TEST REPORT

KOSTEC Co., Ltd.
28(175-20, Annyeong-dong) 406-gil sejaro,
Hwaseong-si, Gyeonggi-do, Korea
Tel:031-222-4251, Fax:031-222-4252

Report No.: KST-FCR-190006

KOSTEC Co., Ltd.
http://www.kostec.org

1. Applicant

- Name : Midland Radio Corporation
- Address : 5900 Parretta Drive Kansas City,MO 64120-2134

2. Test Item

- Product Name: FRS
- Model Name: T250
- Brand: X-TALKER
- FCC ID: MMAT250

3. Manufacturer

- Name : R12 EMS Philadelphia, Inc.
- Address : New Blk 1 Lot 4&5, Calamba Premier International Park, Barangay Batino, Calamba City, Laguna, Philippines

4. Date of Test : 2019. 03. 25. ~ 2019. 03. 26.

5. Test Method Used : FCC CFR 47, Part 95
KDB 888861 D01 Part 95 GMRS FRS v01
ANSI/TIA-603-E-2016
ANSI C63.4-2014

6. Test Result : Compliance

7. Note: None

Supplementary Information

The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with measurement procedures specified in ANSI/TIA-603-E-2016.

We attest to the accuracy of data and all measurements reported herein were performed by KOSTEC Co., Ltd. and were made under Chief Engineer's supervision. We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test report is not related to KOLAS accreditation.

Affirmation	Tested by Name : Choo, Kwang-Yeol (Signature)	Technical Manager Name : Park, Gyeong-Hyeon (Signature)

2019. 04. 02.

KOSTEC Co., Ltd.

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1. GENERAL INFORMATION

1.1 Test Facility

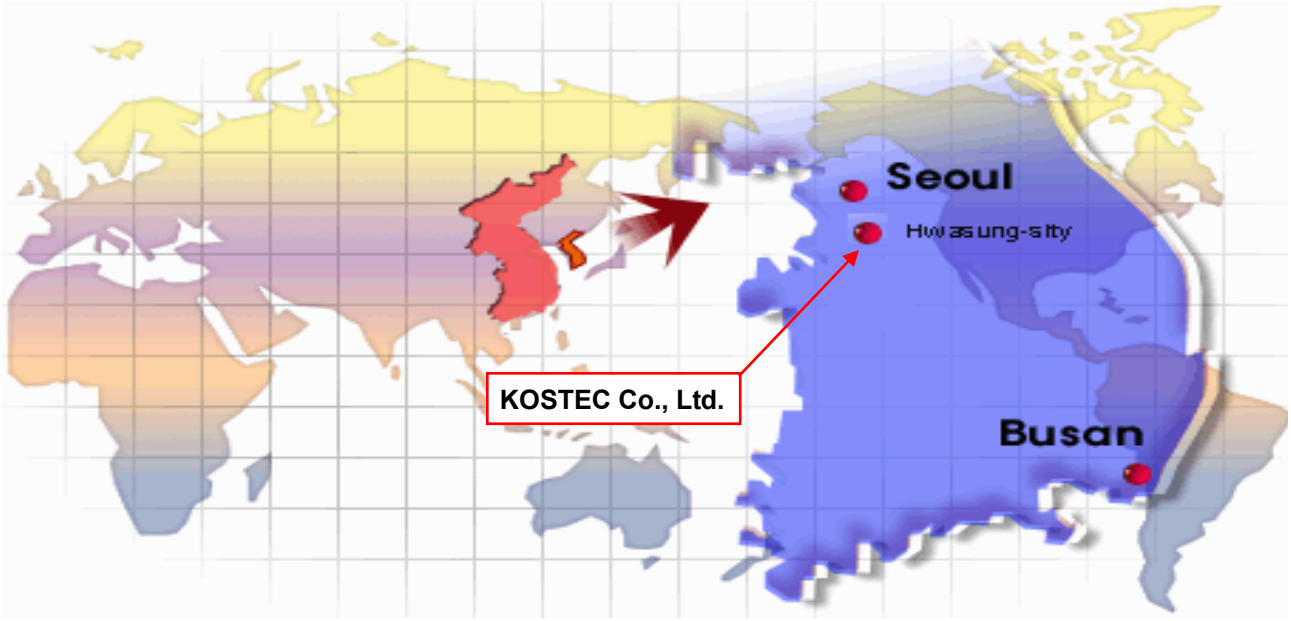
Test laboratory and address

KOSTEC Co., Ltd.
128(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

Registration information

KOLAS No. : 232
FCC/IC Designation No. : KR0041

1.2 Location



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1.3 Revision History of test report

Rev.	Revisions	Effect page	Reviewed	Date
-	Initial issue	All	Gyeong Hyeon, Park	2019. 04. 02.

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2. EQUIPMENT DESCRIPTION

The product specification described herein was declared by manufacturer. And refer to user's manual for the details.

Equipment Name	FRS
Model No	T250
Usage	FRS held-near-face push-to-talk (PTT) portable device
Intended Operating Environment	General population/Uncontrolled exposure
Serial Number	1
Primary User Functions of EUT	2-Way Wireless Voice Communication
Rated output power	0.32 W
Max. E.R.P	0.34 W
Operating Frequency Range	462.562 5 MHz - 462.712 5 MHz, 467.562 5 MHz - 467.712 5 MHz, 462.550 0 MHz - 462.725 0 MHz
Channel Number	22 EA
Channel Spacing	12.5 kHz
Modulation	FM
Occupied Bandwidth (99%)	9.96 kHz
Emission Designation	11K0F3E
Power Source	Ni-MH battery pack / 3.6 VDC nominal / 700 mAh
Antenna Description	Helical antenna, 0.50 dBi
FCC ID	MMAT250
Remark	The above DUT's information was declared by manufacturer. Please refer to the specifications or user manual for more detailed description.

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3. SYSTEM CONFIGURATION FOR TEST

3.1 Characteristics of equipment

FRS

3.2 Used peripherals list

Description	Model No.	Serial No.	Manufacture	Remark
Switching Power Supply	S005CAV0500100	None	Midland Radio Corporation	-
Rechargeable Battery	BATT3R	None	Midland Radio Corporation	-
Ear/Mic	None	None	Midland Radio Corporation	-
Desktop Charger	18CVP17	None	Midland Radio Corporation	-

3.3 Product Modification

N/A

3.4 Operating Mode

Constantly transmitting with a carrier at maximum power.

3.5 Test Setup of EUT

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3.6 Table for Carrier Frequencies

Channel	Freq. [MHz]	Description	Channel	Freq. [MHz]	Description
1	462.562 5	462 MHz Interstitial	12	467.662 5	467 MHz Interstitial
2	462.587 5	462 MHz Interstitial	13	467.687 5	467 MHz Interstitial
3	462.612 5	462 MHz Interstitial	14	467.712 5	467 MHz Interstitial
4	462.637 5	462 MHz Interstitial	15	462.550 0	462 MHz New
5	462.662 5	462 MHz Interstitial	16	462.575 0	462 MHz New
6	462.687 5	462 MHz Interstitial	17	462.600 0	462 MHz New
7	462.712 5	462 MHz Interstitial	18	462.625 0	462 MHz New
8	467.562 5	467 MHz Interstitial	19	462.650 0	462 MHz New
9	467.587 5	467 MHz Interstitial	20	462.675 0	462 MHz New
10	467.612 5	467 MHz Interstitial	21	462.700 0	462 MHz New
11	467.637 5	467 MHz Interstitial	22	462.725 0	462 MHz New

According to ANSI C63.26 section 5.1.2.1:

Measurements of transmitters shall be performed and, if required, reported for each frequency band in which the EUT can be operated with the device transmitting at the number of frequencies in each band specified in Table 2.

Frequency range over which EUT operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle, and 1 near bottom

Description	Frequency Bands [MHz]	Test Channel	Test Frequency [MHz]
462 MHz Interstitial	462.562 5~462.712 5	CH4	462.637 5
467 MHz Interstitial	467.562 5~467.712 5	CH11	467.637 5
462 MHz Main	462.550 0~462.725 0	CH19	462.650 0

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3.7 Used Test Equipment List

No.	Instrument	Model	S/N	Manufacturer	Due to cal date	Cal interval	used
1	T & H Chamber	PL-3J	15003623	ESPEC	2019.11.12	1 year	☐
2	T & H Chamber	SH-662	93000067	ESPEC CORP	2019.09.28	1 year	☒
3	Spectrum Analyzer	8563EC	3046A00527	Agilent Technology	2020.01.25	1 year	☐
4	Signal Analyzer	FSV13	101247	Rohde & Schwarz	2020.01.24	1 year	☐
5	Spectrum Analyzer	FSV30	20-353063	Rohde& Schwarz	2020.01.25	1 year	☐
6	Signal Analyzer	N9010A	MY56070441	Agilent Technologies	2019.05.25	1 year	☒
7	EMI Test Receiver	ESCI7	100823	Rohde& Schwarz	2020.01.22	1 year	☒
8	EMI Test Receiver	ESI	837514/004	Rohde& Schwarz	2019.09.03	1 year	☒
9	Vector Signal Analyzer	89441A	3416A02620	Agilent Technology	2020.01.25	1 year	☐
10	Network Analyzer	8753ES	US39172348	AGILENT	2019.09.03	1 year	☐
11	EPM Series Power meter	E4418B	GB39512547	Agilent Technology	2020.01.23	1 year	☐
12	RF Power Sensor	E9300A	MY41496631	Agilent Technology	2020.01.23	1 year	☐
13	Microwave Frequency Counter	5352B	2908A00480	Agilent Technology	2020.01.24	1 year	☐
14	Audio Analyzer	8903B	3514A16919	Agilent Technology	2020.01.23	1 year	☒
15	Audio Telephone Analyzer	DD-5601CID	520010281	CREDIX	2020.01.23	1 year	☐
16	Modulation Analyzer	8901A	3041A0576	H.P	2020.01.24	1 year	☒
17	Digital storage Oscilloscope	TDS3052	B015962	Tektronix	2019.09.04	1 year	☐
18	ESG-D Series Signal Generator	E4436B	US39260458	Agilent Technology	2020.01.25	1 year	☒
19	Vector Signal Generator	SMBV100A	257557	Rohde & Schwarz	2020.01.25	1 year	☐
20	GNSS Signal Generator	TC-2800A	2800A000494	TESCOM CO., LTD.	2020.01.24	1 year	☐
21	Signal Generator	SMB100A	179628	Rohde & Schwarz	2019.05.09	1 year	☒
22	SLIDAC	None	0207-4	Myoung sung Ele.	2020.01.23	1 year	☐
23	DC Power supply	DRP-5030	9028029	Digital Electronic Co.,Ltd	2020.01.23	1 year	☐
24	DC Power supply	E3610A	KR24104505	Agilent Technology	2020.01.23	1 year	☐
25	DC Power supply	UP-3005T	68	Unicon Co.,Ltd	2020.01.23	1 year	☐
26	DC Power Supply	SM 3400-D	114701000117	DELTA ELEKTRONIKA	2020.01.22	1 year	☐
27	DC Power supply	6632B	MY43004005	Agilent Technology	2020.01.23	1 year	☐
28	DC Power Supply	6632B	MY43004137	Agilent Technology	2020.01.23	1 year	☒
29	Termination	1433-3	LM718	WEINSCHEL	2019.07.09	1 year	☐
30	Termination	1432-3	QR946	AEROFLEX/WEINSCHEL	2019.07.09	1 year	☐
31	Attenuator	24-30-34	BX5630	Aeroflex / Weinschel	2019.12.19	1 year	☐
32	Attenuator	8498A	3318A09485	HP	2020.01.24	1 year	☐
33	Step Attenuator	8494B	3308A32809	HP	2020.01.24	1 year	☐
34	RF Step Attenuator	RSP	100091	Rohde & Schwarz	2020.01.24	1 year	☐
35	Attenuator	18B50W-20F	64671	INMET	2020.01.24	1 year	☐
36	Attenuator	10 dB	1	Rohde & Schwarz	2019.05.04	1 year	☐
37	Attenuator	10 dB	2	Rohde & Schwarz	2019.05.04	1 year	☐
38	Attenuator	10 dB	3	Rohde & Schwarz	2019.05.04	1 year	☐
39	Attenuator	10 dB	4	Rohde & Schwarz	2019.05.04	1 year	☐
40	Attenuator	54A-10	74564	WEINSCHEL	2019.09.04	1 year	☐
41	Attenuator	56-10	66920	WEINSCHEL	2019.05.09	1 year	☐
42	Attenuator	48-20-11	BV2658	Aeroflex/Weinschel	2019.08.06	1 year	☐
43	Attenuator	48-30-33-LIM	BL5350	Weinschel Corp.	2019.07.09	1 year	☒
44	Power divider	11636B	51212	HP	2020.01.28	1 year	☐
45	3Way Power divider	KPDSU3W	00070365	KMW	2019.09.03	1 year	☐
46	4Way Power divider	70052651	173834	KRYTAR	2020.01.28	1 year	☐
47	3Way Power divider	1580	SQ361	WEINSCHEL	2019.05.09	1 year	☐
48	OSP	OSP120	101577	Rohde & Schwarz	2019.05.04	1 year	☐
49	White noise audio filter	ST31EQ	101902	SoundTech	2019.09.04	1 year	☐

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No.	Instrument	Model	S/N	Manufacturer	Due to cal date	Cal interval	used
50	Dual directional coupler	778D	17693	HEWLETT PACKARD	2020.01.24	1 year	☐
51	Dual directional coupler	772D	2839A00924	HEWLETT PACKARD	2020.01.24	1 year	☐
52	Band rejection filter	3TNF-0006	26	DOVER Tech	2020.01.24	1 year	☐
53	Band rejection filter	3TNF-0007	311	DOVER Tech	2020.01.24	1 year	☐
54	Band rejection filter	WTR-BRF2442-84NN	09020001	WAVE TECH Co.,LTD	2020.01.24	1 year	☐
55	Band rejection filter	WRCJV12-5695-5725-5825-5855-50SS	1	Wainwright Instruments GmbH	2019.05.04	1 year	☐
56	Band rejection filter	WRCJV12-5120-5150-5350-5380-40SS	4	Wainwright Instruments GmbH	2019.05.04	1 year	☐
57	Band rejection filter	WRCGV10-2360-2400-2500-2540-50SS	2	Wainwright Instruments GmbH	2019.05.04	1 year	☐
58	Band rejection filter	CTF-155M-S1	001	RF One Electronics	2019.09.06	1 year	☐
59	Band rejection filter	CTF-435M-S1	001	RF One Electronics	2019.09.06	1 year	☒
60	Highpass Filter	WHJS1100-10EF	1	WAINWRIGHT	2020.01.24	1 year	☒
61	Highpass Filter	WHJS3000-10EF	1	WAINWRIGHT	2020.01.24	1 year	☐
62	Highpass Filter	WHNX6-5530-7000-26500-40CC	2	Wainwright Instruments GmbH	2019.05.09	1 year	☐
63	Highpass Filter	WHNX6-2370-3000-26500-40CC	4	Wainwright Instruments GmbH	2019.05.09	1 year	☐
64	WideBand Radio Communication Tester	CMW500	102276	Rohde & Schwarz	2020.01.24	1 year	☐
65	Bluetooth Tester	TC-3000B	3000B6A0166	TESCOM CO., LTD.	2020.01.24	1 year	☐
66	Loop Antenna	6502	9203-0493	EMCO	2019.05.29	2 year	☐
67	BiconiLog Antenna	3142B	1745	EMCO	2020.05.10	2 year	☒
68	Biconical Antenna	VUBA9117	9117-342	Schwarz beck	2020.03.12	2 year	☒
69	Trilog-Broadband Antenna	VULB 9168	9168-606	SCHWARZBECK	2020.09.14	2 year	☐
70	Horn Antenna	3115	2996	EMCO	2020.02.14	2 year	☒
71	Horn Antenna	3115	9605-4834	EMCO	2020.03.12	2 year	☒
72	Horn Antenna	BBHA9170	743	SCHWARZBECK	2021.01.22	2 year	☐
73	PREAMPLIFIER(3)	8449B	3008A00149	Agilent	2019.09.05	1 year	☐
74	AMPLIFIER(10)	TK-PA6S	120009	TESTEK	2020.01.22	1 year	☒
75	AMPLIFIER	TK-PA18	150003	TESTEK	2020.01.24	1 year	☒
76	AMPLIFIER	TK-PA1840H	160010-L	TESTEK	2020.01.22	1 year	☐
77	AMPLIFIER	8447D	2944A07881	H.P	2020.01.24	1 year	☐

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4. SUMMARY TEST RESULTS

Description of Test	FCC Rule	Reference Clause	Used	Test Result
RF Output Power	Part 95.567	Clause 5.1	☒	Compliance
Modulation Characteristics	Part 95.575	Clause 5.2	☒	Compliance
Occupied Bandwidth	Part 95.573 Part 2.1049	Clause 5.3	☒	Compliance
Emission Mask	Part 95.579	Clause 5.4	☒	Compliance
Transmitter Radiated Unwanted Emissions	Part 95.579	Clause 5.5	☒	Compliance
Frequency Stability	Part 95.565 Part 2.1055	Clause 5.6	☒	Compliance
AC Conducted emissions	Part 15.207	Clause 5.7	☒	Compliance
Compliance/pass : The EUT complies with the essential requirements in the standard. Not Compliance : The EUT does not comply with the essential requirements in the standard. N/A : The test was not applicable in the standard.				
Procedure Reference : FCC CFR 47, Part 95 KDB 888861 D01 Part 95 GMRS FRS v01 ANSI/TIA-603-E-2016 ANSI C 63.4-2014				

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5. MEASUREMENT RESULTS

5.1 RF Output Power

5.1.1 Standard Applicable [FCC Part 95.567]

FCC Part 95.567

Each FRS transmitter type must be designed such that the effective radiated power (ERP) on channels 8 through 14 does not exceed 0.5 Watts and the ERP on channels 1 through 7 and 15 through 22 does not exceed 2.0 Watts.

5.1.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) ℃
- Relative Humidity : (48 ~ 52) % R.H.

5.1.3 Measurement Procedure

The EUT was setup according to ANSI/TIA-603-E-2016 for compliance to FCC 47CFR part 95 requirements.

As a below test procedure (①~⑬), The result value of measurement is performed to condition of the below; The EUT will operate in continuous transmission mode during the time necessary to perform the measured of the frequency. Substitution method was performed to determine the actual P_{erp}(or P_{eirp}) emission levels of the EUT.

The following test procedure as below;

The test is performed in a fully pyramidal chamber to determine the accurate frequencies, after maximum emissions level will be checked on a test chamber and measuring distance is 3 m from EUT to test antenna.

① The EUT was set on with continuous transmission mode and placed on a 1.5 meter high non-conductive table on the chamber.

② The test antenna is used on Bi-Log antenna at above 30 MHz, and used on Horn antenna at 1 GHz and then the measurements are repeated with the test antenna for vertical and horizontal polarization. The output of the test antenna will be connected to a measuring receiver, and it is set to tuned over the required standard measuring frequency range.

③ At each frequency at which a relevant spurious component is detected, the test antenna will be raised and lowered through the specified range of heights until an maximum signal level is detected on the measuring receiver.

④ The EUT is position x, y, z axis on rotating through 360 degrees in the horizontal plane, until the Max. signal level is detected by the measuring receiver.

⑤ The receiver is scanned from requested measuring frequency band and then the maximum meter reading is recorded. The radiated emissions were measured with requested standard specification (detector and resolution bandwidth etc.)

⑥ The EUT was then removed and replaced with substitution antenna .The center of the antenna was approximately at the same location as the center of the EUT, and calibrated for the frequency of the spurious component detected.

⑦ Signal generator output port connected with substitution antenna input port. If necessary, may use shield cable between signal generator and substitution antenna

⑧ The frequency of the calibrated signal generator is set to frequency of the spurious component detected, and the input attenuator setting of the measuring receiver was adjust in order to increase the sensitivity of the measuring receiver, if necessary

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⑨ The test antenna was raised and lowered through the specified range of heights to ensure that maximum signal is received.

⑩ The input signal to the substitution antenna was be adjusted until an equal or a known related level to that detected from the transmitter is obtained on the measuring receiver.

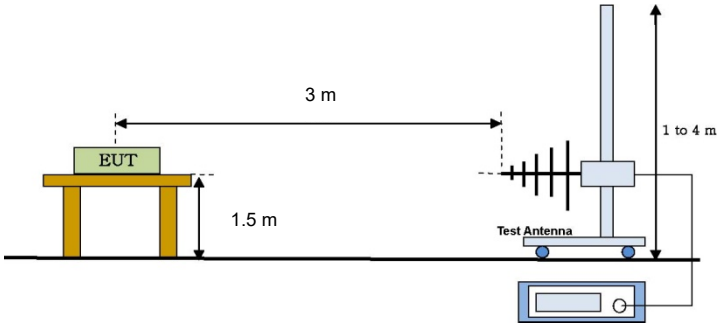
⑪ The input signal to the substitution antenna was be recorded as a power level and corrected for any change of input attenuator setting of the measuring receiver

⑫ The measure of P_{erp}(or P_{eirp}) the spurious components is the larger of the two power levels recorded for each spurious component at the input to the substitution antenna, corrected for the gain of the substitution antenna, if necessary.

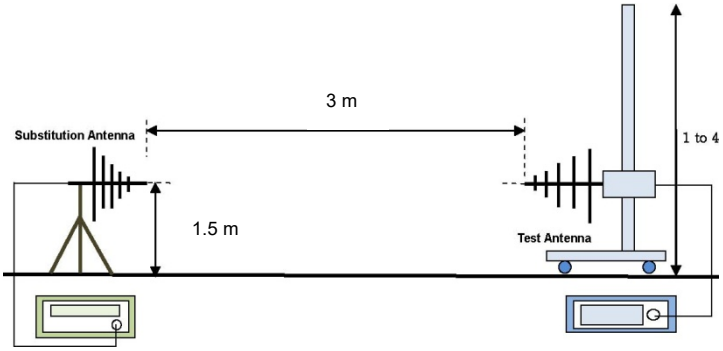
⑬ It is correction to signal generator's offset value. In this case of P_{erp}(or P_{eirp}) shall calculated as follow as formula ;

• P_{erp}(or P_{eirp}) = Signal generator level (dBm) – Cable loss(dB)

5.1.5 Test Setup



[Radiatedmeasurement setup_Below than 1 GHz]



[Effective Radiated Power measurement setup]

※ Above the test antenna is used on Horn antenna at above 1 GHz.

5.1.5 Measurement Result

Channel Description	CH	Frequency [MHz]	Effective Radiated Power		Limit [W]	Test Results
			[dBm]	[W]		
462 MHz Interstitial	4	462.637 5	25.34	0.342	2	Compliance
467 MHz Interstitial	11	467.637 5	24.86	0.306	0.5	Compliance
462 MHz New	19	462.650 0	24.88	0.307	2	Compliance

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5.2 Modulation Characteristics

5.2.1 Standard Applicable [Part 95.575]

Part 95.1775

Each FRS transmitter type must be designed such that the peak frequency deviation does not exceed 2.5 kHz, and the highest audio frequency contributing substantially to modulation must not exceed 3.125 kHz.

5.2.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) ℃
- Relative Humidity : (48 ~ 52) % R.H.

5.2.3 Measurement Procedure

•Modulation Limit

The carrier frequency deviation was measured with the tone adjust the audio input for 60 % of rated system deviation at 1 kHz using this level as a reference (0 dB) and vary the input level from –20 to +20 dB. Record the frequency deviation obtained as a function of the input level at frequencies 0.1, 0.5, 1.0, 3.0 and 5.0 kHz. The maximum deviation was recorded at each test condition.

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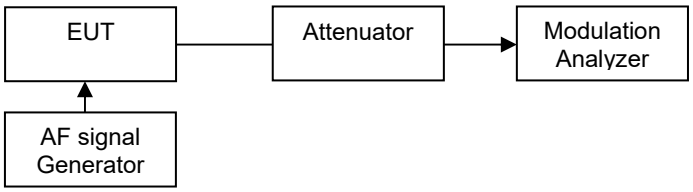
5.2.4 Test setup

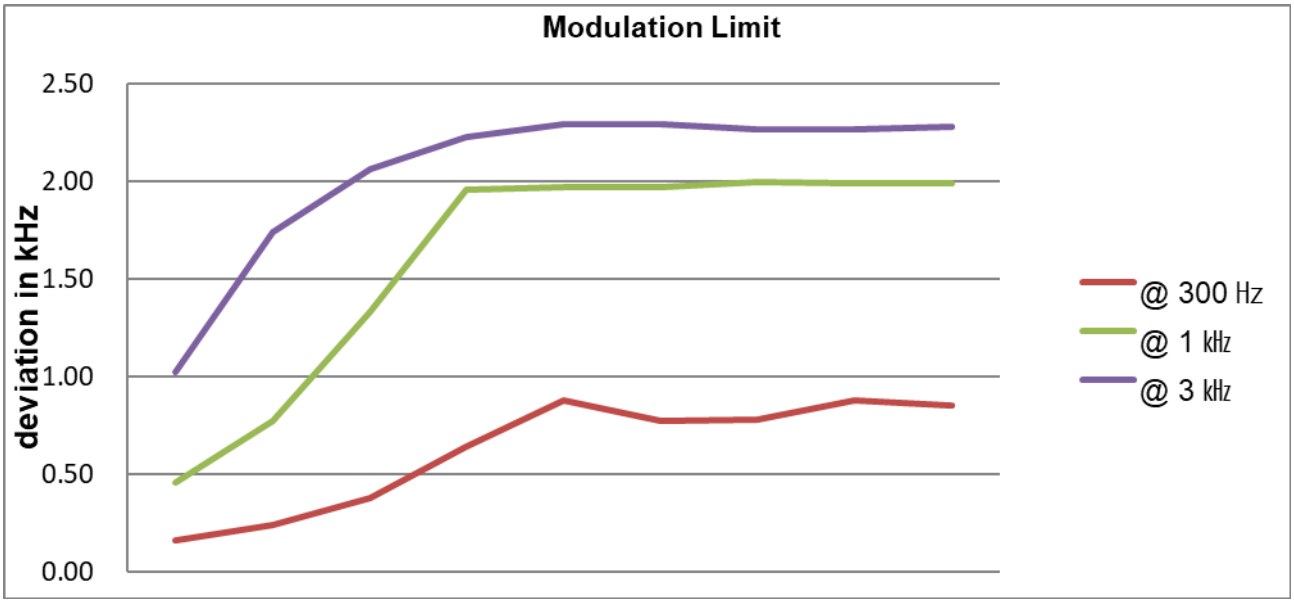


5.2.5 Measurement Result

- Modulation Limit

462 MHz Interstitial (CH4 : 462.637 5 MHz)

Audio input Level (dB)	Frequency Deviation (kHz)			Limit (kHz)
	@ 300 Hz	@ 1 kHz	@ 3kHz	
-20	0.16	0.46	1.02	2.5
-15	0.24	0.77	1.74	2.5
-10	0.38	1.33	2.06	2.5
-5	0.64	1.96	2.23	2.5
0	0.88	1.97	2.29	2.5
5	0.77	1.97	2.29	2.5
10	0.78	2.00	2.27	2.5
15	0.88	1.99	2.27	2.5
20	0.85	1.99	2.28	2.5
Test Results		Compliance		



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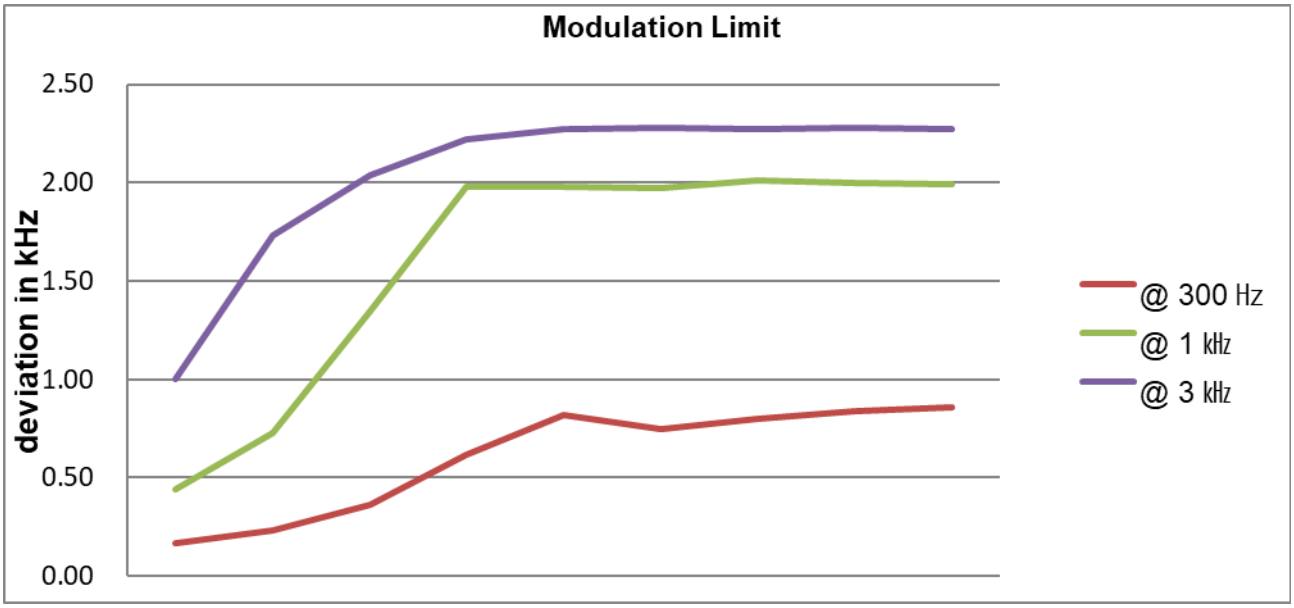
467 MHz Interstitial (Ch11 : 467.637 5 MHz)

Audio input Level (dB)	Frequency Deviation (kHz)			Limit (kHz)
	@ 300 Hz	@ 1 kHz	@ 3kHz	
-20	0.17	0.44	1.00	2.5
-15	0.23	0.73	1.73	2.5
-10	0.36	1.35	2.04	2.5
5	0.62	1.98	2.22	2.5
0	0.82	1.98	2.27	2.5
5	0.75	1.97	2.28	2.5
10	0.80	2.01	2.27	2.5
15	0.84	2.00	2.28	2.5
20	0.86	1.99	2.27	2.5
Test Results		Compliance		



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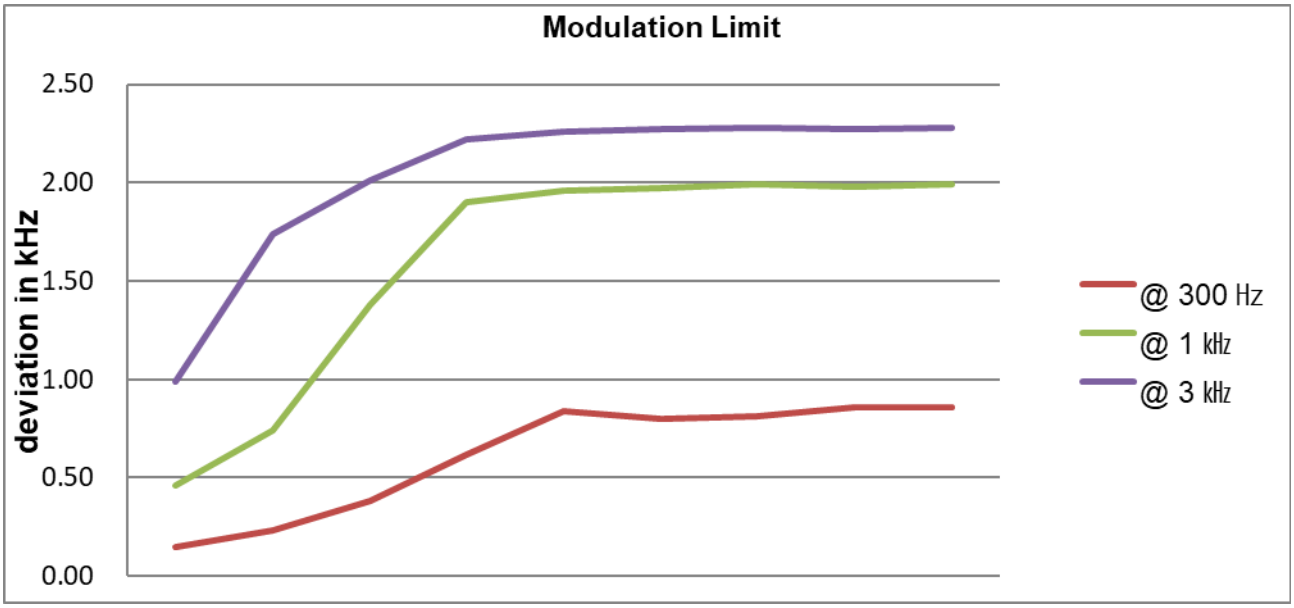
462 MHz New (CH19 : 462.650 0 MHz)

Audio input Level (dB)	Frequency Deviation (kHz)			Limit (kHz)
	@ 300 Hz	@ 1 kHz	@ 3kHz	
-20	0.15	0.46	0.99	2.5
-15	0.23	0.74	1.74	2.5
-10	0.38	1.38	2.01	2.5
5	0.62	1.90	2.22	2.5
0	0.84	1.96	2.26	2.5
5	0.80	1.97	2.27	2.5
10	0.81	1.99	2.28	2.5
15	0.86	1.98	2.27	2.5
20	0.86	1.99	2.28	2.5
Test Results		Compliance		



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5.3 Occupied Bandwidth

5.3.1 Standard Applicable [FCC Part 95.573, Part 2.1049]

The Emission bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits.

FCC Part 95.573

Each FRS transmitter type must be designed such that the occupied bandwidth does not exceed 12.5 kHz.

5.3.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) ℃
- Relative Humidity : (48 ~ 52) % R.H.

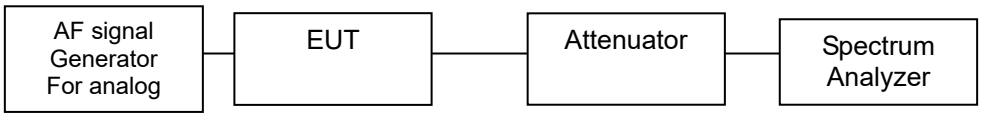
5.3.3 Measurement Procedure

1. The EUT was modulated by 2.5 kHz Sine wave audio signal, The level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation.
2. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
3. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. The 99% occupied bandwidth is the frequency bandwidth of the signal power at the 99% channel power of occupied bandwidth.

The spectrum analyzer is set to the as follows :

- RBW : 300 Hz
- VBW : >3 x RBW
- Detector function : peak
- Trace : max hold

5.3.4 Test setup



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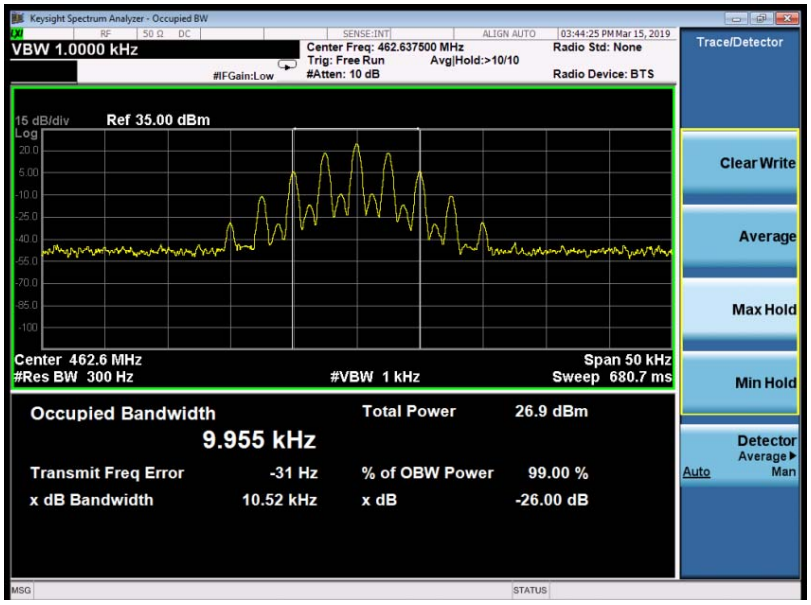
5.3.5 Measurement Result

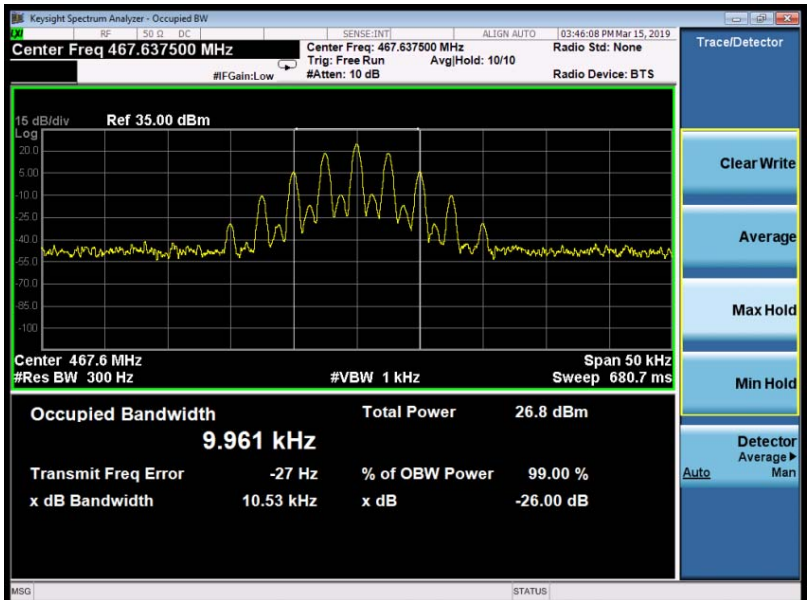
Channel Description	CH	Frequency [MHz]	99 % Bandwidth [kHz]	26 dB Bandwidth [kHz]	Limit [kHz]	Test Results
462 MHz Interstitial	4	462.637 5	9.96	10.52	12.5	Compliance
467 MHz Interstitial	11	467.637 5	9.96	10.53	12.5	Compliance
462 MHz New	19	462.650 0	9.96	10.53	12.5	Compliance

5.3.6 Test Plot

462 MHz Interstitial (CH4 : 462.637 5 MHz)



467 MHz Interstitial (CH11 : 467.637 5 MHz)



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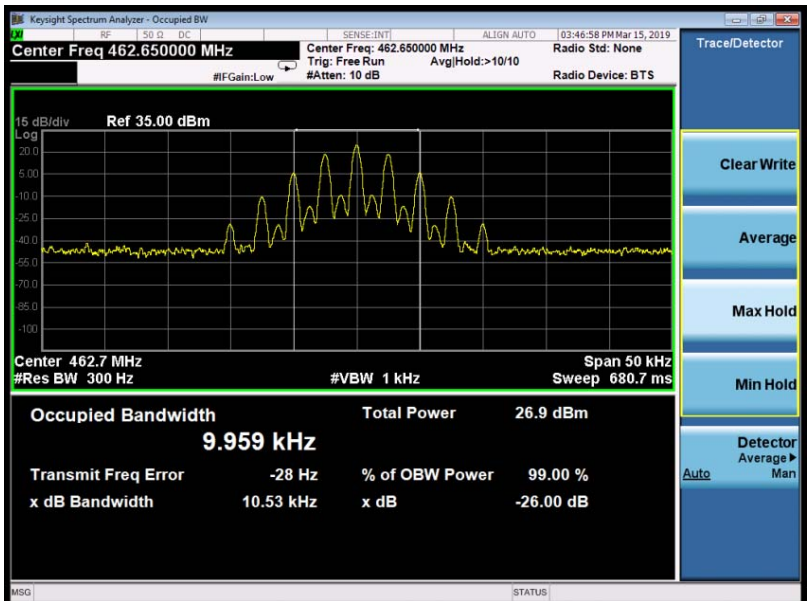
462 MHz New (CH19 : 462.650 0 MHz)



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5.4 Emission Mask

5.4.1 Standard Applicable [FCC Part 95.579]

FCC Part 95.579

Each FRS transmitter type must be designed to satisfy the applicable unwanted emissions limits in this paragraph.

(a)Attenuation requirements. The power of unwanted emissions must be attenuated below the carrier power output in Watts (P) by at least:

(1) 25 dB (decibels) in the frequency band 6.25 kHz to 12.5 kHz removed from the channel center frequency.

(2) 35 dB in the frequency band 12.5 kHz to 31.25 kHz removed from the channel center frequency.

(3) 43 + 10 log (P) dB in any frequency band removed from the channel center frequency by more than 31.25 kHz.

5.4.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) ℃
- Relative Humidity : (48 ~ 52) % R.H.

5.4.3 Measurement Procedure

The EUT was modulated by 2.5 kHz Sine wave audio signal; the level of the audio signal employed is 16 dB greater than that necessary to produce 50 % of rated system deviation. Rated system deviation is 2.5 kHz.

The spectrum analyzer is set to the as follows
- RBW = 300 Hz
- VBW: >3xRBW

5.4.4 Test setup

Please refer 5.3.4

5.4.5 Measurement Result

Compliance: please refer 5.4.6 for details

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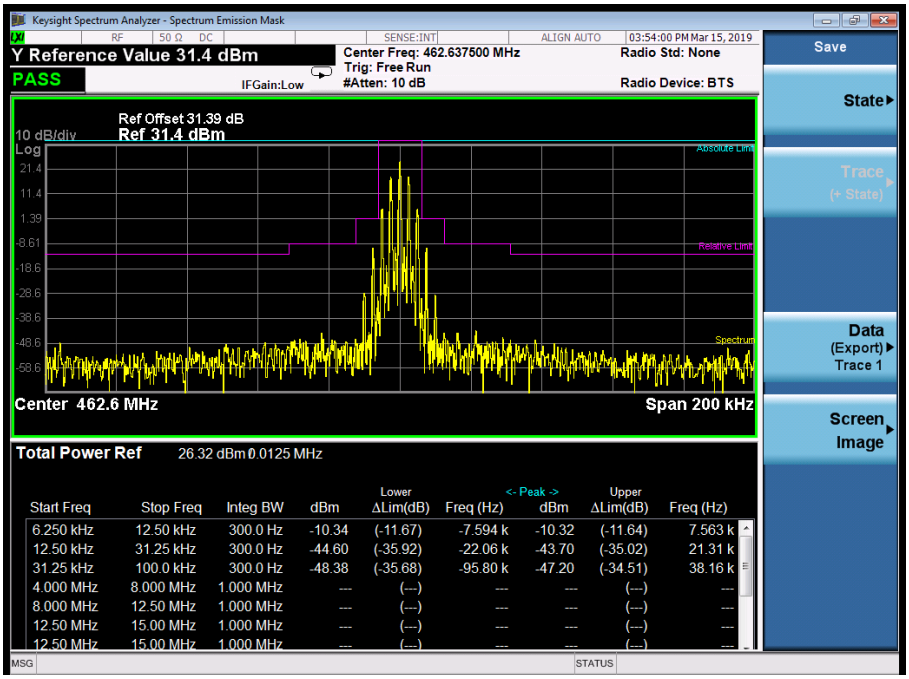
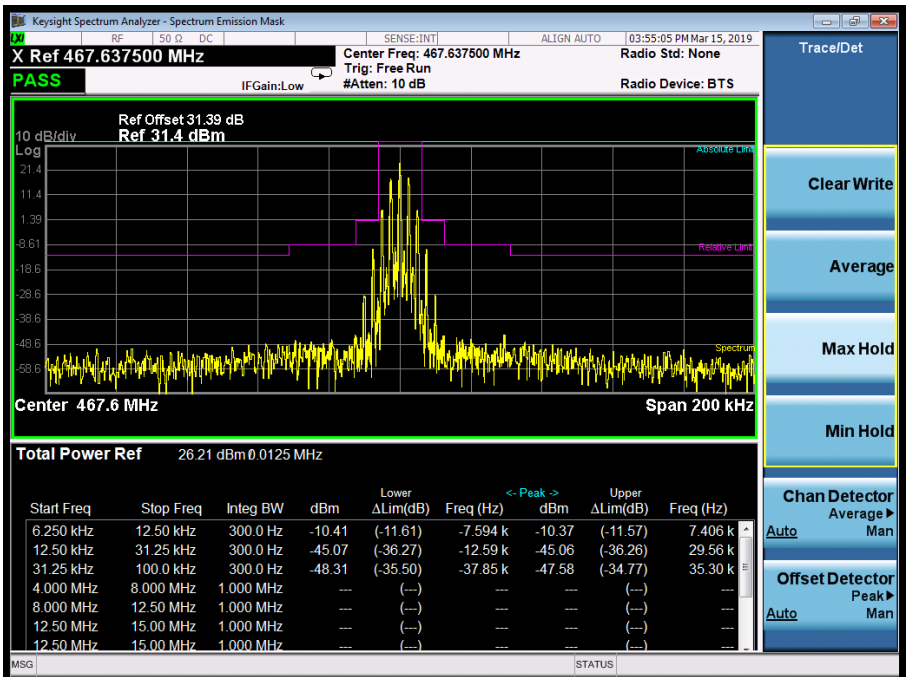
5.4.6 Test Plot

462 MHz Interstitial (CH4 : 462.637 5 MHz)



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
6.250 kHz	12.50 kHz	300.0 Hz	-10.34	(-11.67)	-7.594 k	-10.32	(-11.64)	7.563 k
12.50 kHz	31.25 kHz	300.0 Hz	-44.60	(-35.92)	-22.06 k	-43.70	(-35.02)	21.31 k
31.25 kHz	100.0 kHz	300.0 Hz	-48.38	(-35.68)	-95.80 k	-47.20	(-34.51)	38.16 k
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

467 MHz Interstitial (CH11 : 467.637 5 MHz)



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
6.250 kHz	12.50 kHz	300.0 Hz	-10.41	(-11.61)	-7.594 k	-10.37	(-11.57)	7.406 k
12.50 kHz	31.25 kHz	300.0 Hz	-45.07	(-36.27)	-12.59 k	-45.06	(-36.26)	29.56 k
31.25 kHz	100.0 kHz	300.0 Hz	-48.31	(-35.50)	-37.85 k	-47.58	(-34.77)	35.30 k
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

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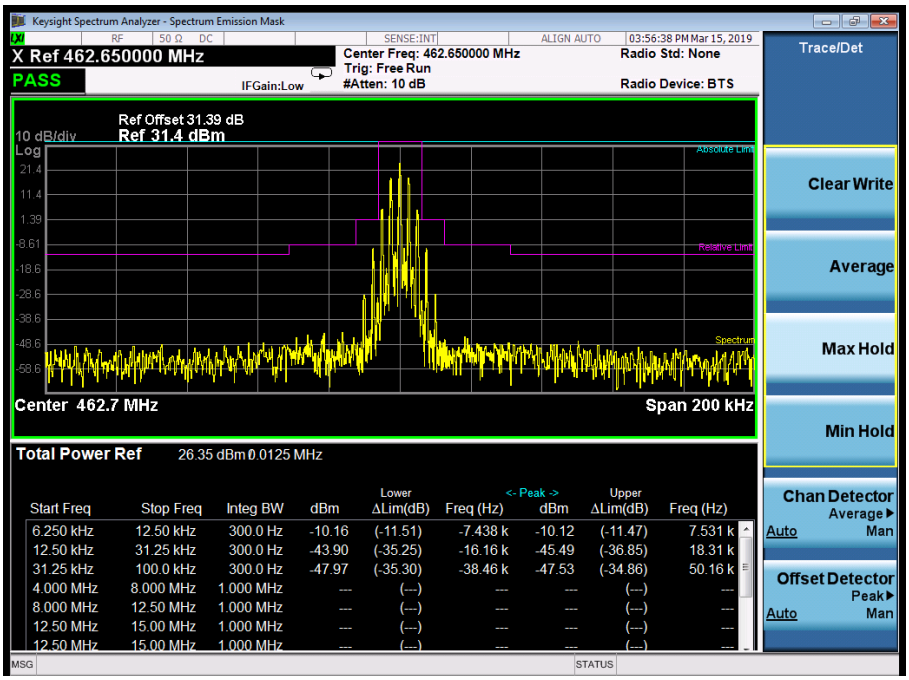
462 MHz New (CH19 : 462.650 0 MHz)



Test Results	Compliance

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5.5 Transmitter Radiated Unwanted Emissions

5.5.1 Standard Applicable [FCC Part 95.579]

According to FCC section 95.579, the unwanted emission should be attenuated below Transmitter output power(P) by at least 43+10 log(P) dB.

5.5.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) ℃
- Relative Humidity : (48 ~ 52) % R.H.

5.5.3 Measurement Procedure

Refer 5.1.3

5.5.4 Test Setup

Refer 5.1.4

5.5.5 Measurement Result

The following frequencies were selected based on the output power results.

Channel Description	CH	Freq. [MHz]	ERP power	
			[dBm]	[W]
462 MHz Interstitial	4	462.637 5	25.34	0.342

Emission Frequency [MHz]	Ant Pol	Level below Carrier [dBc]	Margin [dB]	Limit [dBc]	Test Results
925.275 0	V	61.26	22.92	38.34	Compliance
1 387.912 5	H	53.13	14.79	38.34	Compliance
1 850.550 0	H	50.87	12.53	38.34	Compliance
2 313.187 5	H	53.87	15.53	38.34	Compliance
2 775.825 0	H	50.71	12.37	38.34	Compliance
3 238.462 5	V	45.44	7.10	38.34	Compliance

Note: The formula for limit is below;
43+10 log (P) where, P = EUT's output power in W
Therefore 43+10log(0.342) = 38.34

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Channel Description	CH	Freq. [MHz]	ERP power	
			[dBm]	[W]
467 MHz Interstitial	11	467.637 5	24.86	0.306

Emission Frequency [MHz]	Ant Pol	Level below Carrier [dBc]	Margin [dB]	Limit [dBc]	Test Results
935.275 0	H	58.65	20.79	37.86	Compliance
1 402.912 5	H	54.22	16.36	37.86	Compliance
1 870.550 0	H	51.41	13.55	37.86	Compliance
2 338.187 5	H	54.35	16.49	37.86	Compliance
2 805.825 0	H	45.54	7.68	37.86	Compliance
3 273.462 5	V	42.14	4.28	37.86	Compliance
Note: The formula for limit is below; 43+10 log (P) where, P = EUT's output power in W Therefore 43+10log(0.306) = 37.86					

Channel Description	CH	Freq. [MHz]	ERP power	
			[dBm]	[W]
462 MHz New	19	462.650 0	24.88	0.307

Emission Frequency [MHz]	Ant Pol	Level below Carrier [dBc]	Margin [dB]	Limit [dBc]	Test Results
925.300 0	V	59.06	21.18	37.87	Compliance
1 387.950 0	H	53.53	15.65	37.87	Compliance
1 850.600 0	H	47.78	9.90	37.87	Compliance
2 313.250 0	H	52.45	14.57	37.87	Compliance
2 775.900 0	H	51.11	13.23	37.87	Compliance
3 238.550 0	V	46.55	8.67	37.87	Compliance
Note: The formula for limit is below; 43+10 log (P) where, P = EUT's output power in W Therefore 43+10log(0.307) = 37.87					

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5.6 Frequency Stability

5.6.1 Standard Applicable [FCC Part 95.565, Part 2.1055]

FCC Part 95.565

Each FRS transmitter type must be designed such that the carrier frequencies remain within ±2.5 parts-per-million of the channel center frequencies specified in § 95.563 during normal operating conditions.

5.6.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) ℃
- Relative Humidity : (48 ~ 52) % R.H.

5.6.3 Measurement Procedure

EUT connect to Spectrum analyzer, test is performed in T&H chamber.

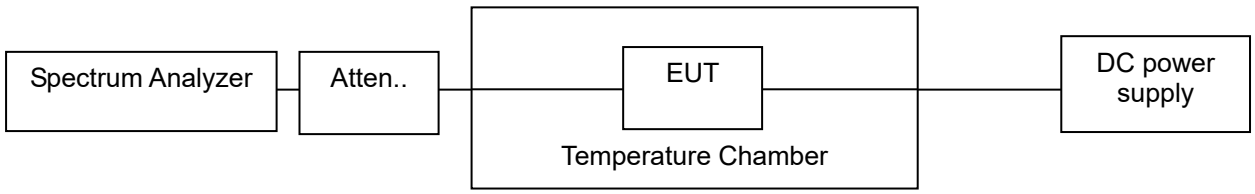
These measurements shall also be performed at normal and extreme test conditions.

▪ Test Method : ANSI/TIA-603-E-2016, clause 3.2.2 for frequency stability tests

-Frequency stability with respect to ambient temperature

-Frequency stability when varying supply voltage

5.6.4 Test setup



5.6.5 Measurement Result

462 MHz Interstitial (CH4 : 462.637 5 MHz)

Temp(℃)	Power Supply	Measured Freq(MHz)	Freq Drift(ppm)
50	DC 3.6 (Vnom)	462.637 525	0.05
40	DC 3.6 (Vnom)	462.637 395	-0.23
30	DC 3.6 (Vnom)	462.637 356	-0.31
20	DC 3.6 (Vnom)	462.637 344	-0.34
10	DC 3.6 (Vnom)	462.637 331	-0.37
0	DC 3.6 (Vnom)	462.637 318	-0.39
-10	DC 3.6 (Vnom)	462.637 295	-0.44
-20	DC 3.6 (Vnom)	462.637 261	-0.52
-30	DC 3.6 (Vnom)	462.637 156	-0.74
Nom Temperature	DC 3.24 (Vmin)	462.637 348	-0.33
Nom Temperature	DC 3.96 (Vmax)	462.637 351	-0.32
Test Results		Compliance	

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467 MHz Interstitial (CH11 : 467.637 5 MHz)

Temp(℃)	Power Supply	Measured Freq(MHz)	Freq Drift(ppm)
50	DC 3.6 (Vnom)	467.637 462	-0.08
40	DC 3.6 (Vnom)	467.637 408	-0.20
30	DC 3.6 (Vnom)	467.637 374	-0.27
20	DC 3.6 (Vnom)	467.637 349	-0.32
10	DC 3.6 (Vnom)	467.637 326	-0.37
0	DC 3.6 (Vnom)	467.637 301	-0.43
-10	DC 3.6 (Vnom)	467.637 292	-0.44
-20	DC 3.6 (Vnom)	467.637 248	-0.54
-30	DC 3.6 (Vnom)	467.637 196	-0.65
Nom Temperature	DC 3.24 (Vmin)	467.637 332	-0.36
Nom Temperature	DC 3.96 (Vmax)	467.637 352	-0.32
Test Results		Compliance	

462 MHz New (CH11 : 462.650 0 MHz)

Temp(℃)	Power Supply	Measured Freq(MHz)	Freq Drift(ppm)
50	DC 3.6 (Vnom)	462.650 040	0.09
40	DC 3.6 (Vnom)	462.649 905	-0.21
30	DC 3.6 (Vnom)	462.649 870	-0.28
20	DC 3.6 (Vnom)	462.649 847	-0.33
10	DC 3.6 (Vnom)	462.649 829	-0.37
0	DC 3.6 (Vnom)	462.649 816	-0.40
-10	DC 3.6 (Vnom)	462.649 791	-0.45
-20	DC 3.6 (Vnom)	462.649 768	-0.50
-30	DC 3.6 (Vnom)	462.649 654	-0.75
Nom Temperature	DC 3.24 (Vmin)	462.649 852	-0.32
Nom Temperature	DC 3.96 (Vmax)	462.649 843	-0.34
Test Results		Compliance	

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5.7 AC Power Conducted emissions

5.7.1 Standard Applicable [FCC §15.207(a)]

For intentional radiator that is designed to be connected to the public utility(AC)power line, the radio frequency. Voltage that is conducted back onto the AC power line on any frequencies hopping mode within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line Impedance stabilization network(LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

§15.207 limits for AC line conducted emissions;

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

* Decreases with the logarithm of the frequency

5.7.2 Test Environment conditions

• Ambient temperature : (21 ~ 22) ℃ • Relative Humidity : (49 ~ 51) % R.H.

5.7.3 Measurement Procedure

EUT was placed on a non- metallic table height of 0.8 m above the reference ground plane. Cables connected to EUT were fixed to cause maximum emission. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the Maximum signal strength.

5.7.4 Used equipment

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Cal interval	Used
Test receiver	ESCS30	100111	Rohde & Schwarz	2020. 01. 22	1 year	☒
Pulse Limiter	ESH3-Z2	100097	Rohde & Schwarz	2020. 01. 22	1 year	☒
LISN	ESH2-Z5	100044	R&S	2020. 01. 22	1 year	☐
	ESH3-Z5	100147	R&S	2020. 01. 22	1 year	☒

*Test Program: “ ESXS-K1 V2.2”

Measurement uncertainty

0.15 ~ 30 MHz : ±3.34 (CL: Approx 95 %, *k*=2)

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5.7.5 Measurement Result

Freq.	Factor [dB]		POL	QP			CISPR AV		
				Limit	Reading	Result	Limit	Reading	Result
[MHz]	LISN	CABLE +P/L		[dBμV]	[dBμV]	[dBμV]	[dBμV]	[dBμV]	[dBμV]
0.295	0.15	9.94	L	60.40	36.31	36.46	50.40	28.25	28.40
0.377	0.15	9.95	L	58.35	39.08	39.23	48.35	35.84	35.99
0.396	0.15	9.95	L	57.93	33.87	34.02	47.93	29.12	29.27
1.068	0.17	9.99	L	56.00	27.35	27.52	46.00	23.24	23.41
1.759	0.19	10.02	L	56.00	26.83	27.02	46.00	22.49	22.68
4.420	0.27	10.09	L	56.00	30.77	31.04	46.00	23.63	23.90
5.095	0.29	10.11	L	60.00	25.12	25.41	50.00	16.25	16.54
0.271	0.15	9.94	N	61.08	37.34	37.49	51.08	25.74	25.89
0.314	0.15	9.94	N	59.86	37.61	37.76	49.86	28.41	28.56
0.380	0.16	9.95	N	58.27	41.56	41.72	48.27	33.20	33.36
0.966	0.18	9.99	N	56.00	28.58	28.76	46.00	22.98	23.16
1.677	0.20	10.02	N	56.00	28.31	28.51	46.00	22.26	22.46
4.322	0.27	10.09	N	56.00	27.26	27.53	46.00	19.36	19.63
4.998	0.29	10.11	N	56.00	23.05	23.34	46.00	15.43	15.72

* LISN: LISN insertion Loss, Cable: Cable Loss, P/L:pulse limiter factor
* L: Line. Live, N: Line. Neutral
* Reading: test receiver reading value (with cable loss & pulse limiter factor)
* Result = LISN + Reading

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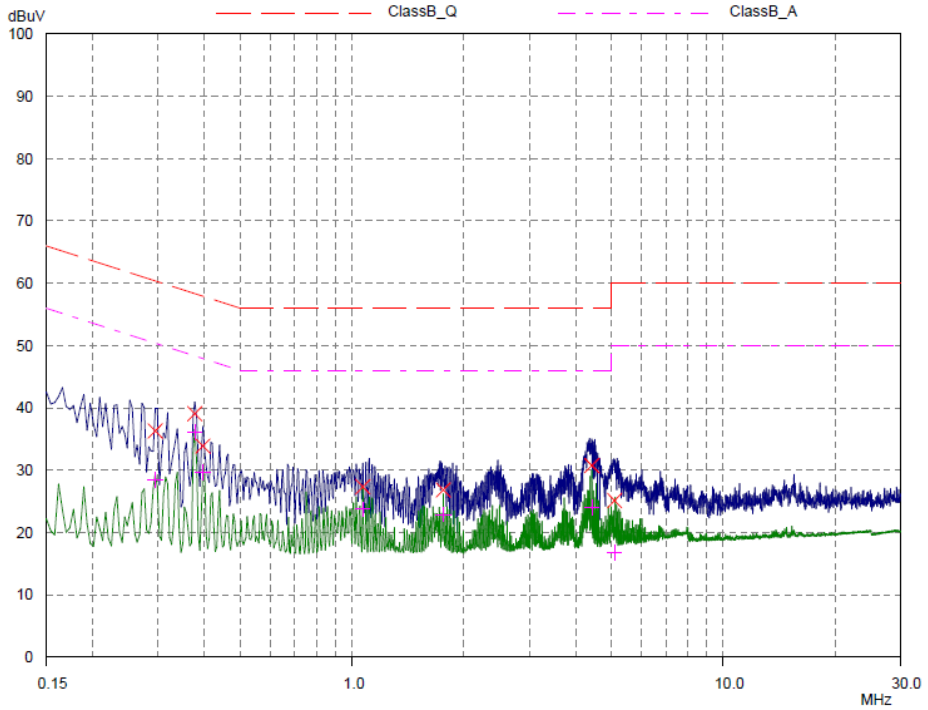
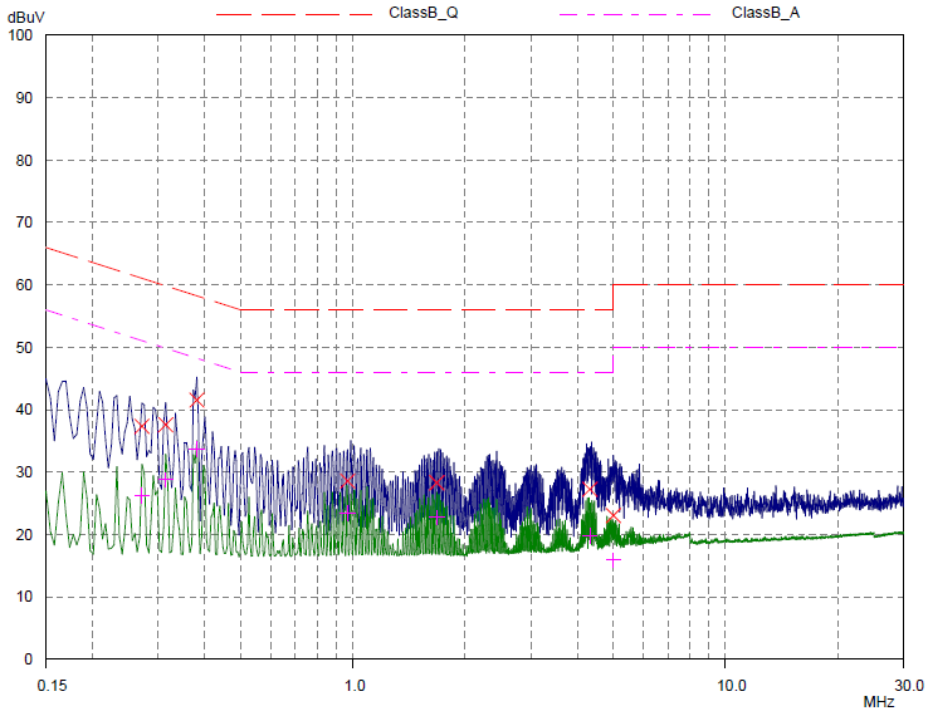
Line. Live



Line. Neutral



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