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## **TEST REPORT COVER PAGE**

Product Information								
Product Name /	HANDHELD RADIO	Applicant Company Number:	109U					
Description:								
Model Number(s):	AAH56RDN9RA1AN	UPN Number:	89FT7065					
All Used IC Test Site(s)	2932I-1	SAR Test Lab Company						
Reg. #:		Number:						

Reg. #:	20021 1			umber:	Jonipany			
				nformation	The second second			
	Band 1	Band 2	Band 3	Band 4	Band 5	Band 6	Band 7	Band 8
RSS # & Issue #	RSS-247				100			
	& Issue 1							
Frequency Min (MHz)	2402				10.00			
Frequency Max (MHz)	2480	70			10.00			
RF Power Min (W) Conducted / EIRP / ERP								
RF Power Max (W)	0.0069							
Conducted	- W/				33			
Field Strength Units @	103.6			V				
distance	dBμV/m		1					
	@ 3m			10. 407				
Measured BW (kHz)	1192							
(99%, 26dB, 6dB, etc.)	(99%)			What				
Calculated BW (kHz)	1200							
As per TRC-43								
Emission Classification	1M20G1							
(FID, GID, DID, etc.)	D	200	A STATE OF		1			
Transmitter Spurious Units	48.3	N %		1				
@ distance	dBμV/m	10 K	3 10 11 11	1 - 10				
	(Peak)	11/10	r veger has	100		1		
	@ 3m	100		-125	-37.77			
	В	В	В	В	В	В	В	В
RSS # & Issue #					7 17		_	
Frequency Min (MHz)				0.00				
Frequency Max (MHz)				107.	1			
RF Power Min (W)								
Conducted / EIRP / ERP								
RF Power Max (W)								
Conducted / EIRP / ERP								
Field Strength Units @								
distance								
Measured BW (kHz)								
(99%, 26dB, 6dB, etc.)								
Calculated BW (kHz)								
As per TRC-43								
Emission Classification								
(FID, GID, DID, etc.)								
Transmitter Spurious Units	1			<del> </del>				
@ distance								
w distalice	1	Α.	rooment.	Cianctura			I	
				Signature				\
ATTESTATION: The test m								
the radio equipment identifie					icable test co	naitions spec	cified in the de	epartmenta
standards and all of the requ								
Applicant / Agent Name:	Lim Che	r Hwee		Applicant / Ag			tant Vice Pres	ident
Applicant / Agent Signature:		111		Signature Dat	te:	22 Se	p 2015	

Handheld Radio [ Model : AAH56RDN9RA1AN ] [ FCC ID : AZ489FT7065 & IC : 109U-89FT7065 ]

Motorola Solutions Malaysia Sdn Bhd

PSB Singapore

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FORMAL REPORT ON TESTING IN ACCORDANCE WITH

47 CFR FCC Parts 15B & C RSS-GEN Issue 4: 2014 RSS-247 Issue 1: 2015

OF A

HANDHELD RADIO (BLUETOOTH CLASSIC)

[ Model : AAH56RDN9RA1AN ] [FCC ID : AZ489FT7065 ] [IC : 109U-89FT7065 ]

TEST FACILITY TÜV SÜD PSB Pte Ltd

Electrical & Electronics Centre (EEC), Product Services,

No. 1 Science Park Drive, Singapore 118221

FCC REG. NO. 99142 (3m and 10m Semi-Anechoic Chamber, Science Park)

IND. CANADA REG. NO. 2932I-1 (3m and 10m Semi-Anechoic Chamber, Science Park)

PREPARED FOR Motorola Solutions Malaysia Sdn Bhd

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QUOTATION NUMBER 2191024450

**JOB NUMBER** 7191121792

**TEST PERIOD** 18 Aug 2015 – 28 Sep 2015

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LA-2007-0380-A LA-2007-0384-G LA-2007-0381-F LA-2007-0385-E LA-2007-0382-B LA-2007-0383-G LA-2010-0464-D

The results reported herein have been performed in accordance with the laboratorys terms of accreditation under the Singapore Accreditation Council - Singapore Laboratory Accreditation Scheme. Tests/Calibrations marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our laboratory.



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## **TEST SUMMARY**

The product was tested in accordance with the customer's specifications.

## **Test Results Summary**

Test Standard	Description	Pass / Fail
47 CFR FCC Part 15 & I	RSS-GEN Issue 4: 2014 and RSS-247 Issue 1: 2	2015
15.207 RSS-GEN 8.8	Conducted Emissions	Not Applicable *See Note 5
15.205, 15.209 RSS-GEN 8.9, 8.10	Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)	Pass
15.247(a)(1)	Carrier Frequency Separation	Pass
RSS-247 5.1(2)	Spectrum Bandwidth (20dB and 99% Bandwidth Measurement)	Pass
15.247(a)(1)(iii)	Number of Hopping Frequencies	Pass
RSS-247 5.1(4)	Average Frequency Dwell Time	Pass
15.247(b)(1) RSS-247 5.4(2)	Maximum Peak Power	Pass
15.247(d) RSS-247 5.5	RF Conducted Spurious Emissions	Pass
15.247(d) RSS-247 5.5	Band Edge Compliance (Conducted)	Pass
15.247(d) RSS-247 5.5	Band Edge Compliance (Radiated)	Pass
15.247(e) RSS-102 4.0, RSS-GEN 3.2	Peak Power Spectral Density	Pass



#### **TEST SUMMARY**

#### **Notes**

 Three channels as listed below, which respectively represent the lower, middle and upper channels of the Equipment Under Test (EUT) were chosen and tested. For each channel, the EUT was configured to operate in the test mode.

Transmit Channel	Frequency (GHz)
Channel 0	2.402
Channel 39	2.441
Channel 78	2 480

- 2. All the measurements in section 15.247 were done based on conducted measurements except Band Edge Compliance (Radiated) test.
- 3. The EUT is a Class B device when in non-transmitting state and meets the 47 CFR FCC Part15B Class B requirements.
- 4. All test measurement procedures are according to ANSI C63.4: 2014 and ANSI C63.10: 2013.
- 5. The Equipment Under Test (EUT) is a battery operated device / DC operated device and contains no provision for public utility connections. And the Equipment Under Test (EUT) will be powered off and not operational during charging mode.
- 6. The EUT was tested using fully charged batteries with DC voltage of 7.45V
- 7. 99% Bandwidth Measurement is applicable to RSS-247 only.
- 8. RSS-102 is RSS-102 Issue 4: 2015.
- 9. The unit was also investigated for inter-modulation products between the co-located Bluetooth and the land mobile radios. All inter-modulation products between the co-located radios were found to be compliant to the FCC limits of 15.209 and Industry Canada RSS-GEN.
- The EUT uses a -4dBi internal PIFA which connects to the RF port via a spring contact. The EUT meets requirements of FCC 15.203.

#### **Modifications**

No modifications were made.



#### PRODUCT DESCRIPTION

Description : The Equipment Under Test (EUT) is a **HANDHELD RADIO**.

Manufacturer : Motorola Solutions Malaysia Sdn Bhd

Plot 2, Technoplex Industrial Park Mukim 12 Swd, Medan Bayan Lepas, Bayan Lepas Industrial Park,

11900 Bayan Lepas, Pulau Penang, Malaysia

Model Number : AAH56RDN9RA1AN

FCC ID : AZ489FT7065

IC : 109U-89FT7065

Serial Number : 871TRP0201 (RF Radiated Radio)

871TRP0174 (RF Conducted Radio)

Microprocessor : Ti OMAPL138BZCEA3R

Operating / Transmitting

Frequency

Bluetooth / Bluetooth LE

2.402GHz (lower channel) to 2.480GHz (upper channel) 79 channels (Bluetooth), 40 channels (Bluetooth LE)

WiF

2.412GHz (lower channel) to 2.462GHz (upper channel)

11 channels

Land Mobile

403MHz to 527MHz /Channel Spacing 12.5kHz/25kHz

Clock / Oscillator Frequency : Reference Clock: 38.4 MHz , LO: 806 MHz - 1054 MHz

Modulation : Bluetooth

Gaussian Frequency Shift Keying (GFSK)

(π/4) DQPSK 8DPSK

<u>WiFi</u>

Differential Binary Phase Shift Keying (DBPSK)
Differential Quadrature Phase Shift Keying (DQPSK)

Complementary Code Keying (CCK)
Binary Phase Shift Keying (BPSK)
Quadrature Phase Shift Keying (QPSK)
16-Quadrature Amplitude Modulation (16QAM)
64-Quadrature Amplitude Modulation (64QAM)

Land Mobile

Frequency Modulation (FM)

Antenna Gain : -4.0 dBi (PIFA Antenna)



### PRODUCT DESCRIPTION

(Continued)

Port / Connectors : Refer to manufacturer's user manual / operating manual

Rated Input Power : 7.4Vdc 20.7Wh 2800mAh Lithium ION battery

Accessories : Refer to manufacturer's user manual / operating manual





## SUPPORTING EQUIPMENT DESCRIPTION

Equipment Description (Including Brand Name)	Model, Serial & FCC ID Number	Cable Description (List Length, Type & Purpose)
Fujitsu Laptop	M/N: S6310	Nil
	S/N: R7100269	
	FCC ID: DoC	
Fujitsu AC Adapter	M/N: CP293662-01	1.80m unshielded power cable
	S/N: O6X00399B	
	FCC ID: DoC	
Microsoft Wheel Mouse	M/N: X08-71118	Nil
	S/N: Nil	
	FCC ID: DoC	





#### **EUT OPERATING CONDITIONS**

#### 47 CFR FCC Part 15 & RSS-GEN Issue 4: 2014 and RSS-247 Issue 1: 2015

- 1. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)
- 2. Spectrum Bandwidth (20dB and 99% Bandwidth Measurement)
- 3. Maximum Peak Power
- 4. RF Conducted Spurious Emissions
- 5. Band Edge Compliance (Conducted)
- 6. Peak Power Spectral Density
- 7. Maximum Permissible Exposure

The EUT was exercised by operating in maximum continuous transmission with frequency hopping off, i.e transmitting at lower, middle and upper channels respectively at one time.

### 47 CFR FCC Part 15 & RSS-GEN Issue 4: 2014 and RSS-247 Issue 1: 2015

- 1. Carrier Frequency Separation
- 2. Number of Hopping Frequencies
- 3. Average Frequency Dwell Time
- 4. Band Edge Compliance (Conducted)
- 5. Band Edge Compliance (Radiated)

The EUT was exercised by operating in maximum continuous transmission with frequency hopping on.

SÜD



## **RADIATED EMISSION TEST**

#### 47 CFR FCC Part 15.205 & RSS-GEN 8.10 Restricted Bands

N	ИHz			MHz			MHz			GHz	
0.090	-	0.110	16.42	-	16.423	399.9	-	410	4.5	-	5.15
0.495	-	0.505	16.69475	-	16.69525	608	-	614	5.35	-	5.46
2.1735	-	2.1905	16.80425	-	16.80475	960	-	1240	7.25	-	7.75
4.125	-	4.128	25.5	-	25.67	1300	-	1427	8.025	-	8.5
4.17725	-	4.17775	37.5	-	38.25	1435	-	1626.5	9.0	-	9.2
4.20725	-	4.20775	73	-	74.6	1645.5	-	1646.5	9.3	-	9.5
6.215	-	6.218	74.8	-	75.2	1660	-	1710	10.6	-	12.7
6.26775	-	6.26825	108	-	121.94	1718.8	-	1722.2	13.25	-	13.4
6.31175	-	6.31225	123	-	138	2200	-	2300	14.47	-	14.5
8.291	-	8.294	149.9	-	150.05	2310	-	2390	15.35	-	16.2
8.362	-	8.366	156.52475	7-	156.52525	2483.5	N	2500	17.7	-	21.4
8.37625	-	8.38675	156.7	-	156.9	2690	100	2900	22.01	-	23.12
8.41425	-	8.41475	162.0125	-	167.17	3260	B . 1	3267	23.6	-	24.0
12.29	-	12.293	167.72	-	173.2	3332	- 7	3339	31.2	-	31.8
12.51975	-	12.52025	240	٠,	285	3345.8	-	3358	36.43	-	36.5
12.57675	-	12.57725	322	11/	335.4	3600	-	4400	Ab	ove 38	3.6
13.36	-	13.41		1/							

## 47 CFR FCC Part 15.209 and RSS-GEN 8.9 Radiated Emission Limits

Frequency Range (MHz)	Quasi-Peak Limit Values (dBµV/m)
0.009 - 0.490	20 log [2400 / F (kHz)] @ 300m
0.490 - 1.705	20 log [24000 / F (kHz)] @ 30m
1.705 - 30.0	30.0 @ 30m
30 - 88	40.0 @ 3m
88 - 216	43.5 @ 3m
216 - 960	46.0 @ 3m
Above 960	54.0* @ 3m
For fraguency bands OkHz OOkHz 110kHz 400l	tHz and above 10Hz average detector was use

<sup>\*</sup> For frequency bands 9kHz – 90kHz, 110kHz – 490kHz and above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.

### 47 CFR FCC Part 15.209, RSS-GEN 8.9 and 8.10 Radiated Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date	Cal Interval
R&S Test Receiver – ESI1	ESI40	100010	14 Jul 2016	1 year
Schaffner Bilog Antenna –(30MHz-2GHz)	CBL6112D	2549	29 Jan 2016	1 year
BL3 (Ref)				
ETS Horn Antenna(18GHz-40GHz)(Ref)	3116	0004-2474	02 Oct 2015	1 year
EMCO Horn Antenna(1GHz-18GHz)	3115	0003-6088	20 Apr 2016	1 year
R&S Preamplifier (1GHz -18GHz)	SCU18	102191	13 Mar 2016	1 year
Agilent Preamplifier(1GHz-26.5GHz) (PA18)	8449D	3008A02305	06 Oct 2015	1 year
Com-Power Preamplifier (1MHz-1GHz)	PAM-103	441096	13 Oct 2015	1 year
Micro-Tronics Bandstop Filter (2.4-2.5 GHz)	BRM50701	017	13 Aug 2016	1 year

Motorola Solutions Malaysia Sdn Bhd Handheld Radio [ Model : AAH56RDN9RA1AN ] [ FCC ID : AZ489FT7065 & IC : 109U-89FT7065 ]



#### **RADIATED EMISSION TEST**

#### 47 CFR FCC Part 15.209, RSS-GEN 8.9 and 8.10 Radiated Emission Test Setup

- The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table. For >1GHz measurements, the EUT is raised further to a height of 1.5m with a non-metallic foam block.
- further to a height of 1.5m with a non-metallic foam block.

  The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
- 3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

#### 47 CFR FCC Part 15.209, RSS-GEN 8.9 and 8.10 Radiated Emission Test Method

- 1. The EUT was switched on and allowed to warm up to its normal operating condition.
- A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a
  portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to
  determine which altitude and equipment arrangement produces such emissions.
- 3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
  - a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
  - b. The EUT was then rotated to the direction that gave the maximum emission.
  - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
- 4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point in the range of 9kHz 90kHz, 110kHz 490kHz and above 1GHz, both Peak and Average measurements were carried out.
- 5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
- 6. The frequency range covered was from the lowest radio frequency signal generated from the EUT, without going below 9kHz to 10<sup>th</sup> harmonics of the EUT fundamental frequency, using the loop antenna for frequency below 30MHz, Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

### **Sample Calculation Example**

At 300 MHz Q-P limit =  $46.0 \text{ dB}_{\text{H}}\text{V/m}$ 

Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dBμV/m (Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 46.0 - 40.0 = 6.0 i.e. 6.0 dB below Q-P limit

Motorola Solutions Malaysia Sdn Bhd Handheld Radio [ Model : AAH56RDN9RA1AN ] [ FCC ID : AZ489FT7065 & IC : 109U-89FT7065 ] Page 11 of 93



### **RADIATED EMISSION TEST**

### 47 CFR FCC Part 15.205, 15.209 and RSS-GEN 8.9 and 8.10 Radiated Emission Results

Test Input Power	7.4Vdc	Temperature	22°C
Test Distance	3m (≥30MHz – 25GHz)	Relative Humidity	55%
Modulation	GFSK (Worst)	Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Limit (dBµV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Channel
32.1770	19.1	40.0	20.9	299	350	V	0
93.1360	22.7	43.5	20.8	100	66	Н	0
540.5330	23.8	46.0	22.2	100	7	V	0
600.4030	32.4	46.0	13.6	100	329	V	0
614.5540	26.9	46.0	19.1	100	7.0	V	0
862.7450	25.9	46.0	20.1	202	155	Н	0

Spurious Emissions above 1GHz - 25GHz

Freq (GHz)	Peak Value (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	AV Value (dBμV/m)	AV Limit (dBμV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Ch
1.8602	48.3	74.0	25.7	29.5	54.0	24.5	300	9	V	0
1.9918	45.5	74.0	28.5	29.6	54.0	24.4	100	248	V	0
2.1335	47.3	74.0	26.7	30.9	54.0	23.1	200	354	Η	0
3.6009	44.2	74.0	29.8	42.4	54.0	11.6	300	354	V	0
4.8052	43.5	74.0	30.5	30.8	54.0	23.2	300	9	V	0
11.9993	47.3	74.0	26.7	39.6	54.0	14.4	400	332	V	0

Spurious Emissions above 1GHz - 25GHz

Opanicae Ei	parious Ermosions above Periz Zeoriz									
Freq (GHz)	Peak Value (dΒμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	AV Value (dΒμV/m)	AV Limit (dBμV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Ch
1.4352	47.0	74.0	27.0	27.3	54.0	26.7	400	104	V	39
1.6578	49.0	74.0	25.0	27.2	54.0	26.8	100	317	V	39
1.9918	44.6	74.0	29.4	29.3	54.0	24.7	100	352	V	39
3.6009	44.1	74.0	29.9	41.1	54.0	12.9	300	168	V	39
4.8862	42.7	74.0	31.3	33.5	54.0	20.5	300	221	Н	39
12.2179	48.9	74.0	25.1	40.3	54.0	13.7	400	328	V	39

Spurious Emissions above 1GHz - 25GHz

Freq (GHz)	Peak Value (dΒμV/m)	Peak Limit (dΒμV/m)	Peak Margin (dB)	AV Value (dΒμV/m)	ΑV Limit (dBμV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Ch
1.3238	47.8	74.0	26.2	30.3	54.0	23.7	400	349	V	78
1.5465	47.4	74.0	26.6	28.1	54.0	25.9	400	92	V	78
1.9918	44.2	74.0	29.8	29.2	54.0	24.8	100	247	V	78
3.6009	44.1	74.0	29.9	42.7	54.0	11.3	300	9	V	78
3.9045	43.5	74.0	30.5	36.1	54.0	17.9	200	312	Η	78
4.9673	44.4	74.0	29.6	38.6	54.0	15.4	400	221	Н	78

Motorola Solutions Malaysia Sdn Bhd Handheld Radio [ Model : AAH56RDN9RA1AN ] [ FCC ID : AZ489FT7065 & IC : 109U-89FT7065 ]



#### RADIATED EMISSION TEST

#### **Notes**

- 1. All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
- 2. Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz. The average measurement was done by averaging over a complete cycle of the pulse train, including the blanking interval as the pulse train duration does not exceed 0.1 second.
- 3. A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative" margin indicates a FAIL.
- 4. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:

30MHz - 1GHz

RBW: 100kHz VBW: 1MHz

>1GHz

RBW: 1MHz VBW: 1MHz

- 5. The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators & Section 15.33(b) for unintentional radiators.
- 6. The upper frequency of radiated emission investigations was according to requirements stated in RSS-GEN 6.13.
- 7. The channel in the table refers to the transmit channel of the EUT.
- 8. Radiated Emissions Measurement Uncertainty

All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25GHz is ±4.0dB.





#### **CARRIER FREQUENCY SEPARATION TEST**

#### 47 CFR FCC Part 15.247(a)(1) and RSS-247 5.1(2) Carrier Frequency Separation Limits

The EUT shows compliance to the requirements of this section, which states the adjacent carrier frequencies must be separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, the EUT may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125mW (21dBm).

### 47 CFR FCC Part 15.247(a)(1) and RSS-247 5.1(2) Carrier Frequency Separation Test Instrumentation

Instrument	Model	S/No	Cal Due Date	Cal Interval
Agilent Spectrum Analyzer	E4404B	US39440632	02 Apr 2016	1 year

## 47 CFR FCC Part 15.247(a)(1) Carrier Frequency Separation Test Setup

- 1. The EUT and supporting equipment were set up as shown in the setup photo.
- 2. The power supply for the EUT was connected to a filtered mains.
- 3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
- 4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
- 5. All other supporting equipment were powered separately from another filtered mains.

#### 47 CFR FCC Part 15.247(a)(1) Carrier Frequency Separation Test Method

- 1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with frequency hopping sequence on.
- 2. The start and stop frequencies of the spectrum analyser were set to 2.400GHz and 2.405GHz.
- 3. The spectrum analyser was set to max hold to capture the two adjacent transmitting frequencies within the span. The signal capturing was continuous until no further signals were detected.
- 4. The carrier frequency separation of the two adjacent transmitting / operating frequency was measured by finding the carrier frequency difference between the two adjacent channels.
- 5. The steps 2 to 4 were repeated with the following start and stop frequencies settings:
  - a. 2.438.5GHz to 2.443.5GHz
  - b. 2.478GHz to 2.481GHz



## **CARRIER FREQUENCY SEPARATION TEST**

## 47 CFR FCC Part 15.247(a)(1) and RSS-247 5.1(2) Carrier Frequency Separation Results

Test Input Power	7.4Vdc	Temperature	24°C
Attached Plots	1 – 4	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Liau Lee Yin

Adjacent Channels	Channel Separation (MHz)
0 and 1 (2.402GHz and 2.403GHz)	1.000
38 and 39 (2.440GHz and 2.441GHz)	1.000
39 and 40 (2.441GHz and 2.442GHz)	1.000
77 and 78 (2.479GHz and 2.480GHz)	1.008



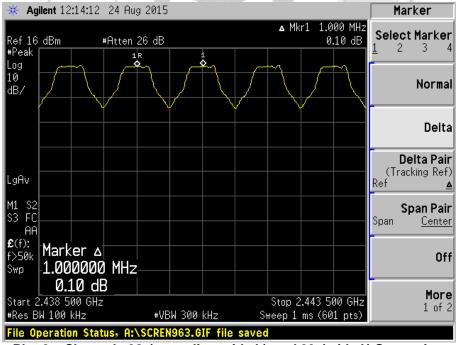


#### **CARRIER FREQUENCY SEPARATION TEST**

#### **Carrier Frequency Separation Plots**



Plot 1 - Channels 0 (lower ch) and 1 (ch after lower ch) Separation

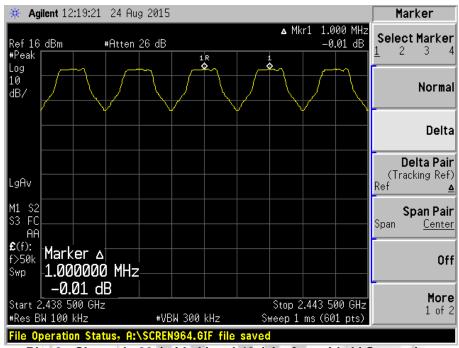


Plot 2 - Channels 38 (preceding mid ch) and 39 (mid ch) Separation

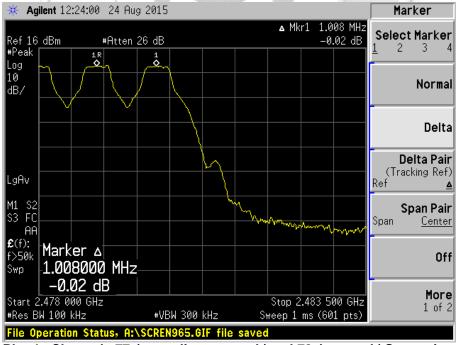


#### **CARRIER FREQUENCY SEPARATION TEST**

#### **Carrier Frequency Separation Plots**



Plot 3 - Channels 39 (mid ch) and 40 (ch after mid ch) Separation



Plot 4 - Channels 77 (preceding upper ch) and 78 (upper ch) Separation



### SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

## 47 CFR FCC Part 15.247(a)(1) and RSS-247 5.1(2) Spectrum Bandwidth (20dB and 99% Bandwidth Measurement) Limits

The EUT shows compliance to the requirements of this section, which states that the 20dB bandwidth of the hopping channel shall be the channel frequency separation by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

## 47 CFR FCC Part 15.247(a)(1) and RSS-247 5.1(2) Spectrum Bandwidth (20dB and 99% Bandwidth Measurement) Test Instrumentation

Instrument	Model	S/No	Cal Due Date	Cal Interval
Agilent Spectrum Analyzer	E4404B	US39440632	02 Apr 2016	1 year

## 47 CFR FCC Part 15.247(a)(1) and RSS-247 5.1(2) Spectrum Bandwidth (20dB and 99% Bandwidth Measurement) Test Setup

- 1. The EUT and supporting equipment were set up as shown in the setup photo.
- 2. The power supply for the EUT was connected to a filtered mains.
- 3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
- 4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 10kHz and 30kHz.
- 5. All other supporting equipment were powered separately from another filtered mains.

## 47 CFR FCC Part 15.247(a)(1) and RSS-247 5.1(2) Spectrum Bandwidth (20dB and 99% Bandwidth Measurement) Test Method

- 1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, non-hopping with transmitting frequency at Channel 0 (2.402GHz) (lower ch).
- 2. The center frequency of the spectrum analyser was set to the transmitting frequency with the frequency span wide enough to capture the 20dB and 99% bandwidth of the transmitting frequency.
- 3. The spectrum analyser was set to max hold to capture the transmitting frequency. The signal capturing was continuous until no further changes were observed.
- 4. The peak of the transmitting frequency was detected with the marker peak function of the spectrum analyser. For 6dB bandwidth measurement, the frequencies below the 20dB peak frequency at lower (f<sub>L</sub>) and upper (f<sub>H</sub>) sides of the transmitting frequency were marked and measured by using the marker-delta function of the spectrum analyser. For 99% bandwidth measurement, the spectrum analyser power measurement was activated with bandwidth measurement as 99%.
- 5. For 6dB bandwidth measurement, the 20dB bandwidth of the transmitting frequency is the frequency difference between the marked lower and upper frequencies,  $|f_H f_L|$ . For 99% bandwidth measurement, the measured 99% bandwidth shown on the spectrum analyser was recorded.
- 1. The steps 2 to 5 were repeated with the transmitting frequency was set to Channel 39 (2.441GHz) *(mid ch)* and Channel 79 (2.480GHz) *(upper ch)* respectively.



## SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

## 47 CFR FCC Part 15.247(a)(1) and RSS-247 5.1(2) Spectrum Bandwidth (20dB and 99% Bandwidth Measurement) Results

Test Input Power	7.4Vdc	Temperature	24°C
Attached Plots (20dB)	5 – 7 (GFSK)	Relative Humidity	60%
	8 – 10 ((π/4) DQPSK)		
	11 – 13 (8DPSK)		
Attached Plots (99%)	14 – 16 (GFSK)	Atmospheric Pressure	1030mbar
,	17 – 19 ((π/4) DQPSK)	·	
	20 – 22 (8DPSK)		
		Tested By	Liau Lee Yin

### **GFSK**

Channel	Channel Frequency (GHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
0 (lower ch)	2.402	0.935	0.888
39 (mid ch)	2.441	0.940	0.861
78 (upper ch)	2.480	0.940	0.885

## (π/4)DQPSK

<b>( · · ·</b>				
	Channel	Channel Frequency (GHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
	0 (lower ch)	2.402	1.358	1.184
	39 (mid ch)	2.441	1.365	1.186
	78 (upper ch)	2.480	1.358	1.181

## 8DPSK

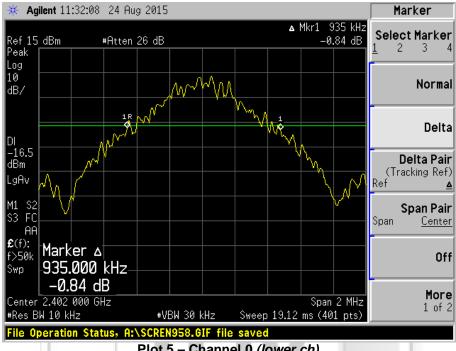
Channel	Channel Frequency (GHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
0 (lower ch)	2.402	1.328	1.189
39 (mid ch)	2.441	1.328	1.181
78 (upper ch)	2.480	1.328	1.192

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### SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

#### Spectrum Bandwidth (20dB Bandwidth Measurement) Plots – GFSK



Plot 5 - Channel 0 (lower ch)

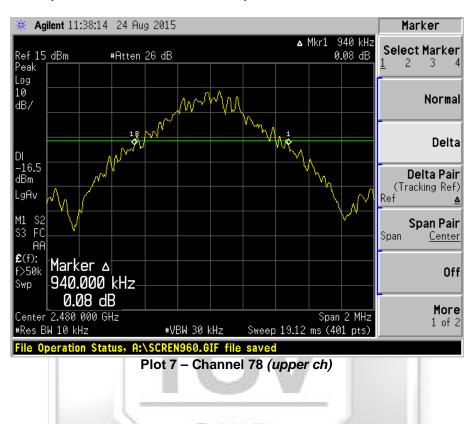


Plot 6 - Channel 39 (mid ch)



## SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

### Spectrum Bandwidth (20dB Bandwidth Measurement) Plots - GFSK

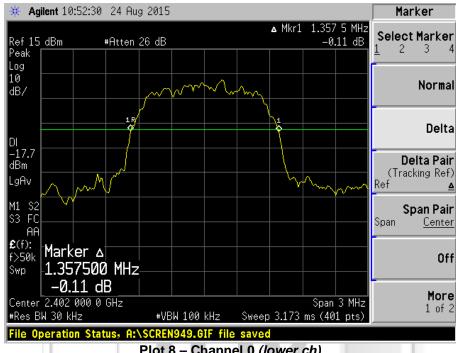


Motorola Solutions Malaysia Sdn Bhd Handheld Radio [ Model : AAH56RDN9RA1AN ] [ FCC ID : AZ489FT7065 & IC : 109U-89FT7065 ]

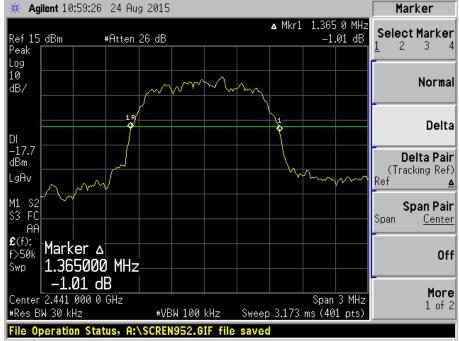


### SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

### Spectrum Bandwidth (20dB Bandwidth Measurement) Plots – (π/4)DQPSK



Plot 8 - Channel 0 (lower ch)

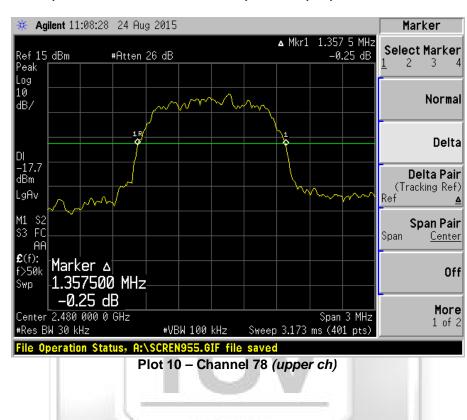


Plot 9 - Channel 39 (mid ch)



### SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

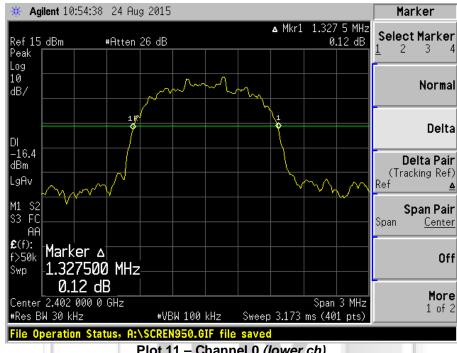
### Spectrum Bandwidth (20dB Bandwidth Measurement) Plots - (π/4)DQPSK





### SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

### Spectrum Bandwidth (20dB Bandwidth Measurement) Plots – 8DPSK



Plot 11 – Channel 0 (lower ch)

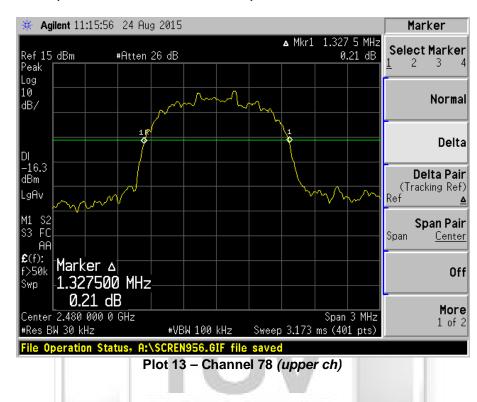


Plot 12 - Channel 39 (mid ch)



## SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

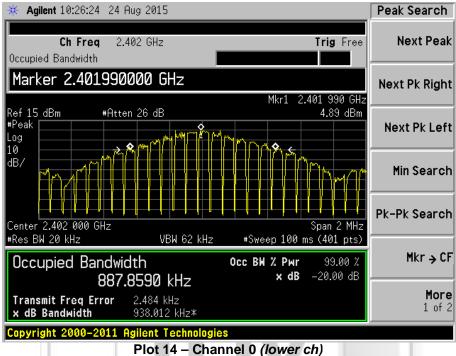
### Spectrum Bandwidth (20dB Bandwidth Measurement) Plots - 8DPSK



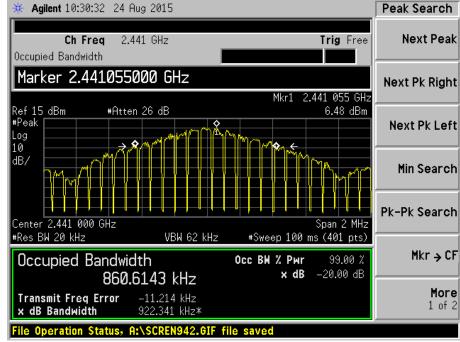


### SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

### Spectrum Bandwidth (99% Bandwidth Measurement) Plots - GFSK



Plot 14 – Channel U (lower cn)

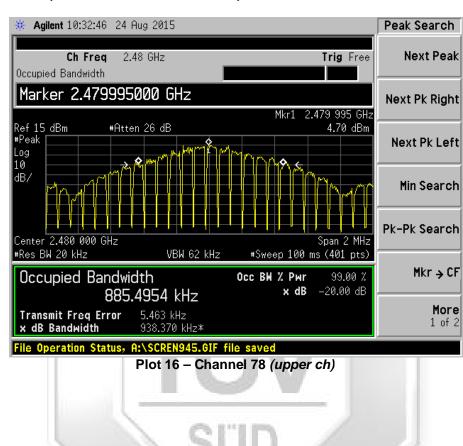


Plot 15 - Channel 39 (mid ch)



#### SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

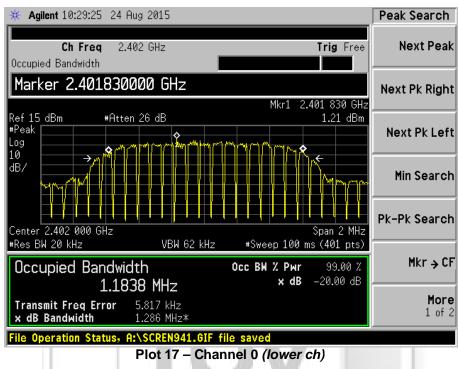
### Spectrum Bandwidth (99% Bandwidth Measurement) Plots - GFSK





#### SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

### Spectrum Bandwidth (99% Bandwidth Measurement) Plots – (π/4)DQPSK



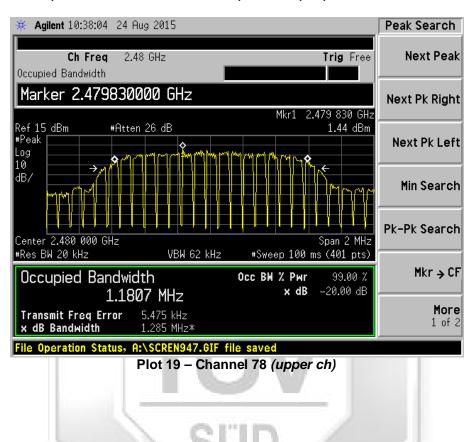
Agilent 10:31:02 24 Aug 2015 Peak Search Next Peak Ch Frea 2.441 GHz Trig Free Occupied Bandwidth Marker 2.440990000 GHz Next Pk Right Mkr1 2.440 990 GHz Ref 15 dBm #Atten 26 dB -0.47 dBm #Peak Next Pk Left .og 10 dB/ Min Search Pk-Pk Search Center 2.441 000 GHz Span 2 MHz #Res BW 20 kHz VBW 62 kHz #Sweep 100 ms (401 pts)  $Mkr \rightarrow CF$ Occupied Bandwidth Occ BW % Pwr 99.00 % x dB -20.00 dB 1.1859 MHz More Transmit Freq Error 7.210 kHz 1 of 2 x dB Bandwidth 1.342 MHz\* A:\SCREN943.GIF file saved

Plot 18 - Channel 39 (mid ch)



### SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

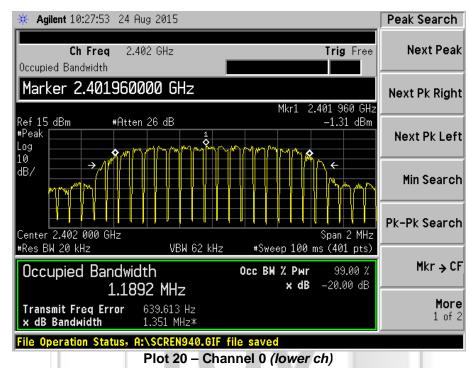
### Spectrum Bandwidth (99% Bandwidth Measurement) Plots - (π/4)DQPSK





### SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

#### Spectrum Bandwidth (99% Bandwidth Measurement) Plots - 8DPSK



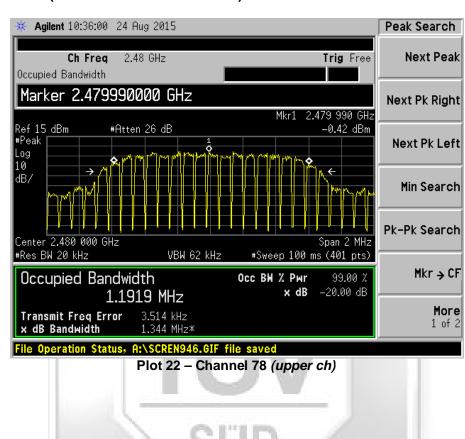
\* Agilent 10:31:51 24 Aug 2015 Peak Search Next Peak Ch Frea 2.441 GHz Trig Free Occupied Bandwidth Marker 2.440835000 GHz Next Pk Right Mkr1 2.440 835 GHz Ref 15 dBm #Atten 26 dB 1.46 dBm #Peak Next Pk Left .og 10 dB/ Min Search Pk-Pk Search Center 2.441 000 GHz #Res BW 20 kHz Span 2 MHz VBW 62 kHz #Sweep 100 ms (401 pts)  $Mkr \rightarrow CF$ Occupied Bandwidth Occ BW % Pwr 99.00 % x dB -20.00 dB 1.1811 MHz More Transmit Freq Error 9.526 kHz 1 of 2 x dB Bandwidth 1.283 MHz\* A:\SCREN944.GIF file saved

Plot 21 - Channel 39 (mid ch)



### SPECTRUM BANDWIDTH (20dB and 99% BANDWIDTH MEASUREMENT) TEST

### Spectrum Bandwidth (99% Bandwidth Measurement) Plots - 8DPSK





#### NUMBER OF HOPPING FREQUENCIES TEST

#### 47 CFR FCC Part 15.247(a)(1)(iii) and RSS-247 5.1(4) Number of Hopping Frequencies Limits

The EUT shows compliance to the requirements of this section, which states the EUT shall use at least 15 channels.

## 47 CFR FCC Part 15.247(a)(1)(iii) and RSS-247 5.1(4) Number of Hopping Frequencies Test Instrumentation

Instrument	Model	S/No	Cal Due Date	Cal Interval
Agilent Spectrum Analyzer	E4404B	US39440632	02 Apr 2016	1 year

#### 47 CFR FCC Part 15.247(a)(1)(iii) and RSS-247 5.1(4) Number of Hopping Frequencies Test Setup

- 1. The EUT and supporting equipment were set up as shown in the setup photo.
- 2. The power supply for the EUT was connected to a filtered mains.
- 3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
- 4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
- 5. All other supporting equipment were powered separately from another filtered mains.

### 47 CFR FCC Part 15.247(a)(1)(iii) and RSS-247 5.1(4) Number of Hopping Frequencies Test Method

- 1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with frequency hopping sequence on.
- 2. The start and stop frequencies of the spectrum analyser were set to 2.390GHz and 2.420GHz.
- 3. The spectrum analyser was set to max hold to capture all the transmitting frequencies within the span. The signal capturing was continuous until all the transmitting frequencies were captured and no further signals were detected.
- 4. The numbers of transmitting frequencies were counted and recorded.
- 5. The steps 2 to 4 were repeated with the following start and stop frequencies settings:
  - a. 2.420GHz to 2.441GHz
  - b. 2.441GHz to 2.461GHz
  - c. 2.461GHz to 2.4835GHz
- 6. The total number of hopping frequencies is the sum of the number of the hopping frequencies found for each span.



### NUMBER OF HOPPING FREQUENCIES TEST

## 47 CFR FCC Part 15.247(a)(1)(iii) and RSS-247 5.1(4) Number of Hopping Frequencies Results

Test Input Power	7.4Vdc	Temperature	24°C
Attached Plots	23 – 26	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Liau Lee Yin

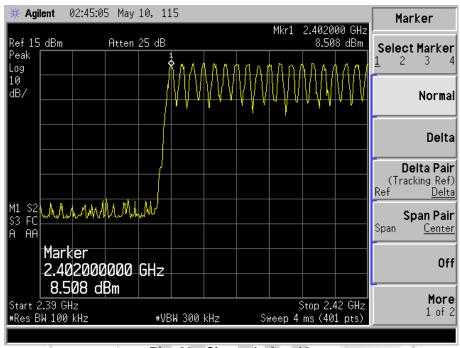
The EUT was found to have 79 hopping frequencies. Please refer to the attached plots.



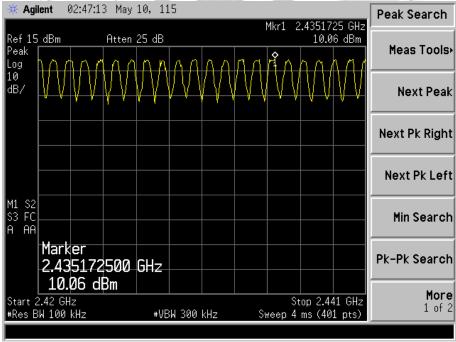


#### NUMBER OF HOPPING FREQUENCIES TEST

#### **Number Of Hopping Frequencies Plots**



Plot 23 - Channels 0 to 18

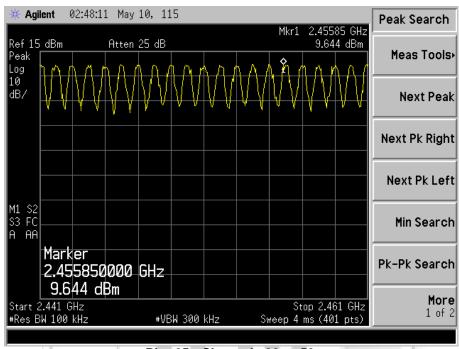


Plot 24 - Channels 18 to 39

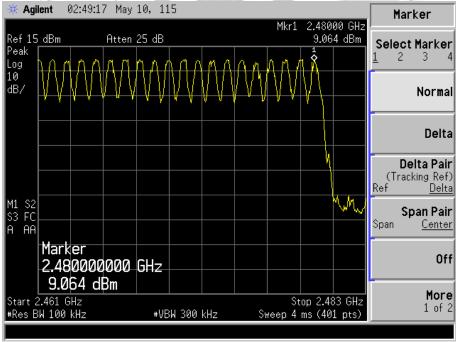


#### NUMBER OF HOPPING FREQUENCIES TEST

#### **Number Of Hopping Frequencies Plots**



Plot 25 - Channels 39 to 59



Plot 26 - Channels 59 to 78



#### AVERAGE FREQUENCY DWELL TIME TEST

#### 47 CFR FCC Part 15.247(a)(1)(iii) and RSS-247 5.1(4) Average Frequency Dwell Time Limits

The EUT shows compliance to the requirements of this section, which states the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

## 47 CFR FCC Part 15.247(a)(1)(iii) and RSS-247 5.1(4) Average Frequency Dwell Time Test Instrumentation

Instrument	Model	S/No	Cal Due Date	Cal Interval
Agilent Spectrum Analyzer	E4404B	US39440632	02 Apr 2016	1 year

### 47 CFR FCC Part 15.247(a)(1)(iii) and RSS-247 5.1(4) Average Frequency Dwell Test Setup

- 1. The EUT and supporting equipment were set up as shown in the setup photo.
- 2. The power supply for the EUT was connected to a filtered mains.
- 3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
- 4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 1MHz and 3MHz.
- 5. All other supporting equipment were powered separately from another filtered mains.

### 47 CFR FCC Part 15.247(a)(1)(iii) and RSS-247 5.1(4) Average Frequency Dwell Test Method

- 1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with frequency hopping sequence on.
- 2. The center frequency of the spectrum analyser was set to 2.402GHz (*lower ch*) with zero frequency span (spectrum analyser acts as an oscilloscope).
- 3. The sweep time of the spectrum analyser was adjusted until a stable signal can be seen on the spectrum analyser.
- 4. The duration (dwell time) of a packet was measured using the marker-delta function of the spectrum analyser. The average dwell time of the transmitting frequency was computed as below:

  Average Frequency Dwell Time = [measured pulse time x hopping rate / number of hopping channels] x [ 0.4 x number of hopping channels ]
- 5. The steps 2 to 4 were repeated with the center frequency of the spectrum analyser were set to 2.441GHz (*mid ch*) and 2.480GHz (*upper ch*) respectively.



#### **AVERAGE FREQUENCY DWELL TIME TEST**

## 47 CFR FCC Part 15.247(a)(1)(iii) and RSS-247 5.1(4) Average Frequency Dwell Time Results

Test Input Power	7.4Vdc	Temperature	24°C
Attached Plots	27 – 29 (DH1)	Relative Humidity	60%
	30 – 32 (DH3)		
	33 – 35 (DH5)		
Hopping Rate	1600 hops / s	Atmospheric Pressure	1030mbar
Number of Hopping	79 channels	Tested By	Liau Lee Yin
Channels			

#### DH1

Channel	Channel Frequency (GHz)	Measured Time Slot Length (ms)	Average Frequency Dwell Time (s)	Average Occupancy Limit (s)
0 (lower ch)	2.402	0.3750	0.1200	0.4
39 (mid ch)	2.441	0.3750	0.1200	0.4
78 (upper ch)	2.480	0.3750	0.1200	0.4

#### DH3

Channel	Channel Channel Measured Time Frequency (GHz) Slot Length (ms)				Average Frequency Dwell Time (s)	Average Occupancy Limit (s)
0 (lower ch)	2.402	1.6300	0.2608	0.4		
39 (mid ch)	2.441	1.6300	0.2608	0.4		
78 (upper ch)	2.480	1.6200	0.2592	0.4		

#### DH5

Channel	Channel Frequency (GHz)	Measured Time Slot Length (ms)	Average Frequency Dwell Time (s)	Average Occupancy Limit (s)
0 (lower ch)	2.402	2.8750	0.3067	0.4
39 (mid ch)	2.441	2.8750	0.3067	0.4
78 (upper ch)	2.480	2.8750	0.3067	0.4

## **Notes**

1. Average Frequency Dwell time = Pulse Time\*(Hop Rate/2/Number of Channels)\*31.6 (DH1)

Pulse Time\*(Hop Rate/2/Number of Channels)\*31.6 (DH1)
Pulse Time\*(Hop Rate/4/Number of Channels)\*31.6 (DH3)
Pulse Time\*(Hop Rate/6/Number of Channels)\*31.6 (DH5)

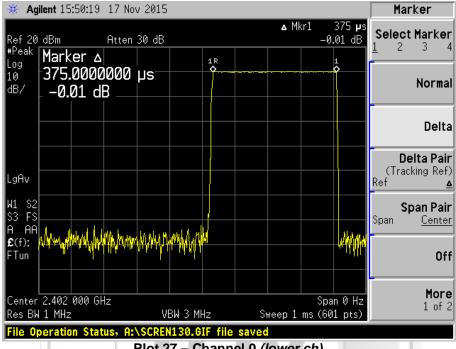
where:

• Hop Rate = 1600

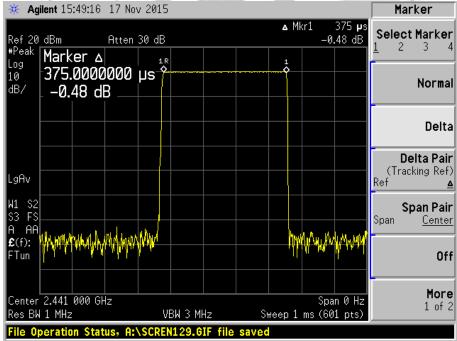
• Number of Channels = 79



#### **AVERAGE FREQUENCY DWELL TIME TEST**



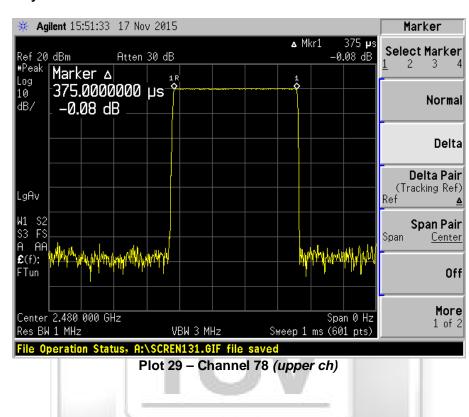
Plot 27 - Channel 0 (lower ch)



Plot 28 - Channel 39 (mid ch)

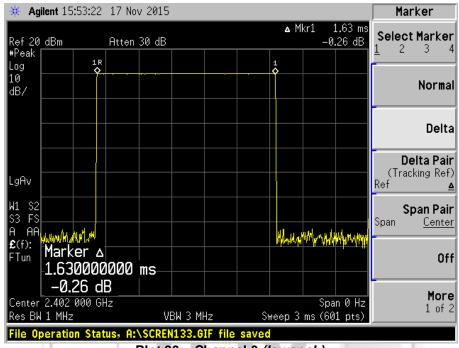


#### **AVERAGE FREQUENCY DWELL TIME TEST**

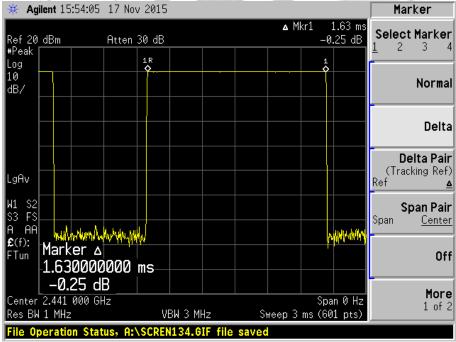




#### **AVERAGE FREQUENCY DWELL TIME TEST**



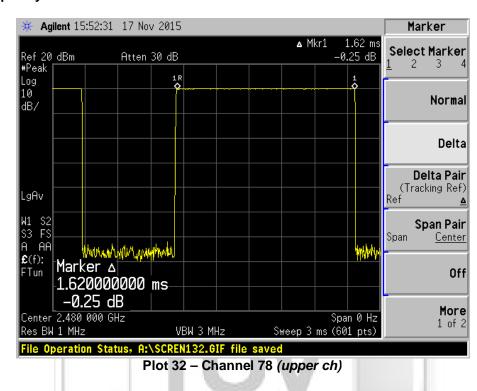
Plot 30 - Channel 0 (lower ch)



Plot 31 - Channel 39 (mid ch)

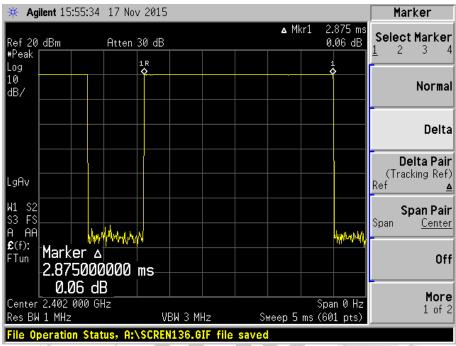


#### **AVERAGE FREQUENCY DWELL TIME TEST**

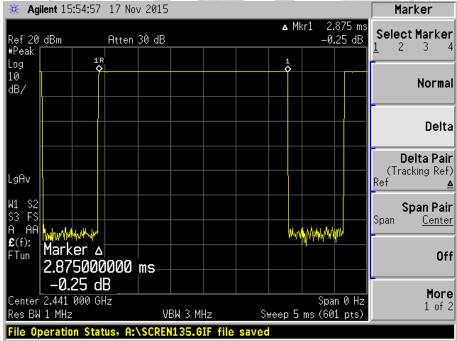




#### **AVERAGE FREQUENCY DWELL TIME TEST**



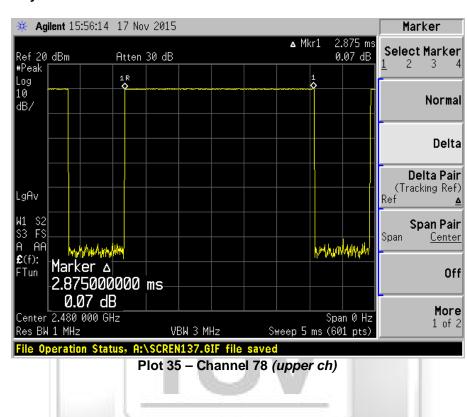
Plot 33- Channel 0 (lower ch)



Plot 34 - Channel 39 (mid ch)



#### **AVERAGE FREQUENCY DWELL TIME TEST**





#### **MAXIMUM PEAK POWER TEST**

#### 47 CFR FCC Part 15.247(b)(1) and RSS-247 5.4(2) Maximum Peak Power Limits

The EUT shows compliance to the requirements of this section, which states the EUT employing at least 75 non-overlapping hopping channels shall not exceed 1W (30dBm). For the EUT employs other frequency hopping systems, the peak power shall not greater than 0.125W (21dBm).

#### 47 CFR FCC Part 15.247(b)(1) Maximum Peak Power Test Instrumentation

Instrument	Model	S/No	Cal Due Date	Cal Interval
Boonton Electronics RF Power Meter	4532	72901	27 Aug 2016	1 year
Boonton Electronics Peak Power Sensor	56218-S/1	1417	27 Aug 2016	1 year

#### 47 CFR FCC Part 15.247(b)(1) and RSS-247 5.4(2) Maximum Peak Power Test Setup

- 1. The EUT and supporting equipment were set up as shown in the setup photo.
- 2. The power supply for the EUT was connected to a filtered mains.
- 3. The RF antenna connector was connected to the Universal Radio Communication Tester, which set into power analyser mode via a low-loss coaxial cable.
- 4. All other supporting equipment were powered separately from another filtered mains.

#### 47 CFR FCC Part 15.247(b)(1) and RSS-247 5.4(2) Maximum Peak Power Test Method

- 1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, non-hopping with transmitting frequency at Channel 0 (2.402GHz) (lower ch).
- 2. The maximum peak power of the transmitting frequency was detected and recorded.
- 3. The Equivalent Isotropic Radiated Power (EIRP) of the EUT was computed by adding its antenna gain to the measured maximum peak power.
- 4. The steps 2 to 3 were repeated with the transmitting frequency was set to Channel 39 (2.441GHz) *(mid ch)* and Channel 78 (2.480GHz) *(upper ch)* respectively.



## **MAXIMUM PEAK POWER TEST**

## 47 CFR FCC Part 15.247(b)(1) and RSS-247 5.4(2) Maximum Peak Power Results

Test Input Power	7.4Vdc	Temperature	24°C
Antenna Gain	-4.0 dBi	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Liau Lee Yin

## **GFSK**

Channel	Channel Frequency (GHz)	Maximum Peak Power (W)	Maximum EIRP (W)	Limit (W)
0 (lower ch)	2.402	0.0069	0.0027	1.0
39 (mid ch)	2.441	0.0066	0.0026	1.0
78 (upper ch)	2.480	0.0068	0.0027	1.0

(π/4) DQPSK

Channel	hannel Channel Maximum Peak Frequency Power (GHz) (W)		Maximum EIRP (W)	Limit (W)	
0 (lower ch)	2.402	0.0036	0.0014	1.0	
39 (mid ch)	2.441	0.0034	0.0014	1.0	
78 (upper ch)	2.480	0.0035	0.0014	1.0	

#### 8DPSK

Channel	Channel Maximum Peak Frequency Power (GHz) (W)		Maximum EIRP (W)	Limit (W)
0 (lower ch)	2.402	0.0037	0.0015	1.0
39 (mid ch)	2.441	0.0034	0.0014	1.0
78 (upper ch)	2.480	0.0035	0.0014	1.0

## **Notes**

1. Nil.

Motorola Solutions Malaysia Sdn Bhd Handheld Radio [ Model : AAH56RDN9RA1AN ] [ FCC ID : AZ489FT7065 & IC : 109U-89FT7065 ]



#### RF CONDUCTED SPURIOUS EMISSIONS TEST

#### 47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

## 47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Test Instrumentation

Instrument	Model	S/No	Cal Due Date	Cal Interval
Agilent Spectrum Analyzer	E7405A	MY45106084	31 Jul 2016	1 year

#### 47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions Test Setup

- 1. The EUT and supporting equipment were set up as shown in the setup photo.
- 2. The power supply for the EUT was connected to a filtered mains.
- 3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
- 4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
- 5. All other supporting equipment were powered separately from another filtered mains.

## 47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions Test Method

- 1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, non-hopping with transmitting frequency at Channel 0 (2.402GHz) (lower ch).
- 2. The start and stop frequencies of the spectrum analyser were set to 30MHz and 10GHz.
- 3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
- 4. The steps 2 to 3 were repeated with frequency span was set from 10GHz to 25GHz.
- 5. The steps 2 to 4 were repeated with the transmitting frequency was set to Channel 39 (2.441GHz) *(mid ch)* and Channel 78 (2.480GHz) *(upper ch)* respectively.



## RF CONDUCTED SPURIOUS EMISSIONS TEST

## 47 CFR FCC Part 15.247(d) and RSS-247 5.5 RF Conducted Spurious Emissions Results

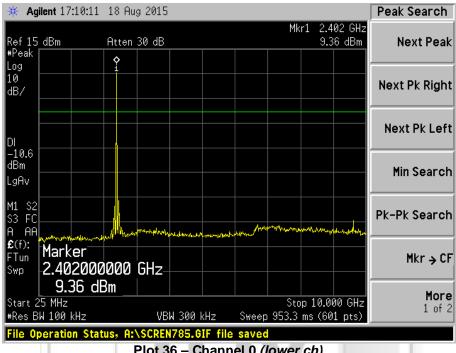
Test Input Power	7.4Vdc	Temperature	24°C
Attached Plots	36 – 41 (GFSK) 42 – 47 ((π/4) DQPSK) 48 – 53 (8DPSK)	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Liau Lee Yin

All spurious signals found were below the specified limit. Please refer to the attached plots.

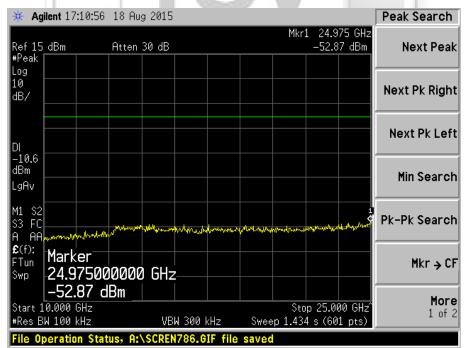




#### RF Conducted Spurious Emissions Plots – GFSK



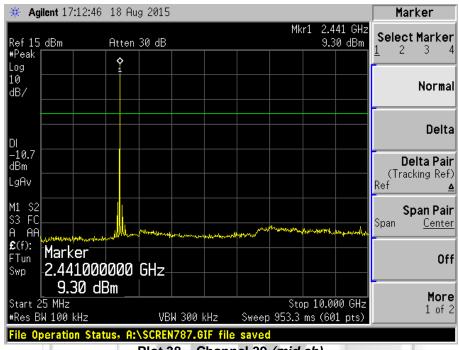
Plot 36 - Channel 0 (lower ch)



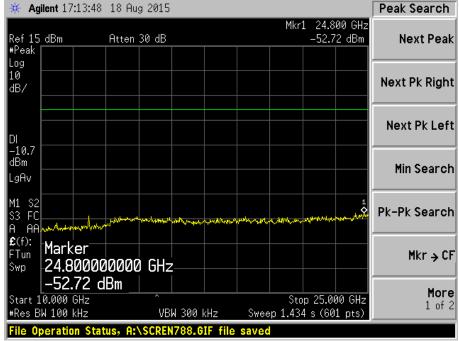
Plot 37 - Channel 0 (lower ch)



#### RF Conducted Spurious Emissions Plots – GFSK



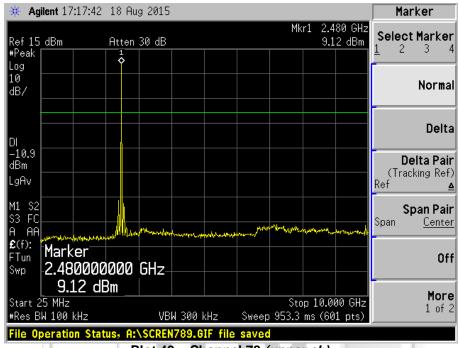
Plot 38 - Channel 39 (mid ch)



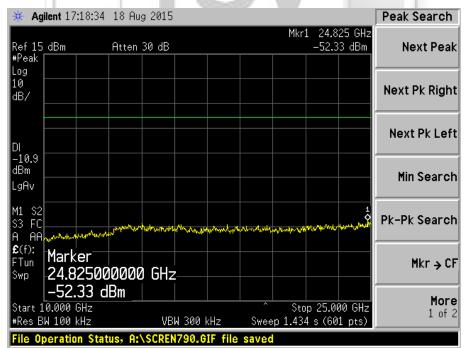
Plot 39 - Channel 39 (mid ch)



#### RF Conducted Spurious Emissions Plots – GFSK



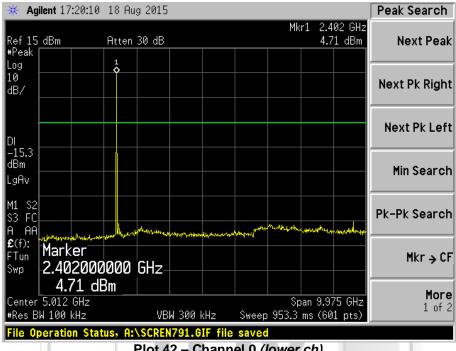
Plot 40 - Channel 78 (upper ch)



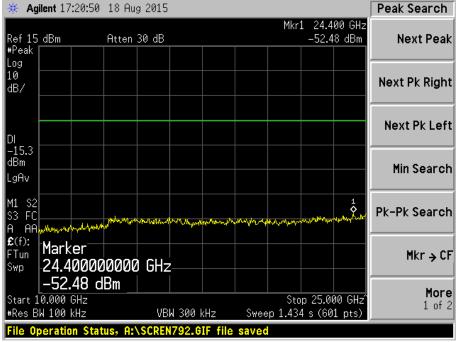
Plot 41 – Channel 78 (upper ch)



#### RF Conducted Spurious Emissions Plots – (π/4)DQPSK



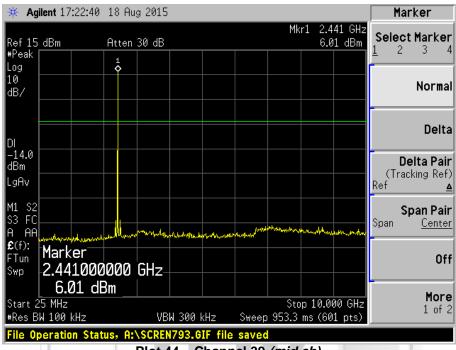
Plot 42 - Channel 0 (lower ch)



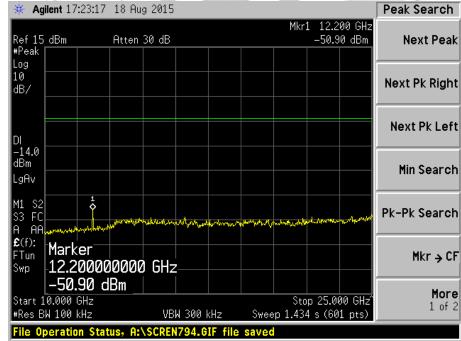
Plot 43 - Channel 0 (lower ch)



#### RF Conducted Spurious Emissions Plots – (π/4)DQPSK



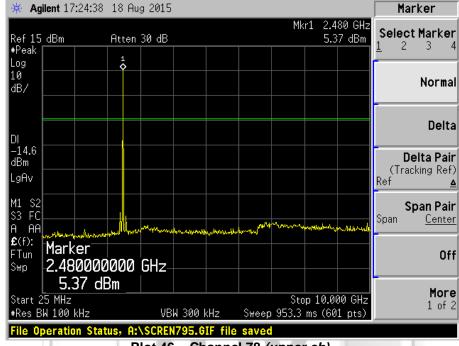
Plot 44 - Channel 39 (mid ch)



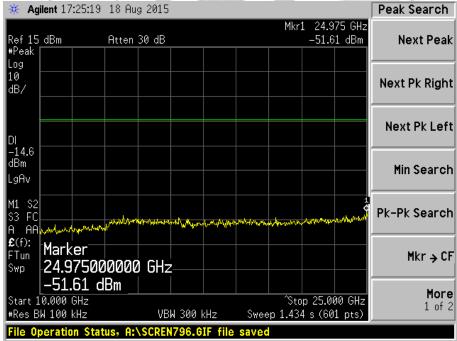
Plot 45 - Channel 39 (mid ch)



#### RF Conducted Spurious Emissions Plots – (π/4)DQPSK



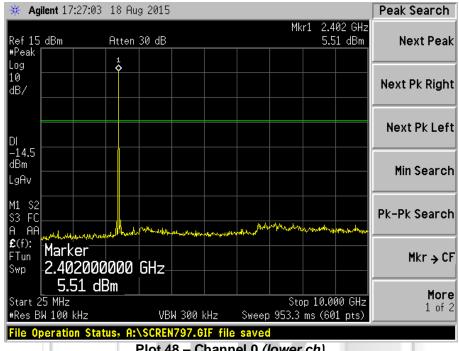
Plot 46 - Channel 78 (upper ch)



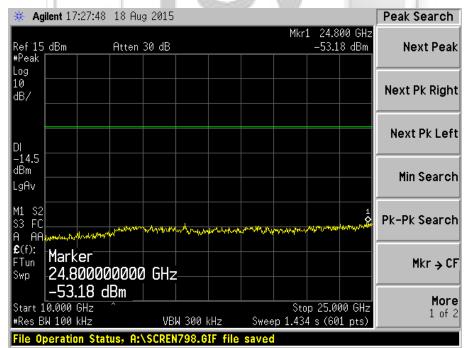
Plot 47 – Channel 78 (upper ch)



#### RF Conducted Spurious Emissions Plots – 8DPSK



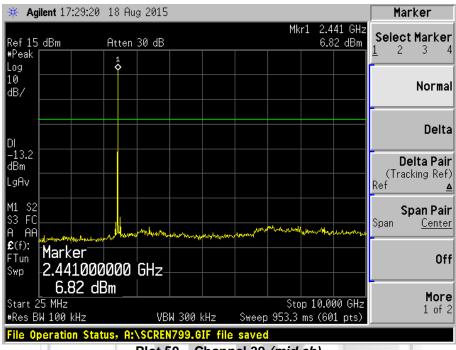
Plot 48 - Channel 0 (lower ch)



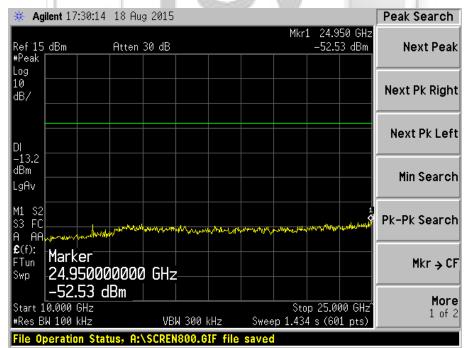
Plot 49 - Channel 0 (lower ch)



#### RF Conducted Spurious Emissions Plots – 8DPSK



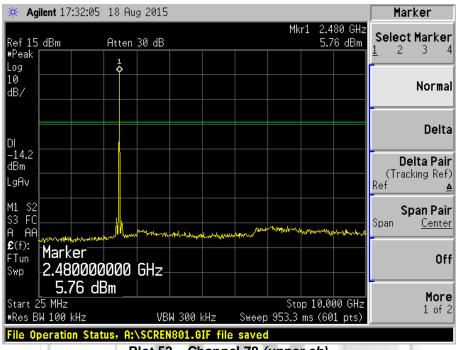
Plot 50 - Channel 39 (mid ch)



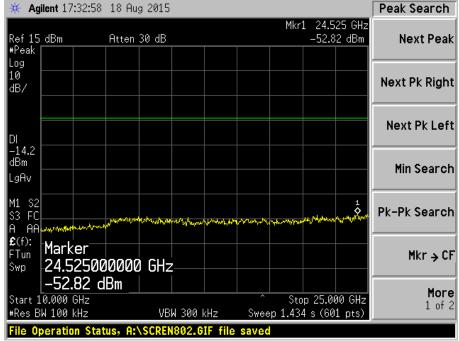
Plot 51 – Channel 39 (mid ch)



#### RF Conducted Spurious Emissions Plots – 8DPSK



Plot 52 - Channel 78 (upper ch)



Plot 53 - Channel 78 (upper ch)



## BAND EDGE COMPLIANCE (CONDUCTED) TEST

#### 47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Conducted) Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

## 47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Conducted) Test Instrumentation

Instrument	Model	S/No	Cal Due Date	Cal Interval
Agilent Spectrum Analyzer	E4404B	US39440632	02 Apr 2016	1 year

#### 47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Conducted) Test Setup

- 1. The EUT and supporting equipment were set up as shown in the setup photo.
- 2. The power supply for the EUT was connected to a filtered mains.
- 3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
- 4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
- 5. All other supporting equipment were powered separately from another filtered mains.

#### 47 CFR FCC Part 15.247(d) and R\$S-247 5.5 Band Edge Compliance (Conducted) Test Method

- 1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with frequency hopping off.
- 2. The frequency span of the spectrum analyser was set to wide enough to capture the lower band edge of the transmission band, 2.400GHz and any spurious emissions at the band edge.
- 3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
- 4. The steps 2 to 3 were repeated with the frequency span of the spectrum analyser was set to wide enough to capture the upper band edge frequency of the transmission band, 2.4835GHz and the any spurious emissions at the band-edge.
- 5. The steps 2 to 4 were repeated with the EUT configured to operate in the test mode with frequency hopping on.



## **BAND EDGE COMPLIANCE (CONDUCTED) TEST**

## 47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Conducted) Results

Test Input Power	7.4Vdc	Temperature	24°C
Attached Plots	54 – 55 (GFSK) 56 – 57 ((π/4) DQPSK) 58 – 59 (8DPSK)	Relative Humidity	60%
Remark	Non-Hopping	Atmospheric Pressure	1030mbar
		Tested By	Liau Lee Yin

No significant signal was found and they were below the specified limit.

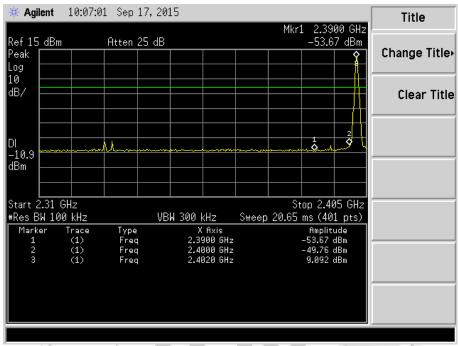
Test Input Power	7.4Vdc	Temperature	24°C
Attached Plots	60 – 61 (GFSK) 62 – 63 ((π/4) DQPSK) 64 – 65 (8DPSK)	Relative Humidity	60%
Remark	Hopping	Atmospheric Pressure	1030mbar
		Tested By	Liau Lee Yin

No significant signal was found and they were below the specified limit.

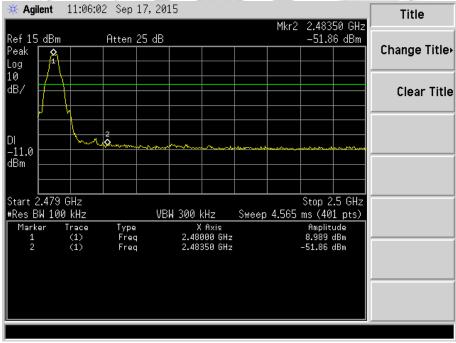




## Band Edge Compliance (Conducted) Plots - GFSK (Non-Hopping)



Plot 54 - Lower Band Edge at 2.4000GHz



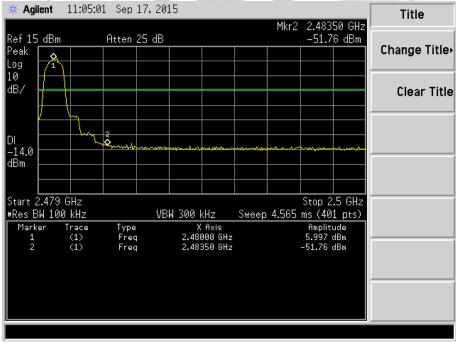
Plot 55 - Upper Band Edge at 2.4835GHz



## Band Edge Compliance (Conducted) Plots – (π/4)DQPSK (Non-Hopping)



Plot 56 - Lower Band Edge at 2.4000GHz



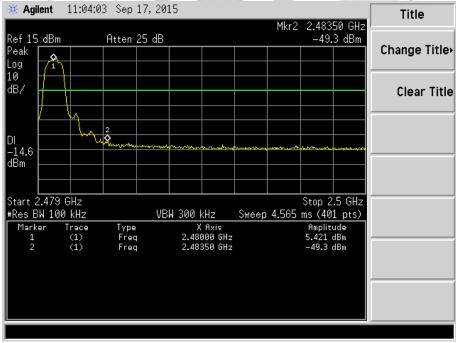
Plot 57 - Upper Band Edge at 2.4835GHz



## Band Edge Compliance (Conducted) Plots – 8DPSK (Non-Hopping)



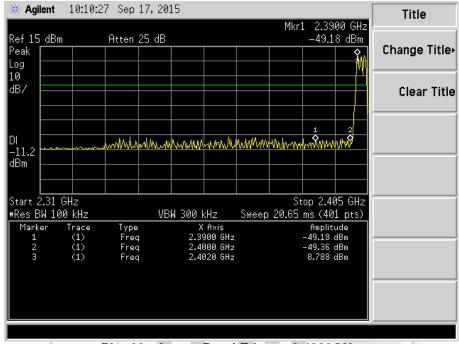
Plot 58 - Lower Band Edge at 2.4000GHz



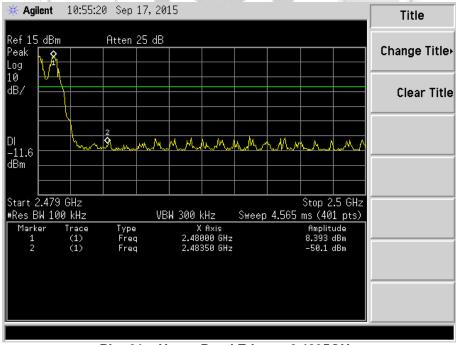
Plot 59 - Upper Band Edge at 2.4835GHz



## Band Edge Compliance (Conducted) Plots - GFSK (Hopping)



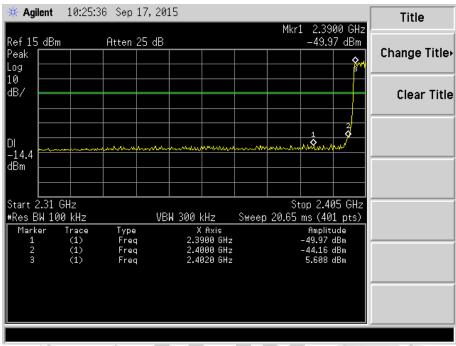
Plot 60 - Lower Band Edge at 2.4000GHz



Plot 61 - Upper Band Edge at 2.4835GHz



## Band Edge Compliance (Conducted) Plots – (π/4)DQPSK (Hopping)



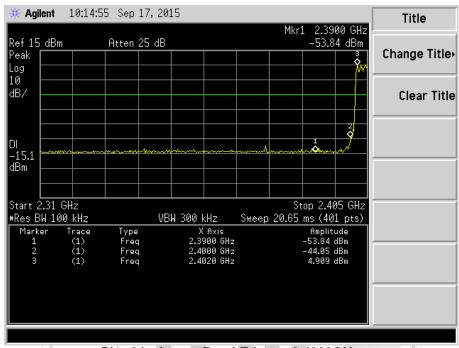
Plot 62 - Lower Band Edge at 2.4000GHz



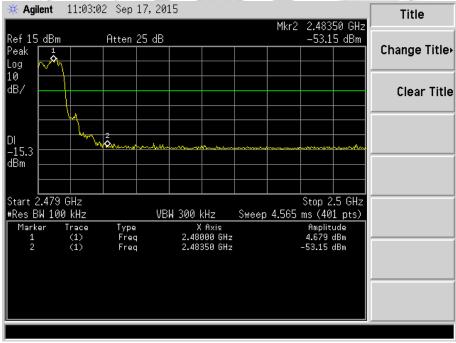
Plot 63 – Upper Band Edge at 2.4835GHz



## Band Edge Compliance (Conducted) Plots – 8DPSK (Hopping)



Plot 64 - Lower Band Edge at 2.4000GHz



Plot 65 - Upper Band Edge at 2.4835GHz



## BAND EDGE COMPLIANCE (RADIATED) TEST

#### 47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Radiated) Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power. In addition, radiated emissions which fall in the restricted bands shall comply to the radiated emission limits specified in 15.209.

#### 47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Radiated) Test Instrumentation

Instrument	Model	S/No	Cal Due Date	Cal Interval
R&S Test Receiver – ESI1	ESI40	100010	14 Jul 2016	1 year
EMCO Horn Antenna(1GHz-18GHz)	3115	0003-6088	20 Apr 2016	1 year
R&S Preamplifier (1GHz -18GHz)	SCU18	102191	13 Mar 2016	1 year

## 47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Radiated) Test Setup

- 1. The EUT and supporting equipment were set up as shown in the setup photo.
- 2. The power supply for the EUT was connected to a filtered mains.
- 3. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz to show compliance of spurious at band edges are at least 20dB below the carriers. For restricted band spurious at band edges, peak and average measurement plots were taken using the following setting:
  - a. Peak Plot:
    - RBW = VBW = 1MHz
  - b. Average Plot
    - RBW = 1MHz, VBW = 30Hz
- 4. All other supporting equipment were powered separately from another filtered mains.

#### 47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Radiated) Test Method

- 1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with frequency hopping sequence on.
- 2. The frequency span of the spectrum analyser was set to wide enough to capture the lower band edge of the transmission band, 2.400GHz and any spurious emissions at the band edge.
- 3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
- 4. The steps 2 to 3 were repeated with the frequency span of the spectrum analyser was set to wide enough to capture the upper band edge frequency of the transmission band, 2.4835GHz and the any spurious emissions at the band-edge.



## BAND EDGE COMPLIANCE (RADIATED) TEST

## 47 CFR FCC Part 15.247(d) and RSS-247 5.5 Band Edge Compliance (Radiated) Results

Test Input Power	7.4Vdc	Temperature	24°C
Attached Plots	66 – 71	Relative Humidity	60%
Modulation	8DPSK (Worst)	Atmospheric Pressure	1030mbar
		Tested By	Lim Kay Tak
		-	Li Chaoming

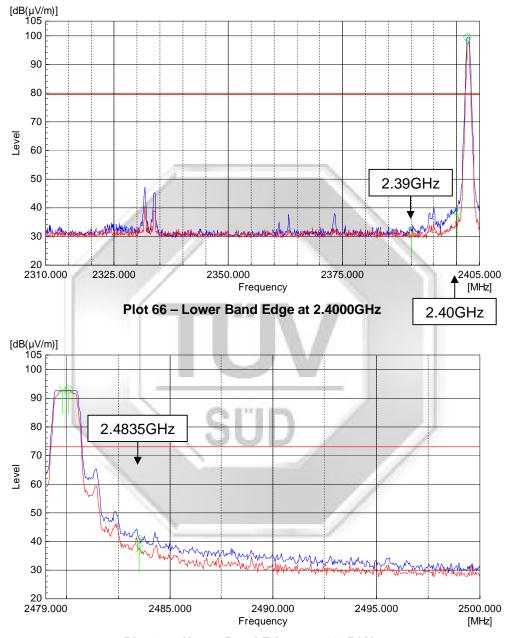
No significant signal was found and they were below the specified limit.





## BAND EDGE COMPLIANCE (RADIATED) TEST

## Band Edge Compliance (Radiated) Plots (20dB Delta from Carrier at Band Edge) - 8DPSK (Worst)

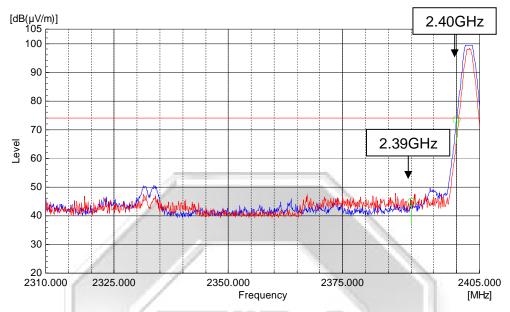


Plot 67 - Upper Band Edge at 2.4835GHz

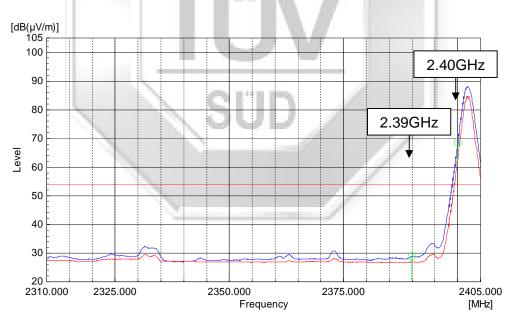


## BAND EDGE COMPLIANCE (RADIATED) TEST

## Band Edge Compliance (Radiated) Plots (Restricted Band) - 8DPSK (Worst)



Plot 68 - Peak Plot at Lower Band Edge at 2.4000GHz

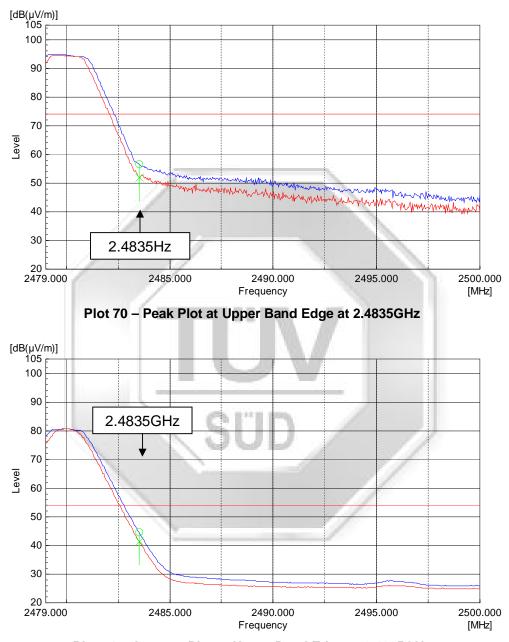


Plot 69 - Average Plot at Lower Band Edge at 2.4000GHz



## BAND EDGE COMPLIANCE (RADIATED) TEST

## Band Edge Compliance (Radiated) Plots (Restricted Band) - 8DPSK (Worst)



Plot 71 - Average Plot at Upper Band Edge at 2.4835GHz



#### PEAK POWER SPECTRAL DENSITY TEST

#### 47 CFR FCC Part 15.247(e) and RSS-247 5.3(2) Peak Power Spectral Density Limits

The EUT shows compliance to the requirements of this section, which states the peak power spectral density conducted from the intentional radiator (EUT) to the antenna shall not be greater than 8dBm (6.3mW) in any 3kHz band during any time interval of continuous transmission.

#### 47 CFR FCC Part 15.247(e) and RSS-247 5.3(2) Peak Power Spectral Density Test Instrumentation

Instrument	Model	S/No	Cal Due Date	Cal Interval
Agilent Spectrum Analyzer	E4404B	US39440632	02 Apr 2016	1 year

#### 47 CFR FCC Part 15.247(e) and RSS-247 5.3(2) Peak Power Spectral Density Test Setup

- 1. The EUT and supporting equipment were set up as shown in the setup photo.
- 2. The power supply for the EUT was connected to a filtered mains.
- 3. The RF antenna connector was connected to the spectrum via a low-loss coaxial cable.
- 4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 3kHz and 10kHz.
- 5. All other supporting equipment were powered separately from another filtered mains.

#### 47 CFR FCC Part 15.247(e) and RSS-247 5.3(2) Peak Power Spectral Density Test Method

- 1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, non-hopping with transmitting frequency at Channel 0 (2.402GHz) (lower ch).
- 2. The sweep time of the spectrum analyser was set to the value of the ratio of the frequency span divided by the RBW.
- 3. The peak power density of the transmitting frequency was detected and recorded.
- 4. The step 3 was repeated with the transmitting frequency was set to Channel 39 (2.441GHz) *(mid ch)* and Channel 78 (2.480GHz) *(upper ch)* respectively.



## PEAK POWER SPECTRAL DENSITY TEST

## 47 CFR FCC Part 15.247(e) and RSS-247 5.3(2) Peak Power Spectral Density Results

Test Input Power	7.4Vdc	Temperature	24°C
Attached Plots	72 – 74 (GFSK)	Relative Humidity	60%
	75 – 77 ((π/4) DQPSK) 78 – 80 (8DPSK)		
		Atmospheric Pressure	1030mbar
		Tested By	Liau Lee Yin

## **GFSK**

Channel	Channel Frequency (GHz)	Peak Power Spectral Density (mW)	Limit (mW)
0 (lower ch)	2.402	0.542	6.3
39 (mid ch)	2.441	0.549	6.3
78 (upper ch)	2.480	0.539	6.3

(π/4)DQPSK

Channel	Channel Frequency (GHz)	Peak Power Spectral Density (mW)	Limit (mW)
0 (lower ch)	2.402	0.137	6.3
39 (mid ch)	2.441	0.141	6.3
78 (upper ch)	2.480	0.140	6.3

## 8DPSK

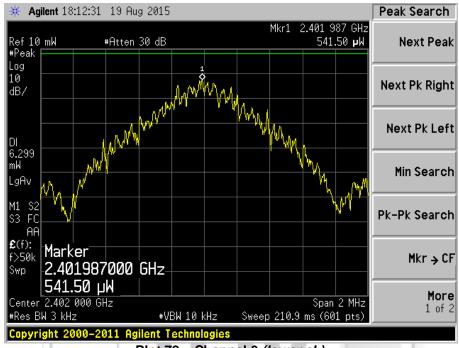
Channel	Channel Frequency (GHz)	Peak Power Spectral Density (mW)	Limit (mW)
0 (lower ch)	2.402	0.147	6.3
39 (mid ch)	2.441	0.178	6.3
78 (upper ch)	2.480	0.171	6.3

Motorola Solutions Malaysia Sdn Bhd Handheld Radio [ Model : AAH56RDN9RA1AN ] [ FCC ID : AZ489FT7065 & IC : 109U-89FT7065 ]

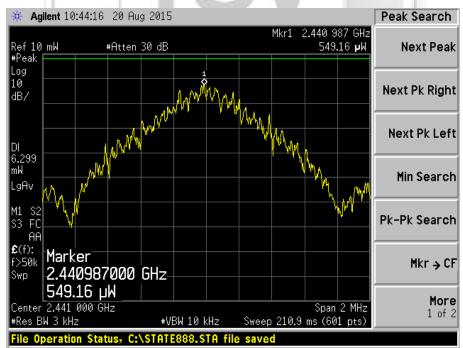


#### PEAK POWER SPECTRAL DENSITY TEST

#### Peak Power Spectral Density Plots - GFSK



Plot 72 - Channel 0 (lower ch)

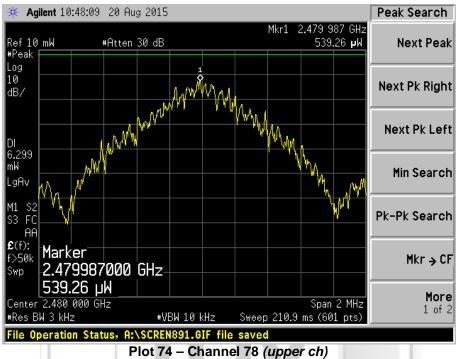


Plot 73 - Channel 39 (mid ch)



#### PEAK POWER SPECTRAL DENSITY TEST

#### Peak Power Spectral Density Plots - GFSK

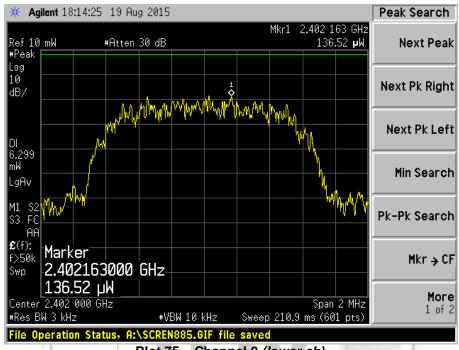


Motorola Solutions Malaysia Sdn Bhd Handheld Radio [ Model : AAH56RDN9RA1AN ] [ FCC ID : AZ489FT7065 & IC : 109U-89FT7065 ]

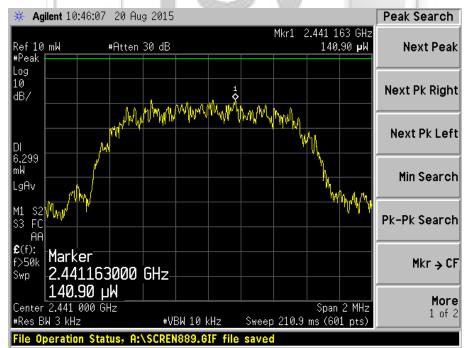


#### PEAK POWER SPECTRAL DENSITY TEST

#### Peak Power Spectral Density Plots – (π/4)DQPSK



Plot 75 - Channel 0 (lower ch)

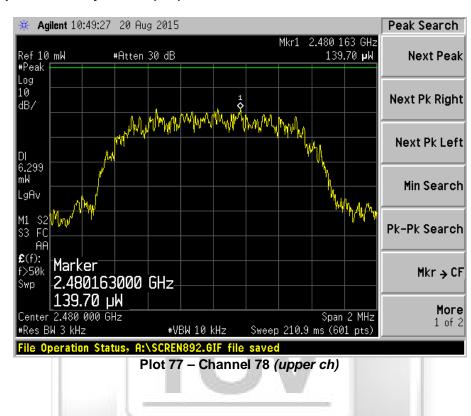


Plot 76 - Channel 39 (mid ch)



#### PEAK POWER SPECTRAL DENSITY TEST

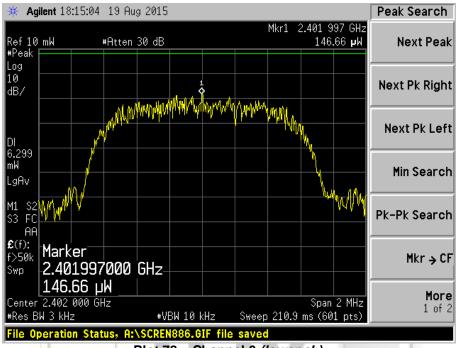
#### Peak Power Spectral Density Plots – (π/4)DQPSK



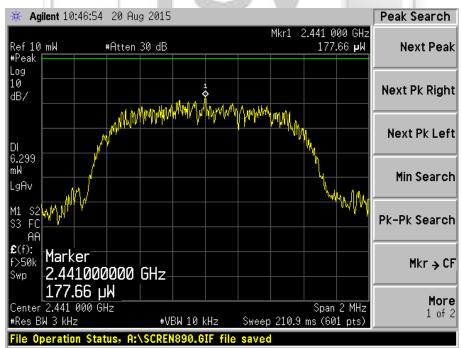


#### PEAK POWER SPECTRAL DENSITY TEST

#### Peak Power Spectral Density Plots - 8DPSK



Plot 78 - Channel 0 (lower ch)

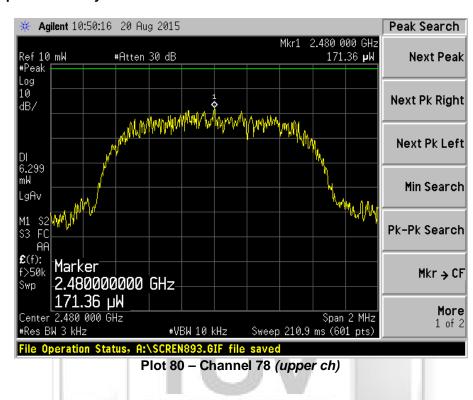


Plot 79 - Channel 39 (mid ch)



#### PEAK POWER SPECTRAL DENSITY TEST

#### Peak Power Spectral Density Plots - 8DPSK





Please note that this Report is issued under the following terms :

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#### ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS

# ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS

Motorola Solutions Malaysia Sdn Bhd Handheld Radio [ Model : AAH56RDN9RA1AN ] [ FCC ID : AZ489FT7065 & IC : 109U-89FT7065 ]

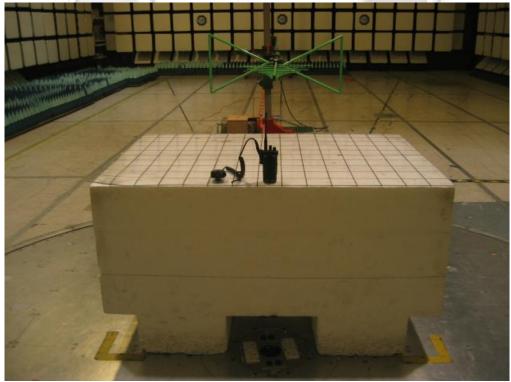


#### ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS

#### TEST SETUP (30MHz to 1GHz)



Radiated Emissions Test Setup (Front View)

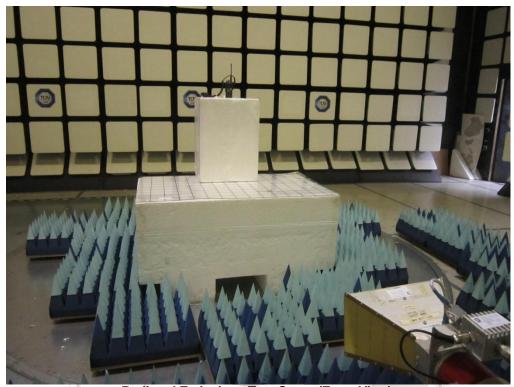


Radiated Emissions Test Setup (Rear View)

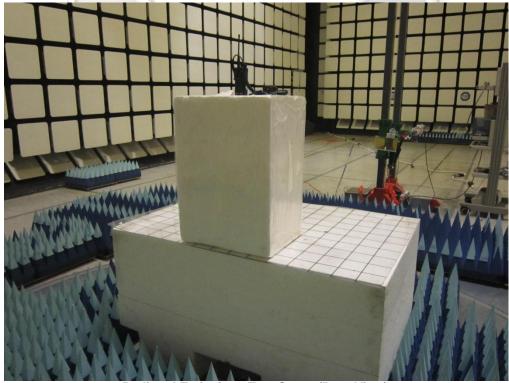


#### ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS

#### **TEST SETUP (Above 1GHz)**



Radiated Emissions Test Setup (Front View)



Radiated Emissions Test Setup (Rear View)



#### ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS



**Carrier Frequency Separation Test Setup** 



Spectrum Bandwidth (20dB Bandwidth Measurement) Test Setup



#### ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS



**Number of Hopping Frequencies Test Setup** 



**Average Frequency Dwell Time Test Setup** 



#### ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS



**Maximum Peak Power Test Setup** 



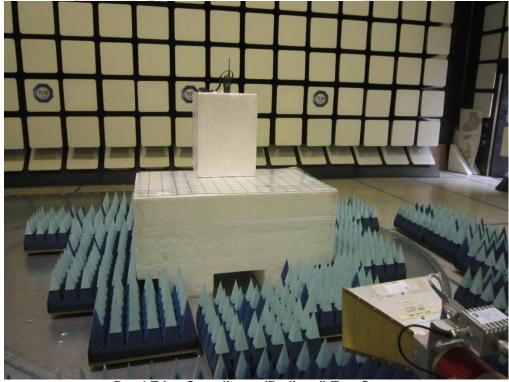
**RF Conducted Spurious Emissions Test Setup** 



#### ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS



Band Edge Compliance (Conducted) Test Setup



Band Edge Compliance (Radiated) Test Setup



#### ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS



**Peak Power Spectral Density Test Setup** 





#### ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS

#### **EUT PHOTOGRAPHS**



**Front View** 



**Rear View** 



#### ANNEX B USER MANUALTECHNICAL DESCRIPTION BLOCK & CIRCUIT DIAGRAMS

#### **ANNEX B**

## USER MANUAL TECHNICAL DESCRIPTION BLOCK & CIRCUIT DIAGRAMS

(Please refer to manufacturer for details)



#### ANNEX C FCC LABEL, IC LABEL & POSITION





#### ANNEX C FCC LABEL & POSITION

Labelling requirements per Section 2.925, 15.19 and RSS-GEN 2.1

The label shown will be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time of purchase.



Physical Location of FCC Label on EUT



#### ANNEX D TEST SITE DESCRIPTION





#### ANNEX D TEST SITE DESCRIPTION

#### Radiated Emission Test Site Description

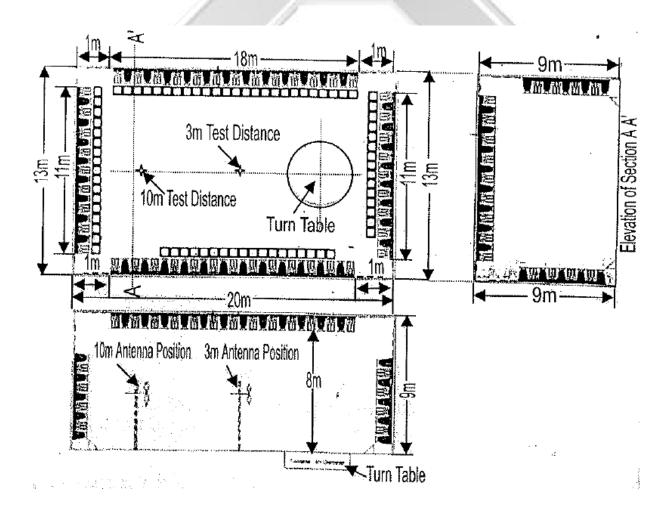
The Radiated Emission test facility consists of a RF-shielded enclosure (Model: 04" x 07") manufactured by Lindgren whose dimensions are shown below. The exterior of the chamber is made of rigid steel panels while the interior is covered with RF absorbing panels on the 4 walls and ceiling. The steel-clad ground place is covered with vinyl flooring.

The Turntable is mounted flushed with the chamber floor and is driven by a pneumatic motor, which is capable of supporting 4,000 kg.

The Boresight Antenna mast is driven by a pneumatic motor with heights variation from 1m- 4m for both vertical and horizontal polarity and with tilt capability.

Both turntable and antenna mast in the chamber are controlled by the System Controller stationed outside the chamber.

The physical layout of the chamber is show below:





#### ANNEX D TEST SITE DESCRIPTION

#### Conducted Emission Test Site Description

The Conducted Emission facility consists of an RF-shielded enclosure measuring 4.3m x 3.7m x 2.45m manufactured by Universal Shielding Corporation. The Conducted Emission data were taken using two LISN.

The physical layout of the test site is show below:

