in any 100kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency (MHz)	Field Strength Limit (uV/m)	Measurement Distance (m)	Field Strength Limit (dBuV/m)
0.009 – 0.490	2400/F(kHz)	300	(48.5 – 13.8) + 80
0.490 – 1.705	24000/F(kHz)	30	(33.8 – 23.0) + 40
1.705 – 30	30	30	69.5
30-88	100	3	40.0
88-216	150	3	43.5
216-960	200	3	46.0
Above 960	500	3	54

Note.

1. 0.009 ~ 30 MHz measurement distance is 3 meter.

2. 0.009 ~ 30 MHz Limit line = specific Limits (dBuV) + Distance extrapolation factor

3. Used comversion factor : Limit (uV/m) = 20 log(Limit (uV/m)/1 uV/m)





Test Configuration

Below 30 MHz



30 MHz - 1 GHz







Above 1 GHz



TEST PROCEDURE

- 1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
- 2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3.75 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 6. Repeat above procedures until the measurements for all frequencies are complete.
- 7. Spectrum Setting

a. Peak: 1 GHz – 25 GHz, RBW = 1 MHz, VBW ≥3*RBW

b. Average: 1 GHz – 25 GHz, RBW = 1 MHz, VBW \geq 1/T Hz, where T = pulse width in seconds.

Note :

- 1. We are performed the RSE and radiated band edge using standard radiated method.
- 2. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance
- from center of turn table. So, we applied the distance factor(reference distance : 3 m).
- 3. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)





TEST RESULTS

9 kHz – 30MHz

Operation Mode: Normal Mode

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBuV/m	dBm/m	dBm	(H/V)	dBuV/m	dBuV/m	dB
No Critical peaks found							

Notes:

- 1. Measuring frequencies from 9 kHz to the 30MHz.
- 2. The reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
- 3. The measurement distance is 3 meter.
- 4. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)
- 5. Limit line = specific Limits (dBuV) + Distance extrapolation factor
- 6. Corrected reading : Antenna Factor + Cable loss + Read Level
- 7. This test is performed with hopping off.
- 8. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.





TEST RESULTS

Below 1 GHz

Operation Mode: Normal Mode

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBuV/m	dBm/m	dBm	(H/V)	dBuV/m	dBuV/m	dB
No Critical peaks found							

Notes:

- 1. Measuring frequencies from 30 MHz to the 1 GHz.
- 2. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.
- 3. Corrected reading : Antenna Factor + Cable loss Amplifier gain + Read Level
- 4. This test is performed with hopping off.
- 5. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.





Above 1 GHz

S800_[Charging Mode]

Operation Mode: CH Low(GFSK)

Frequer	cy Rea	ding	%A.F.+C.LA.G.+D.F	ANT. POL	Total	Limit	Margin	Measurement
[MHz	[dE	uV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4804	53	8.9	-2.36	Н	51.54	53.98	2.44	AV
4804	53	3.3	-2.36	V	50.94	53.98	3.04	AV
4804	68	3.4	-2.36	Н	66.04	73.98	7.94	PK
4804	68	3.5	-2.36	V	66.14	73.98	7.84	PK

Operation Mode: CH Mid(GFSK)

Frequency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4882	51.6	-2.36	Н	49.24	53.98	4.74	AV
4882	52.2	-2.36	V	49.84	53.98	4.14	AV
4882	67.5	-2.36	н	65.14	73.98	8.84	PK
4882	68.5	-2.36	V	66.14	73.98	7.84	PK

Operation Mode: CH High(GFSK)

Frequency	Reading	%A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4960	53.9	-2.36	Н	51.54	53.98	2.44	AV
4960	53.8	-2.36	V	51.44	53.98	2.54	AV
4960	68.0	-2.36	Н	65.64	73.98	8.34	PK
4960	67.8	-2.36	V	65.44	73.98	8.54	PK

[Battery Mode]

Operation Mode: CH High(GFSK)

Frequency	Reading	%A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4960	52.8	-2.36	Н	50.44	53.98	3.54	AV
4960	52.5	-2.36	V	50.14	53.98	3.84	AV
4960	67.6	-2.36	Н	65.24	73.98	8.74	PK
4960	66.4	-2.36	V	64.04	73.98	9.94	PK

Note. In order to simplify the report, attached battery mode result were only the worst case channel.

Report No.: EMCE-R-1812-F001





Operation Mode: CH Low(8DPSK)

Frequency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4804	43.1	-2.36	Н	40.74	53.98	13.24	AV
4804	40.6	-2.36	V	38.24	53.98	15.74	AV
4804	61.7	-2.36	н	59.34	73.98	14.64	PK
4804	55.7	-2.36	V	53.34	73.98	20.64	PK

Operation Mode: CH Mid(8DPSK)

Frequency	Reading	%A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4882	39.1	-2.36	н	36.74	53.98	17.24	AV
4882	39.8	-2.36	V	36.04	53.98	17.94	AV
4882	53.3	-2.36	н	50.94	73.98	23.04	PK
4882	59.9	-2.36	V	57.54	73.98	16.44	PK

Operation Mode: CH High(8DPSK)

Frequency	Reading	ЖА.Ғ.+С.LА.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4960	40.1	-2.36	Н	37.74	53.98	16.24	AV
4960	40.2	-2.36	V	37.84	53.98	16.14	AV
4960	55.1	-2.36	Н	52.74	73.98	21.24	PK
4960	60.1	-2.36	V	57.74	73.98	16.24	PK

[Battery Mode]

Operation Mode: CH Low(8DPSK)

Frequency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4804	42.5	-2.36	Н	40.14	53.98	13.84	AV
4804	42.9	-2.36	V	40.54	53.98	13.44	AV
4804	58.6	-2.36	н	56.24	73.98	17.74	PK
4804	63.5	-2.36	V	61.14	73.98	12.84	PK





Operation Mode: CH Low(π /4DQPSK)

Frequency	Reading	*A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4804	41.6	-2.36	Н	39.24	53.98	14.74	AV
4804	41.9	-2.36	V	39.54	53.98	14.44	AV
4804	58.0	-2.36	н	55.61	73.98	18.37	PK
4804	61.7	-2.36	V	59.34	73.98	14.64	PK

Operation Mode: CH Mid(π /4DQPSK)

Frequency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4882	40.6	-2.36	н	38.24	53.98	15.74	AV
4882	39.4	-2.36	V	37.04	53.98	16.94	AV
4882	58.9	-2.36	Н	56.54	73.98	17.44	PK
4882	54.0	-2.36	V	51.64	73.98	22.34	PK

Operation Mode: CH High(π/4DQPSK)

Frequency	Reading	ЖА.Ғ.+С.LА.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4960	42.1	-2.36	Н	39.74	53.98	14.24	AV
4960	41.9	-2.36	V	39.54	53.98	14.44	AV
4960	62.5	-2.36	Н	60.14	73.98	13.84	PK
4960	63.3	-2.36	V	60.94	73.98	13.04	PK

[Battery Mode]

Operation Mode: CH High(π/4DQPSK)

Fre	quency	Reading	%A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[]	MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4	960	42.0	-2.36	Н	39.64	53.98	14.34	AV
4	960	40.7	-2.36	V	38.34	53.98	15.64	AV
4	960	63.6	-2.36	н	61.24	73.98	12.74	PK
4	960	59.8	-2.36	V	57.44	73.98	16.54	PK





Operation Mode: CH Low(GFSK)

Fre	equency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
2	4804	44.2	-2.36	Н	41.84	53.98	12.14	AV
2	4804	44.3	-2.36	V	41.94	53.98	12.04	AV
2	4804	59.8	-2.36	н	57.44	73.98	16.54	PK
2	4804	59.3	-2.36	V	56.94	73.98	17.04	PK

Operation Mode: CH Mid(GFSK)

Frequency	Reading	≪A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4882	44.1	-2.36	Н	41.74	53.98	12.24	AV
4882	44.9	-2.36	V	42.54	53.98	11.44	AV
4882	59.1	-2.36	н	56.74	73.98	17.24	PK
4882	59.6	-2.36	V	57.24	73.98	16.74	PK

Operation Mode: CH High(GFSK)

Frequency	Reading	ЖА.Ғ.+С.LА.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4960	44.4	-2.36	Н	42.04	53.98	11.94	AV
4960	46.9	-2.36	V	44.54	53.98	9.44	AV
4960	59.8	-2.36	н	57.44	73.98	16.54	PK
4960	61.6	-2.36	V	59.24	73.98	14.74	PK

[Battery Mode]

Operation Mode: CH Mid(GFSK)

Frequency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4882	43.9	-2.36	Н	41.54	53.98	12.44	AV
4882	40.4	-2.36	V	38.04	53.98	15.94	AV
4882	58.7	-2.36	Н	56.34	73.98	17.64	PK
4882	55.4	-2.36	V	53.04	73.98	20.94	PK





Operation Mode: CH Low(8DPSK)

Frequency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4804	39.6	-2.36	Н	37.24	53.98	16.74	AV
4804	41.1	-2.36	V	38.74	53.98	15.24	AV
4804	54.4	-2.36	н	52.04	73.98	21.94	PK
4804	54.9	-2.36	V	52.54	73.98	21.44	PK

Operation Mode: CH Mid(8DPSK)

Frequency	Reading	%A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4882	39.8	-2.36	н	37.44	53.98	16.54	AV
4882	41.3	-2.36	V	38.94	53.98	15.04	AV
4882	53.3	-2.36	н	50.94	73.98	23.04	PK
4882	53.5	-2.36	V	51.14	73.98	22.84	PK

Operation Mode: CH High(8DPSK)

Frequency	Reading	%A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4960	39.4	-2.36	Н	37.04	53.98	16.94	AV
4960	40.8	-2.36	V	38.44	53.98	15.54	AV
4960	54.9	-2.36	Н	52.54	73.98	21.44	PK
4960	56.5	-2.36	V	54.14	73.98	19.84	PK

[Battery Mode]

Operation Mode: CH Low(8DPSK)

Frequency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4804	38.8	-2.36	Н	36.44	53.98	17.54	AV
4804	39.9	-2.36	V	37.54	53.98	16.44	AV
4804	52.7	-2.36	н	50.34	73.98	23.64	PK
4804	53.4	-2.36	V	51.04	73.98	22.94	PK





Operation Mode: CH Low(π /4DQPSK)

Frequency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4804	40.0	-2.36	Н	37.64	53.98	16.34	AV
4804	40.9	-2.36	V	38.54	53.98	15.44	AV
4804	54.1	-2.36	н	51.74	73.98	22.24	PK
4804	54.8	-2.36	V	52.44	73.98	21.54	PK

Operation Mode: CH Mid(π /4DQPSK)

Frequency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4882	39.9	-2.36	Н	37.54	53.98	16.44	AV
4882	41.4	-2.36	V	39.04	53.98	14.94	AV
4882	53.5	-2.36	Н	51.14	73.98	22.84	PK
4882	55.7	-2.36	V	53.34	73.98	20.64	PK

Operation Mode: CH High(π/4DQPSK)

Frequency	Reading	ЖА.Ғ.+С.LА.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4960	39.8	-2.36	Н	37.44	53.98	16.54	AV
4960	40.2	-2.36	V	37.84	53.98	16.14	AV
4960	54.5	-2.36	Н	52.14	73.98	21.84	PK
4960	56.1	-2.36	V	53.74	73.98	20.24	PK

[Battery Mode]

Operation Mode: CH Mid(π/4DQPSK)

Frequency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4882	41.1	-2.36	Н	38.74	53.98	15.24	AV
4882	42.0	-2.36	V	39.64	53.98	14.34	AV
4882	53.8	-2.36	н	51.44	73.98	22.54	PK
4882	55.0	-2.36	V	52.64	73.98	21.34	PK





Operation Mode: CH Low(GFSK)

Frequency	Reading	% A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4804	52.5	-2.36	н	50.14	53.98	3.84	AV
4804	48.9	-2.36	V	46.54	53.98	7.44	AV
4804	68.5	-2.36	н	66.14	73.98	7.84	PK
4804	63.2	-2.36	V	60.84	73.98	13.14	PK

Operation Mode: CH Mid(GFSK)

Frequency	Reading	≪A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4882	53.5	-2.36	Н	51.14	53.98	2.84	AV
4882	49.4	-2.36	V	47.04	53.98	6.94	AV
4882	69.0	-2.36	Н	66.64	73.98	7.34	PK
4882	58.2	-2.36	V	55.84	73.98	18.14	PK

Operation Mode: CH High(GFSK)

Frequency	Reading	%A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4960	54.3	-2.36	Н	51.94	53.98	2.04	AV
4960	50.0	-2.36	V	47.64	53.98	6.34	AV
4960	68.5	-2.36	н	66.14	73.98	7.84	PK
4960	64.4	-2.36	V	62.04	73.98	11.94	PK

[Battery Mode]

Operation Mode: CH High(GFSK)

Frequency	Reading	*A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4960	46.1	-2.36	Н	43.74	53.98	10.24	AV
4960	49.0	-2.36	V	46.64	53.98	7.34	AV
4960	63.4	-2.36	н	61.04	73.98	12.94	PK
4960	63.1	-2.36	V	60.74	73.98	13.24	PK

Note. In order to simplify the report, attached battery mode result





Operation Mode: CH Low(8DPSK)

Frequency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4804	43.6	-2.36	Н	41.24	53.98	12.74	AV
4804	40.3	-2.36	V	37.94	53.98	16.04	AV
4804	61.3	-2.36	н	58.94	73.98	15.04	PK
4804	54.1	-2.36	V	51.74	73.98	22.24	PK

Operation Mode: CH Mid(8DPSK)

Frequency	Reading	%A.F.+C.L.−A.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4882	41.3	-2.36	н	38.94	53.98	15.04	AV
4882	40.0	-2.36	V	37.64	53.98	16.34	AV
4882	59.6	-2.36	н	57.24	73.98	16.74	PK
4882	56.7	-2.36	V	54.34	73.98	19.64	PK

Operation Mode: CH High(8DPSK)

Frequency	Reading	жА.Ғ.+С.LА.G.+D.Ғ.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4960	39.6	-2.36	Н	37.24	53.98	16.74	AV
4960	39.4	-2.36	V	37.04	53.98	16.94	AV
4960	60.9	-2.36	Н	58.54	73.98	15.44	PK
4960	57.5	-2.36	V	55.14	73.98	18.84	PK

[Battery Mode]

Operation Mode: CH Low (8DPSK)

F	requency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
	[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
	4804	42.7	-2.36	Н	40.34	53.98	13.64	AV
	4804	41.0	-2.36	V	38.64	53.98	15.34	AV
	4804	58.9	-2.36	н	56.54	73.98	17.44	PK
	4804	55.6	-2.36	V	53.24	73.98	20.74	PK





Operation Mode: CH Low(π /4DQPSK)

Frequency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4804	44.2	-2.36	н	41.84	53.98	12.14	AV
4804	42.2	-2.36	V	39.84	53.98	14.14	AV
4804	62.6	-2.36	н	60.24	73.98	13.74	PK
4804	59.7	-2.36	V	57.34	73.98	16.64	PK

Operation Mode: CH Mid(π /4DQPSK)

Frequency	Reading	* A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4882	42.9	-2.36	Н	40.54	53.98	13.44	AV
4882	40.5	-2.36	V	38.14	53.98	15.84	AV
4882	64.8	-2.36	н	62.44	73.98	11.54	PK
4882	59.2	-2.36	V	56.84	73.98	17.14	PK

Operation Mode: CH High(π/4DQPSK)

Frequency	Reading	%A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4960	39.7	-2.36	Н	37.34	53.98	16.64	AV
4960	39.4	-2.36	V	37.04	53.98	16.94	AV
4960	62.5	-2.36	Н	60.14	73.98	13.84	PK
4960	55.7	-2.36	V	53.34	73.98	20.64	PK

[Battery Mode]

Operation Mode: CH Low(π/4DQPSK)

Frequency	Reading	%A.F.+C.LA.G.+D.F.	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dBuV]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
4804	45.3	-2.36	Н	42.94	53.98	11.04	AV
4804	41.8	-2.36	V	39.44	53.98	14.54	AV
4804	65.8	-2.36	н	63.44	73.98	10.54	PK
4804	57.3	-2.36	V	54.94	73.98	19.04	PK





Notes:

- 1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
- 3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- 4. Total = Reading Value + Antenna Factor + Cable Loss Amp Gain + Distance Factor
- 5. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
- 6. Spectrum setting:
 - a. Peak Setting 1 GHz 25 GHz, RBW = 1 MHz, VBW = 3 MHz.
 - b. Average Setting 1 GHz 25 GHz, RBW = 1 MHz, VBW \ge 1/T Hz, where T = pulse width in seconds. We performed using a reduced video BW method was done with the analyzer in linear mode.
- 7. We have done Normal Mode and EDR Mode test.
- 8. This test is performed with hopping off.
- 9. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
- 10. A.F. : Antenna Factor / C.L. : Cable Loss / AMP.G. : Amplifier Gain / D.F. : Distance Factor





RESULT PLOTS (Worst case : X-V) Radiated Spurious Emissions plot – (S860_ Charging Mode GFSK, 2rd Harmonic)



Radiated Spurious Emissions plot – (S860_ Battery Mode GFSK, 2rd Harmonic) [dB(uV/m)]









9.6.3 RADIATED RESTRICTED BAND EDGES

Test Requirements and limit, §15.247(d), §15.205, §15.209

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a) (See section 15.205(c).

S800_[Charging Mode]

Operation Mode

Operating Frequency

Normal(GFSK) 2402 MHz, 2480 MHz

Channel No

annel No CH 0, CH 78							
Frequency	Reading	* A.F.+C.L.+D.F.	Ant. Pol.	Total	Limit	Margin	Measurement
[MHz]	dBuV	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
2390.0	56.1	-12.36	Н	43.74	73.98	30.24	PK
2390.0	42.8	-12.36	Н	30.44	53.98	23.54	AV
2390.0	56.9	-12.36	V	44.54	73.98	29.44	PK
2390.0	42.8	-12.36	V	30.44	53.98	23.54	AV
2483.5	61.9	-11.56	Н	50.34	73.98	23.64	PK
2483.5	45.9	-11.56	Н	34.34	53.98	19.64	AV
2483.5	60.3	-11.56	V	48.74	73.98	25.24	PK
2483.5	45.7	-11.56	V	34.14	53.98	19.84	AV

Operation Mode

EDR(8DPSK)

Operating Frequency

2402 MHz , 2480 MHz

Channel No

CH 0, CH 78

Frequency	Reading	* A.F.+C.L.+D.F.	Ant. Pol.	Total	Limit	Margin	Measurement
[MHz]	dBuV	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
2390.0	57.0	-12.36	Н	44.64	73.98	29.34	PK
2390.0	43.1	-12.36	Н	30.74	53.98	23.24	AV
2390.0	57.8	-12.36	V	45.44	73.98	28.54	PK
2390.0	43.3	-12.36	V	30.94	53.98	23.04	AV
2483.5	75.2	-11.56	Н	63.64	73.98	10.34	PK
2483.5	52.7	-11.56	Н	41.14	53.98	12.84	AV
2483.5	76.1	-11.56	V	64.54	73.98	9.44	PK
2483.5	53.2	-11.56	V	41.64	53.98	12.34	AV

Report No.: EMCE-R-1812-F001



2390.0

2390.0

2390.0

2483.5

2483.5

2483.5

2483.5

Channel No

43.7

59.0

44.1

74.5

52.3

75.4

53.4

-12.36

-12.36

-12.36

-11.56

-11.56

-11.56

-11.56



AV

ΡK

AV

ΡK

AV

ΡK

AV

Operation Mode Operating Frequency				EDR(π/4DC				
				2402 MHz ,	2480 MHz			
Channel No				CH 0, CH 7				
Ĩ								
	Frequency	Reading	* A.F.+CL + D.F.	Ant. Pol.	Total	Limit	Margin	Measurement
	[MHz]	dBuV	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
	2390.0	58.9	-12.36	н	46.54	73.98	27.44	PK

Н

V

V

Н

Н

V

V

S800_[Battery Mode]

Operation Mode Operating Frequency EDR(π/4DQPSK) 2402 MHz , 2480 MHz CH 0, CH 78

31.34

46.64

31.74

62.94

40.74

63.84

41.84

53.98

73.98

53.98

73.98

53.98

73.98

53.98

22.64

27.34

22.24

11.04

13.24

10.14

12.14

Frequency	Reading	* A.F.+CL + D.F.	Ant. Pol.	Total	Limit	Margin	Measurement
[MHz]	dBuV	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
2390.0	59.0	-12.36	Н	46.64	73.98	27.34	PK
2390.0	43.7	-12.36	Н	31.34	53.98	22.64	AV
2390.0	59.6	-12.36	V	47.24	73.98	26.74	PK
2390.0	44.3	-12.36	V	31.94	53.98	22.04	AV
2483.5	73.5	-11.56	Н	61.94	73.98	12.04	PK
2483.5	51.8	-11.56	Н	40.24	53.98	13.74	AV
2483.5	76.1	-11.56	V	64.54	73.98	9.44	PK
2483.5	53.7	-11.56	V	42.14	53.98	11.84	AV





Operation Mode	Normal(GFSK)				
Operating Frequency	2402 MHz, 2480 MHz				
Channel No	CH 0, CH 78	_			

Frequency	Reading	※ A.F.+C.L.+D.F.	Ant. Pol.	Total	Limit	Margin	Measurement
[MHz]	dBuV	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
2390.0	56.9	-12.36	Н	44.54	73.98	29.44	PK
2390.0	42.9	-12.36	Н	30.54	53.98	23.44	AV
2390.0	58.2	-12.36	V	45.84	73.98	28.14	PK
2390.0	43.4	-12.36	V	31.04	53.98	22.94	AV
2483.5	60.7	-11.56	Н	49.14	73.98	24.84	PK
2483.5	45.0	-11.56	Н	33.44	53.98	20.54	AV
2483.5	59.3	-11.56	V	47.74	73.98	26.24	PK
2483.5	44.2	-11.56	V	32.64	53.98	21.34	AV

Operation Mode

Channel No

EDR(8DPSK)

2402 MHz , 2480 MHz

Operating Frequency

CH 0, CH 78

Frequency	Reading	* A.F.+C.L.+D.F.	Ant. Pol.	Total	Limit	Margin	Measurement
[MHz]	dBuV	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
2390.0	57.1	-12.36	Н	44.74	73.98	29.24	PK
2390.0	43.1	-12.36	Н	30.74	53.98	23.24	AV
2390.0	57.7	-12.36	V	45.34	73.98	28.64	PK
2390.0	43.4	-12.36	V	31.04	53.98	22.94	AV
2483.5	75.0	-11.56	Н	63.44	73.98	10.54	PK
2483.5	52.0	-11.56	Н	40.44	53.98	13.54	AV
2483.5	73.2	-11.56	V	61.64	73.98	12.34	PK
2483.5	50.7	-11.56	V	39.14	53.98	14.84	AV





ΡK

AV

ΡK

AV

ΡK

AV

Operation Mode				EDR(π/4DC				
Operating Frequency				2402 MHz ,	2480 MHz			
Channel No			CH 0, CH 7	8				
	Frequency	Reading	* A.F.+CL + D.F.	Ant. Pol.	Total	Limit	Margin	Measurement
	[MHz]	dBuV	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
	2390.0	57.8	-12.36	Н	45.44	73.98	28.54	PK
	2390.0	43.2	-12.36	Н	30.84	53.98	23.14	AV

V

V

Н

Н

V

V

-12.36

-12.36

-11.56

-11.56

-11.56

-11.56

S840_[Battery Mode]

2390.0

2390.0

2483.5

2483.5

2483.5

2483.5

58.1

43.2

74.3

53.2

71.2

50.4

Operation	Mode
-----------	------

Operating Frequency Channel No EDR(π/4DQPSK) 2402 MHz , 2480 MHz

45.74

30.84

62.74

41.64

59.64

38.84

73.98

53.98

73.98

53.98

73.98

53.98

28.24

23.14

11.24

12.34

14.34

15.14

CH 0, CH 78

Frequency	Reading	* A.F.+CL + D.F.	Ant. Pol.	Total	Limit	Margin	Measurement
[MHz]	dBuV	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
2390.0	57.2	-12.36	Н	44.84	73.98	29.14	PK
2390.0	43.1	-12.36	Н	30.74	53.98	23.24	AV
2390.0	57.3	-12.36	V	44.94	73.98	29.04	PK
2390.0	43.5	-12.36	V	31.14	53.98	22.84	AV
2483.5	72.2	-11.56	Н	60.64	73.98	13.34	PK
2483.5	51.3	-11.56	Н	39.74	53.98	14.24	AV
2483.5	71.7	-11.56	V	60.14	73.98	13.84	PK
2483.5	50.9	-11.56	V	39.34	53.98	14.64	AV


2390.0

2390.0

2390.0

2483.5

2483.5

2483.5

2483.5

42.8

57.1

43.1

63.0

44.1

66.9

44.5

-12.36

-12.36

-12.36

-11.56

-11.56

-11.56

-11.56



AV

ΡK

AV

ΡK

AV

ΡK

AV

S860

Ор	eration Moc	Norm	nal(GFSK)					
Ор	erating Free	quency	2402	MHz, 2480	_			
Ch	annel No		CH 0	, CH 78			_	
	Frequency	Reading	* A.F.+C.L.+D.F.	Ant. Pol.	Total	Limit	Margin	Measurement
	[MHz]	dBuV	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
	2390.0	56.5	-12.36	Н	44.14	73.98	29.84	PK

30.44

44.74

30.74

51.44

32.54

55.34

32.94

53.98

73.98

53.98

73.98

53.98

73.98

53.98

23.54

29.24

23.24

22.54

21.44

18.64

21.04

Н

V

V

Н

Н

V

V

Operation Mode

EDR(8DPSK)

Operating Frequency

Channel No

2402 MHz , 2480 MHz CH 0, CH 78

Frequency	Reading	* A.F.+C.L.+D.F.	Ant. Pol.	Total	Limit	Margin	Measurement
[MHz]	dBuV	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
2390.0	56.0	-12.36	Н	43.64	73.98	30.34	PK
2390.0	42.8	-12.36	Н	30.44	53.98	23.54	AV
2390.0	58.8	-12.36	V	46.44	73.98	27.54	PK
2390.0	43.9	-12.36	V	31.54	53.98	22.44	AV
2483.5	72.1	-11.56	Н	60.54	73.98	13.44	PK
2483.5	51.4	-11.56	Н	39.84	53.98	14.14	AV
2483.5	73.7	-11.56	V	62.14	73.98	11.84	PK
2483.5	51.6	-11.56	V	40.04	53.98	13.94	AV





ΡK

AV

ΡK

AV

ΡK

AV

Operation N	Node		EDR(π/4DC	QPSK)			
Operating F	requency		2402 MHz ,				
Channel No)		CH 0, CH 7	8			
Frequency	Reading	* A.F.+CL + D.F.	Ant. Pol.	Total	Limit	Margin	Measurement
[MHz]	dBuV	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	Туре
2390.0	57.1	-12.36	Н	44.74	73.98	29.24	PK
2390.0	43.2	-12.36	Н	30.84	53.98	23.14	AV

V

V

Н

Н

V

V

46.34

31.64

62.74

40.94

61.04

39.84

73.98

53.98

73.98

53.98

73.98

53.98

27.64

22.34

11.24

13.04

12.94

14.14

-12.36

-12.36

-11.56

-11.56

-11.56

-11.56

S860_[Battery Mode]

2390.0

2390.0

2483.5

2483.5

2483.5

2483.5

Frequency

[MHz]

2390.0

2390.0

58.7

44.0

74.3

52.5

72.6

51.4

Operation Mode	EDR(π/4DQPSK)
Operating Frequency	2402 MHz , 2480 MHz
Channel No	CH 0, CH 78

CH 0, CH 78 * A.F.+CL + D.F. Limit Reading Total Margin Measurement Ant. Pol. Туре dBuV [dB] [dBuV/m] [dBuV/m] [dB] [H/V] 58.2 -12.36 Н 45.84 73.98 28.14 PΚ 44.1 -12.36 Н 31.74 53.98 22.24 AV

2390.0	60.1	-12.36	V	47.74	73.98	26.24	PK
2390.0	43.8	-12.36	V	31.44	53.98	22.54	AV
2483.5	72.2	-11.56	Н	60.64	73.98	13.34	PK
2483.5	51.8	-11.56	Н	40.24	53.98	13.74	AV
2483.5	71.9	-11.56	V	60.34	73.98	13.64	PK
2483.5	52.2	-11.56	V	40.64	53.98	13.34	AV

Note. In order to simplify the report, attached battery mode result were only the worst case channel.





Notes:

- 1. Frequency range of measurement = 2483.5 MHz ~ 2500 MHz
- 2. Total = Reading Value + Antenna Factor + Cable Loss + Distance Factor + Amp Gain
- 3. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
- 4. Spectrum setting:
 - a. Peak Setting 1 GHz 25 GHz, RBW = 1 MHz, VBW = 3 MHz.
 - b. Average Setting 1 GHz 25 GHz, RBW = 1 MHz, VBW ≥ 1/T Hz, where T = pulse width in seconds.

We performed using a reduced video BW method was done with the analyzer in linear mode.

- 5. We have done Normal Mode, EDR Mode.
- 6. This test is performed with hopping off.
- 7. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
- 8. Corrected reading : Antenna Factor + Cable loss Amplifier gain + Distance Factor + Read Level







Note : Only the worst case plots for Radiated Restricted Band Edges.

Report No.: EMCE-R-1812-F001





9.7 POWERLINE CONDUCTED EMISSIONS

LIMIT

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolt (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

	Limits (dBµV)						
Frequency Range (MHZ)	Quasi-peak	Average					
0.15 to 0.50	66 to 56	56 to 46					
0.50 to 5	56	46					
5 to 30	60	50					

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

- 1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
- 2. The EUT is connected via LISN to a test power supply.
- 3. The measurement results are obtained as described below:
- 4. Detectors Quasi Peak and Average Detector.

Sample Calculation

Quasi-peak(Final Result) = Reading Value + Correction Factor

Note : We don't perform powerline conducted emission test. Because this EUT is used with vehicle.





S800

[AC Mains (L1)]



Final Results (L1)

Frequency MHz	Readin Line dB(μV		ding μV)	Corr.	Le dB(vel (µV)	Limit dB(µV)		Margin dB	
IVITIZ		QP	CAV	ub	QP	CAV	QP	CAV	QP	CAV
0.185	L1	37.1	21.3	9.6	46.7	30.9	64.5	54.5	17.6	23.4
0.268	L1	29.8	14.4	9.6	39.4	24	61	51	21.8	27.2
0.356	L1	24.8	13.9	9.6	34.4	23.5	57.9	47.9	24.4	25.3
0.624	L1	29.2	23.6	9.6	38.8	33.2	56	46	17.2	12.8
1.103	L1	19.2	13.8	9.7	28.9	23.5	56	46	27.1	22.5
1.105	L1	19.4	13.8	9.7	29.1	23.5	56	46	26.9	22.5
10.513	L1	27.1	19.8	10	37.1	29.8	60	50	22.9	20.2
10.623	L1	26.5	19.5	10	36.5	29.5	60	50	23.5	20.5
10.825	L1	26.4	19.8	10	36.4	29.8	60	50	23.6	20.2





[AC Mains (N)]



Frequency MHz	Line	Reading dB(μV)		Corr.	Le dB(vel (µV)	Lir dB(nit μV)	Ma d	rgin B
101112		QP	CAV	uD	QP	CAV	QP	CAV	QP	CAV
0.187	Ν	38.4	19.3	9.6	48	28.9	64.4	54.4	16.2	25.3
0.28	Ν	32	14.3	9.6	41.6	23.9	61.7	51.7	19.2	26.9
0.376	Ν	27.7	12.8	9.6	37.3	22.4	61	51	21.1	26
0.623	Ν	28.8	17.1	9.6	38.4	26.7	56	46	17.6	19.3
0.937	Ν	20.5	12	9.7	30.2	21.7	56	46	25.8	24.3
0.978	Ν	21.7	12.8	9.7	31.4	22.5	56	46	24.6	23.5
9.848	Ν	30.2	21	10	40.2	31	56	46	19.8	19
10.534	Ν	31.3	21.8	10	41.3	31.8	56	46	18.7	18.2
10.99	Ν	31.7	21.9	10	41.7	31.9	56	46	18.3	18.1

Final Results (N)





S840





Final Results (L1)

Frequency	Line	Reading ine dB(μV)		Corr.	Le dB(vel µV)	Limit dB(µV)		Margin dB	
101112		QP	CAV	ub .	QP	CAV	QP	CAV	QP	CAV
0.185	L1	38.5	22.4	9.6	48.1	32	64.3	54.3	16.2	22.3
0.281	L1	32	16.7	9.6	41.6	26.3	61	51	19.2	24.5
0.373	L1	26.8	16.4	9.6	36.4	26	56	46	22	22.4
0.624	L1	29	23.4	9.6	38.6	33	56	46	17.4	13
0.981	L1	18.6	11	9.7	28.3	20.7	56	46	27.7	25.3
1.094	L1	19.1	13.7	9.7	28.8	23.4	56	46	27.2	22.6
9.879	L1	26	20	10	36	30	60	50	24	20
10.153	L1	26	19.8	10	36	29.8	60	50	24	20.2
10.556	L1	27.3	19.8	10	37.3	29.8	60	50	22.7	20.2





[AC Mains (N)]



Frequency MHz	Line	Reading dB(μV)		Corr.	Le dB(vel (µV)	Lir dB(nit μV)	Ma d	rgin B
101112		QP	CAV	uD	QP	CAV	QP	CAV	QP	CAV
0.188	Ν	38.4	19.7	9.6	48	29.3	64.4	54.4	16.1	24.8
0.281	Ν	32.1	14.6	9.6	41.7	24.2	61	51	19.1	26.6
0.371	Ν	27.7	12.7	9.6	37.3	22.3	58.6	48.6	21.2	26.2
0.622	Ν	28.9	17	9.6	38.5	26.6	56	46	17.5	19.4
0.876	Ν	22.8	14.3	9.7	32.5	24	56	46	23.5	22
1.041	Ν	20.1	11.4	9.7	29.8	21.1	56	46	26.2	24.9
10.605	Ν	31.5	22.1	10	41.5	32.1	56	46	18.5	17.9
10.994	Ν	31.8	22.4	10	41.8	32.4	56	46	18.2	17.6
11.517	Ν	30.7	21.4	10.1	40.8	31.5	56	46	19.2	18.5
12.215	Ν	28.7	20	10.1	38.8	30.1	56	46	21.2	19.9

Final Results (N)







[AC Mains (L1)]



Final Results (L1)

Frequency MHz	Line	Reading Line dB(μV)		Corr.	Le [.] dB(vel µV)	Limit dB(µV)		Margin dB	
101112		QP	CAV	40	QP	CAV	QP	CAV	QP	CAV
0.187	L1	37.3	21.5	9.6	46.9	31.1	65.8	55.8	17.3	23.1
0.279	L1	30.7	16.8	9.6	40.3	26.4	63.2	53.2	20.5	24.4
0.373	L1	25.6	15.2	9.6	35.2	24.8	60.5	50.5	23.2	23.6
0.624	L1	26.8	21.8	9.6	36.4	31.4	60.1	50.1	19.6	14.6
1.068	L1	17.6	12.6	9.7	27.3	22.3	57.5	47.5	28.7	23.7
1.135	L1	17	11.1	9.7	26.7	20.8	56.3	46.3	29.3	25.2
10.701	L1	25.2	19	10	35.2	29	56	46	24.8	21
10.989	L1	26.6	19.7	10	36.6	29.7	56	46	23.4	20.3
11.526	L1	25.6	19	10.1	35.7	29.1	56	46	24.3	20.9





[AC Mains (N)]



Final Results (N)

Frequency MHz	Read Line dB(µ		ding μV)	Corr.	Le [.] dB(vel µV)	Limit dB(μV)		Margin dB	
		QP	CAV	ub	QP	CAV	QP	CAV	QP	CAV
0.185	Ν	37.5	19.6	9.6	47.1	29.2	64	54	17.2	25.1
0.289	Ν	29.7	12.4	9.6	39.3	22	56.3	46.3	21.2	28.5
0.372	Ν	28	13	9.6	37.6	22.6	56	46	20.8	25.8
0.611	Ν	25.3	13.8	9.6	34.9	23.4	56	46	21.1	22.6
1.055	Ν	21.5	12.5	9.7	31.2	22.2	56	46	24.8	23.8
1.08	Ν	21.5	13.3	9.7	31.2	23	56	46	24.8	23
10.515	Ν	30.1	21.3	10	40.1	31.3	56	46	19.9	18.7
11.44	Ν	30.4	21	10.1	40.5	31.1	56	46	19.5	18.9
12.069	Ν	28.4	19.6	10.1	38.5	29.7	56	46	21.5	20.3





10. LIST OF TEST EQUIPMENT

No.	Instrument	Model No.	Due to Calibration	Manufacture	Serial No.
	Signal Analyzer (20 Hz ~ 40.0 GHz)	ESU40	2019-12-20	ROHDE & SCHWARZ	100529
\boxtimes	Signal Analyzer (3 Hz ∼ 40 GHz)	N9030A	2019-02-05	AGILENT	MY53311083
\boxtimes	Power Meter	N1914A	2019-02-05	AGILENT	MY56500009
\boxtimes	Power Sensor	E9304A	2019-02-05	AGILENT	MY55320010
\boxtimes	BI-LOG Antenna (30 MHz ~ 1 GHz)	JB6	2019-06-27	Schwarzbeck	A060916
\boxtimes	Attenuator (20 dB, DC ~ 26.5 GHz)	8493C	2019-12-20	HP	09072
\boxtimes	DC power supply	6655A	2019-02-06	HP	KR94907553
\boxtimes	POWER AMP (1 GHz ~ 18 GHz)	CBL18405045-01	2019-02-05	CERNEX	27973
\boxtimes	POWER AMP (0.3GHz ~ 1GHz)	PAM-103A	2019-02-05	Com-Power Corporation	18020005
\boxtimes	Horn Antenna (1 GHz ~ 18 GHz)	DRH-118	2020-05-24	Sunol	A070516
\boxtimes	Power Divider-2way (DC ~ 26.5 GHz)	11636B	2019-12-20	HP	50820
\boxtimes	Loop Antenna (0.009 ~ 30 MHz)	HLA 6121	2020-08-27	Teseq	43964
	Horn Antenna (18 GHz ~ 40 GHz)	DRH-1840	2019-03-13	Sunol	17120
	POWER AMP (18 GHz ~ 40 GHz)	CBL184050-45-01	2019-02-05	CERNEX,Inc.	43964





11. ANNEX A_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description	
1	EMCE-R-1812-F001-P	