

FCC 15.247 & RSS-247 2.4 GHz Test Report

for

Embertec Pty Ltd

182 Fullarton Road Dulwich South Australia 5065 Australia

Product Name : Smart Sensor
Model Name : RD-01
Brand embertec
FCC ID : 2AGKS-RD01SENSOR
IC : 20880-RD01SENSOR

**Prepared by: : AUDIX Technology Corporation,
EMC Department**



The statement is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo.
The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, TAF or any government agencies.

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Audix Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

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TEST REPORT CERTIFICATION

Applicant : Embertec Pty Ltd
Manufacturer : Embertec Pty Ltd
EUT Description
(1) Product : Smart Sensor
(2) Model : RD-01
(3) Brand : embertec
(4) Power Supply : DC 5V (Power Bar)

Applicable Standards:

47 CFR FCC Part 15 Subpart C
RSS-Gen (Issue 5), April 2018
RSS-247 (Issue 2), February 2017
ANSI C63.10:2013
KDB 558074 D01 DTS Meas Guidance v05

Audix Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Audix Technology Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Report: 2018. 09. 11

Reviewed by:

Sabrina Wang

(Sabrina Wang/Administrator)

Approved by:

Ben Cheng

(Ben Cheng/Manager)

1. REVISION RECORD OF TEST REPORT

Edition No	Issued Data	Revision Summary	Report Number
0	2018. 09. 11	Original Report	EM-F180407

2. SUMMARY OF TEST RESULTS

Rule		Description	Results
FCC	IC		
15.207	RSS-Gen §8.8	Conducted Emission	PASS
15.247(d)/ 15.205	RSS-Gen §8.9 RSS-247 §5.5	Radiated Band Edge and Radiated Spurious Emission	PASS
15.247(a)(2)	RSS-247 §5.2(1)	6dB Bandwidth	PASS
15.247(b)(3)	RSS-247 §5.4(4)	Maximum Peak Output	PASS
15.247(d)	RSS-247 §5.5	Conducted Band Edges and Conducted Spurious Emission	PASS
15.247 (e)	RSS-247 §5.2(2)	Peak Power Spectral Density	PASS
15.203	RSS-Gen §8.3	Antenna Requirement	Compliance

3. GENERAL INFORMATION

3.1. Description of Application

Applicant	Embertec Pty Ltd 182 Fullarton Road Dulwich South Australia 5065 Australia
Manufacturer	Embertec Pty Ltd 182 Fullarton Road Dulwich South Australia 5065 Australia
Product	Smart Sensor
Model	RD-01
Brand	embertec

3.2. Description of EUT

Test Model	RD-01
Serial Number	N/A
Power Rating	DC 5V (Refer to Power Bar rating)
RF Features	RF4CE
Transmit Type	1T1R
Sample Status	Production
Date of Receipt	2018. 08. 02
Date of Test	2018. 09. 03 ~ 12
Interface Ports of EUT	• None
Accessories Supplied	• LAN Cable: Unshielded, Undetachable, 3.0m

3.3. Antenna Information

Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
---	---	Printed Antenna	2400 - 2480	-2.31

3.4. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (Mbps)
RF4CE	2425-2475	3	O-QPSK	0.25

Channel List	
Channel Number	Frequency (MHz)
15	2425
20	2450
25	2475

3.5. Descriptions of Key Components

None

3.6. Test Configuration

Mode	Duty Cycle (x)	Duty Cycle Factor (dB)
RF4CE	1	0

Note: When duty cycle is less than 98% (0.98) that duty cycle factor $10\log(1/x)$ is needed to add in conducted test items measured in average detector.

AC Conduction	
Test Case	Normal operation

Item		Mode	Test Channel
Radiated Test Case	Radiated Band Edge ^{Note1}	RF4CE	15/20/25
	Radiated Spurious Emission ^{Note1 & 2}	RF4CE	15/20/25
Conducted Test Case	6dB Bandwidth	RF4CE	15/20/25
	Peak Output Power	RF4CE	15/20/25
	Band Edge	RF4CE	15/20/25
	Spurious Emission	RF4CE	15/20/25
	Peak Power Spectral Density	RF4CE	15/20/25

Note 1: ☒ Mobile Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow: ☒ Lie ☐ Side ☐ Stand

☐ Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow: ☐ Lie ☐ Side ☐ Stand

Note 2: Low, mid, and high channels were measured, only the worst channel was presented in this report.

3.7. Tested Supporting System List

3.7.1. Support Peripheral Unit

No.	Product	Brand	Model No.	Serial No.	Approval
1.	Power Bar	N/A	ESUSAV8-ET-10B	N/A	N/A

3.7.2. Cable Lists

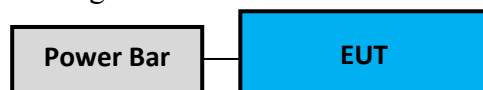
No.	Cable Description Of The Above Support Units
1.	AC Power Cord: Unshielded, Undetachable, 0.5m (3C)

3.8. Setup Configuration

3.8.1. EUT Configuration for Power Line & Radiated Emission



3.8.2. EUT Configuration for RF Conducted Test Items



3.9. Operating Condition of EUT

To set EUT RF function on continues transmitting and choosing channel.

3.10. Description of Test Facility

Name of Test Firm	Audix Technology Corporation / EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan Tel: +886-2-26092133 Fax: +886-2-26099303 Website : www.audixtech.com Contact e-mail: attemc_report@audixtech.com
Accreditations	The laboratory is accredited by following organizations under ISO/IEC 17025:2005 (1) NVLAP(USA) NVLAP Lab Code 200077-0 (2) TAF(Taiwan) No. 1724
Test Facilities	(1) No. 8 Shielding Room (2) Semi-Anechoic Chamber (IC Test Site Registration No.: 5183B-1) (3) Fully Anechoic Chamber (IC Test Site Registration No.: 5183B-4)

3.11.Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Conduction Test	150kHz~30MHz	±3.50dB
Radiation Test (Distance: 3m)	30MHz~1000MHz	± 3.68dB
	Above 1GHz	± 5.82dB

Remark : Uncertainty = $ku_c(y)$

Test Item	Uncertainty
6dB Bandwidth	± 0.05kHz
Maximum peak output power	± 0.33dB
Power spectral density	± 0.13dB
Conducted Emission Limitations	± 0.13dB

4. MEASUREMENT EQUIPMENT LIST

4.1. Conducted Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Test Receiver	R&S	ESR3	101774	2018. 01. 24	1 Year
2.	A.M.N.	R&S	ENV4200	100169	2017. 11. 12	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-855-9	2017. 12. 14	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	100354	2018. 01. 16	1 Year
5.	Signal Cable	Yeida	RG/58AU	CE-08	2017. 09. 22	1 Year
6.	Digital Thermo- Hygro Meter	iMax	HTC-1	No.8 S/R	2018. 04. 20	1 Year
7.	Test Software	Audix	e3	V.6.120424	N.C.R.	N.C.R.

4.2. Radiated Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2018. 09. 13	1 Year
2.	Spectrum Analyzer	Agilent	N9030A-526	MY53310269	2018. 01. 04	1 Year
3.	Test Receiver	R & S	ESCS30	100338	2018. 06. 20	1 Year
4.	Amplifier	HP	8447D	2944A06305	2018. 01. 30	1 Year
5.	Amplifier	HP	8449B	3008A02678	2018. 03. 06	1 Year
6.	Loop Antenna	R&S	HFH2-Z2	891847/27	2017. 12. 18	1 Year
7.	Bilog Antenna	CHASE	CBL6112D	33821	2018. 01. 21	1 Year
8.	Horn Antenna	COM-POWER	AH-840	101092	2018. 05. 07	1 Year
9.	Horn Antenna	ETS-Lindgren	3117	00135902	2018. 03. 08	1 Year
10.	2.4GHz Notch Filter	K&L	7NSL10-2441.5 E130.5-00	1	2018. 07. 24	1 Year
11.	3GHz Notch Filter	Microwave	H3G018G1	484796	2018. 08. 22	1 Year
12.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.1 3m A/C	2018. 04. 20	1 Year
13.	Digital Thermo-Hygro Meter	iMax	E-512	RF-02	2018. 04. 20	1 Year
14.	Test Software	Audix	e3	V.6.110601	N.C.R.	N.C.R.

4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1	Spectrum Analyzer	Agilent	N9010A-507	MY52220264	2018. 08. 09	1 Year
	Power Meter	Anritsu	ML2495A	1145008	2017. 11. 03	1 Year
	Power Sensor	Anritsu	MA2411B	1126096	2017. 11. 03	1 Year
2	Digital Thermo-Hygro Meter	Shenzhen Datronn Electronics	KT-905	RF	2018. 04. 20	1 Year

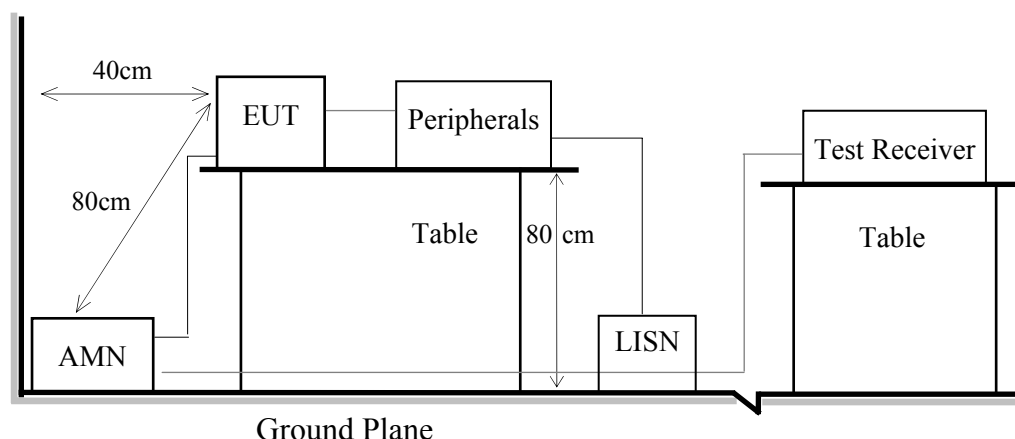
5. CONDUCTED EMISSION

5.1. Block Diagram of Test Setup

5.1.1. Block Diagram of EUT

Indicated as section 3.8

5.1.2. Shielded Room Setup Diagram



5.2. Conducted Emission Limit

Frequency	Conducted Limit	
	Quasi-Peak Level	Average Level
150kHz ~ 500kHz	66 ~ 56 dB μ V	56 ~ 46 dB μ V
500kHz ~ 5MHz	56 dB μ V	46 dB μ V
5MHz ~ 30MHz	60 dB μ V	50 dB μ V

Remark 1.: If the average limit is met when using a Quasi-Peak detector, the measurement using the average detector is not required.

2.: The lower limit applies to the band edges.

5.3. Test Procedure

- 5.3.1. To set up the EUT as indicated in ANSI C 63.10. The EUT was placed on the table which has 80 cm height to the ground and 40 cm distance to the conducting wall.
- 5.3.2. Power supplier of the EUT was connected to the AC mains through an Artificial Mains Network (A.M.N.).
- 5.3.3. The AC power supplies to all peripheral devices must be provided through line impedance stabilization network (L.I.S.N.)
- 5.3.4. To Check frequency range from 150 kHz to 30 MHz and record the emission which does not have 20 dB below limit.

5.4. Test Results

Please refer to Appendix A.

6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance (m)	Limits	
		dBμV/m	μV/m
0.009 - 0.490	300	67.6-20 log f(kHz)	2400/f kHz
0.490 - 1.705	30	87.6-20 log f(kHz)	24000/f kHz
1.705 - 30	30	29.5	30
30 - 88	3	40.0	100
88- 216	3	43.5	150
216- 960	3	46.0	200
Above 960	3	54.0	500
Above 1000	3	74.0 dBμV/m (Peak) 54.0 dBμV/m (Average)	

Remark : (1) $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$

- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Fundamental and emission fall within operation band are exempted from this section.
- (5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

6.3. Test Procedure

Frequency Range 9kHz~30MHz:

The EUT setup on the turn table which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

- (1) RBW = 9kHz with peak and average detector.
- (2) Detector: average and peak (9kHz-490kHz)
Q.P. (490kHz-30MHz)

Frequency Range 30MHz ~ 25GHz:

The EUT setup on the turn table which has 80 cm (for 30-1000 MHz) and 1.5m (for above 1GHz) height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

Frequency below 1 GHz:

Spectrum Analyzer is used for pre-testing with following setting:

- (1) RBW = 120KHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required, otherwise using Q.P. for final measurement.

Frequency above 1GHz to 10th harmonic (up to 25 GHz):

Peak Detector:

- (1) RBW = 1MHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the average detector is not required, otherwise using average detector for final measurement.

Average Detector:☒ **Option 1:**

(1) RBW = 1MHz

(2) VBW $\geq 1/T$.

Mode	T (ms)	1/T (kHz)	VBW Setting (kHz)
RF4CE	---	---	10Hz

N/A: 1/T is not implemented when duty cycle presented in section 3.6 is $\geq 98\%$.

(1) Detector = Peak.

(2) Sweep time = auto.

(3) Trace mode = max hold.

(4) Allow sweeps to continue until the trace stabilizes.

☐ **Option 2:**

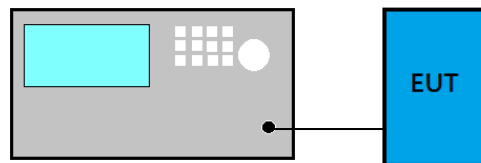
Average Emission Level = Peak Emission Level + D.C.C.F.

6.4. Measurement Result Explanation☒ Peak Emission Level = Antenna Factor + Cable Loss + Meter Reading☒ Average Emission Level = Antenna Factor + Cable Loss + Meter Reading☐ Average Emission Level = Peak Emission Level + DCCFDuty Cycle Correction Factor (DCCF) = $20\log(TX_{on}/TX_{on+off})$ presented in section 3.6☐ ERP = Peak Emission Level - 95.2dB - 2.14dB**6.5. Test Results**

Please refer to Appendix A.

7. 6dB BANDWIDTH

7.1. Block Diagram of Test Setup



7.2. Specification Limits

The minimum 6dB bandwidth shall be at least 500kHz.

7.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v05:

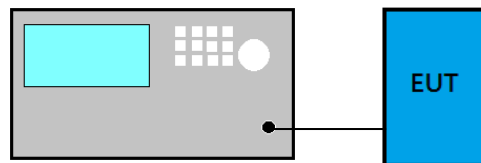
- (1) Set RBW = 100 kHz.
- (2) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -6 dB to record the final bandwidth.

7.4. Test Results

Please refer to Appendix A

8. MAXIMUM PEAK OUTPUT POWER

8.1. Block Diagram of Test Setup



8.2. Specification Limits

The Limits of maximum Peak Output Power for digital modulation in 2400-2483.5MHz is : 1Watt. (30dBm), and E.I.R.P.: 4Watt (36dBm)

8.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v05:

☒ **PKPM1 Peak power meter method:**

EUT is connected to power sensor and record the maximum output power.

☐ **Maximum peak conducted output power method:**

- (1) Set the RBW $\geq$ DTS bandwidth
- (2) Set VBW $\geq 3 \times$ RBW
- (3) Set span $\geq 3 \times$ RBW.
- (4) Sweep time = auto couple
- (5) Detector = peak.
- (6) Trace mode = max hold.
- (7) Allow trace to fully stabilize.
- (8) Use peak marker function to determine the peak amplitude level.

☐ **Method AVGPM (Measurement using an RF average power meter):**

EUT is connected to power sensor and record the maximum average output power and duty cycle factor is added when duty cycle presented in section 3.6 is $< 98\%$.

☐ **Method AVGSA-2 (Spectrum channel power)**

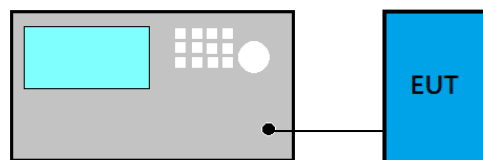
- (1) Set span to at least 1.5 times the OBW
- (2) Set RBW = 1 -5% of OBW
- (3) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- (4) Detector = RMS.
- (5) Trace mode = trace average at least 100 traces
- (6) Sweep = auto couple.
- (7) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges.
- (8) Duty cycle factor is added when duty cycle presented in section 3.6 is $< 98\%$.

8.4. Test Results

Please refer to Appendix A

9. EMISSION LIMITATIONS

9.1. Block Diagram of Test Setup



9.2. Specification Limits

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, that the required attenuation shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in Section 15.209(a)/RSS-Gen Section 8.9 table 4 is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a)/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified in Section 15.209(a)/RSS-Gen Section 8.9 table 4 (See Section 15.205(c)).

9.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v05:

■ Reference Level

- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW $\geq 3 \times$ RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max PSD as reference level.

■ Emission Level Measurement

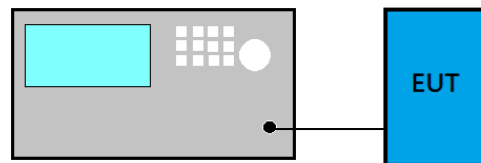
- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW $\geq 3 \times$ RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max level.

9.4. Test Results

Please refer to Appendix A

10. POWER SPECTRAL DENSITY

10.1. Block Diagram of Test Setup



10.2. Specification Limits

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band.

10.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v05:

☒ Method PKPSD (peak PSD)

- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- (4) Set the VBW $\geq 3 \times \text{RBW}$.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize.
- (9) Use the peak marker function to determine the maximum amplitude level.
- (10) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

☐ Method AVGPSD-2

- (1) Using peak PSD procedure step 1 to step 4.
- (2) Detector = RMS detector
- (3) Sweep time = auto couple
- (4) Trace mode = trace averaging over a minimum of 100 traces
- (5) Use the peak marker function to determine the maximum amplitude level.
- (6) Duty cycle factor is added when duty cycle presented in section 3.7 < 98%.
- (7) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

10.4. Test Results

Please refer to Appendix A

11.DEVIATION TO TEST SPECIFICATIONS

【NONE】



Audix Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

APPENDIX A

Tel: +886 2 26099301
Fax: +886 2 26099303

APPDNDIX A

TEST DATA AND PLOTS

(Model: RD-01)

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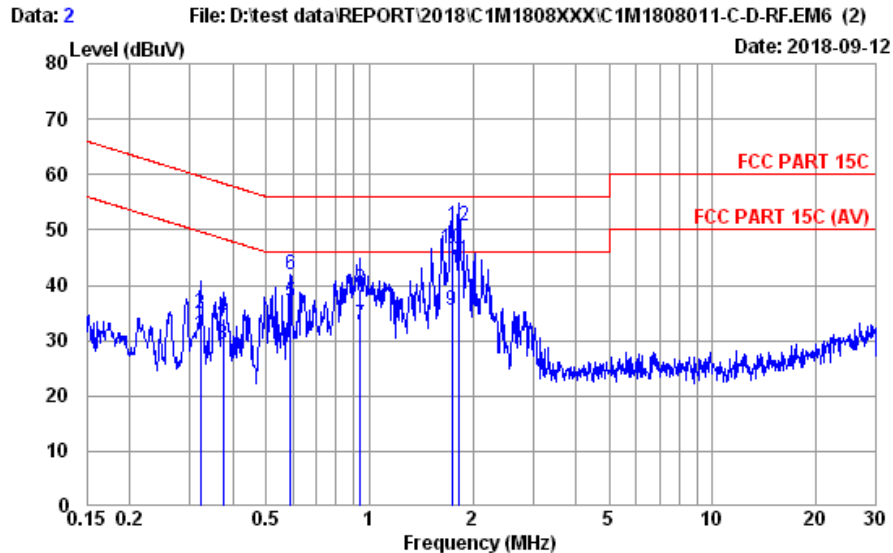
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Audix Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

A.1 CONDUCTED EMISSION

Test Date	2018/09/12	Temp./Hum.	27°C/56%
Test Voltage	AC 120V, 60Hz (via Power Bar)		



Site no. : No.8 Shielded Room Data no. : 2
Condition : ENV4200 100169 LISN Phase : NEUTRAL
Limit : FCC PART 15C
Env. / Ins. : 27°C / 56% ESR3 (1774) Engineer : Nick Du
EUT : RF4CE
Power Rating : 120Vac/60Hz
Test Mode : Operating

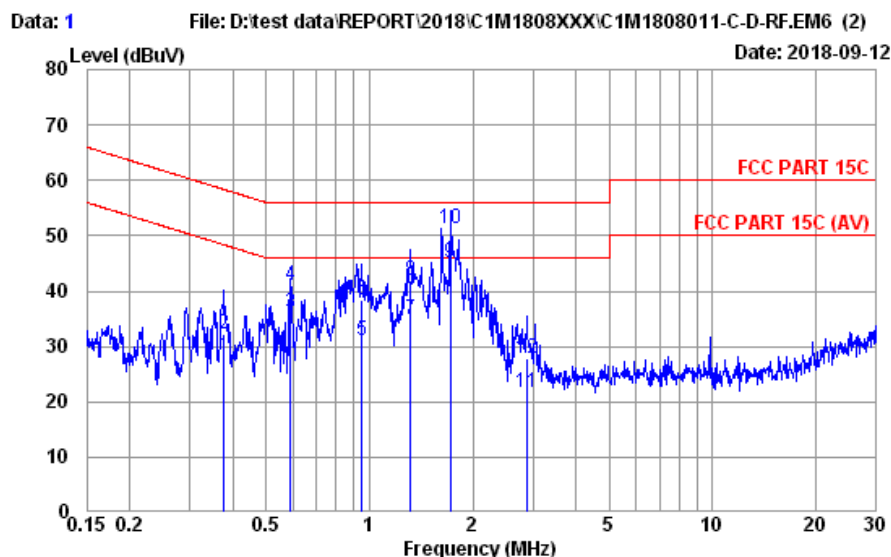
	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.322	10.46	0.04	9.98	10.62	31.10	59.66	28.56	Average
2	0.322	10.46	0.04	9.98	14.28	34.76	59.66	24.90	QP
3	0.375	10.44	0.04	9.98	8.90	29.36	58.39	29.03	Average
4	0.375	10.44	0.04	9.98	13.46	33.92	58.39	24.47	QP
5	0.589	10.43	0.05	9.98	16.55	37.01	56.00	18.99	Average
6	0.589	10.43	0.05	9.98	21.43	41.89	56.00	14.11	QP
7	0.938	10.42	0.06	9.99	12.39	32.86	56.00	23.14	Average
8	0.938	10.42	0.06	9.99	18.78	39.25	56.00	16.75	QP
9	1.734	10.45	0.07	9.99	15.03	35.54	56.00	20.46	Average
10	1.734	10.45	0.07	9.99	26.21	46.72	56.00	9.28	QP
11	1.819	10.45	0.07	9.99	23.95	44.46	56.00	11.54	Average
12	1.819	10.45	0.07	9.99	30.17	50.68	56.00	5.32	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.

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Test Date	2018/09/12	Temp./Hum.	27°C/56%
Test Voltage	AC 120V, 60Hz (via Power Bar)		



Site no. : No.8 Shielded Room Data no. : 1
Condition : ENV4200 100169 LISN Phase : LINE
Limit : FCC PART 15C
Env. / Ins. : 27°C / 56% ESR3 (1774) Engineer : Nick Du
EUT : RF4CE
Power Rating : 120Vac/60Hz
Test Mode : Operating

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.377	10.46	0.04	9.98	7.52	28.00	58.34	30.34	Average
2	0.377	10.46	0.04	9.98	11.88	32.36	58.34	25.98	QP
3	0.589	10.45	0.05	9.98	15.62	36.10	56.00	19.90	Average
4	0.589	10.45	0.05	9.98	20.50	40.98	56.00	15.02	QP
5	0.948	10.44	0.06	9.99	10.60	31.09	56.00	24.91	Average
6	0.948	10.44	0.06	9.99	17.79	38.28	56.00	17.72	QP
7	1.317	10.45	0.06	9.99	14.48	34.98	56.00	21.02	Average
8	1.317	10.45	0.06	9.99	21.26	41.76	56.00	14.24	QP
9	1.716	10.46	0.07	9.99	24.69	45.21	56.00	10.79	Average
10	1.716	10.46	0.07	9.99	30.85	51.37	56.00	4.63	QP
11	2.869	10.53	0.10	10.00	0.92	21.55	56.00	34.45	Average
12	2.869	10.53	0.10	10.00	7.10	27.73	56.00	28.27	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.

A.2 RADIATED EMISSION

Test Date	2018/09/03	Temp./Hum.	23°C/44%
Test Voltage	DC 5V (via Power Bar)		

A.2.1 Emissions within Restricted Frequency Bands

A.2.1.1 Frequency 9kHz~30MHz

The emissions (9kHz~30MHz) not reported for there is no emission be found.

A.2.1.2 Frequency Below 1 GHz

Mode	RF4CE	Frequency	TX 2425MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
61.04	12.57	1.75	4.49	18.81	40.00	21.19	Peak
108.57	18.09	2.38	2.21	22.68	43.50	20.82	Peak
132.82	18.16	2.64	1.65	22.45	43.50	21.05	Peak
227.88	17.72	3.61	2.73	24.06	46.00	21.94	Peak
345.25	20.75	4.92	2.38	28.05	46.00	17.95	Peak
385.99	21.76	5.41	3.26	30.43	46.00	15.57	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
34.85	22.37	1.31	8.77	32.45	40.00	7.55	Peak
74.62	13.32	1.94	5.82	21.08	40.00	18.92	Peak
86.26	14.93	2.09	7.05	24.07	40.00	15.93	Peak
131.85	18.21	2.63	2.74	23.58	43.50	19.92	Peak
867.11	26.52	7.99	2.38	36.89	46.00	9.11	Peak
954.41	27.39	8.54	2.02	37.95	46.00	8.05	Peak

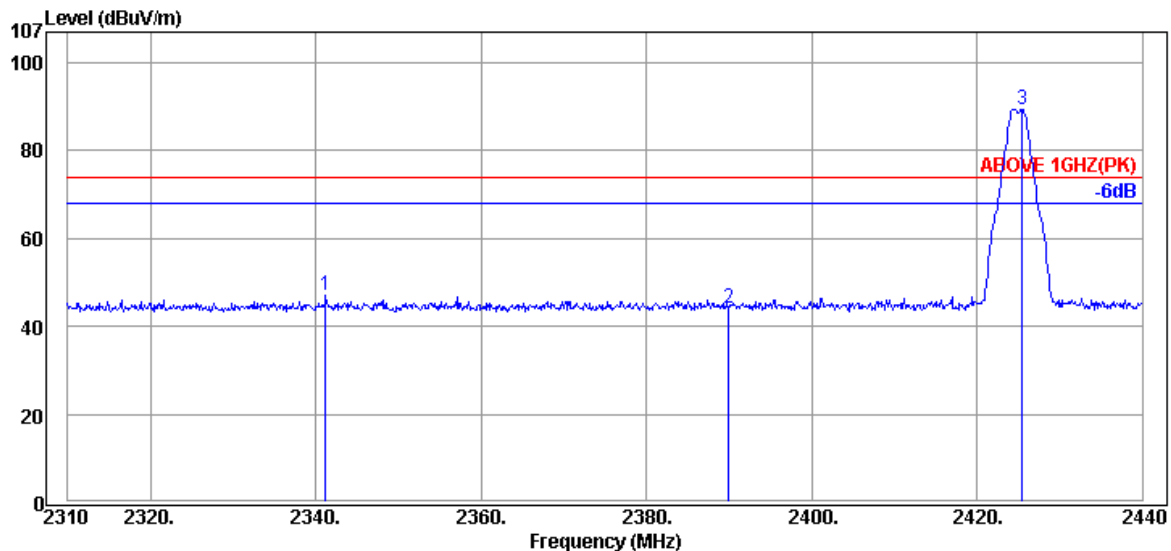
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A.2.1.3 Frequency Above 1 GHz to 10th harmonics

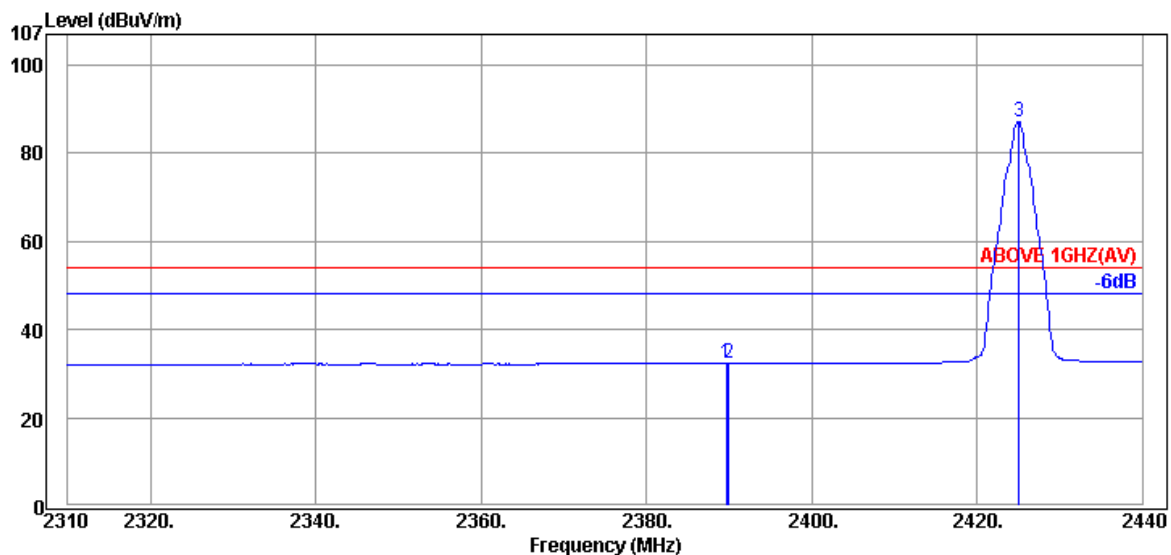
Band Edge:

Mode	RF4CE	Frequency	TX 2425MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2341.20	32.08	6.51	8.42	47.01	74.00	26.99	Peak
2389.95	32.16	6.57	5.33	44.06	74.00	29.94	Peak
2425.44	32.20	6.61	50.71	89.52	---	---	Peak



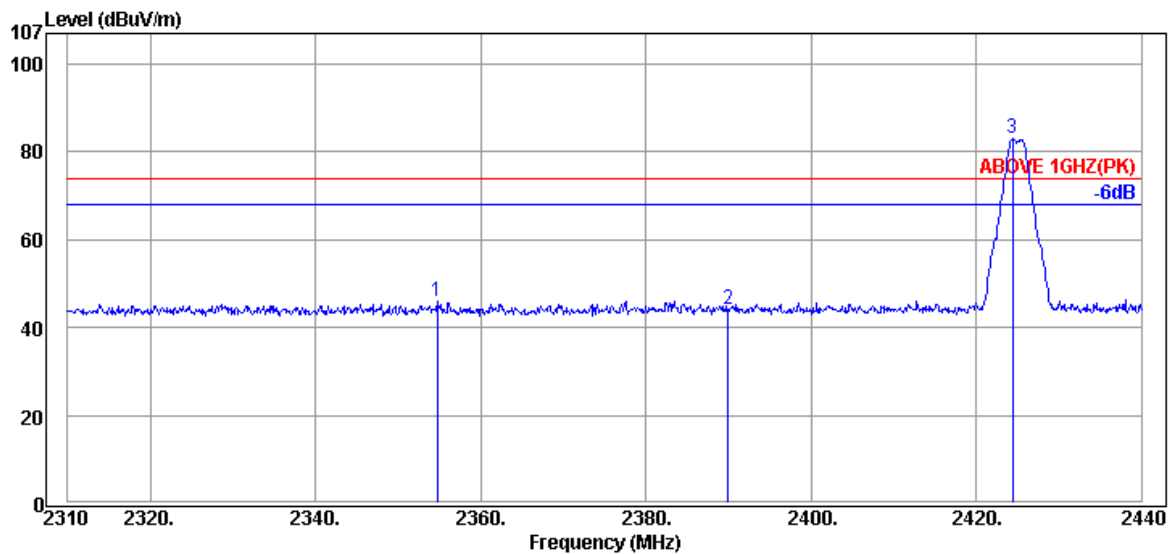
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2389.69	32.16	6.57	-6.30	32.43	54.00	21.57	Average
2389.95	32.16	6.57	-6.32	32.41	54.00	21.59	Average
2425.05	32.20	6.61	48.39	87.20	---	---	Average

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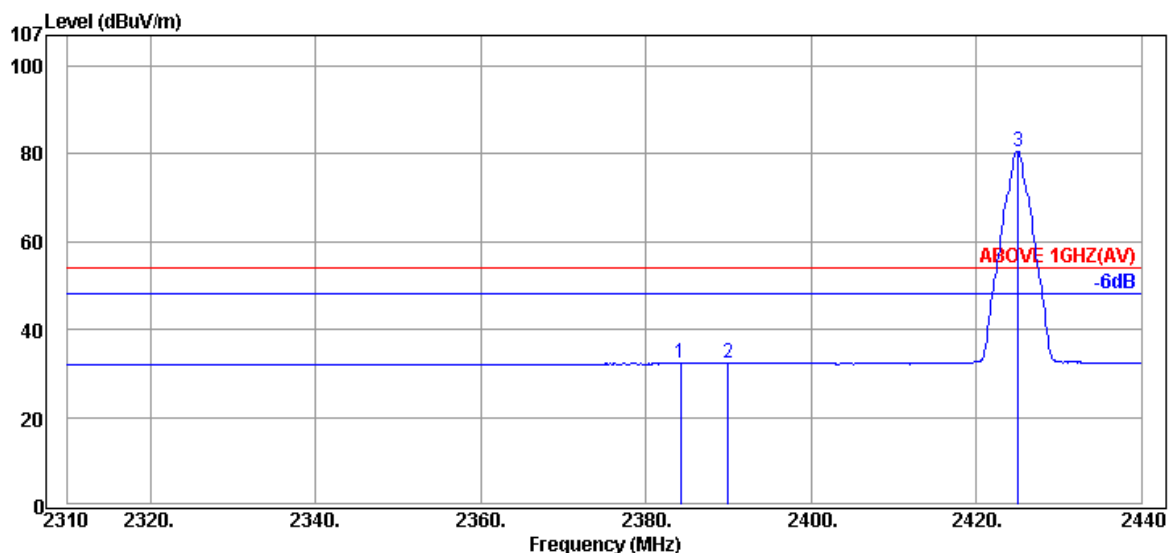
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Fax: +886 2 26099303

Mode	RF4CE	Frequency	TX 2425MHz
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Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2354.72	32.11	6.53	7.33	45.97	74.00	28.03	Peak
2389.95	32.16	6.57	5.28	44.01	74.00	29.99	Peak
2424.40	32.20	6.61	44.16	82.97	---	---	Peak



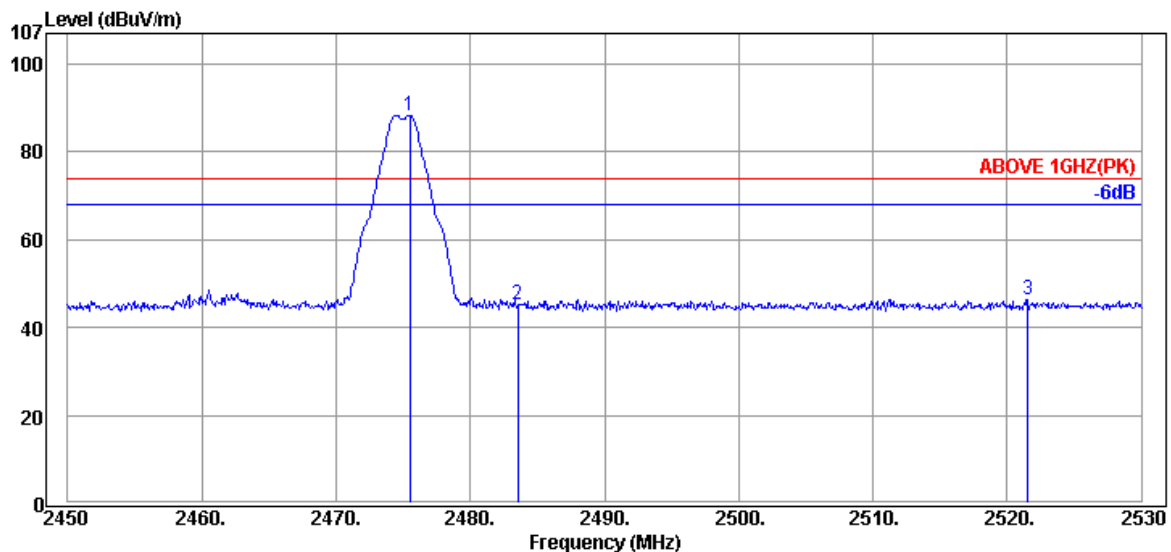
Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2384.23	32.13	6.55	-6.39	32.29	54.00	21.71	Average
2389.95	32.16	6.57	-6.46	32.27	54.00	21.73	Average
2425.05	32.20	6.61	41.85	80.66	---	---	Average

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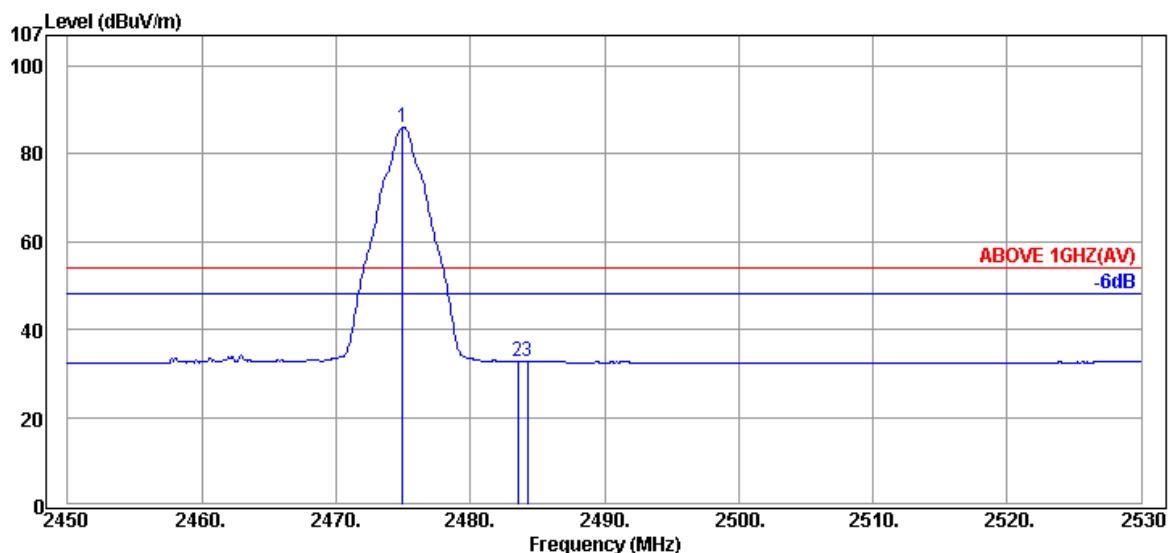
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Mode	RF4CE	Frequency	TX 2475MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2475.52	32.28	6.67	49.35	88.30	74.00	---	Peak
2483.52	32.28	6.67	6.22	45.17	74.00	28.83	Peak
2521.52	32.34	6.74	7.28	46.36	74.00	27.64	Peak



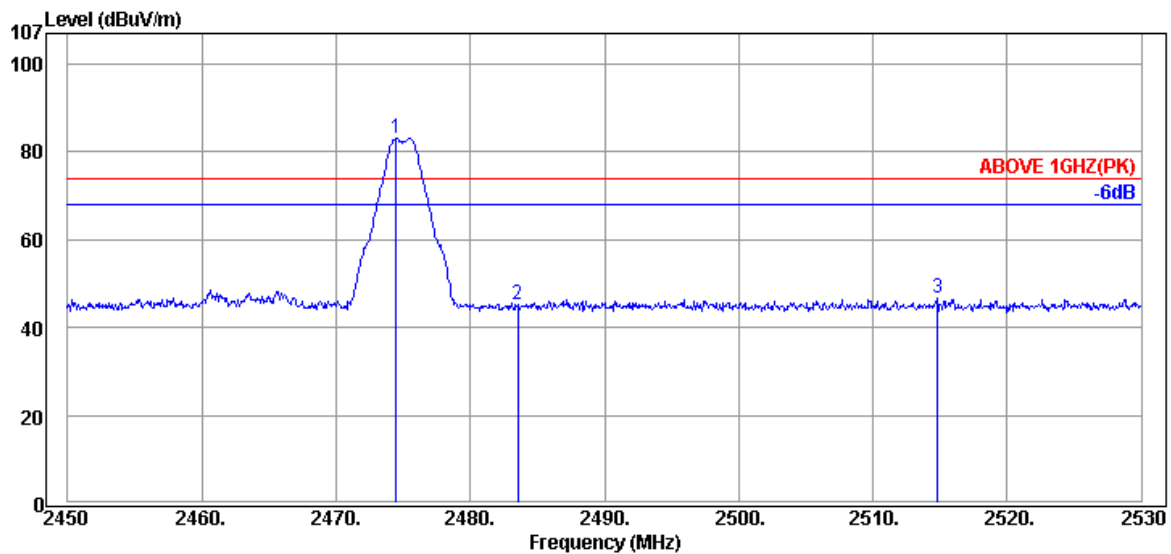
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2474.96	32.28	6.67	47.09	86.04	54.00	---	Average
2483.52	32.28	6.67	-6.20	32.75	54.00	21.25	Average
2484.24	32.28	6.67	-6.27	32.68	54.00	21.32	Average

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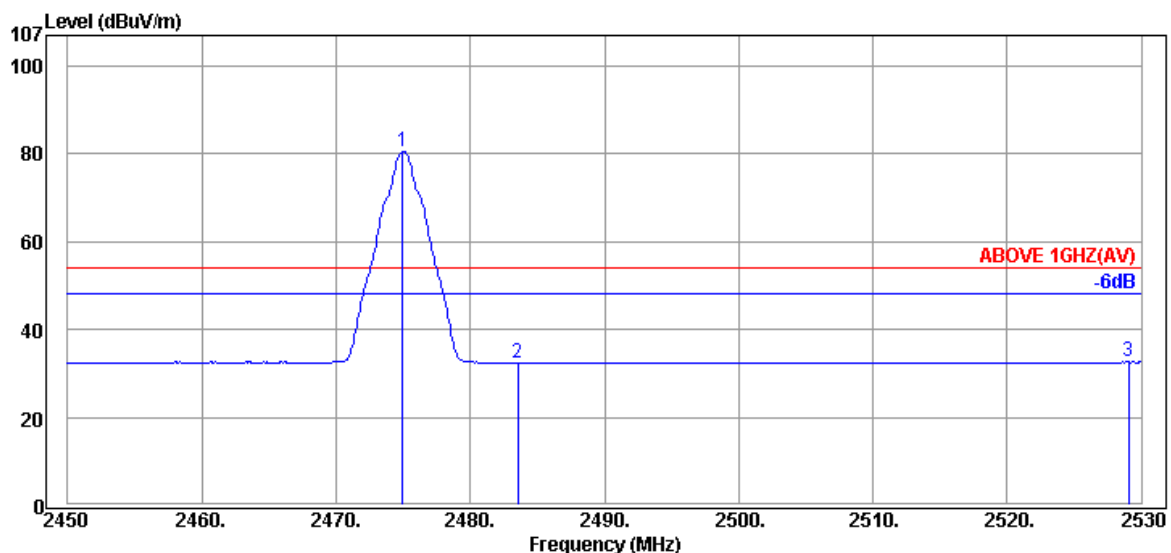
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Mode	RF4CE	Frequency	TX 2480MHz
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Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2474.48	32.28	6.67	44.09	83.04	74.00	---	Peak
2483.52	32.28	6.67	6.15	45.10	74.00	28.90	Peak
2514.80	32.32	6.72	7.80	46.84	74.00	27.16	Peak



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2474.96	32.28	6.67	41.61	80.56	54.00	---	Average
2483.52	32.28	6.67	-6.45	32.50	54.00	21.50	Average
2529.04	32.34	6.74	-6.50	32.58	54.00	21.42	Average

A.2.2 Emissions outside the frequency band:

The emissions (up to 25GHz) not reported for there is no emission be found.

Mode	RF4CE	Frequency	TX 2425MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4850.00	34.24	9.55	0.11	43.90	54.00	10.10	Peak
7275.00	35.80	11.87	-3.31	44.36	54.00	9.64	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4850.00	34.24	9.55	0.97	44.76	54.00	9.24	Peak
7275.00	35.80	11.87	-2.99	44.68	54.00	9.32	Peak

Mode	RF4CE	Frequency	TX 2450MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4900.00	34.26	9.57	0.09	43.92	54.00	10.08	Peak
7350.00	35.80	11.95	-2.15	45.60	54.00	8.40	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4900.00	34.26	9.57	-0.19	43.64	54.00	10.36	Peak
7350.00	35.80	11.95	-2.34	45.41	54.00	8.59	Peak

Mode	RF4CE	Frequency	TX 2475MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4950.00	34.28	9.59	-0.89	42.98	54.00	11.02	Peak
7425.00	35.80	12.02	-2.09	45.73	54.00	8.27	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4950.00	34.28	9.59	-0.24	43.63	54.00	10.37	Peak
7425.00	35.80	12.02	-1.52	46.30	54.00	7.70	Peak

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New Taipei City 244, Taiwan

Tel: +886 2 26099301

Fax: +886 2 26099303

A.2.3 Emissions in Non-restricted Frequency Bands:

Pursuant to KDB 558074 D01 DTS Meas Guidance v05 that emission levels below the 15.209 general radiated emissions limits is not required.

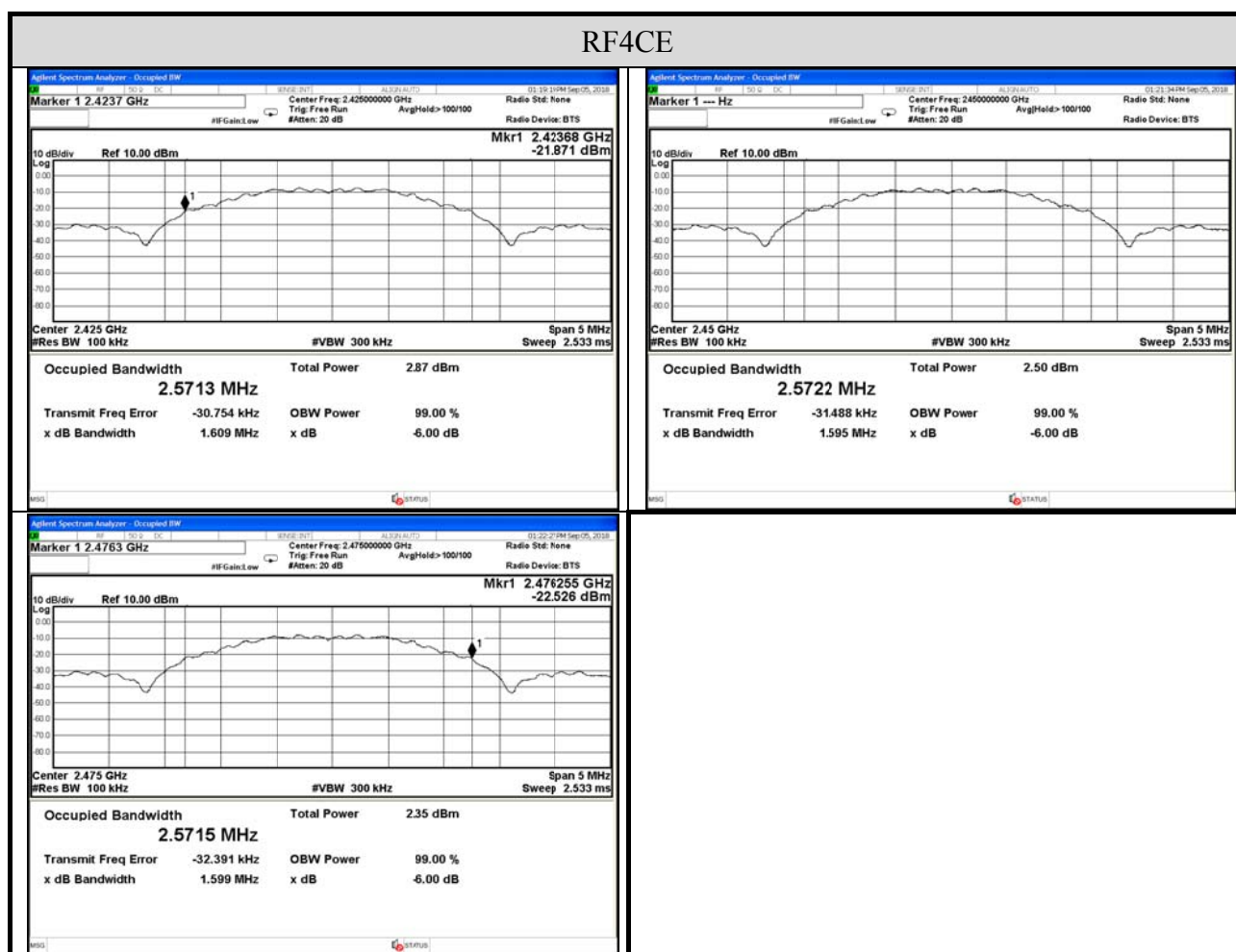
A.3 6dB BANDWIDTH

Test Date	2018/09/05	Temp./Hum.	25°C/56%
Cable Loss	---	Test Voltage	DC 5V (via Power Bar)

A.3.1 6dB Bandwidth Result

Mode	Centre Frequency (MHz)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz) (Reference only)	Limit
RF4CE	2425	1.609	2.5713	>500kHz
	2450	1.595	2.5722	
	2475	1.599	2.5715	

A.3.2 Measurement Plots



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New Taipei City 244, Taiwan

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A.4 MAXIMUM PEAK OUTPUT POWER

Test Date	2018/09/05	Temp./Hum.	25°C/56%
Cable Loss	---	Test Voltage	DC 5V (via Power Bar)

A.4.1 Peak Output Power

Mode	Centre Frequency (MHz)	Peak Output Power (dBm)		Antenna Gain (dBi)	Output Power (E.I.R.P.)		Limit
		(dBm)	(W)		(dBm)	(W)	
RF4CE	2425	-2.70	0.00054	-2.31	-5.01	0.00032	< 30dBm (1W) (Maximum Peak Output Power) < 36dBm (4W) (E.I.R.P)
	2450	-3.12	0.00049		-5.43	0.00029	
	2475	-3.41	0.00046		-5.72	0.00027	

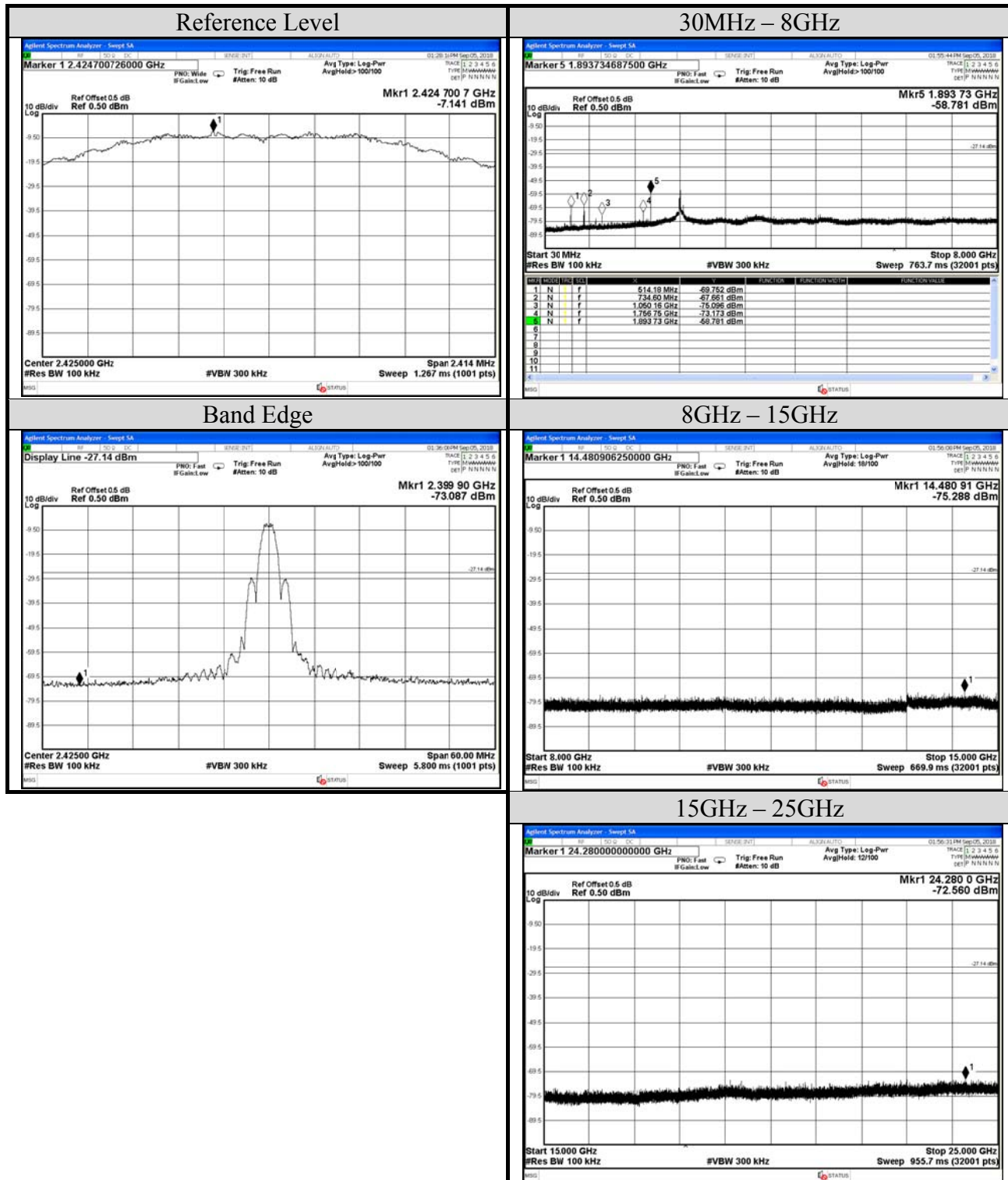
Note: The results have been included cable loss.

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Fax: +886 2 26099303

A.5 EMISSION LIMITATIONS

Test Date	2018/09/05	Temp./Hum.	25°C/56%
Cable Loss	0.50dB	Test Voltage	DC 5V (via Power Bar)
Mode	RF4CE	Frequency	TX 2425MHz



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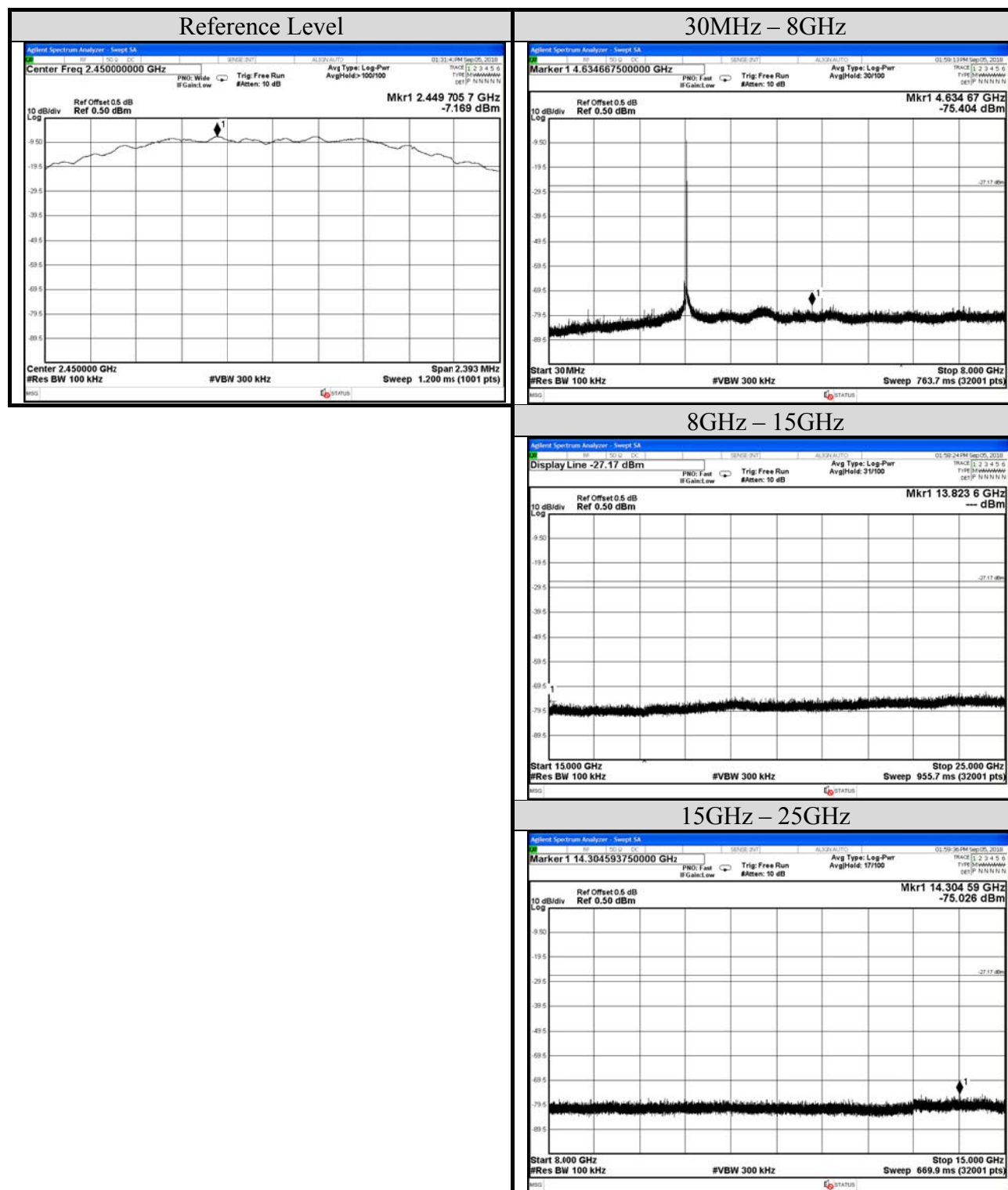
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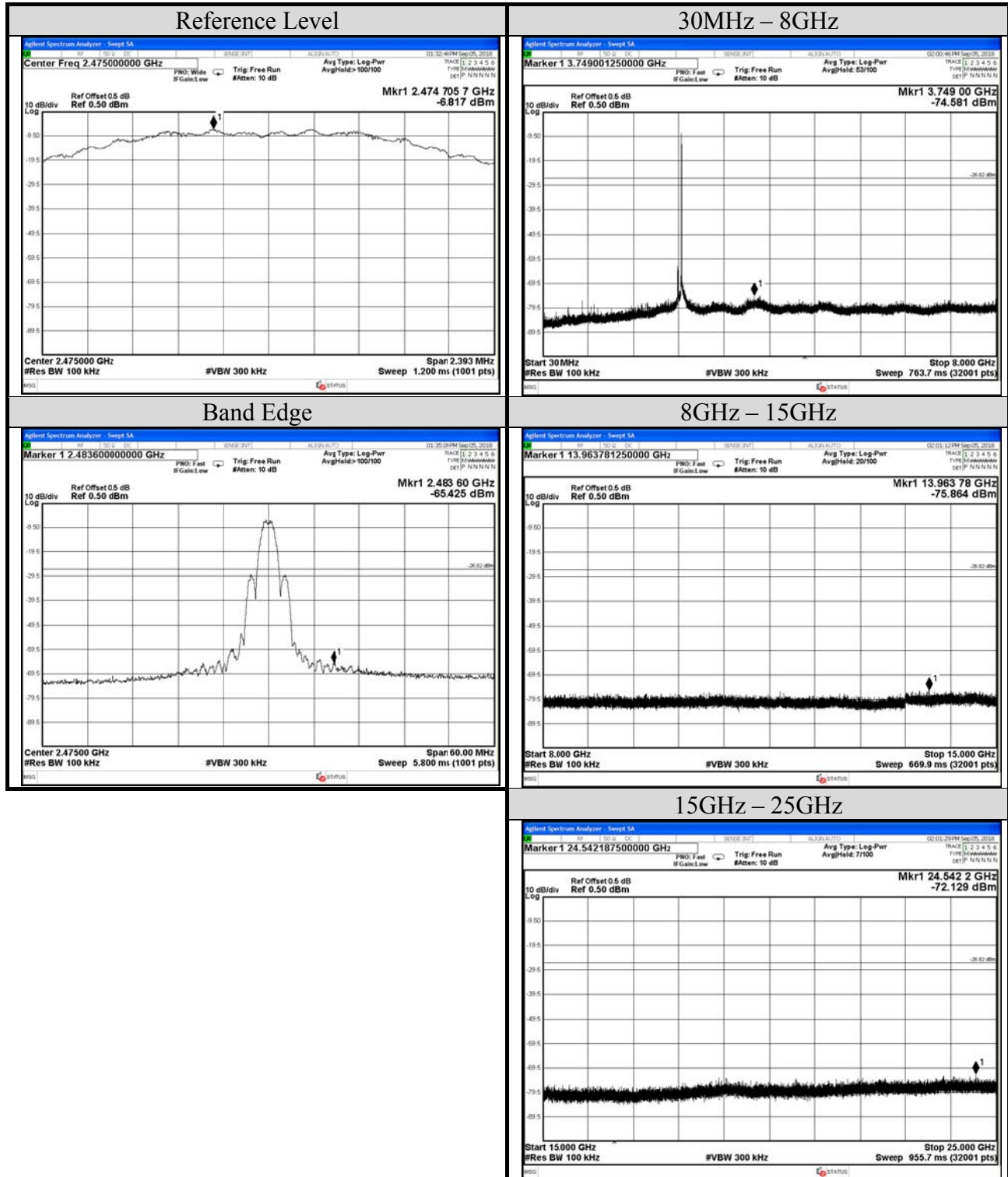
Test Date	2018/09/05	Temp./Hum.	25°C/56%
Cable Loss	0.50dB	Test Voltage	DC 5V (via Power Bar)
Mode	RF4CE	Frequency	TX 2450MHz



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New Taipei City 244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

Test Date	2018/09/05	Temp./Hum.	25°C/56%
Cable Loss	0.50dB	Test Voltage	DC 5V (via Power Bar)
Mode	RF4CE	Frequency	TX 2475MHz



A.6 POWER SPECTRAL DENSITY

Test Date	2018/09/05	Temp./Hum.	25°C/56%
Cable Loss	0.50dB	Test Voltage	DC 5V (via Power Bar)

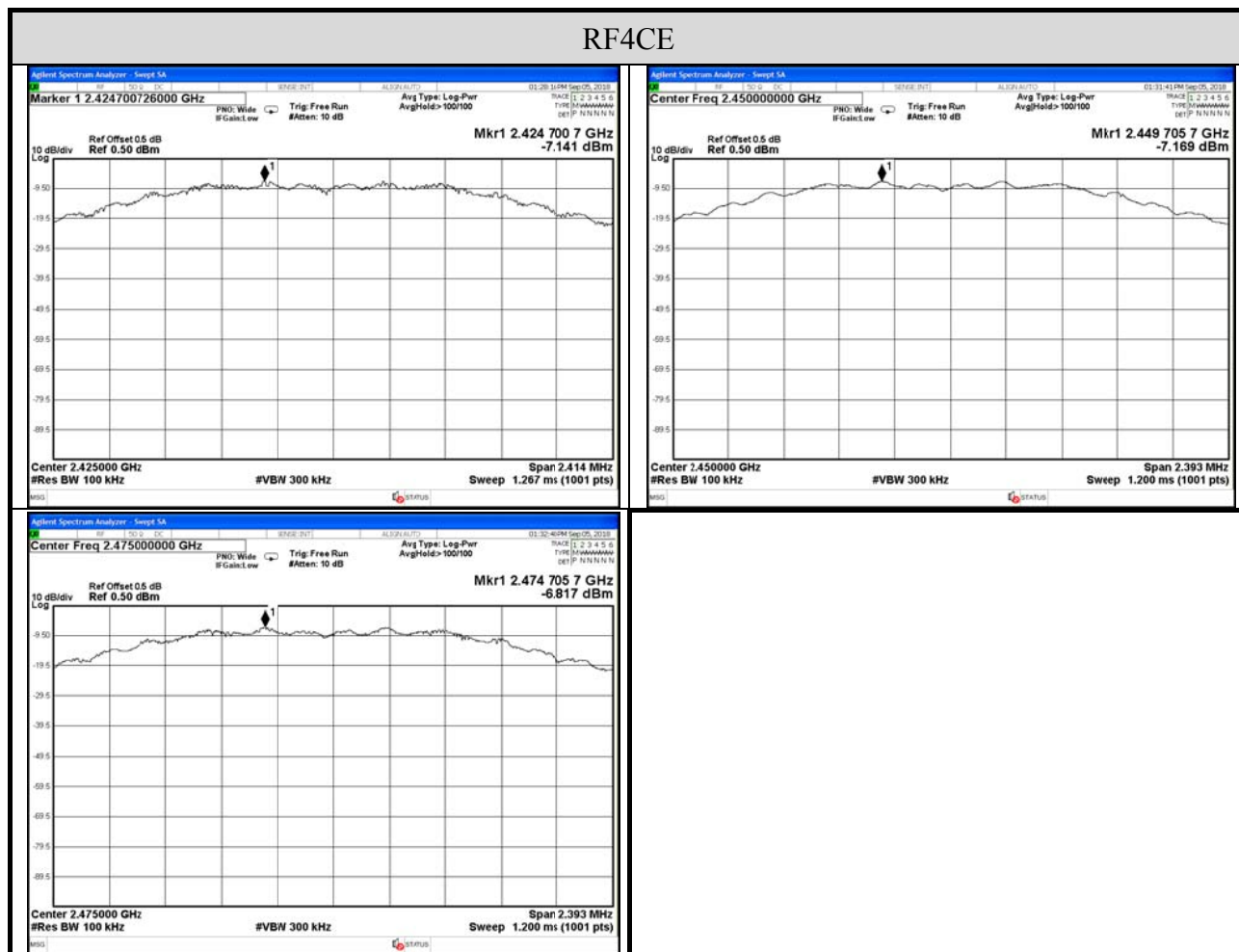
A.6.1 Power Spectral Density Result

Mode	Centre Frequency (MHz)	Power Spectral Density (dBm)	Limit
RF4CE	2405	-7.141	< 8 dBm/3kHz
	2440	-7.169	
	2480	-6.817	

Note: 1. All results have been included cable loss and Simultaneous Factor.

2. For KDB558074 D01 V05, in the test result, when RBW set at 100kHz is stricter than 3kHz.

A.6.2 Measurement Plots



Note: All results have been included cable loss and Simultaneous Factor.



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APPENDIX B

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APPENDIX B

TEST PHOTOGRAPHS

(Model: RD-01)