

Prüfbericht-Nr.: Test report no.:	CN22LZS6 001	Auftrags-Nr.: Order no.:	244355890	Seite 1 von 33 Page 1 of 33
Kunden-Referenz-Nr.: Client reference no.:	N/A	Auftragsdatum: Order date:	2021-08-24	
Auftraggeber: Client:	Testo SE & Co. KGaA Celsiusstrasse 2, 79822 Titisee-Neustadt, Germany			
Prüfgegenstand: Test item:	testo smart valve			
Bezeichnung / Typ-Nr.: Identification / Type no.:	0560 5600 FCC ID: WAF-05605600 IC: 6127B-05605600			
Auftrags-Inhalt: Order content:	Complete test			
Prüfgrundlage: Test specification:	FCC CFR47 Part 15, Subpart C Section 15.247 RSS-Gen Issue 5, Amendment 2, February 2021 RSS-247 Issue 2, February 2017 ANSI C63.10: 2013			
Wareneingangsdatum: Date of sample receipt:	2022-03-01			
Prüfmuster-Nr.: Test sample no.:	A003219639-001			
Prüfzeitraum: Testing period:	Refer to test report			
Ort der Prüfung: Place of testing:	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:	☒ <u>Weidong Wang</u>		genehmigt von: authorized by:	☒ <u>Hongfei Wu</u>
Datum: Date:	2022-05-16 Signed by: Weidong Wang		Ausstellungsdatum: Issue date:	2022-05-16 Signed by: Hongfei Wu
Stellung / Position:	PE		Stellung / Position:	Reviewer
Sonstiges / Other:	HVIN: 0560 5600			
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 6dB & 99% BANDWIDTH

RESULT: Pass

5.1.3 PEAK OUTPUT POWER

RESULT: Pass

5.1.4 POWER SPECTRAL DENSITY

RESULT: Pass

5.1.5 CONDUCTED BAND EDGE AND OUT-OF BAND EMISSIONS

RESULT: Pass

5.2.1 CONDUCTED EMISSION

RESULT: N/A

5.3.1 RADIATED BAND-EDGE

RESULT: Pass

5.3.2 RADIATED SPURIOUS EMISSION

RESULT: Pass

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1. General Remarks

1.1 Complementary Materials

Null.

2. Test Sites

2.1 Test Facilities

TÜV Rheinland (Shanghai) Co., Ltd.

Shanghai TÜV Rheinland Building No. 177, 178 Lane 777, West Guangzhong Rd, Jing'an District, Shanghai, China

The used test equipment is in accordance with CISPR 16 for measurement of radio interference.

The Federal Communications Commission has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance with the requirements of section 2.948 of the FCC rules. The description of the test facility is listed under FCC registration number 958801.

The Innovation, Science and Economic Development Canada has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance. The description of the test facility is listed under chambers filing number 2932F.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Due Date
3m modified semi-anechoic chamber	Frankonia	SAC3	G1811378	2022-06-27
Bilog antenna	Teseq	CBL 6112D	G1811425	2023-03-10
EMI test receiver	Rohde & Schwarz	ESCI	G1811402	2022-09-01
Spectrum analyser	Rohde & Schwarz	FSV40	G1822702	2023-11-04
Preamplifier	Taiwan EMCI	EMC184045SE	G1825372	2023-05-14
Log periodic antenna	Rohde & Schwarz	HL050	G1811417	2023-03-10
Broadband Horn Antenna	Schwarzbeck	BBHA 9170	9170-305	2023-07-08
Preamplifier	Taiwan EMCI	EMC051845SE	G1825371	2023-05-14
Spectrum Analyzer	Keysight	N9020A	MY54500180	2022-09-08

2.3 Traceability

All measurement equipment calibrations are traceable to NIST or where calibration is performed outside the United States, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

Table 2: Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Antenna Port Conducted Emission	< 1GHz	±0.39dB
	> 1GHz	±0.68dB
Radiated Emission	9kHz – 30MHz	±2.93dB
	30MHz - 1GHz	±5.34dB
	> 1GHz	±5.40dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (Equipment Under Test) is a Smart Valve which supports Bluetooth LE. For details refer to the User Manual and Circuit Diagram.

3.2 Ratings and System Details

Table 3: Technical Specification of EUT

General Description of EUT	
Product Name:	testo smart valve
Model No.:	0560 5600
Rated Voltage:	DC 9V(battery)
Hardware Version:	FY-GTV-V1.1
Firmware Version:	V0.7.15
Serial number:	49701950
Technical Specification of BLE	
Frequency Range:	2402 to 2480MHz
Modulation Type:	GFSK
Data Rate:	1Mbps(GFSK)
Antenna Type:	Dipole Antenna
Antenna Gain:	1.54dBi (Provided by the Client)

3.3 Independent Operation Modes

Table 4: Independent Operation Modes

Test Mode	Channel	Frequency	Data Rate
TM1	00	2402	1 MB/s
TM2	19	2440	1 MB/s
TM3	39	2480	1 MB/s

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- Bill of Material
- PCB Layout
- Photo Document
- Circuit Diagram
- Instruction Manual
- Rating Label

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All testing were performed according to the procedures in ANSI C63.10: 2013.

Test Software used: ATK XCOM V2.0

Table 5: Power parameter value

Operating Mode	Power Parameter Value
BLE	Neg16dBm

4.3 Special Accessories and Auxiliary Equipment

Table 6: Auxiliary Equipment

Product Name	Model Name	Manufactory
Laptop	T450	Thinkpad

4.4 Countermeasures to achieve EMC Compliance

Null.

5. Test Results

5.1 Conducted Testing at Antenna Port

5.1.1 Antenna Requirement

RESULT:**Pass**

According to the manufacturer declared, the EUT has one Dipole antenna, the directional gain of antenna is 1.54 dBi and the antenna is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Table 7: Antenna Requirement**FCC 15.203 – Antenna Requirement 1**

Requirement:	No antenna other than that furnished by the responsible party shall be used with the device	
Results:	Antenna type:	Dipole Antenna
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2

Requirement:	An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.	
Results:	Only one Dipole antenna can be used	
Verdict:	Pass	

RSS-Gen 6.4 – External Control

Requirement:	The device shall not have any external controls accessible to the user that enable it to be adjusted, selected or programmed to operate in violation of the regulatory requirements, including RSS-Gen and the applicable RSSs	
Results:	The device does not have any transmitter external controls accessible to the user that can be adjusted and operated in violation of the limits of this standard.	
Verdict:	PASS	

RSS-Gen 6.8 – Antenna Requirement

Requirement: When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

Results:

a) Antenna Type:	Dipole Antenna
b) Manufacture:	Wieson Technologies Co., Ltd.
c) Model No.:	ARY196-3735-001-00
d) Gain with reference to an isotropic radiator:	1.54dBi

Verdict: PASS

5.1.2 6dB & 99% Bandwidth**RESULT:****Pass**

Date of testing : 2022-03-09
Ambient temperature : 20.2°C
Relative humidity : 54.1%
Atmospheric pressure : 101kPa
Test requirement : FCC Part 15.247(a)(2)
RSS-247 Issue 2, February 2017, Clause 5.2(a)
Test procedure : ANSI C63.10: 2013
Test voltage : DC 9V
Test modes applied : TM1 to TM3

Table 8: 6dB & 99% Bandwidth

Test Mode	CH.	Freq. [MHz]	6dB Bandwidth [KHz]	6dB Bandwidth limit [kHz]	99% Bandwidth [MHz]
TM1	00	2402	726.2	≥500	1.0616
TM2	19	2440	748.6	≥500	1.0717
TM3	39	2480	719.9	≥500	1.0601

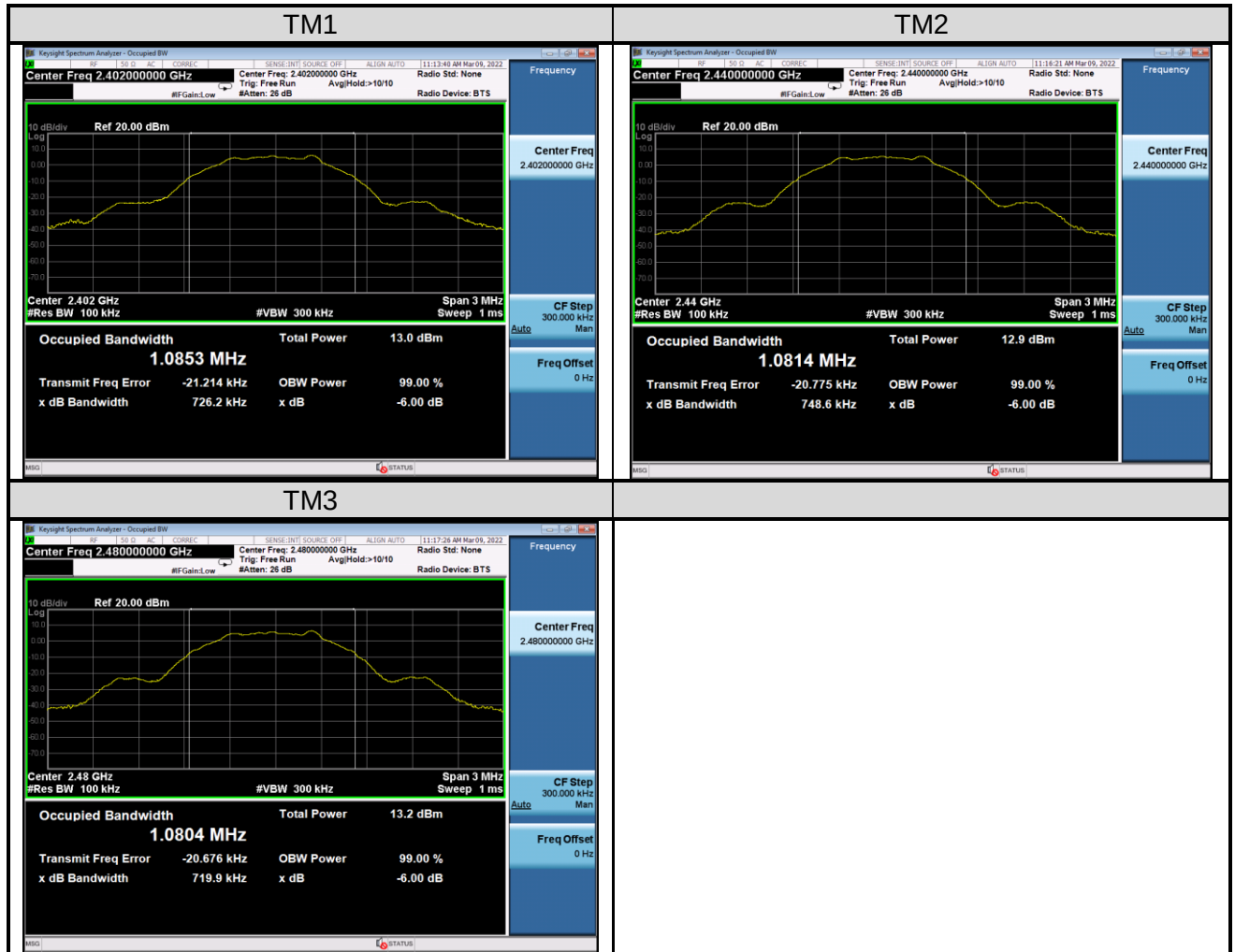
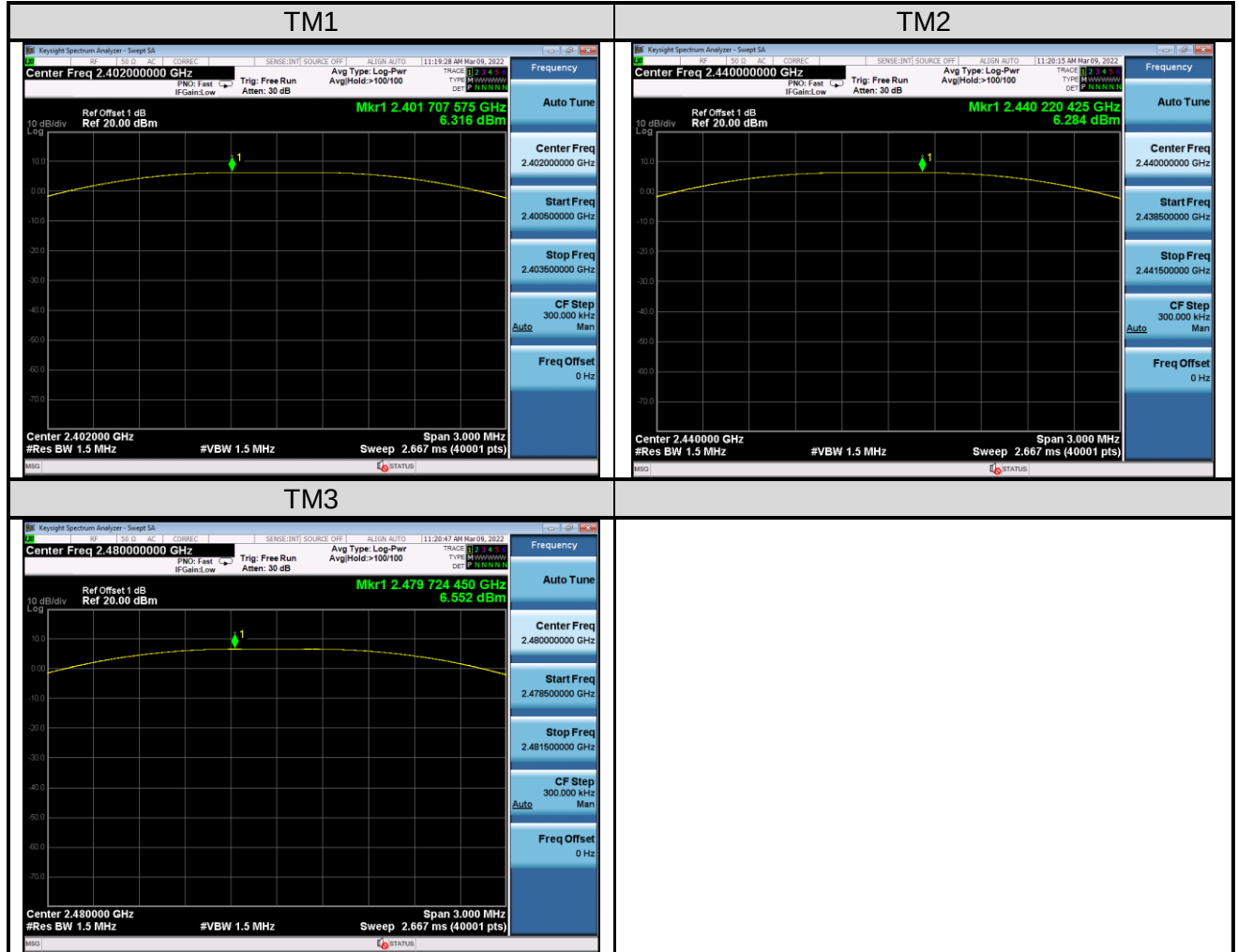
Figure 1: 6dB Bandwidth


Figure 2: 99% Bandwidth


Note:
EIRP=Peak Conducted Output Power + Antenna Gain

Figure 3: Peak Output Power, TM1 to TM3


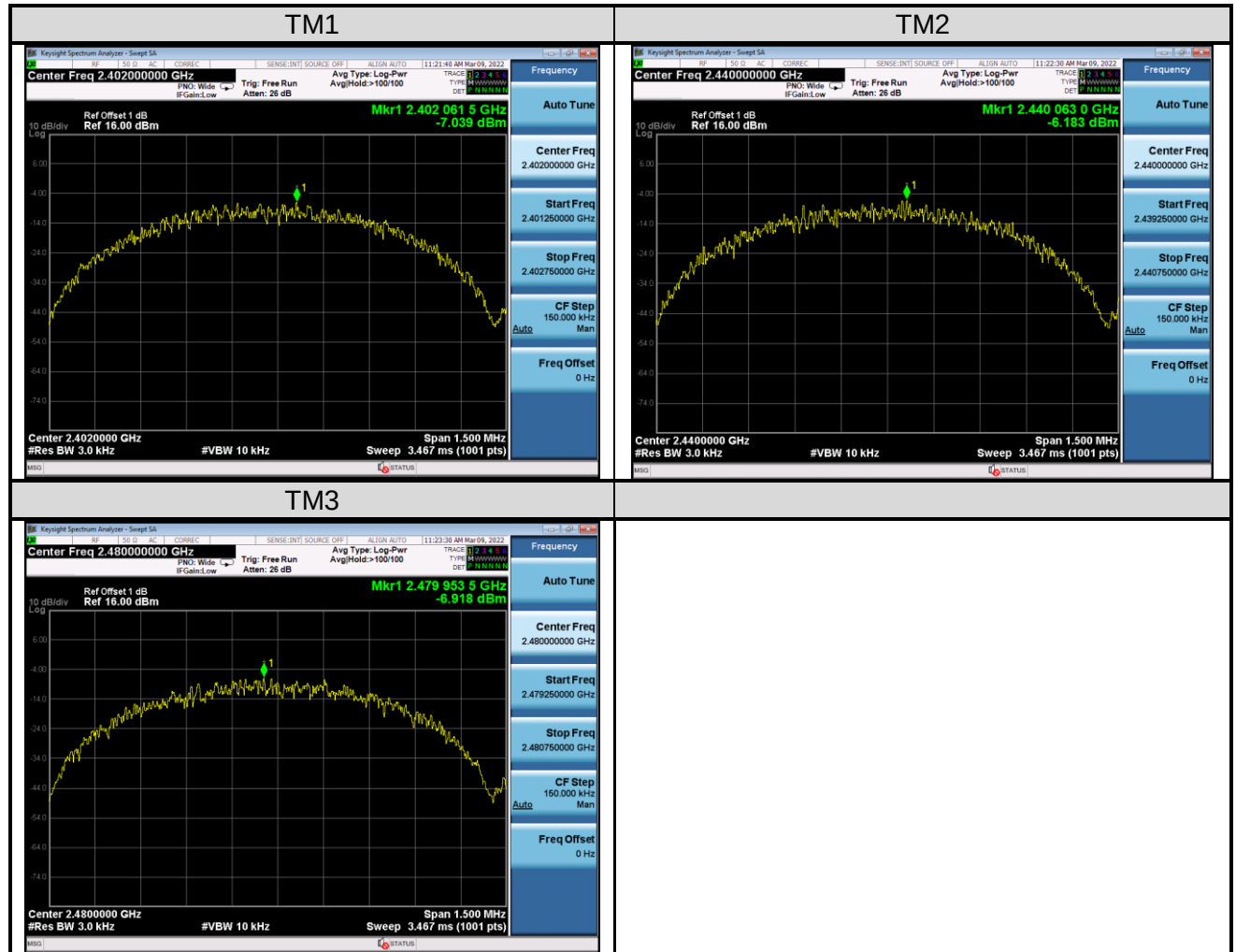
5.1.4 Power Spectral Density

RESULT:**Pass**

Date of testing : 2022-03-09
Ambient temperature : 20.2°C
Relative humidity : 54.1%
Atmospheric pressure : 101kPa
Test requirement : FCC Part 15.247(e)
RSS-247 Issue 2, February 2017, Clause 5.2(b)
Test procedure : ANSI C63.10: 2013
Test voltage : DC 9V
Test modes applied : TM1 to TM3

Table 10: Power Spectral Density

Mode	CH.	Frequency [MHz]	Result [dBm/3kHz]	Limit [dBm/3kHz]
TM1	00	2402	-7.039	8
TM2	19	2440	-6.183	8
TM3	39	2480	-6.918	8

Figure 4: Power Spectral Density


5.1.5 Conducted Band Edge and out-of Band Emissions

RESULT:

Pass

Date of testing	: 2022-03-09
Ambient temperature	: 20.2°C
Relative humidity	: 54.1%
Atmospheric pressure	: 101kPa
Test requirement	: FCC Part 15.247(d) RSS-247 Issue 2, February 2017, Clause 5.5
Test procedure	: ANSI C63.10: 2013
Test voltage	: DC 9V
Test modes applied	: TM1 to TM3

Figure 5: Reference level

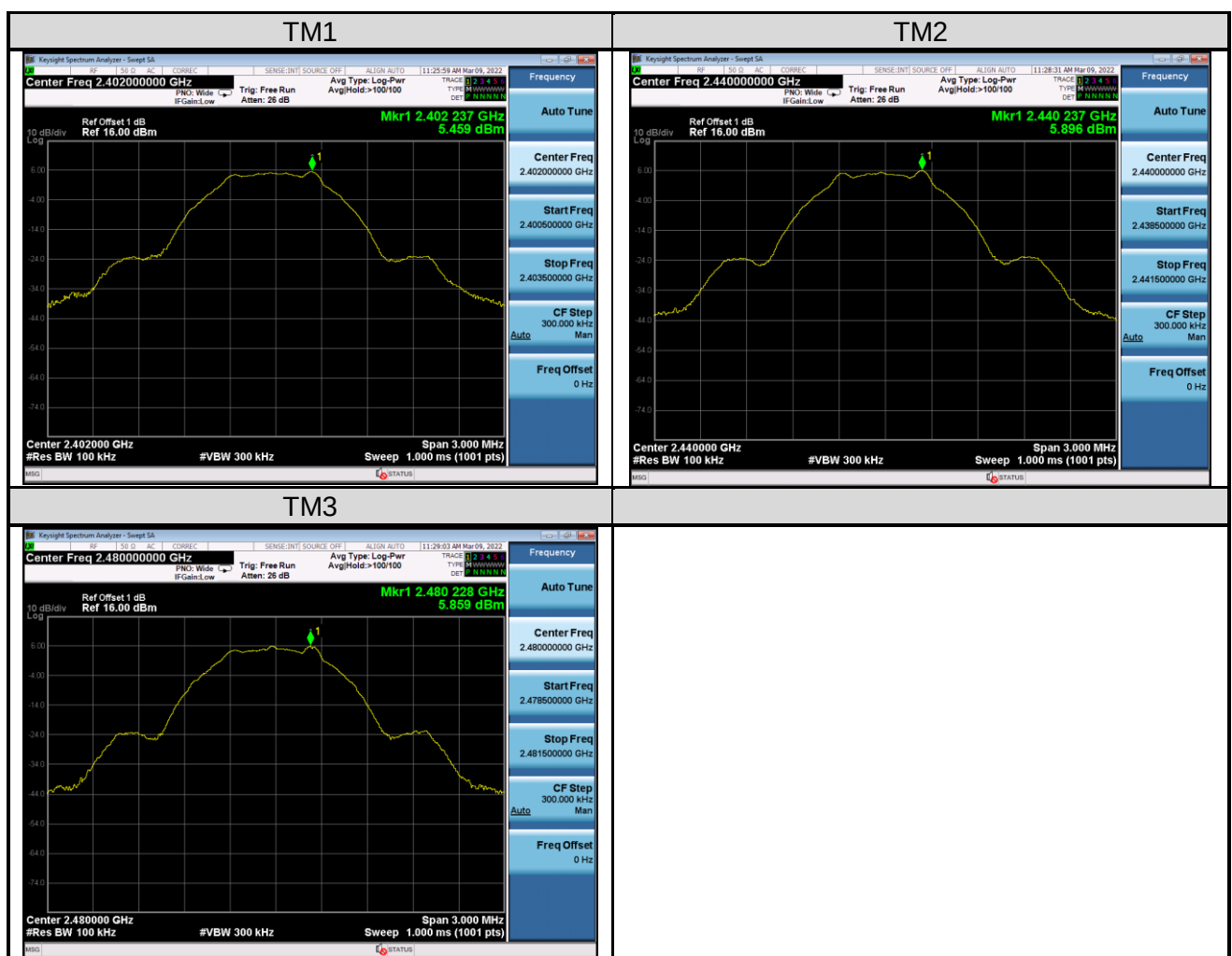
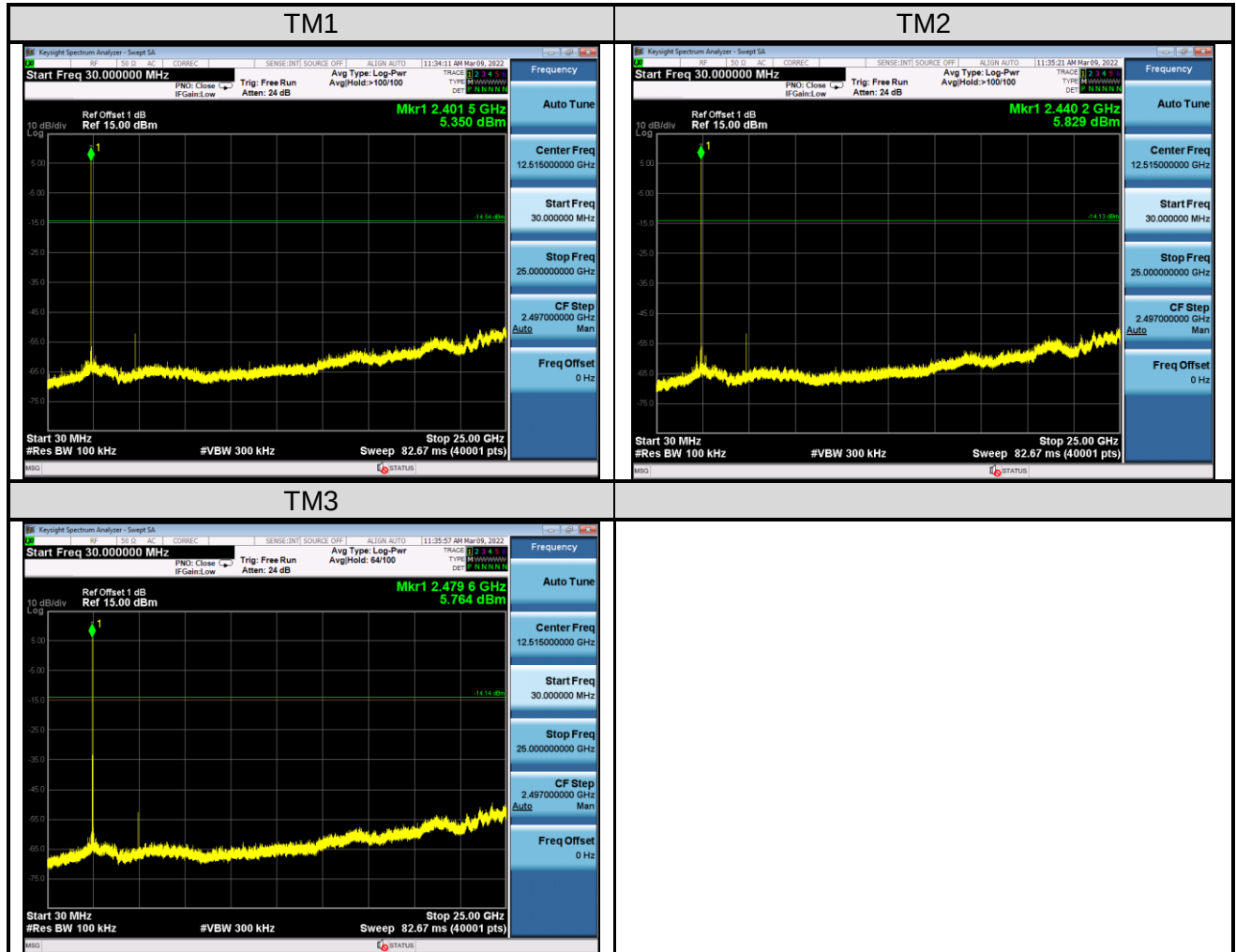
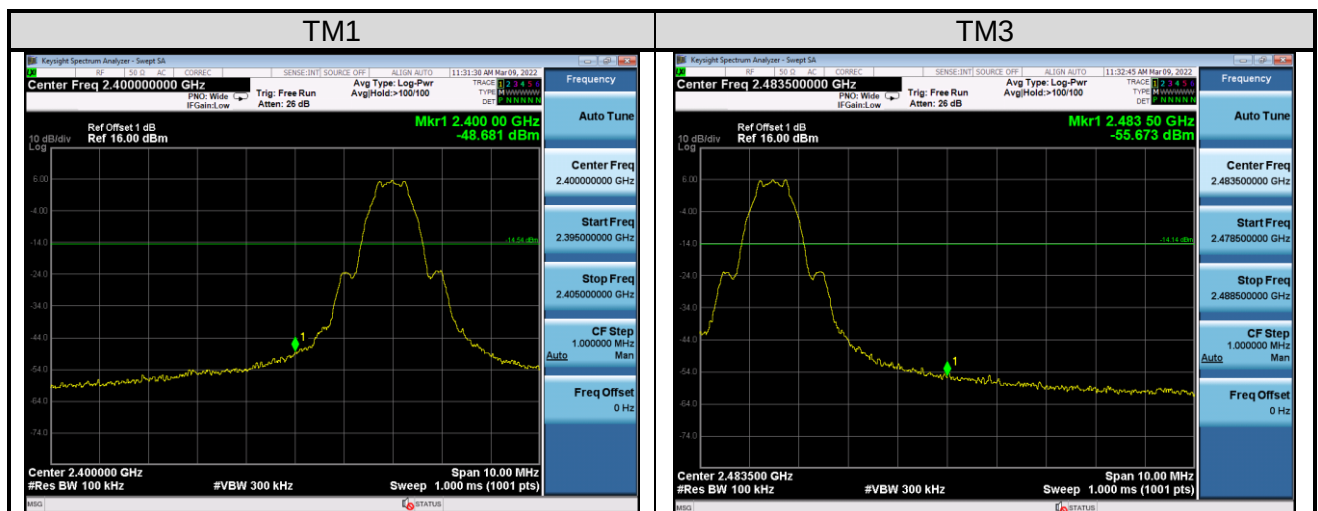


Figure 6: Conducted Spurious Emission

Figure 7: Conducted Band Edge


5.2 Emission in the Frequency Range up to 30MHz

5.2.1 Conducted Emission

RESULT:**N/A**

Test requirement : FCC Part 15.207 (a)
RSS-Gen Issue 5, Amendment 2, February 2021, Clause 8.8
Test procedure : ANSI C63.10: 2013

Note :

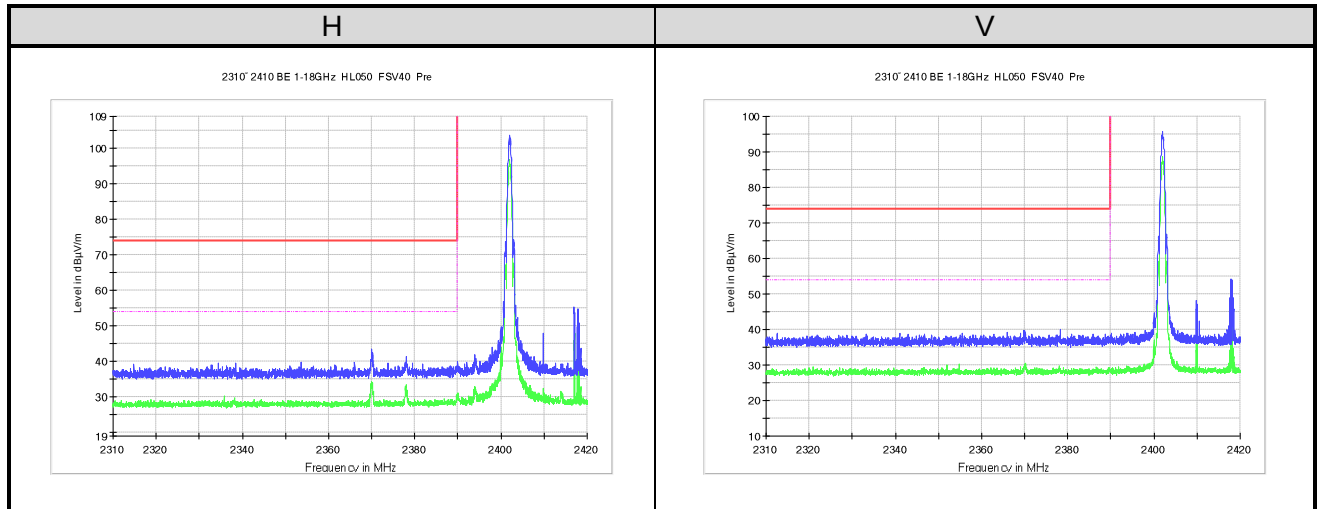
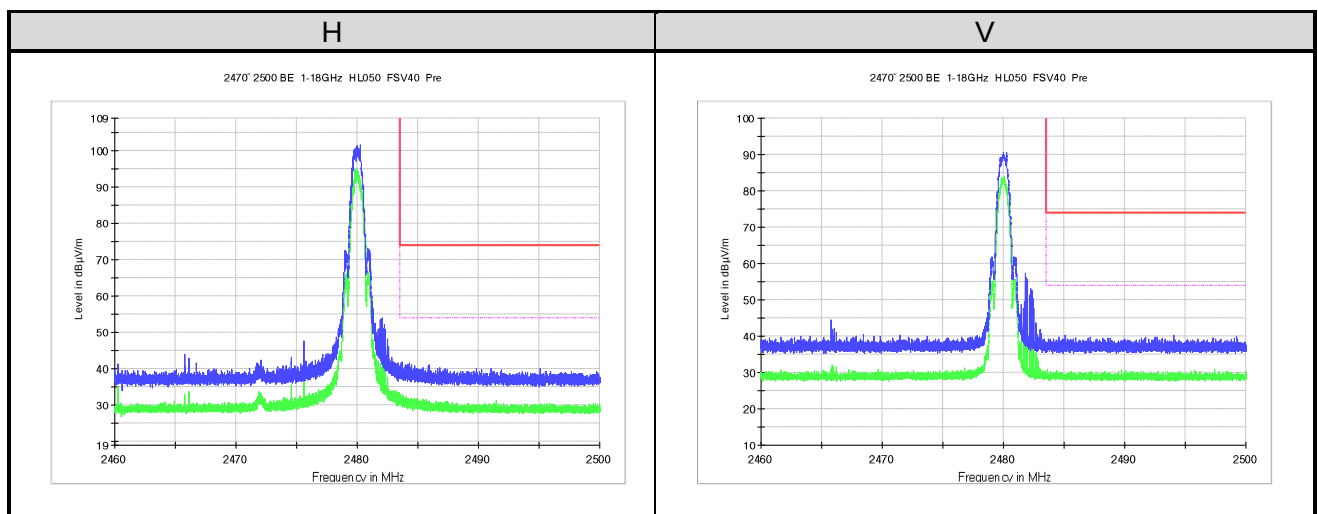
This product is power by DC 9V(battery).
So, this test is not applicable

5.3 Emission in the Frequency Range above 30MHz

5.3.1 Radiated Band-Edge

RESULT:**Pass**

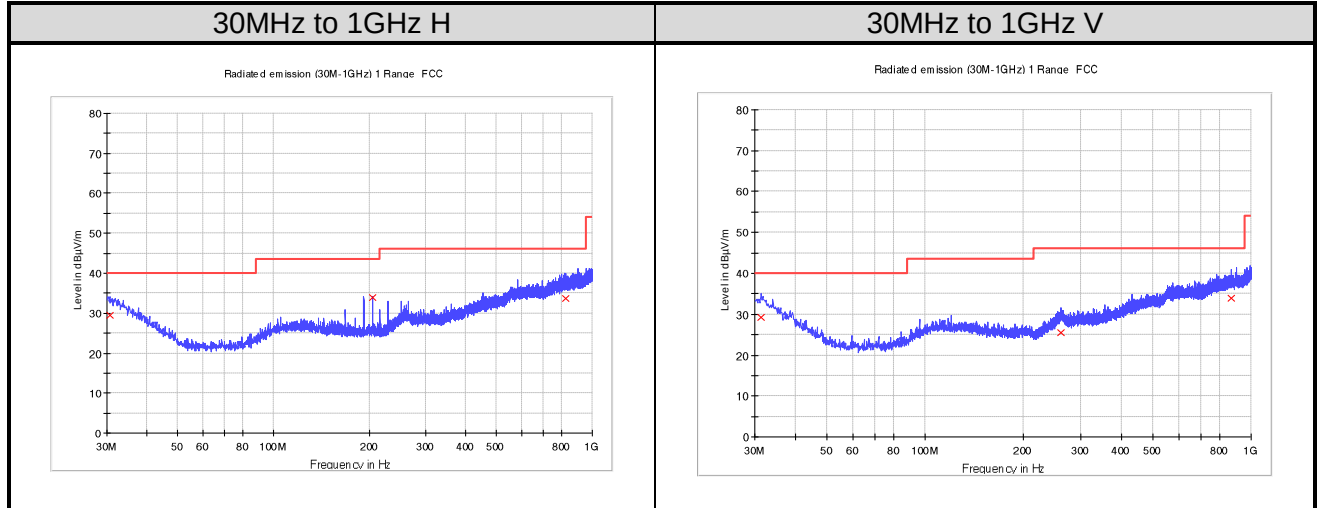
Date of testing	:	2022-03-14
Ambient temperature	:	24.6°C
Relative humidity	:	46.3%
Atmospheric pressure	:	101kPa
Test requirement	:	FCC Part 15.247(d) FCC Part 15.205(a) FCC Part 15.209(a) RSS-Gen Issue 5, Amendment 2, February 2021, Clause 8.9 RSS-Gen Issue 5, Amendment 2, February 2021, Clause 8.10 RSS-247 Issue 2, February 2017, Clause 5.5
Test procedure	:	ANSI C63.10: 2013
Test voltage	:	DC 9V
Test modes applied	:	TM1, TM3

Figure 8: Radiated Band-Edge, TM1

Figure 9: Radiated Band-Edge, TM3


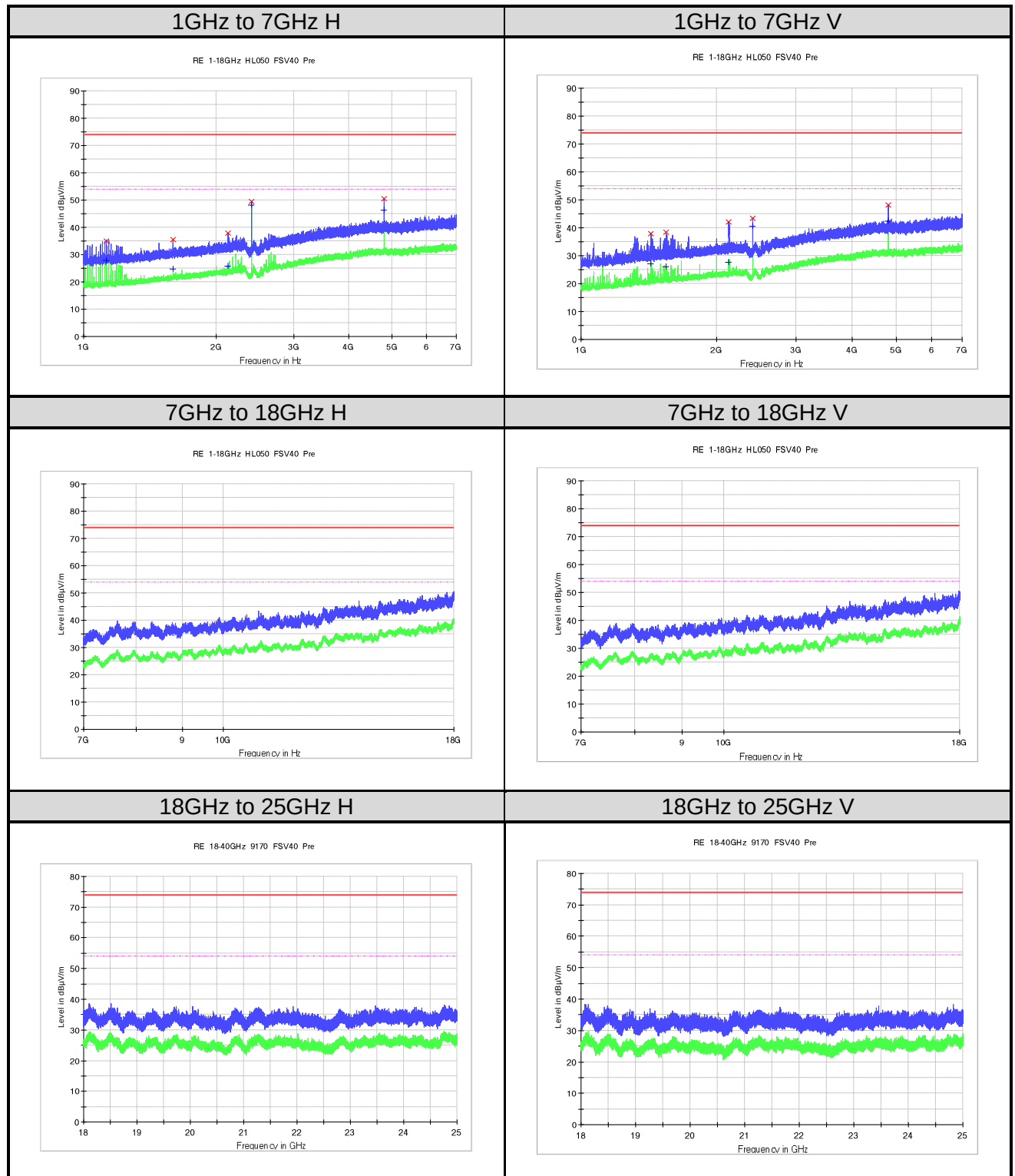
5.3.2 Radiated Spurious Emission

RESULT:**Pass**

Date of testing	:	2022-03-08 ~ 2022-03-14
Ambient temperature	:	24.1°C ~ 24.6°C
Relative humidity	:	42.7% ~ 46.3%
Atmospheric pressure	:	101kPa
Test requirement	:	FCC Part 15.247(d) FCC Part 15.209(a) RSS-Gen Issue 5, Amendment 2, February 2021, Clause 8.9 RSS-247 Issue 2, February 2017, Clause 5.5
Test procedure	:	ANSI C63.10: 2013
Test voltage	:	DC 9V
Test modes applied	:	TM1 to TM3

Figure 10: Radiated Spurious Emission, TM1, 30MHz to 1GHz

Limit and Margin

Frequency (MHz)	QuasiPeak (dBµV/m)	Pol	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
30.606250	29.5	H	25.1	10.5	40.0
203.993750	33.9	H	16.2	9.6	43.5
828.310000	33.6	H	27.5	12.4	46.0
31.455000	29.3	V	24.7	10.7	40.0
261.466250	25.5	V	20.7	20.5	46.0
869.656250	33.9	V	28.0	12.1	46.0

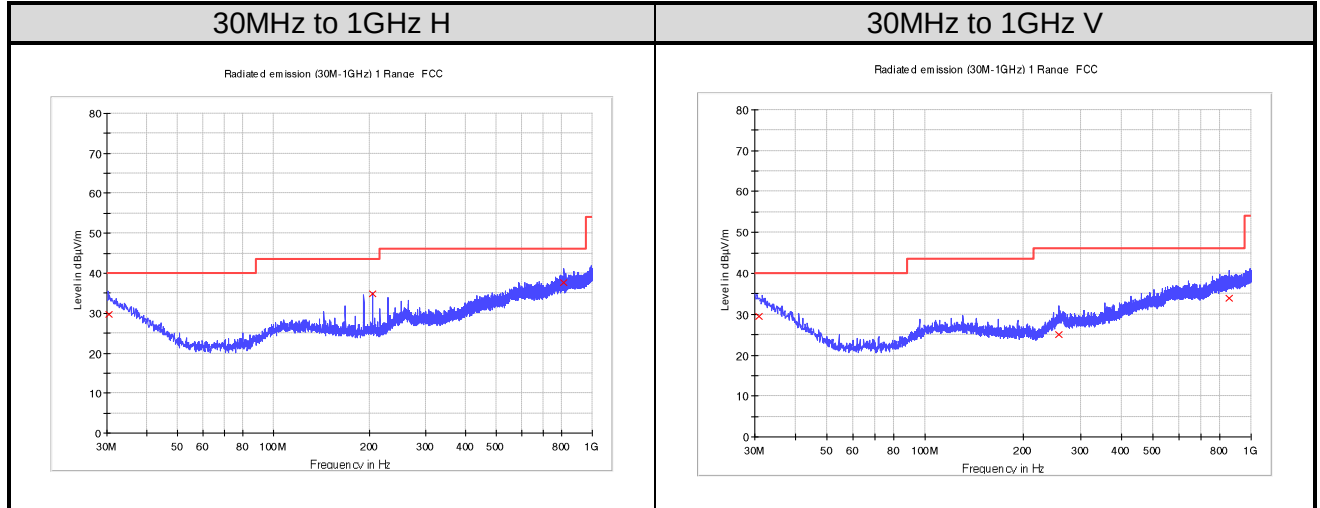
Figure 11: Radiated Spurious Emission, TM1, 1GHz to 25GHz


Limit and Margin
PK

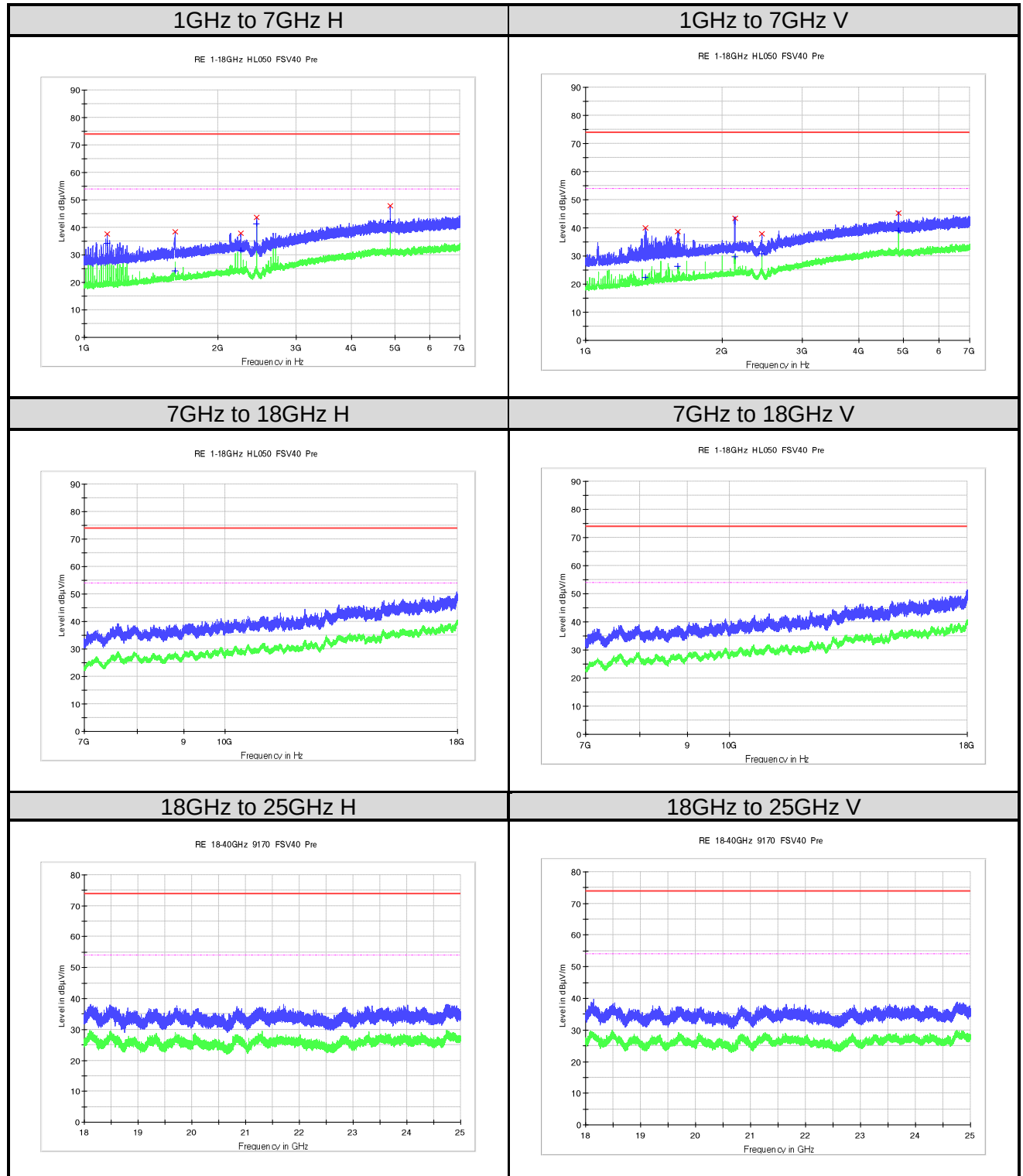
Frequency (MHz)	MaxPeak (dBμV/m)	Pol	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBμV/m)
1128.062500	35.1	H	-21.7	38.9	74.0
1597.562500	35.5	H	-18.3	38.5	74.0
2123.687500	37.8	H	-15.8	36.2	74.0
2401.750000	49.4	H	-14.5	24.6	74.0
4804.375000	50.5	H	-6.5	23.5	74.0
1428.250000	38.0	V	-19.5	36.0	74.0
1543.000000	38.3	V	-18.6	35.7	74.0
2124.062500	42.1	V	-15.8	31.9	74.0
2402.125000	43.4	V	-14.4	30.6	74.0
4803.625000	48.1	V	-6.5	25.9	74.0

AV

Frequency (MHz)	Average (dBμV/m)	Pol	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBμV/m)
1128.062500	27.9	H	-21.7	26.1	54.0
1597.562500	24.7	H	-18.3	29.3	54.0
2123.687500	25.7	H	-15.8	28.3	54.0
2401.750000	48.2	H	-14.5	5.8	54.0
4804.375000	46.3	H	-6.5	7.7	54.0
1428.250000	27.0	V	-19.5	27.0	54.0
1543.000000	26.0	V	-18.6	28.0	54.0
2124.062500	27.7	V	-15.8	26.3	54.0
2402.125000	40.6	V	-14.4	13.4	54.0
4803.625000	42.3	V	-6.5	11.7	54.0

Figure 12: Radiated Spurious Emission, TM2, 30MHz to 1GHz

Limit and Margin

Frequency (MHz)	QuasiPeak (dBµV/m)	Pol	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
30.485000	29.7	H	25.2	10.3	40.0
203.993750	34.9	H	16.2	8.6	43.5
816.185000	37.7	H	27.5	8.3	46.0
30.970000	29.5	V	24.9	10.5	40.0
256.616250	25.1	V	20.2	20.9	46.0
854.500000	33.9	V	27.9	12.1	46.0

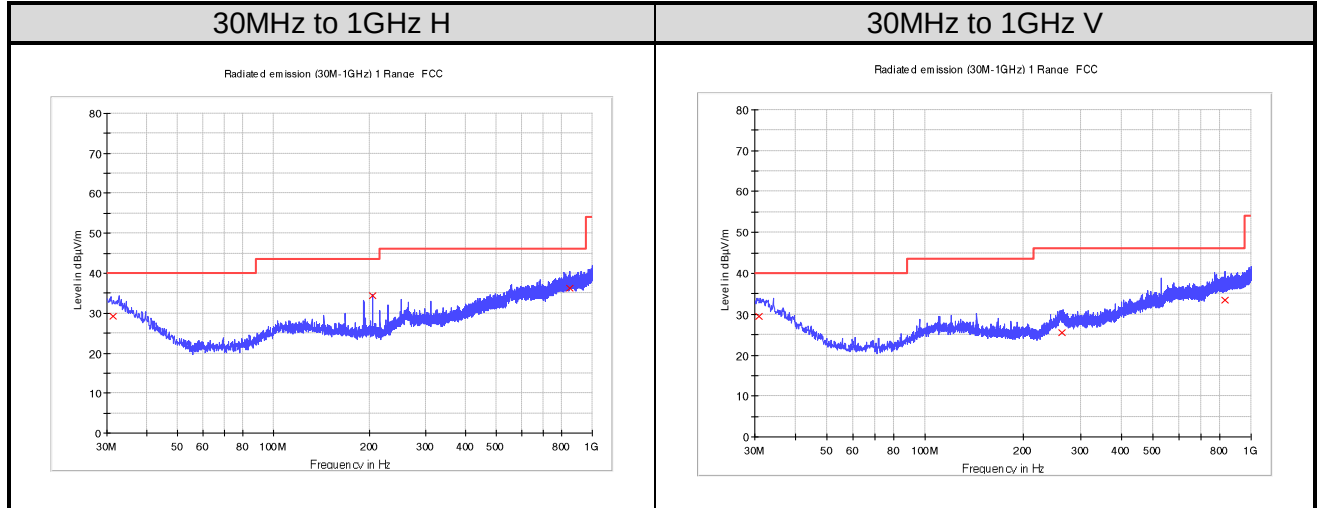
Figure 13: Radiated Spurious Emission, TM2, 1GHz to 25GHz


Limit and Margin
PK

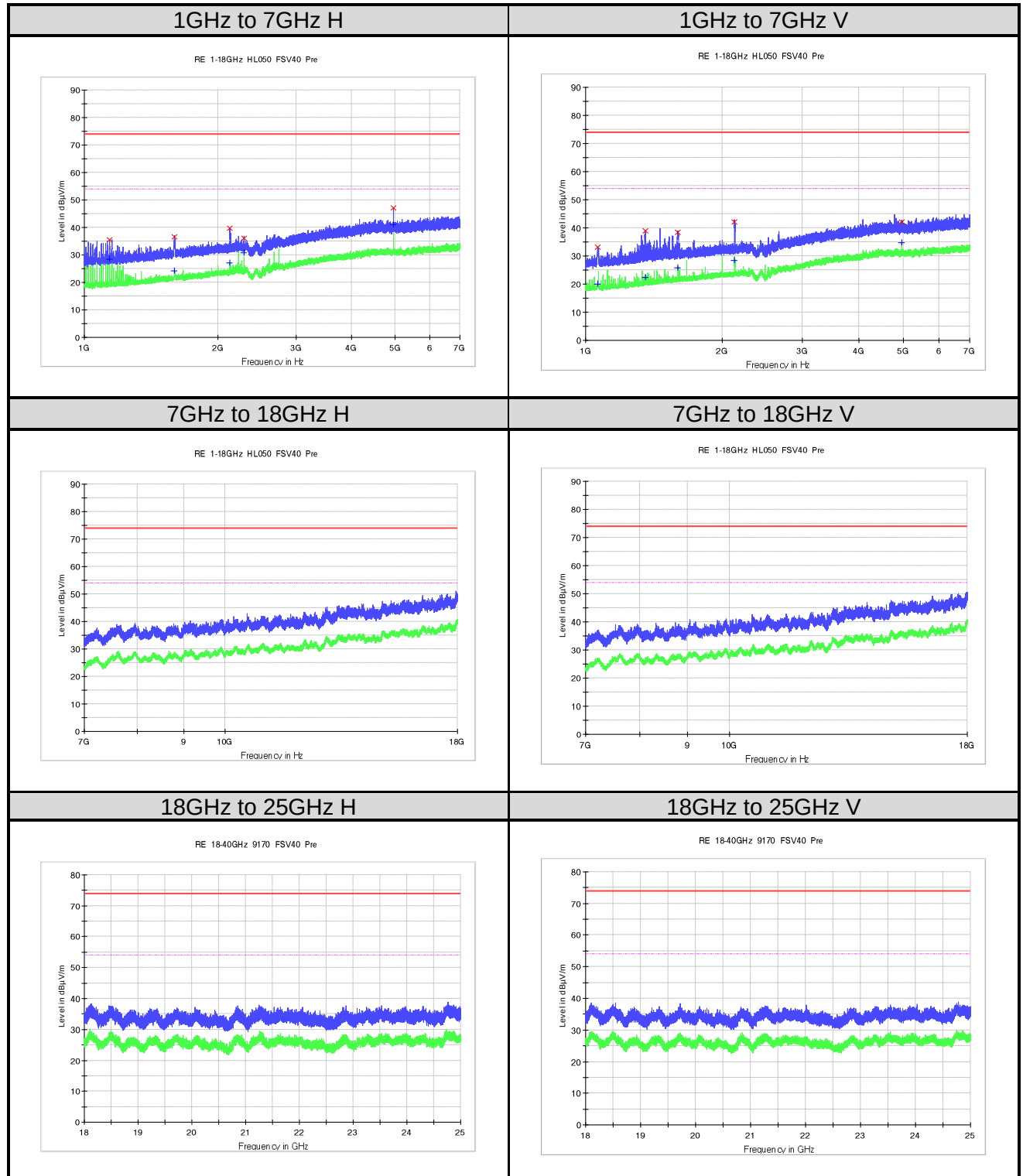
Frequency (MHz)	MaxPeak (dBμV/m)	Pol	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBμV/m)
1128.250000	37.7	H	-21.7	36.3	74.0
1600.000000	38.4	H	-18.3	35.6	74.0
2248.000000	37.8	H	-15.2	36.2	74.0
2439.625000	43.6	H	-14.3	30.4	74.0
4880.500000	47.9	H	-6.5	26.1	74.0
1353.812500	40.0	V	-20.1	34.0	74.0
1596.437500	38.6	V	-18.3	35.4	74.0
2130.250000	43.5	V	-15.7	30.5	74.0
2440.000000	37.8	V	-14.3	36.2	74.0
4880.687500	45.2	V	-6.5	28.8	74.0

AV

Frequency (MHz)	Average (dBμV/m)	Pol	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBμV/m)
1128.250000	34.3	H	-21.7	19.7	54.0
1600.000000	24.2	H	-18.3	29.8	54.0
2248.000000	31.6	H	-15.2	22.4	54.0
2439.625000	41.3	H	-14.3	12.7	54.0
4880.500000	42.0	H	-6.5	12.0	54.0
1353.812500	22.3	V	-20.1	31.7	54.0
1596.437500	26.3	V	-18.3	27.7	54.0
2130.250000	29.8	V	-15.7	24.2	54.0
2440.000000	30.9	V	-14.3	23.1	54.0
4880.687500	38.9	V	-6.5	15.1	54.0

Figure 14: Radiated Spurious Emission, TM3, 30MHz to 1GHz

Limit and Margin

Frequency (MHz)	QuasiPeak (dBµV/m)	Pol	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
31.455000	29.2	H	24.7	10.8	40.0
203.993750	34.5	H	16.2	9.0	43.5
852.196250	36.3	H	27.9	9.7	46.0
30.848750	29.5	V	25.0	10.5	40.0
262.072500	25.5	V	20.7	20.5	46.0
832.190000	33.4	V	27.5	12.6	46.0

Figure 15: Radiated Spurious Emission, TM3, 1GHz to 25GHz


Limit and Margin
PK

Frequency (MHz)	MaxPeak (dBμV/m)	Pol	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBμV/m)
1140.250000	35.4	H	-21.6	38.6	74.0
1592.500000	36.7	H	-18.4	37.3	74.0
2128.562500	39.8	H	-15.7	34.2	74.0
2287.750000	36.1	H	-15.0	37.9	74.0
4959.625000	47.1	H	-6.6	26.9	74.0
1063.937500	33.2	V	-22.1	40.8	74.0
1356.250000	39.1	V	-20.0	34.9	74.0
1593.062500	38.5	V	-18.4	35.5	74.0
2123.125000	42.2	V	-15.8	31.8	74.0
4959.437500	42.2	V	-6.6	31.8	74.0

AV

Frequency (MHz)	Average (dBμV/m)	Pol	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBμV/m)
1140.250000	28.5	H	-21.6	25.5	54.0
1592.500000	24.3	H	-18.4	29.7	54.0
2128.562500	27.1	H	-15.7	26.9	54.0
2287.750000	30.7	H	-15.0	23.3	54.0
4959.625000	41.0	H	-6.6	13.0	54.0
1063.937500	20.1	V	-22.1	33.9	54.0
1356.250000	22.5	V	-20.0	31.5	54.0
1593.062500	25.8	V	-18.4	28.2	54.0
2123.125000	28.4	V	-15.8	25.6	54.0
4959.437500	34.7	V	-6.6	19.3	54.0

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